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# IRFBC30AS, SiHFBC30AS, IRFBC30AL, SiHFBC30AL

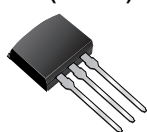
Vishay Siliconix

## Power MOSFET

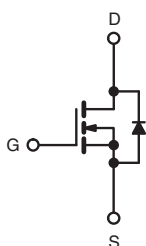
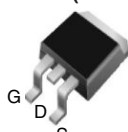
### PRODUCT SUMMARY

|                            |                        |     |
|----------------------------|------------------------|-----|
| V <sub>DS</sub> (V)        | 600                    |     |
| R <sub>DS(on)</sub> (Ω)    | V <sub>GS</sub> = 10 V | 2.2 |
| Q <sub>g</sub> (Max.) (nC) | 23                     |     |
| Q <sub>gs</sub> (nC)       | 5.4                    |     |
| Q <sub>gd</sub> (nC)       | 11                     |     |
| Configuration              | Single                 |     |

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



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



N-Channel MOSFET

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Low Gate Charge Q<sub>g</sub> Results in Simple Drive Requirement
- Improved Gate, Avalanche and Dynamic dV/dt Ruggedness
- Fully Characterized Capacitance and Avalanche Voltage and Current
- Effective C<sub>oss</sub> Specified
- Compliant to RoHS Directive 2002/95/EC



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

### APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply
- High Speed Power Switching

### TYPICAL SMPS TOPOLOGIES

- Single Transistor Flyback

### ORDERING INFORMATION

| Package                         | D <sup>2</sup> PAK (TO-263) | D <sup>2</sup> PAK (TO-263)    | D <sup>2</sup> PAK (TO-263)    | I <sup>2</sup> PAK (TO-262) |
|---------------------------------|-----------------------------|--------------------------------|--------------------------------|-----------------------------|
| Lead (Pb)-free and Halogen-free | SiHFBC30AS-GE3              | SiHFBC30ASTRL-GE3 <sup>a</sup> | SiHFBC30ASTRR-GE3 <sup>a</sup> | SiHFBC30AL-GE3              |
| Lead (Pb)-free                  | IRFBC30ASPbF                | IRFBC30ASTRLPbF <sup>a</sup>   | IRFBC30ASTRRPbF <sup>a</sup>   | IRFBC30ALPbF                |
|                                 | SiHFBC30AS-E3               | SiHFBC30ASTL-E3 <sup>a</sup>   | SiHFBC30ASTR-E3 <sup>a</sup>   | SiHFBC30AL-E3               |

#### Note

a. See device orientation.

### ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25 °C, unless otherwise noted)

| PARAMETER                                        | SYMBOL                            | LIMIT                   | UNIT |
|--------------------------------------------------|-----------------------------------|-------------------------|------|
| Drain-Source Voltage                             | V <sub>DS</sub>                   | 600                     | V    |
| Gate-Source Voltage                              | V <sub>GS</sub>                   | ± 30                    |      |
| Continuous Drain Current                         | V <sub>GS</sub> at 10 V           | T <sub>C</sub> = 25 °C  | A    |
|                                                  |                                   | T <sub>C</sub> = 100 °C |      |
| Pulsed Drain Current <sup>a, e</sup>             | I <sub>DM</sub>                   | 14                      |      |
| Linear Derating Factor                           |                                   | 0.69                    | W/°C |
| Single Pulse Avalanche Energy <sup>b</sup>       | E <sub>AS</sub>                   | 290                     | mJ   |
| Avalanche Current <sup>a</sup>                   | I <sub>AR</sub>                   | 3.6                     | A    |
| Repetitive Avalanche Energy <sup>a</sup>         | E <sub>AR</sub>                   | 7.4                     | mJ   |
| Maximum Power Dissipation                        | P <sub>D</sub>                    | 74                      | W    |
| Peak Diode Recovery dV/dt <sup>c, e</sup>        | dV/dt                             | 7.0                     | V/ns |
| Operating Junction and Storage Temperature Range | T <sub>J</sub> , T <sub>stg</sub> | - 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<sub>J</sub> = 25 °C, L = 46 mH, R<sub>g</sub> = 25 Ω, I<sub>AS</sub> = 3.6 A (see fig. 12).
- I<sub>SD</sub> ≤ 3.6 A, dI/dt ≤ 170 A/μs, V<sub>DD</sub> ≤ V<sub>DS</sub>, T<sub>J</sub> ≤ 150 °C.
- 1.6 mm from case.
- Uses IRFBC30A/SiHFBC30A data and test conditions.

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

# IRFBC30AS, SiHFBC30AS, IRFBC30AL, SiHFBC30AL

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## 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)                                     | $R_{thJC}$ | -    | 1.7  |      |

### Note

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

## SPECIFICATIONS ( $T_J = 25\text{ }^{\circ}\text{C}$ , 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                                                                                                         |                                                                                    | 600  | -    | -     | 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>d</sup>                                                                                               |                                                                                    | -    | 0.67 | -     | 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  | -    | 4.5   | V    |
| Gate-Source Leakage                       | I <sub>GSS</sub>                 | V <sub>GS</sub> = ± 30 V                                                                                                                             |                                                                                    | -    | -    | ± 100 | nA   |
| Zero Gate Voltage Drain Current           | I <sub>DSS</sub>                 | V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0 V                                                                                                       |                                                                                    | -    | -    | 25    | μA   |
|                                           |                                  | V <sub>DS</sub> = 480 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> = 2.2 A <sup>b</sup>                                                | -    | -    | 2.2   | Ω    |
| Forward Transconductance                  | g <sub>fs</sub>                  | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 2.2 A                                                                                                       |                                                                                    | 2.1  | -    | -     | 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                                                                         |                                                                                    | -    | 510  | -     | pF   |
| Output Capacitance                        | C <sub>oss</sub>                 |                                                                                                                                                      |                                                                                    | -    | 70   | -     |      |
| Reverse Transfer Capacitance              | C <sub>rss</sub>                 |                                                                                                                                                      |                                                                                    | -    | 3.5  | -     |      |
| Output Capacitance                        | C <sub>oss</sub>                 | V <sub>GS</sub> = 0 V                                                                                                                                | V <sub>DS</sub> = 1.0 V, f = 1.0 MHz                                               | -    | 730  | -     | pF   |
|                                           |                                  |                                                                                                                                                      | V <sub>DS</sub> = 480 V, f = 1.0 MHz                                               | -    | 19   | -     |      |
| Effective Output Capacitance              | C <sub>oss eff.</sub>            |                                                                                                                                                      | V <sub>DS</sub> = 0 V to 480 V <sup>c</sup>                                        | -    | 31   | -     |      |
| Total Gate Charge                         | Q <sub>g</sub>                   | V <sub>GS</sub> = 10 V                                                                                                                               | I <sub>D</sub> = 3.6 A, V <sub>DS</sub> = 480 V,<br>see fig. 6 and 13 <sup>b</sup> | -    | -    | 23    | nC   |
| Gate-Source Charge                        | Q <sub>gs</sub>                  |                                                                                                                                                      |                                                                                    | -    | -    | 5.4   |      |
| Gate-Drain Charge                         | Q <sub>gd</sub>                  |                                                                                                                                                      |                                                                                    | -    | -    | 11    |      |
| Turn-On Delay Time                        | t <sub>d(on)</sub>               | V <sub>DD</sub> = 300 V, I <sub>D</sub> = 3.6 A,<br>R <sub>g</sub> = 12 Ω, R <sub>D</sub> = 82 Ω, see fig. 10 <sup>b, d</sup>                        |                                                                                    | -    | 9.8  | -     | ns   |
| Rise Time                                 | t <sub>r</sub>                   |                                                                                                                                                      |                                                                                    | -    | 13   | -     |      |
| Turn-Off Delay Time                       | t <sub>d(off)</sub>              |                                                                                                                                                      |                                                                                    | -    | 19   | -     |      |
| Fall Time                                 | t <sub>f</sub>                   |                                                                                                                                                      |                                                                                    | -    | 12   | -     |      |
| Drain-Source Body Diode Characteristics   |                                  |                                                                                                                                                      |                                                                                    |      |      |       |      |
| Continuous Source-Drain Diode Current     | I <sub>S</sub>                   | MOSFET symbol showing the integral reverse p - n junction diode  | -                                                                                  | -    | 3.6  | A     |      |
| Pulsed Diode Forward Current <sup>a</sup> | I <sub>SM</sub>                  |                                                                                                                                                      | -                                                                                  | -    | 14   |       |      |
| Body Diode Voltage                        | V <sub>SD</sub>                  | T <sub>J</sub> = 25 °C, I <sub>S</sub> = 3.6 A, V <sub>GS</sub> = 0 V <sup>b</sup>                                                                   |                                                                                    | -    | -    | 1.6   | V    |
| Body Diode Reverse Recovery Time          | t <sub>rr</sub>                  | T <sub>J</sub> = 25 °C, I <sub>F</sub> = 3.6 A, dI/dt = 100 A/μs <sup>b</sup> ,                                                                      |                                                                                    | -    | 400  | 600   | ns   |
| Body Diode Reverse Recovery Charge        | Q <sub>rr</sub>                  |                                                                                                                                                      |                                                                                    | -    | 1.1  | 1.7   | 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

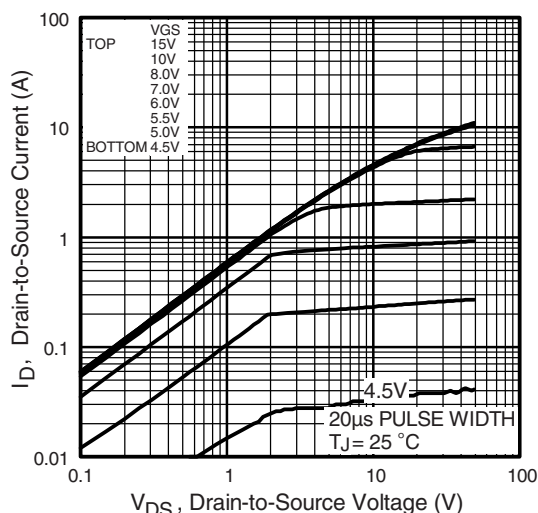
- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- Pulse width  $\leq 300\text{ }\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
- $C_{oss\text{ eff.}}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 80 %  $V_{DS}$ .
- Uses IRFBC30A/SiHFBC30A data and test conditions.



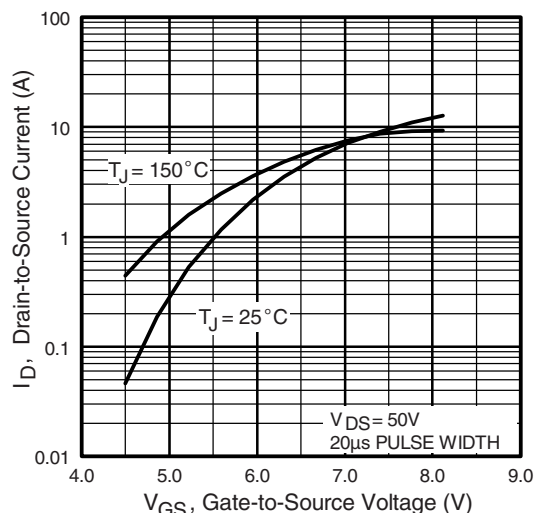
# IRFBC30AS, SiHFBC30AS, IRFBC30AL, SiHFBC30AL

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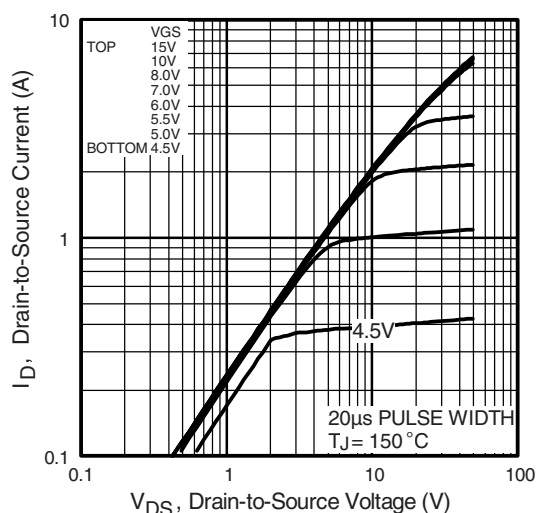
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



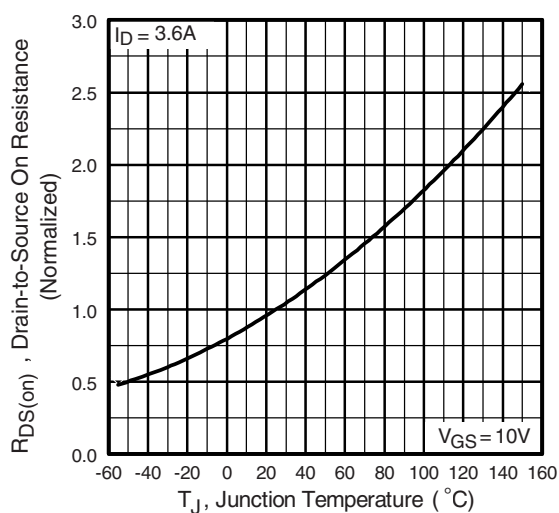
**Fig. 1 - Typical Output Characteristics**



**Fig. 3 - Typical Transfer Characteristics**



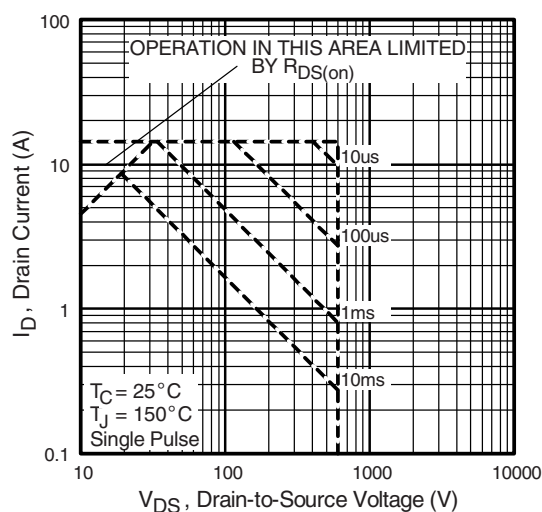
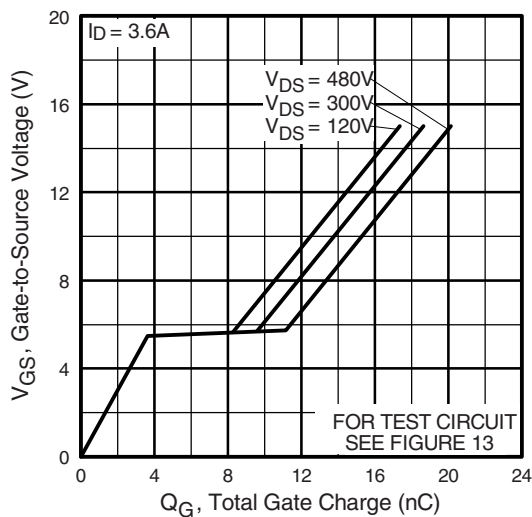
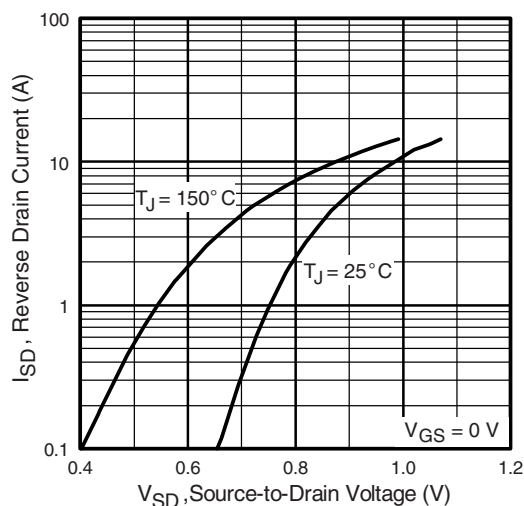
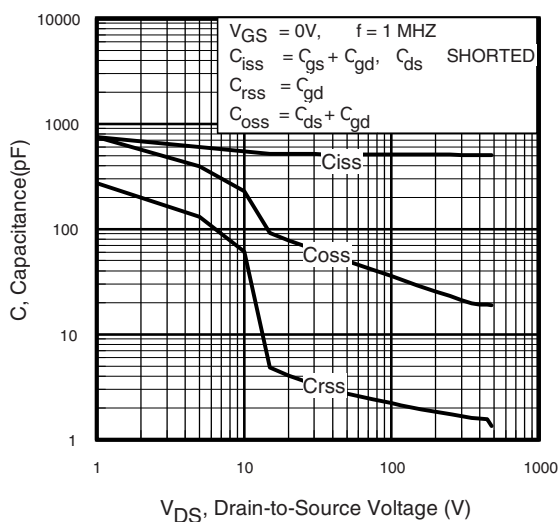
**Fig. 2 - Typical Output Characteristics**



**Fig. 4 - Normalized On-Resistance vs. Temperature**

# IRFBC30AS, SiHFBC30AS, IRFBC30AL, SiHFBC30AL

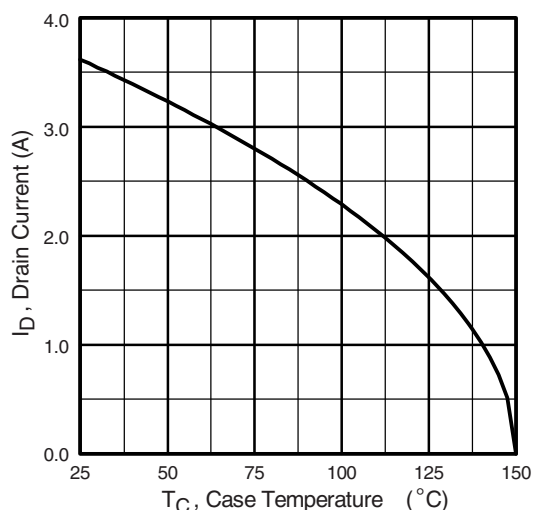
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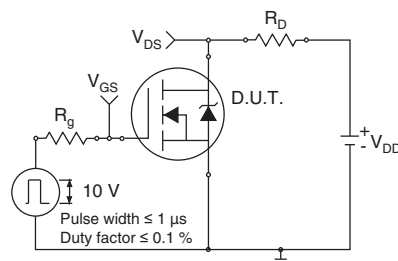


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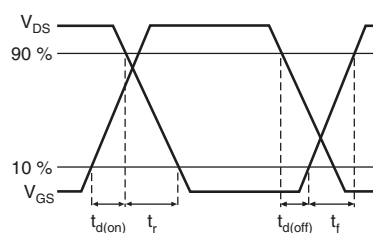
Vishay Siliconix



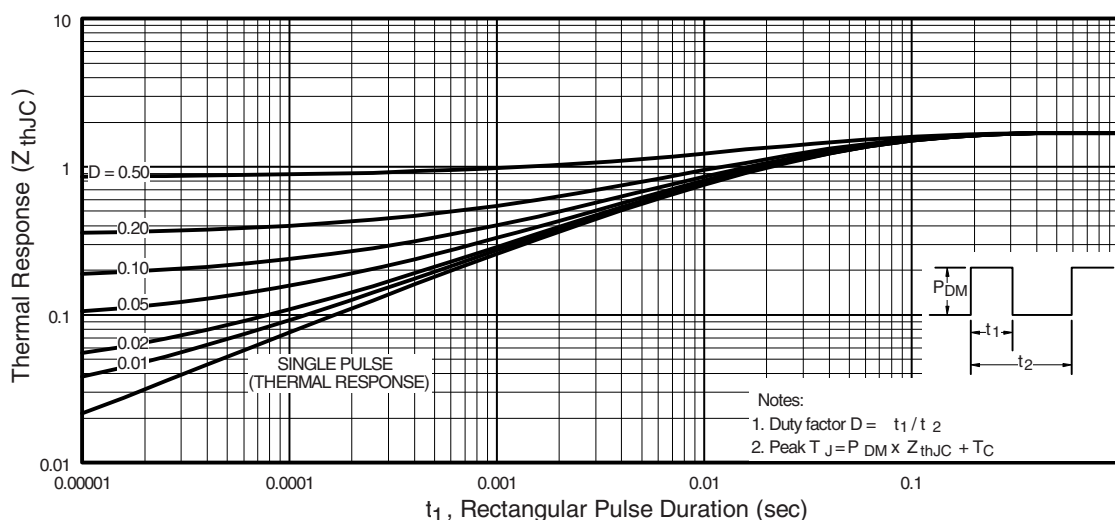
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



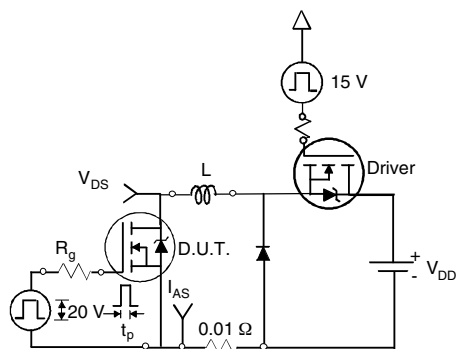
**Fig. 10a - Switching Time Test Circuit**



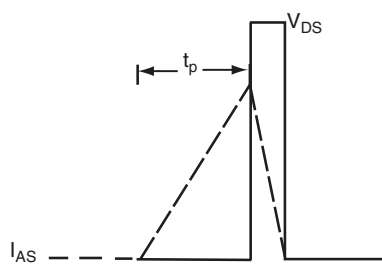
**Fig. 10b - Switching Time Waveforms**



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



**Fig. 12a - Unclamped Inductive Test Circuit**



**Fig. 12b - Unclamped Inductive Waveforms**

# IRFBC30AS, SiHFBC30AS, IRFBC30AL, SiHFBC30AL

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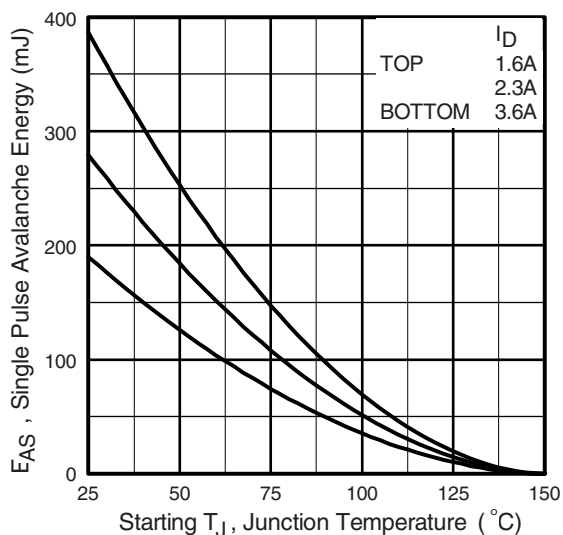


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

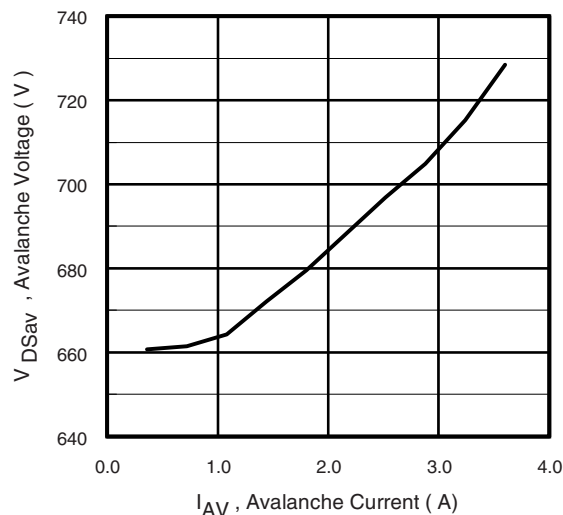


Fig. 12d - Typical Drain-to-Source Voltage vs. Avalanche Current

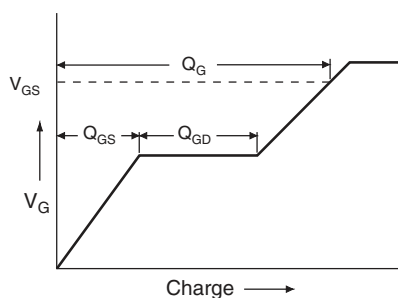


Fig. 13a - Basic Gate Charge Waveform

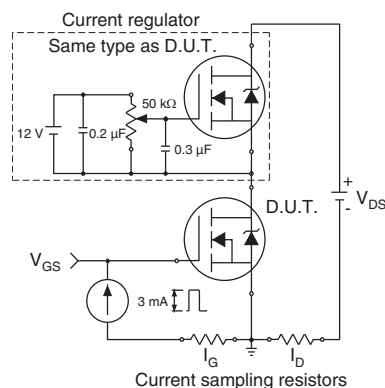


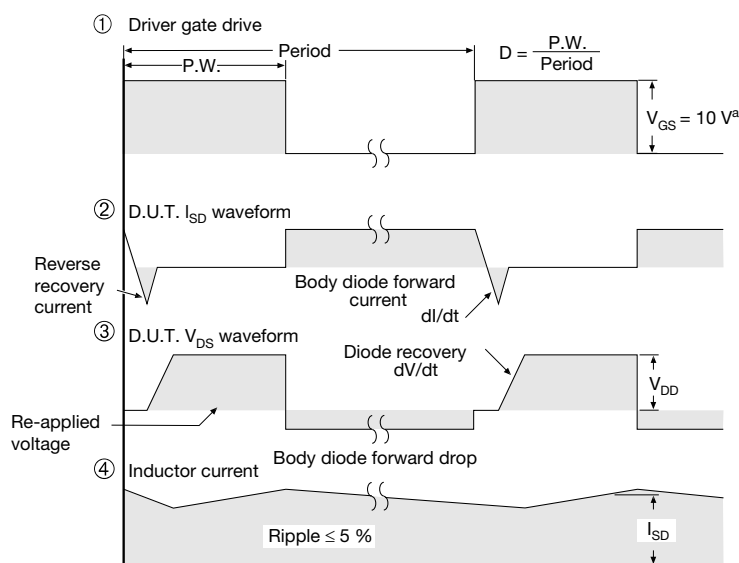
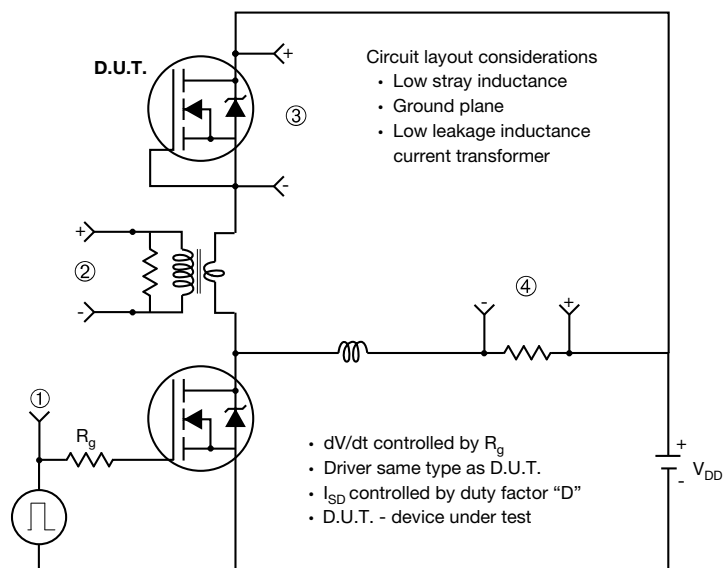
Fig. 13b - Gate Charge Test Circuit



# IRFBC30AS, SiHFBC30AS, IRFBC30AL, SiHFBC30AL

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**Peak Diode Recovery dV/dt Test Circuit**



**Note**

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

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

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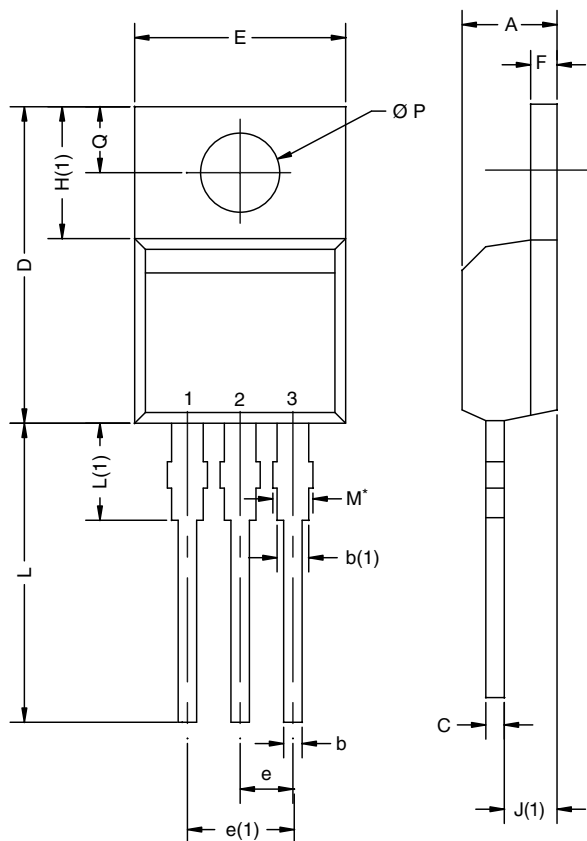


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## Package Information

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### TO-220AB



| DIM. | MILLIMETERS |       | INCHES |       |
|------|-------------|-------|--------|-------|
|      | MIN.        | MAX.  | MIN.   | MAX.  |
| A    | 4.25        | 4.65  | 0.167  | 0.183 |
| b    | 0.69        | 1.01  | 0.027  | 0.040 |
| b(1) | 1.20        | 1.73  | 0.047  | 0.068 |
| c    | 0.36        | 0.61  | 0.014  | 0.024 |
| D    | 14.85       | 15.49 | 0.585  | 0.610 |
| D2   | 12.19       | 12.70 | 0.480  | 0.500 |
| E    | 10.04       | 10.51 | 0.395  | 0.414 |
| e    | 2.41        | 2.67  | 0.095  | 0.105 |
| e(1) | 4.88        | 5.28  | 0.192  | 0.208 |
| F    | 1.14        | 1.40  | 0.045  | 0.055 |
| H(1) | 6.09        | 6.48  | 0.240  | 0.255 |
| J(1) | 2.41        | 2.92  | 0.095  | 0.115 |
| L    | 13.35       | 14.02 | 0.526  | 0.552 |
| L(1) | 3.32        | 3.82  | 0.131  | 0.150 |
| Ø P  | 3.54        | 3.94  | 0.139  | 0.155 |
| Q    | 2.60        | 3.00  | 0.102  | 0.118 |

ECN: T14-0413-Rev. P, 16-Jun-14  
DWG: 5471

#### Note

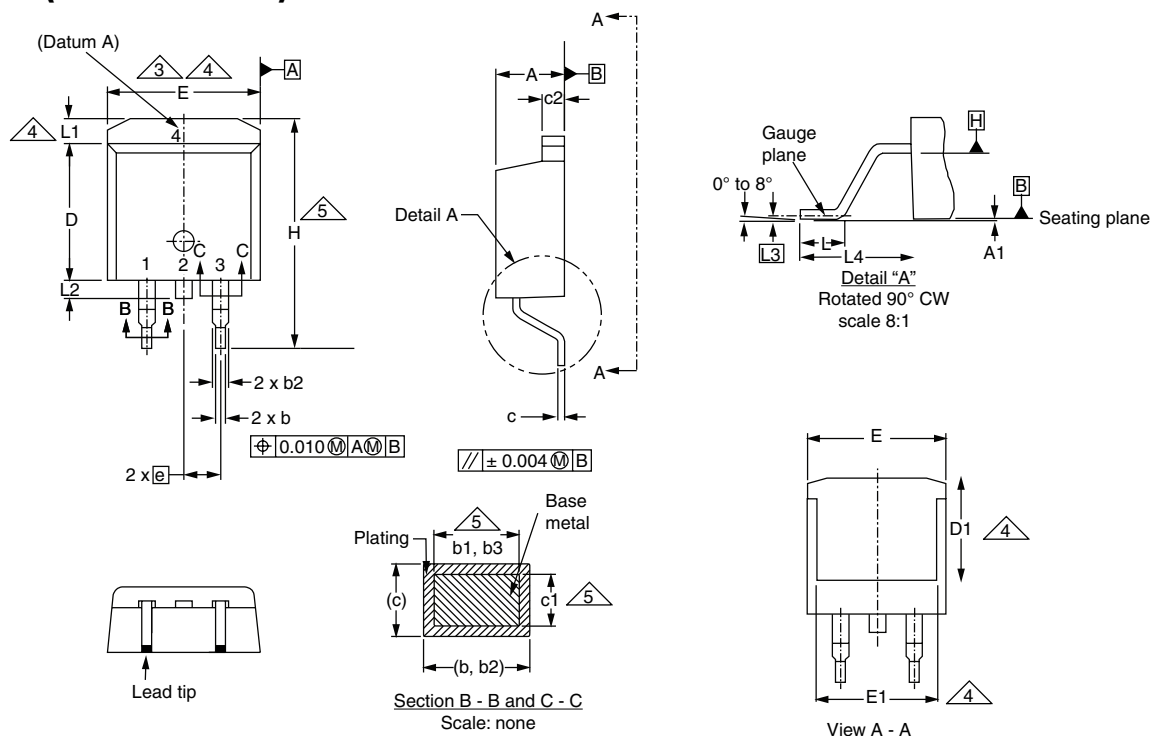
\* M = 1.32 mm to 1.62 mm (dimension including protrusion)  
Heatsink hole for HVM



## Package Information

Vishay Siliconix

### 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

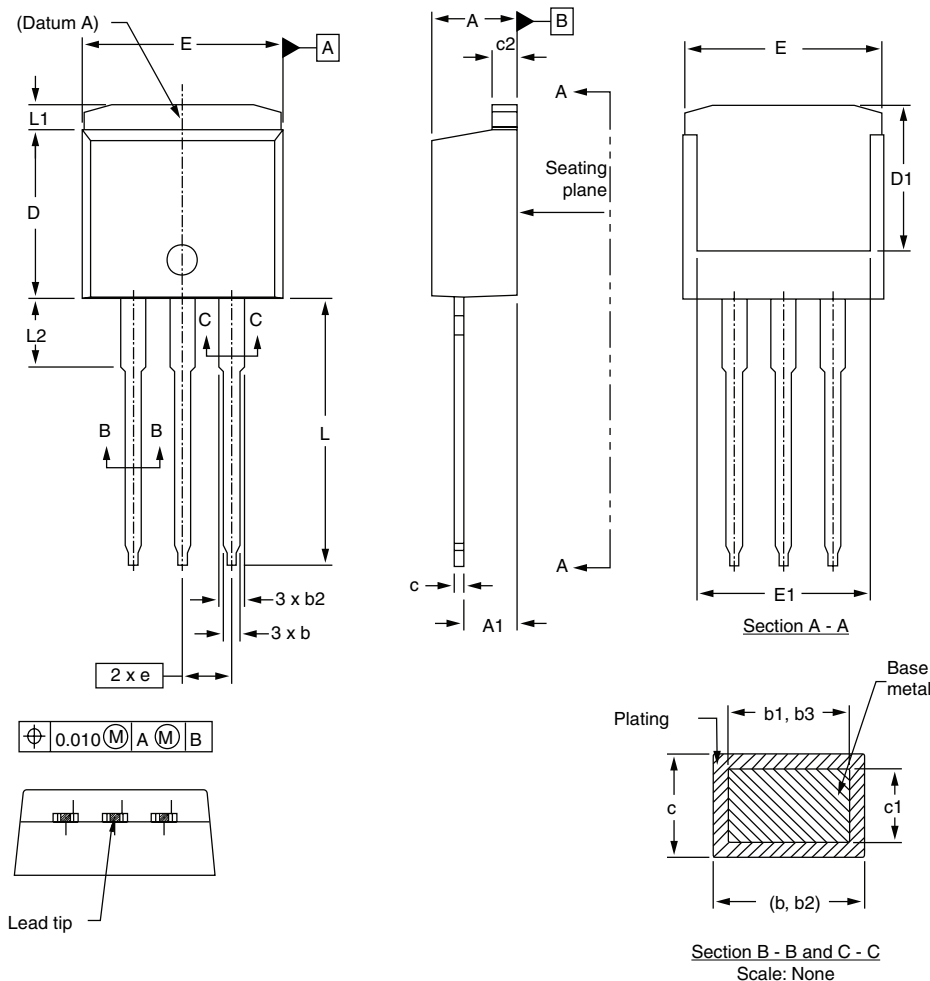
1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimensions are shown in millimeters (inches).
3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
4. Thermal 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.



## Package Information

Vishay Siliconix

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



|      | MILLIMETERS |      | INCHES |       |
|------|-------------|------|--------|-------|
| DIM. | 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 |

|      | MILLIMETERS |       | INCHES    |       |
|------|-------------|-------|-----------|-------|
| DIM. | 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

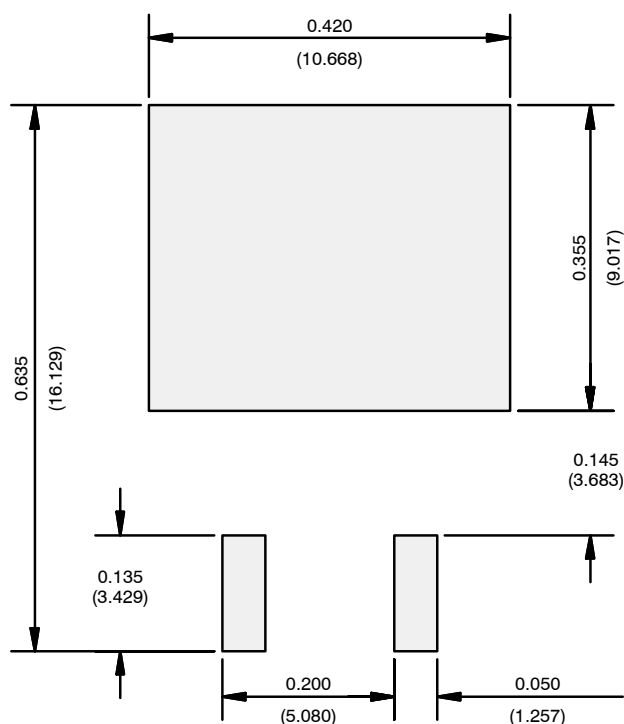
1. Dimensioning and tolerancing per ASME Y14.5M-1994.
2. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outmost extremes of the plastic body.
3. Thermal pad contour optional within dimension E, L1, D1, and E1.
4. Dimension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



**AN826**

**Vishay Siliconix**

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



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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