HIGH-SIDE AND LOW-SIDE GATE DRIVER IN SO-8

Description

The DGD2101M is a high-voltage / high-speed gate driver capable of driving N-Channel MOSFETs and IGBTs in a high-side/low-side configuration. High-voltage processing techniques enable the DGD2101M's high side to switch to 600V in a bootstrap operation. The 50ns (max) propagation delay matching between the high and the low side drivers allows high frequency switching.

The DGD2101M logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) for easy interfacing with controlling devices. The driver outputs feature high-pulse current buffers designed for minimum driver cross conduction. The low-side gate driver and logic share a common ground.

The DGD2101M is available in a space saving SO-8 package, the operating temperature extends from -40°C to +125°C.

Applications

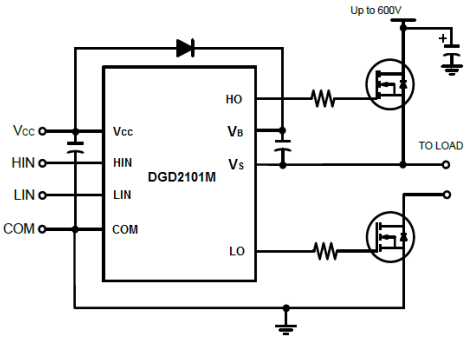
- DC-DC Converters
- DC-AC Inverters
- AC-DC Power Supplies
- Motor Controls
- Class D Power Amplifiers

Features

- Floating High-Side Driver in Bootstrap Operation to 600V
- Drives Two N-Channel MOSFETs or IGBTs in High-Side / Low-Side Configuation
- Outputs Tolerant to Negative Transients
- Wide Low-Side Gate Driver and Logic Supply: 10V to 20V
- Logic Inputs CMOS and TTL Compatible (Down to 3.3V)
- Schmitt Triggered Logic Inputs with Internal Pull Down
- Undervoltage Lockout for V_{CC}
- Extended Temperature Range: -40°C to +125°C
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q101, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.**
- **https://www.diodes.com/quality/product-definitions/**

Mechanical Data

- Case: SO-8 (Type TH)
- Case Material: Molded Plastic. "Green" Molding Compound; UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 3 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.075 grams (Approximate)



Typical Configuration

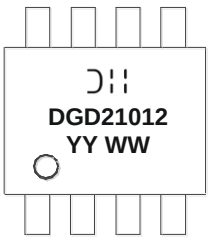
SO-8
Top View

Ordering Information (Note 4)

Part Number	Marking	Reel Size (inches)	Tape Width (mm)	Quantity Per Reel
DGD2101MS8-13	DGD21012	13	12	2,500

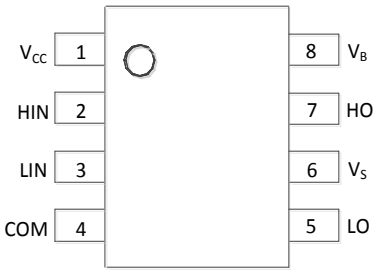
Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information



= Manufacturer's Marking
DGD21012 = Product Type Marking Code
YY = Year (ex: 19 = 2019)
WW = Week (01 to 53)

Pin Diagrams

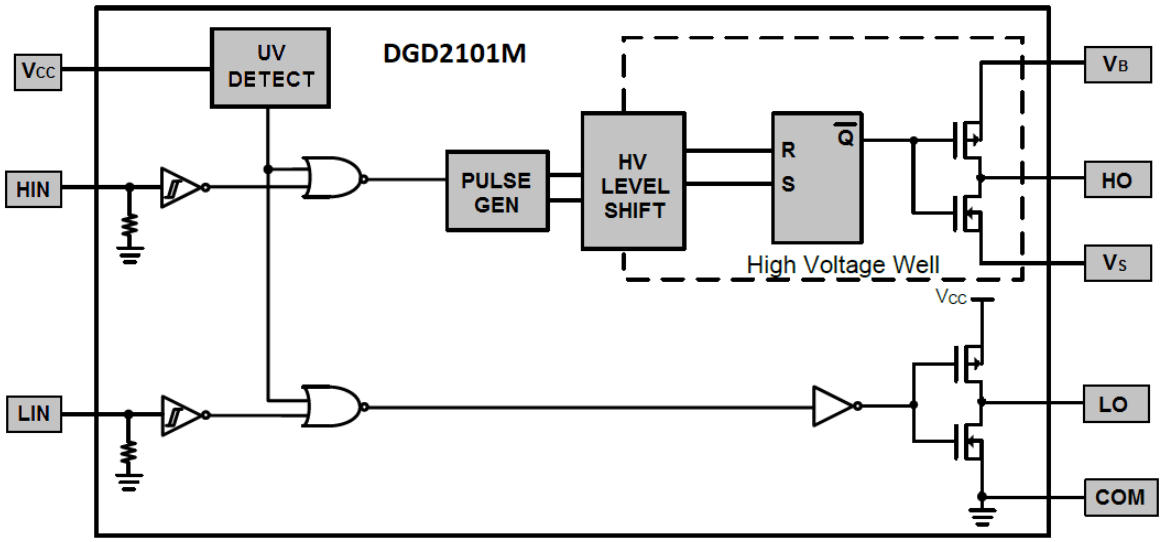


Top View: SO-8

Pin Descriptions

Pin Number	Pin Name	Function
1	V_{CC}	Low-side and logic fixed supply
2	HIN	Logic input for high-side gate driver output (HO), in phase
3	LIN	Logic input for low-side gate driver output (LO), in phase
4	COM	Low-side return
5	LO	Low-side gate drive output
6	V_S	High-side floating supply return
7	HO	High-side gate drive output
8	V_B	High-side floating supply

Functional Block Diagram



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

Characteristic	Symbol	Value	Unit
High-Side Floating Supply Voltage	V_B	-0.3 to +624	V
High-Side Floating Supply Offset Voltage	V_S	V_B-24 to V_B+0.3	V
High-Side Floating Output Voltage	V_{HO}	V_S-0.3 to V_B+0.3	V
Offset Supply Voltage Transient	dV_S / dt	50	V/ns
Low-Side and Logic Fixed Supply Voltage	V_{CC}	-0.3 to +24	V
Low-Side Output Voltage	V_{LO}	-0.3 to V_{CC}+0.3	V
Logic Input Voltage (HIN and LIN)	V_{IN}	-0.3 to V_{CC}+0.3	V

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation Linear Derating Factor (Note 5)	P_D	0.625	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	200	°C/W
Thermal Resistance, Junction to Case (Note 5)	$R_{\theta JC}$	45	°C/W
Operating Temperature	T_J	+150	°C
Storage Temperature Range	T_{STG}	-55 to +150	

Note: 5. When mounted on a standard JEDEC 2-layer FR-4 board.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
High-Side Floating Supply Absolute Voltage	V_B	V_S + 10	V_S + 20	V
High-Side Floating Supply Offset Voltage	V_S	(Note 6)	600	V
High-Side Floating Output Voltage	V_{HO}	V_S	V_B	V
Low-Side and Logic Fixed Supply Voltage	V_{CC}	10	20	V
Low-Side Output Voltage	V_{LO}	0	V_{CC}	V
Logic Input Voltage (HIN and LIN)	V_{IN}	0	5	V
Ambient Temperature	T_A	-40	+125	°C

Note: 6. Logic operation for V_S = -5V to +600V.

DC Electrical Characteristics (V_{BIAS} (V_{CC}, V_{BS}) = 15V, @T_A = +25°C, unless otherwise specified.) (Note 7)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Logic “1” Input Voltage (Note 8)	V_{IH}	2.5	—	—	V	V_{CC} = 10V to 20V
Logic “0” Input Voltage (Note 8)	V_{IL}	—	—	0.8	V	V_{CC} = 10V to 20V
High Level Output Voltage, V_{BIAS} - V_O	V_{OH}	—	0.05	0.2	V	I_O = 2mA
Low Level Output Voltage, V_O	V_{OL}	—	0.02	0.1	V	I_O = 2mA
Offset Supply Leakage Current	I_{LK}	—	—	50	µA	V_B = V_S = 600V
Quiescent V_{BS} Supply Current	I_{BSQ}	—	30	55	µA	V_{IN} = 0V or 5V
Quiescent V_{CC} Supply Current	I_{CCQ}	—	150	270	µA	V_{IN} = 0V or 5V
Logic “1” Input Bias Current	I_{IN+}	—	3.0	10	µA	V_{IN} = 5V
Logic “0” Input Bias Current	I_{IN-}	—	—	5.0	µA	V_{IN} = 0V
V_{CC} Supply Undervoltage Positive Going Threshold	V_{CCUV+}	8.0	8.9	9.8	V	—
V_{CC} Supply Undervoltage Negative Going Threshold	V_{CCUV-}	7.4	8.2	9.0	V	—
Output High Short Circuit Pulsed Current	I_{O+}	130	290	—	mA	V_O = 0V, V_{IN} = Logic“1”, PW ≤ 10µs
Output Low Short Circuit Pulsed Current	I_{O-}	270	600	—	mA	V_O = 15V, V_{IN} = Logic“0”, PW ≤ 10µs

Notes: 7. The V_{IN} and I_{IN} parameters are referenced to COM. The V_O and I_O parameters are referenced to COM and are applicable to the respective output pins: HO and LO.
8. For optimal operation, it is recommended that the input pulses (HIN and LIN) should have a minimum amplitude of 2.5V with a minimum pulse width of 300ns.

AC Electrical Characteristics (V_{BIAS} (V_{CC}, V_{BS}) = 15V, C_L = 1000pF, @T_A = +25°C, unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-On Propagation Delay	t_{ON}	—	160	220	ns	V_S = 0V
Turn-Off Propagation Delay	t_{OFF}	—	150	220	ns	V_S = 600V
Turn-On Rise Time	t_R	—	70	170	ns	—
Turn-Off Fall Time	t_F	—	35	90	ns	—
Delay Matching	t_{DM}	—	—	50	ns	—

Timing Waveforms

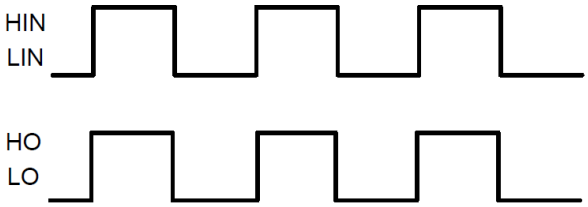


Figure 1. Input / Output Timing Diagram

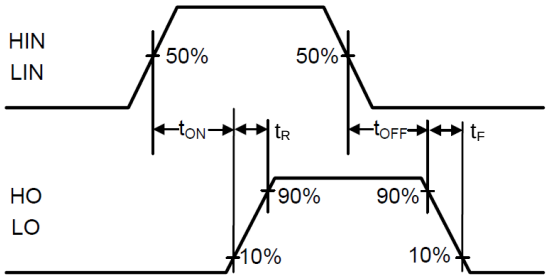


Figure 2. Switching Time Waveform Definitions

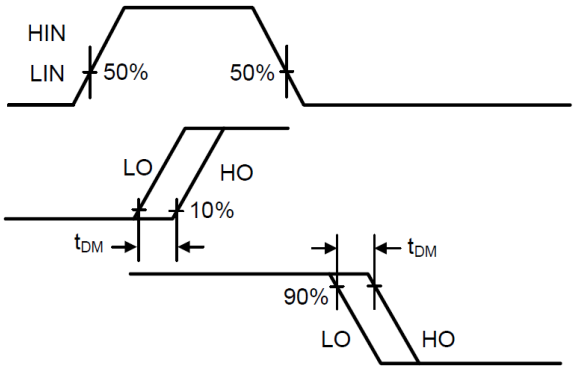


Figure 3. Delay Matching Waveform Definitions

Typical Performance Characteristics (V_{CC} = 15V, @T_A = +25°C, unless otherwise specified.)

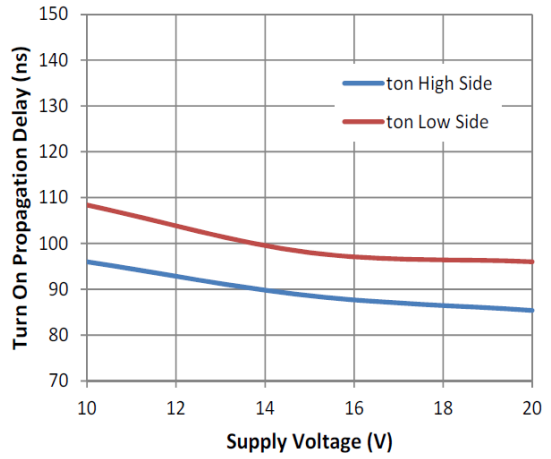


Figure 4. Turn-on Propogation Delay vs. Supply Voltage

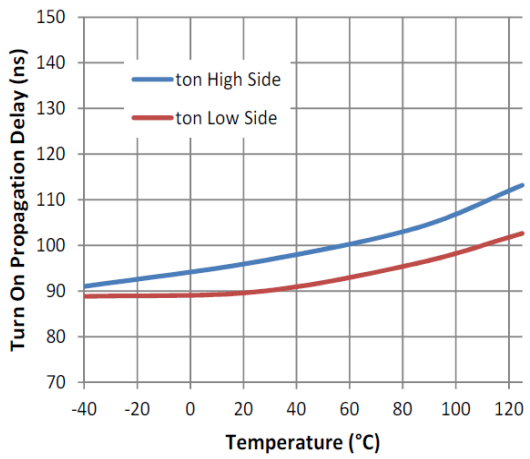


Figure 5. Turn-on Propogation Delay vs. Temperature

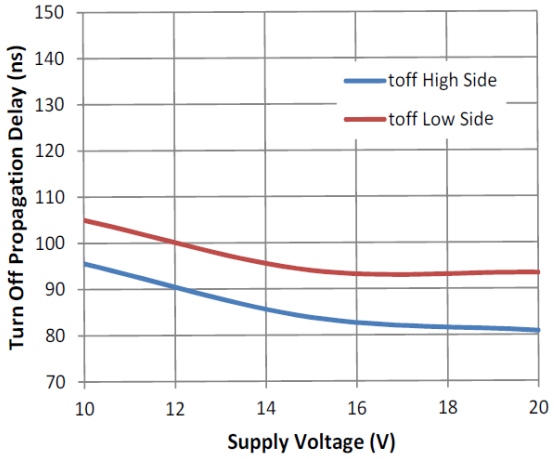


Figure 6. Turn-off Propogation Delay vs. Supply Voltage

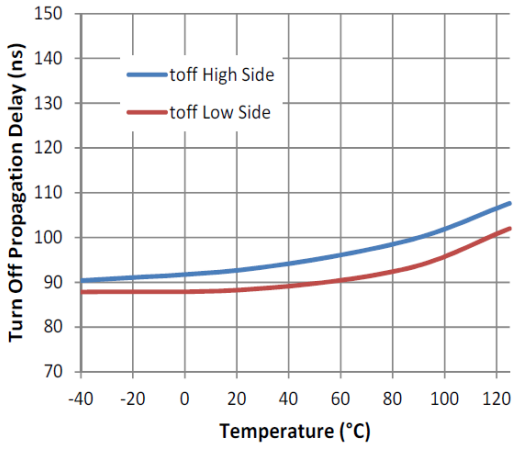


Figure 7. Turn-off Propogation Delay vs. Temperature

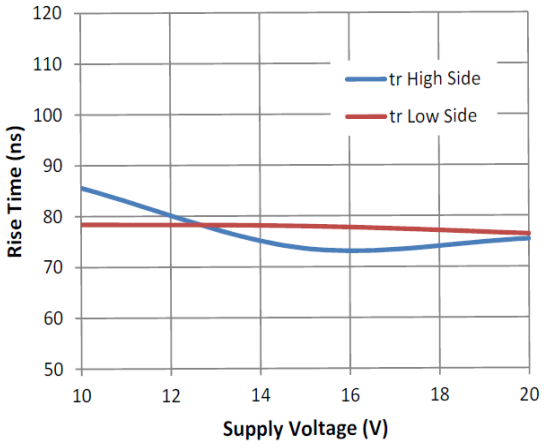


Figure 8. Rise Time vs. Supply Voltage

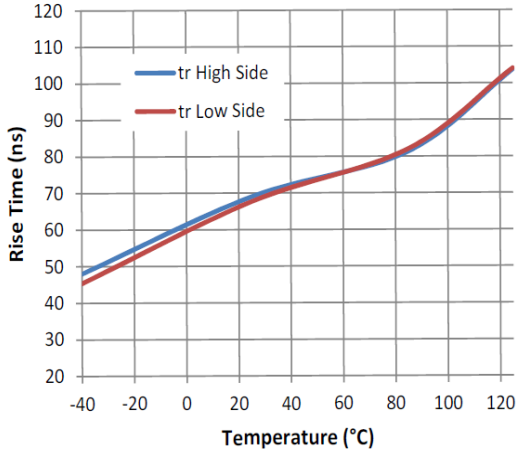


Figure 9. Rise Time vs. Temperature

Typical Performance Characteristics (continued)

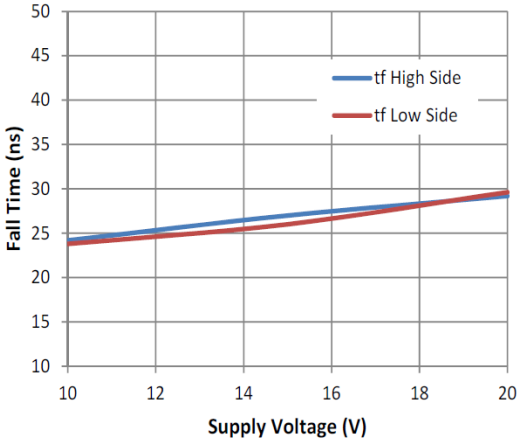


Figure 10. Fall Time vs. Supply Voltage

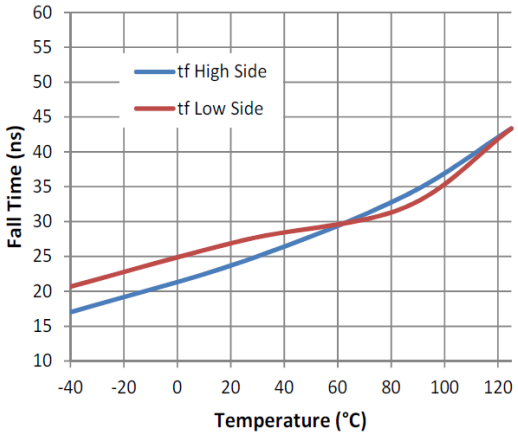


Figure 11. Fall Time vs. Temperature

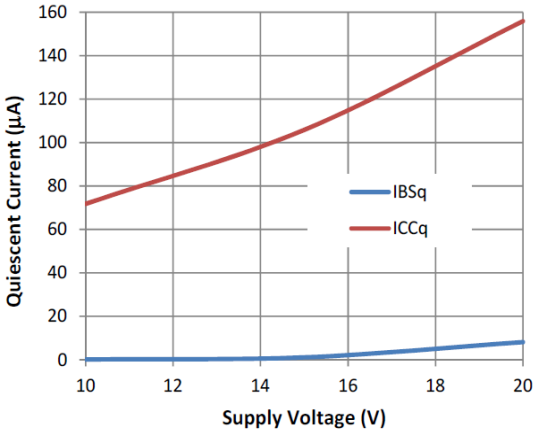


Figure 12. Quiescent Current vs. Supply Voltage

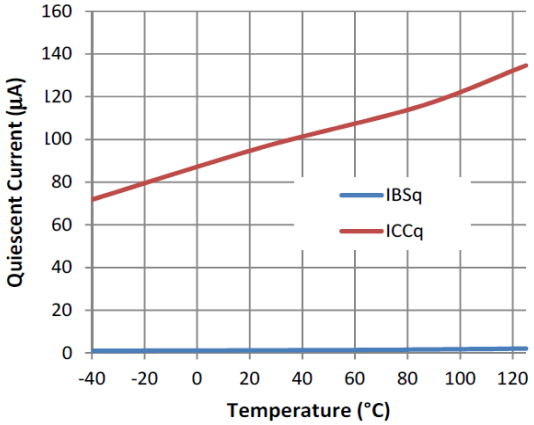


Figure 13. Quiescent Current vs. Temperature

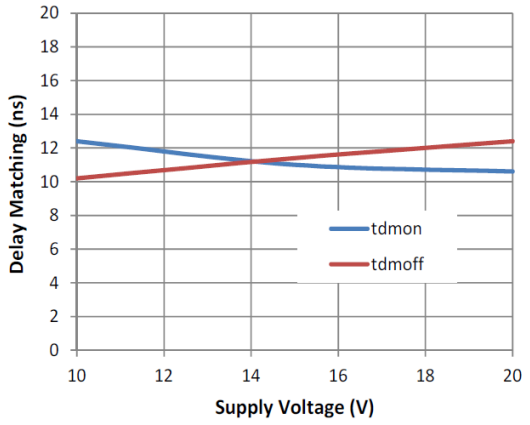


Figure 14. Delay Matching vs. Supply Voltage

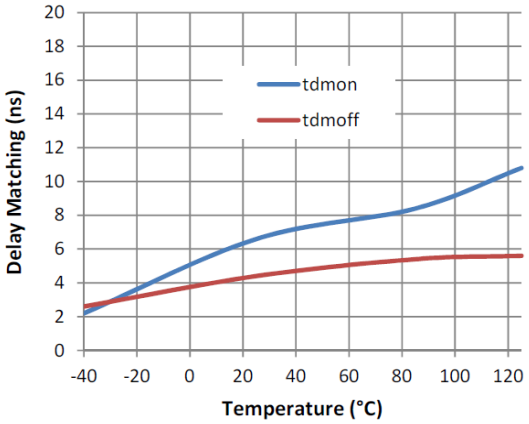


Figure 15. Delay Matching vs. Temperature

Typical Performance Characteristics (continued)

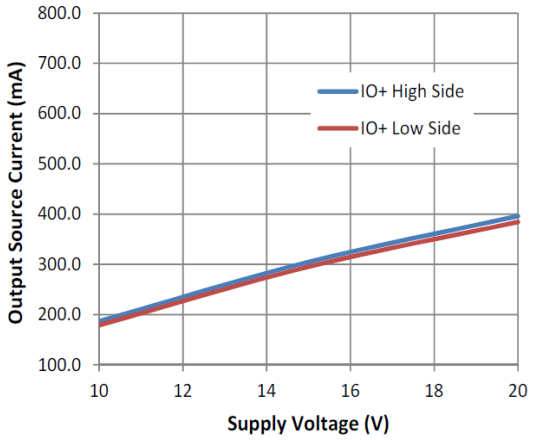


Figure 16. Output Source Current vs. Supply Voltage

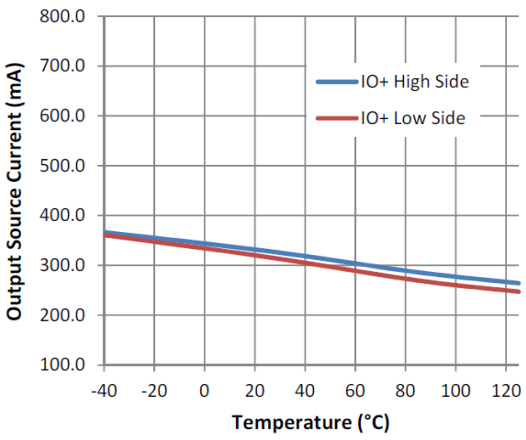


Figure 17. Output Source Current vs. Temperature

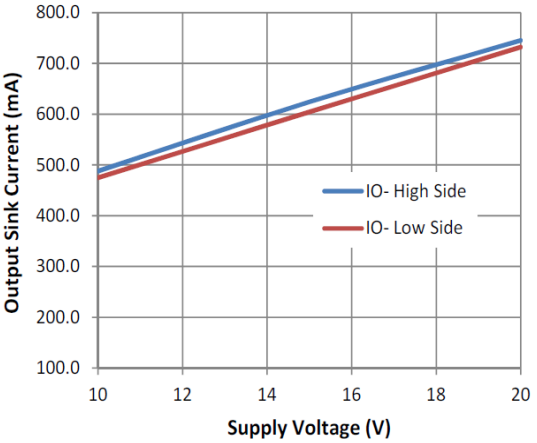


Figure 18. Output Sink Current vs. Supply Voltage

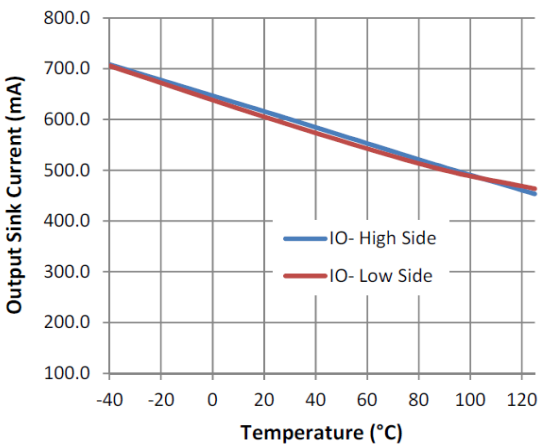


Figure 19. Output Sink Current vs. Temperature

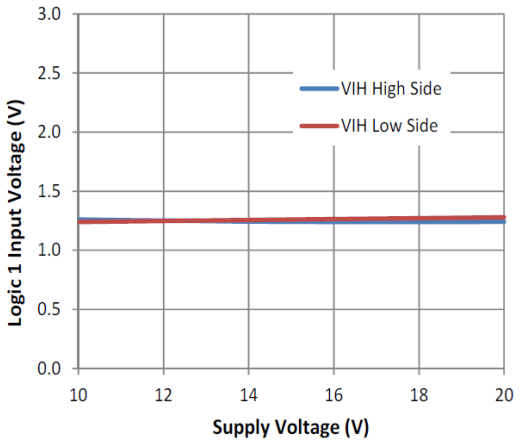


Figure 20. Logic 1 Input Voltage vs. Supply Voltage

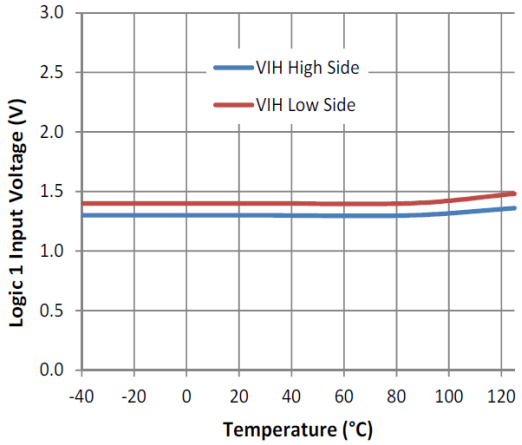


Figure 21. Logic 1 Input Voltage vs. Temperature

Typical Performance Characteristics (continued)

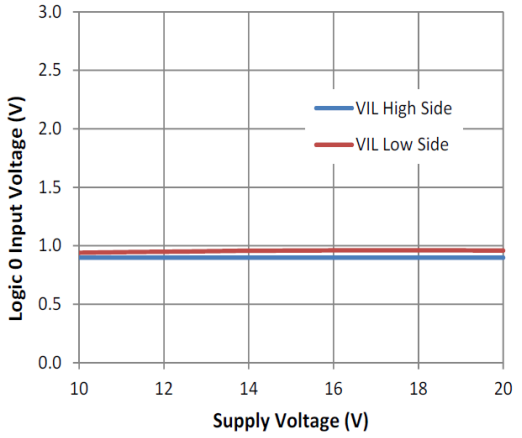


Figure 22. Logic 0 Input Voltage vs. Supply Voltage

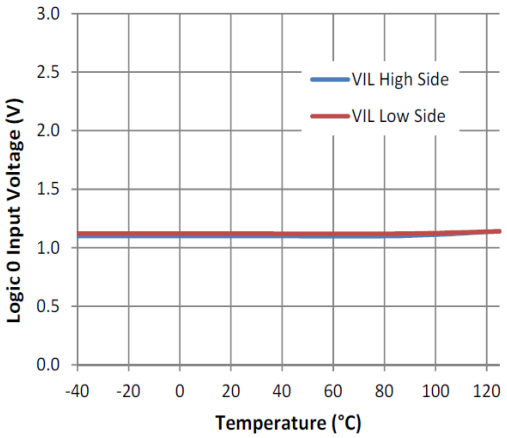


Figure 23. Logic 0 Input Voltage vs. Temperature

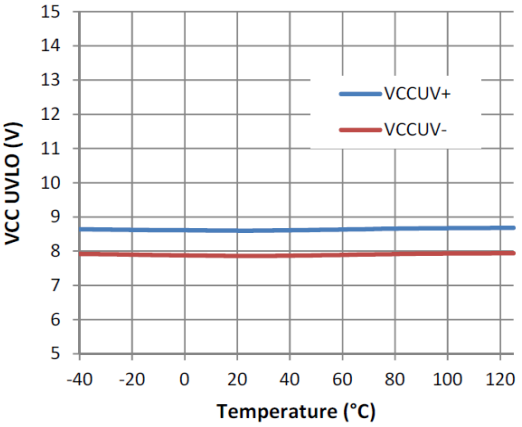


Figure 24. V_{CC} UVLO vs. Temperature

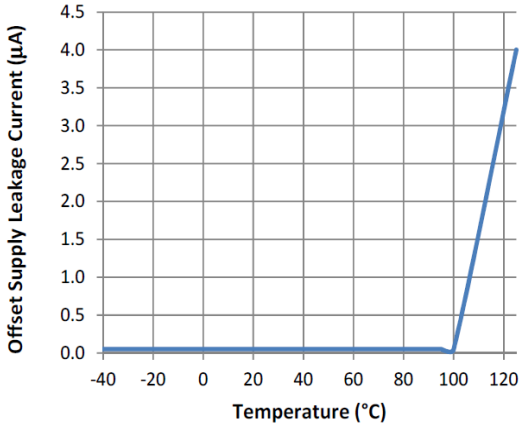
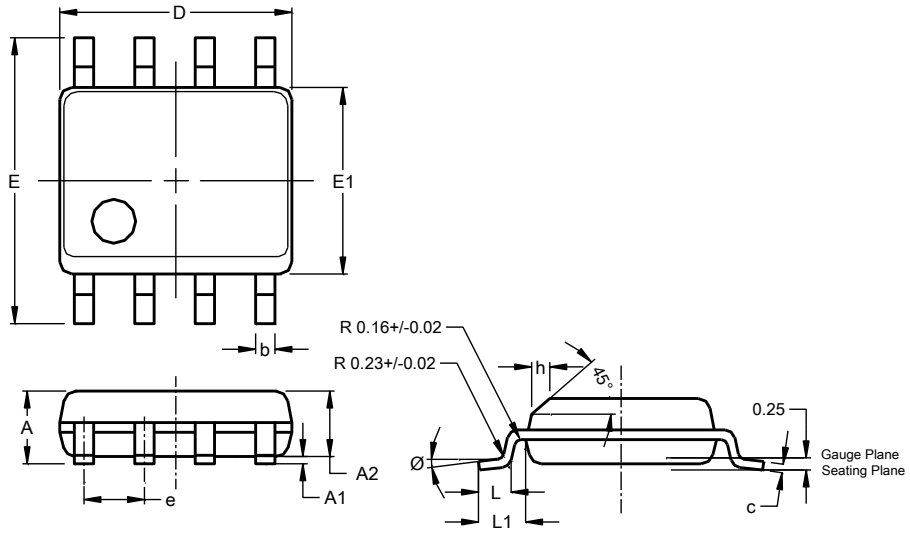


Figure 25. Offset Supply Leakage Current Temperature

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

SO-8 (Type TH)

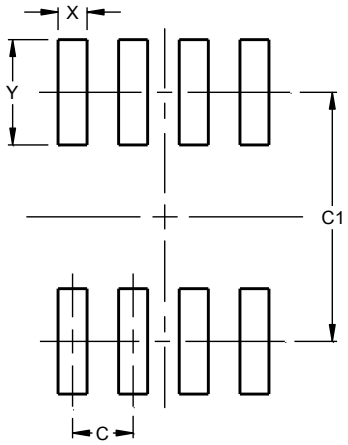


SO-8 (Type TH)			
Dim	**Min**	**Max**	**Typ**
A	1.35	1.75	--
A1	0.10	0.25	--
A2	--	--	1.45
b	0.35	0.51	--
c	0.190	0.248	--
D	4.80	5.00	4.90
E	5.80	6.20	6.00
E1	3.80	4.00	3.90
e	--	--	1.27
h	0.25	0.50	--
L	0.41	1.27	--
L1	--	--	1.04
Ø	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

SO-8 (Type TH)



Dimensions	Value (in mm)
C	1.27
C1	5.20
X	0.60
Y	2.20

Note: For high voltage applications, the appropriate industry sector guidelines should be considered with regards to creepage and clearance distances between device Terminals and PCB tracking.

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1. are intended to implant into the body, or

2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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