

## Description

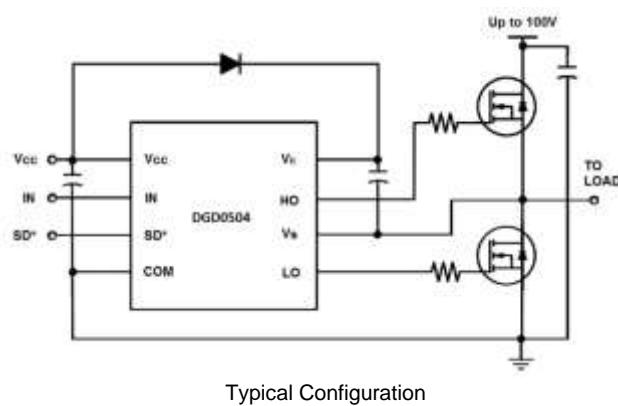
The DGD0504 is a high-voltage, high-speed gate driver capable of driving N-channel MOSFETs and IGBTs in a half-bridge configuration. High-voltage processing techniques enable the DGD0504's high-side to switch to 100V in a bootstrap operation.

The DGD0504 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. DGD0504 has a fixed internal deadtime of 430ns (typical).

The DGD0504 is offered in the W-DFN3030-10 (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



## Features

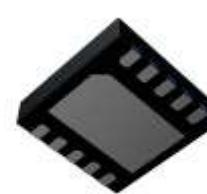
- Floating High-Side Driver in Bootstrap Operation to 100V
- Drives Two N-Channel MOSFETs or IGBTs in a Half-Bridge Configuration
- 290mA Source/600mA Sink Output Current Capability
- Outputs Tolerant to Negative Transients
- Internal Dead Time of 430ns to Protect MOSFETs
- Wide Low-Side Gate Driver Supply Voltage: 10V to 20V
- Logic Input (IN and SD\*) 3.3V Capability
- Schmitt Triggered Logic Inputs
- Undervoltage Lockout for Vcc (Logic and Low Side Supply)
- 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)**

## Mechanical Data

- Case: W-DFN3030-10 (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 Finish  
Solderable per MIL-STD-202, Method 208 <sup>(e3)</sup>
- Weight: 0.017 grams (Approximate)



Top View



Bottom View

W-DFN3030-10 (Type TH)

## Ordering Information (Note 4)

Part Number	Marking	Reel Size (inches)	Tape Width (mm)	Quantity Per Reel
DGD0504FN-7	DGD0504	7	8	3,000

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>.

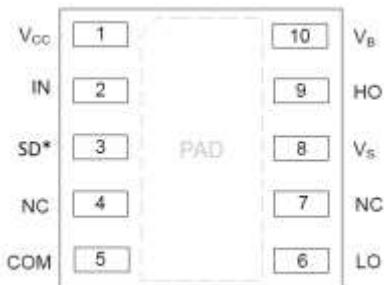
## Marking Information



DGD0504 = Product Type Marking Code  
 YY = Year (ex: 17 = 2017)  
 WW = Week (01 to 53)

## Pin Diagrams

(Top View)

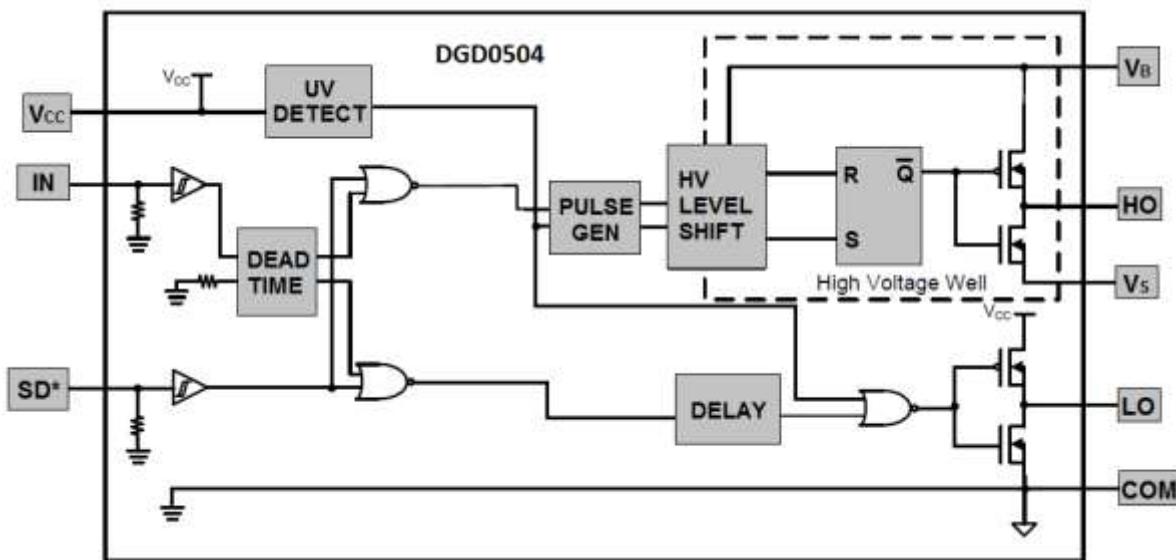


W-DFN3030-10 (Type TH)

## 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, 7	NC	No Connection (No Internal Connection)
5	COM	Low-Side and Logic Return
6	LO	Low-Side Gate Drive Output
8	V <sub>s</sub>	High-Side Floating Supply Return
9	HO	High-Side Gate Drive Output
10	V <sub>b</sub>	High-Side Floating Supply
PAD	Substrate	Connect to COM on PCB

## 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 +124	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)	$P_D$	0.4	W
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	64	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case (Note 5)	$R_{\theta JC}$	42	$^\circ\text{C}/\text{W}$
Operating Temperature	$T_J$	+150	$^\circ\text{C}$
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)	100	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	$^\circ\text{C}$

Note: 6. Logic operation for  $V_S$  of -5V to +100V. Logic state held for  $V_S$  of -5V to  $-V_{BS}$ .

**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" (IN) & Logic "0" (SD*) Input Voltage	$V_{IH}$	2.5	—	—	V	$V_{CC}$ = 10V to 20V
Logic "0" (IN) & Logic "1" (SD*) Input Voltage	$V_{IL}$	—	—	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	$\mu A$	$V_B = V_S = 100V$
Quiescent $V_{BS}$ Supply Current	$I_{BSQ}$	—	60	100	$\mu A$	$V_{IN}$ = 0V or 5V
Quiescent $V_{CC}$ Supply Current	$I_{CCQ}$	—	350	500	$\mu A$	$V_{IN}$ = 0V or 5V
Logic "1" Input Bias Current	$I_{IN+}$	—	3.0	10	$\mu A$	$V_{IN}$ = 5V, $SD^* = 0V$
Logic "0" Input Bias Current	$I_{IN-}$	—	—	5.0	$\mu A$	$V_{IN}$ = 0V, $SD^* = 5V$
$V_{CC}$ Supply Undervoltage Positive Going Threshold	$V_{CCUV+}$	7.4	8.5	9.6	V	—
$V_{CC}$ Supply Undervoltage Negative Going Threshold	$V_{CCUV-}$	7.1	7.8	8.8	V	—
$V_{BS}$ Supply Undervoltage Positive Going Threshold	$V_{BSUV+}$	5.5	6.5	7.5	V	—
$V_{BS}$ Supply Undervoltage Negative Going Threshold	$V_{BSUV-}$	5.3	6.3	7.3	V	—
Output High Short Circuit Pulsed Current	$I_{O+}$	130	290	—	mA	$V_O = 0V$ , $PW \leq 10\mu s$
Output Low Short Circuit Pulsed Current	$I_{O-}$	270	600	—	mA	$V_O = 15V$ , $PW \leq 10\mu s$

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,  $C_L$  = 1,000pF, @ $T_A$  = +25°C, unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-On Propagation Delay	$t_{ON}$	—	680	820	ns	$V_S = 0V$
Turn-Off Propagation Delay	$t_{OFF}$	—	150	220	ns	$V_S = 100V$
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	$V_S = 0V$
Turn-Off Fall Time	$t_F$	—	35	90	ns	$V_S = 0V$
Deadtime: $t_{DT}$ LO-HO & $t_{DT}$ HO-LO	$t_{DT}$	300	430	550	ns	—

## Timing Waveforms

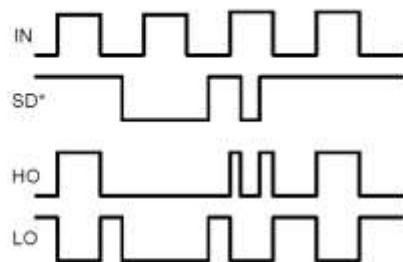


Figure 1. Input / Output Timing Diagram

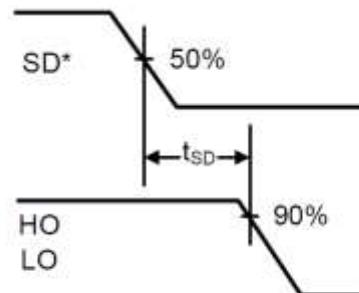
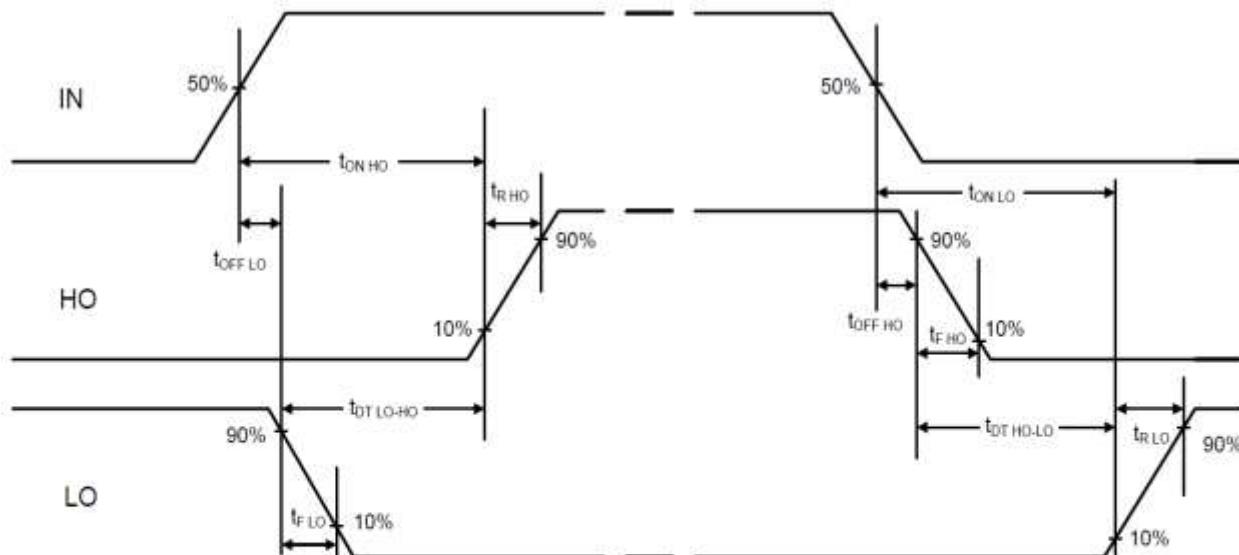


Figure 2. Shutdown Waveform Definition



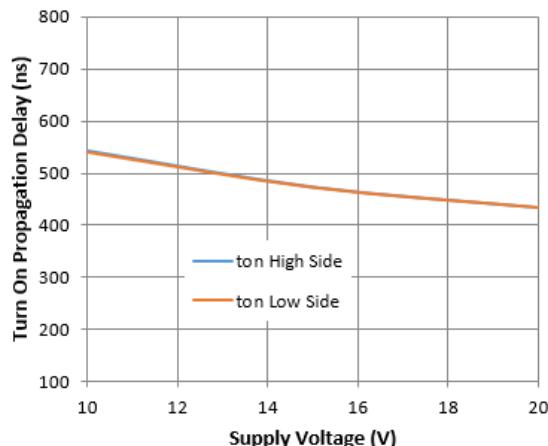
Deadtime  $t_{DT\ LO-HO} = t_{ON\ HO} - t_{OFF\ LO}$   
 $t_{DT\ HO-LO} = t_{ON\ LO} - t_{OFF\ HO}$

Deadtime matching  
 $t_{MDT} = t_{DT\ LO-HO} - t_{DT\ HO-LO}$

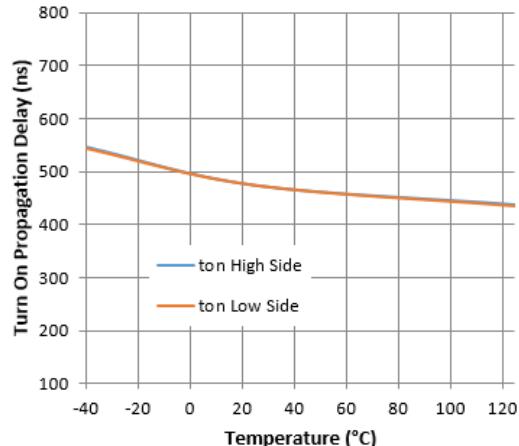
Delay matching  
 $t_{OM\ OFF} = t_{OFF\ LO} - t_{OFF\ HO}$   
 $t_{OM\ ON} = t_{ON\ LO} - t_{ON\ HO}$

Figure 3. Switching Time Waveform Definitions

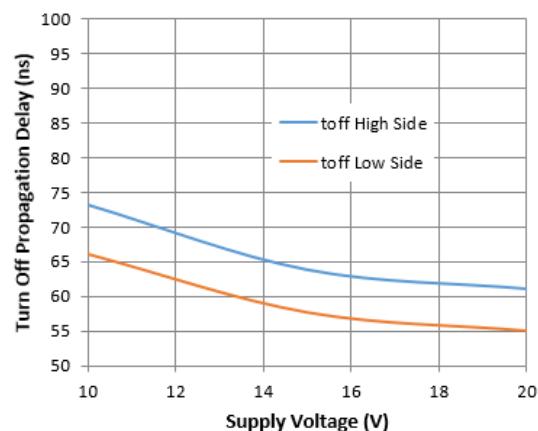
**Typical Performance Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



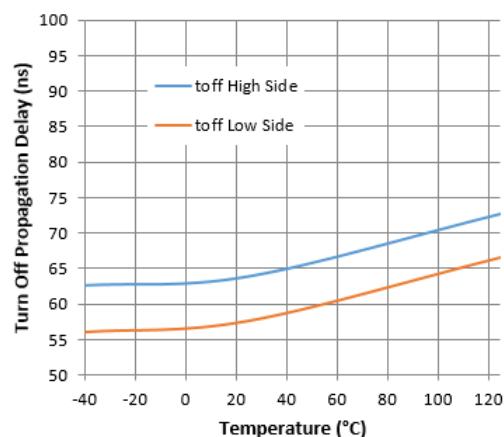
**Figure 4.** Turn-on Propagation Delay vs. Supply Voltage



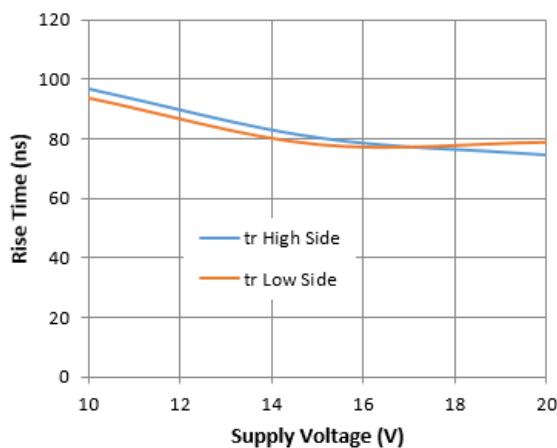
**Figure 5.** Turn-on Propagation Delay vs. Temperature



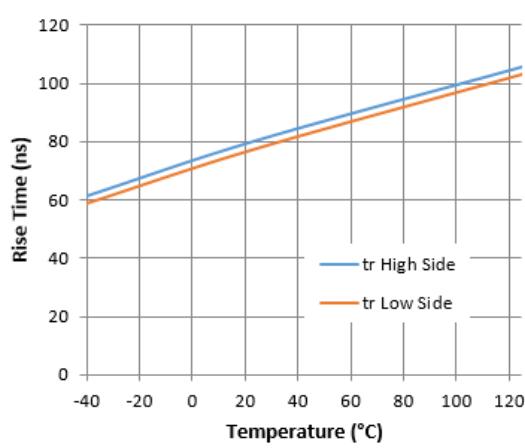
**Figure 6.** Turn-off Propagation Delay vs. Supply Voltage



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

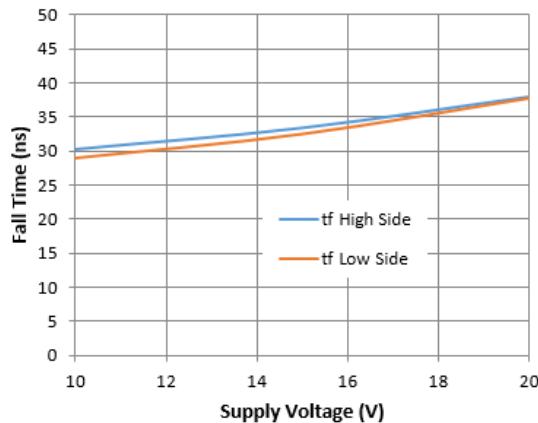


**Figure 8.** Rise Time vs. Supply Voltage

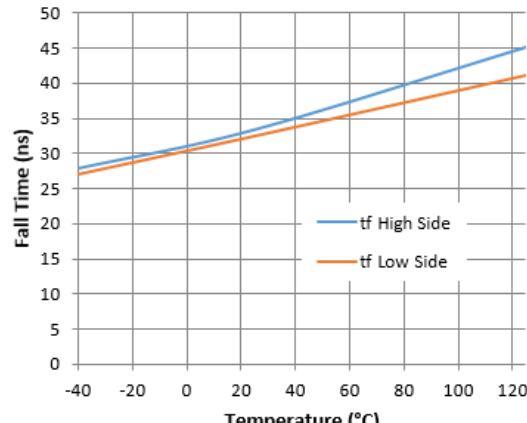


**Figure 9.** Rise Time vs. Temperature

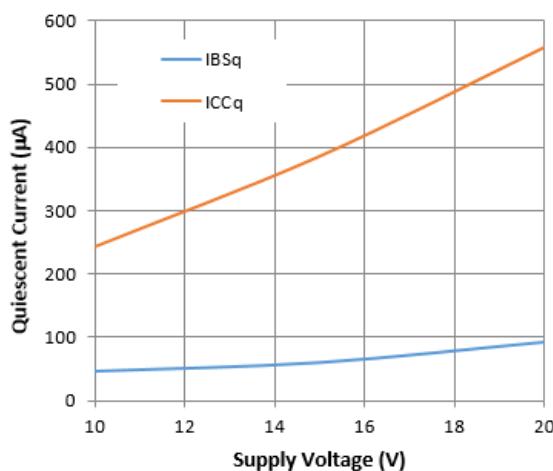
## Typical Performance Characteristics (Continued)



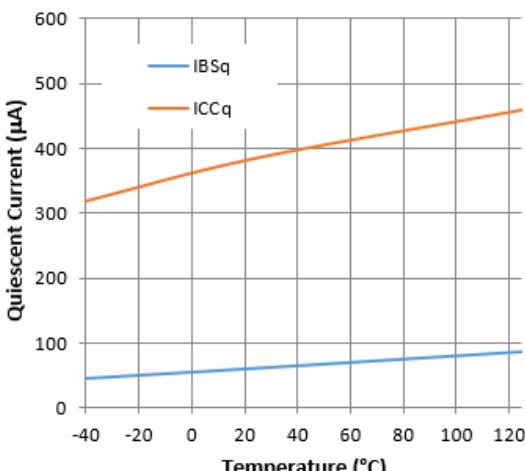
**Figure 10.** Fall Time vs. Supply Voltage



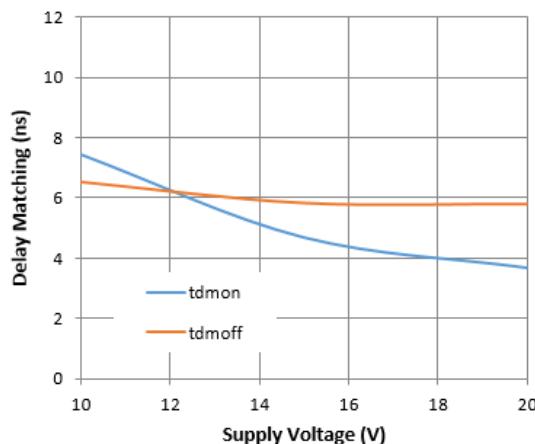
**Figure 11.** Fall Time vs. Temperature



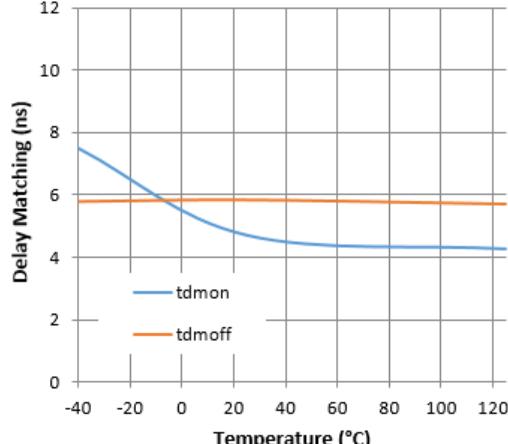
**Figure 12.** Quiescent Current vs. Supply Voltage



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

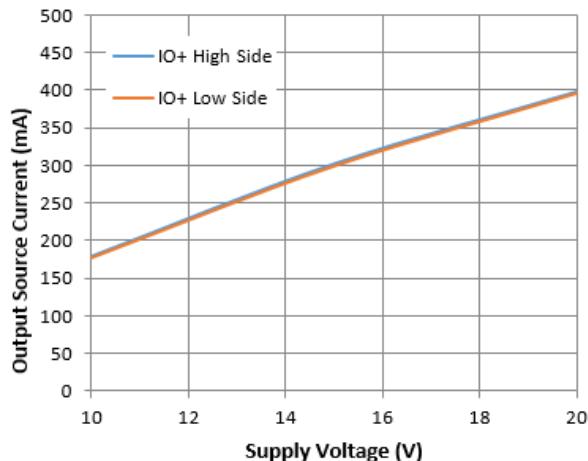


**Figure 14.** Delay Matching vs. Supply Voltage

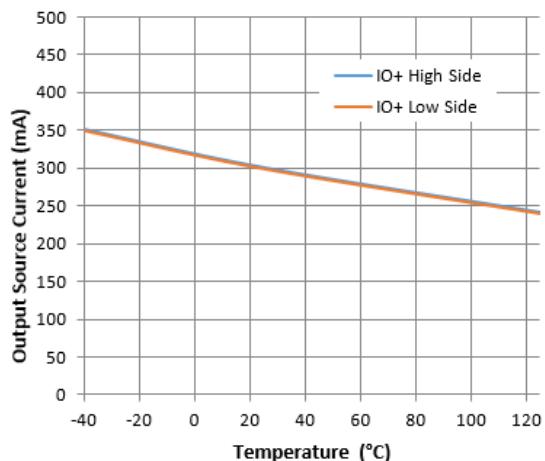


**Figure 15.** Delay Matching vs. Temperature

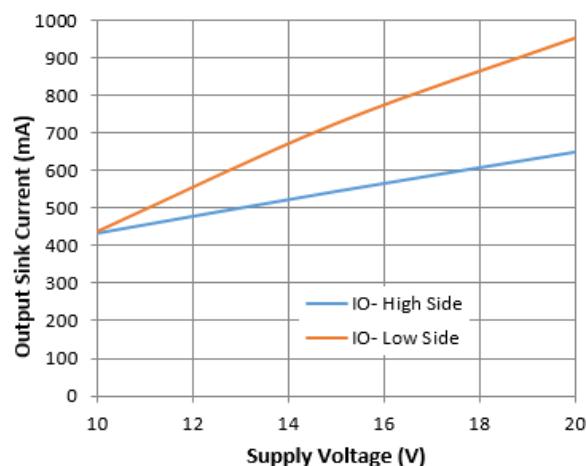
## Typical Performance Characteristics (Cont.)



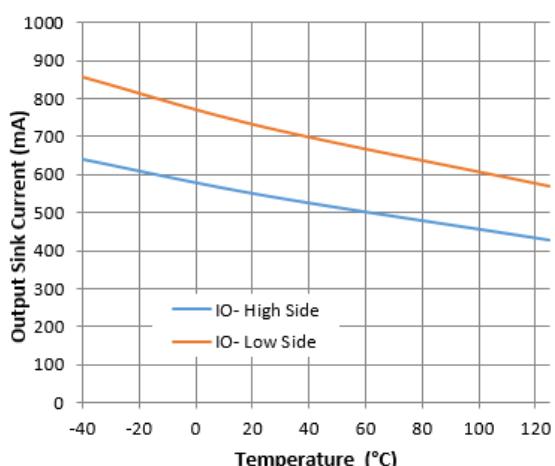
**Figure 16.** Output Source Current vs. Supply Voltage



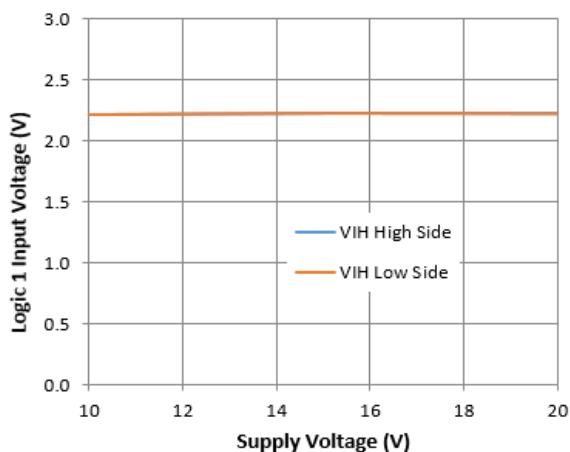
**Figure 17.** Output Source Current vs. Temperature



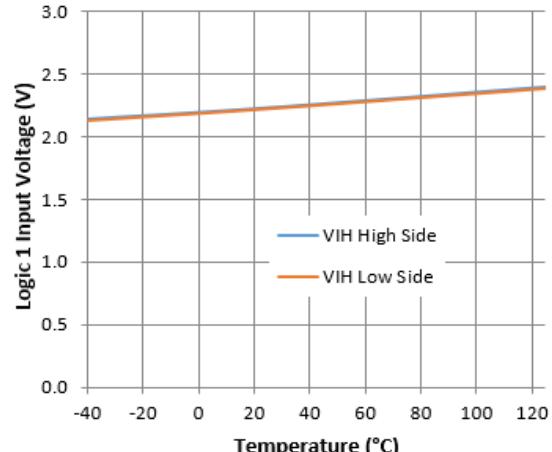
**Figure 18.** Output Sink Current vs. Supply Voltage



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

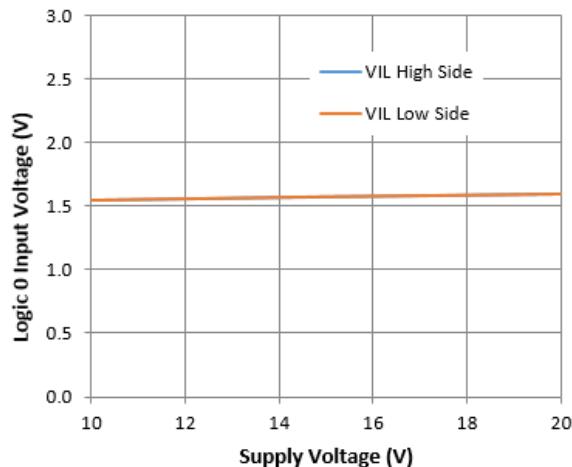


**Figure 20.** Logic 1 Input Voltage vs. Supply Voltage

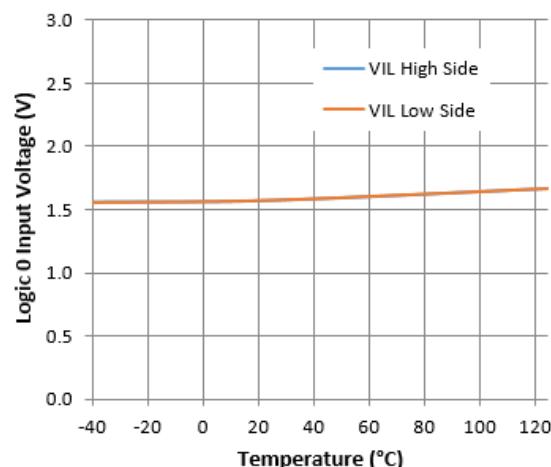


**Figure 21.** Logic 1 Input Voltage vs. Temperature

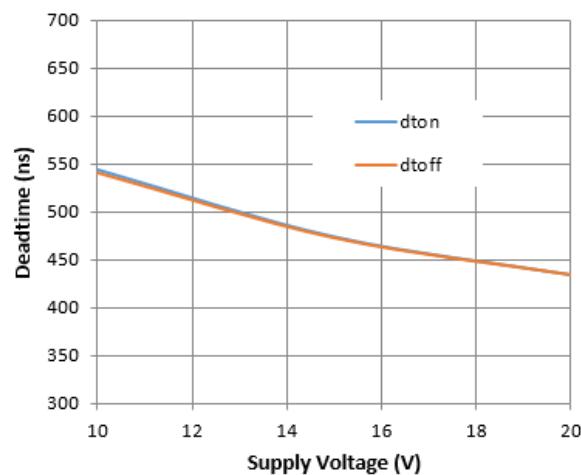
## Typical Performance Characteristics (Cont.)



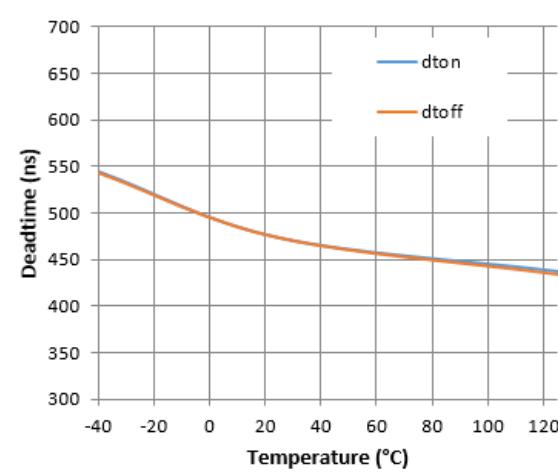
**Figure 22.** Logic 0 Input Voltage vs. Supply Voltage



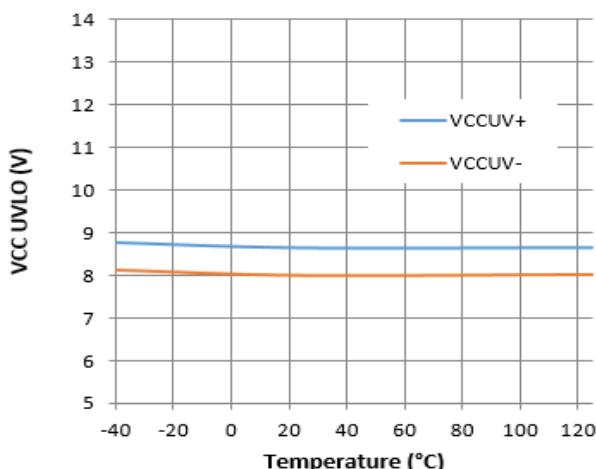
**Figure 23.** Logic 0 Input Voltage vs. Temperature



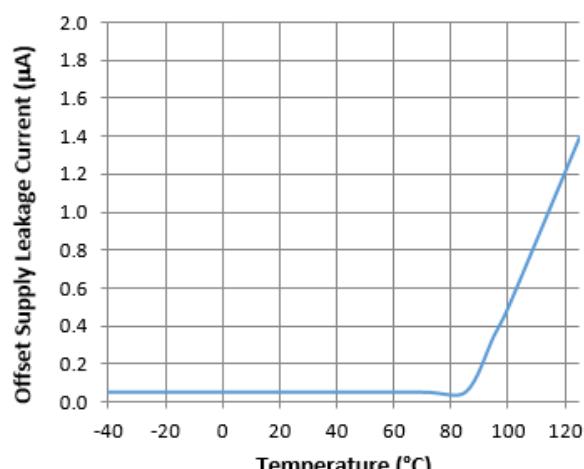
**Figure 24.** Deadtime vs. Supply Voltage



**Figure 25.** Deadtime vs. Temperature



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

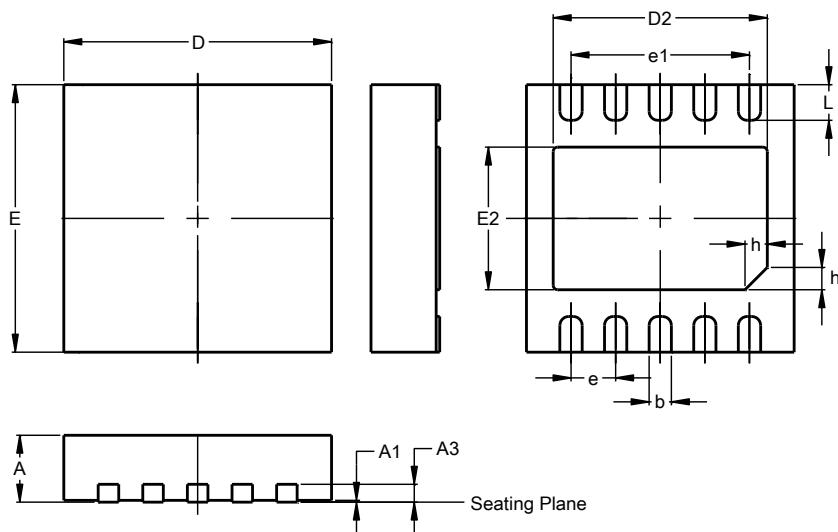


**Figure 27.** Offset Supply Leakage Current vs. Temperature

## Package Outline Dimensions

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

**W-DFN3030-10 (Type TH)**



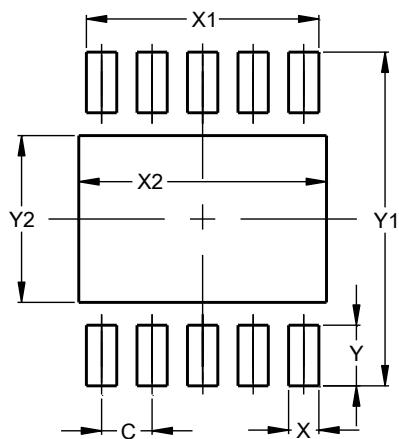
W-DFN3030-10 (Type TH)			
Dim	Min	Max	Typ
A	0.70	0.80	0.75
A1	--	0.05	0.02
A3	0.18	0.25	0.20
b	0.18	0.30	0.25
D	2.90	3.10	3.00
D2	2.40	2.60	2.50
e	0.50BSC		
e1	2.00BSC		
E	2.90	3.10	3.00
E2	1.45	1.65	1.55
h	0.20	0.30	0.25
L	0.30	0.50	0.40

**All Dimensions in mm**

## Suggested Pad Layout

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

**W-DFN3030-10 (Type TH)**



Dimensions	Value (in mm)
C	0.500
X	0.300
X1	2.300
X2	2.600
Y	0.600
Y1	3.300
Y2	1.650

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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