

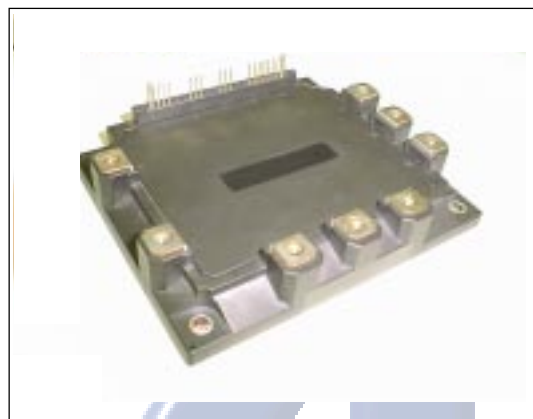
6MBP300RA060

IGBT-IPM R series

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

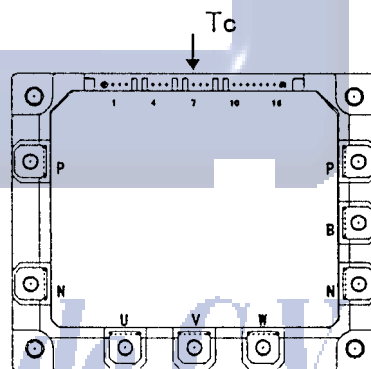


Fig.1 Measurement of case temperature

*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, 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}=15V)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit
INV	Collector current at off signal input	ICES	VCE=600V input terminal open	—	—	1.0	mA
	Collector-Emitter saturation voltage	VCE(sat)	Ic=300A	—	—	2.8	V
	Forward voltage of FWD	VF	-Ic=300A	—	—	3.0	V

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● 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	18	-	96	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
Over current protection delay time	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

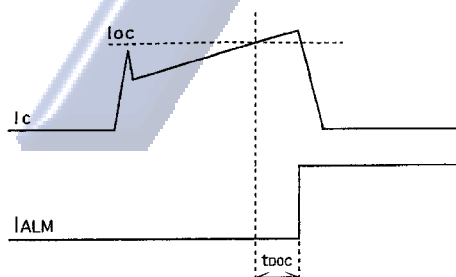


Fig.2 Definition of OC delay time

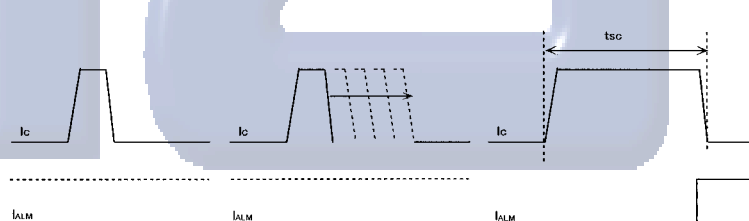
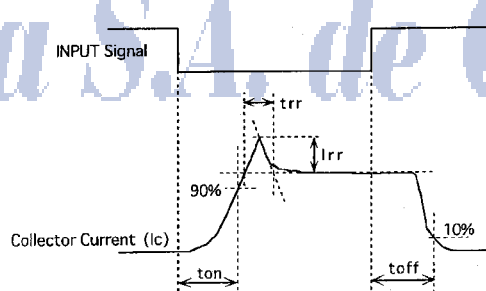
Fig.3 Definition of t_{sc} 

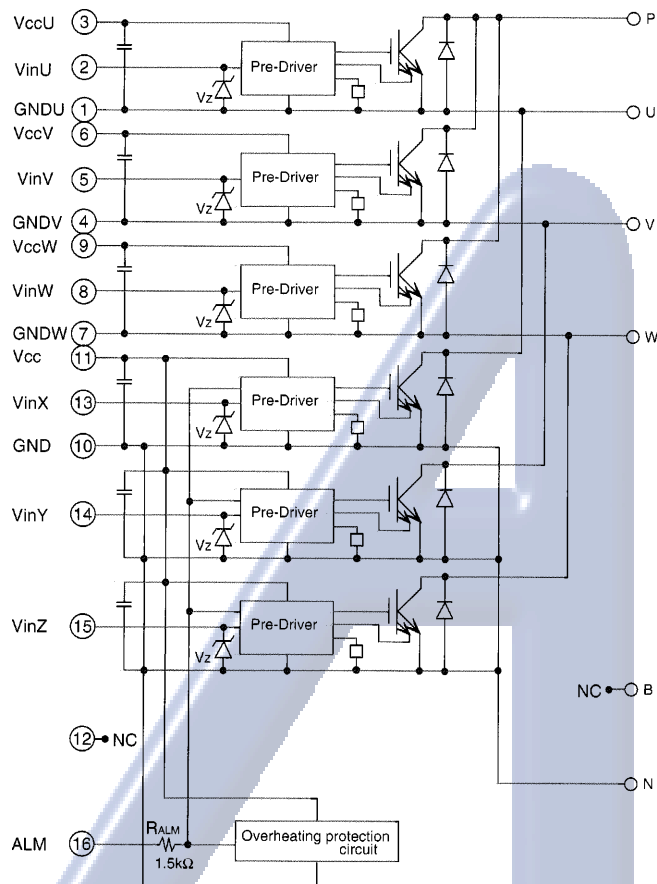
Fig.4 Definition of switching time

● 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	$^\circ\text{C/W}$
Case to fin thermal resistance with compound	$R_{th(c-f)}$	0.05	-	$^\circ\text{C/W}$

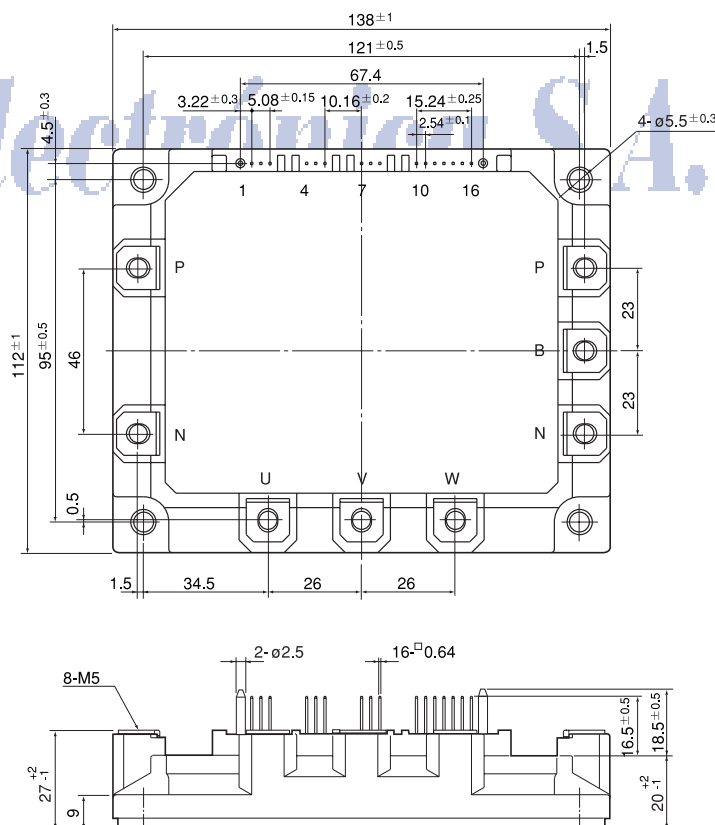
● Recommendable value

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	-	N·m
	Terminal (M5)	-	2.5	-	N·m

6MBP300RA060**IGBT-IPM****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

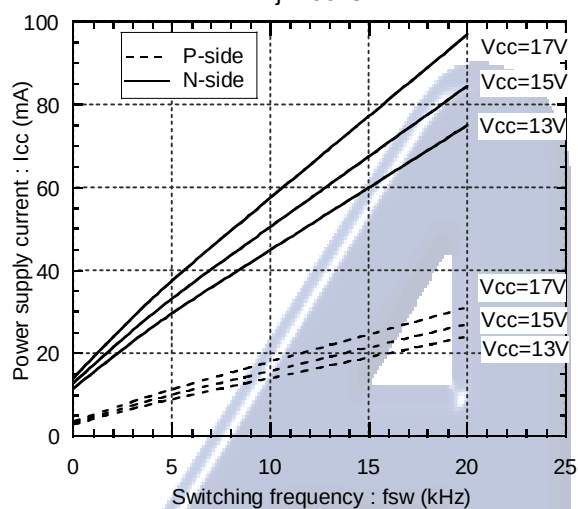
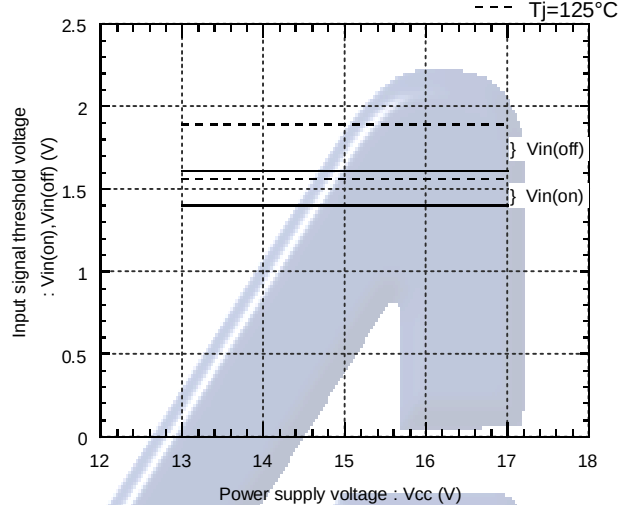
Mass : 920g

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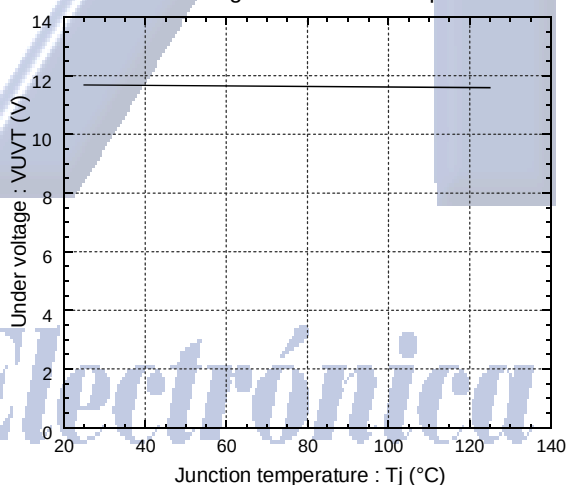
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■ Characteristics (Representative)

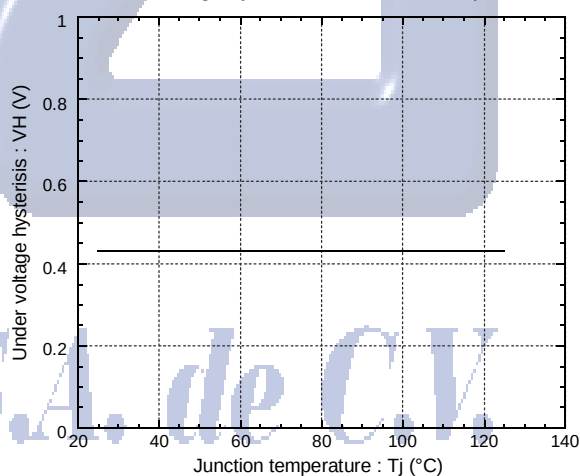
● Control circuit

Power supply current vs. Switching frequency
 $T_j=100^\circ\text{C}$ Input signal threshold voltage
vs. Power supply voltage

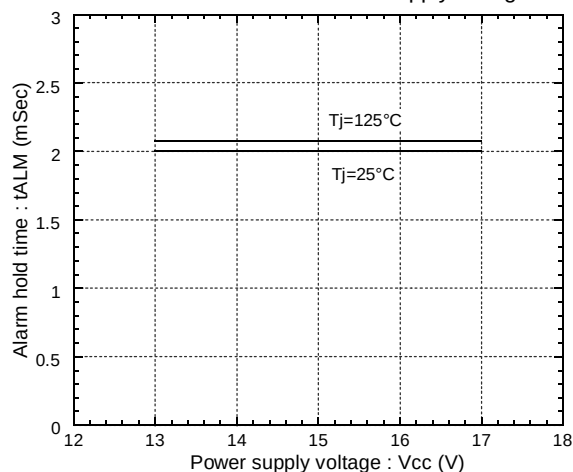
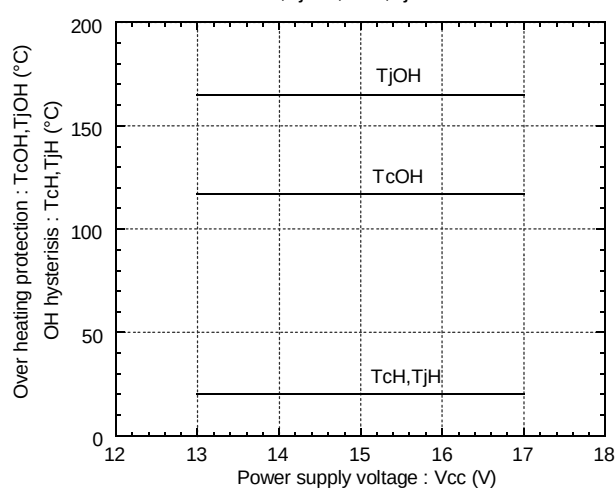
Under voltage vs. Junction temperature



Under voltage hysteresis vs. Jnction temperature



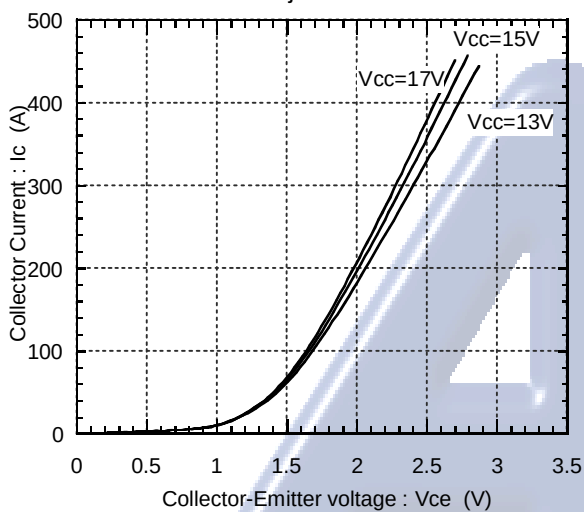
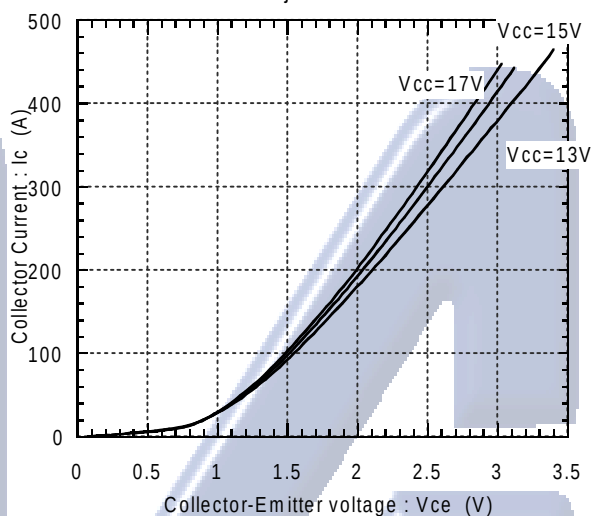
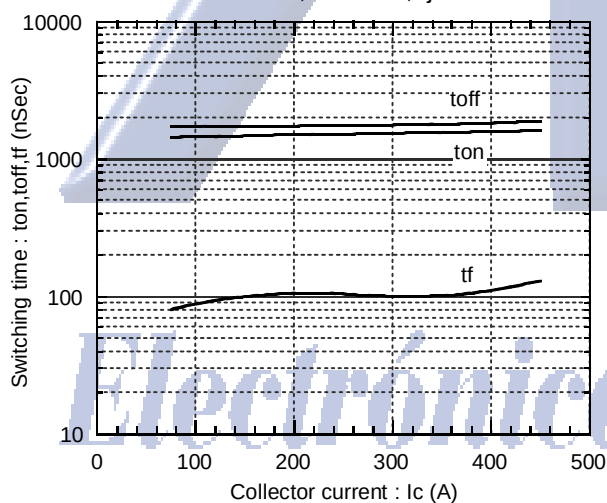
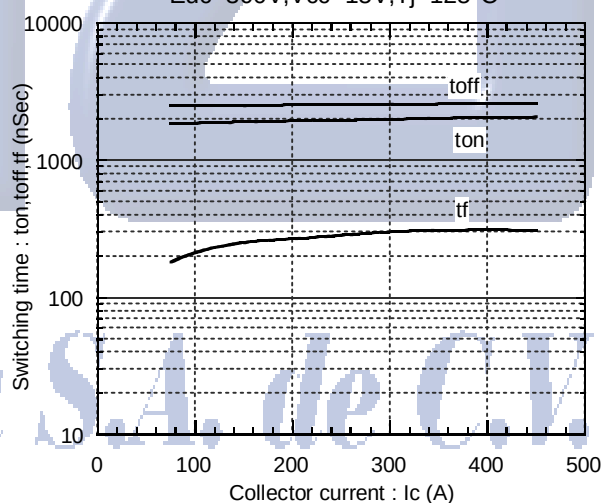
Alarm hold time vs. Power supply voltage

Over heating characteristics
 T_{cOH} , T_{jOH} , T_{cH} , T_{jH} vs. V_{cc} 

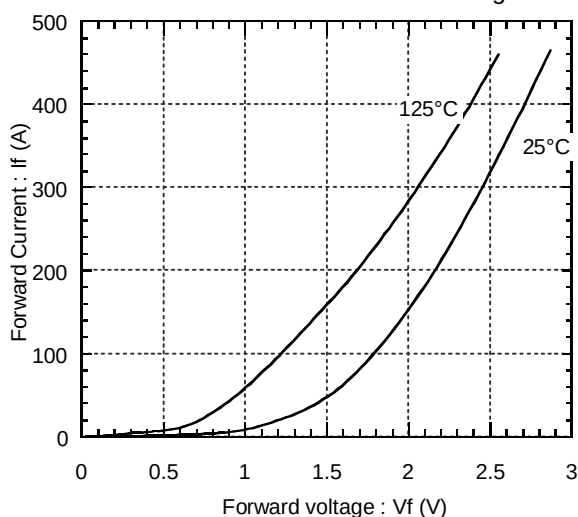
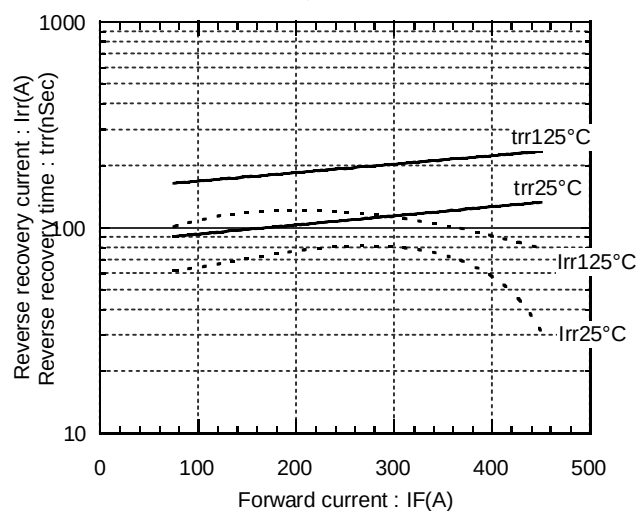
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● Inverter

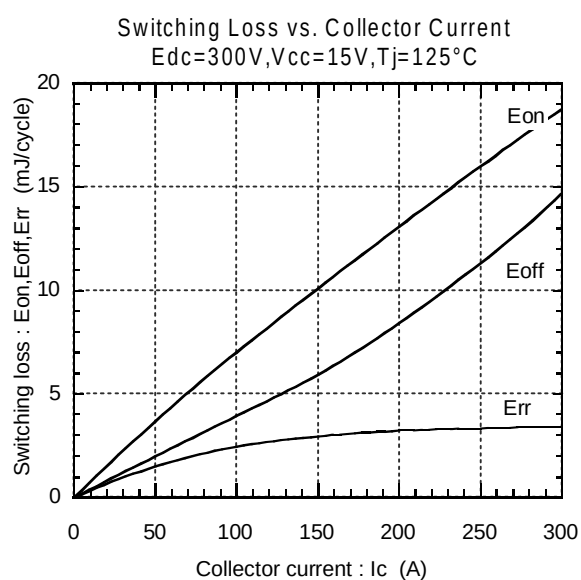
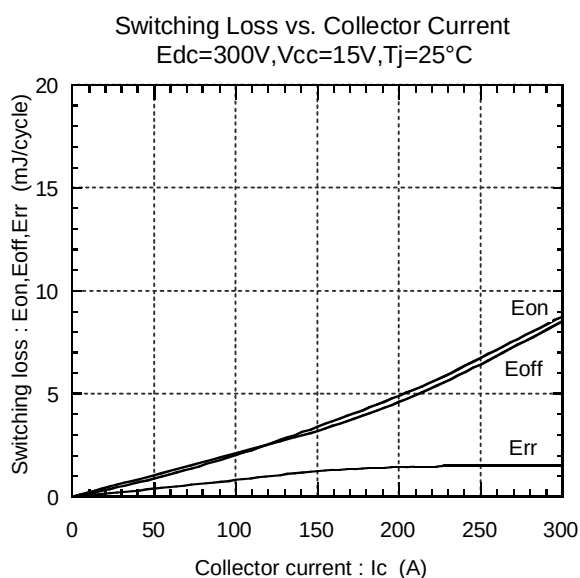
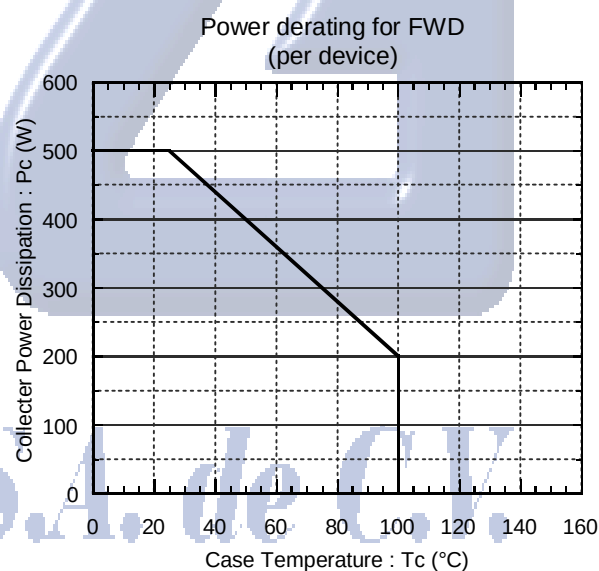
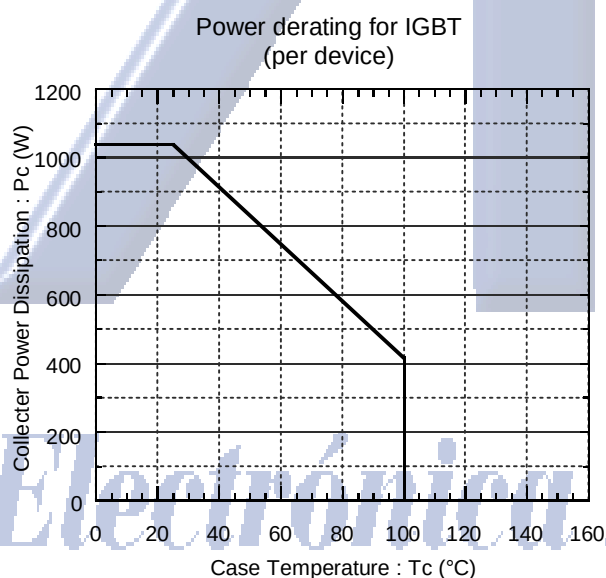
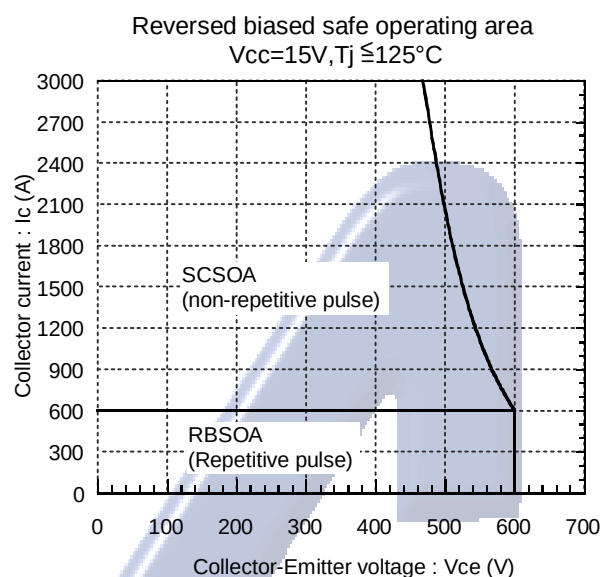
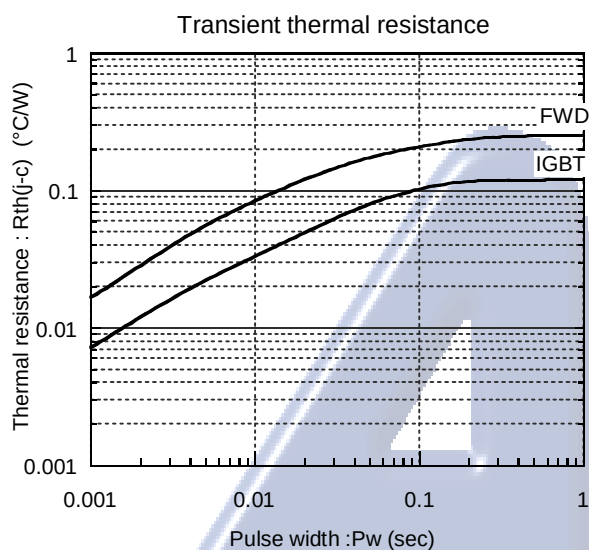
Collector current vs. Collector-Emittter voltage
 $T_j=25^{\circ}\text{C}$ Collector current vs. Collector-Emittter voltage
 $T_j=125^{\circ}\text{C}$ Switching time vs. Collector current
 $E_{dc}=300\text{V}, V_{cc}=15\text{V}, T_j=25^{\circ}\text{C}$ Switching time vs. Collector current
 $E_{dc}=300\text{V}, V_{cc}=15\text{V}, T_j=125^{\circ}\text{C}$ 

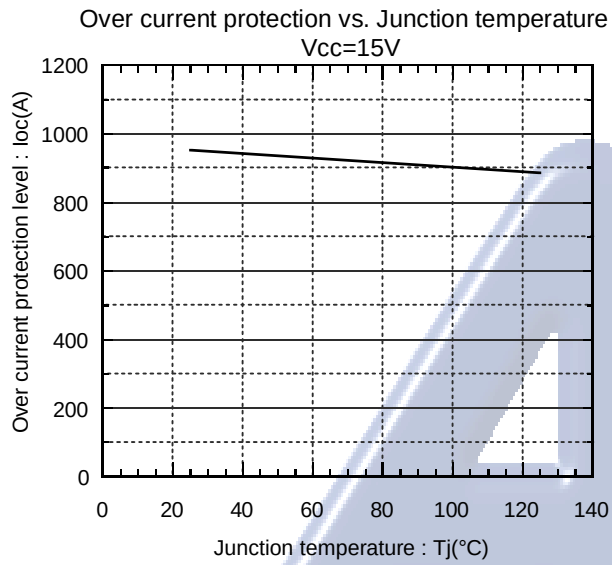
Forward current vs. Forward voltage

Reverse recovery characteristics
 t_{rr}, I_{rr} vs. I_F 

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Electrónica S.A. de C.V.