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FEATURES

IEEE802.3af Compatible

- ❑ Avalanche Rugged Technology
- ❑ Rugged Gate Oxide Technology
- ❑ Lower Input Capacitance
- ❑ Improved Gate Charge
- ❑ Extended Safe Operating Area
- ❑ Lower Leakage Current : 10  $\mu$ A (Max.) @  $V_{DS}$  = 100V
- ❑ Lower  $R_{DS(ON)}$  : 0.155  $\Omega$  (Typ.)

$BV_{DSS} = 100\text{ V}$

$R_{DS(on)} = 0.2\ \Omega$

$I_D = 2.3\text{ A}$

SOT-223



1. Gate 2. Drain 3. Source

Absolute Maximum Ratings

| Symbol         | Characteristic                                                          | Value        | Units                 |
|----------------|-------------------------------------------------------------------------|--------------|-----------------------|
| $V_{DSS}$      | Drain-to-Source Voltage                                                 | 100          | V                     |
| $I_D$          | Continuous Drain Current ( $T_A=25^{\circ}\text{C}$ )                   | 2.3          | A                     |
|                | Continuous Drain Current ( $T_A=70^{\circ}\text{C}$ )                   | 1.84         |                       |
| $I_{DM}$       | Drain Current-Pulsed ①                                                  | 18           | A                     |
| $V_{GS}$       | Gate-to-Source Voltage                                                  | $\pm 20$     | V                     |
| $E_{AS}$       | Single Pulsed Avalanche Energy ②                                        | 123          | mJ                    |
| $I_{AR}$       | Avalanche Current ①                                                     | 2.3          | A                     |
| $E_{AR}$       | Repetitive Avalanche Energy ①                                           | 0.24         | mJ                    |
| dv/dt          | Peak Diode Recovery dv/dt ③                                             | 6.5          | V/ns                  |
| $P_D$          | Total Power Dissipation ( $T_A=25^{\circ}\text{C}$ ) *                  | 2.4          | W                     |
|                | Linear Derating Factor *                                                | 0.019        | W/ $^{\circ}\text{C}$ |
| $T_J, T_{STG}$ | Operating Junction and Storage Temperature Range                        | - 55 to +150 | $^{\circ}\text{C}$    |
| $T_L$          | Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds | 300          |                       |

Thermal Resistance

| Symbol          | Characteristic        | Typ. | Max. | Units                |
|-----------------|-----------------------|------|------|----------------------|
| $R_{\theta JA}$ | Junction-to-Ambient * | --   | 52   | $^{\circ}\text{C/W}$ |

\* When mounted on the minimum pad size recommended (PCB Mount).

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

| Symbol                 | Characteristic                          | Min. | Typ. | Max. | Units               | Test Condition                                                               |
|------------------------|-----------------------------------------|------|------|------|---------------------|------------------------------------------------------------------------------|
| $BV_{DSS}$             | Drain-Source Breakdown Voltage          | 100  | --   | --   | V                   | $V_{GS}=0V, I_D=250\mu A$                                                    |
| $\Delta BV/\Delta T_J$ | Breakdown Voltage Temp. Coeff.          | --   | 0.12 | --   | V/ $^\circ\text{C}$ | $I_D=250\mu A$ <b>See Fig 7</b>                                              |
| $V_{GS(th)}$           | Gate Threshold Voltage                  | 2.0  | --   | 4.0  | V                   | $V_{DS}=5V, I_D=250\mu A$                                                    |
| $I_{GSS}$              | Gate-Source Leakage, Forward            | --   | --   | 100  | nA                  | $V_{GS}=20V$                                                                 |
|                        | Gate-Source Leakage, Reverse            | --   | --   | -100 | nA                  | $V_{GS}=-20V$                                                                |
| $I_{DSS}$              | Drain-to-Source Leakage Current         | --   | --   | 1    | $\mu A$             | $V_{DS}=30V$ ⑥                                                               |
|                        |                                         | --   | --   | 10   |                     | $V_{DS}=100V$                                                                |
|                        |                                         | --   | --   | 100  |                     | $V_{DS}=80V, T_A=125^\circ\text{C}$                                          |
| $R_{DS(on)}$           | Static Drain-Source On-State Resistance | --   | --   | 0.2  | $\Omega$            | $V_{GS}=10V, I_D=1.15A$ ④                                                    |
| $g_{fs}$               | Forward Transconductance                | --   | 3.12 | --   | S                   | $V_{DS}=40V, I_D=1.15A$ ④                                                    |
| $C_{iss}$              | Input Capacitance                       | --   | 370  | 480  | pF                  | $V_{GS}=0V, V_{DS}=25V, f=1\text{MHz}$<br><b>See Fig 5</b>                   |
| $C_{oss}$              | Output Capacitance                      | --   | 95   | 110  |                     |                                                                              |
| $C_{rss}$              | Reverse Transfer Capacitance            | --   | 38   | 45   |                     |                                                                              |
| $t_{d(on)}$            | Turn-On Delay Time                      | --   | 14   | 40   | ns                  | $V_{DD}=50V, I_D=9.2A,$<br>$R_G=18\Omega$<br><b>See Fig 13</b> ④ ⑤           |
| $t_r$                  | Rise Time                               | --   | 14   | 40   |                     |                                                                              |
| $t_{d(off)}$           | Turn-Off Delay Time                     | --   | 36   | 90   |                     |                                                                              |
| $t_f$                  | Fall Time                               | --   | 28   | 70   |                     |                                                                              |
| $Q_g$                  | Total Gate Charge                       | --   | 16   | 22   | nC                  | $V_{DS}=80V, V_{GS}=10V,$<br>$I_D=9.2A$<br><b>See Fig 6 &amp; Fig 12</b> ④ ⑤ |
| $Q_{gs}$               | Gate-Source Charge                      | --   | 2.7  | --   |                     |                                                                              |
| $Q_{gd}$               | Gate-Drain("Miller") Charge             | --   | 7.8  | --   |                     |                                                                              |

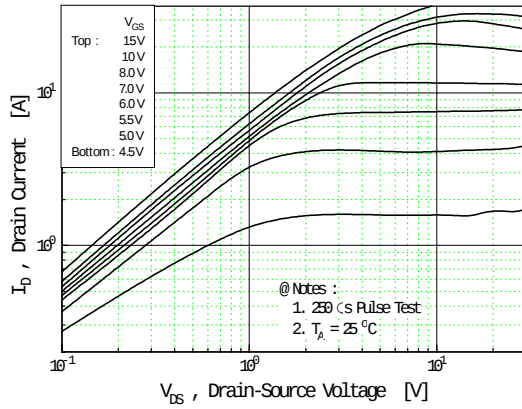
**Source-Drain Diode Ratings and Characteristics**

| Symbol   | Characteristic            | Min. | Typ. | Max. | Units   | Test Condition                              |
|----------|---------------------------|------|------|------|---------|---------------------------------------------|
| $I_S$    | Continuous Source Current | --   | --   | 2.3  | A       | Integral reverse pn-diode in the MOSFET     |
| $I_{SM}$ | Pulsed-Source Current ①   | --   | --   | 18   |         |                                             |
| $V_{SD}$ | Diode Forward Voltage ④   | --   | --   | 1.5  | V       | $T_J=25^\circ\text{C}, I_S=2.3A, V_{GS}=0V$ |
| $t_{rr}$ | Reverse Recovery Time     | --   | 98   | --   | ns      | $T_J=25^\circ\text{C}, I_F=9.2A$            |
| $Q_{rr}$ | Reverse Recovery Charge   | --   | 0.34 | --   | $\mu C$ | $di_F/dt=100A/\mu s$ ④                      |

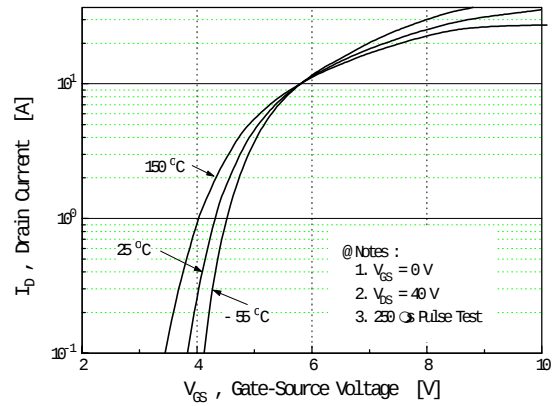
**Notes ;**

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ②  $L=35\text{mH}, I_{AS}=2.3A, V_{DD}=25V, R_G=27\Omega$ , Starting  $T_J=25^\circ\text{C}$
- ③  $I_{SD}\leq 9.2A, di/dt\leq 300A/\mu s, V_{DD}\leq BV_{DSS}$ , Starting  $T_J=25^\circ\text{C}$
- ④ Pulse Test : Pulse Width =  $250\mu s$ , Duty Cycle  $\leq 2\%$
- ⑤ Essentially Independent of Operating Temperature
- ⑥ Adjusted for Cisco

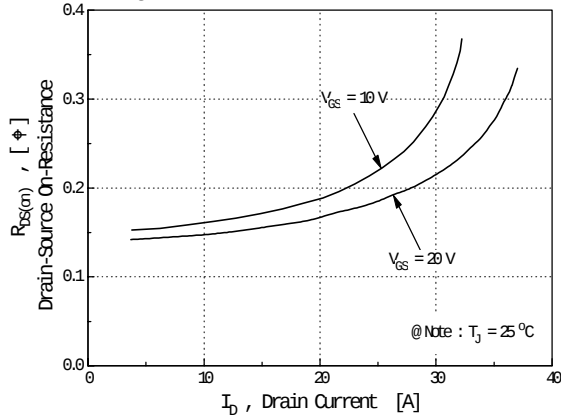
**Fig 1. Output Characteristics**



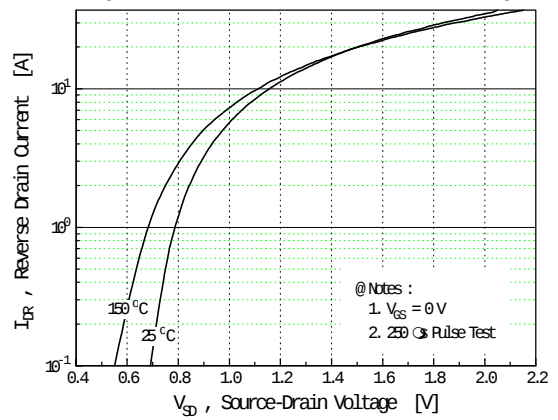
**Fig 2. Transfer Characteristics**



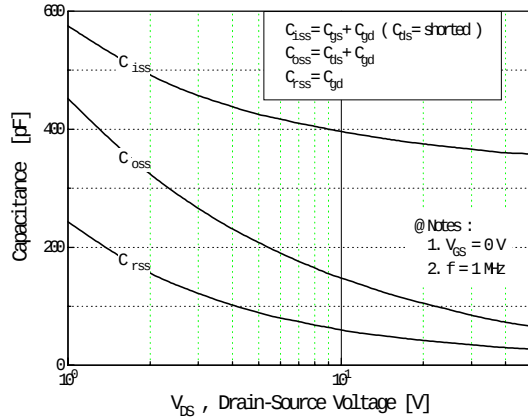
**Fig 3. On-Resistance vs. Drain Current**



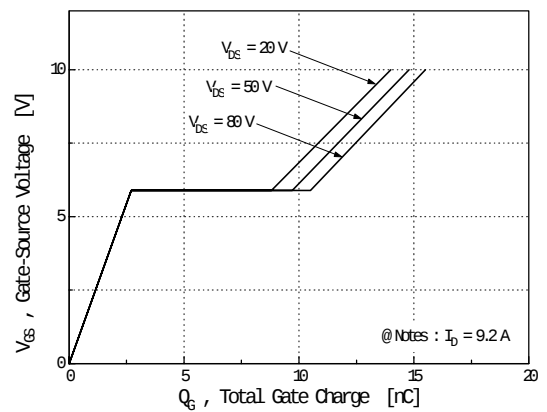
**Fig 4. Source-Drain Diode Forward Voltage**



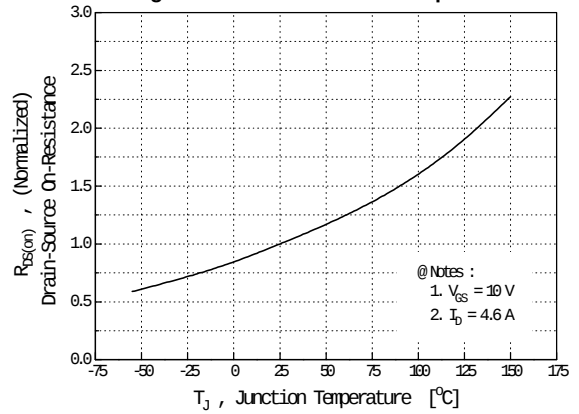
**Fig 5. Capacitance vs. Drain-Source Voltage**



**Fig 6. Gate Charge vs. Gate-Source Voltage**



**Fig 8. On-Resistance vs. Temperature**



**Fig 10. Max. Drain Current vs. Ambient Temperature**

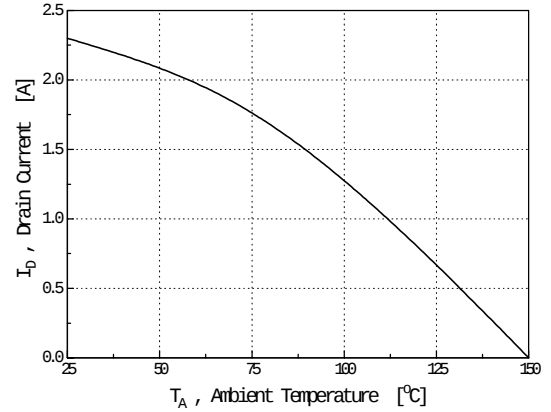


Figure 1 is a log-log plot showing the Thermal Response  $Z_{JA}(t)$  on the y-axis (ranging from  $10^{-1}$  to  $10^2$ ) versus the Square Wave Pulse Duration  $t_1$  in seconds on the x-axis (ranging from  $10^{-5}$  to  $10^3$ ). The plot displays several curves for different duty factors  $D$  (0.01, 0.02, 0.05, 0.1, 0.2, 0.5). A curve labeled 'single pulse' is also shown. An inset diagram illustrates a square wave pulse with peak power  $P_{DM}$ , pulse width  $t_1$ , and period  $t_2$ . The duty factor  $D$  is defined as  $D = t_1/t_2$ . The thermal response is calculated using the equation  $Z_{JA}(t) = P_{DM} \cdot Z_{JA}(t)$ .

Fig 12. Gate Charge Test Circuit & Waveform

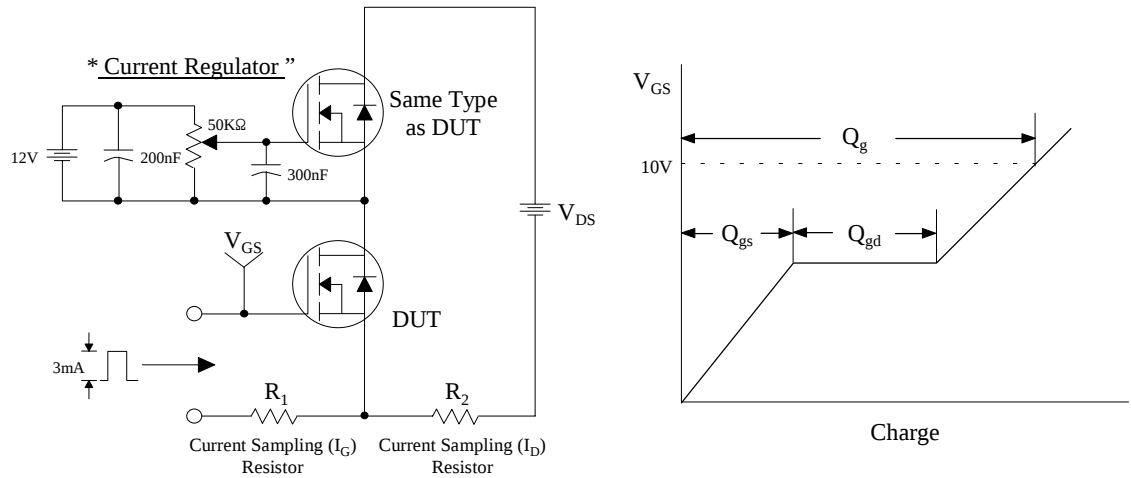


Fig 13. Resistive Switching Test Circuit & Waveforms

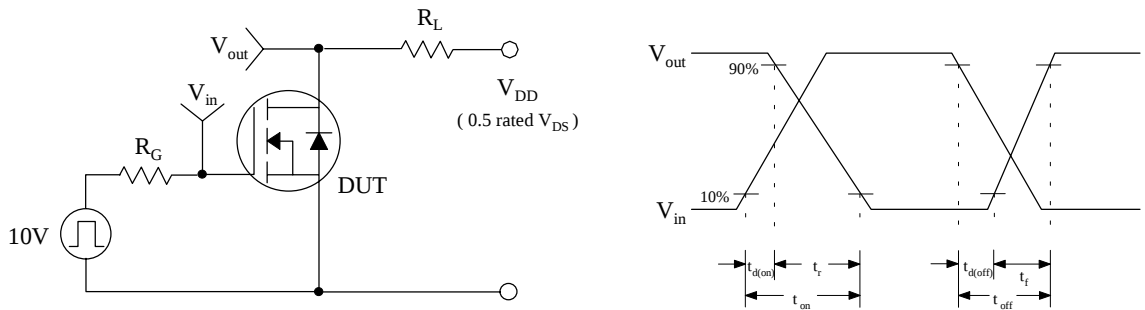


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

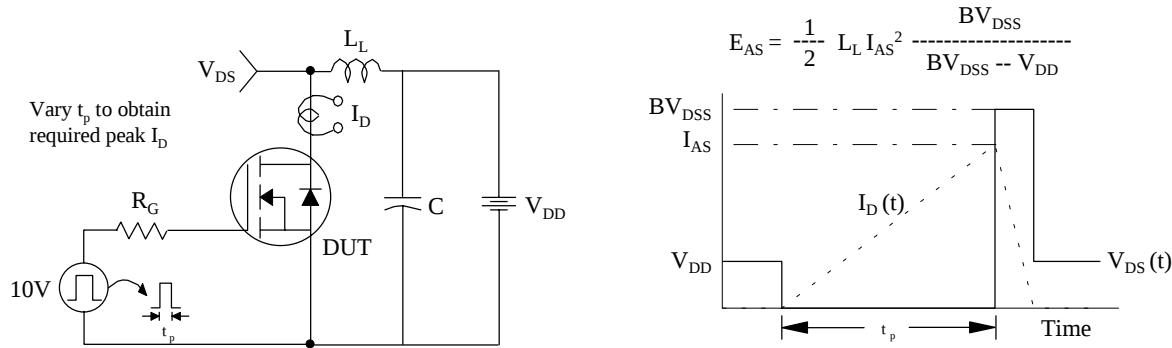
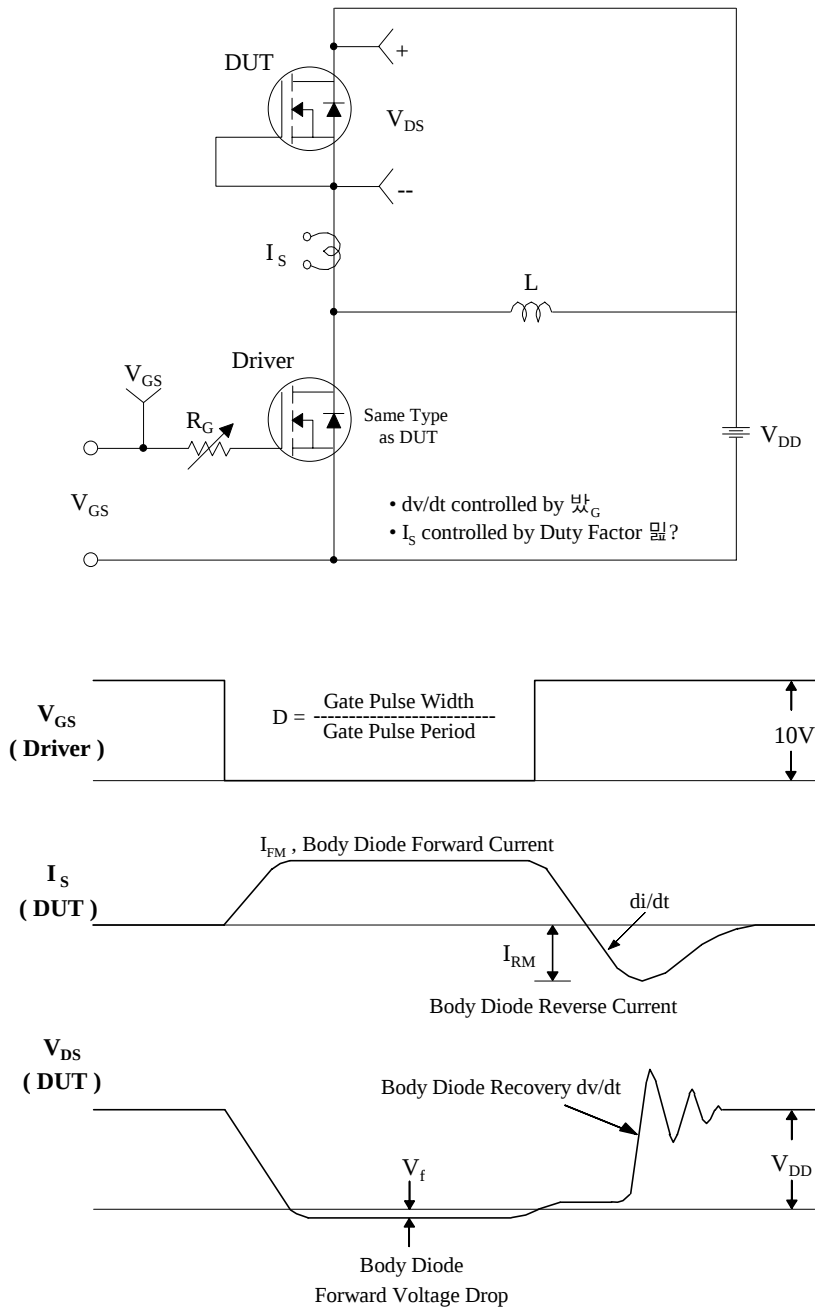
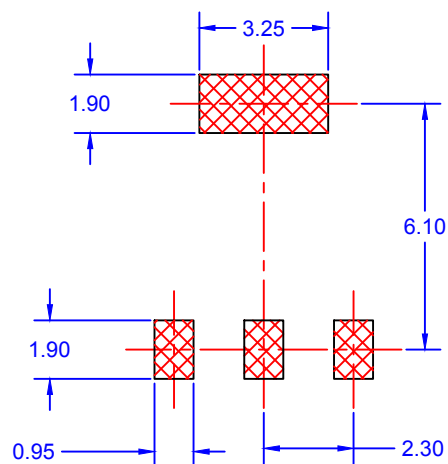
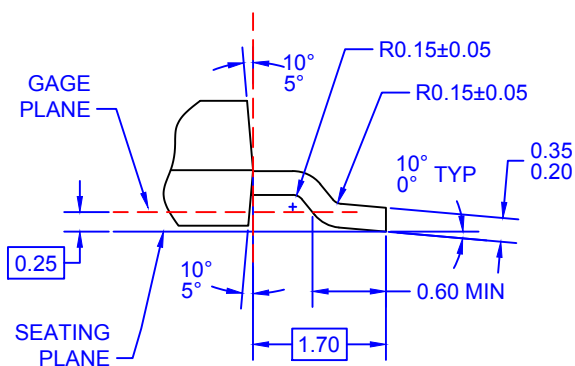
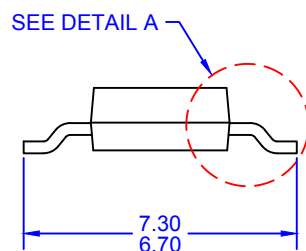
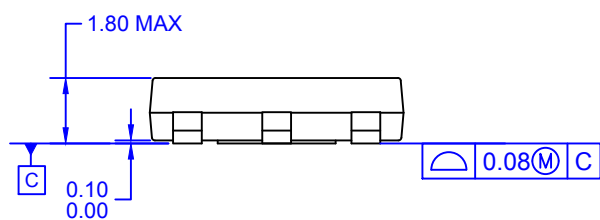


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms





## LAND PATTERN RECOMMENDATION



**DETAIL A**  
**SCALE: 2:1**

NOTES: UNLESS OTHERWISE SPECIFIED

- A) DRAWING BASED ON JEDEC REGISTRATION TO-261C, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
- E) LANDPATTERN NAME: SOT230P700X180-4BN
- F) DRAWING FILENAME: MKT-MA04AREV3



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