

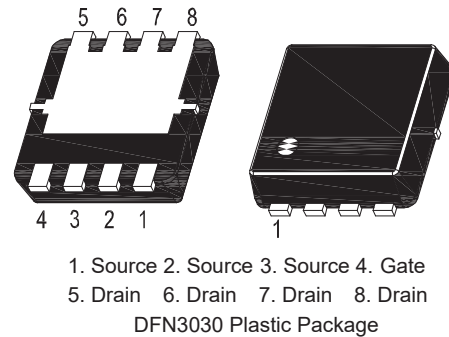
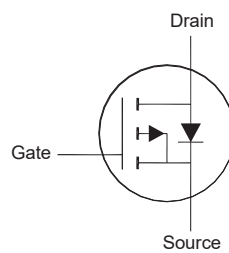
## P-Channel Enhancement Mode MOSFET

### Features

- Low  $R_{DS(ON)}$
- Surface-mounted package
- Low Gate-Source Threshold Voltage
- Halogen and Antimony Free(HAF), RoHS compliant

### Applications

- Load switch
- Battery Switch



### Key Parameters

| Parameter         | Value                  | Unit      |
|-------------------|------------------------|-----------|
| $-BV_{DSS}$       | 30                     | V         |
| $R_{DS(ON)}$ Max  | 15 @ $-V_{GS} = 10$ V  | $m\Omega$ |
|                   | 19 @ $-V_{GS} = 4.5$ V |           |
| $-V_{GS(th)}$ typ | 1.6                    | V         |
| $Q_g$ typ         | 27 @ $-V_{GS} = 10$ V  | nC        |

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

| Parameter                                        | Symbol         | Value         | Unit             |
|--------------------------------------------------|----------------|---------------|------------------|
| Drain-Source Voltage                             | $-V_{DS}$      | 30            | V                |
| Gate-Source Voltage                              | $V_{GS}$       | $\pm 25$      | V                |
| Drain Current                                    | $-I_D$         | 33            | A                |
|                                                  |                | 20.7          |                  |
| Peak Drain Current <sup>1)</sup>                 | $-I_{DM}$      | 132           | A                |
| Avalanche Current                                | $-I_{AS}$      | 28            | A                |
| Avalanche Energy <sup>2)</sup>                   | $E_{AS}$       | 39.2          | mJ               |
| Total Power Dissipation                          | $P_{tot}$      | 21.9          | 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                  | $R_{\theta JC}$ | 5.7  | $^\circ\text{C/W}$ |
| Thermal Resistance from Junction to Ambient <sup>3)</sup> | $R_{\theta JA}$ | 65   | $^\circ\text{C/W}$ |

<sup>1)</sup> Pulse Test: Pulse Width  $\leq 100 \mu\text{s}$ , 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  $T_J = 25^\circ\text{C}$ ,  $L = 0.1$  mH,  $R_g = 25 \Omega$ ,  $-I_{AS} = 28$  A,  $V_{GS} = 10$  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 $-I_D = 250\ \mu\text{A}$                                                                                                                         | $-BV_{DSS}$   | 30     | -         | -         | V             |
| Drain-Source On-State Current<br>at $-V_{DS} = 24\ \text{V}$                                                                                                                           | $-I_{DSS}$    | -      | -         | 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      | -         | 2.5       | V             |
| Drain-Source On-State Resistance<br>at $-V_{GS} = 10\ \text{V}$ , $-I_D = 10\ \text{A}$<br>at $-V_{GS} = 4.5\ \text{V}$ , $-I_D = 7\ \text{A}$                                         | $R_{DS(ON)}$  | -<br>- | 11.6<br>- | 15<br>19  | m $\Omega$    |
| <b>DYNAMIC PARAMETERS</b>                                                                                                                                                              |               |        |           |           |               |
| Forward Transconductance<br>at $-V_{DS} = 5\ \text{V}$ , $-I_D = 7\ \text{A}$                                                                                                          | $g_{fs}$      | -      | 18        | -         | S             |
| Gate resistance<br>at $V_{GS} = 0\ \text{V}$ , $V_{DS} = 0\ \text{V}$ , $f = 1\ \text{MHz}$                                                                                            | $R_g$         | -      | 4.4       | -         | $\Omega$      |
| Input Capacitance<br>at $V_{GS} = 0\ \text{V}$ , $-V_{DS} = 15\ \text{V}$ , $f = 1\ \text{MHz}$                                                                                        | $C_{iss}$     | -      | 1369      | -         | pF            |
| Output Capacitance<br>at $V_{GS} = 0\ \text{V}$ , $-V_{DS} = 15\ \text{V}$ , $f = 1\ \text{MHz}$                                                                                       | $C_{oss}$     | -      | 168       | -         | pF            |
| Reverse Transfer Capacitance<br>at $V_{GS} = 0\ \text{V}$ , $-V_{DS} = 15\ \text{V}$ , $f = 1\ \text{MHz}$                                                                             | $C_{rss}$     | -      | 128       | -         | pF            |
| Total Gate Charge<br>at $-V_{GS} = 10\ \text{V}$ , $-V_{DS} = 15\ \text{V}$ , $-I_D = 10\ \text{A}$<br>at $-V_{GS} = 4.5\ \text{V}$ , $-V_{DS} = 15\ \text{V}$ , $-I_D = 10\ \text{A}$ | $Q_g$         | -<br>- | 27<br>13  | -<br>-    | nC            |
| Gate-Source Charge<br>at $-V_{GS} = 10\ \text{V}$ , $-V_{DS} = 15\ \text{V}$ , $-I_D = 10\ \text{A}$                                                                                   | $Q_{gs}$      | -      | 4.6       | -         | nC            |
| Gate-Drain Charge<br>at $-V_{GS} = 10\ \text{V}$ , $-V_{DS} = 15\ \text{V}$ , $-I_D = 10\ \text{A}$                                                                                    | $Q_{gd}$      | -      | 5.5       | -         | nC            |
| Turn-On Delay Time<br>at $-V_{GS} = 10\ \text{V}$ , $-V_{DD} = 15\ \text{V}$ , $-I_D = 10\ \text{A}$ , $R_G = 3.3\ \Omega$                                                             | $t_{d(on)}$   | -      | 10        | -         | ns            |
| Turn-On Rise Time<br>at $-V_{GS} = 10\ \text{V}$ , $-V_{DD} = 15\ \text{V}$ , $-I_D = 10\ \text{A}$ , $R_G = 3.3\ \Omega$                                                              | $t_r$         | -      | 25        | -         | ns            |
| Turn-Off Delay Time<br>at $-V_{GS} = 10\ \text{V}$ , $-V_{DD} = 15\ \text{V}$ , $-I_D = 10\ \text{A}$ , $R_G = 3.3\ \Omega$                                                            | $t_{d(off)}$  | -      | 17        | -         | ns            |
| Turn-Off Fall Time<br>at $-V_{GS} = 10\ \text{V}$ , $-V_{DD} = 15\ \text{V}$ , $-I_D = 10\ \text{A}$ , $R_G = 3.3\ \Omega$                                                             | $t_f$         | -      | 4         | -         | ns            |
| <b>Body-Diode PARAMETERS</b>                                                                                                                                                           |               |        |           |           |               |
| Drain-Source Diode Forward Voltage<br>at $-I_S = 1\ \text{A}$ , $V_{GS} = 0\ \text{V}$                                                                                                 | $-V_{SD}$     | -      | -         | 1.2       | V             |
| Body-Diode Continuous Current                                                                                                                                                          | $-I_S$        | -      | -         | 33        | A             |
| Body-Diode Continuous Current, Pulsed                                                                                                                                                  | $-I_{SM}$     | -      | -         | 132       | A             |
| Body Diode Reverse Recovery Time<br>at $-I_S = 10\ \text{A}$ , $di/dt = 100\ \text{A} / \mu\text{s}$                                                                                   | $t_{rr}$      | -      | 9.5       | -         | ns            |
| Body Diode Reverse Recovery Charge<br>at $-I_S = 10\ \text{A}$ , $di/dt = 100\ \text{A} / \mu\text{s}$                                                                                 | $Q_{rr}$      | -      | 3.3       | -         | nC            |

## Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

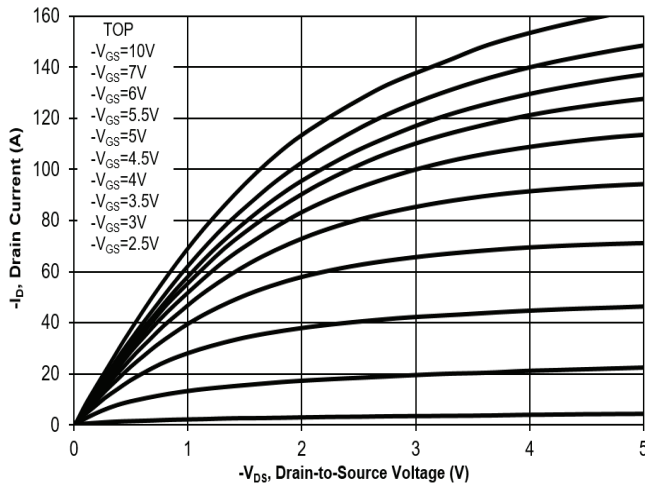


Fig. 2 Typical Transfer Characteristics

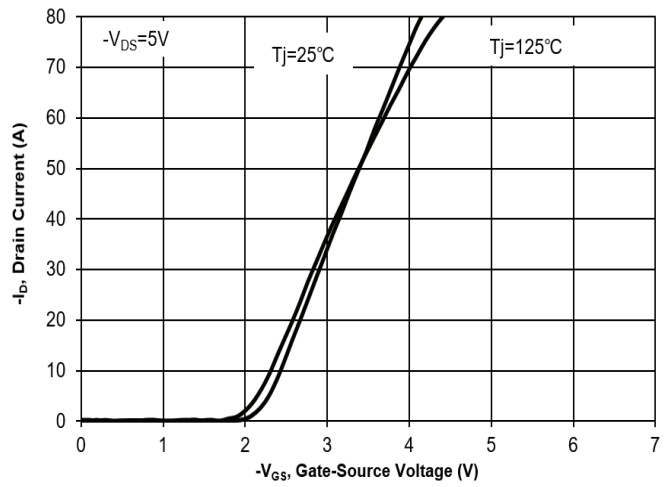


Fig. 3 On-Resistance vs. Drain Current

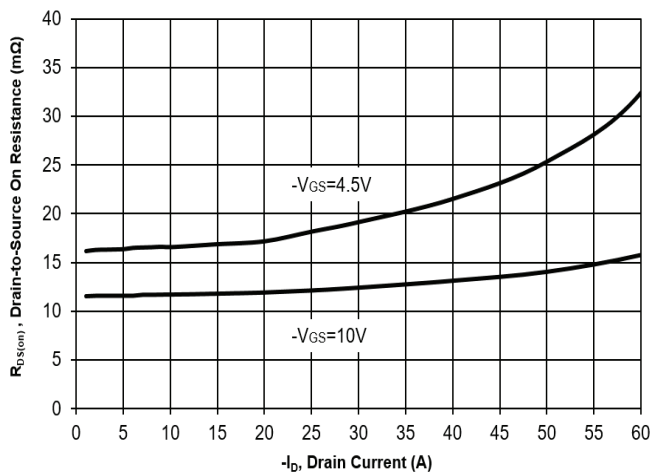


Fig. 4 On-Resistance vs. Gate to Source Voltage

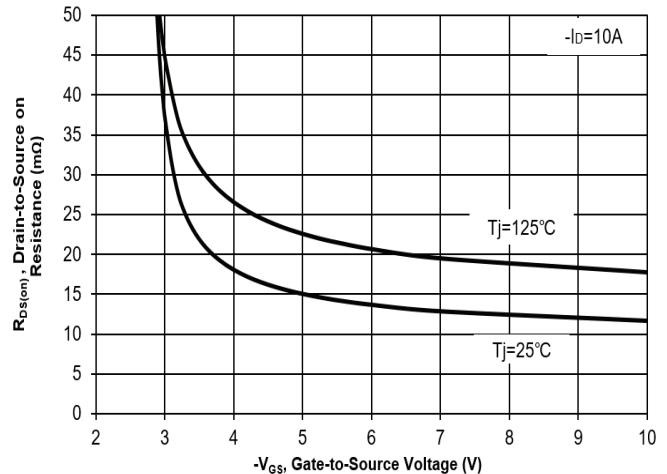


Fig. 5 On-Resistance vs.  $T_J$

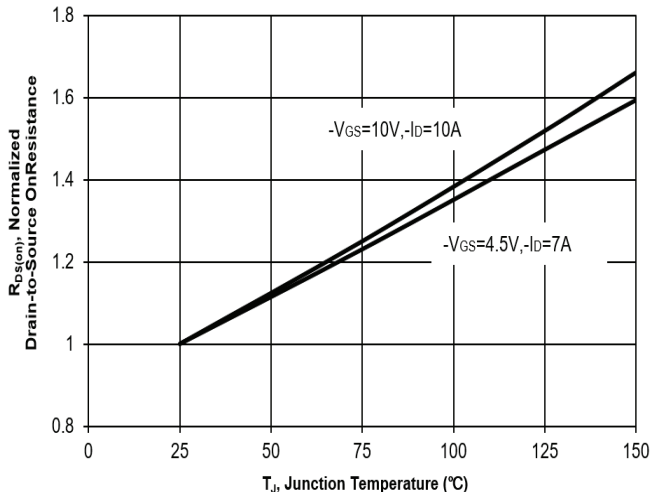
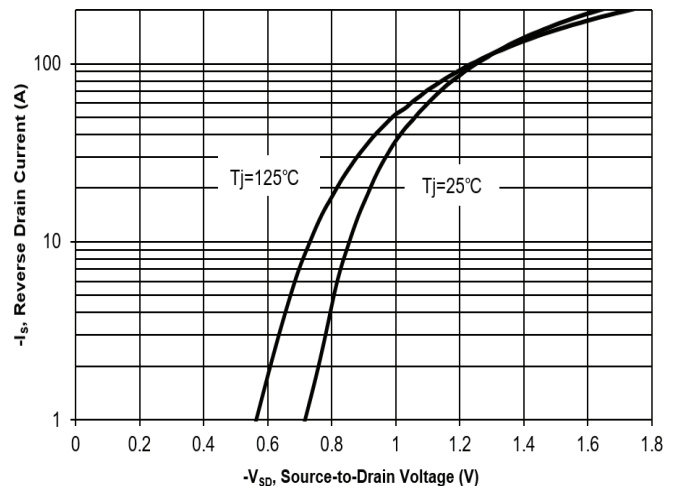


Fig. 6 Typical Body-Diode Forward Characteristics



## Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

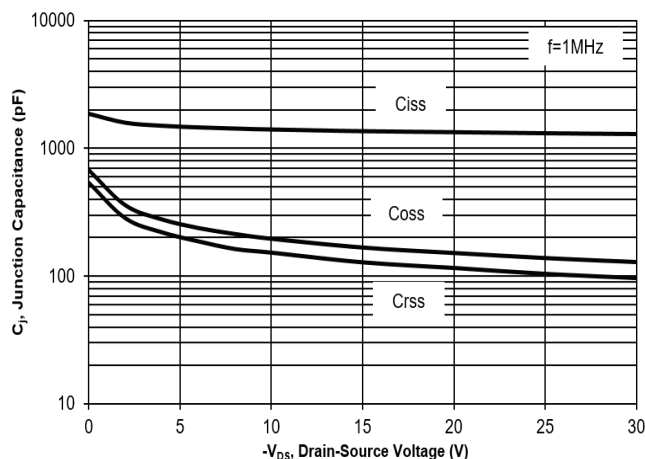


Fig. 8 Drain-Source Leakage Current vs.  $T_J$

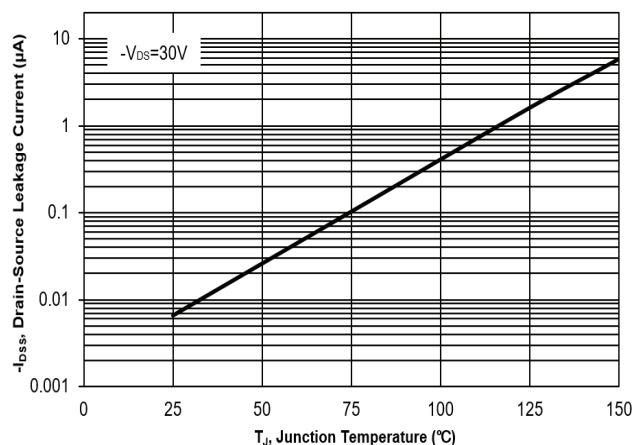


Fig. 9  $V_{(BR)DSS}$  vs. Junction Temperature

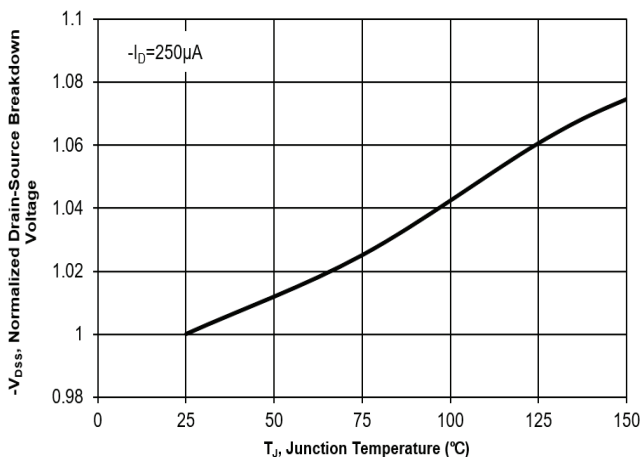


Fig. 10 Gate Threshold Variation vs.  $T_J$

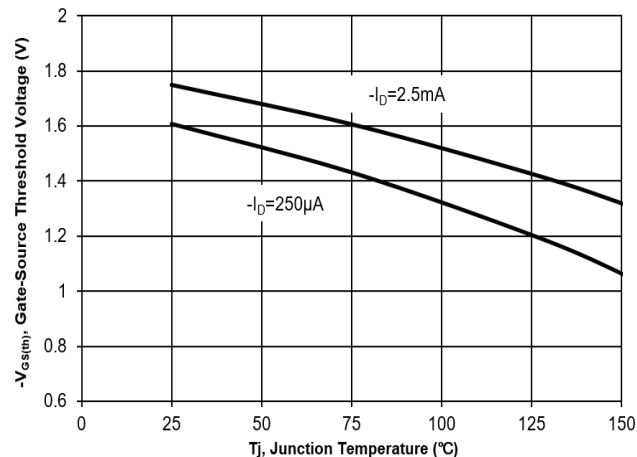


Fig. 11 Gate Charge

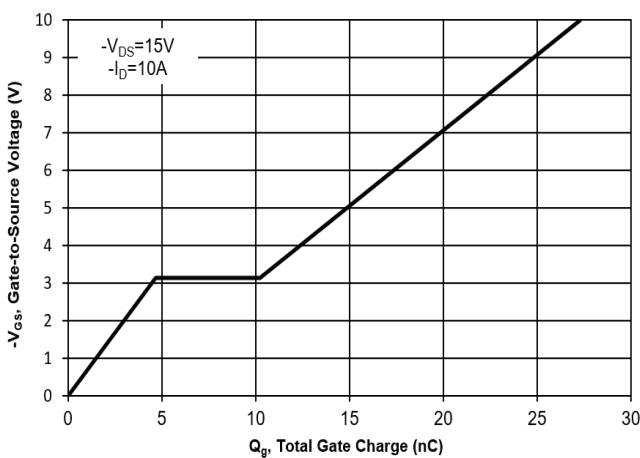
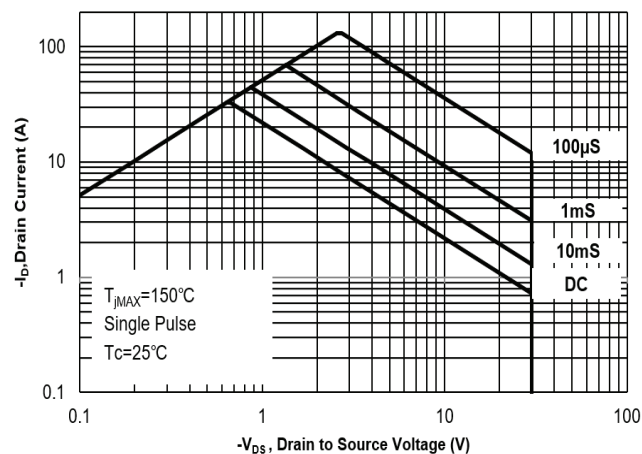


Fig. 12 Safe Operation Area



## Electrical Characteristics Curves

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

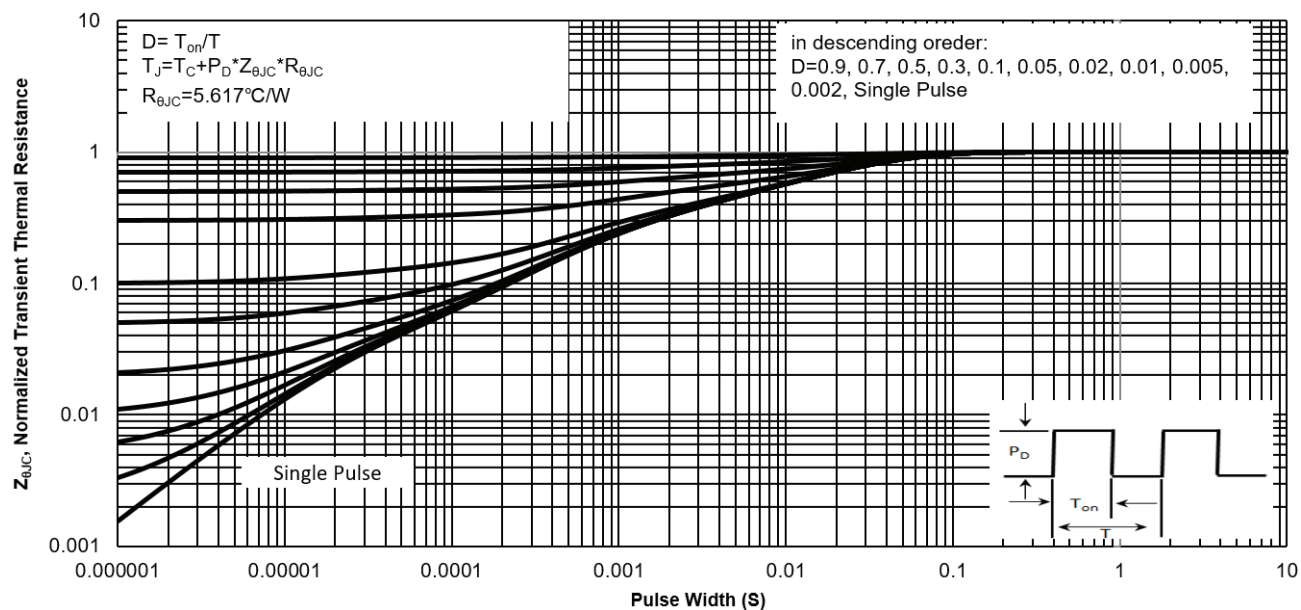
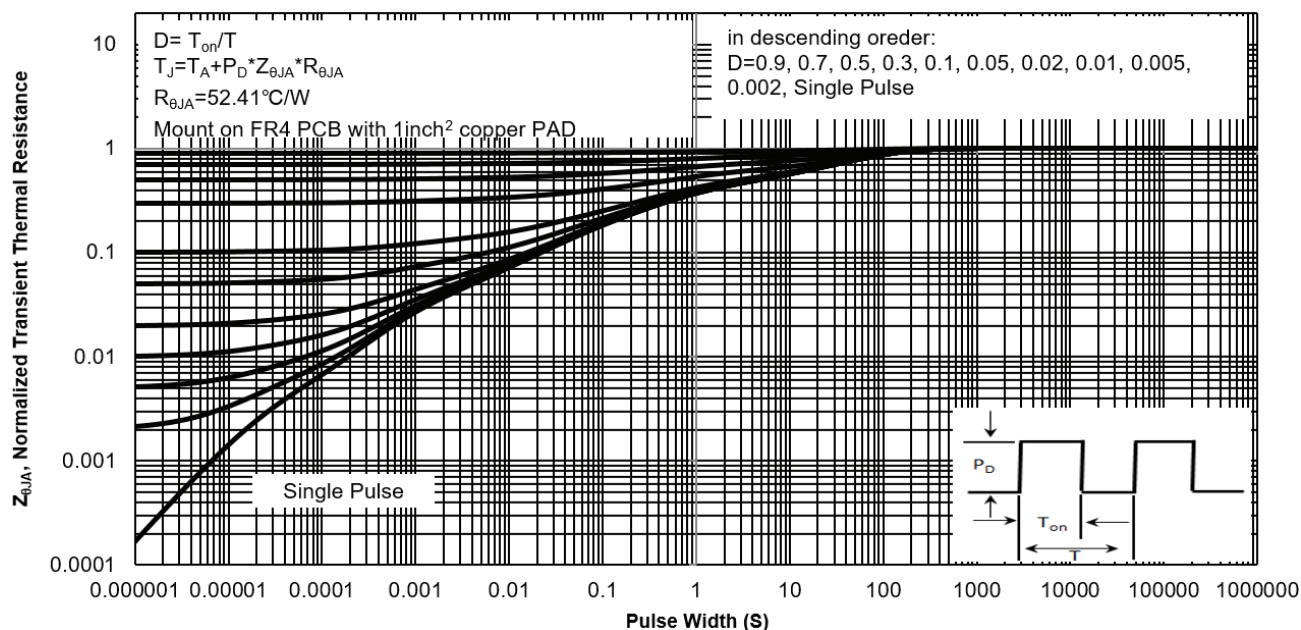


Fig. 14 Normalized Maximum Transient Thermal Impedance( $Z_{\theta JA}$ )



## Test Circuits

Fig.1-1 Switching times test circuit

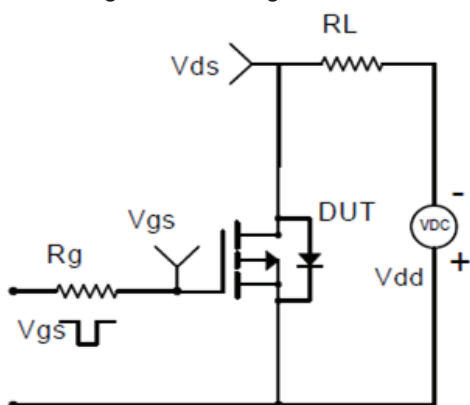


Fig.1-2 Switching Waveform

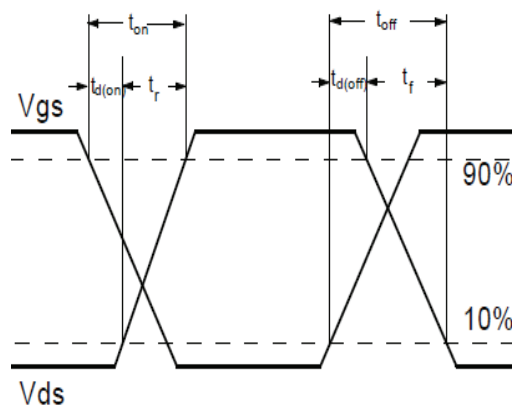


Fig.2-1 Gate charge test circuit

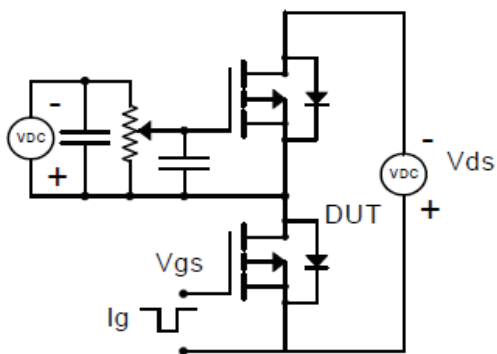


Fig.2-2 Gate charge waveform

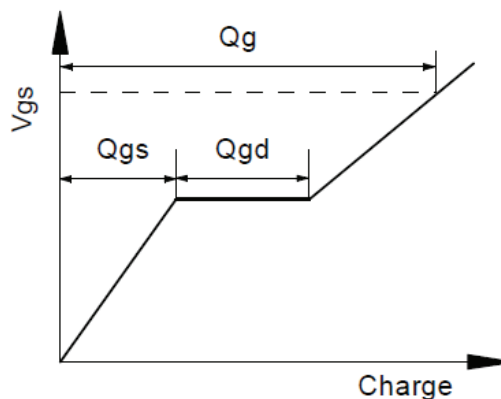


Fig.3-1 Avalanche test circuit

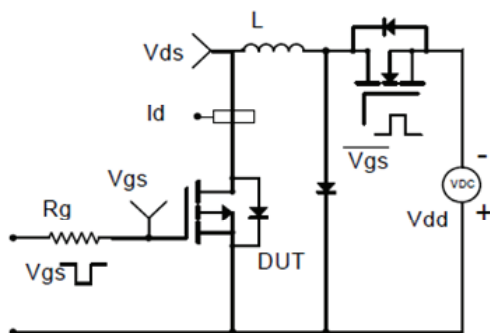
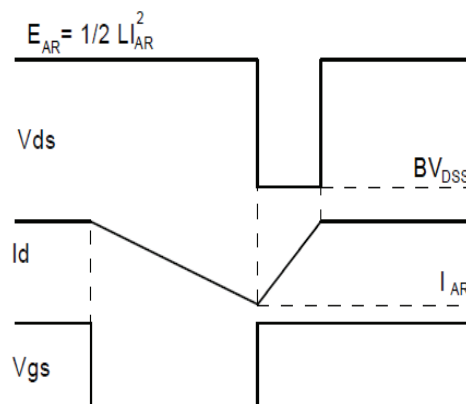
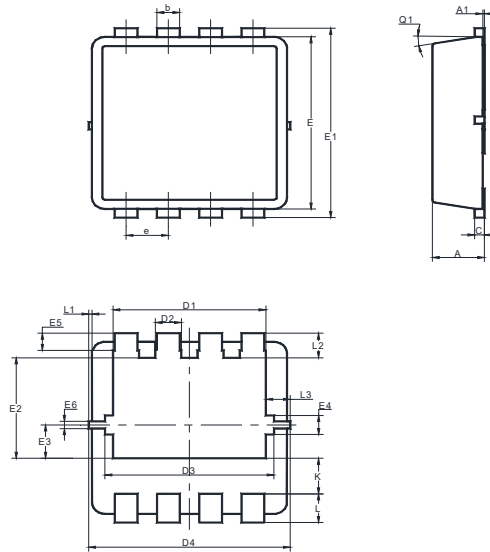


Fig.3-2 Avalanche waveform



Package Outline Dimensions (Units: mm)

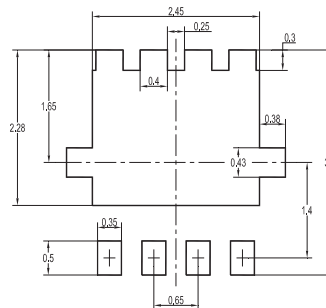
DFN3030



| UNIT | A   | A1   | b    | c    | D1  | D2  | D3  | D4  | E   | E1  | E2   | E3   | E4   |
|------|-----|------|------|------|-----|-----|-----|-----|-----|-----|------|------|------|
| mm   | 0.9 | 0.05 | 0.35 | 0.25 | 2.6 | 0.5 | 2.7 | 3.2 | 3.1 | 3.3 | 1.85 | 0.68 | 0.43 |
|      | 0.7 | 0    | 0.24 | 0.1  | 2.4 | 0.3 | 2.5 | 3   | 2.9 | 3.1 | 1.65 | 0.48 | 0.23 |

| UNIT | E5  | E6   | e   | K    | L   | L1  | L2   | L3    | θ1  |
|------|-----|------|-----|------|-----|-----|------|-------|-----|
| mm   | 0.4 | 0.25 | 0.7 | 0.72 | 0.5 | 0.1 | 0.53 | 0.475 | 12° |
|      | 0.2 | 0.15 | 0.6 | 0.52 | 0.3 | 0   | 0.33 | 0.275 | 0°  |

Recommended Soldering Footprint



Packing information

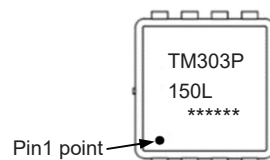
| Package | Tape Width (mm) | Pitch   |               | Reel Size |      | Per Reel Packing Quantity |
|---------|-----------------|---------|---------------|-----------|------|---------------------------|
|         |                 | mm      | inch          | mm        | inch |                           |
| DFN3030 | 12              | 8 ± 0.1 | 0.315 ± 0.004 | 330       | 13   | 5,000                     |

Marking information

" TM303P150L " = 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. Semtech Electronics Limited makes no warranties, representations or warranties regarding the suitability of its products for any particular purpose, and does not accept any liability arising from the application or use of any product or circuit such as: Apply to medical, military, aircraft, space or life support equipment and expressly waive any and all liability, including but not limited to special, consequential or collateral damage.