

N-Channel Power MOSFET

600V, 3A, 1.4Ω

FEATURES

- Super-Junction technology
- High performance due to small figure-of-merit
- High ruggedness performance
- High commutation performance
- 100% UIL tested
- Pb-free plating
- Compliant to RoHS Directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21

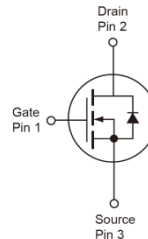
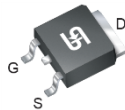
APPLICATIONS

- Power Supply
- Lighting

| KEY PERFORMANCE PARAMETERS | | |
|----------------------------|-------|------|
| PARAMETER | VALUE | UNIT |
| V_{DS} | 600 | V |
| $R_{DS(on)}$ (max) | 1.4 | Ω |
| Q_g | 7.12 | nC |



TO-252 (DPAK)



Note: MSL 3 (Moisture Sensitivity Level) per J-STD-020

| ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted) | | | |
|---|----------------|---------------------------|------|
| PARAMETER | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | V_{DS} | 600 | V |
| Gate-Source Voltage | V_{GS} | ±30 | V |
| Continuous Drain Current ^(Note 1) | I_D | $T_C = 25^\circ\text{C}$ | 3 |
| | | $T_C = 100^\circ\text{C}$ | 1.8 |
| Pulsed Drain Current ^(Note 2) | I_{DM} | 9 | A |
| Total Power Dissipation @ $T_C = 25^\circ\text{C}$ | P_{DTOT} | 28.4 | W |
| Single Pulsed Avalanche Energy ^(Note 3) | E_{AS} | 25 | mJ |
| Single Pulsed Avalanche Current ^(Note 3) | I_{AS} | 1.0 | A |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | - 55 to +150 | °C |

| THERMAL PERFORMANCE | | | |
|--|-----------------|-------|------|
| PARAMETER | SYMBOL | LIMIT | UNIT |
| Junction to Case Thermal Resistance | $R_{\theta JC}$ | 4.4 | °C/W |
| Junction to Ambient Thermal Resistance | $R_{\theta JA}$ | 62 | °C/W |

Thermal Performance Note: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistances. The case-thermal reference is defined at the solder mounting surface of the drain pins. $R_{\theta JA}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design. $R_{\theta JA}$ shown below for single device operation on FR-4 PCB in still air.

| ELECTRICAL SPECIFICATIONS ($T_A = 25^\circ\text{C}$ unless otherwise noted) | | | | | | |
|---|---|--------------|-----|-------|-----------|---------------|
| PARAMETER | CONDITIONS | SYMBOL | MIN | TYP | MAX | UNIT |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$ | BV_{DSS} | 600 | -- | -- | V |
| Gate Threshold Voltage | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$ | $V_{GS(TH)}$ | 2 | 3.3 | 4 | V |
| Gate Body Leakage | $V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$ | I_{GSS} | -- | -- | ± 100 | nA |
| Zero Gate Voltage Drain Current | $V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$ | I_{DSS} | -- | -- | 1 | μA |
| Drain-Source On-State Resistance (Note 4) | $V_{GS} = 10\text{V}, I_D = 0.9\text{A}$ | $R_{DS(on)}$ | -- | 1 | 1.4 | Ω |
| Dynamic (Note 5) | | | | | | |
| Total Gate Charge | $V_{DS} = 380\text{V}, I_D = 3\text{A},$ $V_{GS} = 10\text{V}$ | Q_g | -- | 7.12 | -- | nC |
| Gate-Source Charge | | Q_{gs} | -- | 3.52 | -- | |
| Gate-Drain Charge | | Q_{gd} | -- | 1.62 | -- | |
| Input Capacitance | $V_{DS} = 100\text{V}, V_{GS} = 0\text{V},$ $f = 1.0\text{MHz}$ | C_{iss} | -- | 257.3 | -- | pF |
| Output Capacitance | | C_{oss} | -- | 41.5 | -- | |
| Gate Resistance | $F = 1\text{MHz}, \text{open drain}$ | R_g | -- | 4.1 | -- | Ω |
| Switching (Note 6) | | | | | | |
| Turn-On Delay Time | $V_{DD} = 380\text{V},$ $R_{GEN} = 25\Omega,$ $I_D = 3\text{A}, V_{GS} = 10\text{V},$ | $t_{d(on)}$ | -- | 13.8 | -- | ns |
| Turn-On Rise Time | | t_r | -- | 11.4 | -- | |
| Turn-Off Delay Time | | $t_{d(off)}$ | -- | 28 | -- | |
| Turn-Off Fall Time | | t_f | -- | 8.4 | -- | |
| Source-Drain Diode | | | | | | |
| Forward Voltage (Note 4) | $I_S = 3\text{A}, V_{GS} = 0\text{V}$ | V_{SD} | -- | -- | 1.4 | V |
| Reverse Recovery Time | $V_R = 200\text{V}, I_S = 1.5\text{A}$ $di_F/dt = 100\text{A}/\mu\text{s}$ | t_{rr} | -- | 126 | -- | ns |
| Reverse Recovery Charge | | Q_{rr} | -- | 0.637 | -- | μC |

Notes:

1. Current limited by package.
2. Pulse width limited by the maximum junction temperature.
3. $L = 50\text{mH}, I_{AS} = 1.0\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega,$ Starting $T_J = 25^\circ\text{C}$
4. Pulse test: $PW \leq 300\mu\text{s}, \text{duty cycle} \leq 2\%$.
5. For DESIGN AID ONLY, not subject to production testing.
6. Switching time is essentially independent of operating temperature.

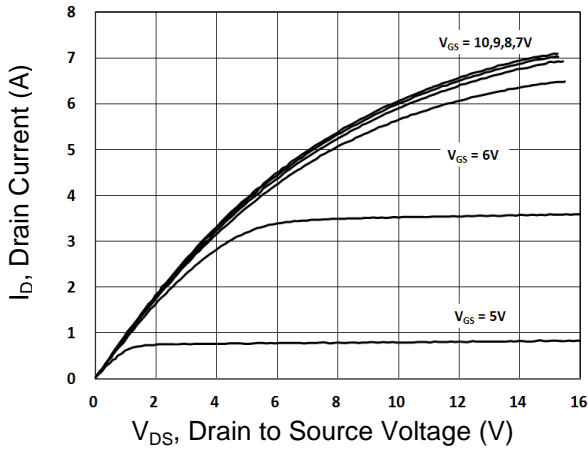
ORDERING INFORMATION

| PART NO. | PACKAGE | PACKING |
|------------------|---------------|---------------------|
| TSM60NB1R4CP ROG | TO-252 (DPAK) | 2,500pcs / 13" Reel |

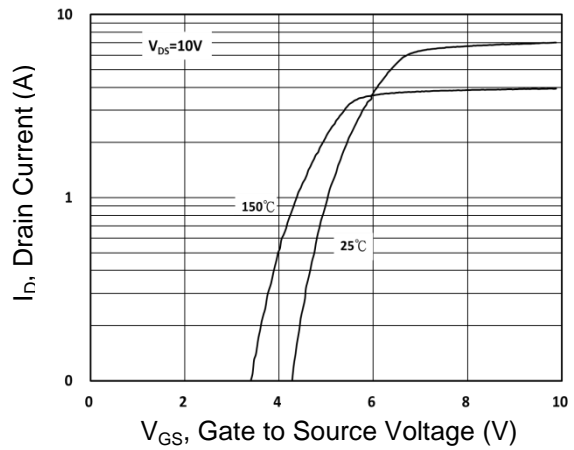
CHARACTERISTICS CURVES

($T_c = 25^\circ\text{C}$ unless otherwise noted)

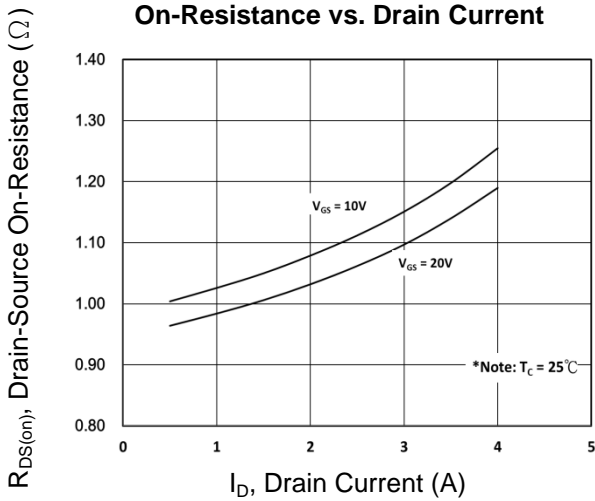
Output Characteristics



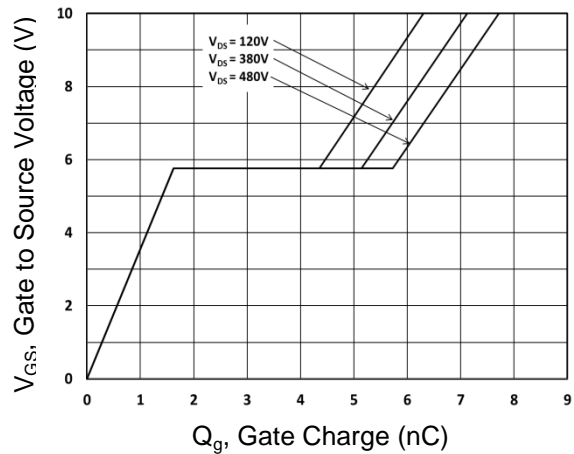
Transfer Characteristics



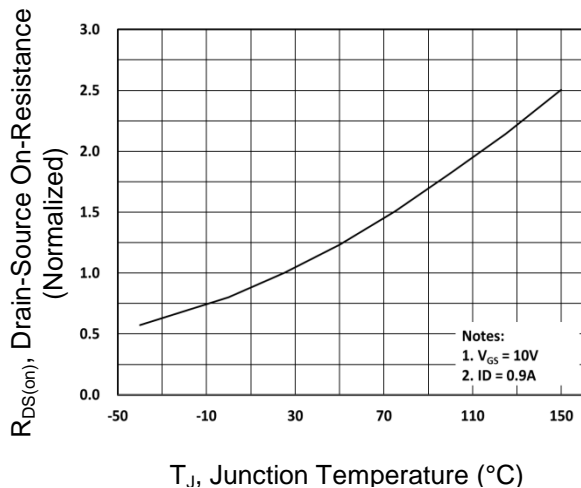
On-Resistance vs. Drain Current



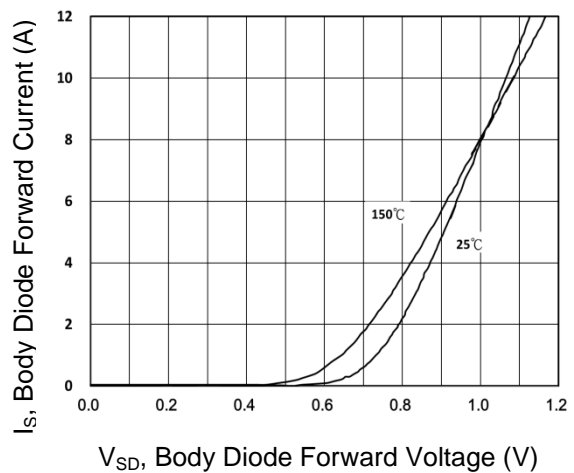
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



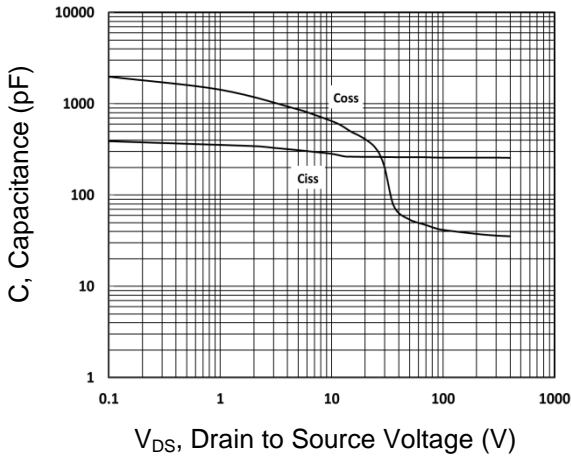
Source-Drain Diode Forward Current vs. Voltage



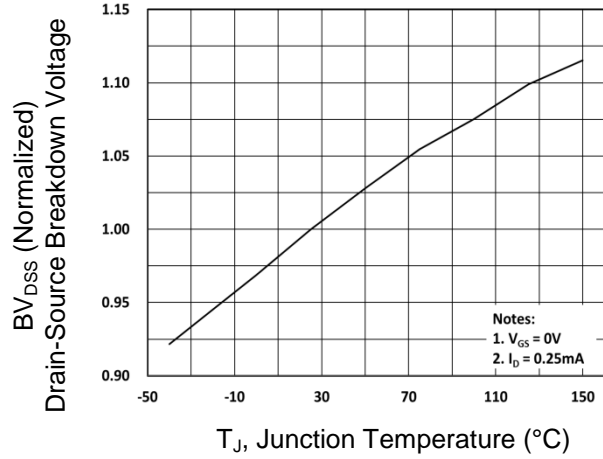
CHARACTERISTICS CURVES

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

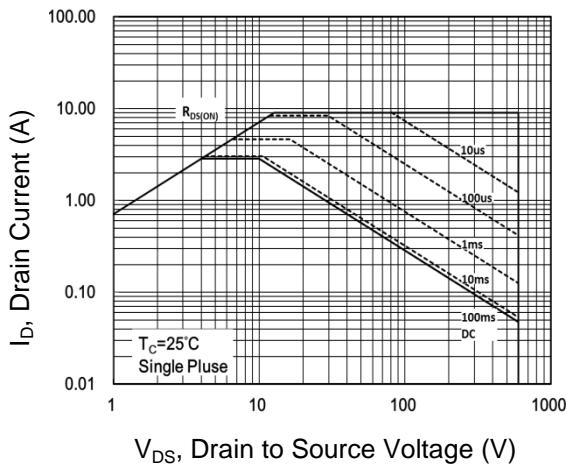
Capacitance vs. Drain-Source Voltage



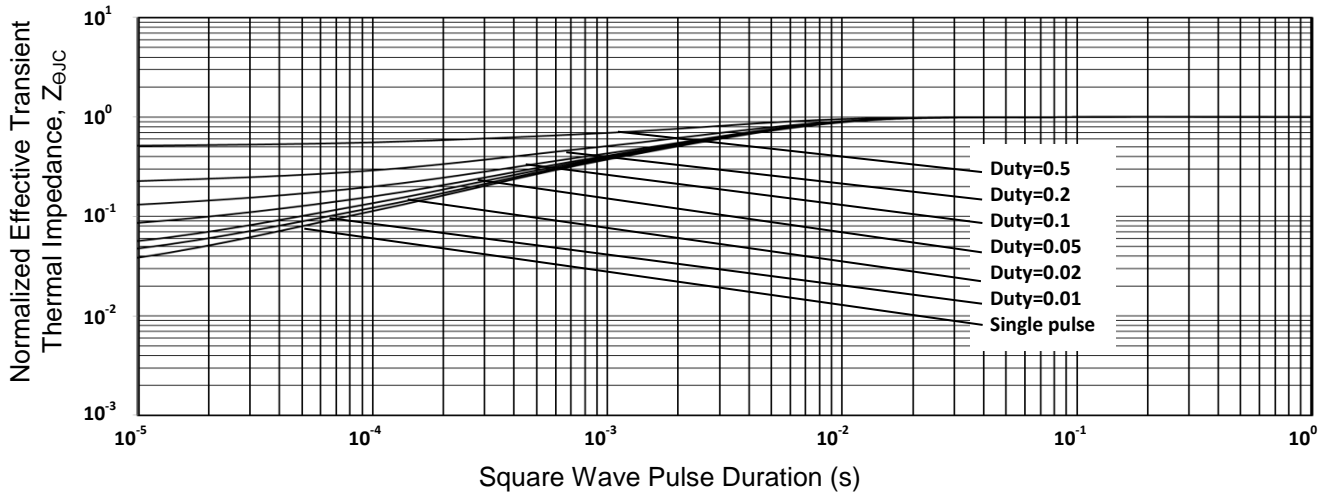
BV_{DSS} vs. Junction Temperature



Maximum Safe Operating Area

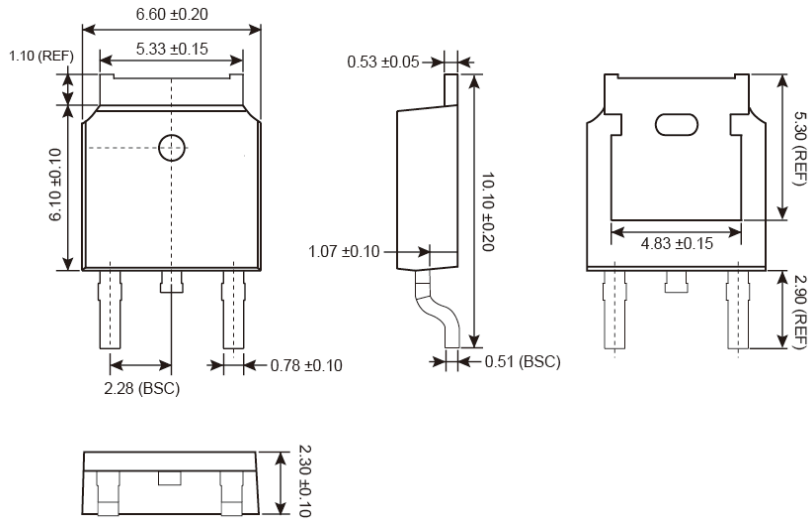


Normalized Thermal Transient Impedance, Junction-to-Case

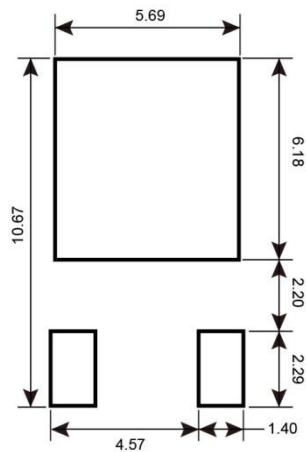


PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

TO-252 (DPAK)



SUGGESTED PAD LAYOUT (Unit: Millimeters)



MARKING DIAGRAM



- Y** = Year Code
- M** = Month Code for Halogen Free Product
- O** =Jan **P** =Feb **Q** =Mar **R** =Apr
- S** =May **T** =Jun **U** =Jul **V** =Aug
- W** =Sep **X** =Oct **Y** =Nov **Z** =Dec
- L** = Lot Code (1~9, A~Z)

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