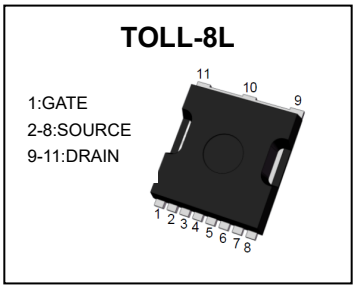
SZCJ

# TOLL-8L Plastic-Encapsulate MOSFET

**I09MS** N-Channel Power MOSFET




## Key Performance Parameters

| $V_{BR(DSS)}$ | $R_{DS(on)}$TYP | $I_D$ |
|---|---|---|
| 90V | 1.2mΩ@10V | 250A |

## DESCRIPTION

The N-Channel enhancement mode power field effect transistors is using SGT technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.These devices are well suited for high efficiency fast switching applications.

## FEATURES

- High Power and current handing capability
- Good stability and uniformity with high $E_{AS}$
- High density cell design for ultra low $R_{DS(ON)}$
- Excellent package for good heat dissipation

## APPLICATIONS

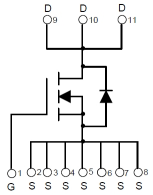
- High-Efficiency DC-DC Converters
- BLDC Motor drive applications
- Synchronous rectifier applications

## MARKING




XXXXXXXXX = TL1R5SN09MS
Solid dot = Pin1 indicator.
YYYYX = Code.

## EQUIVALENT CIRCUIT




## ABSOLUTE MAXIMUM RATINGS ( $T_J$=25℃ unless otherwise specified )

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 90 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current | $T_C$ =25℃ | $I_D$ | 250 | A |
| | $T_C$ =100℃ | | 158 | |
| Pulsed Drain Current | | $I_{DM}$①② | 1000 | A |
| Continuous Drain Current | $T_A$ =25℃ | $I_D$ | 29 | A |
| | $T_A$ =75℃ | | 22 | |
| Avalanche Current | | $I_{AS}$③ | 64 | A |
| Single Pulsed Avalanche Energy | | $E_{AS}$③ | 1024 | mJ |
| Power Dissipation | | $P_D$① | 625 | W |
| Operating Junction and Storage Temperature Range | | $T_J$,$T_{stg}$ | -55~+150 | ℃ |

## Thermal Characteristics

| Parameter | Symbol | Value | | Unit |
|---|---|---|---|---|
| | | Typ | Max | |
| Thermal Resistance from Junction to Case | $R_{\theta JC}$ | 0.12 | 0.20 | ℃/W |
| Thermal Resistance from Junction to Ambient | $R_{\theta JA}$⑥ | 40 | 55 | ℃/W |

# Typical Characteristics

## ELECTRICAL CHARACTERISTICS ($T_J$=25℃ unless otherwise specified)

### Static Characteristics

| Parameter | Symbol | Test Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}$=0V, $I_D$=250μA | | 90 | - | - | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=90V, $V_{GS}$=0V | $T_J$=25℃ | - | - | 1.0 | μA |
| | | | $T_J$=125℃ | - | - | 100 | |
| Gate-body leakage current | $I_{GSS}$ | $V_{GS}$=±20V, $V_{DS}$=0V | | - | - | ±100 | nA |
| Gate-threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | | 2.3 | 3.2 | 3.9 | V |
| Static drain-source on-sate resistance | $R_{DS(on)}$④ | $V_{GS}$=10V, $I_D$=50A | $T_J$=25℃ | - | 1.2 | 1.5 | mΩ |
| | | | $T_J$=125℃ | - | 1.9 | 2.4 | |

### Dynamic Characteristics⑤

| | | | | | | |
|---|---|---|---|---|---|---|
| Input capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=45V, f=100kHz | - | 12725 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 3256 | - | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 73 | - | |
| Gate resistance | $R_g$ | f=1MHz | - | 2.0 | - | Ω |
| Total gate charge | $Q_g$ | $V_{GS}$=10V, $V_{DS}$=45V, $I_D$=50A | - | 170 | - | nC |
| Gate charge at threshold | $Q_{G(th)}$ | | - | 43 | - | |
| Gate-source charge | $Q_{gs}$ | | - | 59 | - | |
| Gate-drain charge | $Q_{gd}$ | | - | 29 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=45V, $V_{GS}$=10V, $I_D$=50A, $R_g$=3Ω | - | 30 | - | ns |
| Turn-on rise time | $t_r$ | | - | 18 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 71 | - | |
| Turn-off fall time | $t_f$ | | - | 21 | - | |

### Reverse Diode Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| Drain-source diode forward voltage | $V_{SD}$④ | $V_{GS}$=0V, $I_S$=50A | - | - | 1.2 | V |
| Continuous drain-source diode forward current | $I_S$① | | - | - | 250 | A |
| Pulsed drain-source diode forward current | $I_{SM}$①② | | - | - | 1000 | A |
| Reverse recovery time | $t_{rr}$ | $V_{DD}$=45V, $I_S$=50A, di/dt=500A/μs | - | 48 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 541 | - | nC |

Notes:

①.$T_C$=25℃ Limited only by maximum temperature allowed.

②.$P_W$ ≤10μs, Duty cycle ≤1%.

③.EAS condition: $V_{DD}$=50V, $V_{GS}$=10V, L=0.5mH, $R_g$=25Ω Starting $T_J$=25℃.

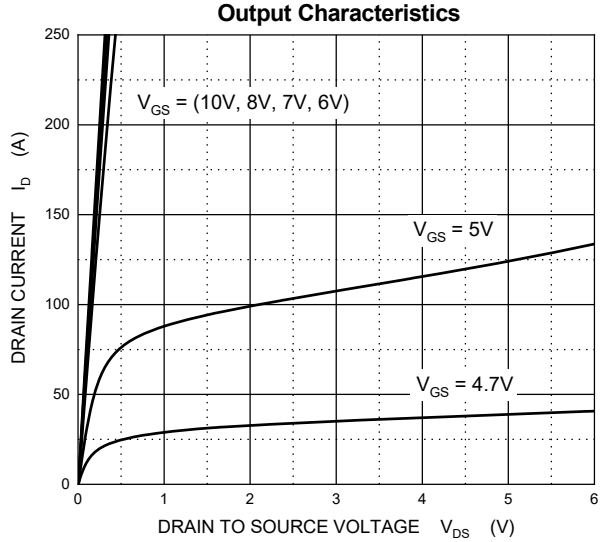
④.Pulse Test : Pulse Width ≤380μs, duty cycle ≤2%.

⑤.Guaranteed by design, not subject to production.

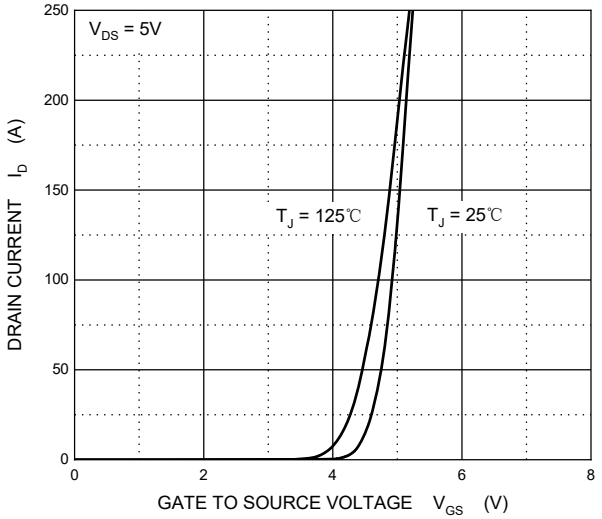
⑥.Device mounted on 1 $in^2$ FR-4 board with 2oz. double-sided Copper, in a still air environment with $T_A$=25℃.

# Typical Characteristics

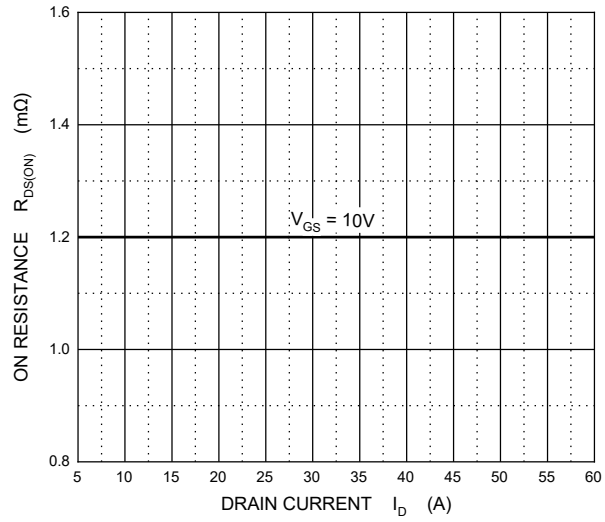
**Output Characteristics**



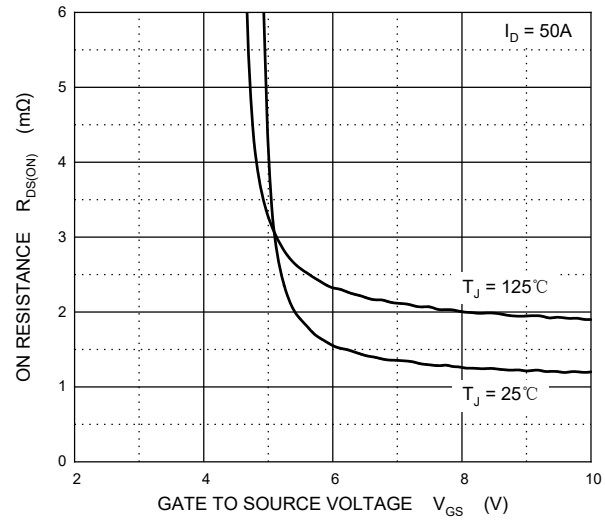

**Transfer Characteristics**



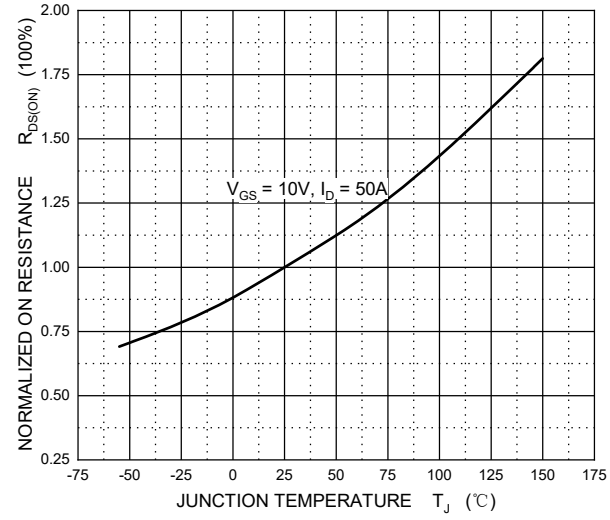

**On Resistance vs. Drain Current**



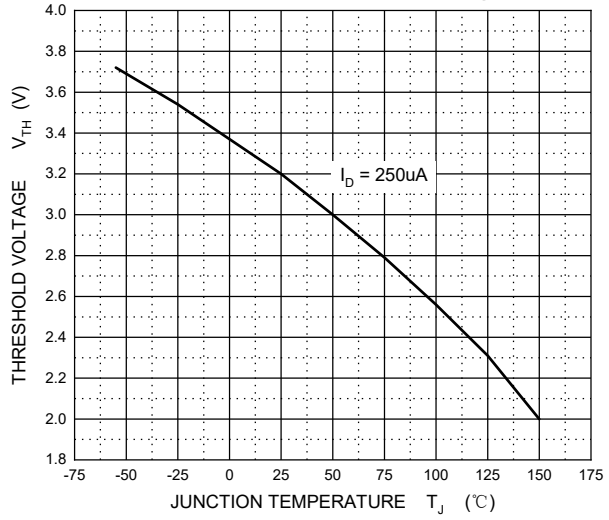

**On Resistance vs. Gate-Source Bias**




**On Resistance vs. Junction Temperature**

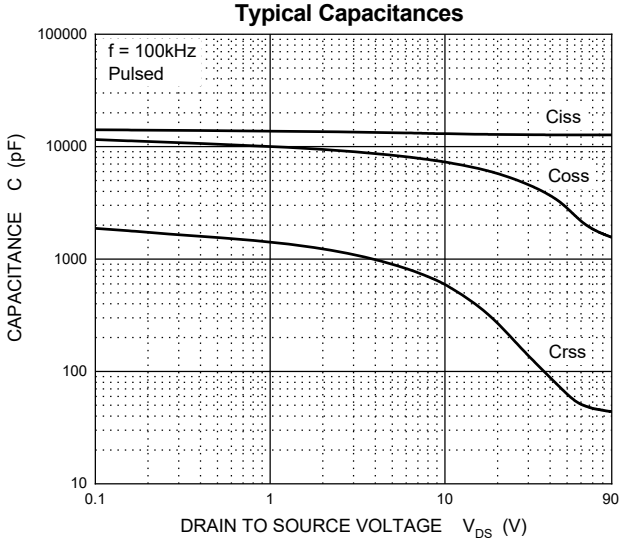



**Gate-Source Threshold Voltage**

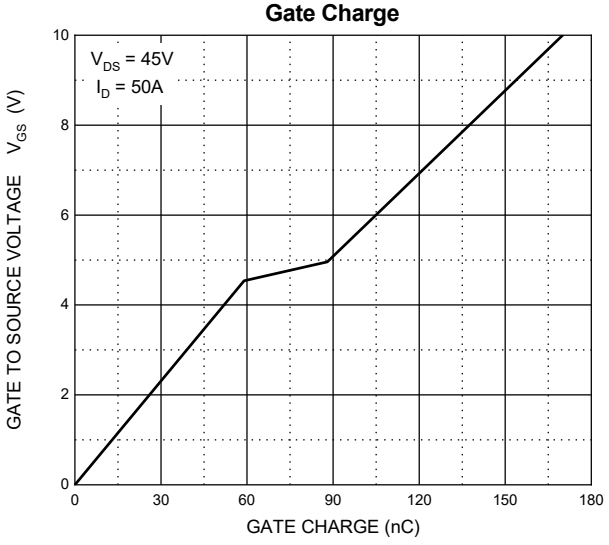


# Typical Characteristics

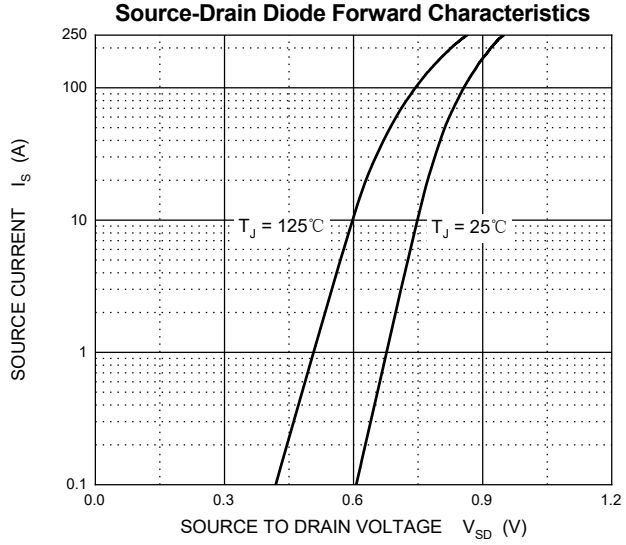
**Typical Capacitances**



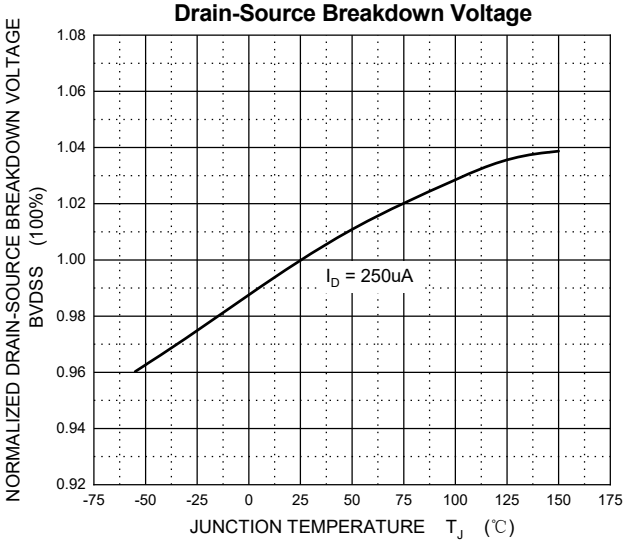

**Gate Charge**



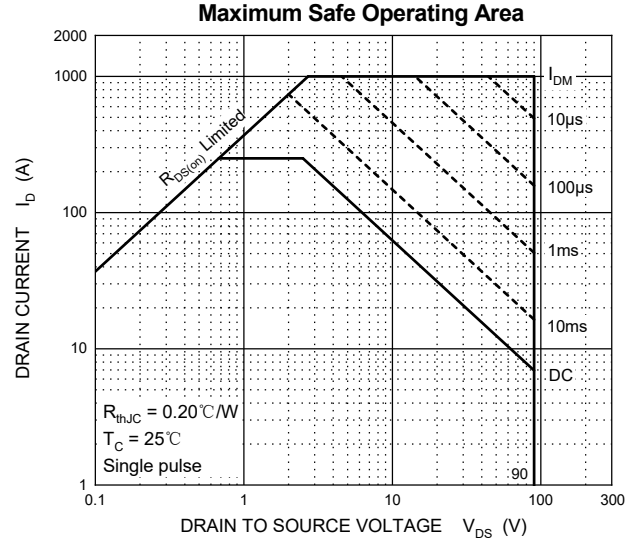

**Source-Drain Diode Forward Characteristics**



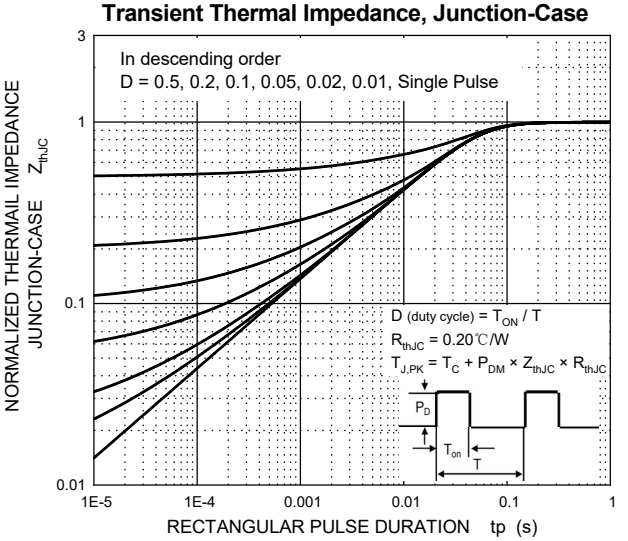

**Drain-Source Breakdown Voltage**




**Maximum Safe Operating Area**

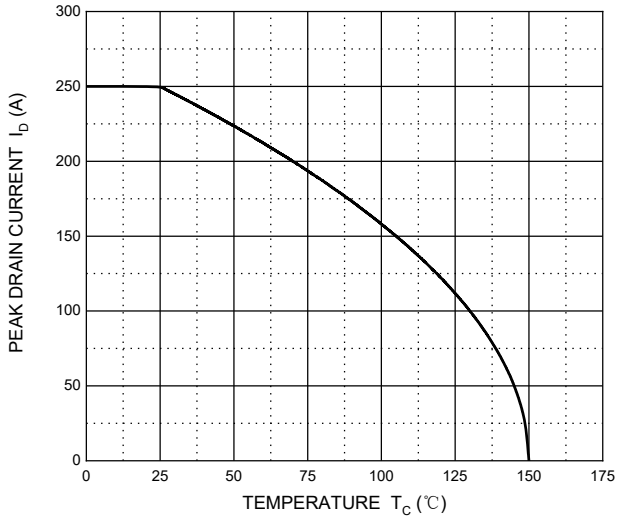



**Transient Thermal Impedance, Junction-Case**

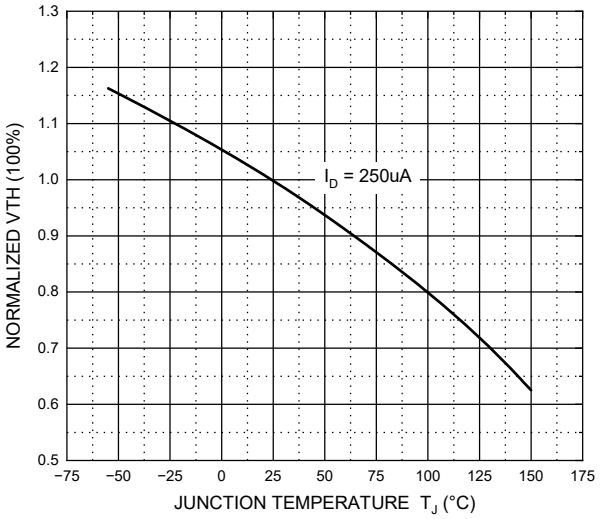


# Typical Characteristics

**ID vs. TC**

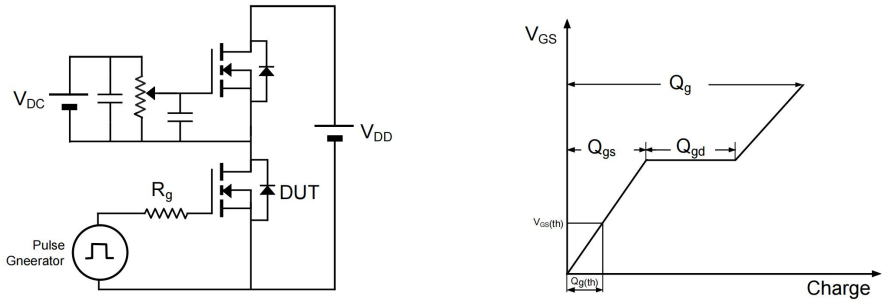



**Normalized Threshold Voltage vs. Junction Temperature**

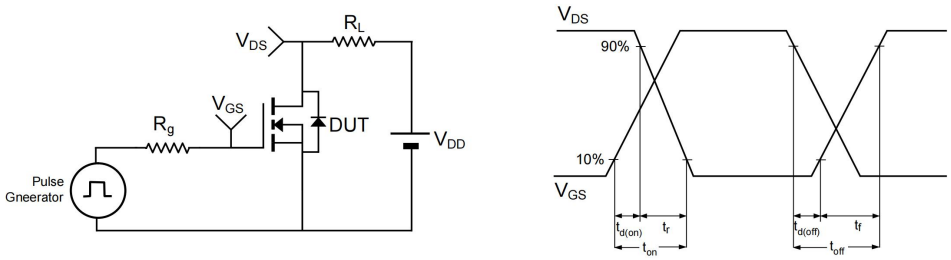


# TEST CIRCUIT AND WAVEFOMRS

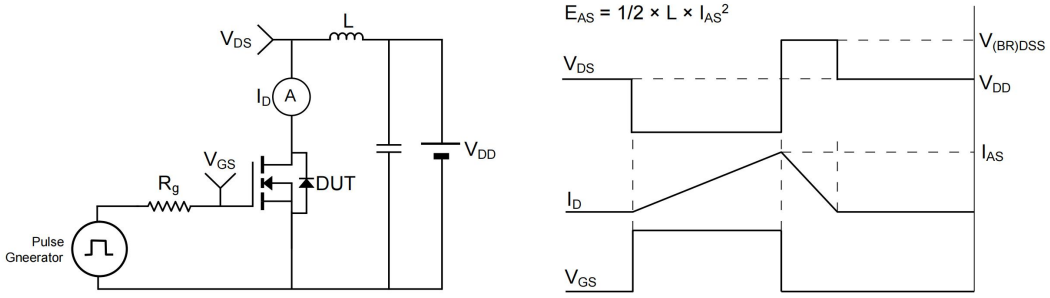
## Gate Charge



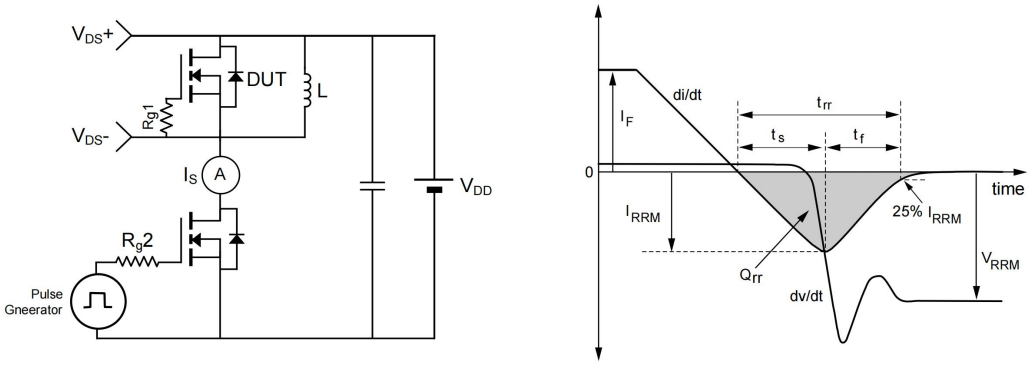

## Resistive Load Switching Time



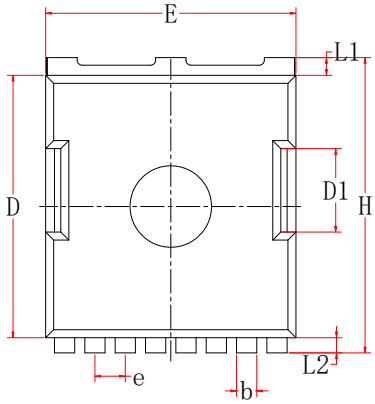

## Un-clamped Inductive Load Switching



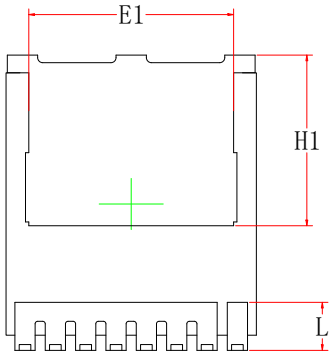

## Drain-Source Body Diode Reverse Recovery



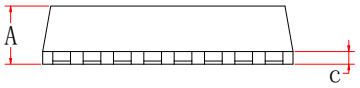
## TOLL-8L PACKAGE OUTLINE DIMENSIONS




Top View
[顶视图]




Bottom View
[背视图]

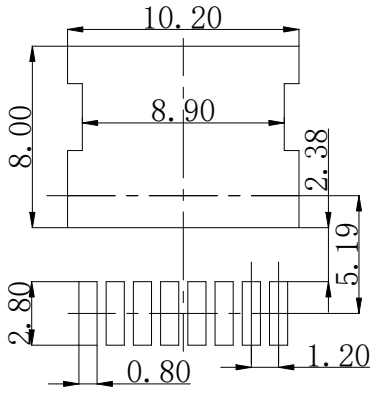



Side View
[侧视图]

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 2.20 | 2.40 | 0.087 | 0.094 |
| b | 0.70 | 0.90 | 0.028 | 0.035 |
| c | 0.40 | 0.60 | 0.016 | 0.024 |
| D | 10.28 | 10.58 | 0.405 | 0.417 |
| D1 | 3.30BSC. | | 0.130BSC. | |
| E | 9.70 | 10.10 | 0.382 | 0.398 |
| E1 | 8.00 | 8.40 | 0.315 | 0.331 |
| e | 1.20BSC. | | 0.047BSC. | |
| H | 11.48 | 11.88 | 0.452 | 0.468 |
| H1 | 7.10BSC. | | 0.280 BSC. | |
| L | 1.55 | 1.95 | 0.061 | 0.077 |
| L1 | 0.50 | 0.90 | 0.020 | 0.035 |
| L2 | 0.50 | 0.70 | 0.020 | 0.028 |

Notes：
1 Dimensions exclusive of mold gate burrs。
2 Dimensions exclusive of mold flash and cutting burrs。

## TOLL-8L Suggested Pad Layout



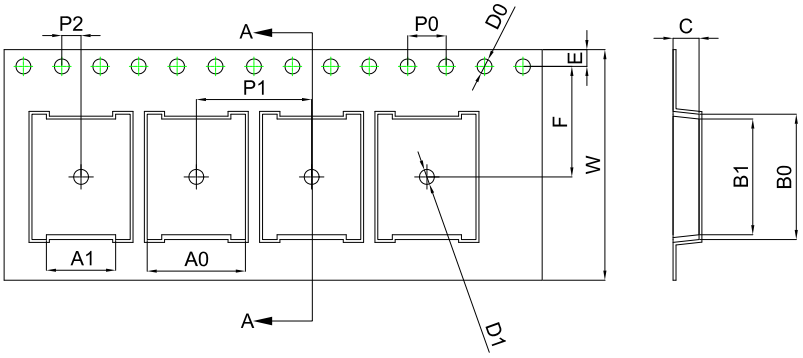

Controlling dimension：in millimeters.

NOTICE

SZCJ reserves the right to make modifications,enhancements,improvements,corrections or other changes without further notice to any product herein.SZCJ does not assume any liability arising out of the application or use of any product described herein.

# TOLL-8L Tape and Reel

## TOLL-8L Embossed Carrier Tape

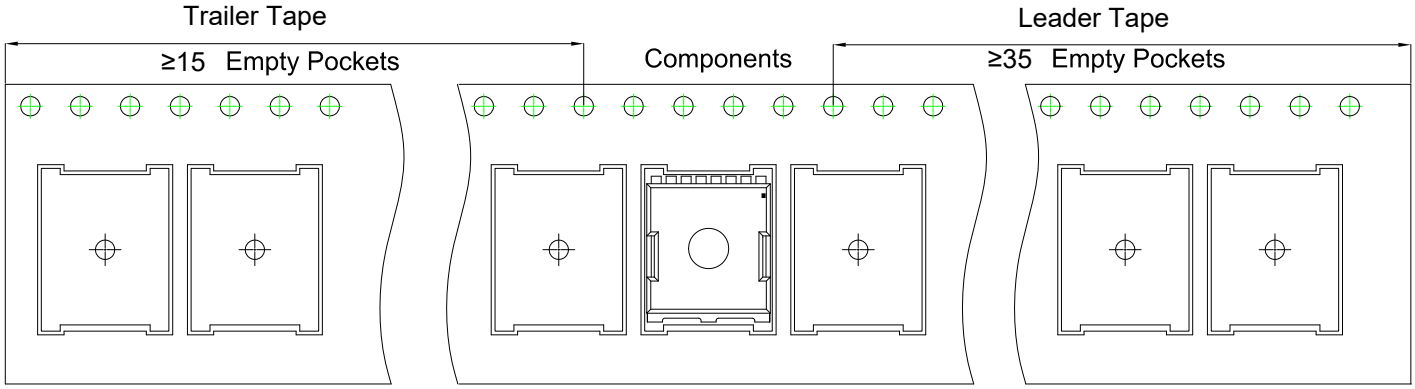



Packaging Description:

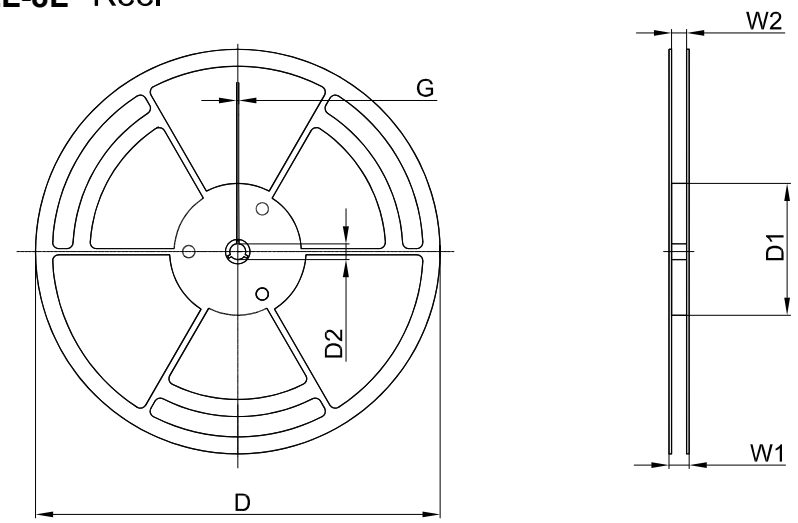
**TOLL-8L** parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with **2,000** units per 13" or 33.0 cm diameter reel. The reels are clear in color and is made of polystyrene plastic (anti-static coated).

| Dimensions are in millimeter | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pkg type | A0 | A1 | B0 | B1 | C | D0 | D1 | E | F | P0 | P1 | P2 | W |
| **TOLL-8L** | 10.22 | 7.20 | 12.04 | 13.04 | 2.70 | 1.55 | 1.55 | 1.75 | 11.50 | 4.00 | 12.00 | 2.00 | 24.00 |

## TOLL-8L Tape Leader and Trailer




## TOLL-8L Reel




| Dimensions are in millimeter | | | | | | |
|---|---|---|---|---|---|---|
| **Reel Option** | **D** | **D1** | **D2** | **G** | **W1** | **W2** |
| 13" Dia | φ330.00 | 100.00 | 13.00 | 2.00 | 28.7 | 24.4 |

| Reel | Reel Size | Box | Box Size (mm) | Carton | Carton Size (mm) |
|---|---|---|---|---|---|
| 2,000 pcs | 13 inch | 2,000 pcs | 360×360×65 | 10,000 pcs | 378×358×382 |