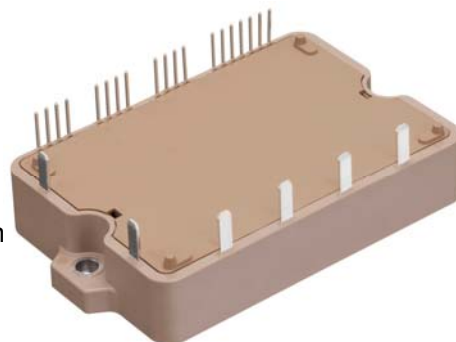


IGBT Modules

■ 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



Technical drawing of a rectangular metal plate. The overall dimensions are 90 ± 0.5 mm in width and 55 ± 0.5 mm in height. The inner rectangular area has dimensions of 80 ± 0.3 mm by 23.68 ± 0.3 mm. The plate features four mounting holes, each with a diameter of 4.5 ± 0.3 mm, located at the corners. The distance between the centers of the horizontal holes is 69 ± 0.3 mm, and the distance between the centers of the vertical holes is 21.05 ± 0.3 mm. The plate has rounded corners with a radius of R5. The thickness of the plate is 2.54 mm. The drawing includes various dimension lines and callouts for specific features, such as 4-φ2, 2-φ4.5 ± 0.3, and 2-R5. The plate is labeled with 'LABEL' in the center.

Weight:190g(typ.)

7MBP100VFN060-50

IGBT Modules

■ Absolute Maximum Ratings

 $T_C=25^{\circ}\text{C}$, $V_{CC}=15\text{V}$ unless otherwise specified.

Items			Symbol	Min.	Max.	Units
Collector-Emitter Voltage *1			V_{CES}	0	600	V
Short Circuit Voltage			V_{SC}	200	400	V
Inverter	Collector Current	DC	I_C	-	100	A
		1ms	I_{CP}	-	200	A
		Duty=100% *2	$-I_C$	-	100	A
	Collector Power Dissipation	1 device *3	P_C	-	403	W
Brake	Collector Current	DC	I_C	-	50	A
		1ms	I_{CP}	-	100	A
	Forward Current of Diode		I_F	-	50	A
	Collector Power Dissipation	1 device *3	P_C	-	290	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
Alarm Signal Voltage *6			V_{ALM}	-0.5	V_{CC}	V
Alarm Signal Current *7			I_{ALM}	-	20	mA
Junction Temperature			T_j	-	150	$^{\circ}\text{C}$
Operating Case Temperature			T_{opr}	-20	110	$^{\circ}\text{C}$
Storage Temperature			T_{stg}	-40	125	$^{\circ}\text{C}$
Solder Temperature *8			T_{sol}	-	260	$^{\circ}\text{C}$
Isolating Voltage *9			V_{iso}	-	AC2500	Vrms
Screw Torque		Mounting (M4)	-	-	1.7	Nm

Notes

*1: V_{CES} shall be applied to the input voltage between terminal P-(U,V, W,B) and (U,V, W,B)-N.

*2: $Duty=125^{\circ}\text{C}/R_{th(j-c)D}/(I_F \times V_F \text{ Max.}) \times 100$

*3: $P_C=125^{\circ}\text{C}/R_{th(j-c)Q}$ (Inverter & Brake)

*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 9,15~18 and 13.

*6: V_{ALM} shall be applied to the voltage between terminal No.2 and 1, 6 and 5, 10 and 9,19 and 13.

*7: I_{ALM} shall be applied to the input current to terminal No.2,6,10 and 19.

*8: Immersion time $10 \pm 1\text{sec}$. 1time

*9: Terminal to base, 50/60Hz sine wave 1min. All terminals should be connected together during the test.

■ Electrical Characteristics ($T_j=25^{\circ}\text{C}$, $V_{CC}=15\text{V}$ unless otherwise specified.)

● Main circuit

Item		Symbol	Conditions		Min.	Typ.	Max.	Units
Inverter	Collector Current at off signal input	ICES	VCE = 600V		-	-	1.0	mA
	Collector-Emitter saturation voltage	VCE(sat)	IC = 100A	Terminal	-	-	1.95	V
				Chip	-	1.25	-	V
	Forward voltage of FWD	VF	IF = 100A	Terminal	-	-	2.2	V
Chip				-	1.6	-	V	
Brake	Collector Current at off signal input	ICES	VCE = 600V		-	-	1.0	mA
	Collector-Emitter saturation voltage	VCE(sat)	IC = 50A	Terminal	-	-	1.9	V
				Chip	-	1.25	-	V
	Forward voltage of FWD	VF	IF = 50A	Terminal	-	-	2.8	V
Chip				-	2.1	-	V	
Switching time		ton	VDC = 300V , Tj=125°C		1.1	-	-	μs
		toff			-	-	2.1	μs
		trr	VDC = 300V IF = 100A		-	-	0.3	μs

7MBP100VFN060-50

IGBT Modules

● Control circuit

Item	Symbol	Conditions		Min.	Typ.	Max.	Units
Supply current of P-side pre-driver (per one unit)	I _{ccp}	Switching Frequency = 0-15kHz Tc=-20~110°C		-	-	17	mA
Supply current of N-side pre-driver	I _{ccn}			-	-	62	mA
Input signal threshold voltage	V _{in} (on)	Vin-GND	ON	1.2	1.4	1.6	V
	V _{in} (off)		OFF	1.5	1.7	1.9	V

● Protection Circuit

Item	Symbol	Conditions	Min.	Typ.	Max.	Units
Over Current Protection Level	I _{oc}	T _j =125°C	200	-	-	A
Over Current Protection Delay time	t _{dOC}	T _j =125°C	-	5	-	μs
Short Circuit Protection Delay time	t _{sc}	T _j =125°C	-	2	3	μs
IGBT Chips Over Heating Protection Temperature Level	T _{jOH}	Surface of IGBT Chips	150	-	-	°C
Over Heating Protection Hysteresis	T _{jH}		-	20	-	°C
Under Voltage Protection Level	V _{UV}		11.0	-	12.5	V
Under Voltage Protection Hysteresis	V _H		0.2	0.5	-	V
Alarm Signal Hold Time	t _{ALM(OC)}	ALM-GND	1.0	2.0	2.4	ms
	t _{ALM(UV)}	T _c = -20~110°C	2.5	4.0	4.9	ms
	t _{ALM(TjOH)}		5.0	8.0	11.0	ms
Resistance for current limit	R _{ALM}		960	1265	1570	Ω

■ Thermal Characteristics (T_c = 25°C)

Item	Symbol	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance*10	Inverter IGBT	R _{th(j-c)Q}	-	-	0.31 °C/W
	Inverter FWD	R _{th(j-c)D}	-	-	0.55 °C/W
	Brake IGBT	R _{th(j-c)Q}	-	-	0.43 °C/W
	Brake FWD	R _{th(j-c)D}	-	-	0.99 °C/W
Case to Fin Thermal Resistance with Compound	R _{th(c-f)}	-	0.05	-	°C/W

*10: For 1device , the measurement point of the case is just under the chip.

■ Noise Immunity (V_{DC}=300V, V_{CC}=15V)

Item	Conditions	Min.	Typ.	Max.	Units
Common mode rectangular noise	Pulse width 1μs,polarity ±,10min. Judge: no over-current, no miss operating	±2.0	-	-	kV

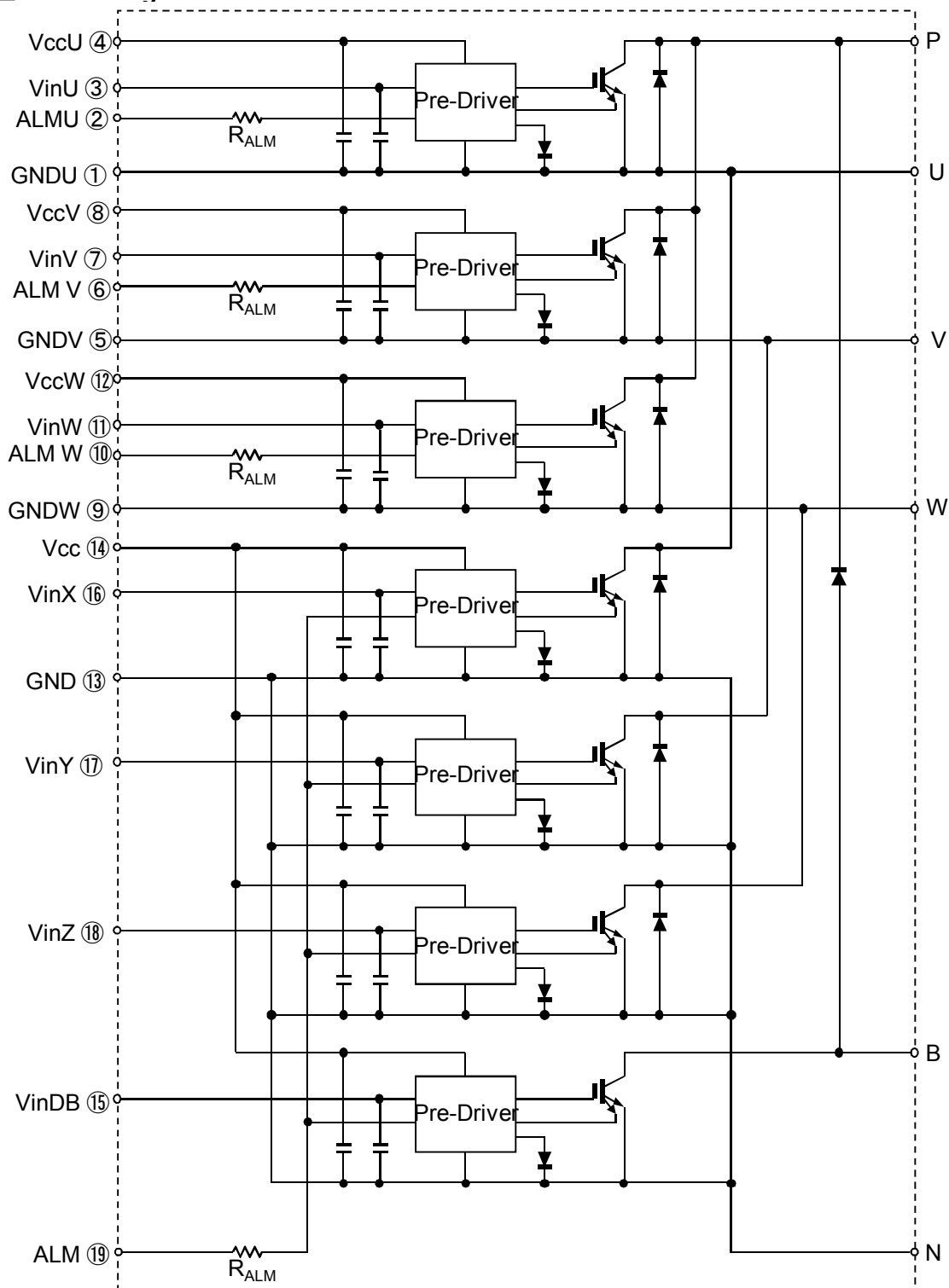
■ Recommended Operating Conditions

Item	Symbol	Min.	Typ.	Max.	Units
DC Bus Voltage	V _{DC}	-	-	400	V
Power Supply Voltage of Pre-Driver	V _{CC}	13.5	15.0	16.5	V
Switching frequency of IPM	f _{sw}	-	-	20	kHz
Arm shoot through blocking time for IPM's input signal	t _{dead}	1.0	-	-	μs
Screw Torque (M4)	-	1.3	-	1.7	Nm

7MBP100VFN060-50

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■ Block Diagram



Pre-drivers include following functions

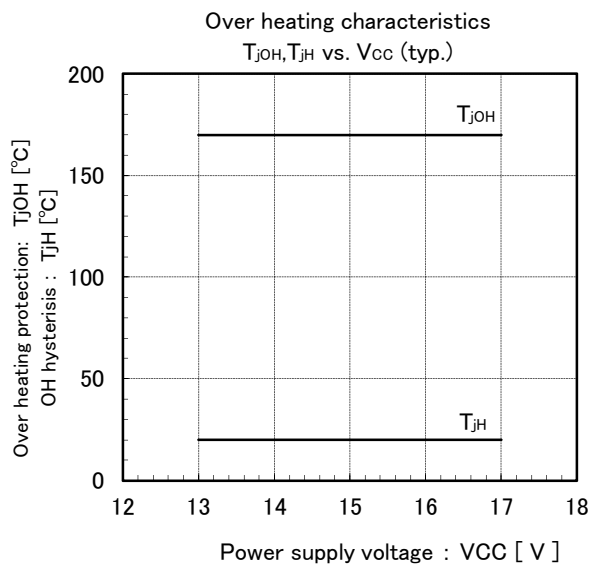
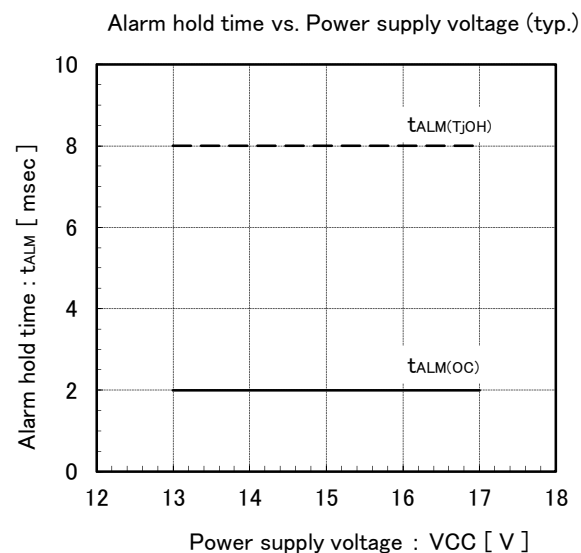
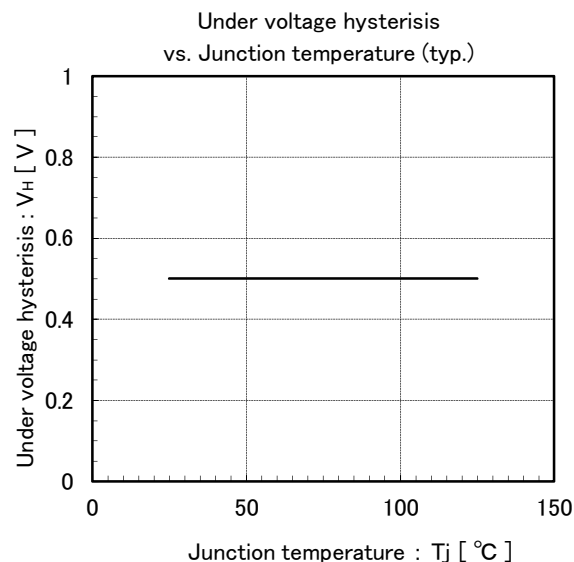
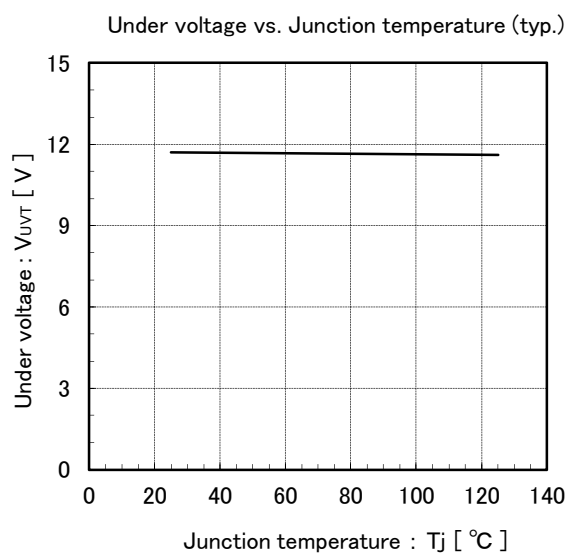
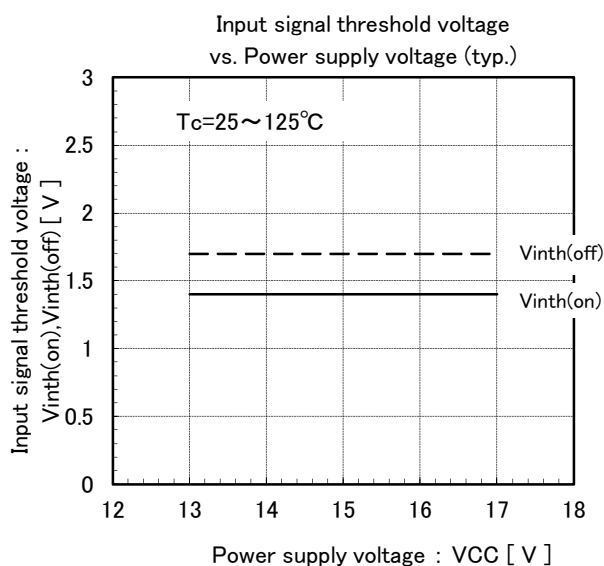
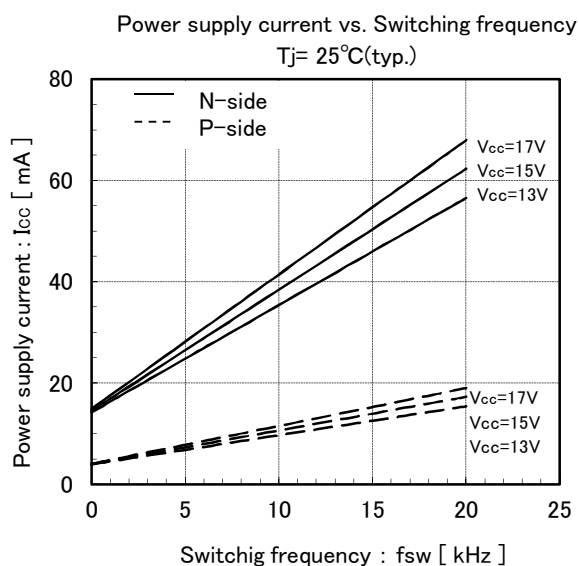
1. Amplifier for driver
2. Short circuit protection
3. Under voltage lockout circuit
4. Over current protection
5. IGBT chip over heating protection

7MBP100VFN060-50

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■ Characteristics (Representative)

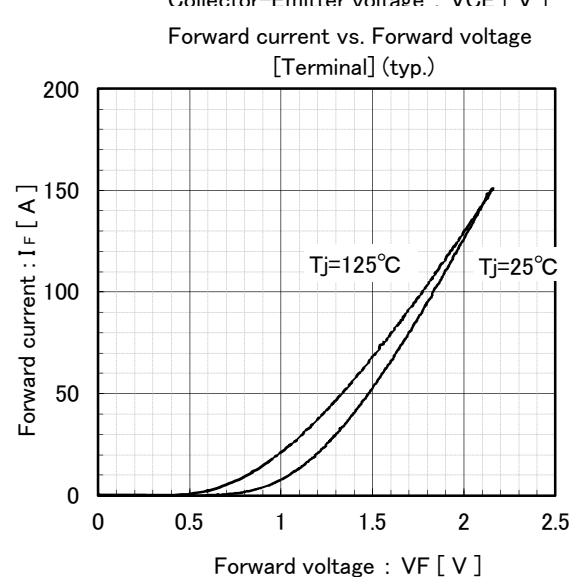
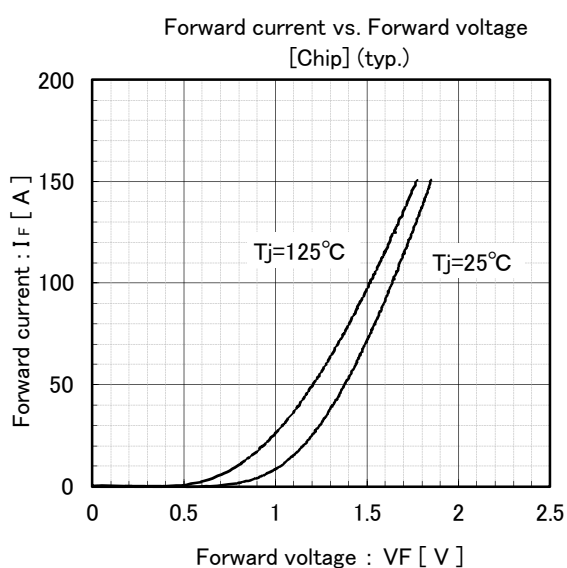
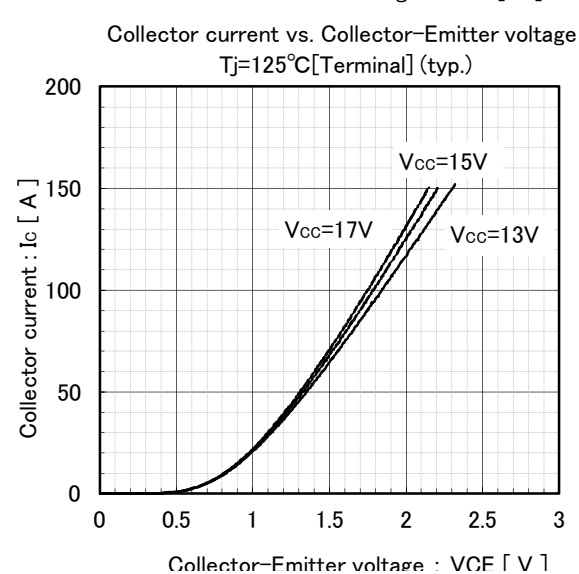
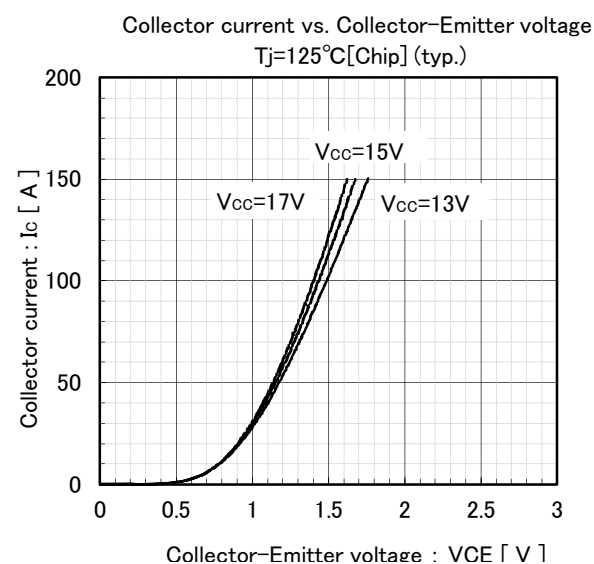
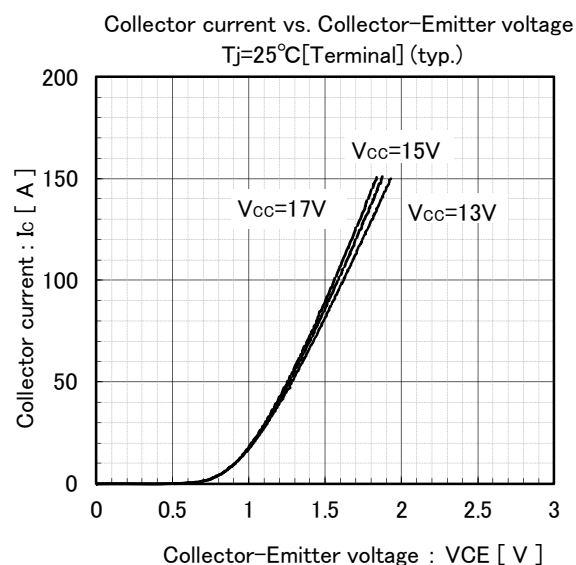
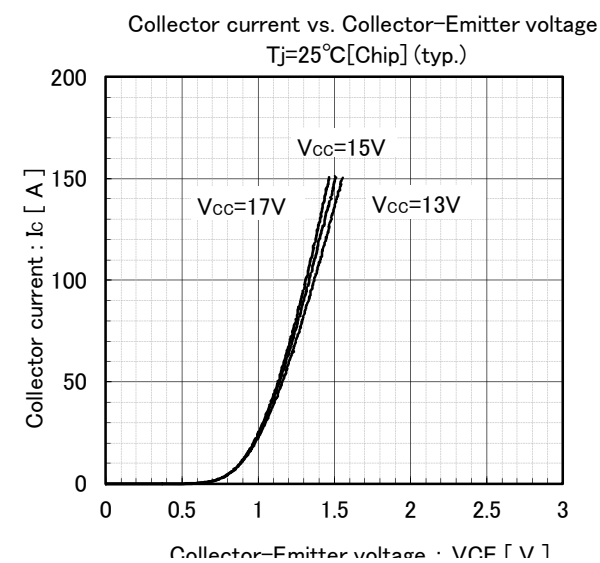
● Control Circuit



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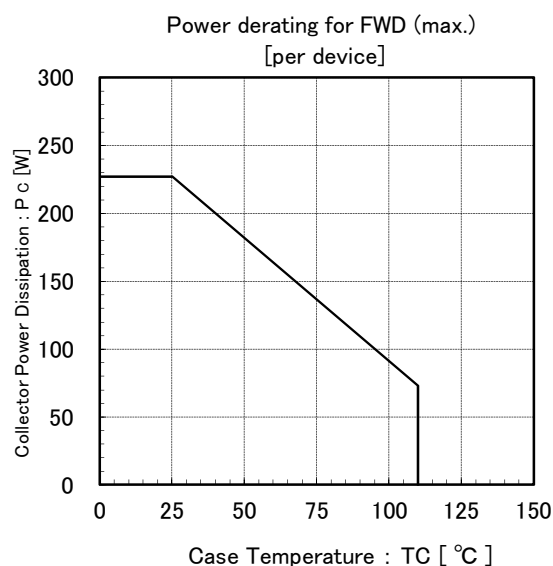
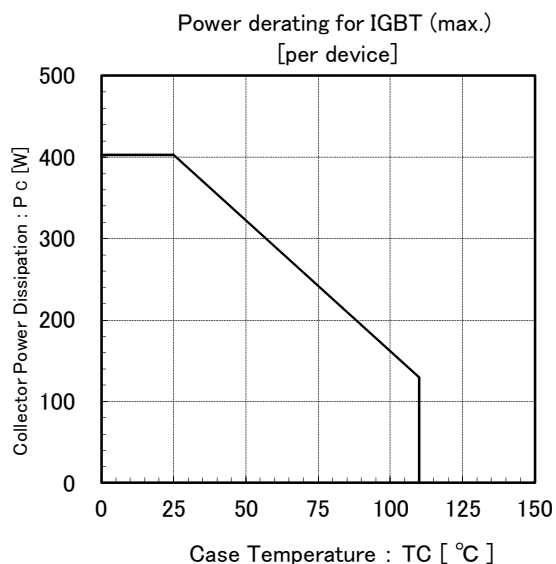
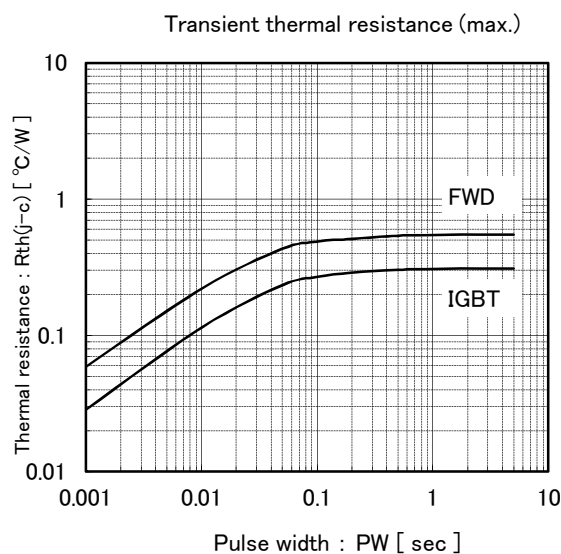
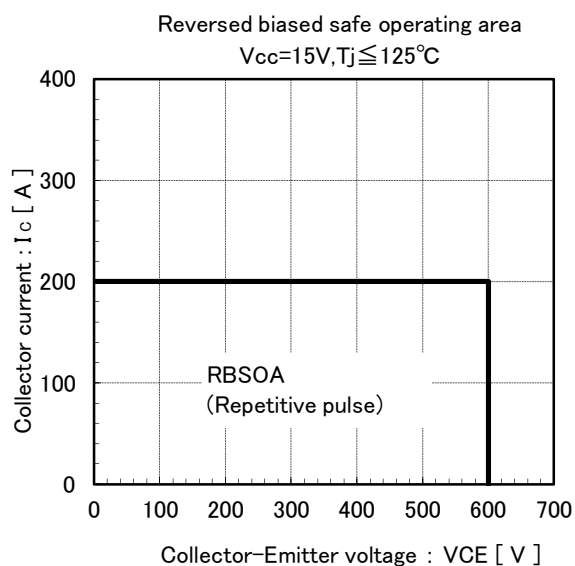
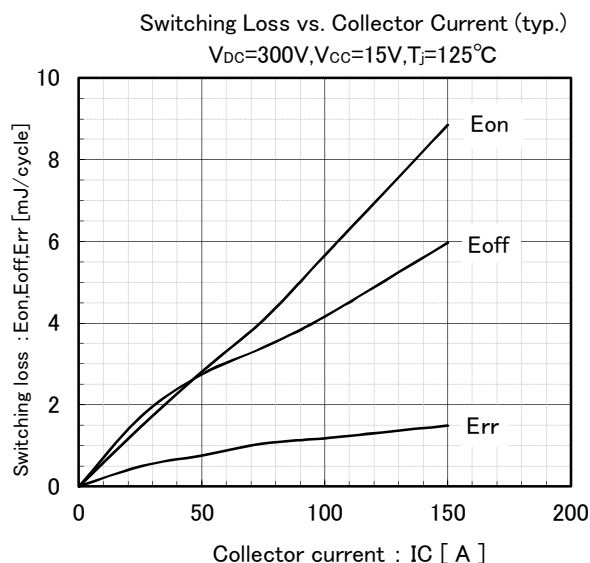
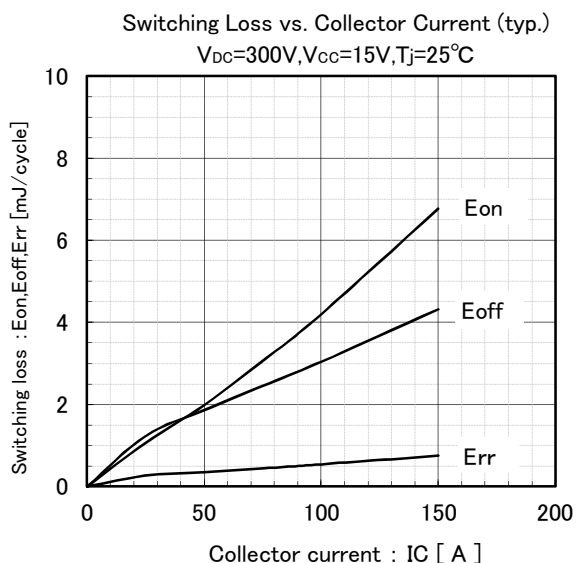
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● Inverter



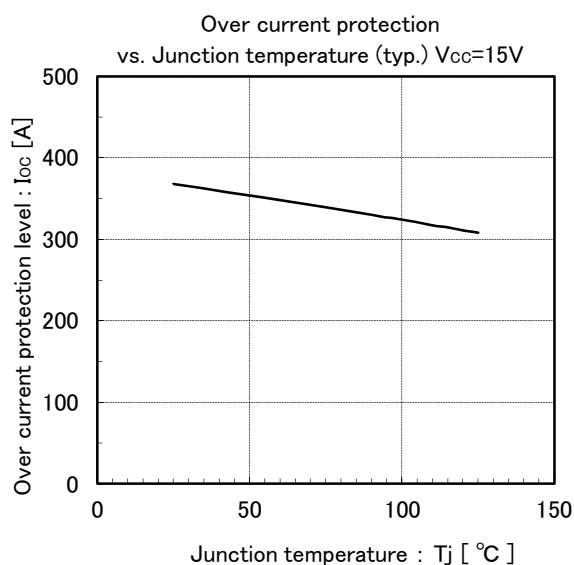
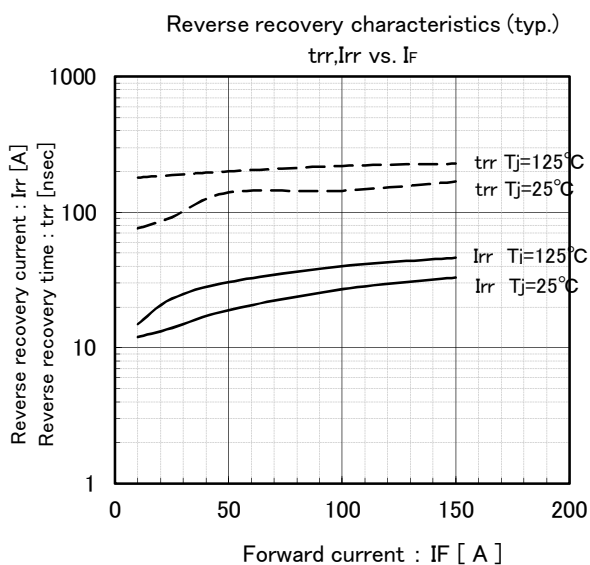
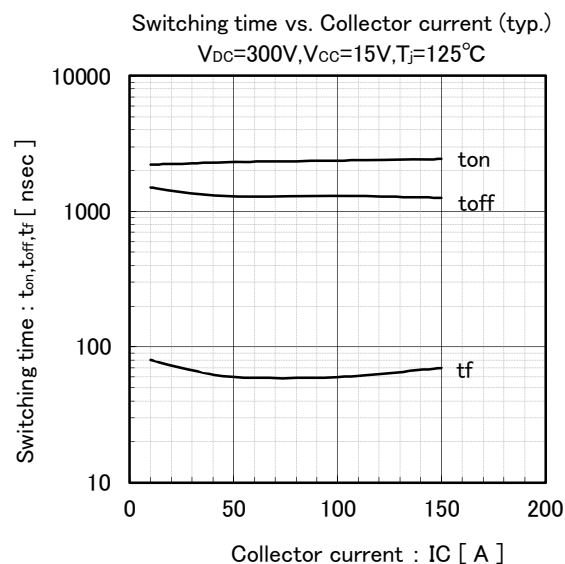
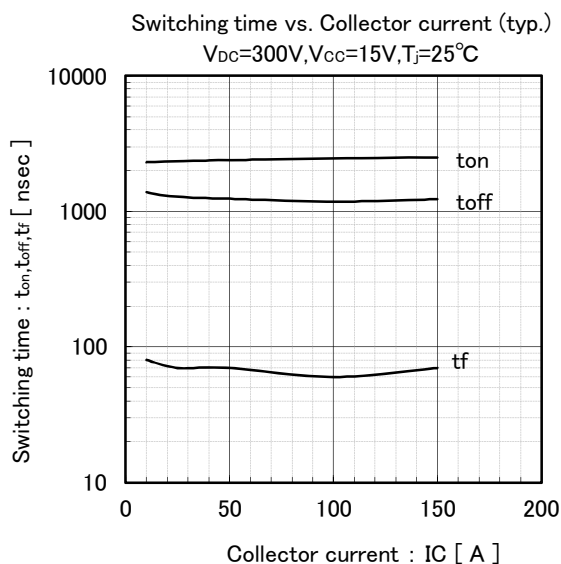
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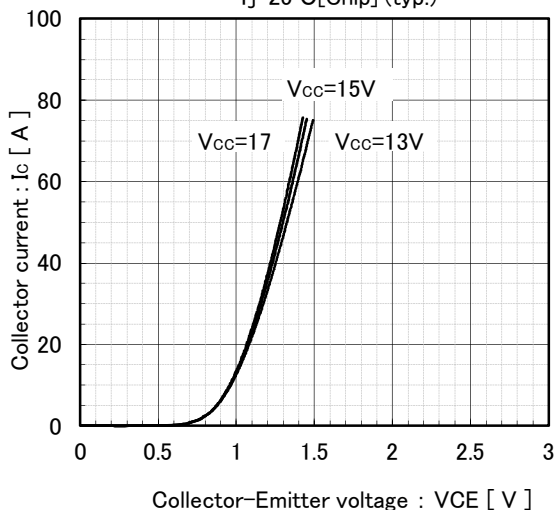


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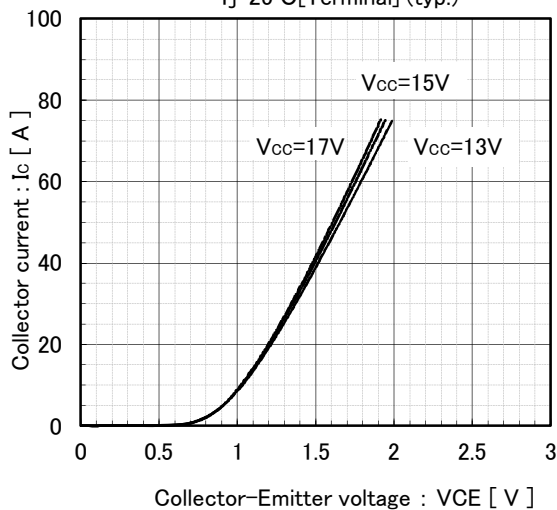
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■ Brake

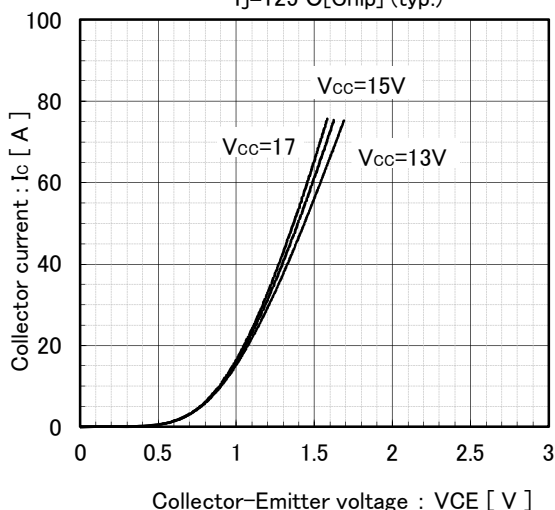
Collector current vs. Collector–Emitter voltage
 $T_j=25^{\circ}\text{C}$ [Chip] (typ.)



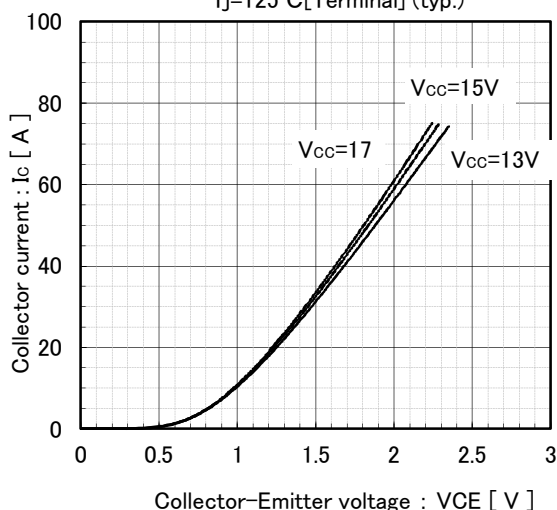
Collector current vs. Collector–Emitter voltage
 $T_j=25^{\circ}\text{C}$ [Terminal] (typ.)



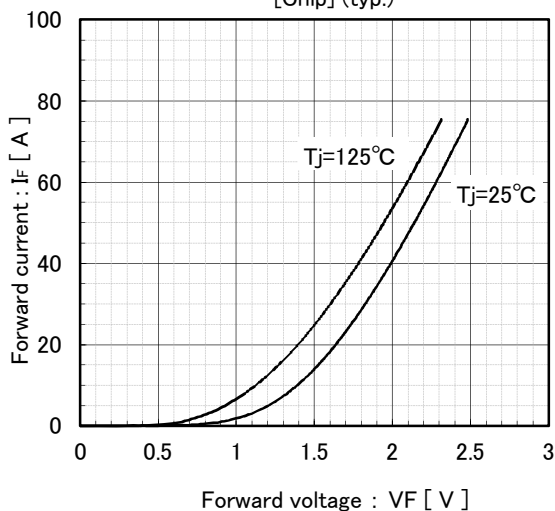
Collector current vs. Collector–Emitter voltage
 $T_j=125^{\circ}\text{C}$ [Chip] (typ.)



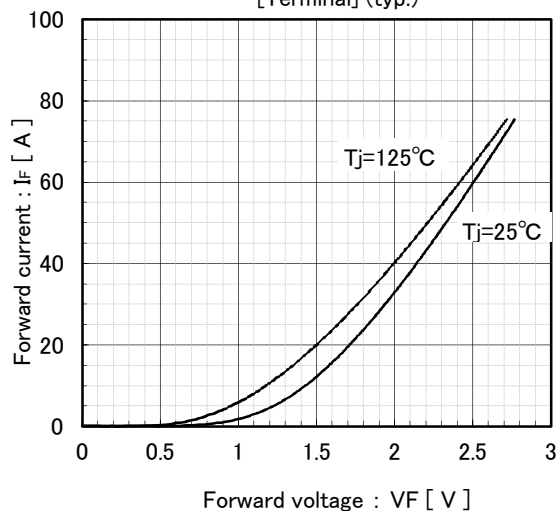
Collector current vs. Collector–Emitter voltage
 $T_j=125^{\circ}\text{C}$ [Terminal] (typ.)



Forward current vs. Forward voltage
[Chip] (typ.)

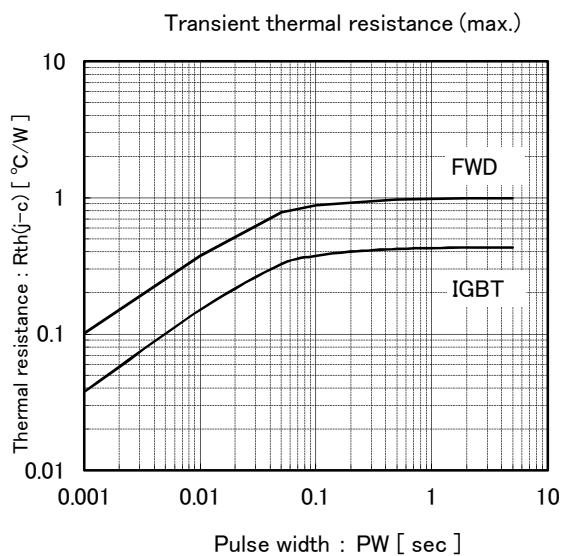
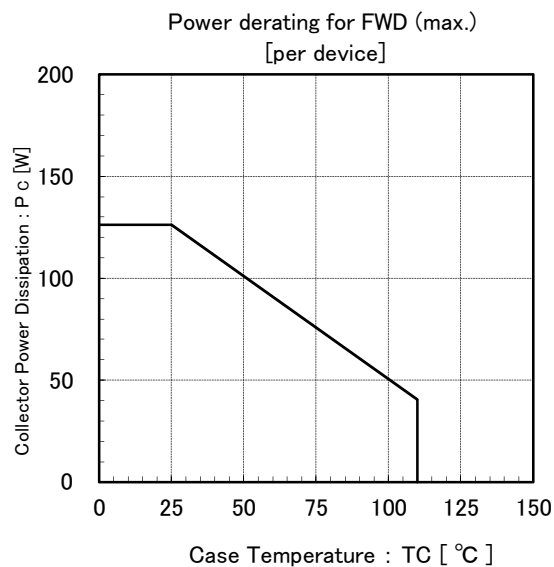
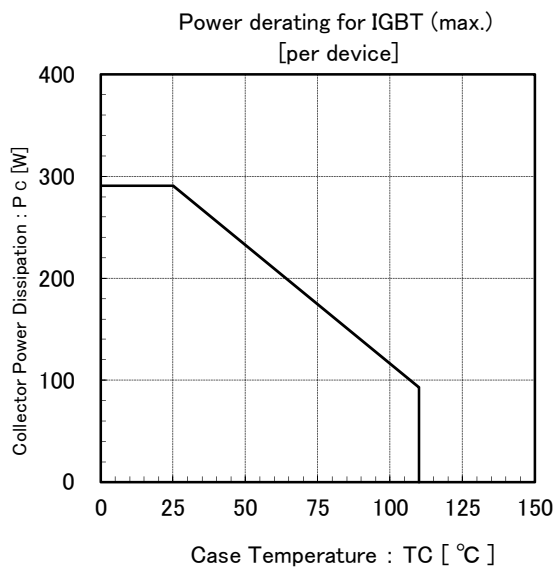
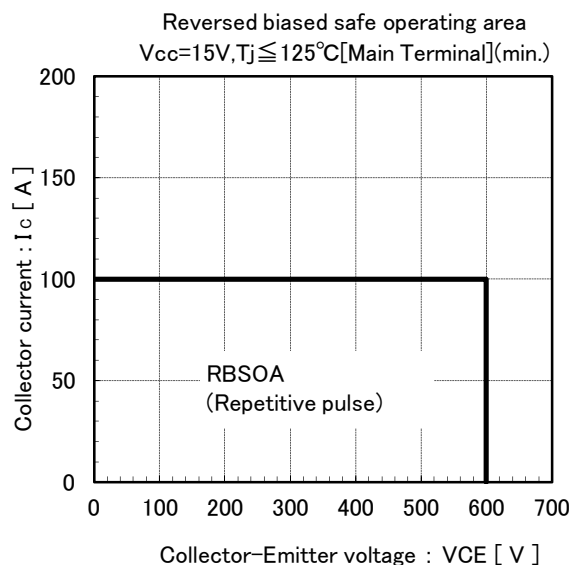
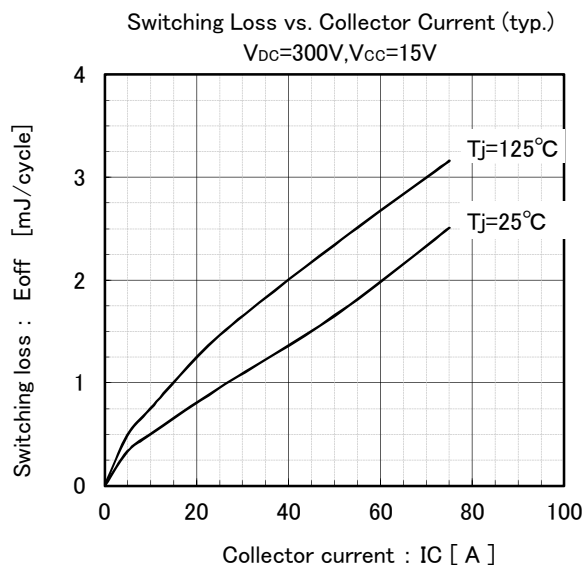


Forward current vs. Forward voltage
[Terminal] (typ.)



7MBP100VFN060-50

IGBT Modules



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