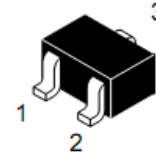
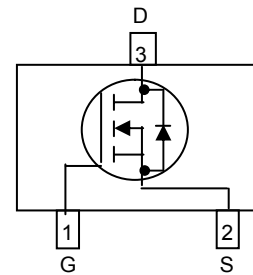
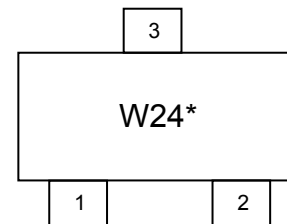


**WNM2024**
**Single N-Channel, 20V, 3.9A, Power MOSFET**
[Http://www.sh-willsemi.com](http://www.sh-willsemi.com)

| V <sub>DS</sub> (V) | R <sub>ds(on)</sub> (Ω)      |
|---------------------|------------------------------|
| 20                  | 0.027@ V <sub>GS</sub> =4.5V |
|                     | 0.031@ V <sub>GS</sub> =2.5V |
|                     | 0.036@ V <sub>GS</sub> =1.8V |


**SOT-23**
**Descriptions**

The WNM2024 is N-Channel enhancement MOS Field Effect Transistor. Uses advanced trench technology and design to provide excellent R<sub>DS(ON)</sub> with low gate charge. This device is suitable for use in DC-DC conversion, power switch and charging circuit. Standard Product WNM2024 is Pb-free and Halogen-free.


**Pin configuration (Top view)**


W24= Device Code

\* = Month (A~Z)

**Marking**
**Features**

- Trench Technology
- Supper high density cell design
- Excellent ON resistance for higher DC current
- Extremely Low Threshold Voltage
- Small package SOT-23

**Applications**

- Driver for Relay, Solenoid, Motor, LED etc.
- DC-DC converter circuit
- Power Switch
- Load Switch
- Charging

**Order information**

| Device       | Package | Shipping       |
|--------------|---------|----------------|
| WNM2024-3/TR | SOT-23  | 3000/Reel&Tape |

**Absolute Maximum ratings**

| Parameter                              |                        | Symbol    | 10 S       | Steady State | Unit             |
|--|------------------------|-----------|------------|--------------|------------------|
| Drain-Source Voltage                   |                        | $V_{DS}$  | 20         |              | V                |
| Gate-Source Voltage                    |                        | $V_{GS}$  | $\pm 8$    |              |                  |
| Continuous Drain Current <sup>a</sup>  | $T_A=25^\circ\text{C}$ | $I_D$     | 3.9        | 3.6          | A                |
|  | $T_A=70^\circ\text{C}$ |           | 3.1        | 2.9          |                  |
| Maximum Power Dissipation <sup>a</sup> | $T_A=25^\circ\text{C}$ | $P_D$     | 0.8        | 0.7          | W                |
|  | $T_A=70^\circ\text{C}$ |           | 0.5        | 0.4          |                  |
| Continuous Drain Current <sup>b</sup>  | $T_A=25^\circ\text{C}$ | $I_D$     | 3.6        | 3.3          | A                |
|  | $T_A=70^\circ\text{C}$ |           | 2.8        | 2.6          |                  |
| Maximum Power Dissipation <sup>b</sup> | $T_A=25^\circ\text{C}$ | $P_D$     | 0.7        | 0.6          | W                |
|  | $T_A=70^\circ\text{C}$ |           | 0.4        | 0.3          |                  |
| Pulsed Drain Current <sup>c</sup>      |                        | $I_{DM}$  | 15         |              | A                |
| Operating Junction Temperature         |                        | $T_J$     | 150        |              | $^\circ\text{C}$ |
| Lead Temperature                       |                        | $T_L$     | 260        |              | $^\circ\text{C}$ |
| Storage Temperature Range              |                        | $T_{stg}$ | -55 to 150 |              | $^\circ\text{C}$ |

**Thermal resistance ratings**

| Parameter   |                       | Symbol          | Typical | Maximum | Unit               |
|---|-----------------------|-----------------|---------|---------|--------------------|
| Junction-to-Ambient Thermal Resistance <sup>a</sup> | $t \leq 10 \text{ s}$ | $R_{\theta JA}$ | 120     | 145     | $^\circ\text{C/W}$ |
|   | Steady State          |                 | 132     | 168     |                    |
| Junction-to-Ambient Thermal Resistance <sup>b</sup> | $t \leq 10 \text{ s}$ | $R_{\theta JA}$ | 145     | 174     |                    |
|   | Steady State          |                 | 158     | 202     |                    |
| Junction-to-Case Thermal Resistance                 |                       | $R_{\theta JC}$ | 60      | 75      |                    |

a Surface mounted on FR4 Board using 1 square inch pad size, 1oz copper

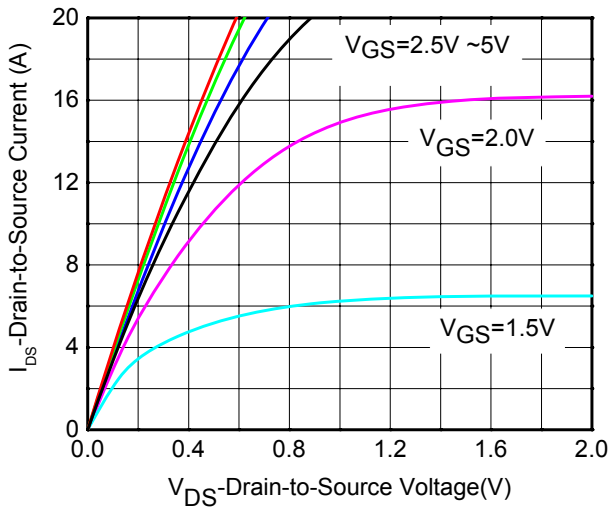
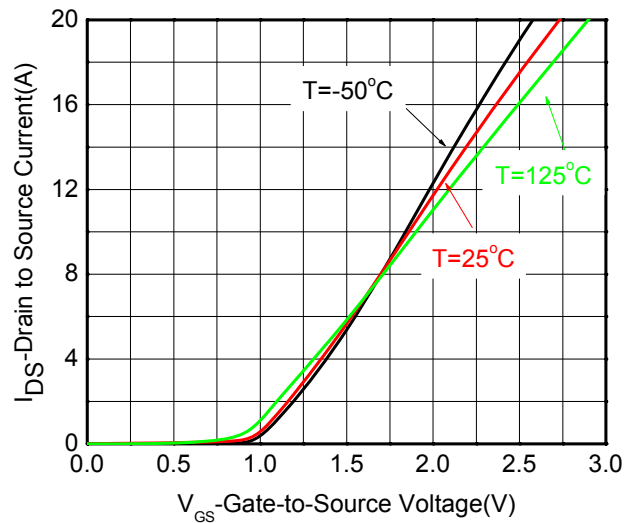
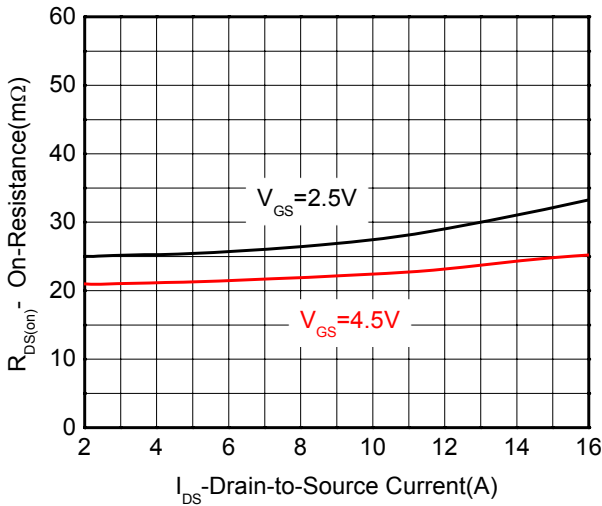
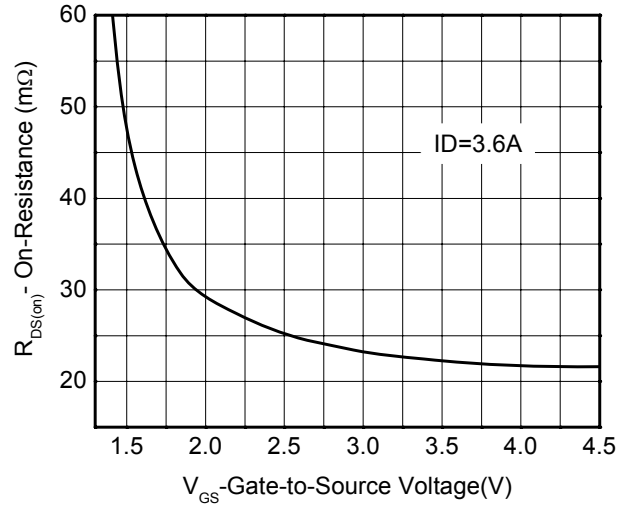
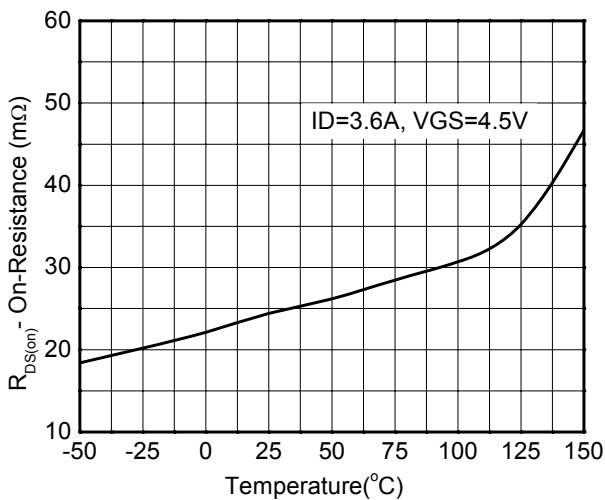
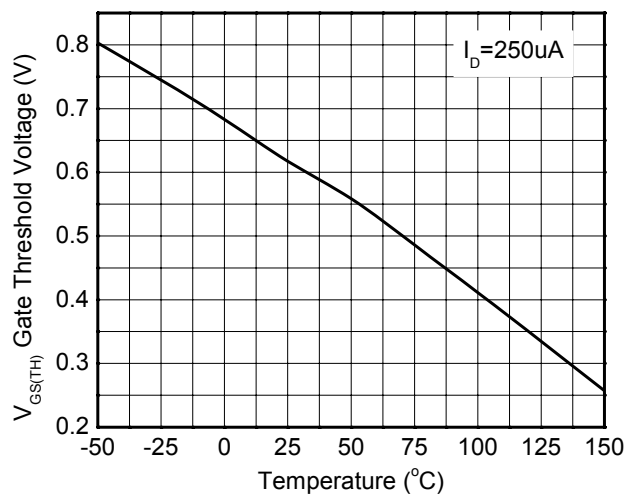
b Surface mounted on FR4 board using minimum pad size, 1oz copper

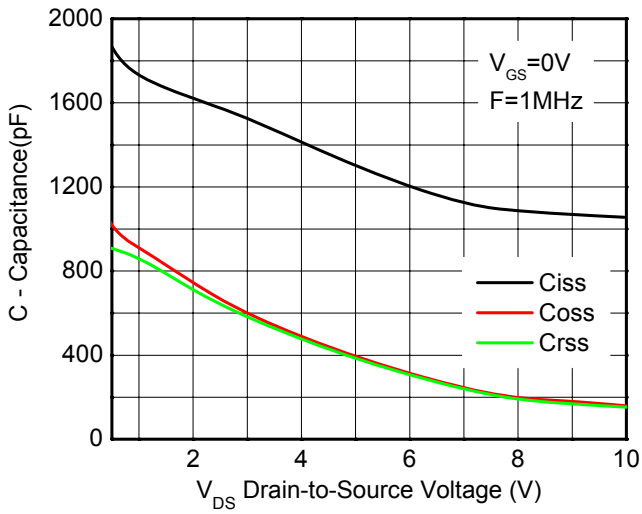
c Repetitive rating, pulse width limited by junction temperature,  $t_p=10\mu\text{s}$ , Duty Cycle=1%

d Repetitive rating, pulse width limited by junction temperature  $T_J=150^\circ\text{C}$ .

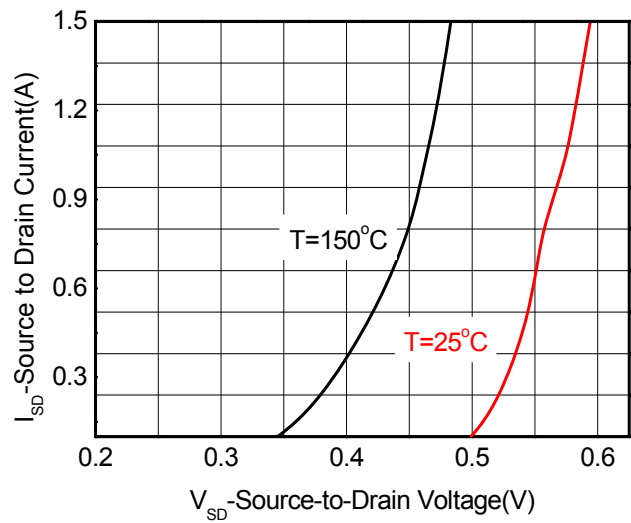
**Electronics Characteristics (Ta=25°C, unless otherwise noted)**

| Parameter  | Symbol       | Test Conditions   | Min | Typ  | Max       | Unit          |
|--|--------------|---|-----|------|-----------|---------------|
| <b>OFF CHARACTERISTICS</b>                       |              |   |     |      |           |               |
| Drain-to-Source Breakdown Voltage                | $BV_{DSS}$   | $V_{GS} = 0\text{ V}, I_D = 250\mu\text{A}$                                       | 20  |      |           | V             |
| Zero Gate Voltage Drain Current                  | $I_{DSS}$    | $V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}$                                       |     |      | 1         | $\mu\text{A}$ |
| Gate-to-source Leakage Current                   | $I_{GSS}$    | $V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$                                    |     |      | $\pm 100$ | nA            |
| <b>ON CHARACTERISTICS</b>                        |              |   |     |      |           |               |
| Gate Threshold Voltage                           | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = 250\mu\text{A}$   | 0.4 | 0.62 | 1.0       | V             |
| Drain-to-source On-resistance                    | $R_{DS(on)}$ | $V_{GS} = 4.5\text{ V}, I_D = 3.6\text{ A}$                                       |     | 27   | 36        | m $\Omega$    |
|  |              | $V_{GS} = -2.5\text{ V}, I_D = 2.8\text{ A}$                                      |     | 31   | 41        |               |
|  |              | $V_{GS} = 1.8\text{ V}, I_D = 2.0\text{ A}$                                       |     | 36   | 47        |               |
| Forward Transconductance                         | $g_{FS}$     | $V_{DS} = 5\text{ V}, I_D = 3.6\text{ A}$   |     | 10   |           | S             |
| <b>CHARGES, CAPACITANCES AND GATE RESISTANCE</b> |              |   |     |      |           |               |
| Input Capacitance                                | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 10\text{ V}$                   |     | 1025 |           | pF            |
| Output Capacitance                               | $C_{OSS}$    |   |     | 125  |           |               |
| Reverse Transfer Capacitance                     | $C_{RSS}$    |   |     | 120  |           |               |
| Total Gate Charge                                | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}, I_D = 3.6\text{ A}$                 |     | 12.0 |           | nC            |
| Threshold Gate Charge                            | $Q_{G(TH)}$  |   |     | 0.66 |           |               |
| Gate-to-Source Charge                            | $Q_{GS}$     |   |     | 1.0  |           |               |
| Gate-to-Drain Charge                             | $Q_{GD}$     |   |     | 3.3  |           |               |
| <b>SWITCHING CHARACTERISTICS</b>                 |              |   |     |      |           |               |
| Turn-On Delay Time                               | $t_d(ON)$    | $V_{GS} = 4.5\text{ V}, V_{DS} = 6\text{ V}, I_D = 2.0\text{ A}, R_G = 6\ \Omega$ |     | 6.5  |           | ns            |
| Rise Time  | $t_r$        |   |     | 11.5 |           |               |
| Turn-Off Delay Time                              | $t_d(OFF)$   |   |     | 48   |           |               |
| Fall Time  | $t_f$        |   |     | 20   |           |               |
| <b>BODY DIODE CHARACTERISTICS</b>                |              |   |     |      |           |               |
| Forward Voltage                                  | $V_{SD}$     | $V_{GS} = 0\text{ V}, I_S = 1.5\text{ A}$   | 0.5 | 0.6  | 1.5       | V             |

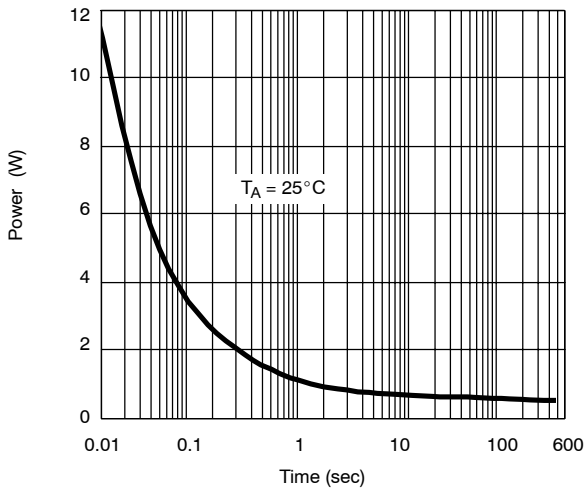
**Typical Characteristics (Ta=25°C, unless otherwise noted)**

**Output characteristics**

**Transfer characteristics**

**On-Resistance vs. Drain current**

**On-Resistance vs. Gate-to-Source voltage**

**On-Resistance vs. Junction temperature**

**Threshold voltage vs. Temperature**



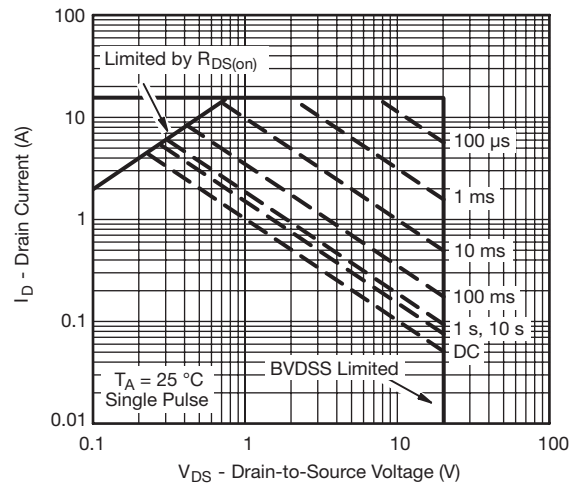
Capacitance



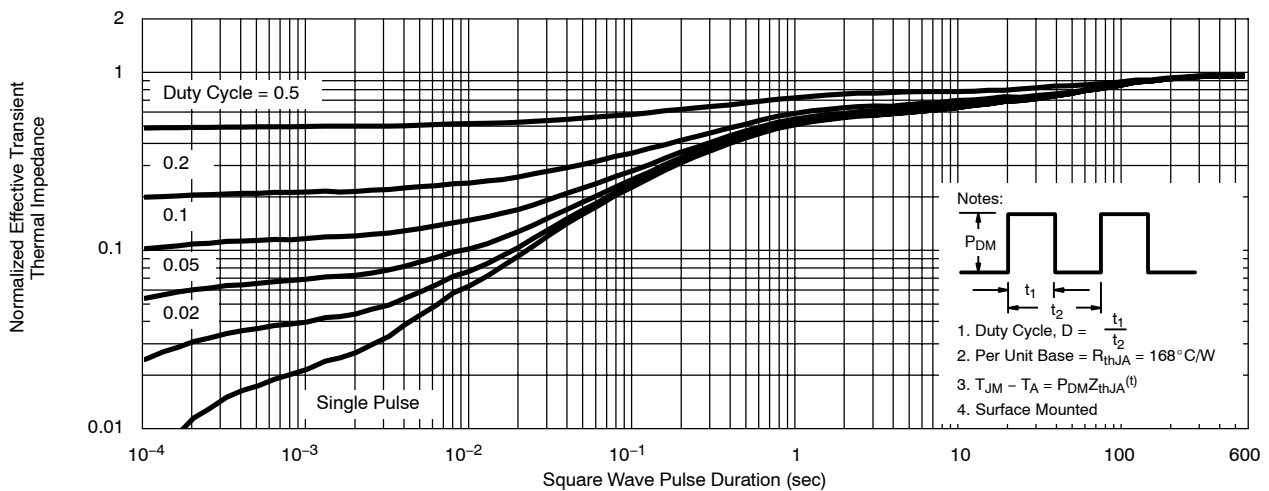
Body diode forward voltage



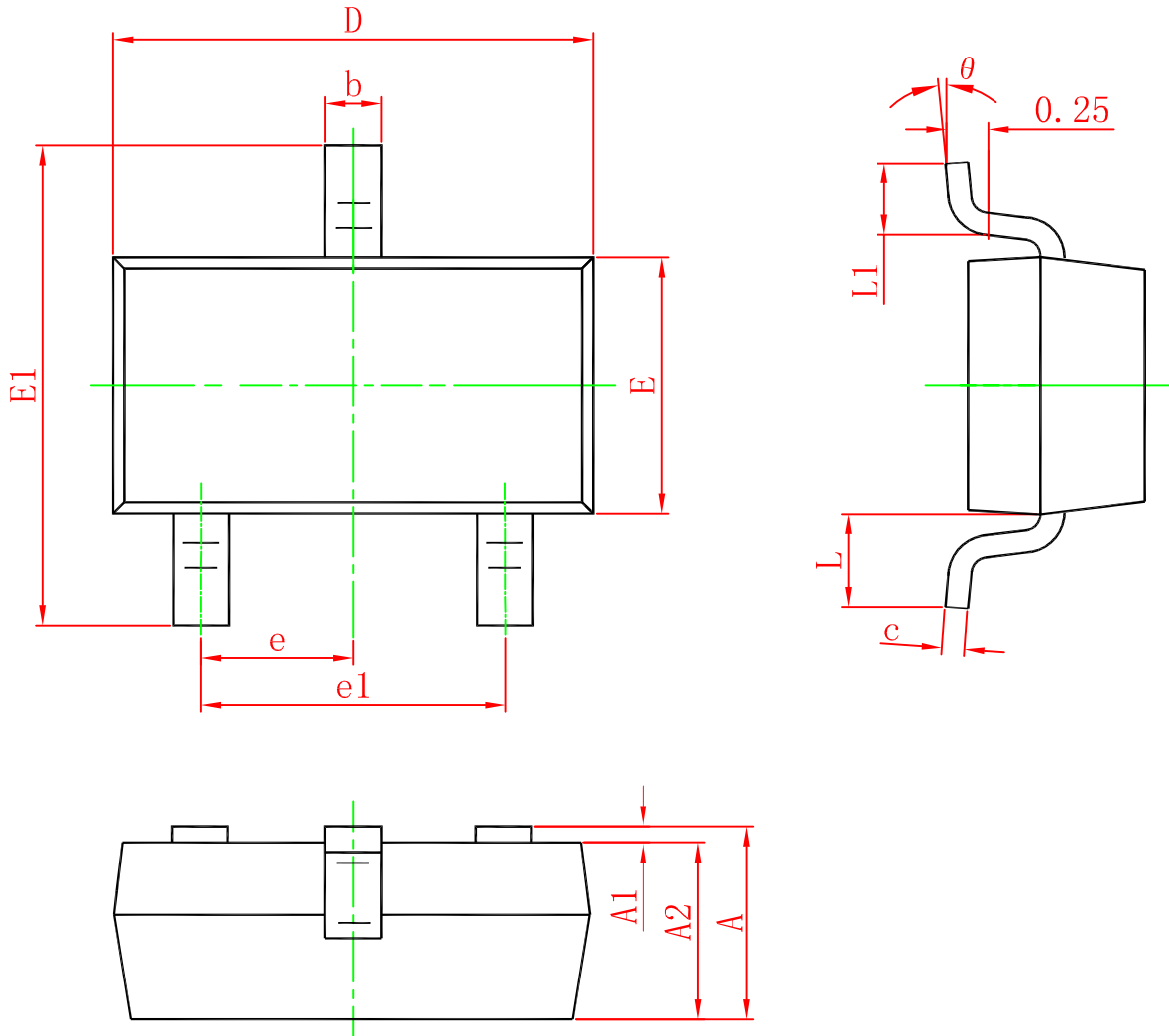
Single pulse power



Safe operating area



Transient thermal response (Junction-to-Ambient)

**Package outline dimensions**
**SOT-23**


| Symbol   | Dimensions in millimeter |       |       |
|----------|--------------------------|-------|-------|
|          | Min.                     | Typ.  | Max.  |
| A        | 0.900                    | 1.025 | 1.150 |
| A1       | 0.000                    | 0.050 | 0.100 |
| A2       | 0.900                    | 0.975 | 1.050 |
| b        | 0.300                    | 0.400 | 0.500 |
| c        | 0.080                    | 0.115 | 0.150 |
| D        | 2.800                    | 2.900 | 3.000 |
| E        | 1.200                    | 1.300 | 1.400 |
| E1       | 2.250                    | 2.400 | 2.550 |
| e        | 0.950TYP                 |       |       |
| e1       | 1.800                    | 1.900 | 2.000 |
| L        | 0.550REF                 |       |       |
| L1       | 0.300                    |       | 0.500 |
| $\theta$ | 0°                       |       | 8°    |

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