

## Lonten N-channel 120V,258A,2.55mΩ Power MOSFET

### Description

These N-channel enhancement mode power field effect transistors are using **shielded gate trench** DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and with stand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.

### Features

- 120V,258A,  $R_{DS(on).max}=2.55m\Omega@V_{GS} = 10V$
- Improved dv/dt capability
- Fast switching
- 100% EAS Guaranteed
- Green device available

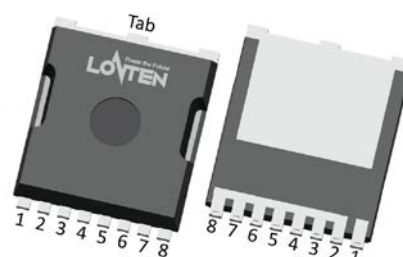
### Applications

- Motor Drives
- UPS
- DC-DC Converter
- SR
- BMS

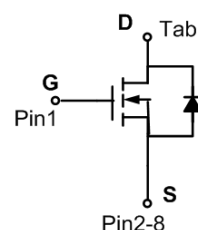
### Product Summary

|                             |        |
|-----------------------------|--------|
| $V_{DSS}$                   | 120V   |
| $R_{DS(on).typ}@V_{GS}=10V$ | 1.99mΩ |
| $I_D$                       | 258A   |

### Pin Configuration



TOLL



N-channel MOSFET



### Absolute Maximum Ratings T<sub>c</sub> = 25°C unless otherwise noted

| Parameter                                                                     | Symbol    | Value       | Unit |
|-------------------------------------------------------------------------------|-----------|-------------|------|
| Drain-Source Voltage                                                          | $V_{DS}$  | 120         | V    |
| Continuous drain current <sup>1)</sup> (T <sub>c</sub> = 25°C, Silicon limit) | $I_D$     | 258         | A    |
| (T <sub>c</sub> = 25°C, Package limit)                                        |           | 300         | A    |
| (T <sub>c</sub> = 100°C, Silicon limit)                                       |           | 163         | A    |
| Pulsed drain current <sup>2)</sup>                                            | $I_{DM}$  | 1032        | A    |
| Gate-Source voltage                                                           | $V_{GS}$  | ±20         | V    |
| Avalanche energy <sup>3)</sup>                                                | $E_{AS}$  | 1024        | mJ   |
| Power Dissipation                                                             | $P_D$     | 357         | W    |
| Storage Temperature Range                                                     | $T_{STG}$ | -55 to +150 | °C   |
| Operating Junction Temperature Range                                          | $T_J$     | -55 to +150 | °C   |

### Thermal Characteristics

| Parameter                                                                              | Symbol          | Value | Unit |
|----------------------------------------------------------------------------------------|-----------------|-------|------|
| Thermal Resistance, Junction-to-Case                                                   | $R_{\theta JC}$ | 0.35  | °C/W |
| Thermal Resistance, Junction-to-Ambient, minimal footprint <sup>4)</sup>               | $R_{\theta JA}$ | 62    | °C/W |
| Soldering temperature, wave soldering only allowed at leads. (1.6mm from case for 10s) | $T_{sold}$      | 260   | °C   |

**Package Marking and Ordering Information**

| Device     | Device Package | Marking    | Units/Reel |
|------------|----------------|------------|------------|
| LSGT12R025 | TOLL           | LSGT12R025 | 2000       |

**Electrical Characteristics**
 $T_J = 25^{\circ}\text{C}$  unless otherwise noted

| Parameter                                                     | Symbol        | Test Condition                                                            | Min. | Typ.  | Max. | Unit          |
|---------------------------------------------------------------|---------------|---------------------------------------------------------------------------|------|-------|------|---------------|
| <b>Static characteristics</b>                                 |               |                                                                           |      |       |      |               |
| Drain-source breakdown voltage                                | $BV_{DSS}$    | $V_{GS}=0\text{ V}, I_D=250\mu\text{A}$                                   | 120  | ---   | ---  | V             |
| Gate threshold voltage                                        | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=250\mu\text{A}$                                       | 3    | 3.5   | 4    | V             |
| Drain-source leakage current                                  | $I_{DSS}$     | $V_{DS}=120\text{V}, V_{GS}=0\text{V}, T_J = 25^{\circ}\text{C}$          | ---  | ---   | 1    | $\mu\text{A}$ |
|                                                               |               | $V_{DS}=120\text{V}, V_{GS}=0\text{V}, T_J = 150^{\circ}\text{C}$         | ---  | ---   | 100  | $\mu\text{A}$ |
| Gate leakage current, Forward                                 | $I_{GSSF}$    | $V_{GS}=20\text{V}, V_{DS}=0\text{V}$                                     | ---  | ---   | 100  | nA            |
| Gate leakage current, Reverse                                 | $I_{GSSR}$    | $V_{GS}=-20\text{V}, V_{DS}=0\text{V}$                                    | ---  | ---   | -100 | nA            |
| Drain-source on-state resistance                              | $R_{DS(on)}$  | $V_{GS}=10\text{V}, I_D=50\text{A}, T_J = 25^{\circ}\text{C}$             | ---  | 1.99  | 2.55 | m $\Omega$    |
|                                                               |               | $T_J = 150^{\circ}\text{C}$                                               | ---  | 4.18  | ---  |               |
| Forward transconductance                                      | $g_{fs}$      | $V_{DS}=20\text{V}, I_D=50\text{A}$                                       | ---  | 150.7 | ---  | S             |
| <b>Dynamic characteristics</b>                                |               |                                                                           |      |       |      |               |
| Input capacitance                                             | $C_{iss}$     | $V_{DS}=60\text{V}, V_{GS}=0\text{V},$<br>$f=250\text{kHz}$               | ---  | 8892  | ---  | pF            |
| Output capacitance                                            | $C_{oss}$     |                                                                           | ---  | 1701  | ---  |               |
| Reverse transfer capacitance                                  | $C_{rss}$     |                                                                           | ---  | 32.6  | ---  |               |
| Turn-on delay time                                            | $t_{d(on)}$   | $V_{DD}=60\text{V}, V_{GS}=10\text{V},$<br>$I_D=50\text{A}, R_g=10\Omega$ | ---  | 134.3 | ---  | ns            |
| Rise time                                                     | $t_r$         |                                                                           | ---  | 161.3 | ---  |               |
| Turn-off delay time                                           | $t_{d(off)}$  |                                                                           | ---  | 155.3 | ---  |               |
| Fall time                                                     | $t_f$         |                                                                           | ---  | 71.7  | ---  |               |
| Gate resistance                                               | $R_g$         | $V_{GS}=0\text{V}, V_{DS}=0\text{V}, f=1\text{MHz}$                       | ---  | 2.39  | ---  | $\Omega$      |
| <b>Gate charge characteristics</b>                            |               |                                                                           |      |       |      |               |
| Gate to source charge                                         | $Q_{gs}$      | $V_{DS}=60\text{V}, I_D=50\text{A},$<br>$V_{GS}=10\text{V}$               | ---  | 45.9  | ---  | nC            |
| Gate to drain charge                                          | $Q_{gd}$      |                                                                           | ---  | 37    | ---  |               |
| Gate charge total                                             | $Q_g$         |                                                                           | ---  | 138.2 | ---  |               |
| Gate plateau voltage                                          | $V_{plateau}$ |                                                                           | ---  | 5.5   | ---  | V             |
| Output Charge                                                 | $Q_{oss}$     | $V_{DS}=60\text{V}, V_{GS}=0\text{V}$                                     | ---  | 195   | ---  | nC            |
| <b>Drain-Source diode characteristics and Maximum Ratings</b> |               |                                                                           |      |       |      |               |
| Continuous Source Current                                     | $I_S$         |                                                                           | ---  | ---   | 258  | A             |
| Pulsed Source Current                                         | $I_{SM}$      |                                                                           | ---  | ---   | 1032 | A             |
| Diode Forward Voltage                                         | $V_{SD}$      | $V_{GS}=0\text{V}, I_S=50\text{A}, T_J=25^{\circ}\text{C}$                | ---  | ---   | 1.1  | V             |
| Peak reverse recovery current                                 | $I_{rrm}$     | $I_S=50\text{A}, di/dt=100\text{A}/\mu\text{s}, T_J=25^{\circ}\text{C}$   | ---  | 4.84  | ---  | A             |
| Reverse Recovery Time                                         | $t_{rr}$      |                                                                           | ---  | 104.4 | ---  | ns            |
| Reverse Recovery Charge                                       | $Q_{rr}$      |                                                                           | ---  | 312.5 | ---  | nC            |

Notes:

- Limited by maximum junction temperature and duty cycle.
- Repetitive Rating: Pulse width limited by maximum junction temperature.
- $V_{DD}=50\text{V}, V_{GS}=10\text{V}, L=0.5\text{mH}, I_{AS}=64\text{A},$  Starting  $T_J=25^{\circ}\text{C}.$
- The value of  $R_{thJA}$  is measured by placing the device in a still air box which is one cubic foot.

## Electrical Characteristics Diagrams

Figure 1. Typ. Output Characteristics

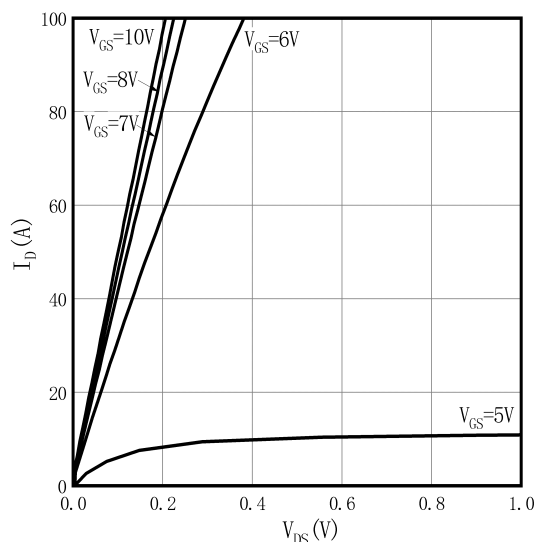


Figure 2. Transfer Characteristics

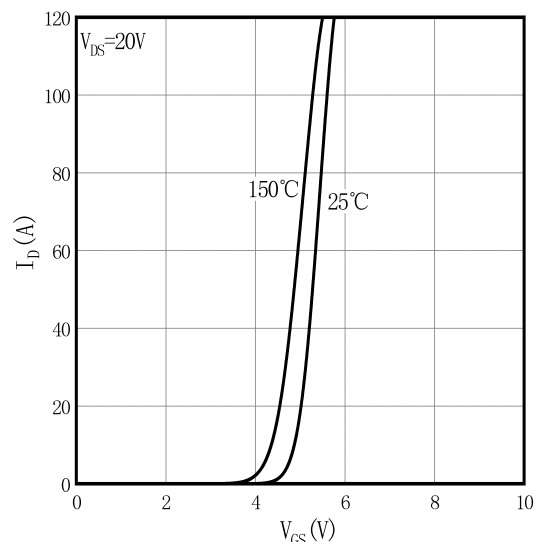


Figure 3. On-Resistance vs. Drain Current

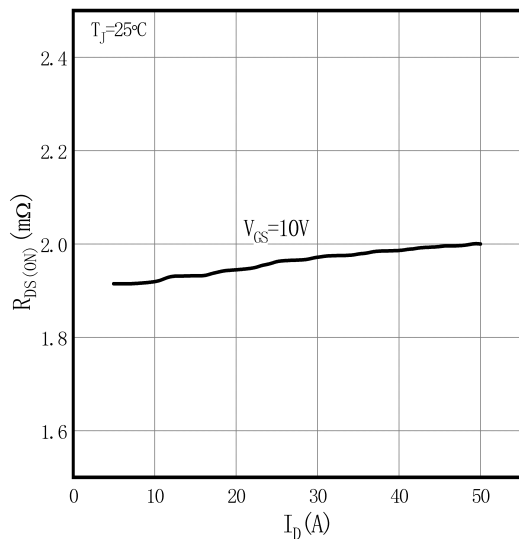


Figure 4. On-Resistance vs. Temperature

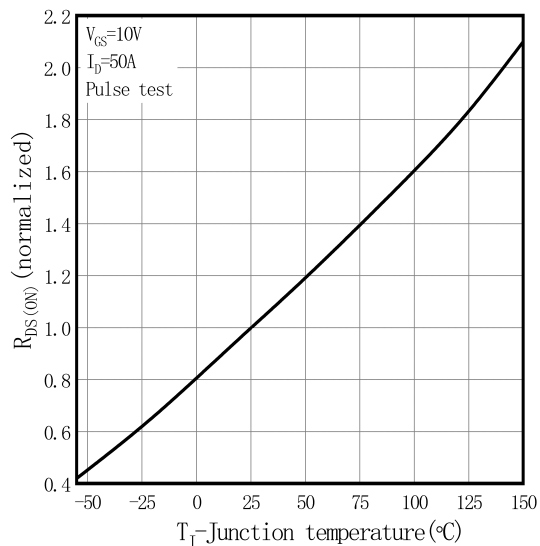


Figure 5. Breakdown Voltage vs. Temperature

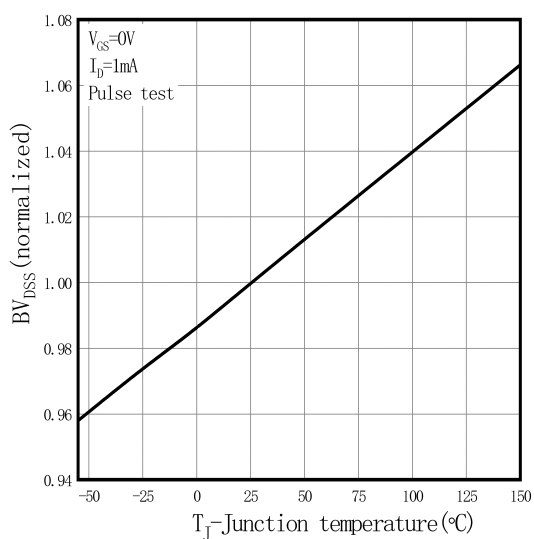


Figure 6. Threshold Voltage vs. Temperature

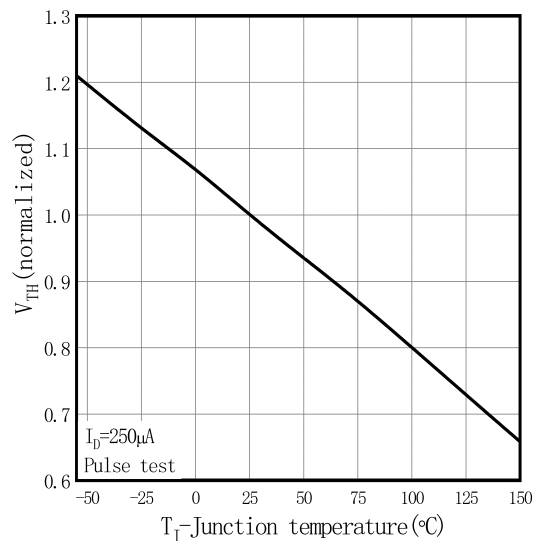


Figure 7.  $R_{DS(on)}$  vs. Gate Voltage

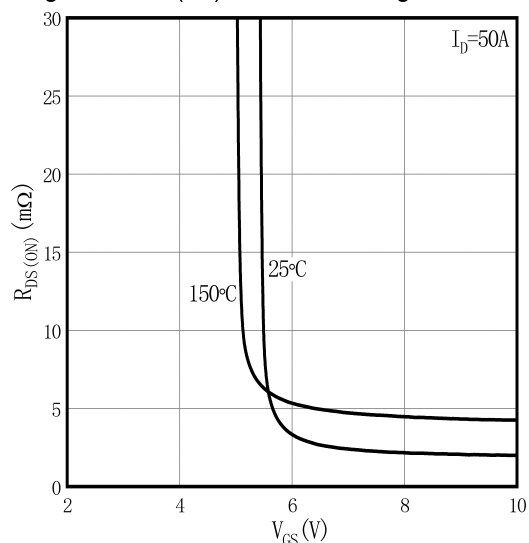


Figure 8. Body-Diode Characteristics

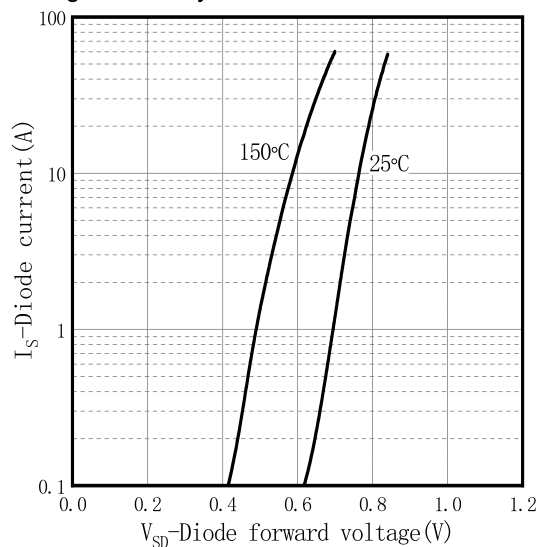


Figure 9. Capacitance Characteristics

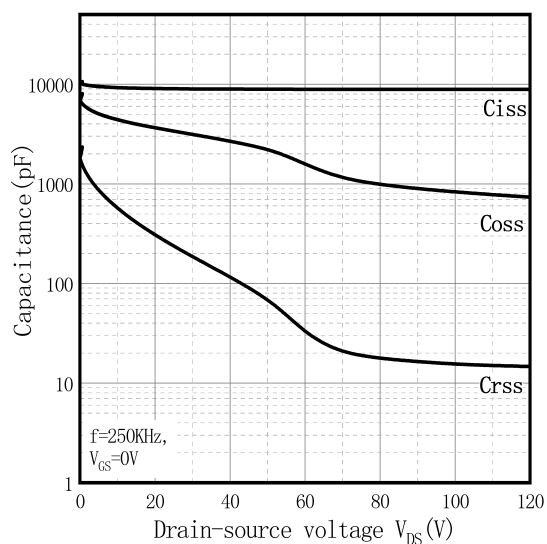


Figure 10. Gate Charge Characteristics

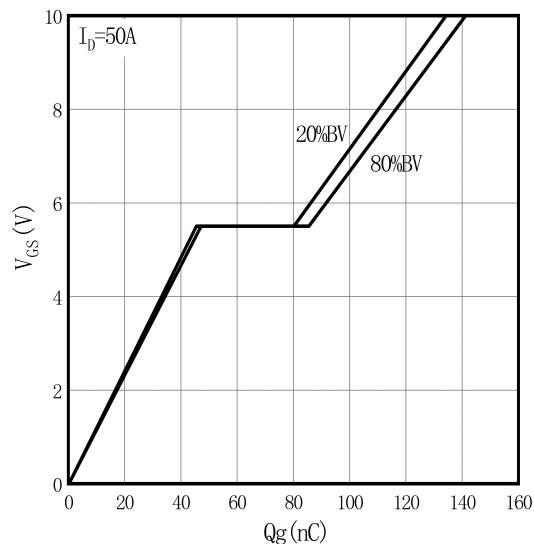


Figure 11. Drain Current Derating

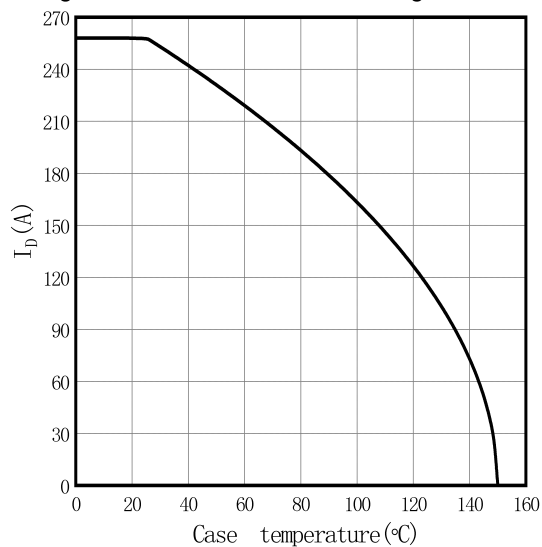


Figure 12. Power Dissipation vs. Temperature

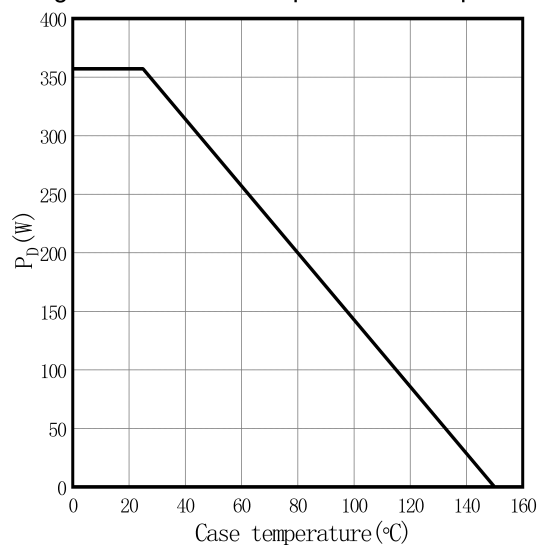


Figure 13. Safe Operating Area

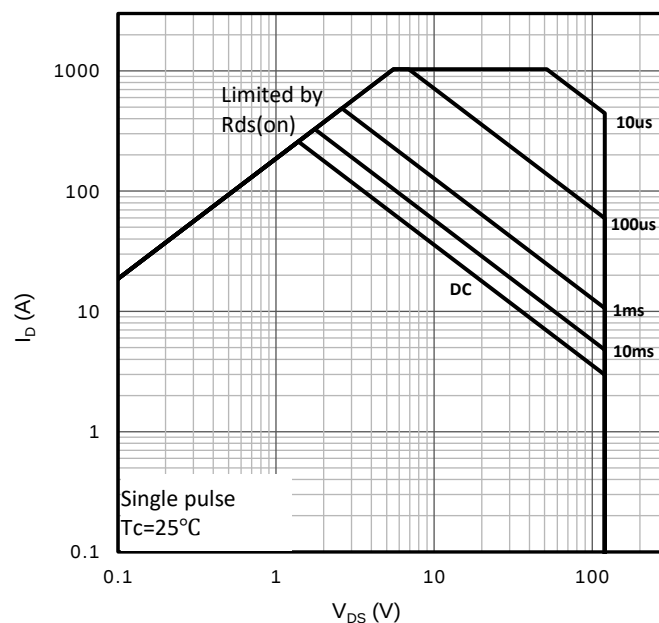
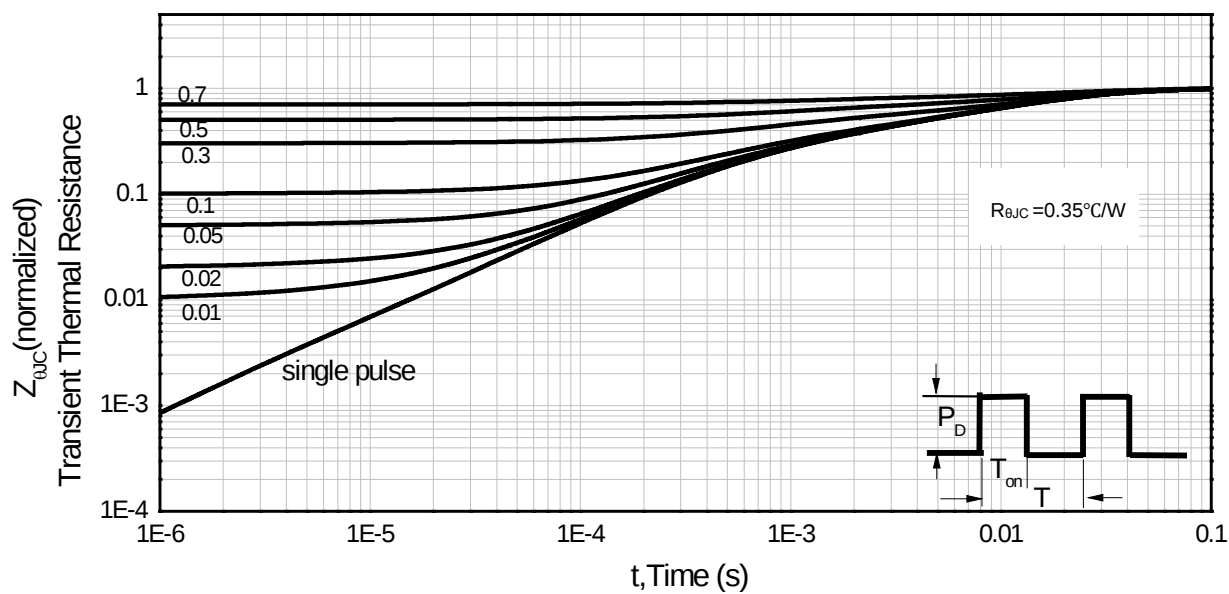
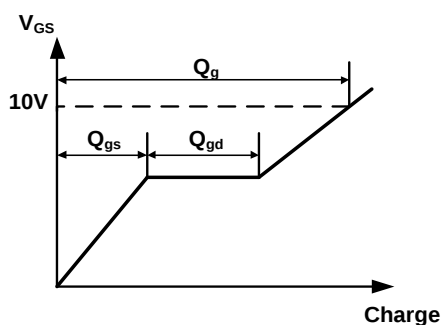
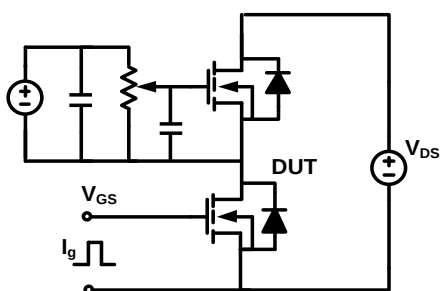


Figure 14. Normalized Maximum Transient Thermal Impedance ( $R_{thJC}$ )

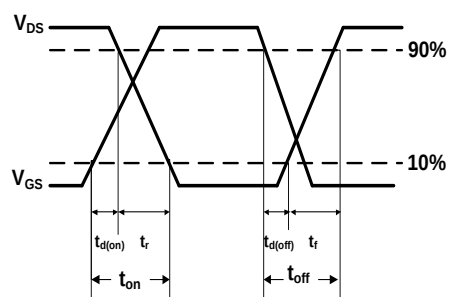
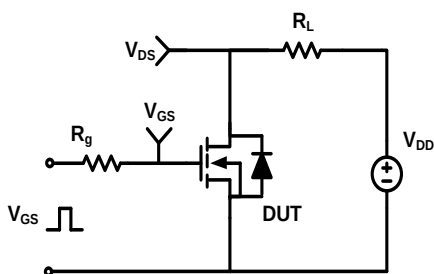


# Test Circuit & Waveforms

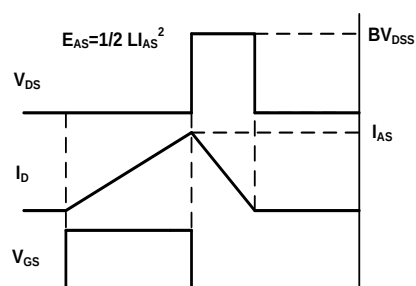
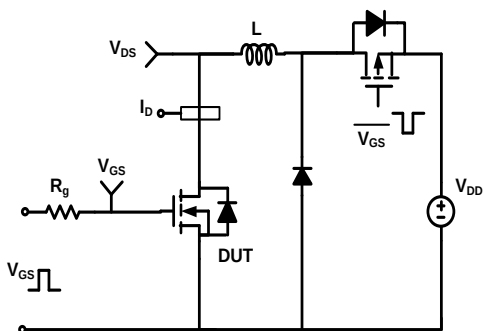
## Gate Charge Test Circuit & Waveform



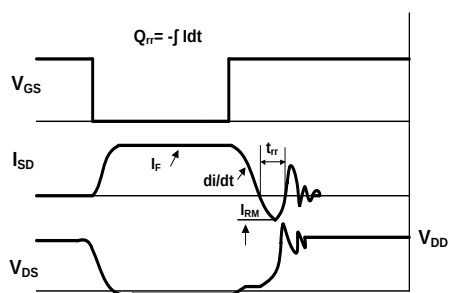
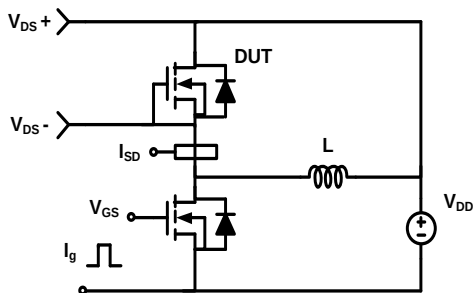
## Resistive Switching Test Circuit & Waveform



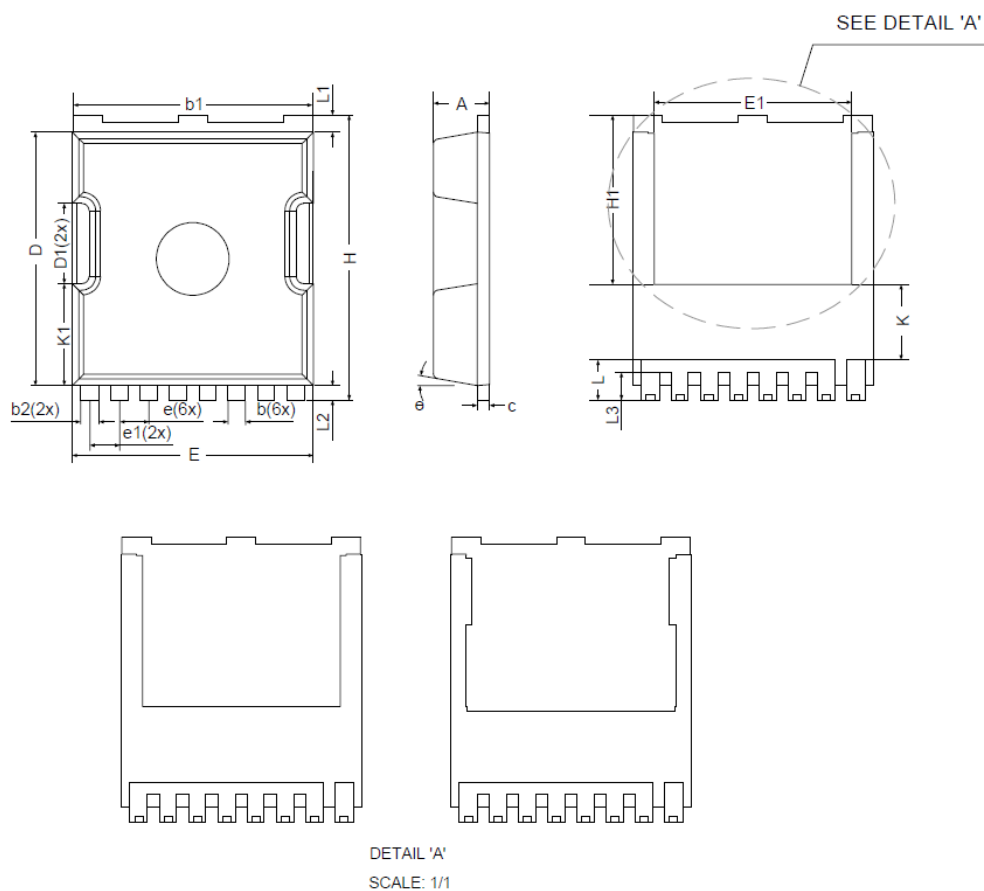
## Unclamped Inductive Switching (UIS) Test Circuit & Waveform



## Diode Recovery Test Circuit & Waveform



**Mechanical Dimensions for TOLL**



| SYMBOLS  | MILLIMETERS |       | INCHES  |       |
|----------|-------------|-------|---------|-------|
|          | MIN         | MAX   | MIN     | MAX   |
| A        | 2.15        | 2.45  | 0.085   | 0.096 |
| b        | 0.60        | 0.90  | 0.024   | 0.035 |
| b1       | 9.65        | 9.95  | 0.380   | 0.392 |
| b2       | 0.65        | 0.90  | 0.026   | 0.035 |
| c        | 0.40        | 0.60  | 0.016   | 0.024 |
| D        | 10.18       | 10.58 | 0.401   | 0.417 |
| D1       | 3.15        | 3.45  | 0.124   | 0.136 |
| E        | 9.70        | 10.10 | 0.382   | 0.398 |
| E1       | 7.90        | 8.40  | 0.311   | 0.331 |
| e        | 1.10        | 1.30  | 0.043   | 0.051 |
| e1       | 1.10        | 1.30  | 0.043   | 0.051 |
| H        | 11.48       | 11.88 | 0.452   | 0.468 |
| H1       | 6.75        | 7.30  | 0.266   | 0.287 |
| K        | 2.45        | 3.33  | 0.096   | 0.131 |
| K1       | 4.03        | 4.33  | 0.159   | 0.170 |
| L        | 1.50        | 2.10  | 0.059   | 0.083 |
| L1       | 0.50        | 0.90  | 0.020   | 0.035 |
| L2       | 0.45        | 0.75  | 0.018   | 0.030 |
| L3       | 1.00        | 1.30  | 0.039   | 0.051 |
| $\theta$ | 10° REF     |       | 10° REF |       |

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**Revision History**

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LSGT12R025

**Revision 1.0****Disclaimer**

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