

TO-252



Pin Definition:

1. Gate
2. Drain
3. Source

PRODUCT SUMMARY

| V_{DS} (V) | $R_{DS(on)}$ (Ω) | 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.

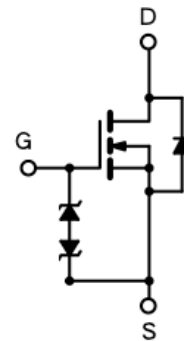
Features

- Low gate charge typical @ 20nC
- Low C_{rss} typical @ 17pF
- Fast Switching
- 100% avalanche tested
- Improved dv/dt capability
- ESD Protection

Ordering Information

| Part No. | Package | Packing |
|---------------|---------|---------------------|
| TSM5ND50CP RO | TO-252 | 2,500pcs / 13" Reel |

Block Diagram



N-Channel MOSFET

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

| Parameter | Symbol | Limit | Unit |
|--|----------------|-------------|------------|
| Drain-Source Voltage | V_{DS} | 500 | V |
| Gate-Source Voltage | V_{GS} | ± 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 @ $T_a = 25^\circ C$ | P_{DTOT} | 70 | W |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 to +150 | $^\circ C$ |

Thermal Performance

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

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

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

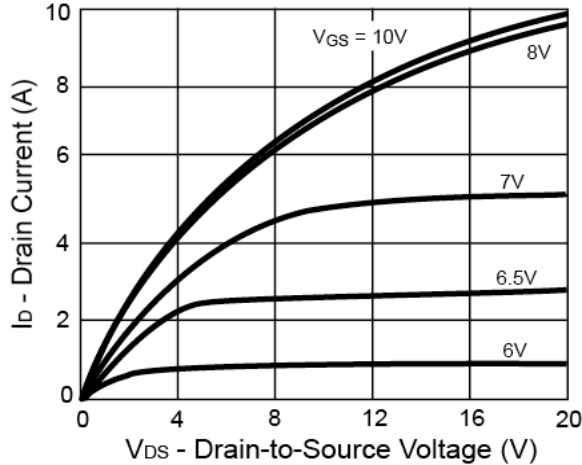
| Parameter | Conditions | Symbol | Min | Typ | Max | Unit |
|----------------------------------|--|--------------|-----|------|----------|----------|
| Static | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS} = 0V, I_D = 250\mu A$ | BV_{DSS} | 500 | -- | -- | V |
| Drain-Source On-State Resistance | $V_{GS} = 10V, I_D = 2.2A$ | $R_{DS(ON)}$ | -- | 1.2 | 1.5 | Ω |
| Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\mu A$ | $V_{GS(TH)}$ | 3.0 | -- | 4.5 | V |
| Zero Gate Voltage Drain Current | $V_{DS} = 500V, V_{GS} = 0V$ | I_{DSS} | -- | -- | 1 | μA |
| Gate Body Leakage | $V_{GS} = \pm 20V, V_{DS} = 0V$ | I_{GSS} | -- | -- | ± 10 | μA |
| Forward Transconductance | $V_{DS} = 15V, I_D = 2.2A$ | g_{fs} | -- | 3.1 | -- | S |
| Dynamic^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 | -- | |
| Switching^c | | | | | | |
| 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 | -- | |
| Source Drain Diode | | | | | | |
| 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 | $V_{DD} = 30V, I_{SD} = 4.4A,$ $dI_f/dt = 100A/\mu s,$ $T_J = 150^\circ C$ | t_{rr} | -- | 310 | -- | nS |
| Reverse Recovery Charge | | Q_{rr} | -- | 1425 | -- | μC |
| Reverse Recovery Current | | Q_{rr} | -- | 9.2 | -- | μC |

Notes:

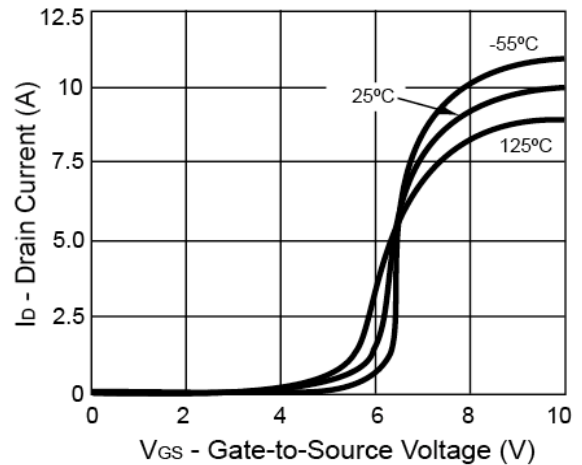
1. Pulse test: pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
2. $I_{SD} < 4.4A$, $di/dt < 200A/\mu s$, $V_{DD} < BV_{DSS}$
3. Starting $V_{DD} = 50V$, $I_{AS} = 4.4A$, $T_J = 25^\circ C$
4. For design reference only, not subject to production testing.
5. Switching time is essentially independent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

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

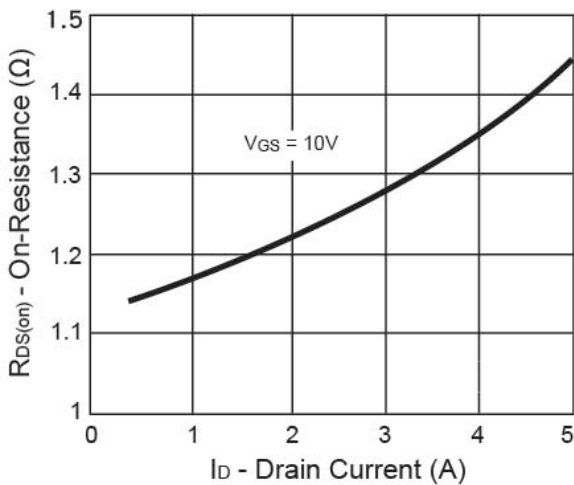
Output Characteristics



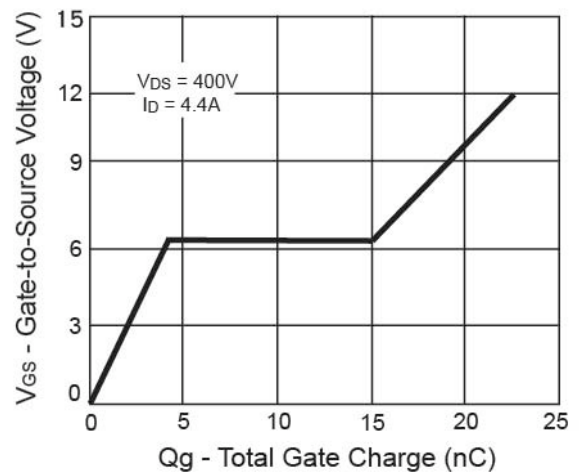
Transfer Characteristics



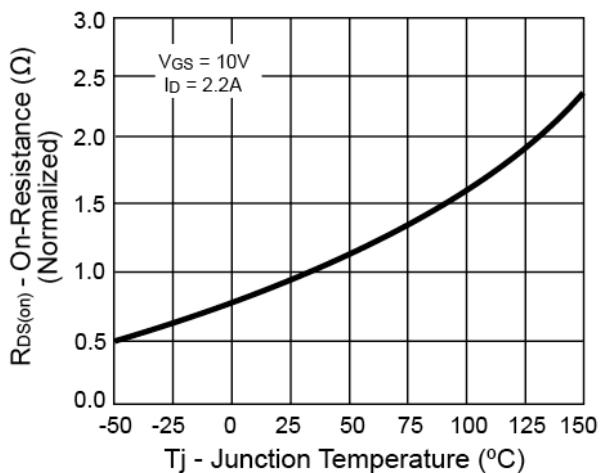
On-Resistance vs. Drain Current



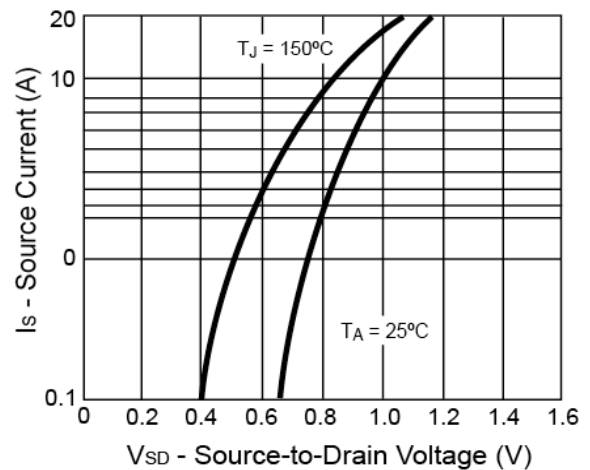
Gate Charge



On-Resistance vs. Junction Temperature

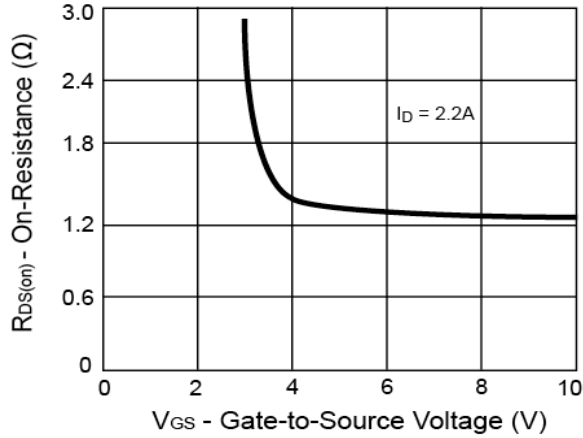


Source-Drain Diode Forward Voltage

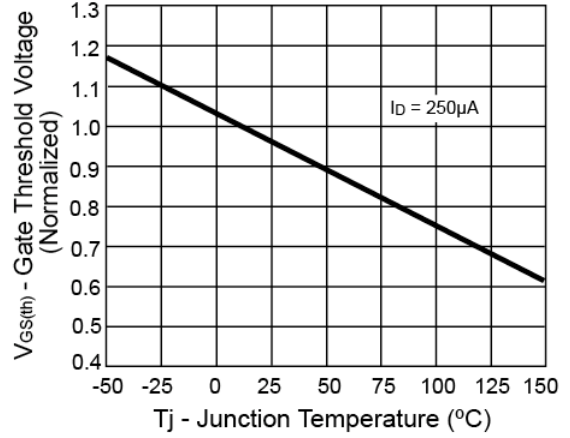


Electrical Characteristics Curve (Ta = 25°C, unless otherwise noted)

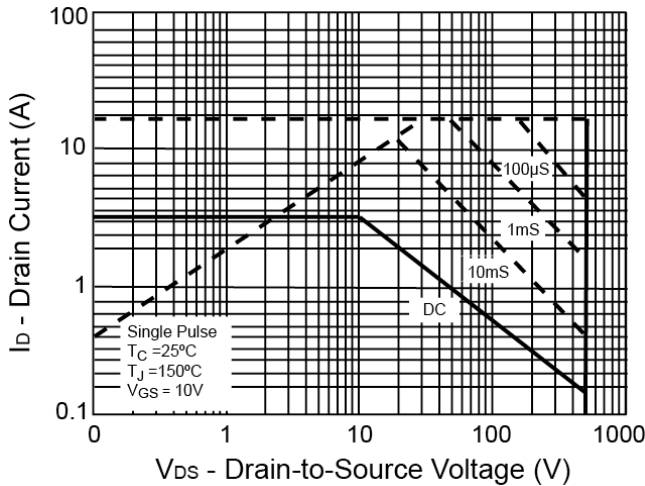
On-Resistance vs. Gate-Source Voltage



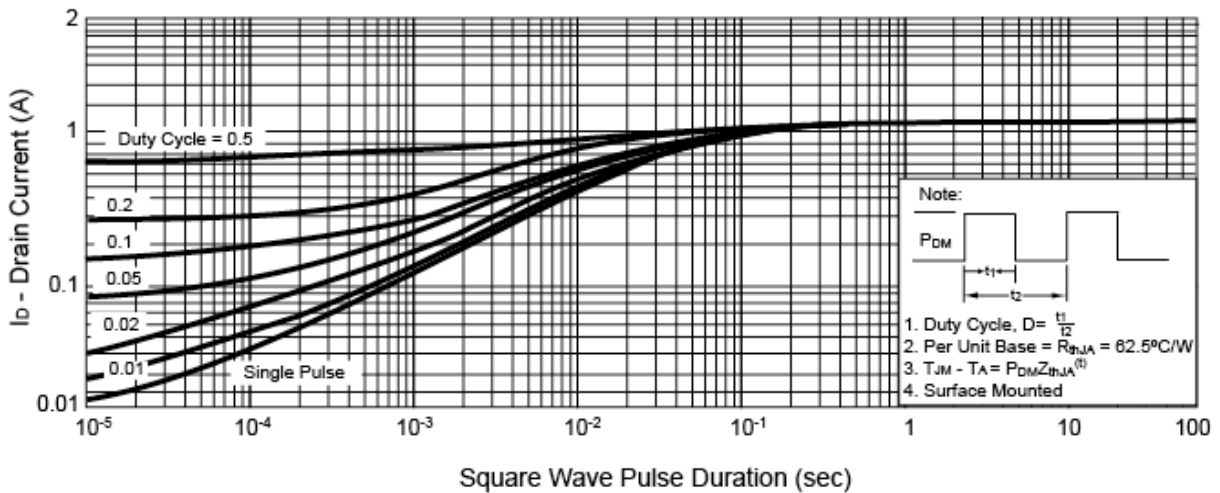
Threshold Voltage



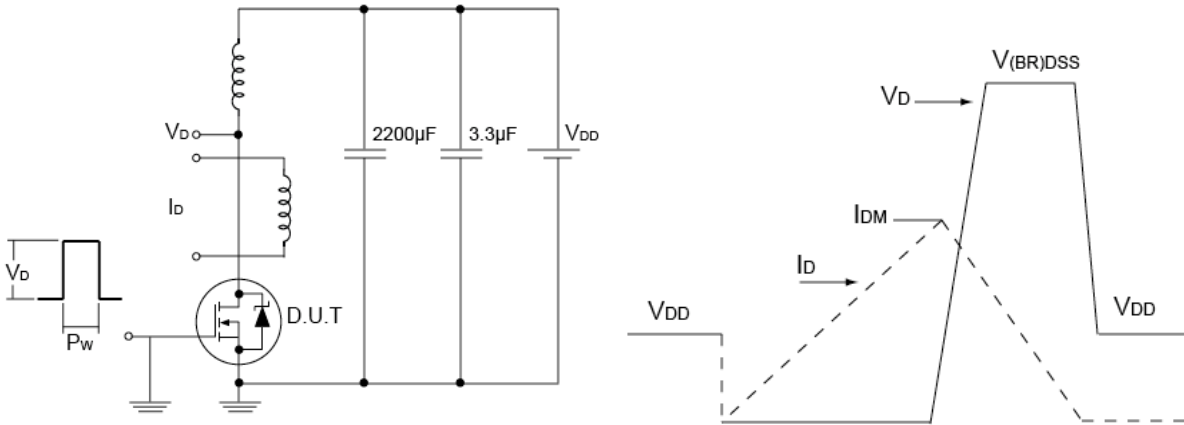
Maximum Safe Operating Area



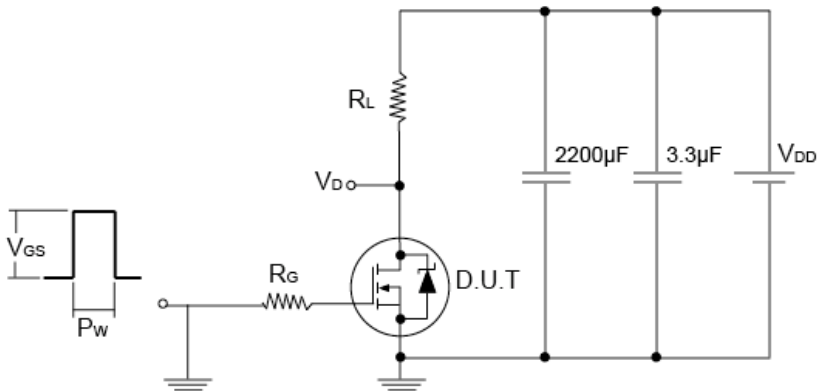
Normalized Thermal Transient Impedance, Junction-to-Ambient



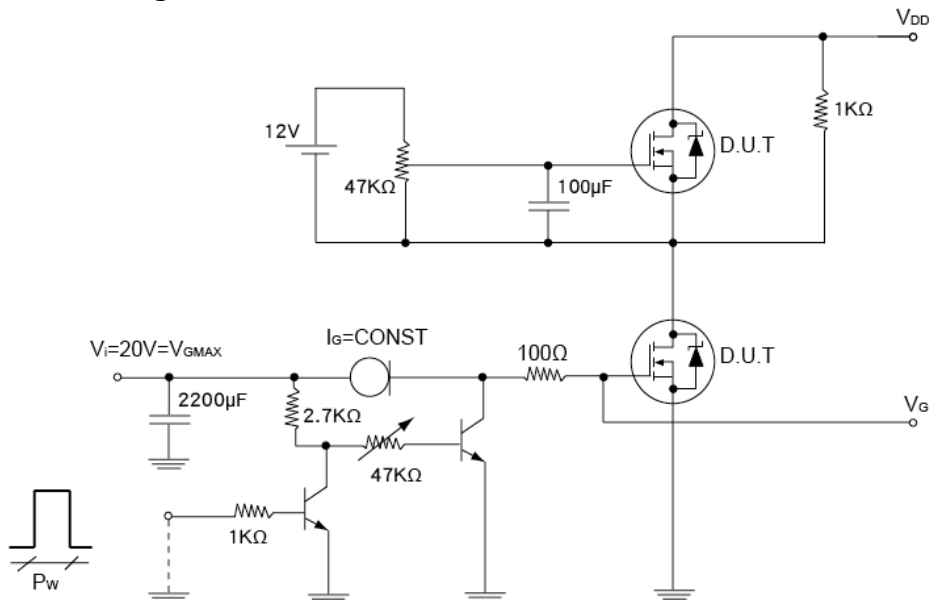
Unclamped Inductive Load Test Circuit and Waveform



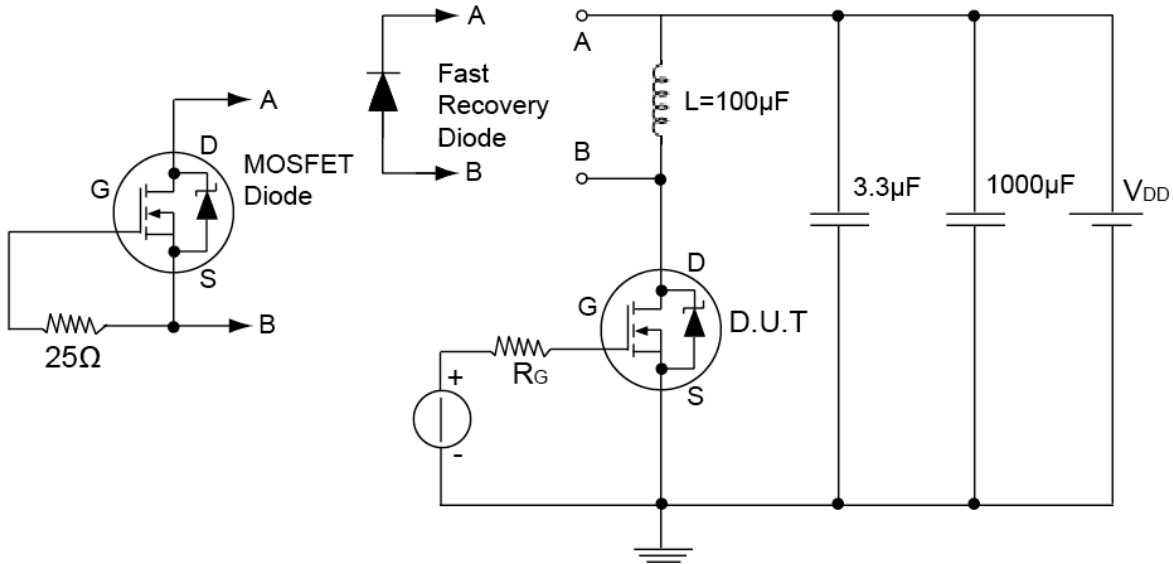
Switching Time Test Circuits for Resistive Load



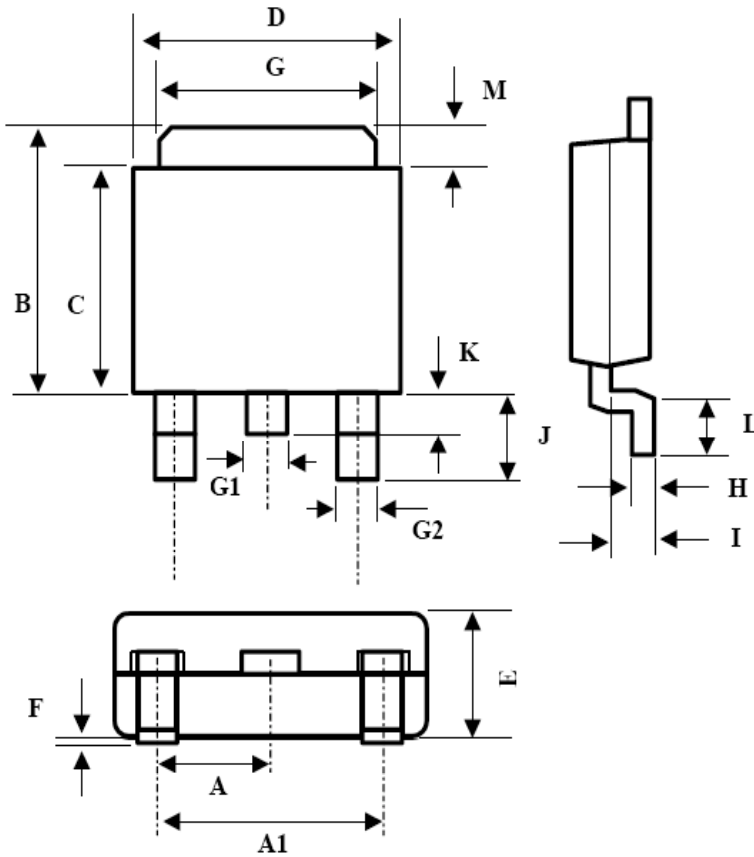
Gate Charge Test Circuit



Test Circuit for Inductive Load Switching and Diode Recovery Times

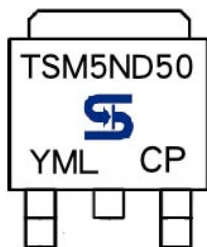


SOT-252 Mechanical Drawing



| TO-252 DIMENSION | | | | |
|------------------|-------------|------|---------|-------|
| DIM | MILLIMETERS | | INCHES | |
| | MIN | MAX | MIN | MAX |
| A | 2.3BSC | | 0.09BSC | |
| A1 | 4.6BSC | | 0.18BSC | |
| B | 6.80 | 7.20 | 0.268 | 0.283 |
| C | 5.40 | 5.60 | 0.213 | 0.220 |
| D | 6.40 | 6.65 | 0.252 | 0.262 |
| E | 2.20 | 2.40 | 0.087 | 0.094 |
| F | 0.00 | 0.20 | 0.000 | 0.008 |
| G | 5.20 | 5.40 | 0.205 | 0.213 |
| G1 | 0.75 | 0.85 | 0.030 | 0.033 |
| G2 | 0.55 | 0.65 | 0.022 | 0.026 |
| H | 0.35 | 0.65 | 0.014 | 0.026 |
| I | 0.90 | 1.50 | 0.035 | 0.059 |
| J | 2.20 | 2.80 | 0.087 | 0.110 |
| 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 | 0.67 |

Marking Diagram



- Y = Year Code
- M = Month Code
- (A=Jan, B=Feb, C=Mar, D=Apl, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)
- L = Lot Code

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