

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 Tc=25°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	°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	°C	
Operating case temperature	T _{op}	-20	100	°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

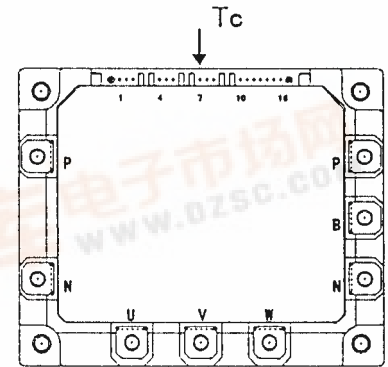


Fig.1 Measurement of case temperature

Electrical characteristics of power circuit (at Tc=Tj=25°C, V_{CC}=15V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
INV	Collector current at off signal input	I _{CES}	V _{CE} =600V input terminal open	-	-	1.0	mA
	Collector-Emitter saturation voltage	V _{CE(sat)}	I _c =300A	-	-	2.8	V
	Forward voltage of FWD	V _F	-I _c =300A	-	-	3.0	V
DB	Collector current at off signal input	I _{CES}	V _{CE} =600V input terminal open	-	-	1.0	mA
	Collector-Emitter saturation voltage	V _{CE(sat)}	I _c =100A	-	-	2.8	V
	Forward voltage of Diode	V _F	-I _c =100A	-	-	3.0	V



● 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

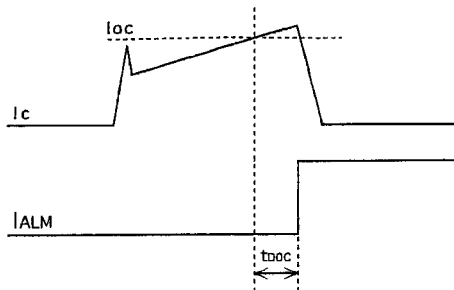


Fig.2 Definition of OC delay time

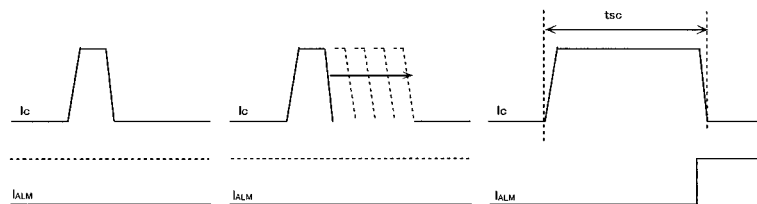


Fig.3 Definition of tsc

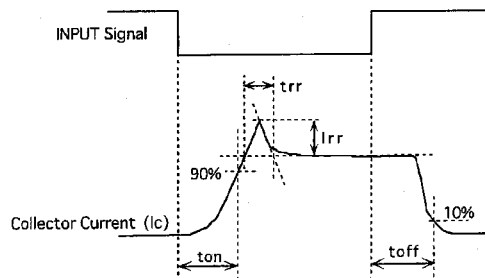


Fig.4 Definition of switching time

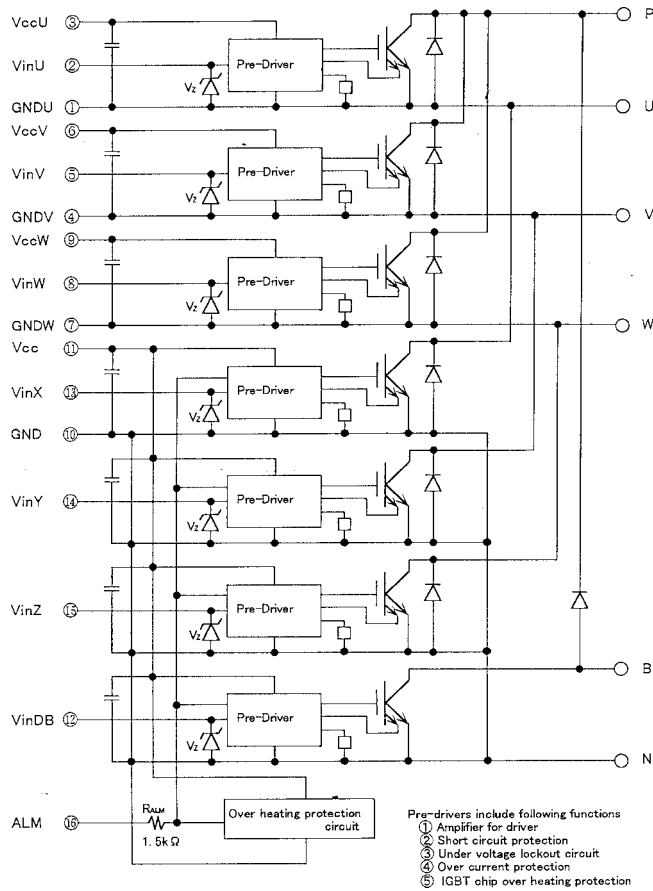
● Thermal characteristics($T_c=25^\circ\text{C}$)

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

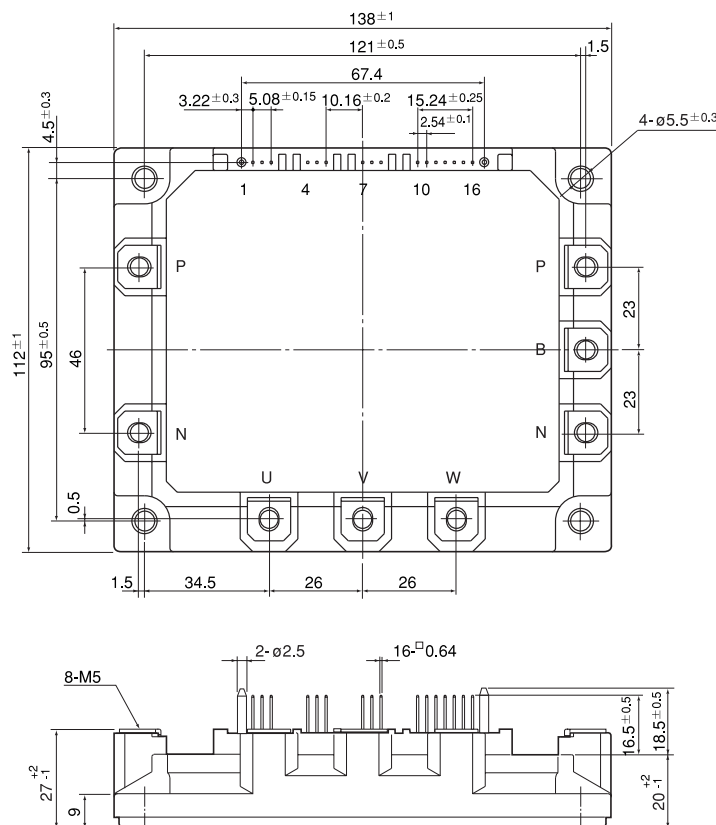
Block diagram



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

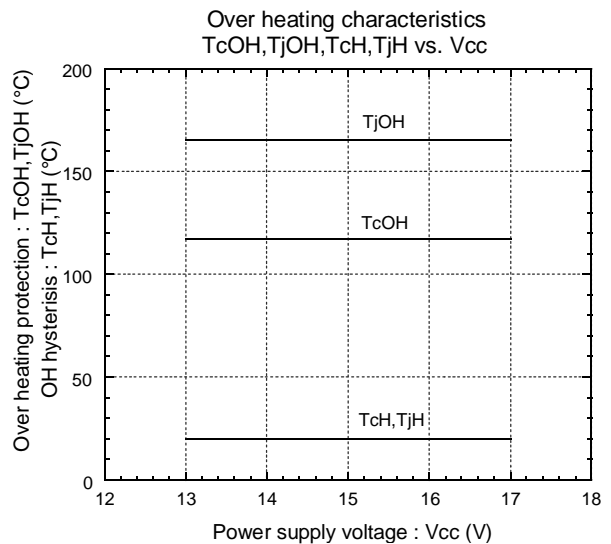
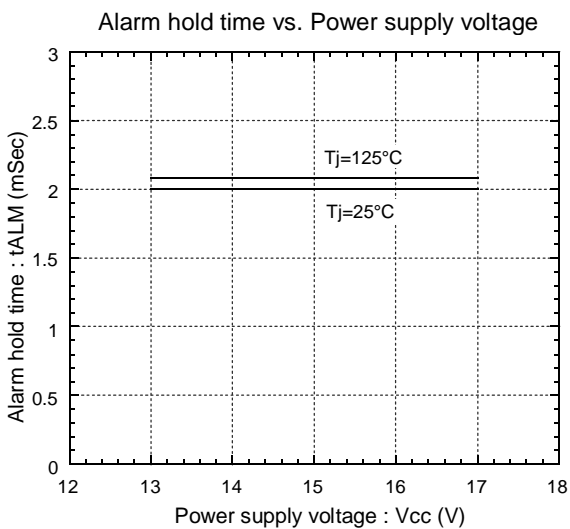
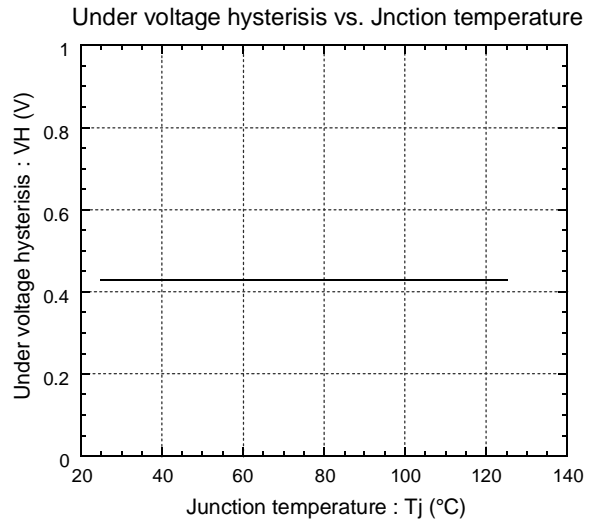
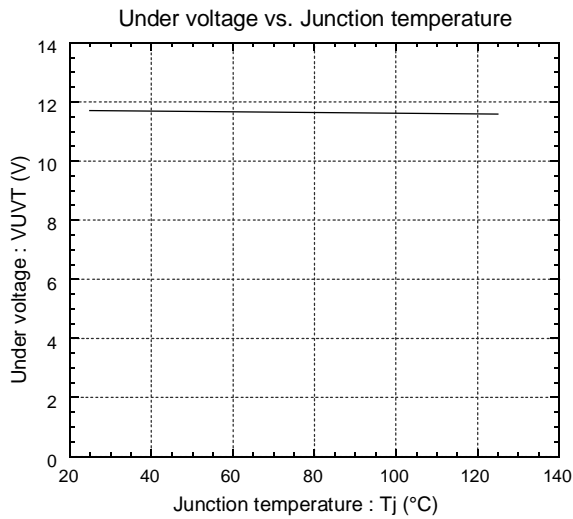
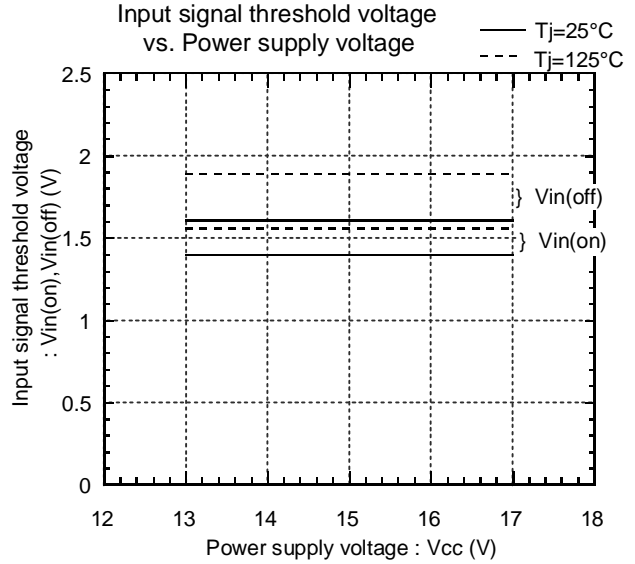
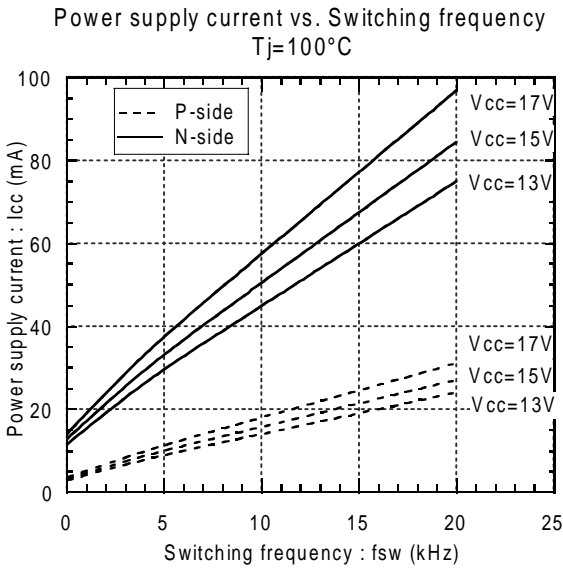
Outline drawings, mm



Mass : 920g

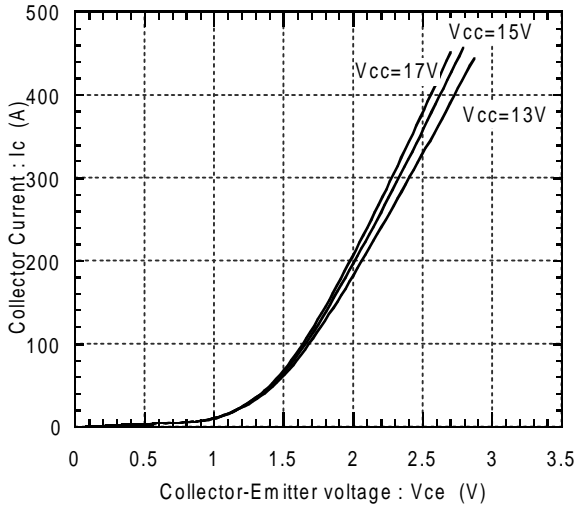
Characteristics (Representative)

Control circuit

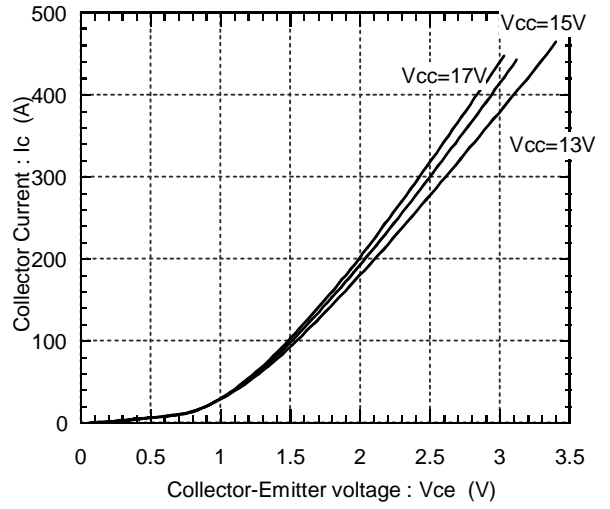


● Inverter

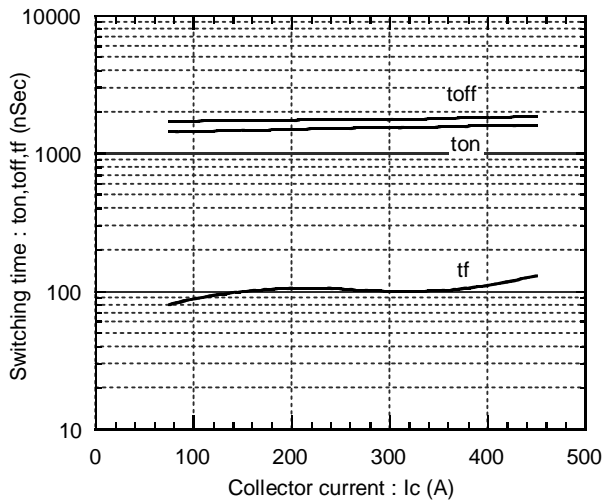
Collector current vs. Collector-Emmitter voltage
T_j=25°C



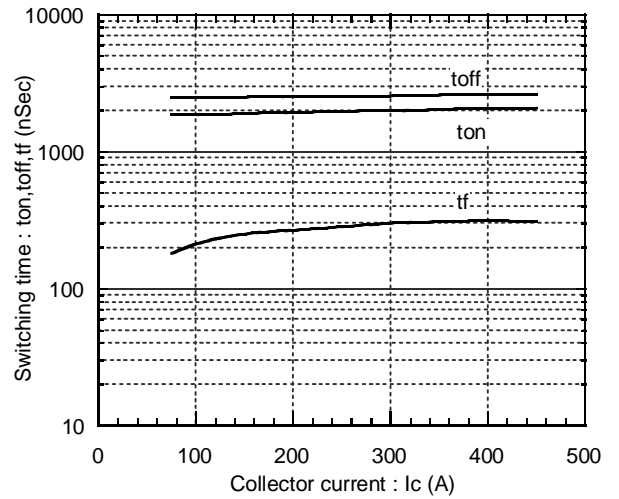
Collector current vs. Collector-Emmitter voltage
T_j=125°C



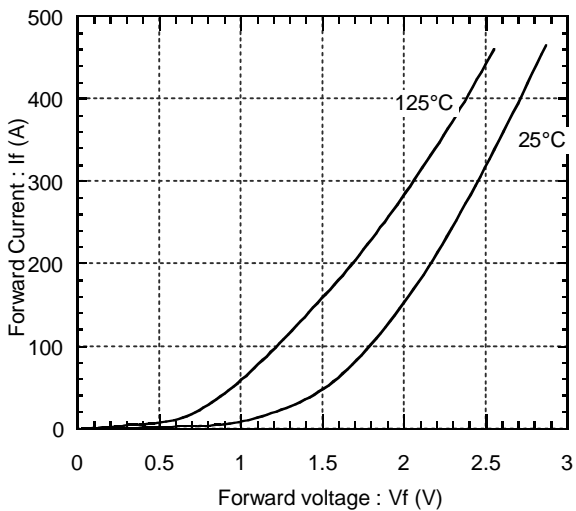
Switching time vs. Collector current
E_{dc}=300V, V_{cc}=15V, T_j=25°C



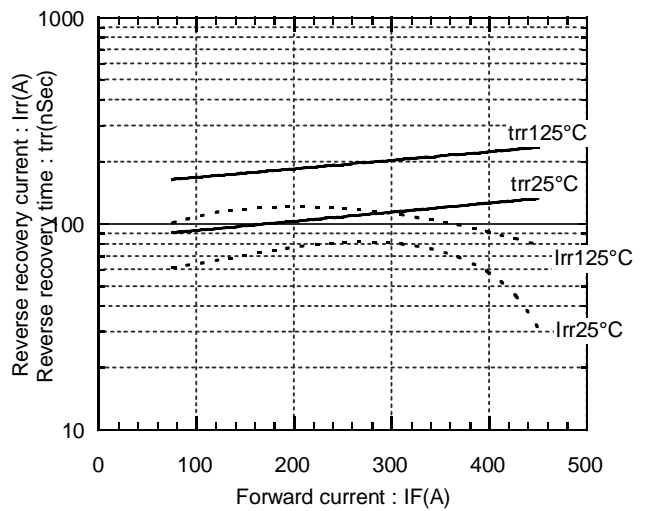
Switching time vs. Collector current
E_{dc}=300V, V_{cc}=15V, T_j=125°C

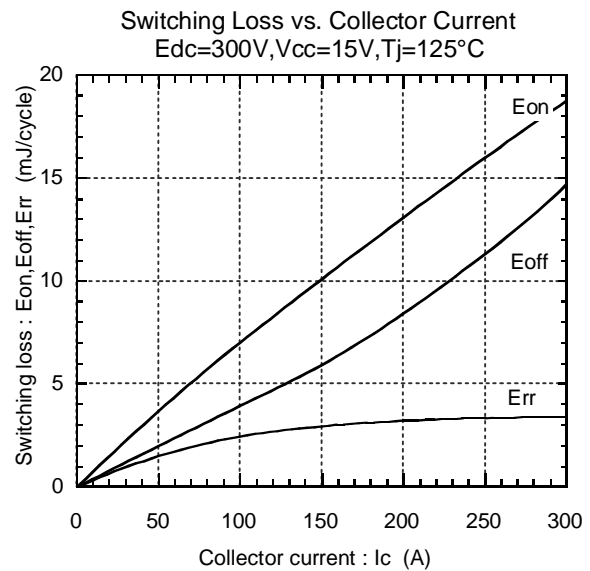
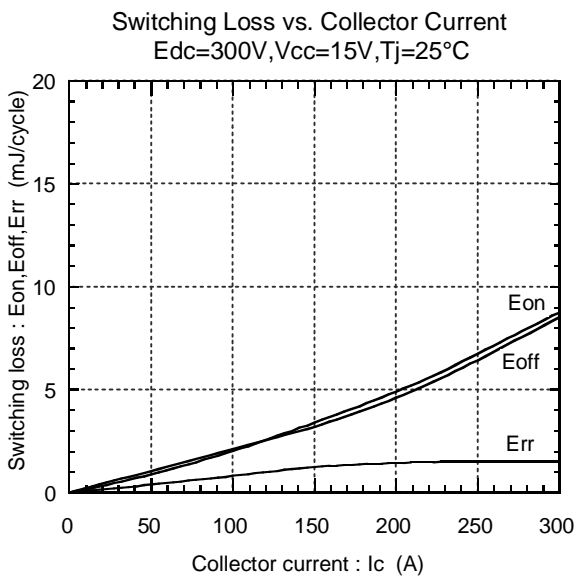
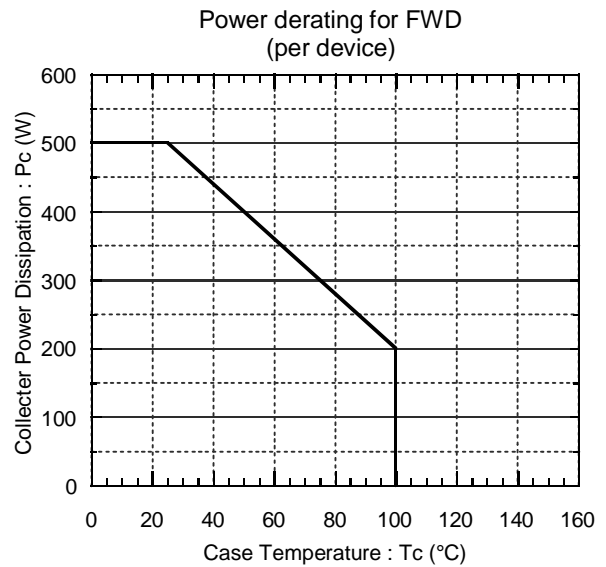
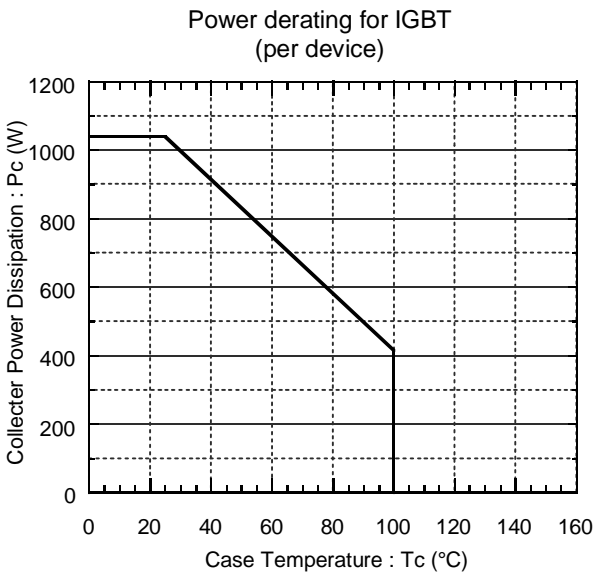
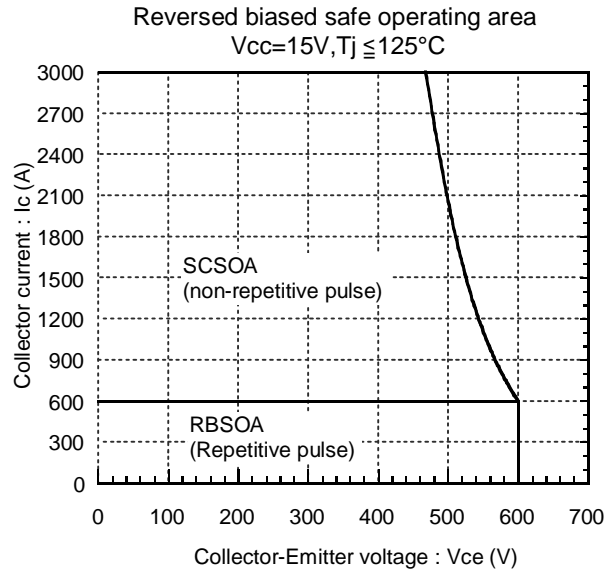
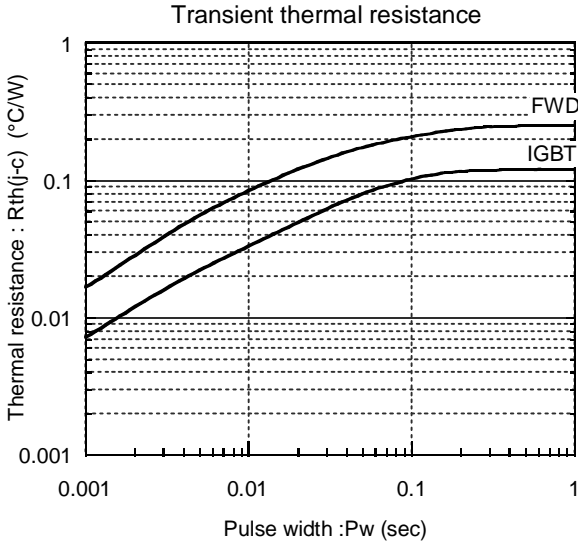


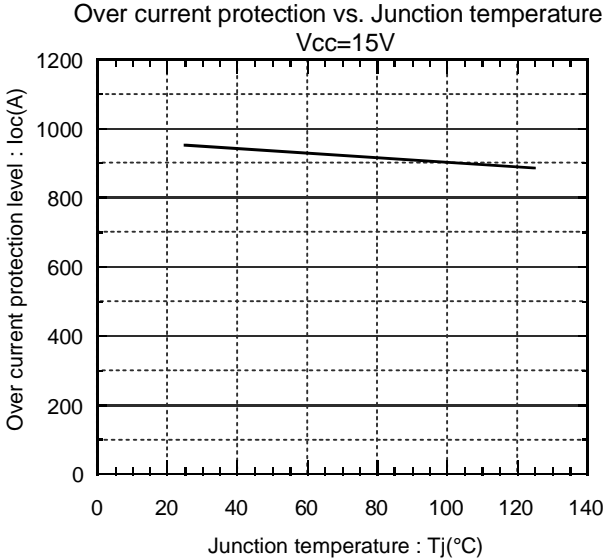
Forward current vs. Forward voltage



Reverse recovery characteristics
trr, Irr vs. IF

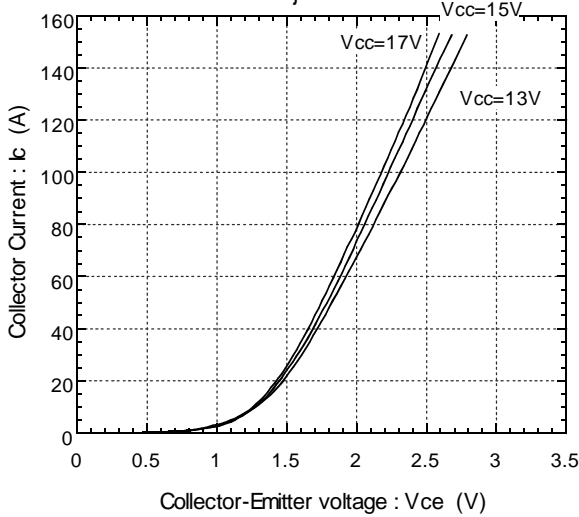




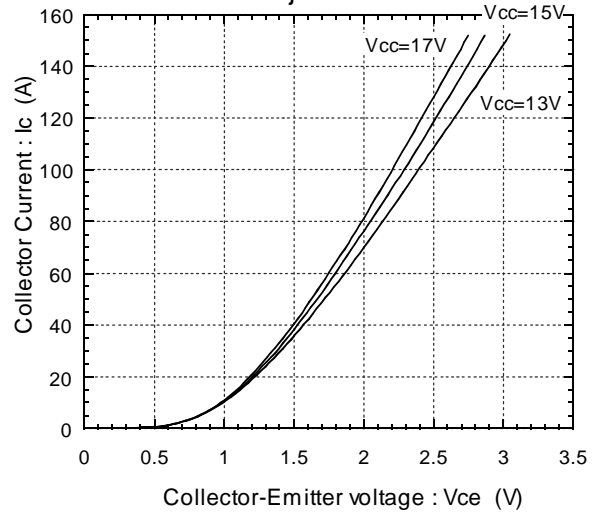


● Brake

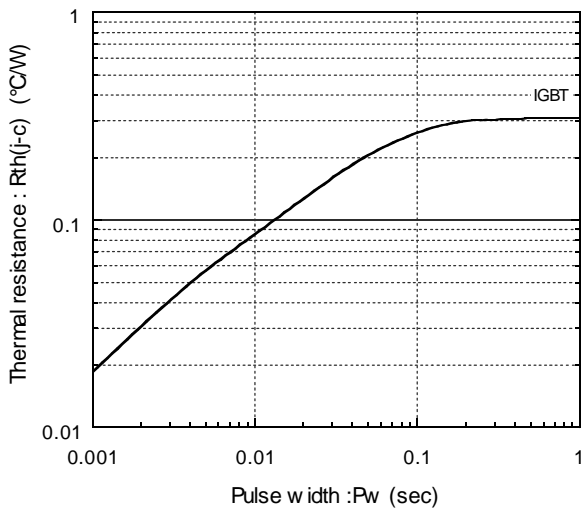
Collector current vs. Collector-Emitter voltage
T_j=25°C



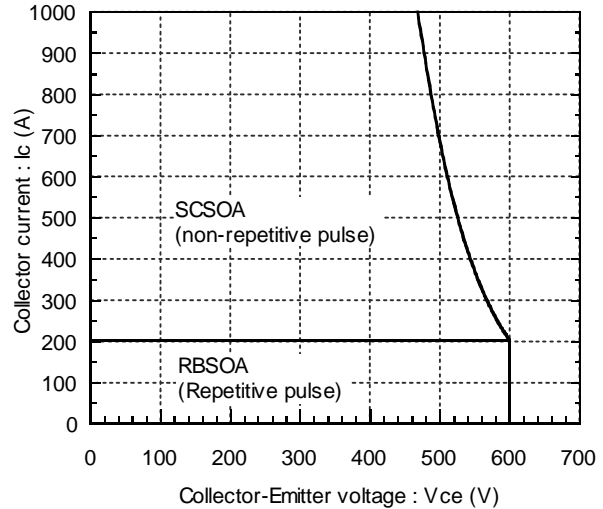
Collector current vs. Collector-Emitter voltage
T_j=125°C



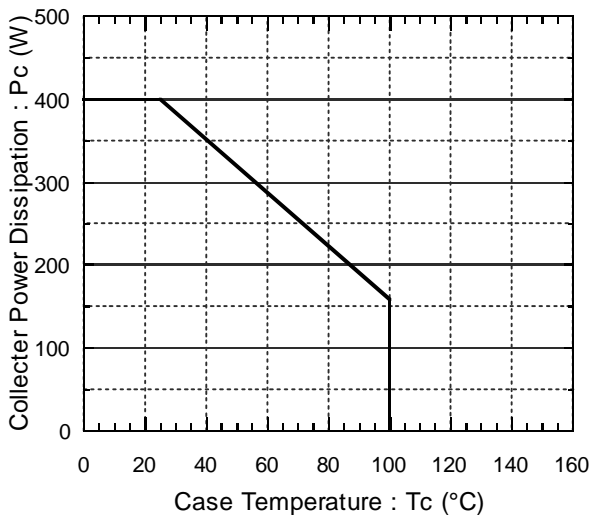
Transient thermal resistance



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

