

## Description

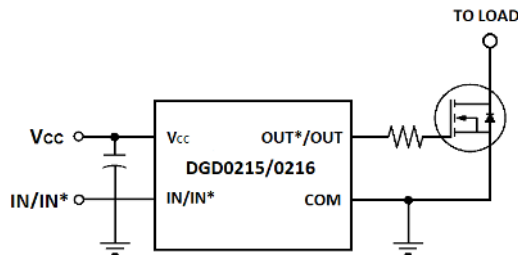
The DIODES™ DGD0215 and DIODES™ DGD0216 high speed / low side MOSFET and IGBT drivers are capable of driving 1.9A of peak current. The DGD0215 and DGD0216 logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with MCUs. Fast and well matched propagation delays allow high speed operation, enabling a smaller and more compact power switching design using smaller associated components.

The DGD0215 and DGD0216 are highly resistant to noise, and are able to withstand up to 5V positive or negative on the ground pin without damage. The devices can also withstand 500mA of reverse current forced back into the outputs without damage or logic change. The DGD0215 provides an inverted output and the DGD0216 provides a non-inverting output.

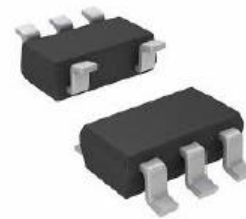
The DGD0215 and DGD0216 are offered in TSOT25 (Standard) package and the operating temperature extends from -40°C to +125°C.

## Applications

- DC-DC converters
- Line drivers
- Motor controls
- Switch mode power supplies



Typical Configuration



TSOT25 (Standard)

## Features

- Efficient Low Cost Solution for Driving MOSFETs and IGBTs
- Wide Supply Voltage Operating Range: 4.5V to 18V
- 1.9A Source / 1.8A Sink Output Current Capability
- Inverting and Non-Inverting Input Configurations
- Fast Propagation Delay (35ns typ)
- Fast Rise and Fall Times (15ns typ)
- Logic Input (IN and IN\*) 3.3V Capability
- 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-Q100/101/104/200, 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

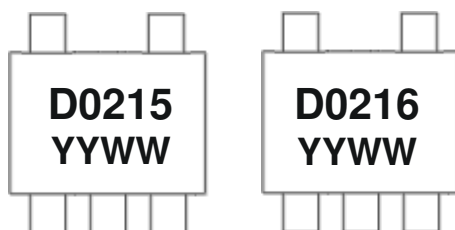
- Package: TSOT25
- Package Material: Molded Plastic. "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 3 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 (e3)
- Weight: 0.012 grams (Approximate)

## Ordering Information (Note 4)

Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
DGD0215WT-7	TSOT25 (Standard)	D0215	7	8	3,000	Reel
DGD0216WT-7	TSOT25 (Standard)	D0216	7	8	3,000	Reel

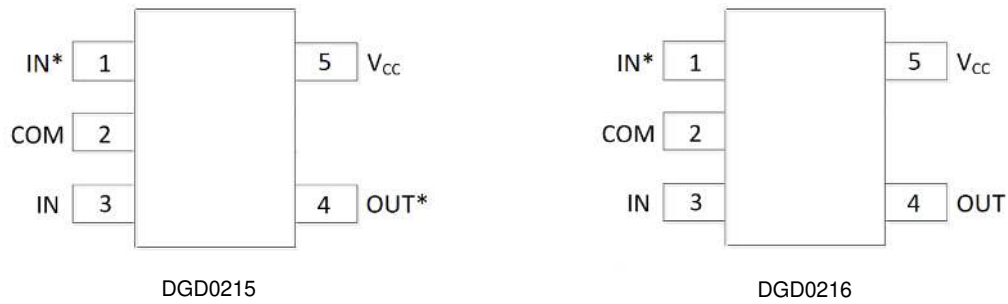
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3.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



D0215/D0216 = Product Type Marking Code  
YY = Year (ex: 22 = 2022)  
WW = Week (01 to 53)

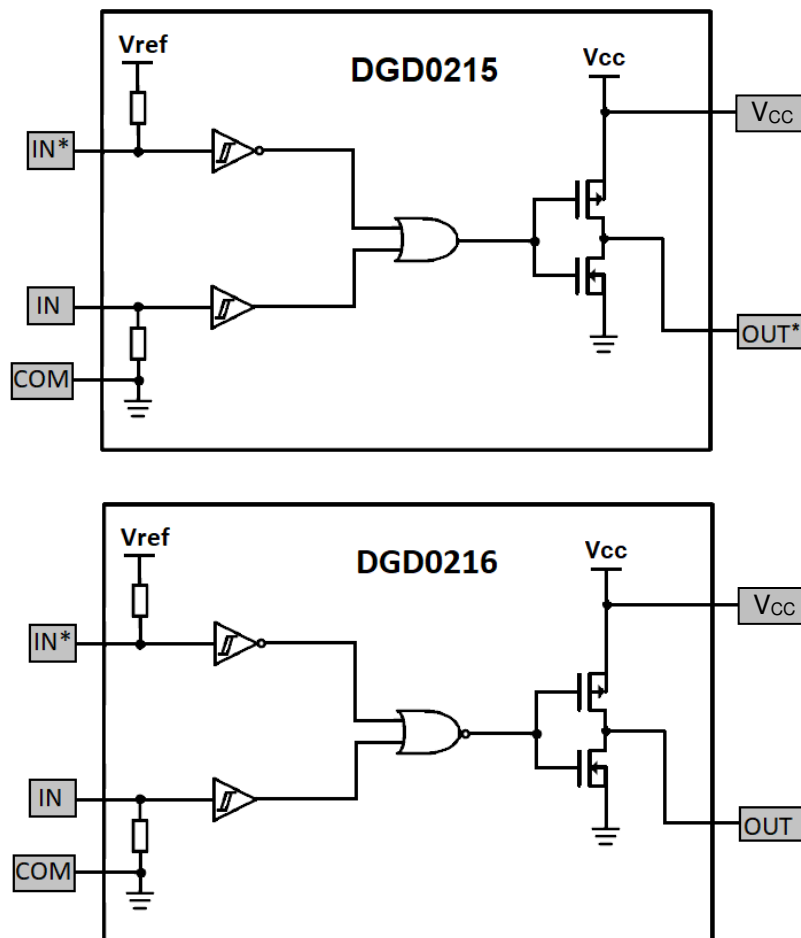
**Pin Diagrams**



**Pin Descriptions**

Pin Number	Pin Name	Function
1	IN*	Logic Input, In Phase with OUT* (DGD0215), Out of Phase with OUT (DGD0216), leave open when not in use.
2	COM	Supply Return
3	IN	Logic Input, Out of Phase with OUT* (DGD0215), In Phase with OUT (DGD0216), leave open when not in use.
4	OUT*/OUT	Gate Drive Output
5	V <sub>CC</sub>	Supply Input

**Functional Block Diagram**



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

Characteristic	Symbol	Value	Unit
Low-Side Fixed Supply Voltage	V <sub>CC</sub>	-0.3 to 22	V
Output Voltage (OUT/OUT*)	V <sub>OUT</sub>	-0.3 to V <sub>CC</sub> + 0.3	V
Logic Input Voltage (IN and IN*)	V <sub>IN</sub>	-5 to V <sub>CC</sub> + 0.3	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>	0.54	W
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	188	°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.

**ESD Ratings** (Note 6)

Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	2,000	V	2

Note: 6. Refer to JEDEC specification JESD22-A114.

**Recommended Operating Conditions**

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V <sub>B</sub>	4.5	18	V
Output Voltage (OUT/OUT*)	V <sub>S</sub>	0	V <sub>CC</sub>	V
Logic Input Voltage (IN and IN*)	V <sub>IN</sub>	0	5	V
Ambient Temperature	T <sub>A</sub>	-40	+125	°C

**DC Electrical Characteristics** ( $V_{BIAS}$  (4.5V <  $V_{CC}$  < 18V), @ $T_A = +25^\circ\text{C}$ , unless otherwise specified.) (Note 7)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Logic "1" Input Voltage	$V_{IH}$	2.4	1.6	—	V	—
Logic "0" Input Voltage	$V_{IL}$	—	1.3	0.8	V	—
Logic "1" Input Bias Current	$I_{IN+}$	—	—	5	$\mu\text{A}$	$V_{IN} = 3\text{V}$ , $V_{IN^*} = 0\text{V}$
Logic "0" Input Bias Current	$I_{IN-}$	—	—	2	$\mu\text{A}$	$V_{IN} = 0\text{V}$ , $V_{IN^*} = 3\text{V}$
High Level Output Voltage, $V_{BIAS} - V_O$	$V_{OH}$	—	25	—	mV	—
Low Level Output Voltage	$V_{OL}$	—	25	—	mV	—
Quiescent $V_{CC}$ Supply Current	$I_{CCQ}$	—	50	100	$\mu\text{A}$	$V_{IN} = 0\text{V}$ or 3V
Output High Short Circuit Pulsed Current	$I_{O+}$	—	1.9	—	A	$V_{CC} = 12\text{V}$
Output Low Short Circuit Pulsed Current	$I_{O-}$	—	1.8	—	A	$V_{CC} = 12\text{V}$
Output Resistance, High	$R_{OH}$	—	3.3	—	$\Omega$	$I_{OUT} = 10\text{mA}$ , $V_{CC} = 12\text{V}$
Output Resistance, Low	$R_{OL}$	—	2.3	—	$\Omega$	$I_{OUT} = 10\text{mA}$ , $V_{CC} = 12\text{V}$

**AC Electrical Characteristics** ( $V_{BIAS}$  (4.5V <  $V_{CC}$  < 18V), @ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-On Rise Time	$t_r$	—	15	25	ns	$C_L = 1000\text{pF}$ , $V_{CC} = 12\text{V}$
Turn-Off Fall Time	$t_f$	—	15	25	ns	$C_L = 1000\text{pF}$ , $V_{CC} = 12\text{V}$
Turn-On Propagation Delay	$t_{ON}$	—	35	50	ns	$V_{CC} = 12\text{V}$
Turn-Off Propagation Delay	$t_{OFF}$	—	35	55	ns	$V_{CC} = 12\text{V}$

**DC Electrical Characteristics** ( $V_{BIAS}$  (4.5V <  $V_{CC}$  < 18V), @ $T_C = -40^\circ\text{C}$  to  $+125^\circ\text{C}$ , unless otherwise specified.) (Note 7)

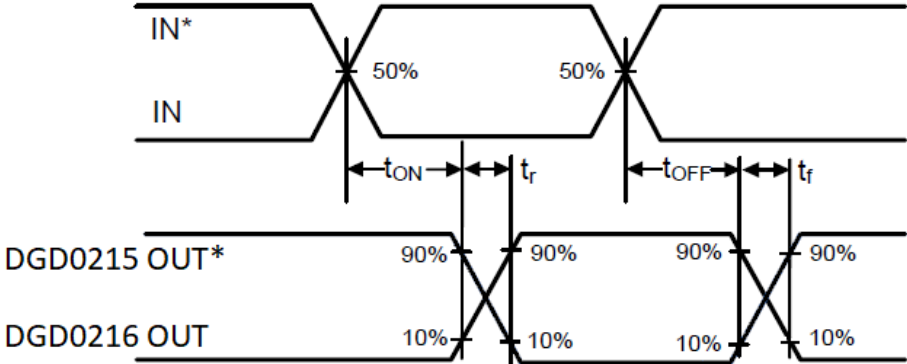
Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Logic "1" Input Voltage	$V_{IH}$	2.4	—	—	V	—
Logic "0" Input Voltage	$V_{IL}$	—	—	0.8	V	—
Logic "1" Input Bias Current	$I_{IN+}$	—	—	10	$\mu\text{A}$	$V_{IN} = 3\text{V}$
Logic "0" Input Bias Current	$I_{IN-}$	—	0	5	$\mu\text{A}$	$V_{IN} = 0\text{V}$
High Level Output Voltage, $V_{BIAS} - V_O$	$V_{OH}$	—	25	—	mV	—
Low Level Output Voltage	$V_{OL}$	—	25	—	mV	—
Quiescent $V_{CC}$ Supply Current	$I_{CCQ}$	—	0.1	0.2	mA	$V_{IN} = 0\text{V}$ or 3V
Output Resistance, High	$R_{OH}$	—	—	10	$\Omega$	$I_{OUT} = 10\text{mA}$ , $V_{CC} = 12\text{V}$
Output Resistance, Low	$R_{OL}$	—	—	7	$\Omega$	$I_{OUT} = 10\text{mA}$ , $V_{CC} = 12\text{V}$

Note: 7. The  $V_{IN}$  and  $I_{IN}$  parameters are applicable to the logic input pins: IN and IN\*. The  $V_O$  and  $I_O$  parameters are applicable to the output pins: OUT and OUT\*.

**AC Electrical Characteristics** ( $V_{BIAS}$  (4.5V <  $V_{CC}$  < 18V), @ $T_C = -40^\circ\text{C}$  to  $+125^\circ\text{C}$ , unless otherwise specified.)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Turn-On Rise Time	$t_r$	—	30	40	ns	$C_L = 1000\text{pF}$ , $V_{CC} = 12\text{V}$
Turn-Off Fall Time	$t_f$	—	30	40	ns	$C_L = 1000\text{pF}$ , $V_{CC} = 12\text{V}$
Turn-On Propagation Delay	$t_{ON}$	—	45	55	ns	$V_{CC} = 12\text{V}$
Turn-Off Propagation Delay	$t_{OFF}$	—	50	60	ns	$V_{CC} = 12\text{V}$

**Timing Waveforms**

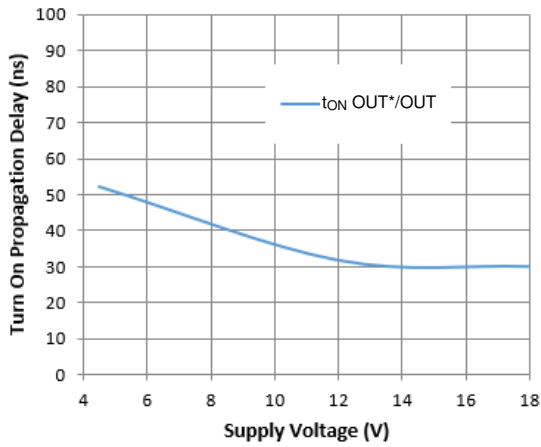


**Figure 1. Switching Time Waveform Definitions**

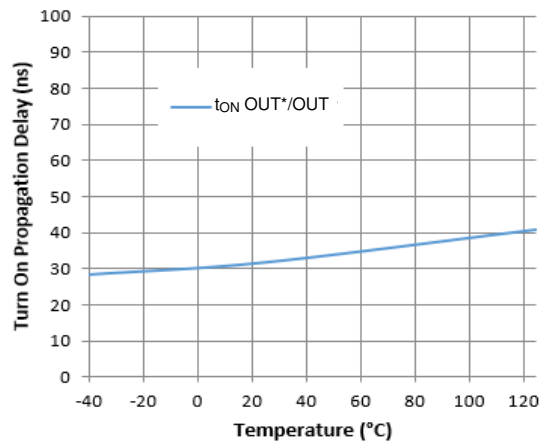
**Input/Output Response Table**

IN	IN*	DGD0215 (OUT*)	DGD0216 (OUT)
H	H (Open)	L	H
L	H (Open)	H	L
L (Open)	H	H	L
L (Open)	L	L	H

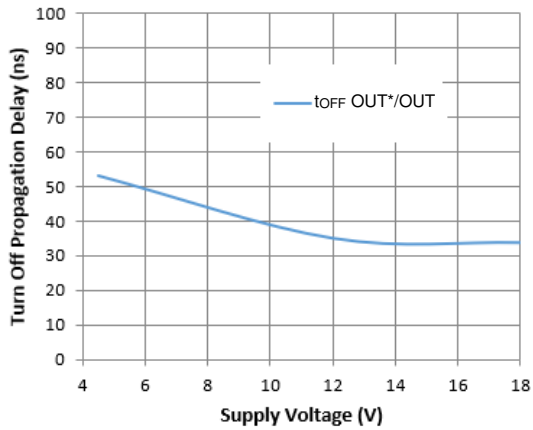
**Typical Performance Characteristics** ( $V_{CC} = 12V$ ,  $@T_A = +25^\circ C$ , unless otherwise specified.)



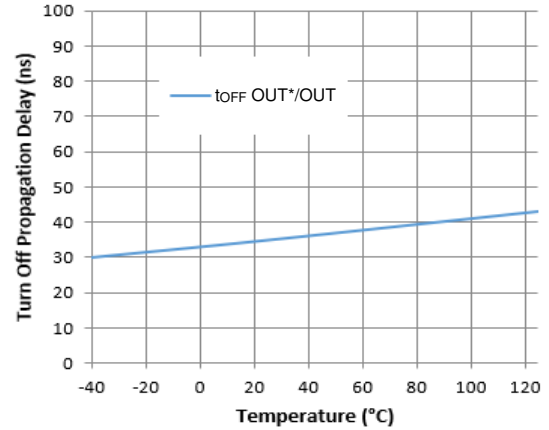
**Figure 2.** Turn-on Propagation Delay vs. Supply Voltage



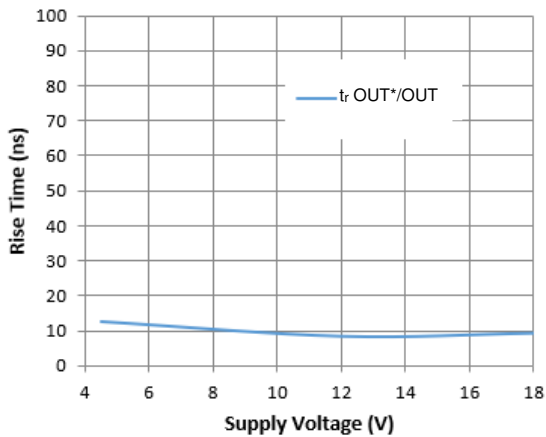
**Figure 3.** Turn-on Propagation Delay vs. Temperature



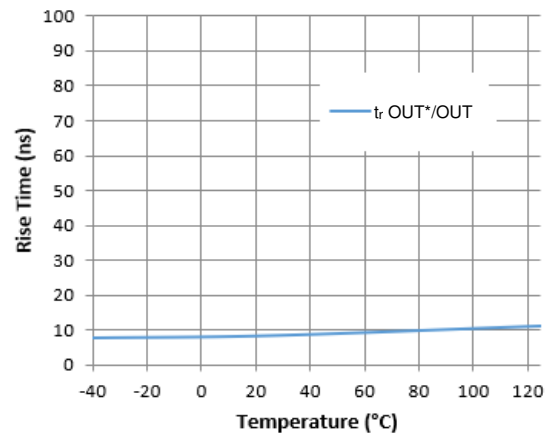
**Figure 4.** Turn-off Propagation Delay vs. Supply Voltage



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



**Figure 6.** Rise Time vs. Supply Voltage



**Figure 7.** Rise Time vs. Temperature

**Typical Performance Characteristics** (continued)

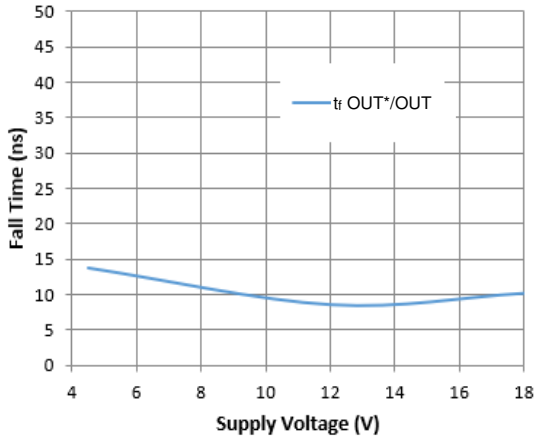


Figure 8. Fall Time vs. Supply Voltage

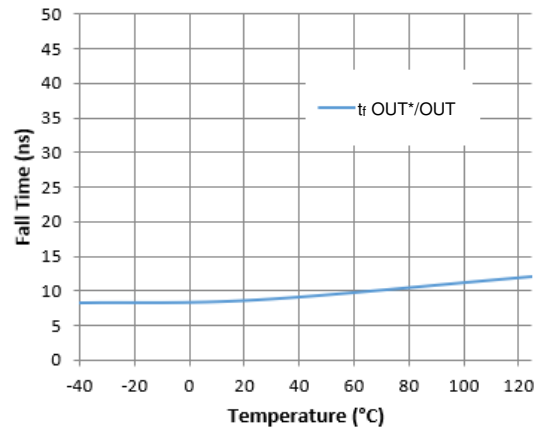


Figure 9. Fall Time vs. Temperature

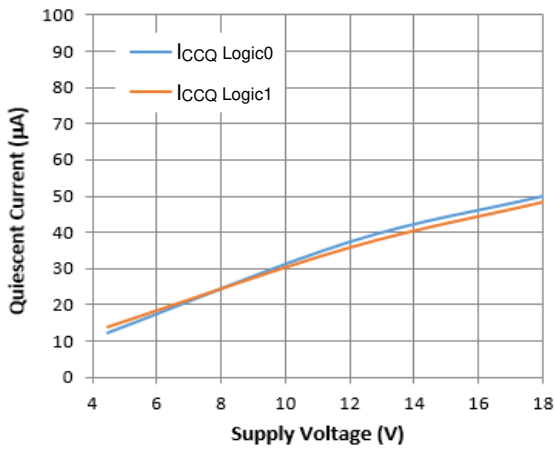


Figure 10. Quiescent Current vs. Supply Voltage

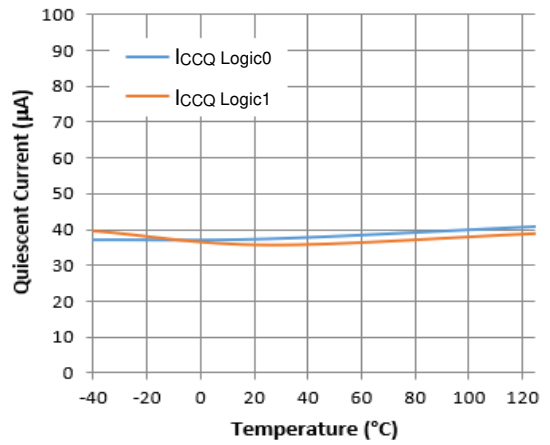


Figure 11. Quiescent Current vs. Temperature

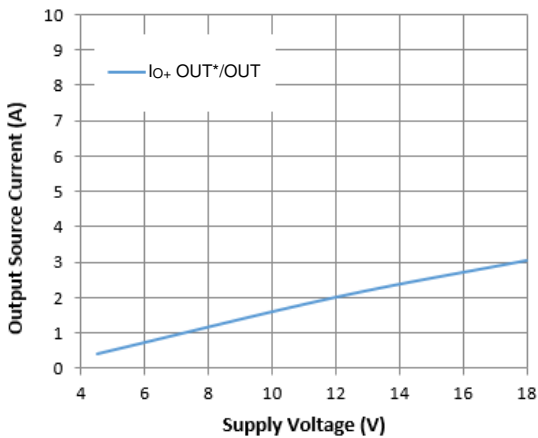


Figure 12. Output Source Current vs. Supply Voltage

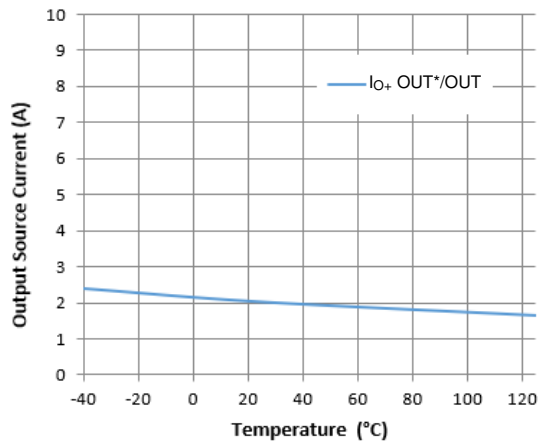


Figure 13. Output Source Current vs. Temperature

**Typical Performance Characteristics** (continued)

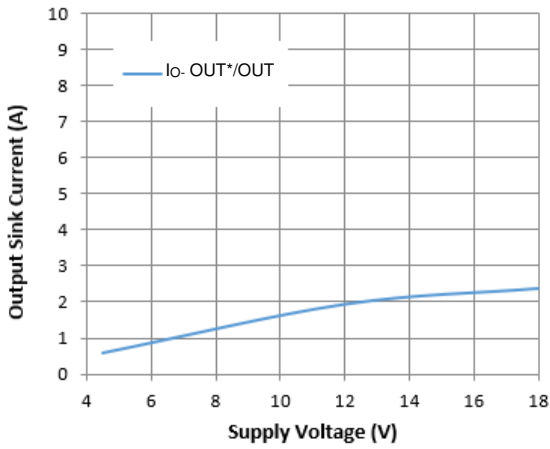


Figure 14. Output Sink Current vs. Supply Voltage

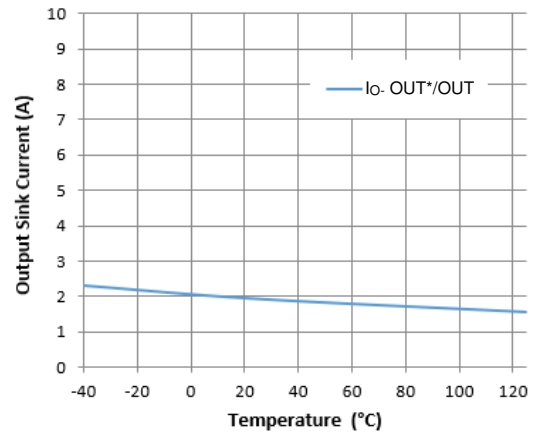


Figure 15. Output Sink Current vs. Temperature

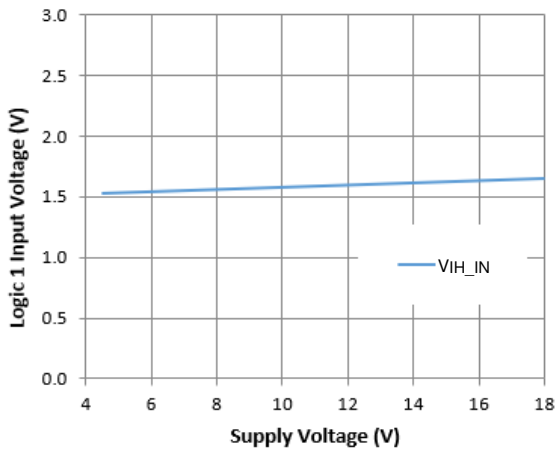


Figure 16. Logic 1 Input Voltage vs. Supply Voltage

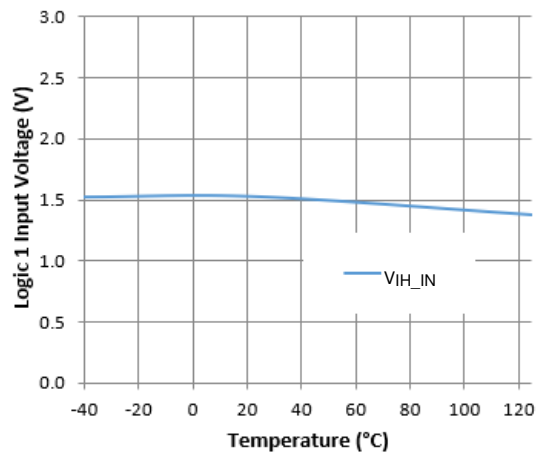


Figure 17. Logic 1 Input Voltage vs. Temperature

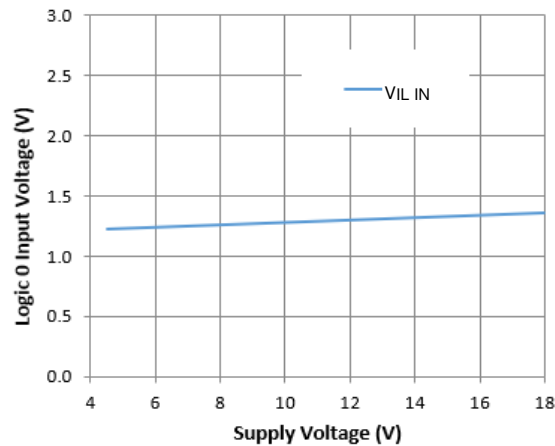


Figure 18. Logic 0 Input Voltage vs. Supply Voltage

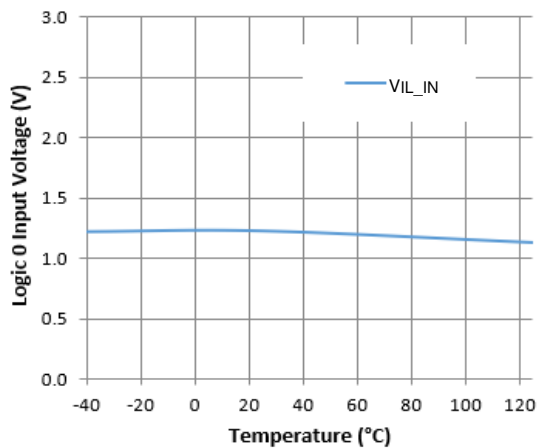
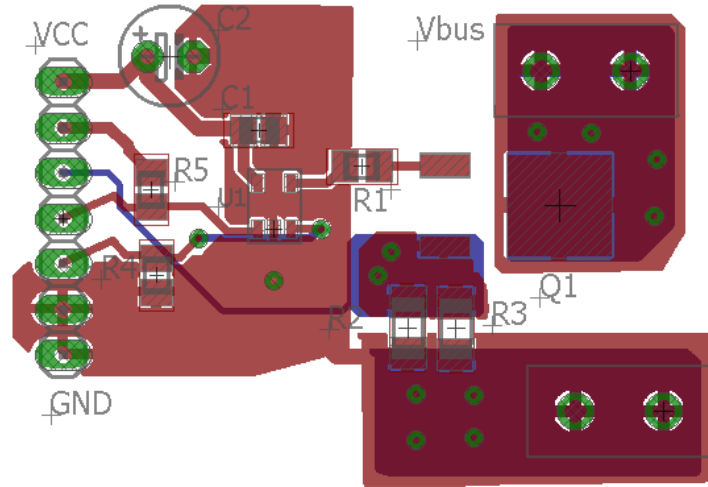


Figure 19. Logic 0 Input Voltage vs. Temperature

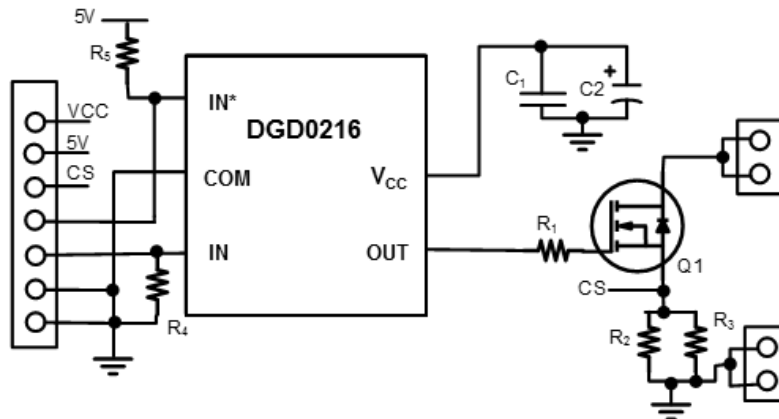


**PCB Layout Information**

The DGD0215 and DGD0216 High Speed, Low-Side, single Gate Drivers demand a fast switching current through  $V_{CC}$ , and in the power switching circuit a much larger current will be switched through the MOSFET. Typical applications are PFC or boost converter. Particular consideration for layout is key to ensuring optimal operation of the Gate Driver IC as well as to minimizing ringing and noise on the power line (VBUS) and ground. Figure 20 shows an example layout of the DGD0216 in the Low-Side power switching of a PFC circuit. Figure 21 shows the schematic of the layout shown in Figure 20, followed by a description of layout considerations for the DGD0215 and DGD0216.



**Figure 20.** Example Layout of DGD0216 Driving a Low-Side MOSFET (For Example PFC Circuit)



**Figure 21.** Schematic for Layout Example Circuit Shown in Figure 20

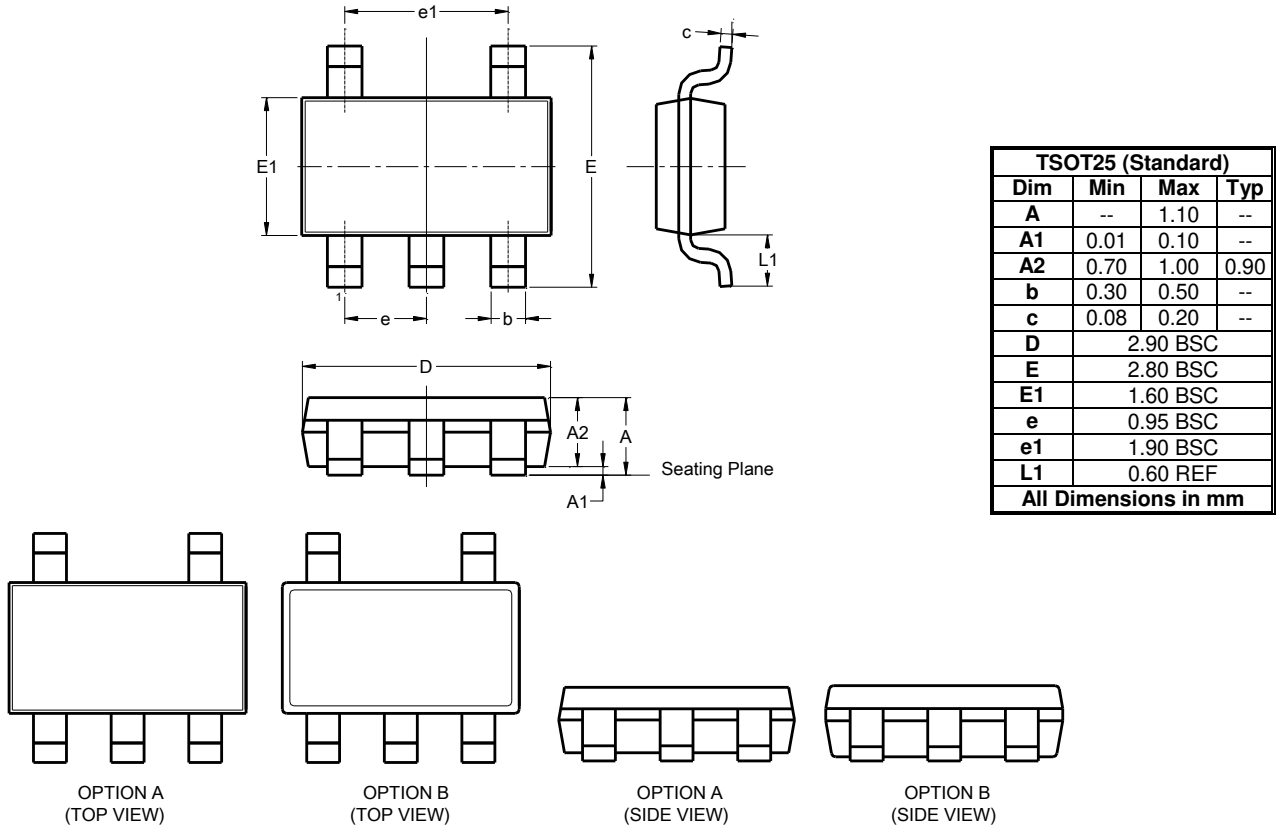
In Gate Driver circuits, most of the current occurs during turning on/off, so when designing optimal layout, it is best to consider the charge transfer during turn on/off.

When the DGD0216 turns on, charge will flow from  $C_1/C_2$  through the logic circuits in the Gate Driver IC and directly to GND. But the majority of the charge will flow from  $C_1/C_2$  via the internal P-channel MOSFET (see Functional Block Diagram Output Stage), through the OUT pin to charge the Gate of the MOSFET, Q1; the return is from the Source of Q1 through the current sense resistors ( $R_2$  and  $R_3$ ) and to GND (back to  $C_1/C_2$ ). **Hence this loop must be as short as possible to minimize stray inductance.**  $C_1$  should be a low ESR ceramic capacitor and along with gate resistor ( $R_1$ ) and MOSFET (Q1) should be located close to the DGD0216 to minimize the inductance of that loop. When the device turns off, the charge on the MOSFET Gate sinks current into the IC through the internal N-channel MOSFET to GND.

**Package Outline Dimensions**

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

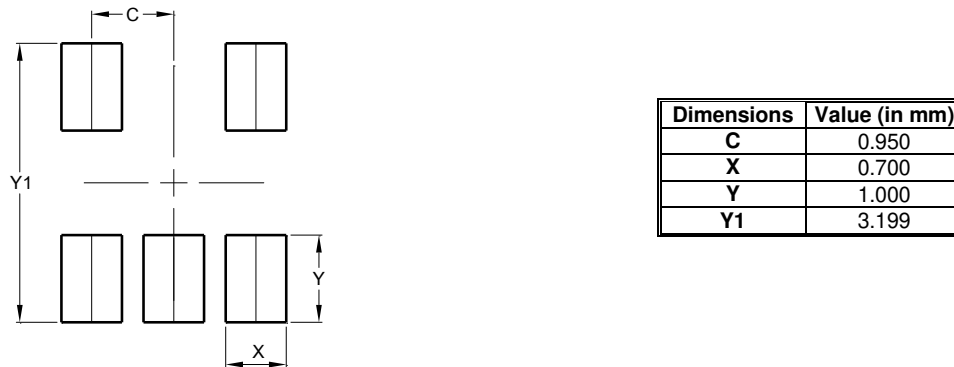
**TSOT25 (Standard)**



**Suggested Pad Layout**

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**TSOT25 (Standard)**



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