7MBP50RJ120

e-Front runners

IGBT IPM R-series 1200V class

1200V / 50A 7 in one-package

Features

- **Temperature protection provided by directly detecting the junction temperature of the IGBTs.**
- Low power loss and soft switching.
- High performance and high reliability IGBT with overheating protection.
- Both P-side and N-side alarm output available.
- 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
Bus voltage		DC	V_{DC}	0	900	V
		Surge	$V_{DC(surge)}$	0	1000	V
		Short operating	V_{SC}	200	800	V
Collector-Emitter voltage *1			V_{CES}	0	1200	V
Inverter	Collector current	DC	I_C	-	50	A
		1ms	I_{CP}	-	100	A
		Duty=98.0% *2	$-I_C$	-	50	A
	Collector power dissipation	One transistor *3	P_C	-	357	W
Brake	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 *3	P_C		198	W
Supply voltage of Pre-Driver *4			V_{CC}	-0.5	20	V
Input signal voltage *5			V_{in}	-0.5	Vcc+0.5	V
Input signal current			I_{in}	-	3	mA
Alarm signal voltage *6			V_{ALM}	-0.5	Vcc	V
Alarm signal current *7			I_{ALM}	-	20	mA
Junction temperature			T_j	-	150	℃
Operating case temperature			T_{opr}	-20	100	℃
Storage temperature			T_{stg}	-40	125	℃
Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.)			V_{iso}	-	AC2500	V
Screw torque		Terminal (M5)		-	3.5	N·m
		Mounting (M5)		-	3.5	N·m

Note

*1 : Vces shall be applied to the input voltage between terminal P and U or V or W or DB, N and U or V or W or DB.

*2 : 125°C/FRD Rth(j-c)/(Ic x VF Max.)=125/0.85(50x3.0)x100=98.0%

*3 : Pc=125°C/IGBT Rth(j-c)=125/0.35=357W [Inverter]

Pc=125°C/IGBT Rth(j-c)=125/0.63=198W [Inverter]

*4 : VCC shall be applied to the input voltage between terminal No.4 and 1, 8 and 5, 12 and 9, 14 and 13

*5 : Vin shall be applied to the input voltage between terminal No.3 and 1, 7 and 5, 11 and 9, 15,16,17,18 and 13.

*6 :VALM shall be applied to the voltage between terminal No.2 and 1, No6 and 5, No10 and 9, No.19 and 13.

*7 : IALMshall be applied to the input current to terminal No.2,6,10 and 19.

Electrical characteristics (at Tc=Tj=25°C, Vcc=15V unless otherwise specified.)

● **Main circuit**

	Item	Symbol	Condition		Min.	Typ.	Max.	Unit
Inverter	Collector current at off signal input	I_{CES}	V_{CE}=1200V Vin terminal open.		-	-	1.0	mA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	Ic=50A	Terminal	-	-	2.6	V
				Chip	-	-	-	
	Forward voltage of FWD	V_F	-Ic=50A	Terminal	-	-	3.0	V
				Chip	-	-	-	
Brake	Collector current at off signal input	I_{CES}	V_{CE}=1200V Vin terminal open.		-	-	1.0	mA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	Ic=25A	Terminal	-	-	2.6	V
	Forward voltage of Diode	V_F	-Ic=25A	Terminal	-	-	3.3	
Turn-on time		ton	VDC=600V,Tj=125°C		1.2	-	-	µs
Turn-off time		toff	IC=50A Fig.1, Fig.6		-	-	3.6	
Reverse recovery time		trr	VDC=600V, IF=50A Fig.1, Fig.6		-	-	0.3	

● **Control circuit**

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current of P-line side pre-driver(one unit)	I_{CCP}	Switching Trequency : 0 to 15kHz	-	-	18	mA
Supply current of N-line side pre-driver	I_{CCN}	Tc=-20 to 125°C Fig.7	-	-	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
Alarm signal hold time	t_{ALM}	Tc=-20°C Fig.2	1.1	-	-	ms
		Tc=25°C Fig.2	-	2.0	-	ms
		Tc=125°C Fig.2	-	-	4.0	ms
Limiting Resistor for Alarm	R_{ALM}		1425	1500	1575	ohm

● **Protection Section** (Vcc=15V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Over Current Protection Level of Inverter circuit	I_{OC}	Tj=125°C	75	-	-	A
Over Current Protection Level of Brake circuit	I_{OC}	Tj=125°C	38	-	-	A
Over Current Protection Delay time	t_{DOC}	Tj=125°C	-	10	-	µs
SC Protection Delay time	t_{SC}	Tj=125°C Fig.4	-	-	12	µs
IGBT Chip Over Heating Protection Temperature Level	T_{jOH}	Surface of IGBT chips	150		-	℃
Over Heating Protection Hysteresis	T_{jH}		-	20	-	℃
Over Heating Protection Protection Temperature Level	T_{cOH}	V_{DC}=0V, I_C=0A CaseTemperature	110	-	125	℃
Over Heating Protection Hysteresis	T_{cH}		-	20	-	℃
Under Voltage Protection Level	V_{UV}		11.0	-	12.5	V
Under Voltage Protection Hysteresis	V_H		0.2	0.5	-	V

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

Item			Symbol	Min.	Typ.	Max.	Unit
Junction to Case thermal resistance *8	Inverter	IGBT	Rth(j-c)	-	-	0.35	°C/W
		FWD	Rth(j-c)	-	-	0.85	°C/W
	Brake	IGBT	Rth(j-c)	-	-	0.63	°C/W
Case to fin thermal resistance with compound			Rth(c-f)	-	0.05	-	

*8 : (For 1 device, Case is under the device)

● **Noise Immunity** (VDC=300V, Vcc=15V, Test Circuit Fig.5)

Item	Condition	Min.	Typ.	Max.	Unit
Common mode rectangular noise	Pulse width 1µs, polarity ±,10minuets Judge : no over-current, no miss operating	±2.0	-	-	kV
Common mode lightning surge	Rise time 1.2µs, Fall time 50µs Interval 20s, 10 times Judge : no over-current, no miss operating	±5.0	-	-	kV

● **Recommendable value**

Item	Symbol	Min.	Typ.	Max.	Unit
DC Bus Voltage	V_{DC}	-	-	800	V
Operating Supply Voltage of Pre-Driver	V_{CC}	13.5	15.0	16.5	V
Screw torque (M5)	-	2.5	-	3.0	Nm

● **Weight**

Item	Symbol	Min.	Typ.	Max.	Unit
Weight	Wt	-	450	-	g

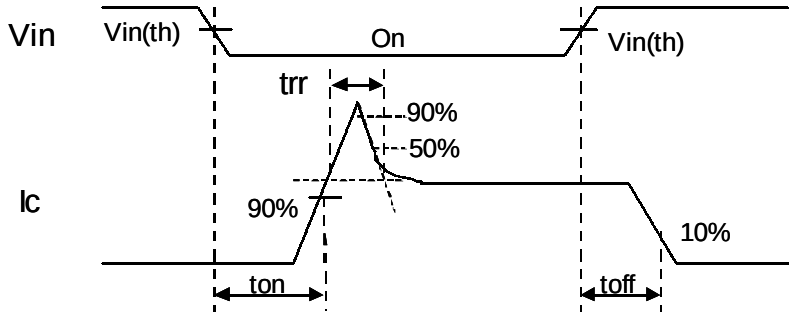
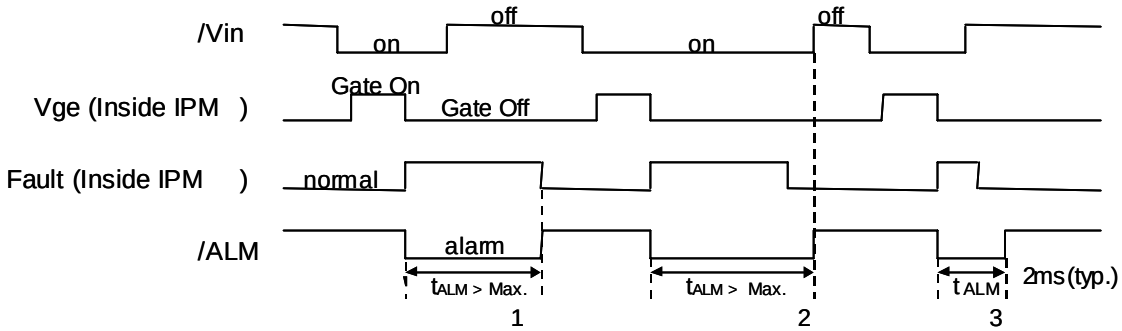


Figure 1. Switching Time Waveform Definitions



Fault : Over-current,Over-heat or Under-voltage

Figure 2. Input/Output Timing Diagram

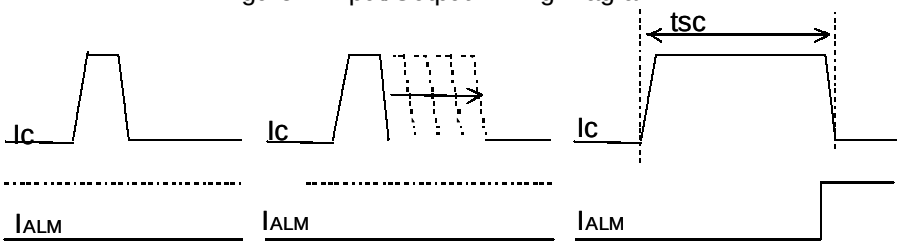


Figure.4 Definition of tsc

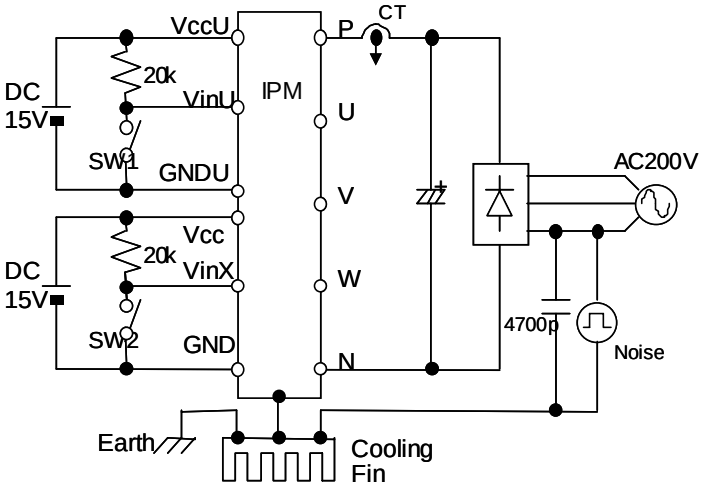


Figure 5. Noise Test Circuit

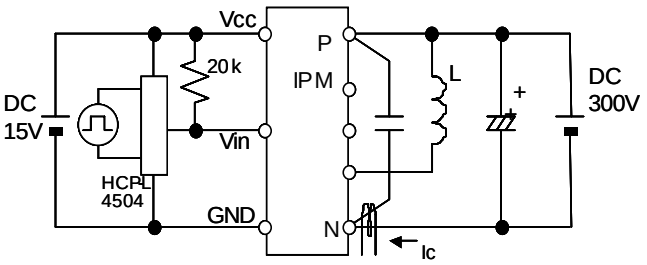


Figure 6. Switching Characteristics Test Circuit

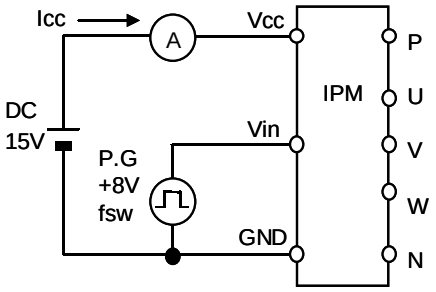
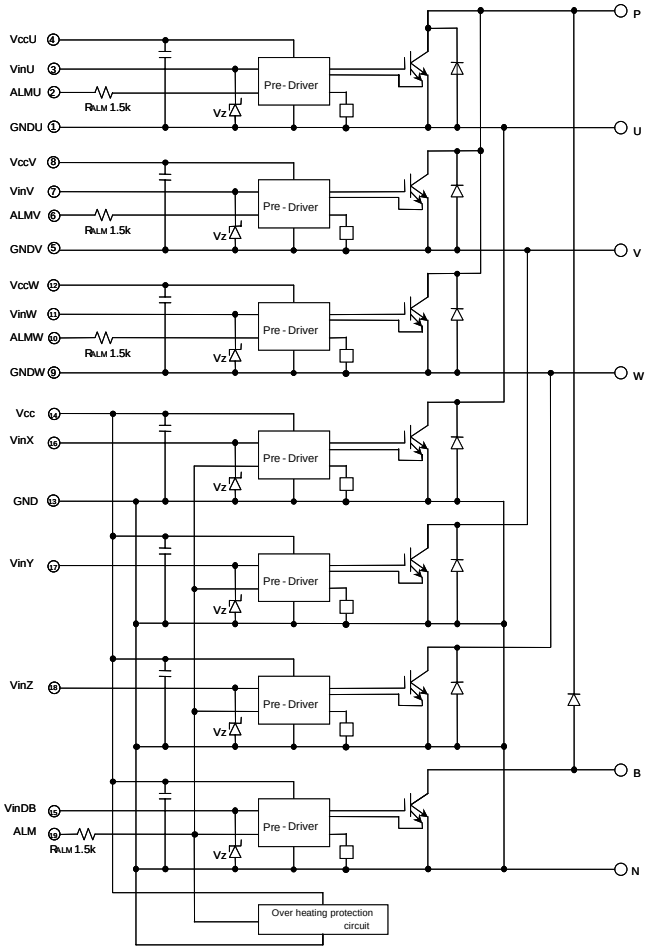


Figure 7. Icc Test Circuit

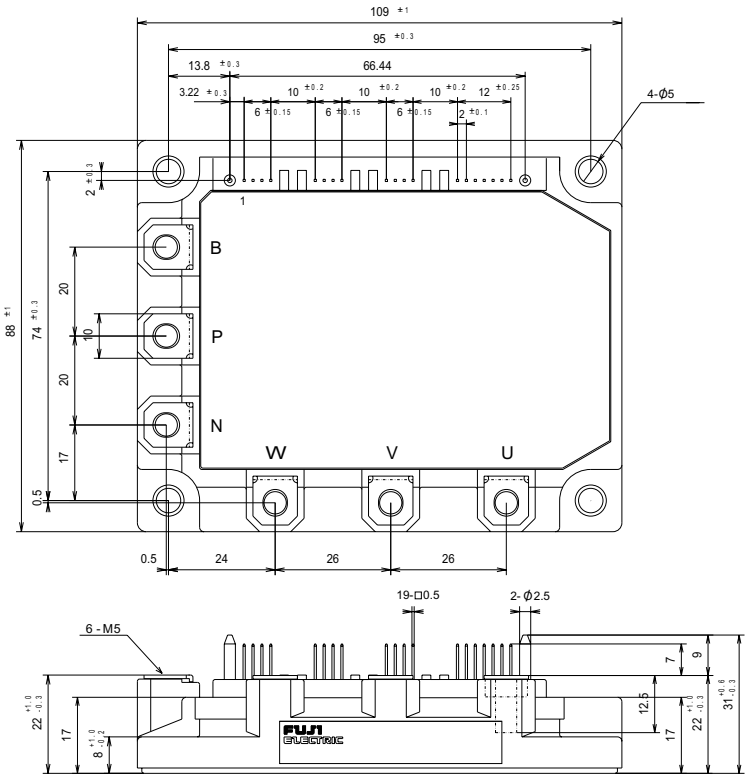
Block diagram



Pre-drivers include following functions

1.Amplifier for driver
2.Short circuit protection
3.Under voltage lockout circuit
4.Over current protection
5.IGBT chip over heating protection

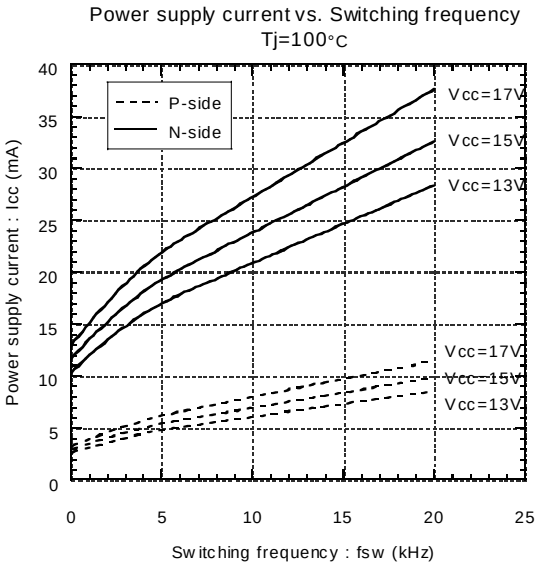
Outline drawings, mm

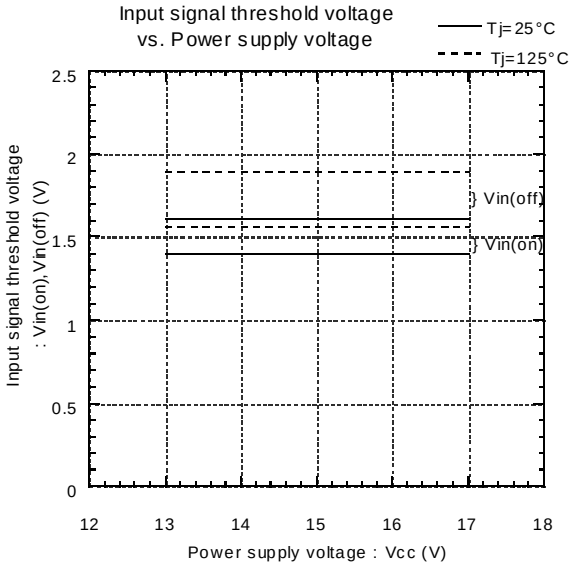


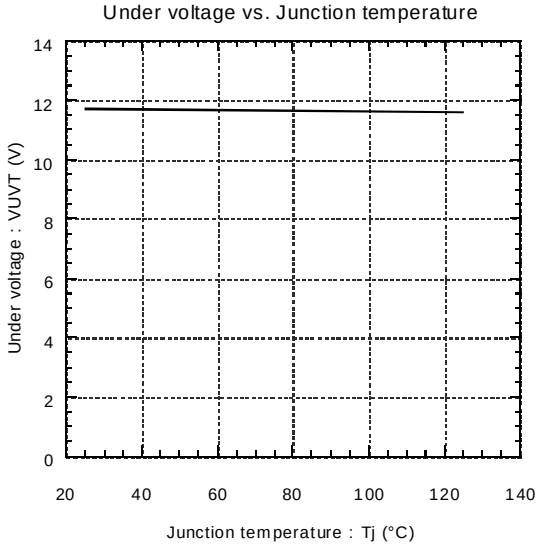
Mass : 450g

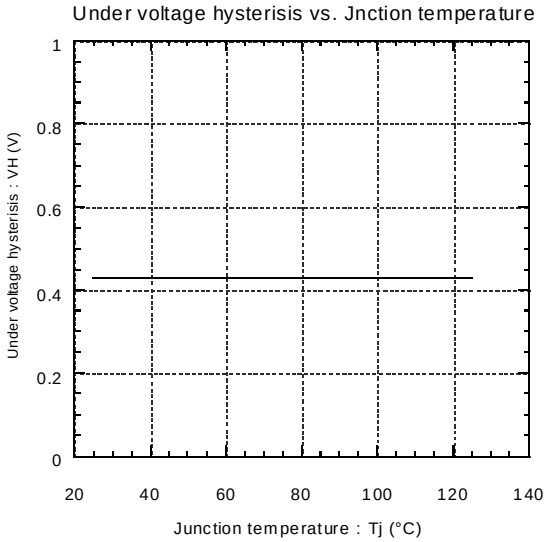
■ Characteristics

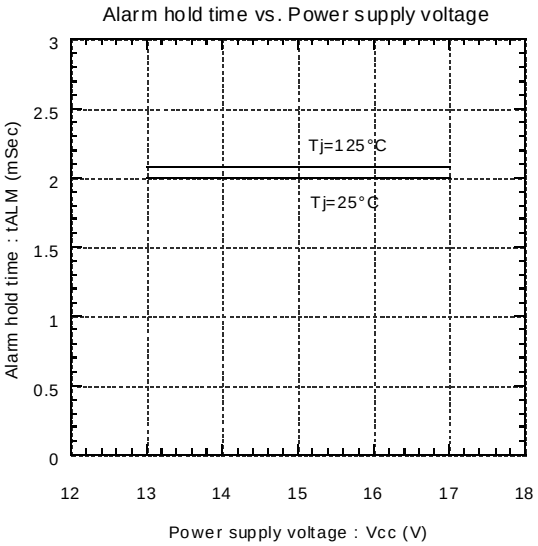
● **Control circuit characteristics (Respresentative)**

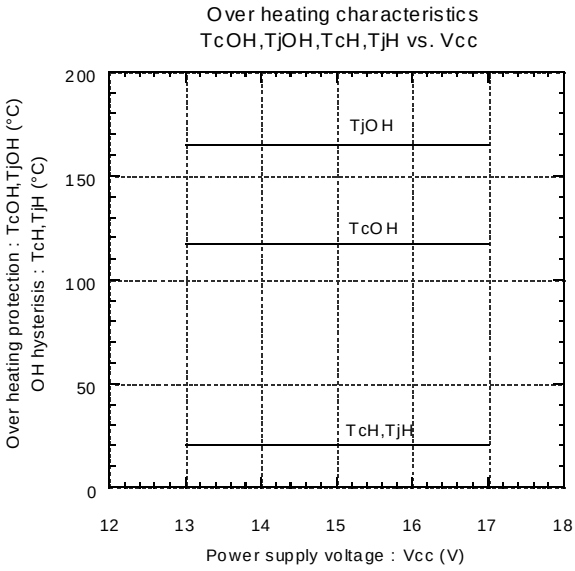






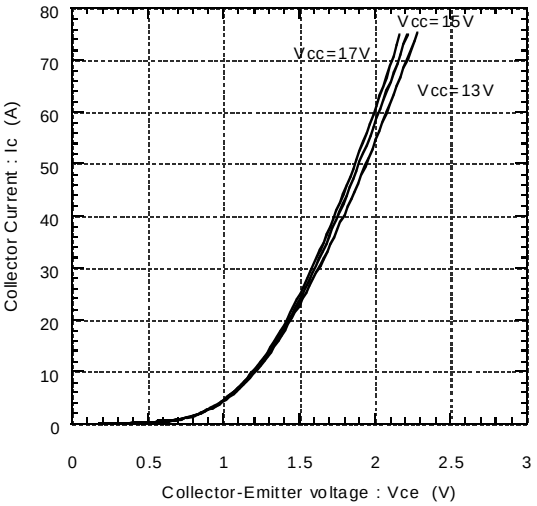




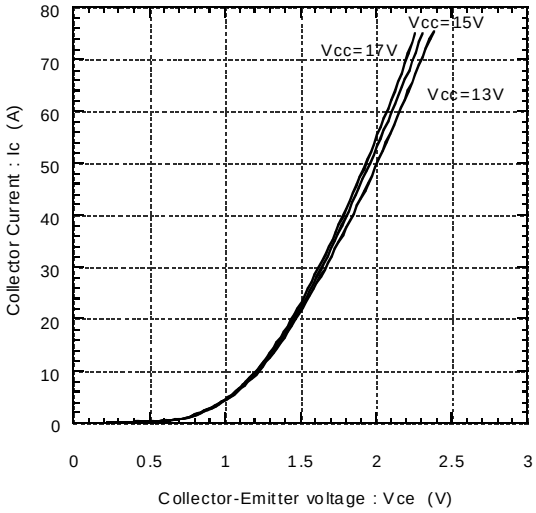


● **Main circuit characteristics (Respresentative)**

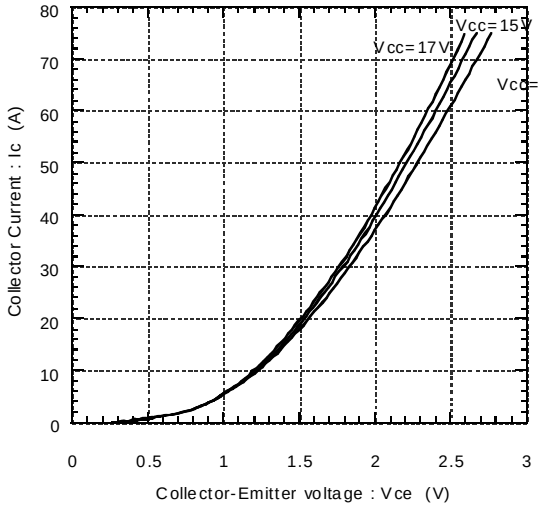
Collector current vs. Collector-Emitter voltage
Tj=25°C(Chip)



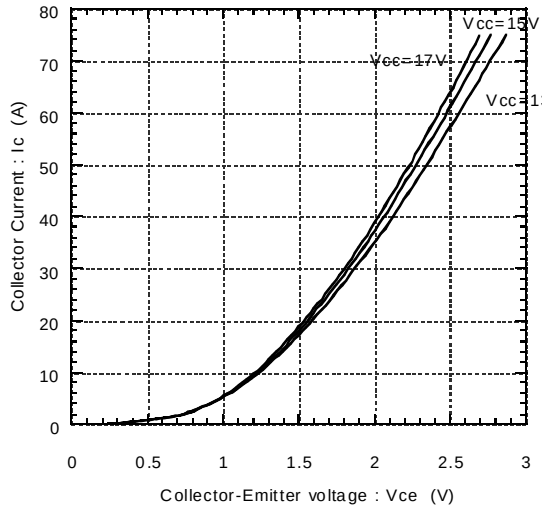
Collector current vs. Collector-Emitter voltage
Tj=25°C (Terminal)



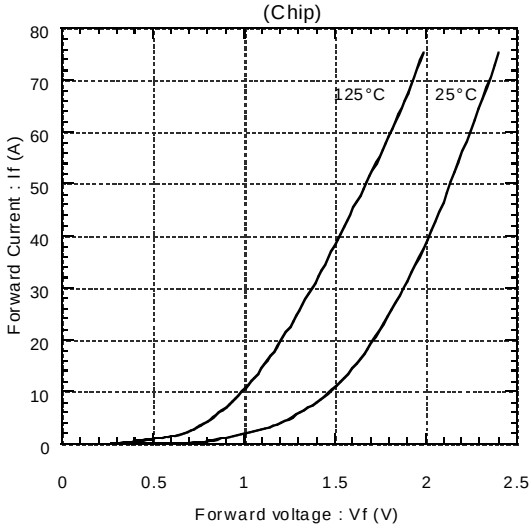
Collector current vs. Collector-Emitter voltage
Tj=125°C(Chip)



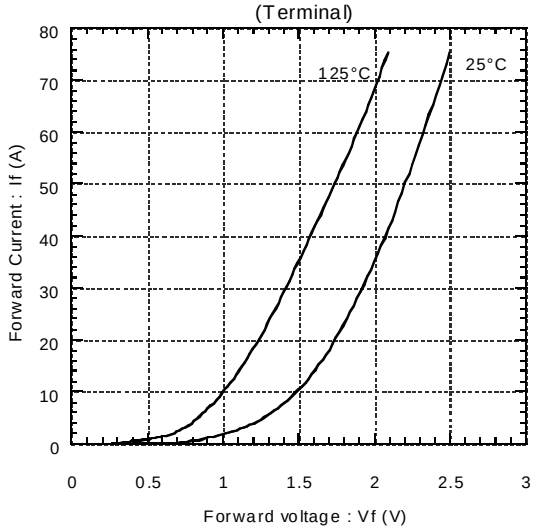
Collector current vs. Collector-Emitter voltage
Tj=125°C (Terminal)



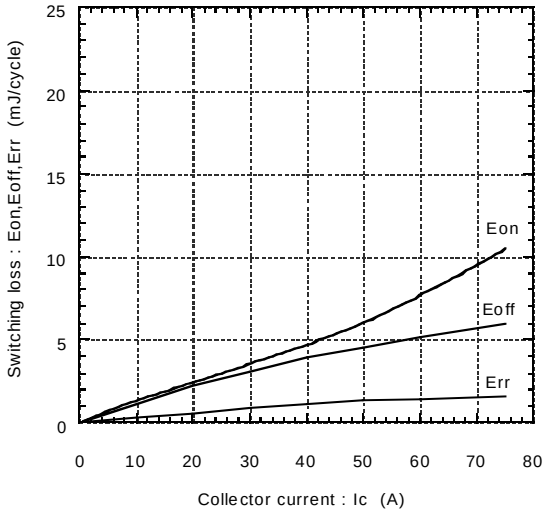
Forward current vs. Forward voltage
(Chip)



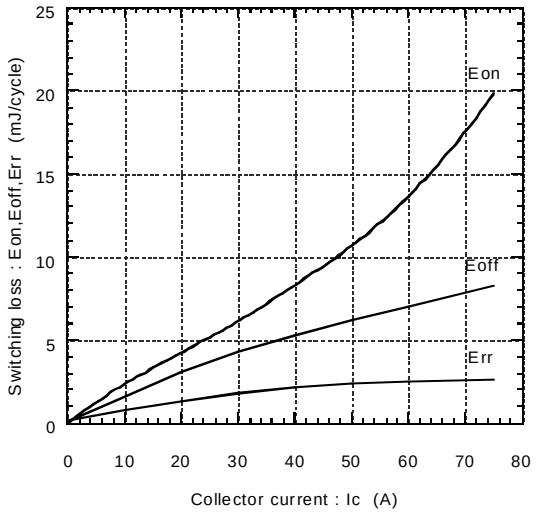
Forward current vs. Forward voltage
(Terminal)



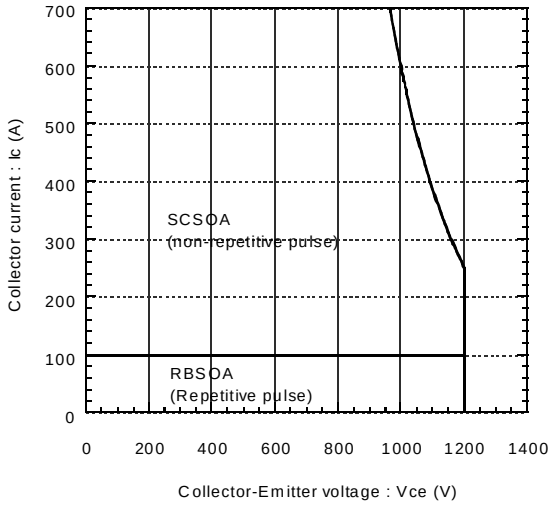
Switching Loss vs. Collector Current
Edc=600V,Vcc=15V,Tj=25°C



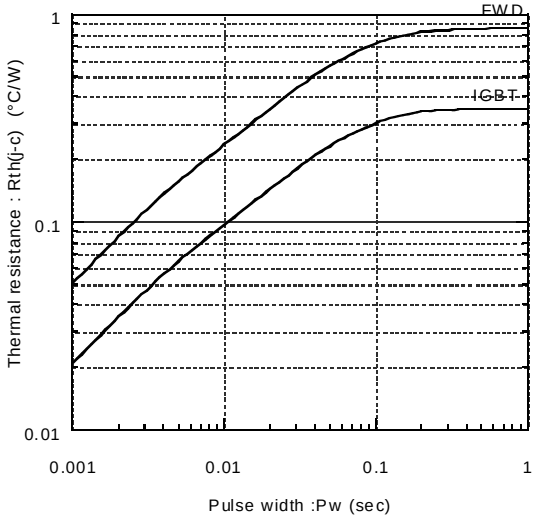
Switching Loss vs. Collector Current
Edc=600V,Vcc=15V,Tj=125°C



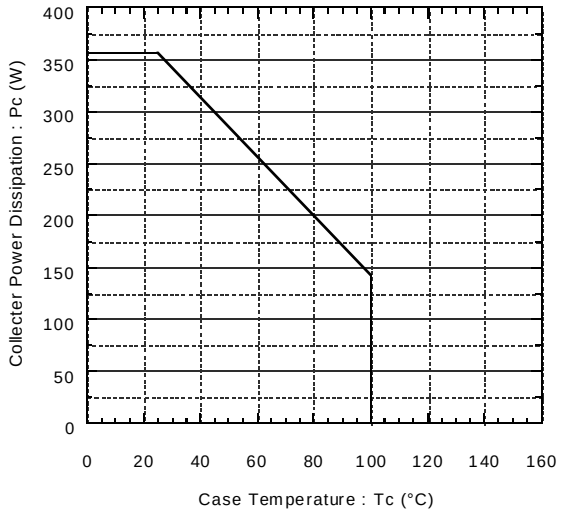
Reversed biased safe operating area
Vcc=15V,Tj ≦125°C



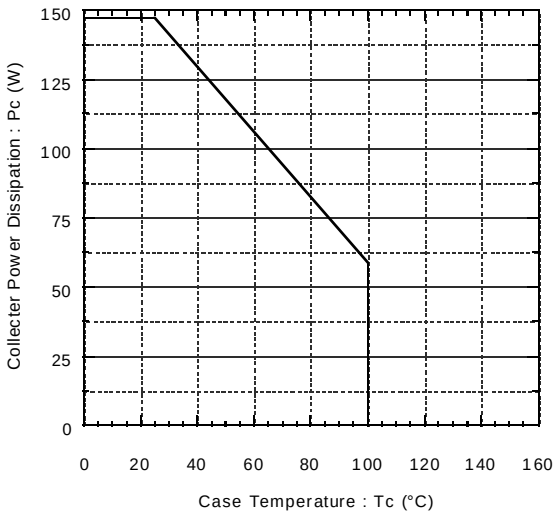
Transient thermal resistance

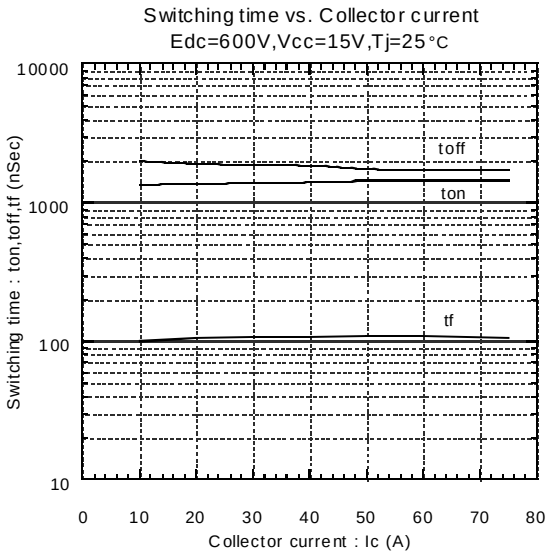


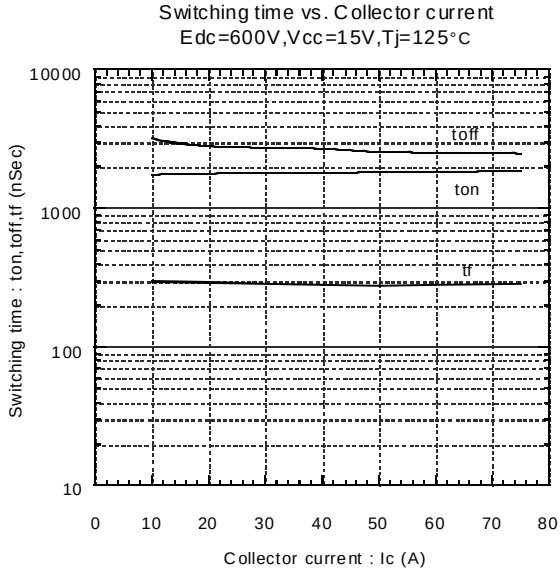
Power derating for IGBT
(per device)

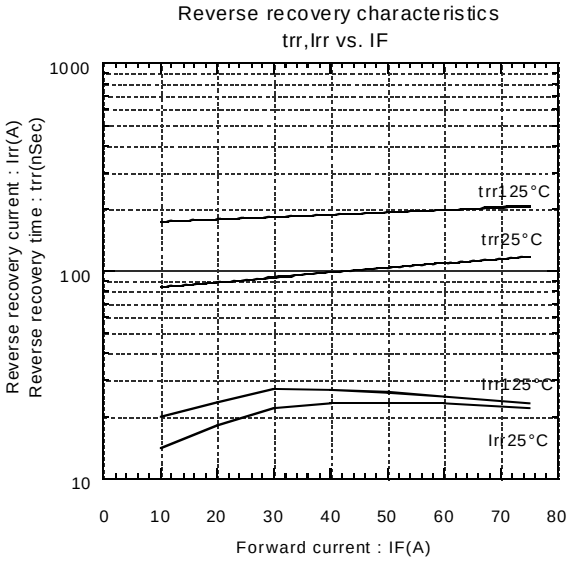


Power derating for FWD
(per device)



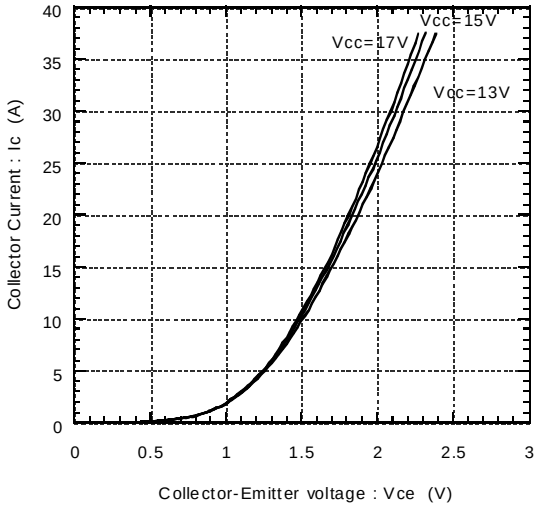

Switching time vs. Collector current
Edc=600V,Vcc=15V,Tj=25°C
Switching time : ton,toff,tf (nSec)
10000
1000
100
10
toff
ton
tf
0
10
20
30
40
50
60
70
80
Collector current : Ic (A)


Switching time vs. Collector current
Edc=600V,Vcc=15V,Tj=125°C
Switching time : ton,toff,tf (nSec)
10000
1000
100
10
toff
ton
tf
0
10
20
30
40
50
60
70
80
Collector current : Ic (A)

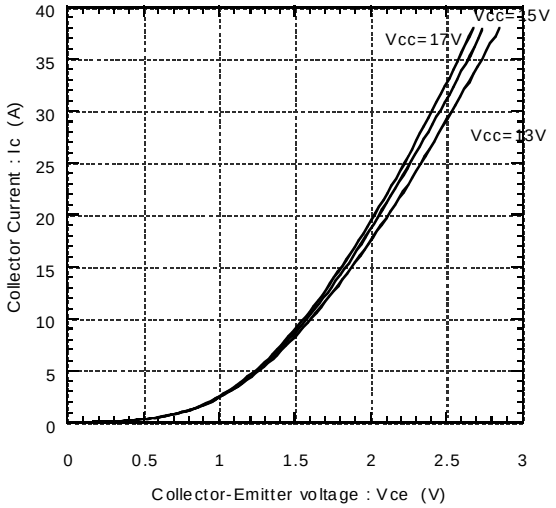

Reverse recovery characteristics
trr,Irr vs. IF
Reverse recovery current : Irr(A)
Reverse recovery time : trr(nSec)
1000
100
10
trr125°C
trr25°C
Irr125°C
Irr25°C
0
10
20
30
40
50
60
70
80
Forward current : IF(A)

● **Dynamic Brake Characteristics (Representative)**

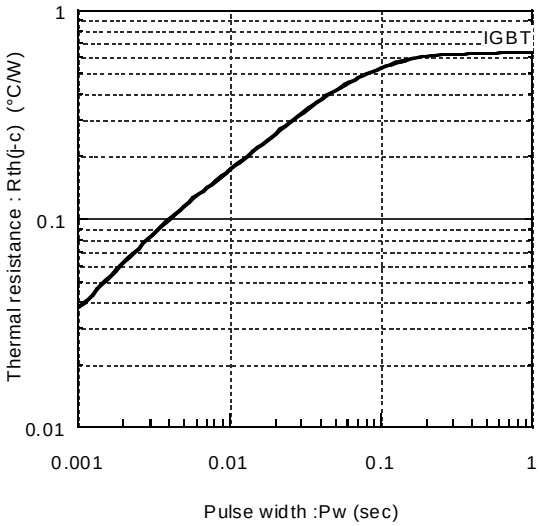
Collector current vs. Collector-Emitter voltage
Tj=25°C (Terminal)



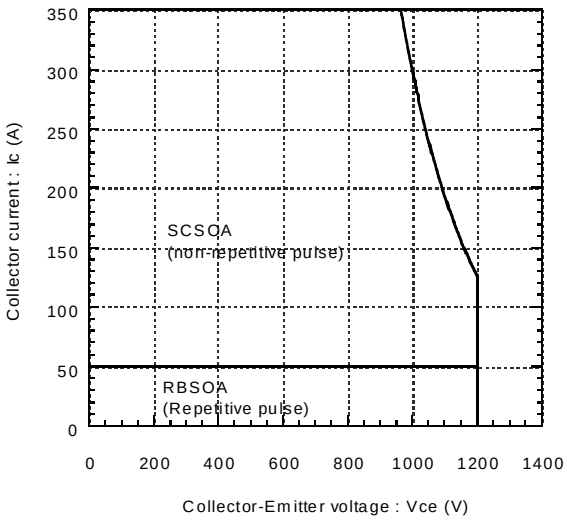
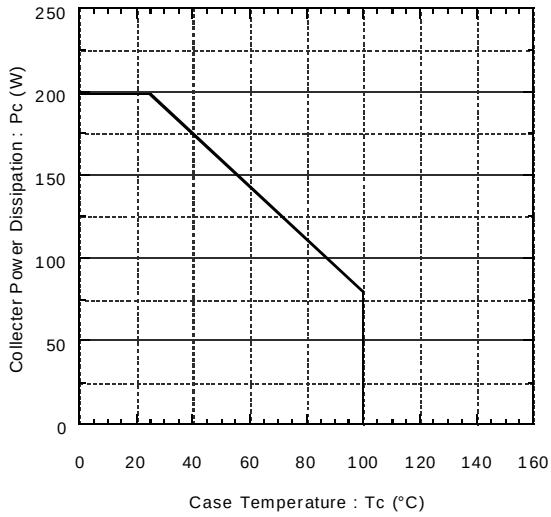
Collector current vs. Collector-Emitter voltage
Tj=125°C(Terminal)



Transient thermal resistance



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



Power derating for IGBT
(per device)