

# 7MBP25RA120

## IGBT-IPM R series

1200V / 25A 7 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
DB Reverse voltage			$V_R$	-	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
DB	Collector current	DC	$I_C$	-	15	A
		1ms	$I_{CP}$	-	30	A
	Forward current of Diode		$I_F$	-	15	A
	Collector power dissipation	One transistor	$P_C$	-	120	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)			-	$3.5^{*6}$	N·m
	Terminal (M5)			-	$3.5^{*6}$	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, 12,13,14,15 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

- 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
DB	Collector current at off signal input	$I_{CES}$	$V_{CE}=1200\text{V}$ input terminal open		-	-	1.0	mA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	$I_C=15\text{A}$		-	-	2.6	V
	Forward voltage of Diode	$V_F$	$-I_C=15\text{A}$		-	-	3.0	V

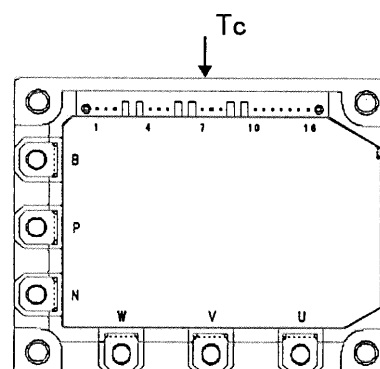
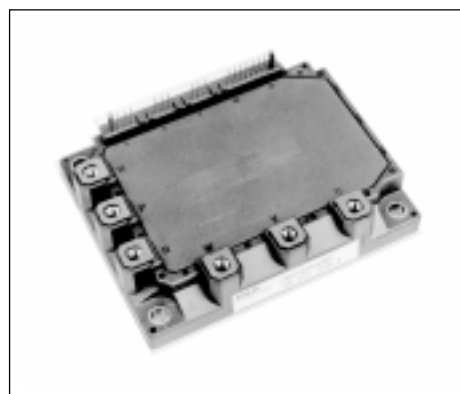


Fig.1 Measurement of case temperature

● **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 $15\text{kHz}$ $T_c=-20$ 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 $15\text{kHz}$ $T_c=-20$ 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 Fig.1	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
	DB	$I_{OC}$ $T_j=125^\circ\text{C}$	23	-	-	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	$\mu\text{s}$

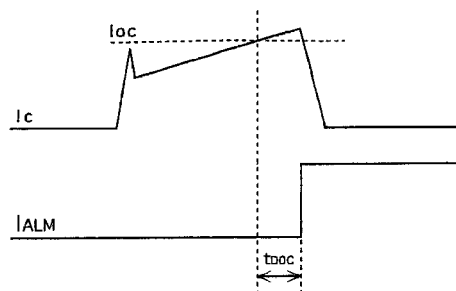


Fig.2 Definition of OC delay time

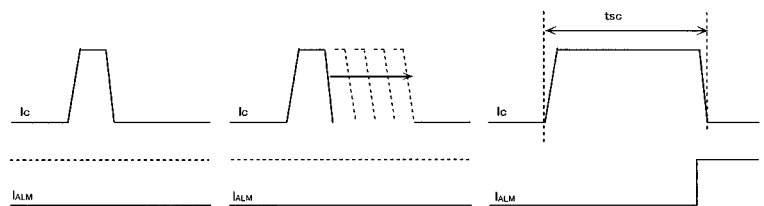


Fig.3 Definition of  $t_{sc}$

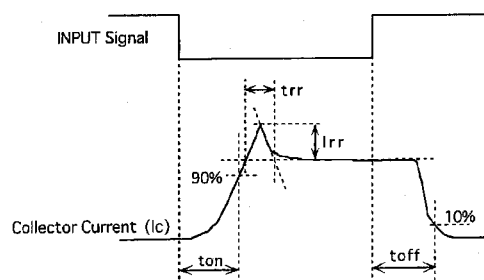


Fig.4 Definition of switching time

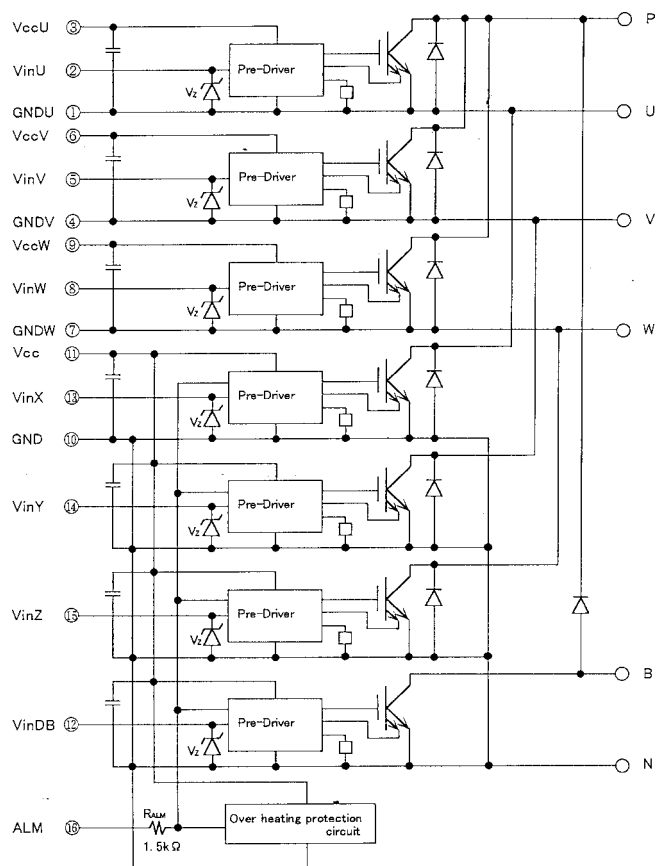
● **Thermal characteristics**( $T_c=25^\circ\text{C}$ )

Item	Symbol		Typ.	Max.	Unit
Junction to Case thermal resistance	INV	IGBT	$R_{th(j-c)}$	0.63	$^\circ\text{C/W}$
		FWD	$R_{th(j-c)}$	1.33	$^\circ\text{C/W}$
	DB	IGBT	$R_{th(j-c)}$	1.04	$^\circ\text{C/W}$
			$R_{th(c-f)}$	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

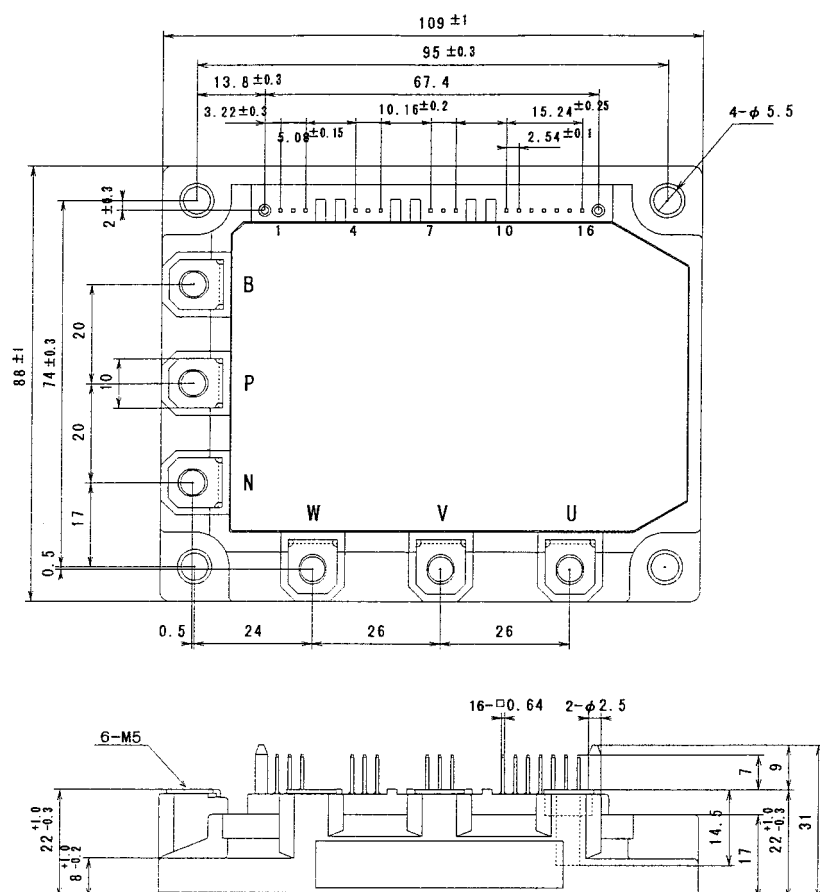
## Block diagram



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

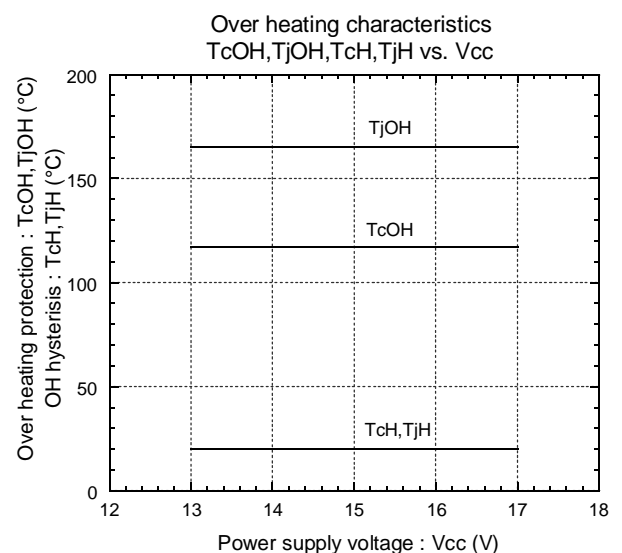
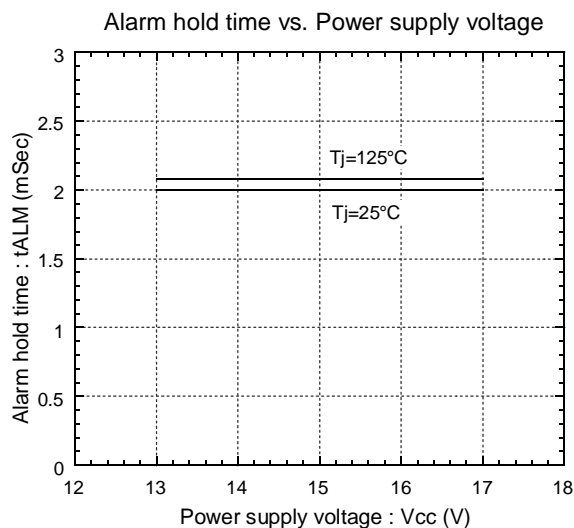
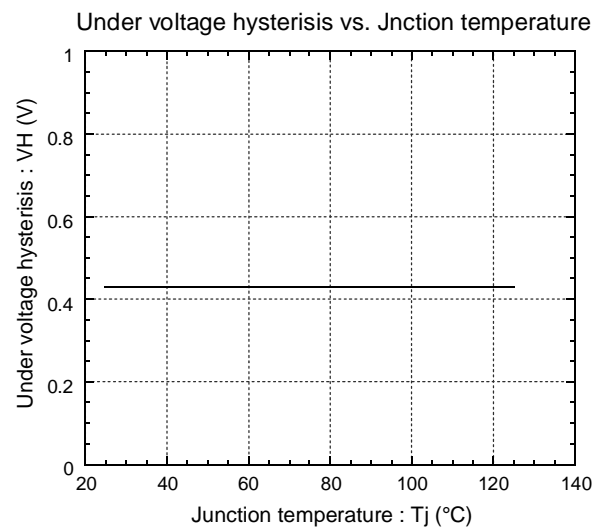
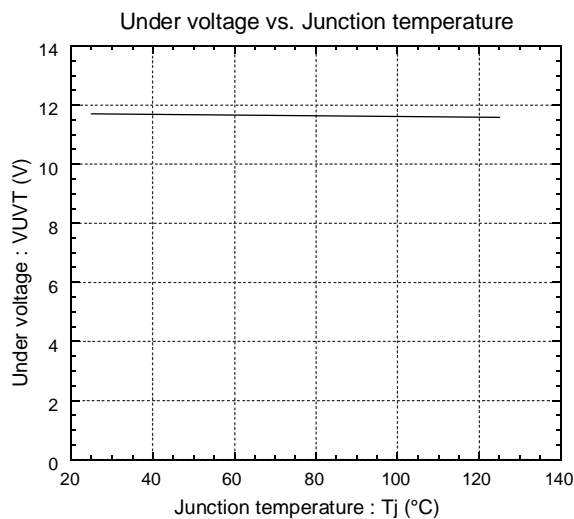
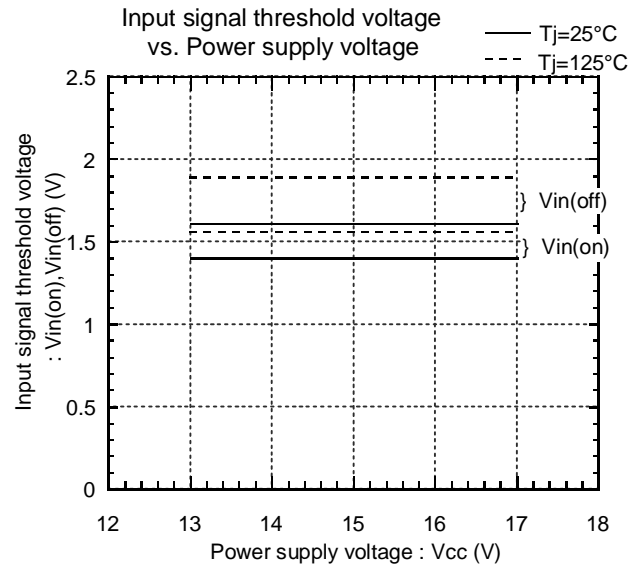
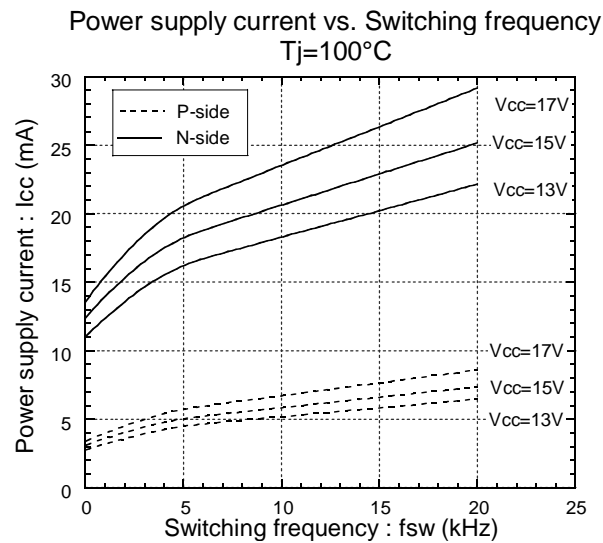
## Outline drawings, mm



Mass : 440g

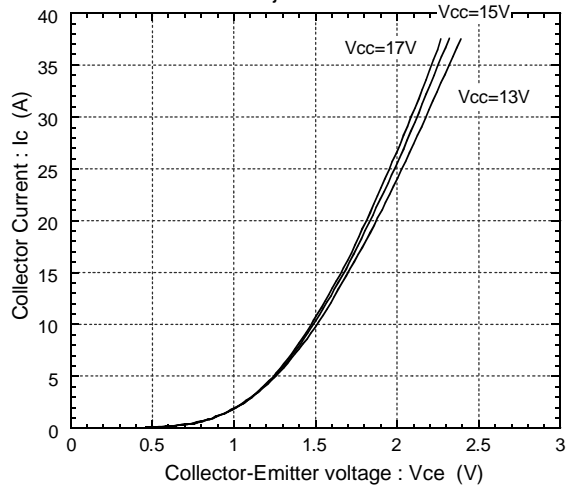
## Characteristics (Representative)

### Control Circuit

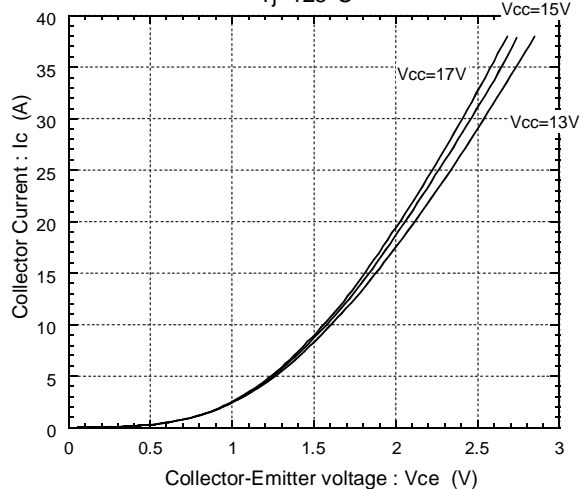


● Inverter

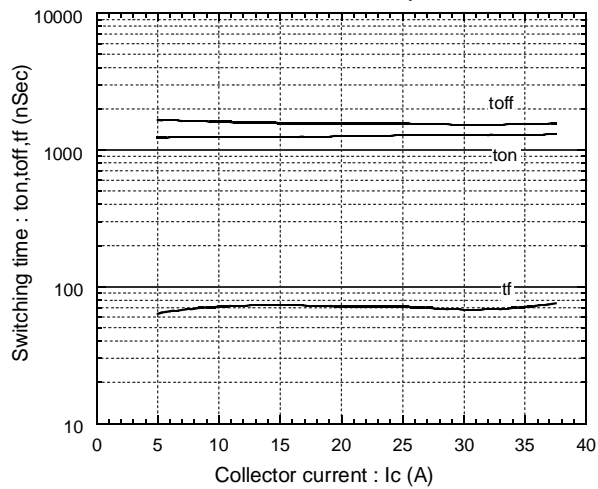
Collector current vs. Collector-Emitter voltage  
 $T_j=25^{\circ}\text{C}$



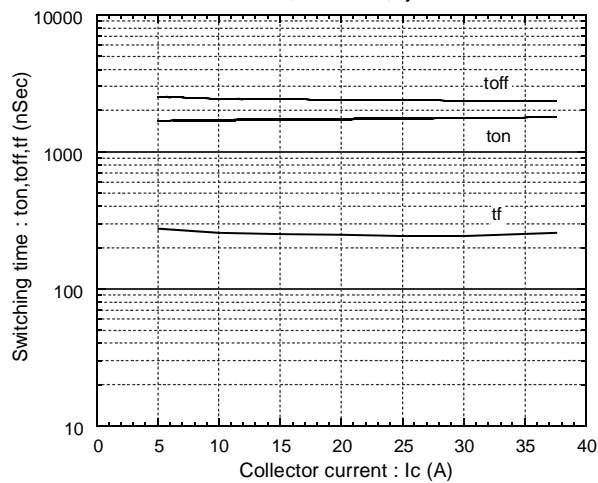
Collector current vs. Collector-Emitter voltage  
 $T_j=125^{\circ}\text{C}$



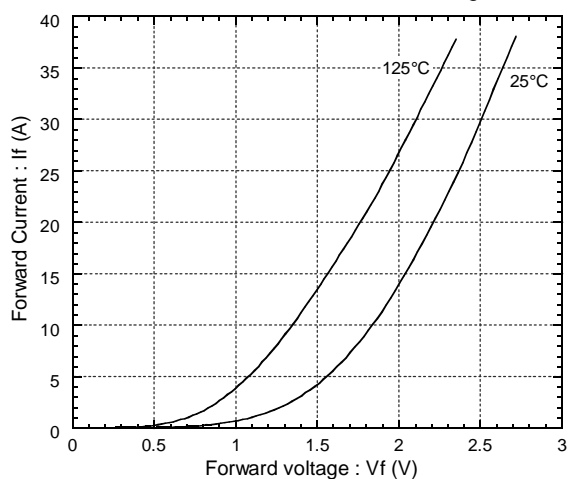
Switching time vs. Collector current  
 $E_{dc}=600\text{V}, V_{cc}=15\text{V}, T_j=25^{\circ}\text{C}$



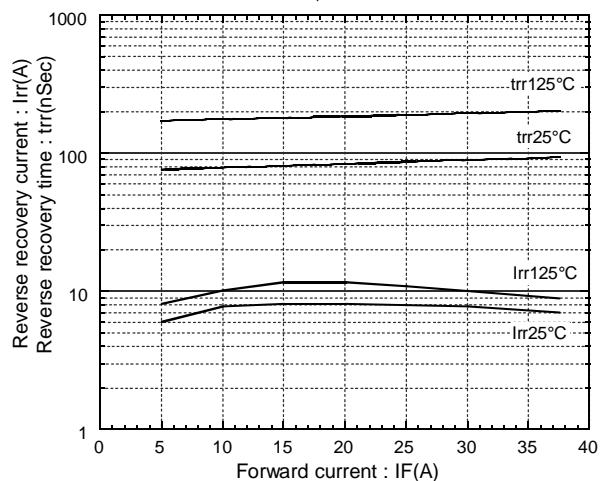
Switching time vs. Collector current  
 $E_{dc}=600\text{V}, V_{cc}=15\text{V}, T_j=125^{\circ}\text{C}$



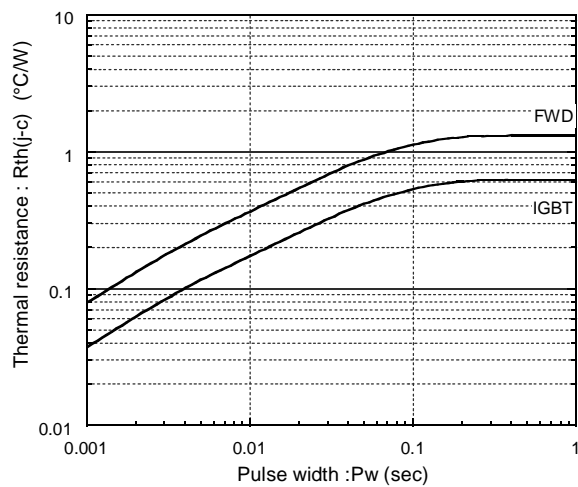
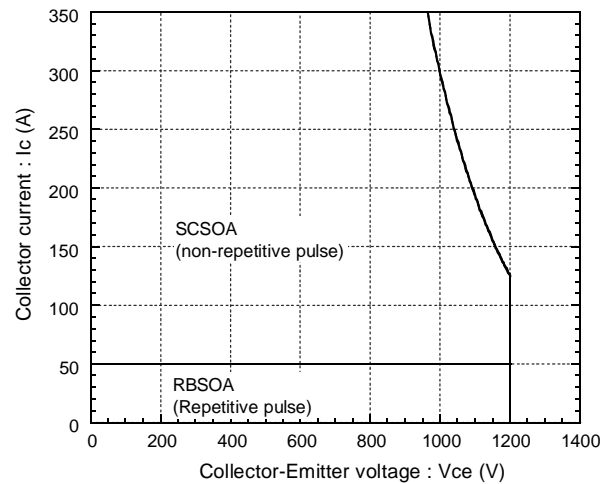
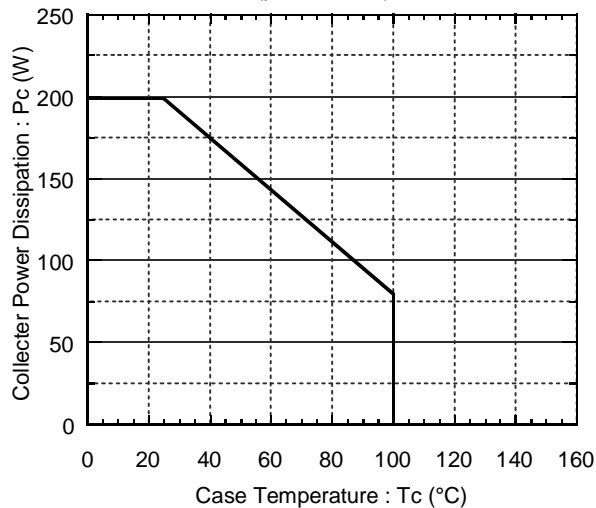
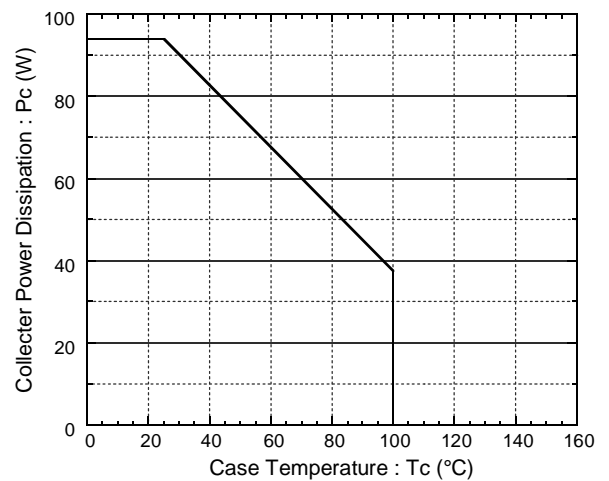
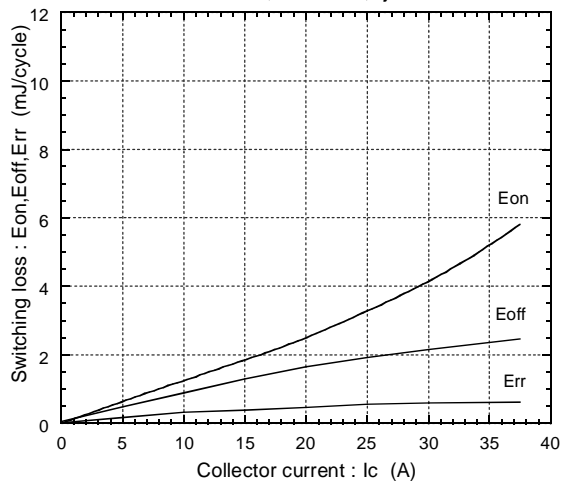
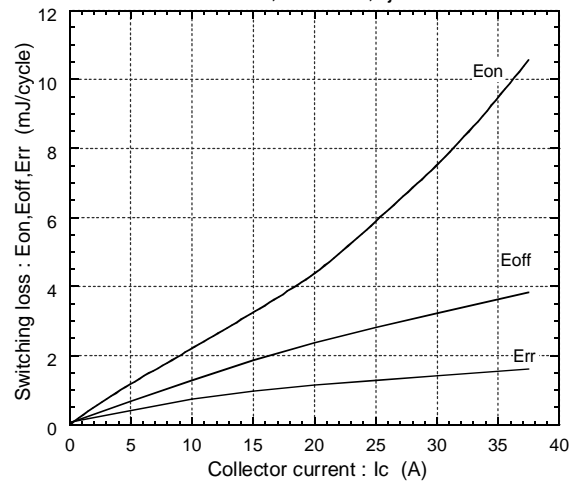
Forward current vs. Forward voltage

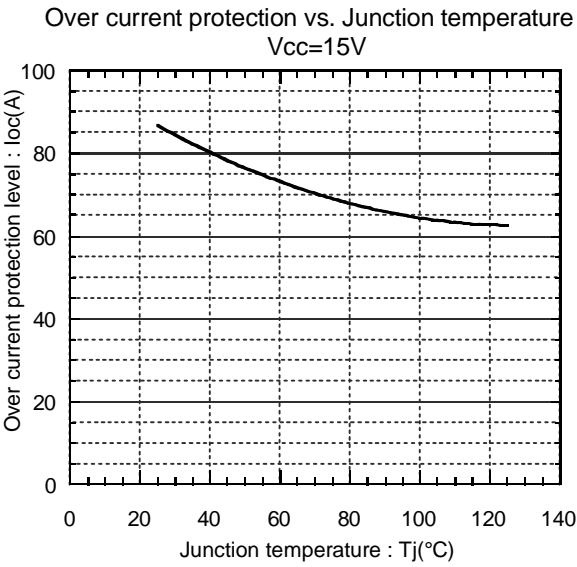


Reverse recovery characteristics  
 $t_{rr}, I_{rr}$  vs.  $I_F$



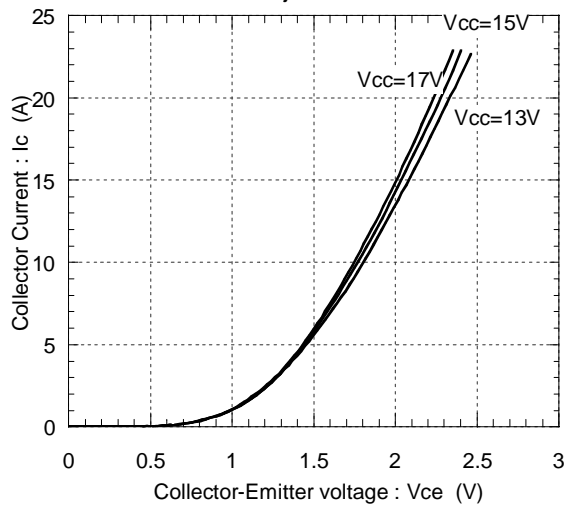
Transient thermal resistance

Reversed biased safe operating area  
 $V_{cc}=15\text{V}, T_j = 125^{\circ}\text{C}$ Power derating for IGBT  
(per device)Power derating for FWD  
(per device)Switching Loss vs. Collector Current  
 $E_{dc}=600\text{V}, V_{cc}=15\text{V}, T_j=25^{\circ}\text{C}$ Switching Loss vs. Collector Current  
 $E_{dc}=600\text{V}, V_{cc}=15\text{V}, T_j=125^{\circ}\text{C}$ 

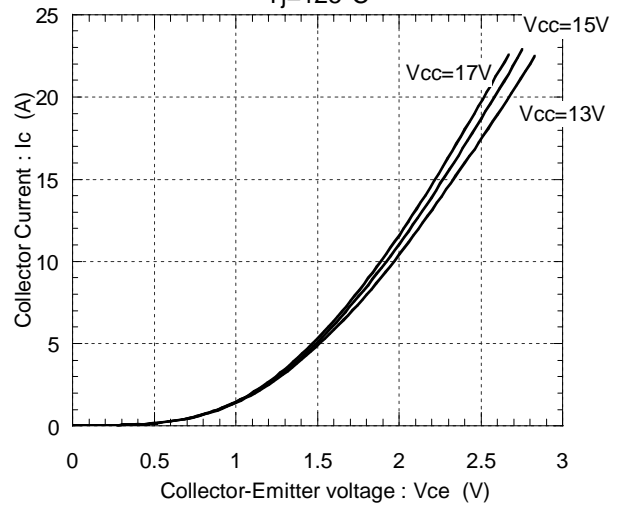


● Brake

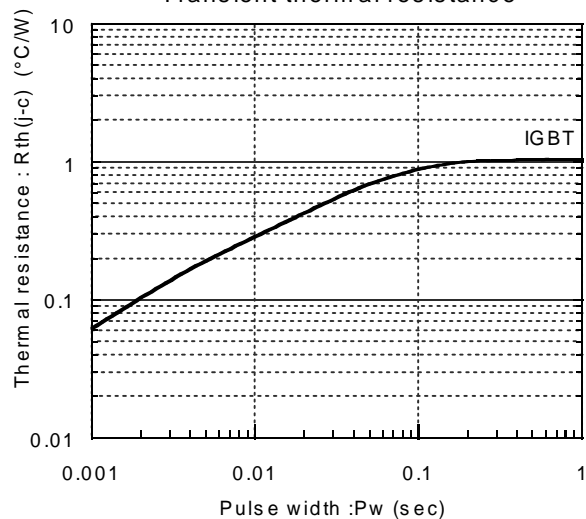
Collector current vs. Collector-Emitter voltage  
 $T_j = 25^\circ\text{C}$



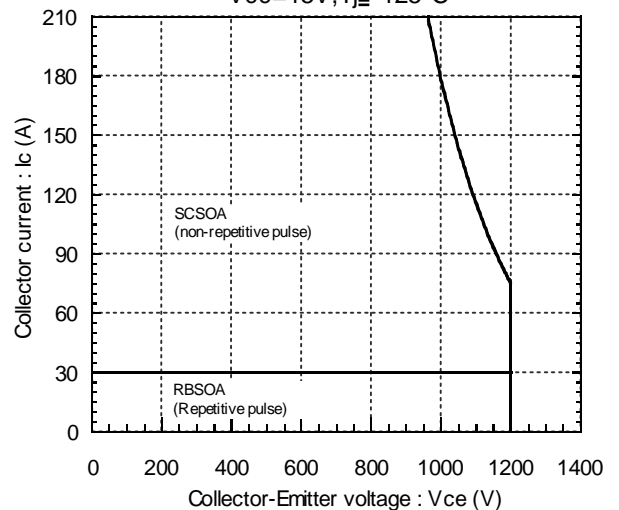
Collector current vs. Collector-Emitter voltage  
 $T_j = 125^\circ\text{C}$



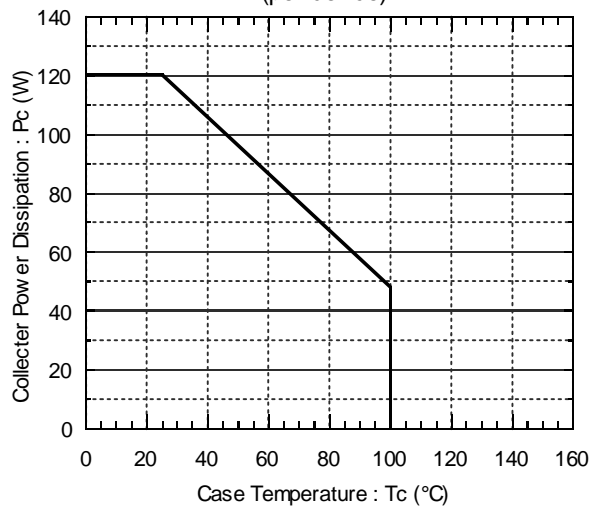
Transient thermal resistance



Reversed biased safe operating area  
 $V_{cc} = 15\text{V}, T_j \leq 125^\circ\text{C}$



Power derating for IGBT  
(per device)



Over current protection vs. Junction temperature  
 $V_{cc} = 15\text{V}$

