

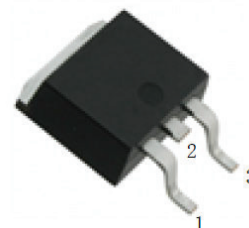
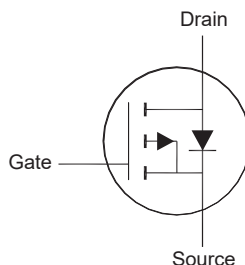
## P-Channel Enhancement Mode MOSFET

### Features

- Advanced trench cell design
- High speed switch
- Halogen and Antimony Free(HAF), RoHS compliant

### Applications

- Portable appliances
- Battery management



1.Gate 2.Drain 3.Source  
TO-252 Plastic Package

### Key Parameters

| Parameter         | Value                         | Unit |
|-------------------|-------------------------------|------|
| $-BV_{DS}$        | 100                           | V    |
| $R_{DS(ON)}$ Max  | 68 @ $-V_{GS} = 10\text{ V}$  | mΩ   |
|                   | 78 @ $-V_{GS} = 4.5\text{ V}$ |      |
| $-V_{GS(th)}$ typ | 1.3                           | V    |
| $Q_g$ typ         | 71 @ $-V_{GS} = 10\text{ V}$  | nC   |

### Absolute Maximum Ratings (at $T_a = 25^\circ\text{C}$ unless otherwise specified)

| Parameter                                        | Symbol         | Value         | Unit             |
|--------------------------------------------------|----------------|---------------|------------------|
| Drain-Source Voltage                             | $-V_{DS}$      | 100           | V                |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 20$      | V                |
| Drain Current                                    | $-I_D$         | 22            | A                |
|                                                  |                | 13            |                  |
| Peak Drain Current <sup>1)</sup>                 | $-I_{DM}$      | 80            | A                |
| Avalanche Current                                | $-I_{AS}$      | 18.2          | A                |
| Single Pulse Avalanche Energy <sup>2)</sup>      | $E_{AS}$       | 82.8          | mJ               |
| Power Dissipation                                | $P_D$          | 64.9          | W                |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | - 55 to + 150 | $^\circ\text{C}$ |

### Thermal Characteristics

| Parameter                                                 | Symbol          | Max. | Unit               |
|-----------------------------------------------------------|-----------------|------|--------------------|
| Thermal Resistance from Junction to Case                  | $R_{\theta JC}$ | 1.9  | $^\circ\text{C/W}$ |
| Thermal Resistance from Junction to Ambient <sup>3)</sup> | $R_{\theta JA}$ | 35   | $^\circ\text{C/W}$ |

<sup>1)</sup> Pulse Test: Pulse Width  $\leq 100\text{ }\mu\text{s}$ , Duty Cycle  $\leq 2\%$ , Repetitive rating, pulse width limited by junction temperature  $T_{J(MAX)}=150^\circ\text{C}$ .

<sup>2)</sup> Limited by  $T_{J(MAX)}$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.5\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $-I_{AS} = 18.2\text{ A}$ ,  $V_{GS} = 10\text{ V}$ .

<sup>3)</sup> Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.

Characteristics at  $T_a = 25^\circ\text{C}$  unless otherwise specified

| Parameter                                                                                                                                                                              | Symbol        | Min.   | Typ.     | Max.      | Unit          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------|----------|-----------|---------------|
| <b>STATIC PARAMETERS</b>                                                                                                                                                               |               |        |          |           |               |
| Drain-Source Breakdown Voltage<br>at $-I_D = 250\ \mu\text{A}$                                                                                                                         | $-BV_{DS}$    | 100    | -        | -         | V             |
| Drain-Source Leakage Current<br>at $-V_{DS} = 100\ \text{V}$                                                                                                                           | $-I_{DSS}$    | -      | -        | 1         | $\mu\text{A}$ |
| Gate-Source Leakage Current<br>at $V_{GS} = \pm 20\ \text{V}$                                                                                                                          | $I_{GSS}$     | -      | -        | $\pm 100$ | nA            |
| Gate-Source Threshold Voltage<br>at $V_{DS} = V_{GS}$ , $-I_D = 250\ \mu\text{A}$                                                                                                      | $-V_{GS(th)}$ | 1      | -        | 2.3       | V             |
| Drain-Source On-State Resistance<br>at $-V_{GS} = 10\ \text{V}$ , $-I_D = 10\ \text{A}$<br>at $-V_{GS} = 4.5\ \text{V}$ , $-I_D = 8\ \text{A}$                                         | $R_{DS(on)}$  | -<br>- | 55<br>-  | 68<br>78  | m $\Omega$    |
| <b>DYNAMIC PARAMETERS</b>                                                                                                                                                              |               |        |          |           |               |
| Forward Transconductance<br>at $-V_{DS} = 5\ \text{V}$ , $-I_D = 8\ \text{A}$                                                                                                          | $g_{FS}$      | -      | 27.3     | -         | S             |
| Gate resistance<br>at $V_{DS} = 0\ \text{V}$ , $V_{GS} = 0\ \text{V}$ , $f = 1\ \text{MHz}$                                                                                            | $R_g$         | -      | 5.1      | -         | $\Omega$      |
| Input Capacitance<br>at $V_{GS} = 0\ \text{V}$ , $-V_{DS} = 50\ \text{V}$ , $f = 1\ \text{MHz}$                                                                                        | $C_{iss}$     | -      | 4177     | -         | pF            |
| Output Capacitance<br>at $V_{GS} = 0\ \text{V}$ , $-V_{DS} = 50\ \text{V}$ , $f = 1\ \text{MHz}$                                                                                       | $C_{oss}$     | -      | 95       | -         | pF            |
| Reverse Transfer Capacitance<br>at $V_{GS} = 0\ \text{V}$ , $-V_{DS} = 50\ \text{V}$ , $f = 1\ \text{MHz}$                                                                             | $C_{rss}$     | -      | 17       | -         | pF            |
| Gate charge total<br>at $-V_{DS} = 50\ \text{V}$ , $-I_D = 10\ \text{A}$ , $-V_{GS} = 10\ \text{V}$<br>at $-V_{DS} = 50\ \text{V}$ , $-I_D = 10\ \text{A}$ , $-V_{GS} = 4.5\ \text{V}$ | $Q_g$         | -<br>- | 71<br>33 | -<br>-    | nC            |
| Gate to Source Charge<br>at $-V_{DS} = 50\ \text{V}$ , $-I_D = 10\ \text{A}$ , $-V_{GS} = 10\ \text{V}$                                                                                | $Q_{gs}$      | -      | 12       | -         | nC            |
| Gate to Drain Charge<br>at $-V_{DS} = 50\ \text{V}$ , $-I_D = 10\ \text{A}$ , $-V_{GS} = 10\ \text{V}$                                                                                 | $Q_{gd}$      | -      | 9        | -         | nC            |
| Turn-On Delay Time<br>at $-V_{DD} = 50\ \text{V}$ , $-I_D = 10\ \text{A}$ , $-V_{GS} = 10\ \text{V}$ , $R_g = 3.3\ \Omega$                                                             | $t_{d(on)}$   | -      | 16       | -         | ns            |
| Turn-On Rise Time<br>at $-V_{DD} = 50\ \text{V}$ , $-I_D = 10\ \text{A}$ , $-V_{GS} = 10\ \text{V}$ , $R_g = 3.3\ \Omega$                                                              | $t_r$         | -      | 20       | -         | ns            |
| Turn-Off Delay Time<br>at $-V_{DD} = 50\ \text{V}$ , $-I_D = 10\ \text{A}$ , $-V_{GS} = 10\ \text{V}$ , $R_g = 3.3\ \Omega$                                                            | $t_{d(off)}$  | -      | 50       | -         | ns            |
| Turn-Off Fall Time<br>at $-V_{DD} = 50\ \text{V}$ , $-I_D = 10\ \text{A}$ , $-V_{GS} = 10\ \text{V}$ , $R_g = 3.3\ \Omega$                                                             | $t_f$         | -      | 9        | -         | ns            |
| <b>Body-Diode PARAMETERS</b>                                                                                                                                                           |               |        |          |           |               |
| Drain-Source Diode Forward Voltage<br>at $-I_S = 1\ \text{A}$ , $V_{GS} = 0\ \text{V}$                                                                                                 | $-V_{SD}$     | -      | -        | 1.3       | V             |
| Body-Diode Continuous Current                                                                                                                                                          | $-I_S$        | -      | -        | 22        | A             |
| Body-Diode Continuous Current, Pulsed                                                                                                                                                  | $-I_{SM}$     | -      | -        | 80        | A             |
| Body Diode Reverse Recovery Time<br>at $-I_S = 10\ \text{A}$ , $di/dt = 100\ \text{A} / \mu\text{s}$                                                                                   | $t_{rr}$      | -      | 28.5     | -         | ns            |
| Body Diode Reverse Recovery Charge<br>at $-I_S = 10\ \text{A}$ , $di/dt = 100\ \text{A} / \mu\text{s}$                                                                                 | $Q_{rr}$      | -      | 40       | -         | nC            |

## Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

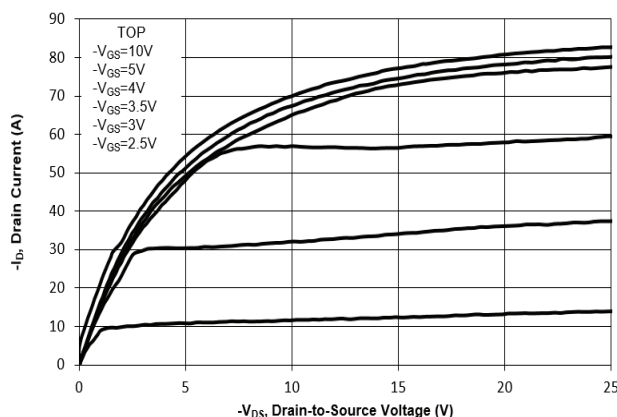


Fig. 2 Typical Transfer Characteristics

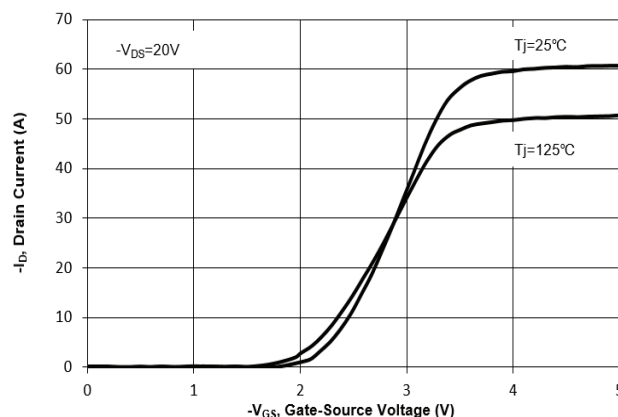


Fig. 3 On-Resistance vs. Drain Current

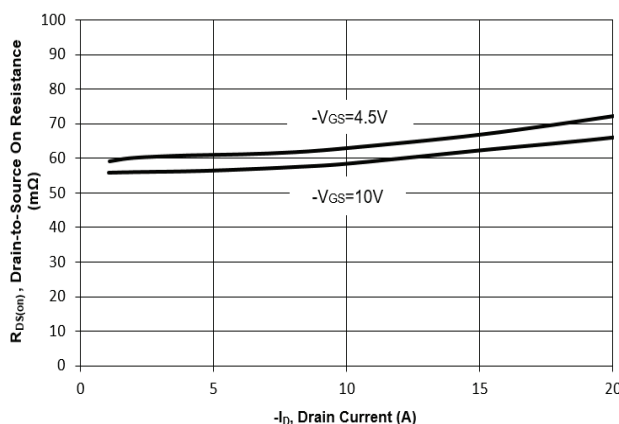


Fig. 4 On-Resistance vs. Gate to Source Voltage

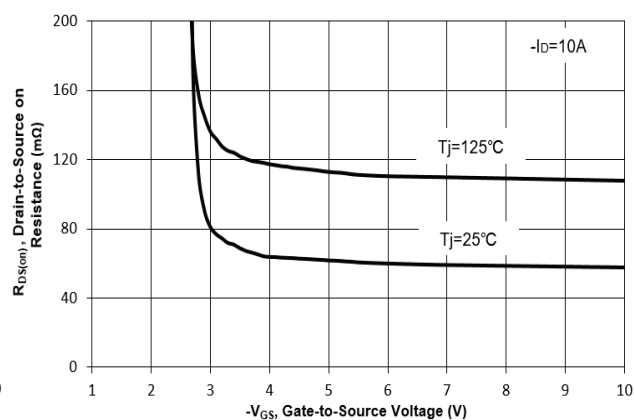


Fig. 5 On-Resistance vs. TJ

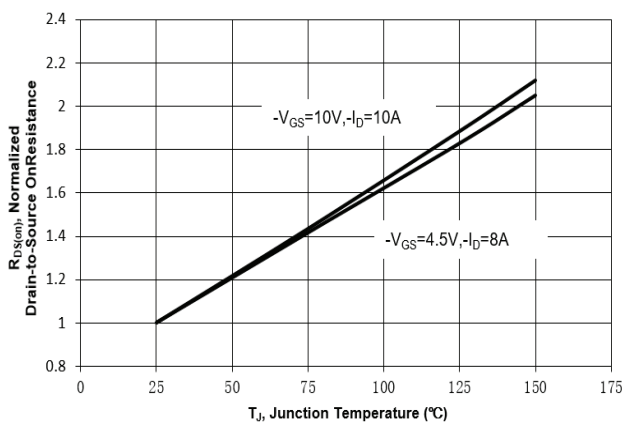
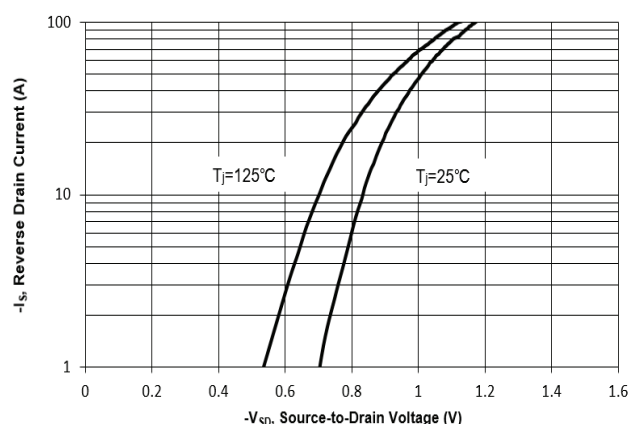


Fig. 6 Typical Body-Diode Forward Characteristics



## Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

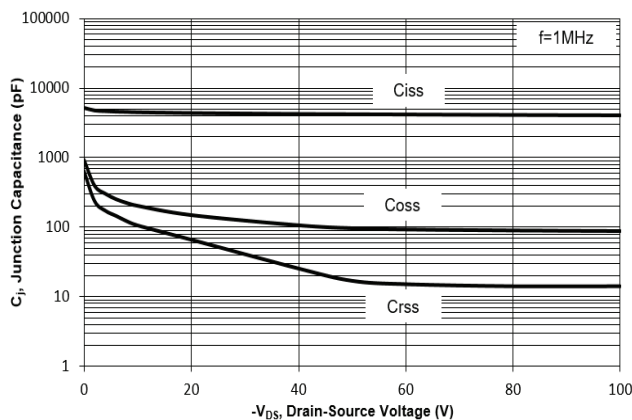


Fig. 8 Drain-Source Leakage Current vs.  $T_J$

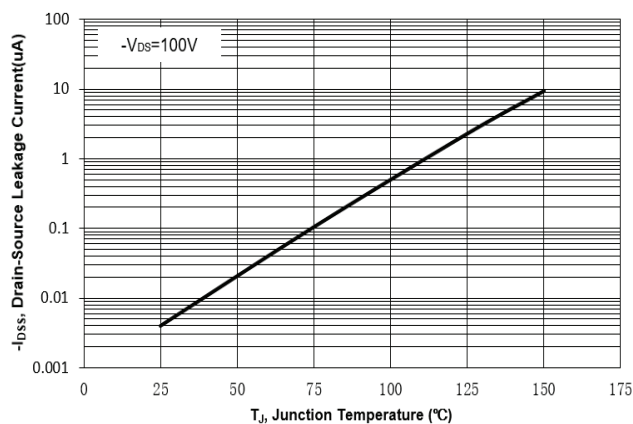


Fig. 9  $V_{(BR)DSS}$  vs. Junction Temperature

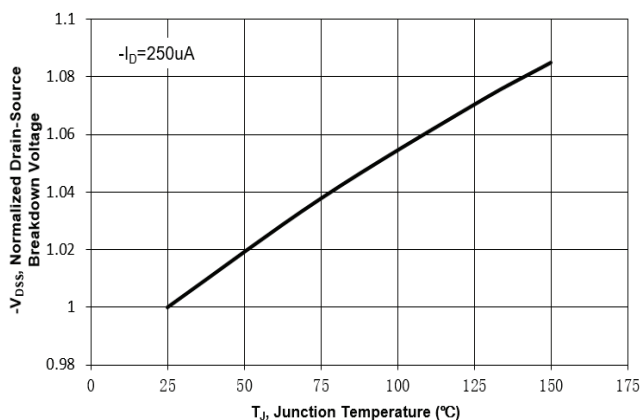


Fig. 10 Gate Threshold Variation vs.  $T_J$

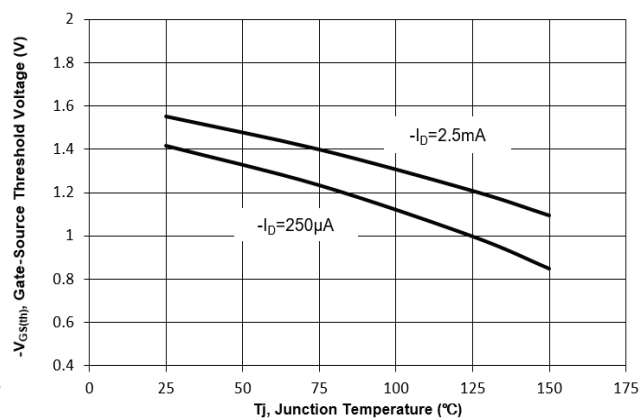


Fig. 11 Gate Charge

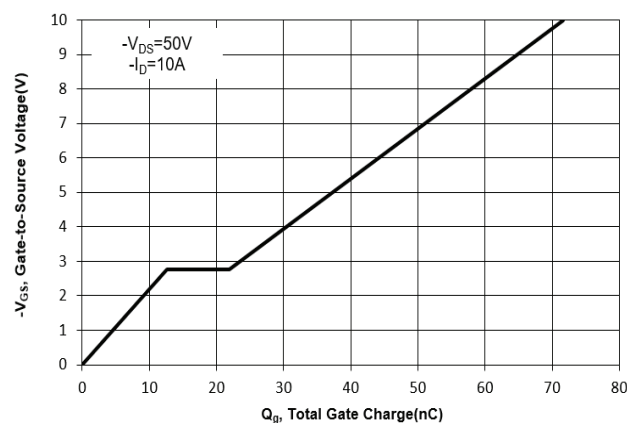
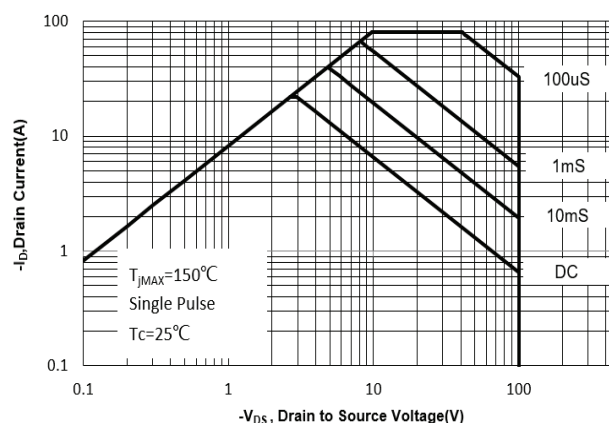


Fig. 12 Safe Operation Area



## Electrical Characteristics Curves

Fig. 13 Normalized Maximum Transient Thermal Impedance( $Z_{\theta JC}$ )

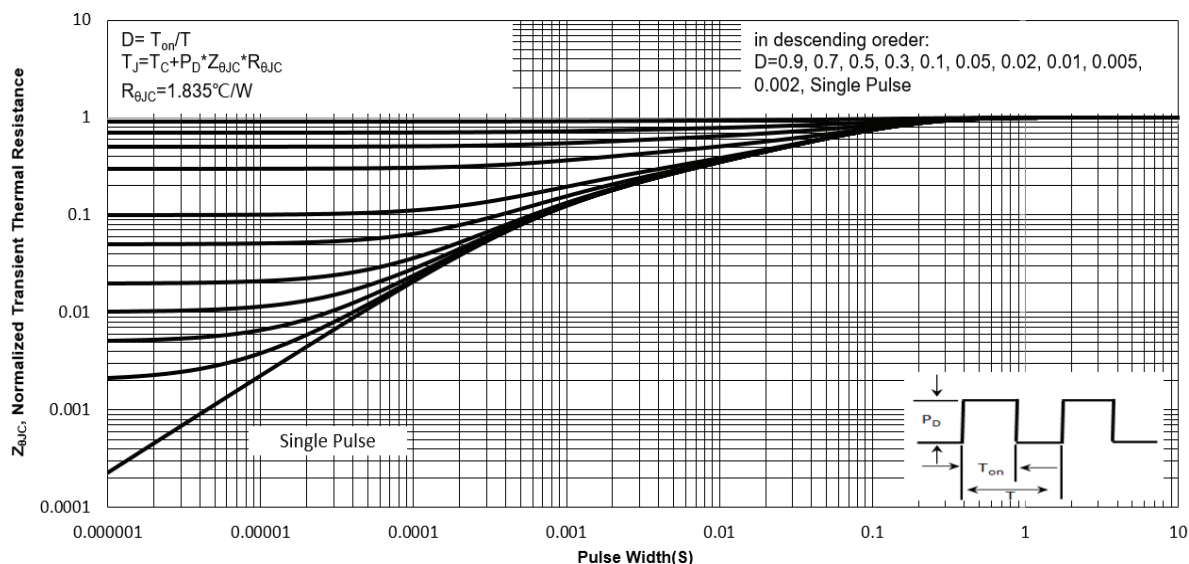
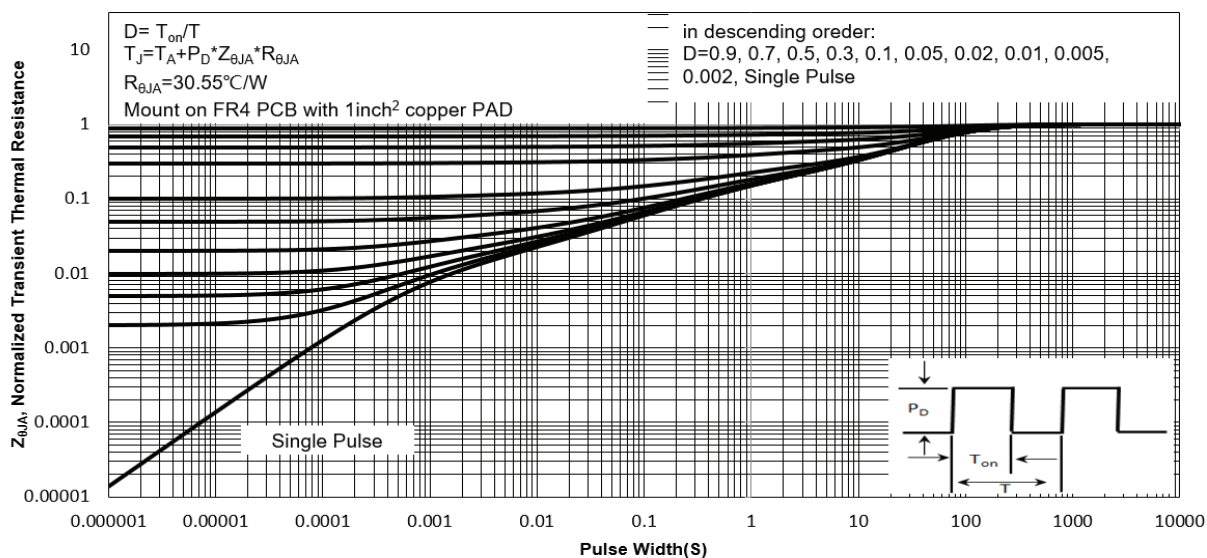
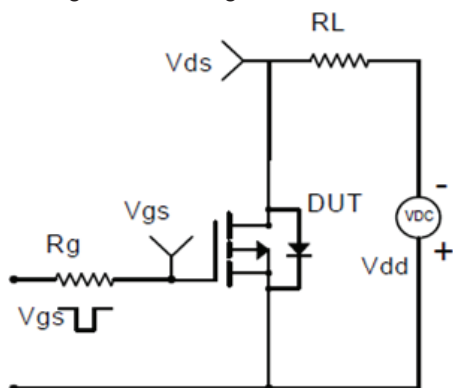
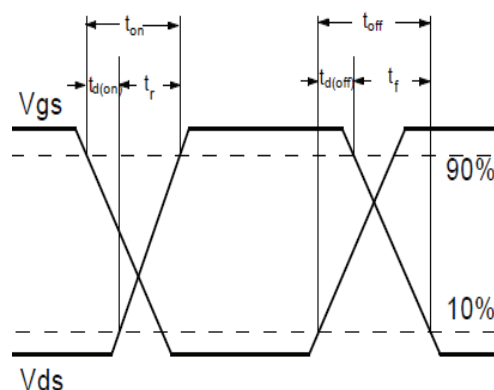
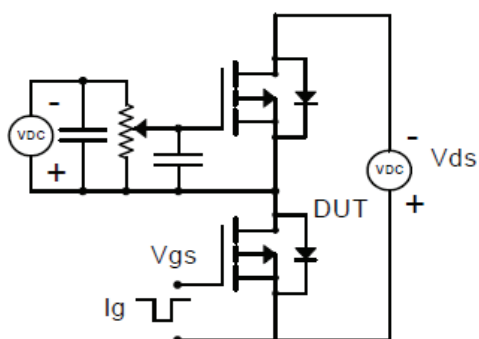
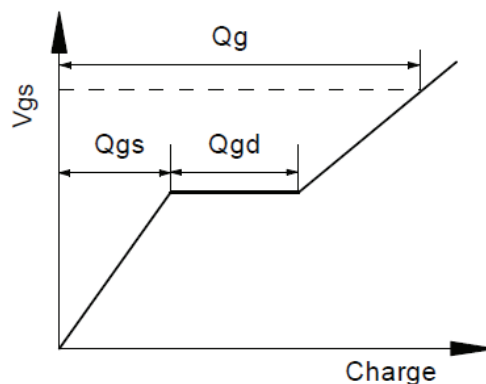
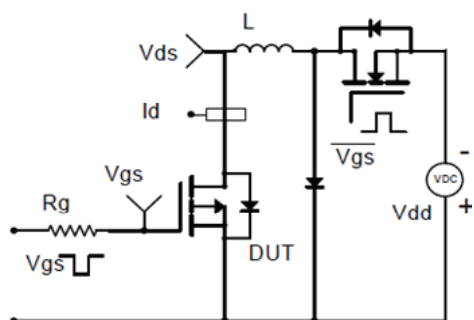
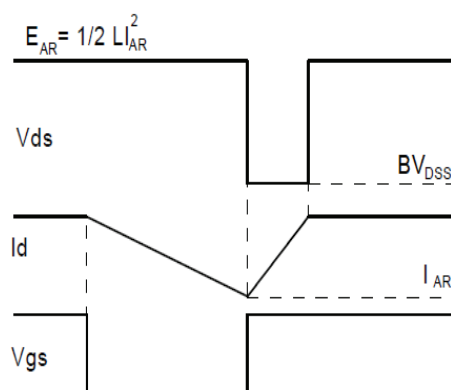


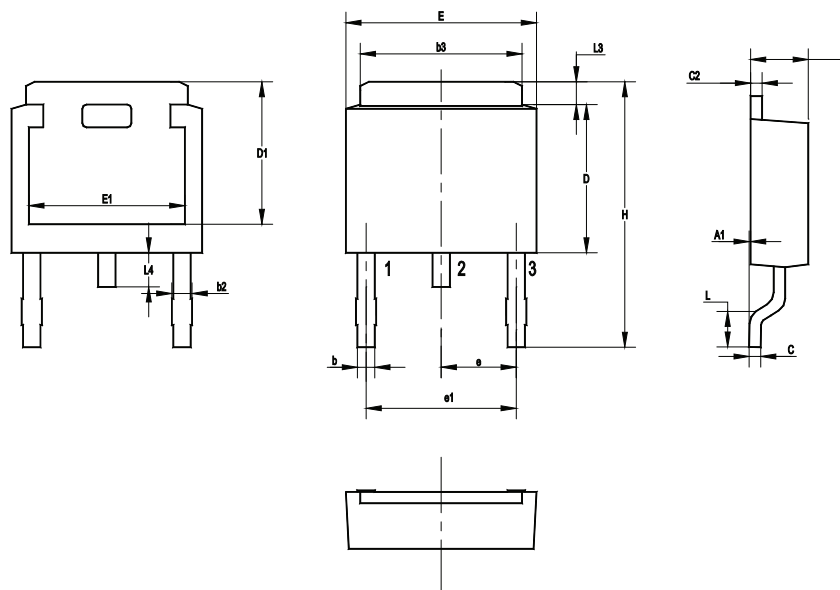
Fig. 14 Normalized Maximum Transient Thermal Impedance( $Z_{\theta JA}$ )



**Test Circuits**
**Fig.1-1 Switching times test circuit**

**Fig.1-2 Switching Waveform**

**Fig.2-1 Gate charge test circuit**

**Fig.2-2 Gate charge waveform**

**Fig.3-1 Avalanche test circuit**

**Fig.3-2 Avalanche waveform**


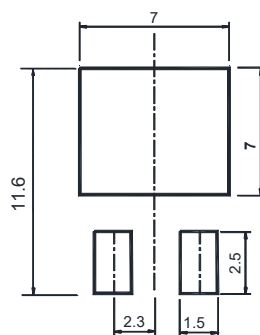
Package Outline (Dimensions in mm)

TO-252



| UNIT | A   | A1   | b   | b2   | b3  | C    | C2   | D   | D1  | E   | E1  | e    | e1   | H    | L    | L3   | L4   |
|------|-----|------|-----|------|-----|------|------|-----|-----|-----|-----|------|------|------|------|------|------|
| mm   | 2.5 | 0.15 | 1.0 | 0.65 | 5.5 | 0.65 | 0.65 | 6.2 | 5.4 | 6.7 | 5.0 | 2.30 | 4.60 | 10.7 | 1.78 | 1.20 | 0.51 |
|      | 2.1 | 0    | 0.5 | 1.15 | 4.9 | 0.4  | 0.4  | 5.6 | 5.0 | 6.1 | 4.6 | TYP  | TYP  | 9    | 1.40 | 0.85 | 1.10 |

Recommended Soldering Footprint



Packing information

| Package | Tape Width (mm) | Pitch   |               | Reel Size |      | Per Reel Packing Quantity |
|---------|-----------------|---------|---------------|-----------|------|---------------------------|
|         |                 | mm      | inch          | mm        | inch |                           |
| TO-252  | 16              | 8 ± 0.1 | 0.315 ± 0.004 | 330       | 13   | 2,500                     |

Marking information

" TR10P680L " = Part No.

" \*\*\*\*\* " = Date Code Marking

Font type: Arial



Disclaimer: Our company reserve the right to make modifications, enhancements, improvements, corrections or other changes to improve product design, functions and reliability, anytime without notice.