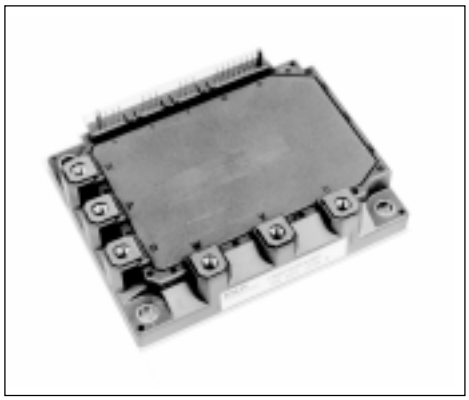
6MBP50RA120

IGBT-IPM R series

1200V / 50A 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 Tc=25°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	-	50	A
		1ms	I_{CP}	-	100	A
		DC	$-I_C$	-	50	A
	Collector power dissipation	One transistor	P_C	-	357	W
Junction temperature			T_j	-	150	°C
Input voltage of power supply for Pre-Driver			V_{CC} *1	0	20	V
Input signal voltage			V_{in} *2	0	Vz	V
Input signal current			I_{in}	-	1	mA
Alarm signal voltage			V_{ALM} *3	0	Vcc	V
Alarm signal current			I_{ALM} *4	-	15	mA
Storage temperature			T_{stg}	-40	125	°C
Operating case temperature			T_{op}	-20	100	°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

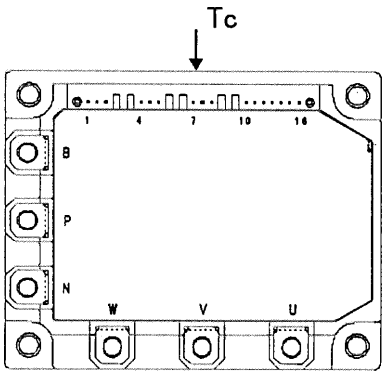


Fig.1 Measurement of case temperature

*1 Apply Vcc between terminal No. 3 and 1, 6 and 4, 9 and 7, 11 and 10.
*2 Apply Vin 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

● **Electrical characteristics of power circuit** (at Tc=Tj=25°C, Vcc=15V)

Item		Symbol	Condtion	Min.	Typ.	Max.	Unit
INV	Collector current at off signal input	I_{CES}	V_{CE}=1200V input terminal open	–	–	1.0	mA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	Ic=50A	–	–	2.6	V
	Forward voltage of FWD	V_F	-Ic=50A	–	–	3.0	V

● **Electrical characteristics of control circuit**(at Tc=Tj=25°C, Vcc=15V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply current of P-line side Pre-driver(one unit)	I_{CCP}	fsw=0 to 15kHz Tc=-20 to 100°C *7	3	-	18	mA
Power supply current of N-line side three Pre-driver	I_{CCN}	fsw=0 to 15kHz Tc=-20 to 100°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	Rin=20k ohm	-	8.0	-	V
Over heating protection temperature level	T_{COH}	VDC=0V, Ic=0A, Case temperature	110	-	125	°C
Hysteresis	T_{CH}		-	20	-	°C
IGBT chips over heating protection temperature level	T_{jOH}	surface of IGBT chips	150	-	-	°C
Hysteresis	T_{jH}		-	20	-	°C
Collector current protection level INV	I_{OC}	Tj=125°C	75	-	-	A
Over current protection delay time	t_{DOC}	Tj=25°C Fig.2	-	10	-	µs
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}	Tj=25°C Fig.3	-	-	12	µs
Limiting resistor for alarm	R_{ALM}		1425	1500	1575	ohm

*7 Switching frequency of IPM

● **Dynamic characteristics**(at Tc=Tj=125°C, Vcc=15V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Switching time (IGBT)	ton	IC=50A, VDC=600V	0.3	-	-	µs
	toff		-	-	3.6	µs
Switching time (FWD)	trr	IF=50A, VDC=600V	-	-	0.4	µs

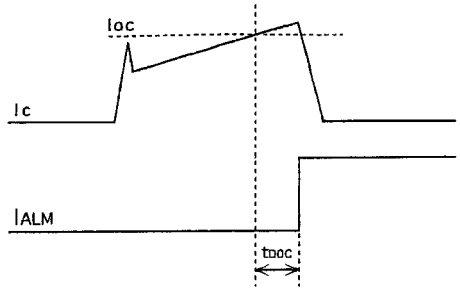


Fig.2 Definition of OC delay time

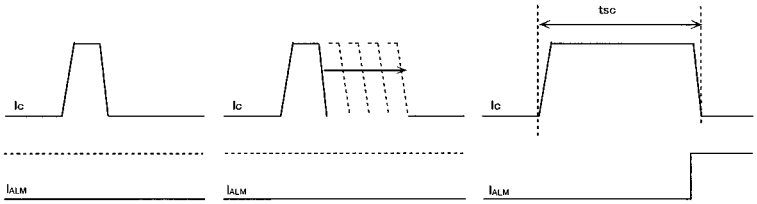


Fig.3 Definition of tsc

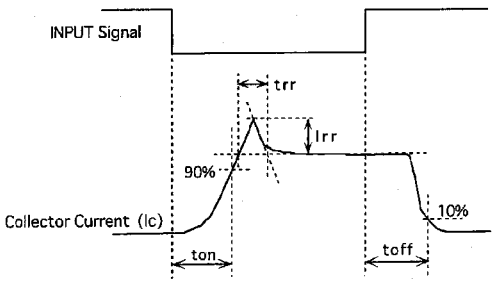


Fig.4 Definition of switching time

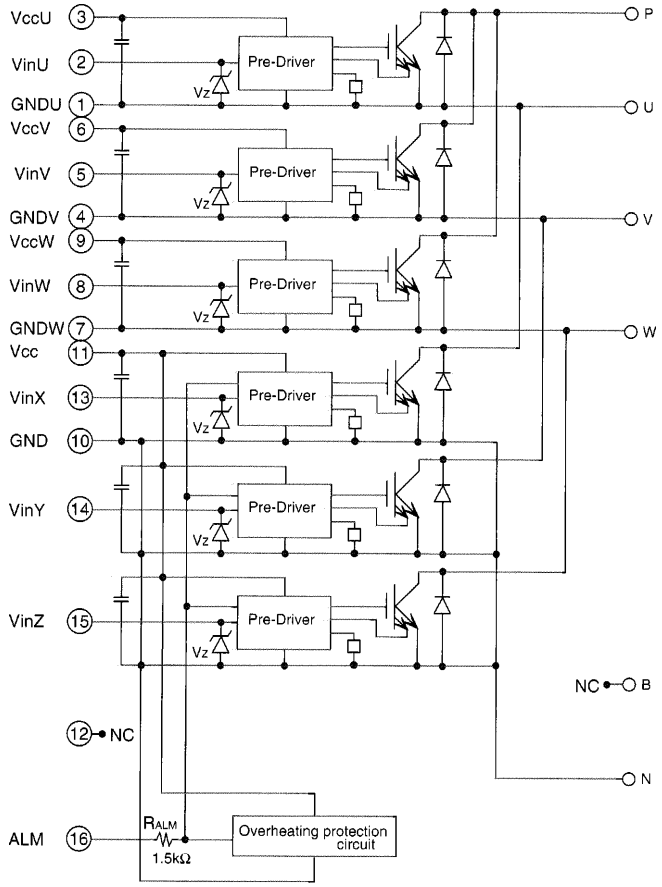
● **Thermal characteristics**(Tc=25°C)

Item			Symbol	Typ.	Max.	Unit
Junction to Case thermal resistance	INV	IGBT	Rth(j-c)	-	0.35	°C/W
		FWD	Rth(j-c)	-	0.85	°C/W
Case to fin thermal resistance with compound			Rth(c-f)	0.05	-	°C/W

● **Recommendable value**

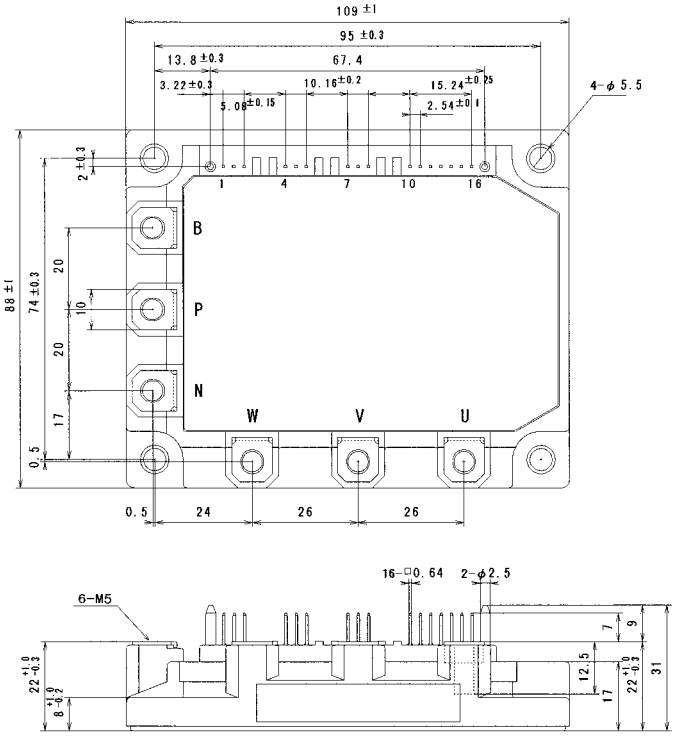
Item		Symbol	Min.	Typ.	Max.	Unit
DC bus voltage		V_{DC}	200	-	800	V
Operating power supply voltage range of Pre-driver		V_{CC}	13.5	15	16.5	V
Switching frequency of IPM		f_{SW}	1	-	20	kHz
Screw torque	Mounting (M5)	-	2.5	-	3.0	N·m
	Terminal (M5)	-	2.5	-	3.0	N·m

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

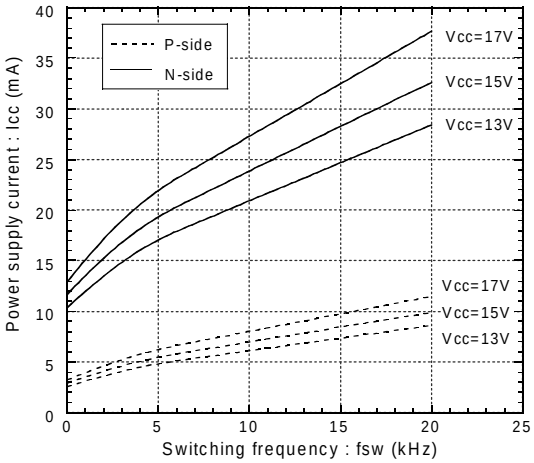


Mass : 440g

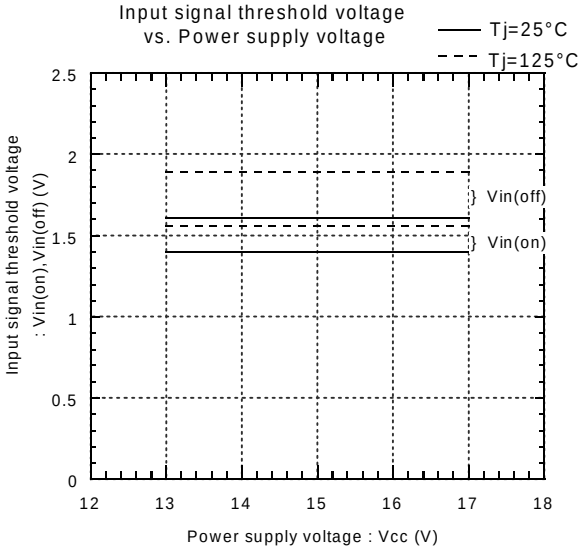
■ Characteristics (Representative)

● Control Circuit

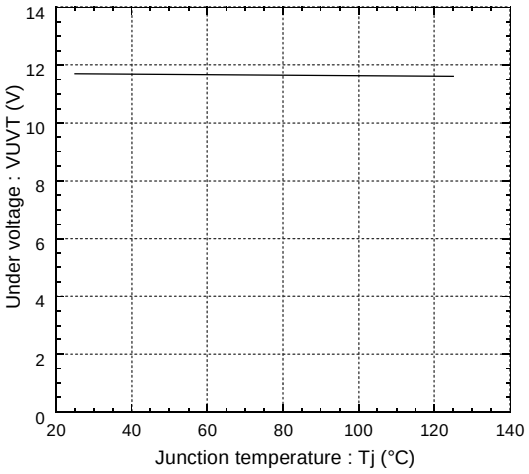
Power supply current vs. Switching frequency
Tj=100°C



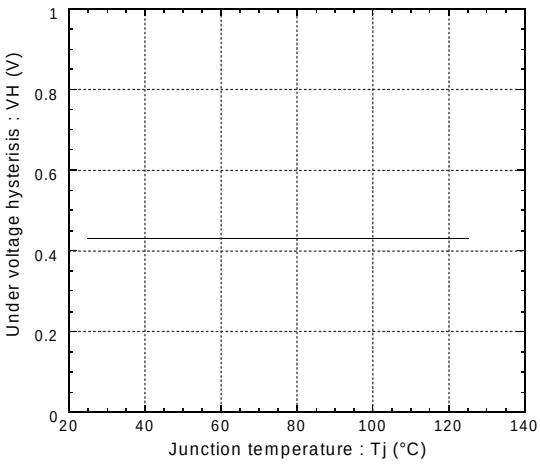
Input signal threshold voltage
vs. Power supply voltage



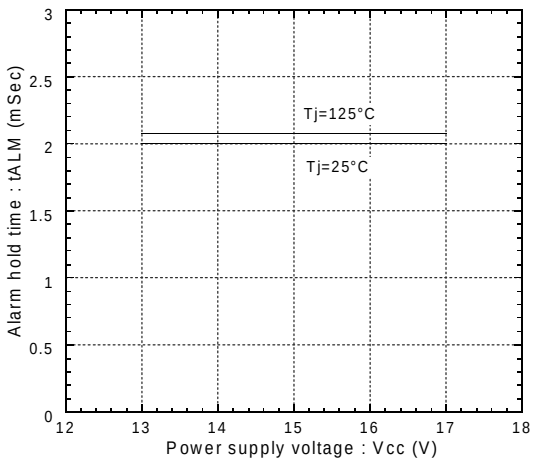
Under voltage vs. Junction temperature



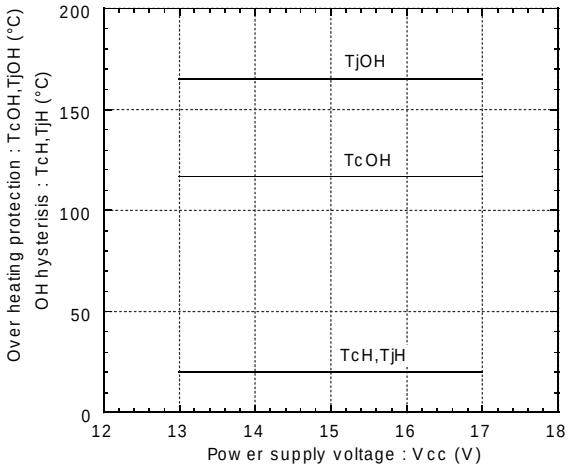
Under voltage hysterisis vs. Jnction temperature



Alarm hold time vs. Power supply voltage

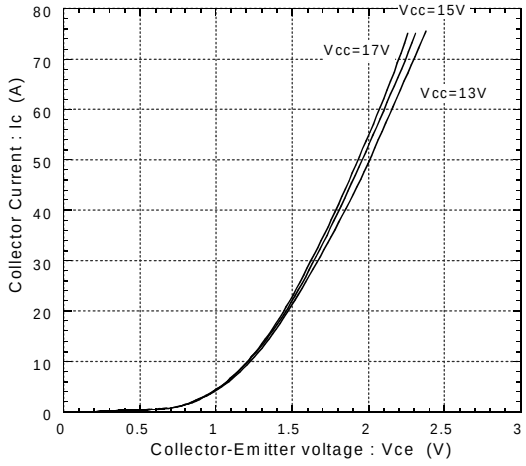


Over heating characteristics
TcOH,TjOH,TcH,TjH vs. Vcc

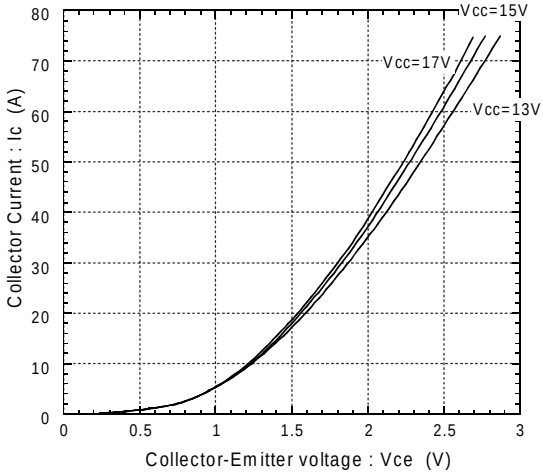


● **Inverter**

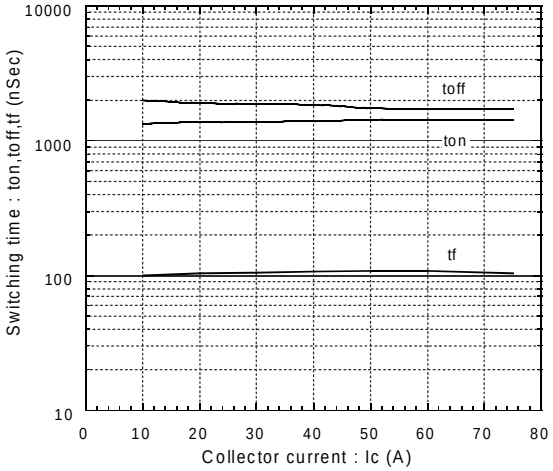
Collector current vs. Collector-Emitter voltage
Tj=25°C



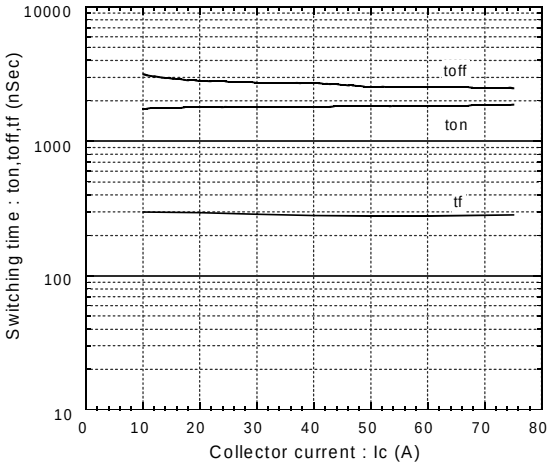
Collector current vs. Collector-Emitter voltage
Tj=125°C



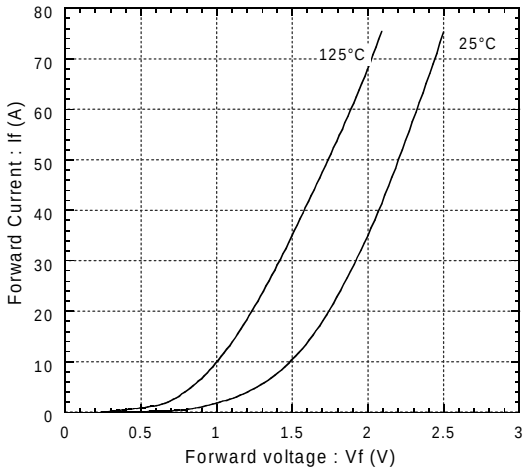
Switching time vs. Collector current
Edc=600V,Vcc=15V,Tj=25°C



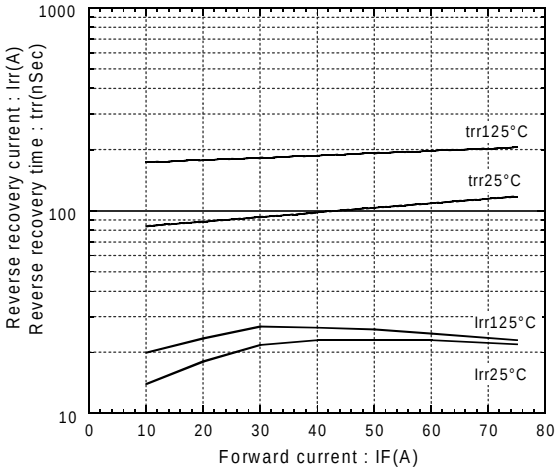
Switching time vs. Collector current
Edc=600V,Vcc=15V,Tj=125°C



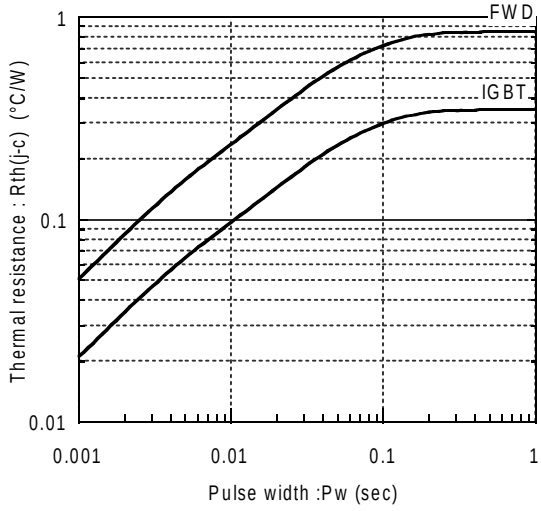
Forward current vs. Forward voltage



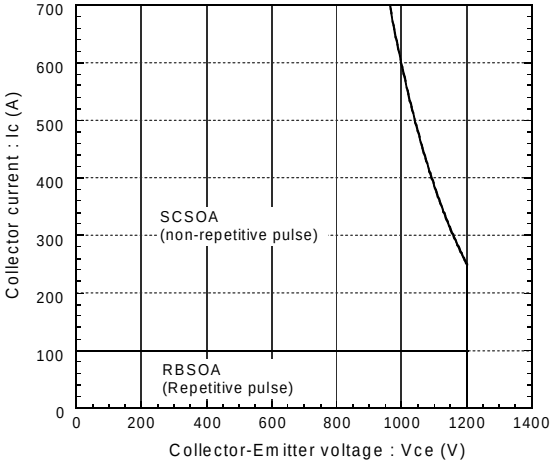
Reverse recovery characteristics
trr,Irr vs. IF



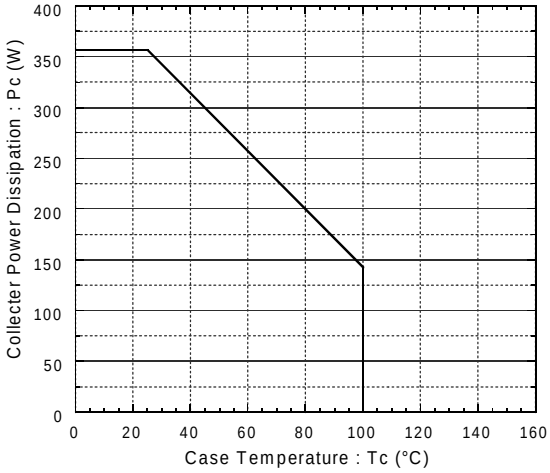
Transient thermal resistance



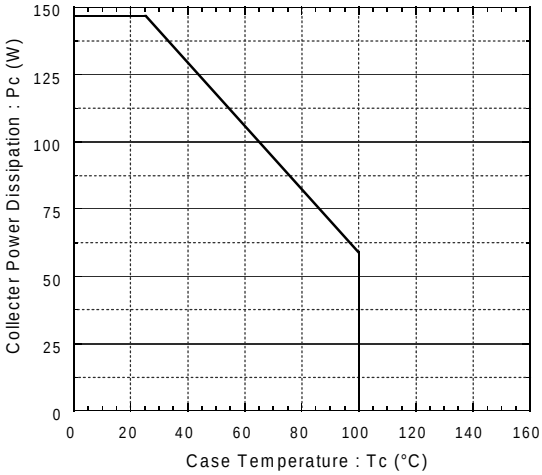
Reversed biased safe operating area
Vcc=15V,Tj≦125°C



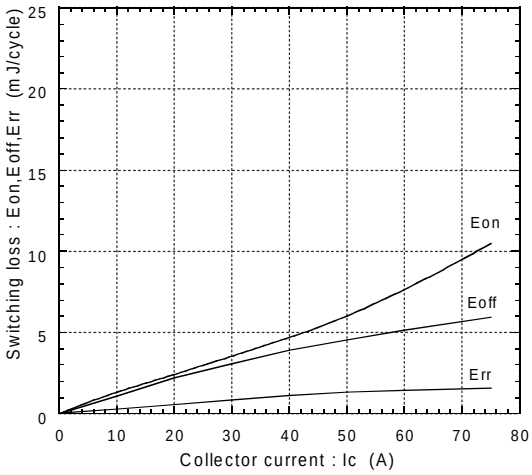
Power derating for IGBT
(per device)



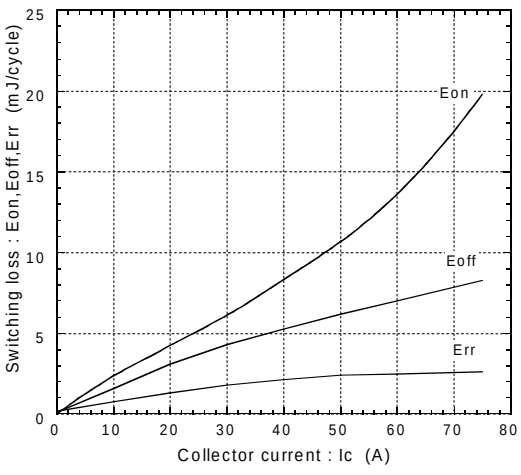
Power derating for FWD
(per device)

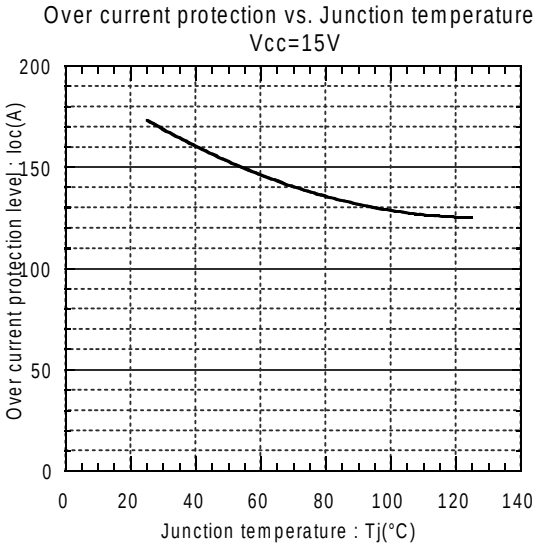


Switching Loss vs. Collector Current
Edc=600V,Vcc=15V,Tj=25°C



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




Over current protection vs. Junction temperature
Vcc=15V
Over current protection level : Ioc(A)
200
150
100
50
0
0
20
40
60
80
100
120
140
Junction temperature : Tj(°C)