International
IOR Rectifier

**IRGR4610DPbF**
**IRGS4610DPbF**
**IRGB4610DPbF**

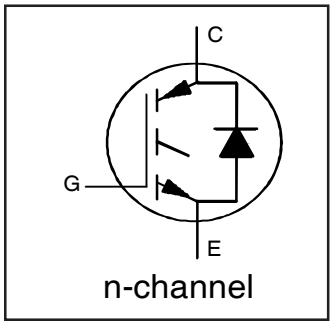
***Insulated Gate Bipolar Transistor with Ultrafast Soft Recovery Diode***

$V_{CES}$ = 600V

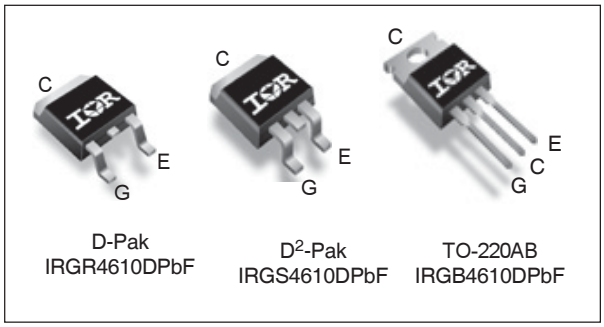
$I_C$ = 10A, $T_C$ = 100°C

$t_{sc}$ > 5µs, $T_{jmax}$ = 175°C

$V_{CE(on)\ typ.}$ = 1.7V @ 6A



n-channel



D-Pak
IRGR4610DPbF

D²-Pak
IRGS4610DPbF

TO-220AB
IRGB4610DPbF

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

**Applications**
- Appliance Drives
- Inverters
- UPS

| 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 and tighter distribution of parameters | | Excellent current sharing in parallel operation |
| 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 | |
| IRGR4610DPbF | D-PAK | Tube | 75 | IRGR4610DPbF |
| | | Tape and Reel | 2000 | IRGR4610DTRPbF |
| | | Tape and Reel Right | 3000 | IRGR4610DTRRPbF |
| | | Tape and Reel Left | 3000 | IRGR4610DTRLPbF |
| IRGS4610DPbF | $D^2$ PAK | Tube | 50 | IRGS4610DPbF |
| | | Tape and Reel Right | 800 | IRGS4610DTRRPbF |
| | | Tape and Reel Left | 800 | IRGS4610DTRLPbF |
| IRGB4610DPbF | TO-220AB | Tube | 50 | IRGB4610DPbF |

**Absolute Maximum Ratings**

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-to-Emitter Breakdown Voltage | 600 | V |
| $I_C$ @ $T_C$ = 25°C | Continuous Collector Current | 16 | A |
| $I_C$ @ $T_C$ = 100°C | Continuous Collector Current | 10 | |
| $I_{CM}$ | Pulsed Collector Current, $V_{GE}$ = 15V① | 18 | |
| $I_{LM}$ | Clamped Inductive Load Current, $V_{GE}$ = 20V ① | 24 | |
| $I_F$ @ $T_C$ = 25°C | Diode Continuous Forward Current | 10 | |
| $I_F$ @ $T_C$=100°C | Diode Continuous Forward Current | 6 | |
| $I_{FM}$ | Diode Maximum Forward Current , | 24 | |
| $V_{GE}$ | Continuous Gate-to-Emitter Voltage | ± 20 | V |
| | Transient Gate-to-Emitter Voltage | ± 30 | |
| $P_D$ @ $T_C$ =25° | Maximum Power Dissipation | 77 | W |
| $P_D$ @ $T_C$ =100° | Maximum Power Dissipation | 39 | |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -40 to + 175 | °C |
| | Soldering Temperature, for 10 seconds (1.6mm from case) | 300 | |
| | Mounting Torque, 6-32 or M3 Screw TO-220 | 10lbf. In (1.1 N.m) | |

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## Thermal Resistance

| | Parameter | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case -(IGBT)② | ---- | ---- | 1.9 | °C/W |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case -(Diode)② | ---- | ---- | 6.3 | |
| $R_{\theta CS}$ | Thermal Resistance, Case-to-Sink (flat, greased surface) (TO-220) | ---- | 0.5 | ---- | |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (PCB mount) (D-PAK)⑥ | ---- | ---- | 50 | |
| | Thermal Resistance, Junction-to-Ambient (D-PAK) | ---- | ---- | 110 | |
| | Thermal Resistance, Junction-to-Ambient (PCB mount, Steady State) ($D^2PAK$)⑥ | ---- | ---- | 40 | |
| | Thermal Resistance, Junction-to-Ambient ( Socket mount) (TO-220) | ---- | ---- | 62 | |

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $V_{(BR)CES}$ | Collector-to-Emitter Breakdown Voltage | 600 | — | — | V | $V_{GE}$ = 0V, $I_c$ =100 µA ③ |
| $\Delta V_{(BR)CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage | — | 0.36 | — | V/°C | $V_{GE}$ = 0V, $I_c$ = 250µA ( 25 -175 °C ) ③ |
| $V_{CE(on)}$ | Collector-to-Emitter Saturation Voltage | — | 1.7 | 2.0 | V | $I_C$ = 6.0A, $V_{GE}$ = 15V, $T_J$ = 25°C |
| | | — | 2.07 | — | | $I_C$ = 6.0A, $V_{GE}$ = 15V, $T_J$ = 150°C |
| | | — | 2.14 | — | | $I_C$ = 6.0A, $V_{GE}$ = 15V, $T_J$ = 175°C |
| $V_{GE(th)}$ | Gate Threshold Voltage | 4.0 | — | 6.5 | V | $V_{CE}$ = $V_{GE}$, $I_C$ = 150µA |
| $\Delta V_{GE(th)}/\Delta TJ$ | Threshold Voltage temp. coefficient | — | -13 | — | mV/°C | $V_{CE}$ = $V_{GE}$, $I_C$ = 250µA ( 25 -175 °C ) |
| gfe | Forward Transconductance | — | 5.8 | — | S | $V_{CE}$ = 25V, $I_C$ = 6.0A, PW =80µS |
| $I_{CES}$ | Collector-to-Emitter Leakage Current | — | — | 25 | µA | $V_{GE}$ = 0V,$V_{CE}$ = 600V |
| | | — | — | 250 | | $V_{GE}$ = 0V, $V_{CE}$ = 600V, $T_J$ =175°C |
| $V_{FM}$ | Diode Forward Voltage Drop | — | 1.60 | 2.30 | V | $I_F$ = 6.0A |
| | | — | 1.30 | — | | $I_F$ = 6.0A, $T_J$ = 175°C |
| $I_{GES}$ | Gate-to-Emitter Leakage Current | — | — | ±100 | nA | $V_{GE}$ = ± 20 V |

Notes:

① $V_{CC}$ = 80% ($V_{CES}$), $V_{GE}$ = 20V, L = 1.0mH, $R_G$ = 100Ω.
② $R_\theta$ is measured at $T_J$ approximately 90°C.
③ Refer to AN-1086 for guidelines for measuring $V_{(BR)CES}$ safely.
④ Pulse width limited by max. junction temperature.
⑤ Values influenced by parasitic L and C in measurement
⑥ When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994: http://www.irf.com/technical-info/appnotes/an-994.pdf

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $Q_g$ | Total Gate Charge (turn-on) | — | 13 | — | nC | $I_C$ = 6.0A |
| $Q_{ge}$ | Gate-to-Emitter Charge (turn-on) | — | 3.0 | — | | $V_{CC}$ = 400V |
| $Q_{gc}$ | Gate-to-Collector Charge (turn-on) | — | 6.4 | — | | $V_{GE}$ = 15V |
| $E_{on}$ | Turn-On Switching Loss | — | 56 | — | µJ | $I_C$ = 6.0A, $V_{CC}$ = 400V, $V_{GE}$ = 15V |
| $E_{off}$ | Turn-Off Switching Loss | — | 122 | — | | $R_G$ = 47Ω, L=1mH, $L_S$= 150nH, $T_J$ = 25°C |
| $E_{total}$ | Total Switching Loss | — | 178 | — | | Energy losses include tail and diode reverse recovery |
| $t_{d(on)}$ | Turn-On delay time | — | 27 | — | ns | $I_C$ = 6.0A, $V_{CC}$ = 400V |
| $t_r$ | Rise time | — | 11 | — | | $R_G$ = 47Ω, L=1mH, $L_S$= 150nH |
| $t_{d(off)}$ | Turn-Off delay time | — | 75 | — | | $T_J$ = 25°C ④⑤ |
| $t_f$ | Fall time | — | 17 | — | | |
| $E_{on}$ | Turn-On Switching Loss | — | 140 | — | µJ | $I_C$ = 6.0A, $V_{CC}$ = 400V, $V_{GE}$ = 15V |
| $E_{off}$ | Turn-Off Switching Loss | — | 189 | — | | $R_G$ = 47Ω, L=1mH, $L_S$= 150nH, $T_J$ = 175°C |
| $E_{total}$ | Total Switching Loss | — | 329 | — | | Energy losses include tail and diode reverse recovery |
| $t_{d(on)}$ | Turn-On delay time | — | 26 | — | ns | $I_C$ = 6.0A, $V_{CC}$ = 400V |
| $t_r$ | Rise time | — | 12 | — | | $R_G$ = 47Ω, L=1mH, $L_S$= 150nH |
| $t_{d(off)}$ | Turn-Off delay time | — | 95 | — | | $T_J$ = 175°C ④⑤ |
| $t_f$ | Fall time | — | 32 | — | | |
| $C_{ies}$ | Input Capacitance | — | 350 | — | pF | $V_{GE}$ = 0V |
| $C_{oes}$ | Output Capacitance | — | 29 | — | | $V_{CC}$ = 30V |
| $C_{res}$ | Reverse Transfer Capacitance | — | 10 | — | | f = 1Mhz |
| RBSOA | Reverse Bias Safe Operating Area | FULL SQUARE | | | | $T_J$ = 175°C, $I_C$ = 24A<br>$V_{CC}$ = 500V, Vp =600V<br>$R_G$ = 100Ω, $V_{GE}$ = +20V to 0V |
| SCSOA | Short Circuit Safe Operating Area | 5 | — | — | µs | $V_{CC}$ = 400V, Vp =600V<br>$R_G$ = 100Ω, $V_{GE}$ = +15V to 0V |
| Erec | Reverse recovery energy of the diode | — | 178 | — | µJ | $T_J$ = 175°C |
| trr | Diode Reverse recovery time | — | 74 | — | ns | $V_{CC}$ = 400V, $I_F$ = 6.0A |
| Irr | Peak Reverse Recovery Current | — | 12 | — | A | $V_{GE}$ = 15V, Rg = 47Ω, L=1mH, $L_S$=150nH |

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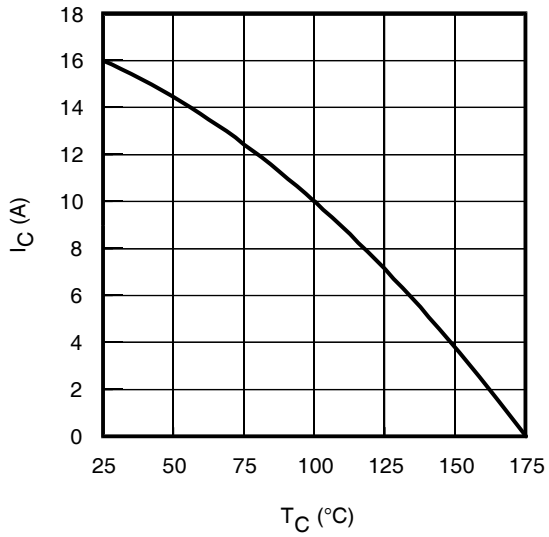



**Fig. 1** - Maximum DC Collector Current vs. Case Temperature

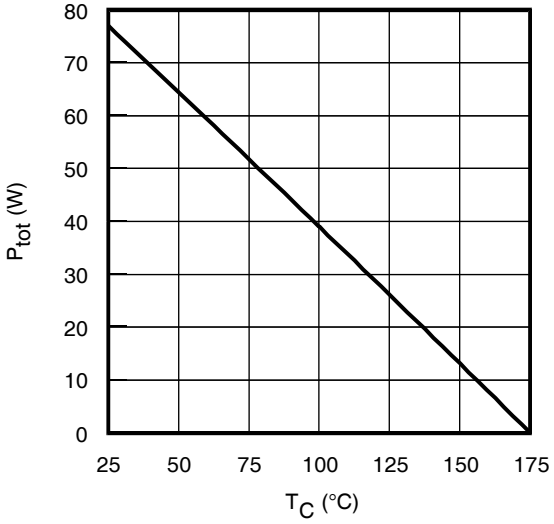



**Fig. 2** - Power Dissipation vs. Case Temperature

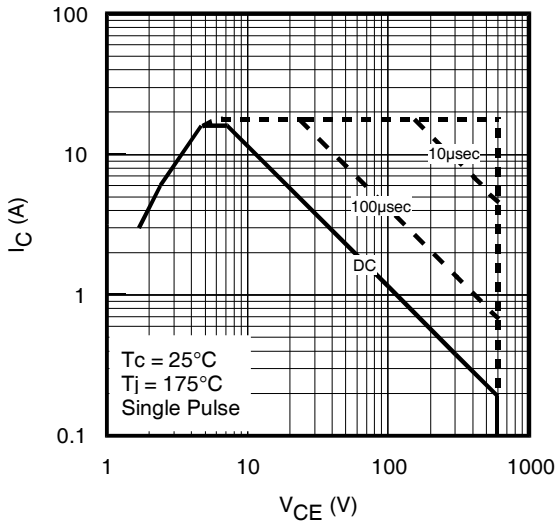



**Fig. 3** - Forward SOA,
$T_C = 25°C$, $T_J \leq 175°C$, $V_{GE} = 15V$

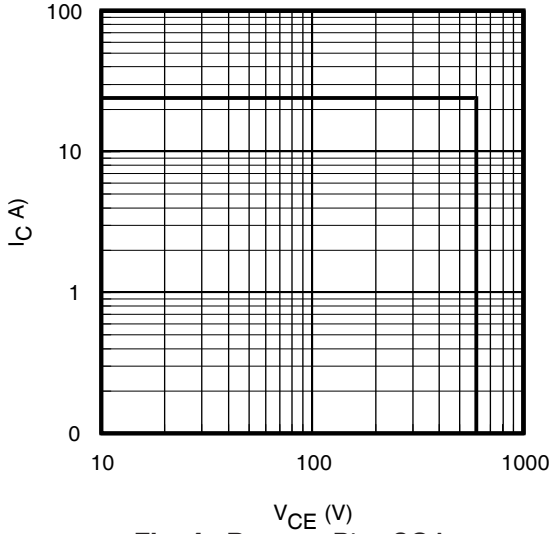



**Fig. 4** - Reverse Bias SOA
$T_J = 175°C$, $V_{GE} = 20V$

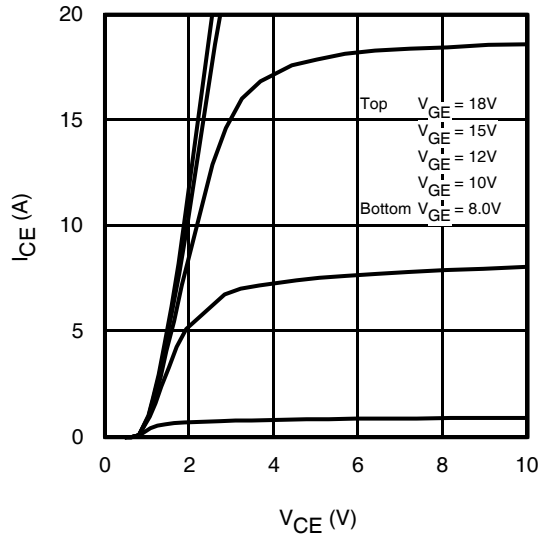



**Fig. 5** - Typ. IGBT Output Characteristics
$T_J = -40°C$; tp = 80µs

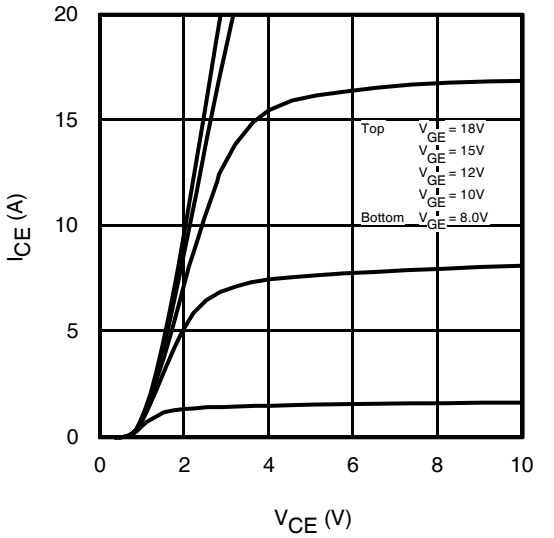



**Fig. 6** - Typ. IGBT Output Characteristics
$T_J = 25°C$; tp = 80µs

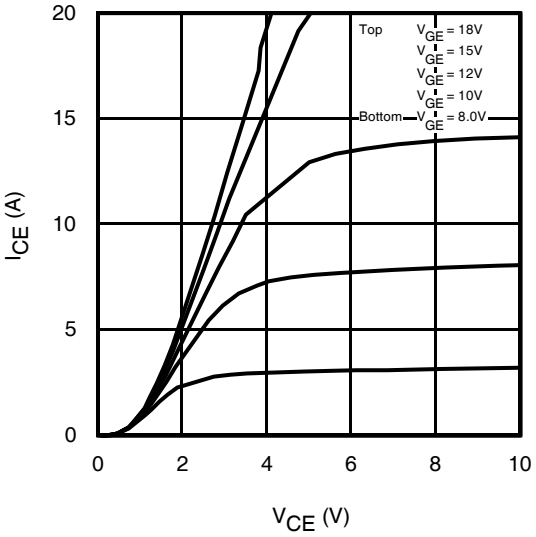



**Fig. 7** - Typ. IGBT Output Characteristics
$T_J$ = 175°C; tp = 80µs

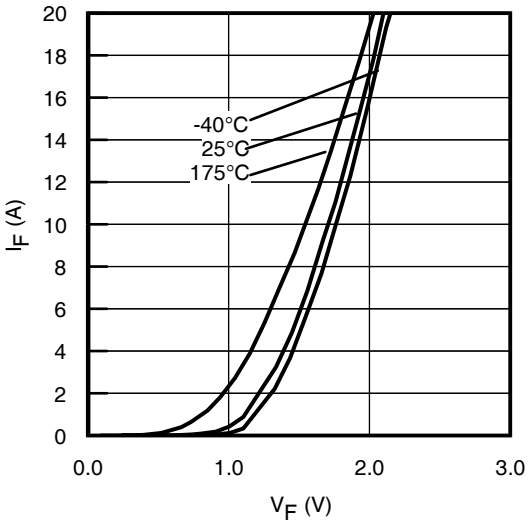



**Fig. 8** - Typ. Diode Forward Characteristics
tp = 80µs

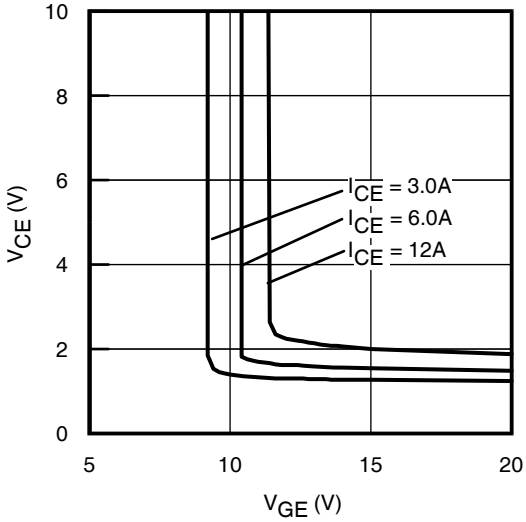



**Fig. 9** - Typical $V_{CE}$ vs. $V_{GE}$
$T_J$ = -40°C

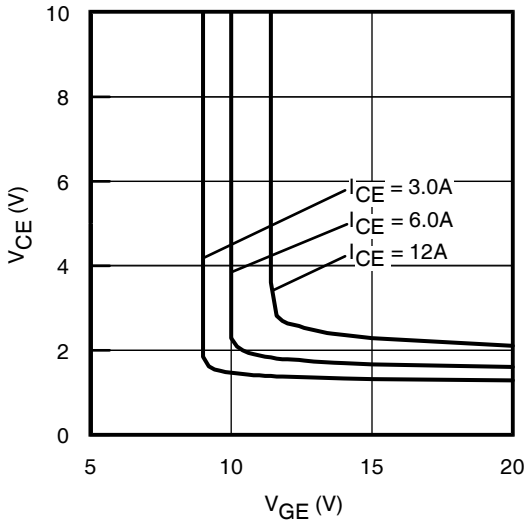



**Fig. 10** - Typical $V_{CE}$ vs. $V_{GE}$
$T_J$ = 25°C

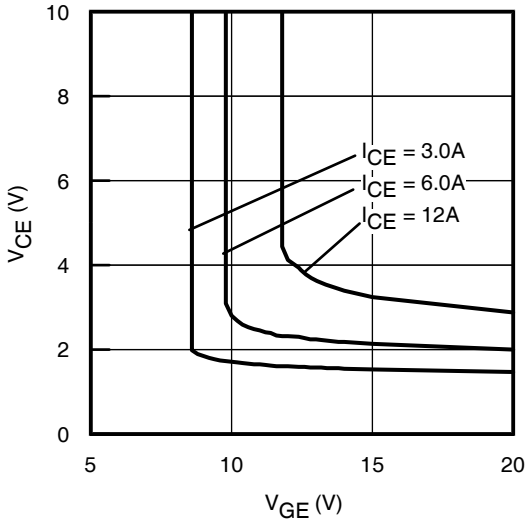



**Fig. 11** - Typical $V_{CE}$ vs. $V_{GE}$
$T_J$ = 175°C

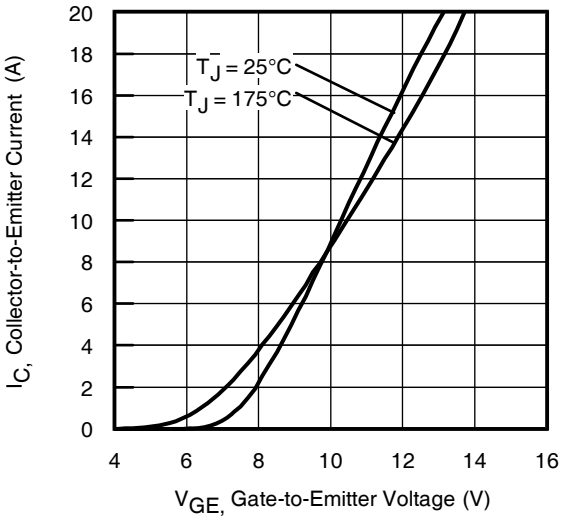



**Fig. 12** - Typ. Transfer Characteristics
$V_{CE}$ = 50V; tp = 10µs

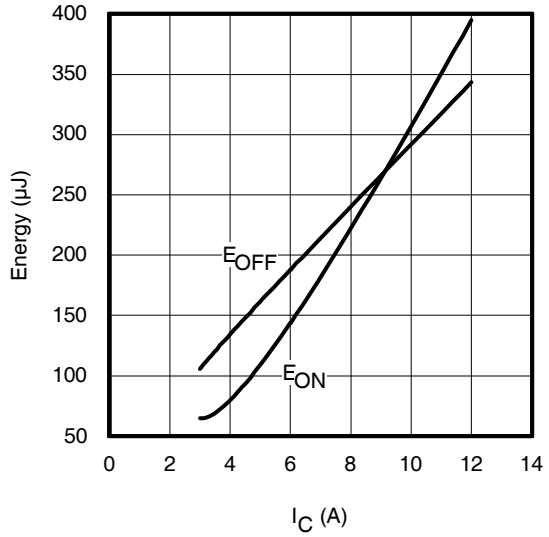



**Fig. 13** - Typ. Energy Loss vs. $I_C$
$T_J$ = 175°C; L = 1mH; $V_{CE}$ = 400V, $R_G$ = 47Ω; $V_{GE}$ = 15V.

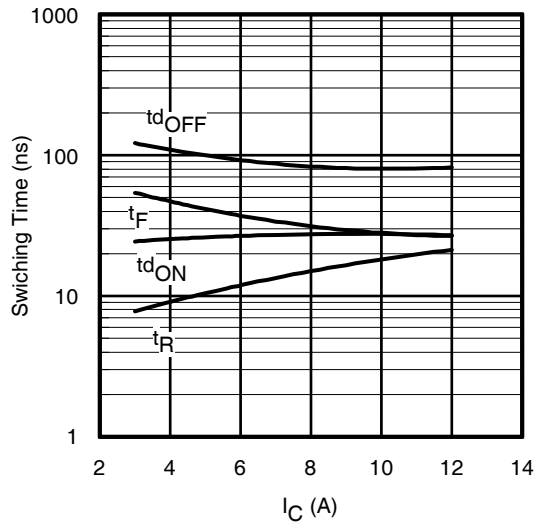



**Fig. 14** - Typ. Switching Time vs. $I_C$
$T_J$ = 175°C; L=1mH; $V_{CE}$= 400V
$R_G$= 47Ω; $V_{GE}$= 15V

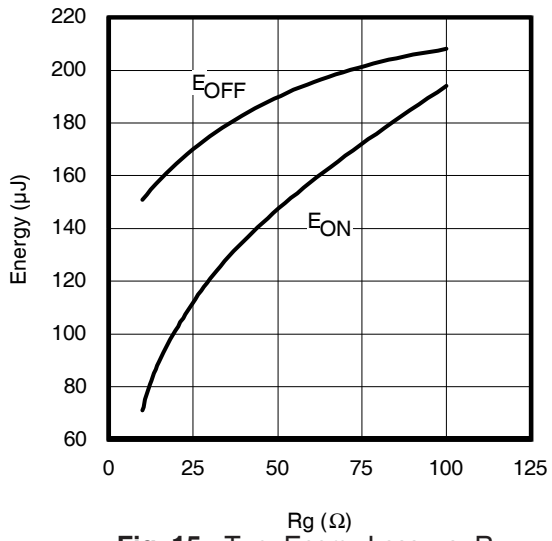



**Fig. 15** - Typ. Energy Loss vs. $R_G$
$T_J$ = 175°C; L = 1mH; $V_{CE}$ = 400V, $I_{CE}$ = 6.0A; $V_{GE}$ = 15V

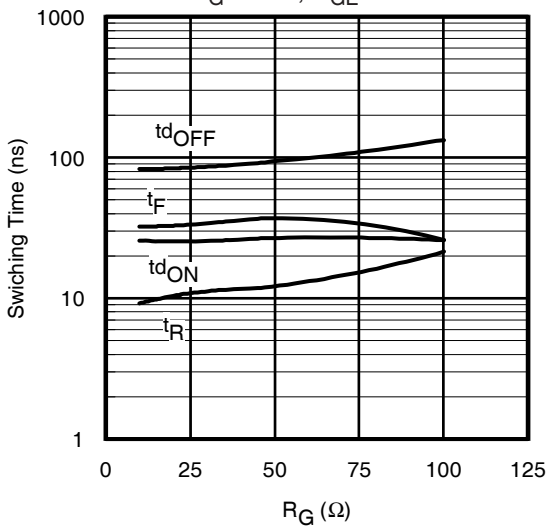



**Fig. 16**- Typ. Switching Time vs. $R_G$
$T_J$ = 175°C; L=1mH; $V_{CE}$= 400V
$I_{CE}$= 6.0A; $V_{GE}$= 15V

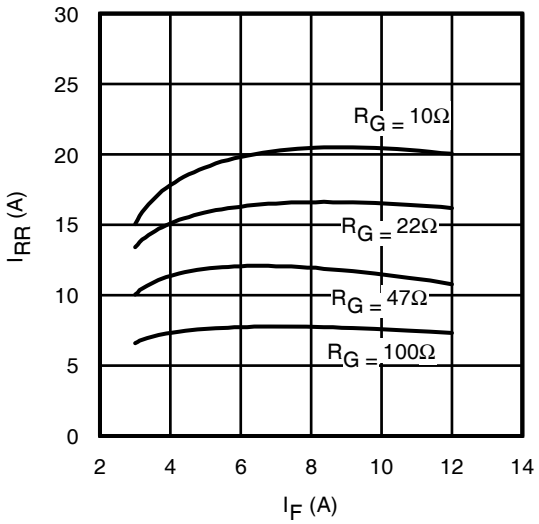



**Fig. 17** - Typical Diode $I_{RR}$ vs. $I_F$
$T_J$ = 175°C

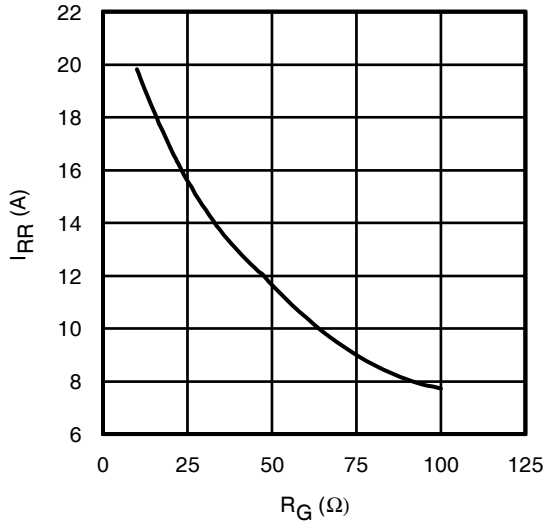



**Fig. 18** - Typical Diode $I_{RR}$ vs. $R_G$
$T_J$ = 175°C; $I_F$ = 6.0A

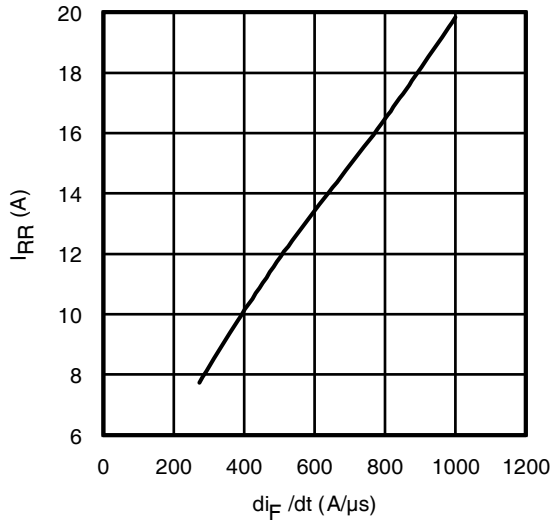



**Fig. 19**- Typical Diode $I_{RR}$ vs. $di_F/dt$
$V_{CC}$= 400V; $V_{GE}$= 15V;
$I_{CE}$= 6.0A; $T_J$ = 175°C

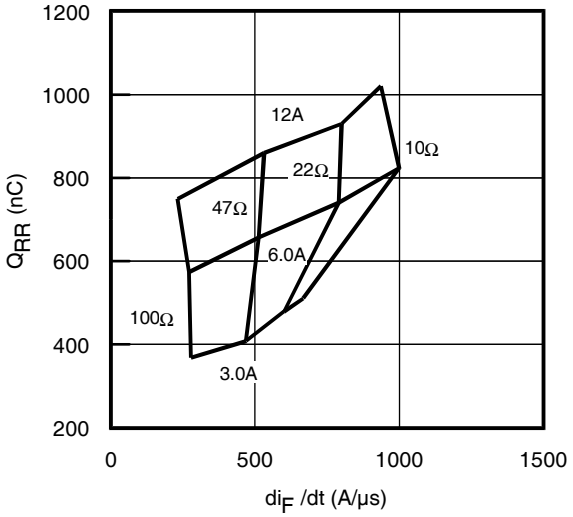



**Fig. 20** - Typical Diode $Q_{RR}$
$V_{CC}$= 400V; $V_{GE}$= 15V; $T_J$ = 175°C

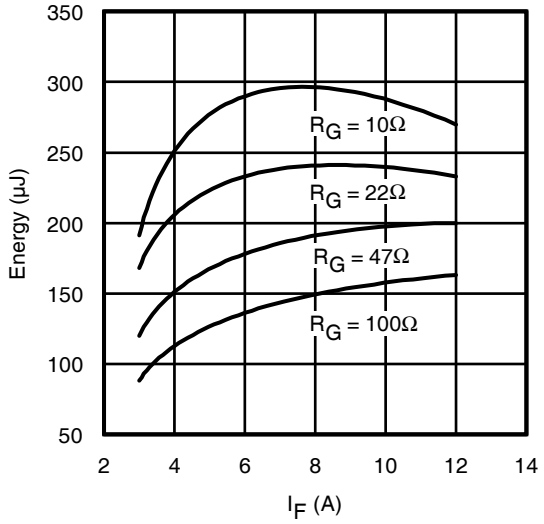



**Fig. 21** - Typical Diode $E_{RR}$ vs. $I_F$
$T_J$ = 175°C

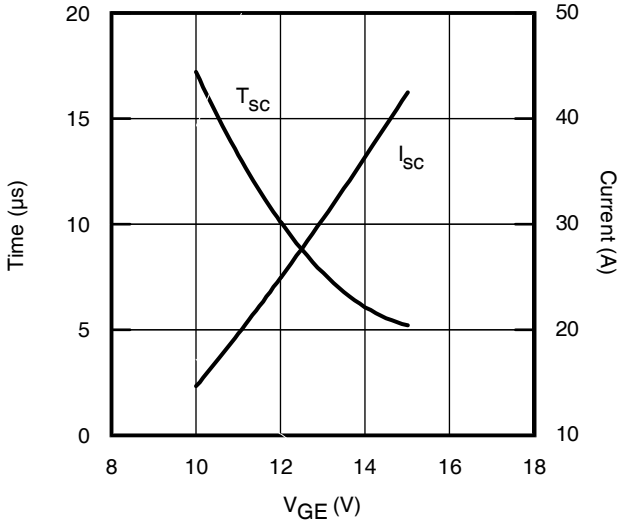



**Fig. 22**- Typ. $V_{GE}$ vs. Short Circuit Time
$V_{CC}$=400V, $T_C$ =25°C

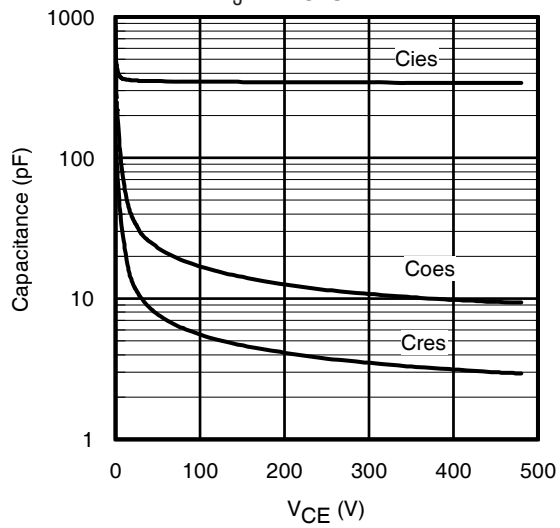



**Fig. 23**- Typ. Capacitance vs. $V_{CE}$
$V_{GE}$= 0V; f = 1MHz

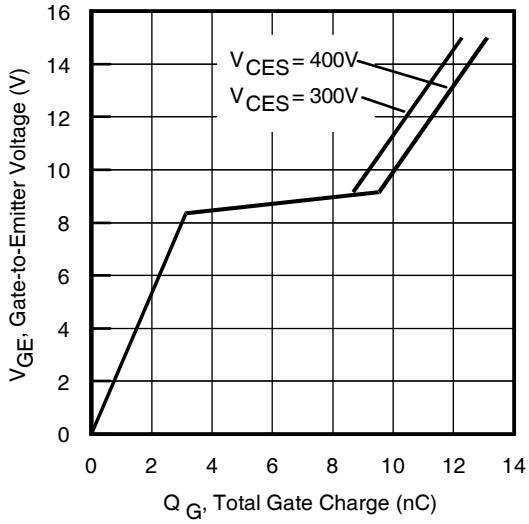



**Fig. 24** - Typical Gate Charge vs. $V_{GE}$
$I_{CE}$ = 6.0A, L=600µH

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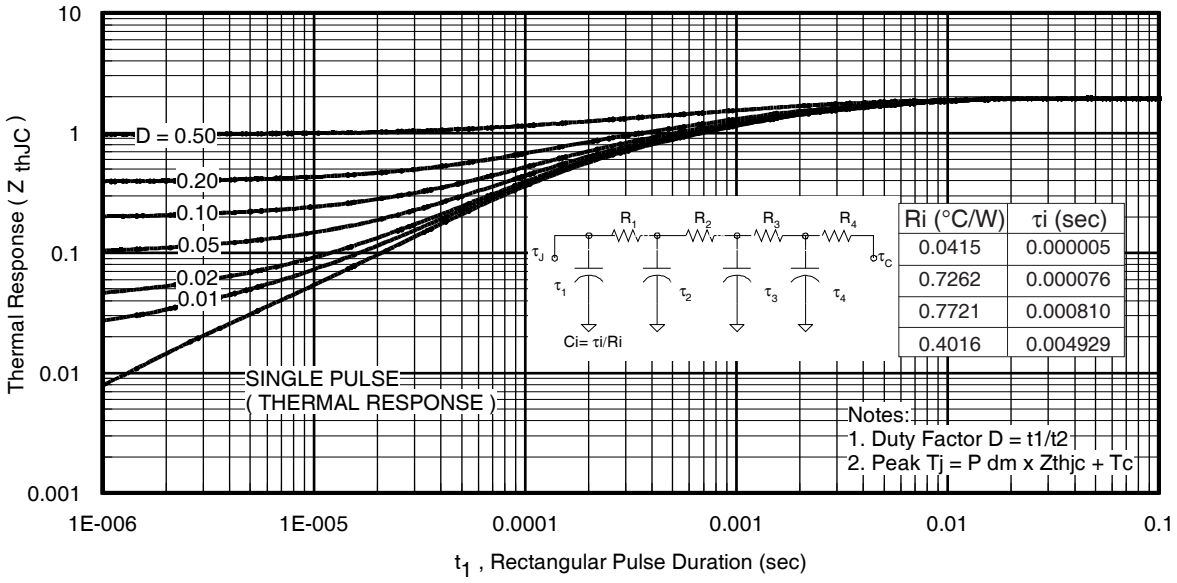



**Fig 25.** Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

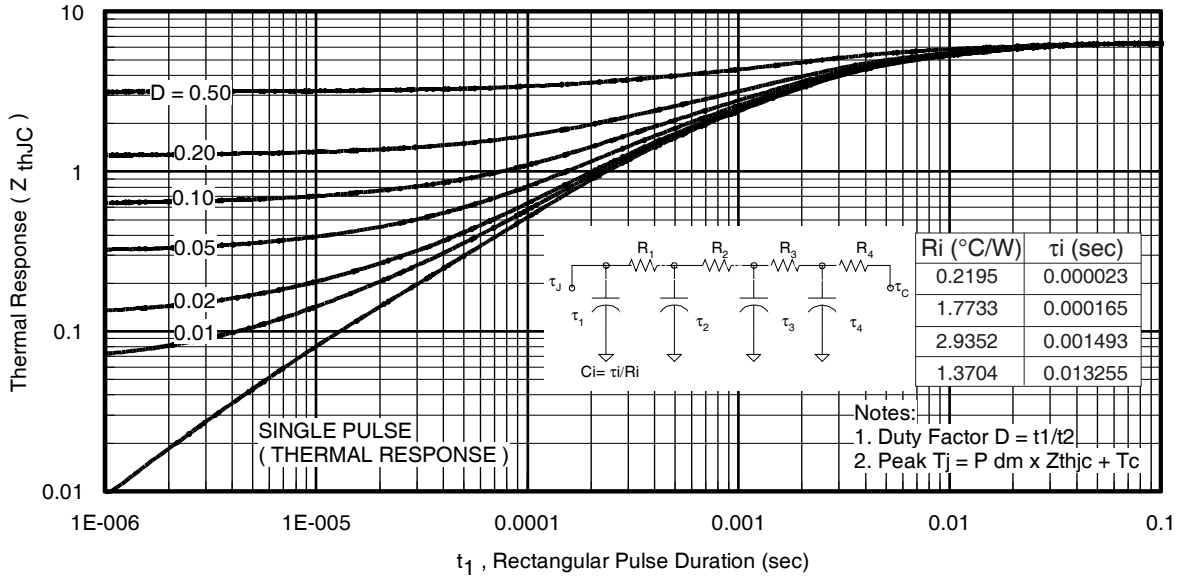



**Fig. 26.** Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

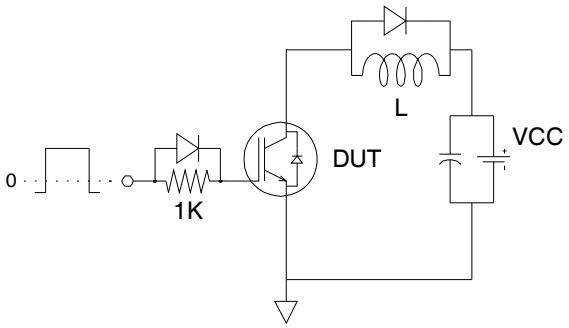



**Fig.C.T.1** - Gate Charge Circuit (turn-off)

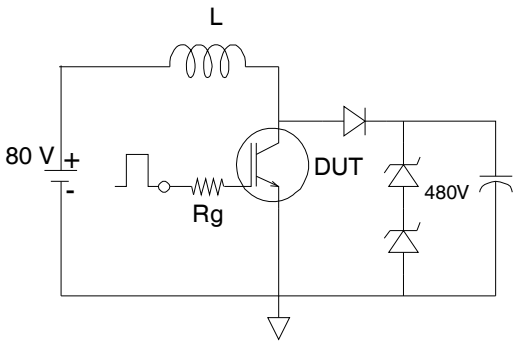



**Fig.C.T.2** - RBSOA Circuit

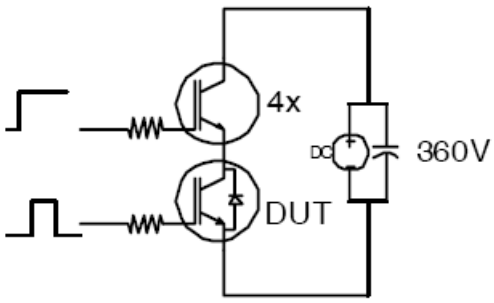



**Fig.C.T.3** - S.C.SOA Circuit

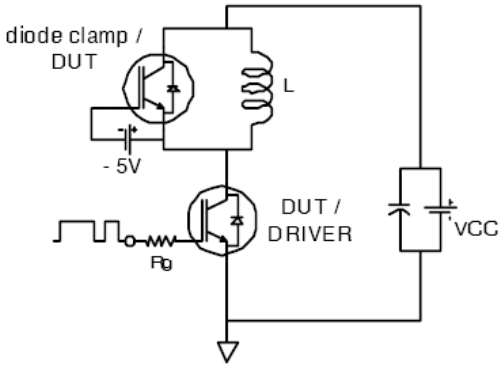



**Fig.C.T.4** - Switching Loss Circuit

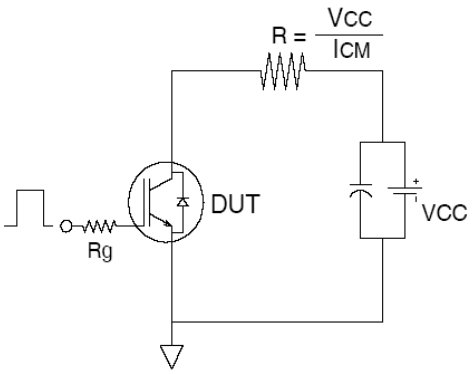



**Fig.C.T.5** - Resistive Load Circuit

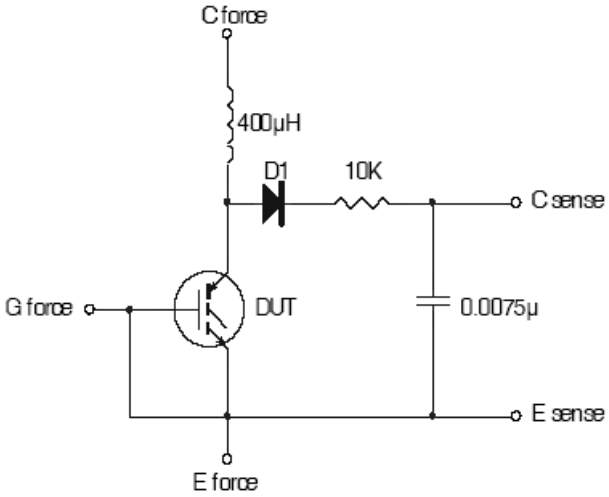



**Fig.C.T.6** - Typical Filter Circuit for $V_{(BR)CES}$ Measurement

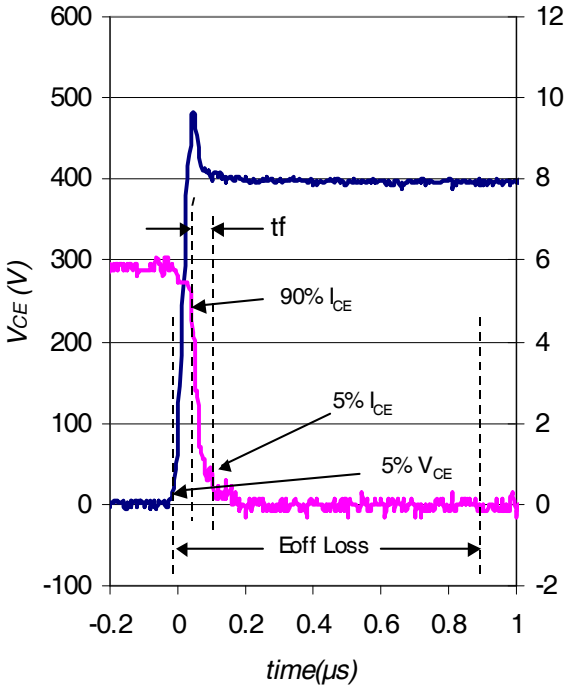



**Fig. WF1** - Typ. Turn-off Loss Waveform
@ $T_J$ = 175°C using Fig. CT.4

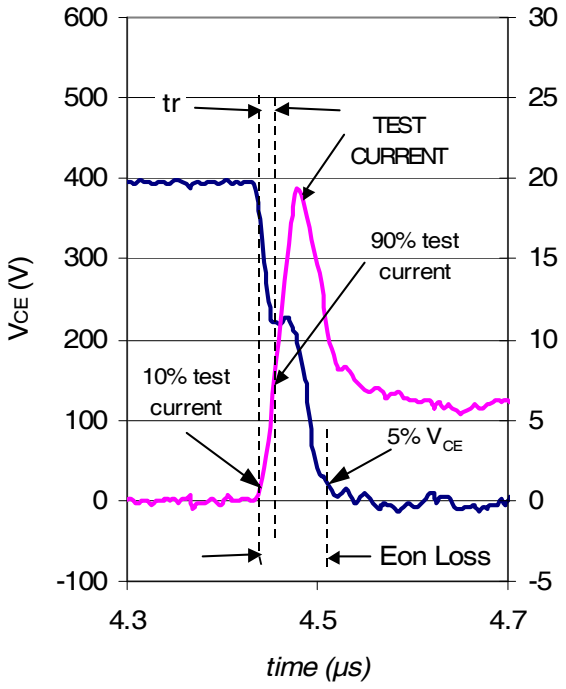
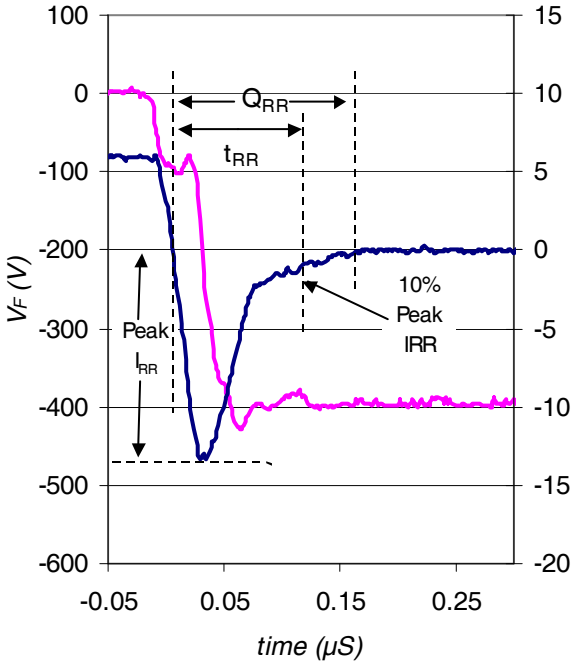
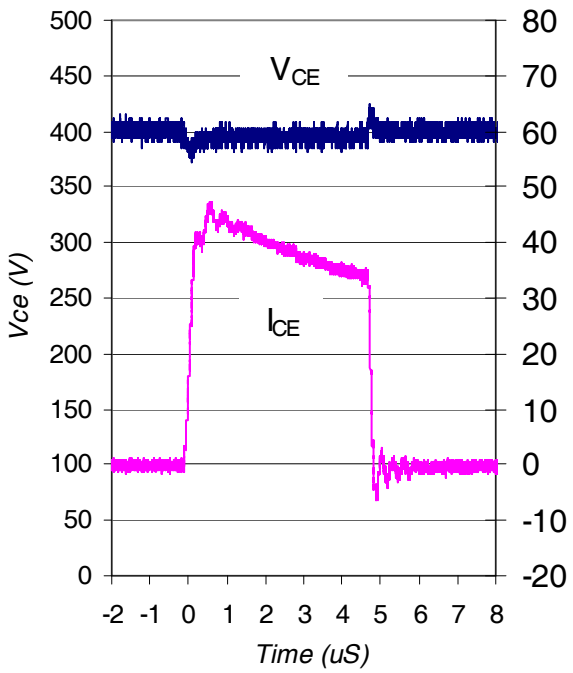



**Fig. WF2** - Typ. Turn-on Loss Waveform
@ $T_J$ = 175°C using Fig. CT.4



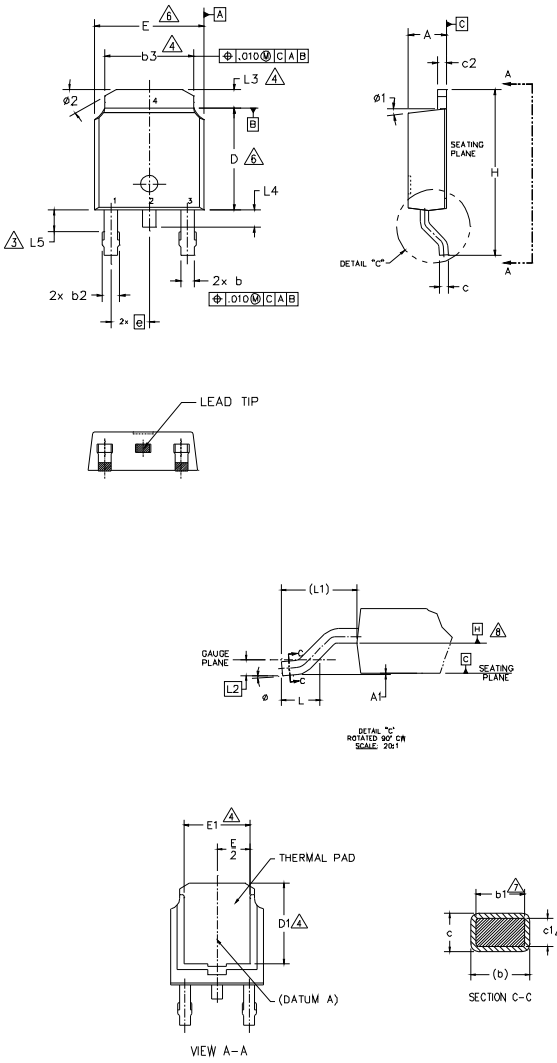

WF.3- Typ. Diode Recovery Waveform
@ $T_J$ = 175°C using CT.4




WF.4- Typ. Short Circuit Waveform
@ $T_J$ = 25°C using CT.3

# D-Pak (TO-252AA) Package Outline

Dimensions are shown in millimeters (inches)




NOTES:

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

2.– DIMENSION ARE SHOWN IN INCHES [MILLIMETERS].

3.– LEAD DIMENSION UNCONTROLLED IN L5.

4.– DIMENSION D1, E1, L3 & b3 ESTABLISH A MINIMUM MOUNTING SURFACE FOR THERMAL PAD.

5.– SECTION C–C DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .005 AND 0.10 [0.13 AND 0.25] FROM THE LEAD TIP.

6.– DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED .005 [0.13] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.

7.– DIMENSION b1 & c1 APPLIED TO BASE METAL ONLY.

8.– DATUM A & B TO BE DETERMINED AT DATUM PLANE H.

9.– OUTLINE CONFORMS TO JEDEC OUTLINE TO–252AA.

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 2.18 | 2.39 | .086 | .094 | |
| A1 | – | 0.13 | – | .005 | |
| b | 0.64 | 0.89 | .025 | .035 | |
| b1 | 0.65 | 0.79 | .025 | .031 | 7 |
| b2 | 0.76 | 1.14 | .030 | .045 | |
| b3 | 4.95 | 5.46 | .195 | .215 | 4 |
| c | 0.46 | 0.61 | .018 | .024 | |
| c1 | 0.41 | 0.56 | .016 | .022 | 7 |
| c2 | 0.46 | 0.89 | .018 | .035 | |
| D | 5.97 | 6.22 | .235 | .245 | 6 |
| D1 | 5.21 | – | .205 | – | 4 |
| E | 6.35 | 6.73 | .250 | .265 | 6 |
| E1 | 4.32 | – | .170 | – | 4 |
| e | 2.29 BSC | | .090 BSC | | |
| H | 9.40 | 10.41 | .370 | .410 | |
| L | 1.40 | 1.78 | .055 | .070 | |
| L1 | 2.74 BSC | | .108 REF. | | |
| L2 | 0.51 BSC | | .020 BSC | | |
| L3 | 0.89 | 1.27 | .035 | .050 | 4 |
| L4 | – | 1.02 | – | .040 | |
| L5 | 1.14 | 1.52 | .045 | .060 | 3 |
| ø | 0° | 10° | 0° | 10° | |
| ø1 | 0° | 15° | 0° | 15° | |
| ø2 | 25° | 35° | 25° | 35° | |

LEAD ASSIGNMENTS

HEXFET

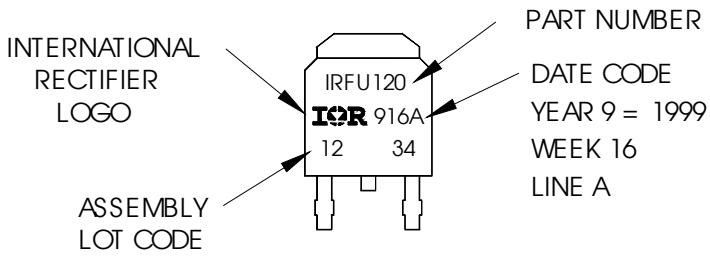
1.– GATE
2.– DRAIN
3.– SOURCE
4.– DRAIN

IGBT & CoPAK

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

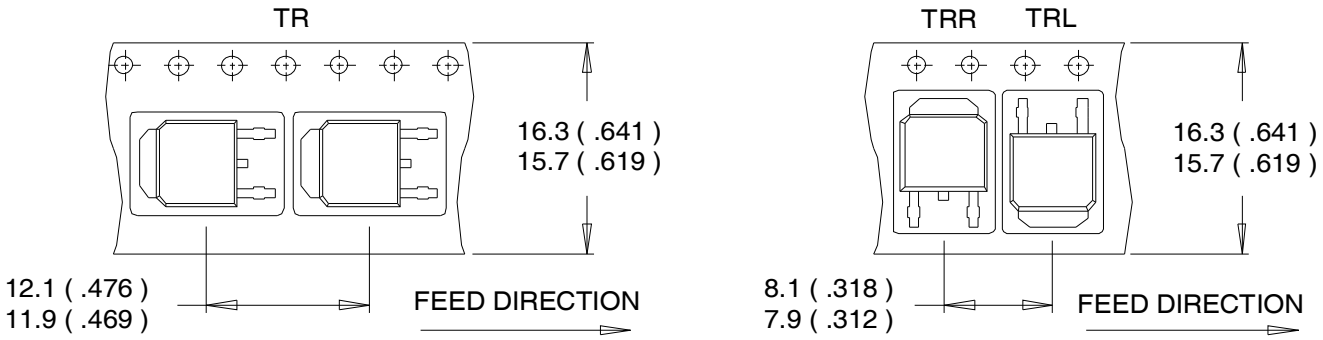
# D-Pak (TO-252AA) Part Marking Information

EXAMPLE: THIS IS AN IRFR120
WITH ASSEMBLY
LOT CODE 1234
ASSEMBLED ON WW 16, 1999
IN THE ASSEMBLY LINE "A"

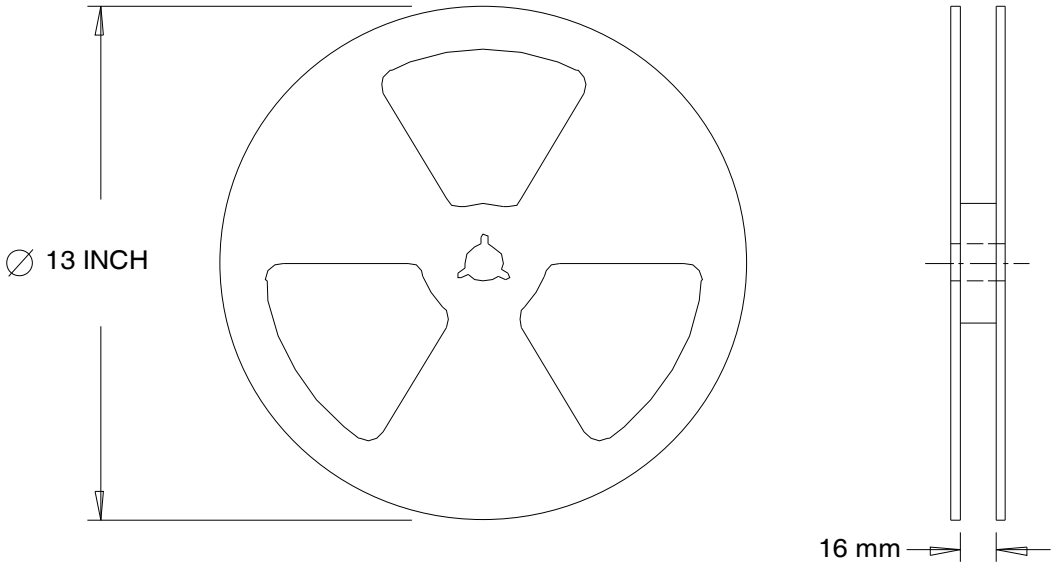



**Note: For the most current drawing please refer to IR website at http://www.irf.com/package/**

## D-Pak (TO-252AA) Tape & Reel Information (Dimensions are shown in millimeters (inches))




NOTES :
1. CONTROLLING DIMENSION : MILLIMETER.
2. ALL DIMENSIONS ARE SHOWN IN MILLIMETERS ( INCHES ).
3. OUTLINE CONFORMS TO EIA-481 & EIA-541.

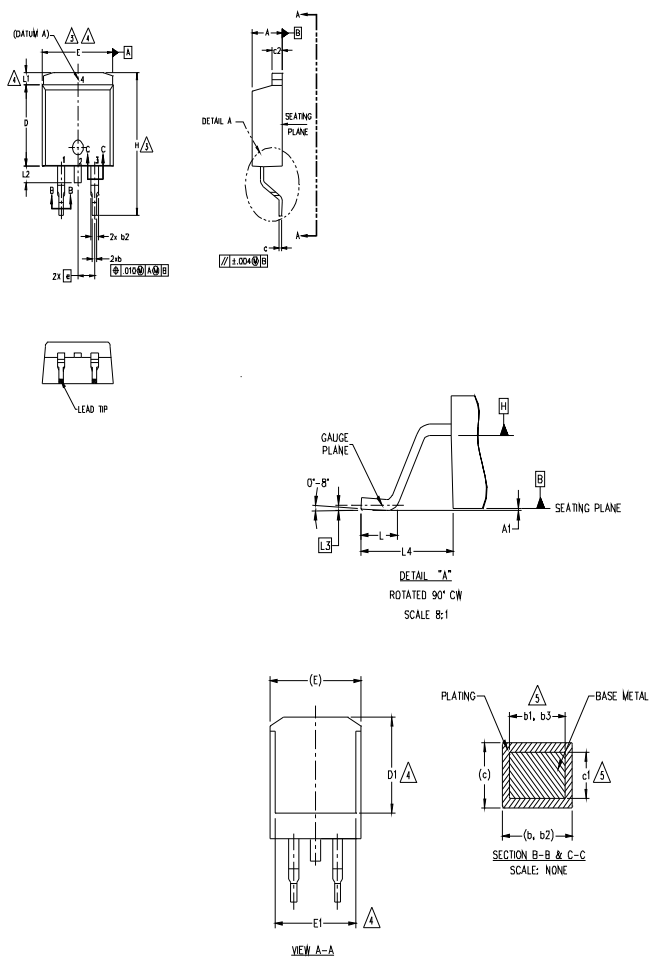



NOTES :
1. OUTLINE CONFORMS TO EIA-481.

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

# D²Pak Package Outline

Dimensions are shown in millimeters (inches)



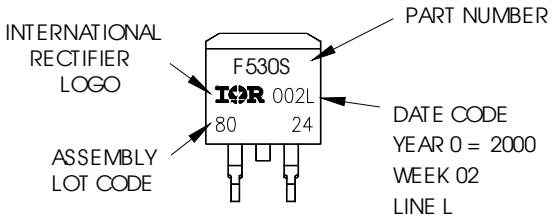

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.06 | 4.83 | .160 | .190 | |
| A1 | 0.00 | 0.254 | .000 | .010 | |
| b | 0.51 | 0.99 | .020 | .039 | |
| b1 | 0.51 | 0.89 | .020 | .035 | 5 |
| b2 | 1.14 | 1.78 | .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 | 9.65 | 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 | 4 |
| L2 | – | 1.78 | – | .070 | |
| L3 | 0.25 BSC | | .010 BSC | | |
| L4 | 4.78 | 5.28 | .188 | .208 | |

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 [.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.

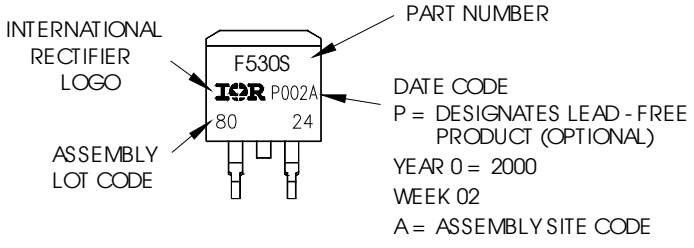
# D²Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW 02, 2000
IN THE ASSEMBLY LINE "L"

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

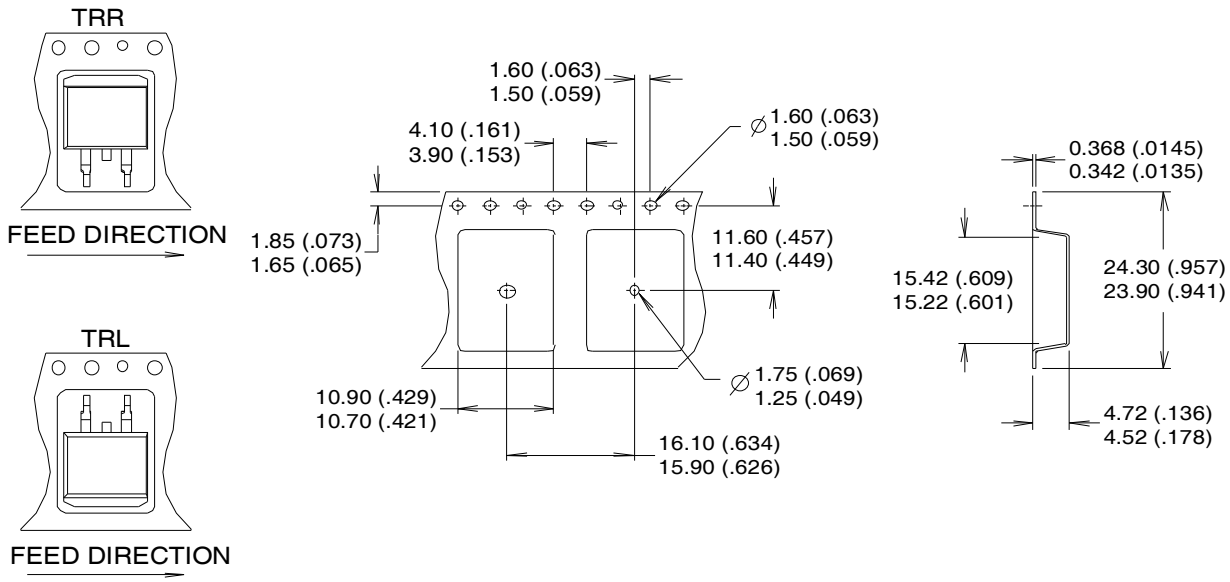


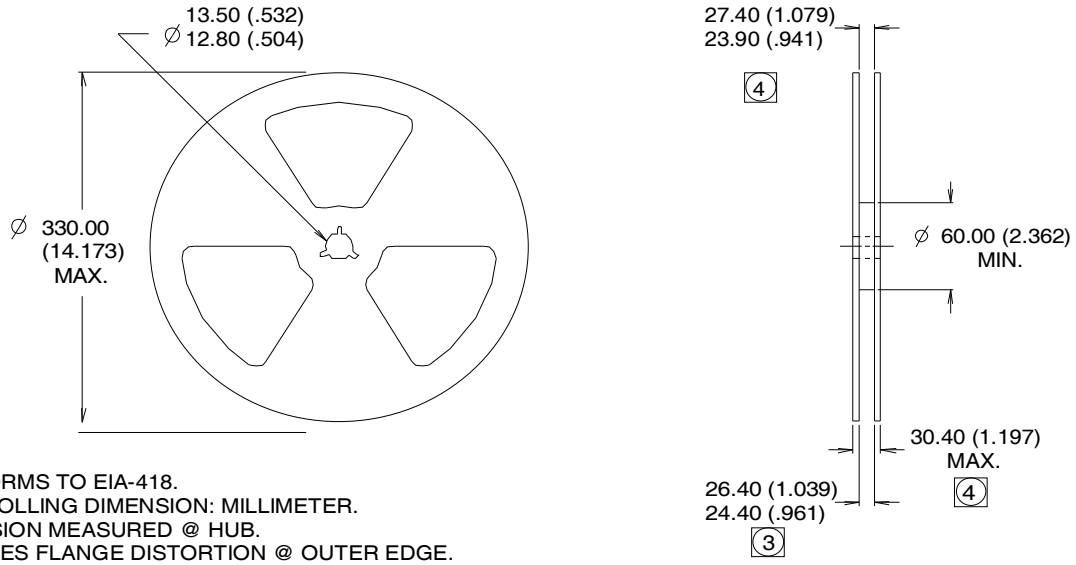

OR




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

## D²Pak Tape & Reel Information (Dimensions are shown in millimeters (inches))

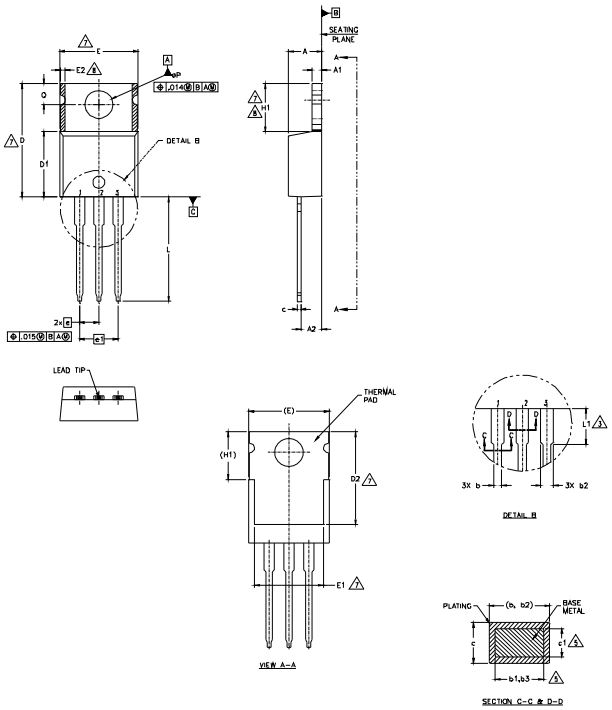



NOTES :
1. COMFORMS TO EIA-418.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION MEASURED @ HUB.
4. INCLUDES FLANGE DISTORTION @ OUTER EDGE.

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

## TO-220AB Package Outline (Dimensions are shown in millimeters (inches))




NOTES:
1.– DIMENSIONING AND TOLERANCING AS PER ASME Y14.5 M– 1994.
2.– DIMENSIONS ARE SHOWN IN INCHES [MILLIMETERS].
3.– LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4.– DIMENSION D, D1 & 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.– DIMENSION b1, b3 & c1 APPLY TO BASE METAL ONLY.
6.– CONTROLLING DIMENSION : INCHES.
7.– THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS E,H1,D2 & E1
8.– DIMENSION E2 X H1 DEFINE A ZONE WHERE STAMPING AND SINGULATION IRREGULARITIES ARE ALLOWED.
9.– OUTLINE CONFORMS TO JEDEC TO-220, EXCEPT A2 (max.) AND D2 (min.) WHERE DIMENSIONS ARE DERIVED FROM THE ACTUAL PACKAGE OUTLINE.

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 3.56 | 4.83 | .140 | .190 | |
| A1 | 0.51 | 1.40 | .020 | .055 | |
| A2 | 2.03 | 2.92 | .080 | .115 | |
| b | 0.38 | 1.01 | .015 | .040 | |
| b1 | 0.38 | 0.97 | .015 | .038 | 5 |
| b2 | 1.14 | 1.78 | .045 | .070 | |
| b3 | 1.14 | 1.73 | .045 | .068 | 5 |
| c | 0.36 | 0.61 | .014 | .024 | |
| c1 | 0.36 | 0.56 | .014 | .022 | 5 |
| D | 14.22 | 16.51 | .560 | .650 | 4 |
| D1 | 8.38 | 9.02 | .330 | .355 | |
| D2 | 11.68 | 12.88 | .460 | .507 | 7 |
| E | 9.65 | 10.67 | .380 | .420 | 4,7 |
| E1 | 6.86 | 8.89 | .270 | .350 | 7 |
| E2 | – | 0.76 | – | .030 | 8 |
| e | 2.54 BSC | | .100 BSC | | |
| e1 | 5.08 BSC | | .200 BSC | | |
| H1 | 5.84 | 6.86 | .230 | .270 | 7,8 |
| L | 12.70 | 14.73 | .500 | .580 | |
| L1 | – | 6.35 | – | .250 | 3 |
| øP | 3.54 | 4.08 | .139 | .161 | |
| Q | 2.54 | 3.42 | .100 | .135 | |

LEAD ASSIGNMENTS

HEXFET
1.– GATE
2.– DRAIN
3.– SOURCE

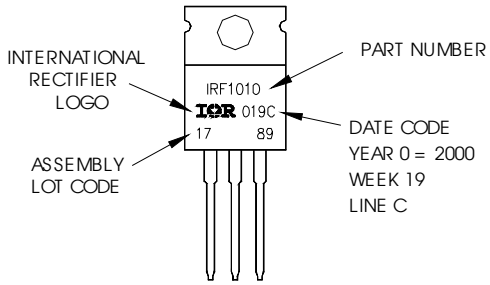
IGBTs, CoPACK
1.– GATE
2.– COLLECTOR
3.– EMITTER

DIODES
1.– ANODE/OPEN
2.– CATHODE
3.– ANODE

## TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 2000
IN THE ASSEMBLY LINE "C"

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




TO-220AB packages are 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** | D-Pak | MSL1 |
| | $D^2$Pak | |
| | TO-220 | N/A |
| **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

International
IOR Rectifier
**IR WORLD HEADQUARTERS:** 101 N. Sepulveda Blvd., El Segundo, California 90245, USA
To contact International Rectifier, please visit http://www.irf.com/whoto-call/

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