OLC049: Radiation-Tolerant, Phototransistor Surface-Mount Optocoupler

Features

- Miniature non-hermetic surface-mount package

- Radiation tolerant

- High CTR guaranteed over –55 °C to +125 °C ambient temperature range

- 1000 V_{DC} electrical isolation

Description

The OLC049 can be used for large satellite constellation applications that require optical isolation in radiation environments such as gamma, neutron, and proton radiation with a high Current Transfer Ratio (CTR) and low saturation V_{CE}. Each optocoupler consists of an LED and N-P-N silicon phototransistor that is electrically isolated, but optically coupled inside a non-hermetic, four-pin Leadless Chip Carrier (LCC) package.

The hermetic surface-mount variant of the OLC049 optocoupler is available as the OLS049, both in a non-screened catalog version as well as a high-reliability screened version.
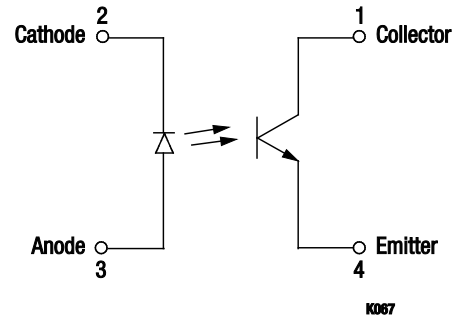
Figure 1. OLC049 Block Diagram

A functional block diagram of the OLC049 is shown in Figure 1. The absolute maximum ratings of the OLC049 are provided in Table 1. Electrical specifications are provided in Table 2.

Typical performance characteristics of the OLC049 are illustrated in Figures 2 through 4. A typical switching test circuit is shown in Figure 5 and package dimensions for the OLC049 are provided in Figure 6.

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Table 1. OLC049 Absolute Maximum Ratings[1]

Parameter	Symbol	Minimum	Maximum	Units
Coupled				
Input to output isolation voltage[2]	V_{DC}	−1000	+1000	V
Storage temperature range	T_{STG}	−65	+150	°C
Operating temperature range	T_A	−55	+125	°C
Soldering temperature (heated collet, 5 seconds)			260	°C
Soldering temperature (vapor phase reflow, 30 seconds)			215	°C
Input Diode				
Average input current	I_{DD}		40	mA
Peak forward current (≤1 ms duration)	I_F		1	A
Reverse voltage	V_R		2	V
Power dissipation[3]	P_D		60	mW
Output Detector				
Collector to emitter voltage	V_{CE}		60	V
Emitter to collector voltage	V_{EC}		5	V
Continuous collector current	I_{CC}		50	mA
Power dissipation[4]	P_D		300	mW

[1] Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

[2] Measured between pins 1 and 4 shorted together, and pins 2 and 3 shorted together. T_A = 25 °C and duration = 1 s.

[3] Derate linearly at 1 mW/°C above 65 °C.

[4] Derate linearly at 3 mW/°C above 25 °C.

ESD HANDLING: *Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.*

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Table 2. OLC049 Electrical Specifications[1]
(T_A = 25 °C, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Max	Units
On-state collector current	I_{C_ON}	I_F = 1 mA, V_{CE} = 5 V I_F = 2.0 mA, V_{CE} = +5.0 V, T_A = −55 °C I_F = 2 mA, V_{CE} = 5 V, T_A = 100 °C	2 +2.8 2	12	mA
Saturation voltage	V_{CE_SAT}	I_F = 2.0 mA, I_C = 2.0 mA		0.3	V
Breakdown voltage: 　Collector to emitter 　Emitter to collector	 BV_{CEO} BV_{ECO}	 I_{CE} = 1 mA I_{EC} = 100 µA	 60 5		V
Leakage current, collector to emitter	I_{CE_OFF}	V_{CE} = 20 V V_{CE} = 20 V, T_A = 100 °C		100 100	nA µA
Input: 　Forward voltage 　Reverse current 　Output resistance[2] 　Output capacitance[2]	 V_F I_R R_{I_O} C_{I_O}	 I_F = 10.0 mA, T_A = −55 °C I_F = 10.0 mA I_F = 10.0 mA, T_A = 100 °C V_R = 2 V V_{I_O} = ±1000 V_{DC} V_{I_O} = 0 V, f = 1 MHz	 +1.4 1.2 1.1 10^{11} 	 +2.0 1.8 1.7 100 5	 V V V µA Ω pF
Time: 　Rise 　Fall	 t_r t_f	 V_{CC} = 10 V, R_L = 100 Ω I_F = 10 mA		 25 25	 µs µs

[1] Performance is guaranteed only under the conditions listed in the above table.

[2] Measured between pins 1 and 4 shorted together, and pins 2 and 3 shorted together. T_A = 25 °C and duration = 1 s.

Typical Performance Characteristics

(T$_A$ = −55 °C to +125 °C, Unless Otherwise Noted)
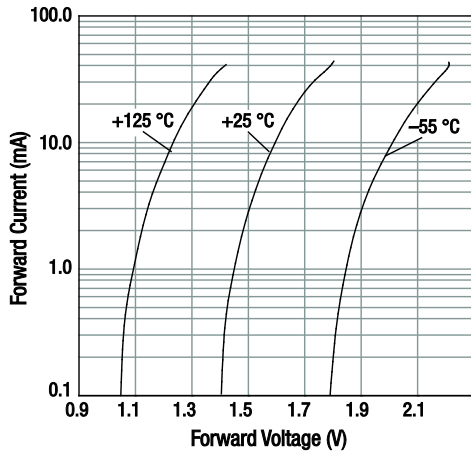
Figure 2. Forward Current vs Forward Voltage
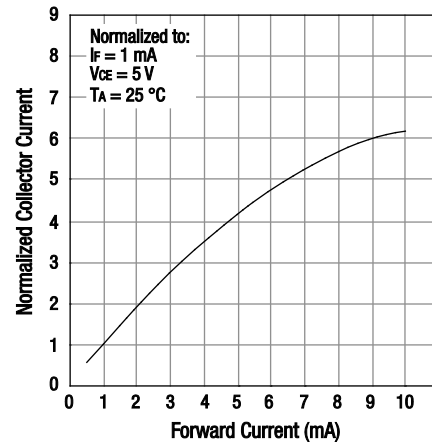
Figure 3. Normalized Collector Current vs Forward Current
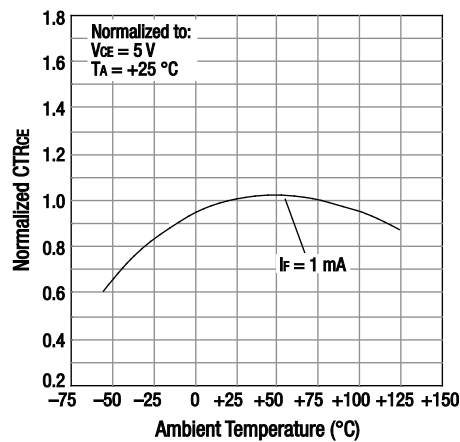
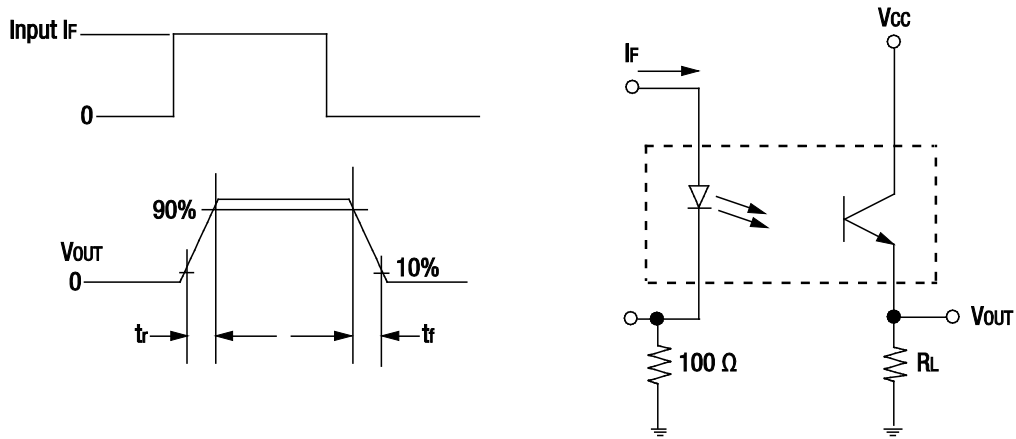Figure 4. Normalized CTR$_{CE}$ vs Temperature

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Figure 5. OLC049 Switching Test Circuit

TOP VIEW

BOTTOM VIEW
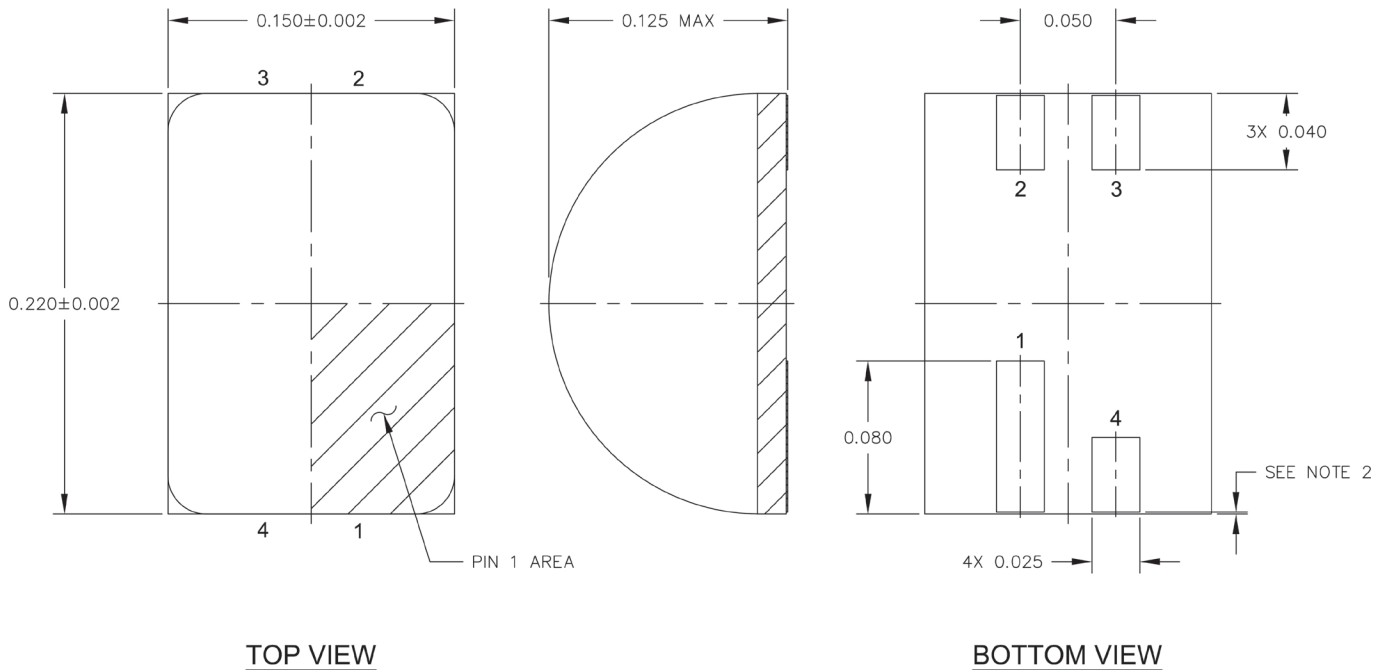
NOTES:
1. ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE NOTED.
2. METALIZATION PULL BACK FROM SUBSTRATE EDGE: 0.002 MAXIMUM.
3. UNLESS SPECIFIED DIMENSIONS ARE SYMMETRICAL ABOUT CENTER LINES.

Figure 6. OLC049 Package Dimensions

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Ordering Information

Model Name	Manufacturing Part Number
OLC049: Radiation-Tolerant, Phototransistor Non-hermetic Surface-Mount Optocoupler	OLC049