

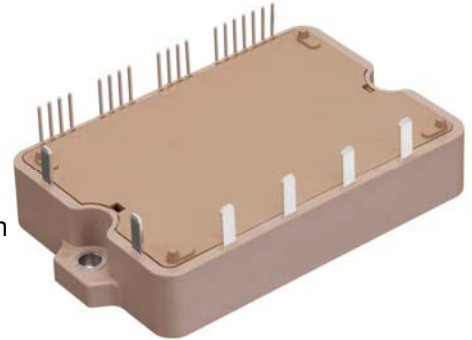
# 7MBP35VFN120-50

IGBT Modules

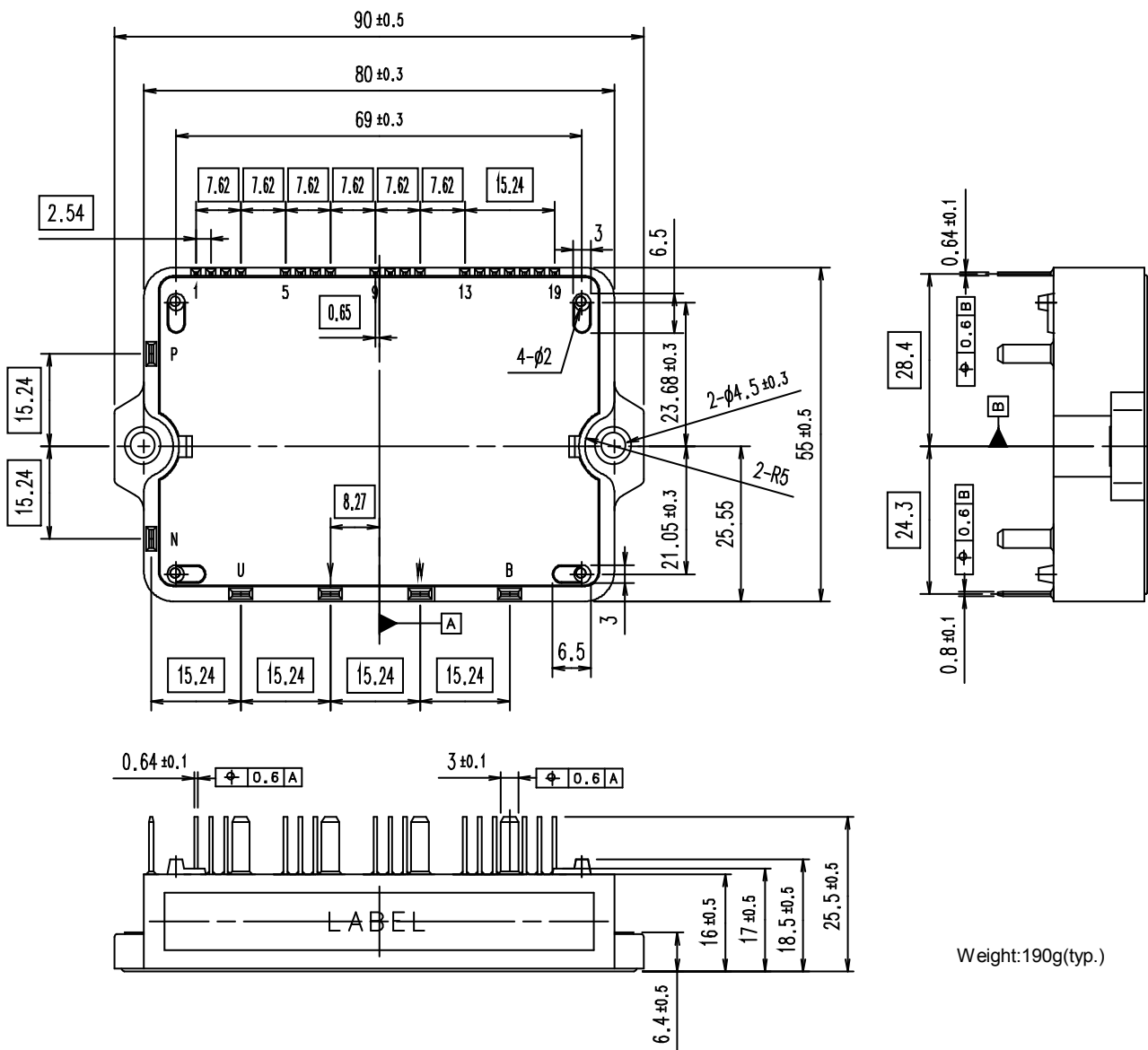
**IGBT Module (V series)  
1200V / 35A / IPM**

■ **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



■ **Outline drawing ( Unit : mm )**



Weight: 190g(typ.)

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■ **Absolute Maximum Ratings**

T<sub>c</sub>=25°C, V<sub>cc</sub>=15V unless otherwise specified.

Items		Symbol	Min.	Max.	Units	
Collector-Emitter Voltage *1		V <sub>CES</sub>	0	1200	V	
Short Circuit Voltage		V <sub>sc</sub>	400	800	V	
Inverter	Collector Current	DC	I <sub>C</sub>	-	35	A
		1ms	I <sub>CP</sub>	-	70	A
		Duty=100% *2	-I <sub>C</sub>	-	35	A
Collector Power Dissipation		1 device *3	P <sub>C</sub>	-	290	W
Brake	Collector Current	DC	I <sub>C</sub>	-	25	A
		1ms	I <sub>CP</sub>	-	50	A
		Forward Current of Diode	I <sub>F</sub>	-	25	A
Collector Power Dissipation		1 device *3	P <sub>C</sub>	-	271	W
Supply Voltage of Pre-Driver *4		V <sub>CC</sub>	-0.5	20	V	
Input Signal Voltage *5		V <sub>in</sub>	-0.5	V <sub>cc</sub> +0.5	V	
Alarm Signal Voltage *6		V <sub>ALM</sub>	-0.5	V <sub>cc</sub>	V	
Alarm Signal Current *7		I <sub>ALM</sub>	-	20	mA	
Junction Temperature		T <sub>j</sub>	-	150	°C	
Operating Case Temperature		T <sub>opr</sub>	-20	110	°C	
Storage Temperature		T <sub>stg</sub>	-40	125	°C	
Solder Temperature *8		T <sub>sol</sub>	-	260	°C	
Isolating Voltage *9		V <sub>iso</sub>	-	AC2500	V <sub>rms</sub>	
Screw Torque		Mounting (M4)	-	-	1.7	Nm

Notes

- \*1: V<sub>CES</sub> shall be applied to the input voltage between terminal P-(U,V, W,B) and (U,V, W,B)-N.
- \*2: Duty=125°C/R<sub>th(j-c)</sub>D/(I<sub>F</sub>×V<sub>F</sub> Max.)×100
- \*3: P<sub>C</sub>=125°C/R<sub>th(j-c)</sub>Q (Inverter & Brake)
- \*4: V<sub>CC</sub> shall be applied to the input voltage between terminal No.4 and 1, 8 and 5, 12 and 9,14 and 13.
- \*5: V<sub>in</sub> 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<sub>ALM</sub> shall be applied to the voltage between terminal No.2 and 1, 6 and 5, 10 and 9,19 and 13.
- \*7: I<sub>ALM</sub> shall be applied to the input current to terminal No.2,6,10 and 19.
- \*8: Immersion time 10±1sec. 1time
- \*9: Terminal to base, 50/60Hz sine wave 1min. All terminals should be connected together during the test.

■ **Electrical Characteristics** (T<sub>j</sub>=25°C, V<sub>CC</sub>=15V unless otherwise specified.)

● **Main circuit**

Item		Symbol	Conditions	Min.	Typ.	Max.	Units	
Inverter	Collector Current at off signal input	I <sub>CES</sub>	V <sub>CE</sub> = 1200V	-	-	1.0	mA	
	Collector-Emitter saturation voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> = 35A	Terminal	-	-	2.20	V
				Chip	-	1.7	-	V
Forward voltage of FWD	V <sub>F</sub>	I <sub>F</sub> = 35A	Terminal	-	-	2.65	V	
			Chip	-	2.1	-	V	
Brake	Collector Current at off signal input	I <sub>CES</sub>	V <sub>CE</sub> = 1200V	-	-	1.0	mA	
	Collector-Emitter saturation voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> = 25A	Terminal	-	-	2.3	V
				Chip	-	1.7	-	V
Forward voltage of FWD	V <sub>F</sub>	I <sub>F</sub> = 25A	Terminal	-	-	3.05	V	
			Chip	-	2.5	-	V	
Switching time	t <sub>on</sub>	V <sub>DC</sub> = 600V , T <sub>j</sub> =125°C		1.1	-	-	μs	
	t <sub>off</sub>	I <sub>C</sub> = 35A		-	-	2.1	μs	
	t <sub>tr</sub>	V <sub>DC</sub> = 600V I <sub>F</sub> = 35A		-	-	0.3	μs	

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● **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 $T_c = -20 \sim 110^\circ\text{C}$	-	-	11	mA	
Supply current of N-side pre-driver	$I_{ccn}$		-	-	42	mA	
Input signal threshold voltage	$V_{in(th)(on)}$	$V_{in-GND}$	ON	1.2	1.4	1.6	V
	$V_{in(th)(off)}$		OFF	1.5	1.7	1.9	V

● **Protection Circuit**

Item	Symbol	Conditions	Min.	Typ.	Max.	Units
Over Current Protection Level	$I_{oc}$	$T_j = 125^\circ\text{C}$ Resistance Load	70	-	-	A
			50	-	-	-
Over Current Protection Delay time	$t_{dOC}$	$T_j = 125^\circ\text{C}$	-	5	-	$\mu\text{s}$
Short Circuit Protection Delay time	$t_{sc}$	$T_j = 125^\circ\text{C}$	-	2	3	$\mu\text{s}$
IGBT Chips Over Heating Protection Temperature Level	$T_{jOH}$	Surface of IGBT Chips	150	-	-	$^\circ\text{C}$
Over Heating Protection Hysteresis	$T_{jH}$		-	20	-	$^\circ\text{C}$
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 $T_c = -20 \sim 110^\circ\text{C}$ $V_{cc} \geq 10\text{V}$	1.0	2.0	2.4	ms
	$t_{ALM(UV)}$		2.5	4.0	4.9	ms
	$t_{ALM(T_{jOH})}$		5.0	8.0	11.0	ms
Resistance for current limit	$R_{ALM}$		960	1265	1570	$\Omega$

■ **Thermal Characteristics ( $T_c = 25^\circ\text{C}$ )**

Item	Symbol	Min.	Typ.	Max.	Units	
Junction to Case Thermal Resistance*10	Inverter	IGBT	-	-	0.43	$^\circ\text{C/W}$
		FWD	-	-	0.62	$^\circ\text{C/W}$
	Brake	IGBT	-	-	0.46	$^\circ\text{C/W}$
		FWD	-	-	1.07	$^\circ\text{C/W}$
Case to Fin Thermal Resistance with Compound	$R_{th(c-f)}$	-	0.05	-	$^\circ\text{C/W}$	

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

■ **Noise Immunity ( $V_{DC}=600\text{V}$ ,  $V_{CC}=15\text{V}$ )**

Item	Conditions	Min.	Typ.	Max.	Units
Common mode rectangular noise	Pulse width $1\mu\text{s}$ , polarity $\pm$ , 10min. Judge: no over-current, no miss operating	$\pm 2.0$	-	-	kV

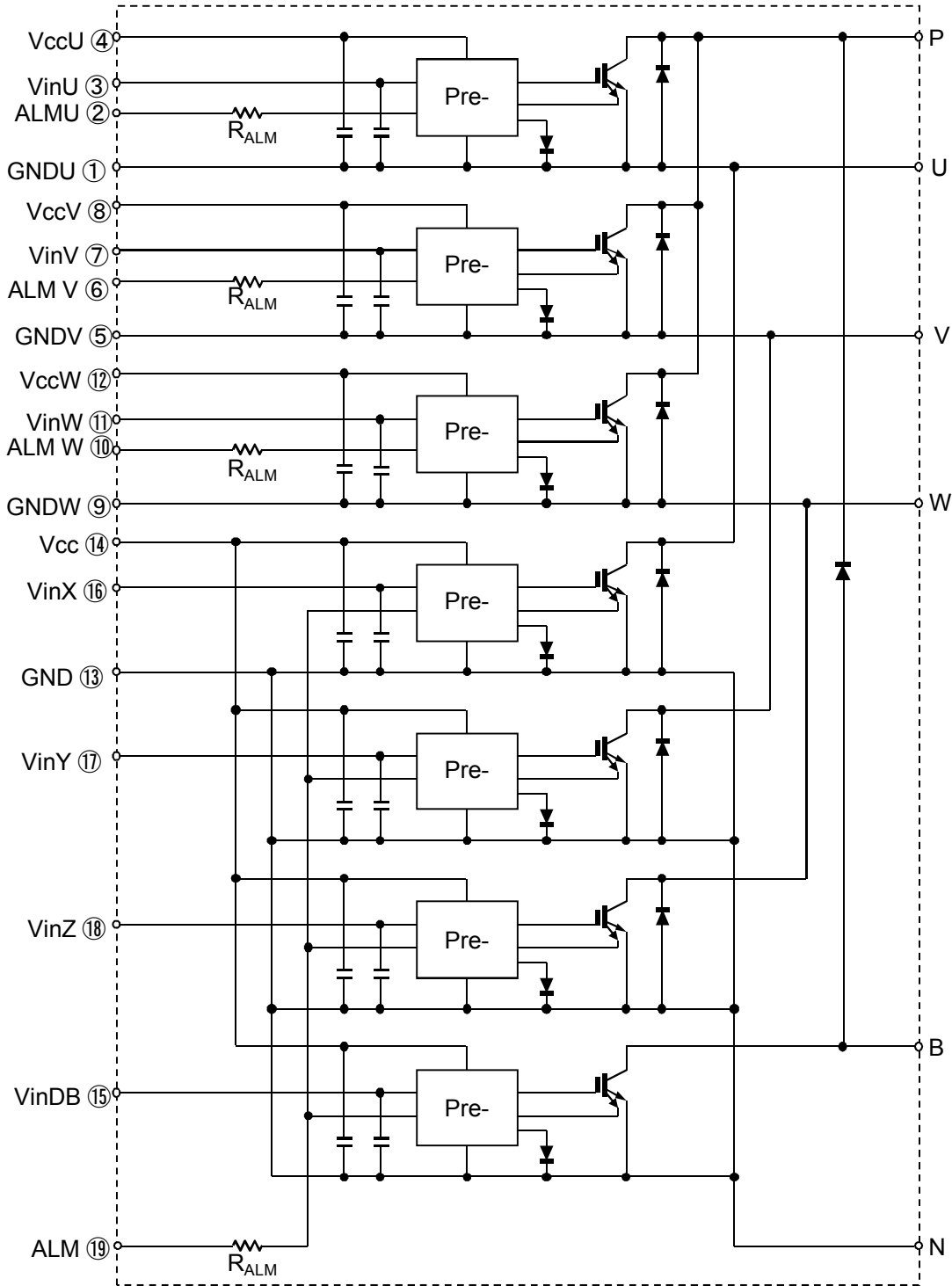
■ **Recommended Operating Conditions**

Item	Symbol	Min.	Typ.	Max.	Units
DC Bus Voltage	$V_{DC}$	-	-	800	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	-	-	$\mu\text{s}$
Screw Torque (M4)	-	1.3	-	1.7	Nm

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## ■ Block Diagram



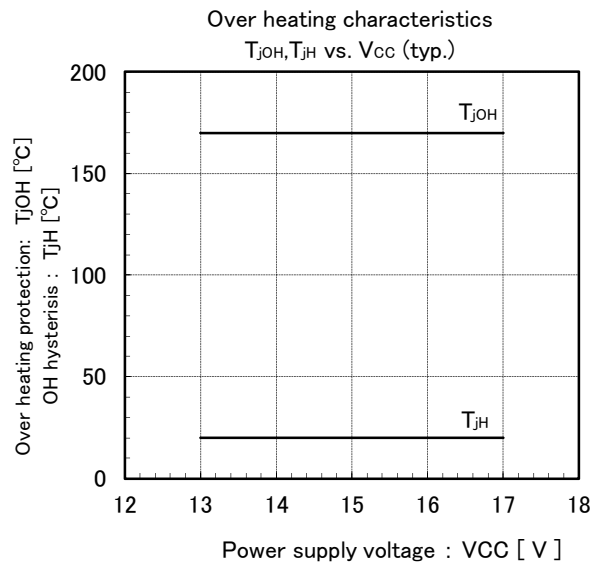
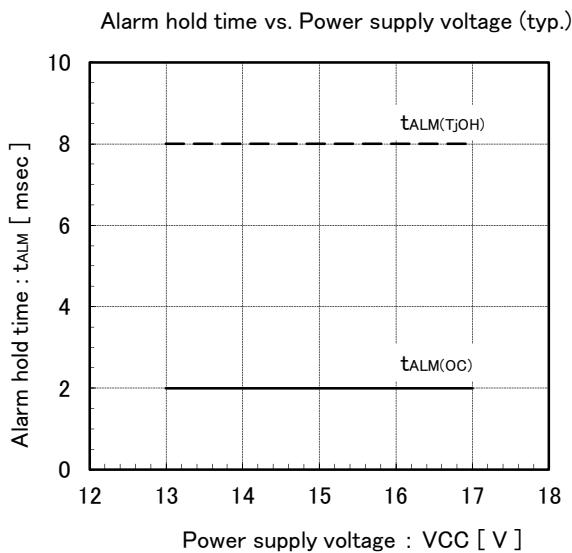
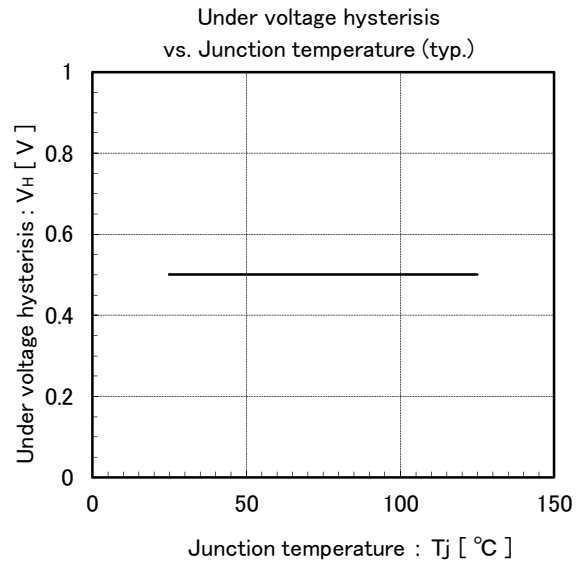
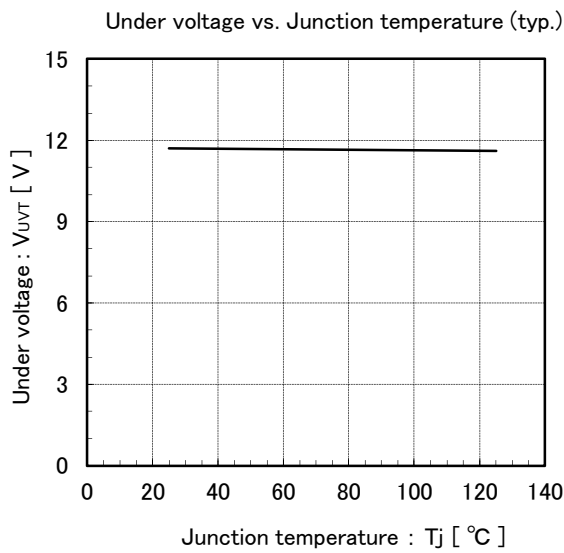
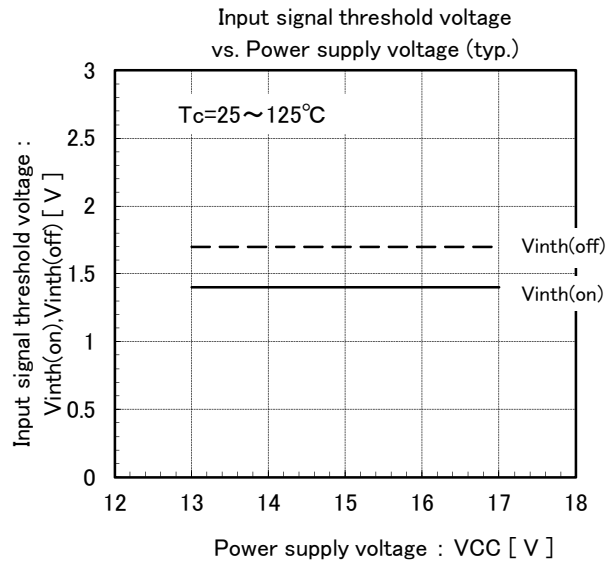
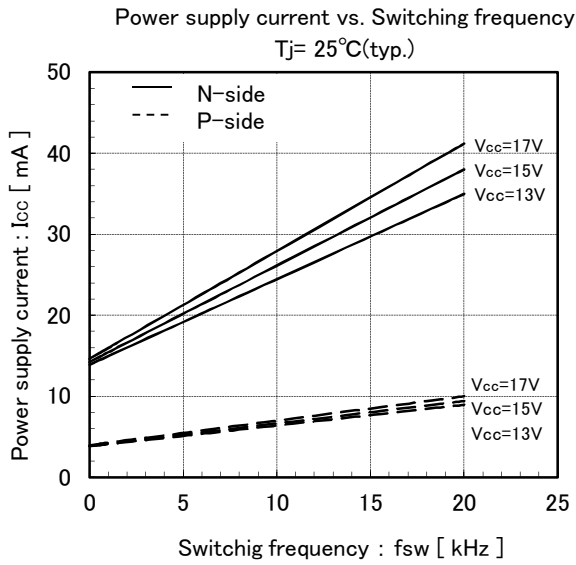
Pre-drivers include following functions

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

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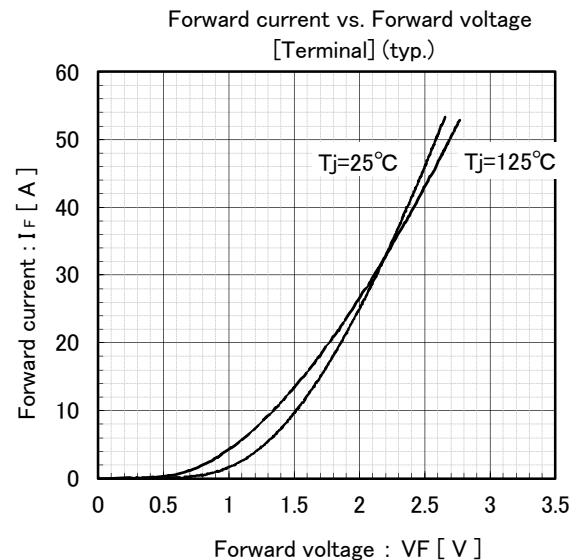
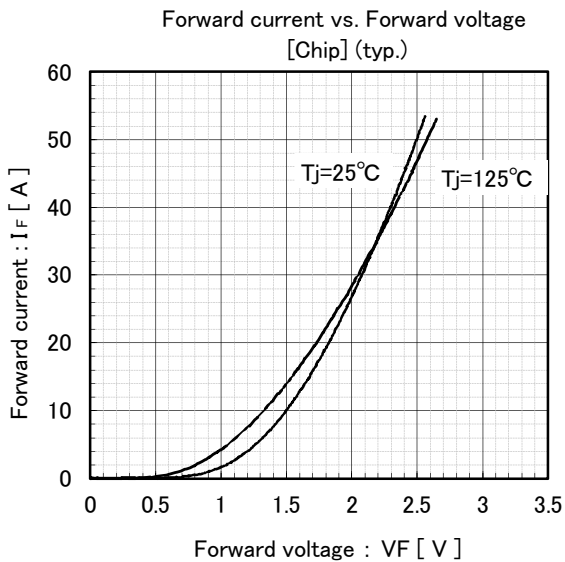
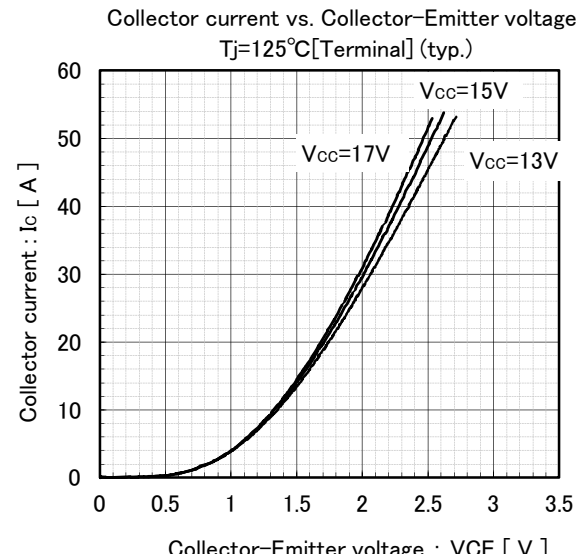
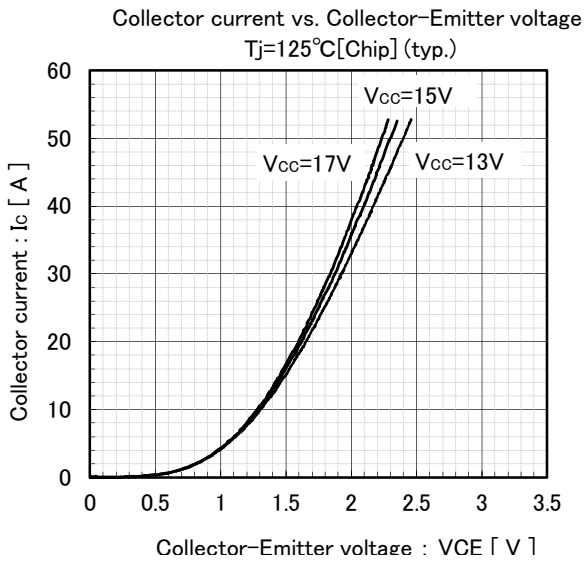
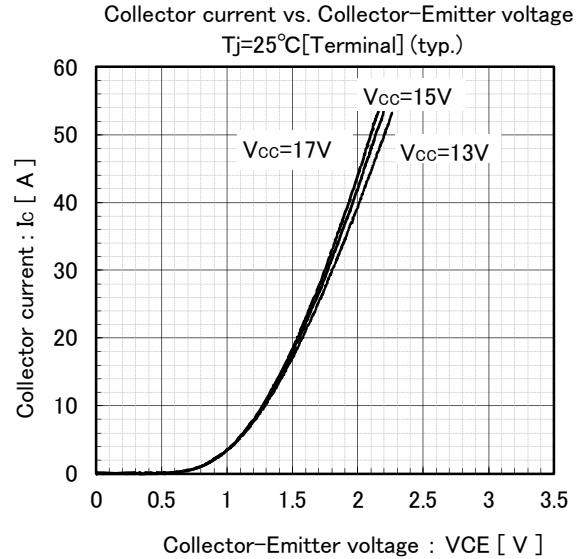
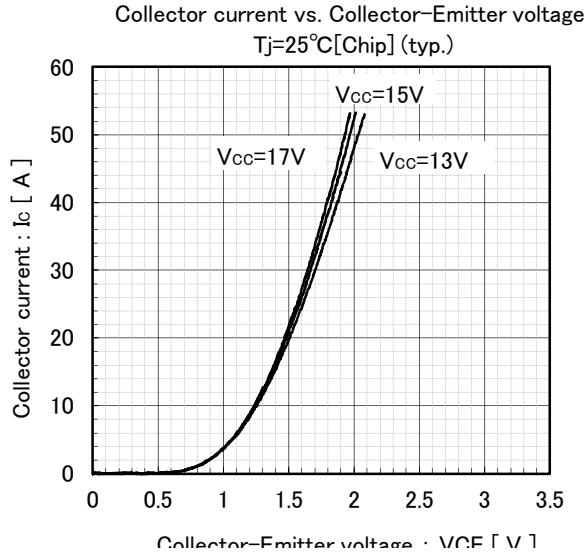
■ Characteristics (Representative)  
● Control Circuit



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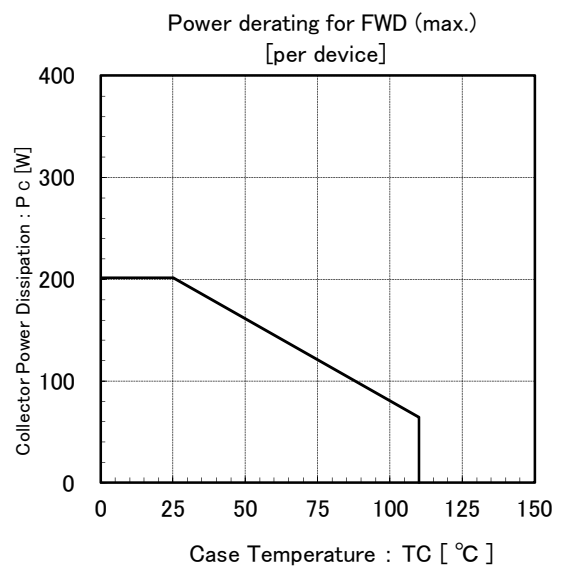
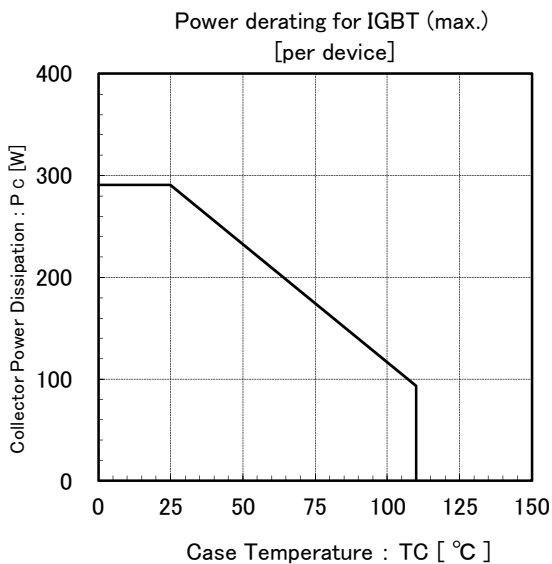
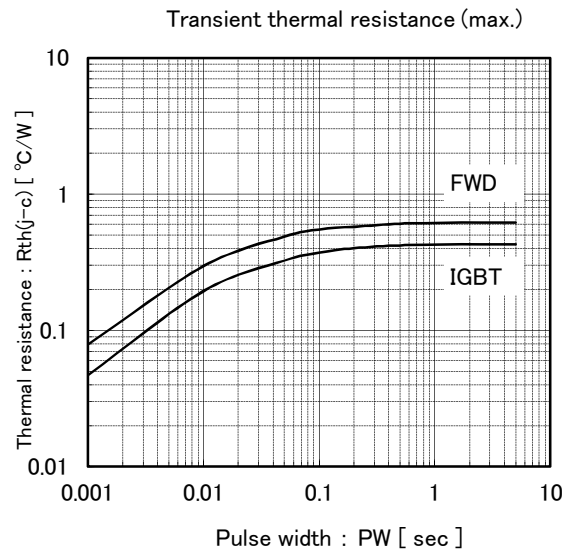
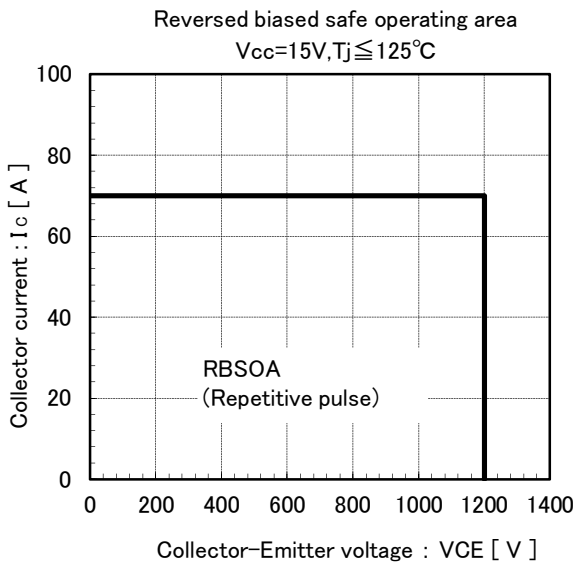
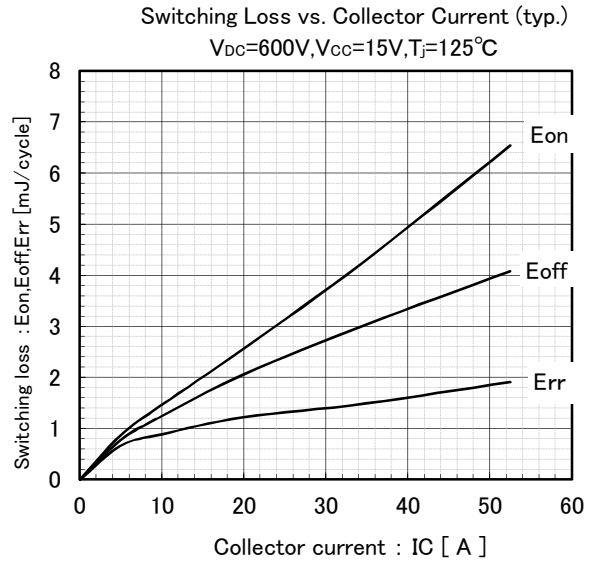
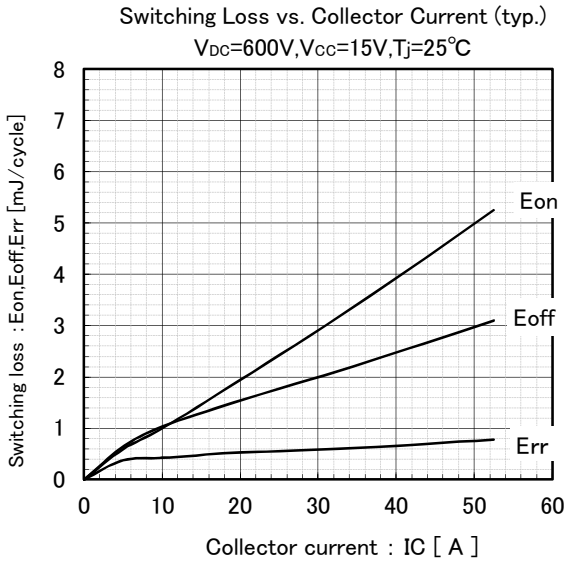
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● Inverter



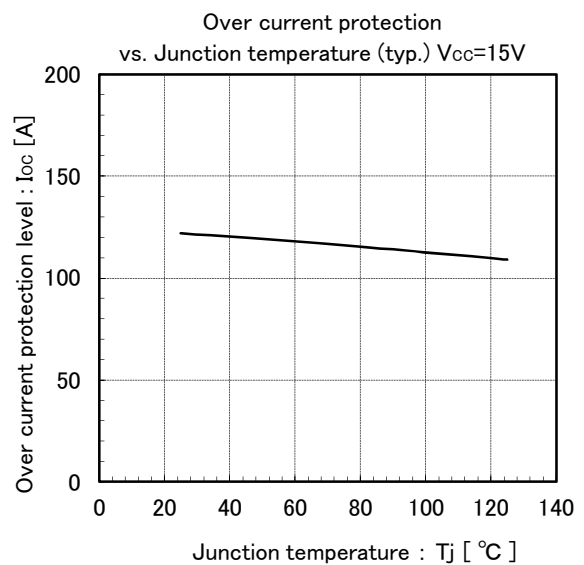
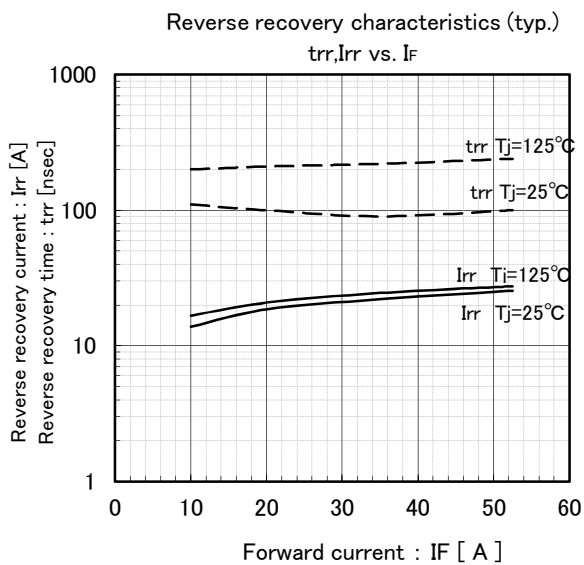
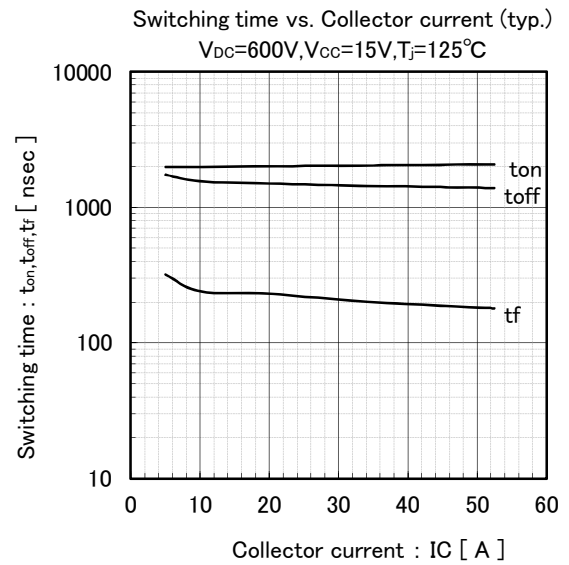
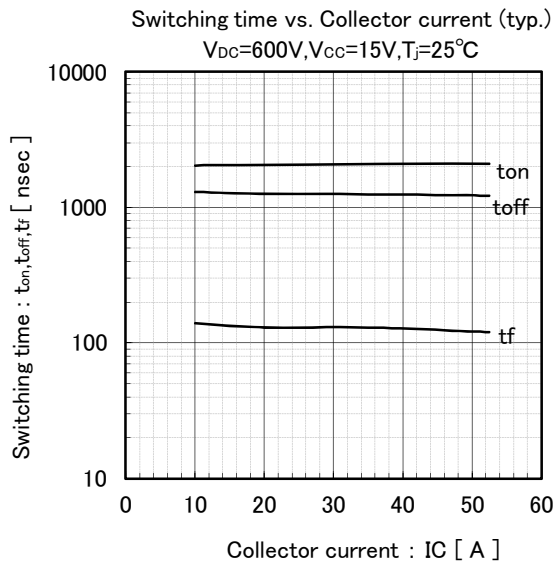
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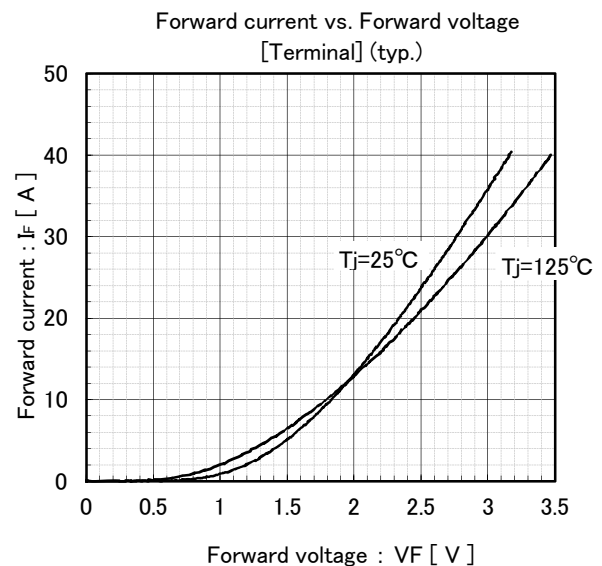
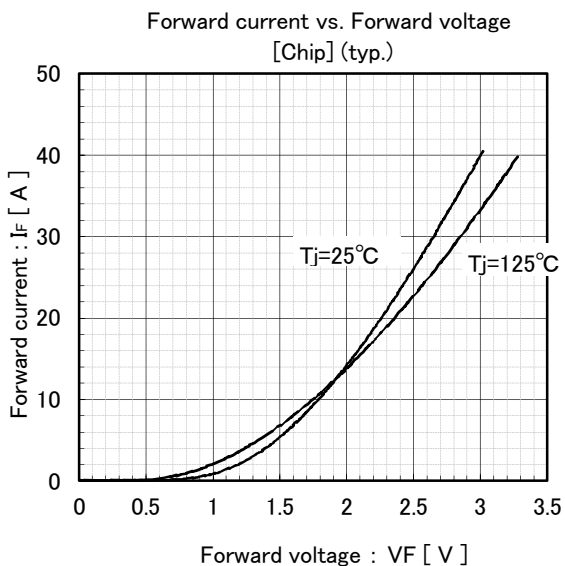
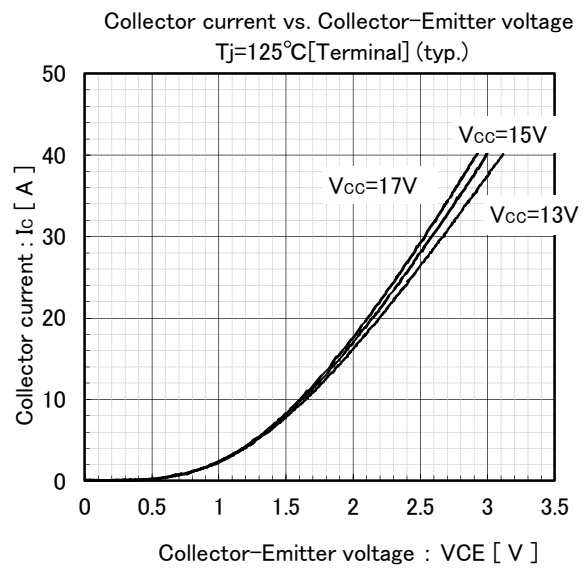
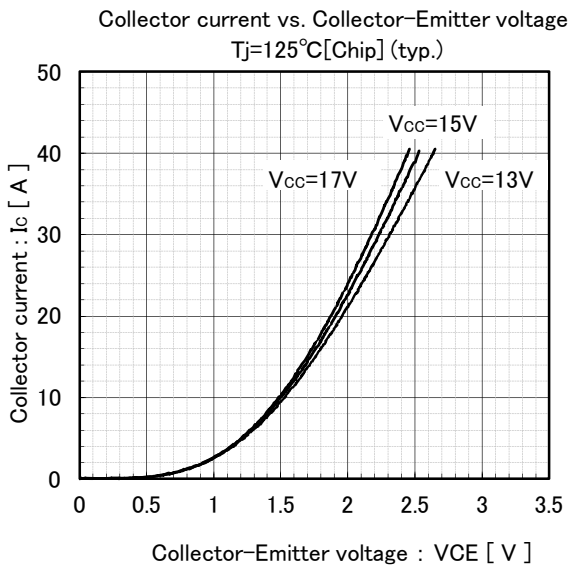
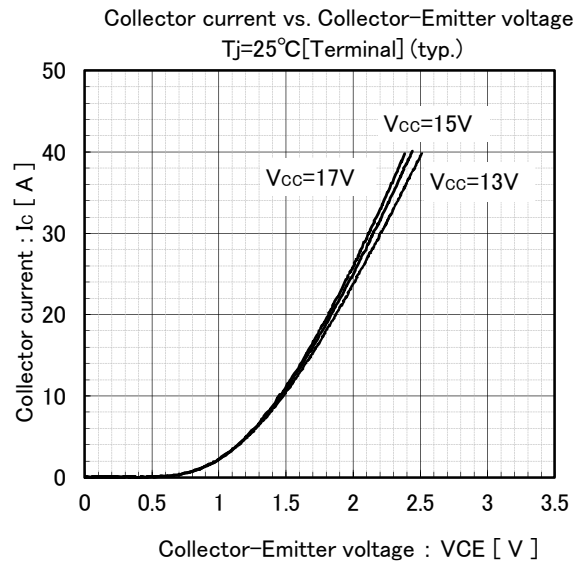
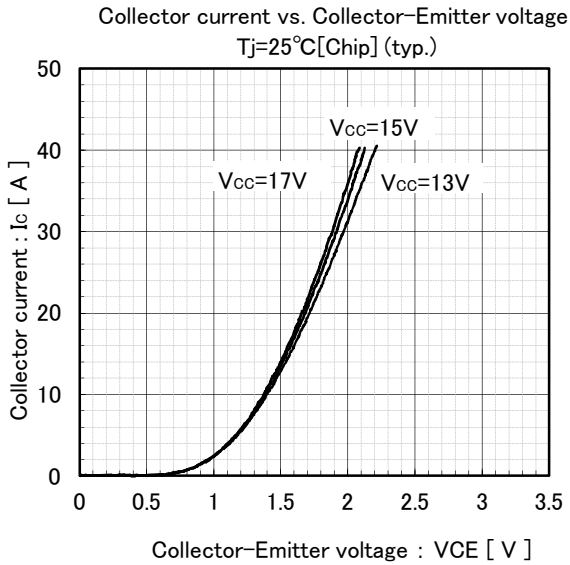




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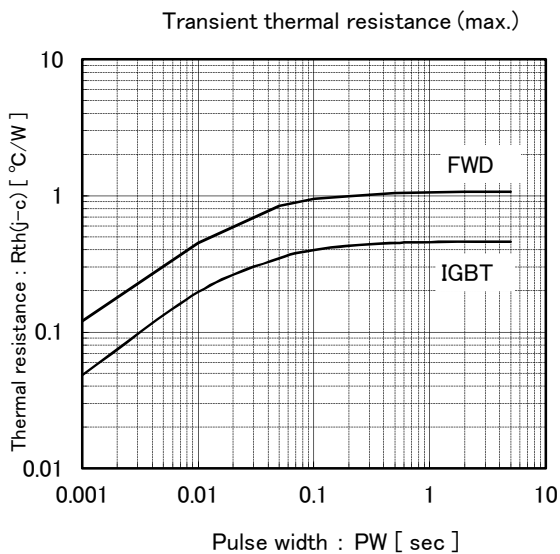
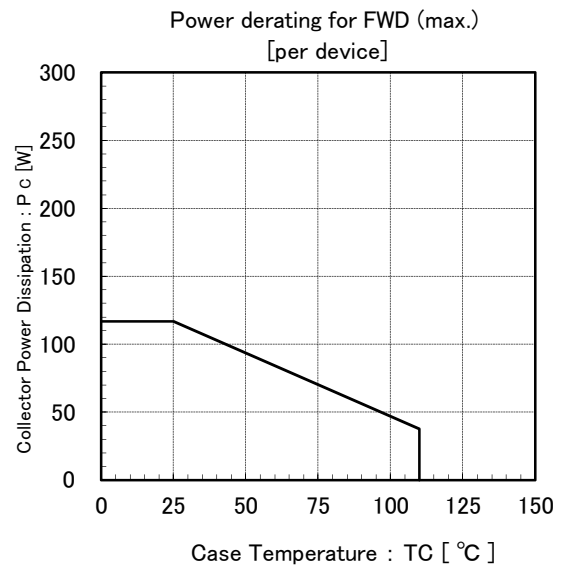
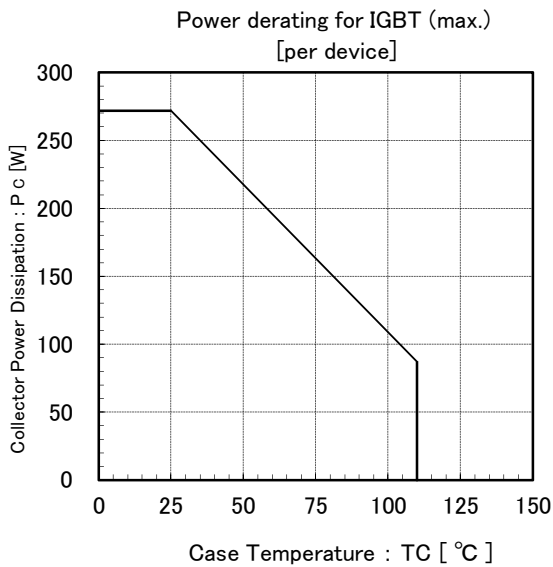
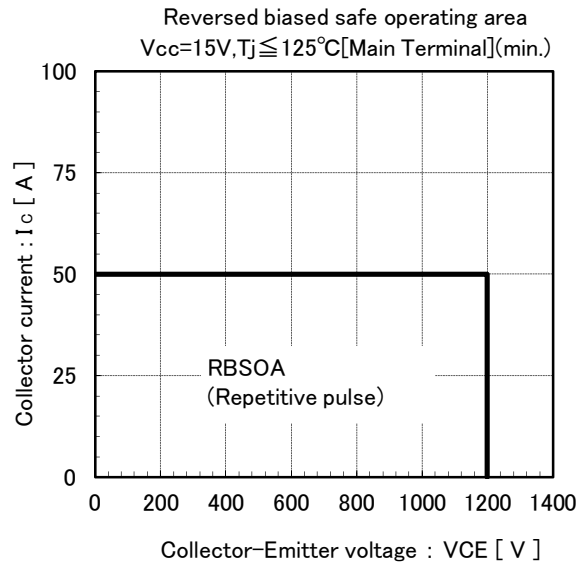
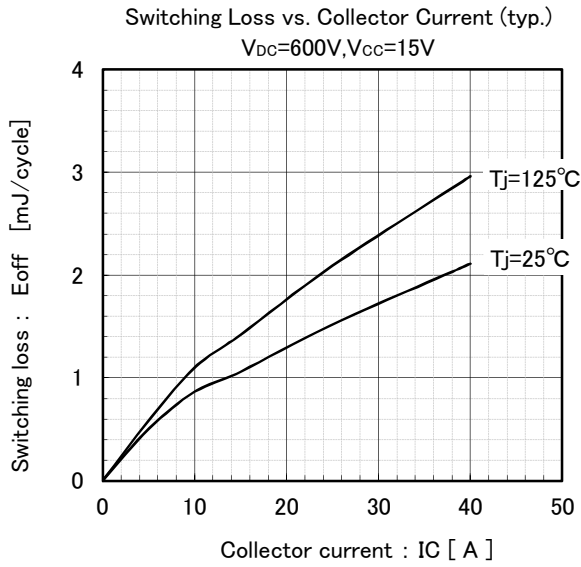
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■ Brake



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