

## Description

ZXGD3006E6 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 ZXGD3006E6 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 problems can be reduced.

## Applications

Gate driving IGBTs and SiC MOSFETs in:

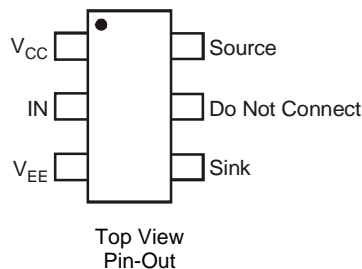
- Solar inverters
- Power supplies
- Plasma display panel power modules
- DC-DC converters in electric cars

## 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
- Separate source and sink outputs for independent control of IGBT turn-on and turn-off times
- 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)



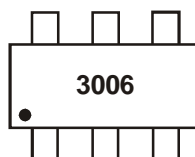
Pin Name	Pin Function
V <sub>CC</sub>	Supply voltage high
IN	Driver input pin
V <sub>EE</sub>	Supply voltage low
SOURCE	Source current output
SINK	Sink current output

## Ordering Information (Notes 4 & 5)

Product	Compliance	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXGD3006E6TA	AEC-Q101	3006	7	8	3000
ZXGD3006E6QTA	Automotive	3006	7	8	3000

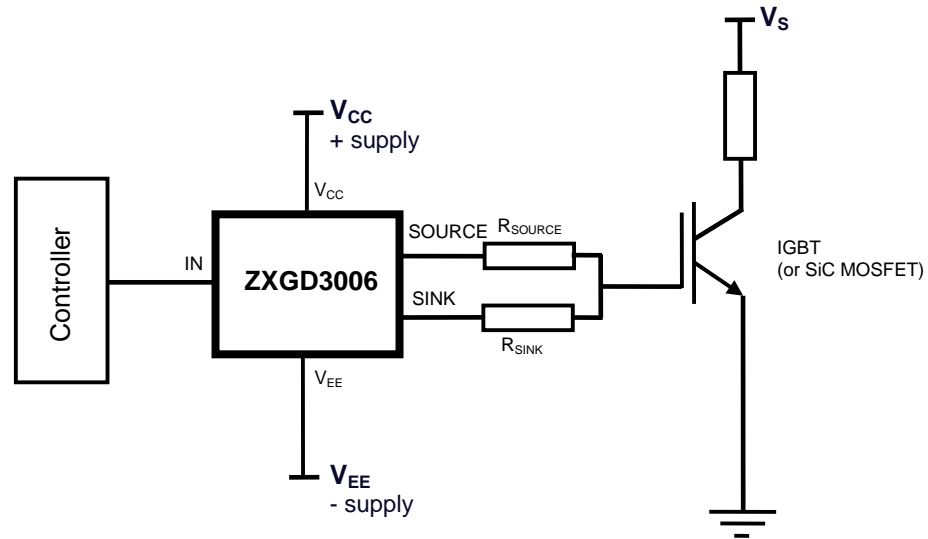
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See <http://www.diodes.com> for more information about Diodes Incorporated's definitions of Halogen and Antimony free, "Green" and Lead-Free.
  3. Halogen and Antimony free "Green" products 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. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified.
  5. For packaging details, go to our website at <http://www.diodes.com>

## Marking Information



3006 = Product Type Marking Code

## Typical Application Circuit



## Maximum Ratings (@ $T_A = +25^\circ\text{C}$ , 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)	$\Delta V_{(\text{source-sink})}$	$\pm 7.5$	V
Peak output current	$I_{PK}$	$\pm 10$	A
Input current	$I_{IN}$	$\pm 100$	mA

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

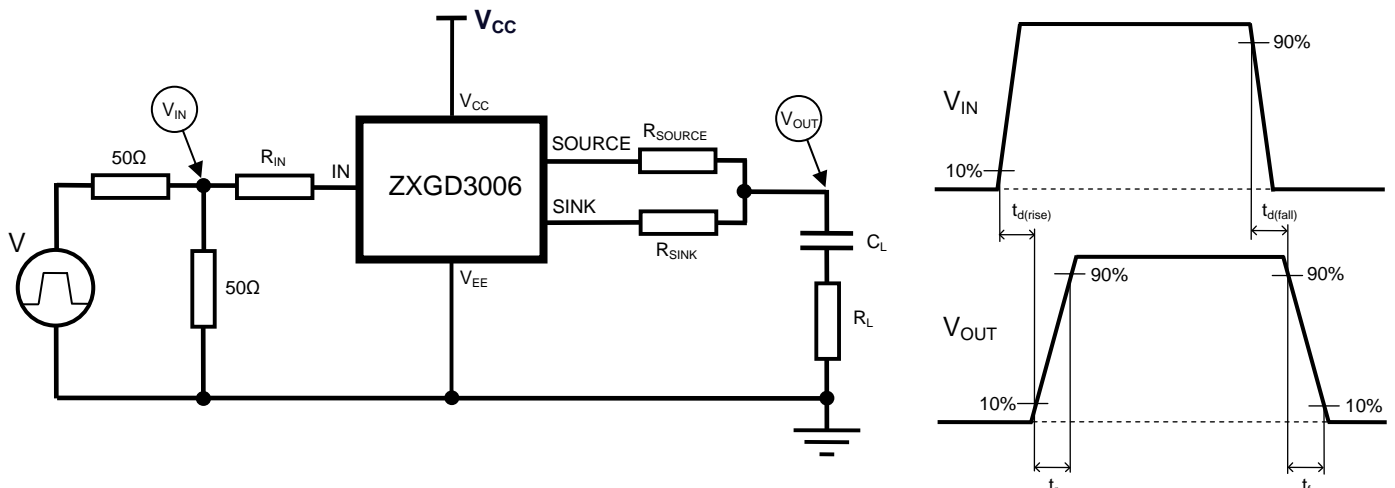
Characteristic	Symbol	Value	Unit
Power Dissipation (Notes 6 & 7)	$P_D$	1.1	W
Linear derating factor		8.8	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Notes 6 & 7)	$R_{\theta JA}$	113	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Lead (Note 8)	$R_{\theta JL}$	105	
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

- Notes:
6. For a device surface mounted on 25mm x 25mm x 0.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition. 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 ( $V_{EE}$ ).

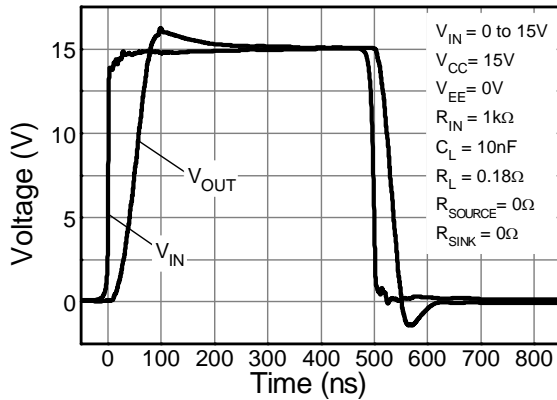
**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Output voltage, high	$V_{OUT(hi)}$	$V_{CC} - 1.0$	$V_{CC} - 0.8$	-	V	$V_{IN} = V_{CC}$ $C_L = 1\text{nF}$
Output voltage, low	$V_{OUT(low)}$	-	$V_{EE} + 0.12$	$V_{EE} + 0.3$		$V_{IN} = V_{EE}$ $R_{SOURCE} = 0\Omega, R_{SINK} = 0\Omega$
Supply breakdown voltage	$BV_{CC}$	40	-	-	V	$I_Q = 100\mu\text{A}, V_{IN} = V_{CC}$
		40	-	-		$I_Q = 100\mu\text{A}, V_{IN} = V_{EE} = 0\text{V}$
Quiescent supply current	$I_Q$	-	-	50	nA	$V_{CC} = 30\text{V}, V_{IN} = V_{CC}$
		-	-	50		$V_{CC} = 30\text{V}, V_{IN} = V_{EE} = 0\text{V}$
Source current	$I_{(source)}$	-	4.0	-	A	$V_{CC} = 5\text{V}, I_{IN} = 1\text{mA}, V_{OUT} = 0\text{V}$
Sink current	$I_{(sink)}$	-	3.8	-		$V_{CC} = 5\text{V}, I_{IN} = -1\text{mA}, V_{OUT} = 5\text{V}$
Source current with varying input resistances	$I_{(source)}$	-	6.4	-	A	$V_{CC} = 15\text{V}, V_{EE} = 0\text{V}$ $V_{IN} = 15\text{V}$ $C_L = 100\text{nF}, R_L = 0.18\Omega$ $R_{SOURCE} = 0\Omega, R_{SINK} = 0\Omega$
			5.5			
			3.9			
			2.2			
			0.44			
Sink current with varying input resistances	$I_{(sink)}$	-	7.7	-	A	$V_{CC} = 15\text{V}, V_{EE} = 0\text{V}$ $V_{IN} = 15\text{V}$ $C_L = 100\text{nF}, R_L = 0.18\Omega$ $R_{SOURCE} = 0\Omega, R_{SINK} = 0\Omega$
			6.5			
			4.4			
			2.3			
			0.46			
Switching times with low load capacitance $C_L = 10\text{nF}$	$t_{d(rise)}$ $t_r$ $t_{d(fall)}$ $t_f$	-	8	-	ns	$V_{CC} = 15\text{V}, V_{EE} = 0\text{V}$ $V_{IN} = 0 \text{ to } 15\text{V}$ $R_{IN} = 1\text{k}\Omega$ $C_L = 10\text{nF}, R_L = 0.18\Omega$ $R_{SOURCE} = 0\Omega, R_{SINK} = 0\Omega$
			48			
			16			
			35			
Switching times with high load capacitance $C_L = 100\text{nF}$	$t_{d(rise)}$ $t_r$ $t_{d(fall)}$ $t_f$	-	46	-	ns	$V_{CC} = 15\text{V}, V_{EE} = 0\text{V}$ $V_{IN} = 0 \text{ to } 15\text{V}$ $R_{IN} = 1\text{k}\Omega$ $C_L = 100\text{nF}, R_L = 0.18\Omega$ $R_{SOURCE} = 0\Omega, R_{SINK} = 0\Omega$
			419			
			47			
			467			
Switching times with asymmetric source and sink resistors	$t_{d(rise)}$ $t_r$ $t_{d(fall)}$ $t_f$	-	27	-	ns	$V_{CC} = 20\text{V}, V_{EE} = -18\text{V}$ $V_{IN} = -18 \text{ to } 20\text{V}$ $R_{IN} = 1\text{k}\Omega$ $C_L = 10\text{nF}, R_L = 0.18\Omega$ $R_{SOURCE} = 4.7\Omega, R_{SINK} = 0\Omega$
			208			
			11			
			53			

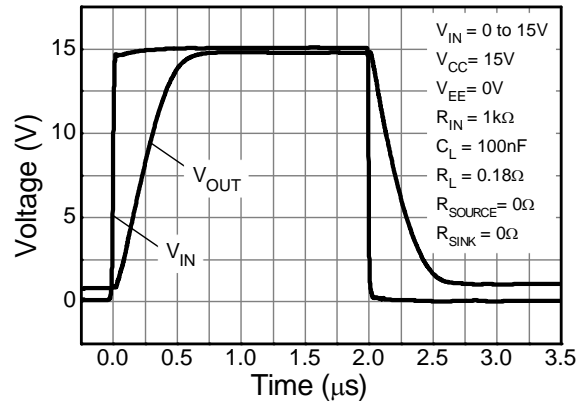
**Switching Test Circuit and Timing Diagram**



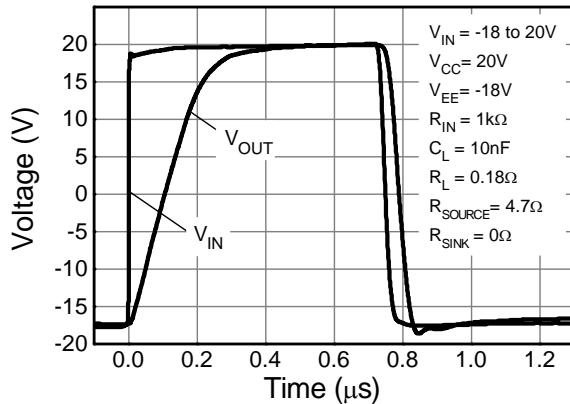
**Typical Switching Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)



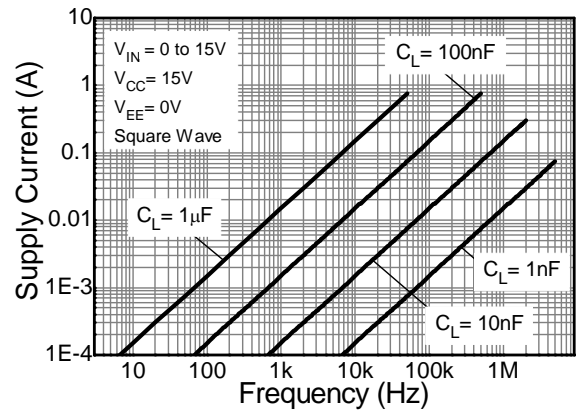
**Switching Speed**  
Low Load Capacitance  $C_L = 10\text{nF}$



**Switching Speed**  
High Load Capacitance  $C_L = 100\text{nF}$

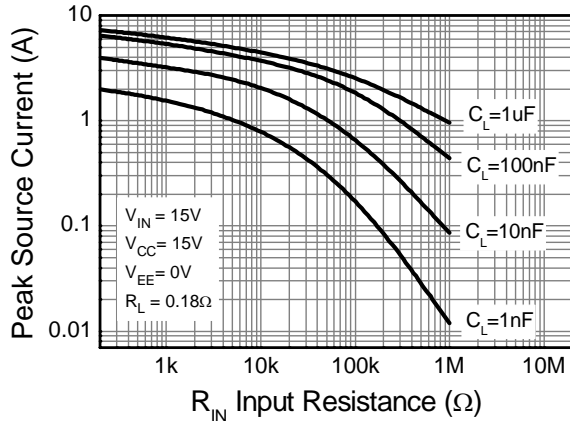


**Switching Speed**  
Asymmetric Source and Sink Resistors

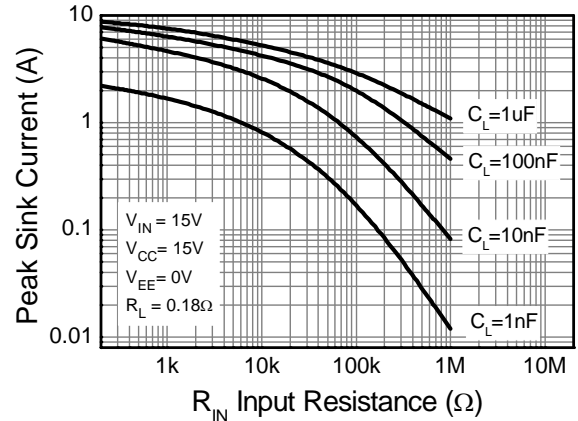


**Supply Current**

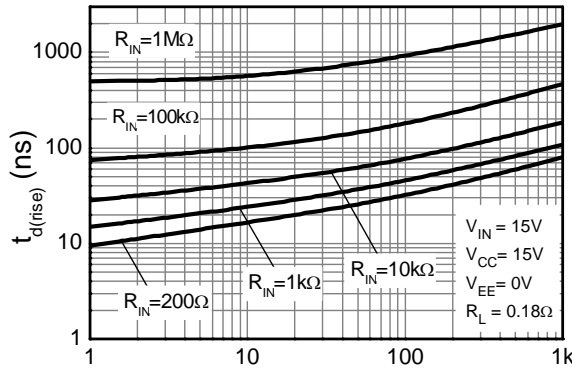
**Typical Switching Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



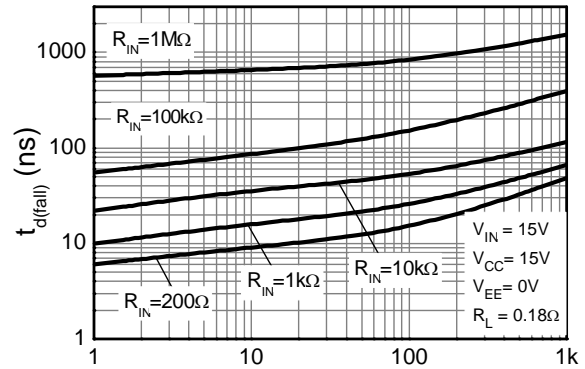
**Source Current vs. Input Resistance**



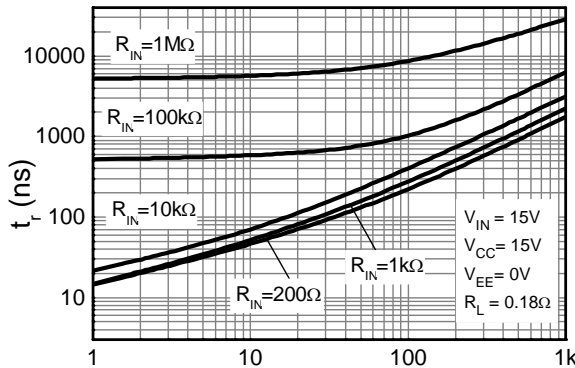
**Sink Current vs. Input Resistance**



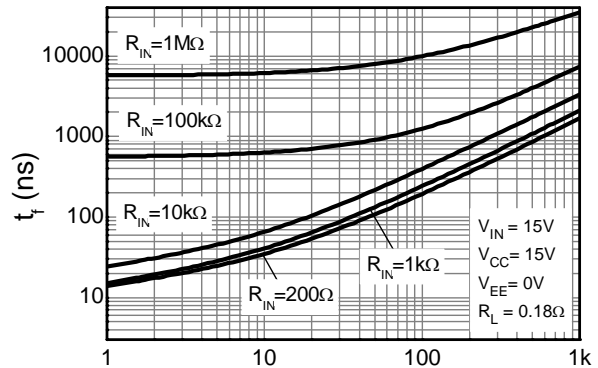
**Turn-On Delay Time**



**Turn-Off Delay Time**



**Turn-On Rise Time**

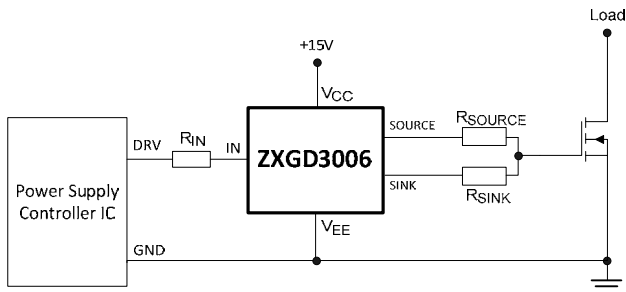


**Turn-Off Fall Time**

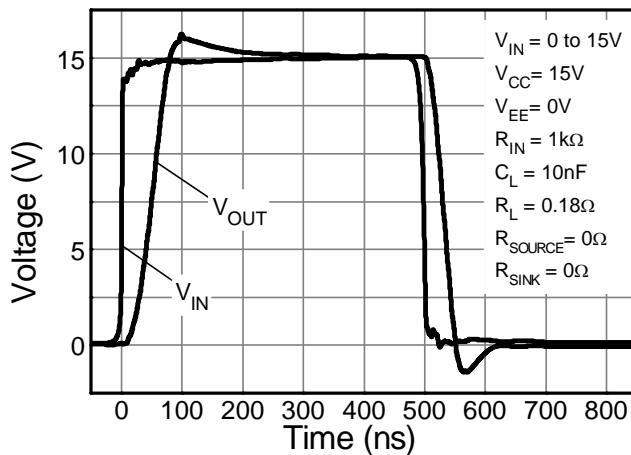
**Circuit Examples**

**ZXGD3006 driving a MOSFET**

Application example of the ZXGD3006 driving the gate of a MOSFET from 0 to +15V with  $R_{SOURCE} = R_{SINK} = 0\Omega$



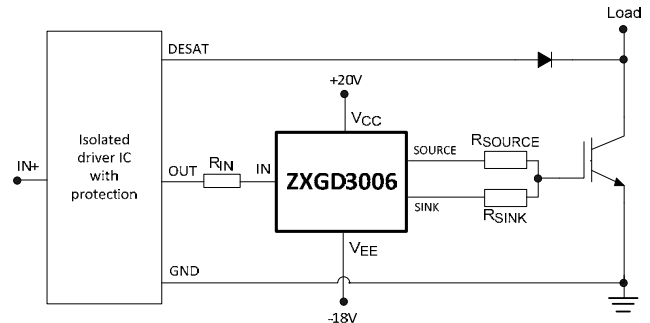
**Switching Time Characteristic**



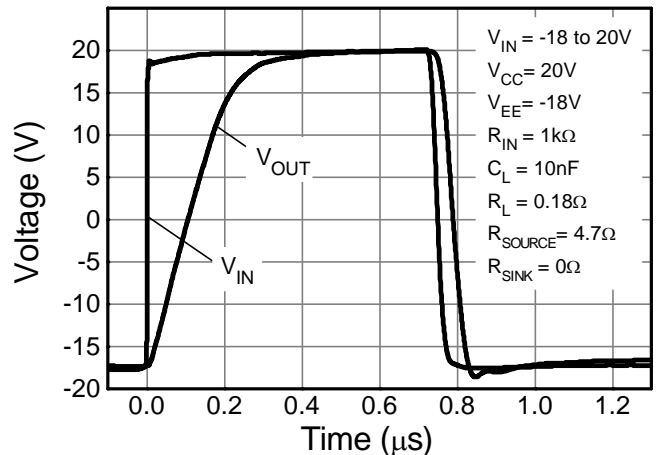
Symmetric Source and Sink Resistors

**ZXGD3006 driving an IGBT**

Application example of ZXGD3006 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.



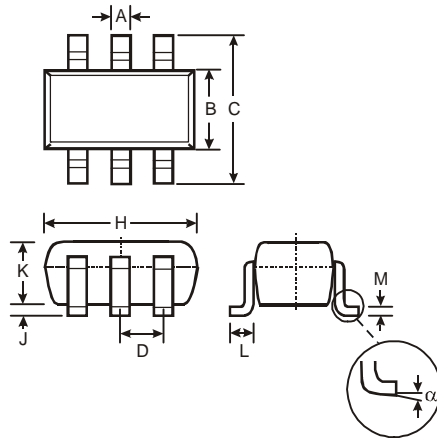
**Switching Time Characteristic**



Asymmetric Source and Sink Resistors

## Package Outline Dimensions

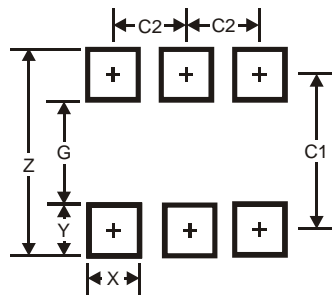
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



SOT26			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	—	—	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
α	0°	8°	—
<b>All Dimensions in mm</b>			

## Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



Dimensions	Value (in mm)
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А