

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)TYP}$ | $I_D$ |
|---------------|-----------------|-------|
| 110V          | 1.6mΩ@10V       | 340A  |



**合肥矽普半导体**

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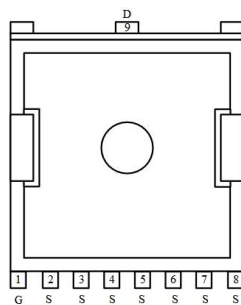
## Feature

- Fast Switching
- Low Gate Charge and Rdson
- Advanced Split Gate Trench Technology
- **100% UIS TESTED**
- **100% ΔVds TESTED**

## Applications

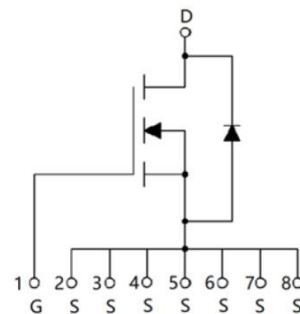
- PWM Application
- Hard switched and high frequency circuits
- Power Management

## Package

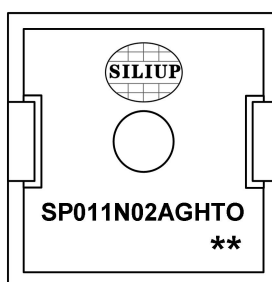


**TOLL-8L**

## Circuit diagram



## Marking



**SP011N02AGHTO** : Product code  
**\*\*** : Week code

## Order Information

| Device        | Package | Unit/Tape |
|---------------|---------|-----------|
| SP011N02AGHTO | TOLL-8L | 2000      |

**Absolute maximum ratings (Ta=25°C, unless otherwise noted)**

| Parameter                                  | Symbol           | Rating     | Unit |
|--------------------------------------------|------------------|------------|------|
| Drain-Source Voltage                       | V <sub>DS</sub>  | 110        | V    |
| Gate-Source Voltage                        | V <sub>GS</sub>  | ±20        | V    |
| Continuous Drain Current (Tc=25°C)         | I <sub>D</sub>   | 340        | A    |
| Continuous Drain Current (Tc=100°C)        | I <sub>D</sub>   | 214        | A    |
| Pulsed Drain Current                       | I <sub>DM</sub>  | 1360       | A    |
| Single Pulse Avalanche Energy <sup>1</sup> | E <sub>AS</sub>  | 1956       | mJ   |
| Power Dissipation (Tc=25°C)                | P <sub>D</sub>   | 320        | W    |
| Power Dissipation (Tc=100°C)               | P <sub>D</sub>   | 128        | W    |
| Thermal Resistance Junction-to-Case        | R <sub>θJC</sub> | 0.39       | °C/W |
| Storage Temperature Range                  | T <sub>STG</sub> | -55 to 150 | °C   |
| Operating Junction Temperature Range       | T <sub>J</sub>   | -55 to 150 | °C   |

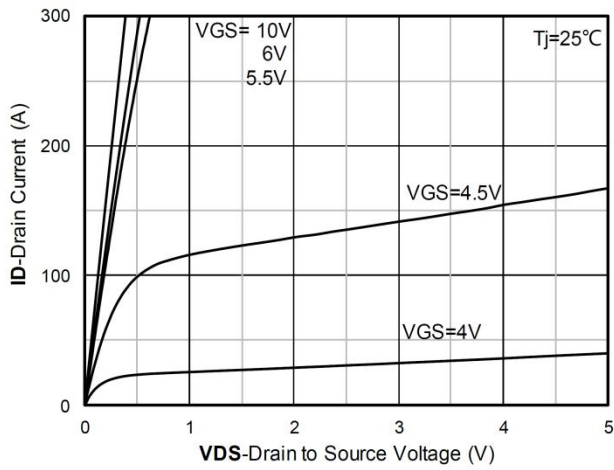
**Electrical characteristics (Ta=25°C, unless otherwise noted)**

| Characteristics                         | Symbol               | Test Condition                             | Min | Typ   | Max  | Unit |
|-----------------------------------------|----------------------|--------------------------------------------|-----|-------|------|------|
| Static Characteristics                  |                      |                                            |     |       |      |      |
| Drain-Source Breakdown Voltage          | BV <sub>DSS</sub>    | VGS=0V , ID=250uA                          | 110 | 120   | -    | V    |
| Drain Cut-Off Current                   | I <sub>DSS</sub>     | VDS=90V , VGS=0V , TJ=25℃                  | -   | -     | 1    | μA   |
| Gate Leakage Current                    | I <sub>GSS</sub>     | VGS=±20V , VDS=0V                          | -   | -     | ±100 |      |
| Gate Threshold Voltage                  | V <sub>GS(th)</sub>  | VGS=VDS , ID =250uA                        | 2.6 | 3.0   | 3.4  | V    |
| Drain-Source ON Resistance              | R <sub>DS(ON)</sub>  | VGS=10V , ID=20A                           | -   | 1.6   | 2.1  | mΩ   |
| Gate Resistance                         | R <sub>G</sub>       | f=1MHz                                     | -   | 1.1   | -    | Ω    |
| Dynamic Characteristics                 |                      |                                            |     |       |      |      |
| Input Capacitance                       | C <sub>iss</sub>     | VDS=50V , VGS=0V , f=1MHz                  | -   | 12220 | -    | pF   |
| Output Capacitance                      | C <sub>oss</sub>     |                                            | -   | 1620  | -    |      |
| Reverse Transfer Capacitance            | C <sub>rss</sub>     |                                            | -   | 55    | -    |      |
| Total Gate Charge                       | Q <sub>g</sub>       | VDS=50V , VGS=10V , ID=125A                | -   | 198   | -    | nC   |
| Gate-Source Charge                      | Q <sub>gs</sub>      |                                            | -   | 51    | -    |      |
| Gate-Drain Charge                       | Q <sub>gd</sub>      |                                            | -   | 37    | -    |      |
| Gate Plateau Voltage                    | V <sub>plateau</sub> |                                            | -   | 4.8   | -    | V    |
| Switching Characteristics               |                      |                                            |     |       |      |      |
| Turn-On Delay Time                      | t <sub>d(on)</sub>   | VDD=50V, VGS=10V , RG=1.6Ω, ID=125A        | -   | 25    | -    | nS   |
| Rise Time                               | t <sub>r</sub>       |                                            | -   | 75    | -    |      |
| Turn-Off Delay Time                     | t <sub>d(off)</sub>  |                                            | -   | 89    | -    |      |
| Fall Time                               | t <sub>f</sub>       |                                            | -   | 29    | -    |      |
| Drain-Source Body Diode Characteristics |                      |                                            |     |       |      |      |
| Source-Drain Diode Forward Voltage      | V <sub>SD</sub>      | I <sub>s</sub> = 1A, VGS = 0V              | -   | -     | 1.2  | V    |
| Maximum Body-Diode Continuous Current   | I <sub>s</sub>       |                                            | -   | -     | 340  | A    |
| Reverse Recovery Time                   | T <sub>rr</sub>      | I <sub>s</sub> =50A, di/dt=100A/us, TJ=25℃ | -   | 108   | -    | nS   |
| Reverse Recovery Charge                 | Q <sub>rr</sub>      |                                            | -   | 276   | -    | nC   |

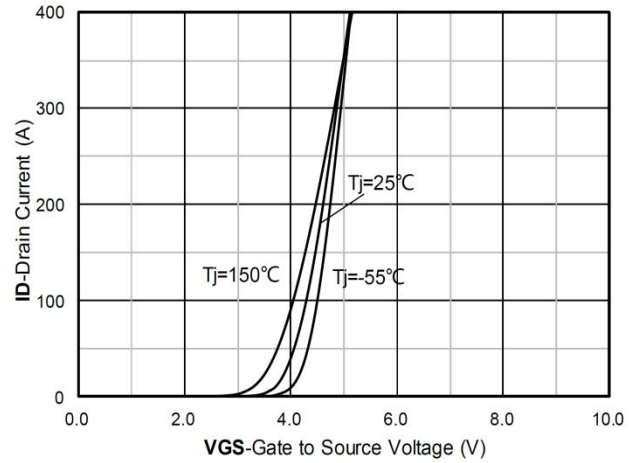
**Note :**

1. The test condition is VDD=50V, VGS=10V, L=0.5mH, RG=25Ω;

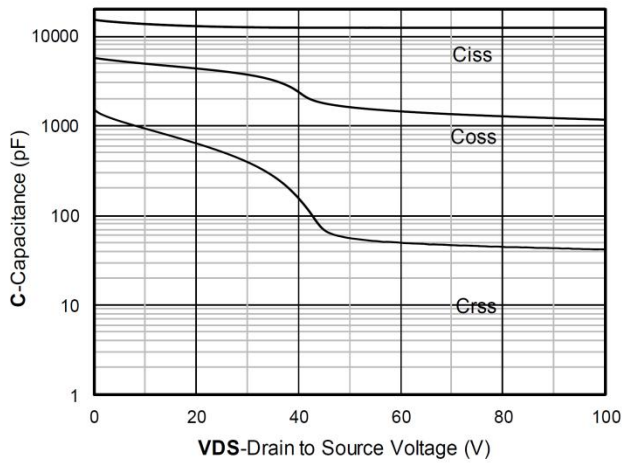
## Typical Characteristics



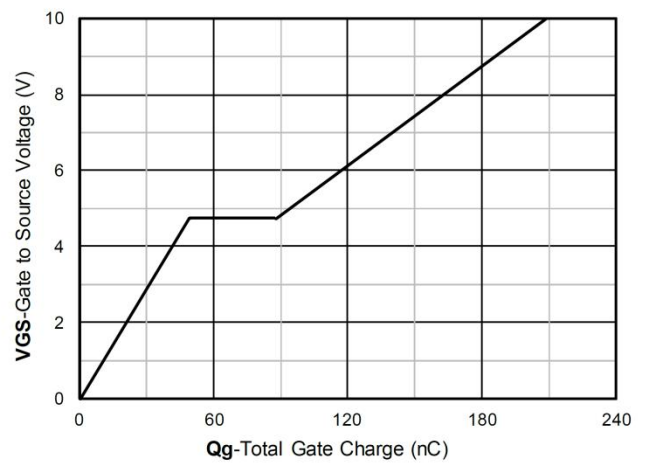
Output Characteristics



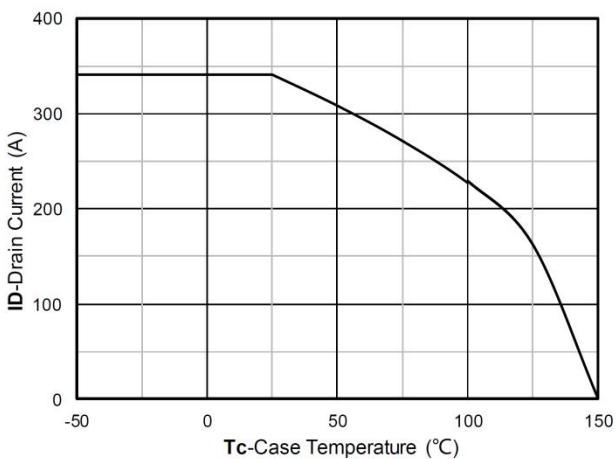
Transfer Characteristics



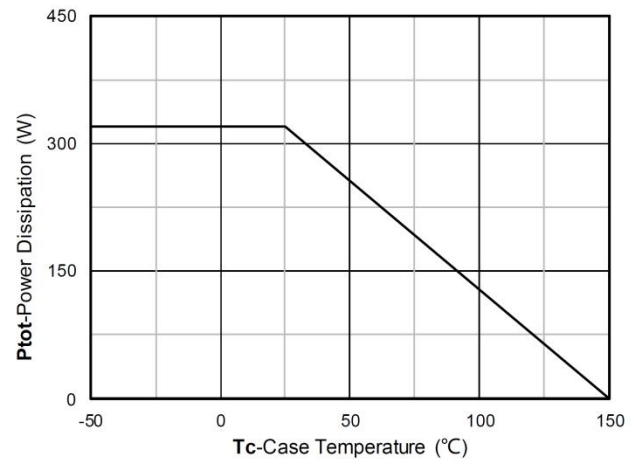
Capacitance Characteristics



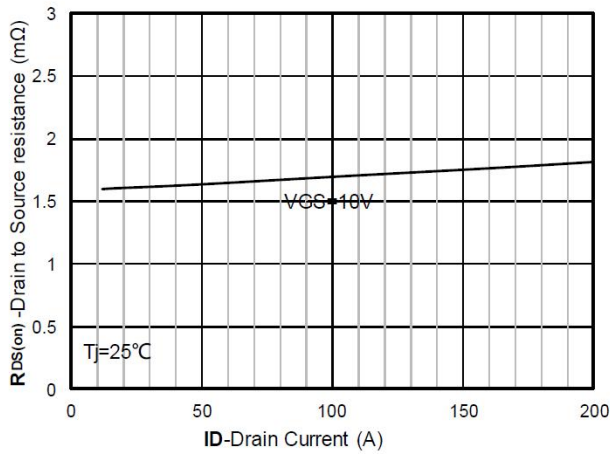
Gate Charge



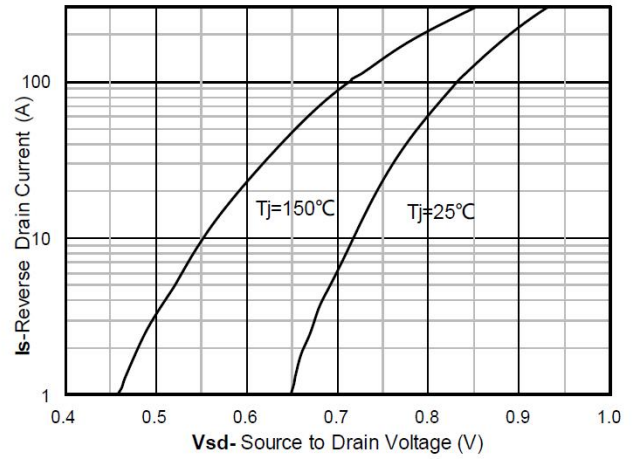
Current dissipation



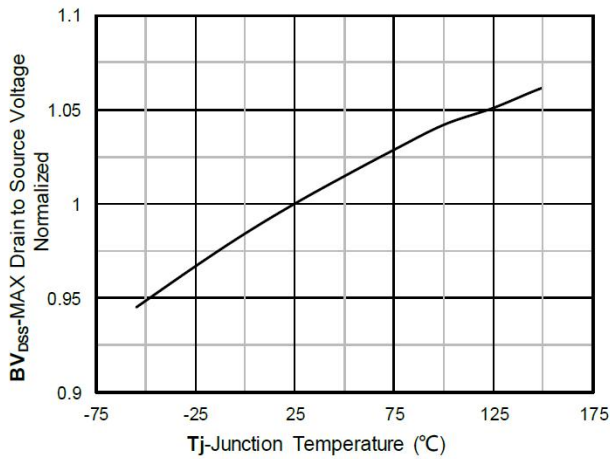
Power dissipation



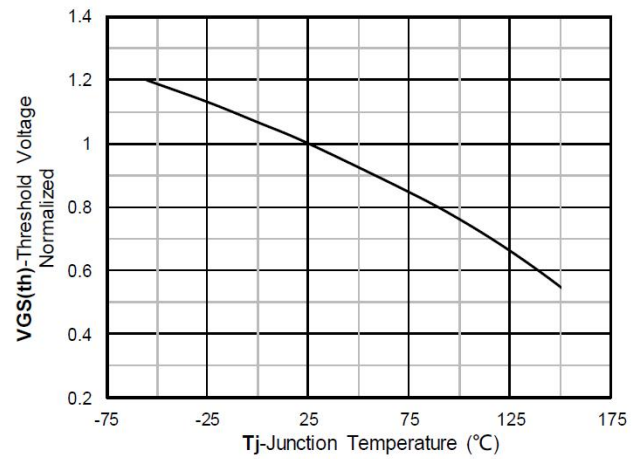
$R_{DS(on)}$  VS Drain Current



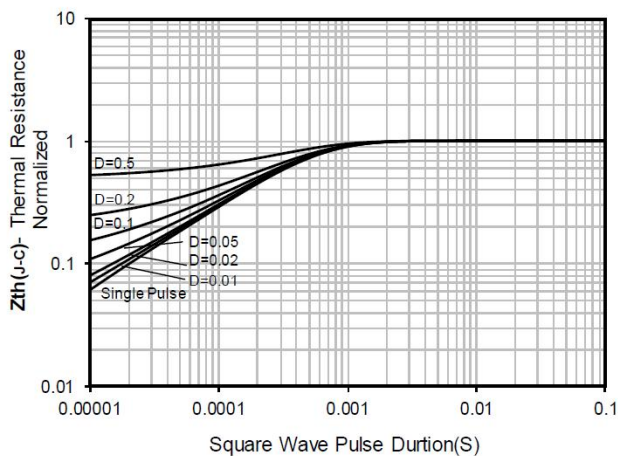
Forward characteristics of reverse diode



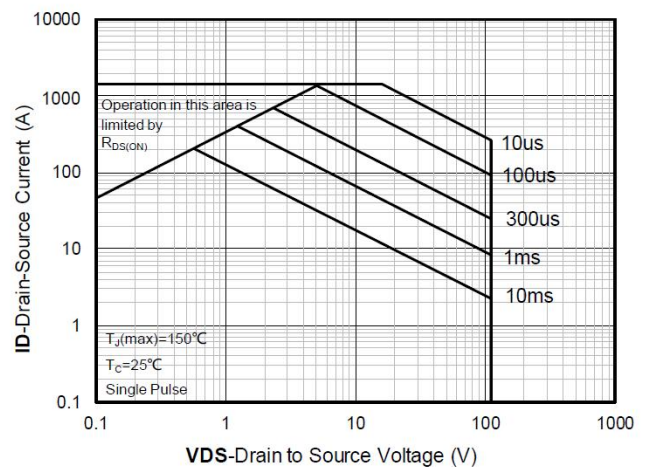
Normalized breakdown voltage



Normalized Threshold voltage



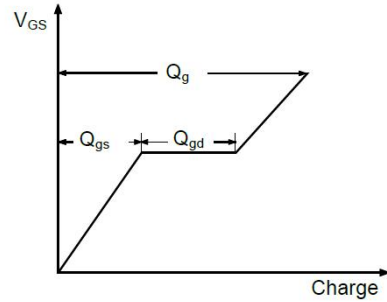
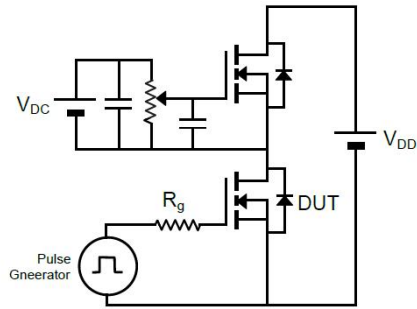
Maximum Transient Thermal Impedance



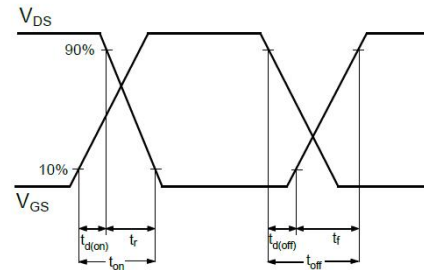
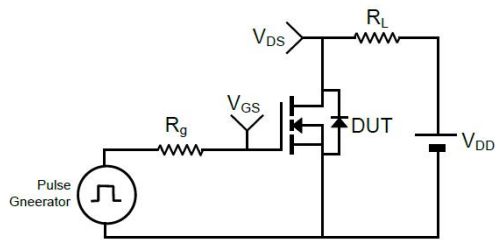
Safe Operation Area

## Test Circuit

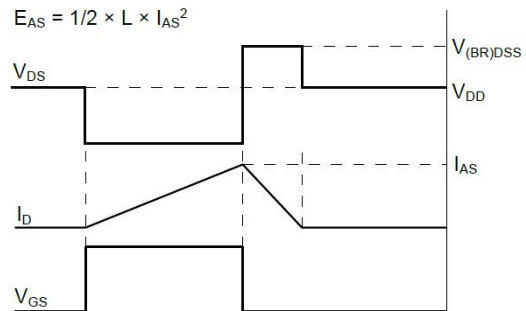
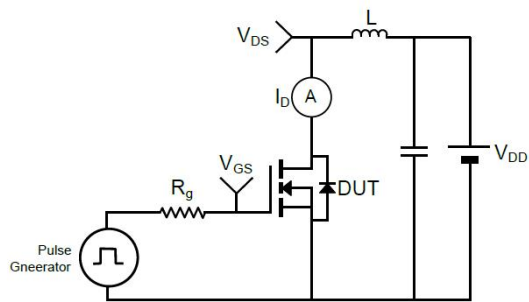
### Gate Charge



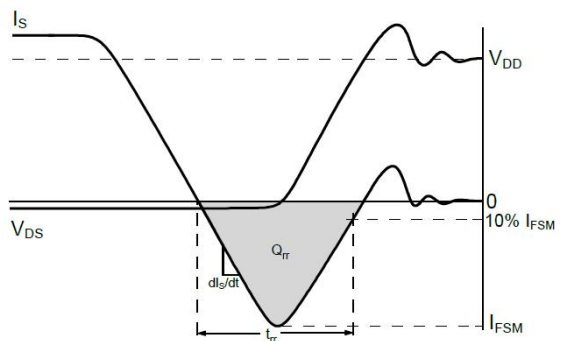
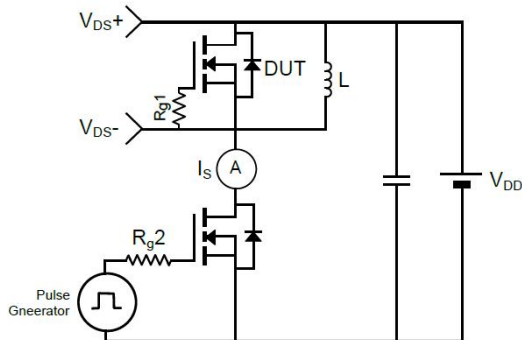
### Resistive Load Switching Time



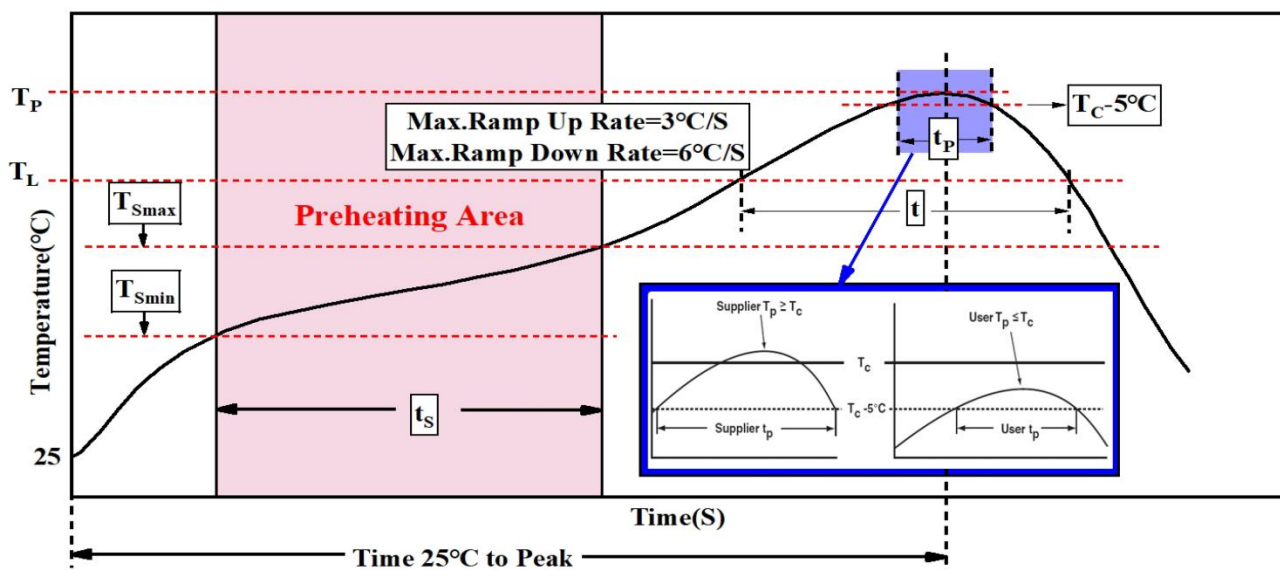
### Un-clamped Inductive Load Switching



### Drain-Source Body Diode Reverse Recovery



## Temperature Profile for IR Reflow Soldering



| Profile Feature                                                                                                                                                                                                                            | Sn-Pb Eutectic Assembly            | Pb-Free Assembly                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------------------|
| <b>Preheat &amp; Soak</b>                                                                                                                                                                                                                  |                                    |                                    |
| Temperature min (T <sub>smin</sub> )                                                                                                                                                                                                       | 100°C                              | 150°C                              |
| Temperature max (T <sub>smax</sub> )                                                                                                                                                                                                       | 150°C                              | 200°C                              |
| Time (T <sub>smin</sub> to T <sub>smax</sub> ) (t <sub>s</sub> )                                                                                                                                                                           | 60-120 seconds                     | 60-120 seconds                     |
| Average ramp-up rate (T <sub>smax</sub> to T <sub>p</sub> )                                                                                                                                                                                | 3 °C/second max.                   | 3°C/second max.                    |
| Liquidous temperature (T <sub>L</sub> )                                                                                                                                                                                                    | 183 °C                             | 217°C                              |
| Time at liquidous (t <sub>L</sub> )                                                                                                                                                                                                        | 60-150 seconds                     | 60-150 seconds                     |
| Peak package body Temperature e (T <sub>p</sub> )*                                                                                                                                                                                         | See Classification Temp in table 1 | See Classification Temp in table 2 |
| Time (t <sub>p</sub> )** within 5°C of the specified classification temperature (T <sub>c</sub> )                                                                                                                                          | 20** seconds                       | 30** seconds                       |
| Average ramp-down rate (T <sub>p</sub> to T <sub>smax</sub> )                                                                                                                                                                              | 6 °C/second max.                   | 6 °C/second max.                   |
| Time 25°C to peak temperature                                                                                                                                                                                                              | 6 minutes max.                     | 8 minutes max.                     |
| * Tolerance for peak profile Temperature (T <sub>p</sub> ) is defined as a supplier minimum and a user maximum.<br>** Tolerance for time at peak profile temperature (t <sub>p</sub> ) is defined as a supplier minimum and a user maximum |                                    |                                    |

Table 1. SnPb Eutectic Process – Classification Temperatures (T<sub>c</sub>)

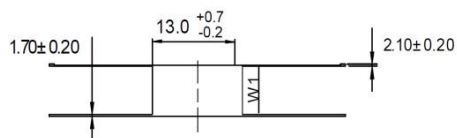
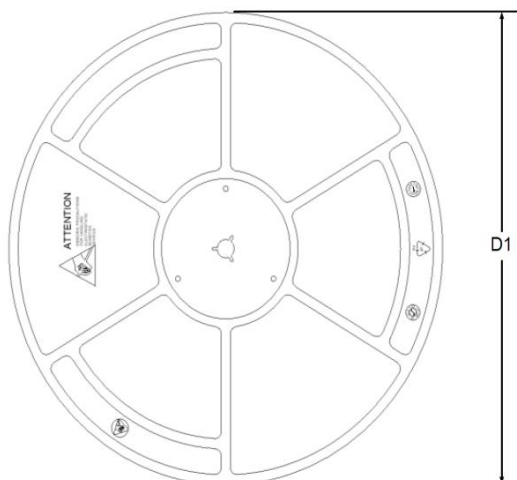
| Package Thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> ≥350 |
|-------------------|-----------------------------|-----------------------------|
| <2.5 mm           | 235 °C                      | 220 °C                      |
| ≥2.5 mm           | 220 °C                      | 220 °C                      |

Table 2. Pb-free Process – Classification Temperatures (T<sub>c</sub>)

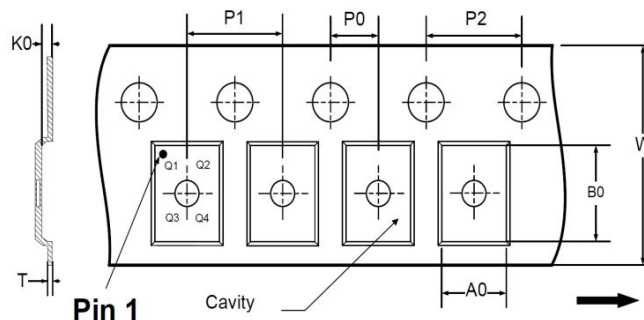
| Package Thickness | Volume mm <sup>3</sup> <350 | Volume mm <sup>3</sup> 350-2000 | Volume mm <sup>3</sup> >2000 |
|-------------------|-----------------------------|---------------------------------|------------------------------|
| <1.6 mm           | 260 °C                      | 260 °C                          | 260 °C                       |
| 1.6 mm – 2.5 mm   | 260 °C                      | 250 °C                          | 245 °C                       |
| ≥2.5 mm           | 250 °C                      | 245 °C                          | 245 °C                       |

## TOLL-8L Reel Information

REEL DIMENSIONS



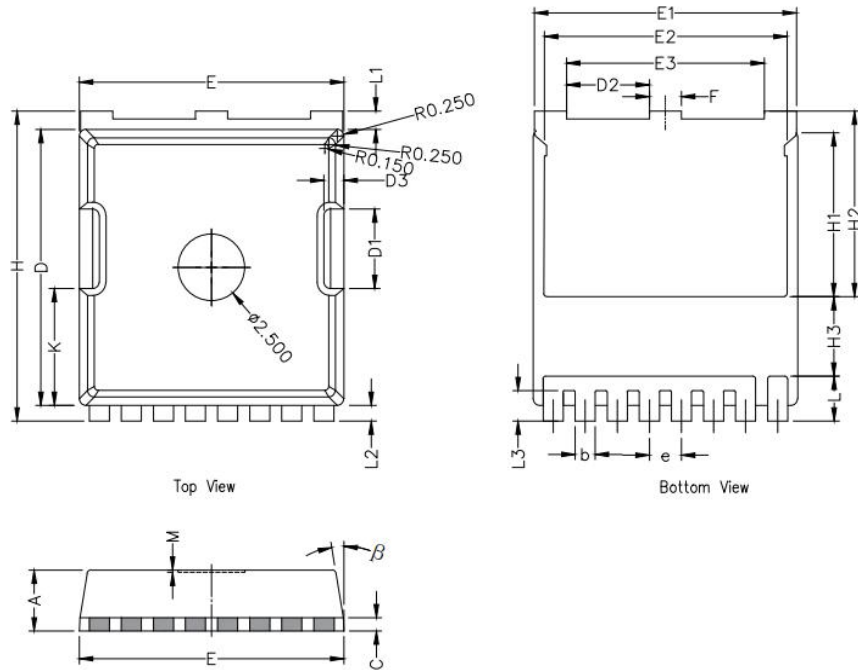
TAPE DIMENSIONS



- A0: Dimension designed to accommodate the component width
- B0: Dimension designed to accommodate the component length
- K0: Dimension designed to accommodate the component thickness
- W: Overall width of the carrier tape
- P0: Pitch between successive cavity centers and sprocket hole
- P1: Pitch between successive cavity centers
- P2: Pitch between sprocket hole
- T: Tape material thickness
- D1: Reel Diameter
- W1: Reel Width

| DIMENSIONS |     |      |    |    |      |      |     |      |                | (Unit: mm) |
|------------|-----|------|----|----|------|------|-----|------|----------------|------------|
| Reel       | D1  | W1   |    |    |      |      |     |      |                | Material   |
|            | 330 | 24.4 |    |    |      |      |     |      |                | Hips       |
| Tape       | P0  | P1   | P2 | W  | A0   | B0   | K0  | T    | Pin 1 Quadrant | Material   |
|            | 2   | 4    | 12 | 24 | 10.3 | 12.1 | 2.6 | 0.35 | Q1             | PC         |

All dimensions are nominal

**TOLL-8L Package Information**


| Symbol  | Dimensions In Millimeters |       |       |
|---------|---------------------------|-------|-------|
|         | Min.                      | Nom.  | Max.  |
| A       | 2.15                      | 2.30  | 2.45  |
| b       | 0.60                      | 0.75  | 0.90  |
| C       | 0.40                      | 0.50  | 0.60  |
| D       | 10.18                     | 10.38 | 10.58 |
| D1      | 3.15                      | 3.3   | 3.45  |
| E       | 9.70                      | 9.90  | 10.10 |
| E1      | 9.65                      | 9.80  | 9.95  |
| E2      | 7.90                      | --    | 9.15  |
| E3      | 7.20                      | --    | 8.40  |
| e       | 1.20 BSC                  |       |       |
| F       | 1.05                      | 1.20  | 1.35  |
| H       | 11.45                     | 11.70 | 11.95 |
| H2      | 6.75                      | 7.00  | 7.3   |
| H3      | 3.00 BSC                  |       |       |
| L       | 1.20                      | --    | 2.10  |
| L1      | 0.50                      | 0.75  | 0.90  |
| L2      | 0.45                      | 0.6   | 0.75  |
| M       | 0.08 REF.                 |       |       |
| $\beta$ | 8°                        | 10°   | 12°   |