

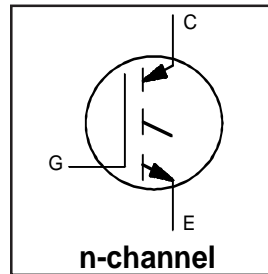
IRG4BC30KPbF

Short Circuit Rated
UltraFast IGBT

INSULATED GATE BIPOLAR TRANSISTOR

Features

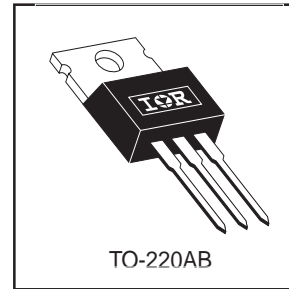
- High short circuit rating optimized for motor control, $t_{sc} = 10\mu s$, @360V V_{CE} (start), $T_J = 125^\circ C$, $V_{GE} = 15V$
- Combines low conduction losses with high switching speed
- Latest generation design provides tighter parameter distribution and higher efficiency than previous generations
- Lead-Free



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 2.21V$
@ $V_{GE} = 15V, I_C = 16A$

Benefits

- As a Freewheeling Diode we recommend our HEXFRED™ ultrafast, ultrasoft recovery diodes for minimum EMI / Noise and switching losses in the Diode and IGBT
- Latest generation 4 IGBTs offer highest power density motor controls possible
- This part replaces the IRGBC30K and IRGBC30M devices



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	28	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	16	
I_{CM}	Pulsed Collector Current ①	58	
I_{LM}	Clamped Inductive Load Current ②	58	
t_{sc}	Short Circuit Withstand Time	10	μs
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	260	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	100	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	42	
T_J	Operating Junction and Storage Temperature Range	-55 to +150	$^\circ C$
T_{STG}			
	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	---	1.2	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.5	---	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	---	80	
Wt	Weight	1.44	---	g

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International
IR Rectifier

Electrical Characteristics @ T_J = 25°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 = 250μA
V _{(BR)ECS}	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	V _{GE} = 0V, I _C = 1.0A
ΔV _{(BR)CES/ΔT_J}	Temperature Coeff. of Breakdown Voltage	—	0.54	—	V/°C	V _{GE} = 0V, I _C = 1.0mA
V _{CE(ON)}	Collector-to-Emitter Saturation Voltage	—	2.21	—	V	I _C = 14A I _C = 16A I _C = 28A I _C = 16A, T _J = 150°C V _{CE} = V _{GE} , I _C = 250μA V _{GE} = 15V See Fig.2, 5
		—	2.21	2.7		
		—	2.88	—		
		—	2.36	—		
V _{GE(th)}	Gate Threshold Voltage	3.0	—	6.0		
ΔV _{GE(th)/ΔT_J}	Temperature Coeff. of Threshold Voltage	—	-12	—	mV/°C	V _{CE} = V _{GE} , I _C = 250μA
g _{fe}	Forward Transconductance ⑤	5.4	8.1	—	S	V _{CE} = 100V, I _C = 16A
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°C
		—	—	1100		V _{GE} = 0V, V _{CE} = 600V, T _J = 150°C
I _{GES}	Gate-to-Emitter Leakage Current	—	—	±100	nA	V _{GE} = ±20V

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q _g	Total Gate Charge (turn-on)	—	67	100	nC	I _C = 16A V _{CC} = 400V V _{GE} = 15V See Fig.8
Q _{ge}	Gate - Emitter Charge (turn-on)	—	11	16		
Q _{gc}	Gate - Collector Charge (turn-on)	—	25	37		
t _{d(on)}	Turn-On Delay Time	—	26	—	ns	T _J = 25°C I _C = 16A, V _{CC} = 480V V _{GE} = 15V, R _G = 23Ω Energy losses include "tail"
t _r	Rise Time	—	28	—		
t _{d(off)}	Turn-Off Delay Time	—	130	200		
t _f	Fall Time	—	120	170		
E _{on}	Turn-On Switching Loss	—	0.36	—	mJ	See Fig. 9,10,14
E _{off}	Turn-Off Switching Loss	—	0.51	—		
E _{ts}	Total Switching Loss	—	0.87	1.3		
t _{sc}	Short Circuit Withstand Time	10	—	—	μs	V _{CC} = 400V, T _J = 125°C V _{GE} = 15V, R _G = 23Ω, V _{CPK} < 500V
t _{d(on)}	Turn-On Delay Time	—	25	—	ns	T _J = 150°C, I _C = 16A, V _{CC} = 480V V _{GE} = 15V, R _G = 23Ω Energy losses include "tail"
t _r	Rise Time	—	29	—		
t _{d(off)}	Turn-Off Delay Time	—	190	—		
t _f	Fall Time	—	190	—		
E _{ts}	Total Switching Loss	—	1.2	—	mJ	See Fig. 11,14
E _{on}	Turn-On Switching Loss	—	0.26	—	mJ	T _J = 25°C, V _{GE} = 15V, R _G = 23Ω I _C = 14A, V _{CC} = 480V Energy losses include "tail"
E _{off}	Turn-Off Switching Loss	—	0.36	—		
E _{ts}	Total Switching Loss	—	0.62	—		
L _E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C _{ies}	Input Capacitance	—	920	—	pF	V _{GE} = 0V V _{CC} = 30V f = 1.0MHz See Fig. 7
C _{oes}	Output Capacitance	—	110	—		
C _{res}	Reverse Transfer Capacitance	—	27	—		

Details of note ① through ⑤ are on the last page

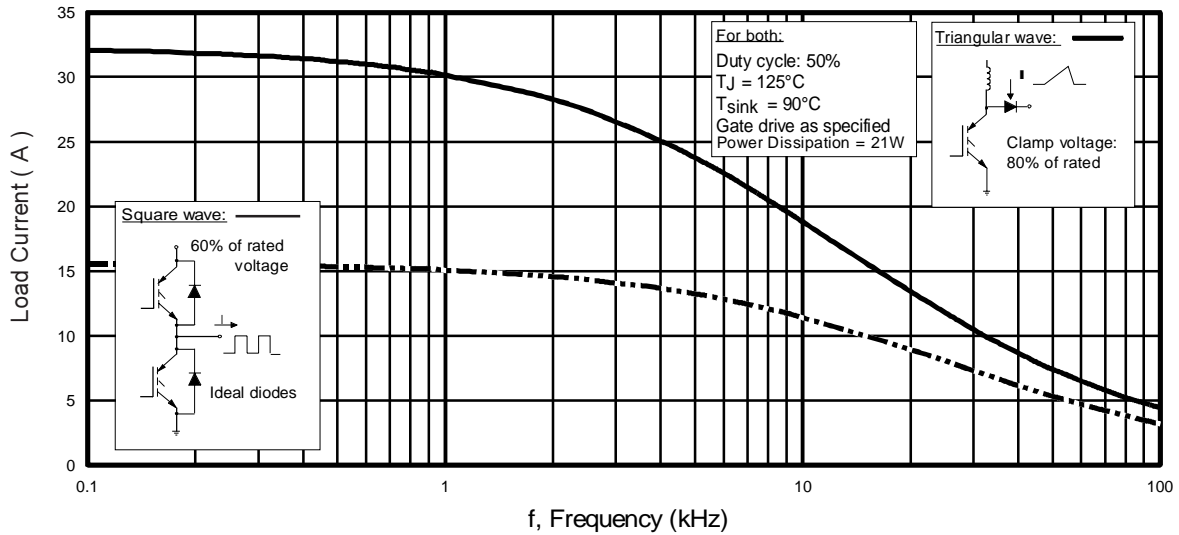


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

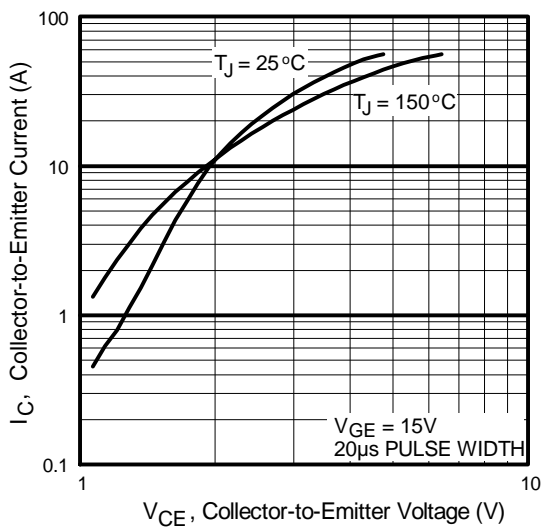


Fig. 2 - Typical Output Characteristics

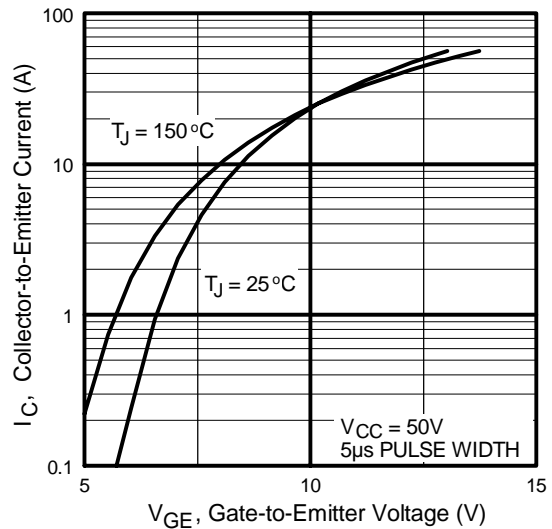


Fig. 3 - Typical Transfer Characteristics

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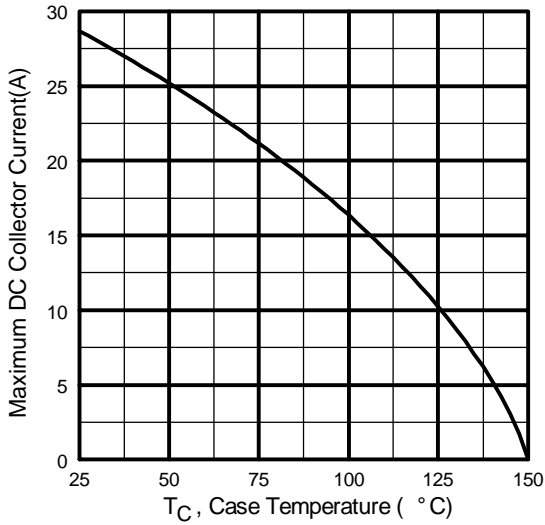


Fig. 4 - Maximum Collector Current vs. Case Temperature

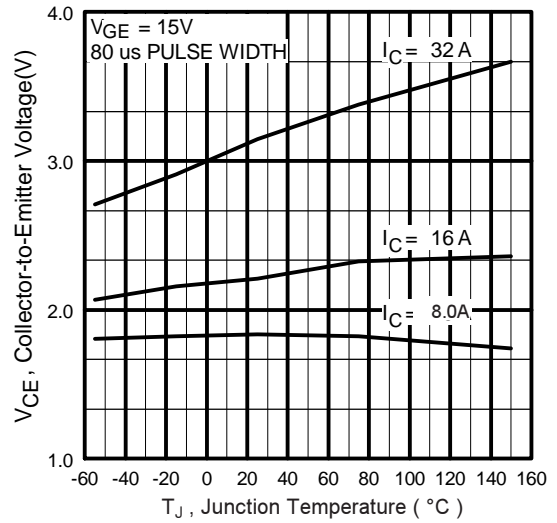


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

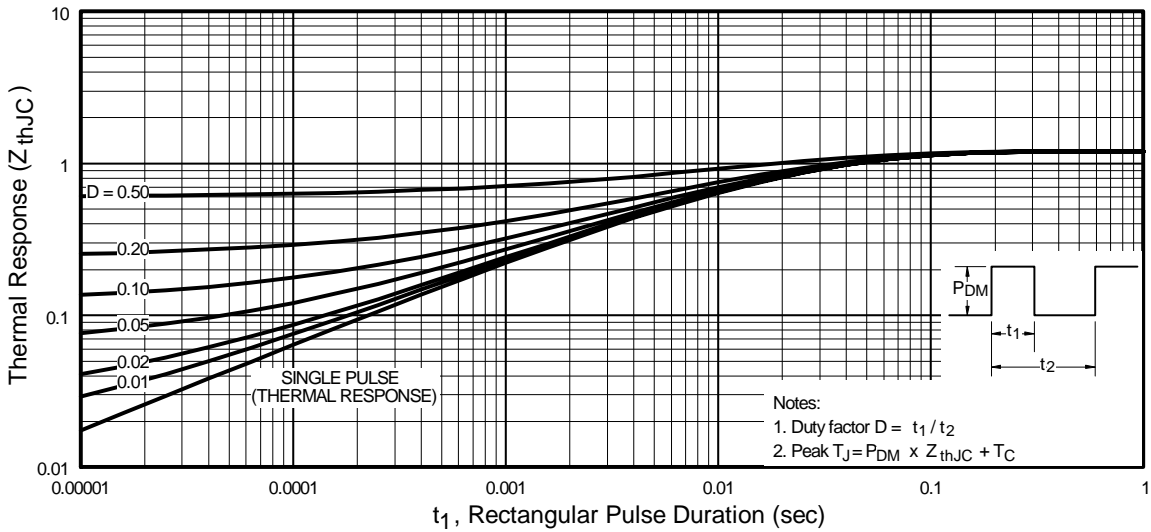


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

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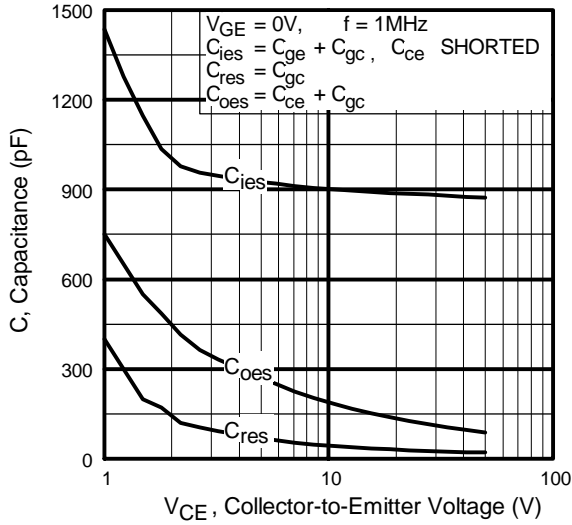


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

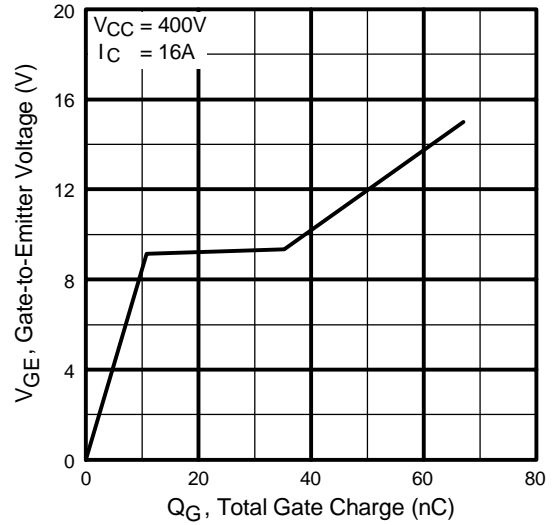


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

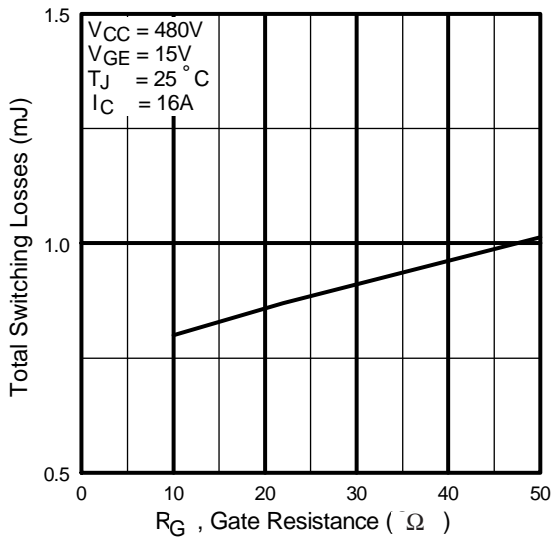


Fig. 9 - Typical Switching Losses vs. Gate Resistance

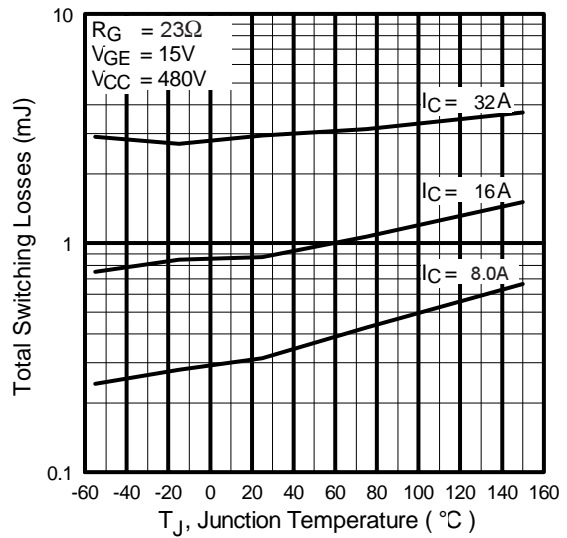


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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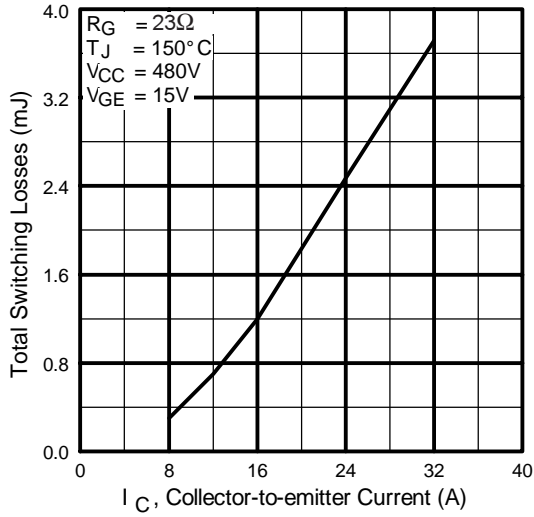


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

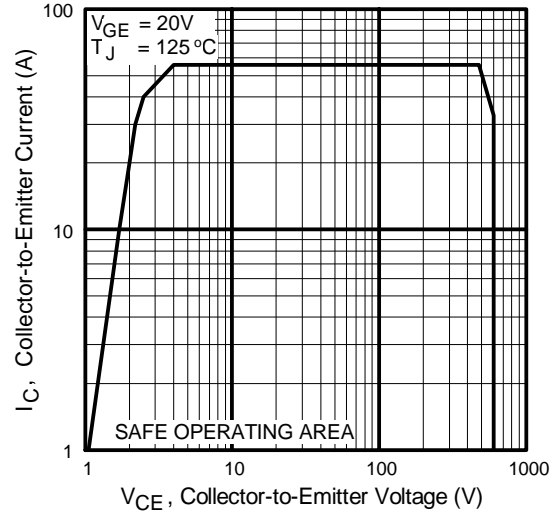
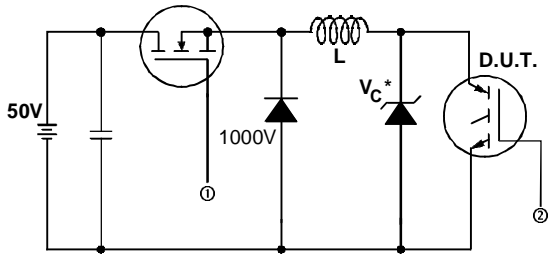


Fig. 12 - Turn-Off SOA

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* Driver same type as D.U.T.; $V_c = 80\%$ of $V_{ce(max)}$
 * Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated I_d .

Fig. 13a - Clamped Inductive Load Test Circuit

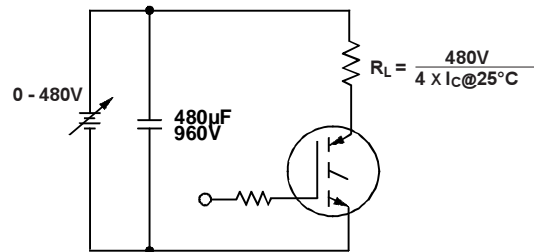


Fig. 13b - Pulsed Collector Current Test Circuit

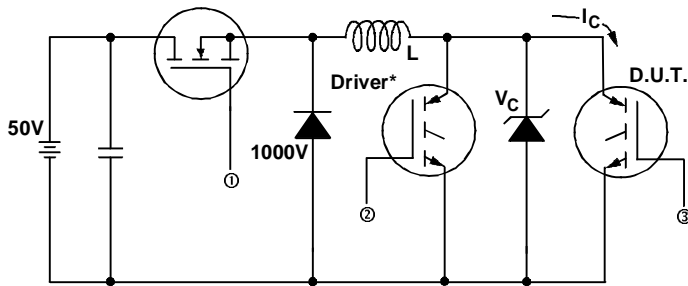


Fig. 14a - Switching Loss Test Circuit

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

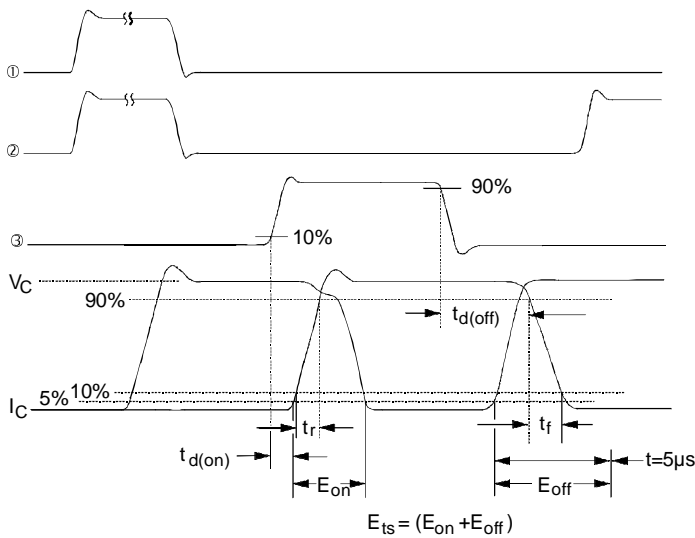


Fig. 14b - Switching Loss Waveforms

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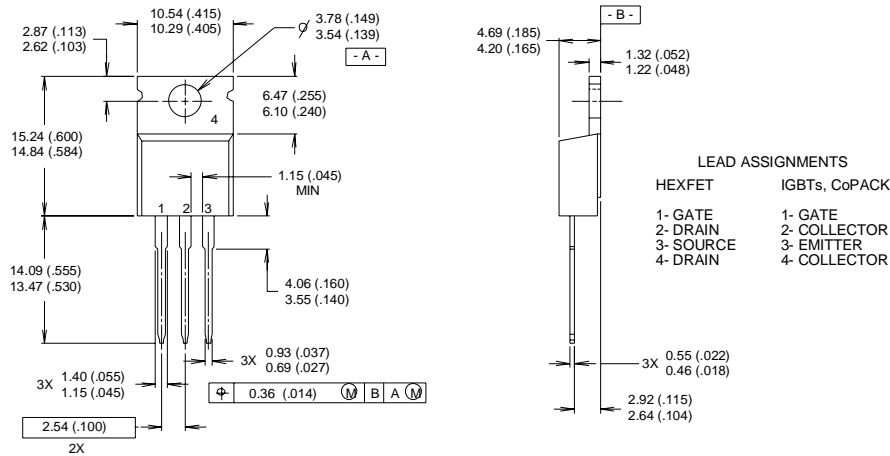


Notes:

- ① Repetitive rating; $V_{GE} = 20V$, pulse width limited by max. junction temperature. (See fig. 13b)
- ② $V_{CC} = 80\%(V_{CES})$, $V_{GE} = 20V$, $L = 10\mu H$, $R_G = 23\Omega$, (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.

TO-220AB Package Outline

Dimensions are shown in millimeters (inches)

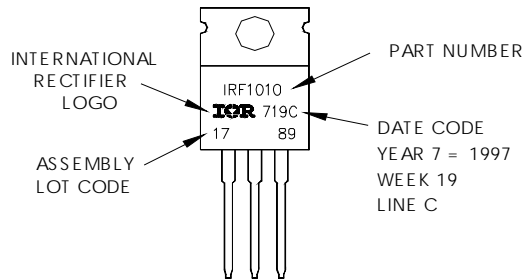


NOTES:

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



Data and specifications subject to change without notice.



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 Visit us at www.irf.com for sales contact information. 07/04

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