
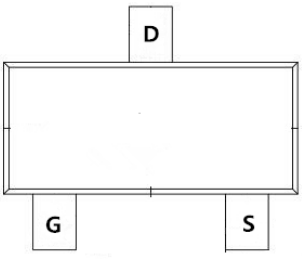


TMP2004AI

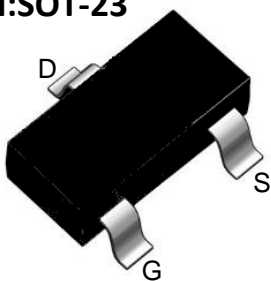
P-Channel Enhancement Mosfet

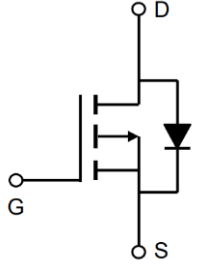
| | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>General Description</p> <ul style="list-style-type: none"> • Low $R_{DS(ON)}$ • RoHS and Halogen-Free Compliant <p>Applications</p> <ul style="list-style-type: none"> • Load switch • PWM | <p>General Features</p> <p>$V_{DS} = -20V, I_D = -4.0A$</p> <p>$R_{DS(ON)} = 35\text{ m}\Omega$ (Typ.) @ $V_{GS} = -4.5V$</p> <p>100% UIS Tested 100% R_g Tested</p>  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



Marking: 3415

I:SOT-23





Absolute Maximum Ratings: ($T_C = 25^\circ\text{C}$ unless otherwise noted)

| Symbol | Parameter | Rating | Units |
|--------------------------------|----------------------------------------------|------------|-------|
| V_{DS} | Drain-Source Voltage | -20 | V |
| V_{GS} | Gate-Source Voltage | ± 12 | V |
| $I_D @ T_A = 25^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ -4.5V^1$ | -4.0 | A |
| $I_D @ T_A = 70^\circ\text{C}$ | Continuous Drain Current, $V_{GS} @ -4.5V^1$ | -3.0 | A |
| I_{DM} | Pulsed Drain Current ² | -10 | A |
| $P_D @ T_A = 25^\circ\text{C}$ | Total Power Dissipation ³ | 0.90 | W |
| $P_D @ T_A = 70^\circ\text{C}$ | Total Power Dissipation ³ | 0.54 | W |
| T_{STG} | Storage Temperature Range | -55 to 150 | °C |
| T_J | Operating Junction Temperature Range | -55 to 150 | °C |

Thermal Data

| Symbol | Parameter | Typ. | Max. | Unit |
|-----------------|-------------------------------------------------------------------|------|------|-------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient ¹ | --- | 120 | °C/ W |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient ¹ ($t \leq 10s$) | --- | 95 | °C/ W |



Electrical Characteristics (T_J=25 °C, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------------|------------------------------------------------|------------------------------------------------------------------------------------------|------|--------|------|--------|
| BV _{DSS} | Drain-Source Breakdown Voltage | V _{GS} =0V, I _D =-250uA | -20 | --- | --- | V |
| ΔBV _{DSS} /ΔT _J | BV _{DSS} Temperature Coefficient | Reference to 25°C, I _D =-1mA | --- | -0.014 | --- | V/ °C |
| R _{DS(ON)} | Static Drain-Source On-Resistance ² | V _{GS} =-4.5V, I _D =-4.9A | --- | 35 | 50 | mΩ |
| | | V _{GS} =-2.5V, I _D =-3.4A | --- | 48 | 65 | |
| | | V _{GS} =-1.8V, I _D =-2A | --- | --- | --- | |
| V _{GS(th)} | Gate Threshold Voltage | V _{GS} =V _{DS} , I _D =-250uA | -0.5 | -1.2 | -1.0 | V |
| ΔV _{GS(th)} | V _{GS(th)} Temperature Coefficient | | --- | 3.95 | --- | mV/ °C |
| I _{DSS} | Drain-Source Leakage Current | V _{DS} =-16V, V _{GS} =0V, T _J =25°C | --- | --- | -1 | uA |
| | | V _{DS} =-16V, V _{GS} =0V, T _J =55°C | --- | --- | -5 | |
| I _{GSS} | Gate-Source Leakage Current | V _{GS} = ±12V, V _{DS} =0V | --- | --- | ±100 | nA |
| g _{fs} | Forward Transconductance | V _{DS} =-5V, I _D =-3A | --- | 12.8 | --- | S |
| Q _g | Total Gate Charge (-4.5V) | V _{DS} =-15V, V _{GS} =-4.5V, I _D =-3A | --- | 9.2 | 14.3 | nC |
| Q _{gs} | Gate-Source Charge | | --- | 1.89 | 2.6 | |
| Q _{gd} | Gate-Drain Charge | | --- | 3.1 | 4.3 | |
| T _{d(on)} | Turn-On Delay Time | V _{DD} =-10V, V _{GS} =-4.5V, R _G =3.3Ω, I _D =-3A | --- | 5.6 | 11.2 | ns |
| T _r | Rise Time | | --- | 40.8 | 73 | |
| T _{d(off)} | Turn-Off Delay Time | | --- | 33.6 | 67 | |
| T _f | Fall Time | | --- | 18 | 36 | |
| C _{iss} | Input Capacitance | V _{DS} =-15V, V _{GS} =0V, f=1MHz | --- | 757 | 1200 | pF |
| C _{oss} | Output Capacitance | | --- | 104 | 160 | |
| C _{rss} | Reverse Transfer Capacitance | | --- | 98 | 151 | |

Diode Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-----------------|------------------------------------------|----------------------------------------------------------------|------|------|------|------|
| I _S | Continuous Source Current ^{1,4} | V _G =V _D =0V, Force Current | --- | --- | -4.0 | A |
| I _{SM} | Pulsed Source Current ^{2,4} | | --- | --- | -10 | A |
| V _{SD} | Diode Forward Voltage ² | V _{GS} =0V, I _S =-1A, T _J =25°C | --- | --- | -1 | V |
| t _{rr} | Reverse Recovery Time | I _F =-3A, di/dt=100A/μs, | --- | 21.8 | --- | nS |
| Q _{rr} | Reverse Recovery Charge | T _J =25°C | --- | 6.9 | --- | nC |

Note :

- 1.The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.
- 2.The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%
- 3.The power dissipation is limited by 150°C junction temperature
- 4.The data is theoretically the same as I_D and I_{DM}, in real applications, should be limited by total power dissipation.

Typical Performance Characteristics

Figure 1: Output Characteristics

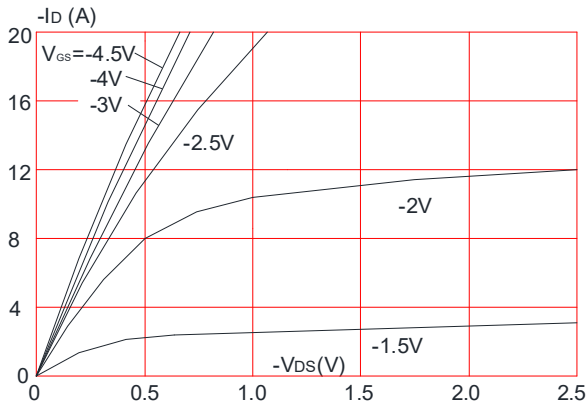


Figure 2: Typical Transfer Characteristics

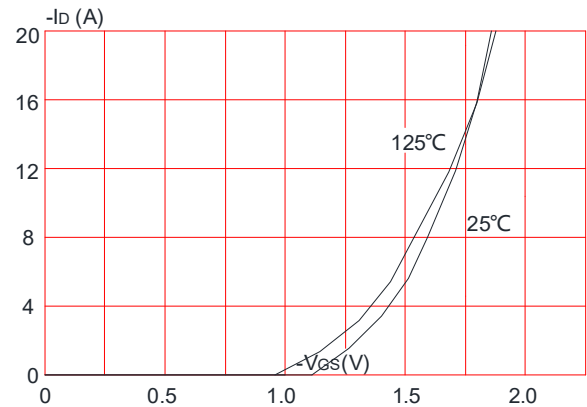


Figure 3: On-resistance vs. Drain Current

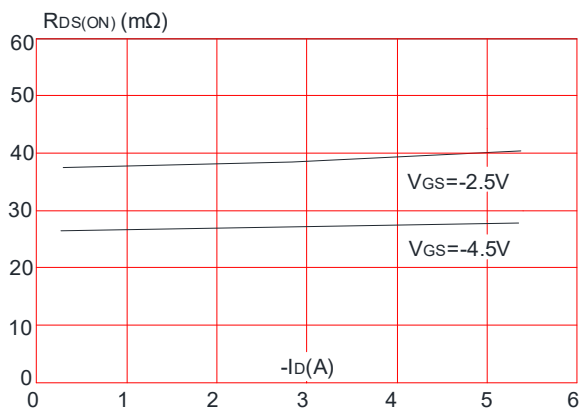


Figure 4: Body Diode Characteristics

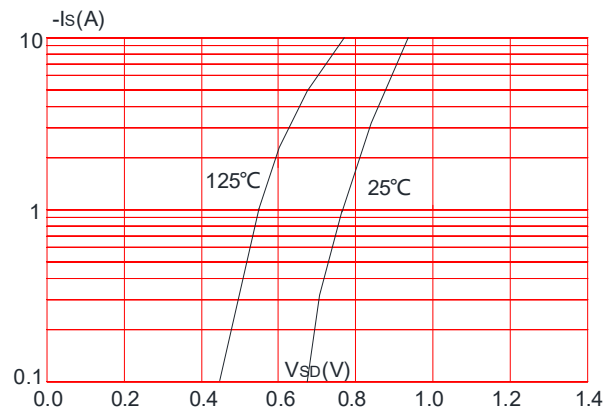


Figure 5: Gate Charge Characteristics

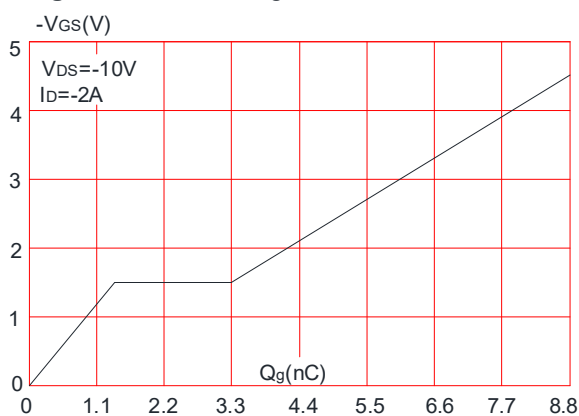
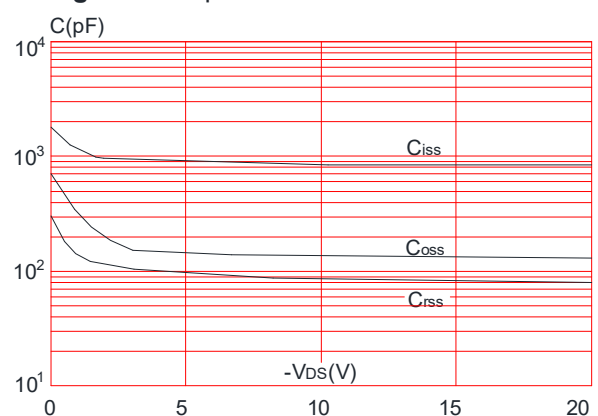


Figure 6: Capacitance Characteristics



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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

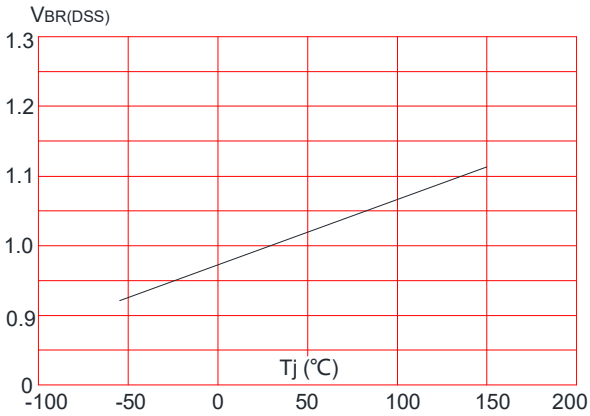


Figure 8: Normalized on Resistance vs. Junction Temperature

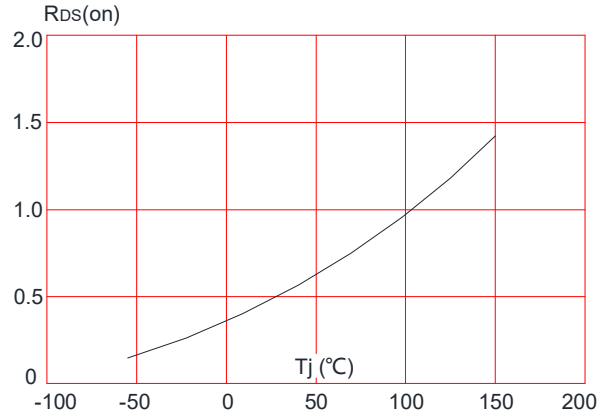


Figure 9: Maximum Safe Operating Area

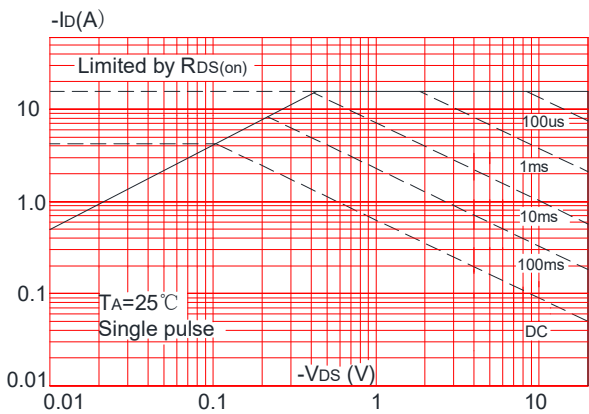


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

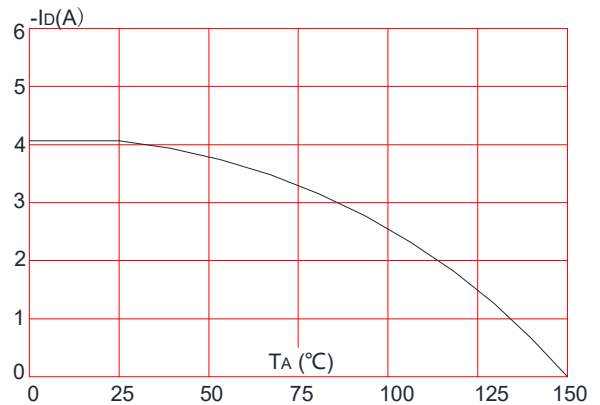
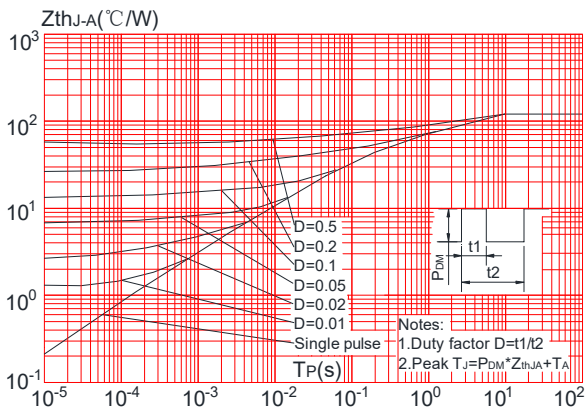
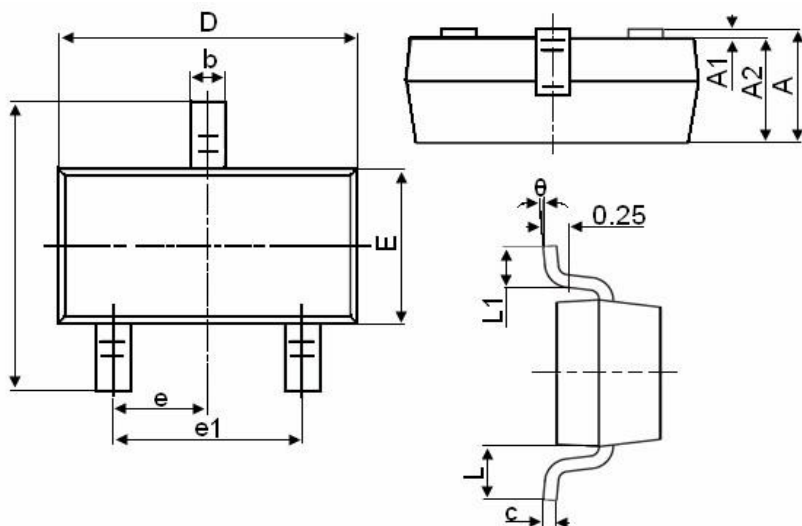


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



Package Mechanical Data:SOT-23



| Symbol | Dimensions in Millimeters | |
|----------|---------------------------|-------|
| | MIN. | MAX. |
| A | 0.900 | 1.150 |
| A1 | 0.000 | 0.100 |
| A2 | 0.900 | 1.050 |
| b | 0.300 | 0.500 |
| c | 0.080 | 0.150 |
| D | 2.800 | 3.000 |
| E | 1.200 | 1.400 |
| E1 | 2.250 | 2.550 |
| e | 0.950TYP | |
| e1 | 1.800 | 2.000 |
| L | 0.550REF | |
| L1 | 0.300 | 0.500 |
| θ | 0° | 8° |

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