

Econo IPM 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	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	-	50	A
		1ms	I _{CP}	-	100	A
		Duty=76.1% *2	-I _c	-	50	A
	Collector power dissipation	One transistor *3	P _c	-	144	W
	Collector current	DC	I _c	-	30	A
		1ms	I _{CP}	-	60	A
	Forward current diode		I _F	-	30	A
	Collector power dissipation	One transistor *3	P _c	-	144	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)=125/1.263/(50 x 2.6) x 100=76.1%

*3 : P_c=125°C/IGBT R_{th(j-c)}=125/0.87=144W [Inverter]

P_c=125°C/IGBT R_{th(j-c)}=125/0.87=144W [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

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	-		
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 inductance=54nH		30	-	-	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	75	-	-	A
Over Current Protection Level of Brake circuit	Ioc	Tj=125°C	45	-	-	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)	-	-	0.87	°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	

*9 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	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

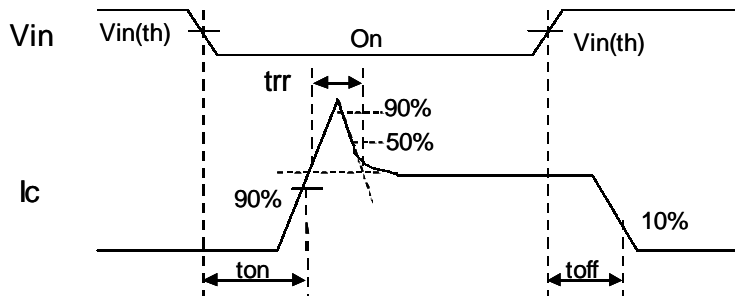
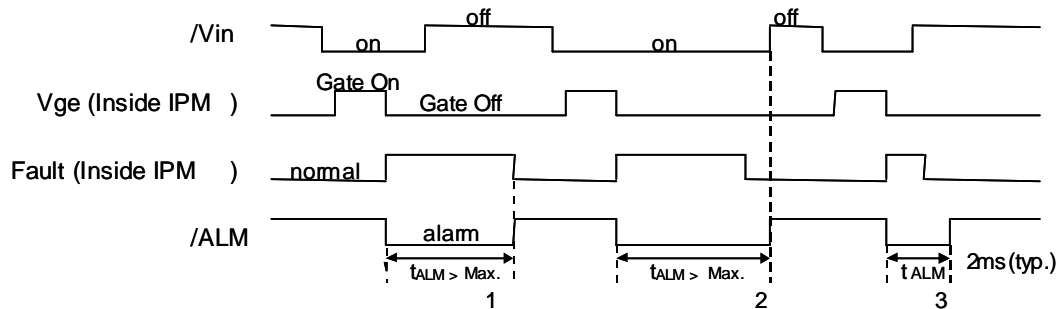


Figure 1. Switching Time Waveform Definitions



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

Figure 2. Input/Output Timing Diagram

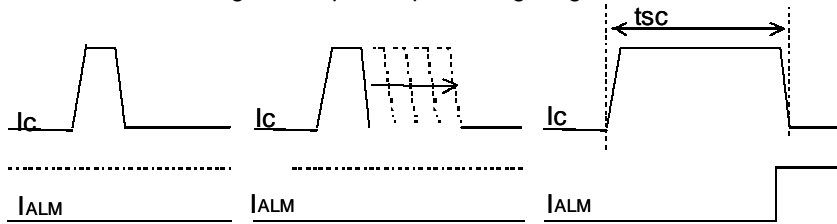


Figure.4 Definition of tsc

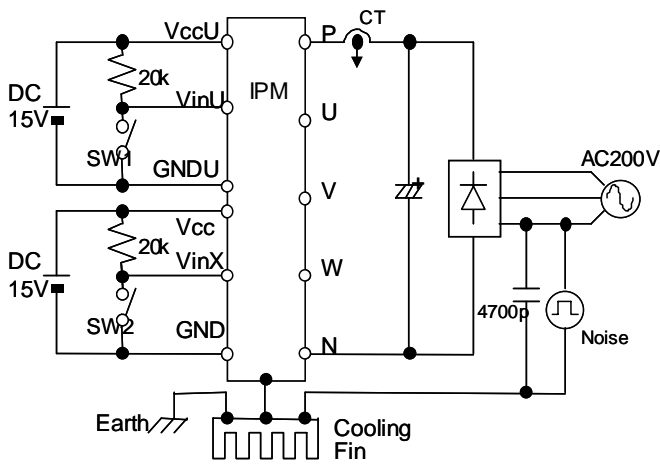


Figure 5. Noise Test Circuit

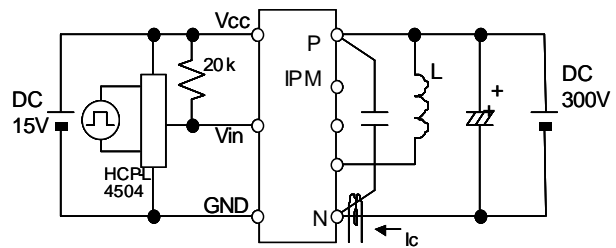


Figure 6. Switching Characteristics Test Circuit

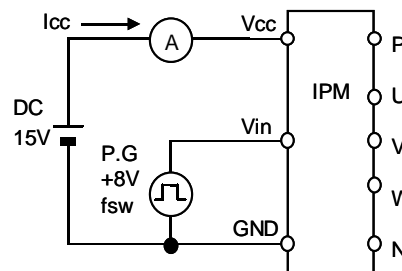
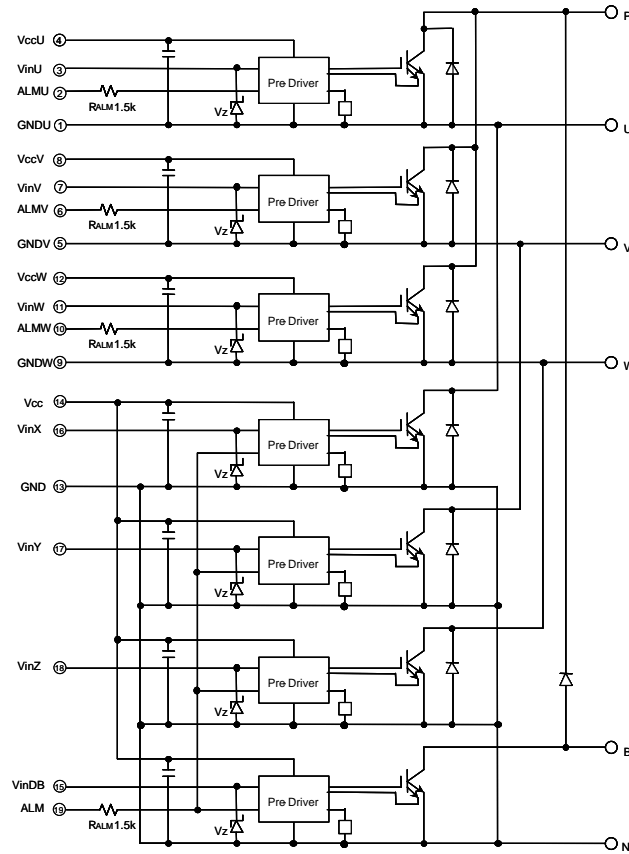


Figure 7. Icc Test Circuit

Block diagram

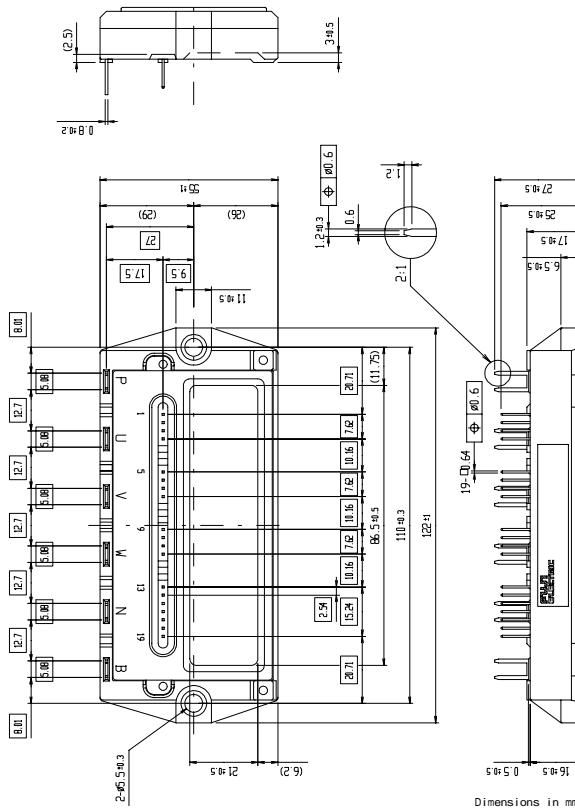


Pre-drivers include following functions

- 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

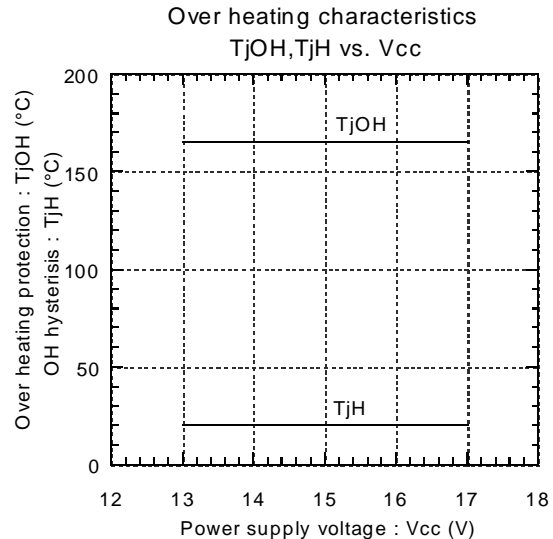
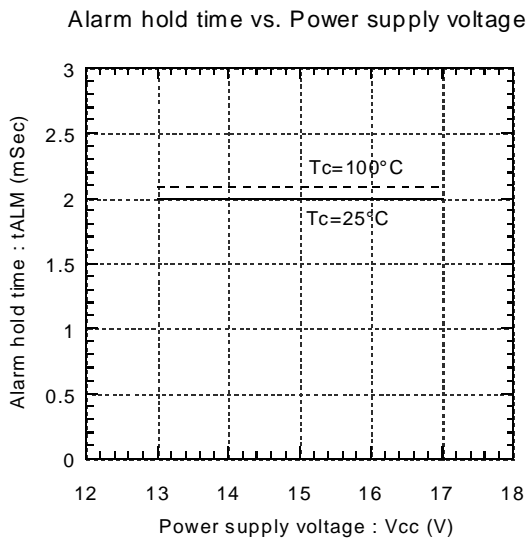
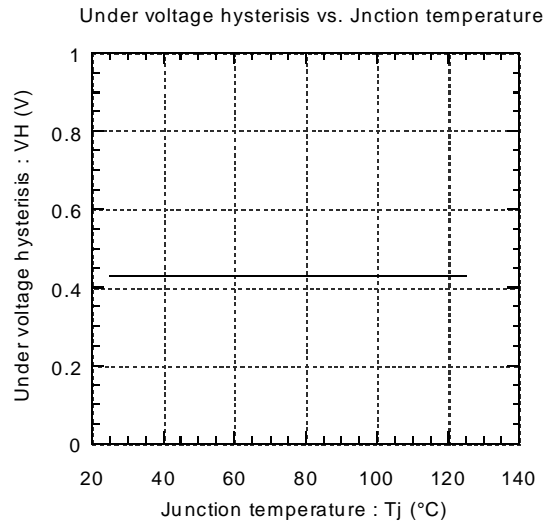
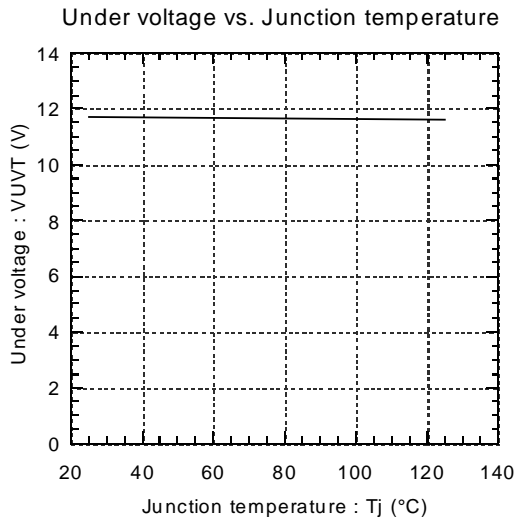
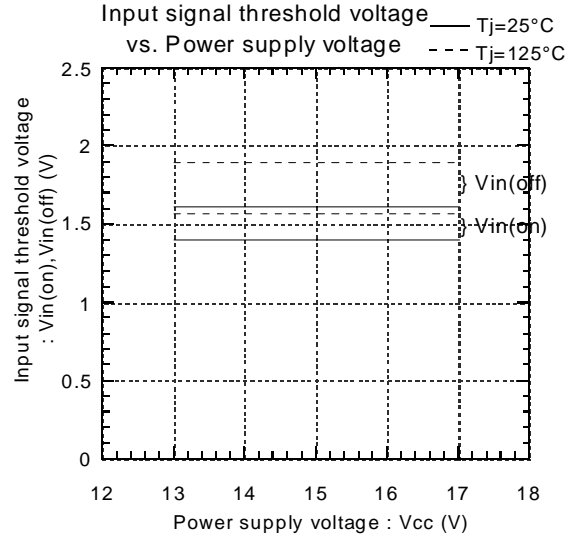
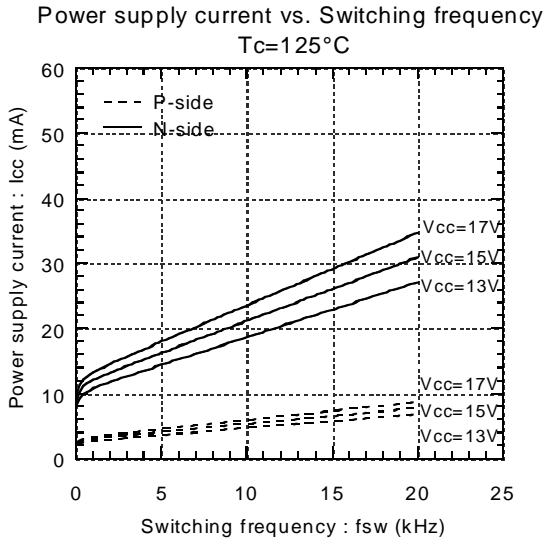
Package type : P622



Mass : 270g

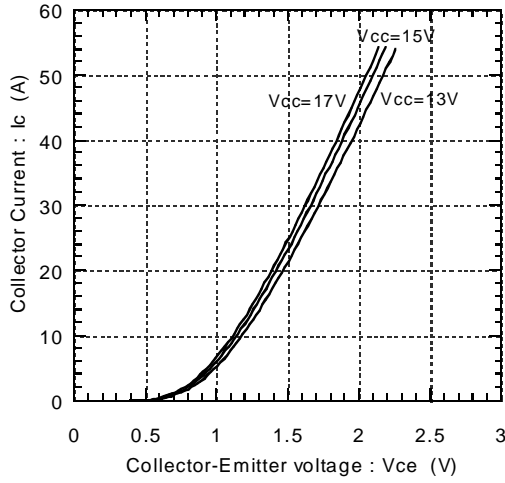
Characteristics

Control circuit characteristics (Representative)

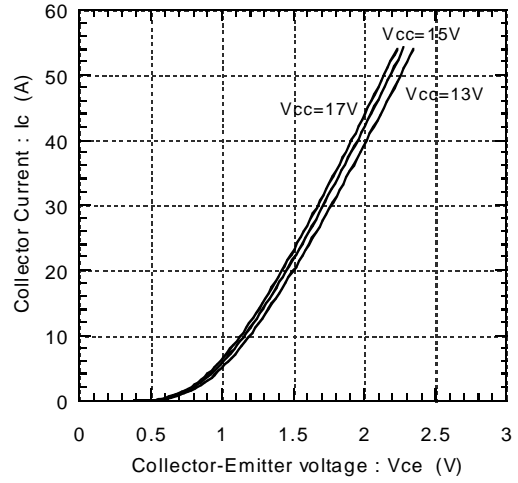


● Main circuit characteristics (Representative)

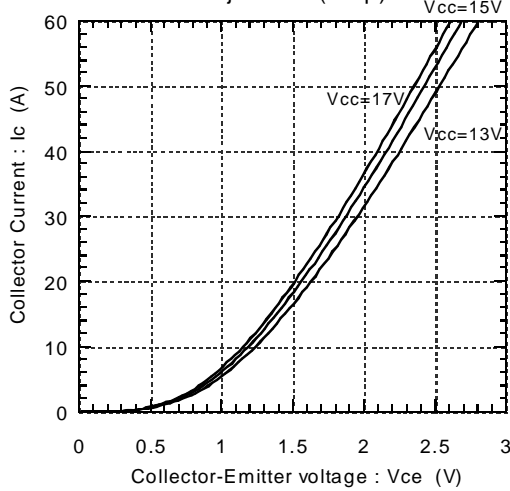
Collector current vs. Collector-Emitter voltage
T_j=25°C(Chip)



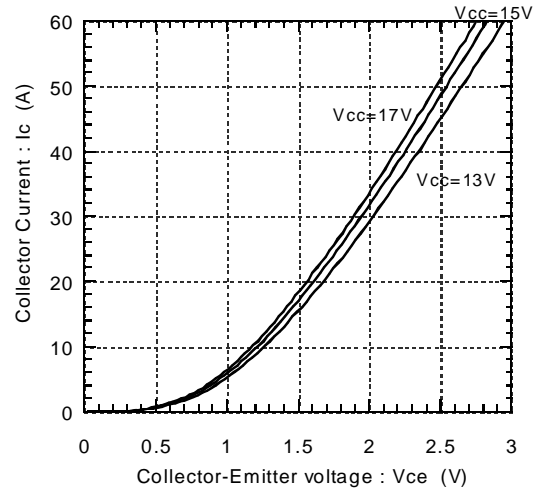
Collector current vs. Collector-Emitter voltage
T_j=25°C(Terminal)



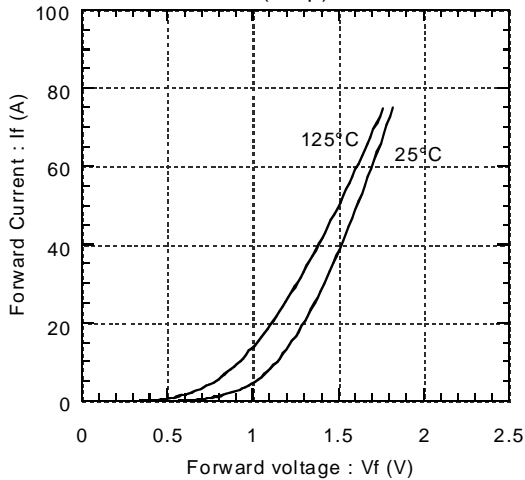
Collector current vs. Collector-Emitter voltage
T_j=125°C(Chip)



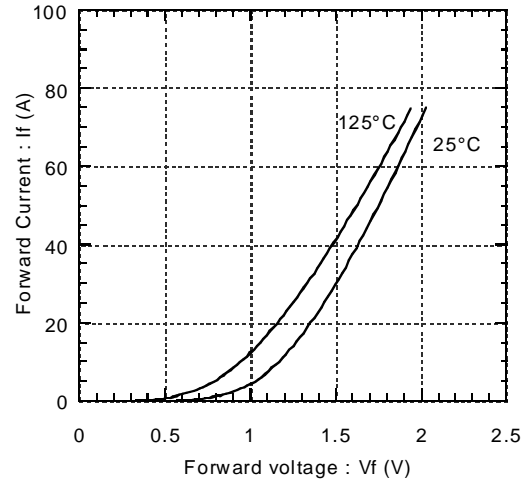
Collector current vs. Collector-Emitter voltage
T_j=125°C(Terminal)

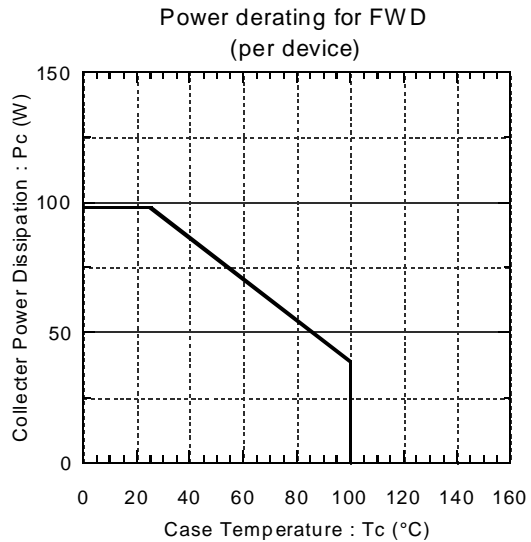
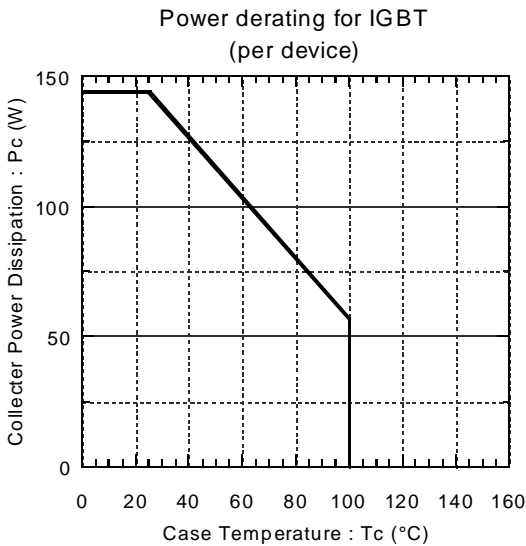
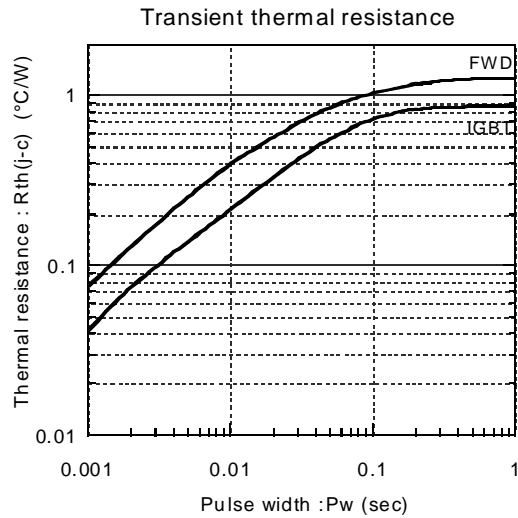
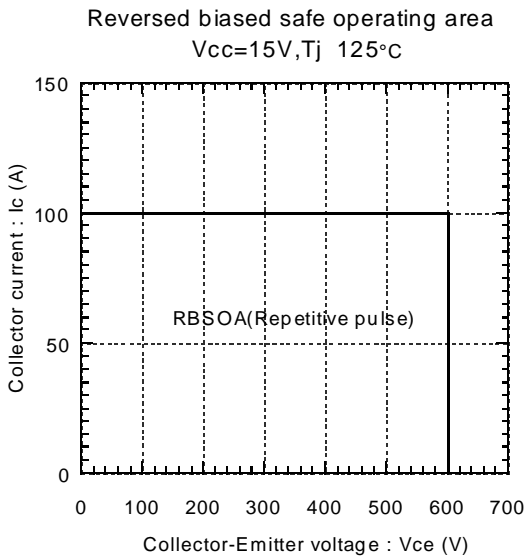
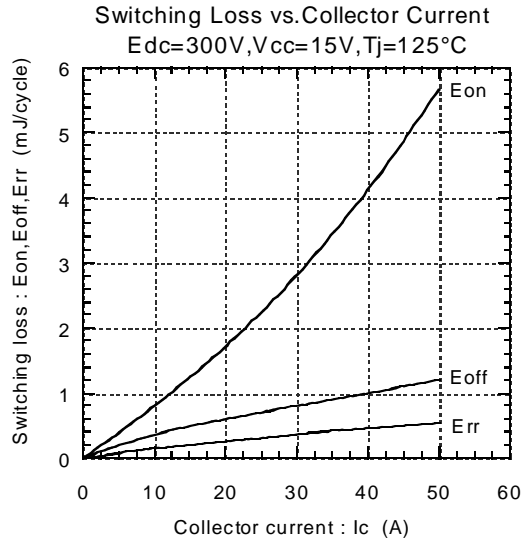
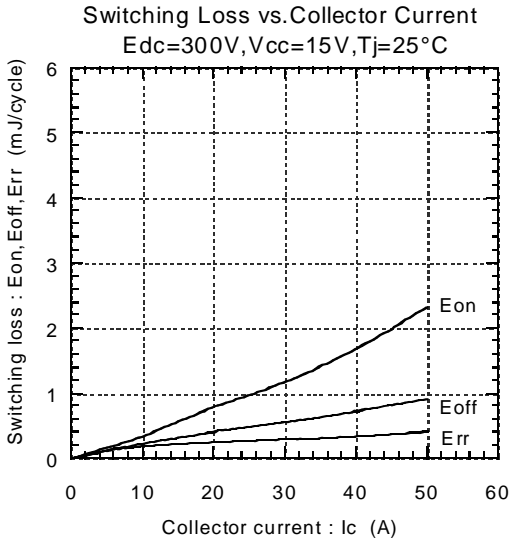


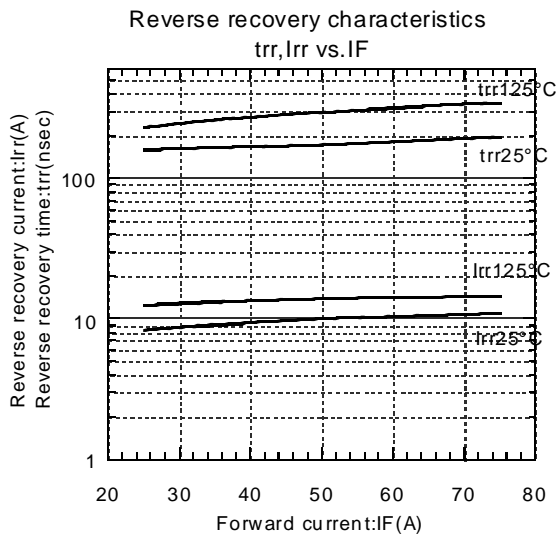
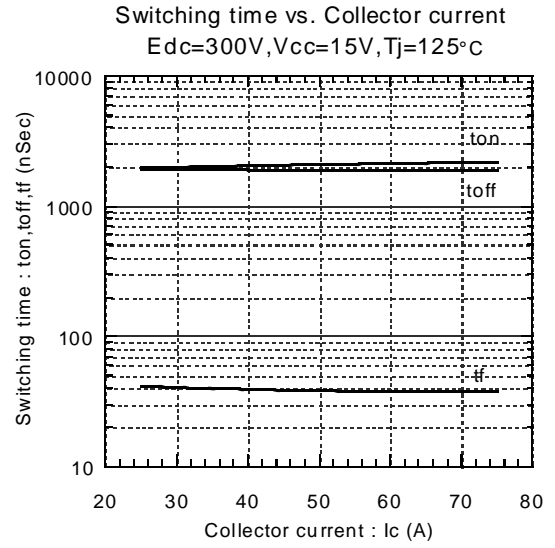
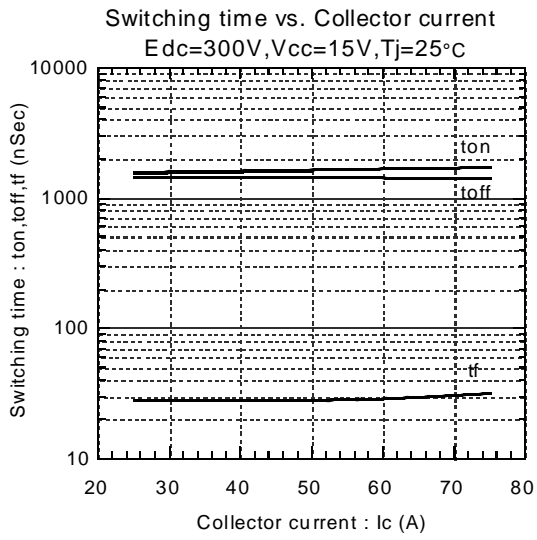
Forward current vs. Forward voltage
(Chip)



Forward current vs. Forward voltage
(Terminal)







Characteristics

Dynamic Brake Characteristics (Representative)

