

53115 POWER MOSFET OPTOCOUPLER**480V / 0.28A / 0.55A, AC/DC, Hermetically Sealed****Features:**

- Hermetically Sealed 8-Pin Dual-In-Line package
- Small Size and Weight
- Options: 5mA or 10mA input forward current
- Performance Guaranteed over -55°C to $+125^{\circ}\text{C}$ Ambient Temperature
- AC / DC Signal & Power Switching
- Maximum Average Current
 - AC/DC: 0.28 A
 - DC only: 0.55 A
- 1200 VDC Withstand Test Voltage
- High Transient Immunity

Applications:

- Satellite/Space Systems
- Military/High Reliability Systems
- AC/DC Electromechanical and Solid State
- Relay Replacement
- I/O Modules

DESCRIPTION

The 53115 is a single channel, hermetically sealed, power MOSFET optocoupler. Low on-resistance of the MOSFET output, combined with 1500 VDC isolation between input and output, makes this optocoupler ideal for solid state relay applications. Operation is specified over the full military temperature range. The part is supplied in an eight-pin, dual-in-line ceramic package. Lead options support both through-hole and surface-mount assembly. Standard lead finish is gold plated.

Functionally, the device operates as a single-pole, normally open (1 Form A) solid state relay. The device is actuated by an input current, which can be supplied from standard logic types such as open-collector TTL. The input current biases a light emitting diode that is optically coupled to an integrated photovoltaic diode array. The photovoltaic array powers control circuitry that operates the output MOSFETs.

Optimum switching of either AC or DC loads is provided by a configurable output. For AC loads, connection A in Figure 1 must be used. Connection A will also switch DC loads but connection B, in Figure 1, provides DC-only operation with the advantages of substantial reduction in on-resistance and twice the output current capability as that obtained with connection A.

ABSOLUTE MAXIMUM RATINGS

Storage Temperature Range	-65°C to +150°C
Operating Ambient Temperature - T _A	-55°C to +125°C
Junction Temperature - T _J	150°C
Operating Case Temperature - T _C	+145°C ⁽¹⁾
Lead Solder Temperature (1.6mm below seating plane).....	260°C for 10s
Average Input Current - I _F	20 mA
Peak Repetitive Input Current - I _{Fpk} (Pulse Width < 100ms; duty cycle < 50%)	40 mA
Peak Surge Input Current - I _{Fpk} surge (Pulse Width < 0.2ms; duty cycle < 0.1%)	100 mA
Reverse Input Voltage - V _R	5 V
Average Output Current	
Connection A - I _O	0.28 A
Connection B - I _O	0.55 A
Single Shot Output Current - Figure 4	
Connection A - I _{Opk} surge (Pulse width < 10ms).....	0.5 A
Connection B - I _{Opk} surge (Pulse width < 10ms).....	1.0 A
Output Voltage	
Connection A - V _O	-480 V to +480 V
Connection B - V _O	0 V to +480 V
Average Output Power Dissipation	800 mW ⁽²⁾

RECOMMENDED OPERATING CONDITIONS:

PARAMETER	SYMBOL	DEVICE TYPE	MIN	MAX	UNITS
Input Current (on)	I _{F (ON)}		5	20	mA
Input Voltage (off)	V _{F (OFF)}	All	0	0.6	VDC
Operating Temperature	T _A	All	-55	+125	°C

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ELECTRICAL SPECIFICATIONS

$T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$, unless otherwise specified.

Parameter	Sym.	Min.	Typ.*	Max.	Units	Test Conditions	Notes
Output Withstand Voltage	$V_{O(OFF)}$	480			V	$V_F = 0.6\text{ V}$ $I_O = 10\ \mu\text{A}$	
Output On-Resistance (Connection A)	$R_{(ON)}$		5.5	8.0	Ω	$I_F = 5\text{ mA}$ $I_O = 100\text{ mA}$ (pulse duration $\leq 30\text{ ms}$)	3, Figure 1
Output On-Resistance (Connection B)				2.0	Ω	$I_F = 5\text{ mA}$ $I_O = 200\text{ mA}$ (pulse duration $\leq 30\text{ ms}$)	
Output Leakage Current	$I_{O(OFF)}$		10^{-4}	25	μA	$V_F = 0.6\text{ V}$ $V_O = 480\text{ V}$	
Input Forward Voltage	V_F	1.0	1.24	1.7	V	$I_F = 5\text{ mA}$	
Input Reverse Breakdown Voltage	V_R	5.0			V	$I_R = 100\ \mu\text{A}$	
Input-Output Insulation	I_{I-O}			1.0	μA	$R_H \leq 45\%$, $t = 5\text{ s}$ $V_{I-O} = 1200\text{ VDC}$ $T_A = 25^\circ\text{C}$	4, 5
Turn-On Time	t_{ON}		1.25	6.0	ms	$I_F = 5\text{ mA}$ $V_{DD} = 350\text{ VDC}$ $I_O = 200\text{ mA}$	8, Figure 3
Turn-Off time	t_{OFF}		1.0	3.0	ms	$I_F = 5\text{ mA}$ $V_{DD} = 350\text{ VDC}$ $I_O = 200\text{ mA}$	8, Figure 3
Output Transient Rejection	dV_O/dt	1000			V/ μs	$V_{PEAK} = 50\text{ V}$ $C_M = 1000\text{ pF}$ $C_L = 15\text{ pF}$ $R_M \geq 1\text{ M}\Omega$	Figure 4
Input-Output Transient Rejection	dV_{I-O}/dt	500			V/ μs	$V_{DD} = 5\text{ V}$ $V_{I-O(PEAK)} = 50\text{ V}$ $R_L = 20\text{ k}\Omega$ $C_L = 15\text{ pF}$	Figure 4

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TYPICAL CHARACTERISTICS

All typical values are at $T_A = 25^\circ\text{C}$, $I_F(\text{ON}) = 10\text{mA}$, $V_F(\text{OFF}) = 0.6\text{V}$ unless otherwise specified.

Parameter	Symbol	Test Conditions	Typ.	Units	Notes
Output Off-Capacitance	$C_{O(\text{OFF})}$	$V_O = 28\text{ V}$ $f = 1\text{ MHz}$	145	pF	
Output Offset Voltage	$ V_{OS} $	$I_F = 10\text{ mA}$ $I_O = 0\text{ mA}$	2	μV	6
Input Diode Temperature Coefficient	$\Delta V_F / \Delta T_A$	$I_F = 10\text{ mA}$	-1.4	$\text{mV}/^\circ\text{C}$	
Input Capacitance	C_{IN}	$V_F = 0\text{ V}$ $f = 1\text{ MHz}$	20	pF	7
Input-Output Capacitance	C_{I-O}	$V_{I-O} = 0\text{ V}$ $f = 1\text{ MHz}$	1.5	pF	4
Input-Output Resistance	R_{I-O}	$V_{I-O} = 500\text{ V}$ $t = 60\text{ s}$	10^{13}	Ω	4

Notes:

1. Maximum junction to case thermal resistance for the device is $15^\circ\text{C}/\text{W}$, where case temperature, T_C , is measured at the center of the package bottom.
2. Maximum permissible Output Power Dissipation is 800mW to 85°C then derate linearly to Zero at 145°C .
3. During the pulsed R_{ON} measurement (I_O duration < 30 ms), ambient (T_A) and case temperature (T_C) are equal.
4. Pins 2 through 3 shorted together and pins 5 through 8 shorted together.
5. This is a momentary withstand test, not an operating condition.
6. V_{OS} is a function of I_F and is defined between pins 5 and 8, with pin 5 as the reference. V_{OS} must be measured in a stable ambient (free of temperature gradients).
7. Zero-bias capacitance measured between the LED anode and cathode.
8. Turn-On and Turn-Off times measured using specified voltage and resistive load. Reactive loads, specific voltage and load currents may affect the actual time measured.

CAUTION:

Care should be taken not to exceed the maximum output power dissipation, maximum case temperature, and maximum junction temperature when repetitively switching loads.

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Case outlines	P, X, Y, AND Z	
Terminal number	Terminal symbol	
	Connection A (AC or DC load)	Conneciton B (DC load only)
1	NC	NC
2	V_{F+}	V_{F+}
3	V_{F-}	V_{F-}
4	NC	NC
5	V_{O-}	V_{O+}
6	NC	NC
7	NC	N_{O-}
8	V_{O+}	V_{O+}

NC = No connection

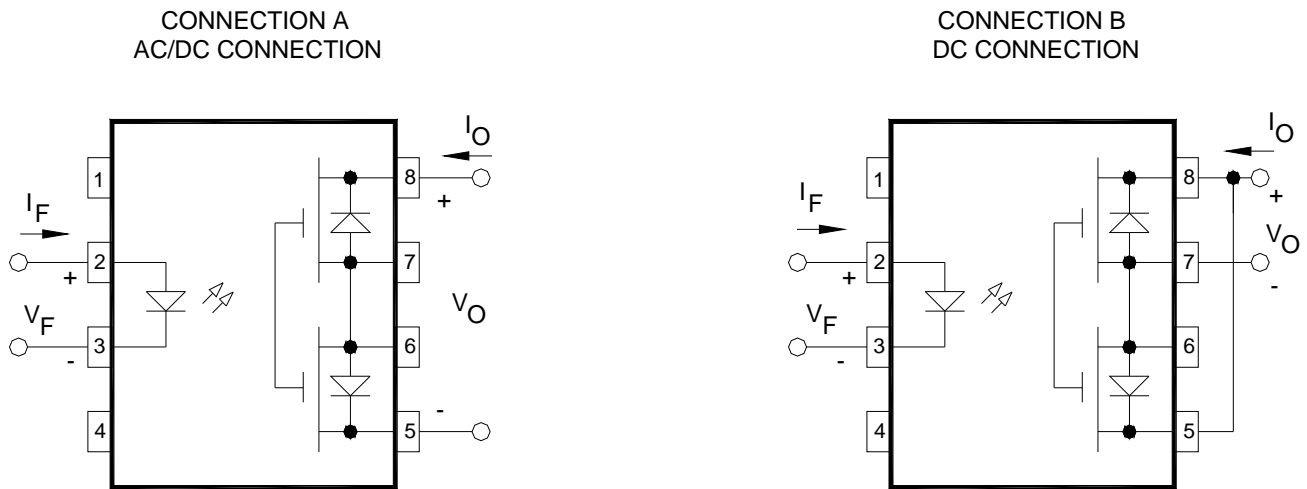


Figure 1 - Terminal Connections

INPUT	OUTPUT
OFF	OFF
ON	ON

Figure 2 - Truth Table

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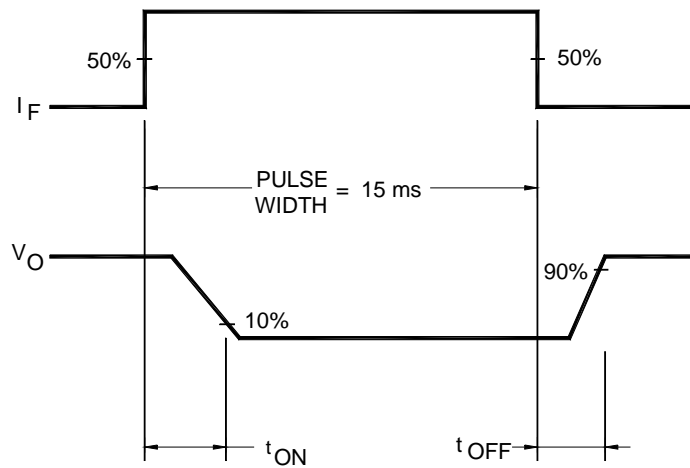
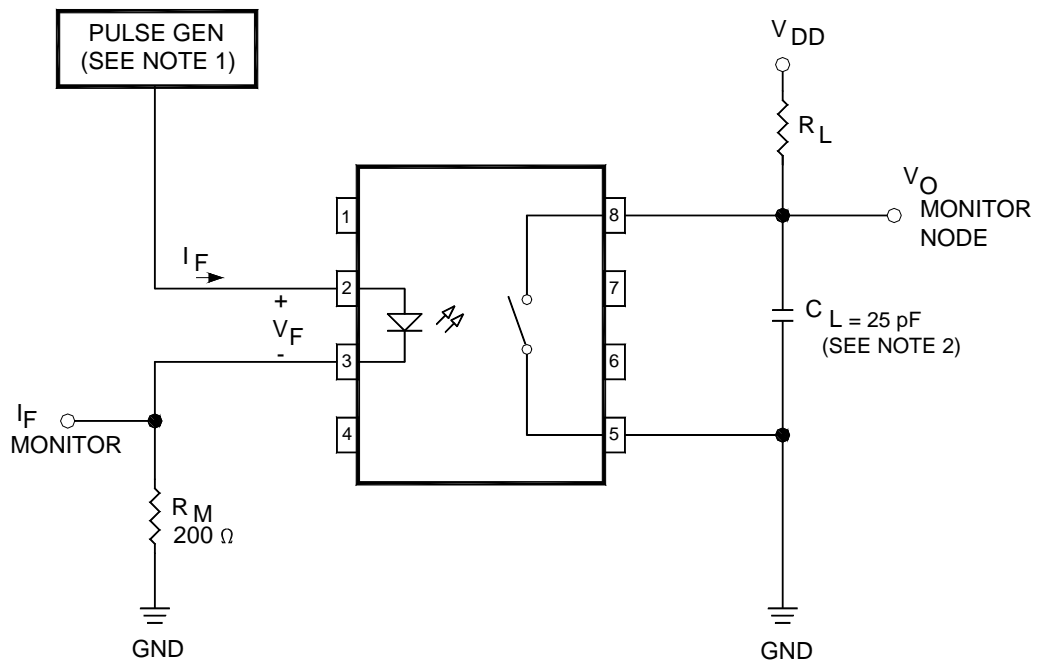
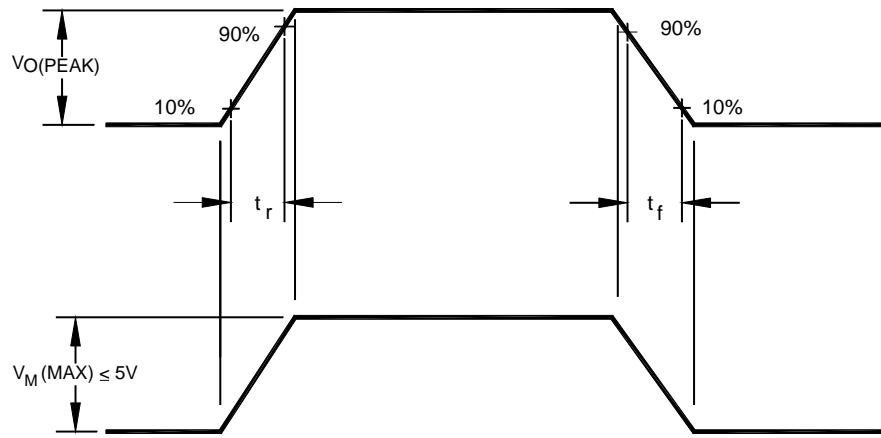
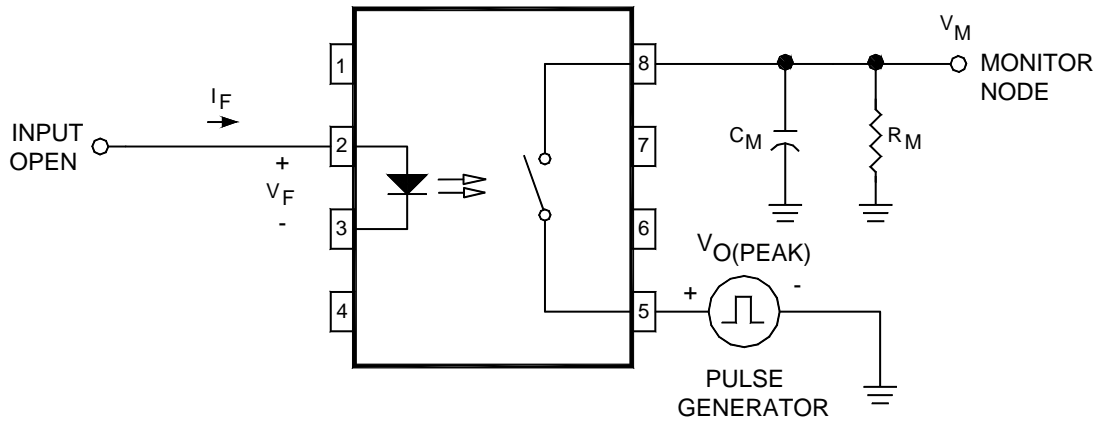


Figure 3. Switching Test Circuit and Waveform.

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$$\frac{dV_O}{dt} = \frac{(0.8)V_O(\text{PEAK})}{t_r} \quad \text{OR} \quad \frac{(0.8)V_O(\text{PEAK})}{t_f}$$

OVERSHOOT ON $V_O(\text{PEAK})$ IS TO BE $\leq 10\%$

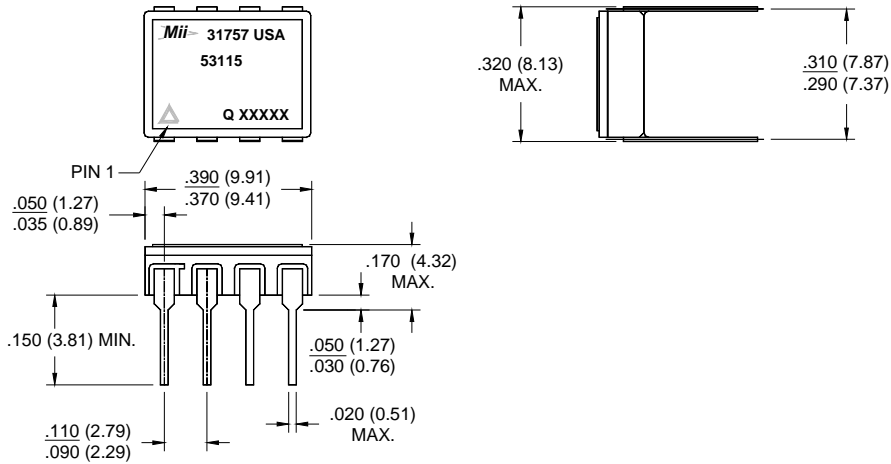
NOTES:

1. C_M INCLUDES PROBE AND FIXTURE CAPACITANCE.
2. R_M INCLUDES PROBE AND FIXTURE RESISTANCE.

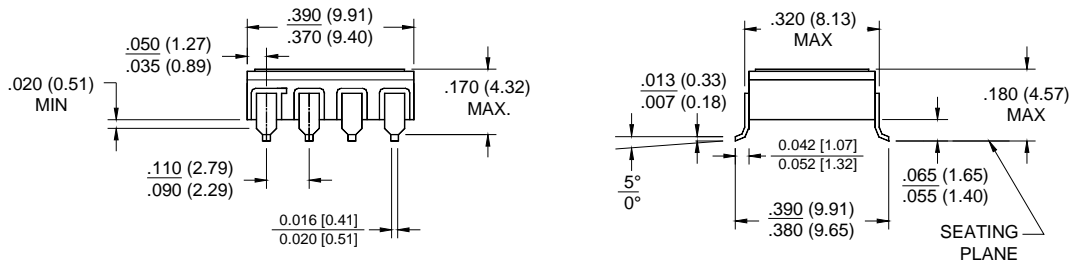
Figure 4. Output Transient Rejection Test Circuit and Waveform.

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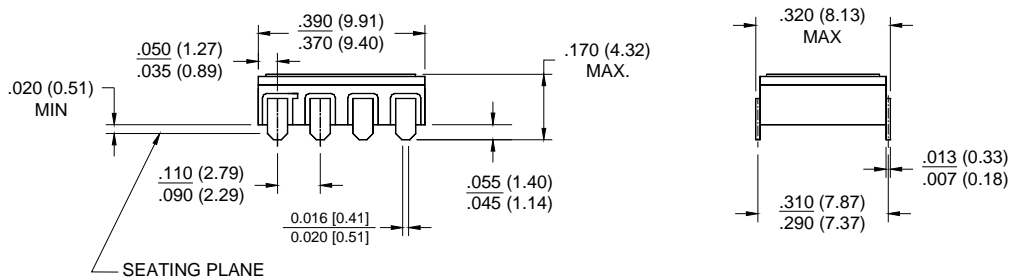
Case Outline P



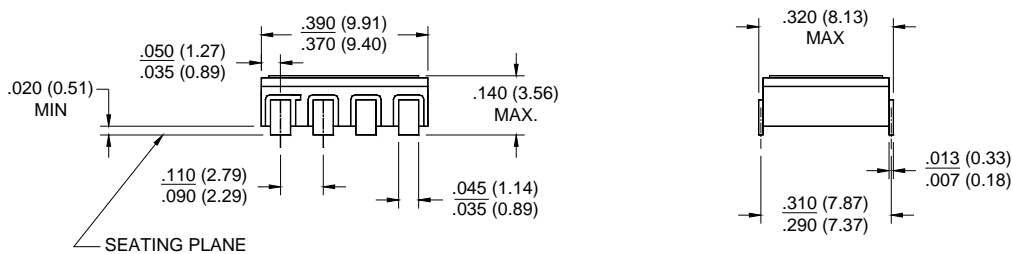
Case Outline X



Case Outline Y



Case Outline Z



NOTES:

1. PIN 1 IS INDICATED BY THE ESD TRIANGLE MARKED ON THE LID OF THE PACKAGE.
2. DIMENSIONS ARE IN INCHES, (mm).
3. METRIC EQUIVALENTS ARE GIVEN FOR GENERAL INFORMATION ONLY.
4. UNLESS OTHERWISE SPECIFIED, TOLERANCE IS ±.005 (0.13mm).

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