

Technical Literature Selector Guide and Cross Reference

ON Semiconductor

A Listing and Cross Reference of Available Technical
Literature from ON Semiconductor



Technical Literature Selector Guide and Cross Reference

A Listing and Cross Reference of Available Technical
Literature from ON Semiconductor

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Introduction

This recently revised Technical Literature Selector Guide and Cross Reference is designed to better assist you in finding and selecting Technical Literature on the broad portfolio of ON Semiconductor's devices. This manual is now broken down into several new sections: a listing of available data books and brochures; an alphabetical subject, device number, and SPICE model indices, as well as abstracts on application notes, article reprints and engineering bulletins. Please see the table of contents on page 5 for details.

ON Semiconductor's "applications literature" provides guidance to the effective use of its Analog, Discrete and Logic product families across a broad range of practical applications. Many different topics are discussed – in a way that is not always possible in a device data sheet. These may range from detailed circuit designs complete with PCB layouts, through matters to consider when embarking on a design, to overviews of a new product family and its design philosophy.

Information is presented in the form of Application Notes (AN's), Article Reprints¹ (AR's) and Engineering Bulletins (EB's). The Application Notes, Article Reprints, and Engineering Bulletins are written to enhance the user's knowledge and understanding of ON Semiconductor's products. However, before attempting to design-in a device referenced in these documents, please contact your local ON Semiconductor supplier or sales representative for product availability and available application support.

Information in this document is given in good faith and no liability is accepted for errors or omissions. Includes literature published or revised between December 1, 1997, and August, 2000.

1. Article Reprints are documents that were originally published in trade or press and have been reprinted with permission of the specific publisher.

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Section 1. Primary Literature Listing

Data Books, Brochures, Selectors Guides and More

Data Book Abstracts

Document Number	T*	Title	Abstract
DL111/D	D	<i>Bipolar Power Transistor Data, Rev 7</i>	<p>ON Semiconductor produces more than 700 off-the-shelf power transistors covering a very wide range of applications. These transistor currents range from 0.1 to 80A and their voltages range from 25 to 1000V, with power dissipations from 5 to 250W. Their electrical, thermal and mechanical characteristics are presented in the form of Data Sheets. The book also includes a competitor Cross Reference and a Selector Guide.</p> <p><i>Note: This data book has been published with an ON Semiconductor cover, but still contains Data Sheets with the ON Semiconductor logos.</i></p>
DL121/D	L	<i>LS TTL Data, Rev 6</i>	<p>Low Power Schottky (LS TTL) has been a long time industry standard for logic devices. ON Semiconductor still offers a wide range of these devices, and will continue to provide this logic family as required by the industry.</p>
DL122/D	L	<i>MECL Device Data, Rev 7</i>	<p>Presents full technical data for ON Semiconductor's monolithic Emitter Coupled Logic families, including MECL 10H, MECL 10K and MECL III, plus Phase-Locked Loop products. MECL offers very high speeds – with propagation delays down to 1.0ns – for use in computer systems, high-performance ATE and process control systems, signal processors and navigation systems. The families also offer other advantages which combine to reduce package count and simplify system design. This book includes a technical introduction to MECL and a detailed discussion of system design considerations.</p>
DL126/D	D	<i>Small Signal Transistors, FETs and Diodes, Rev 6</i>	<p>Presents technical information for the several families that make up ON Semiconductor's small-signal semiconductor product range, including bipolar transistors, JFETs and diodes. Complete device specifications and typical performance curves are given on individual data sheets, which are grouped by families and by their through-hole and surface mount packages. A Selector Guide provides a quick comparison in the form of data sheets, with a competitor Cross Reference and a Selector Guide of performance characteristics. Additional sections describe package outline drawings, footprints for soldering and tape-and-reel specifications.</p>
DL128/D	A	<i>Analog ICs, Rev 6</i>	<p>Presents detailed technical information in the form of data sheets on ON Semiconductor's broad range of linear and interface ICs. Products are divided into 10 sections, including Amplifiers and Comparators, Power Supply Circuits, Motor Control, Voltage References, Data Conversion, Interface Circuits, Communications, Consumer and Automotive. Each section includes its own comprehensive Selector Guide, while an industry Cross Reference lists over 3,000 products with their ON Semiconductor Direct or Similar Replacements. Package mechanical data is provided, plus tape-and-reel information for surface mount.</p>
<p>* Technology A = Analog D = Discrete L = Logic X = Mixed</p>			

Data Book Abstracts

Document Number	T*	Title	Abstract
DL129/D	L	<i>High-Speed CMOS Logic, Rev 7</i>	For many years, CMOS devices have been used in applications where low power consumption, wide power supply range and high noise immunity are the important factors. For higher speed applications, designers were forced to sacrifice the CMOS benefits and select bipolar families such as LSTTL. ON Semiconductor's High Speed CMOS family satisfies many high-speed applications, while retaining the CMOS features. The HSCMOS Data Book includes a Selector Guide by function, a discussion of design and handling considerations, and full electrical and performance data in the form of data sheets.
DL131/D	L	<i>CMOS Logic Data, Rev 4</i>	Presents technical data for ON Semiconductor's broad line of Metal-Gate CMOS logic ICs. Complete specifications are provided in the form of data sheets. In addition, a Product Selector Guide and a Handling and Design Guidelines chapter are included, providing additional product and applications information. Includes data on all the logic circuits from the MC14000 series; non-logic devices in this series are covered in the CMOS Application-Specific Standard ICs data book, reference DL130/D.
DL135/D	P	<i>TMOS Power MOSFETs, Rev 6</i>	The Power MOSFET data book is currently undergoing a complete overhaul. This overhaul includes: the removal of several technologies and part numbers that are obsolete; the addition of several new technologies and part numbers that are being introduced into the portfolio; the correction of other minor documentation errors that have occurred in the past versions of the book; and the addition of indexes and other user-friendly information. Expected completion of this task is the end of October, 2000.
DL137/D	D	<i>Thyristor Device Data, Rev 7</i>	Thyristors are useful across a broad range of control applications. Compared to a mechanical switch a thyristor has a long service life and fast switching times; its regenerative action and low ON-resistance allow it to be used to control AC loads as well as for simple switching tasks. Thyristor Device Data presents data sheet information – plus a comprehensive Selector Guide and industry Cross Reference – on ON Semiconductor's thyristor families, including SCRs, Triacs, surge suppressors and trigger devices. It includes 220 pages of theory and applications information.
DL138/D	L	<i>FACT Data, Rev 3</i>	FACT™ uses a sub 2 micron silicon gate CMOS process to attain speeds similar to Advanced Low Power Schottky, while retaining the ultra low power and high noise immunity of CMOS logic. It also offers superior line driving characteristics and excellent ESD and latchup immunity. This data book describes ON Semiconductor's product line with device specifications and a Selector Guide, plus design considerations and comparisons with previous technologies.

* Technology	A = Analog L = Logic	D = Discrete X = Mixed
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Data Book Abstracts

Document Number	T*	Title	Abstract
DL140/D	L	<i>High Performance ECL Data, Rev 4</i>	This data book contains device specifications in the form of data sheets for ON Semiconductor's ECLinPS™ and ECLinPS Lite™ advanced Emitter coupled Logic family. ECLinPS (ECL in picoseconds) was developed in response to the demand for an even higher performance logic family of standard logic functions, especially for the computer, ATE, instrumentation and communications industries. ECLinPS offers a maximum single gate delay of 500ps including package delay, and a flip-flop toggle frequency up to 1 GHz. Each function is available with either MECL 10KH or 100K compatibility.
DL150/D	D	<i>TVS/Zener Devices, Rev 1</i>	Presents technical data for ON Semiconductor's broad line of Transient Voltage Suppressors (TVS) and Zener Diodes. Complete specifications are given in the form of data sheets, with separate sections for surface mount devices. A comprehensive Selector Guide and Industry Cross Reference are included to assist the choice of devices for specific applications, showing ON Semiconductor direct replacement and similar replacement parts. The comprehensive Technical Information section has been edited and updated from the popular ON Semiconductor Zener Diode Manual, and includes Application Notes/Article Reprints.
DL151/D	D	<i>Rectifier Device Data, Rev 2</i>	ON Semiconductor is one of the world's leading suppliers of rectifiers, including switching power supply devices. This book contains a comprehensive Selector Guide showing Application Specific, Schottky, Ultrafast, Fast, Ultrasoft and general purpose rectifiers, and automotive transient suppressors. Detailed electrical and mechanical information is provided in the form of data sheets for all devices. Industry cross reference data is also included.
DL203/D	L	<i>Very High-Speed CMOS Logic, Rev 2</i>	ON Semiconductor's VHC Advanced High-Speed CMOS logic family is designed for operation on 2V to 5.5V supplies. When operating at supply voltages less than 5V the devices feature 5V-tolerant inputs to aid 3V-5V mixed system designs, and with speeds more than 60% faster than HCMOS, VHC is the perfect family for new, low-cost, low-power designs. Excellent noise performance also makes VHC a good replacement for FACT logic. This data book contains full data sheets on all devices offered by ON Semiconductor.
DLD601/D	L	<i>One-Gate Logic Devices, Rev 0</i>	Less is more! With the ever increasing innovations in wireless electronic equipment, physical space within that equipment is at a premium today. ON Semiconductor's One-Gate logic products are positioned to contribute significantly to the success of equipment designs targeted for the computer, networking and communications, and the consumer electronics markets. This data book introduces the VHC and HC One-Gate product families and contains complete data sheet specifications for each device offered.

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Brochure Abstracts

Document Number	T*	Title	Abstract
BR480/D	D	<i>Energy Efficient Semiconductors for Lighting, Rev 1</i>	A brochure outlining basic information on the use of electronic ballasts in energy efficient lighting applications. Includes data on high intensity discharge lamps, industrial fluorescent lamps, halogen lamps, power factor correction, and ballast applications. Also includes several application notes, packaging information and a selector guide.
BR1339/D	L	<i>LCX Data – Low Voltage CMOS Logic Devices, Rev 3</i>	ON Semiconductor's 3V LCX family features 5V-tolerant inputs and outputs to enable an easy transition to 3V systems or to mixed 3V/5V systems. Low power, low switching noise and fast switching speeds make the family perfect for low power portable applications as well as for high end advanced workstation applications. This data book includes overall specifications for the family, general applications information, a discussion of design considerations, and individual datasheets for all the devices in the family.
BR1487/D	D	<i>Thermal Modeling and Management of Discrete Surface Mount Devices, Rev 2</i>	Thermal management is one of the main challenges facing designers of modern portable electronic equipment. As end users demand more and more features in battery powered devices such as notebook computers and mobile phones, the designer is presented with new issues concerned with "how to get the heat out." This publication is a collection of five technical papers, published during 1996, which will give an insight into the latest methods of thermal measurement and modeling of the discrete surface mount packages commonly used in handheld, battery powered equipment.
BR1492/D	L	<i>LVX Data – Low Voltage CMOS Logic Devices, Rev 0</i>	Presents information in data sheet form on ON Semiconductor's LVX Family of 74-series Low-Voltage CMOS devices with 5V-tolerant inputs.
BR1513/D	L	<i>ECLinPS Plus™ Data Brochure, Rev 1</i>	Presents information in data sheet form on ON Semiconductor's ECLinPS Plus™ Family of 10EP/100EP Low-Voltage ECL devices supporting applications up to 6Gbits/s.
BR1522/D	X	<i>Technical Literature Selector Guide and Cross Reference, Rev 2</i>	This document lists all of the currently available technical literature in the Data Book, Selector Guide, Application Note, Article Reprint, Engineering Bulletin, Hand Book and Cross Reference categories. Individual Data Sheet listings are not included. The book allows users to locate appropriate documentation based on Device Number, Subject Matter and Document Description. It includes a listing of available published SPICE models, as well. It is the best authority on available literature.
BRD8005/D	X	<i>Welcome to ON Semiconductor Corporate Brochure, Rev 0</i>	A brief welcome to ON Semiconductor, who we are, where we came from and where we are going.
BRD8007/D	L	<i>Analog Switches, Rev 0</i>	This data brochure consolidates individual data sheets of Analog Switches from each of the applicable Logic product families.

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Brochure Abstracts

Document Number	T*	Title	Abstract
BRD8008/D	X	<i>Part Marking Transition Brochure, Rev 0</i>	Comprehensive guide to how ON Semiconductor's devices will be marked with the ON Logo as we transition away from Motorola, and as we acquire additional semiconductor companies and integrate them into our portfolio.
BRD8009/D	D	<i>Transient Voltage Suppression Device Brochure, Rev 0</i>	A promotional selector guide including technical information and product previews covering ON Semiconductor's new and existing Transient Voltage Suppression (TVS) devices.

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Selector Guide Abstracts

Document Number	T*	Title	Abstract
SG385/D	P	<i>Low Voltage TMOS Power MOSFET Selector Guide, Rev 2</i>	Selector guide for Low Voltage, Surface Mount (MiniMOS™ SO-8, EZFET™, Micro8™, SOT-223, TSOP-6, SOT-23, SC-70/SOT-323, DPAK and D ² PAK Packages) TMOS Power MOSFET devices offered by ON Semiconductor.
SG388/D	X	<i>MASTER COMPONENT SELECTOR GUIDE, Rev 2</i>	Comprehensive selector guide containing all devices offered by ON Semiconductor. The selector guide is broken down into Analog, Logic, Discrete and Power MOS products and features comprehensive indexes to quickly locate available devices.
SG425/D	D	<i>Lamp Ballast Selector Guide, Rev 1</i>	Continuing research and development of discrete products has led to a family of MOSFET and Bipolar transistors dedicated to the fast growing market of electronic lamp ballasts. The tables in this guide are designed to aid the quick selection of the best devices for specific applications. Includes selector guides by package type/technology, illustrated package dimensions and an industry cross reference.
SGD501/D	X	<i>ON Semiconductor Price Book (Published Quarterly)</i>	Our price book is a listing of standard devices that are readily available direct and via our distributor channel. The information contained includes our Orderable Part Number, Manufacturer's Suggested Retail Price, and device specific packaging quantity.
SGD503/D	X	<i>UPDATE – Quarterly New Product Introduction Folder</i>	Quarterly update of new products being introduced by ON Semiconductor.
SGD504/D	A	<i>Analog IC Family Tree</i>	A breakdown of the Analog portfolio, by device number, into functional product families, including: Signal Conditioning; Battery Management; Power Management; Interface; Thermal Management; Special Functions; and Application Specific Standard Products (ASSP).

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Other Abstracts

Document Number	T*	Title	Abstract
HB205/D	L	<i>MECL System Design Handbook, Rev 1</i>	Engineers look increasingly at ECL families such as MECL III, MECL 10K and MECL 10KH to meet demands for higher performance systems. Designing with MECL is no more difficult than designing with slower logic, but an understanding of factors affecting system performance is essential for optimum design. MECL features such as transmission line driving, complementary outputs, wired-OR and versatile functions contribute as much as short propagation delays and high toggle rates. This book provides complete information about MECL operation, to allow design rules for specific systems to be established.
HB214/D	D	<i>Rectifier Applications Handbook, Rev 0</i>	This handbook provides a theoretical and physical back-ground to a broad range of rectifier applications and problems. Topics include Power Rectifier Physics, Basic Properties of Semiconductors, the SPICE Diode Model, Diode Specifications and Ratings, Single-Phase and Polyphase Rectifier Circuits, Rectifier Filter Systems, Voltage Multiplier Circuits, Transient Protection of Rectifier Diodes, Reliability Considerations, Cooling Principles, Printed Circuit Board Assembly Considerations, and Heatsink Mounting Considerations.
HBD851/D	X	<i>Quality & Reliability Handbook, Rev 0</i>	NOT CURRENTLY AVAILABLE. COMING END OF 3Q00.
CR108/D	P	<i>Low Voltage MOSFET Cross Reference, Rev 2</i>	A cross reference listing from industry part numbers to ON Semiconductor's MiniMOS™ SO-8 Power MOSFETs, SOT-23 and TSOP-6 MOSFETs, and Micro8™ MOSFETs.
CRD800/D	A	<i>Analog Integrated Circuits Cross Reference, Rev 0</i>	A helpful cross reference listing industry standard and competitor part numbers along with ON Semiconductor's Analog replacement devices.
CRD801/D	D	<i>Rectifier Cross Reference, Rev 0</i>	An industry cross reference that lists Rectifiers by either industry standard part number or by manufacturer's part number for which there is an ON Semiconductor nearest or similar replacement.

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Section 2. Application Notes, Article Reprints and Engineering Bulletins

AN's, AR's and EB's

Subject Index

Subject Index

Subject	Document Number	Document Title
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AM Receiver Design	ANHK07/D	A High Performance Manual-Tuned AM Stereo Receiver for Automotive Application Using ON Semiconductor ICs MC13021, MC13020 and MC13041A
Analog-to-Digital Converter	AN559/D	A Single Ramp Analog-to-Digital Converter
Arithmetic Operators	AN703/D	Designing Digitally-Controlled Power Supplies
Automotive Relay	AN1678/D	Automotive Relay Replacement Evaluation Board

B

Battery Management	AR620/D	Quest for the Perfect Battery
Battery Management, Charge Controllers	AN1593/D	Low Cost 1.0 A Current Source For Battery Chargers
Battery Management, Charge Controllers	AN1689/D	ON Semiconductor's Solutions for Very Low Power in Standby Mode In Switchmode Power Supplies
Bipolar Power Transistors	AN1049/D	The Electronic Control of Fluorescent Lamps
Bipolar Power Transistors	AN1319/D	Design Considerations for a Low Voltage N-Channel H-Bridge Motor Drive
Bipolar Power Transistors	AN1577/D	ON Semiconductor's D2 Series Transistors for Fluorescent Converters
Bipolar Power Transistors	AN1628/D	Understanding Power Transistors Breakdown Parameters
Bipolar Power Transistors	AN485/D	High Power Audio Amplifiers with Short Circuit Protection
Bipolar Power Transistors	AN860/D	Power MOSFETs versus Bipolar Transistors
Bipolar Power Transistors	AN873/D	Understanding Power Transistor Dynamic Behavior – dvt Effects on Switching and RBSOA
Bipolar Power Transistors	AN875/D	Power Transistor Safe Operating Area – Special Considerations for Switching Power Supplies
Bipolar Power Transistors	AN915/D	Characterizing Collector-to-Emitter and Drain-to-Source Diodes for Switchmode Applications
Bipolar Power Transistors	AN929/D	Insuring Reliable Performance from Power MOSFETs
Bipolar Power Transistors	AN930/D	High Voltage, High Current, Non-Destructive FBSOA Testing
Bipolar Power Transistors	AN951/D	Drive Optimization for 1.0 KV Off-Line Converter Transistors
Bipolar Power Transistors	AN952/D	Ultrafast Recovery Rectifiers Extend Power Transistor SOA
Bipolar Power Transistors	AR131/D	Baker Clamps: Traditional Concepts Updated for Third Generation Power Transistors
Bipolar Power Transistors	AR177/D	Proper Testing Can Maximize Performance in Power MOSFETs
Bipolar Power Transistors	AR302/D	Thermal Management of Surface Mount Power Devices
Bipolar Power Transistors	AR319/D	DPAK: A Surface Mount Package for Discrete Power Devices
Bipolar Power Transistors	AR326/D	High-Voltage MOSFETs Simplify Flyback Design
Bipolar Power Transistors	AR328/D	Application-Specific Transistors
Bipolar Power Transistors	EB124/D	MOSFETs Compete With Bipolars In Flyback Power Supplies
Bipolar Power Transistors	EB407/D	Basic Halogen Converter
Bipolar Power Transistors	EB79/D	Pulsed f-sub-T, a Technique for Accurately Measuring the Gain Bandwidth Product of Power Transistors
Bipolar Power Transistors	EB85A/D	Full-Bridge Switching Power Supplies
Bipolar Power Transistors	AN930/D	High Voltage, High Current, Non-Destructive FBSOA Testing
Bipolar Power Transistors, Audio	AN930/D	High Voltage, High Current, Non-Destructive FBSOA Testing
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Bipolar Power Transistors, Electronic Lamp Ballasts	AN1577/D	ON Semiconductor's D2 Series Transistors for Fluorescent Converters

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Bipolar Power Transistors, Electronic Lamp Ballasts	AN4001/D	MC44603 in a 110W Output SMPS Application (80–140 Vrms and 180–220 Vrms Mains Voltages)
Bipolar Power Transistors, Electronic Lamp Ballasts	AR609/D	Trouble Shooting Halogen Electronic Transformers
Bipolar Power Transistors, Electronic Lamp Ballasts	EB407/D	Basic Halogen Converter
Bipolar Transistors	AN1048/D	RC Snubber Networks For Thyristor Power Control and Transient Suppression
Bipolar Transistors	AN1076/D	Speeding Up Horizontal Outputs
Bipolar Transistors	AN1080/D	External–Sync Power Supply with Universal Input range for Monitors
Bipolar Transistors	AN1083/D	Basic Thermal Management of Power Semiconductors
Bipolar Transistors	AN1308/D	100 and 200 Watt High Fidelity Audio Amplifiers Utilizing a Wideband–Low Feedback Design
Bipolar Transistors	AN1319/D	Design Considerations for a Low Voltage N–Channel H–Bridge Motor Drive
Bipolar Transistors	AN1603/D	Providing a POTS Phone In an ISDN or Similar Environment
Bipolar Transistors	AN1606/D	ITC132 High Voltage Micro to Motor Interface
Bipolar Transistors	AN1607/D	ITC122 Low Voltage Micro to Motor Interface
Bipolar Transistors	AN1661/D	Low Cost Universal Motor Chopper
Bipolar Transistors	AN1689/D	ON Semiconductor's Solutions for Very Low Power in Standby Mode In Switchmode Power Supplies
Bipolar Transistors	AN485/D	High Power Audio Amplifiers with Short Circuit Protection
Bipolar Transistors	AN581/D	An MSI 500 MHz Frequency Counter Using MECL and MTTL
Bipolar Transistors	AR109/D	Power Transistor Safe Operating Area–Special Considerations for Motor Drives
Bipolar Transistors	AR194/D	Drive Techniques for High Side N–channel MOSFETs
Bipolar Transistors	AR301/D	Solid–State Devices Ease Task of Designing Brushless DC Motors
Bipolar Transistors	AR305/D	Building Push–Pull, Multioctave, VHF Power Amplifiers
Bipolar Transistors	AR609/D	Trouble Shooting Halogen Electronic Transformers
Bipolar Transistors	EB108/D	Relative Efficiencies of ON Semiconductor Power Semiconductors in a PWM DC Motor Controller
Bipolar Transistors	EB128/D	Simple, Low–Cost Motor Controller
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Bus Interface	AN726/D	Bussing with MECL 10,000 Integrated Circuits
Bus Interface	AN759/D	A CMOS Data Entry System for Bus Oriented Memory Systems

C

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Clock Distribution Chips	AND8002/D	ECLinPS Lite™ and ECLinPS Plus™ Device Type and Date Code Guide
Clock Drivers	AN1405/D	ECL Clock Distribution Techniques
Clock Drivers	AN1406/D	Designing with PECL (ECL at +5.0V)
Clock Drivers	AR195/D	Advanced ECL Family Boosts Performance Threefold
Clock Drivers	AR519/D	Low–skew Clock Drivers: Which Type is Best?
Coax Cable Drivers	AN1537/D	MC10SX1189 I/O SPICE Modeling Kit
Comparators	AN1317/D	High–Current DC Motor Drive Uses Low On–Resistance Surface Mount MOSFETs
Comparators	AN1510/D	A Mode Indicator for the MC34118 Speakerphone Circuit

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Subject	Document Number	Document Title
Counters	AN1077/D	Adding Digital Volume Control To Speakerphone Circuits
Counters	AN717/D	Battery-Powered 5 MHz Frequency Counter
Counters	AN759/D	A CMOS Data Entry System for Bus Oriented Memory Systems
Counters	AND8001/D	Odd Number Divide By Counters With 50% Outputs and Synchronous Clocks
Counters	EB47/D	Event Counter and Storage Latches for High-Frequency, High-Resolution Counters
D		
D/A Conversion	AN713/D	Binary D/A Converters Can Provide BCD-Coded Conversion
Date Code Marking, Logic	AND8004/D	ON Semiconductor Logic Date Code and Traceability Marking
Decodermultiplexers	AN759/D	A CMOS Data Entry System for Bus Oriented Memory Systems
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MUR180E	AN1320/D	300 Watt 100 KHz Converter Utilizes Economical Bipolar Planar Power Transistors
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P6KE10	AR450/D	Characterizing Overvoltage Transient Suppressors
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TIP100	EB108/D	Relative Efficiencies of ON Semiconductor Power Semiconductors in a PWM DC Motor Controller
TIP121	AN930/D	High Voltage, High Current, Non-Destructive FBSOA Testing
TIP29B	AN1319/D	Design Considerations for a Low Voltage N-Channel H-Bridge Motor Drive
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TL431ACD	AN1317/D	High-Current DC Motor Drive Uses Low On-Resistance Surface Mount MOSFETs
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UC3845	AN1108/D	Design Considerations for a Two Transistor, Current Mode Forward Converter
UC3845B	AN1327/D	Very Wide Input Voltage Range, Off-Line Flyback Switching Power Supply
V33ZA1	AR450/D	Characterizing Overvoltage Transient Suppressors
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Document Abstracts

by Document Number

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AN004E/D	D	Semiconductor Consideration for DC Power Supply Voltage Protector Circuit Protectors	This paper addresses the requirements for the semiconductor sensing circuitry and SCR crowbar devices used in DC power supply over/under voltage protection schemes.
AN211A/D	D	Field Effect Transistors in Theory and Practice	There are two types of field-effect transistor: the Junction Field-Effect Transistor (JFET) and the Metal Oxide Semiconductor Field-Effect Transistor (MOSFET). The principles on which these devices operate are very similar, the main difference being in the method by which the control element is made. This difference, however, results in a considerable difference in device characteristics and necessitates different approaches in circuit design. This discussion of the basic theory, construction methods, characteristics and figures of merit of the two types is intended as a primer for engineers and technicians.
AN220/D	D	FETs in Chopper and Analog Switching Circuits	The author's discussion begins with elementary chopper and analog switch characteristics, explores fully the considerations required for conventional and FET chopper and analog switch design, and finishes with specific FET circuit examples.
AN222A/D	D	The ABCs of DC to AC Inverters	Transistor DC to AC inverters are useful in a wide variety of applications, including satellites, gyros, other airborne instruments, and even an electric shaver in a car. They may become increasingly important and more widely used with the further development of economic low-voltage DC power sources such as solar cells, nuclear cells and fuel cells. This note provides a thorough examination of a broad range of inverter types, and includes selection of the proper inverter for a specific application and device selection for inverter design.
AN270/D	X	Nanosecond Pulse Handling Techniques	The rapid advancement in the field of high speed digital integrated circuits has brought into focus many problem areas in the methods of pulse measurement techniques and new concepts dealing with these problems. This paper is intended to discuss the more common, yet perhaps not well known, pitfalls of measurement systems, a method of detecting them and possible solutions.
AN294/D	D	Unijunction Transistor Timers and Oscillators	Twelve different unijunction transistor circuits are examined, loading factors are discussed and the effects of compensating techniques are shown.
AN462/D	D	FET Current Regulators – Circuits and Diodes	A brief historical sketch of the development of two-terminal current regulators from vacuum tube days to the present. Included are numerous FET current sourcing circuits, along with an extensive treatment of the current regulating diode and its uses as a valuable component in circuit design.
AN479/D	D	Universal Input Voltage Range Power Supply for High Resolution Monitors with Multi-Sync Capability	This note describes an easy-to-build, high performance, low cost 100W flyback power supply, able to work on any mains supply from 85Vac to 265Vac, and from 40Hz to 100Hz. It is automatically synchronized to the horizontal scanning frequency for minimum screen interference on a multi-sync color monitor. It uses a low cost MC44602P2 current mode controller – designed specifically for driving high voltage bipolar transistors – with an MJH18010 switchmode power transistor.
AN485/D	D	High-Power Audio Amplifiers with Short-Circuit Protection	This application note describes a recommended circuit approach for high-performance audio amplifiers in the 35W to 100W r.m.s. power range. Circuitry is included which enables the amplifier to operate safely continuously under any load condition including a short.
AN489/D	A	Analysis and Basic Operation of the MC1595	The monolithic linear four-quadrant multiplier is discussed. The equations for the analysis are given, along with performance that is characteristic of the device. A few basic applications are given to assist the designer in his system design.
AN556/D	L	Interconnection Techniques for ON Semiconductor's MECL 10,000 Series Emitter Couple Logic	The MECL 10,000 Series is designed to be the most usable very high speed logic available. It satisfies the growing need for high clock rate capability and short propagation delays with minimum layout constraints. This comprehensive note describes some characteristics of high speed digital signal lines and the wiring rules for MECL 10,000. Discussions include PCB interconnects and wirewrapping techniques.

* Technology	A = Analog	D = Discrete	L = Logic	X = Mixed
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Document Abstracts

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AN559/D	A	A Single Ramp Analog-To-Digital Converter	A simple single ramp A/D converter which incorporates a calibration cycle to insure an accuracy of 12 bits is discussed. The circuit uses standard ICs and requires only one precision part – the reference voltage used in the calibration. This converter is useful in a number of instrumentation and measurement applications.
AN569/D	D	Transient Thermal Resistance – General Data and its Use	Data illustrating the thermal response of a number of semiconductor die and package combinations are given. Its use, employing the concepts of transient thermal resistance and superposition, permit the circuit designer to predict semiconductor junction temperature at any point in time during application of a complex power pulse train.
AN581/D	L	An MSI 500MHz Frequency Counter Using MECL and MTTL	The design of an MSI 8–digit LED readout 500MHz counter using MECL III, MECL 10,000 and TTL is discussed. Described are two prescalers using MECL, along with the designs for two input amplifiers. A unique time–base controller is also shown for providing a multiphase clock to the counter.
AN587/D	A	Analysis and Design of the Op Amp Current Source	Voltage–controlled current sources based on operational amplifiers are both versatile and accurate, yet the quality of op amps required is unimportant. This note develops general expressions for basic transfer function and output impedance, and shows that simplified equations give a very accurate description of actual circuit performance. Includes a section on analysis of the errors that result from changes in circuit parameters and temperature.
AN701/D	L	Understanding MECL 10 000 DC and AC Data Sheet Specifications	The DC and AC specifications for emitter–coupled logic are somewhat different to those for saturated logic. This application note describes the specifications found on a MECL 10,000 data sheet and provides information for understanding these specifications for persons unfamiliar with emitter–coupled logic.
AN703/D	A	Designing Digitally–Controlled Power Supplies	This application note shows two design approaches; a basic low voltage supply using an inexpensive MC1723 voltage regulator and a high current, high voltage supply using the MC1466 floating regulator with optoelectronic isolation. Various circuit options are shown to allow the designer maximum flexibility in an application.
AN708A/D	A	Line Driver and Receiver Considerations	This report discusses many line driver and receiver design considerations such as system description, definition of terms, important parameter measurements, design procedures, and application examples. An extensive line of devices is available from ON Semiconductor to provide the designer with the tools to implement the data transmission requirements necessary for almost every type of transmission system.
AN713/D	L	Binary D/A Converters can Provide BCD–Coded Conversion	This note describes the application and use of integrated circuit D/A converters for use in providing a BCD–coded conversion. The technique is illustrated using a 2–1/2 digit digital voltmeter.
AN717/D	L	Battery Powered 5 MHz Frequency Counter	This application note describes a battery–powered 5–MHz frequency counter using the McMOS logic family for low–power operation. The basic counter is optimized at a 12–volt supply for maximum performance with a linear input–signal conditioner. Several options are discussed which optimize the basic counter for minimum power dissipation. These options include a CMOS input signal–conditioner and multiplexed LED displays.
AN719/D	A	A New Approach to Switching Regulators	This article describes a 24 volt, 3 ampere switching mode supply. It operates at 20kHz from a 120V AC line with an overall efficiency of 70%. New techniques are used to shape the load line. The control portion uses a quad comparator and an optocoupler and features short circuit protection.
AN720/D	L	Interfacing with MECL 10,000 Integrated Circuits	This article describes some of the MECL circuits used to interface with signals not meeting MECL input or output requirements. The characteristics of these circuits, such as input impedance, output drive, gain and bandwidth, allow the designer to use these parts to optimize his system. MECL interface circuits overcome a problem area of many system designs which is the efficient coupling of non–compatible signals.
AN726/D	L	Bussing with MECL 10 000 Integrated Circuits	High speed data bus lines are an important part of modern computer systems. Features of the MECL 10,000 family allow construction of data busses in a transmission line environment. This application note describes some of the guidelines to consider when designing high speed bus lines and shows how the MC10123 can be used for maximum bus performance.

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Document Abstracts

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AN738/D	L	NBCD Sign & Magnitude Adder/Subtractor	This note describes a parallel sign and magnitude adder/subtractor for natural binary coded decimal (NBCD) numbers. The design is implemented with CMOS MSI functions: the MC14560 NBCD Adder and MC14561 9's Complementer. Decimal number representations, complement arithmetic, and adder/subtractors for unsigned numbers are also discussed.
AN753/D	L	Scanning Logic for RF Scanner-Receiver Using CMOS Integrated Circuits	This note describes the application of CMOS integrated logic circuits in RF scanner-receiver control functions. Approaches considered include crystal switching methods with and without priority channel capability, of both the fixed and selectable priority channel types, along with reference to their applicability in phase-locked loop system designs.
AN759/D	L	CMOS Keyboard Data EN	This application note describes a keypad to binary data entry system for use with NMOS or CMOS memories, either in a minicomputer/microprocessor application or as a part of any logic system containing random access memory. Manual data entry using a keypad avoids the use of a binary format, offering increased speed and accuracy of manual direct memory accessing.
AN781A/D	X	Revised Data-Interface Standards	The purpose of this application note is to provide a brief overview, and comparison, of the communication interface standards RS232-C, RS422, RS423, RS449 AND RS485 for the hardware designer. A listing of the standards' specifications, and a listing of appropriate ON Semiconductor devices are included. When more detailed information is required, the appropriate standard should be consulted.
AN784/D	D	Transient Power Capability of Zener Diodes	Because of the sensitivity of semiconductor components to voltage transients in excess of their ratings, circuits are often designed to inhibit voltage surges in order to protect equipment from catastrophic failure. External voltage transients are imposed on power lines as a result of lightning strikes, motors, solenoids, relays or SCR switching circuits, which share the same ac source with other equipment. Internal transients can be generated within a piece of equipment by rectifier reverse recovery transients, switching of loads or transformer primaries, fuse blowing, solenoids, etc. The basic relation, $v = L di/dt$, describes most equipment developed transients.
AN829/D	L	Application of the MC1374 TV Modulator	The MC1374 was designed for use in applications where separate audio and composite video signals are available, which need to be converted to a high quality VHF television signal. It is ideally suited as an output device for subscription T.V. decoders, video disk and video tape players.
AN843/D	D	A Review of Transients and Their Means of Suppression	This note addresses the problem of transient overvoltages which most electronic equipment designs must deal with. Effective transient suppression requires that the impulse energy is dissipated in the added suppressor at a low enough voltage so the capabilities of the circuit or device will not be exceeded.
AN849/D	D	Guide to Thyristor Applications	In this note, significant thyristor characteristics, the basis of their rating, and their relationship to circuit design are discussed.
AN860/D	D	Power MOSFETs Versus Bipolar Transistors	What is better, if anything, with the power FETs if we can get a bipolar transistor with an equal power rating for less than half the price?
AN861/D	D	Power Transistor Safe Operating Area: Special Considerations for Motor Drives	Motor drives present a unique set of safe operating area conditions for power output transistors. Starting with the basics of forward and reverse safe operating area, considerations unique to motor drives are discussed. The industrial motor drive application is sufficiently different from the electronics uses of power transistors that a new safe operating area specification has been developed. It is called overload safe operating area (OSLOA). The concept and the data sheet curves that go with it are presented.
AN873/D	D	Understanding Power Transistor Dynamic Behavior: dv/dt Effects on Switching RBSOA	Power transistor dynamic behavior can be affected to a large extent by dv/dt limitations. A look at the internal workings of the transistor readily shows how these limitations arise. A simple circuit model is developed which reproduces the behavior of power transistors in dv/dt-limited modes of operation. Experience with the model gives some guidelines for minimizing dv/dt limitations in practical circuits.
AN875/D	D	Power Transistor Safe Operating Area: Special Considerations for Switching Power Supplies	The purpose of this application note is to take a look at some of the more subtle aspects of how stress imposed by the power supply relates to transistor safe operating area, and to differentiate those stresses that the transistor can handle from those it cannot. In order to provide a proper foundation, special considerations are preceded by a review of forward bias safe operating area.

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Document Abstracts

Doc Number	T*	Title	Abstract
AN876/D	D	Using Power MOSFETs in Stepping Motor Control	Stepping Motor control techniques and circuits utilizing Power MOSFETs driven from CMOS Integrated Circuits are discussed. The techniques described are shift register phase generation, comparator switched current limiting, utilization of synchronous rectification, transient current suppression by use of the Power FET transfer characteristic, and the transient voltage protection requirements of the Power FET. The techniques are presented as components for an 88% efficient stepping motor drive circuit; however they are also applicable to other power control tasks.
AN913/D	D	Designing with TMOS Power MOSFETs	Clearly, the advantages and disadvantages that the power MOSFET gives technology are its specific realm of usefulness. Some designers also favour the power MOSFET because of its extended FBSOA or its other more subtle advantages. The most common considerations that designers should be aware of when designing with TMOS power MOSFETs are outlined and explained here.
AN915/D	D	Characterizing Collector-to-Emitter and Drain-to-Source Diodes for Switchmode Applications	Most power Darlington transistors and power MOSFETs contain integral Collector-to-Emitter (C-E) and Drain-to-Source (D-S) diodes which for certain inductive load applications can be used as commutating diodes. Whether these diodes are fast enough or have adequate power handling capability is addressed. Also described is a real world test circuit which accurately characterizes the diodes for switching times. The surge current capability and forward characteristics of a number of devices are also listed.
AN917/D	A	Reading and Writing in Floppy Disc Systems	This application note will initially discuss recording heads, formats and disk capacities. Subsequently, the discussion will focus on the MC3469, MC3470 and MC3471 Integrated Circuits, which have been developed to facilitate the design of floppy disk systems.
AN918/D	D	Paralleling Power MOSFETs in Switching Applications	The present TDT series of application notes are updated in this note with a more detailed analysis and design guide for TMOS power MOSFET parallel applications to account for device-to-device parameter differences and responses.
AN920/D	A	Theory and Applications of the MC34063 and μ A78S40 Switching Regulator Circuits	This paper describes in detail the principle of operation of the MC34063 and μ A78S40 switching regulator subsystems. Several converter design examples and numerous applications circuits with test data are included.
AN921/D	L	Horizontal APC/AFC Loops	The most popular method used in modern television receivers to synchronize the line frequency oscillator is the phase locked loop. Although in detail the circuits may vary considerably, the fundamental operation is the same. Any designer with a good understanding of phase locked loops in general and the required operating characteristics of television line frequency oscillators in particular, should be able to handle these circuits successfully.
AN924/D	D	Measurement of Zener Voltage to Thermal Equilibrium with Pulsed Test Current	This paper discusses the Zener voltage correlation problem which sometimes exists between the manufacturer and the customer's incoming inspection. A method is shown to aid in the correlation of Zener voltage between thermal equilibrium and pulse testing. A unique double-pulsed sample and hold test circuit is presented which improves the accuracy of correlation. Several Zener voltages versus Zener pulsed test current curves are shown for ten package styles. An appendix is attached for incoming inspection groups giving detailed information on tolerances involved in correlation.
AN929/D	D	Insuring Reliable Performance from Power MOSFETs	Due to their many unique advantages, power MOSFETs are being used in an increasing number of applications. To aid the circuit designer in developing reliable power MOSFET circuits, this application note examines six potential problem areas and offers suggestions for eliminating or minimizing problems in each area. In addition, as an aid to the many designers who are using power MOSFETs in switched-mode power supplies, this note includes a section on improving switching power supply circuits.
AN930/D	D	High Voltage, High Current, Non-Destructive FBSOA Testing	This application note provides specifications for a test instrument which can be used to perform non-destructive testing of the Second Breakdown (SB) limits of the Forward Bias Safe Operating Area (FBSOA) curve. In addition this note illustrates typical SB portions of the FBSOA and temperature derating curves for various technologies.
AN951/D	D	Drive Optimization for 1.0kV Off-Line Converter Transistors	The purpose of this application note is to take a look at how best to use these parts. Both switching time and reverse safe area are examined in several different circuit configurations.

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Document Abstracts

Doc Number	T*	Title	Abstract
AN952/D	D	Ultrafast Recovery Rectifiers Extend Power Transistor SOA	The purpose of this application note is to examine the improvement in turn-on safe operating area that can be realized with ULTRAFAST clamp diodes. In order to provide a complete analysis, the ULTRAFAST results are preceded with a review of conventional design rules.
AN954/D	A	A Unique Converter Configuration Provides Step-Up/Step-Down Functions	The use of switching regulators in new portable equipment designs is becoming more pronounced over that of linear regulators.
AN957/D	A	Interfacing Speakerphone to MC34010/11/13	Interfacing the MC34018 speakerphone circuit to the MC34010 series of telephone circuits is described in this application note. The series includes the MC34010, MC34011, MC34013, and the newer "A" version of each of those. The interface is applicable to existing designs, as well as to new designs.
AN958/D	A	Transmit Gain Adjustments for MC34014 Speech	The MC34014 telephone speech network provides for direct connection to an electret microphone and to Tip and Ring. In between, the circuit provides gain, drive capability, and determination of the ac impedance for compatibility with the telephone lines. Since different microphones have different sensitivity levels, different gain levels are required from the microphone to the Tip and Ring lines. This application note will discuss how to change the gain level to suit a particular microphone while not affecting the other circuit parameters.
AN959/D	A	A Speakerphone with Receive Idle Mode	The MC34018 speakerphone system operates on the principle of comparing the transmit and receive signals to determine which is stronger, and then switching the circuit into that mode. Under conditions where noise from the telephone line (in the receive path) exceeds the background noise in the transmit path, the speakerphone will switch easily, or even lock, into the receive mode. Under these conditions the conversation will sound "dead" to the party at the far-end. It will also be more difficult for the near-end party to activate the transmit channel since the transmit detection is at the output of the transmit attenuator, which will be at maximum attenuation during this time. The addition of a receive idle mode can alleviate this problem by ensuring that the transmit and receive gains will be approximately equal when no voice signals are present. This allows the far-end party to hear ambient noises, and also increases the sensitivity to transmit signals.
AN960/D	A	Equalization of DTMF Signal MC64014	This application note will describe how to obtain equalization (line length compensation) of the DTMF dialing tones using the MC34014 speech network. While the MC34014 does not have an internal dialer, it has the interface for a dialer so as to provide the means for putting the DTMF tones onto the Tip & Ring lines. The equalization amplifier, whose gain varies with loop current, was meant primarily to equalize the speech signals. However, by adding one resistor, it can be used to equalize the DTMF signals as well.
AN964/D	D	Trigger Design Ideas for DIAC Replacements	With the reduced availability of DIACs it is necessary to find alternative triac trigger options. This note examines eight other discrete devices or combinations where the parts cost is generally the same or less than the DIAC they replace, but performance is improved.
AN976/D	A	A New High Performance Current Mode Controller Teams Up with Current Sensing Power MOSFETs	The second-generation architecture of the MC34129 power supply control IC is shown to provide a number of advantages for current-mode supplies, notably 'lossless' sensing when used with current sensing power MOSFETs. The discussion includes subtle factors to watch out for in practical designs, and an applications example.
AN980/D	A	VHF Narrowband FM receiver Design Using MC3362 and the MC3363 Dual Conversion Receivers	ON Semiconductor has developed a series of low power narrow-band FM dual conversion receivers in monolithic silicon integrated circuits. The MC3362 and MC3363 are manufactured in the MOSAIC process technology. This process develops NPN transistors with $f_T = 4+$ GHz, which allows the MC3362 and MC3363 to have excellent very high frequency (VHF) operation with low power drain.
AN1006/D	A	Linearize the Volume Control MC34118	The volume control level of the MC34118 speaker-phone IC has a nonlinear relationship with respect to the position of the volume control potentiometer, evident in Figure 14 of the data sheet. Since the input impedance at VLC (Pin 13) is very high, the horizontal axis in the graph of Figure 14 can be said to represent the potentiometer's mechanical position (using a linear taper potentiometer), with the two extreme ends of the potentiometer's position at 0.3 and 1.0. As can be seen, the gain changes at a slow rate when near maximum volume, but changes rapidly when near the minimum volume setting.

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Document Abstracts

Doc Number	T*	Title	Abstract
AN1016/D	A	Infrared Sensing and Data Transmission Fundamentals	Many applications today benefit greatly from electrical isolation of assemblies, require remote control, or need to sense a position or presence. Infrared light is an excellent solution for these situations due to low cost, ease of use, ready availability of components, and freedom from licensing requirements or interference concerns that may be required by RF techniques. Construction of these systems is not difficult, but many designers are not familiar with the principles involved. The purpose of this application note is to present a "primer" on those techniques and thus speed their implementation.
AN1019/D	A	Decoding Using TDA3330 with Emphasis on Video Cable Drive	The TDA3330 is a composite video to TGB Color Decoder originally intended for PAL and NTSC color TV receivers and monitors. The data sheet is oriented toward picture tube drive, rather than cable level outputs. This application note is intended to supplement the data sheet by providing circuits for video cable drive, such as used in video processing circuits, frame store, and other specialized applications, and to expand upon the functional details of the TDA3330.
AN1020/D	D	A High-Performance Video Amplifier for High Resolution CRT Applications	This note describes a state-of-the-art video amplifier making use of the superior performance characteristics of ON Semiconductor CRT driver transistors. In particular, it shows the high speed obtainable with low DC power consumption. The circuit is insensitive to load variations and interconnect methods.
AN1040/D	D	Mounting Considerations for Power Semiconductors	The operating environment is a vital factor in setting current and power ratings of a semiconductor device. Reliability is increased considerably for relatively small reductions in junction temperature. Faulty mounting not only increases the thermal gradient between the device and its heat sink, but can also cause mechanical damage. This comprehensive note shows correct and incorrect methods of mounting all types of discrete packages, and discusses methods of thermal system evaluation.
AN1042/D	D	High Fidelity Switching Audio Amplifiers Using TMOS Power MOSFETs	Switching audio amplifiers were impractical before the availability of complementary Power MOSFETs. Now, gate drive circuitry is simpler than for bipolar transistors, and the MOS devices operate more efficiently at higher frequencies. This detailed discussion of switching amplifier design is supported by a 72W Class D circuit.
AN1043/D	D	Spice Model for TMOS Power MOSFETs	SPICE is a user-friendly, general-purpose circuit simulation program for non-linear DC, non-linear transient and linear AC analysis. It is now available in various commercial versions for use on personal computers. ON Semiconductor and the LAAS-CNRS Research Laboratory have built a TMOS Power MOSFET library to simplify power dissipation simulation using SPICE. This note describes how to use the library; the physics of the Power MOSFET; the implementation of the model within SPICE; the method of extracting the parameters for the library; and a comparison of practical and simulated characteristics. The library is printed here and is also available on disk.
AN1045/D	D	Series Triacs in AC High Voltage Switching Circuits	An analysis of the circuit design of series connected triacs used to create high voltage switches operating up to 2000 volts. Triacs offer many advantages over electromechanical switches, but blocking voltage and dV/dt capability must often be far higher than the line voltage would suggest. Properly designed series circuits can solve many of the problems.
AN1046/D	X	Three Piece Solution for Brushless Motor Controller Design	Until recently, the design of compact but comprehensive circuits taking full advantage of the unique attributes of brushless DC motors has been difficult, while available power transistors have not always performed as well as is necessary for the application. This high-performance three-chip solution couples the rugged MPM3003 three phase MOSFET bridge (in a 12-pin power package) with the MC33035 Brushless DC Motor Controller and the MC33039 Closed-Loop Brushless Motor Adapter. Design is simplified, board area reduced. Full circuit, parts list, and discussion of practical considerations.
AN1048/D	D	RC Snubber Networks for Thyristor Power Control and Transient Suppression	RC Snubbers are used to control transients that could falsely turn on a thyristor or triac. But if not used properly they can cause unreliable operation and even damage to the device. This detailed analysis of the problem examines the physics, and provides design examples for many practical applications.

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Document Abstracts

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AN1049/D	D	The Electronic Control of Fluorescent Lamps	A circuit is described including PCB artwork and component layout that demonstrates the use of the BUL45 bipolar power transistor for fluorescent lamp control. Electronic control can improve efficiency, extend lamp life and eliminate low frequency flicker. This note discusses the limitations of different types of 'electronic ballast', and shows how the specially designed BUL45 can provide excellent performance without special screening or matching.
AN1076/D	D	Speeding up Horizontal Outputs	ON Semiconductor's SCANSWITCH transistors are designed specifically as fast drivers for horizontal outputs. Optimum performance is achieved when 5 base drive conditions are met. This successful base drive circuit starts with the output transistor's physics and works back to the horizontal oscillator.
AN1077/D	A	Adding Digital Volume Control Speakerphone	The volume control provided on many speakerphones in a potentiometer, some rotary and some linear, wired so the wiper provides a varying DC voltage to a variable gain stage. This application note will describe how to replace the potentiometer with a digital circuit which allows control of the speaker volume from a set of "UP" and "DOWN" pushbutton switches. The circuit uses only 3 standard CMOS ICs.
AN1078/D	X	New Components Simplify Brush DC Motor Drives	A variety of new components simplify the design of brush motor drives. One is a brushless motor control IC which is easily adapted to brush motors. Others include multiple Power MOSFETs in H-Bridge configuration, a new MOS turn-off device, and gain-stable opto level shifters. Several circuits illustrate how the new devices can be used in practical motor drives, in particular to control speed in both directions and operate from a single power supply.
AN1080/D	X	External-Sync Power Supply with Universal Input Voltage Range for Monitors	A variety of new components simplify the design of brush motor drives. One is a brushless motor control IC which is easily adapted to brush motors. Others include multiple Power MOSFETs in H-Bridge configuration, a new MOS turn-off device, and gain-stable opto level shifters. Several circuits illustrate how the new devices can be used in practical motor drives, in particular to control speed in both directions and operate from a single power supply.
AN1083/D	D	Basic Thermal Management of Power Semiconductors	As a rule of thumb, for every 10 C rise in junction temperature above 100 C, the operating life of the device is halved. But for various reasons, thermal management of power semiconductors is often overlooked - when the system is ready for packaging, it may be too late. A discussion of Bipolar and Power MOSFET thermal characteristics and how to measure them under various conditions.
AN1090/D	D	Understanding and Predicting Power MOSFET Switching Behavior	RC time constants and Miller capacitance have their uses, but they are not the best way to predict MOSFET switching speed or select a power MOSFETs gate drive resistor. An alternative approach that capitalizes on the nature of the load makes selection of the resistor quite simple.
AN1091/D	L	Low Skew Clock Drivers and their System Design Considerations	With microprocessor-based systems now running at 33MHz and beyond, low-skew clock drivers have become essential - ON Semiconductor produces several devices with less than 1ns skew between outputs. Unfortunately, simply plugging one of these high performance clock drivers into a board does not guarantee trouble-free operation. Careful board layout and system noise considerations must also be taken into account.
AN1092/D	L	Driving High Capacitance DRAMs in an ECL System	In systems where speed and efficiency are of utmost importance, designers often mix technologies to achieve the right combination of speed, power, cost and processing capability. ON Semiconductor's Emitter Coupled Logic (ECL) makes it possible to operate up to 1GHz clock rates. However, ECL speeds are not necessary in memory that is not accessed every clock cycle - a large CMOS DRAM is cheaper and uses less power and board space than ECL memory. The MC10H/100H660 4-bit ECL-TTL Load Reducing DRAM Driver was designed as a translator for such applications.
AN1101/D	X	One-Horsepower Off-Line Brushless Permanent Magnet Motor Drive	Brushless Permanent Magnet (BPM) motors (brushless DC motors) using MOSFET inverters are common in low voltage, variable speed applications such as disk drives. Higher voltage off-line applications can also use the same technology, but there have been problems in designing a reliable, low-cost high side driver and understanding the more subtle effects of diode snap and PCB layout. This one-horsepower off-line BPM motor drive board uses opto-isolators and a special MOSFET turn-off IC for level translation. Includes PCB artwork and parts list, and a discussion of the theory.

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AN1102/D	D	Interfacing Power MOSFETs to Logic Devices	Most popular power MOSFETs need 10 volts of gate drive to support their maximum drain current. This creates problems when attempting to drive from 5V logic. The new Logic Level power MOSFETs solve some but not all of the problems. This note discusses easy methods of directly interfacing both types of MOSFET to TTL and CMOS logic, and to microprocessors such as the M68HC11. Discusses a method of calculating switching times, to minimize switching losses, and stresses the significance of logic power supply variations.
AN1108/D	D	Design Considerations for a Two Transistor, Current Mode Forward Converter	This design for a 150W, 150KHz, two transistor, current mode forward converter illustrates solutions for noise control, feedback circuit analysis and magnetic component design < topics that often create the most problems for designers. Improved Schottky rectifiers, power MOSFETs and optocouplers < and their effects on switched mode power supply design < are also considered. Includes circuit, analysis, parts list and theoretical discussion.
AN1122/D	A	Running the MC44802A PLL Circuit	The MC44802A is the PLL portion of a tuning circuit intended for applications involving television, FM radio, and Set-Top converters up to 1.3 GHz. Coupled with a VCO and mixer, a complete tuning circuit can be formed. The tuning frequency is controlled through an MCU serial interface (I2C). As noted in the MC44802A data sheet, an MCU is recommended for sending the serial control bytes. This application note describes combining an MC68HC11E9 with an MC44802A in a tuner design. The information is sufficiently general however, that most any MCU could be used for this function. Those with a limited background in the use and programming of MCUs will find the information adequately detailed to permit a thorough understanding.
AN1207/D	A	The MC145170 in Basic HF and VHF Oscillators	Phase-locked loop (PLL) frequency synthesizers are commonly found in communication gear today. The carrier oscillator in a transmitter and local oscillator (LO) in a receiver are where PLL frequency synthesizers are utilized. In some cellular phones, a synthesizer can also be used to generate 90 MHz for an offset loop. In addition, synthesizers can be used in computers and other digital systems to create different clocks which are synchronized to a master clock.
AN1253/D	L	Improved PLL Design Method Without	This is a design guide for PLL synthesizers used in wireless products. It focuses on compact, low current and low cost synthesizers. Natural frequency and damping are not used in the calculations. The topics covered are: a) PLL-related limitations of receiver and transmitter performance. b) A simple measurement of charge pump spurious current at the reference frequency has been developed. It will be included on future datasheets. Formulas have been developed relating the spurious current at one reference frequency to other frequencies. c) Optimal loop filter component values and PLL performance where design criteria include reference modulation bandwidth, VCO modulation bandwidth, switching time, overshoot after switching time period, reference sideband level, and noise within loop bandwidth. d) Circuit and charge pump design compromises. Also design tolerance to changes in loop gain can be determined.
AN1277/D	A	Offset Reference PLLs for Fine Resolution	Frequency synthesis by use of two loops, with reference frequencies offset from each other, can provide much finer resolution or faster hopping than a single loop. Dual PLL ICs are available to make compact low-current synthesizers using the technique. Alternative techniques will be discussed, the design method described, and examples provided. This technique has been used successfully with the ON Semiconductor MC145220 dual PLL, providing 10 Hz step size, 30 MHz frequency range, and switching time of 30 ms.
AN1308/D	D	100 and 200 Watt High Fidelity Audio Amplifiers Utilizing a Wideband Low Feedback Design	A new pair of complementary bipolar power transistors – the 2SC3281 and 2SA1302 – have better linearity than earlier devices used in high power audio amplifiers. The amplifier circuits presented here use a topology that is fully complementary in design with a dual differential input. Other goals are a wide open-loop bandwidth (greater than the audio band) and minimal negative feedback (less than 25dB). The purpose is to show that a low feedback design can yield low distortion without any special distortion cancelling circuitry for localized feedback loops.

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AN1314/D	A	Automatic Line Voltage Selector	Line voltage selection for international equipment has traditionally been achieved by a manual switch, a solution that invites malfunction, damage or safety hazard due to human error. This note describes an automatic line voltage selector circuit for use in switching power supplies. It makes use of the MC34161 Voltage Monitor IC, and keeps its output voltage in an acceptable range for the remainder of the supply by sensing the amplitude of the line voltage at its input. The circuit is easy to incorporate into existing AC switchmode designs with little extra cost or space requirement.
AN1317/D	D	High-Current DC Motor Drive Uses Low On-Resistance Surface Mount MOSFETs	Surface mount technology has hitherto been used in controllers for small disk drive motors with peak currents of 1 or 2 amps. Now the availability of low ON-resistance, surface mount power MOSFETs has increased the current handling capability of surface mount technology. This application note presents a 5 amp DC motor drive board (DEVB148) using all surface mount components apart from the filter capacitor. It features a cycle-by-cycle current limit and is intended for direct control from a microcontroller.
AN1319/D	D	Design Considerations for a Low Voltage N-Channel H-Bridge Motor Drive	Complementary MOSFET half-bridges are commonly used in low voltage motor drives to simplify gate drive design. However the P-channel FET in the half-bridge usually has higher ON-resistance or is larger and more expensive than the N-channel device. The alternative is to use an N-channel half-bridge, which uses silicon more efficiently and minimizes cost and conduction losses. The trade-off is usually a more complex gate drive; this note looks at ways of minimizing gate drive complexity, and also discusses diode snap, shoot-through current and general design considerations. A design is implemented in the DEVB151 development board.
AN1320/D	D	300 Watt, 100kHz Converter Utilizes Economical Bipolar Planar Power Transistors	Although MOSFETs are often preferred for new switchmode power supply designs, ON Semiconductor has now extended the capabilities of bipolar transistors using a new planar process. This 300W forward converter operates at 100kHz, and demonstrates the performance that may be achieved with the MJW18010 planar bipolar power transistor. Discusses the merits of planar devices in this application, and provides circuit analysis for all major sections including the output transformer. The design is 84% efficient with 1% voltage regulation, at a lower cost than the MOSFET alternative.
AN1321/D	D	Brushless DC Motor Drive Incorporates Small Outline Integrated Circuit Packaged MOSFETs	Product miniaturization demands smaller components, including semiconductors. Surface mount components now include power MOSFETs in SOIC (Small Outline Integrated Circuit) surface mount packages. In particular the MMDF2C05E, an S0-16 packaged complementary half-bridge, is relatively easy to implement into a motor drive system. This application note describes a brushless DC motor drive design similar in size to those found in hard disk drives. The evaluation board DEVB156 resulted from the design; it is partitioned into control, power, feedback and motor sections.
AN1327/D	D	Very Wide Input Voltage Range, Off-line Flyback Switching Power Supply	One of the problems for power supply designers is coping with the very wide input voltage range presented by the international marketplace. Forward mode switching power supplies operate typically over a single system's range, such as 90-130V AC or 200-270V AC. Creating products for specific markets or using jumpers can be costly or at least inconvenient. This design for a discontinuous mode flyback converter can operate over a 6.6:1 input voltage range without affecting its reliability. This is done by changing its mode of operation and by using new power MOSFETs with breakdown voltage ratings of 1200V.
AN1400/D	L	MC10/100H640 Clock Driver Family I/O SPICE Modelling Kit	The difficulties of designing high-speed, controlled-impedance PC boards and the expense of reworking them makes it essential for designers to model circuit performance prior to committing to a layout. This note provides sufficient information for basic SPICE analysis on the interconnect traces driving or being driven by the 'H640, 'H641, 'H642, 'H643, 'H644 and 'H645 clock distribution chips. It includes schematics of the input, output and ESD protection structures, and package models which may affect the waveforms. A SPICE parameter set for the referenced devices is provided.
AN1401/D	L	Using SPICE to Analyze the Effects of Board Layout on System Skew designing with the MC10/100H640 Family of Clock Drivers	Illustrates the complex influences of board layout on the total skew of a system when designing with the MC10H/100H64x family of clock drivers. Discusses transmission line theory and the various termination techniques, and presents guidelines to assist designers in analyzing board layouts and loading schemes using SPICE simulations to predict and minimize the total skew of a system.

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AN1402/D	L	MC10/100H00 Translator Family I/O SPICE Modelling Kit	The difficulties of designing high-speed, controlled-impedance PC boards and the expense of reworking them – makes it essential for designers to model circuit performance prior to committing to a layout. This note provides sufficient information for basic SPICE analysis on the interconnect traces driving or being driven by the 'H600, 'H601, 'H602, 'H603, 'H604, 'H605, 'H606 and 'H607 translator chips. It includes schematics of the input, output and ESD structures, and package models which may affect the waveforms. A SPICE parameter set for the referenced devices is provided.
AN1403/D	L	FACT I/O Model Kit	This note provides SPICE information to allow users to perform system level interconnect modelling for the ON Semiconductor FACT™ logic family. It contains representative circuit schematics of the different I/O structures and a worst case package model schematic used in the FACT family. A list of SPICE parameters for the referenced transistors is included. (The information is not intended for the purpose of extensive device modelling).
AN1404/D	L	ECLinPS Circuit Performance at Non-Standard VIH Levels	When ECLinPS devices are interfaced to other technologies there may be times when the input voltages do not meet the specification detailed in the ECLinPS data book. This application note discusses the consequences of driving ECLinPS devices with an Input Voltage HIGH level which is outside the specification.
AN1405/D	L	ECL Clock Distribution Techniques	Clock skew – the time difference between supposedly simultaneous clock transitions within a system – is one of the main factors limiting system performance at high frequencies. If clock skew can be reduced, designers can increase performance without using faster logic or more complex and more expensive architectures. Emitter Coupled Logic (ECL) technologies offer a number of advantages over the CMOS and TTL alternatives; this note describes the advantages, the three skew problem areas, and methods of clock distribution to minimize skew.
AN1406/D	L	Designing with PECL (ECL at +5.0V)	Positive Emitter Coupled Logic (PECL) provides a high speed solution for the CMOS/TTL designer. The technique involves standard ECL devices running of a positive power supply. ECL, and so PECL, has long been the 'black magic' of the logic world; by breaking down the misconceptions concerning its use, CMOS and TTL designers can gain a powerful solution to the most difficult of high speed problems. This note has the details.
AN1410/D	L	Configuring and Applying the MC74HC4046A Phase-Locked Loop	Note describes a versatile device for 0.1 to 16MHz frequency synchronization.
AN1503/D	L	ECLinPS™ I/O SPICE Modelling Kit	A series of representative schematics for the different I/O circuits used in the ECLinPS and ECLinPS Lite families to allow users to perform system interconnect modelling. SPICE parameters for the transistors referenced in the schematics are also provided.
AN1504/D	L	Metastability and the ECLinPS™ Family	Examines the concept of metastability – an anomalous state caused typically by violation of set-up and hold times – with a theoretical discussion of the reasons for it. Presents an equation characterizing metastability and derives a test circuit. Metastability results are then applied to the ECLinPS family.
AN1510/D	A	Mode Indicator for the MC34118 Speakerphone	In most applications involving a normal conversation, the operation mode (receive, transmit, idle) of the MC34118 speakerphone IC is obvious to the users of the speakerphone. There are some applications, however where it is beneficial to have an indication of the operation mode. This indication may have to be visual, or logic levels to a microprocessor or other circuitry. This application note describes how to create a mode indicator for use with the MC34118 speakerphone circuit.
AN1520/D	D	HDTMOS Power MOSFETs Excel in Synchronous Rectifier Applications	The new HDTMOS technology combines VLSI techniques with the ruggedness of vertical power structures to obtain increased cell density and to provide devices with lower overall on-resistance. The reverse recovery characteristic of the parasitic body diode is also faster than in MOSFETs that use conventional technologies. This note examines the advantages of using HDTMOS transistors as synchronous rectifiers in a high power buck converter, and in a 5V DC to 3.3V DC buck converter, in order to increase circuit performance and efficiency while minimizing parts count.
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Doc Number	T*	Title	Abstract
AN1524/D	D	AC Motor Drive Using Integrated Power Stage	The AC induction motor is the workhorse of modern industry. Worldwide about 50 million motors are installed every year that have greater than 1/2 hp. Today only a small percentage of these motors utilize variable speed drives. Almost half of the variable speed AC drives sold today are in the 1 to 5 hp range. Companies producing this range of drives are under a great deal of pressure to reduce costs. Lower system cost will result in higher volumes as more applications use variable speed. The power semiconductors are a significant portion of the cost of these drives. A new module called an Integrated Power Stage may be used to reduce the cost and complexity of the power semiconductors. A functional demo board has been developed using this module for a 1 to 2 hp AC motor drive.
AN1537/D	L	MC10SX1189 I/O SPICE Modeling Kit	This application note provides the SPICE information necessary to accurately model system interconnect situations for designs which utilize the MC10SX1189 Fibre Channel Coaxial Cable Driver and Loop Resiliency Circuit.
AN1540/D	D	Application Consideration Using Insulated Gate Bipolar Transistors IGBTs	Many of the problems associated with paralleling of power devices can be greatly reduced by using IGBTs. It has been shown that the device characteristics of the IGBT device favors parallel operation as opposed to BJTs. Its dual device characteristics can be utilized to give design engineers very satisfactory performance under static and dynamic current sharing of the devices.
AN1541/D	D	Introduction to Insulated Gate Bipolar Transistors	The ideal switch for use in power conversion applications would have zero voltage drop in the ON state, infinite resistance in the OFF state, would switch with infinite speed and not need any power to make it operate. In practice, the designer must make a compromise and choose a device that suits the application with minimal loss of efficiency. Combining the low conduction losses of a BJT with the switching speed of a power MOSFET would create an optimal solid state switch. The Insulated Gate Bipolar Transistor (IGBT) offers a combination of these attributes. This note explains how it is made, how it works, and how it compares with BJTs and power MOSFETs.
AN1542/D	D	Active Inrush Current Limiting Using MOSFETs	The input filter of a power supply is an integral part of the design. Typically it incorporates an inductor and capacitors - these need to be able to provide EMI reduction and to hold up the supply in the case of a short duration line dropout, requirements which can lead to large capacitors being used, coupled with a large and heavy inductor to limit the inrush current. This note presents an innovative method of inrush current limiting which is based on a single MOSFET and a small number of other components. Design methods and simple equations are described, plus proposals for applications of the same circuit in other areas.
AN1543/D	D	Electronic Lamp Ballast Design	Although the light output of a fluorescent tube has a discontinuous spectrum, the higher efficiency brought about by electronic control makes it the best choice for energy-saving lighting systems. Until recently the lack of reliable and efficient power transistors made the design of electronic ballasts difficult - now there are transistors designed specifically for lighting applications. This comprehensive application note discusses the design criteria for electronic ballast design, including safety circuits and power factor correction, and presents demonstration circuits for a full featured electronic ballast and for a dimmable version.
AN1544/D	A	Design of Continuously Variable Slope Delta	This paper is intended to give practical guidance in designing an optimum deltamod configuration for the most common voice applications using a Continuously Variable Slope Delta Modulator/Demodulator, MC34115 or MC3418, and provide some useful SNR performance information. Delta modulation theory is briefly reviewed, and a MathCAD Version 3.1 model (see Appendix A) is presented that provides the designer with suggested parameter values and simulates the deltamod signal, given the clock frequency, input voltage function (including amplitude and frequency), and supply voltage. It is possible to methodically design a system with limited knowledge of communications theory using simple guidelines presented in this model, which is presented as a supplement to the design guidance provided by the Continuously Variable Slope Delta Modulator/Demodulator(CVSD) data sheet.
AN1546/D	D	High Voltage High Side Driver Electronic Lamp	As electronic ballasts continue to displace their old core and coil predecessors, we see increased emphasis being placed upon cost reduction, reduced part count, and overall simplification of designs. ON Semiconductor's new MPIC2151 Self Oscillating Half-Bridge Driver was developed to simplify electronic ballast designs, using Mos gated output switches in a half-bridge configuration.
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AN1547/D	D	A DC to DC Converter for Notebook Computers Using HDTMOS and Synchronous Rectification	A prime issue for low output voltage power supplies is power loss in the power semiconductors. This is especially true for notebook computers which need High Cell Density TMOS (HDTMOS) – the latest technology – to meet their high efficiency PSU requirements. Logic supplies are currently standardizing on 3.3V, forcing power supply designers to look at devices other than junction diodes for rectification. Low on-resistance power MOSFETs using HDTMOS technology can overcome the problems of poor performance, low PIV and slow reverse recovery times. This note discusses the theory and practice of a 5V to 3.3V, 4A DC to DC converter with up to 92% efficiency.
AN1548/D	A	Guidelines for Debugging MC44011 Video Decoder	Normally, the implementation of the MC44011 Multistandard video decoder is fairly simple in that there are no external adjustments, or critical components to deal with. However, since this IC contains several interrelated functions and a substantial amount of programmability, debugging an improperly working circuit can sometimes be daunting. The purpose of this document is to provide a procedure for debugging and checking the operation of this IC, and an indication of what to expect at some of the various pins.
AN1558/D	L	Retrigger Time in HC4538A Dual Precision Monostable Multivibrator	This application note characterizes the retrigger time in the MC54/74HC4538A dual precision monostable multivibrator.
AN1560/D	L	Low Voltage ECLinPS SPICE Modeling Kit	This document extends to the low voltage family of ECLinPS and ECLinPS Lite devices the information given in AN1503: ECLinPS I/O SPICE Modelling Kit. The Low Voltage ECLinPS and ECLinPS Lite devices are the newest additions to ON Semiconductor's highest performance ECL/PECL family, offering similar performance to the standard ECLinPS and ECLinPS Lite products, but at 3.3V. The kit contains all the input and output schematics for the Low Voltage devices that are available at the time of writing, and allows a system level interconnect simulation to be performed.
AN1568/D	L	Interfacing Between LVDS and ECL	LVDS (Low Voltage Differential Signaling) signals are used to interface between today's CMOS or BiCMOS ASICs supplied with 3.3V. LVDS signals are differential signals with a swing of 250 to 400 mV and a DC offset of 1.2V. External components are required for board to board data transfer or clock distribution.
AN1570/D	D	Basic Semiconductor Thermal Measurement	This application note provides basic information about power semiconductor thermal parameters, how they are measured, and how they are used. The intention is to enable the reader to better describe power semiconductors and to answer many common questions relating to their power handling capability. Four key topics are covered: Understanding basic semiconductor thermal parameters; Semiconductor thermal test equipment; Thermal parameter test procedures; Using thermal parameters to solve frequently asked thermal questions.
AN1574/D	A	A Group Listening-In Application for MC33215	The MC33215 is developed and optimized for use in fully electronic telephone sets with both handset and handsfree operation. A mode for group listening-in operation is not incorporated, but can easily be built, and is described in this application note.
AN1575/D	D	Worldwide Cordless Telephone Frequencies	The following tables contain CT-1 USA and Asia Pacific (CT-0 EUROPE) frequencies for cordless telephone. These tables reference application information provided in MC13109, MC13110, AND MC13111 Universal Cordless Telephone Subsystem Integrated Circuit technical data sheets. Channel number, Tx channel frequency, 1st LO frequency, and Tx and Rx divider values, for both handset and basestation, are listed in this addendum. The device data sheets can be found in Chapter 8 of the data book (DL128).
AN1576/D	D	Reduce Compact Fluorescent Cost with ON Semiconductor's IGBTs for Lighting	Compact Fluorescent Lamps (CFL) are becoming more popular in the consumer market because of their energy savings compared to incandescent lamps. Today's focus for manufacturers is to reduce the costs and miniaturize the circuits associated with these low pressure lamps in order to make them more attractive to the consumer. Although there are many solutions for CFL drive circuits, virtually all the electronic ballasts use the half bridge topology described here. The IGBT (Insulated Gate Bipolar Transistor) is designed specifically for CFL applications.
AN1577/D	D	ON Semiconductor's D2 Series Transistors for Fluorescent Converters	The aim of the D2 series is to drastically simplify the design of electronic ballasts for fluorescent tubes. This is possible due to the integration of two extra devices (D2); a freewheeling diode and an anti-saturation network. This application note presents the interest of the D2 structure and how to utilize this new series to solve the critical issues than the designer must deal with.

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Doc Number	T*	Title	Abstract
AN1578/D	L	MECL 10H SPICE Kit for Berkeley SPICE (PSPICE)	<p>Presents SPICE parameters and schematics for a particular set of MC10H MECL devices for use with Berkeley SPICE Type simulators (PSPICE).</p> <p>The devices are MC10H101, MC10H102, MC10H103, MC10H104, MC10H105, MC10H116, MC10H131, MC10H188, MC10H189, MC10H210 and MC10H211.</p>
AN1582/D	L	AutoBahn™ FRD/INFC Design	This application note provides detailed information about board design and interface circuits for the AutoBahn Spanceiver.
AN1593/D	A	Low Cost 1.0 A Current Source for Battery Chargers	This paper describes two designs of low cost current sources for battery charger applications based on the LM2575–ADJ switching step–down converter and the MC33341 regulator control circuit.
AN1594/D	A	Critical Conduction Mode, Flyback Switching Power Supply Using the MC33364	This application note presents a way of designing an AC–DC flyback converter that is operating in the critical conduction current mode, using the MC33364. The first section describes the main differences of operation between fixed frequency and critical conduction current mode flyback converters. The second section describes the design of a typical converter, including the design of the transformer.
AN1596/D	L	ECLinPS Lite Translator ELT Family SPICE I/O Model Kit	The objective of this kit is to provide customers with enough schematic and SPICE parameter information to perform system level interconnect modeling with the ON Semiconductor ECLinPS Lite Translator ELT family. The ELT devices MC10ELT2xD and MC100ELT2xD are single or dual supply 1 or 2 Bit translators between the TTL and ECL world. Single supply devices translate between TTL and PECL, dual supply devices translate to or from negative supplied ECL. All devices are designed as 100K compatible 100ELT2x or as 10H compatible 10ELT2x.
AN1598/D	L	H124, 125, 350–352 Translator I/O SPICE Modelling Kit	This application note provides the SPICE information necessary to accurately model system interconnect situations for designs which utilize the translator circuits of the MECL10KH family. The note includes information on the H124, H125, H350, H351, and H352 translators.
AN1601/D	D	Efficient Safety Circuit for Electronic Ballast	<p>The self oscillate circuit, commonly used in the low cost half bridge converter, is prone to thermal runaway when the fluorescent lamp does not strike. As a consequence, either the switches are over sized to sustain such a fault condition, or the circuit includes a safety network to avoid this risk.</p> <p>Although several schematics are usable to perform such a function, the one described in this paper is easy to implement and does not influence the normal operation of the converter.</p>
AN1603/D	D	Providing A Pots Phone in an ISDN Environment	This circuit is intended to provide an auxiliary circuit for the connection of a POTS phone (or answering machine, fax, etc.) to a digital communication line (ISDN, e.g.). The first two circuits assume there is a 5.0 V supply, a 12 V supply, and a microprocessor or other controlling circuit, although the circuits can also work from 5.0 V only. A single line, and a dual line system are discussed.
AN1606/D	D	1TC132 High Voltage Micro to Motor Interface	An IGBT power stage that is designed to run 3 phase AC Induction motors with input signals from an ASB124 Motion Control Development Board is presented here. It is intended to facilitate code development for the 68HC908MR24. Power ratings include motors up to 1 Horsepower and DC bus voltages up to 380 volts.
AN1607/D	D	ITC122 Low Voltage Micro to Motor Interface	A MOSFET power stage that is designed to run Brush or Brushless DC motors with input signals from an ASB124 Motion Control Development Board is presented here. It will supply up to 4 amps continuous current from DC bus voltages up to 48 volts.
AN1608/D	X	Guidelines for the Speaker in a Line–Powered SP	In the design of a speakerphone, the selection, and mounting, of a speaker plays a major role in the resulting quality of sound which the user hears in using the end product. The purpose of this application note is to provide some guidelines in selecting the optimum speaker impedance, drive configuration, and the mounting within the speakerphone enclosure. Among the key items to be discussed here are the choice of speaker impedance, and the drive configuration to the speaker.
AN1626/D	D	Noise Management in Motor Drives	During motor drive design and development, a lot of time is normally spent dealing with high noise levels that are present in these systems. A number of techniques are presented here that make the nuts and bolts of noise management easier, and therefore take a lot of redesign and debugging out of motor drive design. Many of these techniques trade some component cost for noise robustness. The benefits are reduced development cost, faster time to market, and a higher likelihood of trouble free operation in the field.
* Technology A = Analog D = Discrete L = Logic X = Mixed			

Document Abstracts

Doc Number	T*	Title	Abstract
AN1628/D	D	Understanding Power Transistors Breakdown Parameters	<p>Contains:</p> <ol style="list-style-type: none"> 1 Breakdown Mechanisms 2 Basic Power Transistor Geometry 3 Dynamic Breakdown Characteristics 4 Power Device Behavior 5 Parameters Definitions 6 Annexes
AN1631/D	D	Using PSpice to Analyze Performance of Power MOSFETs In Step-Down, Switching Regulators Employing Synchronous Rectification	<p>This paper will describe an easy method to analyze performance of various power MOSFETs in step down switching regulators using the PSpice circuit analysis tool. A comparison will be made between circuit simulation results and the measured performance described in ON Semiconductor Application Note AN1520/D.</p> <p>The utility of having a model which closely simulates switching performance is that different MOSFETs and diodes can be used in the model and comparisons can be made for proper performance vs. price, size, etc. prior to building breadboards. Actual hardware should always be used to verify performance, but a good simulation model gives the designer a means of trying various combinations of parts quickly to see how well they work in a particular circuit.</p>
AN1644/D	L	ON Semiconductor's LCX SPICE Modeling Kit	This application note provides SPICE Modeling information for ON Semiconductor's MC74LCX245 and MC74LCX16244 devices.
AN1650/D	L	Using Wire-OR Ties in ECLinPS Designs	This application note discusses the use of wire-OR ties in ECLinPS designs. Theoretical descriptions of the problems associated with wire-OR ties are included as well as an evaluation and SPICE simulation results. In addition, general guidelines and recommendations are provided to assist the system designer in successfully using wire-OR ties in ECLinPS designs.
AN1661/D	D	Low Cost Universal Motor Chopper Drive System	This application note describes the design of low cost chopper motor control drive system based on the MC68HC705MC4 microcontroller, MGP7N60E IGBT (Insulated Gate Bipolar Transistor) and the MSR860 Ultra Fast Soft Diode.
AN1662/D	D	Low Cost Universal Motor Phase Angle Drive System	This application note describes the design of a low cost phase angle motor control drive system based on the MC68HC05JJ6/ MC68HC705JJ7 microcontroller and the MAC4DC snubberless triac. The low cost single-phase power board is dedicated for universal brushed motors operating from 1000 rpm to 15,000 rpm. The operational mode, which is used in this application, is closed loop and regulated speed. This mode requires a speed sensor on the motor shaft. Such a sensor is usually a tachometer generator. The kind of motor and its drive have a high impact on many home appliance features: like cost, size, noise and efficiency. Electronic control is usually necessary when variable speed or energy savings are required.
AN1663/D	D	Low Cost Universal Motor Sensorless Phase Angle Drive System	This application note describes the design of a low cost phase angle motor control drive system based on the MC68HC05JJ6/ MC68HC705JJ7 microcontroller and the MAC4DC snubberless triac.
AN1669/D	A,D	MC44603 in a 110W Output SMPS Application	The purpose of this application note is to present a way of designing the MC44603 in a fly-back dedicated to a 110 W output power supply in two distinct cases: 110 Vrms mains and 220 Vrms mains. For this range of power, the discontinuous mode must be chosen as it limits the stress on the power switch and the out-put diodes. This kind of working can be guaranteed, thanks to the demagnetization arrangement of the MC44603. This application note considers both high and low mains voltages. In the high voltage a.c. line case, it deals with both MOSFET and BIPOLAR transistor use. In the low mains voltage case, only the MOSFET solution is considered as the inductor peak current is high.

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Document Abstracts

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AN1672/D	L	The ECL Translator Guide	<p>ECL – TTL – PECL – LVECL – LVPECL – CMOS – LVTTTL</p> <p>How To Make Them Talk To Each Other – Are You Designing with Different I/O Levels?</p> <p>This document guides you to the appropriate interface. For interfacing between ECL devices and the TTL / CMOS world discrete interfaces could be used. But the switching points are usually not controlled and may vary with temperature, device variation, or supply voltage. This results in duty cycle variation. To avoid this signal quality uncertainty translating devices with controlled switching levels and specified propagation delays and skews are available.</p>
AN1677/D	A	Get Your Best From Your LDO Designs	<p>This article contains details new high performance regulators thus giving you the ability to predict behaviors when dropped into the final circuit. This learning stage is essential when design cycles could be as low as 6 months.</p>
AN1678/D	A	Automotive Relay Replacement Evaluation Board	<p>The evaluation board is designed to drive automotive bulbs and solenoids. It is controlled by an HC11 microprocessor that can be programmed via an on board serial interface. The microcontroller delivered with the board is pre-programmed but can be re-programmed from PC with the help of software. The user can select the different loads with the buttons at the bottom of the board</p>
AN1679/D	A	Leakage Elements / Flyback Converters	<p>To evaluate the effect of the leakage inductances on the circuit performance in the design phase is a challenging task. Here a simulation program can be quite helpful. This paper reviews the magnetic and electric models of the two-winding and three-winding transformers, discusses how to extract the inductance values of the models by measurements and calculations, and how to feed a SPICE model with. Furthermore, the paper analyses the influence of the primary leakage inductance on the switch voltage waveform, provides guidelines on how to protect the switch from the voltage overshoot, and considers the effect of the secondary leakage inductances on the cross regulation of multiple-output flyback power supplies.</p>
AN1680/D	A	Design Considerations for PWM Controllers	<p>In the large family of Switch-Mode Power Supply (SMPS) components, the recently introduced high-voltage monolithic switchers start to play an important role. First of all because they provide an easy mean to instantaneously build an efficient off-line supply but also because their internal structure offers everything a designer needs: internal clock, pulse-by-pulse limitation, Leading Edge Blanking (LEB) etc. However, the internal MOSFET exhibits a low-energy capability body-diode which no longer protects the device against accidental avalanche. This element thus needs an adequate protection network against the electromagnetic leakage energy. This paper details what network is best adapted to the protection of these devices and how to predict its efficiency in the application.</p>
AN1681/D	A	Flyback Switch Mode Supply	<p>Switch Mode Power Supplies (SMPS) can operate in two different conduction modes, each one depicting the level of the current circulating in the power choke when the power switch is turned on. As will be shown, the properties of two black boxes delivering the same power levels but working in different conduction modes, will change dramatically in DC and AC conditions. The stress upon the power elements they are made of will also be affected. This article explains why the vast majority of low-power FLYBACK SMPS (off-line cellular battery chargers, VCR's etc.) operate in the discontinuous area and present a new integrated solution especially dedicated to these particular converters.</p>
AN1682/D	A	MC33157 Controller	<p>The purpose of the MC33157 is to implement all the basic functions needed to operate an electronic ballast. This integrated circuit comes in a 16 pin SOIC package and can run 10A/500 V power MOSFET operated up to 250 kHz. A simplified internal circuit, depicted in Figure 2.1, together with the data sheet, are useful to understand the MC33157. Since this Application Note is focused on the electronic ballast controller, the reader will get the technical information related to the Power Factor circuit in the ON Semiconductor Analog Data Book, DL128/D (see MC33262 data sheet).</p>

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Document Abstracts

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AN1683/D	A	SPICE Model for Hi-Volt Switchers	<p>The recent introduction of high-voltage integrated circuits (HVICs) has drastically simplified the implementation of rugged and reliable Switch Mode Power Supplies (SMPS). However, behind the apparent simplicity of the final design, SMPS complexity is still there:</p> <ul style="list-style-type: none"> a) the feedback information circulates as a current flow and no longer as a voltage level b) the feedback chains usually combines numerous feedback paths, sometimes up to three. <p>To help the designer quickly assess the choices he made and, above all secure them, a SPLICE simulator is an invaluable tool. This paper describes the development of an AC and transient model for the new ON Semiconductor MC33370 offline switchers series. The tricks given along the article will facilitate the model handling and let you immediately put it to work.</p>
AN1686/D	A	Intelligent LDO Regulator	<p>Glitch-Free Supply Transition from the 5V primary supply to the auxiliary 3.3V supply can be easily implemented for PCI/NIC and other motherboard slot cards via the MC33565 Intelligent LDO regulator. This linear regulator contains detection and logic circuitry to determine which supply is active and take appropriate action to maintain a steady 3.3V output, even as the supply planes change from "working" state to "system sleep" state.</p>
AN1689/D	A	Solutions for Low Power in SMPS	<p>The quest for low standby power represents one of the most challenging task for Switch-Mode Power Supply (SMPS) designers. This sentence becomes pregnant when you tackle very low output loads: the efficiency degrades to poor values and you barely reach 45% for outputs as low as 300 mW. Thanks to the appropriate technology, the below circuit helps you easily reach 34.8 mW when the load is disconnected ($V_{in}=85$ VAC). The consumption increases up to 44mW at high line (260 VAC). The efficiency also exhibits a good value at low loads: 67.45% @ $P_{out}=88$ mW and $V_{in}=120$ VAC.</p>
AN1692/D	A	SPICE Model Eases Feedback Loop Designs	<p>Within the wide family of Switch Mode Power Supplies (SMPS), the Flyback converters represent the preferred structure for use in small and medium power application (50–100 W) such as wall adapters, off-line battery chargers, fax machines etc. Thanks to the recent introduction of ON Semiconductor Very High Voltage Integrated Circuits (VHVICs), the design phase of a Flyback converter has almost turned into child's play: a bunch of passive components around the MC33370 and you are all set! However, the impact of the environment upon the system can be much longer to iterate in order to cover the numerous situations the converter will encounter in its future life: ESRs variations due to temperature cycles, aging of the capacitors, various types of load, load and line transients, effect of the filter stage etc.</p>
AN1695/D	A	Handling EMI in Switch Mode PWR Supply Design	<p>When designing switch mode power supplies (SMPS), undesirable noise and Electromagnetic Interference (EMI) are always present. Their effects are even more severe as the switching frequency increases, especially in applications requiring the use of small size transformer and capacitors. This application note describes the nature and sources of EMI noise, and the design techniques used to reduce their shortcomings. All the examples of the circuitry used are referred to flyback topology however, they are also applicable to any other common SMPS topology.</p>
AN4001/D	A	MC44603 in a 110W Output SMPS Application	<p>The purpose of this application note is to present a way of designing the MC44603 in a fly-back dedicated to a 110W output power supply in two distinct cases: 110Vrms mains and 220Vrms mains.</p>
AND8001/D	L	Odd Number Divide By Counters With 50% Outputs and Synchronous Clocks	<p>This application inquiries handled by the Product Applications gives opportunities to solve customer needs with new ideas and learn of ways the customer has used our devices in new applications. A couple of these calls lead to techniques of designing odd number counters with synchronous clocks and 50% outputs.</p>
AND8002/D	L	ECLinPS Lite™ and ECLinPS Plus™ Device Type and Date Code Guide	<p>Summary of ECLinPS Lite and ECLinPS Plus device labeling guidelines.</p>
AND8003/D	X	Storage and Handling of Drypacked Surface Mounted Devices (SMD)	<p>Provides customers with the necessary storage and handling guidelines to preclude component package cracking during solder reflow procedures.</p>

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AND8004/D	L	ON Semiconductor Logic Date Code and Traceability Marking	This is a summary of ON Semiconductor Logic Device, Date Code, and Traceability Marking. We want to provide our customers with easy access to this information on the web. This applications note summarizes and explains the Date Code and Traceability Marking for Logic packages. This is not intended to replace the proper documentation. To properly decode the Logic marking you need 12MRH00191A ON Semiconductor marking spec, and S.O.P. 7-19 ID of Products to Location of Test/Assy/Wafer Fab. Also, you need to know the abbreviations used for Logic products (see the appropriate Logic data sheet for the specific device naming/ordering information).
AND8005/D	D	Automatic AC Line Voltage Selector	In some cases, appliances and equipment are able to operate when supplied by two different levels of AC line voltage to their main terminals (120V or 240V). This is why, it is very common that appliances and equipment have mechanical selectors or switches as an option for selecting the level of voltage needed. Nevertheless, it is also very common that these types of equipment can suffer extensive damage caused for not putting the selector in the right position. To prevent these kinds of problems, thyristors can be used as a solution for making automatic voltage selectors in order to avoid possibilities of equipment damage due to over or low voltages AC line supplied to them.
AND8006/D	D	Electronic Starter for Fluorescent Lamps	In the large family of electronic switches, the thyristor must be considered as a low cost and powerful device for lighting applications. Thyristors can take many forms, but they have certain features in common. All of them are solid state switches that act as open circuits capable of withstanding the rated voltage until triggered. When they are triggered, thyristors become low impedance current paths and remain in that condition (i.e. conduction) until the current either stops or drops below a minimum value called the holding level. Once a thyristor has been triggered, the trigger current can be removed without turning off the device.
AND8007/D	D	Momentary Solid State Switch for Split Phase Motors	In the large family of electronic switches, the thyristor must be considered as a low cost and powerful device for motor applications. Thyristors can take many forms, but they have certain features in common. All of them are solid state switches that act as open circuits capable of withstanding the rated voltage until triggered. When they are triggered, thyristors become low impedance current paths and remain in that condition (i.e. conduction) until the current either stops or drops below a minimum value called the holding level. Once a thyristor has been triggered, the trigger current can be removed without turning off the device.
AND8008/D	D	Solid State Control Solutions for Three Phase 1 HP Motor	In all kinds of manufacturing, it is very common to have equipment that has three phase motors for doing different work functions on the production lines. Therefore, it is necessary to have the equipment for controlling the start and stop of the motors and in some cases for reversing them. One of the most common solutions for performing this control function is by using three phase magnetic starters. Thyristor must be considered as a low cost and powerful device for motor control applications. Thyristors can take many forms, but they have certain features in common. All of them are solid state switches that act as open circuits capable of withstanding the rated voltage until triggered. When they are triggered, thyristors become low impedance current paths and remain in that condition (i.e. conduction) until the current either stops or drops below a minimum value called the holding level. Once a thyristor has been triggered, the trigger current can be removed without turning off the device.
AND8009/D	L	ECLinPS Plus™ SPICE Modeling Kit	The objective of this kit is to provide customers with enough circuit schematic and SPICE parameter information to allow them to perform system level interconnect modeling for the current devices of the ECLinPS Plus logic line, ON Semiconductor's highest performance ECL family. With packaged gate delays of 160ps and output edge rates as low as 130ps this family defines the state-of-the-art in ECL logic. The ECLinPS Plus line is the newest addition to ON Semiconductor's highest performance ECL/PECL family of products. The kit is not intended to provide information necessary to perform circuit level modeling on ECLinPS Plus devices.
AND8010/D	L	ECLinPS Lite™ MC100LVELT22 SPICE Model Kit	The objective of this kit is to provide schematic and SPICE parameter information for performing system level interconnect modeling with the Low Voltage ECLinPS Lite Translator TTL to PECL "LVELT22" device. The LVELT22 device is a dual 1 Bit translator from LVTTTL/LVCMOS levels to PECL levels. This kit contains model netlists and transistor parameter descriptions for the Input and Output buffers, package models, and ESD protection networks for Input and Output circuits used by the LVELT22 device. These may be interconnected as subcircuits to simulate buffer signals.

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AND8011/D	D	High Resolution Digital Dimmer	Phase Control with Thyristors – An effective and widely used method of controlling the average power to a load through a triac is by phase control. Phase control is a method of utilizing the triac to apply the ac supply to the load for a controlled fraction of each cycle. In this mode of operation, the triac is held in an off or open condition at a time in the half cycle determined by the control circuitry. In the on condition, the circuit current is limited only by the load i.e., the entire line voltage (less the forward drop of the triac) is applied to the load.
AND8012/D	D	Solid State Overvoltage Protector for AC Line	It is very necessary and important that appliances and similar kinds of equipment have reliable protection against transient voltage conditions because it is very common that these types of equipment can suffer significant damage caused when a transient voltage appears in the ac voltage line. Transients arise internally from normal circuit operation or externally from the environment. The latter is particularly frustrating because the transient characteristics are undefined. A statistical description can apply though. Greater or smaller stresses are possible. Long duration high voltage transients are much less probable than those of lower amplitude and higher frequency.
AND8013/D	A	Application Hints on ON Semiconductor's MC34280	This paper explains the operation of PFM boost regulator inside MC34280 by mathematical derivation. Equations derived will be helpful for user to select circuit components and predict the performance of MC34280. Additionally, collection of application hints were included, potential problems when using the device can be remedied easily with the recommended methods.
AND8014/D	L	EPT SPICE Modeling Kit	<p>The objective of this kit is to provide customers with enough schematic and SPICE parameter information to perform system level interconnect modeling with the ON Semiconductor ECLinPS Plus™ Translator EPT family. The EPT devices MC100EPT2xD are single or dual supply 1 or 2 Bit translators between the TTL and ECL/PECL worlds. Single supply devices translate between TTL and PECL, dual supply devices translate to or from negative supplied ECL. All devices are designed as 100K compatible 100EPT2x.</p> <p>The kit contains representative schematics and model files for the I/O circuits used by the EPT20 and EPT22 devices. The package model should be placed on all external inputs, outputs and supply pins.</p>
AND8015/D	D	Long Life Incandescent Lamps Using SIDACs	Nowadays we are more environmentally conscious and more demanding on energy cost saving products, along with their durability. We present here an application concept which involves this simple incandescent lamp bulb in conjunction with the Bilateral Trigger semiconductor device called SIDAC, offering an alternative way to save money in energy consumption and also giving a longer life time to the lamp bulbs. The SIDAC is a high voltage bilateral trigger device that extends the trigger capabilities to significantly higher voltages and currents than have been previously obtainable, thus permitting new, cost effective applications.
AND8016/D	A	Design of Power Factor Correction Circuit Using Greenline™ Compact Power Factor Controller MC33260	The MC33260 is an active power factor controller that functions as a boost pre-converter which, meeting international standard requirement in electronic ballast and off-line power supply application. MC33260 is designed to drive a free running frequency discontinuous mode, it can also be synchronized and in any case, it features very effective protections that ensure a safe and reliable operation.
AND8017/D	D	Solid State Control for Bi-Directional Motors	Some split phase motors are able to operate in forward and reverse directions since they have two windings for these purposes. Depending on which winding is energized, the motor operates in that direction. These motors are especially used in applications for washing machines, transport belts, and all kinds of equipment in which the operation in both directions is needed. One of the most traditional ways to control these kinds of motors is through mechanical relays. Nevertheless, they have a lot of disadvantages which make them ineffective. This paper is going to show how triacs can substitute the function of the mechanical relays for controlling bi-directional motors offering a higher level of quality and reliability for control purposes.
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AND8018/D	L	Unique and Novel Uses for ON Semiconductor's New One-Gate Family	One-Gate logic devices have been in use for several years, and are nothing more than single-gate derivatives of their multi-gate cousins. Initial offerings were pioneered in Japan, to help solve particular problems the design community had encountered. Earlier, traditional ICs were packaged in 14 and 16 pin Dual-in-line Packages (DIPs), and the goal of the IC manufacturer was to get as much functionality as possible into a single-package device. Double, triple, quadruple, and quintuple versions of simple logic functions became the norm. The enormously successful 7400-TTL/LS logic family of standard bipolar logic IC's became the industry standard for nearly 20 years. Ceramic, and later plastic, dip packages became a staple item for logic designers. New, Small-Outline-Integrated-Circuit (SOIC) packages began to replace DIPs as packaging technologies evolved.
AND8020/D	L	An Introduction to VCX Logic	ON Semiconductor is introducing a .35 micron family of logic, called VCX. This family achieves a maximum propagation delay of < 3ns and can operate between 3.3 and 1.8 Volts. The family is compatible with mixed voltages, since the I/Os are tolerant to any voltage within its specification, regardless of operating voltage. Not only does VCX offer high speed, it also offers balanced drive, and is able to source or sink 24 mA.
AND8022/D	D	TSPD (Thyristor Surge Protective Devices)	The current Telecom infrastructure in special the two wire systems are exposed to the outside environment and are susceptible to any electromagnetic disturbance caused by lightning strikes during a thunderstorm or by Power Induced due to High Voltage power lines. These situation generates in the Telecom wire system very fast Transients of Voltage of Several hundreds or Volts that can harm people if they are using an unprotected telephone handset during these situations, and destroying the telecom equipment connected to the telephone line.
ANE402/D	A	130W Ringing Choke Power Supply Using TDA4601	This application note describes the multiple output SWITCHMODE power supply delivering a total output power of 130 Watts.
ANE424/D	A	50W Current Mode Controlled Offline Switch Mode	The design of a medium power Offline Switch Mode Power Supply based on the Fly-back architecture has been widely developed for the voltage controlled PWM technique. This application note describes a way to improve the dynamic characteristics of this power supply using a technique called "Current Controlled PWM". A dedicated bipolar integrated circuit, UC 3842A, has been used to achieve the current control, regulation and safety features.
AR109/D	D	Power Transistor Safe Operating Area – Special Considerations for Motor Drives	Motor drives present a unique set of safe operating area conditions to power output transistors. Starting with the basics of forward and reverse safe operating area, considerations unique to motor drives are discussed.
AR119/D	D	Dynamic Saturation Voltage – A Designer's Comparison	Dynamic saturation voltage is an often overlooked power transistor parameter. Despite first order effect on switching efficiency, it is seldom discussed. Both semiconductor manufacturers and equipment designers generally avoid specifying saturation because it is relatively difficult to measure.
AR120/D	D	Speeding Up the Very High Voltage Transistor	For an increasing number of power conversion systems, it is either necessary or desirable to select output transistors with collector-base breakdown voltages above 1,000 volts. Popular off-line power supply topologies, for example, benefit considerably from voltage ratings higher than the 650-850 volt industry standards.
AR131/D	D	Baker Clamps – Traditional Concepts Updated for Third Generation Power Transistors	Baker clamps are a well known technique for improving the dynamic performance of bipolar power transistors. They are also relatively popular. Yet, there are many subtle factors affecting performance that are not widely appreciated. As components improve, these subtle factor become more of an issue.
AR133/D	D	Multichip Power MOSFETs Beat Bipolars at High-Current Switching	Two devices bring the advantages of MOSFETs – higher speed and lower losses – to applications that call for handling currents of up to 200 A.
AR145/D	D	DPAK: The Power Package for Surface Mount Applications	Devices with ratings up to 500 volts or 14 amps can be efficiently integrated into surface-mount assemblies using this new discrete power semiconductor package.
AR160/D	D	Lossless Current Sensing with SENSEFETs Enhances Motor Drive	New power MOSFETs allow "lossless" current sensing in fractional horsepower motor drives. Once available only to IC designers, this technique brings significant benefits to servo system designs.

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AR175/D	D	A Power FET SPICE Model From Data Sheet Specs	Improved CAE models can be used as an initial analysis that will give circuit designers an idea of circuit performance and enhance breadboard evaluations.
AR177/D	D	Proper Testing Can Maximize Performance in Power MOSFETs	MOSFETs are a viable option when it comes to satisfying the needs of today's power electronics systems. Some problems do occur in certain applications, however, and you must address these problems by realistically testing the transistor to ensure successful system performance.
AR180/D	D	Electronic Ballasts	Voltage fed and current fed resonant inverter circuits for fluorescent lamp ballasts are discussed and a design example is presented.
AR181/D	D	Bipolar Transistors Excel in Off-Line Resonant Converters	Resonant converters place high voltage stresses on the switching devices and are a natural application for the new generation of high-speed bipolar power transistors.
AR183/D	L	Motorola* Grabs Lead in ECL Density Using MOSAIC III *Now ON Semiconductor	Chip density keeps steadily moving higher in most product families, and nowhere has the job been more difficult than in bipolar emitter-coupled logic.
AR194/D	D	Drive Techniques for High Side N-Channel MOSFETs	Although upper half-bridge N-channels are inevitably more difficult to drive than their P-channel complements, a variety of relatively simple straightforward circuits are described that can do the job.
AR195/D	L	Advanced ECL Family Boosts Performance Threefold	With the arrival of the next generation of standard ECL circuits, propagation delays fall to 350 ps, and system speeds rise to 800 MHz.
AR196/D	D	Understanding the Power MOSFETs Input Characteristics	The traditional method of specifying input impedance of the power MOSFET is not incorrect, but it is incomplete and often leads to confusion when it is used as a design tool. An alternate method of specifying capacitance is presented.
AR197/D	D	Packaging Trends in Discrete Surface Mount Components	As the 1990's approach, miniaturization in electronics is the name of the game. Several years ago, electronics manufacturers began mounting miniaturized components directly on the surface of printed circuit boards – and automated technique that evolved from thick film hybrids.
AR300/D	D	The Hidden Dangers of Electrostatic Discharge – ESD	You could be zapping your CMOS ICs without knowing it. With a bit of insight, and a lot of care, you can break the habit.
AR301/D	D	Solid-State Devices Ease Task of Designing Brushless DC Motors	The solid-state devices available today – linear driver ICs, sense-cell MOSFETs, and fourth-generation power MOSFETs – make motor-drive control circuitry less complex, more efficient, and more compact. With such devices, brushless dc motor drives appear more attractive as a systems solution.
AR302/D	D	Thermal Management of Surface Mount Power Devices	A metal-clad printed wiring board material is described that offers efficient thermal management of surface mount devices.
AR305/D	D	Building Push-Pull Multioctave, VHF Power Amplifiers	Twin FET packages are the heart of a unique, push-pull 300 W power amplifier. With a 50 V power supply, this broadband amplifier is easy to implement, and has excellent impedance-matching characteristics and low DC current levels.
AR314/D	A	A 60-Watt PEP Linear Amplifier	A 60 W P.E.P. linear amplifier with a gain of 40 dB and frequency range of 2–30 MHz employing RF Power FETs is described.
AR319/D	D	DPAK: A Surface Mount Package for Discrete Power Devices	The revolution in packaging electronic devices is continuing to grow. Hybrid circuit board real estate is being reduced as everything continues to shrink. Several years ago, electronic manufacturers began to mount miniature components directly to the surface of hybrid circuits. These surface mounted components are helping to meet the industries' insatiable demand for smaller, more reliable, and less expensive hybrids.
AR321/D	A	Current Sensing Simplifies Motor Control Design	PWM ICs and current-sensing MOSFETs combine for more efficient, lower-cost designs.

* Technology A = Analog D = Discrete L = Logic X = Mixed

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AR326/D	D	High-Voltage MOSFETs Simplify Flyback Design	Using 1000-volt MOSFETs increases conduction losses and silicon costs, but simplifies the design and reduces component counts to the point where MOSFETs are a cost-effective alternative to bipolar-based and multi-transistor bridge designs.
AR328/D	D	Application-Specific Transistors	Bipolar power transistors are traditionally developed as general-purpose devices, and, as a result, provide less than optimum performance in any given application. But, their design can be tailored to optimize performance in a specific application.
AR335/D	D	Ultra-Fast Rectifiers and Inductive Loads	Quite a bit has been written about the effects of avalanche current power on power MOSFETs, but very little attention has been paid to output rectifiers. They get hit by the same reverse voltage spikes and if they're not rugged enough, they won't survive.
AR338/D	X	Metal-Backed Boards Improve Thermal Performance of Power Semis	Metal-backed boards produce cooler operating temperatures for power semiconductors than conventional epoxy-glass boards. Their thermal properties are particularly useful for surface mount components that require small board real estate.
AR340/D	D	The Low Forward Voltage Schottky	The major portion of power losses in switching power supplies is in the output rectification circuits. Schottky rectifier technology appears to hold the most potential in efforts to develop more efficient rectifiers.
AR341/D	D	Power MOSFET, 1HP Brushless DC Motor Drive Withstands Commutation Stresses	Design of a 1HP off-line brushless DC motor drive accounts for switching time, PWM loss, effects of diode reverse recovery and MOSFET parasitics, and board layout.
AR345/D	D	Switched for High-Definition Displays	High-definition television (HDTV) will provide viewers with an "enhanced viewing experience." All proposed systems would deliver this experience through greater resolution and a wider aspect ratio, which can be achieved on CRT systems only by increasing the scan frequency. Doing this will require semiconductors for horizontal deflection circuits that offer greater performance than those now available.
AR348/D	X	Higher Power Levels in Surface Mount Designs	Surface mount technology (SMT) has come a long way since its beginnings in more than 20 years ago. Surface mount designs originally started out as low power applications using small signal semiconductors such as the SOT-23 transistors and leadless MELF diodes. When the DPAK package was introduced in 1985, changes began to occur in the surface mount arena.
AR450/D	D	Characterizing Overvoltage Transient Suppressors	The use of overvoltage transient suppressors for protecting electronic equipment is prudent and economically justified. For relatively low cost, expensive circuits can be safely protected by one or even several of the transient suppressors on the market today. Dictated by the type and energy of the transient, these suppressors can take on several forms.
AR514/D	A	Build Ultra-Low Dropout Regulator	Switching-regulator post regulators, battery powered apparatuses, and other applications require low-dropout linear regulators. Frequently, battery life is significantly affected by the regulator's dropout performance. This simple circuit offers a lower dropout voltage than any available monolithic regulator.
AR519/D	L	Low-Skew Clock Drivers: Which Type Is Best?	Gate, divider, phase-lock loop, and programmable delay types are available. Each must be evaluated against the specific design requirements to determine which is most suitable.
AR523/D	D	An Overview of Surface Mount Technology (SMT) for Power Supply Applications	Compared with conventional through-hole packaging, surface mount technology (SMT) offers the ability to reduce size and cost of electronic systems. Originally lagging behind in the use of SMT, power-oriented devices are now beginning to emerge that allow the production of power supplies that employ SMT. This paper looks at the present state-of-the-art in both active and passive devices that are compatible with SMT packaging.
AR563/D	L	Active SCSI Terminators Confront Critics and Gain Acceptance	Active SCSI terminators have a reputation for not being able to handle heat dissipation adequately. However, waveform measurements and calculations are proving otherwise.
AR607/D		Modular DC-DC Converter Sends Power Density Soaring	It's been a while since the last generation of so-called "brick" dc-dc converters came onto the scene. At that time, the supplies' 200 W of output power in the 4.6-by-2.4-by-0.5-in. package that has since become the industry standard seemed to be plenty.

* Technology

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Document Abstracts

Doc Number	T*	Title	Abstract
AR609/D	D	Trouble Shooting Halogen Electronic Transformers	Halogen Electronic Transformers are basic electronic step-down converters used to supply 12 V to low voltage halogen lamps. Based on a high frequency conversion they are less bulky than 50/60Hz transformers. In order to achieve a low cost, electronic transformers are designed using bipolar transistors instead of MOSFETs.
AR617/D	D	Next Generation Power MOSFETs Slash On-Resistance, Mfg Cost	Extremely low on-resistance, $R_{ds(on)}$, high density discrete power MOSFETs rely on use of conventional CMOS processes to improve performance and simplify manufacturing. A new generation of discrete power MOSFETs is based on the low cost and easily manufacturable planar Vertical DMOS technology.
AR618/D	D	Three Large Markets Drive for Low Power	To serve automotive, mobile-computing and disk-drive markets, Motorola (now ON Semiconductor) as well as many other MOSFET manufacturers have spent significant resources driving design and cost efficiencies of low-voltage power MOSFETs below 100 V drain-source breakdown voltage.
ARE402/D	D	The Electronic Control of Fluorescent Tubes	The use of fluorescent tubes, improperly named "neon tubes", is wide-spread in the consumer and industrial market. The main interest in this kind of lighting is its higher output compared with a standard incandescent bulb. The following technical paper is dedicated to the analysis of the standard ballast, the electronic approach, their constraints and solutions, carried out by ON Semiconductor from a semiconductor point of view.
EB20/D	A	Multiplier/OP Amp Circuit Detects True RMS	Mathematically, the RMS value of a function is obtained by squaring the function, averaging it over a time period and then taking the square root. In a practical sense the same technique can also be used to find the RMS value of a waveform, eliminating the thermal-response time that is prevalent in most RMS measuring circuits.
EB27A/D	D	Get 300 Watts PEP Linear Across 2 To 30 MHz From This Push-Pull Amplifier	This bulletin supplies sufficient information to build a push-pull linear amplifier for 300 watts of PEP or CW output power across the 2- to 30-MHz band. One of ON Semiconductor's new high-power transistors developed for single-sideband, MRF422, is used in this application.
EB30/D	D	Sensitive Gate SCRs - Don't Forget the Gate-Cathode Resistor	In applications of sensitive gate SCRs, the gate-cathode resistor is an important factor. Its value affects, to varying degrees, parameters such as IGT, VDRM, dV/dt , IH, leakage current and noise immunity. This bulletin discusses these relationships and gives typical data on the performance of devices in the 2N6236 (4A) family; similar relationships can be expected for the 2N5060 (800mA) family.
EB47/D	L	Event Counter and Storage Latches for High-Frequency, High-Resolution Counters	The introduction of the MECL III state-of-the-art decade counter-MC1696-makes it possible to achieve direct counting at 1.2 GHz. This engineering bulletin describes an event counter/storage latch circuit design for use in counters of high frequency and resolution, which is based on the MC1696, 1.2-GHz, BCD output counter. The design, in combination with the time base and control block described in reference 1, and 9-1/2-digit display block described in reference 2 and a suitable front end, make it possible to implement a frequency counter that counts directly at 1.2 GHz.
EB79/D	D	Pulsed fT, A Technique for Accurately Measuring the Gain Bandwidth Product of Power Transistors	Standard DC biasing techniques used in measuring fT for small-signal transistors have been used for many years with a good degree of accuracy, repeatability and correlation. However, when trying to use the relatively high DC power sometimes required for power transistor rT measurements, errors often can result. These errors are due to the change in fT with the increased transistor junction temperature, TJ, that results from the higher input bias power. The change in carrier mobility and recombination that occur at higher temperature effectively reduces hfr (the common-emitter small-signal short circuit current transfer ratio) and thus rT is accordingly reduced. To minimize this heating effect requires that the device under test (DUT) be either mounted on an efficient heat sink (ideally, an infinite sink-a situation difficult to obtain), or tested using pulse techniques.
EB85A/D	D	Full-Bridge Switching Power Supplies	A useful selection chart presenting preferred Bipolar, Power MOSFET, Rectifier and Control devices for various areas of typical 500-1000W full-bridge switching power supplies.

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Doc Number	T*	Title	Abstract
EB108/D	A	Relative efficiencies of ON Semiconductor Power Semiconductors in a PWM Motor Controller	The prime requisite of a power switch, semiconductor or otherwise, is to transfer the maximum power to the load and therefore contribute little system loss of dissipation. Additionally, the total system loss from an efficiency point of view should also include the input drive power, both forward for turning the device on and reverse for turning it off. How the relative efficiencies of the various power semiconductor switches compare will be demonstrated in a Pulse Width Modulation (PWM) application.
EB121/D	D	SCR Improves DC Motor Controller Efficiency	SCRs are commonly associated with ac applications because of their drive simplicity and inherent self turnoff when the anode current drops below the holding current. However, with proper commutating techniques, they can be as readily used in dc applications. There are several ways of commutating the SCRs off in these circuits: a) Using a series switch to open the anode circuit; b) Using a switchable commutating capacitor which reverse biases the SCR anode-cathode, or; c) Using a clamp or shunt switch across the anode-cathode, thus diverting the anode (load) current.
EB123/D	A	A Simple Brush Type DC Motor Controller	A simple and cost-effective way to drive brush type DC motors is to use power MOSFETs with a Brushless DC Motor Control IC. The low-cost MC33033 controller and integrated 8A/100V MPM3002 H-bridge combine to give a minimum parts count brush motor drive.
EB124/D	D	MOSFETs Compete with Bipolars in Flyback Power Supplies	Power MOSFETs with 400V to 500V breakdown ratings are widely used in multiple-transistor off-line power supplies. Now they can be used in flyback supplies as well, as breakdown voltages are extended to 1000V. A discussion of the advantages and disadvantages, illustrated with typical 100W MOSFET and Bipolar designs.
EB125/D	D	Testing Power MOSFET Gate Charge	Most power MOSFET manufacturers now specify Gate Charge, as well as Input Capacitance, as an indication of the drive current required to turn on the device. The data can be useful in predicting switching speeds and drive losses. Commercially available gate charge test equipment is not yet widely used, and this simple tester for both N and P-channel devices is a practical alternative for smaller users.
EB126/D	D	Ultra-Rapid Nickel-Cadmium Battery Charger	Charging NiCad batteries is a particular problem when their voltage exceeds the voltage of the available charging source. The ultra-fast charger presented here is capable of charging 8 to 12 1.5 volt batteries at 1.2 to 1.8Ah in 30 to 45 minutes from a 10 to 14 volt source – a feat made possible by the use of new sintered electrode technology by battery manufacturers. Includes PC artwork and layout.
EB128/D	D	Simple, Low-Cost Motor Controller	This low-cost DC motor controller uses the cost-effective MPM3002 SENSEFET-based H-Bridge, plus the MC34060 PWM IC. It is capable of driving a 1/3 HP, permanent magnet 90V DC motor, and includes dynamic braking and soft-start.
EB131/D	D	Curve Tracer Measurement Techniques for Power MOSFETs	Most curve tracers are designed to measure the parameters of bipolar transistors, but because of similarities in their characteristics, the same techniques can also be used to measure the parameters of power MOSFETs. This bulletin explains how, with particular reference to the Tektronix 370A Curve Tracer.
EB141/D	D	Boost MOSFETs Drive Current in Solid State AC Relay	MOSFETs are usually easy to drive because they are voltage controlled, but a problem arises when a power MOSFET is used as a high-side switch in applications such as AC or DC relays or H-bridge motor control circuits – because it is difficult to reference the gate drive circuit and supply to the MOSFET's Source. A clean and inexpensive solution is to use the voltage available at the Drain to drive the Gate.
EB201/D	D	High Cell Density MOSFETs	A few years ago an affordable 60V, 10m power transistor was only a dream (10m is the resistance of about 20cm of #22 gauge wire). Today a sub-10m power MOSFET is available housed in a standard TO-220 package. In addition, ON Semiconductor's high cell density technology, HDTMOS™, brings other advantages such as greatly improved body diode performance. The technological advances are sufficiently great that they are fundamentally changing low voltage power transistor technology. This bulletin discusses high cell density technology and its benefits for the end user.

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Document Abstracts

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EB205/D	D	ON Semiconductor GaAs Rectifiers Offer High Efficiency in a 1 MHz, 400 to 48 Volt DC-DC Converter	Efficient power conversion circuitry requires rectifiers that exhibit low forward voltage drop, low reverse recovery current, and fast recovery time. Silicon has been the material of choice for fast, efficient rectification in switched power applications. However, technology is nearing the theoretical limit for optimizing reverse recovery in silicon devices. A new material is required to increase switching speed.					
EB206/D	A	Solving Noise Problems in High Power, High Frequency Control IC Driven Power Stages	The MPIC2113 (high & low side driver) Control IC is one of a family of ON Semiconductor devices which provides a convenient and cost effective gate drive solution. The electrical design using the MPIC2113 is simple as it accepts ground-referenced logic level input signals and drives high & low side MOSFET or IGBT power transistors with an offset voltage of up to 500 V. All that is required is one MPIC2113 and a few external components.					
EB207/D	D	High Current Buffer for Control IC's	Modules and other paralleled MOS-gated power transistors can present difficulties to gate drive circuits. ON Semiconductor's family of Control IC drivers can provide large peak output currents acceptable for most applications. However, when driving the extremely large loads of many paralleled devices, excess power dissipation in the MOS-gate drive section of the Control IC may become an issue when switching above the few tens of kilohertz range. The subject of this Engineering Bulletin is a current-buffer to alleviate this problem.					
EB208/D	A	Design Check List for MPIC21XX Control IC's	Specific design checklist to be used when designing with ON Semiconductor's MPIC21xx Control Integrated Circuits.					
EB407/D	D	Basic Halogen Converter	Low voltage halogen lamps are becoming increasingly popular due to their higher quality light and increased efficiency compared to incandescent lamps. Since all modern 220/12V transformers are based on an electronic step-down converter, ON Semiconductor has developed a new series of bipolar power devices that can handle the full range of power values requested for these applications. This bulletin discusses the basic converter circuit and the most common design trade-offs. Includes a short-circuit detection network.					
EB415/D	L	Extend SPI Addressing with the MC74HC595	This logic reduces the number of parallel port lines required for generating SPI chip selects by putting them on the slave end of the SPI bus. In this way, chip select signals can be generated remotely from the SPI master. The main advantage of this technique is that we now have a true 5-wire bus, capable of supporting an almost unlimited number of remote slave devices.					
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">* Technology</td> <td style="padding: 2px;">A = Analog</td> <td style="padding: 2px;">D = Discrete</td> <td style="padding: 2px;">L = Logic</td> <td style="padding: 2px;">X = Mixed</td> </tr> </table>				* Technology	A = Analog	D = Discrete	L = Logic	X = Mixed
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MOTOROLA SPS STANDARD DOCUMENT TYPE DEFINITIONS

REFERENCE MANUAL

A Reference Manual is a publication that contains a comprehensive system or device-specific description of the structure and function (operation) of a particular part/system; used overwhelmingly to describe the functionality of a microprocessor, microcontroller, or some other sub-micron sized device. Procedural information in a Reference Manual is limited to less than 40 percent (usually much less).

USER'S GUIDE

A User's Guide contains procedural, task-oriented instructions for using or running a device or product. A User's Guide differs from a Reference Manual in the following respects:

- * Majority of information (> 60%) is procedural, not functional, in nature
- * Volume of information is typically less than for Reference Manuals
- * Usually written more in active voice, using second-person singular (you) than is found in Reference Manuals
- * May contain photographs and detailed line drawings rather than simple illustrations that are often found in Reference Manuals

POCKET GUIDE

A Pocket Guide is a pocket-sized document that contains technical reference information. Types of information commonly found in pocket guides include block diagrams, pinouts, alphabetized instruction set, alphabetized registers, alphabetized third-party vendors and their products, etc.

ADDENDUM

A documentation Addendum is a supplemental publication that contains missing information or replaces preliminary information in the primary publication it supports. Individual addendum items are published cumulatively. Addendums end with the next revision of the primary document.

APPLICATION NOTE

An Application Note is a document that contains real-world application information about how a specific Motorola device/product is used with other Motorola or vendor parts/software to address a particular technical issue. Parts and/or software must already exist and be available.

A document called "Application-Specific Information" is not the same as an Application Note.

SELECTOR GUIDE

A Selector Guide is a tri-fold (or larger) document published on a regular basis (usually quarterly) by many, if not all, divisions, that contains key line-item, device-specific information for particular product families. Some Selector Guides are published in book format and contain previously published information.

PRODUCT PREVIEW

A Product Preview is a summary document for a product/device under consideration or in the early stages of development. The Product Preview exists only until an "Advance Information" document is published that replaces it. The Product Preview is often used as the first section or chapter in a corresponding reference manual. The Product Preview displays the following disclaimer at the bottom of the first page: "Motorola reserves the right to change or discontinue this product without notice."

ADVANCE INFORMATION


The Advance Information document is for a device that is NOT fully MC-qualified. The Advance Information document is replaced with the Technical Data document once the device/part becomes fully MC-qualified. The Advance Information document displays the following disclaimer at the bottom of the first page: "This document contains information on a new product. Specifications and information herein are subject to change without notice."

TECHNICAL DATA

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