

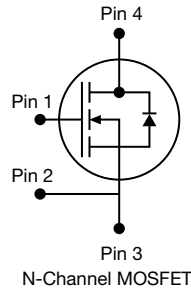
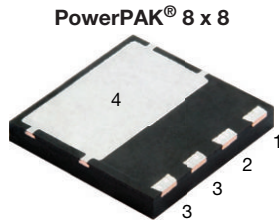


**THE DATASHEET OF
SIHH11N60EF-T1-GE3**



EF Series Power MOSFET with Fast Body Diode

| PRODUCT SUMMARY | |
|---|-------------------------|
| V_{DS} (V) at T_J max. | 650 |
| $R_{DS(on)}$ typ. (Ω) at 25 °C | $V_{GS} = 10$ V 0.310 |
| Q_g max. (nC) | 62 |
| Q_{gs} (nC) | 7 |
| Q_{gd} (nC) | 13 |
| Configuration | Single |



FEATURES

- Fast body diode MOSFET using E series technology
- Reduced t_{rr} , Q_{rr} , and I_{RRM}
- Completely lead (Pb)-free device
- Low figure-of-merit (FOM) $R_{on} \times Q_g$
- Low input capacitance (C_{iss})
- Low switching losses due to reduced Q_{rr}
- Ultra low gate charge (Q_g)
- Avalanche energy rated (UIS)
- Material categorization: for definitions of compliance please see 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)

| ORDERING INFORMATION | |
|---------------------------------|--------------------|
| Package | PowerPAK 8 x 8 |
| Lead (Pb)-free and Halogen-free | SiHH11N60EF-T1-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} | ± 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 ^a | I_{DM} | 27 | |
| Linear Derating Factor | | 0.9 | W/°C |
| Single Pulse Avalanche Energy ^b | E_{AS} | 127 | mJ |
| Maximum Power Dissipation | P_D | 114 | 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 ^c | | | |

Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 140$ V, starting $T_J = 25$ °C, $L = 28.2$ mH, $R_g = 25$ Ω , $I_{AS} = 3$ A.
- $I_{SD} \leq I_D$, $dI/dt = 100$ A/ μ s, starting $T_J = 25$ °C.



| THERMAL RESISTANCE RATINGS | | | | |
|----------------------------------|-------------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient | R _{thJA} | 42 | 55 | °C/W |
| Maximum Junction-to-Case (Drain) | R _{thJC} | 0.76 | 1.10 | |

| SPECIFICATIONS (T _J = 25 °C, unless otherwise noted) | | | | | | | |
|---|----------------------------------|---|---|-----------------------|-------|-------|------|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V _{DS} | V _{GS} = 0 V, I _D = 250 μA | | 600 | - | - | V |
| V _{DS} Temperature Coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = 10 mA | | - | 0.66 | - | V/°C |
| Gate-Source Threshold Voltage (N) | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | | 2.0 | - | 4.0 | V |
| Gate-Source Leakage | I _{GSS} | V _{GS} = ± 20 V | | - | - | ± 100 | nA |
| | | V _{GS} = ± 30 V | | - | - | ± 1 | μA |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = 480 V, V _{GS} = 0 V | | - | - | 1 | μA |
| | | V _{DS} = 480 V, V _{GS} = 0 V, T _J = 125 °C | | - | - | 50 | |
| Drain-Source On-State Resistance | R _{DS(on)} | V _{GS} = 10 V | I _D = 5.5 A | - | 0.310 | 0.357 | Ω |
| Forward Transconductance | g _{fs} | V _{DS} = 30 V, I _D = 5.5 A | | - | 3.7 | - | S |
| Dynamic | | | | | | | |
| Input Capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 100 V, f = 1 MHz | | - | 1078 | - | pF |
| Output Capacitance | C _{oss} | | | - | 57 | - | |
| Reverse Transfer Capacitance | C _{rss} | | | - | 4 | - | |
| Effective Output Capacitance, Energy Related ^a | C _{o(er)} | | | - | 35 | - | |
| Effective Output Capacitance, Time Related ^b | C _{o(tr)} | V _{DS} = 0 V to 480 V, V _{GS} = 0 V | | - | 145 | - | |
| Total Gate Charge | Q _g | V _{GS} = 10 V | I _D = 5.5 A, V _{DS} = 480 V | - | 31 | 62 | nC |
| Gate-Source Charge | Q _{gs} | | | - | 7 | - | |
| Gate-Drain Charge | Q _{gd} | | | - | 13 | - | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = 480 V, I _D = 5.5 A, V _{GS} = 10 V, R _g = 9.1 Ω | | - | 16 | 32 | ns |
| Rise Time | t _r | | | - | 21 | 42 | |
| Turn-Off Delay Time | t _{d(off)} | | | - | 39 | 68 | |
| Fall Time | t _f | | | - | 21 | 42 | |
| Gate Input Resistance | R _g | | | f = 1 MHz, open drain | | 0.2 | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I _S | MOSFET symbol showing the integral reverse p - n junction diode  | | - | - | 11 | A |
| Pulsed Diode Forward Current | I _{SM} | | | - | - | 27 | |
| Diode Forward Voltage | V _{SD} | T _J = 25 °C, I _S = 5.5 A, V _{GS} = 0 V | | - | 0.9 | 1.2 | V |
| Reverse Recovery Time | t _{rr} | T _J = 25 °C, I _F = I _S = 5.5 A, dI/dt = 100 A/μs, V _R = 25 V | | - | 114 | 228 | ns |
| Reverse Recovery Charge | Q _{rr} | | | - | 0.56 | 1.12 | μC |
| Reverse Recovery Current | I _{RRM} | | | - | 9.5 | - | A |

Notes

- a. 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_{DS}.
- b. 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_{DS}.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

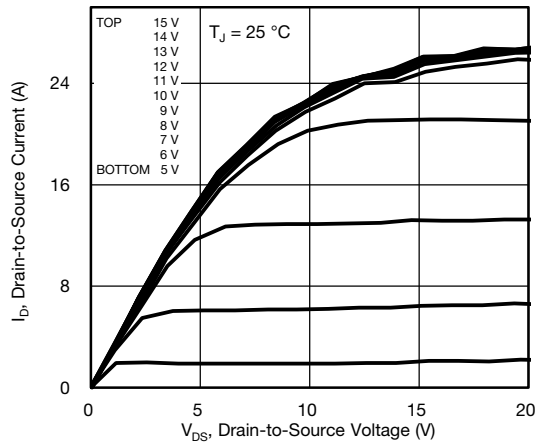


Fig. 1 - Typical Output Characteristics

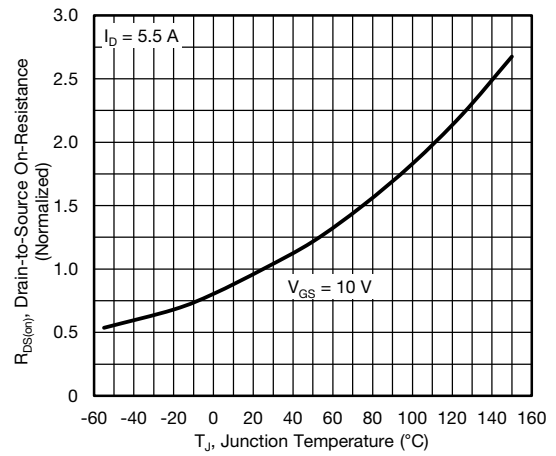


Fig. 4 - Normalized On-Resistance vs. Temperature

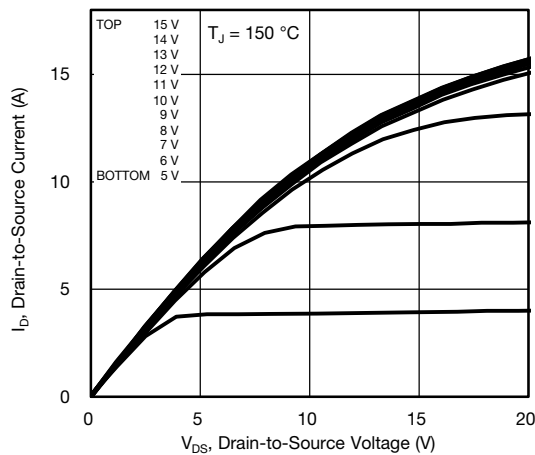


Fig. 2 - Typical Output Characteristics

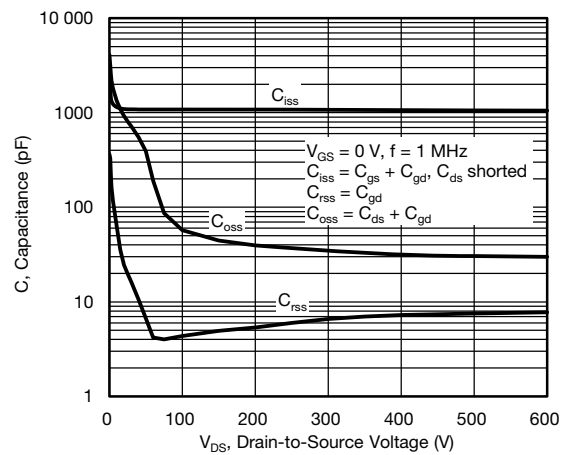


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

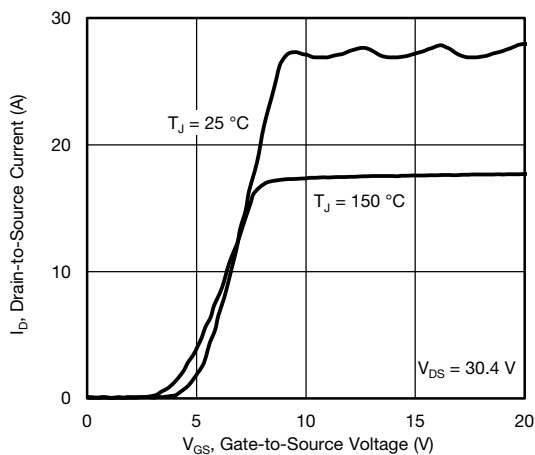


Fig. 3 - Typical Transfer Characteristics

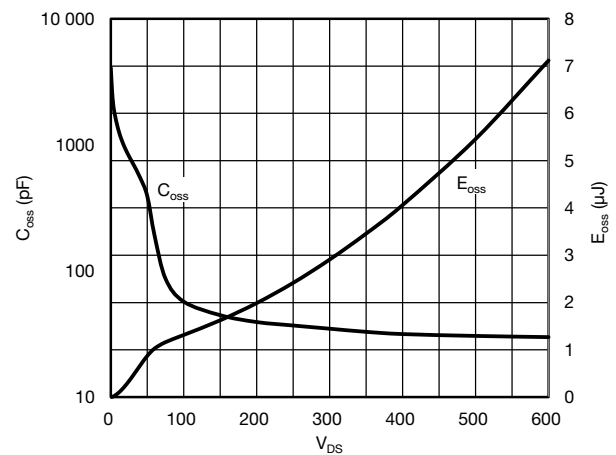


Fig. 6 - C_{oss} and E_{oss} vs. V_{DS}

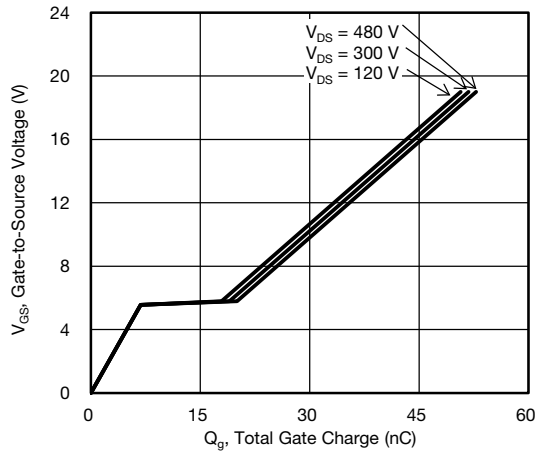


Fig. 7 - Typical Gate Charge vs. Gate-to-Source Voltage

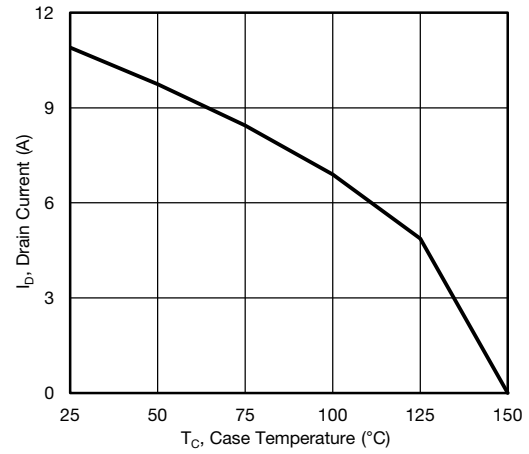


Fig. 10 - Maximum Drain Current vs. Case Temperature

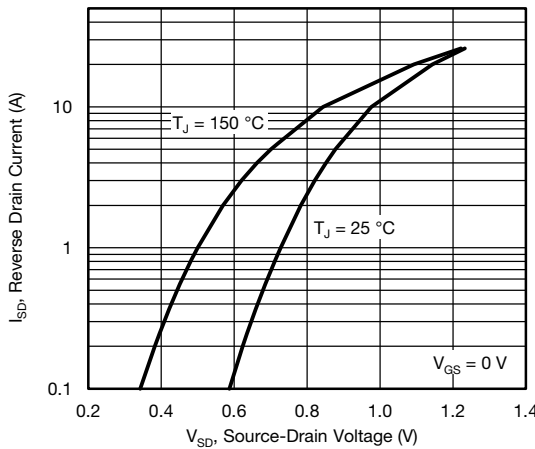


Fig. 8 - Typical Source-Drain Diode Forward Voltage

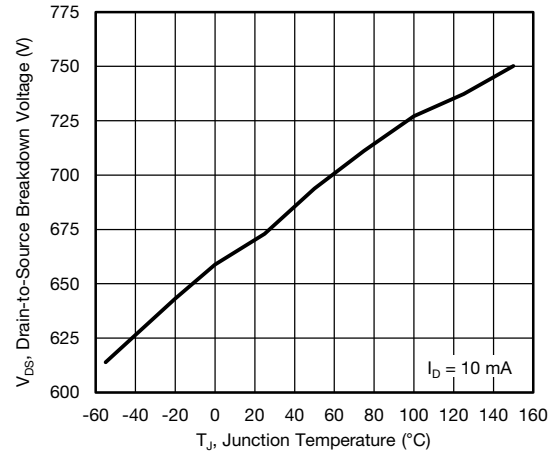


Fig. 11 - Temperature vs. Drain-to-Source Voltage

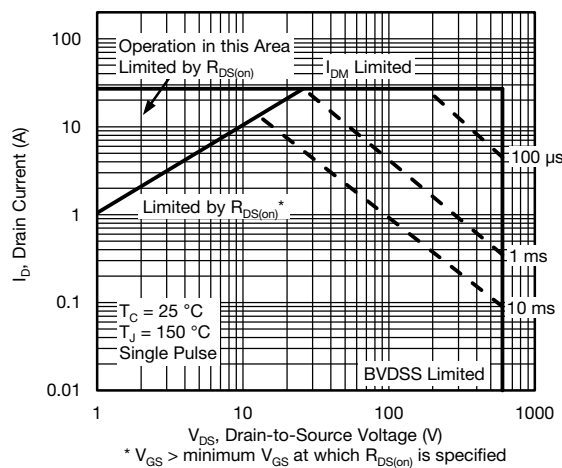


Fig. 9 - Maximum Safe Operating Area

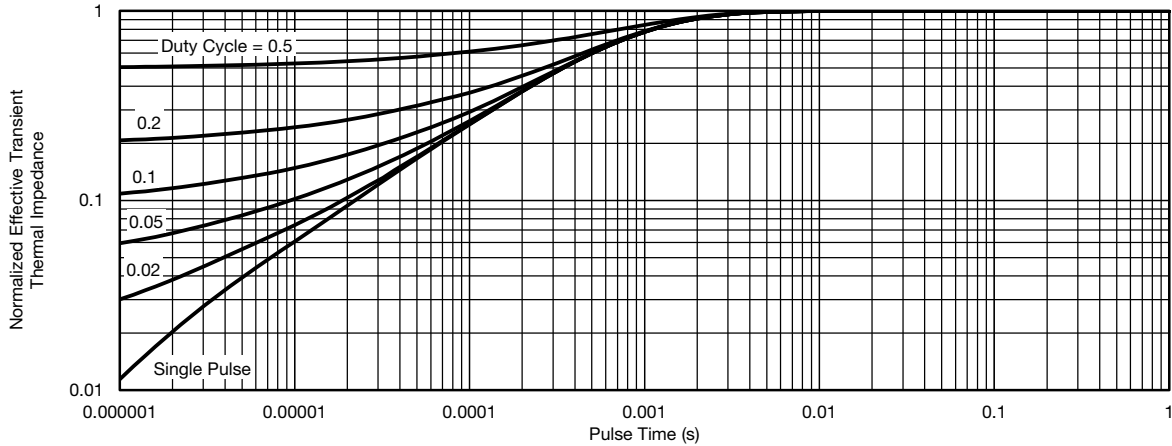


Fig. 12 - Normalized Thermal Transient Impedance, Junction-to-Case

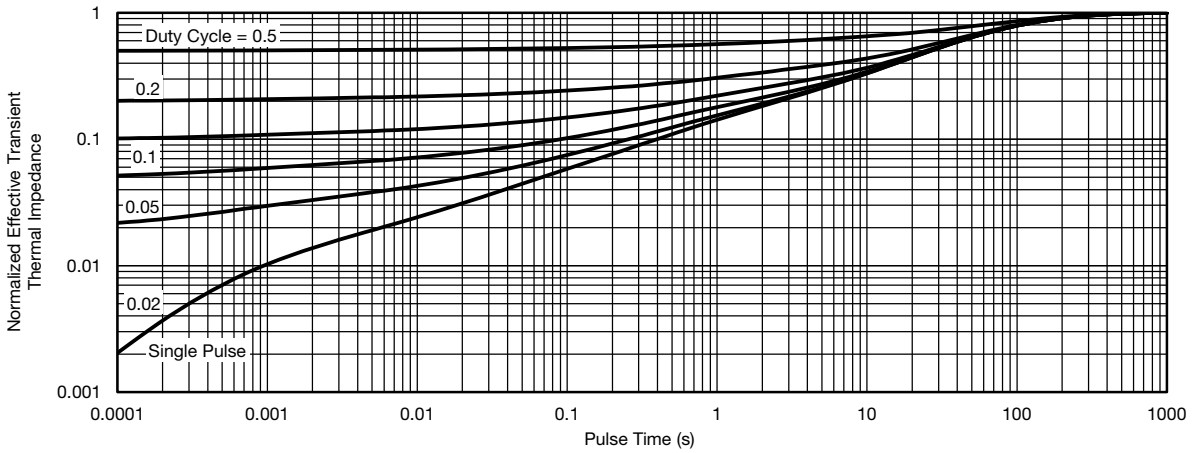


Fig. 13 - Normalized Thermal Transient Impedance, Junction-to-Ambient

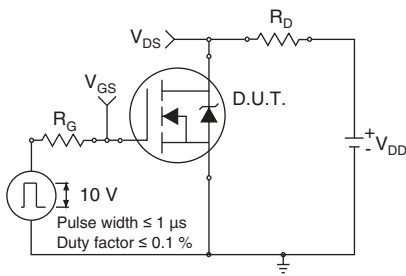


Fig. 14 - Switching Time Test Circuit

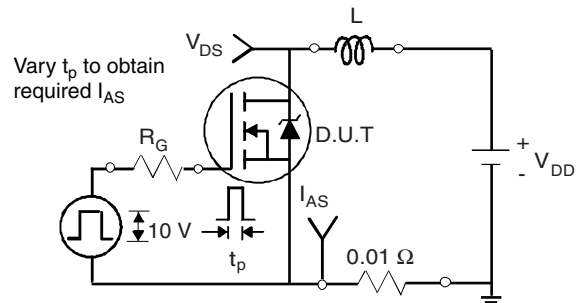


Fig. 16 - Unclamped Inductive Test Circuit

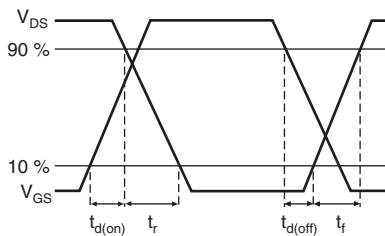


Fig. 15 - Switching Time Waveforms

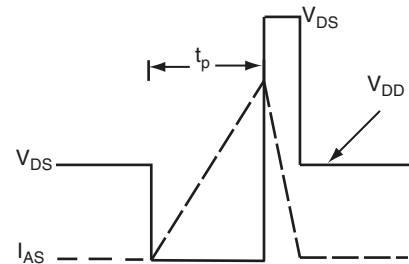


Fig. 17 - Unclamped Inductive Waveforms

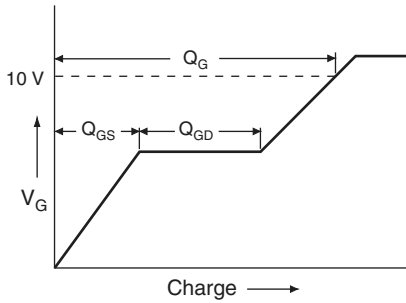


Fig. 18 - Basic Gate Charge Waveform

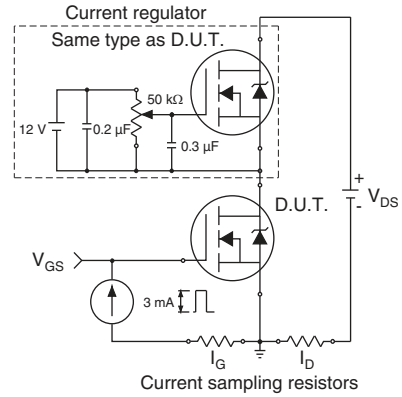
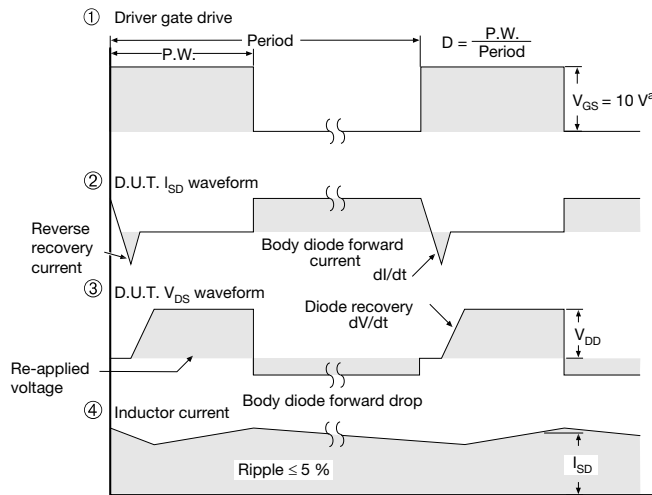
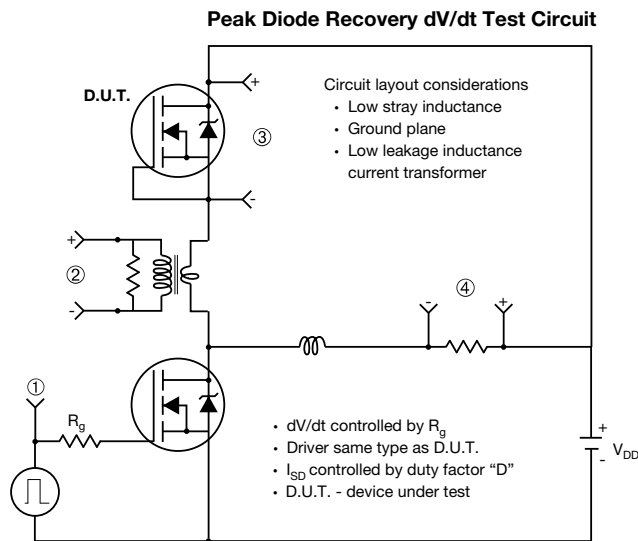


Fig. 19 - Gate Charge Test Circuit

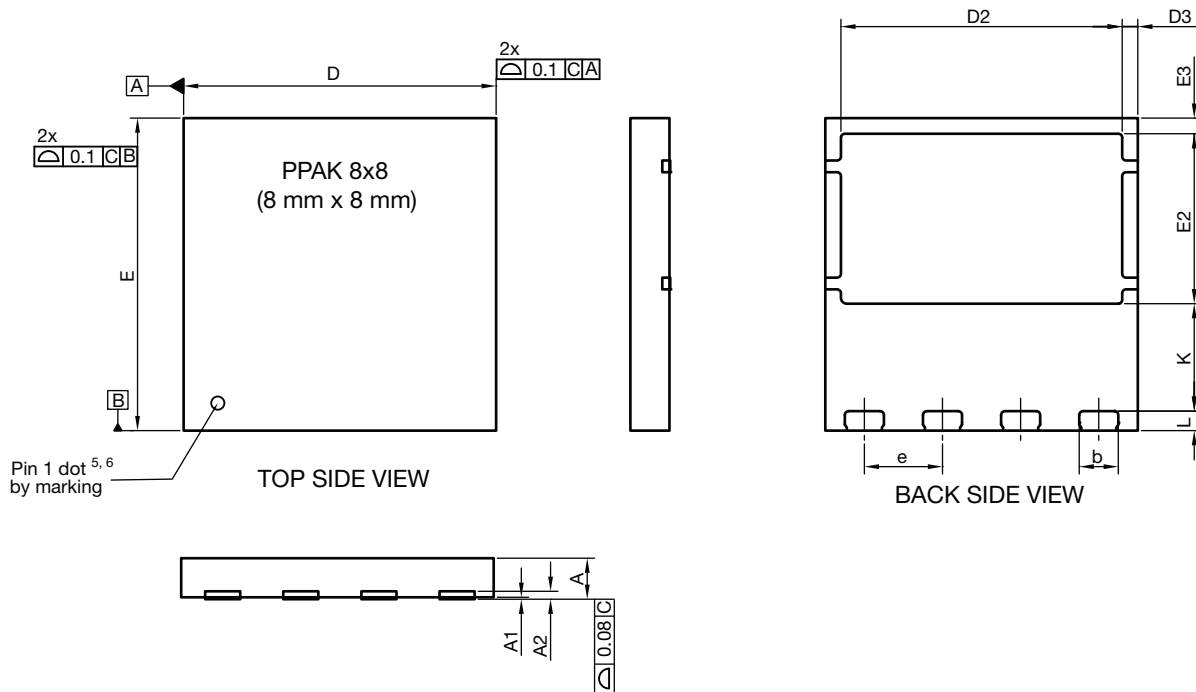


Note
a. $V_{GS} = 5\text{ V}$ for logic level devices

Fig. 20 - For N-Channel

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PowerPAK[®] 8 x 8 Case Outline



| DIM. | MILLIMETERS | | | INCHES | | |
|----------------|-------------|------|------|------------|-------|-------|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A ⁸ | 0.95 | 1.00 | 1.05 | 0.037 | 0.039 | 0.041 |
| A1 | 0.00 | - | 0.05 | 0.000 | - | 0.002 |
| A2 | 020 ref. | | | 0.008 ref. | | |
| b ⁴ | 0.95 | 1.00 | 1.05 | 0.037 | 0.039 | 0.041 |
| D | 7.90 | 8.00 | 8.10 | 0.311 | 0.315 | 0.319 |
| D2 | 7.10 | 7.20 | 7.30 | 0.280 | 0.283 | 0.287 |
| D3 | 0.40 BSC | | | 0.016 BSC | | |
| e | 2.00 BSC | | | 0.079 BSC | | |
| E | 7.90 | 8.00 | 8.10 | 0.311 | 0.315 | 0.319 |
| E2 | 4.30 | 4.35 | 4.40 | 0.169 | 0.171 | 0.173 |
| E3 | 0.40 BSC | | | 0.016 BSC | | |
| K | 2.75 BSC | | | 0.108 BSC | | |
| L | 0.45 | 0.50 | 0.55 | 0.018 | 0.020 | 0.022 |
| N ³ | 8 | | | 8 | | |

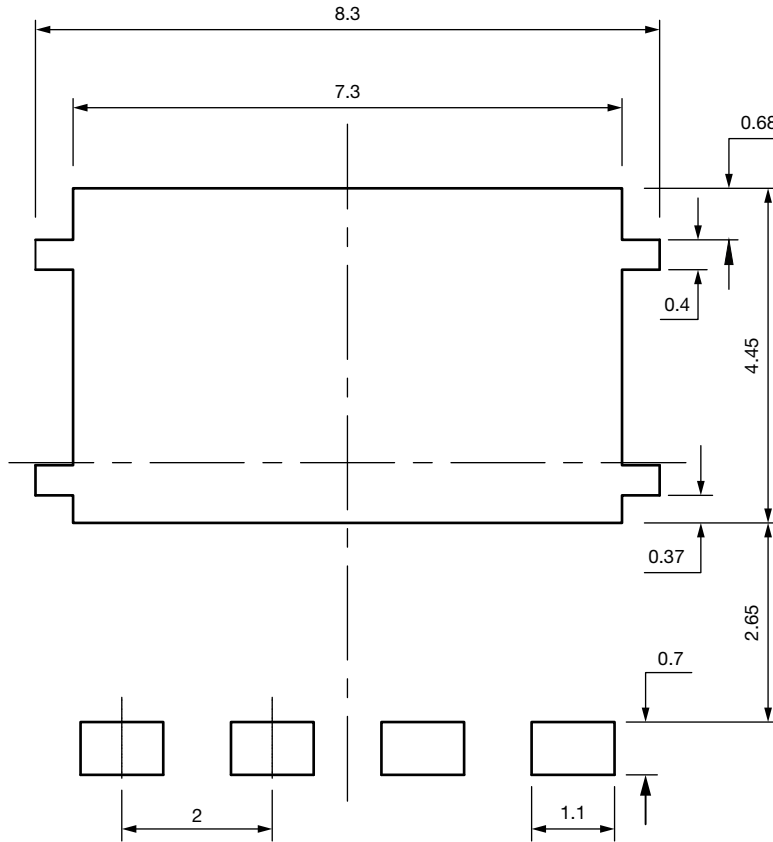
Notes

1. Use millimeters as the primary measurement.
2. Dimensioning and tolerances conform to ASME Y14.5 M - 1994.
3. N is the number of terminals.
4. Package warpage max. 0.08 mm.
5. The pin 1 identifier must be existed on the top surface of the package by using indentation mark or other feature of package body.
6. Exact shape and size of this feature is optional.

ECN: T15-0225-Rev. A, 18-May-15
 DWG: 6041



Recommended Minimum PADs for PowerPAK[®] 8 mm x 8 mm



Dimensions in millimeters



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