International
IOR Rectifier

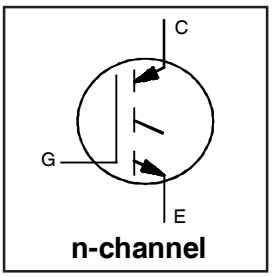
**PDP TRENCH IGBT**

# IRG6S330UPbF

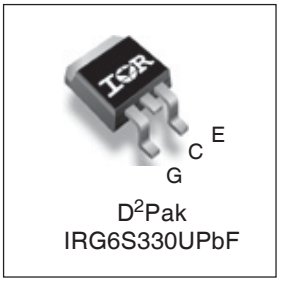
### Features

- 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 | 1.80 | V |
| $I_{RP}$ max @ $T_C$= 25°C | 250 | A |
| $T_J$ max | 150 | °C |




**n-channel**




D²Pak
IRG6S330UPbF

| 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 |
| $T_J$ | Operating Junction and | -40 to + 150 | °C |
| $T_{STG}$ | Storage Temperature Range | | |
| | Soldering Temperature for 10 seconds | 300 | |

### Thermal Resistance

| | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case ② | — | 0.8 | °C/W |

## 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 |
| $V_{(BR)ECS}$ | Emitter-to-Collector Breakdown Voltage③ | 30 | — | — | V | $V_{GE}$ = 0V, $I_{CE}$ = 1 A |
| $\Delta BV_{CES}/\Delta T_J$ | Breakdown Voltage Temp. Coefficient | — | 0.29 | — | V/°C | Reference to 25°C, $I_{CE}$ = 1mA |
| $V_{CE(on)}$ | Static Collector-to-Emitter Voltage | — | 1.25 | — | V | $V_{GE}$ = 15V, $I_{CE}$ = 25A ③ |
| | | — | 1.43 | — | | $V_{GE}$ = 15V, $I_{CE}$ = 40A ③ |
| | | | 1.80 | 2.10 | | $V_{GE}$ = 15V, $I_{CE}$ = 70A ③ |
| | | — | 2.38 | — | | $V_{GE}$ = 15V, $I_{CE}$ = 120A ③ |
| | | — | 2.10 | — | | $V_{GE}$ = 15V, $I_{CE}$ = 70A, $T_J$ = 150°C ③ |
| $V_{GE(th)}$ | 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 | — | -12 | — | mV/°C | |
| $I_{CES}$ | Collector-to-Emitter Leakage Current | — | 2.0 | 20 | µA | $V_{CE}$ = 330V, $V_{GE}$ = 0V |
| | | — | 10 | — | | $V_{CE}$ = 330V, $V_{GE}$ = 0V, $T_J$ = 100°C |
| | | — | 40 | 200 | | $V_{CE}$ = 330V, $V_{GE}$ = 0V, $T_J$ = 125°C |
| | | — | 150 | — | | $V_{CE}$ = 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 | — | 94 | — | S | $V_{CE}$ = 25V, $I_{CE}$ = 25A |
| $Q_g$ | Total Gate Charge | — | 86 | — | nC | $V_{CE}$ = 200V, $I_C$ = 25A, $V_{GE}$ = 15V③ |
| $Q_{gc}$ | Gate-to-Collector Charge | — | 36 | — | | |
| $t_{d(on)}$ | Turn-On delay time | — | 39 | — | ns | $I_C$ = 25A, $V_{CC}$ = 196V |
| $t_r$ | Rise time | — | 32 | — | | $R_G$ = 10Ω, L=200µH, $L_S$= 150nH |
| $t_{d(off)}$ | Turn-Off delay time | — | 120 | — | | $T_J$ = 25°C |
| $t_f$ | Fall time | — | 55 | — | | |
| $t_{d(on)}$ | Turn-On delay time | — | 37 | — | ns | $I_C$ = 25A, $V_{CC}$ = 196V |
| $t_r$ | Rise time | — | 33 | — | | $R_G$ = 10Ω, L=200µH, $L_S$= 150nH |
| $t_{d(off)}$ | Turn-Off delay time | — | 159 | — | | $T_J$ = 150°C |
| $t_f$ | Fall time | — | 95 | — | | |
| $t_{st}$ | Shoot Through Blocking Time | 100 | — | — | ns | $V_{CC}$ = 240V, $V_{GE}$ = 15V, $R_G$= 5.1Ω |
| $E_{PULSE}$ | Energy per Pulse | — | 943 | — | µJ | L = 220nH, C= 0.40µF, $V_{GE}$ = 15V<br>$V_{CC}$ = 240V, $R_G$= 5.1Ω, $T_J$ = 25°C |
| | | — | 1086 | — | | L = 220nH, C= 0.40µF, $V_{GE}$ = 15V<br>$V_{CC}$ = 240V, $R_G$= 5.1Ω, $T_J$ = 100°C |
| ESD | Human Body Model | Class 2<br>(Per JEDEC standard JESD22-A114) | | | | |
| | Machine Model | Class B<br>(Per EIA/JEDEC standard EIA/JESD22-A115) | | | | |
| $C_{ies}$ | Input Capacitance | — | 2275 | — | pF | $V_{GE}$ = 0V |
| $C_{oes}$ | Output Capacitance | — | 108 | — | | $V_{CE}$ = 30V |
| $C_{res}$ | Reverse Transfer Capacitance | — | 75 | — | | $f$ = 1.0MHz, See Fig.13 |
| $L_C$ | 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%.

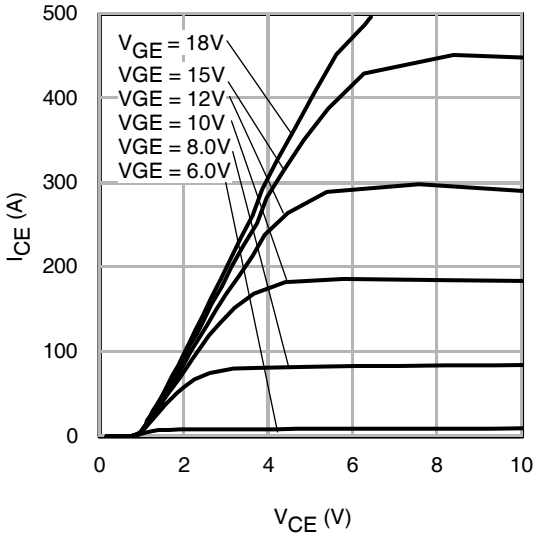



Fig 1. Typical Output Characteristics @ 25°C

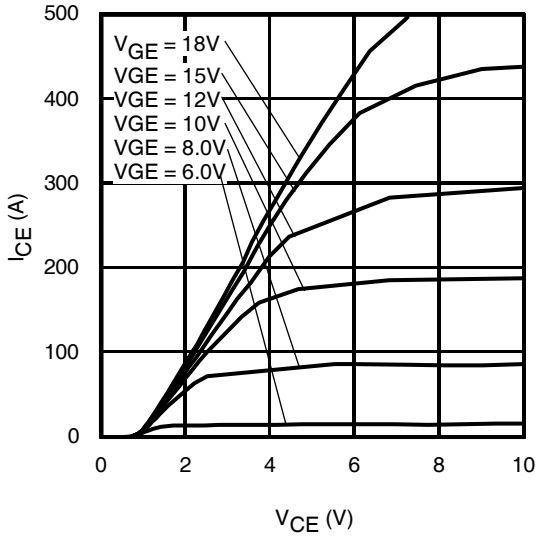



Fig 2. Typical Output Characteristics @ 75°C

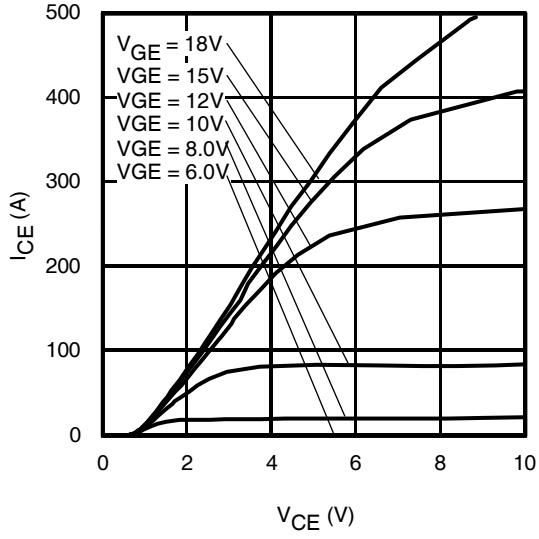



Fig 3. Typical Output Characteristics @ 125°C

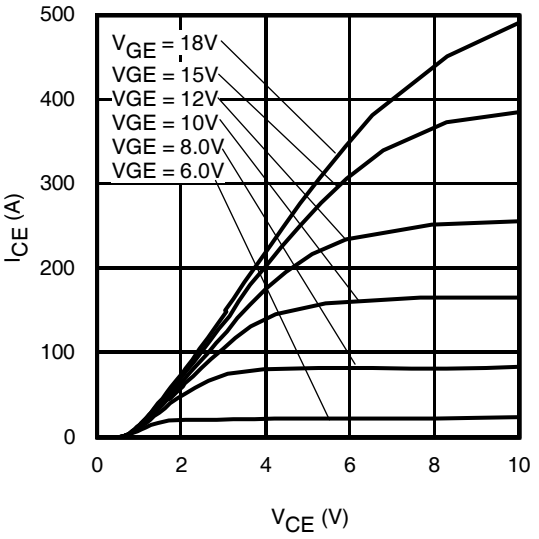



Fig 4. Typical Output Characteristics @ 150°C

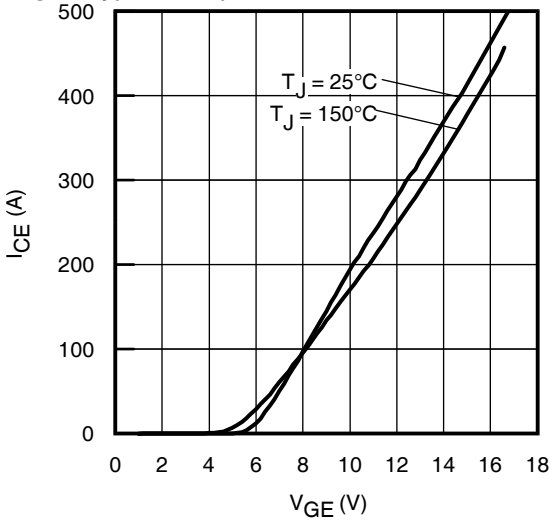



Fig 5. Typical Transfer Characteristics

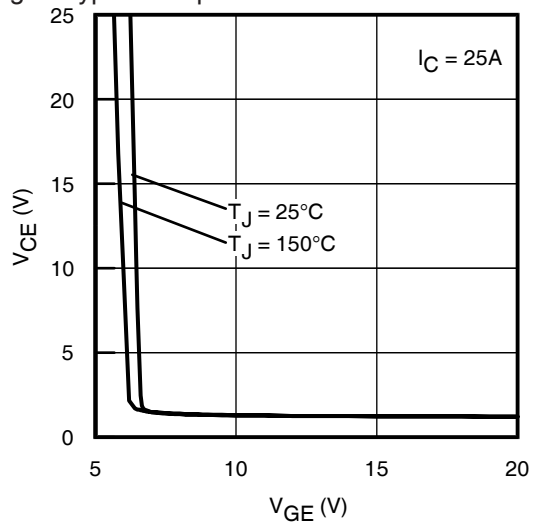



Fig 6. $V_{CE(ON)}$ vs. Gate Voltage

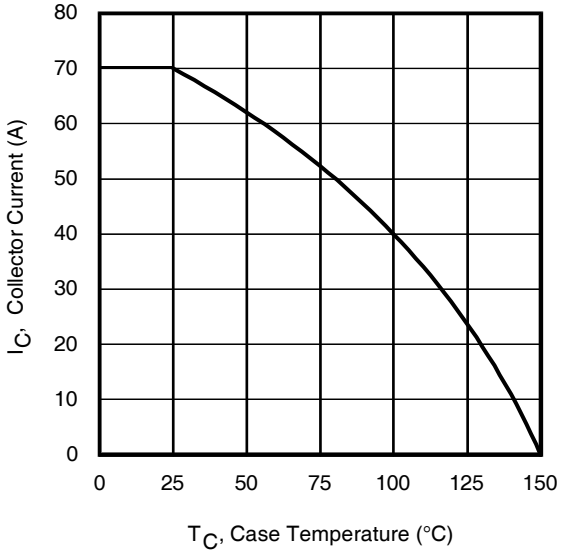



Fig 7. Maximum Collector Current vs. Case Temperature

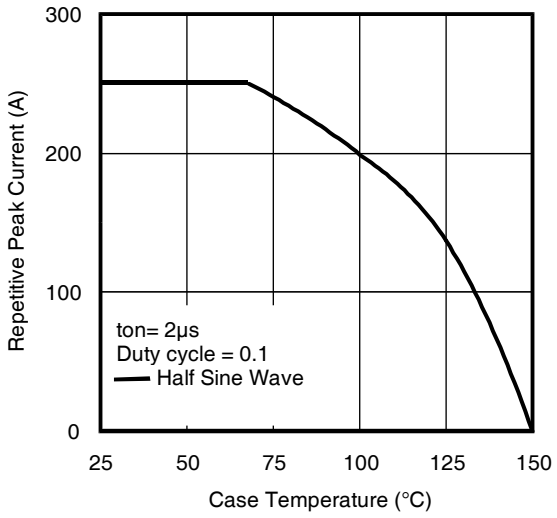



Fig 8. Typical Repetitive Peak Current vs. Case Temperature

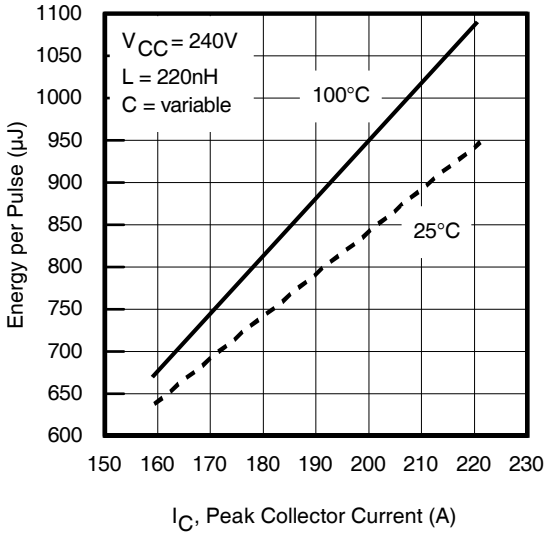



Fig 9. Typical $E_{PULSE}$ vs. Collector Current

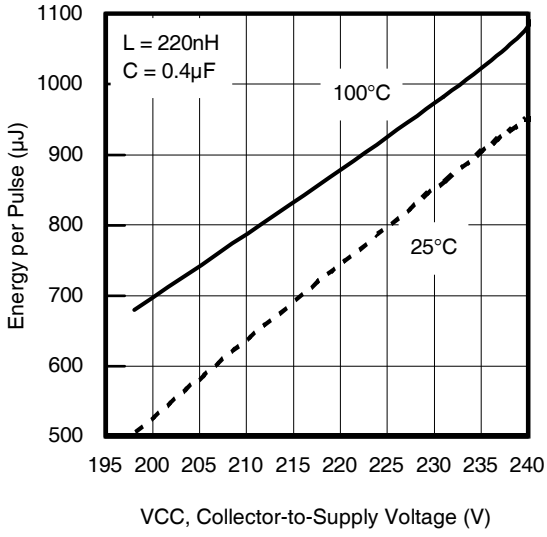



Fig 10. Typical $E_{PULSE}$ vs. Collector-to-Supply Voltage

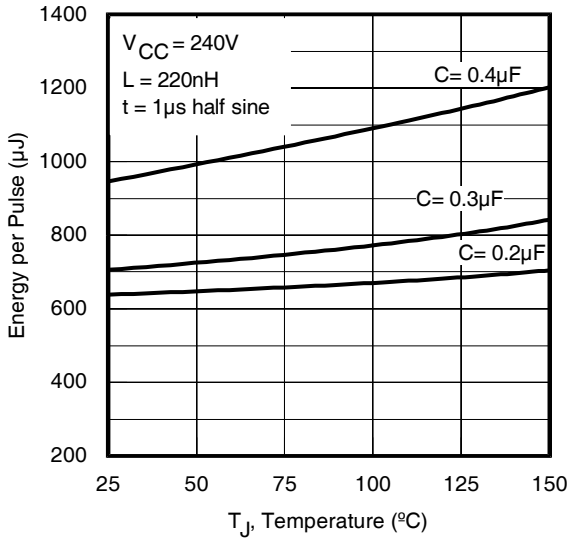



Fig 11. $E_{PULSE}$ vs. Temperature

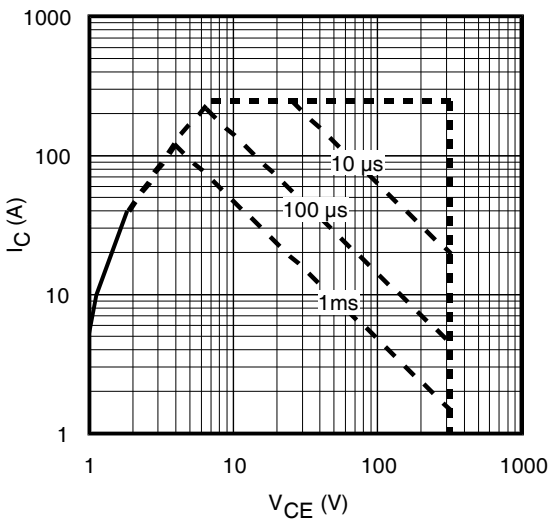



Fig 12. Forward Bias Safe Operating Area

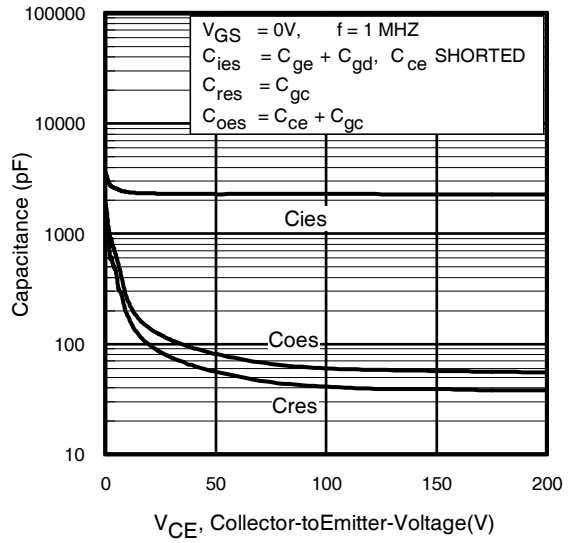



Fig 13. Typical Capacitance vs. Collector-to-Emitter Voltage

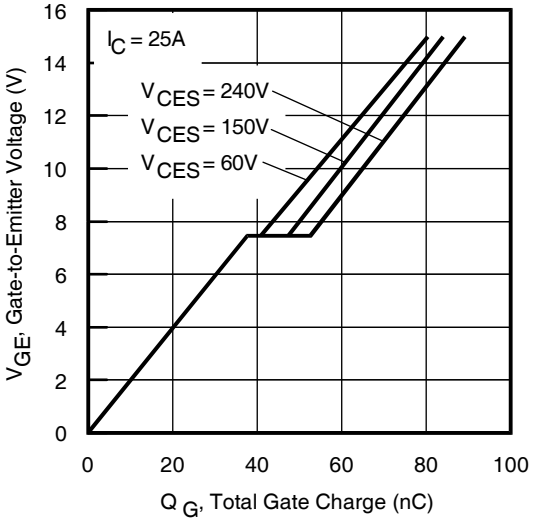



Fig 14. Typical Gate Charge vs. Gate-to-Emitter Voltage

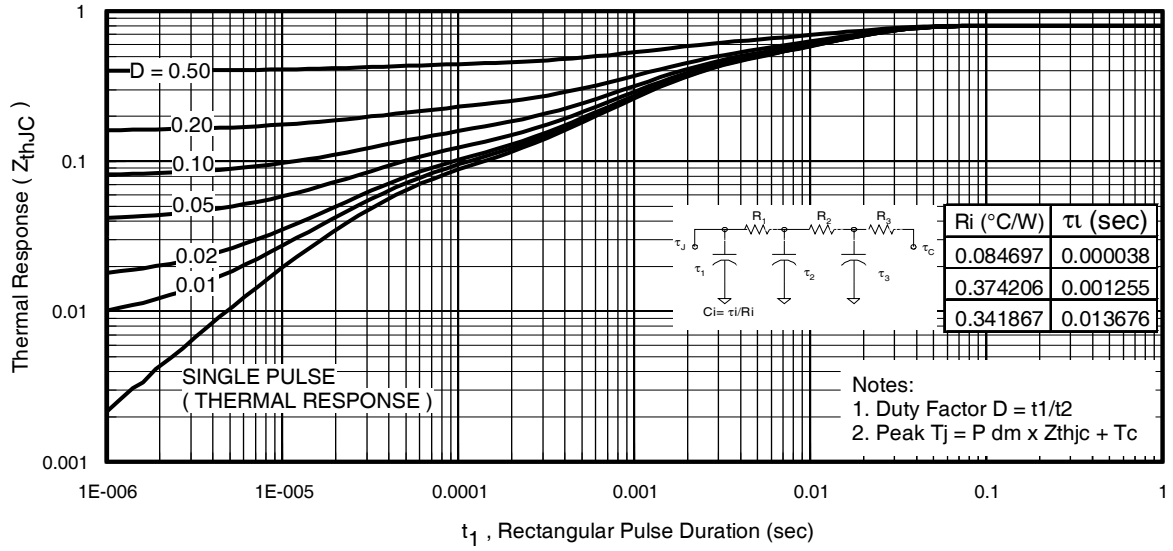



Fig 15. Maximum Effective Transient Thermal Impedance, Junction-to-Case

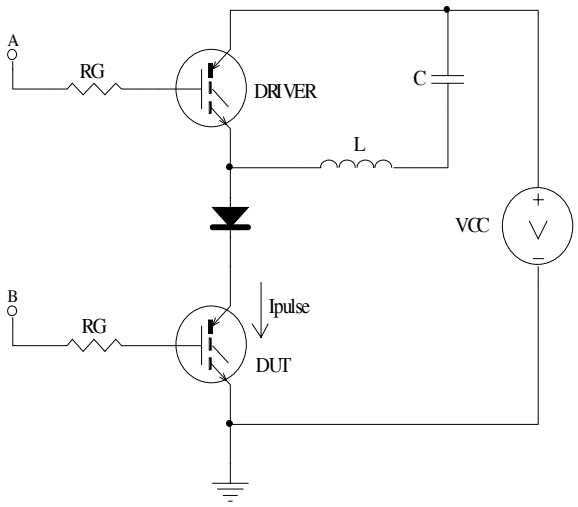



**Fig 16a.** $t_{st}$ and $E_{PULSE}$ Test Circuit

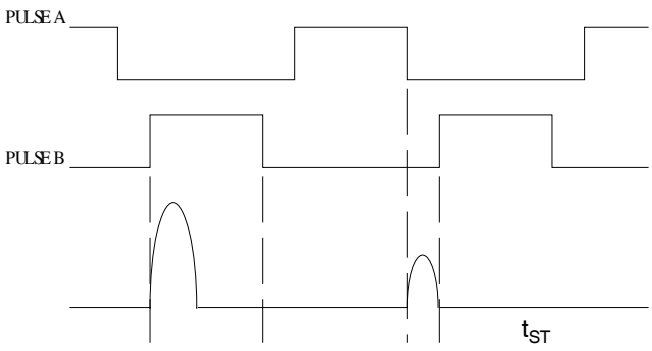



**Fig 16b.** $t_{st}$ Test Waveforms

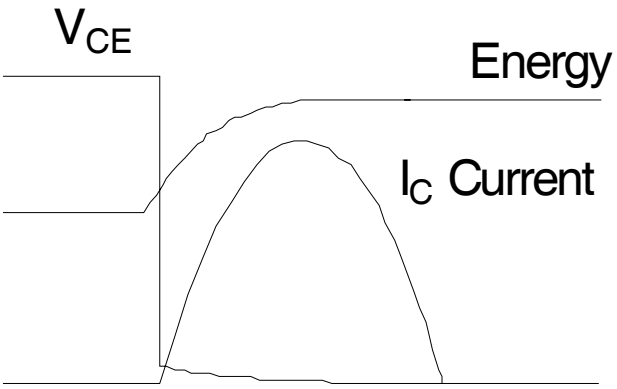



**Fig 16c.** $E_{PULSE}$ Test Waveforms

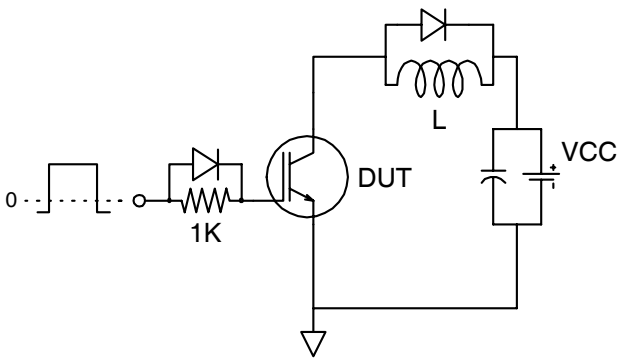
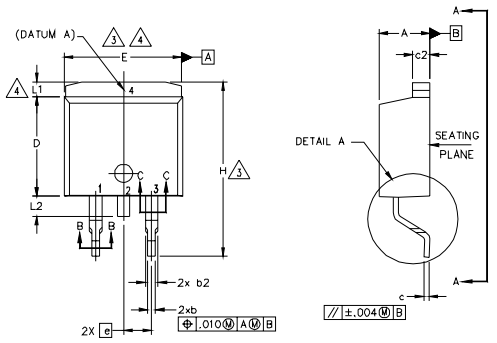
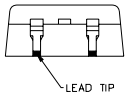


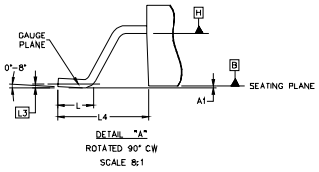

**Fig. 17** - Gate Charge Circuit (turn-off)

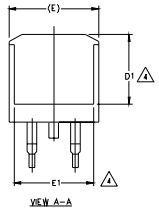
# D²Pak (TO-263AB) Package Outline

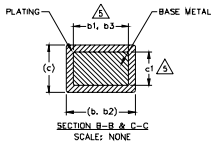
Dimensions are shown in millimeters (inches)




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 [.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 | 9.65 | 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 | 1.27 | 1.78 | – | .070 | |
| L3 | 0.25 BSC | | .010 BSC | | |
| L4 | 4.78 | 5.28 | .188 | .208 | |

LEAD ASSIGNMENTS

HEXFET

1.– GATE
2, 4.– DRAIN
3.– SOURCE

IGBTs, CoPACK

1.– GATE
2, 4.– COLLECTOR
3.– EMITTER

DIODES

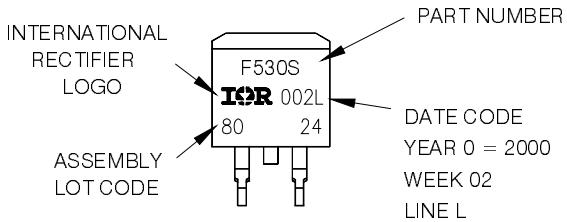
1.– ANODE *
2, 4.– CATHODE
3.– ANODE

* PART DEPENDENT.

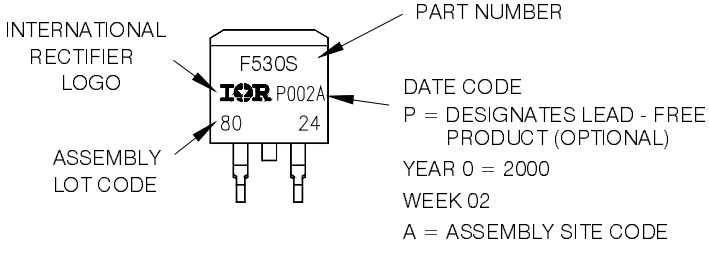
# D²Pak (TO-263AB) Part Marking Information

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"



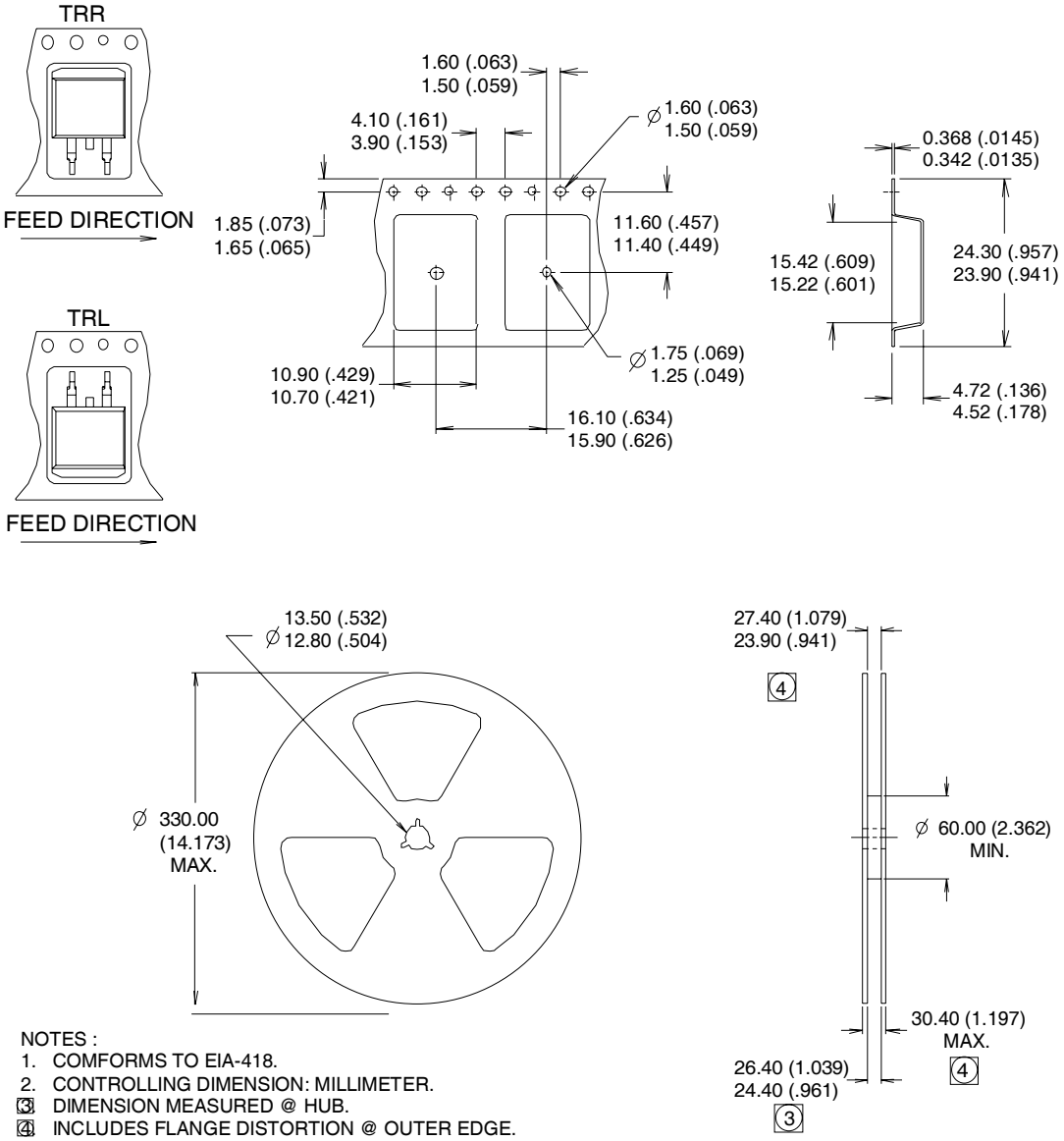

OR




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

## D²Pak (TO-263AB) 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/**

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

**IR WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903
Visit us at www.irf.com for sales contact information.09/2009