International
IOR Rectifier

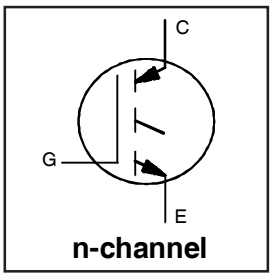
# IRG7IA13UPbF

## 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 | 360 | V |
| $V_{CE(ON)}$ typ. @ $I_C$ = 20A | 1.42 | V |
| $I_{RP}$ max @ $T_C$= 25°C | 160 | A |
| $T_J$ max | 150 | °C |




n-channel


TO-220 Full-Pak
IRG7IA13UPbF

| 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 | 20 | A |
| $I_C$ @ $T_C$ = 100°C | Continuous Collector, $V_{GE}$ @ 15V | 10 | |
| $I_{RP}$ @ $T_C$ = 25°C | Repetitive Peak Current ① | 160 | |
| $P_D$ @$T_C$ = 25°C | Power Dissipation | 34 | W |
| $P_D$ @$T_C$ = 100°C | Power Dissipation | 14 | |
| | Linear Derating Factor | 0.27 | 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 | 10 lbf·in (1.1 N·m) | |

### Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case ② | — | 3.7 | °C/W |
| $R_{\theta CS}$ | Case-to-Sink, flat, greased surface | 0.50 | — | |
| $R_{\theta JA}$ | Junction-to-Ambient, typical socket mount | — | 65 | |
| Wt | Weight | 2.0 | — | g |

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | Collector-to-Emitter Breakdown Voltage | 360 | --- | --- | V | $V_{GE}$ = 0V, $I_{CE}$ = 250µA |
| $\Delta BV_{CES}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | --- | 0.4 | --- | V/°C | Reference to 25°C, $I_{CE}$ = 1mA |
| $V_{CE(on)}$ | Static Collector-to-Emitter Voltage | --- | 1.26 | 1.52 | V | $V_{GE}$ = 15V, $I_{CE}$ = 12A ③ |
| | | --- | 1.42 | --- | | $V_{GE}$ = 15V, $I_{CE}$ = 20A ③ |
| | | | 1.84 | --- | | $V_{GE}$ = 15V, $I_{CE}$ = 40A ③ |
| | | --- | 2.25 | --- | | $V_{GE}$ = 15V, $I_{CE}$ = 60A ③ |
| | | --- | 1.48 | --- | | $V_{GE}$ = 15V, $I_{CE}$ = 20A, $T_J$ = 150°C ③ |
| $V_{GE(th)}$ | Gate Threshold Voltage | 2.2 | --- | 4.7 | V | $V_{CE}$ = $V_{GE}$, $I_{CE}$ = 1.0mA |
| $\Delta V_{GE(th)}/\Delta T_J$ | Gate Threshold Voltage Coefficient | --- | -10 | --- | mV/°C | |
| $I_{CES}$ | Collector-to-Emitter Leakage Current | --- | 1.0 | 10 | µA | $V_{CE}$ = 360V, $V_{GE}$ = 0V |
| | | | 25 | 150 | | $V_{CE}$ = 360V, $V_{GE}$ = 0V, $T_J$ = 125°C |
| | | --- | 75 | --- | | $V_{CE}$ = 360V, $V_{GE}$ = 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 | --- | 47 | --- | S | $V_{CE}$ = 25V, $I_{CE}$ = 12A |
| $Q_g$ | Total Gate Charge | --- | 33 | --- | nC | $V_{CE}$ = 240V, $I_C$ = 12A, $V_{GE}$ = 15V③ |
| $Q_{gc}$ | Gate-to-Collector Charge | --- | 12 | --- | | |
| $t_{d(on)}$ | Turn-On delay time | --- | 11 | --- | ns | $I_C$ = 12A, $V_{CC}$ = 196V |
| $t_r$ | Rise time | --- | 13 | --- | | $R_G$ = 10Ω, L=210µH |
| $t_{d(off)}$ | Turn-Off delay time | --- | 75 | --- | | $T_J$ = 25°C |
| $t_f$ | Fall time | --- | 120 | --- | | |
| $t_{d(on)}$ | Turn-On delay time | --- | 11 | --- | ns | $I_C$ = 12A, $V_{CC}$ = 196V |
| $t_r$ | Rise time | --- | 14 | --- | | $R_G$ = 10Ω, L=200µH, $L_S$= 150nH |
| $t_{d(off)}$ | Turn-Off delay time | --- | 86 | --- | | $T_J$ = 150°C |
| $t_f$ | Fall time | --- | 190 | --- | | |
| $t_{st}$ | Shoot Through Blocking Time | 100 | --- | --- | ns | $V_{CC}$ = 240V, $V_{GE}$ = 15V, $R_G$= 5.1Ω |
| $E_{PULSE}$ | Energy per Pulse | --- | 480 | --- | µJ | L = 220nH, C= 0.20µF, $V_{GE}$ = 15V<br>$V_{CC}$ = 240V, $R_G$= 5.1Ω, $T_J$ = 25°C |
| | | --- | 570 | --- | | L = 220nH, C= 0.20µF, $V_{GE}$ = 15V<br>$V_{CC}$ = 240V, $R_G$= 5.1Ω, $T_J$ = 100°C |
| ESD | Human Body Model | Class 1C<br>(Per JEDEC standard JESD22-A114) | | | | |
| | Machine Model | Class B<br>(Per EIA/JEDEC standard EIA/JESD22-A115) | | | | |
| $C_{ies}$ | Input Capacitance | --- | 880 | --- | pF | $V_{GE}$ = 0V |
| $C_{oes}$ | Output Capacitance | --- | 47 | --- | | $V_{CE}$ = 30V |
| $C_{res}$ | Reverse Transfer Capacitance | --- | 26 | --- | | $f$ = 1.0MHz |
| $L_C$ | Internal Collector Inductance | --- | 4.5 | --- | nH | Between lead,<br>6mm (0.25in.) |
| $L_E$ | Internal Emitter Inductance | --- | 7.5 | --- | | from package<br>and center of die contact |

**Notes:**

① Half sine wave with duty cycle = 0.05, ton=2µsec.

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

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

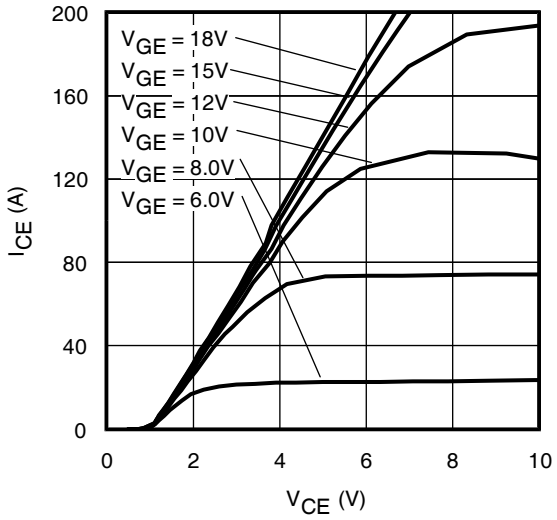



Fig 1. Typical Output Characteristics @ 25°C

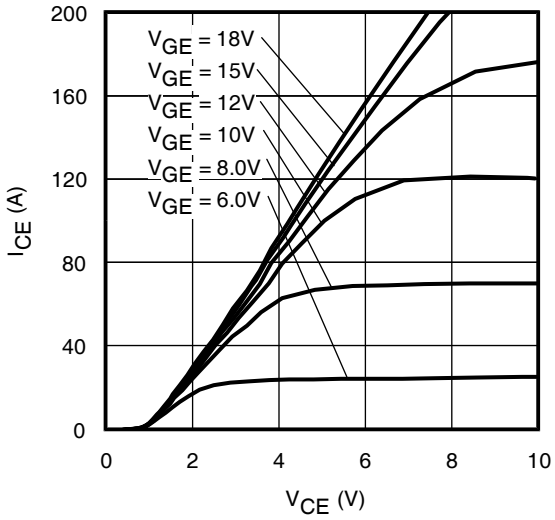



Fig 2. Typical Output Characteristics @ 75°C

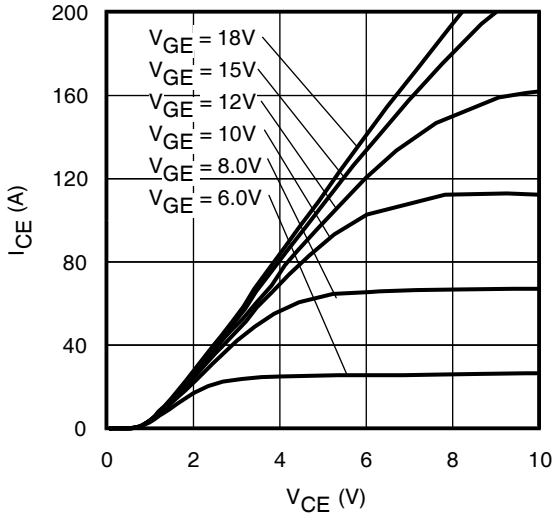



Fig 3. Typical Output Characteristics @ 125°C

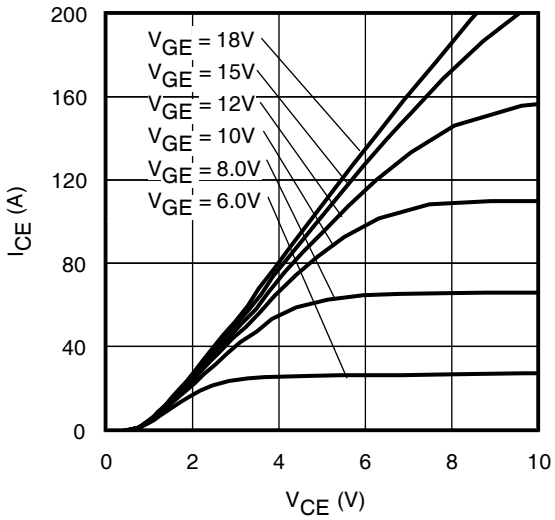



Fig 4. Typical Output Characteristics @ 150°C

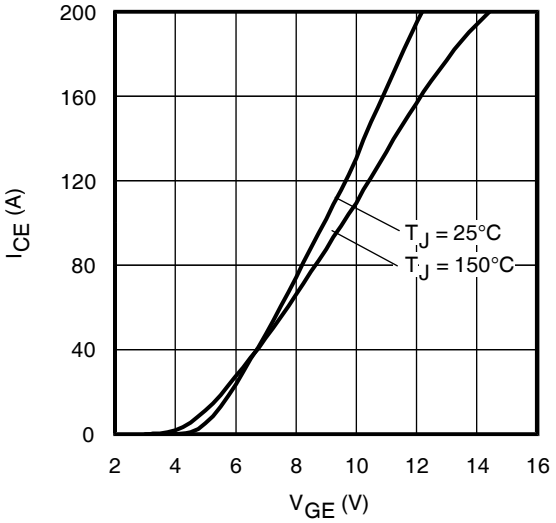



Fig 5. Typical Transfer Characteristics

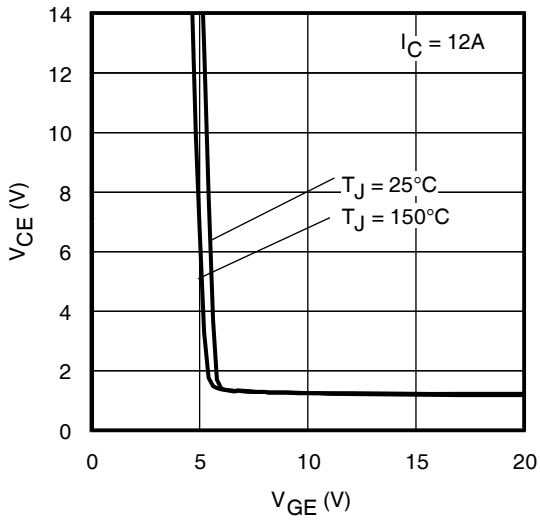



Fig 6. $V_{CE(ON)}$ vs. Gate Voltage

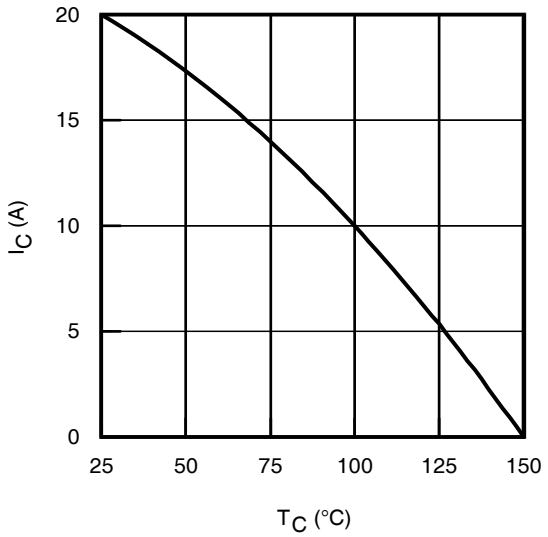



Fig 7. Maximum Collector Current vs. Case Temperature

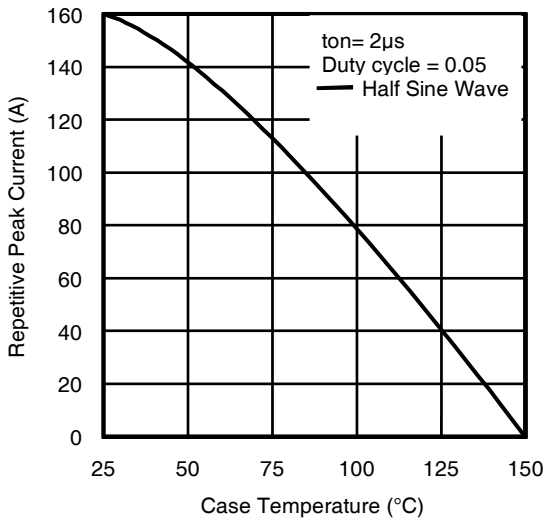



Fig 8. Typical Repetitive Peak Current vs. Case Temperature

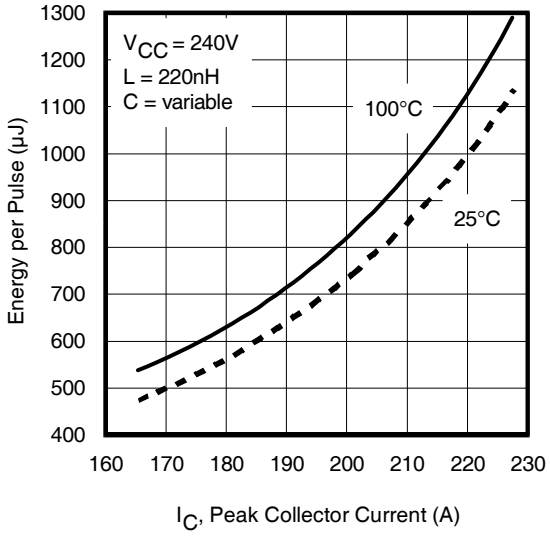



Fig 9. Typical $E_{PULSE}$ vs. Collector Current

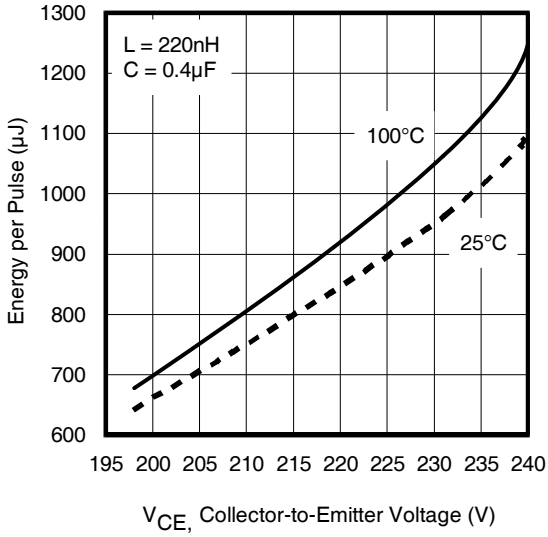



Fig 10. Typical $E_{PULSE}$ vs. Collector-to-Emitter Voltage

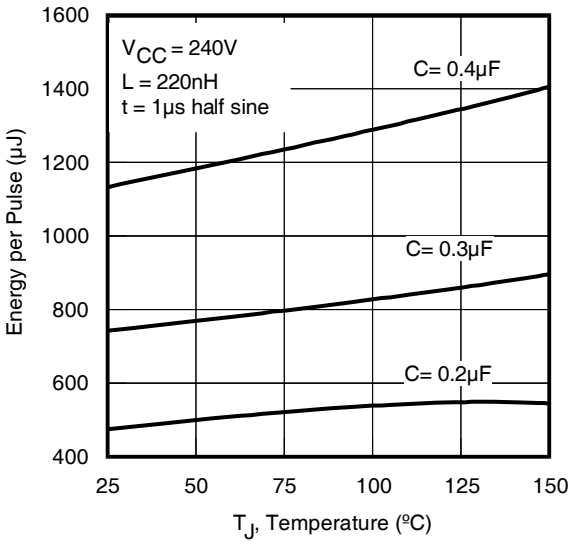



Fig 11. $E_{PULSE}$ vs. Temperature

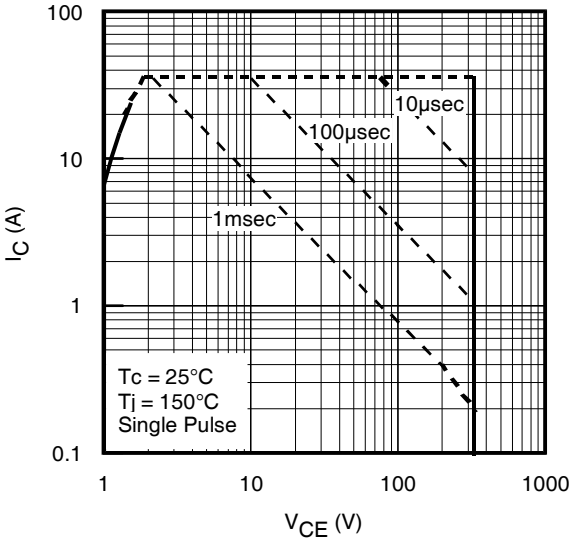



Fig 12. Forrward Bias Safe Operating Area

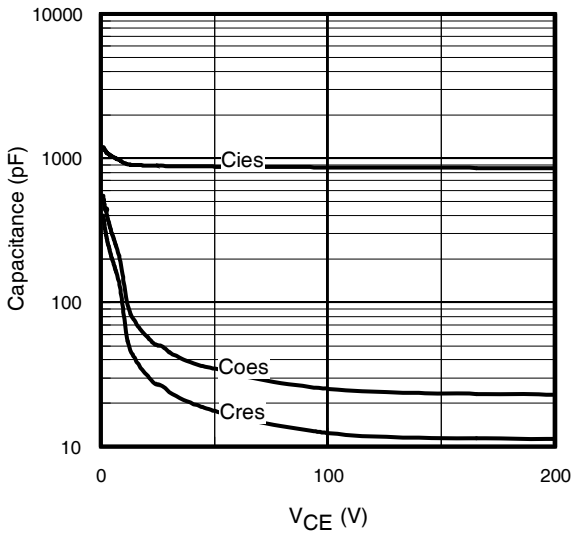



Fig 13. Typical Capacitance vs. Collector-to-Emitter Voltage

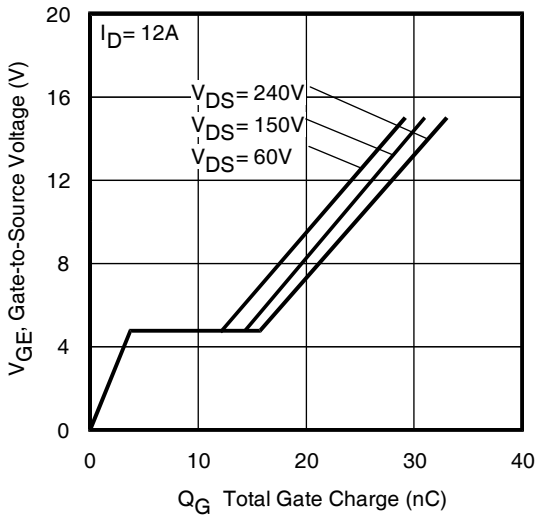



Fig 14. Typical Gate Charge vs. Gate-to-Emitter Voltage

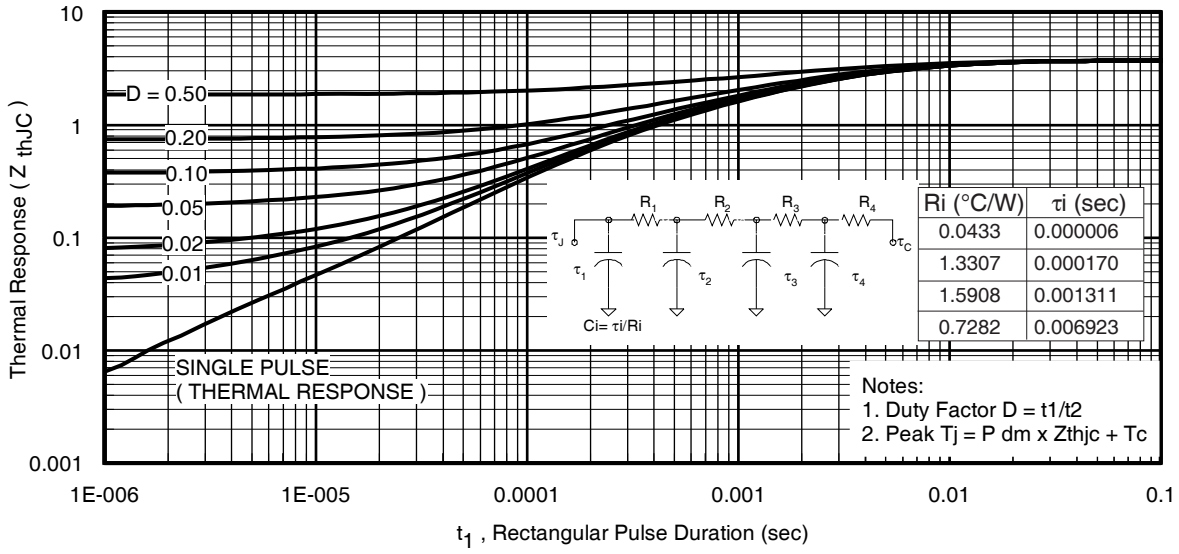



Fig 15. Maximum Effective Transient Thermal Impedance, Junction-to-Case

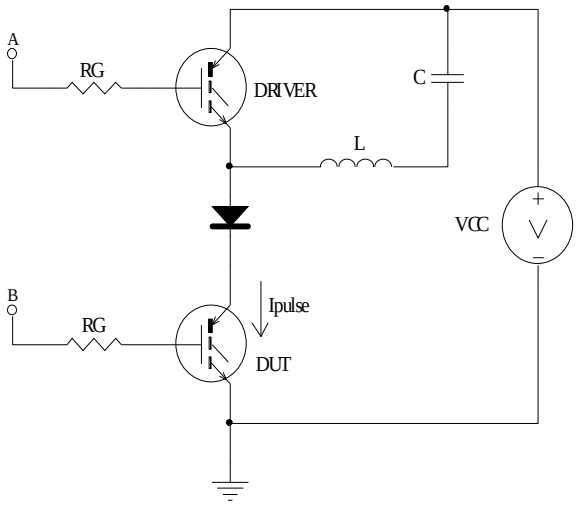



**Fig 16a.** $t_{st}$ and $E_{PULSE}$ Test Circuit

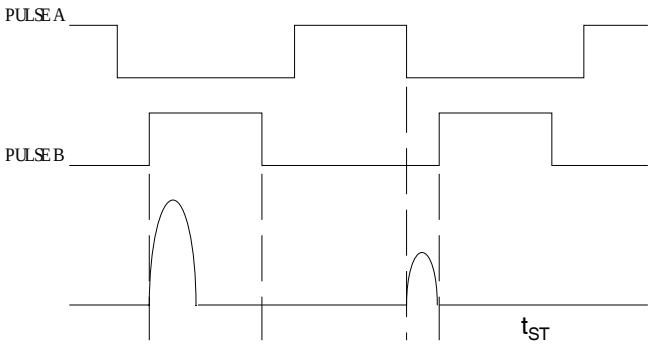



**Fig 16b.** $t_{st}$ Test Waveforms

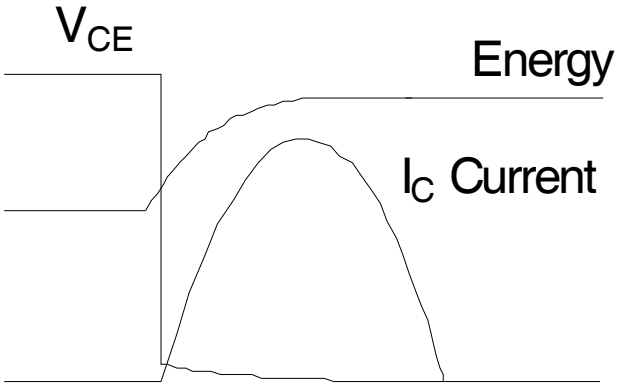



**Fig 16c.** $E_{PULSE}$ Test Waveforms

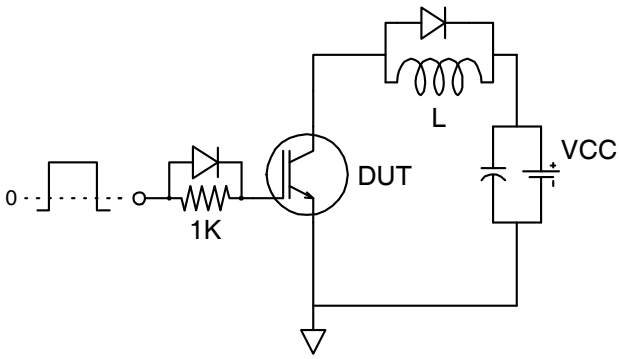
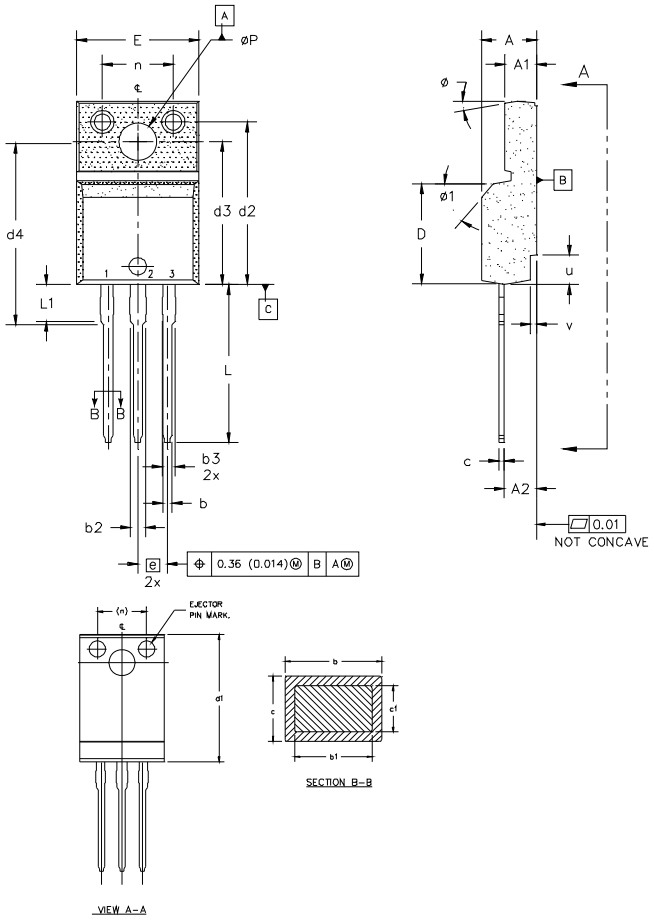



**Fig. 17** - Gate Charge Circuit (turn-off)

## TO-220 Full-Pak Package Outline

Dimensions are shown in millimeters (inches)




NOTES:
1.0 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M– 1994.
2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3.0 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
4.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5.0 DIMENSION b1 APPLY TO BASE METAL ONLY.
6.0 STEP OPTIONAL ON PLASTIC BODY DEFINED BY DIMENSIONS u & v.
7.0 CONTROLLING DIMENSION : INCHES.

| SYMBOL | DIMENSIONS | | | | NOTES |
|---|---|---|---|---|---|
| | MILLIMETERS | | INCHES | | |
| | MIN. | MAX. | MIN. | MAX. | |
| A | 4.57 | 4.83 | 0.180 | 0.190 | |
| A1 | 2.57 | 2.83 | 0.101 | 0.114 | |
| A2 | 2.51 | 2.85 | 0.099 | 0.112 | |
| b | 0.622 | 0.89 | 0.024 | 0.035 | |
| b1 | 0.622 | 0.838 | 0.024 | 0.033 | 5 |
| b2 | 1.229 | 1.400 | 0.048 | 0.055 | |
| b3 | 1.229 | 1.400 | 0.048 | 0.055 | |
| c | 0.440 | 0.629 | 0.017 | 0.025 | |
| c1 | 0.440 | 0.584 | 0.017 | 0.023 | |
| D | 8.65 | 9.80 | 0.341 | 0.386 | 4 |
| d1 | 15.80 | 16.12 | 0.622 | 0.635 | |
| d2 | 13.97 | 14.22 | 0.550 | 0.560 | |
| d3 | 12.30 | 12.92 | 0.484 | 0.509 | |
| d4 | 8.64 | 9.91 | 0.340 | 0.390 | |
| E | 10.36 | 10.63 | 0.408 | 0.419 | 4 |
| e | 2.54 BSC | | 0.100 BSC | | |
| L | 13.20 | 13.73 | 0.520 | 0.541 | |
| L1 | 3.10 | 3.50 | 0.122 | 0.138 | 3 |
| n | 6.05 | 6.15 | 0.238 | 0.242 | |
| øP | 3.05 | 3.45 | 0.120 | 0.136 | |
| u | 2.40 | 2.50 | 0.094 | 0.098 | 6 |
| v | 0.40 | 0.50 | 0.016 | 0.020 | 6 |
| ø | 3° | 7° | 3° | 7° | |
| ø1 | | 45° | | 45° | |

LEAD ASSIGNMENTS

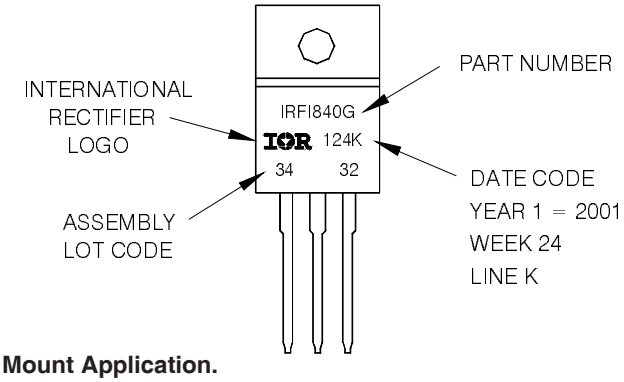
HEXFET
1.– GATE
2.– DRAIN
3.– SOURCE

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

## TO-220 Full-Pak Part Marking Information

EXAMPLE: THIS IS AN IRFI840G
WITH ASSEMBLY
LOT CODE 3432
ASSEMBLED ON WW 24, 2001
IN THE ASSEMBLY LINE "K"

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




**TO-220 Full-Pak 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/**

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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