

7MBP300RA060

IGBT-IPM R series

600V / 300A 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 $T_c=25^\circ\text{C}$ unless otherwise specified)

Item	Symbol	Rating		Unit	
		Min.	Max.		
DC bus voltage	V_{DC}	0	450	V	
DC bus voltage (surge)	$V_{DC(surge)}$	0	500	V	
DC bus voltage (short operating)	V_{SC}	200	400	V	
Collector-Emitter voltage	V_{CES}	0	600	V	
DB Reverse voltage	V_R	-	600	V	
INV Collector current	DC	I_C	-	300	A
	1ms	I_{CP}	-	600	A
	Duty=55.5%	$-I_C$	-	300	A
Collector power dissipation	One transistor	P_C	-	1040	W
DB Collector current	DC	I_C	-	100	A
	1ms	I_{CP}	-	200	A
Forward current of Diode		I_F	-	100	A
Collector power dissipation	One transistor	P_C	-	400	W
Junction temperature	T_j	-	150	$^\circ\text{C}$	
Input voltage of power supply for Pre-Driver	V_{CC}^*1	0	20	V	
Input signal voltage	V_{in}^*2	0	V_Z	V	
Input signal current	I_{in}	-	1	mA	
Alarm signal voltage	V_{ALM}^*3	0	V_{CC}	V	
Alarm signal current	I_{ALM}^*4	-	15	mA	
Storage temperature	T_{stg}	-40	125	$^\circ\text{C}$	
Operating case temperature	T_{op}	-20	100	$^\circ\text{C}$	
Isolating voltage (Case-Terminal)	V_{iso}^*5	-	AC2.5	kV	
Screw torque	Mounting (M5)		-	3.5 ^{*6}	N·m
	Terminal (M5)		-	3.5 ^{*6}	N·m

*1 Apply V_{CC} between terminal No. 3 and 1, 6 and 4, 9 and 7, 11 and 10.

*2 Apply V_{in} between terminal No. 2 and 1, 5 and 4, 8 and 7, 12,13,14,15 and 10.

*3 Apply V_{ALM} between terminal No. 16 and 10.

*4 Apply I_{ALM} to terminal No. 16.

*5 50Hz/60Hz sine wave 1 minute.

*6 Recommendable Value : 2.5 to 3.0 N·m

- Electrical characteristics of power circuit (at $T_c=T_j=25^\circ\text{C}$, $V_{CC}=15\text{V}$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
INV	Collector current at off signal input	I_{CES}	$V_{CE}=600\text{V}$ input terminal open	-	-	1.0	mA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	$I_C=300\text{A}$	-	-	2.8	V
	Forward voltage of FWD	V_F	$-I_C=300\text{A}$	-	-	3.0	V
DB	Collector current at off signal input	I_{CES}	$V_{CE}=600\text{V}$ input terminal open	-	-	1.0	mA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	$I_C=100\text{A}$	-	-	2.8	V
	Forward voltage of Diode	V_F	$-I_C=100\text{A}$	-	-	3.0	V

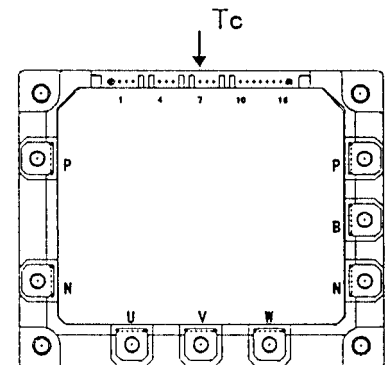


Fig.1 Measurement of case temperature

● Electrical characteristics of control circuit(at $T_c=T_j=25^\circ\text{C}$, $V_{cc}=15\text{V}$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Power supply current of P-line side Pre-driver(one unit)	I_{ccp}	$f_{sw}=0$ to 15kHz $T_c=-20$ to 100°C *7	6	-	32	mA	
Power supply current of N-line side three Pre-driver	I_{ccn}	$f_{sw}=0$ to 15kHz $T_c=-20$ to 100°C *7	24	-	114	mA	
Input signal threshold voltage (on/off)	$V_{in(th)}$	ON	1.00	1.35	1.70	V	
		OFF	1.70	2.05	2.40	V	
Input zener voltage	V_z	$R_{in}=20\text{k ohm}$	-	8.0	-	V	
Over heating protection temperature level	T_{COH}	$V_{DC}=0\text{V}$, $I_c=0\text{A}$, Case temperature, Fig.1	110	-	125	$^\circ\text{C}$	
Hysteresis	T_{CH}		-	20	-	$^\circ\text{C}$	
IGBT chips over heating protection temperature level	T_{jOH}	surface of IGBT chips	150	-	-	$^\circ\text{C}$	
Hysteresis	T_{jH}		-	20	-	$^\circ\text{C}$	
Collector current protection level	INV	I_{oc}	$T_j=125^\circ\text{C}$	450	-	-	A
	DB	I_{oc}	$T_j=125^\circ\text{C}$	150	-	-	A
Over current protection delay time (Fig.2)	t_{DOC}	$T_j=25^\circ\text{C}$ Fig.2	-	10	-	μs	
Under voltage protection level	V_{UV}		11.0	-	12.5	V	
Hysteresis	V_H		0.2	-	-	V	
Alarm signal hold time	t_{ALM}		1.5	2	-	ms	
SC protection delay time	t_{SC}	$T_j=25^\circ\text{C}$ Fig.3	-	-	12	μs	
Limiting resistor for alarm	R_{ALM}		1425	1500	1575	ohm	

*7 Switching frequency of IPM

● Dynamic characteristics(at $T_c=T_j=125^\circ\text{C}$, $V_{cc}=15\text{V}$)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Switching time (IGBT)	t_{on}	$I_C=300\text{A}$, $V_{DC}=300\text{V}$	0.3	-	-	μs
	t_{off}		-	-	3.6	μs
Switching time (FWD)	t_{rr}	$I_F=300\text{A}$, $V_{DC}=300\text{V}$	-	-	0.4	μs

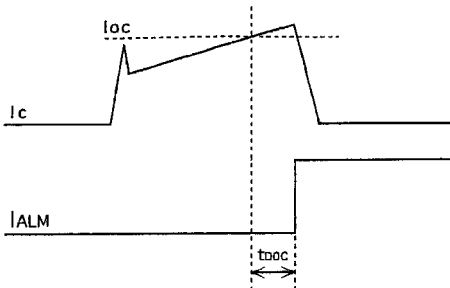


Fig.2 Definition of OC delay time

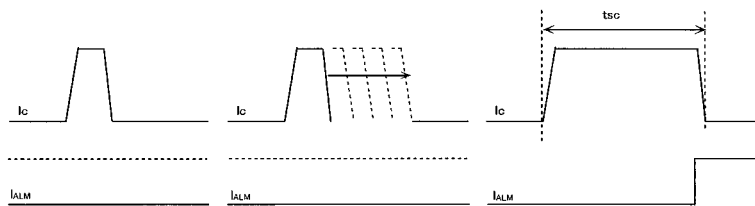


Fig.3 Definition of t_{sc}

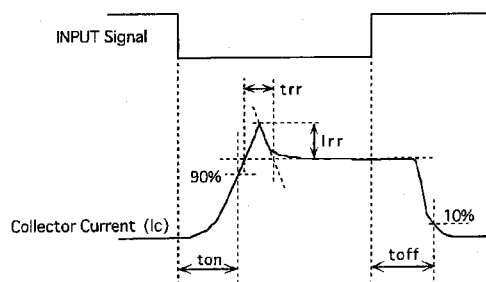


Fig.4 Definition of switching time

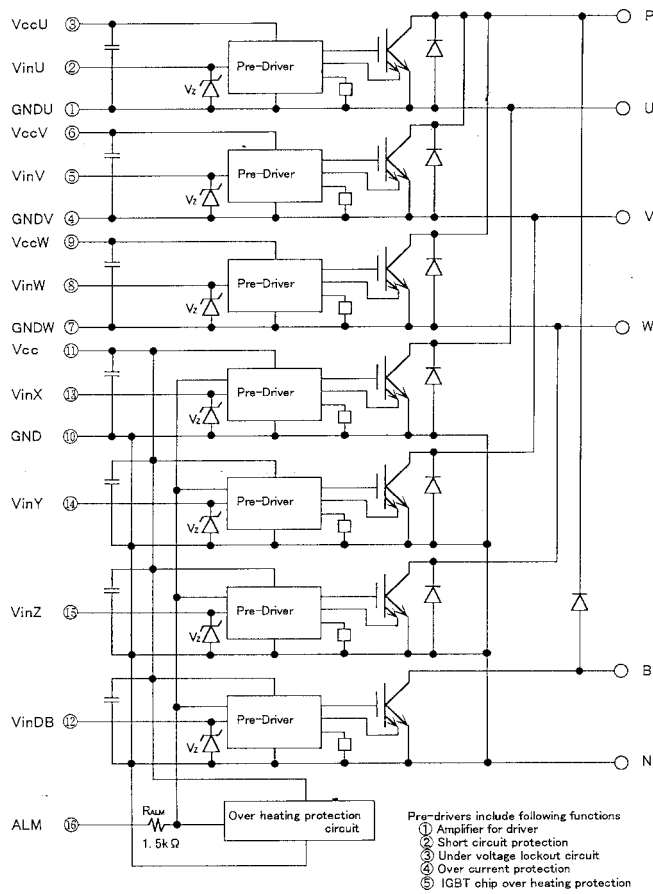
● Thermal characteristics($T_c=25^\circ\text{C}$)

Item	Symbol	Typ.	Max.	Unit		
Junction to Case thermal resistance	INV	IGBT	$R_{th(j-c)}$	-	0.12	$^\circ\text{C/W}$
		FWD	$R_{th(j-c)}$	-	0.25	$^\circ\text{C/W}$
	DB	IGBT	$R_{th(j-c)}$	-	0.31	$^\circ\text{C/W}$
Case to fin thermal resistance with compound	$R_{th(c-f)}$	0.05	-	$^\circ\text{C/W}$		

● Recommendable value

Item	Symbol	Min.	Typ.	Max.	Unit	
DC bus voltage	V_{DC}	200	-	400	V	
Operating power supply voltage range of Pre-driver	V_{CC}	13.5	15	16.5	V	
Switching frequency of IPM	f_{sw}	1	-	20	kHz	
Screw torque	Mounting (M5)	-	2.5	-	3.0	N·m
	Terminal (M5)	-	2.5	-	3.0	N·m

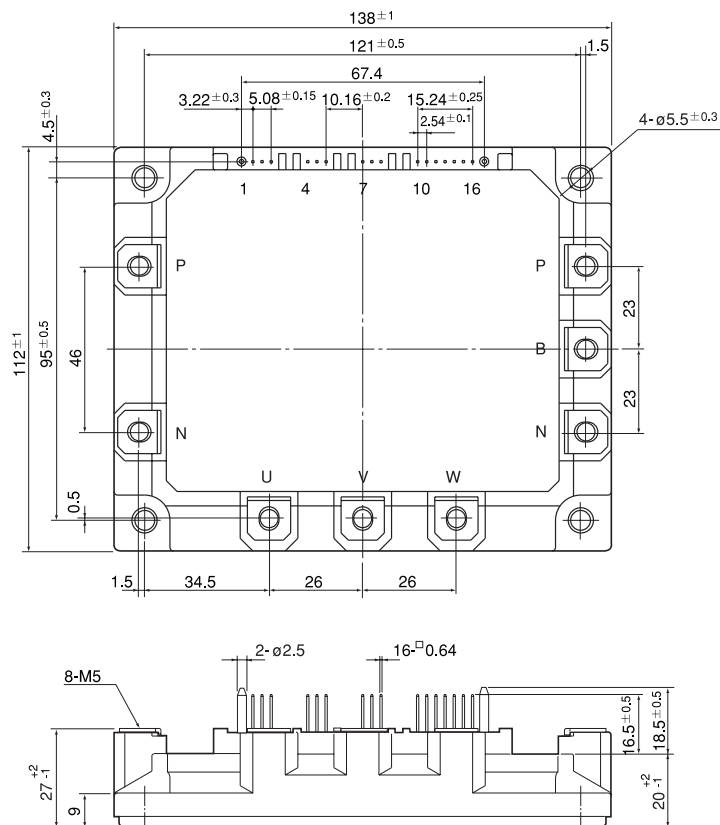
Block diagram



Pre-drivers include following functions

- a) Amplifier for driver
- b) Short circuit protection
- c) Undervoltage lockout circuit
- d) Over current protection
- e) IGBT chip over heating protection

Outline drawings, mm

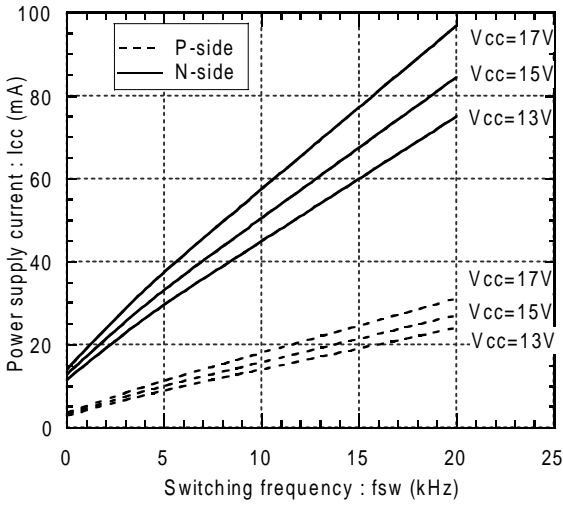


Mass : 920g

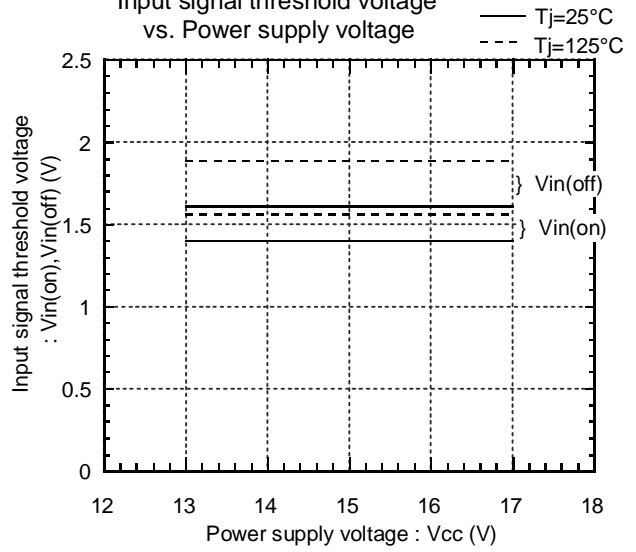
Characteristics (Representative)

Control circuit

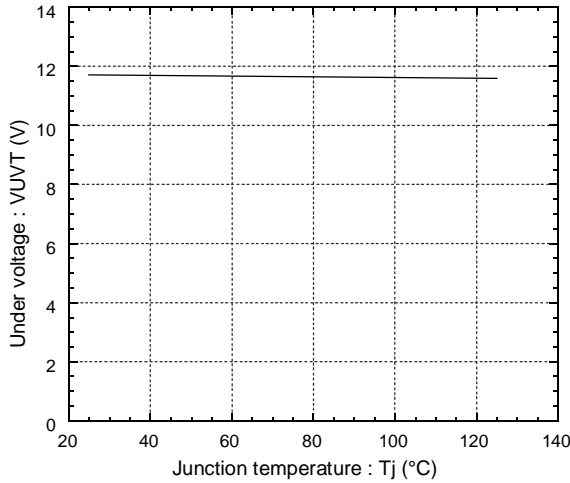
Power supply current vs. Switching frequency
Tj=100°C



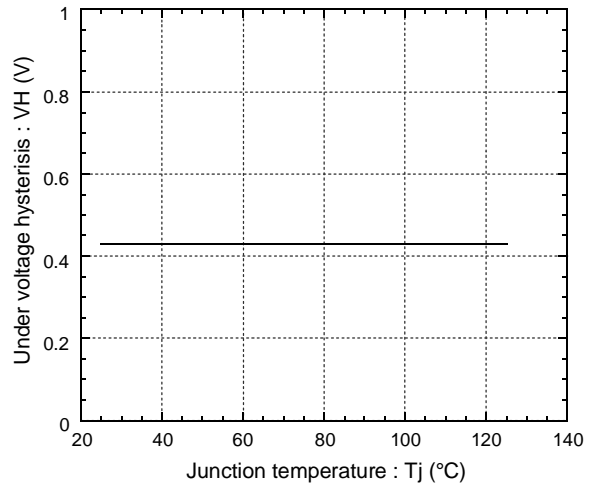
Input signal threshold voltage vs. Power supply voltage



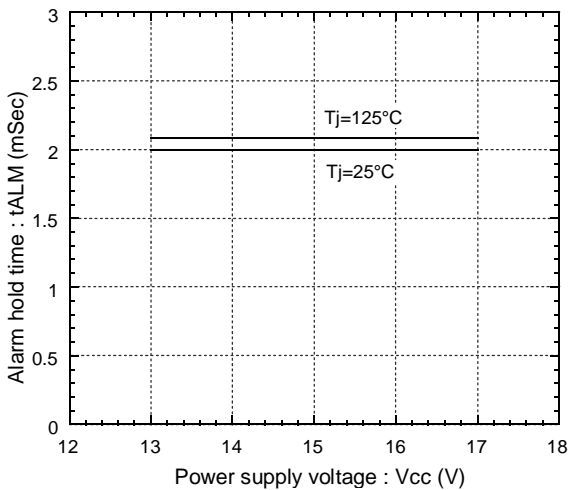
Under voltage vs. Junction temperature



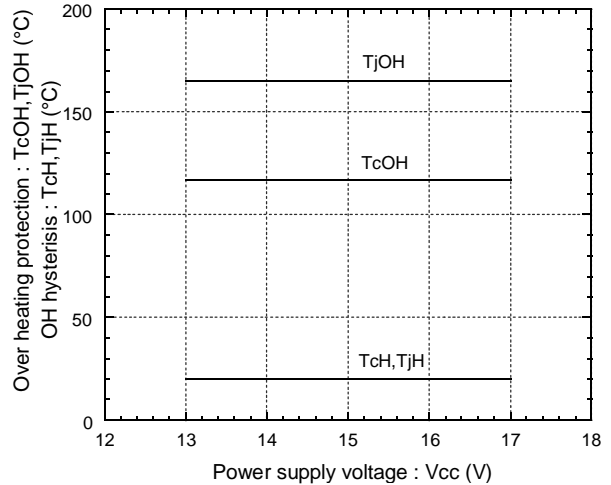
Under voltage hysteresis vs. Junction temperature



Alarm hold time vs. Power supply voltage

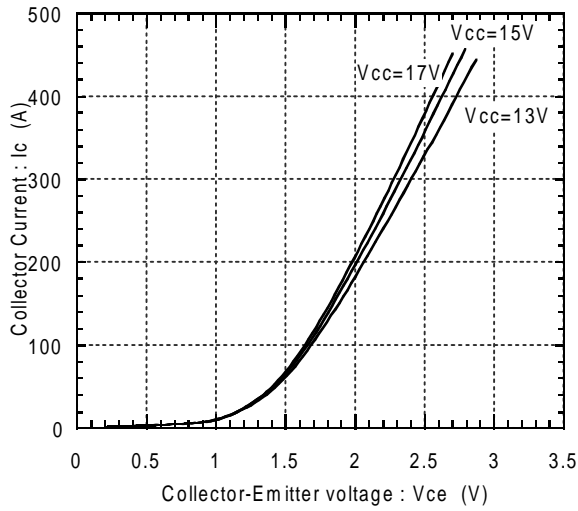


Over heating characteristics
TcOH, TjOH, TcH, TjH vs. Vcc

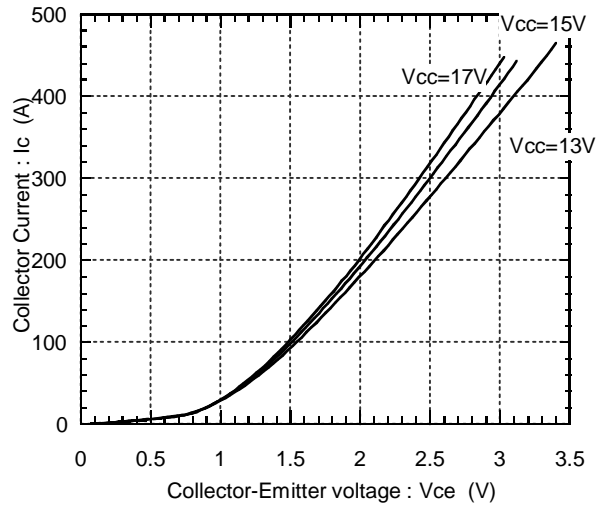


● Inverter

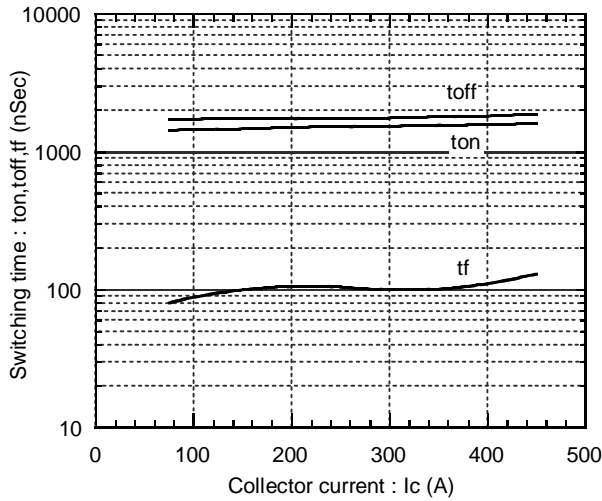
Collector current vs. Collector-Emitter voltage
T_j=25°C



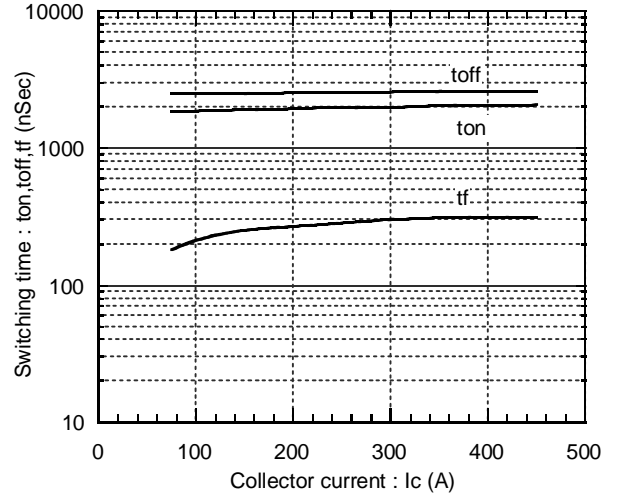
Collector current vs. Collector-Emitter voltage
T_j=125°C



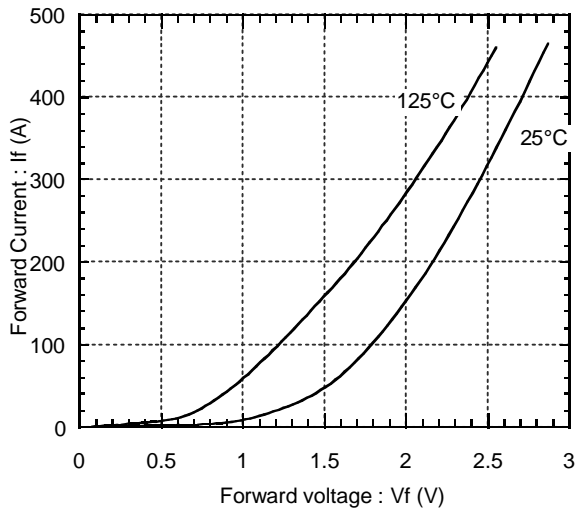
Switching time vs. Collector current
E_{dc}=300V, V_{cc}=15V, T_j=25°C



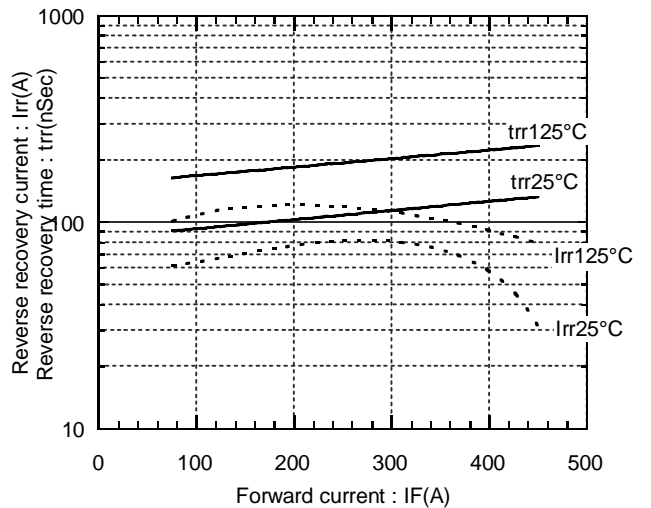
Switching time vs. Collector current
E_{dc}=300V, V_{cc}=15V, T_j=125°C



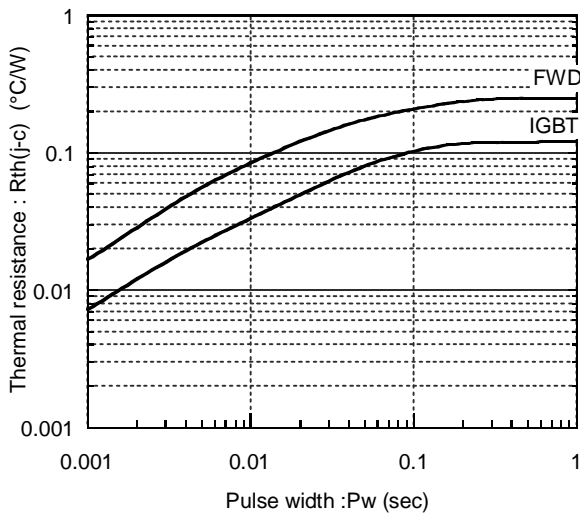
Forward current vs. Forward voltage



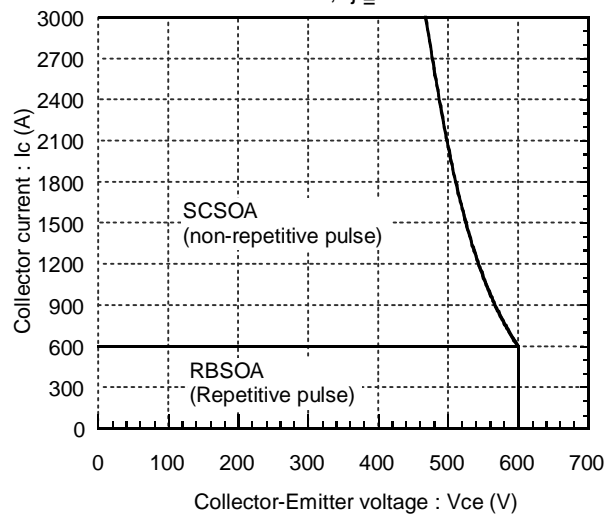
Reverse recovery characteristics
trr, Irr vs. IF



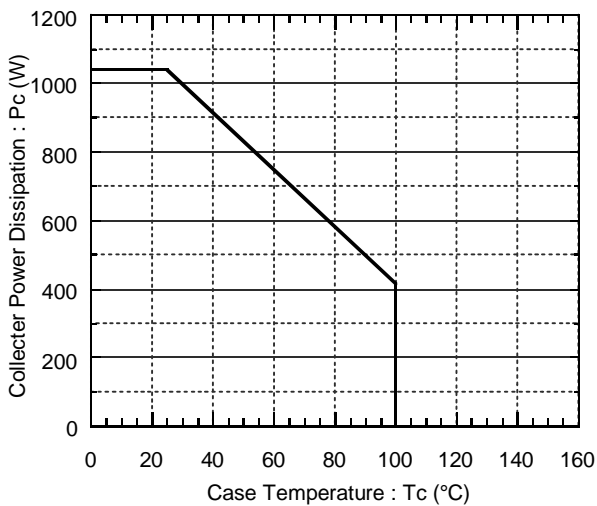
Transient thermal resistance



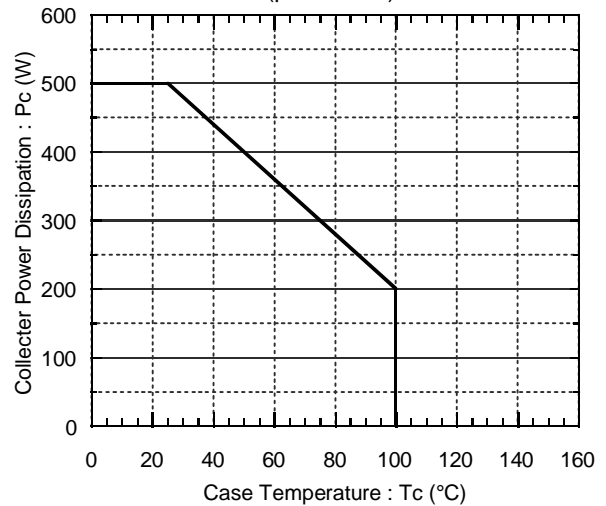
Reversed biased safe operating area
 $V_{cc}=15V, T_j \leq 125^{\circ}C$



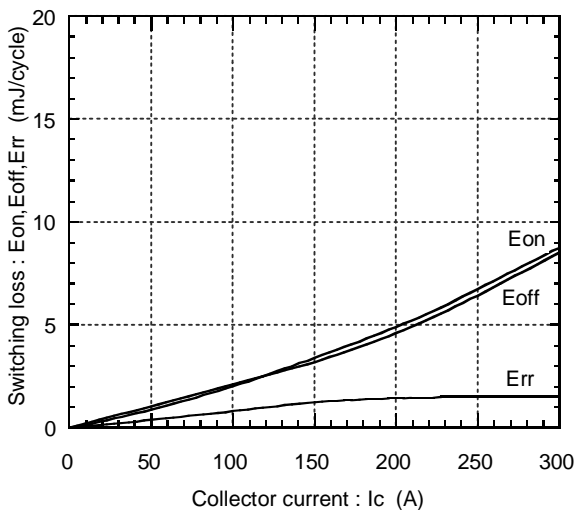
Power derating for IGBT
(per device)



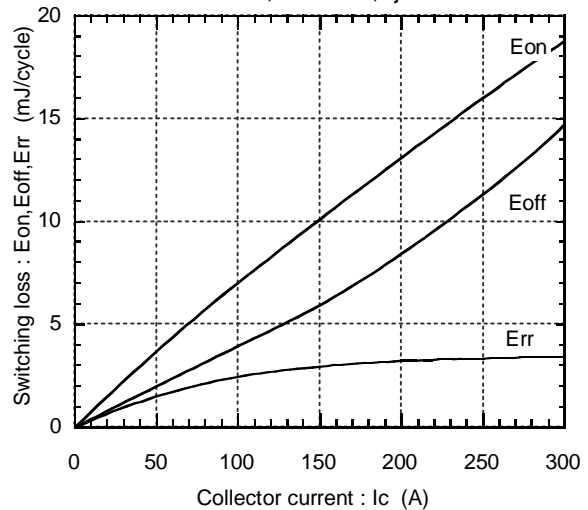
Power derating for FWD
(per device)

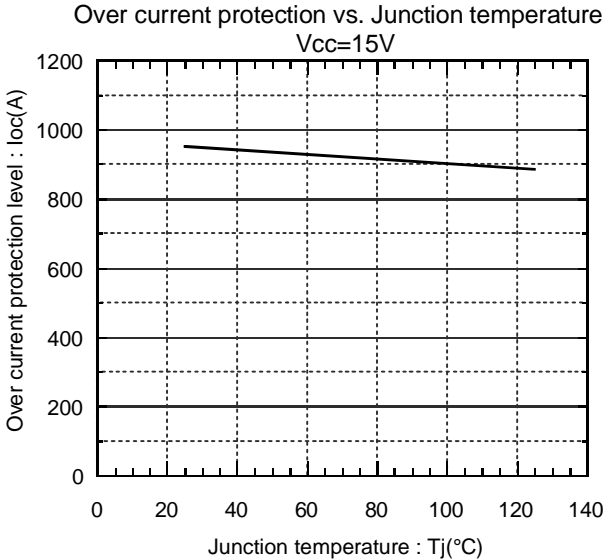


Switching Loss vs. Collector Current
 $E_{dc}=300V, V_{cc}=15V, T_j=25^{\circ}C$



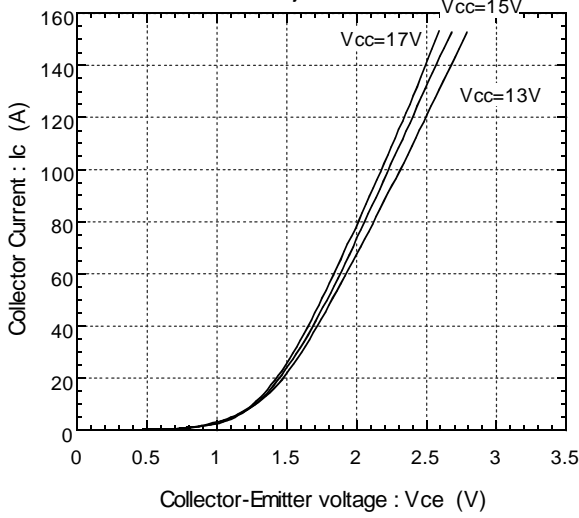
Switching Loss vs. Collector Current
 $E_{dc}=300V, V_{cc}=15V, T_j=125^{\circ}C$



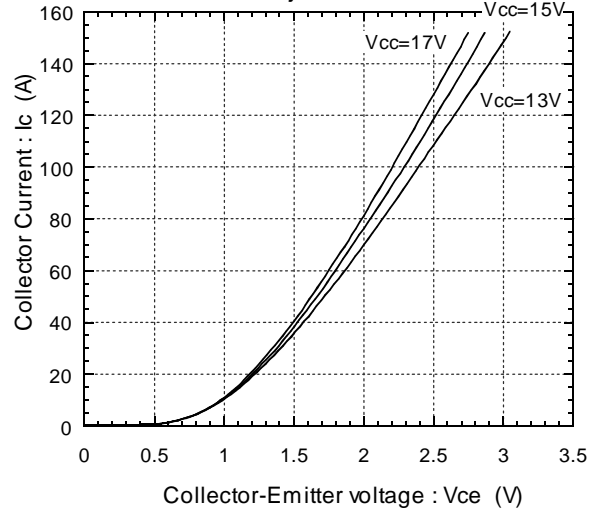


● Brake

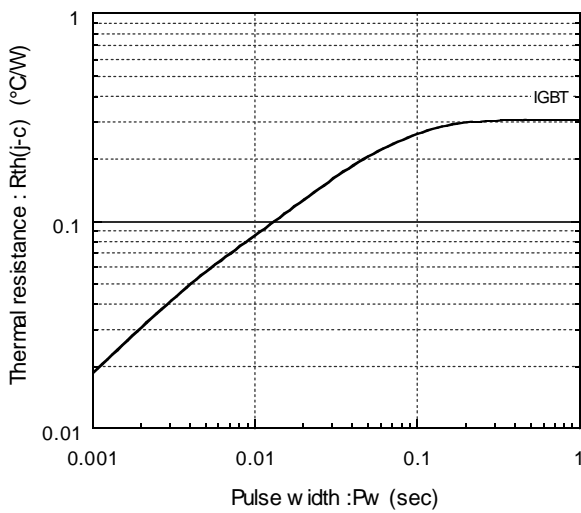
Collector current vs. Collector-Emitter voltage
T_j=25°C



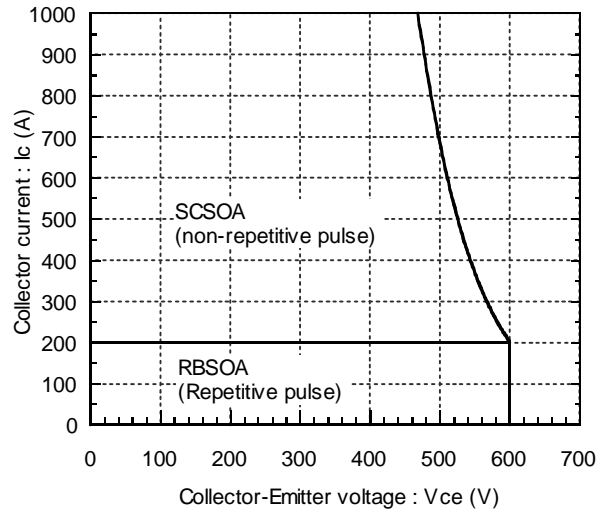
Collector current vs. Collector-Emitter voltage
T_j=125°C



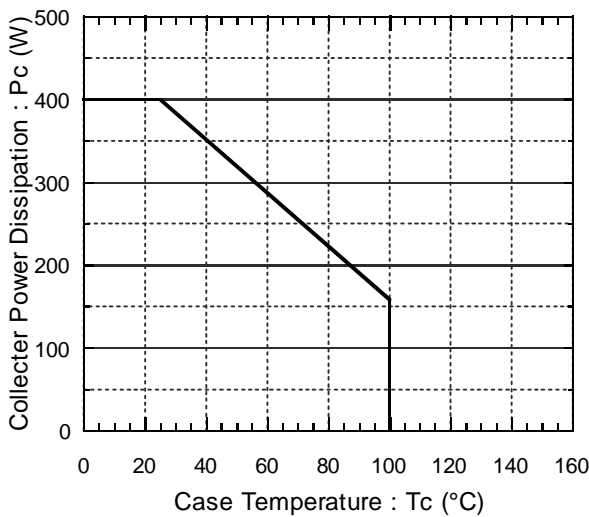
Transient thermal resistance



Reversed biased safe operating area
V_{cc}=15V, T_j ≤ 125°C



Power derating for IGBT
(per device)



Over current protection vs. Junction temperature
V_{cc}=15V

