

## E Series Power MOSFET



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

| PRODUCT SUMMARY                         |                 |       |
|---|-----------------|-------|
| $V_{DS}$ (V) at $T_J$ max.              | 650             |       |
| $R_{DS(on)}$ typ. ( $\Omega$ ) at 25 °C | $V_{GS} = 10$ V | 0.156 |
| $Q_g$ max. (nC)                         | 96              |       |
| $Q_{gs}$ (nC)                           | 12              |       |
| $Q_{gd}$ (nC)                           | 25              |       |
| Configuration                           | Single          |       |

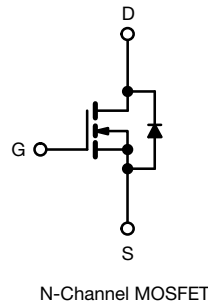
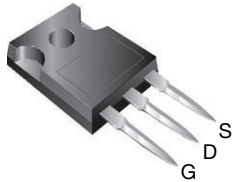
### FEATURES

- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Ultra low gate charge ( $Q_g$ )
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

### APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
  - High-intensity discharge (HID)
  - Fluorescent ballast lighting
- Industrial
  - Welding
  - Induction heating
  - Motor drives
  - Battery chargers
  - Renewable energy
  - Solar (PV inverters)

TO-247AC



| ORDERING INFORMATION            |                 |
|---------------------------------|-----------------|
| Package                         | TO-247AC        |
| Lead (Pb)-Free and Halogen-Free | SiHG22N60AE-GE3 |


| ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted) |                  |                |      |
|---|------------------|----------------|------|
| PARAMETER   | SYMBOL           | LIMIT          | UNIT |
| Drain-Source Voltage  | $V_{DS}$         | 600            | V    |
| Gate-Source Voltage   | $V_{GS}$         | $\pm 30$       |      |
| Continuous Drain Current ( $T_J = 150$ °C)                        | $V_{GS}$ at 10 V | $T_C = 25$ °C  | A    |
|   |                  | $T_C = 100$ °C |      |
| Pulsed Drain Current <sup>a</sup>                                 | $I_{DM}$         | 49             |      |
| Linear Derating Factor  |                  | 1.4            | W/°C |
| Single Pulse Avalanche Energy <sup>b</sup>                        | $E_{AS}$         | 204            | mJ   |
| Maximum Power Dissipation   | $P_D$            | 179            | 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 | V/ns |
| Reverse Diode $dV/dt$ <sup>d</sup>                                |                  |                |      |
| Soldering Recommendations (Peak temperature) <sup>c</sup>         | For 10 s         | 300            | °C   |

### Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 140$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 3.8$  A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/ $\mu$ s, starting  $T_J = 25$  °C.



| THERMAL RESISTANCE RATINGS       |                   |      |      |      |
|----------------------------------|-------------------|------|------|------|
| PARAMETER                        | SYMBOL            | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient      | R <sub>thJA</sub> | -    | 62   | °C/W |
| Maximum Junction-to-Case (Drain) | R <sub>thJC</sub> | -    | 0.7  |      |

| SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted) |                                  |   |  |                       |       |       |      |
|---|----------------------------------|---|--|-----------------------|-------|-------|------|
| PARAMETER   | SYMBOL                           | TEST CONDITIONS   |  | MIN.                  | TYP.  | MAX.  | UNIT |
| <b>Static</b>   |                                  |   |  |                       |       |       |      |
| Drain-Source Breakdown Voltage                                  | V <sub>DS</sub>                  | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA  |  | 600                   | -     | -     | V    |
| V <sub>DS</sub> Temperature Coefficient                         | ΔV <sub>DS</sub> /T <sub>J</sub> | Reference to 25 °C, I <sub>D</sub> = 250 μA   |  | -                     | 0.72  | -     | V/°C |
| Gate-Source Threshold Voltage (N)                               | V <sub>GS(th)</sub>              | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA   |  | 2                     | -     | 4     | V    |
| Gate-Source Leakage   | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 20 V  |  | -                     | -     | ± 100 | nA   |
|   |                                  | V <sub>GS</sub> = ± 30 V  |  | -                     | -     | ± 1   | μA   |
| Zero Gate Voltage Drain Current                                 | I <sub>DSS</sub>                 | V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0 V  |  | -                     | -     | 1     | μA   |
|   |                                  | V <sub>DS</sub> = 480 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C   |  | -                     | -     | 10    |      |
| Drain-Source On-State Resistance                                | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 10 V  | I <sub>D</sub> = 11 A                          | -                     | 0.156 | 0.180 | Ω    |
| Forward Transconductance  | g <sub>fs</sub>                  | V <sub>DS</sub> = 30 V, I <sub>D</sub> = 11 A   |  | -                     | 4.8   | -     | S    |
| <b>Dynamic</b>  |                                  |   |  |                       |       |       |      |
| Input Capacitance   | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 100 V,<br>f = 1 MHz   |  | -                     | 1451  | -     | pF   |
| Output Capacitance  | C <sub>oss</sub>                 |   |  | -                     | 73    | -     |      |
| Reverse Transfer Capacitance                                    | C <sub>rss</sub>                 |   |  | -                     | 5     | -     |      |
| Effective Output Capacitance, Energy Related <sup>a</sup>       | C <sub>o(er)</sub>               |   |  | -                     | 50    | -     |      |
| Effective Output Capacitance, Time Related <sup>b</sup>         | C <sub>o(tr)</sub>               | V <sub>DS</sub> = 0 V to 480 V, V <sub>GS</sub> = 0 V   |  | -                     | 258   | -     |      |
| Total Gate Charge   | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V  | I <sub>D</sub> = 11 A, V <sub>DS</sub> = 480 V | -                     | 48    | 96    | nC   |
| Gate-Source Charge  | Q <sub>gs</sub>                  |   |  | -                     | 12    | -     |      |
| Gate-Drain Charge   | Q <sub>gd</sub>                  |   |  | -                     | 25    | -     |      |
| Turn-On Delay Time  | t <sub>d(on)</sub>               | V <sub>DD</sub> = 480 V, I <sub>D</sub> = 11 A,<br>V <sub>GS</sub> = 10 V, R <sub>g</sub> = 9.1 Ω   |  | -                     | 19    | 38    | ns   |
| Rise Time   | t <sub>r</sub>                   |   |  | -                     | 33    | 66    |      |
| Turn-Off Delay Time   | t <sub>d(off)</sub>              |   |  | -                     | 45    | 90    |      |
| Fall Time   | t <sub>f</sub>                   |   |  | -                     | 21    | 42    |      |
| Gate Input Resistance   | R <sub>g</sub>                   |   |  | f = 1 MHz, open drain |       | 0.3   |      |
| <b>Drain-Source Body Diode Characteristics</b>                  |                                  |   |  |                       |       |       |      |
| Continuous Source-Drain Diode Current                           | I <sub>S</sub>                   | MOSFET symbol showing the integral reverse p - n junction diode  |  | -                     | -     | 20    | A    |
| Pulsed Diode Forward Current                                    | I <sub>SM</sub>                  |   |  | -                     | -     | 49    |      |
| Diode Forward Voltage   | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 11 A, V <sub>GS</sub> = 0 V  |  | -                     | -     | 1.2   | V    |
| Reverse Recovery Time   | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = I <sub>S</sub> = 11 A,<br>dI/dt = 100 A/μs, V <sub>R</sub> = 25 V  |  | -                     | 319   | 638   | ns   |
| Reverse Recovery Charge   | Q <sub>rr</sub>                  |   |  | -                     | 4.9   | 9.8   | μC   |
| Reverse Recovery Current  | I <sub>RRM</sub>                 |   |  | -                     | 28    | -     | A    |

**Notes**

- a. C<sub>oss(er)</sub> is a fixed capacitance that gives the same energy as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 % to 80 % V<sub>DSS</sub>.
- b. C<sub>oss(tr)</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 % to 80 % V<sub>DSS</sub>.

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

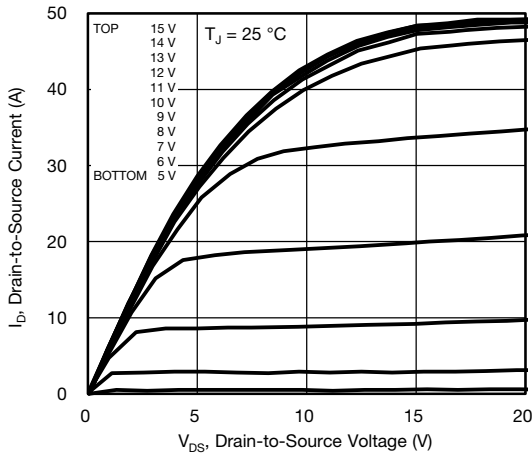


Fig. 1 - Typical Output Characteristics

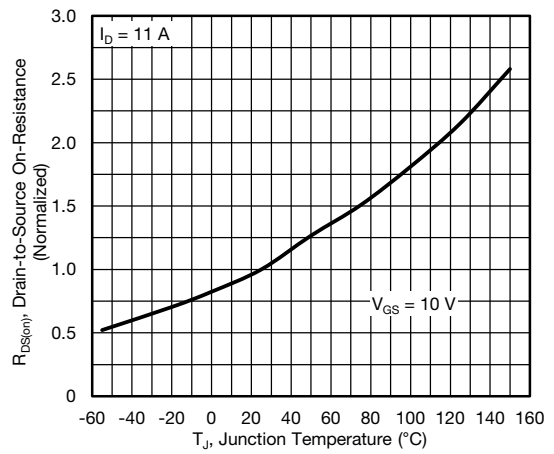


Fig. 4 - Normalized On-Resistance vs. Temperature

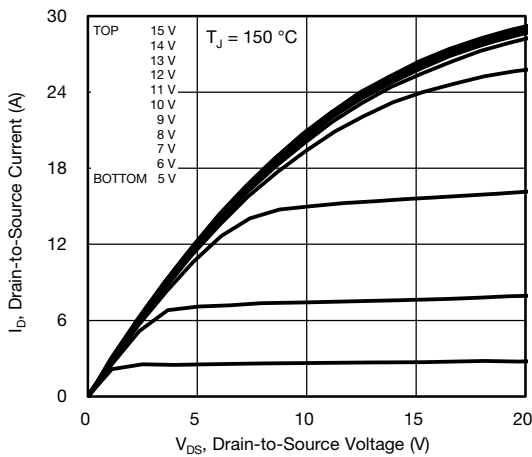


Fig. 2 - Typical Output Characteristics

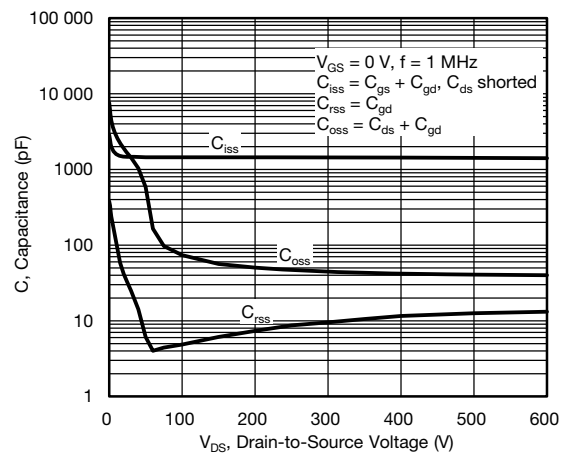


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

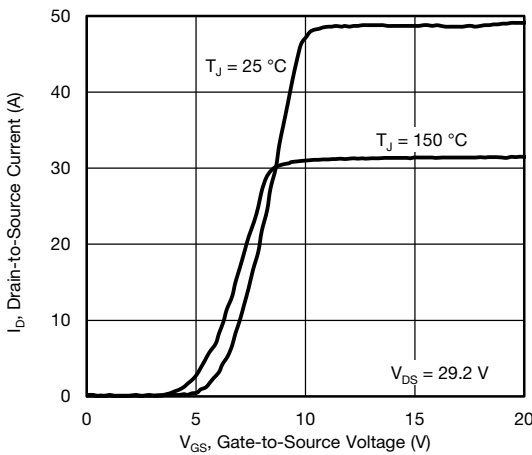


Fig. 3 - Typical Transfer Characteristics



Fig. 6 -  $C_{oss}$  and  $E_{oss}$  vs.  $V_{DS}$



Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

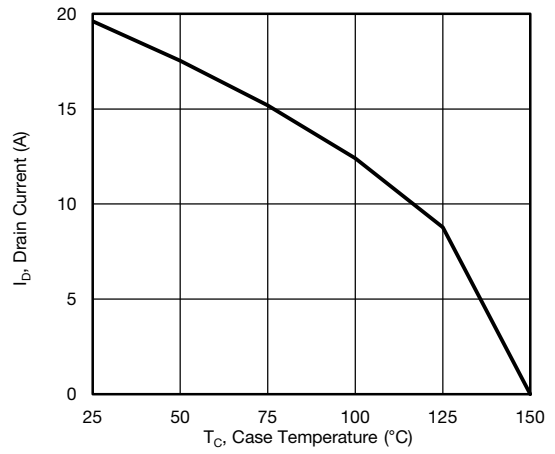


Fig. 10 - Maximum Drain Current vs. Case Temperature

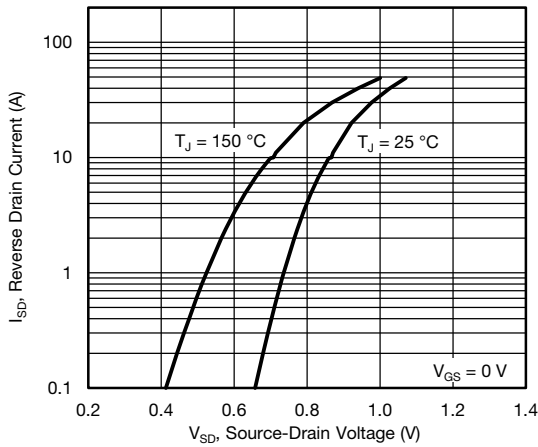


Fig. 8 - Typical Source-Drain Diode Forward Voltage

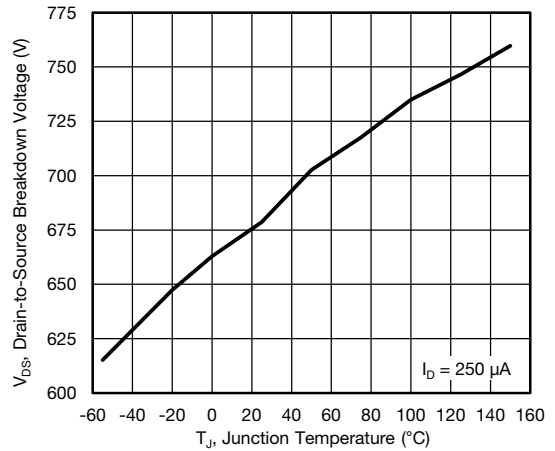


Fig. 11 - Temperature vs. Drain-to-Source Voltage



Fig. 9 - Maximum Safe Operating Area

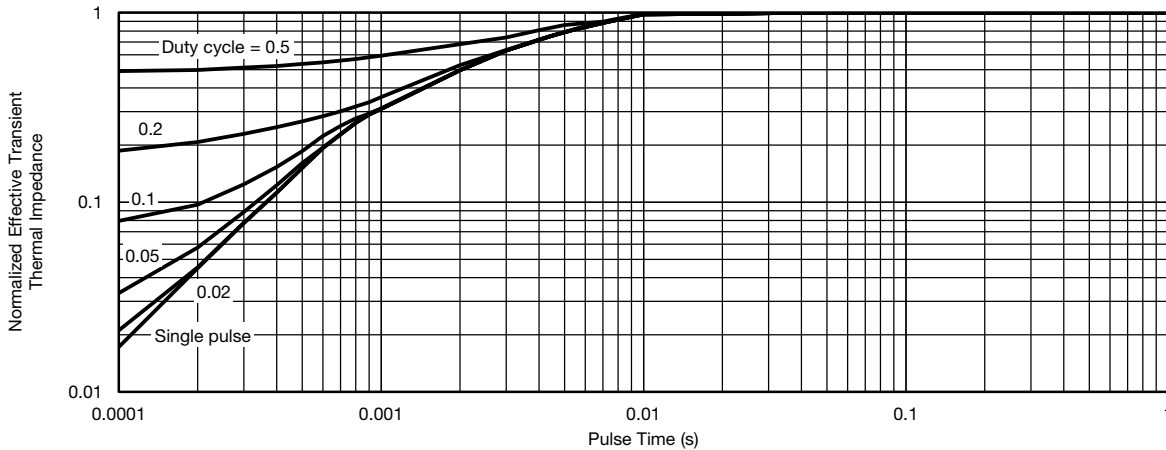


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case



Fig. 13 - Switching Time Test Circuit

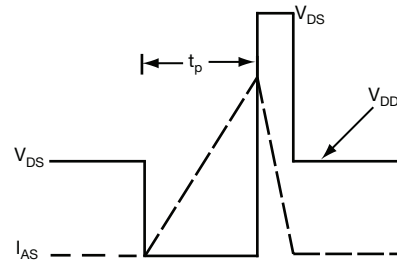


Fig. 16 - Unclamped Inductive Waveforms



Fig. 14 - Switching Time Waveforms



Fig. 17 - Basic Gate Charge Waveform



Fig. 15 - Unclamped Inductive Test Circuit

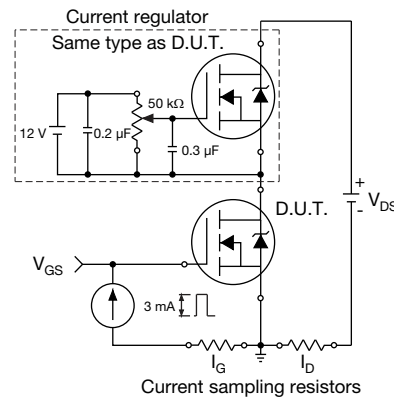
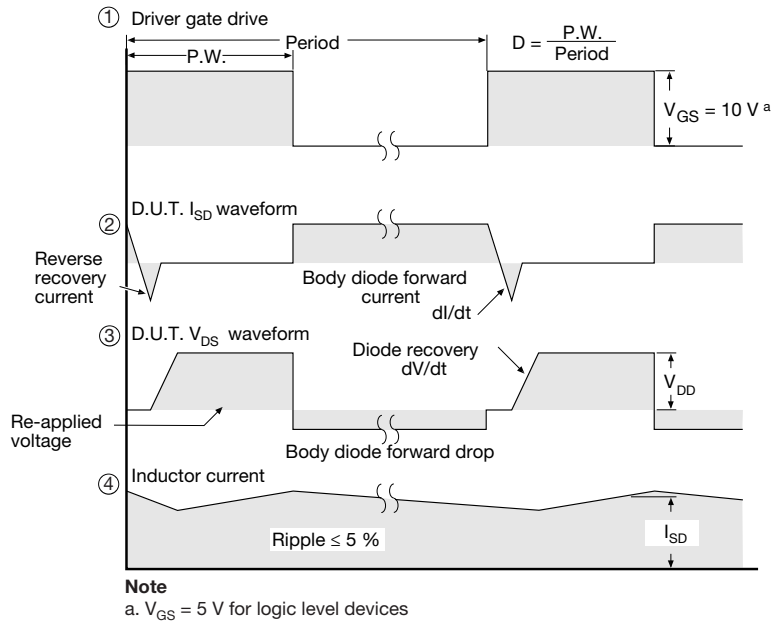
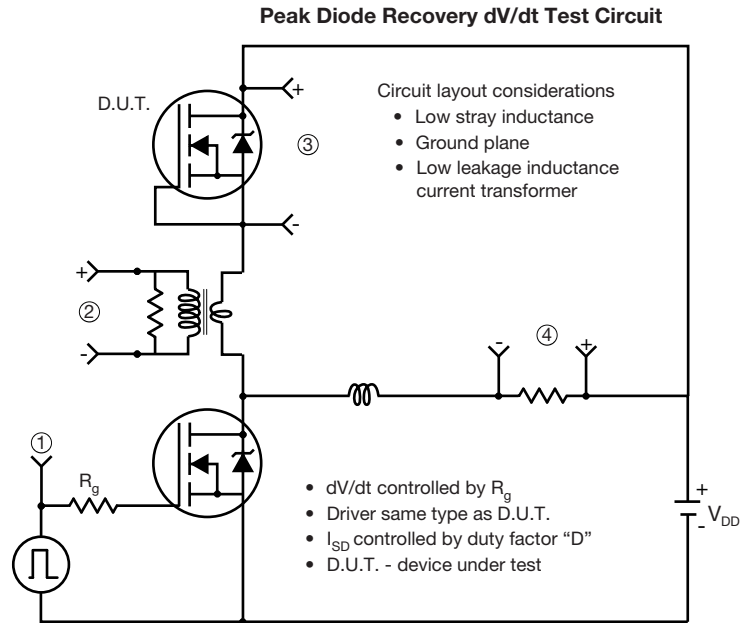


Fig. 18 - Gate Charge Test Circuit



**Fig. 19 - For N-Channel**

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#### Как с нами связаться

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