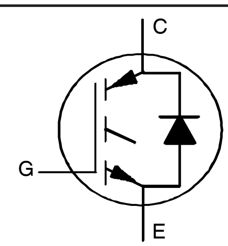
International
IOR Rectifier

# IRG6B330UDPbF

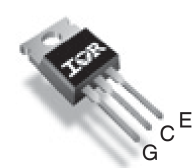
## PDP TRENCH IGBT

### Features
- Advanced Trench IGBT Technology
- Optimized for Sustain and Energy Recovery Circuits in PDP Applications
- Low $V_{CE(on)}$ and Energy per Pulse ($E_{PULSE}$™) for Improved Panel Efficiency
- High Repetitive Peak Current Capability
- Lead Free Package

| Key Parameters | | |
|---|---|---|
| $V_{CE}$ min | 330 | V |
| $V_{CE(ON)}$ typ. @ $I_C$ = 70A | 1.69 | V |
| $I_{RP}$ max @ $T_C$= 25°C ① | 250 | A |
| $T_J$ max | 150 | °C |




n-channel




TO-220AB

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

### Description
This IGBT is specifically designed for applications in Plasma Display Panels. This device utilizes advanced trench IGBT technology to achieve low $V_{CE(on)}$ and low $E_{PULSE}$™ rating per silicon area which improve panel efficiency. Additional features are 150°C operating junction temperature and high repetitive peak current capability. These features combine to make this IGBT a highly efficient, robust and reliable device for PDP applications.

### Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{GE}$ | Gate-to-Emitter Voltage | ±30 | V |
| $I_C$ @ $T_C$ = 25°C | Continuous Collector Current, $V_{GE}$ @ 15V | 70 | A |
| $I_C$ @ $T_C$ = 100°C | Continuous Collector, $V_{GE}$ @ 15V | 40 | |
| $I_{RP}$ @ $T_C$ = 25°C | Repetitive Peak Current ① | 250 | |
| $P_D$ @$T_C$ = 25°C | Power Dissipation | 160 | W |
| $P_D$ @$T_C$ = 100°C | Power Dissipation | 63 | |
| | Linear Derating Factor | 1.3 | W/°C |
| $T_J$<br>$T_{STG}$ | Operating Junction and<br>Storage Temperature Range | -40 to + 150 | °C |
| | Soldering Temperature for 10 seconds | 300 | |
| | Mounting Torque, 6-32 or M3 Screw | 10lb·in (1.1N·m) | N |

### Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ (IGBT) | Thermal Resistance Junction-to-Case-(each IGBT) ② | ––– | 0.80 | °C/W |
| $R_{\theta JC}$ (Diode) | Thermal Resistance Junction-to-Case-(each Diode) ② | 1.6 | 2.4 | |
| $R_{\theta CS}$ | Case-to-Sink (flat, greased surface) | 0.24 | ––– | |
| $R_{\theta JA}$ | Junction-to-Ambient (typical socket mount) ② | ––– | 40 | |
| | Weight | 6.0 (0.21) | ––– | g (oz) |



4/20/10

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | Collector-to-Emitter Breakdown Voltage | 330 | — | — | V | $V_{GE}$ = 0V, $I_{CE}$ = 1 mA |
| $\Delta BV_{CES}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.34 | — | V/°C | Reference to 25°C, $I_{CE}$ = 1mA |
| $V_{CE(on)}$ | Static Collector-to-Emitter Voltage | — | 1.18 | 1.48 | V | $V_{GE}$ = 15V, $I_{CE}$ = 25A ③ |
| | | — | 1.36 | 1.68 | | $V_{GE}$ = 15V, $I_{CE}$ = 40A ③ |
| | | — | 1.69 | 2.09 | | $V_{GE}$ = 15V, $I_{CE}$ = 70A ③ |
| | | — | 2.26 | 2.76 | | $V_{GE}$ = 15V, $I_{CE}$ = 120A ③ |
| | | — | 1.93 | — | | $V_{GE}$ = 15V, $I_{CE}$ = 70A, $T_J$ = 150°C |
| $V_{GE(th)}$ | Gate Threshold Voltage | 2.6 | — | 5.0 | V | $V_{CE}$ = $V_{GE}$, $I_{CE}$ = 500µA |
| $\Delta V_{GE(th)}/\Delta T_J$ | Gate Threshold Voltage Coefficient | — | -11 | — | mV/°C | |
| $I_{CES}$ | Collector-to-Emitter Leakage Current | — | 2.0 | 25 | µA | $V_{CE}$ = 330V, $V_{GE}$ = 0V |
| | | — | 5.0 | — | | $V_{CE}$ = 330V, $V_{GE}$ = 0V, $T_J$ = 100°C |
| | | — | 100 | — | | $V_{CE}$ = 330V, $V_{GE}$ = 0V, $T_J$ = 150°C |
| $I_{GES}$ | Gate-to-Emitter Forward Leakage | — | — | 100 | nA | $V_{GE}$ = 30V |
| | Gate-to-Emitter Reverse Leakage | — | — | -100 | | $V_{GE}$ = -30V |
| $g_{fe}$ | Forward Transconductance | — | 50 | — | S | $V_{CE}$ = 25V, $I_{CE}$ = 25A |
| $Q_g$ | Total Gate Charge | — | 85 | — | nC | $V_{CE}$ = 200V, $I_C$ = 25A, $V_{GE}$ = 15V③ |
| $Q_{gc}$ | Gate-to-Collector Charge | — | 31 | — | | |
| $t_{d(on)}$ | Turn-On delay time | — | 47 | — | ns | $I_C$ = 25A, $V_{CC}$ = 196V |
| $t_r$ | Rise time | — | 37 | — | | $R_G$ = 10Ω, L=200µH, $L_S$= 200nH |
| $t_{d(off)}$ | Turn-Off delay time | — | 176 | — | | $T_J$ = 25°C |
| $t_f$ | Fall time | — | 99 | — | | |
| $t_{d(on)}$ | Turn-On delay time | — | 45 | — | ns | $I_C$ = 25A, $V_{CC}$ = 196V |
| $t_r$ | Rise time | — | 38 | — | | $R_G$ = 10Ω, L=200µH, $L_S$= 200nH |
| $t_{d(off)}$ | Turn-Off delay time | — | 228 | — | | $T_J$ = 150°C |
| $t_f$ | Fall time | — | 183 | — | | |
| $t_{st}$ | Shoot Through Blocking Time | 100 | — | — | ns | $V_{CC}$ = 240V, $V_{GE}$ = 15V, $R_G$= 5.1Ω |
| $E_{PULSE}$ | Energy per Pulse | — | 834 | — | µJ | L = 220nH, C= 0.40µF, $V_{GE}$ = 15V<br>$V_{CC}$ = 240V, $R_G$= 5.1Ω, $T_J$ = 25°C |
| | | — | 985 | — | | L = 220nH, C= 0.40µF, $V_{GE}$ = 15V<br>$V_{CC}$ = 240V, $R_G$= 5.1Ω, $T_J$ = 100°C |
| $C_{iss}$ | Input Capacitance | — | 2297 | — | pF | $V_{GE}$ = 0V |
| $C_{oss}$ | Output Capacitance | — | 141 | — | | $V_{CE}$ = 30V |
| $C_{rss}$ | Reverse Transfer Capacitance | — | 74 | — | | ƒ = 1.0MHz, See Fig.13 |
| $L_C$ | Internal Collector Inductance | — | 5.0 | — | nH | Between lead,<br>6mm (0.25in.) |
| $L_E$ | Internal Emitter Inductance | — | 13 | — | | from package<br>and center of die contact |

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions | |
|---|---|---|---|---|---|---|---|
| $I_{F(AV)}$ | Average Forward Current at $T_C$=155°C | — | — | 8.0 | A | | |
| $I_{FSM}$ | Non Repetitive Peak Surge Current | — | — | 100 | A | $T_J$ = 155°C, PW = 6.0ms half sine wave | |
| $V_F$ | Forward Voltage | — | 1.19 | 1.3 | V | $I_F$ = 8A | |
| | | — | 0.94 | 1.0 | | $I_F$ = 8A, $T_J$ = 150°C | |
| $t_{rr}$ | Reverse Recovery Time | — | 35 | 60 | ns | $I_F$ = 1A, di/dt = -50A/µs, $V_R$ =30V | |
| | | — | 43 | — | | $T_J$ = 25°C | $I_F$ = 8A<br>di/dt = 200A/µs<br>$V_R$ = 200V |
| | | — | 67 | — | | $T_J$ = 125°C | |
| $Q_{rr}$ | Reverse Recovery Charge | — | 60 | — | nC | $T_J$ = 25°C | |
| | | — | 210 | — | | $T_J$ = 125°C | |
| $I_{rr}$ | Peak Recovery Current | — | 2.8 | — | A | $T_J$ = 25°C | |
| | | — | 6.3 | — | | $T_J$ = 125°C | |

**Notes:**

① Half sine wave with duty cycle = 0.1, ton=2µsec.

② $R_\theta$ is measured at $T_J$ of approximately 90°C.

③ Pulse width ≤ 400µs; duty cycle ≤ 2%.

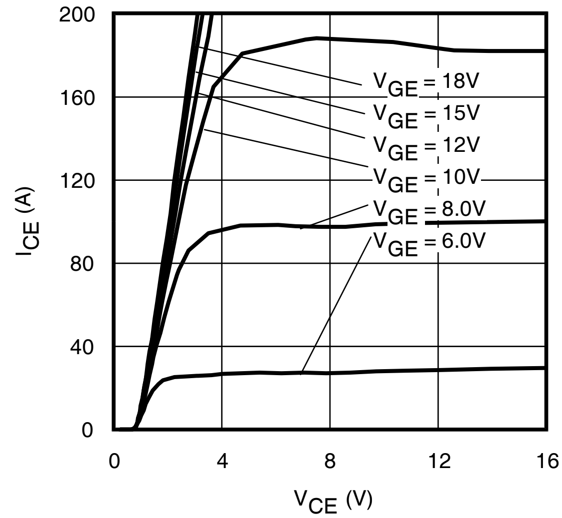



Fig 1. Typical Output Characteristics @ 25°C

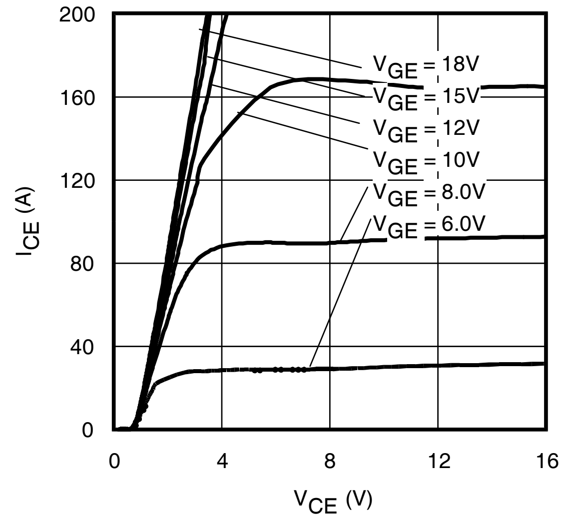



Fig 2. Typical Output Characteristics @ 75°C

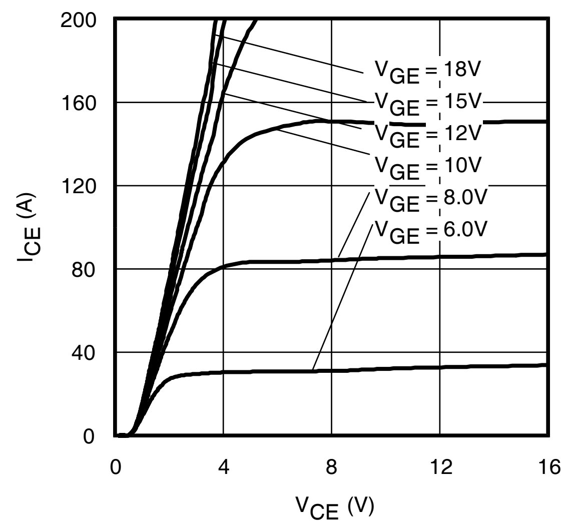



Fig 3. Typical Output Characteristics @ 125°C

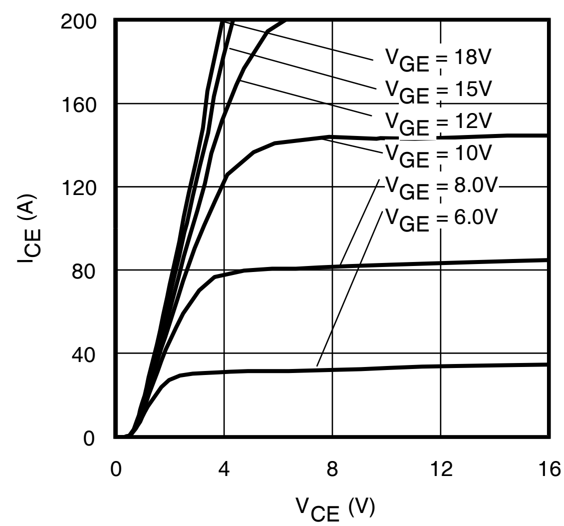



Fig 4. Typical Output Characteristics @ 150°C

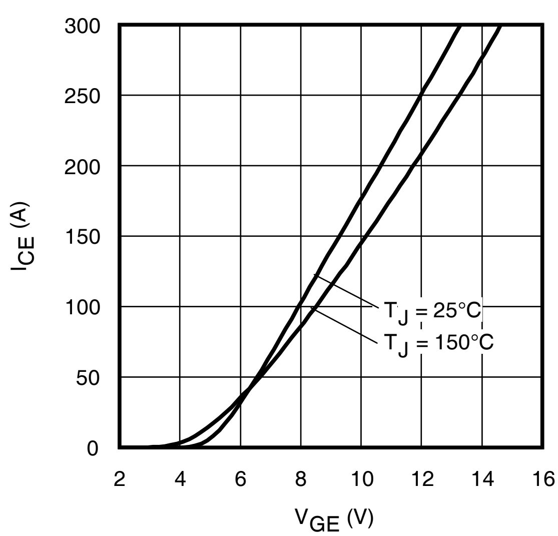



Fig 5. Typical Transfer Characteristics

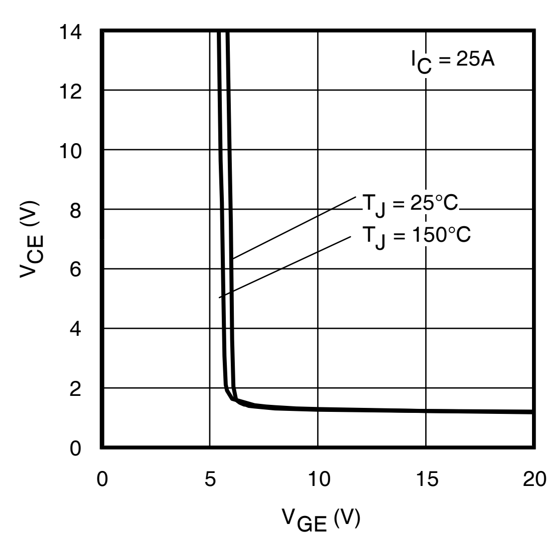



Fig 6. $V_{CE(ON)}$ vs. Gate Voltage

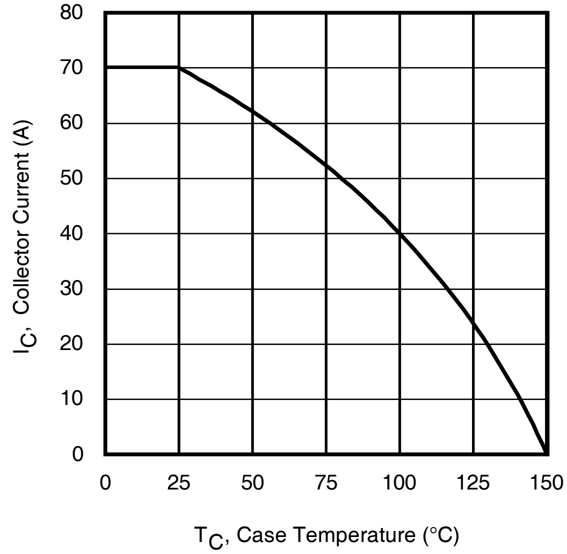



Fig 7. Maximum Collector Current vs. Case Temperature

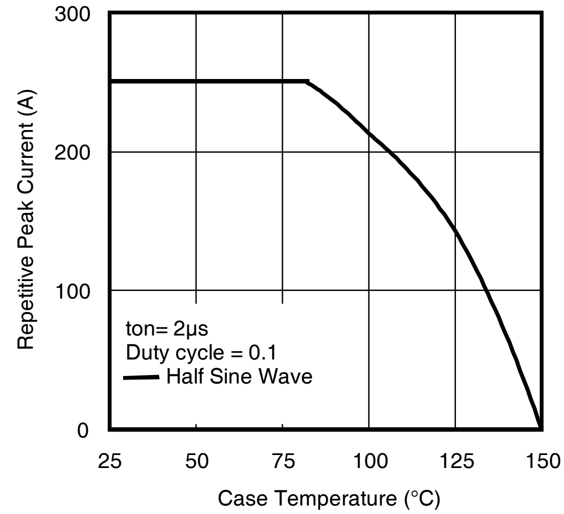



Fig 8. Typical Repetitive Peak Current vs. Case Temperature

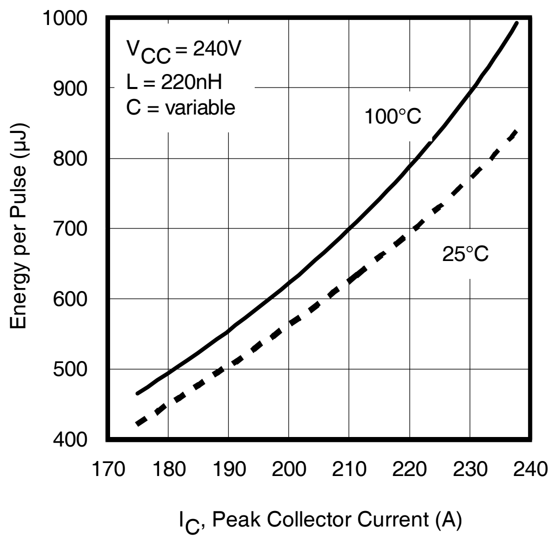



Fig 9. Typical $E_{PULSE}$ vs. Collector Current

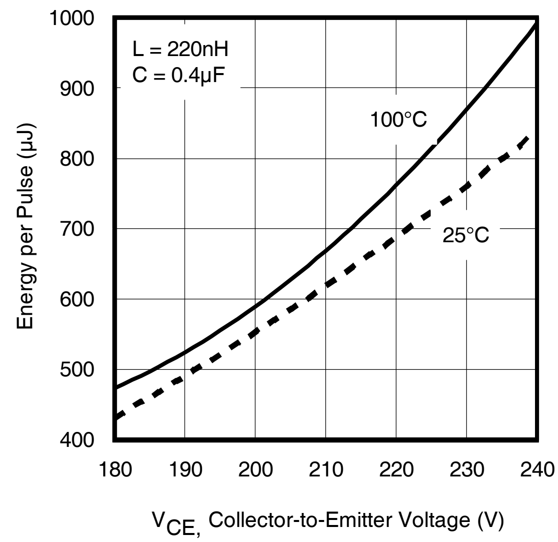



Fig 10. Typical $E_{PULSE}$ vs. Collector-to-Emitter Voltage

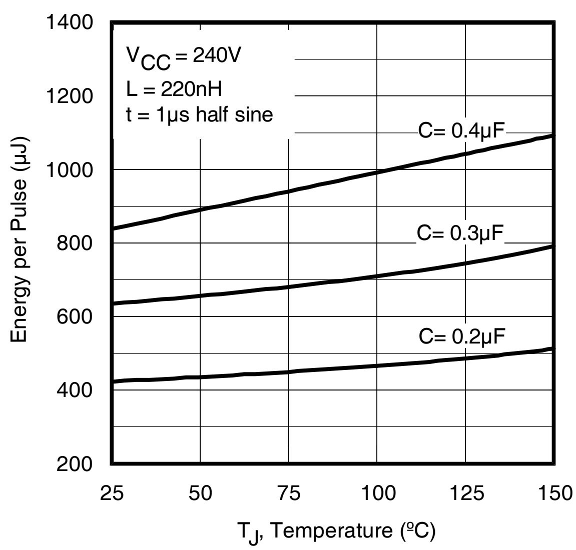



Fig 11. $E_{PULSE}$ vs. Temperature

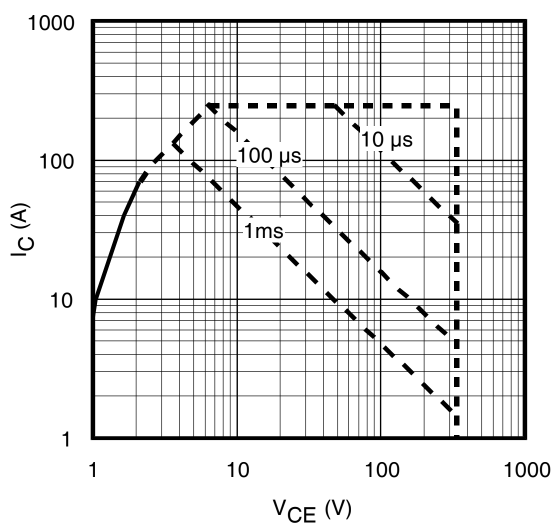



Fig 12. Forward Bias Safe Operating Area

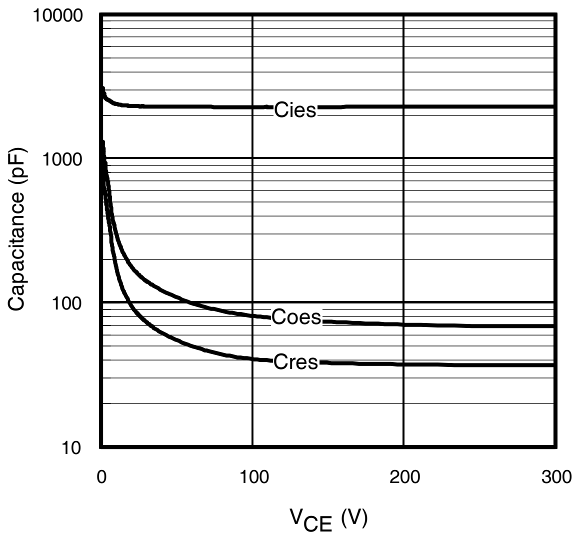



Fig 13. Typical Capacitance vs. Collector-to-Emitter Voltage

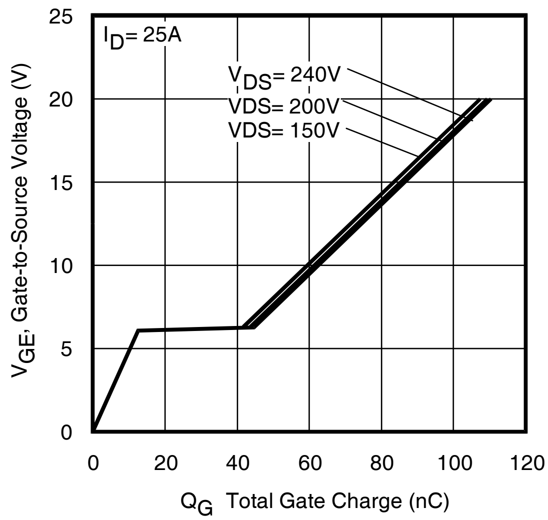



Fig 14. Typical Gate Charge vs. Gate-to-Emitter Voltage

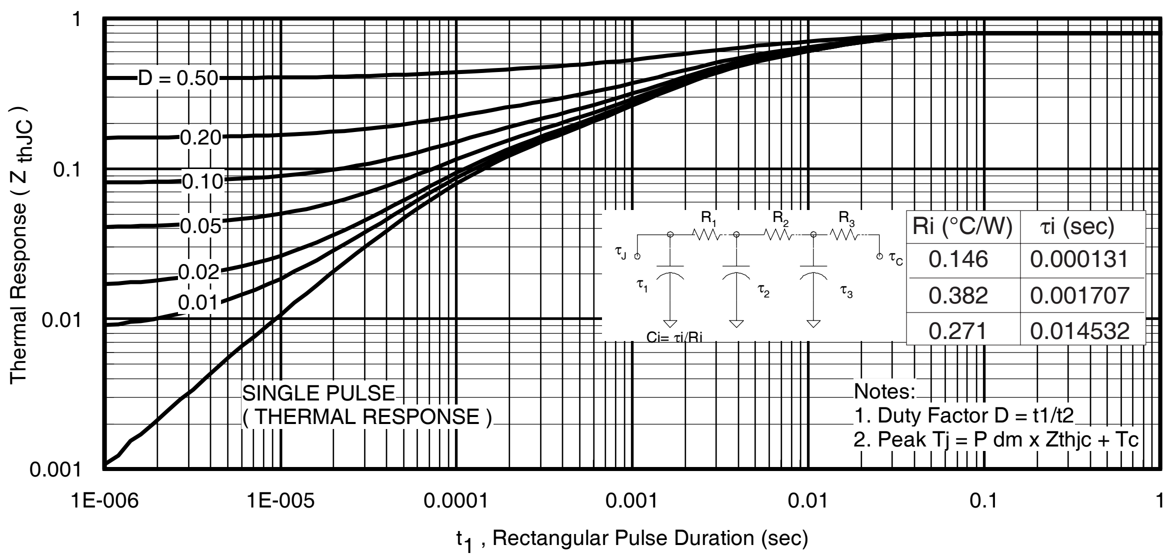



Fig 15. Maximum Effective Transient Thermal Impedance, Junction-to-Case (IGBT)

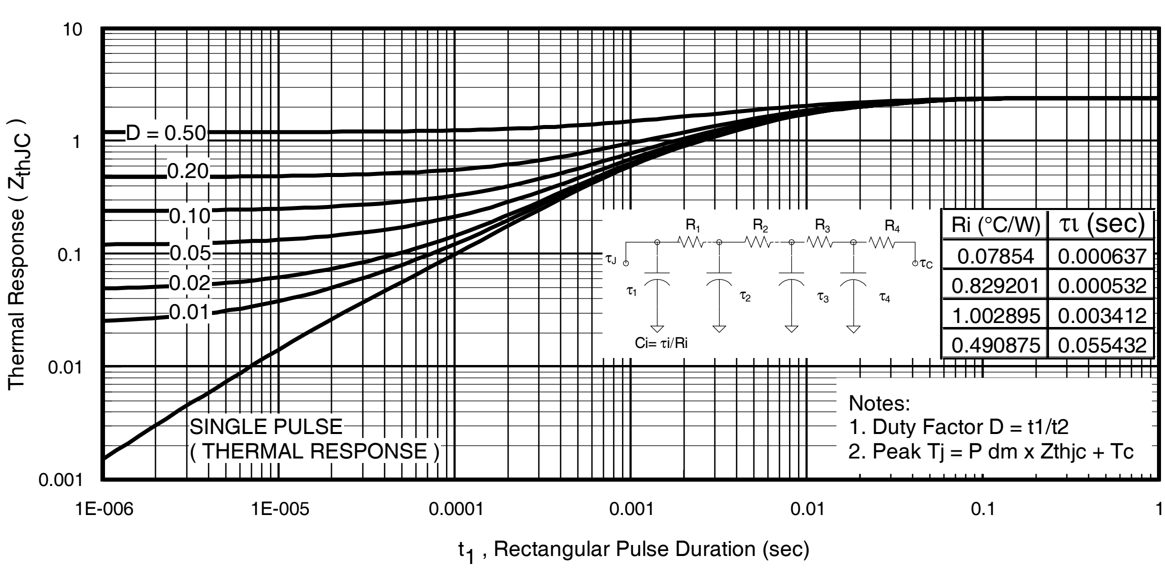



Fig 16. Maximum Effective Transient Thermal Impedance, Junction-to-Case (DIODE)

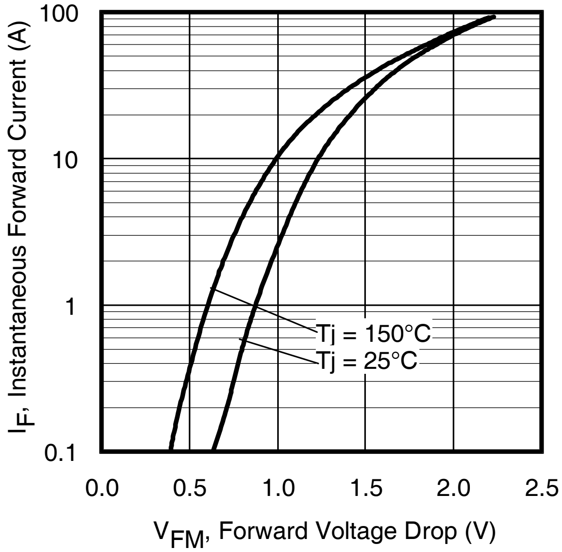



Fig. 17 - Typical Forward Voltage Drop Characteristics

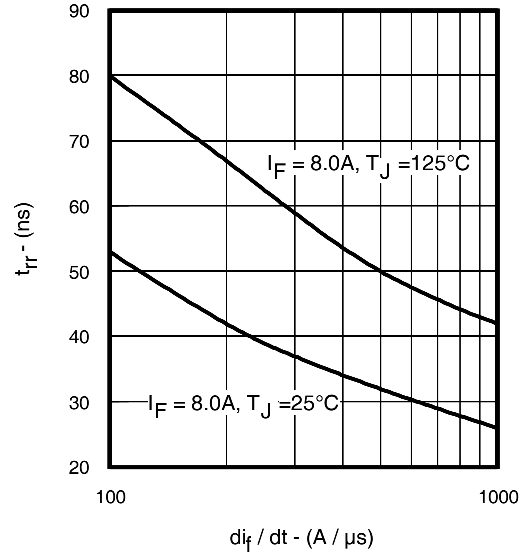



Fig. 18 - Typical Reverse Recovery vs. $di_F$/dt

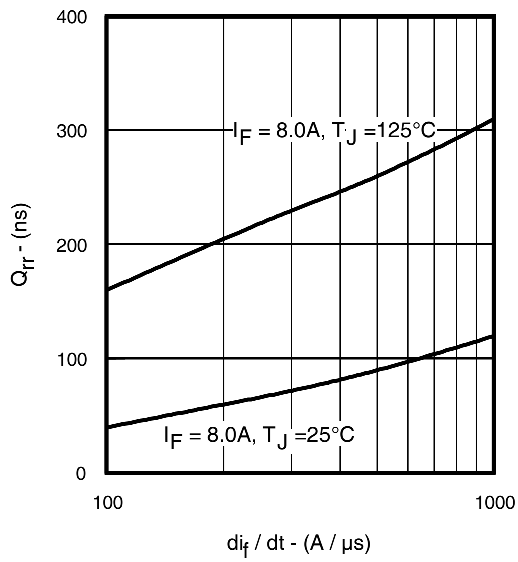



Fig. 19 - Typical Stored Charge vs. $di_F$/dt

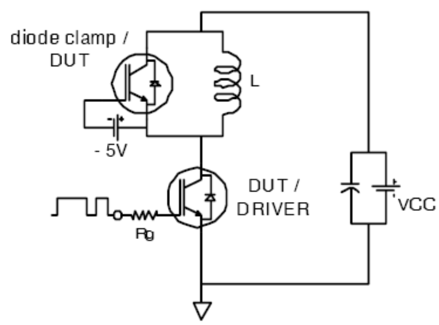



Fig.20 - Switching Loss Circuit

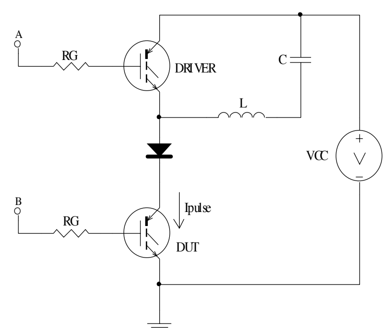



Fig 21a. $t_{st}$ and $E_{PULSE}$ Test Circuit

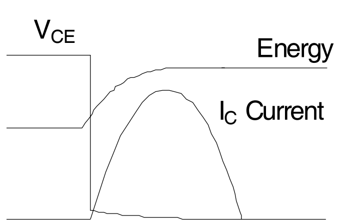



Fig 21b. $t_{st}$ Test Waveforms

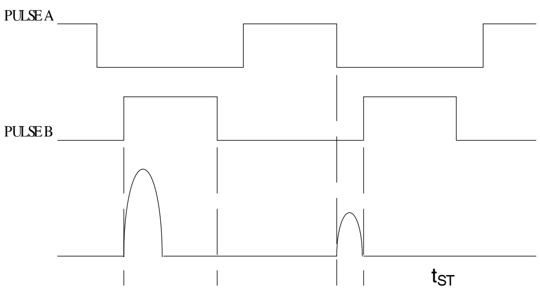



Fig 21c. $E_{PULSE}$ Test Waveforms

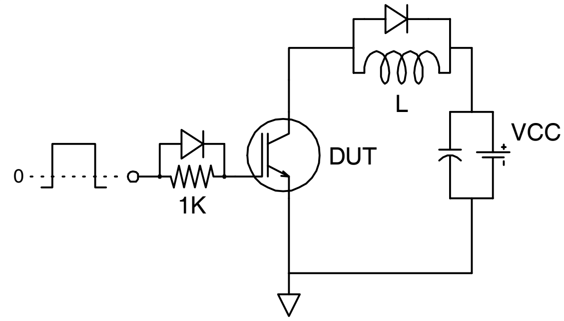
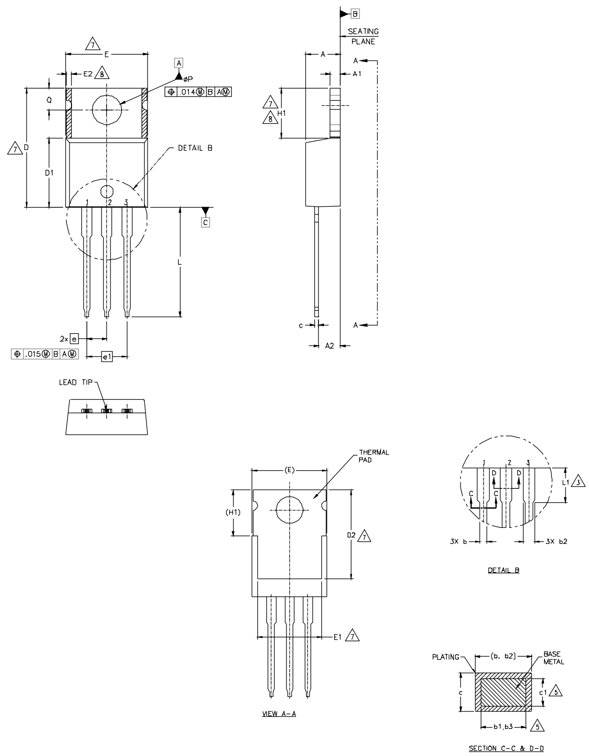



Fig. 22 - Gate Charge Circuit (turn-off)

## 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 | 3.56 | 4.06 | .140 | .160 | 3 |
| øP | 3.54 | 4.08 | .139 | .161 | |
| Q | 2.54 | 3.42 | .100 | .135 | |

LEAD ASSIGNMENTS

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

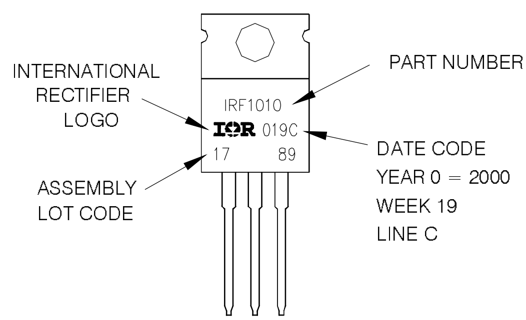
IGBTs, CoPACK
1.- GATE
2.- COLLECTOR
3.- EMITTER

DIODES
1.- ANODE
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/pkigbt.html**

Data and specifications subject to change without notice.
This product has been designed for the Industrial market.
Qualification Standards can be found on IR's Web site.

International
IOR Rectifier

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