

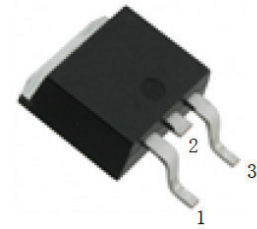
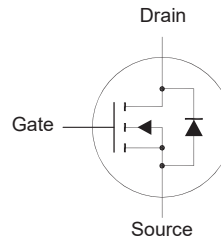
## N-Channel Enhancement Mode MOSFET

### Features

- Low  $R_{DS(ON)}$
- Fully Characterized Capacitance and Avalanche
- Halogen and Antimony Free(HAF),  
RoHS compliant

### Application

- Synchronous Rectification
- BLDC Motor drive applications
- Battery powered circuits



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

### Key Parameters

| Parameter        | Value                        | Unit |
|------------------|------------------------------|------|
| $BV_{DSS}$       | 100                          | V    |
| $R_{DS(ON)}$ Max | 17 @ $V_{GS} = 10\text{ V}$  | mΩ   |
|                  | 23 @ $V_{GS} = 4.5\text{ V}$ |      |
| $V_{GS(th)}$ typ | 2                            | V    |
| $Q_g$ typ        | 22 @ $V_{GS} = 10\text{ V}$  | 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                |
| Continuous Drain Current                                      | $I_D$          | 44            | A                |
|                                                               |                | 30            |                  |
| Peak Drain Current, Pulsed <sup>1)</sup>                      | $I_{DM}$       | 140           | A                |
| Avalanche Current                                             | $I_{AS}$       | 17.4          | A                |
| Single Pulse Avalanche Energy <sup>2)</sup>                   | $E_{AS}$       | 15            | mJ               |
| Drain-Source Voltage, Spike ( $t_p = 10\text{ }\mu\text{s}$ ) | $V_{SPIKE}$    | 120           | V                |
| Power Dissipation                                             | $P_{tot}$      | 62.5          | W                |
|                                                               |                | 3             |                  |
| Operating Junction and Storage Temperature Range              | $T_J, T_{stg}$ | - 55 to + 175 | $^\circ\text{C}$ |

### Thermal Characteristics

| Parameter                                                 | Symbol          | Max. | Unit               |
|-----------------------------------------------------------|-----------------|------|--------------------|
| Thermal Resistance from Junction to Case                  | $R_{\theta JC}$ | 2.4  | $^\circ\text{C/W}$ |
| Thermal Resistance from Junction to Ambient <sup>3)</sup> | $R_{\theta JA}$ | 50   | $^\circ\text{C/W}$ |

<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  $T_{J(MAX)} = 175^\circ\text{C}$ .

<sup>2)</sup> Limited by  $T_{J(MAX)}$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 0.1\text{ mH}$ ,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 17.4\text{ A}$ ,  $V_{GS} = 10\text{ V}$ .

<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 $I_D = 1\text{ mA}$                                                                                                                 | $BV_{DS}$    | 100    | -          | -         | V             |
| Drain-Source Leakage Current<br>at $V_{DS} = 100\text{ V}$                                                                                                               | $I_{DSS}$    | -      | -          | 1         | $\mu\text{A}$ |
| Gate Leakage Current<br>at $V_{GS} = \pm 20\text{ V}$                                                                                                                    | $I_{GSS}$    | -      | -          | $\pm 100$ | nA            |
| Gate-Source Threshold Voltage<br>at $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                                                   | $V_{GS(th)}$ | 1.2    | -          | 2.5       | V             |
| Drain-Source On-State Resistance<br>at $V_{GS} = 10\text{ V}$ , $I_D = 7\text{ A}$<br>at $V_{GS} = 4.5\text{ V}$ , $I_D = 5\text{ A}$                                    | $R_{DS(on)}$ | -<br>- | 14<br>18.7 | 17<br>23  | m $\Omega$    |
| <b>DYNAMIC PARAMETERS</b>                                                                                                                                                |              |        |            |           |               |
| Forward Transconductance<br>at $V_{DS} = 5\text{ V}$ , $I_D = 7\text{ A}$                                                                                                | $g_{fs}$     | -      | 16         | -         | S             |
| Gate resistance<br>at $V_{GS} = 0\text{ V}$ , $V_{DS} = 0\text{ V}$ , $f = 1\text{ MHz}$                                                                                 | $R_g$        | -      | 0.6        | -         | $\Omega$      |
| Input Capacitance<br>at $V_{GS} = 0\text{ V}$ , $V_{DS} = 40\text{ V}$ , $f = 1\text{ MHz}$                                                                              | $C_{iss}$    | -      | 1093       | -         | pF            |
| Output Capacitance<br>at $V_{GS} = 0\text{ V}$ , $V_{DS} = 40\text{ V}$ , $f = 1\text{ MHz}$                                                                             | $C_{oss}$    | -      | 538        | -         | pF            |
| Reverse Transfer Capacitance<br>at $V_{GS} = 0\text{ V}$ , $V_{DS} = 40\text{ V}$ , $f = 1\text{ MHz}$                                                                   | $C_{rss}$    | -      | 69         | -         | pF            |
| Gate charge total<br>at $V_{DS} = 50\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 7\text{ A}$<br>at $V_{DS} = 50\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 7\text{ A}$ | $Q_g$        | -<br>- | 22<br>12   | -<br>-    | nC            |
| Gate to Source Charge<br>at $V_{DS} = 50\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 7\text{ A}$                                                                         | $Q_{gs}$     | -      | 3          | -         | nC            |
| Gate to Drain Charge<br>at $V_{DS} = 50\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 7\text{ A}$                                                                          | $Q_{gd}$     | -      | 6          | -         | nC            |
| Turn-On Delay Time<br>at $V_{DS} = 50\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 7\text{ A}$ , $R_g = 4.7\text{ }\Omega$                                                | $t_{d(on)}$  | -      | 14         | -         | ns            |
| Turn-On Rise Time<br>at $V_{DS} = 50\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 7\text{ A}$ , $R_g = 4.7\text{ }\Omega$                                                 | $t_r$        | -      | 8          | -         | ns            |
| Turn-Off Delay Time<br>at $V_{DS} = 50\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 7\text{ A}$ , $R_g = 4.7\text{ }\Omega$                                               | $t_{d(off)}$ | -      | 14         | -         | ns            |
| Turn-Off Fall Time<br>at $V_{DS} = 50\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 7\text{ A}$ , $R_g = 4.7\text{ }\Omega$                                                | $t_f$        | -      | 5          | -         | 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         | V             |
| Body-Diode Continuous Current                                                                                                                                            | $I_S$        | -      | -          | 44        | A             |
| Body-Diode Continuous Current, Pulsed                                                                                                                                    | $I_{SM}$     | -      | -          | 140       | A             |
| Body Diode Reverse Recovery Time<br>at $I_S = 7\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$                                                                           | $t_{rr}$     | -      | 37         | -         | ns            |
| Body Diode Reverse Recovery Charge<br>at $I_S = 7\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$                                                                         | $Q_{rr}$     | -      | 32         | -         | nC            |

## Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

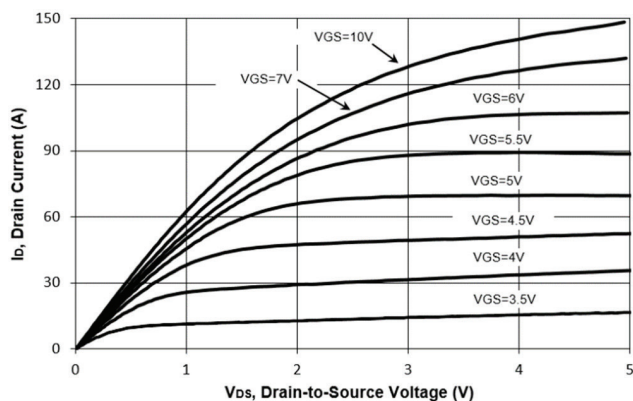


Fig. 2 Typical Transfer Characteristics

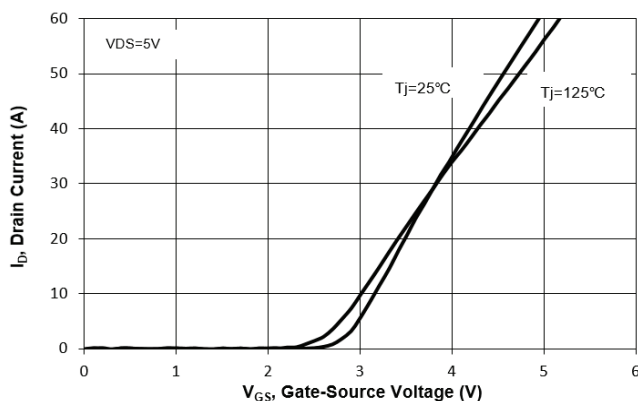


Fig. 3 On-Resistance vs. Drain Current

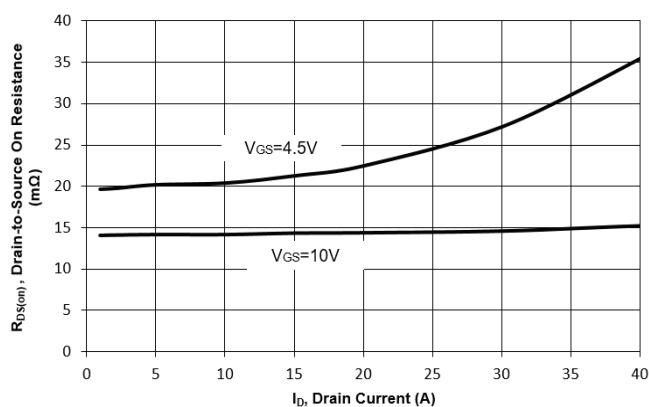


Fig. 4 on-Resistance vs. Gate to Source Voltage

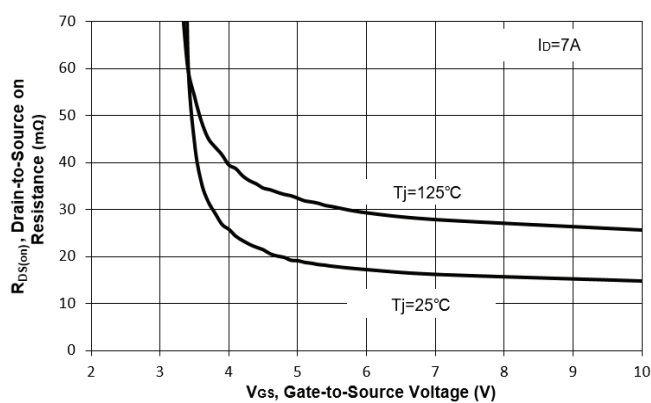


Fig. 5 on-Resistance vs.  $T_J$

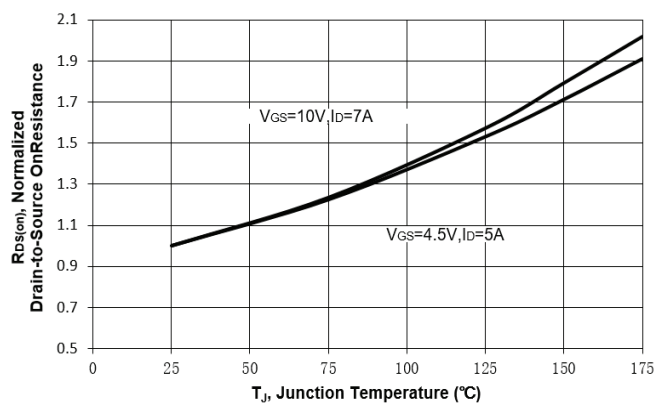
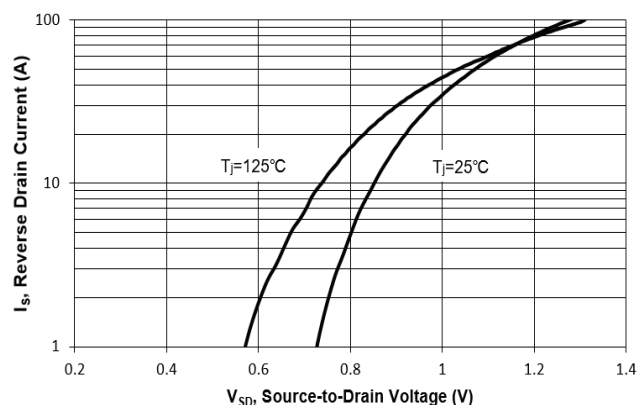


Fig. 6 Typical Body-Diode Forward Characteristics



## Electrical Characteristics Curves

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

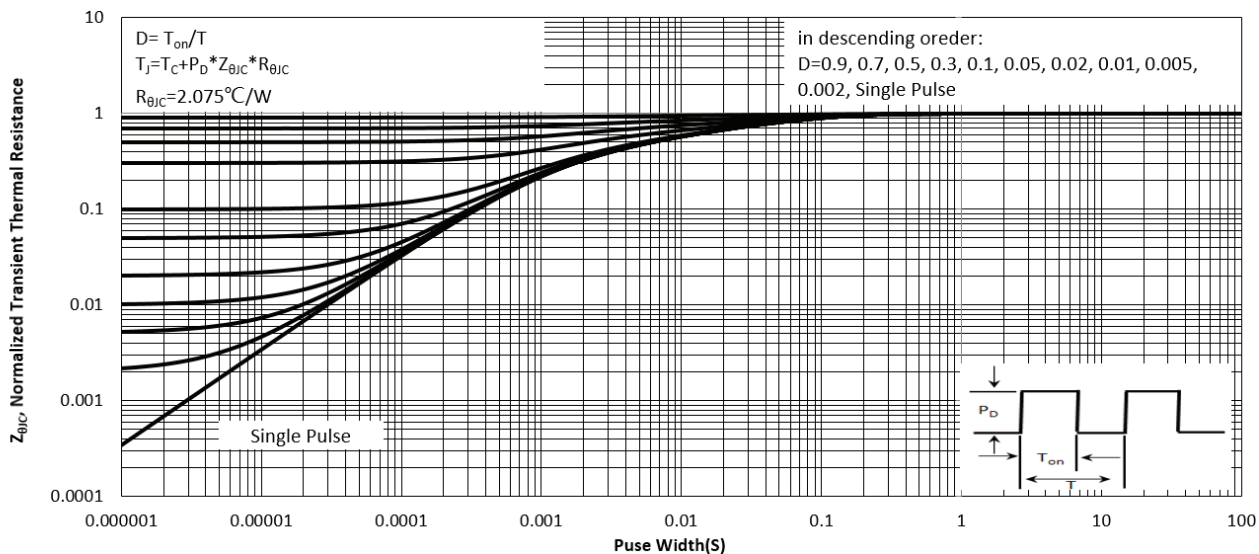


Fig. 14 Normalized Maximum Transient Thermal Impedance( $Z_{\theta JA}$ )

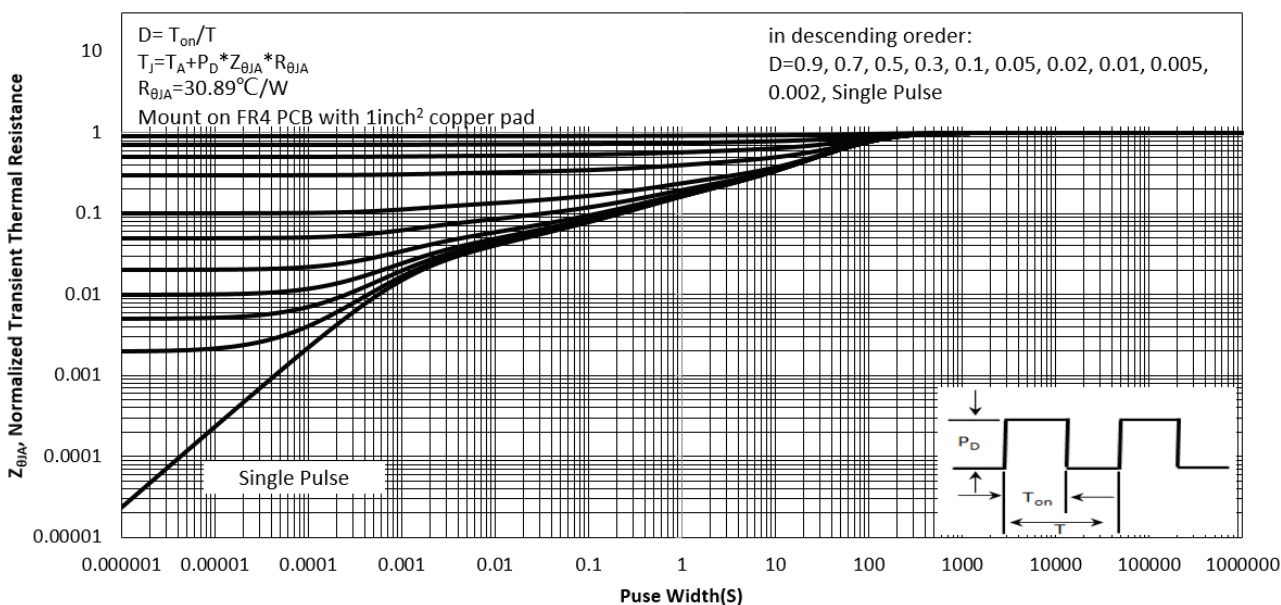


Fig. 7 Typical Junction Capacitance

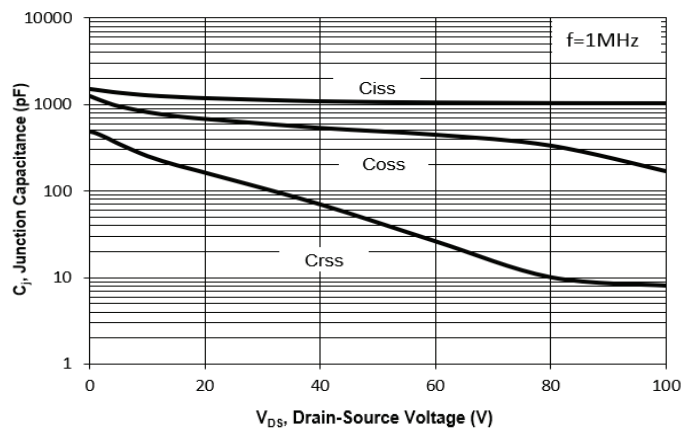


Fig. 8 Drain-Source Leakage Current vs.  $T_J$

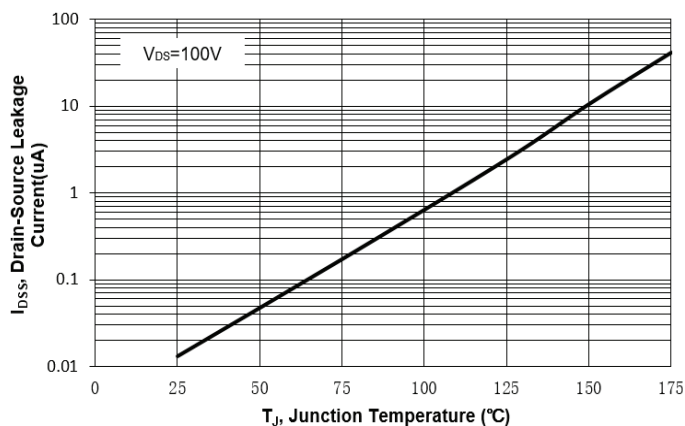


Fig. 9  $V_{(BR)DSS}$  vs. Junction Temperature

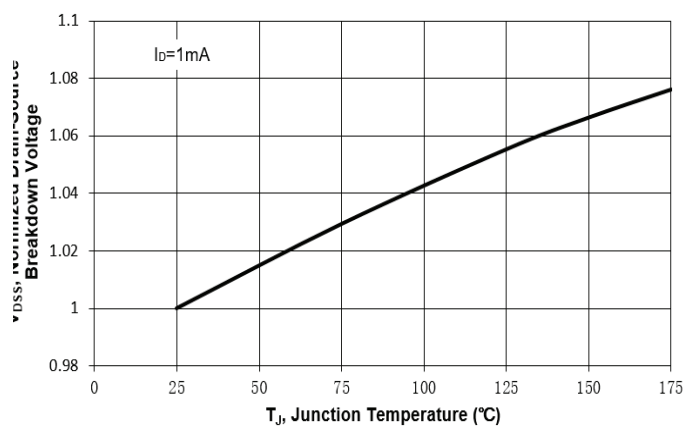


Fig. 10 Gate Threshold Variation vs.  $T_J$

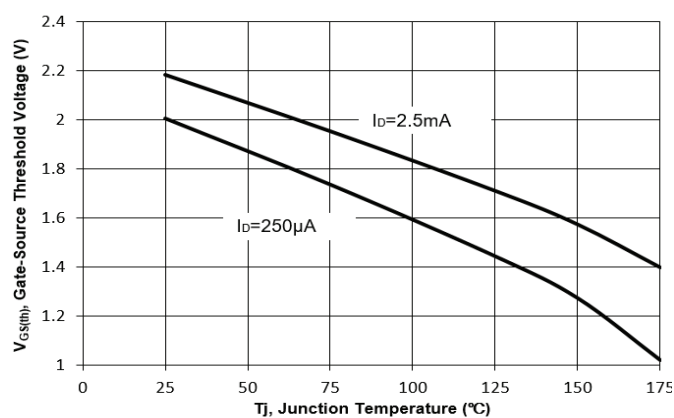


Fig. 11 Gate Charge

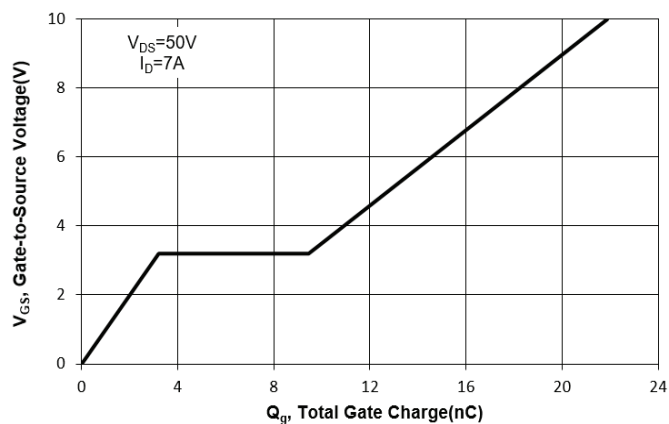
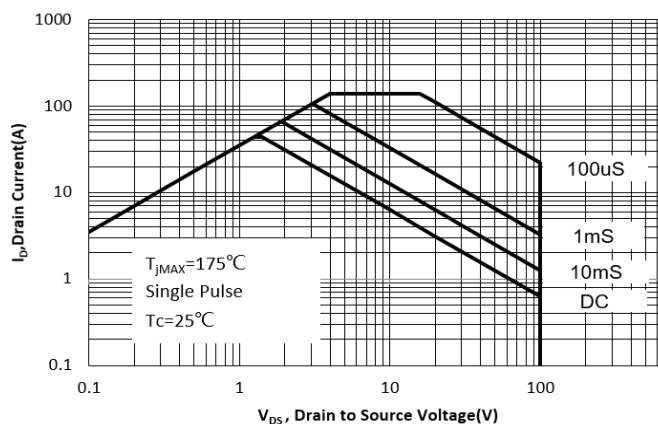
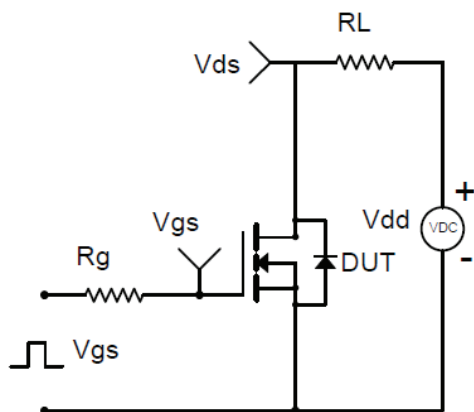
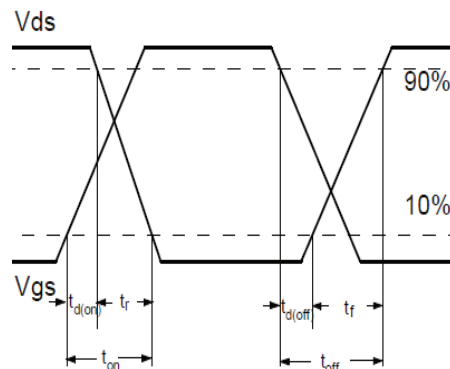
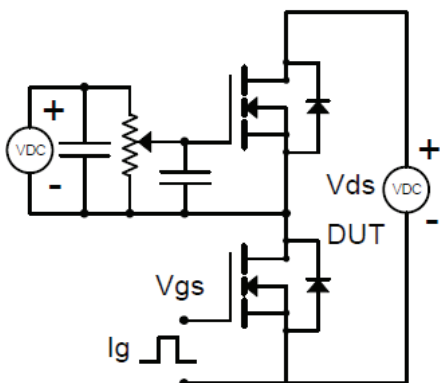
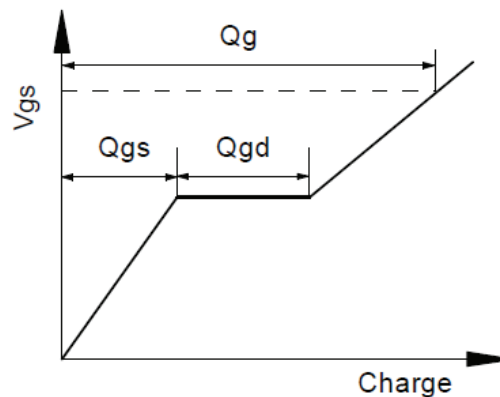
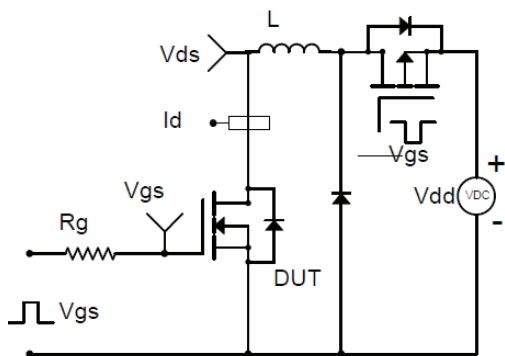
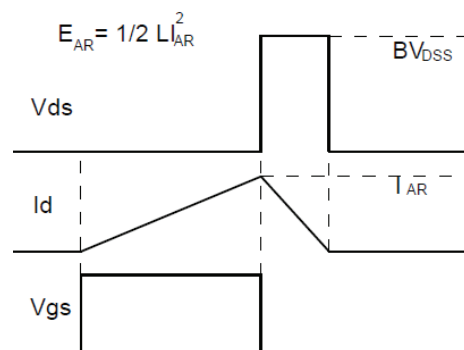


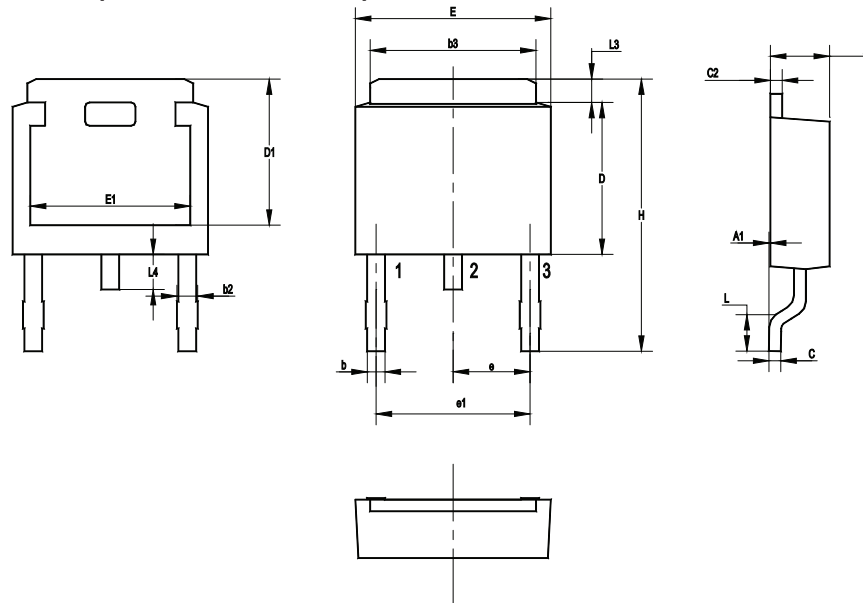
Fig. 12 SOA, Safe Operating Area



**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**


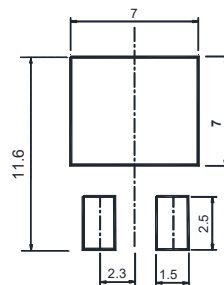
Package Outline (Dimensions in mm)

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 | 1.15 | 5.5 | 0.65 | 0.65 | 6.2 | 5.4 | 6.7 | 5.0 | 2.30 | 4.60 | 10.7 | 1.78 | 1.20 | 1.10 |
|      | 2.1 | 0    | 0.5 | 0.65 | 4.9 | 0.4  | 0.4  | 5.6 | 5.0 | 6.1 | 4.6 | TYP. | TYP. | 9    | 1.40 | 0.85 | 0.51 |

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

" DR10N170LS " = Part No.

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

Font type: Arial



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