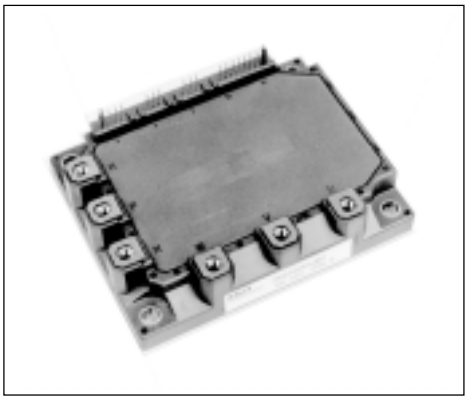
7MBP75RA120

IGBT-IPM R series

1200V / 75A 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 Tc=25°C unless otherwise specified)

Item			Symbol	Rating Min.	Rating Max.	Unit
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	-	75	A
		1ms	I_{CP}	-	150	A
		DC	$-I_C$	-	75	A
	Collector power dissipation	One transistor	P_C	-	500	W
DB	Collector current	DC	I_C	-	25	A
		1ms	I_{CP}	-	50	A
	Forward current of Diode		I_F	-	25	A
	Collector power dissipation	One transistor	P_C	-	198	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

*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, 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

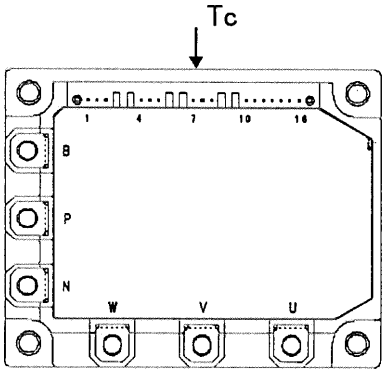


Fig.1 Measurement of case temperature

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

Item		Symbol	Condition	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=75A	–	–	2.6	V
	Forward voltage of FWD	V_F	-Ic=75A	–	–	3.0	V
DB	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=25A	–	–	2.6	V
	Forward voltage of Diode	V_F	-Ic=25A	–	–	3.3	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, Fig.1	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	113	-	-	A
	DB	I_{OC}	Tj=125°C	38	-	-	A
Over current protection delay time (Fig.2)		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=75A, VDC=600V	0.3	-	-	µs
	toff		-	-	3.6	µs
Switching time (FWD)	trr	IF=75A, VDC=600V	-	-	0.4	µs

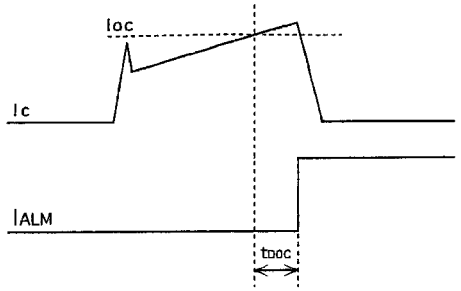


Fig.2 Definition of OC delay time

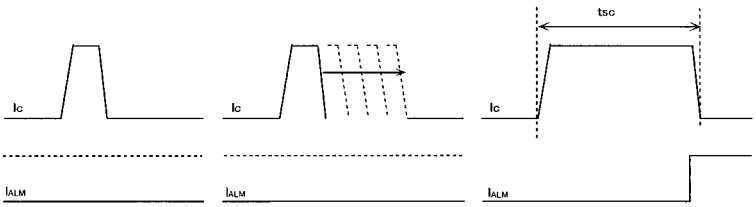


Fig.3 Definition of tsc

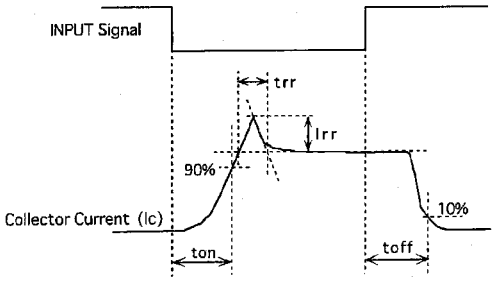


Fig.4 Definition of switching time

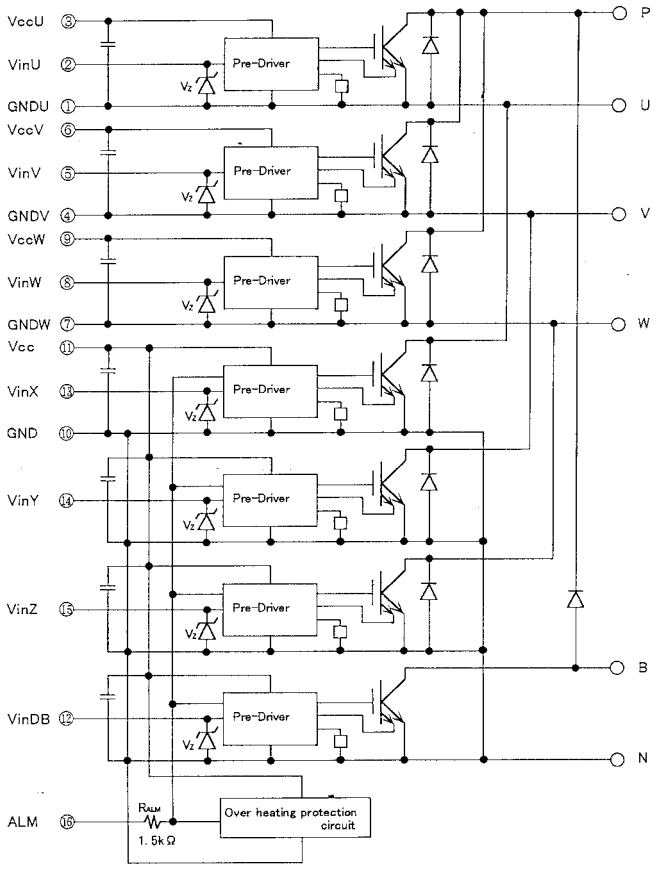
● Thermal characteristics(Tc=25°C)

Item			Symbol	Typ.	Max.	Unit
Junction to Case thermal resistance	INV	IGBT	Rth(j-c)	-	0.25	°C/W
		FWD	Rth(j-c)	-	0.73	°C/W
	DB	IGBT	Rth(j-c)	-	0.63	°C/W
Case to fin thermal resistance with compound			Rth(c-f)	0.05	-	°C/W

● Recommendable value

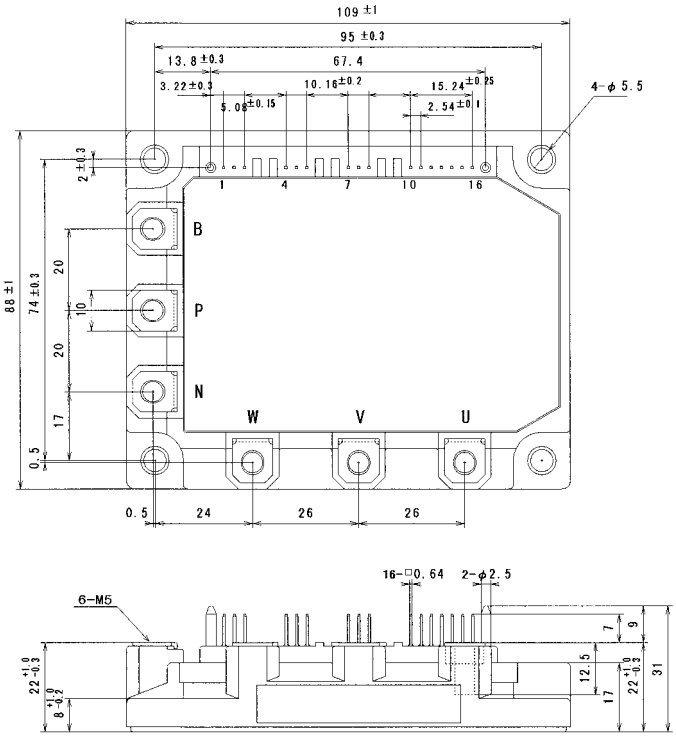
Item		Symbol	Min.	Typ.	Max.	Unit
DC bus voltage		V_{DC}	200	-	800	V
Operating power supply voltage range of Pre-driver		V_{CC}	13.5	15	16.5	V
Switching frequency of IPM		fsw	1	-	20	kHz
Screw torque	Mounting (M5)	-	2.5	-	3.0	N·m
	Terminal (M5)	-	2.5	-	3.0	N·m

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

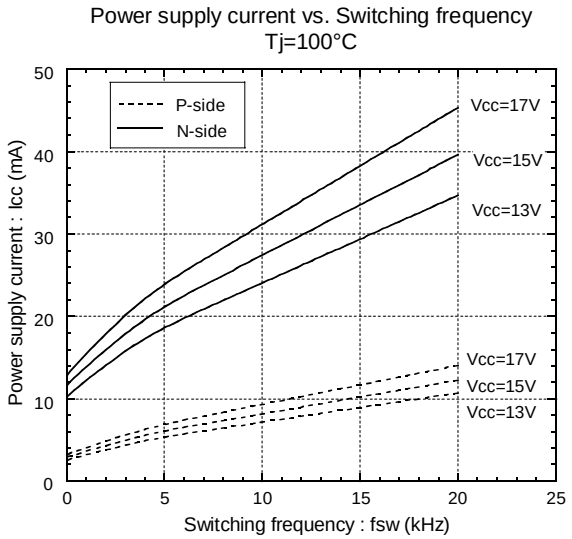
Outline drawings, mm

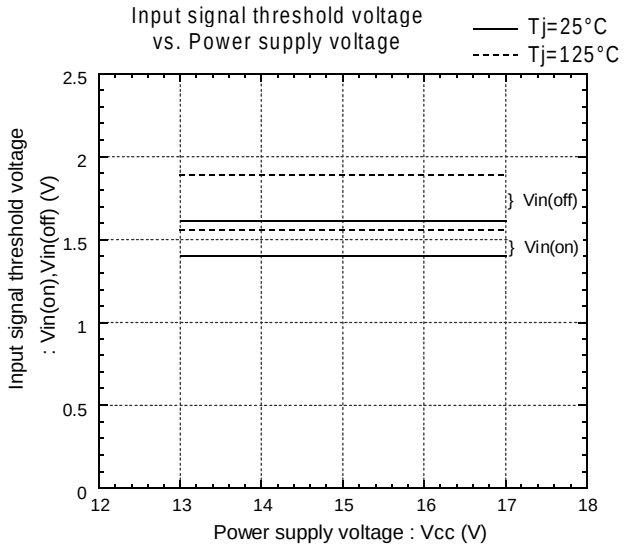


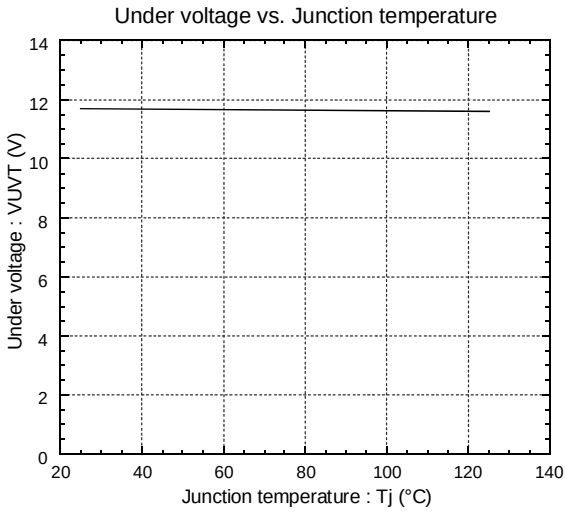
Mass : 440g

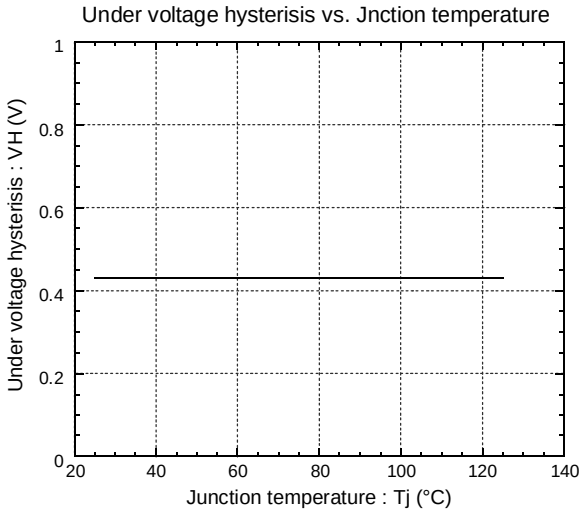
Characteristics (Representative)

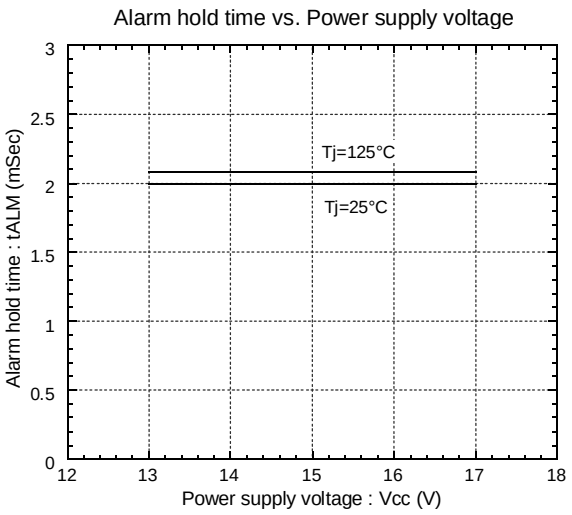
Control Circuit

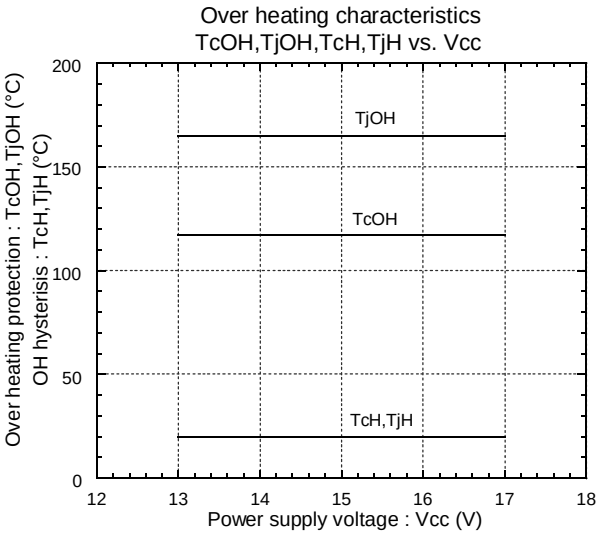






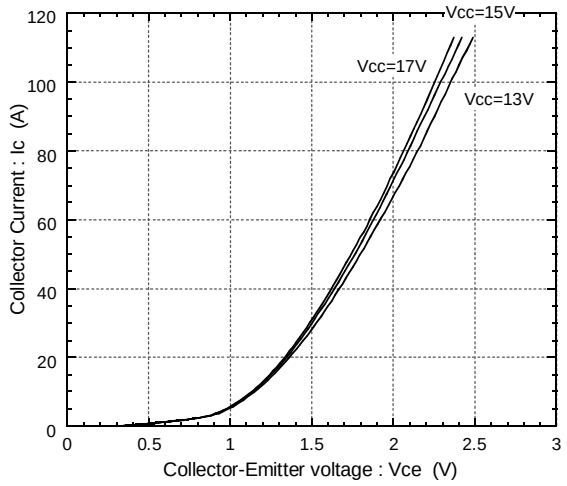




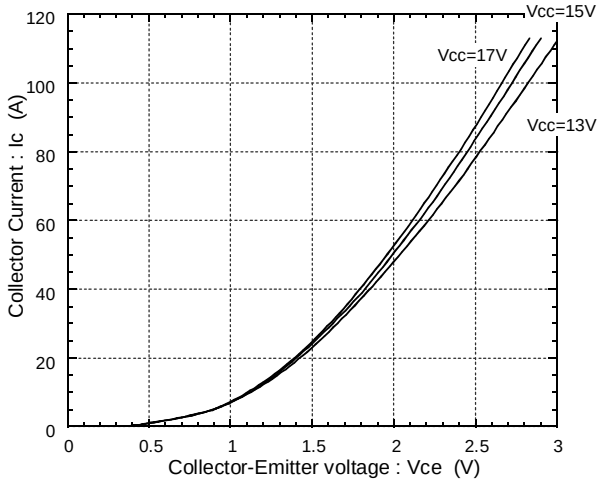


● **Inverter**

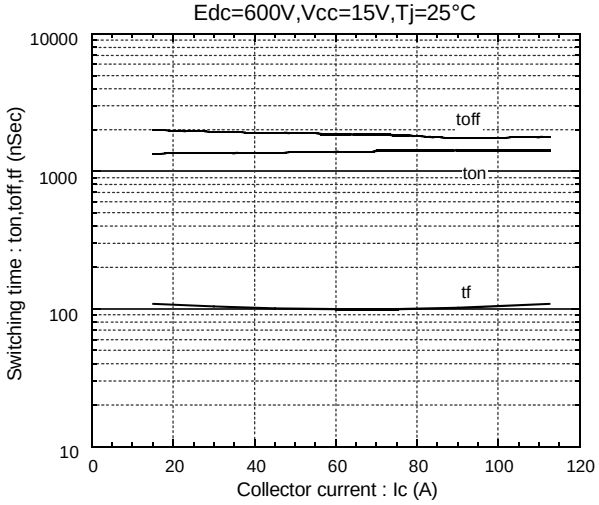
Collector current vs. Collector-Emitter voltage
Tj=25°C



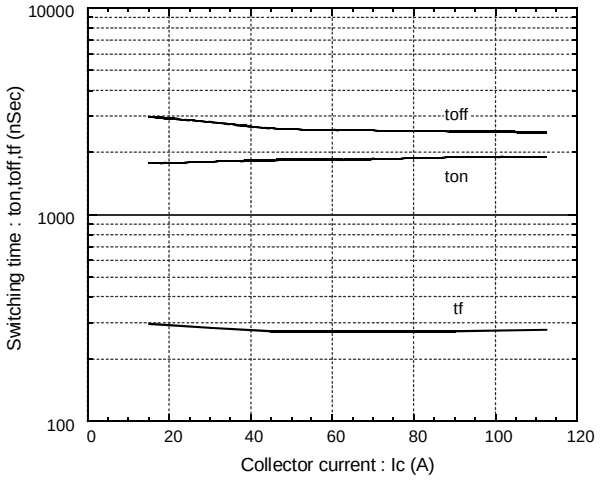
Collector current vs. Collector-Emitter voltage
Tj=125°C



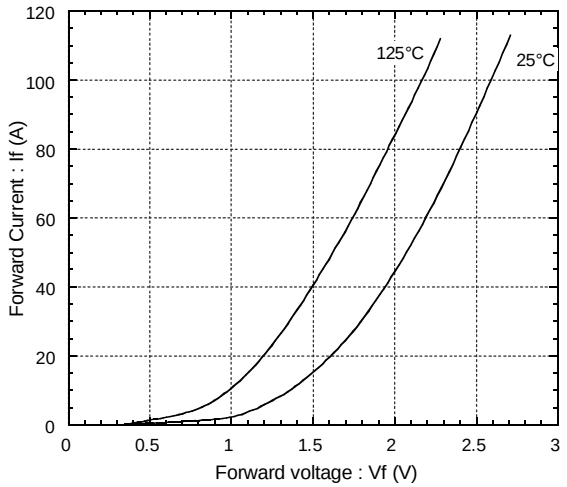
Switching time vs. Collector current
Edc=600V,Vcc=15V,Tj=25°C



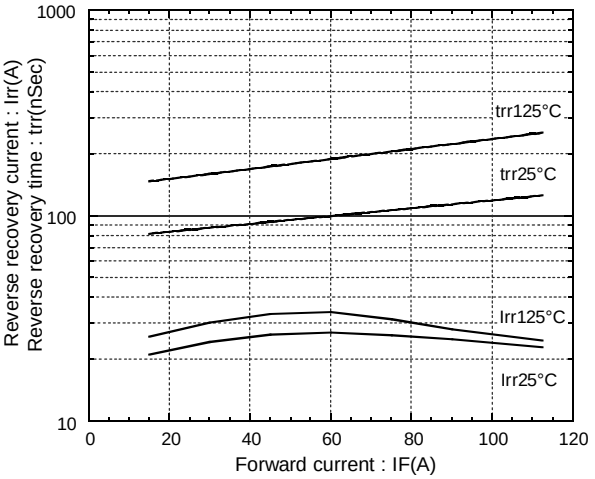
Switching time vs. Collector current
Edc=600V,Vcc=15V,Tj=125°C



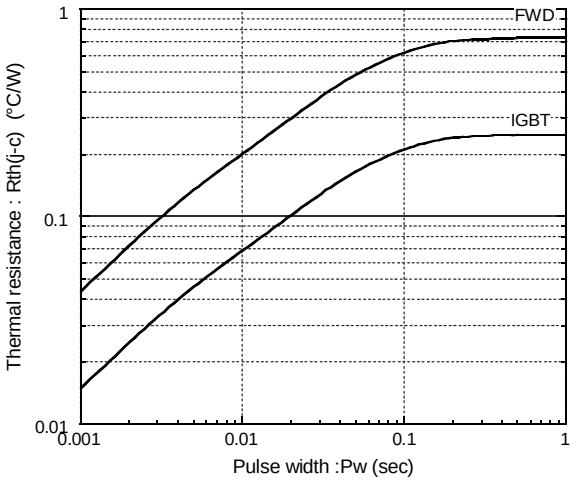
Forward current vs. Forward voltage



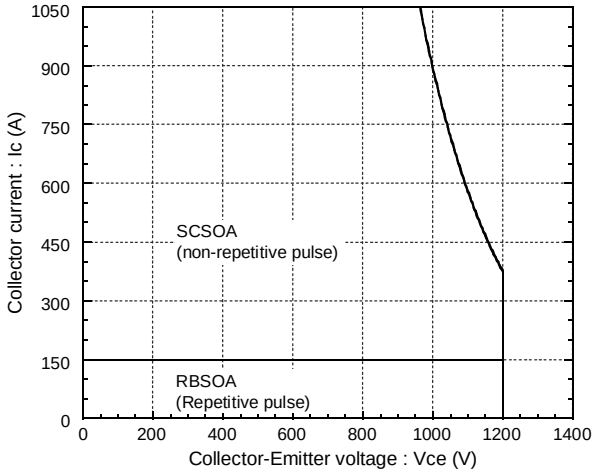
Reverse recovery characteristics
trr,Irr vs. IF



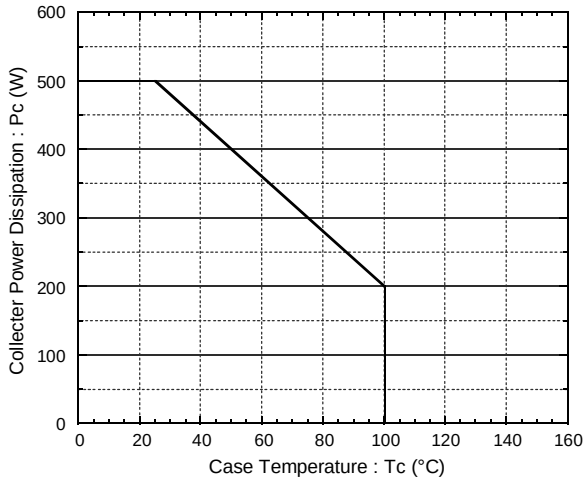
Transient thermal resistance



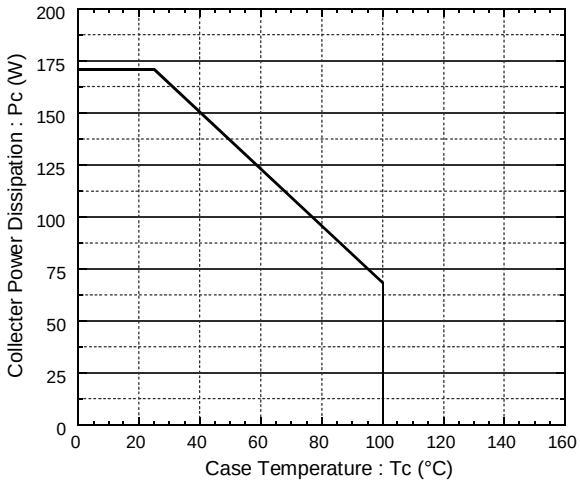
Reversed biased safe operating area
Vcc=15V,Tj 125°C



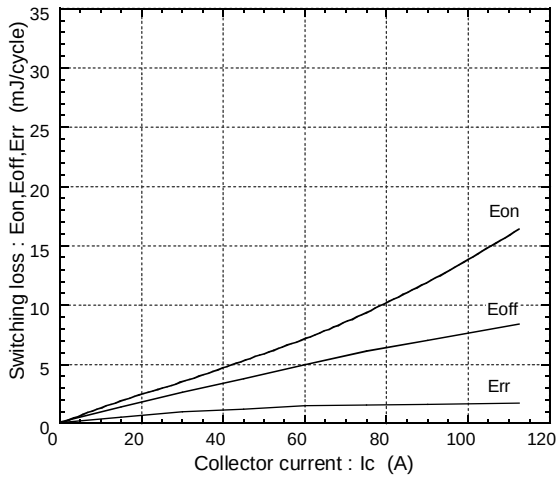
Power derating for IGBT
(per device)



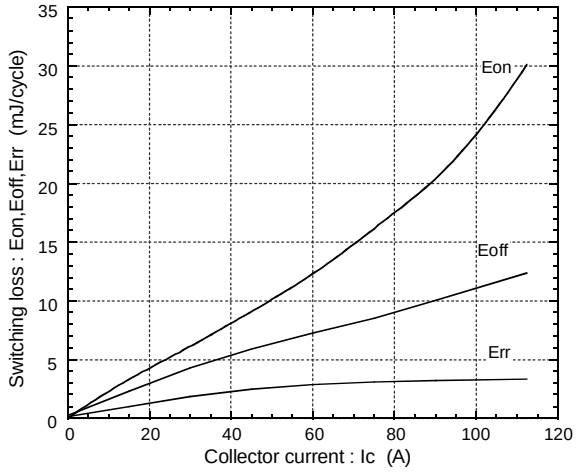
Power derating for FWD
(per device)

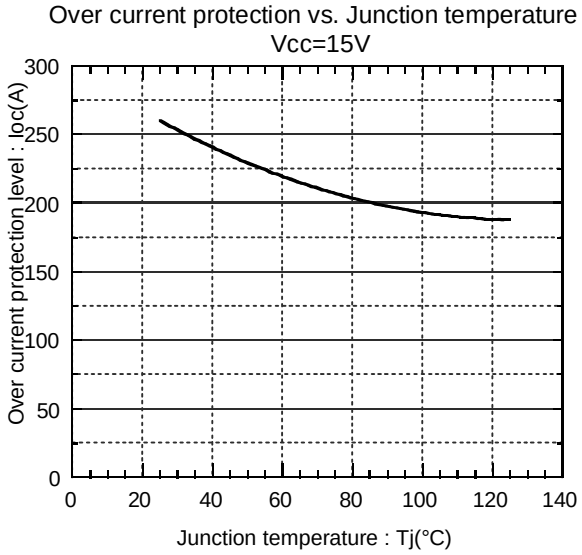


Switching Loss vs. Collector Current
Edc=600V,Vcc=15V,Tj=25°C

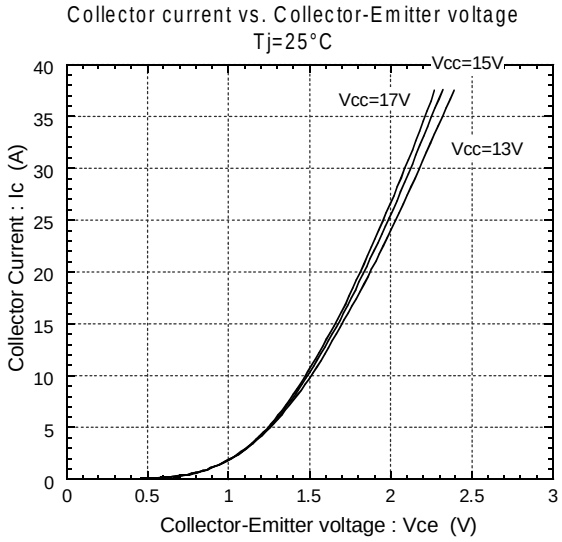


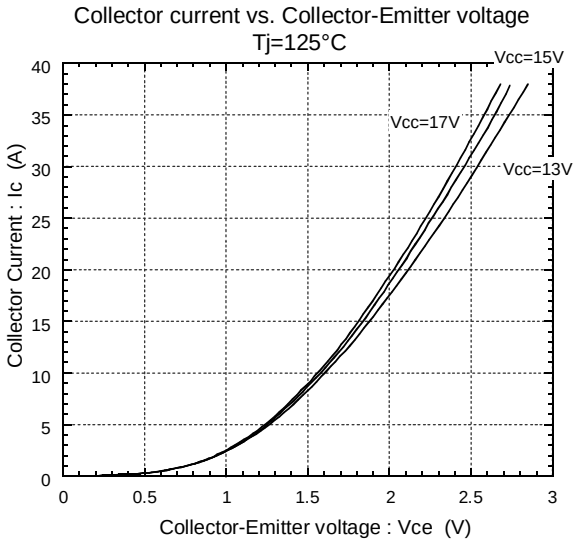
Switching Loss vs. Collector Current
Edc=600V,Vcc=15V,Tj=125°C

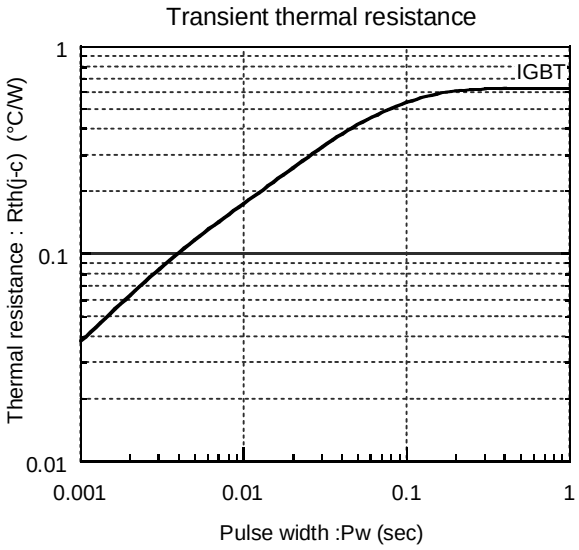


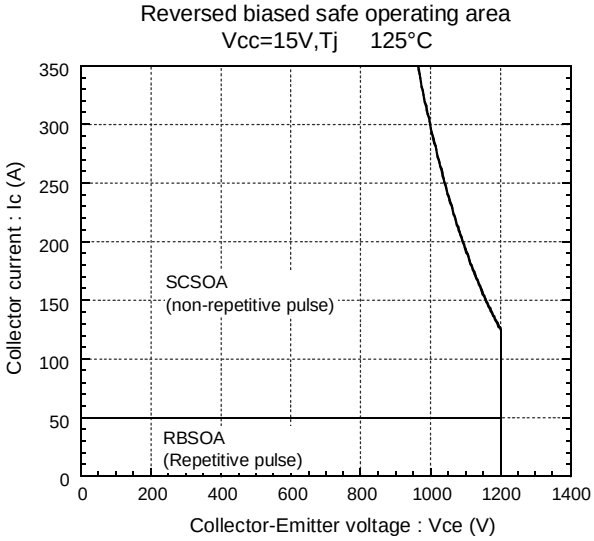

Over current protection vs. Junction temperature
Vcc=15V
Over current protection level : Ioc(A)
300
250
200
150
100
50
0
0
20
40
60
80
100
120
140
Junction temperature : Tj(°C)

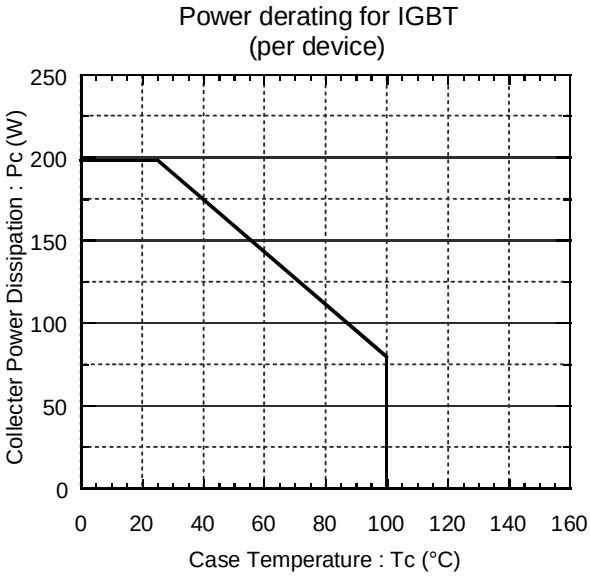
● **Brake**

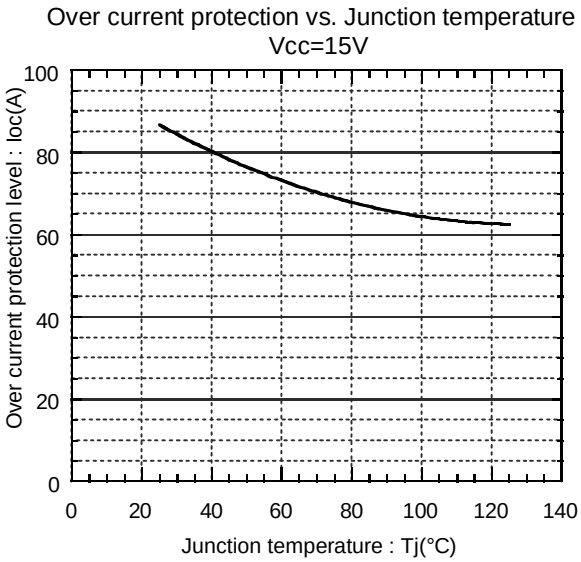

Collector current vs. Collector-Emitter voltage
Tj=25°C
Vcc=15V
Vcc=17V
Vcc=13V
Collector Current : Ic (A)
Collector-Emitter voltage : Vce (V)
0
5
10
15
20
25
30
35
40
0
0.5
1
1.5
2
2.5
3


Collector current vs. Collector-Emitter voltage
Tj=125°C
Vcc=15V
Vcc=17V
Vcc=13V
Collector Current : Ic (A)
Collector-Emitter voltage : Vce (V)
0
5
10
15
20
25
30
35
40
0
0.5
1
1.5
2
2.5
3


Transient thermal resistance
IGBT
Thermal resistance : Rth(j-c) (°C/W)
Pulse width :Pw (sec)
0.01
0.1
1
0.001
0.01
0.1
1


Reversed biased safe operating area
Vcc=15V,Tj 125°C
SCSOA
(non-repetitive pulse)
RBSOA
(Repetitive pulse)
Collector current : Ic (A)
Collector-Emitter voltage : Vce (V)
0
50
100
150
200
250
300
350
0
200
400
600
800
1000
1200
1400


Power derating for IGBT
(per device)
Collecter Power Dissipation : Pc (W)
Case Temperature : Tc (°C)
0
50
100
150
200
250
0
20
40
60
80
100
120
140
160


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