

Description

The ZXGD3006E6Q is a 40V Gate Driver for switching IGBTs and SiC MOSFETs. It can transfer up to 10A peak source/sink current into the gate for effective charging and discharging of a large capacitive load.

The ZXGD3006E6Q can drive typically 4A into the low gate impedance of an IGBT, with just 1mA input from a controller. Also, the turn-on and turn-off switching behavior of the IGBT can be individually tailored to suit an application. In particular, by defining the switching characteristics appropriately, EMI and cross conduction can be reduced.

Applications

Gate driving IGBTs and SiC MOSFETs in:

- DC-DC Converters in Electric Cars
- Automotive Active Suspension Systems
- Solar Inverters
- Power Supplies
- Plasma Display Panel Power Modules

Features

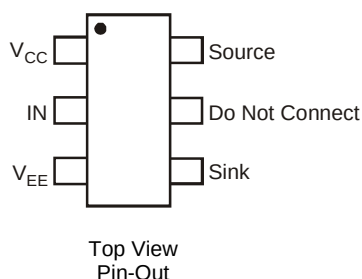
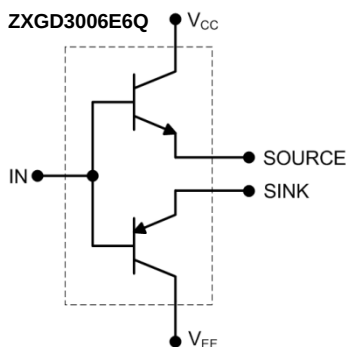
- High-Gain Buffer with Typically 4A Output from 1mA Input
- 40V Supply for +20V to -18V gate driving to prevent dV/dt induced false triggering
- Emitter-Follower that is Rugged to Latch-Up / Shoot-Through Issues, and Delivers <10ns Propagation Delay Time
- Optimized Pin-Out to Simplify PCB Layout and Reduce Parasitic Trace Inductances
- Near-Zero Quiescent Supply Current
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **PPAP Capable (Note 4)**

Mechanical Data

- Case: SOT26
- Case Material: Molded Plastic. "Green" Molding Compound. UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 
- Weight: 0.018 grams (Approximate)



Top View



Top View
Pin-Out

Pin Name	Pin Function
VCC	Supply Voltage High
IN	Driver Input Pin
VEE	Supply Voltage Low
SOURCE	Source Current Output *
SINK	Sink Current Output *

* Typically connect SOURCE & SINK together

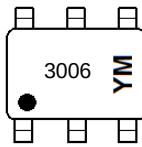
Ordering Information (Note 5)

Product	Compliance	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
ZXGD3006E6QTA	Automotive	3006	7	8	3,000

- 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 http://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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to <https://www.diodes.com/quality/>.
 5. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information

SOT26



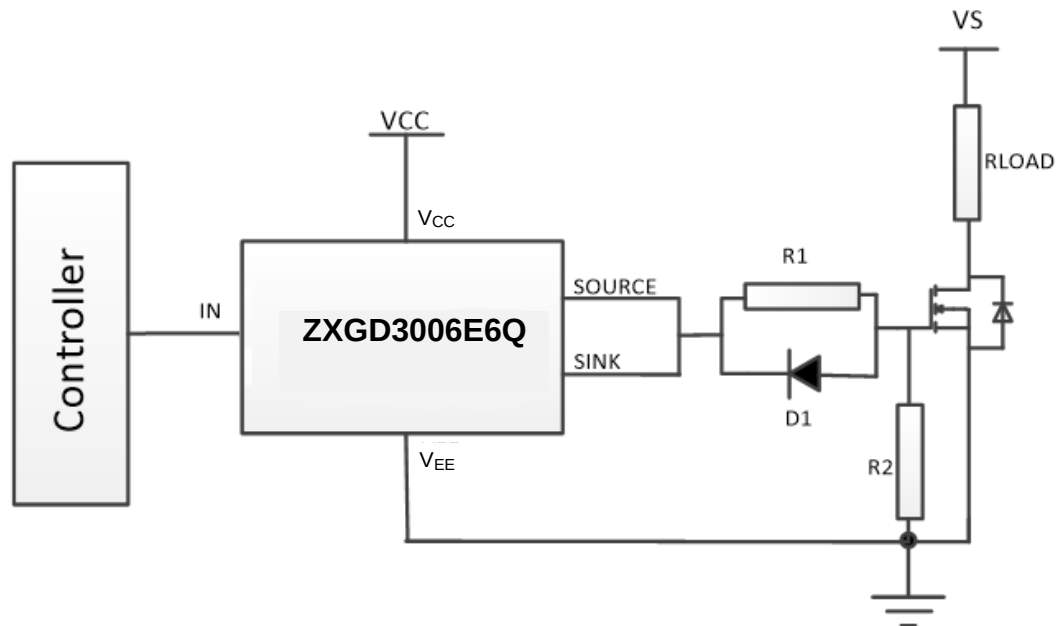
3006 = Product Type Marking Code
YM = Date Code Marking
Y or $\bar{Y}$ = Year (ex: F = 2018)
M or $\bar{M}$ = Month (ex: 9 = September)

Date Code Key

Year	2018	2019	2020	2021	2022	2022	2023	2024	2025	2026	2027
Code	F	G	H	I	J	K	L	M	N	O	P

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Code	1	2	3	4	5	6	7	8	9	O	N	D

Typical Application Circuit



R1, D1 combination can be used for variable turn on and turn off times.

Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Supply Voltage, with Respect to V _{EE}	V _{CC}	40	V
Input Voltage, with Respect to V _{EE}	V _{IN}	40	V
Output Difference Voltage (Source – Sink)	ΔV _(source-sink)	±7	V
Peak Pulsed Output Current (Source – Sink)	I _{OM}	±10	A
Peak Pulsed Input Current	I _{IN}	±100	mA

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Power Dissipation (Notes 6 & 7)	P _D	1.1	W
Linear Derating Factor		8.8	mW/°C
Thermal Resistance, Junction to Ambient (Notes 6 & 7)	R _{θJA}	113	°C/W
Thermal Resistance, Junction to Lead (Note 8)	R _{θJL}	105	
Operating and Storage Temperature Range	T _J , T _{STG}	-55 to +150	°C

ESD Ratings (Note 9)

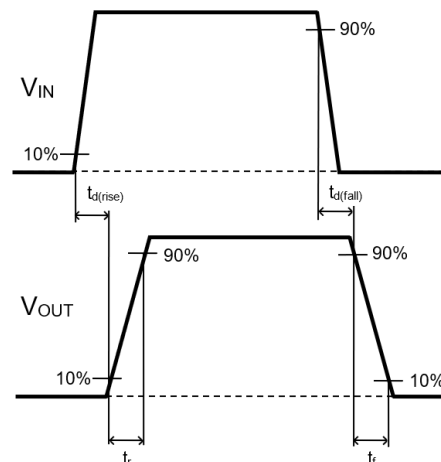
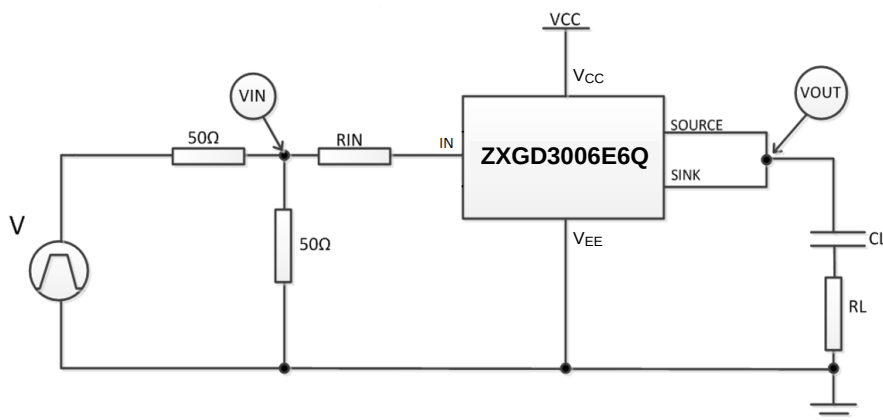
Characteristic	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge - Human Body Model	ESD HBM	1,500	V	1C
Electrostatic Discharge – Charged Device Model	ESD CDM	1,000	V	IV

- Notes:
6. For a device mounted on 25mm x 25mm 1oz copper that is on a single-sided 1.6mm FR-4 PCB; device is measured under still air conditions whilst operating in a steady-state. The heatsink is split in half with the pin 1 (V_{CC}) and pin 3 (V_{EE}) connected separately to each half.
 7. For device with two active die running at equal power.
 8. Thermal resistance from junction to solder-point at the end of each lead on pin 1 (V_{CC}) and pin 3 (V_{EE}).
 9. Refer to JEDEC specification JESD22-A114 and JESD22-C101.

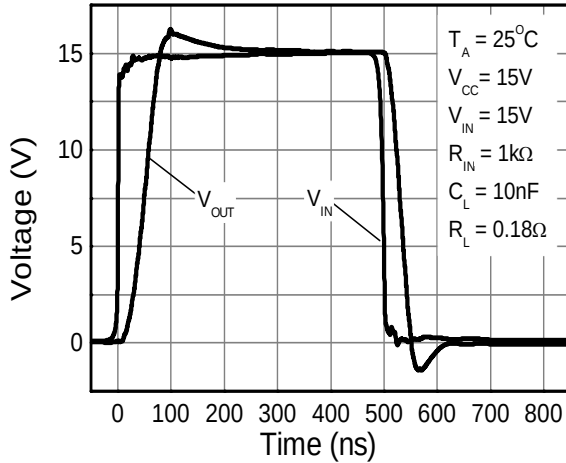
Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition	
Output Voltage, High	V _{OUT(hi)}	V _{CC} - 1.0	V _{CC} - 0.8	—	V	V _{IN} = V _{CC}	C _L = 1nF
Output Voltage, Low	V _{OUT(low)}	—	V _{EE} + 0.12	V _{EE} + 0.3		V _{IN} = V _{EE}	
Supply Breakdown Voltage	BV _{CC}	40	—	—	V	I _Q = 100μA, V _{IN} = V _{CC}	
		40	—	—		I _Q = 100μA, V _{IN} = V _{EE} = 0V	
Quiescent Supply Current	I _Q	—	—	50	nA	V _{CC} = 30V, V _{IN} = V _{CC}	
		—	—	50		V _{CC} = 30V, V _{IN} = V _{EE} = 0V	
Peak Pulsed Source Current	I _{(source)M}	—	4.0	—	A	V _{CC} = 5V, I _{IN} = 1mA, V _{OUT} = 0V	
Peak Pulsed Sink Current	I _{(sink)M}	—	3.8	—		V _{CC} = 5V, I _{IN} = -1mA, V _{OUT} = 5V	
Source Current with Varying Input Resistances	I _{SOURCE}	—	6.4	—	A	R _{IN} = 200Ω	V _{CC} = 15V, V _{EE} = 0V V _{IN} = 15V C _L = 100nF, R _L = 0.18Ω
			5.5			R _{IN} = 1kΩ	
			3.9			R _{IN} = 10kΩ	
			2.2			R _{IN} = 100kΩ	
			0.44			R _{IN} = 1000kΩ	
Sink Current with Varying Input Resistances	I _{SINK}	—	7.7	—	A	R _{IN} = 200Ω	V _{CC} = 15V, V _{EE} = 0V V _{IN} = 15V C _L = 100nF, R _L = 0.18Ω
			6.5			R _{IN} = 1kΩ	
			4.4			R _{IN} = 10kΩ	
			2.3			R _{IN} = 100kΩ	
			0.46			R _{IN} = 1000kΩ	
Switching Times with Low Load Capacitance C _L = 10nF	t _{d(rise)}	—	8	—	ns	V _{CC} = 15V, V _{EE} = 0V	
	t _r		48			V _{IN} = 0 to 15V	
	t _{d(fall)}		16			R _{IN} = 1kΩ	
	t _f		35			C _L = 10nF, R _L = 0.18Ω	
Switching Times with High Load Capacitance C _L = 100nF	t _{d(rise)}	—	46	—	ns	V _{CC} = 15V, V _{EE} = 0V	
	t _r		419			V _{IN} = 0 to 15V	
	t _{d(fall)}		47			R _{IN} = 1kΩ	
	t _f		467			C _L = 100nF, R _L = 0.18Ω	
Switching Times with Asymmetric Source and Sink Resistors	t _{d(rise)}	—	27	—	ns	V _{CC} = 20V, V _{EE} = -18V	
	t _r		208			V _{IN} = -18V to 20V	
	t _{d(fall)}		11			R _{IN} = 1kΩ	
	t _f		53			C _L = 10nF, R _L = 0.18Ω	
	R _{SOURCE} = 4.7Ω, R _{SINK} = 0Ω (See page 7).						

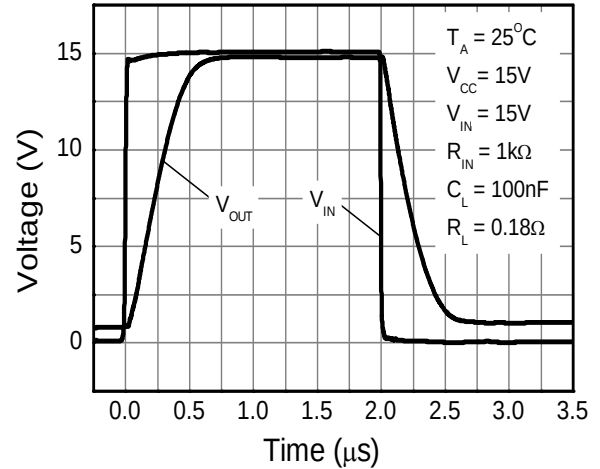
Switching Test Circuit and Timing Diagram



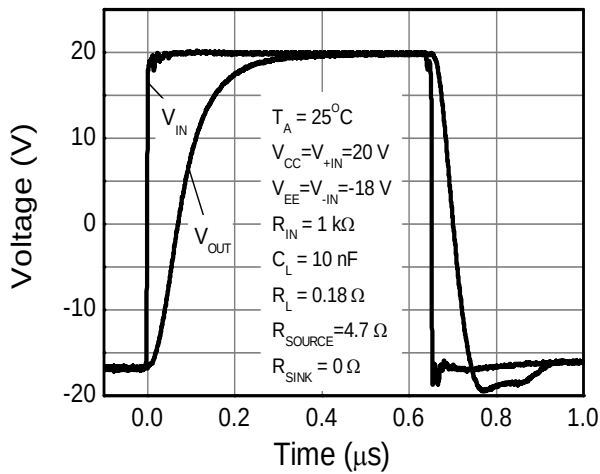
Typical Switching Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)



Switching Speed

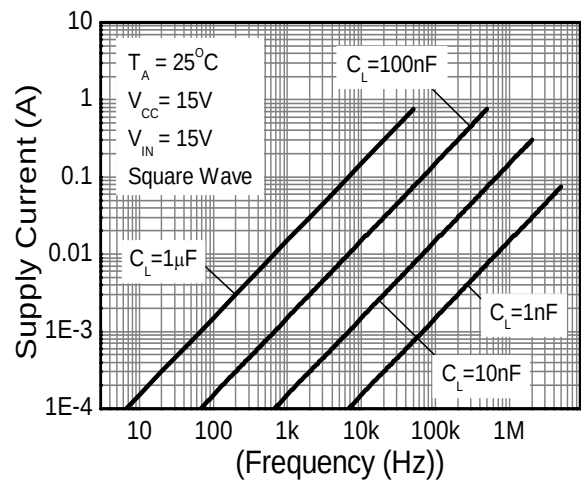


Switching Speed



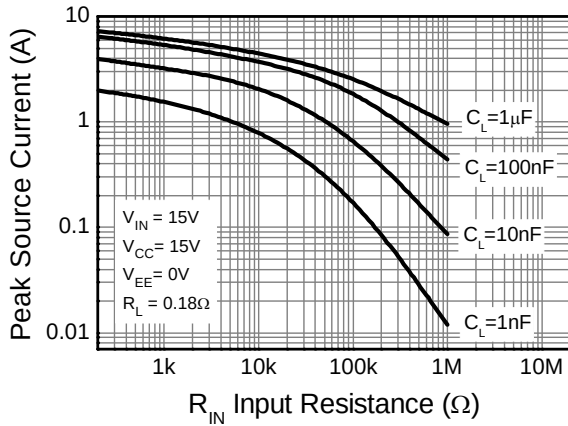
Switching Speed

Asymmetric Source and Sink Resistance

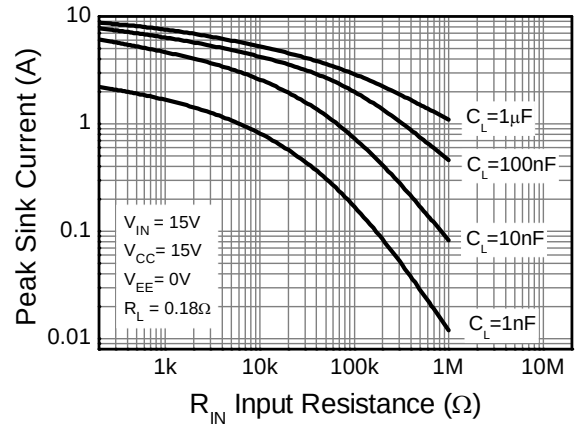


Supply Current

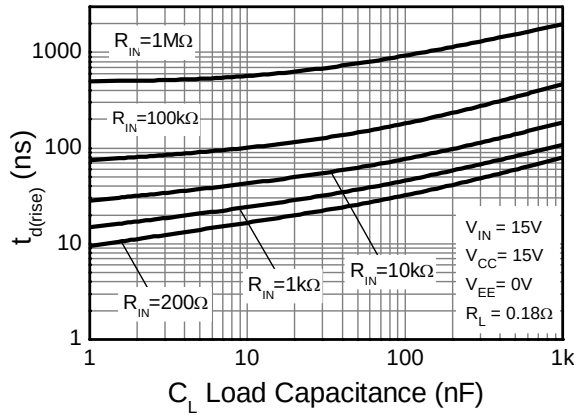
Typical Switching Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)



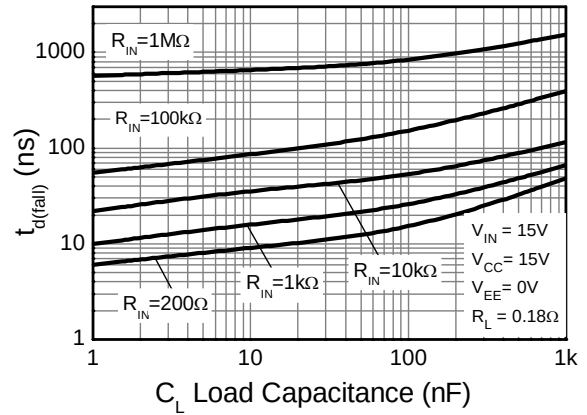
Source Current vs. Input Resistance



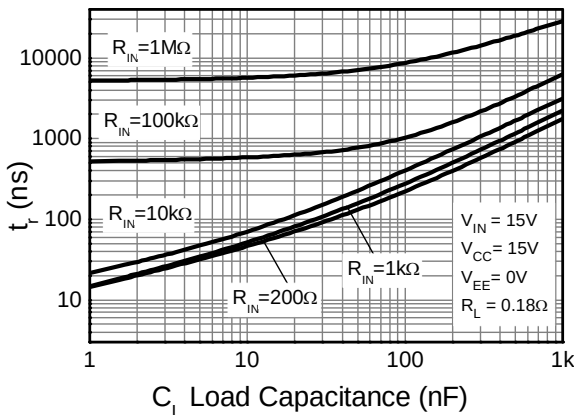
Sink Current vs. Input Resistance



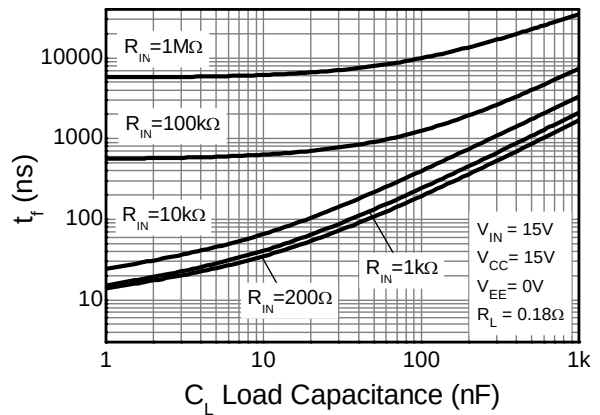
Turn-On Delay Time



Turn-Off Delay Time



Turn-On Rise Time

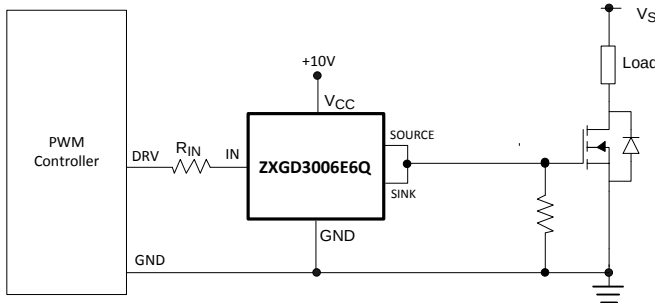


Turn-Off Fall Time

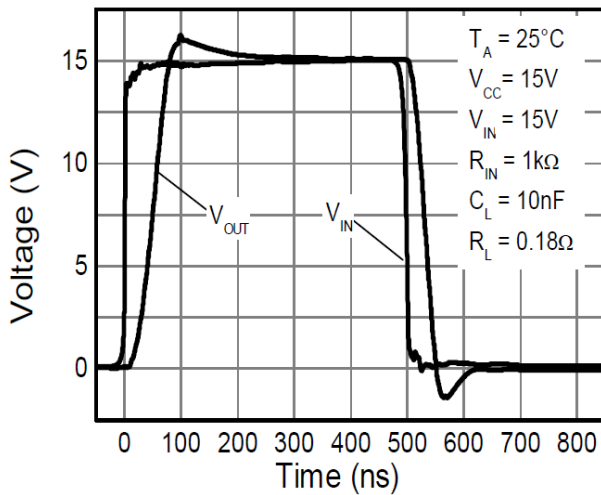
Circuit Examples

ZXGD3006E6Q Driving a MOSFET

Application example of the ZXGD3006E6Q driving the gate of a MOSFET from 0 to +15V.



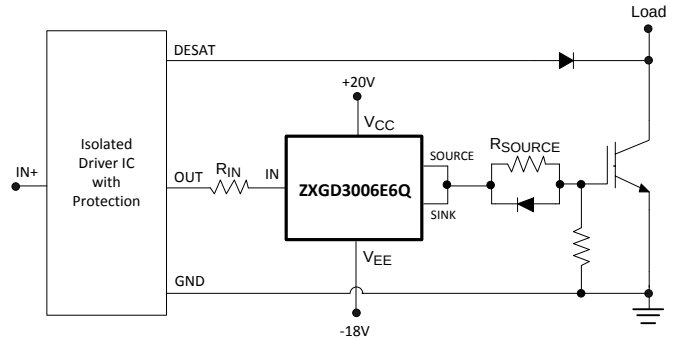
Switching Time Characteristic



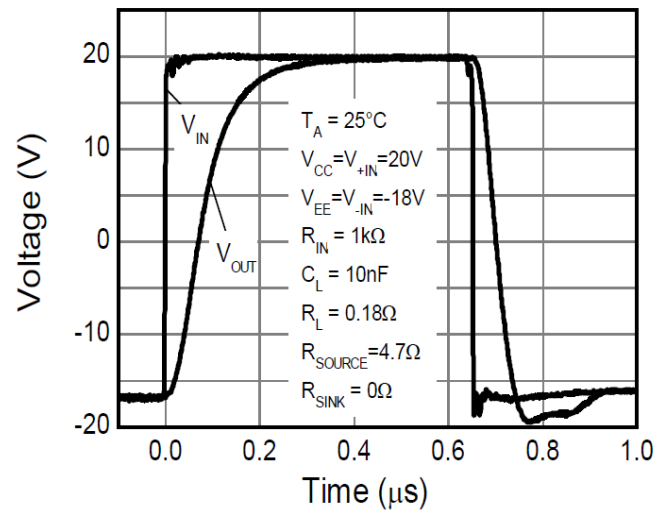
Symmetric Source and Sink Resistors

ZXGD3006E6Q Driving an IGBT

Application example of ZXGD3006E6Q driving the gate of an IGBT with independent t_{ON} and t_{OFF} using asymmetric R_{SOURCE} and R_{SINK} . In addition, the gate is driven negative to -18V to prevent dV/dt induced false triggering.



Switching Time Characteristic

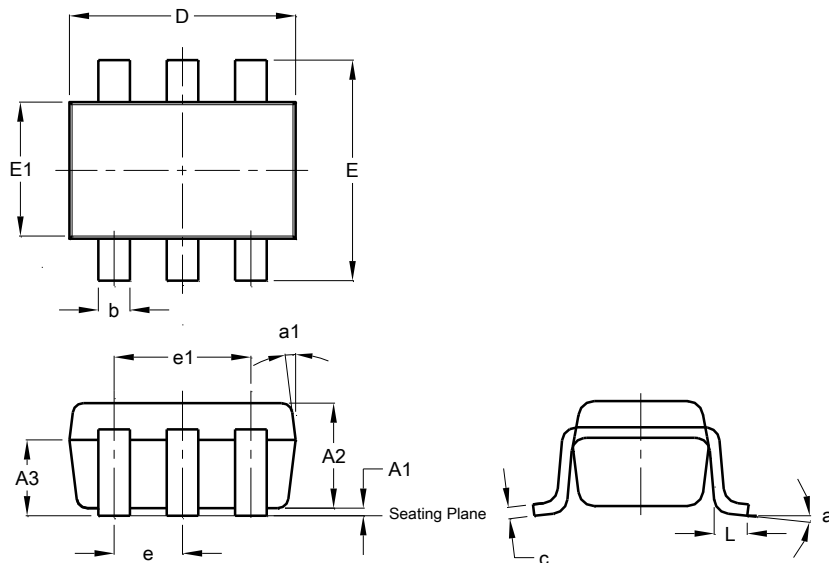


Asymmetric Source and Sink Resistors

Package Outline Dimensions

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

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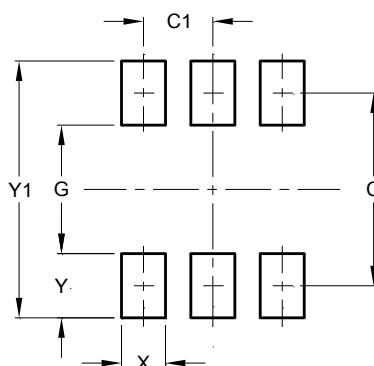


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Dim	Min	Max	Typ
A1	0.013	0.10	0.05
A2	1.00	1.30	1.10
A3	0.70	0.80	0.75
b	0.35	0.50	0.38
c	0.10	0.20	0.15
D	2.90	3.10	3.00
e	-	-	0.95
e1	-	-	1.90
E	2.70	3.00	2.80
E1	1.50	1.70	1.60
L	0.35	0.55	0.40
a	-	-	8°
a1	-	-	7°
All Dimensions in mm			

Suggested Pad Layout

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

SOT26



Dimensions	Value (in mm)
C	2.40
C1	0.95
G	1.60
X	0.55
Y	0.80
Y1	3.20

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