

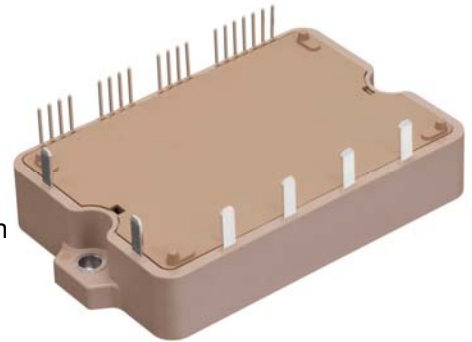
# 6MBP50VFN060-50

IGBT Modules

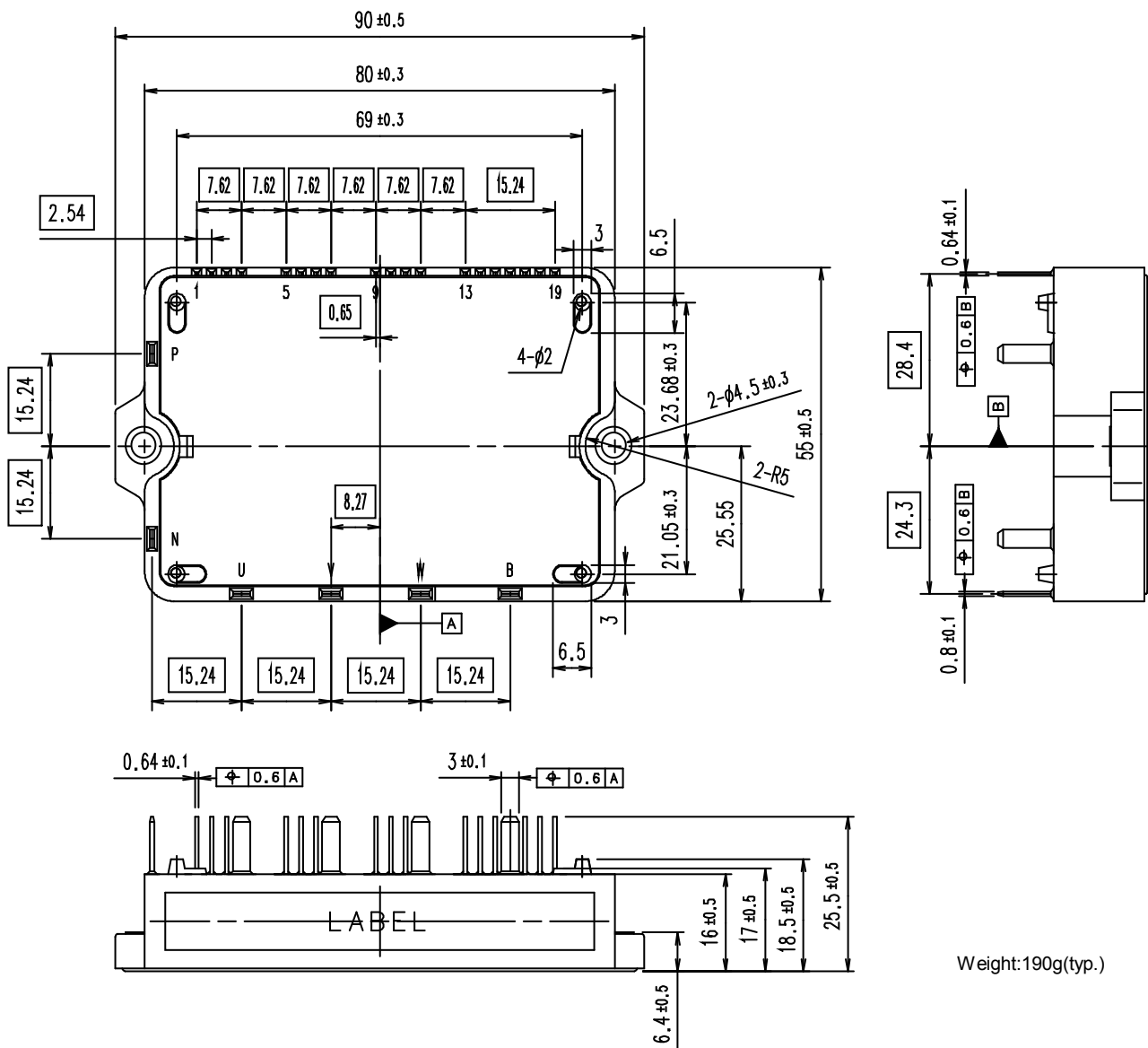
**IGBT Module (V series)**  
**600V / 50A / IPM**

**■ 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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**Absolute Maximum Ratings**

Tc=25°C, Vcc=15V unless otherwise specified.

Items		Symbol	Min.	Max.	Units	
Collector-Emitter Voltage *1		V <sub>CES</sub>	0	600	V	
Short Circuit Voltage		V <sub>sc</sub>	200	400	V	
Inverter	Collector Current	DC	I <sub>C</sub>	-	50	A
		1ms	I <sub>CP</sub>	-	100	A
		Duty=100% *2	-I <sub>C</sub>	-	50	A
Collector Power Dissipation		1 device *3	P <sub>C</sub>	-	290	W
Brake	Collector Current	DC	I <sub>C</sub>	-	-	A
		1ms	I <sub>CP</sub>	-	-	A
	Forward Current of Diode		I <sub>F</sub>	-	-	A
Collector Power Dissipation		1 device *3	P <sub>C</sub>	-	-	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> = 600V	-	-	1.0	mA	
	Collector-Emitter saturation voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> = 50A	Terminal	-	-	1.85	V
				Chip	-	1.25	-	V
Forward voltage of FWD	V <sub>F</sub>	I <sub>F</sub> = 50A	Terminal	-	-	2.1	V	
			Chip	-	1.6	-	V	
Brake	Collector Current at off signal input	I <sub>CES</sub>	V <sub>CE</sub> =	-	-	-	mA	
	Collector-Emitter saturation voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> =	Terminal	-	-	-	V
				Chip	-	-	-	V
Forward voltage of FWD	V <sub>F</sub>	I <sub>F</sub> =	Terminal	-	-	-	V	
			Chip	-	-	-	V	
Switching time	t <sub>on</sub>	V <sub>DC</sub> = 300V , T <sub>j</sub> =125°C		1.1	-	-	μs	
	t <sub>off</sub>	I <sub>C</sub> = 50A		-	-	2.1	μs	
	t <sub>tr</sub>	V <sub>DC</sub> = 300V I <sub>F</sub> = 50A		-	-	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 <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>		-	-	36	mA	
Input signal threshold voltage	V <sub>in</sub> (on)	V <sub>in</sub> -GND	ON	1.2	1.4	1.6	V
	V <sub>in</sub> (off)		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	-	-	-	°C/W
		FWD	-	-	-	°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

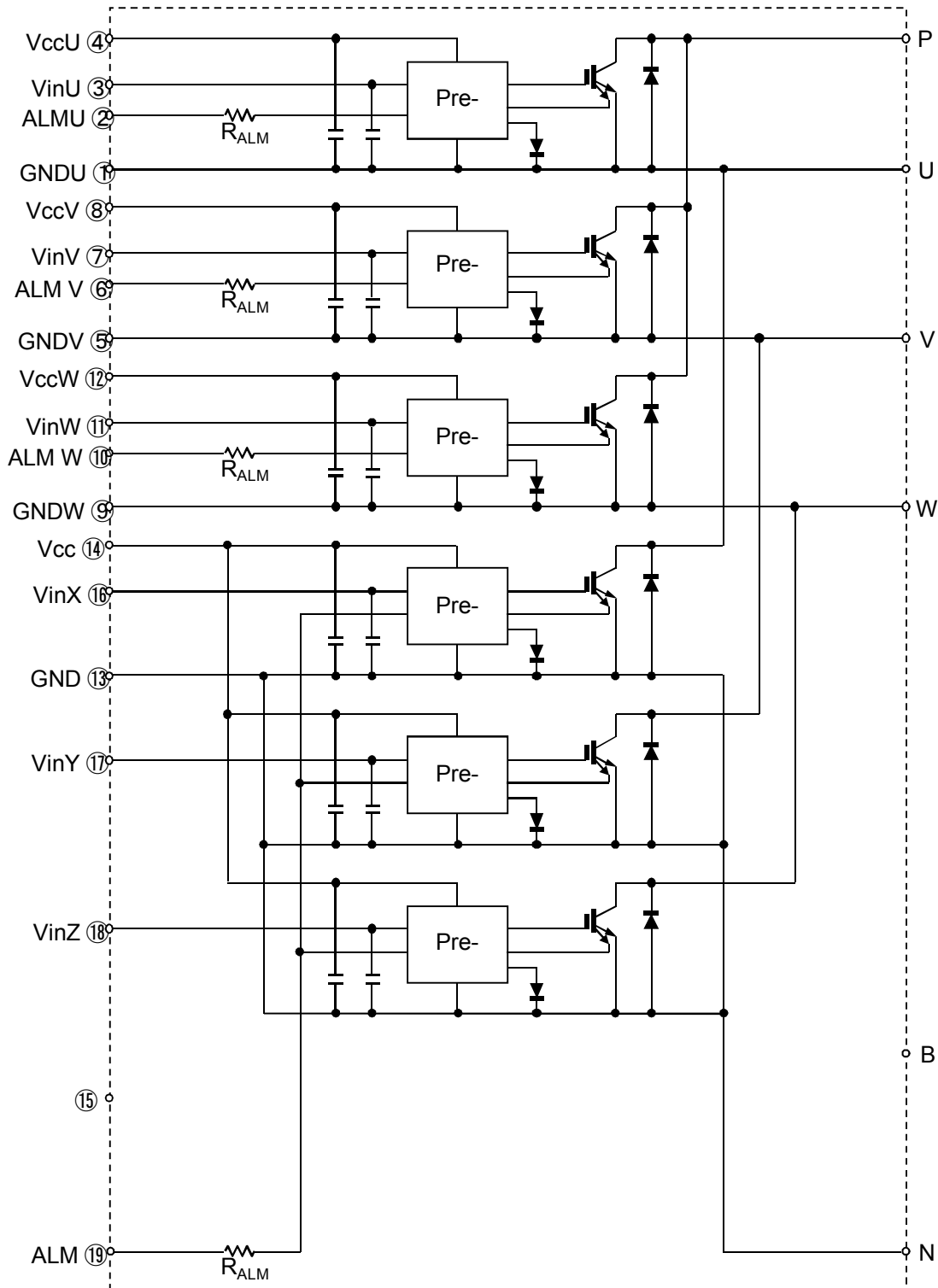
■ **Recommended Operating Conditions**

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



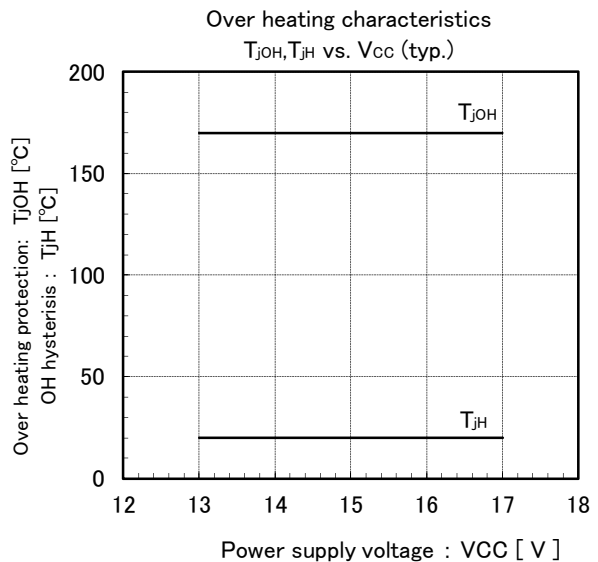
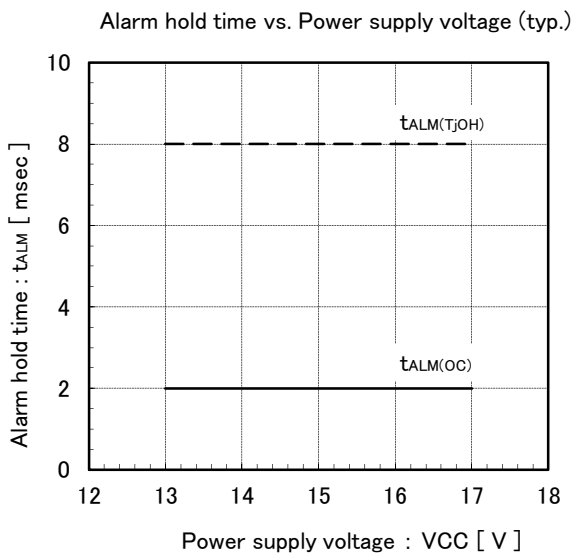
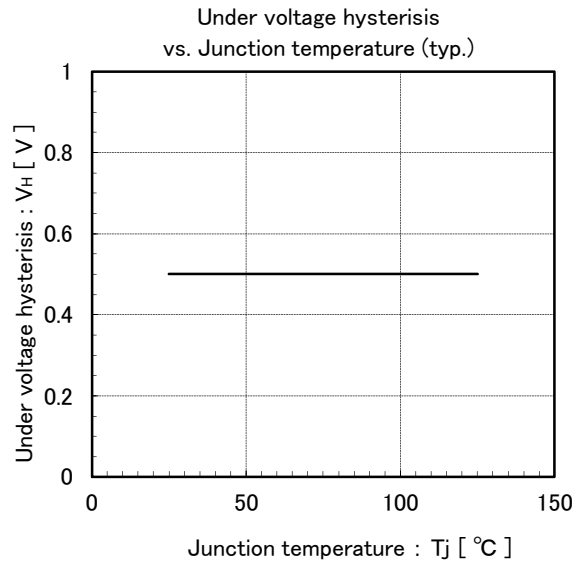
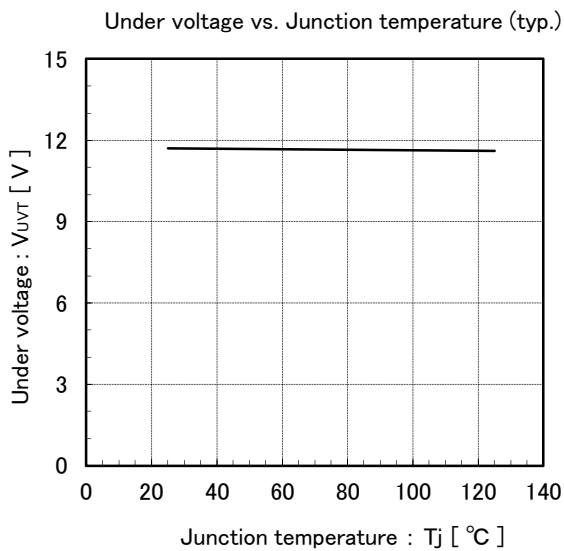
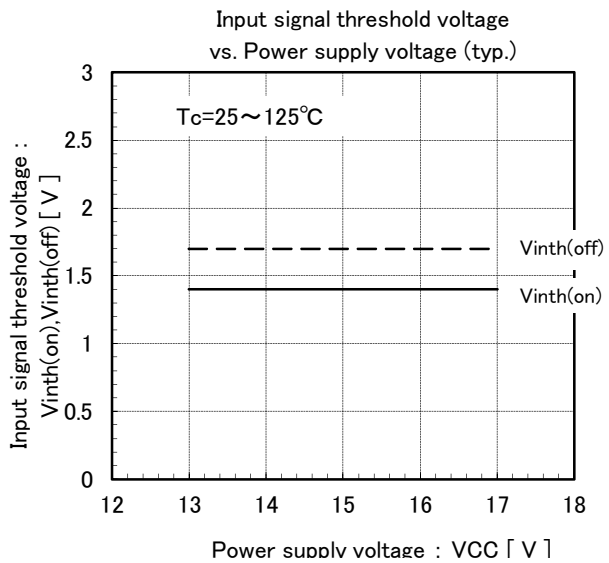
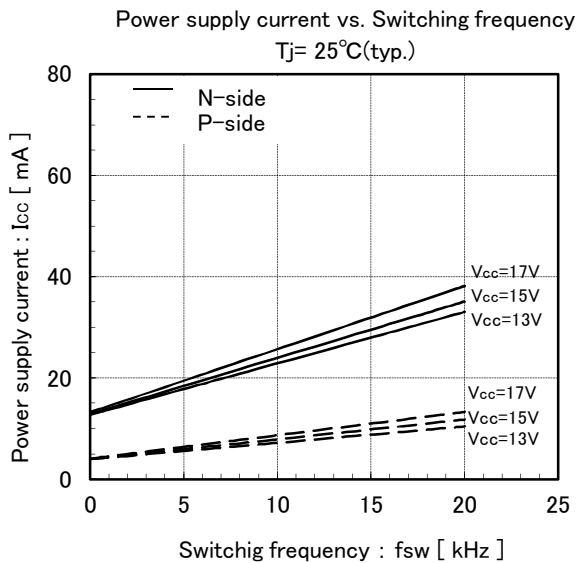
Pre-drivers include following functions

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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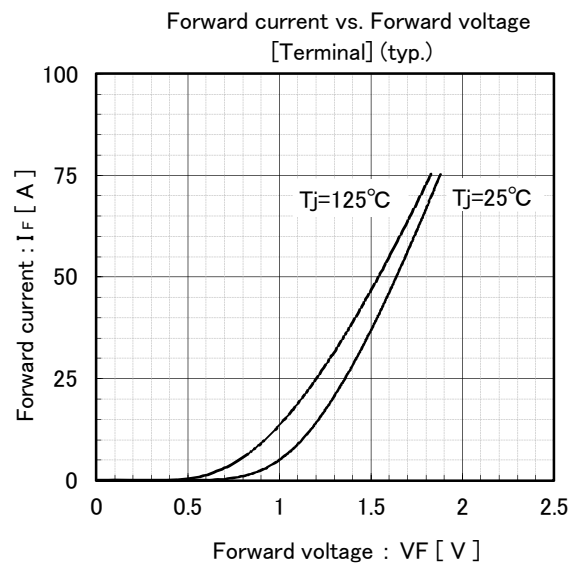
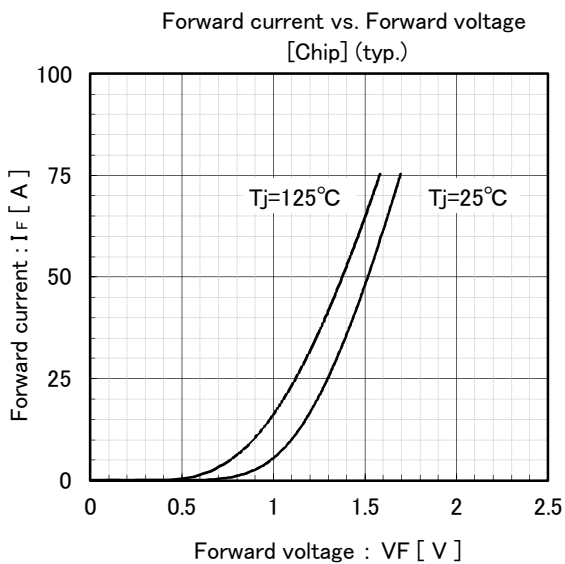
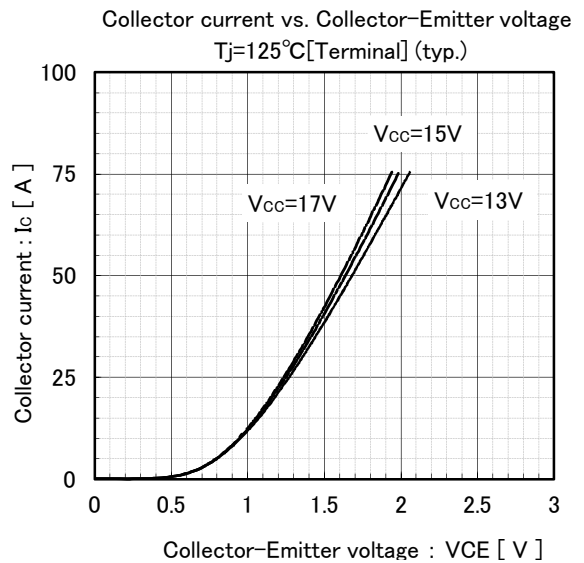
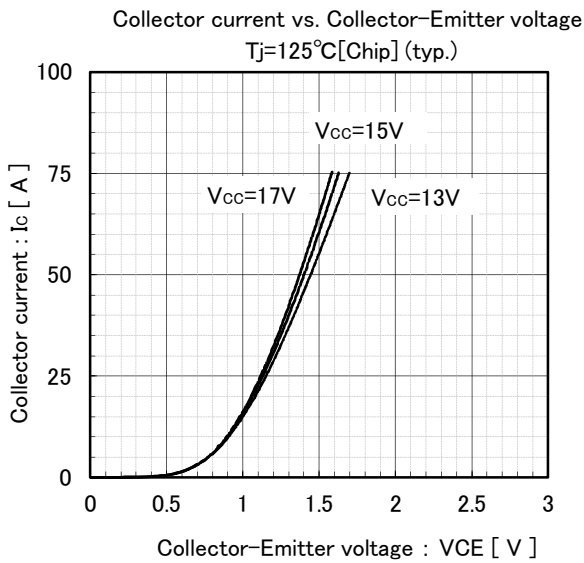
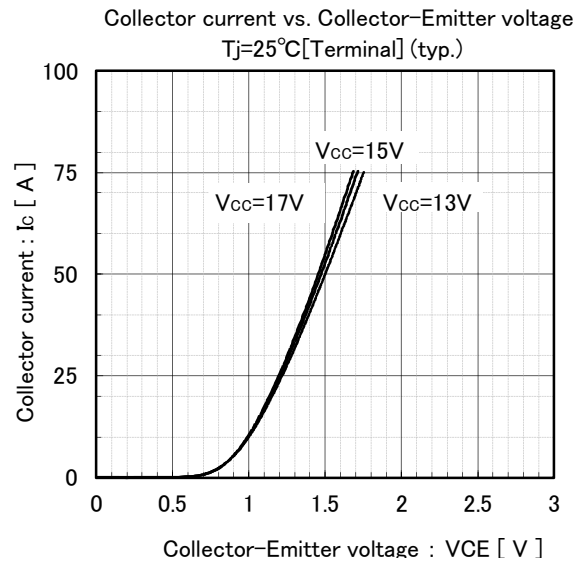
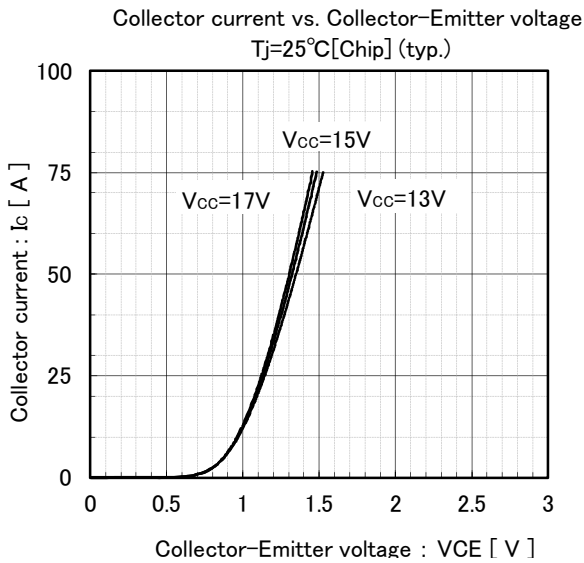
■ Characteristics (Representative)  
● Control Circuit



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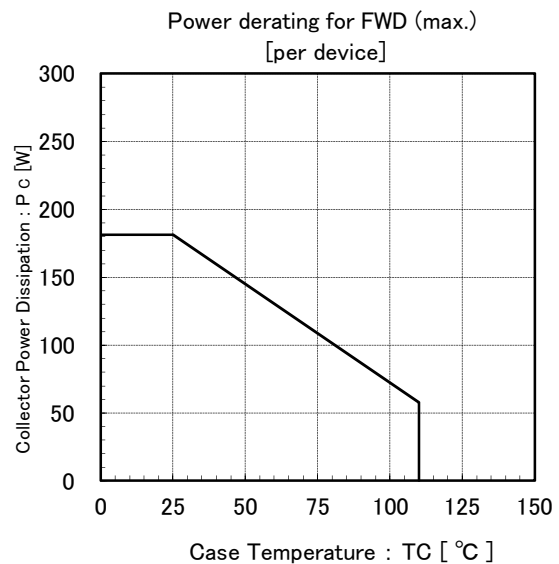
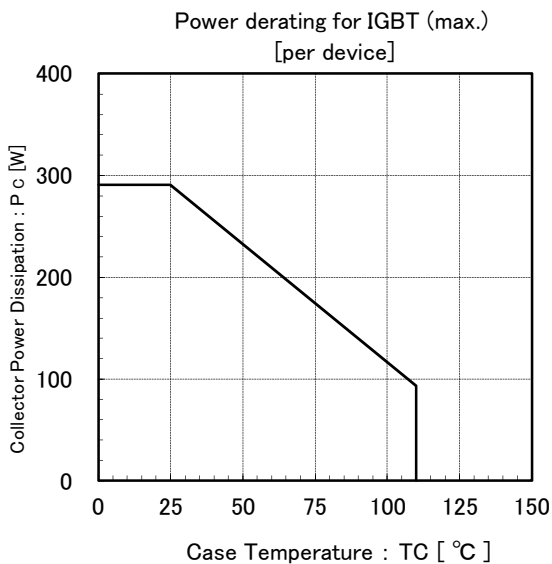
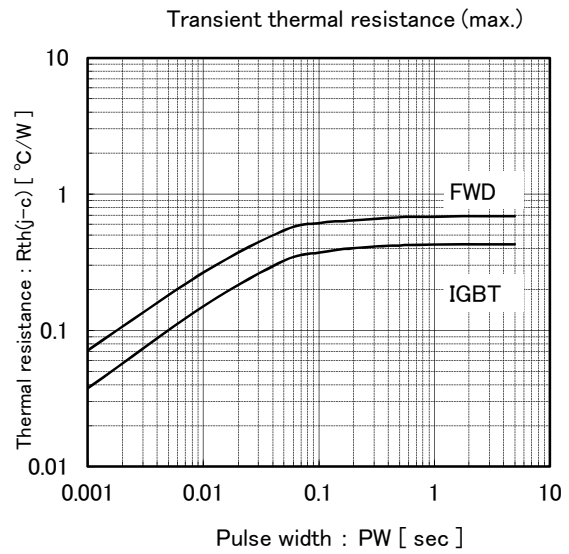
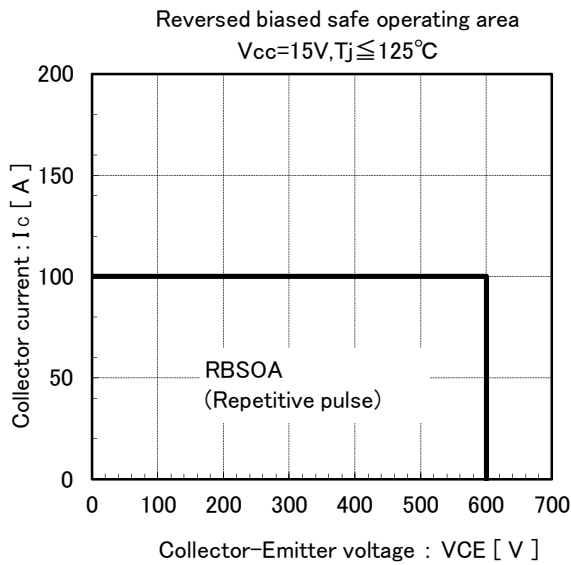
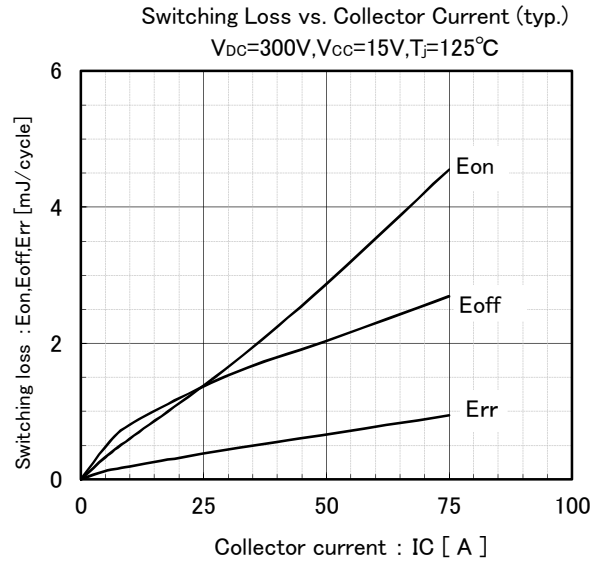
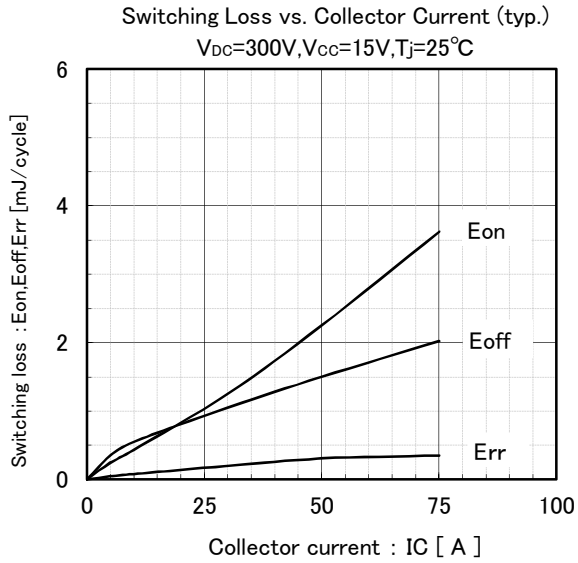
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● Inverter



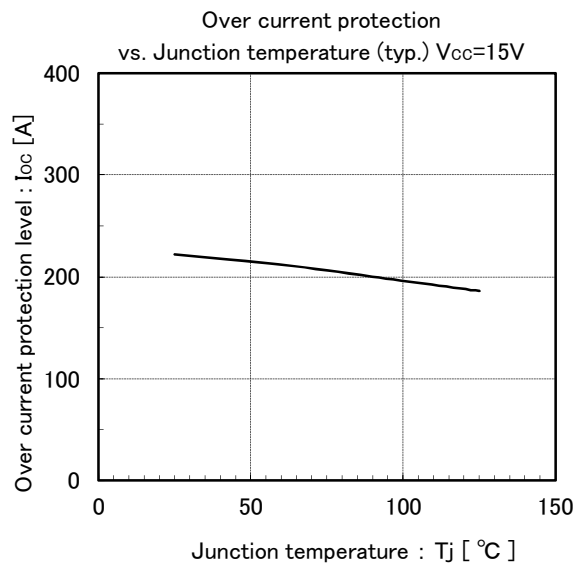
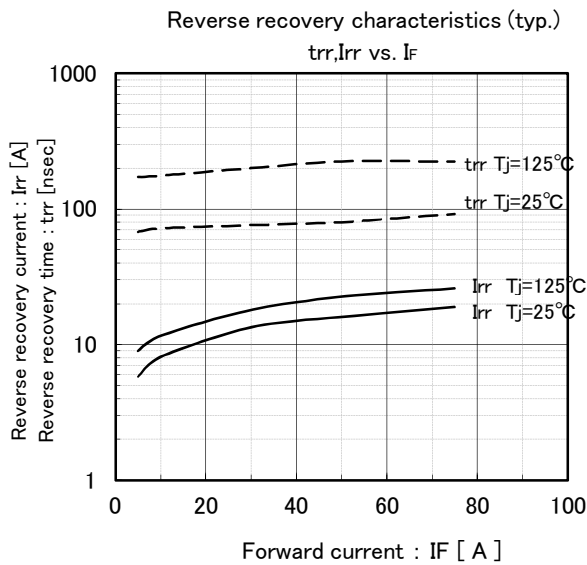
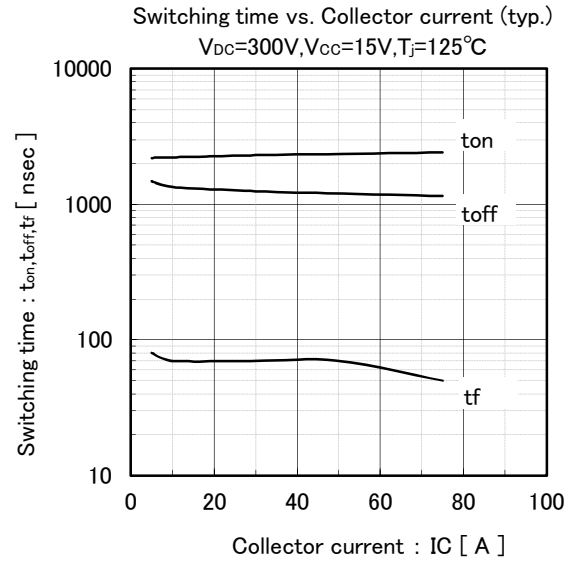
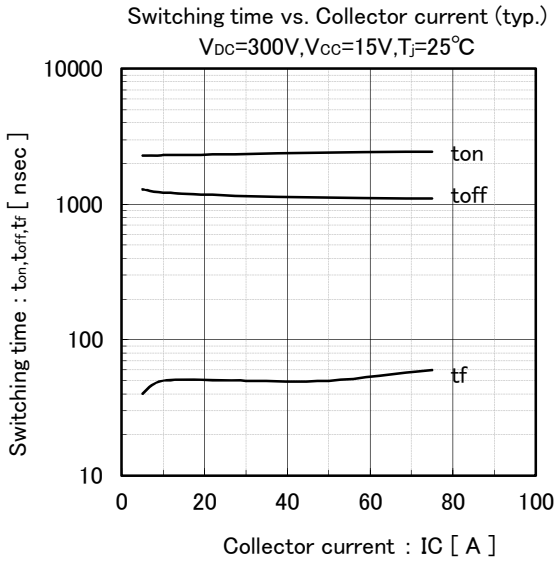
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