

# 6MBP150VEA120-50

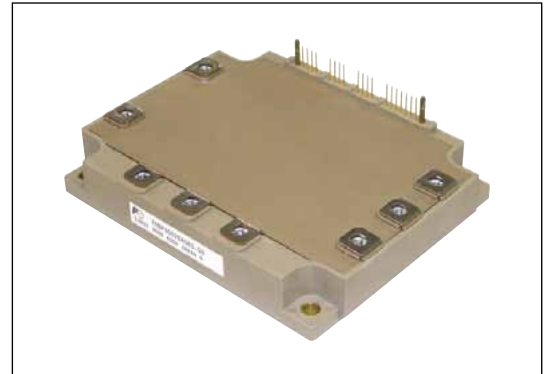
IGBT Modules

## IGBT MODULE (V series)

1200V / 150A / 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	1200	V		
Short Circuit Voltage	V <sub>sc</sub>	400	800	V		
Inverter	Collector Current	DC	I <sub>c</sub>	-	150	A
		1ms	I <sub>CP</sub>	-	300	A
		Duty=100% (*2)	-I <sub>c</sub>	-	150	A
Collector Power Dissipation	1 device (*3)	P <sub>c</sub>	-	781	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)	-	-	-		
	Mounting (M5)	-	-	3.5	Nm	

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 ( $T_J=25^\circ\text{C}$ ,  $V_{CC}=15\text{V}$  unless otherwise specified)

Items		Symbol	Conditions	Min.	Typ.	Max.	Units	
Inverter	Collector Current at off signal input	$I_{CES}$	$V_{CE}=1200\text{V}$	-	-	1.0	mA	
	Collector-Emitter saturation voltage (*10)	$V_{CE(sat)}$	$I_C=150\text{A}$	Terminal	-	-	2.20	V
				Chip	-	1.70	-	V
	Forward voltage of FWD (*10)	$V_F$	$I_F=150\text{A}$	Terminal	-	-	2.70	V
Chip				-	2.10	-	V	
Brake	Collector Current at off signal input	$I_{CES}$	-	-	-	-	mA	
	Collector-Emitter saturation voltage (*10)	$V_{CE(sat)}$	-	-	-	-	V	
			-	-	-	-	V	
Forward voltage of FWD (*10)	$V_F$	-	-	-	-	V		
		-	-	-	-	V		
Switching time	$t_{on}$	$V_{DC}=600\text{V}$ , $T_J=125^\circ\text{C}$ , $I_C=150\text{A}$		1.1	-	-	$\mu\text{s}$	
	$t_{off}$			-	-	2.1	$\mu\text{s}$	
	$t_{rr}$	$V_{DC}=600\text{V}$ , $I_F=150\text{A}$		-	-	0.3	$\mu\text{s}$	
Supply current of P-side pre-driver (per one unit)		$I_{cop}$	Switching Frequency= 0-15kHz $T_C=-20\sim 110^\circ\text{C}$	-	-	35	mA	
Supply current of N-side pre-driver		$I_{con}$		-	-	105	mA	
Input signal threshold voltage		$V_{in(th)(on)}$	$V_{in}-\text{GND}$	ON	1.2	1.4	1.6	V
		$V_{in(th)(off)}$		OFF	1.5	1.7	1.9	V
Over Current Protection Level	Inverter	$I_{OC}$	$T_J=125^\circ\text{C}$	225	-	-	A	
	Brake			-	-	-	A	
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		$T_{J(OH)}$	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
		$t_{ALM(TJOH)}$			5.0	8.0	11.0	ms
Resistance for current limit		$R_{ALM}$		960	1265	1570	$\Omega$	

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

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

Items			Symbol	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance (*11)	Inverter	IGBT	$R_{th(j-c)Q}$	-	-	0.160	$^\circ\text{C}/\text{W}$
		FWD	$R_{th(j-c)D}$	-	-	0.235	$^\circ\text{C}/\text{W}$
	Brake	IGBT	$R_{th(j-c)Q}$	-	-	-	$^\circ\text{C}/\text{W}$
		FWD	$R_{th(j-c)D}$	-	-	-	$^\circ\text{C}/\text{W}$
Case to Fin Thermal Resistance with Compound			$R_{th(c-f)}$	-	0.05	-	$^\circ\text{C}/\text{W}$

Note \*11: For 1device, the measurement point of the case is just under the chip.

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

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

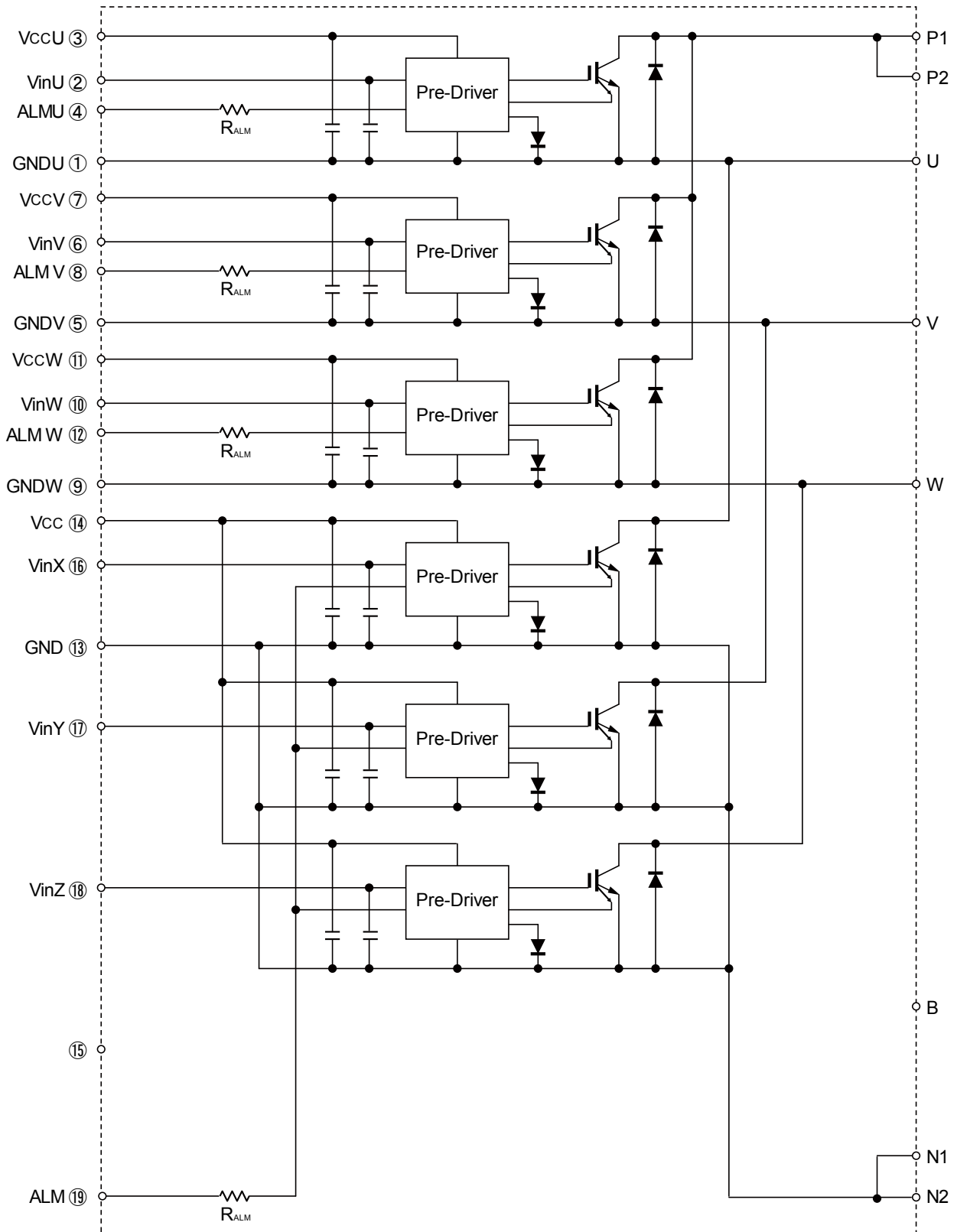
● Recommended Operating Conditions

Items	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 (M5)	-	2.5	-	3.5	Nm

● Weight

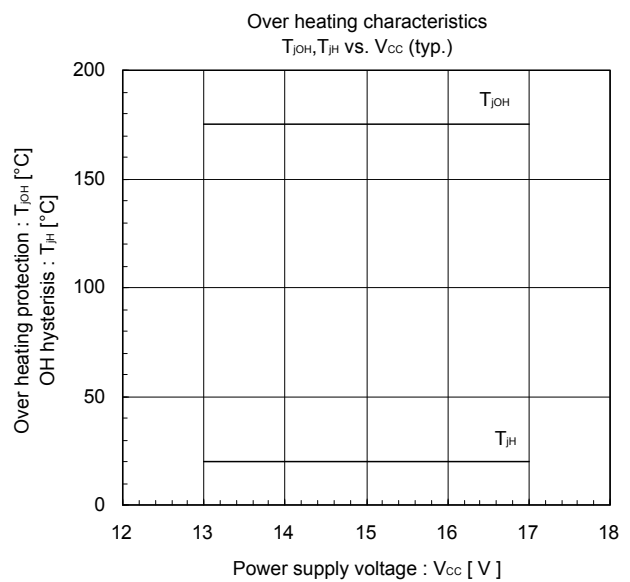
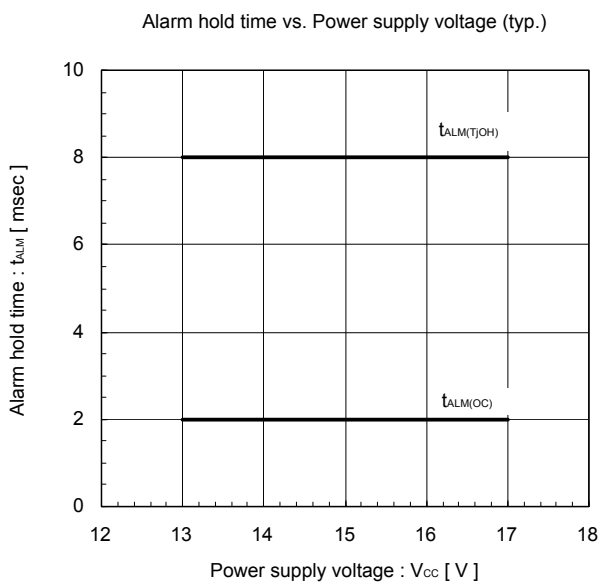
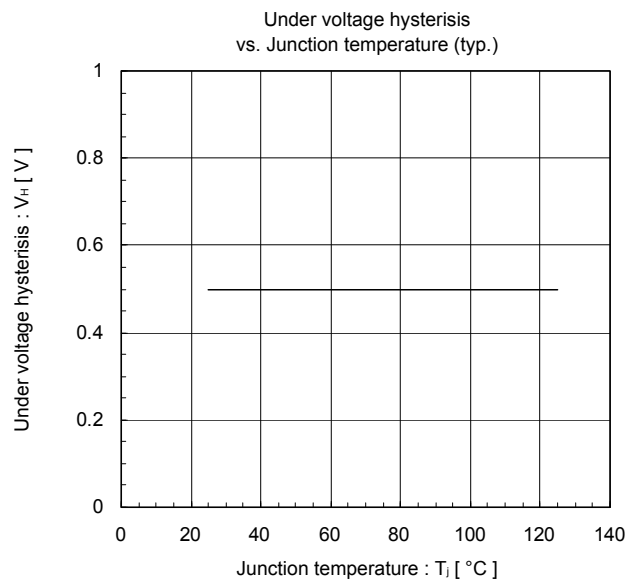
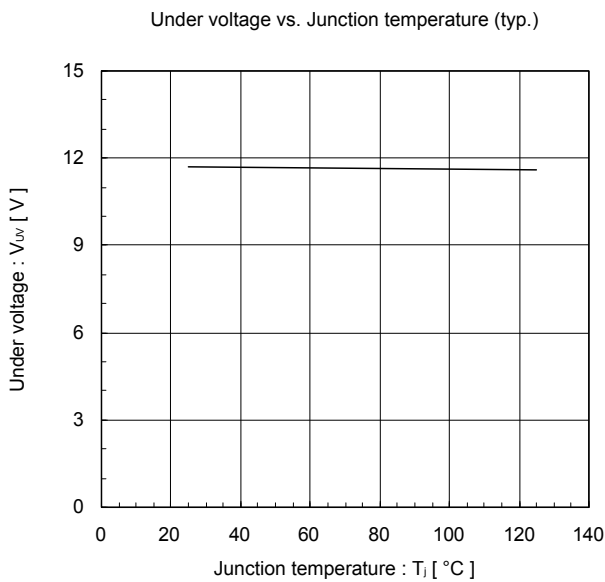
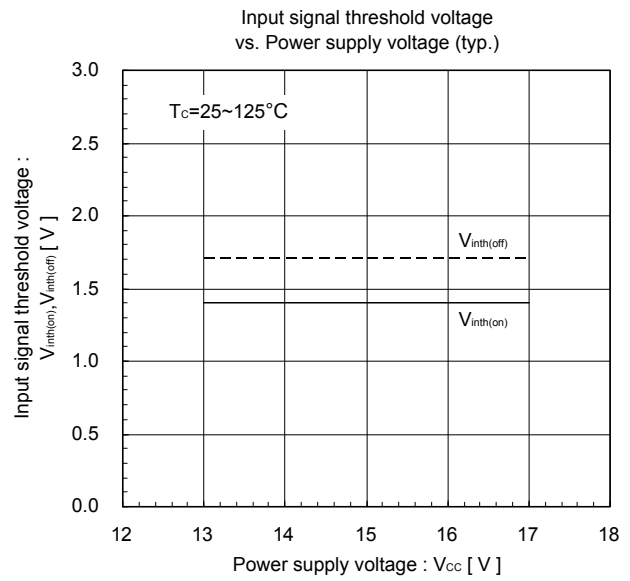
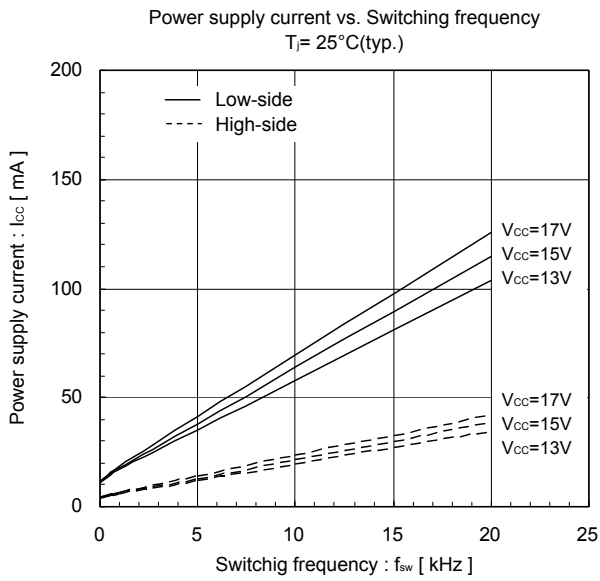
Items	Symbol	Min.	Typ.	Max.	Units
Weight	$W_t$	-	980	-	g

■ Block Diagram



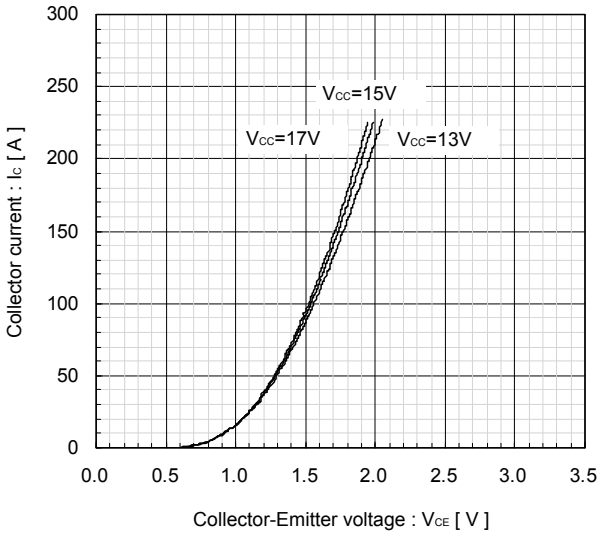
- Pre-drivers include following functions
1. Amplifier for driver
  2. Short circuit protection
  3. Under voltage lockout circuit
  4. Over current protection
  5. IGBT chip over heating protection

■ Characteristics (Representative)

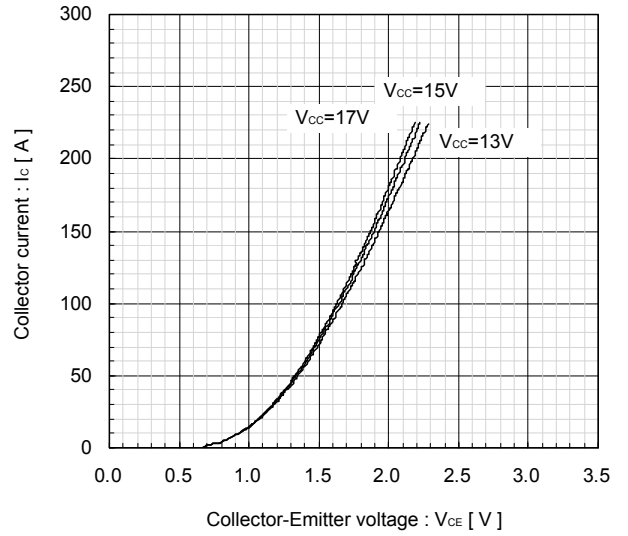


Inverter

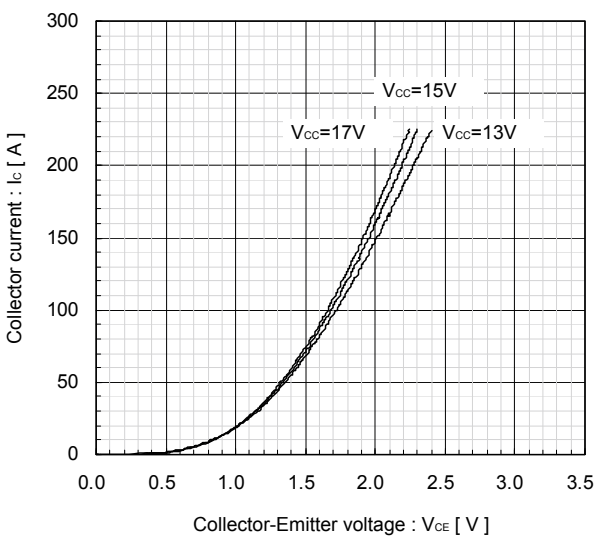
Collector current vs. Collector-Emitter voltage  
 $T_j=25^\circ\text{C}$ [Chip] (typ.)



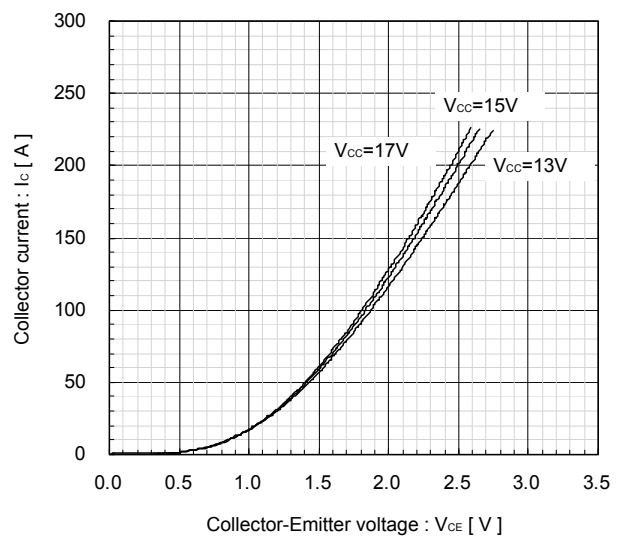
Collector current vs. Collector-Emitter voltage  
 $T_j=25^\circ\text{C}$ [Terminal] (typ.)



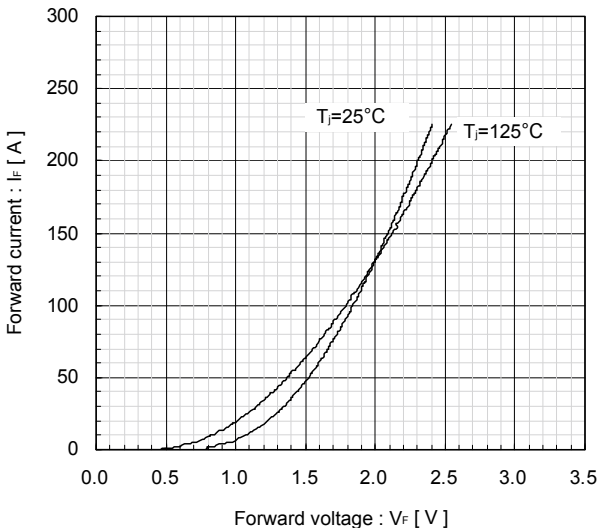
Collector current vs. Collector-Emitter voltage  
 $T_j=125^\circ\text{C}$ [Chip] (typ.)



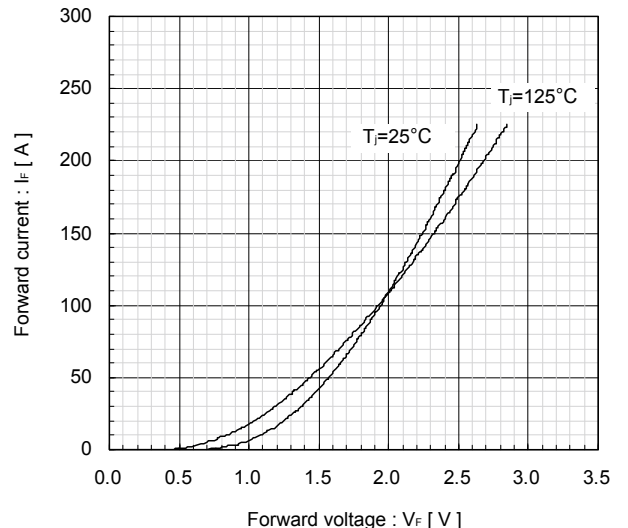
Collector current vs. Collector-Emitter voltage  
 $T_j=125^\circ\text{C}$ [Terminal] (typ.)



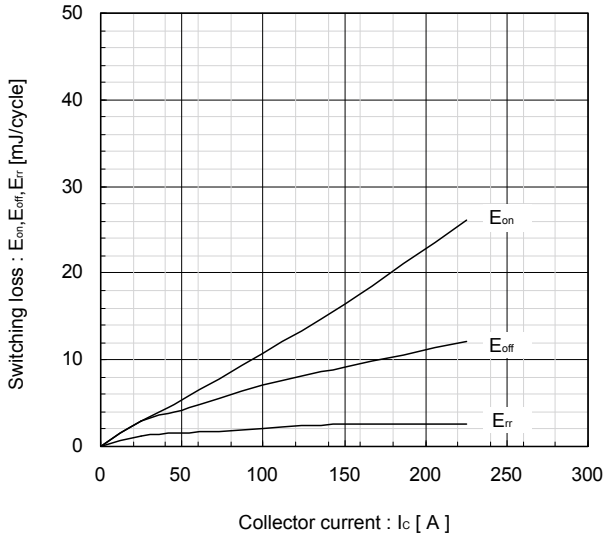
Forward current vs. Forward voltage  
 [Chip] (typ.)



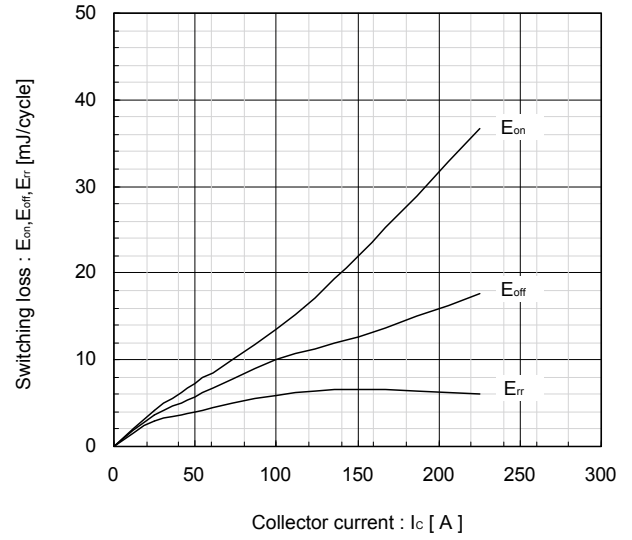
Forward current vs. Forward voltage  
 [Terminal] (typ.)



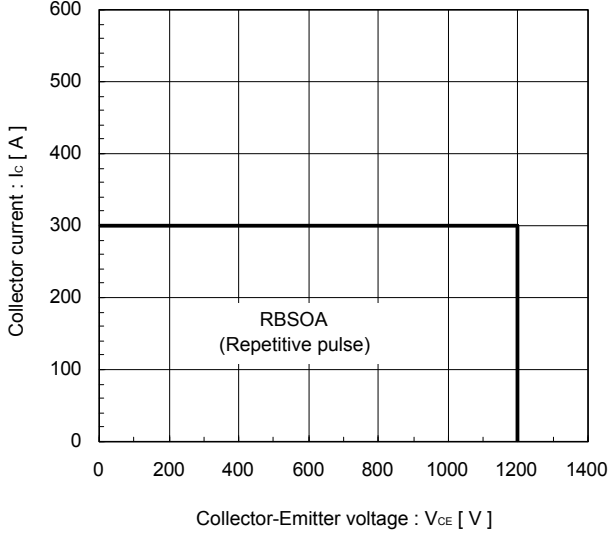
Switching Loss vs. Collector Current (typ.)  
 $V_{DC}=600V, V_{CC}=15V, T_J=25^\circ C$



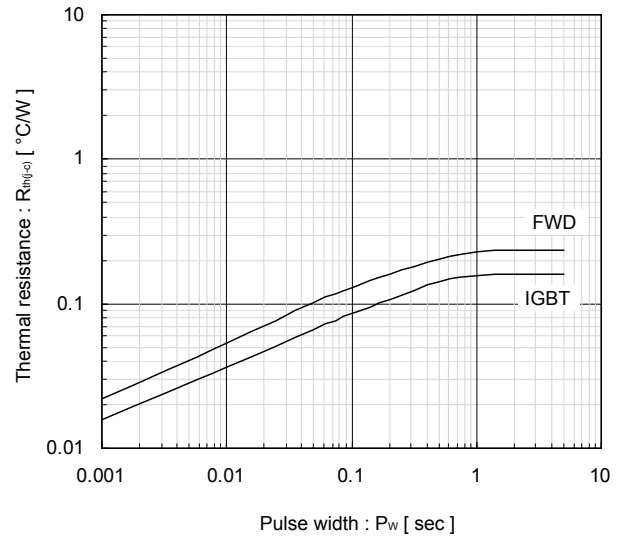
Switching Loss vs. Collector Current (typ.)  
 $V_{DC}=600V, V_{CC}=15V, T_J=125^\circ C$



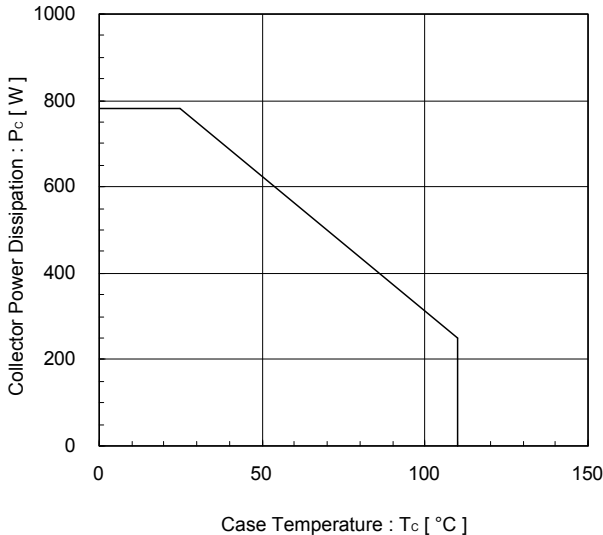
Reversed biased safe operating area  
 $V_{CC}=15V, T_J \le 125^\circ C$  [Main Terminal] (min.)



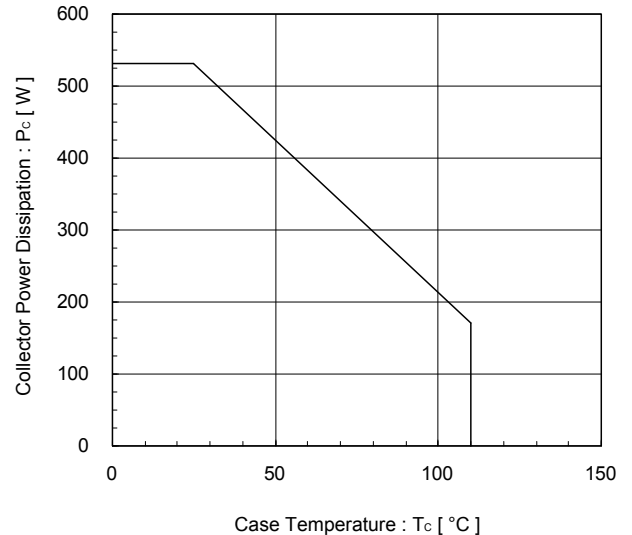
Transient thermal resistance (max.)



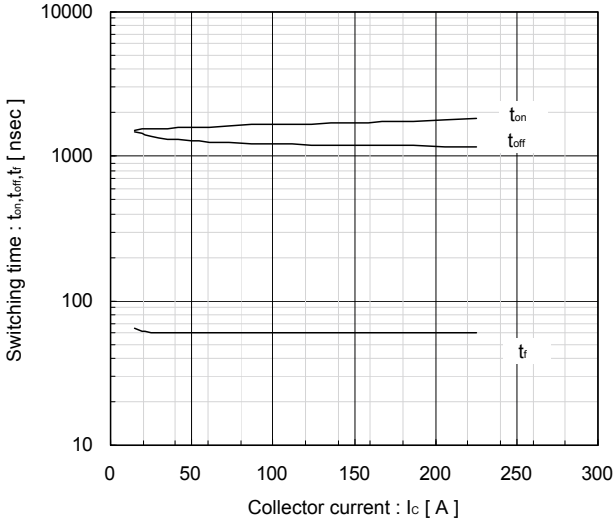
Power derating for IGBT (max.)  
 [per device]



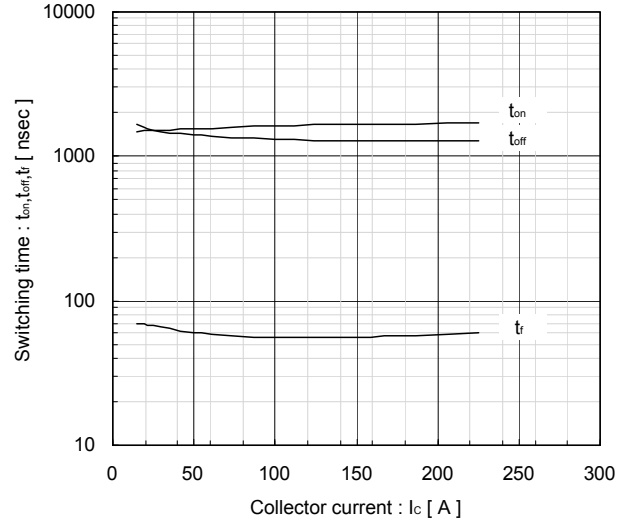
Power derating for FWD (max.)  
 [per device]



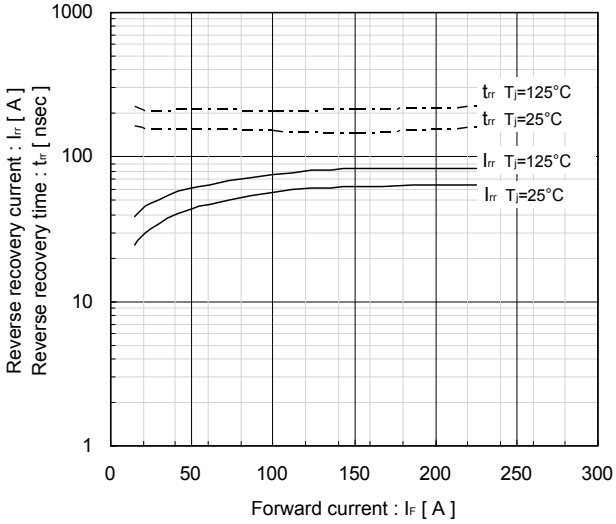
Switching time vs. Collector current (typ.)  
 $V_{DC}=600V, V_{CC}=15V, T_J=25^\circ C$



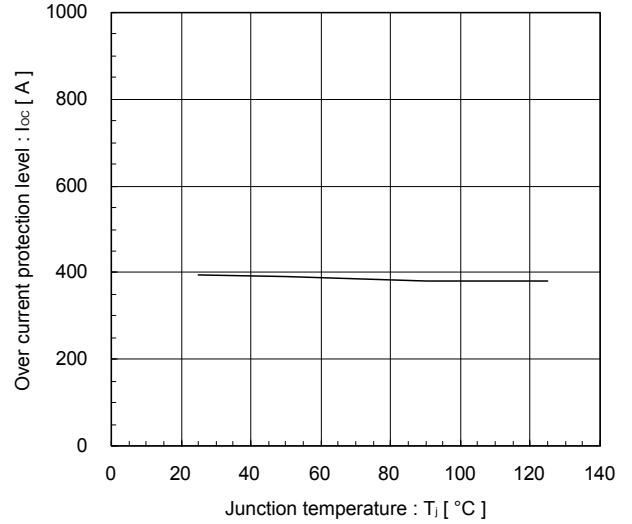
Switching time vs. Collector current (typ.)  
 $V_{DC}=600V, V_{CC}=15V, T_J=25^\circ C$



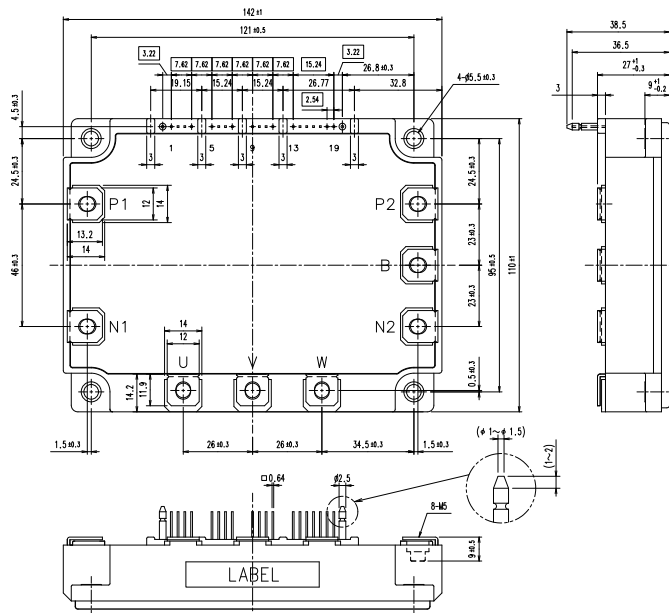
Reverse recovery characteristics (typ.)  
 $t_{rr}, I_{rr}$  vs.  $I_F$



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



■ Outline Drawings, mm



**WARNING**

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  - Measurement equipment
  - Machine tools
  - Audiovisual equipment
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  - Personal equipment
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