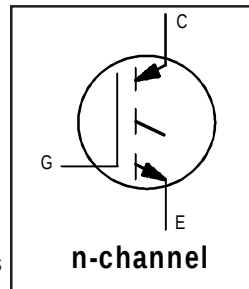


IRG4BC30W-S

INSULATED GATE BIPOLAR TRANSISTOR

Features

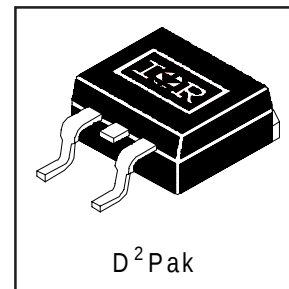
- Designed expressly for Switch-Mode Power Supply and PFC (power factor correction) applications
- Industry-benchmark switching losses improve efficiency of all power supply topologies
- 50% reduction of Eoff parameter
- Low IGBT conduction losses
- Latest-generation IGBT design and construction offers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



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 2.10V$
@ $V_{GE} = 15V, I_C = 12A$

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°C	Continuous Collector Current	23	A
I _C @ T _C = 100°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°C	Maximum Power Dissipation	100	W
P _D @ T _C = 100°C	Maximum Power Dissipation	42	
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)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	1.2	$^\circ C/W$
$R_{\theta JA}$	Junction-to-Ambient, (PCB Mounted,steady-state)*	—	40	

* When mounted on 1" square PCB (FR-4 or G-10 Material). For recommended footprint and soldering techniques refer to application note #AN-994.

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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	—	0.34	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	2.1	2.7	V	$I_C = 12A, V_{GE} = 15V$
		—	2.45	—		$I_C = 23A, V_{GE} = 15V$
		—	1.95	—		$I_C = 12A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$	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	—	-11	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 250\mu A$
g_{fe}	Forward Transconductance ⑤	11	16	—	S	$V_{CE} = 100V, I_C = 12A$
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)	—	51	76	nC	$I_C = 12A$
Q_{ge}	Gate - Emitter Charge (turn-on)	—	7.6	11		$V_{CC} = 400V, V_{GE} = 15V$
Q_{gc}	Gate - Collector Charge (turn-on)	—	18	27		See Fig.8
$t_{d(on)}$	Turn-On Delay Time	—	25	—	ns	$T_J = 25^\circ\text{C}$
t_r	Rise Time	—	16	—		$I_C = 12A, V_{CC} = 480V$
$t_{d(off)}$	Turn-Off Delay Time	—	99	150		$V_{GE} = 15V, R_G = 23\Omega$
t_f	Fall Time	—	67	100		Energy losses include "tail"
E_{on}	Turn-On Switching Loss	—	0.13	—	mJ	See Fig. 9, 10, 13, 14
E_{off}	Turn-Off Switching Loss	—	0.13	—		
E_{ts}	Total Switching Loss	—	0.26	0.35		
$t_{d(on)}$	Turn-On Delay Time	—	24	—	ns	$T_J = 150^\circ\text{C},$
t_r	Rise Time	—	17	—		$I_C = 12A, V_{CC} = 480V$
$t_{d(off)}$	Turn-Off Delay Time	—	150	—		$V_{GE} = 15V, R_G = 23\Omega$
t_f	Fall Time	—	150	—		Energy losses include "tail"
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	$V_{GE} = 0V$
C_{oes}	Output Capacitance	—	71	—		$V_{CC} = 30V$
C_{res}	Reverse Transfer Capacitance	—	18	—		$f = 1.0MHz$

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.

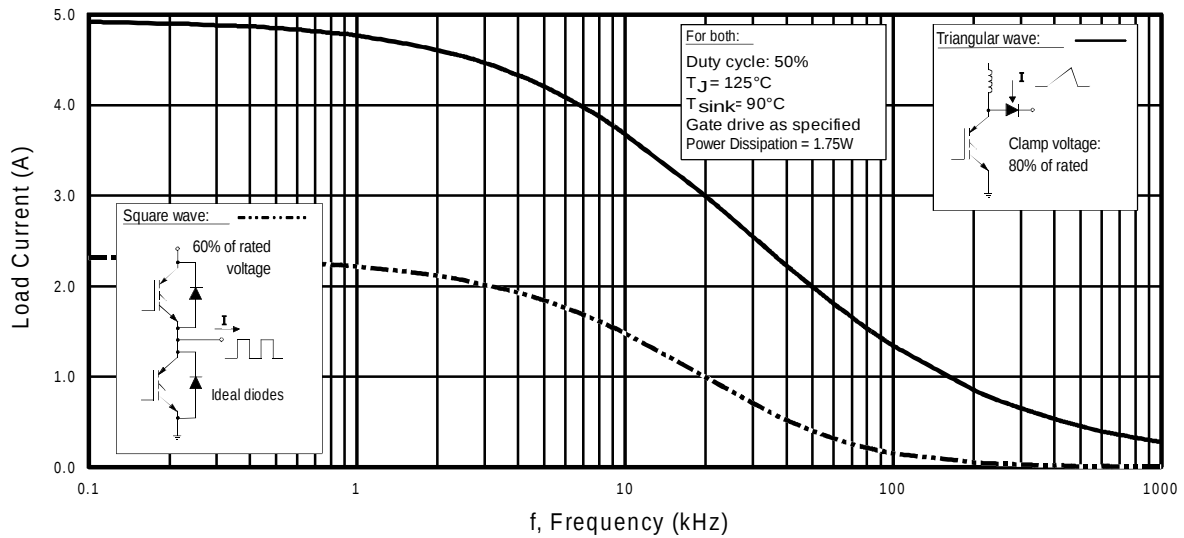


Fig. 1 - Typical Load Current vs. Frequency
(For square wave, $I = I_{\text{RMS}}$ of fundamental; for triangular wave, $I = I_{\text{PK}}$)

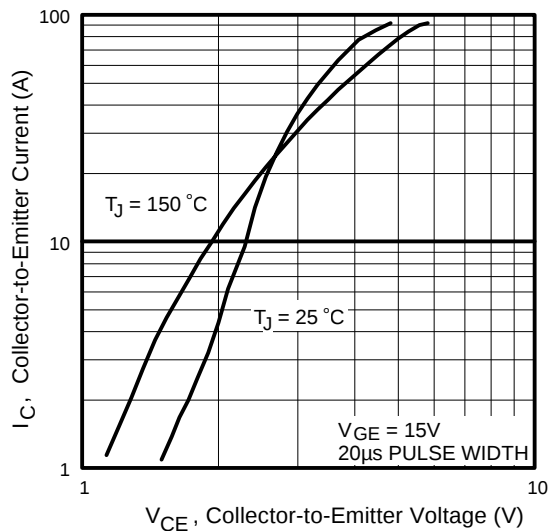


Fig. 2 - Typical Output Characteristics

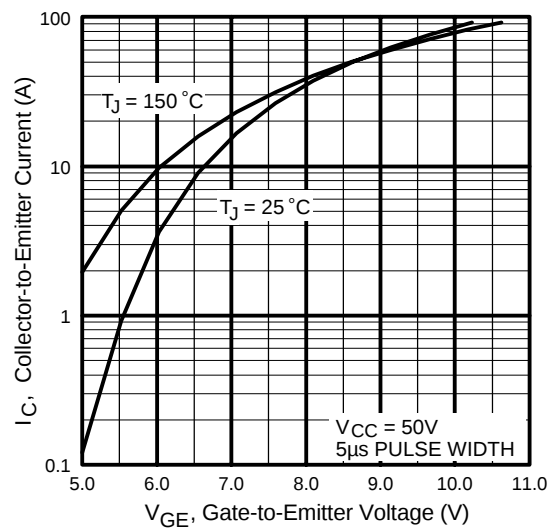


Fig. 3 - Typical Transfer Characteristics

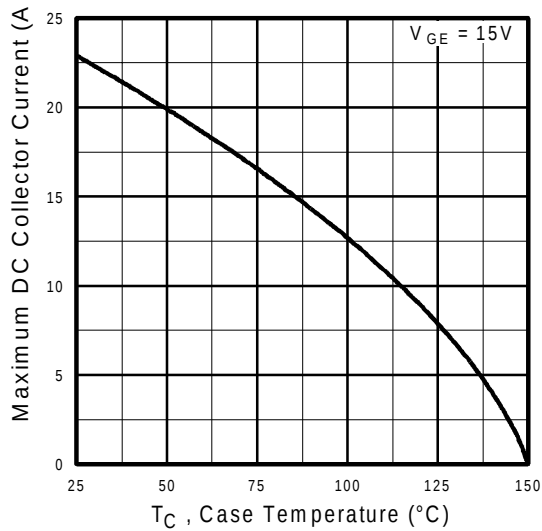


Fig. 4 - Maximum Collector Current vs. Case Temperature

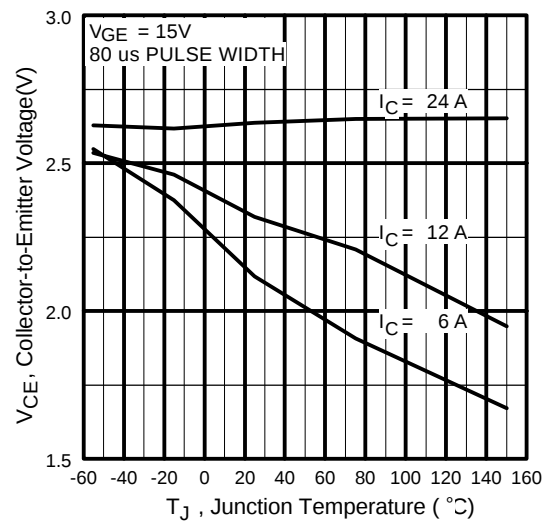


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

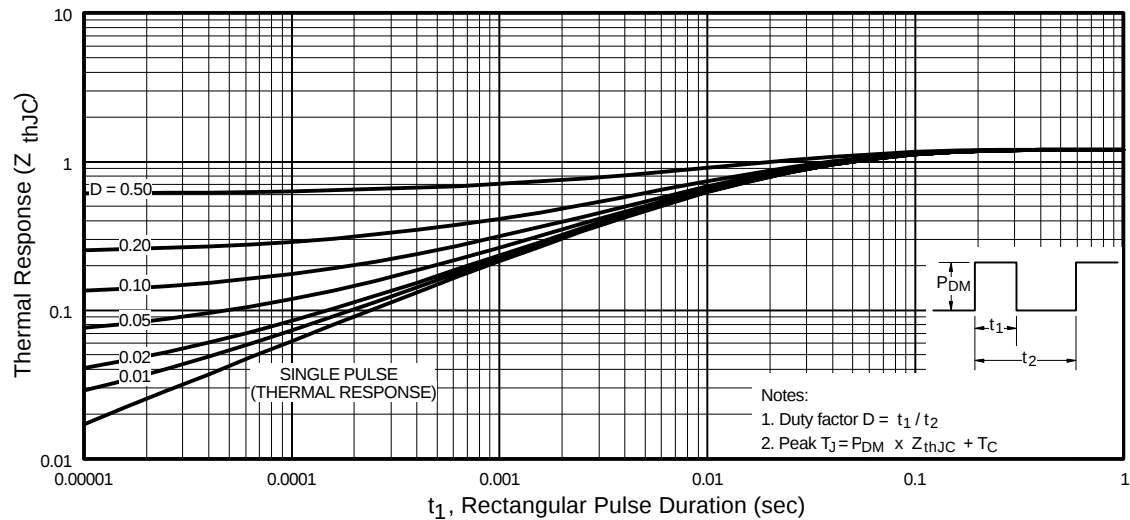


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

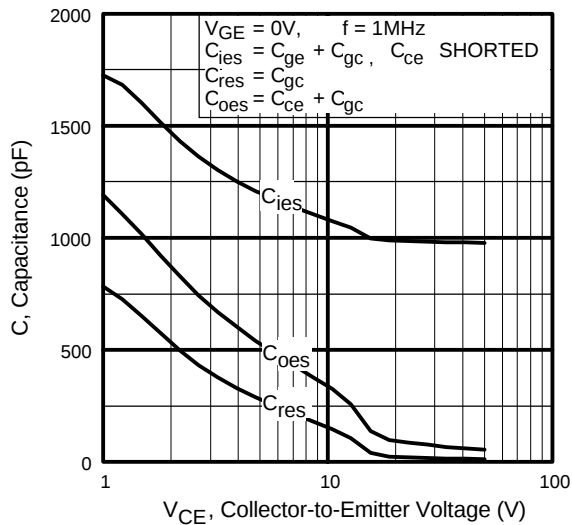


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

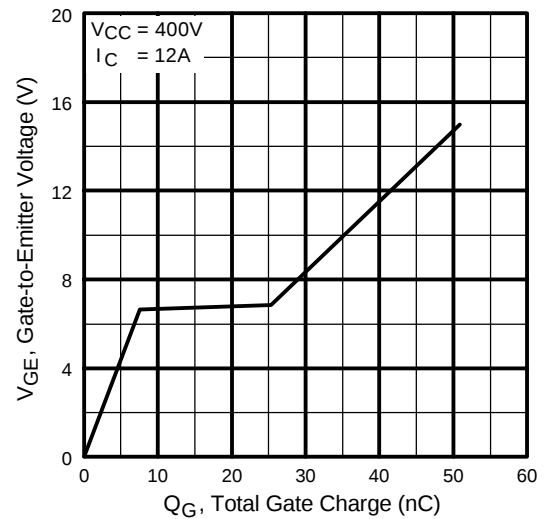


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

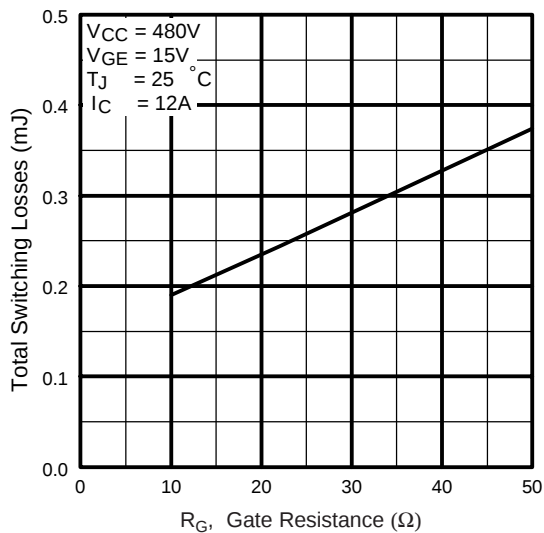


Fig. 9 - Typical Switching Losses vs. Gate Resistance

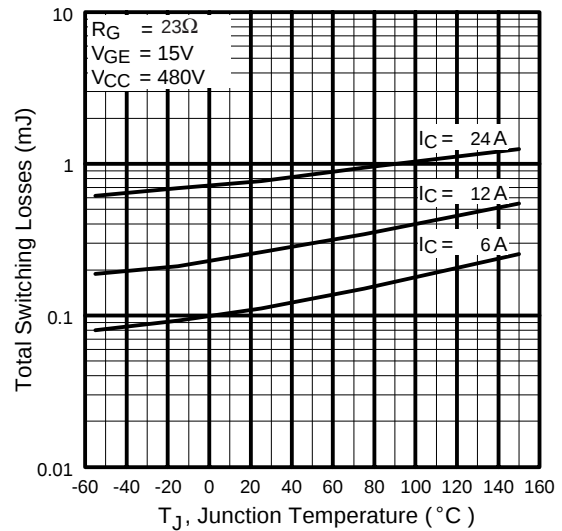


Fig. 10 - Typical Switching Losses vs. Junction Temperature

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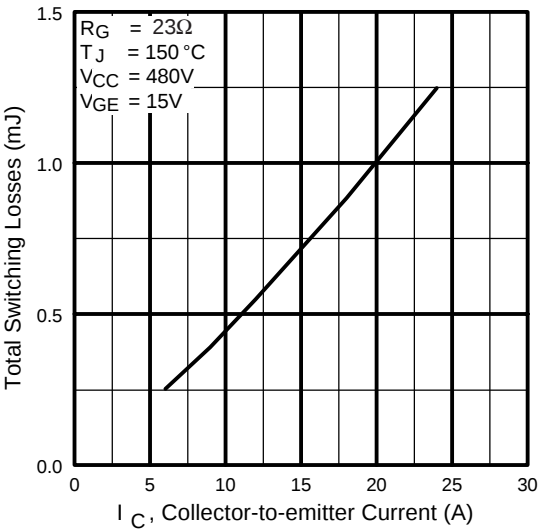


Fig. 11 - Typical Switching Losses vs. Collector-to-Emitter Current

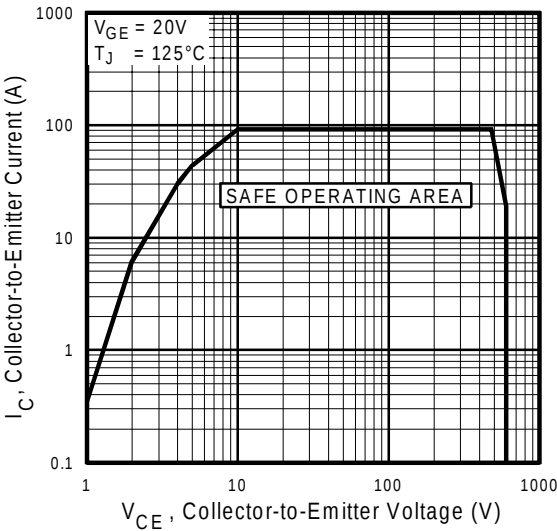
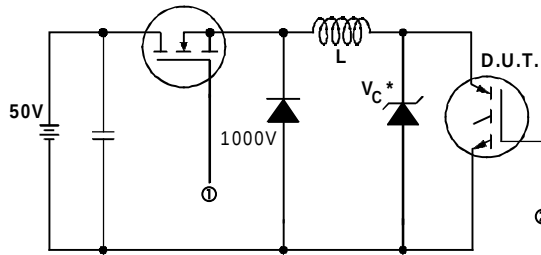


Fig. 12 - Turn-Off SOA



* 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

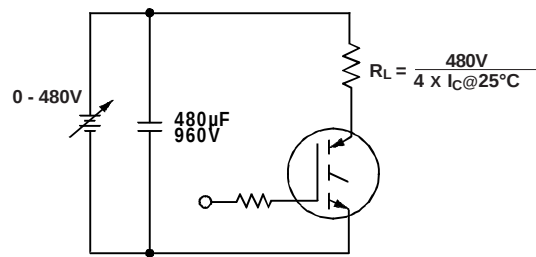


Fig. 13b - Pulsed Collector Current Test Circuit

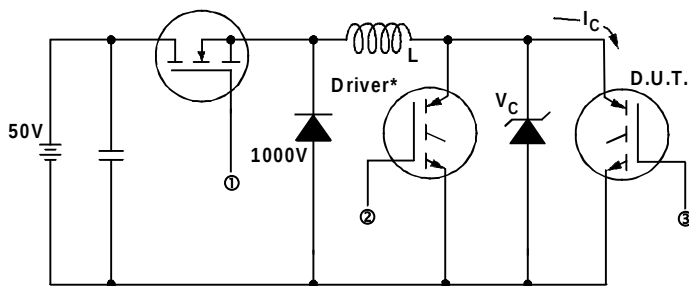


Fig. 14a - Switching Loss Test Circuit

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

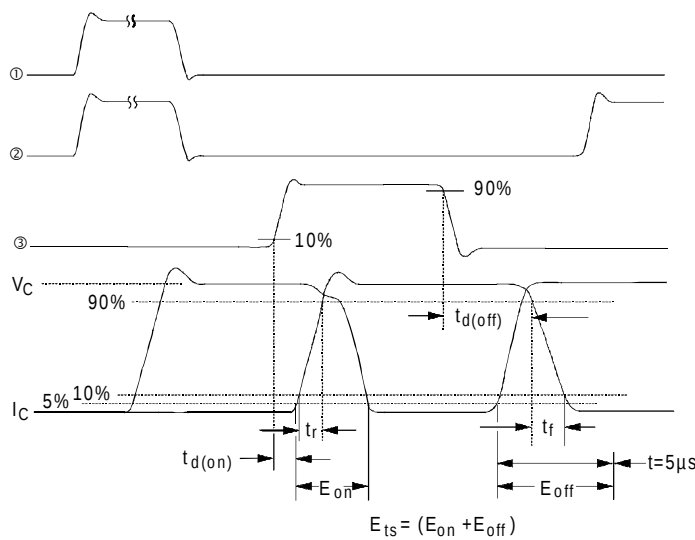
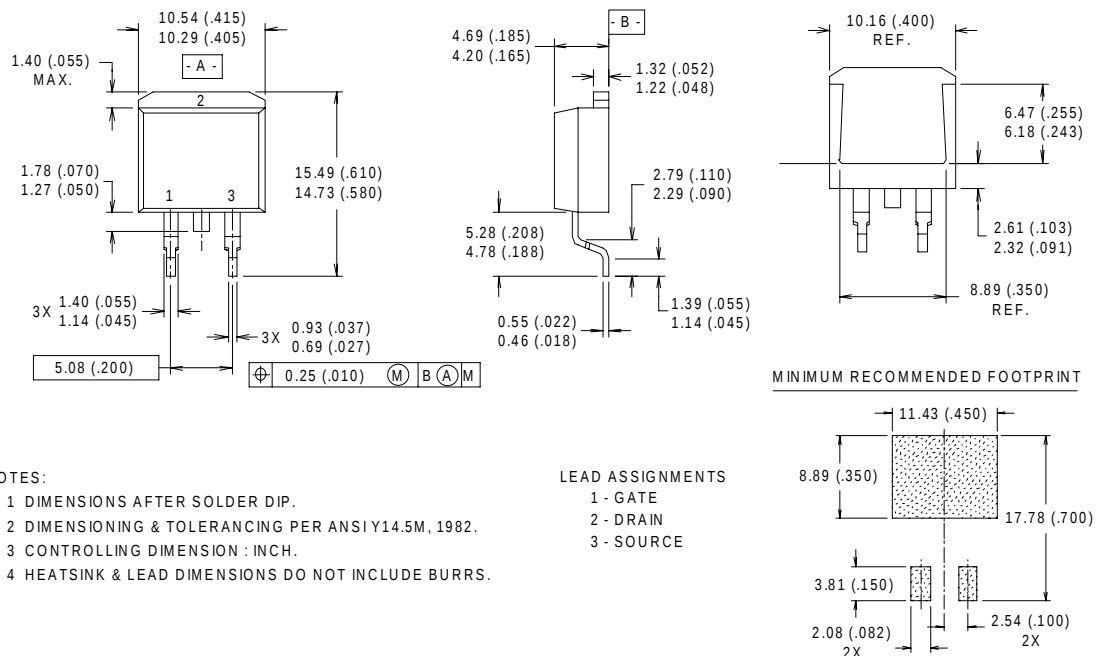


Fig. 14b - Switching Loss Waveforms

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D²Pak Package Outline



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EUROPEAN HEADQUARTERS: Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: ++ 44 1883 732020

IR CANADA: 7321 Victoria Park Ave., Suite 201, Markham, Ontario L3R 2Z8, Tel: (905) 475 1897

IR GERMANY: Saalburgstrasse 157, 61350 Bad Homburg Tel: ++ 49 6172 96590

IR ITALY: Via Liguria 49, 10071 Borgaro, Torino Tel: ++ 39 11 451 0111

IR FAR EAST: K&H Bldg., 2F, 30-4 Nishi-Ikebukuro 3-Chome, Toshima-Ku, Tokyo Japan 171 Tel: 81 3 3983 0086

IR SOUTHEAST ASIA: 315 Outram Road, #10-02 Tan Boon Liat Building, Singapore 0316 Tel: 65 221 8371

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