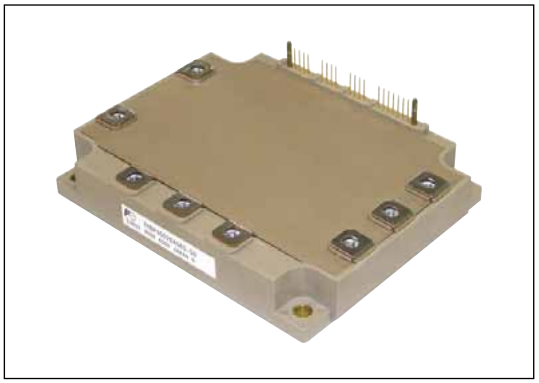
6MBP400VEA060-50

IGBT Modules

IGBT MODULE (V series)
600V / 400A / 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_c=25°C, V_{cc}=15V 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	I_C	-	400	A
		1ms	I_{CP}	-	800	A
		Duty=68.6% (*2)	$-I_C$	-	400	A
	Collector Power Dissipation	1 device (*3)	P_C	-	1086	W
Brake	Collector Current	DC	I_C	-	-	A
		1ms	I_{CP}	-	-	A
	Forward Current of Diode		I_F	-	-	A
	Collector Power Dissipation	1 device (*3)	P_C	-	-	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	°C
Operating Case Temperature			T_{opr}	-20	110	°C
Storage Temperature			T_{stg}	-40	125	°C
Solder Temperature (*8)			T_{sol}	-	260	°C
Isolating Voltage (*9)			V_{iso}	-	AC2500	Vrms
Screw Torque		Terminal (M5)	-	-	3.5	Nm
		Mounting (M5)				

Note *1: V_{CES} 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/$R_{th(j-c)D}$/(I_F×V_F Max.)×100
Note *3: P_C=125°C/$R_{th(j-c)Q}$ (Inverter & Brake)
Note *4: V_{CC} 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_{in} 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_{ALM} shall be applied to the voltage between terminal No.4 and 1, 8 and 5, 12 and 9, 19 and 13.
Note *7: I_{ALM} 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°C, V_{cc}=15V unless otherwise specified)

Items		Symbol	Conditions		Min.	Typ.	Max.	Units
Inverter	Collector Current at off signal input	I_{CES}	V_{CE}=600V		-	-	1.0	mA
	Collector-Emitter saturation voltage (*10)	$V_{CE(sat)}$	I_C=400A	Terminal	-	-	2.05	V
				Chip	-	1.25	-	V
	Forward voltage of FWD (*10)	V_F	I_F=400A	Terminal	-	-	2.60	V
				Chip	-	1.80	-	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}=300V, T_j=125°C, I_C=400A		1.1	-	-	μs
		t_{off}			-	-	2.1	μs
		t_{rr}	V_{DC}=300V, I_F=400A		-	-	0.3	μs
Supply current of P-side pre-driver (per one unit)		I_{ccp}	Switching Frequency= 0-15kHz T_C=-20~110°C		-	-	45	mA
Supply current of N-side pre-driver		I_{ccn}			-	-	135	mA
Input signal threshold voltage		$V_{inth(on)}$	V_{in}-GND	ON	1.2	1.4	1.6	V
		$V_{inth(off)}$		OFF	1.5	1.7	1.9	V
Over Current Protection Level	Inverter	I_{OC}	T_j=125°C		600	-	-	A
	Brake				-	-	-	A
Over Current Protection Delay time		t_{dOC}	T_j=125°C		-	5	-	μs
Short Circuit Protection Delay time		t_{SC}	T_j=125°C		-	2	3	μs
IGBT Chips Over Heating Protection Temperature Level		T_{jOH}	Surface of IGBT Chips		150	-	-	°C
Over Heating Protection Hysteresis		T_{jH}			-	20	-	°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=-20~110°C	V_{CC}≧10V	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	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_c = 25ºC)

Items			Symbol	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance (*11)	Inverter	IGBT	$R_{th(j-c)Q}$	-	-	0.115	°C/W
		FWD	$R_{th(j-c)D}$	-	-	0.175	°C/W
	Brake	IGBT	$R_{th(j-c)Q}$	-	-	-	°C/W
		FWD	$R_{th(j-c)D}$	-	-	-	°C/W
Case to Fin Thermal Resistance with Compound			$R_{th(c-f)}$	-	0.05	-	°C/W

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

● Noise Immunity (V_{DC}=300V, V_{cc}=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

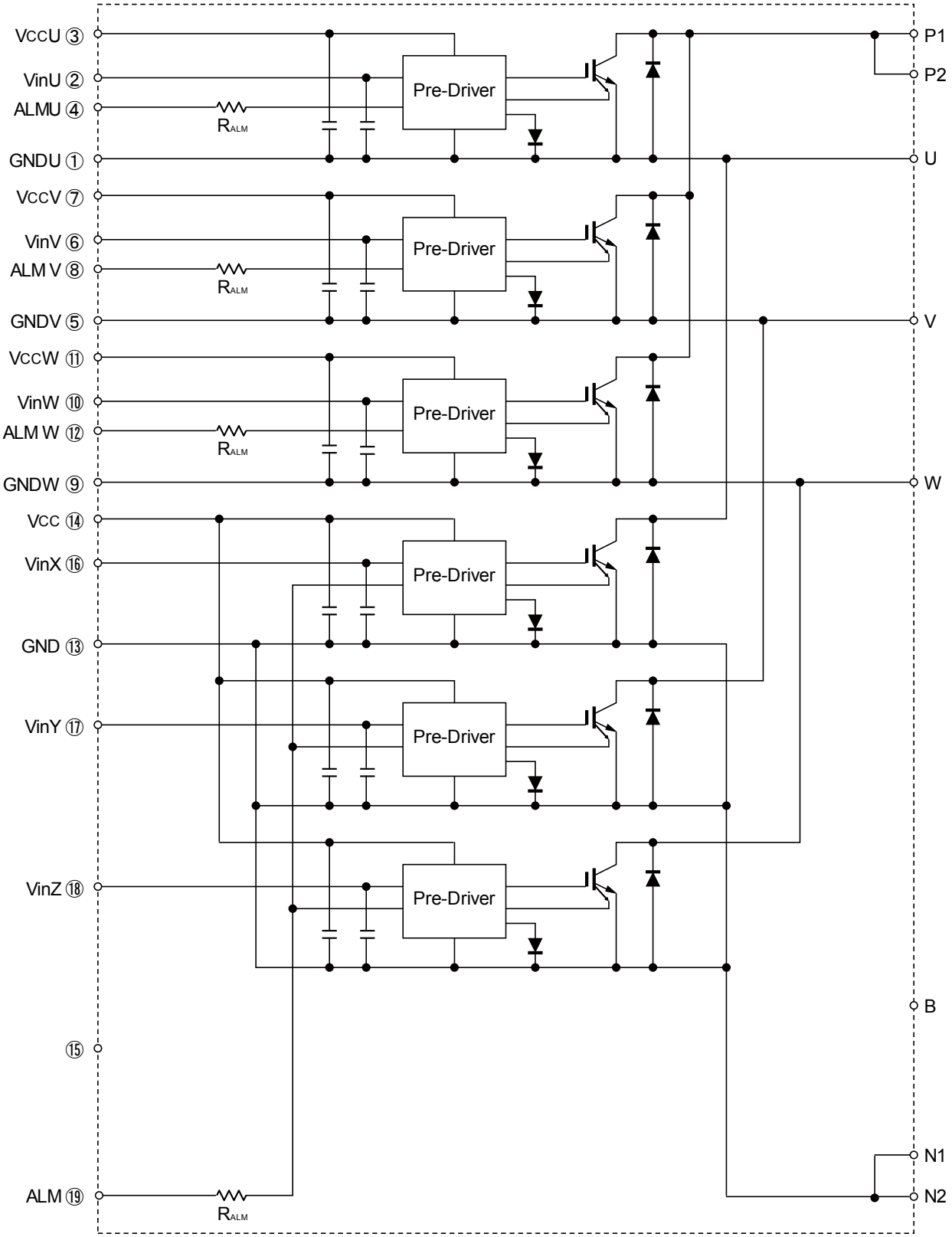
● Recommended Operating Conditions

Items	Symbol	Min.	Typ.	Max.	Units
DC Bus Voltage	V_{DC}	-	-	400	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	-	-	μs
Screw Torque (M5)	-	2.5	-	3.5	Nm

● Weight

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

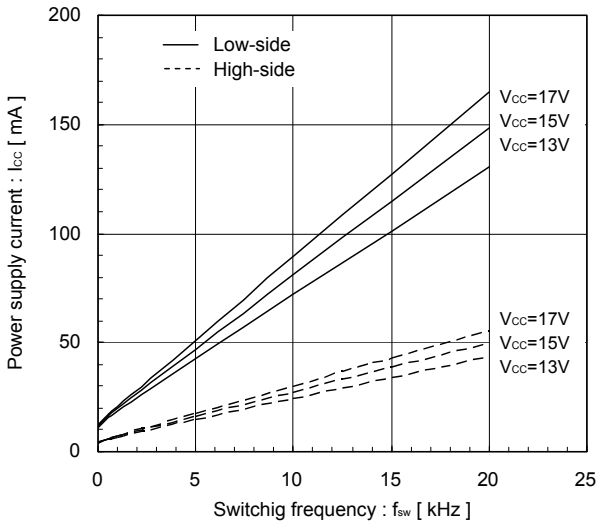
■ Block Diagram



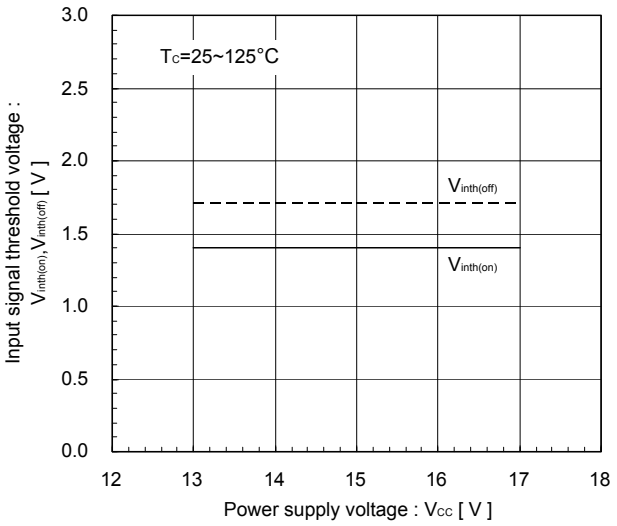
Pre-drivers include following functions
1. Amplifier for driver
2. Short circuit protection
3. Under voltage lockout circuit
4. Over current protection
5. IGBT chip over heating protection

■ Characteristics (Representative)

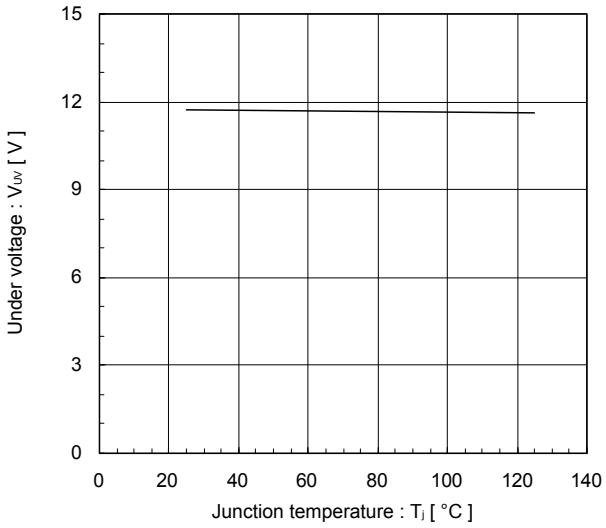
Power supply current vs. Switching frequency
T_j= 25°C(typ.)



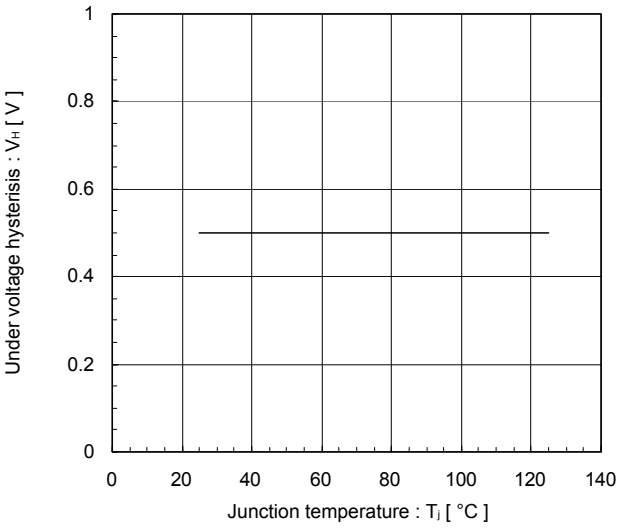
Input signal threshold voltage
vs. Power supply voltage (typ.)



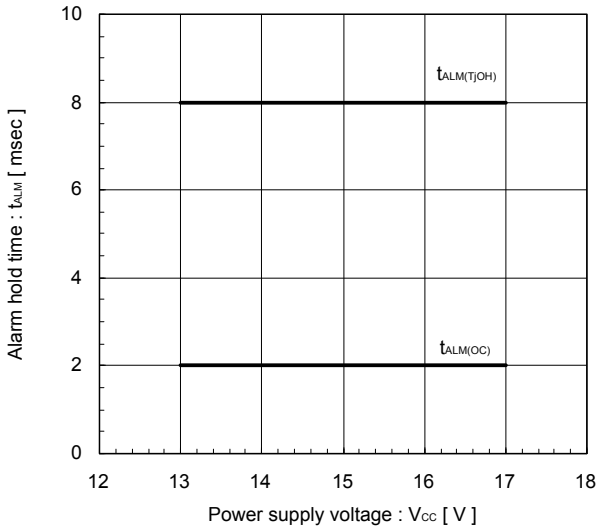
Under voltage vs. Junction temperature (typ.)



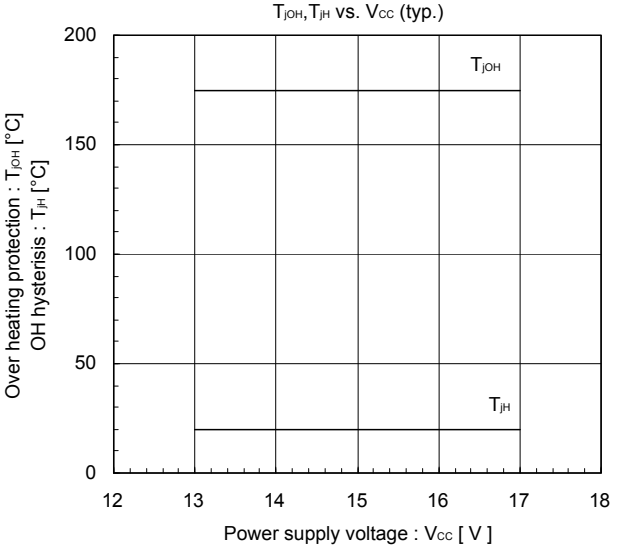
Under voltage hysterisis
vs. Junction temperature (typ.)



Alarm hold time vs. Power supply voltage (typ.)

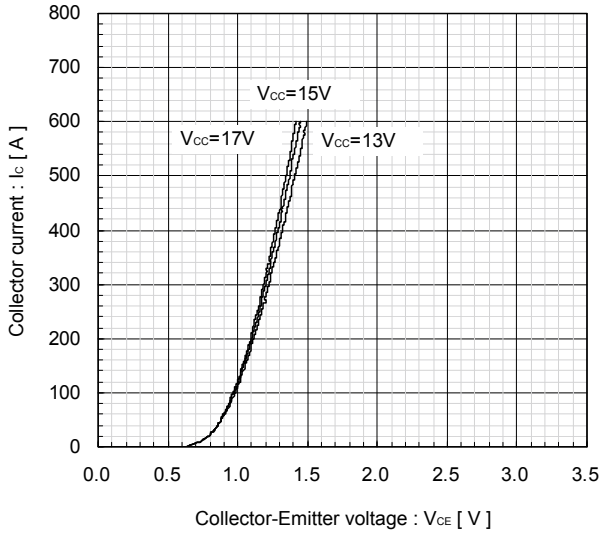


Over heating characteristics
T_{jOH},T_{jH} vs. Vcc (typ.)

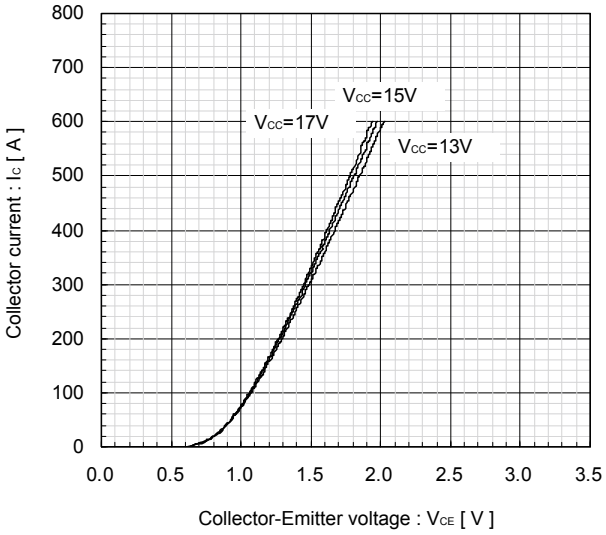


Inverter

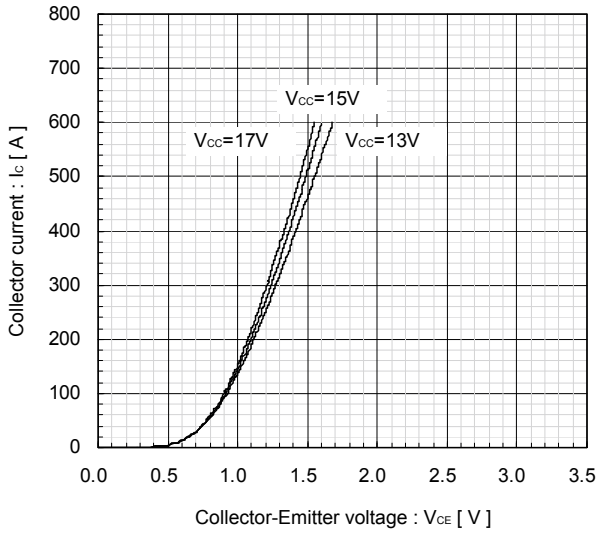
Collector current vs. Collector-Emitter voltage
T_j=25°C[Chip] (typ.)



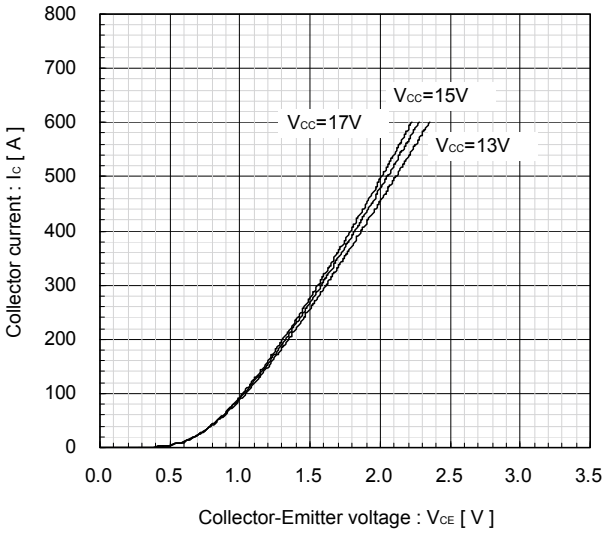
Collector current vs. Collector-Emitter voltage
T_j=25°C[Terminal] (typ.)



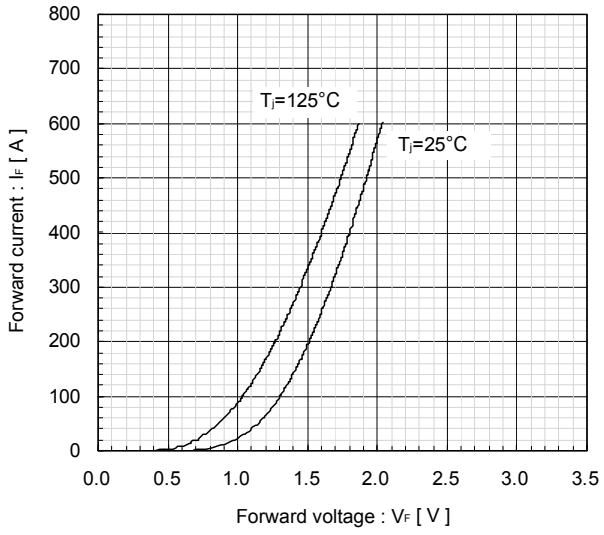
Collector current vs. Collector-Emitter voltage
T_j=125°C[Chip] (typ.)



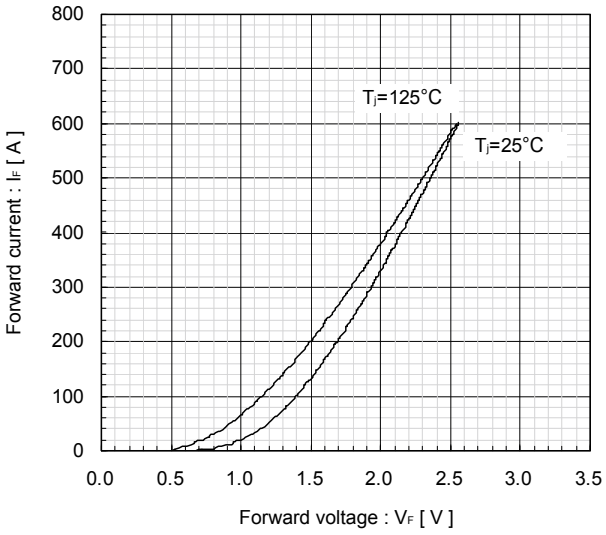
Collector current vs. Collector-Emitter voltage
T_j=125°C[Terminal] (typ.)



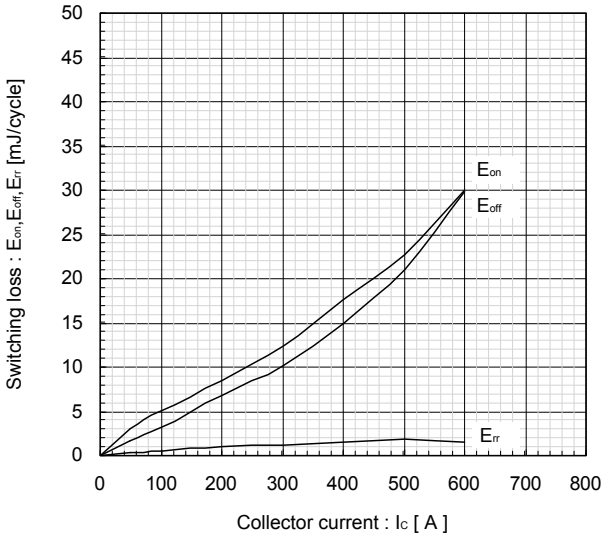
Forward current vs. Forward voltage
[Chip] (typ.)



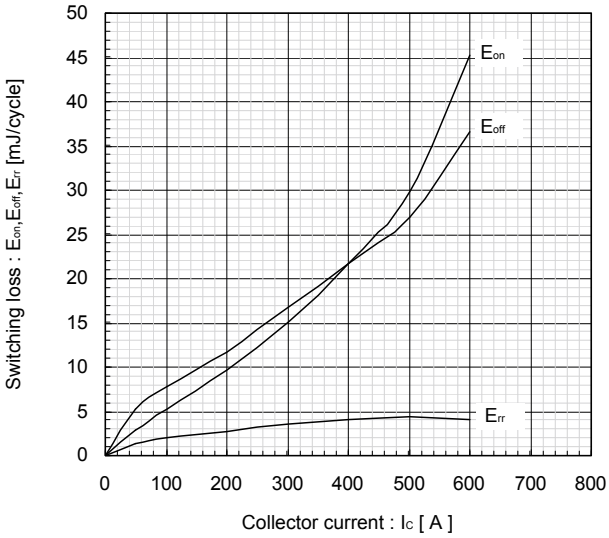
Forward current vs. Forward voltage
[Terminal] (typ.)



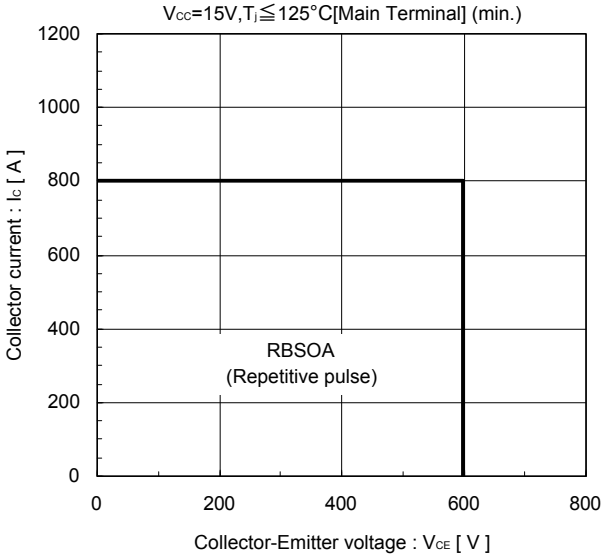
Switching Loss vs. Collector Current (typ.)
V_{DC}=300V,V_{CC}=15V,T_j=25°C



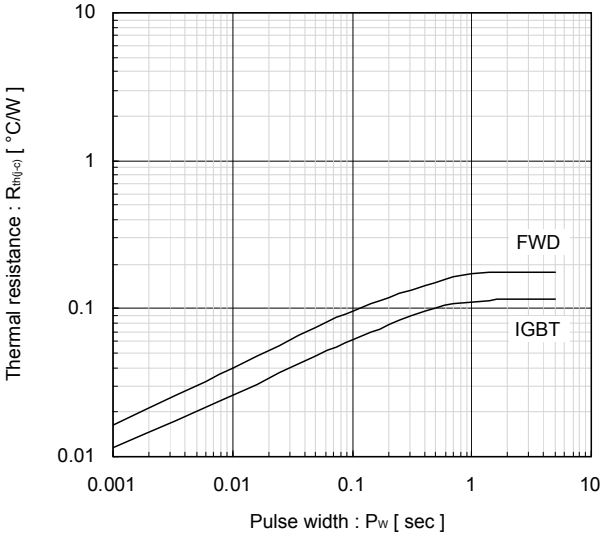
Switching Loss vs. Collector Current (typ.)
V_{DC}=300V,V_{CC}=15V,T_j=125°C



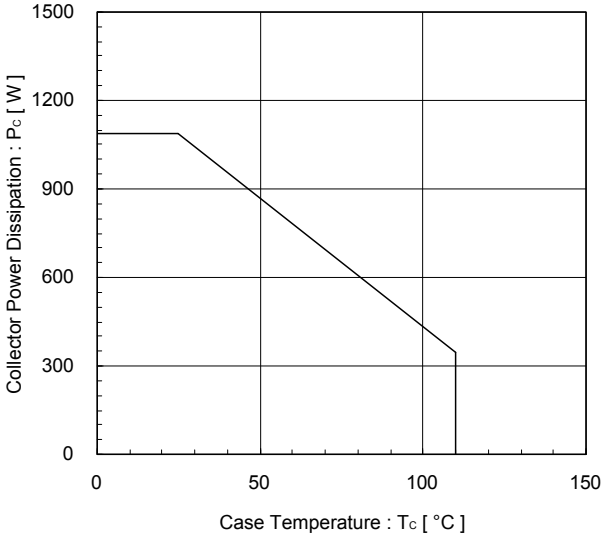
Reversed biased safe operating area
V_{CC}=15V,T_j≦125°C[Main Terminal] (min.)



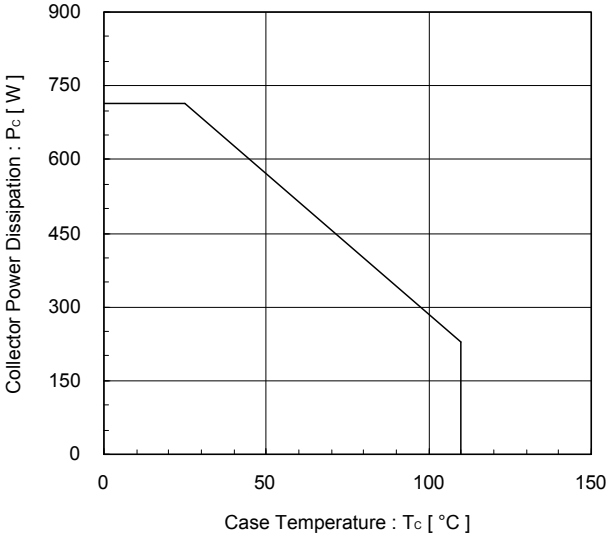
Transient thermal resistance (max.)



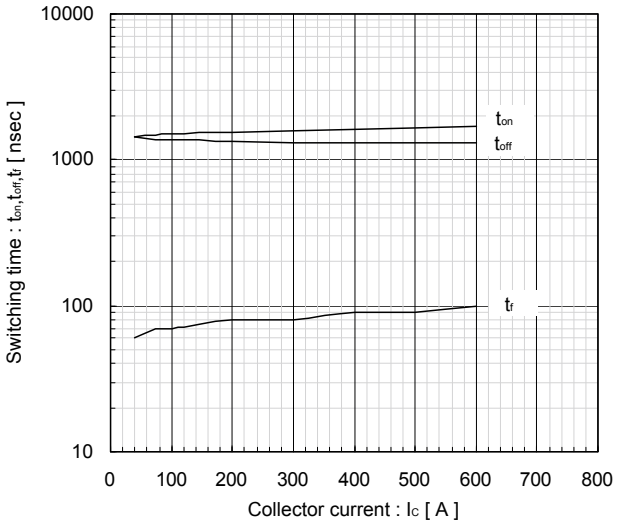
Power derating for IGBT (max.)
[per device]



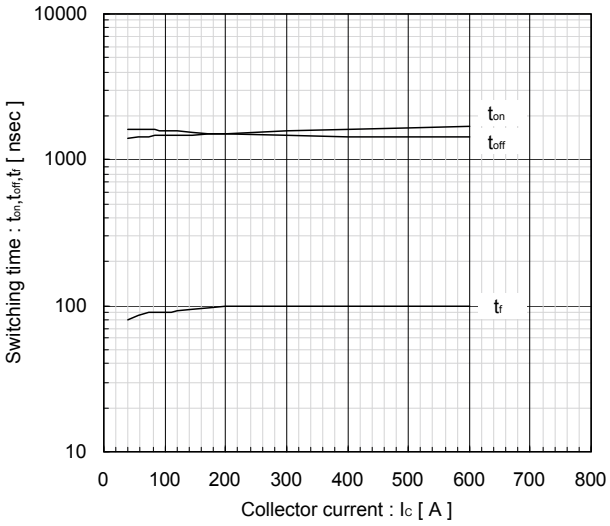
Power derating for FWD (max.)
[per device]



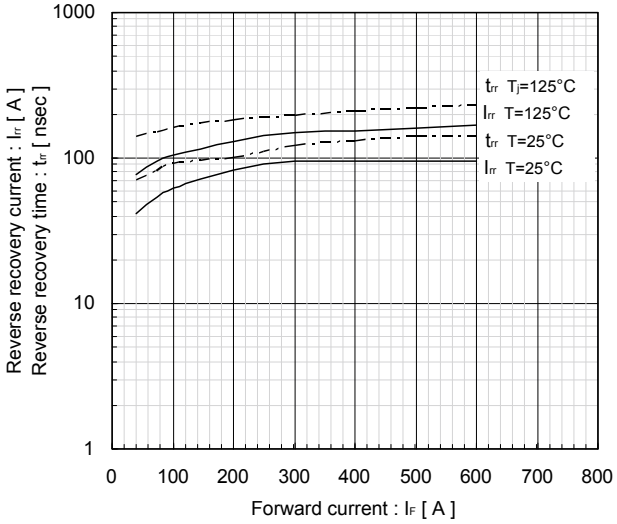
Switching time vs. Collector current (typ.)
V_{DC}=300V,V_{CC}=15V,T_j=25°C



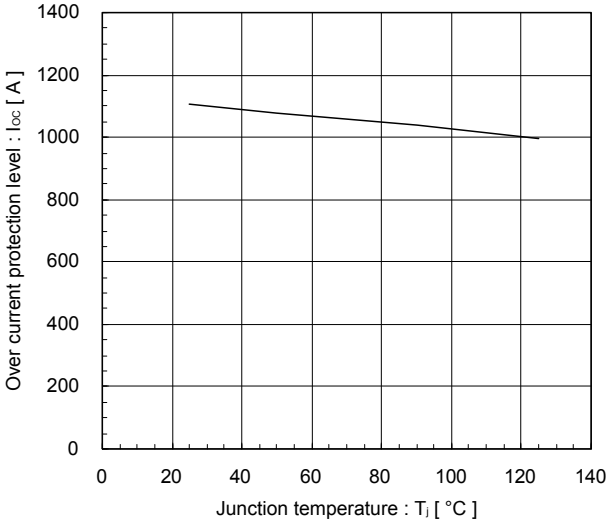
Switching time vs. Collector current (typ.)
V_{DC}=300V,V_{CC}=15V,T_j=125°C



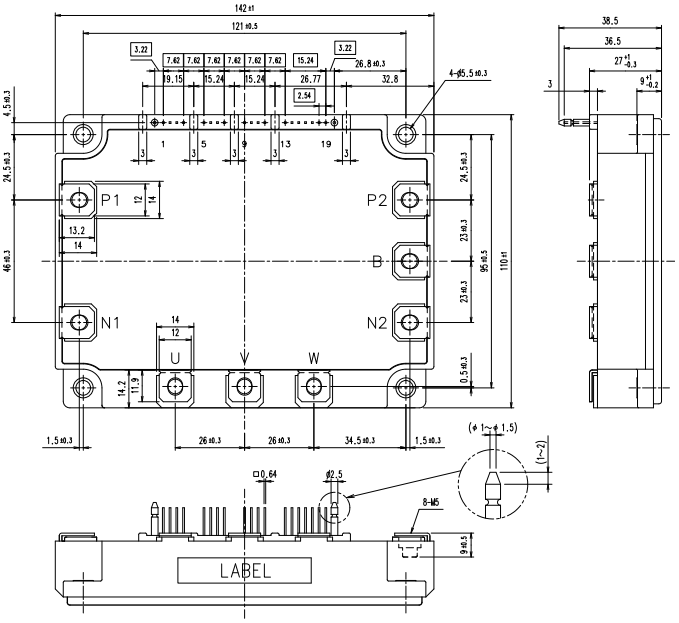
Reverse recovery characteristics (typ.)
t_{rr},I_{rr} vs. I_f



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



■ Outline Drawings, mm



WARNING

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