# HIGH FREQUENCY HALF-BRIDGE GATE DRIVER WITH PROGRAMMABLE DEADTIME IN W-DFN3030-10 (Type TH)

## Description

The DGD05463 is a high-frequency half-bridge gate driver capable of driving N-channel MOSFETs in a half-bridge configuration. The floating high-side driver is rated up to 50V.

The DGD05463 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 DGD05463 is offered in the W-DFN3030-10 (Type TH) package and operates over an extended -40°C to +125°C temperature range.

## Applications

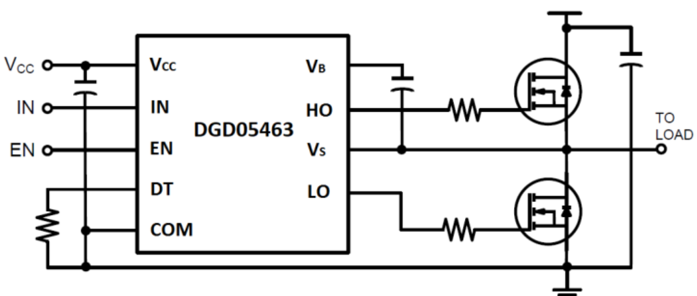
- DC-DC Converters
- Motor Controls
- Battery Powered Hand Tools
- eCig Devices
- Class D Power Amplifiers

## Features

- 50V Floating High-Side Driver
- 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 (<1µA)
- 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)




Typical Configuration

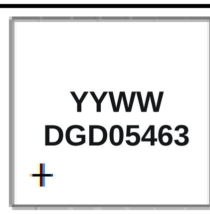
Top View Bottom View
W-DFN3030-10 (Type TH)

## Ordering Information (Note 4)

| Part Number | Marking | Reel Size (inches) | Tape Width (mm) | Quantity per Reel |
|---|---|---|---|---|
| DGD05463FN-7 | DGD05463 | 7 | 8 | 3000 |

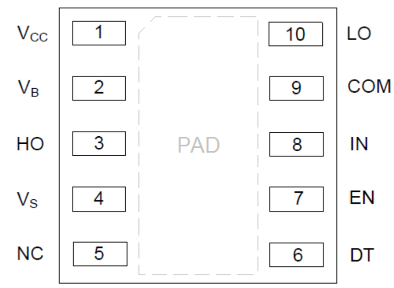
Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated’s definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- 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




DGD05463 = Product Type Marking Code
YY = Year (ex: 18 = 2018)
WW = Week (01 to 53)

## Pin Diagrams

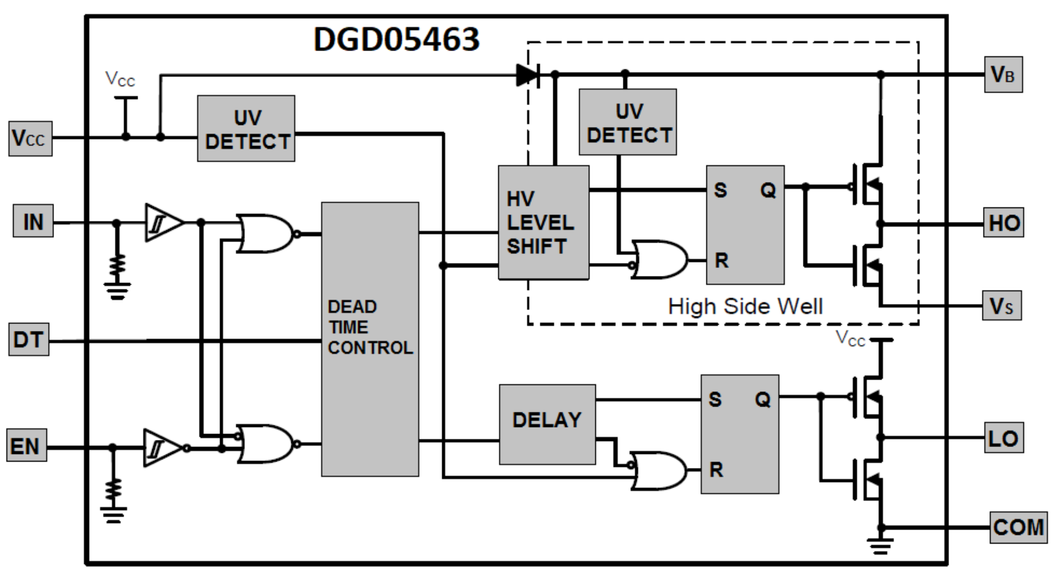



Top View: W-DFN3030-10 (Type TH)

## Pin Descriptions

| Pin Number | Pin Name | Function |
|---|---|---|
| 1 | $V_{CC}$ | Low-Side and Logic Supply |
| 2 | $V_B$ | High-Side Floating Supply |
| 3 | HO | High-Side Gate Drive Output |
| 4 | $V_S$ | High-Side Floating Supply Return |
| 5 | NC | No Connection (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 (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| High-Side Floating Positive Supply Voltage | $V_B$ | -0.3 to +60 | V |
| High-Side Floating Negative Supply Voltage | $V_S$ | $V_B$-14 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 |
| Logic and Low-Side Fixed Supply Voltage | $V_{CC}$ | -0.3 to +14 | V |
| Low-Side Output Voltage | $V_{LO}$ | -0.3 to $V_{CC}$+0.3 | V |
| Logic Input Voltage (IN and EN) | $V_{IN}$ | -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) | $P_D$ | 0.4 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | $R_{\theta JA}$ | 64 | °C/W |
| Thermal Resistance, Junction to Case (Note 5) | $R_{\theta JC}$ | 42 | °C/W |
| Operating Temperature | $T_J$ | +150 | °C |
| Lead Temperature (Soldering, 10s) | $T_L$ | +300 | °C |
| Storage Temperature Range | $T_{STG}$ | -55 to +150 | °C |

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 | $V_B$ | $V_S$ + 4.2 | $V_S$ + 14 | V |
| High-Side Floating Supply Offset Voltage | $V_S$ | (Note 6) | 50 (Note 7) | V |
| High-Side Floating Output Voltage | $V_{HO}$ | $V_S$ | $V_B$ | V |
| Logic and Low Side Fixed Supply Voltage | $V_{CC}$ | 4.5 (Note 8) | 14 | V |
| Low-Side Output Voltage | $V_{LO}$ | 0 | $V_{CC}$ | V |
| Logic Input Voltage (IN and EN) | $V_{IN}$ | 0 | 5 | V |
| Ambient Temperature | $T_A$ | -40 | +125 | °C |

Notes:
6. Logic operation for $V_S$ of -5V to +50V.
7. Provided $V_B$ doesn't exceed absolute maximum rating of 60V.
8. For operation of $V_{CC}$ = 4.5V to 4.9V, an external bootstrap Schottky diode (0.3V $V_{FD}$, 1A) is necessary, see Figure 3. For operation $V_{CC} \geqslant$ 4.9V, the external Schottky diode is not required.

## DC Electrical Characteristics ($V_{CC}$ = $V_{BS}$ = 12V, COM = $V_S$ = 0V, @$T_A$ = +25°C, unless otherwise specified.) (Note 9)

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Logic "1" Input Voltage | $V_{IH}$ | 2.4 | — | — | V | — |
| Logic "0" Input Voltage | $V_{IL}$ | — | — | 0.8 | V | — |
| Enable Logic "1" Input Voltage | $V_{ENIH}$ | 1.5 | — | — | V | — |
| Enable Logic "0" Input Voltage | $V_{ENIL}$ | — | — | 0.7 | 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 | µA | $V_B$ = $V_S$ = 60V |
| $V_{CC}$ Shutdown Supply Current | $I_{CCSD}$ | — | 0 | 1 | µA | $V_{IN}$ = 0V or 5V, $V_{EN}$ = 0V |
| $V_{CC}$ Quiescent Supply Current | $I_{CCQ}$ | — | 0.28 | 0.5 | mA | $V_{IN}$ = 0V or 5V, $R_{DT}$ = 100kΩ |
| $V_{CC}$ Operating Supply Current | $I_{CCOP}$ | — | 7.6 | — | mA | fs = 500kHz, $C_L$ = 1000pF |
| $V_{BS}$ Quiescent Supply Current | $I_{BSQ}$ | — | 32 | 100 | µA | $V_{IN}$ = 0V or 5V |
| $V_{BS}$ Operating Supply Current | $I_{BSOP}$ | — | 7.6 | — | mA | fs = 500kHz, $C_L$ = 1000pF |
| Logic "1" Input Bias Current | $I_{IN+}$ | — | 25 | 60 | µA | $V_{IN}$ = 5V |
| Logic "0" Input Bias Current | $I_{IN-}$ | — | 0 | 1 | µA | $V_{IN}$ = 0V |
| $V_{BS}$ Supply Undervoltage Positive Going Threshold | $V_{BSUV+}$ | 3.3 | 3.8 | 4.2 | V | — |
| $V_{BS}$ Supply Undervoltage Negative Going Threshold | $V_{BSUV-}$ | 2.9 | 3.3 | 3.9 | V | — |
| $V_{CC}$ Supply Undervoltage Positive Going Threshold | $V_{CCUV+}$ | 3.3 | 3.8 | 4.2 | V | — |
| $V_{CC}$ Supply Undervoltage Negative Going Threshold | $V_{CCUV-}$ | 2.9 | 3.3 | 3.9 | V | — |
| Output High Short-Circuit Pulsed Current | $I_{O+}$ | 1.0 | 1.5 | — | A | $V_O$ = 0V, PW ≤ 10µs |
| Output Low Short-Circuit Pulsed Current | $I_{O-}$ | 1.9 | 2.5 | — | A | $V_O$ = 15V, PW ≤ 10µs |
| Forward Voltage of Bootstrap Diode | $V_{F1}$ | — | 0.67 | — | V | $I_F$ = 100µA |
| Forward Voltage of Bootstrap Diode | $V_{F2}$ | — | 1.7 | — | V | $I_F$ = 100mA |

Note: 9. 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°C, unless otherwise specified.)

| Parameter | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Turn-on Propagation Delay, HO & LO | $t_{ON}$ | 65 | 96 | 125 | ns | $R_{DT}$ = 10kΩ |
| | | 350 | 463 | 580 | ns | $R_{DT}$ = 100kΩ |
| 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: $t_{DT\ LO\text{-}HO}$ & $t_{DT\ HO\text{-}LO}$ | $t_{DT}$ | 40 | 70 | 100 | ns | $R_{DT}$ = 10kΩ |
| | | 300 | 430 | 560 | ns | $R_{DT}$ = 100kΩ |
| Deadtime Matching | $t_{MDT}$ | — | — | 50 | ns | $R_{DT}$ = 100kΩ |

## Timing Waveforms

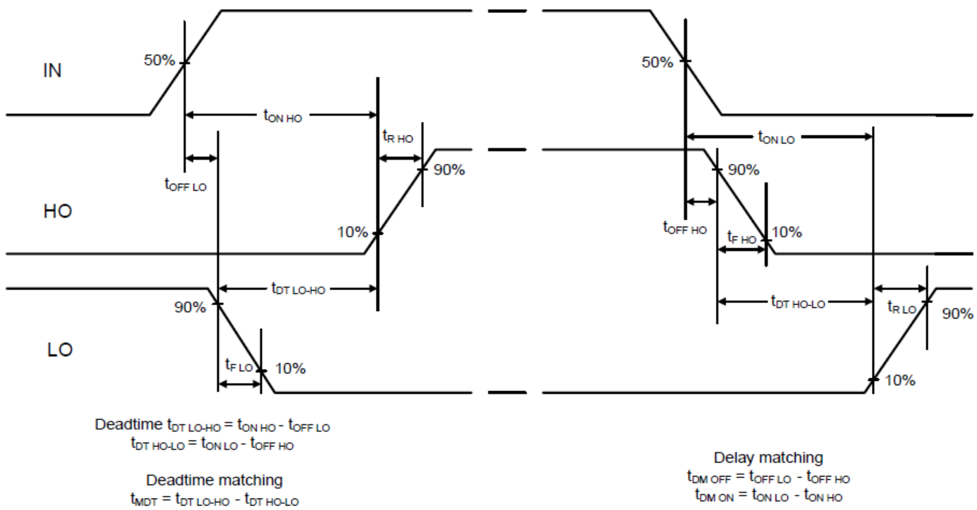



**Figure 1.** Switching Time Waveform Definitions

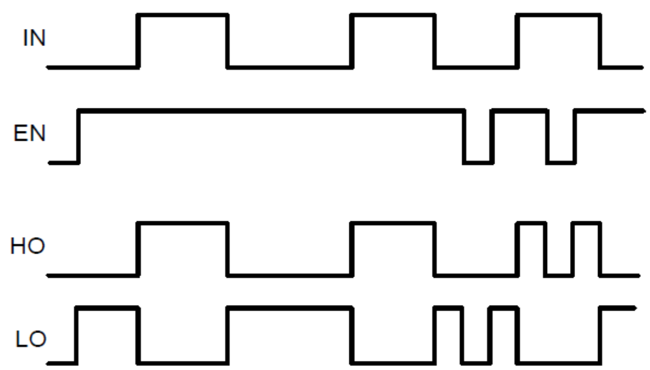



**Figure 2.** Input / Output Timing Diagram

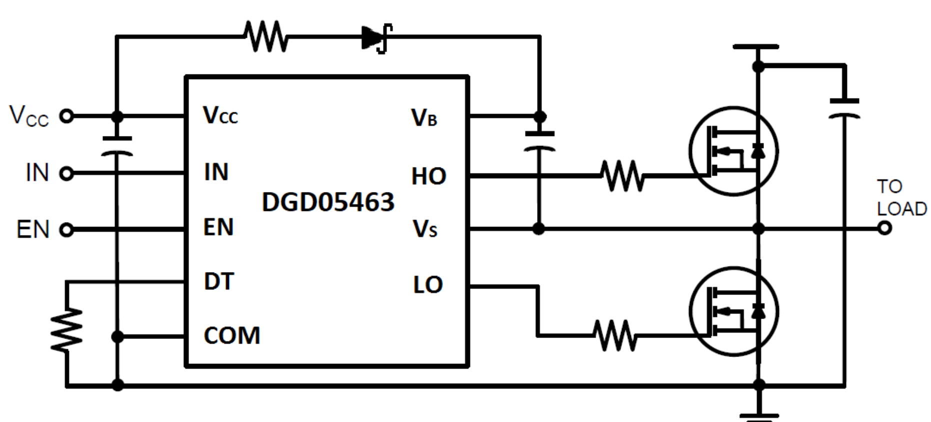



**Figure 3.** Typical application necessary for $V_{CC}$ = 4.5V to 4.9V operation. For $V_{CC} \geq 4.9V$, the bootstrap Schottky diode (0.3V Voltage drop, 1A) and resistor are not required.

## Typical Performance Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

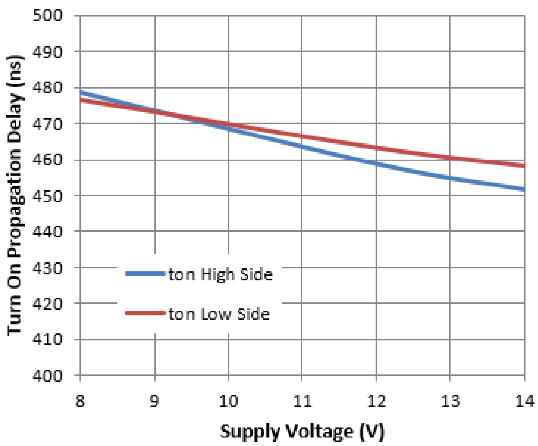



**Figure 4.** Turn-on Propagation Delay vs. Supply Voltage

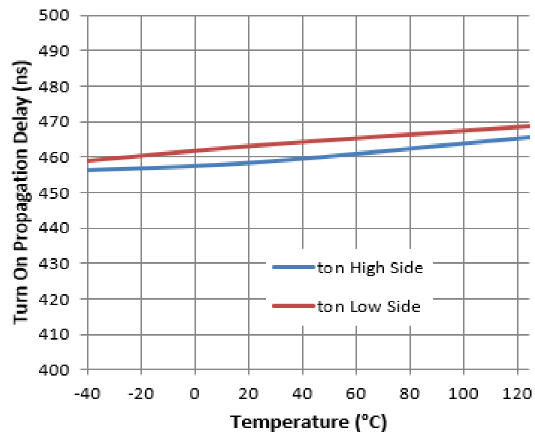



**Figure 5.** Turn-on Propagation Delay vs. Temperature

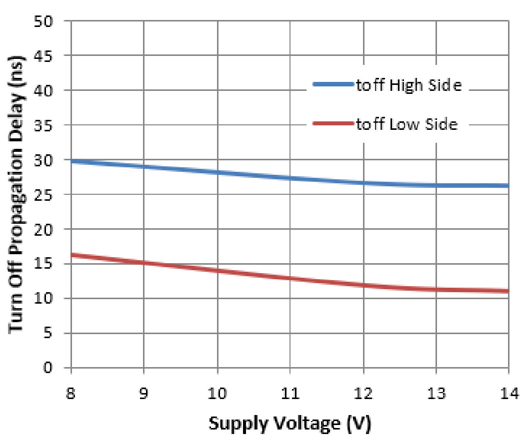



**Figure 6.** Turn-off Propagation Delay vs. Supply Voltage

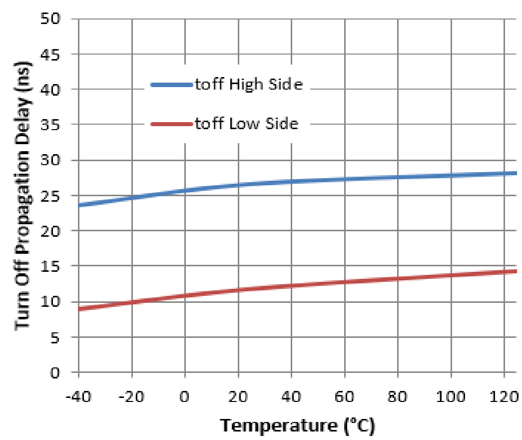



**Figure 7.** Turn-off Propagation Delay vs. Temperature

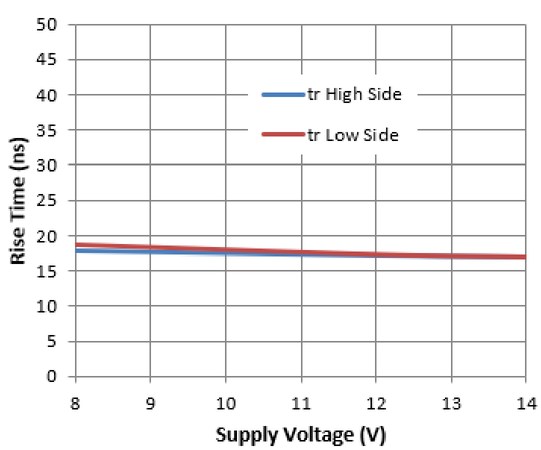



**Figure 8.** Rise Time vs. Supply Voltage

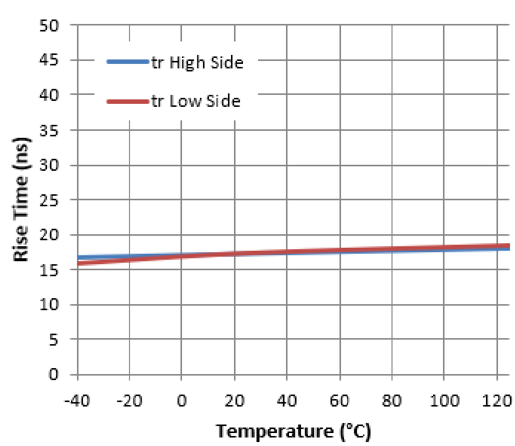



**Figure 9.** Rise Time vs. Temperature

## Typical Performance Characteristics (Cont.)

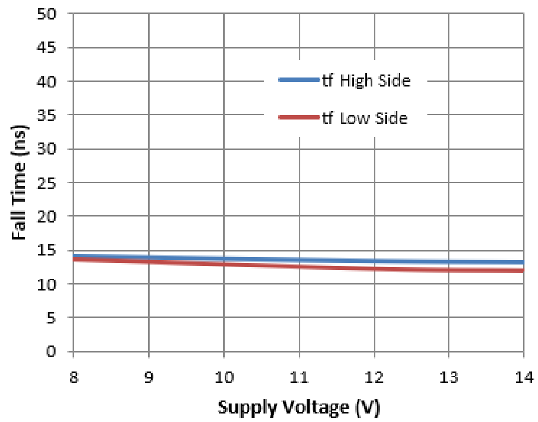



**Figure 10.** Fall Time vs. Supply Voltage

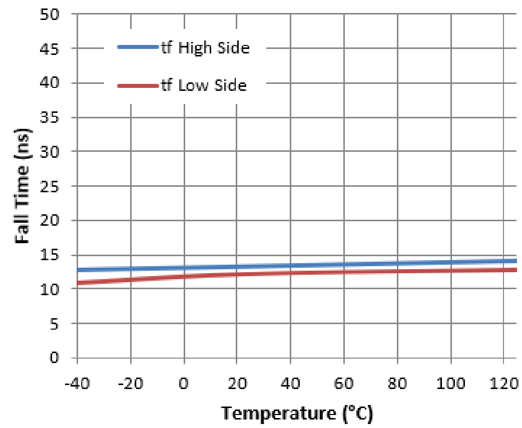



**Figure 11.** Fall Time vs. Temperature

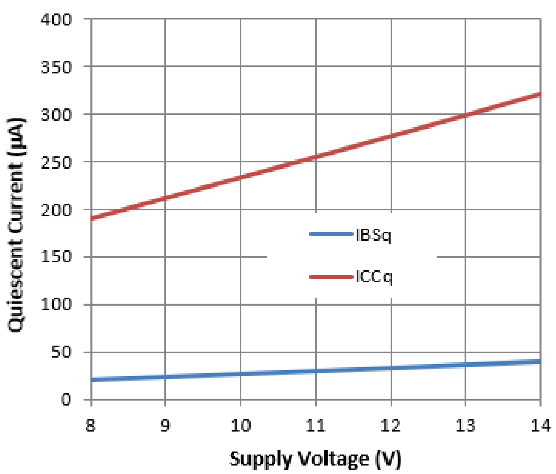



**Figure 12.** Quiescent Current vs. Supply Voltage

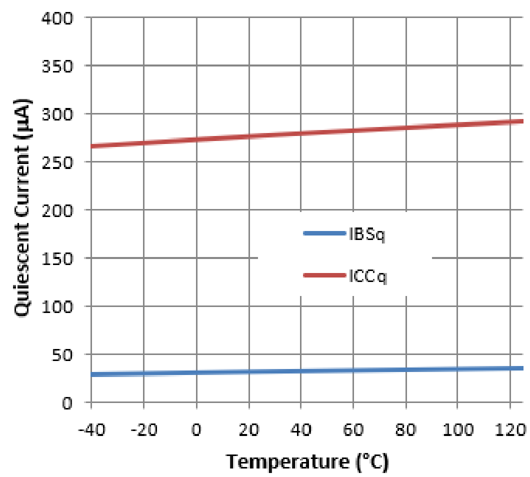



**Figure 13.** Quiescent Current vs. Temperature

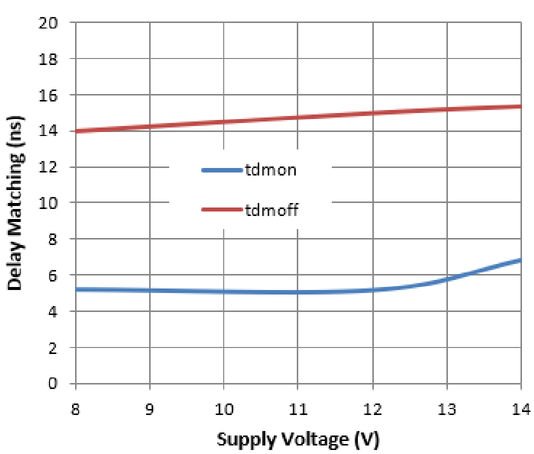



**Figure 14.** Delay Matching vs. Supply Voltage

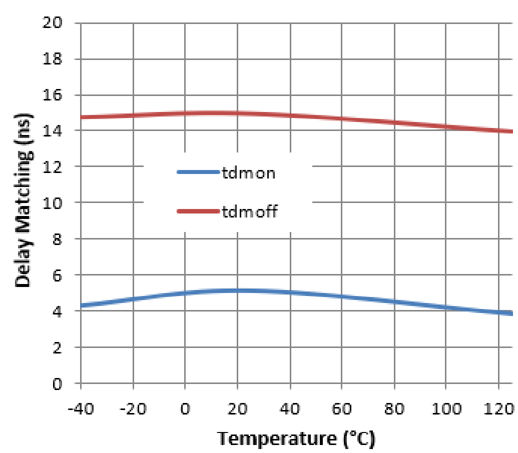



**Figure 15.** Delay Matching vs. Temperature

## Typical Performance Characteristics (Cont.)

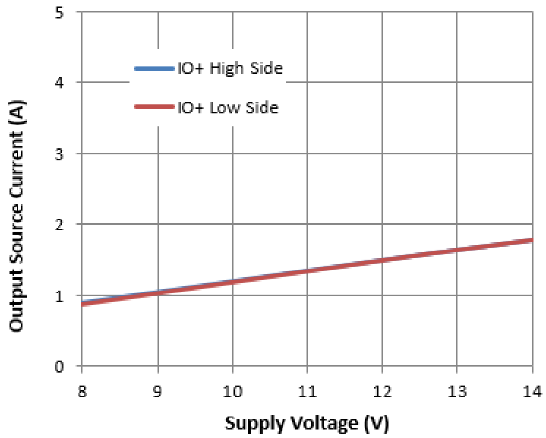



**Figure 16.** Output Source Current vs. Supply Voltage

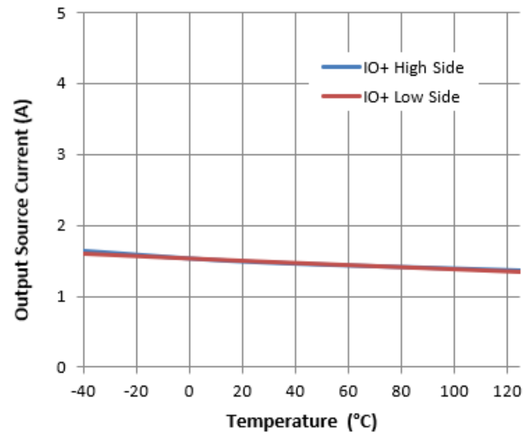



**Figure 17.** Output Source Current vs. Temperature

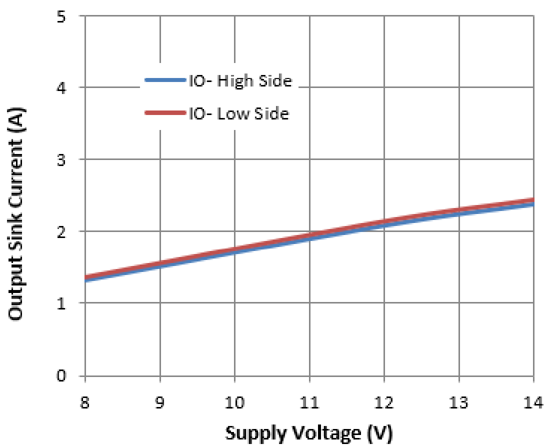



**Figure 18.** Output Sink Current vs. Supply Voltage

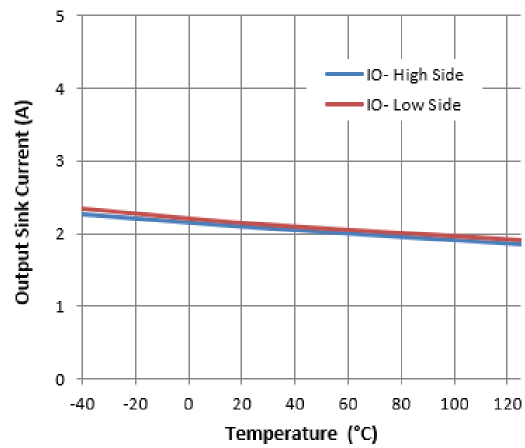



**Figure 19.** Output Sink Current vs. Temperature

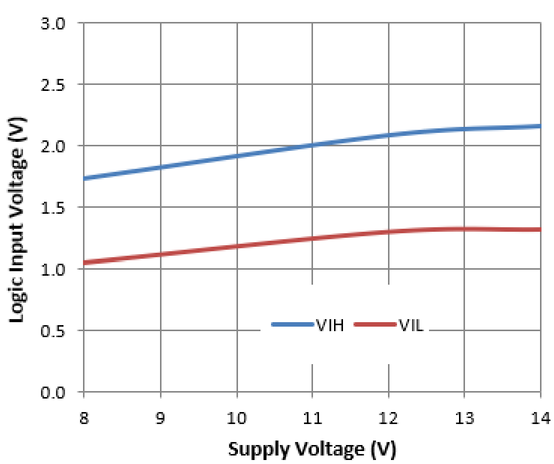



**Fig 20.** Logic Input Voltage vs. Supply Voltage

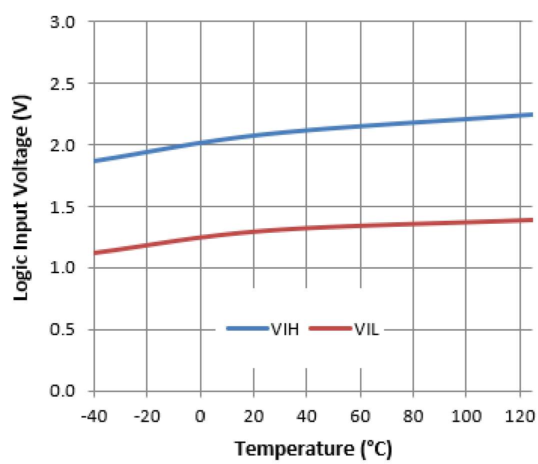



**Fig 21.** Logic Input Voltage vs. Temperature

## Typical Performance Characteristics (Cont.)

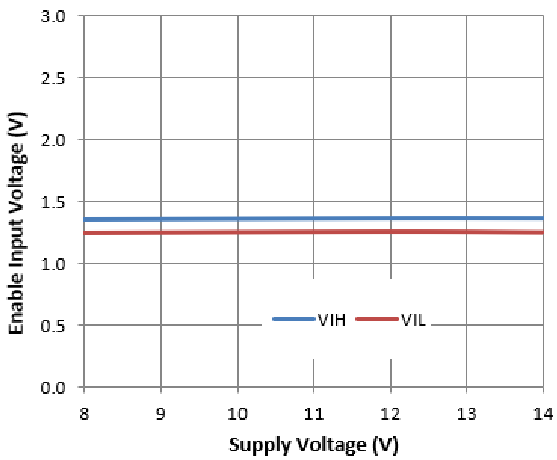



**Fig 22.** Enable Input Voltage vs. Supply Voltage

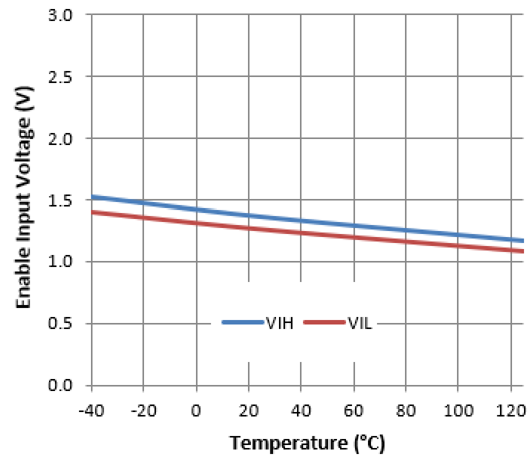



**Fig 23.** Enable Input Voltage vs. Temperature

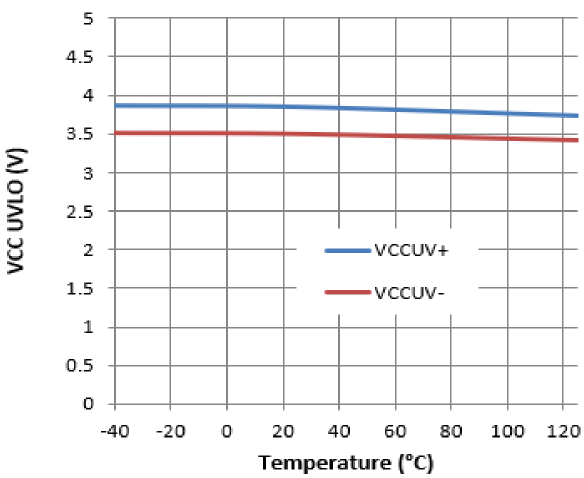



**Figure 24.** VCC UVLO vs. Temperature

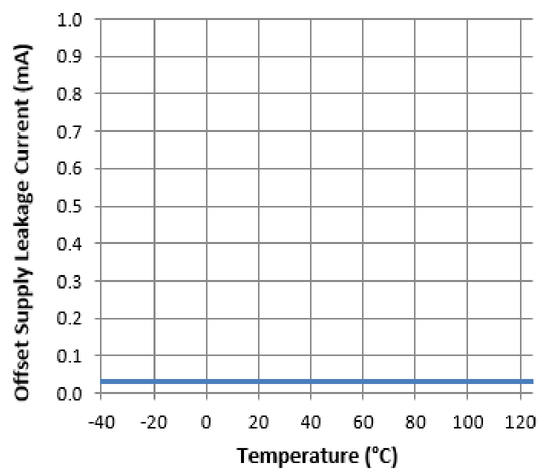
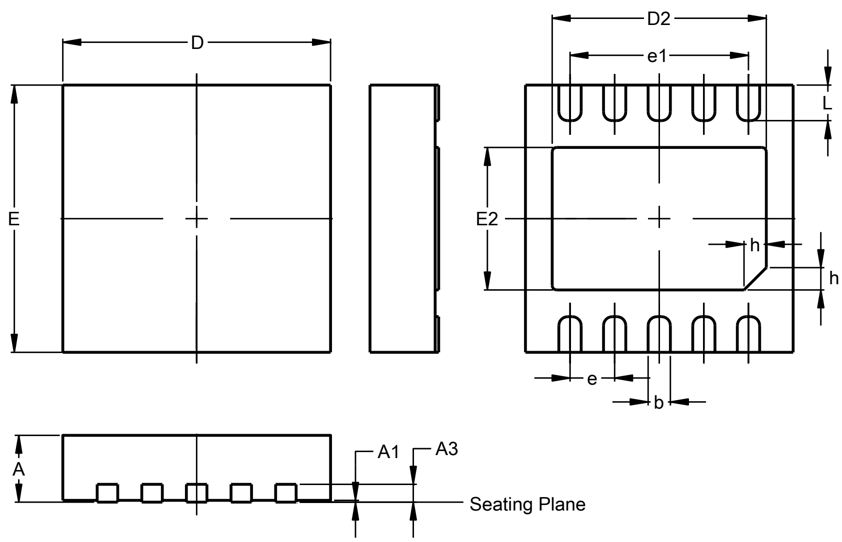



**Figure 25.** Offset Supply Leakage Current vs. Temperature

## Package Outline Dimensions

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

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

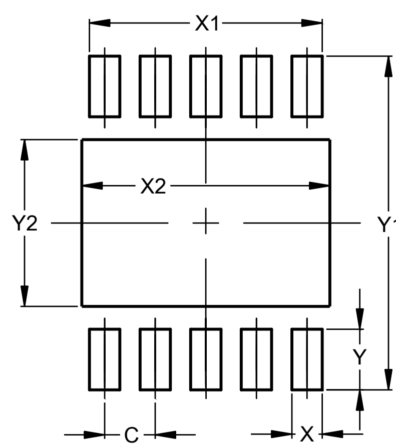



| W-DFN3030-10 (Type TH) | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.70 | 0.80 | 0.75 |
| **A1** | -- | 0.05 | 0.02 |
| **A3** | 0.18 | 0.25 | 0.20 |
| **b** | 0.18 | 0.30 | 0.25 |
| **D** | 2.90 | 3.10 | 3.00 |
| **D2** | 2.40 | 2.60 | 2.50 |
| **e** | 0.50BSC | | |
| **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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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.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.



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