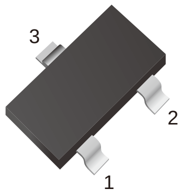
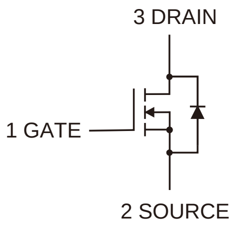
# N-Channel Mosfet

## Features

- 50V , 0.22A
  $R_{DS(ON)}$=3.5 Ω @$V_{GS}$=10 V
  $R_{DS(ON)}$=6.0 Ω @$V_{GS}$=4.5V
- Rugged and Reliable
- High Density Cell Design for Entremely $R_{DS(ON)}$
- Compact Industry Standard SOT-23 Surface Mount Package
- This Device is Pb-Free and Halogen Free
- Lead free in comply with EU RoHS 2011/65/EU directives





## Machanical Data

- Case:SOT-23
- Approx. Weight: 8.1mg

## Ordering Information

| Part Number | Marking | Shipping | Reel |
|---|---|---|---|
| LTM138N-TR3 | SS138 | 3000PCS Tape&Reel | 7 inchs |
| LTM138N-TR12 | SS138 | 12000PCS Tape&Reel | 13 inchs |

## Absolute Maximum Ratings (TA=25°C)

| Parameter | Symbols | Ratings | Units |
|---|---|---|---|
| Drain-Source Voltage | $V_{DSS}$ | 50 | V |
| Gate-Source Voltage | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current | $I_D$ | 0.22 | A |
| Pulsed Drain Current | | 0.88 | A |
| Power Dissipation | $P_D$ | 0.36 | W |
| Thermal Resistance - Junction to Case(1) | $R_{\theta JA}$ | 350 | °C/W |
| Operation Junction Temperature and Storage Temperature | $T_{j}, T_{stg}$ | -55~+150 | °C |

Notes:

1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance ,where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design, while $R_{\theta JA}$ is determined by the board design, The maximum rating presented here is based on mounting on a 1 in 2 pad of 2oz copper.

## Electrical Characteristics (TA=25°C)

| Parameter | Symbols | Text conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V,$I_D$=250uA | 50 | | | V |
| Gate-Body Leakage | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | | | ±100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=50V,$V_{GS}$=0V | | | 0.5 | uA |
| | | $V_{DS}$=30V,$V_{GS}$=0V | | | 100 | nA |
| **On Characteristics** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=1mA | 0.8 | 1.3 | 1.5 | V |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V,$I_D$=0.22A | | 0.7 | 3.5 | Ω |
| | | $V_{GS}$=4.5V,$I_D$=0.22A | | 1.0 | 6.0 | Ω |
| On-State Drain Current | $I_{D(on)}$ | $V_{GS}$=10V, $V_{DS}$=5V | 0.2 | | | A |
| Forward Transconductance | $g_{FS}$ | $V_{GS}$=10V, $I_D$= 0.22A | 0.12 | 0.5 | | S |
| **Dynamic Characteristics** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$=25 V,<br>$V_{GS}$=0V,<br>f=1.0MHz | | 27 | | pF |
| Output Capacitance | $C_{oss}$ | | | 13 | | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 6 | | pF |
| Gate Resistance | $R_G$ | $V_{GS}$=15mV,f=1.0MHz | | 9 | | Ω |
| **Switching Characteristics** | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$=25 V,$V_{GS}$=10V,<br>$I_D$=0.22A | | 1.7 | 2.4 | nC |
| Gate-Source Charge | $Q_{gs}$ | | | 0.1 | | nC |
| Gate-Drain Charge | $Q_{gd}$ | | | 0.4 | | nC |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$=30V,$R_{GEN}$=6Ω ,<br>$V_{GS}$=10V ,$I_D$=0.29A | | 2.5 | 5 | ns |
| Turn-On Rise Time | $t_r$ | | | 9 | 18 | ns |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 20 | 36 | ns |
| Turn-Off Fall Time | $t_f$ | | | 7 | 14 | ns |
| Source-Drain Diode Characteristics | | | | | | |
| Maximum Continuous Drain-Source Forward Current | $I_S$ | | | | 0.22 | A |
| Drain-Source Diode Forward Voltage | $V_{SD}$ | $V_{GS}$=0V,$I_S$=0.44A | | 0.8 | 1.4 | V |

## Characteristics Curves

**Fig.1 On-Region Characteristics**

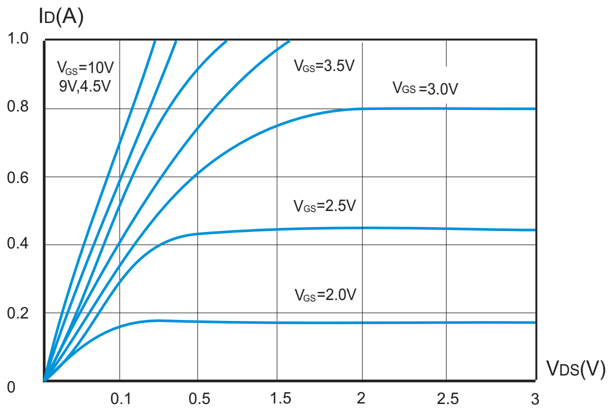


**Fig.2 On-Resistance Variation with Drain Current and Gate Voltage**

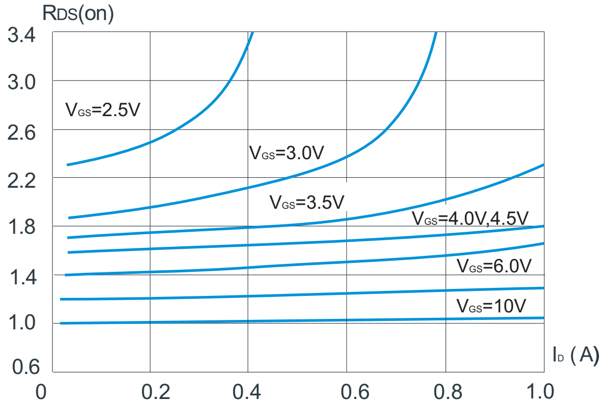


**Fig.3 On-Resitance Variation with Temperature**

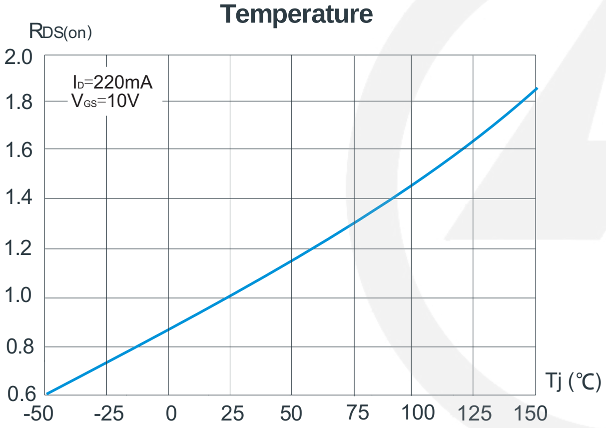


**Fig.4 On-resistance variation with Gate-to-Source voltage**

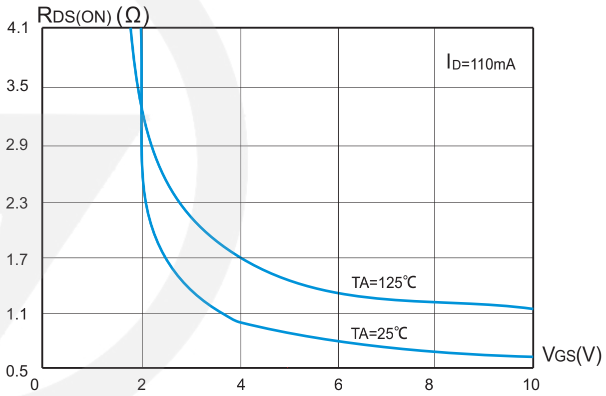


**Fig.5 Transfer Characteristics**

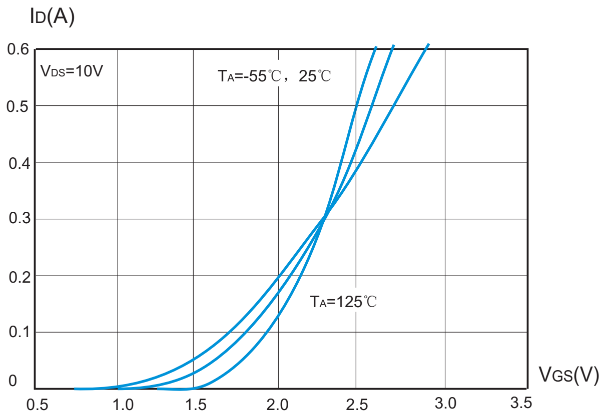


**Fig.6 Body Diode Forward Voltage Variation with Source Current and Temperature**

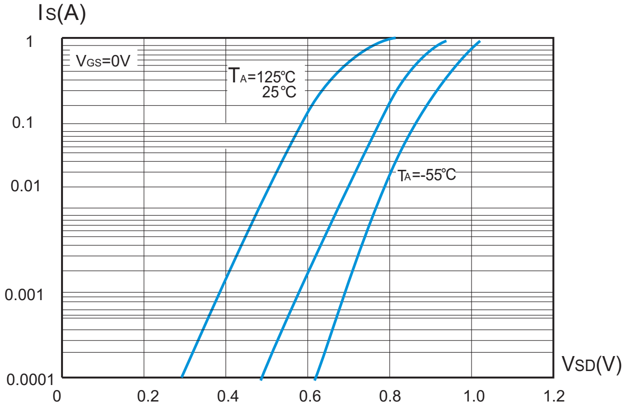


Fig.7 Gate Charge Characteristics

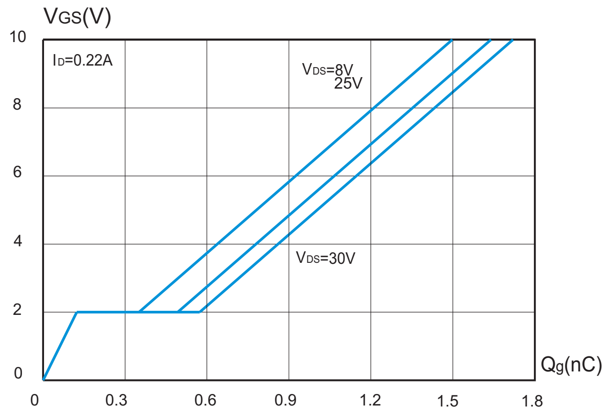


Fig.8 Capacitance Characteristics

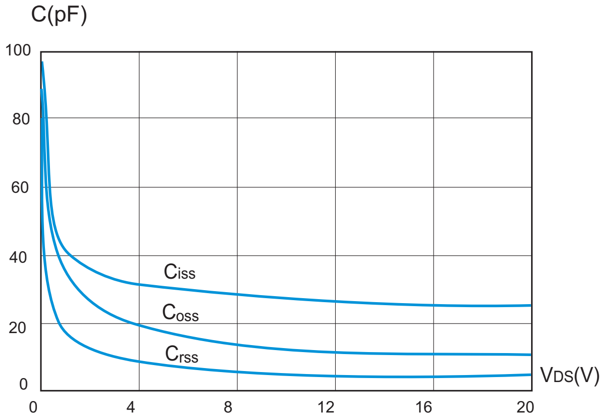


Fig.9 Maximum Safe Operating Area

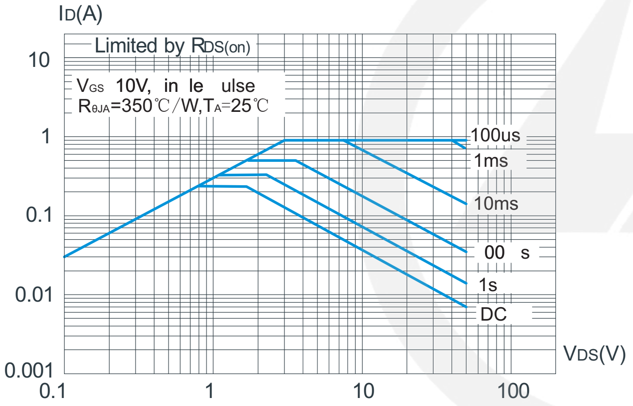
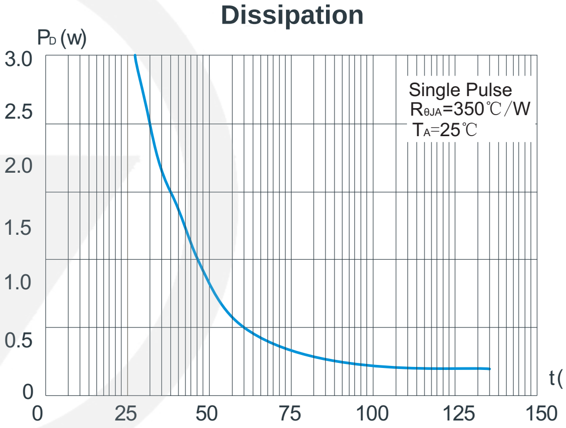
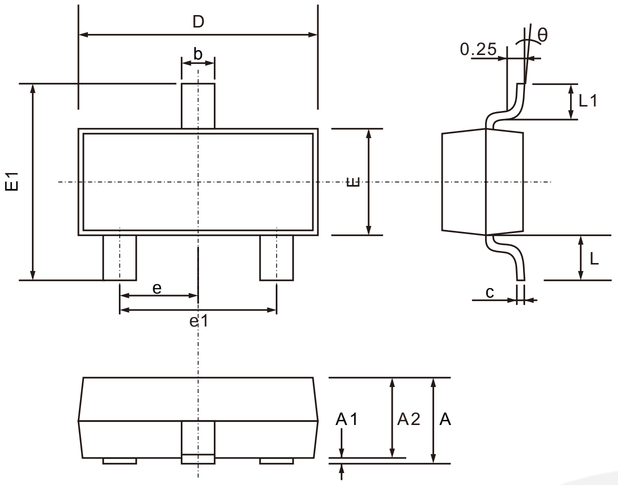


Fig.10 Single Pulse Maximum Power Dissipation



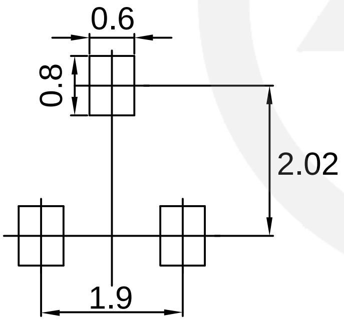
## SOT-23 Package Outline



Unit: mm

| SYMBOL | DIMENSIONS | |
|---|---|---|
| | MIN. | MAX. |
| A | 0.900 | 1.200 |
| A1 | 0.000 | 0.100 |
| A2 | 0.900 | 1.050 |
| b | 0.300 | 0.500 |
| c | 0.080 | 0.200 |
| D | 2.700 | 3.100 |
| E | 1.200 | 1.400 |
| E1 | 2.200 | 2.600 |
| e | 0.950 TYP. | |
| e1 | 1.750 | 2.050 |
| L | 0.550 TYP. | |
| L1 | 0.300 | 0.500 |
| θ | 0° | 8° |

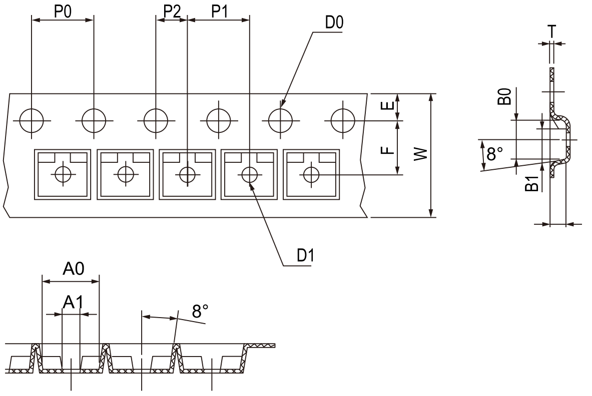
## SOT-23 Suggested Pad Layout



Note:
1.Controlling dimension:in millimeters.
2.General tolerance:± 0.05mm
3.The pad layout is for reference purpose only.

## Carrier Tape Dimensions

Unit：mm

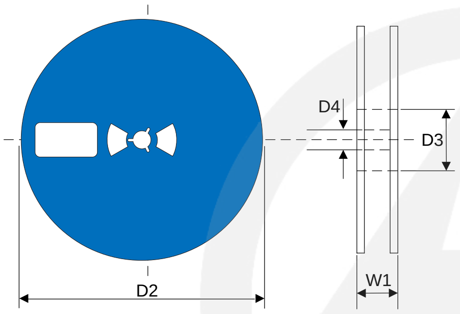


| Symbol | Spec | Symbol | Spec |
|---|---|---|---|
| A0 | 3.15±0.10 | P0 | 4.00±0.05 |
| A1 | 1.09±0.10 | P1 | 4.00±0.02 |
| B0 | 2.77±0.10 | W | 8.00±0.10 |
| B1 | 2.15±0.10 | E | 1.75±0.10 |
| K0 | 1.22±0.10 | F | 3.50±0.05 |
| D0 | 1.50±0.10 | T | 2.00±0.10 |
| D1 | 1.00±0.10 | | |

## Reel Dimensions

Unit：mm

7” Reel

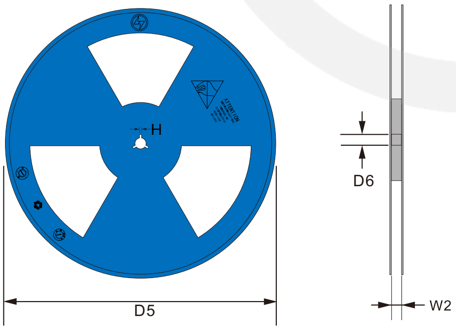


| | |
|---|---|
| D2 | Φ178.0±2.0 |
| D3 | Φ50 |
| D4 | 13.0±0.5 |
| W1 | 12±0.5 |
| Quantity: 3000PCS | |

## Reel Dimensions

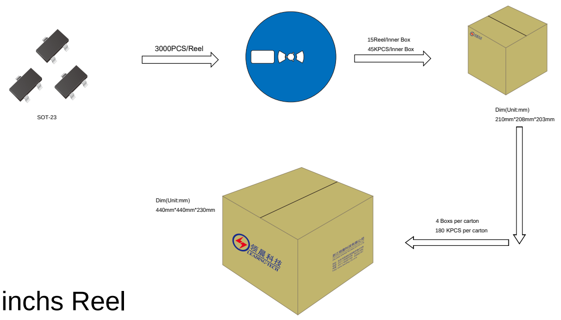
Unit：mm

13” Reel

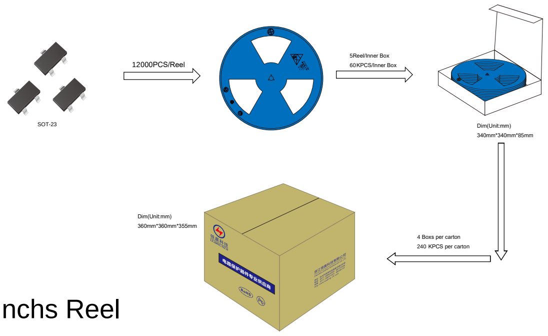


| | |
|---|---|
| D5 | Φ330.0±2.0 |
| D6 | Φ13.5±0.5 |
| H | 2.5±1.0 |
| W2 | 12±2.0 |
| Quantity: 12000PCS | |

## Packaging



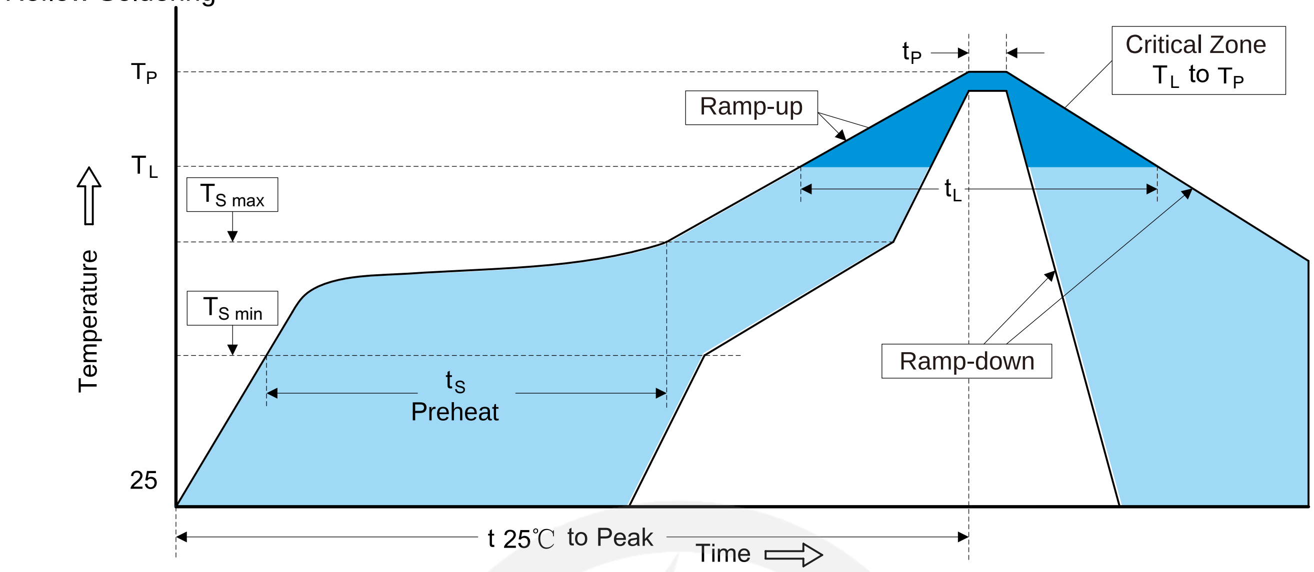
7 inchs Reel



13 inchs Reel

## Recommended Soldering Conditons

Reflow Soldering



Recommended Conditions

| Profile Feature | Pb-Free Assembly |
|---|---|
| Average ramp-up rate (T$_L$ to T$_P$) | 3℃/second max. |
| Preheat<br>-Temperature Min (T$_{S\ min}$)<br>-Temperature Max (T$_{S\ max}$)<br>-Time (min to max) ( t$_S$) | <br>150℃<br>200℃<br>60-180 seconds |
| T$_{S\ max}$ to T$_L$<br>-Ramp-up Rate | <br>3℃/second max. |
| Time maintained above:<br>-Temperature (T$_L$)<br>-Time (t$_L$) | <br>217℃<br>60-150 seconds |
| Peak Temperature (T$_P$) | 260℃ |
| Time within 5℃ of actual Peak Temperature (t$_P$) | 20-40 seconds |
| Ramp-down Rate | 6℃/second max. |
| Time 25℃ to Peak Temperature | 8 minutes max. |

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## Version Update information

| Series NO. | Enactment/Revision Date | Effective Date | Version | Revision Content | Revision Reason | Revision Person | Note |
|---|---|---|---|---|---|---|---|
| 01 | 2025.03.19 | 2025.03.19 | 3.0 | New file | / | Ding | |
| 02 | 2026.03.04 | 2026.03.04 | 3.1 | Package outline E1(max)=2.6mm | / | Ding | |