

Midium Power Transistors ($\pm 30V / \pm 3A$)

QS5Y1

● Structure

PNP/NPN Silicon epitaxial planar transistor

● Features

1) Low saturation voltage, typically

$$V_{CE(sat)} = -0.40V \text{ (Max.) } (I_C / I_B = -1A / -50mA)$$

$$V_{CE(sat)} = 0.40V \text{ (Max.) } (I_C / I_B = 1A / 50mA)$$

2) High speed switching

● Applications

Low Frequency Amplifier
Driver

● Packaging specifications

Type	Package	TSMT5
	Code	TR
	Basic ordering unit (pieces)	3000

● Absolute maximum ratings ($T_a = 25^\circ C$)

<Tr.1>

Parameter	Symbol	Limits	Unit	
Collector-base voltage	V_{CBO}	-30	V	
Collector-emitter voltage	V_{CEO}	-30	V	
Emitter-base voltage	V_{EBO}	-6	V	
Collector current	DC	I_C	-3	A
	Pulsed	I_{CP}^{*1}	-6	A

<Tr.2>

Parameter	Symbol	Limits	Unit	
Collector-base voltage	V_{CBO}	30	V	
Collector-emitter voltage	V_{CEO}	30	V	
Emitter-base voltage	V_{EBO}	6	V	
Collector current	DC	I_C	3	A
	Pulsed	I_{CP}^{*1}	6	A

<Tr.1 and Tr.2>

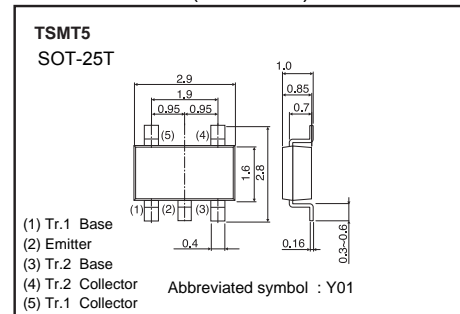
Parameter	Symbol	Limits	Unit
Power dissipation	P_D^{*2}	0.5	W/Total
	P_D^{*3}	1.25	W/Total
	P_D^{*3}	0.9	W/Element
Junction temperature	T_j	150	$^\circ C$
Range of storage temperature	T_{stg}	-55 to 150	$^\circ C$

*1 $P_w=10ms$, Single Pulse

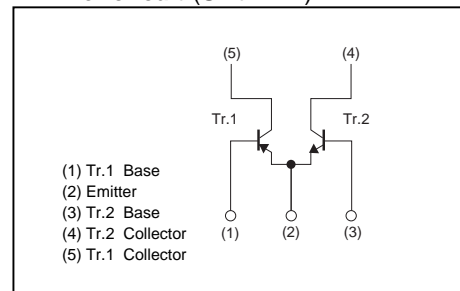
*2 Mounted on a recommended land.

*3 Mounted on a 25 x 25 x 0.8[mm] ceramic board.

● Dimensions (Unit : mm)



● Inner circuit (Unit : mm)



●Electrical characteristics (Ta=25°C)

<Tr.1>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Collector-emitter breakdown voltage	BV_{CEO}	-30	-	-	V	$I_C = -1mA$
Collector-base breakdown voltage	BV_{CBO}	-30	-	-	V	$I_C = -100\mu A$
Emitter-base breakdown voltage	BV_{EBO}	-6	-	-	V	$I_E = -100\mu A$
Collector cut-off current	I_{CBO}	-	-	-1	μA	$V_{CB} = -30V$
Emitter cut-off current	I_{EBO}	-	-	-1	μA	$V_{EB} = -4V$
Collector-emitter saturation voltage	$V_{CE(sat)}^{*1}$	-	-200	-400	mV	$I_C = -1A, I_B = -50mA$
DC current gain	h_{FE}	200	-	500	-	$V_{CE} = -2V, I_C = -500mA$
Transition frequency	f_T^{*1}	-	300	-	MHz	$V_{CE} = -10V$ $I_E = 100mA, f = 100MHz$
Collector output capacitance	C_{ob}	-	26	-	pF	$V_{CB} = -10V, I_E = 0A$ $f = 1MHz$
Turn-on time	t_{on}^{*2}	-	35	-	ns	$I_C = -1.5A, I_{B1} = -150mA,$ $I_{B2} = 150mA, V_{CC} \simeq -12V$
Storage time	t_{stg}^{*2}	-	210	-	ns	
Fall time	t_f^{*2}	-	15	-	ns	

*1 Pulsed

*2 See switching time test circuit

<Tr.2>

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Collector-emitter breakdown voltage	BV_{CEO}	30	-	-	V	$I_C = 1mA$
Collector-base breakdown voltage	BV_{CBO}	30	-	-	V	$I_C = 100\mu A$
Emitter-base breakdown voltage	BV_{EBO}	6	-	-	V	$I_E = 100\mu A$
Collector cut-off current	I_{CBO}	-	-	1	μA	$V_{CB} = 30V$
Emitter cut-off current	I_{EBO}	-	-	1	μA	$V_{EB} = 4V$
Collector-emitter saturation voltage	$V_{CE(sat)}^{*1}$	-	200	400	mV	$I_C = 1A, I_B = 50mA$
DC current gain	h_{FE}	200	-	500	-	$V_{CE} = 2V, I_C = 500mA$
Transition frequency	f_T^{*1}	-	270	-	MHz	$V_{CE} = 10V$ $I_E = -100mA, f = 100MHz$
Collector output capacitance	C_{ob}	-	16	-	pF	$V_{CB} = 10V, I_E = 0A$ $f = 1MHz$
Turn-on time	t_{on}^{*2}	-	25	-	ns	$I_C = 1.5A, I_{B1} = 150mA,$ $I_{B2} = -150mA, V_{CC} \simeq 12V$
Storage time	t_{stg}^{*2}	-	300	-	ns	
Fall time	t_f^{*2}	-	20	-	ns	

*1 Pulsed

*2 See switching time test circuit

●Electrical characteristic curves (Ta=25°C)

<Tr.1>

Fig.1 Typical Output Characteristics

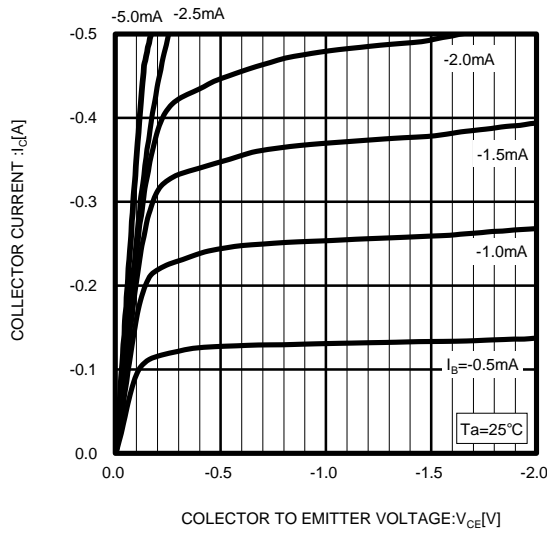


Fig.2 DC Current Gain vs. Collector Current (I)

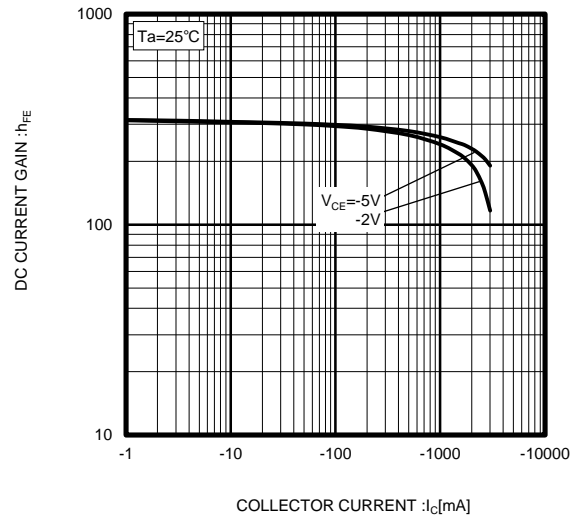


Fig.3 DC Current Gain vs. Collector Current (II)

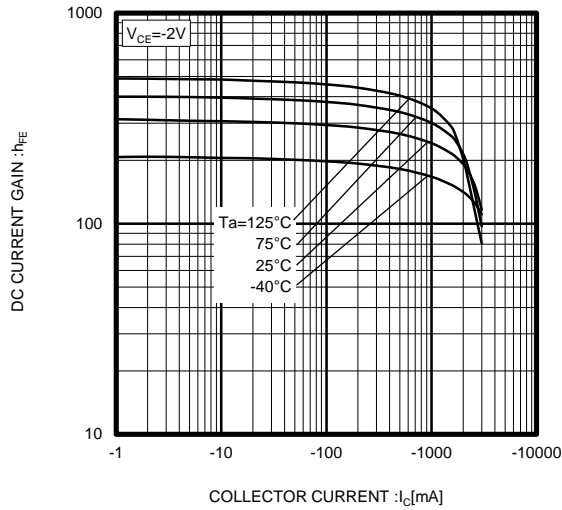


Fig.4 Collector-Emitter Saturation Voltage vs. Collector Current(I)

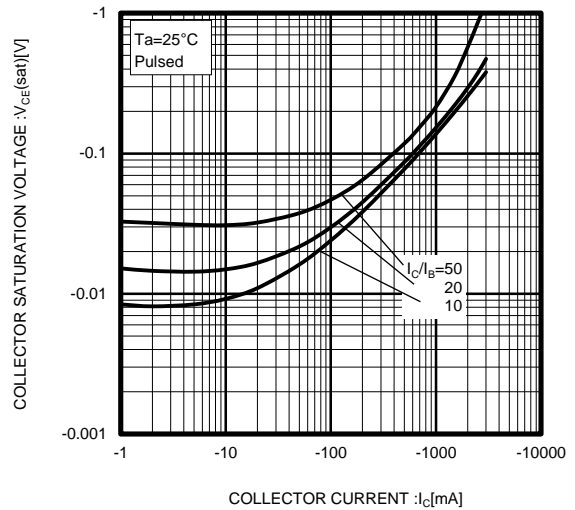


Fig.5 Collector-Emitter Saturation Voltage vs. Collector Current (II)

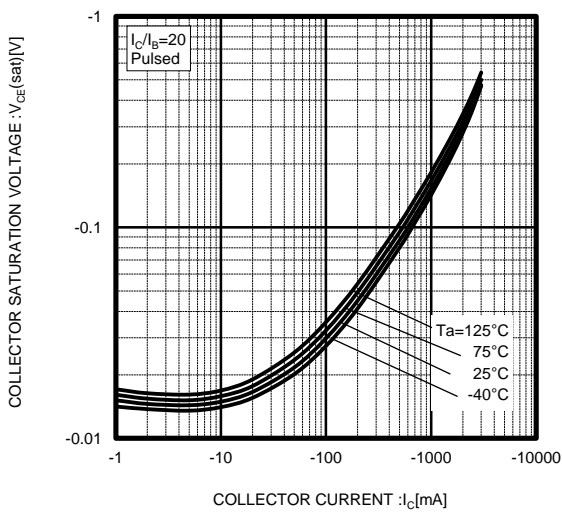


Fig.6 Ground Emitter Propagation Characteristics

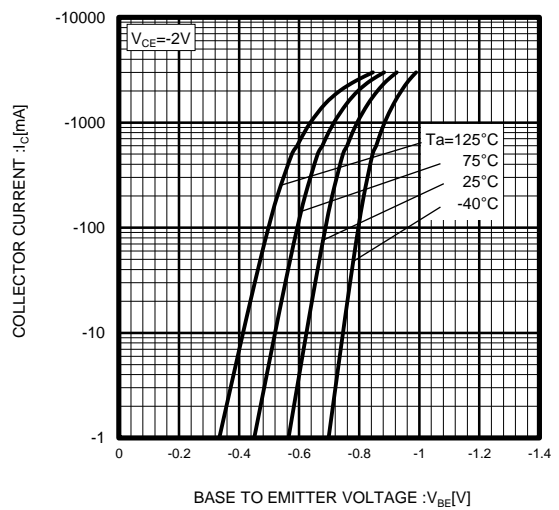


Fig.7 Emitter input capacitance vs. Emitter-Base Voltage
Collector output capacitance vs. Collector-Base Voltage

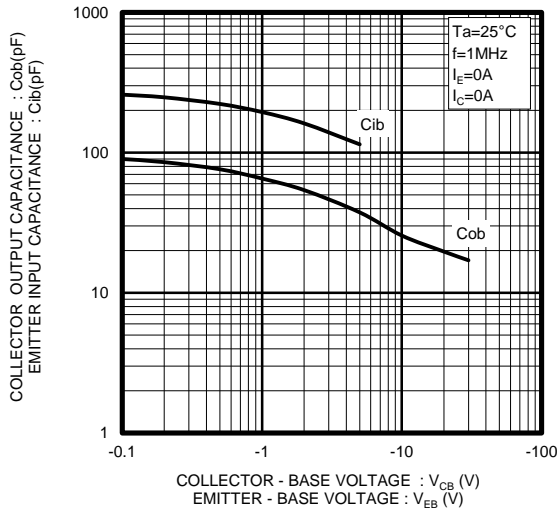


Fig.8 Gain Bandwidth Product vs. Emitter Current

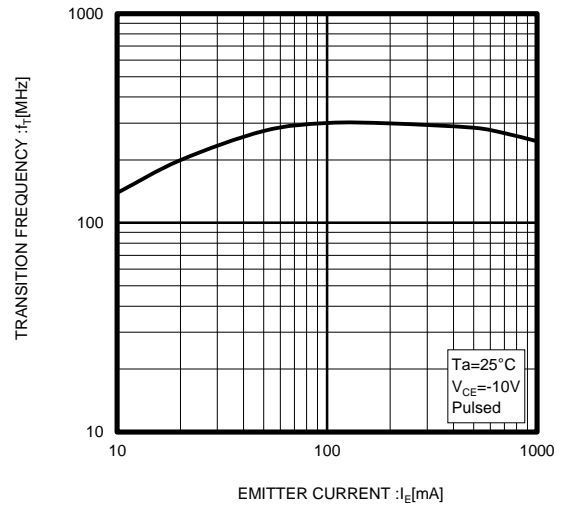
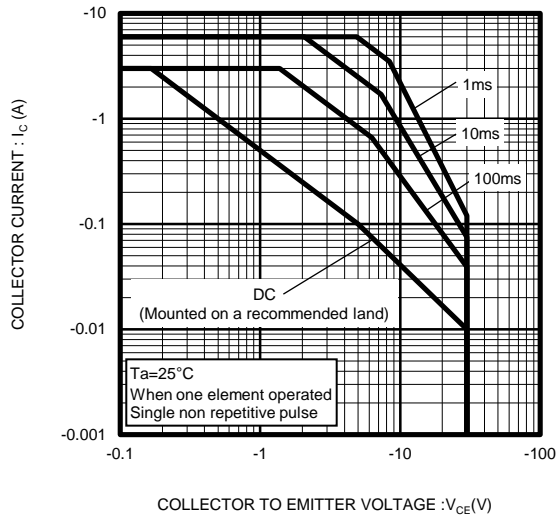


Fig.9. Safe Operating Area



<Tr.2>

Fig.1 Typical Output Characteristics

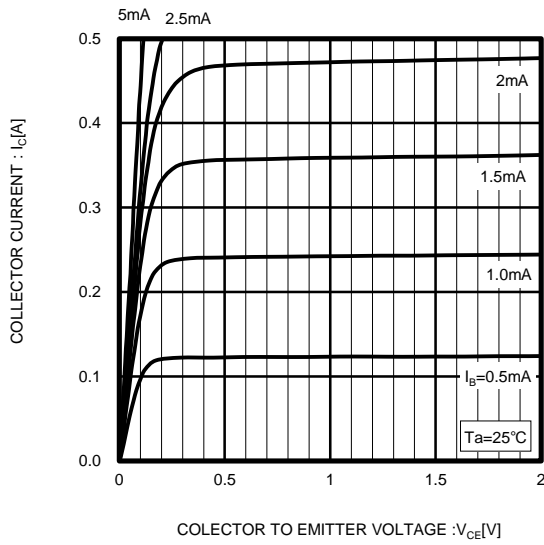


Fig.2 DC Current Gain vs. Collector Current (I)

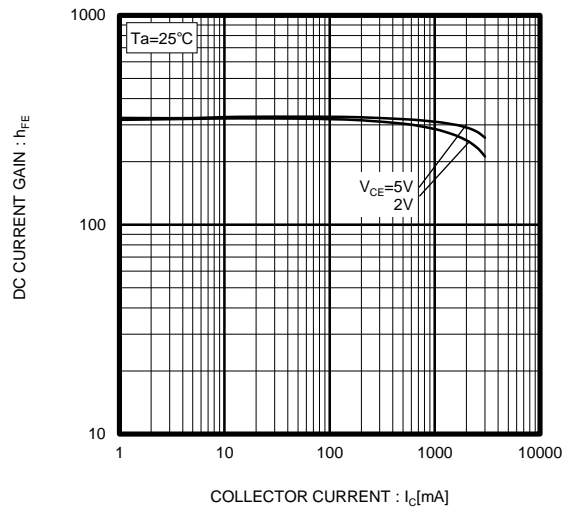


Fig.3. DC Current Gain vs. Collector Current (II)

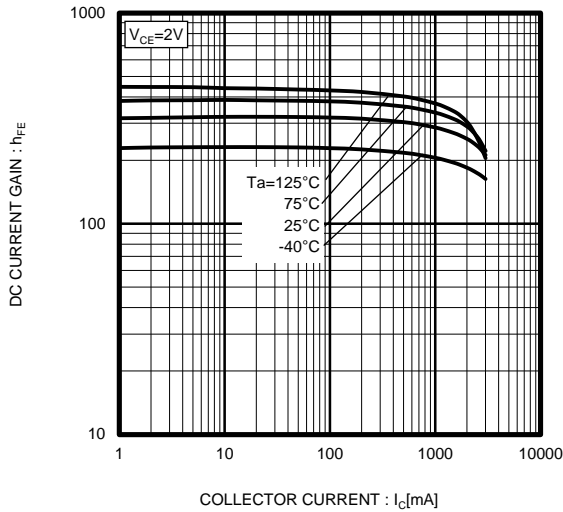


Fig.4 Collector-Emitter Saturation Voltage vs. Collector Current (I)

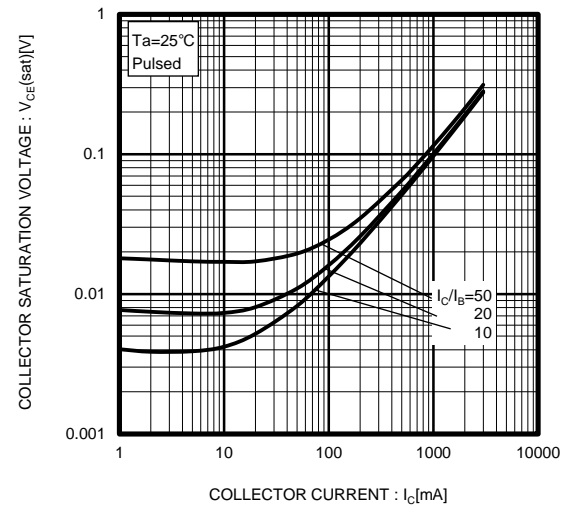


Fig.5 Collector-Emitter Saturation Voltage vs. Collector Current (II)

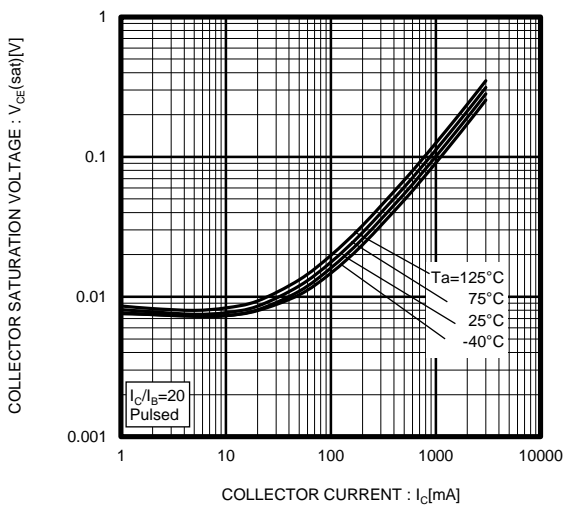


Fig.6 Ground Emitter Propagation Characteristics

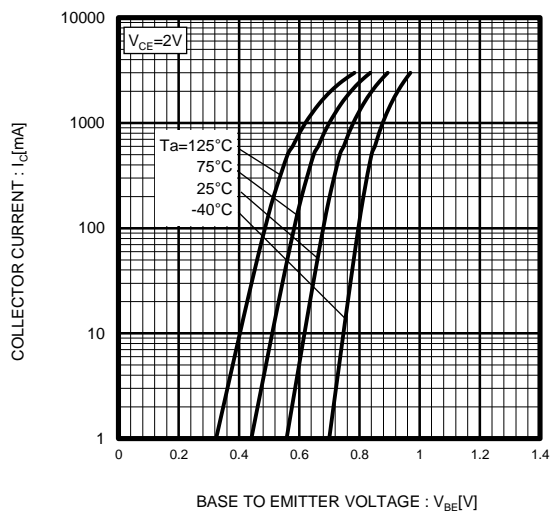


Fig.7 Emitter Input Capacitance vs. Emitter-Base Voltage
Collector Output Capacitance vs. Collector-Base Voltage

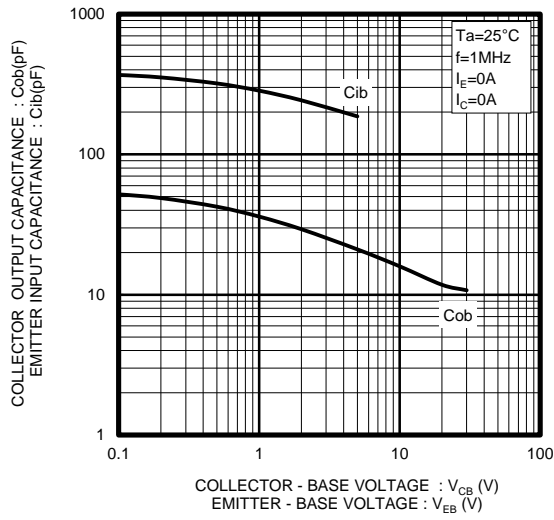


Fig.8 Gain Bandwidth Product vs. Emitter Current

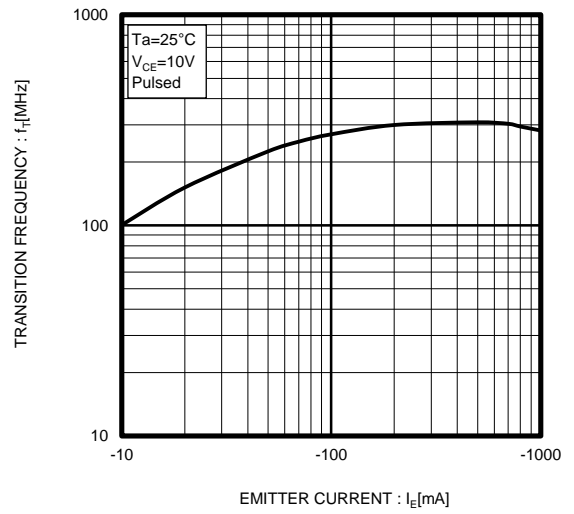
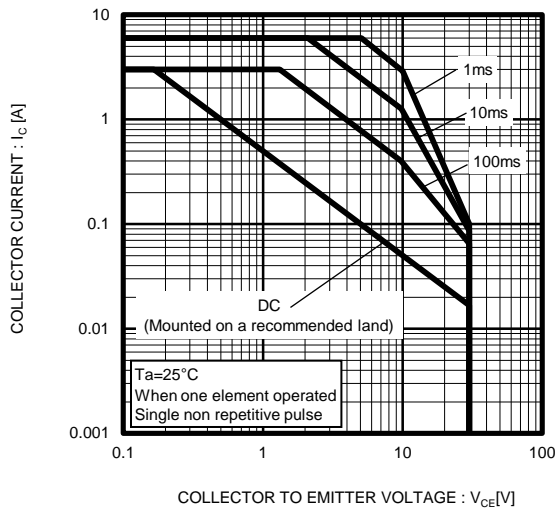
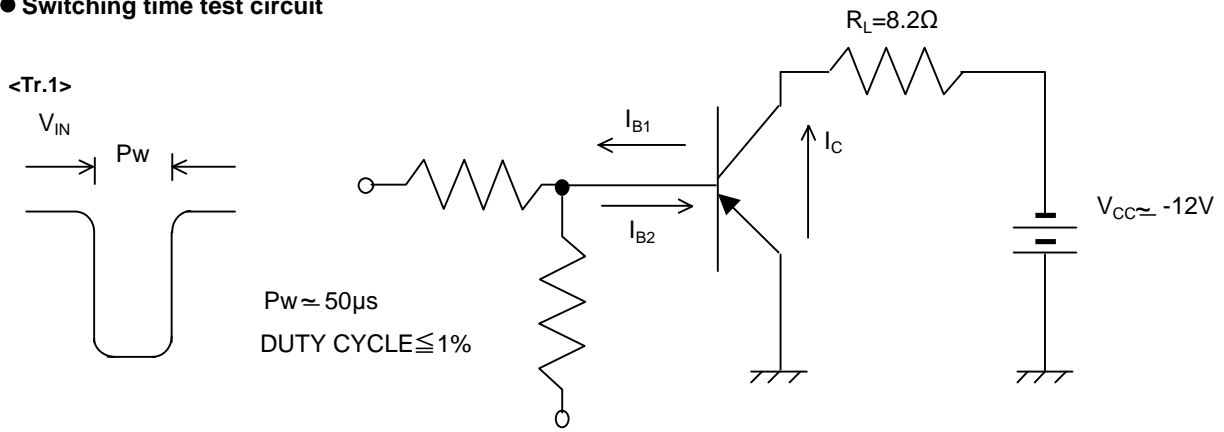


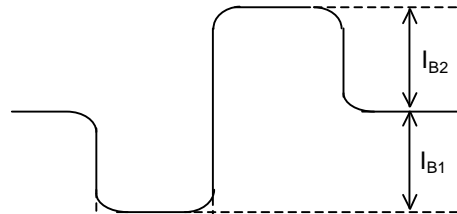
Fig.9 Safe Operating Area



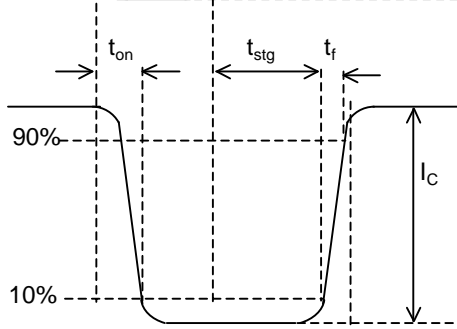
● Switching time test circuit



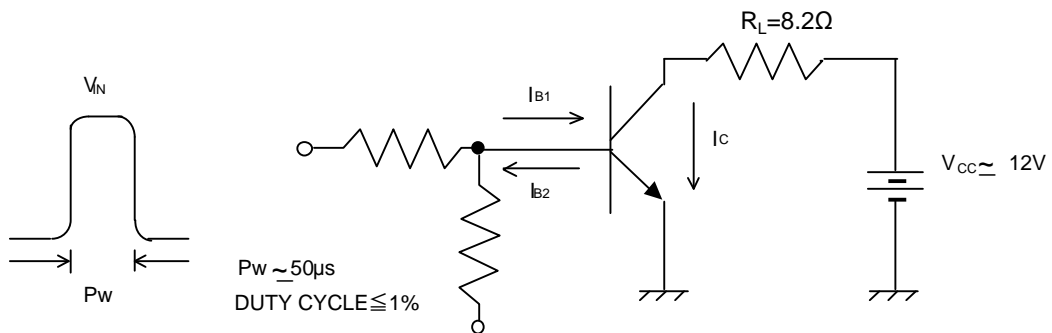
BASE CURRENT WAVEFORM



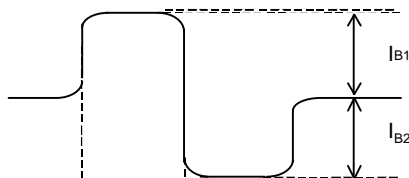
COLLECTOR CURRENT WAVEFORM



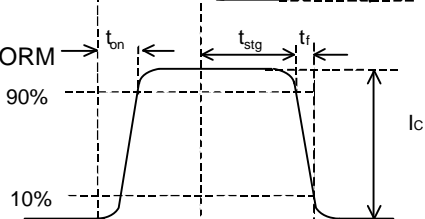
<Tr.2>



BASE CURRENT WAVEFORM



COLLECTOR CURRENT WAVEFORM



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