



**DGD2003** 

### HALF-BRIDGE GATE DRIVER IN SO-8

### Description

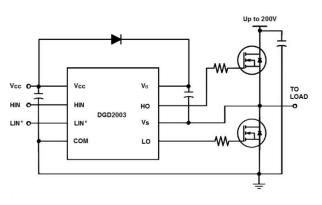
The DGD2003 is a high-voltage / high-speed gate driver capable of driving N-channel MOSFETs in a half-bridge configuration. High voltage processing techniques enable the DGD2003's high side to switch to 200V in a bootstrap operation.

The DGD2003 logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with controlling devices. The driver output features high pulse current buffers designed for minimum driver cross conduction. The DGD2003 has a fixed internal deadtime of 420ns (typical).

The DGD2003 is offered in the SO-8 package and operates over an extended -40°C to +125°C temperature range.

### Applications

- Battery Power Tools and Appliances
- Light Electric Vehicles (LEV)
- Inverters



Typical Configuration

### **Features**

- Floating High-Side Driver in Bootstrap Operation to 200V •
- Drives Two N-Channel MOSFETs in a Half-Bridge Configuration
- 290mA Source/600mA Sink Output Current Capability
- Outputs Tolerant to Negative Transients
- Internal Dead Time of 420ns to Protect MOSFETs
- Wide Low Side Gate Driver Supply Voltage: 10V to 20V
- Logic Input (HIN and LIN\*) 3.3V Capability
- Schmitt Triggered Logic Inputs
- Undervoltage Lockout for High-Side and Low-Side Drivers
- 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: SO-8 (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 Plated Leads. Solderable per MIL-STD-202, Method 208 @3
  - Weight: 0.075 grams (Approximate)

SO-8



Top View

### Ordering Information (Note 4)

	Part Number	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel	
C	)GD2003S8-13	DGD2003	13	12	2,500	
Notes:	Notes: 1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.					

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/.

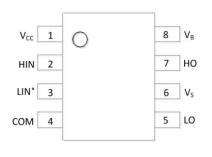
### Marking Information



 $\gamma$ !! = Manufacturer's Marking DGD2003 = Product Type Marking Code YY = Year (ex: 19 = 2019)WW = Week (01 to 53)



## **Pin Diagrams**

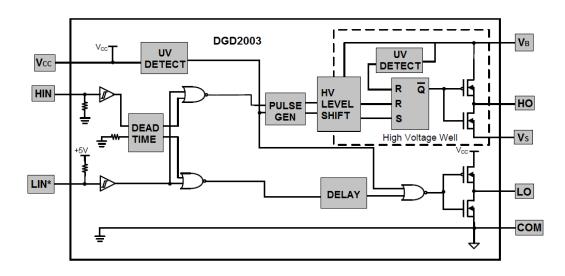




# **Pin Descriptions**

Pin Number	Pin Name	Function
1	V <sub>CC</sub>	Logic and Low Side Supply
2	HIN	Logic Input for High-Side Gate Driver Output in Phase with HO
3	LIN*	Logic Input for Low-Side Gate Driver Output out of Phase with LO
4	COM	Low-Side and Logic Return
5	LO	Low-Side Gate Drive Output
6	Vs	High-Side Floating Supply Return
7	HO	High-Side Gate Drive Output
8	VB	High-Side Floating Supply

# **Functional Block Diagram**





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

Characteristic	Symbol	Value	Unit
High-Side Floating Supply Voltage	VB	-0.3 to +224	V
High-Side Floating Supply Offset Voltage	Vs	V <sub>B</sub> -24 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
Low-Side Fixed Supply Voltage	V <sub>CC</sub>	-0.3 to +24	V
Low-Side Output Voltage	V <sub>LO</sub>	-0.3 to V <sub>CC</sub> +0.3	V
Logic Input Voltage (HIN and LIN*)	V <sub>IN</sub>	-0.3 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)	PD	0.625	W
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>0JA</sub>	200	°C/W
Operating Temperature	TJ	+150	
Lead Temperature (Soldering, 10s)	TL	+300	°C
Storage Temperature Range	T <sub>STG</sub>	-55 to +150	

# **Recommended Operating Conditions**

Parameter	Symbol	Min	Мах	Unit
High Side Floating Supply Absolute Voltage	VB	V <sub>S</sub> + 10	V <sub>S</sub> + 20	V
High Side Floating Supply Offset Voltage	Vs	(Note 6)	200	V
High Side Floating Output Voltage	V <sub>HO</sub>	Vs	VB	V
Low Side Supply Voltage	V <sub>CC</sub>	10	20	V
Low Side Output Voltage	V <sub>LO</sub>	0	V <sub>CC</sub>	V
Logic Input Voltage (HIN and LIN*)	V <sub>IN</sub>	0	5	V
Ambient Temperature	T <sub>A</sub>	-40	+125	°C

Notes: 5. When mounted on a standard JEDEC 2-layer FR-4 board.

6. Logic operation for  $V_{\mbox{S}}$  of -5V to +200V.



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

Parameter	Symbol	Min	Тур	Max	Unit	Conditions
Logic "1" (HIN) and Logic "0" (LIN*) Input Voltage	V <sub>IH</sub>	2.5	-	-	V	$V_{CC} = 10V$ to 20V
Logic "0" (HIN) and Logic "1" (LIN*) Input Voltage	VIL	-	-	0.8	V	$V_{CC} = 10V$ to 20V
High Level Output Voltage, V <sub>BIAS</sub> - V <sub>O</sub>	V <sub>OH</sub>	-	0.05	0.2	V	$I_0 = 2mA$
Low Level Output Voltage, V <sub>O</sub>	V <sub>OL</sub>	-	0.02	0.1	V	$I_0 = 2mA$
Offset Supply Leakage Current	I <sub>LK</sub>	-	-	50	μΑ	$V_{B} = V_{S} = 200V$
Quiescent V <sub>BS</sub> Supply Current	I <sub>BSQ</sub>	-	60	100	μA	$V_{IN} = 0V \text{ or } 5V$
Quiescent V <sub>CC</sub> Supply Current	Iccq	-	350	500	μΑ	$V_{IN} = 0V \text{ or } 5V$
Logic "1" Input Bias Current	I <sub>IN+</sub>	-	3	10	μΑ	$HIN = 5V, LIN^* = 0V$
Logic "0" Input Bias Current	I <sub>IN-</sub>	-	-	5	μA	$HIN = 0V, LIN^* = 5V$
V <sub>CC</sub> Supply Undervoltage Positive Going Threshold	V <sub>CCUV+</sub>	8.0	8.9	9.8	V	-
V <sub>CC</sub> Supply Undervoltage Negative Going Threshold	V <sub>CCUV-</sub>	7.4	8.2	9.0	V	-
V <sub>BS</sub> Supply Undervoltage Positive Going Threshold	V <sub>BSUV+</sub>	4.5	5.5	6.5	V	-
V <sub>BS</sub> Supply Undervoltage Negative Going Threshold	V <sub>BSUV-</sub>	4.2	5.2	6.2	V	-
Output High Short Circuit Pulsed Current	I <sub>O+</sub>	130	290	-	mA	V <sub>O</sub> = 0V, PW ≤ 10µs
Output Low Short Circuit Pulsed Current	I <sub>O-</sub>	270	600	-	mA	V <sub>O</sub> = 15V, PW ≤ 10µs

 Note:
 7. The V<sub>IN</sub> and I<sub>IN</sub> parameters are applicable to the two logic pins: HIN and LIN\*. The V<sub>O</sub> and I<sub>O</sub> parameters are applicable to the respective output pins: HO and LO.

### **AC Electrical Characteristics** (V<sub>BIAS</sub> (V<sub>CC</sub>, V<sub>BS</sub>) = 15V, C<sub>L</sub> = 1000pF, @T<sub>A</sub> = +25°C, unless otherwise specified.)

Parameter	Symbol	Min	Тур	Max	Unit	Conditions
Turn-On Propagation Delay	ton	-	680	820	ns	$V_{\rm S} = 0V$
Turn-Off Propagation Delay	toff	-	150	220	ns	V <sub>S</sub> = 200V
Delay Matching, HO and LO Turn-On/Turn-Off	t <sub>DM</sub>	-	-	60	ns	-
Turn-On Rise Time	t <sub>R</sub>	-	70	170	ns	$V_{\rm S} = 0V$
Turn-Off Fall Time	t <sub>F</sub>	-	35	90	ns	$V_{\rm S} = 0V$
Deadtime: t <sub>DT LO-HO</sub> and t <sub>DT HO-LO</sub>	tот	300	420	650	ns	-



## **Timing Waveforms**

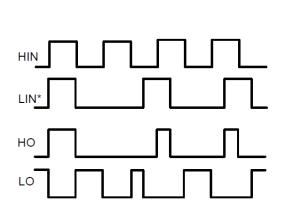
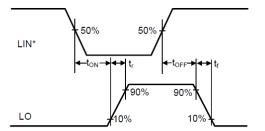


Figure 1. Input / Output Timing Diagram



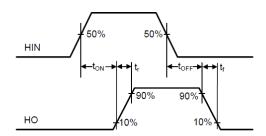


Figure 2. Switching Time Waveform Definitions

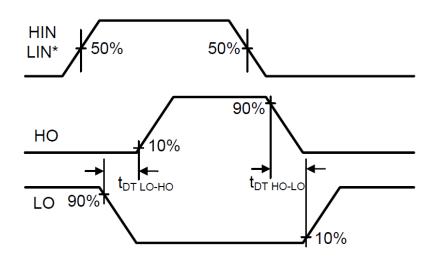


Figure 3. Deadtime Waveform Definitions



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

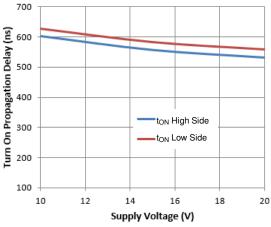


Figure 4. Turn-on Propagation Delay vs. Supply Voltage

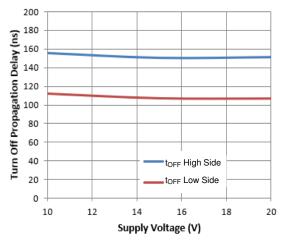


Figure 6. Turn-off Propagation Delay vs. Supply Voltage

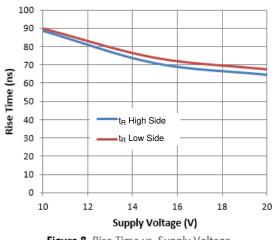


Figure 8. Rise Time vs. Supply Voltage

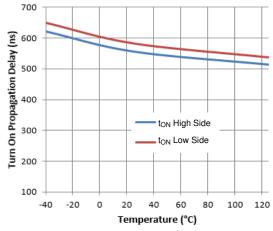


Figure 5. Turn-on Propagation Delay vs. Temperature

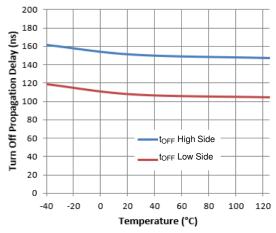


Figure 7. Turn-off Propagation Delay vs. Temperature

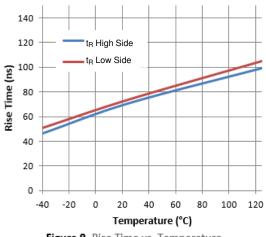
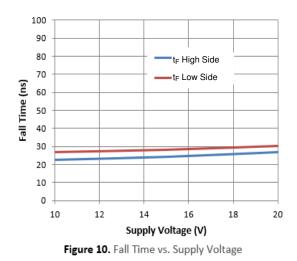
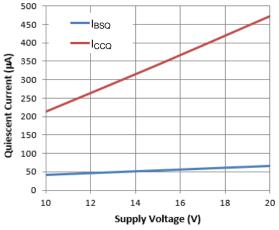


Figure 9. Rise Time vs. Temperature

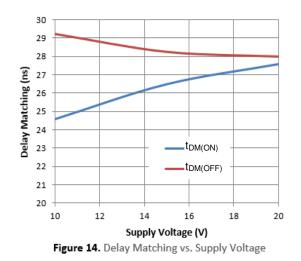


## Typical Performance Characteristics (Continued)









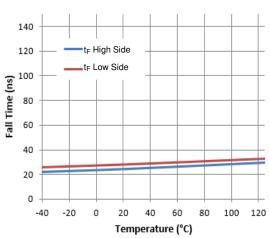
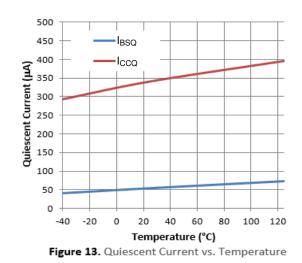


Figure 11. Fall Time vs. Temperature



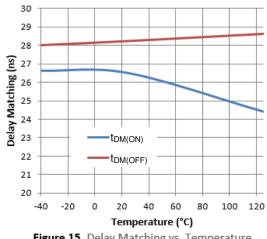


Figure 15. Delay Matching vs. Temperature



### Typical Performance Characteristics (Continued)

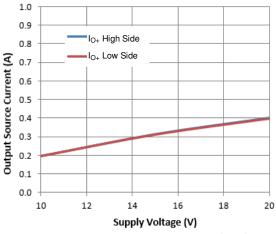


Figure 16. Output Source Current vs. Supply Voltage

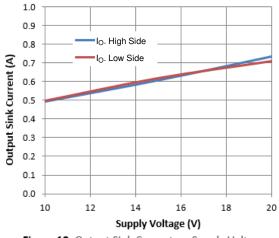


Figure 18. Output Sink Current vs. Supply Voltage

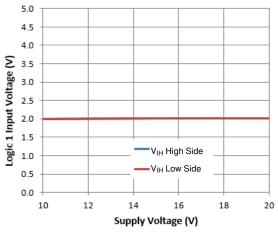


Figure 20. Logic 1 Input Voltage vs. Supply Voltage

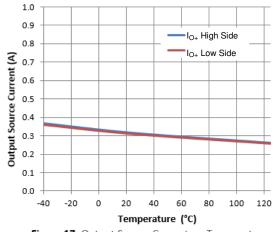
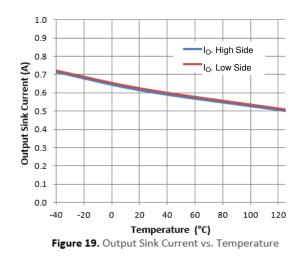


Figure 17. Output Source Current vs. Temperature



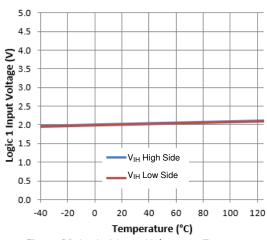


Figure 21. Logic 1 Input Voltage vs. Temperature



## Typical Performance Characteristics (Continued)

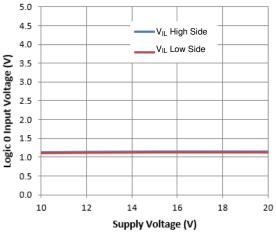


Figure 22. Logic 0 Input Voltage vs. Supply Voltage

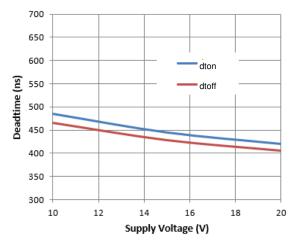


Figure 24. Deadtime vs. Supply Voltage

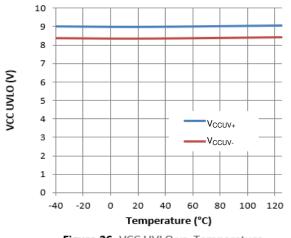


Figure 26. VCC UVLO vs. Temperature

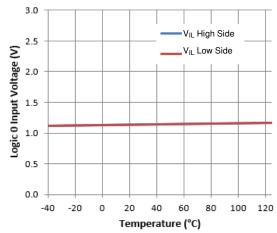


Figure 23. Logic 0 Input Voltage vs. Temperature

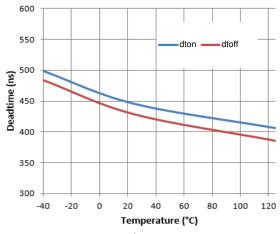


Figure 25. Deadtime vs. Temperature

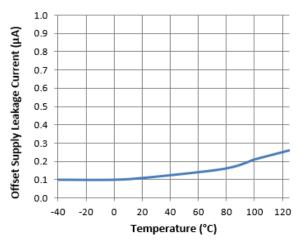
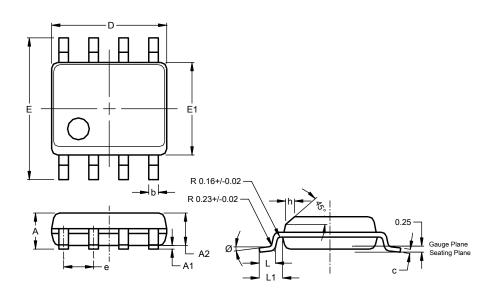


Figure 27. Offset Supply Leakage Current vs. Temperature



### **Package Outline Dimensions**

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



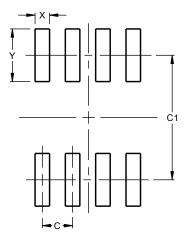
SO-8 (Type TH)						
Dim	Min	Max	Тур			
Α	1.35	1.75				
A1	0.10	0.25				
A2			1.45			
b	0.35	0.51				
c	0.190	0.248				
D	4.80	5.00	4.90			
Е	5.80	6.20	6.00			
E1	3.80	4.00	3.90			
e			1.27			
h	0.25	0.50				
L	0.41	1.27				
L1			1.04			
Ø	0°	8°				
All [	All Dimensions in mm					

### **Suggested Pad Layout**

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

SO-8 (Type TH)

SO-8 (Type TH)



Dimensions	Value (in mm)
С	1.27
C1	5.20
Х	0.60
Y	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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