

International
IR Rectifier
 INSULATED GATE BIPOLAR TRANSISTOR

PD - 95356

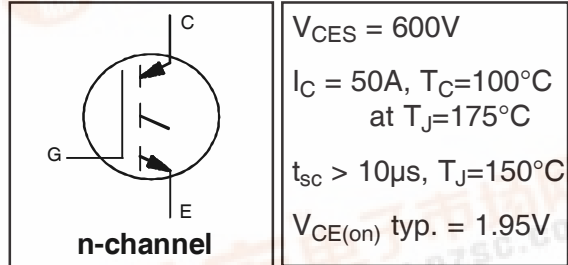
IRGB30B60KPbF
 IRGS30B60K
 IRGSL30B60K

Features

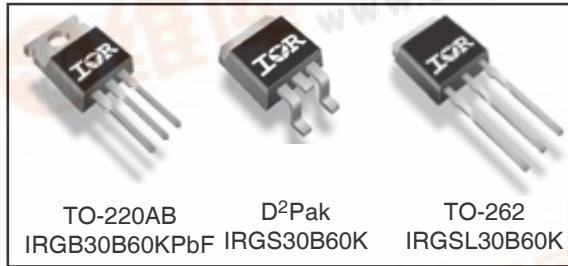
- Low VCE (on) Non Punch Through IGBT Technology.
- 10µs Short Circuit Capability.
- Square RBSOA.
- Positive VCE (on) Temperature Coefficient.
- Maximum Junction Temperature rated at 175°C.
- TO-220 is available in PbF as Lead-Free

Benefits

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



$V_{CES} = 600V$
 $I_C = 50A, T_C=100^\circ C$
 at $T_J=175^\circ C$
 $t_{sc} > 10\mu s, T_J=150^\circ C$
 $V_{CE(on)} \text{ typ.} = 1.95V$



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	78 ^⑤	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	50	
I_{CM}	Pulse Collector Current (Ref.Fig.C.T.5)	120	
I_{LM}	Clamped Inductive Load current ①	120	
V_{ISOL}	RMS Isolation Voltage, Terminal to Case, t=1 min.	2500	V
V_{GE}	Gate-to-Emitter Voltage	±20	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	370	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	180	
T_J	Operating Junction and	-55 to +175	°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 (1.1 N·m)	

Thermal / Mechanical Characteristics

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case- IGBT	—	—	0.41	°C/W
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount ②	—	—	62	
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount, Steady State)③	—	—	40	
Wt	Weight	—	1.44	—	g



IRGB30B60KPbF, IRGS/L30B60K

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig.
V _{(BR)CES}	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V _{GE} = 0V, I _C = 500μA	
ΔV _{(BR)CES} /ΔT _J	Temperature Coeff. of Breakdown Voltage	—	0.40	—	V/°C	V _{GE} = 0V, I _C = 1mA (25°C-150°C)	
V _{CE(on)}	Collector-to-Emitter Voltage	—	1.95	2.35	V	I _C = 30A, V _{GE} = 15V, T _J = 25°C	5,6,7
		—	2.40	2.75		I _C = 30A, V _{GE} = 15V, T _J = 150°C	8,9,10
		—	2.6	2.95		I _C = 30A, V _{GE} = 15V, T _J = 175°C	
V _{GE(th)}	Gate Threshold Voltage	3.5	4.5	5.5	V	V _{CE} = V _{GE} , I _C = 250μA	8,9,10
ΔV _{GE(th)} /ΔT _J	Threshold Voltage temp. coefficient	—	-10	—	mV/°C	V _{CE} = V _{GE} , I _C = 1.0mA (25°C-150°C)	11
g _{fe}	Forward Transconductance	—	18	—	S	V _{CE} = 50V, I _C = 50A, PW = 80μs	
I _{CES}	Zero Gate Voltage Collector Current	—	5.0	250	μA	V _{GE} = 0V, V _{CE} = 600V	
		—	1000	2000		V _{GE} = 0V, V _{CE} = 600V, T _J = 150°C	
		—	1830	3000		V _{GE} = 0V, V _{CE} = 600V, T _J = 175°C	
I _{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V _{GE} = ±20V, V _{CE} = 0V	

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

	Parameter	Min.	Typ.	Max.	Units	Conditions	Ref.Fig.	
Q _g	Total Gate Charge (turn-on)	—	102	153	nC	I _C = 30A	17	
Q _{ge}	Gate-to-Emitter Charge (turn-on)	—	14	21		V _{CC} = 400V	CT1	
Q _{gc}	Gate-to-Collector Charge (turn-on)	—	44	66		V _{GE} = 15V		
E _{on}	Turn-On Switching Loss	—	350	620	μJ	I _C = 30A, V _{CC} = 400V	CT4	
E _{off}	Turn-Off Switching Loss	—	825	955		V _{GE} = 15V, R _G = 10Ω, L = 200μH		
E _{tot}	Total Switching Loss	—	1175	1575		T _J = 25°C ④		
t _{d(on)}	Turn-On delay time	—	46	60	ns	I _C = 30A, V _{CC} = 400V	CT4	
t _r	Rise time	—	28	39		V _{GE} = 15V, R _G = 10Ω, L = 200μH		
t _{d(off)}	Turn-Off delay time	—	185	200		T _J = 25°C		
t _f	Fall time	—	31	40				
E _{on}	Turn-On Switching Loss	—	635	1085		I _C = 30A, V _{CC} = 400V		CT4
E _{off}	Turn-Off Switching Loss	—	1150	1350		V _{GE} = 15V, R _G = 10Ω, L = 200μH		12,14
E _{tot}	Total Switching Loss	—	1785	2435	T _J = 150°C ④	WF1,WF2		
t _{d(on)}	Turn-On delay time	—	46	60	ns	I _C = 30A, V _{CC} = 400V	13,15	
t _r	Rise time	—	28	39		V _{GE} = 15V, R _G = 10Ω, L = 200μH	CT4	
t _{d(off)}	Turn-Off delay time	—	205	235		T _J = 150°C	WF1	
t _f	Fall time	—	32	42			WF2	
L _E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package		
C _{ies}	Input Capacitance	—	1750	2500	pF	V _{GE} = 0V	16	
C _{oes}	Output Capacitance	—	160	255		V _{CC} = 30V		
C _{res}	Reverse Transfer Capacitance	—	60	90		f = 1.0MHz		
RBSOA	Reverse Bias Safe Operating Area	FULL SQUARE				T _J = 150°C, I _C = 120A, V _p = 600V V _{CC} =500V, V _{GE} = +15V to 0V, R _G =10Ω	4 CT2	
SCSOA	Short Circuit Safe Operating Area	10	—	—	μs	T _J = 150°C, V _p = 600V, R _G = 10Ω V _{CC} =360V, V _{GE} = +15V to 0V	CT3 WF3	
I _{sc (Peak)}	Peak Short Circuit Collector Current	—	200	—	A		WF3	

Note ① to ⑤ are on page 13

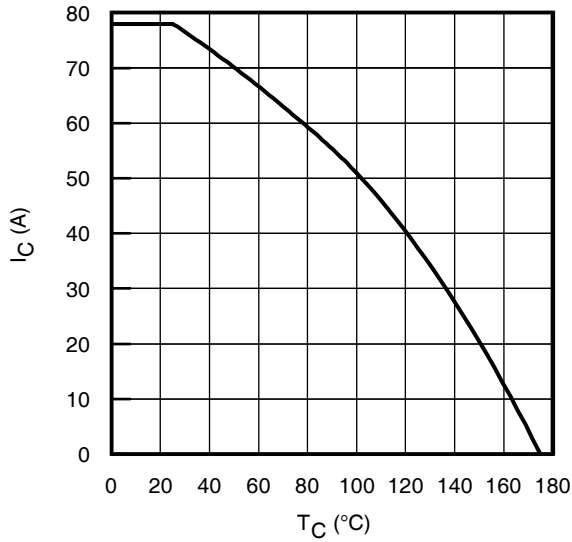


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

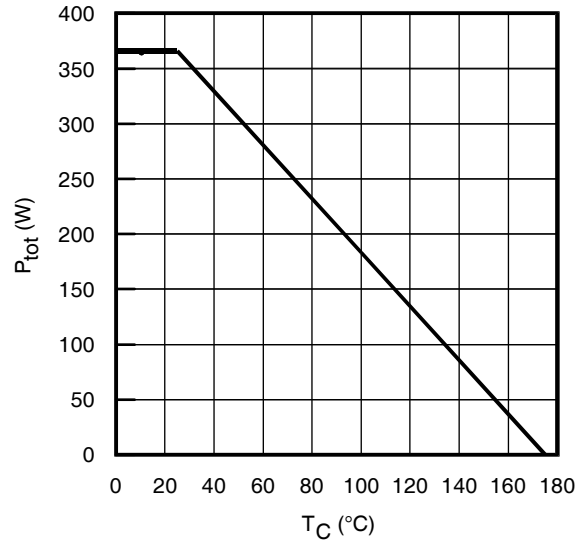


Fig. 2 - Power Dissipation vs. Case Temperature

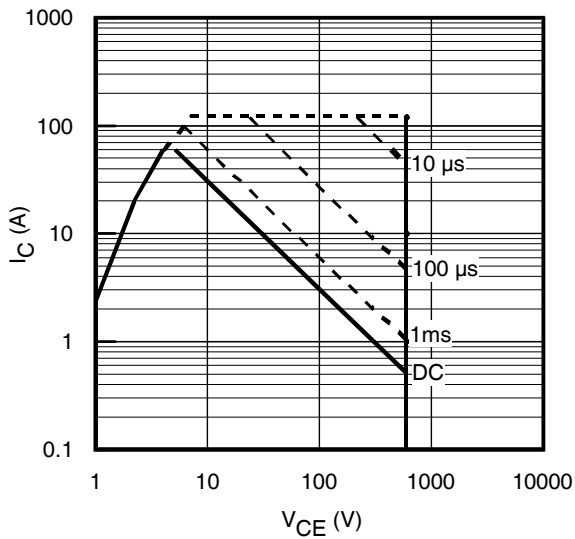


Fig. 3 - Forward SOA
 $T_C = 25^\circ\text{C}$; $T_J \leq 150^\circ\text{C}$

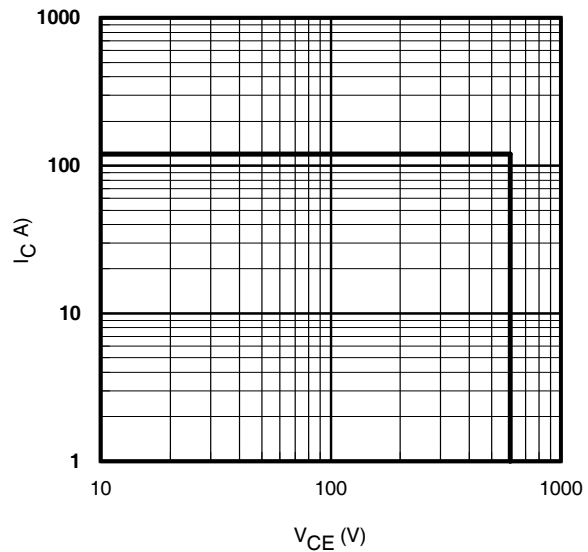


Fig. 4 - Reverse Bias SOA
 $T_J = 150^\circ\text{C}$; $V_{GE} = 15\text{V}$

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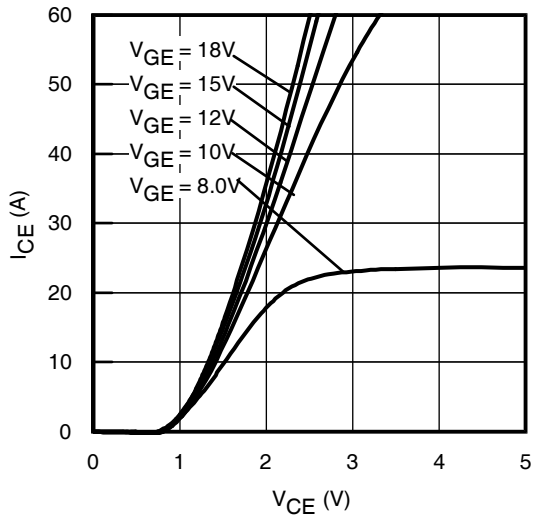


Fig. 5 - Typ. IGBT Output Characteristics
 $T_J = -40^\circ\text{C}$; $t_p = 80\mu\text{s}$

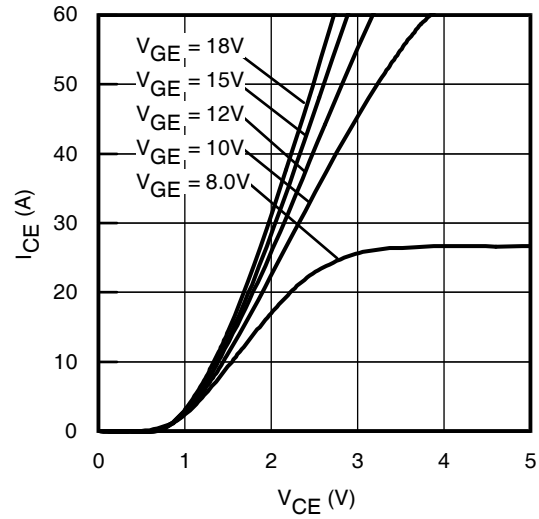


Fig. 6 - Typ. IGBT Output Characteristics
 $T_J = 25^\circ\text{C}$; $t_p = 80\mu\text{s}$

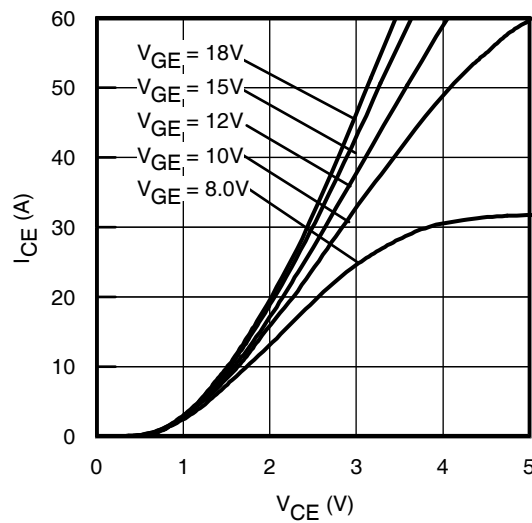


Fig. 7 - Typ. IGBT Output Characteristics
 $T_J = 150^\circ\text{C}$; $t_p = 80\mu\text{s}$

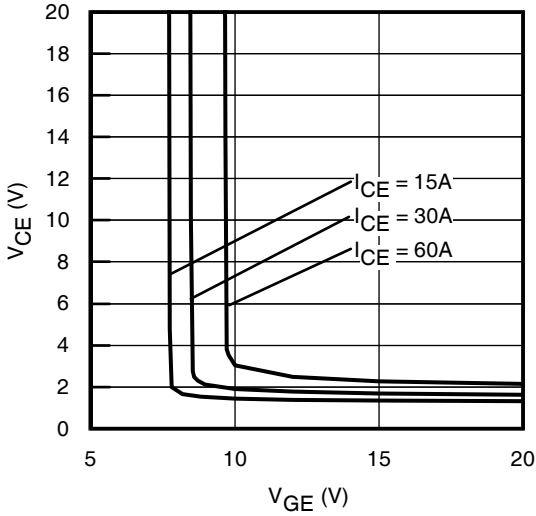


Fig. 8 - Typical V_{CE} vs. V_{GE}
 $T_J = -40^\circ\text{C}$

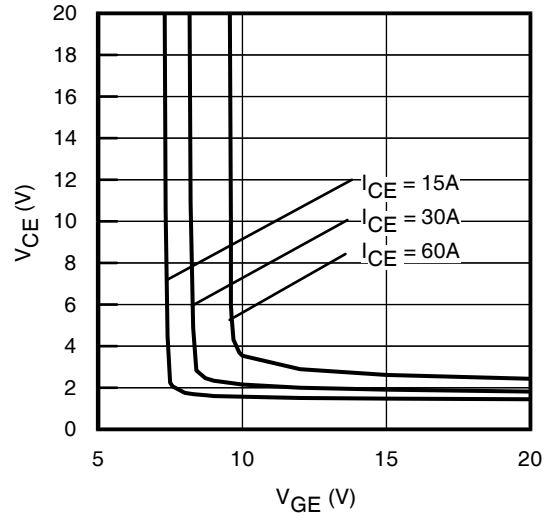


Fig. 9 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^\circ\text{C}$

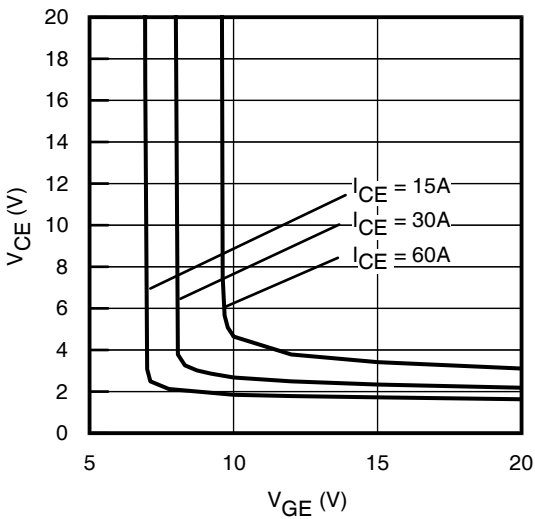


Fig. 10 - Typical V_{CE} vs. V_{GE}
 $T_J = 150^\circ\text{C}$

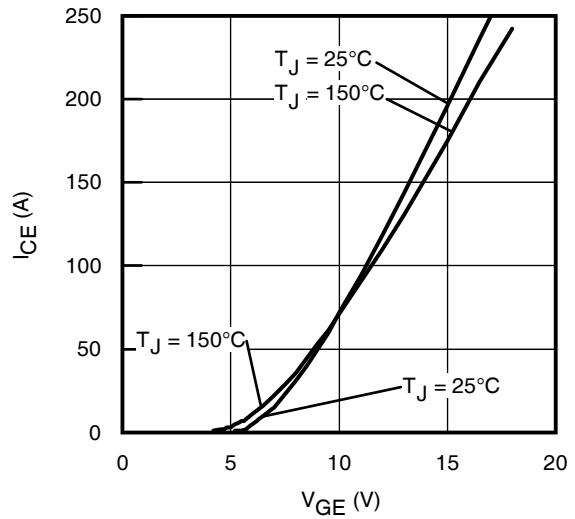


Fig. 11 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 10\mu\text{s}$

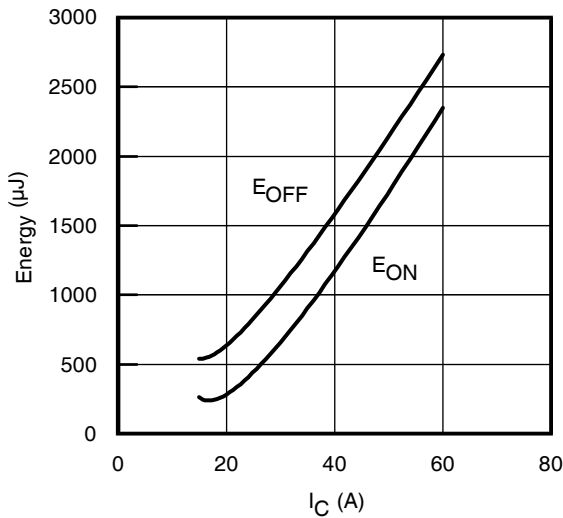


Fig. 12 - Typ. Energy Loss vs. I_C
 $T_J = 150^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=400\text{V}$,
 $R_G=10\Omega$; $V_{GE}=15\text{V}$

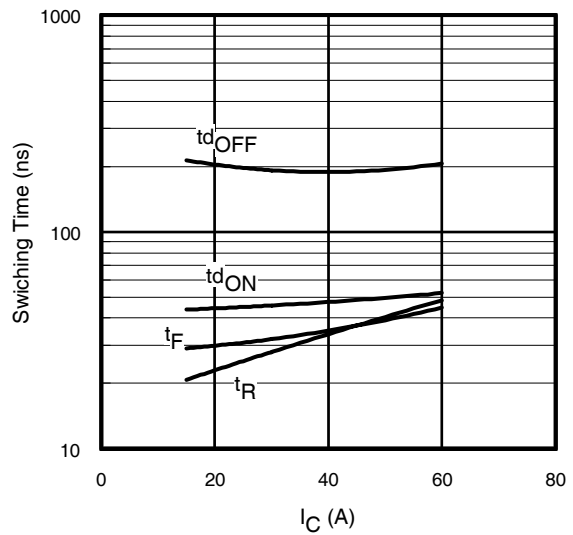


Fig. 13 - Typ. Switching Time vs. I_C
 $T_J = 150^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=400\text{V}$
 $R_G=10\Omega$; $V_{GE}=15\text{V}$

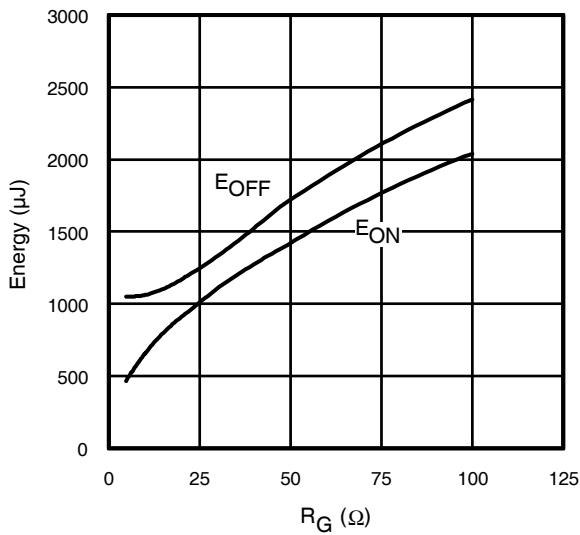


Fig. 14 - Typ. Energy Loss vs. R_G
 $T_J = 150^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=400\text{V}$
 $I_{CE}=30\text{A}$; $V_{GE}=15\text{V}$

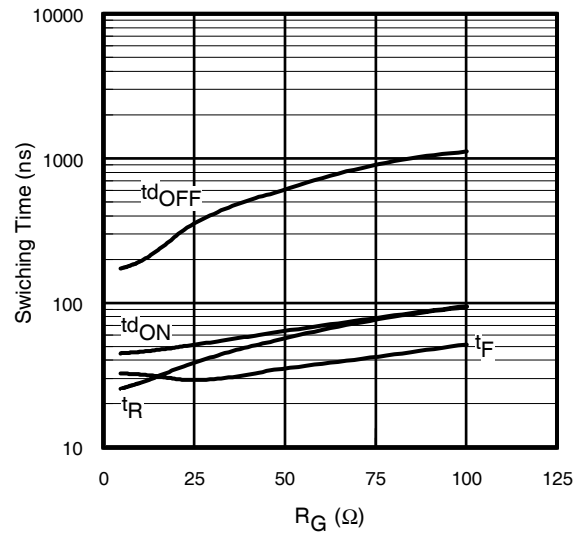


Fig. 15 - Typ. Switching Time vs. R_G
 $T_J = 150^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=400\text{V}$
 $I_{CE}=30\text{A}$; $V_{GE}=15\text{V}$

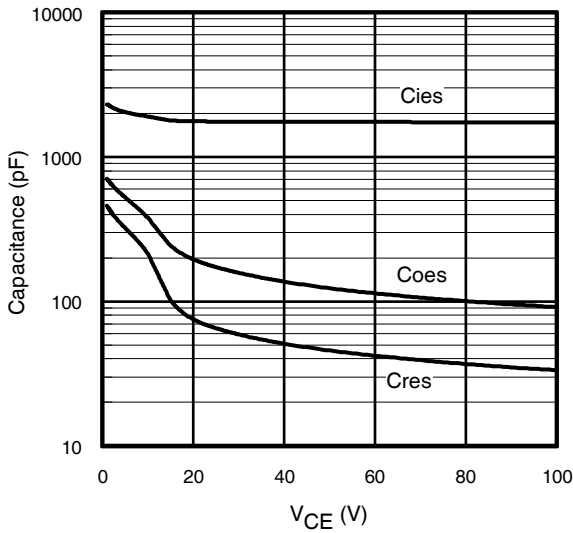


Fig. 16- Typ. Capacitance vs. V_{CE}
 $V_{GE} = 0V$; $f = 1MHz$

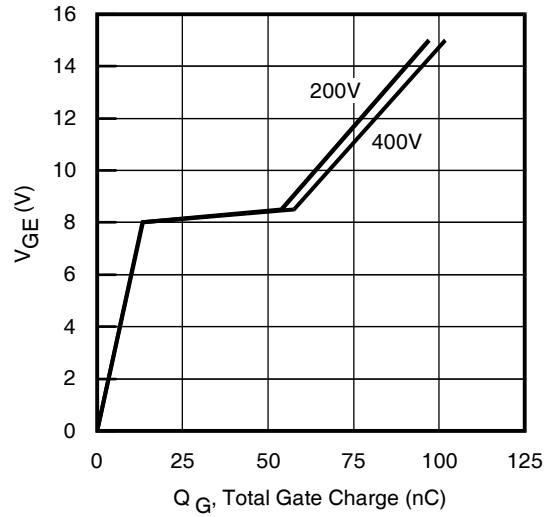


Fig. 17 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 30A$; $L = 600\mu H$

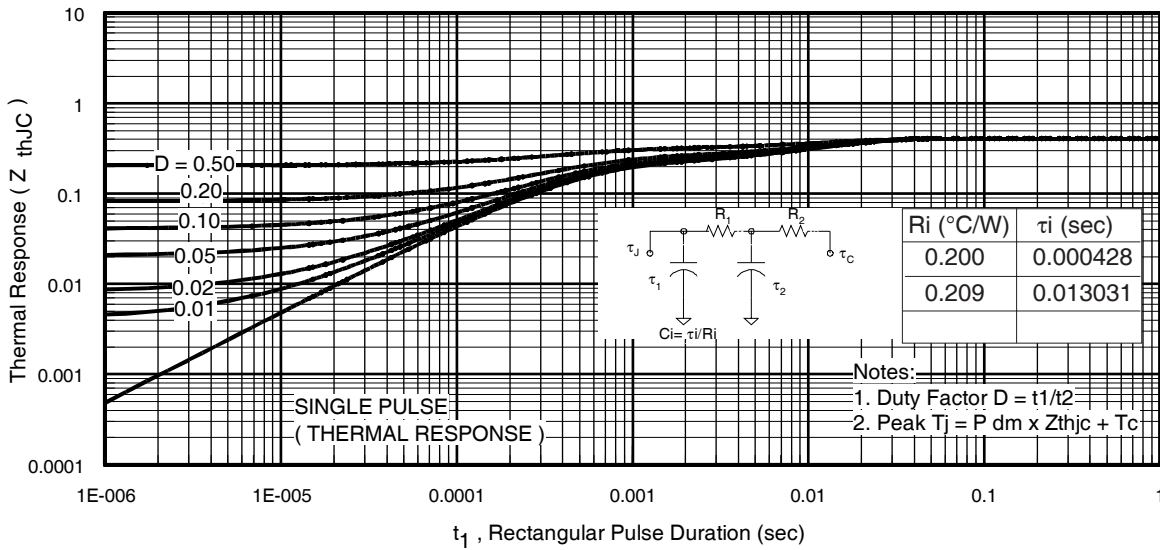


Fig 18. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

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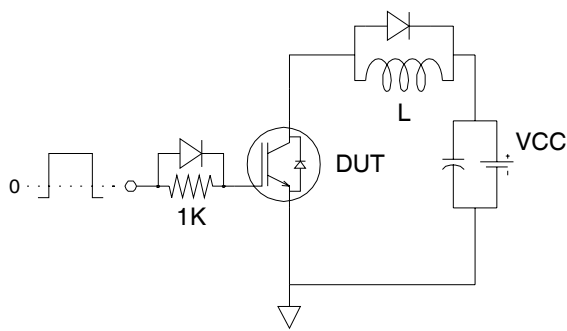


Fig.C.T.1 - Gate Charge Circuit (turn-off)

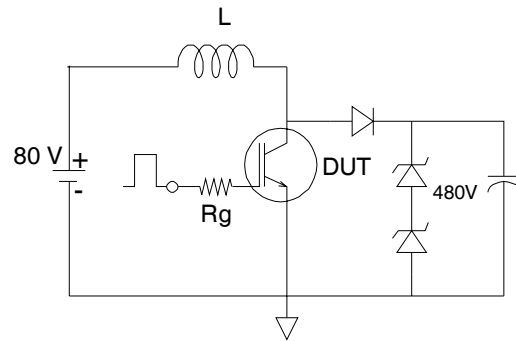


Fig.C.T.2 - RBSOA Circuit

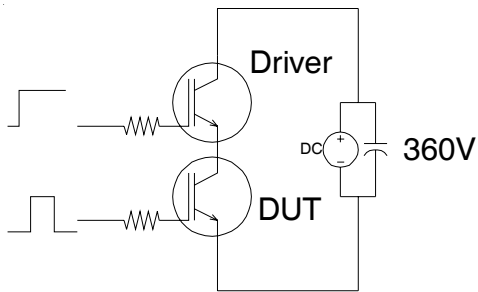


Fig.C.T.3 - S.C.SOA Circuit

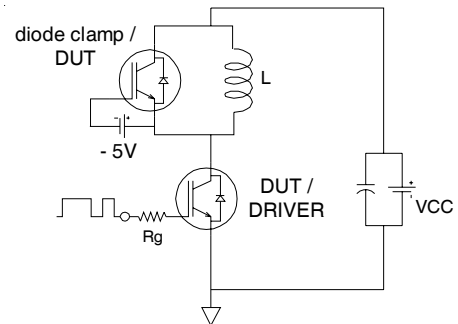


Fig.C.T.4 - Switching Loss Circuit

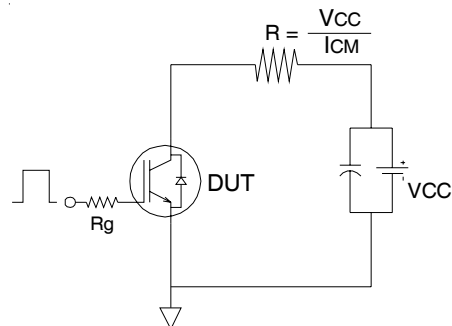


Fig.C.T.5 - Resistive Load Circuit

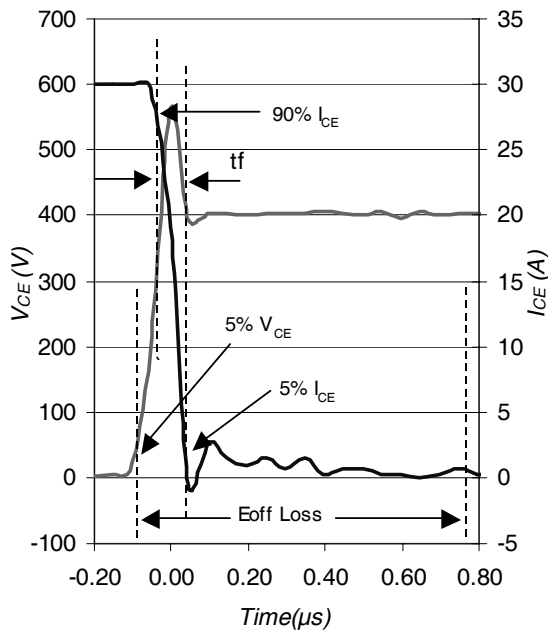


Fig. WF1- Typ. Turn-off Loss Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.4

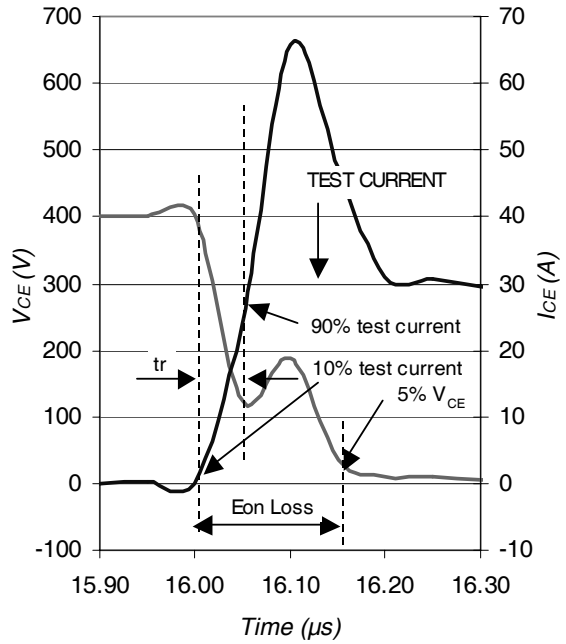


Fig. WF2- Typ. Turn-on Loss Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.4

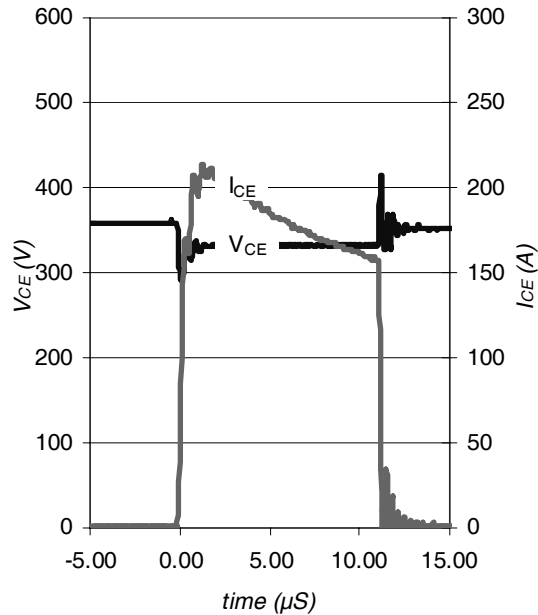
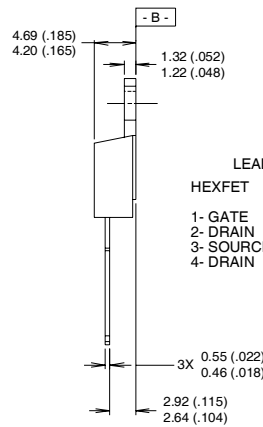
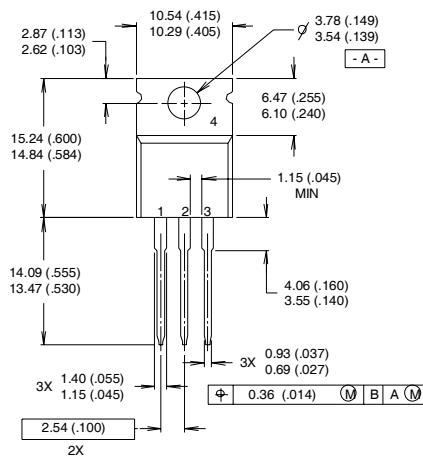


Fig. WF3- Typ. S.C. Waveform
@ $T_C = 150^\circ\text{C}$ using Fig. CT.3

IRGB30B60KPbF, IRGS/L30B60K

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



LEAD ASSIGNMENTS

HEXFET	IGBTs, CoPACK
1- GATE	1- GATE
2- DRAIN	2- COLLECTOR
3- SOURCE	3- EMITTER
4- DRAIN	4- COLLECTOR

NOTES:

- 1 DIMENSIONING & TOLERANCING PER ANSI Y14.5M, 1982.
- 2 CONTROLLING DIMENSION : INCH

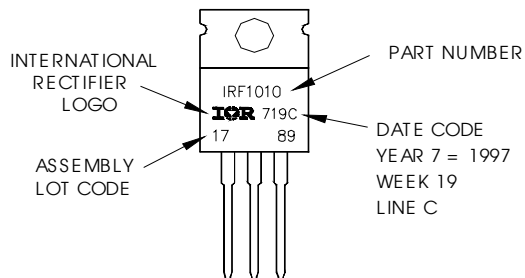
- 3 OUTLINE CONFORMS TO JEDEC OUTLINE TO-220AB.
- 4 HEATSINK & LEAD MEASUREMENTS DO NOT INCLUDE BURRS.

TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010

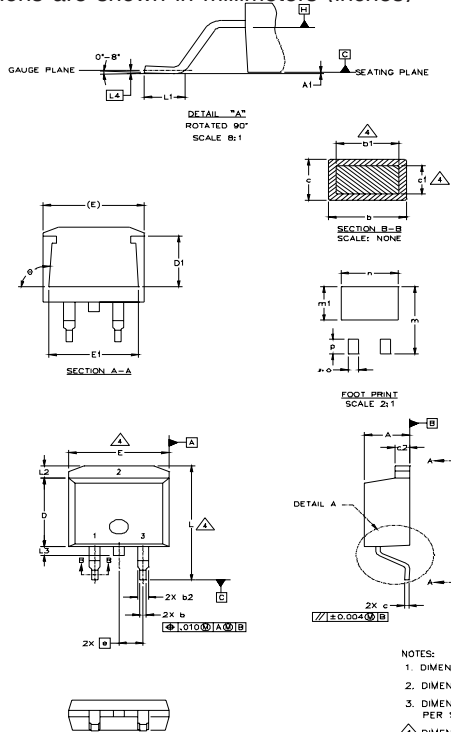
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"

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



D²Pak Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1	0.127			.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	3
c2	1.14	1.40	.045	.055	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	14.61	15.88	.575	.625	
L1	1.78	2.79	.070	.110	
L2		1.65		.065	
L3	1.27	1.78	.050	.070	
L4	0.25 BSC		.010 BSC		
m	17.78		.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
θ	90°	93°	90°	93°	

LEAD ASSIGNMENTS

HEXFET	IGBTs, CoPACK	DIODES
1.- GATE	1.- GATE	1.- ANODE *
2.- DRAIN	2.- COLLECTOR	2.- CATHODE
3.- SOURCE	3.- EMITTER	3.- ANODE

* PART DEPENDENT.

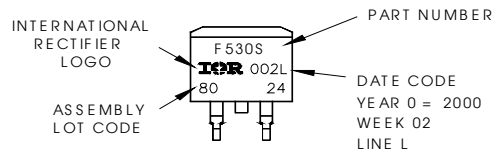
NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
- △ DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
- CONTROLLING DIMENSION: INCH.

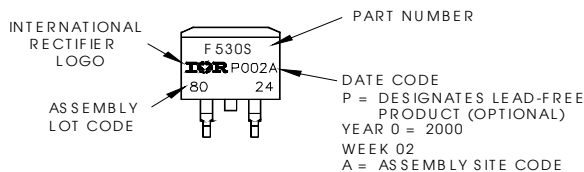
D²Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW 02, 2000
IN THE ASSEMBLY LINE "L"

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

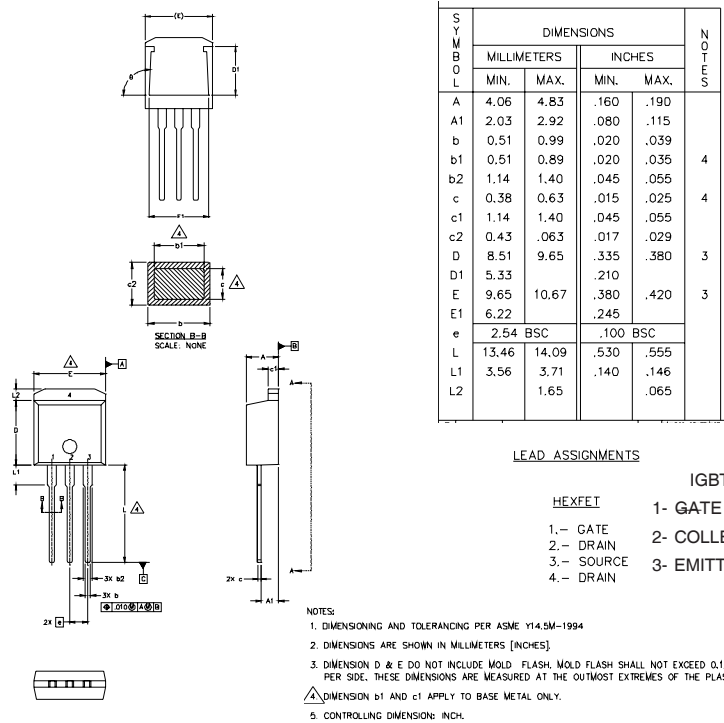


OR



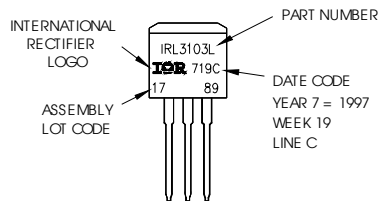
IRGB30B60KPbF, IRGS/L30B60K

TO-262 Package Outline

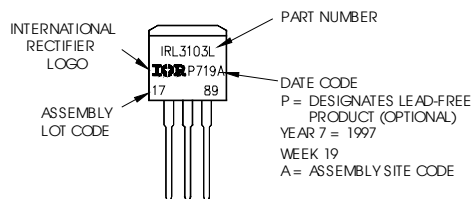


TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L
 LOT CODE 1789
 ASSEMBLED ON WW 19, 1997
 IN THE ASSEMBLY LINE "C"
 Note: "P" in assembly line position indicates "Lead-Free"



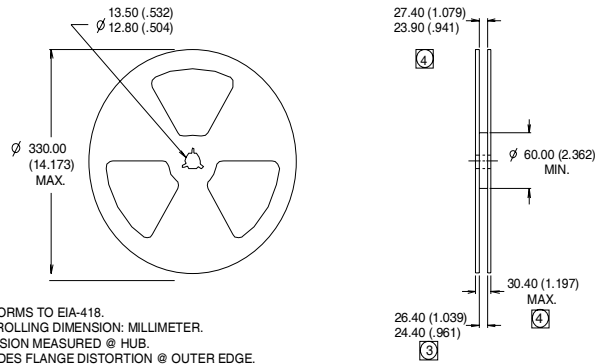
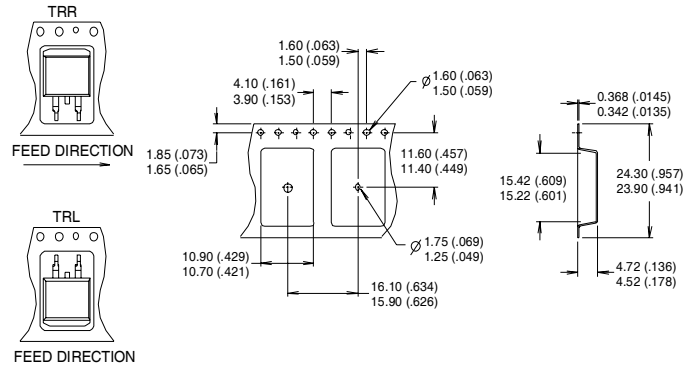
OR



IRGB30B60KPbF, IRGS/L30B60K

D²Pak Tape & Reel Infomation

Dimensions are shown in millimeters (inches)



- NOTES:
1. CONFORMS TO EIA-418.
 2. CONTROLLING DIMENSION: MILLIMETER.
 - ① DIMENSION MEASURED @ HUB.
 - ② INCLUDES FLANGE DISTORTION @ OUTER EDGE.

Notes:

- ① $V_{CC} = 80\% (V_{CES})$, $V_{GE} = 15V$, $L = 28\mu H$, $R_G = 22\Omega$.
- ② This is only applied to TO-220AB package.
- ③ This is applied to D²Pak, when mounted on 1" square PCB (FR-4 or G-10 Material).
For recommended footprint and soldering techniques refer to application note #AN-994.
- ④ Energy losses include "tail" and diode reverse recovery.
- ⑤ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.

TO-220AB package is not recommended for Surface Mount Application.

Data and specifications subject to change without notice.

International


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TAC Fax: (310) 252-7903

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