

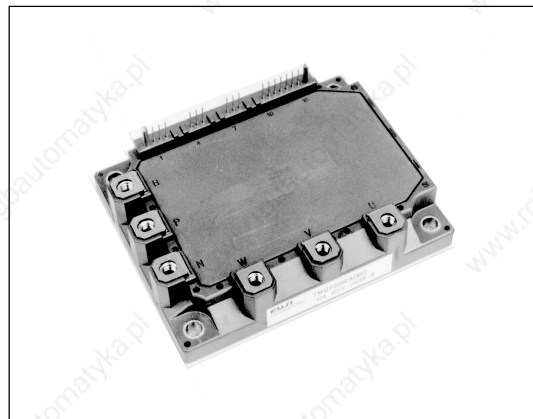
6MBP150RTB060

IPM-R3 series

600V / 150A 6 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
- 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	VDC	0	450	V		
DC bus voltage (surge)	VDC(surge)	0	500	V		
DC bus voltage (short operating)	VSC	200	400	V		
Collector-Emitter voltage	VCES *1	0	600	V		
INV Collector current	DC	Ic	-	150	A	
			1ms	IcP	-	300
	Duty=68.2%	-Ic	*2	-	150	A
Collector power dissipation	One transistor	PC	*3	-	431	W
Junction temperature	Tj	-	150	°C		
Input voltage of power supply for Pre-Driver	VCC *4	-0.5	20	V		
Input signal voltage	Vin *5	-0.5	Vcc+0.5	V		
Input signal current	Iin	-	3	mA		
Alarm signal voltage	VALM *6	-0.5	Vcc	V		
Alarm signal current	IALM *7	-	20	mA		
Storage temperature	Tstg	-40	125	°C		
Operating case temperature	Topr	-20	100	°C		
Isolating voltage (Case-Terminal)	Viso *8	-	AC2.5	kV		
Screw torque	Mounting (M5)	-	3.5 *9	N·m		
	Terminal (M5)	-	3.5 *9	N·m		

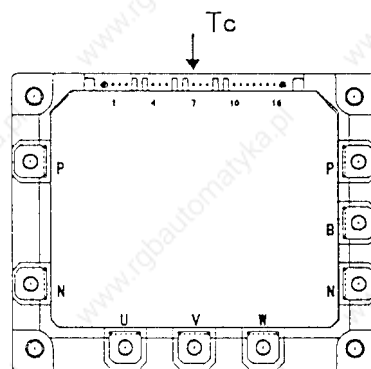


Fig.1 Measurement of case temperature

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

*2 : $125^{\circ}\text{C}/\text{FWD Rth}(j-c)/(\text{Ic} \times \text{Vf MAX})=125/0.47/(150 \times 2.6) \times 100=68.2\%$

*3 : $\text{Pc}=125^{\circ}\text{C}/\text{IGBT Rth}(j-c)=125/0.29=431\text{W}$ [Inverter]

*4 : Vcc shall be applied to the input voltage between terminal No. 3 and 1, 6 and 4, 9 and 7, 11 and 10.

*5 : Vin shall be applied to the input voltage between terminal No. 2 and 1, 5 and 4, 8 and 7, 13,14,15 and 10.

*6 : VALM shall be applied to the voltage between terminal No. 16 and 10.

*7 : IALM shall be applied to the input current to terminal No. 16.

*8 : 50Hz/60Hz sine wave 1 minute.

*9 : Recommendable Value : 2.5 to 3.0 N·m

● **Electrical characteristics** (at $T_c=T_j=25^\circ\text{C}$, $V_{cc}=15\text{V}$ unless otherwise specified.)

Main circuit

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
INV	Collector current at off signal input	ICES	VCE=600V Vin terminal open.		-	1.0	mA
	Collector-Emitter saturation voltage	VCE(sat)	Ic=150A	Terminal	-	2.3	V
				Chip	-	1.8	
	Forward voltage of FWD	VF	-Ic=150A	Terminal	-	2.6	V
Chip				-	1.6		
Turn-on time	ton	VDC=300V, Tj=125°C	1.2	-	-	µs	
Turn-off time	toff	IC=150A Fig.1, Fig.6	-	-	3.6		
Reverse recovery time	trr	VDC=300V, IC=150A Fig.1, Fig.6	-	-	0.3		
Maximum Avalanche Energy (A non-repetition)	PAV	Internal wiring inductance=50nH Main circuit wiring inductance=54nH	170	-	-	mJ	

● **Control circuit**

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current of P-line side pre-driver(one unit)	Iccp	Switching Frequency : 0 to 15kHz Tc=-20 to 125°C Fig.7	-	-	18	mA
Supply current of N-line side pre-driver	ICCN		-	-	65	mA
Input signal threshold voltage (on/off)	Vin(th)	ON	1.00	1.35	1.70	V
		OFF	1.25	1.60	1.95	V
Input zener voltage	Vz	Rin=20k ohm	-	8.0	-	V
Alarm signal hold time	tALM	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	RALM		1425	1500	1575	ohm

● **Protection Section** ($V_{cc}=15\text{V}$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Over Current Protection Level of Inverter circuit	Ioc	Tj=125°C	225	-	-	A
Over Current Protection Delay time	tDOC	Tj=125°C	-	5	-	µs
SC Protection Delay time	tSC	Tj=125°C Fig.4	-	-	8	µs
IGBT Chip Over Heating	TjOH	surface of IGBT chips	150	-	-	°C
Over Heating Protection Hysteresis	TjH	VDC=0V, Ic=0A, Case temperature	-	20	-	°C
Over Heating Protection Temperature Level	TcOH		110	-	125	°C
Over Heating Protection Hysteresis	TcH		-	20	-	
Under Voltage Protection Level	VUV		11.0	-	12.5	V
Under Voltage Protection Hysteresis	VH		0.2	0.5	-	

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

Item	Symbol	Min.	Typ.	Max.	Unit	
Junction to Case thermal resistance	INV	IGBT	Rth(j-c)	-	0.29	°C/W
		FWD	Rth(j-c)	-	0.47	°C/W
Case to fin thermal resistance with compound		Rth(c-f)	-	0.05	-°C/W	

● **Noise Immunity** ($V_{DC}=300\text{V}$, $V_{cc}=15\text{V}$, 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	VDC	-	-	400	V
Operating Supply Voltage of Pre-Driver	Vcc	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

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

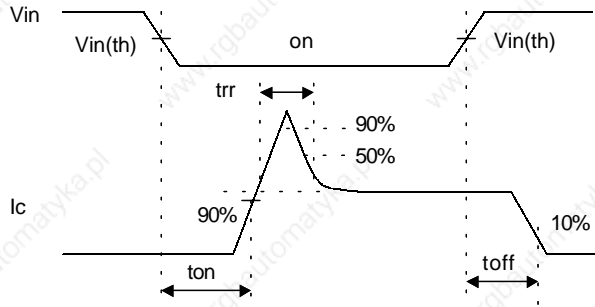
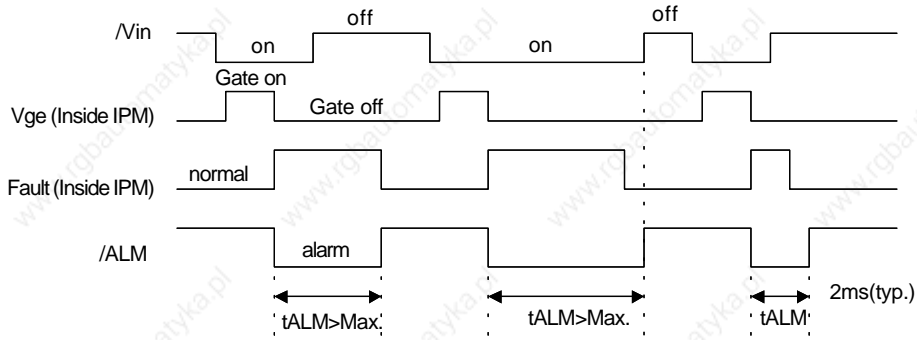


Figure 1. Switching Time Waveform Definitions



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

Figure 2. Input / Output Timing Diagram

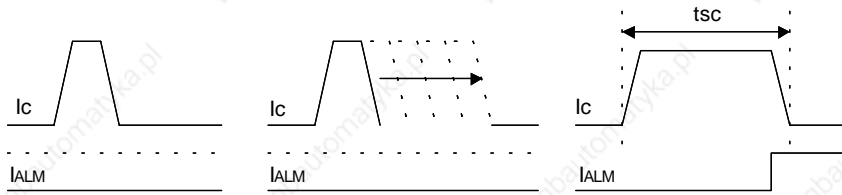


Figure 4 Definition of tsc

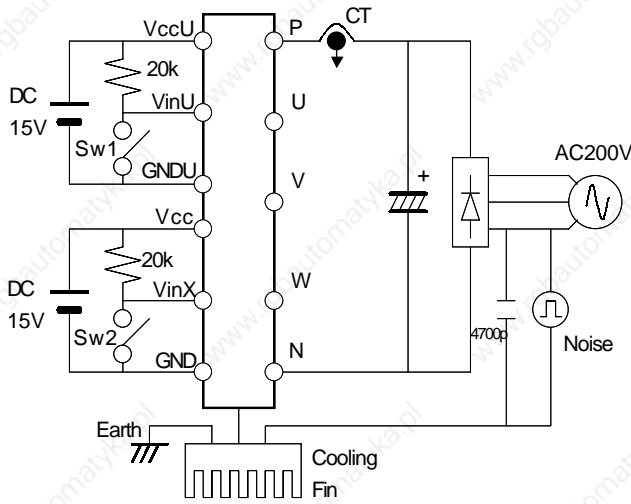


Figure 5. Noise Test Circuit

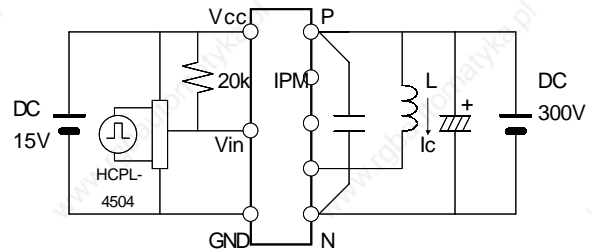


Figure 6. Switching Characteristics Test Circuit

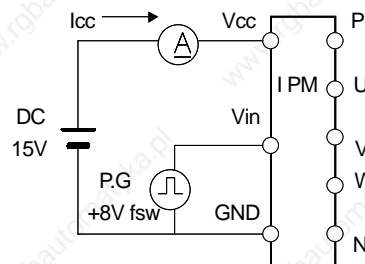
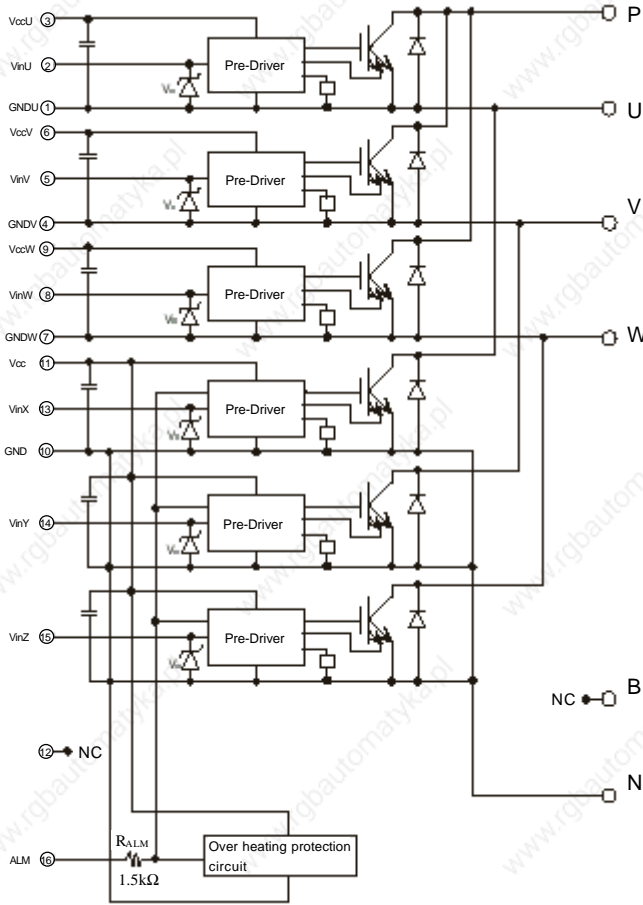


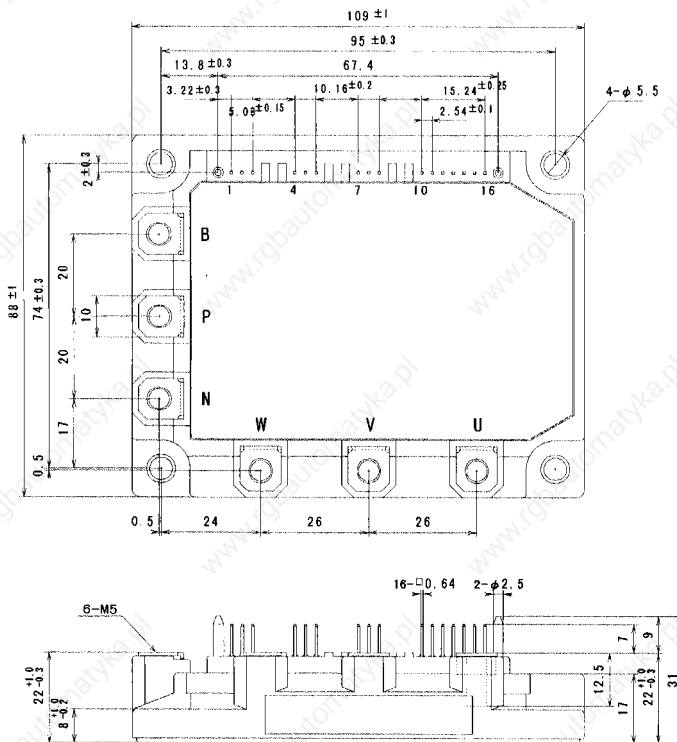
Figure 7. Icc Test Circuit

Block diagram



- Pre-driver include following functions
- ① Amplifier for drive
 - ② Short circuit protection
 - ③ Under voltage lockout circuit
 - ④ Over current protection
 - ⑤ IGBT chip over heating protection

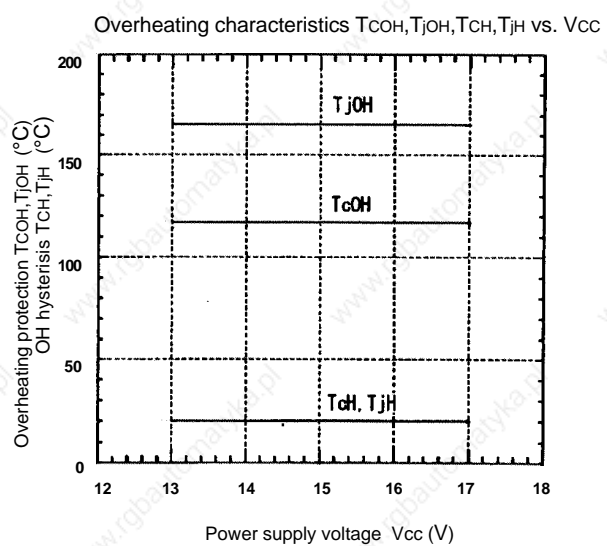
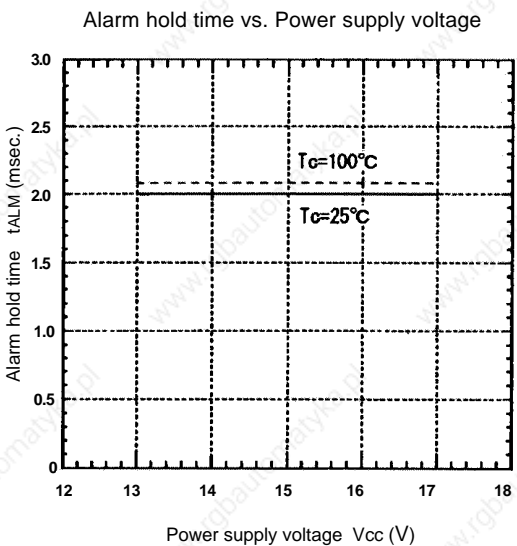
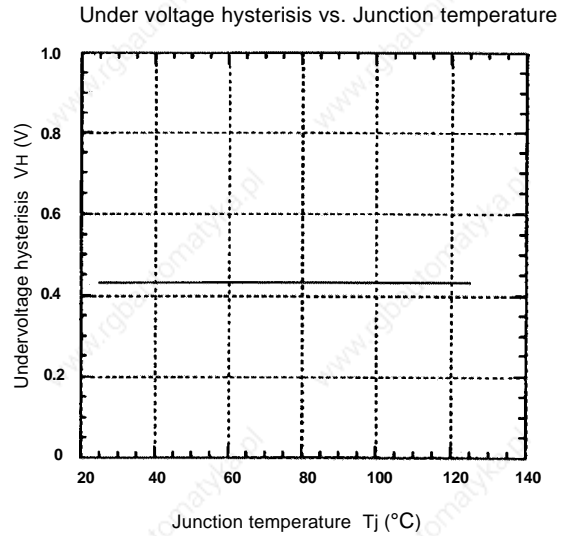
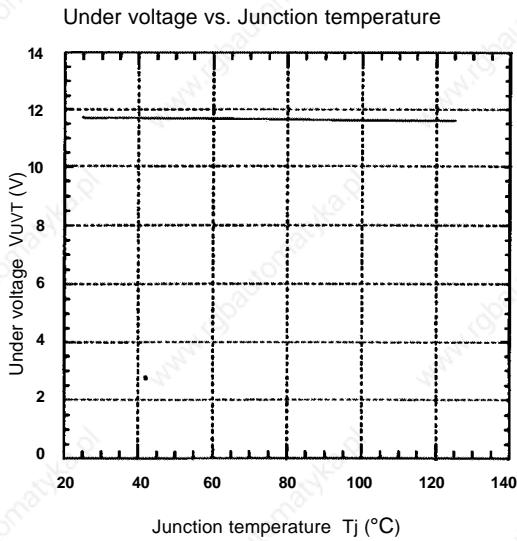
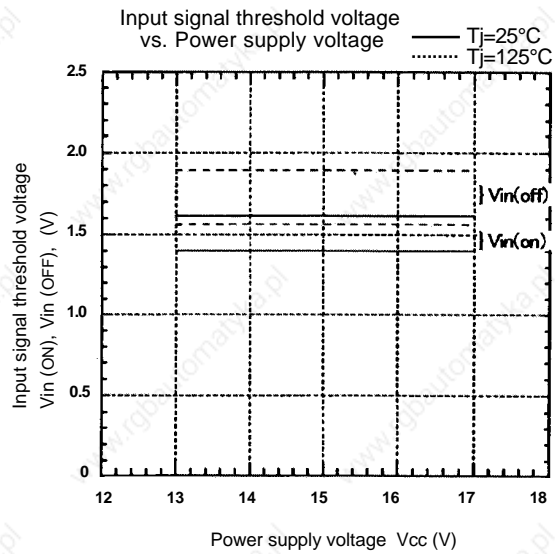
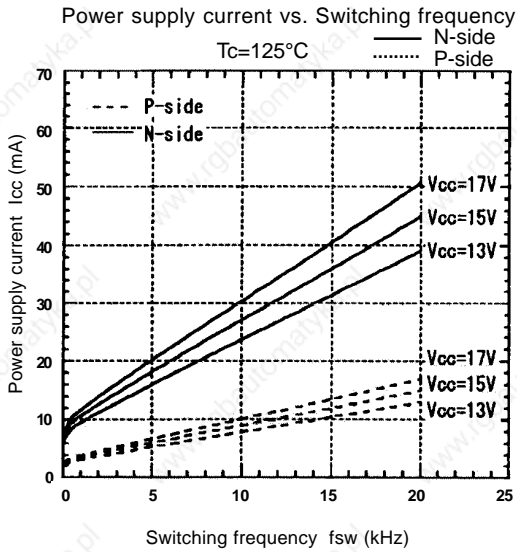
Outline drawings, mm



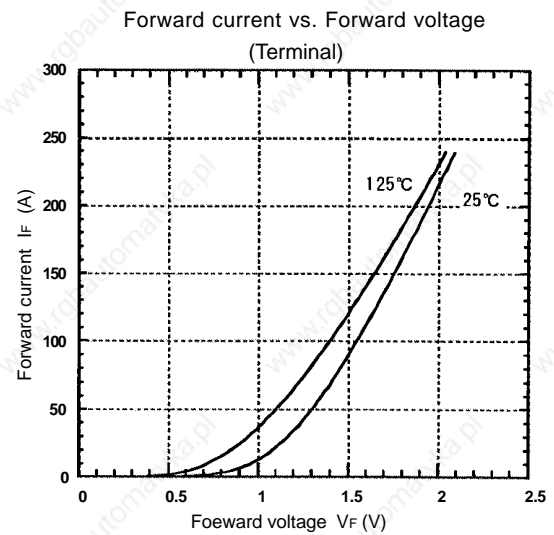
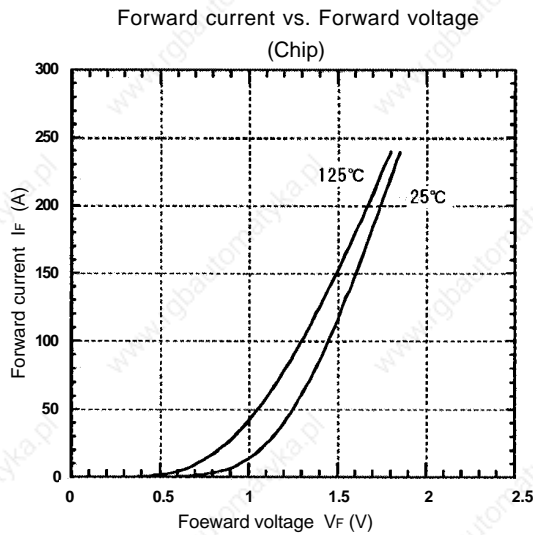
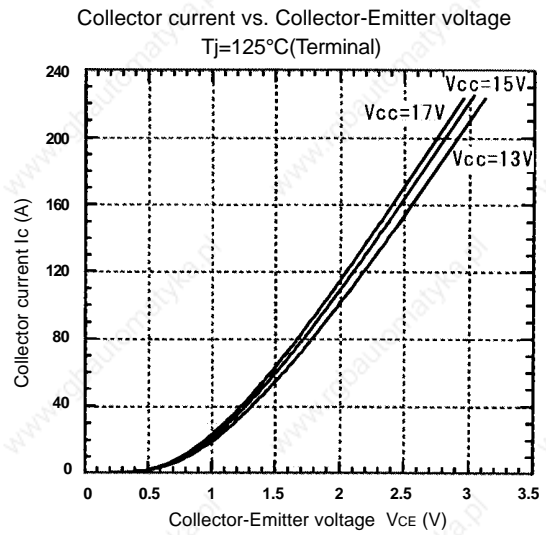
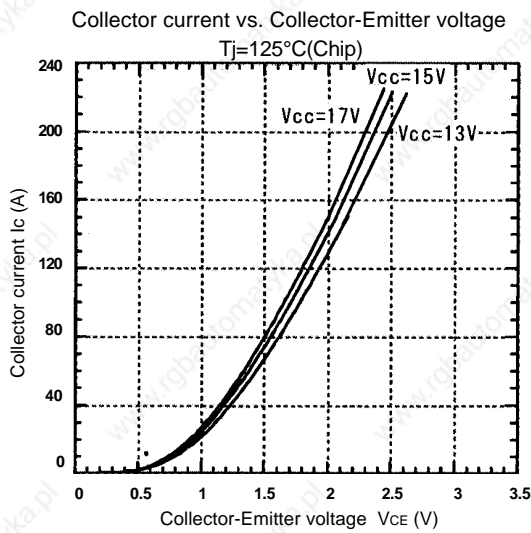
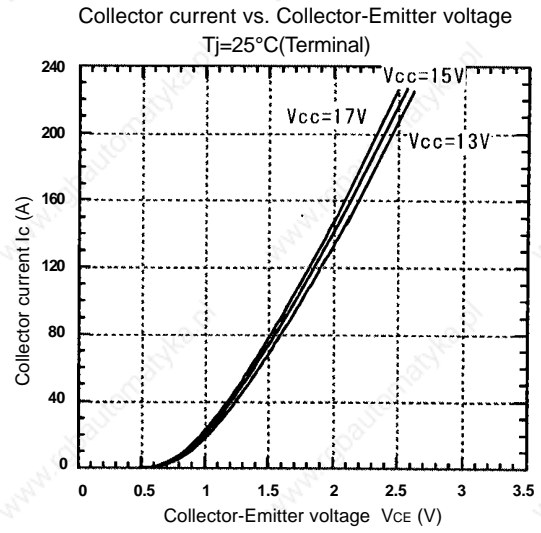
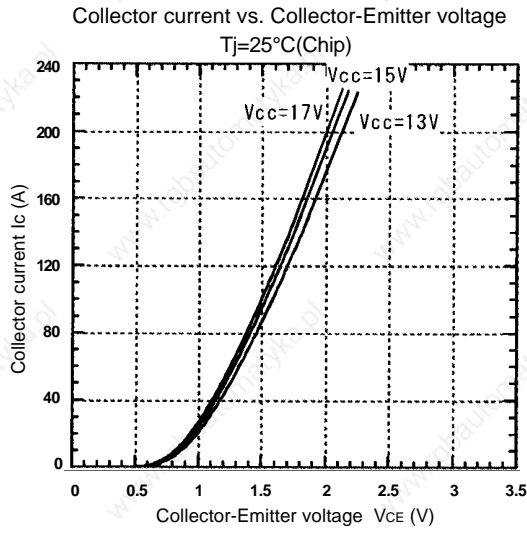
Mass : 450g

Characteristics

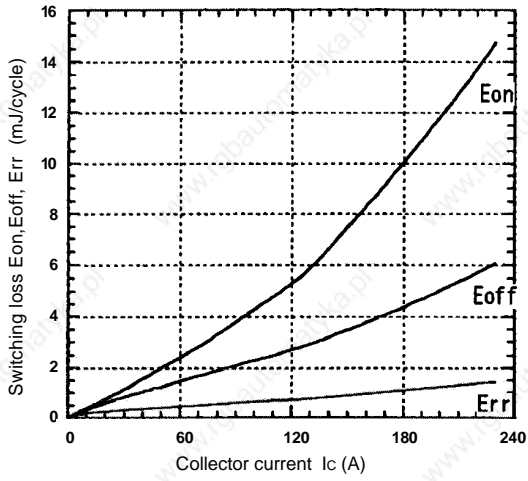
Control circuit characteristics (Representative)



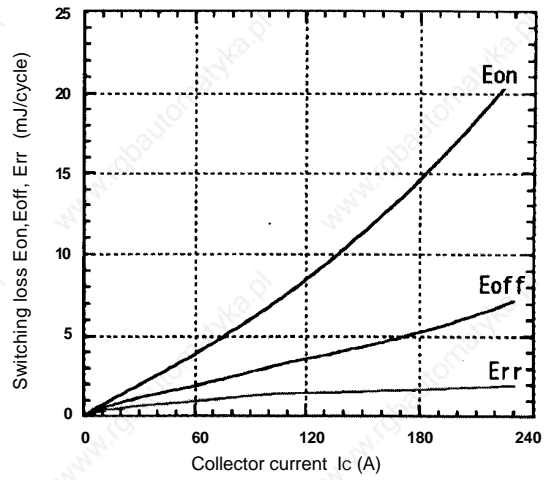
● Main circuit characteristics (Representative)



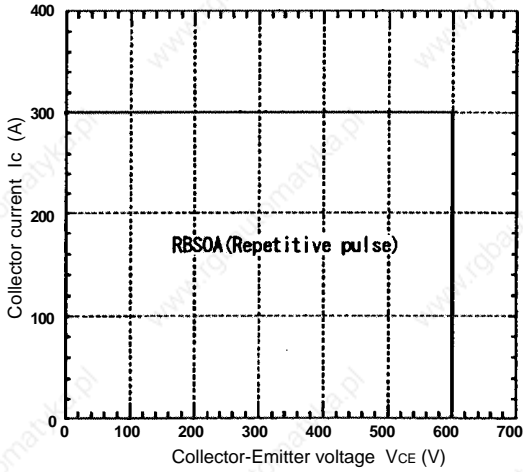
Switching Loss vs. Collector current
 $E_{dc}=300V, V_{cc}=15V, T_j=25^\circ C$



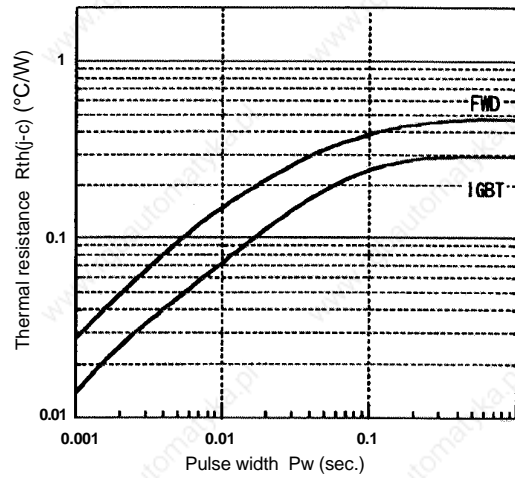
Switching Loss vs. Collector current
 $E_{dc}=300V, V_{cc}=15V, T_j=125^\circ C$



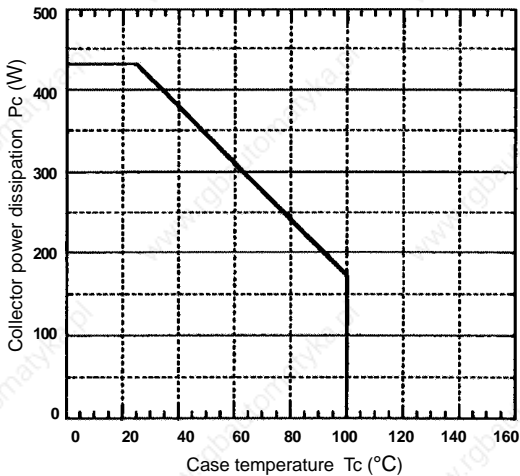
Reverse biased safe operating area
 $V_{cc}=15V, T_j \le 125^\circ C$



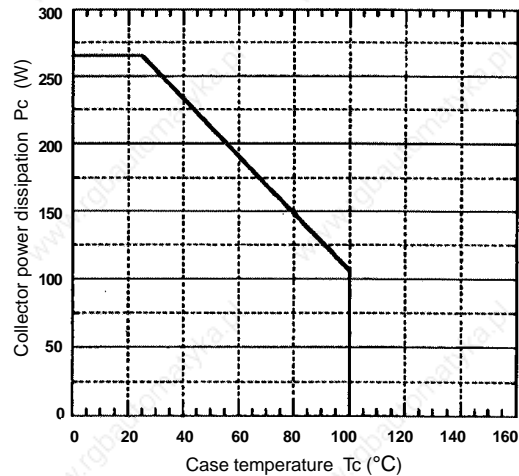
Transient thermal resistance



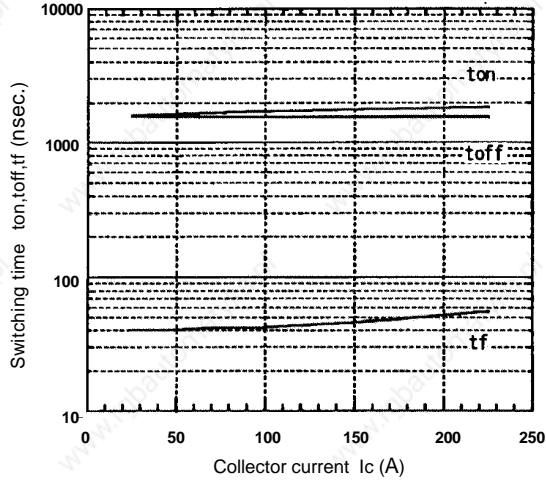
Power derating for IGBT (per device)



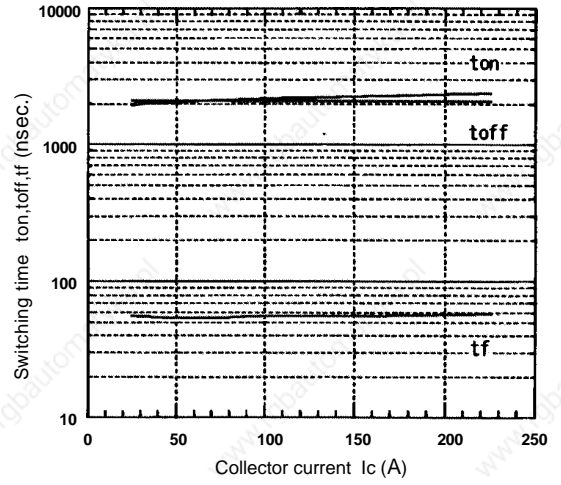
Power derating for FWD (per device)



Switching time vs. Collector current
 $E_{dc}=300V, V_{cc}=15V, T_j=25^\circ C$



Switching time vs. Collector current
 $E_{dc}=300V, V_{cc}=15V, T_j=125^\circ C$



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

