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International
IOR Rectifier

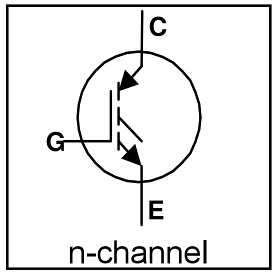
IRGP20B120U-EP

INSULATED GATE BIPOLAR TRANSISTOR

UltraFast IGBT

Features

- UltraFast Non Punch Through (NPT) Technology
- 10 µs Short Circuit capability
- Square RBSOA
- Positive V_{CE}(on) Temperature Coefficient
- Extended lead TO-247 package
- Lead-Free



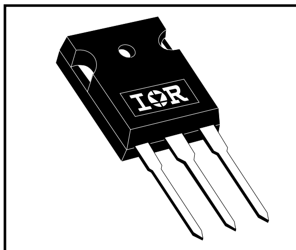
V_{CES} = 1200V

$V_{CE(on)\ typ.}$ = 3.05V

V_{GE} = 15V, I_C = 20A, 25°C

Benefits

- Benchmark efficiency above 20KHz
- Optimized for Welding, UPS, and Induction Heating applications
- Rugged with UltraFast performance
- Low EMI
- Significantly Less Snubber required
- Excellent Current sharing in Parallel operation
- Longer leads for easier mounting



TO-247AD

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	1200	V
I_C @ T_C = 25°C	Continuous Collector Current (Fig.1)	40	A
I_C @ T_C = 100°C	Continuous Collector Current (Fig.1)	20	
I_{CM}	Pulsed Collector Current (Fig.3, Fig. CT.5)	120	
I_{LM}	Clamped Inductive Load Current(Fig.4, Fig. CT.2)	120	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{AS} @ T_C =25°C	Avalanche Energy, single pulse I_C = 25A, V_{CC} = 50V, R_{GE} = 25ohm L = 200µH (Fig. CT.6)	65	mJ
P_D @ T_C = 25°C	Maximum Power Dissipation (Fig.2)	300	W
P_D @ T_C = 100°C	Maximum Power Dissipation (Fig.2)	120	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds	300, (0.063 in. (1.6mm) from case)	
	Mounting torque, 6-32 or M3 screw.	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case - IGBT	–––	–––	0.42	°C/W
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	–––	0.24	–––	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	–––	–––	40	
Wt	Weight	–––	6 (0.21)	–––	g (oz)
$Z_{\theta JC}$	Transient Thermal Impedance Junction-to-Case (Fig.18)				

09/14/04

Electrical Characteristics @ TJ = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions	Fig.
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200			V	V_{GE} = 0V, I_c = 250 µA	
$\Delta V_{(BR)CES} / \Delta T_j$	Temperature Coeff. of Breakdown Voltage		+1.2		V/°C	V_{GE} = 0V, I_c = 1 mA (25 -125 °C)	
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage		3.05	3.45	V	I_C = 20A, V_{GE} = 15V	5, 6
			3.37	3.80		I_C = 25A, V_{GE} = 15V	7, 8
			4.23	4.85		I_C = 40A, V_{GE} = 15V	9
			3.89	4.50		I_C = 20A, V_{GE} = 15V, T_J = 125°C	10
			4.31	5.06		I_C = 25A, V_{GE} = 15V, T_J = 125°C	
$V_{GE(th)}$	Gate Threshold Voltage	4.0	5.0	6.0	V	V_{CE} = V_{GE}, I_C = 250 µA	8,9,10,11
$\Delta V_{GE(th)} / \Delta T_j$	Temperature Coeff. of Threshold Voltage		- 1.2		mV/°C	V_{CE} = V_{GE}, I_C = 1 mA (25 -125 °C)	
g_{fe}	Forward Transconductance	13.6	15.7	17.8	S	V_{CE} = 50V, I_C = 20A, PW=80µs	
I_{CES}	Zero Gate Voltage Collector Current			250	µA	V_{GE} = 0V, V_{CE} = 1200V	
			420	750		V_{GE} = 0V, V_{CE} = 1200V, T_J =125°C	
			1482	2200		V_{GE} = 0V, V_{CE} = 1200V, T_J =150°C	
I_{GES}	Gate-to-Emitter Leakage Current			±100	nA	V_{GE} = ±20V	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Fig.
Q_g	Total Gate charge (turn-on)		169	254	nC	I_C = 20A	17
Q_{ge}	Gate - Emitter Charge (turn-on)		24	36		V_{CC} = 600V	CT 1
Q_{gc}	Gate - Collector Charge (turn-on)		82	126		V_{GE} = 15V	
E_{on}	Turn-On Switching Loss *		850	1050	µJ	I_C = 20A, V_{CC} = 600V	CT 4
E_{off}	Turn-Off Switching Loss *		425	650		V_{GE} = 15V, Rg = 5Ω, L = 200µH	WF 1
E_{tot}	Total Switching Loss *		1275	1800		T_J = 25°C, Energy losses include tail and diode reverse recovery	WF2
E_{on}	Turn-on Switching Loss *		1350	1550	µJ	Ic = 20A, V_{CC} = 600V	12, 14
E_{off}	Turn-off Switching Loss *		610	875		V_{GE} = 15V, Rg = 5Ω, L = 200µH	CT 4
E_{tot}	Total Switching Loss *		1960	2425		T_J = 125°C, Energy losses include tail and diode reverse recovery	WF 1 & 2
td(on)	Turn - on delay time		50	65	ns	Ic = 20A, V_{CC} = 600V	13, 15
tr	Rise time		20	30		V_{GE} = 15V, Rg = 5Ω, L = 200µH	CT 4
td(off)	Turn - off delay time		204	230		T_J = 125°C	WF 1
tf	Fall time		24	35			WF2
C_{ies}	Input Capacitance		2200		pF	V_{GE} = 0V	
C_{oes}	Output Capacitance		210			V_{CC} = 30V	16
C_{res}	Reverse Transfer Capacitance		85			f = 1.0 MHz	
RBSOA	Reverse bias safe operating area	FULL SQUARE				T_J = 150°C, Ic = 120A V_{CC} = 1000V, V_P = 1200V Rg = 5Ω, V_{GE} = +15V to 0V	4 CT 2
SCSOA	Short Circuit Safe Operating Area	10	----	----	µs	T_J = 150°C V_{CC} = 900V, V_P = 1200V Rg = 5Ω, V_{GE} = +15V to 0V	CT 3 WF3
Le	Internal Emitter Inductance		13		nH	Measured 5 mm from the package.	

* Used Diode HF40D120ACE

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

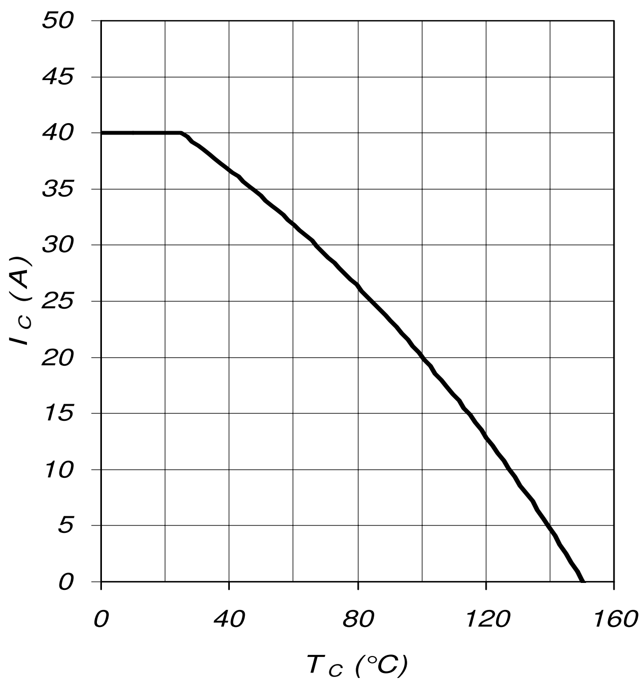


Fig.2 - Power Dissipation vs. Case Temperature

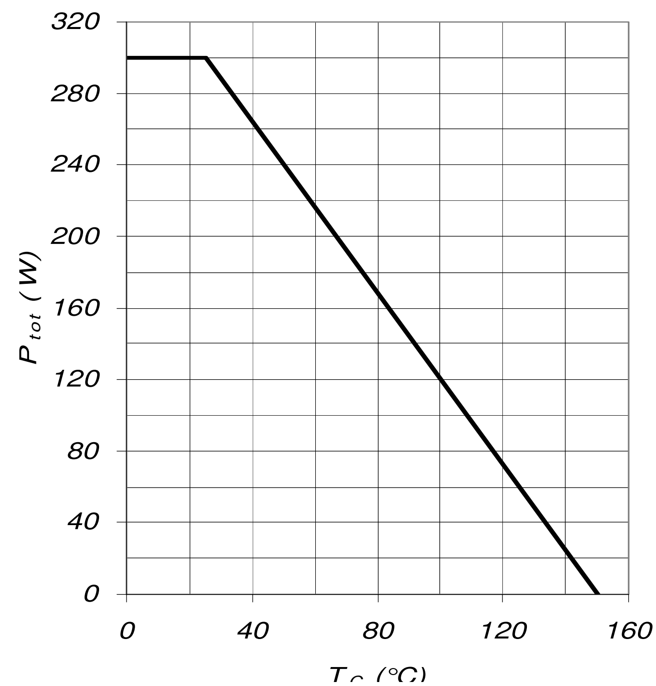


Fig.3 - Forward SOA T_C=25°C; Tj≤ 150°C

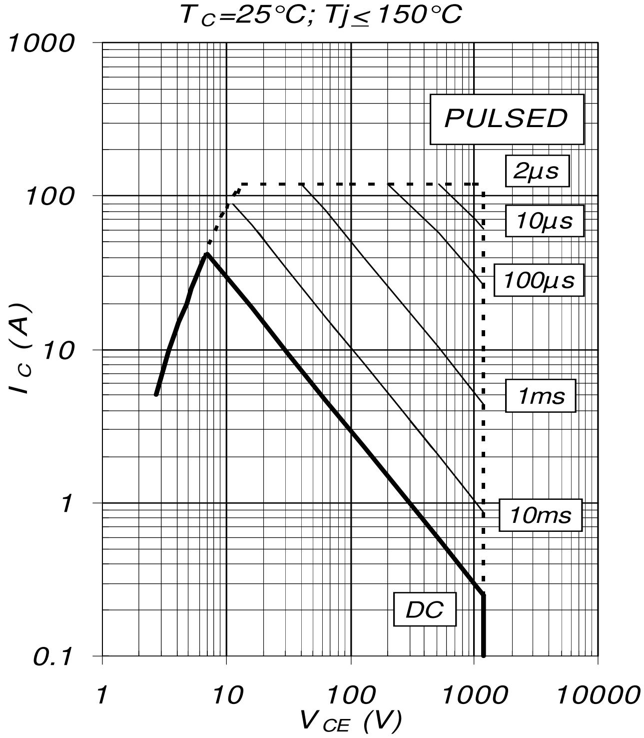


Fig.4 - Reverse Bias SOA Tj = 150°C, V_{GE} = 15V

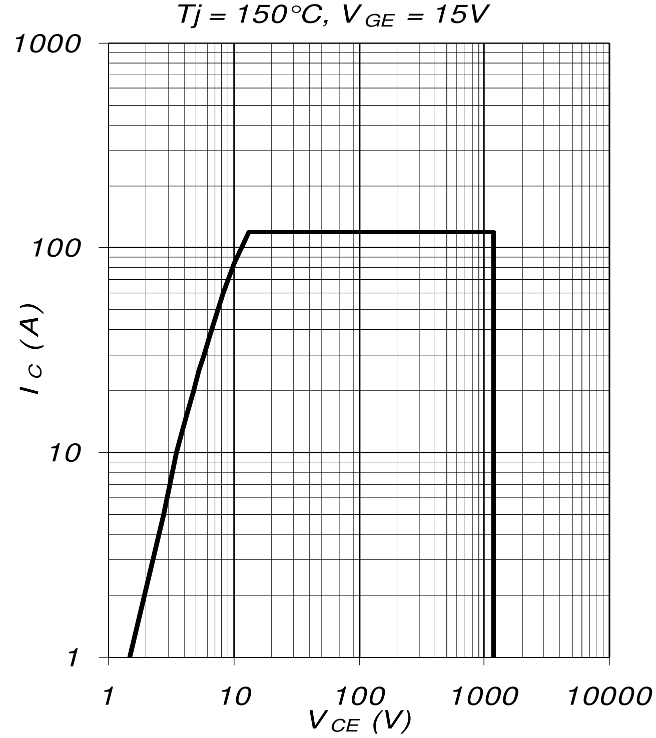


Fig.5 - Typical IGBT Output Characteristics
Tj= -40°C; tp=300µs

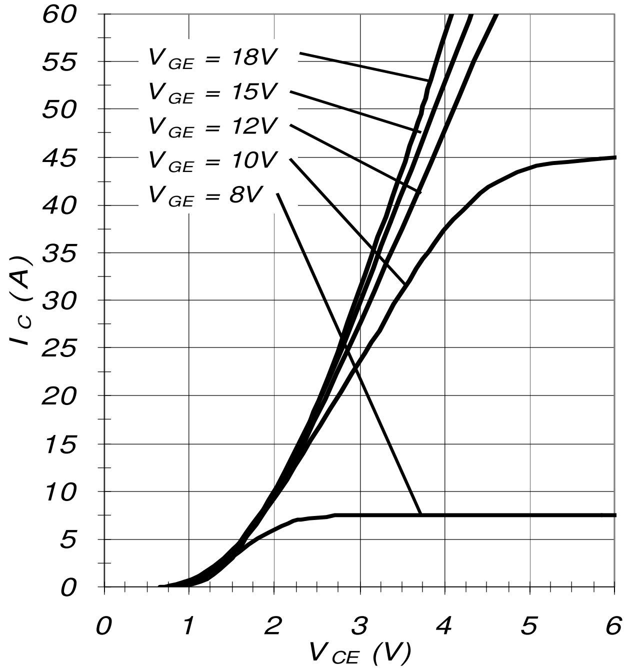


Fig.6 - Typical IGBT Output Characteristics
Tj=25°C; tp=300µs

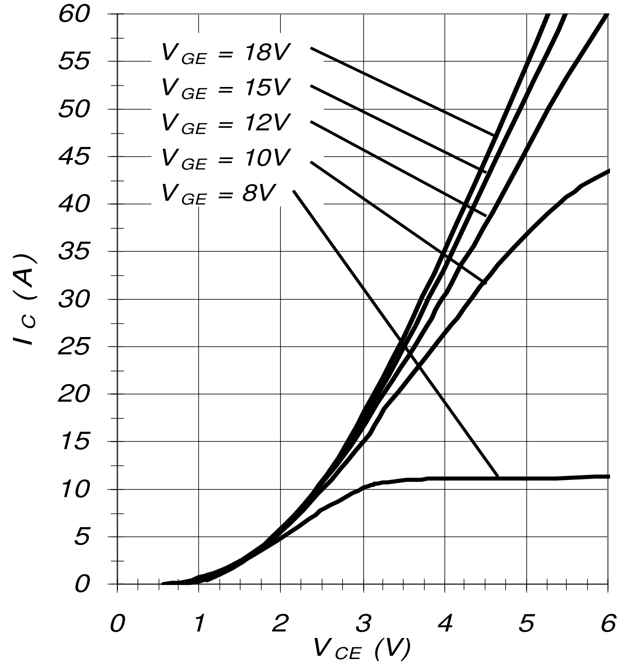


Fig.7 - Typical IGBT Output Characteristics
Tj=125°C; tp=300µs

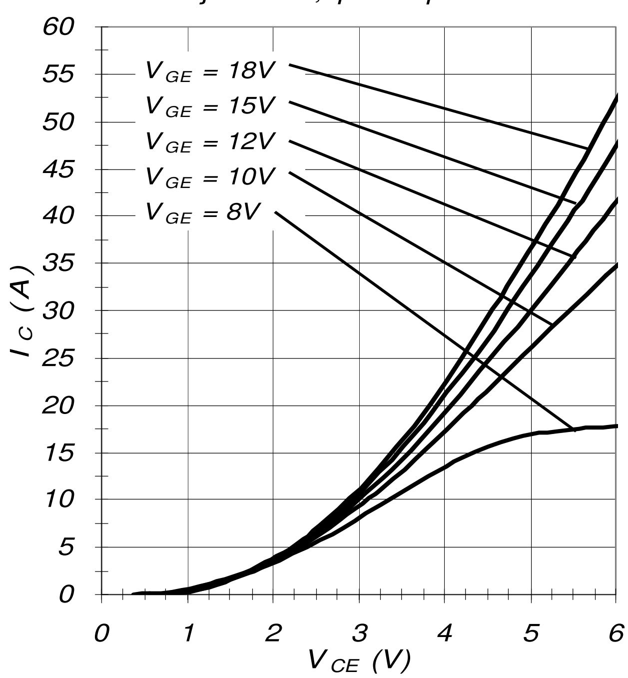


Fig. 8 - Typical V_{CE} vs V_{GE}
Tj= -40°C

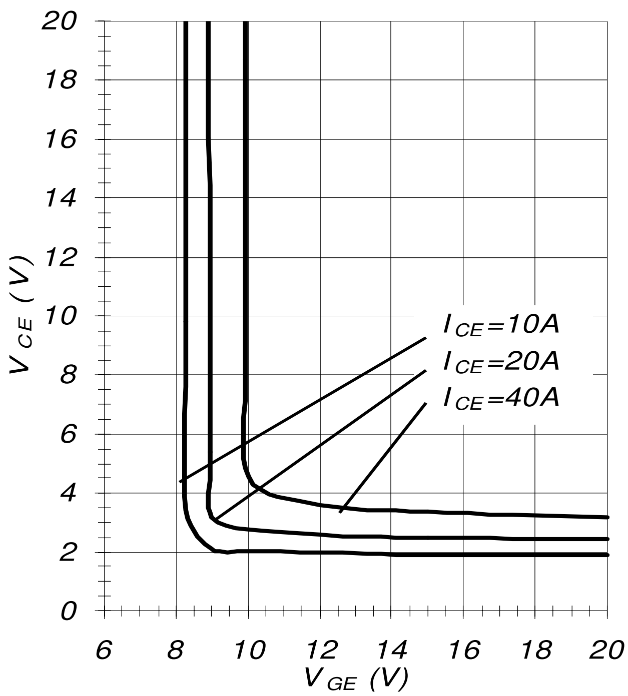


Fig. 9 - Typical V_{CE} vs V_{GE}
Tj= 25°C

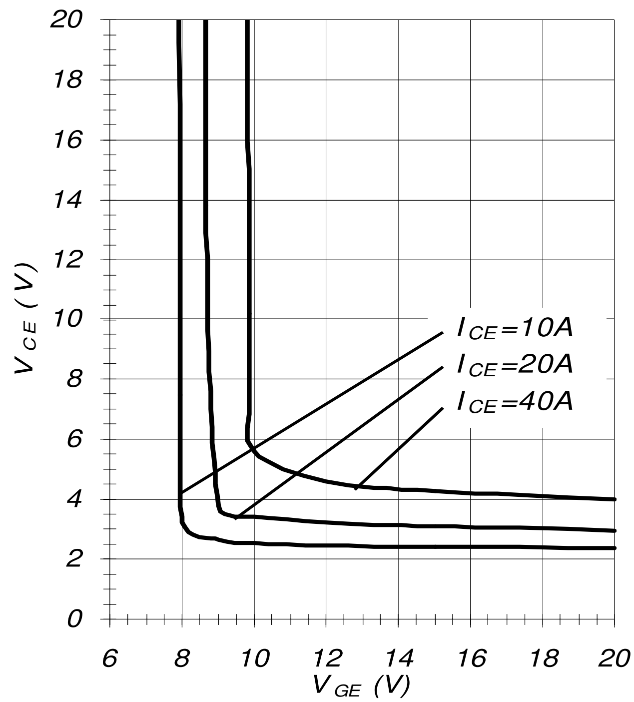


Fig.10 - Typical V_{CE} vs V_{GE}
Tj= 125°C

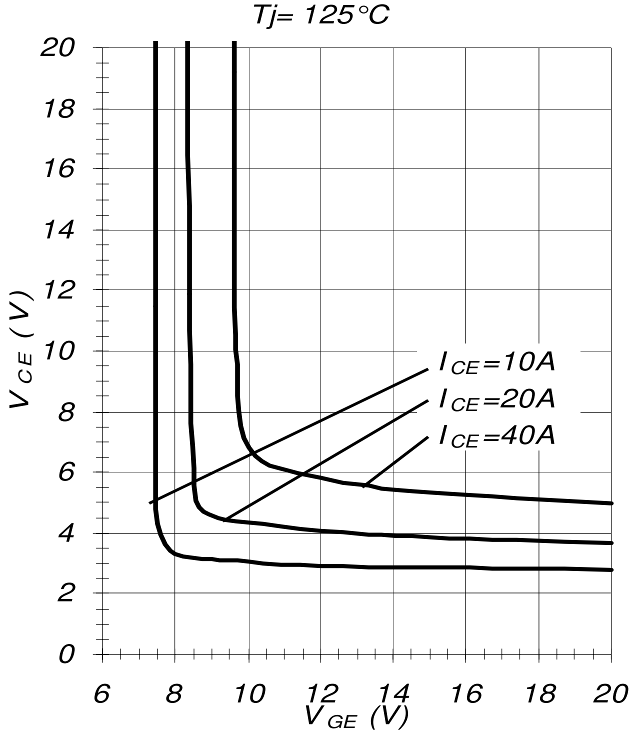


Fig.11 - Typ. Transfer Characteristics
V_{CE}=20V; tp=20µs

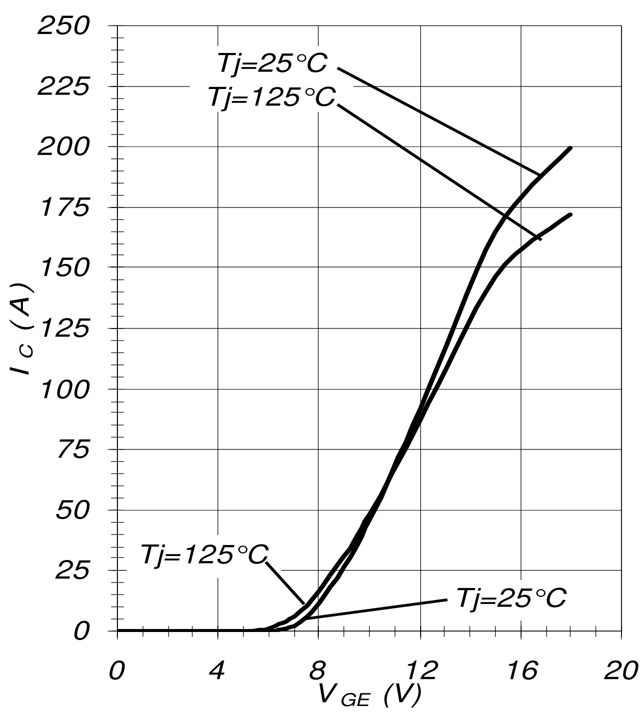


Fig.12 - Typical Energy Loss vs Ic
Tj=125°C; L=200µH; V_{CE}=600V;
Rg=22 Ω; V_{GE}=15V

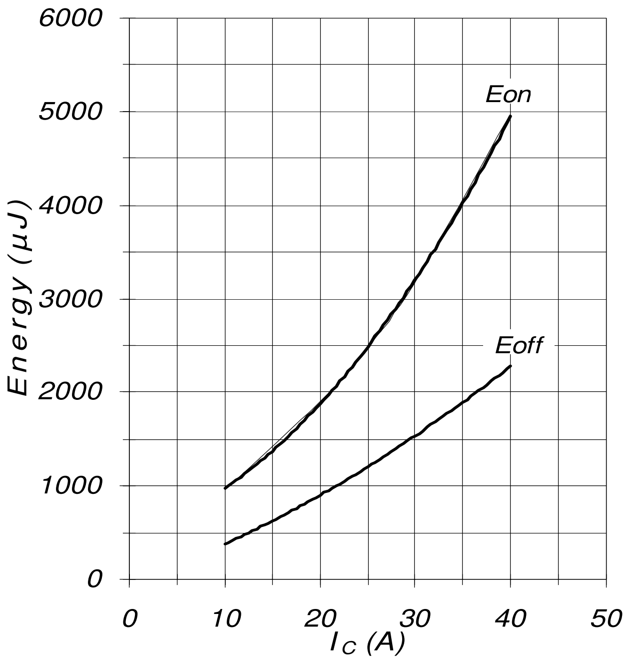


Fig.13 - Typical Switching Time vs Ic
Tj=125°C; L=200µH; V_{CE}=600V;
Rg=22 Ω; V_{GE}=15V

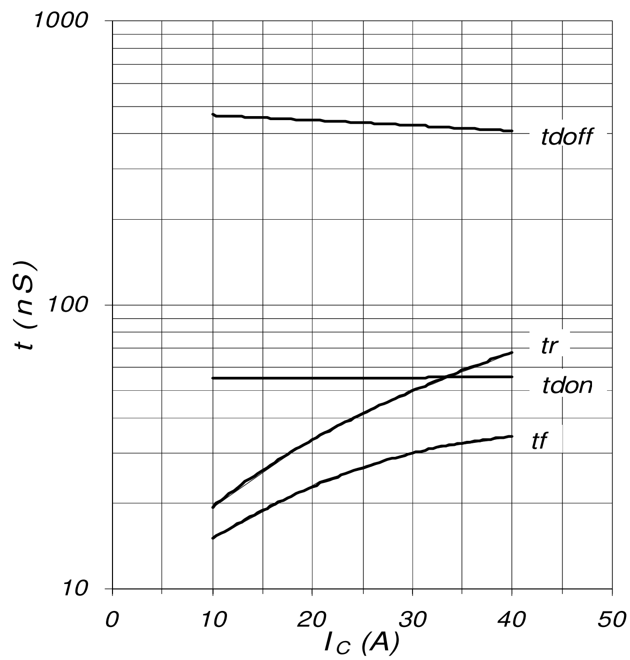


Fig.14 - Typical Energy Loss vs Rg
Tj=125°C; L=200µH; V_{CE}=600V;
I_{CE}=20A; V_{GE}=15V

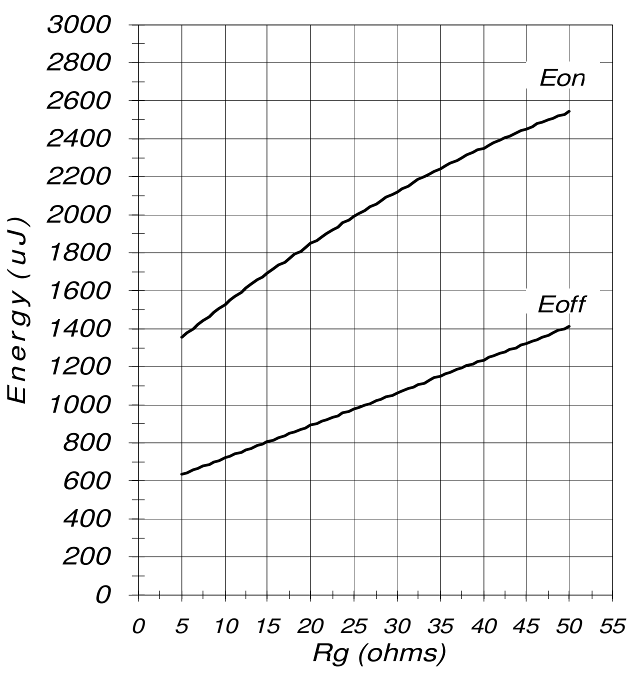


Fig.15 - Typical Switching Time vs Rg
Tj=125°C; L=200µH; V_{CE}=600V;
I_{CE}=20A; V_{GE}=15V

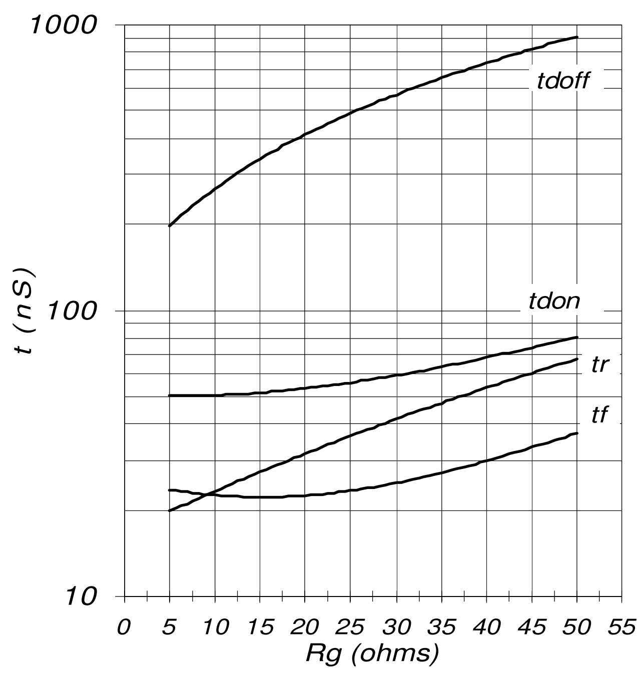


Fig.16 - Typical Capacitance vs V_{CE}
V_{GE}=0V; f=1MHz

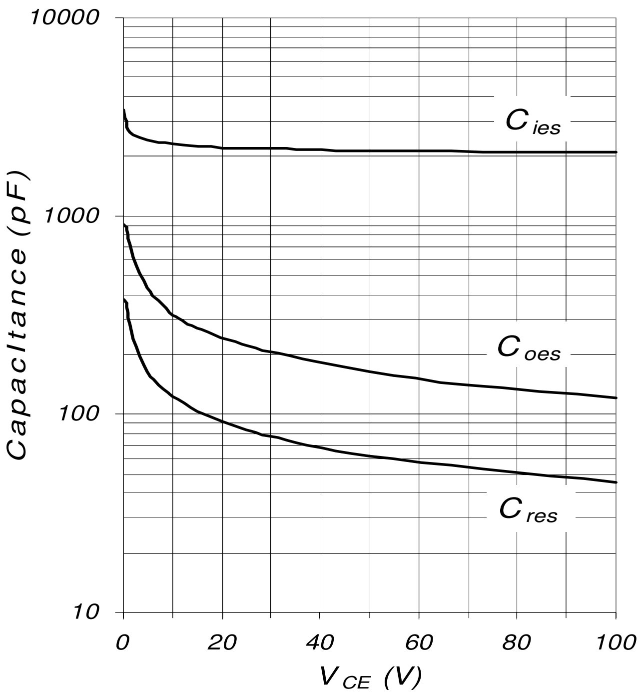


Fig.17 - Typ. Gate Charge vs. V_{GE}
I_C=20A; L=600µH

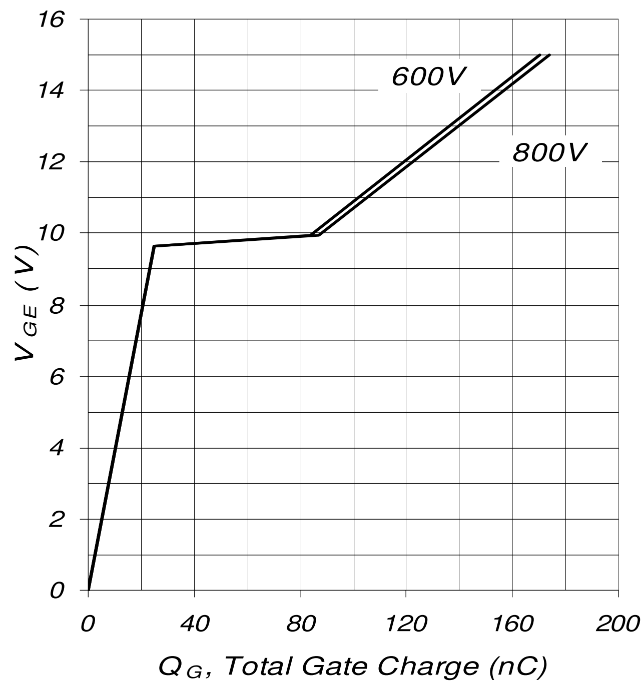


Fig. 18 - Normalized Transient Thermal Impedance, Junction-to-Case

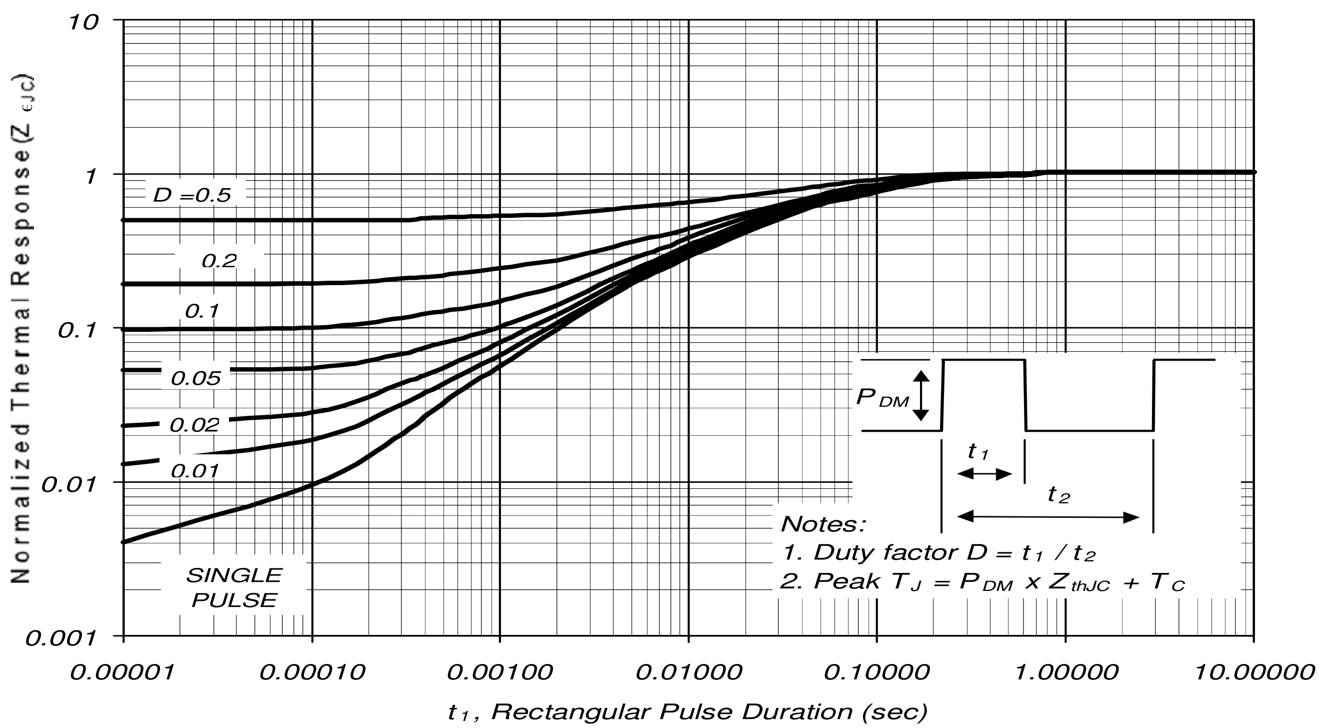


Fig. CT.1 - Gate Charge Circuit (turn-off)

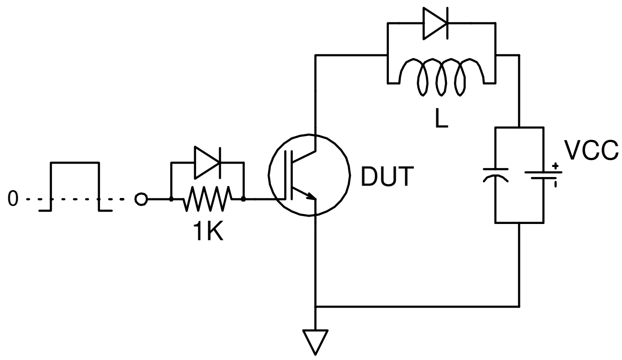


Fig. CT.2 - RBSOA Circuit

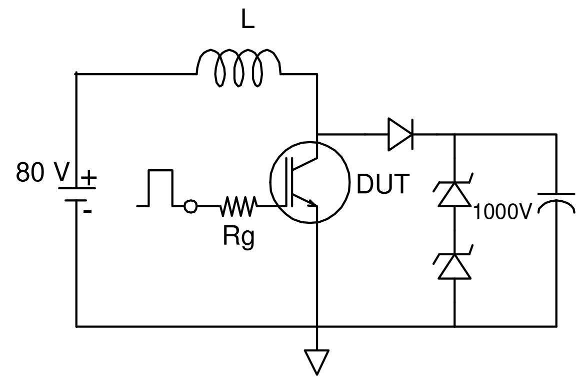


Fig. CT.3 - S.C. SOA Circuit

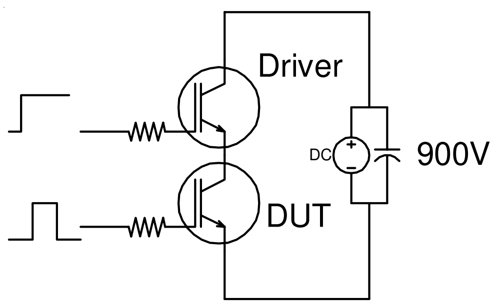


Fig. CT.4 - Switching Loss Circuit

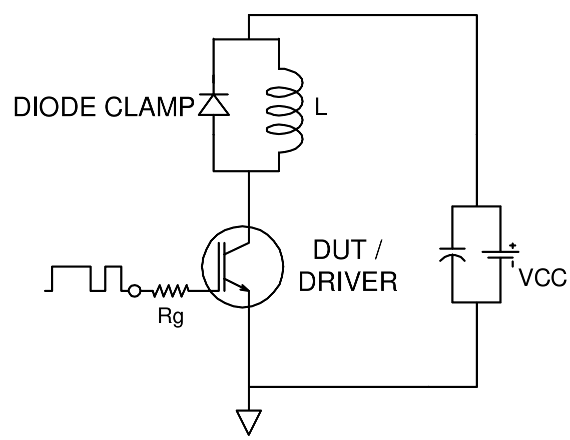


Fig. CT.5 - Resistive Load Circuit

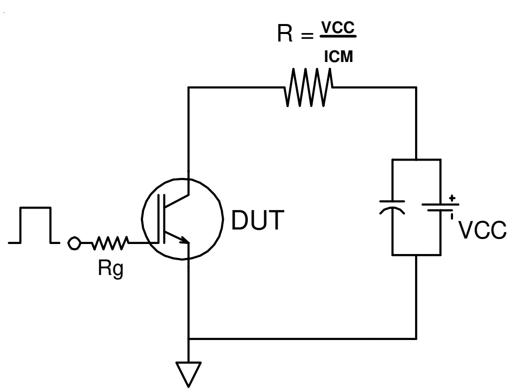


Fig. CT.6 - Unclamped Inductive Load Circuit

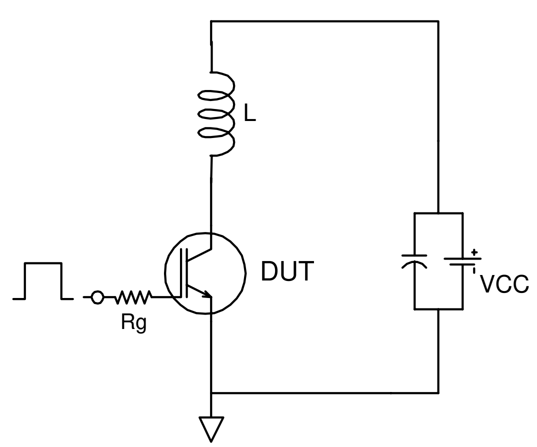


Fig. WF.1 - Typ. Turn-off Loss Waveform @ Tj=125°C using Fig. CT.4

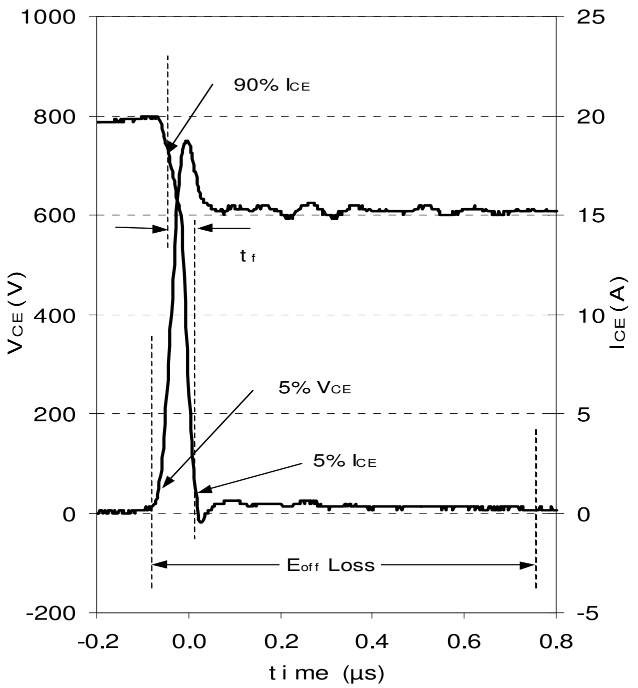


Fig. WF.2 - Typ. Turn-on Loss Waveform @ Tj=125°C using Fig. CT.4

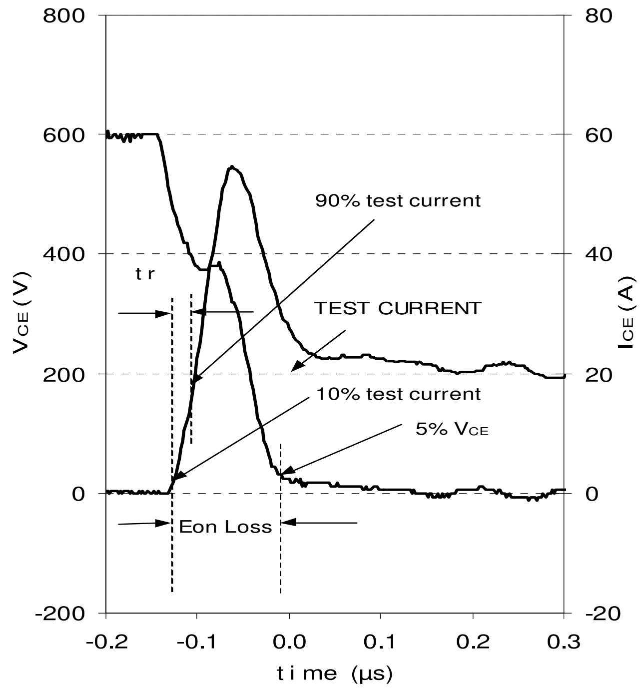
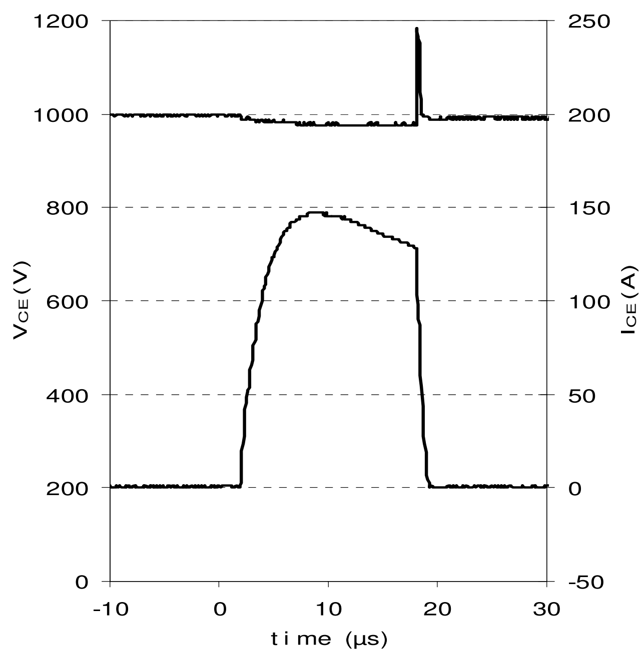
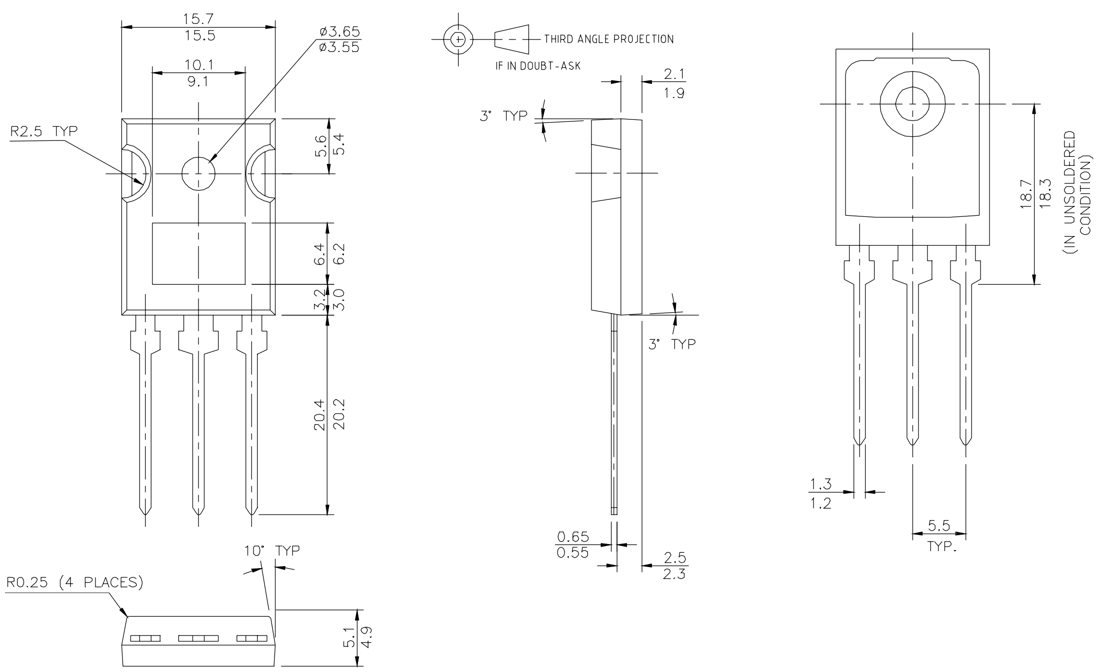


Fig. WF.3- Typ. S.C. Waveform @ T_C=150°C using Fig. CT.3



TO-247AD Package Outline

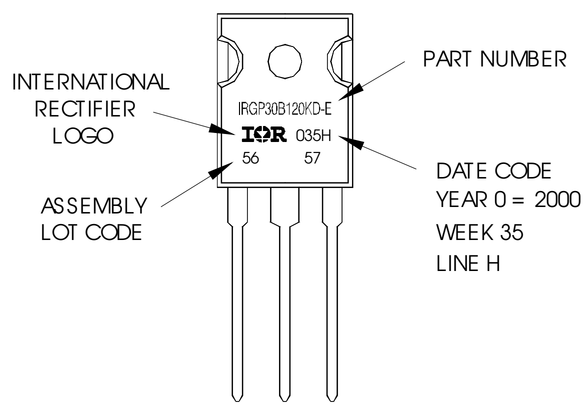
Dimensions are shown in millimeters (inches)



TO-247AD Part Marking Information

EXAMPLE: THIS IS AN IRGP30B120KD-E
WITH ASSEMBLY
LOT CODE 5657
ASSEMBLED ON WW 35, 2000
IN THE ASSEMBLY LINE "H"

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



Data and specifications subject to change without notice.
This product has been designed and qualified 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.09/04

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