

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)TYP}$ | $I_D$ |
|---------------|-----------------|-------|
| 20V           | 4.1mΩ@4.5V      | 80A   |
|               | 5.7mΩ@2.5V      |       |



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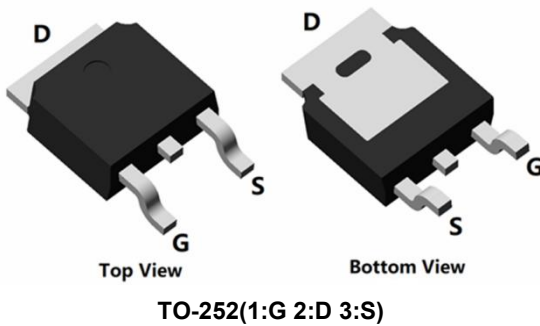
## Feature

- Fast Switching
- Low Gate Charge and  $R_{DS(on)}$
- 100% Single Pulse avalanche energy Test

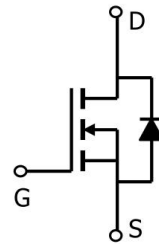
## Applications

- DC-DC Converter
- Ideal for high-frequency switching and synchronous rectification

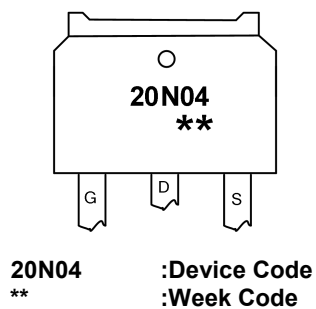
## Package



## Circuit diagram



## Marking



## Order Information

| Device    | Package | Unit/Tape |
|-----------|---------|-----------|
| SP20N04TH | TO-252  | 2500      |

**Absolute maximum ratings (Ta=25°C, unless otherwise noted)**

| Parameter                                            | Symbol          | Rating     | Units              |
|------------------------------------------------------|-----------------|------------|--------------------|
| Drain-Source Voltage                                 | $V_{DS}$        | 20         | V                  |
| Gate-Source Voltage                                  | $V_{GS}$        | $\pm 12$   | V                  |
| Continuous Drain Current ( $T_C=25^\circ\text{C}$ )  | $I_D$           | 80         | A                  |
| Continuous Drain Current ( $T_C=100^\circ\text{C}$ ) | $I_D$           | 53         | A                  |
| Pulsed Drain Current                                 | $I_{DM}$        | 320        | A                  |
| Single Pulse Avalanche Energy <sup>1</sup>           | $E_{AS}$        | 100        | mJ                 |
| Power Dissipation ( $T_C=25^\circ\text{C}$ )         | $P_D$           | 39         | W                  |
| Thermal Resistance Junction-to-Case                  | $R_{\theta JC}$ | 3.2        | $^\circ\text{C/W}$ |
| Storage Temperature Range                            | $T_{STG}$       | -55 to 150 | $^\circ\text{C}$   |
| Operating Junction Temperature Range                 | $T_J$           | -55 to 150 | $^\circ\text{C}$   |

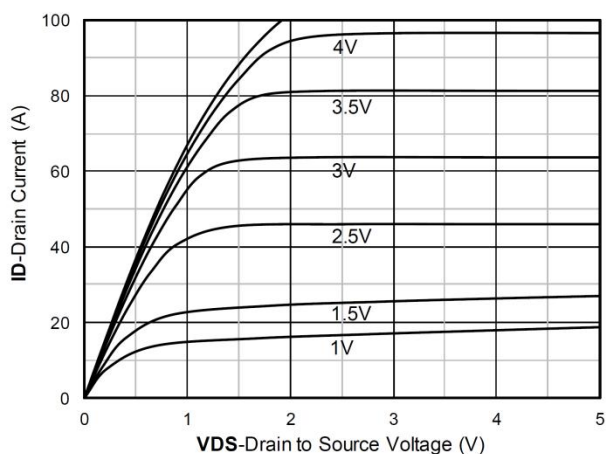
**Electrical characteristics (Ta=25°C, unless otherwise noted)**

| Parameter                             | Symbol            | Conditions                    | Min. | Typ. | Max. | Unit |
|---------------------------------------|-------------------|-------------------------------|------|------|------|------|
| Static Characteristics                |                   |                               |      |      |      |      |
| Drain-Source Breakdown Voltage        | BV <sub>DSS</sub> | VGS=0V , ID=250uA             | 20   | -    | -    | V    |
| Drain-Source Leakage Current          | IDSS              | VDS=16V , VGS=0V , TJ=25℃     | -    | -    | 1    | uA   |
| Gate-Source Leakage Current           | IGSS              | VGS=±12V , VDS=0V             | -    | -    | ±100 | nA   |
| Gate Threshold Voltage                | VGS(th)           | VGS=VDS , ID =250uA           | 0.4  | 0.7  | 1.0  | V    |
| Static Drain-Source On-Resistance     | RDS(ON)           | VGS=4.5V , ID=20A             | -    | 3.8  | 4.9  | mΩ   |
|                                       |                   | VGS=2.5V , ID=15A             | -    | 5.0  | 6.5  |      |
| Dynamic characteristics               |                   |                               |      |      |      |      |
| Input Capacitance                     | Ciss              | VDS=10V , VGS=0V , f=1MHz     | -    | 3180 | -    | pF   |
| Output Capacitance                    | Coss              |                               | -    | 398  | -    |      |
| Reverse Transfer Capacitance          | Crss              |                               | -    | 355  | -    |      |
| Total Gate Charge                     | Qg                | VDS=20V,VGS=4.5V,ID=1A        | -    | 2.3  | -    | nC   |
| Gate-Source Charge                    | Qgs               |                               | -    | 7    | -    |      |
| Gate-Drain Charge                     | Qgd               |                               | -    | 4.5  | -    |      |
| Switching Characteristics             |                   |                               |      |      |      |      |
| Turn-On Delay Time                    | Td(on)            | VGS=4.5V,VDD=10V,ID=2A, RG=3Ω | -    | 13   | -    | nS   |
| Rise Time                             | Tr                |                               | -    | 31   | -    |      |
| Turn-Off Delay Time                   | Td(off)           |                               | -    | 73   | -    |      |
| Fall Time                             | Tf                |                               | -    | 92   | -    |      |
| Diode Characteristics                 |                   |                               |      |      |      |      |
| Diode Forward Voltage                 | VSD               | VGS=0V , IS=1A , TJ=25℃       | -    | -    | 1.2  | V    |
| Maximum Body-Diode Continuous Current | IS                |                               | -    | -    | 80   | A    |
| Reverse Recovery Time                 | Trr               | IS=20A, di/dt=100A/us, TJ=25℃ | -    | 13   | -    | nS   |
| Reverse Recovery Charge               | Qrr               |                               | -    | 4    | -    | nC   |

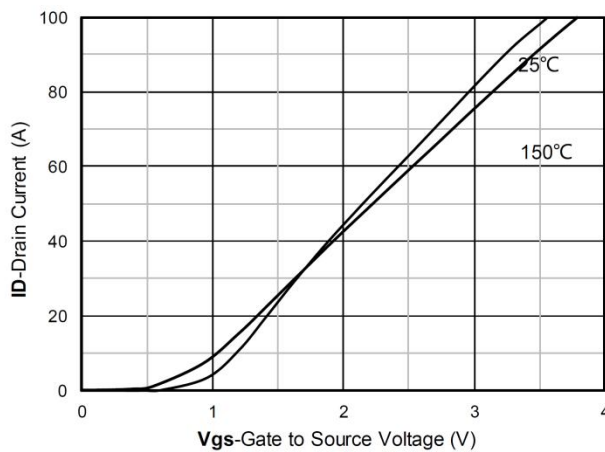
**Note :**

- The EAS test condition is  $V_{DD}=10V, V_{GS}=10V, L=0.5mH, R_G=25\Omega$

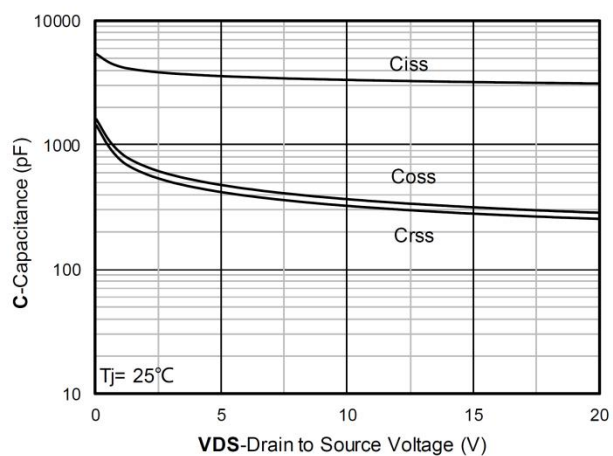
## Typical Characteristics



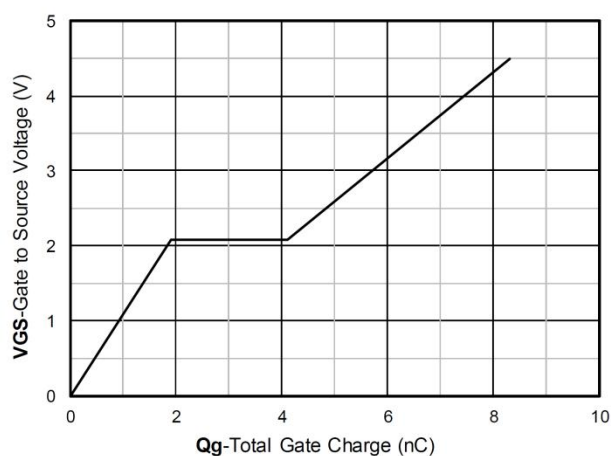
Output Characteristics



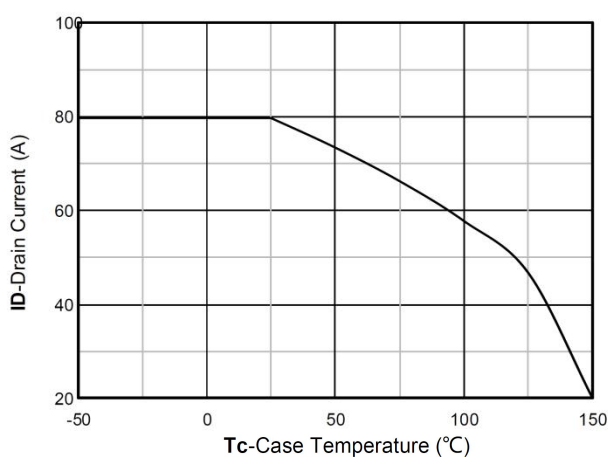
Transfer Characteristics



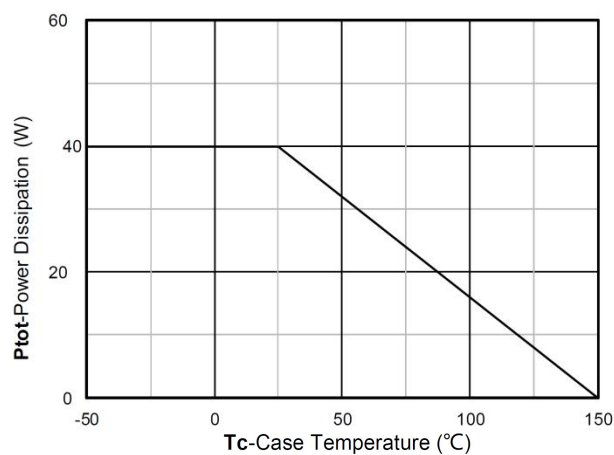
Capacitance Characteristics



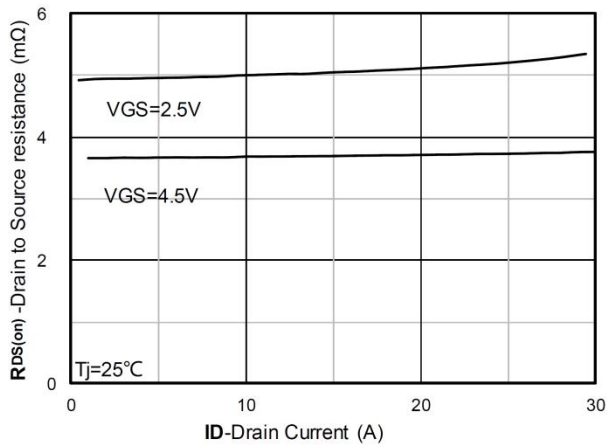
Gate Charge



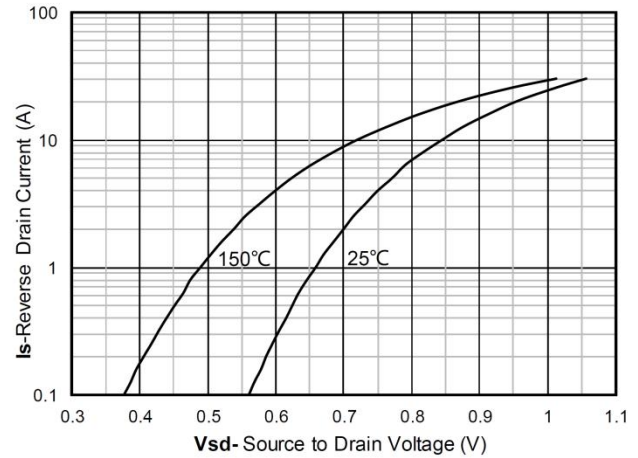
Current dissipation



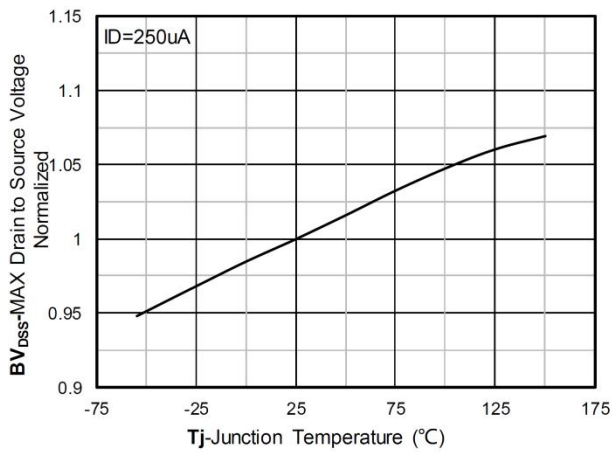
Power dissipation



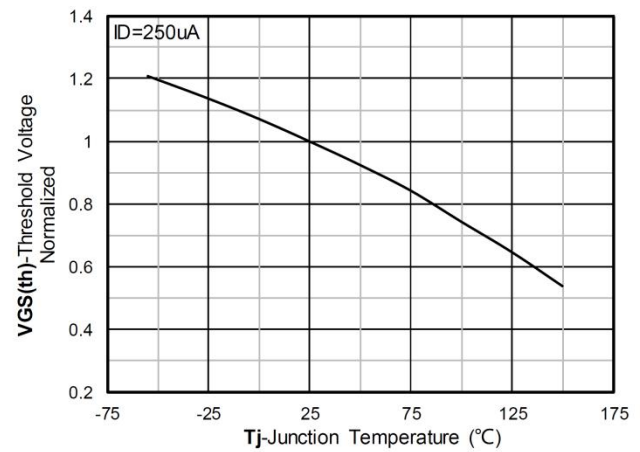
RDS(on) VS Drain Current



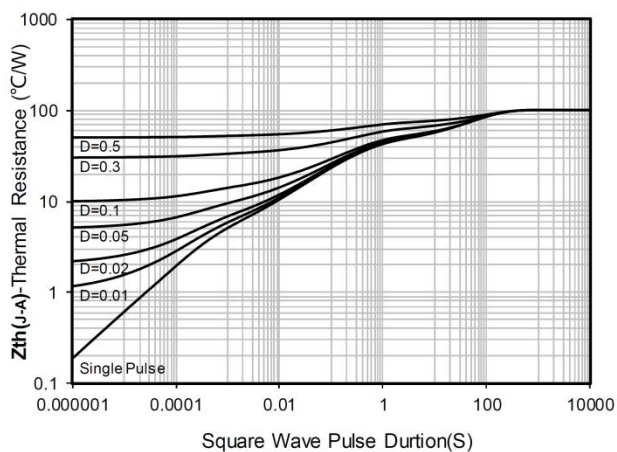
Forward characteristics of reverse diode



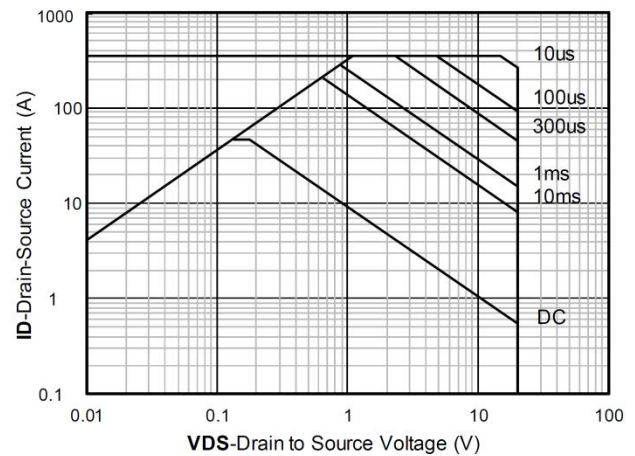
Normalized breakdown voltage



Normalized Threshold voltage



Maximum Transient Thermal Impedance



Safe Operation Area

## TO-252 Package Information



| 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 REF.                |        | 0.190 REF.           |       |
| 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 REF.                |        | 0.114 REF.           |       |
| L2     | 1.400                     | 1.700  | 0.055                | 0.067 |
| L3     | 1.600 REF.                |        | 0.063 REF.           |       |
| 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 REF.                |        | 0.211 REF.           |       |

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