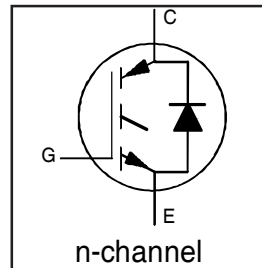


INSULATED GATE BIPOLAR TRANSISTOR WITH  
ULTRAFAST SOFT RECOVERY DIODE

IRGB10B60KDPbF  
IRGS10B60KDPbF  
IRGSL10B60KDPbF

**Features**

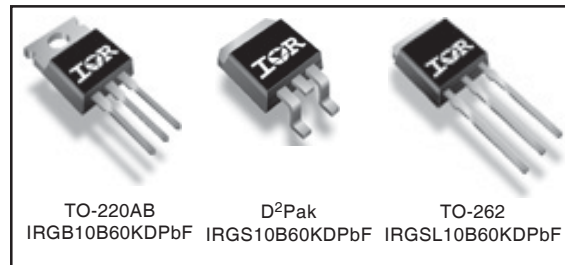
- Low VCE (on) Non Punch Through IGBT Technology.
- Low Diode VF.
- 10µs Short Circuit Capability.
- Square RBSOA.
- Ultrasoft Diode Reverse Recovery Characteristics.
- Positive VCE (on) Temperature Coefficient.
- Lead-Free



$V_{CES} = 600V$   
 $I_C = 19A, T_C = 100^\circ C$   
 $t_{sc} > 10\mu s, T_J = 150^\circ C$   
 $V_{CE(on)} \text{ typ.} = 1.8V$

**Benefits**

- Benchmark Efficiency for Motor Control.
- Rugged Transient Performance.
- Low EMI.
- Excellent Current Sharing in Parallel Operation.



**Absolute Maximum Ratings**

|                           | Parameter                          | Max.                              | Units      |
|---------------------------|------------------------------------|-----------------------------------|------------|
| $V_{CES}$                 | Collector-to-Emitter Voltage       | 600                               | V          |
| $I_C @ T_C = 25^\circ C$  | Continuous Collector Current       | 35                                | A          |
| $I_C @ T_C = 100^\circ C$ | Continuous Collector Current       | 19                                |            |
| $I_{CM}$                  | Pulsed Collector Current           | 44                                |            |
| $I_{LM}$                  | Clamped Inductive Load Current ④   | 44                                |            |
| $I_F @ T_C = 25^\circ C$  | Diode Continuous Forward Current   | 35                                |            |
| $I_F @ T_C = 100^\circ C$ | Diode Continuous Forward Current   | 19                                | A          |
| $I_{FM}$                  | Diode Maximum Forward Current      | 44                                |            |
| $V_{GE}$                  | Gate-to-Emitter Voltage            | $\pm 20$                          | V          |
| $P_D @ T_C = 25^\circ C$  | Maximum Power Dissipation          | 156                               | W          |
| $P_D @ T_C = 100^\circ C$ | Maximum Power Dissipation          | 62                                |            |
| $T_J$                     | Operating Junction and             | -55 to +150                       | $^\circ C$ |
| $T_{STG}$                 | Storage Temperature Range          |                                   |            |
|                           | Soldering Temperature, for 10 sec. | 300 (0.063 in. (1.6mm) from case) |            |

**Thermal Resistance**

|                 | Parameter                                      | Min. | Typ. | Max. | Units        |
|-----------------|------------------------------------------------|------|------|------|--------------|
| $R_{\theta JC}$ | Junction-to-Case - IGBT                        | —    | —    | 0.8  | $^\circ C/W$ |
| $R_{\theta JC}$ | Junction-to-Case - Diode                       | —    | —    | 3.4  |              |
| $R_{\theta CS}$ | Case-to-Sink, flat, greased surface            | —    | 0.50 | —    |              |
| $R_{\theta JA}$ | Junction-to-Ambient, typical socket mount①     | —    | —    | 62   |              |
| $R_{\theta JA}$ | Junction-to-Ambient (PCB Mount, steady state)② | —    | —    | 40   |              |
| Wt              | Weight                                         | —    | 1.44 | —    | g            |

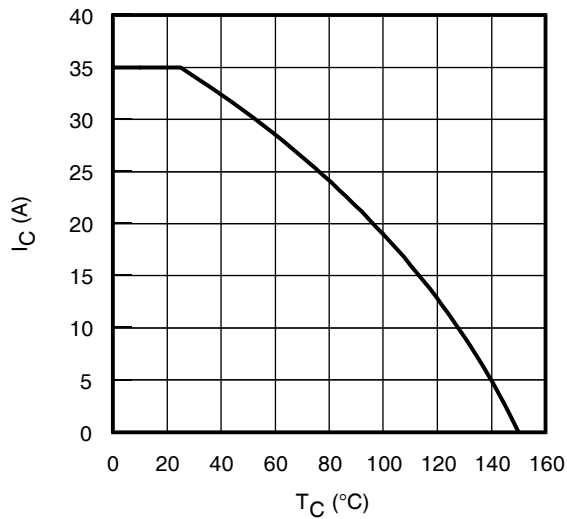
## Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

|                                 | Parameter                               | Min. | Typ. | Max.      | Units                | Conditions                                                           | Ref.Fig. |
|---------------------------------|-----------------------------------------|------|------|-----------|----------------------|----------------------------------------------------------------------|----------|
| $V_{(BR)CES}$                   | Collector-to-Emitter Breakdown Voltage  | 600  | —    | —         | V                    | $V_{GE} = 0V, I_C = 500\mu A$                                        |          |
| $\Delta V_{(BR)CES}/\Delta T_J$ | Temperature Coeff. of Breakdown Voltage | —    | 0.3  | —         | V/ $^\circ\text{C}$  | $V_{GE} = 0V, I_C = 1.0mA, (25^\circ\text{C}-150^\circ\text{C})$     |          |
| $V_{CE(on)}$                    | Collector-to-Emitter Saturation Voltage | 1.5  | 1.80 | 2.20      | V                    | $I_C = 10A, V_{GE} = 15V$                                            | 5, 6,7   |
|                                 |                                         | —    | 2.20 | 2.50      |                      | $I_C = 10A, V_{GE} = 15V, T_J = 150^\circ\text{C}$                   | 9,10,11  |
| $V_{GE(th)}$                    | Gate Threshold Voltage                  | 3.5  | 4.5  | 5.5       | V                    | $V_{CE} = V_{GE}, I_C = 250\mu A$                                    | 9,10,11  |
| $\Delta V_{GE(th)}/\Delta T_J$  | Temperature Coeff. of Threshold Voltage | —    | -10  | —         | mV/ $^\circ\text{C}$ | $V_{CE} = V_{GE}, I_C = 1.0mA, (25^\circ\text{C}-150^\circ\text{C})$ | 12       |
| $g_{fe}$                        | Forward Transconductance                | —    | 7.0  | —         | S                    | $V_{CE} = 50V, I_C = 10A, PW=80\mu s$                                |          |
| $I_{CES}$                       | Zero Gate Voltage Collector Current     | —    | 3.0  | 150       | $\mu A$              | $V_{GE} = 0V, V_{CE} = 600V$                                         |          |
|                                 |                                         | —    | 300  | 700       |                      | $V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$                |          |
| $V_{FM}$                        | Diode Forward Voltage Drop              | —    | 1.30 | 1.45      | V                    | $I_C = 10A$                                                          | 8        |
|                                 |                                         | —    | 1.30 | 1.45      |                      | $I_C = 10A, T_J = 150^\circ\text{C}$                                 |          |
| $I_{GES}$                       | Gate-to-Emitter Leakage Current         | —    | —    | $\pm 100$ | nA                   | $V_{GE} = \pm 20V$                                                   |          |

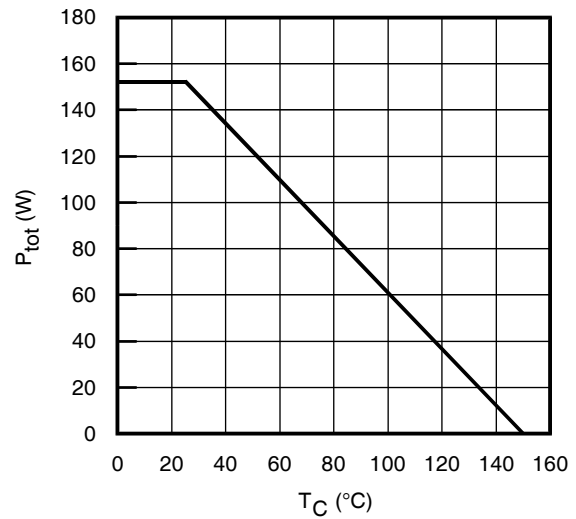
## Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

|              | Parameter                            | Min.        | Typ. | Max. | Units   | Conditions                                                                                                        | Ref.Fig.                    |
|--------------|--------------------------------------|-------------|------|------|---------|-------------------------------------------------------------------------------------------------------------------|-----------------------------|
| $Q_g$        | Total Gate Charge (turn-on)          | —           | 38   | —    | nC      | $I_C = 10A$                                                                                                       | CT1                         |
| $Q_{ge}$     | Gate - Emitter Charge (turn-on)      | —           | 4.3  | —    |         | $V_{CC} = 400V$                                                                                                   |                             |
| $Q_{gc}$     | Gate - Collector Charge (turn-on)    | —           | 16.3 | —    |         | $V_{GE} = 15V$                                                                                                    |                             |
| $E_{on}$     | Turn-On Switching Loss               | —           | 140  | 247  | $\mu J$ | $I_C = 10A, V_{CC} = 400V$                                                                                        | CT4                         |
| $E_{off}$    | Turn-Off Switching Loss              | —           | 250  | 360  |         | $V_{GE} = 15V, R_G = 47\Omega, L = 200\mu H$                                                                      |                             |
| $E_{tot}$    | Total Switching Loss                 | —           | 390  | 607  |         | $L_s = 150nH, T_J = 25^\circ\text{C} \text{ ③}$                                                                   |                             |
| $t_{d(on)}$  | Turn-On Delay Time                   | —           | 30   | 39   | ns      | $I_C = 10A, V_{CC} = 400V$                                                                                        | CT4                         |
| $t_r$        | Rise Time                            | —           | 20   | 29   |         | $V_{GE} = 15V, R_G = 47\Omega, L = 200\mu H$                                                                      |                             |
| $t_{d(off)}$ | Turn-Off Delay Time                  | —           | 230  | 262  |         | $L_s = 150nH, T_J = 25^\circ\text{C}$                                                                             |                             |
| $t_f$        | Fall Time                            | —           | 23   | 32   |         |                                                                                                                   |                             |
| $E_{on}$     | Turn-On Switching Loss               | —           | 230  | 340  | $\mu J$ | $I_C = 10A, V_{CC} = 400V$                                                                                        | CT4<br>13,15                |
| $E_{off}$    | Turn-Off Switching Loss              | —           | 350  | 464  |         | $V_{GE} = 15V, R_G = 47\Omega, L = 200\mu H$                                                                      |                             |
| $E_{tot}$    | Total Switching Loss                 | —           | 580  | 804  |         | $L_s = 150nH, T_J = 150^\circ\text{C} \text{ ③}$                                                                  |                             |
| $t_{d(on)}$  | Turn-On Delay Time                   | —           | 30   | 39   | ns      | $I_C = 10A, V_{CC} = 400V$                                                                                        | 14, 16<br>CT4<br>WF1<br>WF2 |
| $t_r$        | Rise Time                            | —           | 20   | 28   |         | $V_{GE} = 15V, R_G = 47\Omega, L = 200\mu H$                                                                      |                             |
| $t_{d(off)}$ | Turn-Off Delay Time                  | —           | 250  | 274  |         | $L_s = 150nH, T_J = 150^\circ\text{C}$                                                                            |                             |
| $t_f$        | Fall Time                            | —           | 26   | 34   |         |                                                                                                                   |                             |
| $C_{ies}$    | Input Capacitance                    | —           | 620  | —    | pF      | $V_{GE} = 0V$                                                                                                     |                             |
| $C_{oes}$    | Output Capacitance                   | —           | 62   | —    |         | $V_{CC} = 30V$                                                                                                    |                             |
| $C_{res}$    | Reverse Transfer Capacitance         | —           | 22   | —    |         | $f = 1.0MHz$                                                                                                      |                             |
| RBSOA        | Reverse Bias Safe Operating Area     | FULL SQUARE |      |      |         | $T_J = 150^\circ\text{C}, I_C = 44A, V_p = 600V$<br>$V_{CC} = 500V, V_{GE} = +15V \text{ to } 0V, R_G = 47\Omega$ | 4<br>CT2                    |
| SCSOA        | Short Circuit Safe Operating Area    | 10          | —    | —    | $\mu s$ | $T_J = 150^\circ\text{C}, V_p = 600V, R_G = 47\Omega$<br>$V_{CC} = 360V, V_{GE} = +15V \text{ to } 0V$            | CT3<br>WF4                  |
| $E_{rec}$    | Reverse Recovery energy of the diode | —           | 245  | 330  | $\mu J$ | $T_J = 150^\circ\text{C}$                                                                                         | 17,18,19                    |
| $t_{rr}$     | Diode Reverse Recovery time          | —           | 90   | 105  | ns      | $V_{CC} = 400V, I_F = 10A, L = 200\mu H$                                                                          | 20, 21                      |
| $I_{rr}$     | Diode Peak Reverse Recovery Current  | —           | 19   | 22   | A       | $V_{GE} = 15V, R_G = 47\Omega, L_s = 150nH$                                                                       | CT4,WF3                     |

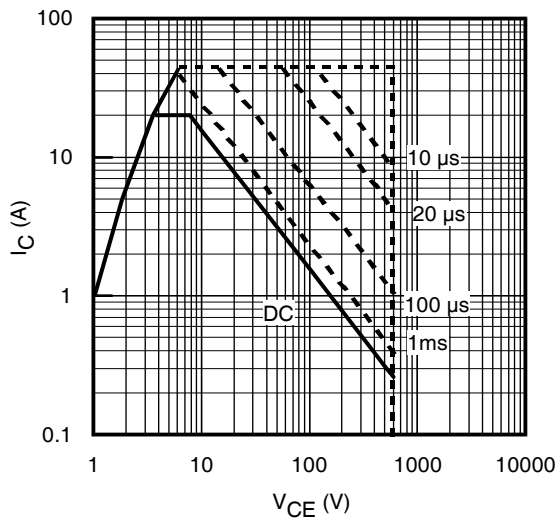
Note ① to ④ are on page 15



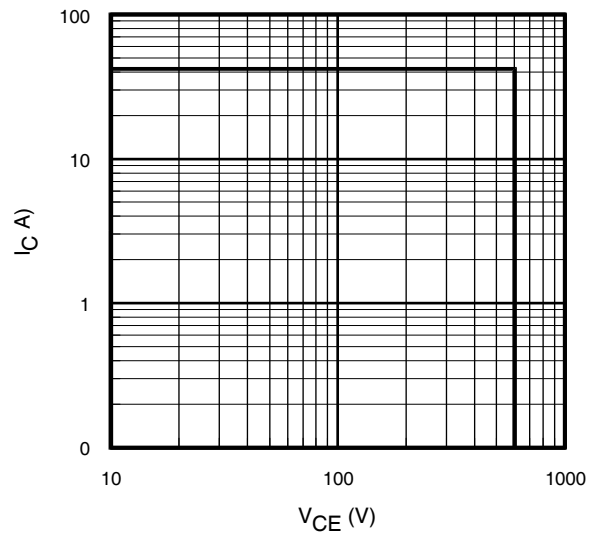
**Fig. 1** - Maximum DC Collector Current vs. Case Temperature



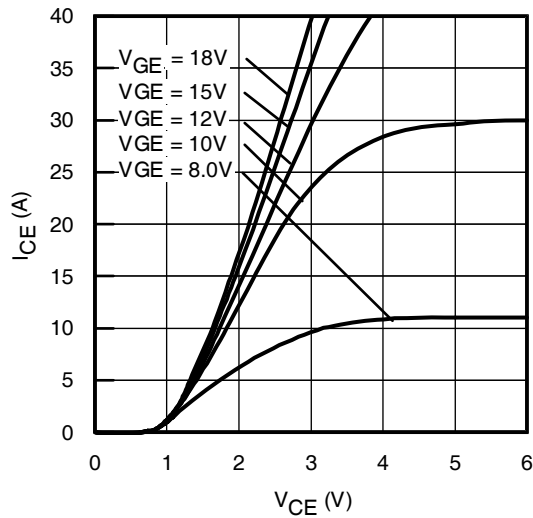
**Fig. 2** - Power Dissipation vs. Case Temperature



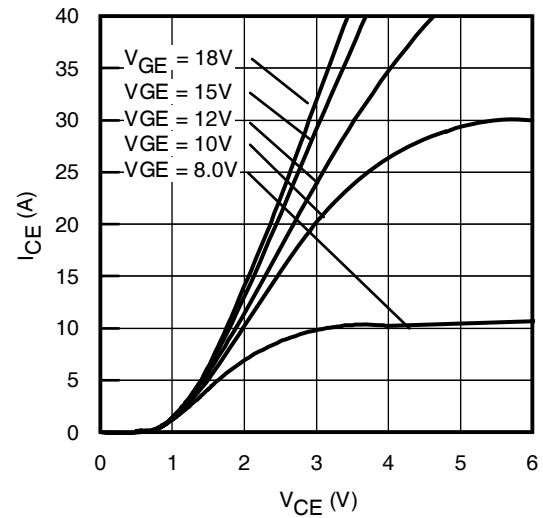
**Fig. 3** - Forward SOA  
 $T_C = 25^{\circ}\text{C}$ ;  $T_J \leq 150^{\circ}\text{C}$



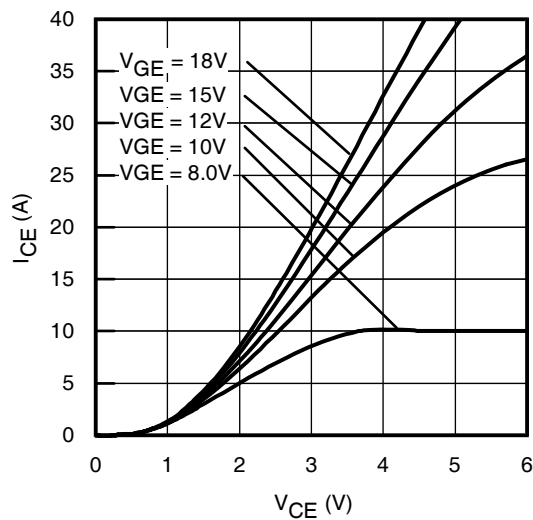
**Fig. 4** - Reverse Bias SOA  
 $T_J = 150^{\circ}\text{C}$ ;  $V_{GE} = 15\text{V}$



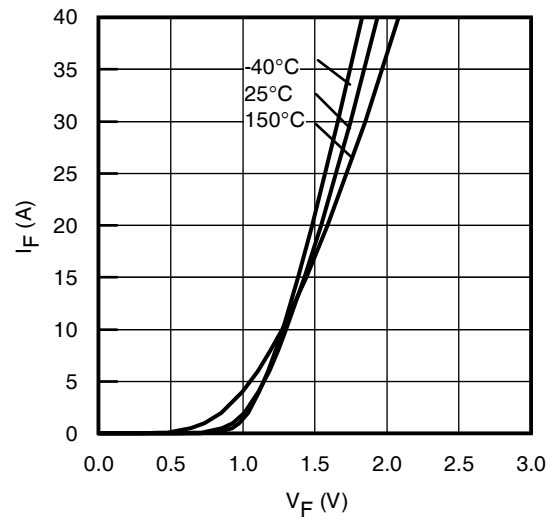
**Fig. 5** - Typ. IGBT Output Characteristics  
 $T_J = -40^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$



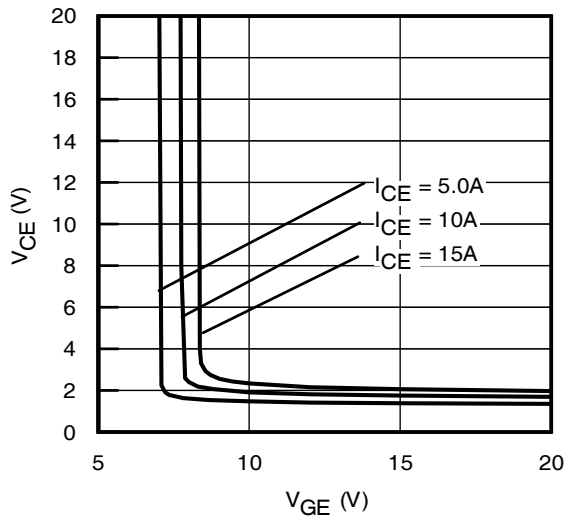
**Fig. 6** - Typ. IGBT Output Characteristics  
 $T_J = 25^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$



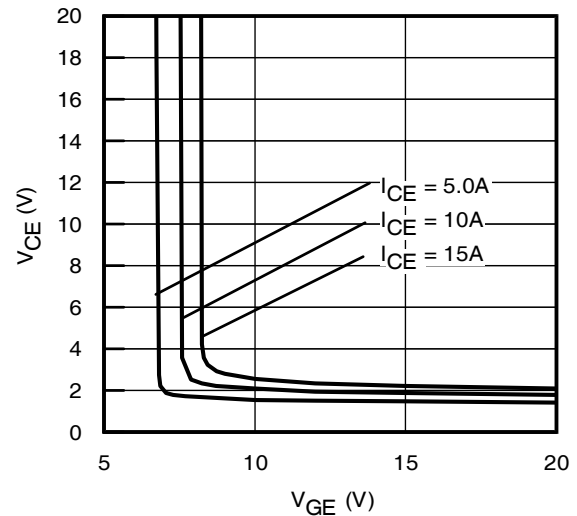
**Fig. 7** - Typ. IGBT Output Characteristics  
 $T_J = 150^\circ\text{C}$ ;  $t_p = 80\mu\text{s}$



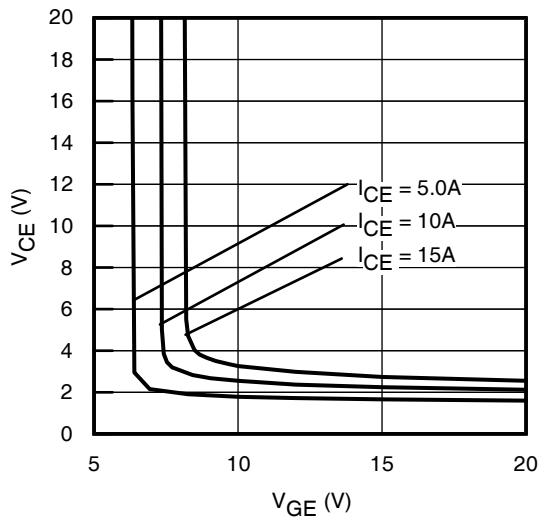
**Fig. 8** - Typ. Diode Forward Characteristics  
 $t_p = 80\mu\text{s}$



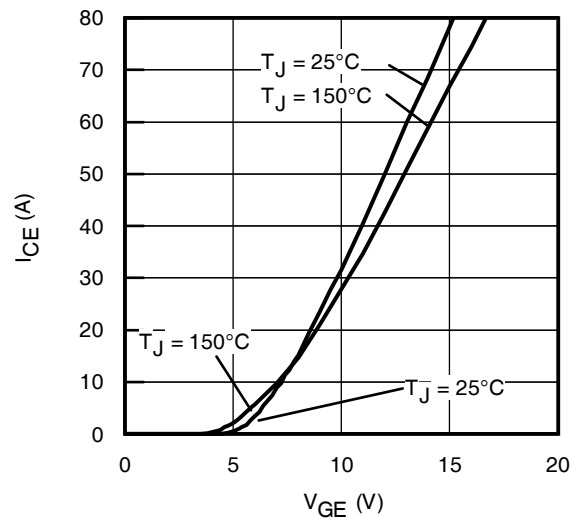
**Fig. 9** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = -40^\circ\text{C}$



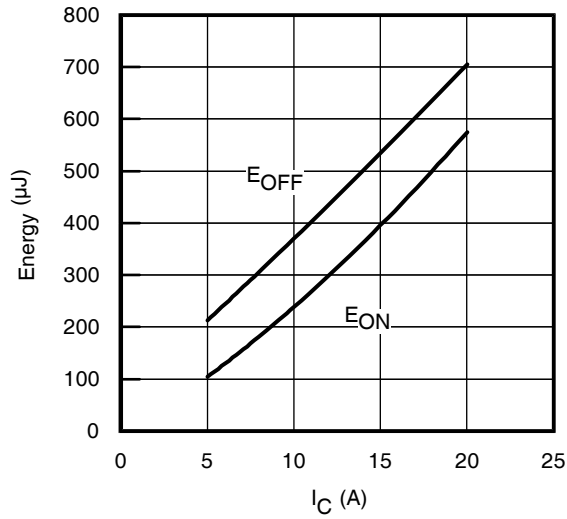
**Fig. 10** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 25^\circ\text{C}$



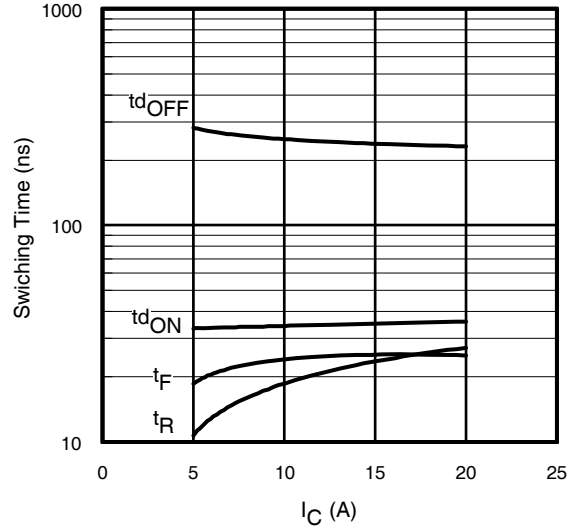
**Fig. 11** - Typical  $V_{CE}$  vs.  $V_{GE}$   
 $T_J = 150^\circ\text{C}$



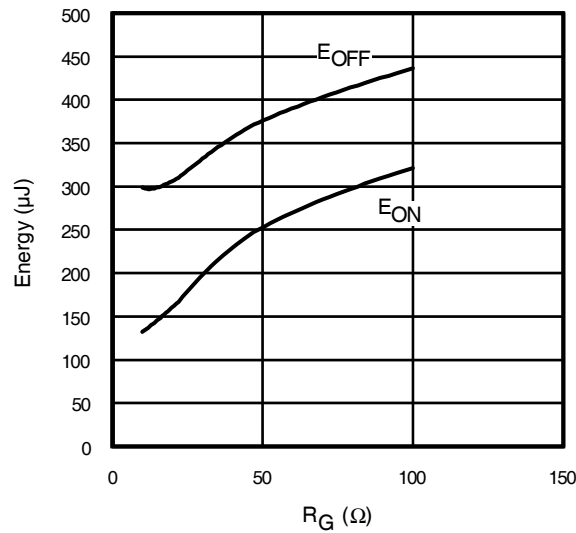
**Fig. 12** - Typ. Transfer Characteristics  
 $V_{CE} = 50\text{V}$ ;  $t_p = 10\mu\text{s}$



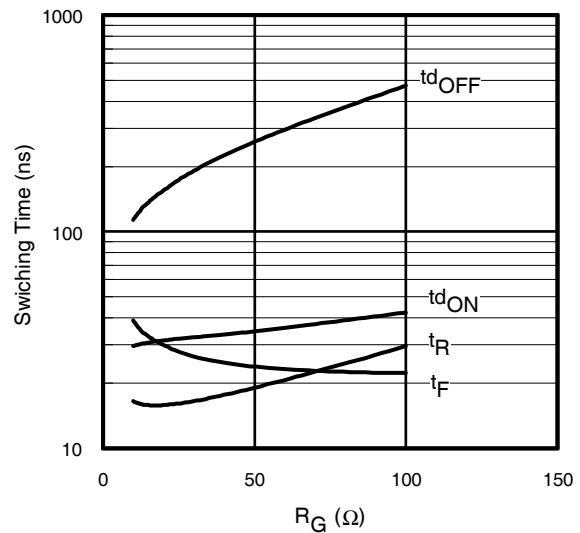
**Fig. 13** - Typ. Energy Loss vs.  $I_C$   
 $T_J = 150^\circ\text{C}$ ;  $L=200\mu\text{H}$ ;  $V_{CE}=400\text{V}$   
 $R_G=47\Omega$ ;  $V_{GE}=15\text{V}$



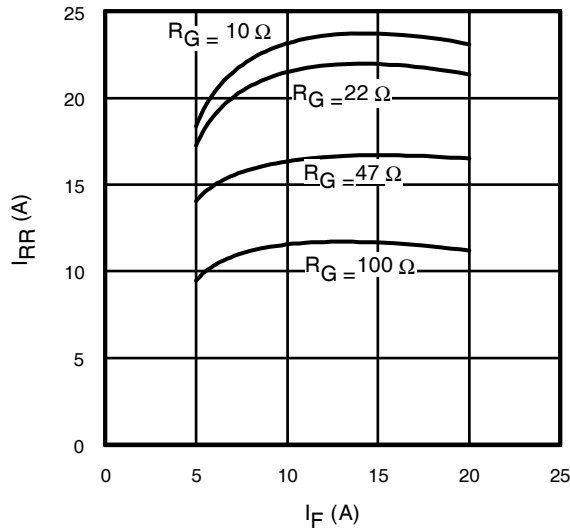
**Fig. 14** - Typ. Switching Time vs.  $I_C$   
 $T_J = 150^\circ\text{C}$ ;  $L=200\mu\text{H}$ ;  $V_{CE}=400\text{V}$   
 $R_G=47\Omega$ ;  $V_{GE}=15\text{V}$



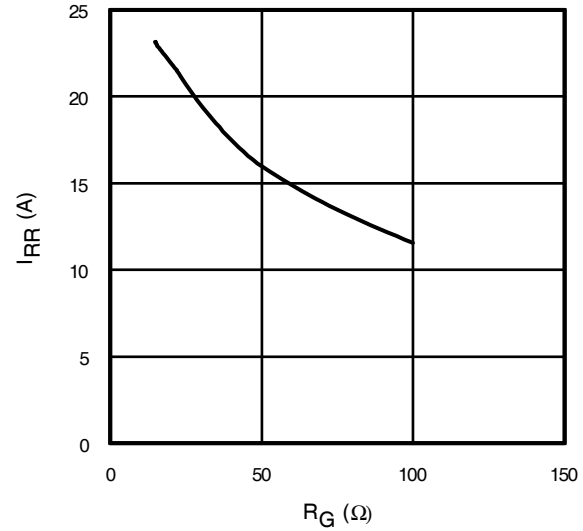
**Fig. 15** - Typ. Energy Loss vs.  $R_G$   
 $T_J = 150^\circ\text{C}$ ;  $L=200\mu\text{H}$ ;  $V_{CE}=400\text{V}$   
 $I_{CE}=10\text{A}$ ;  $V_{GE}=15\text{V}$



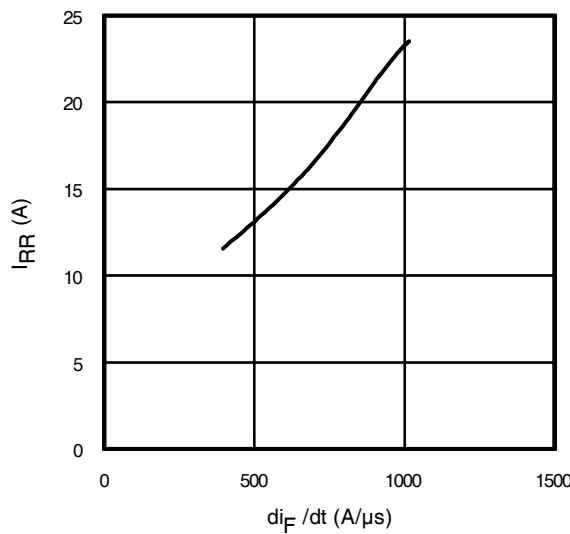
**Fig. 16** - Typ. Switching Time vs.  $R_G$   
 $T_J = 150^\circ\text{C}$ ;  $L=200\mu\text{H}$ ;  $V_{CE}=400\text{V}$   
 $I_{CE}=10\text{A}$ ;  $V_{GE}=15\text{V}$



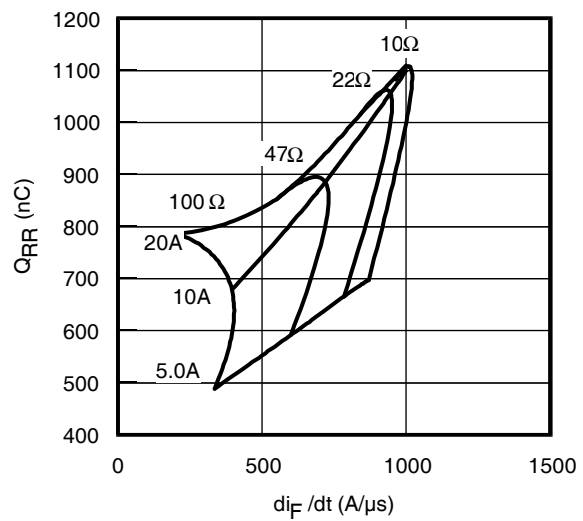
**Fig. 17** - Typical Diode  $I_{RR}$  vs.  $I_F$   
 $T_J = 150^\circ\text{C}$



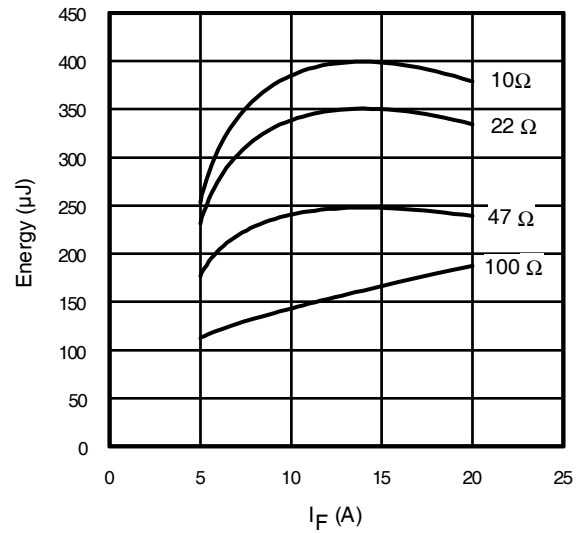
**Fig. 18** - Typical Diode  $I_{RR}$  vs.  $R_G$   
 $T_J = 150^\circ\text{C}; I_F = 10\text{A}$



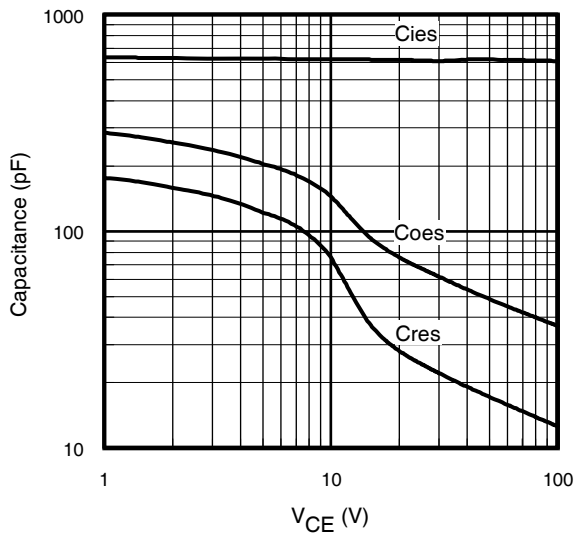
**Fig. 19** - Typical Diode  $I_{RR}$  vs.  $di_F/dt$   
 $V_{CC} = 400\text{V}; V_{GE} = 15\text{V};$   
 $I_{CE} = 10\text{A}; T_J = 150^\circ\text{C}$



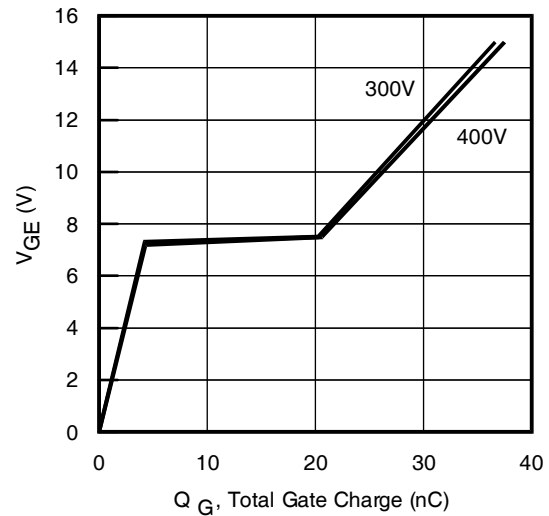
**Fig. 20** - Typical Diode  $Q_{RR}$   
 $V_{CC} = 400\text{V}; V_{GE} = 15\text{V}; T_J = 150^\circ\text{C}$



**Fig. 21** - Typical Diode  $E_{RR}$  vs.  $I_F$   
 $T_J = 150^\circ\text{C}$



**Fig. 22**- Typ. Capacitance vs.  $V_{CE}$   
 $V_{GE} = 0\text{V}$ ;  $f = 1\text{MHz}$



**Fig. 23** - Typical Gate Charge vs.  $V_{GE}$   
 $I_{CE} = 10\text{A}$ ;  $L = 600\mu\text{H}$

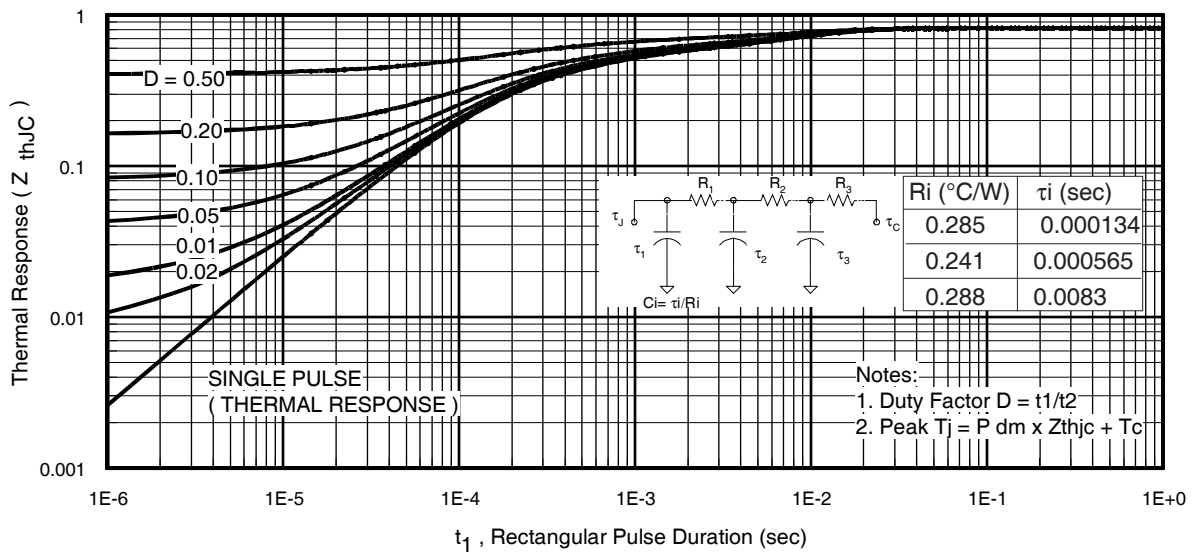


Fig 24. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

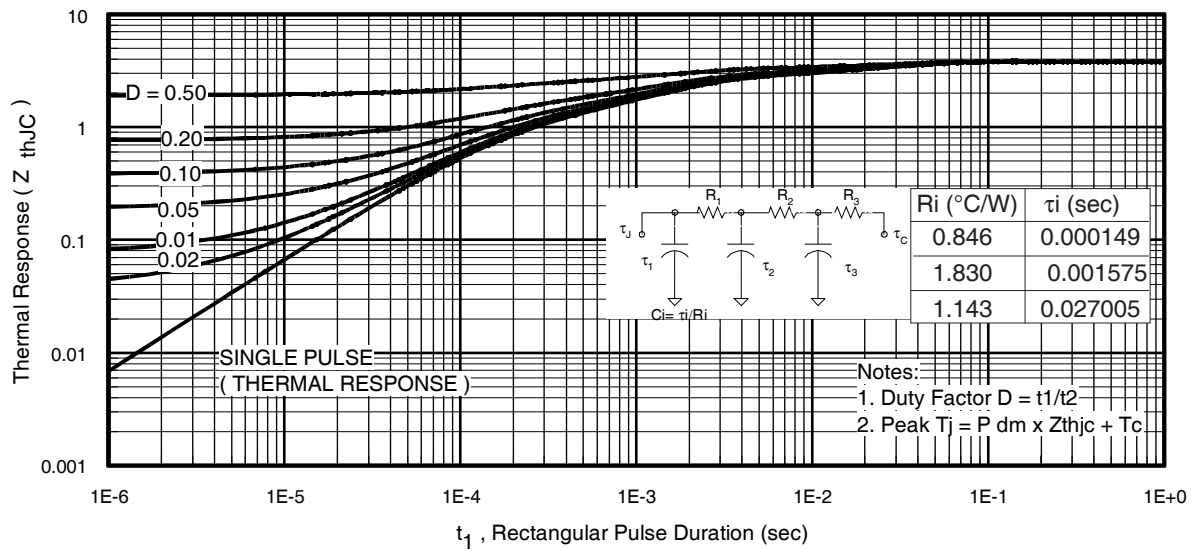
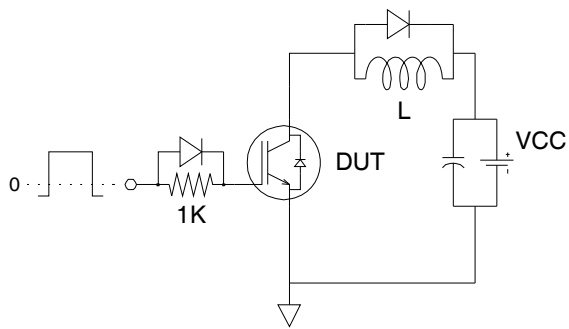
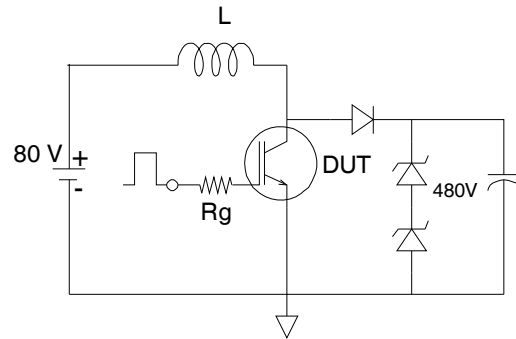


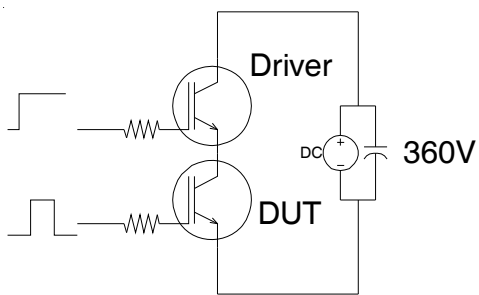
Fig 25. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)



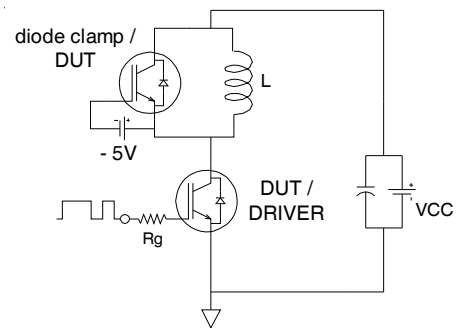
**Fig.C.T.1** - Gate Charge Circuit (turn-off)



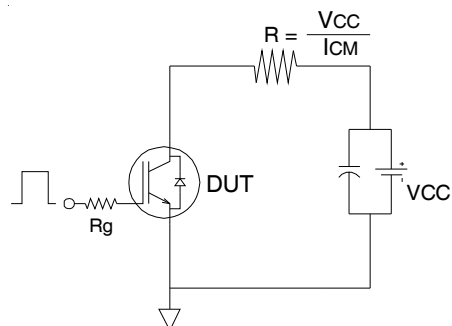
**Fig.C.T.2** - RBSOA Circuit



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



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



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

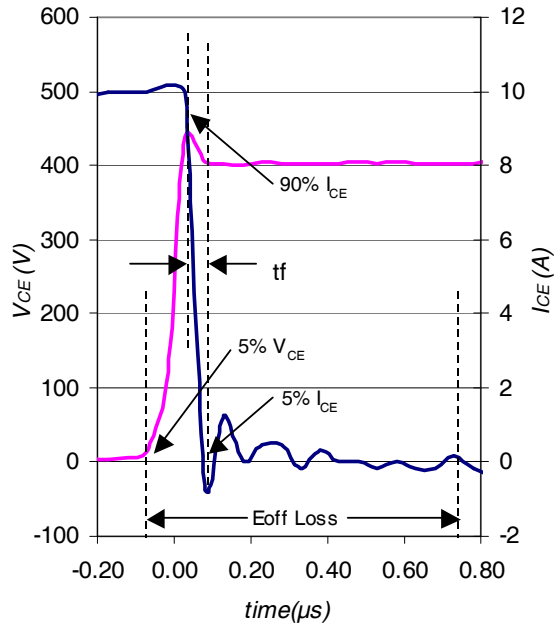


Fig. WF1- Typ. Turn-off Loss Waveform  
@  $T_J = 150^\circ\text{C}$  using Fig. CT.4

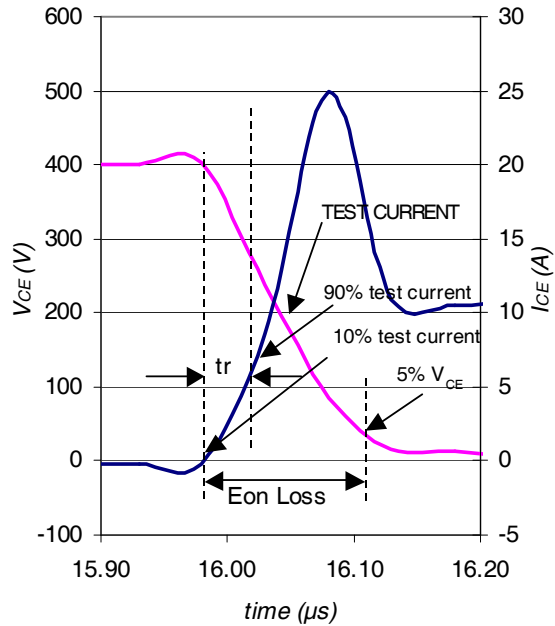


Fig. WF2- Typ. Turn-on Loss Waveform  
@  $T_J = 150^\circ\text{C}$  using Fig. CT.4

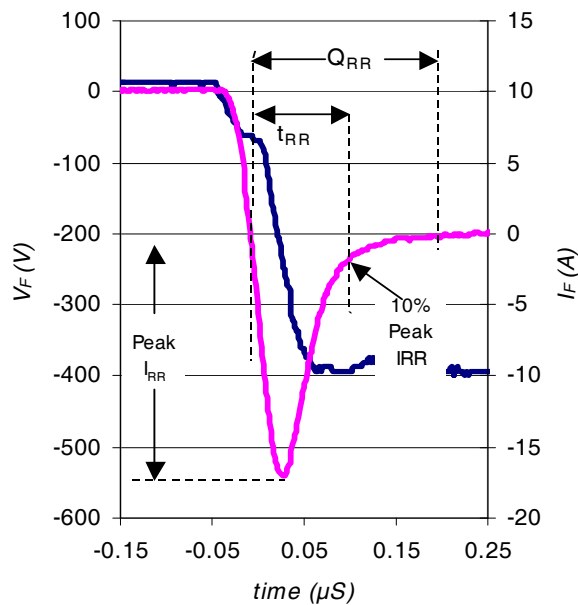


Fig. WF3- Typ. Diode Recovery Waveform  
@  $T_J = 150^\circ\text{C}$  using Fig. CT.4

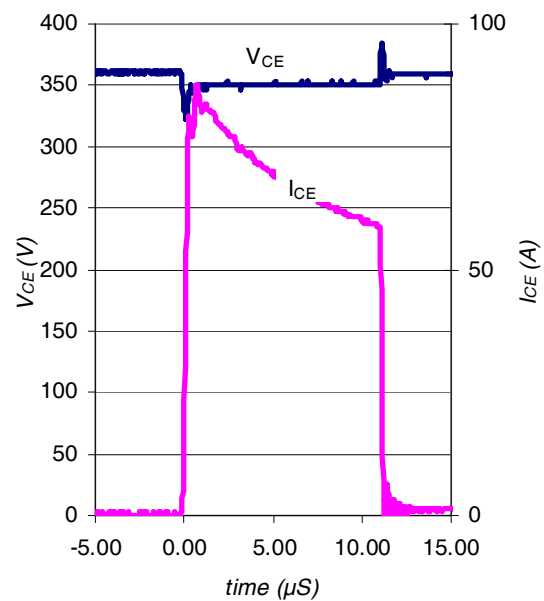


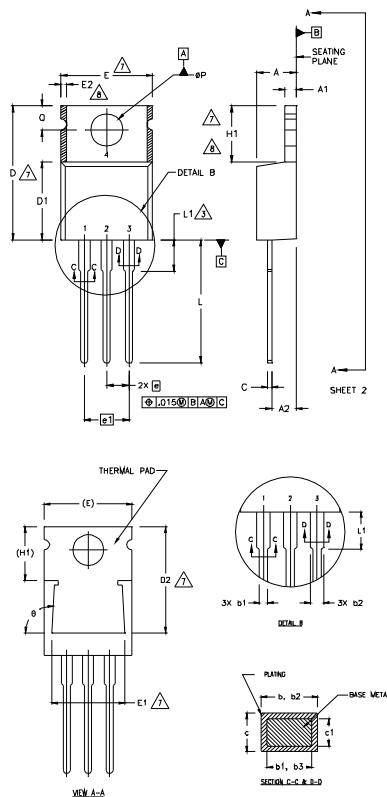
Fig. WF4- Typ. S.C Waveform  
@  $T_J = 150^\circ\text{C}$  using Fig. CT.3

# IRG/B/S/SL10B60KDPbF

International  
**IR** Rectifier

## TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5 M- 1994.
2. DIMENSIONS ARE SHOWN IN INCHES (MILLIMETERS).
3. LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
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. DIMENSION b1 & 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.

### LEAD ASSIGNMENTS

#### HEXMET

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

#### IGBTs, COPACK

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

#### DIODES

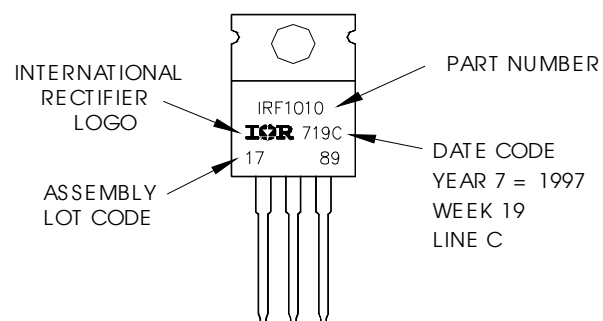
- 1.- ANODE/OPEN
- 2.- CATHODE
- 3.- ANODE

| SYMBOL | DIMENSIONS  |       |          |      | NOTES |
|--------|-------------|-------|----------|------|-------|
|        | MILLIMETERS |       | INCHES   |      |       |
|        | MIN.        | MAX.  | MIN.     | MAX. |       |
| A      | 3.56        | 4.82  | .140     | .190 | 5     |
| A1     | 0.51        | 1.40  | .020     | .055 |       |
| A2     | 2.04        | 2.92  | .080     | .115 |       |
| b      | 0.38        | 1.01  | .015     | .040 |       |
| b1     | 0.38        | 0.96  | .015     | .038 |       |
| b2     | 1.15        | 1.77  | .045     | .070 | 5     |
| b3     | 1.15        | 1.73  | .045     | .068 |       |
| c      | 0.36        | 0.61  | .014     | .024 |       |
| c1     | 0.36        | 0.56  | .014     | .022 |       |
| D      | 14.22       | 16.51 | .560     | .650 |       |
| D1     | 8.38        | 9.02  | .330     | .355 |       |
| D2     | 12.19       | 12.88 | .480     | .507 | 7     |
| E      | 9.66        | 10.66 | .380     | .420 |       |
| E1     | 8.38        | 8.89  | .330     | .350 | 7     |
| e      | 2.54 BSC    |       | .100 BSC |      | 7,8   |
| e1     | 5.08        |       | .200 BSC |      |       |
| H1     | 5.85        | 6.55  | .230     | .270 | 3     |
| L      | 12.70       | 14.73 | .500     | .580 |       |
| L1     | -           | 6.35  | -        | .250 |       |
| øP     | 3.54        | 4.08  | .139     | .161 |       |
| Q      | 2.54        | 3.42  | .100     | .135 |       |
| ø      | 90°-93°     |       | 90°-93°  |      |       |

## TO-220AB Part Marking Information

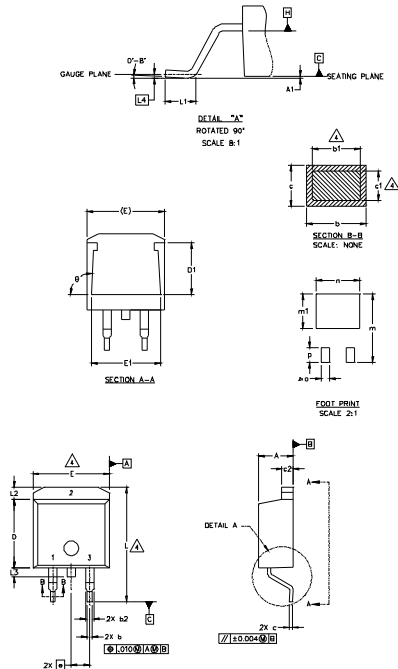
EXAMPLE: THIS IS AN IRF1010  
LOT CODE 1789  
ASSEMBLED ON WW 19, 1997  
IN THE ASSEMBLY LINE "C"

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



## D<sup>2</sup>Pak Package Outline

Dimensions are shown in millimeters (inches)



| SYMBOL | DIMENSIONS  |       |          |      | NOTES |
|--------|-------------|-------|----------|------|-------|
|        | MILLIMETERS |       | INCHES   |      |       |
|        | MIN.        | MAX.  | MIN.     | MAX. |       |
| A      | 4.06        | 4.83  | .160     | .190 | 4     |
| A1     |             | 0.127 |          | .005 |       |
| b      | 0.51        | 0.99  | .020     | .039 |       |
| b1     | 0.51        | 0.89  | .020     | .035 |       |
| b2     | 1.14        | 1.40  | .045     | .055 | 4     |
| c      | 0.43        | 0.63  | .017     | .025 |       |
| c1     | 0.38        | 0.74  | .015     | .029 |       |
| c2     | 1.14        | 1.40  | .045     | .055 |       |
| D      | 8.51        | 9.65  | .335     | .380 | 3     |
| D1     | 5.33        |       | .210     |      | 3     |
| E      | 9.65        | 10.67 | .380     | .420 |       |
| E1     | 6.22        |       | .245     |      |       |
| e      | 2.54 BSC    |       | .100 BSC |      |       |
| L      | 14.61       | 15.88 | .575     | .625 |       |
| L1     | 1.78        | 2.79  | .070     | .110 |       |
| L2     |             | 1.65  |          | .065 |       |
| L3     | 1.27        | 1.78  | .050     | .070 |       |
| L4     | 0.25 BSC    |       | .010 BSC |      |       |
| m      | 17.78       |       | .700     |      |       |
| m1     | 8.89        |       | .350     |      |       |
| n      | 11.43       |       | .450     |      |       |
| o      | 2.08        |       | .082     |      |       |
| p      | 3.81        |       | .150     |      |       |
| θ      | 90°         | 93°   | 90°      | 93°  |       |



### LEAD ASSIGNMENTS

IGBTs, CoPACK

DIODES

#### HEXFEET

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

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

- 1.- ANODE \*
- 2.- CATHODE
- 3.- ANODE

\* PART DEPENDENT.

### NOTES:

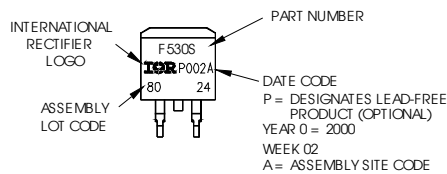
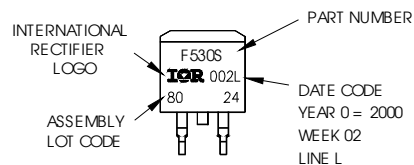
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

## D<sup>2</sup>Pak 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

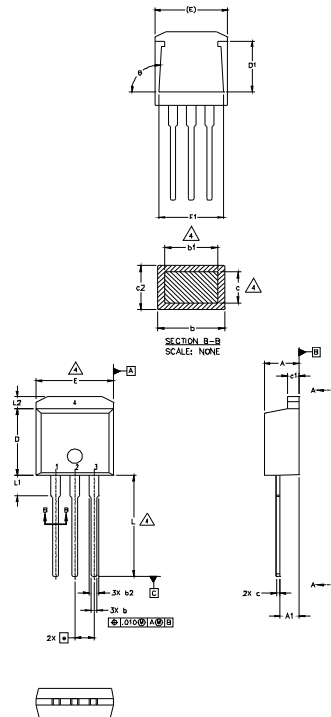


# IRG/B/S/SL10B60KDPbF

International  
**IR** Rectifier

## TO-262 Package Outline

Dimensions are shown in millimeters (inches)



| SYMBOL | DIMENSIONS  |       |          |      | NOTES |
|--------|-------------|-------|----------|------|-------|
|        | MILLIMETERS |       | INCHES   |      |       |
|        | MIN.        | MAX.  | MIN.     | MAX. |       |
| A      | 4.06        | 4.83  | .160     | .190 | 4     |
| A1     | 2.03        | 2.92  | .080     | .115 |       |
| b      | 0.51        | 0.99  | .020     | .039 |       |
| b1     | 0.51        | 0.89  | .020     | .035 |       |
| b2     | 1.14        | 1.40  | .045     | .055 | 4     |
| c      | 0.38        | 0.63  | .015     | .025 |       |
| c1     | 1.14        | 1.40  | .045     | .055 |       |
| c2     | 0.43        | .063  | .017     | .029 |       |
| D      | 8.51        | 9.65  | .335     | .380 | 3     |
| D1     | 5.33        |       | .210     |      |       |
| E      | 9.65        | 10.67 | .380     | .420 |       |
| E1     | 6.22        |       | .245     |      |       |
| e      | 2.54 BSC    |       | .100 BSC |      | 3     |
| L      | 13.46       | 14.09 | .530     | .555 |       |
| L1     | 3.56        | 3.71  | .140     | .146 |       |
| L2     |             | 1.65  |          | .065 |       |

### LEAD ASSIGNMENTS

#### HEXFET

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

#### IGBT

- 1 - GATE
- 2 - COLLECTOR
- 3 - EMITTER

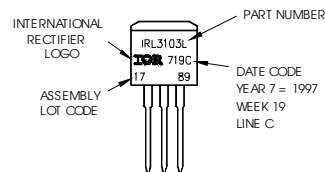
#### NOTES

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 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

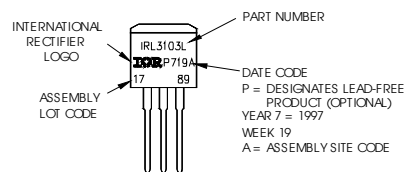
## TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L  
LOT CODE 1789  
ASSEMBLED ON WW 19, 1997  
IN THE ASSEMBLY LINE "C"

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

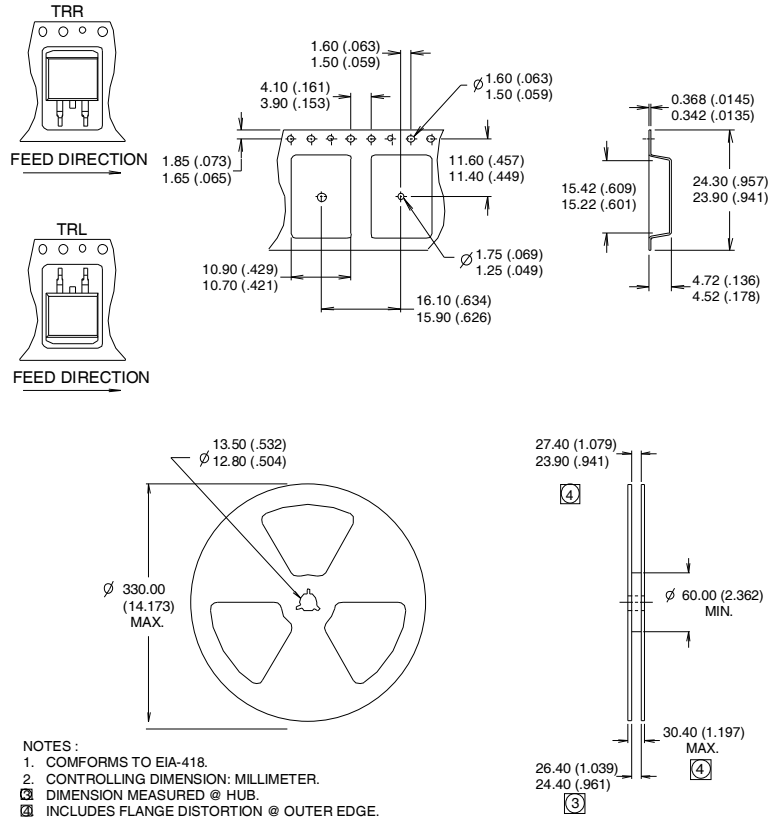


OR



## D<sup>2</sup>Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



### Notes:

- ① This is only applied to TO-220AB package
- ② This is applied to D<sup>2</sup>Pak, when mounted on 1" square PCB ( FR-4 or G-10 Material ).  
For recommended footprint and soldering techniques refer to application note #AN-994.
- ③ Energy losses include "tail" and diode reverse recovery.
- ④  $V_{CC} = 80\% (V_{CES})$ ,  $V_{GE} = 20V$ ,  $L = 100\mu H$ ,  $R_G = 47\Omega$ .

TO-220 package is not recommended for Surface Mount Application

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

International  
**IR** 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](http://www.irf.com) for sales contact information. 01/2013