

Intelligent Power Module (R-Series)

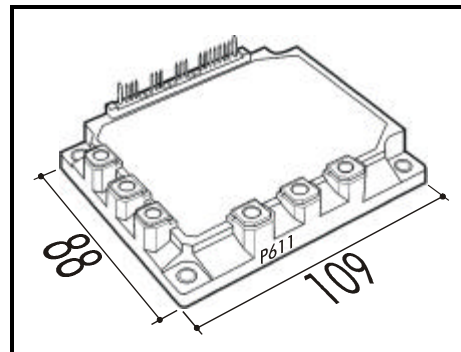
Maximum Ratings and Characteristics

Absolute Maximum Ratings ($T_c=25^\circ\text{C}$)

Items	Symbols	Ratings		Units
		Min.	Max.	
DC Bus Voltage	V_{DC}	0	900	V
DC Bus Voltage (surge)	$V_{DC}(\text{Surge})$	0	1000	
DC Bus Voltage (short operating)	V_{SC}	200	800	
Collector-Emitter Voltage	V_{CES}	0	1200	
Inverter	Continuous	I_C	75	A
Collector	1ms	I_{CP}	150	
Current	Duty=62.6%	$-I_C$	75	
Collector Power Dissipation One Transistor	P_C		595	W
Dynamic Brake	Continuous	I_C	25	A
Collector Current	1ms	I_{CP}	50	
Forward Current of Diode	I_F		25	
Collector Power Dissi. DB One Transistor	P_C		198	W
Voltage of Power Supply for Driver	V_{CC}	0	20	V
Input Signal Voltage	V_{IN}	0	V_Z	V
Input Signal Current	I_{IN}		1	mA
Alarm Signal Voltage	V_{ALM}	0	V_{CC}	V
Alarm Signal Current	I_{ALM}		15	mA
Junction Temperature	T_J		150	$^\circ\text{C}$
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



Electrical Characteristics of Power Circuit (at $T_J=25^\circ\text{C}$, $V_{CC}=15\text{V}$)

Items		Symbols	Conditions	Min.	Typ.	Max.	Units
INV	Collector Current At Off Signal Input	I_{CES}	$V_{CE}=1200\text{V}$, Input Terminal Open			1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE}(\text{Sat})$	$I_C=75\text{A}$			2.6	V
	Forward Voltage of FWD	V_F	$-I_C=75\text{A}$			3.0	V
DB	Collector Current At Off Signal Input	I_{CES}	$V_{CE}=1200\text{V}$, Input Terminal Open			1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE}(\text{Sat})$	$I_C=25\text{A}$			2.6	V
	Forward Voltage of FWD	V_F	$-I_C=25\text{A}$			3.3	V

Electrical Characteristics of Control Circuit (at $T_J=25^\circ\text{C}$, $V_{CC}=15\text{V}$)

Items		Symbols	Conditions	Min.	Typ.	Max.	Units
Current of P-Line Side Driver (One Unit)		I_{CCP}	$f_{sw}=0\sim 15\text{kHz}$, $T_c=-20\sim 100^\circ\text{C}$	3		18	mA
Current of N-Line Side Driver (Three Units)		I_{CCN}	$f_{sw}=0\sim 15\text{kHz}$, $T_c=-20\sim 100^\circ\text{C}$	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	$R_{IN}=20\text{k}\Omega$		8.0		
Over Heating Protection Temperature Level		T_{COH}	$V_{DC}=0\text{V}$, $I_C=0\text{A}$, Case Temp.	110		125	$^\circ\text{C}$
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}	$T_J=125^\circ\text{C}$	113			A
DB Collector Current Protection Level		I_{OC}	$T_J=125^\circ\text{C}$	38			
Over Current Detecting Time		t_{DOC}	$T_J=25^\circ\text{C}$		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			

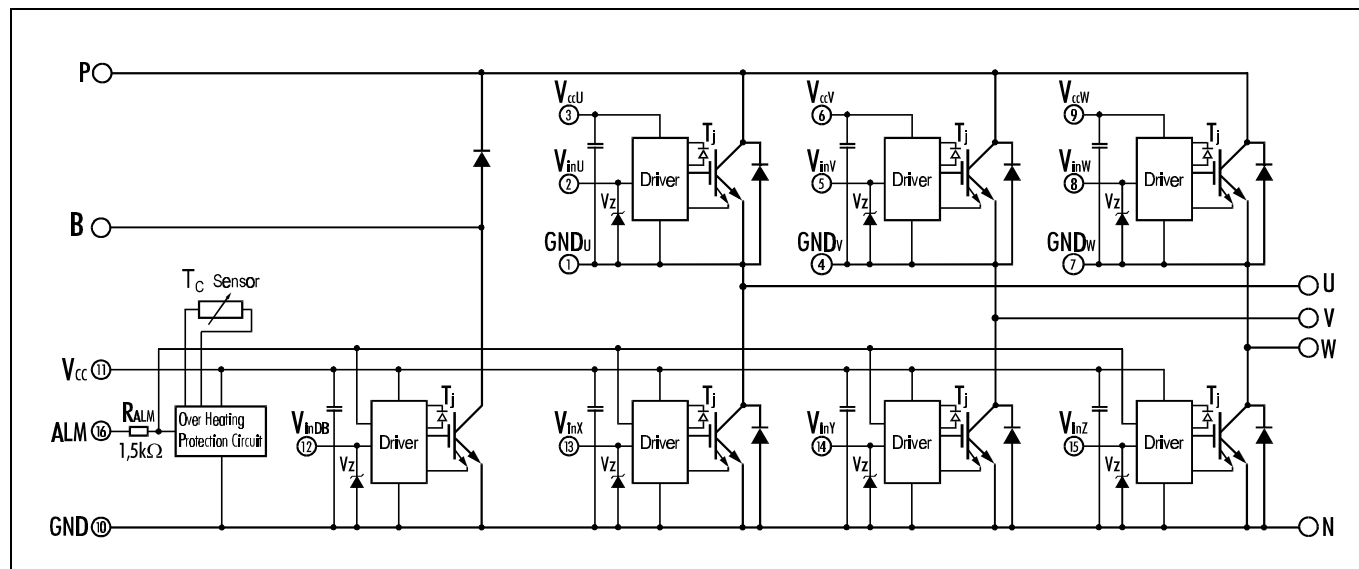
Dynamic Characteristics (at $T_c=T_J=125^\circ\text{C}$, $V_{CC}=15\text{V}$)

Items		Symbols	Conditions	Min.	Typ.	Max.	Units
Switching Time		t_{ON}	$I_C=75\text{A}$, $V_{DC}=600\text{V}$	0.3			μs
		t_{OFF}				3.6	
		t_{RR}	$I_F=75\text{A}$, $V_{DC}=600\text{V}$			0.4	

• Thermal Characteristics

Items	Symbols	Conditions	Min.	Typ.	Max.	Units
Thermal Resistance	$R_{th(j-c)}$	Inverter IGBT			0.21	°C/W
	$R_{th(j-c)}$	Diode			0.47	
	$R_{th(j-c)}$	DB IGBT			0.63	
	$R_{th(c-f)}$	With Thermal Compound		0.05		

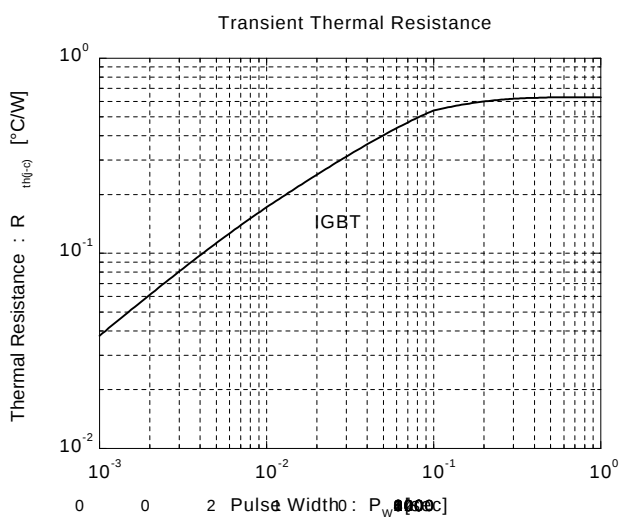
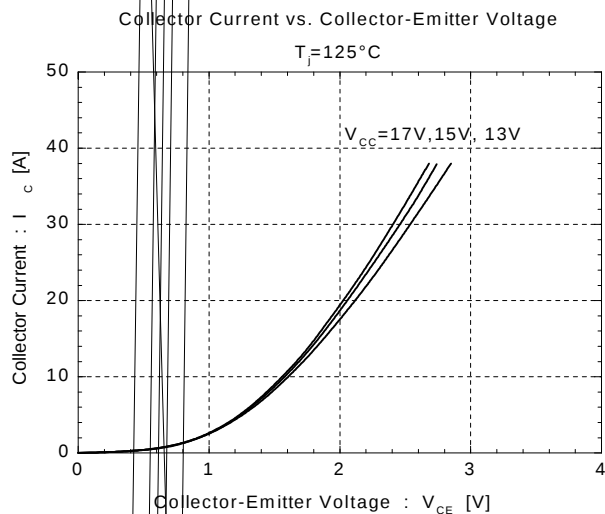
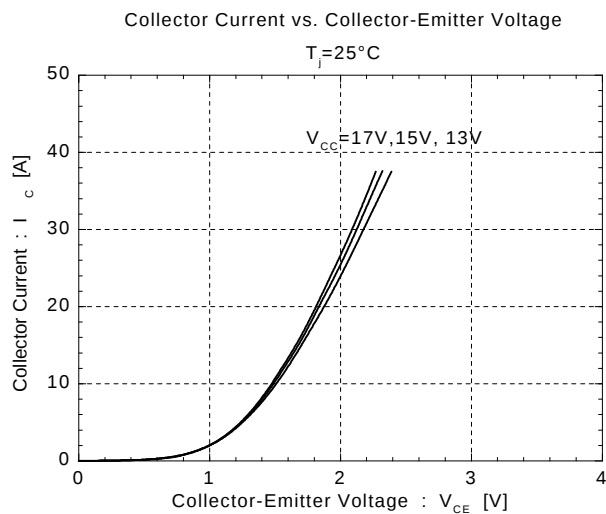
■ Equivalent Circuit



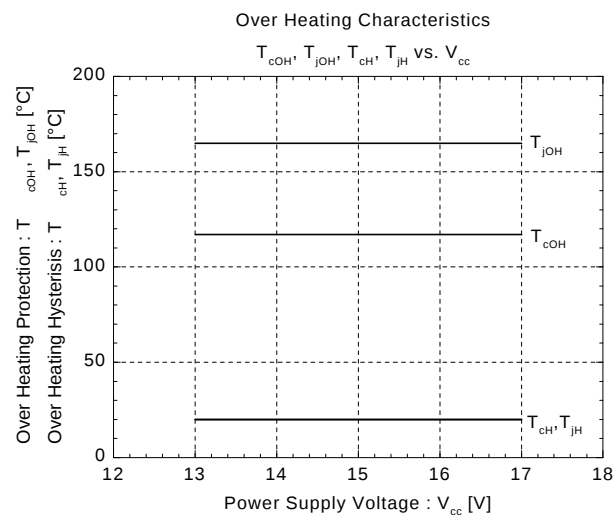
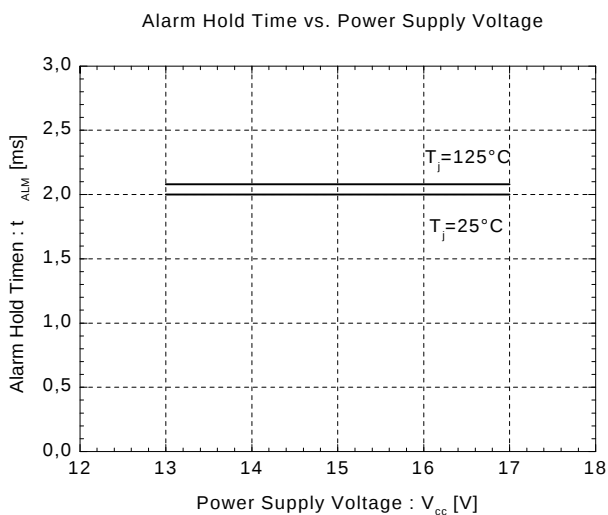
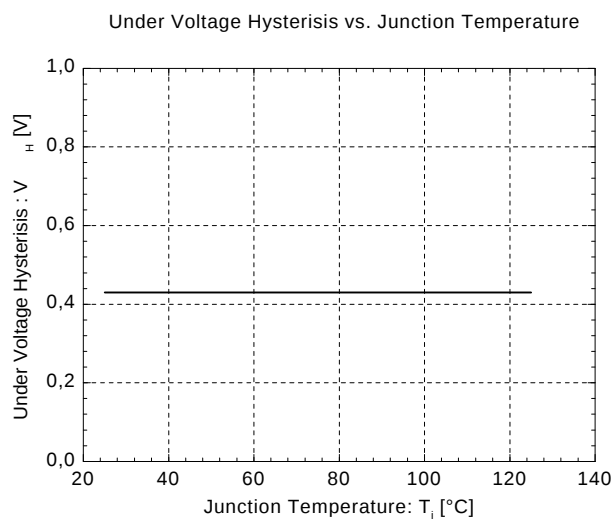
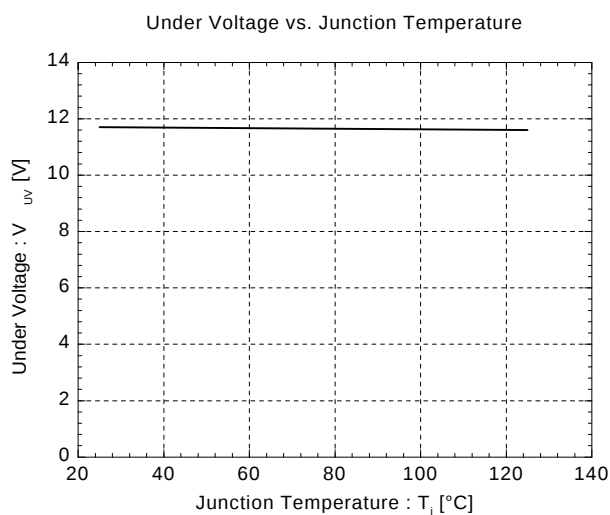
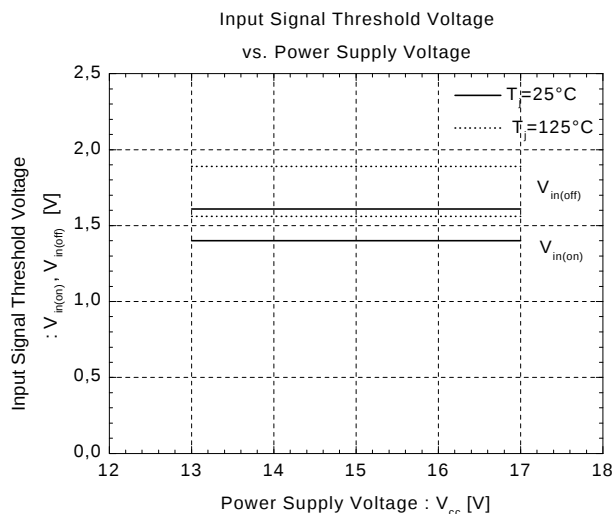
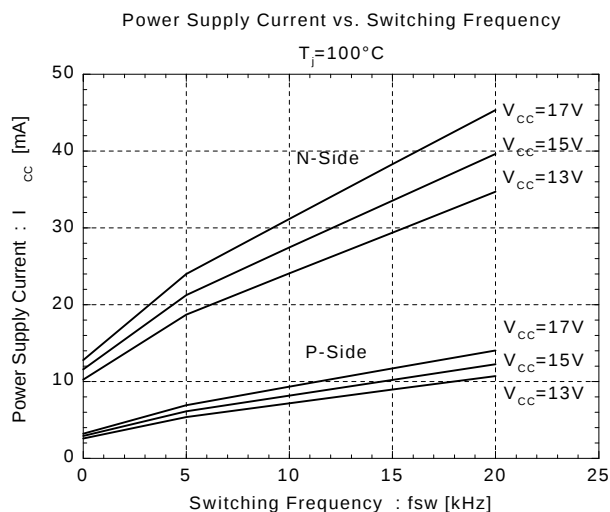
Drivers include following functions

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

Dynamic Brake

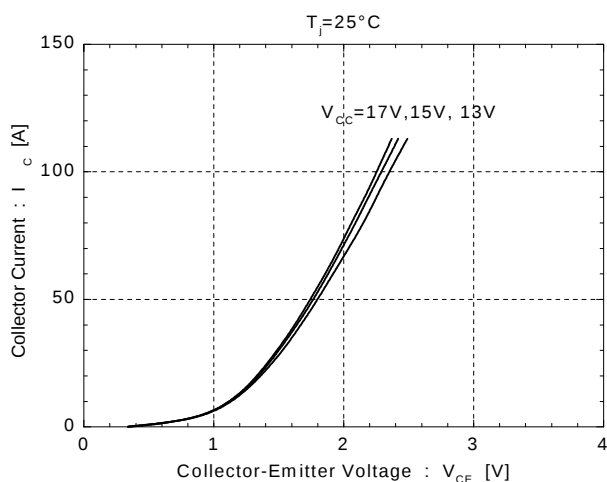


■ Control Circuit

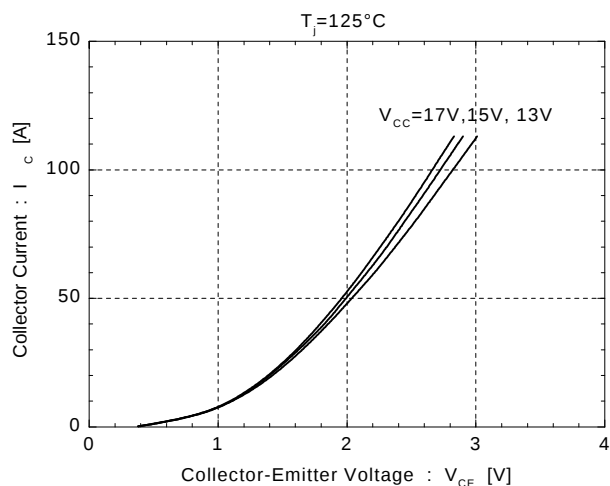


■ Inverter

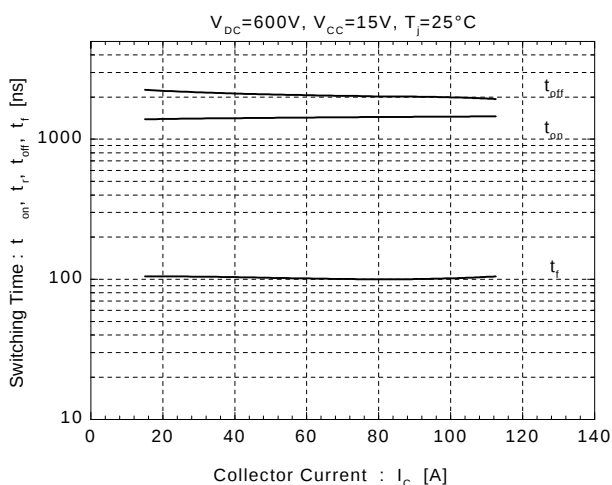
Collector Current vs. Collector-Emitter Voltage



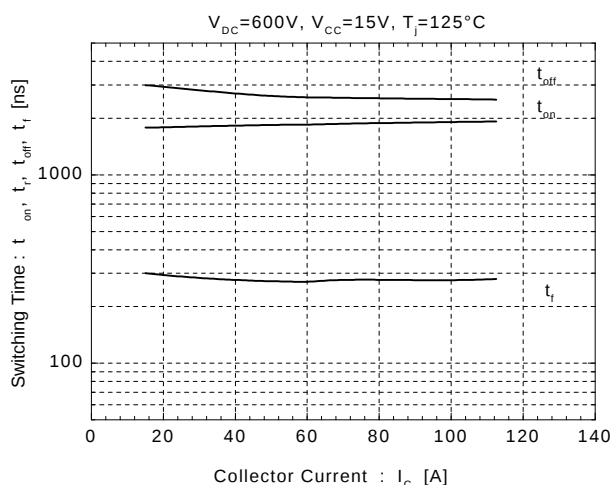
Collector Current vs. Collector-Emitter Voltage



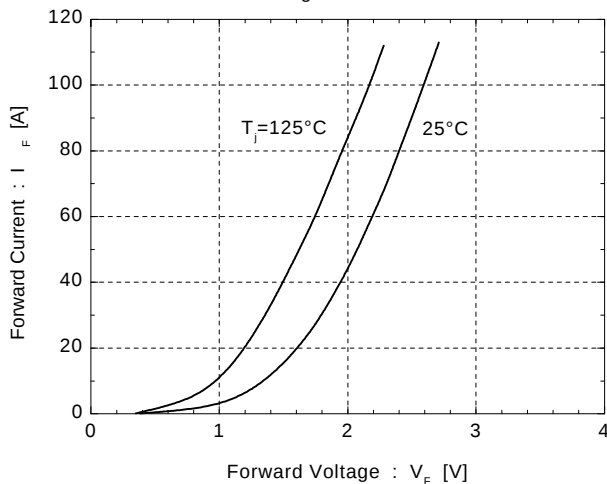
Switching Time vs. Collector Current



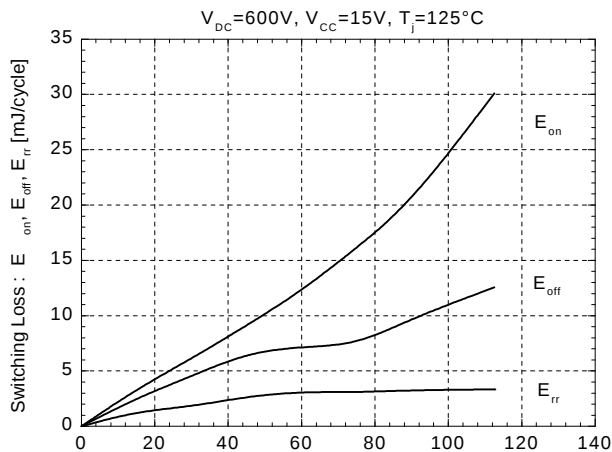
Switching Time vs. Collector Current



Forward Voltage vs. Forward Current

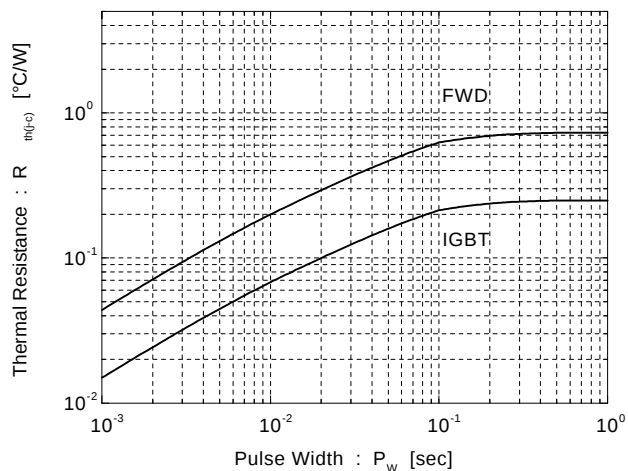


Switching Loss vs. Collector Current

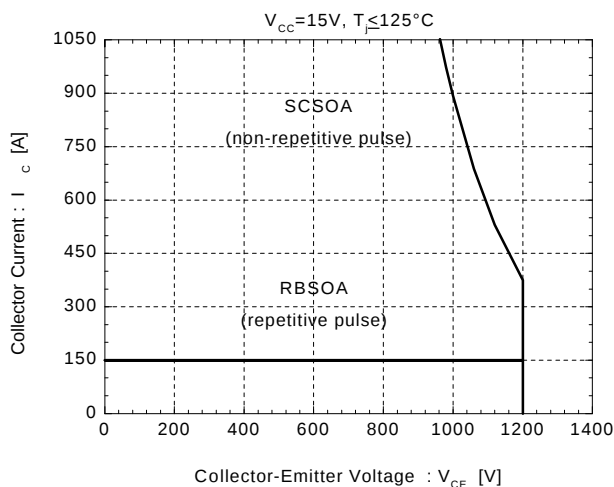


■ Inverter

Transient Thermal Resistance

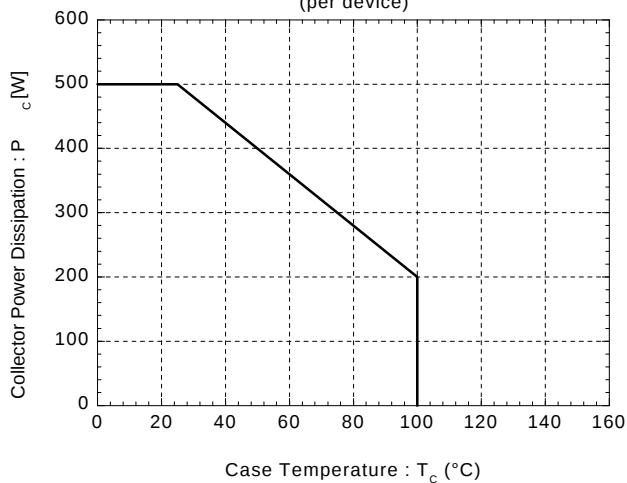


Reverse Biased Safe Operating Area



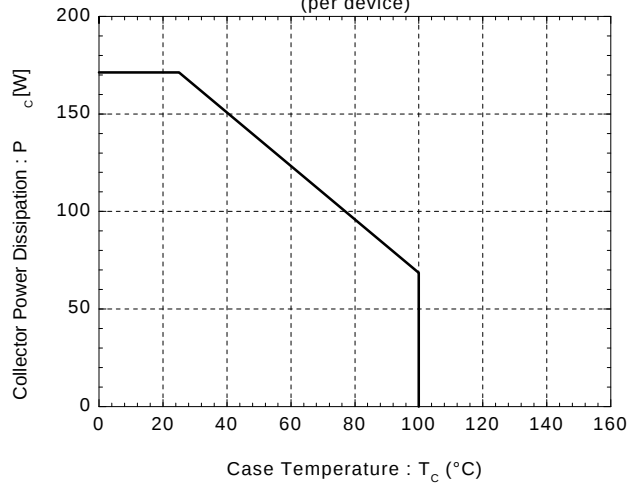
Power Derating For IGBT

(per device)



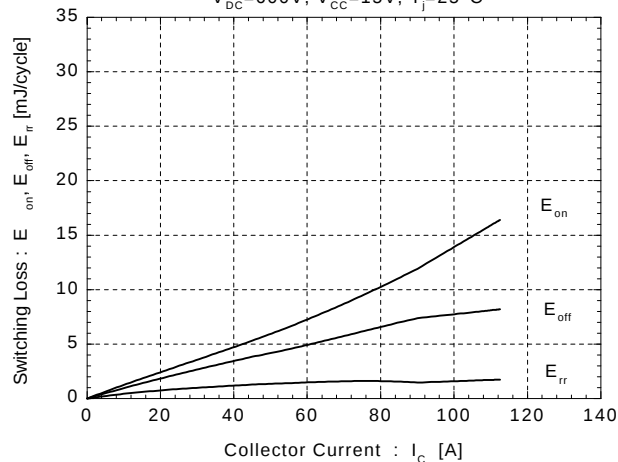
Power Derating For FWD

(per device)



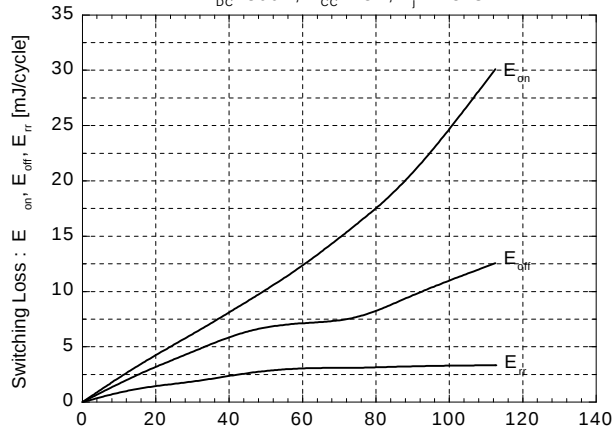
Switching Loss vs. Collector Current

$V_{DC}=600V, V_{CC}=15V, T_j=25^\circ C$

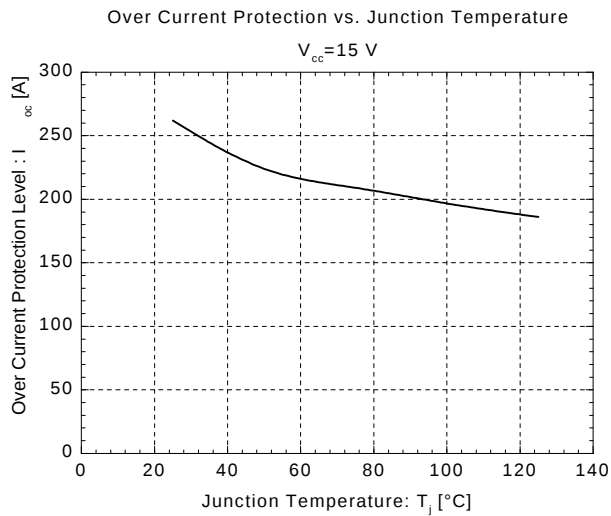


Switching Loss vs. Collector Current

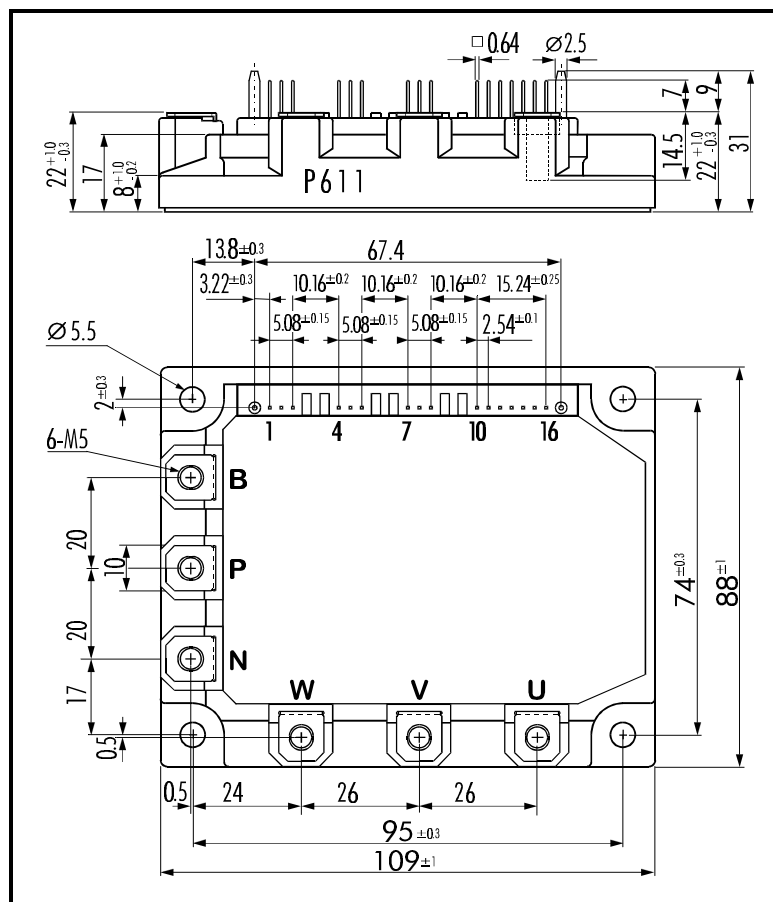
$V_{DC}=300V, V_{CC}=15V, T_j=125^\circ C$



■ Inverter



■ Outline Drawing



Weight: 440g