

D Series Power MOSFET



RoHS
COMPLIANT
HALOGEN
FREE
Available

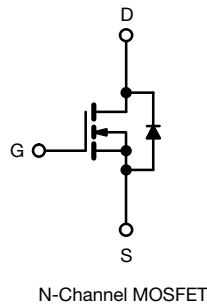
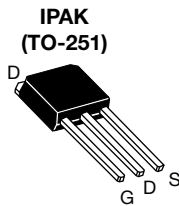
| PRODUCT SUMMARY | |
|---|-----------------------|
| V_{DS} (V) at T_J max. | 550 |
| $R_{DS(on)}$ max. (Ω) at 25 °C | $V_{GS} = 10$ V 1.5 |
| Q_g max. (nC) | 20 |
| Q_{gs} (nC) | 3 |
| Q_{gd} (nC) | 5 |
| Configuration | Single |

FEATURES

- Optimal design
 - Low area specific on-resistance
 - Low input capacitance (C_{iss})
 - Reduced capacitive switching losses
 - High body diode ruggedness
 - Avalanche energy rated (UIS)
- Optimal efficiency and operation
 - Low cost
 - Simple gate drive circuitry
 - Low figure-of-merit (FOM): $R_{on} \times Q_g$
 - Fast switching
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- Consumer electronics
 - Displays (LCD or plasma TV)
- Server and telecom power supplies
 - SMPS
- Industrial
 - Welding
 - Induction heating
 - Motor drives
- Battery chargers




| ORDERING INFORMATION | |
|---------------------------------|---------------|
| Package | IPAK (TO-251) |
| Lead (Pb)-free | SiHU5N50D-E3 |
| Lead (Pb)-free and Halogen-free | SiHU5N50D-GE3 |

| ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted) | | | | |
|---|------------------|----------------|------|------|
| PARAMETER | SYMBOL | LIMIT | UNIT | |
| Drain-Source Voltage | V_{DS} | 500 | V | |
| Gate-Source Voltage | V_{GS} | ± 30 | | |
| Gate-Source Voltage AC ($f > 1$ Hz) | | 30 | | |
| Continuous Drain Current ($T_J = 150$ °C) | V_{GS} at 10 V | $T_C = 25$ °C | 5.3 | A |
| | | $T_C = 100$ °C | 3.4 | |
| Pulsed Drain Current ^a | I_{DM} | 10 | | |
| Linear Derating Factor | | 0.83 | W/°C | |
| Single Pulse Avalanche Energy ^b | E_{AS} | 28.8 | mJ | |
| Maximum Power Dissipation | P_D | 104 | W | |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | °C | |
| Drain-Source Voltage Slope | dV/dt | $T_J = 125$ °C | 24 | V/ns |
| Reverse Diode dV/dt ^d | | 0.28 | | |
| Soldering Recommendations (Peak temperature) ^c | for 10 s | 300 | °C | |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 50$ V, starting $T_J = 25$ °C, $L = 2.3$ mH, $R_g = 25$ Ω , $I_{AS} = 5$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$, starting $T_J = 25$ °C.

| THERMAL RESISTANCE RATINGS | | | | |
|----------------------------------|------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R_{thJA} | - | 62 | °C/W |
| Maximum Junction-to-Case (Drain) | R_{thJC} | - | 1.2 | |

| 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} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 500 | - | - | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | Reference to $25\text{ }^\circ\text{C}$, $I_D = 250\text{ }\mu\text{A}$ | - | 0.58 | - | V/°C |
| Gate-Source Threshold Voltage (N) | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 3 | - | 5 | V |
| Gate-Source Leakage | I_{GSS} | $V_{GS} = \pm 30\text{ V}$ | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$ | - | - | 1 | μA |
| | | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$ | - | - | 10 | |
| Drain-Source On-State Resistance | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}$ | - | 1.2 | 1.5 | Ω |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = 20\text{ V}, I_D = 2.5\text{ A}$ | - | 1.8 | - | S |
| Dynamic | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}, V_{DS} = 100\text{ V}, f = 1\text{ MHz}$ | - | 325 | - | pF |
| Output Capacitance | C_{oss} | | - | 34 | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | 6 | - | |
| Effective Output Capacitance, Energy Related ^b | $C_{o(er)}$ | $V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$ | - | 31 | - | |
| Effective Output Capacitance, Time Related ^c | $C_{o(tr)}$ | | - | 41 | - | |
| Total Gate Charge | Q_g | $V_{GS} = 10\text{ V}, I_D = 2.5\text{ A}, V_{DS} = 400\text{ V}$ | - | 10 | 20 | nC |
| Gate-Source Charge | Q_{gs} | | - | 3 | - | |
| Gate-Drain Charge | Q_{gd} | | - | 5 | - | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 400\text{ V}, I_D = 2.5\text{ A}, R_g = 9.1\text{ }\Omega, V_{GS} = 10\text{ V}$ | - | 12 | 24 | ns |
| Rise Time | t_r | | - | 11 | 22 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 14 | 28 | |
| Fall Time | t_f | | - | 11 | 22 | |
| Gate Input Resistance | R_g | $f = 1\text{ MHz}, \text{open drain}$ | - | 1.7 | - | Ω |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I_S | MOSFET symbol showing the integral reverse P - N junction diode  | - | - | 5 | A |
| Pulsed Diode Forward Current | I_{SM} | | - | - | 20 | |
| Diode Forward Voltage | V_{SD} | $T_J = 25\text{ }^\circ\text{C}, I_S = 4\text{ A}, V_{GS} = 0\text{ V}$ | - | - | 1.2 | V |
| Reverse Recovery Time | t_{rr} | $T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 2.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_R = 20\text{ V}$ | - | 320 | - | ns |
| Reverse Recovery Charge | Q_{rr} | | - | 1.2 | - | μC |
| Reverse Recovery Current | I_{RRM} | | - | 8 | - | A |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $C_{oss(er)}$ is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .
- $C_{oss(tr)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 % to 80 % V_{DSS} .

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

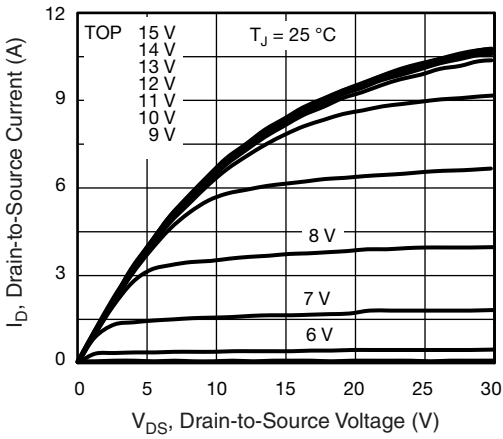


Fig. 1 - Typical Output Characteristics

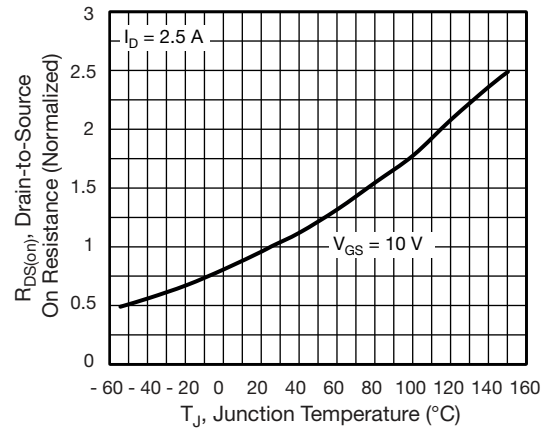


Fig. 4 - Normalized On-Resistance vs. Temperature

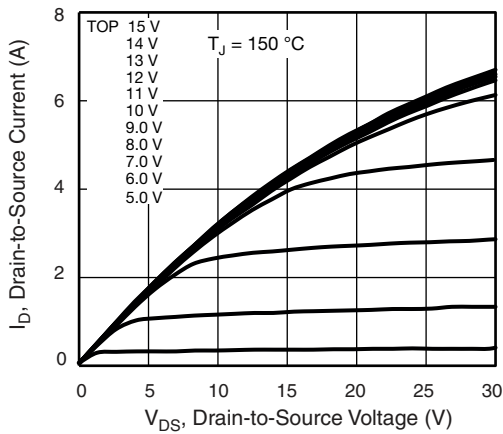


Fig. 2 - Typical Output Characteristics



Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

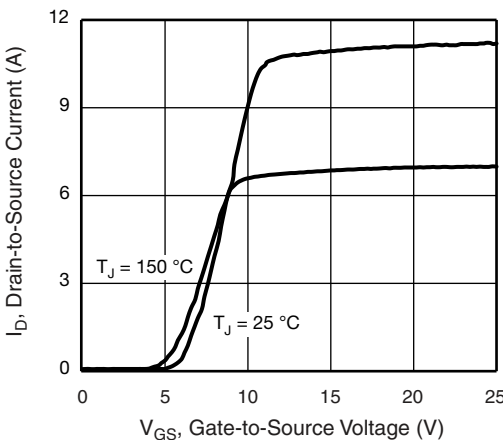


Fig. 3 - Typical Transfer Characteristics

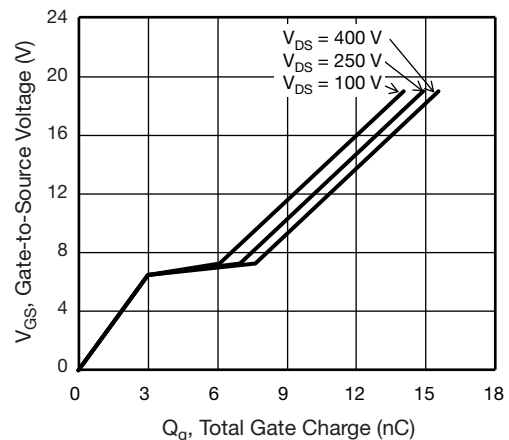


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage



Fig. 7 - Typical Source-Drain Diode Forward Voltage

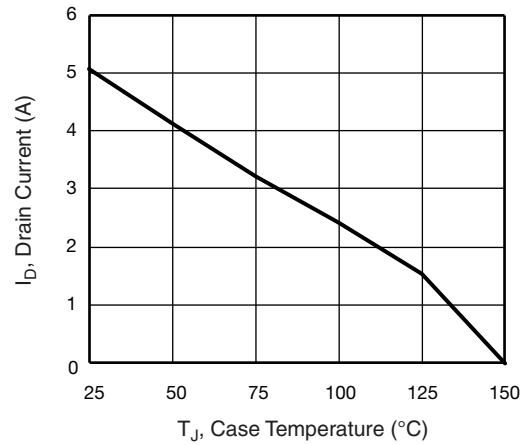


Fig. 9 - Maximum Drain Current vs. Case Temperature



Fig. 8 - Maximum Safe Operating Area

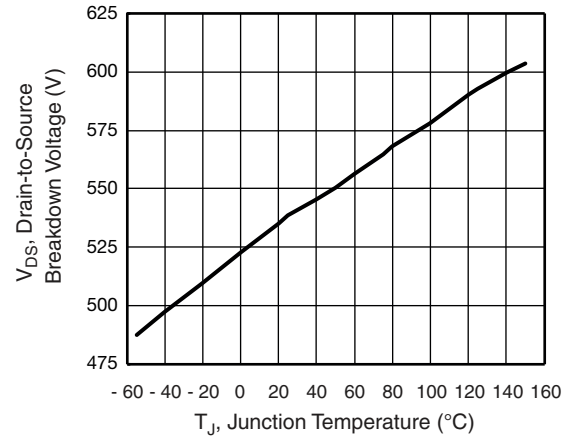


Fig. 10 - Typical Drain-to-Source Voltage vs. Temperature

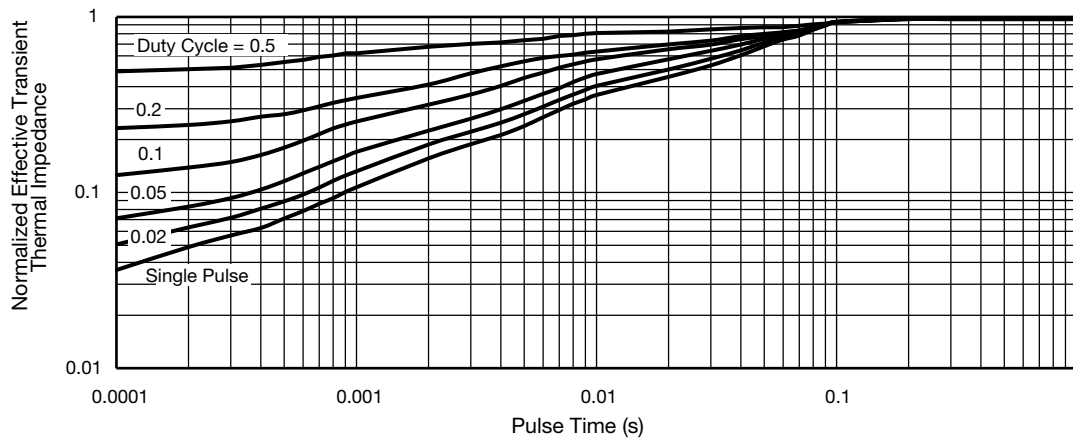


Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case



Fig. 12 - Switching Time Test Circuit



Fig. 16 - Basic Gate Charge Waveform



Fig. 13 - Switching Time Waveforms

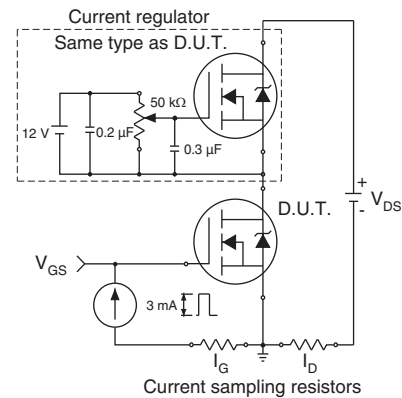


Fig. 17 - Gate Charge Test Circuit

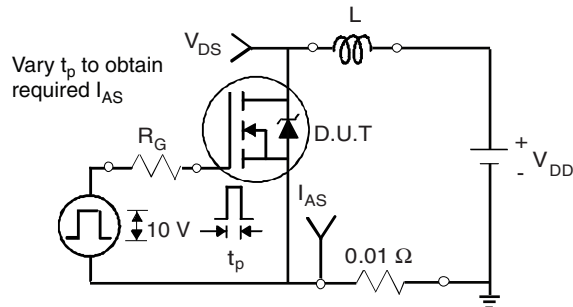


Fig. 14 - Unclamped Inductive Test Circuit

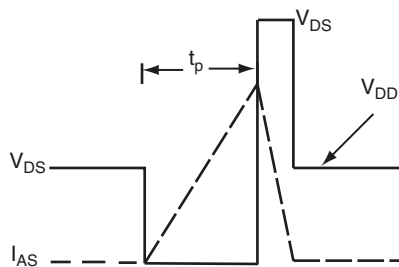
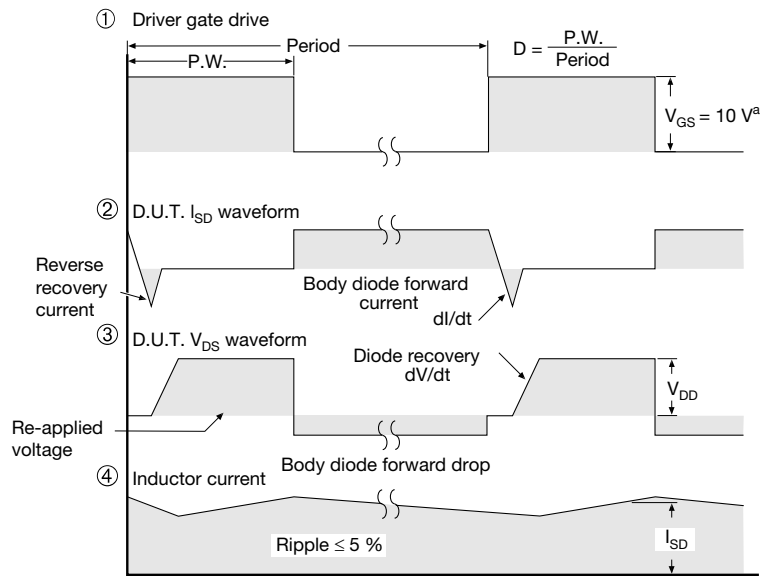
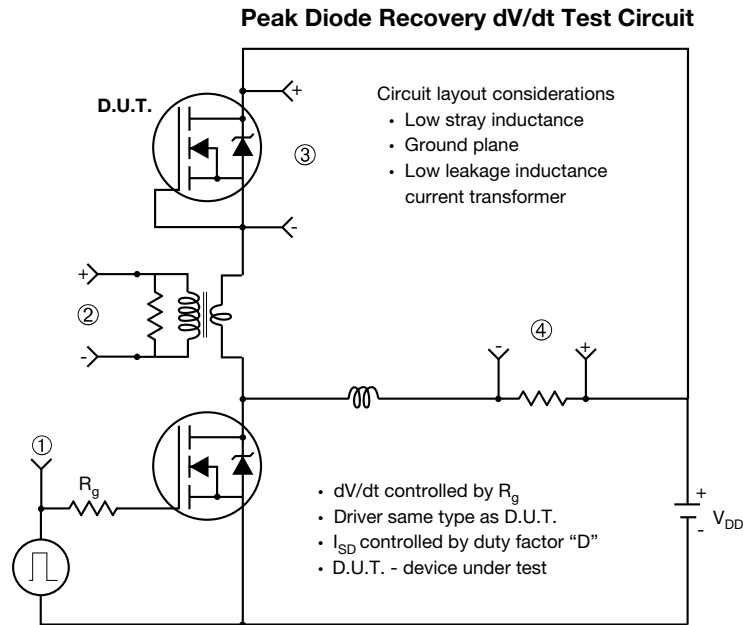


Fig. 15 - Unclamped Inductive Waveforms



Note

a. $V_{GS} = 5 V$ for logic level devices

Fig. 18 - For N-Channel

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TO-251AA (HIGH VOLTAGE)



| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|------|--------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 2.18 | 2.39 | 0.086 | 0.094 |
| A1 | 0.89 | 1.14 | 0.035 | 0.045 |
| b | 0.64 | 0.89 | 0.025 | 0.035 |
| b1 | 0.65 | 0.79 | 0.026 | 0.031 |
| b2 | 0.76 | 1.14 | 0.030 | 0.045 |
| b3 | 0.76 | 1.04 | 0.030 | 0.041 |
| b4 | 4.95 | 5.46 | 0.195 | 0.215 |
| c | 0.46 | 0.61 | 0.018 | 0.024 |
| c1 | 0.41 | 0.56 | 0.016 | 0.022 |
| c2 | 0.46 | 0.86 | 0.018 | 0.034 |
| D | 5.97 | 6.22 | 0.235 | 0.245 |

| DIM. | MILLIMETERS | | INCHES | |
|--------|-------------|------|----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| D1 | 5.21 | - | 0.205 | - |
| E | 6.35 | 6.73 | 0.250 | 0.265 |
| E1 | 4.32 | - | 0.170 | - |
| e | 2.29 BSC | | 2.29 BSC | |
| L | 8.89 | 9.65 | 0.350 | 0.380 |
| L1 | 1.91 | 2.29 | 0.075 | 0.090 |
| L2 | 0.89 | 1.27 | 0.035 | 0.050 |
| L3 | 1.14 | 1.52 | 0.045 | 0.060 |
| theta1 | 0' | 15' | 0' | 15' |
| theta2 | 25' | 35' | 25' | 35' |

ECN: S-82111-Rev. A, 15-Sep-08
 DWG: 5968

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimension are shown in inches and millimeters.
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.13 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body.
4. Thermal pad contour optional with dimensions b4, L2, E1 and D1.
5. Lead dimension uncontrolled in L3.
6. Dimension b1, b3 and c1 apply to base metal only.
7. Outline conforms to JEDEC outline TO-251AA.



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