FUJI ELECTRIC

7MBP 50RA-060

IGBT IPM
600V
6×50A+DB

Intelligent Power Module (R-Series)

■ Maximum Ratings and Characteristics

• Absolute Maximum Ratings (T_c=25°C)

Items		Symbols	Ratings		Units
			Min.	Max.	
DC Bus Voltage		V_{DC}	0	450	V
DC Bus Voltage (surge)		$V_{DC(Surge)}$	0	500	
DC Bus Voltage (short operating)		V_{SC}	200	400	
Collector-Emitter Voltage		V_{CES}	0	600	
Inverter	Continuous	I_C		50	A
Collector	1ms	I_{CP}		100	
Current	Duty=62.6%	$-I_C$		50	
Collector Power Dissipation	One Transistor	P_C		198	W
Dynamic Brake	Continuous	I_C		30	A
Collector Current	1ms	I_{CP}		60	
Forward Current of Diode		I_F		30	
Collector Power Dissi. DB	One Transistor	P_C		120	W
Voltage of Power Supply for Driver		V_{CC} *1	0	20	V
Input Signal Voltage		V_{IN} *2	0	V_Z	
Input Signal Current		I_{IN}		1	mA
Alarm Signal Voltage		V_{ALM} *3	0	V_{CC}	V
Alarm Signal Current		I_{ALM} *4		15	mA
Junction Temperature		T_j		150	°C
Operating Temperature		T_{OP}	-20	100	
Storage Temperature		T_{stg}	-40	125	
Isolation Voltage	A.C. 1min.	V_{iso}		2500	V
Screw Torque		Mounting *1		3.5	Nm
		Terminals *1		3.5	

Note: *1: Recommendable Value; 2.5 – 3.0 Nm (M5)

■ Outline Drawing

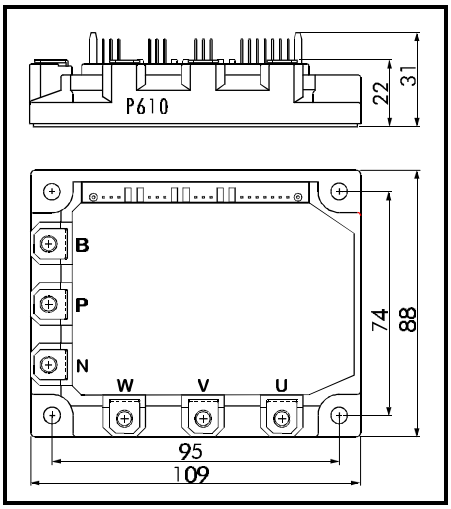


Fig. 1

• Electrical Characteristics of Power Circuit (at T_j=25°C, V_{CC}=15V)

Items		Symbols	Conditions	Min.	Typ.	Max.	Units
INV	Collector Current At Off Signal Input	I_{CES}	V_{CE}=600V, Input Terminal Open			1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE(Sat)}$	I_C=50A			2.8	V
	Forward Voltage of FWD	V_F	$-I_C$=50A			3.0	V
DB	Collector Current At Off Signal Input	I_{CES}	V_{CE}=600V, Input Terminal Open			1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE(Sat)}$	I_C=30A			2.8	V
	Forward Voltage of FWD	V_F	$-I_C$=30A			3.3	V

• Electrical Characteristics of Control Circuit (at T_j=25°C, V_{CC}=15V)

Items	Symbols	Conditions	Min.	Typ.	Max.	Units
Current of P-Line Side Driver (One Unit)	I_{CCP}	f_{SW}=0~15kHz, T_C=-20~100°C	3		18	mA
Current of N-Line Side Driver (Three Units)	I_{CCN}	f_{SW}=0~15kHz, T_C=-20~100°C	10		65	
Input Signal Threshold Voltage	$V_{IN(th)}$	On	1.00	1.35	1.70	V
		Off	1.25	1.60	1.95	
Input Zener Voltage	V_Z	R_{IN}=20kΩ		8.0		
Over Heating Protection Temperature Level	T_{COH}	V_{DC}=0V, I_C=0A, Case Temp.	110		125	°C
Hysteresis	T_{CH}			20		
IGBT Chips Over Heating Protec. Temp. Level	T_{jOH}	Surface Of IGBT Chip	150			
Hysteresis	T_{jH}			20		
Inverter Collector Current Protection Level	I_{OC}	T_j=125°C	75			A
DB Collector Current Protection Level	I_{OC}	T_j=125°C	45			
Over Current Detecting Time	t_{DOC}	T_j=25°C		10		µs
Alarm Signal Hold Time	t_{ALM}		1.5	2		ms
Limiting Resistor for Alarm	R_{ALM}		1425	1500	1575	Ω
Under Voltage Protection Level	V_{UV}		11.0		12.5	V
Hysteresis	V_H		0.2			

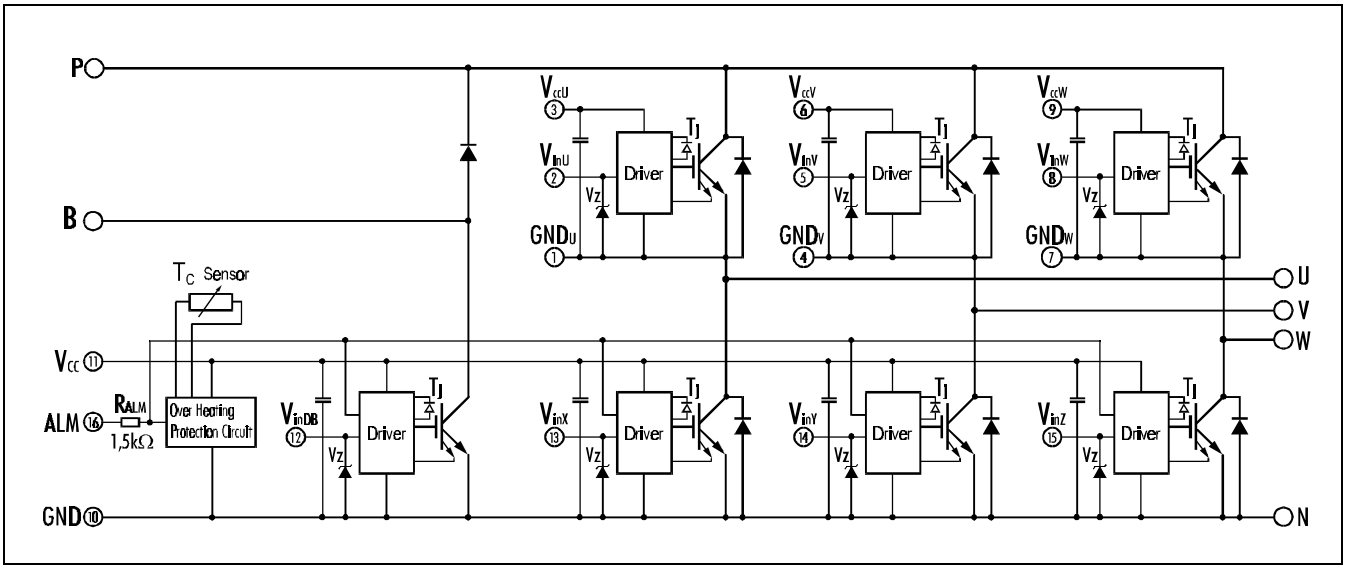
• Dynamic Characteristics (at T_C=T_j=125°C, V_{CC}=15V)

Items	Symbols	Conditions	Min.	Typ.	Max.	Units
Switching Time	t_{ON}	I_C=50A, V_{DC}=300V	0.3			µs
	t_{OFF}				3.6	
	t_{RR}	I_F=50A, V_{DC}=300V			0.4	

• Thermal Characteristics

Items	Symbols	Conditions	Min.	Typ.	Max.	Units
Thermal Resistance	$R_{th(j-c)}$	Inverter IGBT			0.63	°C/W
	$R_{th(j-c)}$	Diode			1.33	
	$R_{th(j-c)}$	DB IGBT			1.04	
	$R_{th(c-f)}$	With Thermal Compound		0.05		

■ Equivalent Circuit



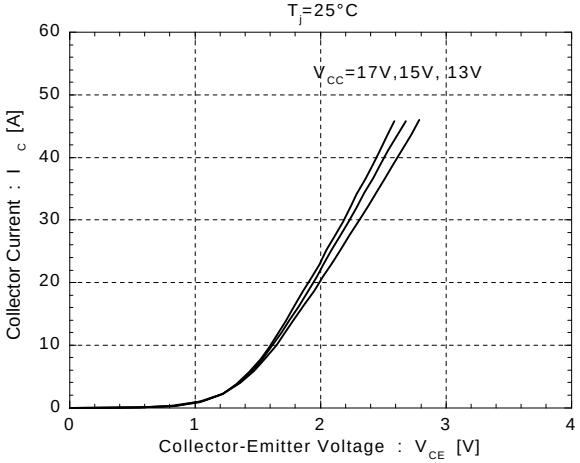
Drivers include following functions

Short circuit protection circuit
Amplifier for driver
Undervoltage protection circuit
Overcurrent protection circuit
IGBT Chip overheating protection

■ Dynamic Brake

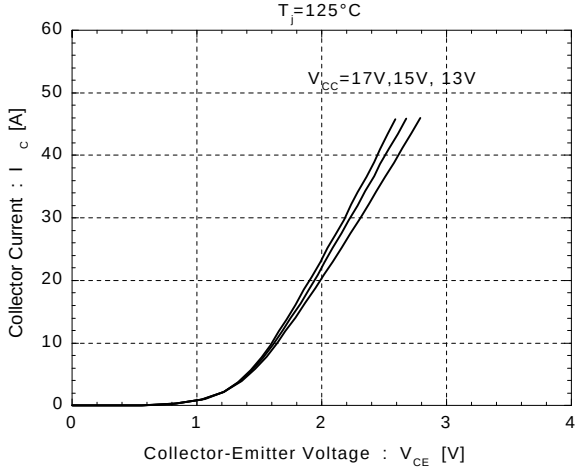
Collector Current vs. Collector-Emitter Voltage

T_j=25°C

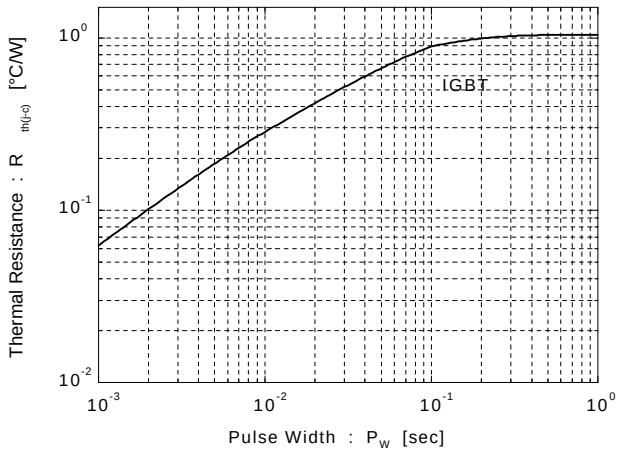


Collector Current vs. Collector-Emitter Voltage

T_j=125°C

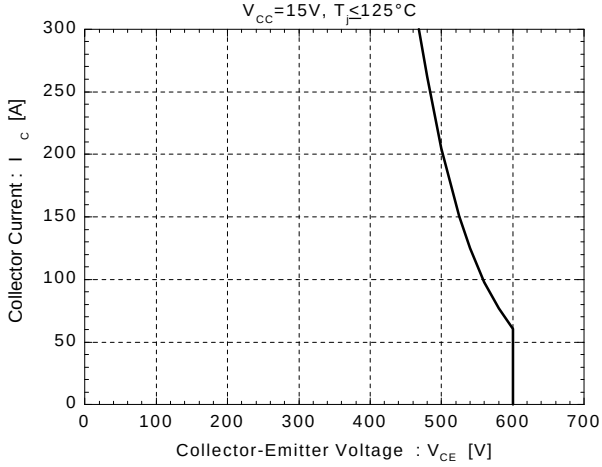


Transient Thermal Resistance



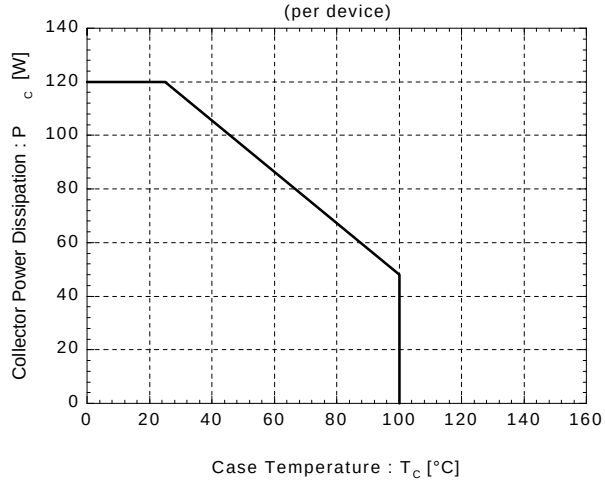
Reverse Biased Safe Operating Area

V_{CC}=15V, T_j≤125°C



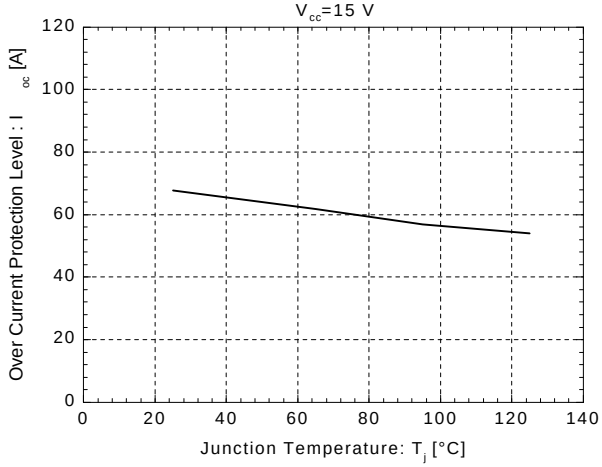
Power Derating For IGBT

(per device)



Over Current Protection vs. Junction Temperature

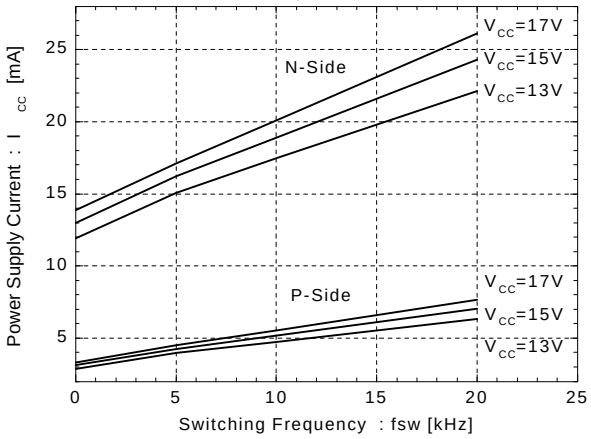
V_{cc}=15 V



■ Control Circuit

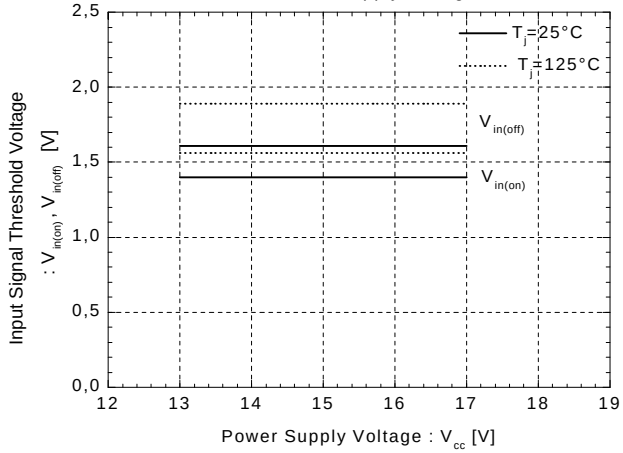
Power Supply Current vs. Switching Frequency

T_j=100°C

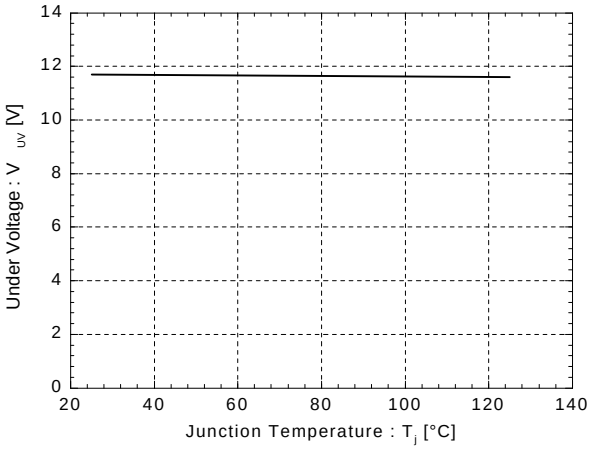


Input Signal Threshold Voltage

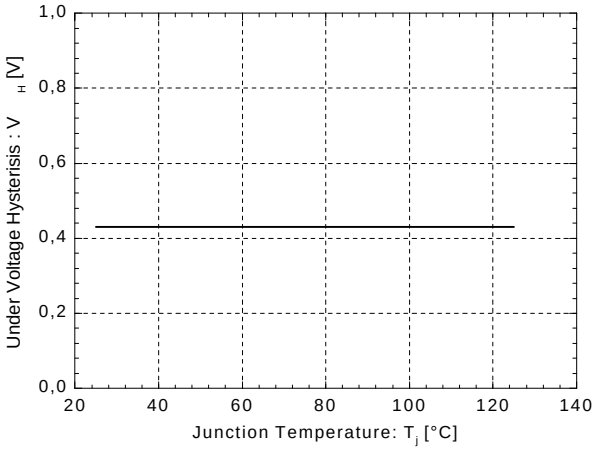
vs. Power Supply Voltage



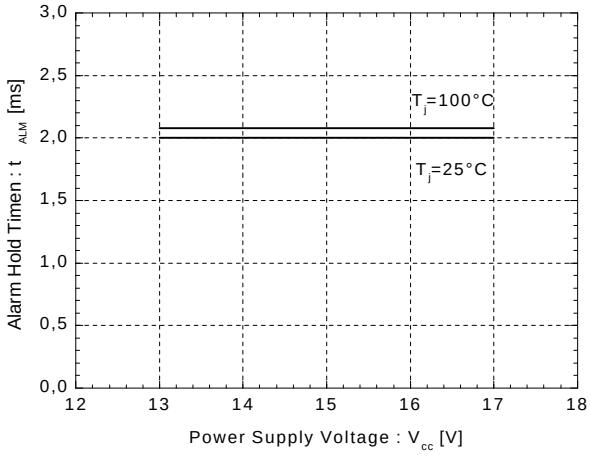
Under Voltage vs. Junction Temperature



Under Voltage Hysterisis vs. Junction Temperature

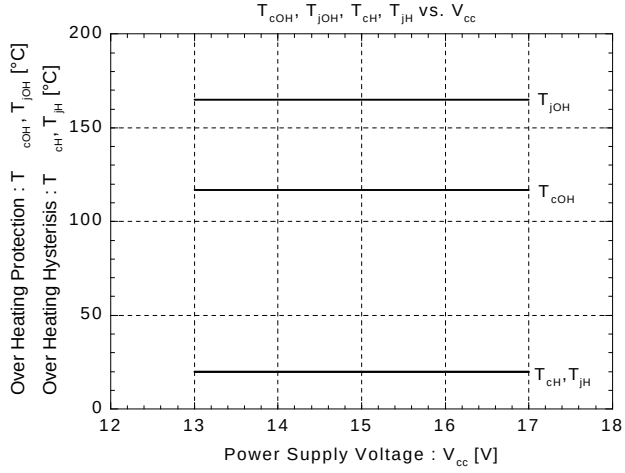


Alarm Hold Time vs. Power Supply Voltage



Over Heating Characteristics

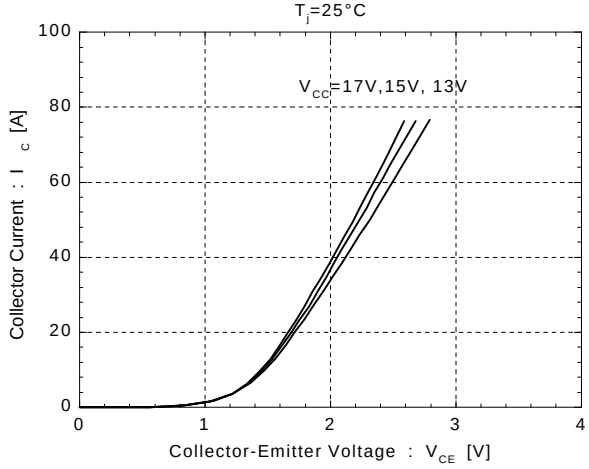
T_{cOH}, T_{jOH}, T_{cH}, T_{jH} vs. V_{cc}



■ Inverter

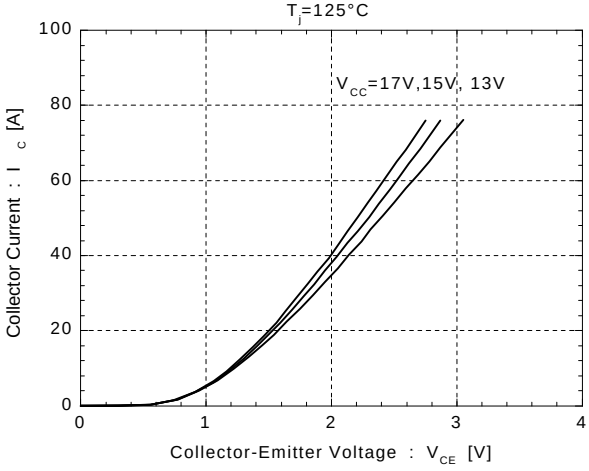
Collector Current vs. Collector-Emitter Voltage

T_j=25°C



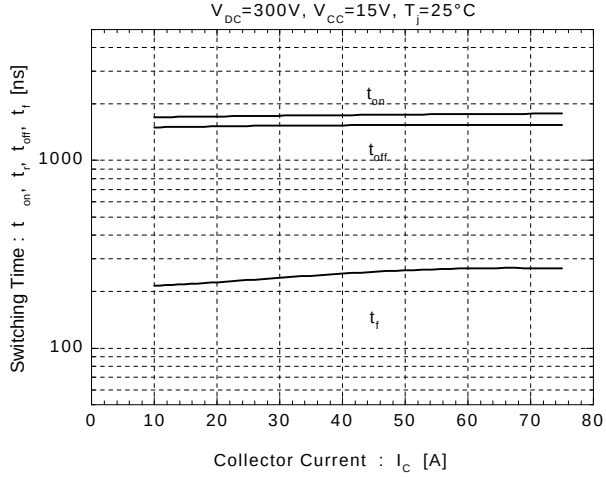
Collector Current vs. Collector-Emitter Voltage

T_j=125°C



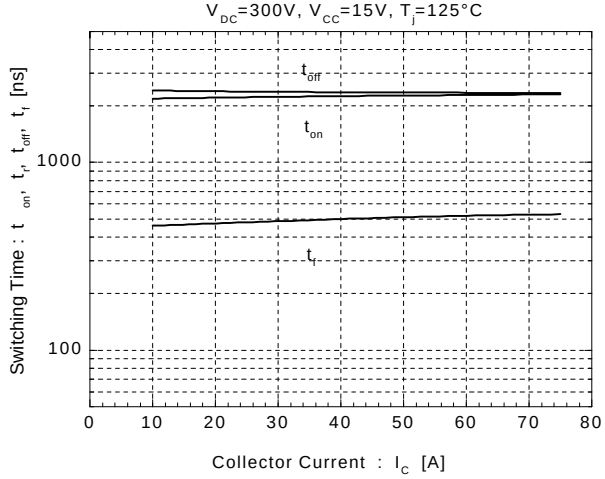
Switching Time vs. Collector Current

V_{DC}=300V, V_{CC}=15V, T_j=25°C

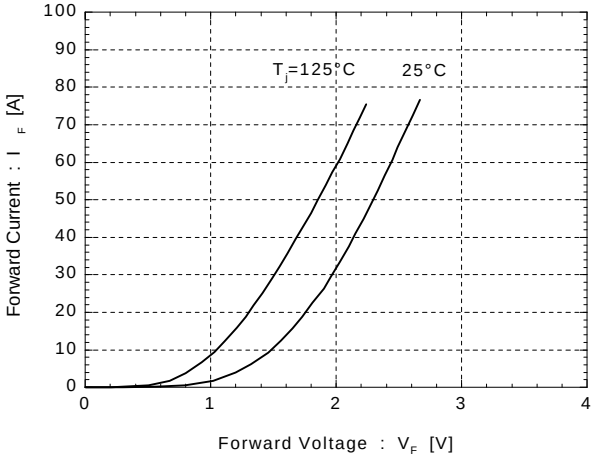


Switching Time vs. Collector Current

V_{DC}=300V, V_{CC}=15V, T_j=125°C

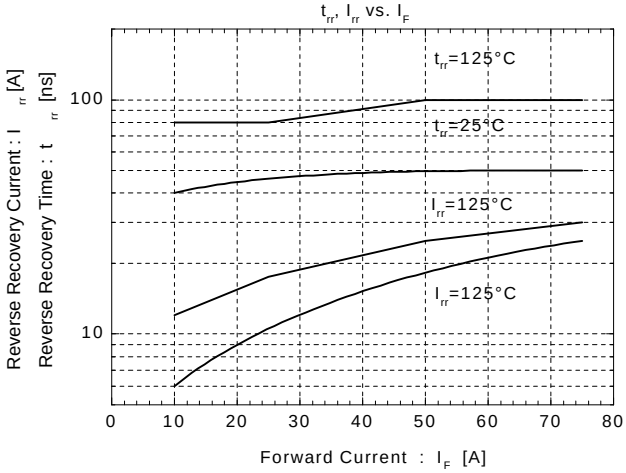


Forward Voltage vs. Forward Current

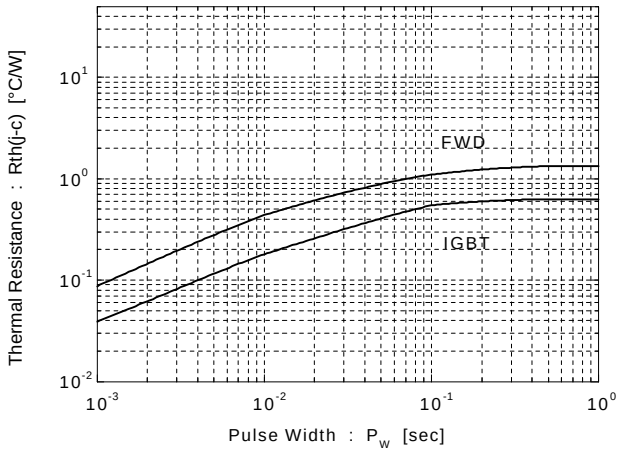


Reverse Recovery Characteristics

t_{rr}, I_{rr} vs. I_F

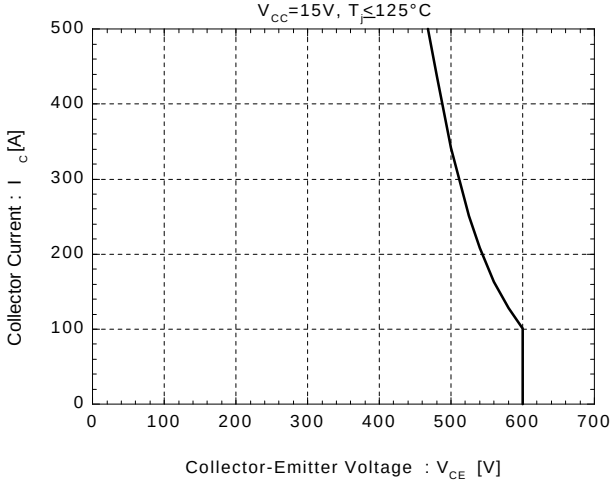


Transient Thermal Resistance



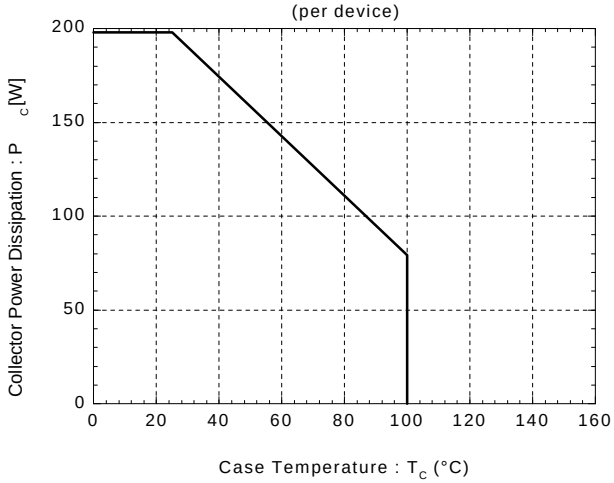
Reverse Biased Safe Operating Area

V_{CC}=15V, $T_j \leq 125°C$



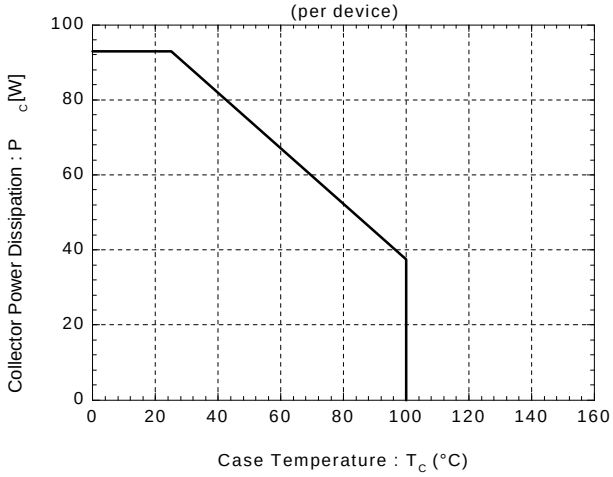
Power Derating For IGBT

(per device)



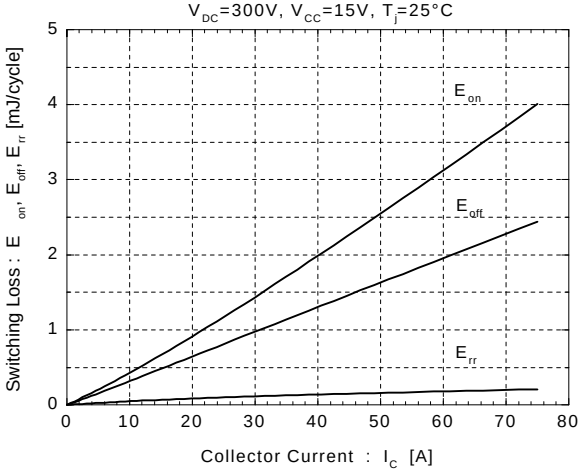
Power Derating For FWD

(per device)



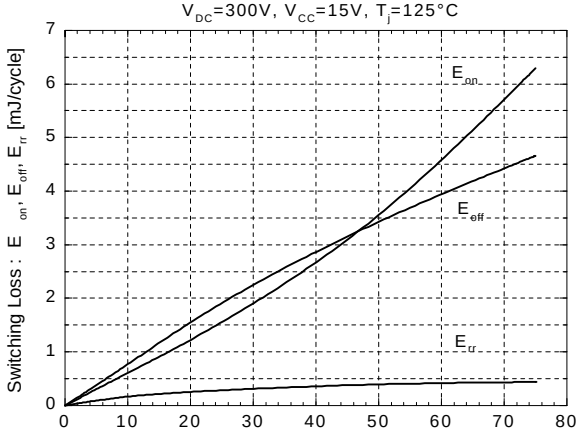
Switching Loss vs. Collector Current

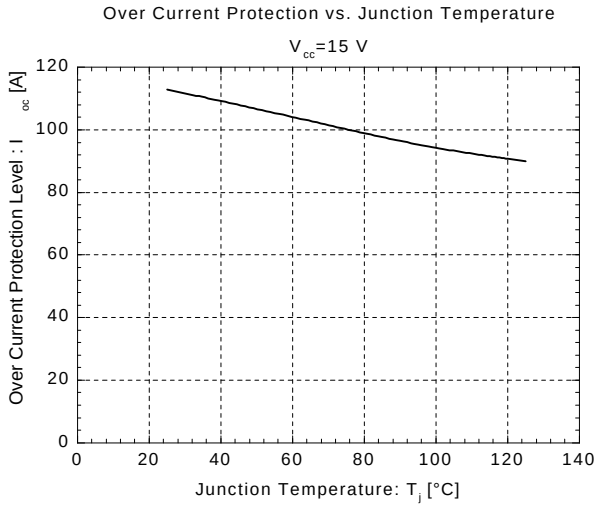
V_{DC}=300V, V_{CC}=15V, T_j=25°C



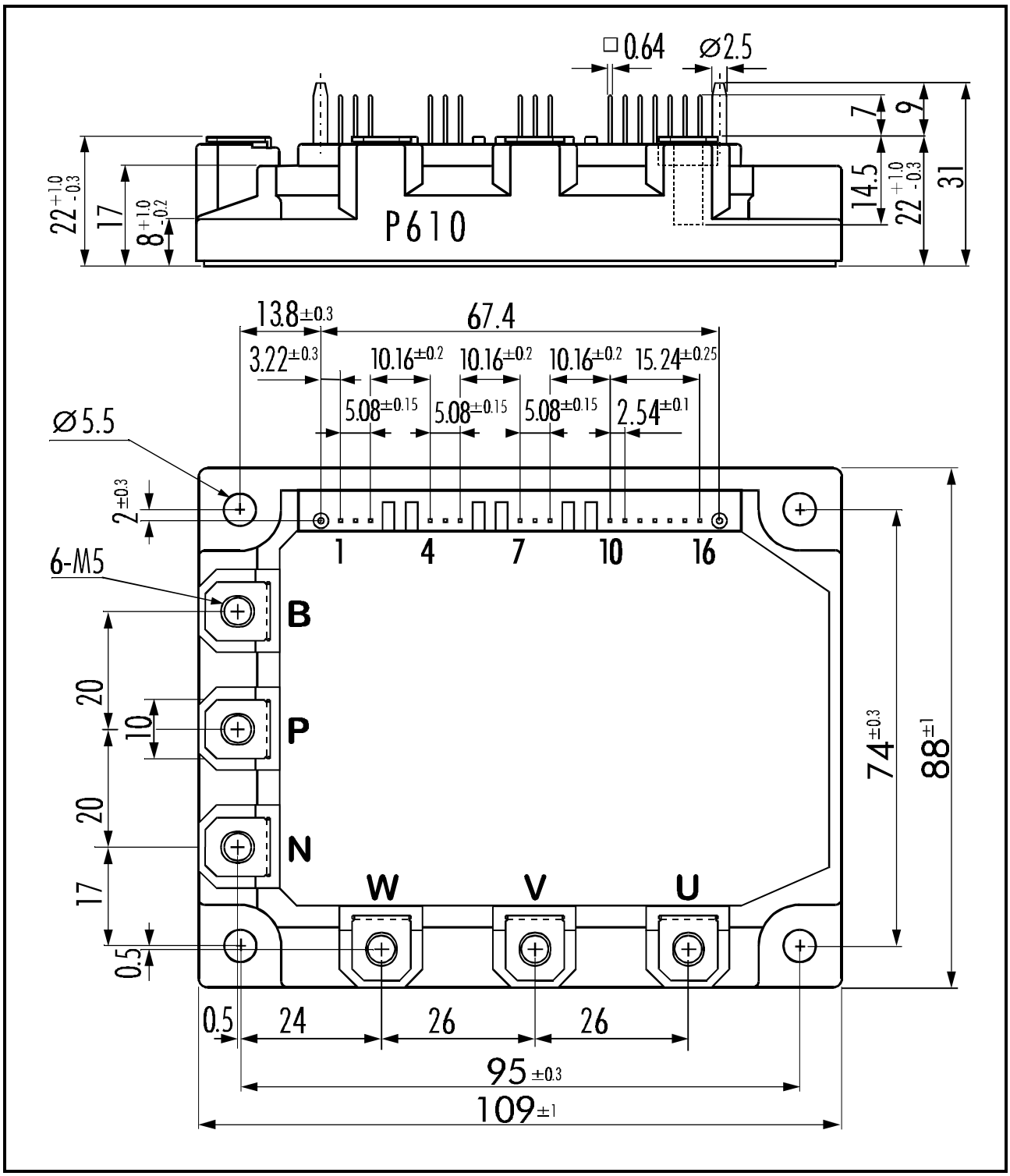
Switching Loss vs. Collector Current

V_{DC}=300V, V_{CC}=15V, T_j=125°C




Over Current Protection vs. Junction Temperature
V_cc=15 V
Over Current Protection Level : I_oc [A]
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
Junction Temperature: T_j [°C]

■ Outline Drawing



Weight: 440g