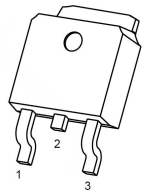
SZCJ

# TO-252-2L Plastic-Encapsulate MOSFET

**A** P-Channel Power MOSFET

**TO-252-2L**




1. GATE
2. DRAIN
3. SOURCE

## Key Performance Parameters

| $V_{BR(DSS)}$ | $R_{DS(on)}$TYP | $I_D$ |
|---|---|---|
| -40V | 9.4mΩ@-10V | -50A |
| | 12.5mΩ@-4.5V | |

## DESCRIPTION

The P-Channel enhancement mode power field effect transistors is using trench 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.

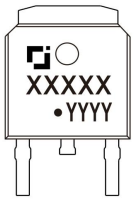
## FEATURES

- 100% Avalanche tested
- Low drain-source on-resistance
- Low gate charge
- High current capability

## APPLICATIONS

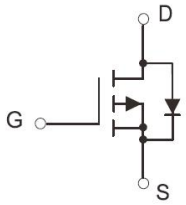
- DC/DC
- Switching application

## MARKING




XXXXX = 014P04A
Solid dot = Green molding compound device.
YYYY = Code.

## EQUIVALENT CIRCUIT




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

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | -40 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±25 | V |
| Continuous Drain Current | $T_C$ =25℃ | $I_D$ | -50 | A |
| | $T_C$ =100℃ | | -31.5 | |
| Pulsed Drain Current | | $I_{DM}$①② | -200 | A |
| Continuous Drain Current | $T_A$ =25℃ | $I_D$ | -9.5 | A |
| | $T_A$ =75℃ | | -7.3 | |
| Avalanche Current | | $I_{AS}$③ | -25 | A |
| Single Pulsed Avalanche Energy | | $E_{AS}$③ | 156 | mJ |
| Power Dissipation | | $P_D$① | 78 | 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 | $R_{\theta JC}$ | 1.2 | 1.6 | ℃/W |
| Thermal Resistance from Junction to Ambient | $R_{\theta JA}$⑥ | 50 | 62.5 | ℃/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 | | -40 | - | - | V |
| Zero gate voltage drain current | $I_{DSS}$ | $V_{DS}$=-40V, $V_{GS}$=0V | $T_J$=25℃ | - | - | -1.0 | μA |
| | | | $T_J$=125℃ | - | - | -100 | |
| Gate-body leakage current | $I_{GSS}$ | $V_{GS}$=±25V, $V_{DS}$=0V | | - | - | ±100 | nA |
| Gate-threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=-250μA | | -1.0 | -1.7 | -2.5 | V |
| Static drain-source on-sate resistance | $R_{DS(on)}$④ | $V_{GS}$=-10V, $I_D$=-20A | $T_J$=25℃ | - | 9.4 | 13 | mΩ |
| | | | $T_J$=125℃ | - | 14.7 | 21 | |
| | | $V_{GS}$=-4.5V, $I_D$=-15A | | - | 12.5 | 18 | |
| Forward transconductance | $g_{FS}$ | $V_{DS}$=-5V, $I_D$=-20A | | - | 53 | - | S |

### Dynamic Characteristics⑤

| | | | | | | |
|---|---|---|---|---|---|---|
| Input capacitance | $C_{iss}$ | $V_{GS}$=0V, $V_{DS}$=-20V, f=1MHz | - | 2237 | - | pF |
| Output capacitance | $C_{oss}$ | | - | 237 | - | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 178 | - | |
| Gate resistance | $R_g$ | f=1MHz | - | 13 | - | Ω |
| Total gate charge | $Q_g$ | $V_{GS}$=-4.5V, $V_{DS}$=-20V, $I_D$=-20A | - | 20.4 | - | nC |
| Total gate charge | $Q_g$ | $V_{GS}$=-10V, $V_{DS}$=-20V, $I_D$=-20A | - | 43.2 | - | |
| Gate charge at threshold | $Q_{G(th)}$ | | - | 4.2 | - | |
| Gate-source charge | $Q_{gs}$ | | - | 7.1 | - | |
| Gate-drain charge | $Q_{gd}$ | | - | 8.4 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$=-20V, $V_{GS}$=-10V, $I_D$=-20A, $R_g$=1Ω | - | 3.6 | - | ns |
| Turn-on rise time | $t_r$ | | - | 3.1 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 99 | - | |
| Turn-off fall time | $t_f$ | | - | 35 | - | |

### Reverse Diode Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| Drain-source diode forward voltage | $V_{SD}$④ | $V_{GS}$=0V, $I_S$=-20A | - | - | -1.2 | V |
| Continuous drain-source diode forward current | $I_S$① | | - | - | -50 | A |
| Pulsed drain-source diode forward current | $I_{SM}$①② | | - | - | -200 | A |
| Reverse recovery time | $t_{rr}$ | $V_{DD}$=-20V, $I_S$=-20A, di/dt=-500A/μs | - | 12 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | | - | 21 | - | nC |

Notes:

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

②.$P_W$ ≤10μs, Duty cycle ≤1%.

③.EAS condition: $V_{DD}$=-20V, $V_{GS}$=-10V, L=0.5mH, $R_g$=25Ω Starting $T_J$=25℃.

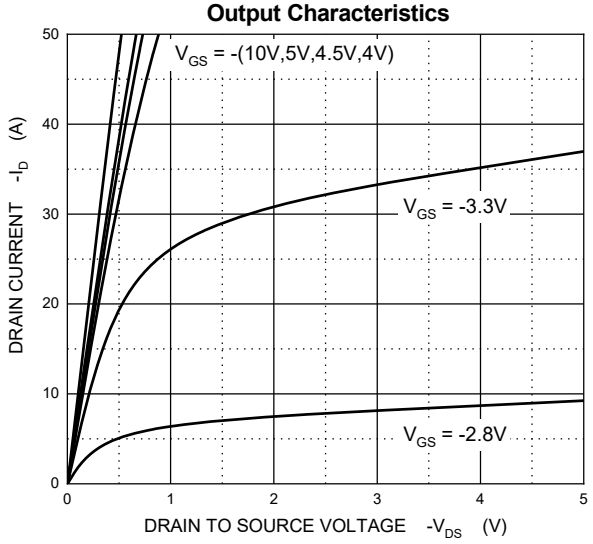
④.Pulse Test : Pulse Width ≤380μs, duty cycle ≤2%.

⑤.Guaranteed by design, not subject to production.

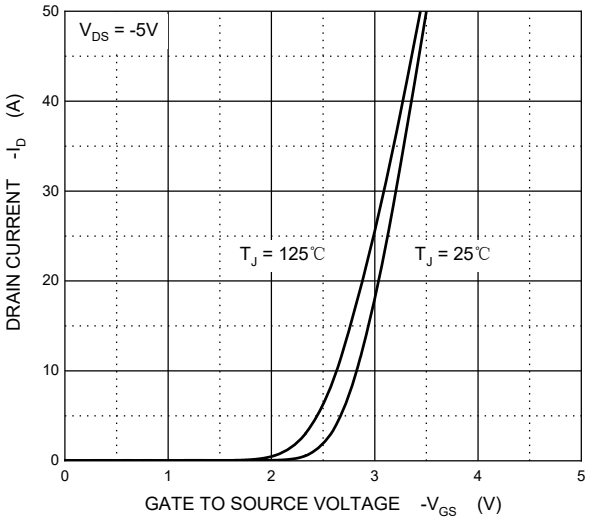
⑥.Device mounted on 1 $in^2$ FR-4 board with 2oz. double-sided Copper, in a still air environment with $T_A$=25℃.

# Typical Characteristics

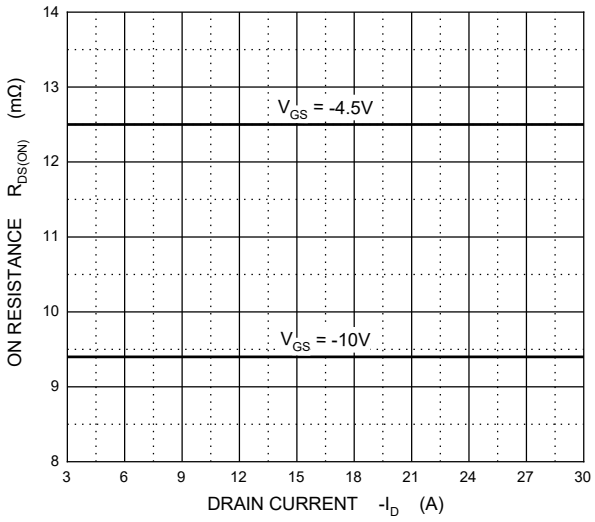
**Output Characteristics**



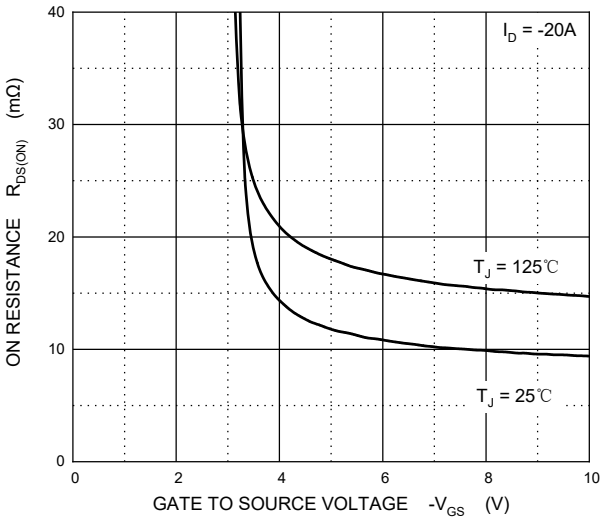

**Transfer Characteristics**



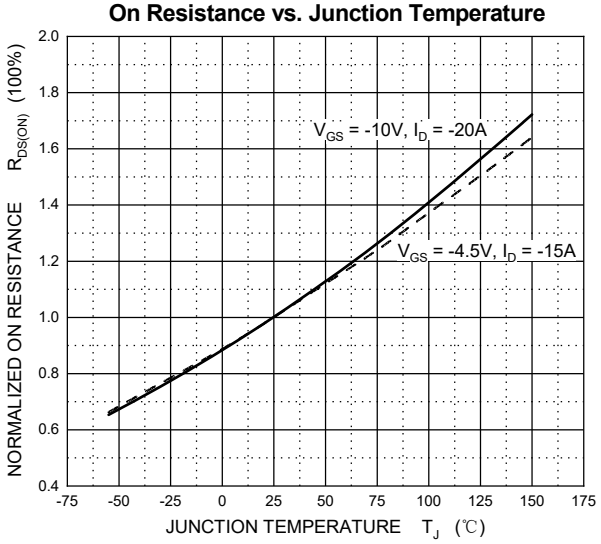

**On Resistance vs. Drain Current**



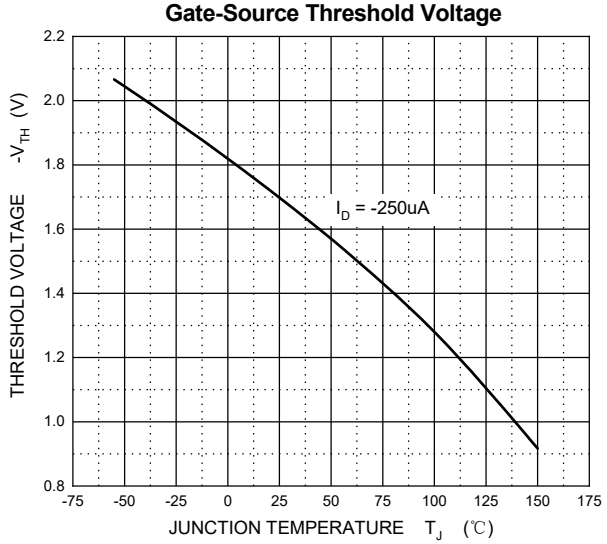

**On Resistance vs. Gate-Source Bias**




**On Resistance vs. Junction Temperature**

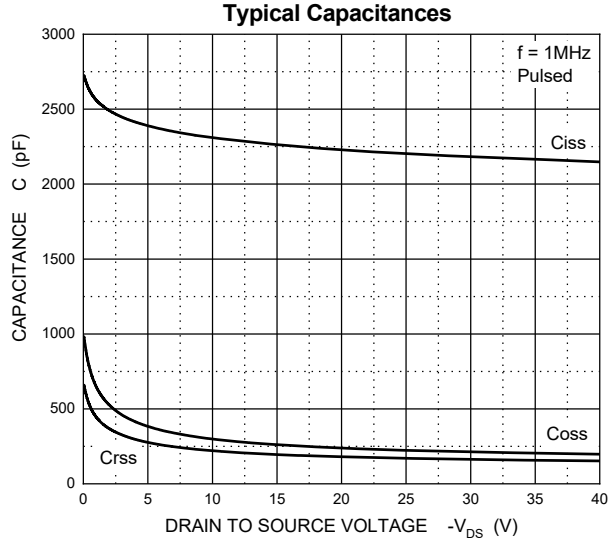



**Gate-Source Threshold Voltage**

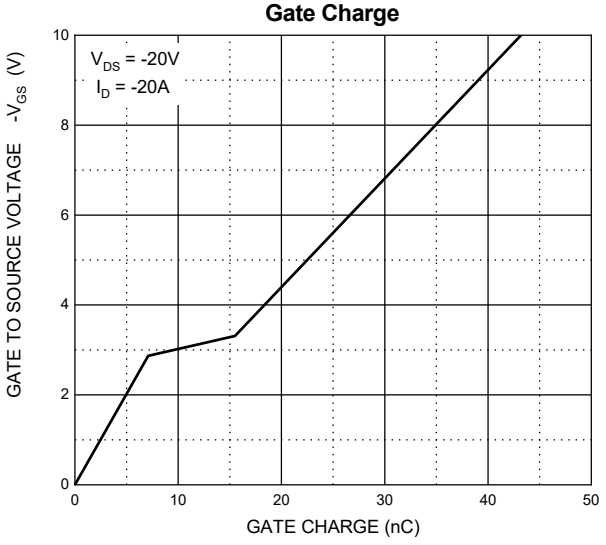


# Typical Characteristics

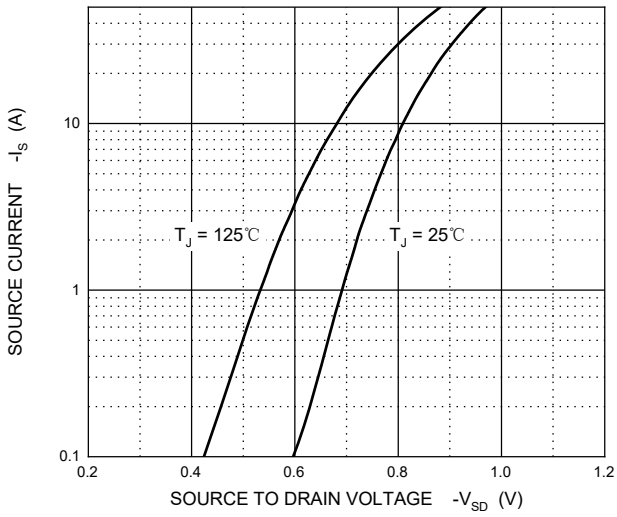
**Typical Capacitances**



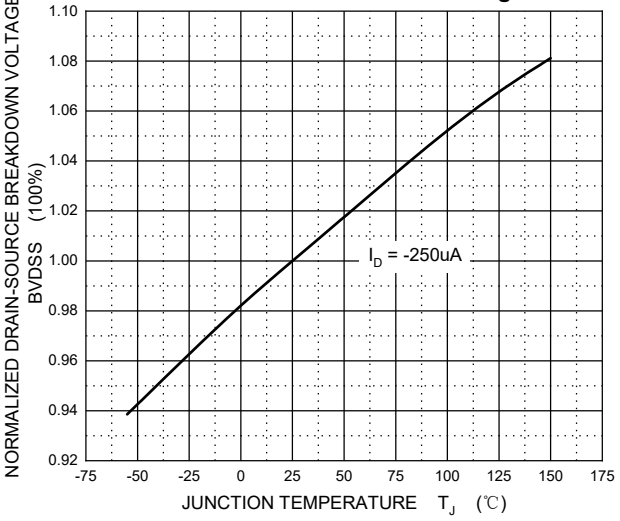

**Gate Charge**



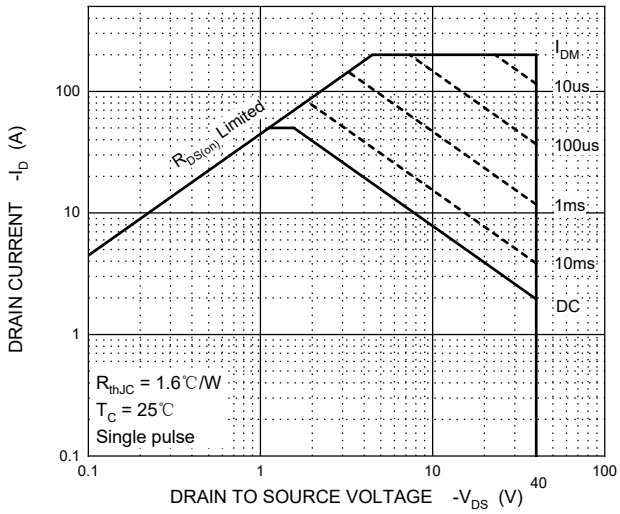

**Source-Drain Diode Forward Characteristics**



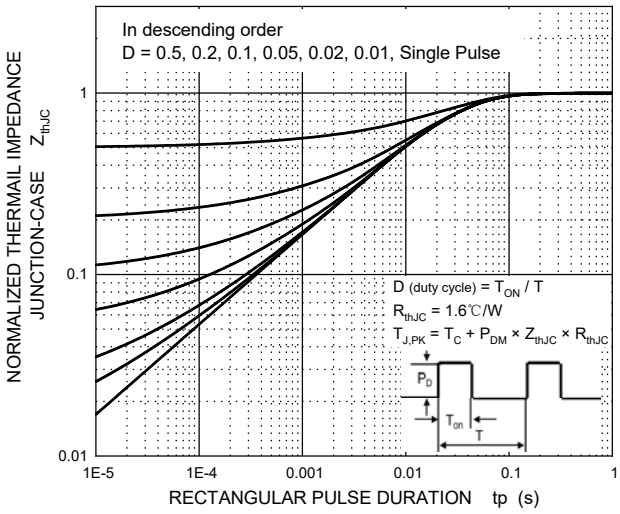

**Drain-Source Breakdown Voltage**




**Maximum Safe Operating Area**

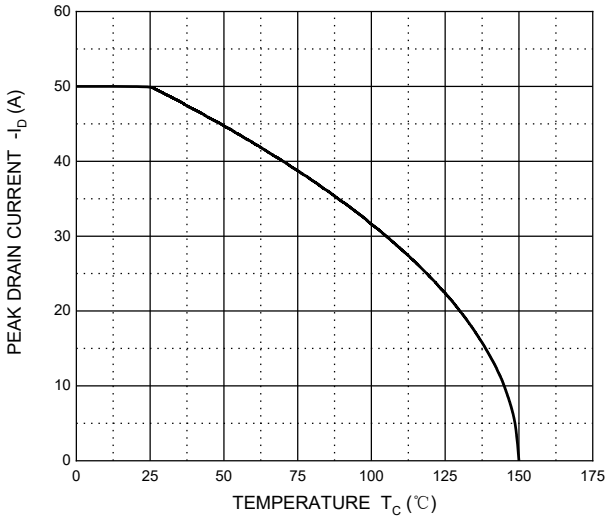



**Transient Thermal Impedance, Junction-Case**

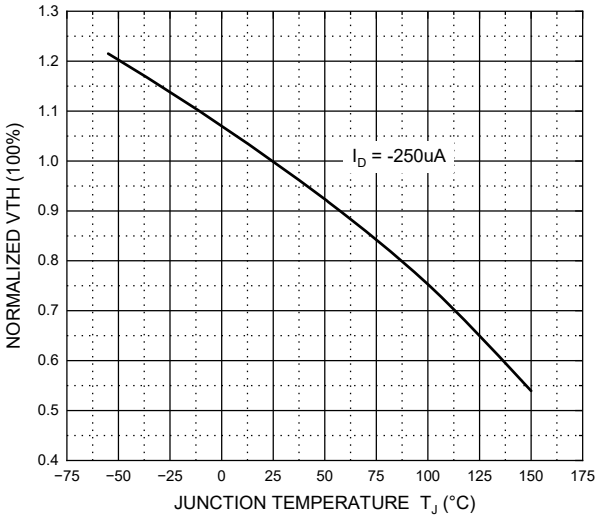


# Typical Characteristics

**ID vs. TC**

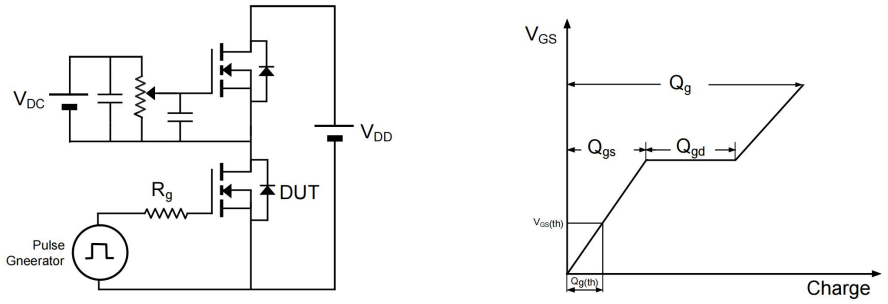



**Normalized Threshold Voltage vs. Junction Temperature**

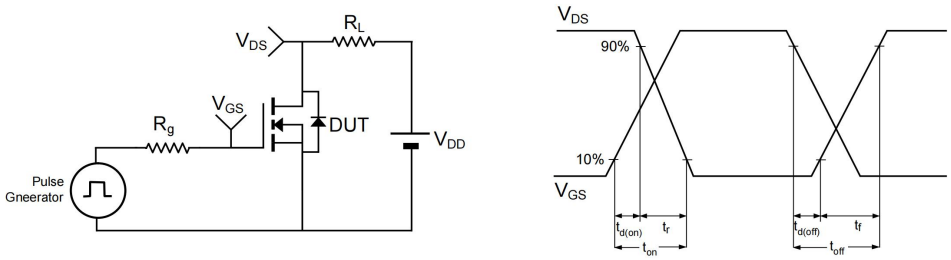


## Test Circuit And Waveforms

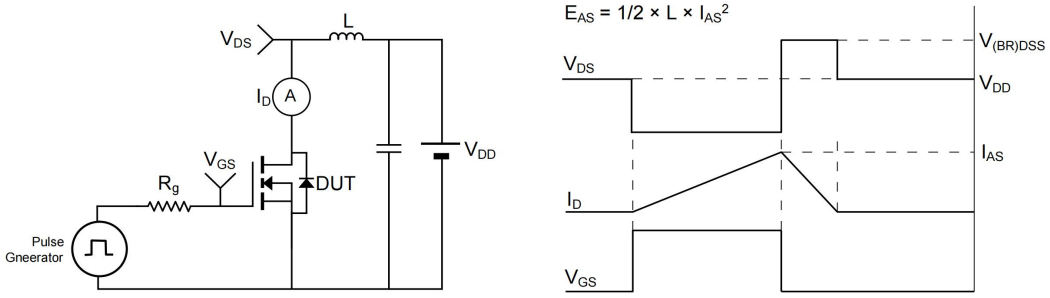
### Gate Charge



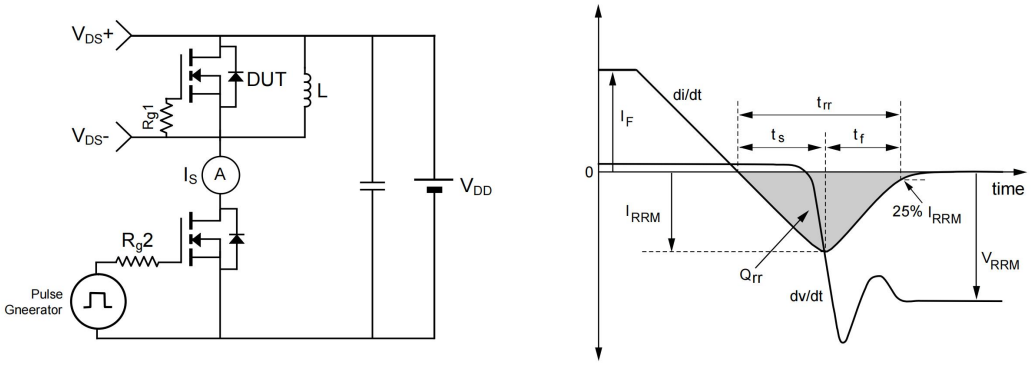

### Resistive Load Switching Time



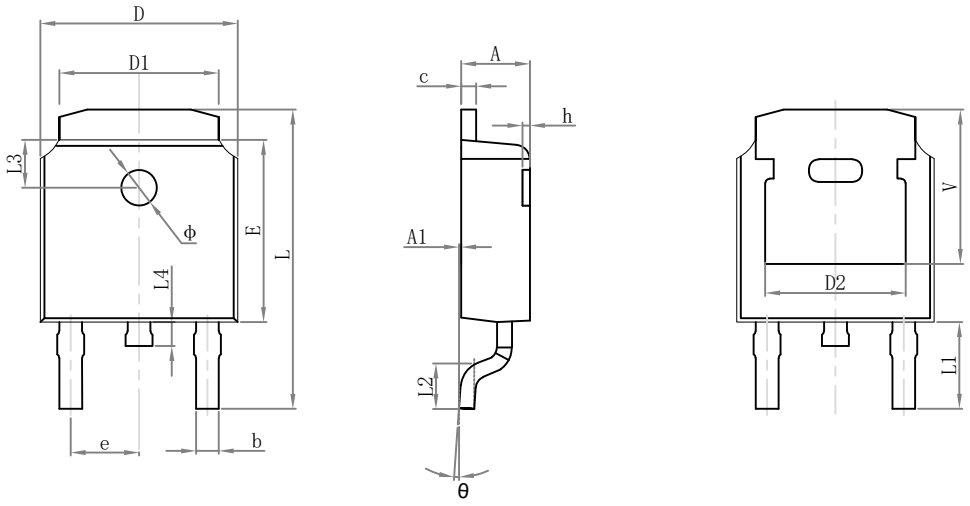

### Un-clamped Inductive Load Switching




### Drain-Source Body Diode Reverse Recovery

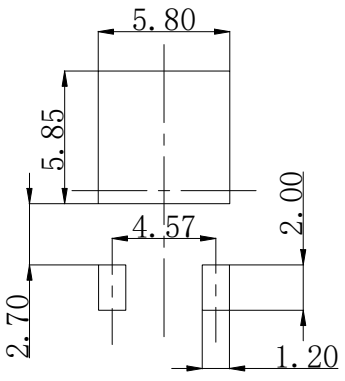


## TO-252-2L Package Outline Dimensions




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 2.200 | 2.400 | 0.087 | 0.094 |
| A1 | 0.000 | 0.127 | 0.000 | 0.005 |
| b | 0.635 | 0.770 | 0.025 | 0.030 |
| c | 0.460 | 0.580 | 0.018 | 0.023 |
| D | 6.500 | 6.700 | 0.256 | 0.264 |
| D1 | 5.100 | 5.460 | 0.201 | 0.215 |
| D2 | 4.830 REF. | | 0.190 REF. | |
| E | 6.000 | 6.200 | 0.236 | 0.244 |
| e | 2.186 | 2.386 | 0.086 | 0.094 |
| L | 9.712 | 10.312 | 0.382 | 0.406 |
| L1 | 2.900 REF. | | 0.114 REF. | |
| L2 | 1.400 | 1.700 | 0.055 | 0.067 |
| L3 | 1.600 REF. | | 0.063 REF. | |
| L4 | 0.600 | 1.000 | 0.024 | 0.039 |
| Φ | 1.100 | 1.300 | 0.043 | 0.051 |
| θ | 0° | 8° | 0° | 8° |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| V | 5.250 REF. | | 0.207 REF. | |

## TO-252-2L Suggested Pad Layout



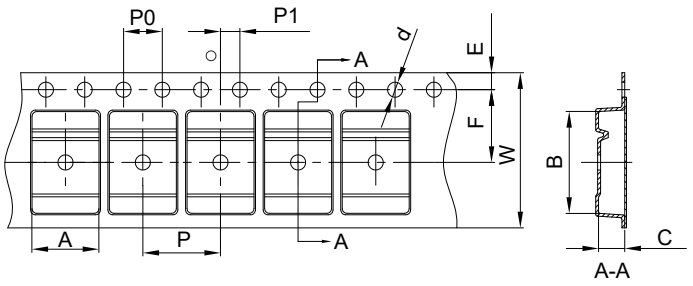

Controlling dimension：in millimeters.

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.

## TO-252-2L Tape and Reel

### TO-252-2L Embossed Carrier Tabe



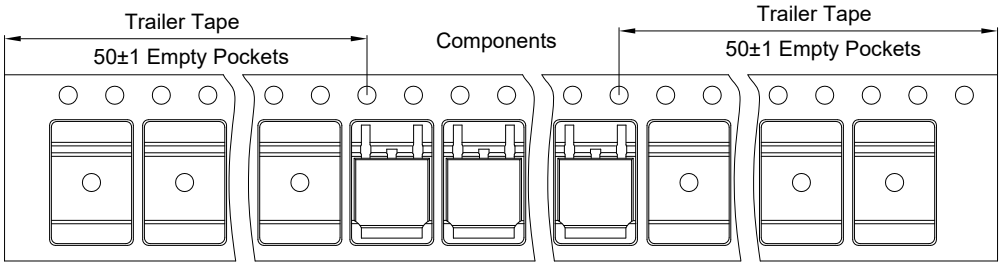

Packaging Description:

**TO-252-2L** 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 2,500 units per 13" or 33cm diameter reel. The reels are clear in color and is made of polystyrene plastic (anti-static coated).

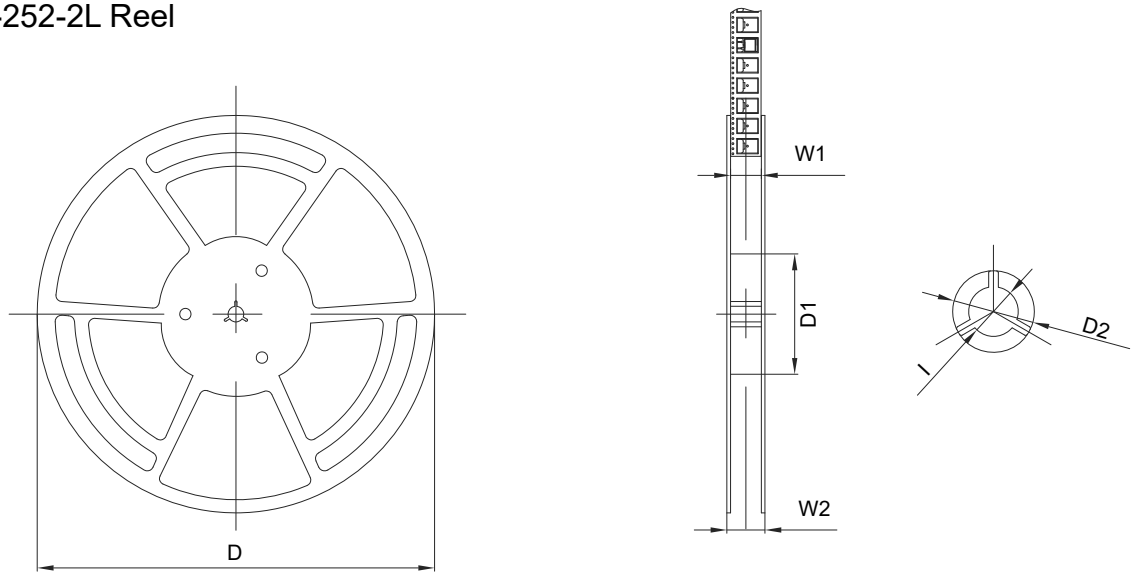
ALL DIM IN mm

| Dimensions are in millimeter | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Pkg type | A | B | C | d | E | F | P0 | P | P1 | W |
| TO-252 | 6.90 | 10.50 | 2.70 | Φ1.55 | 1.75 | 7.50 | 4.00 | 8.00 | 2.00 | 16.00 |

### TO-252-2L Tape Leader and Trailer




### TO-252-2L Reel




| Dimensions are in millimeter | | | | | | |
|---|---|---|---|---|---|---|
| Reel | D | D1 | D2 | W1 | W2 | I |
| 13" Dia | 330.00 | 100.00 | Φ21.00 | 16.40 | 21.40 | Φ13.00 |

| Reel | Reel Size | Box | Box Size(mm) | Carton | Carton Size(mm) |
|---|---|---|---|---|---|
| 2,500 pcs | 13 inch | 5,000 pcs | 360×360×65 | 25,000 pcs | 378×358×382 |