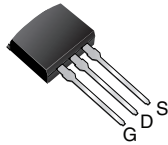
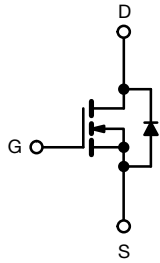
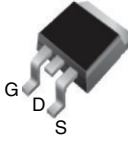


Power MOSFET

 I²PAK (TO-262)

 D²PAK (TO-263)


N-Channel MOSFET

FEATURES

- Surface-mount (IRFBC40S, SiHFBC40S)
- Low-profile through-hole (IRFBC40L, SiHFBC40L)
- Available in tape and reel (IRFBC40S, SiHFBC40S)
- Dynamic dV/dt rating
- 150 °C operating temperature
- Fast switching
- Fully avalanche rated
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS*
Available
HALOGEN FREE
Available

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

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 D²PAK is a surface-mount power package capable of the accommodating die sizes up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface-mount package. The D²PAK 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. The through-hole version (IRFBC40L, SiHFBC40L) is available for low-profile applications.

PRODUCT SUMMARY

| | | |
|--------------------------|------------------------|-----|
| V _{DS} (V) | 600 | |
| R _{DS(on)} (Ω) | V _{GS} = 10 V | 1.2 |
| Q _g max. (nC) | 60 | |
| Q _{gs} (nC) | 8.3 | |
| Q _{gd} (nC) | 30 | |
| Configuration | Single | |

ORDERING INFORMATION

| Package | D ² PAK (TO-263) | D ² PAK (TO-263) | I ² PAK (TO-262) |
|---------------------------------|-----------------------------|-------------------------------|-----------------------------|
| Lead (Pb)-free and Halogen-free | SiHFBC40S-GE3 | SiHFBC40STRL-GE3 ^a | SiHFBC40L-GE3 |
| Lead (Pb)-free | IRFBC40SPbF | IRFBC40STRLPbF ^a | IRFBC40LPbF |

Note

a. See device orientation

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

| PARAMETER | SYMBOL | LIMIT | UNIT |
|---|-----------------------------------|-------------------------|------|
| Drain-source voltage ^e | V _{DS} | 600 | V |
| Gate-source voltage ^e | V _{GS} | ± 20 | |
| Continuous drain current | V _{GS} at 10 V | T _C = 25 °C | 6.2 |
| | | T _C = 100 °C | 3.9 |
| Pulsed drain current ^{a, e} | I _{DM} | 25 | A |
| Linear derating factor | | 1.0 | W/°C |
| Single pulse avalanche energy ^{b, e} | E _{AS} | 570 | mJ |
| Repetitive avalanche current ^a | I _{AR} | 6.2 | A |
| Repetitive avalanche energy ^a | E _{AR} | 13 | mJ |
| Maximum power dissipation | P _D | T _C = 25 °C | 130 |
| | | T _A = 25 °C | 3.1 |
| Peak diode recovery dV/dt ^{c, e} | dV/dt | 3.0 | V/ns |
| Operating junction and storage temperature range | T _J , T _{stg} | -55 to +150 | °C |
| Soldering recommendations (peak temperature) ^d | for 10 s | 300 | |

Notes


- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- V_{DD} = 50 V; starting T_J = 25 °C, L = 27 mH, R_g = 25 Ω, I_{AS} = 6.2 A (see fig. 12)
- I_{SD} ≤ 6.2 A, dI/dt ≤ 80 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C
- 1.6 mm from case
- Uses IRFBC40, SiHFBC40 data and test conditions



| THERMAL RESISTANCE RATINGS | | | | |
|--|-------------------|------|------|------|
| PARAMETER | SYMBOL | TYP. | MAX. | UNIT |
| Maximum junction-to-ambient (PCB mounted, steady-state) ^a | R _{thJA} | - | 40 | °C/W |
| Maximum junction-to-case | R _{thJC} | - | 1.0 | |

Note

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

| 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, I _D = 250 μA | 600 | - | - | V |
| V _{DS} temperature coefficient | ΔV _{DS} /T _J | Reference to 25 °C, I _D = 1 mA | - | 0.70 | - | V/°C |
| Gate-source threshold voltage | 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 |
| Zero gate voltage drain current | I _{DSS} | V _{DS} = 600 V, V _{GS} = 0 V | - | - | 100 | μA |
| | | V _{DS} = 480 V, V _{GS} = 0 V, T _J = 125 °C | - | - | 500 | |
| Drain-source on-state resistance | R _{DS(on)} | V _{GS} = 10 V, I _D = 3.7 A ^b | - | - | 1.2 | Ω |
| Forward transconductance | g _{fs} | V _{DS} = 100 V, I _D = 3.7 A ^b | 4.7 | - | - | S |
| Dynamic | | | | | | |
| Input capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 25 V, f = 1.0 MHz, see fig. 5 ^c | - | 1300 | - | pF |
| Output capacitance | C _{oss} | | - | 160 | - | |
| Reverse transfer capacitance | C _{rss} | | - | 30 | - | |
| Total gate charge | Q _g | V _{GS} = 10 V, I _D = 6.2 A, V _{DS} = 480 V, see fig. 6 and 13 ^{b, c} | - | - | 60 | nC |
| Gate-source charge | Q _{gs} | | - | - | 8.3 | |
| Gate-drain charge | Q _{gd} | | - | - | 30 | |
| Turn-on delay time | t _{d(on)} | V _{DD} = 300 V, I _D = 6.2 A, R _g = 9.1 Ω, R _D = 47 Ω, see fig. 10 ^{b, c} | - | 13 | - | ns |
| Rise time | t _r | | - | 18 | - | |
| Turn-off delay time | t _{d(off)} | | - | 55 | - | |
| Fall time | t _f | | - | 20 | - | |
| Gate input resistance | R _g | f = 1 MHz, open drain | 0.3 | - | 3.9 | Ω |
| Internal source inductance | L _S | Between lead, and center of die contact | - | 7.5 | - | nH |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous source-drain diode current | I _S | MOSFET symbol showing the integral reverse p - n junction diode  | - | - | 6.2 | A |
| Pulsed diode forward current ^a | I _{SM} | | - | - | 25 | |
| Body diode voltage | V _{SD} | T _J = 25 °C, I _S = 6.2 A, V _{GS} = 0 V ^b | - | - | 1.5 | V |
| Body diode reverse recovery time | t _{rr} | T _J = 25 °C, I _F = 6.2 A, dI/dt = 100 A/μs ^b | - | 450 | 940 | ns |
| Body diode reverse recovery charge | Q _{rr} | | - | 3.8 | 7.9 | μC |
| Forward turn-on time | t _{on} | Intrinsic turn-on time is negligible (turn-on is dominated by L _S and L _D) | | | | |

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- b. Pulse width ≤ 300 μs; duty cycle ≤ 2 %
- c. Uses IRFBC40, SiHFBC40 data and test conditions



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

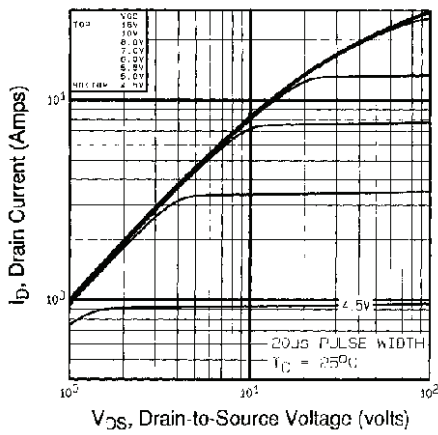


Fig. 1 - Typical Output Characteristics

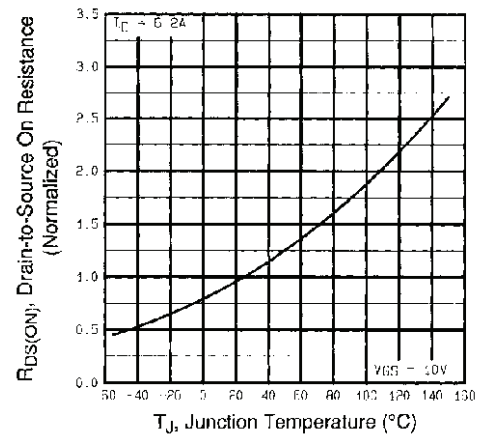


Fig. 4 - Normalized On-Resistance vs. Temperature

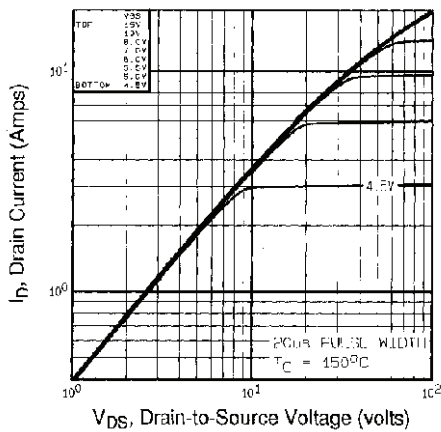


Fig. 2 - Typical Output Characteristics

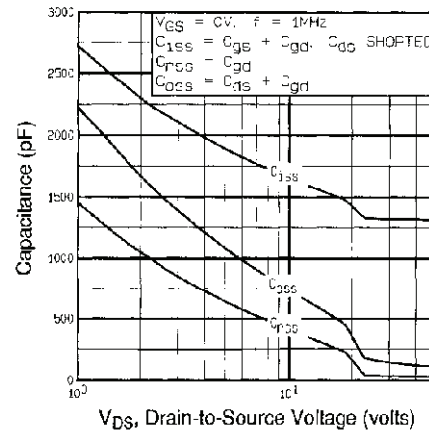


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

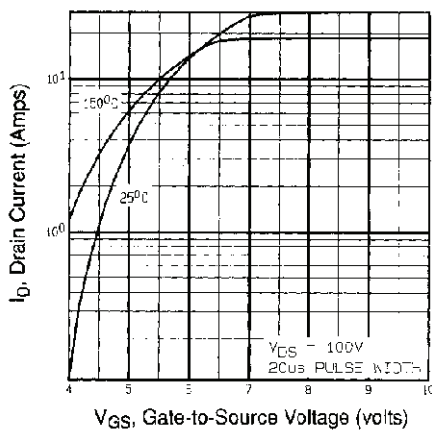


Fig. 3 - Typical Transfer Characteristics

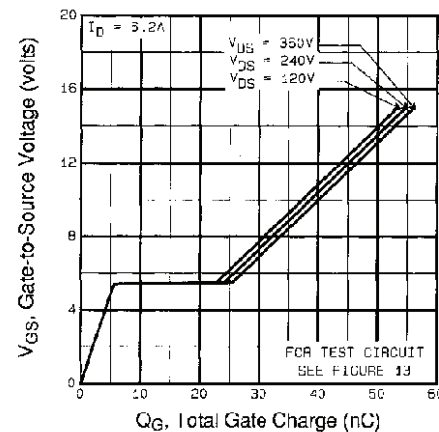


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

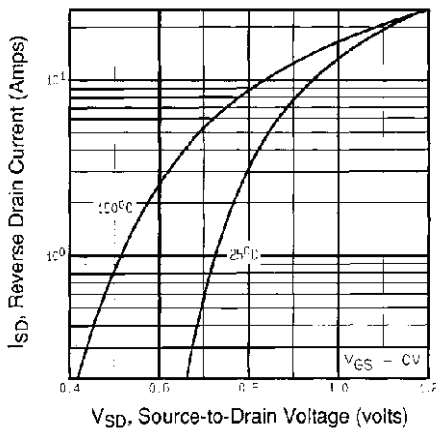


Fig. 7 - Typical Source-Drain Diode Forward Voltage

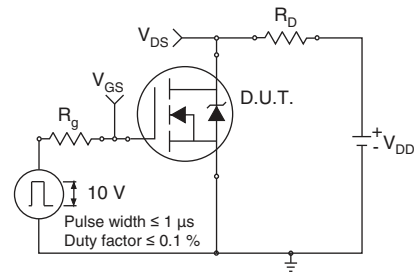


Fig. 10a - Switching Time Test Circuit

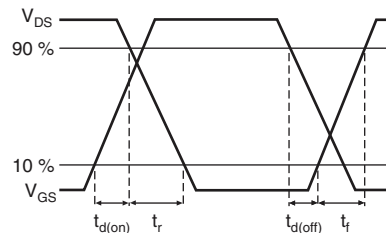


Fig. 10b - Switching Time Waveforms

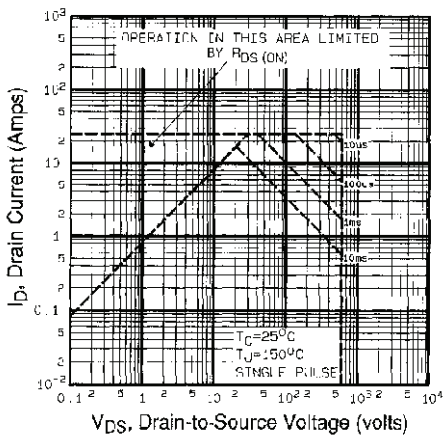


Fig. 8 - Maximum Safe Operating Area

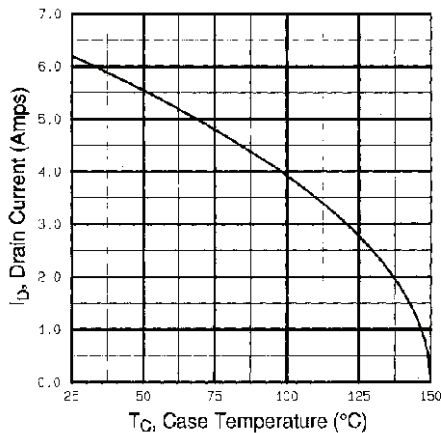


Fig. 9 - Maximum Drain Current vs. Case Temperature

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

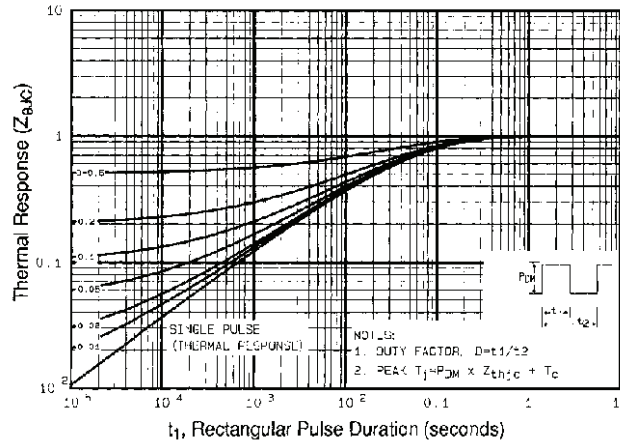


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

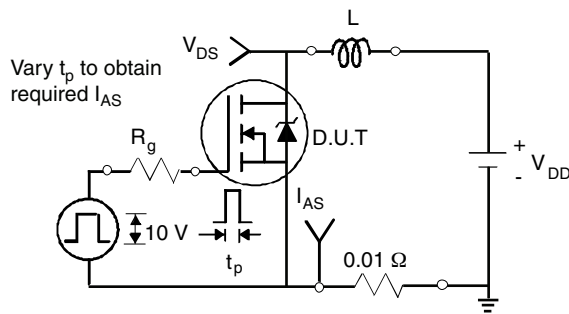


Fig. 12a - Unclamped Inductive Test Circuit

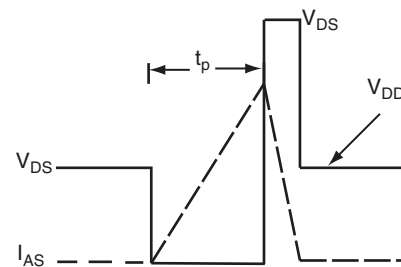


Fig. 12b - Unclamped Inductive Waveforms

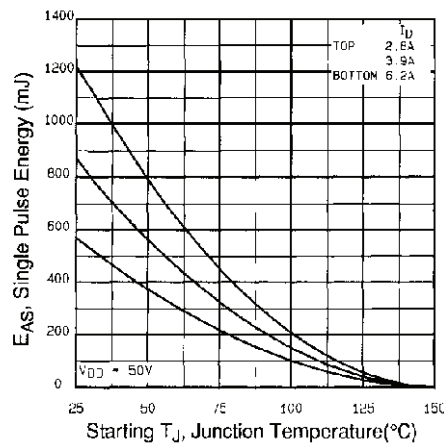
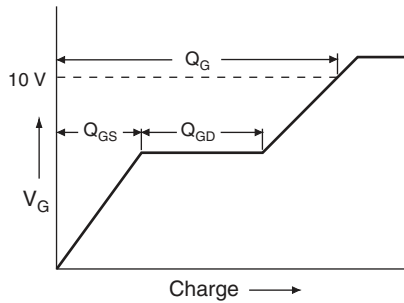
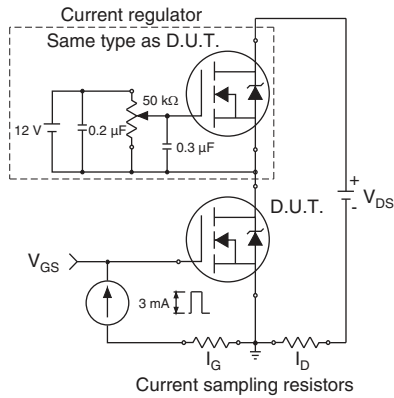
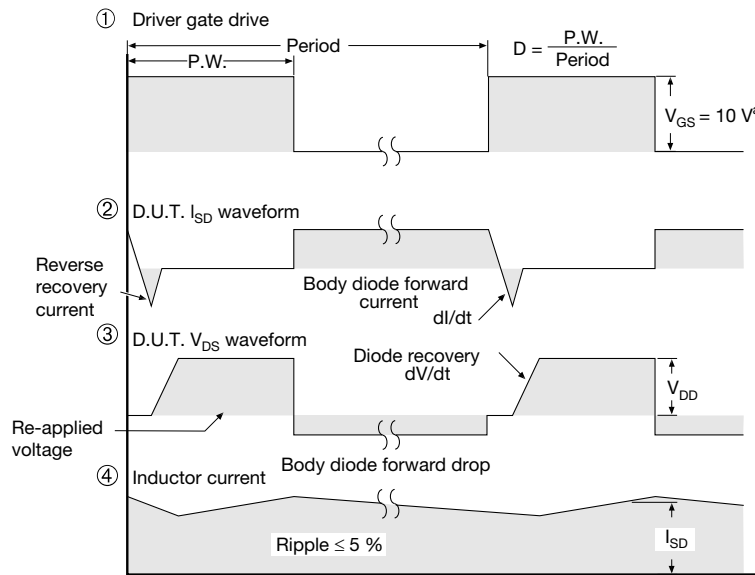
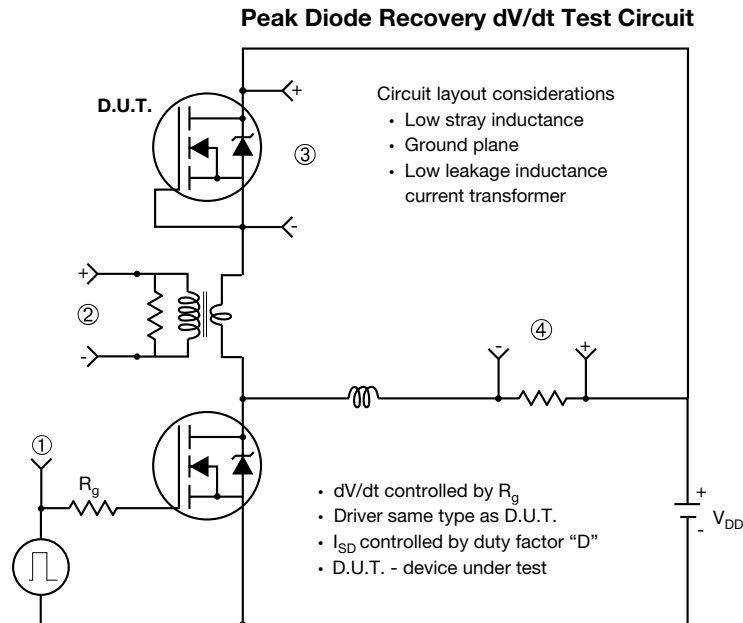


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Fig. 13a - Basic Gate Charge Waveform

Fig. 13b - Gate Charge Test Circuit



Note

a. $V_{GS} = 5 V$ 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.

I²PAK (TO-262) (HIGH VOLTAGE)



| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|------|--------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.06 | 4.83 | 0.160 | 0.190 |
| A1 | 2.03 | 3.02 | 0.080 | 0.119 |
| 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 |

| DIM. | MILLIMETERS | | INCHES | |
|------|-------------|-------|-----------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| D | 8.38 | 9.65 | 0.330 | 0.380 |
| 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 | |
| L | 13.46 | 14.10 | 0.530 | 0.555 |
| L1 | - | 1.65 | - | 0.065 |
| L2 | 3.56 | 3.71 | 0.140 | 0.146 |

ECN: S-82442-Rev. A, 27-Oct-08
DWG: 5977

Notes

1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outmost extremes of the plastic body.
3. Thermal pad contour optional within dimension E, L1, D1, and E1.
4. Dimension b1 and c1 apply to base metal only.

RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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