

40V, 64A, 4.6mΩ N-channel Power SGT MOSFET
JMSH0406PK
Features

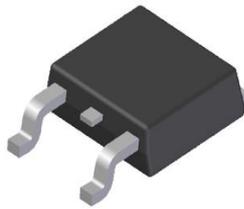
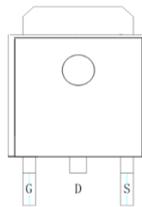
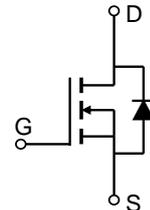
- Excellent $R_{DS(ON)}$ and Low Gate Charge
- 100% UIS Tested
- 100% ΔV_{ds} Tested
- Halogen-free; RoHS-compliant

Applications

- Load Switch
- PWM Application
- Power Management

Product Summary

| Parameters | Value | Unit |
|---------------------------------|-------|------|
| V_{DSS} | 40 | V |
| $V_{GS(th)}_{Typ}$ | 2.9 | V |
| $I_D(@V_{GS}=10V)$ | 64 | A |
| $R_{DS(ON)}_{Typ}(@V_{GS}=10V)$ | 4.6 | mΩ |


TO-252-3L

Pin Assignment

Schematic Diagram
Ordering Information

| Device | Marking | MSL | Form | Package | Reel(pcs) | Per Carton (pcs) |
|---------------|---------|-----|-----------|-----------|-----------|------------------|
| JMSH0406PK-13 | SH0406P | 3 | Tape&Reel | TO-252-3L | 2500 | 25000 |

Absolute Maximum Ratings (@ $T_C = 25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Value | Unit |
|----------------|---|---------------------------|------------------|
| V_{DS} | Drain-to-Source Voltage | 40 | V |
| V_{GS} | Gate-to-Source Voltage | ± 20 | V |
| I_D | Continuous Drain Current | $T_C = 25^\circ\text{C}$ | 64 |
| | | $T_C = 100^\circ\text{C}$ | 40 |
| I_{DM} | Pulsed Drain Current ⁽¹⁾ | Refer to Fig.4 | A |
| E_{AS} | Single Pulsed Avalanche Energy ⁽²⁾ | 89 | mJ |
| P_D | Power Dissipation | $T_C = 25^\circ\text{C}$ | 40 |
| | | $T_C = 100^\circ\text{C}$ | 16 |
| T_J, T_{STG} | Junction & Storage Temperature Range | -55 to 150 | $^\circ\text{C}$ |

Thermal Characteristics

| Symbol | Parameter | Max | Unit |
|-----------------|--|-----|---------------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient ⁽³⁾ | 45 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 3.1 | |

**Electrical Characteristics** ($T_J = 25^\circ\text{C}$ unless otherwise specified)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------|--|---|------|------|-----------|---------------|
| Off Characteristics | | | | | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $I_D = 250\mu\text{A}$, $V_{GS} = 0\text{V}$ | 40 | - | - | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 32\text{V}$, $V_{GS} = 0\text{V}$ | - | - | 1.0 | μA |
| I_{GSS} | Gate-Body Leakage Current | $V_{DS} = 0\text{V}$, $V_{GS} = \pm 20\text{V}$ | - | - | ± 100 | nA |
| On Characteristics | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS} = V_{GS}$, $I_D = 250\mu\text{A}$ | 2.0 | 2.9 | 3.8 | V |
| $R_{DS(ON)}$ | Static Drain-Source ON-Resistance ⁽⁴⁾ | $V_{GS} = 10\text{V}$, $I_D = 20\text{A}$ | - | 4.6 | 6.0 | m Ω |
| Dynamic Characteristics | | | | | | |
| R_g | Gate Resistance | $f = 1\text{MHz}$ | - | 0.9 | - | Ω |
| C_{iss} | Input Capacitance | $V_{GS} = 0\text{V}$, $V_{DS} = 20\text{V}$, $f = 1\text{MHz}$ | 863 | 1208 | 1631 | pF |
| C_{oss} | Output Capacitance | | 538 | 753 | 1016 | pF |
| C_{rss} | Reverse Transfer Capacitance | | 51 | 71 | 96 | pF |
| Q_g | Total Gate Charge | $V_{GS} = 0$ to 10V $V_{DS} = 20\text{V}$, $I_D = 20\text{A}$ | 15 | 20 | 28 | nC |
| Q_{gs} | Gate Source Charge | | - | 6.3 | - | nC |
| Q_{gd} | Gate Drain ("Miller") Charge | | - | 6.1 | - | nC |
| Switching Characteristics | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{GS} = 10\text{V}$, $V_{DD} = 20\text{V}$ $I_D = 20\text{A}$, $R_{GEN} = 3\Omega$ | - | 10 | - | ns |
| t_r | Turn-On Rise Time | | - | 16 | - | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 16 | - | ns |
| t_f | Turn-Off Fall Time | | - | 5.8 | - | ns |
| Body Diode Characteristics | | | | | | |
| I_S | Maximum Continuous Body Diode Forward Current | | - | - | 64 | A |
| I_{SM} | Maximum Pulsed Body Diode Forward Current | | - | - | 256 | A |
| V_{SD} | Body Diode Forward Voltage | $V_{GS} = 0\text{V}$, $I_S = 20\text{A}$ | - | - | 1.2 | V |
| t_{rr} | Body Diode Reverse Recovery Time | $I_F = 20\text{A}$, $di/dt = 100\text{A}/\mu\text{s}$ | 23 | 32 | 43 | ns |
| Q_{rr} | Body Diode Reverse Recovery Charge | | - | 23 | - | nC |

- Notes:
1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
 2. E_{AS} condition: Starting $T_J = 25^\circ\text{C}$, $V_{DD} = 20\text{V}$, $V_{GS} = 10\text{V}$, $R_G = 25\text{ohm}$, $L = 3\text{mH}$, $I_{AS} = 7.7\text{A}$, $V_{DD} = 0\text{V}$ during time in avalanche.
 3. $R_{\theta JA}$ is measured with the device mounted on a 1inch^2 pad of 2oz copper FR4 PCB.
 4. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 0.5\%$.



Typical Performance Characteristics

Figure 1: Power De-rating

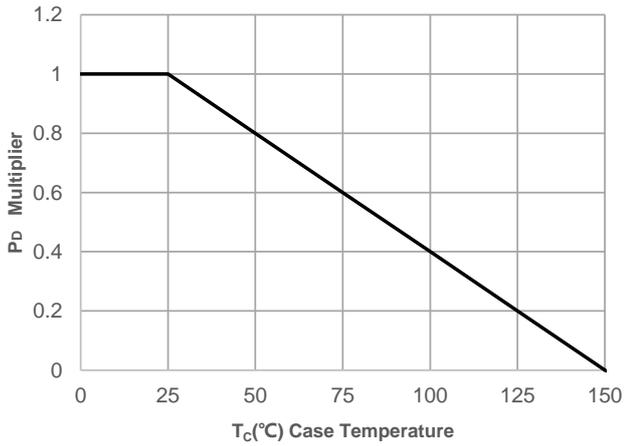


Figure 2: Current De-rating

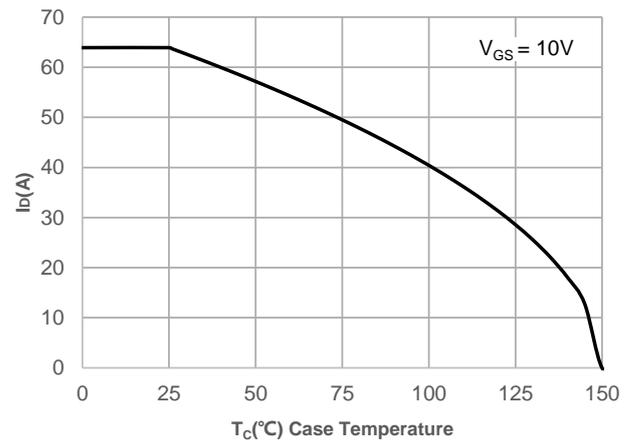


Figure 3: Normalized Maximum Transient Thermal Impedance

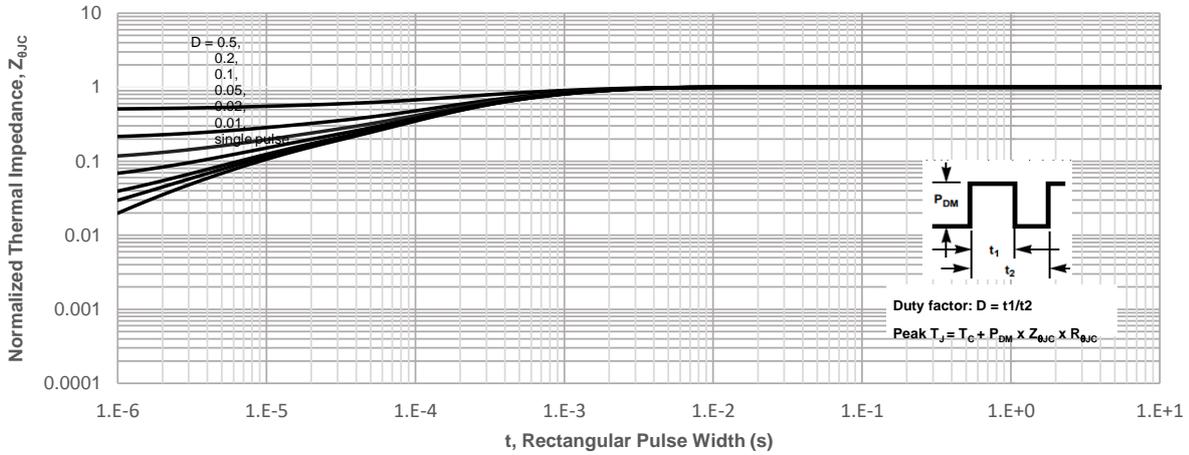
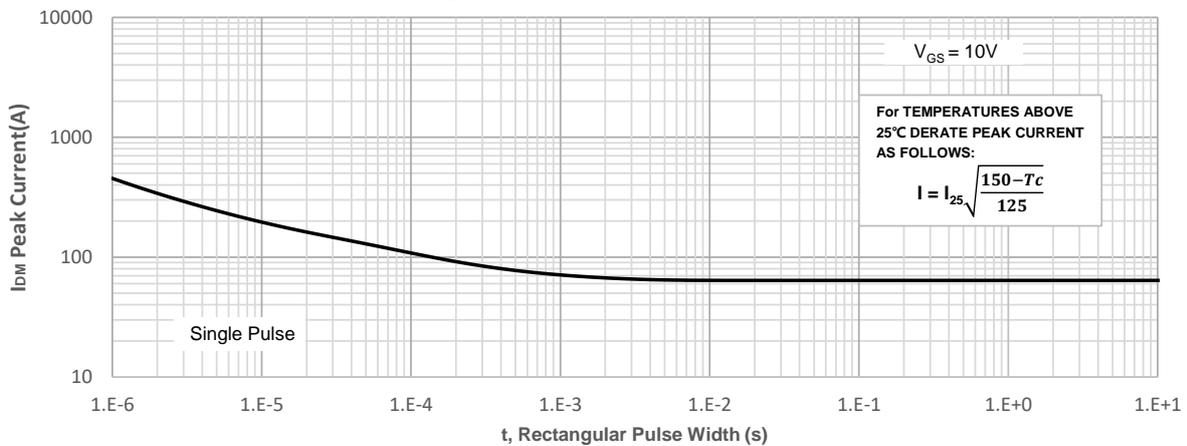
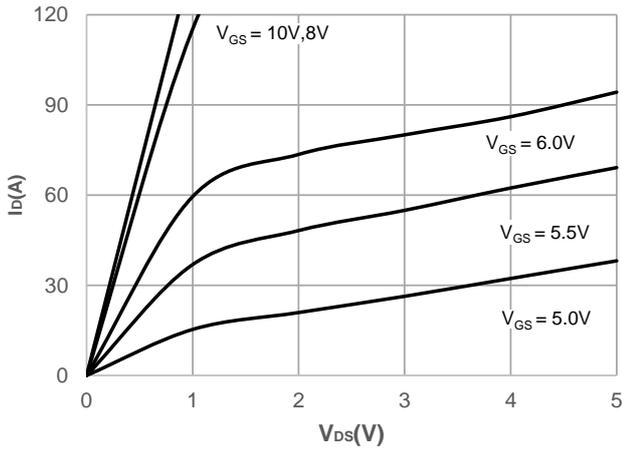
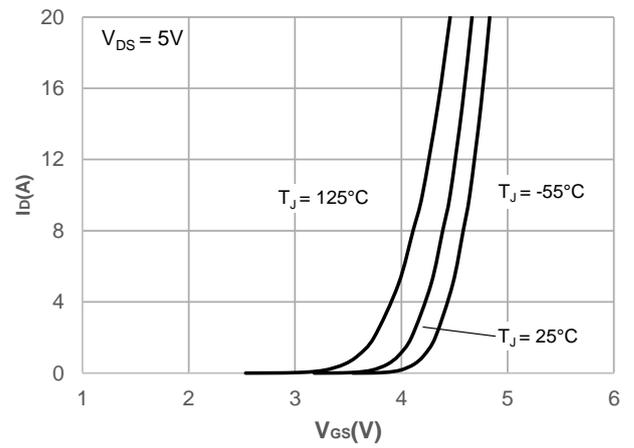
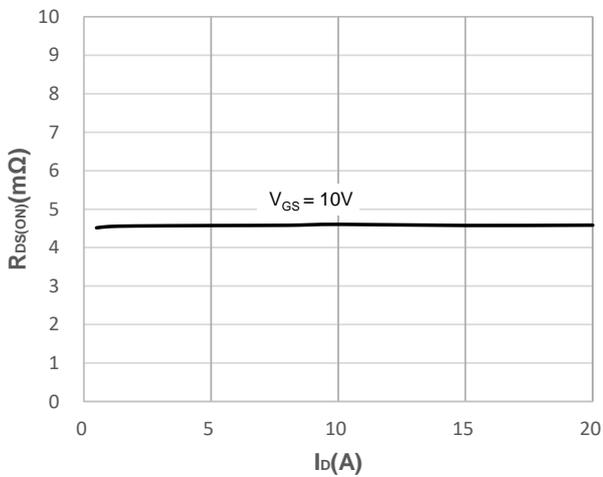
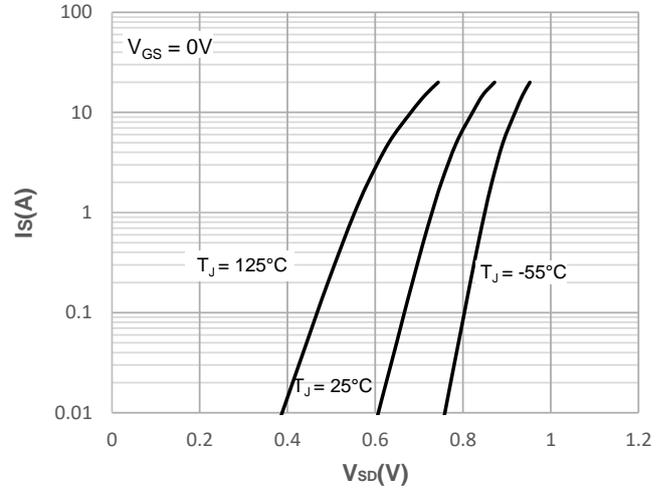
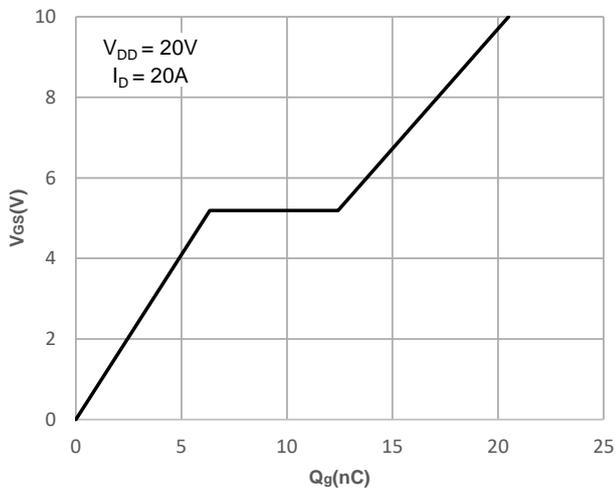
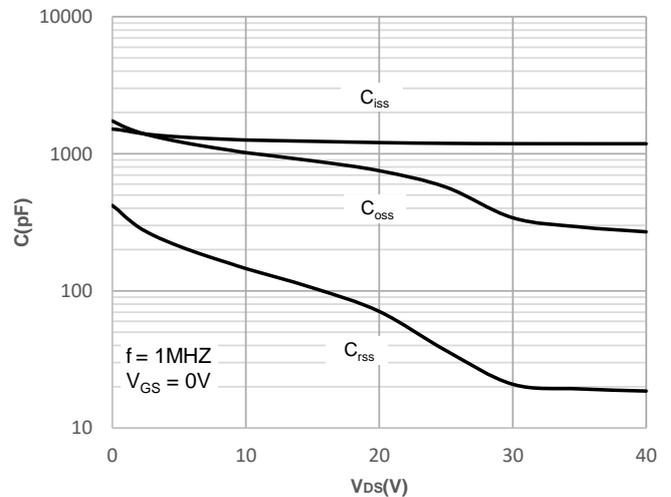


Figure 4: Peak Current Capacity



Typical Performance Characteristics

Figure 5: Output Characteristics

Figure 6: Typical Transfer Characteristics

Figure 7: On-resistance vs. Drain Current

Figure 8: Body Diode Characteristics

Figure 9: Gate Charge Characteristics

Figure 10: Capacitance Characteristics


Typical Performance Characteristics

Figure 11: Normalized Breakdown voltage vs. Junction Temperature

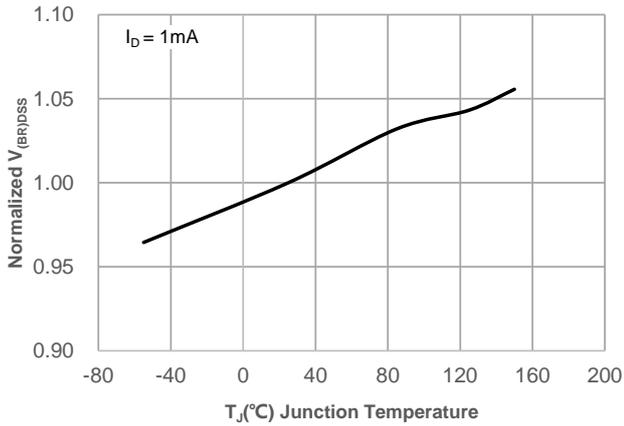


Figure 12: Normalized on Resistance vs. Junction Temperature

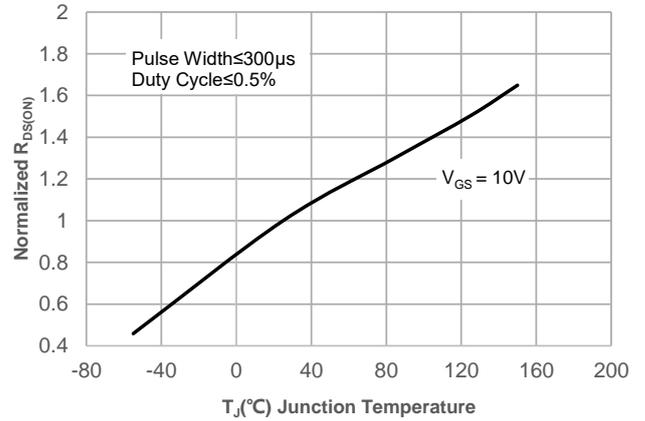


Figure 13: Normalized Threshold Voltage vs. Junction Temperature

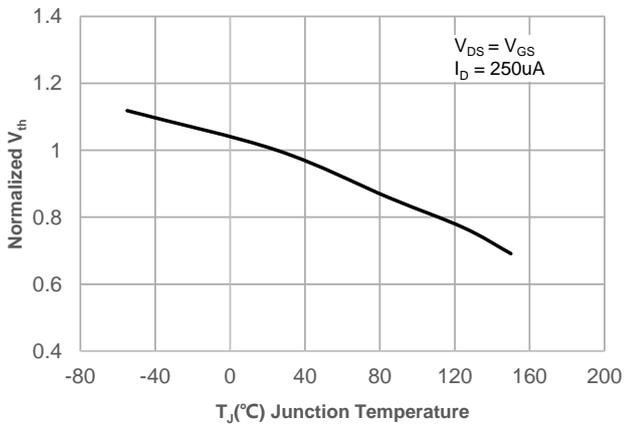


Figure 14: $R_{DS(ON)}$ vs. V_{GS}

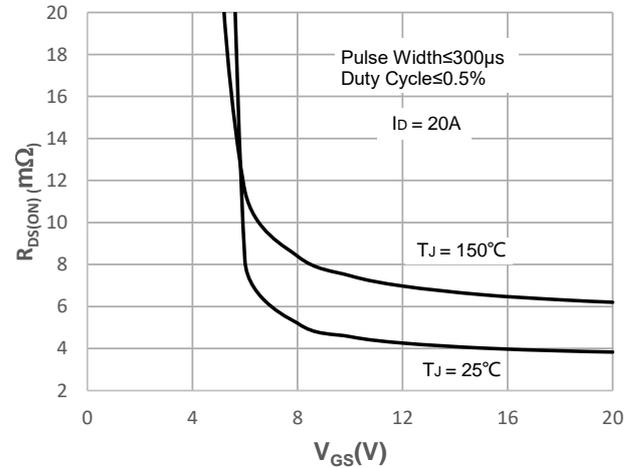
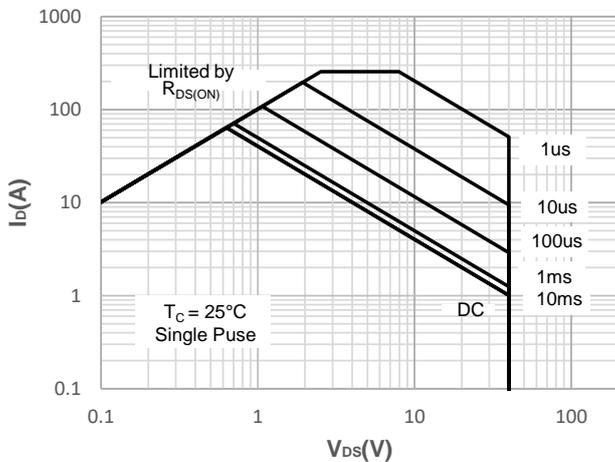
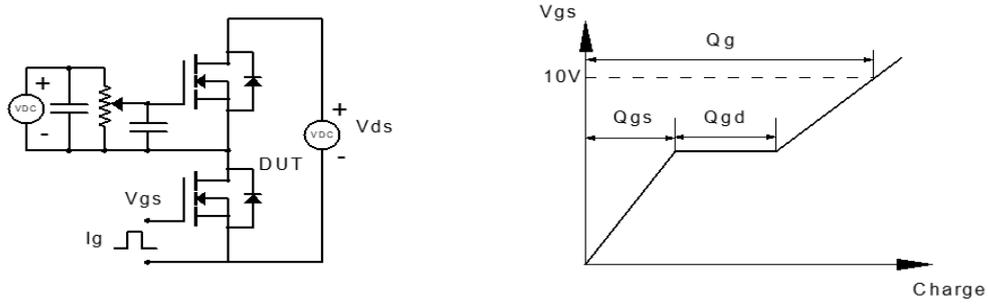
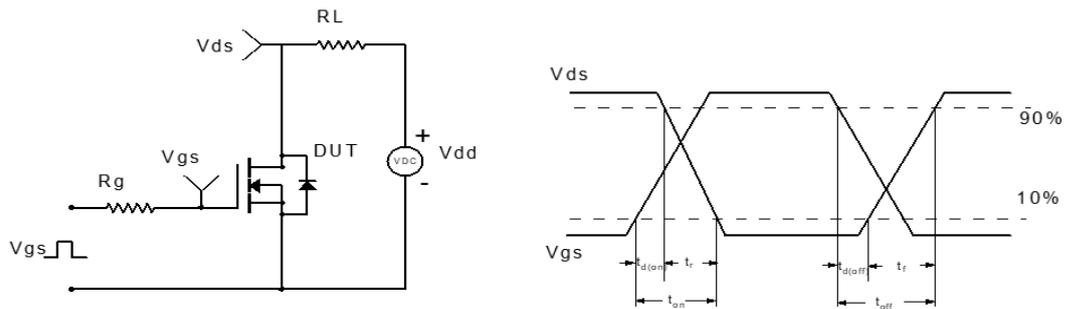
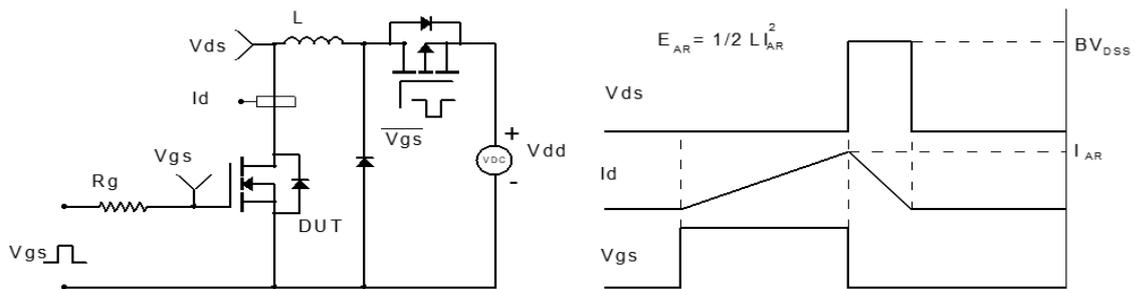
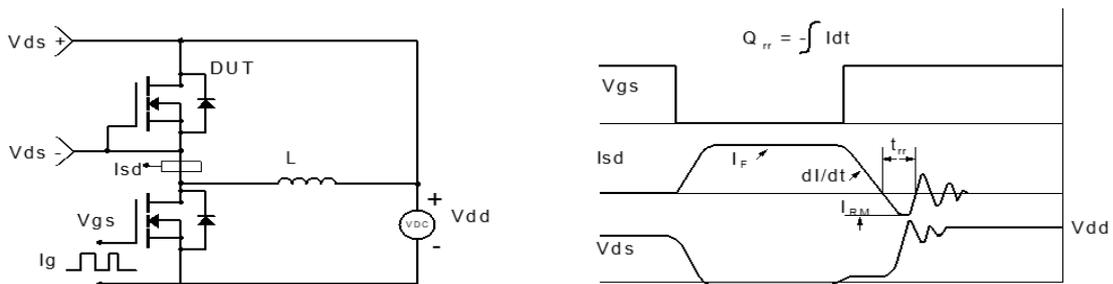


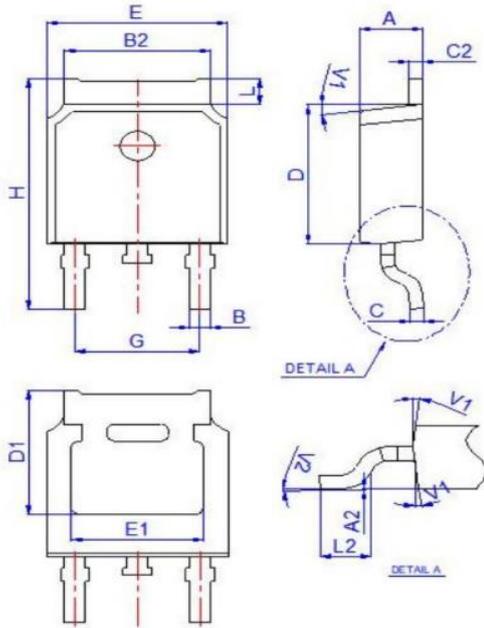
Figure 15: Maximum Safe Operating Area



Test Circuit

Figure 1: Gate Charge Test Circuit & Waveform

Figure 2: Resistive Switching Test Circuit & Waveform

Figure 3: Unclamped Inductive Switching Test Circuit & Waveform

Figure 4: Diode Recovery Test Circuit & Waveform

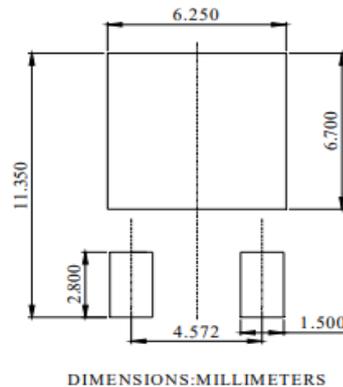

Package Mechanical Data(TO-252-3L)

Package Outline



| Ref. | Dimensions | | | | | |
|------|-------------|------|-------|----------|------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 2.10 | | 2.50 | 0.083 | | 0.098 |
| A2 | 0 | | 0.10 | 0 | | 0.004 |
| B | 0.66 | | 0.86 | 0.026 | | 0.034 |
| B2 | 5.18 | | 5.48 | 0.202 | | 0.216 |
| C | 0.40 | | 0.60 | 0.016 | | 0.024 |
| C2 | 0.44 | | 0.58 | 0.017 | | 0.023 |
| D | 5.90 | | 6.30 | 0.232 | | 0.248 |
| D1 | 5.30REF | | | 0.209REF | | |
| E | 6.40 | | 6.80 | 0.252 | | 0.268 |
| E1 | 4.63 | | | 0.182 | | |
| G | 4.47 | | 4.67 | 0.176 | | 0.184 |
| H | 9.50 | | 10.70 | 0.374 | | 0.421 |
| L | 1.09 | | 1.21 | 0.043 | | 0.048 |
| L2 | 1.35 | | 1.65 | 0.053 | | 0.065 |
| V1 | | 7° | | | 7° | |
| V2 | 0° | | 6° | 0° | | 6° |

Recommended Soldering Footprint



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