# IRGP4266PbF
# IRGP4266-EPbF

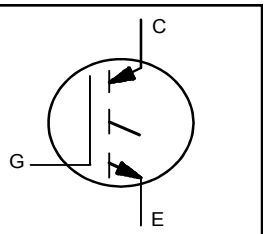
***Insulated Gate Bipolar Transistor***

$V_{CES}$ = 650V

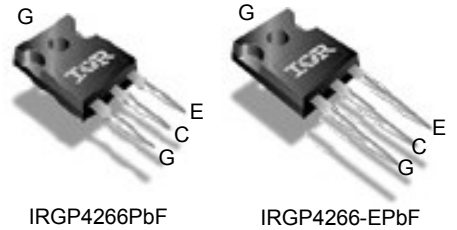
$I_C$ = 90A, $T_C$ =100°C

$t_{SC} \geq$ 5.5µs, $T_{J(max)}$ = 175°C

$V_{CE(ON)}$ typ. = 1.7V @ $I_C$ = 75A




**n-channel**




IRGP4266PbF
TO-247AC

IRGP4266-EPbF
TO-247AD

| G | C | E |
|---|---|---|
| Gate | Collector | Emitter |

**Applications**
- Industrial Motor Drive
- Inverters
- UPS
- Welding

| Features | → | Benefits |
|---|---|---|
| Low $V_{CE(ON)}$ and switching Losses | | High efficiency in a wide range of applications and switching frequencies |
| Square RBSOA and Maximum Junction Temperature 175°C | | Improved reliability due to rugged hard switching performance and higher power capability |
| Positive $V_{CE\ (ON)}$ Temperature Coefficient | | Excellent current sharing in parallel operation |
| 5.5µs short circuit SOA | | Enables short circuit protection scheme |
| Lead-Free, RoHS compliant | | Environmentally friendly |

| Base part number | Package Type | Standard Pack | | Orderable Part Number |
|---|---|---|---|---|
| | | Form | Quantity | |
| IRGP4266PbF | TO-247AC | Tube | 25 | IRGP4266PbF |
| IRGP4266-EPbF | TO-247AD | Tube | 25 | IRGP4266-EPbF |

**Absolute Maximum Ratings**

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-to-Emitter Voltage | 650 | V |
| $I_C$ @ $T_C$ = 25°C | Continuous Collector Current | 140 | A |
| $I_C$ @ $T_C$ = 100°C | Continuous Collector Current | 90 | |
| $I_{CM}$ | Pulse Collector Current, $V_{GE}$=20V | 300 | |
| $I_{LM}$ | Clamped Inductive Load Current, $V_{GE}$=20V ① | 300 | |
| $V_{GE}$ | Continuous Gate-to-Emitter Voltage | ±20 | V |
| $P_D$ @ $T_C$ = 25°C | Maximum Power Dissipation | 450 | W |
| $P_D$ @ $T_C$ = 100°C | Maximum Power Dissipation | 230 | |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -40 to +175 | °C |
| | Soldering Temperature, for 10 sec. | 300 (0.063 in. (1.6mm) from case) | |
| | Mounting Torque, 6-32 or M3 Screw | 10 lbf·in (1.1 N·m) | |

**Thermal Resistance**

| | Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance Junction-to-Case ② | — | — | 0.33 | °C/W |
| $R_{\theta CS}$ | Thermal Resistance, Case-to-Sink (flat, greased surface) | — | 0.24 | — | |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (typical socket mount) | — | 40 | — | |

**Electrical Characteristics @ $T_J$ = 25°C (unless otherwise specified)**

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)CES}$ | Collector-to-Emitter Breakdown Voltage | 650 | — | — | V | $V_{GE}$ = 0V, $I_C$ = 100µA ③ |
| $\Delta V_{(BR)CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage | — | 570 | — | mV/°C | $V_{GE}$ = 0V, $I_C$ = 1.0mA (25°C-175°C) |
| $V_{CE(on)}$ | Collector-to-Emitter Saturation Voltage | — | 1.7 | 2.1 | V | $I_C$ = 75A, $V_{GE}$ = 15V, $T_J$ = 25°C |
| | | — | 2.1 | — | | $I_C$ = 75A, $V_{GE}$ = 15V, $T_J$ = 175°C |
| $V_{GE(th)}$ | Gate Threshold Voltage | 5.5 | — | 7.7 | V | $V_{CE}$ = $V_{GE}$, $I_C$ = 2.1mA |
| $\Delta V_{GE(th)}/\Delta TJ$ | Threshold Voltage temp. coefficient | — | -22 | — | mV/°C | $V_{CE}$=$V_{GE}$, $I_C$ = 2.1mA (25°C - 175°C) |
| gfe | Forward Transconductance | — | 43 | — | S | $V_{CE}$ = 50V, $I_C$ = 75A, PW = 20µs |
| $I_{CES}$ | Collector-to-Emitter Leakage Current | — | 1.0 | 25 | µA | $V_{GE}$ = 0V, $V_{CE}$ = 650V |
| | | — | 1.1 | — | mA | $V_{GE}$ = 0V, $V_{CE}$ = 650V, $T_J$ = 175°C |
| $I_{GES}$ | Gate-to-Emitter Leakage Current | — | — | ±100 | nA | $V_{GE}$ = ±20V |

**Switching Characteristics @ $T_J$ = 25°C (unless otherwise specified)**

| | Parameter | Min. | Typ. | Max.④ | Units | Conditions |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge (turn-on) | — | 140 | 210 | nC | $I_C$ = 75A |
| $Q_{ge}$ | Gate-to-Emitter Charge (turn-on) | — | 40 | 60 | | $V_{GE}$ = 15V |
| $Q_{gc}$ | Gate-to-Collector Charge (turn-on) | — | 60 | 90 | | $V_{CC}$ = 400V |
| $E_{on}$ | Turn-On Switching Loss | — | 3.2 | 4.2 | mJ | $I_C$ = 75A, $V_{CC}$ = 400V, $V_{GE}$ = 15V |
| $E_{off}$ | Turn-Off Switching Loss | — | 1.7 | 2.6 | | $R_G$ = 10Ω, L = 200µH, $T_J$ = 25°C |
| $E_{total}$ | Total Switching Loss | — | 4.9 | 6.8 | | Energy losses include tail & diode |
| $t_{d(on)}$ | Turn-On delay time | — | 80 | 95 | ns | reverse recovery ⑤⑥ |
| $t_r$ | Rise time | — | 85 | 105 | | |
| $t_{d(off)}$ | Turn-Off delay time | — | 200 | 220 | | |
| $t_f$ | Fall time | — | 40 | 55 | | |
| $E_{on}$ | Turn-On Switching Loss | — | 4.6 | — | mJ | $I_C$ = 75A, $V_{CC}$ = 400V, $V_{GE}$=15V |
| $E_{off}$ | Turn-Off Switching Loss | — | 2.4 | — | | $R_G$=10Ω, L=200µH,$T_J$ = 175°C |
| $E_{total}$ | Total Switching Loss | — | 7.0 | — | | Energy losses include tail & diode |
| $t_{d(on)}$ | Turn-On delay time | — | 60 | — | ns | reverse recovery ⑤⑥ |
| $t_r$ | Rise time | — | 95 | — | | |
| $t_{d(off)}$ | Turn-Off delay time | — | 205 | — | | |
| $t_f$ | Fall time | — | 60 | — | | |
| $C_{ies}$ | Input Capacitance | — | 4300 | — | pF | $V_{GE}$ = 0V |
| $C_{oes}$ | Output Capacitance | — | 230 | — | | $V_{CC}$ = 30V |
| $C_{res}$ | Reverse Transfer Capacitance | — | 120 | — | | f = 1.0Mhz |
| RBSOA | Reverse Bias Safe Operating Area | FULL SQUARE | | | | $T_J$ = 175°C, $I_C$ = 300A<br>$V_{CC}$ = 520V, Vp ≤ 650V<br>Rg = 50Ω, $V_{GE}$ = +20V to 0V |
| SCSOA | Short Circuit Safe Operating Area | 5.5 | — | — | µs | $T_J$ = 150°C,$V_{CC}$ = 400V, Vp ≤600V<br>Rg = 50Ω, $V_{GE}$ = +15V to 0V |

**Notes:**

① $V_{CC}$ = 80% ($V_{CES}$), $V_{GE}$ = 20V, L = 50µH, $R_G$ = 50Ω.
② $R_\theta$ is measured at $T_J$ of approximately 90°C.
③ Refer to AN-1086 for guidelines for measuring $V_{(BR)CES}$ safely.
④ Maximum limits are based on statistical sample size characterization.
⑤ Pulse width limited by max. junction temperature.
⑥ Values influenced by parasitic L and C in measurement.

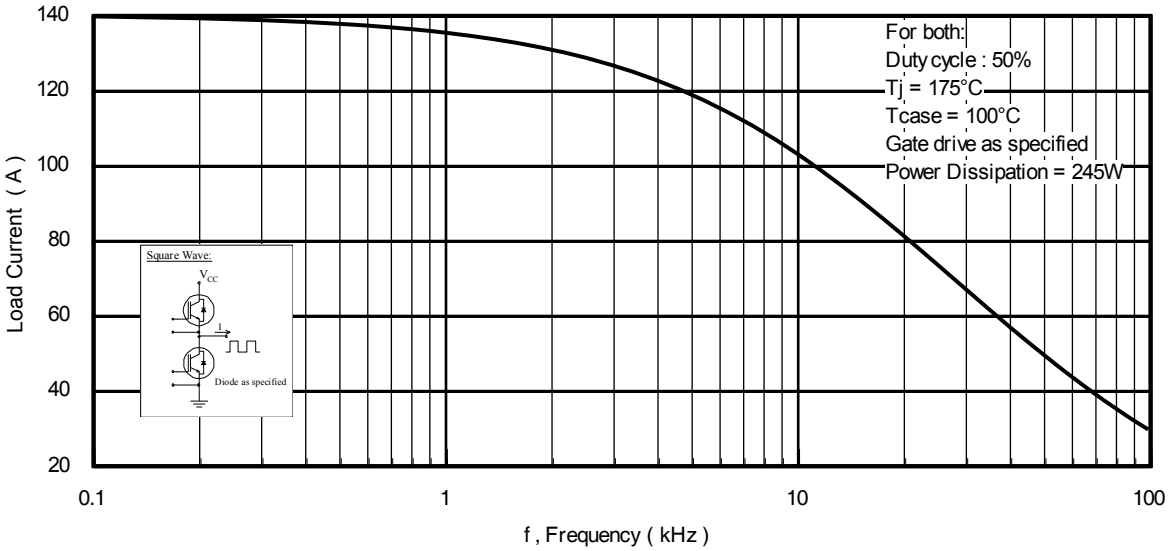



**Fig. 1** - Typical Load Current vs. Frequency
(Load Current= $I_{RMS}$ of fundamental)

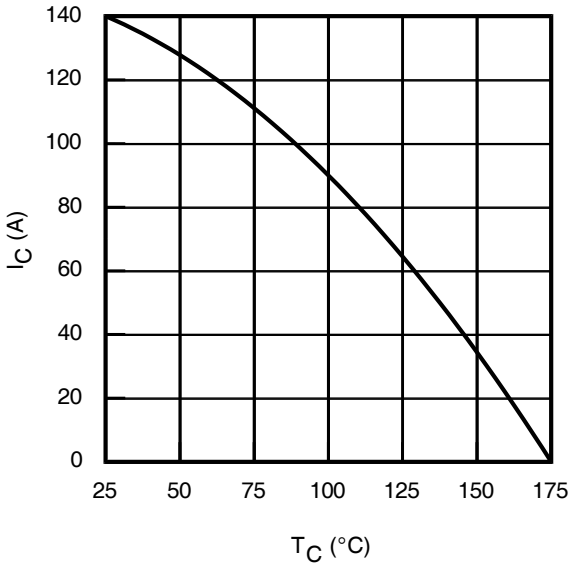



**Fig. 2** - Maximum DC Collector Current vs.
Case Temperature

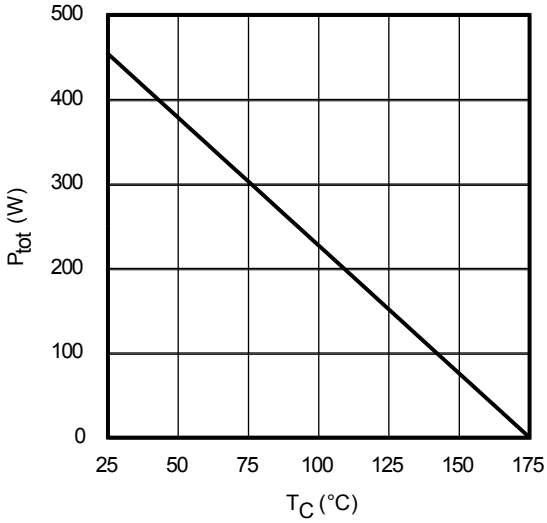



**Fig. 3** - Power Dissipation vs.
Case Temperature

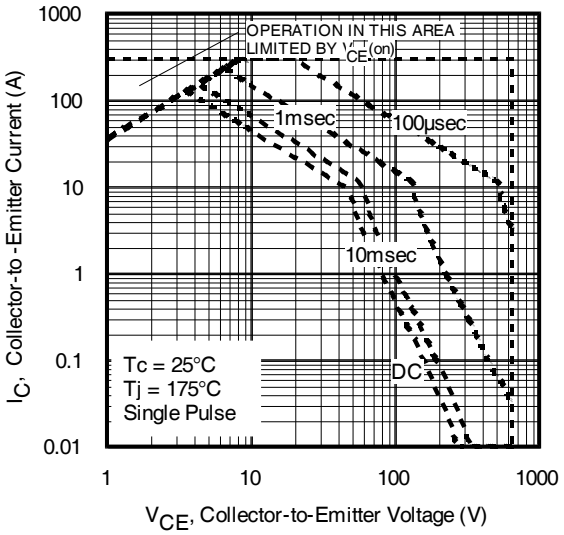



**Fig. 4** - Forward SOA

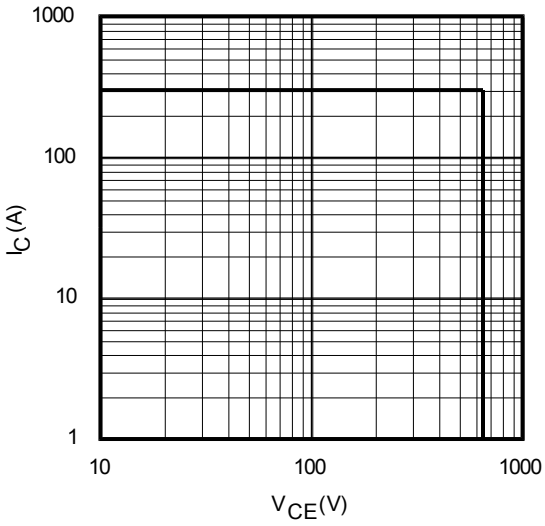



**Fig. 5** - Reverse Bias SOA
$T_J$ = 175°C; $V_{GE}$ = 20V

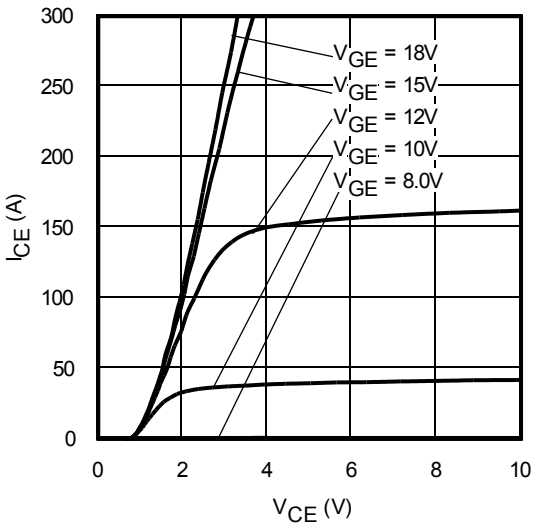



**Fig. 6** - Typ. IGBT Output Characteristics
$T_J$ = -40°C; tp = 20µs

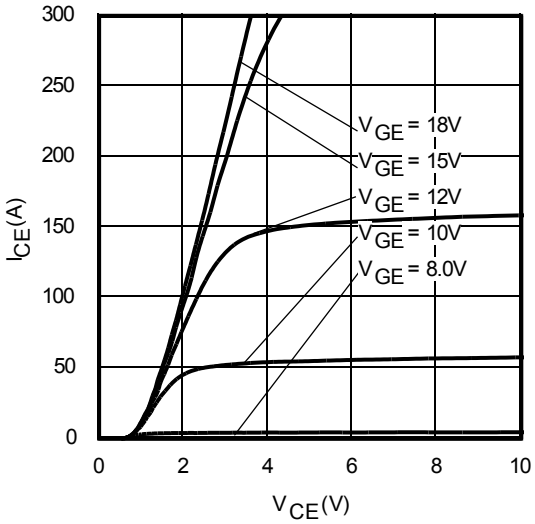



**Fig. 7** - Typ. IGBT Output Characteristics
$T_J$ = 25°C; tp = 20µs

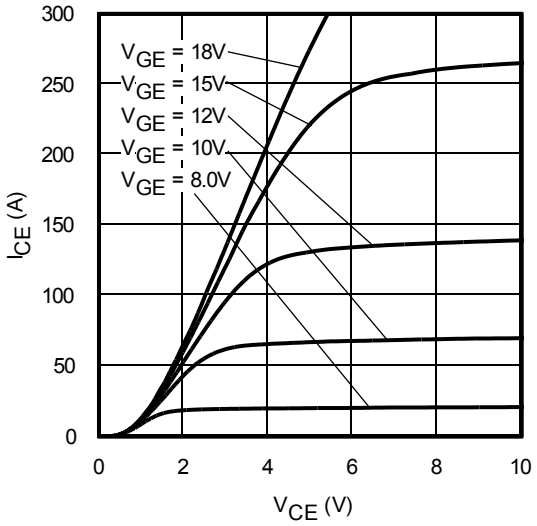



**Fig. 8** - Typ. IGBT Output Characteristics
$T_J$ = 175°C; tp = 20µs

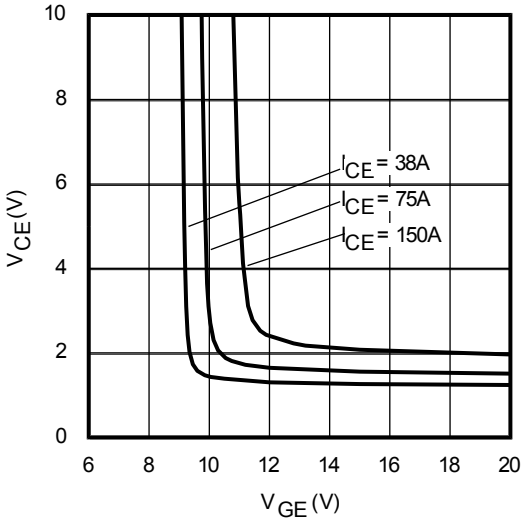



**Fig. 9** - Typical $V_{CE}$ vs. $V_{GE}$
$T_J$ = -40°C

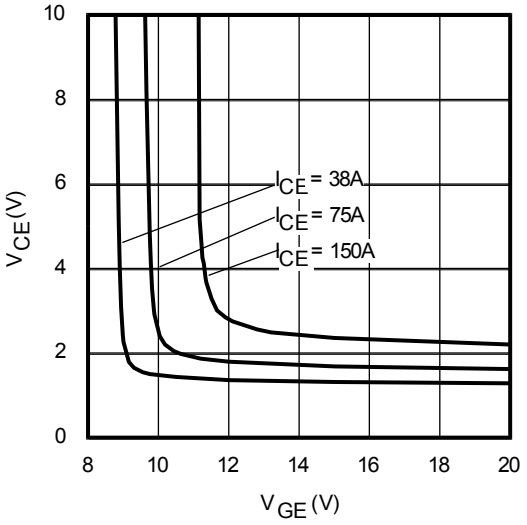



**Fig. 10** - Typical $V_{CE}$ vs. $V_{GE}$
$T_J$ = 25°C

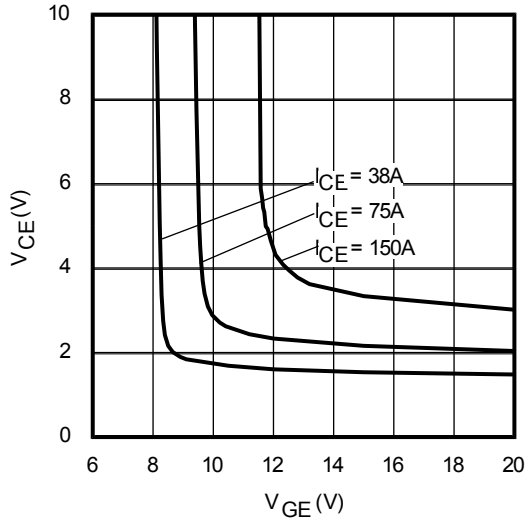



**Fig. 11** - Typical $V_{CE}$ vs. $V_{GE}$
$T_J$ = 175°C

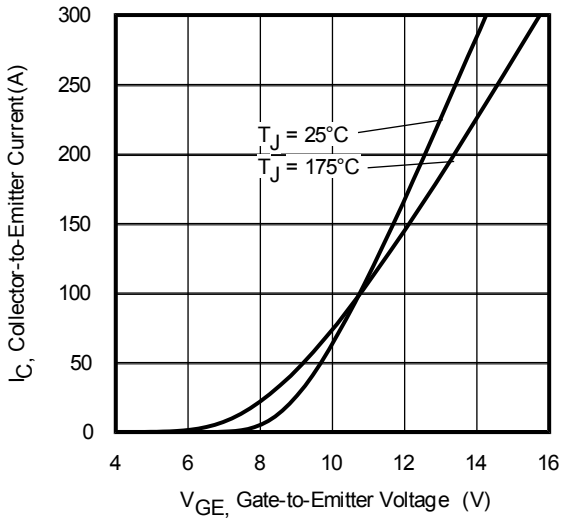



**Fig. 12** - Typ. Transfer Characteristics
$V_{CE}$ = 50V; tp = 20µs

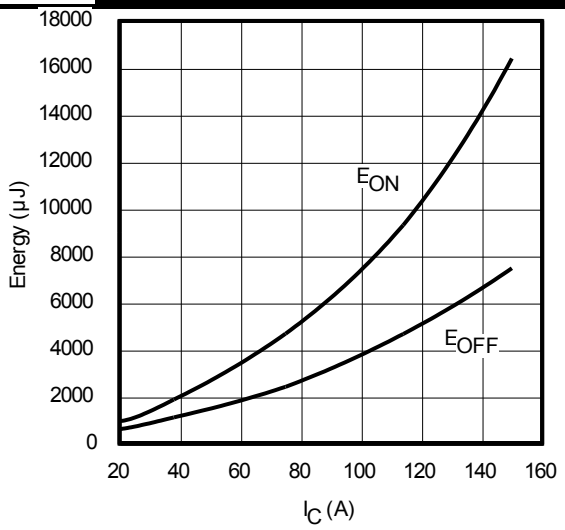



**Fig. 13** - Typ. Energy Loss vs. $I_C$
$T_J$ = 175°C; L = 200µH; $V_{CE}$ = 400V, $R_G$ = 10Ω; $V_{GE}$ = 15V

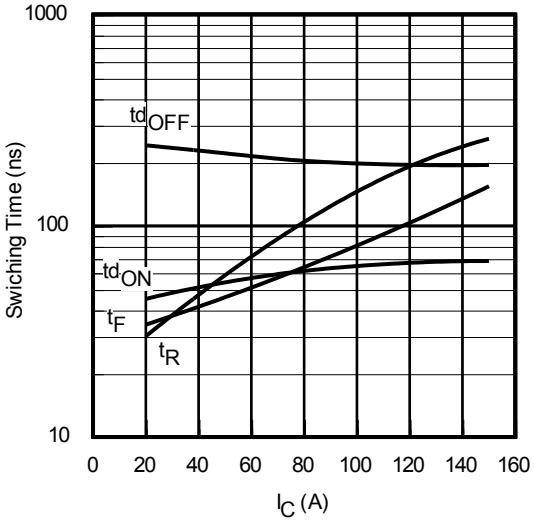



**Fig. 14** - Typ. Switching Time vs. $I_C$
$T_J$ = 175°C; L = 200µH; $V_{CE}$ = 400V, $R_G$ = 10Ω; $V_{GE}$ = 15V

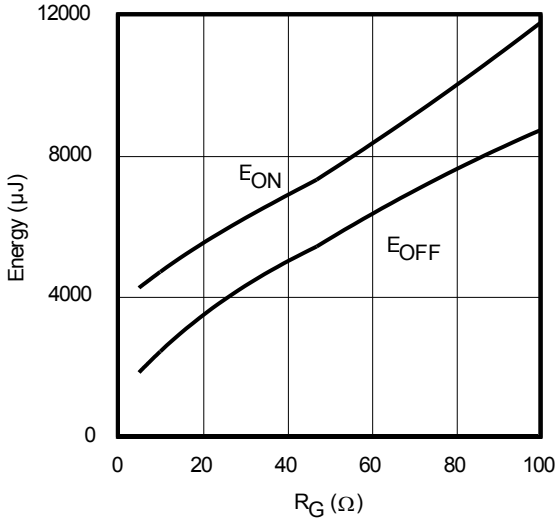



**Fig. 15** - Typ. Energy Loss vs. $R_G$
$T_J$ = 175°C; L = 200µH; $V_{CE}$ = 400V, $I_{CE}$ = 75A; $V_{GE}$ = 15V

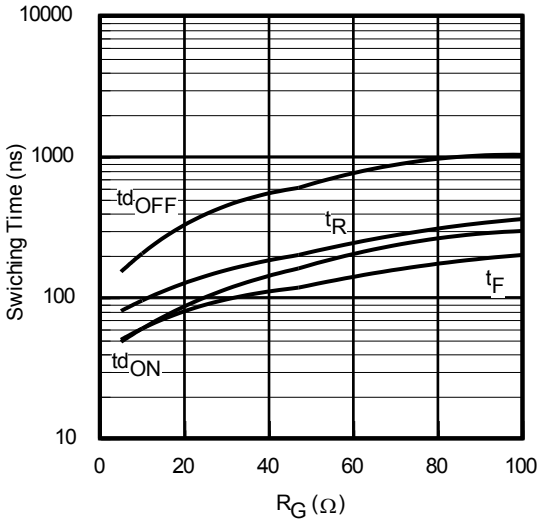



**Fig. 16** - Typ. Switching Time vs. $R_G$
$T_J$ = 175°C; L = 200µH; $V_{CE}$ = 400V, $I_{CE}$ = 75A; $V_{GE}$ = 15V

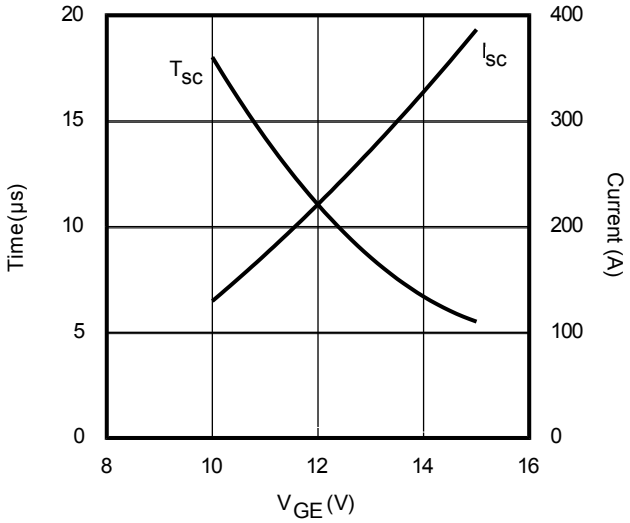



**Fig. 17** - $V_{GE}$ vs. Short Circuit Time
$V_{CC}$ = 400V; $T_C$ = 150°C

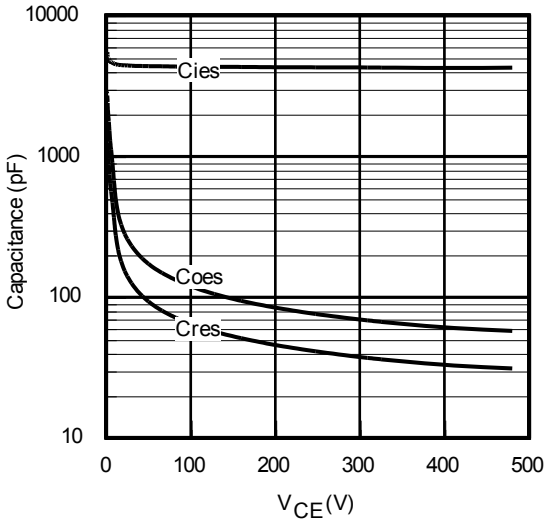



**Fig. 18** - Typ. Capacitance vs. $V_{CE}$

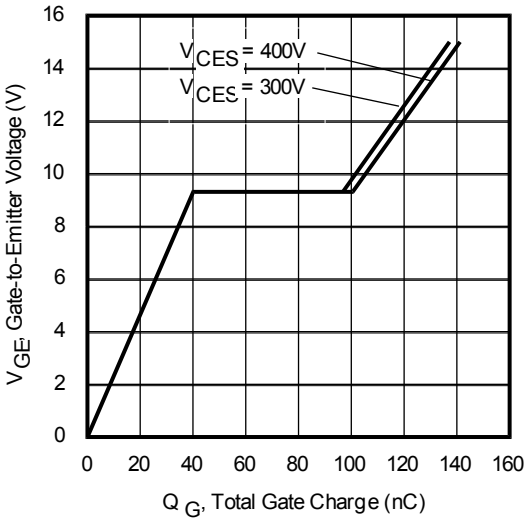



**Fig. 19** - Typical Gate Charge vs. $V_{GE}$

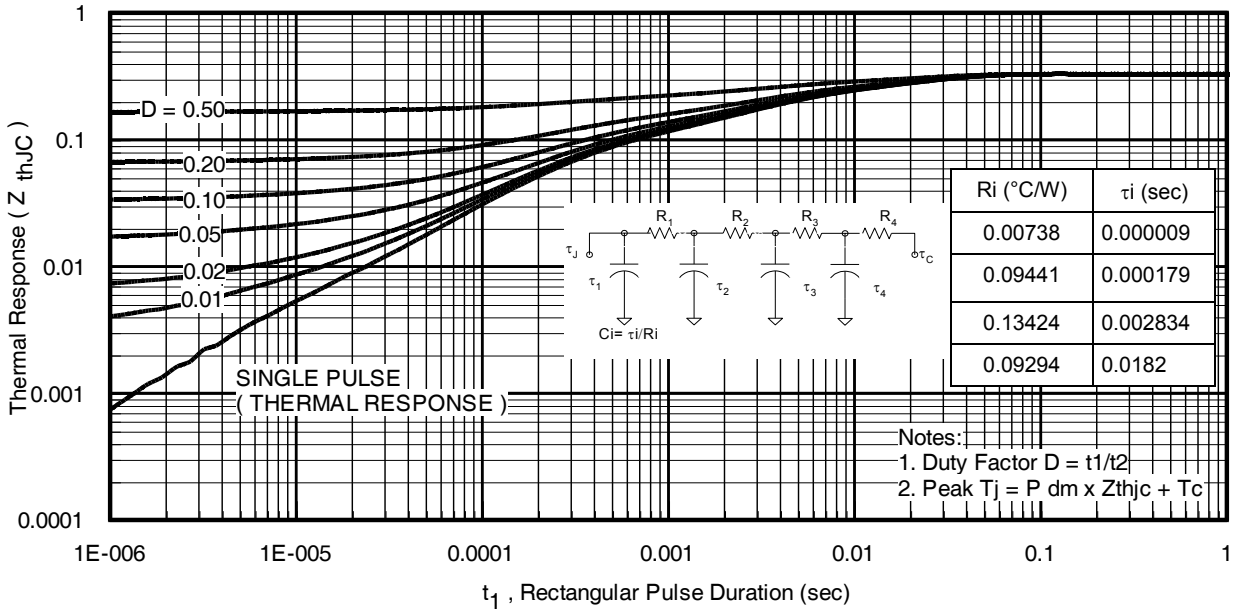



**Fig 20.** Maximum Transient Thermal Impedance, Junction-to-Case

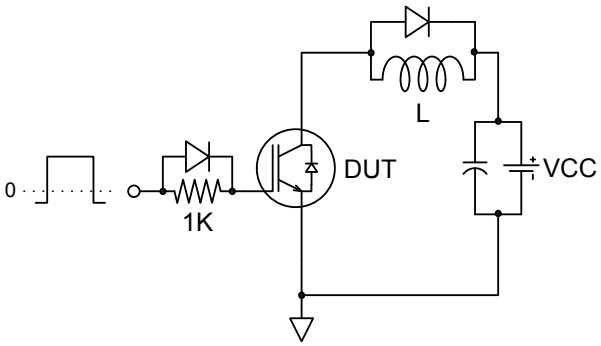



**Fig.C.T.1** - Gate Charge Circuit (turn-off)

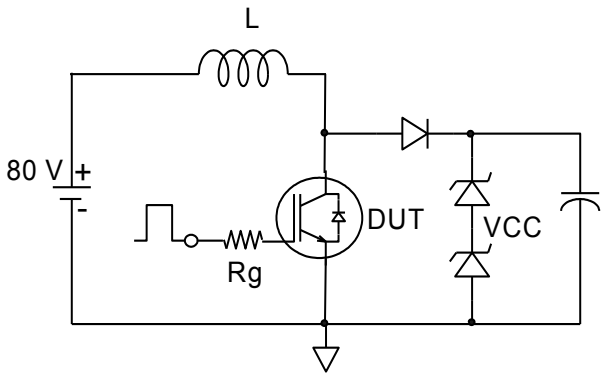



**Fig.C.T.2** - RBSOA Circuit

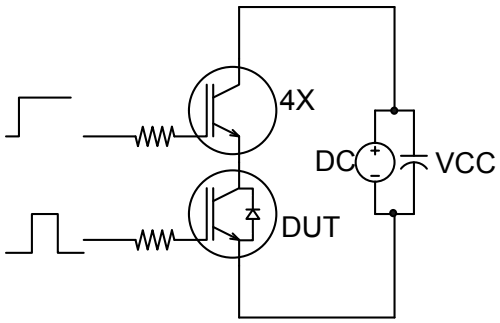



**Fig.C.T.3** - S.C. SOA Circuit

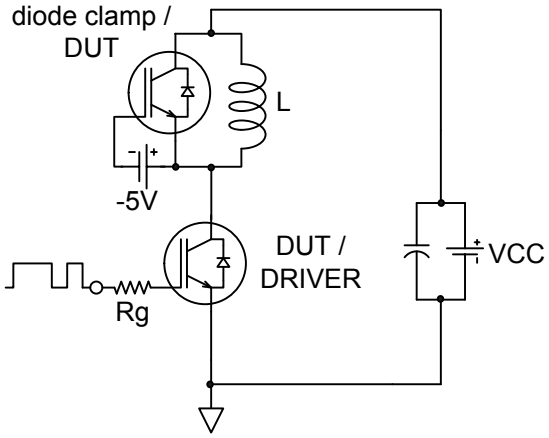
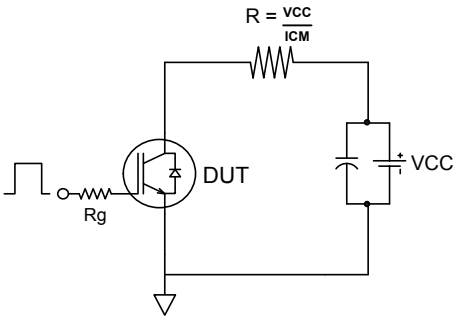



**Fig.C.T.4** - Switching Loss Circuit




Resistive Load

**Fig.C.T.5** - Resistive Load Circuit

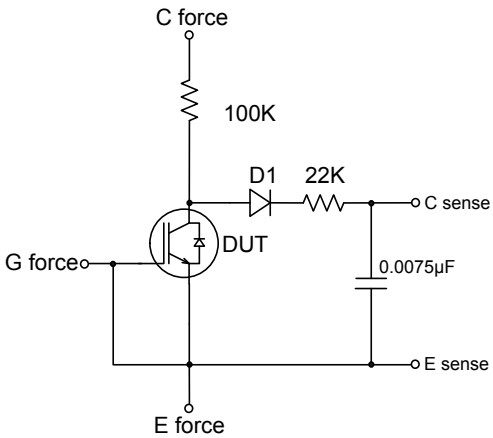



**Fig.C.T.6** - BVCES Filter Circuit

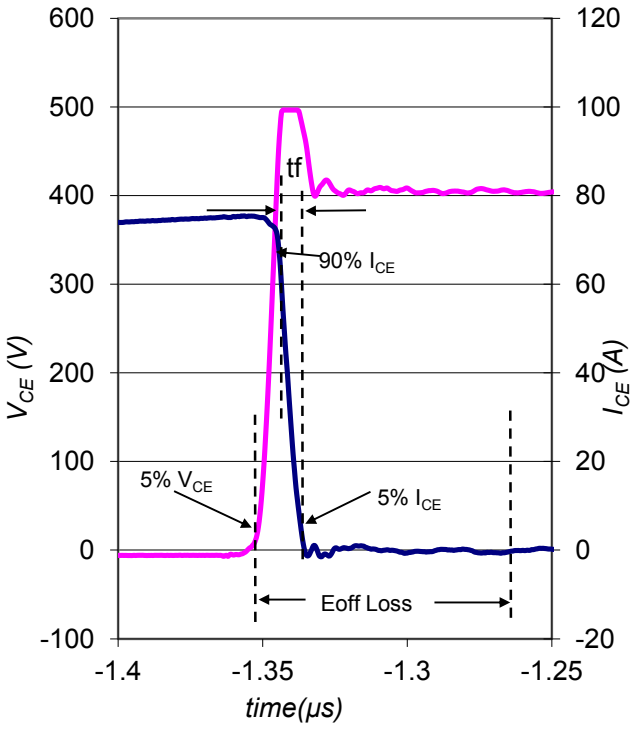



**Fig. WF1** - Typ. Turn-off Loss Waveform
@ $T_J$ = 175°C using Fig. CT.3

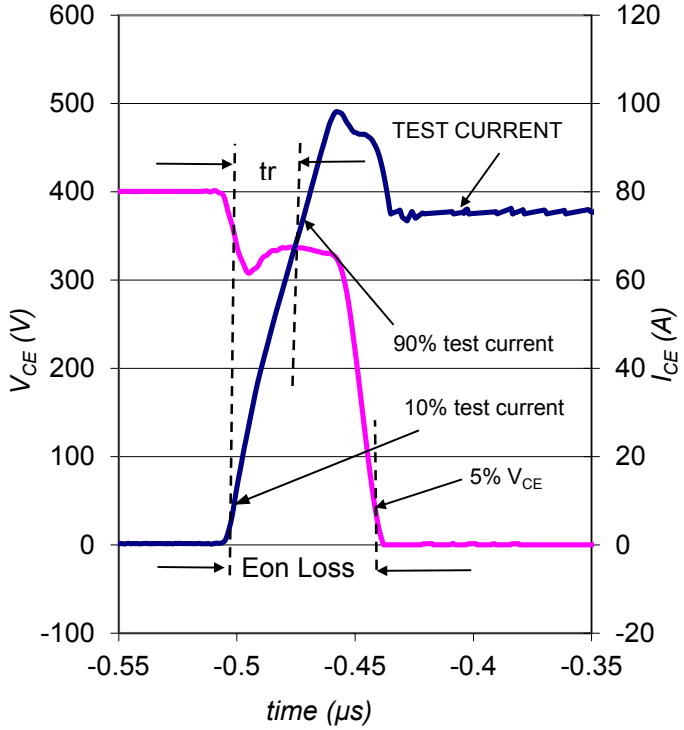



**Fig. WF2** - Typ. Turn-on Loss Waveform
@ $T_J$ = 175°C using Fig. CT.4

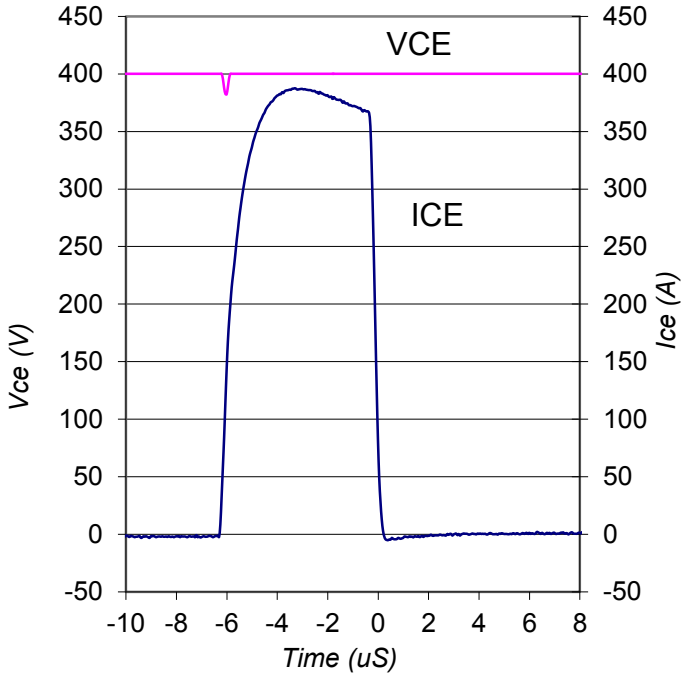
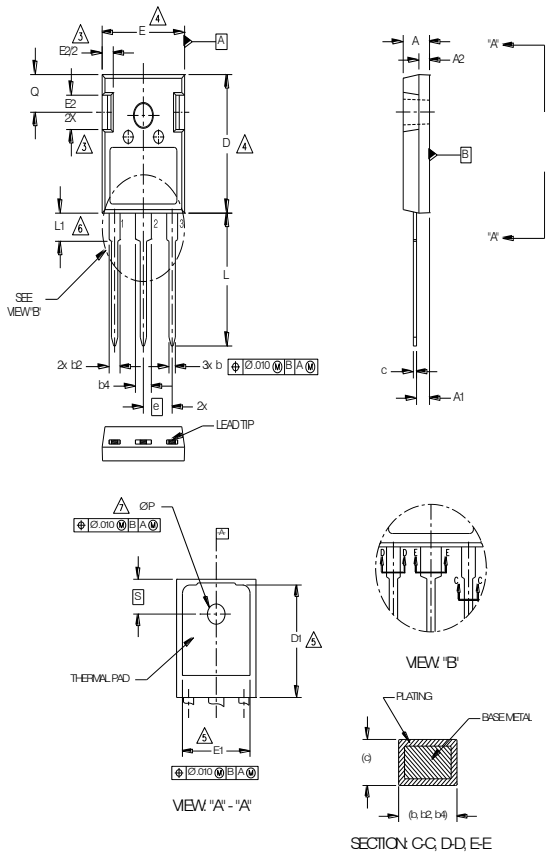



**Fig. WF3** - Typ. S.C. Waveform
@ $T_J$ = 150°C using Fig. CT.3

## TO-247AC Package Outline

Dimensions are shown in millimeters (inches)




| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | INCHES | | MILLIMETERS | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | .190 | .204 | 4.83 | 5.20 | |
| A1 | .090 | .100 | 2.29 | 2.54 | |
| A2 | .075 | .085 | 1.91 | 2.16 | |
| b | .042 | .052 | 1.07 | 1.33 | |
| b2 | .075 | .094 | 1.91 | 2.41 | |
| b4 | .113 | .133 | 2.87 | 3.38 | |
| c | .022 | .026 | 0.55 | 0.68 | |
| D | .819 | .830 | 20.80 | 21.10 | 4 |
| D1 | .640 | 694 | 16.25 | 17.65 | 5 |
| E | .620 | .635 | 15.75 | 16.13 | 4 |
| E1 | .512 | .570 | 13.00 | 14.50 | |
| E2 | .145 | .196 | 3.68 | 5.00 | |
| e | .215 Typical | | 5.45 Typical | | |
| L | .780 | .800 | 19.80 | 20.32 | |
| L1 | .161 | .173 | 4.10 | 4.40 | |
| ø P | .138 | .143 | 3.51 | 3.65 | |
| Q | .216 | .236 | 5.49 | 6.00 | |
| S | .238 | .248 | 6.04 | 6.30 | |

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

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

DIODES

1.– ANODE/OPEN
2.– CATHODE
3.– ANODE

NOTES:

1 DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.

2 DIMENSIONS ARE SHOWN IN INCHES AND MILLIMETERS.

3 CONTOUR OF SLOT OPTIONAL.

4 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.

5 THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.

6 LEAD FINISH UNCONTROLLED IN L1.

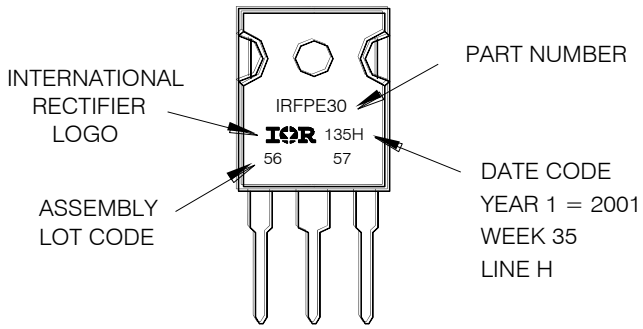
7 ø P TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.

## TO-247AC Part Marking Information

Notes: This part marking information applies to devices produced after 02/26/2001

EXAMPLE: THIS IS AN IRFPE30
WITH ASSEMBLY
LOT CODE 5657
ASSEMBLED ON WW 35, 2001
IN THE ASSEMBLY LINE "H"

Note: "P" in assembly line position
indicates "Lead-Free"



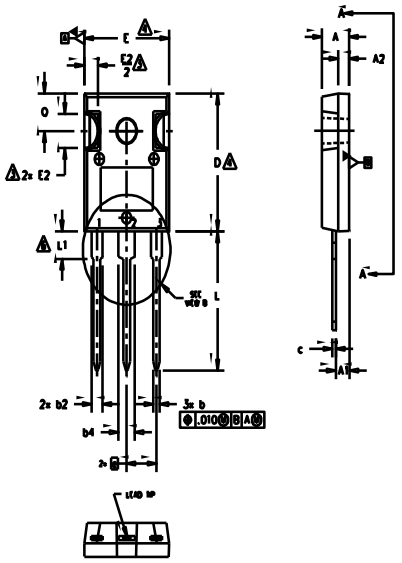

TO-247AC package is not recommended for Surface Mount Application.

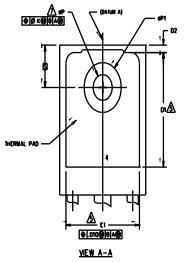
Note: For the most current drawing please refer to IR website at http://www.irf.com/package/

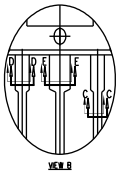
  

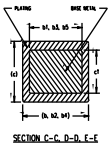
## TO-247AD Package Outline

Dimensions are shown in millimeters (inches)









NOTES:

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
2. DIMENSIONS ARE SHOWN IN INCHES.
3. CONTOUR OF SLOT OPTIONAL.
4. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS D1 & E1.
6. LEAD FINISH UNCONTROLLED IN L1.
7. øP TO HAVE A MAXIMUM DRAFT ANGLE OF 1.5 ° TO THE TOP OF THE PART WITH A MAXIMUM HOLE DIAMETER OF .154 INCH.
8. OUTLINE CONFORMS TO JEDEC OUTLINE TO-247AD.

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | INCHES | | MILLIMETERS | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | .183 | .209 | 4.65 | 5.31 | |
| A1 | .087 | .102 | 2.21 | 2.59 | |
| A2 | .059 | .098 | 1.50 | 2.49 | |
| b | .039 | .055 | 0.99 | 1.40 | |
| b1 | .039 | .053 | 0.99 | 1.35 | |
| b2 | .065 | .094 | 1.65 | 2.39 | |
| b3 | .065 | .092 | 1.65 | 2.34 | |
| b4 | .102 | .135 | 2.59 | 3.43 | |
| b5 | .102 | .133 | 2.59 | 3.38 | |
| c | .015 | .035 | 0.38 | 0.89 | |
| c1 | .015 | .033 | 0.38 | 0.84 | |
| D | .776 | .815 | 19.71 | 20.70 | 4 |
| D1 | .515 | – | 13.08 | – | 5 |
| D2 | .020 | .053 | 0.51 | 1.35 | |
| E | .602 | .625 | 15.29 | 15.87 | 4 |
| E1 | .530 | – | 13.46 | – | |
| E2 | .178 | .216 | 4.52 | 5.49 | |
| e | .215 BSC | | 5.46 BSC | | |
| øk | .010 | | 0.25 | | |
| L | .780 | .827 | 19.57 | 21.00 | |
| L1 | .146 | .169 | 3.71 | 4.29 | |
| øP | .140 | .144 | 3.56 | 3.66 | |
| øP1 | – | .291 | – | 7.39 | |
| Q | .209 | .224 | 5.31 | 5.69 | |
| S | .217 BSC | | 5.51 BSC | | |

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

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

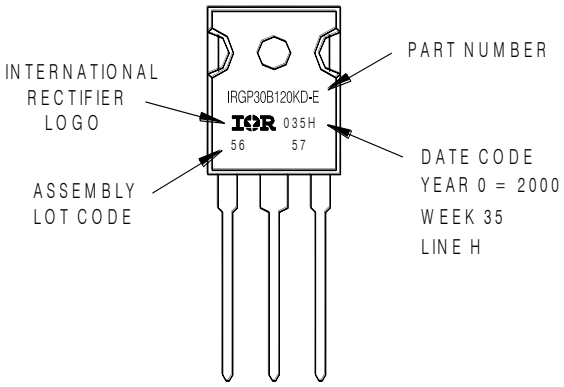
DIODES

1.- ANODE/OPEN
2.- CATHODE
3.- ANODE

## TO-247AD Part Marking Information

EXAMPLE: THIS IS AN IRGP30B120KD-E
WITH ASSEMBLY
LOT CODE 5657
ASSEMBLED ON WW 35, 2000
IN THE ASSEMBLY LINE "H"

Note: "P" in assembly line position
indicates "Lead-Free"




TO-247AD package is not recommended for Surface Mount Application.

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

**Qualification Information**†

| | | |
|---|---|---|
| **Qualification Level** | Industrial† (per JEDEC JESD47F) †† | |
| **Moisture Sensitivity Level** | TO-247AC | N/A |
| | TO-247AD | |
| **RoHS Compliant** | Yes | |

† Qualification standards can be found at International Rectifier's web site: http://www.irf.com/product-info/reliability/

†† Applicable version of JEDEC standard at the time of product release.

Data and specifications subject to change without notice.

International
IOR Rectifier

**IR WORLD HEADQUARTERS:** 101N Sepulveda Blvd, El Segundo, California 90245,USA

Visit us at www.irf.com for sales contact information.