

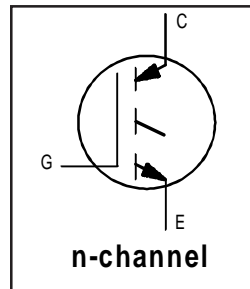
# IRG4PSC71U

INSULATED GATE BIPOLAR TRANSISTOR

UltraFast Speed IGBT

## Features

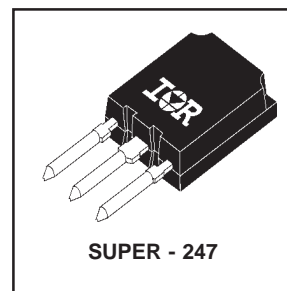
- UltraFast switching speed optimized for operating frequencies 8 to 40kHz in hard switching, 200kHz in resonant mode soft switching
- Generation 4 IGBT design provides tighter parameter distribution and higher efficiency (minimum switching and conduction losses) than prior generations
- Industry-benchmark Super-247 package with higher power handling capability compared to same footprint TO-247
- Creepage distance increased to 5.35mm



$V_{CES} = 600V$
$V_{CE(on)} \text{ typ.} = 1.67V$
@ $V_{GE} = 15V, I_C = 60A$

## Benefits

- Generation 4 IGBT's offer highest efficiencies available
- Maximum power density, twice the power handling of the TO-247, less space than TO-264
- IGBTs optimized for specific application conditions
- Cost and space saving in designs that require multiple, paralleled IGBTs



## 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	85 <sup>⑥</sup>	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	60	
$I_{CM}$	Pulsed Collector Current <sup>①</sup>	200	
$I_{LM}$	Clamped Inductive Load Current <sup>②</sup>	200	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$E_{ARV}$	Reverse Voltage Avalanche Energy <sup>③</sup>	180	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	350	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	140	
$T_J$	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\ Mechanical

	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	0.36	°C/W
$R_{\theta CS}$	Case-to-Sink, flat, greased surface	—	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	—	38	
	Recommended Clip Force	20.0(2.0)	—	—	N (kgf)
	Weight	—	6 (0.21)	—	g (oz)

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

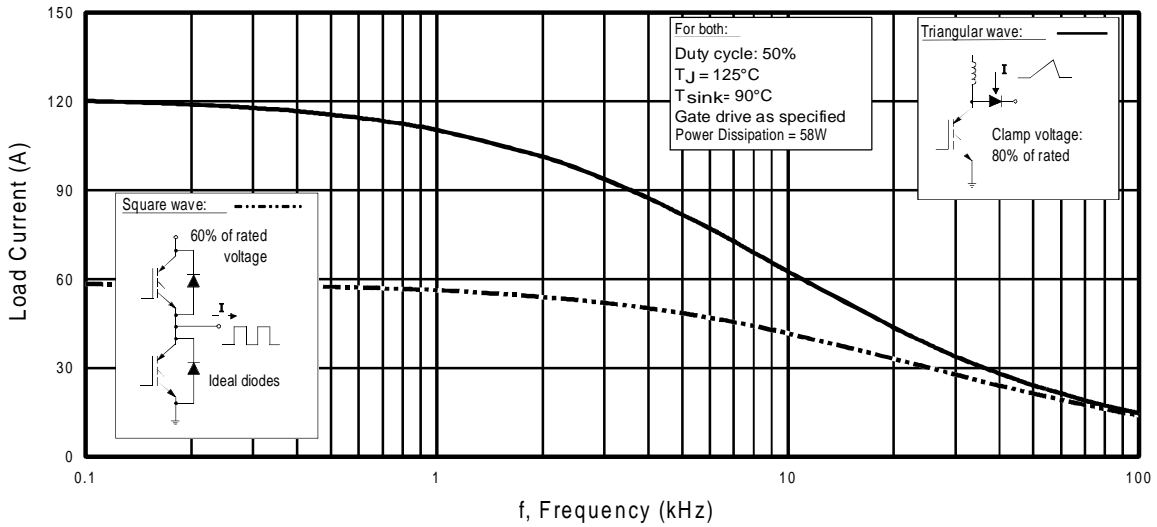
	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)CES</sub>	Collector-to-Emitter Breakdown Voltage	600	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 250μA
V <sub>(BR)ECS</sub>	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	V <sub>GE</sub> = 0V, I <sub>C</sub> = 1.0A
ΔV <sub>(BR)CES/ΔT<sub>J</sub></sub>	Temperature Coeff. of Breakdown Voltage	—	0.45	—	V/°C	V <sub>GE</sub> = 0V, I <sub>C</sub> = 5.0mA
V <sub>CE(ON)</sub>	Collector-to-Emitter Saturation Voltage	—	1.67	2.0	V	I <sub>C</sub> = 60A I <sub>C</sub> = 100A I <sub>C</sub> = 60A, T <sub>J</sub> = 150°C V <sub>GE</sub> = 15V See Fig.2, 5
		—	1.95	—		
		—	1.71	—		
V <sub>GE(th)</sub>	Gate Threshold Voltage	3.0	—	6.0		V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250μA
ΔV <sub>GE(th)/ΔT<sub>J</sub></sub>	Temperature Coeff. of Threshold Voltage	—	-10	—	mV/°C	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 1.0mA
g <sub>fe</sub>	Forward Transconductance ⑤	47	70	—	S	V <sub>CE</sub> = 50V, I <sub>C</sub> = 60A
I <sub>CES</sub>	Zero Gate Voltage Collector Current	—	—	500	μA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V V <sub>GE</sub> = 0V, V <sub>CE</sub> = 10V, T <sub>J</sub> = 25°C
		—	—	2.0		
		—	—	5.0	mA	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 600V, 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)**

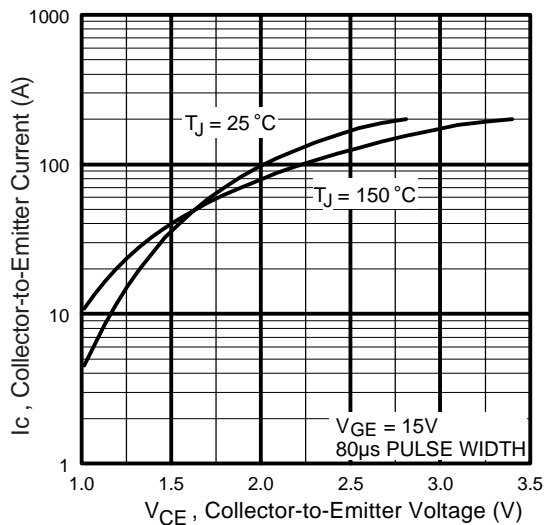
	Parameter	Min.	Typ.	Max.	Units	Conditions
Q <sub>g</sub>	Total Gate Charge (turn-on)	—	340	520	nC	I <sub>C</sub> = 60A V <sub>CC</sub> = 400V V <sub>GE</sub> = 15V See Fig. 8
Q <sub>ge</sub>	Gate - Emitter Charge (turn-on)	—	44	66		
Q <sub>gc</sub>	Gate - Collector Charge (turn-on)	—	160	240		
t <sub>d(on)</sub>	Turn-On Delay Time	—	34	—	ns	T <sub>J</sub> = 25°C I <sub>C</sub> = 60A, V <sub>CC</sub> = 480V V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω Energy losses include "tail" See Fig. 10, 11, 13, 14
t <sub>r</sub>	Rise Time	—	50	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	56	84		
t <sub>f</sub>	Fall Time	—	86	130		
E <sub>on</sub>	Turn-On Switching Loss	—	0.42	—	mJ	See Fig. 10, 11, 13, 14
E <sub>off</sub>	Turn-Off Switching Loss	—	1.99	—		
E <sub>ts</sub>	Total Switching Loss	—	2.41	3.2		
t <sub>d(on)</sub>	Turn-On Delay Time	—	30	—	ns	T <sub>J</sub> = 150°C, I <sub>C</sub> = 60A, V <sub>CC</sub> = 480V V <sub>GE</sub> = 15V, R <sub>G</sub> = 5.0Ω Energy losses include "tail" See Fig. 13, 14
t <sub>r</sub>	Rise Time	—	49	—		
t <sub>d(off)</sub>	Turn-Off Delay Time	—	129	—		
t <sub>f</sub>	Fall Time	—	175	—		
E <sub>ts</sub>	Total Switching Loss	—	4.5	—	mJ	
L <sub>E</sub>	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
C <sub>ies</sub>	Input Capacitance	—	7500	—	pF	V <sub>GE</sub> = 0V V <sub>CC</sub> = 30V f = 1.0MHz See Fig. 7
C <sub>oes</sub>	Output Capacitance	—	720	—		
C <sub>res</sub>	Reverse Transfer Capacitance	—	93	—		

**Notes:**

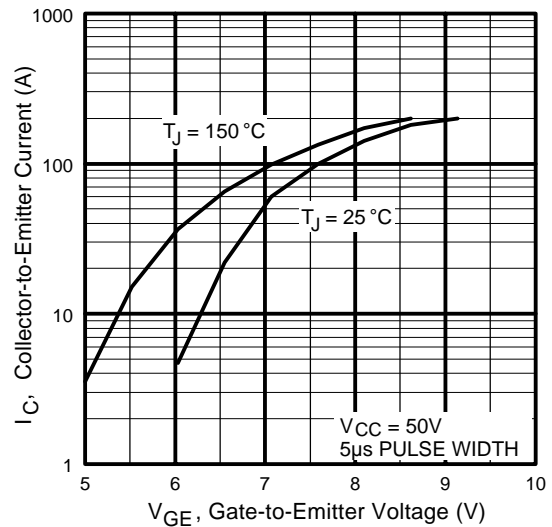
- ① Repetitive rating; V<sub>GE</sub> = 20V, pulse width limited by max. junction temperature. ( See fig. 13b )
- ② V<sub>CC</sub> = 80%(V<sub>CES</sub>), V<sub>GE</sub> = 20V, L = 10μH, R<sub>G</sub> = 5.0Ω, (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width ≤ 80μs; duty factor ≤ 0.1%.
- ⑤ Pulse width 5.0μs, single shot.
- ⑥ Current limited by the package, (Die current = 100A)



**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**

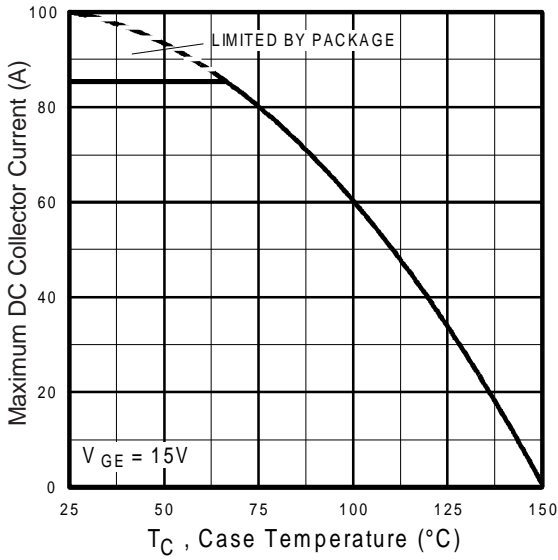


Fig. 4 - Maximum Collector Current vs. Case Temperature

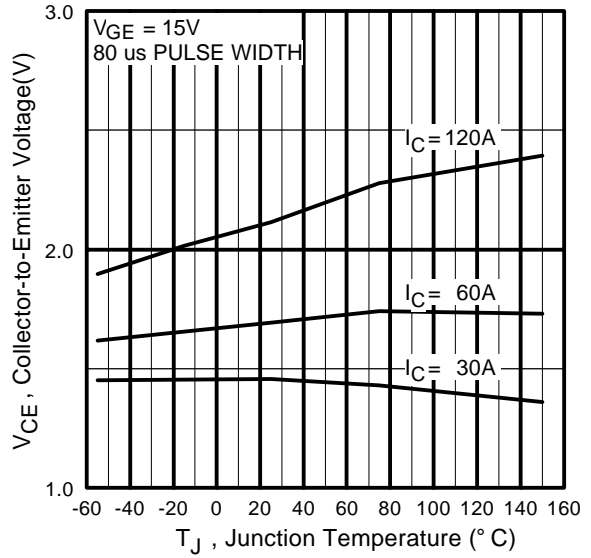


Fig. 5 - Collector-to-Emitter Voltage vs. Junction Temperature

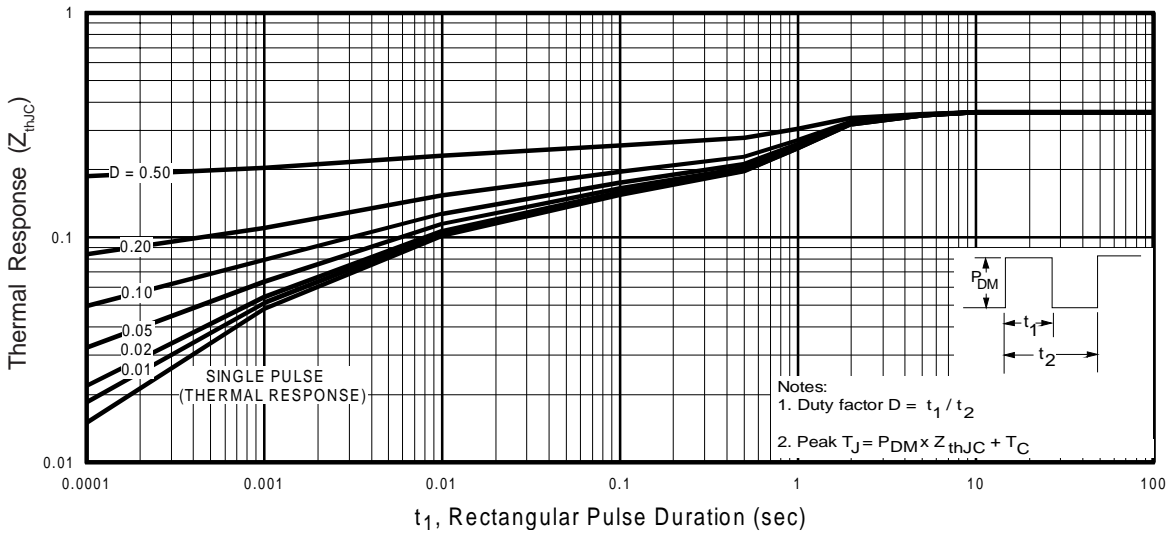


Fig. 6 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

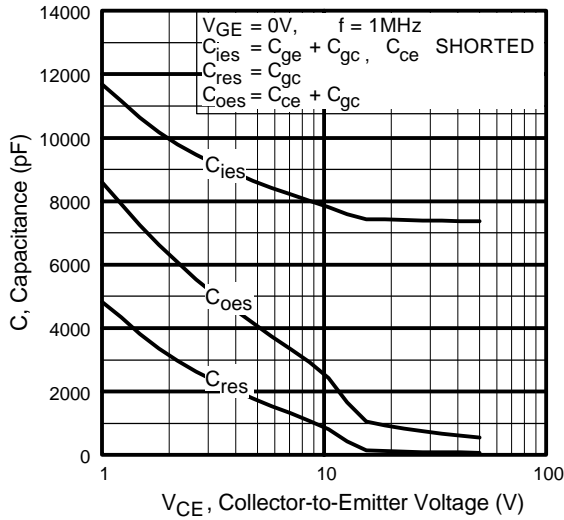


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

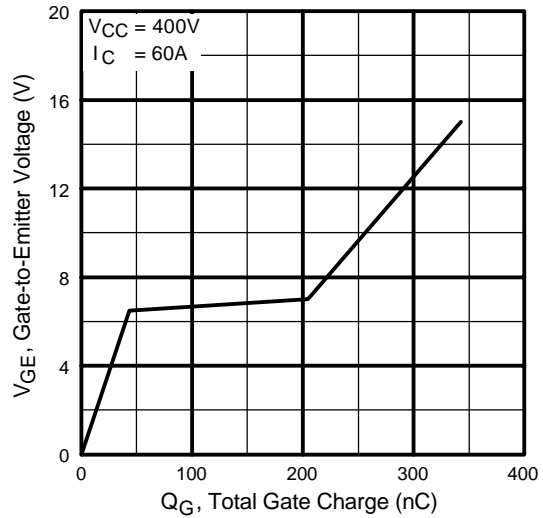


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

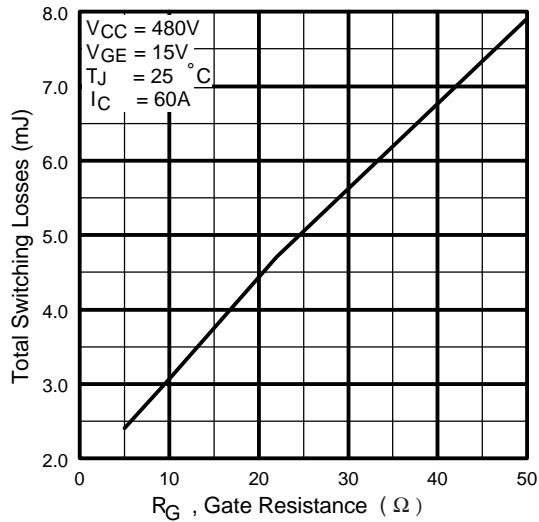


Fig. 9 - Typical Switching Losses vs. Gate Resistance

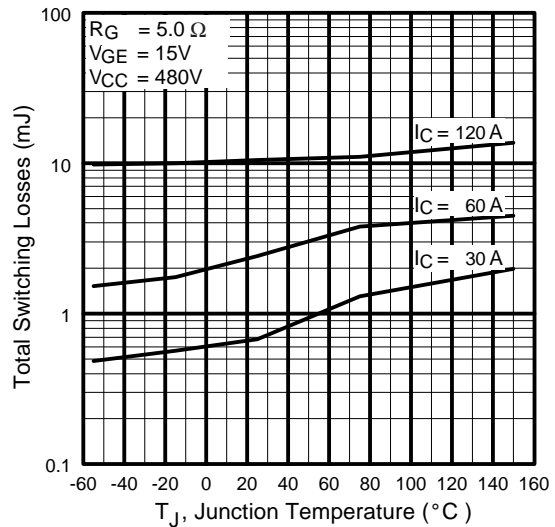
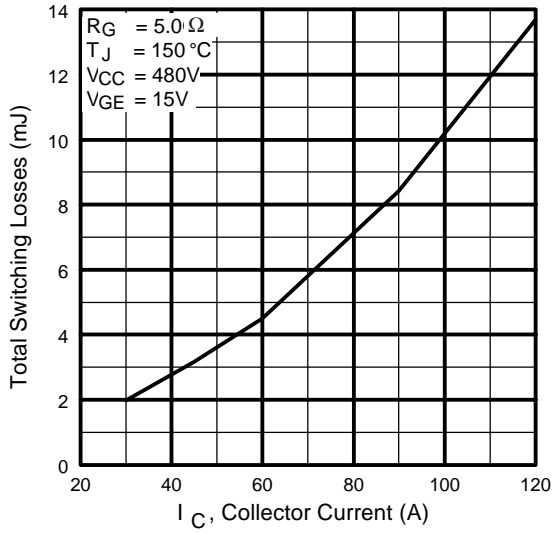
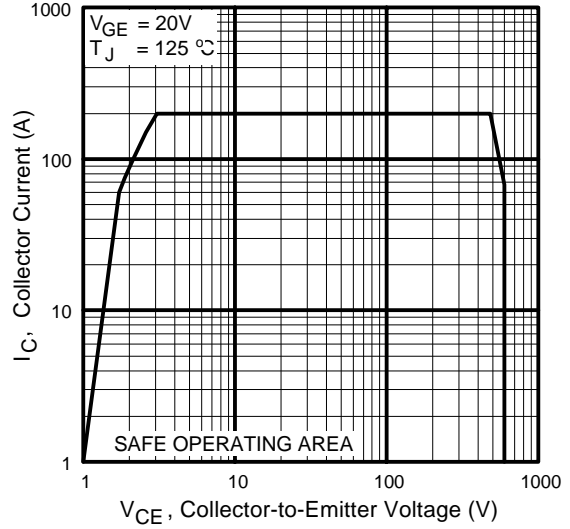


Fig. 10 - Typical Switching Losses vs. Junction Temperature

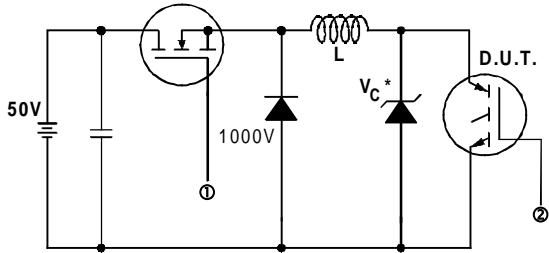
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**Fig. 11** - Typical Switching Losses vs. Collector-to-Emitter Current



**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

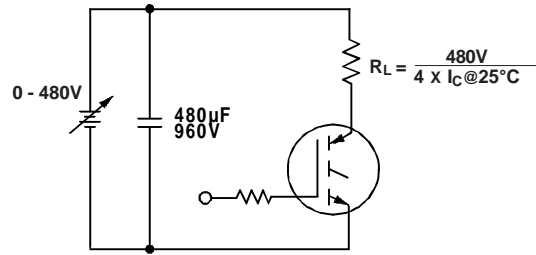


Fig. 13b - Pulsed Collector Current Test Circuit

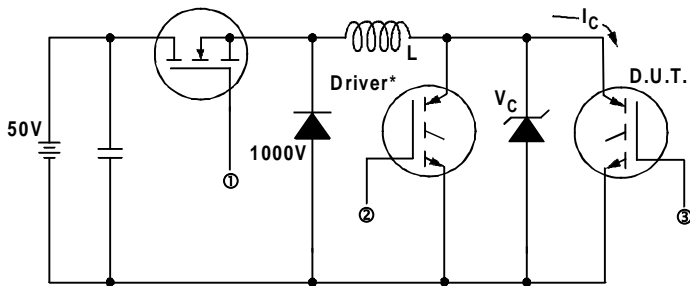


Fig. 14a - Switching Loss Test Circuit

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

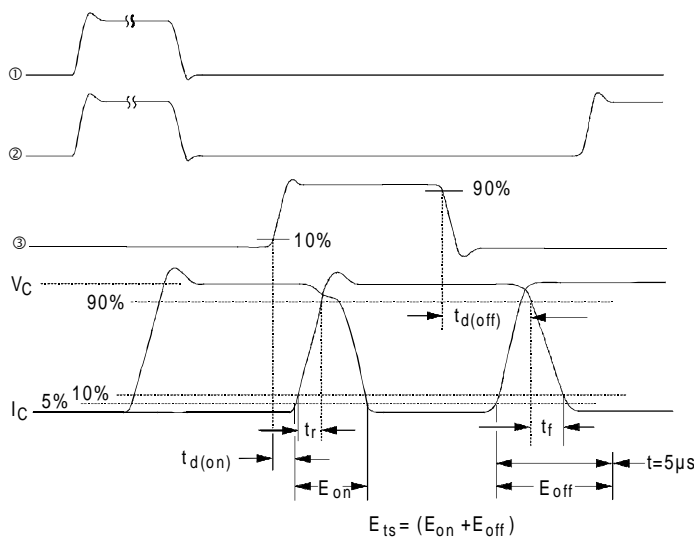


Fig. 14b - Switching Loss Waveforms

**Case Outline and Dimensions — Super-247**

Dimensions are shown in millimeters

