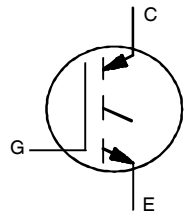
PD - 94799A

International
IOR Rectifier

IRGB30B60K
IRGS30B60K
IRGSL30B60K

INSULATED GATE BIPOLAR TRANSISTOR



n-channel

V_{CES} = 600V

I_C = 50A, T_C=100°C
at T_J=175°C

t_{sc} > 10µs, T_J=150°C

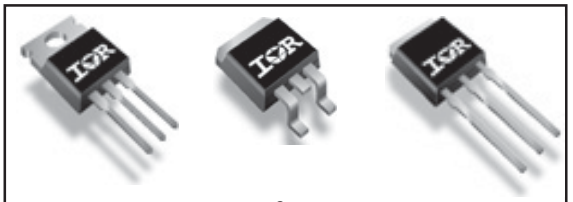
$V_{CE(on)}$ typ. = 1.95V

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.

Benefits

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



TO-220AB
IRGB30B60K

D^2Pak
IRGS30B60K

TO-262
IRGSL30B60K

Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
I_C @ T_C = 25°C	Continuous Collector Current	78⑤	A
I_C @ T_C = 100°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°C	Maximum Power Dissipation	370	W
P_D @ T_C = 100°C	Maximum Power Dissipation	180	
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to +175	°C
	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

02/26/04

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	
$\Delta V_{(BR)CES}/\Delta T_J$	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
$\Delta V_{GE(th)}/\Delta T_J$	Threshold Voltage temp. coefficient	—	-10	—	mV/°C	V_{CE} = V_{GE}, I_C = 1.0mA (25°C-150°C)	11
gfe	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	
t_r	Rise time	—	28	39		V_{GE} = 15V, R_G = 10Ω, L = 200µH	CT4
$t_{d(off)}$	Turn-Off delay time	—	185	200		T_J = 25°C	
t_f	Fall time	—	31	40			
E_{on}	Turn-On Switching Loss	—	635	1085	µJ	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	
C_{oes}	Output Capacitance	—	160	255		V_{CC} = 30V	16
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, Vp = 600V	4
						V_{CC}=500V,V_{GE} = +15V to 0V,R_G =10Ω	CT2
SCSOA	Short Circuit Safe Operating Area	10	—	—	µs	T_J = 150°C, Vp = 600V, R_G = 10Ω	CT3
						V_{CC}=360V,V_{GE} = +15V to 0V	WF3
I_{SC} (Peak)	Peak Short Circuit Collector Current	—	200	—	A		WF3

Note ① to ⑤ are on page 13

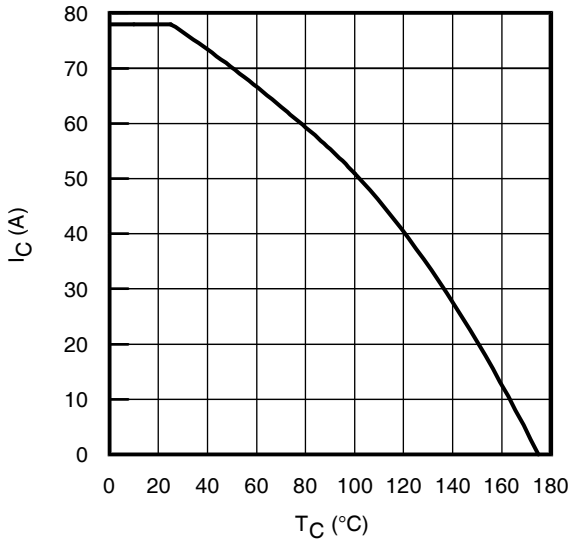


Fig. 1 - Maximum DC Collector Current vs. Case Temperature

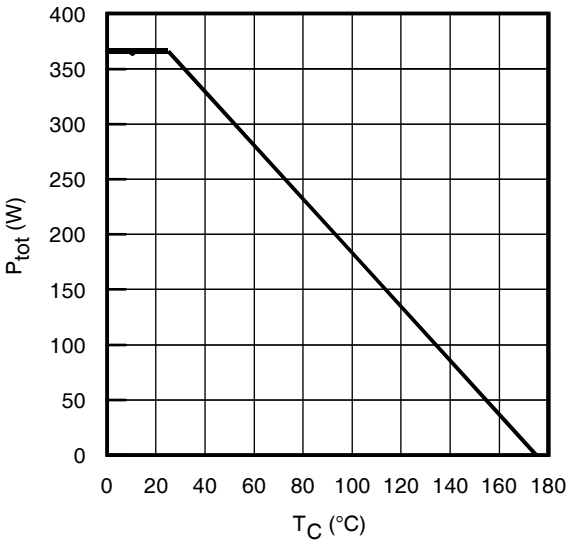


Fig. 2 - Power Dissipation vs. Case Temperature

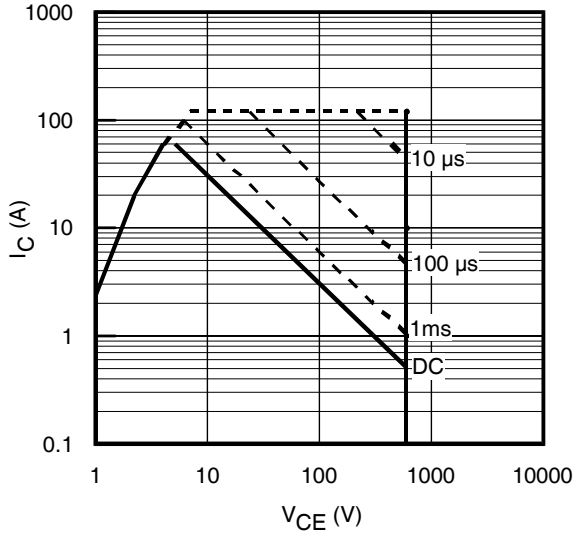


Fig. 3 - Forward SOA
T_C = 25°C; $T_J \leq$ 150°C

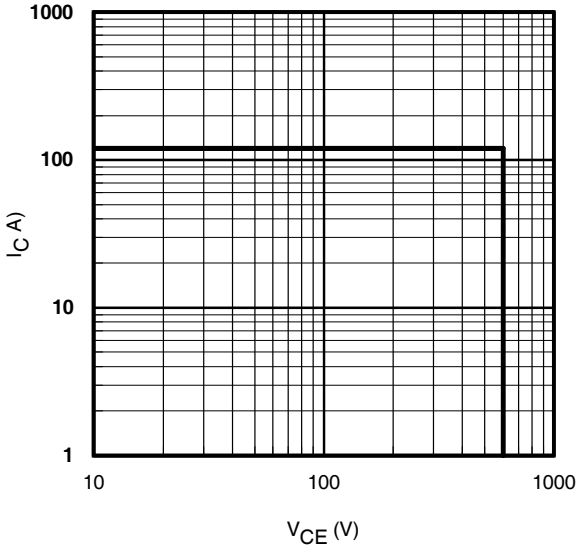


Fig. 4 - Reverse Bias SOA
T_J = 150°C; V_{GE} =15V

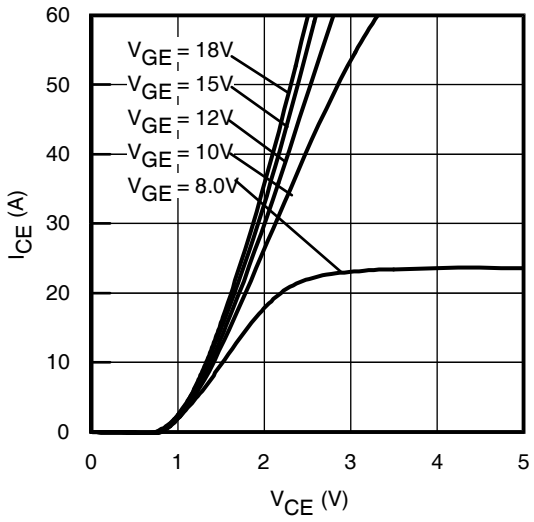


Fig. 5 - Typ. IGBT Output Characteristics
T_J = -40°C; tp = 80µs

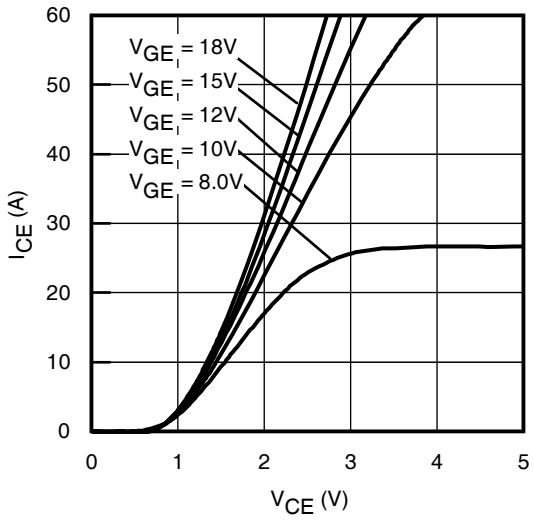


Fig. 6 - Typ. IGBT Output Characteristics
T_J = 25°C; tp = 80µs

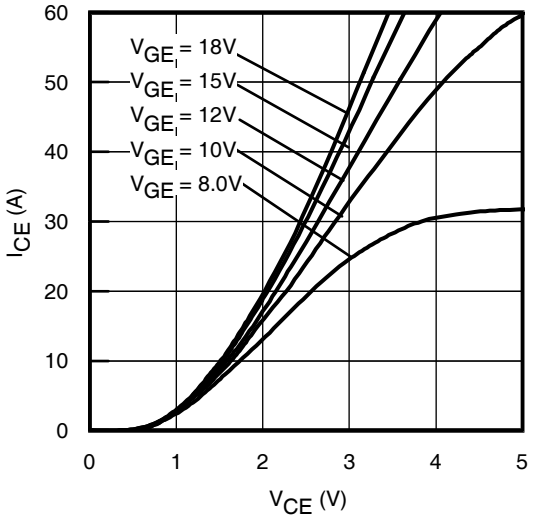


Fig. 7 - Typ. IGBT Output Characteristics
T_J = 150°C; tp = 80µs

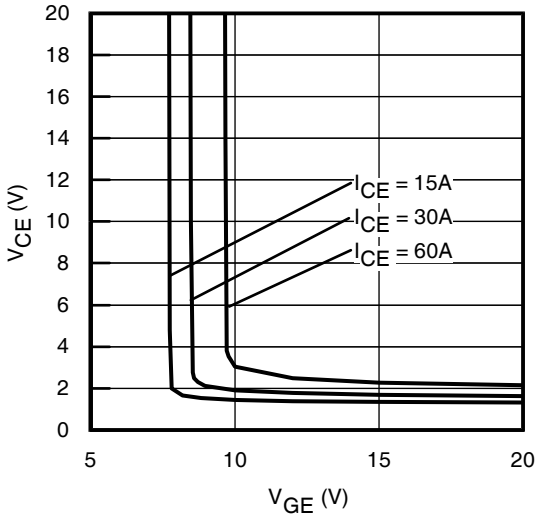


Fig. 8 - Typical V_{CE} vs. V_{GE}
T_J = -40°C

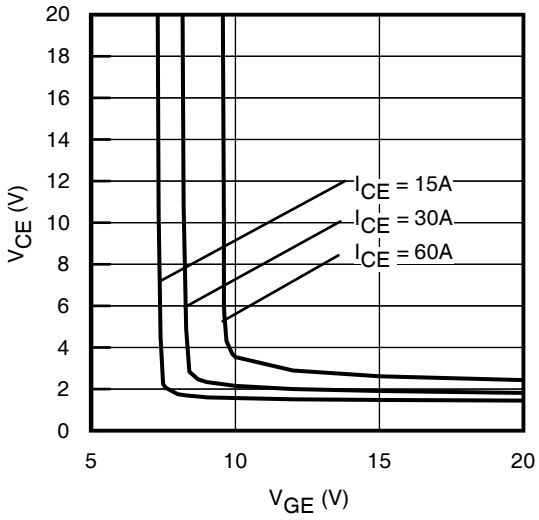


Fig. 9 - Typical V_{CE} vs. V_{GE}
T_J = 25°C

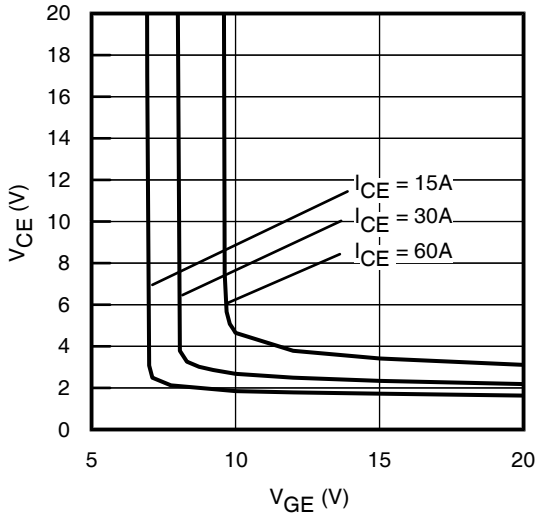


Fig. 10 - Typical V_{CE} vs. V_{GE}
T_J = 150°C

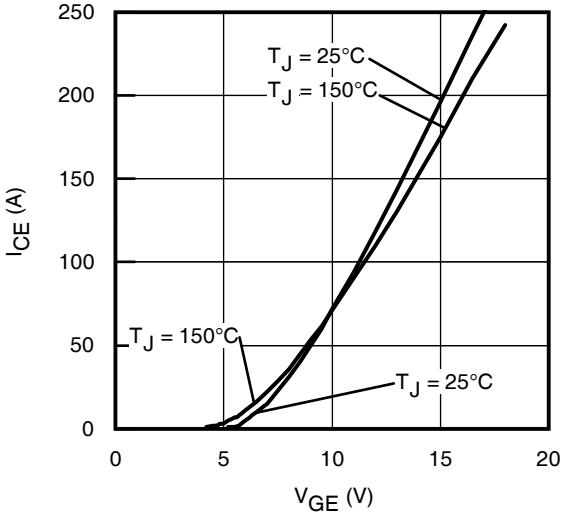


Fig. 11 - Typ. Transfer Characteristics
V_{CE} = 50V; tp = 10µs

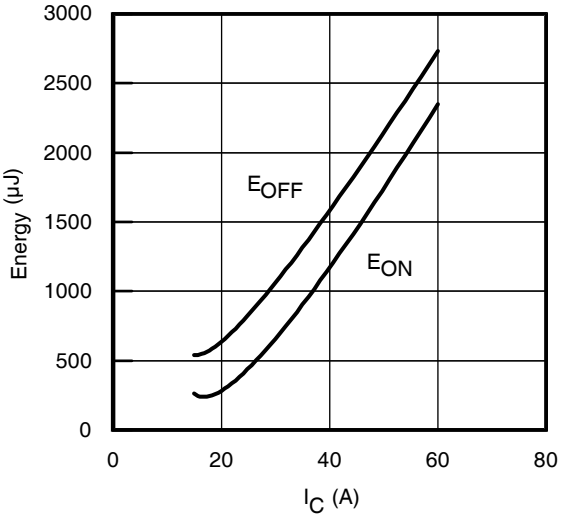


Fig. 12 - Typ. Energy Loss vs. I_C
T_J = 150°C; L=200µH; V_{CE}= 400V,
R_G= 10Ω; V_{GE}= 15V

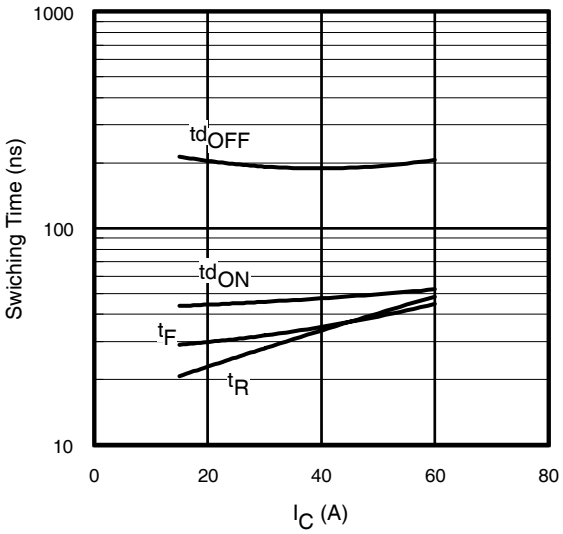


Fig. 13 - Typ. Switching Time vs. I_C
T_J = 150°C; L=200µH; V_{CE}= 400V
R_G= 10Ω; V_{GE}= 15V

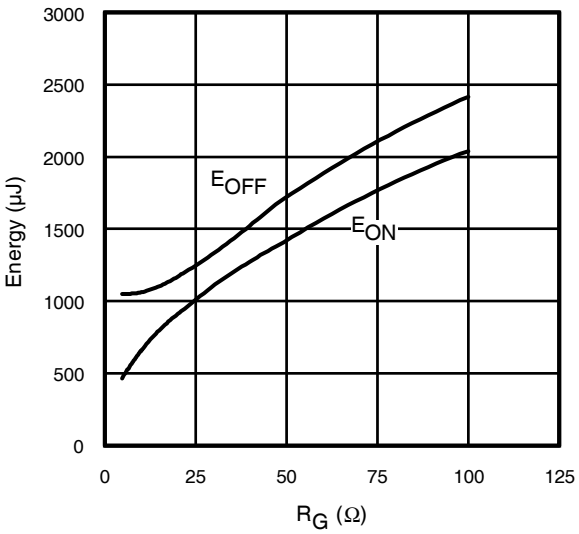


Fig. 14 - Typ. Energy Loss vs. R_G
T_J = 150°C; L=200µH; V_{CE}= 400V
I_{CE}= 30A; V_{GE}= 15V

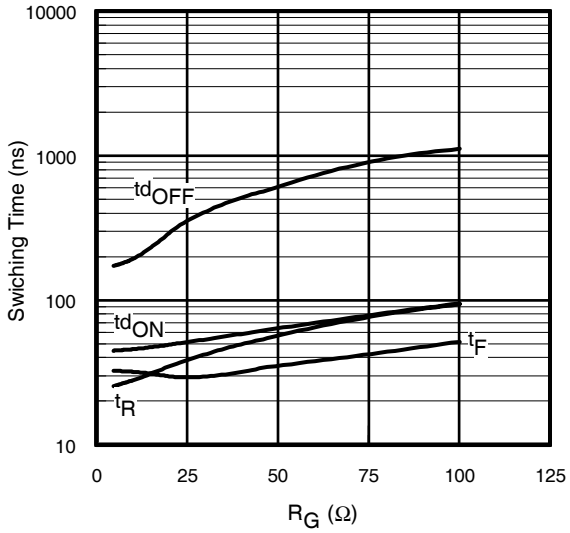


Fig. 15 - Typ. Switching Time vs. R_G
T_J = 150°C; L=200µH; V_{CE}= 400V
I_{CE}= 30A; V_{GE}= 15V

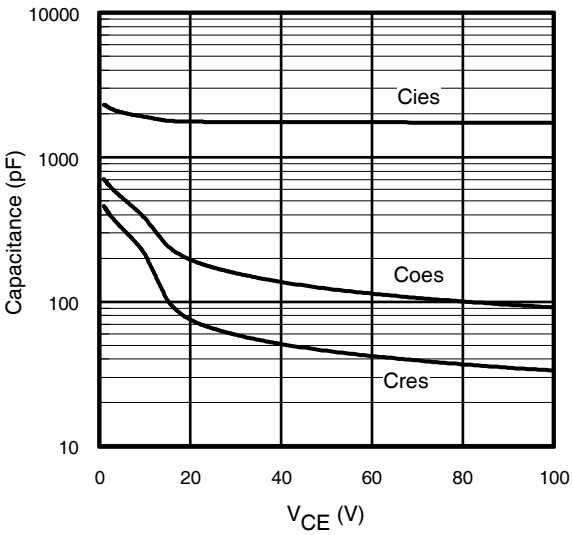


Fig. 16- Typ. Capacitance vs. V_{CE}
V_{GE}= 0V; f = 1MHz

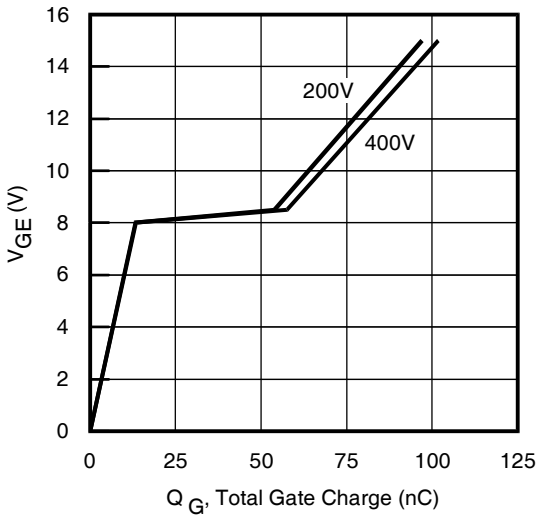


Fig. 17 - Typical Gate Charge vs. V_{GE}
I_{CE} = 30A; L = 600µH

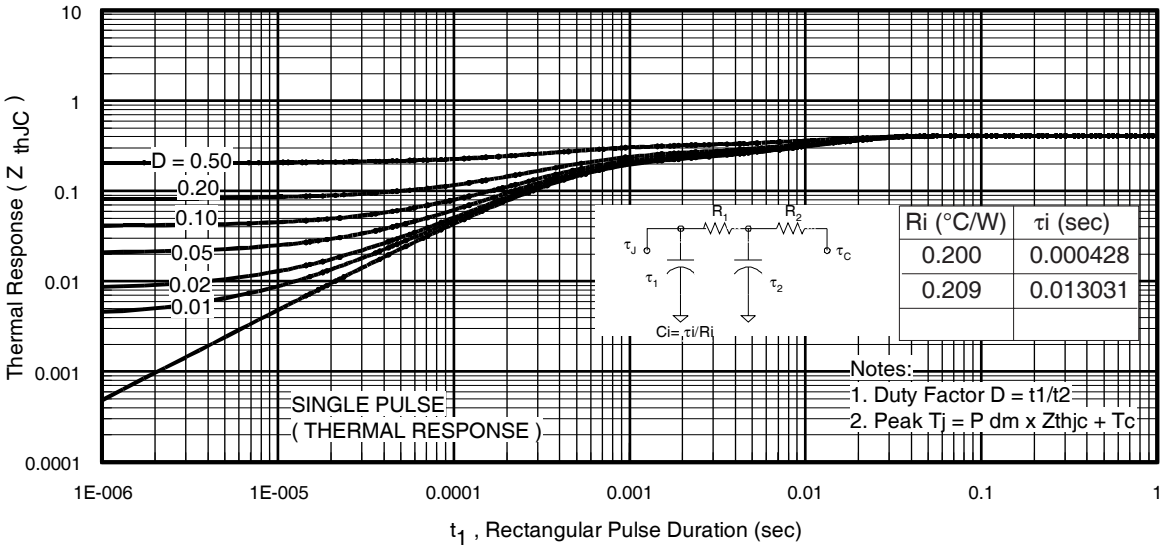


Fig 18. Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

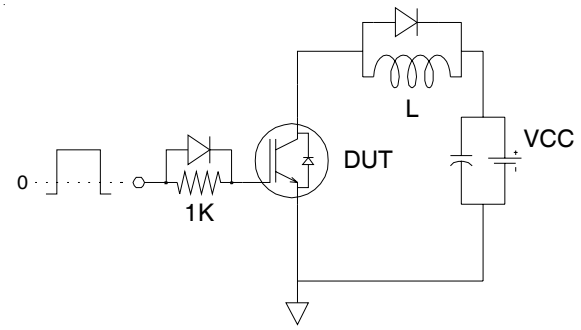


Fig.C.T.1 - Gate Charge Circuit (turn-off)

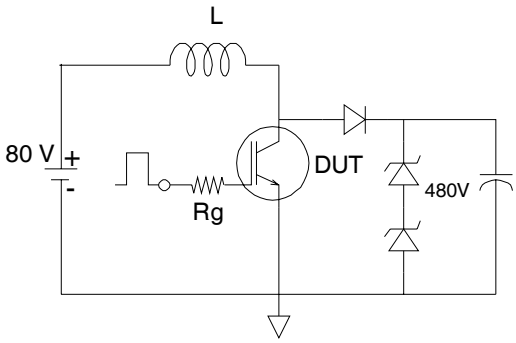


Fig.C.T.2 - RBSOA Circuit

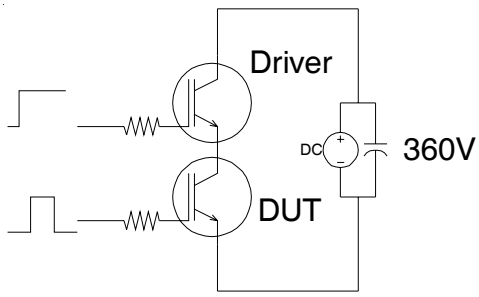


Fig.C.T.3 - S.C.SOA Circuit

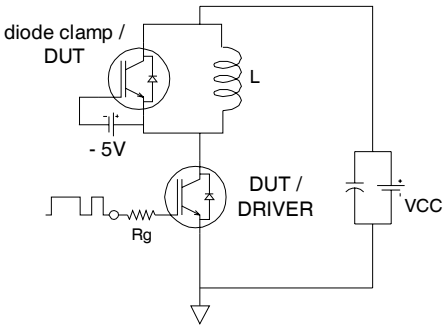


Fig.C.T.4 - Switching Loss Circuit

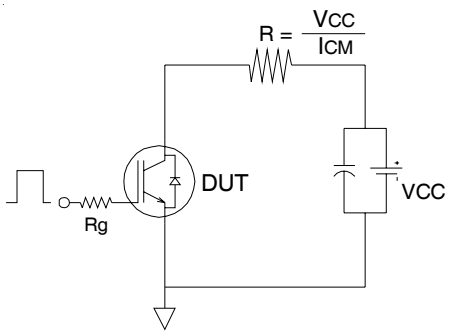


Fig.C.T.5 - Resistive Load Circuit

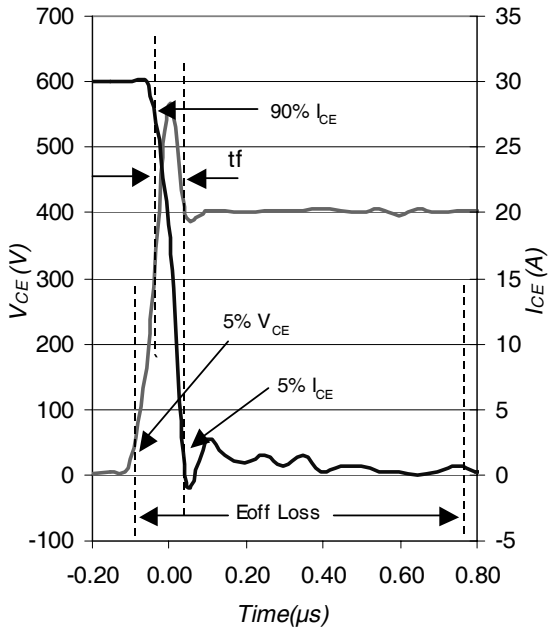


Fig. WF1- Typ. Turn-off Loss Waveform
@ T_J = 150°C using Fig. CT.4

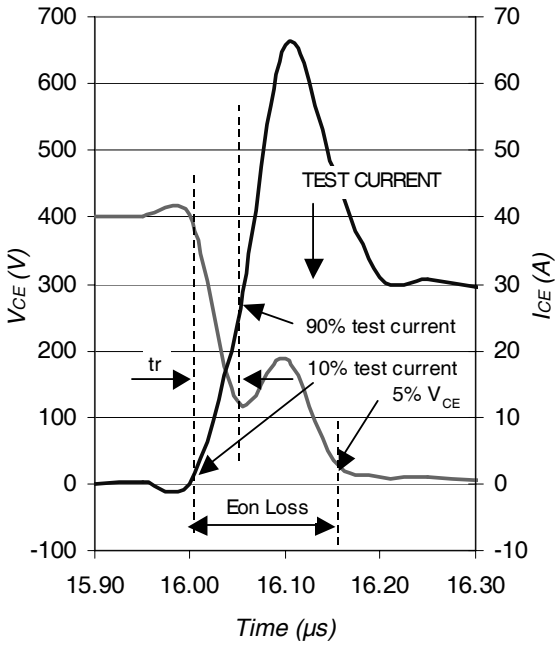


Fig. WF2- Typ. Turn-on Loss Waveform
@ T_J = 150°C using Fig. CT.4

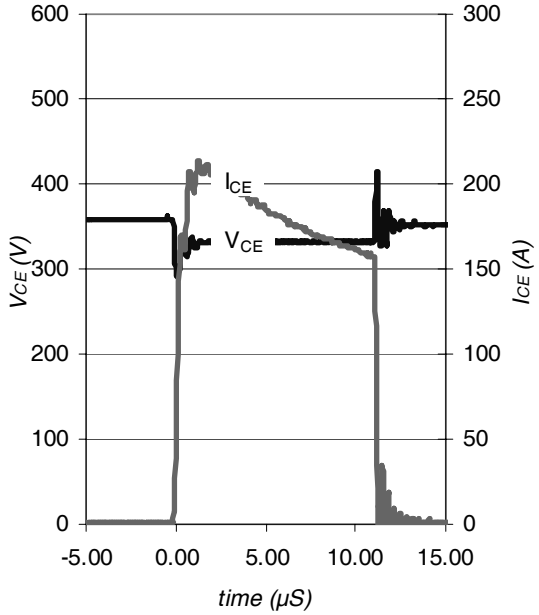
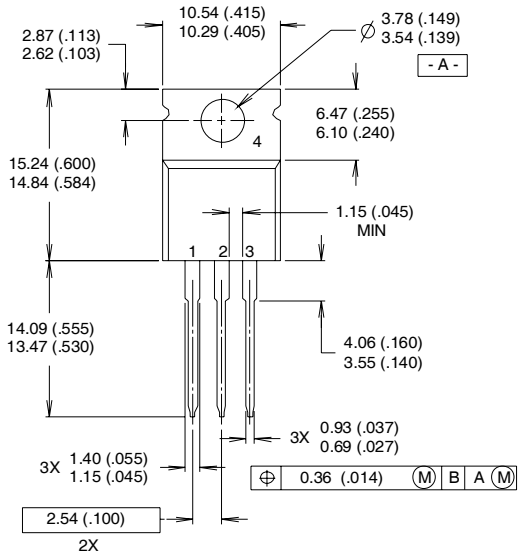
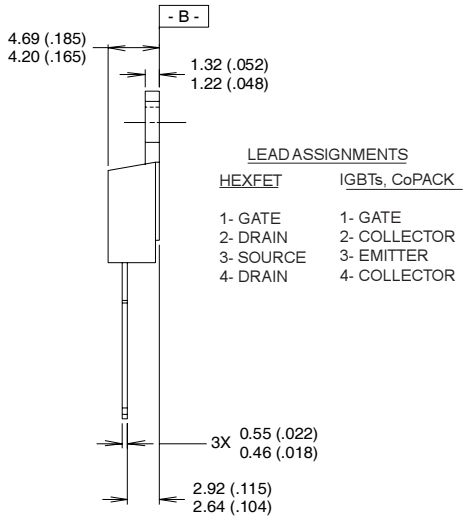


Fig. WF3- Typ. S.C Waveform
@ T_C = 150°C using Fig. CT.3

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)



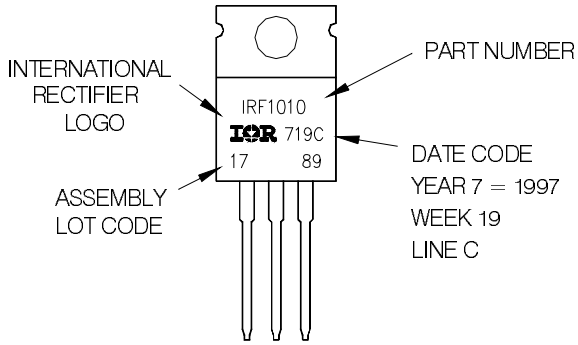


NOTES:

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.

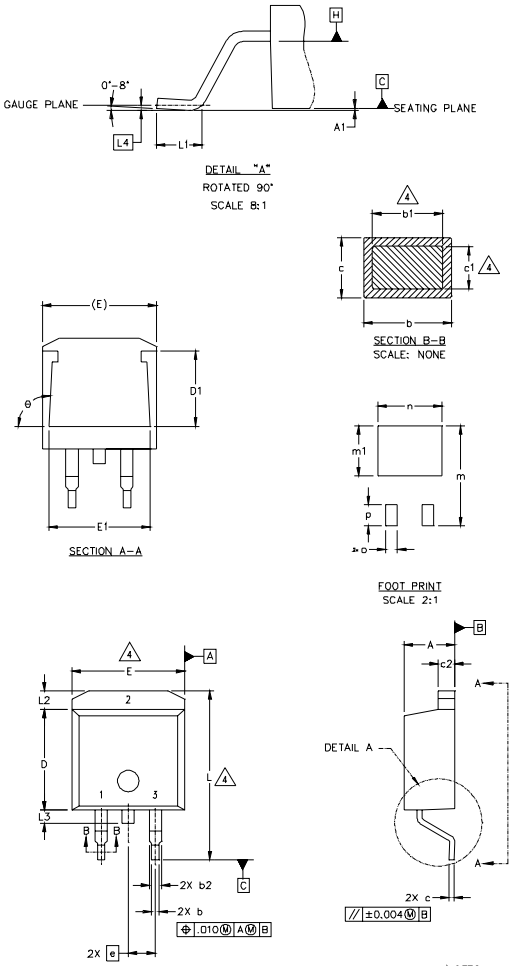
TO-220AB Part Marking Information

EXAMPLE: THIS IS AN IRF1010
LOT CODE 1789
ASSEMBLED ON WW 19, 1997
IN THE ASSEMBLY LINE "C"



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	
A1		0.127		.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	4
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	3
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

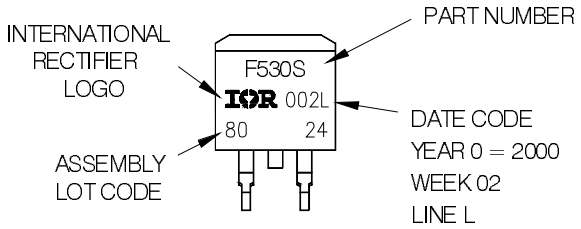
* PART DEPENDENT.

NOTES:

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.

D²Pak Part Marking Information

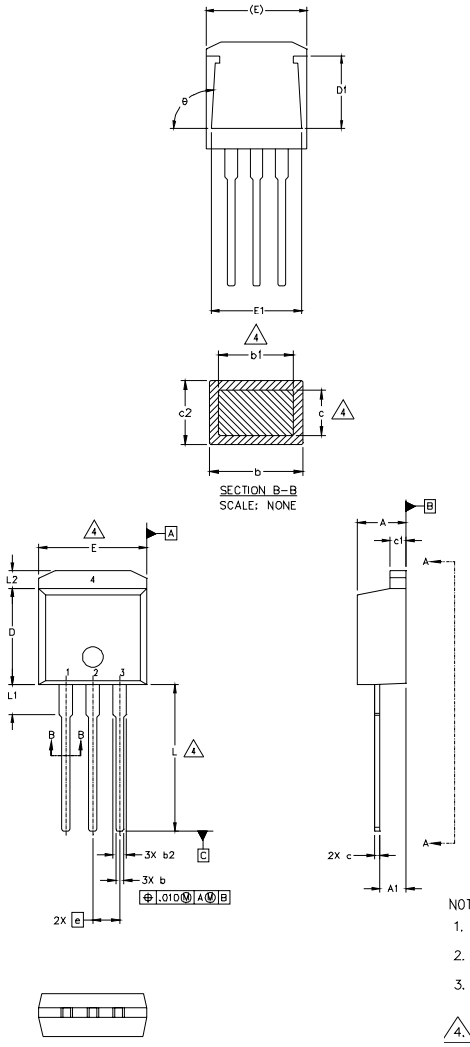
EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW 02, 2000
IN THE ASSEMBLY LINE "L"



International
IOR Rectifier

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	
A1	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.38	0.63	.015	.025	4
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	3
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

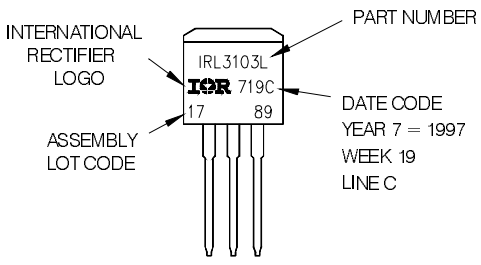
HEXFET	IGBT
1.– GATE	1- GATE
2.– DRAIN	2- COLLECTOR
3.– SOURCE	3- EMITTER
4.– DRAIN	4- COLLECTOR

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.

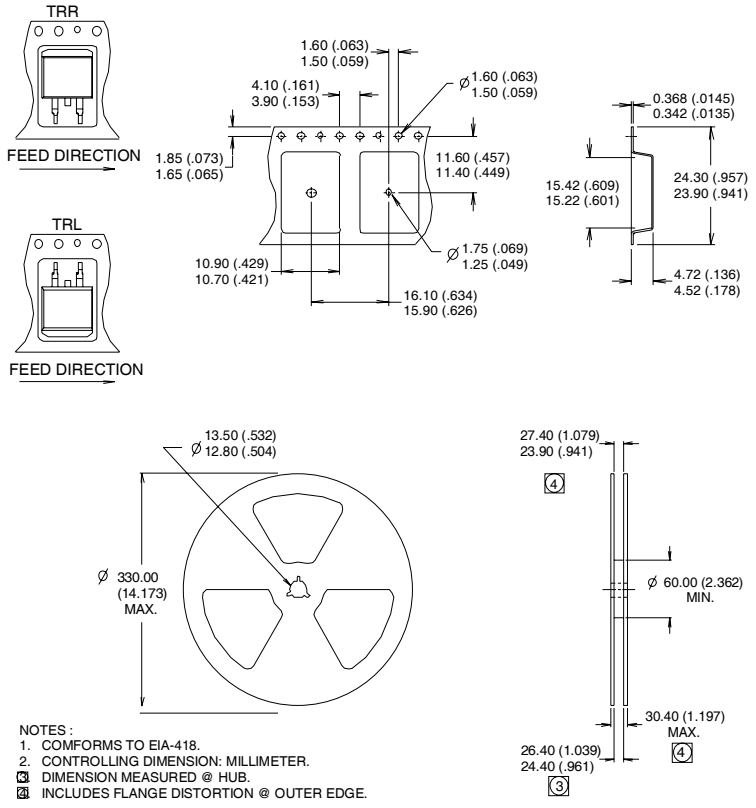
TO-262 Part Marking Information

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} = 20V, L = 28µH, R_G = 22Ω.

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
IOR 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. 02/04

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