OLC249: Radiation-Tolerant Phototransistor Non-Hermetic Surface-Mount Optocoupler

Features

- Non-Hermetic SMT package
- 1000 V_{DC} electrical isolation
- High CTR
- Small package size
- Radiation tolerant

Description

The OLC249 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 CTR and low saturation VCE. Each optocoupler consists of an LED and N-P-N silicon phototransistor that is electrically isolated, but optically coupled inside a non-hermetic six-pin Leadless Chip Carrier (LCC) package.

Electrical parameters are similar to the JEDEC registered 4N49 optocoupler, but with a higher CTR and better CTR degradation characteristics due to radiation exposure.

The hermetic surface mount variant of the OLC249 optocoupler is available as the OLS249, both in a non-screened catalog version as well as a high-reliability screened version.

The OLC249 is designed for a low LED operating current while providing excellent radiation tolerance margins.
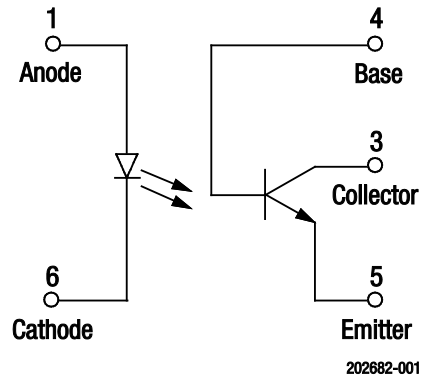

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Figure 1. OLC249 Block Diagram

A functional block diagram of the OLC249 is shown in Figure 1. The absolute maximum ratings of the OLC249 are provided in Table 1. Electrical specifications are provided in Table 2.

Typical performance characteristics of the OLC249 are illustrated in Figures 2 through 4. A typical switching test circuit is shown in Figure 5 and package dimensions for the OLC249 are provided in Figure 6.

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Table 1. OLC249 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
Mounting temperature range (10 seconds maximum)	T_{MTG}		+240	°C
Input Diode				
Average input current[3]	I_{DD}		40	mA
Peak forward current[4]	I_F		1	A
Reverse voltage	V_R		2	V
Output Detector				
Collector to emitter voltage	V_{CE}		40	V
Emitter to base voltage	V_{EB}		7	V
Collector to base voltage	V_{CB}		45	V
Continuous collector current	I_{CC}		50	mA
Power dissipation[5]	P_D		300	mW

[1] Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to the 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, 2, and 6 shorted together, and pins 3, 4, and 5 shorted together. T_A = 25°C and duration = 1 s.

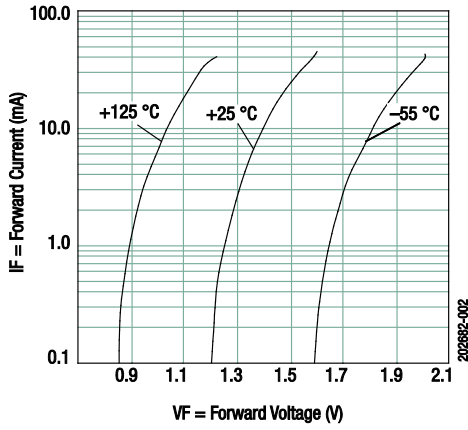[3] Derate linearly to 125 °C free-air temperature at 0.67 mA/°C above 65 °C.

[4] For pulse width ≤ 1 μs, pulse repetition rate ≤ 300 pps.

[5] Derate linearly to 125 °C free-air temperature at 3.0 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. OLC249 Electrical Specifications[1]
(T_A = 25 °C, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Minimum	Maximum	Units
On-state:					
Collector current	I_{C_ON}	I_F = 1 mA, V_{CE} = 5 V	2.0	12.0	mA
		I_F = +2 mA, V_{CE} = +5 V, T_A = −55 °C	+2.8		mA
		I_F = 2 mA, V_{CE} = 5 V, T_A = 125 °C	2.0		mA
Collector base current	I_{CB_ON}	I_F = 10 mA, V_{CB} = 5 V	30		µA
Saturation voltage	V_{CE_SAT}	I_F = 2 mA, I_C = 2 mA		0.3	V
Breakdown voltage:					
Collector to emitter	BV_{CEO}	I_{CE} = 1 mA	40		V
Collector to base	BV_{CBO}	I_{CB} = 100 µA	45		
Emitter to base	BV_{EBO}	I_{EB} = 100 µA	7		
Off-state leakage current:					
Collector to emitter	I_{CE_OFF}	V_{CE} = 20 V		100	nA
		V_{CE} = 20 V, T_A = 125 °C		100	µA
Collector to base	I_{CB_OFF}	V_{CB} = 20 V		10	nA
Input:					
Forward voltage	V_F	I_F = +10.0 mA, T_A = −55 °C	+1.4	+2.0	V
		I_F = 10.0 mA	1.2	1.8	V
		I_F = 10.0 mA, T_A = 125 °C	1.1	1.7	V
Reverse current	I_R	V_R = 2 V		100	µA
Output resistance[2]	r_{I_O}	$V_{I\text{-}O}$ = ±1000 V_{DC}	10^{11}		Ω
Output capacitance[2]	C_{I_O}	f = 1 MHz		5	pF
Times:					
Rise	t_r	V_{CC} = 10 V, R_L = 100 Ω		25	µs
Fall	t_f	I_F = 5 mA		25	µs

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

2   Measured between pins 1, 2, and 6 shorted together, and pins 3, 4, and 5 shorted together. T_A = 25°C and duration = 1 s.

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Typical Performance Characteristics

Figure 2. Forward Current vs Diode Forward Voltage
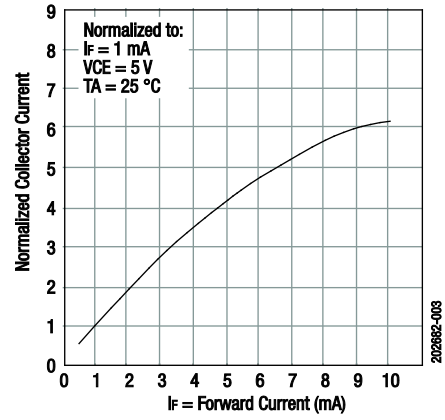
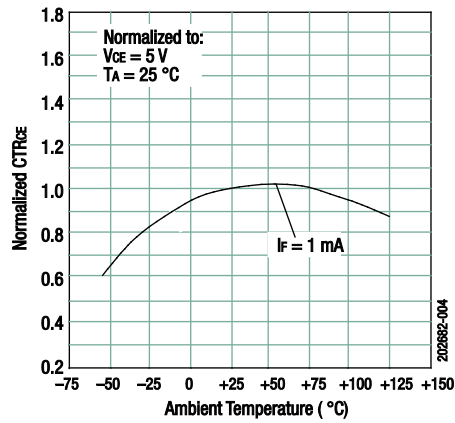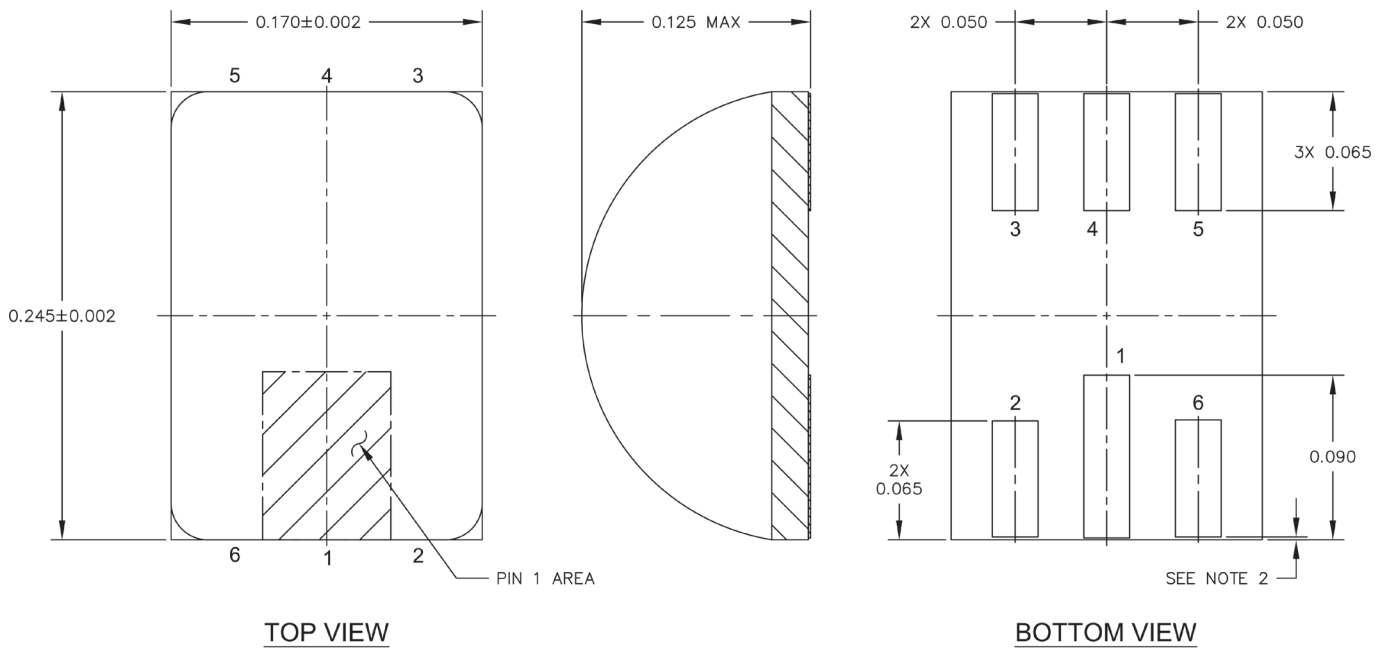Figure 3. Normalized Collector Current vs Forward Current

Figure 4. Normalized CTRCE vs Temperature

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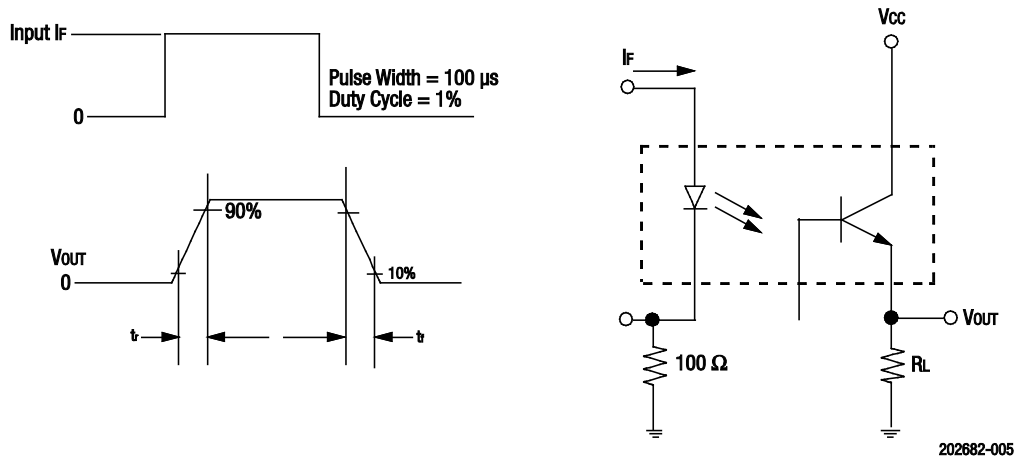
Figure 5. OLC249 Switching Test Circuit

Figure 6. OLC249 Package Dimensions

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Ordering Information

Model Name	Manufacturing Part Number
OLC249: Radiation-Tolerant Phototransistor Hermetic Surface-Mount Optocoupler	OLC249

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