

Excellent Integrated System Limited

Stocking Distributor

Click to view price, real time Inventory, Delivery & Lifecycle Information:

[International Rectifier \(Infineon Technologies Americas Corp.\)](#)
[IRGIB15B60KD1P](#)

For any questions, you can email us directly:

sales@integrated-circuit.com

International

PD- 94914

IR Rectifier

IRGIB15B60KD1P

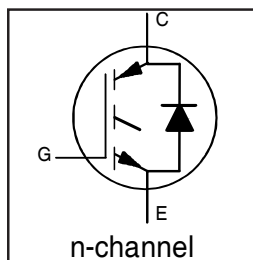
INSULATED GATE BIPOLAR TRANSISTOR WITH
ULTRAFAST SOFT RECOVERY DIODE

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.
- Maximum Junction Temperature Rated at 175°C
- Lead-Free

Benefits

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



$V_{CES} = 600V$

$I_C = 12A, T_C = 100^\circ C$

$t_{sc} > 10\mu s, T_J = 150^\circ C$

$V_{CE(on)} \text{ typ.} = 1.80V$



TO-220
Full-Pak

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	19	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	12	
I_{CM}	Pulse Collector Current (Ref.Fig.C.T.5)	38	
I_{LM}	Clamped Inductive Load current ①	38	
$I_F @ T_C = 25^\circ C$	Diode Continuous Forward Current	19	
$I_F @ T_C = 100^\circ C$	Diode Continuous Forward Current	12	
I_{FM}	Diode Maximum Forward Current	38	V
V_{ISOL}	RMS Isolation Voltage, Terminal to Case, $t = 1 \text{ min}$	2500	
V_{GE}	Gate-to-Emitter Voltage	± 20	W
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	52	
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	26	
T_J	Operating Junction and	-55 to +175	$^\circ C$
T_{STG}	Storage Temperature Range		
	Soldering Temperature for 10 sec.	300 (0.063 in. (1.6mm) from case)	
	Mounting Torque, 6-32 or M3 Screw	10 lbf.in (1.1N.m)	

Thermal / Mechanical Characteristics

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case- IGBT	—	—	2.9	$^\circ C/W$
$R_{\theta JC}$	Junction-to-Case- Diode	—	—	4.6	
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	62	
Wt	Weight	—	2.0	—	g

IRGIB15B60KD1P

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

International
IR Rectifier

	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	—	0.32	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1mA (25^\circ\text{C}-150^\circ\text{C})$	
$V_{CE(on)}$	Collector-to-Emitter Voltage	—	1.80	2.20	V	$I_C = 15A, V_{GE} = 15V, T_J = 25^\circ\text{C}$	5,6,7
		—	2.05	2.50		$I_C = 15A, V_{GE} = 15V, T_J = 150^\circ\text{C}$	9,10,11
		—	2.10	2.60		$I_C = 15A, V_{GE} = 15V, T_J = 175^\circ\text{C}$	
$V_{GE(th)}$	Gate Threshold Voltage	3.5	4.5	5.5	V	$V_{CE} = V_{GE}, I_C = 250\mu A$	9,10,11
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-10	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 1mA (25^\circ\text{C}-150^\circ\text{C})$	12
g_{fe}	Forward Transconductance	—	10	—	S	$V_{CE} = 50V, I_C = 15A, PW = 80\mu s$	
I_{CES}	Zero Gate Voltage Collector Current	—	1.0	150	μA	$V_{GE} = 0V, V_{CE} = 600V$	
		—	163	500		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$	
		—	829	1800		$V_{GE} = 0V, V_{CE} = 600V, T_J = 175^\circ\text{C}$	
V_{FM}	Diode Forward Voltage Drop	—	1.69	2.30	V	$I_F = 15A, V_{GE} = 0V$	8
		—	1.31	1.75		$I_F = 15A, V_{GE} = 0V, T_J = 150^\circ\text{C}$	
		—	1.25	1.65		$I_F = 15A, V_{GE} = 0V, T_J = 175^\circ\text{C}$	
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 20V, V_{CE} = 0V$	

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)	—	56	84	nC	$I_C = 15A$	23
Q_{ge}	Gate-to-Emitter Charge (turn-on)	—	7.0	10		$V_{CC} = 400V$	CT1
Q_{gc}	Gate-to-Collector Charge (turn-on)	—	26	39		$V_{GE} = 15V$	
E_{on}	Turn-On Switching Loss	—	127	140	μJ	$I_C = 15A, V_{CC} = 400V$	CT4
E_{off}	Turn-Off Switching Loss	—	334	422		$V_{GE} = 15V, R_G = 22\Omega, L = 1.07mH$	
E_{tot}	Total Switching Loss	—	461	556		$L_s = 150nH, T_J = 25^\circ\text{C} \text{ ②}$	
$t_{d(on)}$	Turn-On delay time	—	30	39	ns	$I_C = 15A, V_{CC} = 400V$	CT4
t_r	Rise time	—	25	35		$V_{GE} = 15V, R_G = 22\Omega, L = 1.07mH$	
$t_{d(off)}$	Turn-Off delay time	—	173	188		$L_s = 150nH, T_J = 25^\circ\text{C}$	
t_f	Fall time	—	41	53	μJ	$I_C = 15A, V_{CC} = 400V$	CT4
E_{on}	Turn-On Switching Loss	—	258	282		$V_{GE} = 15V, R_G = 22\Omega, L = 1.07mH$	13,15
E_{off}	Turn-Off Switching Loss	—	570	646		$L_s = 150nH, T_J = 150^\circ\text{C} \text{ ②}$	WF1,WF2
E_{tot}	Total Switching Loss	—	829	915	ns	$I_C = 15A, V_{CC} = 400V$	14,16
$t_{d(on)}$	Turn-On delay time	—	30	39		$V_{GE} = 15V, R_G = 22\Omega, L = 1.07mH$	CT4
t_r	Rise time	—	25	35		$L_s = 150nH, T_J = 150^\circ\text{C}$	WF1
$t_{d(off)}$	Turn-Off delay time	—	194	207	nH		WF2
t_f	Fall time	—	56	73			
L_E	Internal Emitter Inductance	—	7.5	—		Measured 5 mm from package	
C_{ies}	Input Capacitance	—	850	1275	pF	$V_{GE} = 0V$	22
C_{oes}	Output Capacitance	—	100	150		$V_{CC} = 30V$	
C_{res}	Reverse Transfer Capacitance	—	32	48		$f = 1.0MHz$	
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 150^\circ\text{C}, I_C = 38A, V_p = 600V$ $V_{CC}=500V, V_{GE} = +15V \text{ to } 0V, R_G = 22\Omega$	4 CT2
SCSOA	Short Circuit Safe Operating Area	10	—	—	μs	$T_J = 150^\circ\text{C}, V_p = 600V, R_G = 22\Omega$ $V_{CC}=360V, V_{GE} = +15V \text{ to } 0V$	CT3 WF4
$I_{SC(PEAK)}$	Peak Short Circuit Collector Current	—	140	—	A		WF4
E_{rec}	Reverse Recovery Energy of the Diode	—	267	347	μJ	$T_J = 150^\circ\text{C}$	17,18,19
t_{rr}	Diode Reverse Recovery Time	—	67	87	ns	$V_{CC} = 400V, I_F = 15A, L = 1.07mH$	20,21
I_{rr}	Peak Reverse Recovery Current	—	23	30	A	$V_{GE} = 15V, R_G = 22\Omega$	CT4,WF3
Q_{rr}	Diode Reverse Recovery Charge	—	984	1279	nC	$di/dt = 875A/\mu s$	

① $V_{CC} = 80\% (V_{CES}), V_{GE} = 15V, L = 100\mu H, R_G = 22\Omega$.

② Energy losses include "tail" and diode reverse recovery.

International
IR Rectifier

IRGIB15B60KD1P

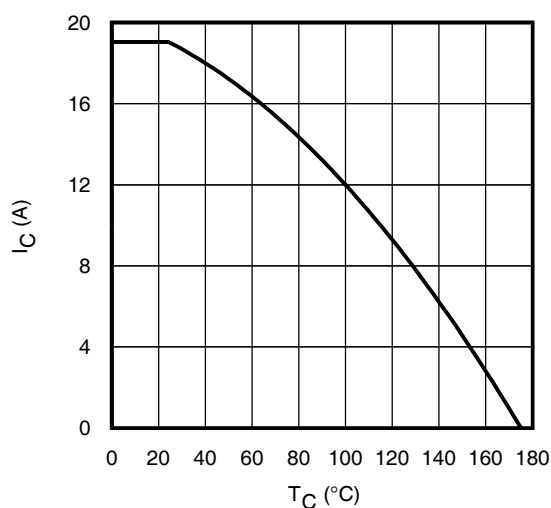


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

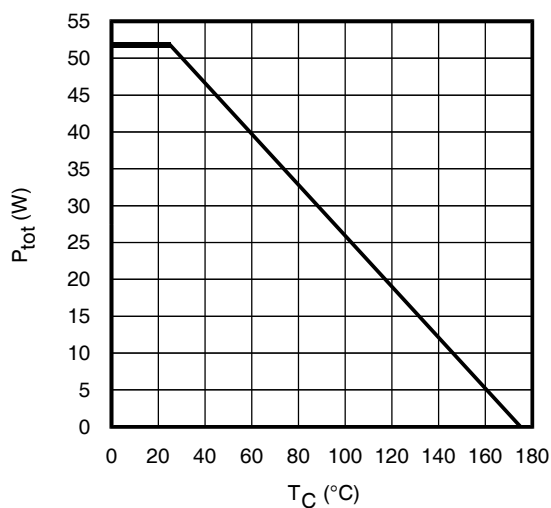


Fig. 2 - Power Dissipation vs. Case Temperature

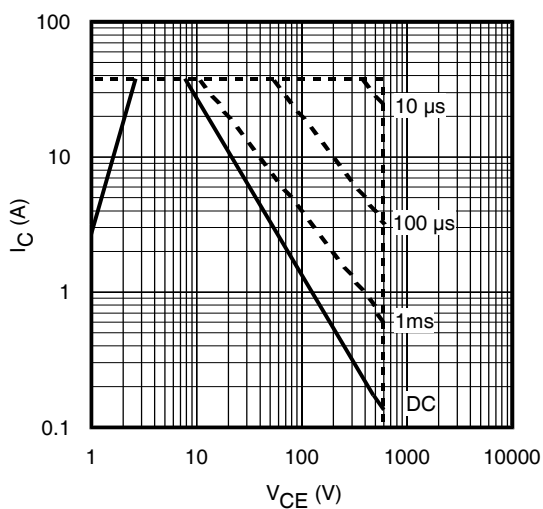


Fig. 3 - Forward SOA
 $T_C = 25^\circ\text{C}$; $T_J \leq 150^\circ\text{C}$

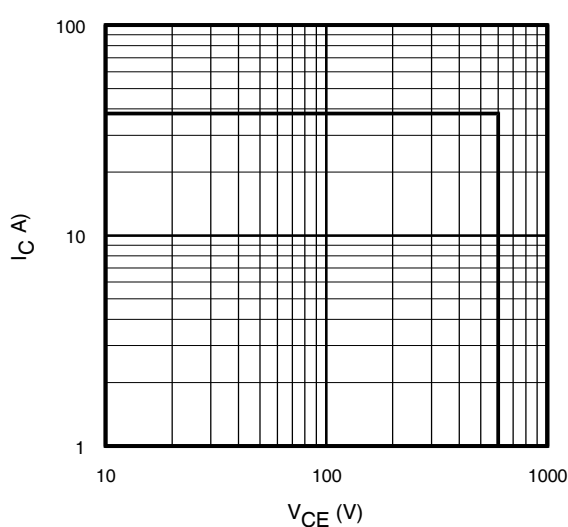


Fig. 4 - Reverse Bias SOA
 $T_J = 150^\circ\text{C}$; $V_{GE} = 15\text{V}$

IRGIB15B60KD1P

International
IR Rectifier

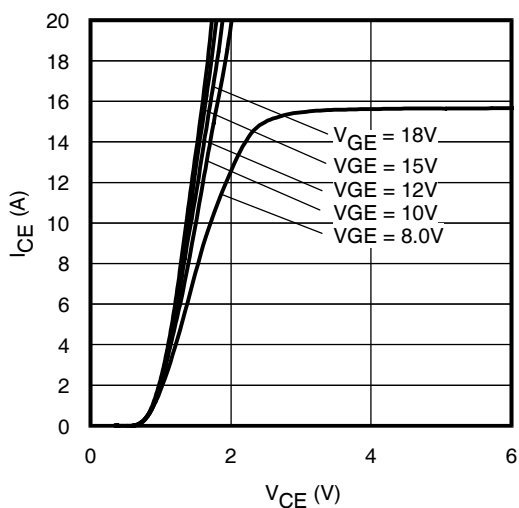


Fig. 5 - Typ. IGBT Output Characteristics
 $T_J = -40^\circ\text{C}$; $t_p = 60\mu\text{s}$

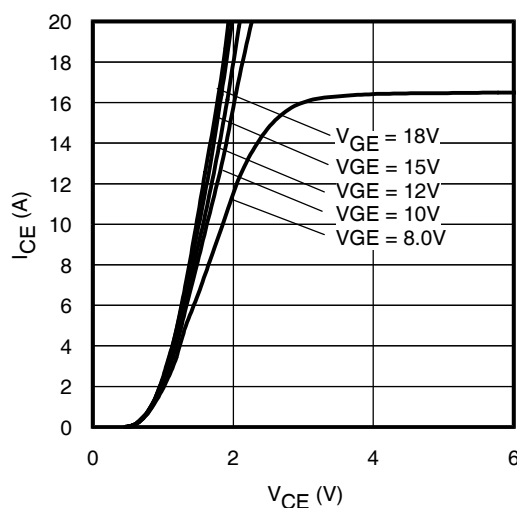


Fig. 6 - Typ. IGBT Output Characteristics
 $T_J = 25^\circ\text{C}$; $t_p = 60\mu\text{s}$

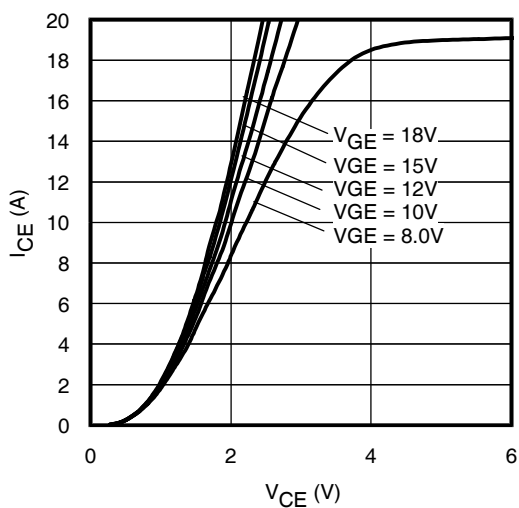


Fig. 7 - Typ. IGBT Output Characteristics
 $T_J = 150^\circ\text{C}$; $t_p = 60\mu\text{s}$

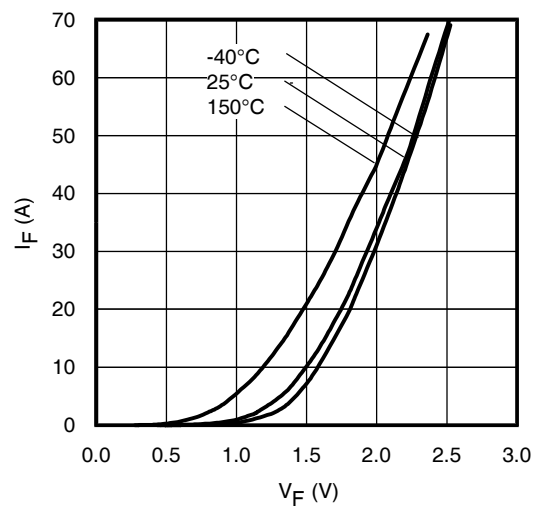


Fig. 8 - Typ. Diode Forward Characteristics
 $t_p = 60\mu\text{s}$

International
IR Rectifier

IRGIB15B60KD1P

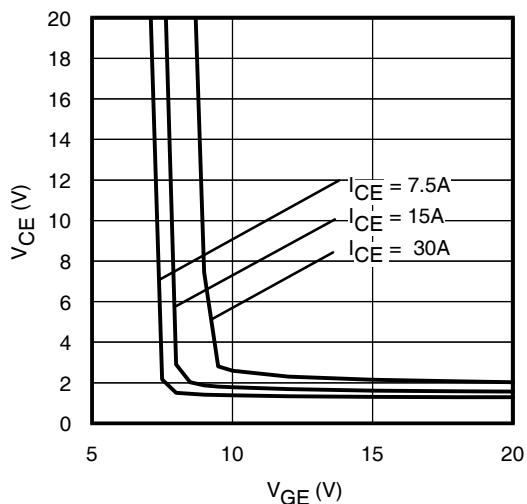


Fig. 9 - Typical V_{CE} vs. V_{GE}
 $T_J = -40^\circ\text{C}$

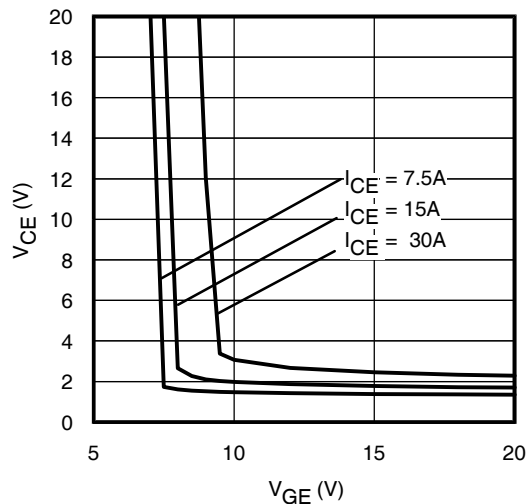


Fig. 10 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^\circ\text{C}$

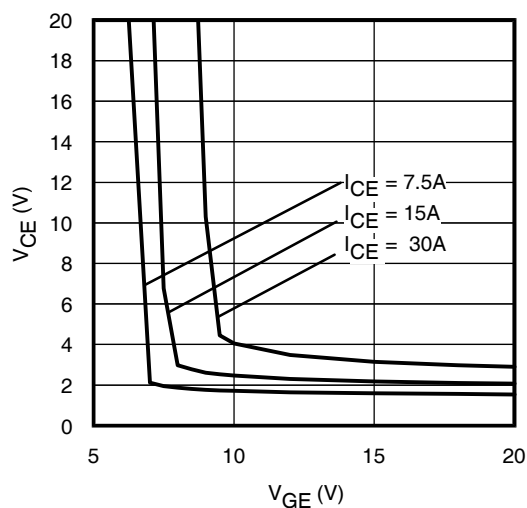


Fig. 11 - Typical V_{CE} vs. V_{GE}
 $T_J = 150^\circ\text{C}$

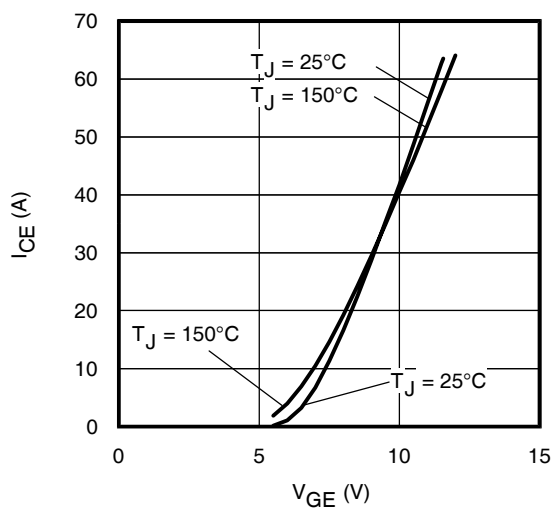


Fig. 12 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 10\mu\text{s}$

IRGIB15B60KD1P

International
IR Rectifier

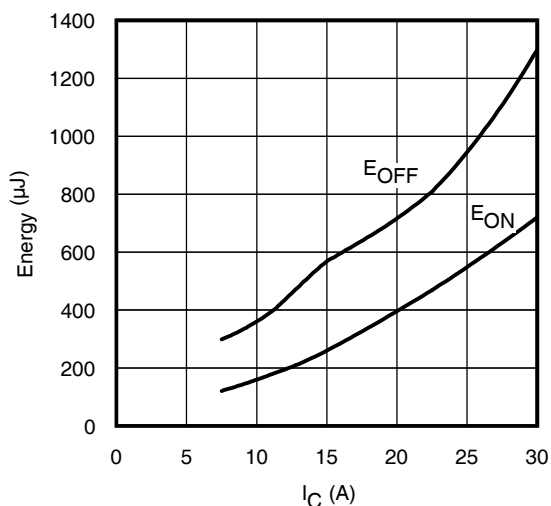


Fig. 13 - Typ. Energy Loss vs. I_C
 $T_J = 150^\circ\text{C}$; $L = 1.07\text{mH}$; $V_{CE} = 400\text{V}$
 $R_G = 22\Omega$; $V_{GE} = 15\text{V}$

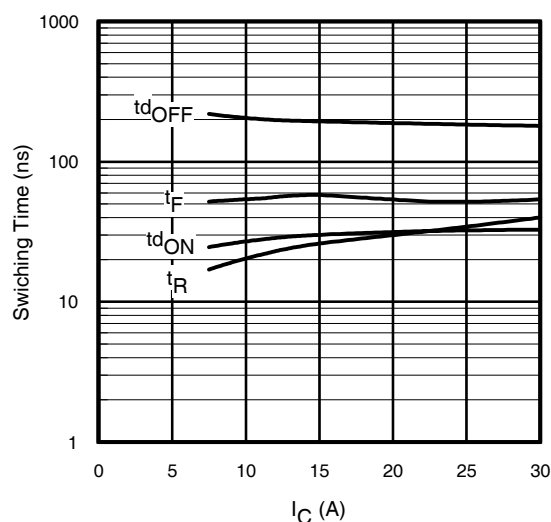


Fig. 14 - Typ. Switching Time vs. I_C
 $T_J = 150^\circ\text{C}$; $L = 1.07\text{mH}$; $V_{CE} = 400\text{V}$
 $R_G = 22\Omega$; $V_{GE} = 15\text{V}$

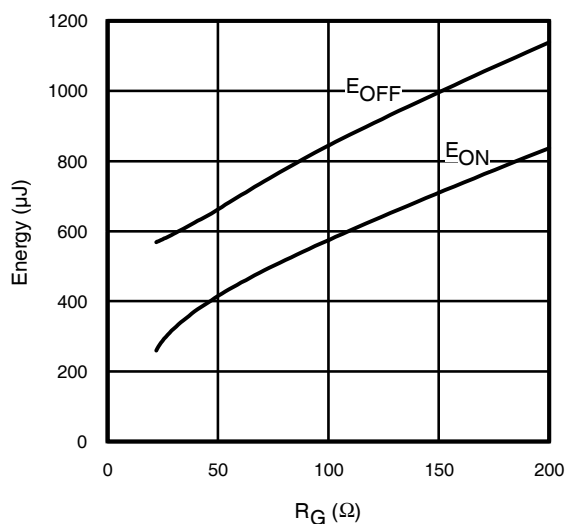


Fig. 15 - Typ. Energy Loss vs. R_G
 $T_J = 150^\circ\text{C}$; $L = 1.07\text{mH}$; $V_{CE} = 400\text{V}$
 $I_{CE} = 15\text{A}$; $V_{GE} = 15\text{V}$

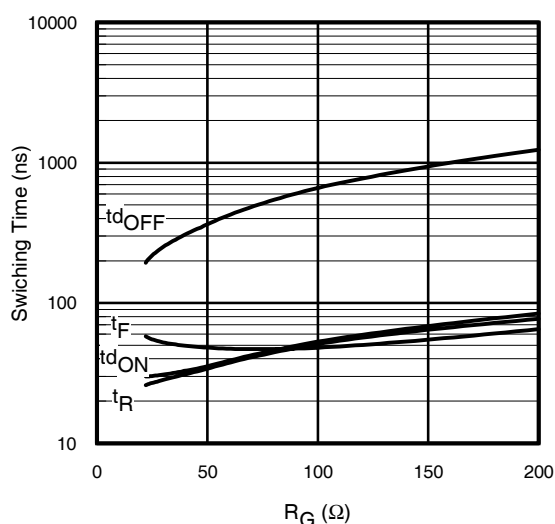


Fig. 16 - Typ. Switching Time vs. R_G
 $T_J = 150^\circ\text{C}$; $L = 1.07\text{mH}$; $V_{CE} = 400\text{V}$
 $I_{CE} = 15\text{A}$; $V_{GE} = 15\text{V}$

International
IR Rectifier

IRGIB15B60KD1P

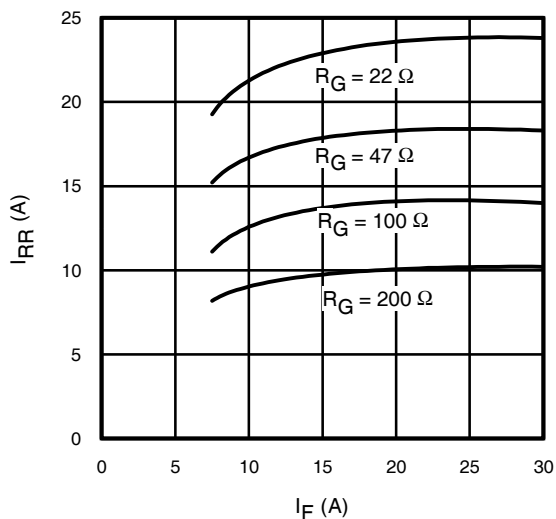


Fig. 17 - Typical Diode I_{RR} vs. I_F
 $T_J = 150^\circ\text{C}$

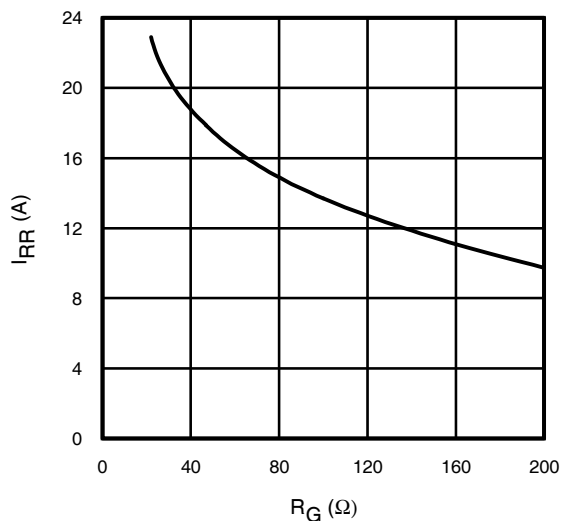


Fig. 18 - Typical Diode I_{RR} vs. R_G
 $T_J = 150^\circ\text{C}$; $I_F = 15\text{A}$

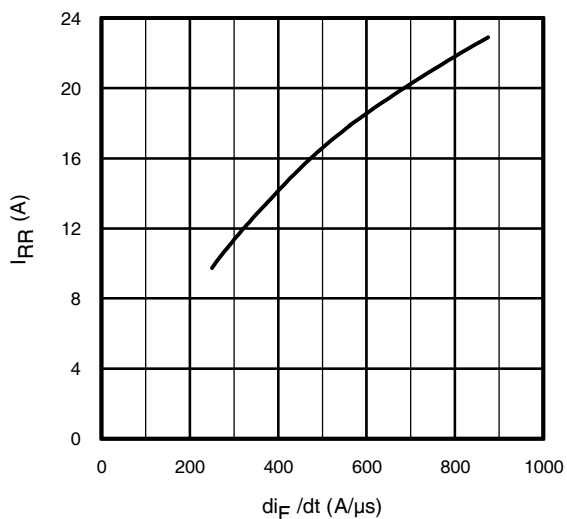


Fig. 19 - Typical Diode I_{RR} vs. di_F/dt
 $V_{CC} = 400\text{V}$; $V_{GE} = 15\text{V}$;
 $I_{CE} = 15\text{A}$; $T_J = 150^\circ\text{C}$

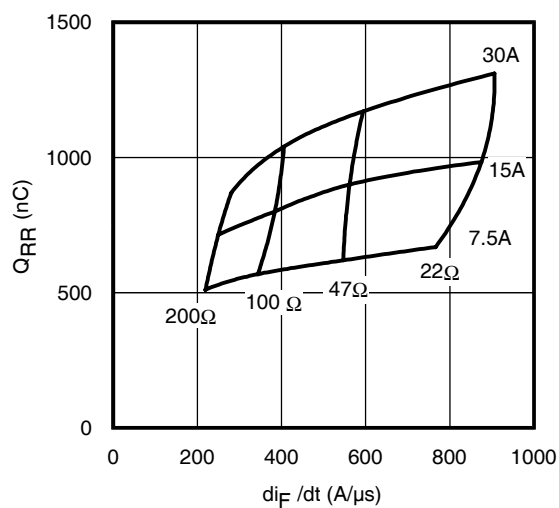


Fig. 20 - Typical Diode Q_{RR}
 $V_{CC} = 400\text{V}$; $V_{GE} = 15\text{V}$; $T_J = 150^\circ\text{C}$

IRGIB15B60KD1P

International
IR Rectifier

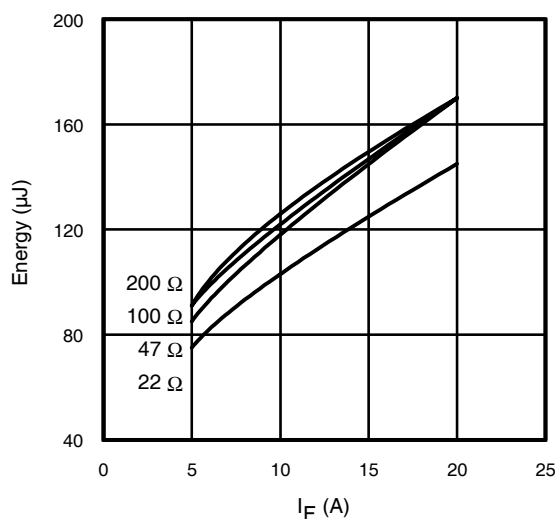


Fig. 21 - Typical Diode E_{RR} vs. I_F
 $T_J = 150^\circ\text{C}$

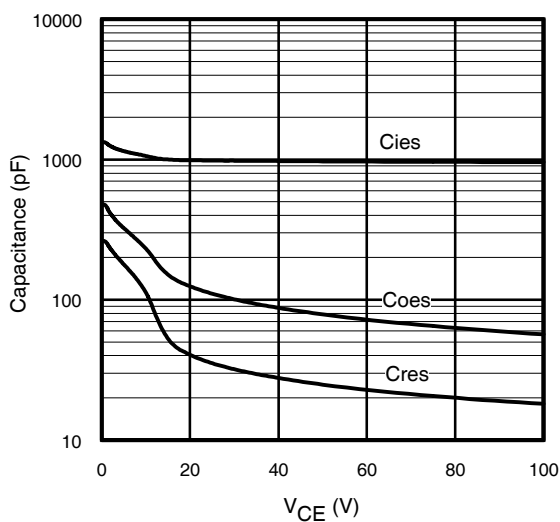


Fig. 22- Typ. Capacitance vs. V_{CE}
 $V_{GE} = 0\text{V}$; $f = 1\text{MHz}$

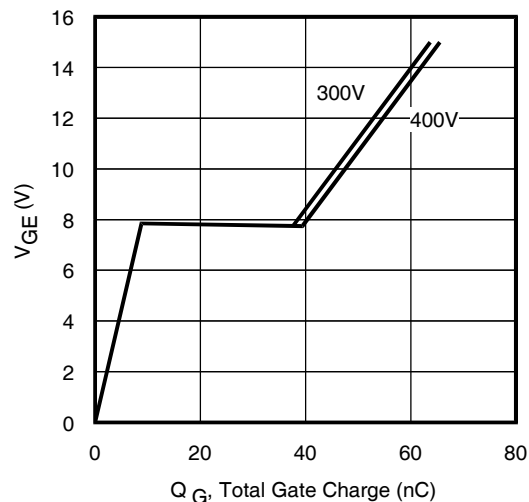


Fig. 23 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 15\text{A}$; $L = 2500\mu\text{H}$

www.irf.com

International
IR Rectifier

IRGIB15B60KD1P

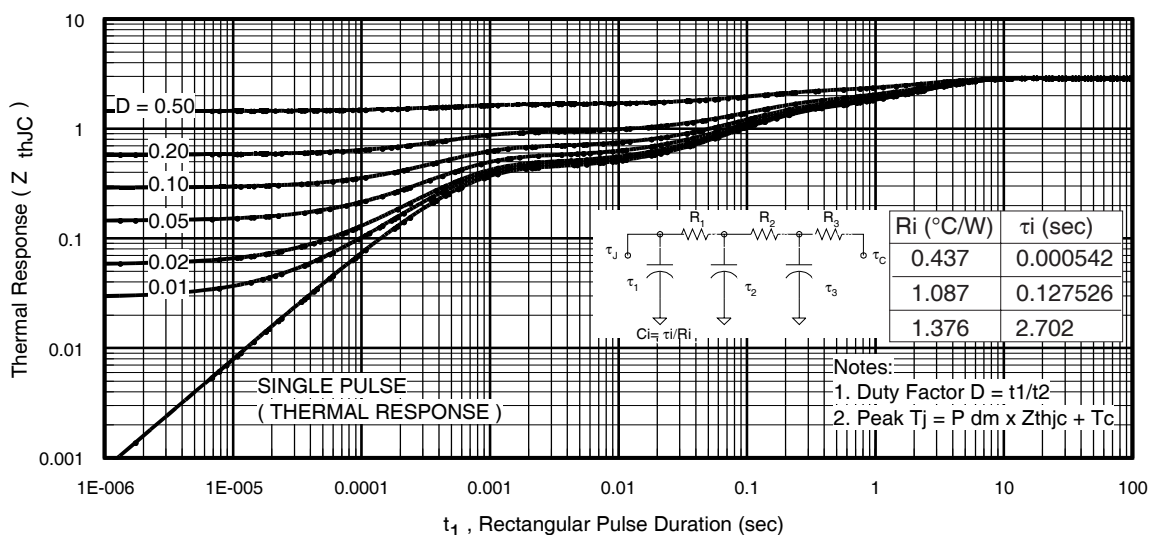


Fig 24. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

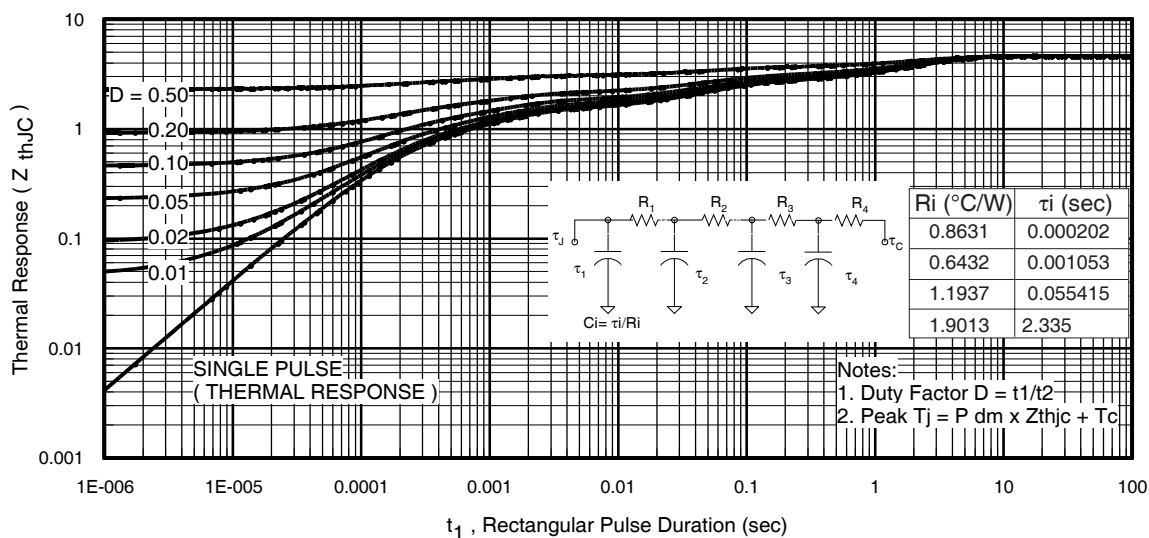


Fig 25. Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

IRGIB15B60KD1P

International
IR Rectifier

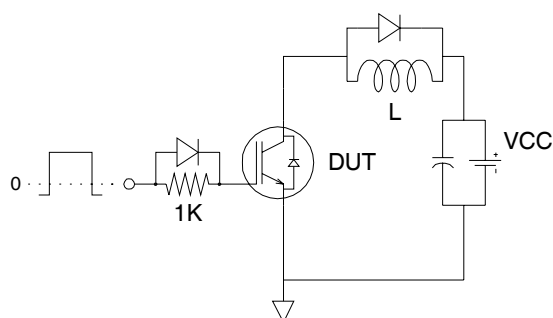


Fig.C.T.1 - Gate Charge Circuit (turn-off)

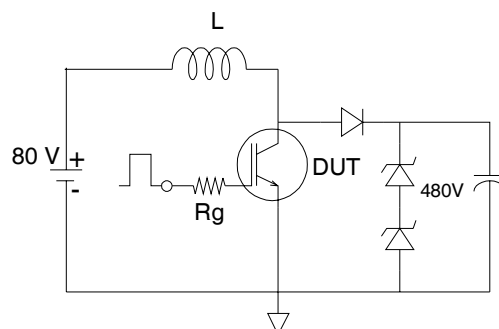


Fig.C.T.2 - RBSOA Circuit

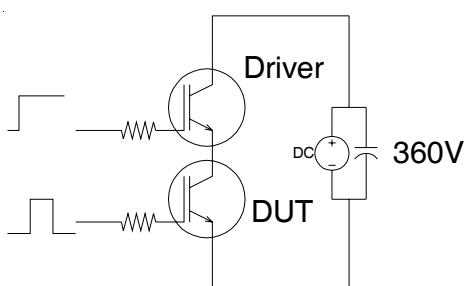


Fig.C.T.3 - S.C.SOA Circuit

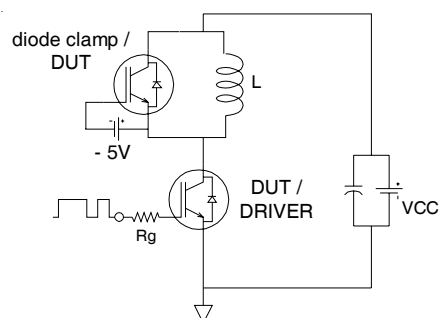


Fig.C.T.4 - Switching Loss Circuit

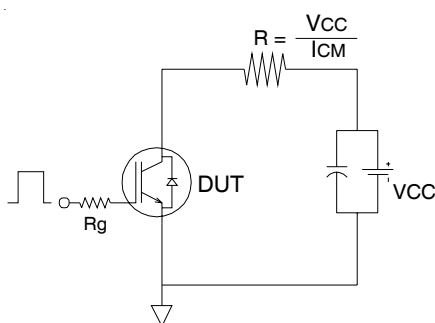


Fig.C.T.5 - Resistive Load Circuit

International
IR Rectifier

IRGIB15B60KD1P

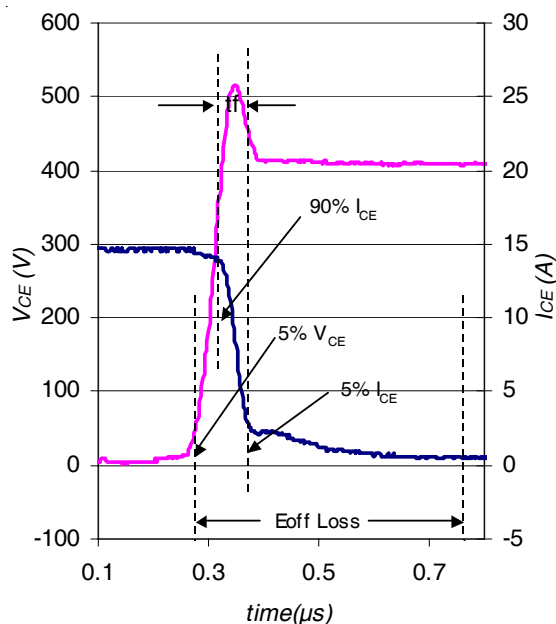


Fig. WF1- Typ. Turn-off Loss Waveform
@ $T_J = 150^{\circ}\text{C}$ using Fig. CT.4

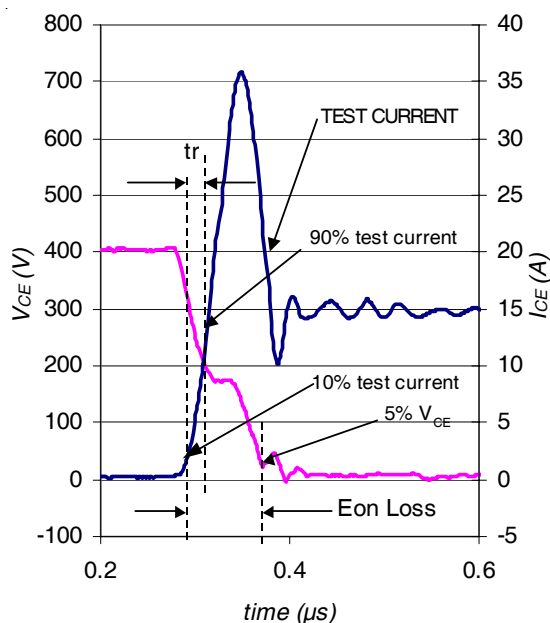


Fig. WF2- Typ. Turn-on Loss Waveform
@ $T_J = 150^{\circ}\text{C}$ using Fig. CT.4

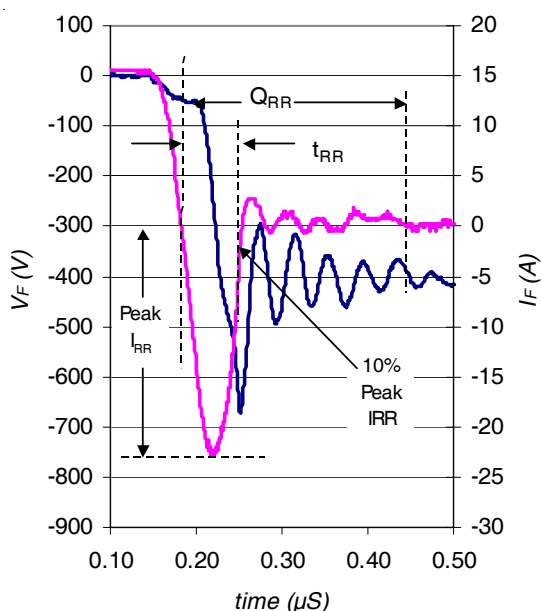


Fig. WF3- Typ. Diode Recovery Waveform
@ $T_J = 150^{\circ}\text{C}$ using Fig. CT.4

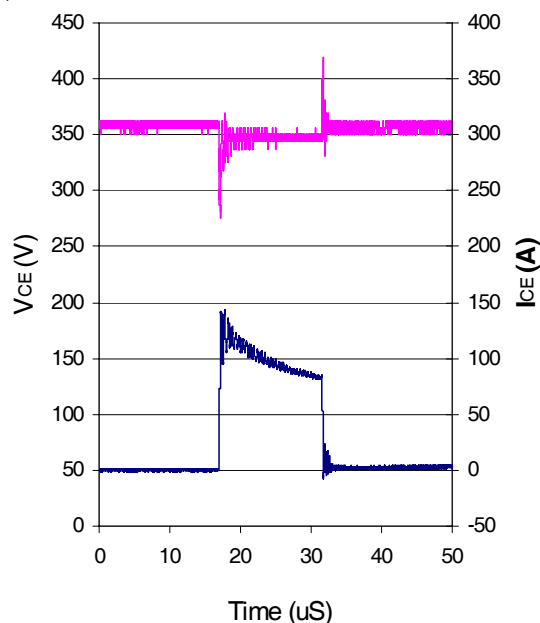


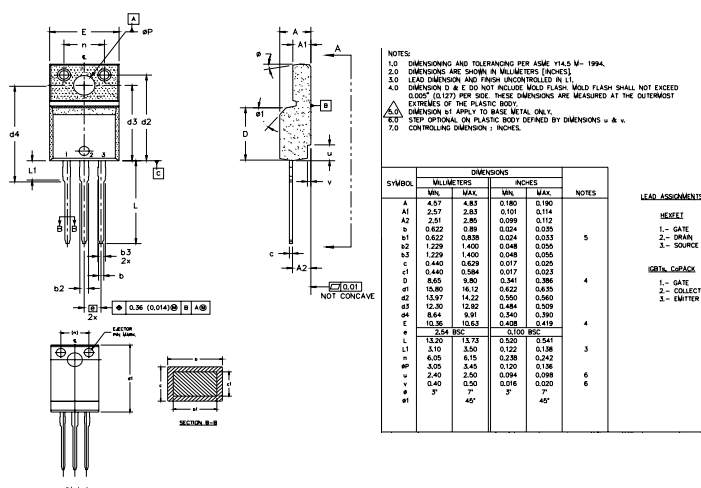
Fig. WF4- Typ. S.C Waveform
@ $T_C = 150^{\circ}\text{C}$ using Fig. CT.3

IRGIB15B60KD1P

International
IR Rectifier

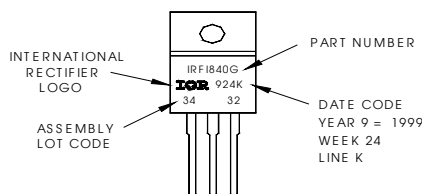
TO-220 Full-Pak Package Outline

Dimensions are shown in millimeters (inches)



TO-220 Full-Pak Part Marking Information

EXAMPLE: THIS IS AN IRF1840G
WITH ASSEMBLY
LOT CODE 3432
ASSEMBLED ON WW 24 1999
IN THE ASSEMBLY LINE "K"
Note: "P" in assembly line
position indicates "Lead-Free"



TO-220 FullPak packages are not recommended for Surface Mount Application.

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
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 for sales contact information.12/03

www.irf.com

Note: For the most current drawings please refer to the IR website at:

<http://www.irf.com/package/>