

SPD09N05-VB Datasheet

N-Channel 60 V (D-S) MOSFET

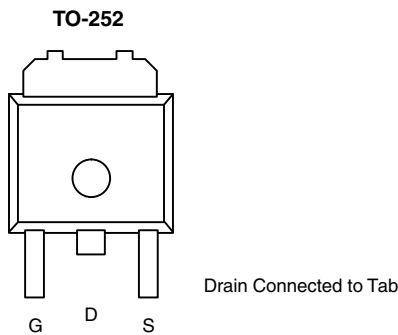
| PRODUCT SUMMARY | | | |
|---------------------|----------------------------------|--------------------|-----------------------|
| V _{DS} (V) | R _{DS(on)} (Ω) Max. | I _D (A) | Q _g (Typ.) |
| 60 | 0.073 at V _{GS} = 10 V | 18 | 19.8 |
| | 0.085 at V _{GS} = 4.5 V | 15 | |

FEATURES

- TrenchFET[®] Power MOSFET
- 100 % R_g and UIS Tested
- Material categorization:
For definitions of compliance please see

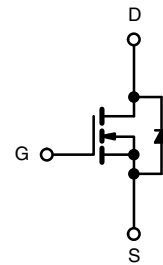


RoHS
COMPLIANT
HALOGEN
FREE



APPLICATIONS

- DC/DC Converters
- DC/AC Inverters
- Motor Drives



N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted) | | | | | |
|---|-----------------------------------|-------------------------------------|-------------------|----|--|
| Parameter | Symbol | Limit | Unit | | |
| Drain-Source Voltage | V _{DS} | 60 | V | | |
| Gate-Source Voltage | V _{GS} | ± 20 | | | |
| Continuous Drain Current | I _D | T _C = 25 °C | 18 | A | |
| | | T _C = 70 °C | 14 | | |
| Pulsed Drain Current (t = 300 μs) | I _{DM} | 25 | | | |
| Avalanche Current | I _{AS} | 15 | | | |
| Single Avalanche Energy ^a | E _{AS} | L = 0.1 mH | 11.25 | mJ | |
| Maximum Power Dissipation ^a | P _D | T _C = 25 °C | 41.7 ^b | W | |
| | | T _A = 25 °C ^c | 2.1 | | |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | - 55 to 150 | °C | | |

| THERMAL RESISTANCE RATINGS | | | | |
|--|-------------------|-------|------|--|
| Parameter | Symbol | Limit | Unit | |
| Junction-to-Ambient (PCB Mount) ^c | R _{thJA} | 60 | °C/W | |
| Junction-to-Case (Drain) | R _{thJC} | 3 | | |

Notes:

- Duty cycle ≤ 1 %.
- See SOA curve for voltage derating.
- When mounted on 1" square PCB (FR-4 material).
- Base on T_C = 25 °C.

| SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted) | | | | | | |
|---|---------------|--|------|-------|-----------|---------------|
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 60 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 1.0 | | 3.0 | |
| Gate-Body Leakage | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | | | ± 250 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$ | | | 1 | μA |
| | | $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | | | 50 | |
| | | $V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$ | | | 250 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} \geq 10\text{ V}, V_{GS} = 10\text{ V}$ | 20 | | | A |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 6.6\text{ A}$ | | 0.073 | | Ω |
| | | $V_{GS} = 4.5\text{ V}, I_D = 6\text{ A}$ | | 0.085 | | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = 15\text{ V}, I_D = 6.6\text{ A}$ | | 25 | | S |
| Dynamic^b | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | | 660 | | μF |
| Output Capacitance | C_{oss} | | | 85 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 40 | | |
| Total Gate Charge ^c | Q_g | $V_{DS} = 30\text{ V}, V_{GS} = 10\text{ V}, I_D = 6.6\text{ A}$ | | 19.8 | 30 | nC |
| Gate-Source Charge ^c | Q_{gs} | | | 3.6 | | |
| Gate-Drain Charge ^c | Q_{gd} | | | 4.1 | | |
| Gate Resistance | R_g | $f = 1\text{ MHz}$ | 0.4 | 2 | 4 | Ω |
| Turn-On Delay Time ^c | $t_{d(on)}$ | $V_{DD} = 30\text{ V}, R_L = 9.6\text{ }\Omega$ $I_D \cong 5.2\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$ | | 8 | 16 | ns |
| Rise Time ^c | t_r | | | 11 | 20 | |
| Turn-Off Delay Time ^c | $t_{d(off)}$ | | | 18 | 27 | |
| Fall Time ^c | t_f | | | 5 | 10 | |
| Turn-On Delay Time ^c | $t_{d(on)}$ | $V_{DD} = 30\text{ V}, R_L = 9.6\text{ }\Omega$ $I_D \cong 5.2\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$ | | 38 | 57 | |
| Rise Time ^c | t_r | | | 58 | 87 | |
| Turn-Off Delay Time ^c | $t_{d(off)}$ | | | 18 | 27 | |
| Fall Time ^c | t_f | | | 8 | 16 | |
| Drain-Source Body Diode Ratings and Characteristics^b $T_C = 25\text{ }^\circ\text{C}$ | | | | | | |
| Continuous Current | I_S | | | | 18 | A |
| Pulsed Current | I_{SM} | | | | 25 | |
| Forward Voltage ^a | V_{SD} | $I_F = 5.2\text{ A}, V_{GS} = 0\text{ V}$ | | 0.8 | 1.5 | V |
| Reverse Recovery Time | t_{rr} | $I_F = 5.2\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$ | | 34 | 51 | ns |
| Peak Reverse Recovery Current | $I_{RM(REC)}$ | | | 3 | 5 | A |
| Reverse Recovery Charge | Q_{rr} | | | | 50 | 75 |

Notes:

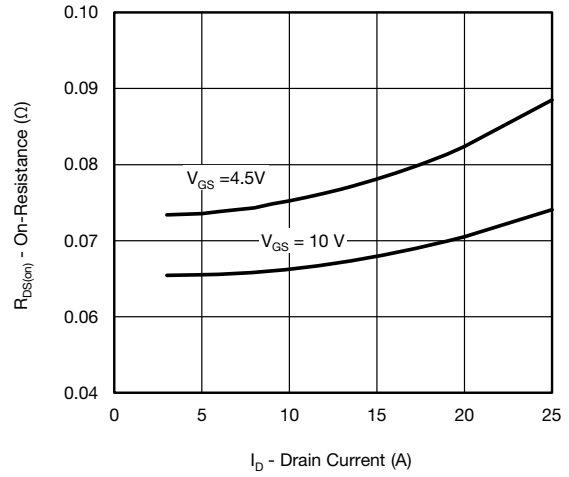
- Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

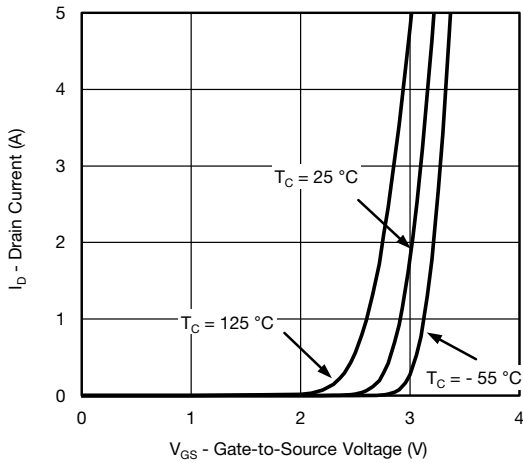
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



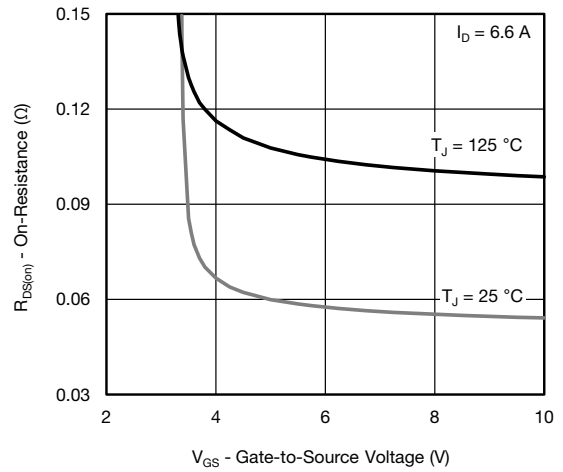
Output Characteristics



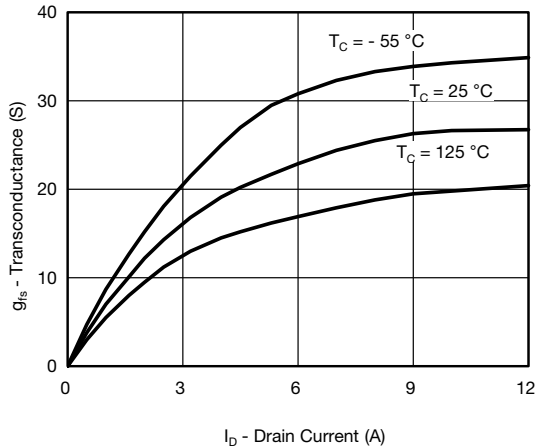
On-Resistance vs. Drain Current



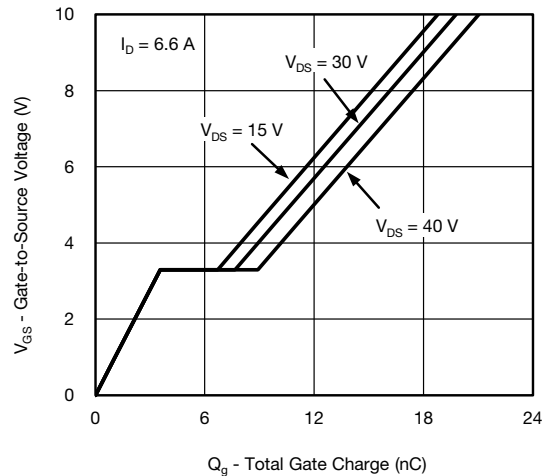
Transfer Characteristics



On-Resistance vs. Gate-to-Source Voltage

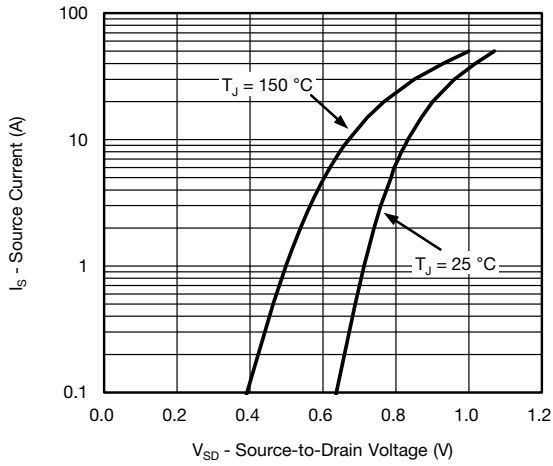


Transconductance



Gate Charge

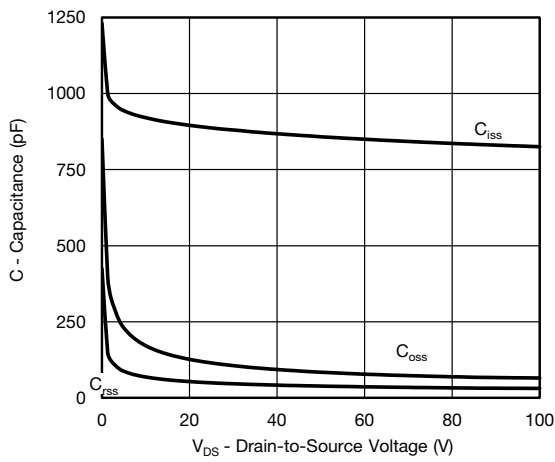
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Source-Drain Diode Forward Voltage



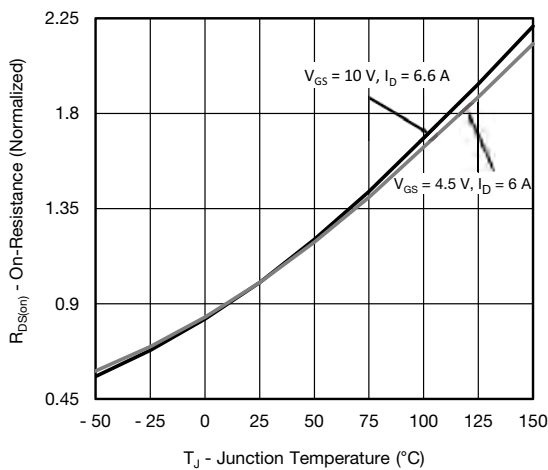
Threshold Voltage



Capacitance



Drain Source Breakdown vs. Junction Temperature



On-Resistance vs. Junction Temperature



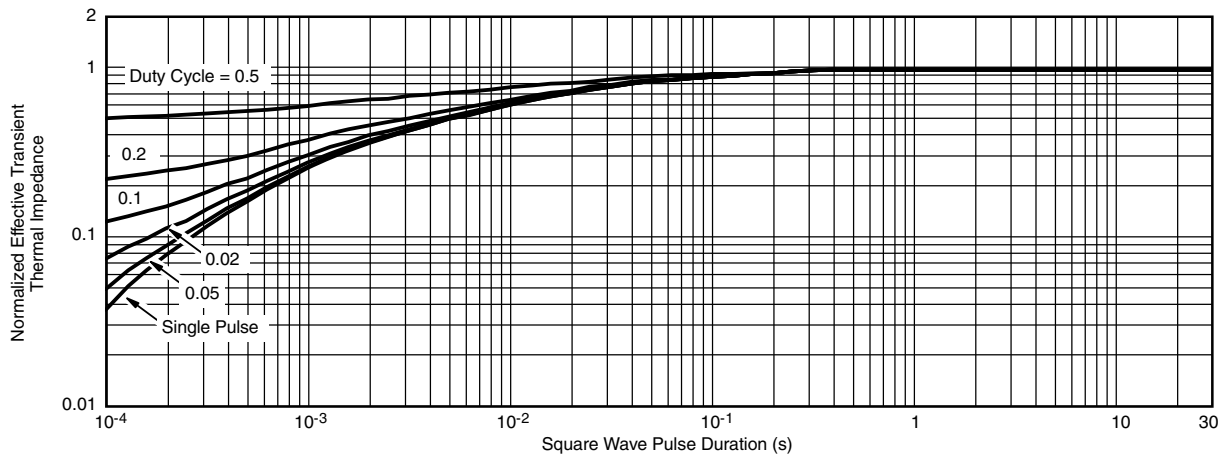
Current Derating

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Single Pulse Avalanche Current Capability vs. Time

Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

TO-252AA Case Outline

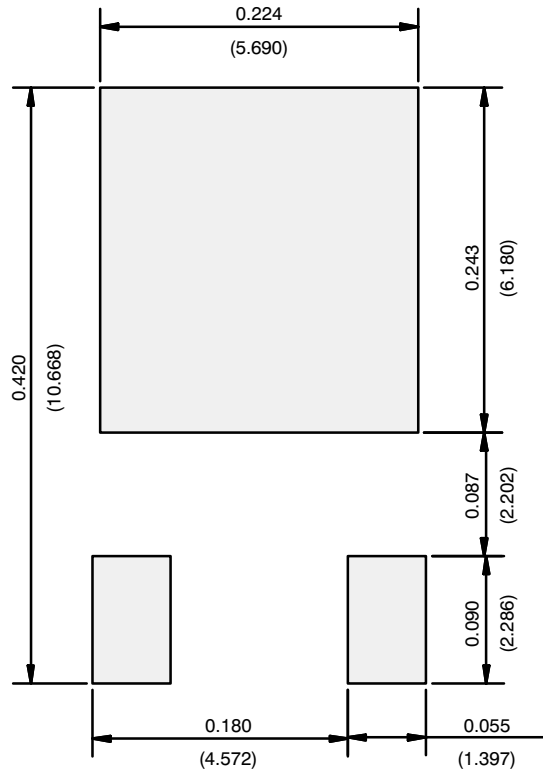


| DIM. | MILLIMETERS | | INCHES | |
|--|-------------|-------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 2.18 | 2.38 | 0.086 | 0.094 |
| A1 | - | 0.127 | - | 0.005 |
| b | 0.64 | 0.88 | 0.025 | 0.035 |
| b2 | 0.76 | 1.14 | 0.030 | 0.045 |
| b3 | 4.95 | 5.46 | 0.195 | 0.215 |
| C | 0.46 | 0.61 | 0.018 | 0.024 |
| C2 | 0.46 | 0.89 | 0.018 | 0.035 |
| D | 5.97 | 6.22 | 0.235 | 0.245 |
| D1 | 4.10 | - | 0.161 | - |
| E | 6.35 | 6.73 | 0.250 | 0.265 |
| E1 | 4.32 | - | 0.170 | - |
| H | 9.40 | 10.41 | 0.370 | 0.410 |
| e | 2.28 BSC | | 0.090 BSC | |
| e1 | 4.56 BSC | | 0.180 BSC | |
| L | 1.40 | 1.78 | 0.055 | 0.070 |
| L3 | 0.89 | 1.27 | 0.035 | 0.050 |
| L4 | - | 1.02 | - | 0.040 |
| L5 | 1.01 | 1.52 | 0.040 | 0.060 |
| ECN: T16-0236-Rev. P, 16-May-16 DWG: 5347 | | | | |

Notes

- Dimension L3 is for reference only.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads
Dimensions in Inches/(mm)

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