

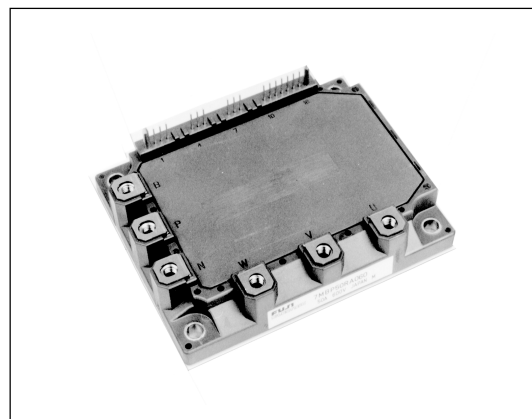
7MBP50RTB060

IPM-R3 series

600V / 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
- 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.	
Bus voltage (between terminal P and N)	DC		V _{DC}	0	450	V
	Surge		V _{DC(surge)}	0	500	V
	Shortoperating		V _{SC}	200	400	V
Collector-Emitter voltage			V _{CES} *1	0	600	V
Inverter	Collector current	DC	I _C	-	50	A
		1ms	I _{CP}	-	100	A
		Duty=76.1%	-I _C *2	-	50	A
	Collector power dissipation	One transistor	P _C *3	-	144	W
Brake	Collector current	DC	I _C	-	30	A
		1ms	I _{CP}	-	60	A
	Forward Current of Diode		I _F	-	30	A
	Collector power dissipation	One transistor	P _C *3	-	144	W
Input voltage of power supply for Pre-Driver			V _{CC} *4	-0.5	20	V
Input signal voltage			V _{in} *5	-0.5	V _{CC} +0.5	V
Input signal current			I _{in}	-	3	mA
Alarm signal voltage			V _{ALM} *6	-0.5	V _{CC}	V
Alarm signal current			I _{ALM} *7	-	20	mA
Junction temperature			T _J	-	150	°C
Operating case temperature			T _{OP}	-20	100	°C
Storage temperature			T _{stg}	-40	125	°C
Isolating voltage (Case-Terminal)			V _{iso} *8	-	AC2.5	kV
Screw torque	Mounting (M5)			-	3.5 *9	N·m
	Terminal (M5)			-	3.5 *9	N·m

Note

*1 : V_{CES} 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 : $125^{\circ}\text{C}/\text{FWD Rth(j-c)}/(\text{Ic} \times \text{V}_{\text{F MAX}})=125/1.263/(50 \times 2.6) \times 100=76.1\%$

*3 : $\text{Pc}=125^{\circ}\text{C}/\text{IGBT Rth(j-c)}=125/0.87=144\text{W}$ [Inverter]

$\text{Pc}=125^{\circ}\text{C}/\text{IGBT Rth(j-c)}=125/0.87=144\text{W}$ [Break]

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

*5 : V_{in} shall be applied to the input voltage between terminal No. 2 and 1, 5 and 4, 8 and 7, 12,13,14,15 and 10.

*6 : V_{ALM} shall be applied to the voltage between terminal No. 16 and 10.

*7 : I_{ALM} 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

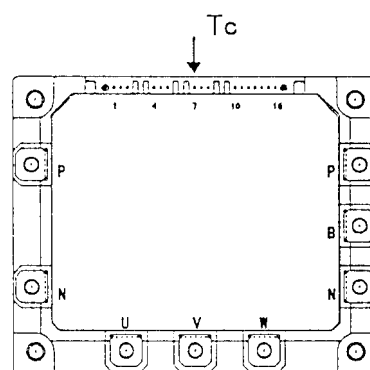


Fig.1 Measurement of case temperature

Weight

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

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

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
Inverter	Collector current at off signal input	ICES	VCE=600V Vin terminal open.		-	-	1.0	mA
	Collector-Emitter saturation voltage	VCE(sat)	Ic=50A	Terminal	-	-	2.5	V
				Chip	-	2.0	-	
	Forward voltage of FWD	VF	Ic=50A	Terminal	-	-	2.6	V
				Chip	-	1.6	-	
Brake	Collector current at off signal input	ICES	VCE=600V Vin terminal open.		-	-	1.0	mA
	Collector-Emitter saturation voltage	VCE(sat)	Ic=30A	Terminal	-	-	2.2	V
				Chip	-	1.75	-	
	Forward voltage of Diode	VF	-Ic=30A	Terminal	-	-	3.3	V
				Chip	-	1.9	-	V
Turn-on time		ton	VDC=300V,Tj=125°C		1.2	-	-	µs
Turn-off time		toff	IC=50A Fig.1, Fig.6		-	-	3.6	
Reverse recovery time		trr	VDC=300V, IC=50A Fig.1, Fig.6		-	-	0.3	
Maximum Avalanche Energy (A non-repetition)		PAV	Internal wiring inductance=50nH Main circuit wiring inductace=54nH		30	-	-	mJ

● **Control circuit**

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current of P-line side pre-driver(one unit)	I_{ccp}	Switching Frequency : 0 to 15kHz $T_c=-20$ to 125°C Fig.7	-	-	18	mA
Supply current of N-line side pre-driver	I_{ccn}		-	-	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
Alarm signal hold time	t_{ALM}	$T_c=-20^{\circ}\text{C}$ Fig.2	1.1	-	-	ms
		$T_c=25^{\circ}\text{C}$ Fig.2	-	2.0	-	ms
		$T_c=125^{\circ}\text{C}$ Fig.2	-	-	4.0	ms
Limiting resistor for alarm	R_{ALM}		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	I_{OC}	$T_j=125^{\circ}\text{C}$	75	-	-	A
Over Current Protection Level of brake circuit		$T_j=125^{\circ}\text{C}$	45	-	-	A
Over Current Protection Delay time	t_{DOC}	$T_j=125^{\circ}\text{C}$	-	5	-	μs
SC Protection Delay time	t_{SC}	$T_j=125^{\circ}\text{C}$ Fig.4	-	-	8	μs
IGBT Chip Over Heating	T_{jOH}	surface of IGBT chips	150	-	-	$^{\circ}\text{C}$
Over Heating Protection Hysteresis	T_{jH}		-	20	-	$^{\circ}\text{C}$
Over Heating Protection Temperature Level	T_{COH}	$V_{DC}=0\text{V}$, $I_c=0\text{A}$, Case temperature	110	-	125	$^{\circ}\text{C}$
Over Heating Protection Hysteresis	T_{CH}		-	20	-	$^{\circ}\text{C}$
Under Voltage Protection Level	V_{UV}		11.0	-	12.5	V
Under Voltage Protection Hysteresis	V_H		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)	-	-	0.87	°C/W
		FWD	Rth(j-c)	-	-	1.263	°C/W
	Brake	IGBT	Rth(j-c)	-	-	0.87	°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 $1\mu\text{s}$, polarity $\pm 10\text{minuets}$ Judge : no over-current, no miss operating	± 2.0	-	-	kV
Common mode lightning surge	Rise time $1.2\mu\text{s}$, Fall time $50\mu\text{s}$ 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}	-	-	400	V
Operating Supply Voltage of Pre-Driver	V_{CC}	13.5	15.0	16.5	V
Screw torque (M5)	-	2.5	-	3.0	Nm

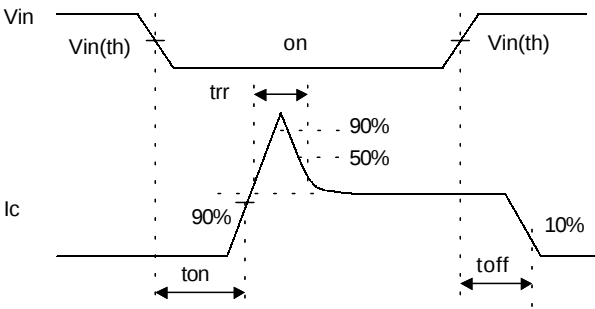
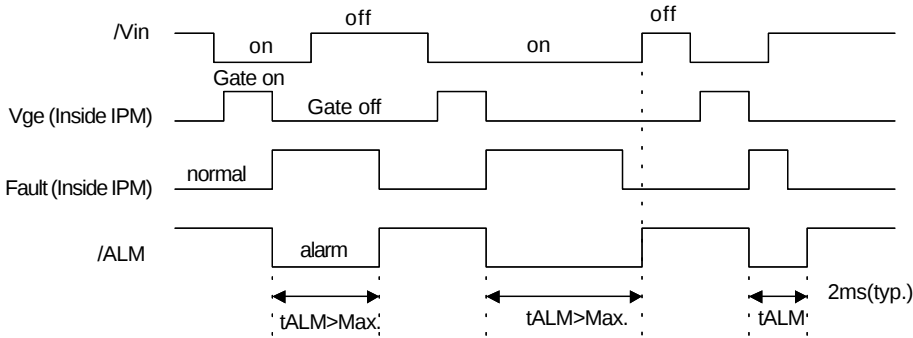


Figure 1. Switching Time Waveform Definitions



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

Figure 2. Input / Output Timing Diagram

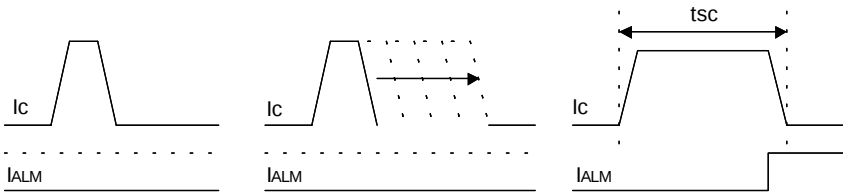


Figure. 4 Definition of tsc

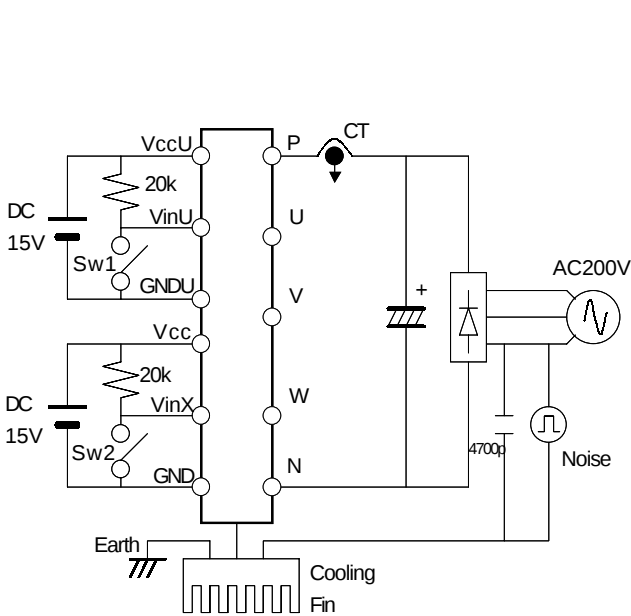


Figure 5. Noise Test Circuit

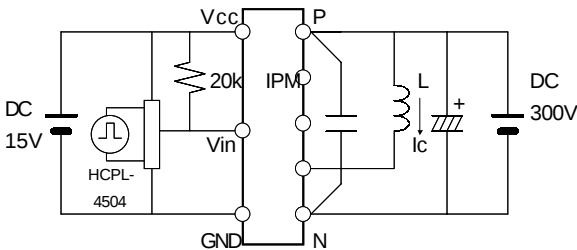


Figure 6. Switching Characteristics Test Circuit

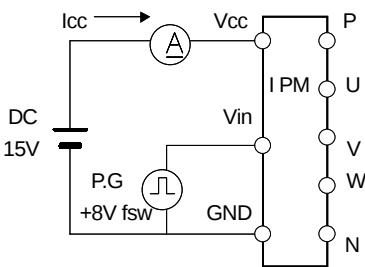
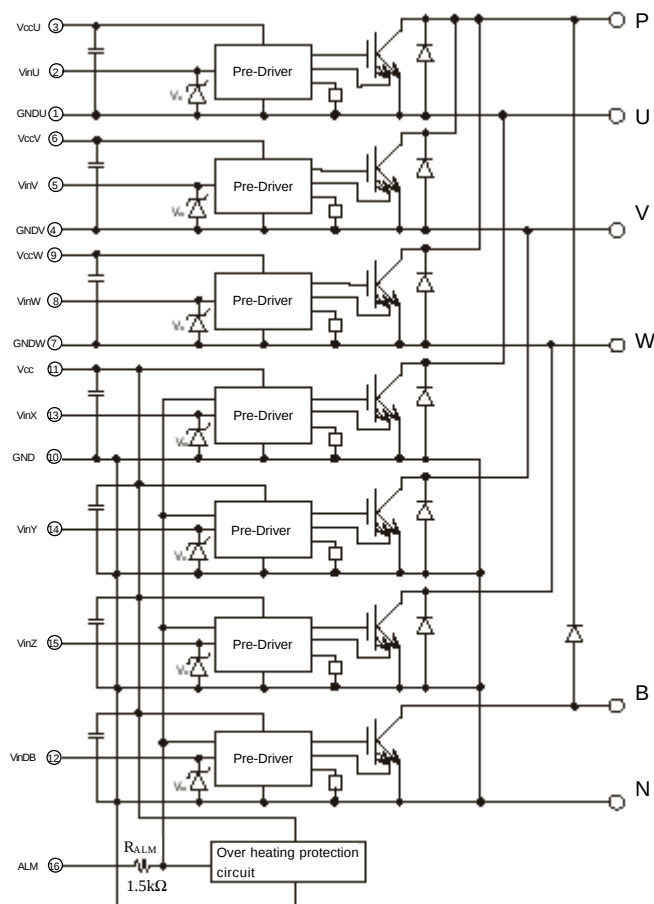


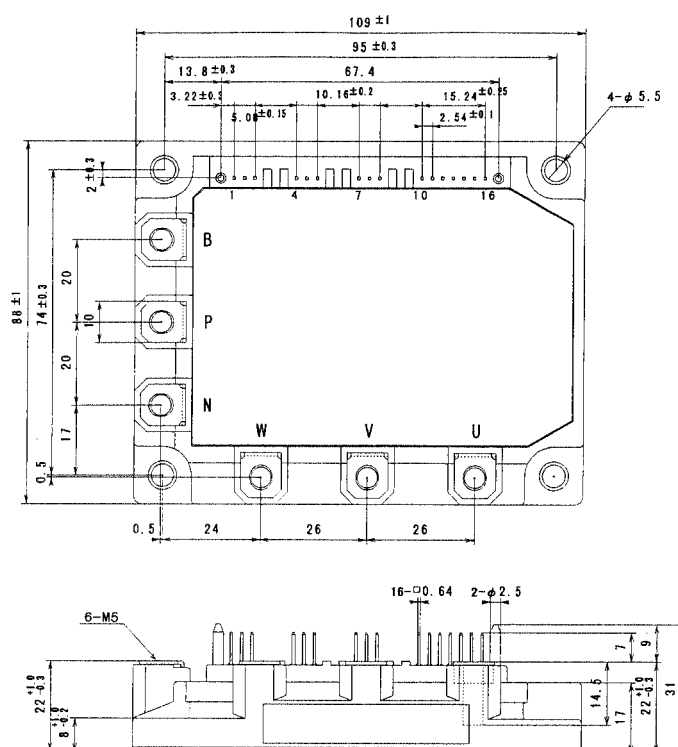
Figure 7. Icc Test Circuit

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

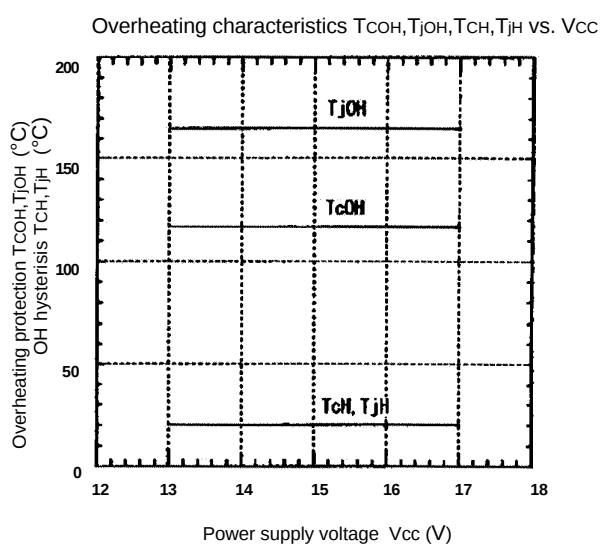
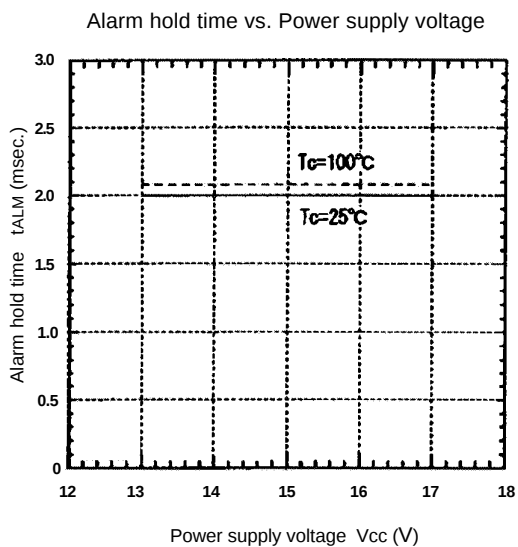
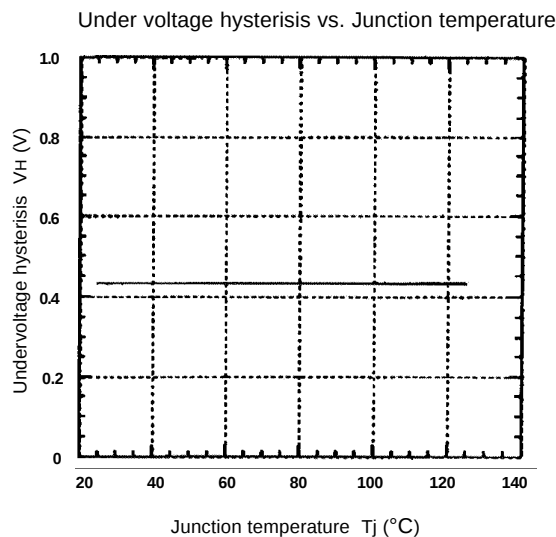
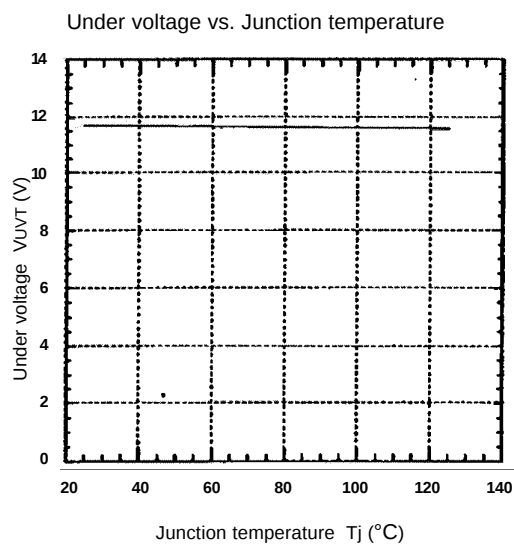
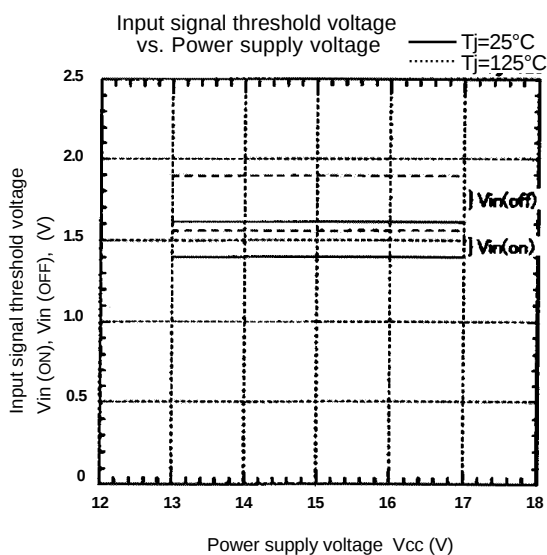
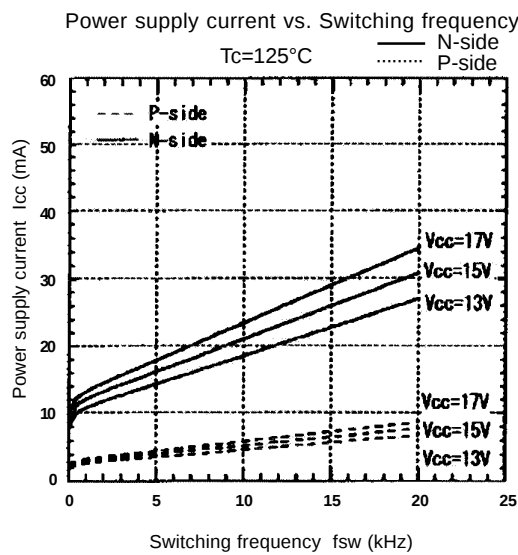
Outline drawings, mm



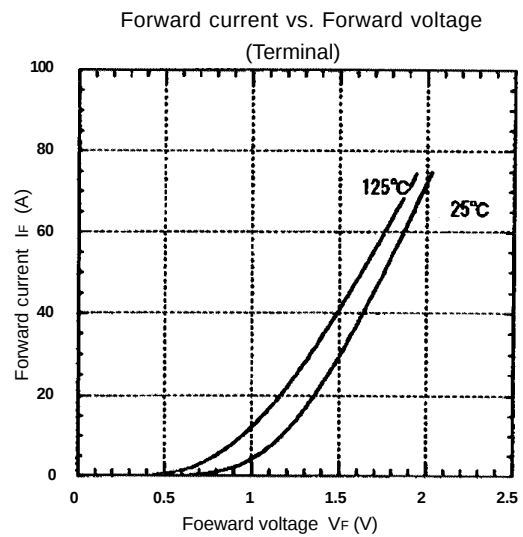
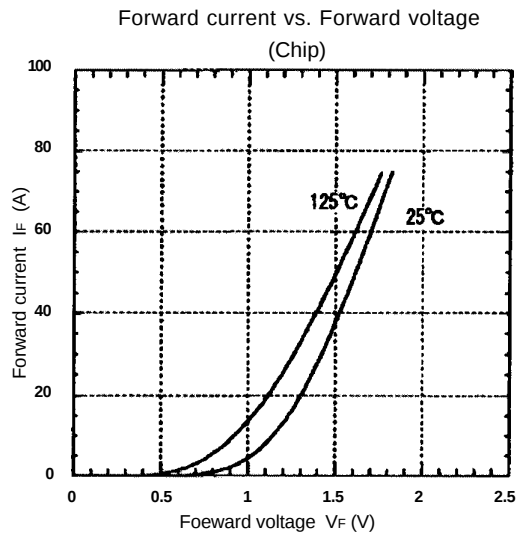
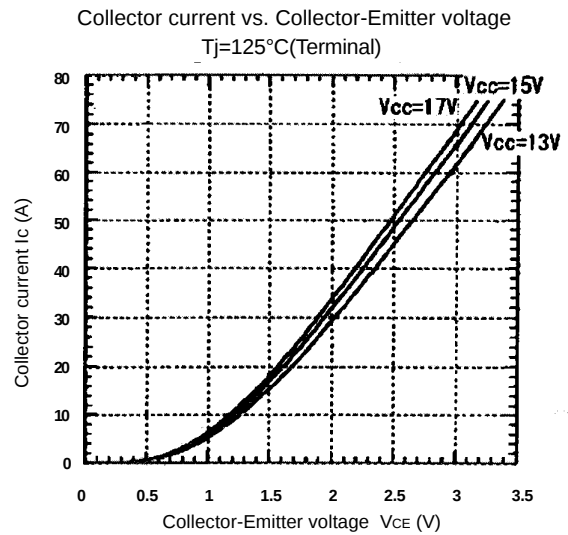
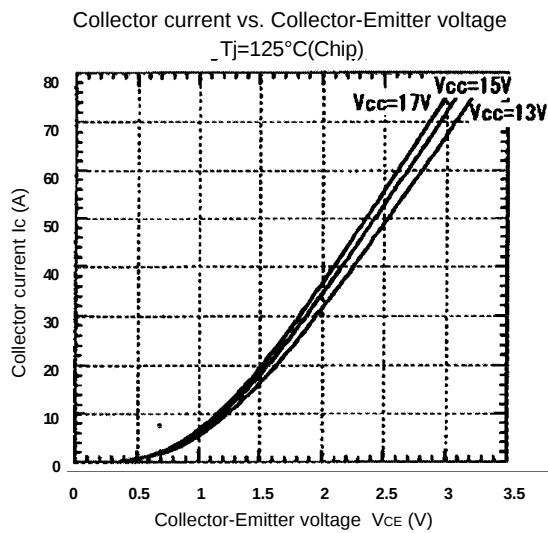
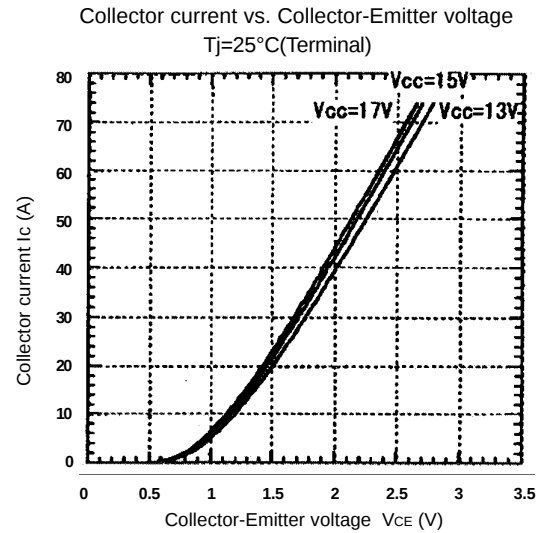
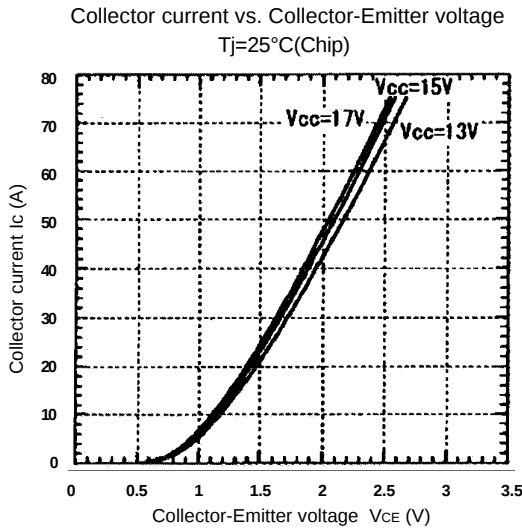
Mass : 450g

Characteristics

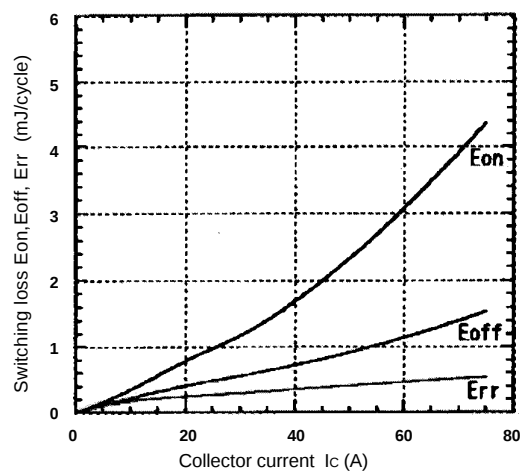
Control circuit characteristics (Representative)



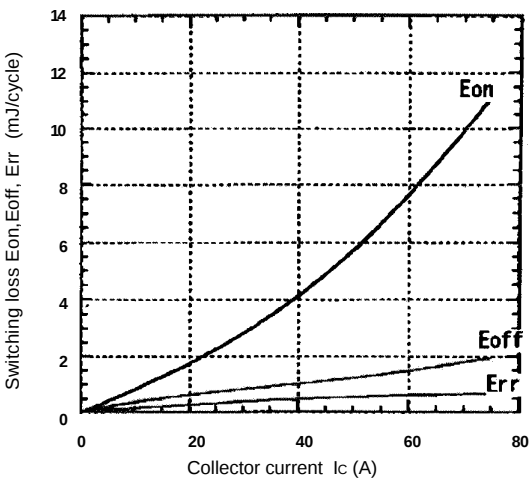
● Main circuit characteristics (Representative)



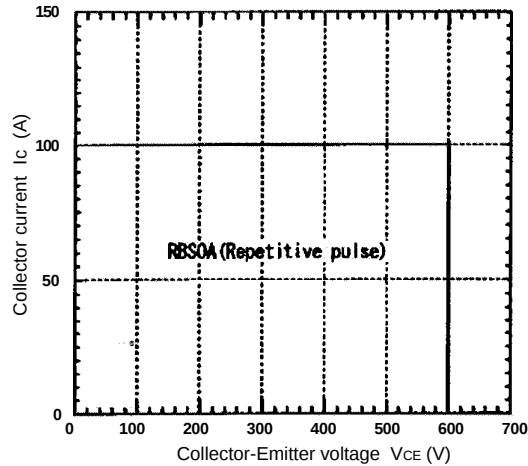
Switching Loss vs. Collector current
Edc=300V, Vcc=15V, Tj=25°C



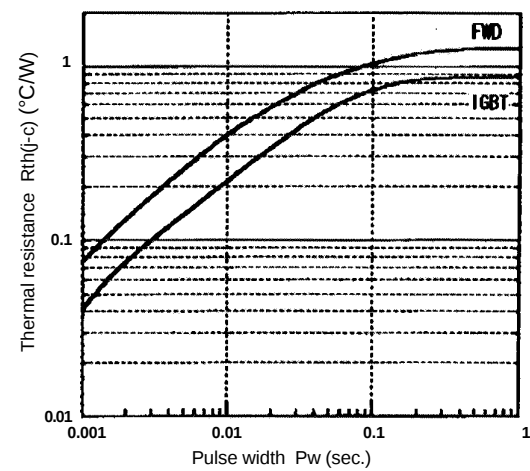
Switching Loss vs. Collector current
Edc=300V, Vcc=15V, Tj=125°C



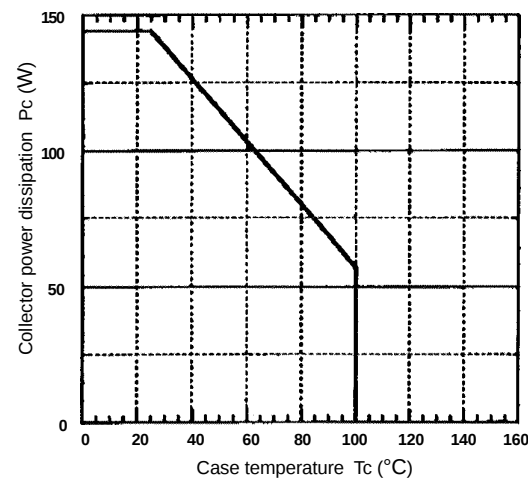
Reverse biased safe operating area
Vcc=15V, Tj ≤125°C



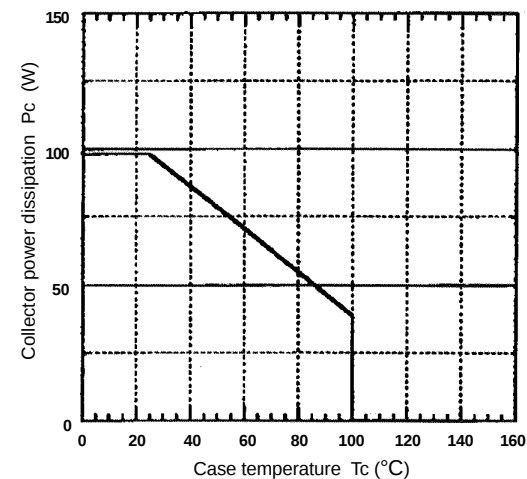
Transient thermal resistance

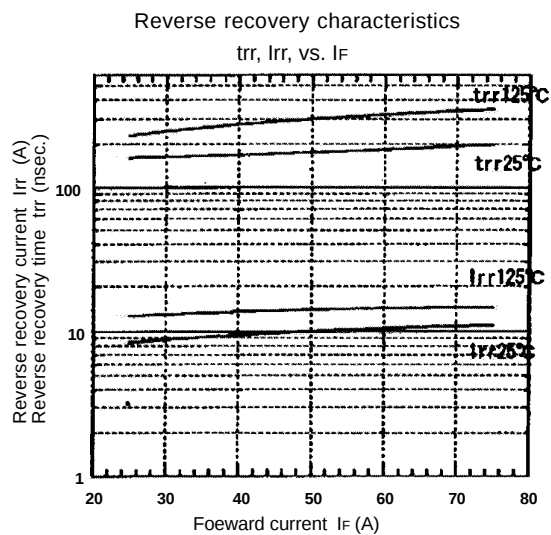
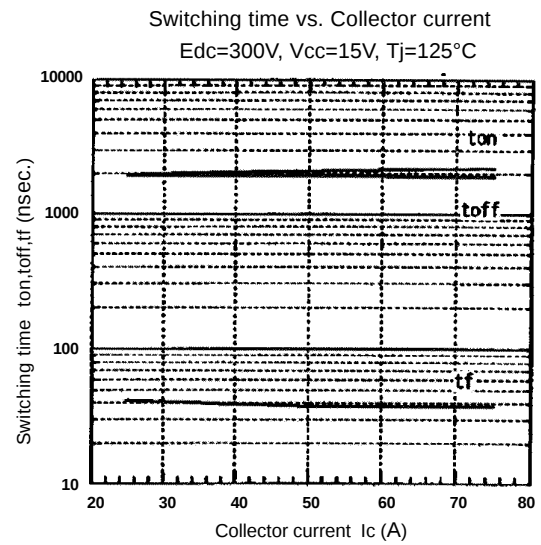
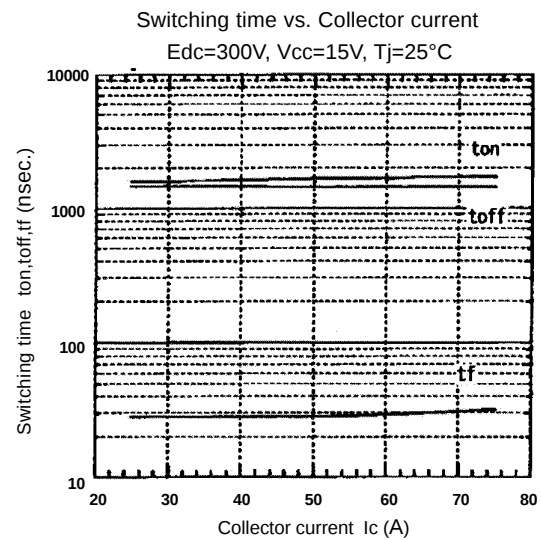


Power derating for IGBT (per device)



Power derating for FWD (per device)





● Dynamic brake characteristics (Representative)

