

IRG4IBC20WPbF

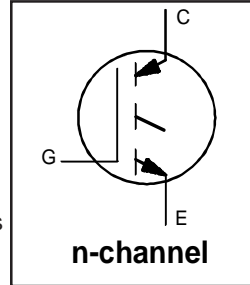
INSULATED GATE BIPOLAR TRANSISTOR

Features

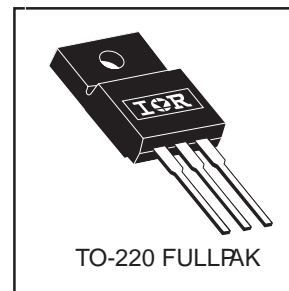
- Designed expressly for Switch-Mode Power Supply and PFC (power factor correction) applications
- 2.5kV, 60s insulation voltage ©
- Industry-benchmark switching losses improve efficiency of all power supply topologies
- 50% reduction of Eoff parameter
- Low IGBT conduction losses
- Latest-generation IGBT design and construction offers tighter parameters distribution, exceptional reliability
- Industry standard Isolated TO-220 Fullpak™ outline
- Lead-Free

Benefits

- Lower switching losses allow more cost-effective operation than power MOSFETs up to 150 kHz ("hard switched" mode)
- Of particular benefit to single-ended converters and boost PFC topologies 150W and higher
- Low conduction losses and minimal minority-carrier recombination make these an excellent option for resonant mode switching as well (up to >>300 kHz)



$V_{CES} = 600V$
$V_{CE(on) typ.} = 2.16V$
@ $V_{GE} = 15V, I_C = 6.5A$



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Breakdown Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	11.8	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	6.2	
I_{CM}	Pulsed Collector Current ①	52	
I_{LM}	Clamped Inductive Load Current ②	52	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	200	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	34	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	14	
T_J	Operating Junction and	-55 to + 150	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (0.063 in. (1.6mm) from case)	
	Mounting torque, 6-32 or M3 screw.	10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case - IGBT	—	3.7	°C/W
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	65	
Wt	Weight	2.0 (0.07)	—	g (oz)

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{GE} = 0V, I_C = 250\mu A$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	$V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.48	—	V/°C	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	2.16	2.6	V	$I_C = 6.5A, V_{GE} = 15V$
		—	2.55	—		$I_C = 13A, V_{GE} = 15V$
		—	2.05	—		$I_C = 6.5A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$V_{CE} = V_{GE}, I_C = 250\mu A$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-8.8	—	mV/°C	$V_{CE} = V_{GE}, I_C = 250\mu A$
g_{fe}	Forward Transconductance ⑤	5.5	8.3	—	S	$V_{CE} = 100V, I_C = 6.5A$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{GE} = 0V, V_{CE} = 600V$
		—	—	2.0		$V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$
		—	—	1000		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{GE} = \pm 20V$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	26	38	nC	$I_C = 6.5A$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	3.7	5.5		$V_{CC} = 400V$
Q_{gc}	Gate - Collector Charge (turn-on)	—	10	15		$V_{GE} = 15V$
$t_{d(on)}$	Turn-On Delay Time	—	22	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 6.5A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 50\Omega$
t_r	Rise Time	—	14	—		
$t_{d(off)}$	Turn-Off Delay Time	—	110	160		
t_f	Fall Time	—	64	96		
E_{on}	Turn-On Switching Loss	—	0.06	—	mJ	Energy losses include "tail" See Fig. 9, 10, 14
E_{off}	Turn-Off Switching Loss	—	0.08	—		
E_{ts}	Total Switching Loss	—	0.14	0.2	ns	$T_J = 150^\circ\text{C}$, $I_C = 6.5A, V_{CC} = 480V$ $V_{GE} = 15V, R_G = 50\Omega$ Energy losses include "tail" See Fig. 10, 11, 14
$t_{d(on)}$	Turn-On Delay Time	—	21	—		
t_r	Rise Time	—	15	—		
$t_{d(off)}$	Turn-Off Delay Time	—	150	—		
t_f	Fall Time	—	150	—	mJ	See Fig. 10, 11, 14
E_{ts}	Total Switching Loss	—	0.34	—		
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	490	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0MHz$
C_{oes}	Output Capacitance	—	38	—		
C_{res}	Reverse Transfer Capacitance	—	8.8	—		

Notes:

- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature. (See fig. 13b)
- ② $V_{CC} = 80\%(V_{CES}), V_{GE} = 20V, L = 10\mu H, R_G = 50\Omega$, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width $\leq 80\mu s$; duty factor $\leq 0.1\%$.
- ⑤ Pulse width $5.0\mu s$, single shot.
- ⑥ $t = 60s, f = 60Hz$

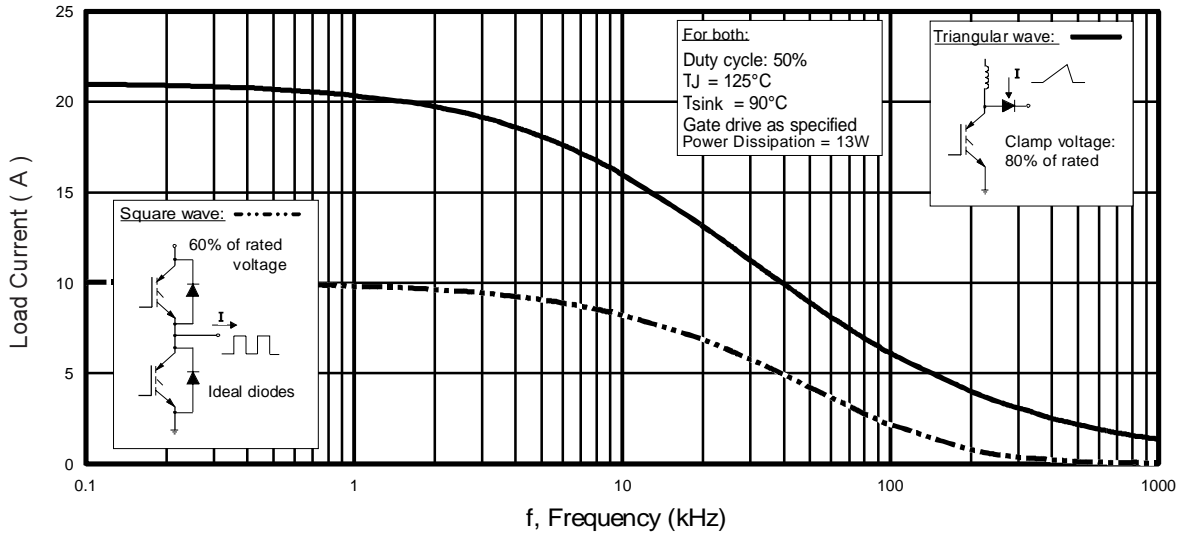


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

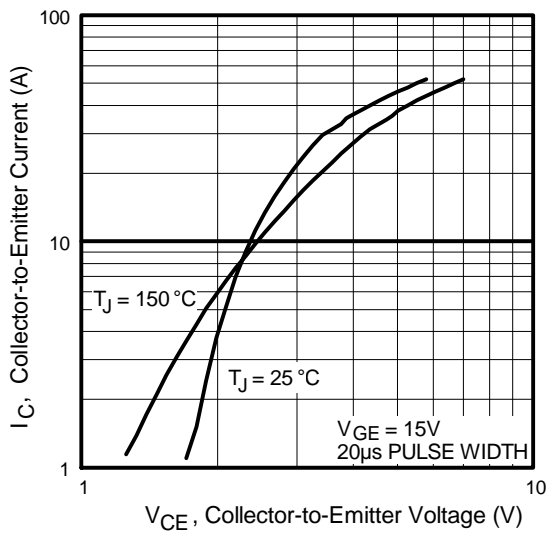


Fig. 2 - Typical Output Characteristics

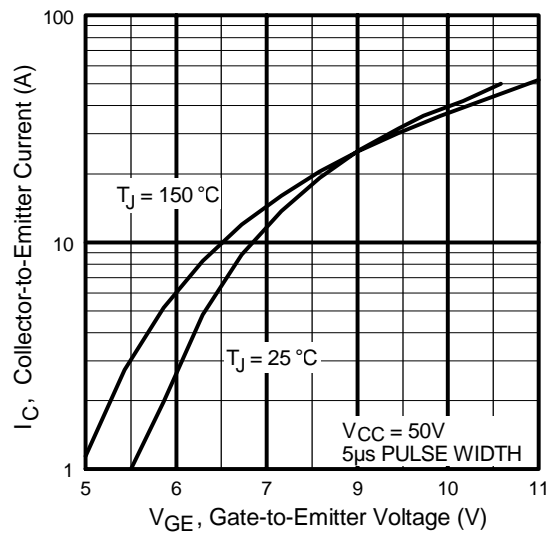


Fig. 3 - Typical Transfer Characteristics

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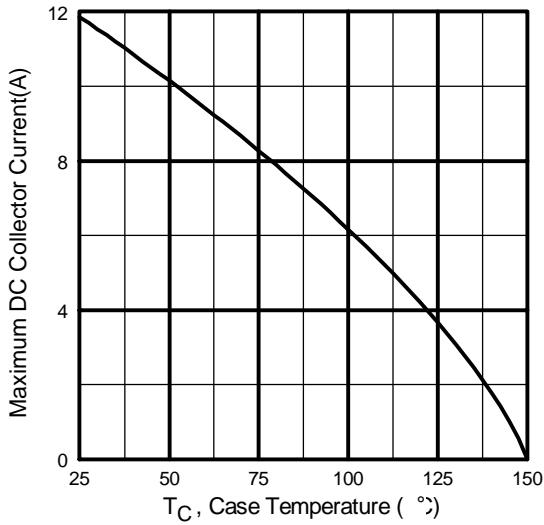


Fig. 4 - Maximum Collector Current vs. Case Temperature

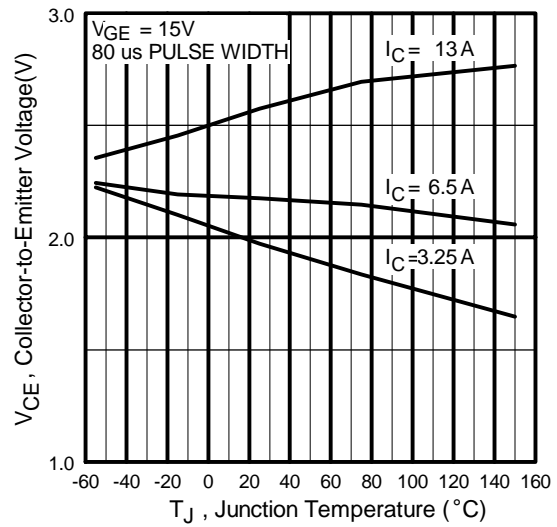


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

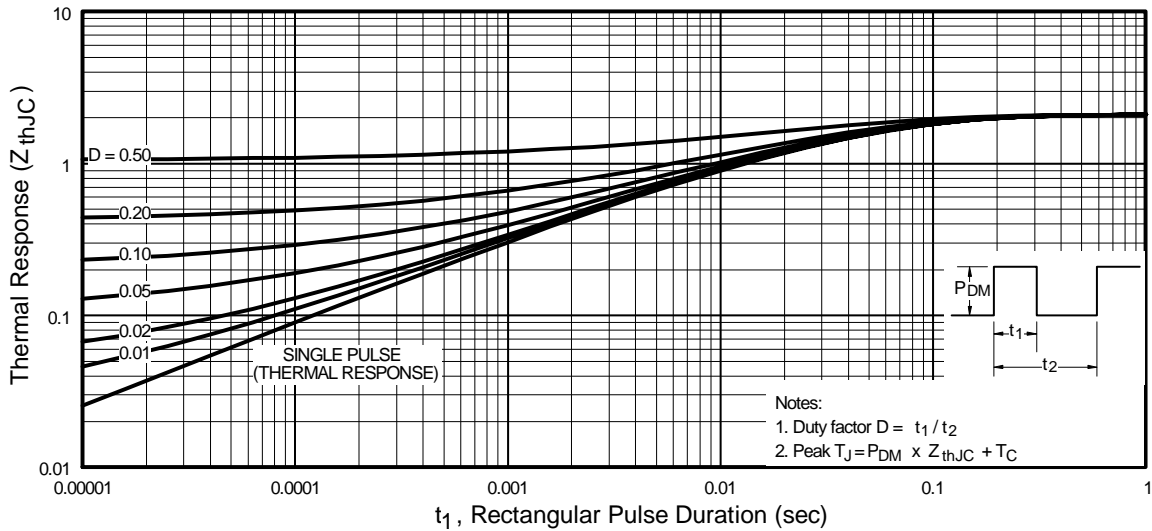


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

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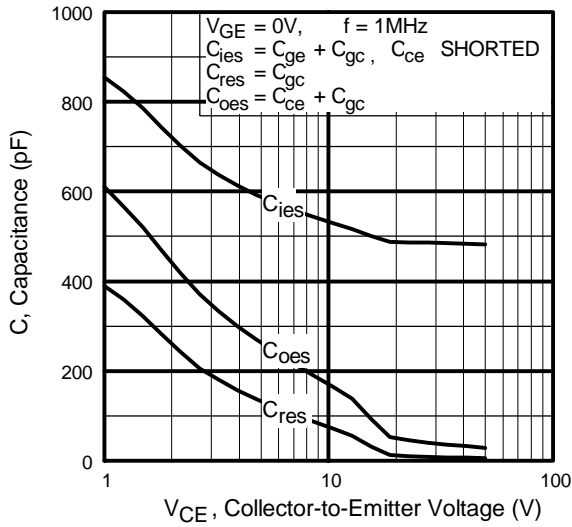


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

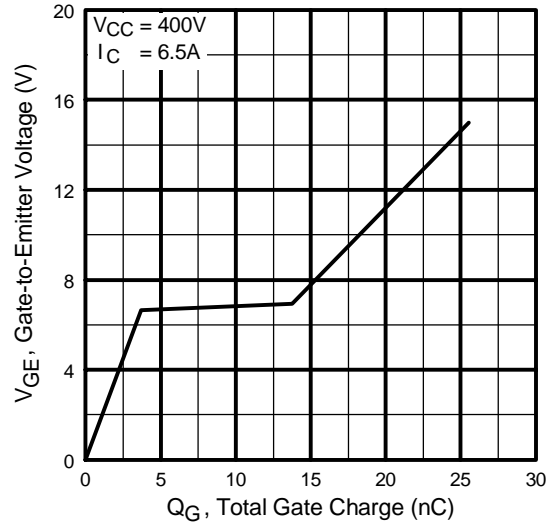


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

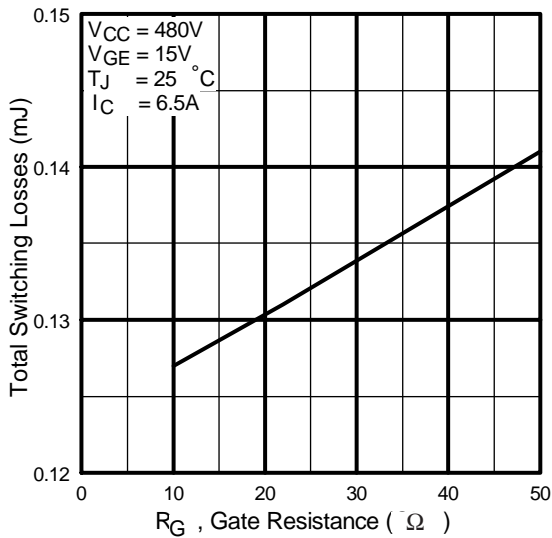


Fig. 9 - Typical Switching Losses vs. Gate Resistance

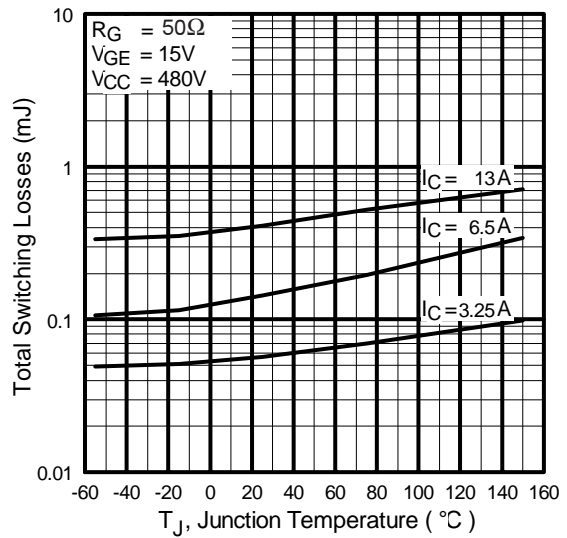


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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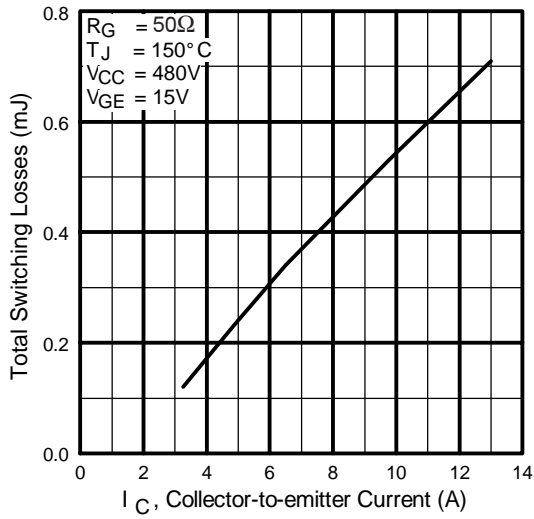


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

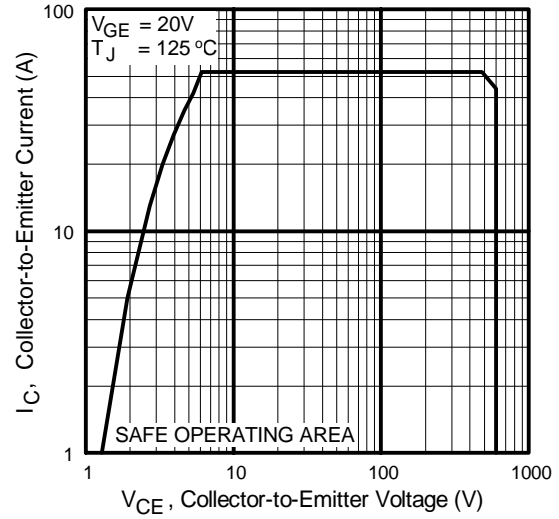


Fig. 12 - Turn-Off SOA

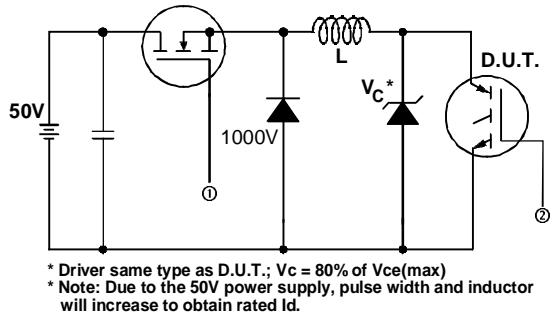


Fig. 13a - Clamped Inductive Load Test Circuit

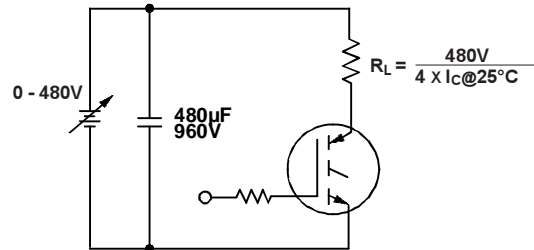


Fig. 13b - Pulsed Collector Current Test Circuit

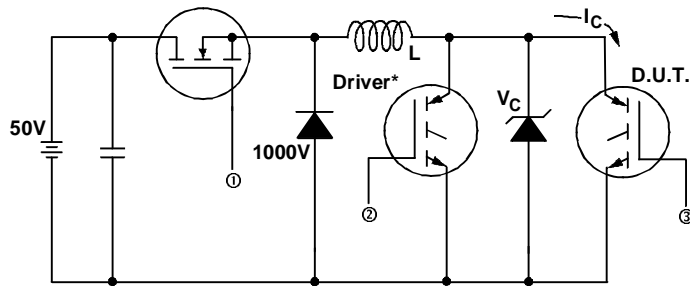


Fig. 14a - Switching Loss Test Circuit

* Driver same type as D.U.T., $V_C = 480V$

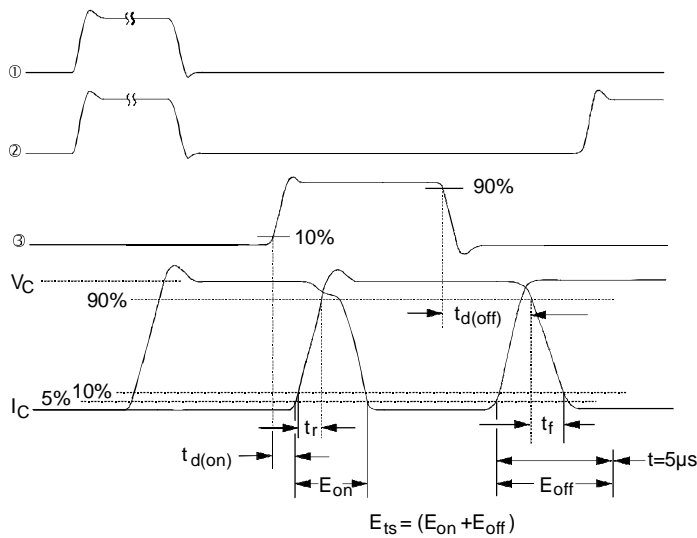


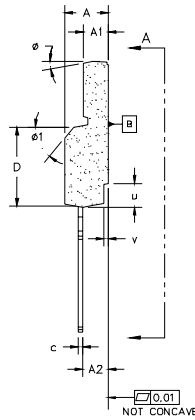
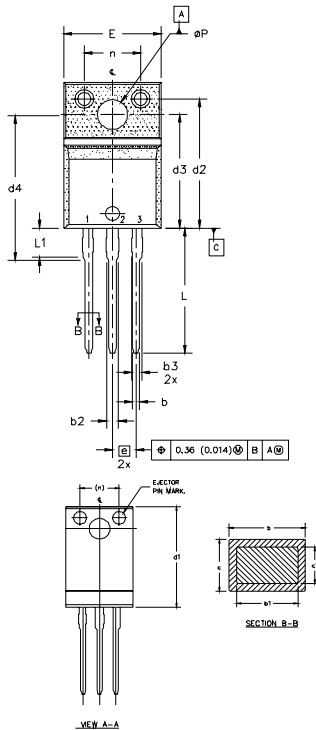
Fig. 14b - Switching Loss Waveforms

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TO-220 Full-Pak Package Outline

Dimensions are shown in millimeters (inches)



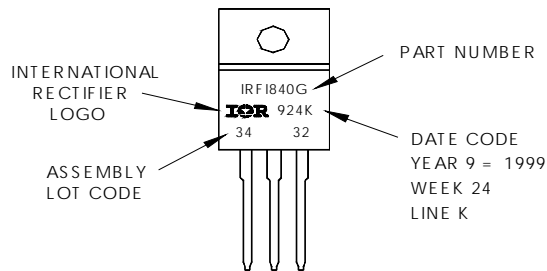
- NOTES:
- 1.0 DIMENSIONING AND TOLERANCING PER ASME Y14.5 M-1994.
 - 2.0 DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
 - 3.0 LEAD DIMENSION AND FINISH UNCONTROLLED IN L1.
 - 4.0 DIMENSION D & E DO NOT INCLUDE MOLD FLASH; MOLD FLASH SHALL NOT EXCEED 0.005" (0.127) PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
 - 5.0 DIMENSION d1 APPLY TO BASE METAL ONLY.
 - 6.0 STEP OPTIONAL ON PLASTIC BODY DEFINED BY DIMENSIONS u & v.
 - 7.0 CONTROLLING DIMENSION : INCHES.

SYMBOL	DIMENSIONS				NOTES	LEAD ASSIGNMENTS
	MILLIMETERS		INCHES			
A	4.57	4.83	0.180	0.190	5	HEMIFET 1- GATE 2- DRAIN 3- SOURCE
A1	2.57	2.85	0.101	0.114		
A2	2.51	2.85	0.099	0.112		
b	0.622	0.89	0.024	0.035	4	IGBTs, CoPACK 1- GATE 2- COLLECTOR 3- EMITTER
b1	0.622	0.838	0.024	0.033		
b2	1.229	1.400	0.048	0.055		
b3	1.229	1.400	0.048	0.055	4	
c	0.440	0.629	0.017	0.025		
c1	0.440	0.584	0.017	0.023		
D	8.65	9.80	0.341	0.386	4	
d1	15.80	16.12	0.622	0.635		
d2	13.97	14.22	0.550	0.560		
d3	12.30	12.92	0.484	0.509	4	
d4	8.64	9.91	0.340	0.390		
E	10.36	10.63	0.408	0.419		
e	2.54 BSC		0.100 BSC		3	
L	13.20	13.73	0.520	0.541		
L1	3.10	3.50	0.122	0.138		
n	6.05	6.15	0.238	0.242	6	
nP	3.05	3.45	0.120	0.136		
u	2.40	2.50	0.094	0.098		
v	0.40	0.50	0.016	0.020	6	
w	3"	7"	3"	7"		
d1		45"		45"		

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"



Data and specifications subject to change without notice.



IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903

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