

## Features

- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- $R_{DS(on).typ}=1.3m\Omega@V_{GS}=10V$
- High Reliability Capability

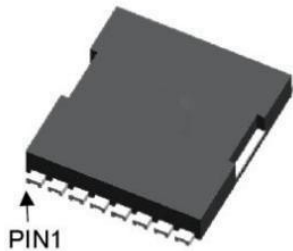
## Application

- Charger
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

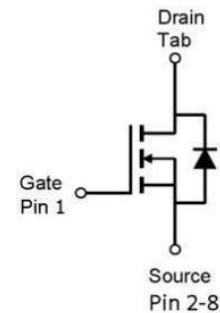
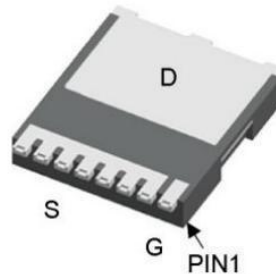
## Product Summary

|                             |       |
|-----------------------------|-------|
| $V_{DS}$                    | 60V   |
| $R_{DS(on).typ}@V_{GS}=10V$ | 1.3mΩ |
| $I_D$                       | 250A  |

TOLL Top View



TOLL Bottom View



## Package Marking and Ordering Information

| Type        | Package | Marking  | Reel Size | Qty  |
|-------------|---------|----------|-----------|------|
| SFT015N60C3 | TOLL    | 015N60C3 | -         | 2000 |

## Maximum Ratings

| Parameter                                                             | Symbol                | Value      | Unit       |
|-----------------------------------------------------------------------|-----------------------|------------|------------|
| Drain-source Voltage                                                  | $V_{DS}$              | 60         | V          |
| Continuous Drain Current<br>$T_C = 25^\circ C$<br>$T_C = 100^\circ C$ | $I_D$                 | 250<br>158 | A          |
| Pulsed Drain Current                                                  | $I_{D \text{ pulse}}$ | 1000       | A          |
| Avalanche Energy, Single Pulse                                        | $E_{AS}$              | 1296       | mJ         |
| Gate-emitter Voltage                                                  | $V_{GS}$              | $\pm 20$   | V          |
| Power Dissipation, $T_C = 25^\circ C$                                 | $P_D$                 | 179        | W          |
| Operating Junction And Storage Temperature                            | $T_j, T_{stg}$        | -55~150    | $^\circ C$ |

## Thermal Resistance

| Parameter                               | Symbol     | Typ | Max | Unit         |
|-----------------------------------------|------------|-----|-----|--------------|
| Thermal Resistance, Junction to Case    | $R_{thJC}$ | 0.5 | 0.7 | $^\circ C/W$ |
| Thermal Resistance, Junction to Ambient | $R_{thJA}$ | 45  | 62  | $^\circ C/W$ |

**Electrical Characteristic, at T<sub>j</sub> = 25 °C, unless otherwise specified**

| Parameter                        | Symbol        | Test Condition                | Value |      |           | Unit       |
|----------------------------------|---------------|-------------------------------|-------|------|-----------|------------|
|                                  |               |                               | min.  | typ. | max.      |            |
| Static Characteristic            |               |                               |       |      |           |            |
| Drain-source Breakdown Voltage   | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=250\mu A$     | 60    | 66   | -         | V          |
| Gate Threshold Voltage           | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=250\mu A$ | 2.2   | 3    | 3.8       |            |
| Zero Gate Voltage Drain Current  | $I_{DSS}$     | $V_{DS}=60V, V_{GS}=0V$       | -     | -    | 1         | $\mu A$    |
| Gate-source leakage current      | $I_{GSS}$     | $V_{GS}=\pm 20V, V_{DS}=0V$   | -     | -    | $\pm 100$ | nA         |
| Drain-source on-state Resistance | $R_{DS(on)}$  | $V_{GS}=10V, I_D=40A$         | -     | 1.3  | 1.5       | m $\Omega$ |

**Dynamic Characteristic**

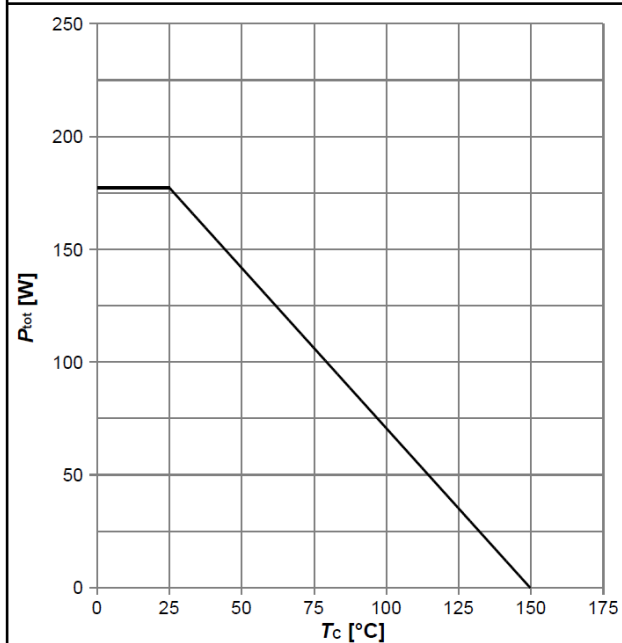
|                              |              |                                                               |   |      |   |    |
|------------------------------|--------------|---------------------------------------------------------------|---|------|---|----|
| Input Capacitance            | $C_{iss}$    | $V_{GS}=0V,$<br>$V_{DS}=30V,$<br>$f=1MHz$                     | - | 6944 | - | pF |
| Output Capacitance           | $C_{oss}$    |                                                               | - | 1421 | - |    |
| Reverse Transfer Capacitance | $C_{rss}$    |                                                               | - | 256  | - |    |
| Gate Total Charge            | $Q_g$        | $V_{GS}=10V,$<br>$V_{DS}=30V,$<br>$I_D=50A$                   | - | 131  | - | nC |
| Gate-Source charge           | $Q_{gs}$     |                                                               | - | 42   | - |    |
| Gate-Drain charge            | $Q_{gd}$     |                                                               | - | 28   | - |    |
| Turn-on Delay Time           | $t_{d(on)}$  | $V_{GS}=10V,$<br>$V_{DD}=30V,$<br>$I_D=50A,$<br>$R_G=3\Omega$ | - | 23   | - | ns |
| Turn-on Rise Time            | $t_r$        |                                                               | - | 40   | - |    |
| Turn-off Delay Time          | $t_{d(off)}$ |                                                               | - | 60   | - |    |
| Turn-off Fall Time           | $t_f$        |                                                               | - | 27   | - |    |

**Body Diode Characteristic**

|                            |          |                                 |   |     |     |    |
|----------------------------|----------|---------------------------------|---|-----|-----|----|
| Body Diode Forward Voltage | $V_{SD}$ | $V_{GS}=0V, I_{SD}=50A$         | - | -   | 1.2 | V  |
| Reverse Recovery Time      | $t_{rr}$ | $I_F=50A,$<br>$dI_F/dt=100A/us$ | - | 60  | -   | ns |
| Reverse Recovery Charge    | $Q_{rr}$ |                                 | - | 123 | -   | nC |

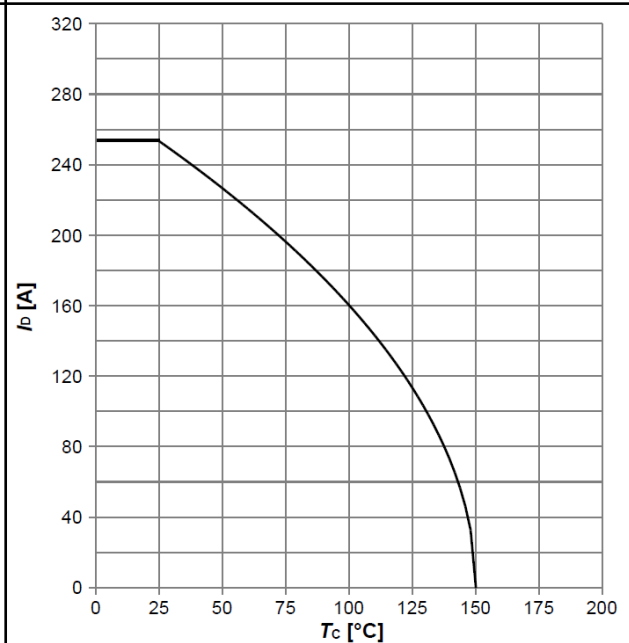
## Typical Performance Characteristics

Diagram 1: Power dissipation



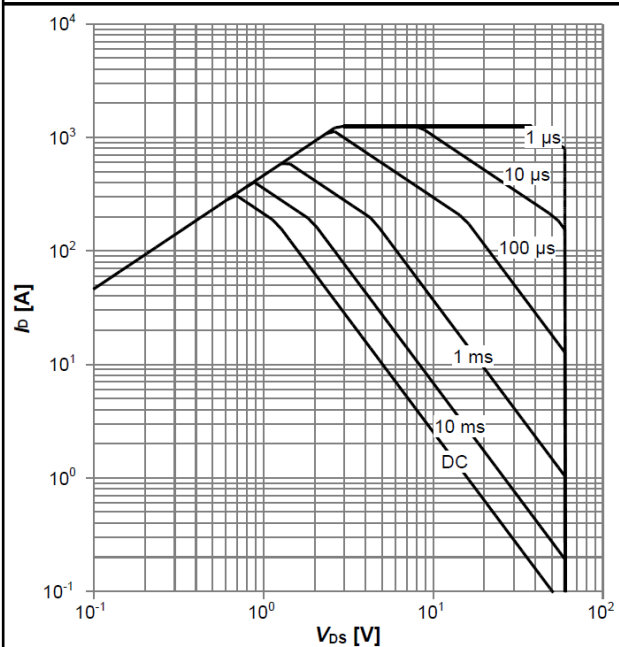
$$P_{tot}=f(T_c)$$

Diagram 2: Drain current



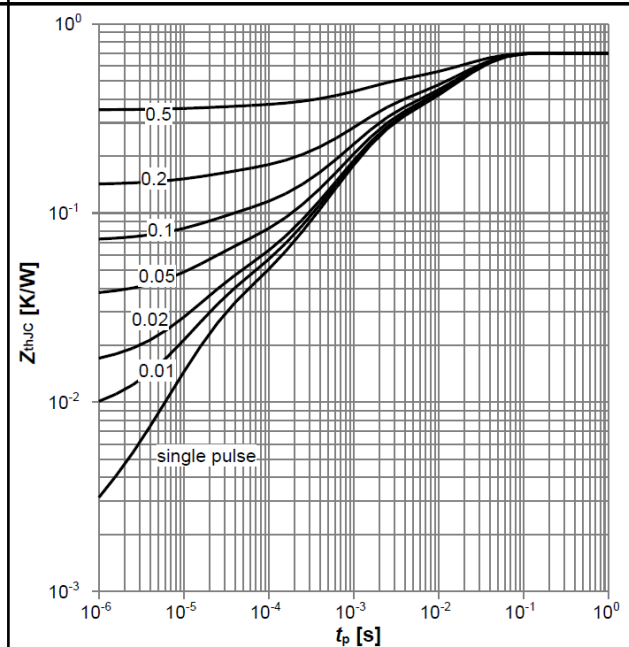
$$I_D=f(T_c); V_{GS}\geq 10\text{ V}$$

Diagram 3: Safe operating area



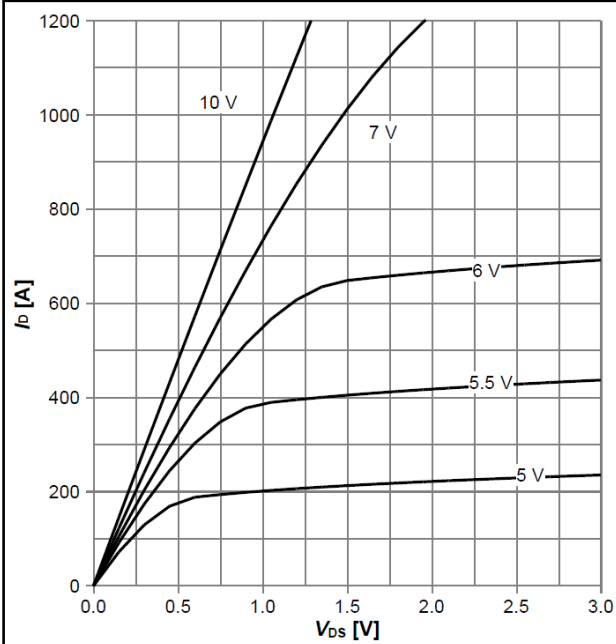
$$I_D=f(V_{DS}); T_c=25\text{ °C}; D=0; \text{parameter: } t_p$$

Diagram 4: Max. transient thermal impedance



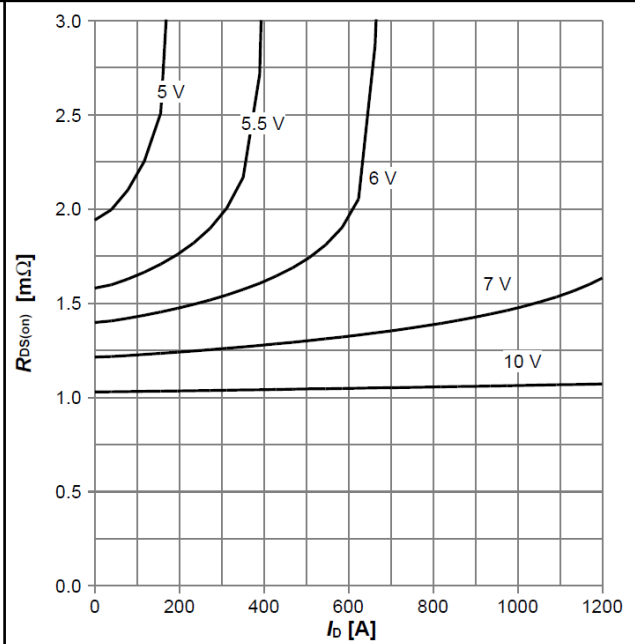
$$Z_{thJC}=f(t_p); \text{parameter: } D=t_p/T$$

Diagram 5: Typ. output characteristics



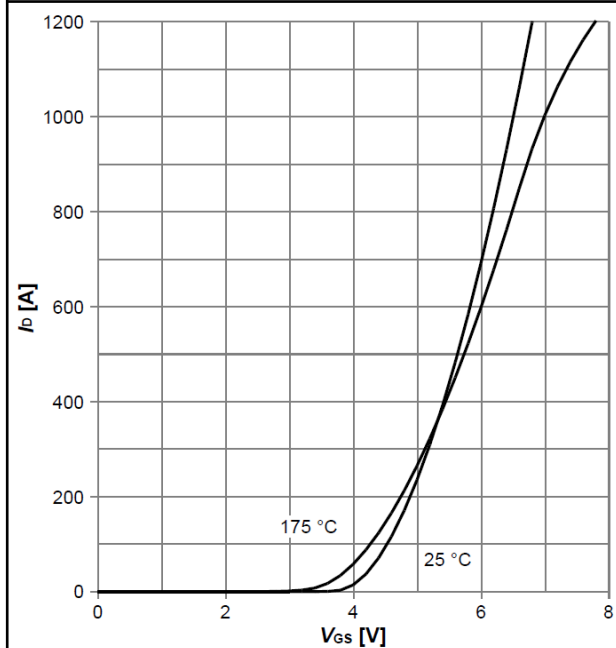
$I_D = f(V_{DS})$ ;  $T_J = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 6: Typ. drain-source on resistance



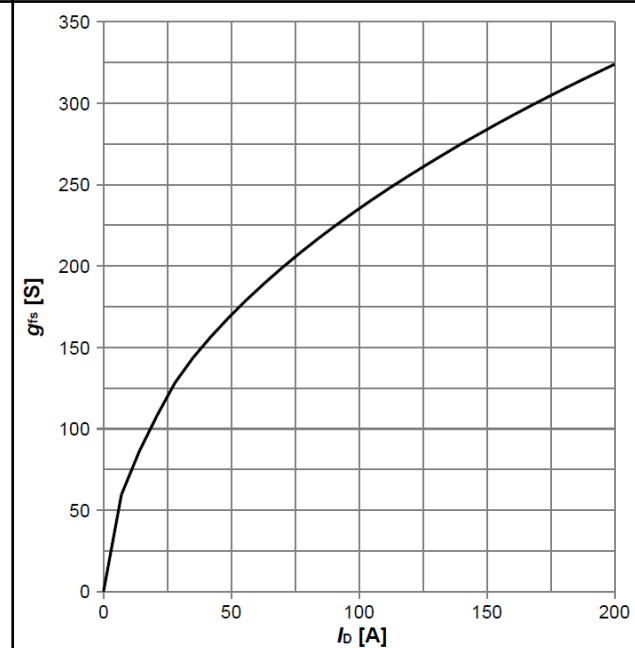
$R_{DS(on)} = f(I_D)$ ;  $T_J = 25^\circ\text{C}$ ; parameter:  $V_{GS}$

Diagram 7: Typ. transfer characteristics



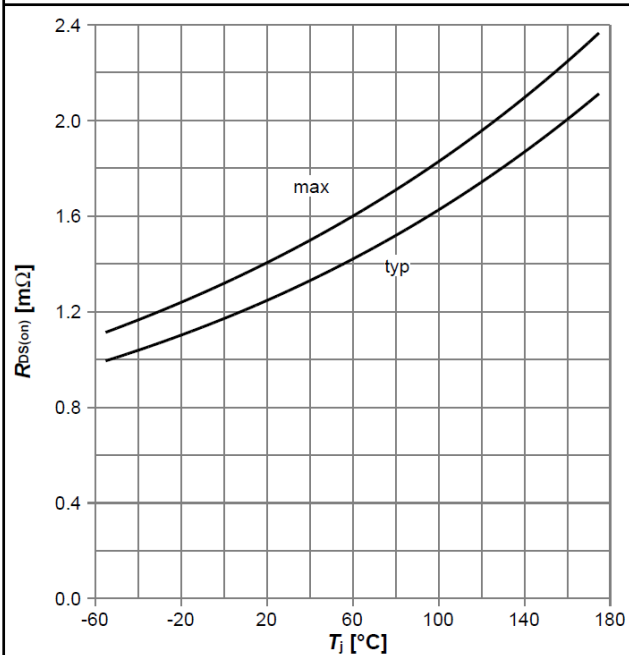
$I_D = f(V_{GS})$ ;  $|V_{DS}| > 2|I_D|R_{DS(on)max}$ ; parameter:  $T_J$

Diagram 8: Typ. forward transconductance



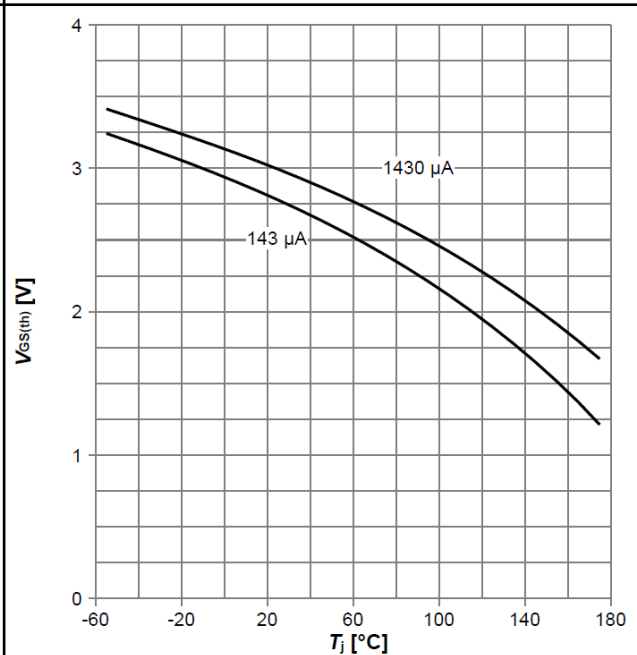
$g_{fs} = f(I_D)$ ;  $T_J = 25^\circ\text{C}$

Diagram 9: Drain-source on-state resistance



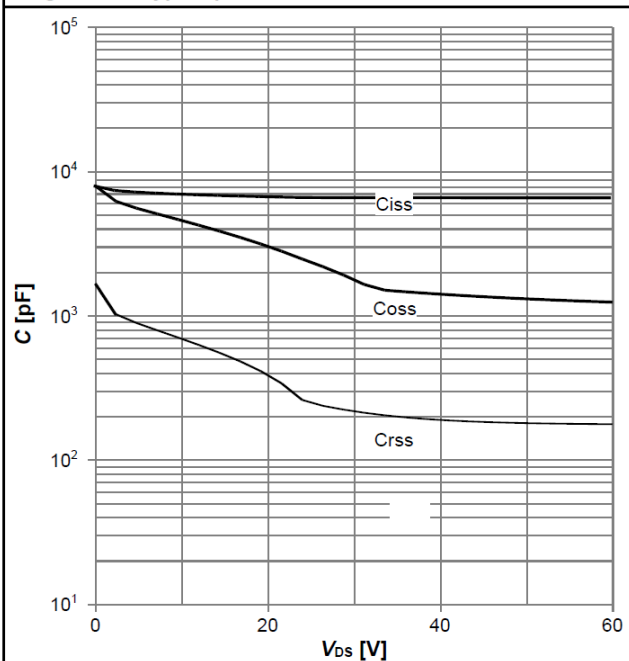
$R_{DS(on)} = f(T_j); I_D = 40 \text{ A}; V_{GS} = 10 \text{ V}$

Diagram 10: Typ. gate threshold voltage



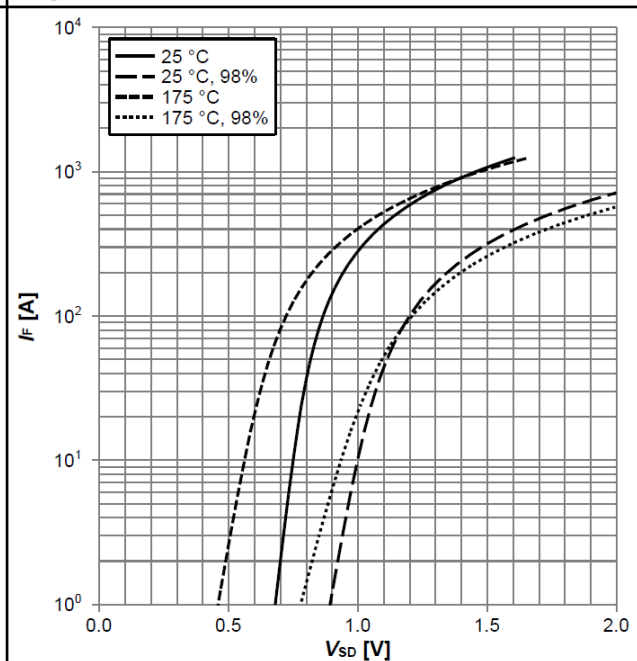
$V_{GS(th)} = f(T_j); V_{GS} = V_{DS}$

Diagram 11: Typ. capacitances



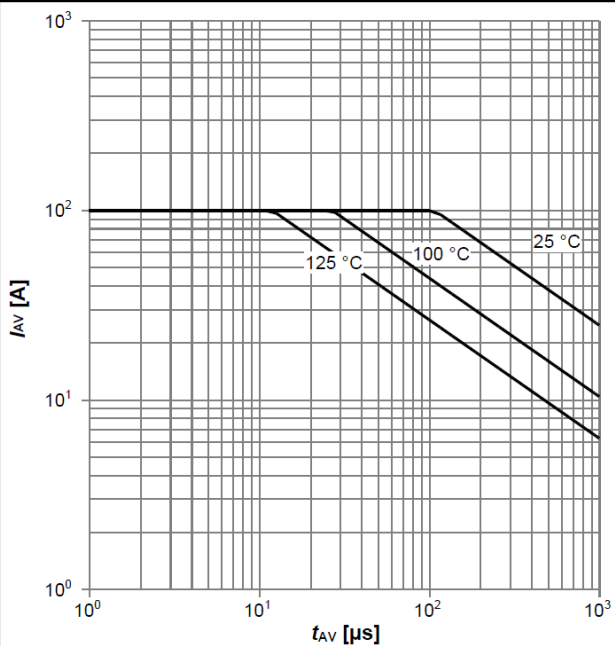
$C = f(V_{DS}); V_{GS} = 0 \text{ V}; f = 1 \text{ MHz}$

Diagram 12: Forward characteristics of reverse diode



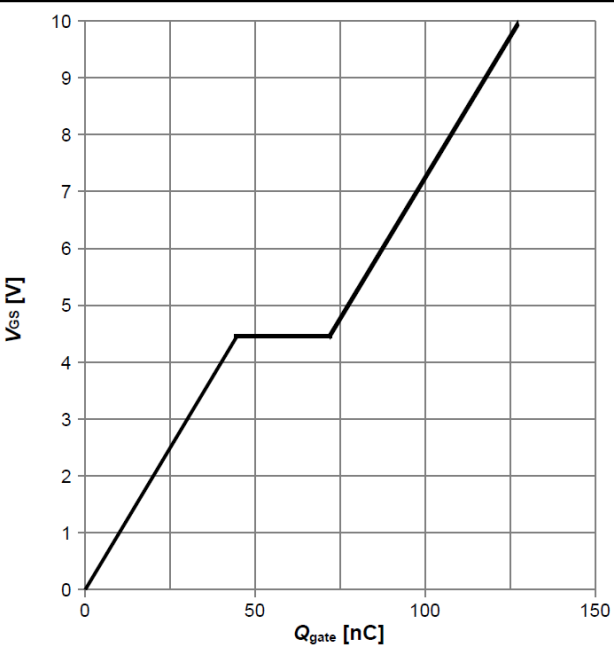
$I_F = f(V_{SD}); \text{parameter: } T_j$

Diagram 13: Avalanche characteristics



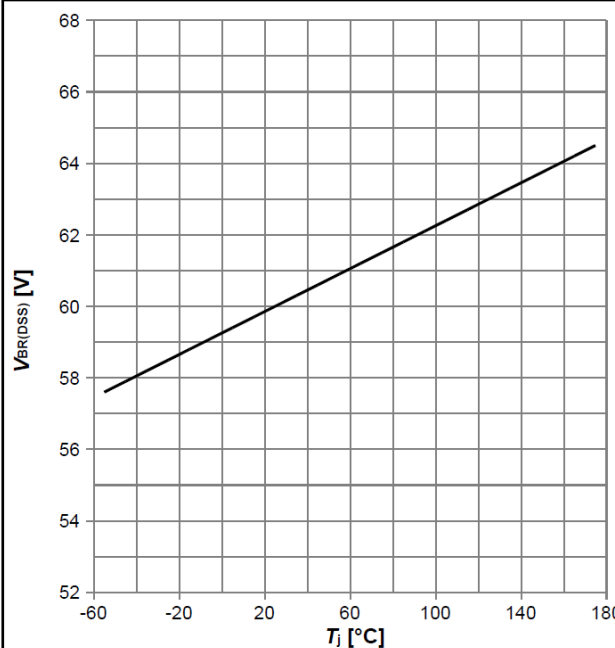
$I_{AS}=f(t_{AV})$ ; parameter:  $T_{J(start)}$

Diagram 14: Typ. gate charge



$V_{GS}=f(Q_{gate})$ ;  $I_D=50$  A pulsed; parameter:  $V_{DD}$

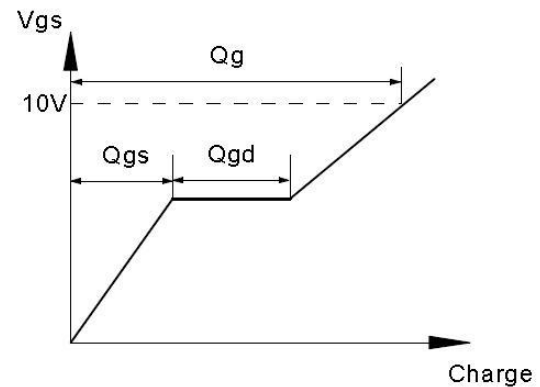
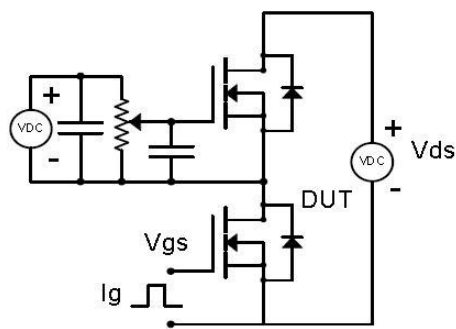
Diagram 15: Drain-source breakdown voltage



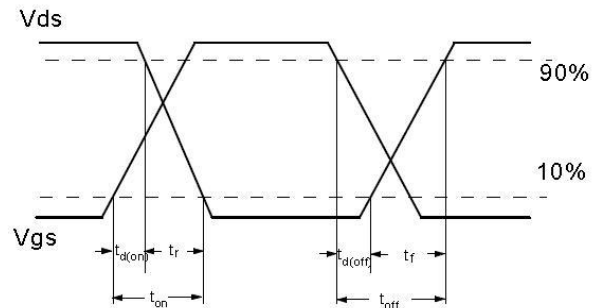
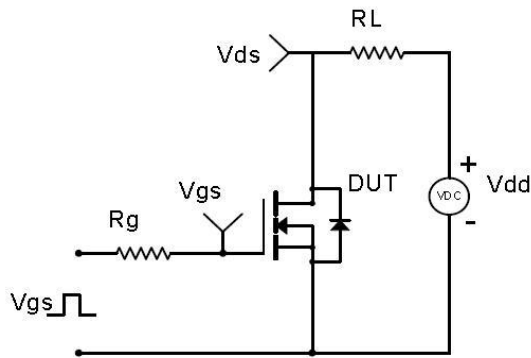
$V_{BR(DSS)}=f(T_J)$ ;  $I_D=1$  mA

## Test Circuit & Waveform

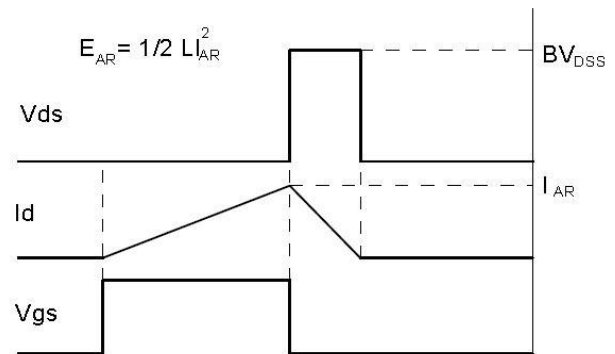
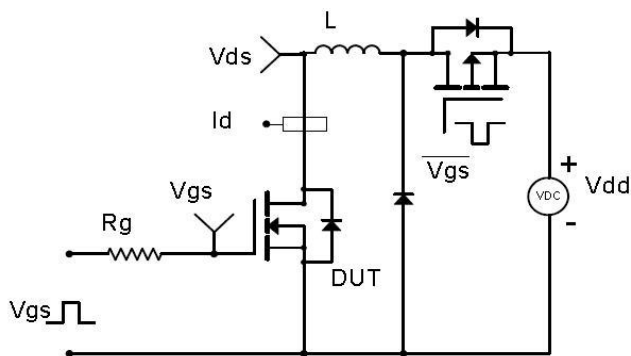
Gate Charge Test Circuit & Waveform



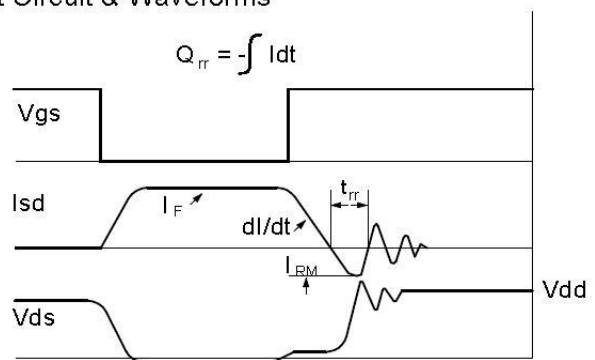
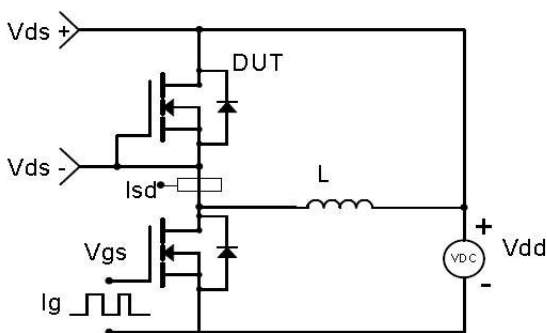
Resistive Switching Test Circuit & Waveforms



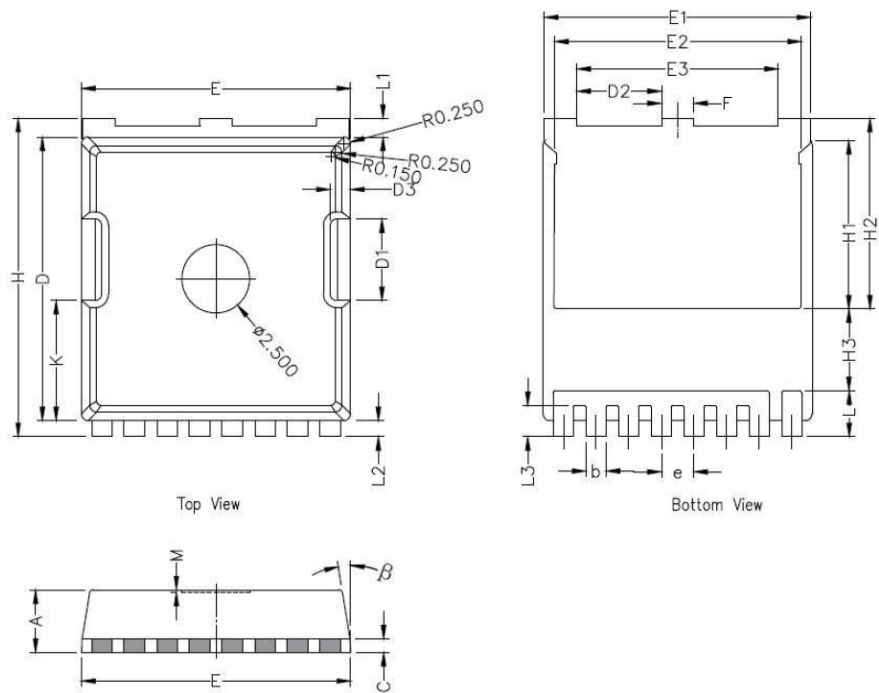
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Package Outline: TOLL



| Symbols | Millimeters |       |       |
|---------|-------------|-------|-------|
|         | MIN.        | NOM.  | MAX.  |
| A       | 2.20        | 2.30  | 2.40  |
| b       | 0.65        | 0.75  | 0.85  |
| C       | 0.508 REF   |       |       |
| D       | 10.25       | 10.40 | 10.55 |
| D1      | 2.85        | 3.00  | 3.15  |
| D2      | 2.95        | 3.10  | 3.25  |
| D3      | 0.75 REF    |       |       |
| E       | 9.75        | 9.90  | 10.05 |
| E1      | 9.65        | 9.80  | 9.95  |
| E2      | 8.95        | 9.10  | 9.25  |
| E3      | 7.25        | 7.40  | 7.55  |
| e       | 1.20 BSC    |       |       |
| F       | 1.05        | 1.20  | 1.35  |
| H       | 11.55       | 11.70 | 11.85 |
| H1      | 6.03        | 6.18  | 6.33  |
| H2      | 6.85        | 7.00  | 7.15  |
| H3      | 3.00 BSC    |       |       |
| L       | 1.55        | 1.70  | 1.85  |
| L1      | 0.55        | 0.70  | 0.85  |
| L2      | 0.45        | 0.60  | 0.75  |
| L3      | 1.00        | 1.15  | 1.30  |
| M       | 0.08 REF    |       |       |
| $\beta$ | 8°          | 10°   | 12°   |
| K       | 4.25        | 4.40  | 4.55  |