6MBP50TEA060

e-Front runners

Econo IPM series

600V / 50A 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.	
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
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	℃
Solder temperature *8			T_{sol}	-	260	℃
Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.)			V_{iso}	-	AC2500	V
Screw torque		Mounting (M5)		-	3.5	N·m

Note

*1 : Vces 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 Rth(j-c)/(Ic x VF MAX)=125/1.263/(50 x 2.6) x 100=76.1%

*3 : Pc=125°C/IGBT Rth(j-c)=125/0.87=144W [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, 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.

*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	I_{CES}	V_{CE}=600V Vin terminal open.		-	-	1.0	mA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	Ic=50A	Terminal	-	-	2.5	V
				Chip	-	2.0	-	
	Forward voltage of FWD	V_F	-Ic=50A	Terminal	-	-	2.6	V
				Chip	-	1.6	-	
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)		P_{AV}	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 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
Current limit resistor	R_{ALM}	Alarm terminal	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 Delay time	t_{DOC}	Tj=125°C	-	5	-	µs
SC Protection Delay time	t_{SC}	Tj=125°C Fig.4	-	-	8	µs
IGBT Chip Over Heating	T_{jOH}	Surface of IGBT chips	150		- -	℃
Over Heating Protection Hysteresis	T_{jH}		-	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 *10	Inverter	IGBT	Rth(j-c)	-	-	0.87	°C/W
		FWD	Rth(j-c)	-	-	1.263	°C/W
Case to fin thermal resistance with compound			Rth(c-f)	-	0.05		-°C/W

*10 : (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}	-	-	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

● **Weight**

Item	Symbol	Min.	Typ.	Max.	Unit
Weight	Wt	-	270	-	g

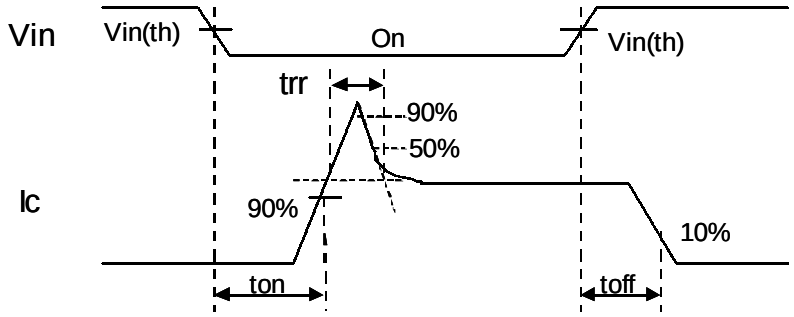
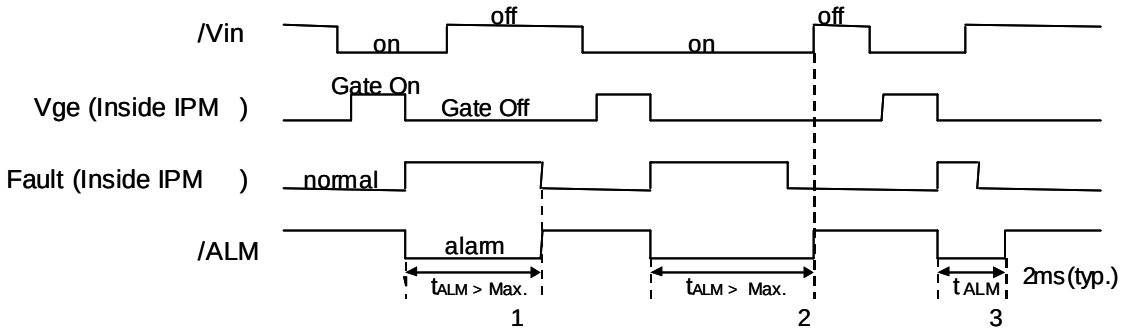


Figure 1. Switching Time Waveform Definitions



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

Figure 2. Input/Output Timing Diagram

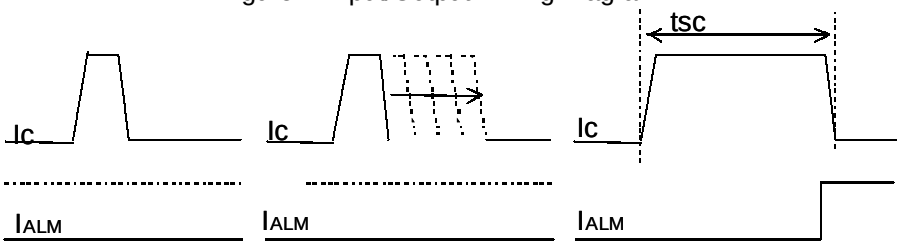


Figure.4 Definition of tsc

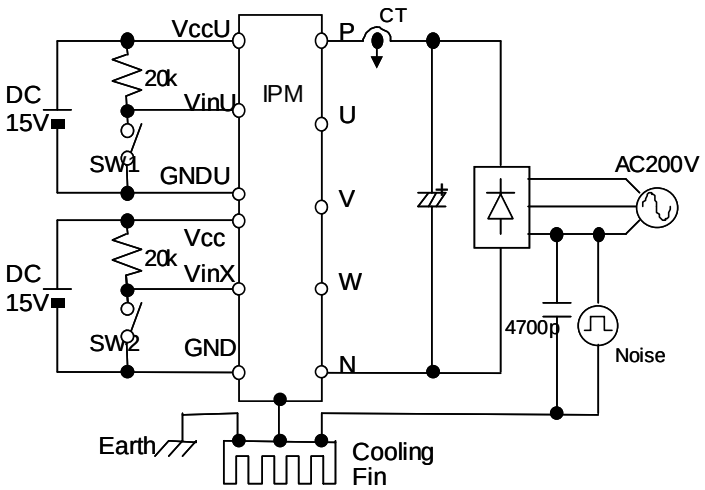


Figure 5. Noise Test Circuit

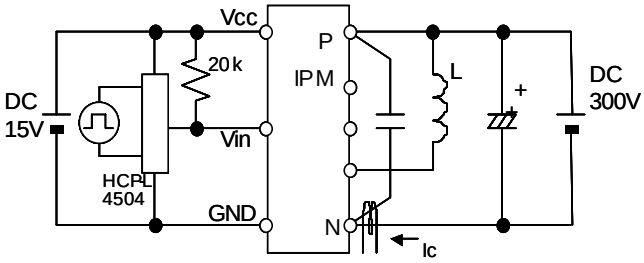


Figure 6. Switching Characteristics Test Circuit

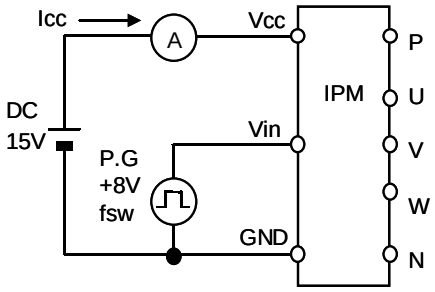
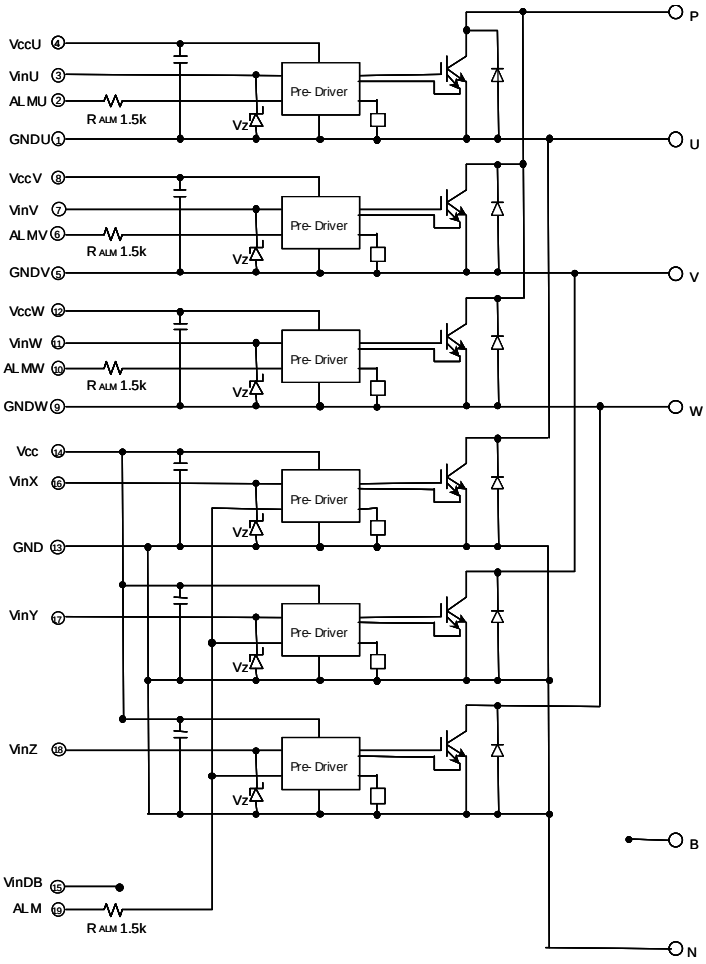


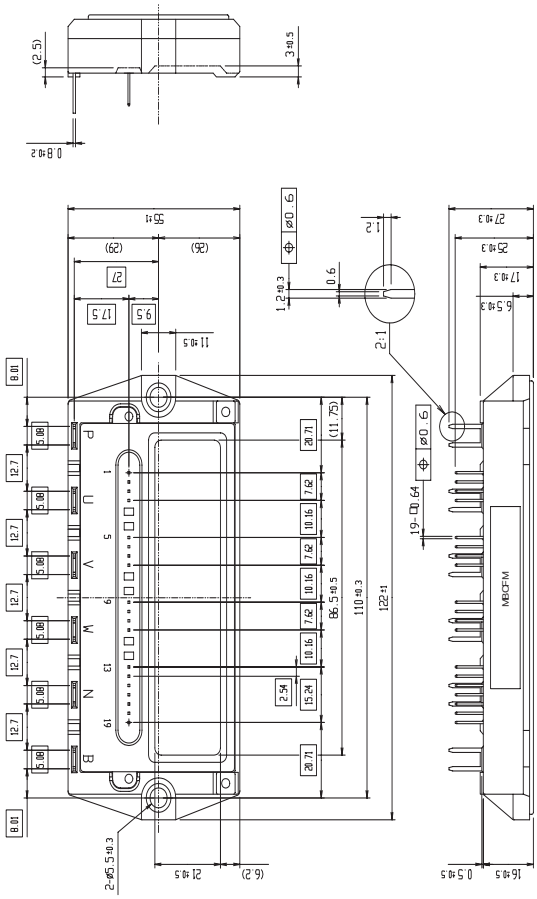
Figure 7. Icc Test Circuit

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

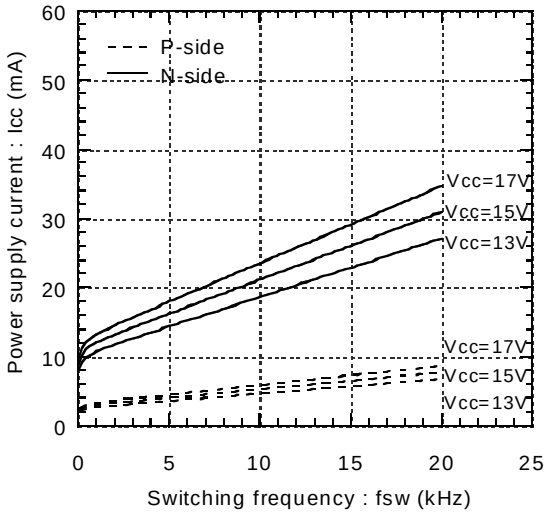


Mass : 270g

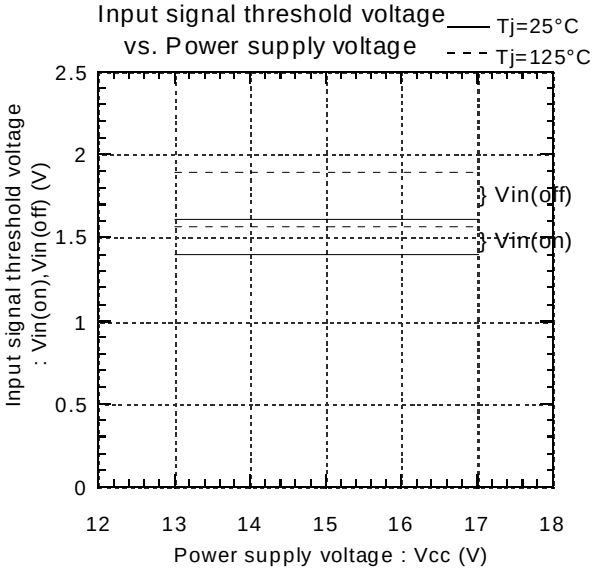
■ Characteristics

● **Control circuit characteristics (Respresentative)**

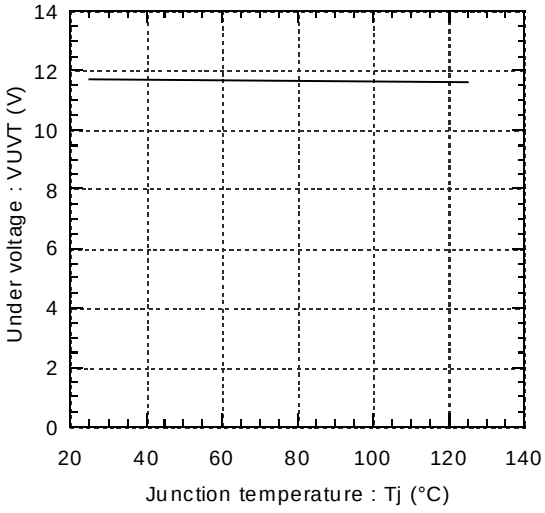
Power supply current vs. Switching frequency
Tc=125°C



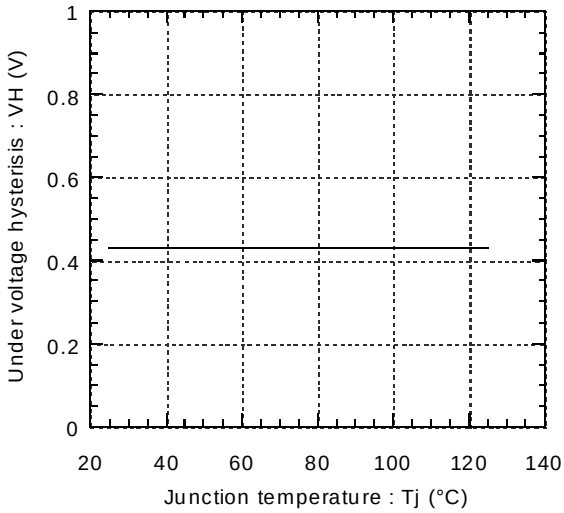
Input signal threshold voltage
vs. Power supply voltage



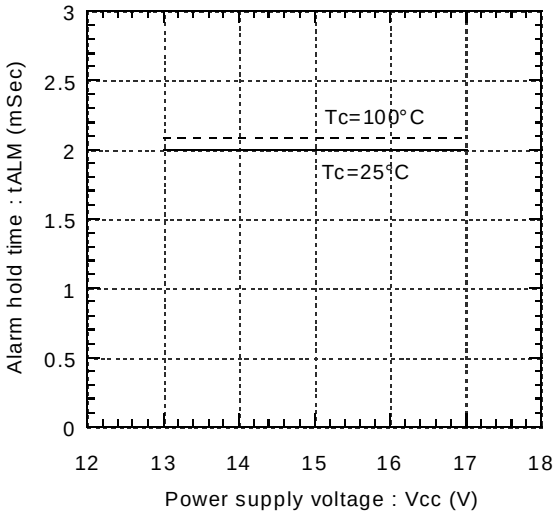
Under voltage vs. Junction temperature



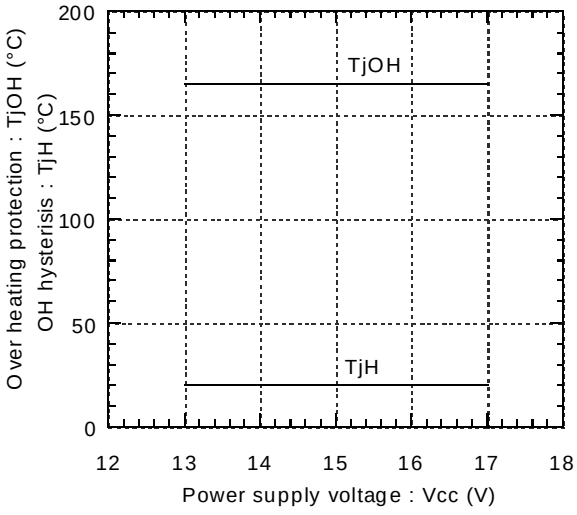
Under voltage hysterisis vs. Jnction temperature



Alarm hold time vs. Power supply voltage

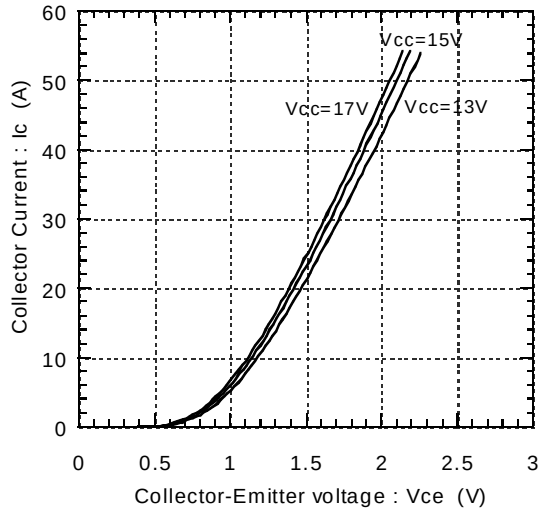


Over heating characteristics
TjOH,TjH vs. Vcc

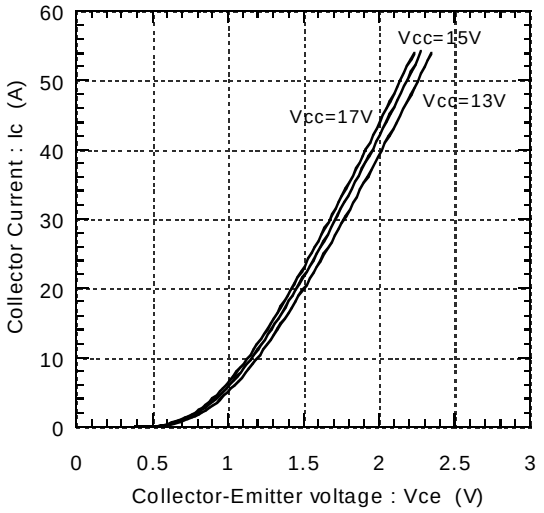


● **Main circuit characteristics (Respresentative)**

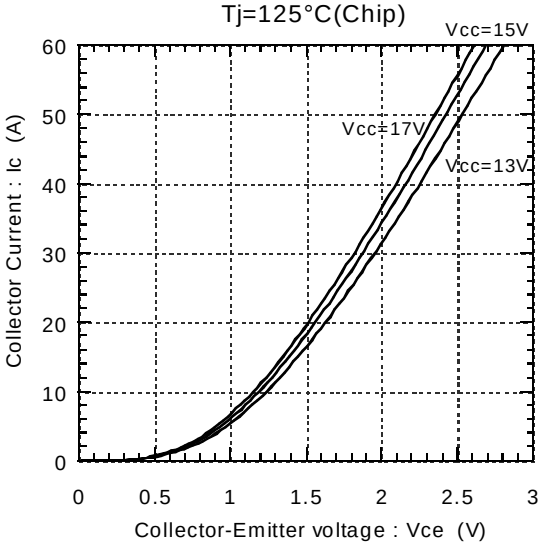
Collector current vs. Collector-Emitter voltage
Tj=25°C(Chip)



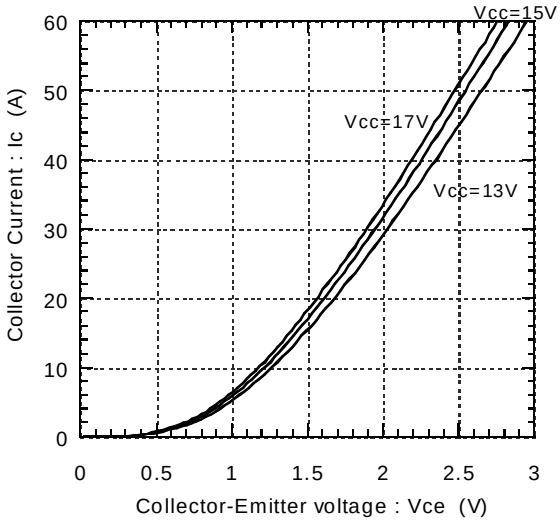
Collector current vs. Collector-Emitter voltage
Tj=25°C(Terminal)



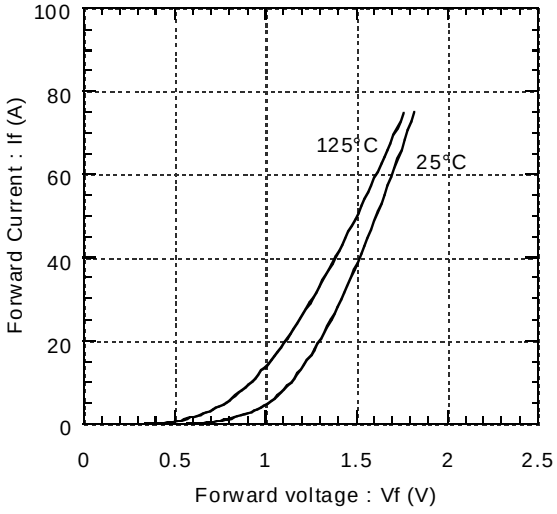
Collector current vs. Collector-Emitter voltage
Tj=125°C(Chip)



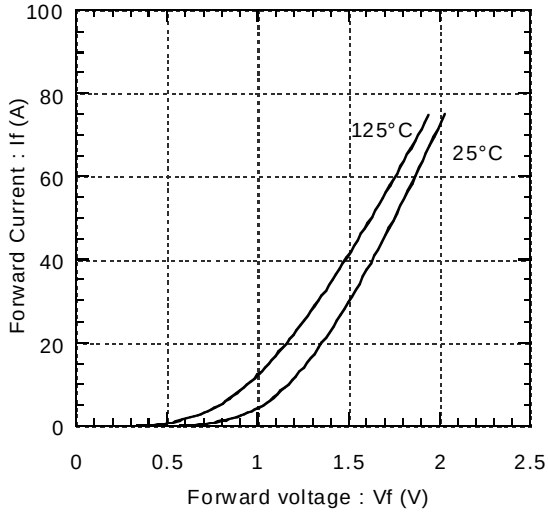
Collector current vs. Collector-Emitter voltage
Tj=125°C(Terminal)



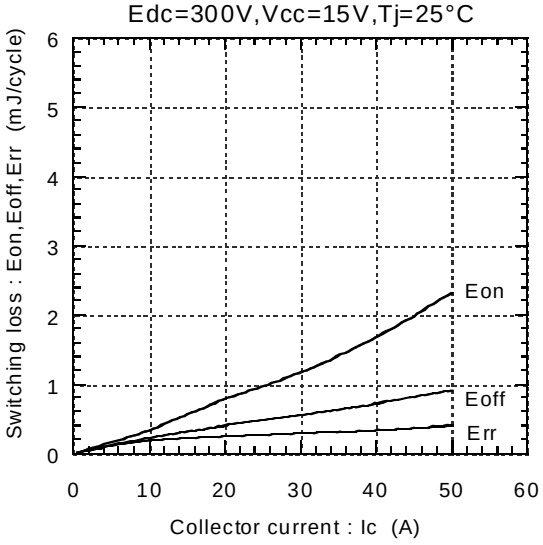
Forward current vs. Forward voltage
(Chip)



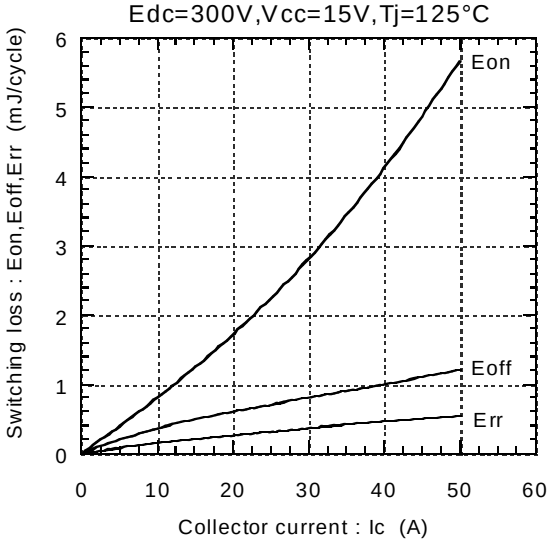
Forward current vs. Forward voltage
(Terminal)



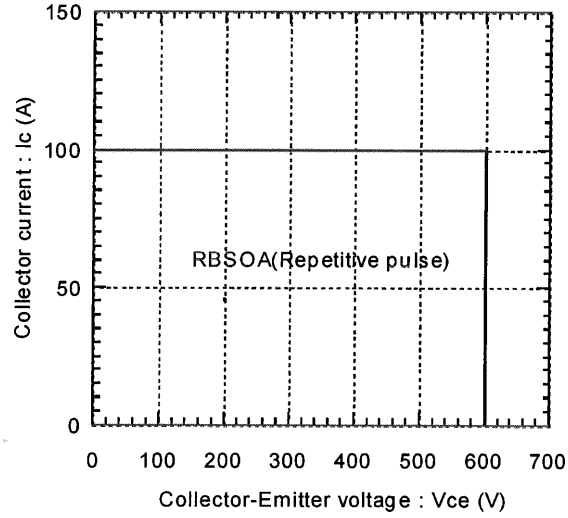
Switching Loss vs.Collector Current
Edc=300V,Vcc=15V,Tj=25°C



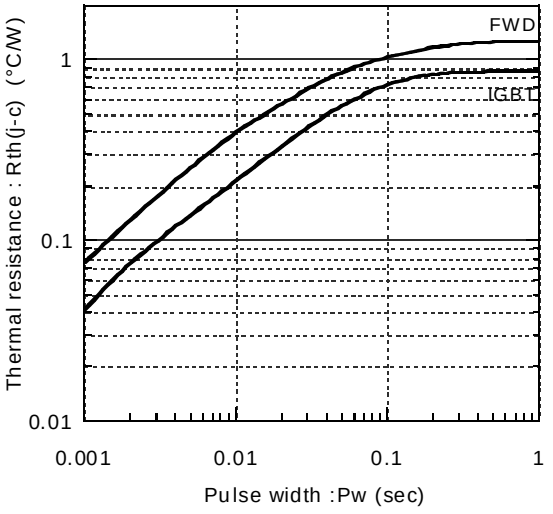
Switching Loss vs.Collector Current
Edc=300V,Vcc=15V,Tj=125°C



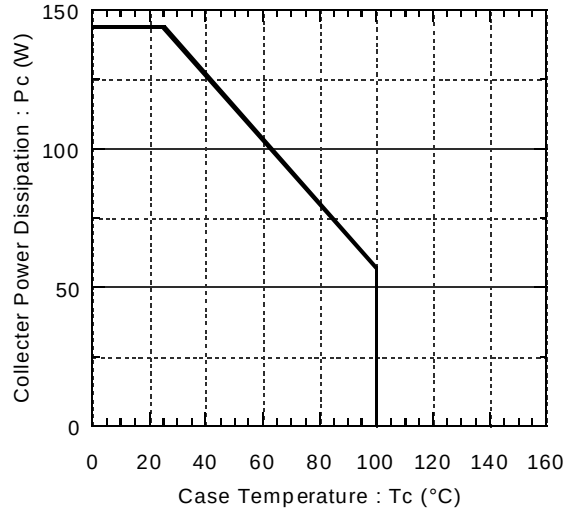
Reversed biased safe operating area
Vcc=15V,Tj≦125°C



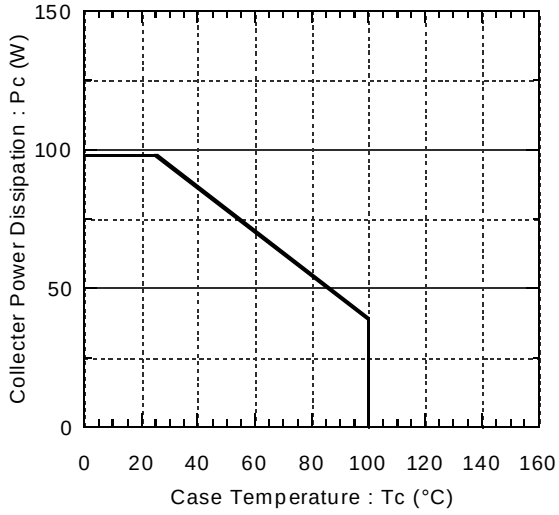
Transient thermal resistance



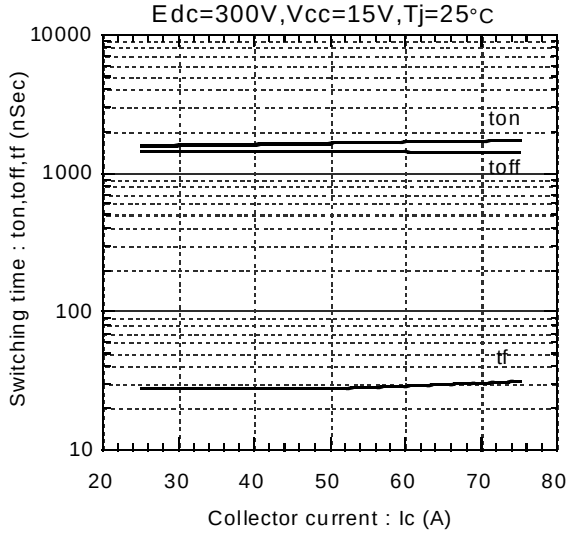
Power derating for IGBT
(per device)



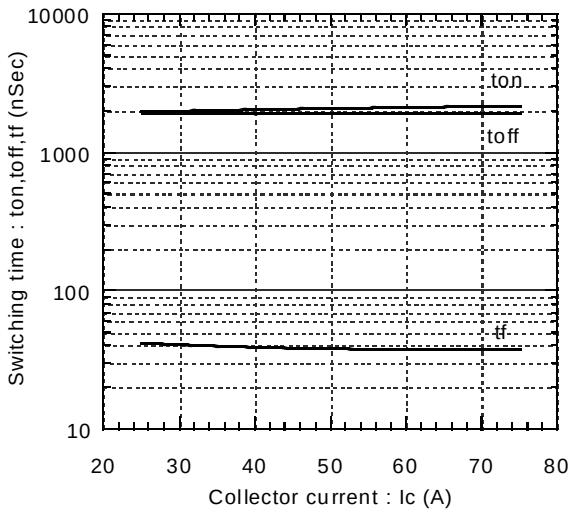
Power derating for FWD
(per device)



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



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



Reverse recovery characteristics
trr,Irr vs.IF