

Econo IPM series

600V / 100A 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	DC		V _{DC}	0	450	V
	Surge		V _{DC(surge)}	0	500	V
	Short operating		V _{SC}	200	400	V
Collector-Emitter voltage *1			V _{CES}	0	600	V
Inverter	Collector current	DC	I _C	-	100	A
		1ms	I _{CP}	-	200	A
		Duty=72.3% *2	-I _C	-	100	A
	Collector power dissipation	One transistor *3	P _C	-	347	W
	Collector current	DC	I _C	-	50	A
		1ms	I _{CP}	-	100	A
	Forward current diode		I _F	-	50	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	V _{CC} +0.5	V
Input signal current			I _{in}	-	3	mA
Alarm signal voltage *6			V _{ALM}	-0.5	V _{CC}	V
Alarm signal current *7			I _{ALM}	-	20	mA
Junction temperature			T _j	-	150	°C
Operating case temperature			T _{opr}	-20	100	°C
Storage temperature			T _{stg}	-40	125	°C
Solder temperature *8			T _{sol}	-	260	°C
Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.)			V _{iso}	-	AC2500	V
Screw torque	Mounting (M5)			-	3.5	N·m

Note

*1 : V_{CES} shall be applied to the input voltage between terminal P and U or ,u or W, N and U or V or W

*2 : 125°C/FWD R_{th(j-c)}/(I_C x V_F MAX)=125/0.665/(100 x 2.6) x 100=72.3%

*3 : P_C=125°C/IGBT R_{th(j-c)}=125/0.36=347W [Inverter]

P_C=125°C/IGBT R_{th(j-c)}=125/0.63=198W [Breake]

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

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

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

*7 : I_{ALM} shall be applied to the input current to terminal No.2,6,10 and 19.

*8 : Immersion time 10±1sec.

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

● Main circuit

Main circuit		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=100A	Terminal	-	-	2.3
				Chip	-	1.8	-
	Forward voltage of FWD	VF	-Ic=100A	Terminal	-	-	2.6
				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=50A	Terminal	-	-	2.2
				Chip	-	1.75	-
	Forward voltage of Diode	VF	-Ic=50A	Terminal	-	-	3.3
				Chip	-	1.9	-
Turn-on time		ton	VDC=300V,Tj=125°C IC=100A Fig.1, Fig.6	1.2	-	-	μs
Turn-off time		toff		-	-	3.6	
Reverse recovery time		trr	VDC=300V, IC=100A Fig.1, Fig.6	-	-	0.3	
Maximum Avalanche Energy (A non-repetition)		PAV	Internal wiring inductance=50nH Main circuit wiring inductace=54nH	100	-	-	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
Current limit resistor	RALM	Alarm terminal	1425	1500	1575	ohm

● Protection Section (Vcc=15V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Over Current Protection Level of Inverter circuit	Ioc	Tj=125°C	150		-	A
Over Current Protection Level of Brake circuit	Ioc	Tj=125°C	75		-	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		-	20	-	°C
Under Voltage Protection Level	Vuv		11.0	-	12.5	V
Under Voltage Protection Hysteresis	VH		0.2	0.5	-	V

● Thermal characteristics(Tc=25°C)

Item			Symbol	Min.	Typ.	Max.	Unit
Junction to Case thermal resistance *9	Inverter	IGBT	Rth(j-c)	-	-	0.36	°C/W
		FWD	Rth(j-c)	-	-	0.665	°C/W
	Brake	IGBT	Rth(j-c)	-	-	0.63	°C/W
Case to fin thermal resistance with compound			Rth(c-f)	-	0.05		-°C/W

*9 For 1device, 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	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	-	270	-	g

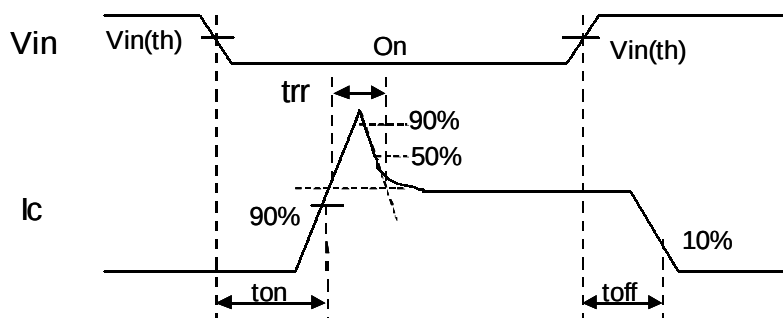
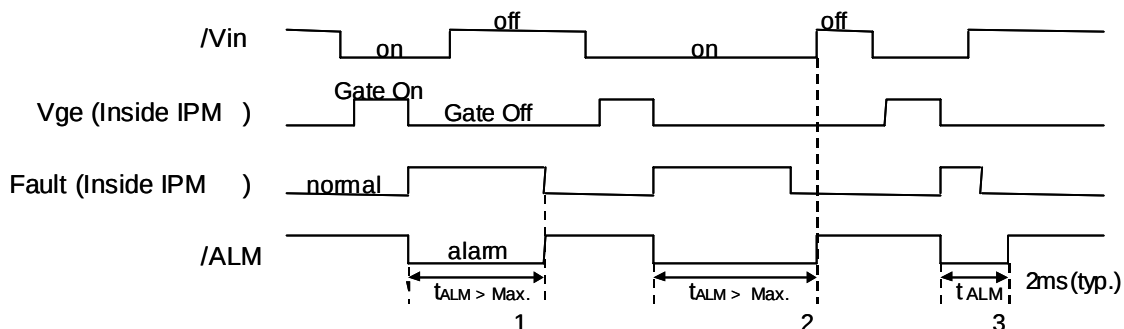


Figure 1. Switching Time Waveform Definitions



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

Figure 2. Input/Output Timing Diagram

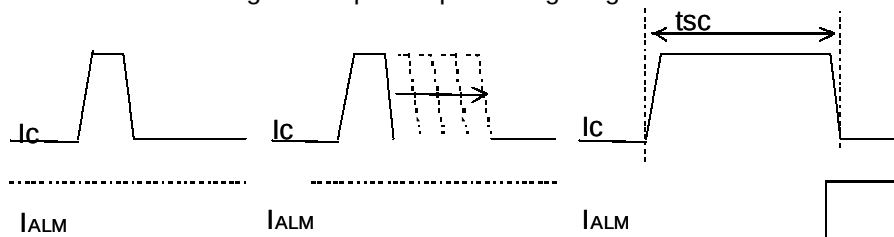


Figure.4 Definition of tsc

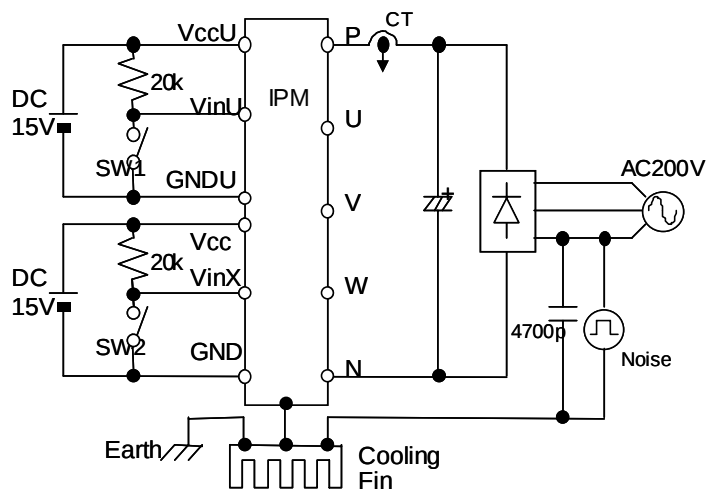


Figure 5. Noise Test Circuit

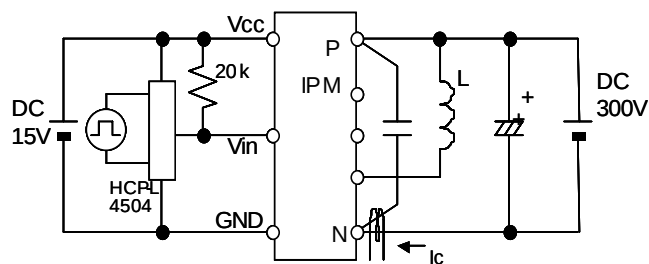


Figure 6. Switching Characteristics Test Circuit

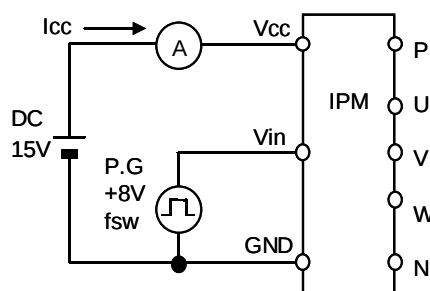
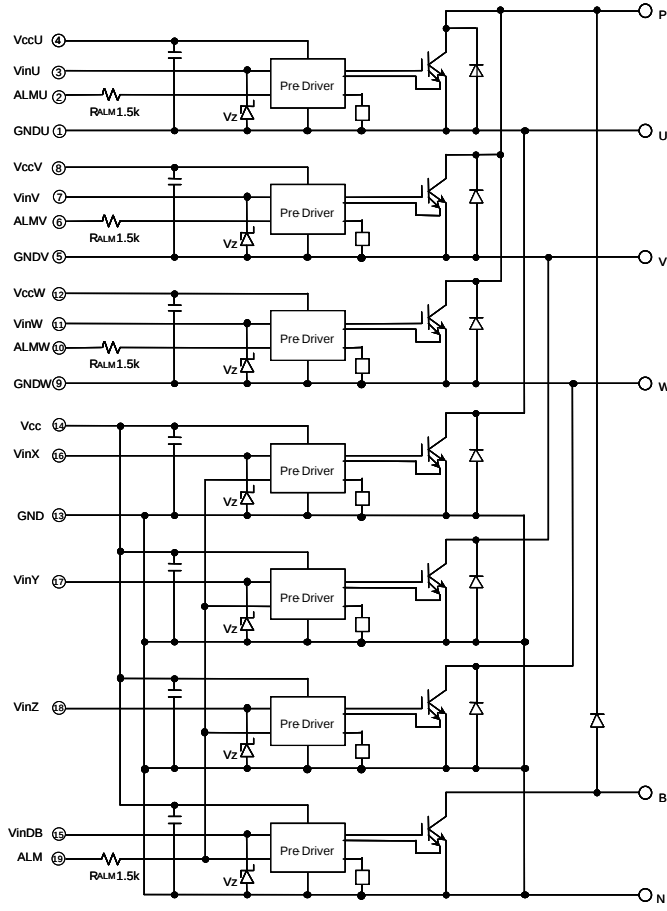


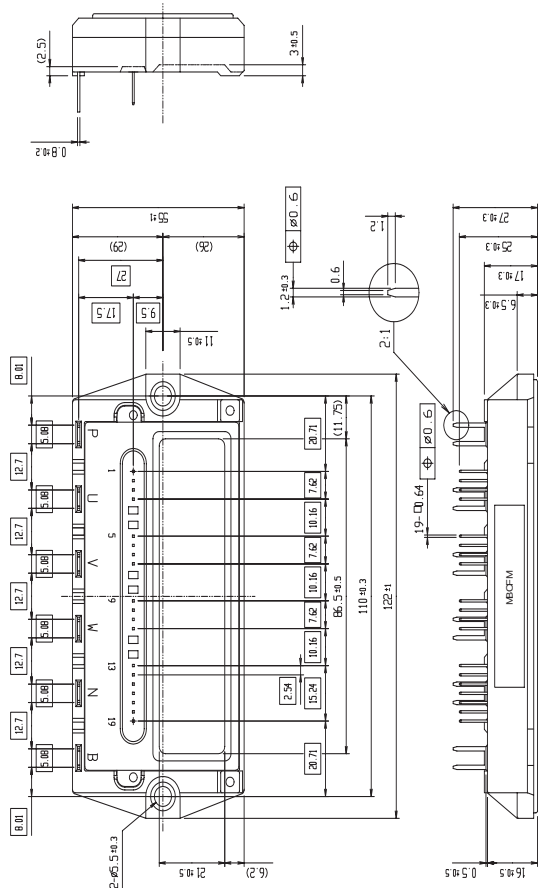
Figure 7. Icc Test Circuit

■ 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

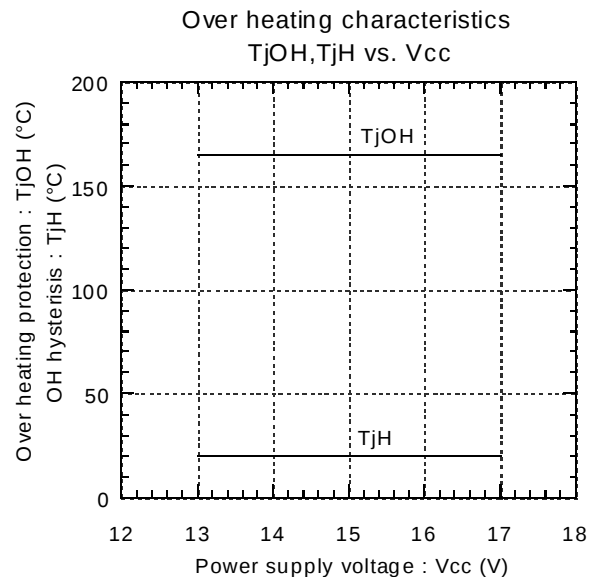
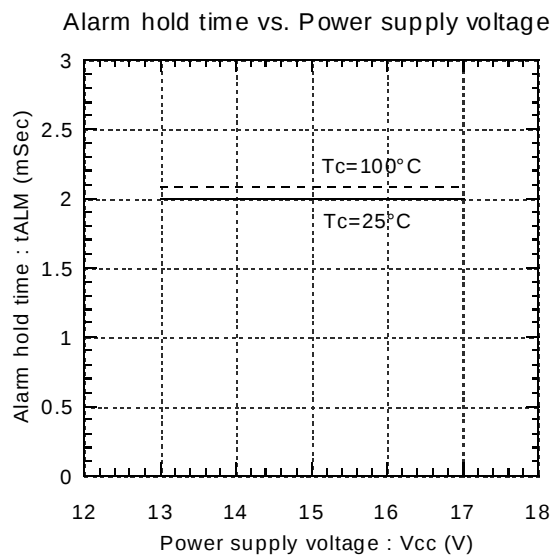
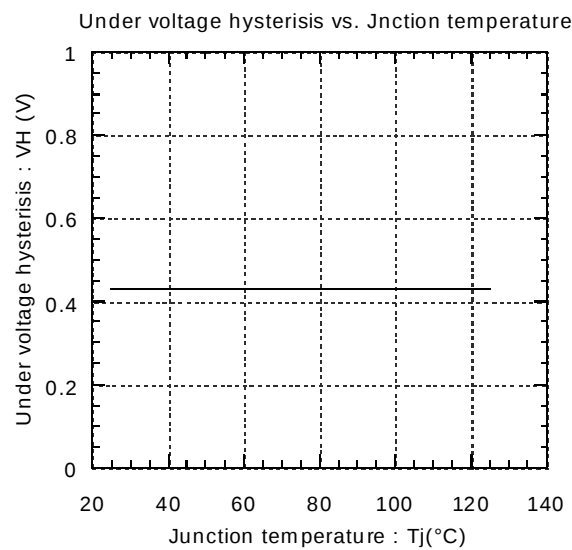
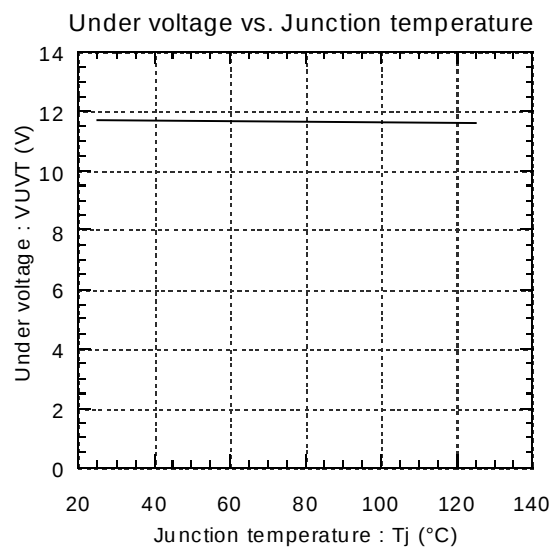
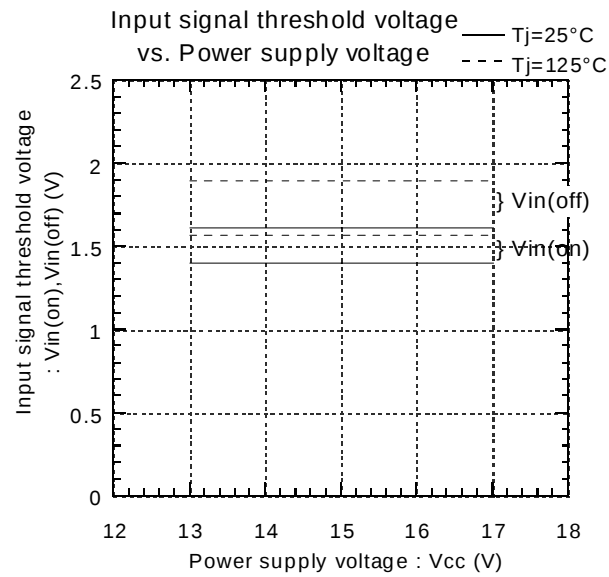
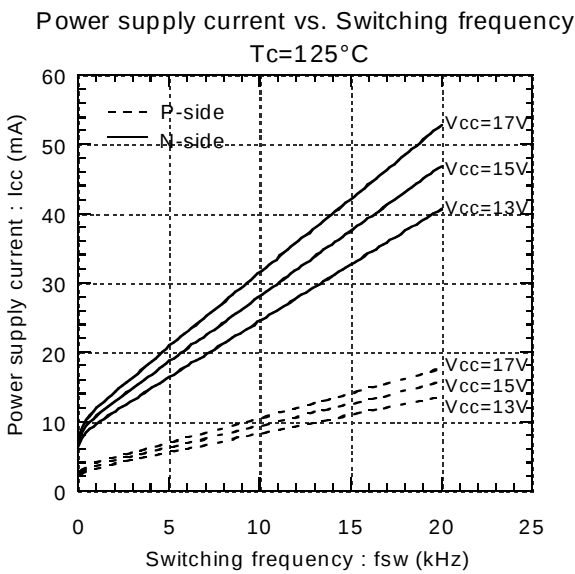
■ Outline drawings, mm



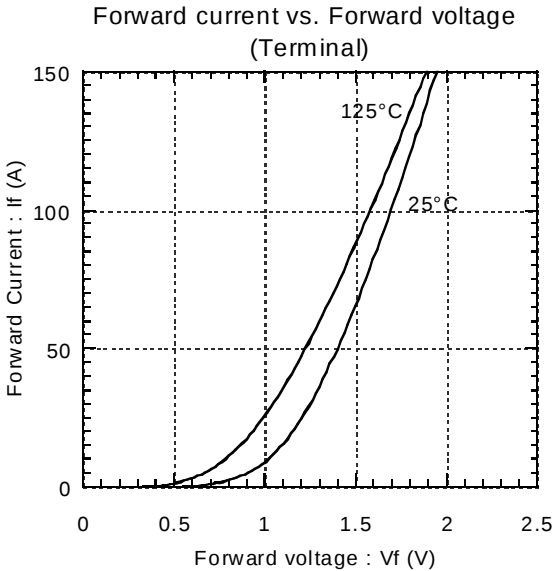
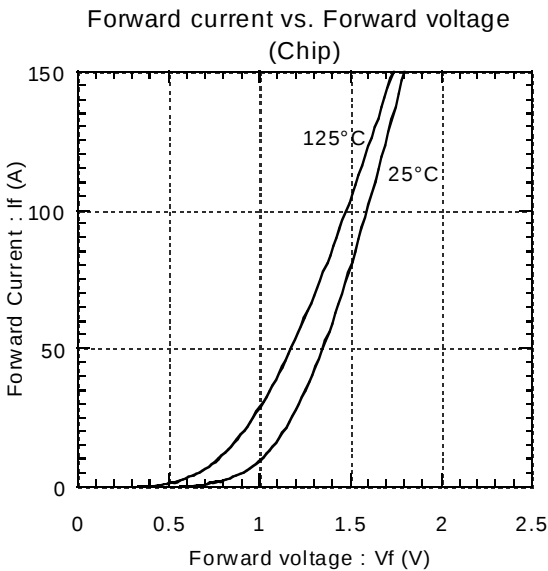
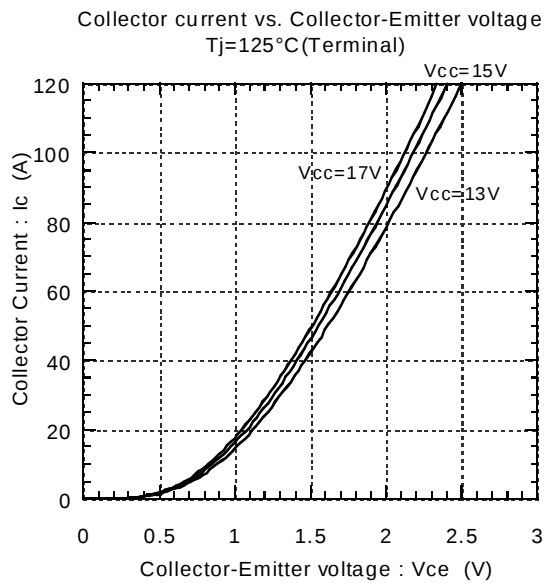
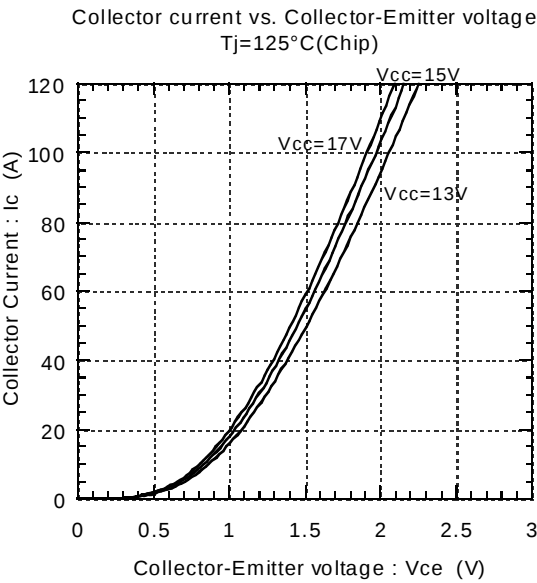
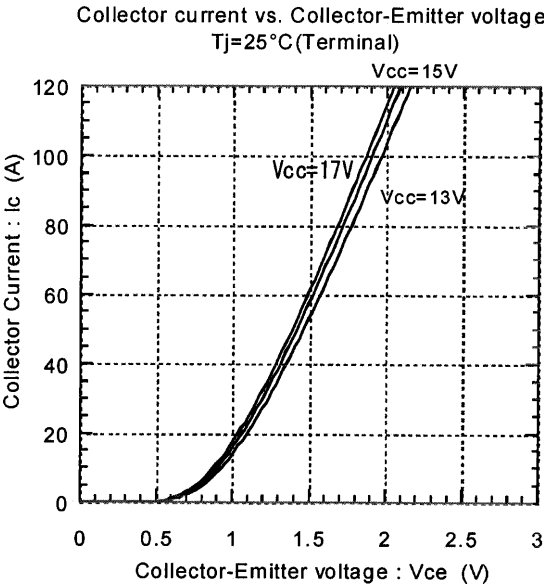
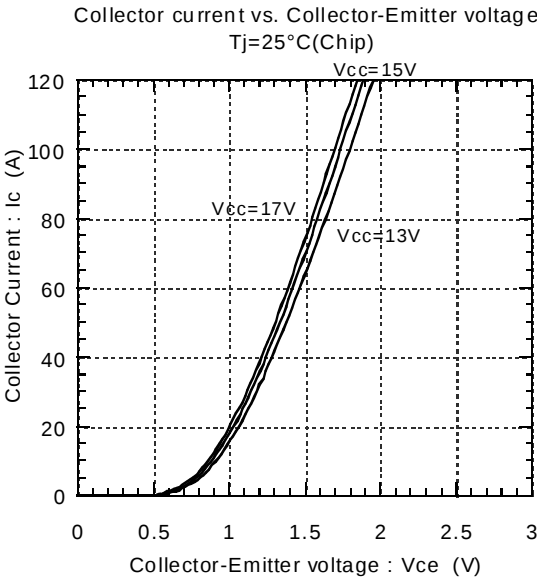
Mass : 270g

Characteristics

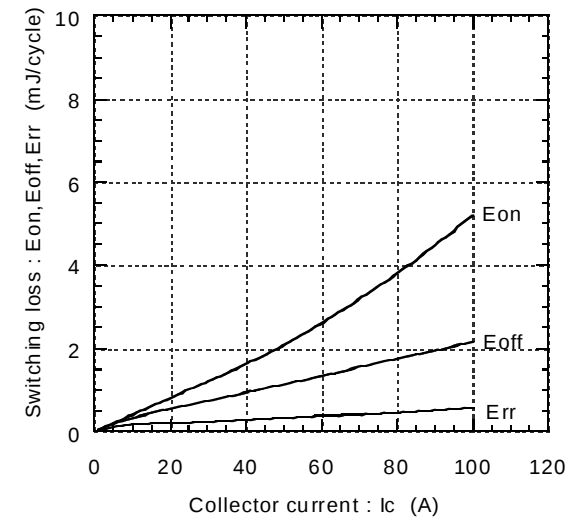
Control circuit characteristics (Representative)



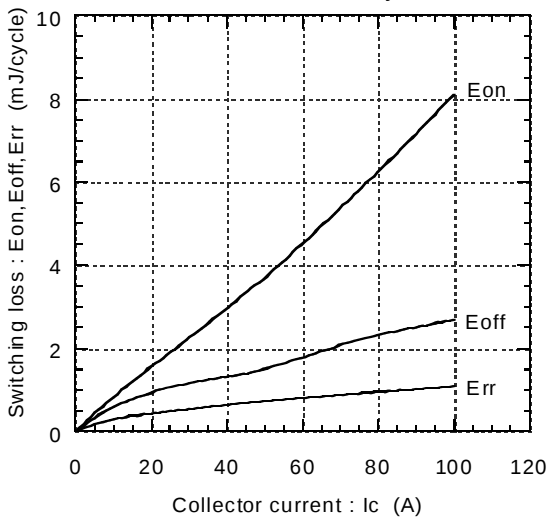
● Main circuit characteristics (Representative)



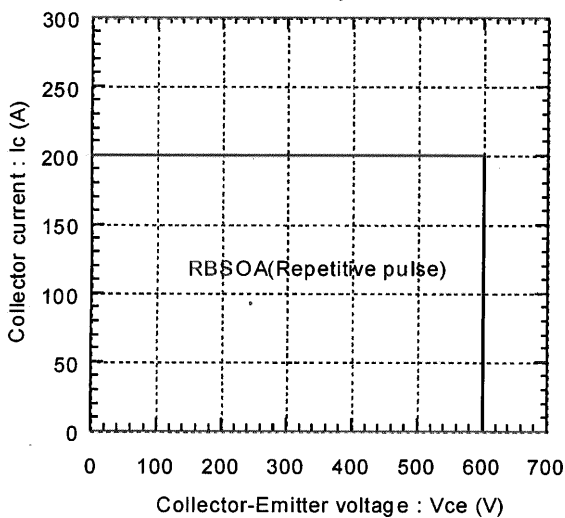
Switching Loss vs. Collector Current
Edc=300V,Vcc=15V,Tj=25°C



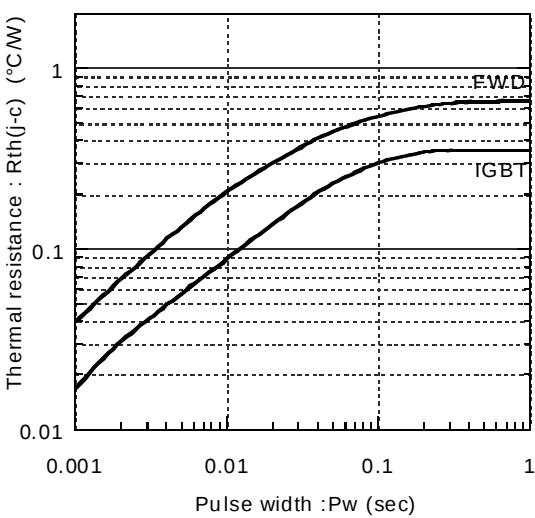
Switching Loss vs. Collector Current
Edc=300V,Vcc=15V,Tj=125°C



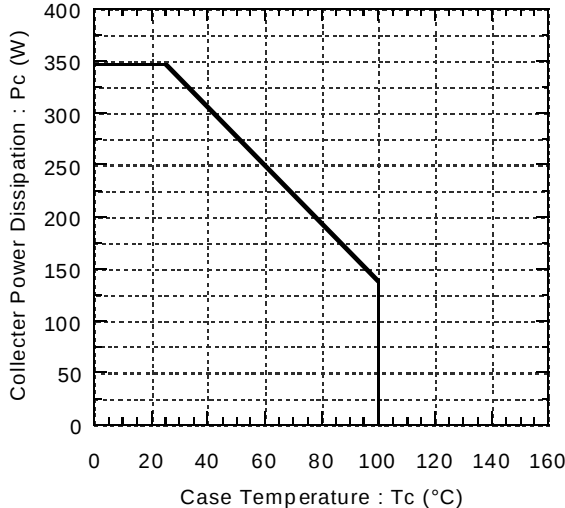
Reversed biased safe operating area
Vcc=15V,Tj≤125°C



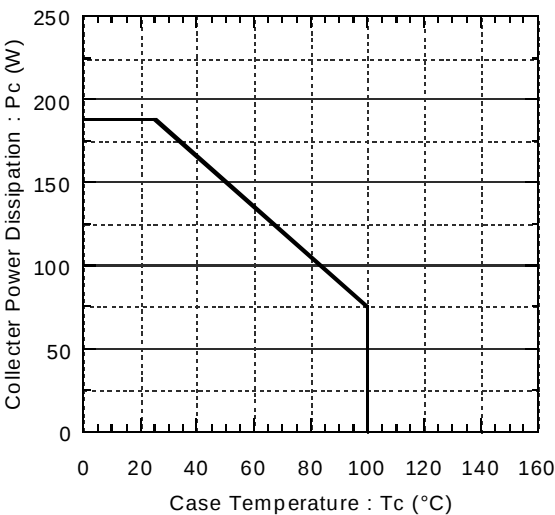
Transient thermal resistance

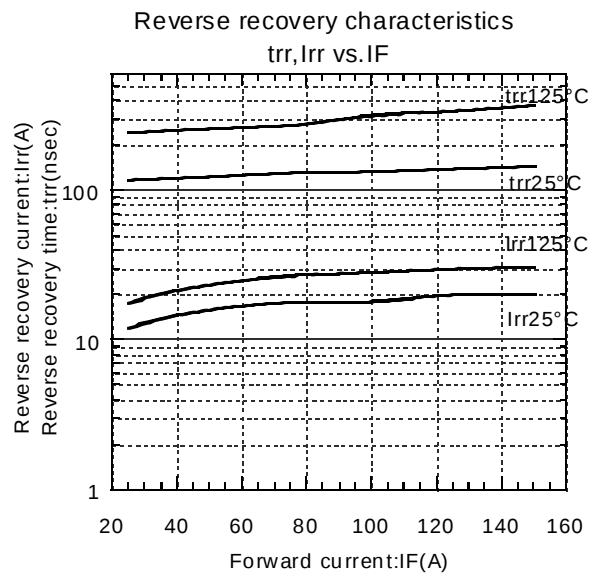
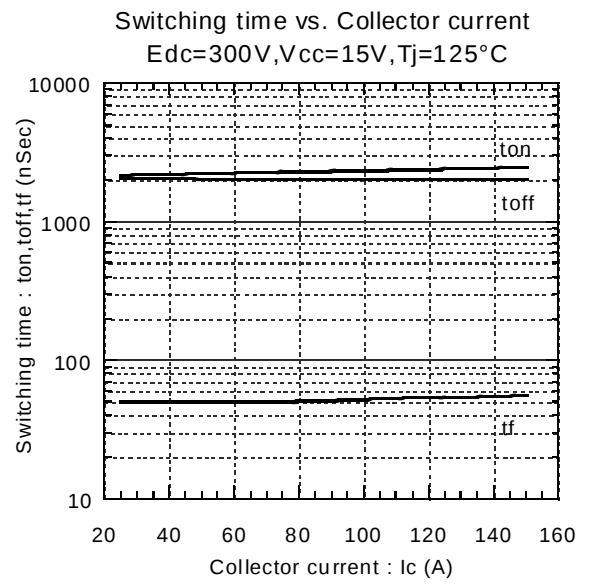
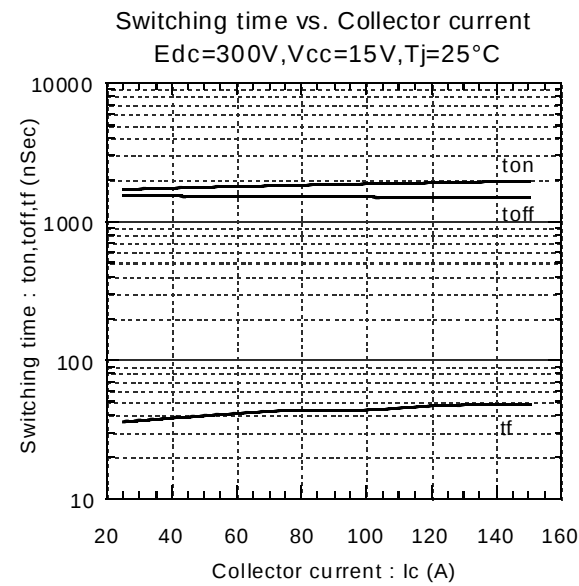


Power derating for IGBT
(per device)



Power derating for FWD
(per device)

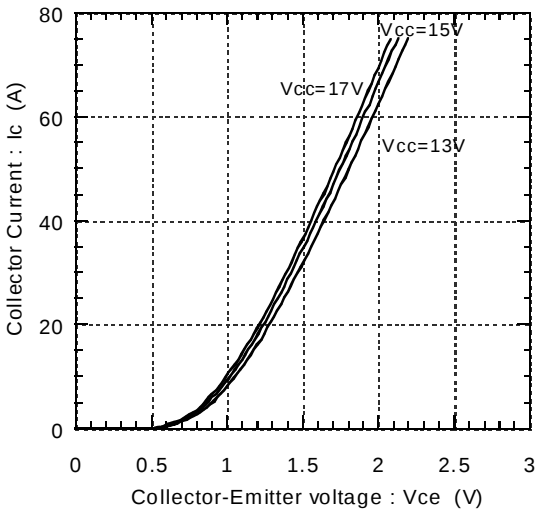




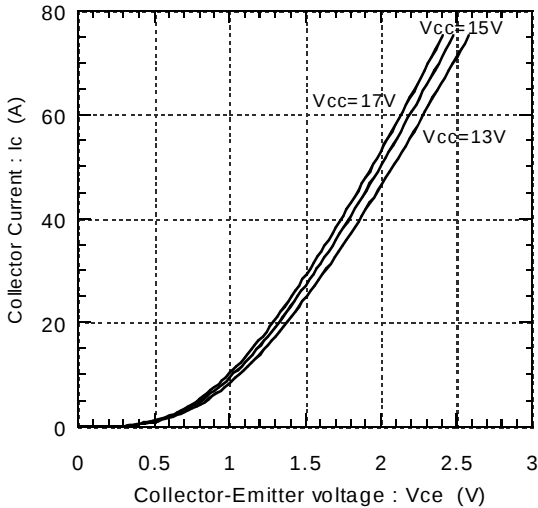
Characteristics

Dynamic Brake Characteristics (Representative)

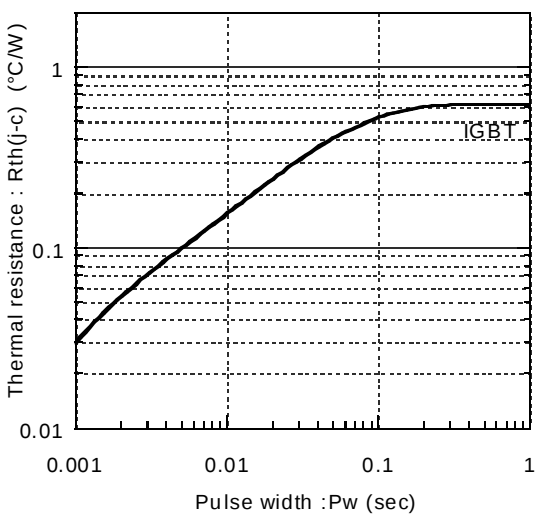
Collector current vs. Collector-Emittter voltage
Tj=25°C



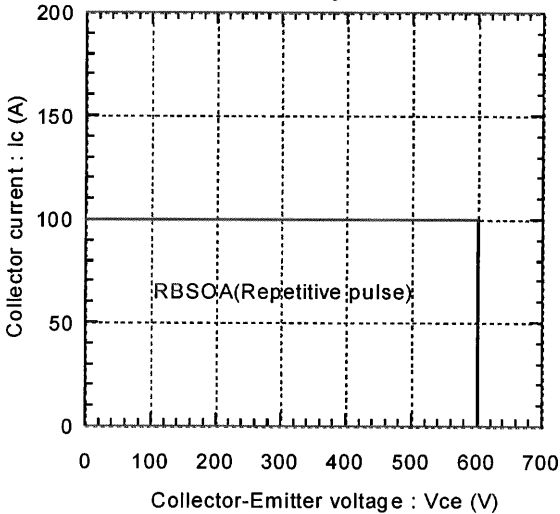
Collector current vs. Collector-Emittter voltage
Tj=125°C



Transient thermal resistance



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



Power derating for IGBT
(per device)

