

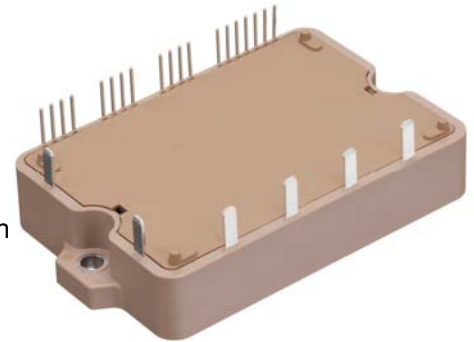
# 7MBP50VFN060-50

IGBT Modules

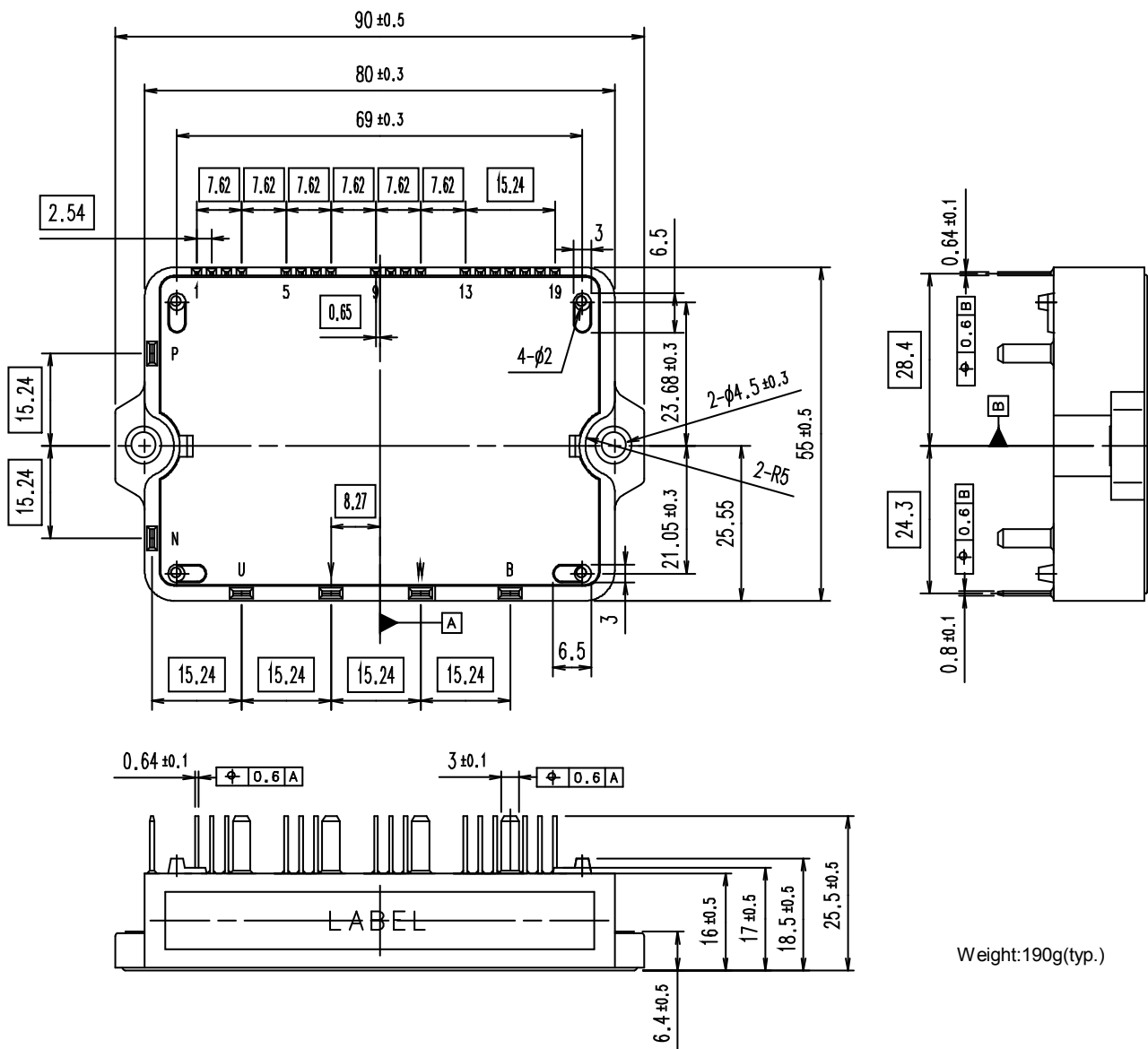
**IGBT Module (V series)**  
**600V / 50A / IPM**

■ **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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**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	-	50	A
		1ms	-	100	A
		Duty=100% *2	-	50	A
Collector Power Dissipation		1 device *3	-	290	W
Brake	Collector Current	DC	-	30	A
		1ms	-	60	A
		Forward Current of Diode	-	30	A
Collector Power Dissipation		1 device *3	-	198	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:  $PC=125^{\circ}\text{C}/R_{th(j-c)Q}$  (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	$I_{CES}$	$V_{CE} = 600\text{V}$	-	-	1.0	mA	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	$I_C = 50\text{A}$	Terminal	-	-	1.85	V
				Chip	-	1.25	-	V
Forward voltage of FWD	$V_F$	$I_F = 50\text{A}$	Terminal	-	-	2.1	V	
			Chip	-	1.6	-	V	
Brake	Collector Current at off signal input	$I_{CES}$	$V_{CE} = 600\text{V}$	-	-	1.0	mA	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	$I_C = 30\text{A}$	Terminal	-	-	2.0	V
				Chip	-	1.4	-	V
Forward voltage of FWD	$V_F$	$I_F = 30\text{A}$	Terminal	-	-	2.55	V	
			Chip	-	2.0	-	V	
Switching time	$t_{on}$	$V_{DC} = 300\text{V}$ , $T_j=125^{\circ}\text{C}$		1.1	-	-	$\mu\text{s}$	
	$t_{off}$	$I_C = 50\text{A}$		-	-	2.1	$\mu\text{s}$	
	$t_{rr}$	$V_{DC} = 300\text{V}$ $I_F = 50\text{A}$		-	-	0.3	$\mu\text{s}$	

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● **Control circuit**

Item	Symbol	Conditions	Min.	Typ.	Max.	Units	
Supply current of P-side pre-driver (per one unit)	I <sub>ccp</sub>	Switching Frequency = 0-15kHz T <sub>c</sub> =-20~110°C	-	-	12	mA	
Supply current of N-side pre-driver	I <sub>ccn</sub>		-	-	49	mA	
Input signal threshold voltage	V <sub>inth(on)</sub>	V <sub>in</sub> -GND	ON	1.2	1.4	1.6	V
	V <sub>inth(off)</sub>		OFF	1.5	1.7	1.9	V

● **Protection Circuit**

Item	Symbol	Conditions	Min.	Typ.	Max.	Units
Over Current Protection Level	I <sub>oc</sub>	T <sub>j</sub> =125°C Resistance Load	100	-	-	A
Over Current Protection Delay time	t <sub>dOC</sub>	T <sub>j</sub> =125°C	-	5	-	μs
Short Circuit Protection Delay time	t <sub>sc</sub>	T <sub>j</sub> =125°C	-	2	3	μs
IGBT Chips Over Heating Protection Temperature Level	T <sub>jOH</sub>	Surface of IGBT Chips	150	-	-	°C
Over Heating Protection Hysteresis	T <sub>jH</sub>		-	20	-	°C
Under Voltage Protection Level	V <sub>UV</sub>		11.0	-	12.5	V
Under Voltage Protection Hysteresis	V <sub>H</sub>		0.2	0.5	-	V
Alarm Signal Hold Time	t <sub>ALM(OC)</sub>	ALM-GND	1.0	2.0	2.4	ms
	t <sub>ALM(UV)</sub>	T <sub>c</sub> =-20~110°C V <sub>cc</sub> ≥10V	2.5	4.0	4.9	ms
	t <sub>ALM(TjOH)</sub>		5.0	8.0	11.0	ms
Resistance for current limit	R <sub>ALM</sub>		960	1265	1570	Ω

■ **Thermal Characteristics (T<sub>c</sub> = 25°C)**

Item	Symbol	Min.	Typ.	Max.	Units	
Junction to Case Thermal Resistance*10	Inverter	IGBT	-	-	0.43	°C/W
		FWD	-	-	0.69	°C/W
	Brake	IGBT	-	-	0.63	°C/W
		FWD	-	-	1.42	°C/W
Case to Fin Thermal Resistance with Compound	R <sub>th(c-f)</sub>	-	0.05	-	°C/W	

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

■ **Noise Immunity (V<sub>DC</sub>=300V, V<sub>CC</sub>=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

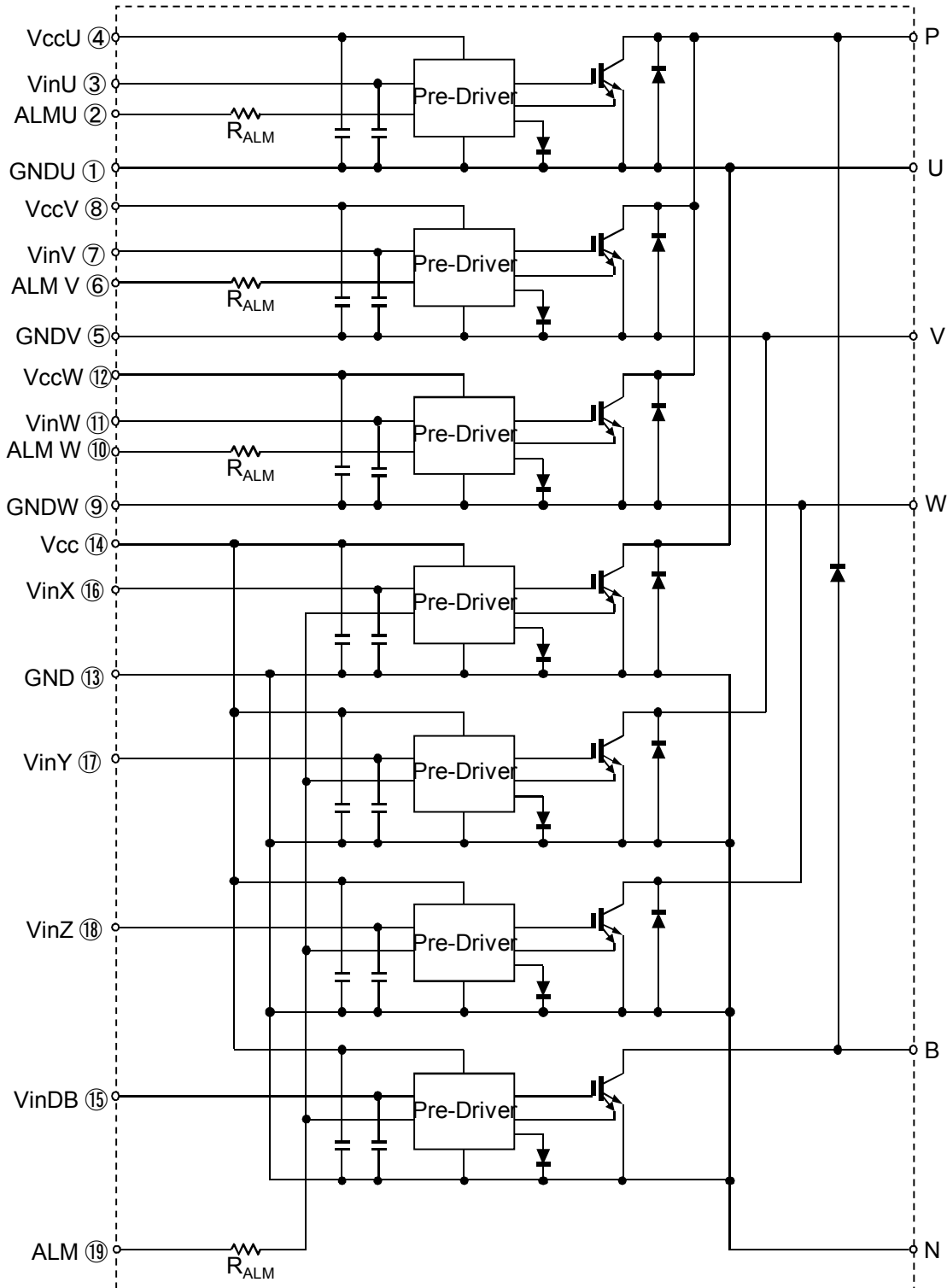
■ **Recommended Operating Conditions**

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

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## ■ Block Diagram



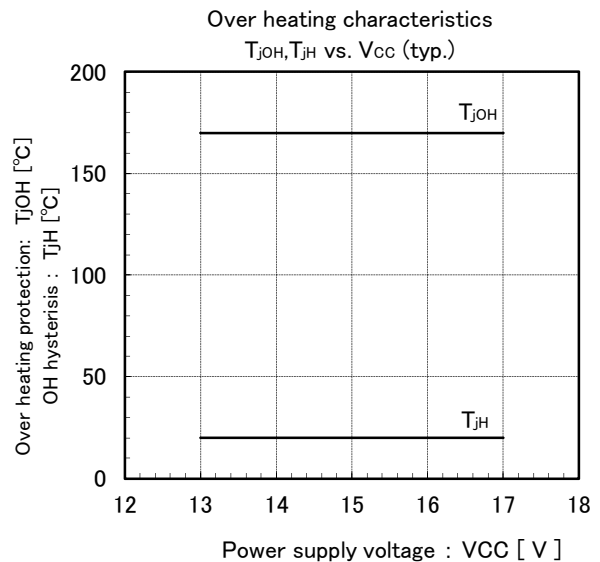
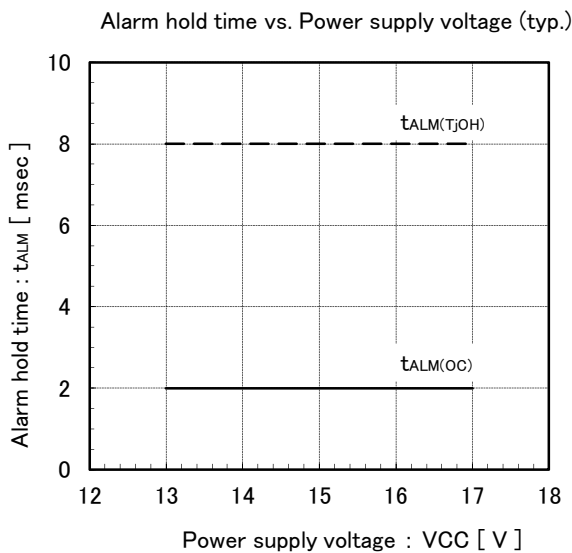
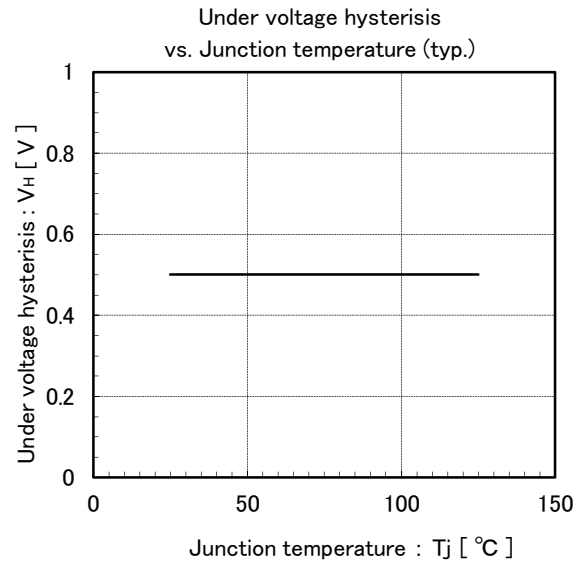
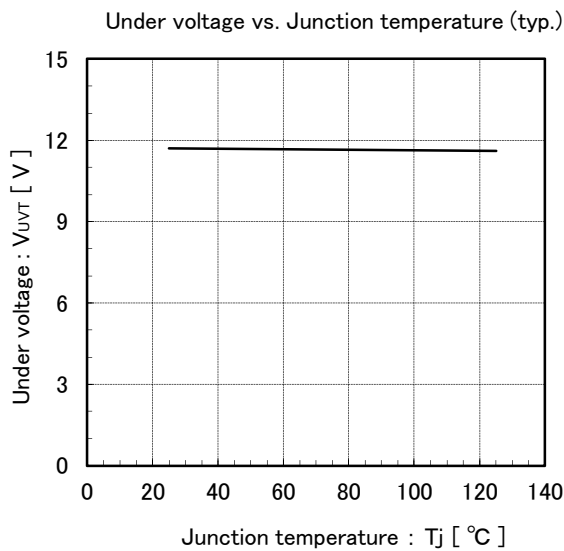
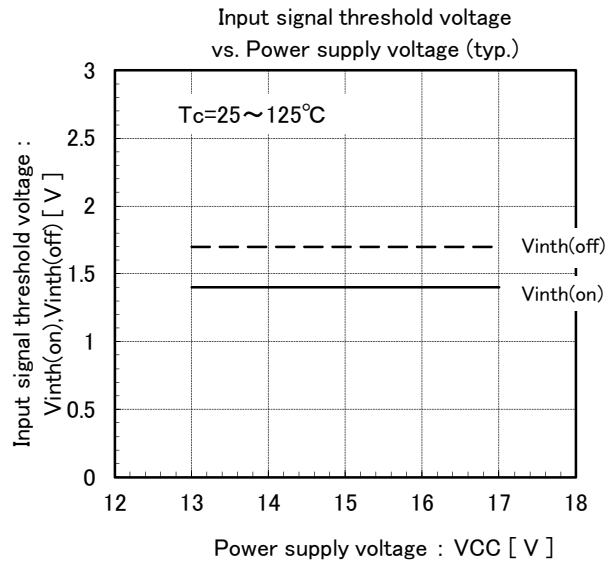
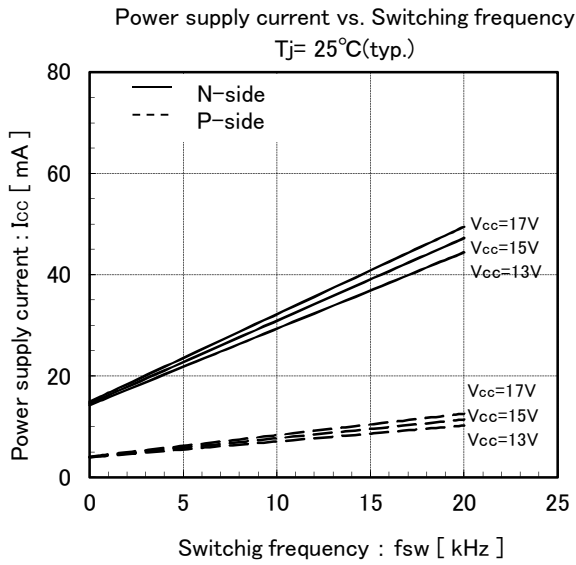
Pre-drivers include following functions

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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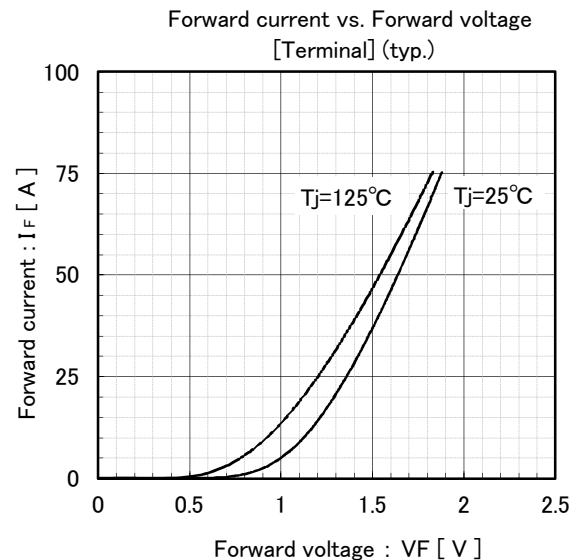
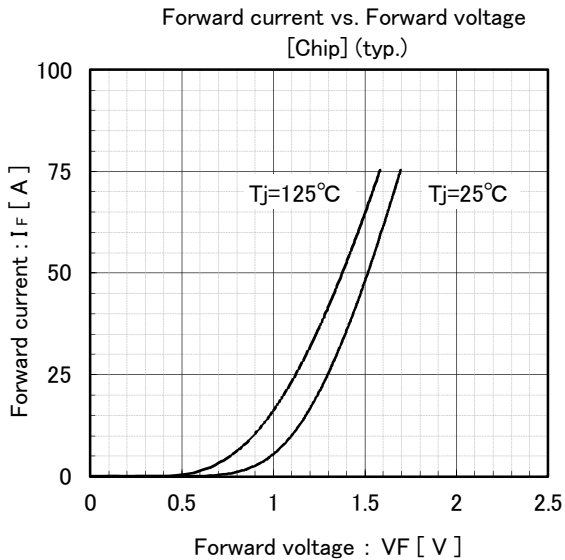
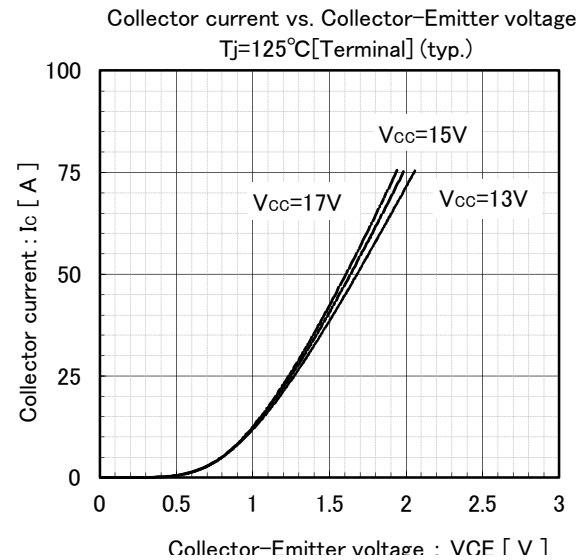
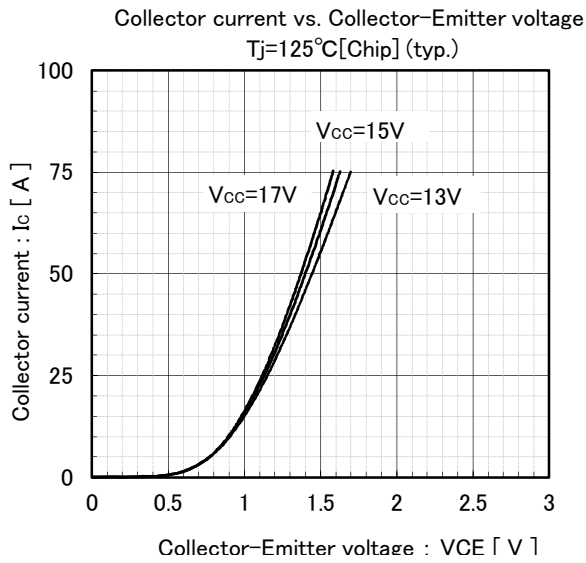
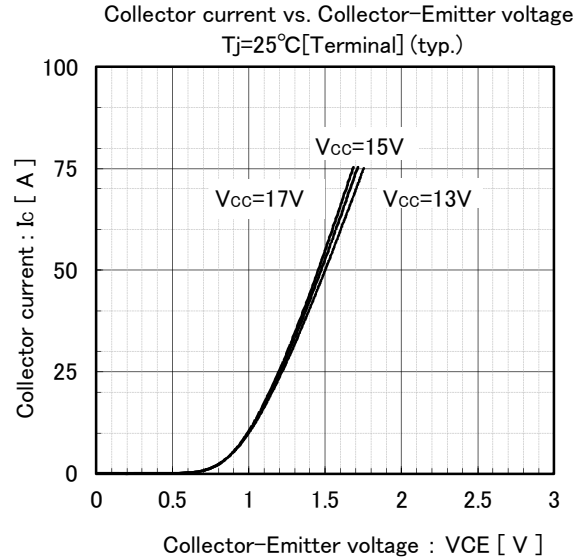
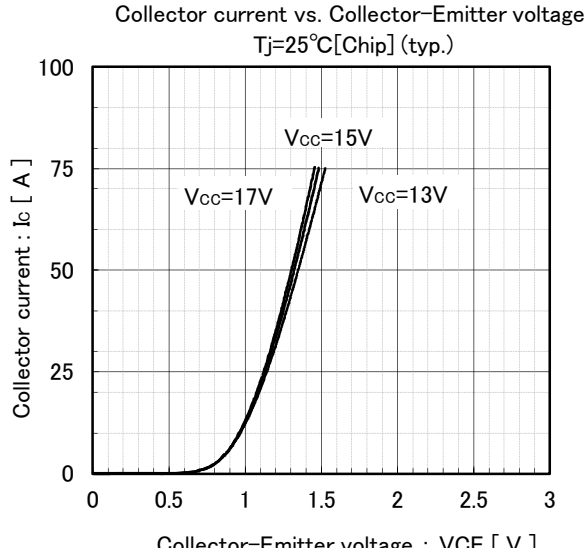
■ Characteristics (Representative)  
● Control Circuit



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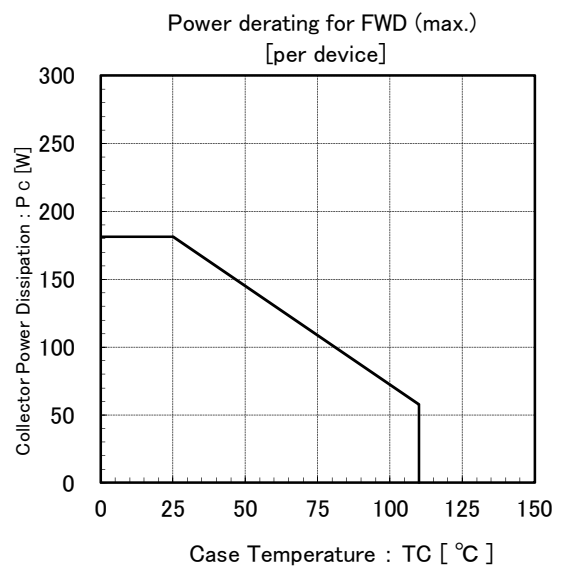
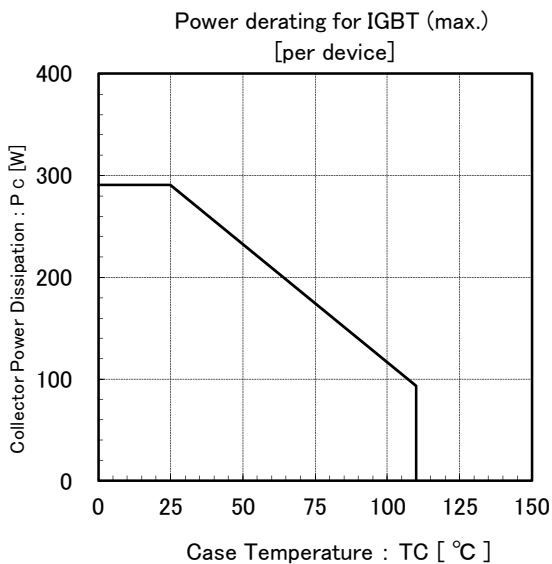
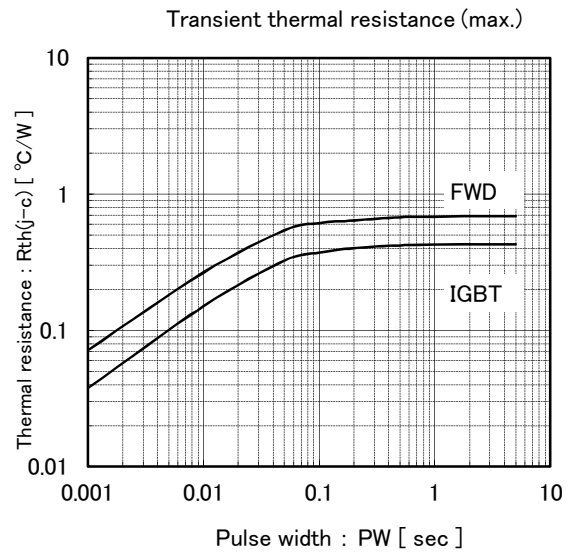
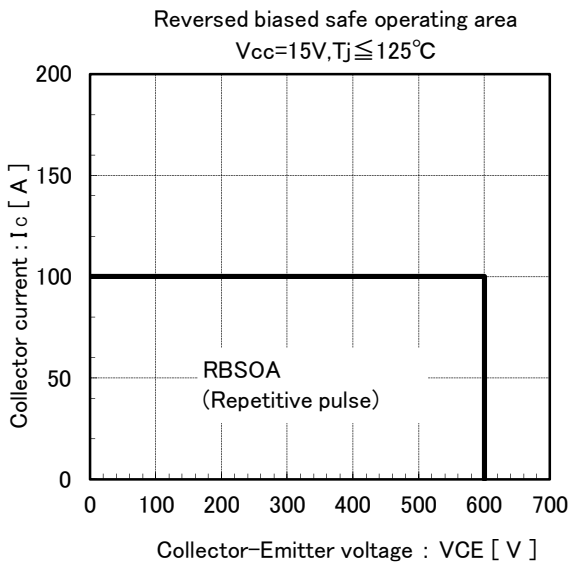
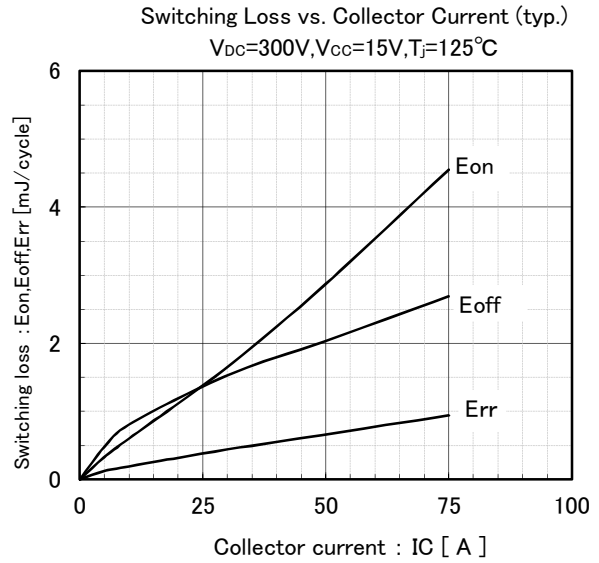
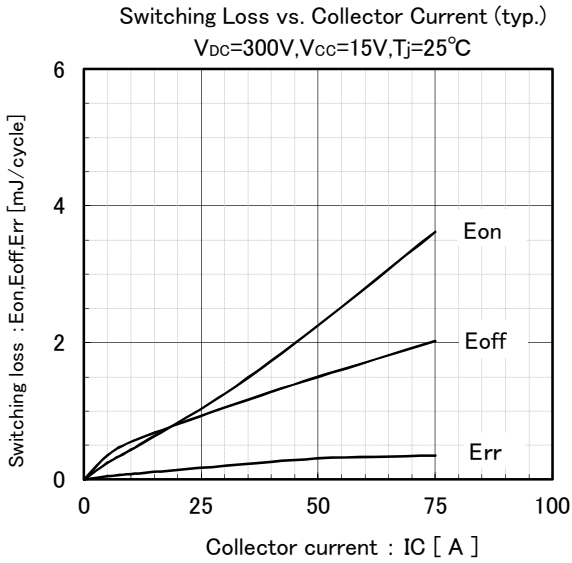
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● Inverter



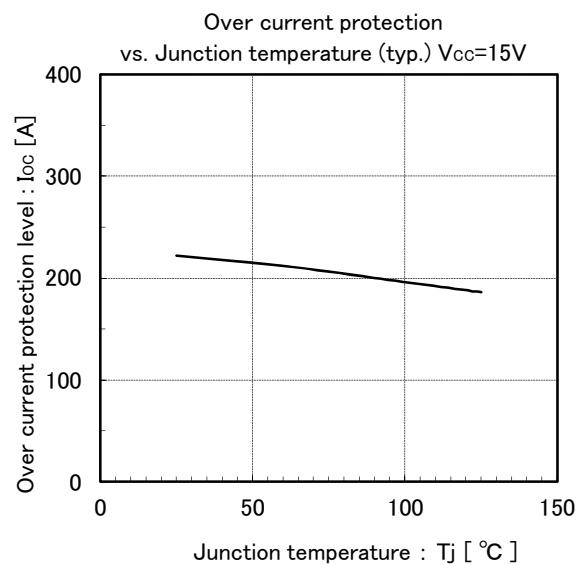
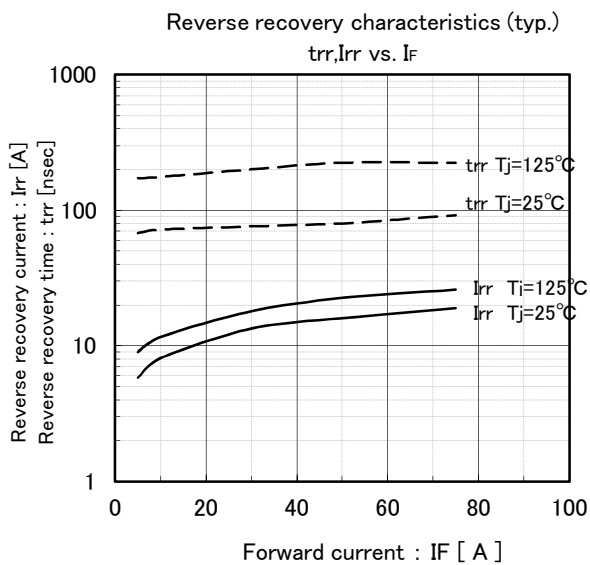
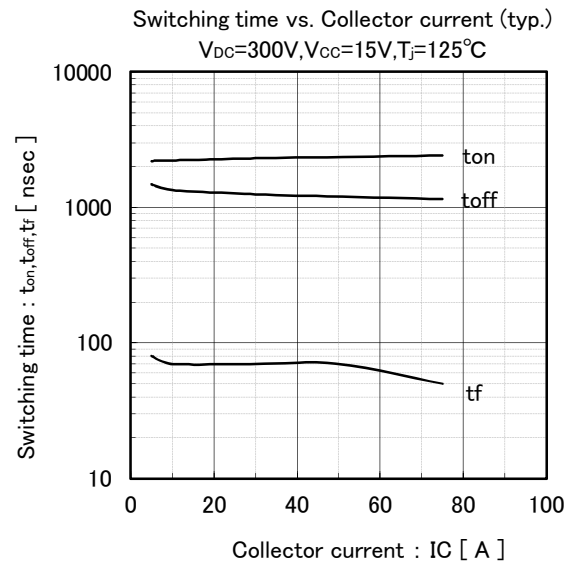
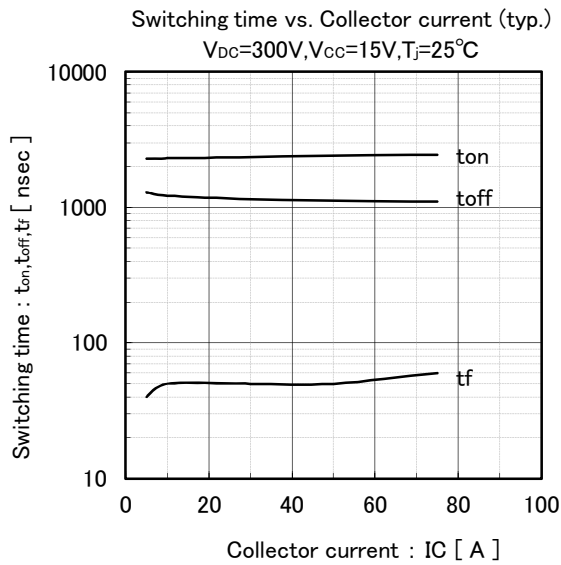
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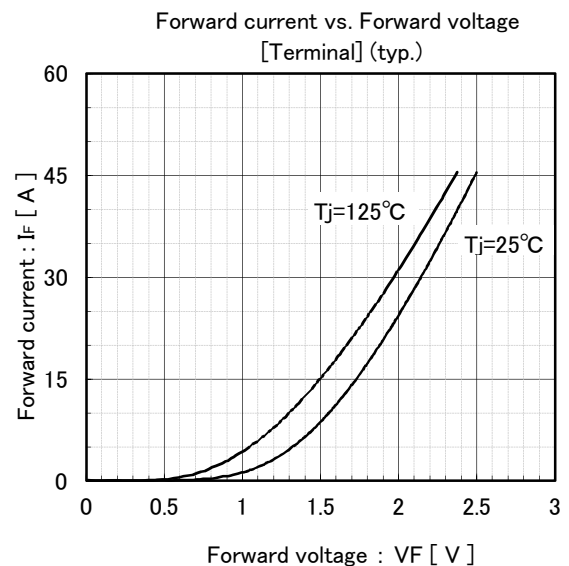
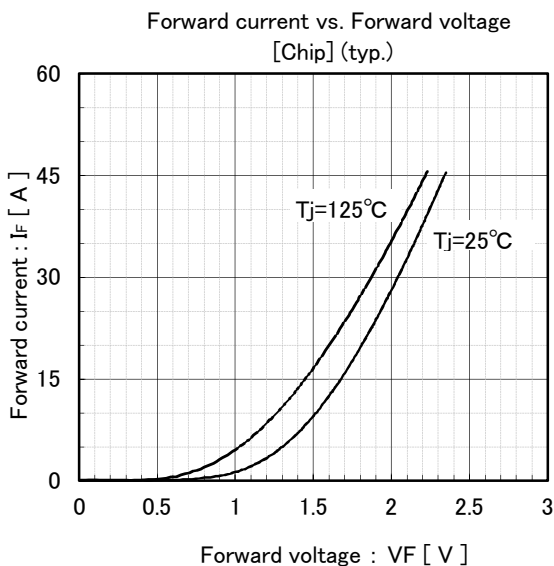
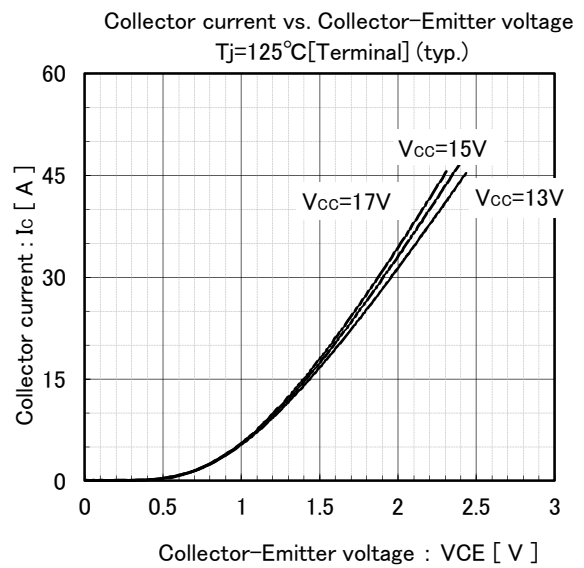
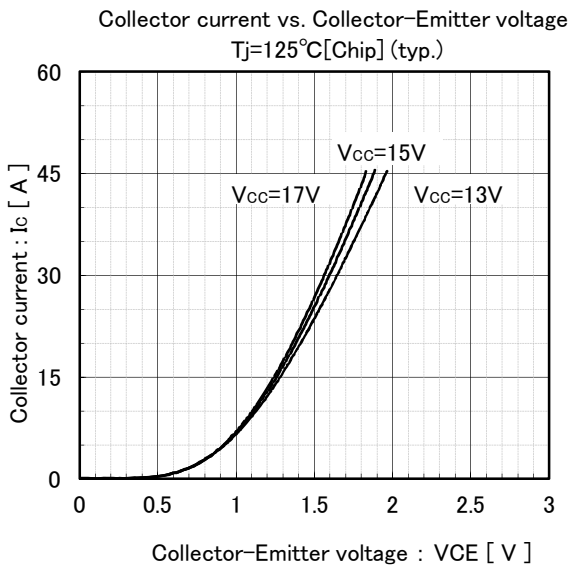
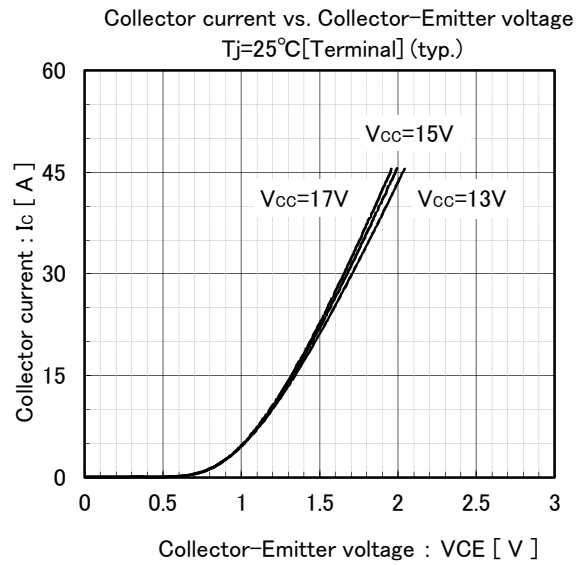
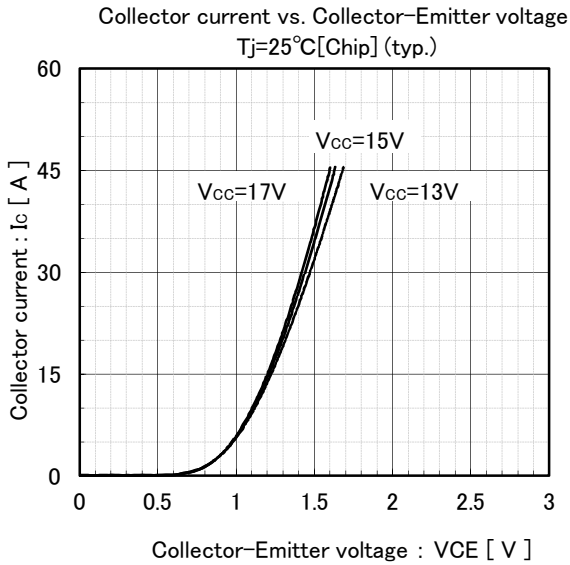




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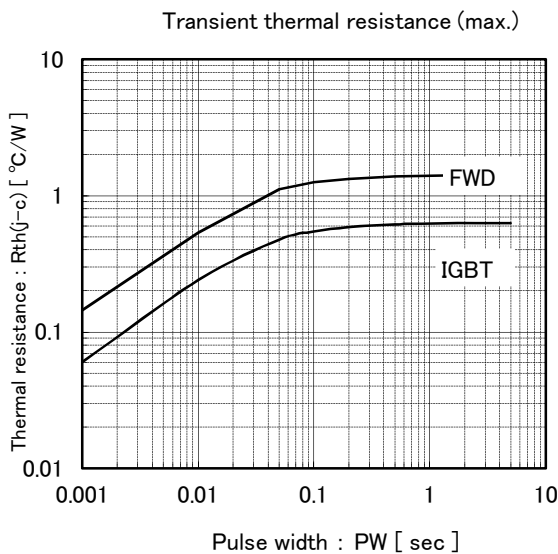
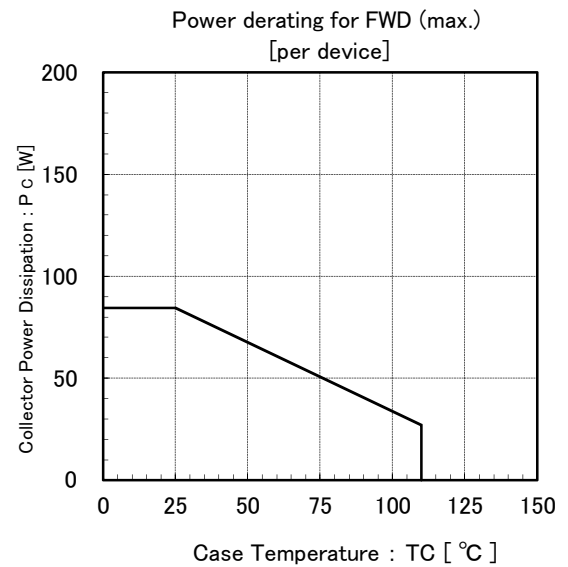
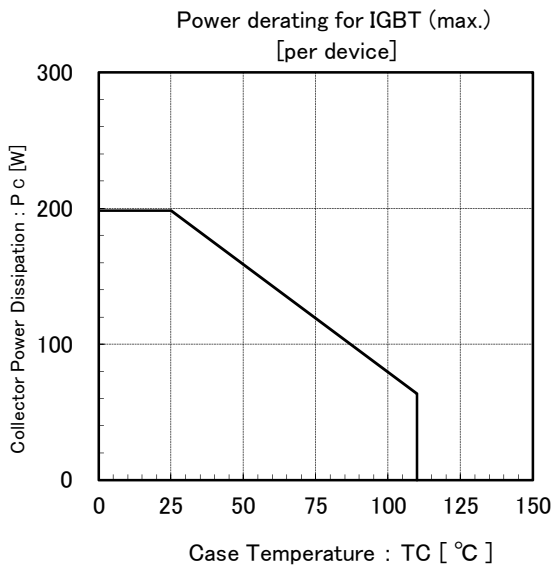
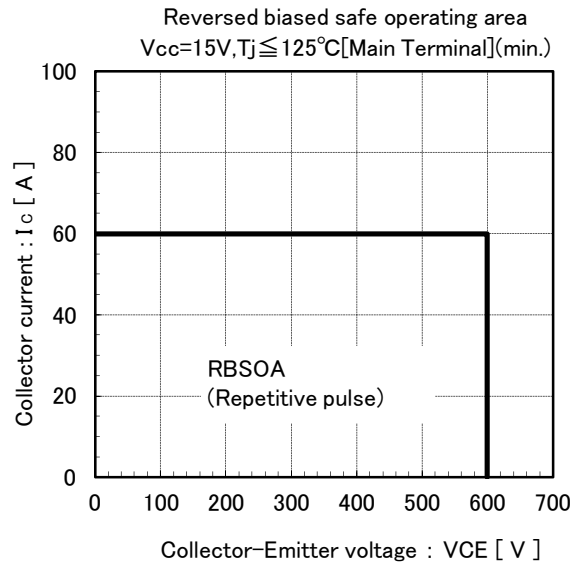
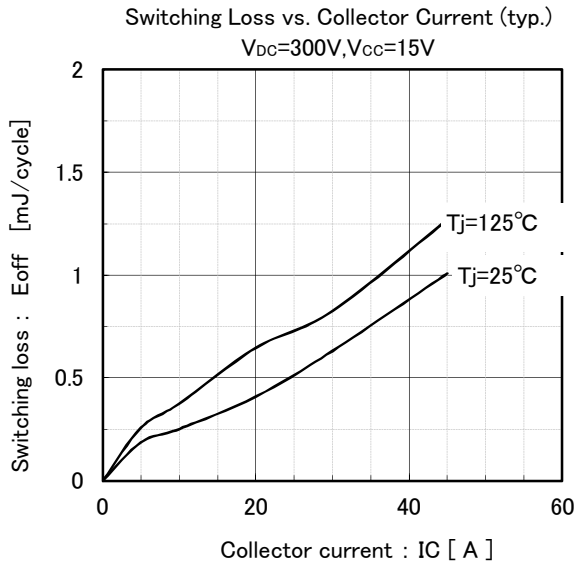
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■ Brake



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