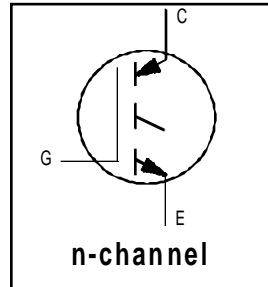


## Features

- UltraFast: Optimized for high operating frequencies up to 40 kHz in hard switching, >200 kHz in resonant mode
- New IGBT design provides tighter parameter distribution and higher efficiency than previous generations
- Optimized for power conversion; SMPS, UPS and welding
- Industry standard TO-247AC package



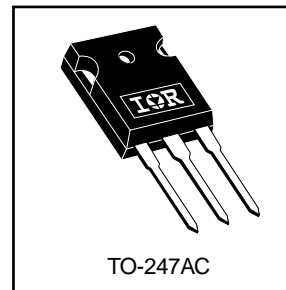
$$V_{CES} = 1200V$$

$$V_{CE(on)} \text{ typ.} = 2.65V$$

$$@V_{GE} = 15V, I_C = 15A$$

## Benefits

- Higher switching frequency capability than competitive IGBTs
- Highest efficiency available
- Much lower conduction losses than MOSFETs
- More efficient than short circuit rated IGBTs



TO-247AC

## Absolute Maximum Ratings

	Parameter	Max.	Units
$V_{CES}$	Collector-to-Emitter Breakdown Voltage	1200	V
$I_C @ T_C = 25^\circ C$	Continuous Collector Current	30	A
$I_C @ T_C = 100^\circ C$	Continuous Collector Current	15	
$I_{CM}$	Pulsed Collector Current ①	120	
$I_{LM}$	Clamped Inductive Load Current ②	120	
$V_{GE}$	Gate-to-Emitter Voltage	$\pm 20$	V
$E_{ARV}$	Reverse Voltage Avalanche Energy ③	180	mJ
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	160	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	65	
$T_J$	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 )	
	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	—	0.77	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	0.24	—	
$R_{\theta JA}$	Junction-to-Ambient, typical socket mount	—	40	
$W_t$	Weight	6 (0.21)	—	g (oz)

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

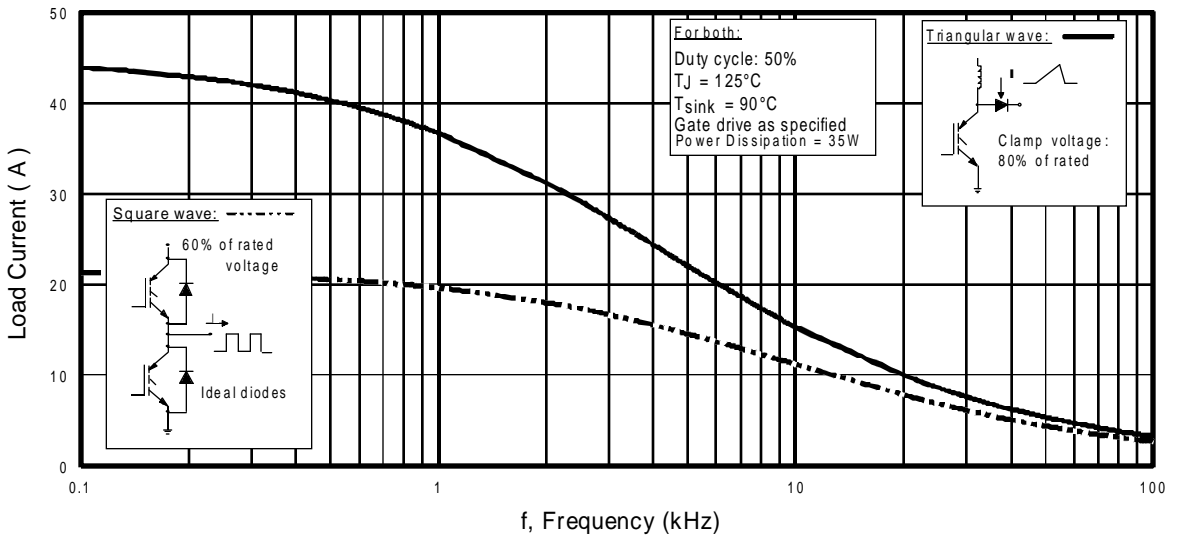
	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)CES}$	Collector-to-Emitter Breakdown Voltage	1200	—	—	V	$V_{GE} = 0V, I_C = 250\mu\text{A}$
$V_{(BR)ECS}$	Emitter-to-Collector Breakdown Voltage ④	18	—	—	V	$V_{GE} = 0V, I_C = 1.0A$
$\Delta V_{(BR)CES}/\Delta T_J$	Temperature Coeff. of Breakdown Voltage	—	0.43	—	V/ $^\circ\text{C}$	$V_{GE} = 0V, I_C = 1.0mA$
$V_{CE(ON)}$	Collector-to-Emitter Saturation Voltage	—	2.65	3.5	V	$I_C = 15A$ $V_{GE} = 15V$ See Fig.2, 5
		—	3.08	—		
		—	2.46	—		
$V_{GE(th)}$	Gate Threshold Voltage	3.0	—	6.0		$I_C = 15A, T_J = 150^\circ\text{C}$ $V_{CE} = V_{GE}, I_C = 250\mu\text{A}$
$\Delta V_{GE(th)}/\Delta T_J$	Temperature Coeff. of Threshold Voltage	—	-11	—	mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 250\mu\text{A}$
$g_{fe}$	Forward Transconductance ⑤	14	20	—	S	$V_{CE} = 100V, I_C = 15A$
$I_{CES}$	Zero Gate Voltage Collector Current	—	—	250	$\mu\text{A}$	$V_{GE} = 0V, V_{CE} = 1200V$
		—	—	2.0		$V_{GE} = 0V, V_{CE} = 10V, T_J = 25^\circ\text{C}$
		—	—	5000		$V_{GE} = 0V, V_{CE} = 1200V, T_J = 150^\circ\text{C}$
$I_{GES}$	Gate-to-Emitter Leakage Current	—	—	$\pm 100$	nA	$V_{GE} = \pm 20V$

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

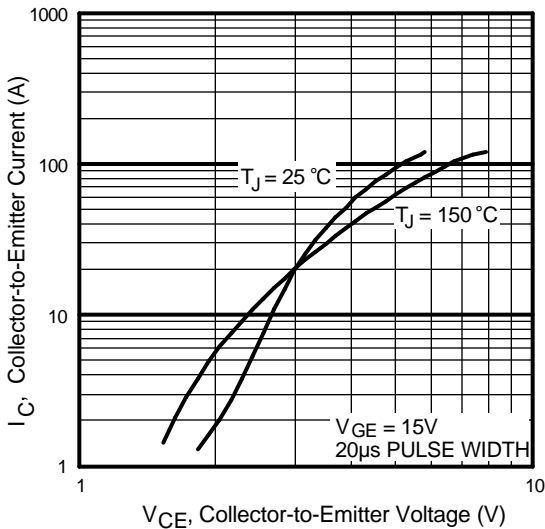
	Parameter	Min.	Typ.	Max.	Units	Conditions
$Q_g$	Total Gate Charge (turn-on)	—	86	130	nC	$I_C = 21A$ $V_{CC} = 400V$ $V_{GE} = 15V$ See Fig. 8
$Q_{ge}$	Gate - Emitter Charge (turn-on)	—	13	20		
$Q_{gc}$	Gate - Collector Charge (turn-on)	—	29	44		
$t_{d(on)}$	Turn-On Delay Time	—	27	—	ns	$T_J = 25^\circ\text{C}$ $I_C = 15A, V_{CC} = 960V$ $V_{GE} = 15V, R_G = 10\Omega$ Energy losses include "tail" See Fig. 9, 10, 14
$t_r$	Rise Time	—	18	—		
$t_{d(off)}$	Turn-Off Delay Time	—	150	230		
$t_f$	Fall Time	—	130	190	mJ	See Fig. 11, 14
$E_{on}$	Turn-On Switching Loss	—	0.55	—		
$E_{off}$	Turn-Off Switching Loss	—	1.24	—		
$E_{ts}$	Total Switching Loss	—	1.79	2.7	ns	$T_J = 150^\circ\text{C},$ $I_C = 15A, V_{CC} = 960V$ $V_{GE} = 15V, R_G = 10\Omega$ Energy losses include "tail" See Fig. 11, 14
$t_{d(on)}$	Turn-On Delay Time	—	26	—		
$t_r$	Rise Time	—	20	—		
$t_{d(off)}$	Turn-Off Delay Time	—	260	—	mJ	See Fig. 11, 14
$t_f$	Fall Time	—	310	—		
$E_{ts}$	Total Switching Loss	—	4.16	—		
$L_E$	Internal Emitter Inductance	—	13	—	nH	Measured 5mm from package
$C_{ies}$	Input Capacitance	—	1800	—	pF	$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0MHz$ See Fig. 7
$C_{oes}$	Output Capacitance	—	120	—		
$C_{res}$	Reverse Transfer Capacitance	—	18	—		

### Notes:

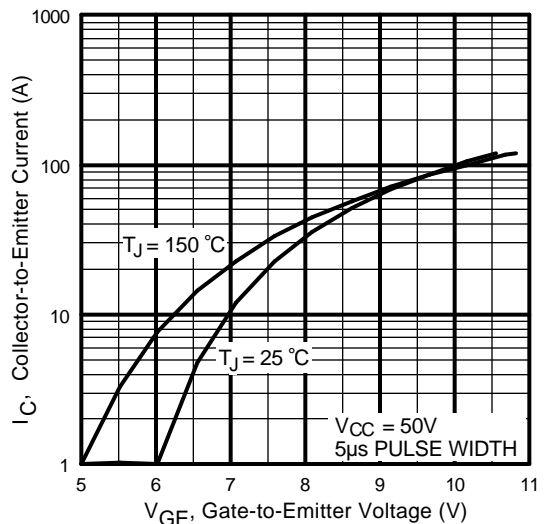
- ① Repetitive rating;  $V_{GE} = 20V$ , pulse width limited by max. junction temperature. ( See fig. 13b )
- ②  $V_{CC} = 80\%(V_{CES}), V_{GE} = 20V, L = 10\mu\text{H}, R_G = 10\Omega$ , (See fig. 13a)
- ③ Repetitive rating; pulse width limited by maximum junction temperature.
- ④ Pulse width  $\leq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



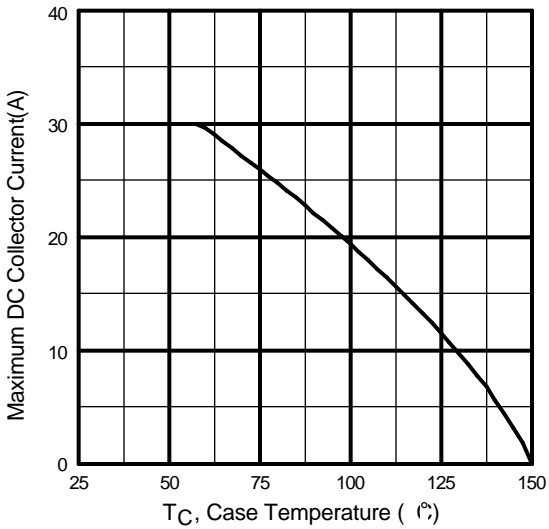
**Fig. 1 - Typical Load Current vs. Frequency**  
 (Load Current =  $I_{RMS}$  of fundamental)



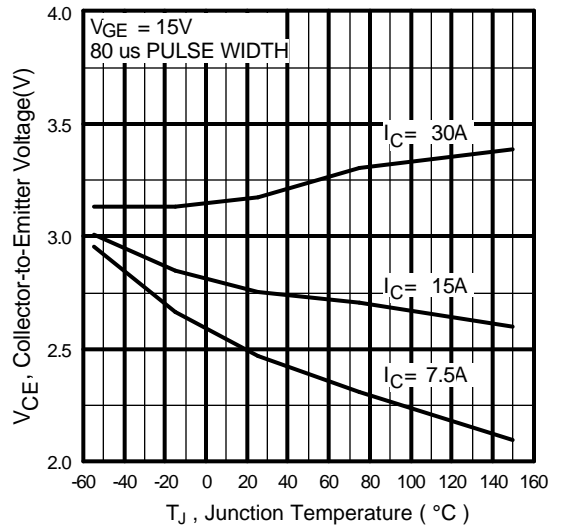
**Fig. 2 - Typical Output Characteristics**



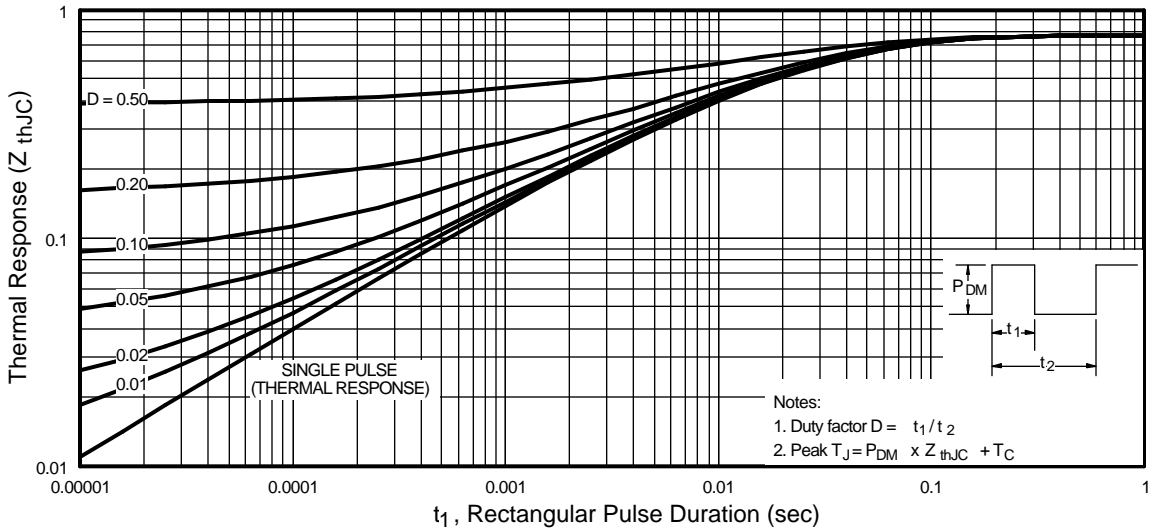
**Fig. 3 - Typical Transfer Characteristics**



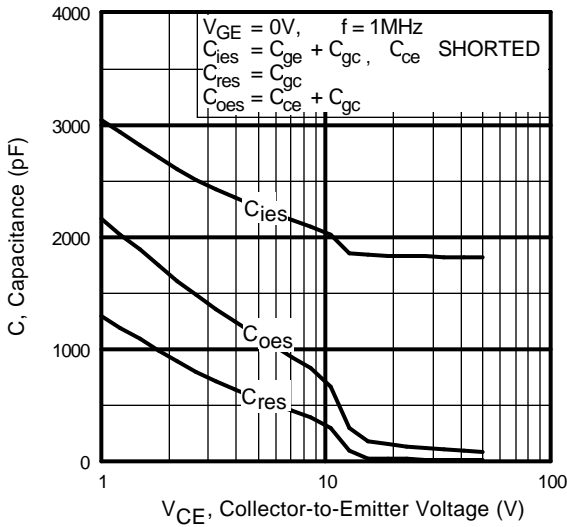
**Fig. 4** - Maximum Collector Current vs. Case Temperature



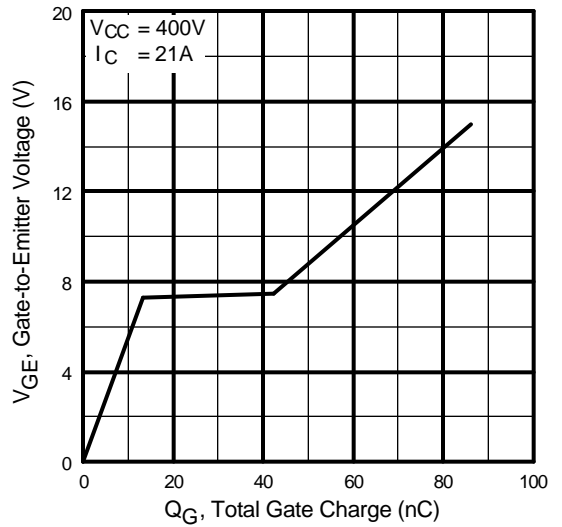
**Fig. 5** - Typical Collector-to-Emitter Voltage vs. Junction Temperature



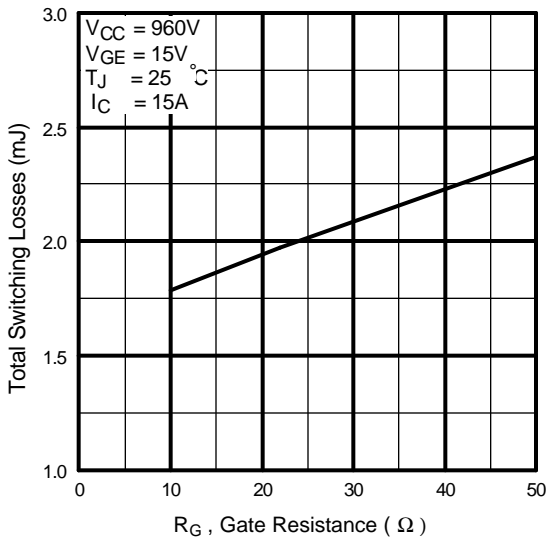
**Fig. 6** - Maximum Effective Transient Thermal Impedance, Junction-to-Case



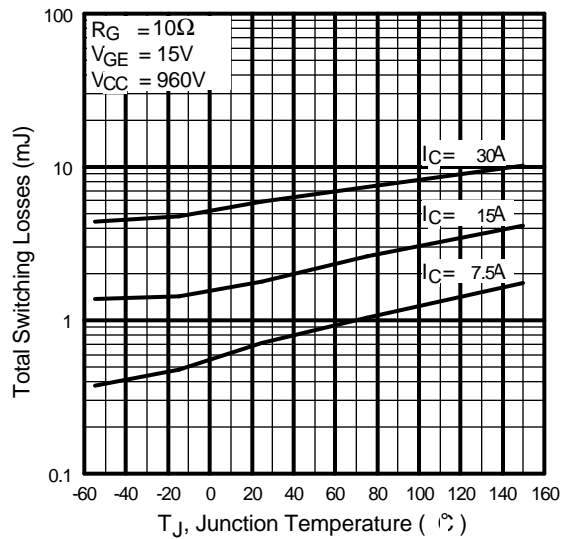
**Fig. 7** - Typical Capacitance vs. Collector-to-Emitter Voltage



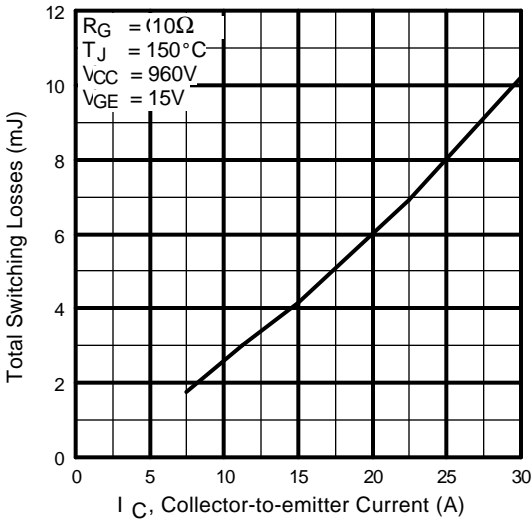
**Fig. 8** - Typical Gate Charge vs. Gate-to-Emitter Voltage



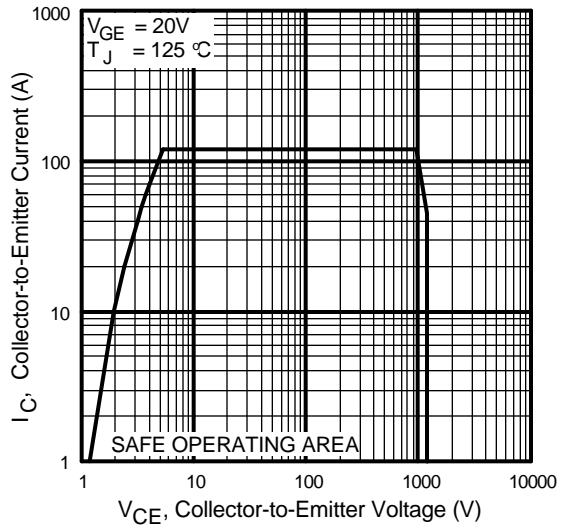
**Fig. 9** - Typical Switching Losses vs. Gate Resistance



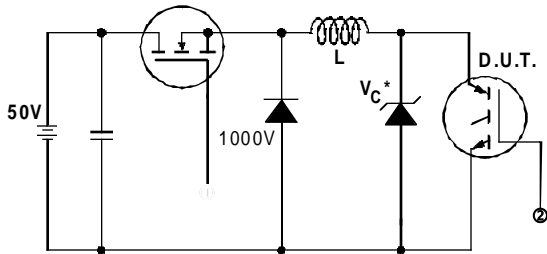
**Fig. 10** - Typical Switching Losses vs. Junction Temperature



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

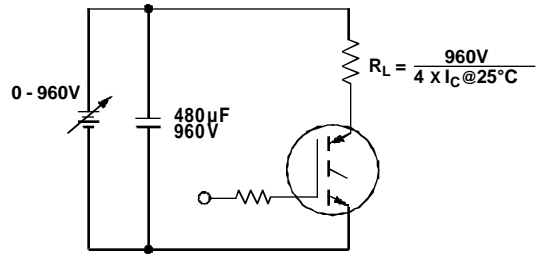


**Fig. 12** - Turn-Off SOA

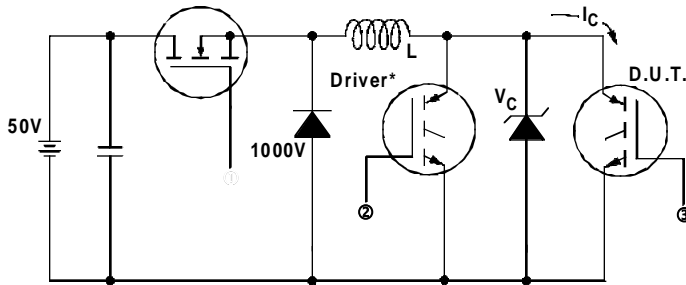


\* Driver same type as D.U.T.;  $V_c = 80\%$  of  $V_{ce(max)}$   
 \* Note: Due to the 50V power supply, pulse width and inductor will increase to obtain rated  $I_d$ .

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

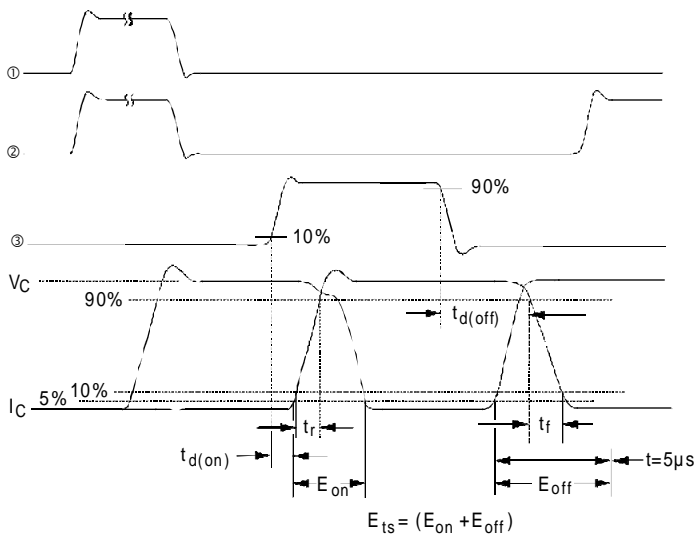


**Fig. 13b** - Pulsed Collector Current Test Circuit



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

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



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

## Case Outline and Dimensions — TO-247AC

