ZXGD3005E6

25V 10A GATE DRIVER IN SOT26

Description and Applications

The ZXGD3005E6 is a high-speed non-inverting single gate driver capable of driving up to 10A into a MOSFET or IGBT gate capacitive load from supply voltages up to 25V. With propagation delay times down to <10ns and correspondingly rise/fall times of <20ns.

This gate driver ensures rapid switching of the MOSFET or IGBT to minimize power losses and distortion in high current switching applications. It is ideally suited to act as a voltage buffer between the typically high output impedances of a controller IC and the effectively low impedance on the gate of a power MOSFET or IGBT during switching. Its low input voltage requirement and high current gain allows high current driving from low voltage controller ICs.

The ZXGD3005E6 has separate source and sink outputs that enables the turn-on and turn-off times of the MOSFET or IGBT to be independently controlled. In addition, the wide supply voltage range allows full enhancement of the MOSFET or IGBT to minimize on-state losses and permits +15V to -5V gate drive voltage to prevent dV/dt induced false triggering of IGBTs. The ZXGD3005E6 has been designed to be inherently rugged to latch-up and shoot-through issues. The optimized pin-out SOT26 package eases board layout, enabling reduced parasitic inductance of traces.

Power MOSFET and IGBT Gate Driving in:

- Synchronous switch-mode power supplies
- Power Factor Correction (PFC) in power supplies
- Secondary side synchronous rectification
- Plasma Display Panel power modules
- 1, 2 and 3-phase motor control circuits
- Audio switching amplifier power output stages
- Solar inverters

Features and Benefits

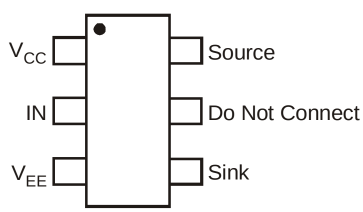
- Emitter-follower configuration for ultra-fast switching
  - <10ns propagation delay time
  - <20ns rise/fall time
- Non-inverting voltage buffer stage
- Wide supply voltage up to 25V to minimize on-losses
- 10A peak current drive into capacitive loads
- Low input current of 1mA to deliver 4A output current
- Separate source and sink outputs for independent control of rise and fall time
- Optimized pin-out to ease board layout and minimize parasitic inductance of traces
- Rugged design that avoids latch-up or shoot-through issues
- Near - Zero quiescent supply current
- **"Lead-Free", RoHS Compliant (Note 1)**
- **"Green" Devices (Note 2)**
- **Qualified to AEC-Q101 Standards for High Reliability**

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: Matte Tin Finish
- Weight: 0.018 grams (approximate)

SOT26

Top View



Top View
Pin-Out

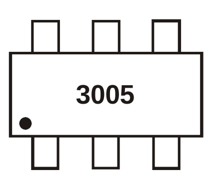
Pin Name	Pin Function
V_{CC}	Supply voltage high
IN	Driver input pin
V_{EE}	Supply voltage low
SOURCE	Source current output
SINK	Sink current output

Ordering Information (Note 3)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXGD3005E6TA	3005	7	8	3000

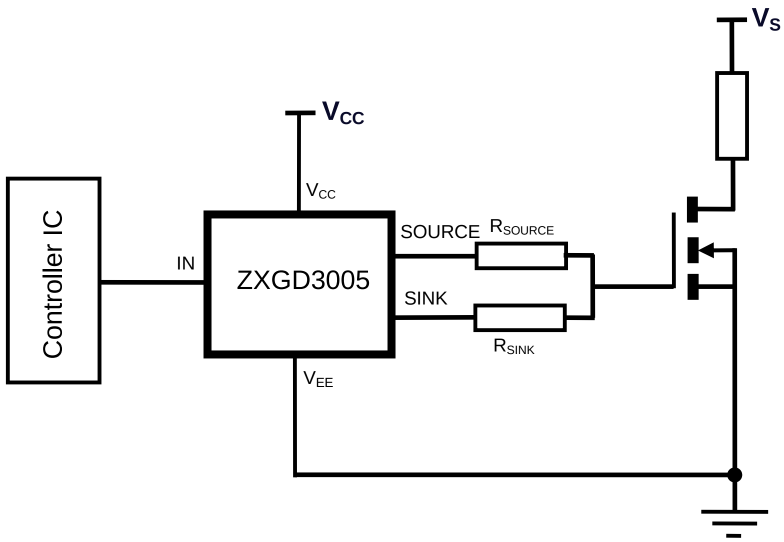
Notes: 1. No purposefully added lead
2. "Green" devices, Halogen and Antimony Free, Diodes Inc's "Green" Policy can be found on our website at http://www.diodes.com
3. For packaging details, go to our website at http://www.diodes.com

Marking Information



3005 = Product Type Marking Code

Typical Application Circuit



Maximum Ratings @T_A = 25°C unless otherwise specified

Characteristic	Symbol	Value	Unit
Supply voltage, with respect to V_{EE}	V_{CC}	25	V
Input voltage, with respect to V_{EE}	V_{IN}	25	V
Output difference voltage (Source – Sink)	$\Delta V_{(source-sink)}$	±7.5	V
Peak output current	I_{PK}	±10	A
Input current	I_{IN}	±100	mA

Thermal Characteristics @T_A = 25°C unless otherwise specified

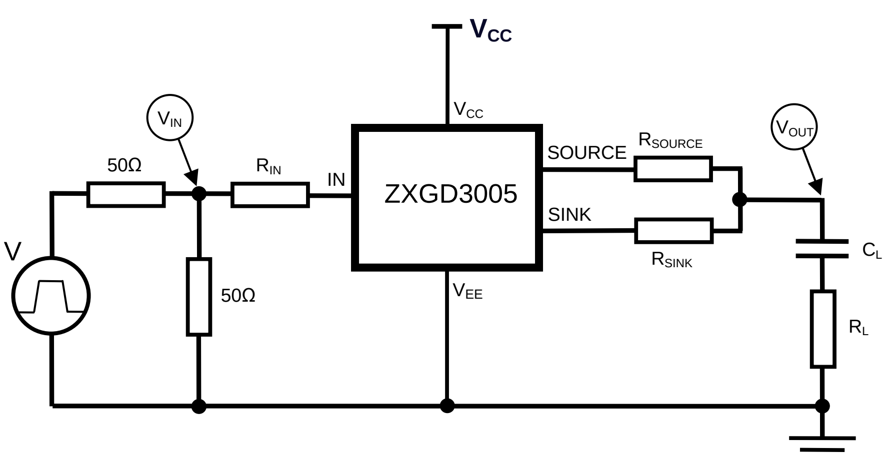
Characteristic	Symbol	Value	Unit
Power Dissipation (Notes 4 & 5) Linear derating factor	P_D	1.1 8.8	W mW/°C
Thermal Resistance, Junction to Ambient (Notes 4 & 5)	$R_{\theta JA}$	113	°C/W
Thermal Resistance, Junction to Lead (Note 6)	$R_{\theta JL}$	105	
Operating and Storage Temperature Range	T_J, T_{STG}	-55 to +150	°C

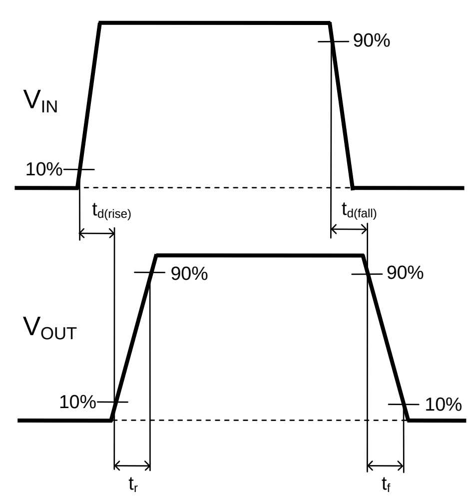
Notes: 4. For a device surface mounted on 25mm x 25mm x 0.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition. The heatsink is split in half with the pin 1 (V_{CC}) and pin 3 (V_{EE}) connected separately to each half.
5. For device with two active die running at equal power.
6. 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°C unless otherwise specified

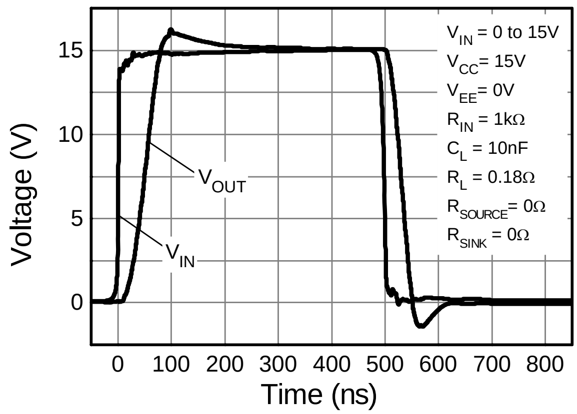
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition	
Output voltage, high	V_{OH}	-	V_{CC} - 0.8	-	V	$V_{IN} = V_{CC}$	
Output voltage, low	V_{OL}	-	V_{EE} + 0.2	V_{EE} + 0.5		$V_{IN} = V_{EE}$	
Supply breakdown voltage	BV_{CC}	25	-	-	V	I_Q = 100µA, $V_{IN} = V_{CC}$	
		25	-	-		I_Q = 100µA, $V_{IN} = V_{EE}$ = 0V	
Quiescent supply current	I_Q	-	-	50	nA	V_{CC}= 20V,$V_{IN} = V_{CC}$	
		-	-	50		V_{CC}= 20V,$V_{IN} = V_{EE}$ = 0V	
Source current	$I_{(source)}$	-	4.0	-	A	V_{CC}= 5V, I_{IN}= 1mA, V_{OUT}= 0V	
Sink current	$I_{(sink)}$	-	3.8	-		V_{CC}= 5V, I_{IN}=-1mA, V_{OUT}= 5V	
Source current with varying input resistances	$I_{(source)}$	-	6.4 5.5 3.9 2.2 0.44	-	A	R_{IN} = 200Ω R_{IN} = 1kΩ R_{IN} = 10kΩ R_{IN} = 100kΩ R_{IN} = 1000kΩ	V_{CC} = 15V, V_{EE} = 0V V_{IN} = 15V C_L = 100nF, R_L = 0.18Ω R_{SOURCE} = 0Ω, R_{SINK} = 0Ω
Sink current with varying input resistances	$I_{(sink)}$	-	7.7 6.5 4.4 2.3 0.46	-	A	R_{IN} = 200Ω R_{IN} = 1kΩ R_{IN} = 10kΩ R_{IN} = 100kΩ R_{IN} = 1000kΩ	V_{CC} = 15V, V_{EE} = 0V V_{IN} = 15V C_L = 100nF, R_L = 0.18Ω R_{SOURCE} = 0Ω, R_{SINK} = 0Ω
Switching times with low load capacitance C_L = 10nF	$t_{d(rise)}$ t_r $t_{d(fall)}$ t_f	-	8 48 16 35	-	ns	V_{CC} = 15V, V_{EE} = 0V V_{IN} = 0 to 15V R_{IN} = 1kΩ C_L = 10nF, R_L = 0.18Ω R_{SOURCE} = 0Ω, R_{SINK} = 0Ω	
Switching times with high load capacitance C_L = 100nF	$t_{d(rise)}$ t_r $t_{d(fall)}$ t_f	-	46 419 47 467	-	ns	V_{CC} = 15V, V_{EE} = 0V V_{IN} = 0 to 15V R_{IN} = 1kΩ C_L = 100nF, R_L = 0.18Ω R_{SOURCE} = 0Ω, R_{SINK} = 0Ω	
Switching times with asymmetric source and sink resistors	$t_{d(rise)}$ t_r $t_{d(fall)}$ t_f		24 133 16 37		ns	V_{CC} = 15V, V_{EE} = -5V V_{IN} = -5 to 15V R_{IN}= 1kΩ C_L = 10nF, R_L = 0.18Ω R_{SOURCE}=4.7Ω, R_{SINK}=0Ω	

Switching Test Circuit and Timing Diagram



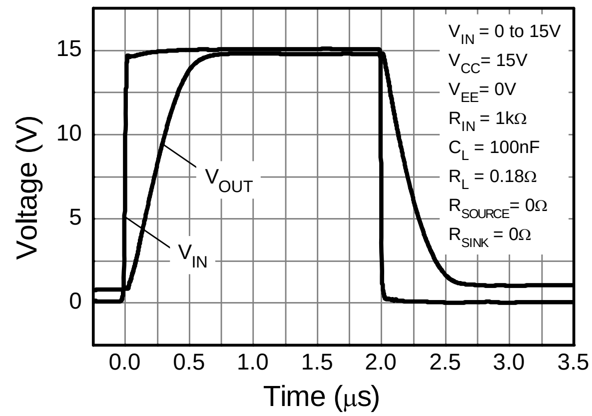


Typical Switching Characteristics @T_A = 25°C unless otherwise specified



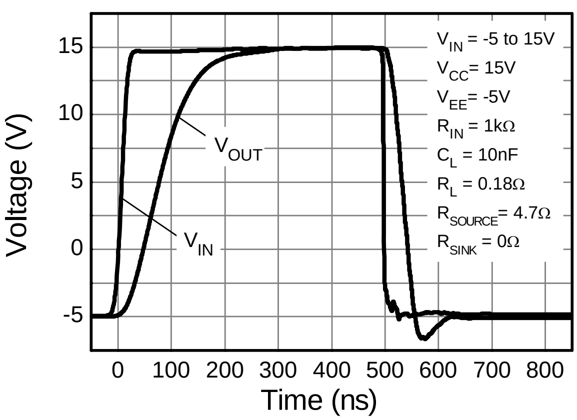
Switching Speed

Low Load Capacitance C_L = 10nF



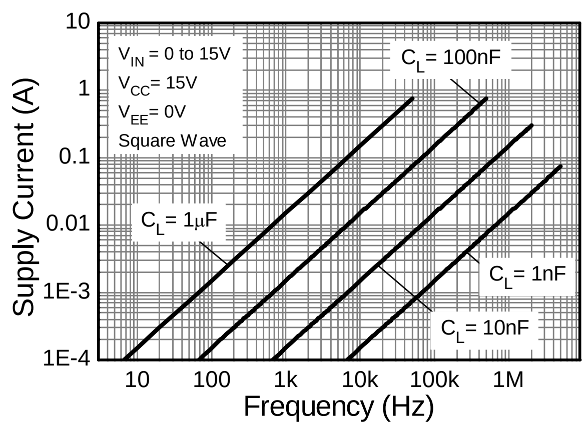
Switching Speed

High Load Capacitance C_L = 100nF



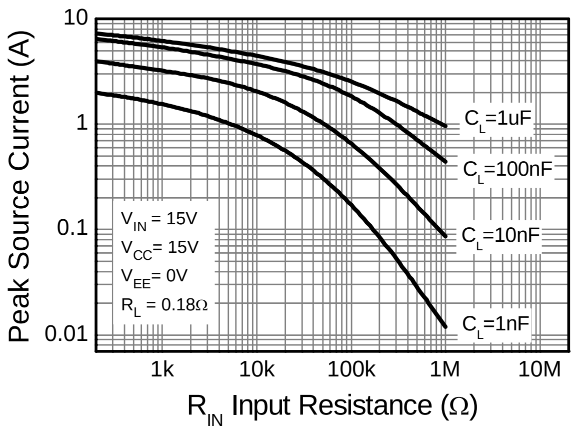
Switching Speed

Asymmetric Source and Sink Resistors

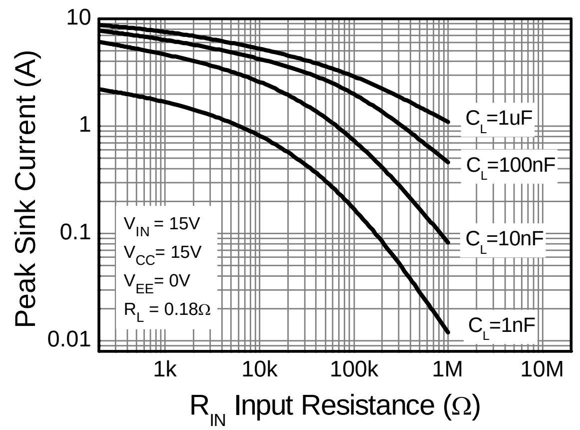


Supply Current

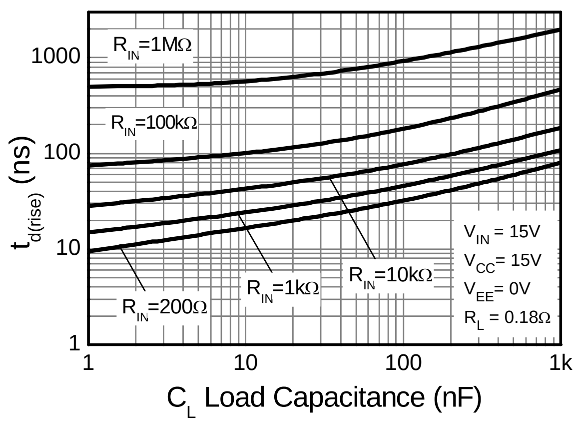
Typical Switching Characteristics @T_A = 25°C unless otherwise specified



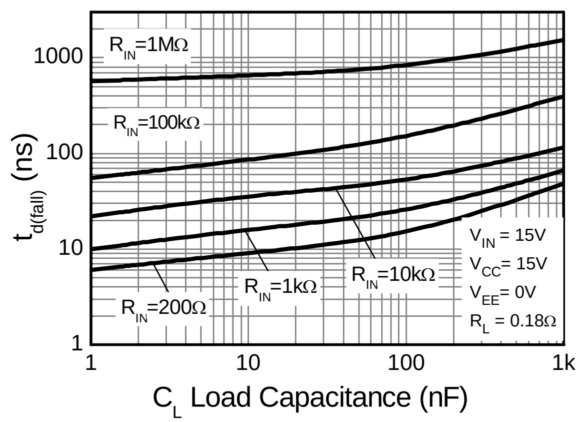
Source Current vs. Input Resistance



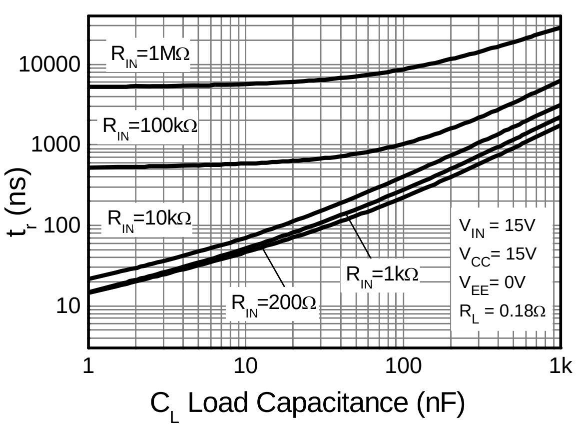
Sink Current vs. Input Resistance



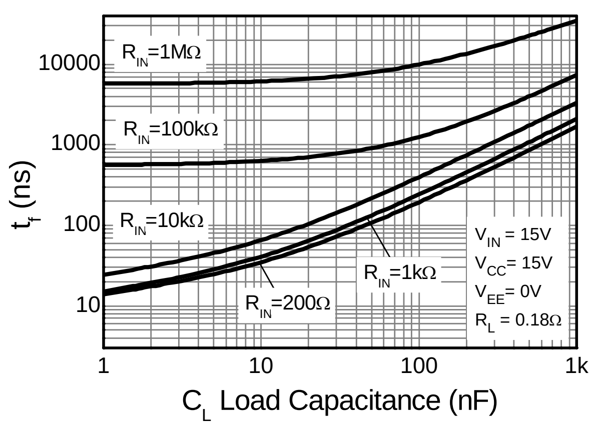
Turn-On Delay Time



Turn-Off Delay Time



Turn-On Rise Time



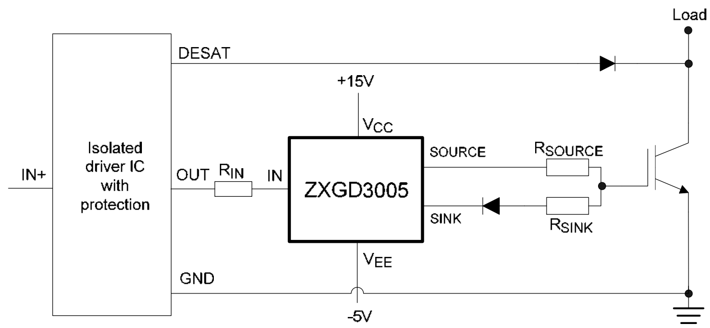
Turn-Off Fall Time

Application Notes

Independent control of rise and fall time

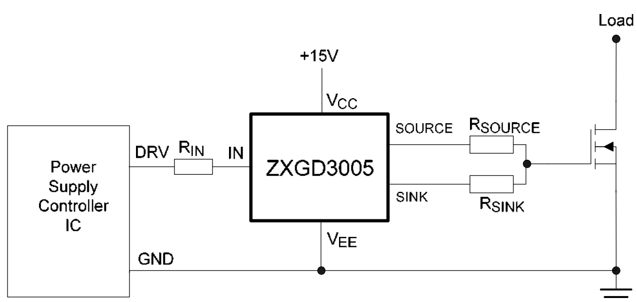
An application may require the turn-on (t_{on}) and turn-off (t_{off}) time to be independently controlled, which can be achieved by setting different R_{SOURCE} and R_{SINK} values. With asymmetric R_{SOURCE} and R_{SINK} resistors, then a potential difference will occur between the SOURCE and SINK pins during the switching transition. If the potential difference across the SOURCE and SINK pins is greater than 7.5V, then it could damage the ZXGD3005.

In this circuit example of driving an IGBT, a blocking diode is added in series with R_{SINK} to protect against excess reverse current being induced into the SINK pin.

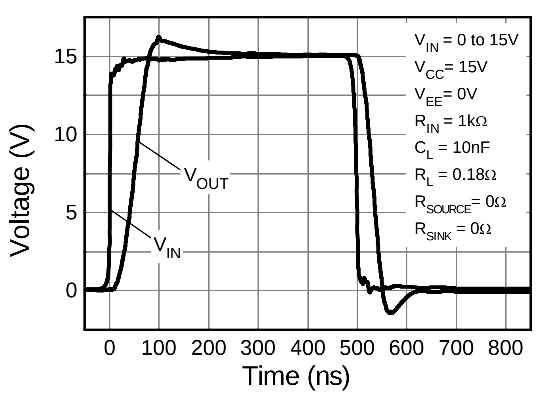


Circuit example of driving a MOSFET

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



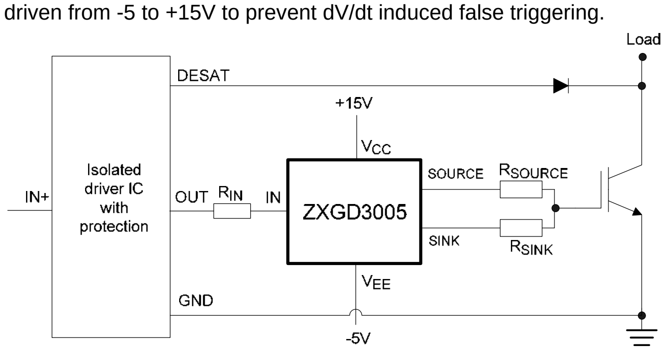
Switching Time Characteristic



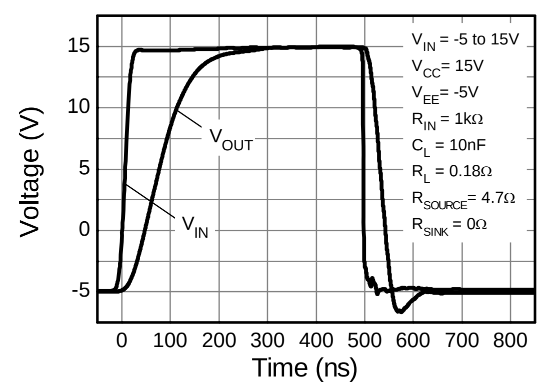
Symmetric Source and Sink Resistors

Circuit example of driving an IGBT

Application example of gate driving an IGBT with independent t_{on} and t_{off} using asymmetric R_{SOURCE} and R_{SINK}. In addition, the gate is driven from -5 to +15V to prevent dV/dt induced false triggering.

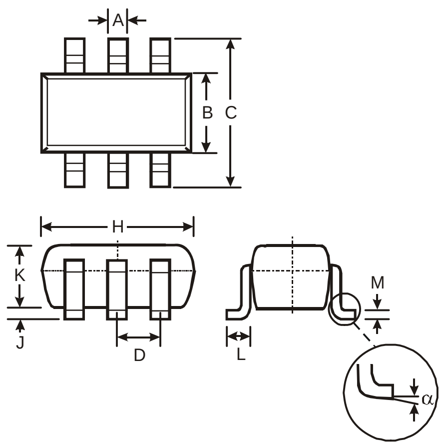


Switching Time Characteristic



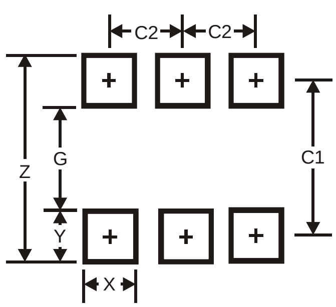
Asymmetric Source and Sink Resistors

Package Outline Dimensions



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°	—
All Dimensions in mm			

Suggested Pad Layout



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