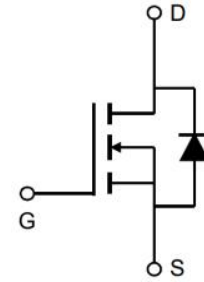




### Feature

- 60V/160A  
 $R_{DS(ON)} = 2.5 \text{ m}\Omega$  (typ.) @  $V_{GS} = 10\text{V}$   
 $R_{DS(ON)} = 3.7 \text{ m}\Omega$  (typ.) @  $V_{GS} = 4.5\text{V}$
- 100% Avalanche Tested
- Reliable and Rugged
- Halogen- Free Devices Available  
 (RoHS Compliant)

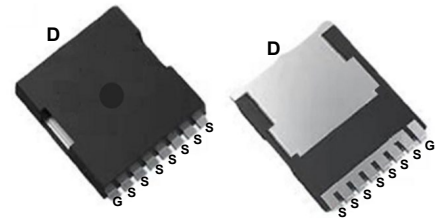


Single N-Channel MOSFET

### TOLL Pin Configuration

### Applications

- High Frequency Point-of-Load Synchronous Buck Converter
- Power Tool Application
- Networking DC-DC Power System



TOLL

### Absolute Maximum Ratings

| Symbol   | Parameter                                  |                         | Rating     | Unit               |
|--|--|-------------------------|------------|--------------------|
| <b>Common Ratings</b> ( $T_c=25^\circ\text{C}$ Unless Otherwise Noted) |  |                         |            |                    |
| $V_{DSS}$  | Drain-Source Voltage                       |                         | 60         | V                  |
| $V_{GSS}$  | Gate-Source Voltage                        |                         | $\pm 20$   | V                  |
| $T_J$  | Maximum Junction Temperature               |                         | 175        | $^\circ\text{C}$   |
| $T_{STG}$  | Storage Temperature Range                  |                         | -55 to 175 | $^\circ\text{C}$   |
| $I_S$  | Source Current-Continuous(Body Diode)      | $T_c=25^\circ\text{C}$  | 160        | A                  |
| <b>Mounted on Large Heat Sink</b>                                      |  |                         |            |                    |
| $I_{DM}$   | Pulsed Drain Current *                     | $T_c=25^\circ\text{C}$  | 620        | A                  |
| $I_D$  | Continuous Drain Current                   | $T_c=25^\circ\text{C}$  | 160        | A                  |
|  |  | $T_c=100^\circ\text{C}$ | 113        | A                  |
| $P_D$  | Maximum Power Dissipation                  | $T_c=25^\circ\text{C}$  | 125        | W                  |
|  |  | $T_c=100^\circ\text{C}$ | 62.5       | W                  |
| $R_{\theta JC}$  | Thermal Resistance, Junction-to-Case       |                         | 1.2        | $^\circ\text{C/W}$ |
| $R_{\theta JA}$  | Thermal Resistance, Junction-to-Ambient ** |                         | 62         | $^\circ\text{C/W}$ |
| $E_{AS}$   | SinglePulsed-Avalanche Energy ***          | $L=0.3\text{mH}$        | 301.8      | mJ                 |

Note: \* Repetitive rating; pulse width limited by max.junction temperature.  
 \*\* Surface mounted on FR-4 board.  
 \*\*\* Limited by  $T_{Jmax}$ , starting  $T_J=25^\circ\text{C}$ ,  $L = 0.3\text{mH}$ ,  $V_{DS} = 48\text{V}$ ,  $V_{GS} = 10\text{V}$ .



### Electrical Characteristics (T<sub>c</sub> =25°C Unless Otherwise Noted)

| Symbol                        | Parameter                        | Test Conditions   | Min | Typ. | Max | Unit |
|-------------------------------|----------------------------------|---|-----|------|-----|------|
| <b>Static Characteristics</b> |                                  |   |     |      |     |      |
| BV <sub>DSS</sub>             | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>DS</sub> =250μA               | 60  | -    | -   | V    |
| I <sub>DSS</sub>              | Drain-to-Source Leakage Current  | V <sub>DS</sub> =60V, V <sub>GS</sub> =0V                 | -   | -    | 1   | μA   |
|                               |                                  | T <sub>J</sub> =100°C                                     | -   | -    | 50  | μA   |
| V <sub>GS(th)</sub>           | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>DS</sub> =250μA | 1.0 | 2.1  | 3.0 | V    |
| I <sub>GSS</sub>              | Gate-Source Leakage Current      | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                | -   | -    | 100 | nA   |
| R <sub>DS(ON)*</sub>          | Drain-Source On-State Resistance | V <sub>GS</sub> =10V, I <sub>DS</sub> =40A                | -   | 2.5  | 3.2 | mΩ   |
|                               |                                  | V <sub>GS</sub> =4.5V, I <sub>DS</sub> =40A               | -   | 3.7  | 4.5 | mΩ   |
| <b>Diode Characteristics</b>  |                                  |   |     |      |     |      |
| V <sub>SD*</sub>              | Diode Forward Voltage            | I <sub>SD</sub> =40A, V <sub>GS</sub> =0V                 | -   | 0.85 | 1.3 | V    |
| t <sub>rr</sub>               | Reverse Recovery Time            | I <sub>SD</sub> =40A, dI <sub>SD</sub> /dt=100A/μs        | -   | 41.1 | -   | ns   |
| Q <sub>rr</sub>               | Reverse Recovery Charge          |   | -   | 48.2 | -   | nC   |

### Electrical Characteristics (Cont.) (T<sub>c</sub> =25°C Unless Otherwise Noted)

| Symbol                             | Parameter                    | Test Conditions   | Min | Typ. | Max | Unit |
|------------------------------------|------------------------------|---|-----|------|-----|------|
| <b>Dynamic Characteristics</b>     |                              |   |     |      |     |      |
| R <sub>G</sub>                     | Gate Resistance              | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1MHz  | -   | 0.58 | -   | Ω    |
| C <sub>iss</sub>                   | Input Capacitance            | V <sub>GS</sub> =0V,<br>V <sub>DS</sub> =25V,<br>Frequency=1.0MHz                       | -   | 3915 | -   | pF   |
| C <sub>oss</sub>                   | Output Capacitance           |   | -   | 1310 | -   |      |
| C <sub>rss</sub>                   | Reverse Transfer Capacitance |   | -   | 10.2 | -   |      |
| t <sub>d(ON)</sub>                 | Turn-on Delay Time           | V <sub>DD</sub> =30V, R <sub>G</sub> =4Ω,<br>I <sub>DS</sub> =40A, V <sub>GS</sub> =10V | -   | 15.3 | -   | ns   |
| T <sub>r</sub>                     | Turn-on Rise Time            |   | -   | 34   | -   |      |
| t <sub>d(OFF)</sub>                | Turn-off Delay Time          |   | -   | 33   | -   |      |
| T <sub>f</sub>                     | Turn-off Fall Time           |   | -   | 9.4  | -   |      |
| <b>Gate Charge Characteristics</b> |                              |   |     |      |     |      |
| Q <sub>g (10V)</sub>               | Total Gate Charge            | V <sub>DS</sub> =48V, V <sub>GS</sub> =10V,<br>I <sub>D</sub> =40A                      | -   | 58.3 | -   | nC   |
| Q <sub>g (4.5V)</sub>              | Total Gate Charge            |   | -   | 27.7 | -   |      |
| Q <sub>gs</sub>                    | Gate-Source Charge           |   | -   | 15.7 | -   |      |
| Q <sub>gd</sub>                    | Gate-Drain Charge            |   | -   | 9.7  | -   |      |

Note: \*Pulse test, pulse width ≤ 300us, duty cycle ≤ 2%



### Typical Operating Characteristics

Figure 1: Power Dissipation

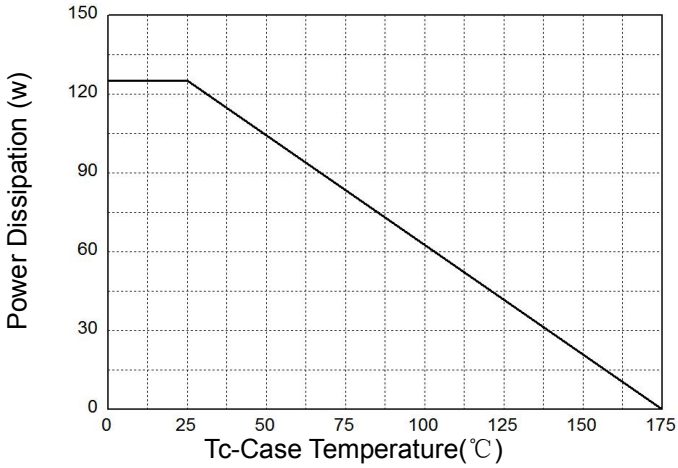


Figure 2: Drain Current

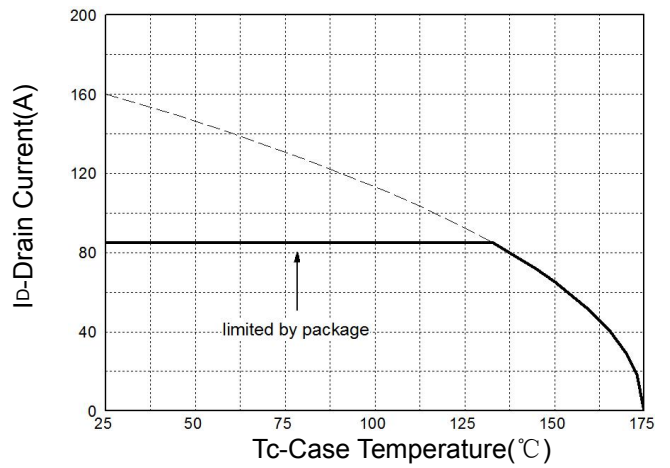


Figure 3: Safe Operation Area

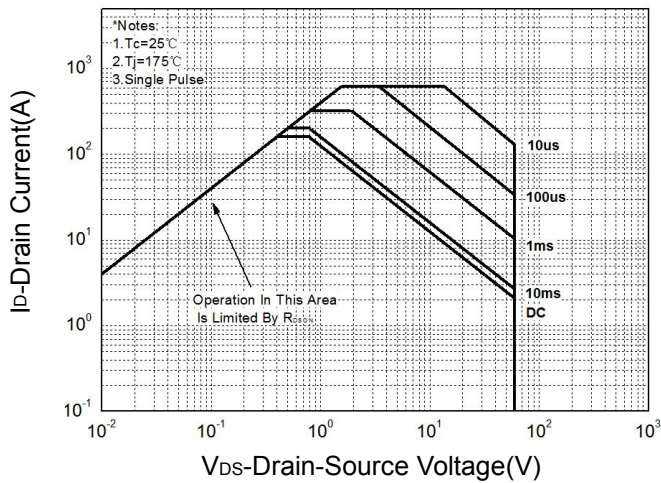


Figure 4: Thermal Transient Impedance

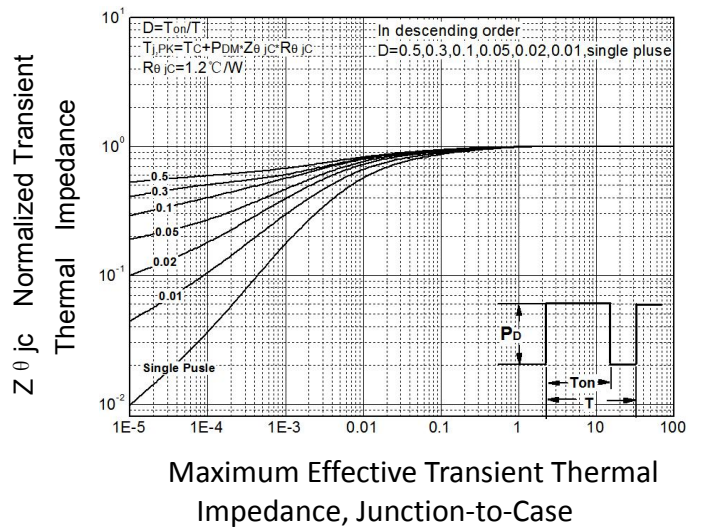


Figure 5: Output Characteristics

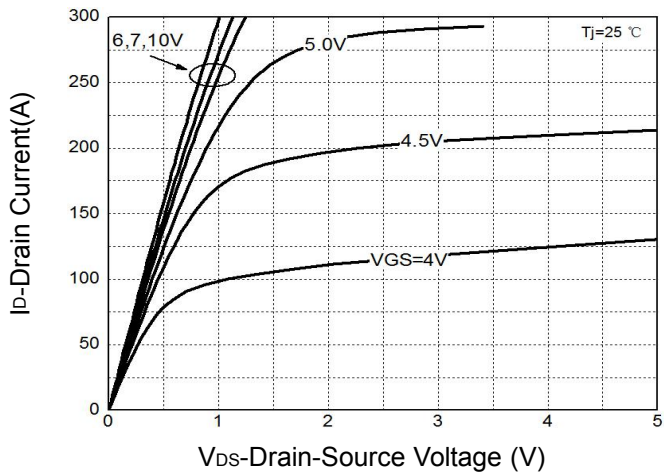
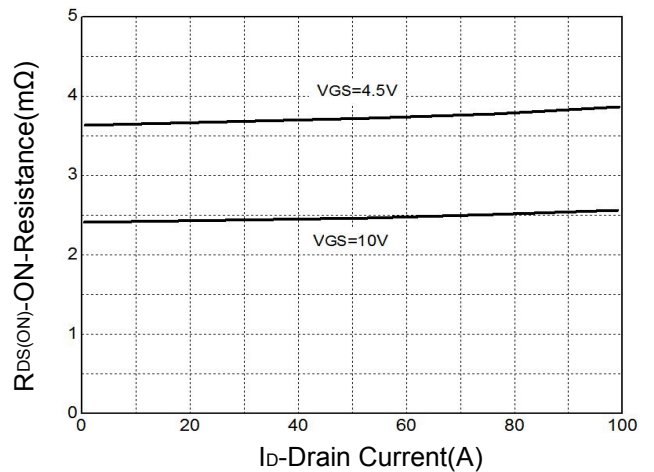


Figure 6: Drain-Source On Resistance





### Typical Operating Characteristics(Cont.)

Figure 7: On-Resistance vs. Temperature

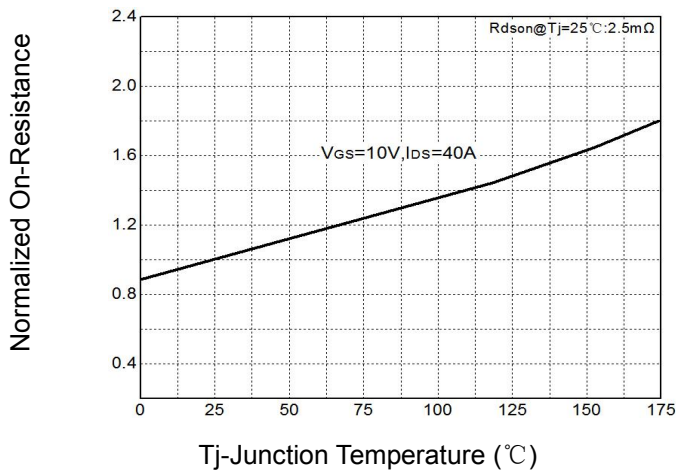


Figure 8: Source-Drain Diode Forward

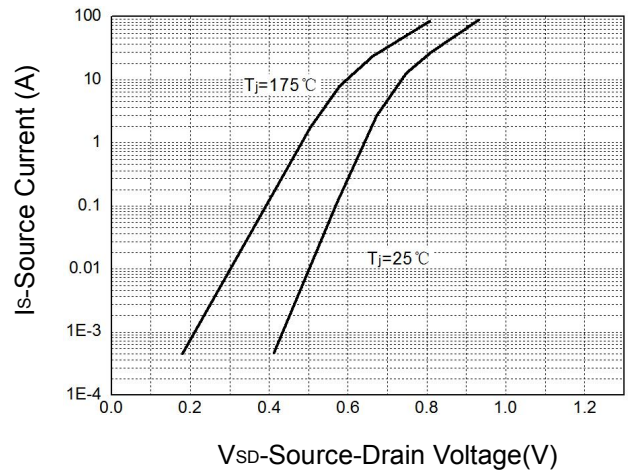


Figure 9: Capacitance Characteristics

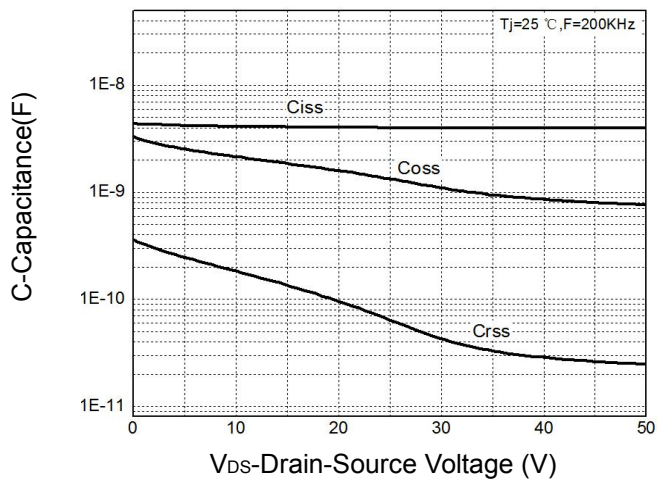
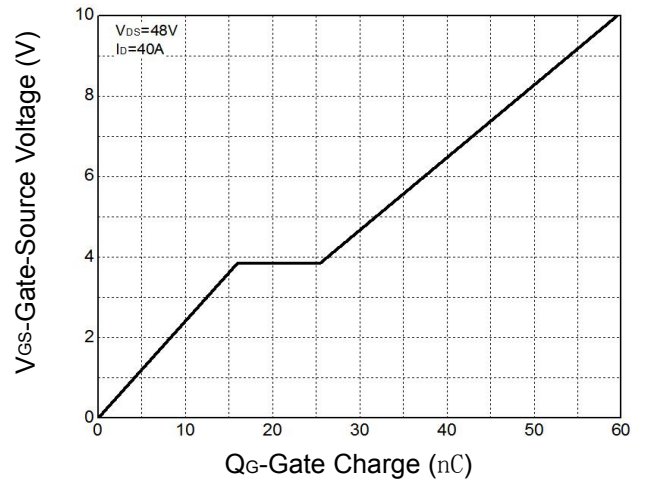
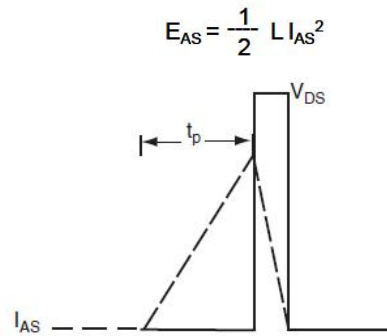
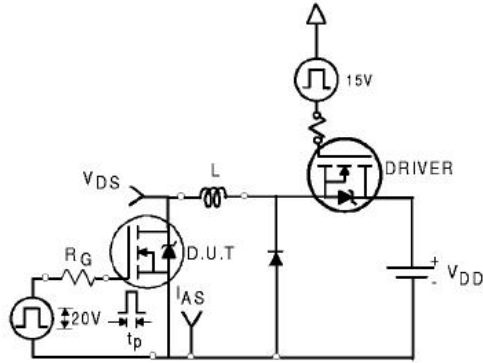


Figure 10: Gate Charge Characteristics

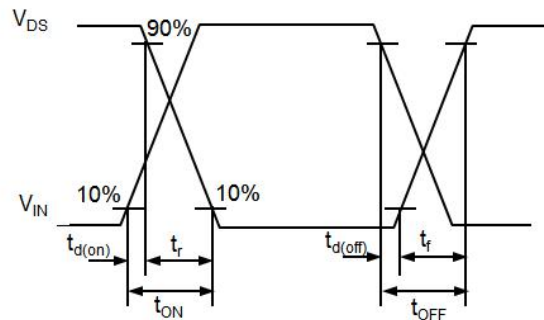
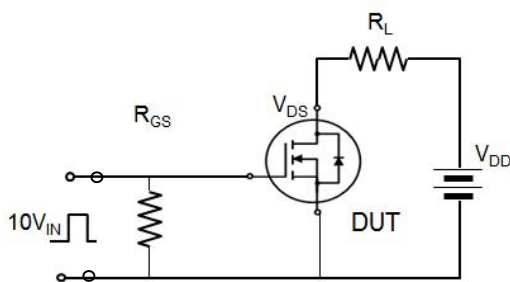




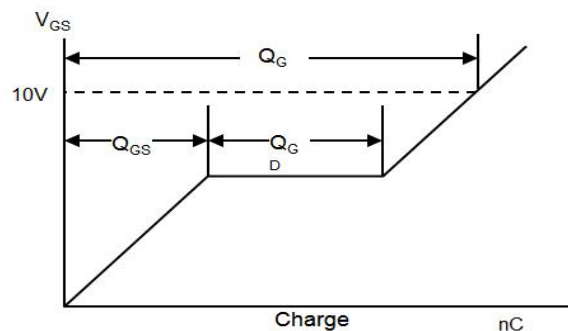
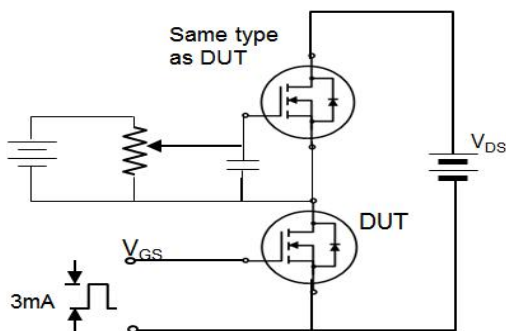
### Avalanche Test Circuit and Waveforms



### Switching Time Test Circuit and Waveforms

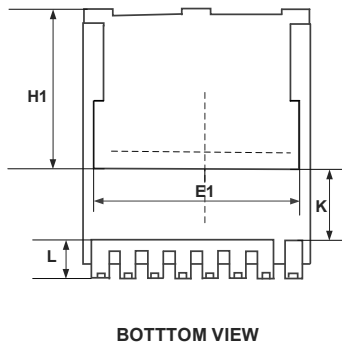
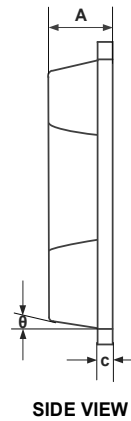
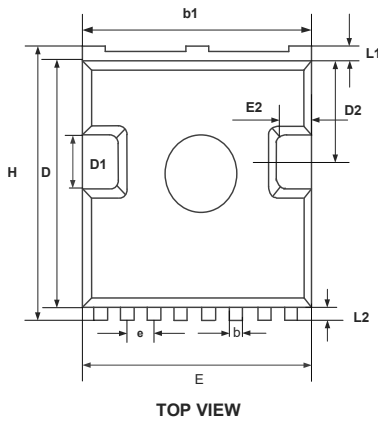


### Gate Charge Test Circuit and Waveforms





### Mechanical Dimensions for TOLL-8L



### COMMON DIMENSIONS

| SYMBOL   | MM        |       |
|----------|-----------|-------|
|          | MIN       | MAX   |
| A        | 2.20      | 2.40  |
| b        | 0.60      | 0.90  |
| $b_1$    | 9.70      | 9.90  |
| c        | 0.40      | 0.60  |
| D        | 10.20     | 10.60 |
| $D_1$    | 3.10      | 3.50  |
| $D_2$    | 4.45      | 4.75  |
| E        | 9.70      | 10.10 |
| $E_1$    | 7.80BSC   |       |
| $E_2$    | 0.50      | 0.70  |
| e        | 1.200 BSC |       |
| H        | 11.45     | 11.90 |
| $H_1$    | 6.75 BSC  |       |
| K        | 3.10 REF  |       |
| L        | 1.70      | 2.10  |
| $L_1$    | 0.60      | 0.80  |
| $L_2$    | 0.50      | 0.70  |
| $\theta$ | 10° REF   |       |



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