

## Description

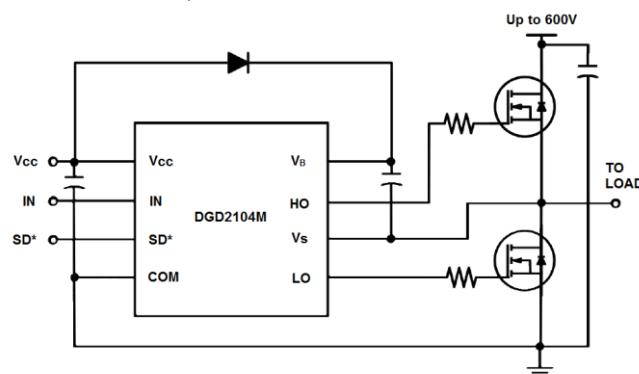
The DGD2104M is a high-voltage / high-speed gate driver capable of driving N-channel MOSFETs and IGBTs in a half bridge configuration. High-voltage processing techniques enable the DGD2104M's high side to switch to 600V in a bootstrap operation.

The DGD2104M logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with controlling devices. The driver outputs feature high-pulse current buffers designed for minimum driver cross conduction.

The DGD2104M is offered in the SO-8 (Type TH) package and operates over an extended -40°C to +125°C temperature range.

## Applications

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



Typical Configuration



SO-8 (Type TH)  
Top View

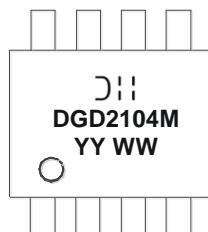
## Ordering Information (Note 4)

Product	Marking	Reel Size (inch)	Tape Width (mm)	Quantity per Reel
DGD2104MS8-13	DGD2104M	13	12	2,500

Notes:

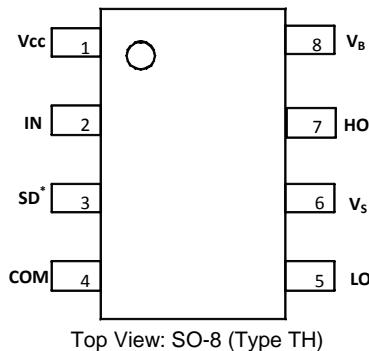
- No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
- See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and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

## Marking Information



DGD2104M = Manufacturer's Marking  
 DGD2104M = Product Type Marking Code  
 YY = Year (ex: 16 = 2016)  
 WW = Week (01 to 53)

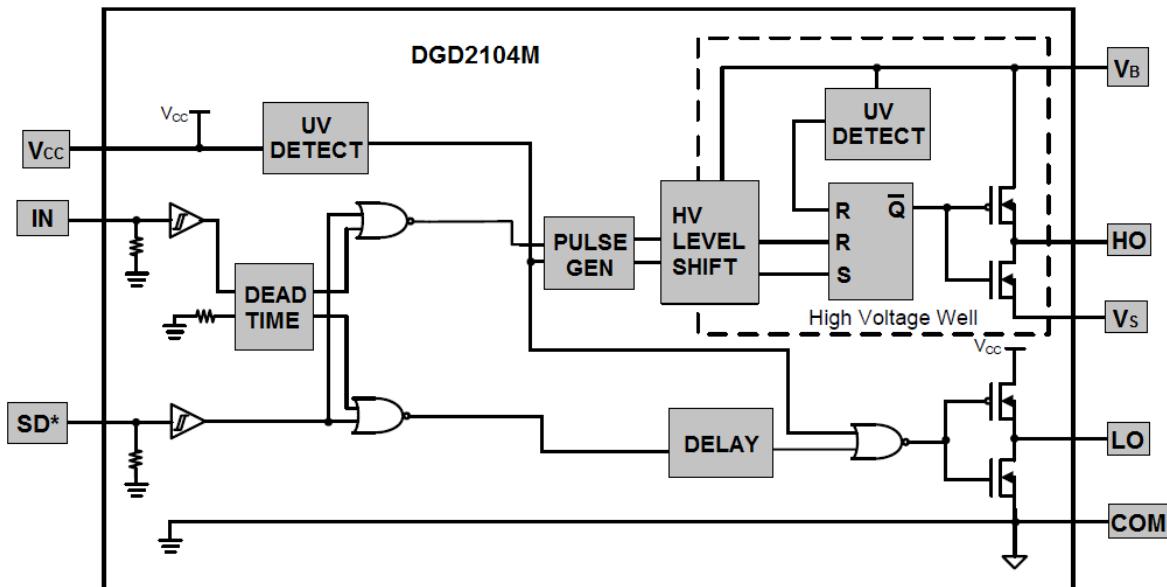
## Pin Diagrams



## Pin Descriptions

Pin Number	Pin Name	Function
1	V <sub>CC</sub>	Logic and Low Side Supply
2	IN	Logic Input for High-Side and Low-Side Gate Driver Outputs (HO and LO), in Phase with HO
3	SD*	Logic input for Shutdown, Enabled Low
4	COM	Low-Side and Logic Return
5	LO	Low-Side Gate Drive Output
6	V <sub>S</sub>	High-Side Floating Supply Return
7	HO	High-Side Gate Drive Output
8	V <sub>B</sub>	High-Side Floating Supply

## Functional Block Diagram



**Absolute Maximum Ratings** (@ $T_A = +25^\circ\text{C}$ , 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 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 (IN and SD*)	$V_{IN}$	-0.3 to $V_{CC}+0.3$	V

**Thermal Characteristics** (@ $T_A = +25^\circ\text{C}$ , 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
Operating Temperature	$T_J$	+150	°C
Lead Temperature (Soldering, 10s)	$T_L$	+300	
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 Fixed Supply Voltage	$V_{CC}$	10	20	V
Low Side Output Voltage	$V_{LO}$	0	$V_{CC}$	V
Logic Input Voltage (IN and SD*)	$V_{IN}$	0	5	V
Ambient Temperature	$T_A$	-40	+125	°C

Note: 6. Logic operation for  $V_S$  of -5V to +600V. Logic state held for  $V_S$  of -5V to  $-V_{BS}$ .

**DC Electrical Characteristics** ( $V_{BIAS}$  ( $V_{CC}$ ,  $V_{BS}$ ) = 15V,  $@T_A = +25^\circ\text{C}$ , unless otherwise specified.) (Note 7)

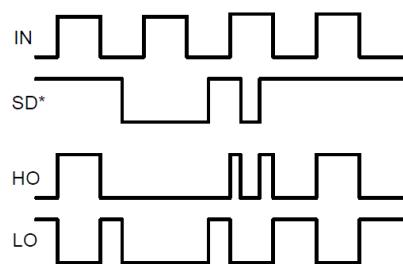
Parameter	Symbol	Min	Typ	Max	Unit	Condition
Logic "1" (IN) & Logic "0" (SD*) Input Voltage	$V_{IH}$	2.5	—	—	V	$V_{CC} = 10\text{V to } 20\text{V}$
Logic "0" (IN) & Logic "1" (SD*) Input Voltage	$V_{IL}$	—	—	0.8	V	$V_{CC} = 10\text{V to } 20\text{V}$
High Level Output Voltage, $V_{BIAS} - V_O$	$V_{OH}$	—	0.05	0.2	V	$I_O = 2\text{mA}$
Low Level Output Voltage, $V_O$	$V_{OL}$	—	0.02	0.1	V	$I_O = 2\text{mA}$
Offset Supply Leakage Current	$I_{LK}$	—	—	50	$\mu\text{A}$	$V_B = V_S = 600\text{V}$
Quiescent $V_{BS}$ Supply Current	$I_{BSQ}$	—	60	100	$\mu\text{A}$	$V_{IN} = 0\text{V or } 5\text{V}$
Quiescent $V_{CC}$ Supply Current	$I_{CCQ1}$	—	350	500	$\mu\text{A}$	$V_{IN} = 0\text{V or } 5\text{V, SD*} = 5\text{V}$
Quiescent $V_{CC}$ Supply Current in Shutdown	$I_{CCQ2}$	—	590	750	$\mu\text{A}$	$V_{IN} = 0\text{V or } 5\text{V, SD*} = 0\text{V}$
Logic "1" Input Bias Current	$I_{IN+}$	—	3.0	10	$\mu\text{A}$	$V_{IN} = 5\text{V, SD*} = 0\text{V}$
Logic "0" Input Bias Current	$I_{IN-}$	—	—	5.0	$\mu\text{A}$	$V_{IN} = 0\text{V, SD*} = 5\text{V}$
$V_{CC}$ 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	—
$V_{BS}$ Supply Undervoltage Positive Going Threshold	$V_{BSUV+}$	4.5	5.5	6.5	V	—
$V_{BS}$ Supply Undervoltage Negative Going Threshold	$V_{BSUV-}$	4.2	5.2	6.2	V	—
Output High Short Circuit Pulsed Current	$I_O+$	130	290	—	mA	$V_O = 0\text{V, PW} \leq 10\mu\text{s}$
Output Low Short Circuit Pulsed Current	$I_O-$	270	600	—	mA	$V_O = 15\text{V, PW} \leq 10\mu\text{s}$

Note: 7. The  $V_{IN}$  and  $I_{IN}$  parameters are applicable to the two logic pins: IN and SD\*. The  $V_O$  and  $I_O$  parameters are applicable to the respective output pins: HO and LO.

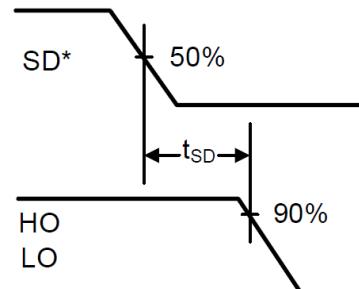
**AC Electrical Characteristics** ( $V_{BIAS}$  ( $V_{CC}$ ,  $V_{BS}$ ) = 15V,  $C_L = 1000\text{pF}$ ,  $@T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Condition
Turn-On Propagation Delay	$t_{ON}$	—	680	820	ns	$V_S = 0\text{V}$
Turn-Off Propagation Delay	$t_{OFF}$	—	150	220	ns	$V_S = 600\text{V}$
Shutdown Propagation Delay	$t_{SD}$	—	160	220	ns	—
Delay Matching, HO and LO Turn-On / Turn-Off	$t_{DM}$	—	—	60	ns	—
Turn-On Rise Time	$t_R$	—	70	170	ns	$V_S = 0\text{V}$
Turn-Off Fall Time	$t_F$	—	35	90	ns	$V_S = 0\text{V}$
Deadtime: $t_{DT}$ LO-HO & $t_{DT}$ HO-LO	$t_{DT}$	300	420	650	ns	—

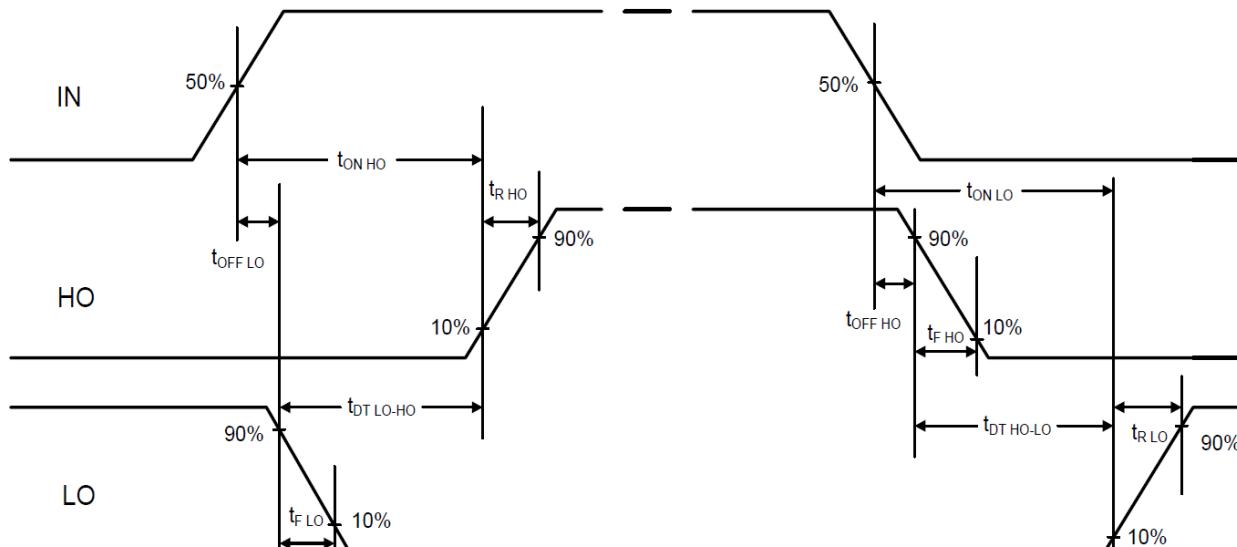
## Timing Waveforms



**Figure 1.** Input / Output Timing Diagram



**Figure 2.** Shutdown Waveform Definition



$$\text{Deadtime } t_{DT\ LO-HO} = t_{ON\ HO} - t_{OFF\ LO}$$

$$t_{DT\ HO-LO} = t_{ON\ LO} - t_{OFF\ HO}$$

$$t_{DT\text{ HO-LO}} = t_{ON\text{ LO}} - t_{OFF\text{ HO}}$$

### Deadtime matching

Deadline matching

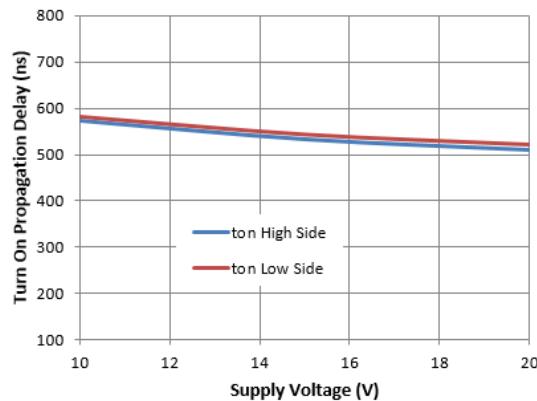
$$\text{Delay matching}$$

$$t_{\text{DM OFF}} = t_{\text{OFF LO}} - t_{\text{OFF HO}}$$

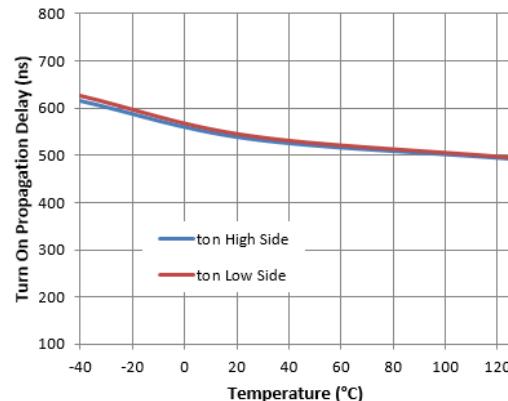
$$t_{\text{DM ON}} = t_{\text{ON LO}} - t_{\text{ON HO}}$$

**Figure 3.** Switching Time Waveform Definitions

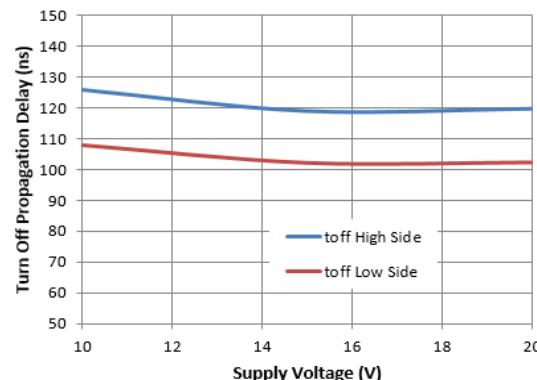
**Typical Performance Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



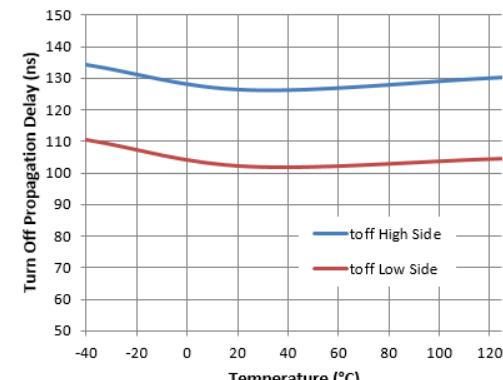
**Figure 4.** Turn-on Propagation Delay vs. Supply Voltage



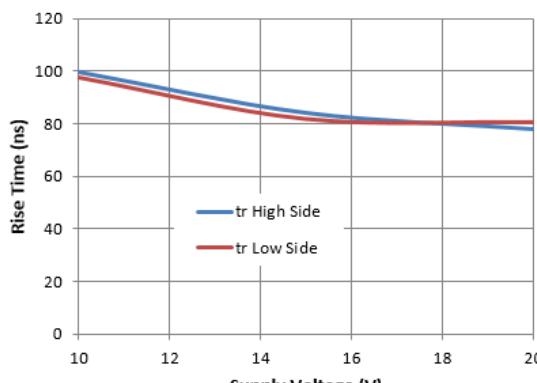
**Figure 5.** Turn-on Propagation Delay vs. Temperature



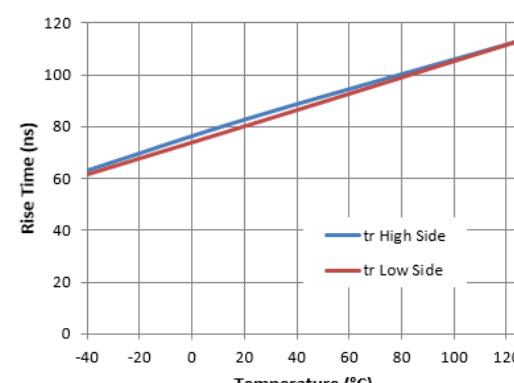
**Figure 6.** Turn-off Propagation Delay vs. Supply Voltage



**Figure 7.** Turn-off Propagation Delay vs. Temperature

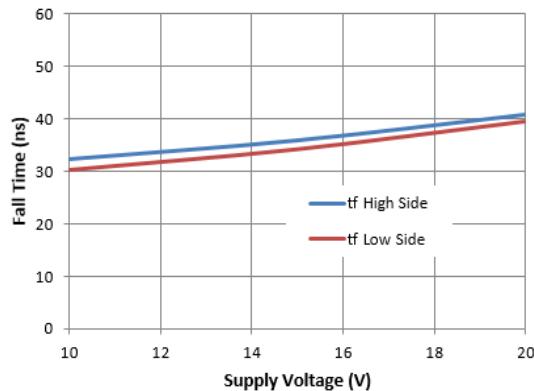


**Figure 8.** Rise Time vs. Supply Voltage

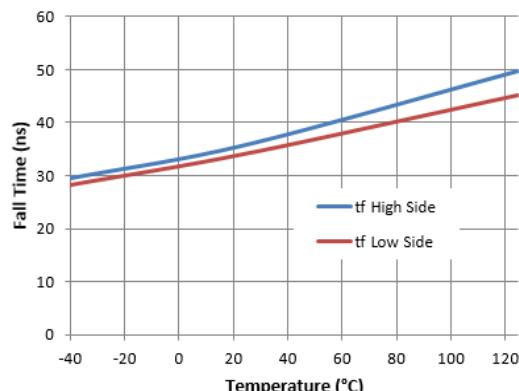


**Figure 9.** Rise Time vs. Temperature

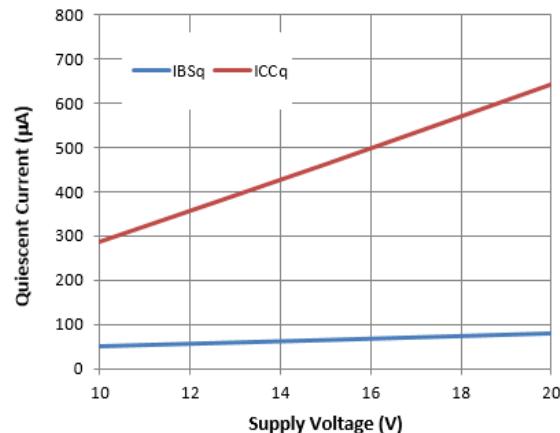
**Typical Performance Characteristics (Cont.)**



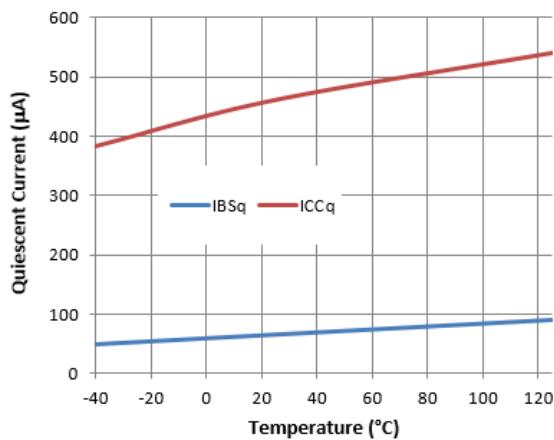
**Figure 10.** Fall Time vs. Supply Voltage



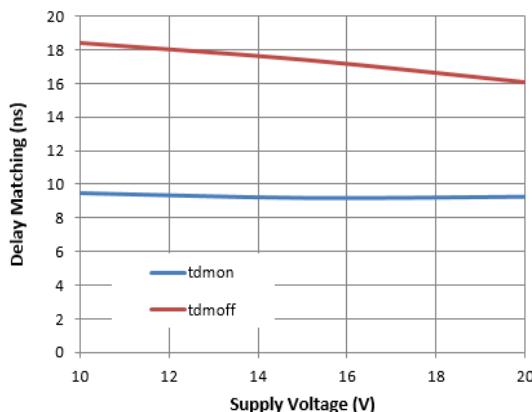
**Figure 11.** Fall Time vs. Temperature



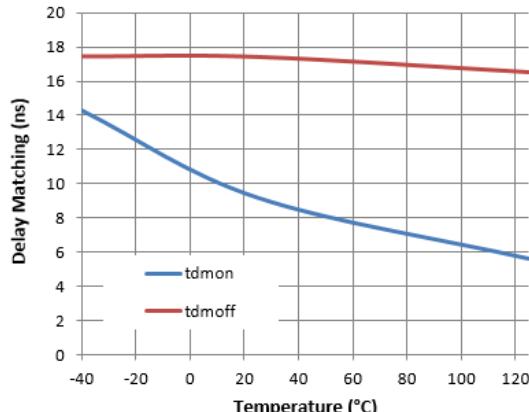
**Figure 12.** Quiescent Current vs. Supply Voltage



**Figure 13.** Quiescent Current vs. Temperature

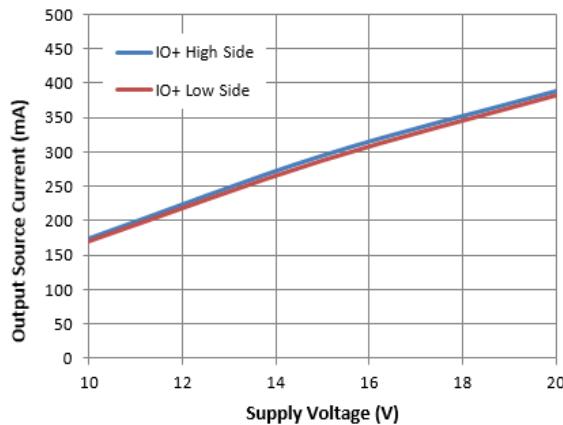


**Figure 14.** Delay Matching vs. Supply Voltage

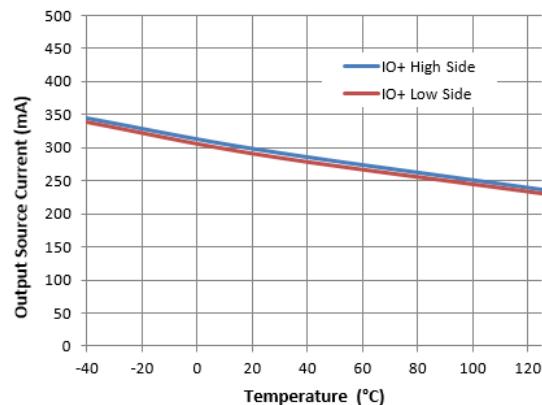


**Figure 15.** Delay Matching vs. Temperature

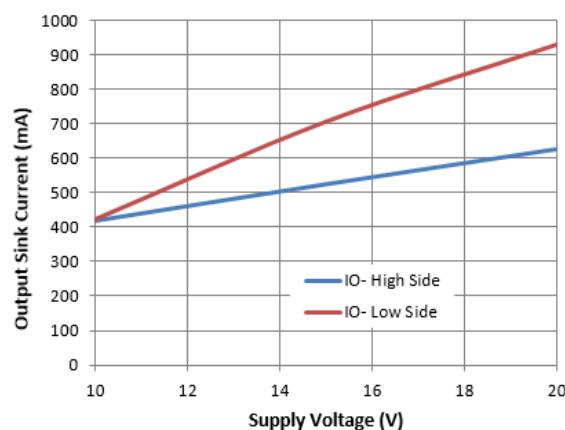
**Typical Performance Characteristics (Cont.)**



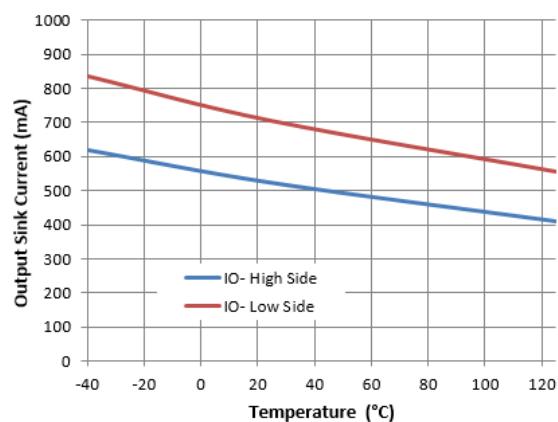
**Figure 16.** Output Source Current vs. Supply Voltage



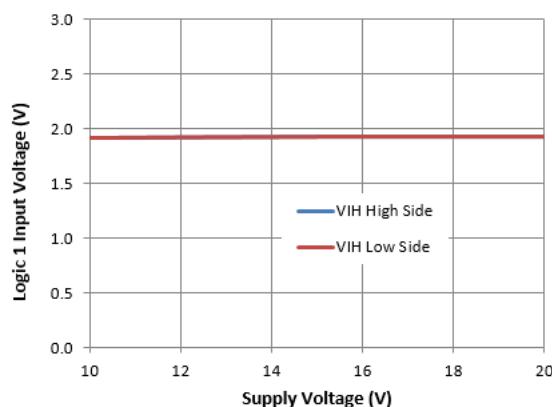
**Figure 17.** Output Source Current vs. Temperature



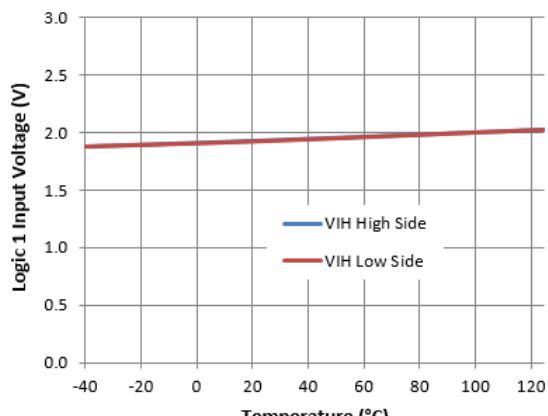
**Figure 18.** Output Sink Current vs. Supply Voltage



**Figure 19.** Output Sink Current vs. Temperature

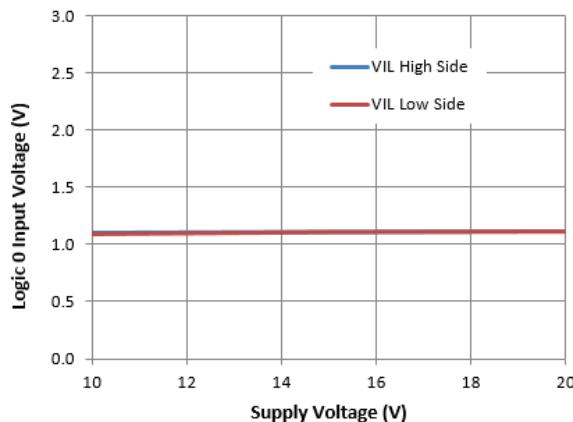


**Figure 20.** Logic 1 Input Voltage vs. Supply Voltage

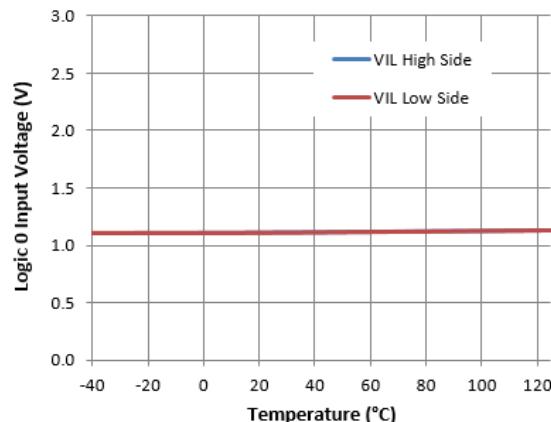


**Figure 21.** Logic 1 Input Voltage vs. Temperature

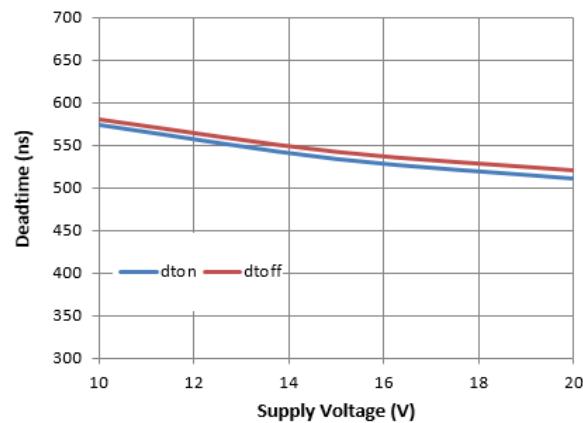
**Typical Performance Characteristics (Cont.)**



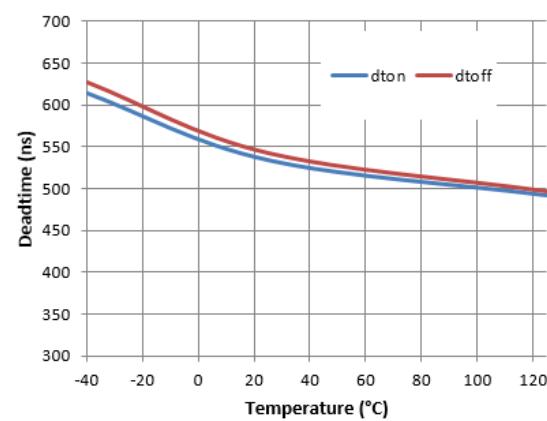
**Figure 22.** Logic 0 Input Voltage vs. Supply Voltage



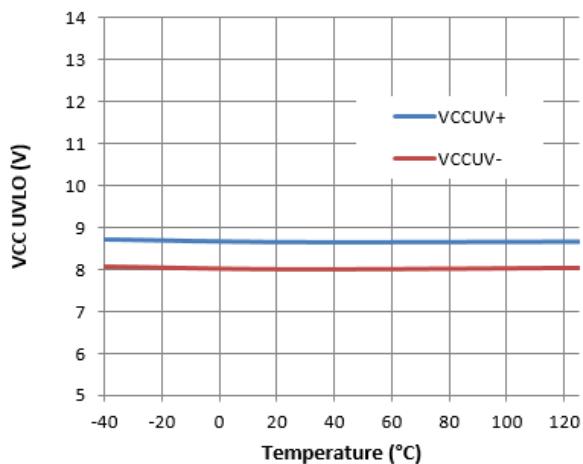
**Figure 23.** Logic 0 Input Voltage vs. Temperature



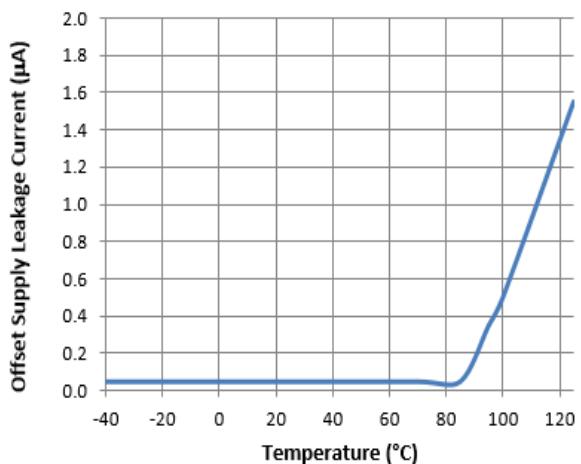
**Figure 24.** Deadtime vs. Supply Voltage



**Figure 25.** Deadtime vs. Temperature



**Figure 26.** VCC UVLO vs. Temperature

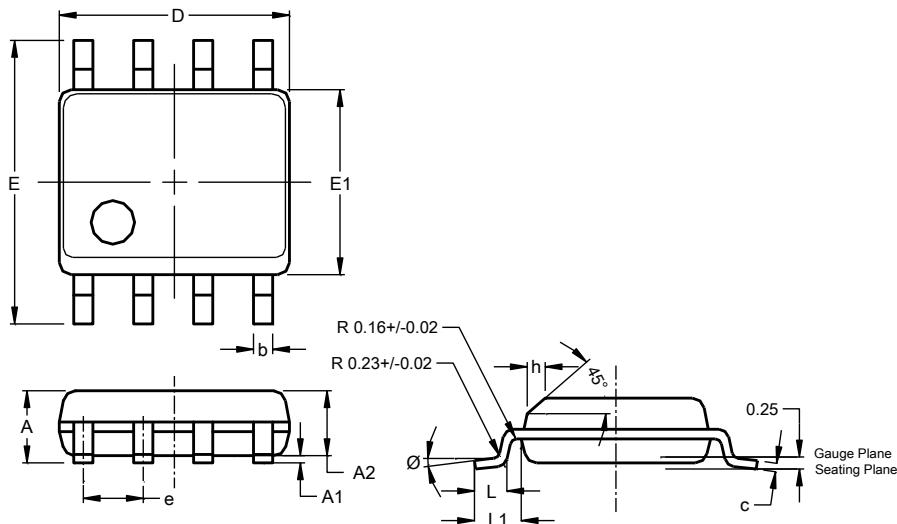


**Figure 27.** Offset Supply Leakage Current vs. Temperature

## Package Outline Dimensions

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

SO-8 (Type TH)



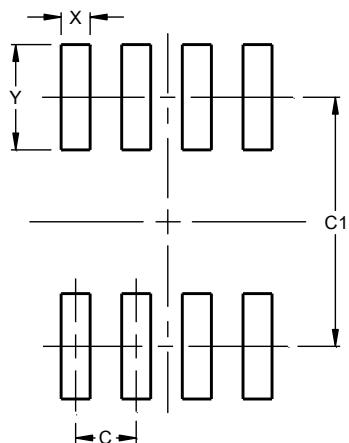
SO-8 (Type TH)			
Dim	Min	Max	Typ
<b>A</b>	1.35	1.75	--
<b>A1</b>	0.10	0.25	--
<b>A2</b>	--	--	1.45
<b>b</b>	0.35	0.51	--
<b>c</b>	0.190	0.248	--
<b>D</b>	4.80	5.00	4.90
<b>E</b>	5.80	6.20	6.00
<b>E1</b>	3.80	4.00	3.90
<b>e</b>	--	--	1.27
<b>h</b>	0.25	0.50	--
<b>L</b>	0.41	1.27	--
<b>L1</b>	--	--	1.04
<b>Ø</b>	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)
<b>C</b>	1.27
<b>C1</b>	5.20
<b>X</b>	0.60
<b>Y</b>	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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