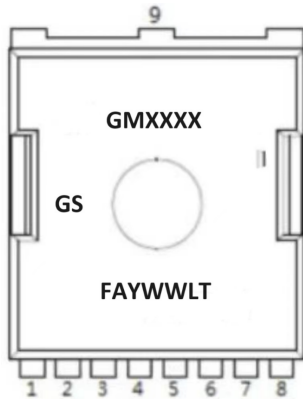


#### Product Summary

| $V_{DS}$ (V) | $R_{DS(on),max}$ (mΩ) | $I_D$ (A)          |
|--------------|-----------------------|--------------------|
| 40           | 1.0 @ $V_{GS} = 10V$  | 370 <sup>(1)</sup> |

#### Features

- Low  $R_{DS(on)}$  SGT technology
- Low thermal impedance
- Fast switching speed
- 100% avalanche tested



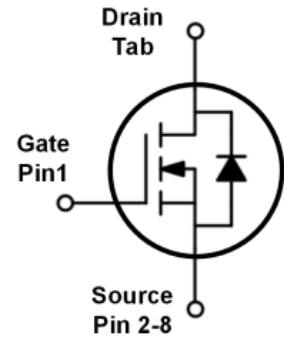
TOLL

NOTE:  
 LOGO - GS  
 GMXXXXX- Part number code  
 F - Fab location code  
 A - Assembly location code  
 Y - Year code  
 WW - Week code  
 L&T - Assembly lot code

#### Application

- DC/DC conversion
- Power switch
- Motor drives
- Battery Management System

#### Equivalent circuit



#### Absolute Maximum Rating ( $T_a=25^\circ\text{C}$ )

| Parameter                                        | Symbol                                 | Limit      | Unit             |
|--------------------------------------------------|----------------------------------------|------------|------------------|
| Drain-source voltage                             | $V_{DS}$                               | 40         | V                |
| Gate-source voltage                              | $V_{GS}$                               | $\pm 20$   |                  |
| Continuous drain current                         | $T_C=25^\circ\text{C}$ <sup>(1)</sup>  | 370        | A                |
|                                                  | $T_C=100^\circ\text{C}$ <sup>(1)</sup> | 259        | A                |
| Pulsed drain current <sup>(2)</sup>              | $I_{D,pulse}$                          | 530        | A                |
| Avalanche energy, single pulse <sup>(3)</sup>    | $E_{AS}$                               | 841        | mJ               |
| Power dissipation                                | $T_C=25^\circ\text{C}$                 | $P_D$      | 278 W            |
| Operating junction and storage temperature range | $T_J, T_{stg}$                         | -55 to 150 | $^\circ\text{C}$ |

#### Thermal Characteristic ( $T_a=25^\circ\text{C}$ )

| Parameter                                              | Symbol          | Max. | Unit               |
|--------------------------------------------------------|-----------------|------|--------------------|
| Thermal resistance, junction-to-case                   | $R_{\theta JC}$ | 0.45 | $^\circ\text{C/W}$ |
| Thermal resistance, junction-to-ambient <sup>(4)</sup> | $R_{\theta JA}$ | 35   |                    |

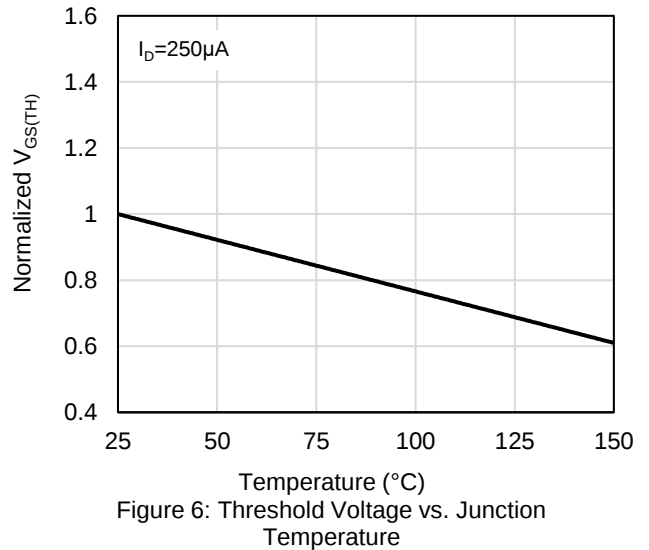
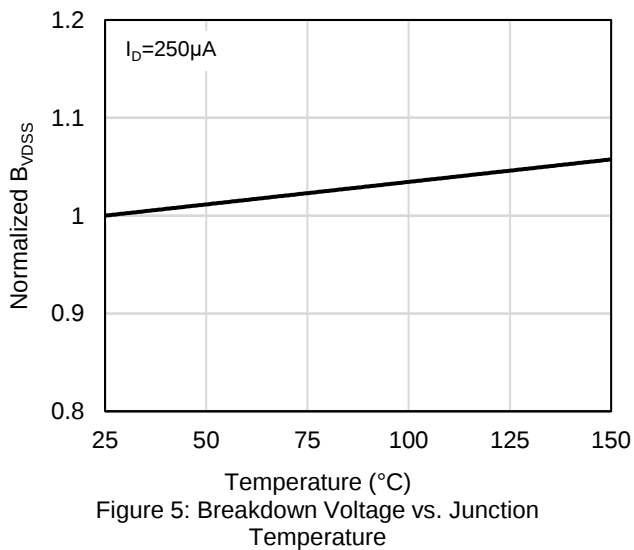
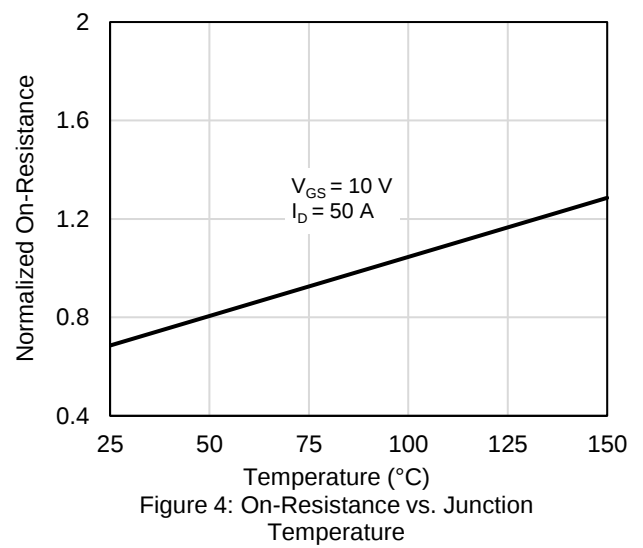
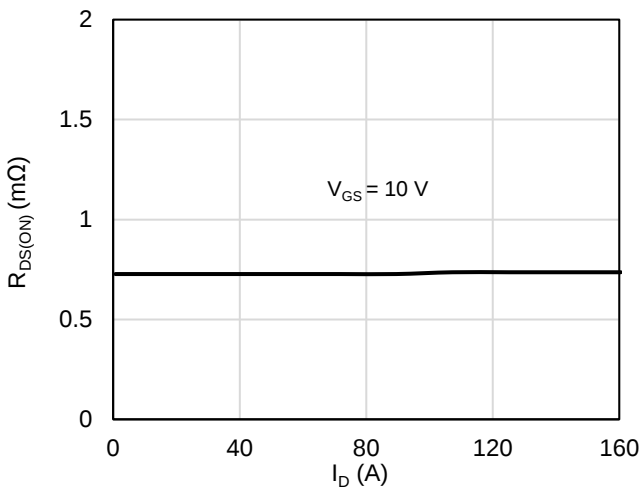
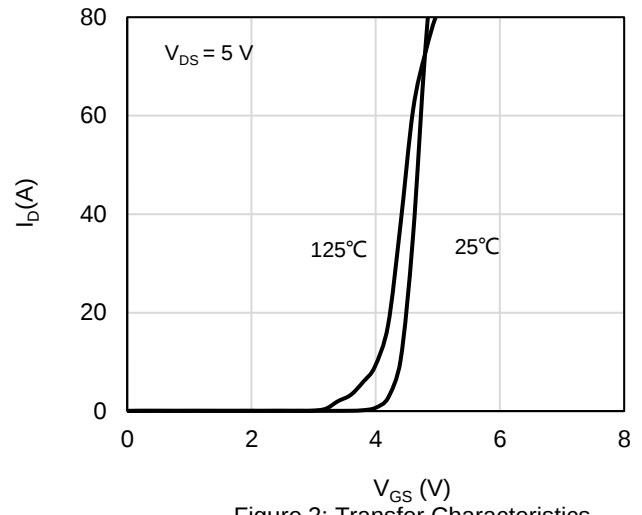
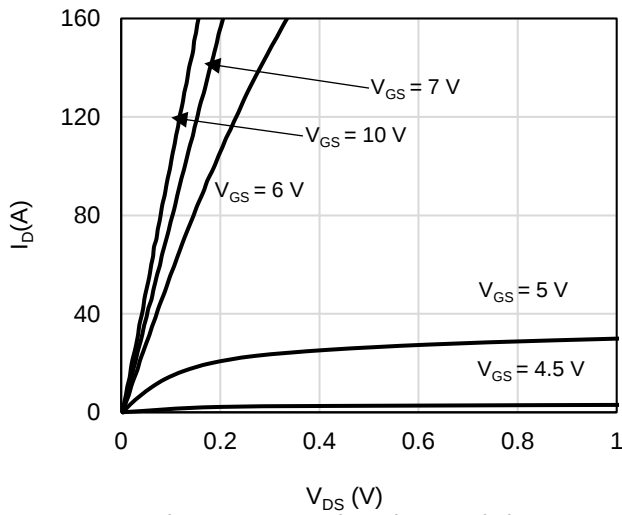
**Electrical characteristics (Ta=25°C ± 3°C)**

| Parameter                                    | Symbol        | Test conditions                                                                                        | Min. | Typ. | Max.      | Unit          |
|----------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------|------|------|-----------|---------------|
| Static parameter                             |               |                                                                                                        |      |      |           |               |
| Drain to source breakdown voltage            | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$                                                 | 40   |      |           | V             |
| Gate-source threshold voltage                | $V_{GS(th)}$  | $V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$                                                     | 2    | 2.8  | 4         | V             |
| Gate-body leakage                            | $I_{GSS}$     | $V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$                                                     |      |      | $\pm 100$ | nA            |
| Zero gate voltage drain current              | $I_{DSS}$     | $V_{DS} = 40\text{ V}$ , $V_{GS} = 0\text{ V}$                                                         |      |      | 1         | $\mu\text{A}$ |
| Drain-source on-resistance                   | $R_{DS(on)}$  | $V_{GS} = 10\text{ V}$ , $I_D = 50\text{ A}$                                                           |      | 0.7  | 1.0       | m $\Omega$    |
| Gate resistance                              | $R_g$         | $f = 1\text{ MHz}$                                                                                     |      | 5    |           | $\Omega$      |
|                                              |               |                                                                                                        |      |      |           |               |
| Dynamic <sup>(5)</sup>                       |               |                                                                                                        |      |      |           |               |
| Total gate charge                            | $Q_g$         | $V_{DS} = 20\text{ V}$ , $I_D = 50\text{ A}$ , $V_{GS} = 10\text{ V}$                                  |      | 80   |           | nC            |
| Gate-source charge                           | $Q_{gs}$      |                                                                                                        |      | 36   |           |               |
| Gate-drain charge                            | $Q_{gd}$      |                                                                                                        |      | 8    |           |               |
| Turn-on delay time                           | $t_{d(on)}$   | $V_{DS} = 20\text{ V}$ , $I_D = 50\text{ A}$ , $V_{GS} = 10\text{ V}$ ,<br>$R_{GEN} = 4\text{ }\Omega$ |      | 28   |           | ns            |
| Rise time                                    | $t_r$         |                                                                                                        |      | 96   |           |               |
| Turn-off delay time                          | $t_{d(off)}$  |                                                                                                        |      | 73   |           |               |
| Fall time                                    | $t_f$         |                                                                                                        |      | 116  |           |               |
| Input capacitance                            | $C_{iss}$     | $V_{DS} = 25\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$                                    |      | 7020 |           | pF            |
| Output capacitance                           | $C_{oss}$     |                                                                                                        |      | 2000 |           |               |
| Reverse transfer capacitance                 | $C_{rss}$     |                                                                                                        |      | 10   |           |               |
| Reverse Diode Characteristics <sup>(5)</sup> |               |                                                                                                        |      |      |           |               |
| Diode forward voltage                        | $V_{SD}$      | $V_{GS} = 0\text{ V}$ , $I_F = 40\text{ A}$                                                            |      | 0.8  | 1.2       | V             |
| Reverse recovery time                        | $t_{rr}$      | $V_{DS} = 20\text{ V}$ , $I_F = 40\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$                      |      | 98   |           | ns            |
| Reverse recovery charge                      | $Q_{rr}$      |                                                                                                        |      | 229  |           | nC            |

**Notes**

- (1) Limited by maximum junction temperature..
- (2) Pulse width limited by maximum junction temperature.
- (3)  $V_{DD} = 40\text{ V}, V_{GS} = 10\text{ V}, L = 0.5\text{ mH}$ .
- (4)  $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> pad 2 oz copper pad on a 1.5x1.5 in. board of FR-4 material.
- (5) Guaranteed by design, not subject to production testing.
- (6) The max drain current rating is silicon limited.

## Electrical characteristics diagrams



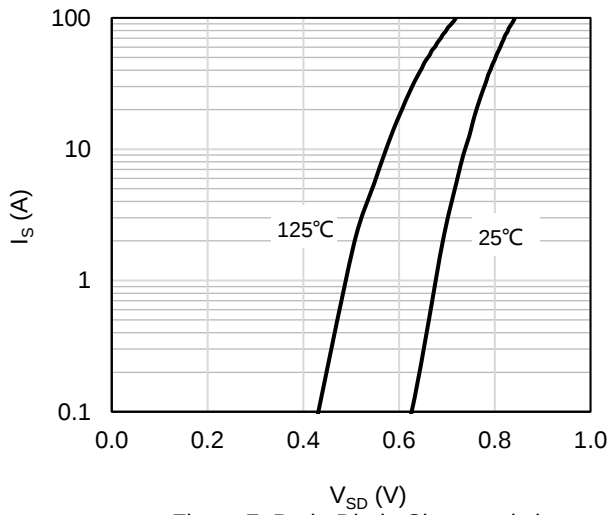


Figure 7: Body-Diode Characteristics

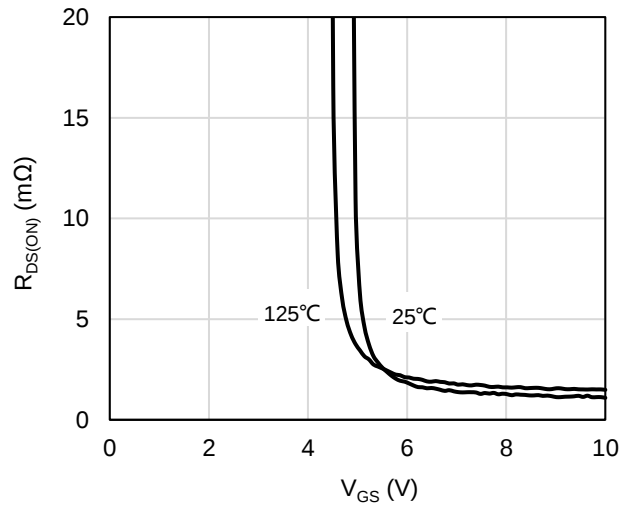


Figure 8: On-Resistance vs. Gate-Source Voltage

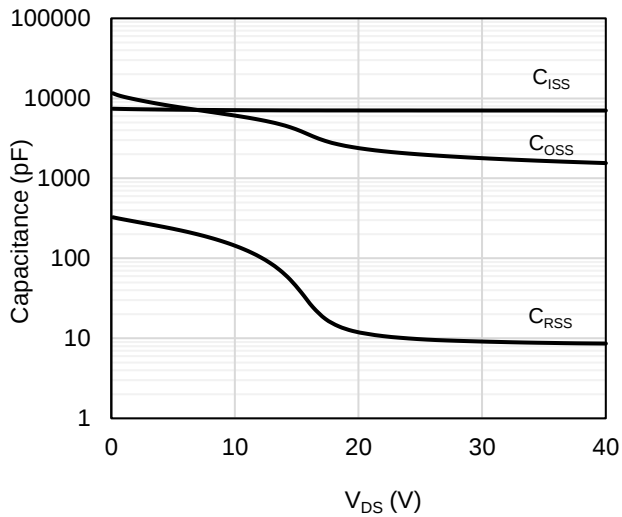


Figure 9: Capacitance Characteristics

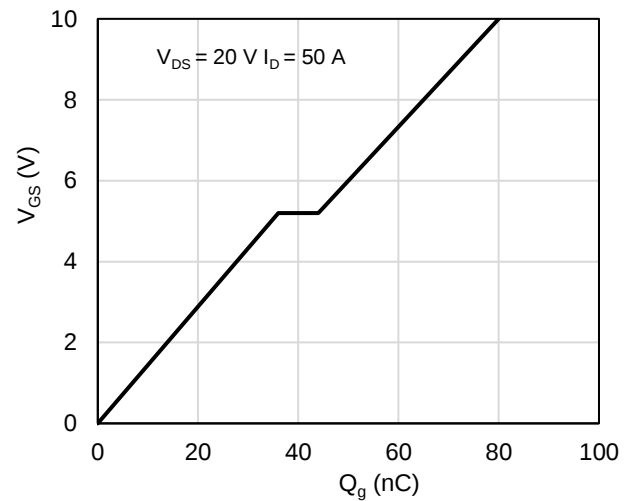


Figure 10: Gate-Charge Characteristics

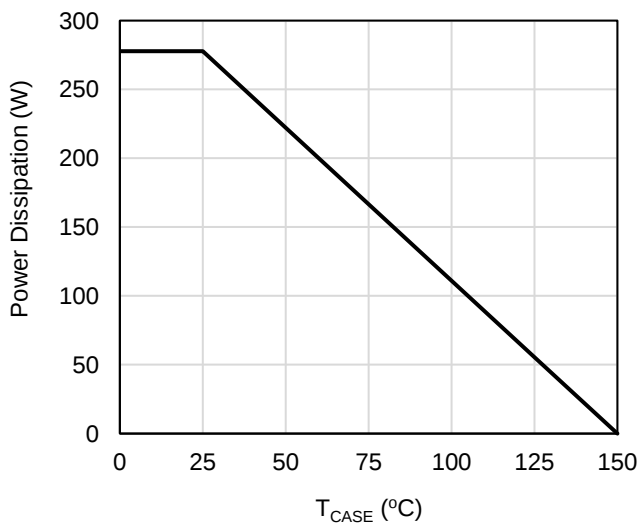


Figure 11: Power De-rating

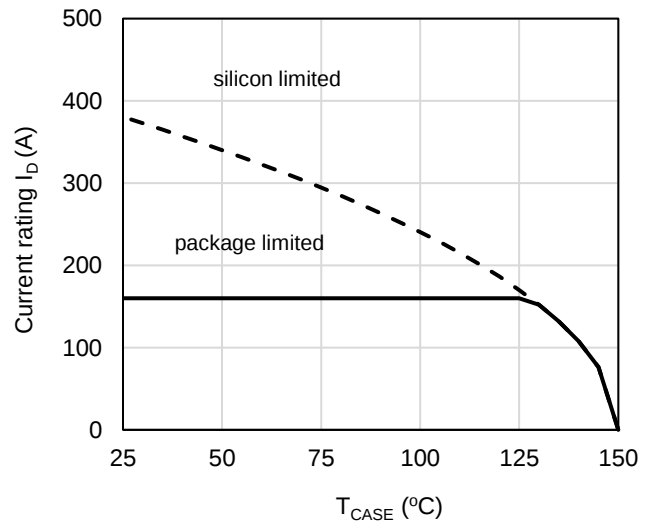


Figure 12: Current De-rating

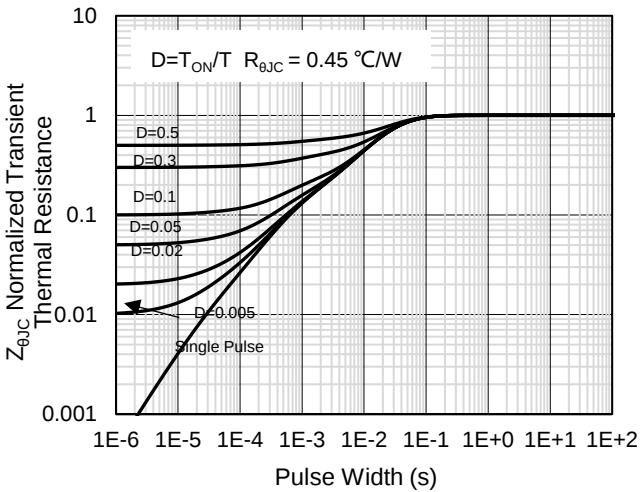


Figure 13: Normalized Maximum Transient Thermal Impedance

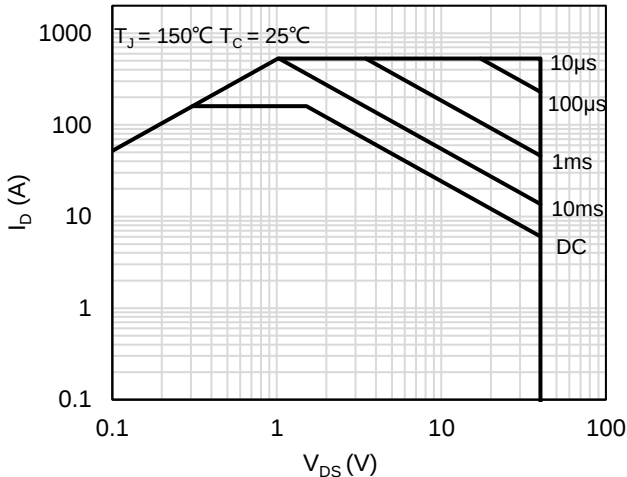
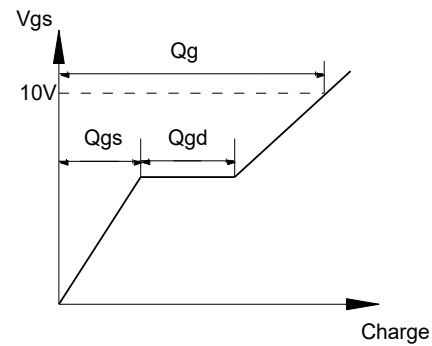
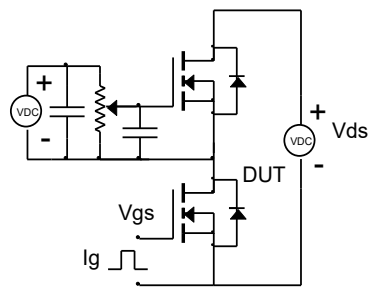


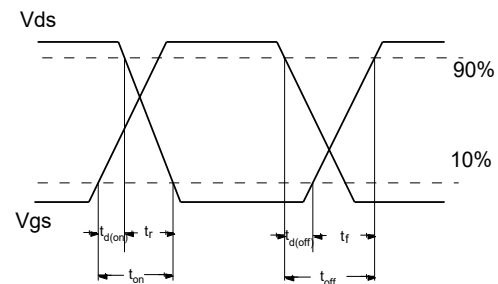
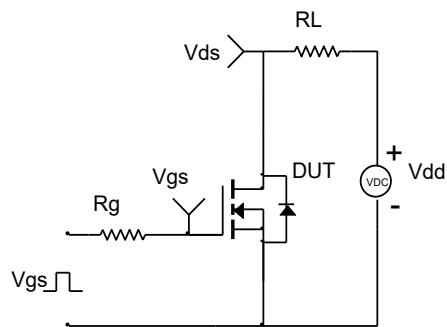
Figure 14: Maximum Forward Biased Safe Operating Area

**Test Circuit and Waveform**

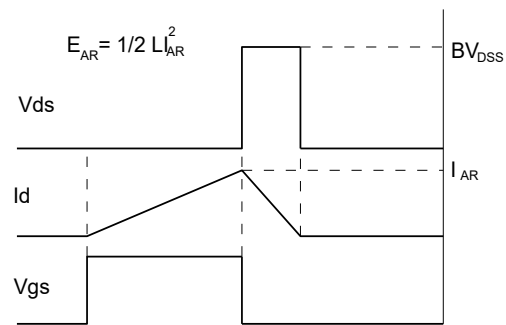
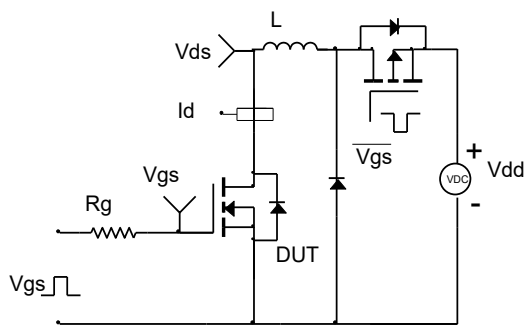
Gate Charge Test Circuit &amp; Waveform



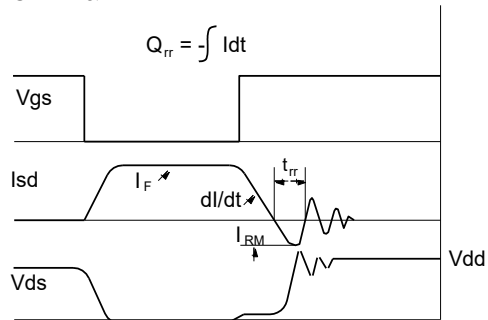
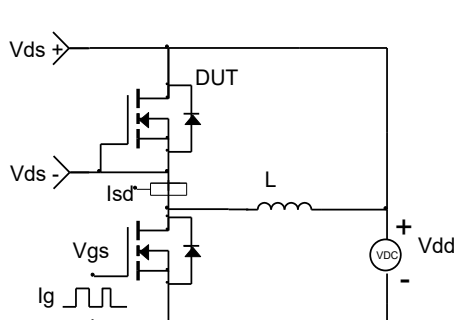
Resistive Switching Test Circuit &amp; Waveforms

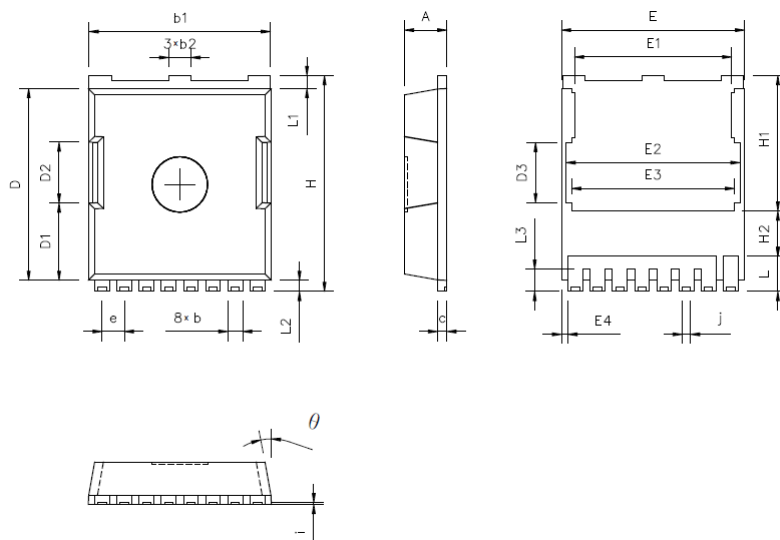


Unclamped Inductive Switching (UIS) Test Circuit &amp; Waveforms



Diode Recovery Test Circuit &amp; Waveforms



**Package outline dimensions:TOLL**


| Dim | Millimeters |     |       |
|-----|-------------|-----|-------|
|     | Min         | Nom | Max   |
| A   | 2.20        | -   | 2.40  |
| b   | 0.70        | -   | 0.90  |
| b1  | 9.70        | -   | 9.90  |
| b2  | 1.20 REF    |     |       |
| c   | 0.40        | -   | 0.60  |
| D   | 10.28       | -   | 10.48 |
| D1  | 4.08        | -   | 4.28  |
| D2  | 3.20        | -   | 3.40  |
| D3  | 3.16        | -   | 3.36  |
| E   | 9.80        | -   | 10.00 |
| E1  | 8.40        | -   | 8.60  |
| E2  | 9.30        | -   | 9.50  |
| E3  | 8.80 REF    |     |       |
| E4  | 0.25        | -   | 0.45  |
| e   | 1.20 BASIC  |     |       |
| H   | 11.58       | -   | 11.78 |
| H1  | 7.23        | -   | 7.43  |
| H2  | 2.45 REF    |     |       |
| i   | 0.10        | -   | -     |
| j   | 0.45 REF    |     |       |
| L   | 1.60        | -   | 2.10  |
| L1  | 0.60        | -   | 0.80  |
| L2  | 0.50        | -   | 0.70  |
| L3  | 1.05        | -   | 1.30  |
| θ   | 10° REF     |     |       |

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