


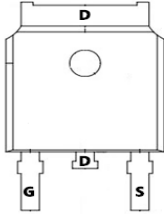
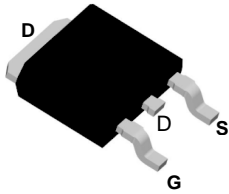
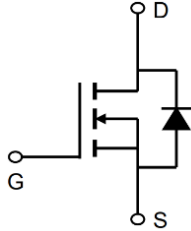


TM20N04D

N-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} = 40V I_D =20 A</p> <p>R_{DS(ON)}=28mΩ (Typ.) @ V_{GS}=10V</p> <p>100% UIS Tested 100% R_g Tested</p>  |
|---|--|

D:TO-252-3L

Marking: 20N04

Absolute Maximum Ratings (T_c=25°C unless otherwise noted)

| Symbol | Parameter | Rating | Units |
|---------------------------------------|--|------------|-------|
| V _{DS} | Drain-Source Voltage | 40 | V |
| V _{GS} | Gate-Source Voltage | ±20 | V |
| I _D @T _C =25°C | Continuous Drain Current, V _{GS} @ 10V ¹ | 20 | A |
| I _D @T _C =100°C | Continuous Drain Current, V _{GS} @ 10V ¹ | 10 | A |
| I _{DM} | Pulsed Drain Current ² | 46 | A |
| EAS | Single Pulse Avalanche Energy ³ | 13.1 | mJ |
| I _{AS} | Avalanche Current | 5 | A |
| P _D @T _C =25°C | Total Power Dissipation ⁴ | 4 | 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 _{θJA} | Thermal Resistance Junction-ambient (Steady State) ¹ | --- | 68 | °C/W |
| R _{θJC} | Thermal Resistance Junction-Case ¹ | --- | --- | °C/W |



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

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Units |
|---|---|--|------|------|-----------|------------|
| Off Characteristic | | | | | | |
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=250\mu A$ | 40 | - | - | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=40V, V_{GS}=0V,$ | - | - | 1.0 | μA |
| I_{GSS} | Gate to Body Leakage Current | $V_{DS}=0V, V_{GS}= \pm 20V$ | - | - | ± 100 | nA |
| On Characteristics | | | | | | |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}, I_D=250\mu A$ | 1.0 | 1.5 | 2.2 | V |
| $R_{DS(on)}$ | Static Drain-Source on-Resistance <small>note3</small> | $V_{GS}=10V, I_D=4A$ | - | 28 | 40 | m Ω |
| | | $V_{GS}=4.5V, I_D=3A$ | - | 40 | 60 | |
| Dynamic Characteristics | | | | | | |
| C_{iss} | Input Capacitance | $V_{DS}=20V, V_{GS}=0V,$ $f=1.0MHz$ | - | 435 | - | pF |
| C_{oss} | Output Capacitance | | - | 58 | - | pF |
| C_{rss} | Reverse Transfer Capacitance | | - | 35 | - | pF |
| Q_g | Total Gate Charge | $V_{DS}=20V, I_D=3A,$ $V_{GS}=10V$ | - | 11 | - | nC |
| Q_{gs} | Gate-Source Charge | | - | 2 | - | nC |
| Q_{gd} | Gate-Drain("Miller") Charge | | - | 2.5 | - | nC |
| Switching Characteristics | | | | | | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}=20V, I_D=4A,$ $R_L=1\Omega, R_{GEN}=3\Omega,$ $V_{GS}=10V$ | - | 10 | - | ns |
| t_r | Turn-on Rise Time | | - | 8 | - | ns |
| $t_{d(off)}$ | Turn-off Delay Time | | - | 29 | - | ns |
| t_f | Turn-off Fall Time | | - | 12 | - | ns |
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| I_S | Maximum Continuous Drain to Source Diode Forward Current | | - | - | 200 | A |
| I_{SM} | Maximum Pulsed Drain to Source Diode Forward Current | | - | - | 20 | A |
| V_{SD} | Drain to Source Diode Forward Voltage | $V_{GS}=0V, I_S=5A$ | - | - | 1.2 | V |
| t_{rr} | Body Diode Reverse Recovery Time | $T_J=25^{\circ}\text{C},$ $I_F=5A, di/dt=100A/\mu s$ | - | 20 | - | ns |
| Q_{rr} | Body Diode Reverse Recovery Charge | | - | 11 | - | nC |

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

2. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 0.5\%$

Typical Performance Characteristics

Figure 1: Output Characteristics

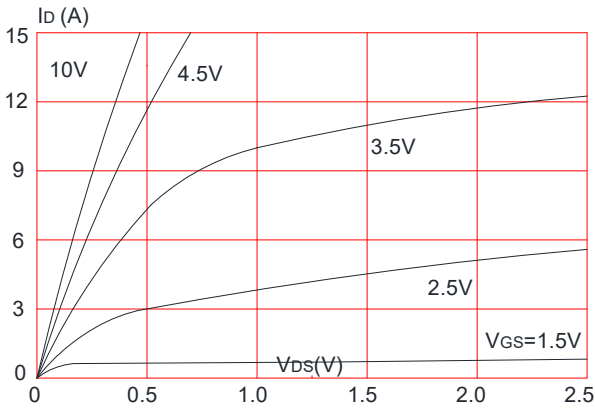


Figure 2: Typical Transfer Characteristics

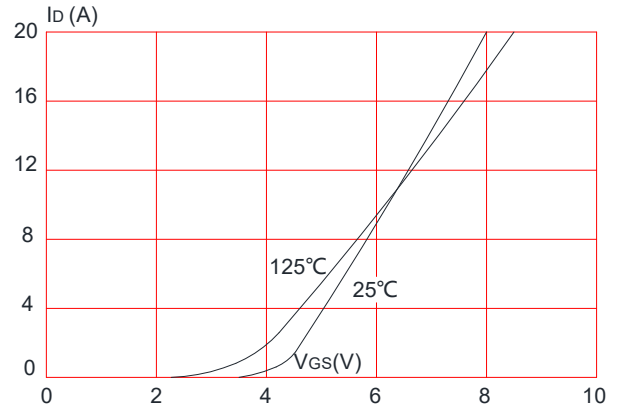


Figure 3: On-resistance vs. Drain Current

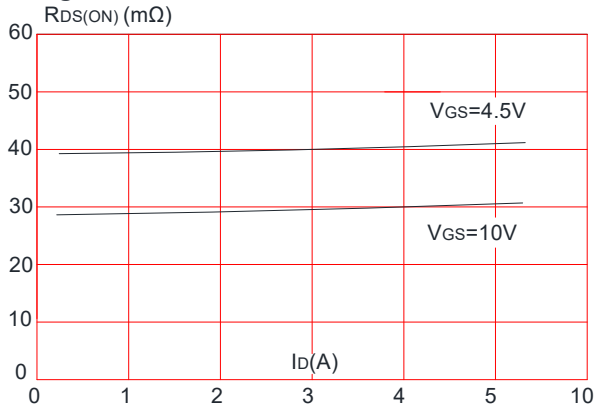


Figure 4: Body Diode Characteristics

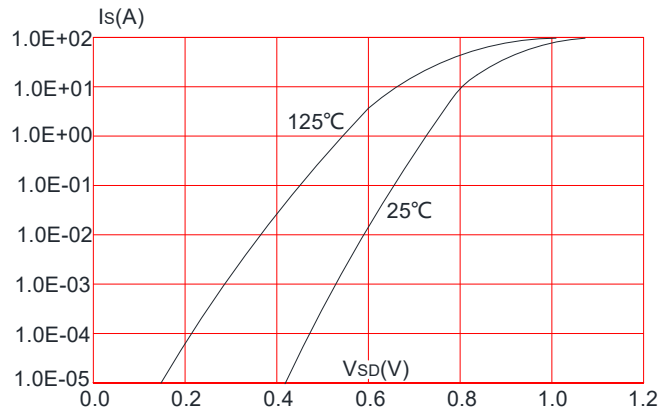


Figure 5: Gate Charge Characteristics

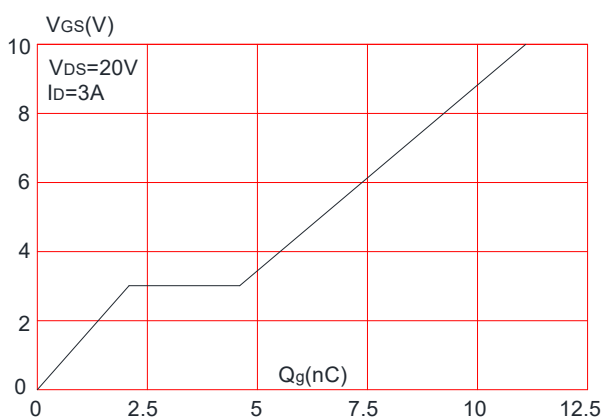
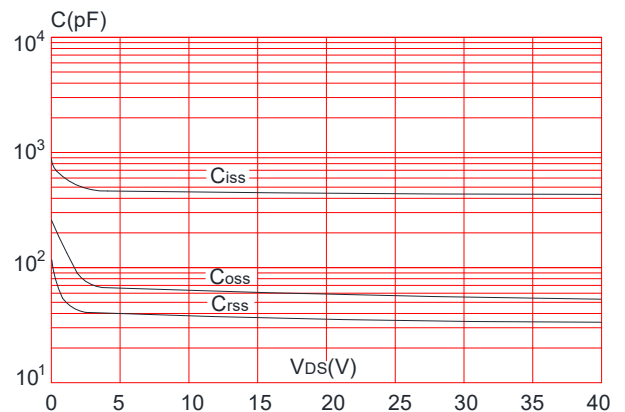


Figure 6: Capacitance Characteristics



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Figure 7: Normalized Breakdown Voltage vs. Junction Temperature

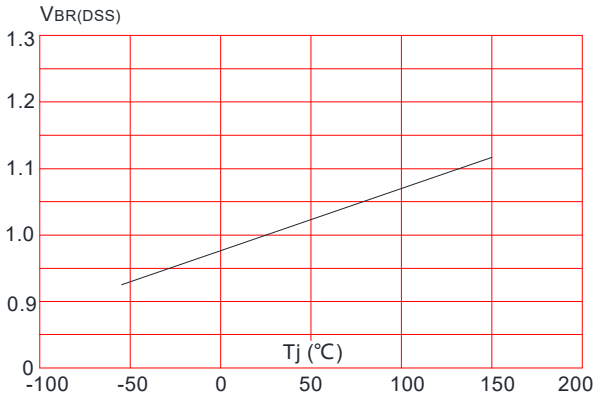


Figure 8: Normalized on Resistance vs. Junction Temperature

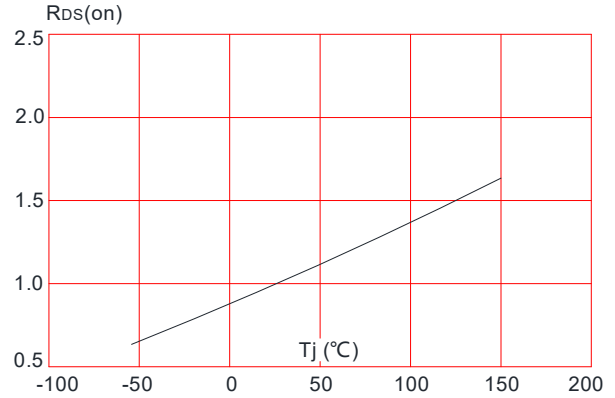


Figure 9: Maximum Safe Operating Area

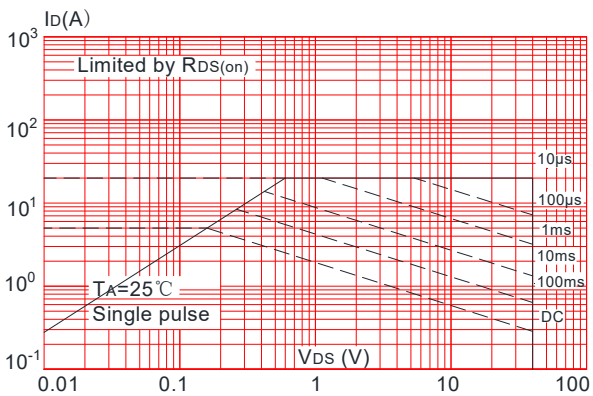


Figure 10: Maximum Continuous Drain Current vs. Ambient Temperature

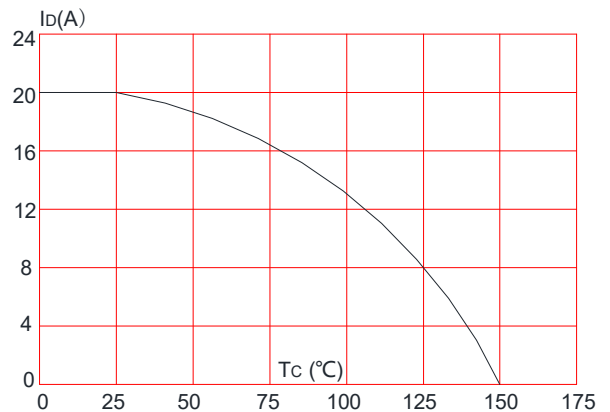
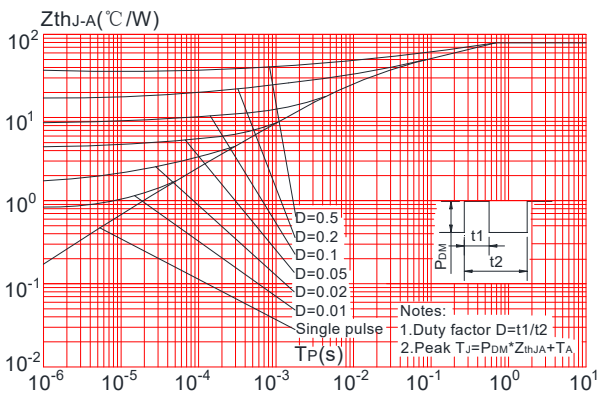
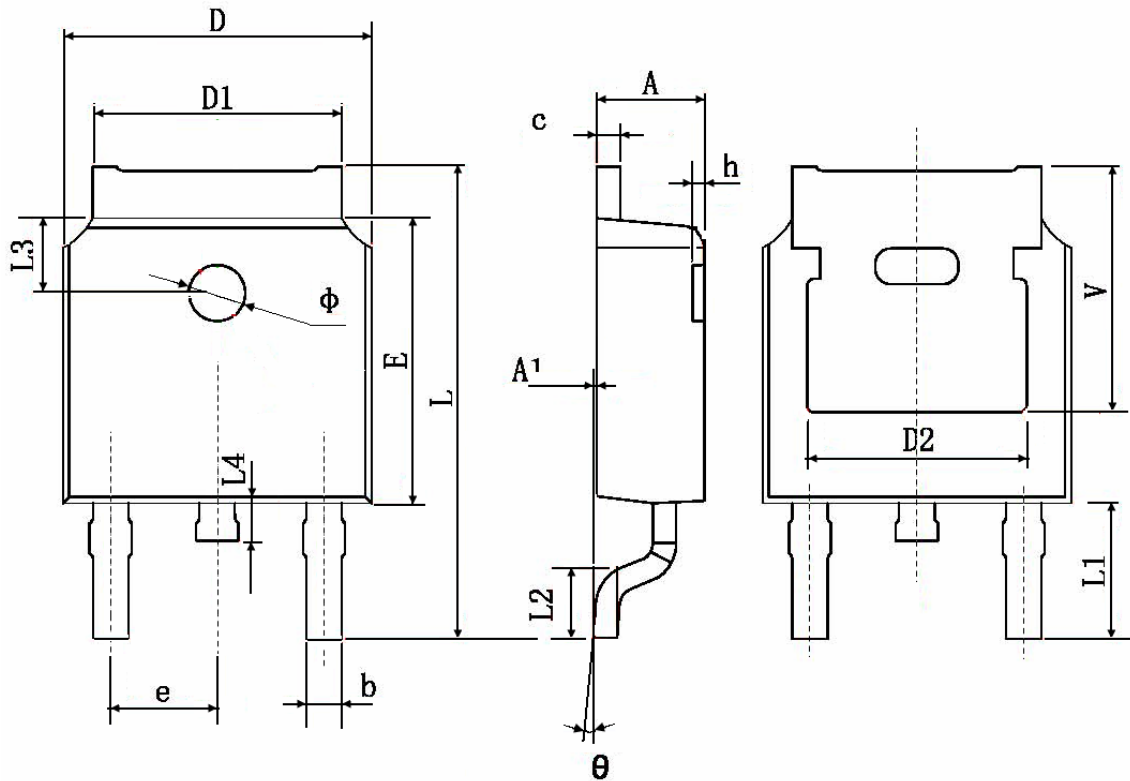


Figure.11: Maximum Effective Transient Thermal Impedance, Junction-to-Ambient



Package Information: TO-252-3L



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|--------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 2.200 | 2.400 | 0.087 | 0.094 |
| A1 | 0.000 | 0.127 | 0.000 | 0.005 |
| b | 0.660 | 0.860 | 0.026 | 0.034 |
| c | 0.460 | 0.580 | 0.018 | 0.023 |
| D | 6.500 | 6.700 | 0.256 | 0.264 |
| D1 | 5.100 | 5.460 | 0.201 | 0.215 |
| D2 | 4.830 TYP. | | 0.190 TYP. | |
| E | 6.000 | 6.200 | 0.236 | 0.244 |
| e | 2.186 | 2.386 | 0.086 | 0.094 |
| L | 9.800 | 10.400 | 0.386 | 0.409 |
| L1 | 2.900 TYP. | | 0.114 TYP. | |
| L2 | 1.400 | 1.700 | 0.055 | 0.067 |
| L3 | 1.600 TYP. | | 0.063 TYP. | |
| L4 | 0.600 | 1.000 | 0.024 | 0.039 |
| φ | 1.100 | 1.300 | 0.043 | 0.051 |
| θ | 0° | 8° | 0° | 8° |
| h | 0.000 | 0.300 | 0.000 | 0.012 |
| V | 5.350 TYP. | | 0.211 TYP. | |