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[International Rectifier \(Infineon Technologies Americas Corp.\)](#)
[IRG4BC20KPBF](#)

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International **IR** Rectifier

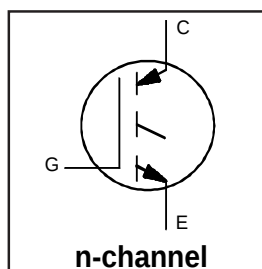
INSULATED GATE BIPOLAR TRANSISTOR

Features

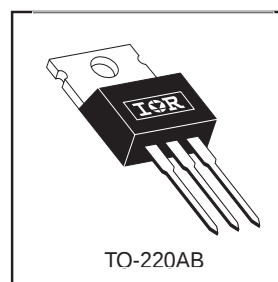
- High short circuit rating optimized for motor control, $t_{sc} = 10\mu s$, @360V V_{CE} (start), $T_J = 125^\circ C$, $V_{GE} = 15V$
- Combines low conduction losses with high switching speed
- Latest generation design provides tighter parameter distribution and higher efficiency than previous generations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

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 IRGBC20K and IRGBC20M devices



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 2.27V$
@ $V_{GE} = 15V$, $I_C = 9.0A$



Absolute Maximum Ratings

	Parameter	Max.	Units
V_{CES}	Collector-to-Emitter Voltage	600	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	16	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	9.0	
I_{CM}	Pulsed Collector Current ①	32	
I_{LM}	Clamped Inductive Load Current ②	32	
t_{sc}	Short Circuit Withstand Time	10	μs
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	29	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	60	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	24	
T_J	Operating Junction and	-55 to +150	$^\circ C$
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 sec.		
	Mounting torque, 6-32 or M3 screw.	300 (0.063 in. (1.6mm) from case) 10 lbf•in (1.1N•m)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	2.1	$^\circ C/W$
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.5	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	80	
Wt	Weight	2.0 (0.07)	—	g (oz)

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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	—	0.49	—	V/°C	V _{GE} = 0V, I _C = 1.0mA
V _{CE(ON)}	Collector-to-Emitter Saturation Voltage	—	2.00	—	V	I _C = 6.0A
		—	2.27	2.8		I _C = 9.0A
		—	3.01	—		I _C = 16A
		—	2.43	—		I _C = 9.0A, T _J = 150°C
V _{GE(th)}	Gate Threshold Voltage	3.0	—	6.0		V _{CE} = V _{GE} , I _C = 250μA
ΔV _{GE(th)} /ΔT _J	Temperature Coeff. of Threshold Voltage	—	-10	—	mV/°C	V _{CE} = V _{GE} , I _C = 250μA
g _{fe}	Forward Transconductance ⑤	2.9	4.3	—	S	V _{CE} = 100 V, I _C = 9.0A
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
		—	—	1000		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)	—	34	51	nC	I _C = 9.0A
Q _{ge}	Gate - Emitter Charge (turn-on)	—	4.9	7.4		V _{CC} = 400V
Q _{gc}	Gate - Collector Charge (turn-on)	—	14	21		V _{GE} = 15V
t _{d(on)}	Turn-On Delay Time	—	28	—	ns	T _J = 25°C
t _r	Rise Time	—	27	—		I _C = 9.0A, V _{CC} = 480V
t _{d(off)}	Turn-Off Delay Time	—	150	220		V _{GE} = 15V, R _G = 50Ω
t _f	Fall Time	—	100	150		Energy losses include "tail"
E _{on}	Turn-On Switching Loss	—	0.15	—	mJ	See Fig. 9,10,14
E _{off}	Turn-Off Switching Loss	—	0.25	—		
E _{ts}	Total Switching Loss	—	0.40	0.6		
t _{sc}	Short Circuit Withstand Time	10	—	—	μs	V _{CC} = 400V, T _J = 125°C V _{GE} = 15V, R _G = 50Ω, V _{CPK} < 500V
t _{d(on)}	Turn-On Delay Time	—	28	—	ns	T _J = 150°C,
t _r	Rise Time	—	29	—		I _C = 9.0A, V _{CC} = 480V
t _{d(off)}	Turn-Off Delay Time	—	190	—		V _{GE} = 15V, R _G = 50Ω
t _f	Fall Time	—	190	—		Energy losses include "tail"
E _{ts}	Total Switching Loss	—	0.68	—	mJ	See Fig. 11,14
E _{on}	Turn-On Switching Loss	—	0.07	—	mJ	T _J = 25°C, V _{GE} = 15V, R _G = 50Ω
E _{off}	Turn-Off Switching Loss	—	0.13	—		I _C = 6.0A, V _{CC} = 480V
E _{ts}	Total Switching Loss	—	0.20	—		Energy losses include "tail"
L _E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C _{ies}	Input Capacitance	—	450	—	pF	V _{GE} = 0V
C _{oes}	Output Capacitance	—	61	—		V _{CC} = 30V
C _{res}	Reverse Transfer Capacitance	—	14	—		f = 1.0MHz

Details of note ① through ⑤ are on the last page

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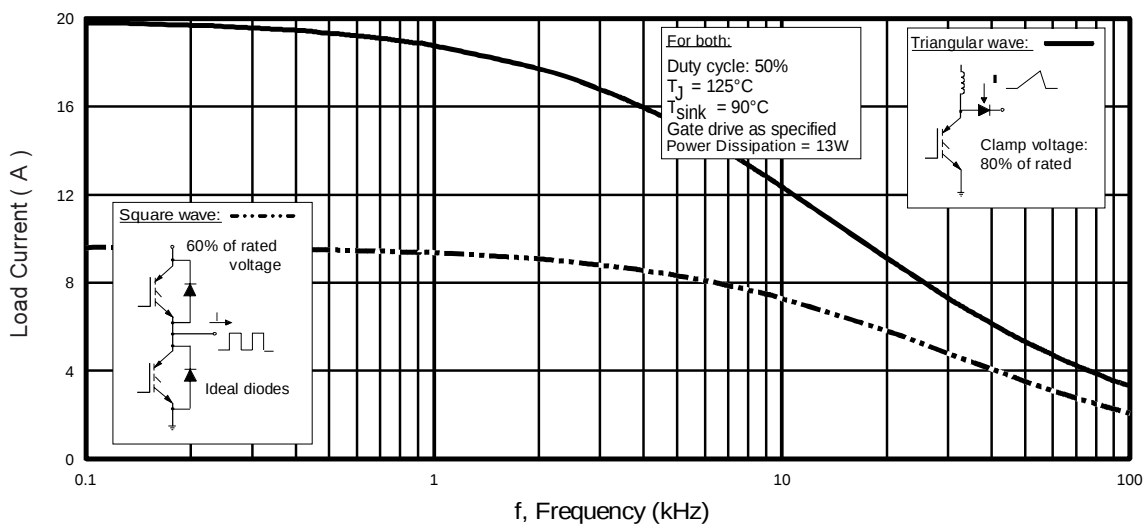


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

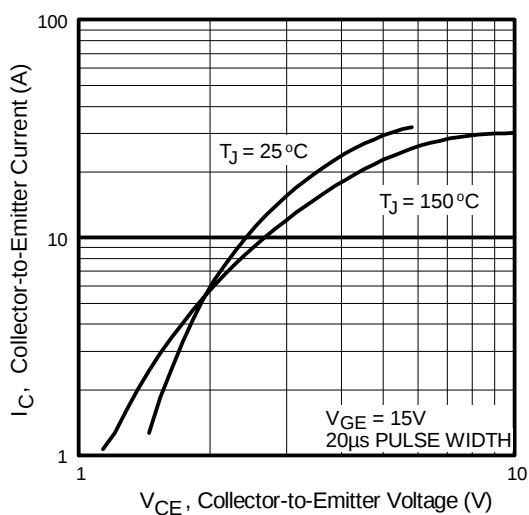


Fig. 2 - Typical Output Characteristics

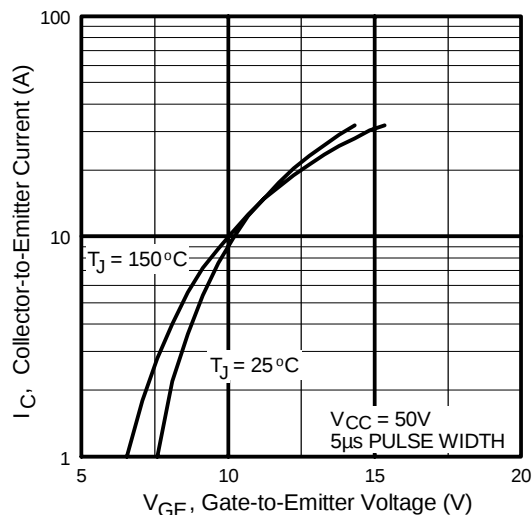


Fig. 3 - Typical Transfer Characteristics

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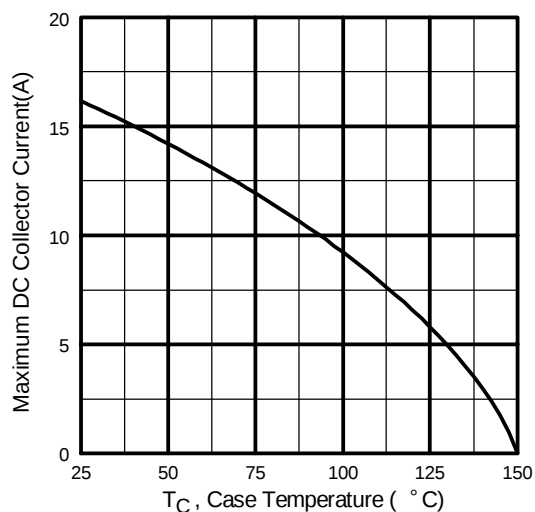


Fig. 4 - Maximum Collector Current vs. Case Temperature

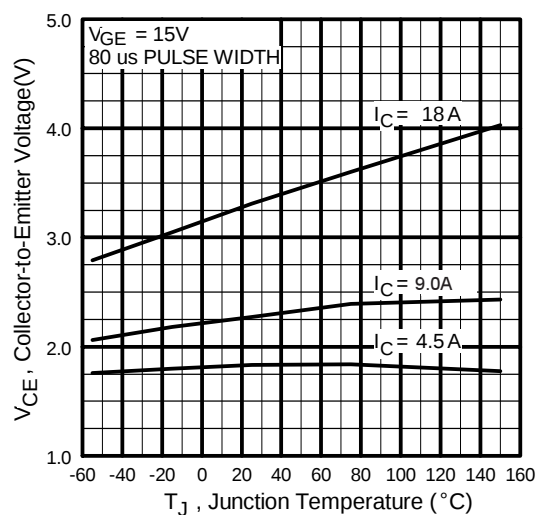


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

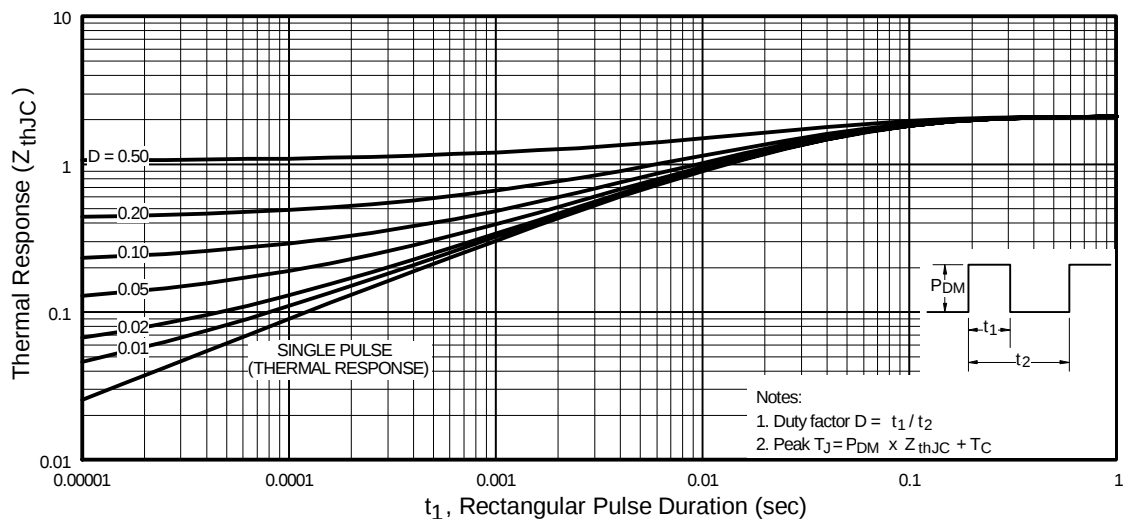


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

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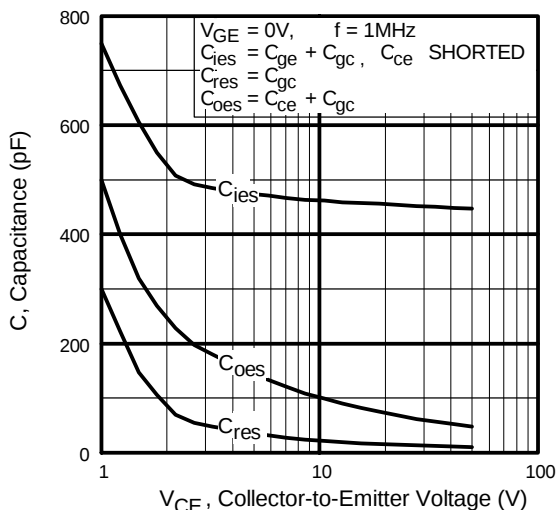


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

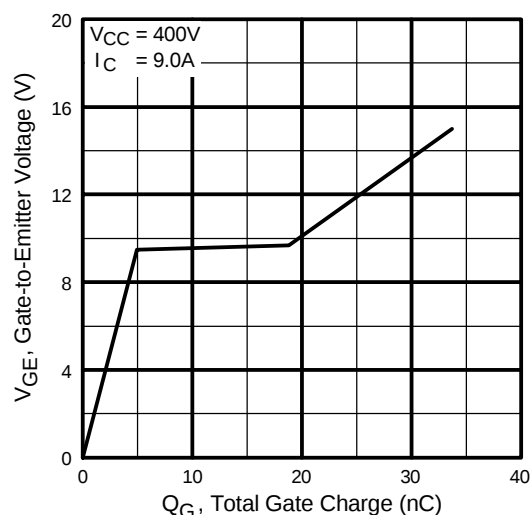


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

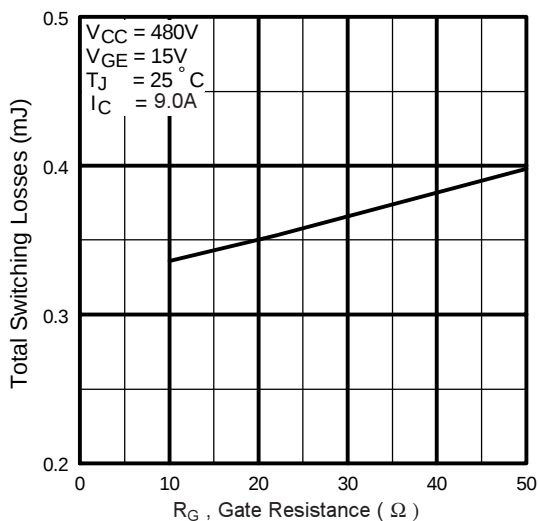


Fig. 9 - Typical Switching Losses vs. Gate Resistance

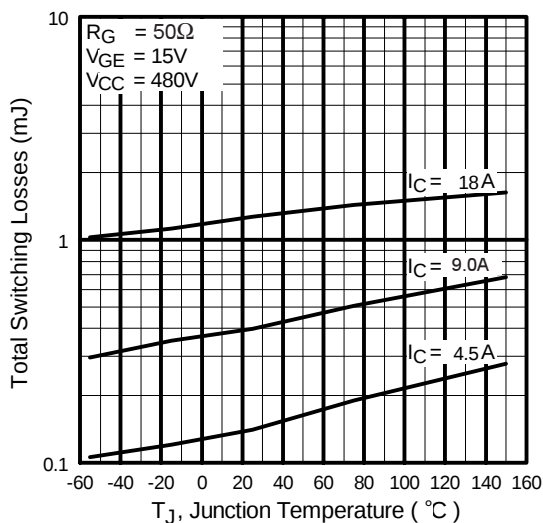


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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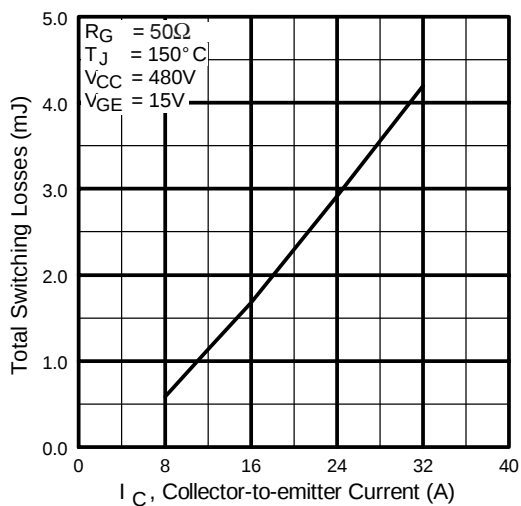


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

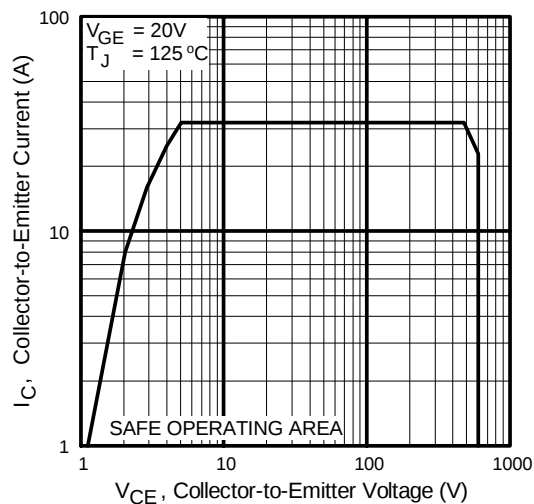


Fig. 12 - Turn-Off SOA

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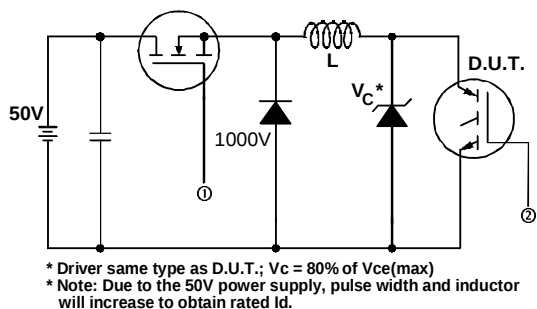


Fig. 13a - Clamped Inductive Load Test Circuit

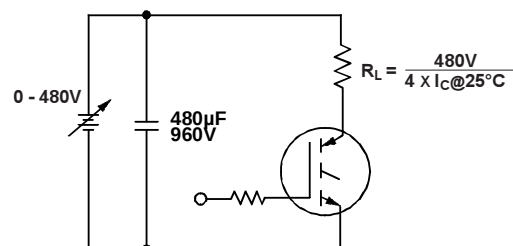


Fig. 13b - Pulsed Collector Current Test Circuit

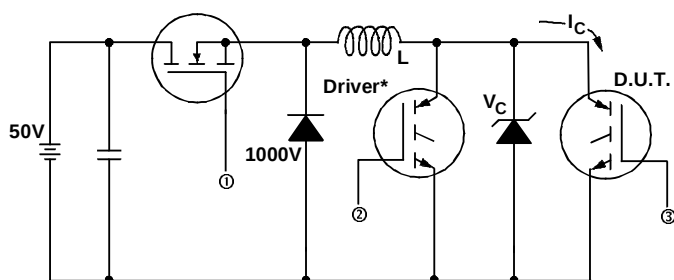


Fig. 14a - Switching Loss Test Circuit

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

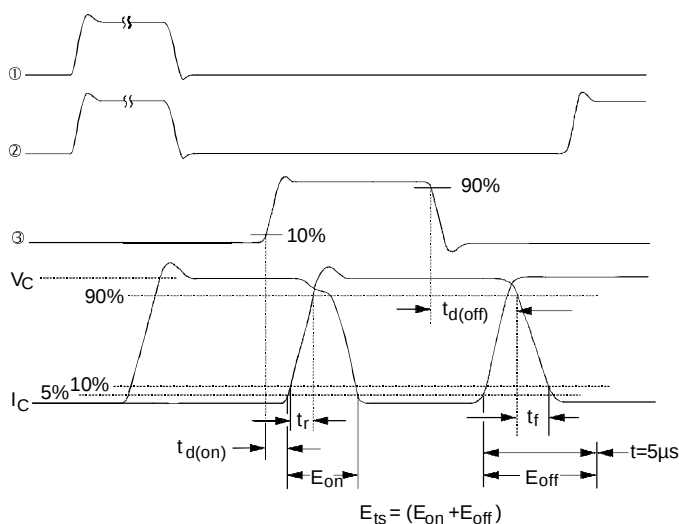
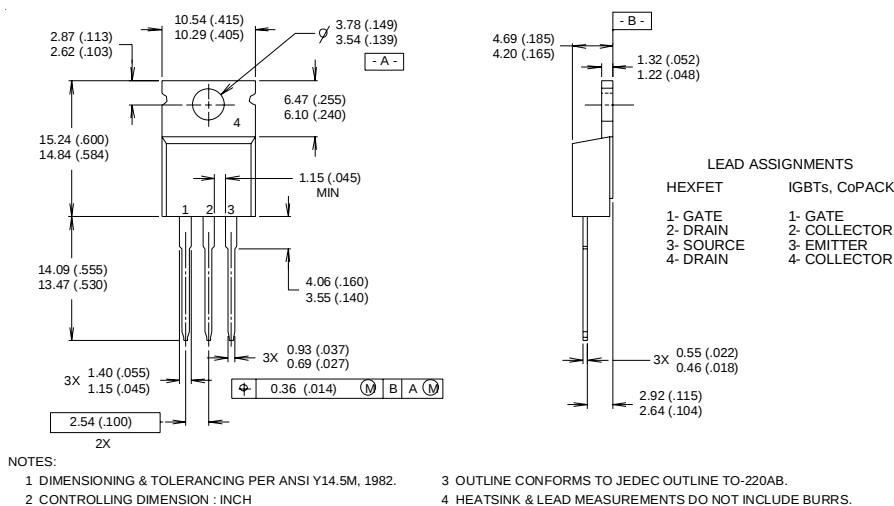


Fig. 14b - Switching Loss Waveforms

IRG4BC20KPbF TO-220AB Package Outline

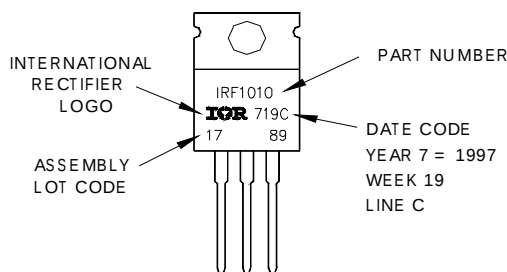
Dimensions are shown in millimeters (inches)

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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"



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.

Data and specifications subject to change without notice.

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Note: For the most current drawings please refer to the IR website at:

<http://www.irf.com/package/>