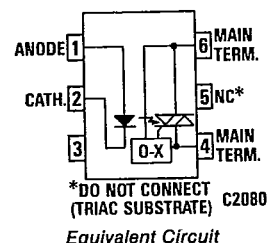
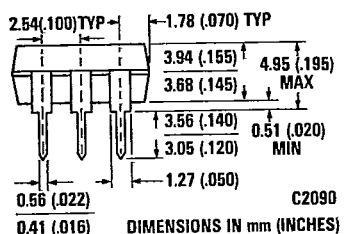
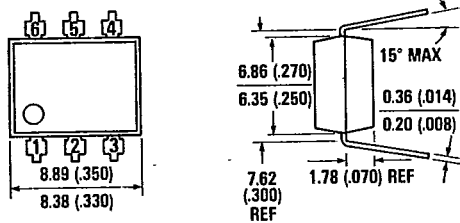


# GENERAL INSTRUMENT ZERO-CROSSING TRIACS

Optocouplers

## AIGaAs ZERO-CROSSING 10 mA MCP3032 MCP3042 5 mA MCP3033 MCP3043

**PACKAGE DIMENSIONS**



**DESCRIPTION**

These devices are optically isolated zero-crossing triac drivers. They consist of a very low degradation Aluminum Gallium Arsenide (AIGaAs) infrared emitting diode optically coupled to a photosensitive silicon detector which functions as a zero voltage crossing bilateral triac driver. This series is designed for interfacing between electronic controls, motors, solenoids and consumer appliances, etc.

**FEATURES**

- Low input current, I<sub>FT</sub> = 5 mA (MCP3033, MCP3043)
- Logic control for 110 VAC or 220 VAC Power
- High isolation voltage—minimum 7500 VAC peak
- Underwriters Laboratory (UL) recognized File #E50151
- Excellent I<sub>FT</sub> stability—IR emitting diode has very low degradation.

**APPLICATIONS**

- Triac driver
- Industrial controls
- Solid state relay
- Traffic lights
- Motor controls
- Home appliances

**ABSOLUTE MAXIMUM RATINGS** (T<sub>A</sub> = 25°C Unless Otherwise Specified)

<b>TOTAL PACKAGE</b>	
Storage temperature	-55°C to 150°C
Operating temperature	-40°C to 100°C
Lead temperature (Soldering, 10 sec)	260°C
Total package power dissipation	
@ 25°C (LED plus detector)	330 mW
Derate linearly from 25°C	4.0 mW/°C
Surge isolation voltage	7500 VAC Peak
Withstand test voltage	7500 VAC Peak (50-60 Hz)
<b>INPUT DIODE</b>	
Forward DC current	40 mA
Reverse voltage	3 V
Peak forward current (1 μs pulse, 300 pps)	3.0 A
Power dissipation	100 mW
Derate linearly from 25°C	1.33 mW/°C

**OUTPUT DRIVER**

Off-state output terminal voltage	
MCP3032, MCP3033	250 V
MCP3042, MCP3043	400 V
On-state RMS current	T <sub>A</sub> = 25°C 100 mA
(Full cycle, 50 to 60 Hz) T <sub>A</sub> = 70°C	50 mA
Peak nonrepetitive surge current	
(PW = 10 ms, DC = 10%)	1.2 A
Total Power Dissipation	300 mW
Derate above 25°C	4.0 mW/°C

**MCP3032/33 MCP3042/43**

88D 02954 DT-41-87

**ELECTRO-OPTICAL CHARACTERISTICS (T<sub>A</sub> = 25°C Unless Otherwise Specified)**

TRANSFER CHARACTERISTICS							
	CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
DC	LED trigger current (current required to latch output)			7	10	mA	Main terminal voltage = 3.0 V either direction
	MCP3032, MCP3042	I <sub>FT</sub>		3.5	5	mA	
	MCP3033, MCP3043	I <sub>FT</sub>		200		μA	
	Holding current	I <sub>H</sub>				μA	
ZERO CROSSING	Inhibit voltage (MT1-MT2 voltage above which device will not trigger)	V <sub>IH</sub>		15	25	V	I <sub>F</sub> = Rated I <sub>FT</sub>
	Leakage in inhibited state			100	200	μA	I <sub>F</sub> = Rated I <sub>FT</sub>
	MCP3032, MCP3033	I <sub>DRM2</sub>		100	200	μA	V <sub>DRM</sub> = 250 V
	MCP3042, MCP3043	I <sub>DRM2</sub>		100	300	μA	V <sub>DRM</sub> = 400 V
ISOLATION	Isolation Voltage	V <sub>ISO</sub>	5300			V <sub>ACRMS</sub>	Relative humidity ≤ 50%, I <sub>I-O</sub> ≤ 10 μA, 5 seconds
		V <sub>ISO</sub>	7500			V <sub>ACPEAK</sub>	Relative humidity ≤ 50%, I <sub>I-O</sub> ≤ 10 μA, 5 seconds
	Isolation resistance	R <sub>ISO</sub>	10 <sup>11</sup>			ohms	V <sub>I-O</sub> = 500 VDC
	Isolation capacitance	C <sub>ISO</sub>		0.5		pF	f = 1 MHz

INDIVIDUAL COMPONENT CHARACTERISTICS							
	CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
INPUT DIODE	Forward voltage	V <sub>F</sub>		1.3	1.5	V	I <sub>F</sub> = 10 mA
	Forward voltage temperature coefficient			-1.8		mV/°C	
	Reverse voltage	V <sub>R</sub>	3.0	25		V	I <sub>R</sub> = 10 μA
	Junction capacitance	C <sub>J</sub>		50	65	pF	V <sub>F</sub> = 0 V, f = 1 MHz
						pF	V <sub>F</sub> = 1 V, f = 1 MHz
OUTPUT DETECTOR	Peak blocking current, either direction			2	100	nA	V <sub>DRM</sub> = 250 V, Note 1
	MCP3032, MCP3033	I <sub>DRM1</sub>		2	100	nA	V <sub>DRM</sub> = 400 V, Note 1
	MCP3042, MCP3043	I <sub>DRM1</sub>					
	Peak on-state voltage, either direction	V <sub>TM</sub>		1.8	3.0	V	I <sub>TM</sub> = 100 mA peak
Critical rate of rise of off-state voltage	dV/dt		1000			V/μs	
	Note 1. Test voltage must be applied within dV/dt rating.						

CAUTION: Normal anti-static precautions are required when handling this product.

**MCP3032/33 MCP3042/43**

88D 02955

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**TYPICAL ELECTRICAL CHARACTERISTIC CURVES** ( $T_A = 25^\circ\text{C}$  Unless Otherwise Specified)

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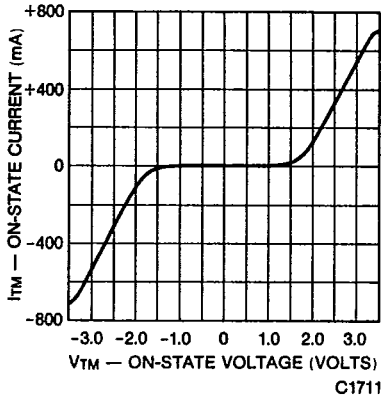


Fig. 1. On-State Characteristics

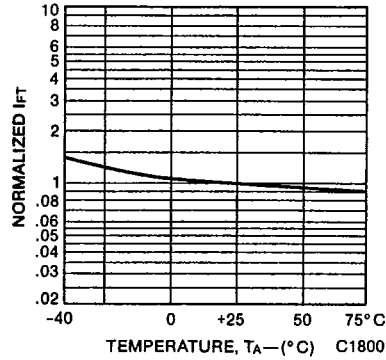


Fig. 2. Trigger Current vs. Temperature

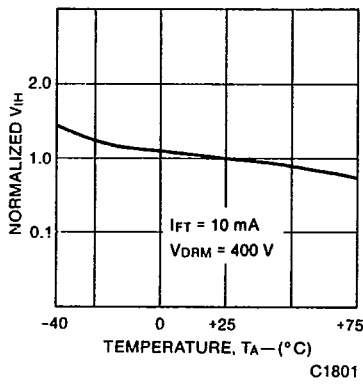


Fig. 3. Normalized Inhibit Voltage ( $V_{IH}$ ) vs. Temperature

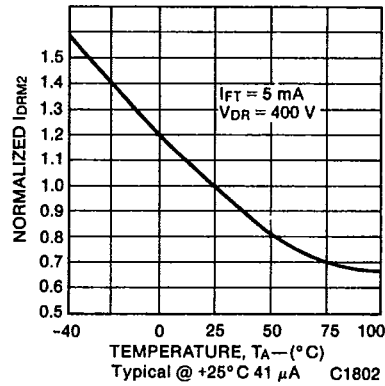


Fig. 4. Normalized  $I_{DRM2}$  vs. Temperature

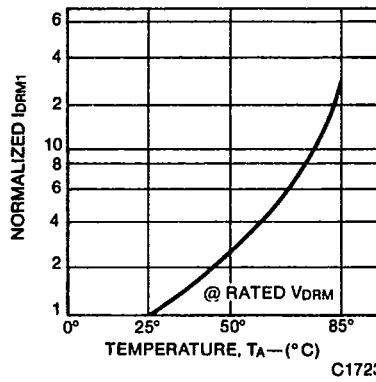


Fig. 5. Normalized  $I_{DRM1}$  vs. Temperature

# MCP3032/33 MCP3042/43

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## APPLICATIONS

### Typical TTL Logic - AC Power Interface

#### I. LED Trigger Current Requirements

DEVICE	V <sub>CC</sub>	R <sub>F</sub>	I <sub>FT</sub>
MCP30X2	5V	330Ω	10 mA
MCP30X2	12V	1000Ω	10 mA
MCP30X3	5V	620Ω	5 mA
MCP30X3	12V	2000Ω	5 mA

#### II. Device/Line Voltage/Load Selection

DEVICE	V <sub>p</sub> (RMS)	LOAD TYPE	SNUBBER REQUIREMENT
MCP303X	≤120V	Resistive	No
MCP304X	≤240V	Resistive	No
MCP303X	≤120V	Inductive	Yes
MCP304X	≤240V	Inductive	Yes

#### III. Typical Circuits @ T<sub>A</sub> ≤ 70°C

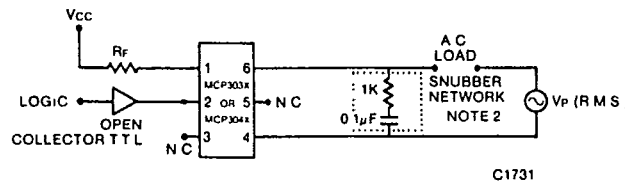


Figure 6 For Load Current I<sub>L</sub> = 50mA RMS · Direct Load Interface

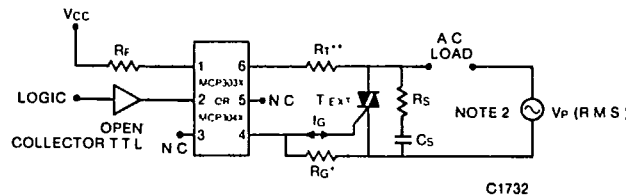


Figure 7 For Load Current I<sub>L</sub> = 50mA RMS · Interface Via External Triac (T<sub>EXT</sub>)

- \* R<sub>G</sub> = 1kΩ optional for sensitive gate T<sub>EXT</sub> · I<sub>G</sub> < 10mA
- \*\* R<sub>T</sub> = 180Ω for I<sub>G</sub> = 100mA
- R<sub>T</sub> = 86Ω for 100mA · I<sub>G</sub> = 200mA

Typical Snubber Values — Fig. 7. Circuit Driving Inductive Load:

T <sub>EXT</sub> dv/dt (V/µs)	RMS LOAD CURRENT I <sub>L</sub> (A)							LEGEND: R <sub>S</sub> (Ω)/C <sub>S</sub> (µF)
	100mA	500mA	1A	2A	5A	10A	50A	
1	33k / 0.015	5.6k / 0.068	3.3k / 0.15	1k / 0.22	560 / 0.68	330 / 1.5	56 / 6.8	
2	56k / 0.0033	8.2k / 0.022	5.6k / 0.033	3.3k / 0.068	820 / 0.22	560 / 0.33	86 / 2.20	
5	no snubber	33k / 0.0033	10k / 0.005	6.8k / 0.01	3.3k / 0.02	1k / 0.05	330 / 0.33	
10	no snubber	no snubber	33k / 0.0022	10k / 0.0033	6.8k / 0.0068	3.3k / 0.015	620 / 0.068	

- Given:
1. RMS Load Current
  2. ≤240 V (RMS) Line
  3. Commutating dv/dt rating of T<sub>EXT</sub>

#### NOTES

1. MCP304X and T<sub>EXT</sub> V<sub>DRM</sub> ≥ 400 V recommended for 120 V Inductive Loads - Fig. 7
2. Capacitor Working Voltage ≥ 2X RMS Line Voltage (V<sub>p</sub>)