

7MBP50VDA060-50

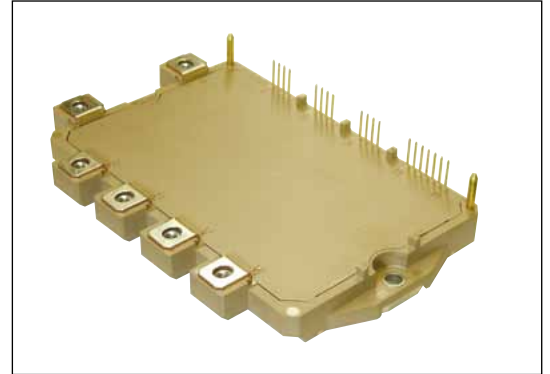
IGBT Modules

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



■ Maximum Ratings and Characteristics

● 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	I_C	-	50	A
		1ms	I_{cp}	-	100	A
		Duty=100% (*2)	$-I_C$	-	50	A
Collector Power Dissipation	1 device (*3)	P_C	-	201	W	
Brake	Collector Current	DC	I_C	-	30	A
		1ms	I_{cp}	-	60	A
	Forward Current of Diode		I_F	-	30	A
	Collector Power Dissipation	1 device (*3)	P_C	-	126	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	Terminal (M4)	-	-	-		
	Mounting (M4)	-	-	1.7	Nm	

Note *1: V_{CES} shall be applied to the input voltage between terminal P-(U, V, W) and (U, V, W, B)-N.

Note *2: Duty=125 $^\circ\text{C}/R_{th(j-c)}$ / ($I_F \times V_F$ Max.) $\times 100$

Note *3: $P_C=125^\circ\text{C}/R_{th(j-c)}$ (Inverter & Brake)

Note *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.

Note *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.

Note *6: V_{ALM} shall be applied to the voltage between terminal No.2 and 1, 6 and 5, 10 and 9, 19 and 13.

Note *7: I_{ALM} shall be applied to the input current to terminal No.2, 6, 10 and 19.

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

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}	$V_{CE}=600\text{V}$	-	-	1.0	mA	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	$I_c=50\text{A}$	Terminal	-	-	1.95	V
				Chip	-	1.40	-	V
	Forward voltage of FWD	V_F	$I_F=50\text{A}$	Terminal	-	-	2.35	V
Chip				-	1.80	-	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	-	-	1.85	V
				Chip	-	1.40	-	V
	Forward voltage of FWD	V_F	$I_F=30\text{A}$	Terminal	-	-	2.20	V
Chip				-	1.80	-	V	
Switching time	t_{on}	$V_{DC}=300\text{V}$, $T_j=125^\circ\text{C}$, $I_c=50\text{A}$		1.1	-	-	μs	
	t_{off}			-	-	2.1	μs	
	t_{rr}			$V_{DC}=300\text{V}$, $I_F=50\text{A}$	-	-	0.3	μs
Supply current of P-side pre-driver (per one unit)		I_{ccp}	Switching Frequency= 0-15kHz $T_c=-20\sim 110^\circ\text{C}$	-	-	12	mA	
Supply current of N-side pre-driver		I_{ccn}		-	-	46	mA	
Input signal threshold voltage		$V_{in(th)(on)}$	Vin-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}	$T_j=125^\circ\text{C}$	75	-	-	A	
	Brake			45	-	-	A	
Over Current Protection Delay time		t_{dOC}	$T_j=125^\circ\text{C}$	-	5	-	μs	
Short Circuit Protection Delay time		t_{sc}	$T_j=125^\circ\text{C}$	-	2	3	μs	
IGBT Chips Over Heating Protection Temperature Level		T_{jOH}	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	Ω	

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

Items			Symbol	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance (*10)	Inverter	IGBT	$R_{th(j-c)Q}$	-	-	0.62	$^\circ\text{C/W}$
		FWD	$R_{th(j-c)D}$	-	-	0.98	$^\circ\text{C/W}$
	Brake	IGBT	$R_{th(j-c)Q}$	-	-	0.99	$^\circ\text{C/W}$
		FWD	$R_{th(j-c)D}$	-	-	1.38	$^\circ\text{C/W}$
Case to Fin Thermal Resistance with Compound			$R_{th(c-f)}$	-	0.05	-	$^\circ\text{C/W}$

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

● Noise Immunity ($V_{dc}=300\text{V}$, $V_{cc}=15\text{V}$)

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	± 2.0	-	-	kV

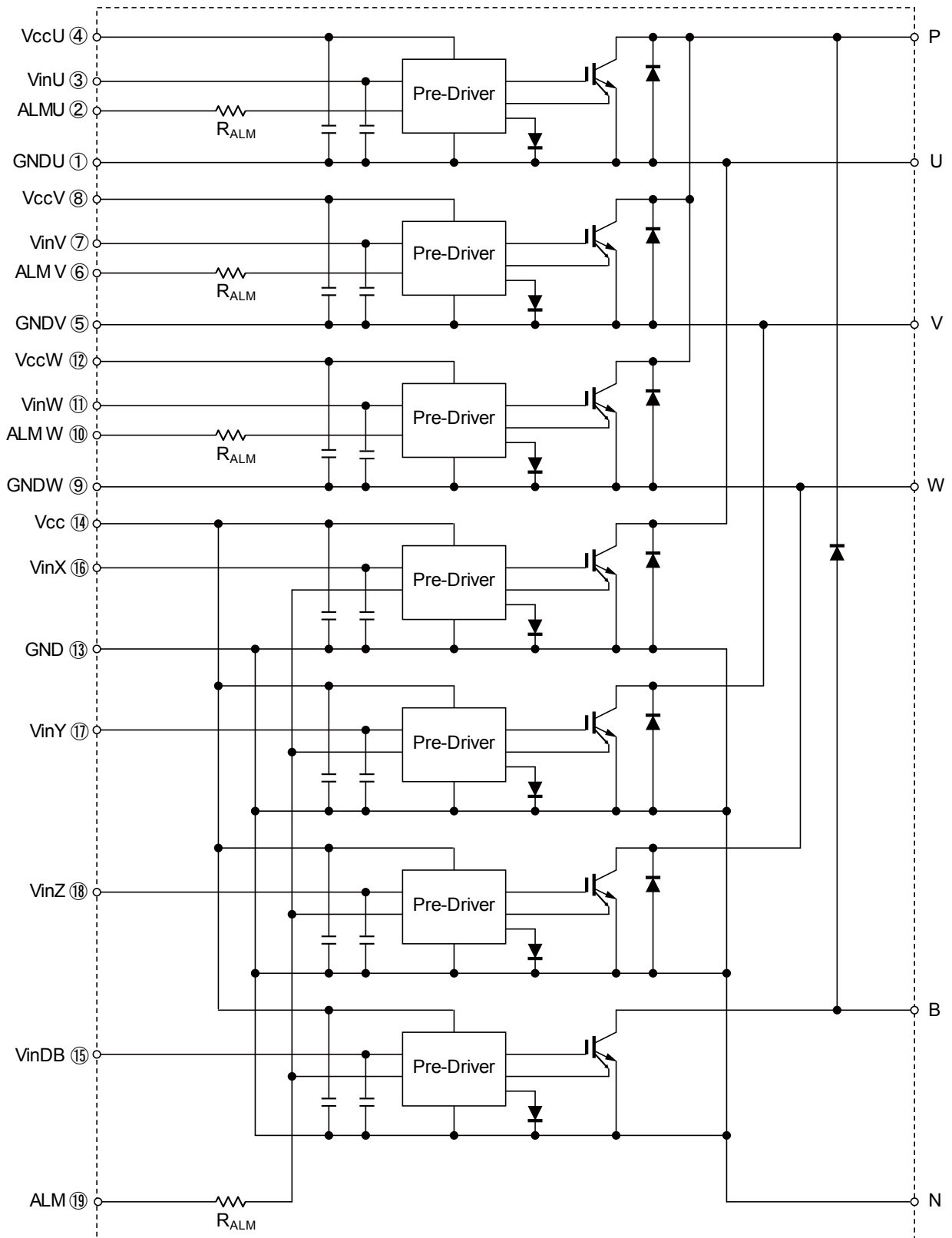
● Recommended Operating Conditions

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 (M4)	-	1.3	-	1.7	Nm

● Weight

Items	Symbol	Min.	Typ.	Max.	Units
Weight	W_t	-	290	-	g

■ Block Diagram

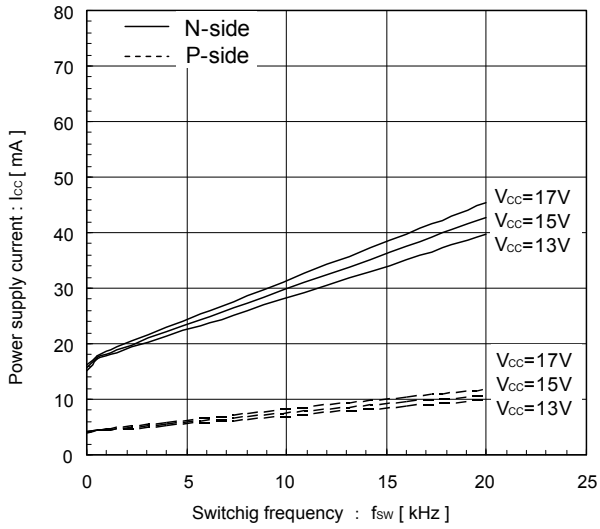


Pre-drivers include following functions

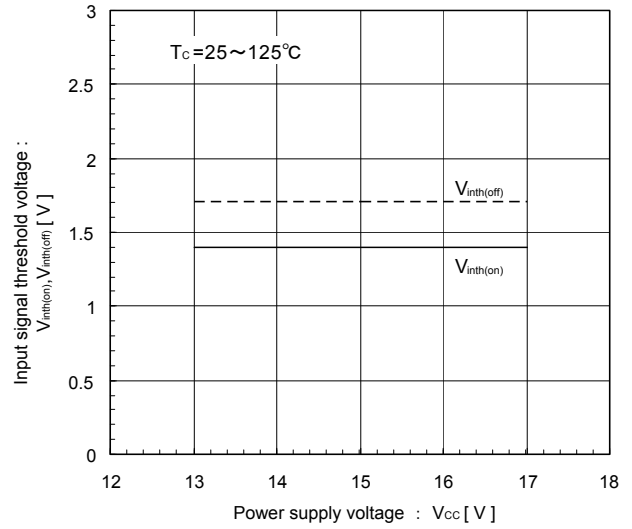
1. Amplifier for driver
2. Short circuit protection
3. Under voltage lockout circuit
4. Over current protection
5. IGBT chip over heating protection

■ Characteristics (Representative)

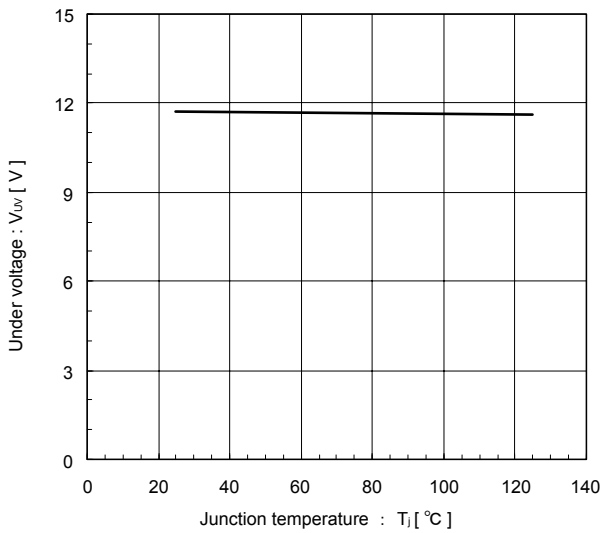
Power supply current vs. Switching frequency
 $T_j = 25^\circ\text{C}(\text{typ.})$



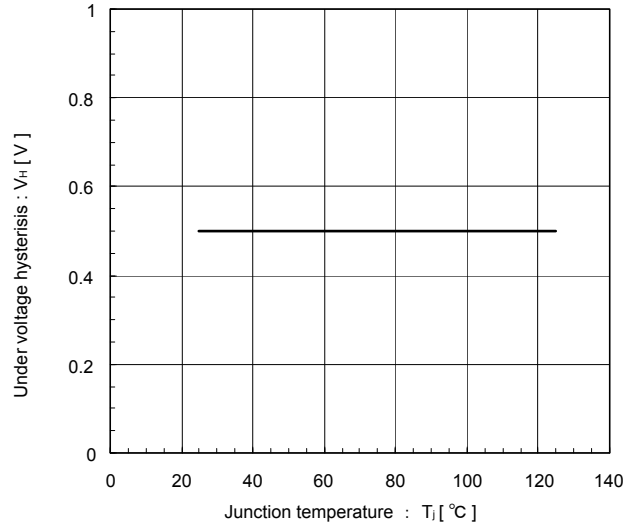
Input signal threshold voltage vs. Power supply voltage (typ.)



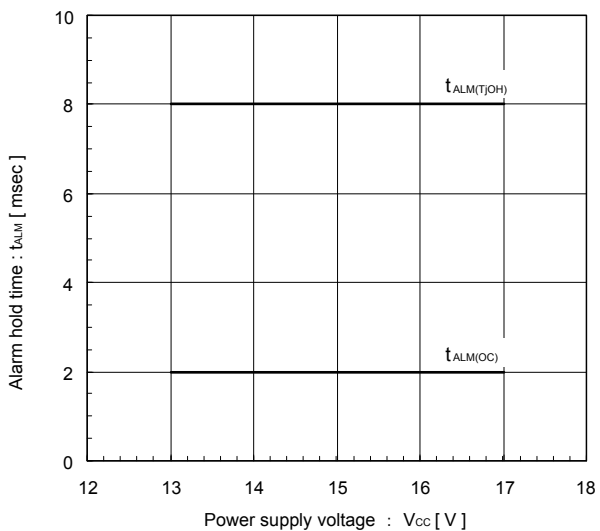
Under voltage vs. Junction temperature (typ.)



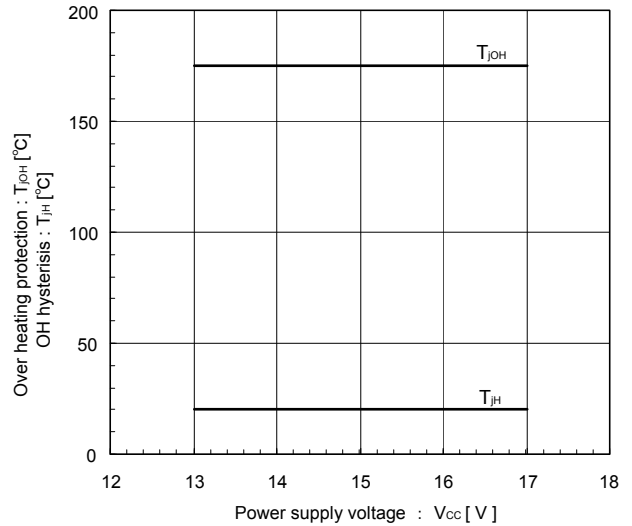
Under voltage hysteresis vs. Junction temperature (typ.)



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

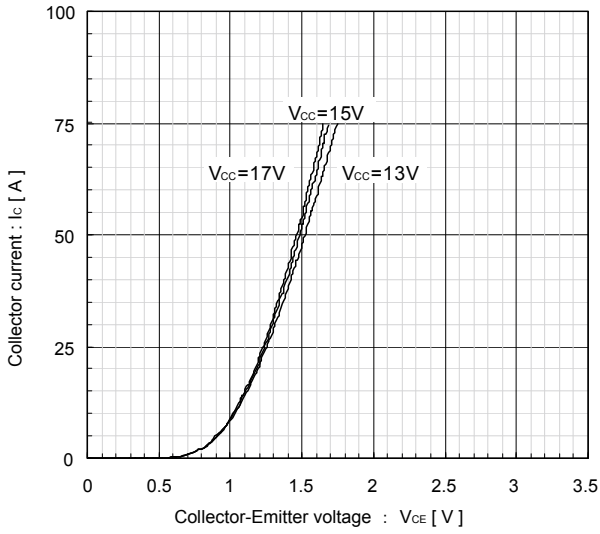


Over heating characteristics
 T_{jOH}, T_{jH} vs. V_{cc} (typ.)

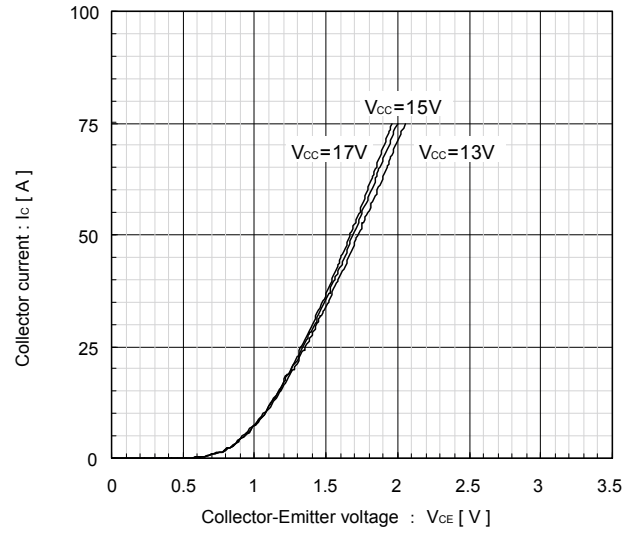


Inverter

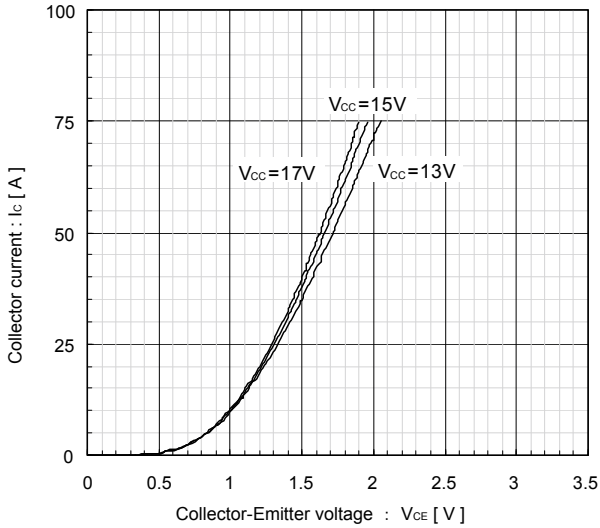
Collector current vs. Collector-Emitter voltage
 $T_j=25^\circ\text{C}$ [Chip] (typ.)



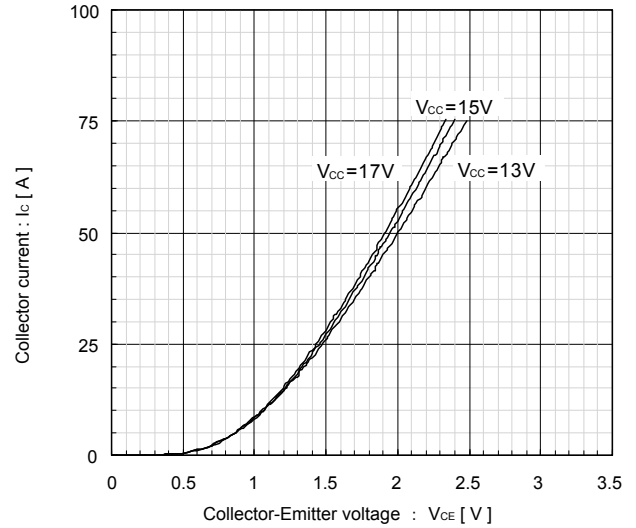
Collector current vs. Collector-Emitter voltage
 $T_j=25^\circ\text{C}$ [Terminal] (typ.)



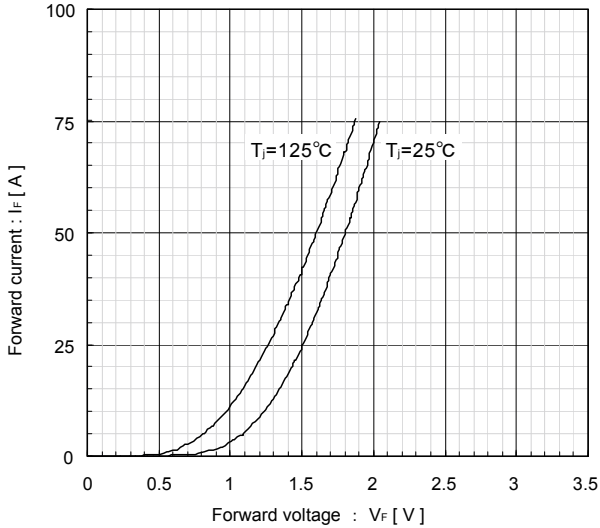
Collector current vs. Collector-Emitter voltage
 $T_j=125^\circ\text{C}$ [Chip] (typ.)



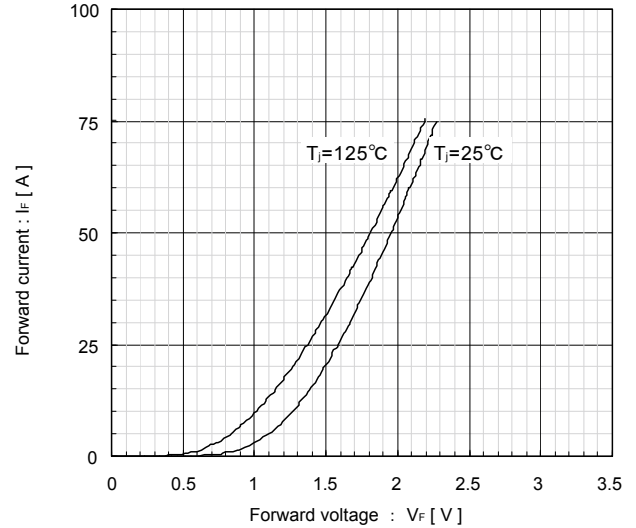
Collector current vs. Collector-Emitter voltage
 $T_j=125^\circ\text{C}$ [Terminal] (typ.)



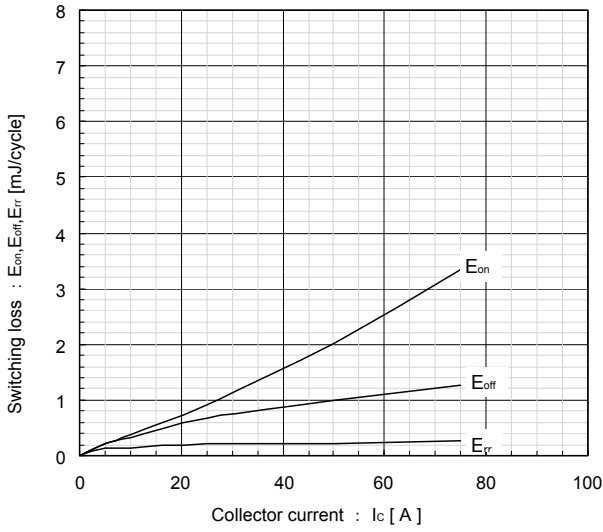
Forward current vs. Forward voltage
 [Chip] (typ.)



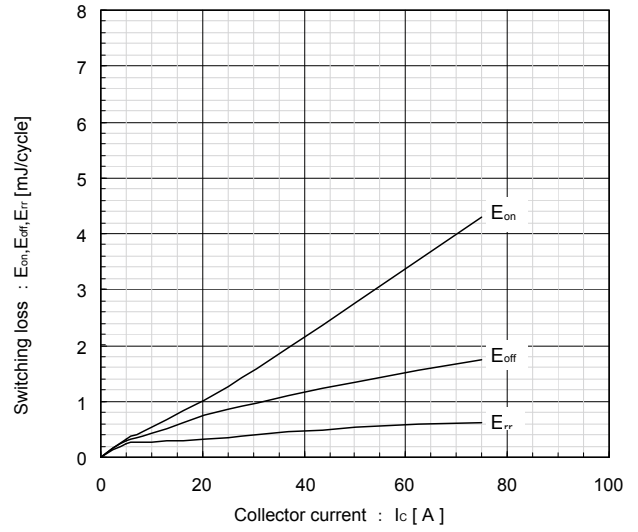
Forward current vs. Forward voltage
 [Terminal] (typ.)



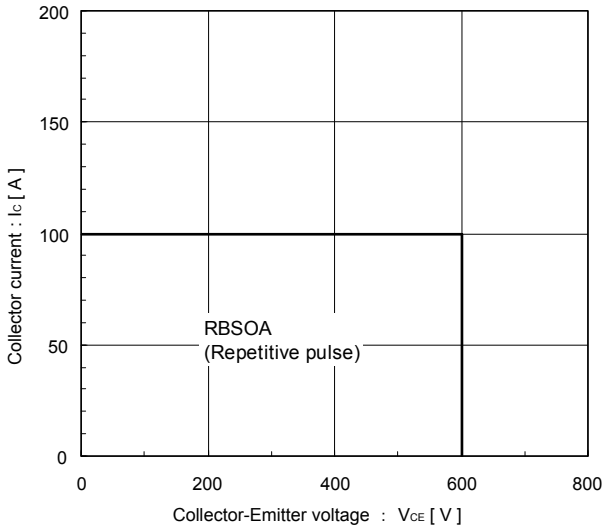
Switching Loss vs. Collector Current (typ.)
 $V_{DC}=300V, V_{CC}=15V, T_J=25^{\circ}C$



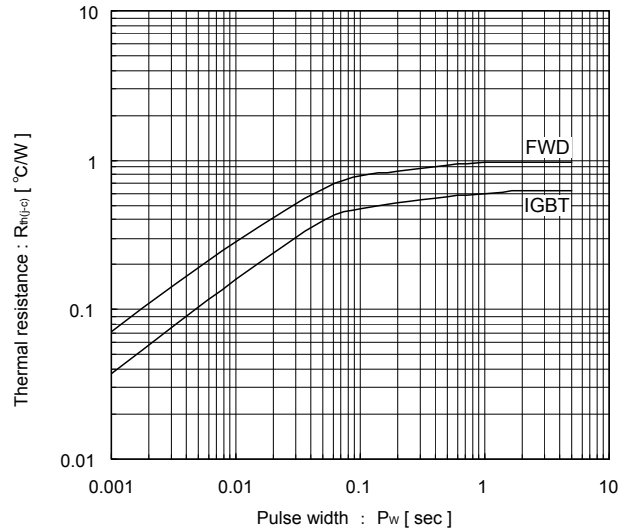
Switching Loss vs. Collector Current (typ.)
 $V_{DC}=300V, V_{CC}=15V, T_J=125^{\circ}C$



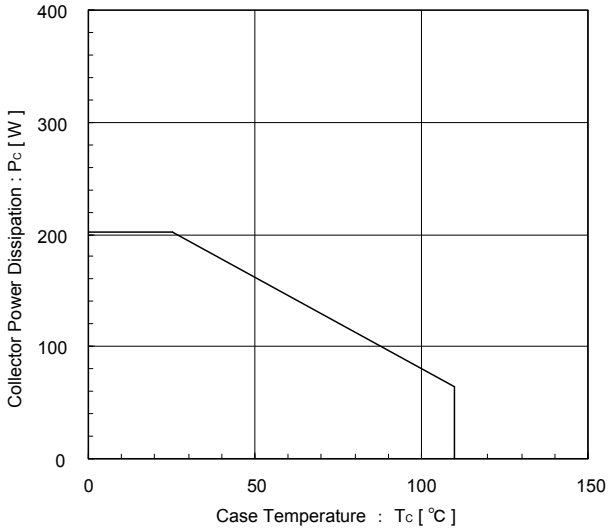
Reversed biased safe operating area
 $V_{CC}=15V, T_J \leq 125^{\circ}C$ [Main Terminal] (min.)



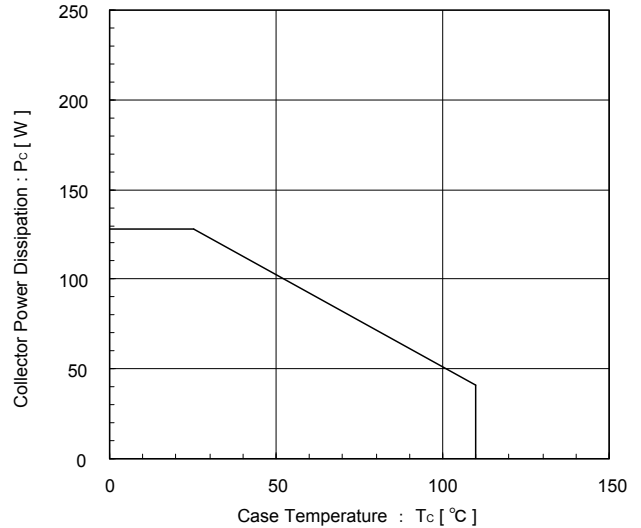
Transient thermal resistance (max.)



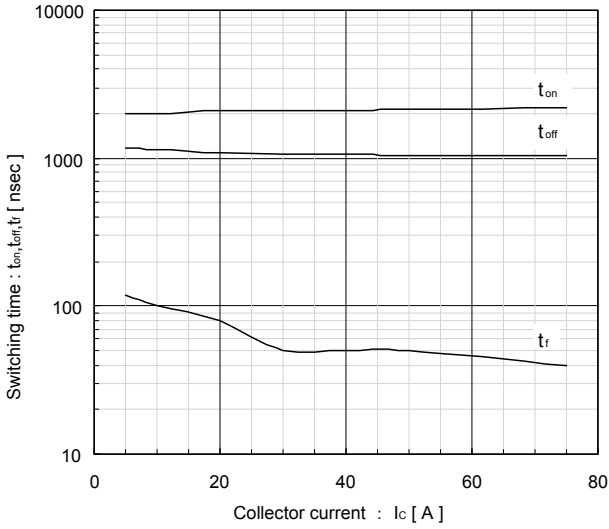
Power derating for IGBT (max.)
 [per device]



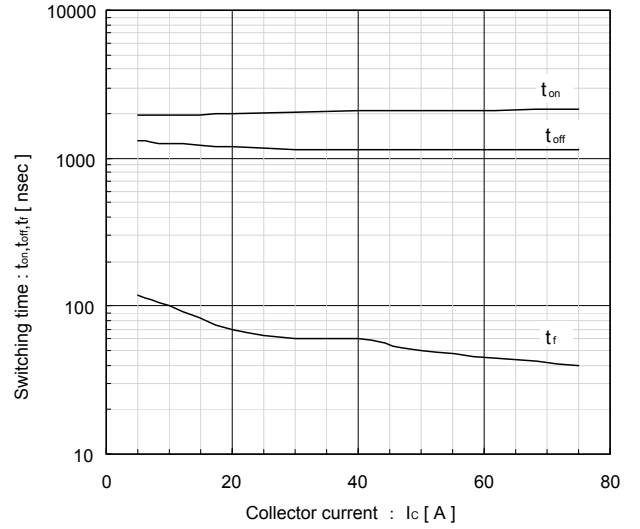
Power derating for FWD (max.)
 [per device]



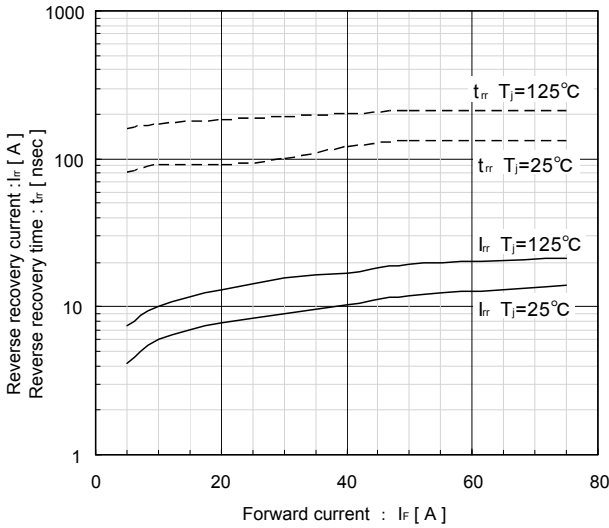
Switching time vs. Collector current (typ.)
 $V_{DC}=300V, V_{CC}=15V, T_J=25^\circ C$



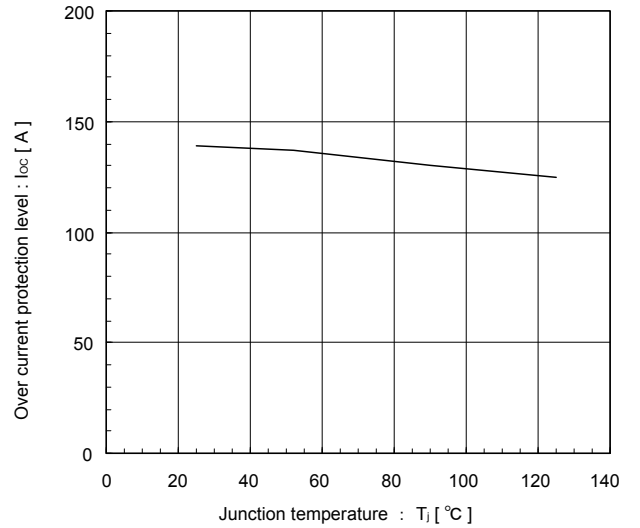
Switching time vs. Collector current (typ.)
 $V_{DC}=300V, V_{CC}=15V, T_J=125^\circ C$



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

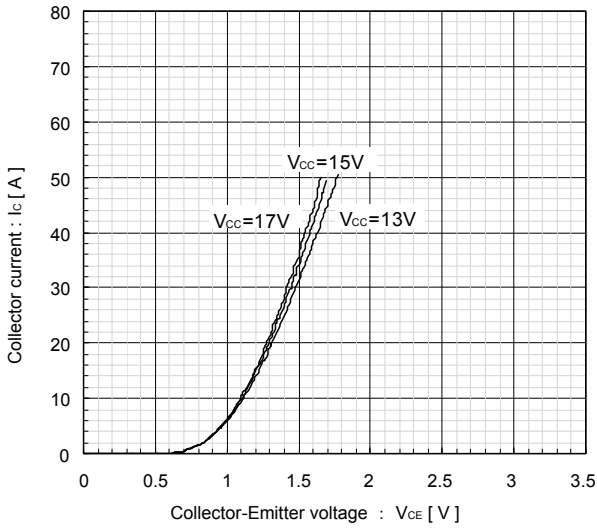


Over current protection vs. Junction temperature (typ.)
 $V_{CC}=15V$

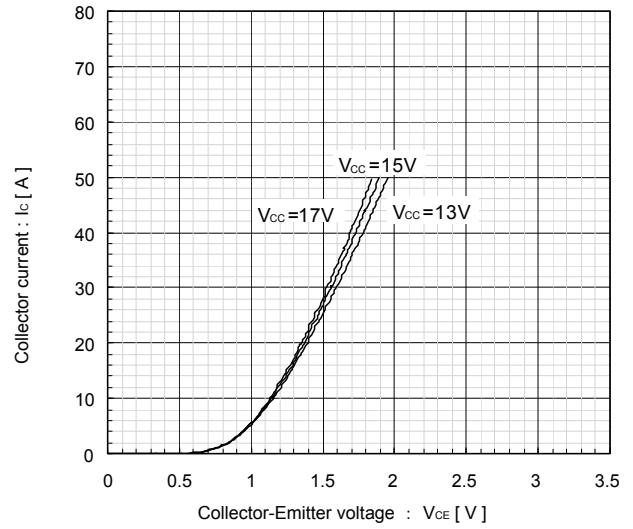


Brake

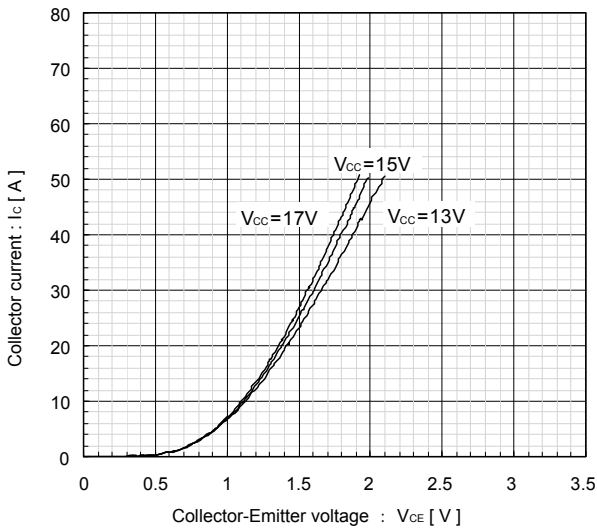
Collector current vs. Collector-Emitter voltage
 $T_j=25^\circ\text{C}$ [Chip] (typ.)



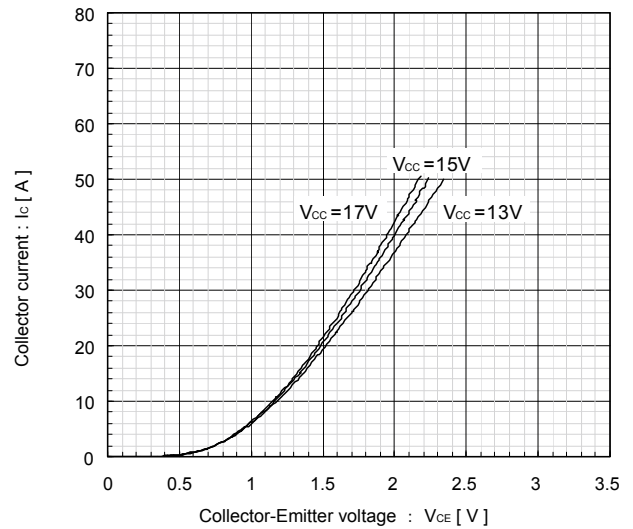
Collector current vs. Collector-Emitter voltage
 $T_j=25^\circ\text{C}$ [Terminal] (typ.)



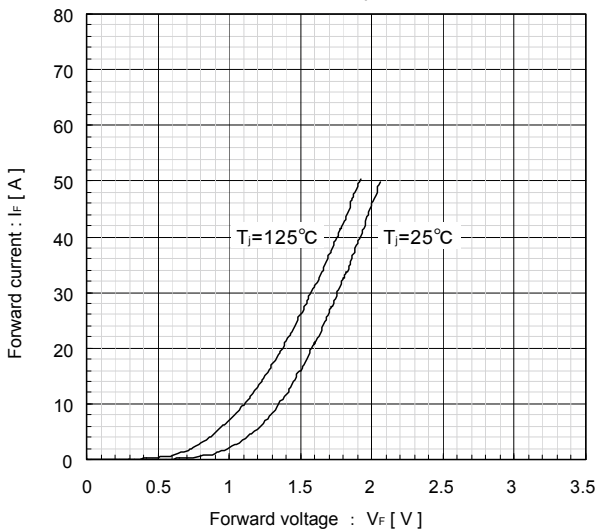
Collector current vs. Collector-Emitter voltage
 $T_j=125^\circ\text{C}$ [Chip] (typ.)



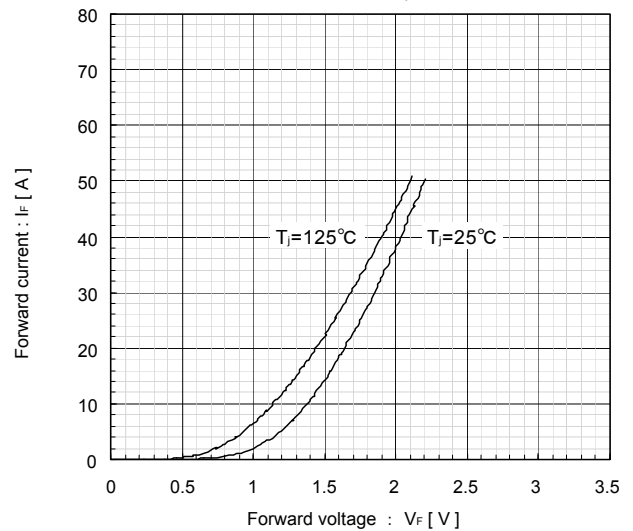
Collector current vs. Collector-Emitter voltage
 $T_j=125^\circ\text{C}$ [Terminal] (typ.)



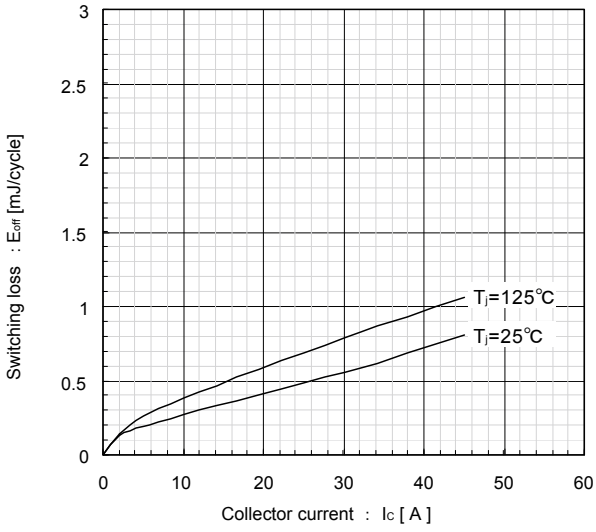
Forward current vs. Forward voltage
 [Chip] (typ.)



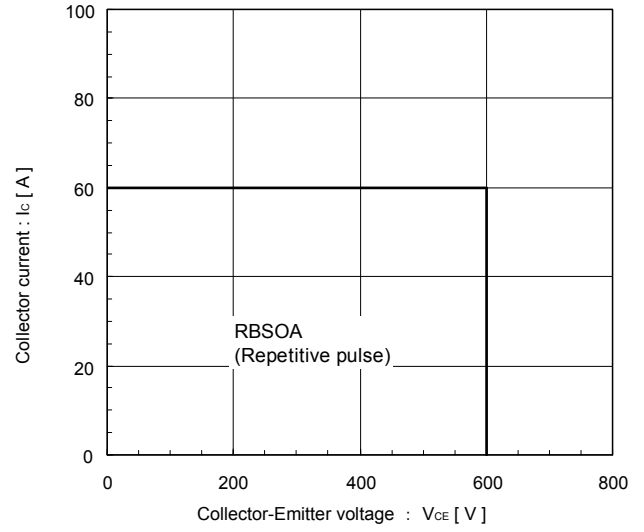
Forward current vs. Forward voltage
 [Terminal] (typ.)



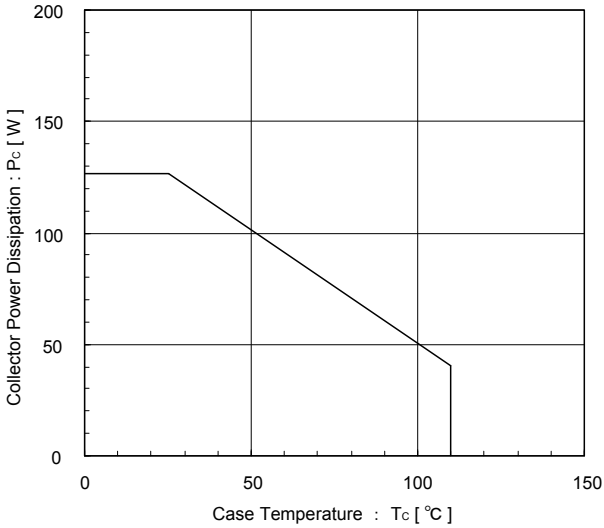
Switching Loss vs. Collector Current (typ.)
 $V_{DC}=300V, V_{CC}=15V$



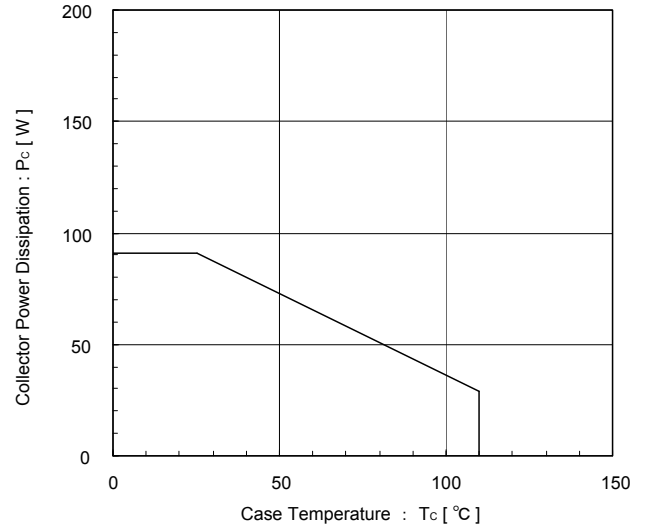
Reversed biased safe operating area
 $V_{CC}=15V, T_j \le 125^\circ C$ [Main Terminal] (min.)



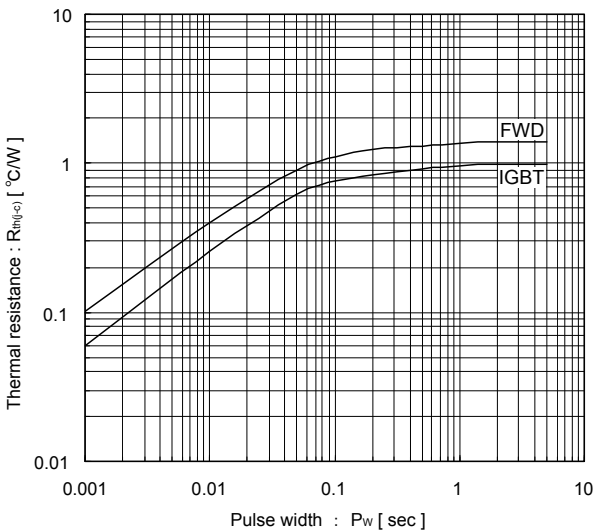
Power derating for IGBT (max.)
 [per device]



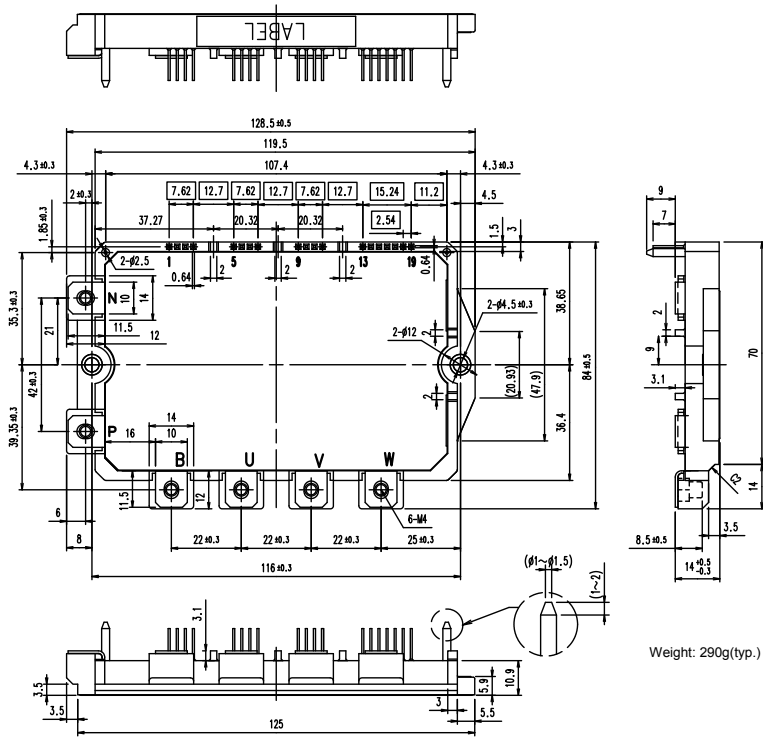
Power derating for FWD (max.)
 [per device]



Transient thermal resistance (max.)



■ Outline Drawings, mm



WARNING

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IGBT Modules

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