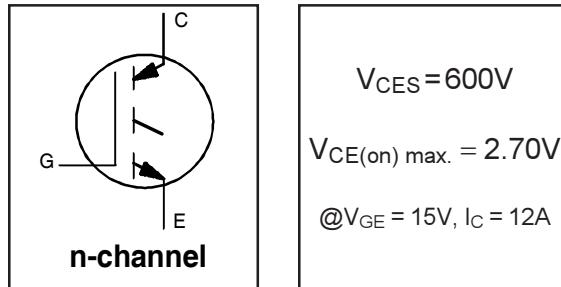


INSULATED GATE BIPOLEAR TRANSISTOR

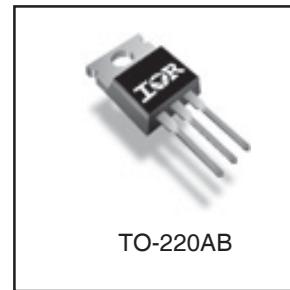
Features

- Designed expressly for Switch-Mode Power Supply and PFC (power factor correction) applications
- Industry-benchmark switching losses improve efficiency of all power supply topologies
- 50% reduction of E_{off} parameter
- Low IGBT conduction losses
- Latest-generation IGBT design and construction offers tighter parameters distribution, exceptional reliability
- 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)



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	23	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	12	
I_{CM}	Pulsed Collector Current ①	92	
I_{LM}	Clamped Inductive Load Current ②	92	
V_{GE}	Gate-to-Emitter Voltage	± 20	V
E_{ARV}	Reverse Voltage Avalanche Energy ③	180	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 T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	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	---	1.2	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.50	---	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	---	80	
Wt	Weight	1.44	---	g

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{CES}}$	Collector-to-Emitter Breakdown Voltage	600	—	—	V	$V_{\text{GE}} = 0\text{V}, I_C = 250\mu\text{A}$
$V_{(\text{BR})\text{ECS}}$	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	$V_{\text{GE}} = 0\text{V}, I_C = 1.0\text{A}$
$\Delta V_{(\text{BR})\text{CES}/\Delta T_J}$	Temperature Coeff. of Breakdown Voltage	—	0.34	—	V/ $^\circ\text{C}$	$V_{\text{GE}} = 0\text{V}, I_C = 1.0\text{mA}$
$V_{\text{CE}(\text{ON})}$	Collector-to-Emitter Saturation Voltage	—	2.1	2.7	V	$I_C = 12\text{A}$ $V_{\text{GE}} = 15\text{V}$
		—	2.45	—		$I_C = 23\text{A}$ See Fig.2, 5
		—	1.95	—		$I_C = 12\text{A}, T_J = 150^\circ\text{C}$
$V_{\text{GE}(\text{th})}$	Gate Threshold Voltage	3.0	—	6.0		$V_{\text{CE}} = V_{\text{GE}}, I_C = 250\mu\text{A}$
$\Delta V_{\text{GE}(\text{th})/\Delta T_J}$	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/ $^\circ\text{C}$	$V_{\text{CE}} = V_{\text{GE}}, I_C = 250\mu\text{A}$
g_{fe}	Forward Transconductance ⑤	11	16	—	S	$V_{\text{CE}} = 100\text{V}, I_C = 12\text{A}$
I_{CES}	Zero Gate Voltage Collector Current	—	—	250	μA	$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = 600\text{V}$
		—	—	2.0		$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = 10\text{V}, T_J = 25^\circ\text{C}$
		—	—	1000		$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = 600\text{V}, T_J = 150^\circ\text{C}$
I_{GES}	Gate-to-Emitter Leakage Current	—	—	± 100	nA	$V_{\text{GE}} = \pm 20\text{V}$

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q_g	Total Gate Charge (turn-on)	—	51	76	nC	$I_C = 12\text{A}$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	7.6	11		$V_{\text{CC}} = 400\text{V}$ See Fig.8
Q_{gc}	Gate - Collector Charge (turn-on)	—	18	27		$V_{\text{GE}} = 15\text{V}$
$t_{\text{d}(\text{on})}$	Turn-On Delay Time	—	25	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 12\text{A}, V_{\text{CC}} = 480\text{V}$ $V_{\text{GE}} = 15\text{V}, R_G = 23\Omega$
t_r	Rise Time	—	16	—		
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time	—	99	150		
t_f	Fall Time	—	67	100		
E_{on}	Turn-On Switching Loss	—	0.13	—	mJ	Energy losses include "tail" See Fig. 9, 10, 13, 14
E_{off}	Turn-Off Switching Loss	—	0.13	—		
E_{ts}	Total Switching Loss	—	0.26	0.35		
$t_{\text{d}(\text{on})}$	Turn-On Delay Time	—	24	—	ns	$T_J = 150^\circ\text{C},$ $I_C = 12\text{A}, V_{\text{CC}} = 480\text{V}$ $V_{\text{GE}} = 15\text{V}, R_G = 23\Omega$ Energy losses include "tail"
t_r	Rise Time	—	17	—		
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time	—	150	—		
t_f	Fall Time	—	150	—		
E_{ts}	Total Switching Loss	—	0.55	—	mJ	See Fig. 11, 13, 14
L_E	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C_{ies}	Input Capacitance	—	980	—	pF	$V_{\text{GE}} = 0\text{V}$ $V_{\text{CC}} = 30\text{V}$ See Fig. 7 $f = 1.0\text{MHz}$
C_{oes}	Output Capacitance	—	71	—		
C_{res}	Reverse Transfer Capacitance	—	18	—		

Notes:

- ① Repetitive rating; $V_{\text{GE}} = 20\text{V}$, pulse width limited by max. junction temperature. (See fig. 13b)
- ② $V_{\text{CC}} = 80\%(V_{\text{CES}})$, $V_{\text{GE}} = 20\text{V}$, $L = 10\mu\text{H}$, $R_G = 23\Omega$, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width $\leq 80\mu\text{s}$; duty factor $\leq 0.1\%$.
- ⑤ Pulse width $5.0\mu\text{s}$, single shot.

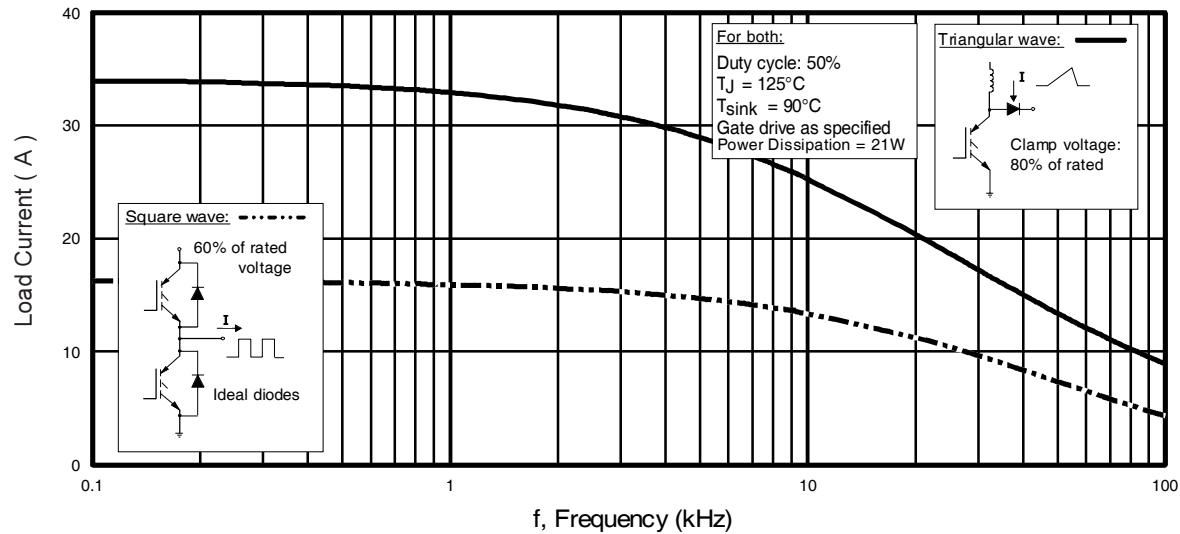


Fig. 1 - Typical Load Current vs. Frequency
 (For square wave, $I=I_{\text{RMS}}$ of fundamental; for triangular wave, $I=I_{\text{PK}}$)

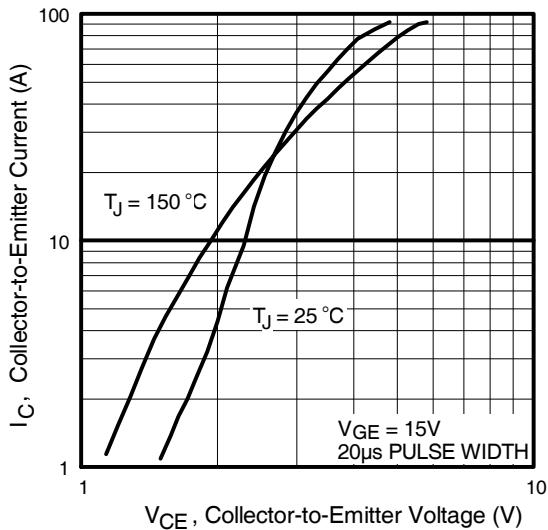


Fig. 2 - Typical Output Characteristics

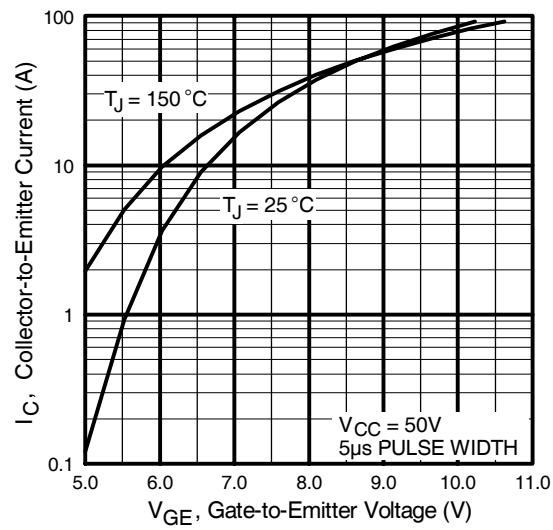


Fig. 3 - Typical Transfer Characteristics

IRG4BC30WPbF

International
IR Rectifier

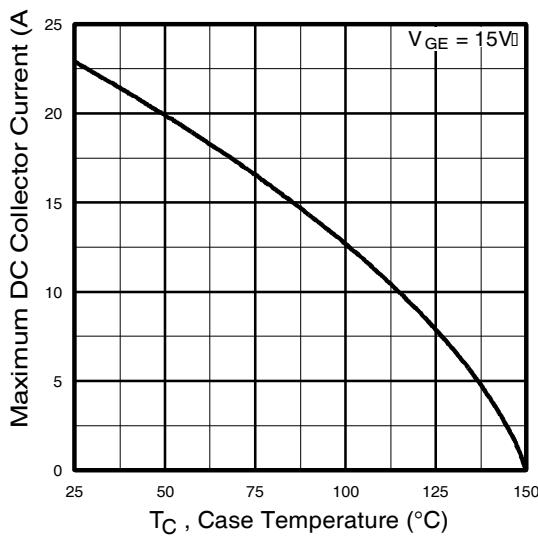


Fig. 4 - Maximum Collector Current vs. Case Temperature

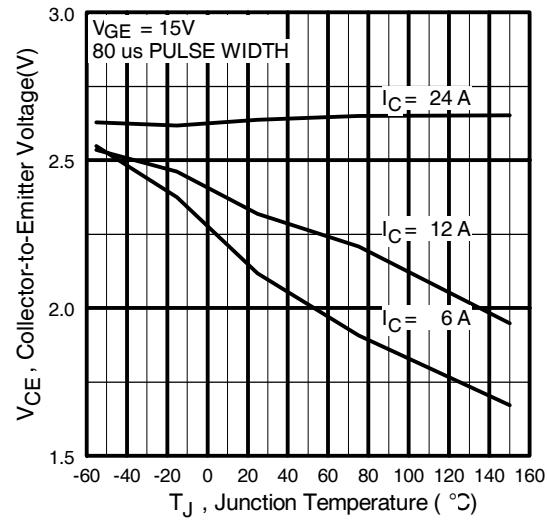


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

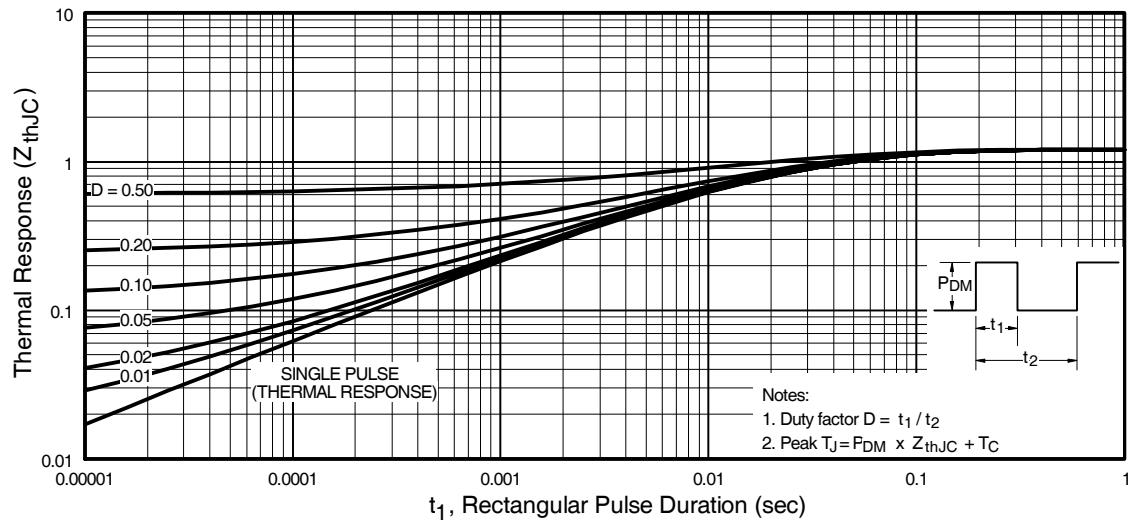


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

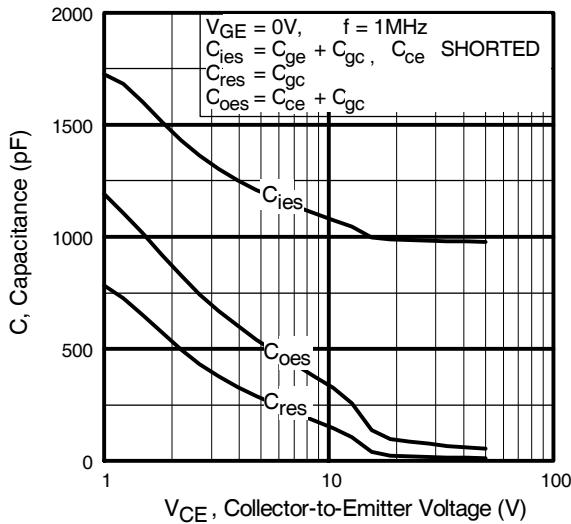


Fig. 7 - Typical Capacitance vs.
 Collector-to-Emitter Voltage

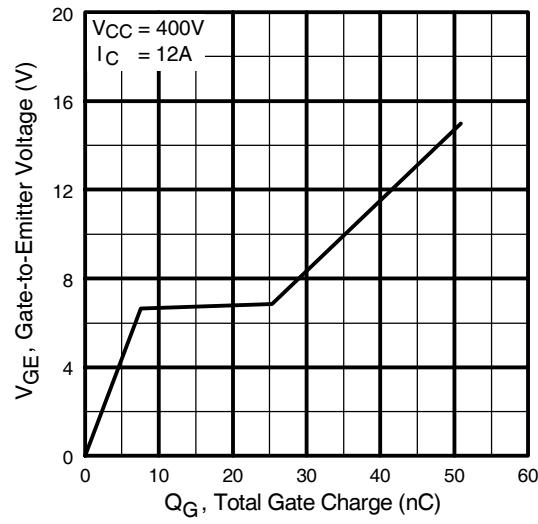


Fig. 8 - Typical Gate Charge vs.
 Gate-to-Emitter Voltage

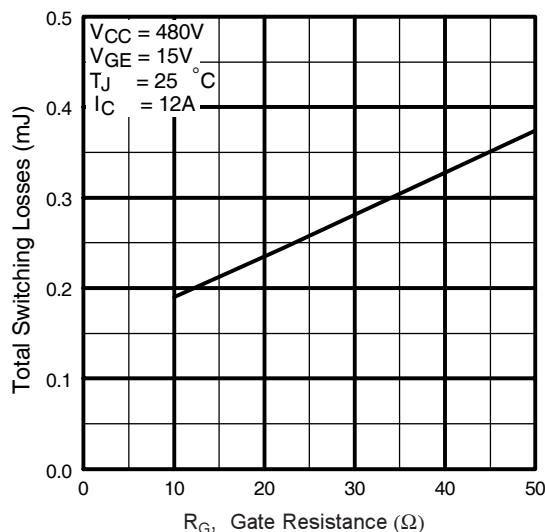


Fig. 9 - Typical Switching Losses vs. Gate
 Resistance

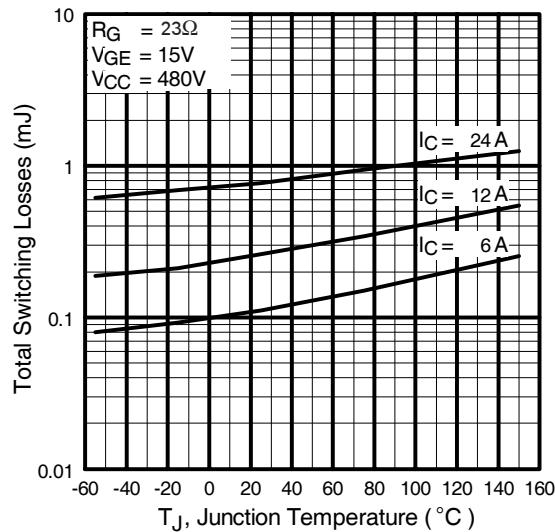


Fig. 10 - Typical Switching Losses vs.
 Junction Temperature

IRG4BC30WPbF

International
IR Rectifier

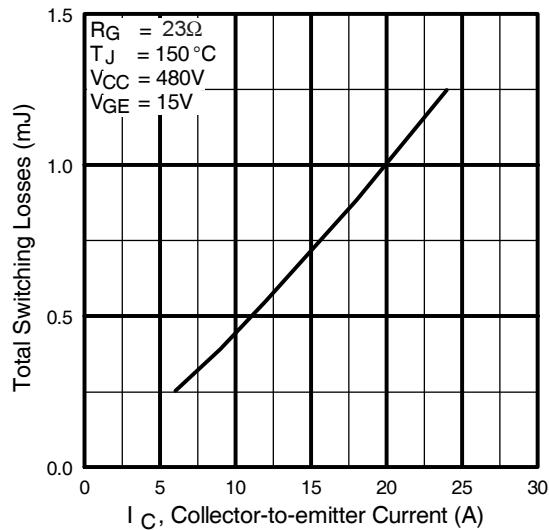


Fig. 11 - Typical Switching Losses vs.
Collector-to-Emitter Current

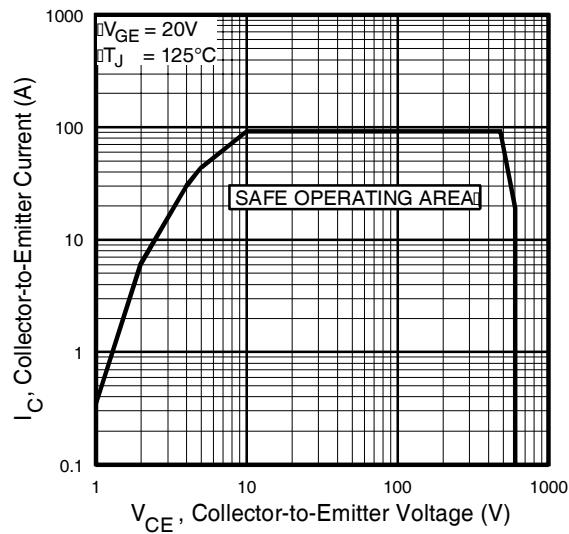
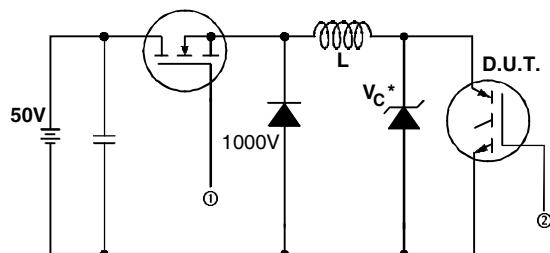
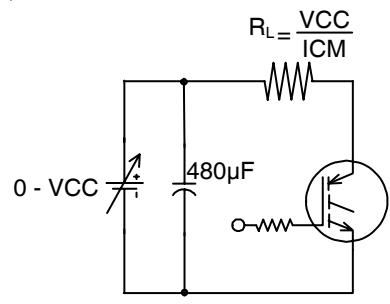


Fig. 12 - Turn-Off SOA



* 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



Pulsed Collector Current Test Circuit

Fig. 13b - Pulsed Collector Current Test Circuit

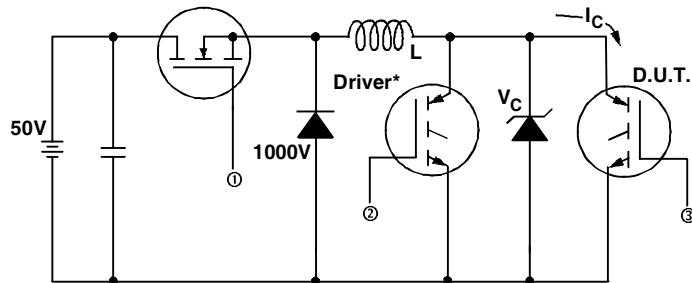


Fig. 14a - Switching Loss Test Circuit

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

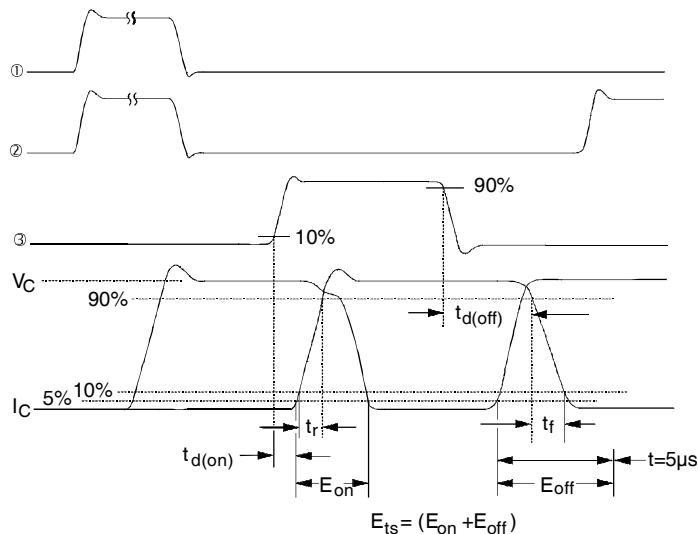
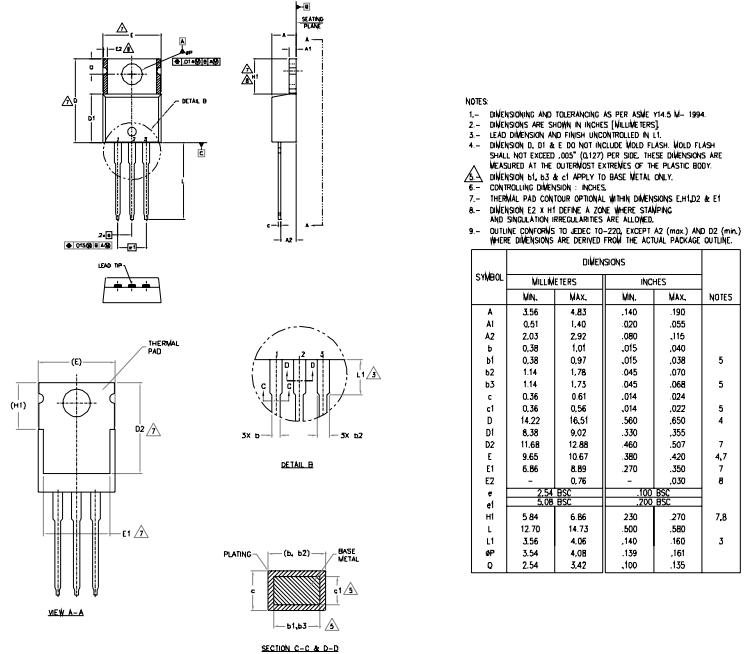


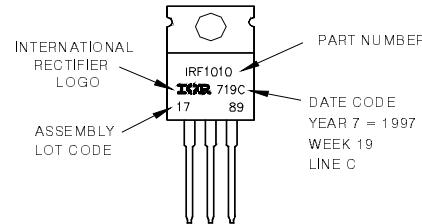
Fig. 14b - Switching Loss Waveforms

TO-220AB Package Outline (Dimensions are shown in millimeters (inches))



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"



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

Data and specifications subject to change without notice.

International
IR 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. 02/2010