

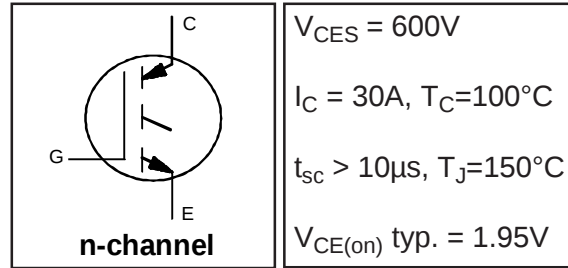
International
IR Rectifier

INSULATED GATE BIPOLAR TRANSISTOR

IRGS30B60K
IRGSL30B60K

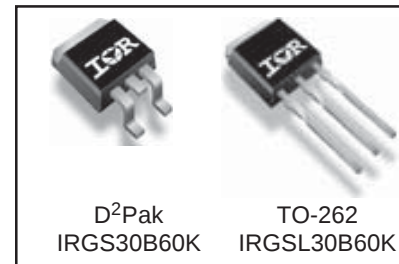
Features

- Low VCE (on) Non Punch Through IGBT Technology.
- 10 μ s Short Circuit Capability.
- Square RBSOA.
- Positive VCE (on) Temperature Coefficient.
- Maximum Junction Temperature rated at 150°C.



Benefits

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



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	60	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	30	
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	W
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	304	
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	122	
T_J	Operating Junction and	-55 to +150	$^\circ C$
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 (1.1 N-m)	

Thermal / Mechanical Characteristics

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

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	600	—	—	V	$V_{GE} = 0V, I_C = 500\mu A$	
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.40	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1mA (25^\circ\text{C}-150^\circ\text{C})$	
$V_{CE(on)}$	Collector-to-Emitter Voltage	—	1.95	2.35	V	$I_C = 30A, V_{GE} = 15V, T_J = 25^\circ\text{C}$	5,6,7
		—	2.40	2.75		$I_C = 30A, V_{GE} = 15V, T_J = 150^\circ\text{C}$	8,9,10
$V_{GE(th)}$	Gate Threshold Voltage	3.5	4.5	5.5	V	$V_{CE} = V_{GE}, I_C = 250\mu A$	8,9,10
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-10	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 1.0mA (25^\circ\text{C}-150^\circ\text{C})$	11
gfe	Forward Transconductance	—	18	—	S	$V_{CE} = 50V, I_C = 50A, PW = 80\mu s$	
I_{CES}	Zero Gate Voltage Collector Current	—	5.0	250	μA	$V_{GE} = 0V, V_{CE} = 600V$	
		—	1000	2000		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$	
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)	—	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		$V_{GE} = 15V, R_G = 10\Omega, L = 200\mu H$	
E_{tot}	Total Switching Loss	—	1175	1575		$T_J = 25^\circ\text{C}$ ③	
$t_{d(on)}$	Turn-On delay time	—	46	60	ns	$I_C = 30A, V_{CC} = 400V$	CT4
t_r	Rise time	—	28	39		$V_{GE} = 15V, R_G = 10\Omega, L = 200\mu H$	
$t_{d(off)}$	Turn-Off delay time	—	185	200		$T_J = 25^\circ\text{C}$	
t_f	Fall time	—	31	40			
E_{on}	Turn-On Switching Loss	—	635	1085	μJ	$I_C = 30A, V_{CC} = 400V$	CT4
E_{off}	Turn-Off Switching Loss	—	1150	1350		$V_{GE} = 15V, R_G = 10\Omega, L = 200\mu H$	12,14
E_{tot}	Total Switching Loss	—	1785	2435		$T_J = 150^\circ\text{C}$ ③	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		$V_{GE} = 15V, R_G = 10\Omega, L = 200\mu H$	CT4
$t_{d(off)}$	Turn-Off delay time	—	205	235		$T_J = 150^\circ\text{C}$	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	—	pF	$V_{GE} = 0V$	16
C_{oes}	Output Capacitance	—	160	—		$V_{CC} = 30V$	
C_{res}	Reverse Transfer Capacitance	—	60	—		$f = 1.0MHz$	
RB SOA	Reverse Bias Safe Operating Area	FULL SQUARE				$T_J = 150^\circ\text{C}, I_C = 120A, V_p = 600V$ $V_{CC}=500V, V_{GE} = +15V \text{ to } 0V, R_G = 10\Omega$	4 CT2
SC SOA	Short Circuit Safe Operating Area	10	—	—	μs	$T_J = 150^\circ\text{C}, V_p = 600V, R_G = 10\Omega$ $V_{CC}=360V, V_{GE} = +15V \text{ to } 0V$	CT3 WF3
$I_{SC}(\text{Peak})$	Peak Short Circuit Collector Current	—	200	—	A		WF3

Note ① to ③ are on page 12

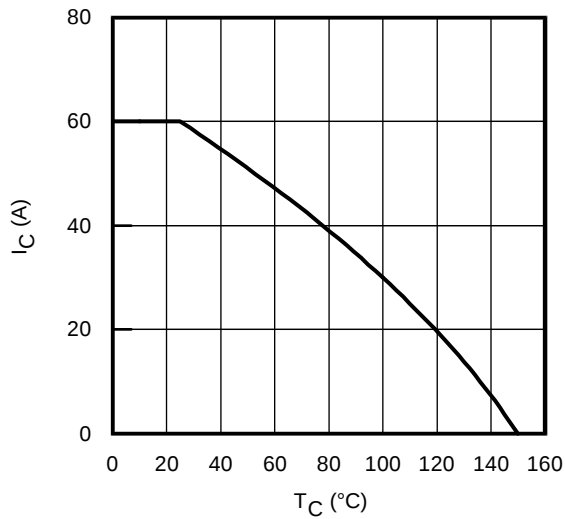


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

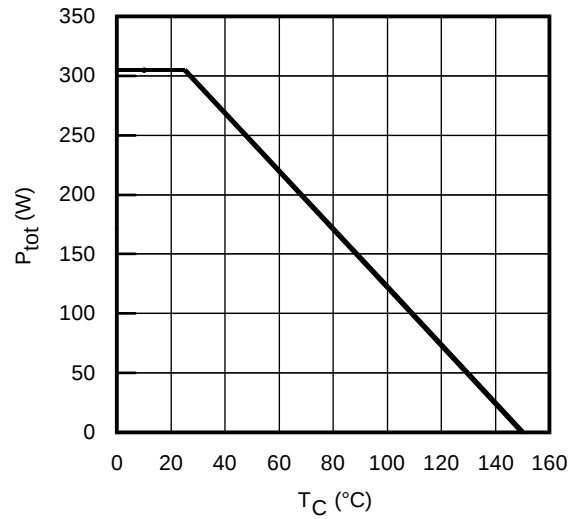


Fig. 2 - Power Dissipation vs. Case Temperature

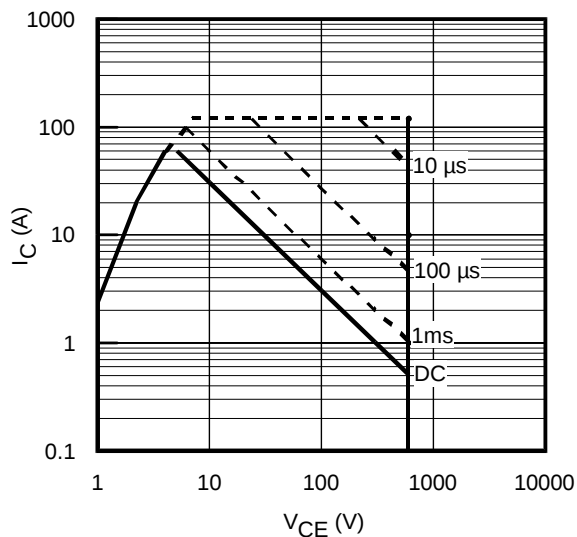


Fig. 3 - Forward SOA
 $T_C = 25^{\circ}\text{C}$; $T_J \leq 150^{\circ}\text{C}$

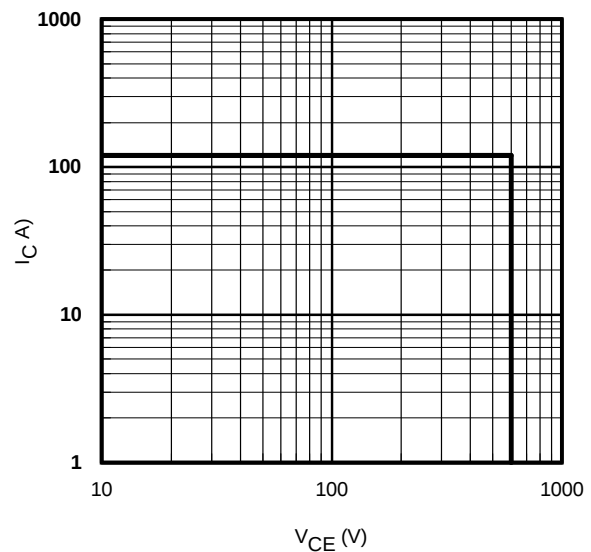


Fig. 4 - Reverse Bias SOA
 $T_J = 150^{\circ}\text{C}$; $V_{GE} = 15\text{V}$

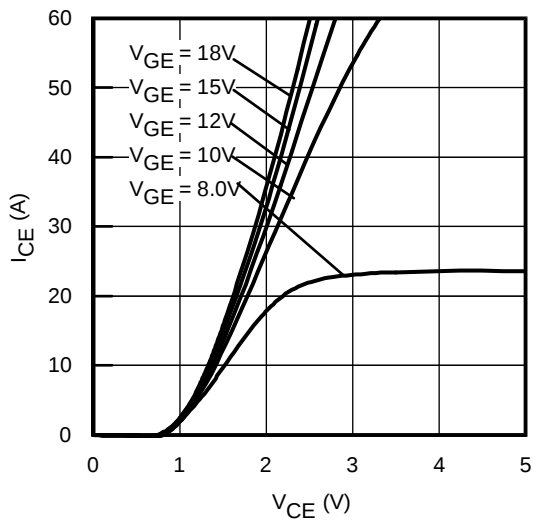


Fig. 5 - Typ. IGBT Output Characteristics
 $T_J = -40^\circ\text{C}$; $t_p = 80\mu\text{s}$

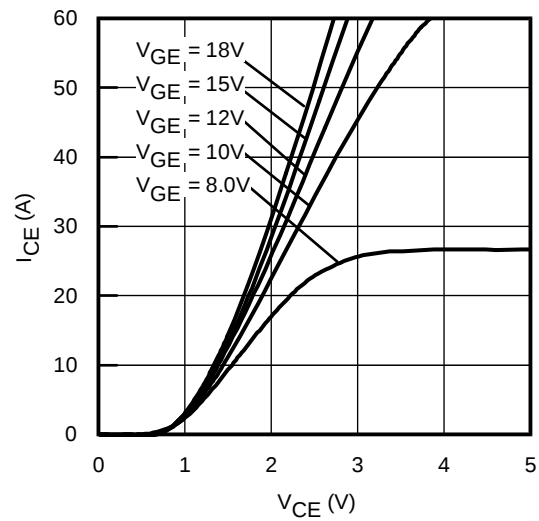


Fig. 6 - Typ. IGBT Output Characteristics
 $T_J = 25^\circ\text{C}$; $t_p = 80\mu\text{s}$

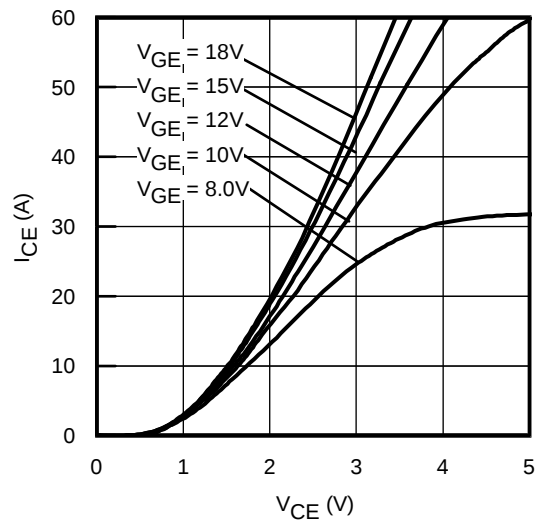


Fig. 7 - Typ. IGBT Output Characteristics
 $T_J = 150^\circ\text{C}$; $t_p = 80\mu\text{s}$

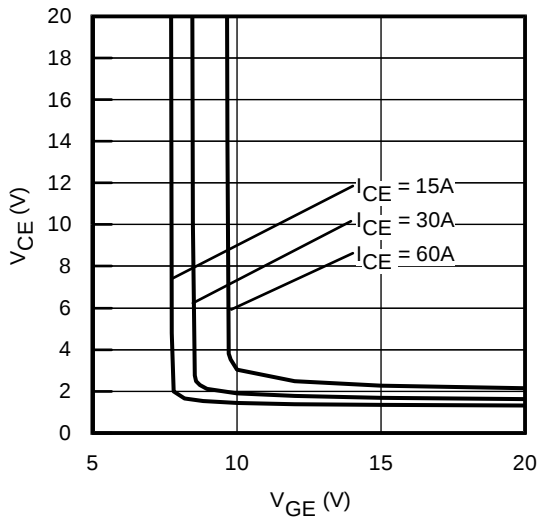


Fig. 8 - Typical V_{CE} vs. V_{GE}
 $T_J = -40^{\circ}\text{C}$

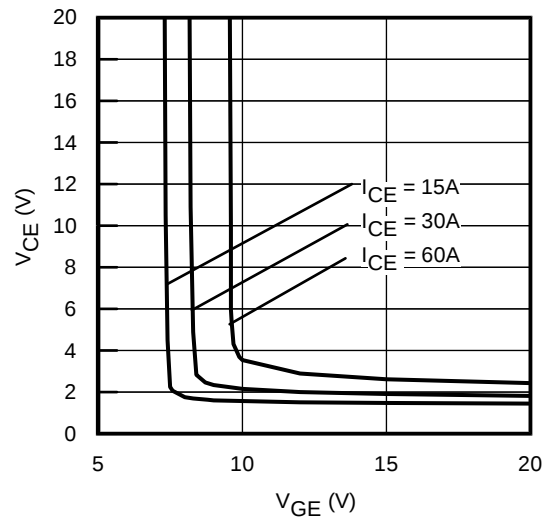


Fig. 9 - Typical V_{CE} vs. V_{GE}
 $T_J = 25^{\circ}\text{C}$

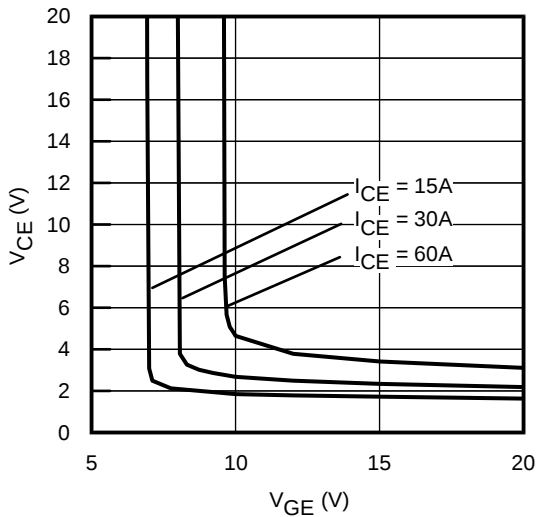


Fig. 10 - Typical V_{CE} vs. V_{GE}
 $T_J = 150^{\circ}\text{C}$

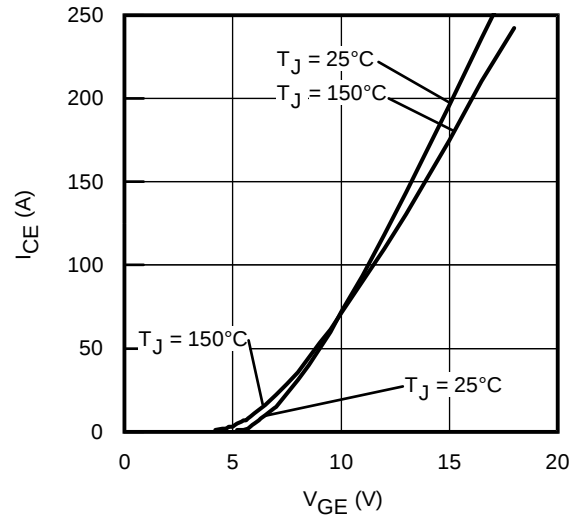


Fig. 11 - Typ. Transfer Characteristics
 $V_{CE} = 50\text{V}$; $t_p = 10\mu\text{s}$

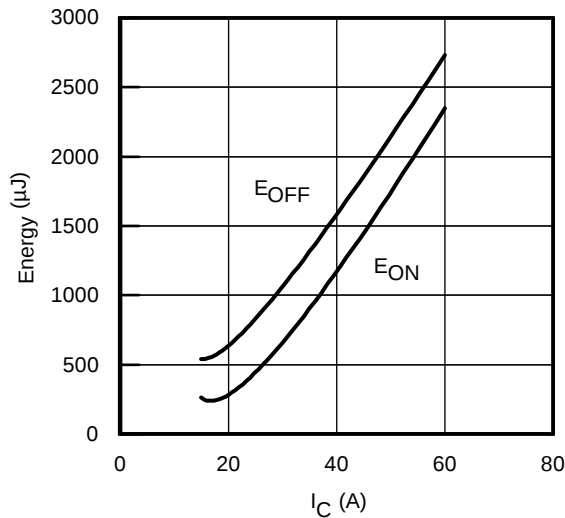


Fig. 12 - Typ. Energy Loss vs. I_C
 $T_J = 150^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=400\text{V}$,
 $R_G=10\Omega$; $V_{GE}=15\text{V}$

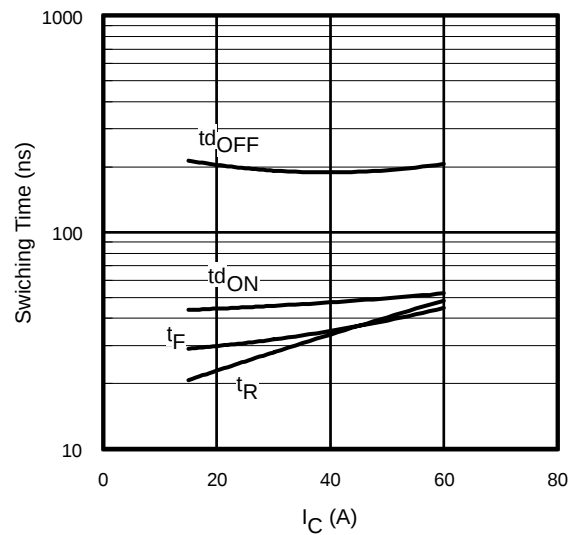


Fig. 13 - Typ. Switching Time vs. I_C
 $T_J = 150^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=400\text{V}$
 $R_G=10\Omega$; $V_{GE}=15\text{V}$

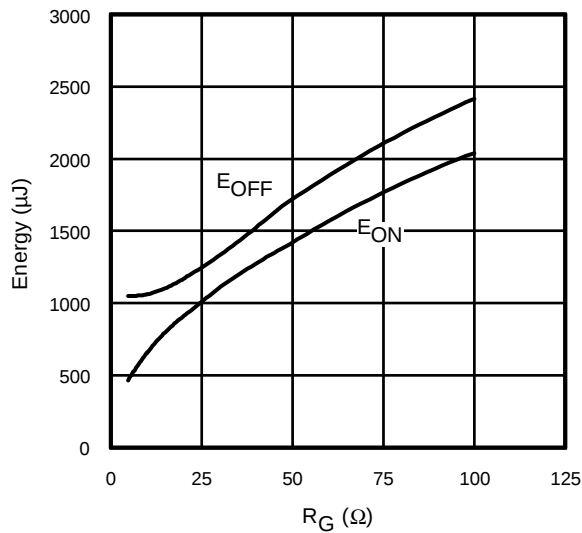


Fig. 14 - Typ. Energy Loss vs. R_G
 $T_J = 150^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=400\text{V}$
 $I_{CE}=30\text{A}$; $V_{GE}=15\text{V}$

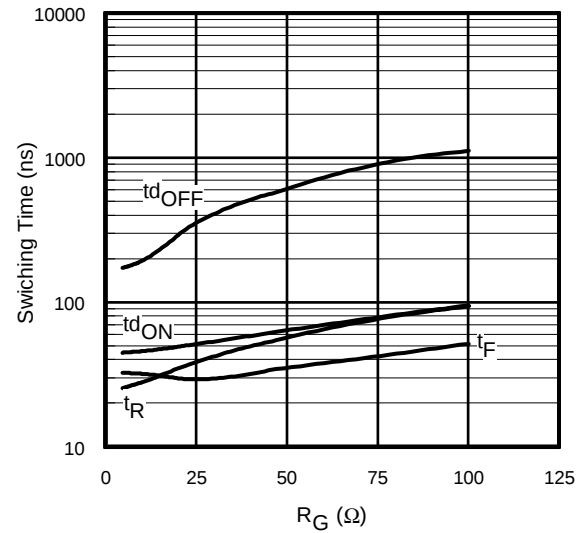


Fig. 15 - Typ. Switching Time vs. R_G
 $T_J = 150^\circ\text{C}$; $L=200\mu\text{H}$; $V_{CE}=400\text{V}$
 $I_{CE}=30\text{A}$; $V_{GE}=15\text{V}$

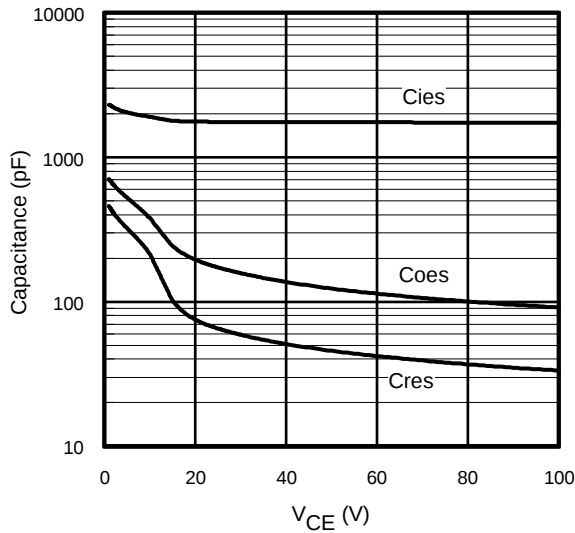


Fig. 16- Typ. Capacitance vs. V_{CE}
 $V_{GE} = 0V$; $f = 1MHz$

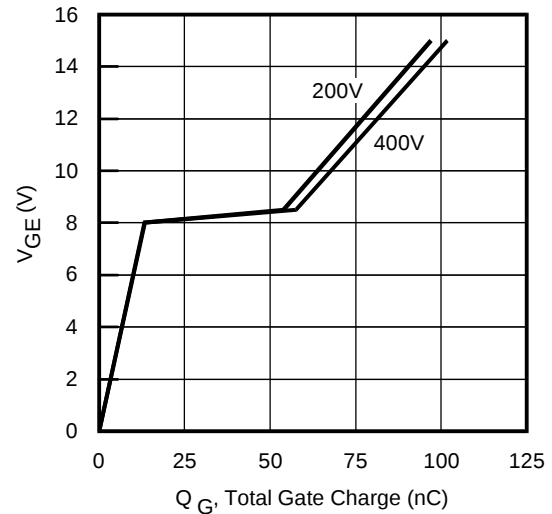


Fig. 17 - Typical Gate Charge vs. V_{GE}
 $I_{CE} = 30A$; $L = 600\mu H$

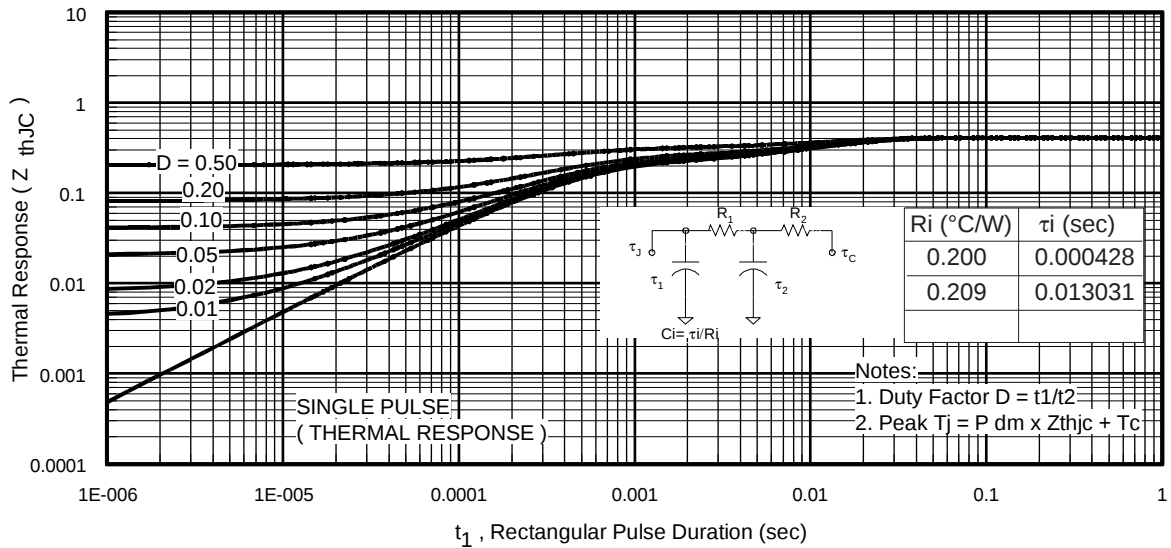


Fig 18. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

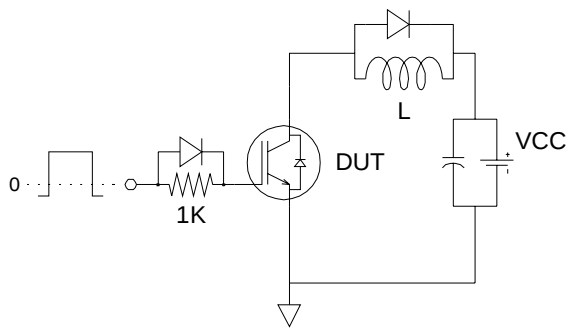


Fig.C.T.1 - Gate Charge Circuit (turn-off)

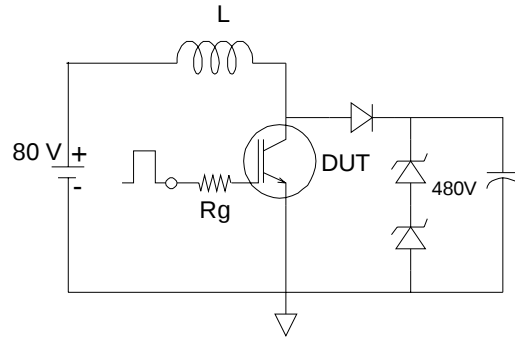


Fig.C.T.2 - RBSOA Circuit

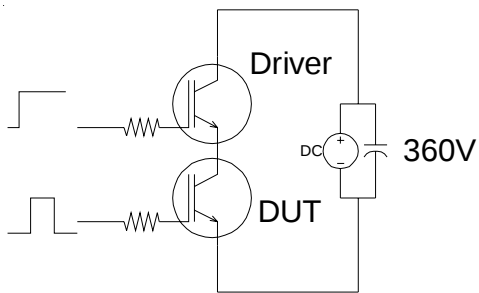


Fig.C.T.3 - S.C.SOA Circuit

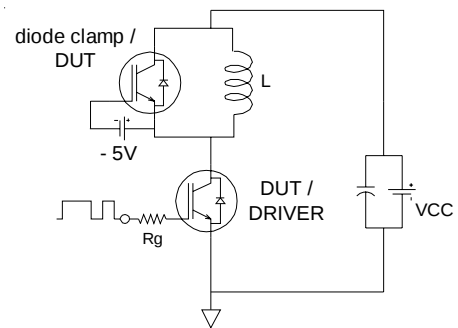


Fig.C.T.4 - Switching Loss Circuit

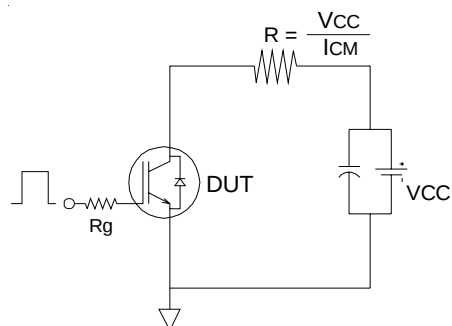


Fig.C.T.5 - Resistive Load Circuit

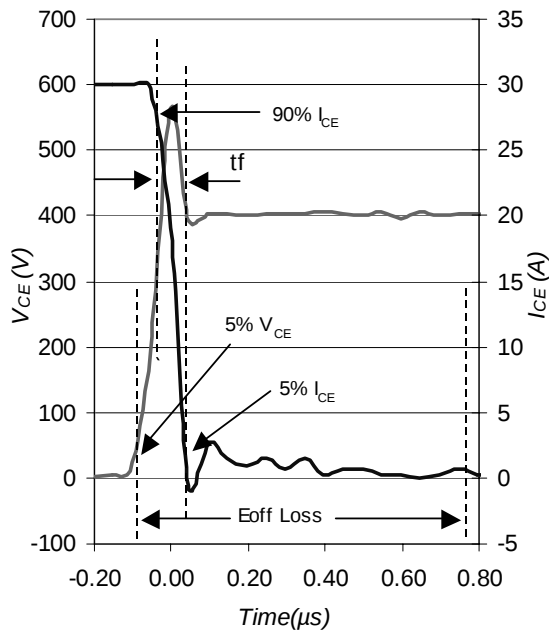


Fig. WF1- Typ. Turn-off Loss Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.4

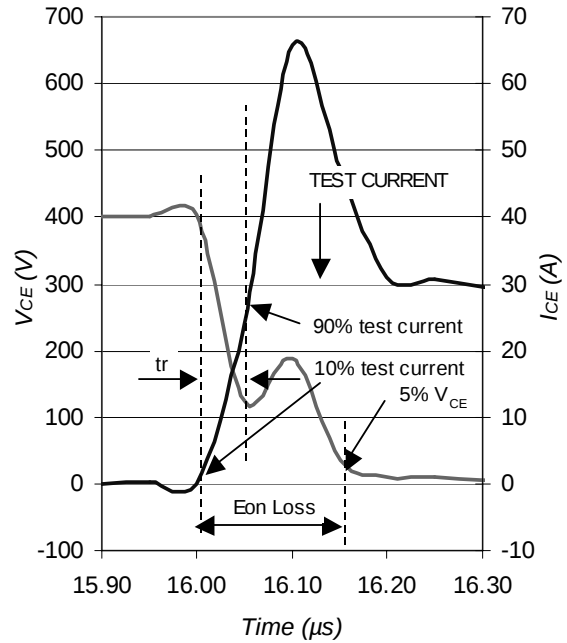


Fig. WF2- Typ. Turn-on Loss Waveform
@ $T_J = 150^\circ\text{C}$ using Fig. CT.4

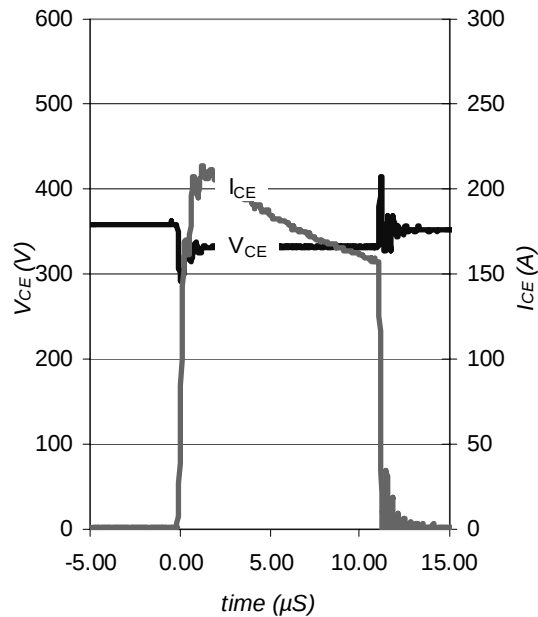


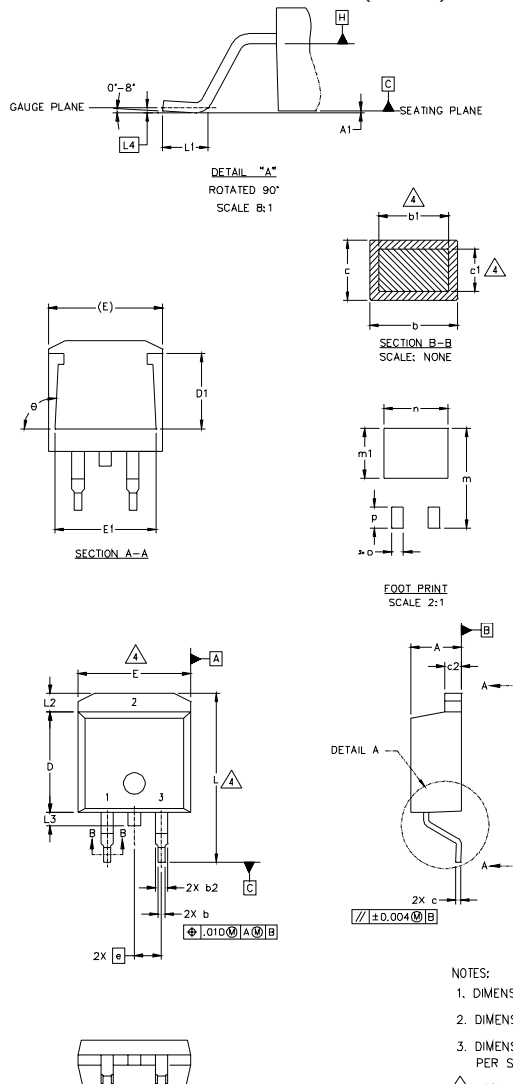
Fig. WF3- Typ. S.C Waveform
@ $T_C = 150^\circ\text{C}$ using Fig. CT.3

IRGS/SL30B60K

International
IR Rectifier

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	
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		3
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	93°	.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
θ	90°		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

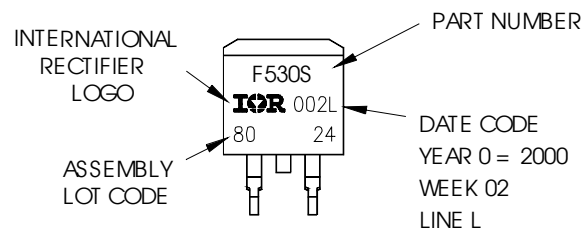
* PART DEPENDENT.

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.

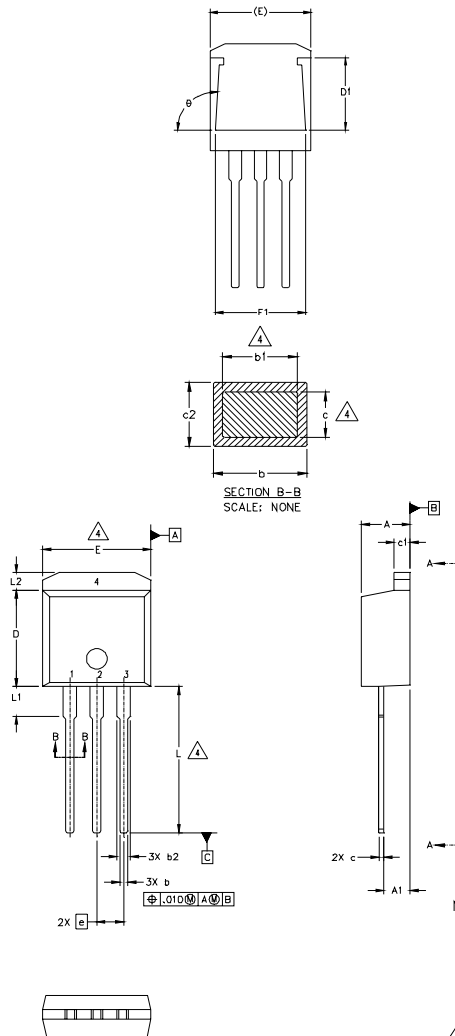
D²Pak Part Marking Information

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



TO-262 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	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.38	0.63	.015	.025	
c1	1.14	1.40	.045	.055	
c2	0.43	.063	.017	.029	
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	13.46	14.09	.530	.555	
L1	3.56	3.71	.140	.146	
L2		1.65		.065	

LEAD ASSIGNMENTS

HEXFET

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

IGBT

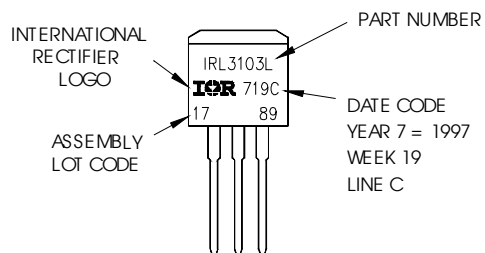
- 1- GATE
- 2- COLLECTOR
- 3- EMITTER
- 4- COLLECTOR

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
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 OUTMOST EXTREMES OF THE PLASTIC BODY.
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

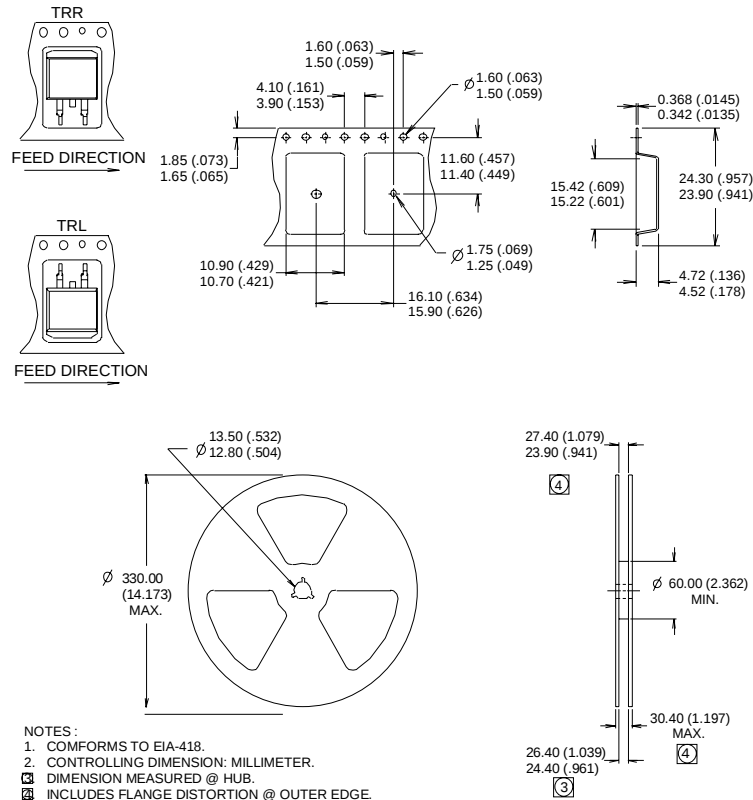
TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"



D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



Notes:

- ① $V_{CC} = 80\% (V_{CES})$, $V_{GE} = 15V$, $L = 28\mu H$, $R_G = 22\Omega$.
- ② 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.
- ③ Energy losses include "tail" and diode reverse recovery.

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial market.
Qualification Standards can be found on IR's Web site.

International
IR Rectifier

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Visit us at www.irf.com for sales contact information. 07/03