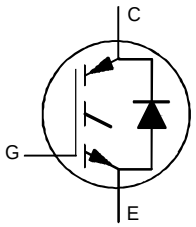
PD- 95238

International
IOR Rectifier

IRGP30B120KD-EP

INSULATED GATE BIPOLAR TRANSISTOR WITH ULTRAFAST SOFT RECOVERY DIODE

Motor Control Co-Pack IGBT



N-channel

V_{CES} = 1200V

$V_{CE(on)\ typ.}$ = 2.28V

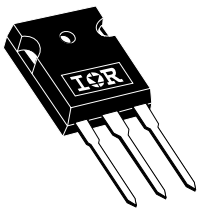
V_{GE} = 15V, I_C = 25A, 25°C

Features

- Low V_{CE}(on) Non Punch Through (NPT) Technology
- Low Diode V_F (1.76V Typical @ 25A & 25°C)
- 10 µs Short Circuit Capability
- Square RBSOA
- Ultrasoft Diode Recovery Characteristics
- Positive V_{CE}(on) Temperature Coefficient
- Extended Lead TO-247AD Package
- Lead-Free

Benefits

- Benchmark Efficiency for Motor Control Applications
- Rugged Transient 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)	60	A
I_C @ T_C = 100°C	Continuous Collector Current (Fig.1)	30	
I_{CM}	Pulsed Collector Current (Fig.3, Fig. CT.5)	120	
I_{LM}	Clamped Inductive Load Current(Fig.4, Fig. CT.2)	120	
I_F @ T_C = 100°C	Diode Continuous Forward Current	30	
I_{FM}	Diode Maximum Forward Current	120	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
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	Operating Junction and	-55 to + 150	°C
T_{STG}	Storage Temperature Range		
	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
$R_{\theta JC}$	Junction-to-Case - Diode	——	——	0.83	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	——	0.24	——	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	——	——	40	
W_t	Weight	——	6 (0.21)	——	g (oz)
$Z_{\theta JC}$	Transient Thermal Impedance Junction-to-Case (Fig.24)				

7/27/04

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	
$\Delta V_{(BR)CES}$ / ΔTj	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		2.28	2.48	V	I_C = 25A, V_{GE} = 15V	5, 6
			2.46	2.66		I_C = 30A, V_{GE} = 15V	7, 9
			3.43	4.00		I_C = 60A, V_{GE} = 15V	10
			2.74	3.10		I_C = 25A, V_{GE} = 15V, T_J = 125°C	11
			2.98	3.35		I_C = 30A, 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	9,10,11,12
$\Delta V_{GE(th)}$ / ΔTj	Temperature Coeff. of Threshold Voltage		- 1.2		mV/°C	V_{CE} = V_{GE}, I_C = 1 mA (25 -125 °C)	
g_{fe}	Forward Transconductance	14.8	16.9	19.0	S	V_{CE} = 50V, I_C = 25A, PW=80µs	
I_{CES}	Zero Gate Voltage Collector Current			250	µA	V_{GE} = 0V,V_{CE} = 1200V	
			325	675		V_{GE} = 0v, V_{CE} = 1200V, T_J =125°C	
				2000		V_{GE} = 0v, V_{CE} = 1200V, T_J =150°C	
V_{FM}	Diode Forward Voltage Drop		1.76	2.06	V	I_C = 25A	8
			1.86	2.17		I_C = 30A	
			1.87	2.18		I_C = 25A, T_J = 125°C	
			2.01	2.40		I_C = 30A, T_J = 125°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 = 25A	23
Q_{ge}	Gate - Emitter Charge (turn-on)		19	29		V_{CC} =600V	CT1
Q_{gc}	Gate - Collector Charge (turn-on)		82	123		V_{GE} = 15V	
E_{on}	Turn-On Switching Loss		1066	1250	µJ	I_C = 25A, V_{CC} = 600V	CT4
E_{off}	Turn-Off Switching Loss		1493	1800		V_{GE} = 15V, Rg = 5Ω, L=200µH	WF1
E_{tot}	Total Switching Loss		2559	3050		T_J = 25°C, Energy losses include tail and diode reverse recovery	WF2
E_{on}	Turn-on Switching Loss		1660	1856	µJ	Ic =25A, V_{CC}=600V	13, 15
E_{off}	Turn-off Switching Loss		2118	2580		V_{GE} = 15V, Rg = 5Ω, L=200µH	CT4
E_{tot}	Total Switching Loss		3778	4436		T_J = 125°C, Energy losses include tail and diode reverse recovery	WF1 & 2
td(on)	Turn - on delay time		50	65	ns	Ic =25A, V_{CC}=600V	14, 16
tr	Rise time		25	35		V_{GE} = 15V, Rg = 5Ω, L=200µH	CT4
td(off)	Turn - off delay time		210	230		T_J = 125°C,	WF1
tf	Fall time		60	75			WF2
C_{ies}	Input Capacitance		2200		pF	V_{GE} = 0V	
C_{oes}	Output Capacitance		210			V_{CC} = 30V	22
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 0 V	4 CT2
SCSOA	Short Circuit Safe Operating Area	10	----	----	µs	T_J = 150°C V_{CC} = 900V,V_P = 1200V Rg = 5Ω, V_{GE} = +15V to 0 V	CT3 WF4
E_{rec}	Reverse recovery energy of the diode		1820	2400	µJ	T_J = 125°C	17,18,19
trr	Diode Reverse recovery time		300		ns	V_{CC} = 600V, Ic = 25A	20, 21
Irr	Peak Reverse Recovery Current		34	38	A	V_{GE} = 15V, Rg = 5Ω, L=200µH	CT4, WF3
Le	Internal Emitter Inductance		13		nH	Measured 5 mm from the package.	

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

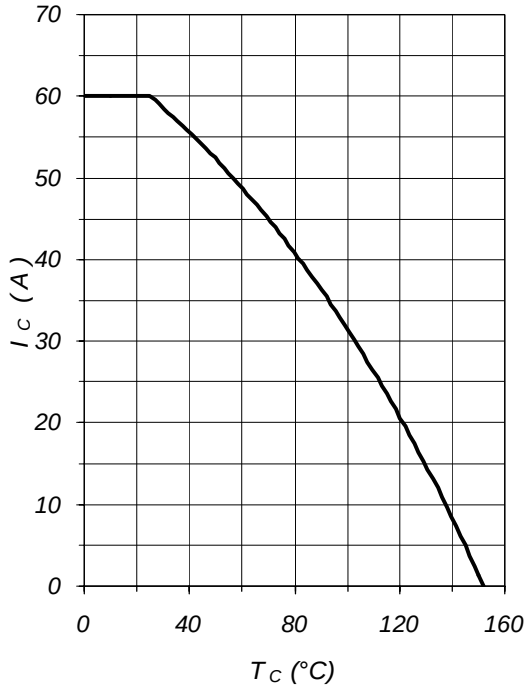


Fig.2 - Power Dissipation vs. Case Temperature

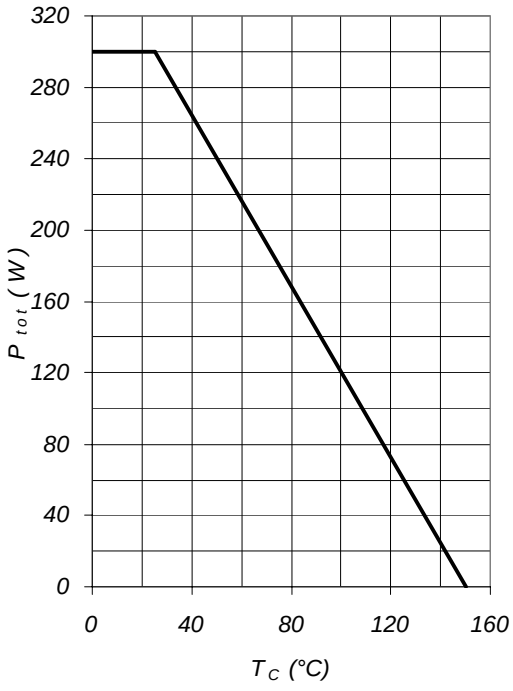


Fig.3 - Forward SOA
T_C=25°C; Tj≤150°C

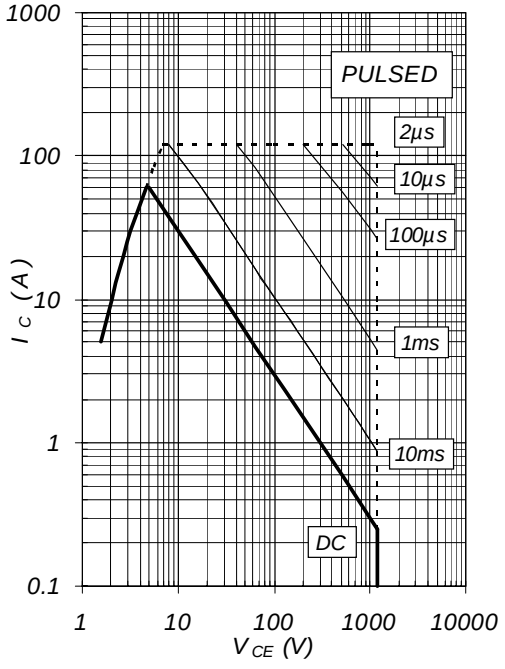


Fig.4 - Reverse Bias SOA
Tj = 150°C, V_{GE} = 15V

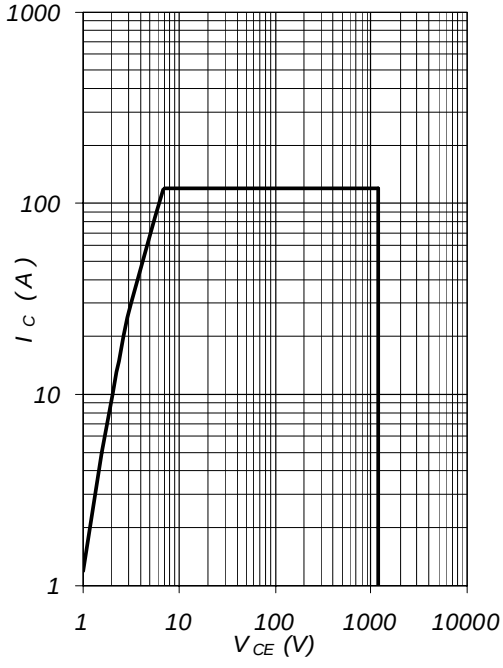


Fig.5 - Typical IGBT Output Characteristics
Tj= -40°C; tp=300µs

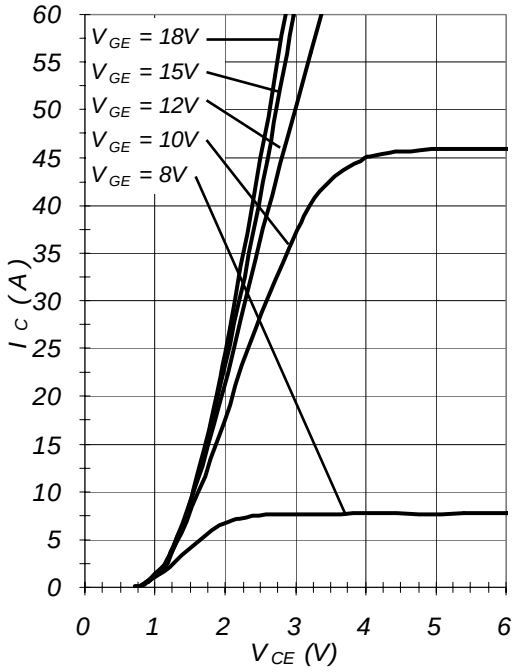


Fig.6 - Typical IGBT Output Characteristics
Tj=25°C; tp=300µs

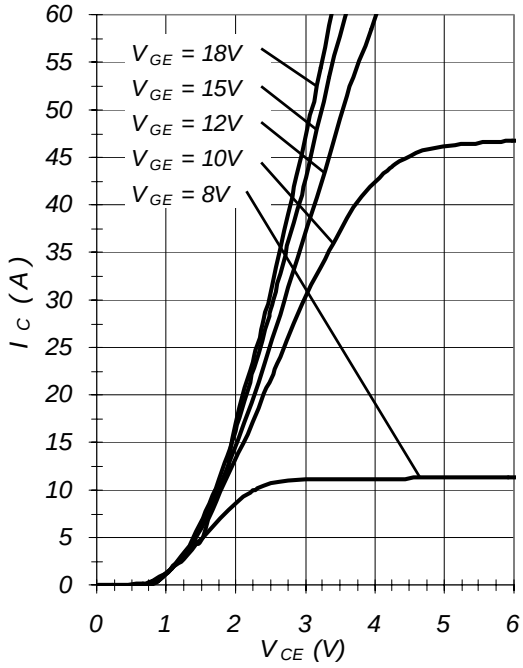


Fig.7 - Typical IGBT Output Characteristics
Tj=125°C; tp=300µs

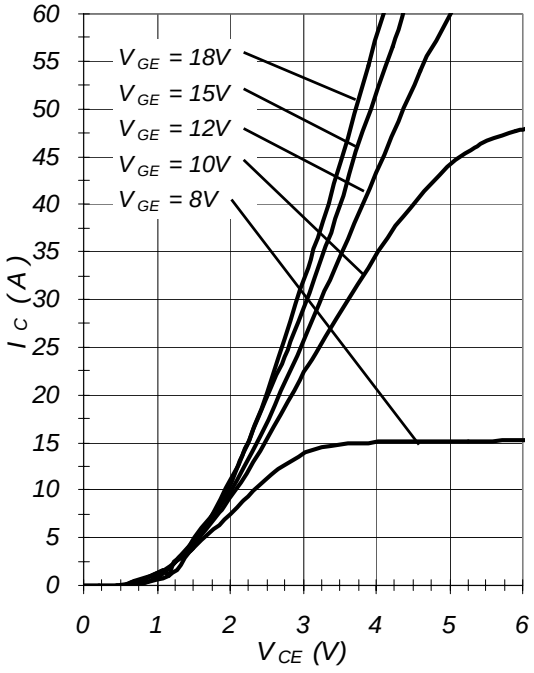


Fig.8 - Typical Diode Forward Characteristic
tp=300µs

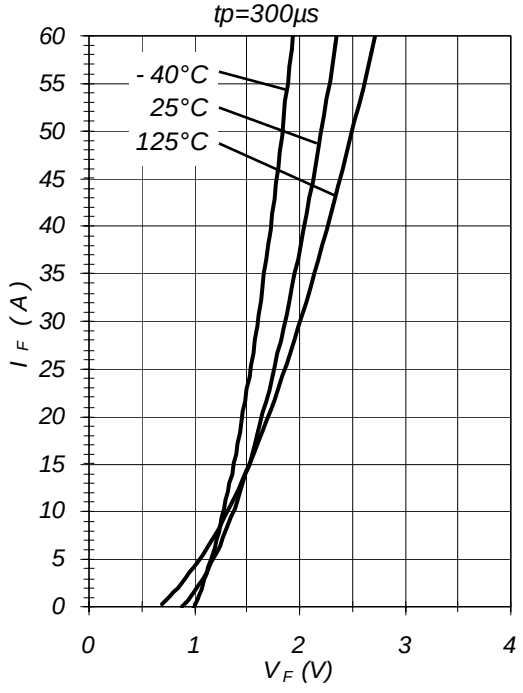


Fig.9 - Typical V_{CE} vs V_{GE}
Tj= -40°C

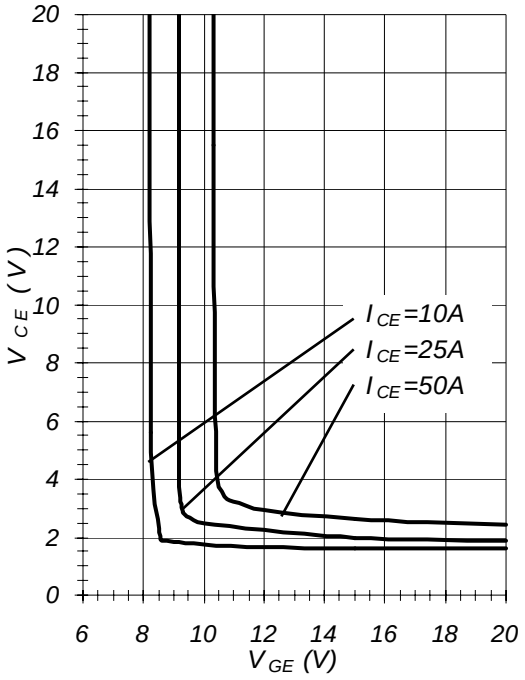


Fig.10 - Typical V_{CE} vs V_{GE}
Tj= 25°C

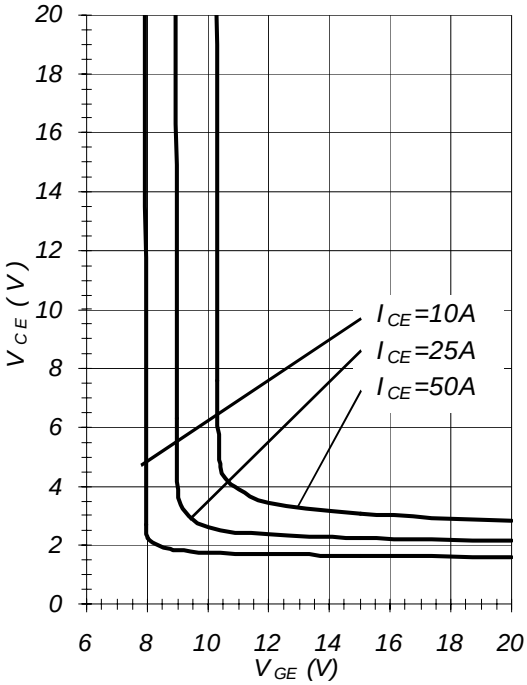


Fig.11 - Typical V_{CE} vs V_{GE}
Tj= 125°C

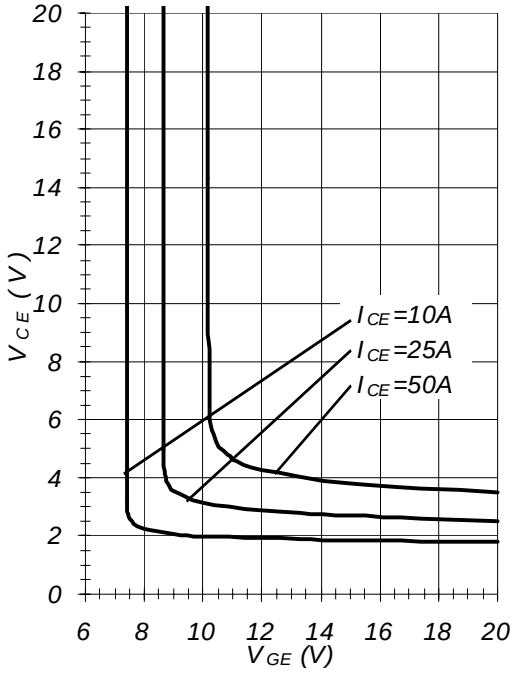


Fig.12 - Typ. Transfer Characteristics
V_{CE}=20V; tp=20µs

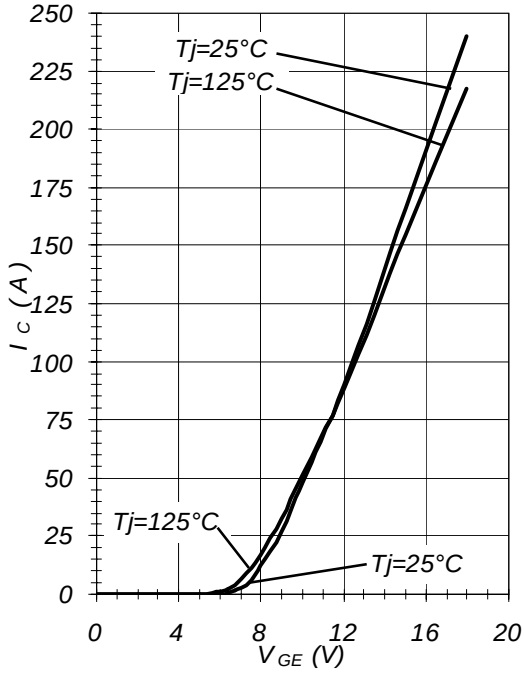


Fig.13 - Typical Energy Loss vs Ic
Tj=125°C; L=200µH; V_{CE}=600V;
Rg=22 Ω; V_{GE}=15V

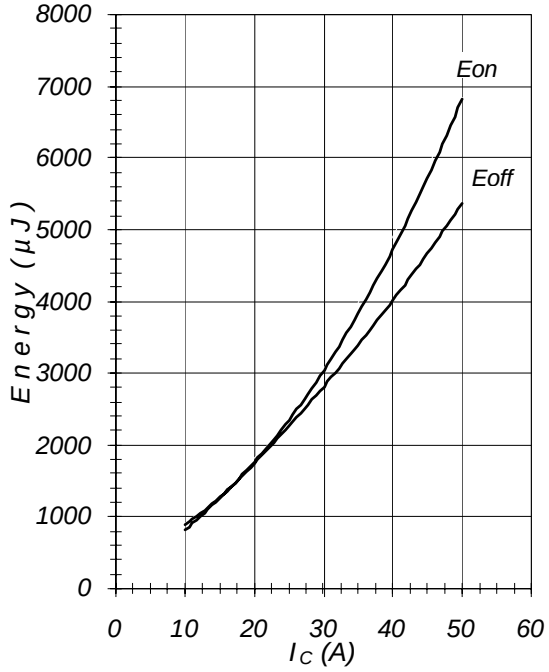


Fig.14 - Typical Switching Time vs Ic
Tj=125°C; L=200µH; V_{CE}=600V;
Rg=22 Ω;V_{GE}=15V

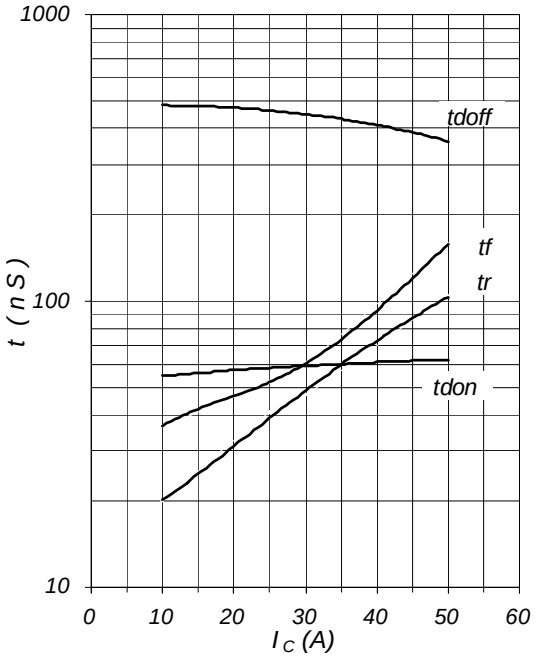


Fig.15 - Typical Energy Loss vs Rg
Tj=125°C; L=200µH; V_{CE}=600V;
I_{CE}=25A; V_{GE}=15V

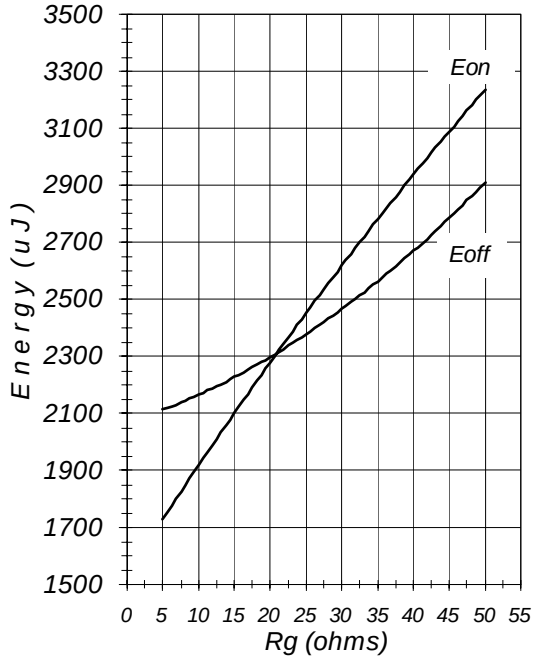


Fig.16 - Typical Switching Time vs Rg
Tj=125°C; L=200µH; V_{CE}=600V;
I_{CE}=25A; V_{GE}=15V

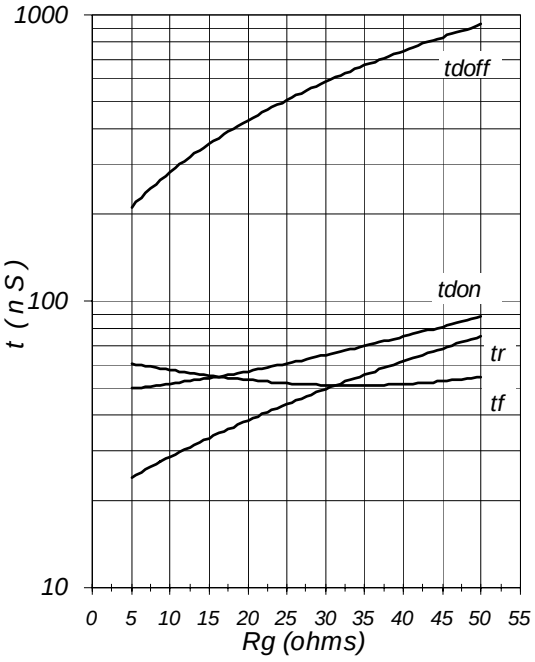


Fig.17 - Typical Diode I_{RR} vs I_F
Tj=125°C

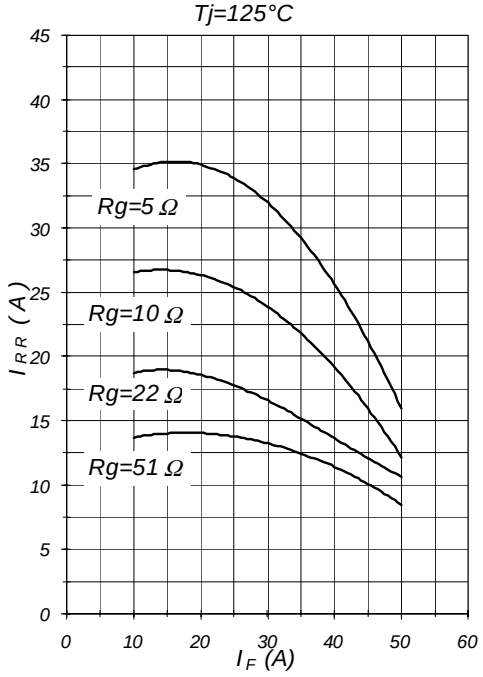


Fig.18 - Typical Diode I_{RR} vs Rg
Tj=125°C; I_F=25A

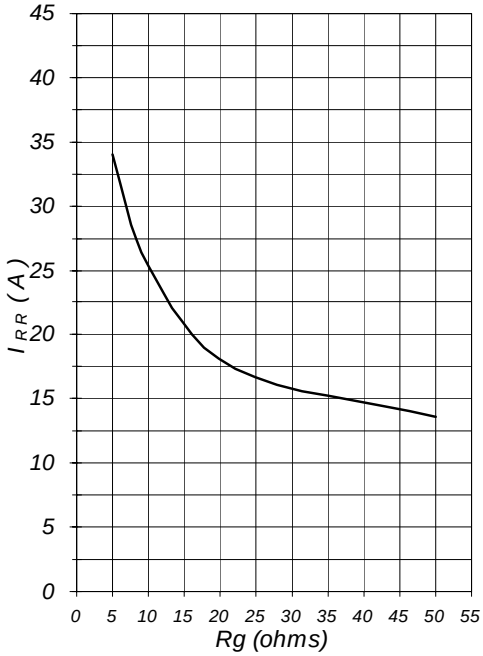


Fig.19 - Typical Diode I_{RR} vs dI_F/dt
V_{CC}=600V; V_{GE}=15V
I_F=25A; Tj=125°C

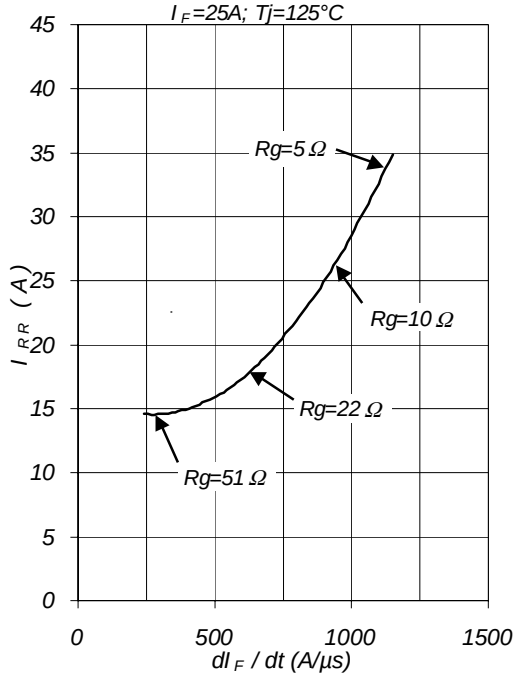


Fig.20 - Typical Diode Q_{RR}
V_{CC}=600V; V_{GE}=15V; Tj=125°C

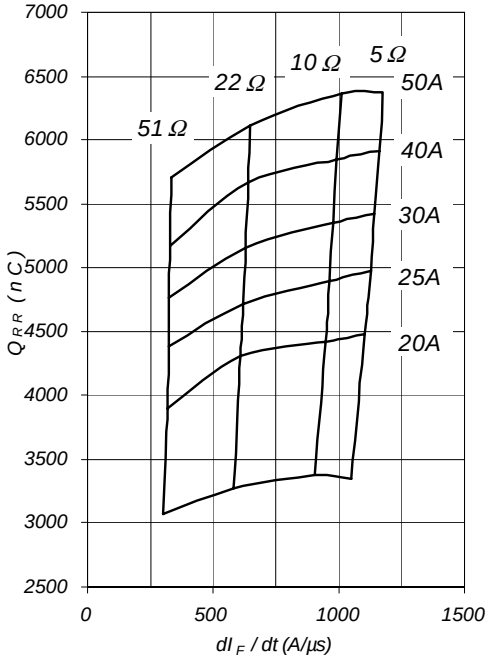


Fig.21 - Typ. Diode E_{rec} vs. I_F
Tj=125°C

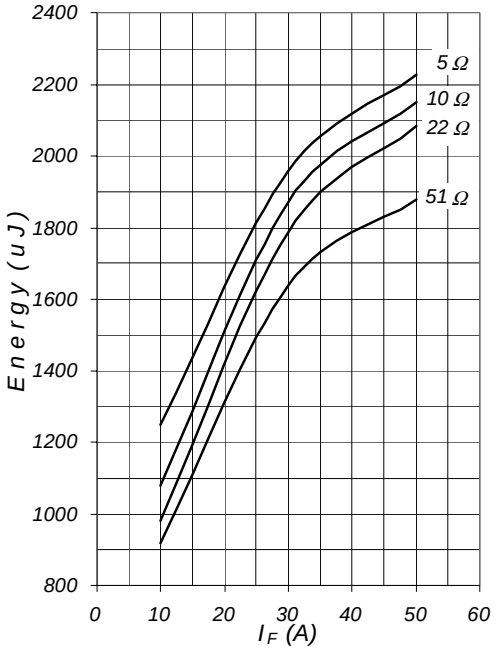


Fig.22 - Typical Capacitance vs V_{CE}
V_{GE}=0V; f=1MHz

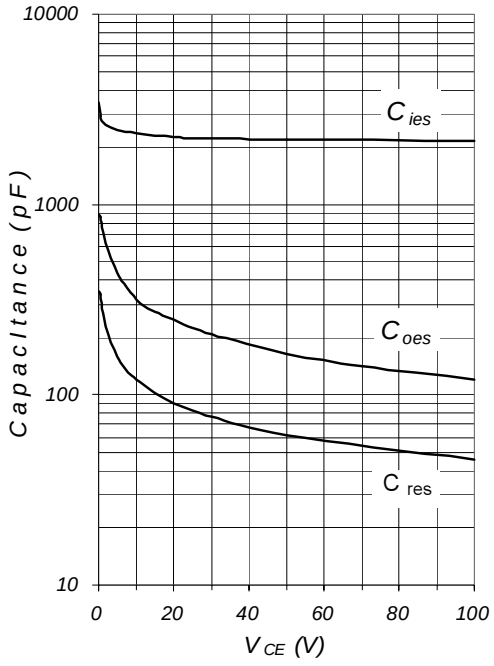


Fig.23 - Typ. Gate Charge vs. V_{GE}
I_C=25A; L=600µH

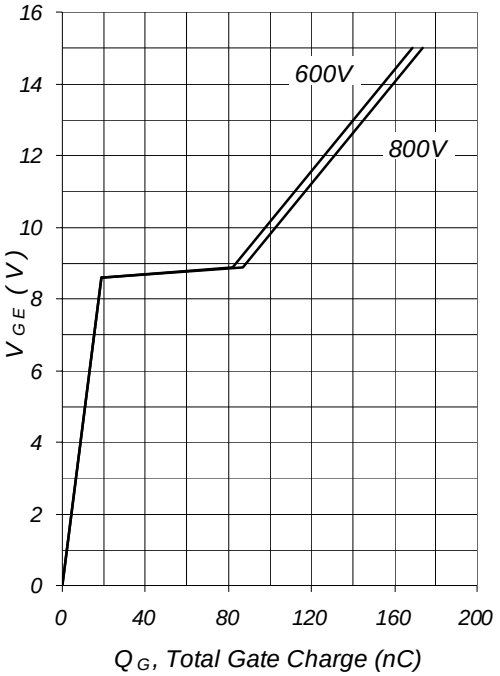


Fig.24 - Normalized Transient Thermal Impedance, Junction-to-Case

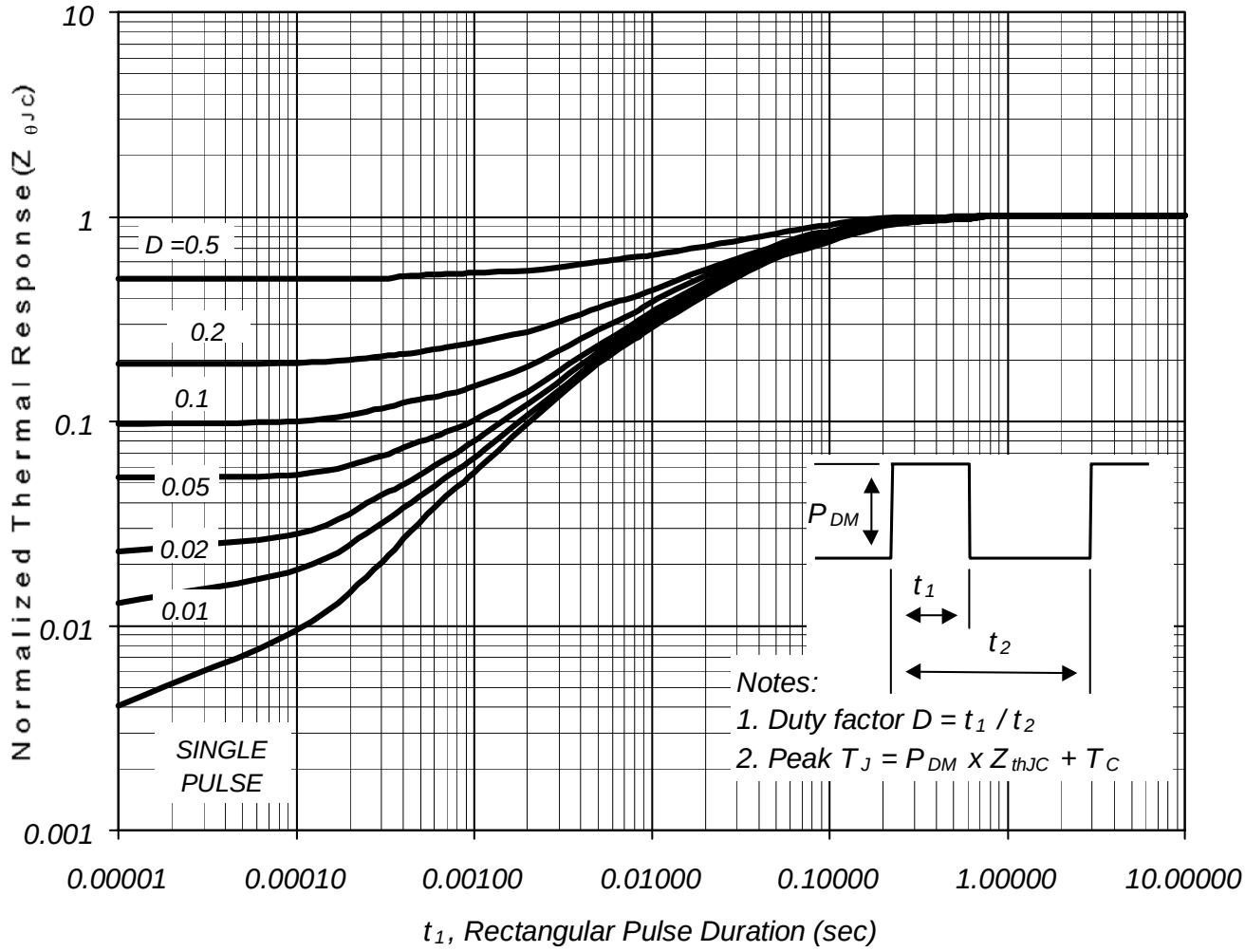


Fig. CT.1 - Gate Charge Circuit (turn-off)

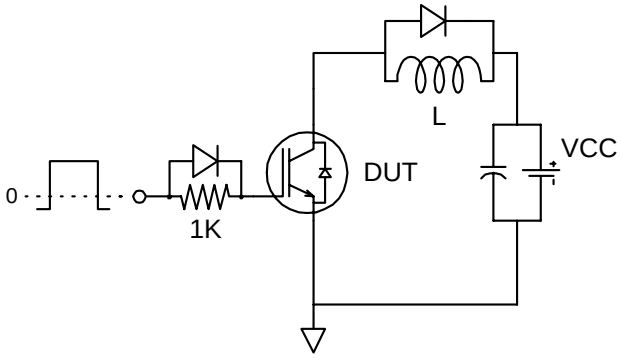


Fig. CT.2 - RBSOA Circuit

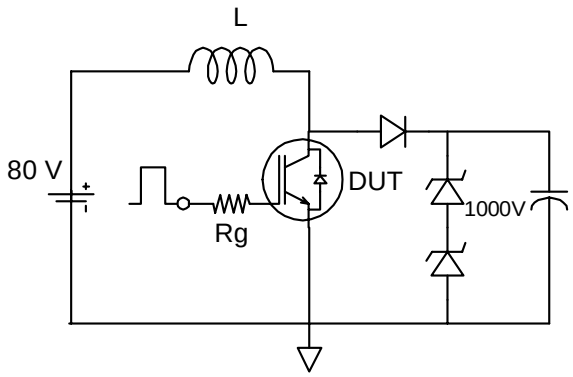


Fig. CT.3 - S.C. SOA Circuit

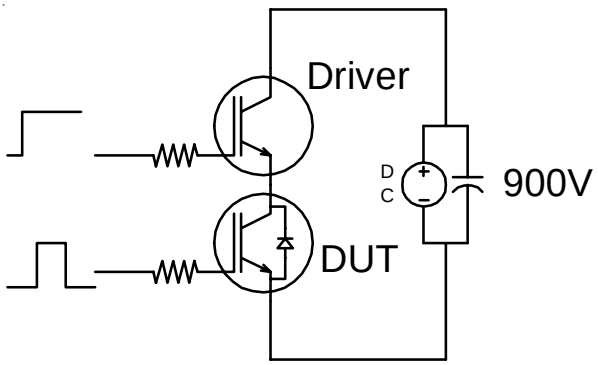


Fig. CT.4 - Switching Loss Circuit

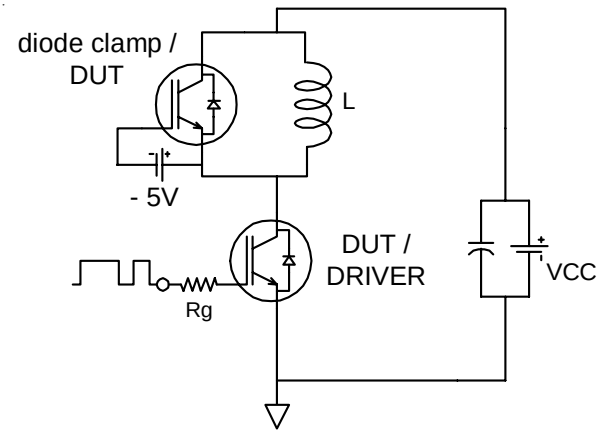


Fig. CT.5 - Resistive Load Circuit

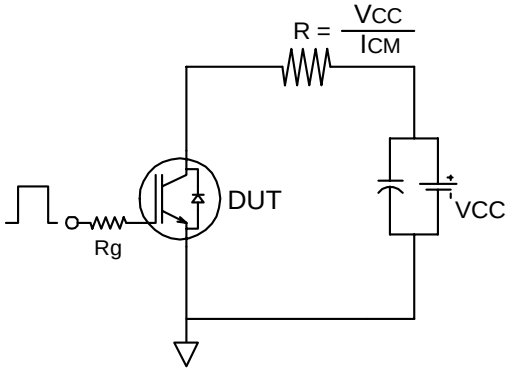


Fig. WF.1 - Typ. Turn-off Loss Waveform @ Tj=125°C using Fig. CT.4

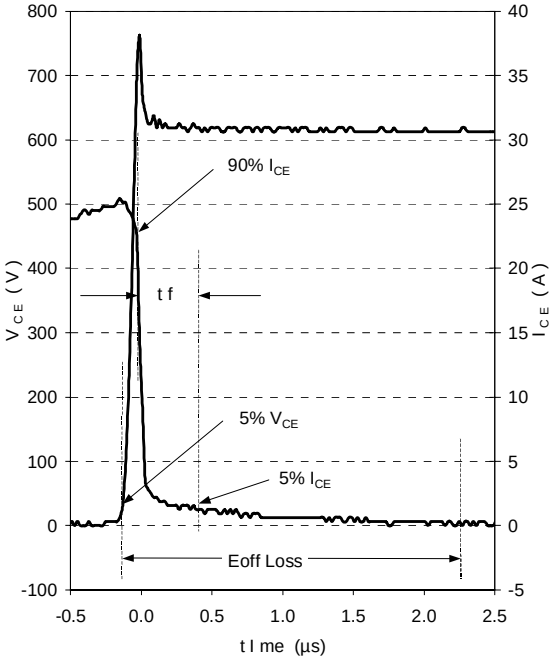


Fig. WF.2 - Typ. Turn-on Loss Waveform @ Tj=125°C using Fig. CT.4

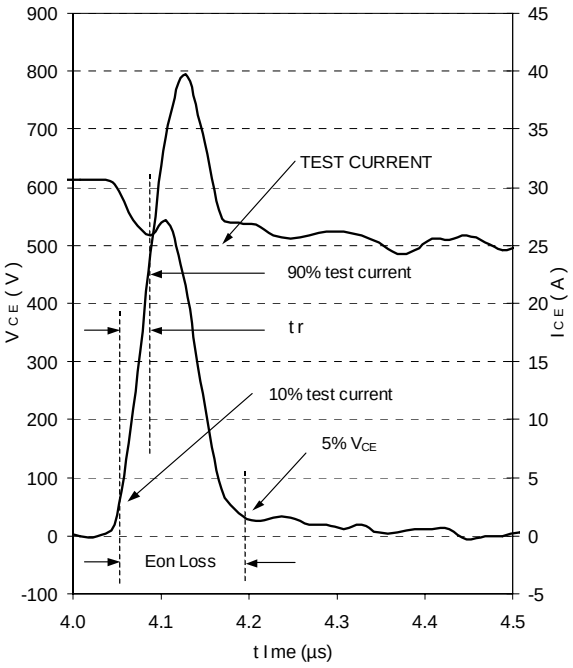


Fig. WF.3 - Typ. Diode Recovery Waveform @ Tj=125°C using Fig. CT.4

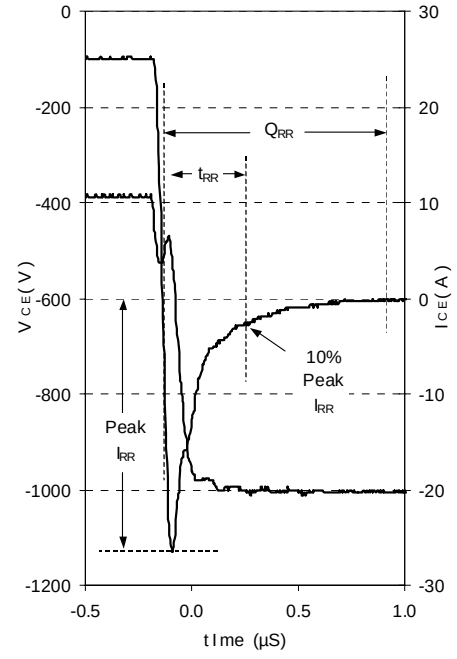
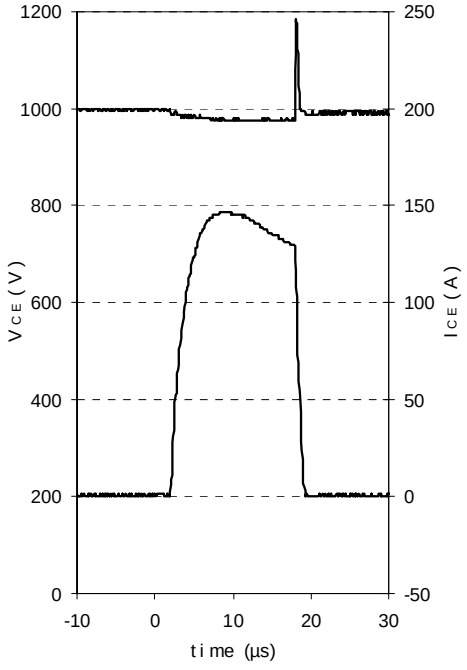
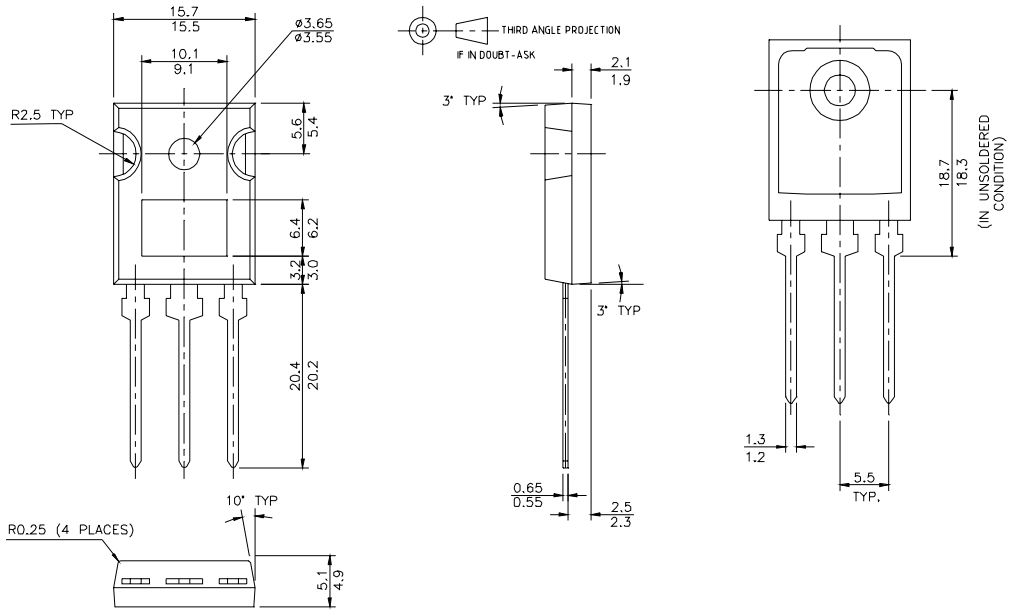


Fig. WF.4 - Typ. S.C. Waveform @ T_C=150°C using Fig. CT.3



TO-247AD Package Outline

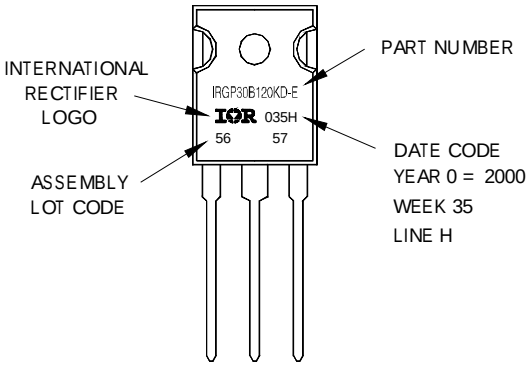
Dimensions are shown in millimeters (inches)



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.

International
IOR Rectifier

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