

**HIGH FREQUENCY HALF-BRIDGE GATE DRIVER WITH PROGRAMMABLE DEADTIME IN W-DFN3030-10**
**Description**

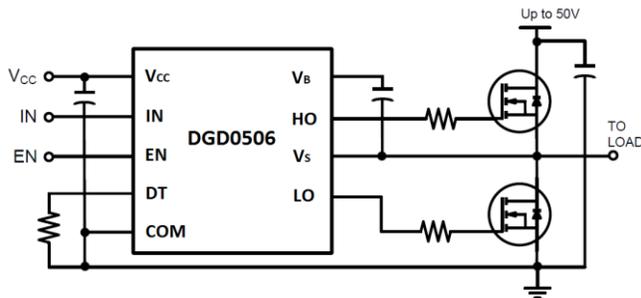
The DGD0506 is a high-frequency half-bridge gate driver capable of driving N-channel MOSFETs in a half-bridge configuration. The floating high-side driver can switch to 50V in a bootstrap configuration.

The DGD0506 logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with MCUs. UVLO for high-side and low-side will protect a MOSFET with loss of supply. To protect MOSFETs, cross conduction prevention logic prevents the HO and LO outputs being on at the same time.

Fast and well matched propagation delays allow a higher switching frequency, enabling a smaller, more compact power switching design using smaller associated components. The DGD0506 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
- Motor Controls
- Battery Powered Hand Tools
- eCig Devices
- Class D Power Amplifiers



Typical Configuration

**Features**

- Floating high-side driver in bootstrap operation to 50V
- Drives two N-channel MOSFETs in a half-bridge configuration
- 1.5A source / 2.5A sink output current capability
- Internal bootstrap diode included
- Undervoltage lockout for high-side and low-side drivers
- Programmable deadtime to protect MOSFETs
- Logic input (IN and EN) 3.3V capability
- Ultra low standby currents (<math>< \mu\text{A}</math>)
- 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 (E3)
- Weight: 0.017 grams (Approximate)



Top View



Bottom View

W-DFN3030-10 (Type TH)

**Ordering Information** (Note 4)

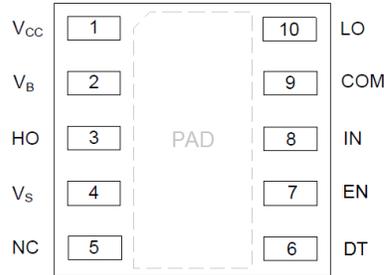
Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DGD0506FN-7	DGD0506	7	8	3,000

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. 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.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <math>< 900\text{ppm}</math> bromine, <math>< 900\text{ppm}</math> chlorine (<math>< 1500\text{ppm}</math> total Br + Cl) and <math>< 1000\text{ppm}</math> antimony compounds.
  4. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

**Marking Information**


DGD0506 = Product Type Marking Code  
 YY = Year (ex: 17 = 2017)  
 WW = Week (01 - 53)

**Pin Diagrams**

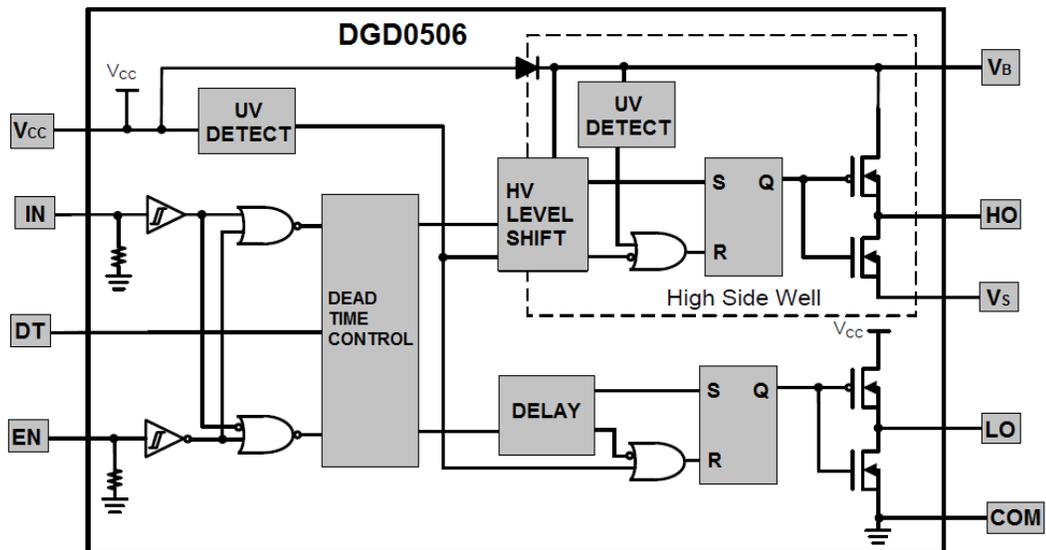


Top view: W-DFN3030-10 (Type TH)

**Pin Descriptions**

Pin Number	Pin Name	Function
1	V <sub>CC</sub>	Low-Side and Logic Supply
2	V <sub>B</sub>	High-Side Floating Supply
3	HO	High-Side Gate Drive Output
4	V <sub>S</sub>	High-Side Floating Supply Return
5	NC	No connect (No Internal Connection)
6	DT	Deadtime Control
7	EN	Logic Input Enable, a Logic Low turns off Gate Driver
8	IN	Logic Input for High-Side and Low-Side Gate Driver Outputs (HO and LO), in Phase with HO
9	COM	Low-Side and Logic Return
10	LO	Low-Side Gate Drive Output
PAD	Substrate	Connect to COM on PCB

**Functional Block Diagram**



**Absolute Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
High-Side Floating Positive Supply Voltage	V <sub>B</sub>	-0.3 to +50	V
High-Side Floating Negative Supply Voltage	V <sub>S</sub>	V <sub>B</sub> -14 to V <sub>B</sub> +0.3	V
High-Side Floating Output Voltage	V <sub>HO</sub>	V <sub>S</sub> -0.3 to V <sub>B</sub> +0.3	V
Offset Supply Voltage Transient	dV <sub>S</sub> / dt	50	V/ns
Logic and Low-Side Fixed Supply Voltage	V <sub>CC</sub>	-0.3 to +15	V
Low-Side Output Voltage	V <sub>LO</sub>	-0.3 to V <sub>CC</sub> +0.3	V
Logic Input Voltage (IN and EN)	V <sub>IN</sub>	-0.3 to 15	V

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation Linear Derating Factor (Note 5)	P <sub>D</sub>	0.4	W
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	64	°C/W
Thermal Resistance, Junction to Case (Note 5)	R <sub>θJC</sub>	42	°C/W
Operating Temperature	T <sub>J</sub>	+150	°C
Lead Temperature (soldering, 10s)	T <sub>L</sub>	+300	
Storage Temperature Range	T <sub>STG</sub>	-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	V <sub>B</sub>	V <sub>S</sub> + 8	V <sub>S</sub> + 14	V
High-Side Floating Supply Offset Voltage	V <sub>S</sub>	(Note 6)	50	V
High-Side Floating Output Voltage	V <sub>HO</sub>	V <sub>S</sub>	V <sub>B</sub>	V
Logic and Low Side Fixed Supply Voltage	V <sub>CC</sub>	8	14	V
Low-Side Output Voltage	V <sub>LO</sub>	0	V <sub>CC</sub>	V
Logic Input Voltage (IN and EN)	V <sub>IN</sub>	0	5	V
Ambient Temperature	T <sub>A</sub>	-40	+125	°C

Note: 6. Logic operation for V<sub>S</sub> of -5V to +50V. Logic state held for V<sub>S</sub> of -5V to -V<sub>BS</sub>.

**DC Electrical Characteristics** ( $V_{CC} = V_{BS} = 12V$ ,  $COM = V_S = 0V$ ,  $@T_A = +25^\circ C$ , unless otherwise specified.) (Note 7)

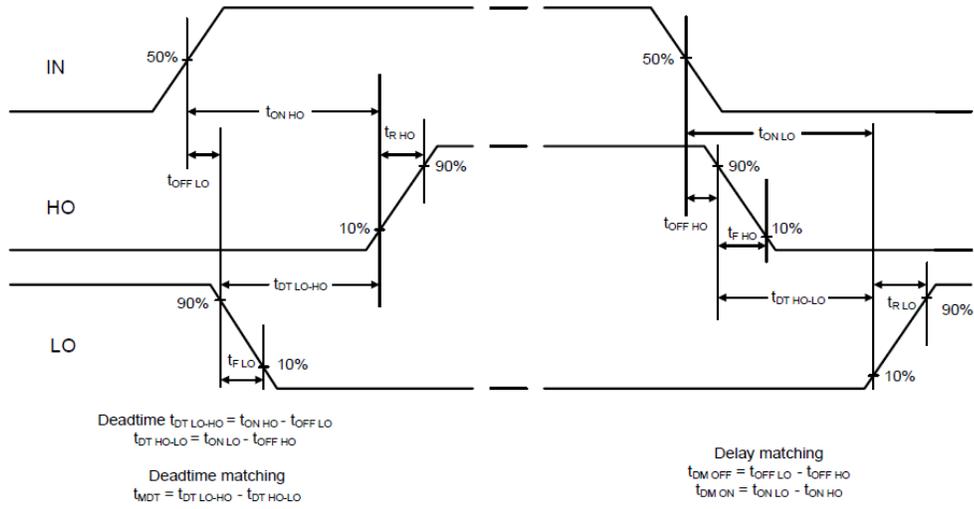
Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Logic "1" Input Voltage	$V_{IH}$	2.5	–	–	V	–
Logic "0" Input Voltage	$V_{IL}$	–	–	1.0	V	–
Input Voltage Hysteresis	$V_{INHYS}$	–	0.6	–	V	–
High Level Output Voltage, $V_{BIAS} - V_O$	$V_{OH}$	–	0.45	0.6	V	$I_{O+} = 100mA$
Low Level Output Voltage, $V_O$	$V_{OL}$	–	0.15	0.22	V	$I_{O-} = 100mA$
Offset Supply Leakage Current	$I_{LK}$	–	10	50	$\mu A$	$V_B = V_S = 50V$
$V_{CC}$ Shutdown Supply Current	$I_{CCSD}$	–	0	1	$\mu A$	$V_{IN} = 0V$ or $5V$ , $V_{EN} = 0V$
$V_{CC}$ Quiescent Supply Current	$I_{CCQ}$	–	0.8	1.5	mA	$V_{IN} = 0V$ or $5V$ , RDT = 100k $\Omega$
$V_{CC}$ Operating Supply Current	$I_{CCOP}$	–	1.35	3.0	mA	fs = 500kHz
$V_{BS}$ Quiescent Supply Current	$I_{BSQ}$	–	62	100	$\mu A$	$V_{IN} = 0V$ or $5V$
$V_{BS}$ Operating Supply Current	$I_{BSOP}$	–	1.1	2.0	mA	fs = 500kHz
Logic "1" Input Bias Current	$I_{IN+}$	–	25	50	$\mu A$	$V_{IN} = 5V$
Logic "0" Input Bias Current	$I_{IN-}$	–	0	1	$\mu A$	$V_{IN} = 0V$
$V_{BS}$ Supply Undervoltage Positive Going Threshold	$V_{BSUV+}$	6.0	6.9	7.8	V	–
$V_{BS}$ Supply Undervoltage Negative Going Threshold	$V_{BSUV-}$	5.7	6.6	7.5	V	–
$V_{CC}$ Supply Undervoltage Positive Going Threshold	$V_{CCUV+}$	6.0	6.9	7.8	V	–
$V_{CC}$ Supply Undervoltage Negative Going Threshold	$V_{CCUV-}$	5.7	6.6	7.5	V	–
Output High Short Circuit Pulsed Current	$I_{O+}$	0.9	1.5	–	A	$V_O = 0V$ , $PW \leq 10\mu s$
Output Low Short Circuit Pulsed Current	$I_{O-}$	1.5	2.5	–	A	$V_O = 15V$ , $PW \leq 10\mu s$
Forward Voltage of Bootstrap Diode	$V_{F1}$	–	0.3	–	V	$I_F = 100\mu A$
Forward Voltage of Bootstrap Diode	$V_{F2}$	–	0.8	–	V	$I_F = 100mA$

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

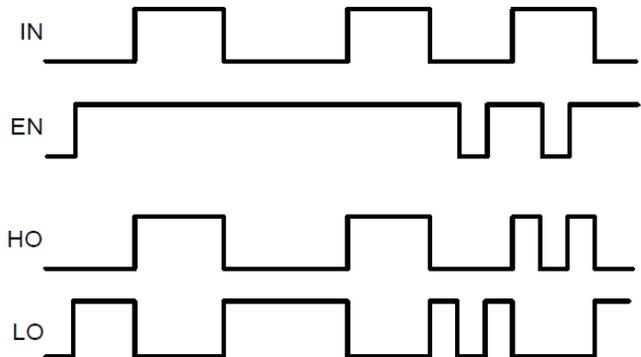
**AC Electrical Characteristics** ( $V_{CC} = V_{BS} = 12V$ ,  $COM = V_S = 0V$ ,  $C_L = 1000pF$ ,  $@T_A = +25^\circ C$ , unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-on Propagation Delay, HO & LO	$t_{ON}$	65	96	125	ns	RDT = 10k $\Omega$
		350	463	570	ns	RDT = 100k $\Omega$
Turn-off Propagation Delay, HO & LO	$t_{OFF}$	–	22	56	ns	–
Turn-on Rise Time	$t_r$	–	17	35	ns	–
Turn-off Fall Time	$t_f$	–	12	25	ns	–
Delay Matching	$t_{DM}$	–	–	50	ns	–
Deadtime: $t_{DT\ LO-HO}$ & $t_{DT\ HO-LO}$	$t_{DT}$	40	70	100	ns	RDT = 10k $\Omega$
		300	420	560	ns	RDT = 100k $\Omega$
Deadtime Matching	$t_{MDT}$	–	–	50	ns	RDT = 10k $\Omega$ or 100k $\Omega$

**Timing Waveforms**

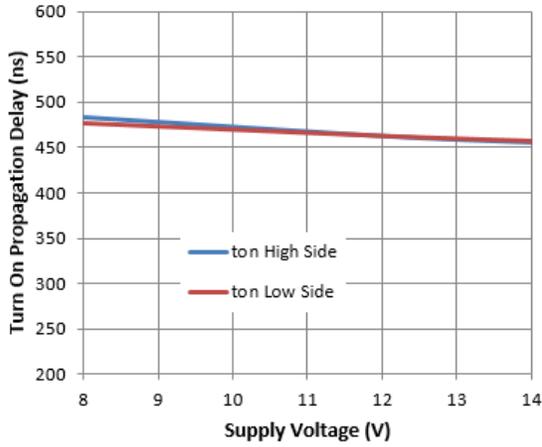


**Figure 1. Switching Time Waveform Definitions**

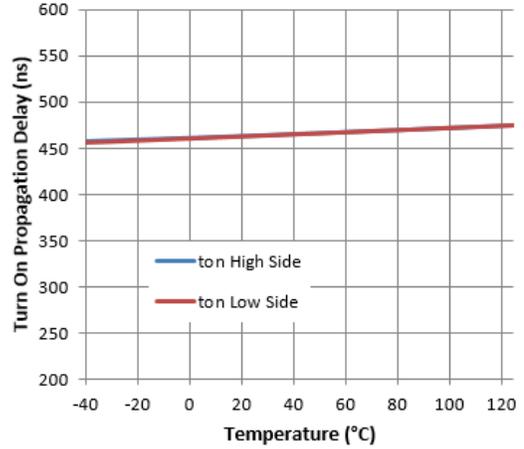


**Figure 2. Input / Output Timing Diagram**

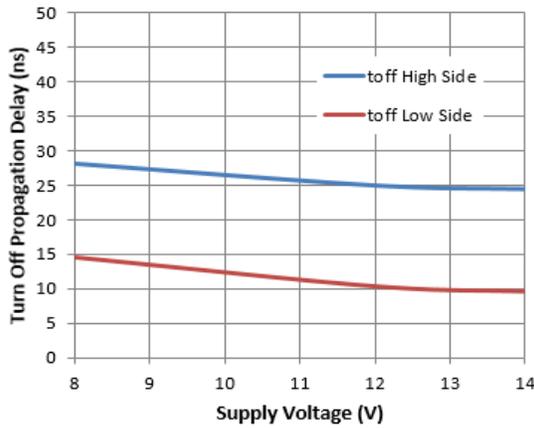
**Typical Performance Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)



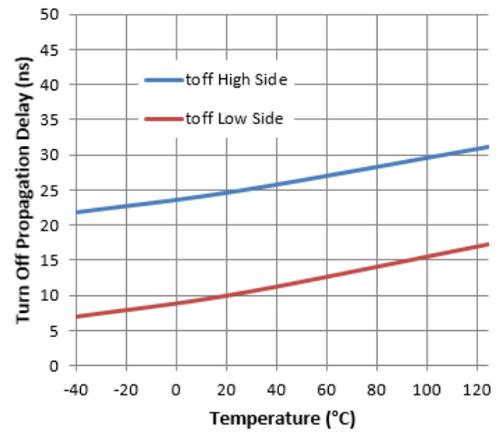
**Figure 4.** Turn-on Propagation Delay vs. Supply Voltage



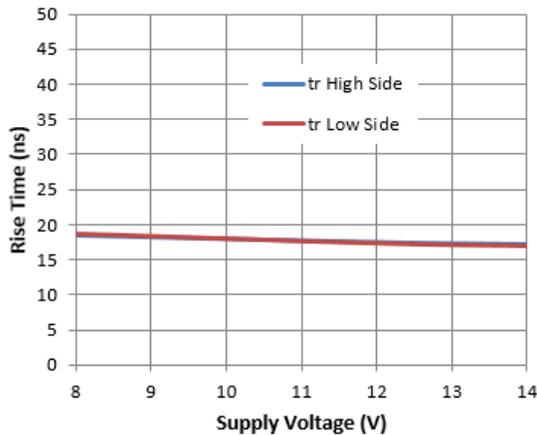
**Figure 5.** Turn-on Propagation Delay vs. Temperature



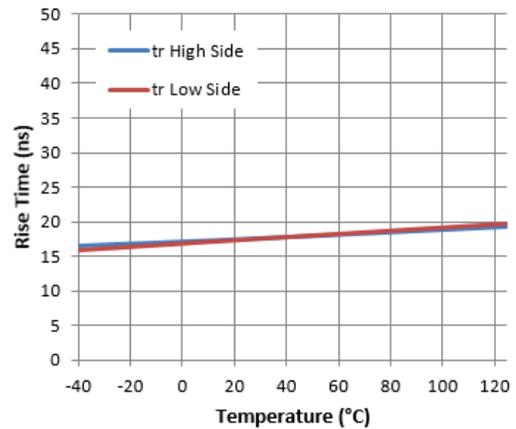
**Figure 6.** Turn-off Propagation Delay vs. Supply Voltage



**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)

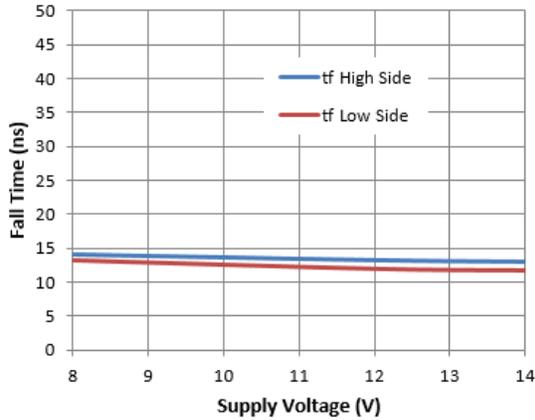


Figure 10. Fall Time vs. Supply Voltage

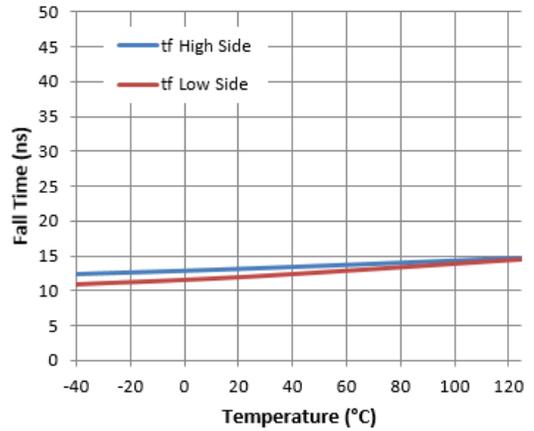


Figure 11. Fall Time vs. Temperature

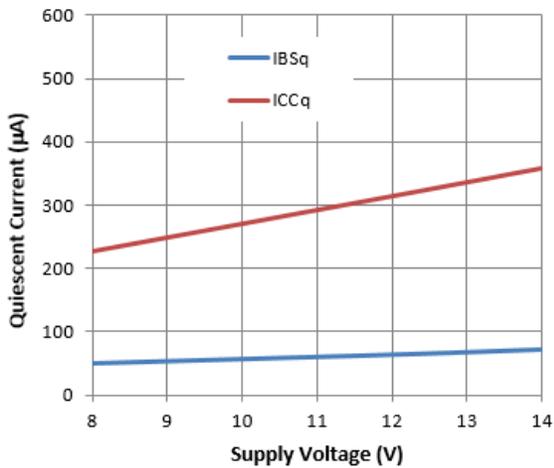


Figure 12. Quiescent Current vs. Supply Voltage

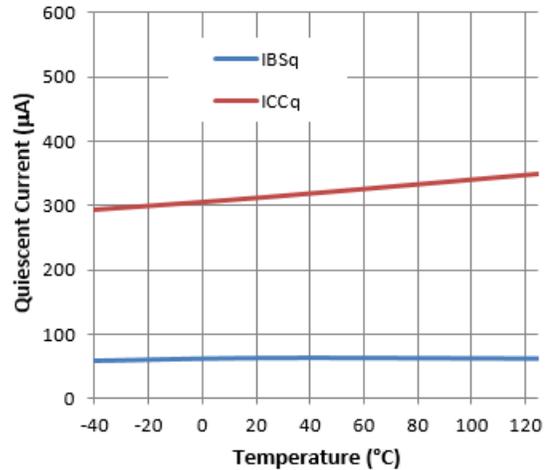


Figure 13. Quiescent Current vs. Temperature

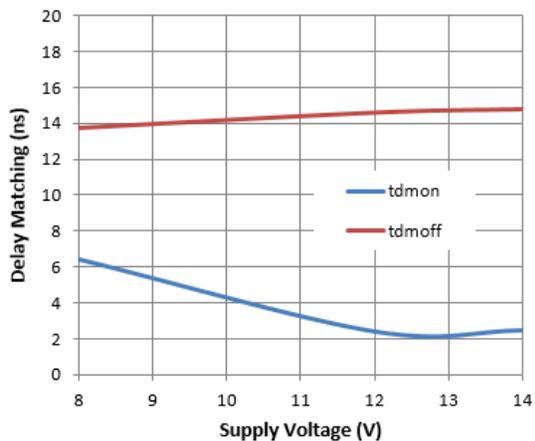


Figure 14. Delay Matching vs. Supply Voltage

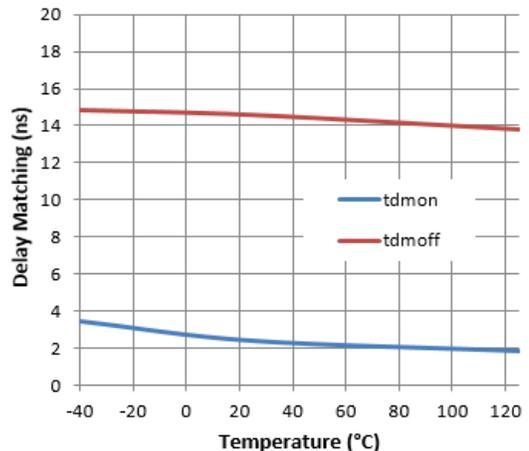


Figure 15. Delay Matching vs. Temperature

**Typical Performance Characteristics** (cont.)

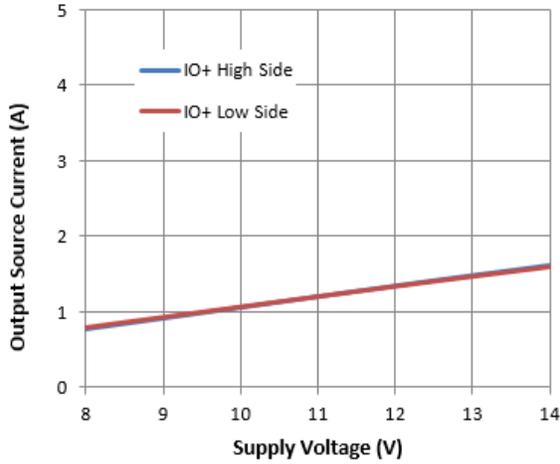


Figure 16. Output Source Current vs. Supply Voltage

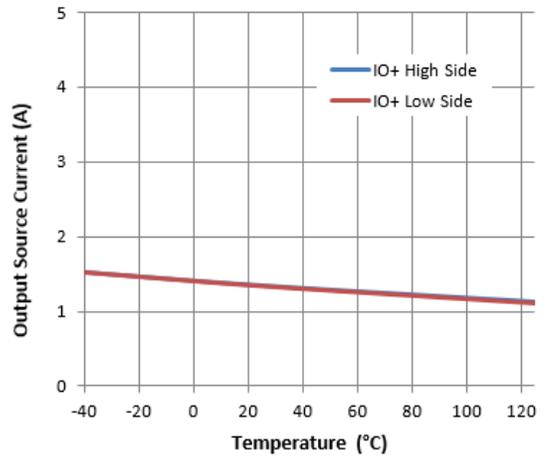


Figure 17. Output Source Current vs. Temperature

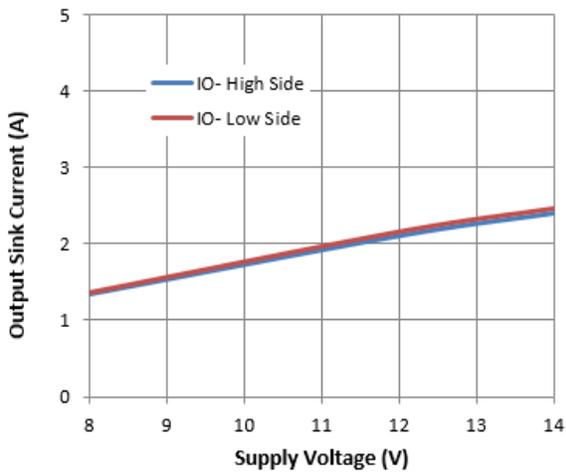


Figure 18. Output Sink Current vs. Supply Voltage

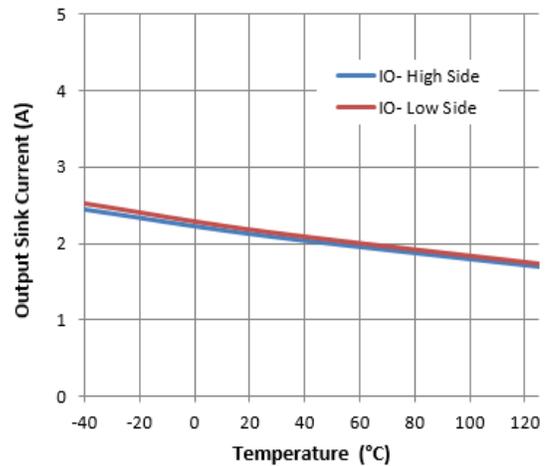


Figure 19. Output Sink Current vs. Temperature

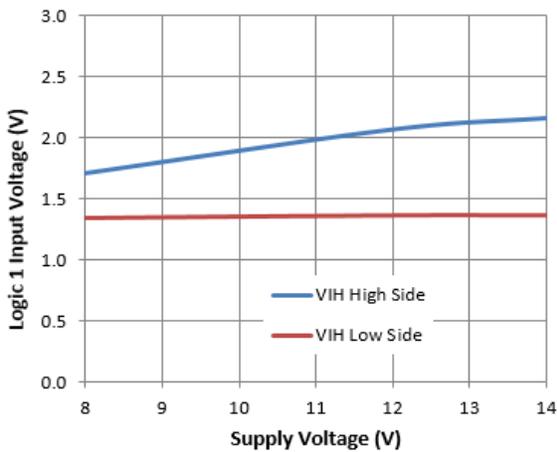


Figure 20. Logic 1 Input Voltage vs. Supply Voltage

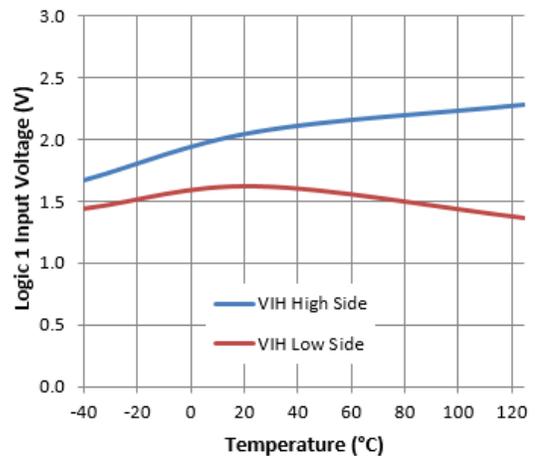
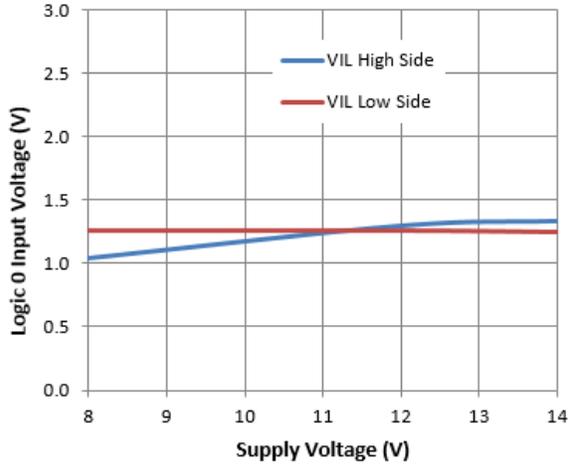
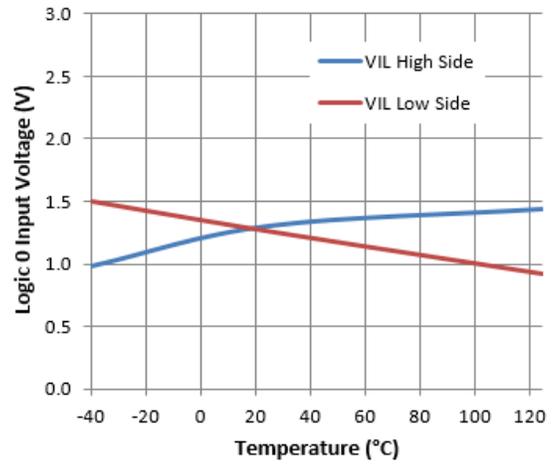


Figure 21. Logic 1 Input Voltage vs. Temperature

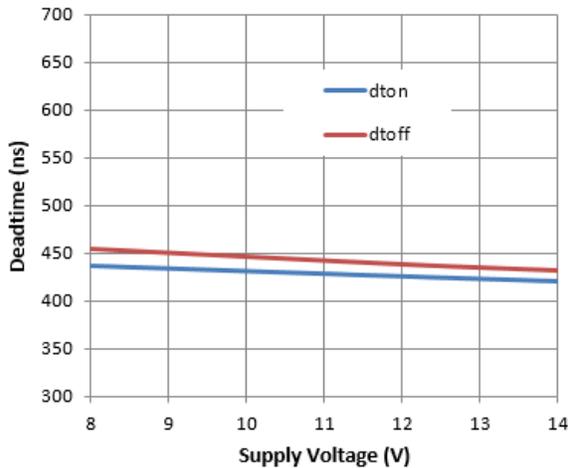
**Typical Performance Characteristics (cont.)**



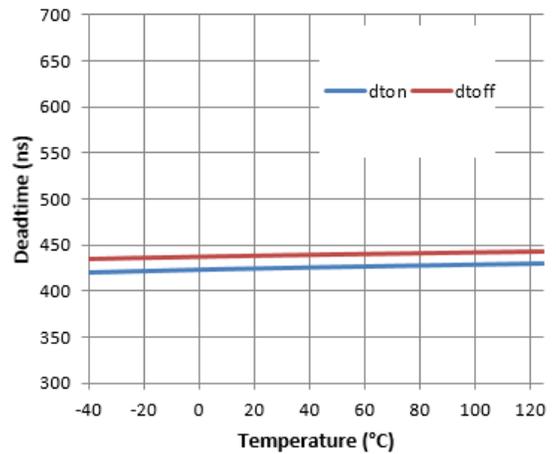
**Figure 22.** Logic 0 Input Voltage vs. Supply Voltage



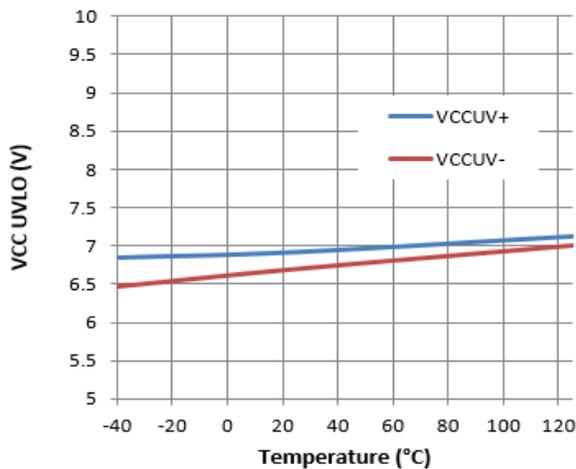
**Figure 23.** Logic 0 Input Voltage vs. Temperature



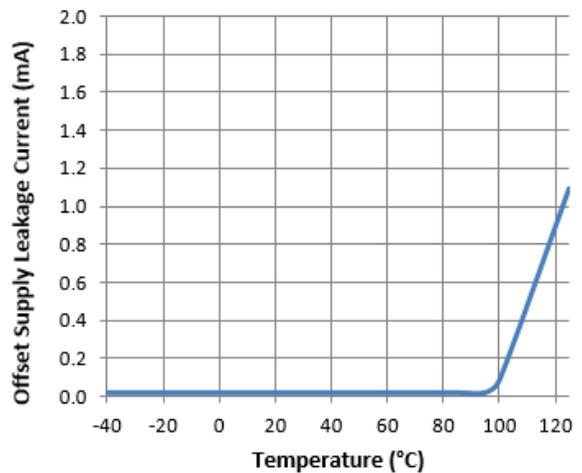
**Figure 24.** Deadtime vs. Supply Voltage



**Figure 25.** Deadtime vs. Temperature



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

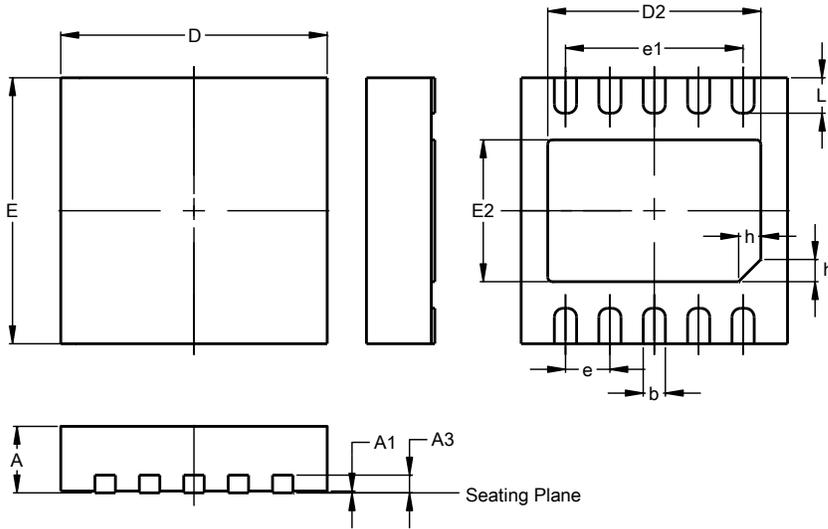


**Figure 27.** Offset Supply Leakage Current vs. Temperature

**Package Outline Dimensions**

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

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

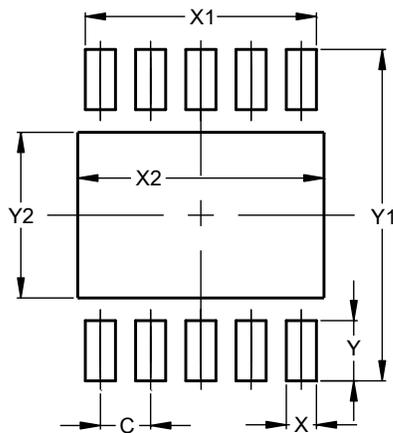


W-DFN3030-10 (Type TH)			
Dim	Min	Max	Typ
A	0.70	0.80	0.75
A1	--	0.05	0.02
A3	0.18	0.25	0.20
b	0.18	0.30	0.25
D	2.90	3.10	3.00
D2	2.40	2.60	2.50
e	0.50BSC		
e1	2.00BSC		
E	2.90	3.10	3.00
E2	1.45	1.65	1.55
h	0.20	0.30	0.25
L	0.30	0.50	0.40
All Dimensions in mm			

**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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