

# 6MBP300VEA060-50

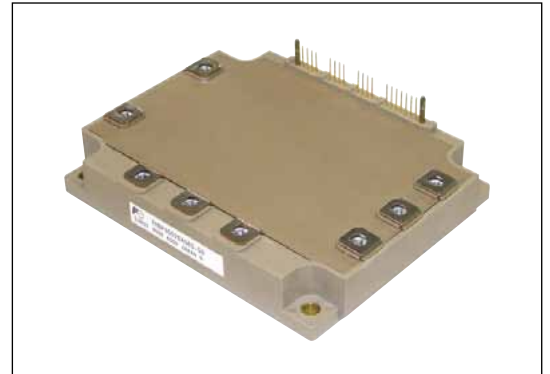
IGBT Modules

## IGBT MODULE (V series)

600V / 300A / 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



### ■ Maximum Ratings and Characteristics

#### ● 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	600	V		
Short Circuit Voltage	V <sub>sc</sub>	200	400	V		
Inverter	Collector Current	DC	I <sub>c</sub>	-	300	A
		1ms	I <sub>CP</sub>	-	600	A
		Duty=73.9% (*2)	-I <sub>c</sub>	-	300	A
Collector Power Dissipation	1 device (*3)	P <sub>c</sub>	-	925	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	Vrms		
Screw Torque	Terminal (M5)	-	-	3.5	Nm	
	Mounting (M5)					

Note \*1: V<sub>CEs</sub> shall be applied to the input voltage between all Collector and Emitter.

[ P1-(U,V,W,B) , P2-(U,V,W,B) , (U,V,W,B)-N1 , (U,V,W,B)-N2 ]

Note \*2: Duty=125°C/R<sub>th(j-c)/D</sub>/(I<sub>F</sub>×V<sub>F</sub> Max.)×100

Note \*3: P<sub>c</sub>=125°C/R<sub>th(j-c)</sub> (Inverter & Brake)

Note \*4: V<sub>CC</sub> shall be applied to the input voltage between terminal No.3 and 1, 7 and 5, 11 and 9, 14 and 13.

Note \*5: V<sub>in</sub> shall be applied to the input voltage between terminal No.2 and 1, 6 and 5, 10 and 9, 15~18 and 13.

Note \*6: V<sub>ALM</sub> shall be applied to the voltage between terminal No.4 and 1, 8 and 5, 12 and 9, 19 and 13.

Note \*7: I<sub>ALM</sub> shall be applied to the input current to terminal No.4, 8, 12 and 19.

Note \*8: Immersion time 10±1sec. 1 time

Note \*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)

Items		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 (*10)	V <sub>CE(sat)</sub>	I <sub>c</sub> =300A	Terminal	-	-	1.90	V
				Chip	-	1.25	-	V
	Forward voltage of FWD (*10)	V <sub>F</sub>	I <sub>F</sub> =300A	Terminal	-	-	2.45	V
Chip				-	1.80	-	V	
Brake	Collector Current at off signal input	I <sub>CEs</sub>	-	-	-	-	mA	
	Collector-Emitter saturation voltage (*10)	V <sub>CE(sat)</sub>	-	-	-	-	V	
				-	-	-	V	
Forward voltage of FWD (*10)	V <sub>F</sub>	-	-	-	-	V		
			-	-	-	V		
Switching time	t <sub>on</sub>	V <sub>DC</sub> =300V, T <sub>J</sub> =125°C, I <sub>c</sub> =300A		1.1	-	-	μs	
	t <sub>off</sub>			-	-	2.1	μs	
	t <sub>rr</sub>			V <sub>DC</sub> =300V, I <sub>F</sub> =300A	-	-	0.3	μs
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	-	-	36	mA	
Supply current of N-side pre-driver		I <sub>ccn</sub>		-	-	108	mA	
Input signal threshold voltage		V <sub>in(th)(on)</sub>	V <sub>in</sub> -GND	ON	1.2	1.4	1.6	V
		V <sub>in(th)(off)</sub>		OFF	1.5	1.7	1.9	V
Over Current Protection Level	Inverter	I <sub>oc</sub>	T <sub>J</sub> =125°C	450	-	-	A	
	Brake			-	-	-	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 T <sub>c</sub> =-20~110°C	V <sub>cc</sub> ≥10V	1.0	2.0	2.4	ms
		t <sub>ALM(UV)</sub>			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	

Note \*10: The Max value is a case where it measures from P2-(U,V,W,B) , (U,V,W,B)-N2.

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

Items			Symbol	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance (*11)	Inverter	IGBT	R <sub>th(j-c)Q</sub>	-	-	0.135	°C/W
		FWD	R <sub>th(j-c)D</sub>	-	-	0.230	°C/W
	Brake	IGBT	R <sub>th(j-c)Q</sub>	-	-	-	°C/W
		FWD	R <sub>th(j-c)D</sub>	-	-	-	°C/W
Case to Fin Thermal Resistance with Compound			R <sub>th(c-f)</sub>	-	0.05	-	°C/W

Note \*11: 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)

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

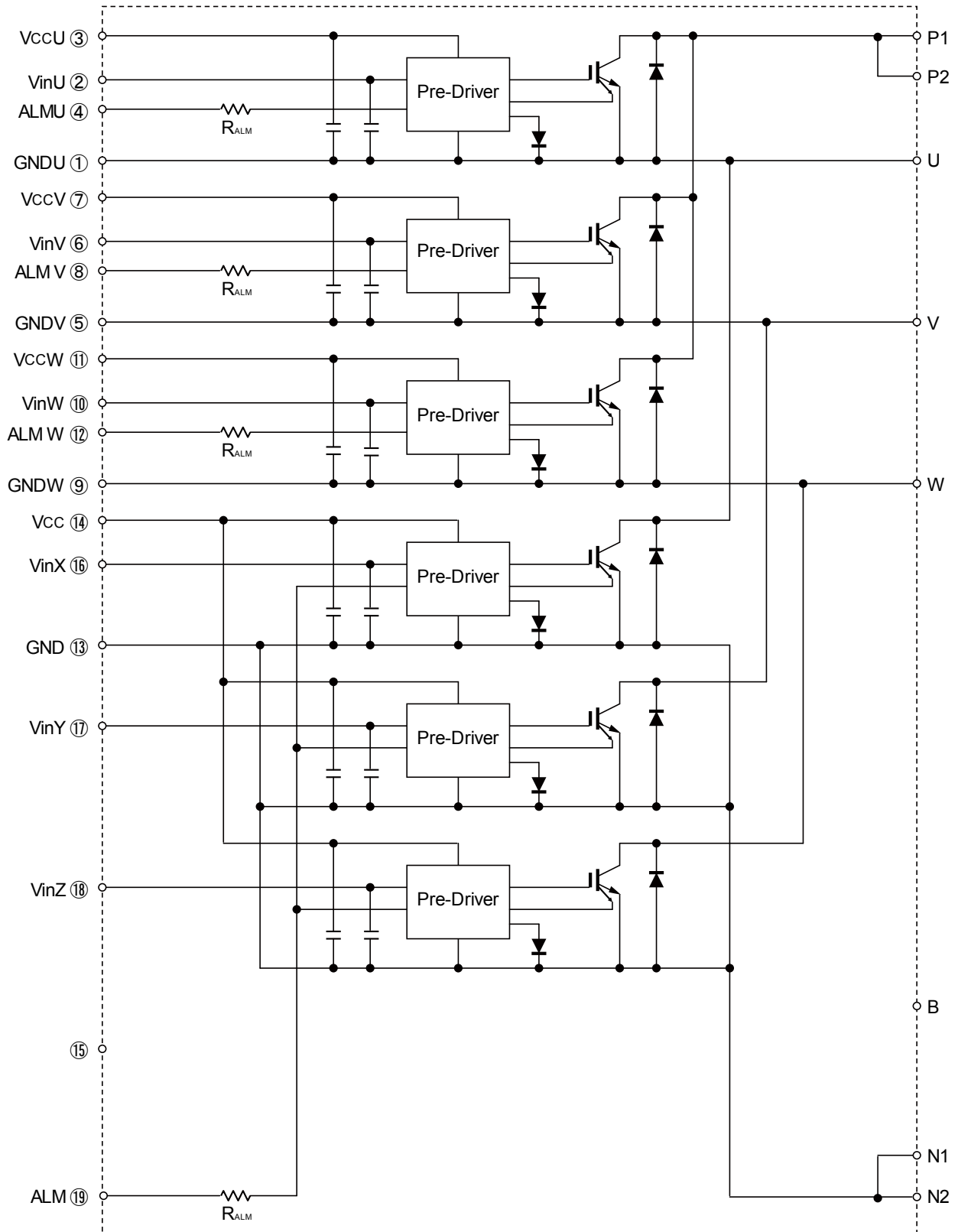
● Recommended Operating Conditions

Items	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 (M5)	-	2.5	-	3.5	Nm

● Weight

Items	Symbol	Min.	Typ.	Max.	Units
Weight	W <sub>t</sub>	-	980	-	g

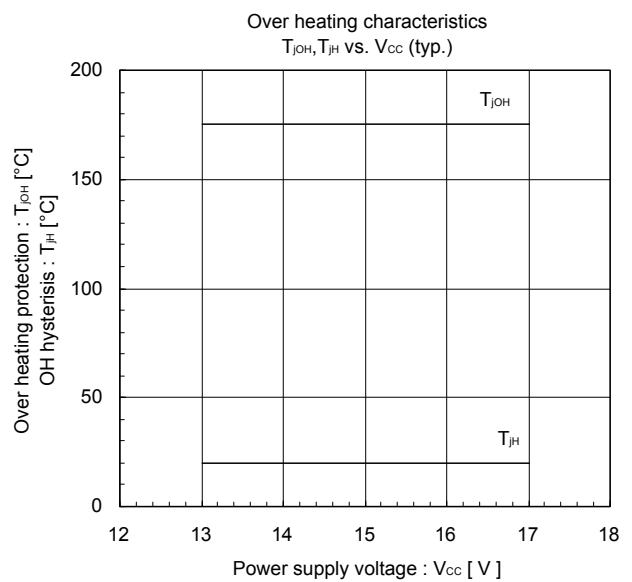
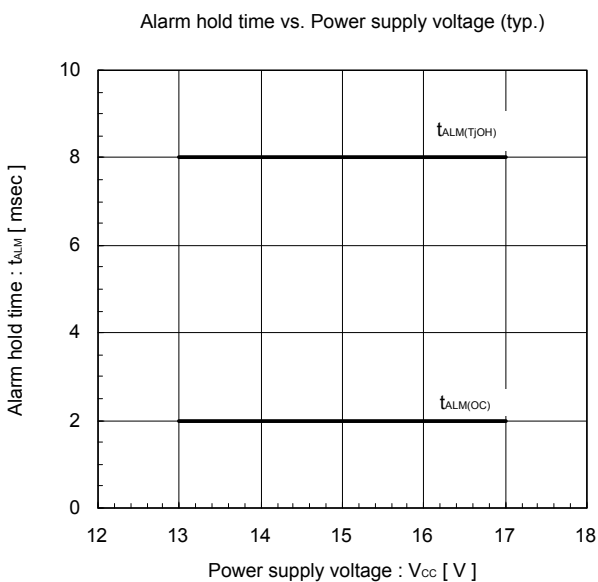
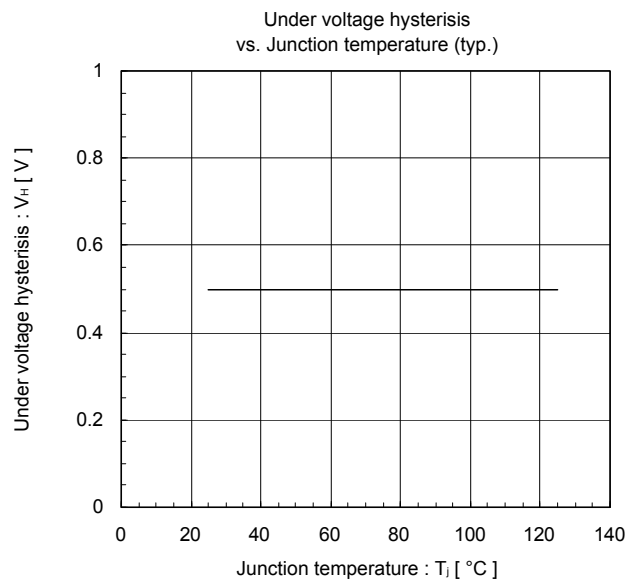
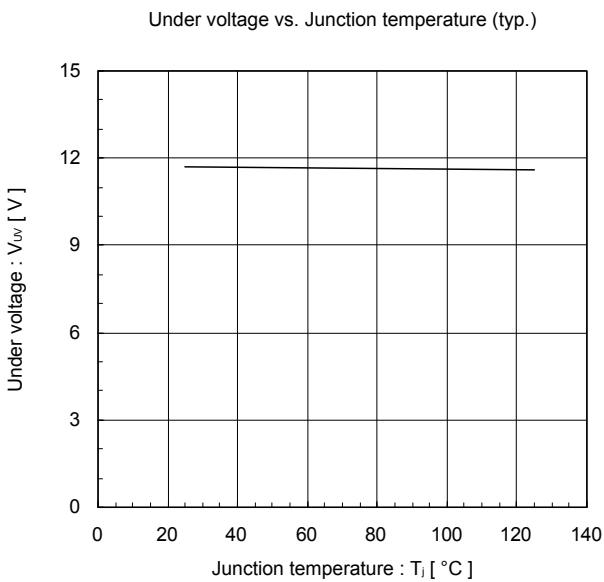
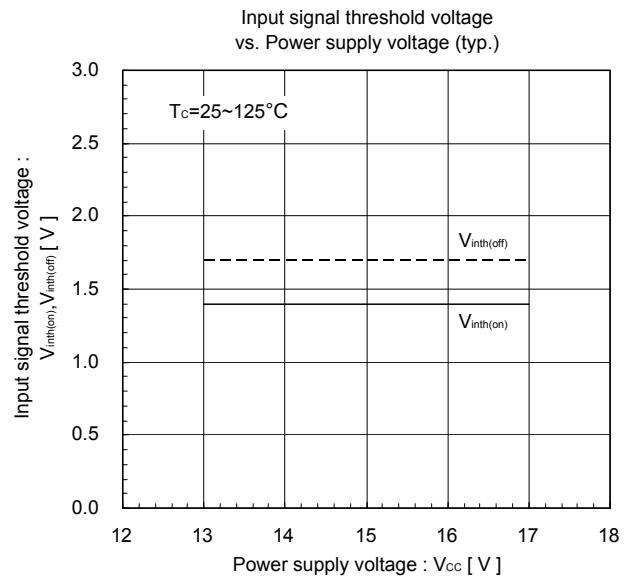
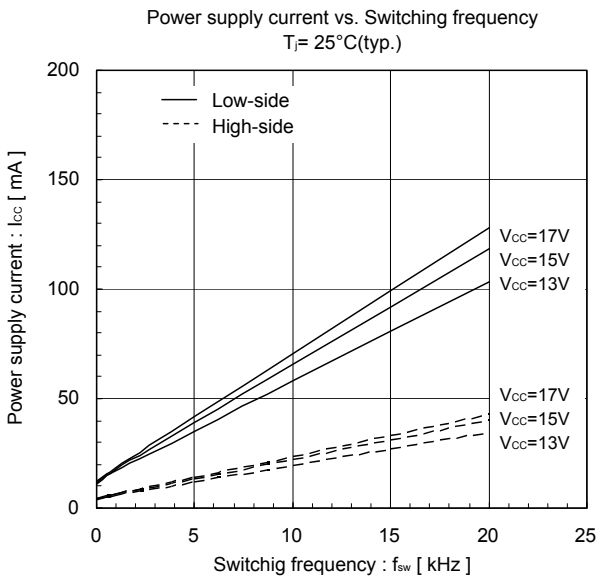
■ Block Diagram



Pre-drivers include following functions

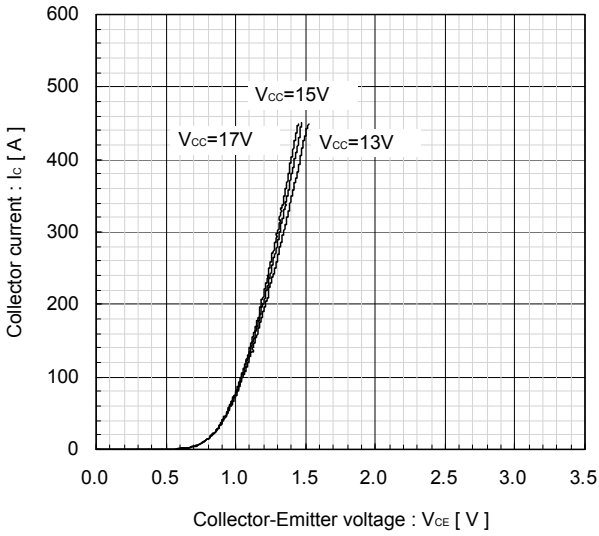
1. Amplifier for driver
2. Short circuit protection
3. Under voltage lockout circuit
4. Over current protection
5. IGBT chip over heating protection

■ Characteristics (Representative)

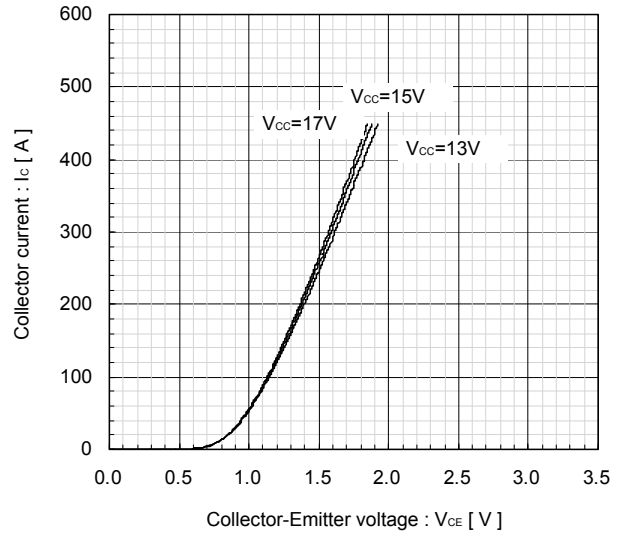


Inverter

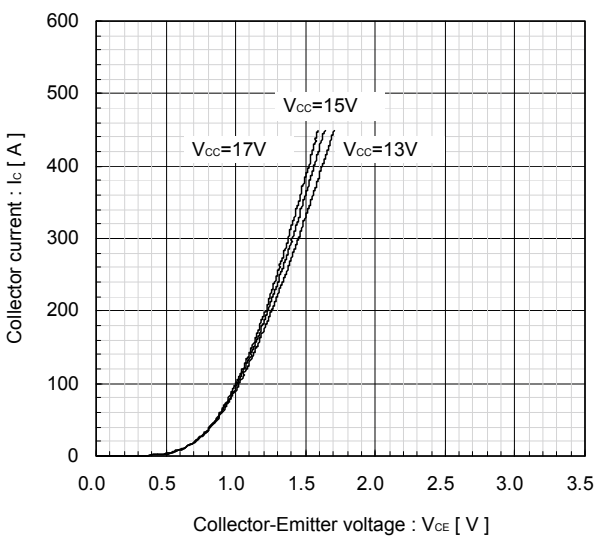
Collector current vs. Collector-Emitter voltage  
 $T_j=25^\circ\text{C}$ [Chip] (typ.)



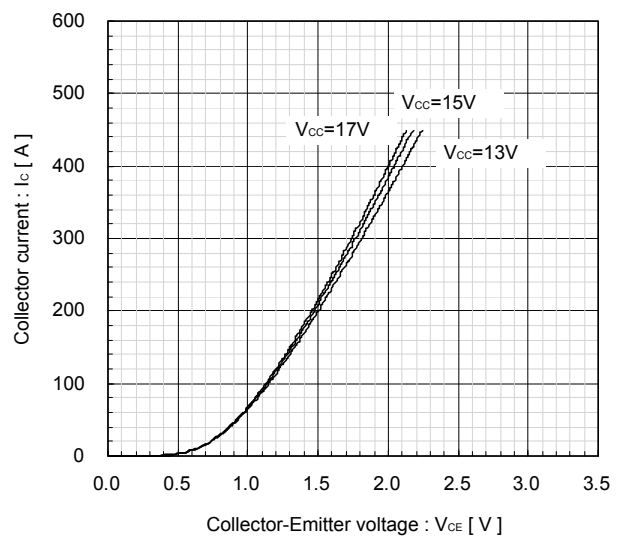
Collector current vs. Collector-Emitter voltage  
 $T_j=25^\circ\text{C}$ [Terminal] (typ.)



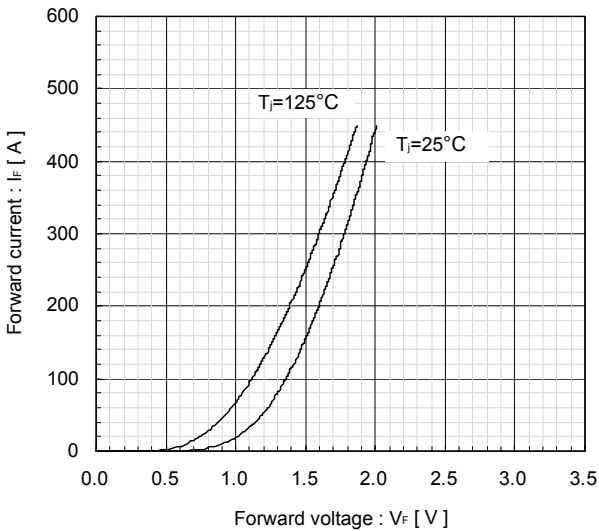
Collector current vs. Collector-Emitter voltage  
 $T_j=125^\circ\text{C}$ [Chip] (typ.)



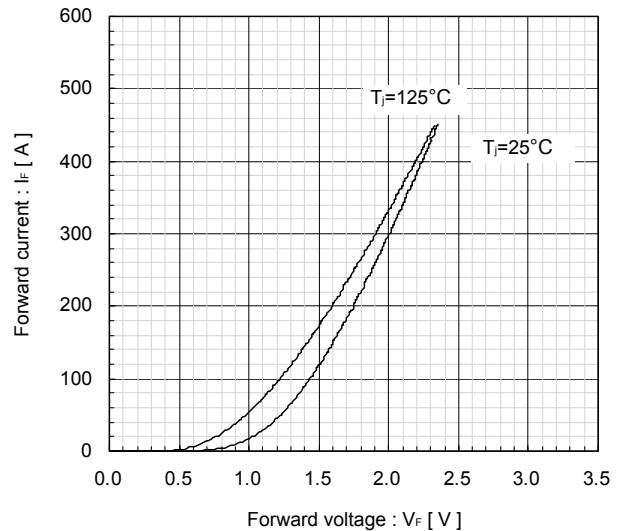
Collector current vs. Collector-Emitter voltage  
 $T_j=125^\circ\text{C}$ [Terminal] (typ.)



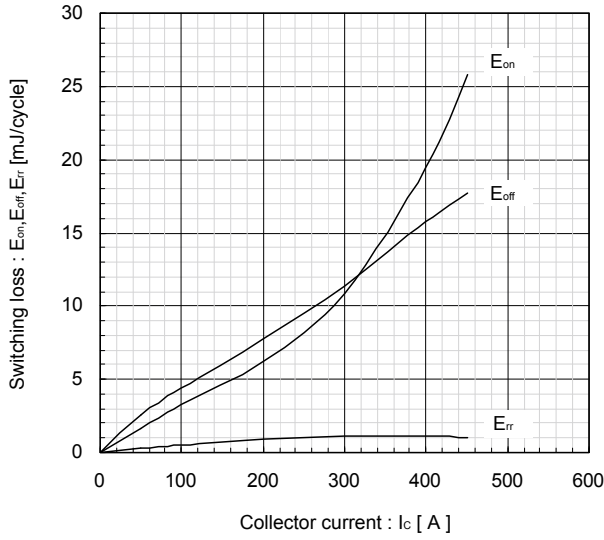
Forward current vs. Forward voltage  
 [Chip] (typ.)



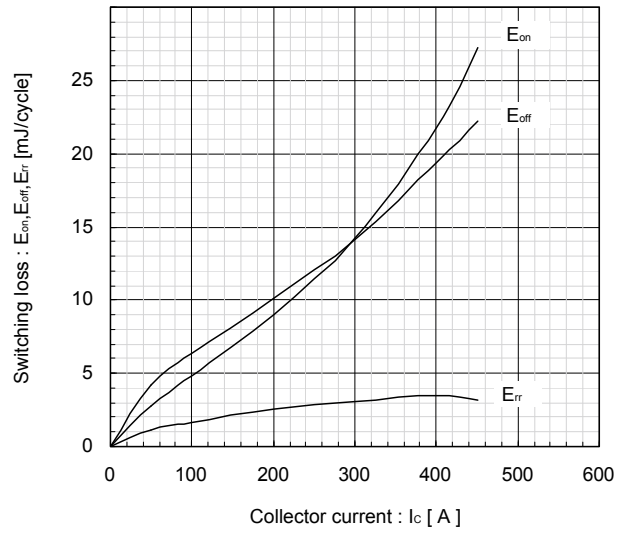
Forward current vs. Forward voltage  
 [Terminal] (typ.)



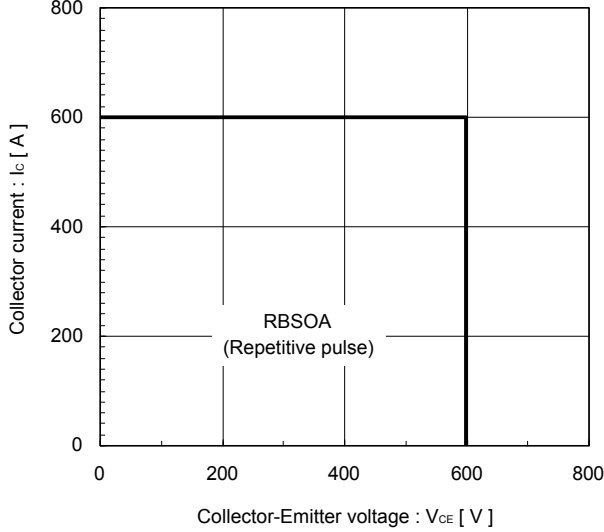
Switching Loss vs. Collector Current (typ.)  
 $V_{DC}=300V, V_{CC}=15V, T_J=25^\circ C$



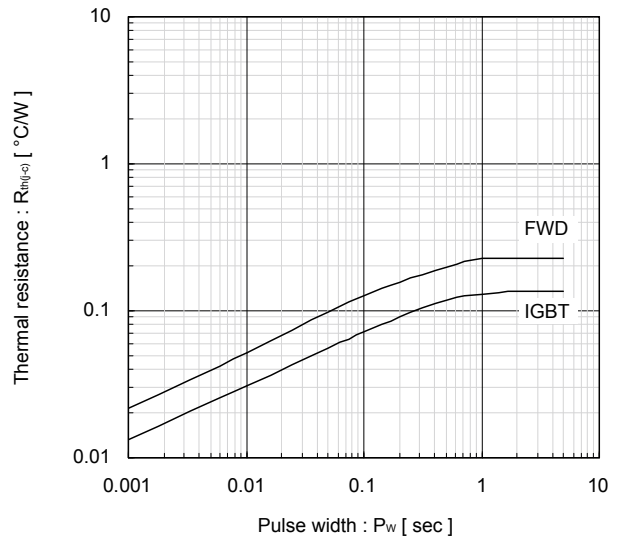
Switching Loss vs. Collector Current (typ.)  
 $V_{DC}=300V, V_{CC}=15V, T_J=125^\circ C$



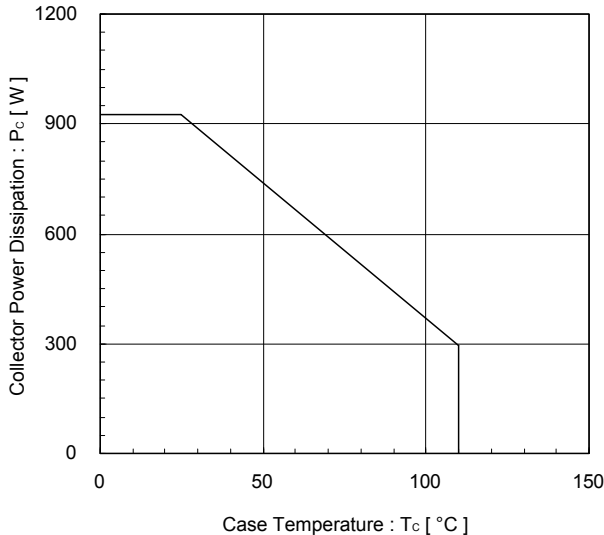
Reversed biased safe operating area  
 $V_{CC}=15V, T_J \le 125^\circ C$  [Main Terminal] (min.)



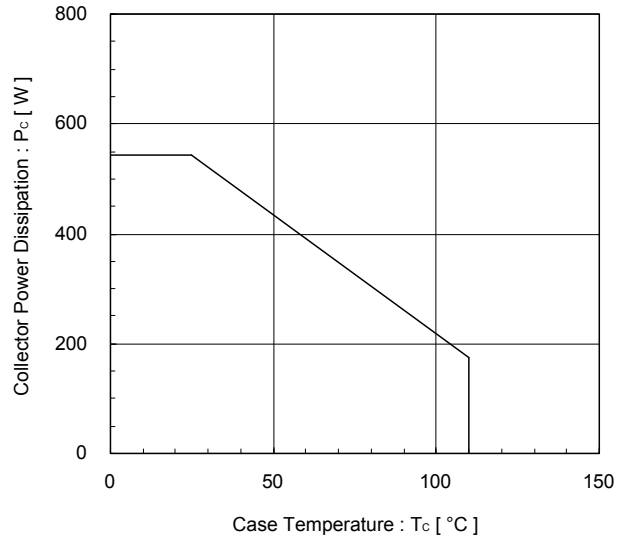
Transient thermal resistance (max.)



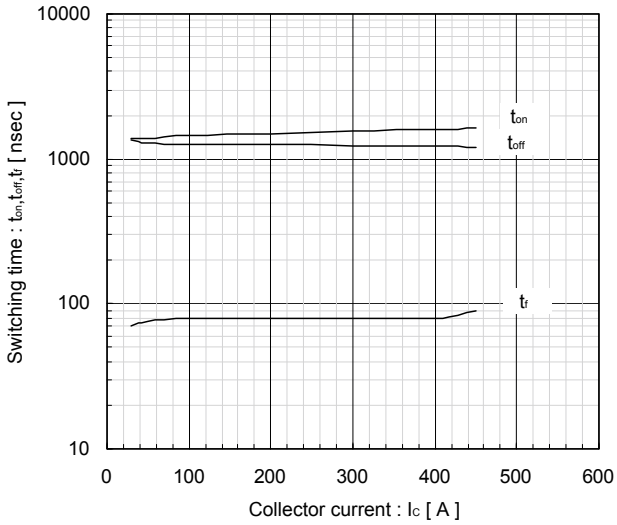
Power derating for IGBT (max.)  
 [per device]



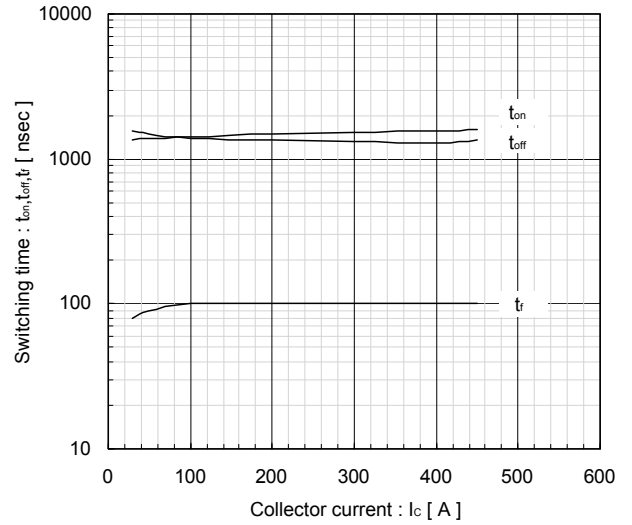
Power derating for FWD (max.)  
 [per device]



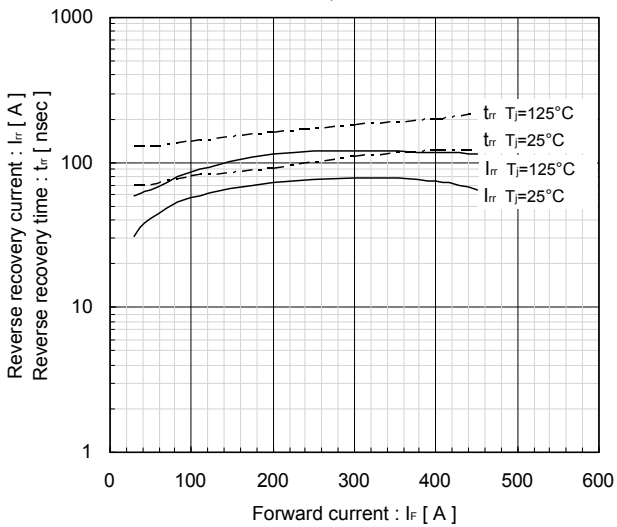
Switching time vs. Collector current (typ.)  
 $V_{DC}=300V, V_{CC}=15V, T_J=25^\circ C$



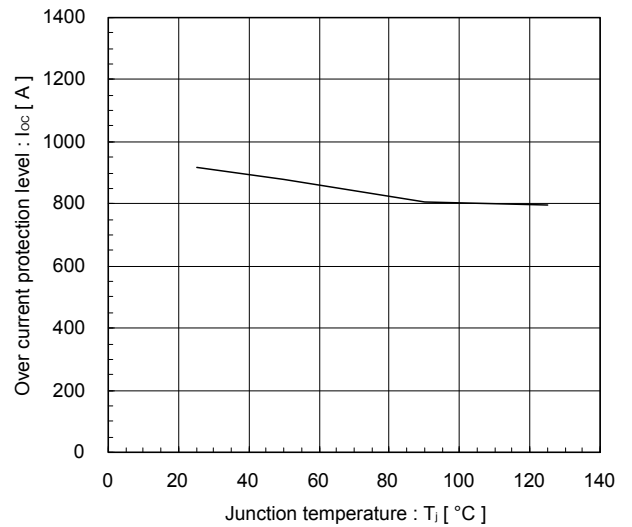
Switching time vs. Collector current (typ.)  
 $V_{DC}=300V, V_{CC}=15V, T_J=125^\circ C$



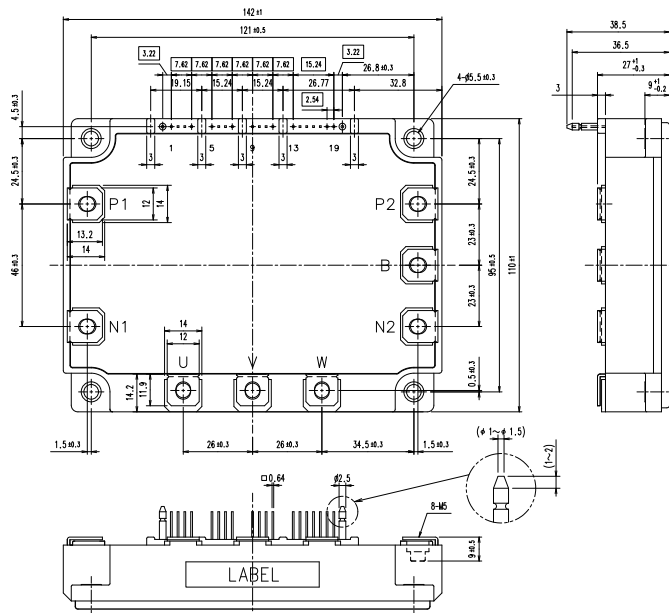
Reverse recovery characteristics (typ.)  
 $t_{rr}, I_{rr}$  vs.  $I_f$



Over current protection vs. Junction temperature (typ.)  
 $V_{CC}=15V$



■ Outline Drawings, mm



**WARNING**

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  - Measurement equipment
  - Machine tools
  - Audiovisual equipment
  - Electrical home appliances
  - Personal equipment
  - Industrial robots etc.
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  - Safety devices
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