July 2015

FOD8314, FOD8314T
1.0 A Output Current, Gate Drive Optocoupler in Stretched Body SOP 6-Pin

Features

- FOD8314T - 8 mm Creepage and Clearance Distance, and 0.4 mm Insulation Distance to Achieve Reliable and High-Voltage Insulation
- 1.0 A Output Current Driving Capability for Medium-Power IGBT/MOSFET
  - Use of P-Channel MOSFETs at Output Stage Enables Output Voltage Swing Close to Supply Rail
- 20 kV/µs Minimum Common Mode Rejection
- Wide Supply Voltage Range: 15 V to 30 V
- Fast Switching Speed Over Full Operating Temperature Range
  - 500 ns Maximum Propagation Delay
  - 300 ns Maximum Pulse Width Distortion
- Under-Voltage Lockout (UVLO) with Hysteresis
- Extended Industrial Temperate Range: -40°C to 100°C
- Safety and Regulatory Approvals:
  - UL1577, 5,000 V_{RMS} for 1 Minute
  - DIN EN/IEC60747-5-5 (Pending Approvals)

Applications

- AC and Brushless DC Motor Drives
- Industrial Inverter
- Uninterruptible Power Supply
- Induction Heating
- Isolated IGBT/Power MOSFET Gate Drive

Related Resources

- FOD3150, High Noise Immunity, 1.0 A Output Current, Gate Drive Optocoupler Datasheet
- www.fairchildsemi.com/products/optoelectronics/

Description

The FOD8314 series is a 1.0 A output current gate drive optocoupler, capable of driving medium-power IGBT/MOSFETs. It is ideally suited for fast-switching driving of power IGBT and MOSFET used in motor-control inverter applications, and high-performance power systems.

The FOD8314 series utilizes stretched body package to achieve 8 mm creepage and clearance distances (FOD8314T), and optimized IC design to achieve reliably high-insulation voltage and high-noise immunity.

The FOD8314 series consists of an Aluminum Gallium Arsenide (AlGaAs) Light-Emitting Diode (LED) optically coupled to an integrated circuit with a high-speed driver for push-pull MOSFET output stage. The device is housed in a stretched body, 6-pin, small outline, plastic package.

Functional Schematic

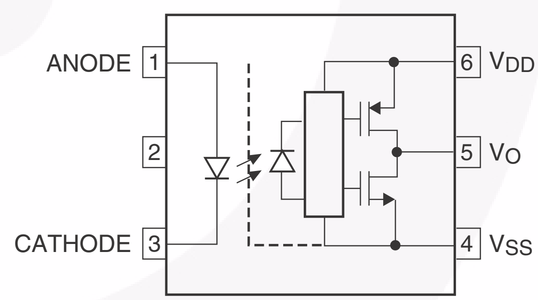


Figure 1. Schematic

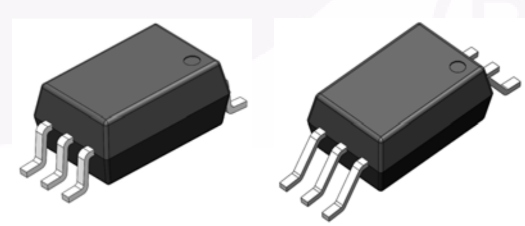


Figure 2. Package Outline

Truth Table

LED	$V_{DD} – V_{SS}$ "Positive Going" (Turn-on)	$V_{DD} – V_{SS}$ "Negative Going" (Turn-off)	V_O
Off	0 V to 30 V	0 V to 30 V	LOW
On	0 V to 11.5 V	0 V to 10 V	LOW
On	11.5 V to 14.5 V	10 V to 13 V	Transition
On	14.5 V to 30 V	13 V to 30 V	HIGH

Pin Definitions

Pin #	Name	Description
1	ANODE	LED Anode
2	N.C	Not Connection
3	CATHODE	LED Cathode
4	V_{SS}	Negative Supply Voltage
5	V_O	Output Voltage
6	V_{DD}	Positive Supply Voltage

Pin Configuration

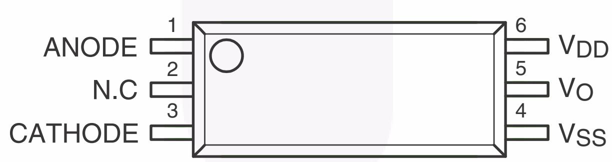


Figure 3. Pin Configuration

Safety and Insulation Ratings

As per DIN EN/IEC60747-5-5 (pending certification), this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

Parameter		Characteristics	
		FOD8314	FOD8314T
Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage	< 150 V_{RMS}	I–IV	I–IV
	< 300 V_{RMS}	I–IV	I–IV
	< 450 V_{RMS}	I–III	I–IV
	< 600 V_{RMS}	I–III	I–III
Climatic Classification		40/100/21	40/100/21
Pollution Degree (DIN VDE 0110/1.89)		2	2
Comparative Tracking Index		175	175

Symbol	Parameter	Value		Unit
		FOD8314	FOD8314T	
V_{PR}	Input-to-Output Test Voltage, Method B, V_{IORM} x 1.875 = V_{PR}, 100% Production Test with t_m = 1 s, Partial Discharge < 5 pC	1,671	2,137	V_{peak}
	Input-to-Output Test Voltage, Method A, V_{IORM} x 1.6 = V_{PR}, Type and Sample Test with t_m = 10 s, Partial Discharge < 5 pC	1,426	1,824	V_{peak}
V_{IORM}	Maximum Working Insulation Voltage	891	1,140	V_{peak}
V_{IOTM}	Highest Allowable Over-Voltage	6,000	8,000	V_{peak}
	External Creepage	≥ 8.0	≥ 8.0	mm
	External Clearance	≥ 7.0	≥ 8.0	mm
DTI	Distance Through Insulation (Insulation Thickness)	≥ 0.4	≥ 0.4	mm
	Safety Limit Values – Maximum Values Allowed in the Event of a Failure,			
T_S	Case Temperature	150	150	°C
$I_{S,INPUT}$	Input Current	200	200	mA
$P_{S,OUTPUT}$	Output Power	600	600	mW
R_{IO}	Insulation Resistance at T_S, V_{IO} = 500 V	10^9	10^9	Ω

Absolute Maximum Ratings (T_A = 25°C unless otherwise specified.)

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Value	Unit
T_{STG}	Storage Temperature	-40 to +125	°C
T_{OPR}	Operating Temperature	-40 to +100	°C
T_J	Junction Temperature	-40 to +125	°C
T_{SOL}	Lead Solder Temperature *(Refer to Reflow Temperature Profile)*	260 for 10 sec	°C
$I_{F(AVG)}$	Average Input Current	25	mA
V_R	Reverse Input Voltage	5.0	V
$I_{O(PEAK)}$	Peak Output Current(1)	1.5	A
V_{DD}	Supply Voltage	0 to 35	V
$V_{O(PEAK)}$	Peak Output Voltage	0 to V_{DD}	V
$t_{R(IN)}$, $t_{F(IN)}$	Input Signal Rise and Fall Time	500	ns
PD_I	Input Power Dissipation(2)(4)	45	mW
PD_O	Output Power Dissipation(3)(4)	500	mW

Notes:
1. Maximum pulse width = 10 µs, maximum duty cycle = 0.2%.
2. No derating required across operating temperature range.
3. Derate linearly from 25°C at a rate of 5.2 mW/°C.
4. Functional operation under these conditions is not implied. Permanent damage may occur if the device is subjected to conditions outside these ratings.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min.	Max.	Unit
T_A	Ambient Operating Temperature	-40	+100	°C
$V_{DD} – V_{SS}$	Supply Voltage	16	30	V
$I_{F(ON)}$	Input Current (ON)	10	16	mA
$V_{F(OFF)}$	Input Voltage (OFF)	0	0.8	V

Isolation Characteristics

Apply over all recommended conditions, typical value is measured at T_A = 25°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{ISO}	Input-Output Isolation Voltage	T_A = 25°C, R.H. < 50%, t = 1.0 minute, $I_{I-O} \le 20\ \mu A$ (5)(6)	5000			VAC_{RMS}
R_{ISO}	Isolation Resistance	V_{I-O} = 500 V(5)		10^{11}		Ω
C_{ISO}	Isolation Capacitance	V_{I-O} = 0 V, Frequency = 1.0 MHz(5)		1		pF

Notes:

5. Device is considered a two terminal device: pins 1, 2 and 3 are shorted together and pins 4, 5 and 6 are shorted together.
6. 5,000 VAC_{RMS} for 1 minute duration is equivalent to 6,000 VAC_{RMS} for 1 second duration.

Electrical Characteristics

Apply over all recommended conditions, typical value is measured at V_{DD} = 30 V, V_{SS} = Ground, T_A = 25°C unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Input Forward Voltage	I_F = 10 mA	1.1	1.5	1.8	V
$\Delta(V_F/T_A)$	Temperature Coefficient of Forward Voltage			-1.8		mV/°C
BV_R	Input Reverse Breakdown Voltage	$I_R = 10\ \mu A$	5			V
C_{IN}	Input Capacitance	f = 1 MHz, V_F = 0 V		20		pF
I_{OH}	High Level Output Current(1)	$V_{OH} = V_{DD} – 0.75$ V	0.2			A
		$V_{OH} = V_{DD} – 4$ V	1.0			A
I_{OL}	Low Level Output Current(1)	$V_{OL} = V_{SS} + 0.75$ V	0.2			A
		$V_{OL} = V_{SS} + 4$ V	1.0			A
V_{OH}	High Level Output Voltage(7)(8)	I_F = 10 mA, I_O = -1.0 A	V_{DD} – 6.0	V_{DD} – 1.5		V
		I_F = 10 mA, I_O = -100 mA	V_{DD} – 0.5	V_{DD} – 0.1		
V_{OL}	Low Level Output Voltage(7)(8)	I_F = 10 mA, I_O = 1.0 A		V_{SS} + 1.5	V_{SS} + 6.0	V
		I_F = 0 mA, I_O = 100 mA		V_{SS} + 0.1	V_{SS} + 0.5	
I_{DDH}	High Level Supply Current	V_O = Open, I_F = 7 to 16 mA		2.9	5.0	mA
I_{DDL}	Low Level Supply Current	V_O = Open, V_F = 0 to 0.8 V		2.8	5.0	mA
I_{FLH}	Threshold Input Current Low to High	I_O = 0 mA, V_O > 5 V		1.5	7.5	mA
V_{FHL}	Threshold Input Voltage High to Low	I_O = 0 mA, V_O < 5 V	0.8			V
V_{UVLO+}	UnderVoltage Lockout Threshold	I_F = 10 mA, V_O > 5 V	11.5	12.7	14.5	V
V_{UVLO-}		I_F = 10 mA, V_O < 5 V	10.0	11.2	13.0	V
$UVLO_{HYS}$	UnderVoltage Lockout Threshold Hysteresis			1.5		V

Notes:

7. In this test, V_{OH} is measured with a dc load current of 100 mA. When driving capacitive load V_{OH} will approach V_{DD} as I_{OH} approaches 0 A.
8. Maximum pulse width = 1 ms, maximum duty cycle = 20%.

Switching Characteristics

Apply over all recommended conditions, typical value is measured at V_{DD} = 30V, V_{SS} = Ground, T_A = 25°C unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
t_{PHL}	Propagation Delay Time to Logic Low Output[9]	I_F = 7 mA to 16 mA, R_g = 10 Ω, C_g = 10 nF, f = 10 kHz, Duty Cycle = 50%	100	270	500	ns
t_{PLH}	Propagation Delay Time to Logic High Output[10]		100	260	500	ns
PWD	Pulse Width Distortion[11] $\mid t_{PHL} - t_{PLH} \mid$			25	300	ns
PDD (Skew)	Propagation Delay Difference Between Any Two Parts[12]		-350		350	
t_R	Output Rise Time (10% to 90%)			60		ns
t_F	Output Fall Time (90% to 10%)			40		ns
$t_{ULVO\ ON}$	ULVO Turn On Delay	I_F = 10 mA, V_O > 5 V		0.8		µs
$t_{ULVO\ OFF}$	ULVO Turn Off Delay	I_F = 10 mA, V_O < 5 V		0.2		µs
$\mid CM_H \mid$	Common Mode Transient Immunity at Output High	V_{DD} = 30 V, I_F = 10 mA to 16 mA, V_{CM} = 2000 V, T_A = 25°C[13]	20	50		kV/µs
$\mid CM_L \mid$	Common Mode Transient Immunity at Output Low	V_{DD} = 30 V, V_F = 0 V, V_{CM} = 2000 V, T_A = 25°C[14]	20	50		kV/µs

Notes:

9. Propagation delay t_{PHL} is measured from the 50% level on the falling edge of the input pulse to the 50% level of the falling edge of the V_O signal.
10. Propagation delay t_{PLH} is measured from the 50% level on the rising edge of the input pulse to the 50% level of the rising edge of the V_O signal.
11. PWD is defined as $\mid t_{PHL} - t_{PLH} \mid$ for any given device.
12. The difference between t_{PHL} and t_{PLH} between any two FOD8314 parts under the same operating conditions, with equal loads.
13. Common mode transient immunity at output high is the maximum tolerable negative dVcm/dt on the trailing edge of the common mode impulse signal, V_{CM}, to ensure that the output remains high (i.e., V_O > 15.0 V).
14. Common mode transient immunity at output low is the maximum tolerable positive dVcm/dt on the leading edge of the common pulse signal, V_{CM}, to ensure that the output remains low (i.e., V_O < 1.0 V).

Typical Performance Characteristics

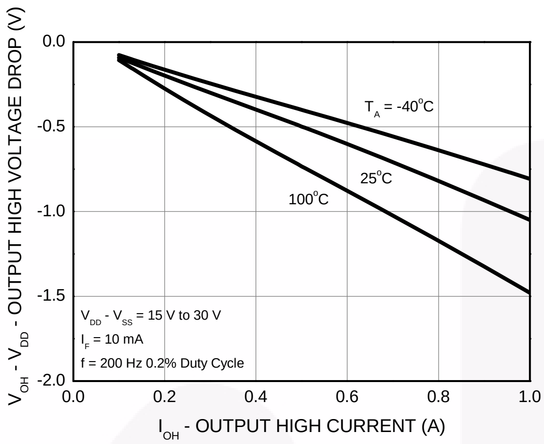


Figure 4. Output High Voltage Drop vs. Output High Current

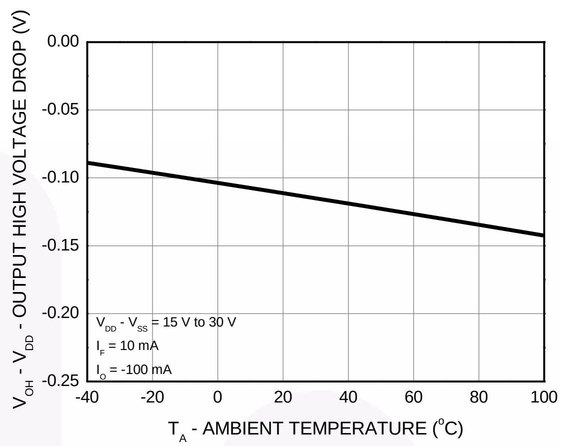


Figure 5. Output High Voltage Drop vs. Ambient Temperature

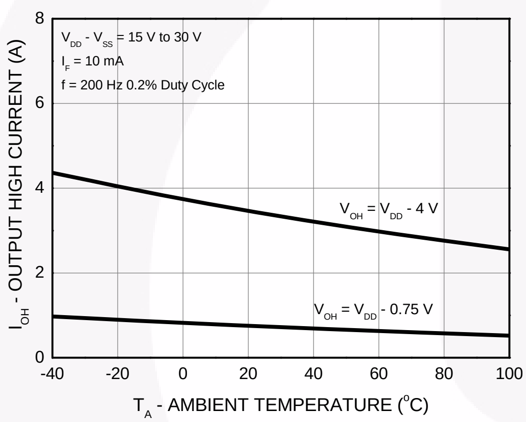


Figure 6. Output High Current vs. Ambient Temperature

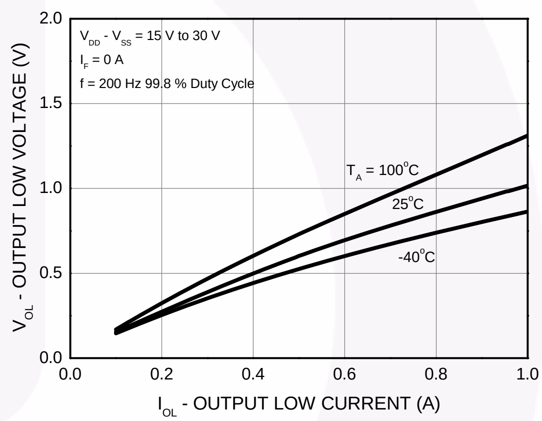


Figure 7. Output Low Voltage vs. Output Low Current

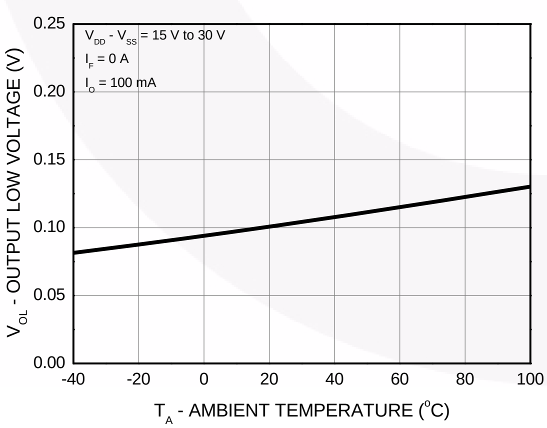


Figure 8. Output Low Voltage vs. Ambient Temperature

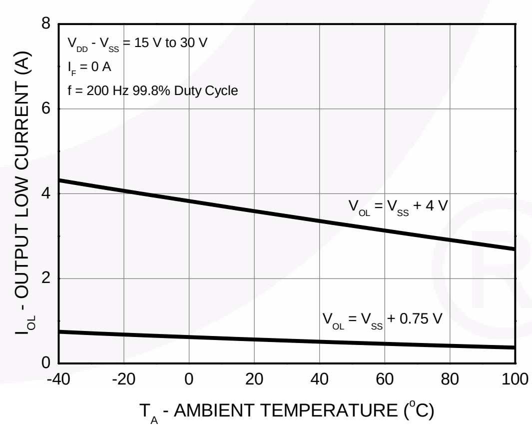


Figure 9. Output Low Current vs. Ambient Temperature

Typical Performance Characteristics (Continued)

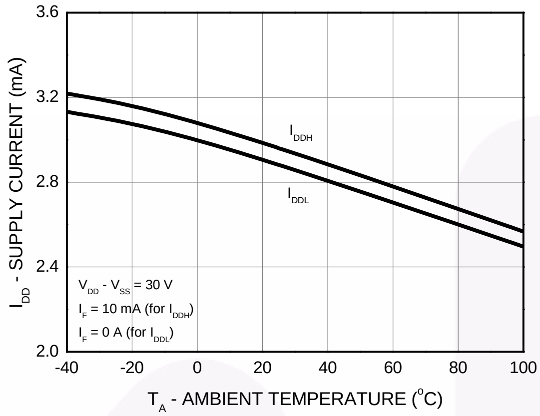


Figure 10. Supply Current vs. Ambient Temperature

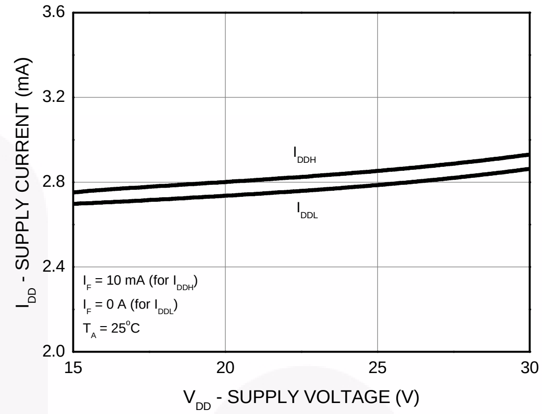


Figure 11. Supply Current vs. Supply Voltage

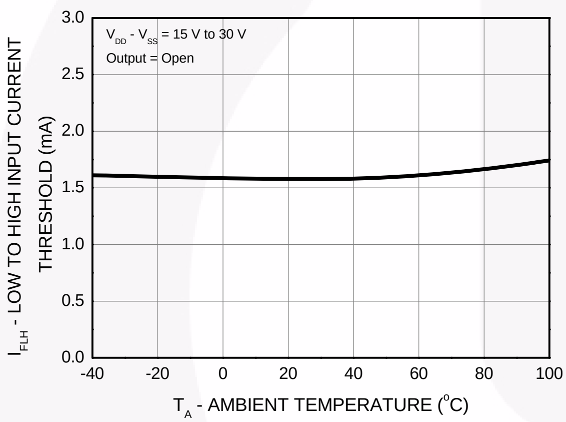


Figure 12. Low to High Input Current Threshold vs. Ambient Temperature

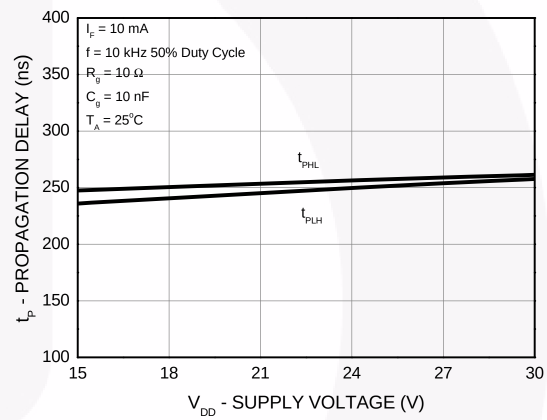


Figure 13. Propagation Delay vs. Supply Voltage

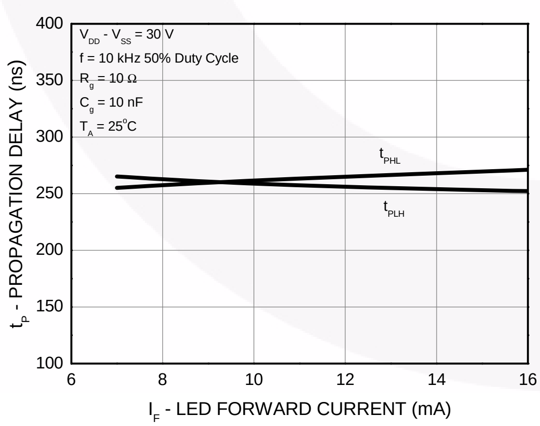


Figure 14. Propagation Delay vs. LED Forward Current

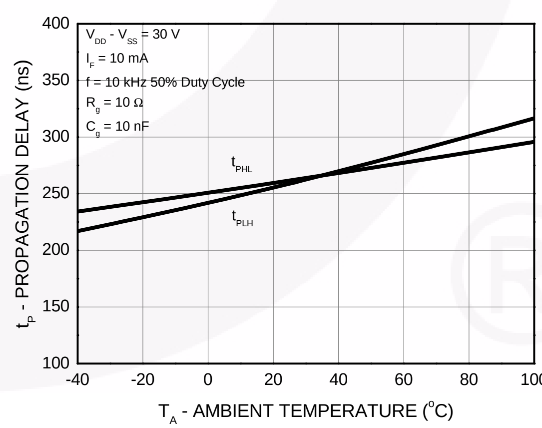


Figure 15. Propagation Delay vs. Ambient Temperature

Typical Performance Characteristics (Continued)

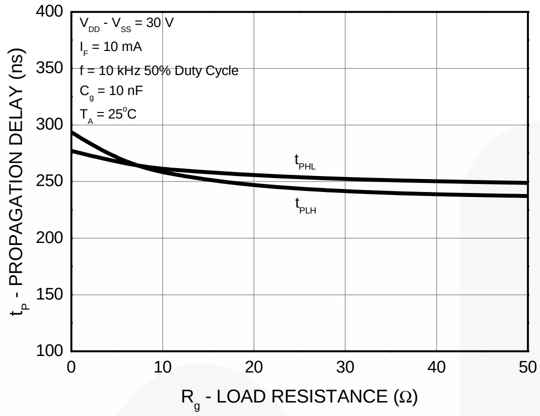


Figure 16. Propagation Delay vs. Load Resistance

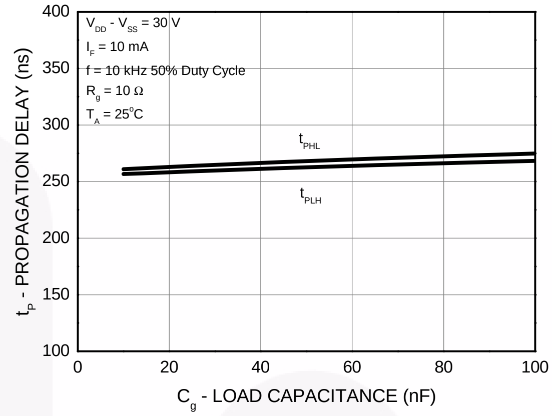


Figure 15. Propagation Delay vs. Load Capacitance

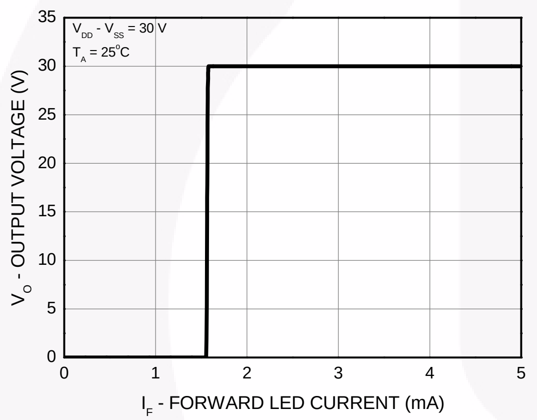


Figure 18. Transfer Characteristics

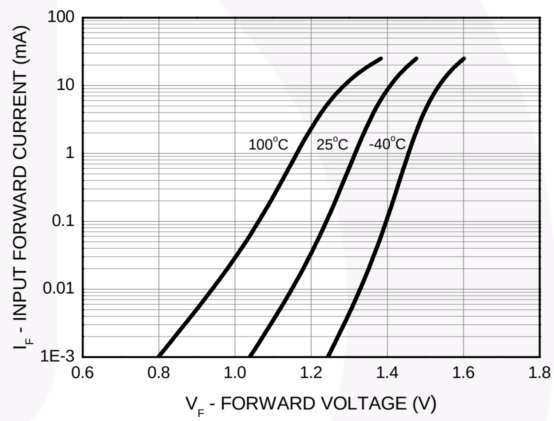


Figure 19. Input Forward Current vs. Forward Voltage

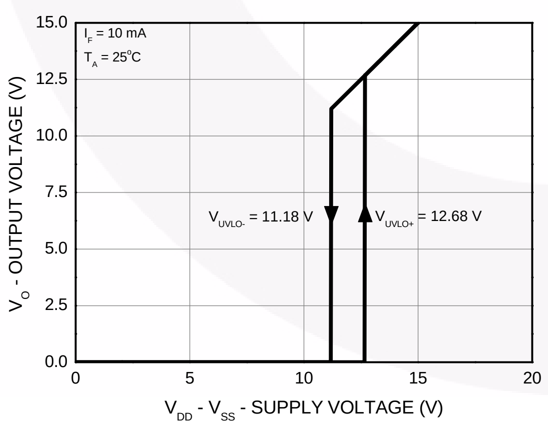


Figure 20. Under Voltage Lockout

Test Circuit

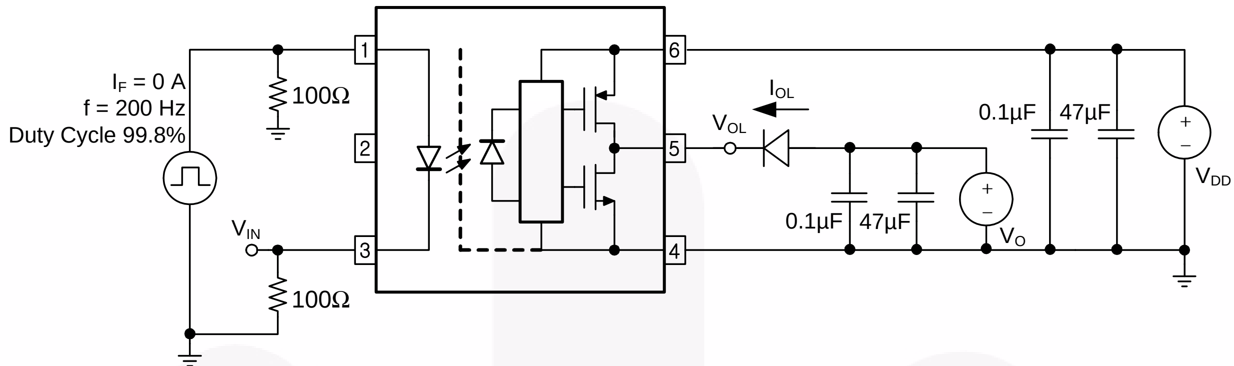


Figure 21. I_{OL} Test Circuit

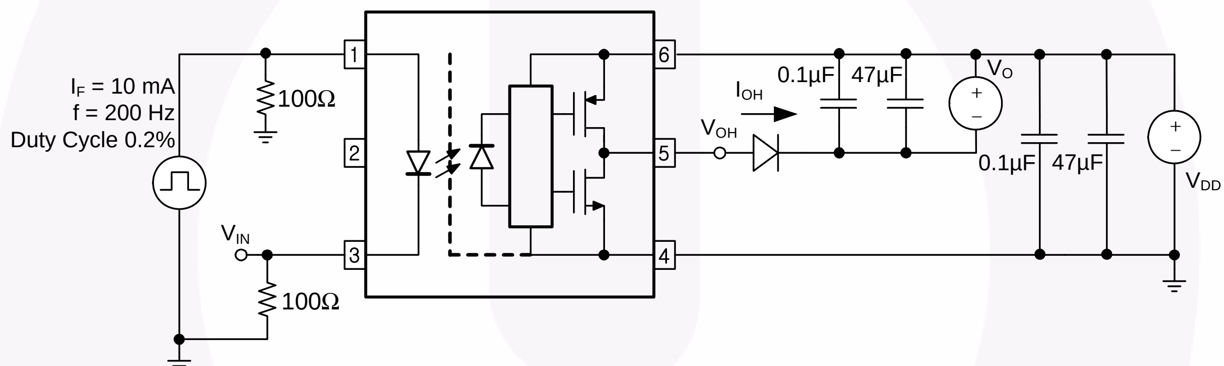


Figure 22. I_{OH} Test Circuit

Test Circuit (Continued)

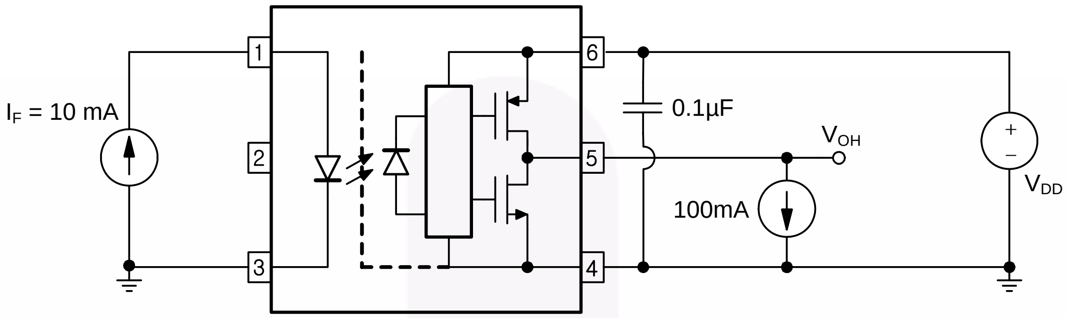


Figure 23. V_{OH} Test Circuit

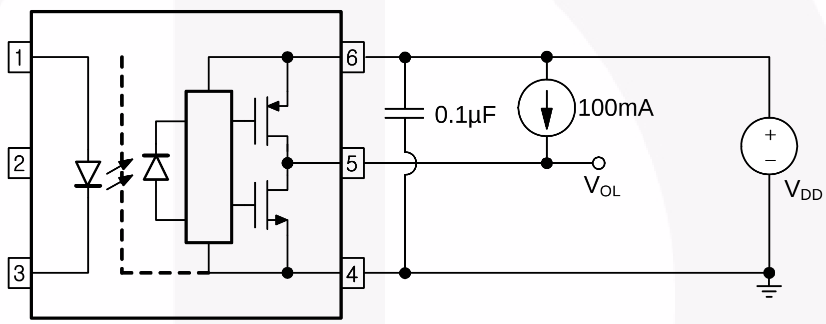


Figure 24. V_{OL} Test Circuit

Test Circuit (Continued)

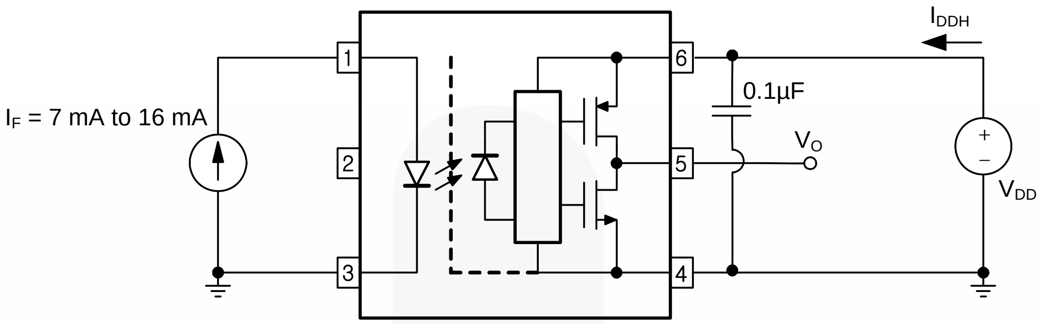


Figure 25. I_{DDH} Test Circuit

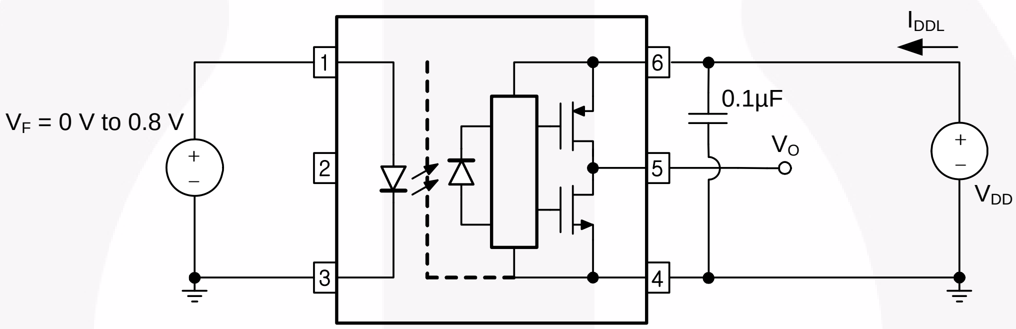


Figure 26. I_{DDL} Test Circuit

Test Circuit (Continued)

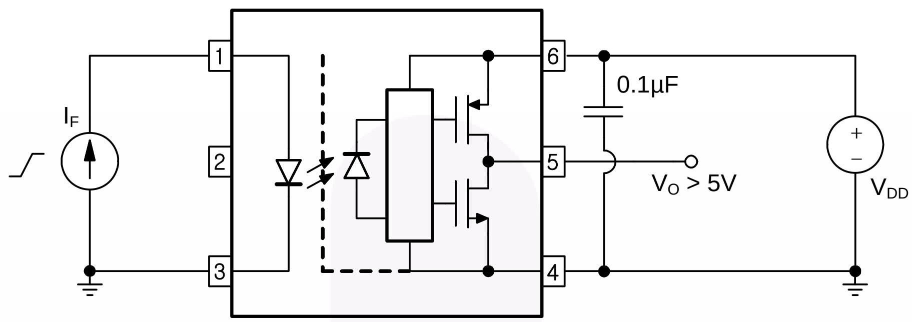


Figure 27. I_{FLH} Test Circuit

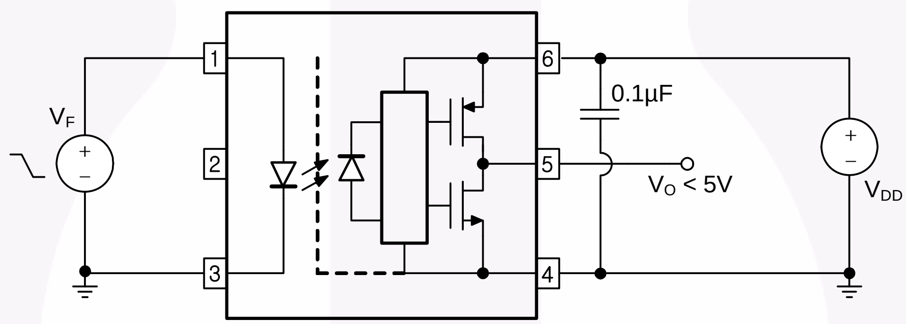


Figure 28. V_{FHL} Test Circuit

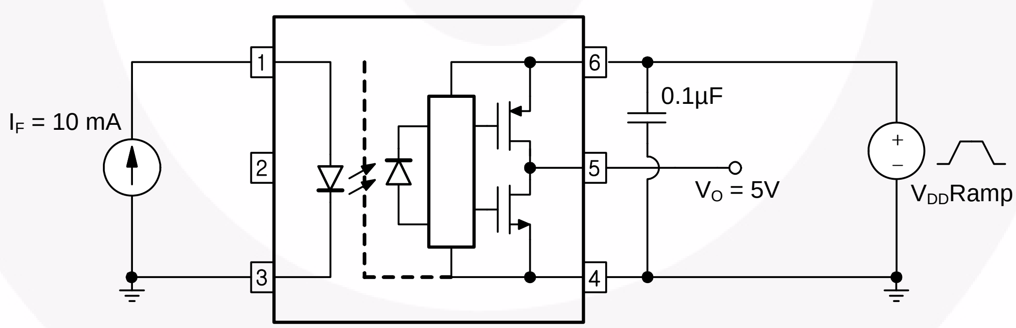


Figure 29. UVLO Test Circuit

Test Circuit (Continued)

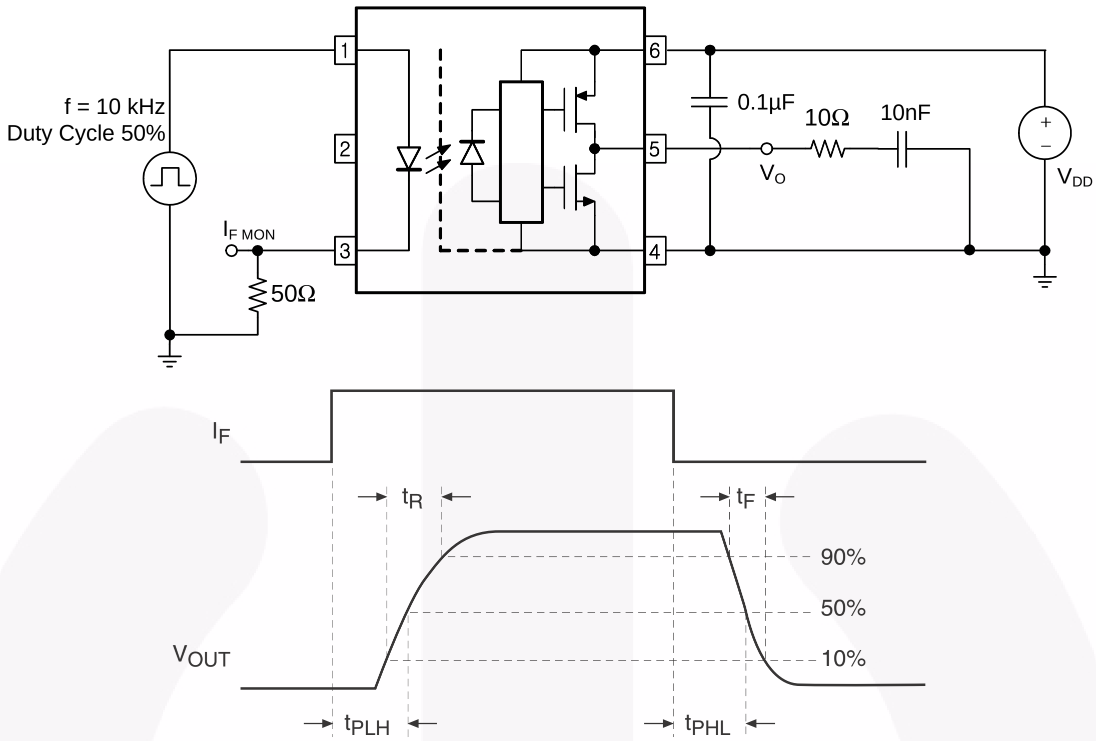


Figure 30. t_{PHL}, t_{PLH}, t_R and t_F Test Circuit and Waveforms

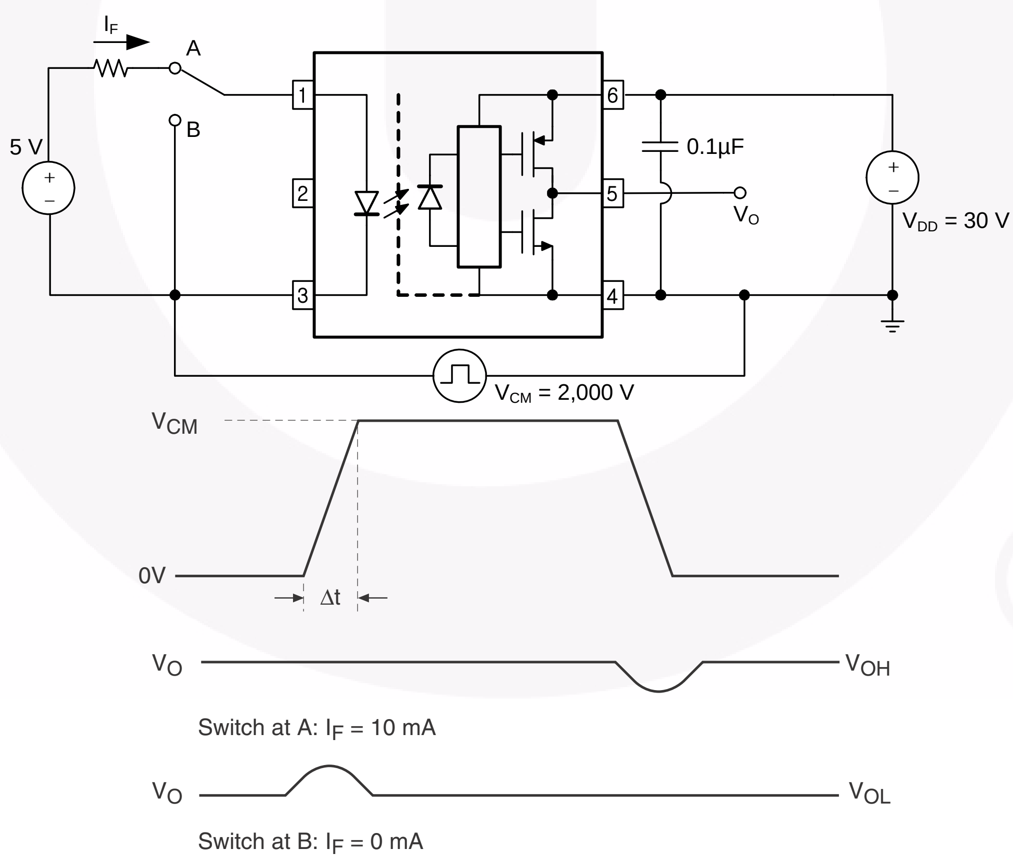
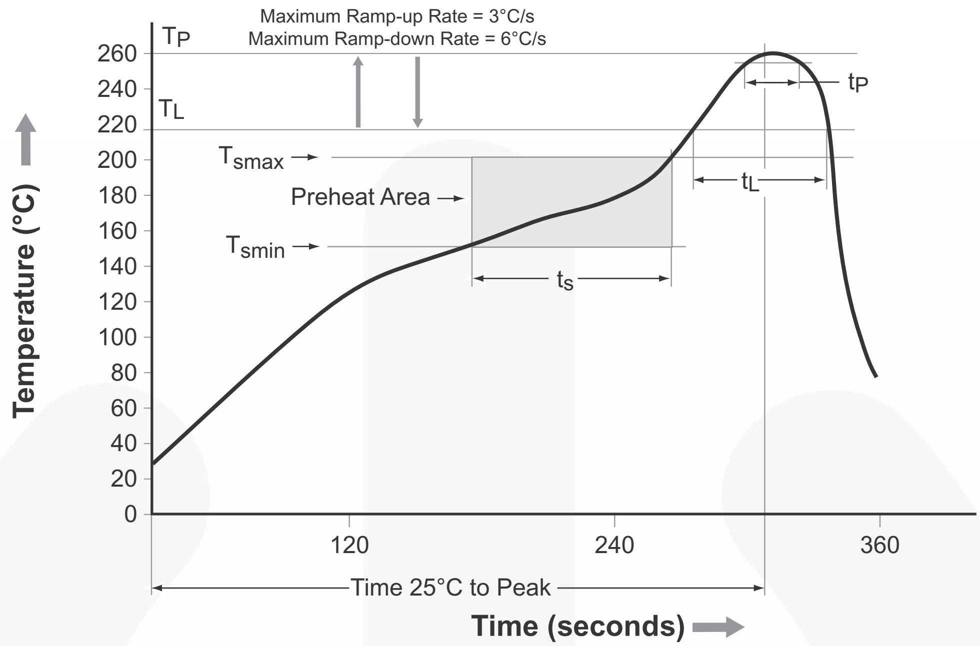


Figure 31. CMR Test Circuit and Waveforms

Reflow Profile



Profile Freature	Pb-Free Assembly Profile
Temperature Minimum (T_{smin})	150°C
Temperature Maximum (T_{smax})	200°C
Time (t_S) from (T_{smin} to T_{smax})	60 s to 120 s
Ramp-up Rate (t_L to t_P)	3°C/second maximum
Liquidous Temperature (T_L)	217°C
Time (t_L) Maintained Above (T_L)	60 s to 150 s
Peak Body Package Temperature	260°C +0°C / –5°C
Time (t_P) within 5°C of 260°C	30 s
Ramp-Down Rate (T_P to T_L)	6°C/s maximum
Time 25°C to Peak Temperature	8 minutes maximum

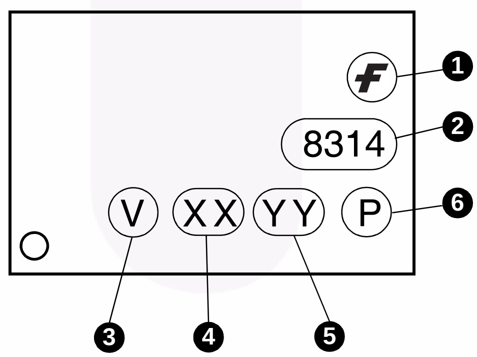
Figure 32. Reflow Profile

Ordering Information

Part Number	Package	Packing Method
FOD8314	Stretched Body SOP 6-Pin	Tube (100 units per tube)
FOD8314R2	Stretched Body SOP 6-Pin	Tape and Reel (1,000 units per reel)
FOD8314V	Stretched Body SOP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 units per tube)
FOD8314R2V	Stretched Body SOP 6-Pin, DIN EN/IEC60747-5-5 Option	Tape and Reel (1,000 units per reel)
FOD8314T	Stretched Body SOP 6-Pin, Wide Lead	Tube (100 units per tube)
FOD8314TR2	Stretched Body SOP 6-Pin, Wide Lead	Tape and Reel (1,000 units per reel)
FOD8314TV	Stretched Body SOP 6-Pin, Wide Lead, DIN EN/IEC60747-5-5 Option	Tube (100 units per tube)
FOD8314TR2V	Stretched Body SOP 6-Pin, Wide Lead, DIN EN/IEC60747-5-5 Option	Tape and Reel (1,000 units per reel)

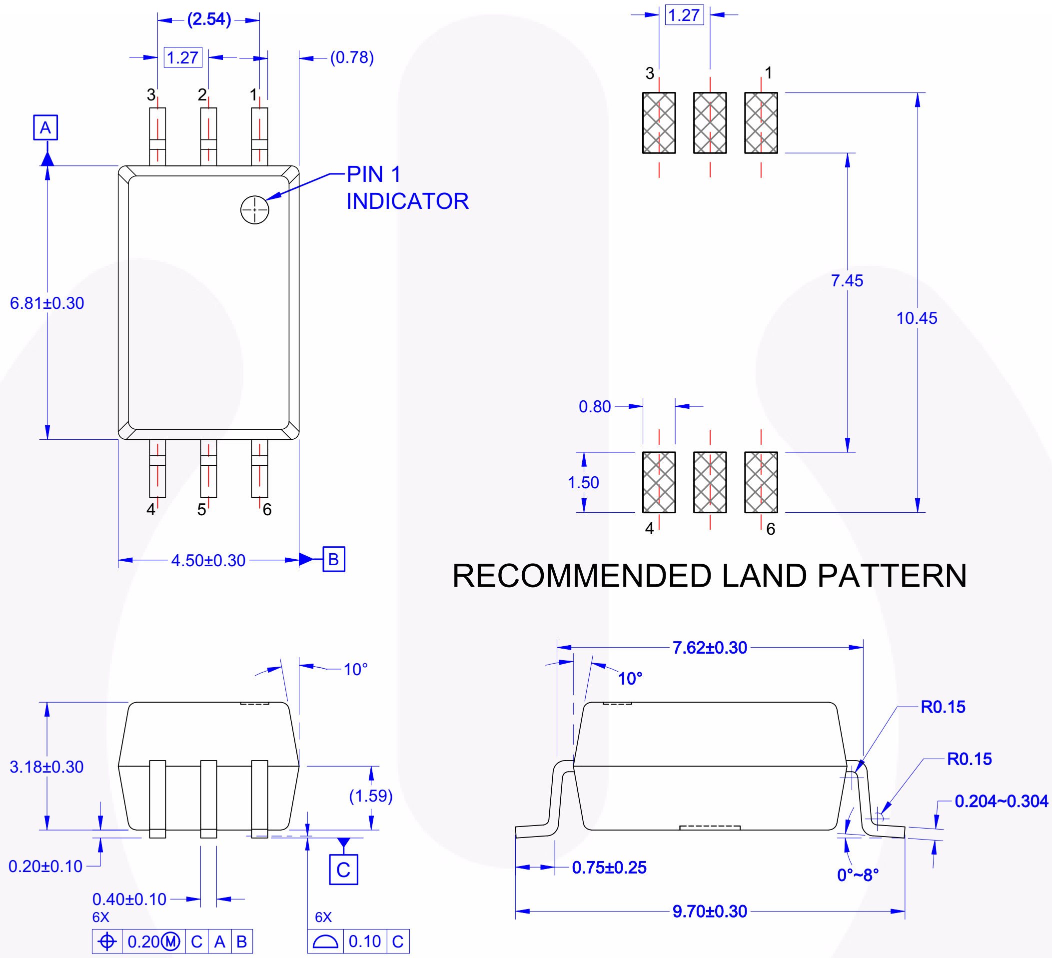
All packages are lead free per JEDEC: J-STD-020B standard.

Marking Information



Definitions	
1	Fairchild Logo
2	Device Number, e.g. 8314 or 8314T
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option) (Pending Approvals)
4	Last Digit Year Code, e.g. ‘5’
5	Two Digit Work Week Ranging from ‘01’ to ‘53’
6	Assembly Package Code

Package Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED
- A) NO STANDARD APPLIES TO THIS PACKAGE
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH, AND TIE BAR EXTRUSION.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- E) DRAWING FILE NAME: MKT-M06BREV1

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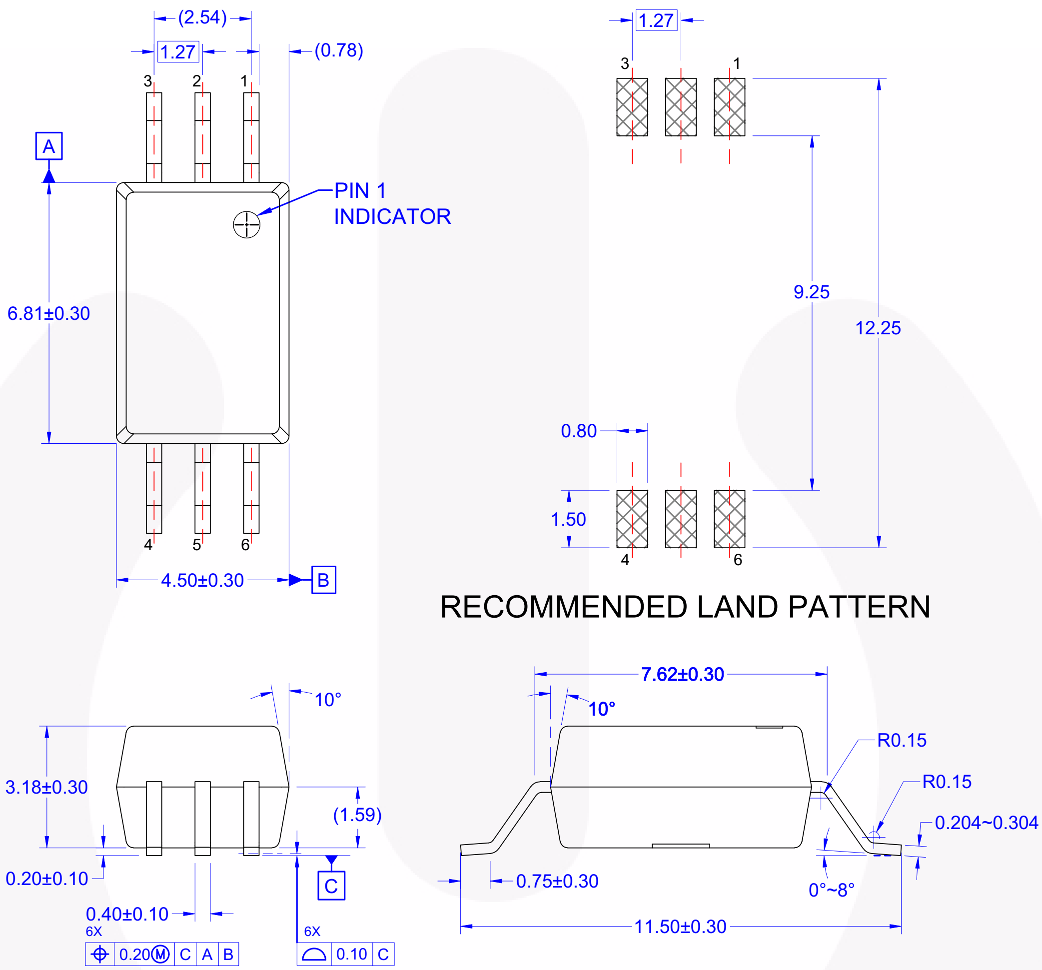
Figure 33. Stretched Body SOP 6-Pin

Package Dimensions (Continued)



NOTES: UNLESS OTHERWISE SPECIFIED
- A) NO STANDARD APPLIES TO THIS PACKAGE
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH, AND TIE BAR EXTRUSION.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- E) DRAWING FILE NAME: MKT-M06CREV1

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Figure 34. Stretched Body SOP 6-Pin, "T" Package Option

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