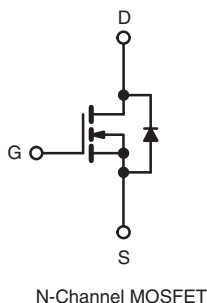
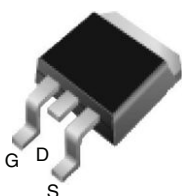


## Power MOSFET

### PRODUCT SUMMARY

|                           |                 |      |
|---------------------------|-----------------|------|
| $V_{DS}$ (V)              | 100             |      |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10$ V | 0.27 |
| $Q_g$ (Max.) (nC)         | 16              |      |
| $Q_{gs}$ (nC)             | 4.4             |      |
| $Q_{gd}$ (nC)             | 7.7             |      |
| Configuration             | Single          |      |

**D<sup>2</sup>PAK (TO-263)**


### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Surface Mount
- Available in Tape and Reel
- Dynamic  $dV/dt$  Rating
- Repetitive Avalanche Rated
- 175 °C Operating Temperature
- Fast Switching
- Ease of Paralleling
- Compliant to RoHS Directive 2002/95/EC



**RoHS\***  
COMPLIANT  
HALOGEN  
**FREE**  
Available

### DESCRIPTION

Third generation Power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The D<sup>2</sup>PAK (TO-263) is a surface mount power package capable of accommodating die size up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The D<sup>2</sup>PAK (TO-263) is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0 W in a typical surface mount application.

### ORDERING INFORMATION

|                                 |                             |
|---------------------------------|-----------------------------|
| Package                         | D <sup>2</sup> PAK (TO-263) |
| Lead (Pb)-free and Halogen-free | SiHF520S-GE3                |
| Lead (Pb)-free                  | IRF520SPbF                  |
|                                 | SiHF520S-E3                 |

### ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)

| PARAMETER                                          | SYMBOL           | LIMIT            | UNIT |
|----------------------------------------------------|------------------|------------------|------|
| Drain-Source Voltage                               | $V_{DS}$         | 100              | V    |
| Gate-Source Voltage                                | $V_{GS}$         | $\pm 20$         |      |
| Continuous Drain Current                           | $V_{GS}$ at 10 V | $T_C = 25$ °C    | A    |
|                                                    |                  | $T_C = 100$ °C   |      |
| Pulsed Drain Current <sup>a</sup>                  | $I_{DM}$         | 37               | W/°C |
| Linear Derating Factor                             |                  | 0.40             |      |
| Linear Derating Factor (PCB Mount) <sup>e</sup>    |                  | 0.025            |      |
| Single Pulse Avalanche Energy <sup>b</sup>         | $E_{AS}$         | 200              | mJ   |
| Avalanche Current <sup>a</sup>                     | $I_{AR}$         | 9.2              | A    |
| Repetitive Avalanche Energy <sup>a</sup>           | $E_{AR}$         | 6.0              | mJ   |
| Maximum Power Dissipation                          | $P_D$            | $T_C = 25$ °C    | W    |
| Maximum Power Dissipation (PCB Mount) <sup>e</sup> |                  | $T_A = 25$ °C    |      |
| Peak Diode Recovery $dV/dt$ <sup>c</sup>           | $dV/dt$          | 5.5              | V/ns |
| Operating Junction and Storage Temperature Range   | $T_J, T_{stg}$   | - 55 to + 175    | °C   |
| Soldering Recommendations (Peak Temperature)       | for 10 s         | 300 <sup>d</sup> |      |

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- $V_{DD} = 25$  V, starting  $T_J = 25$  °C,  $L = 3.5$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 9.2$  A (see fig. 12).
- $I_{SD} \leq 9.2$  A,  $dI/dt \leq 110$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 175$  °C.
- 1.6 mm from case.
- When mounted on 1" square PCB (FR-4 or G-10 material).

\* Pb containing terminations are not RoHS compliant, exemptions may apply

**THERMAL RESISTANCE RATINGS**

| PARAMETER                                            | SYMBOL     | TYP. | MAX. | UNIT |
|------------------------------------------------------|------------|------|------|------|
| Maximum Junction-to-Ambient                          | $R_{thJA}$ | -    | 62   | °C/W |
| Maximum Junction-to-Ambient (PCB Mount) <sup>a</sup> | $R_{thJA}$ | -    | 40   |      |
| Maximum Junction-to-Case (Drain)                     | $R_{thJC}$ | -    | 2.5  |      |

**Note**

a. When mounted on 1" square PCB (FR-4 or G-10 material).

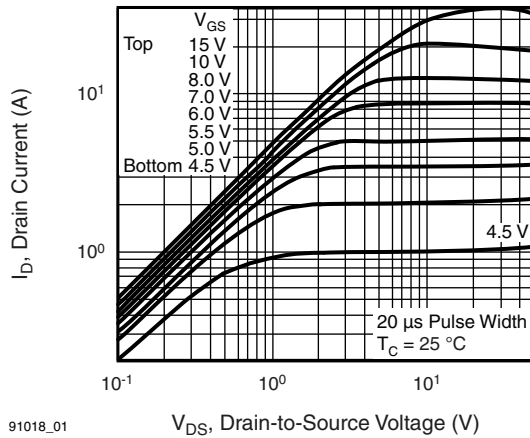
**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

| PARAMETER                                 | SYMBOL                           | TEST CONDITIONS                                                                                                            |                                                                                   | MIN. | TYP. | MAX.  | UNIT |
|-------------------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|------|-------|------|
| Static                                    |                                  |                                                                                                                            |                                                                                   |      |      |       |      |
| Drain-Source Breakdown Voltage            | V <sub>DS</sub>                  | V <sub>GS</sub> = 0, I <sub>D</sub> = 250 μA                                                                               |                                                                                   | 100  | -    | -     | V    |
| V <sub>DS</sub> Temperature Coefficient   | ΔV <sub>DS</sub> /T <sub>J</sub> | Reference to 25 °C, I <sub>D</sub> = 1 mA                                                                                  |                                                                                   | -    | 0.13 | -     | V/°C |
| Gate-Source Threshold Voltage             | V <sub>GS(th)</sub>              | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                                |                                                                                   | 2.0  | -    | 4.0   | V    |
| Gate-Source Leakage                       | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 20 V                                                                                                   |                                                                                   | -    | -    | ± 100 | nA   |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>                 | V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V                                                                             |                                                                                   | -    | -    | 25    | μA   |
|                                           |                                  | V <sub>DS</sub> = 80 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150 °C                                                     |                                                                                   | -    | -    | 250   |      |
| Drain-Source On-State Resistance          | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 10 V                                                                                                     | I <sub>D</sub> = 5.5 A <sup>b</sup>                                               | -    | -    | 0.27  | Ω    |
| Forward Transconductance                  | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 5.5 A <sup>b</sup>                                                                |                                                                                   | 2.7  | -    | -     | S    |
| Dynamic                                   |                                  |                                                                                                                            |                                                                                   |      |      |       |      |
| Input Capacitance                         | C <sub>iss</sub>                 | V <sub>GS</sub> = 0 V,<br>V <sub>DS</sub> = 25 V,<br>f = 1.0 MHz, see fig. 5                                               |                                                                                   | -    | 360  | -     | pF   |
| Output Capacitance                        | C <sub>oss</sub>                 |                                                                                                                            |                                                                                   | -    | 150  | -     |      |
| Reverse Transfer Capacitance              | C <sub>rss</sub>                 |                                                                                                                            |                                                                                   | -    | 34   | -     |      |
| Total Gate Charge                         | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                     | I <sub>D</sub> = 9.2 A, V <sub>DS</sub> = 80 V,<br>see fig. 6 and 13 <sup>b</sup> | -    | -    | 16    | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>                  |                                                                                                                            |                                                                                   | -    | -    | 4.4   |      |
| Gate-Drain Charge                         | Q <sub>gd</sub>                  |                                                                                                                            |                                                                                   | -    | -    | 7.7   |      |
| Turn-On Delay Time                        | t <sub>d(on)</sub>               | V <sub>DD</sub> = 50 V, I <sub>D</sub> = 9.2 A,<br>R <sub>g</sub> = 18 Ω, R <sub>D</sub> = 5.2 Ω, see fig. 10 <sup>b</sup> |                                                                                   | -    | 8.8  | -     | ns   |
| Rise Time                                 | t <sub>r</sub>                   |                                                                                                                            |                                                                                   | -    | 30   | -     |      |
| Turn-Off Delay Time                       | t <sub>d(off)</sub>              |                                                                                                                            |                                                                                   | -    | 19   | -     |      |
| Fall Time                                 | t <sub>f</sub>                   |                                                                                                                            |                                                                                   | -    | 20   | -     |      |
| Internal Drain Inductance                 | L <sub>D</sub>                   | Between lead,<br>6 mm (0.25") from<br>package and center of<br>die contact                                                 |                                                                                   | -    | 4.5  | -     | nH   |
| Internal Source Inductance                | L <sub>S</sub>                   |                                                                                                                            |                                                                                   | -    | 7.5  | -     |      |
| Drain-Source Body Diode Characteristics   |                                  |                                                                                                                            |                                                                                   |      |      |       |      |
| Continuous Source-Drain Diode Current     | I <sub>S</sub>                   | MOSFET symbol<br>showing the<br>integral reverse<br>p - n junction diode                                                   |                                                                                   | -    | -    | 9.2   | A    |
| Pulsed Diode Forward Current <sup>a</sup> | I <sub>SM</sub>                  |                                                                                                                            |                                                                                   | -    | -    | 37    |      |
| Body Diode Voltage                        | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 9.2 A, V <sub>GS</sub> = 0 V <sup>b</sup>                                         |                                                                                   | -    | -    | 1.8   | V    |
| Body Diode Reverse Recovery Time          | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 9.2 A, dI/dt = 100 A/μs <sup>b</sup>                                              |                                                                                   | -    | 110  | 260   | ns   |
| Body Diode Reverse Recovery Charge        | Q <sub>rr</sub>                  |                                                                                                                            |                                                                                   | -    | 0.53 | 1.3   | μC   |
| Forward Turn-On Time                      | t <sub>on</sub>                  | Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> and L <sub>D</sub> )                          |                                                                                   |      |      |       |      |

**Notes**

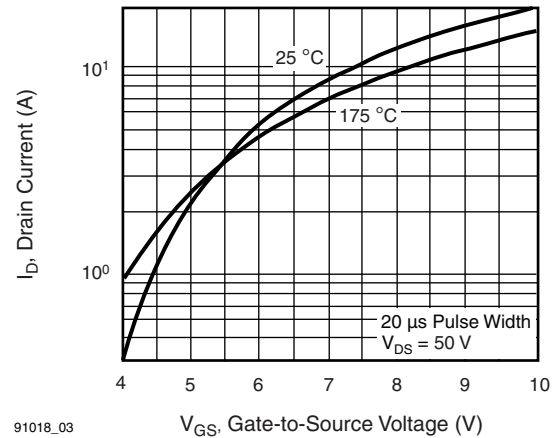
- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).  
b. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

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



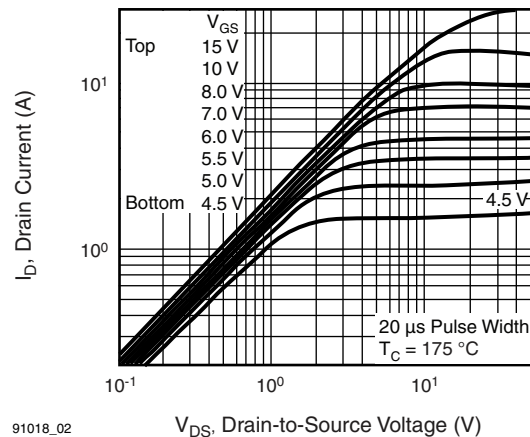
91018\_01

Fig. 1 - Typical Output Characteristics,  $T_C = 25^\circ\text{C}$



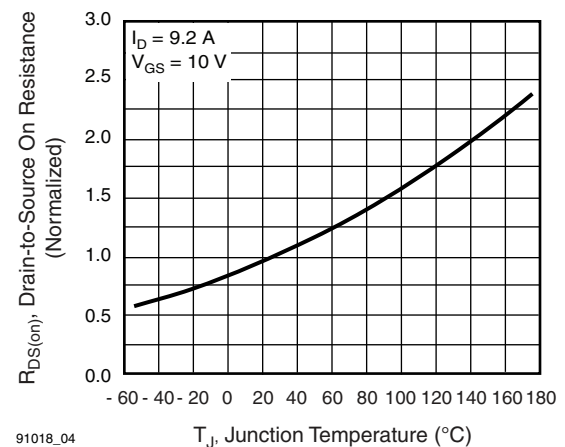
91018\_03

Fig. 3 - Typical Transfer Characteristics



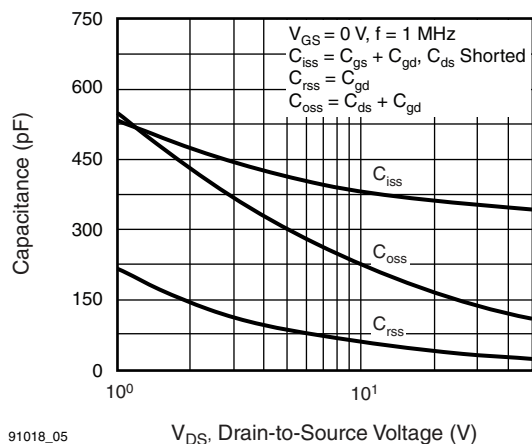
91018\_02

Fig. 2 - Typical Output Characteristics,  $T_C = 175^\circ\text{C}$



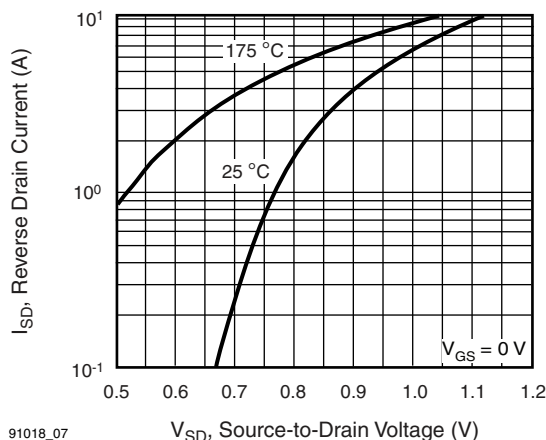
91018\_04

Fig. 4 - Normalized On-Resistance vs. Temperature



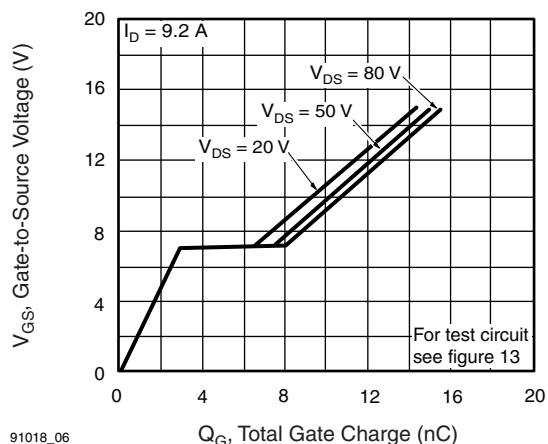
91018\_05

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



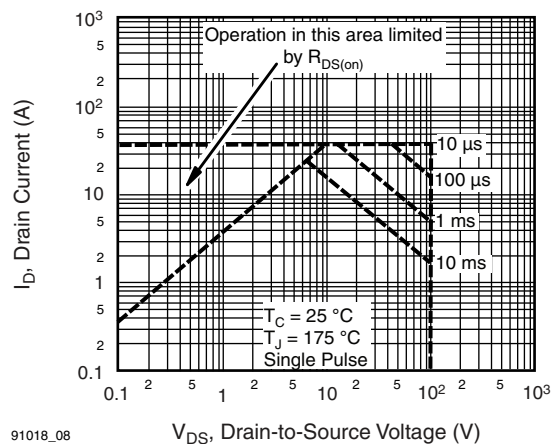
91018\_07

**Fig. 7 - Typical Source-Drain Diode Forward Voltage**



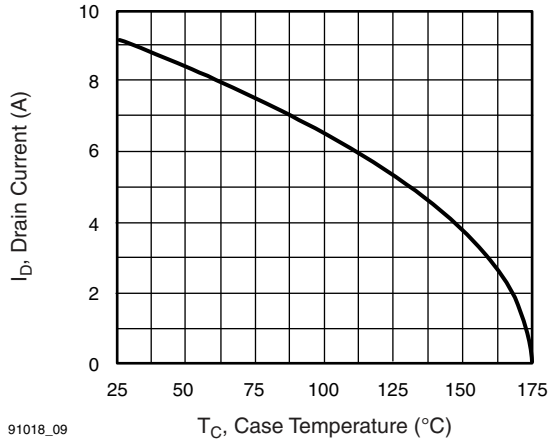
91018\_06

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

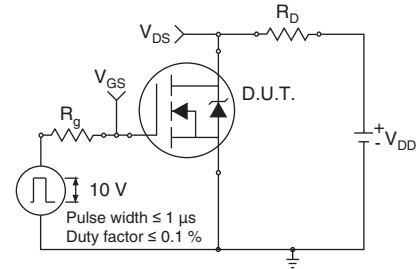


91018\_08

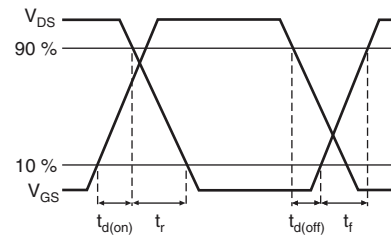
**Fig. 8 - Maximum Safe Operating Area**



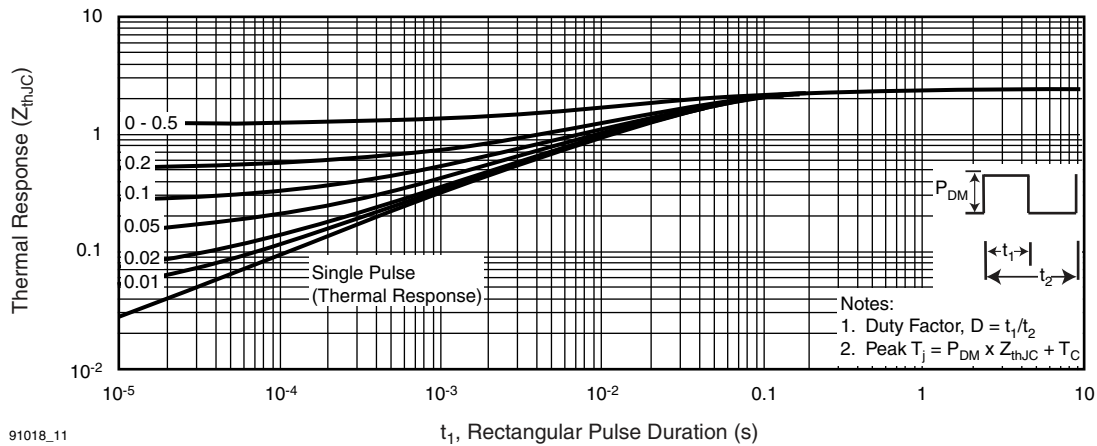
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



**Fig. 10a - Switching Time Test Circuit**



**Fig. 10b - Switching Time Waveforms**



**Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**

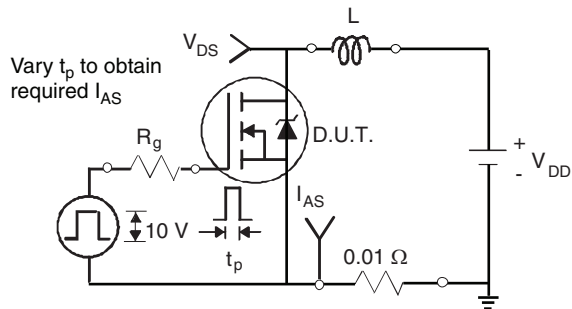


Fig. 12a - Unclamped Inductive Test Circuit

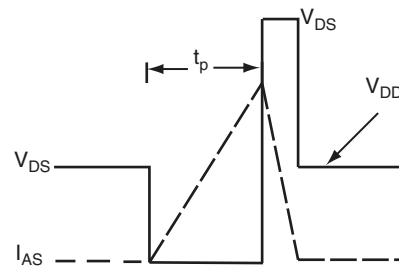


Fig. 12b - Unclamped Inductive Waveforms

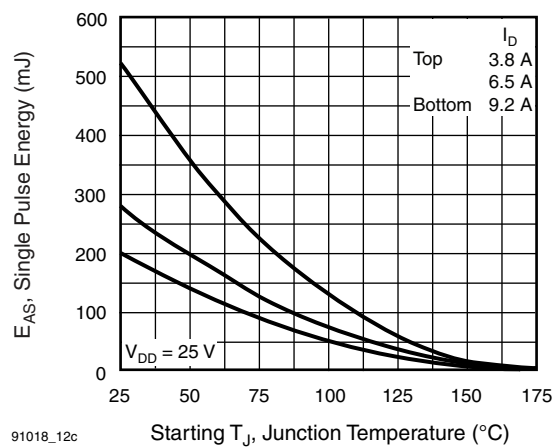


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

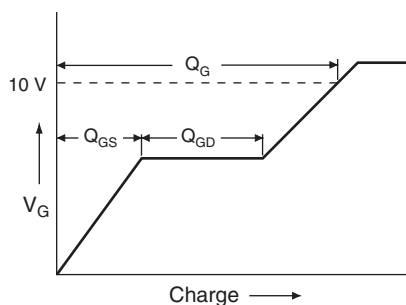


Fig. 13a - Basic Gate Charge Waveform

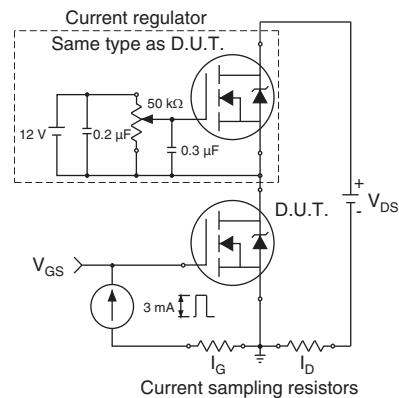
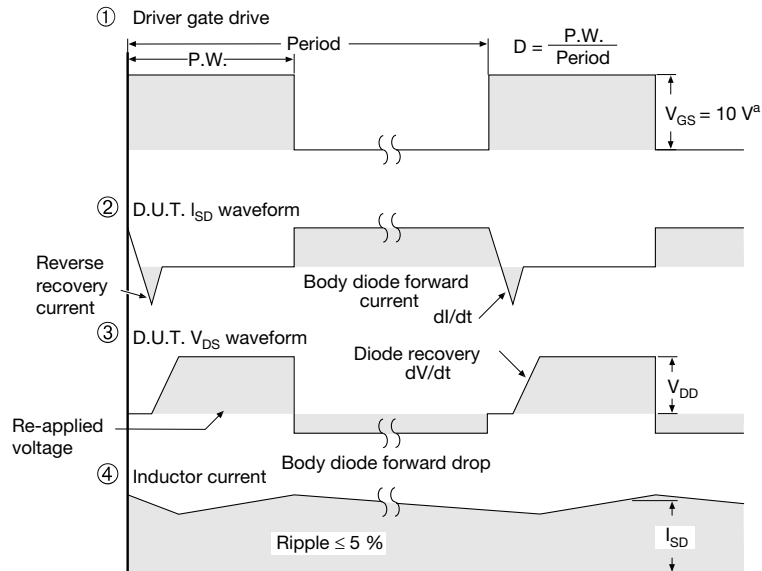
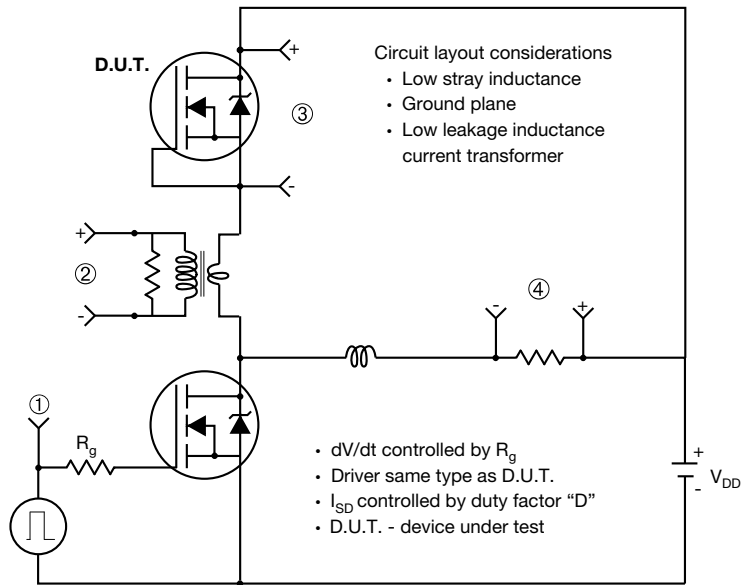


Fig. 13b - Gate Charge Test Circuit

## Peak Diode Recovery $dV/dt$ Test Circuit



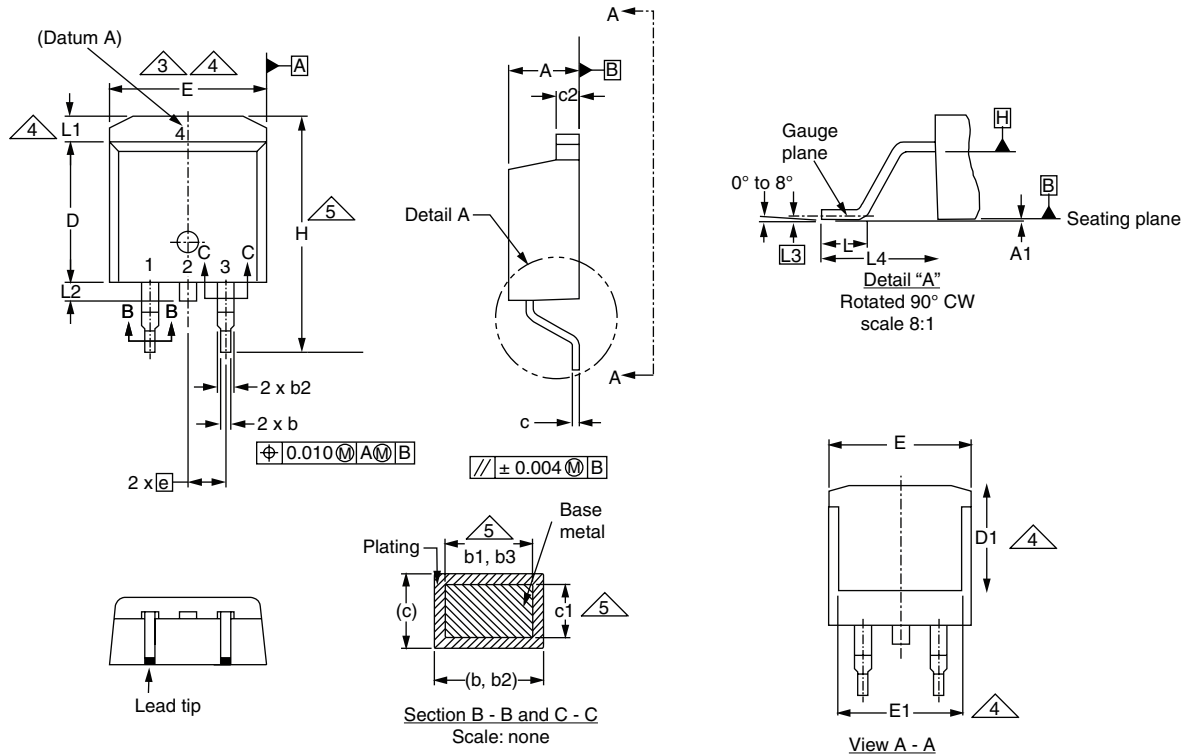
### Note

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

**Fig. 14 - For N-Channel**

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?91018](http://www.vishay.com/ppg?91018).

### TO-263AB (HIGH VOLTAGE)



| DIM. | MILLIMETERS |      | INCHES |       |
|------|-------------|------|--------|-------|
|      | MIN.        | MAX. | MIN.   | MAX.  |
| A    | 4.06        | 4.83 | 0.160  | 0.190 |
| A1   | 0.00        | 0.25 | 0.000  | 0.010 |
| b    | 0.51        | 0.99 | 0.020  | 0.039 |
| b1   | 0.51        | 0.89 | 0.020  | 0.035 |
| b2   | 1.14        | 1.78 | 0.045  | 0.070 |
| b3   | 1.14        | 1.73 | 0.045  | 0.068 |
| c    | 0.38        | 0.74 | 0.015  | 0.029 |
| c1   | 0.38        | 0.58 | 0.015  | 0.023 |
| c2   | 1.14        | 1.65 | 0.045  | 0.065 |
| D    | 8.38        | 9.65 | 0.330  | 0.380 |

| DIM. | MILLIMETERS |       | INCHES    |       |
|------|-------------|-------|-----------|-------|
|      | MIN.        | MAX.  | MIN.      | MAX.  |
| D1   | 6.86        | -     | 0.270     | -     |
| E    | 9.65        | 10.67 | 0.380     | 0.420 |
| E1   | 6.22        | -     | 0.245     | -     |
| e    | 2.54 BSC    |       | 0.100 BSC |       |
| H    | 14.61       | 15.88 | 0.575     | 0.625 |
| L    | 1.78        | 2.79  | 0.070     | 0.110 |
| L1   | -           | 1.65  | -         | 0.066 |
| L2   | -           | 1.78  | -         | 0.070 |
| L3   | 0.25 BSC    |       | 0.010 BSC |       |
| L4   | 4.78        | 5.28  | 0.188     | 0.208 |

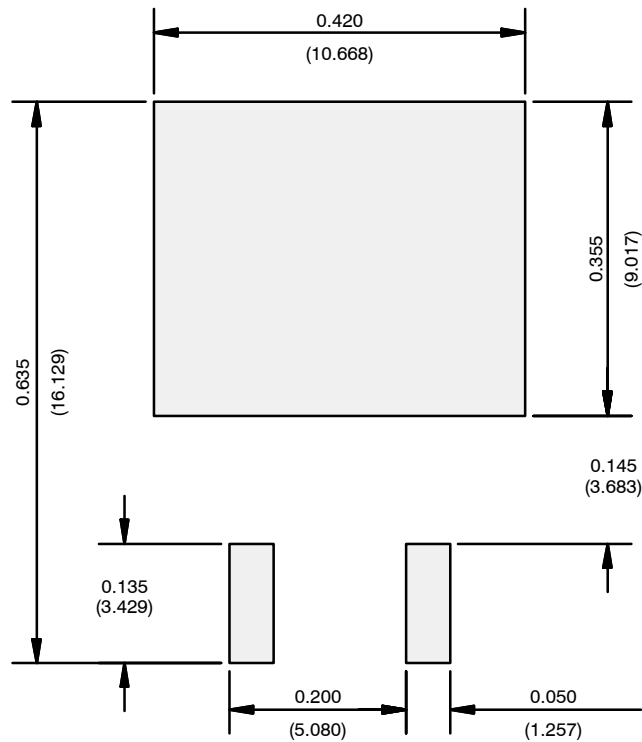
ECN: S-82110-Rev. A, 15-Sep-08  
DWG: 5970

#### Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
5. Dimension b1 and c1 apply to base metal only.
6. Datum A and B to be determined at datum plane H.
7. Outline conforms to JEDEC outline to TO-263AB.



**RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead**



Recommended Minimum Pads  
Dimensions in Inches/(mm)

[Return to Index](#)



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**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**

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- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



## JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели,  
кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



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