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March 2016



## 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<sub>RMS</sub> for 1 Minute
  - DIN EN/IEC60747-5-5, 1,140 V Peak Working Insulation Voltage

#### 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/

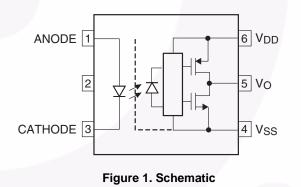
#### Description

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**



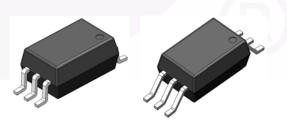


Figure 2. Package Outline

Truth Table			
LED	V <sub>DD</sub> – V <sub>SS</sub> "Positive Going" (Turn-on)	V <sub>DD</sub> – V <sub>SS</sub> "Negative Going" (Turn-off)	v <sub>o</sub>
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 <sub>SS</sub>	Negative Supply Voltage
5	Vo	Output Voltage
6	V <sub>DD</sub>	Positive Supply Voltage

## **Pin Configuration**

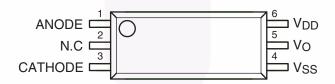


Figure 3. Pin Configuration

#### **Safety and Insulation Ratings**

As per DIN EN/IEC60747-5-5, 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		
Farameter	FOD8314	FOD8314T	
	< 150 V <sub>RMS</sub>	I–IV	I–IV
Installation Classifications per DIN VDE 0110/1.89 Table 1,	< 300 V <sub>RMS</sub>	I–IV	I–IV
For Rated Mains Voltage	< 450 V <sub>RMS</sub>	I–III	I–IV
	< 600 V <sub>RMS</sub>	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	Va	lue	Unit
Symbol	Falameter	FOD8314 FOD8314T	Onic	
V	Input-to-Output Test Voltage, Method B, $V_{IORM} \times 1.875 = V_{PR}$ , 100% Production Test with $t_m = 1$ s, Partial Discharge < 5 pC	1,671	2,137	V <sub>peak</sub>
¥ PR	$V_{PR}$ Input-to-Output Test Voltage, Method A, $V_{IORM} \times 1.6 = V_{PR}$ , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC		1,824	V <sub>peak</sub>
V <sub>IORM</sub>	Maximum Working Insulation Voltage	891	1,140	V <sub>peak</sub>
V <sub>IOTM</sub>	Highest Allowable Over-Voltage	6,000	8,000	V <sub>peak</sub>
	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,			
Τ <sub>S</sub>	Case Temperature	150	150	°C
I <sub>S,INPUT</sub>	Input Current	200	200	mA
P <sub>S,OUTPUT</sub>	Output Power	600	600	mW
R <sub>IO</sub>	Insulation Resistance at $T_S$ , $V_{IO}$ = 500 V	10 <sup>9</sup>	10 <sup>9</sup>	Ω

#### Absolute Maximum Ratings (T<sub>A</sub> = 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 <sub>STG</sub>	Storage Temperature	-40 to +125	°C
T <sub>OPR</sub>	Operating Temperature	-40 to +100	°C
TJ	Junction Temperature	-40 to +125	°C
T <sub>SOL</sub>	Lead Solder Temperature (Refer to Reflow Temperature Profile)	260 for 10 sec	°C
I <sub>F(AVG)</sub>	Average Input Current	25	mA
V <sub>R</sub>	Reverse Input Voltage	5.0	V
I <sub>O(PEAK)</sub>	Peak Output Current <sup>(1)</sup>	1.5	A
V <sub>DD</sub>	Supply Voltage	0 to 35	V
V <sub>O(PEAK)</sub>	Peak Output Voltage	0 to V <sub>DD</sub>	V
t <sub>R(IN)</sub> , t <sub>F(IN)</sub>	Input Signal Rise and Fall Time	500	ns
PDI	Input Power Dissipation <sup>(2)(4)</sup>	45	mW
PDO	Output Power Dissipation <sup>(3)(4)</sup>	500	mW

Notes:

- 1. Maximum pulse width = 10  $\mu$ s, 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 <sub>A</sub>	Ambient Operating Temperature	-40	+100	°C
$V_{DD} - V_{SS}$	Supply Voltage	16	30	V
I <sub>F(ON)</sub>	Input Current (ON)	10	16	mA
V <sub>F(OFF)</sub>	Input Voltage (OFF)	0	0.8	V

#### **Isolation Characteristics**

Symbol	Parameter	Conditions	Min.	Тур.	Max.	Unit
V <sub>ISO</sub>	Input-Output Isolation Voltage	$\begin{array}{l} T_{A} = 25^{\circ}C, \ R.H. < 50\%, \\ t = 1.0 \ minute, \ I_{I-O} \leq 20 \ \mu A^{(5)(6)} \end{array}$	5000			VAC <sub>RMS</sub>
R <sub>ISO</sub>	Isolation Resistance	$V_{I-O} = 500 V^{(5)}$		10 <sup>11</sup>		Ω
C <sub>ISO</sub>	Isolation Capacitance	$V_{I-O} = 0$ V, Frequency = 1.0 MHz <sup>(5)</sup>		1		pF

Apply over all recommended conditions, typical value is measured at  $T_A = 25^{\circ}C$ .

#### 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<sub>RMS</sub> for 1 minute duration is equivalent to 6,000 VAC<sub>RMS</sub> 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.	Тур.	Max.	Unit
V <sub>F</sub>	Input Forward Voltage		1.1	1.5	1.8	V
$\Delta(V_F/T_A)$	Temperature Coefficient of Forward Voltage	l <sub>F</sub> = 10 mA		-1.8		mV/°C
BV <sub>R</sub>	Input Reverse Breakdown Voltage	I <sub>R</sub> = 10 μA	5			V
C <sub>IN</sub>	Input Capacitance	f = 1 MHz, V <sub>F</sub> = 0 V		20		pF
1	High Level Output Current <sup>(1)</sup>	V <sub>OH</sub> = V <sub>DD</sub> - 0.75 V	0.2			A
I <sub>ОН</sub>		$V_{OH} = V_{DD} - 4 V$	1.0			A
1	Low Level Output Current <sup>(1)</sup>	$V_{OL} = V_{SS} + 0.75 V$	0.2			A
I <sub>OL</sub>		$V_{OL} = V_{SS} + 4 V$	1.0			A
Val	High Level Output Voltage <sup>(7)(8)</sup>	I <sub>F</sub> = 10 mA, I <sub>O</sub> = -1.0 A	$V_{DD} - 6.0$	$V_{DD} - 1.5$		V
V <sub>OH</sub>	VOH Thigh Level Output Voltage VO	I <sub>F</sub> = 10 mA, I <sub>O</sub> = -100 mA	$V_{DD} - 0.5$	$V_{DD} - 0.1$		
V <sub>OL</sub>	Low Level Output Voltage <sup>(7)(8)</sup>	I <sub>F</sub> = 10 mA, I <sub>O</sub> = 1.0 A		V <sub>SS</sub> + 1.5	$V_{SS}$ + 6.0	V
VOL	Low Level Output Voltage	I <sub>F</sub> = 0 mA, I <sub>O</sub> = 100 mA		$V_{SS} + 0.1$	$V_{SS} + 0.5$	
I <sub>DDH</sub>	High Level Supply Current	$V_{O}$ = Open, $I_{F}$ = 7 to 16 mA		2.9	5.0	mA
I <sub>DDL</sub>	Low Level Supply Current	$V_{O}$ = Open, $V_{F}$ = 0 to 0.8 V		2.8	5.0	mA
I <sub>FLH</sub>	Threshold Input Current Low to High	I <sub>O</sub> = 0 mA, V <sub>O</sub> > 5 V		1.5	7.5	mA
V <sub>FHL</sub>	Threshold Input Voltage High to Low	I <sub>O</sub> = 0 mA, V <sub>O</sub> < 5 V	0.8			V
V <sub>UVLO+</sub>	UnderVoltage Lockout	I <sub>F</sub> = 10 mA, V <sub>O</sub> > 5 V	11.5	12.7	14.5	V
V <sub>UVLO-</sub>	Threshold	I <sub>F</sub> = 10 mA, V <sub>O</sub> < 5 V	10.0	11.2	13.0	V
UVLO <sub>HYS</sub>	UnderVoltage Lockout Threshold Hysteresis			1.5		V

#### Notes:

- In this test, V<sub>OH</sub> is measured with a dc load current of 100 mA. When driving capacitive load V<sub>OH</sub> will approach V<sub>DD</sub> as I<sub>OH</sub> approaches 0 A.
- 8. Maximum pulse width = 1 ms, maximum duty cycle = 20%.

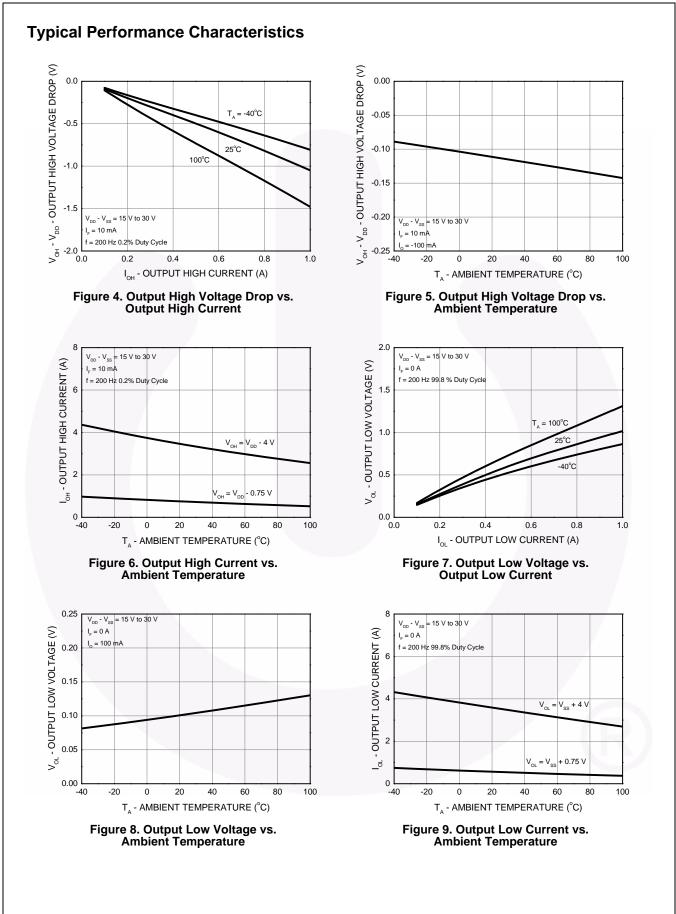
## **Switching Characteristics**

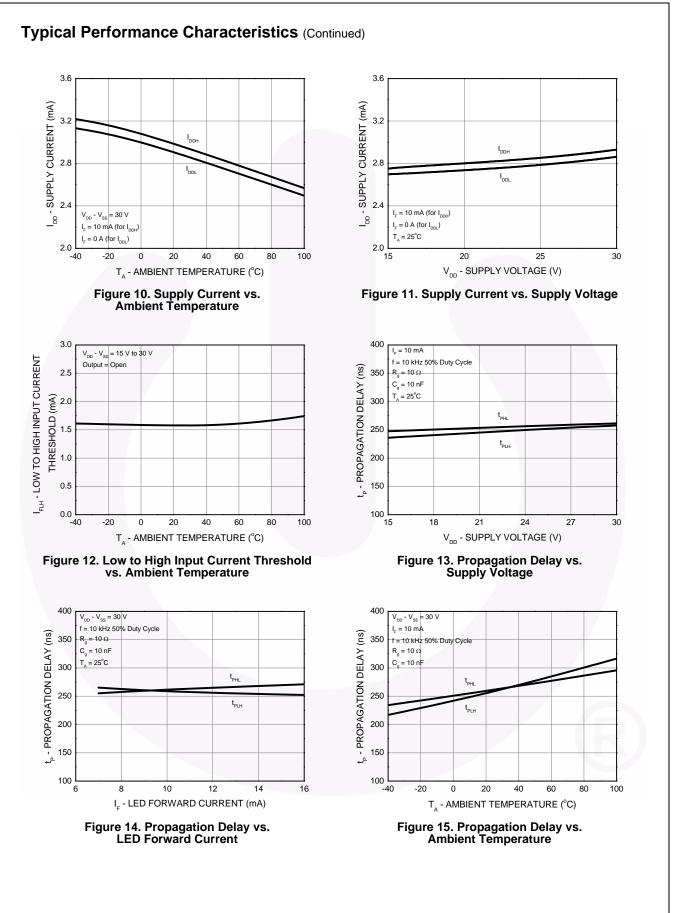
Apply over all recommended conditions, typical value is measured at  $V_{DD}$  = 30V,  $V_{SS}$  = Ground,  $T_A$  = 25°C unless otherwise specified.

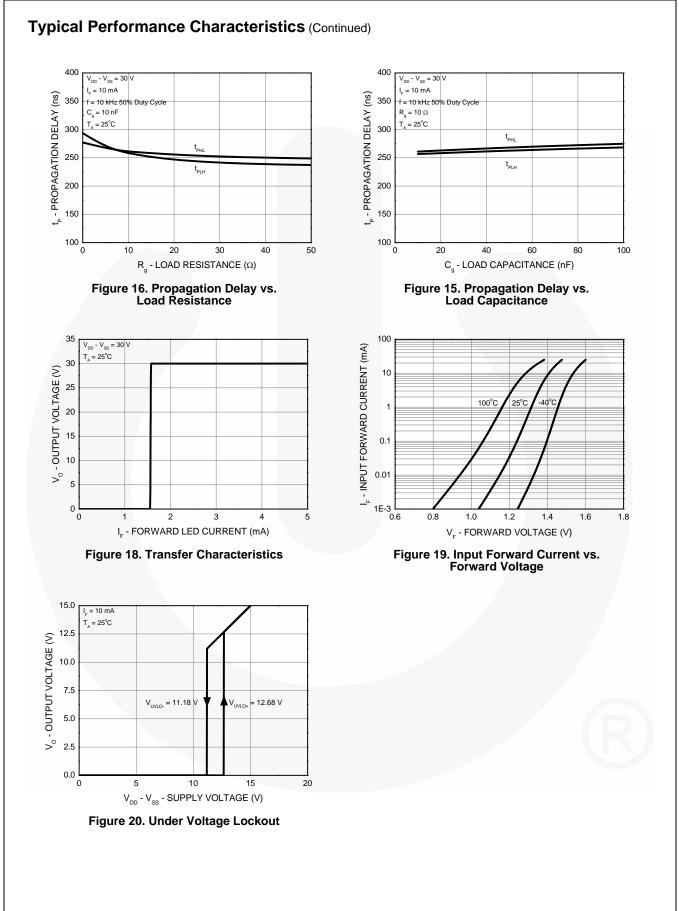
Symbol	Parameter	Conditions	Min.	Тур.	Max.	Unit
t <sub>PHL</sub>	Propagation Delay Time to Logic Low Output <sup>(9)</sup>		100	270	500	ns
t <sub>PLH</sub>	Propagation Delay Time to Logic High Output <sup>(10)</sup>		100	260	500	ns
PWD	Pulse Width Distortion <sup>(11)</sup>   t <sub>PHL</sub> – t <sub>PLH</sub>	$I_F = 7 \text{ mA to 16 mA,}$ $R_g = 10 \Omega$ , $C_g = 10 \text{ nF, f} = 10 \text{ kHz,}$ Duty Cycle = 50%		25	300	ns
PDD (Skew)	Propagation Delay Difference Between Any Two Parts <sup>(12)</sup>		-350		350	
t <sub>R</sub>	Output Rise Time (10% to 90%)			60		ns
t <sub>F</sub>	Output Fall Time (90% to 10%)			40		ns
t <sub>ULVO</sub> ON	ULVO Turn On Delay	$I_{\rm F}$ = 10 mA, $V_{\rm O}$ > 5 V		0.8		μS
t <sub>ULVO</sub> OFF	ULVO Turn Off Delay	$I_{\rm F}$ = 10 mA, V <sub>O</sub> < 5 V		0.2		μS
CM <sub>H</sub>	Common Mode Transient Immunity at Output High	$V_{DD} = 30$ V, I <sub>F</sub> = 10 mA to 16 mA, $V_{CM} = 2000$ V, T <sub>A</sub> = 25°C <sup>(13)</sup>	20	50		kV/μs
CM <sub>L</sub>	Common Mode Transient Immunity at Output Low	$V_{DD} = 30 \text{ V}, V_F = 0 \text{ V},$ $V_{CM} = 2000 \text{ V}, T_A = 25^{\circ}\text{C}^{(14)}$	20	50		kV/μs

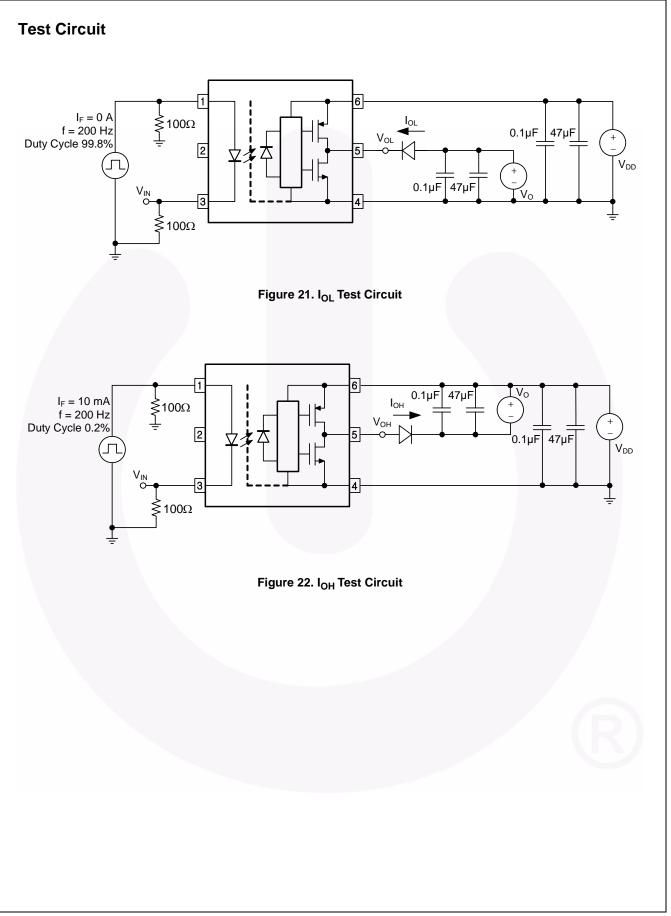
#### Notes:

- Propagation delay t<sub>PHL</sub> 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<sub>O</sub> signal.
- 10. Propagation delay t<sub>PLH</sub> 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<sub>O</sub> signal.
- 11. PWD is defined as | t<sub>PHL</sub> t<sub>PLH</sub> | for any given device.
- 12. The difference between t<sub>PHL</sub> and t<sub>PLH</sub> between any two FOD8314 parts under the same operating conditions, with equal loads.
- 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<sub>CM</sub>, to ensure that the output remains high (i.e., V<sub>O</sub> > 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).

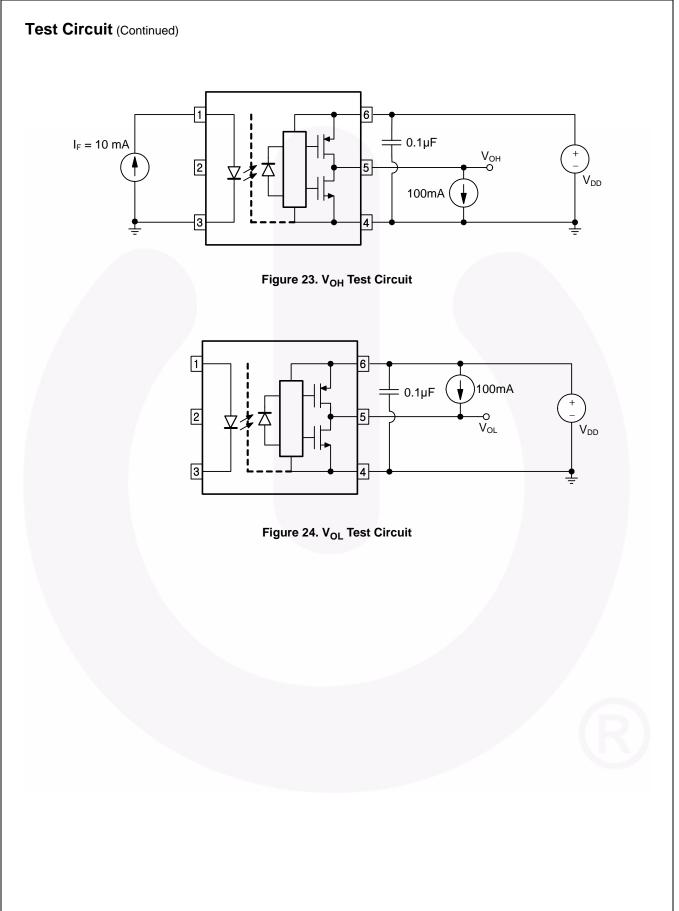


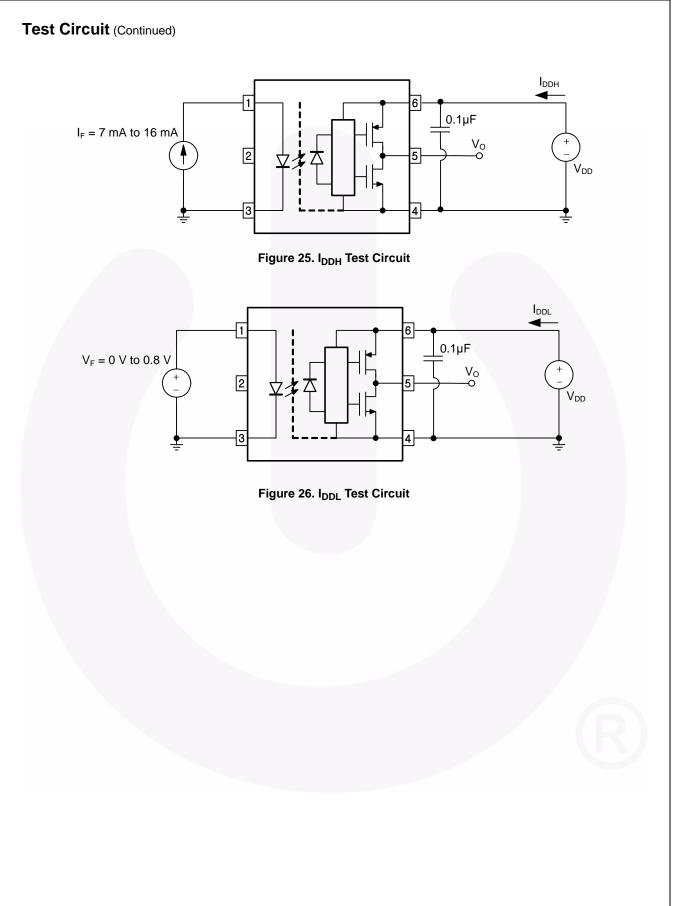


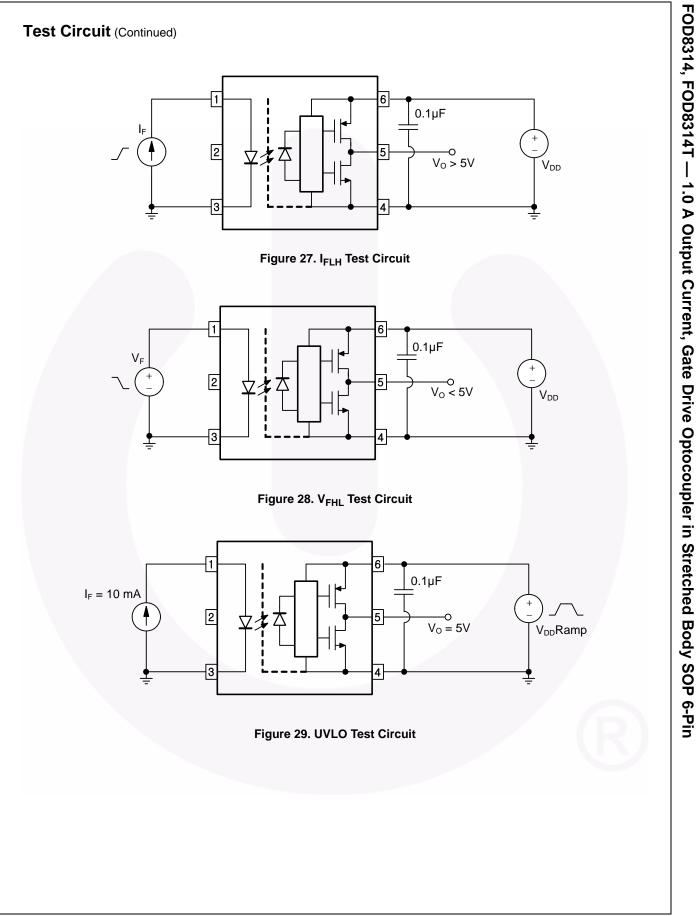


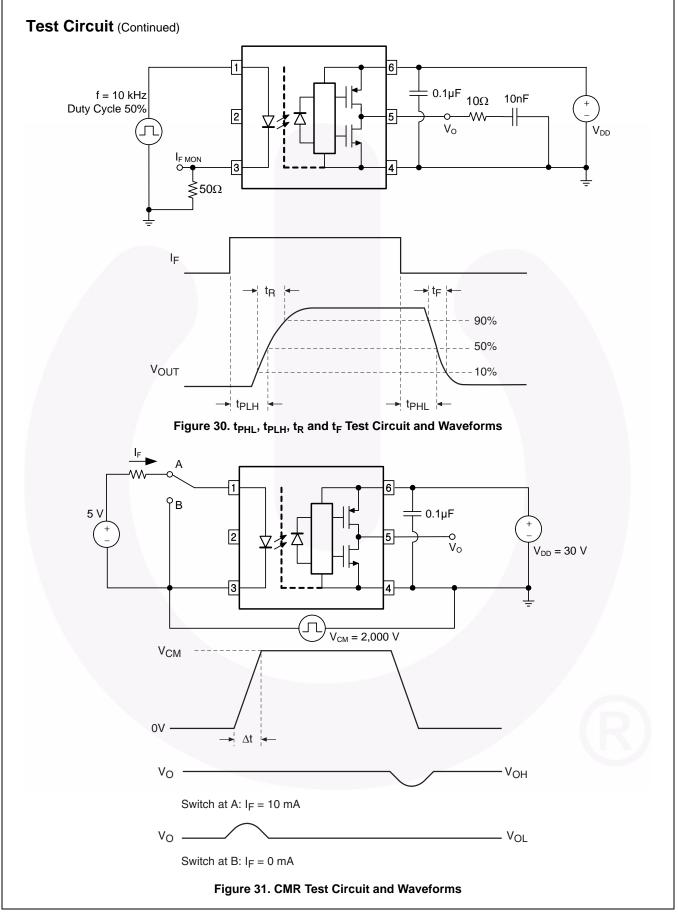


FOD8314, FOD8314T — 1.0 A Output Current, Gate Drive Optocoupler in Stretched Body SOP 6-Pin

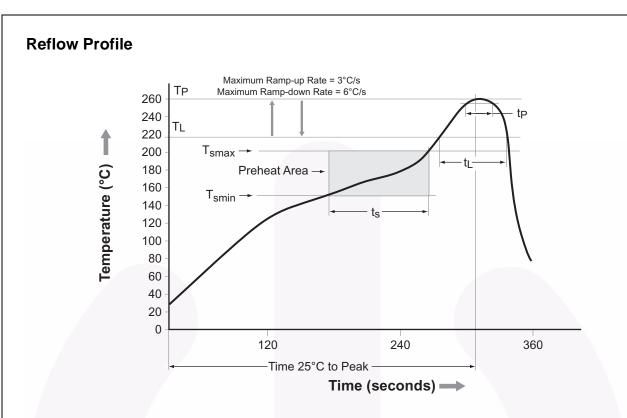








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Profile Freature	Pb-Free Assembly Profile
Temperature Minimum (T <sub>smin</sub> )	150°C
Temperature Maximum (T <sub>smax</sub> )	200°C
Time ( $t_S$ ) from ( $T_{smin}$ to $T_{smax}$ )	60 s to 120 s
Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second maximum
Liquidous Temperature (T <sub>L</sub> )	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 <sub>P</sub> ) within 5°C of 260°C	30 s
Ramp-Down Rate (T <sub>P</sub> to T <sub>L</sub> )	6°C/s maximum
Time 25°C to Peak Temperature	8 minutes maximum

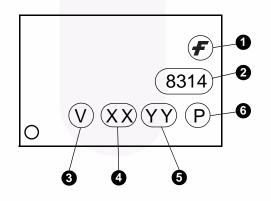
Figure 32. Reflow Profile

## **Ordering Information**

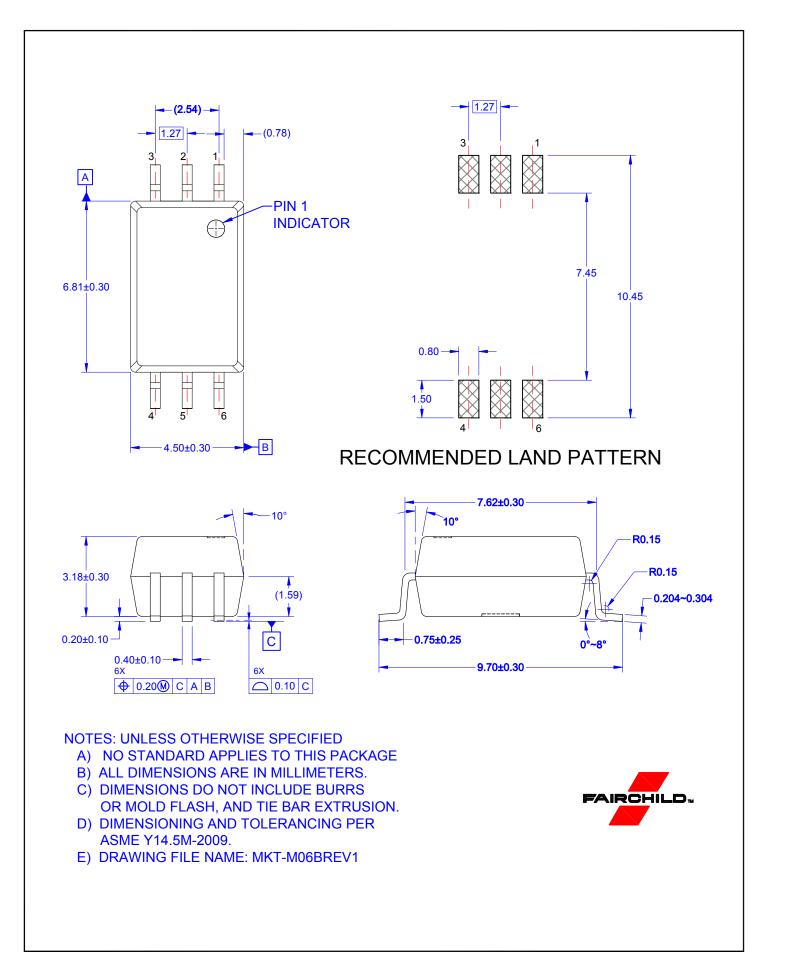
Part Number	Package	Packing Method	
FOD8314	Stretched Body SOP 6-Pin	Tube (100 units per tube)	
FOD8314R2	Stretched Body SOP 6-Pin	Tape and Reel (1,000 units per reel)	
FOD8314V	Stretched Body SOP 6-Pin, DIN EN/IEC60747-5-5 Option	Tube (100 units per tube)	
FOD8314R2V	Stretched Body SOP 6-Pin, DIN EN/IEC60747-5-5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

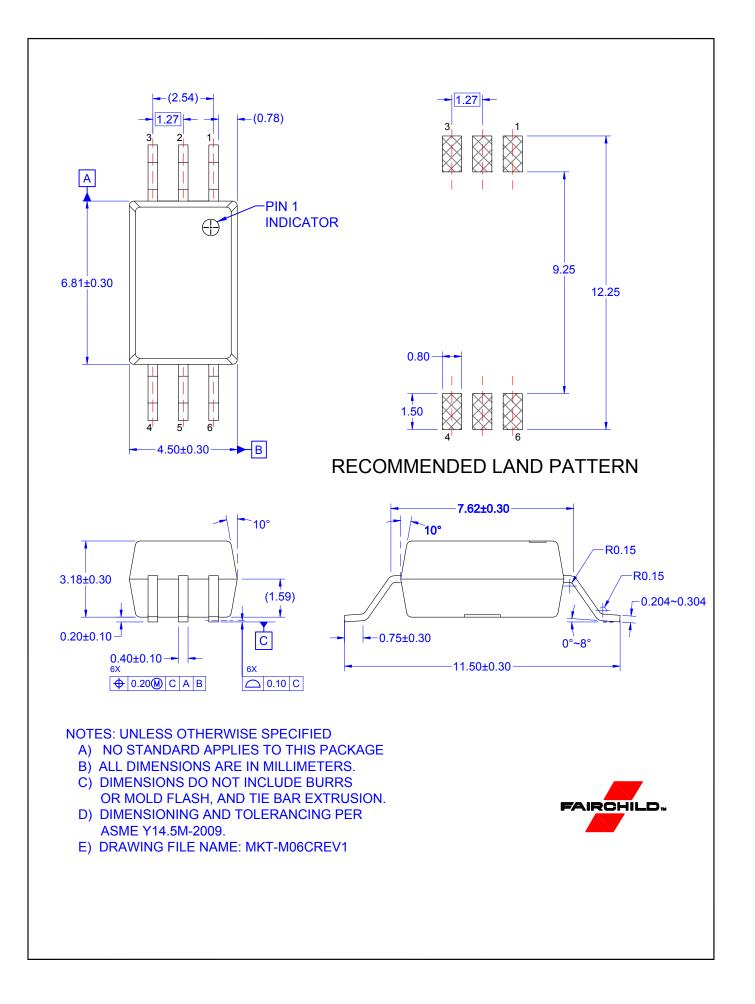
All packages are lead free per JEDEC: J-STD-020B standard.

## **Marking Information**



Definiti	Definitions			
1	Fairchild Logo			
2	Device Number, e.g. 8314			
3	DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)			
4	Last Digit Year Code, e.g. '5'			
5	Two Digit Work Week Ranging from '01' to '53'			
6	Assembly Package Code			





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