

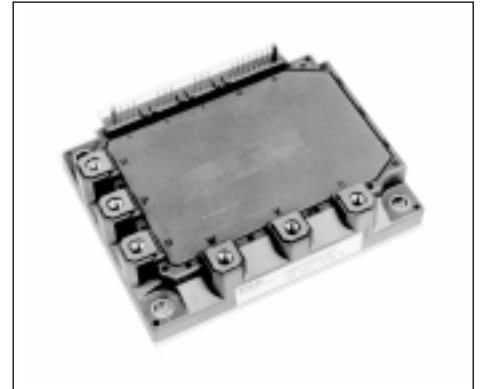
# 6MBP25RA120

## IGBT-IPM R series

1200V / 25A 6 in one-package

### Features

- Temperature protection provided by directly detecting the junction temperature of the IGBTs
- Low power loss and soft switching
- Compatible with existing IPM-N series packages
- High performance and high reliability IGBT with overheating protection
- Higher reliability because of a big decrease in number of parts in built-in control circuit



### Maximum ratings and characteristics

- Absolute maximum ratings(at  $T_c=25^\circ\text{C}$  unless otherwise specified)

Item	Symbol	Rating		Unit		
		Min.	Max.			
DC bus voltage	$V_{DC}$	0	900	V		
DC bus voltage (surge)	$V_{DC(surge)}$	0	1000	V		
DC bus voltage (short operating)	$V_{SC}$	200	800	V		
Collector-Emitter voltage	$V_{CES}$	0	1200	V		
INV	Collector current	DC	$I_C$	-	25	A
		1ms	$I_{CP}$	-	50	A
		DC	$-I_C$	-	25	A
	Collector power dissipation	One transistor	$P_C$	-	198	W
Junction temperature	$T_J$	-	150	$^\circ\text{C}$		
Input voltage of power supply for Pre-Driver	$V_{CC}^*1$	0	20	V		
Input signal voltage	$V_{in}^*2$	0	$V_z$	V		
Input signal current	$I_{in}$	-	1	mA		
Alarm signal voltage	$V_{ALM}^*3$	0	$V_{CC}$	V		
Alarm signal current	$I_{ALM}^*4$	-	15	mA		
Storage temperature	$T_{stg}$	-40	125	$^\circ\text{C}$		
Operating case temperature	$T_{op}$	-20	100	$^\circ\text{C}$		
Isolating voltage (Case-Terminal)	$V_{iso}^*5$	-	AC2.5	kV		
Screw torque	Mounting (M5)	-	3.5 <sup>*6</sup>	N·m		
	Terminal (M5)	-	3.5 <sup>*6</sup>	N·m		

\*1 Apply  $V_{CC}$  between terminal No. 3 and 1, 6 and 4, 9 and 7, 11 and 10.

\*2 Apply  $V_{in}$  between terminal No. 2 and 1, 5 and 4, 8 and 7, 13,14,15 and 10.

\*3 Apply  $V_{ALM}$  between terminal No. 16 and 10.

\*4 Apply  $I_{ALM}$  to terminal No. 16.

\*5 50Hz/60Hz sine wave 1 minute.

\*6 Recommendable Value : 2.5 to 3.0 N·m

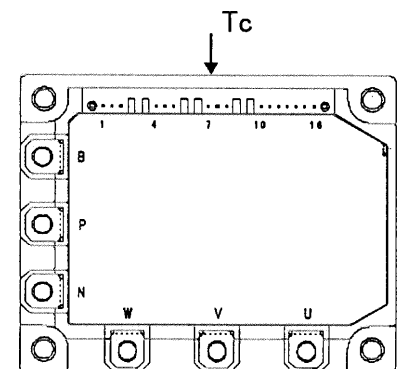


Fig.1 Measurement of case temperature

- Electrical characteristics of power circuit (at  $T_c=T_J=25^\circ\text{C}$ ,  $V_{CC}=15\text{V}$ )

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
INV	Collector current at off signal input	$I_{CES}$	$V_{CE}=1200\text{V}$ input terminal open	-	-	1.0	mA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	$I_C=25\text{A}$	-	-	2.6	V
	Forward voltage of FWD	$V_F$	$-I_C=25\text{A}$	-	-	3.0	V

● Electrical characteristics of control circuit(at  $T_c=T_j=25^\circ\text{C}$ ,  $V_{cc}=15\text{V}$ )

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply current of P-line side Pre-driver(one unit)	$I_{ccp}$	$f_{sw}=0$ to 15kHz $T_c=-20$ to $100^\circ\text{C}$ *7	3	-	18	mA
Power supply current of N-line side three Pre-driver	$I_{CCN}$	$f_{sw}=0$ to 15kHz $T_c=-20$ to $100^\circ\text{C}$ *7	10	-	65	mA
Input signal threshold voltage (on/off)	$V_{in(th)}$	ON	1.00	1.35	1.70	V
		OFF	1.25	1.60	1.95	V
Input zener voltage	$V_z$	$R_{in}=20\text{k ohm}$	-	8.0	-	V
Over heating protection temperature level	$T_{COH}$	$V_{DC}=0\text{V}$ , $I_c=0\text{A}$ , Case temperature	110	-	125	$^\circ\text{C}$
Hysteresis	$T_{CH}$		-	20	-	$^\circ\text{C}$
IGBT chips over heating protection temperature level	$T_{jOH}$	surface of IGBT chips	150	-	-	$^\circ\text{C}$
Hysteresis	$T_{jH}$		-	20	-	$^\circ\text{C}$
Collector current protection level	INV	$I_{oc}$	$T_j=125^\circ\text{C}$	38	-	A
Over current protection delay time	$t_{DOC}$	$T_j=25^\circ\text{C}$ Fig.2	-	10	-	$\mu\text{s}$
Under voltage protection level	$V_{UV}$		11.0	-	12.5	V
Hysteresis	$V_H$		0.2	-	-	V
Alarm signal hold time	$t_{ALM}$		1.5	2	-	ms
SC protection delay time	$t_{SC}$	$T_j=25^\circ\text{C}$ Fig.3	-	-	12	$\mu\text{s}$
Limiting resistor for alarm	$R_{ALM}$		1425	1500	1575	ohm

\*7 Switching frequency of IPM

● Dynamic characteristics(at  $T_c=T_j=125^\circ\text{C}$ ,  $V_{cc}=15\text{V}$ )

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Switching time (IGBT)	$t_{on}$	$I_C=25\text{A}$ , $V_{DC}=600\text{V}$	0.3	-	-	$\mu\text{s}$
	$t_{off}$		-	-	3.6	$\mu\text{s}$
Switching time (FWD)	$t_{rr}$	$I_F=25\text{A}$ , $V_{DC}=600\text{V}$	-	-	0.4	$\mu\text{s}$

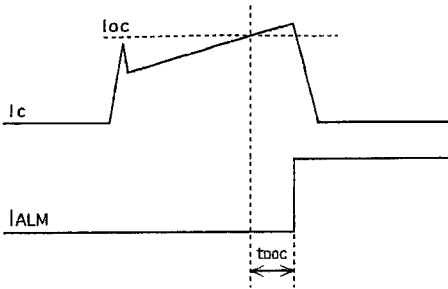


Fig.2 Definition of OC delay time

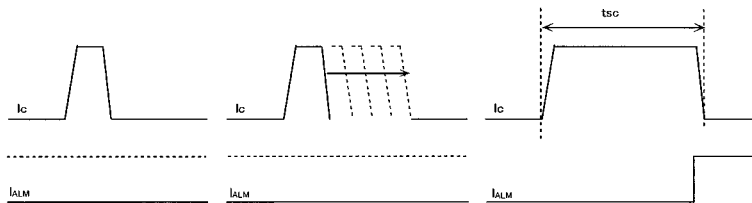


Fig.3 Definition of tsc

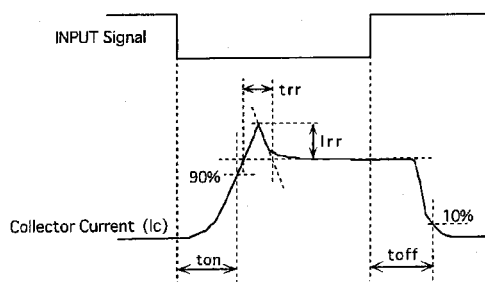


Fig.4 Definition of switching time

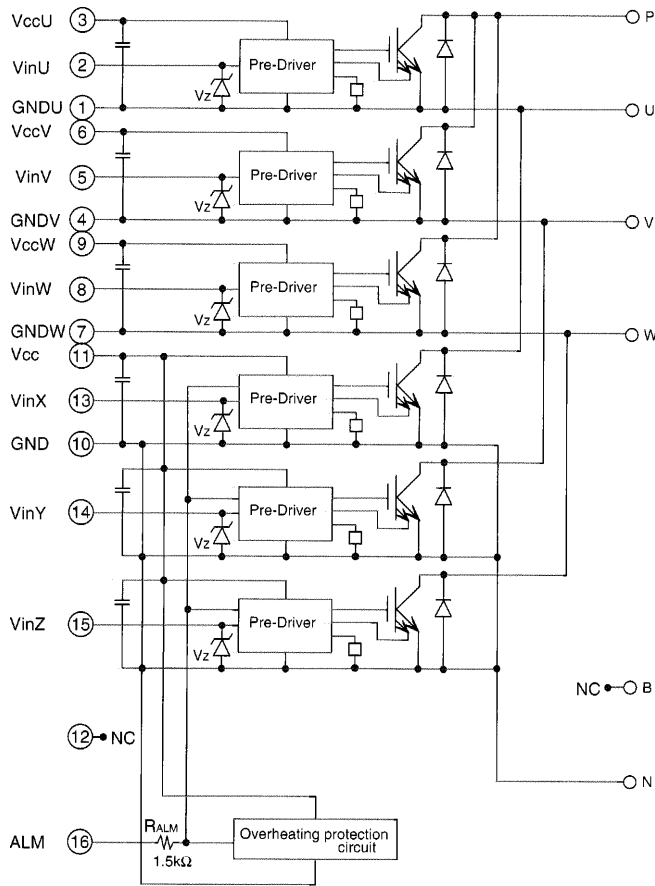
● Thermal characteristics(  $T_c=25^\circ\text{C}$ )

Item	Symbol	Typ.	Max.	Unit
Junction to Case thermal resistance	INV			
	IGBT	-	0.63	$^\circ\text{C/W}$
	FWD	-	1.33	$^\circ\text{C/W}$
Case to fin thermal resistance with compound	$R_{th(c-f)}$	0.05	-	$^\circ\text{C/W}$

● Recommendable value

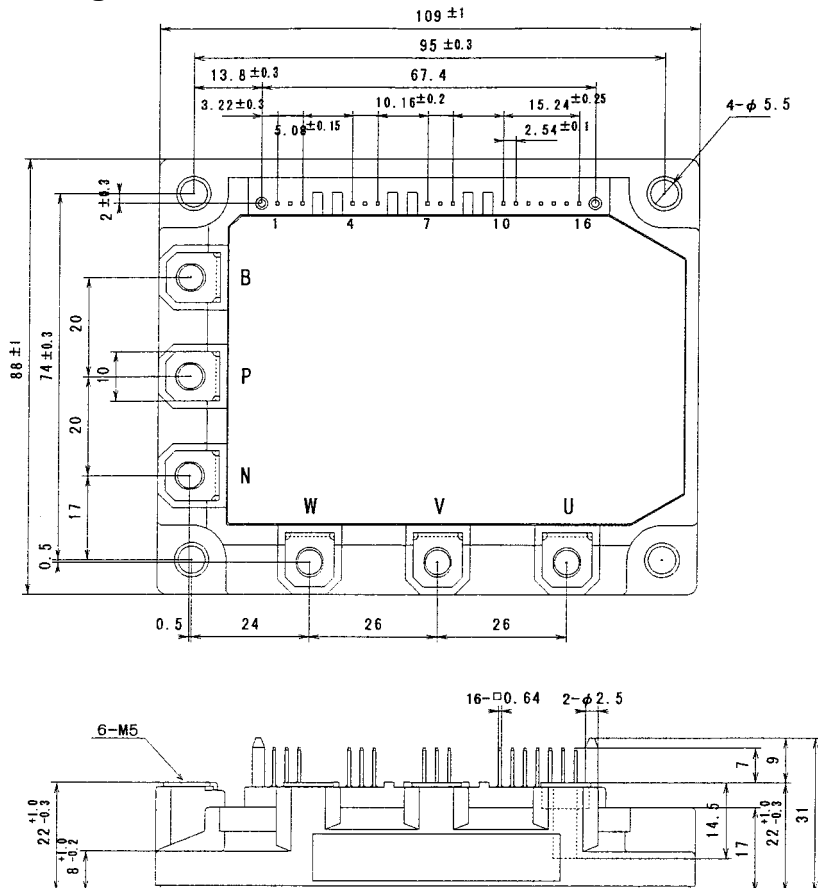
Item	Symbol	Min.	Typ.	Max.	Unit
DC bus voltage	$V_{DC}$	200	-	800	V
Operating power supply voltage range of Pre-driver	$V_{CC}$	13.5	15	16.5	V
Switching frequency of IPM	$f_{sw}$	1	-	20	kHz
Screw torque	Mounting (M5)	-	2.5	3.0	N·m
	Terminal (M5)	-	2.5	3.0	N·m

Block diagram



- Pre-drivers include following functions
- a) Amplifier for driver
  - b) Short circuit protection
  - c) Undervoltage lockout circuit
  - d) Over current protection
  - e) IGBT chip over heating protection

Outline drawings, mm

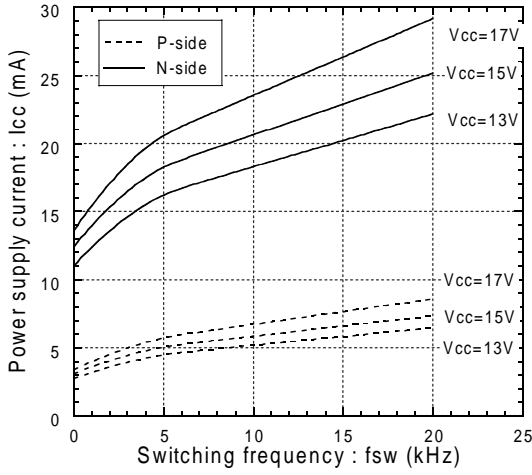


Mass : 440g

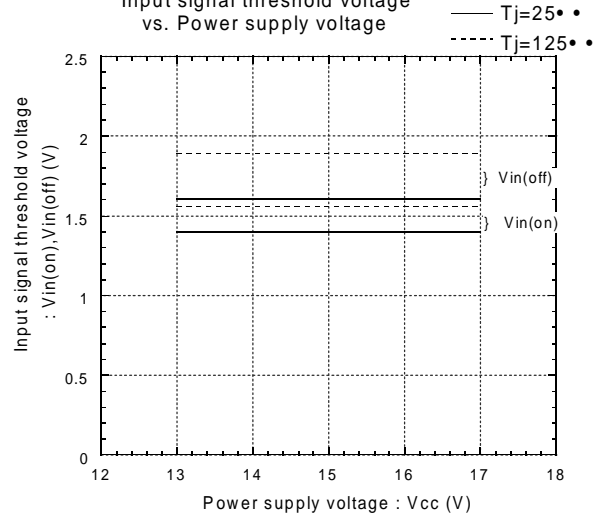
Characteristics (Representative)

Control Circuit

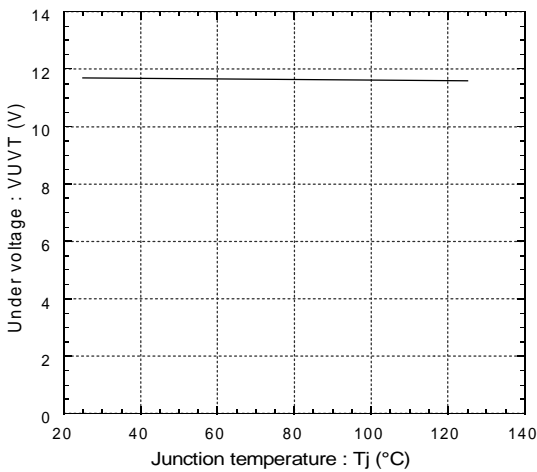
Power supply current vs. Switching frequency  
T<sub>j</sub>=100°C



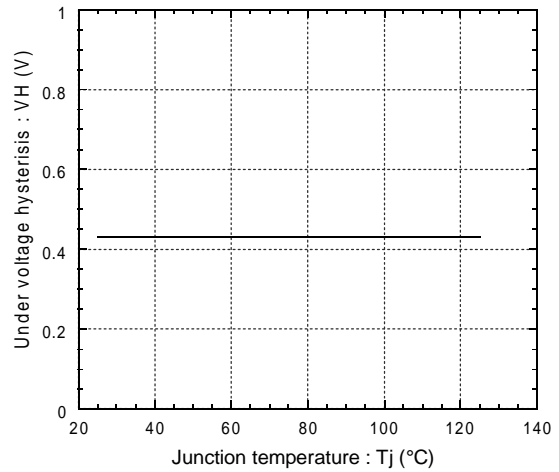
Input signal threshold voltage vs. Power supply voltage



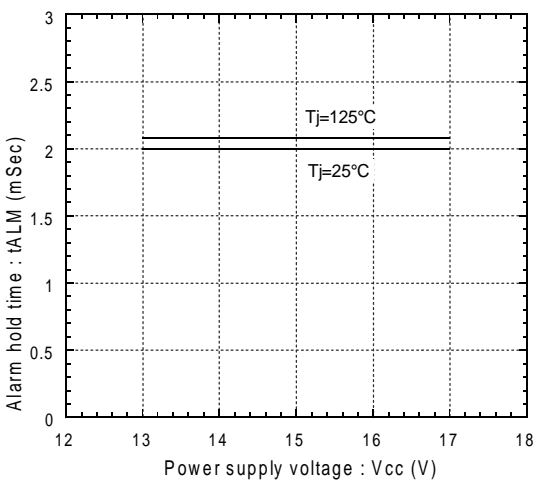
Under voltage vs. Junction temperature



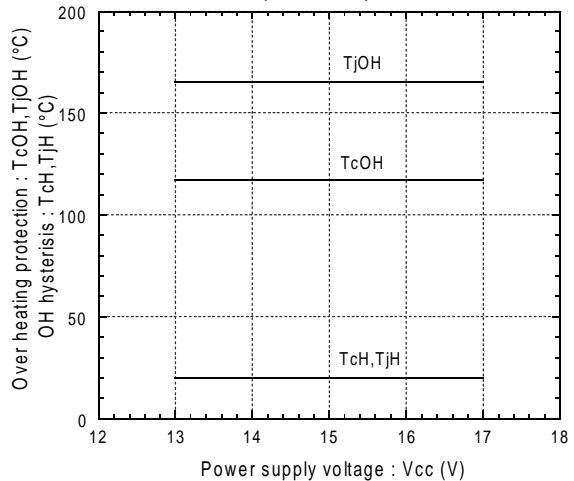
Under voltage hysteresis vs. Junction temperature



Alarm hold time vs. Power supply voltage

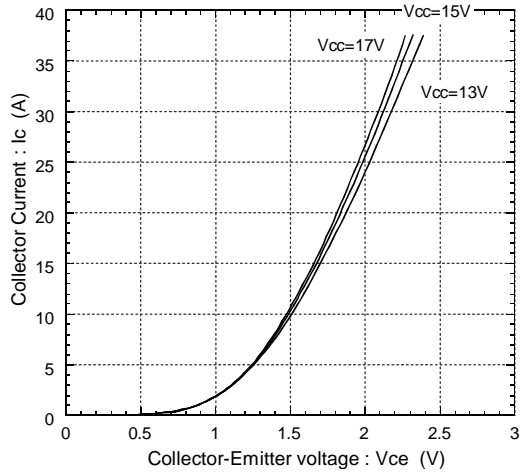


Over heating characteristics  
TcOH, TjOH, TcH, TjH vs. Vcc

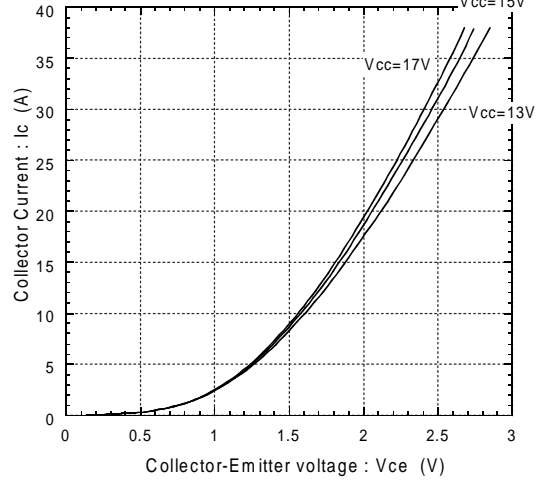


● Inverter

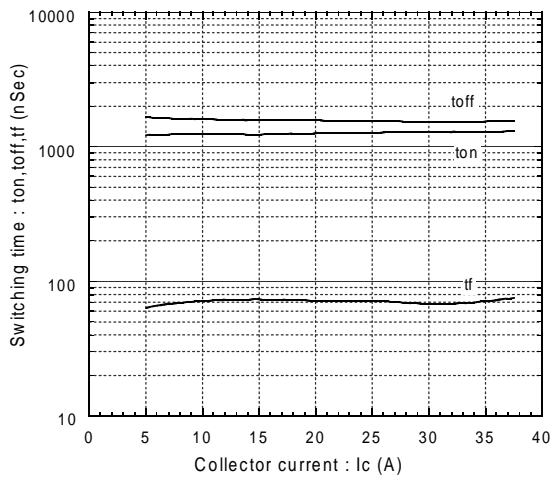
Collector current vs. Collector-Emittor voltage  
T<sub>j</sub>=25°C



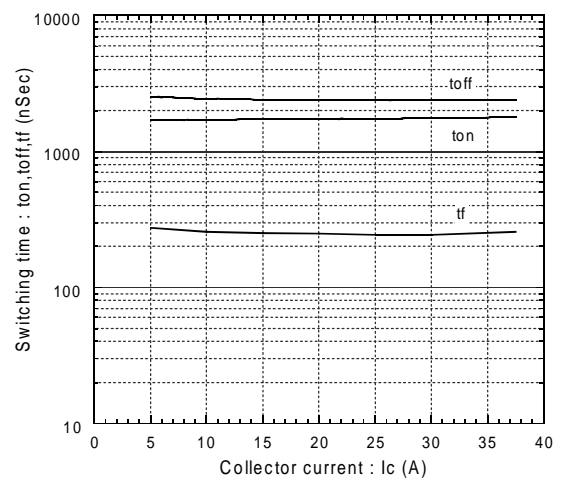
Collector current vs. Collector-Emittor voltage  
T<sub>j</sub>=125°C



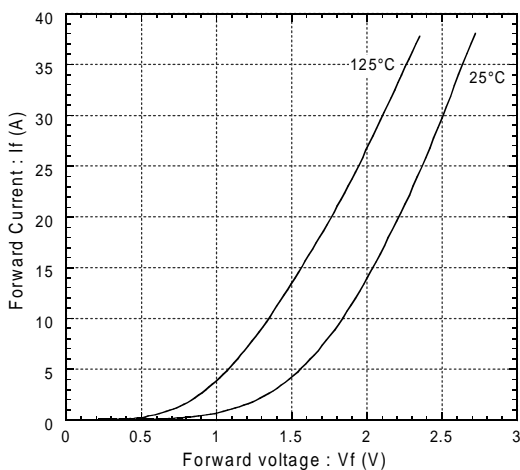
Switching time vs. Collector current  
E<sub>dc</sub>=600V, V<sub>cc</sub>=15V, T<sub>j</sub>=25°C



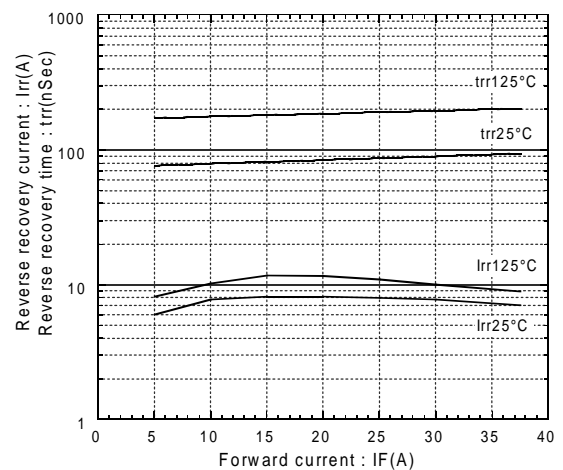
Switching time vs. Collector current  
E<sub>dc</sub>=600V, V<sub>cc</sub>=15V, T<sub>j</sub>=125°C



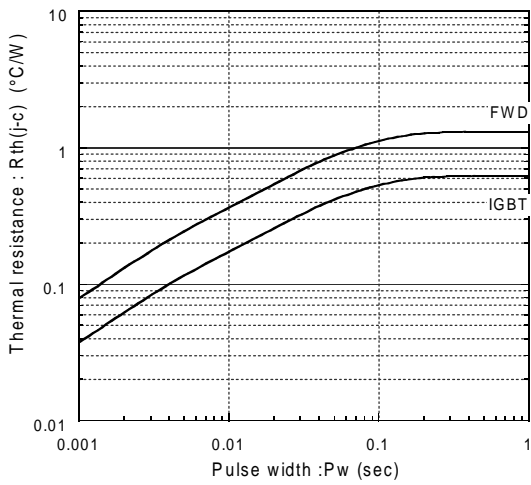
Forward current vs. Forward voltage



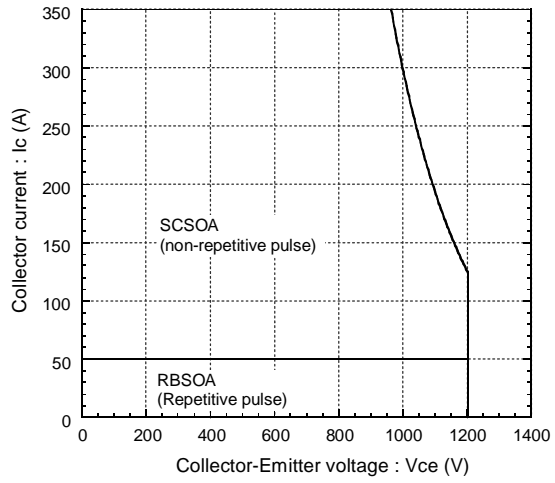
Reverse recovery characteristics  
trr, Irr vs. IF



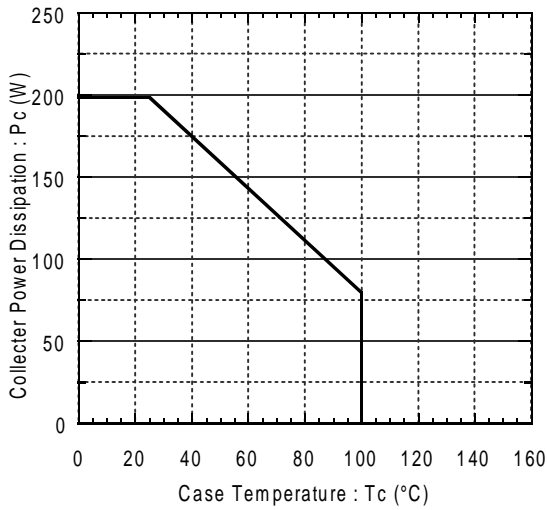
Transient thermal resistance



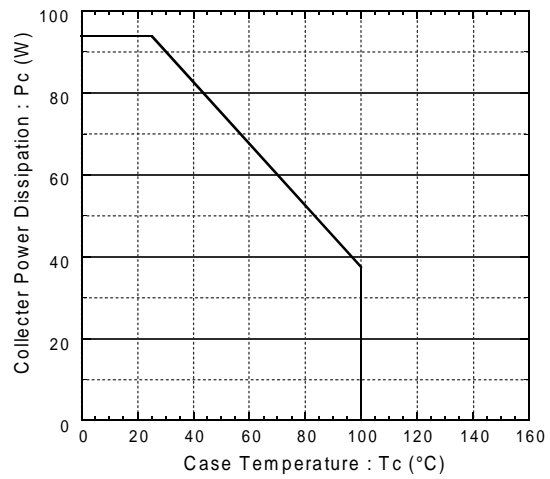
Reversed biased safe operating area  
Vcc=15V, Tj ≤ 125°C



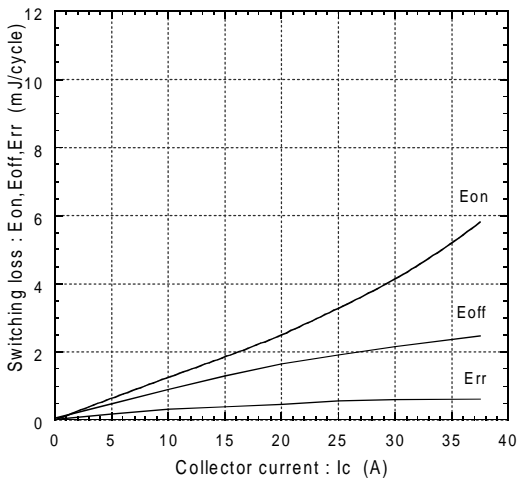
Power derating for IGBT  
(per device)



Power derating for FWD  
(per device)



Switching Loss vs. Collector Current  
Edc=600V, Vcc=15V, Tj=25°C



Switching Loss vs. Collector Current  
Edc=600V, Vcc=15V, Tj=125°C

