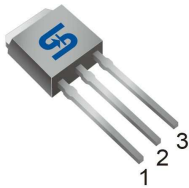
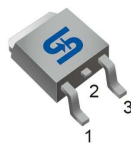




TO-251  
(IPAK)



TO-252  
(DPAK)



Pin Definition:

1. Gate
2. Drain
3. Source

### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
500	1.5 @ $V_{GS}=10V$	2.2

### General Description

The TSM5ND50 N-Channel enhancement mode Power MOSFET is produced by planar stripe DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switch mode power supply, power factor correction, electronic lamp ballast based on half bridge.

### Features

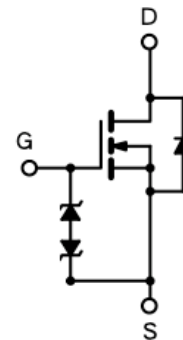
- Low gate charge typical @ 20nC
- Low Crss typical @ 17pF
- Fast Switching
- Improved dv/dt capability
- ESD Protection

### Ordering Information

Part No.	Package	Packing
TSM5ND50CP ROG	TO-252	2,500pcs / 13" Reel
TSM5ND50CH C5G	TO-251	75pcs / Tube

Note: "G" denotes for Halogen Free

### Block Diagram



N-Channel MOSFET

### Absolute Maximum Rating ( $T_a = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	500	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current	$I_D$	4.4	A
Pulsed Drain Current	$I_{DM}$	17.6	A
Continuous Source Current (Diode Conduction)	$I_S$	4.4	A
Peak Diode Recovery (Note 2)	dv/dt	4.5	V/ns
Single Pulse Drain to Source Avalanche Energy (Note 3)	$E_{AS}$	130	mJ
Total Power Dissipation @ $T_a = 25^\circ\text{C}$	$P_{DTOT}$	70	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

### Thermal Performance

Parameter	Symbol	Limit	Unit
Thermal Resistance - Junction to Case	$R\theta_{JC}$	1.78	$^\circ\text{C/W}$
Thermal Resistance - Junction to Ambient	$R\theta_{JA}$	62.5	$^\circ\text{C/W}$

Notes: Surface mounted on FR4 board  $t \leq 10\text{sec}$

**Electrical Specifications** ( $T_a = 25^\circ\text{C}$  unless otherwise noted)

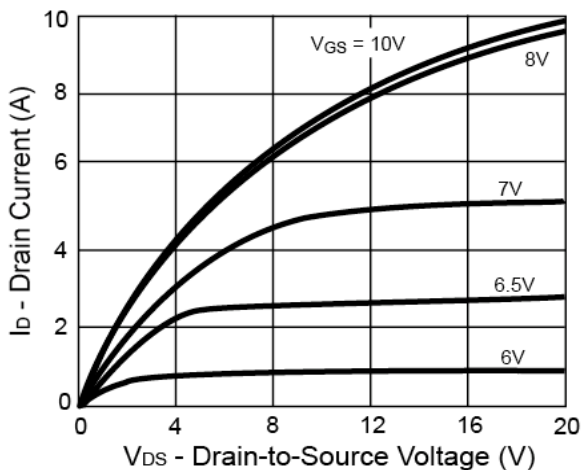
Parameter	Conditions	Symbol	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	$BV_{DSS}$	500	--	--	V
Drain-Source On-State Resistance	$V_{GS} = 10V, I_D = 2.2A$	$R_{DS(ON)}$	--	1.2	1.5	$\Omega$
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 50\mu A$	$V_{GS(TH)}$	3.0	--	4.8	V
Zero Gate Voltage Drain Current	$V_{DS} = 500V, V_{GS} = 0V$	$I_{DSS}$	--	--	1	$\mu A$
Gate Body Leakage	$V_{GS} = \pm 20V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 10$	$\mu A$
Forward Transconductance	$V_{DS} = 15V, I_D = 2.2A$	$g_{fs}$	--	3.1	--	S
<b>Dynamic<sup>b</sup></b>						
Total Gate Charge	$V_{DS} = 250V, I_D = 4.4A,$ $V_{GS} = 10V$	$Q_g$	--	20	--	nC
Gate-Source Charge		$Q_{gs}$	--	4	--	
Gate-Drain Charge		$Q_{gd}$	--	10	--	
Input Capacitance	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0MHz$	$C_{iss}$	--	535	--	pF
Output Capacitance		$C_{oss}$	--	75	--	
Reverse Transfer Capacitance		$C_{rss}$	--	17	--	
<b>Switching<sup>c</sup></b>						
Turn-On Delay Time	$V_{GS} = 10V, I_D = 4.4A,$ $V_{DD} = 250V, R_G = 25\Omega$	$t_{d(on)}$	--	21.6	--	nS
Turn-On Rise Time		$t_r$	--	11.7	--	
Turn-Off Delay Time		$t_{d(off)}$	--	14.5	--	
Turn-Off Fall Time		$t_f$	--	4.5	--	
<b>Source Drain Diode</b>						
Source-drain Current		$I_{SD}$	--	--	4.4	A
Diode Forward Voltage	$I_S = 4.4A, V_{GS} = 0V$	$V_{SD}$	--	0.82	1.2	V
Reverse Recovery Time	$V_{DD} = 30V, I_{SD} = 4.4A,$ $di_F/dt = 100A/\mu s.$	$t_{rr}$	--	310	--	nS
Reverse Recovery Charge		$Q_{rr}$	--	1425	--	nC
Reverse Recovery Current	$T_J = 150^\circ\text{C}$	$I_{RRM}$	--	9.2	--	A

**Notes:**

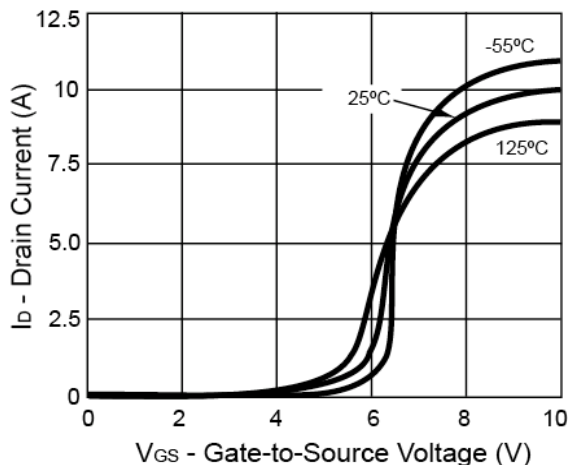
1. Pulse test: pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
2.  $I_{SD} < 4.4A$ ,  $di/dt < 200A/\mu s$ ,  $V_{DD} < BV_{DSS}$
3. Starting  $V_{DD} = 50V$ ,  $I_{AS} = 4.4A$ ,  $T_J = 25^\circ\text{C}$
4. For design reference only, not subject to production testing.
5. Switching time is essentially independent of operating temperature.

**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

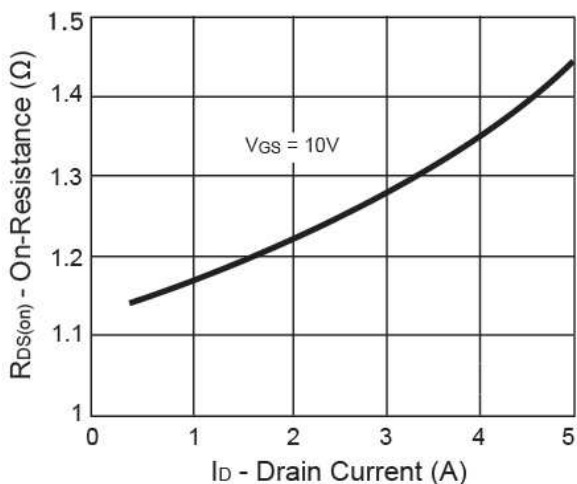
**Output Characteristics**



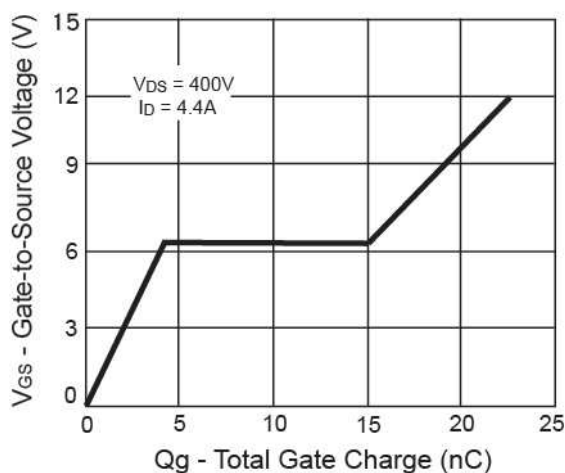
**Transfer Characteristics**



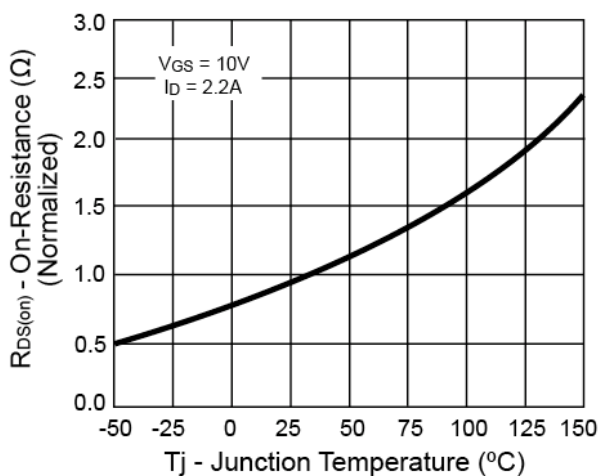
**On-Resistance vs. Drain Current**



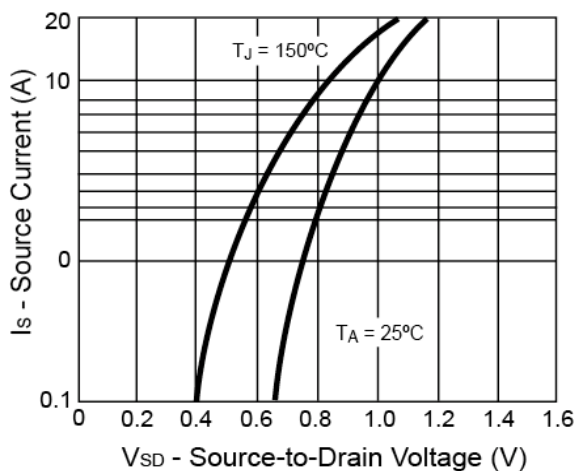
**Gate Charge**



**On-Resistance vs. Junction Temperature**

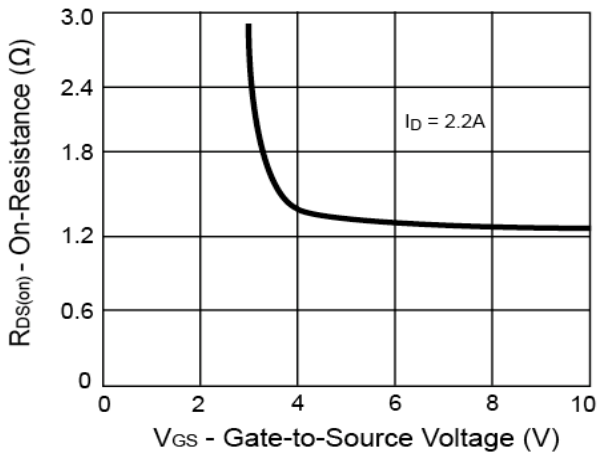


**Source-Drain Diode Forward Voltage**

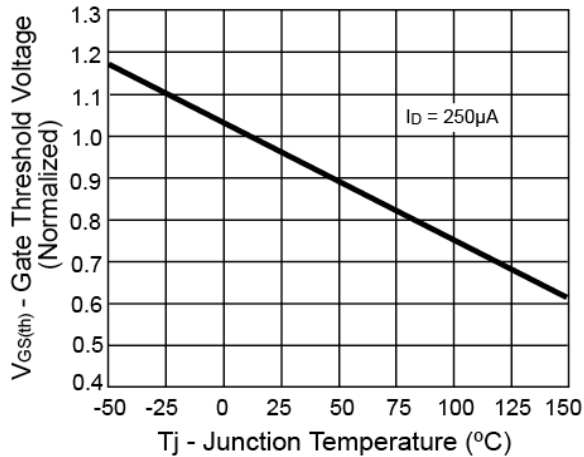


**Electrical Characteristics Curve** ( $T_a = 25^\circ\text{C}$ , unless otherwise noted)

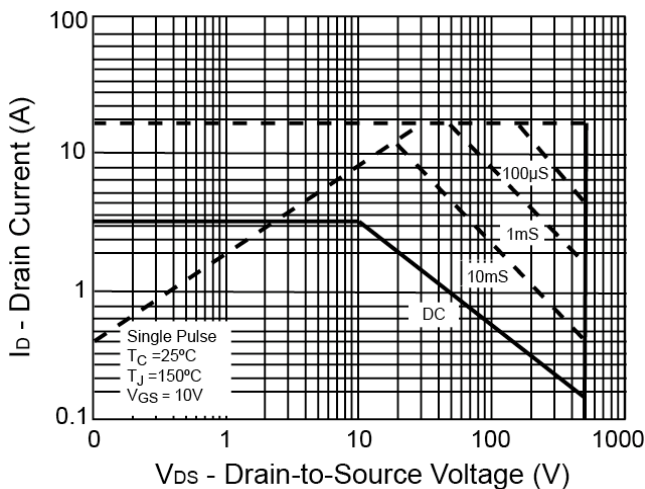
**On-Resistance vs. Gate-Source Voltage**



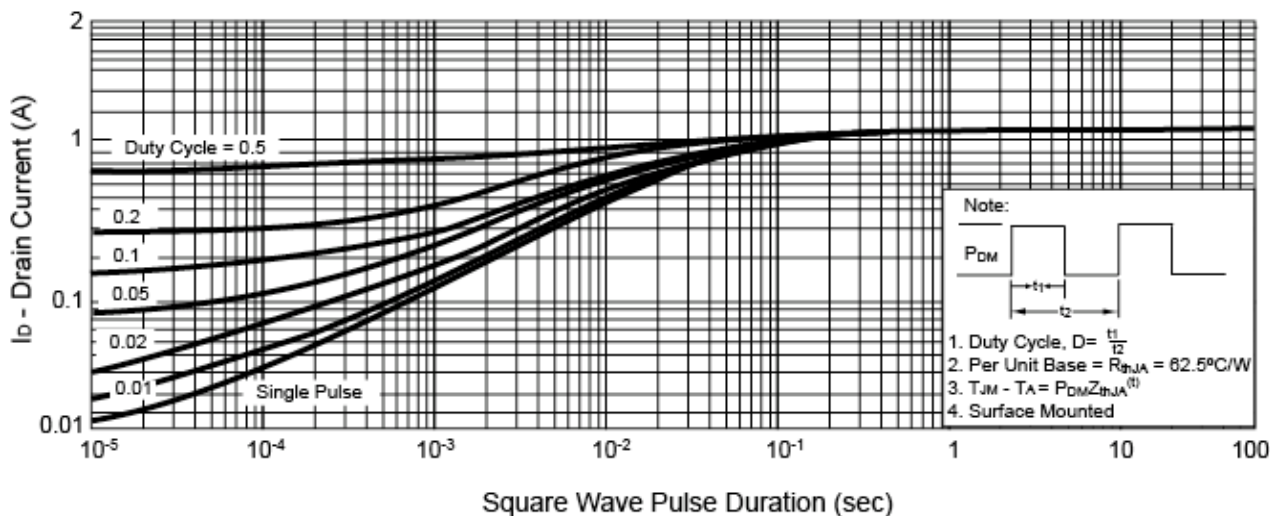
**Threshold Voltage**



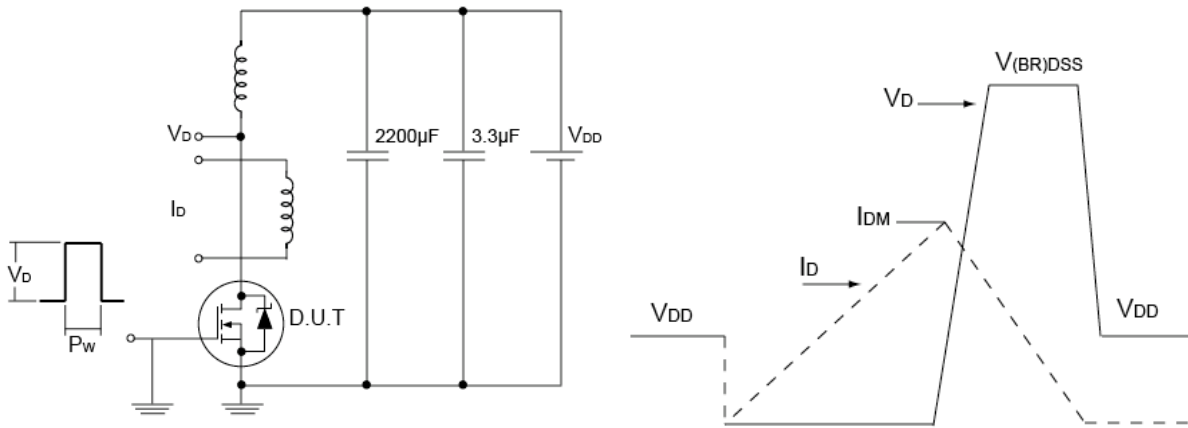
**Maximum Safe Operating Area**



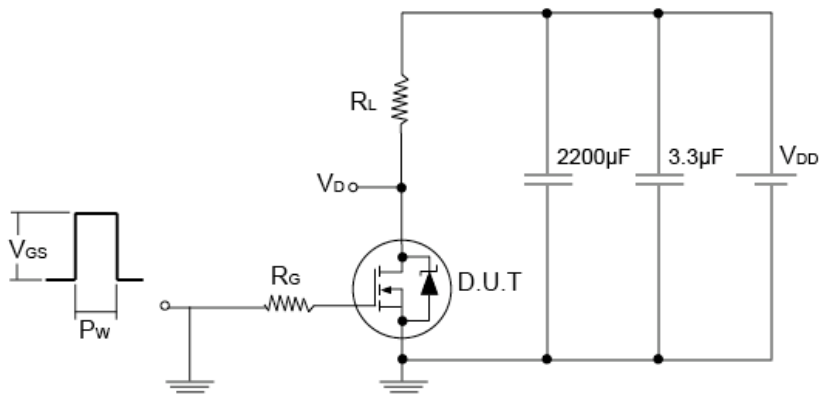
**Normalized Thermal Transient Impedance, Junction-to-Ambient**



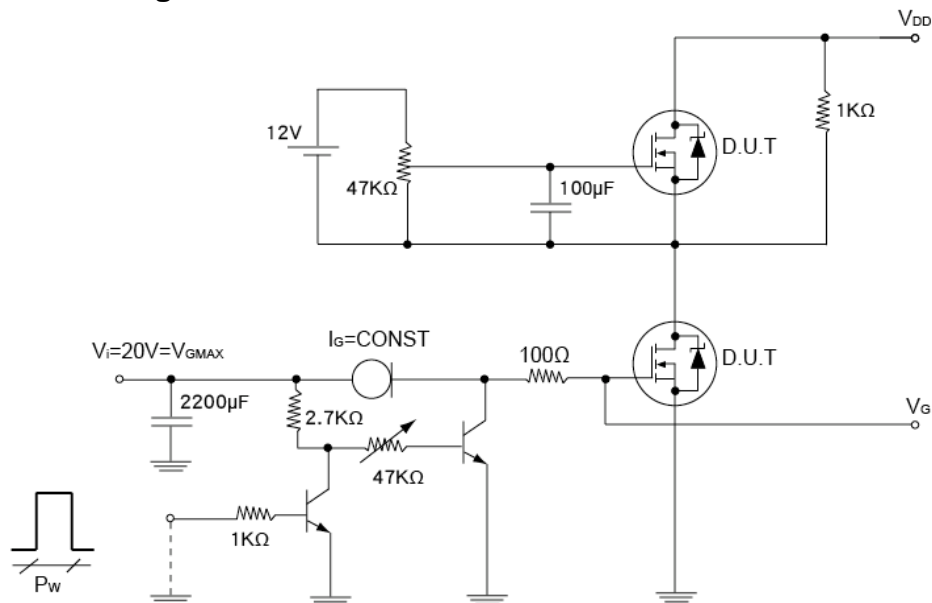
**Unclamped Inductive Load Test Circuit and Waveform**



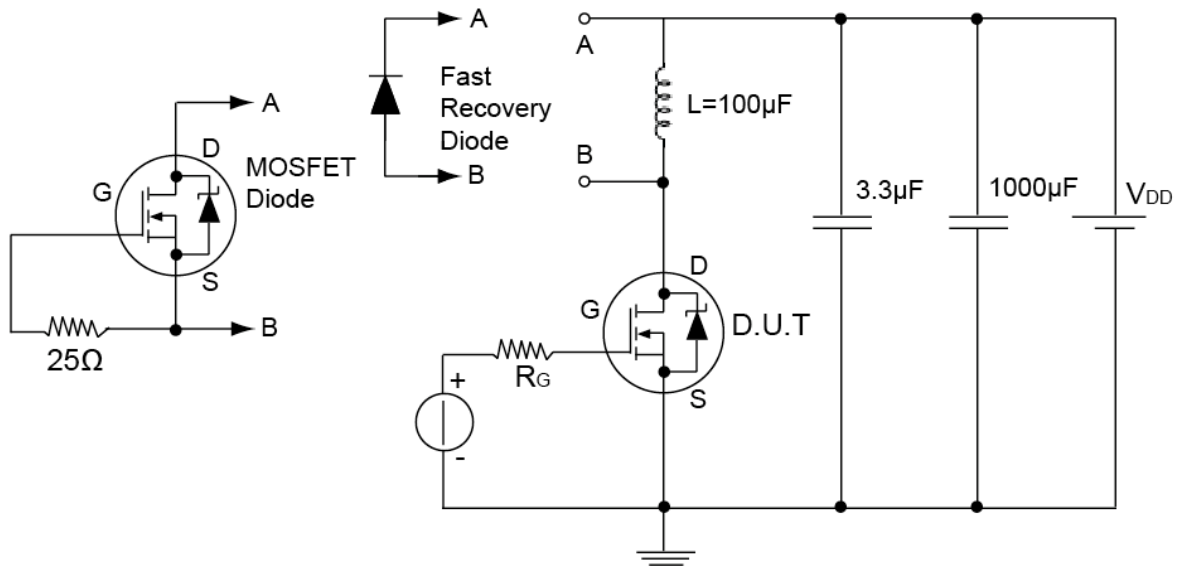
**Switching Time Test Circuits for Resistive Load**



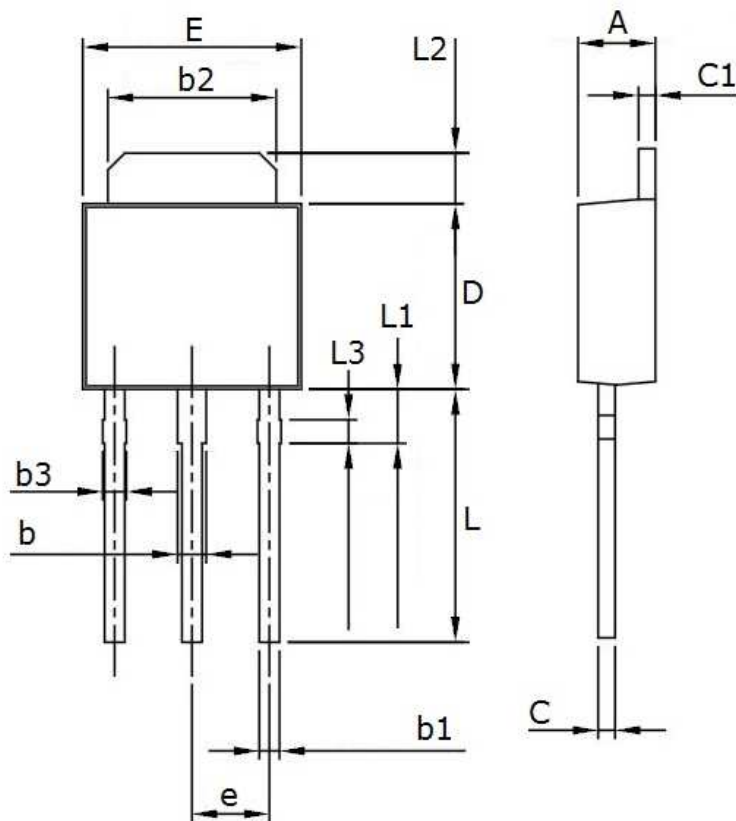
**Gate Charge Test Circuit**



**Test Circuit for Inductive Load Switching and Diode Recovery Times**

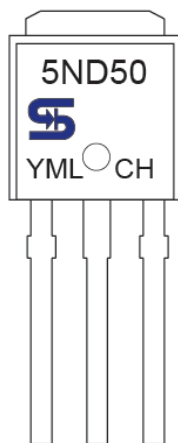


**TO-251 Mechanical Drawing**



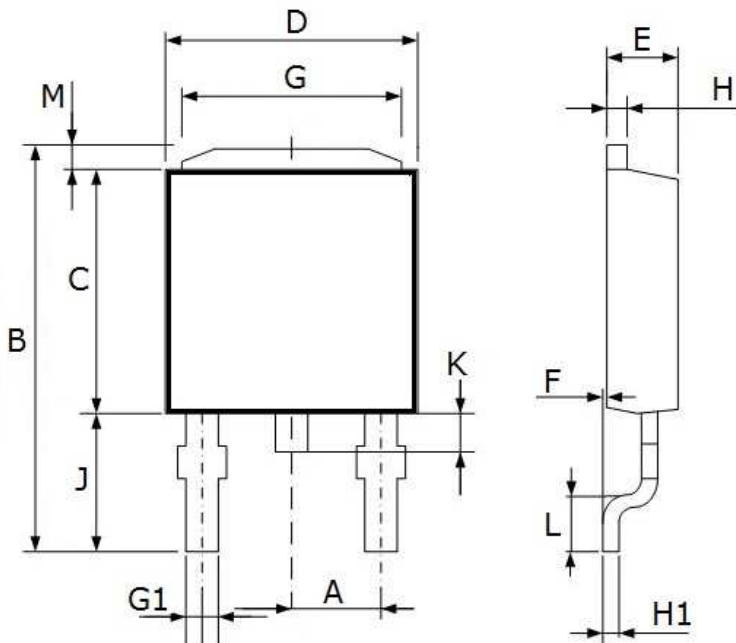
TO-251 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.10	2.50	0.083	0.098
b	0.65	1.05	0.026	0.041
b1	0.58	0.62	0.023	0.024
b2	4.80	5.20	0.189	0.205
b3	0.68	0.72	0.027	0.028
C	0.35	0.65	0.014	0.026
C1	0.40	0.60	0.016	0.024
D	5.30	5.70	0.209	0.224
E	6.30	6.70	0.248	0.264
e	2.30 BSC		0.09 BSC	
L	7.00	8.00	0.276	0.315
L1	1.40	1.80	0.055	0.071
L2	1.30	1.70	0.051	0.067
L3	0.50	0.90	0.020	0.035

**Marking Diagram**



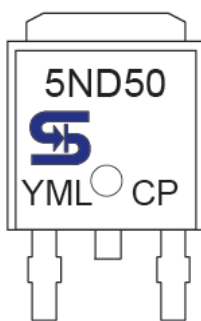
- Y** = Year Code
- M** = Month Code for Halogen Free Product  
(O=Jan, P=Feb, Q=Mar, R=Apl, S=May, T=Jun, U=Jul, V=Aug, W=Sep, X=Oct, Y=Nov, Z=Dec)
- L** = Lot Code

**TO-252 Mechanical Drawing**



TO-252 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.30 BSC		0.090 BSC	
B	10.20	10.80	0.402	0.425
C	5.30	5.70	0.209	0.224
D	6.30	6.70	0.248	0.264
E	2.10	2.50	0.083	0.098
F	0.00	0.20	0.000	0.008
G	4.80	5.20	0.189	0.205
G1	0.40	0.80	0.016	0.031
H	0.40	0.60	0.016	0.024
H1	0.35	0.65	0.014	0.026
J	3.35	3.65	0.132	0.144
K	0.50	1.10	0.020	0.043
L	0.90	1.50	0.035	0.059
M	1.30	1.70	0.051	0.067

**Marking Diagram**



- Y** = Year Code
- M** = Month Code for Halogen Free Product  
(O=Jan, P=Feb, Q=Mar, R=Apr, S=May, T=Jun, U=Jul, V=Aug, W=Sep, X=Oct, Y=Nov, Z=Dec)
- L** = Lot Code



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