Bulletin I27209 01/06

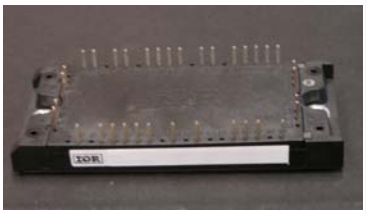
International
IOR Rectifier

# GB75YF120N

## IGBT FOUR PAK MODULE

### Features

- Square RBSOA
- HEXFRED low Qrr, low Switching Energy
- Positive $V_{CE(on)}$ Temperature Coefficient
- Copper Baseplate
- Low Stray Inductance Design



ECONO2 4PAK

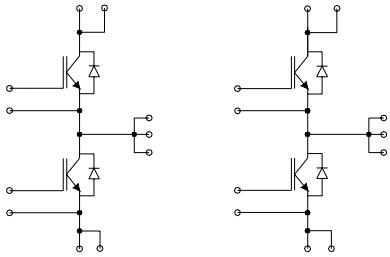
$V_{CES}$ = 1200V

$I_C$ = 75A @ $T_C$ = 67°C

$V_{CE(on)}$ typ. = 3.4V

### Benefits

- Benchmark Efficiency for SMPS appreciation in particular HF welding
- Rugged Transient Performance
- Low EMI, Requires Less Snubbing
- Direct Mounting to Heatsink space saving
- PCB Solderable Terminals
- Low Junction to Case Thermal Resistance



### Absolute Maximum Ratings

| | Parameter | Max. | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-to-Emitter Voltage | 1200 | V |
| $I_C$ @ Tc=25°C | Continuous Collector Current | 100 | A |
| $I_C$ @ Tc=80°C | Continuous Collector Current | 67 | |
| $I_{CM}$ | Pulsed Collector Current (Ref. Fig. C.T.5) | 200 | |
| $I_{LM}$ | Clamped Inductive Load Current | 200 | |
| $I_F$ @ Tc=25°C | Diode Continuous Forward Current | 40 | |
| $I_F$ @ Tc=80°C | Diode Continuous Forward Current | 25 | |
| $I_{FM}$ | Diode Maximum Forward Current | 150 | |
| $V_{GE}$ | Gate-to-Emitter Voltage | ±20 | V |
| $P_D$ @ Tc=25°C | Maximum Power Dissipation (IGBT) | 480 | W |
| $P_D$ @ Tc=80°C | Maximum Power Dissipation (IGBT) | 270 | |
| $T_J$ | Maximum Operating Junction Temperature | 150 | ℃ |
| $T_{STG}$ | Storage Temperature Range | -40 to +125 | |
| $V_{ISOL}$ | Isolation Voltage | AC 2500 (MIN) | V |



### Thermal and Mechanical Characteristics

| | Parameter | Min | Typical | Maximum | Units |
|---|---|---|---|---|---|
| $R_{\theta JC}$ (IGBT) | Junction-to-Case IGBT | - | - | 0.26 | °C/W |
| $R_{\theta JC}$ (Diode) | Junction-to-Case Diode | - | - | 1.00 | |
| $R_{\theta CS}$ (Module) | Case-to-Sink, flat, greased surface | - | 0.05 | - | |
| | Mounting Torque (M5) | 2.7 | - | 3.3 | N*m |
| | Weight | - | 170 | - | g |

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $BV_{(CES)}$ | Collector-to-Emitter Breakdown Voltage | 1200 | - | - | V | $V_{GE}$ = 0 IC = 500µA |
| $V_{CE(ON)}$ | Collector-to-Emitter Voltage | - | 3.4 | 4.0 | V | $I_C$ = 75A $V_{GE}$ = 15V |
| | | - | 3.8 | 4.5 | | $I_C$ = 100A $V_{GE}$ = 15V |
| | | - | 4.0 | 4.5 | | $I_C$ = 75A $V_{GE}$ = 15V $T_J$ = 125°C |
| | | - | 4.53 | 5.1 | | $I_C$ = 100A $V_{GE}$ = 15V $T_J$ = 125°C |
| $V_{GE}(th)$ | Gate Threshold Voltage | 4.0 | 5.0 | 6.0 | | $V_{CE}$ = $V_{GE}$ IC = 250µA |
| $\Delta V_{GE}(th)/\Delta T_J$ | Thresold Voltage temp. coefficient | - | -11 | - | mV/°C | $V_{CE}$ = $V_{GE}$ IC = 1mA (25°C-125°C) |
| $I_{CES}$ | Zero Gate Voltage Collector Current | - | 7 | 250 | µA | $V_{GE}$ = 0 $V_{CE}$ = 1200V |
| | | - | 580 | 2000 | | $V_{GE}$ = 0 $V_{CE}$ = 1200V Tj = 125°C |
| $V_{FM}$ | Diode Forward Voltage Drop | - | 3.9 | 5.0 | V | $I_F$ = 75A |
| | | - | 4.43 | 5.8 | | $I_F$ = 100A |
| | | - | 4.37 | 5.4 | | $I_F$ = 75A Tj = 125°C |
| | | - | 5.02 | 6.4 | | $I_F$ = 100A Tj = 125°C |
| $I_{GES}$ | Gate-to-Emitter Leakage Current | - | - | ± 200 | nA | $V_{GE}$ = ±20V |

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

| | Parameter | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| $Q_G$ | Total Gate Charge (turn-on) | - | 630 | - | | $I_C$ = 50A |
| $Q_{GE}$ | Gate-to-Emitter Charge (turn-on) | - | 65 | - | nC | $V_{CC}$ = 600A |
| $Q_{GC}$ | Gate-to-Collector Charge (turn-on) | - | 250 | - | | $V_{GE}$ = 15V |
| $E_{ON}$ | Turn-On Switching Loss | - | 1505 | - | µJ | $I_C$ = 50A $V_{CC}$ = 600V |
| $E_{OFF}$ | Turn-Off Switching Loss | - | 2411 | - | | $V_{GE}$ = 15V $R_G$ = 4.7Ω L = 500µH |
| $E_{TOT}$ | Total Switching Loss | - | 3916 | - | | Tj = 25°C ① |
| $E_{ON}$ | Turn-On Switching Loss | - | 2248 | - | µJ | $I_C$ = 50A $V_{CC}$ = 600V |
| $E_{OFF}$ | Turn-Off Switching Loss | - | 3351 | - | | $V_{GE}$ = 15V $R_G$ = 4.7Ω L = 500µH |
| $E_{TOT}$ | Total Switching Loss | - | 7599 | - | | Tj = 125°C ① |
| $t_{d(on)}$ | Turn-On delay time | - | 169 | - | ns | $I_C$ = 50A $V_{CC}$ = 600V |
| $t_r$ | Rise time | - | 71 | - | | $V_{GE}$ = 15V $R_G$ = 4.7Ω L =500µH |
| $t_{d(off)}$ | Turn-Off delay time | - | 393 | - | | Tj = 125°C |
| $t_f$ | Fall time | - | 136 | - | | |
| RBSOA | Reverse Bias Safe Operating Area | FULL SQUARE | | | | Tj = 150°C $I_C$ = 150A<br>$R_G$ =10Ω $V_{GE}$ = 15V to 0 |
| SCSOA | Short Circuit Safe Operating Area | 10 | - | - | µs | Tj = 150°C<br>$V_{CC}$ = 900V $V_P$ = 1200V<br>$R_G$ = 10Ω $V_{GE}$ = 15V to 0 |
| $I_{rr}$ | Diode Peak Rev. Recovery Current | - | 1.45 | 2.5 | A | Tj = 25°C |
| | | - | 2.35 | 4.0 | | Tj = 125°C |
| $t_{rr}$ | Diode Rev. Recovery Time | - | 0.401 | 0.5 | µs | Tj = 25°C $V_{CC}$ = 600V $I_F$ = 75A |
| | | - | 0.655 | 0.8 | µs | Tj = 125°C dI/ dt = 10A/µs |
| $Q_{rr}$ | Total Rev. Recovery Charge | - | 0.181 | 0.4 | µC | Tj = 25°C |
| | | - | 0.54 | 1.5 | µC | Tj = 125°C |

① Energy losses include "tail" and diode reverse recovery.

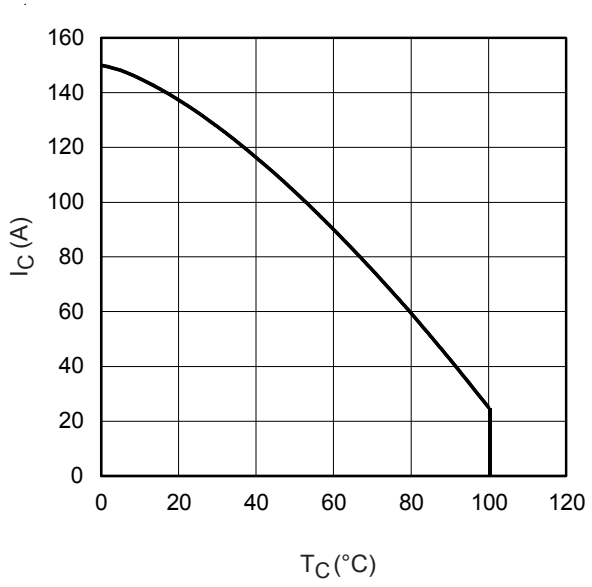



**Fig. 1** - Maximum DC Collector Current vs. Case Temperature

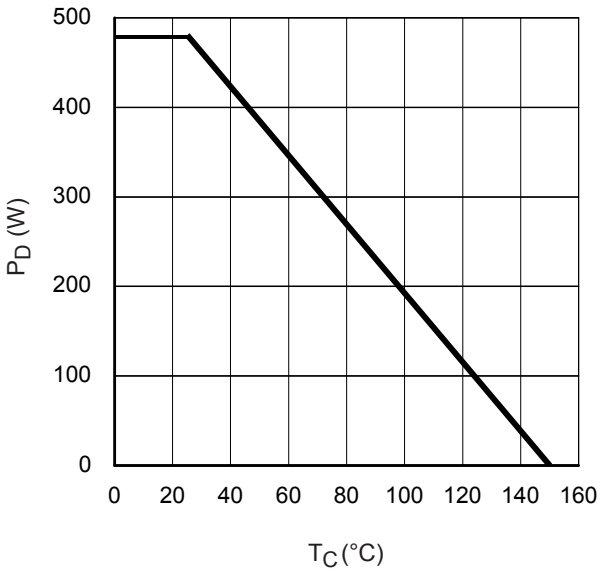



**Fig. 2** - Power Dissipation vs. Case Temperature



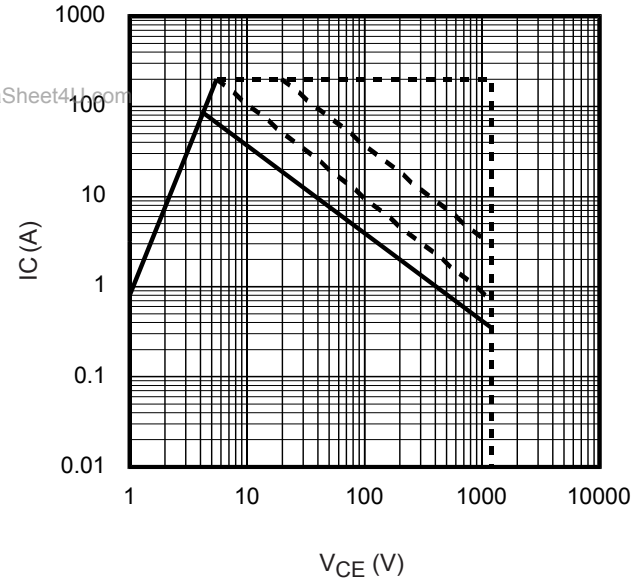



**Fig. 3** - Forward SOA
$T_C$ = 25°C; $T_J \leq$ 150°C

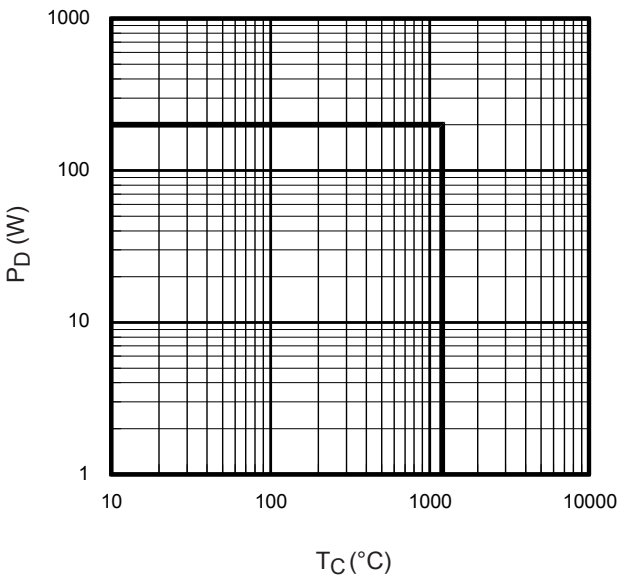



**Fig. 4** - Reverse Bias SOA
$T_J$ = 150°C; $V_{GE}$ =15V

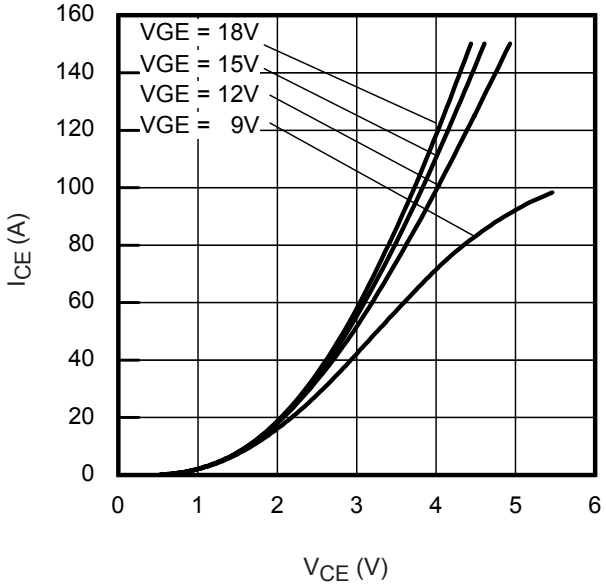



**Fig. 5** - Typ. IGBT Output Characteristics
$T_J$ = 25°C; tp = 500µs

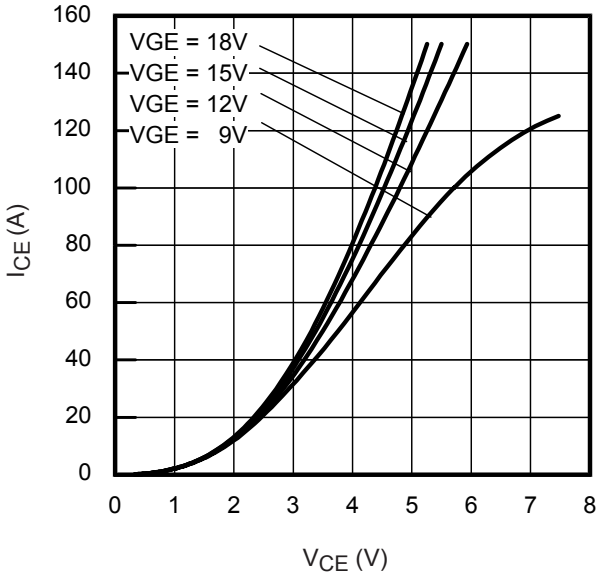



**Fig. 6** - Typ. IGBT Output Characteristics
$T_J$ = 125°C; tp = 500µs



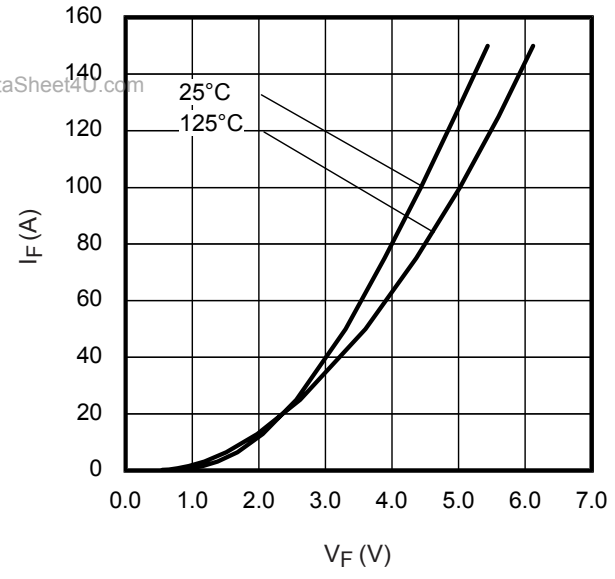



**Fig. 7** - Typ. Diode Forward Characteristics
tp = 500µs

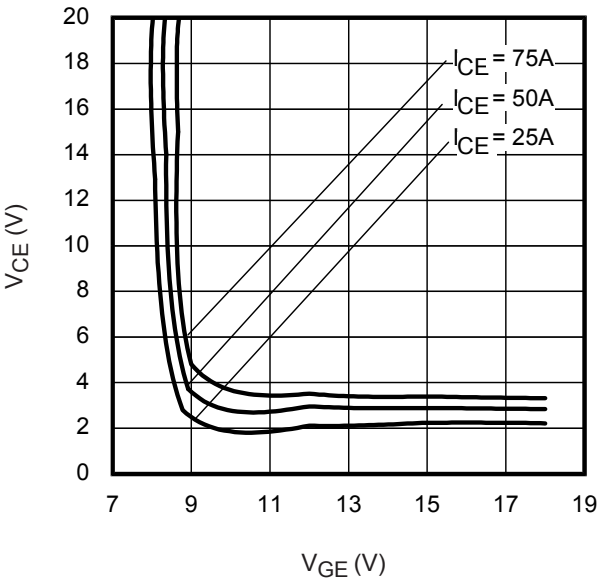



**Fig. 8** - Typical $V_{CE}$ vs. $V_{GE}$
$T_J$ = 25°C

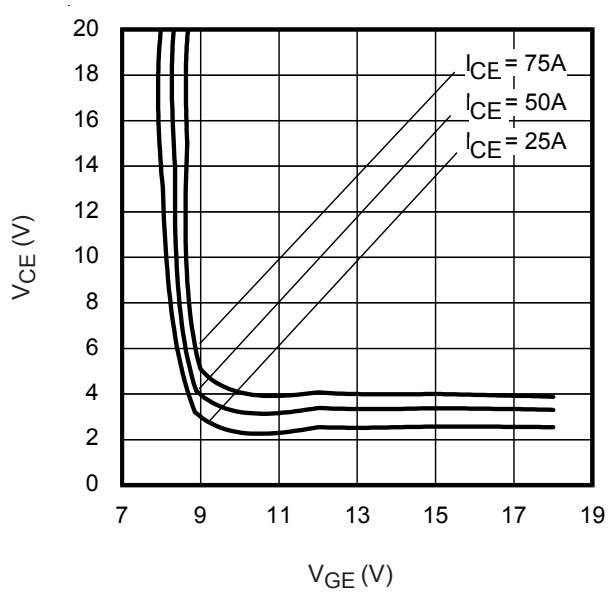



**Fig. 9** - Typical $V_{CE}$ vs. $V_{GE}$
$T_J$ = 125°C

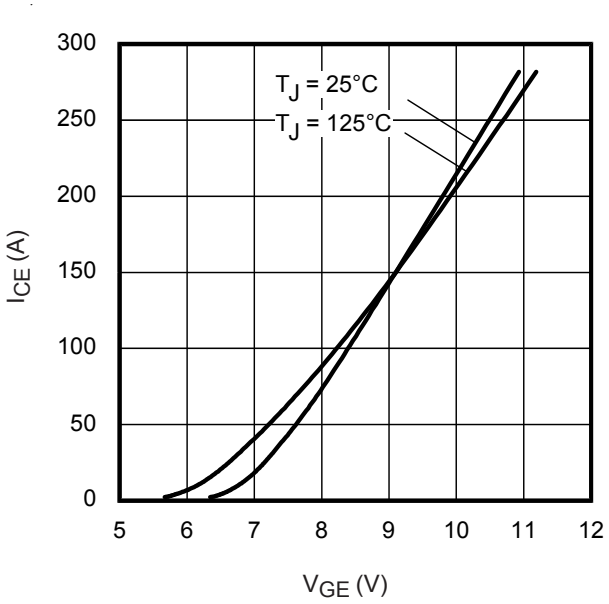



**Fig. 10** - Typ. Transfer Characteristics
$V_{CE}$ = 20V; tp = 500µs



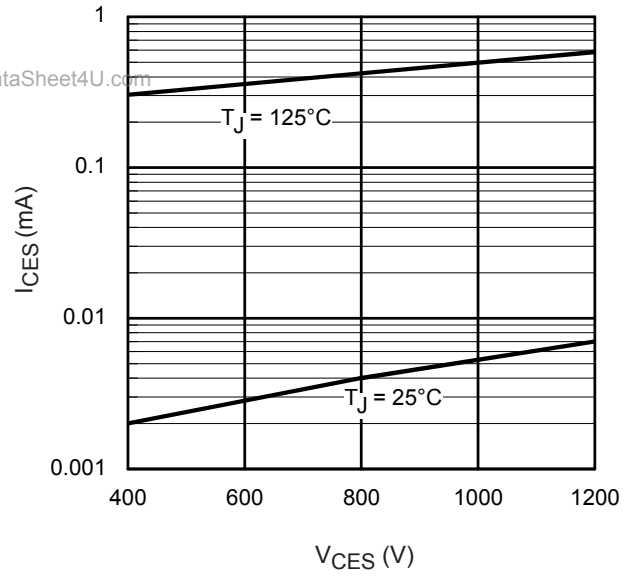



**Fig. 11** - Typ Zero Gate Voltage Collector Current

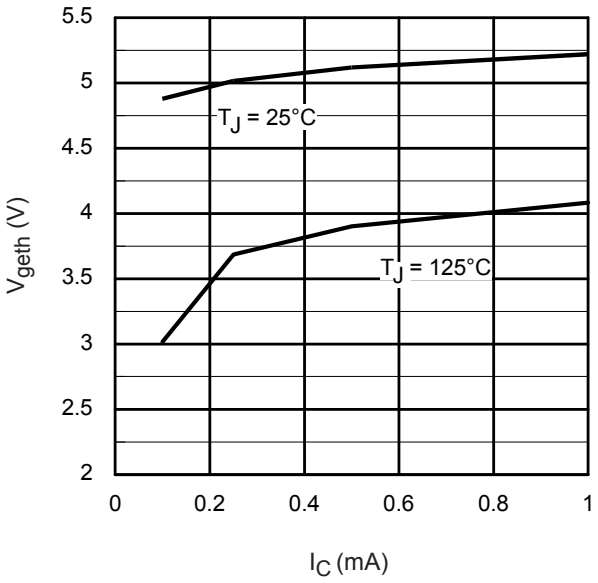



**Fig. 12** - Typ Threshold Voltage

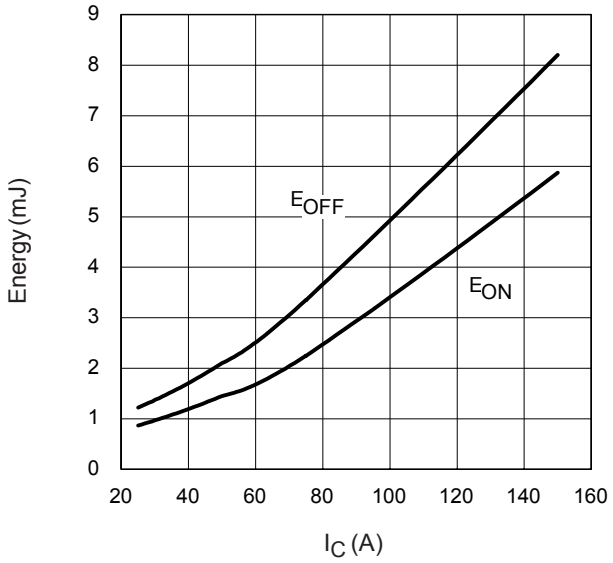



**Fig. 13** - Typ. Energy Loss vs. $I_C$
$T_J$ = 125°C; L=200µH; $V_{CE}$= 600V
$R_G$= 5Ω; $V_{GE}$= 15V

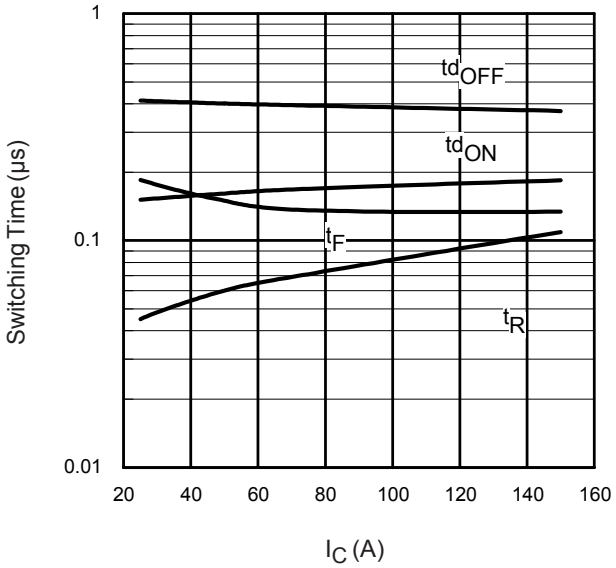



**Fig. 14** - Typ. Switching Time vs. $I_C$
$T_J$ = 125°C; L=200µH; $V_{CE}$= 600V
$R_G$= 5Ω; $V_{GE}$= 15V



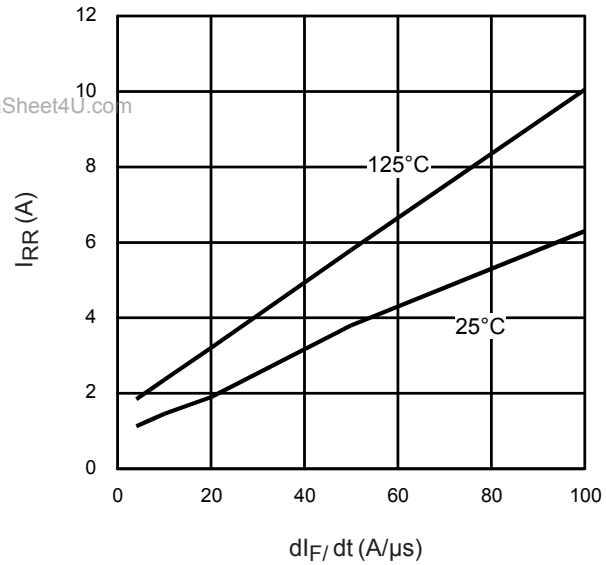



**Fig. 15**- Typical Diode $I_{REC}$ vs. $di_F/dt$
$V_{CC}$= 600V; $I_F$= 50A

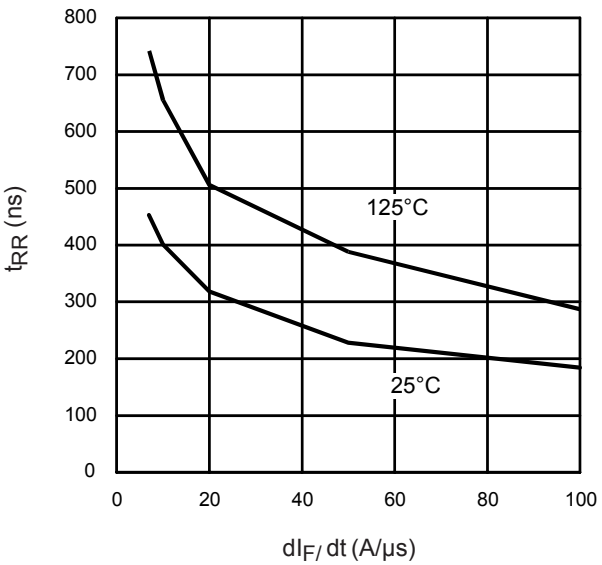



**Fig. 16**- Typical Diode $t_{RR}$ vs. $di_F/dt$
$V_{CC}$= 600V; $I_F$= 50A

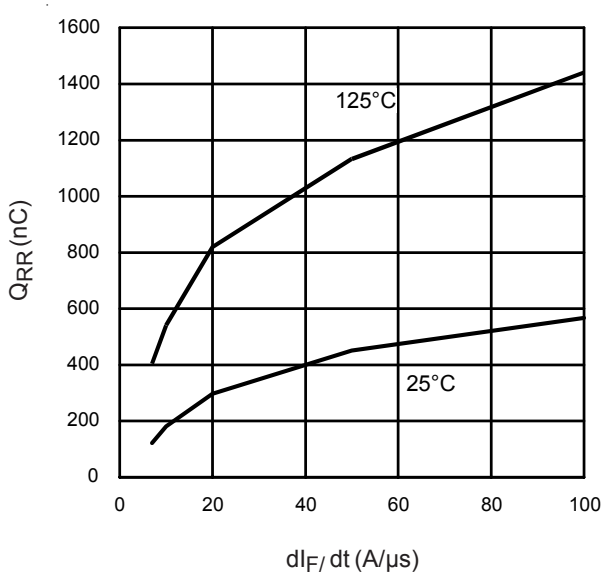



**Fig. 17**- Typical Diode $Q_{RR}$ vs. $di_F/dt$
$V_{CC}$= 600V; $I_F$= 50A

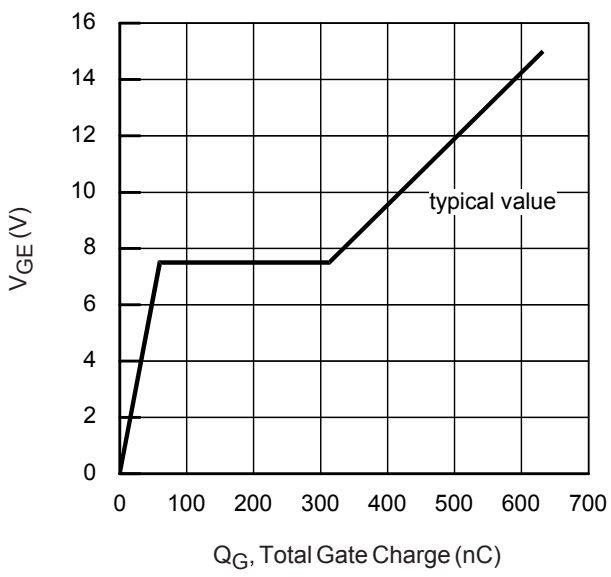



**Fig. 18** - Typical Gate Charge vs. $V_{GE}$
$I_{CE}$ = 5.0A; L = 600µH

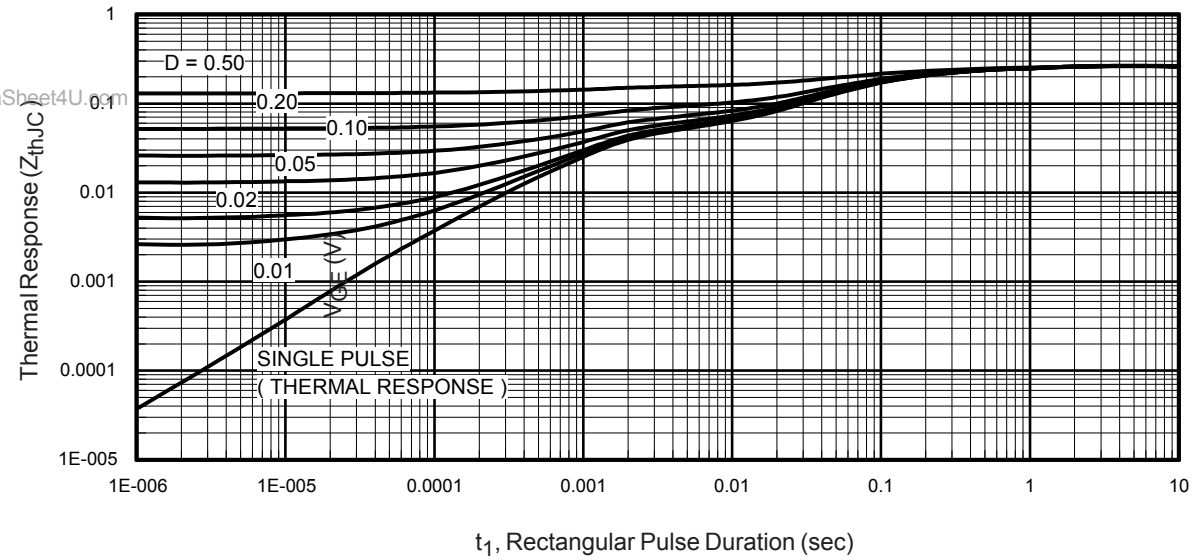





**Fig 19** - Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

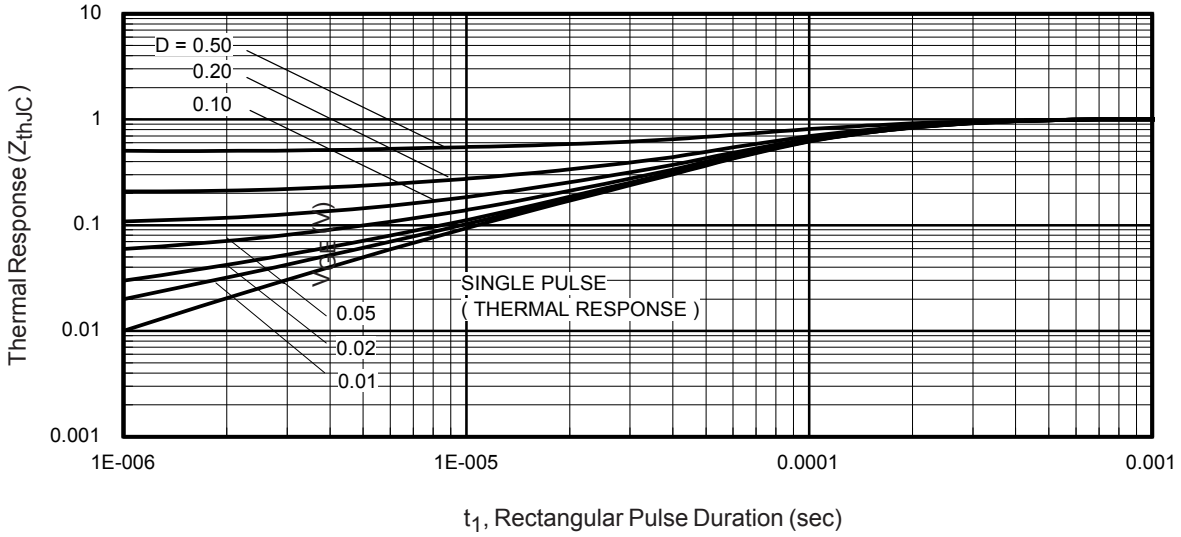



**Fig 20** - Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

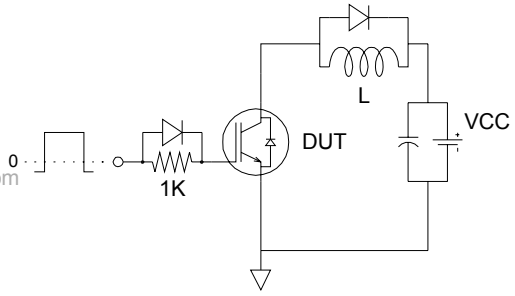





**Fig.C.T.1** - Gate Charge Circuit (turn-off)

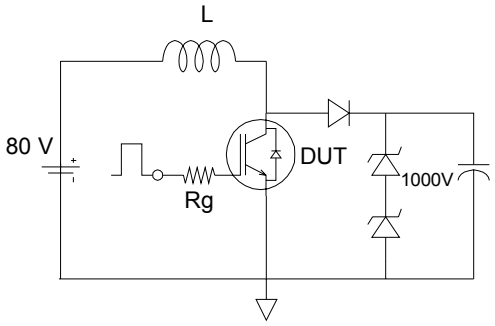



**Fig.C.T.2** - RBSOA Circuit

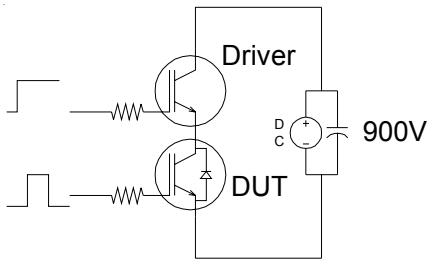



**Fig.C.T.3** - S.C. SOA Circuit

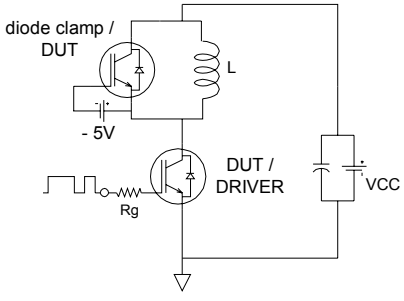



**Fig.C.T.4** - Switching Loss Circuit

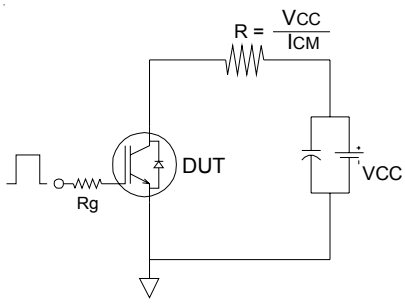
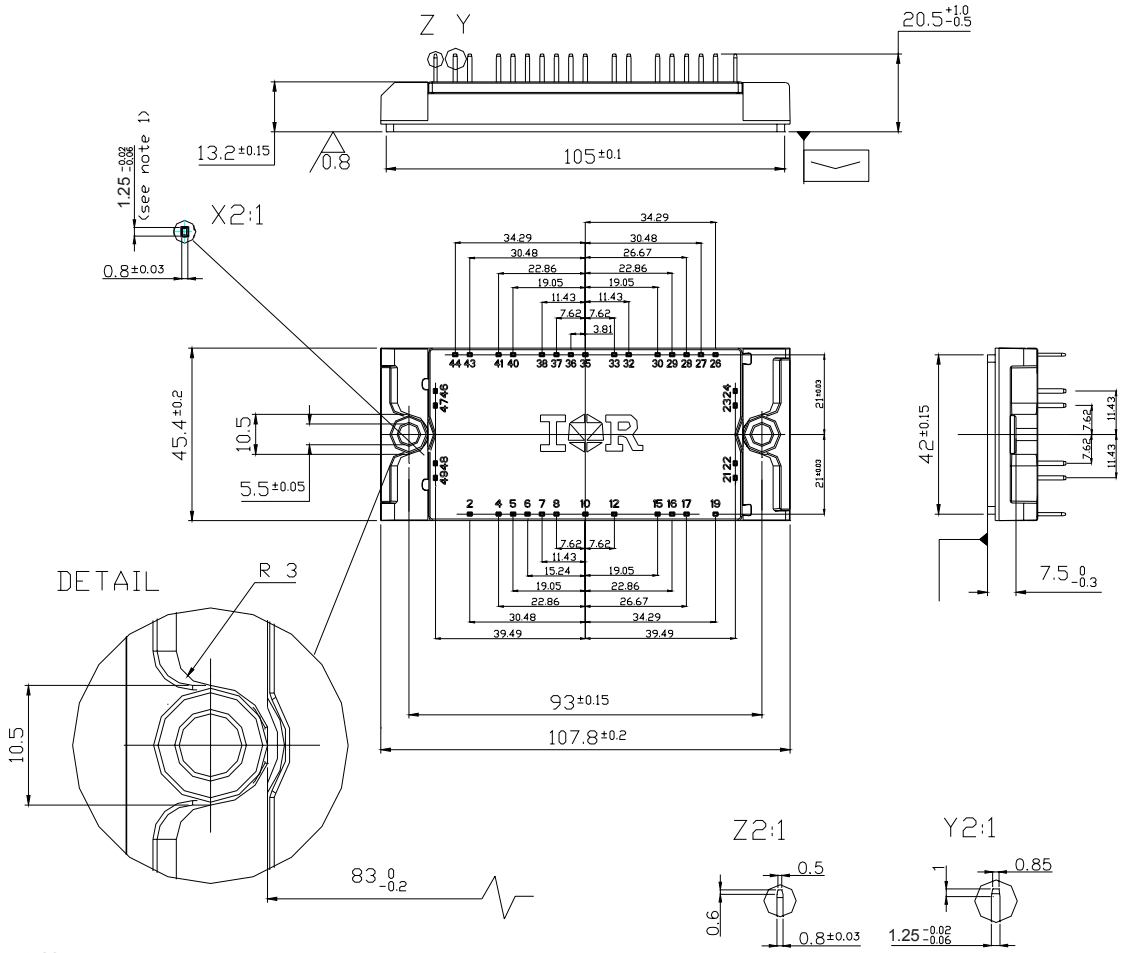


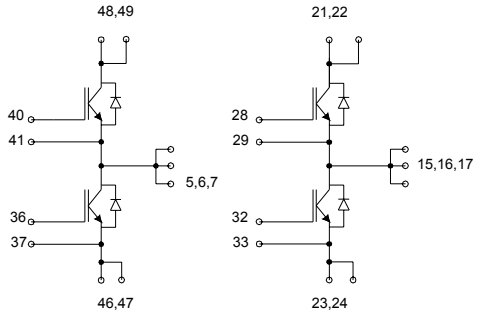

**Fig.C.T.5** - Resistive Load Circuit

## Econo2 4Pak Package Outline

Dimensions are shown in millimeters (inches)






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.

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**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. 01/06