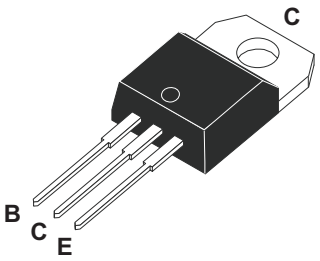
High Voltage Fast-switching NPN Power Transistor
5A/450V

FEATURES

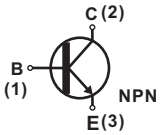
- High voltage capability
- Fast switching speed
- TO-220AB package which can be installed to the heat sink with one screw

APPLICATIONS

- Flyback and forward single transistor low power converters
- Inverters
- Converters
- Switching regulators
- Motor control systems



TO-220AB
(BUT11A)



ABSOLUTE MAXIMUM RATINGS (T_C = 25°C unless otherwise specified)				
SYMBOL	PARAMETER	TEST CONDITIONS	VALUE	UNIT
V_{CES}	Collector to emitter voltage	V_{BE}=0	1000	V
V_{CEO}	Collector to emitter voltage	I_B=0	450	
V_{EBO}	Emitter to base voltage	I_C=0	9	
I_C	Collector current-continuous		5	A
I_{CM}	Peak collector current	t_p<5 ms	10	
I_B	Base Current		2	
I_{BM}	Peak base current	t_p<5ms	4	
P_D	Collector power dissipation	T_a=25°C	100	W
T_J	Junction temperature		150	°C
T_{STG}	Storage temperature		-65 to 150	

THERMAL CHARACTERISTICS (T_C = 25°C)			
SYMBOL	PARAMETER	VALUE	UNIT
$R_{th(j-c)}$	Thermal resistance, junction to case	1.5	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise specified)							
SYMBOL	**PARAMETER**	**TEST CONDITIONS**		**Min.**	**Typ.**	**Max.**	**UNIT**
I_{CES}	Collector to emitter cutoff current	V_{CE}=1000V, V_{BE}=0	T_C=25°C			1.0	mA
			T_C=125°C			2.0	
I_{EBO}	Emitter to base cutoff current	V_{EBO}=9V, I_C=0				10	
V_{CEO}	Collector to emitter voltage	I_B=0		450			V
$V_{CEO(SUS)}$*	Collector to emitter sustaining voltage	I_C=100mA, I_B=0, L=25mH		450			
h_{FE}*	Forward current transfer ratio (DC current gain)	I_C=5mA, V_{CE}=5V		10	18	35	
		I_C=0.5A, V_{CE}=5V		10	20	35	
$V_{CE(sat)}$*	Collector to emitter saturation voltage	I_C=2.5A, I_B=0.5A				1.5	V
$V_{BE(sat)}$*	Base to emitter saturation voltage	I_C=2.5A, I_B=0.5A				1.3	
◎ **SWITCHING TIMES RESISTIVE LOAD**							
t_{on}	Turn-on time	I_C=2.5A, $I_{B(on)}$= -$I_{B(off)}$=0.5A, V_{CC}=250V				1	µS
t_{stg}	Storage time					4	
t_f	Fall time					0.8	
◎ **SWITCHING TIMES INDUCTIVE LOAD**							
t_{stg}	Storage time	I_C=2.5A, $I_{B(on)}$=0.5A, V_{CC}=300V,V_{EB}=5V, L_B=1µH	T_C=25°C		1.1	1.4	µS
			T_C=100°C		1.2	1.5	
t_f	Fall time		T_C=25°C		80	150	nS
			T_C=100°C		140	300	

*Pulsed: Pulse duration= 300µs, duty cycle= 1.5%.

Fig.1 Reverse bias SOA

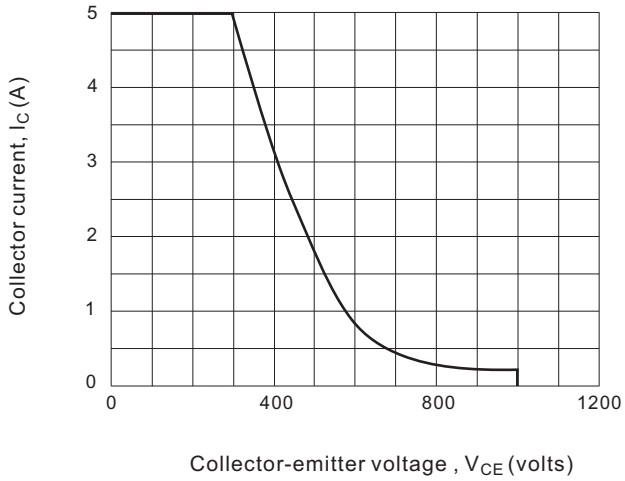


Fig.2 Power derating curve

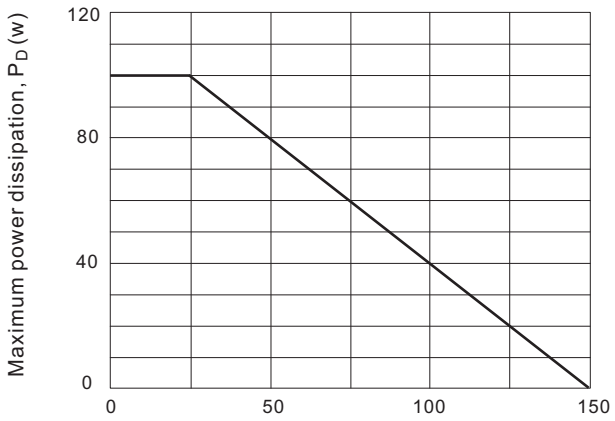
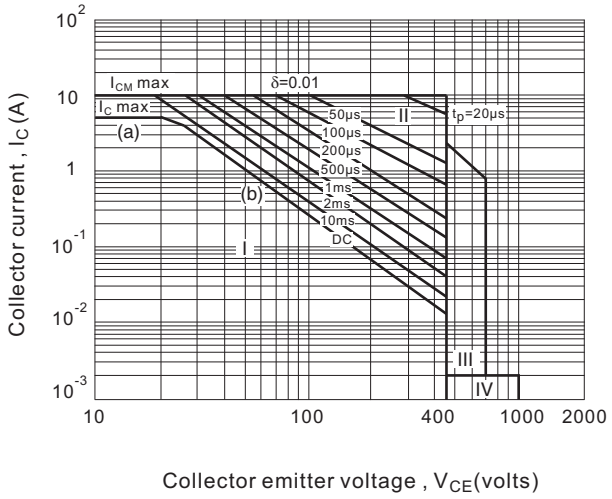


Fig.3 Forward bias SOA



$T_a \leq 25°C$

I - Region permissible DC operation

II - Permissible extension for repetitive pulse operation

III - Area of permissible operation during turn-on in single transistor converters, provided $R_{BE} \leq 100\Omega$ and $t_p \leq 0.6\mu s$

IV - Repetitive pulse operation in this region is permissible provided $V_{BE} \leq 0$ and $t_p \leq 5ms$.

(a) $P_D$max and P_D peak max lines.

(b) Second breakdown limits.

Fig.4 Test circuit for V_{CE} (sus)

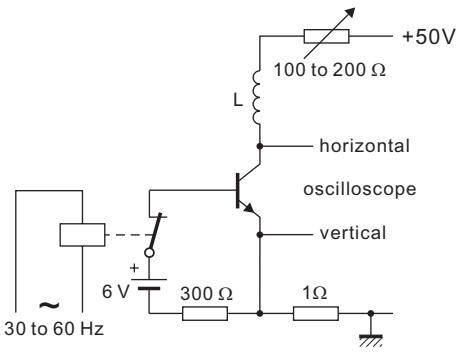


Fig.5 Oscilloscope display for $V_{CE\ (sus)}$

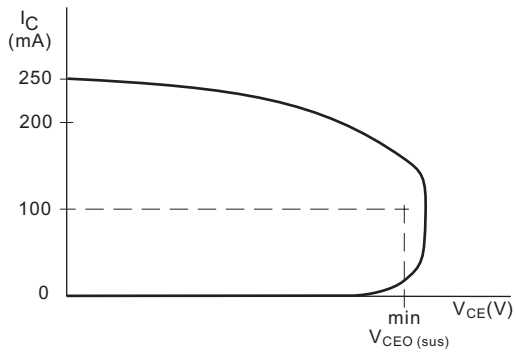


Fig.6 $V_{BE(sat)}$·$V_{CE(sat)}$ - I_C Temperature characteristics (Typical)

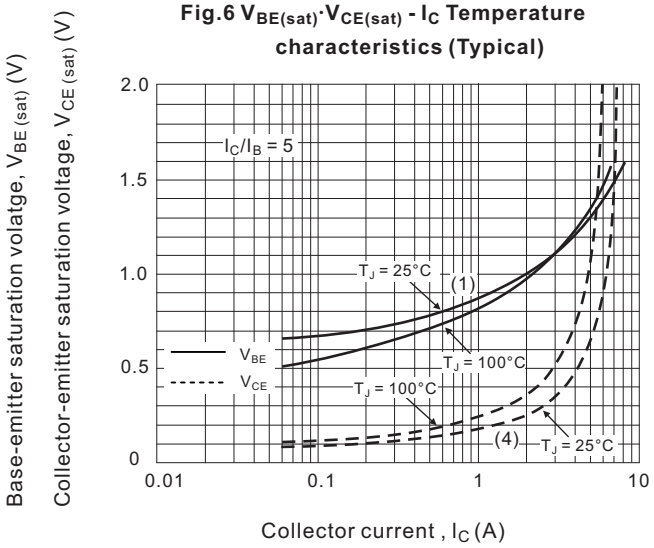


Fig.7 V_{BE} - I_B Characteristics

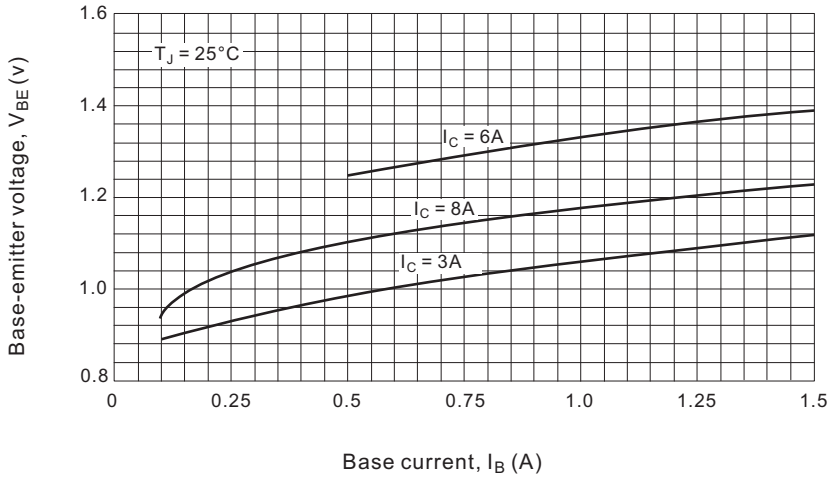


Fig.8 $V_{CE(sat)}$ - I_B Characteristics (Typical)

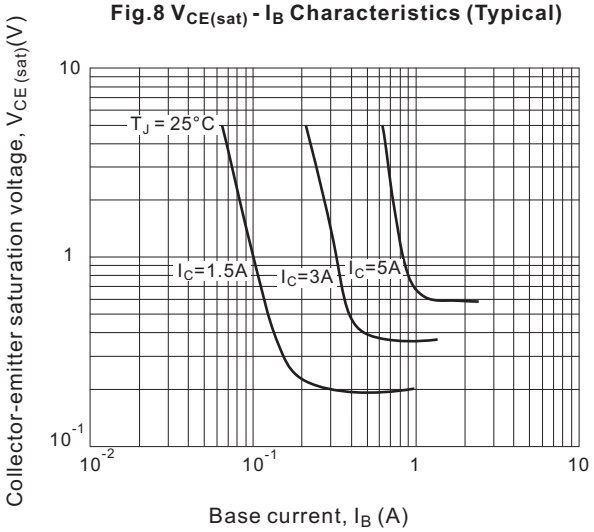


Fig.9 DC current gain

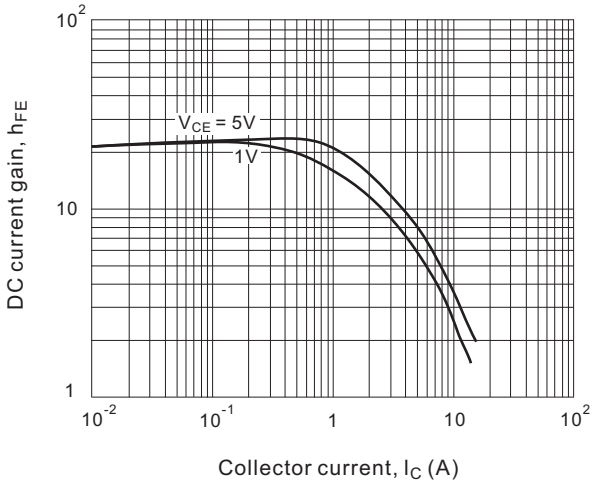
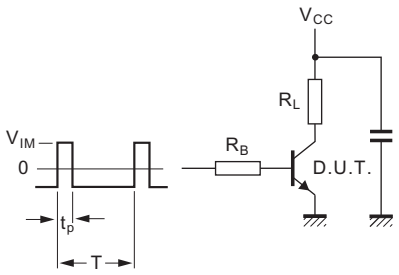


Fig.10 Test circuit resistive load



V_{CC} = 250V; t_p = 20μs; V_{IM} = -6 to +8V; t_p/T = 0.01.
The values of R_B and R_L are selected in accordance with $I_{C(ON)}$ and $I_{B(ON)}$ requirements

Fig.11 Switching time waveforms with resistive load

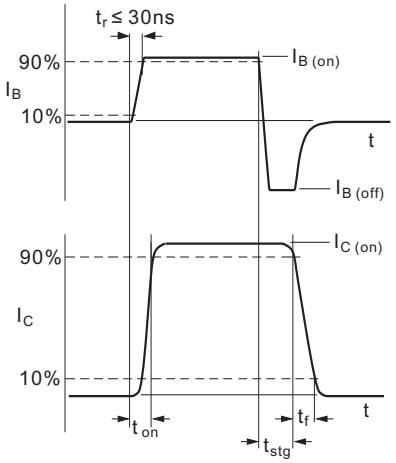
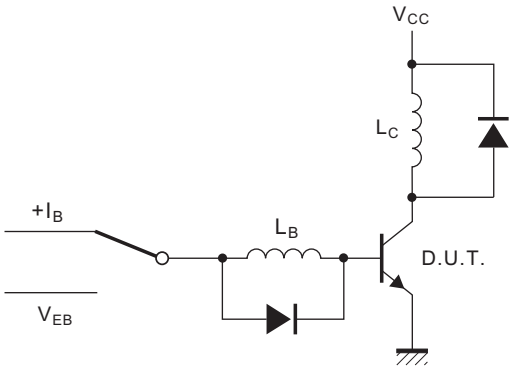
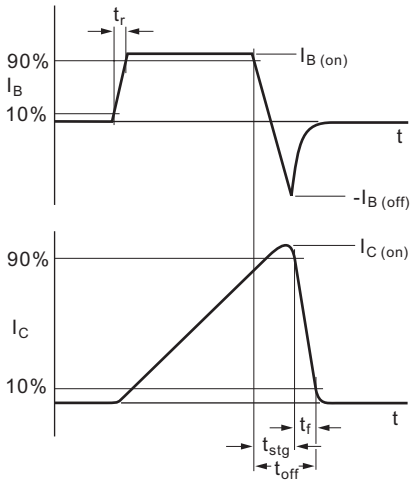


Fig.12 Test circuit inductive load



V_{CC} = 300V; V_{EB} = 5V; L_B = 1μH

Fig.13 Switching time waveforms with inductive load



Case Style

TO-220AB