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With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



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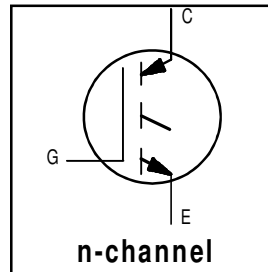
# IRG4BH20K-L

INSULATED GATE BIPOLAR TRANSISTOR

Short Circuit Rated  
UltraFast IGBT

## Features

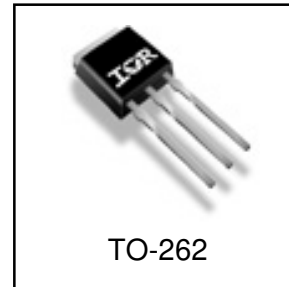
- High short circuit rating optimized for motor control,  $t_{sc} = 10\mu s$ ,  $V_{CC} = 720V$ ,  $T_J = 125^\circ C$ ,  $V_{GE} = 15V$
- Combines low conduction losses with high switching speed
- Latest generation design provides tighter parameter distribution and higher efficiency than previous generations
- Industry standard TO-262 package



$V_{CES} = 1200V$
$V_{CE(on)} \text{ typ.} = 3.17V$
@ $V_{GE} = 15V, I_C = 5.0A$

## 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 IGBT's offer highest power density motor controls possible



## Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Voltage	1200	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	11	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	5.0	
$I_{CM}$	Pulsed Collector Current ①	22	
$I_{LM}$	Clamped Inductive Load Current ②	22	
$t_{sc}$	Short Circuit Withstand Time	10	$\mu s$
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$E_{ARV}$	Reverse Voltage Avalanche Energy ③	130	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	60	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	24	
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	$^\circ C$

## 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	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	40	
Wt	Weight	6 (0.21)	—	g (oz)

**Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA
V <sub>(BR)ECS</sub>	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0A
ΔV <sub>(BR)CES</sub> /ΔT <sub>J</sub>	Temperature Coeff. of Breakdown Voltage	—	1.13	—	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 2.5mA
V <sub>CE(ON)</sub>	Collector-to-Emitter Saturation Voltage	—	3.17	4.3	V	I <sub>C</sub> = 5.0A V <sub>GE</sub> = 15V
		—	4.04	—		I <sub>C</sub> = 11A See Fig.2, 5
		—	2.84	—		I <sub>C</sub> = 5.0A, T <sub>J</sub> = 150°C
V <sub>GE(th)</sub>	Gate Threshold Voltage	3.5	—	6.5		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
ΔV <sub>GE(th)</sub> /ΔT <sub>J</sub>	Temperature Coeff. of Threshold Voltage	—	-10	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1mA
g <sub>fe</sub>	Forward Transconductance ⑤	2.3	3.5	—	S	V <sub>CE</sub> = 100 V, I <sub>C</sub> = 5.0A
I <sub>CES</sub>	Zero Gate Voltage Collector Current	—	—	250	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 1200V
		—	—	2.0		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 10V, T <sub>J</sub> = 25°C
		—	—	1000		V <sub>GE</sub> = 0V, V <sub>CE</sub> = 1200V, T <sub>J</sub> = 150°C
I <sub>GES</sub>	Gate-to-Emitter Leakage Current	—	—	±100	nA	V <sub>GE</sub> = ±20V

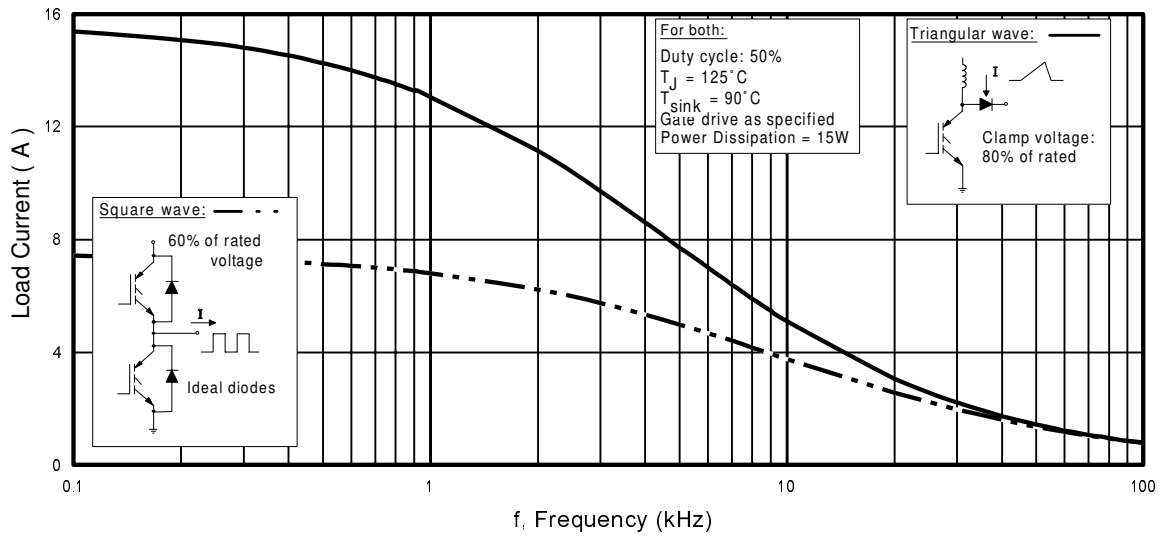
**Switching Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge (turn-on)	—	28	43	nC	I <sub>C</sub> = 5.0A
Q <sub>ge</sub>	Gate - Emitter Charge (turn-on)	—	4.4	6.6		V <sub>CC</sub> = 400V See Fig.8
Q <sub>gc</sub>	Gate - Collector Charge (turn-on)	—	12	18		V <sub>GE</sub> = 15V
t <sub>d(on)</sub>	Turn-On Delay Time	—	23	—	ns	T <sub>J</sub> = 25°C I <sub>C</sub> = 5.0A, V <sub>CC</sub> = 960V V <sub>GE</sub> = 15V, R <sub>G</sub> = 50Ω
t <sub>r</sub>	Rise Time	—	26	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	93	140		
t <sub>f</sub>	Fall Time	—	270	400		
E <sub>on</sub>	Turn-On Switching Loss	—	0.45	—	mJ	Energy losses include "tail" See Fig. 9,10,14
E <sub>off</sub>	Turn-Off Switching Loss	—	0.44	—		
E <sub>ts</sub>	Total Switching Loss	—	0.89	1.2		
t <sub>sc</sub>	Short Circuit Withstand Time	10	—	—	μs	V <sub>CC</sub> = 720V, T <sub>J</sub> = 125°C V <sub>GE</sub> = 15V, R <sub>G</sub> = 50Ω
t <sub>d(on)</sub>	Turn-On Delay Time	—	23	—	ns	T <sub>J</sub> = 150°C, I <sub>C</sub> = 5.0A, V <sub>CC</sub> = 960V V <sub>GE</sub> = 15V, R <sub>G</sub> = 50Ω Energy losses include "tail" See Fig. 10,11,14
t <sub>r</sub>	Rise Time	—	28	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	100	—		
t <sub>f</sub>	Fall Time	—	620	—		
E <sub>ts</sub>	Total Switching Loss	—	1.7	—	mJ	
L <sub>E</sub>	Internal Emitter Inductance	—	7.5	—	nH	Measured 5mm from package
C <sub>ies</sub>	Input Capacitance	—	435	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V See Fig. 7 f = 1.0MHz
C <sub>oes</sub>	Output Capacitance	—	44	—		
C <sub>res</sub>	Reverse Transfer Capacitance	—	8.3	—		

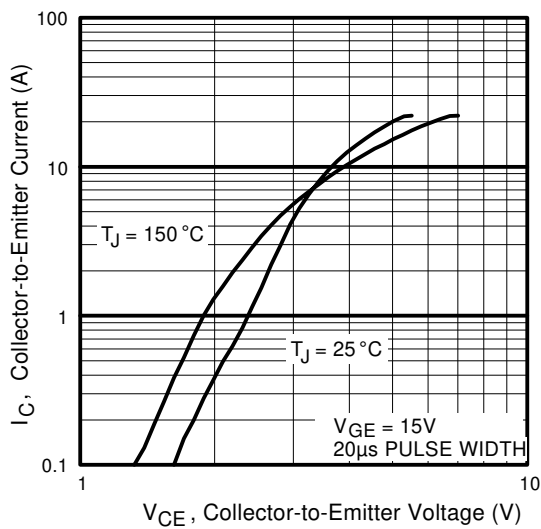
**Notes:**

- ① Repetitive rating; V<sub>GE</sub> = 20V, pulse width limited by max. junction temperature. ( See fig. 13b )
- ② V<sub>CC</sub> = 80%(V<sub>CES</sub>), V<sub>GE</sub> = 20V, L = 10μH, R<sub>G</sub> = 50Ω, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width ≤ 80μs; duty factor ≤ 0.1%.
- ⑤ Pulse width 5.0μs, single shot.

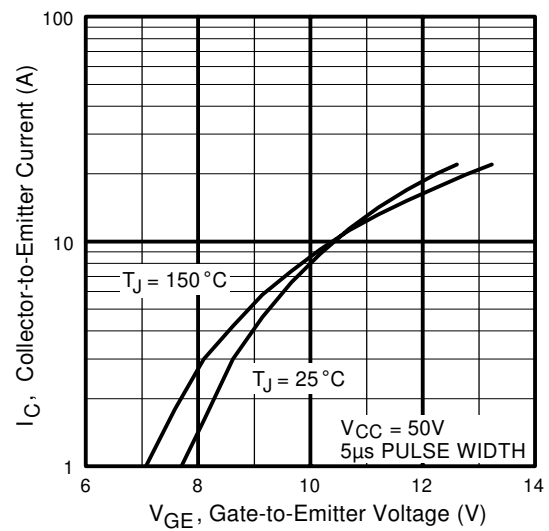
\* When mounted on 1" square PCB (FR-4 or G-10 Material ). For recommended footprint and soldering techniques refer to application note #AN-994.



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



**Fig. 2 - Typical Output Characteristics**  
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**Fig. 3 - Typical Transfer Characteristics**

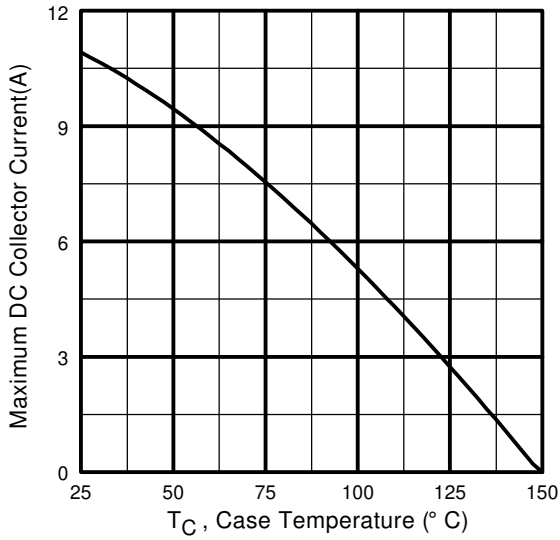


Fig. 4 - Maximum Collector Current vs. Case Temperature

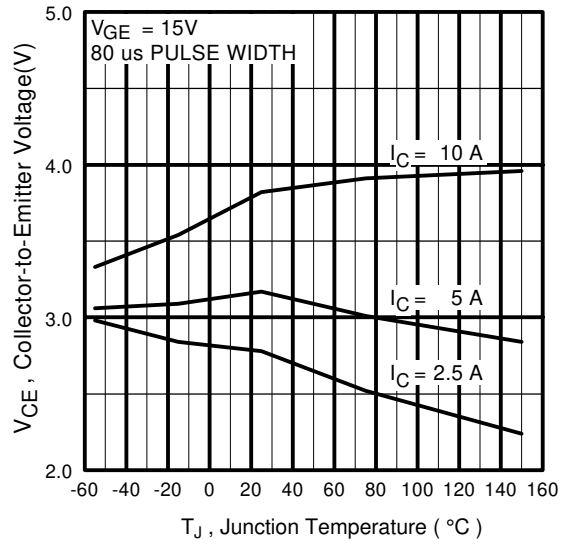


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

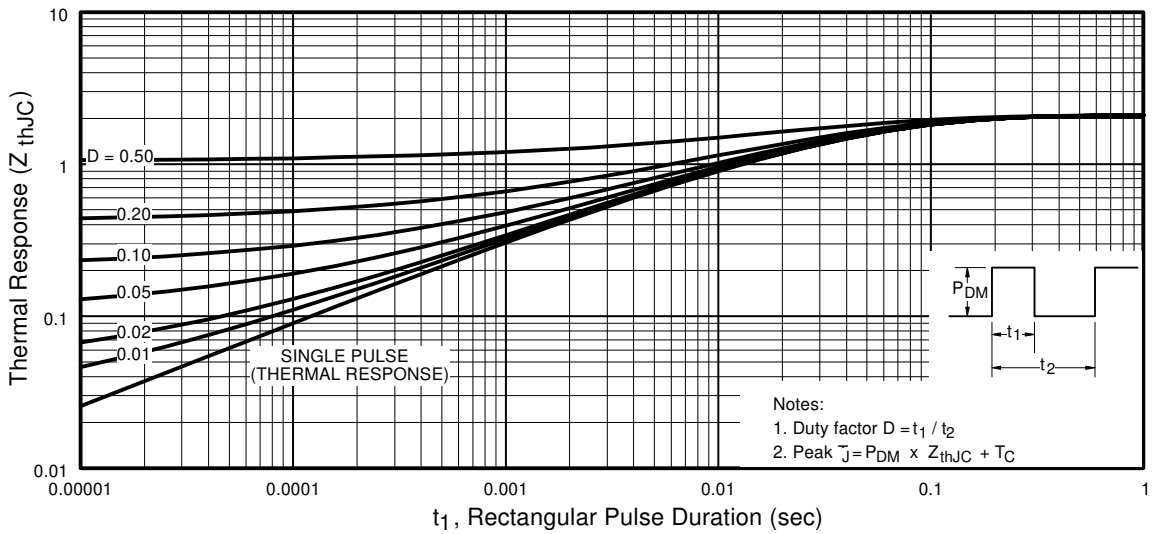


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

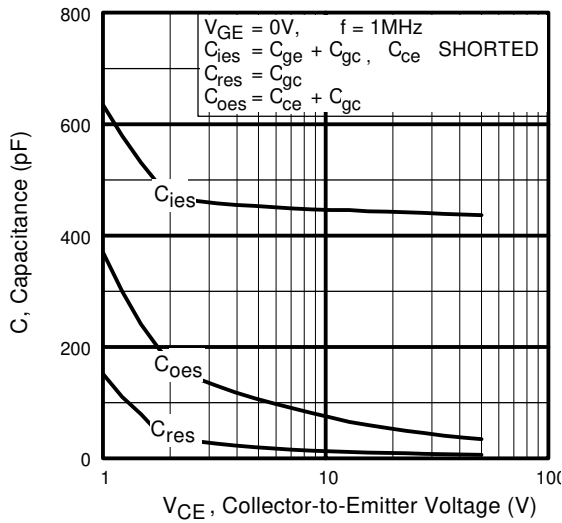


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

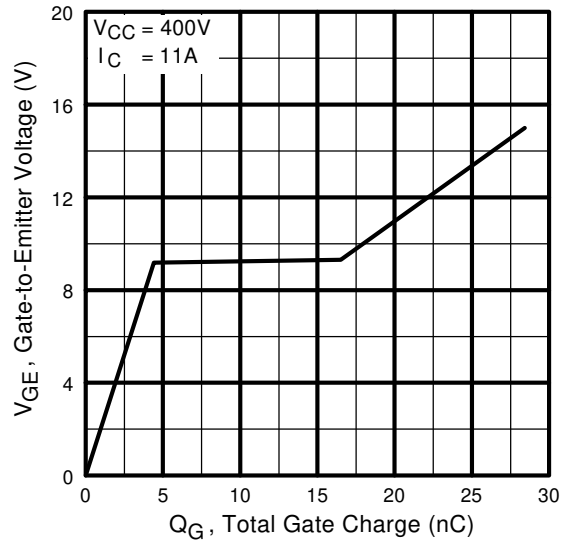


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

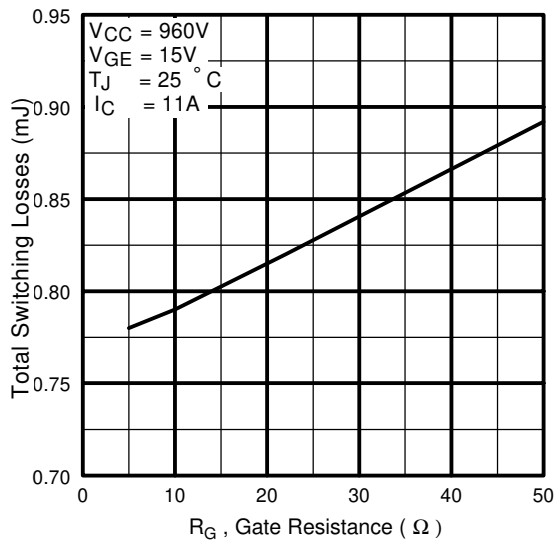


Fig. 9 - Typical Switching Losses vs. Gate Resistance

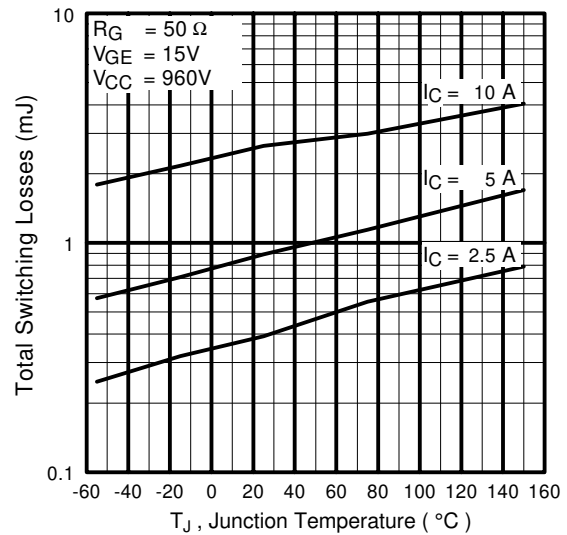
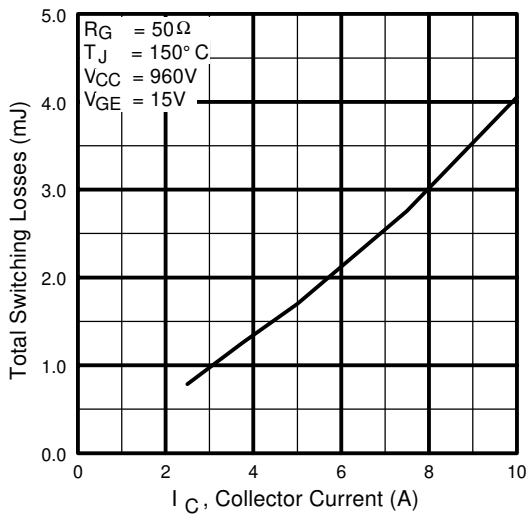
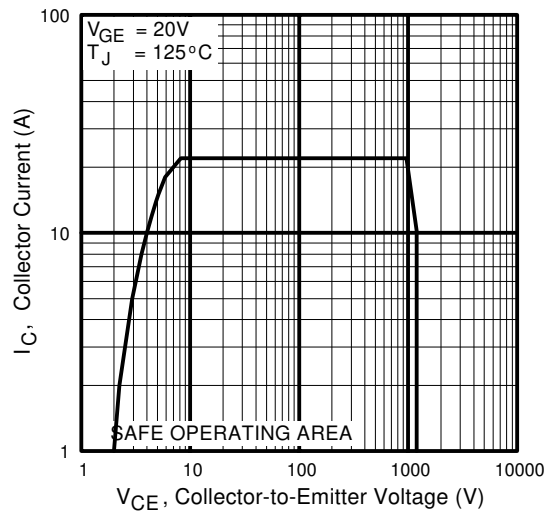


Fig. 10 - Typical Switching Losses vs. Junction Temperature

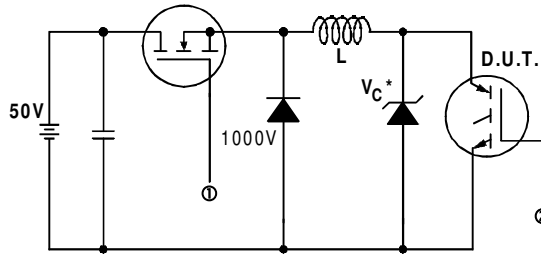
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**Fig. 11** - Typical Switching Losses vs. Collector-to-Emitter Current

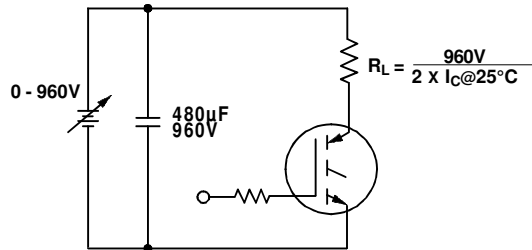


**Fig. 12** - Turn-Off SOA

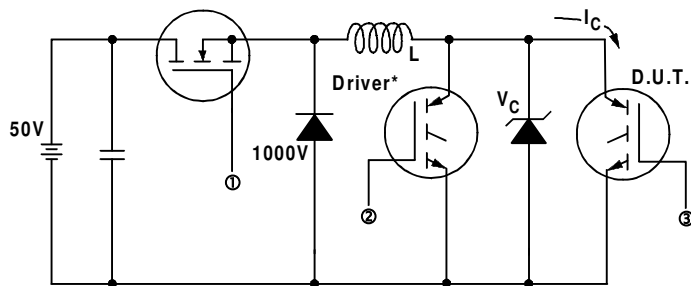


\* Driver same type as D.U.T.;  $V_c = 80\%$  of  $V_{ce(max)}$   
\* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated  $I_d$ .

**Fig. 13a** - Clamped Inductive Load Test Circuit

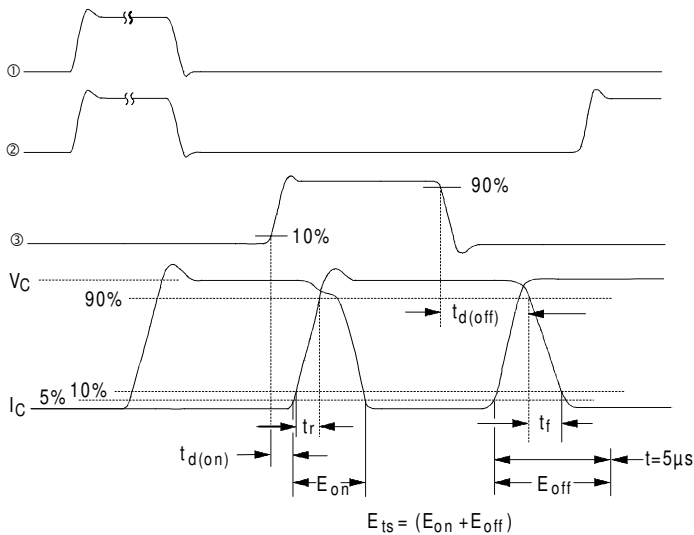


**Fig. 13b** - Pulsed Collector Current Test Circuit



**Fig. 14a** - Switching Loss Test Circuit

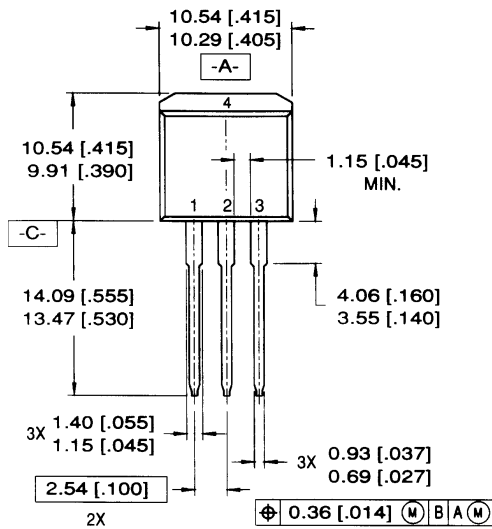
\* Driver same type as D.U.T.,  $V_C = 960V$



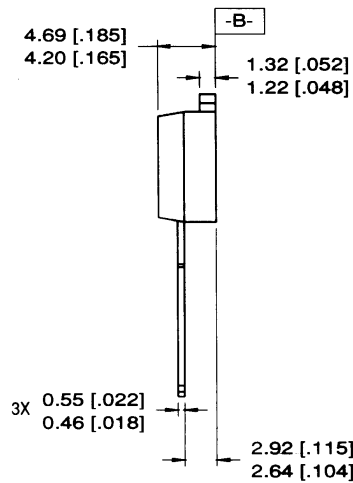
**Fig. 14b** - Switching Loss Waveforms



TO-262 Package Details



**LEAD ASSIGNMENTS**  
 1 = GATE      3 = SOURCE  
 2 = DRAIN    4 = DRAIN



NOTES:

1. DIMENSIONING & TOLERANCING PER ANSI Y14.5M-1982
2. CONTROLLING DIMENSION: INCH.
3. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
4. HEATSINK & LEAD DIMENSIONS DO NOT INCLUDE BURRS.