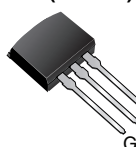
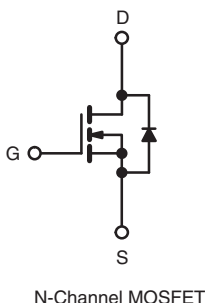
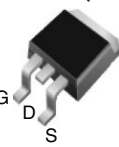


## Power MOSFET

### PRODUCT SUMMARY

|                           |                 |      |
|---------------------------|-----------------|------|
| $V_{DS}$ (V)              | 500             |      |
| $R_{DS(on)}$ ( $\Omega$ ) | $V_{GS} = 10$ V | 0.85 |
| $Q_g$ (Max.) (nC)         | 39              |      |
| $Q_{gs}$ (nC)             | 10              |      |
| $Q_{gd}$ (nC)             | 19              |      |
| Configuration             | Single          |      |

I<sup>2</sup>PAK (TO-262)

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


### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Ultra Low Gate Charge
- Reduced Gate Drive Requirement
- Enhanced 30 V  $V_{GS}$  Rating
- Reduced  $C_{iss}$ ,  $C_{oss}$ ,  $C_{rss}$
- Extremely High Frequency Operation
- Repetitive Avalanche Rated
- Compliant to RoHS Directive 2002/95/EC



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

### DESCRIPTION

This new series of low charge Power MOSFETs achieve significantly lower gate charge than conventional Power MOSFETs. Utilizing the new LCDMOS (low charge device Power MOSFETs) technology, the device improvements are achieved without added product cost, allowing for reduced gate drive requirements and total system savings. In addition, reduced switching losses and improved efficiency are achievable in a variety of high frequency applications. Frequencies of a few MHz at high current are possible using the new low charge Power MOSFETs.

These device improvements combined with the proven ruggedness and reliability that characterize Power MOSFETs offer the designer a new power transistor standard for switching applications.

### ORDERING INFORMATION

|                                 |                             |                             |
|---------------------------------|-----------------------------|-----------------------------|
| Package                         | D <sup>2</sup> PAK (TO-263) | I <sup>2</sup> PAK (TO-262) |
| Lead (Pb)-free and Halogen-free | SiHF840LCS-GE3              | SiHF840LCL-GE3              |
| Lead (Pb)-free                  | IRF840LCSPbF                | IRF840LCLPbF                |
|                                 | SiHF840LCS-E3               | SiHF840LCL-E3               |

#### Note

a. See device orientation.

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

| PARAMETER                                        | SYMBOL           | LIMIT            | UNIT |
|--------------------------------------------------|------------------|------------------|------|
| Drain-Source Voltage                             | $V_{DS}$         | 500              | V    |
| Gate-Source Voltage                              | $V_{GS}$         | $\pm 30$         |      |
| Continuous Drain Current                         | $V_{GS}$ at 10 V | $T_C = 25$ °C    | A    |
|                                                  |                  | $T_C = 100$ °C   |      |
| Pulsed Drain Current <sup>a, e</sup>             | $I_{DM}$         | 28               |      |
| Linear Derating Factor                           |                  | 1.0              | W/°C |
| Single Pulse Avalanche Energy <sup>b, e</sup>    | $E_{AS}$         | 510              | mJ   |
| Avalanche Current <sup>a</sup>                   | $I_{AR}$         | 8.0              | A    |
| Repetitive Avalanche Energy <sup>a</sup>         | $E_{AR}$         | 13               | mJ   |
| Maximum Power Dissipation                        | $T_C = 25$ °C    | 125              | W    |
|                                                  |                  | $T_A = 25$ °C    |      |
| Peak Diode Recovery $dV/dt$ <sup>c, e</sup>      | $dV/dt$          | 3.5              | V/ns |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$   | - 55 to + 150    | °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).
- Starting  $T_J = 25$  °C,  $L = 14$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 8.0$  A (see fig. 12).
- $I_{SD} \leq 8.0$  A,  $dI/dt \leq 100$  A/ $\mu$ s,  $V_{DD} \leq V_{DS}$ ,  $T_J \leq 150$  °C.
- 1.6 mm from case.
- Uses IRF840LC, SiHF840LC data and test conditions.

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

| THERMAL RESISTANCE RATINGS                                           |            |      |      |      |
|----------------------------------------------------------------------|------------|------|------|------|
| PARAMETER                                                            | SYMBOL     | TYP. | MAX. | UNIT |
| Maximum Junction-to-Ambient (PCB Mounted, Steady-State) <sup>a</sup> | $R_{thJA}$ | -    | 40   | °C/W |
| Maximum Junction-to-Case (Drain)                                     | $R_{thJC}$ | -    | 1.0  |      |

## Note

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

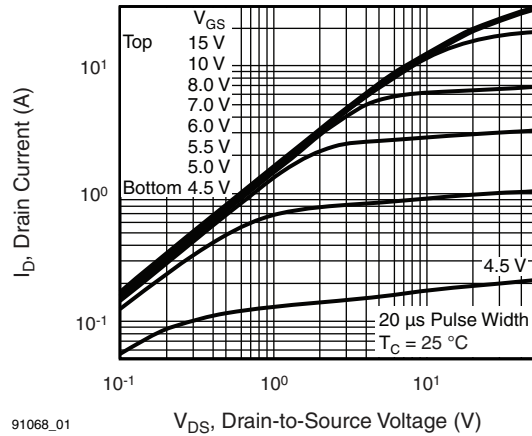
| SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted) |                                  |                                                                                                                                                         |                                                                                       |      |      |       |      |
|-----------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|------|------|-------|------|
| 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                                                                                                            |                                                                                       | 500  | -    | -     | 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 <sup>c</sup>                                                                                                  |                                                                                       | -    | 0.63 | -     | 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> = 500 V, V <sub>GS</sub> = 0 V                                                                                                          |                                                                                       | -    | -    | 25    | μA   |
|                                                                 |                                  | V <sub>DS</sub> = 400 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C                                                                                 |                                                                                       | -    | -    | 250   |      |
| Drain-Source On-State Resistance                                | R <sub>DS(on)</sub>              | V <sub>GS</sub> = 10 V                                                                                                                                  | I <sub>D</sub> = 4.8 A <sup>b</sup>                                                   | -    | -    | 0.85  | Ω    |
| Forward Transconductance                                        | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 4.8 A <sup>b</sup>                                                                                             |                                                                                       | 4.0  | -    | -     | 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 <sup>c</sup>                                                               |                                                                                       | -    | 1100 | -     | pF   |
| Output Capacitance                                              | C <sub>oss</sub>                 |                                                                                                                                                         |                                                                                       | -    | 170  | -     |      |
| Reverse Transfer Capacitance                                    | C <sub>rss</sub>                 |                                                                                                                                                         |                                                                                       | -    | 18   | -     |      |
| Total Gate Charge                                               | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                                                  | I <sub>D</sub> = 8.0 A, V <sub>DS</sub> = 400 V,<br>see fig. 6 and 13 <sup>b, c</sup> | -    | -    | 39    | nC   |
| Gate-Source Charge                                              | Q <sub>gs</sub>                  |                                                                                                                                                         |                                                                                       | -    | -    | 10    |      |
| Gate-Drain Charge                                               | Q <sub>gd</sub>                  |                                                                                                                                                         |                                                                                       | -    | -    | 19    |      |
| Turn-On Delay Time                                              | t <sub>d(on)</sub>               | V <sub>DD</sub> = 250 V, I <sub>D</sub> = 8.0 A,<br>R <sub>g</sub> = 9.1 Ω, R <sub>D</sub> = 30 Ω, see fig. 10 <sup>b, c</sup>                          |                                                                                       | -    | 12   | -     | ns   |
| Rise Time                                                       | t <sub>r</sub>                   |                                                                                                                                                         |                                                                                       | -    | 25   | -     |      |
| Turn-Off Delay Time                                             | t <sub>d(off)</sub>              |                                                                                                                                                         |                                                                                       | -    | 27   | -     |      |
| Fall Time                                                       | t <sub>f</sub>                   |                                                                                                                                                         |                                                                                       | -    | 19   | -     |      |
| Drain-Source Body Diode Characteristics                         |                                  |                                                                                                                                                         |                                                                                       |      |      |       |      |
| Continuous Source-Drain Diode Current                           | I <sub>S</sub>                   | MOSFET symbol showing the integral reverse p - n junction diode<br> |                                                                                       | -    | -    | 8.0   | A    |
| Pulsed Diode Forward Current <sup>a</sup>                       | I <sub>SM</sub>                  |                                                                                                                                                         |                                                                                       | -    | -    | 28    |      |
| Body Diode Voltage                                              | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 8.0 A, V <sub>GS</sub> = 0 V <sup>b</sup>                                                                      |                                                                                       | -    | -    | 2.0   | V    |
| Body Diode Reverse Recovery Time                                | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 8.0 A, dI/dt = 100 A/μs <sup>b, c</sup>                                                                        |                                                                                       | -    | 490  | 740   | ns   |
| Body Diode Reverse Recovery Charge                              | Q <sub>rr</sub>                  |                                                                                                                                                         |                                                                                       | -    | 3.0  | 4.5   | 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

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- Uses SiHF840LC data and test conditions.

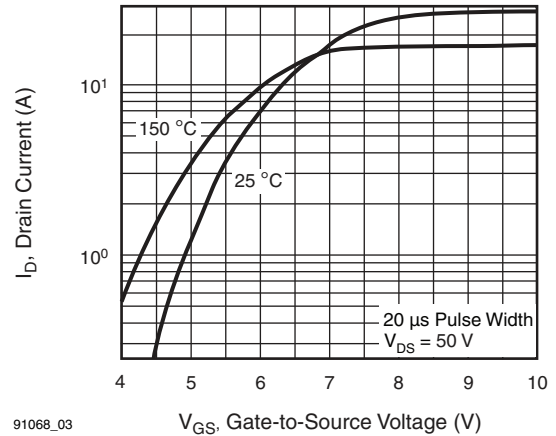


## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



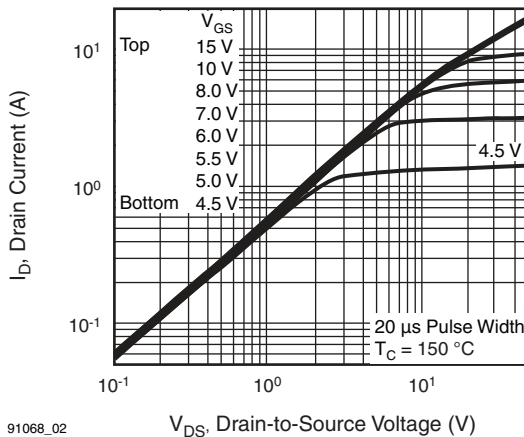
91068\_01

Fig. 1 - Typical Output Characteristics



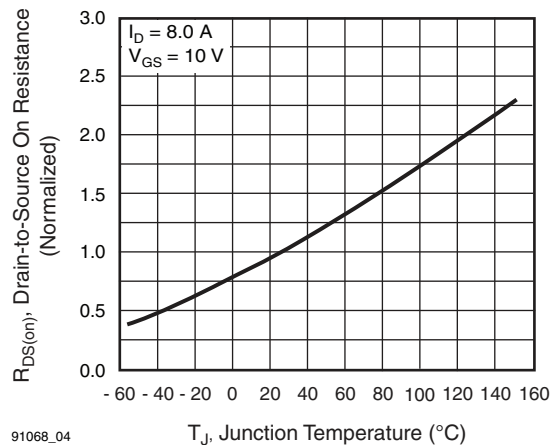
91068\_03

Fig. 3 - Typical Transfer Characteristics



91068\_02

Fig. 2 - Typical Output Characteristics



91068\_04

Fig. 4 - Normalized On-Resistance vs. Temperature

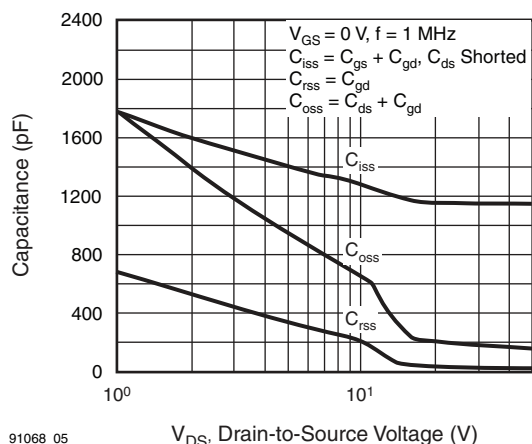


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

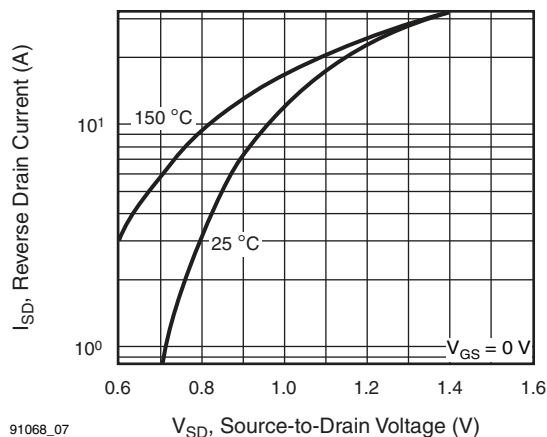


Fig. 7 - Typical Source-Drain Diode Forward Voltage

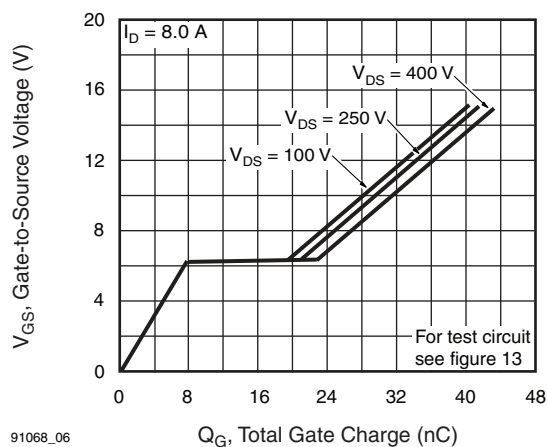


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

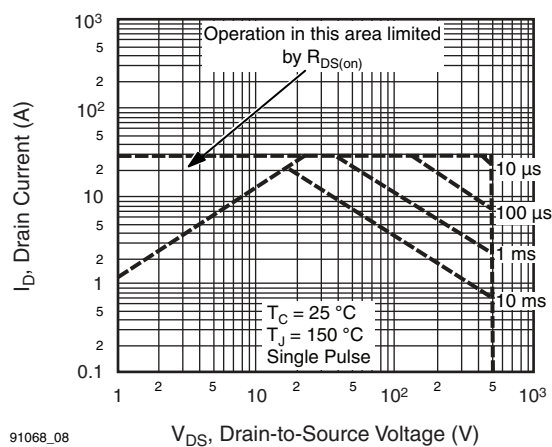
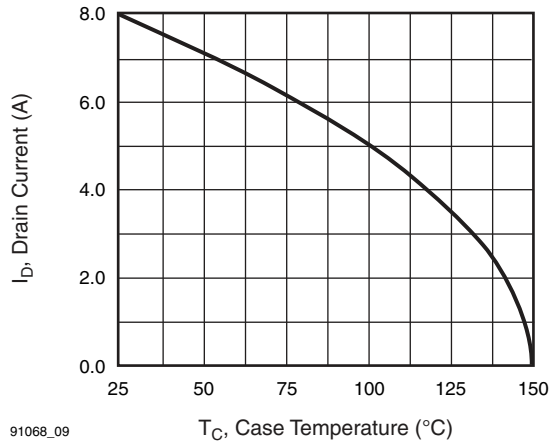
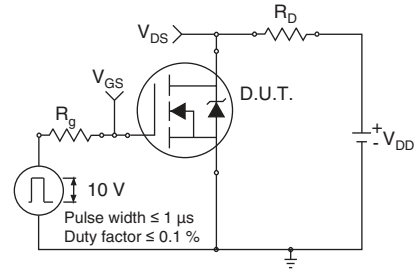


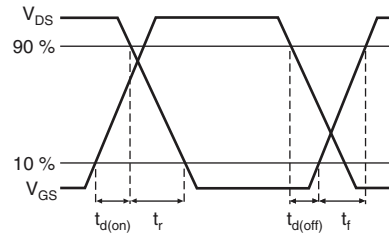
Fig. 8 - Maximum Safe Operating Area



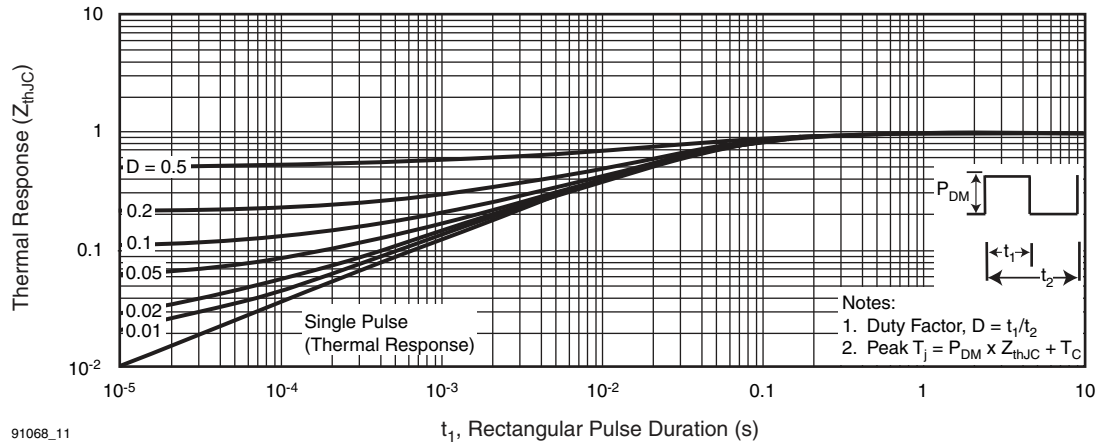
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



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



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



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

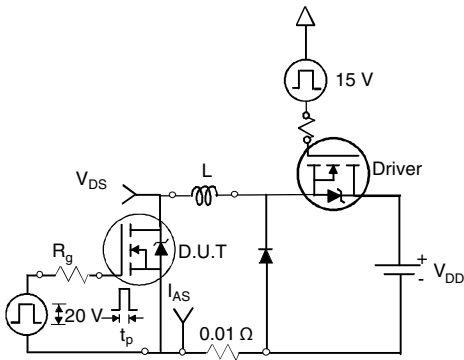


Fig. 12a - Unclamped Inductive Test Circuit

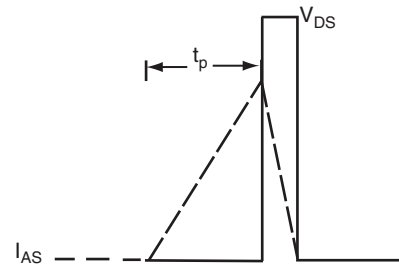


Fig. 12b - Unclamped Inductive Waveforms

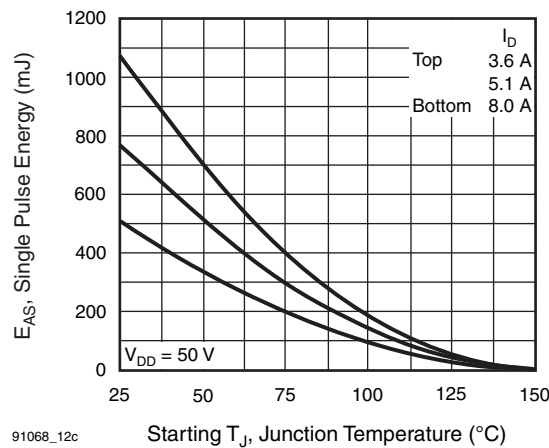


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

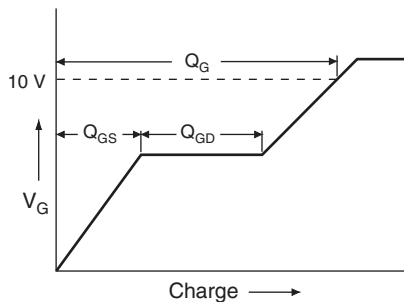


Fig. 13a - Basic Gate Charge Waveform

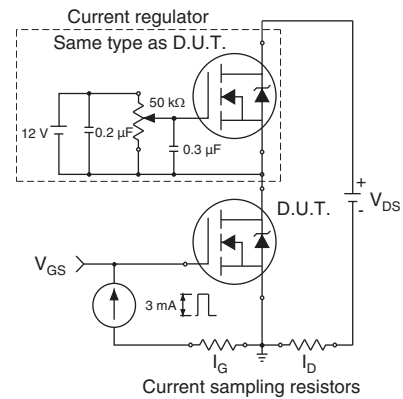
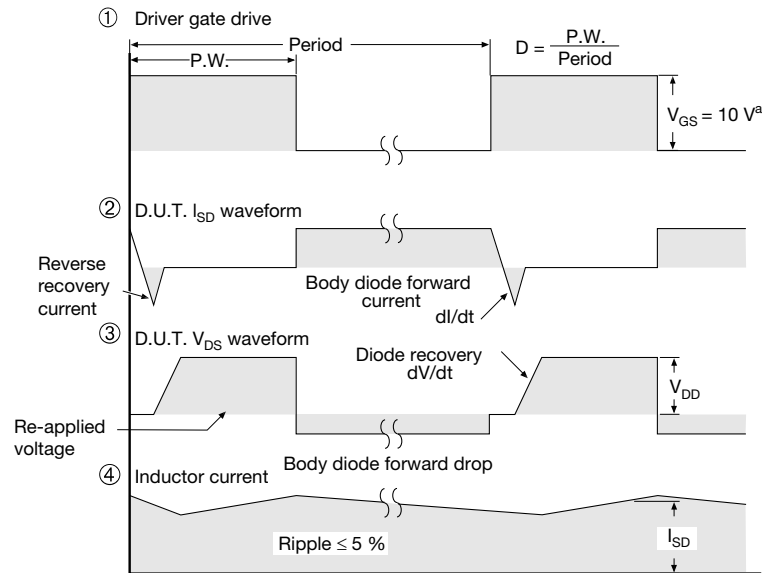
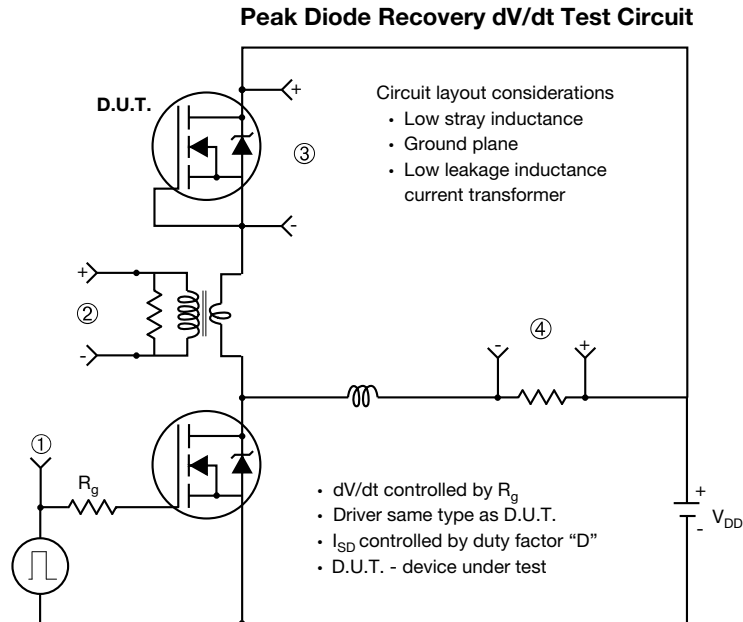


Fig. 13b - Gate Charge Test Circuit



**Note**

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

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

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### 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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**Адрес:** 198099, Санкт-Петербург,  
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помещение 100-Н Офис 331