
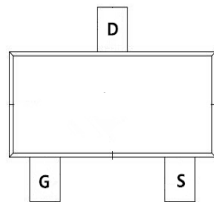


**TM05P04I**

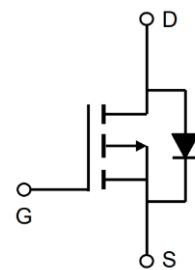
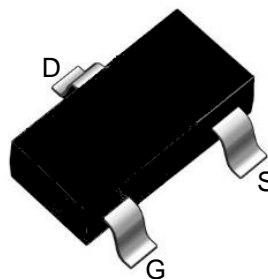
**P-Channel Enhancement Mosfet**

|  |   |
|--|---|
| <p><b>General Description</b></p> <ul style="list-style-type: none"> <li>• Low <math>R_{DS(ON)}</math></li> <li>• RoHS and Halogen-Free Compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>• Load switch</li> <li>• PWM</li> </ul> | <p><b>General Features</b></p> <p><math>V_{DS} = -40V, I_D = -5.0A</math></p> <p><math>R_{DS(ON)} = 47m\Omega</math> (Typ.) @ <math>V_{GS} = -10V</math></p> <p>100% UIS Tested<br/>             100% <math>R_g</math> Tested</p>  |
|--|---|

**I:SOT-23**



Marking: 5P04



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

| Symbol                   | Parameter                            | Rating     | Units      |
|--------------------------|--------------------------------------|------------|------------|
| $V_{DS}$                 | Drain-Source Voltage                 | -40        | V          |
| $V_{GS}$                 | Gate-Source Voltage                  | $\pm 20$   | V          |
| $I_D @ T_A = 25^\circ C$ | Continuous Drain Current             | -5         | A          |
| $I_D @ T_A = 70^\circ C$ | Continuous Drain Current             | -3.6       | A          |
| $I_{DM}$                 | Pulsed Drain Current <sup>2</sup>    | -22        | A          |
| $P_D @ T_A = 25^\circ C$ | Total Power Dissipation <sup>3</sup> | 2.0        | W          |
| $P_D @ T_A = 70^\circ C$ | Total Power Dissipation <sup>3</sup> | 1.5        | W          |
| $T_{STG}$                | Storage Temperature Range            | -55 to 150 | $^\circ C$ |
| $T_J$                    | Operating Junction Temperature Range | -55 to 150 | $^\circ C$ |

**Thermal Data**

| Symbol          | Parameter   | Typ. | Max. | Unit         |
|-----------------|---|------|------|--------------|
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient <sup>1</sup>                  | ---  | 65   | $^\circ C/W$ |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient <sup>1</sup> ( $t \leq 10s$ ) | ---  | 48   | $^\circ C/W$ |

**Electrical Characteristics** ( $T_J=25^{\circ}\text{C}$  unless otherwise specified)

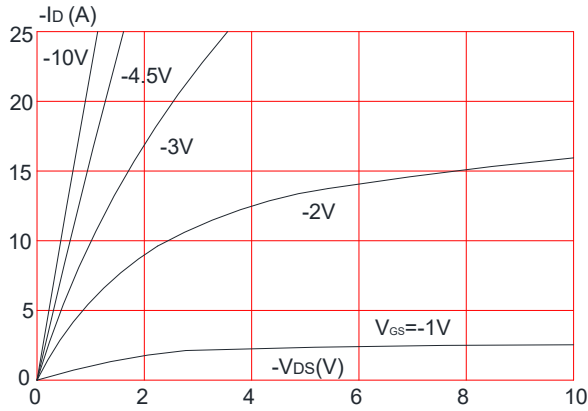
| Symbol  | Parameter  | Test Condition  | Min. | Typ. | Max.      | Units      |
|---|--|---|------|------|-----------|------------|
| <b>Off Characteristic</b>                                     |  |   |      |      |           |            |
| $V_{(BR)DSS}$   | Drain-Source Breakdown Voltage                           | $V_{GS}=0V, I_D = -250\mu A$                                    | -40  | -    | -         | V          |
| $I_{DSS}$   | Zero Gate Voltage Drain Current                          | $V_{DS} = -40V, V_{GS}=0V$                                      | -    | -    | -1        | $\mu A$    |
| $I_{GSS}$   | Gate to Body Leakage Current                             | $V_{DS}=0V, V_{GS} = \pm 20V$                                   | -    | -    | $\pm 100$ | nA         |
| <b>On Characteristics</b>                                     |  |   |      |      |           |            |
| $V_{GS(th)}$  | Gate Threshold Voltage                                   | $V_{DS}=V_{GS}, I_D = -250\mu A$                                | -1.0 | -1.7 | -2.5      | V          |
| $R_{DS(on)}$  | Static Drain-Source on-Resistance<br>Note2               | $V_{GS} = -10V, I_D = -5A$                                      | -    | 47   | 52        | m $\Omega$ |
|   |  | $V_{GS} = -4.5V, I_D = -4A$                                     | -    | 53   | 69        |            |
| <b>Dynamic Characteristics</b>                                |  |   |      |      |           |            |
| $C_{iss}$   | Input Capacitance  | $V_{DS} = -20V, V_{GS}=0V,$<br>$f=1.0MHz$                       | -    | 869  | -         | pF         |
| $C_{oss}$   | Output Capacitance                                       |   | -    | 94   | -         | pF         |
| $C_{rss}$   | Reverse Transfer Capacitance                             |   | -    | 69   | -         | pF         |
| $Q_g$   | Total Gate Charge  | $V_{DS} = -20V, I_D = -4A,$<br>$V_{GS} = -10V$                  | -    | 17.3 | -         | nC         |
| $Q_{gs}$  | Gate-Source Charge                                       |   | -    | 3.2  | -         | nC         |
| $Q_{gd}$  | Gate-Drain("Miller") Charge                              |   | -    | 4.3  | -         | nC         |
| <b>Switching Characteristics</b>                              |  |   |      |      |           |            |
| $t_{d(on)}$   | Turn-on Delay Time                                       | $V_{DS} = -20V, I_D = -4A,$<br>$V_{GS} = -10V, R_{GEN}=3\Omega$ | -    | 10.3 | -         | ns         |
| $t_r$   | Turn-on Rise Time  |   | -    | 4.3  | -         | ns         |
| $t_{d(off)}$  | Turn-off Delay Time                                      |   | -    | 39   | -         | ns         |
| $t_f$   | Turn-off Fall Time                                       |   | -    | 46.5 | -         | ns         |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |  |   |      |      |           |            |
| $I_S$   | Maximum Continuous Drain to Source Diode Forward Current |   | -    | -    | -5        | A          |
| $I_{SM}$  | Maximum Pulsed Drain to Source Diode Forward Current     |   | -    | -    | -22       | A          |
| $V_{SD}$  | Drain to Source Diode Forward Voltage                    | $V_{GS}=0V, I_S = -5.5A$  | -    | -0.8 | -1.2      | V          |
| $t_{rr}$  | Reverse Recovery Time                                    | $V_{GS}=0V, I_S = -5.5A,$                                       | -    | 17   | -         | ns         |
| $Q_{rr}$  | Reverse Recovery Charge                                  | $di/dt=100A/\mu s$  | -    | 11.5 | -         | nC         |

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

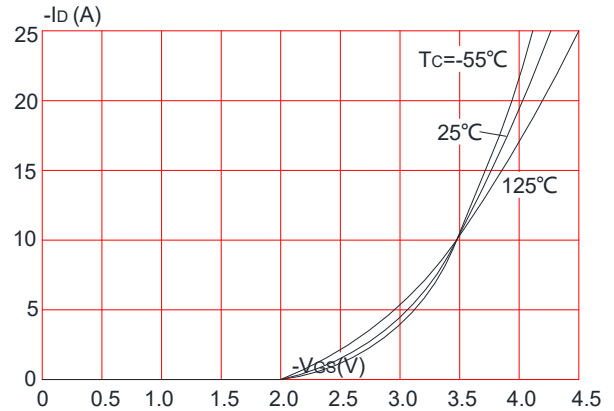
2. Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 2\%$

**Typical Performance Characteristics**

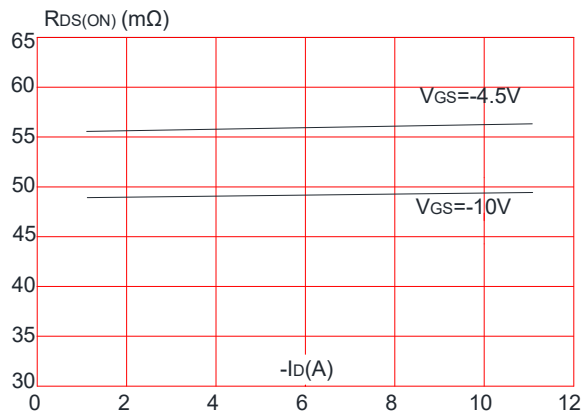
**Figure 1: Output Characteristics**



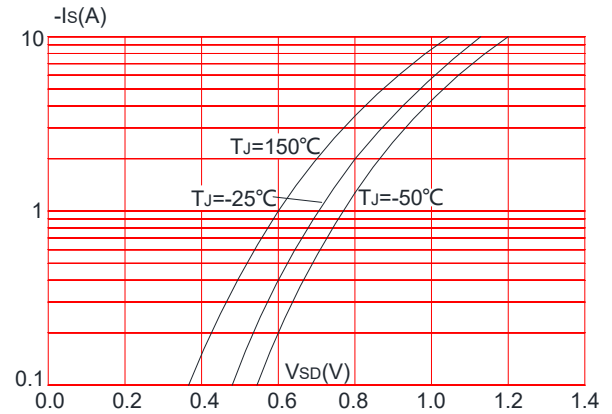
**Figure 2: Typical Transfer Characteristics**



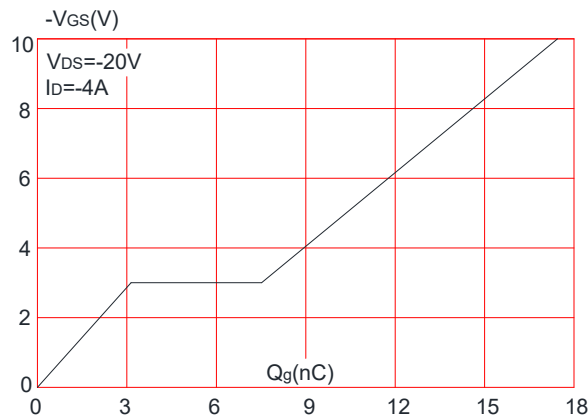
**Figure 3: On-resistance vs. Drain Current**



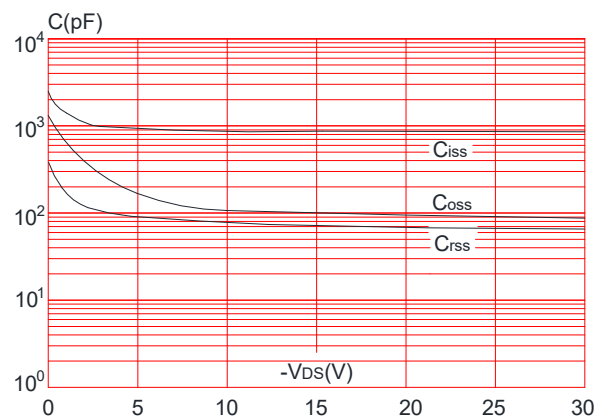
**Figure 4: Body Diode Characteristics**



**Figure 5: Gate Charge Characteristics**



**Figure 6: Capacitance Characteristics**



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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

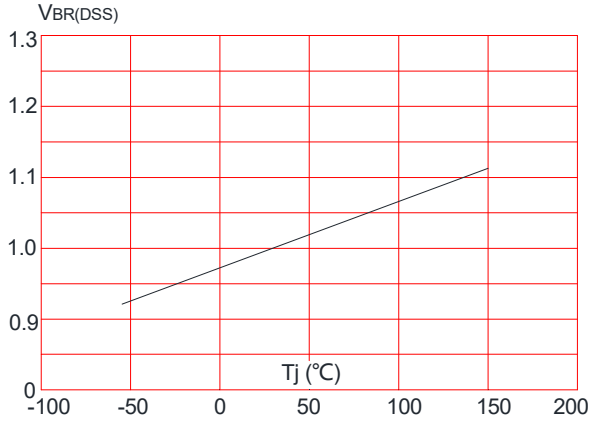


Figure 8: Normalized on Resistance vs. Junction Temperature

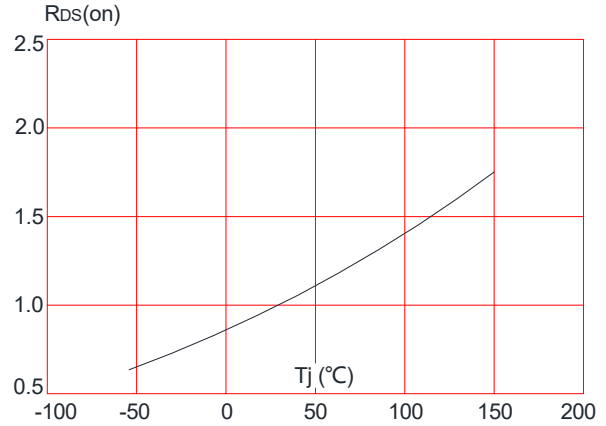


Figure 9: Maximum Safe Operating Area

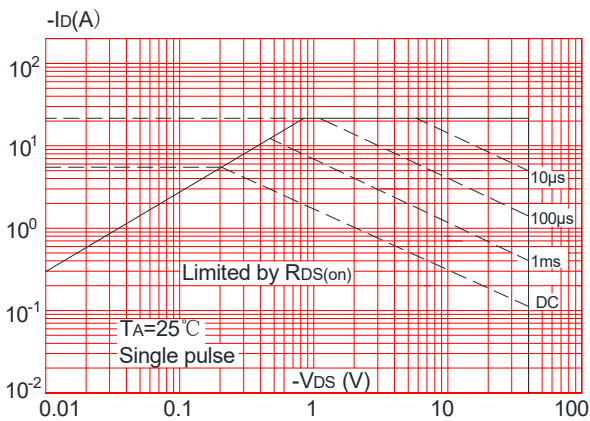


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

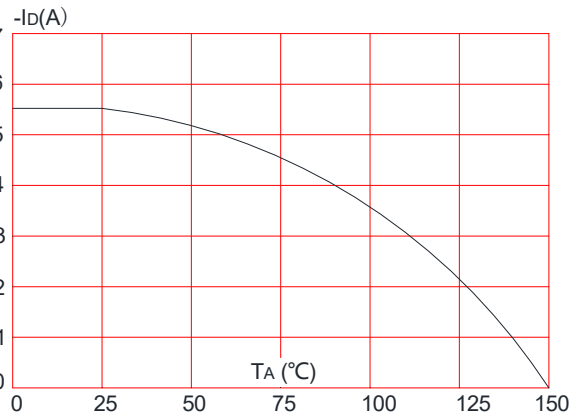
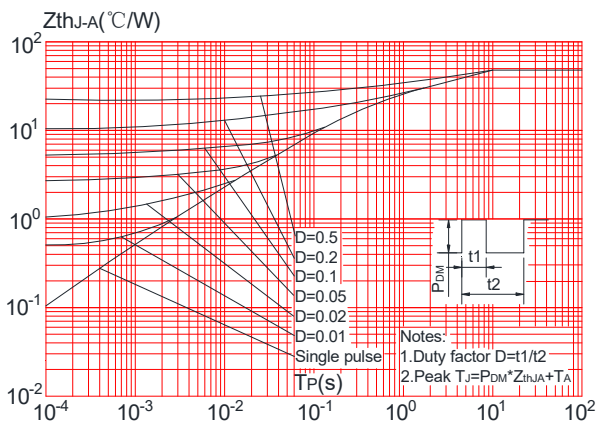
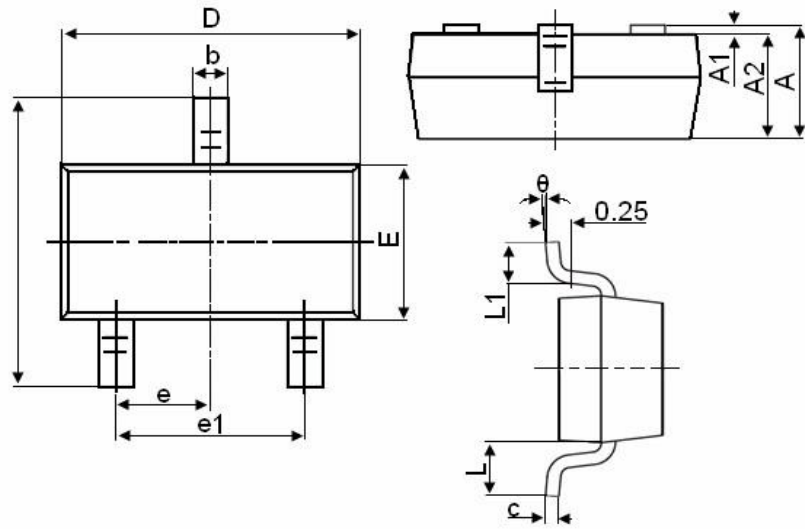


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



## 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°    |