

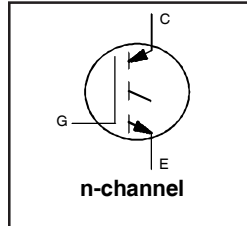
INSULATED GATE BIPOLAR TRANSISTOR

**Features**

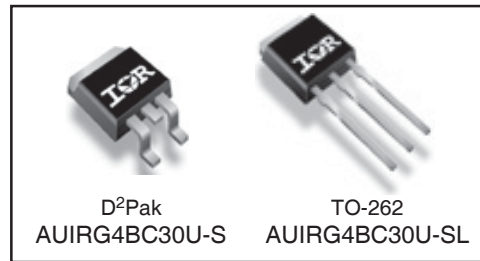
- UltraFast: Optimized for high operating frequencies 8-40 kHz in hard switching, >200 kHz in resonant mode
- Industry standard D<sup>2</sup>Pak & TO-262 package
- Lead-Free, RoHS Compliant
- Automotive Qualified \*

**Benefits**

- Typical Applications: SMPS, PFC



|                             |
|-----------------------------|
| $V_{CES} = 600V$            |
| $V_{CE(on) typ.} = 1.95V$   |
| @ $V_{GE} = 15V, I_C = 12A$ |



|          |           |          |
|----------|-----------|----------|
| <b>G</b> | <b>C</b>  | <b>E</b> |
| Gate     | Collector | Emitter  |

**Absolute Maximum Ratings**

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only; and functional operation of the device at these or any other condition beyond those indicated in the specifications is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions. Ambient temperature ( $T_A$ ) is 25°C, unless otherwise specified

|                           | Parameter   | Max.         | Units |
|---------------------------|---|--------------|-------|
| $V_{CES}$                 | Collector-to-Emitter Breakdown Voltage              | 600          | V     |
| $I_C @ T_C = 25^\circ C$  | Continuous Collector Current                        | 23           | A     |
| $I_C @ T_C = 100^\circ C$ | Continuous Collector Current                        | 12           |       |
| $I_{CM}$                  | Pulsed Collector Current ①                          | 92           |       |
| $I_{LM}$                  | Clamped Inductive Load Current ②                    | 92           |       |
| $V_{GE}$                  | Gate-to-Emitter Voltage                             | ± 20         | V     |
| $E_{ARV}$                 | Reverse Voltage Avalanche Energy ③                  | 10           | mJ    |
| $P_D @ T_C = 25^\circ C$  | Maximum Power Dissipation                           | 100          | W     |
| $P_D @ T_C = 100^\circ C$ | Maximum Power Dissipation                           | 42           |       |
| $T_J$<br>$T_{STG}$        | Operating Junction and<br>Storage Temperature Range | -55 to + 150 | °C    |

**Thermal Resistance**

|                 | Parameter   | Typ. | Max. | Units |
|-----------------|---|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case                                    | —    | 1.2  | °C/W  |
| $R_{\theta JA}$ | Junction-to-Ambient, ( PCB Mounted, steady-state)** | —    | 40   |       |

\* \* When mounted on 1" square PCB (FR-4 or G-10 Material ). For recommended footprint and soldering techniques refer to application note #AN-994.

\* Qualification standards can be found at <http://www.irf.com/>

## Dynamic Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

|                                 | Parameter   | Min. | Typ. | Max.      | Units   | Conditions  |
|---------------------------------|---|------|------|-----------|---------|---|
| $V_{(BR)CES}$                   | Collector-to-Emitter Breakdown Voltage              | 600  | —    | —         | V       | $V_{GE} = 0V, I_C = 250\mu A$                         |
| $V_{(BR)ECS}$                   | Emitter-to-Collector Breakdown Voltage <sup>④</sup> | 18   | —    | —         | V       | $V_{GE} = 0V, I_C = 1.0A$                             |
| $\Delta V_{(BR)CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage             | —    | 0.63 | —         | V/°C    | $V_{GE} = 0V, I_C = 1.0mA$                            |
| $V_{CE(ON)}$                    | Collector-to-Emitter Saturation Voltage             | —    | 1.95 | 2.1       | V       | $I_C = 12A, V_{GE} = 15V$                             |
|                                 |   | —    | 2.52 | —         |         | $I_C = 23A$   |
|                                 |   | —    | 2.09 | —         |         | $I_C = 12A, T_J = 150^\circ\text{C}$                  |
| $V_{GE(th)}$                    | Gate Threshold Voltage                              | 3.0  | —    | 6.0       |         | $V_{CE} = V_{GE}, I_C = 250\mu A$                     |
| $\Delta V_{GE(th)}/\Delta T_J$  | Temperature Coeff. of Threshold Voltage             | —    | -13  | —         | mV/°C   | $V_{CE} = V_{GE}, I_C = 250\mu A$                     |
| $g_{fe}$                        | Forward Transconductance <sup>⑤</sup>               | 3.1  | 8.6  | —         | S       | $V_{CE} = 100V, I_C = 12A$                            |
| $I_{CES}$                       | Zero Gate Voltage Collector Current                 | —    | —    | 250       | $\mu A$ | $V_{GE} = 0V, V_{CE} = 600V$                          |
|                                 |   | —    | —    | 2.0       |         | $V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$   |
|                                 |   | —    | —    | 1000      |         | $V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$ |
| $I_{GES}$                       | Gate-to-Emitter Leakage Current                     | —    | —    | $\pm 100$ | nA      | $V_{GE} = \pm 20V$                                    |

## Static or Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

|              | Parameter                         | Min. | Typ. | Max. | Units | Conditions  |
|--------------|-----------------------------------|------|------|------|-------|---|
| $Q_g$        | Total Gate Charge (turn-on)       | —    | 50   | 75   | nC    | $I_C = 12A$<br>$V_{CC} = 400V$<br>$V_{GE} = 15V$<br>See Fig.8   |
| $Q_{ge}$     | Gate - Emitter Charge (turn-on)   | —    | 8.1  | 12   |       |   |
| $Q_{gc}$     | Gate - Collector Charge (turn-on) | —    | 18   | 27   |       |   |
| $t_{d(on)}$  | Turn-On Delay Time                | —    | 17   | —    | ns    | $T_J = 25^\circ\text{C}$<br>$I_C = 12A, V_{CC} = 480V$<br>$V_{GE} = 15V, R_G = 23\Omega$<br>Energy losses include "tail"<br>See Fig. 10, 11, 13, 14 |
| $t_r$        | Rise Time                         | —    | 9.6  | —    |       |   |
| $t_{d(off)}$ | Turn-Off Delay Time               | —    | 78   | 120  |       |   |
| $t_f$        | Fall Time                         | —    | 97   | 150  |       |   |
| $E_{on}$     | Turn-On Switching Loss            | —    | 0.16 | —    | mJ    | See Fig. 10, 11, 13, 14   |
| $E_{off}$    | Turn-Off Switching Loss           | —    | 0.20 | —    |       |   |
| $E_{ts}$     | Total Switching Loss              | —    | 0.36 | 0.50 |       |   |
| $t_{d(on)}$  | Turn-On Delay Time                | —    | 20   | —    | ns    | $T_J = 150^\circ\text{C}$ ,<br>$I_C = 12A, V_{CC} = 480V$<br>$V_{GE} = 15V, R_G = 23\Omega$<br>Energy losses include "tail"<br>See Fig. 13, 14      |
| $t_r$        | Rise Time                         | —    | 13   | —    |       |   |
| $t_{d(off)}$ | Turn-Off Delay Time               | —    | 180  | —    |       |   |
| $t_f$        | Fall Time                         | —    | 140  | —    |       |   |
| $E_{ts}$     | Total Switching Loss              | —    | 0.73 | —    | mJ    |   |
| $L_E$        | Internal Source Inductance        | —    | 7.5  | —    | nH    | Measured 5mm from package   |
| $C_{ies}$    | Input Capacitance                 | —    | 1100 | —    | pF    | $V_{GE} = 0V$<br>$V_{CC} = 30V$<br>$f = 1.0MHz$<br>See Fig.7  |
| $C_{oes}$    | Output Capacitance                | —    | 73   | —    |       |   |
| $C_{res}$    | Reverse Transfer Capacitance      | —    | 14   | —    |       |   |

### Notes:

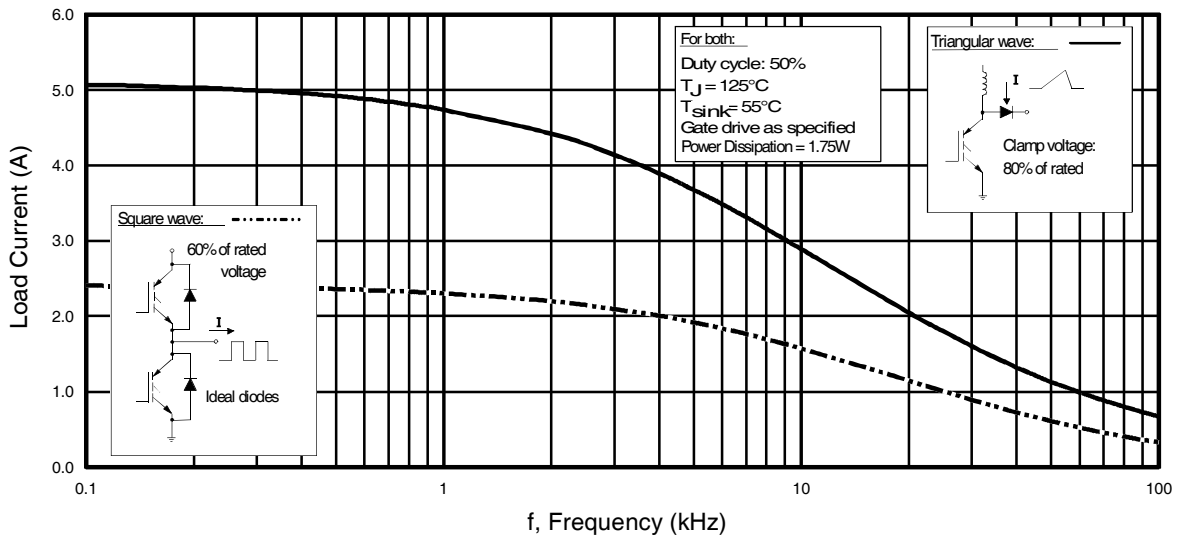
- ① Repetitive rating;  $V_{GE} = 20V$ , pulse width limited by max. junction temperature. ( See fig. 13b )
- ②  $V_{CC} = 80\%(V_{CES})$ ,  $V_{GE} = 20V$ ,  $L = 10\mu H$ ,  $R_G = 23\Omega$ , (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width  $\leq 80\mu s$ ; duty factor  $\leq 0.1\%$ .
- ⑤ Pulse width  $5.0\mu s$ , single shot.

## Qualification Information<sup>†</sup>

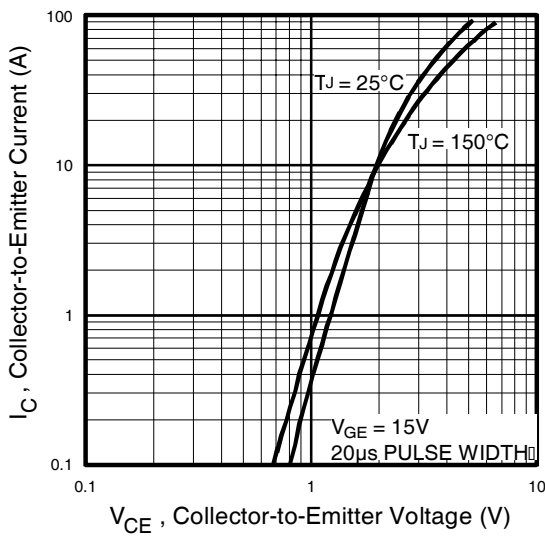
|                                   |                      |   |      |
|-----------------------------------|----------------------|---|------|
| <b>Qualification Level</b>        |                      | Automotive<br>(per AEC-Q101) <sup>††</sup>  |      |
|                                   |                      | Comments: This part number(s) passed Automotive qualification. IR's Industrial and Consumer qualification level is granted by extension of the higher Automotive level. |      |
| <b>Moisture Sensitivity Level</b> |                      | D <sup>2</sup> PAK  | MSL1 |
|                                   |                      | TO-262  | N/A  |
| <b>ESD</b>                        | Machine Model        | Class M4 (+/-450V)<br>AEC-Q101-002  |      |
|                                   | Human Body Model     | Class H1C (+/-1750V)<br>AEC-Q101-001  |      |
|                                   | Charged Device Model | Class C5 (+/-1000V)<br>AEC-Q101-005   |      |
| <b>RoHS Compliant</b>             |                      | Yes   |      |

† Qualification standards can be found at International Rectifier's web site: <http://www.irf.com>

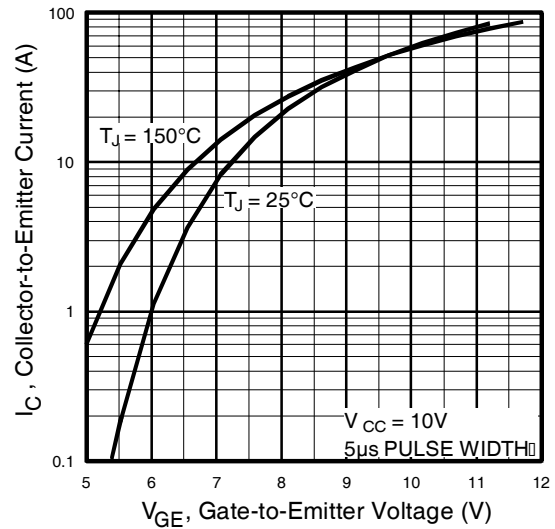
†† Exceptions to AEC-Q101 requirements are noted in the qualification report.



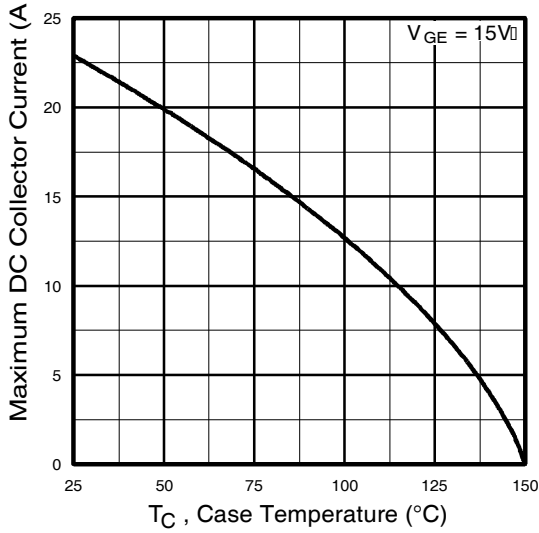
**Fig. 1 - Typical Load Current vs. Frequency**  
(For square wave,  $I = I_{RMS}$  of fundamental; for triangular wave,  $I = I_{PK}$ )



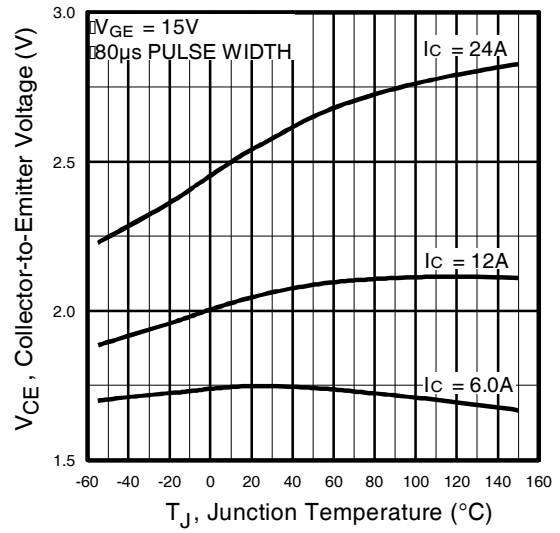
**Fig. 2 - Typical Output Characteristics**



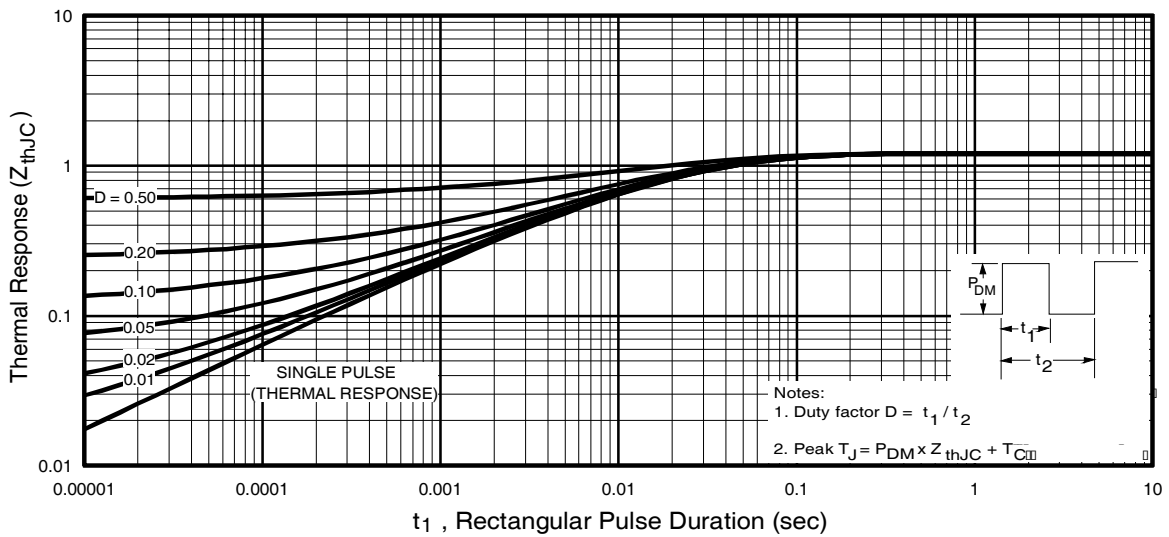
**Fig. 3 - Typical Transfer Characteristics**



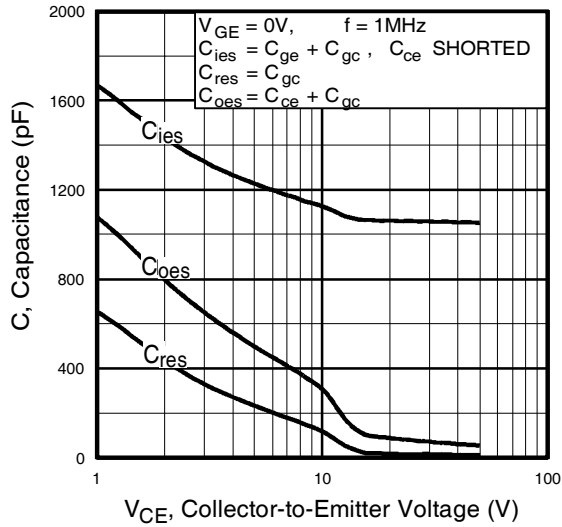
**Fig. 4 - Maximum Collector Current vs. Case Temperature**



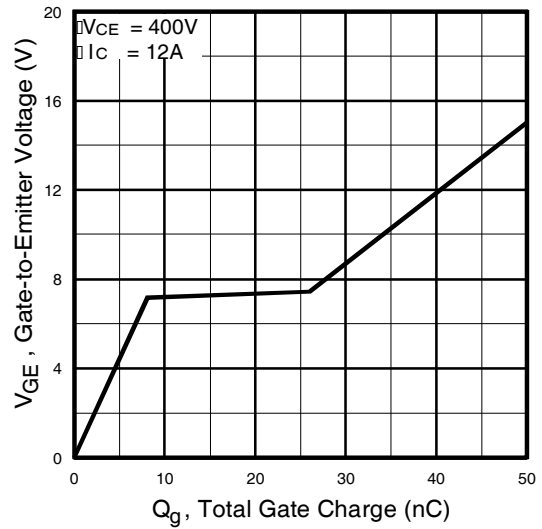
**Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature**



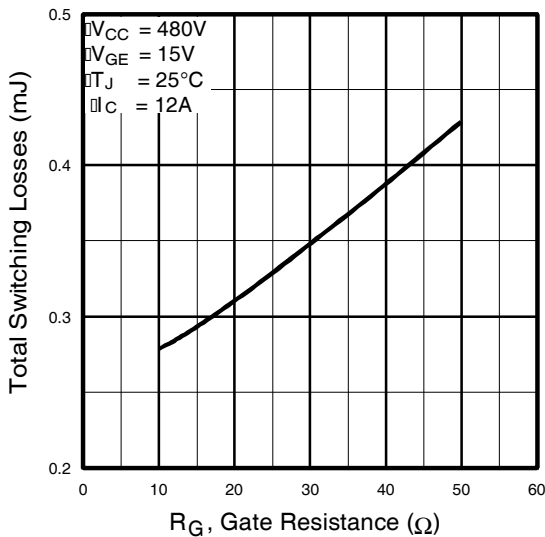
**Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case**



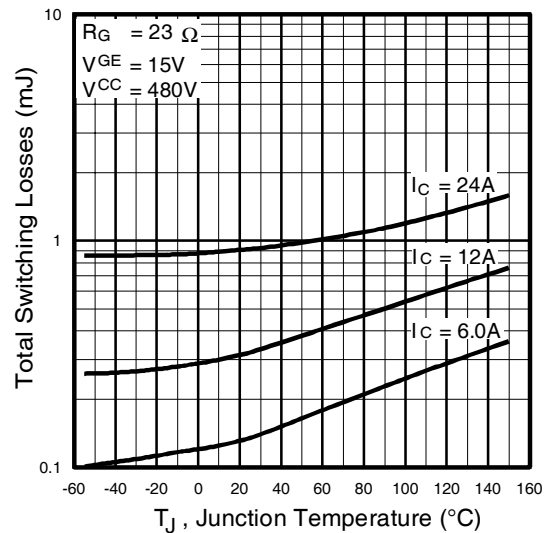
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



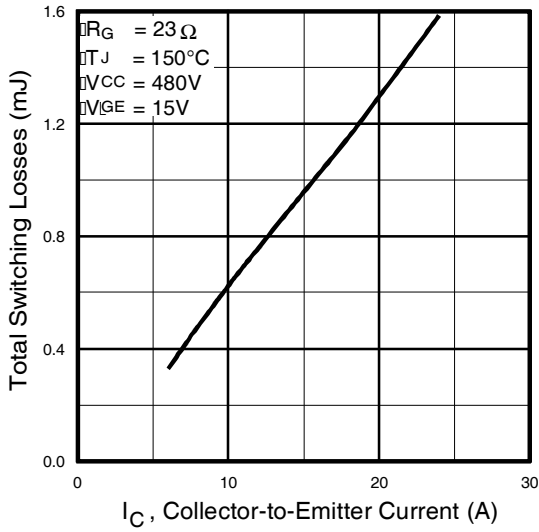
**Fig. 8** - Typical Gate Charge vs. Gate-to-Emitter Voltage



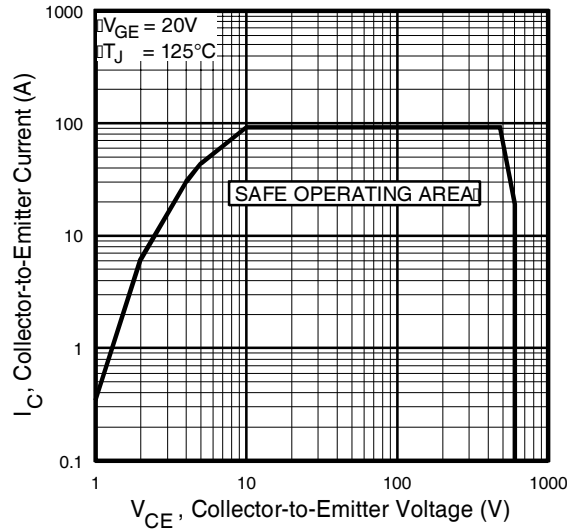
**Fig. 9** - Typical Switching Losses vs. Gate Resistance



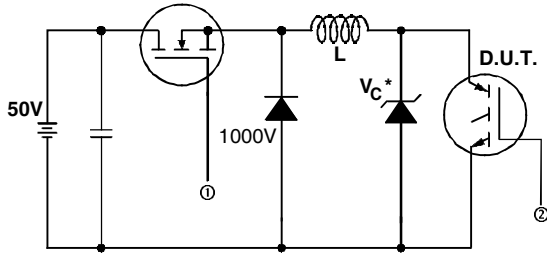
**Fig. 10** - Typical Switching Losses vs. Junction Temperature



**Fig. 11** - Typical Switching Losses vs. Collector-to-Emitter Current

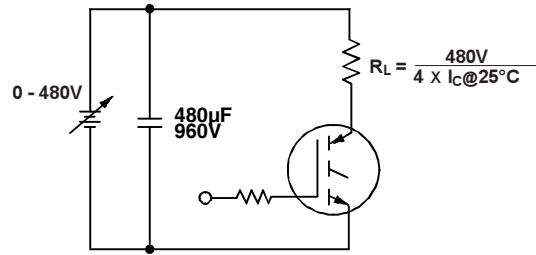


**Fig. 12** - Turn-Off SOA

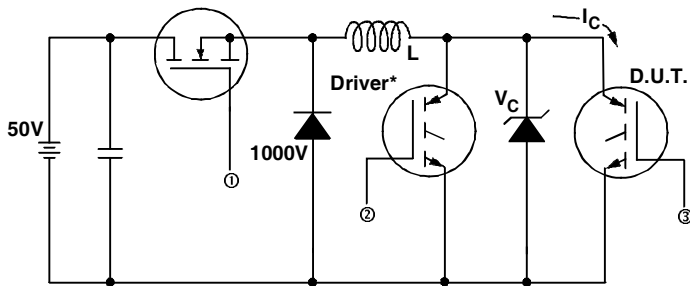


\* Driver same type as D.U.T.;  $V_c = 80\%$  of  $V_{ce(max)}$   
 \* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated  $I_d$ .

**Fig. 13a** - Clamped Inductive Load Test Circuit

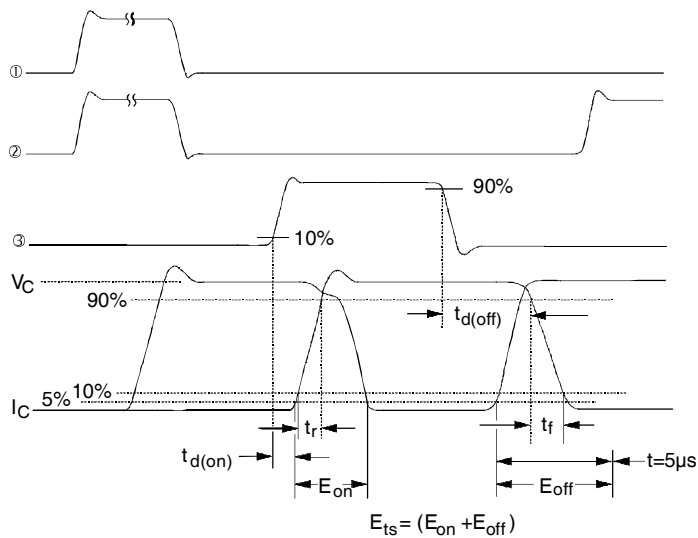


**Fig. 13b** - Pulsed Collector Current Test Circuit



**Fig. 14a** - Switching Loss Test Circuit

\* Driver same type as D.U.T.,  $V_C = 480V$

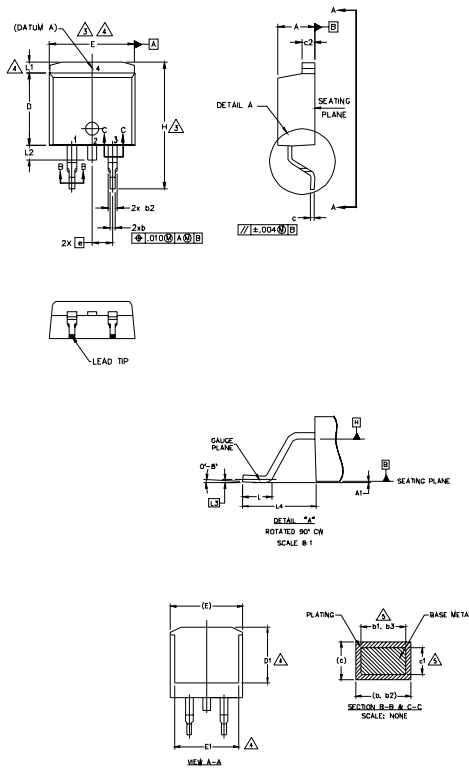


**Fig. 14b** - Switching Loss Waveforms



## D<sup>2</sup>Pak (TO-263AB) Package Outline

Dimensions are shown in millimeters (inches)



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
6. DATUM A & B TO BE DETERMINED AT DATUM PLANE H.
7. CONTROLLING DIMENSION: INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-263AB.

| SYMBOL | DIMENSIONS  |       |          |      | NOTES |
|--------|-------------|-------|----------|------|-------|
|        | MILLIMETERS |       | INCHES   |      |       |
|        | MIN.        | MAX.  | MIN.     | MAX. |       |
| A      | 4.06        | 4.83  | .160     | .190 |       |
| A1     | 0.00        | 0.254 | .000     | .010 |       |
| b      | 0.51        | 0.99  | .020     | .039 |       |
| b1     | 0.51        | 0.89  | .020     | .035 | 5     |
| b2     | 1.14        | 1.78  | .045     | .070 |       |
| b3     | 1.14        | 1.73  | .045     | .068 | 5     |
| c      | 0.38        | 0.74  | .015     | .029 |       |
| c1     | 0.38        | 0.58  | .015     | .023 | 5     |
| c2     | 1.14        | 1.65  | .045     | .065 |       |
| D      | 8.38        | 9.65  | .330     | .380 | 3     |
| D1     | 6.86        | -     | .270     | -    | 4     |
| E      | 9.85        | 10.67 | .380     | .420 | 3,4   |
| E1     | 6.22        | -     | .245     | -    | 4     |
| e      | 2.54 BSC    |       | .100 BSC |      |       |
| H      | 14.61       | 15.88 | .575     | .625 |       |
| L      | 1.78        | 2.79  | .070     | .110 |       |
| L1     | -           | 1.65  | -        | .066 |       |
| L2     | 1.27        | 1.78  | -        | .070 |       |
| L3     | 0.25 BSC    |       | .010 BSC |      |       |
| L4     | 4.78        | 5.28  | .188     | .208 |       |

LEAD ASSIGNMENTS

HEXFET

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE

IGBTs, CoPACK

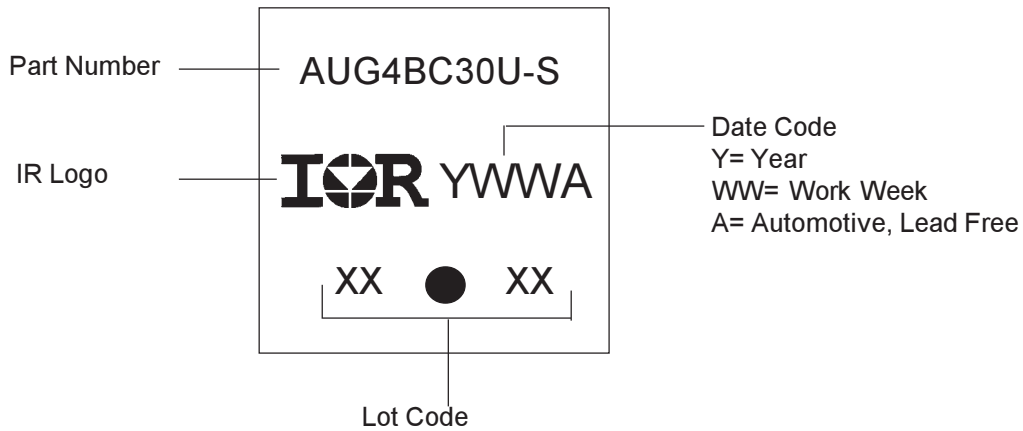
- 1.- GATE
- 2.- COLLECTOR
- 3.- EMITTER

DIODES

- 1.- ANODE \*
- 2.- CATHODE
- 3.- ANODE

\* PART DEPENDENT.

## D<sup>2</sup>Pak (TO-263AB) Part Marking Information



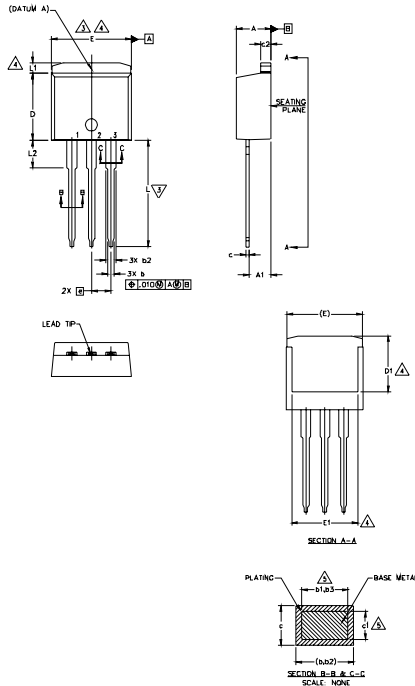
Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>  
www.irf.com

# AUIRG4BC30U-S/SL



## TO-262 Package Outline

Dimensions are shown in millimeters (inches)



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
  2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
  3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
  4. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSION E, L1, D1 & E1.
  5. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
  6. CONTROLLING DIMENSION: INCH.
  7. OUTLINE CONFORM TO JEDEC TO-262 EXCEPT A1(max.), b(min.) AND D1(min.) WHERE DIMENSIONS DERIVED THE ACTUAL PACKAGE OUTLINE.

| SYMBOL | DIMENSIONS  |       |          |      | NOTES |
|--------|-------------|-------|----------|------|-------|
|        | MILLIMETERS |       | INCHES   |      |       |
|        | MIN.        | MAX.  | MIN.     | MAX. |       |
| A      | 4.06        | 4.83  | .160     | .190 |       |
| A1     | 2.03        | 3.02  | .080     | .119 |       |
| b      | 0.51        | 0.99  | .020     | .039 |       |
| b1     | 0.51        | 0.89  | .020     | .035 | 5     |
| b2     | 1.14        | 1.78  | .045     | .070 |       |
| b3     | 1.14        | 1.73  | .045     | .068 | 5     |
| c      | 0.38        | 0.74  | .015     | .029 |       |
| c1     | 0.38        | 0.58  | .015     | .023 | 5     |
| c2     | 1.14        | 1.65  | .045     | .065 |       |
| D      | 8.38        | 9.65  | .330     | .380 | 3     |
| D1     | 6.86        | -     | .270     | -    | 4     |
| E      | 9.65        | 10.67 | .380     | .420 | 3,4   |
| E1     | 6.22        | -     | .245     | -    | 4     |
| e      | 2.54 BSC    |       | .100 BSC |      |       |
| L      | 13.46       | 14.10 | .530     | .555 |       |
| L1     | -           | 1.65  | -        | .065 |       |
| L2     | 3.56        | 3.71  | .140     | .146 |       |

**LEAD ASSIGNMENTS**

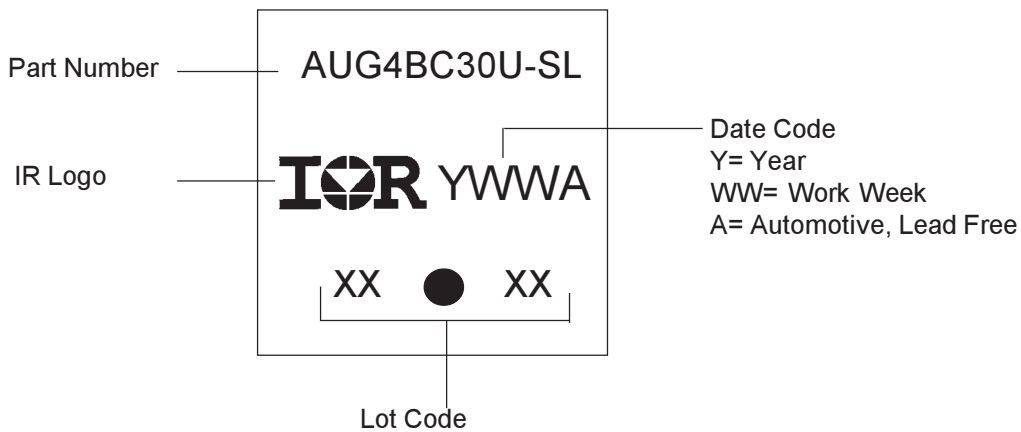
**HEXFET**

1. - GATE
2. - DRAIN
3. - SOURCE
4. - DRAIN

**IGBTs, CoPACK**

1. - GATE
2. - COLLECTOR
3. - EMITTER
4. - COLLECTOR

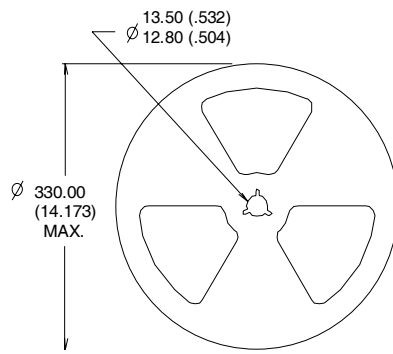
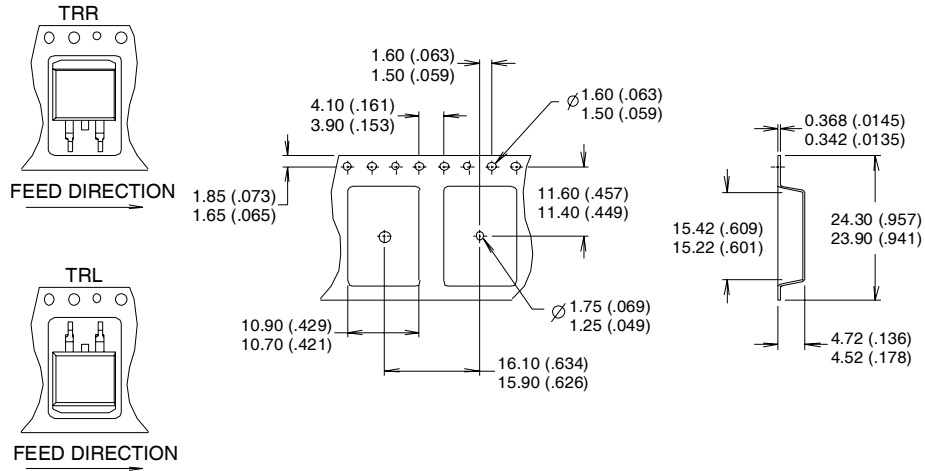
## TO-262 Part Marking Information



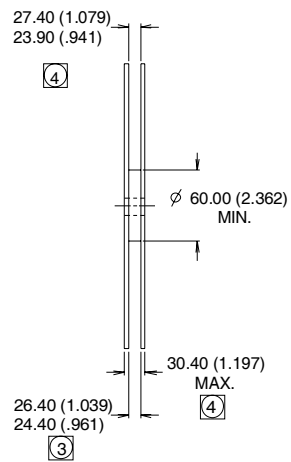
Note: For the most current drawing please refer to IR website at <http://www.irf.com/package/>

## D<sup>2</sup>Pak (TO-263AB) Tape & Reel Information

Dimensions are shown in millimeters (inches)



- NOTES:
1. CONFORMS TO EIA-418.
  2. CONTROLLING DIMENSION: MILLIMETER.
  - ③ DIMENSION MEASURED @ HUB.
  - ④ INCLUDES FLANGE DISTORTION @ OUTER EDGE.



# AUIRG4BC30U-S/SL

International  
**IR** Rectifier

## Ordering Information

| Base part number | Package Type | Standard Pack       |          | Complete Part Number |
|------------------|--------------|---------------------|----------|----------------------|
|                  |              | Form                | Quantity |                      |
| AUIRG4BC30U-SL   | TO-262       | Tube                | 50       | AUIRG4BC30U-SL       |
| AUIRG4BC30U-S    | D2Pak        | Tube                | 50       | AUIRG4BC30U-S        |
|                  |              | Tape and Reel Left  | 800      | AUIRG4BC30USTRL      |
|                  |              | Tape and Reel Right | 800      | AUIRG4BC30USTRR      |

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