

IRGPS60B120KD

International
IR Rectifier

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	1200	—	—	V	$V_{GE} = 0V, I_C = 500\mu A$	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.40	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0mA, (25^\circ\text{C}-125^\circ\text{C})$	
$V_{CE(on)}$	Collector-to-Emitter Saturation Voltage	—	2.33	2.50	V	$I_C = 50A, V_{GE} = 15V$	5, 6
		—	2.50	2.75		$I_C = 60A$	7, 9
		—	2.79	3.1		$I_C = 50A, T_J = 125^\circ\text{C}$	10
		—	3.04	3.5		$I_C = 60A, T_J = 125^\circ\text{C}$	11
$V_{GE(th)}$	Gate Threshold Voltage	4.0	5.0	6.0		$V_{CE} = V_{GE}, I_C = 250\mu A$	9,10
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-12	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 1.0mA, (25^\circ\text{C}-125^\circ\text{C})$	11, 12
g_{fe}	Forward Transconductance	—	34.4	—	S	$V_{CE} = 50V, I_C = 60A, PW=80\mu s$	
I_{CES}	Zero Gate Voltage Collector Current	—	—	500	μA	$V_{GE} = 0V, V_{CE} = 1200V$	
		—	650	1350		$V_{GE} = 0V, V_{CE} = 1200V, T_J = 125^\circ\text{C}$	
V_{FM}	Diode Forward Voltage Drop	—	1.82	2.10	V	$I_C = 50A$	8
		—	1.93	2.20		$I_C = 60A$	
		—	1.96	2.20		$I_C = 50A, T_J = 125^\circ\text{C}$	
		—	2.13	2.40		$I_C = 60A, T_J = 125^\circ\text{C}$	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 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)	—	340	510	nC	I _C = 60A	23
Q _{ge}	Gate - Emitter Charge (turn-on)	—	40	60		V _{CC} = 600V	CT1
Q _{gc}	Gate - Collector Charge (turn-on)	—	165	248		V _{GE} = 15V	
E _{on}	Turn-On Switching Loss	—	3214	4870	μJ	I _C = 60A, V _{CC} = 600V	CT4
E _{off}	Turn-Off Switching Loss	—	4783	5450		V _{GE} = 15V, R _G = 4.7Ω, L =200μH	WF1
E _{tot}	Total Switching Loss	—	8000	10320		L _s = 150nH T _J = 25°C	WF2
E _{on}	Turn-On Switching Loss	—	5032	6890	μJ	T _J = 125°C	13,15
E _{off}	Turn-Off Switching Loss	—	7457	8385		Energy losses include "tail" and diode reverse recovery.	
E _{tot}	Total Switching Loss	—	12500	15275			
t _{d(on)}	Turn-On Delay Time	—	72	94	ns	I _C = 15A, V _{CC} = 600V	14, 16
t _r	Rise Time	—	32	45		V _{GE} = 15V, R _G = 4.7Ω L =200μH	CT4
t _{d(off)}	Turn-Off Delay Time	—	366	400		L _s = 150nH, T _J = 125°C	WF1
t _f	Fall Time	—	45	58			WF2
C _{ies}	Input Capacitance	—	4300	—	pF	V _{GE} = 0V	22
C _{oes}	Output Capacitance	—	395	—		V _{CC} = 30V	
C _{res}	Reverse Transfer Capacitance	—	160	—		f = 1.0MHz	
RBSOA	Reverse Bias Safe Operting Area	FULL SQUARE				T _J = 150°C, I _C = 240A, V _p =1200V V _{Clamp} = 1000V, V _{GE} = +15V to 0V R _G = 4.7Ω	4 CT2
SCSOA	Short Circuit Safe Operting Area	10	—	—	μs	T _J = 150°C, V _p =1200V V _{CC} = 900V, V _{GE} = +15V to 0V, R _G = 4.7Ω	CT3 WF4
E _{rec}	Reverse Recovery energy of the diode	—	3346	—	μJ	T _J = 125°C	17,18,19
t _{rr}	Diode Reverse Recovery time	—	180	—	ns	V _{CC} = 600V, I _F = 60A, L =200μH	20, 21
I _{rr}	Diode Peak Reverse Recovery Current	—	50	—	A	V _{GE} = 15V, R _G = 4.7Ω, L _s = 150nH	CT4,WF3

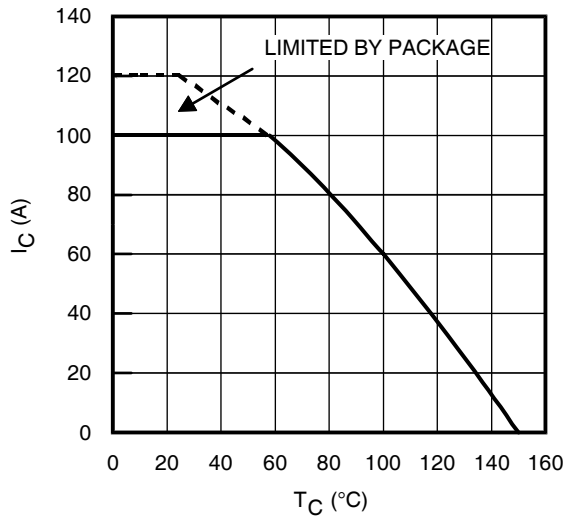


Fig. 1 - Maximum DC Collector Current vs. Case Temperature®

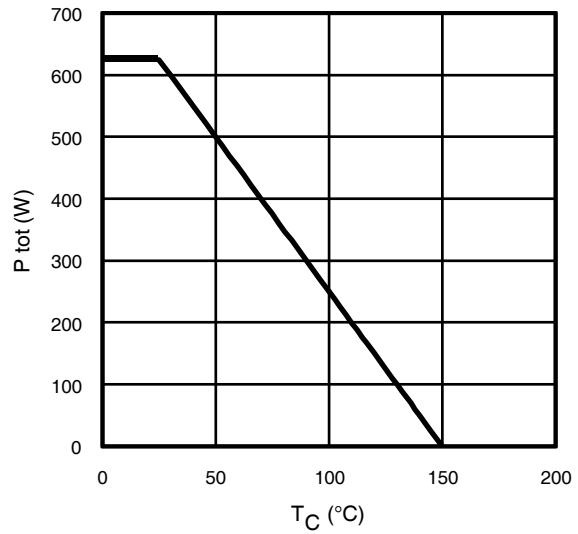


Fig. 2 - Power Dissipation vs. Case Temperature

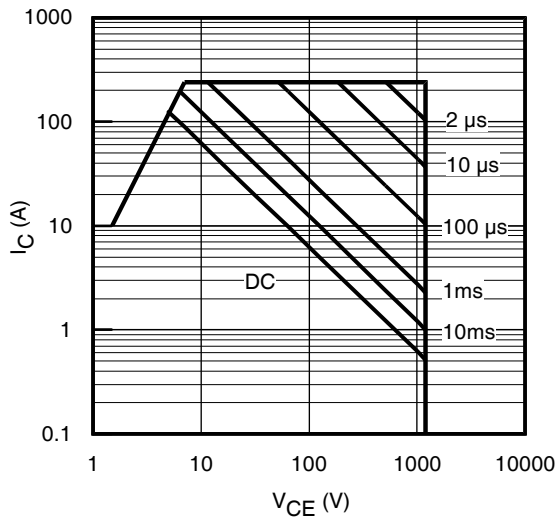


Fig. 3 - Forward SOA
 $T_C = 25^\circ C$; $T_{JS} \leq 150^\circ C$

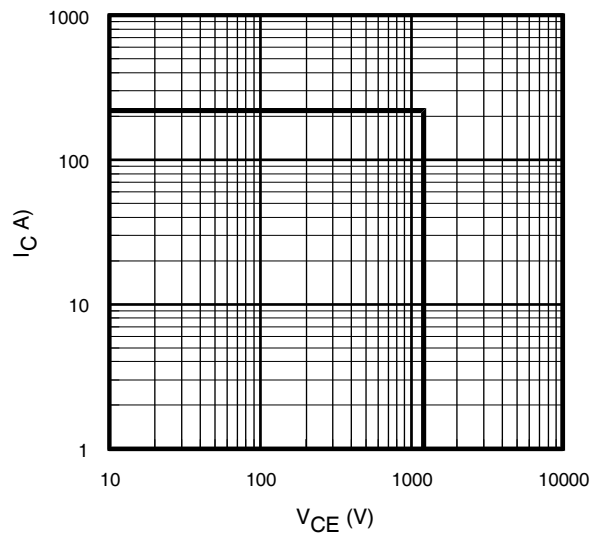


Fig. 4 - Reverse Bias SOA
 $T_J = 150^\circ C$; $V_{GE} = 15V$

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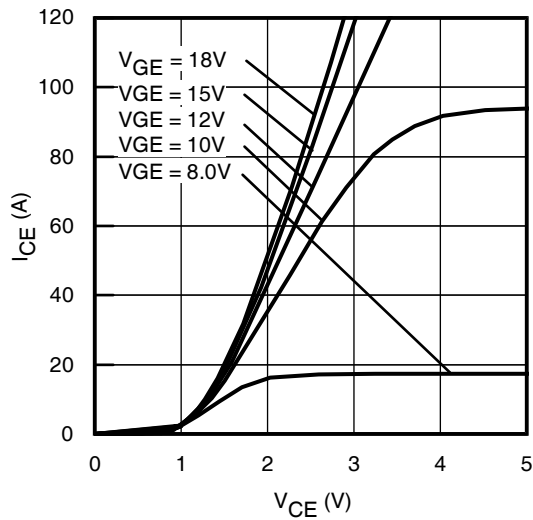


Fig. 5 - Typ. IGBT Output Characteristics
T_J = -40°C; tp = 80μs

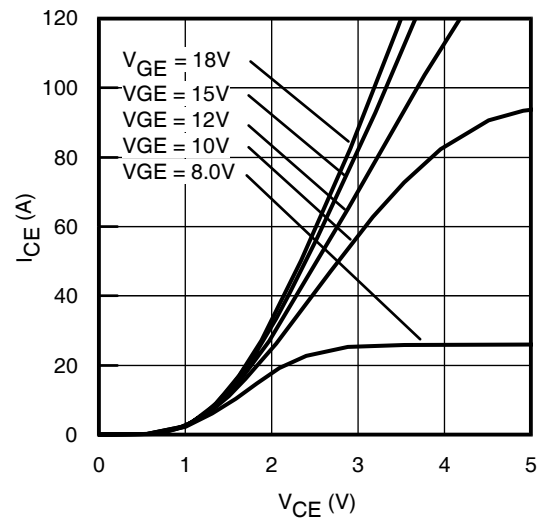


Fig. 6 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80μs

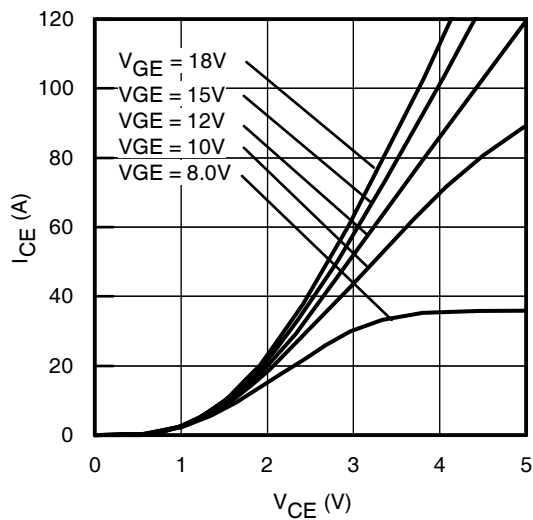


Fig. 7 - Typ. IGBT Output Characteristics
T_J = 125°C; tp = 80μs

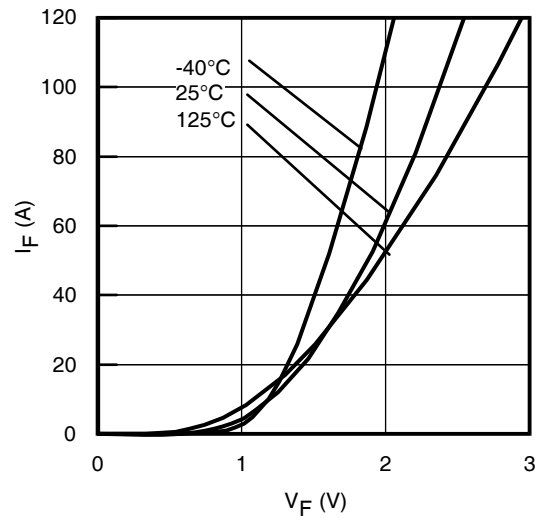


Fig. 8 - Typ. Diode Forward Characteristics
tp = 80μs

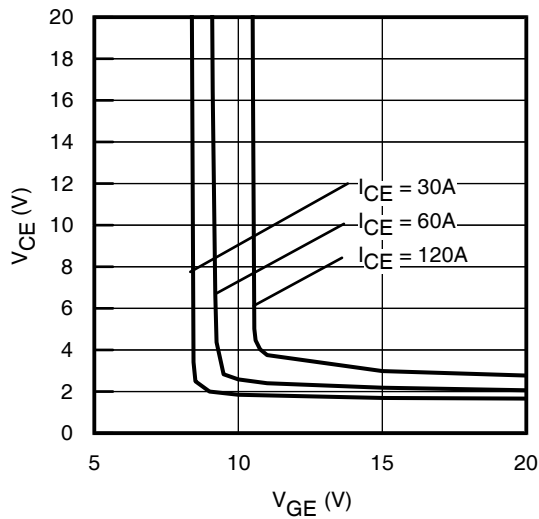


Fig. 9 - Typical V_{CE} vs. V_{GE}
 $T_J = -40^\circ\text{C}$

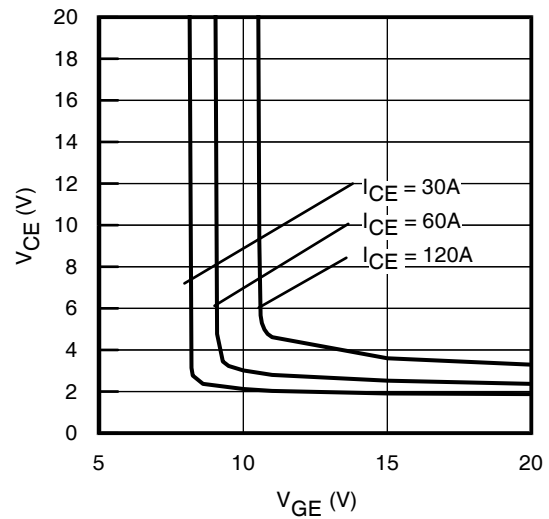


Fig. 10 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^\circ\text{C}$

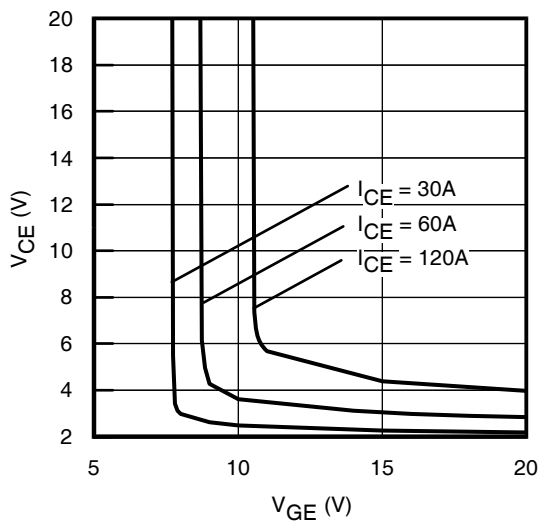


Fig. 11 - Typical V_{CE} vs. V_{GE}
 $T_J = 125^\circ\text{C}$

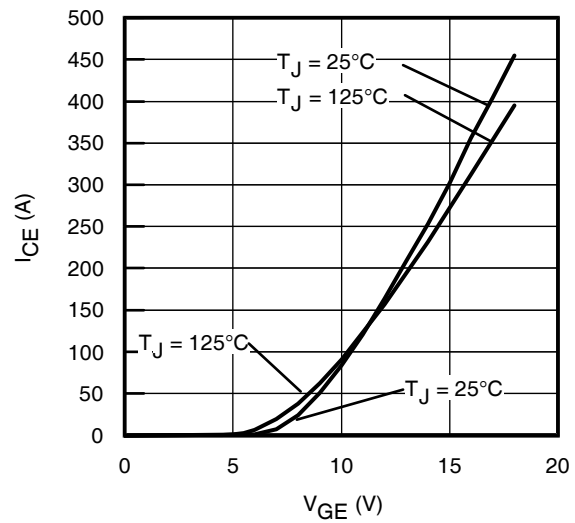


Fig. 12 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 10\mu\text{s}$

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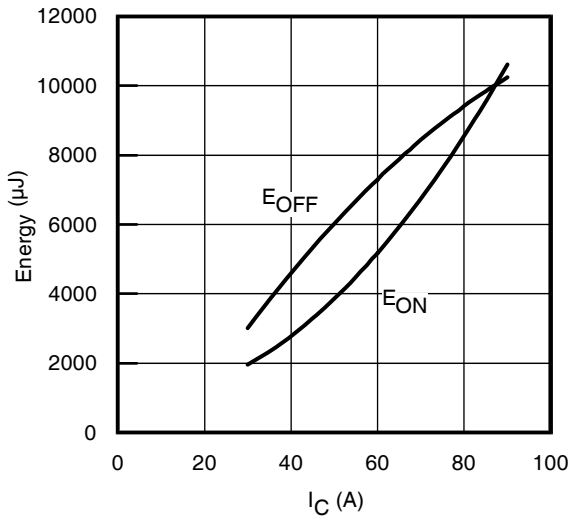


Fig. 13 - Typ. Energy Loss vs. I_C
 $T_J = 125^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=600\text{V}$
 $R_G=4.7\Omega$; $V_{GE}=15\text{V}$

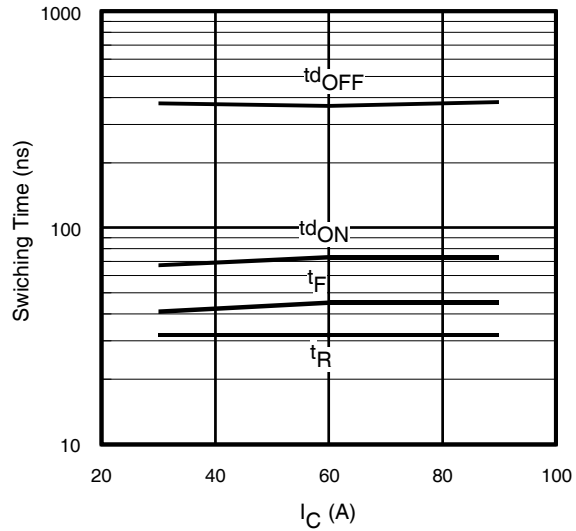


Fig. 14 - Typ. Switching Time vs. I_C
 $T_J = 125^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=600\text{V}$
 $R_G=4.7\Omega$; $V_{GE}=15\text{V}$

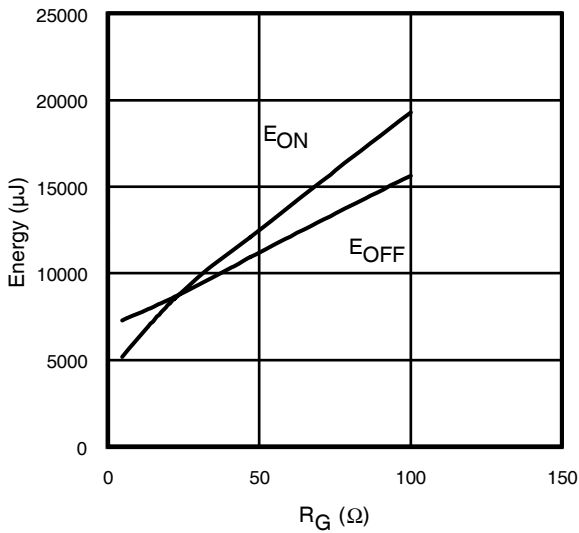


Fig. 15 - Typ. Energy Loss vs. R_G
 $T_J = 125^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=600\text{V}$
 $I_{CE}=60\text{A}$; $V_{GE}=15\text{V}$

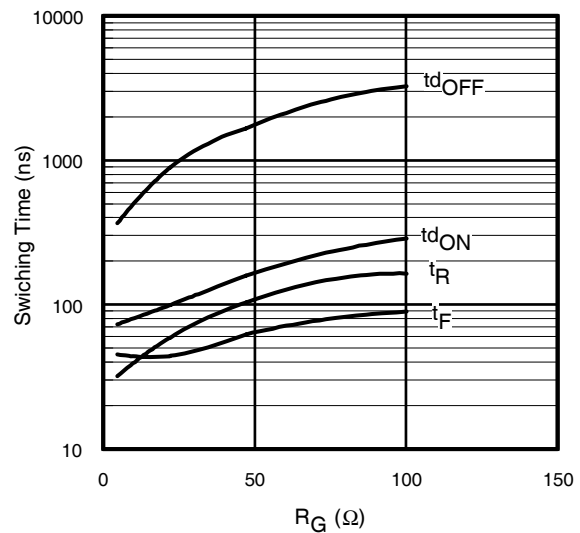


Fig. 16 - Typ. Switching Time vs. R_G
 $T_J = 125^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=600\text{V}$
 $I_{CE}=60\text{A}$; $V_{GE}=15\text{V}$

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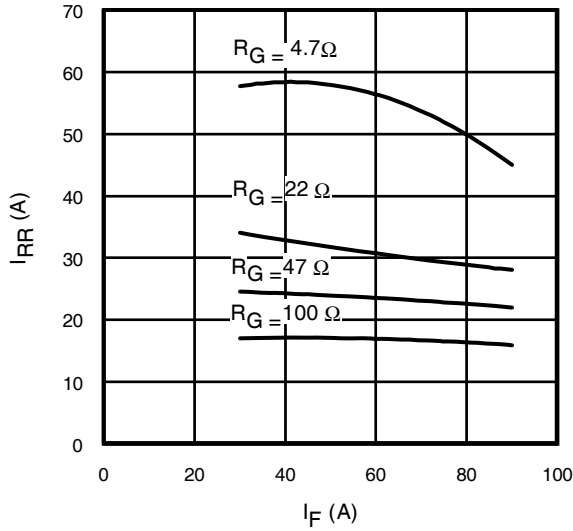


Fig. 17 - Typical Diode I_{RR} vs. I_F
 $T_J = 125^\circ\text{C}$

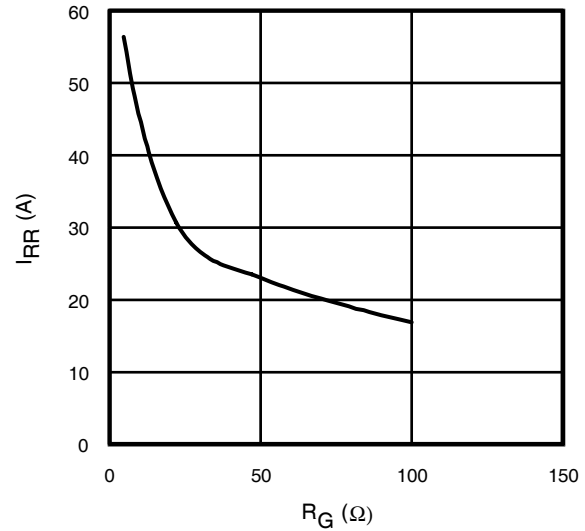


Fig. 18 - Typical Diode I_{RR} vs. R_G
 $T_J = 125^\circ\text{C}; I_F = 60\text{A}$

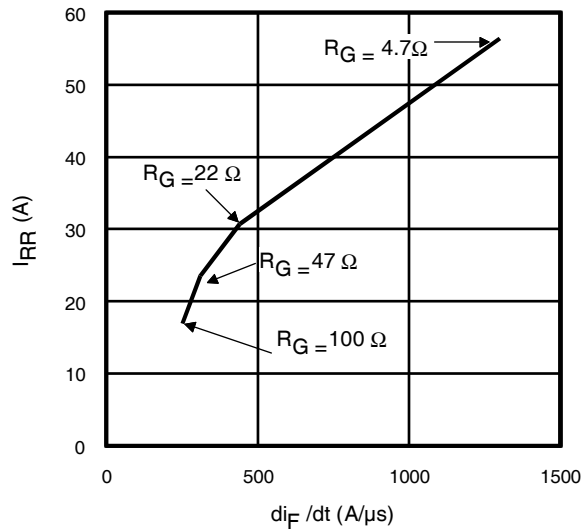


Fig. 19 - Typical Diode I_{RR} vs. di_F/dt
 $V_{CC} = 600\text{V}; V_{GE} = 15\text{V};$
 $I_{CE} = 60\text{A}; T_J = 125^\circ\text{C}$

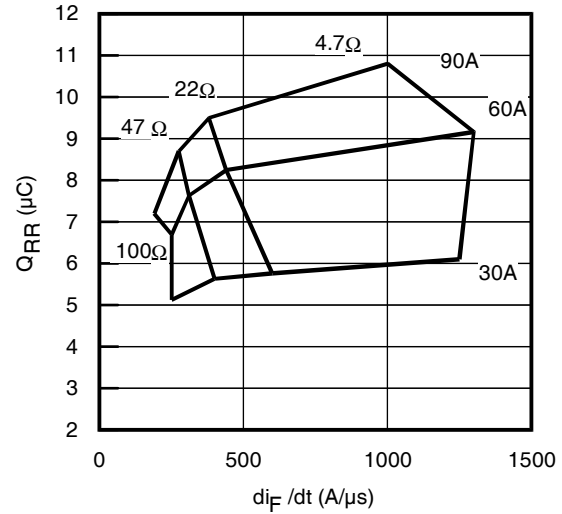


Fig. 20 - Typical Diode Q_{RR}
 $V_{CC} = 600\text{V}; V_{GE} = 15\text{V}; T_J = 125^\circ\text{C}$

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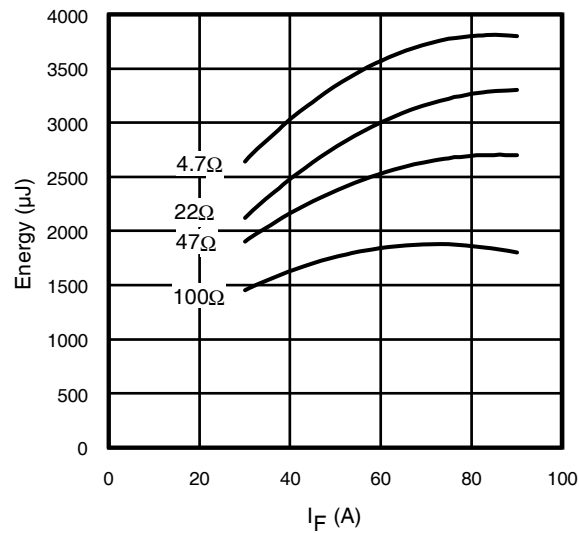


Fig. 21 - Typical Diode E_{RR} vs. I_F
 $T_J = 125^\circ\text{C}$

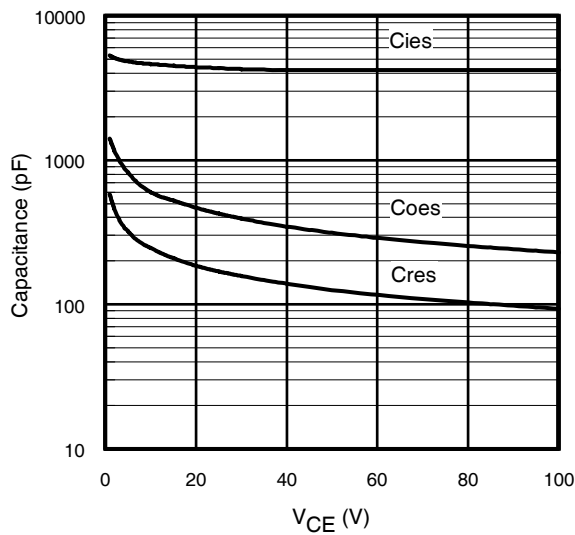


Fig. 22- Typ. Capacitance vs. V_{CE}
 $V_{GE} = 0\text{V}$; $f = 1\text{MHz}$

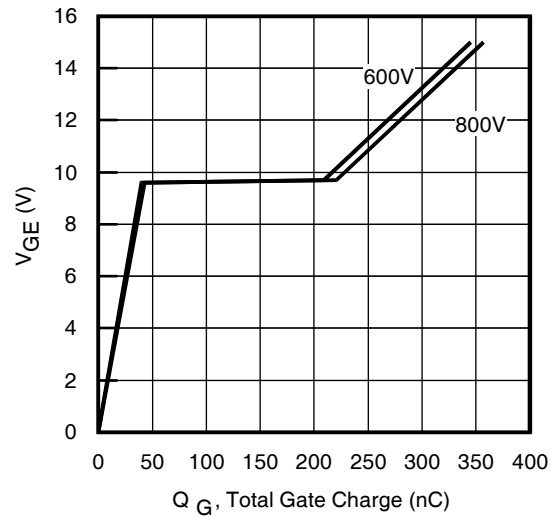


Fig. 23 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 60\text{A}$; $L = 600\mu\text{H}$

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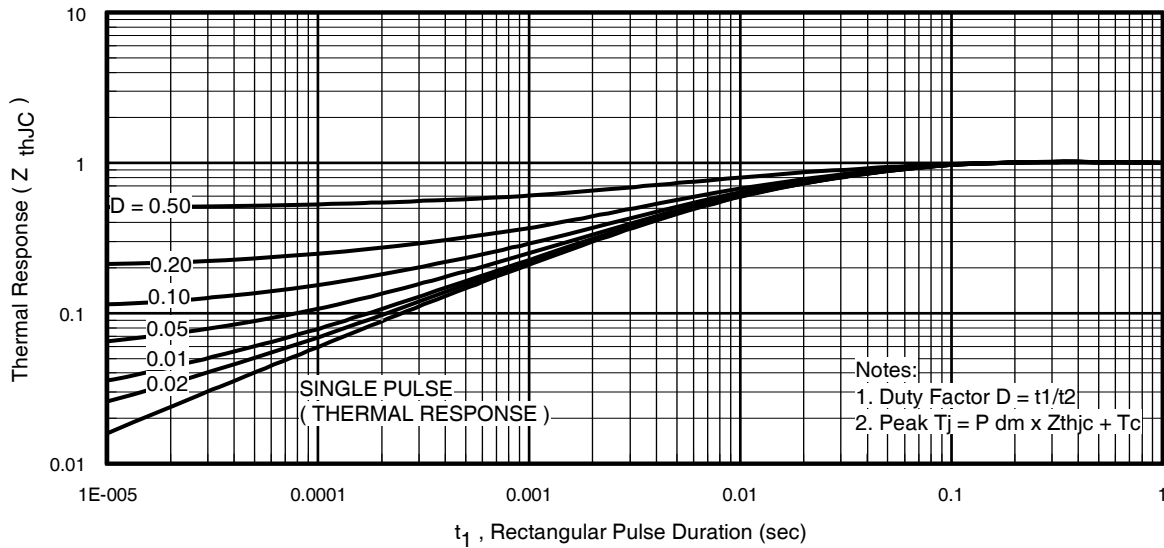


Fig 24. Normalized Transient Thermal Impedance, Junction-to-Case (IGBT)

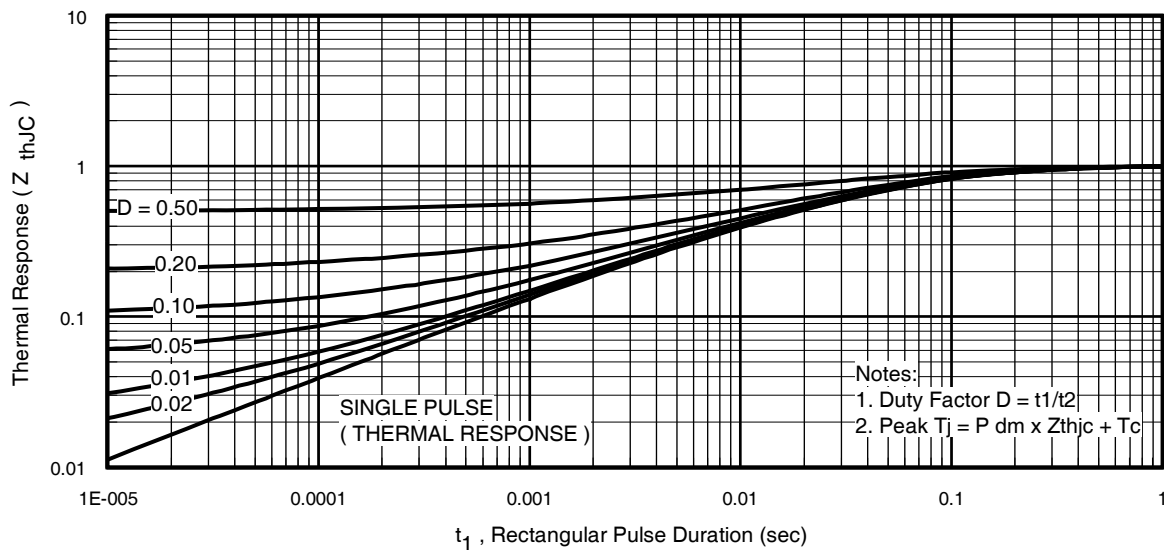


Fig 25. Normalized Transient Thermal Impedance, Junction-to-Case (DIODE)

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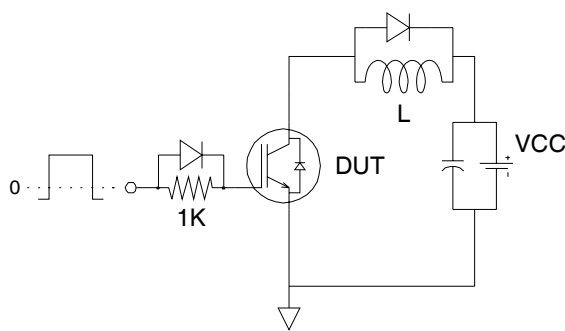


Fig.C.T.1 - Gate Charge Circuit (turn-off)

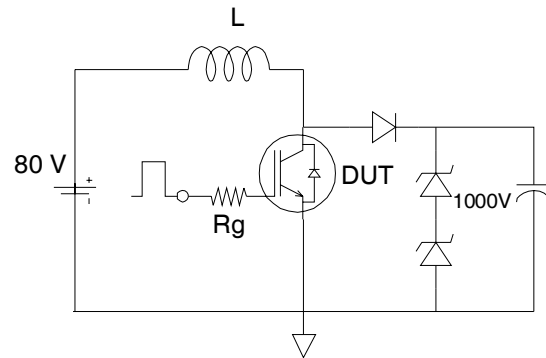


Fig.C.T.2 - RBSOA Circuit

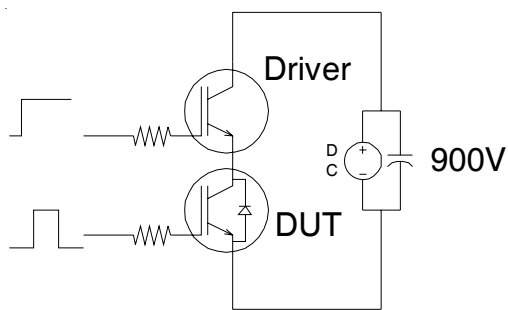


Fig.C.T.3 - S.C. SOA Circuit

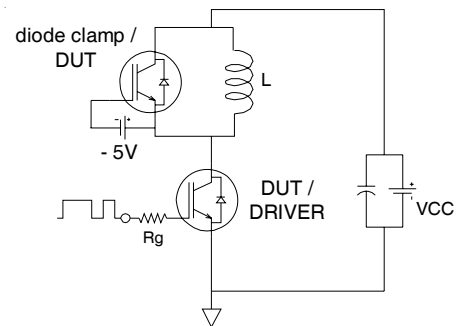


Fig.C.T.4 - Switching Loss Circuit

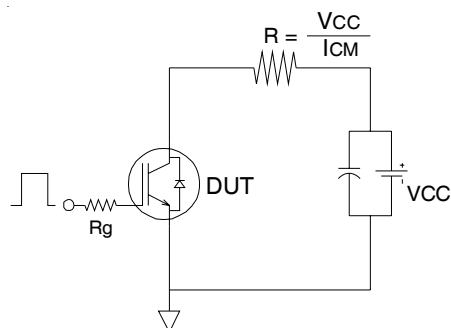


Fig.C.T.5 - Resistive Load Circuit

Fig. WF1 - Typ. Turn-off Loss Waveform
@ $T_J=125^\circ\text{C}$ using Fig. CT.4

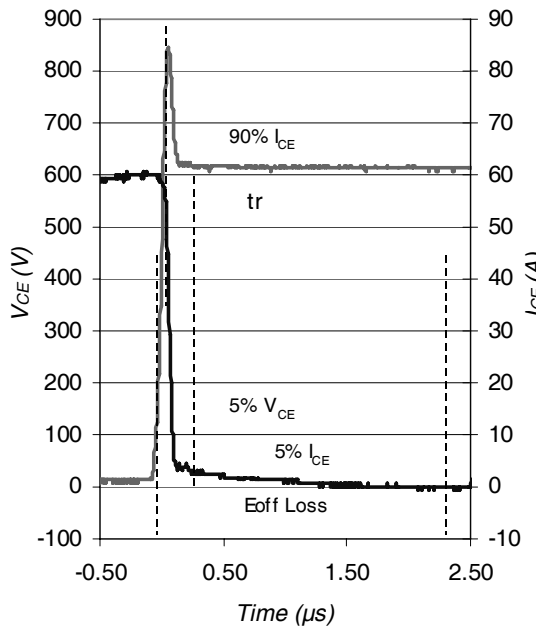


Fig. WF2 - Typ. Turn-On Loss Waveform
@ $T_J=125^\circ\text{C}$ using Fig. CT.4

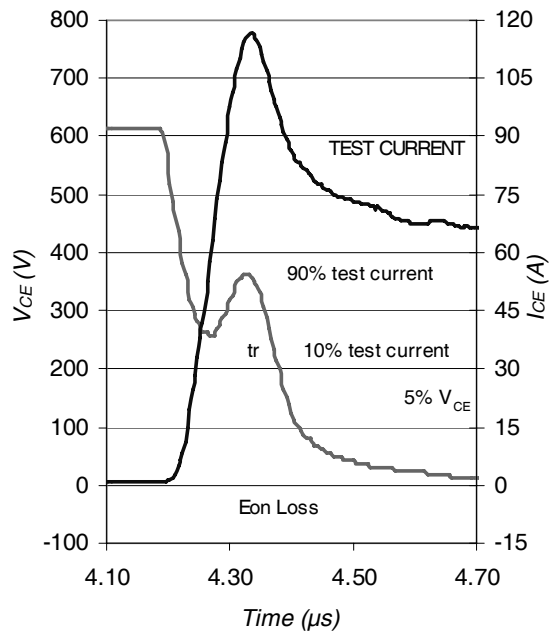


Fig. WF.3 - Typ. Diode Recovery Waveform
@ $T_J=125^\circ\text{C}$ using Fig. CT.4

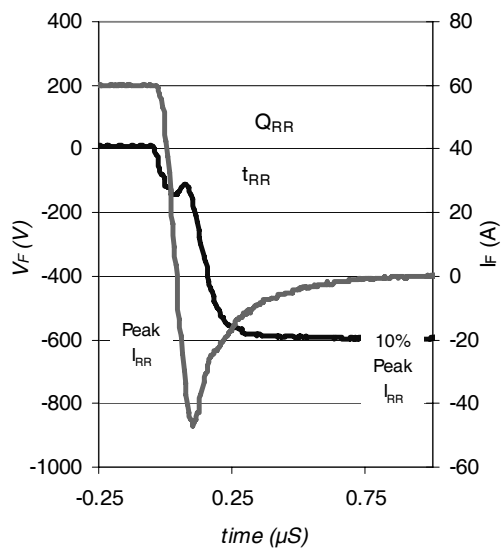
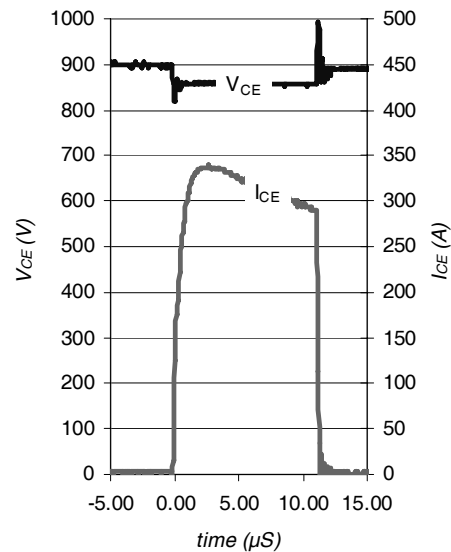


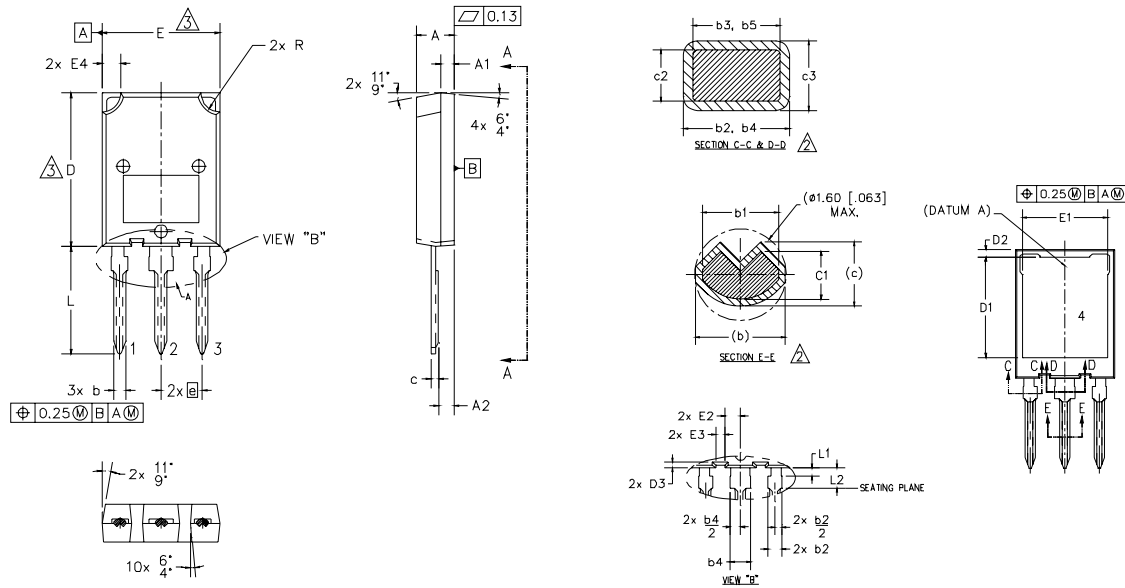
Fig. WF.4 - Typ. S.C. Waveform
@ $T_C=150^\circ\text{C}$ using Fig. CT.3



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Super-247™ Package Outline

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- NOTES:
1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M-1994
 2. DIMENSIONS b1, b3, b5, c1 & c3 APPLY TO BASE METAL ONLY.
 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 OUTER EXTREMES OF THE PLASTIC BODY.
 4. ALL DIMENSIONS SHOWN IN MILLIMETERS.
 5. CONTROLLING DIMENSION: MILLIMETER.
 6. OUTLINE CONFORMS TO JEDEC OUTLINE TO-274AA

SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.50	5.50	.177	.217	
A1	1.45	2.15	.057	.085	
A2	1.65	2.35	.065	.093	
b	1.45	1.60	.054	.063	
b1	1.40	1.50	.055	.059	2
b2	2.00	2.40	.079	.094	
b3	1.95	2.35	.077	.093	2
b4	3.00	3.15	.118	.124	
b5	2.95	3.35	.116	.132	2
c	1.10	1.30	.043	.051	
c1	0.90	1.10	.035	.043	2
c2	0.65	0.85	.026	.033	
c3	0.50	0.70	.020	.028	2
D	19.80	20.80	.780	.819	3
D1	15.50	16.10	.610	.634	
D2	0.70	1.30	.028	.051	
D3	0.75	1.25	.030	.049	
E	15.10	16.10	.594	.634	3
E1	13.30	13.90	.524	.547	
E2	2.25	2.70	.089	.109	
E3	1.20	1.70	.047	.067	
E4	2.00	3.00	.079	.118	
e	5.45 BSC		.215 BSC		
L	13.80	14.80	.535	.583	
L1	1.00	1.60	.039	.063	
L2	3.85	4.25	.152	.167	
R	2.00	3.00	.079	.118	

LEAD ASSIGNMENTS

MOSFET

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

IGBT

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

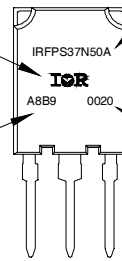
Note: For the most current drawing please refer to IR website at: <http://www.irf.com/package/>

Super-247™ Part Marking Information

EXAMPLE: THIS IS AN IRFPS37N50A WITH
ASSEMBLY LOT CODE A8B9

INTERNATIONAL RECTIFIER
LOGO

ASSEMBLY LOT CODE



PART NUMBER

DATE CODE
(YYWW)

YY = YEAR
WW = WEEK

Notes:

- ① $V_{CC} = 80\% (V_{CES})$, $V_{GE} = 20V$, $L = 100 \mu H$, $R_G = 4.7\Omega$.
- ② Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 105A.

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.

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TAC Fax: (310) 252-7903

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