6.1.1 Definiciones y Terminología.

Varistor.

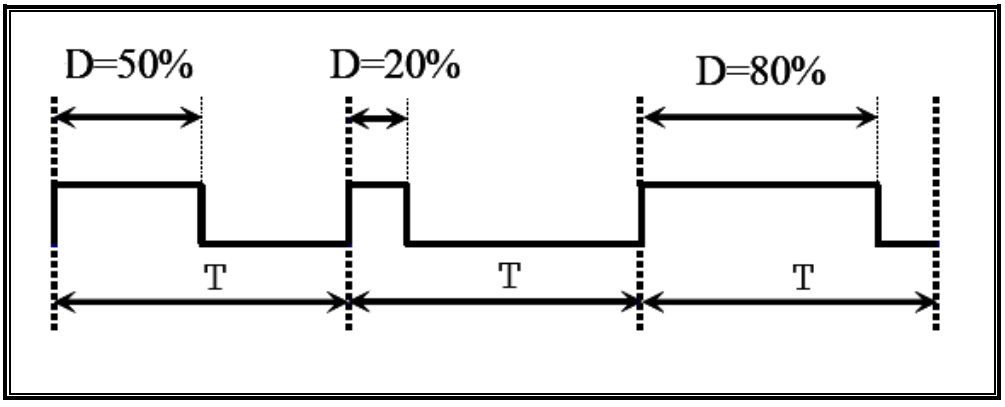
Un varistor es un componente que protege a los circuitos electrónicos de variaciones y picos bruscos de tensión, cuya resistencia óhmica disminuye cuando el voltaje que se le aplica aumenta. Se coloca en paralelo al circuito y de esta forma absorbe todos los picos transitorios mayores a su tensión nominal. El varistor tiene un tiempo de respuesta rápido y proporcionan una protección fiable y económica.

Características:

- Amplia gama para el manejo de voltajes – desde 14V a 550V.
- Alta capacidad de absorción de energía respecto a las dimensiones del componente.
- El tiempo de respuesta es instantáneo, absorbiendo el transitorio en el momento que ocurre.
- Tiene buena disipación de energía.
- Alto grado de aislamiento.

PWM (Pulse Wide Modulation).

El PWM (Modulador de ancho de pulso) es un circuito de control de frecuencia y corriente, por medio de una señal de onda cuadrada modulada para transmitir información a través de un canal de comunicaciones o para controlar la cantidad de energía que se envía a una carga. Los parámetros fundamentales del PWM son la frecuencia de oscilación (f), el periodo (T) y el ciclo de trabajo (D).



Viper.

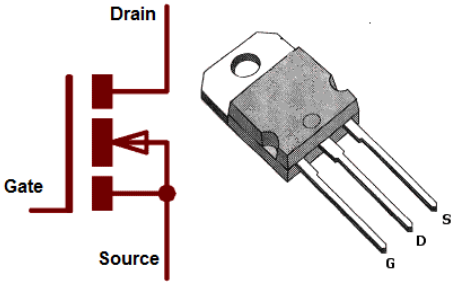
El viper es un dispositivo semiconductor que combina un modo de corriente especializado controlado por un PWM y un MOSFET de alto poder en el mismo circuito integrado. Su control interno de circuitos ofrece los siguientes beneficios:

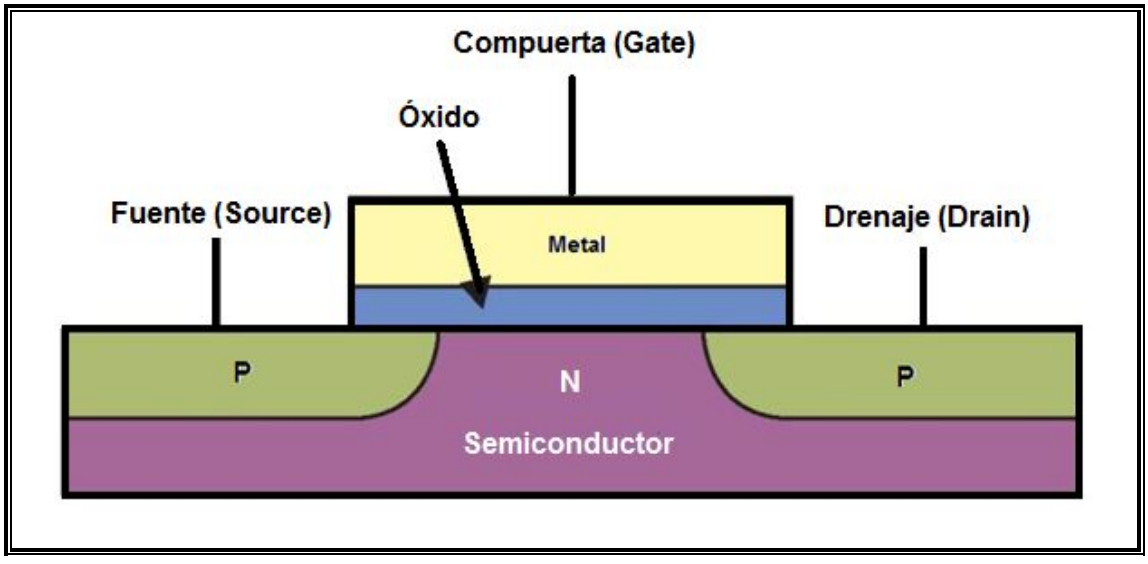
- Amplio rango de voltaje de entrada.
- Modo de control de corriente.
- Protección contra sobre temperatura, corriente y voltaje.

MOSFET.

Metal Oxide Semiconductor Field Effect Transistor.

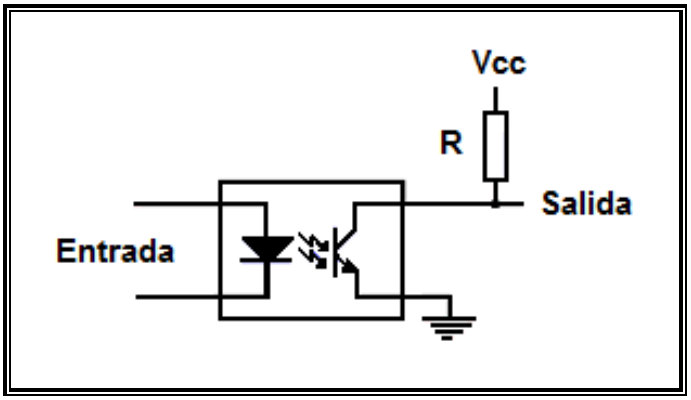
Es un transistor de efecto de campo basado en la estructura MOS, consiste en un condensador cuya armadura es metálica y se le conoce como compuerta (Gate), el dieléctrico se forma con un óxido del semiconductor del sustrato, y la otra armadura es un semiconductor, que llamaremos sustrato tipo especial de transistor FET que tiene una versión NPN y otra PNP.





Optoacoplador.

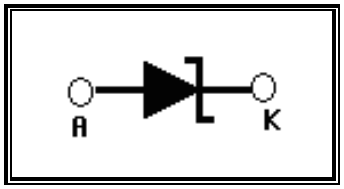
El Optoacoplador es un dispositivo de emisión y recepción de luz, que funciona como un interruptor; se compone de un diodo LED y un fototransistor, de manera de que cuando el diodo LED emite luz, ilumine el fototransistor y conduzca. Estos dos elementos están acoplados de la forma más eficiente posible.



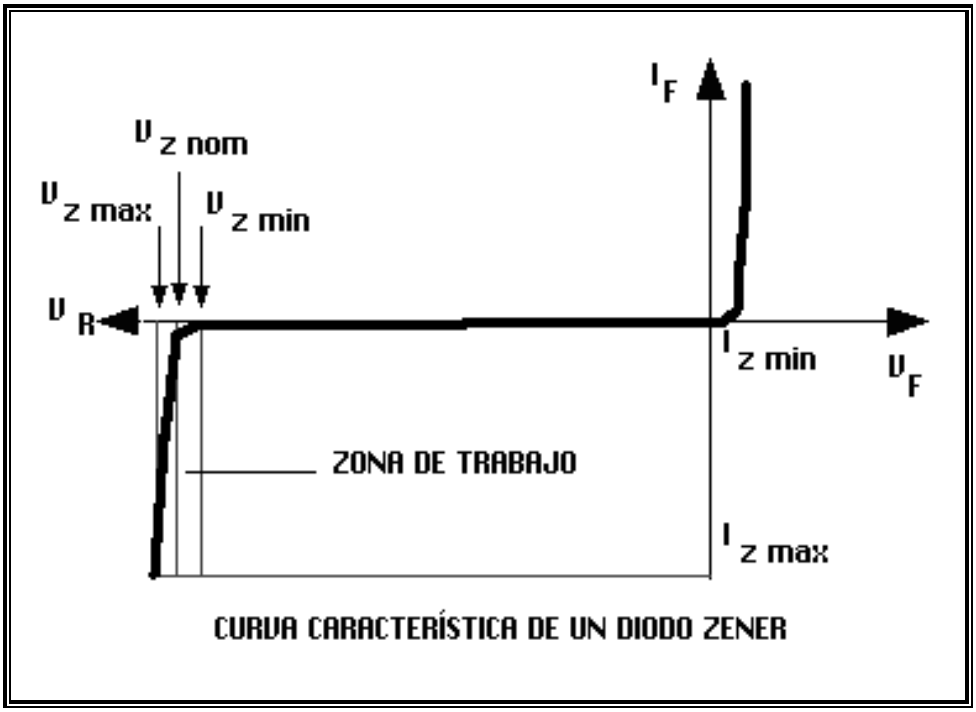
La corriente de salida I_C del optocoplador (corriente de colector del fototransistor) es proporcional a la corriente de entrada I_F (corriente en el diodo LED). La relación entre estas dos corrientes se llama razón de transferencia de corriente (CTR) y depende de la temperatura ambiente. A mayor temperatura ambiente, I_C es mayor para la misma corriente I_F. El optoacoplador es un dispositivo sensible a la frecuencia y el CTR disminuye al aumentar ésta.

ZENER.

Es un tipo de diodo que funciona exclusivamente en la zona de ruptura; esta tensión de ruptura depende de las características de construcción del diodo. Polarizado en directa actúa como un diodo normal y por tanto no se utiliza en dicho estado.



El efecto zener se basa en la aplicación de tensiones inversas que originan fuertes campos eléctricos que causan la ruptura de los enlaces entre átomos, dejando así electrones libres capaces de establecer la conducción.



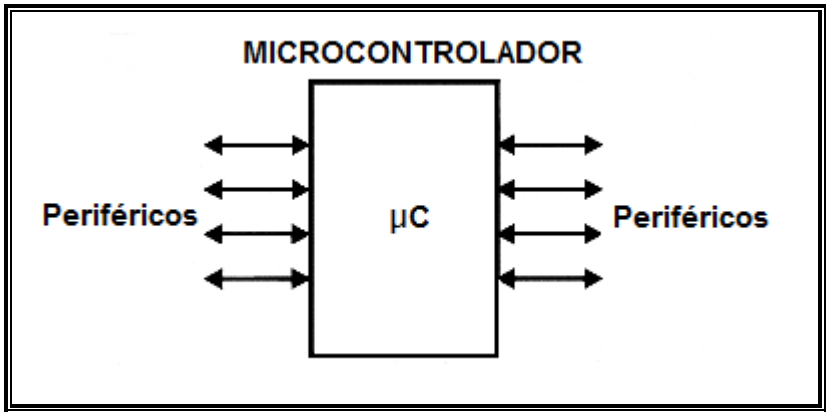
CURVA CARACTERÍSTICA DE UN DIODO ZENER

Drivers.

Un driver es un software o dispositivo electrónico que sirve de intermediario entre el hardware y el sistema operativo. Su finalidad como software es la de permitir extraer el máximo de las funciones del dispositivo para el cual ha sido diseñado. El driver como dispositivo electrónico es un circuito integrado, el cual gestionará instrucciones de control para diferentes aplicaciones.

Microcontrolador.

Un microcontrolador es un dispositivo electrónico capaz de llevar a cabo procesos lógicos, en un solo circuito integrado que contiene: la unidad de proceso, la memoria RAM, memoria ROM, puertos de entrada, salida y otros periféricos. Estos procesos o acciones son programados a partir de un algoritmo y en función de algún lenguaje de programación por el usuario.



6.1.2 Hojas de Especificación (Data Sheet).

VIPer12ADIP
VIPer12AS

LOW POWER OFF LINE SMPS PRIMARY SWITCHER

TYPICAL POWER CAPABILITY

Mains type	SO-8	DIP8
European (195 - 265 Vac)	8 W	13 W
US / Wide range (85 - 265 Vac)	5 W	8 W

- FIXED 60 KHZ SWITCHING FREQUENCY
- 9V TO 38V WIDE RANGE V_{DD} VOLTAGE
- CURRENT MODE CONTROL
- AUXILIARY UNDERVOLTAGE LOCKOUT WITH HYSTERESIS
- HIGH VOLTAGE START UP CURRENT SOURCE
- OVERTEMPERATURE, OVERCURRENT AND OVERVOLTAGE PROTECTION WITH AUTORESTART

SO-8

DIP-8

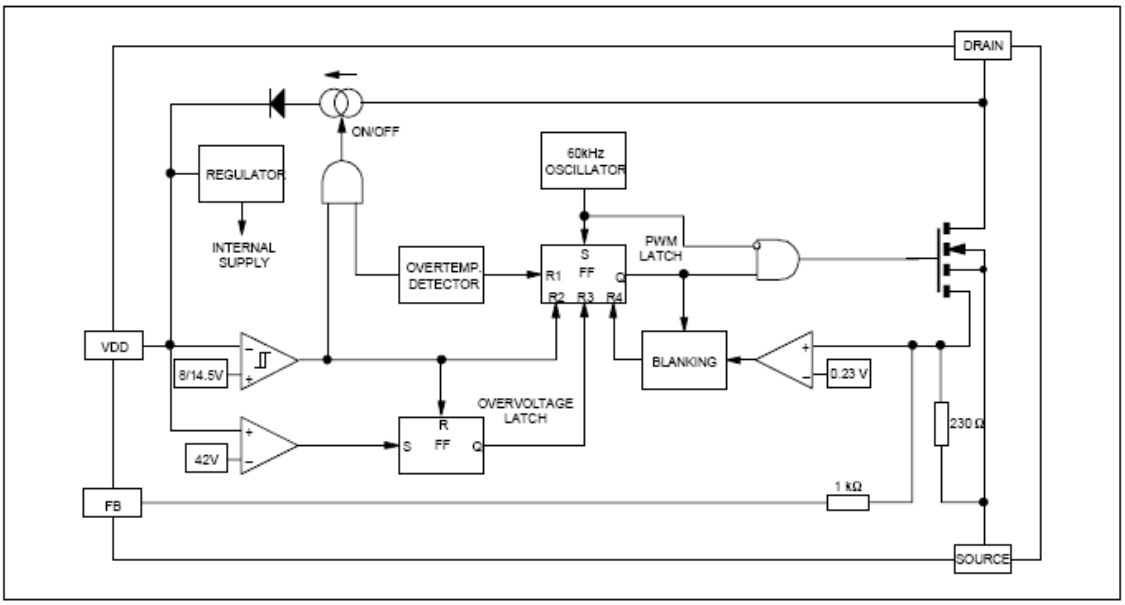
ORDER CODES		
PACKAGE	TUBE	T&R
SO-8	VIPer12AS	VIPer12AS13TR
DIP-8	VIPer12ADIP	

DESCRIPTION

The VIPer12A combines a dedicated current mode PWM controller with a high voltage Power MOSFET on the same silicon chip. Typical applications cover off line power supplies for battery charger adapters, standby power supplies for TV or monitors, auxiliary supplies for motor control, etc. The internal control circuit offers the following benefits:

- Large input voltage range on the V_{DD} pin accommodates changes in auxiliary supply voltage. This feature is well adapted to battery charger adapter configurations.
- Automatic burst mode in low load condition.
- Overvoltage protection in hiccup mode.

BLOCK DIAGRAM

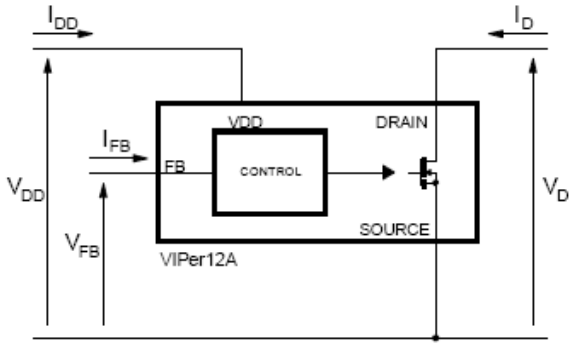


VIPer12ADIP / VIPer12AS

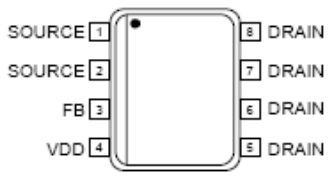
PIN FUNCTION

Name	Function
V_{DD}	Power supply of the control circuits. Also provides a charging current during start up thanks to a high voltage current source connected to the drain. For this purpose, an hysteresis comparator monitors the V_{DD} voltage and provides two thresholds: - V_{DDon}: Voltage value (typically 14.5V) at which the device starts switching and turns off the start up current source. - V_{DDoff}: Voltage value (typically 8V) at which the device stops switching and turns on the start up current source.
SOURCE	Power MOSFET source and circuit ground reference.
DRAIN	Power MOSFET drain. Also used by the internal high voltage current source during start up phase for charging the external V_{DD} capacitor.
FB	Feedback input. The useful voltage range extends from 0V to 1V, and defines the peak drain MOSFET current. The current limitation, which corresponds to the maximum drain current, is obtained for a FB pin shorted to the SOURCE pin.

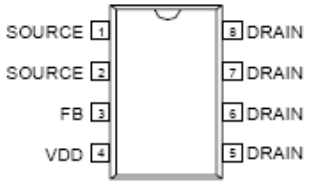
CURRENT AND VOLTAGE CONVENTIONS



CONNECTION DIAGRAM



SO-8



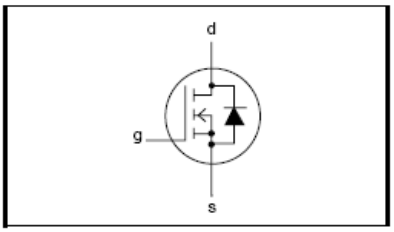
DIP8

N-channel TrenchMOS™ transistor IRF640, IRF640S

FEATURES

- **'Trench'** technology
- Low on-state resistance
- Fast switching
- Low thermal resistance

SYMBOL



QUICK REFERENCE DATA

V_{DSS} = 200 V

I_D = 16 A

$R_{DS(ON)} \leq 180\ m\Omega$

GENERAL DESCRIPTION

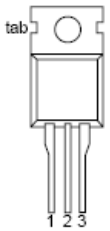
N-channel, enhancement mode field-effect power transistor using **Trench** technology, intended for use in off-line switched mode power supplies, T.V. and computer monitor power supplies, d.c. to d.c. converters, motor control circuits and general purpose switching applications.

The IRF640 is supplied in the SOT78 (TO220AB) conventional leaded package.
The IRF640S is supplied in the SOT404 (D^2PAK) surface mounting package.

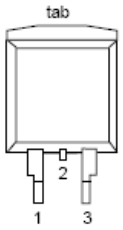
PINNING

PIN	DESCRIPTION
1	gate
2	drain[1]
3	source
tab	drain

SOT78 (TO220AB)



SOT404 (D^2PAK)



LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DSS}	Drain-source voltage	T_j = 25 °C to 175°C	-	200	V
V_{DGR}	Drain-gate voltage	T_j = 25 °C to 175°C; R_{GS} = 20 kΩ	-	200	V
V_{GS}	Gate-source voltage		-	± 20	V
I_D	Continuous drain current	T_{mb} = 25 °C; V_{GS} = 10 V	-	16	A
		T_{mb} = 100 °C; V_{GS} = 10 V	-	11	A
I_{DM}	Pulsed drain current	T_{mb} = 25 °C	-	64	A
P_D	Total power dissipation	T_{mb} = 25 °C	-	136	W
T_j, T_{stg}	Operating junction and storage temperature		- 55	175	°C

AVALANCHE ENERGY LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
E_{AS}	Non-repetitive avalanche energy	Unclamped inductive load, I_{AS} = 6.2 A; t_p = 720 µs; T_j prior to avalanche = 25˚C; $V_{DD} \leq 25$ V; R_{GS} = 50 Ω; V_{GS} = 10 V; refer to fig;14	-	580	mJ
I_{AS}	Peak non-repetitive avalanche current		-	16	A

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Thermal resistance junction to mounting base		-	-	1.1	K/W
$R_{th\ j\text{-}a}$	Thermal resistance junction to ambient	SOT78 package, in free air	-	60	-	K/W
		SOT404 package, pcb mounted, minimum footprint	-	50	-	K/W

THERMAL RESISTANCES

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$R_{th\ j\text{-}mb}$	Thermal resistance junction to mounting base		-	-	1.1	K/W
$R_{th\ j\text{-}a}$	Thermal resistance junction to ambient	SOT78 package, in free air	-	60	-	K/W
		SOT404 package, pcb mounted, minimum footprint	-	50	-	K/W

ELECTRICAL CHARACTERISTICS

T_j= 25˚C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V; I_D = 0.25 mA;	200	-	-	V
		T_j = -55˚C	178	-	-	V
$V_{GS(TO)}$	Gate threshold voltage	$V_{DS} = V_{GS}$; I_D = 1 mA	2	3	4	V
		T_j = 175˚C	1	-	-	V
		T_j = -55˚C	-		6	V
$R_{DS(ON)}$	Drain-source on-state resistance	V_{GS} = 10 V; I_D = 8 A	-	130	180	mΩ
		T_j = 175˚C	-	-	522	mΩ
I_{GSS}	Gate source leakage current	V_{GS} = ± 20 V; V_{DS} = 0 V	-	10	100	nA
I_{DSS}	Zero gate voltage drain current	V_{DS} = 200 V; V_{GS} = 0 V;	-	0.05	10	µA
		V_{DS} = 160 V; V_{GS} = 0 V; T_j = 175˚C	-	-	250	µA
$Q_{g(tot)}$	Total gate charge	I_D = 18 A; V_{DD} = 160 V; V_{GS} = 10 V	-	-	63	nC
Q_{gs}	Gate-source charge		-	-	12	nC
Q_{gd}	Gate-drain (Miller) charge		-	-	35	nC
$t_{d\ on}$	Turn-on delay time	V_{DD} = 100 V; R_D = 5.6 Ω;	-	12	-	ns
t_r	Turn-on rise time	V_{GS} = 10 V; R_G = 5.6 Ω	-	45	-	ns
$t_{d\ off}$	Turn-off delay time	Resistive load	-	54	-	ns
t_f	Turn-off fall time		-	38	-	ns
L_d	Internal drain inductance	Measured tab to centre of die	-	3.5	-	nH
L_d	Internal drain inductance	Measured from drain lead to centre of die (SOT78 package only)	-	4.5	-	nH
L_s	Internal source inductance	Measured from source lead to source bond pad	-	7.5	-	nH

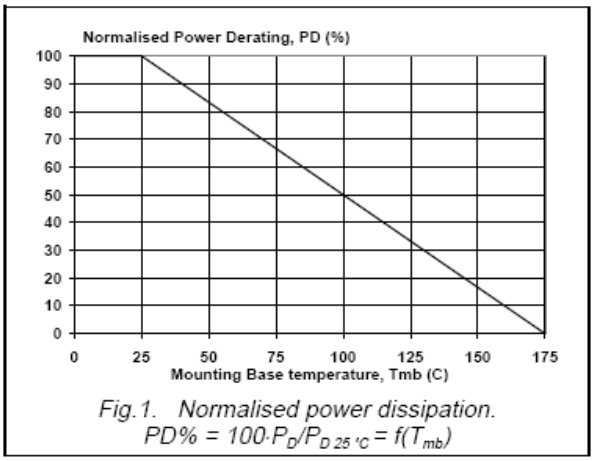


Fig.1. Normalised power dissipation.
$PD\% = 100 \cdot P_D / P_{D\ 25\ °C} = f(T_{mb})$

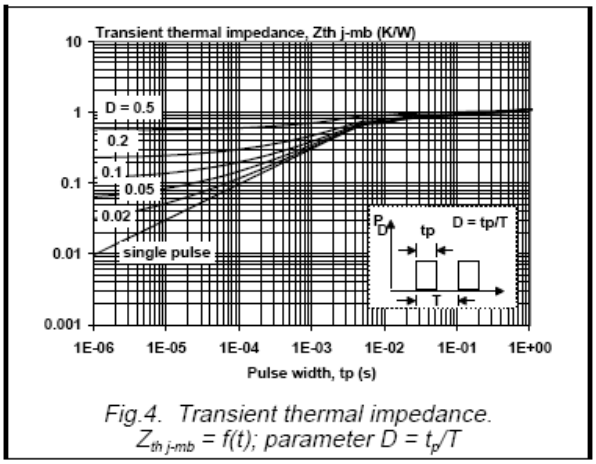


Fig.4. Transient thermal impedance.
$Z_{th\ j\text{-}mb} = f(t)$; parameter $D = t_p/T$

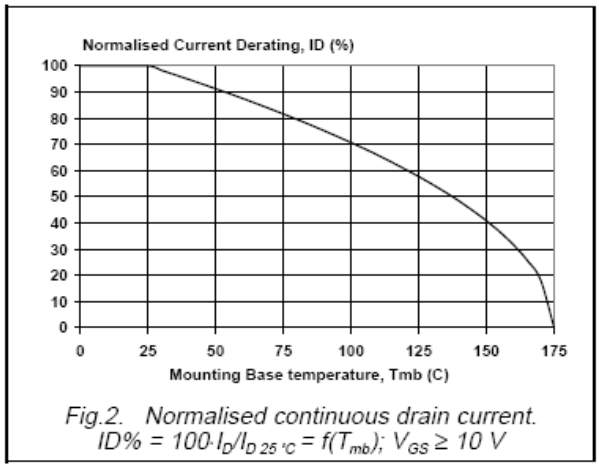


Fig.2. Normalised continuous drain current.
$ID\% = 100 \cdot I_D / I_{D\ 25\ °C} = f(T_{mb})$; $V_{GS} \geq 10$ V

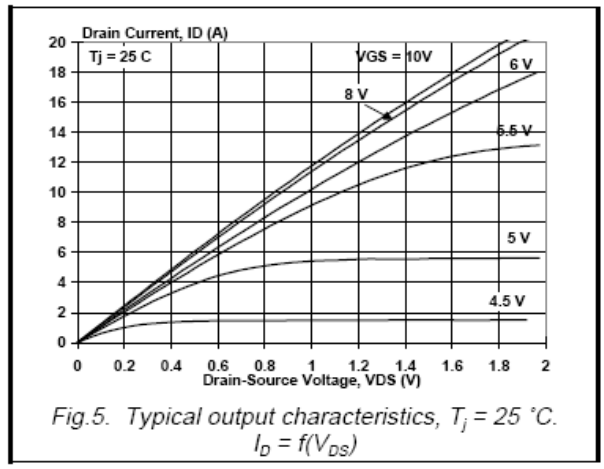


Fig.5. Typical output characteristics, $T_j = 25$ °C.
$I_D = f(V_{DS})$

FAIRCHILD SEMICONDUCTOR®

www.fairchildsemi.com

UC3842/UC3843/UC3844/UC3845

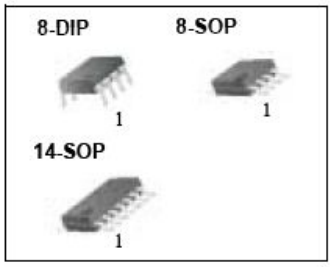
SMPS Controller

Features

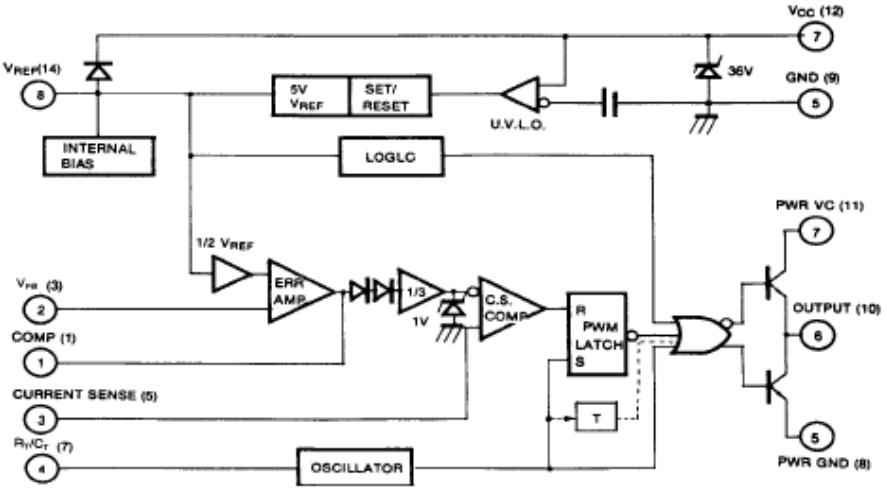
- Low Start up Current
- Maximum Duty Clamp
- UVLO With Hysteresis
- Operating Frequency up to 500KHz

Description

The UC3842/UC3843/UC3844/UC3845 are fixed frequencycurrent-mode PWM controller. They are specially designed for Off-Line and DC to DC converter applications with minimum external components. These integrated circuits feature a trimmed oscillator for precise duty cycle control, a temperature compensated reference, high gain error amplifier, current sensing comparator and a high current totempole output for driving a Power MOSFET. The UC3842 and UC3844 have UVLO thresholds of 16V (on) and 10V (off). The UC3843 and UC3845 are 8.5V(on) and 7.9V (off). The UC3842 and UC3843 can operate within 100% duty cycle. The UC3844 and UC3845 can operate with 50% duty cycle.



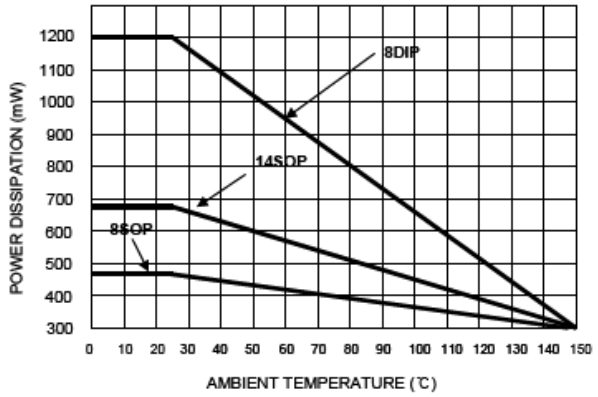
Internal Block Diagram



Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Supply Voltage	VCC	30	V
Output Current	IO	±1	A
Analog Inputs (Pin 2.3)	V(ANA)	-0.3 to 6.3	V
Error Amp Output Sink Current	ISINK (E.A)	10	mA
Power Dissipation at $T_A \leq 25°C$ (8DIP)	P_D(Note1,2)	1200	mW
Power Dissipation at $T_A \leq 25°C$ (8SOP)	P_D(Note1,2)	460	mW
Power Dissipation at $T_A \leq 25°C$ (14SOP)	P_D(Note1,2)	680	mW
Storage Temperature Range	TSTG	-65 ~ +150	°C
Lead Temperature (Soldering, 10sec)	TLEAD	+300	°C

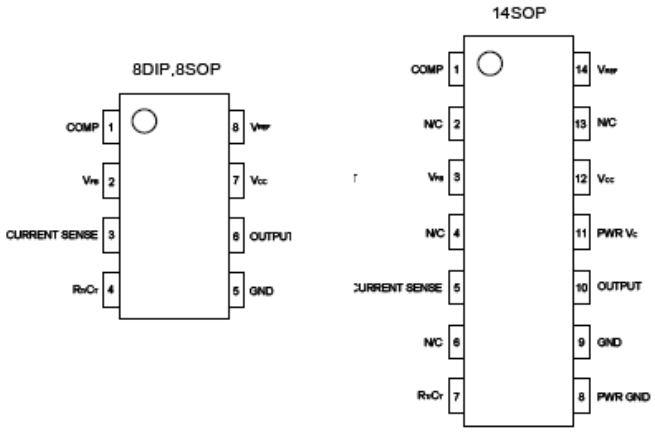
Power Dissipation Curve



Thermal Data

Characteristic	Symbol	8-DIP	8-SOP	14-SOP	Unit
Thermal Resistance Junction-ambient	Rthj-amb(MAX)	100	265	180	°C/W

Pin Array



Electrical Characteristics

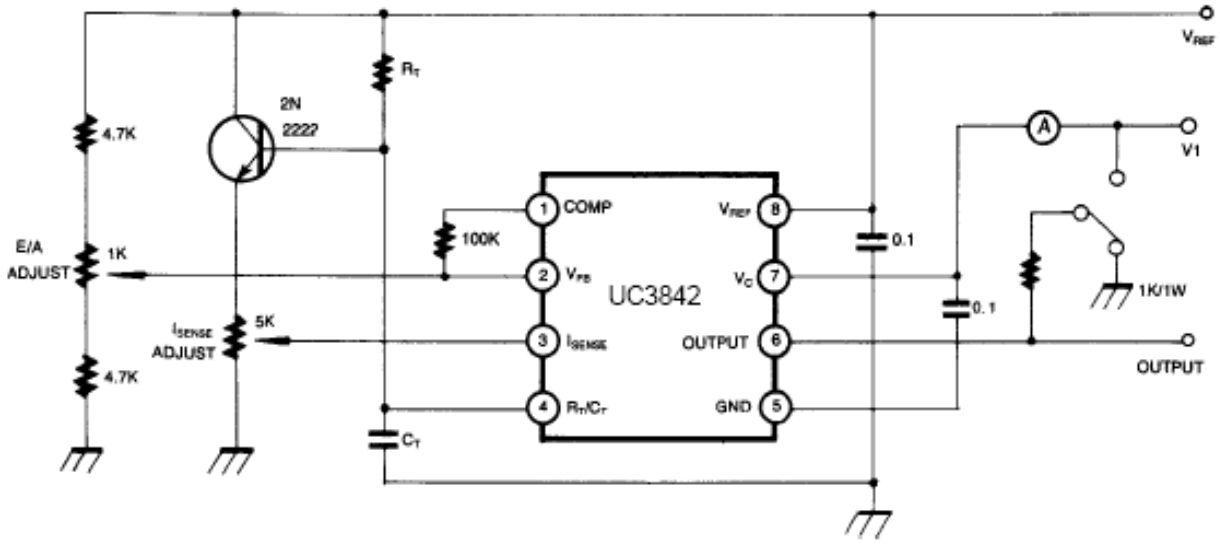
(V_{CC}=15V, R_T=10kΩ, C_T=3.3nF, T_A= 0°C to +70°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
REFERENCE SECTION						
Reference Output Voltage	V_{REF}	T_J = 25°C, I_{REF} = 1mA	4.90	5.00	5.10	V
Line Regulation	ΔVREF	12V ≤ V_{CC} ≤ 25V	-	6	20	mV
Load Regulation	ΔVREF	1mA ≤ IREF ≤ 20mA	-	6	25	mV
Short Circuit Output Current	I_{SC}	T_A = 25°C	-	-100	-180	mA
OSCILLATOR SECTION						
Oscillation Frequency	f	T_J = 25°C	47	52	57	kHz
Frequency Change with Voltage	$\Delta f/\Delta V_{CC}$	12V ≤ V_{CC} ≤ 25V	-	0.05	1	%
Oscillator Amplitude	V_{OSC}	-	-	1.6	-	V_{P-P}

Electrical Characteristics (Continued)

(V_{CC}=15V, R_T=10kΩ, C_T=3.3nF, T_A= 0°C to +70°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
PWM SECTION						
Max. Duty Cycle	D(Max)	UC3842/UC3843	95	97	100	%
	D(Max)	UC3844/UC3845	47	48	50	%
Min. Duty Cycle	D(MIN)	-	-	-	0	%
TOTAL STANDBY CURRENT						
Start-Up Current	I_{ST}	-	-	0.45	1	mA
Operating Supply Current	$I_{CC(OPR)}$	V_{pin3}=V_{pin2}=ON	-	14	17	mA
Zener Voltage	VZ	I_{CC} = 25mA	30	38	-	V



MC68HC908QY4A
Rev. 0
12/2005

freescale™ semiconductor

General Description

Introduction

The MC68HC908QY4A is a member of the low-cost, high-performance M68HC08 Family of 8-bit microcontroller units (MCUs). All MCUs in the family use the enhanced M68HC08 central processor unit (CPU08) and are available with a variety of modules, memory sizes and types, and package types.

Table 1-1. Summary of Device Variations

Device	FLASH Memory Size	ADC	Pin Count
MC68HC908QT1A	1536 bytes	—	8 pins
MC68HC908QT2A	1536 bytes	6 channel, 10 bit	8 pins
MC68HC908QT4A	4096 bytes	6 channel, 10 bit	8 pins
MC68HC908QY1A	1536 bytes	—	16 pins
MC68HC908QY2A	1536 bytes	6 channel, 10 bit	16 pins
MC68HC908QY4A	4096 bytes	6 channel, 10 bit	16 pins

Features

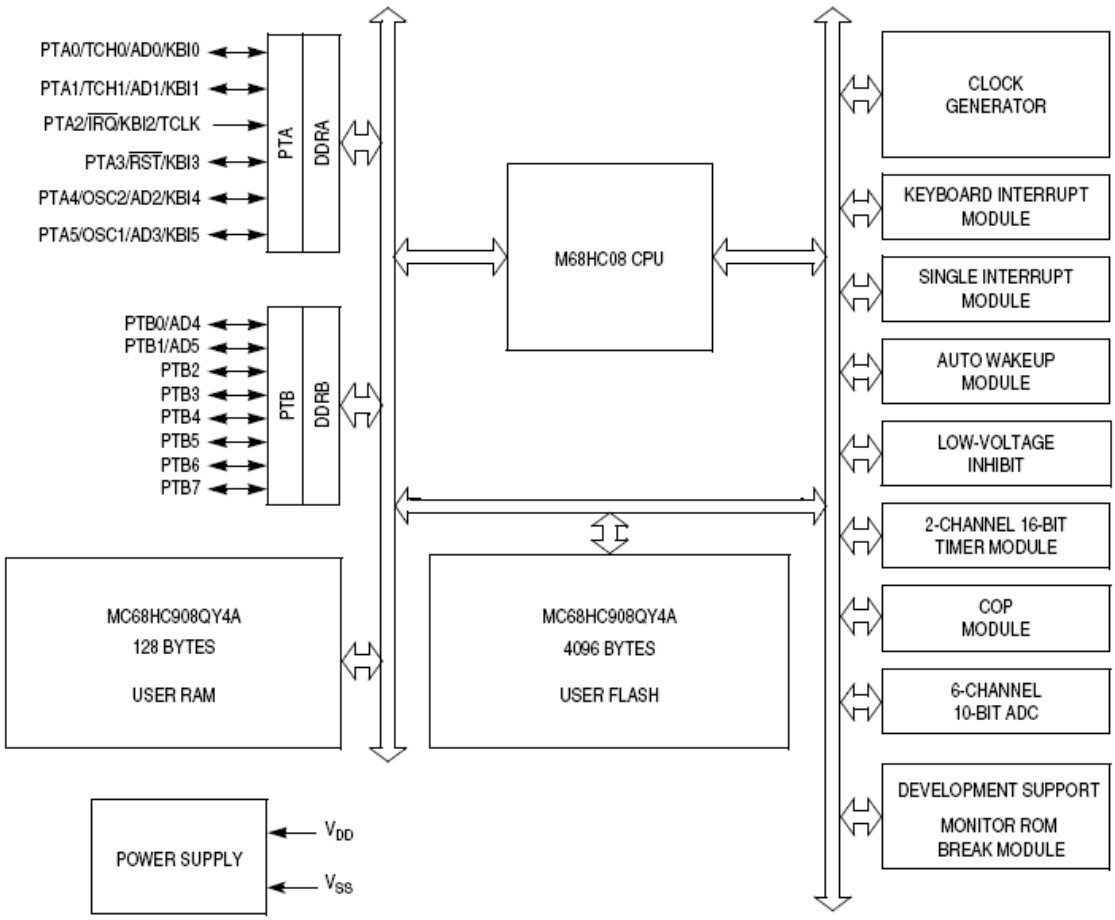
Features include:

- High-performance M68HC08 CPU core
- Fully upward-compatible object code with M68HC05 Family
- 5-V and 3-V operating voltages (V_{DD})
- 8-MHz internal bus operation at 5 V, 4-MHz at 3 V
- Trimmable internal oscillator
  - Software selectable 1 MHz, 2 MHz, or 3.2 MHz internal bus operation
  - 8-bit trim capability
  - ±25% untrimmed
  - Trimmable to approximately 0.4%(1)
- Software selectable crystal oscillator range, 32–100 kHz, 1–8 MHz and 8–32 MHz
- Software configurable input clock from either internal or external source
- Auto wakeup from STOP capability using dedicated internal 32-kHz RC or bus clock source
- On-chip in-application programmable FLASH memory
  - Internal program/erase voltage generation
  - Monitor ROM containing user callable program/erase routines
  - FLASH security

- On-chip random-access memory (RAM)
- 2-channel, 16-bit timer interface (TIM) module
- 6-channel, 10-bit analog-to-digital converter (ADC) with internal bandgap reference channel (ADC10)

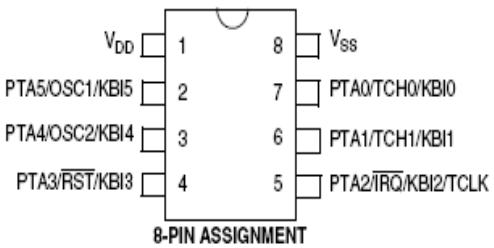
MCU Block Diagram

shows the structure of the MC68HC908QY4A.

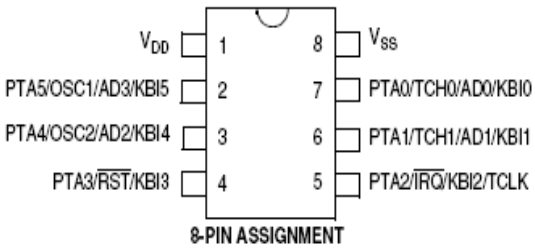


Pin Assignments

The MC68HC908QT8 is available in 8-pin packages and the MC68HC908QB8, MC68HC908QB4 and MC68HC908QY8 in 16-pin packages. shows the pin assignment for these packages.

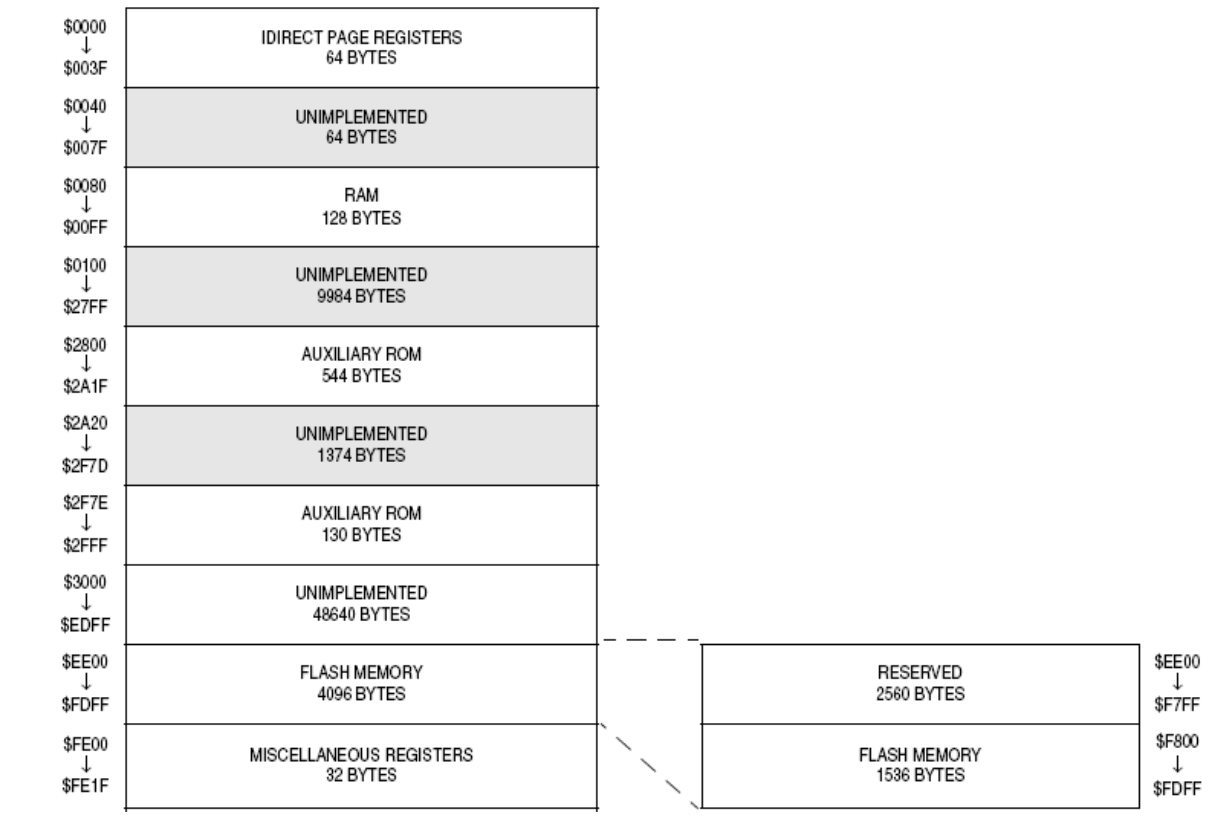


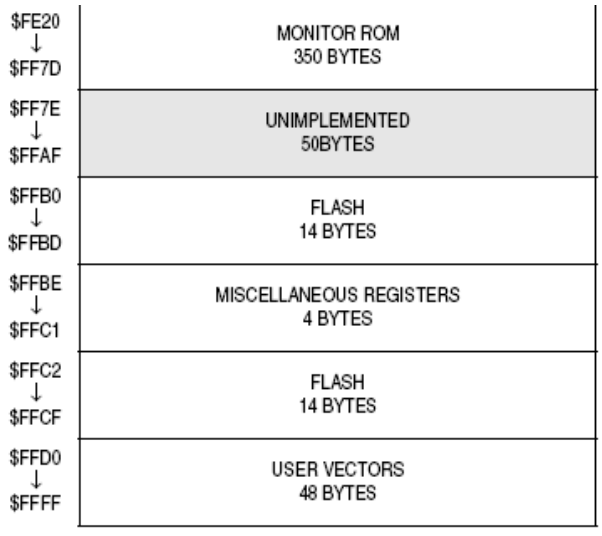
8-PIN ASSIGNMENT
MC68HC908QT1A PDIP/SOIC



8-PIN ASSIGNMENT
MC68HC908QT2A AND MC68HC908QT4A PDIP/SOIC

Memory





MC68HC908QY4A, MC68HC908QT4A Memory Map

MC68HC908QT1A, MC68HC908QT2A, MC68HC908QY1A, and MC68HC908QY2A Memory Map

International
IOR Rectifier

Data Sheet No. PD-6.028C

IR2111

HALF-BRIDGE DRIVER

Features

- Floating channel designed for bootstrap operation
  Fully operational to +600V
  Tolerant to negative transient voltage
  dV/dt immune
- Gate drive supply range from 10 to 20V
- Undervoltage lockout for both channels
- CMOS Schmitt-triggered inputs with pull-down
- Matched propagation delay for both channels
- Internally set deadtime
- High side output in phase with input

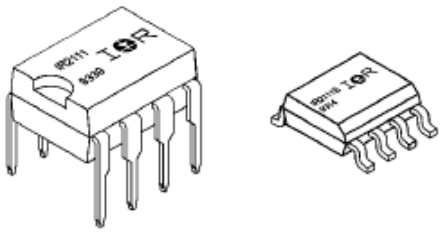
Product Summary

V_{OFFSET}	600V max.
I_O+/-	200 mA / 420 mA
V_{OUT}	10 - 20V
$t_{on/off}$ (typ.)	850 & 150 ns
Deadtime (typ.)	700 ns

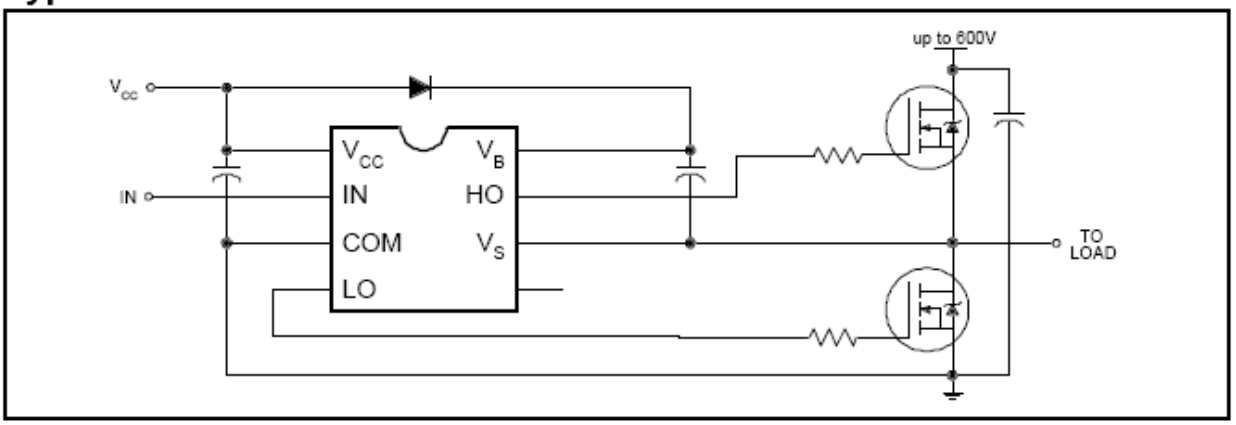
Description

The IR2111 is a high voltage, high speed power MOSFET and IGBT driver with dependent high and low side referenced output channels designed for half-bridge applications. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. Logic input is compatible with standard CMOS outputs. The output drivers feature a high pulse current buffer stage designed for minimum driver cross-conduction. Internal deadtime is provided to avoid shoot-through in the output half-bridge. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high side configuration which operates up to 600 volts.

Packages



Typical Connection

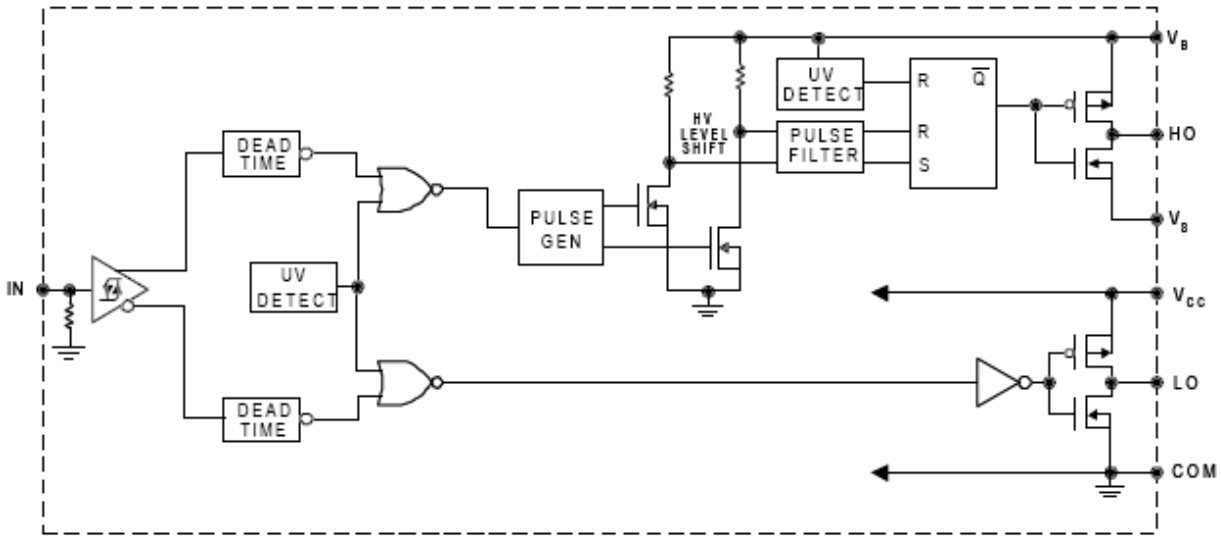


Absolute Maximum Ratings

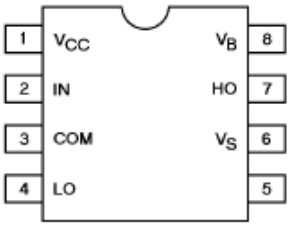
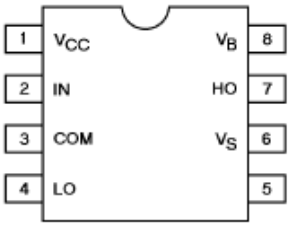
Absolute Maximum Ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM. The Thermal Resistance and Power Dissipation ratings are measured under board mounted and still air conditions. Additional information is shown in Figures 7 through 10.

Parameter			Value		
Symbol	Definition		Min.	Max.	Units
V_B	High Side Floating Supply Voltage		-0.3	625	V
V_S	High Side Floating Supply Offset Voltage		V_B - 25	V_B + 0.3	
V_{HO}	High Side Floating Output Voltage		V_S - 0.3	V_B + 0.3	
V_{CC}	Low Side and Logic Fixed Supply Voltage		-0.3	25	
V_{LO}	Low Side Output Voltage		-0.3	V_{CC} + 0.3	
V_{IN}	Logic Input Voltage		-0.3	V_{CC} + 0.3	
dV_s/dt	Allowable Offset Supply Voltage Transient (Figure 2)		—	50	V/ns
P_D	Package Power Dissipation @ $T_A \leq +25°C$	(8 Lead DIP)	—	1.0	W
		(8 Lead SOIC)	—	0.625	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(8 Lead DIP)	—	125	°C/W
		(8 Lead SOIC)	—	200	
T_J	Junction Temperature		—	150	°C
T_S	Storage Temperature		-55	150	
T_L	Lead Temperature (Soldering, 10 seconds)		—	300	

Functional Block Diagram



Lead Assignments

	
8 Lead DIP	SO-8
IR2111	**IR2111S**
Part Number	

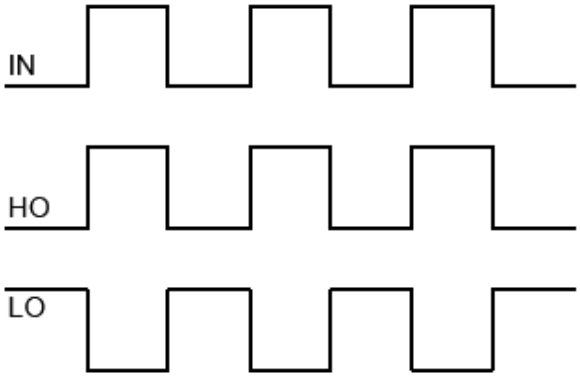


Figure 1. Input/Output Timing Diagram

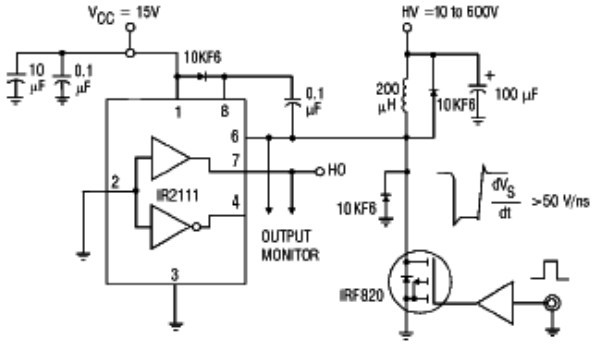


Figure 2. Floating Supply Voltage Transient Test Circuit

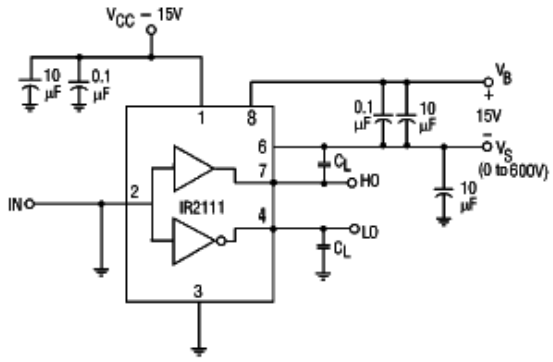


Figure 3. Switching Time Test Circuit

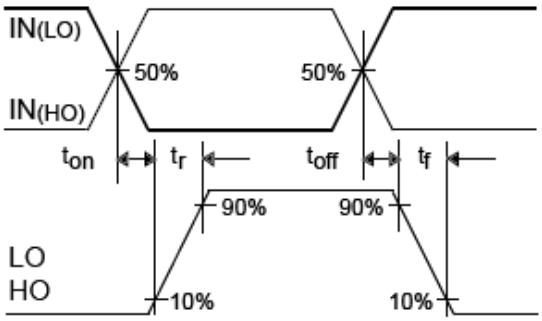


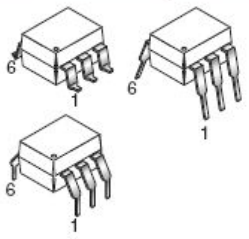
Figure 4. Switching Time Waveform Definition

FAIRCHILD
SEMICONDUCTOR®

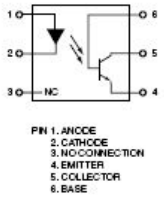
GENERAL PURPOSE 6-PIN PHOTOTRANSISTOR OPTOCOUPLERS

4N25	4N26	4N27	4N28	4N35	4N36
4N37	H11A1	H11A2	H11A3	H11A4	H11A5

WHITE PACKAGE (-M SUFFIX)

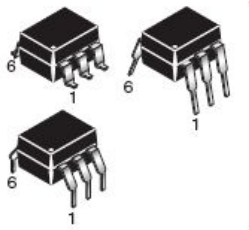


SCHEMATIC



PIN 1. ANODE
2. CATHODE
3. NO CONNECTION
4. EMITTER
5. COLLECTOR
6. BASE

BLACK PACKAGE (NO -M SUFFIX)



DESCRIPTION

The general purpose optocouplers consist of a gallium arsenide infrared emitting diode driving a silicon phototransistor in a 6-pin dual in-line package.

FEATURES

- Also available in white package by specifying -M suffix, eg. 4N25-M
- UL recognized (File # E90700)
- VDE recognized (File # 94766)
  - Add option V for white package (e.g., 4N25V-M)
  - Add option 300 for black package (e.g., 4N25.300)

APPLICATIONS

- Power supply regulators
- Digital logic inputs
- Microprocessor inputs

FAIRCHILD
SEMICONDUCTOR®

GENERAL PURPOSE 6-PIN PHOTOTRANSISTOR OPTOCOUPLERS

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise specified)

Parameter	Symbol	Value	Units
TOTAL DEVICE			
Storage Temperature	T_{STG}	-55 to +150	°C
Operating Temperature	T_{OPR}	-55 to +100	°C
Wave solder temperature (see page 14 for reflow solder profiles)	T_{SOL}	260 for 10 sec	°C
Total Device Power Dissipation @ T_A = 25°C	P_D	250	mW
Derate above 25°C		3.3 (non-M), 2.94 (-M)	
EMITTER			
DC/Average Forward Input Current	I_F	100 (non-M), 60 (-M)	mA
Reverse Input Voltage	V_R	6	V
Forward Current - Peak (300µs, 2% Duty Cycle)	I_F(pk)	3	A
LED Power Dissipation @ T_A = 25°C	P_D	150 (non-M), 120 (-M)	mW
Derate above 25°C		2.0 (non-M), 1.41 (-M)	mW/°C
DETECTOR			
Collector-Emitter Voltage	V_{CEO}	30	V
Collector-Base Voltage	V_{CBO}	70	V
Emitter-Collector Voltage	V_{ECO}	7	V
Detector Power Dissipation @ T_A = 25°C	P_D	150	mW
Derate above 25°C		2.0 (non-M), 1.76 (-M)	mW/°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise specified)

INDIVIDUAL COMPONENT CHARACTERISTICS

Parameter	Test Conditions	Symbol	Min	Typ*	Max	Unit
EMITTER						
Input Forward Voltage	(I_F = 10 mA)	V_F		1.18	1.50	V
Reverse Leakage Current	(V_R = 6.0 V)	I_R		0.001	10	µA
DETECTOR						
Collector-Emitter Breakdown Voltage	(I_C = 1.0 mA, I_F = 0)	BV_{CEO}	30	100		V
Collector-Base Breakdown Voltage	(I_C = 100 µA, I_F = 0)	BV_{CBO}	70	120		V
Emitter-Collector Breakdown Voltage	(I_E = 100 µA, I_F = 0)	BV_{ECO}	7	10		V
Collector-Emitter Dark Current	(V_{CE} = 10 V, I_F = 0)	I_{CEO}		1	50	nA
Collector-Base Dark Current	(V_{CB} = 10 V)	I_{CBO}			20	nA
Capacitance	(V_{CE} = 0 V, f = 1 MHz)	C_{CE}		8		pF

FAIRCHILD
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GENERAL PURPOSE 6-PIN PHOTOTRANSISTOR OPTOCOUPLERS

TYPICAL PERFORMANCE CURVES

Fig. 1 LED Forward Voltage vs. Forward Current (Black Package)

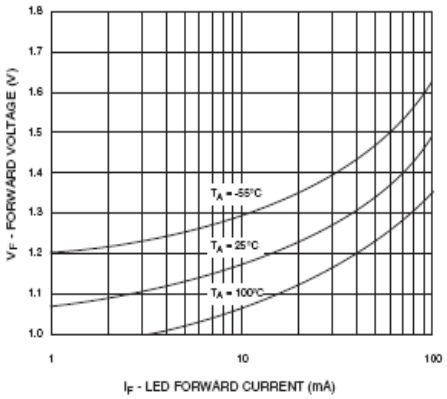


Fig. 2 LED Forward Voltage vs. Forward Current (White Package)

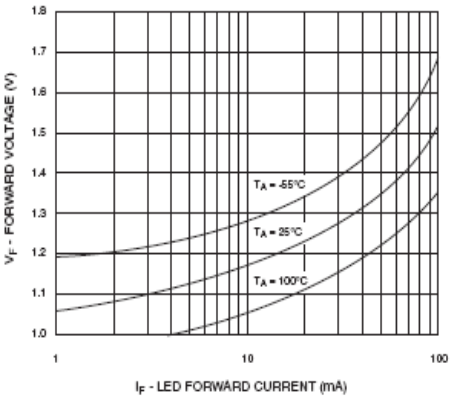


Fig.3 Normalized CTR vs. Forward Current (Black Package)

Fig.4 Normalized CTR vs. Forward Current (White Package)

Fig.3 Normalized CTR vs. Forward Current (Black Package)

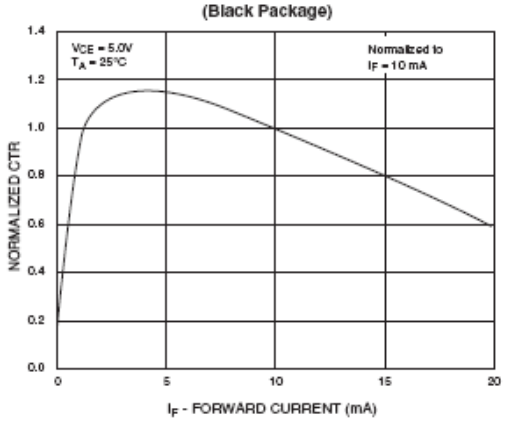


Fig.4 Normalized CTR vs. Forward Current (White Package)

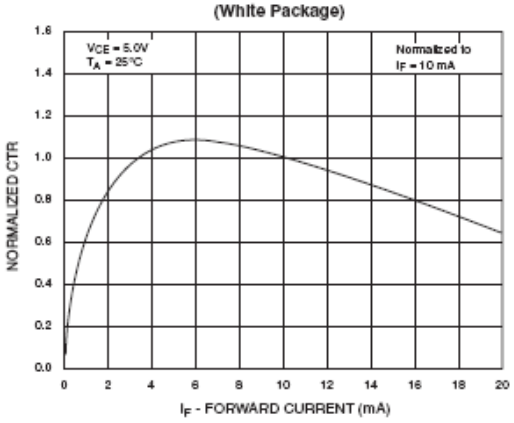


Fig. 5 Normalized CTR vs. Ambient Temperature (Black Package)

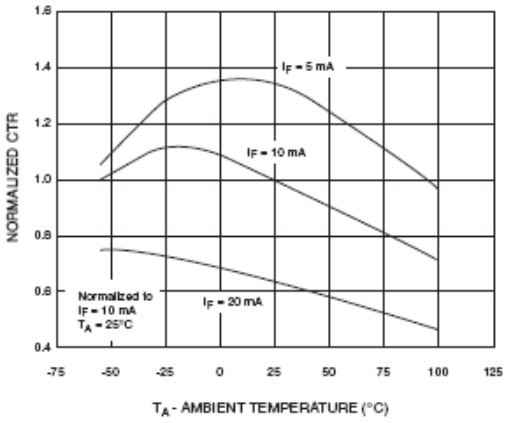
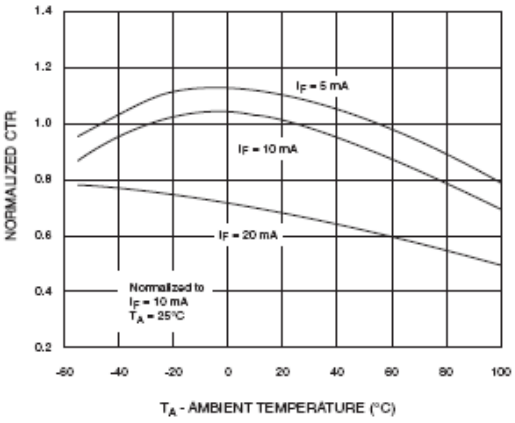


Fig. 6 Normalized CTR vs. Ambient Temperature (White Package)



MOTOROLA
SEMICONDUCTOR TECHNICAL DATA

Order this document
by MUR420/D

SWITCHMODE™ Power Rectifiers

. . . designed for use in switching power supplies, inverters and as free wheeling diodes, these state–of–the–art devices have the following features:

- Ultrafast 25, 50 and 75 Nanosecond Recovery Times
- 175°C Operating Junction Temperature
- Low Forward Voltage
- Low Leakage Current
- High Temperature Glass Passivated Junction
- Reverse Voltage to 600 Volts

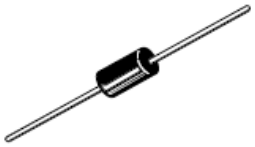
Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.1 gram (approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads are Readily Solderable
- Lead and Mounting Surface Temperature for Soldering Purposes: 220°C Max. for 10 Seconds, 1/16″ from case
- Shipped in plastic bags, 5,000 per bag
- Available Tape and Reeled, 1500 per reel, by adding a "RL" suffix to the part number
- Polarity: Cathode indicated by Polarity Band
- Marking: U420, U460

MUR420
MUR460

MUR420 and MUR460 are
Motorola Preferred Devices

ULTRAFAST
RECTIFIERS
4.0 AMPERES
200–600 VOLTS



CASE 267–03
PLASTIC

MAXIMUM RATINGS

Rating	Symbol	MUR 420	MUR 460	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	200	600	Volts
Average Rectified Forward Current (Square Wave) (Mounting Method #3 Per Note 1)	$I_{F(AV)}$	4.0 @ T_A = 80°C	4.0 @ T_A = 40°C	Amps
Nonrepetitive Peak Surge Current (Surge applied at rated load conditions, half wave, single phase, 60 Hz)	I_{FSM}	125	70	Amps
Operating Junction Temperature and Storage Temperature	T_J, T_{stg}	– 65 to +175		°C

THERMAL CHARACTERISTICS

Maximum Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	See Note 1	°C/W

ELECTRICAL CHARACTERISTICS

Maximum Instantaneous Forward Voltage (1) (i_F = 3.0 Amps, T_J = 150°C) (i_F = 3.0 Amps, T_J = 25°C) (i_F = 4.0 Amps, T_J = 25°C)	v_F	 0.710 0.875 0.890	 1.05 1.25 1.28	Volts
Maximum Instantaneous Reverse Current (1) (Rated dc Voltage, T_J = 150°C) (Rated dc Voltage, T_J = 25°C)	i_R	 150 5.0	 250 10	μA
Maximum Reverse Recovery Time (I_F = 1.0 Amp, di/dt = 50 Amp/μs) (I_F = 0.5 Amp, i_R = 1.0 Amp, I_{REC} = 0.25 Amp)	t_{rr}	 35 25	 75 50	ns
Maximum Forward Recovery Time (I_F = 1.0 A, di/dt = 100 A/μs, Recovery to 1.0 V)	t_{fr}	25	50	ns

MUR420

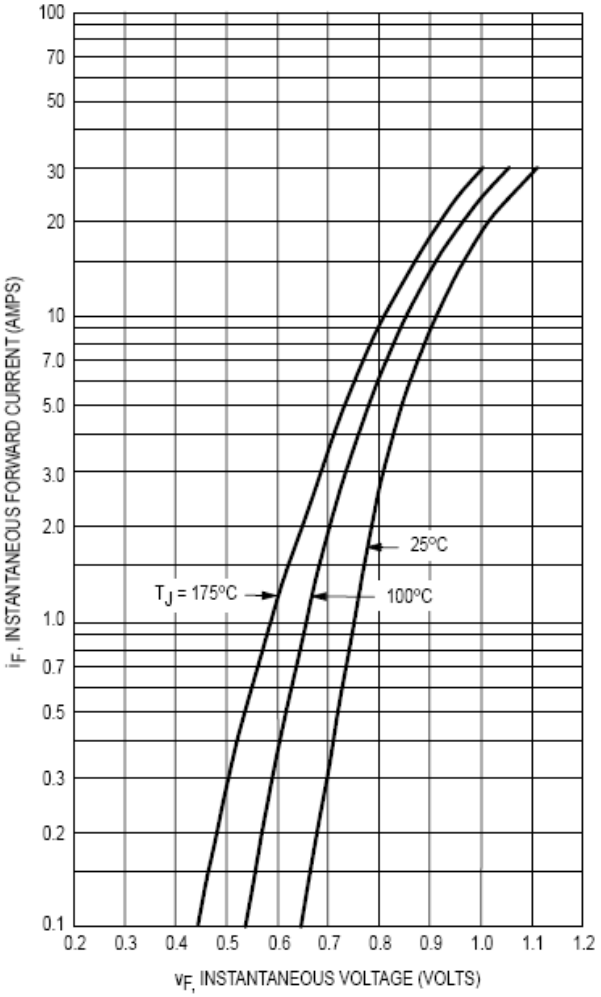


Figure 1. Typical Forward Voltage

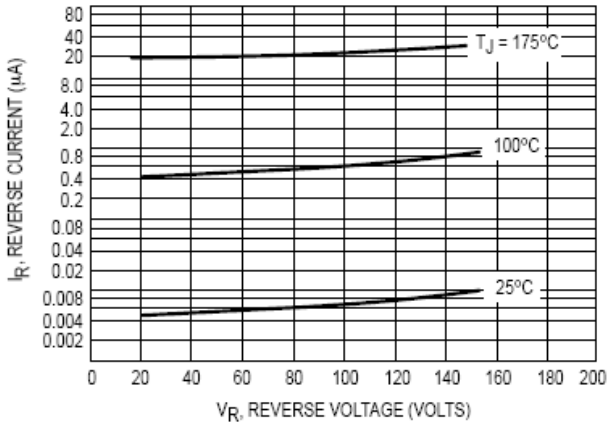


Figure 2. Typical Reverse Current

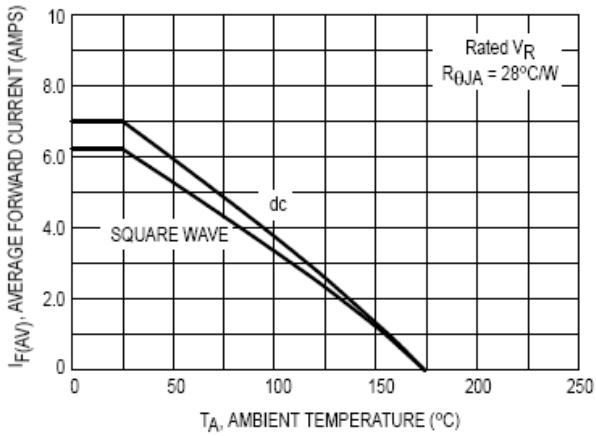


Figure 3. Current Derating (Mounting Method #3 Per Note 1)

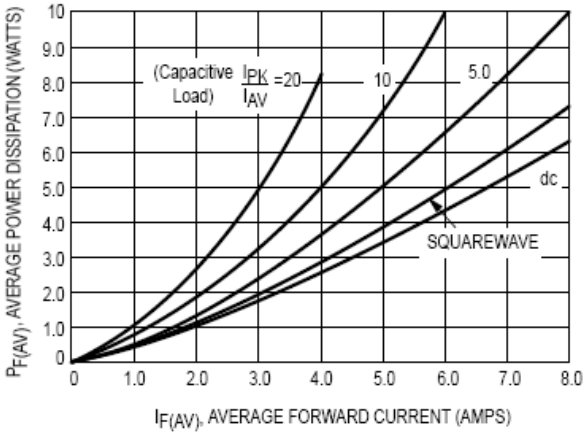


Figure 4. Power Dissipation

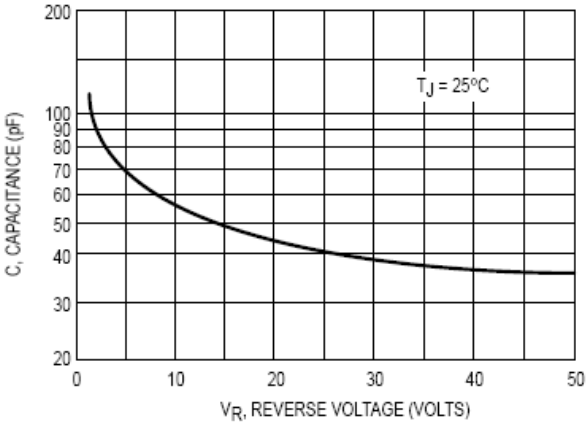


Figure 5. Typical Capacitance

MOTOROLA

Programmable Precision References

TL431, A, B Series

PROGRAMMABLE PRECISION REFERENCES

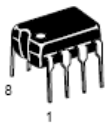
SEMICONDUCTOR TECHNICAL DATA

The TL431, A, B integrated circuits are three–terminal programmable shunt regulator diodes. These monolithic IC voltage references operate as a low temperature coefficient zener which is programmable from V_{ref} to 36 V with two external resistors. These devices exhibit a wide operating current range of 1.0 mA to 100 mA with a typical dynamic impedance of 0.22 Ω. The characteristics of these references make them excellent replacements for zener diodes in many applications such as digital voltmeters, power supplies, and op amp circuitry. The 2.5 V reference makes it convenient to obtain a stable reference from 5.0 V logic supplies, and since the TL431, A, B operates as a shunt regulator, it can be used as either a positive or negative voltage reference.

- Programmable Output Voltage to 36 V
- Voltage Reference Tolerance: ±0.4%, Typ @ 25°C (TL431B)
- Low Dynamic Output Impedance, 0.22 Ω Typical
- Sink Current Capability of 1.0 mA to 100 mA
- Equivalent Full–Range Temperature Coefficient of 50 ppm/°C Typical
- Temperature Compensated for Operation over Full Rated Operating Temperature Range
- Low Output Noise Voltage

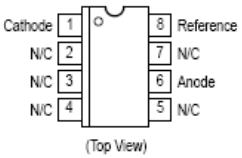
LP SUFFIX
PLASTIC PACKAGE
CASE 29
(TO–92)

Pin 1. Reference
2. Anode
3. Cathode



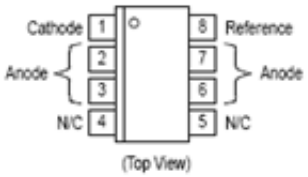
P SUFFIX
PLASTIC PACKAGE
CASE 626

DM SUFFIX
PLASTIC PACKAGE
CASE 846A
(Micro–8)



(Top View)

D SUFFIX
PLASTIC PACKAGE
CASE 751
(SOP–8)



(Top View)

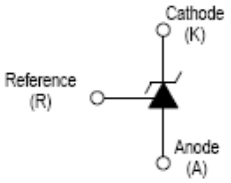
SOP–8 is an internally modified SO–8 package. Pins 2, 3, 6 and 7 are electrically common to the die attach flag. This internal lead frame modification decreases power dissipation capability when appropriately mounted on a printed circuit board. SOP–8 conforms to all external dimensions of the standard SO–8 package.

ORDERING INFORMATION

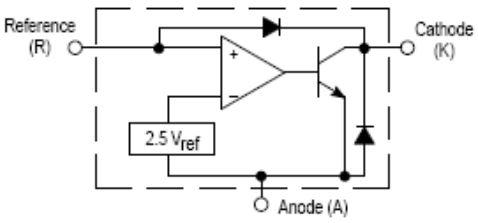
Device	Operating Temperature Range	Package
TL431CLP, ACLP, BCLP	T_A = 0° to +70°C	TO–92
TL431CP, ACP, BCP		Plastic
TL431CDM, ACDM, BCDM		Micro–8
TL431CD, ACD, BCD		SOP–8
TL431ILP, AILP, BILP	T_A = –40° to +85°C	TO–92
TL431IP, AIP, BIP		Plastic
TL431IDM, AIDM, BIDM		Micro–8
TL431ID, AID, BID		SOP–8

TL431, A, B Series

Symbol

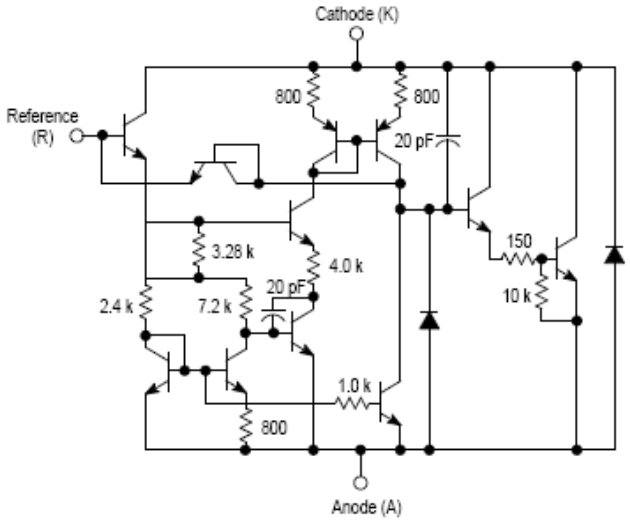


Representative Block Diagram



Representative Schematic Diagram

Component values are nominal



This device contains 12 active transistors.

MAXIMUM RATINGS (Full operating ambient temperature range applies, unless otherwise noted.)

Rating	Symbol	Value	Unit
Cathode to Anode Voltage	V_{KA}	37	V
Cathode Current Range, Continuous	I_K	–100 to +150	mA
Reference Input Current Range, Continuous	I_{ref}	–0.05 to +10	mA
Operating Junction Temperature	T_J	150	°C
Operating Ambient Temperature Range TL431I, TL431AI, TL431BI TL431C, TL431AC, TL431BC	T_A	 –40 to +85 0 to +70	°C
Storage Temperature Range	T_{stg}	–65 to +150	°C
Total Power Dissipation @ T_A = 25°C Derate above 25°C Ambient Temperature D, LP Suffix Plastic Package P Suffix Plastic Package DM Suffix Plastic Package	P_D	 0.70 1.10 0.52	W
Total Power Dissipation @ T_C = 25°C Derate above 25°C Case Temperature D, LP Suffix Plastic Package P Suffix Plastic Package	P_D	 1.5 3.0	W

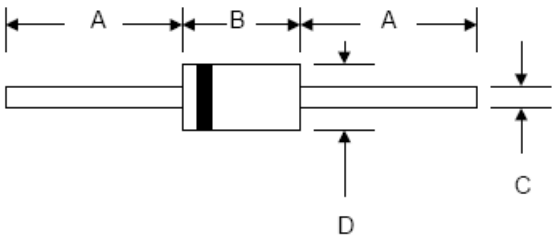
WTE
POWER SEMICONDUCTORS

FR301 – FR307

3.0A FAST RECOVERY RECTIFIER

Features

- Diffused Junction
- Low Forward Voltage Drop
- High Current Capability
- High Reliability
- High Surge Current Capability



DO-201AD		
Dim	Min	Max
A	25.4	—
B	8.50	9.50
C	1.20	1.30
D	5.0	5.60
All Dimensions in mm		

Mechanical Data

- Case: Molded Plastic
- Terminals: Plated Leads Solderable per MIL-STD-202, Method 208
- Polarity: Cathode Band
- Weight: 1.2 grams (approx.)
- Mounting Position: Any
- Marking: Type Number
- Epoxy: UL 94V-O rate flame retardant

Maximum Ratings and Electrical Characteristics @T_A=25°C unless otherwise specified

Single Phase, half wave, 60Hz, resistive or inductive load.
For capacitive load, derate current by 20%.

Characteristic	Symbol	FR301	FR302	FR303	FR304	FR305	FR306	FR307	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	200	400	600	800	1000	V
RMS Reverse Voltage	$V_{R(RMS)}$	35	70	140	280	420	560	700	V
Average Rectified Output Current (Note 1) @T_A = 55°C	Io	3.0							A
Non-Repetitive Peak Forward Surge Current 8.3ms Single half sine-wave superimposed on rated load (JEDEC Method)	I_{FSM}	150							A
Forward Voltage @I_F = 3.0A	V_{FM}	1.2							V
Peak Reverse Current @T_A = 25°C At Rated DC Blocking Voltage @T_A = 100°C	I_{RM}	10 150							μA
Reverse Recovery Time (Note 2)	t_{rr}	150				250	500		nS
Typical Junction Capacitance (Note 3)	C_j	60							pF
Operating Temperature Range	T_j	-65 to +125							°C
Storage Temperature Range	T_{STG}	-65 to +150							°C