

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	450	V
DC Bus Voltage (surge)	$V_{DC}(\text{Surge})$	0	500	
DC Bus Voltage (short operating)	V_{SC}	200	400	
Collector-Emitter Voltage	V_{CES}	0	600	
Inverter	Continuous	I_C	150	A
Collector	1ms	I_{CP}	300	
Current	Duty=58.8%	$-I_C$	150	
Collector Power Dissipation	One Transistor	P_C	595	W
Voltage of Power Supply for Driver	$V_{CC} *1$	0	20	V
Input Signal Voltage	$V_{IN} *2$	0	V_Z	V
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	$^\circ\text{C}$
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

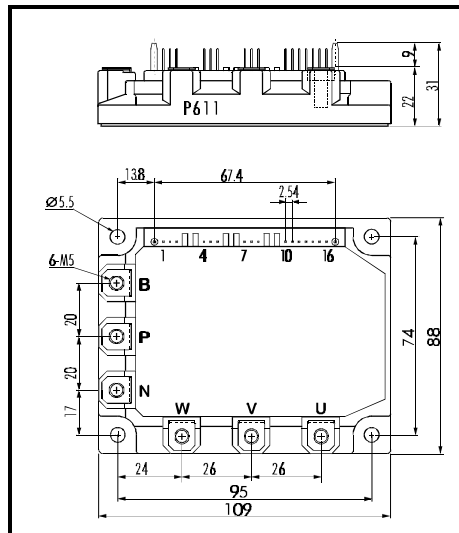


Fig. 1

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}	$V_{CE}=600\text{V}$, Input Terminal Open			1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE(\text{Sat})}$	$I_C=150\text{A}$			2.8	V
	Forward Voltage of FWD	V_F	$-I_C=150\text{A}$			3.0	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_{OH}	Surface of IGBT Chip	150			
	Hysteresis	T_{IH}			20		
	Inverter Collector Current Protection Level	I_{OC}	$T_J=125^\circ\text{C}$	225			A
	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			

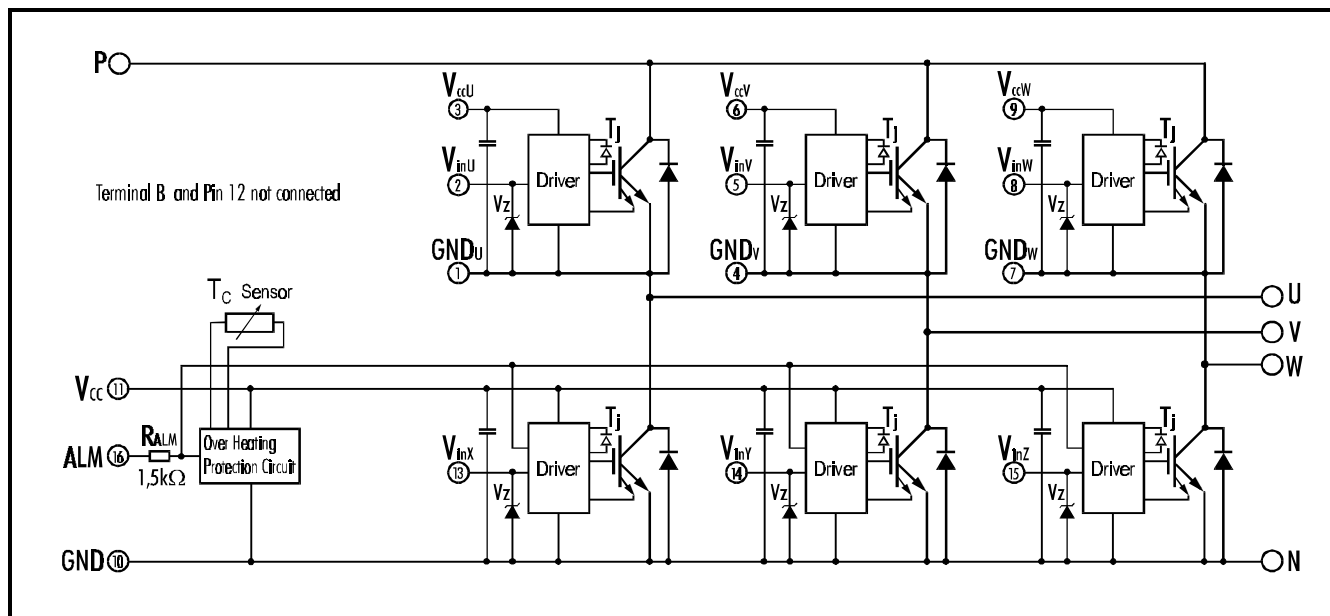
Dynamic Characteristics (at $T_c=T_J=125^\circ\text{C}$, $V_{CC}=15\text{V}$)

	Items	Symbols	Conditions	Min.	Typ.	Max.	Units
Switching Time		t_{ON}	$I_C=150\text{A}$, $V_{DC}=300\text{V}$	0.3			μs
		t_{OFF}				3.6	
		t_{RR}	$I_F=150\text{A}$, $V_{DC}=300\text{V}$			0.4	

Thermal Characteristics

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

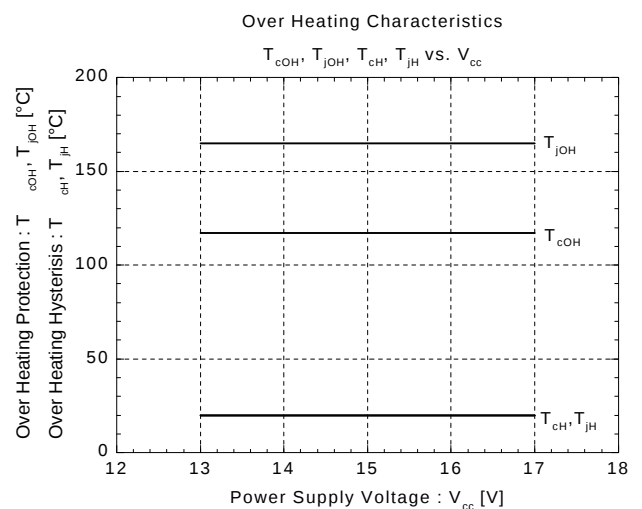
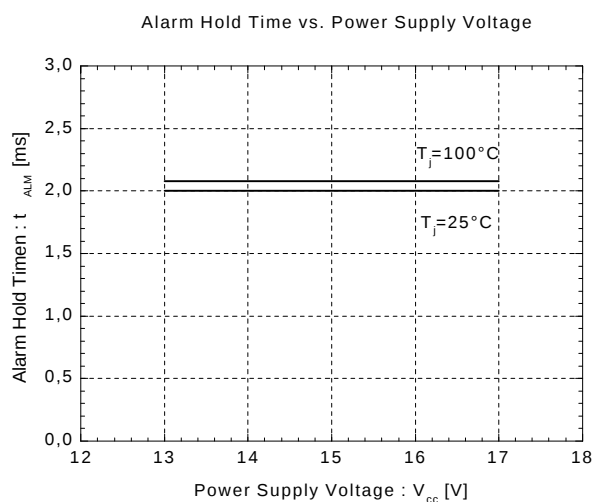
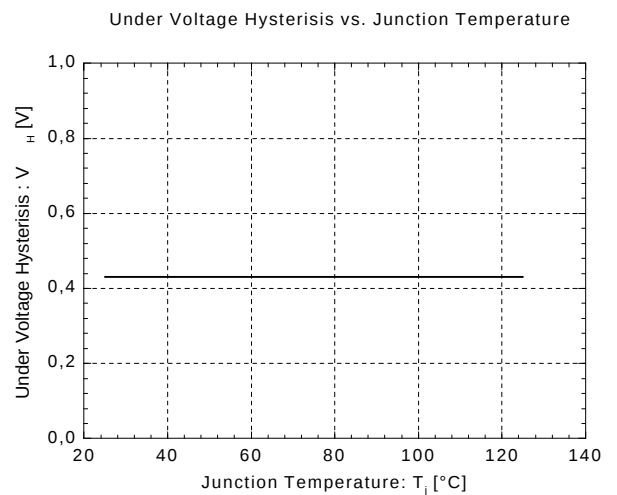
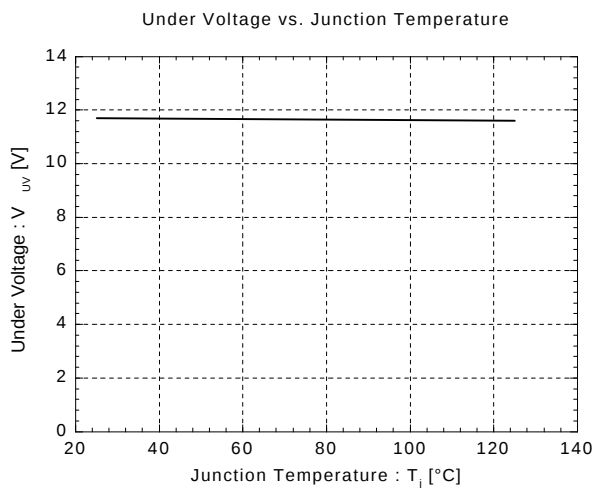
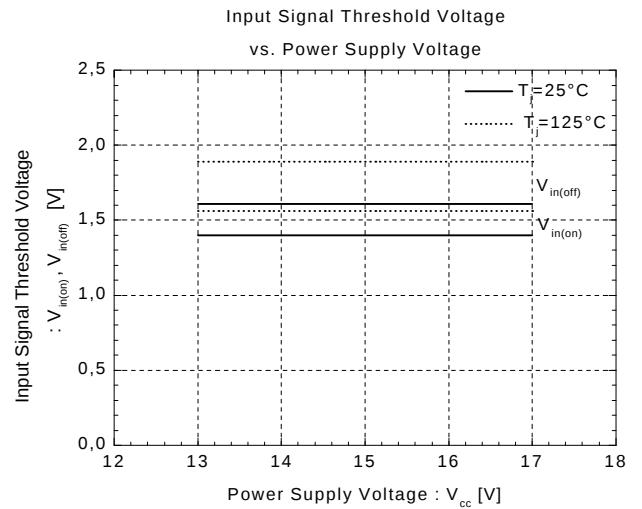
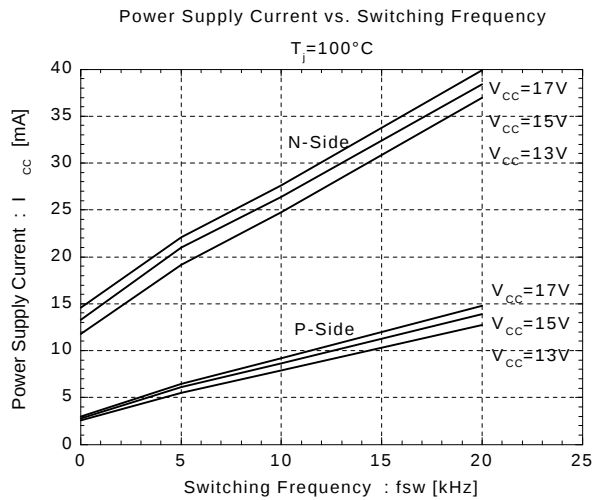
■ Equivalent Circuit



Drivers include following functions

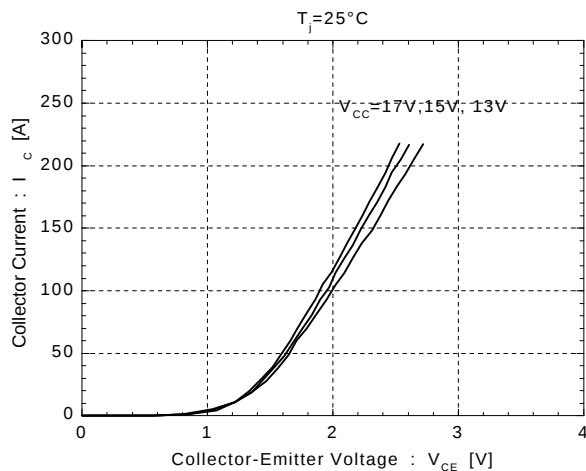
- Short circuit protection circuit
- Amplifier for driver
- Undervoltage protection circuit
- Overcurrent protection circuit
- IGBT Chip overheating protection

Control Circuit

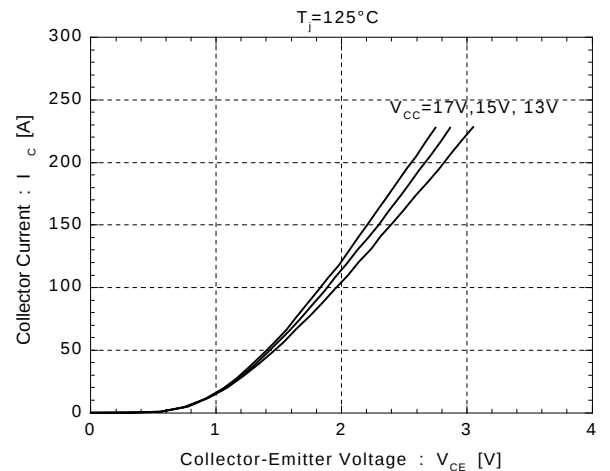


■ Inverter

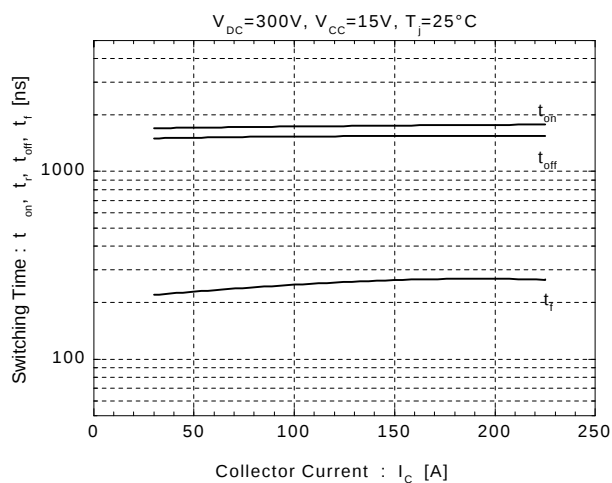
Collector Current vs. Collector-Emitter Voltage



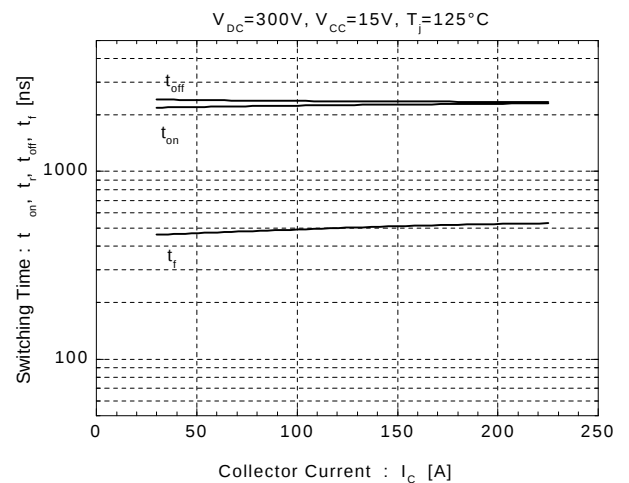
Collector Current vs. Collector-Emitter Voltage



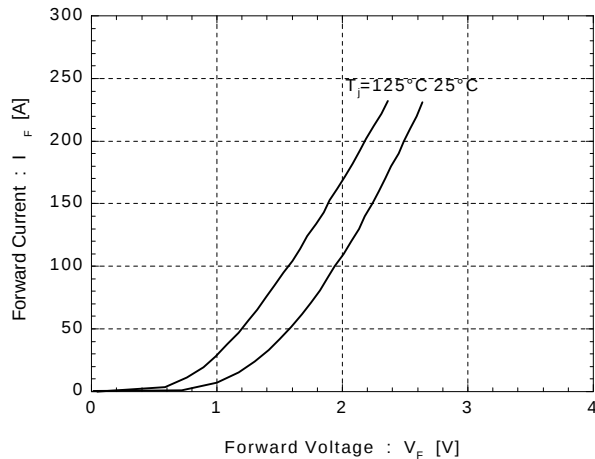
Switching Time vs. Collector Current



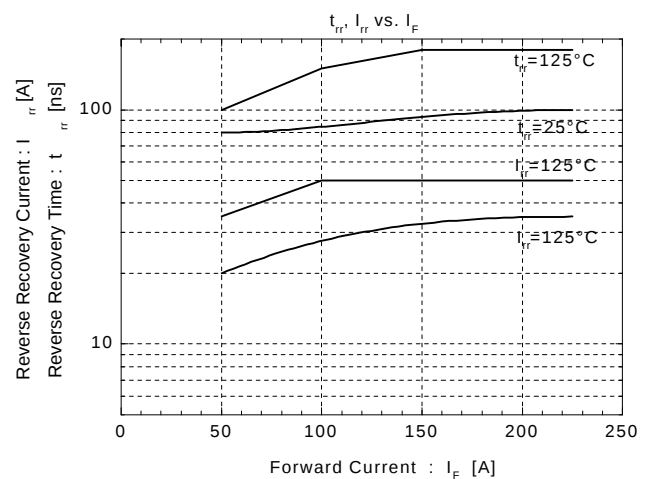
Switching Time vs. Collector Current



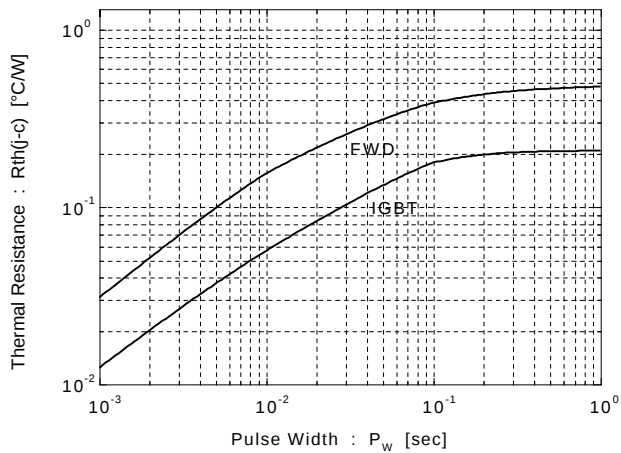
Forward Voltage vs. Forward Current



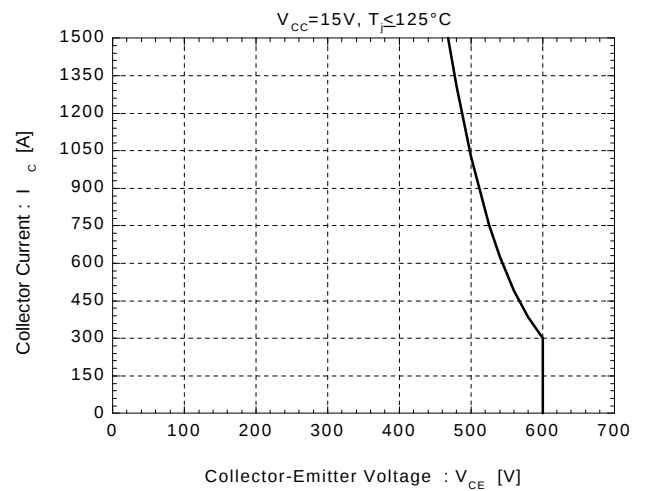
Reverse Recovery Characteristics



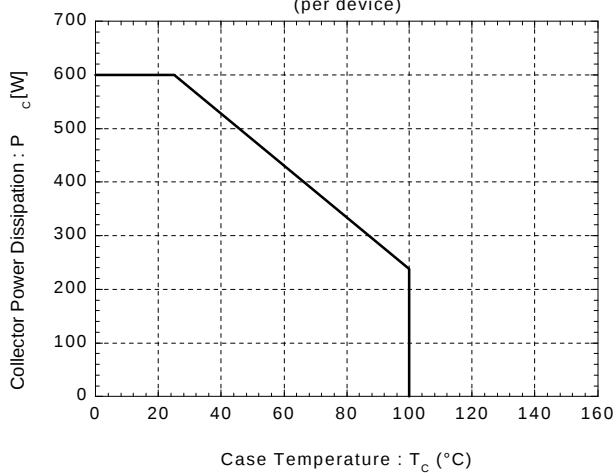
Transient Thermal Resistance



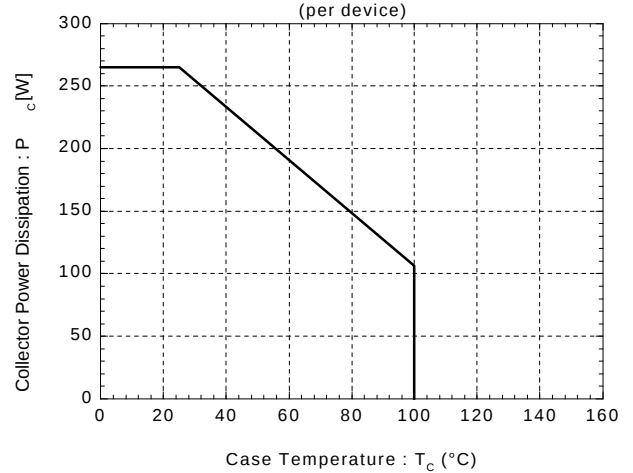
Reverse Biased Safe Operating Area



Power Derating For IGBT
(per device)

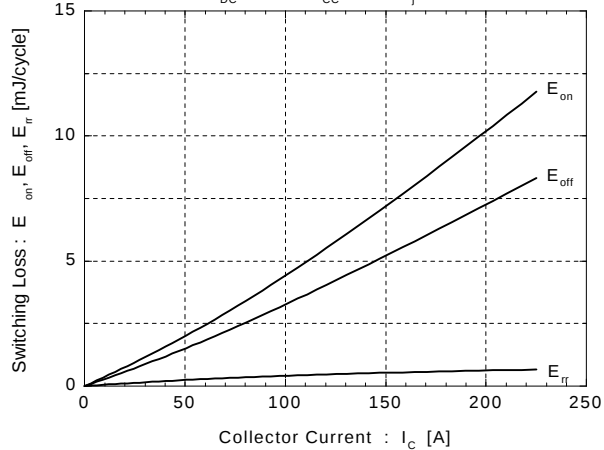


Power Derating For FWD
(per device)



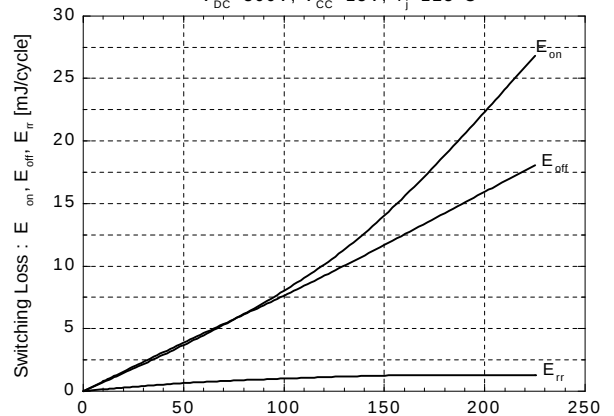
Switching Loss vs. Collector Current

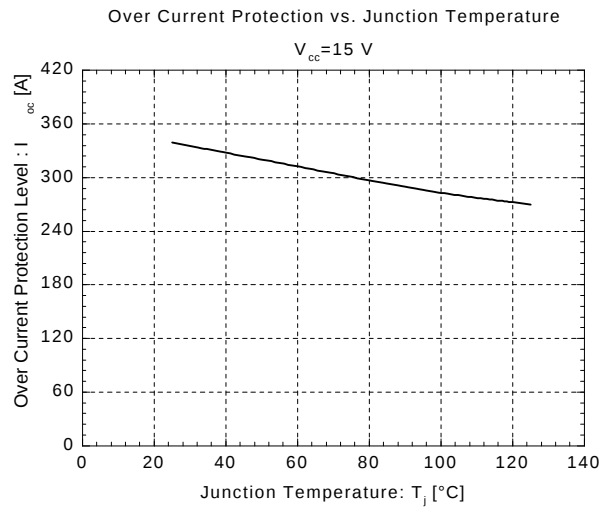
$V_{DC}=300\text{V}$, $V_{CC}=15\text{V}$, $T_j=25^{\circ}\text{C}$



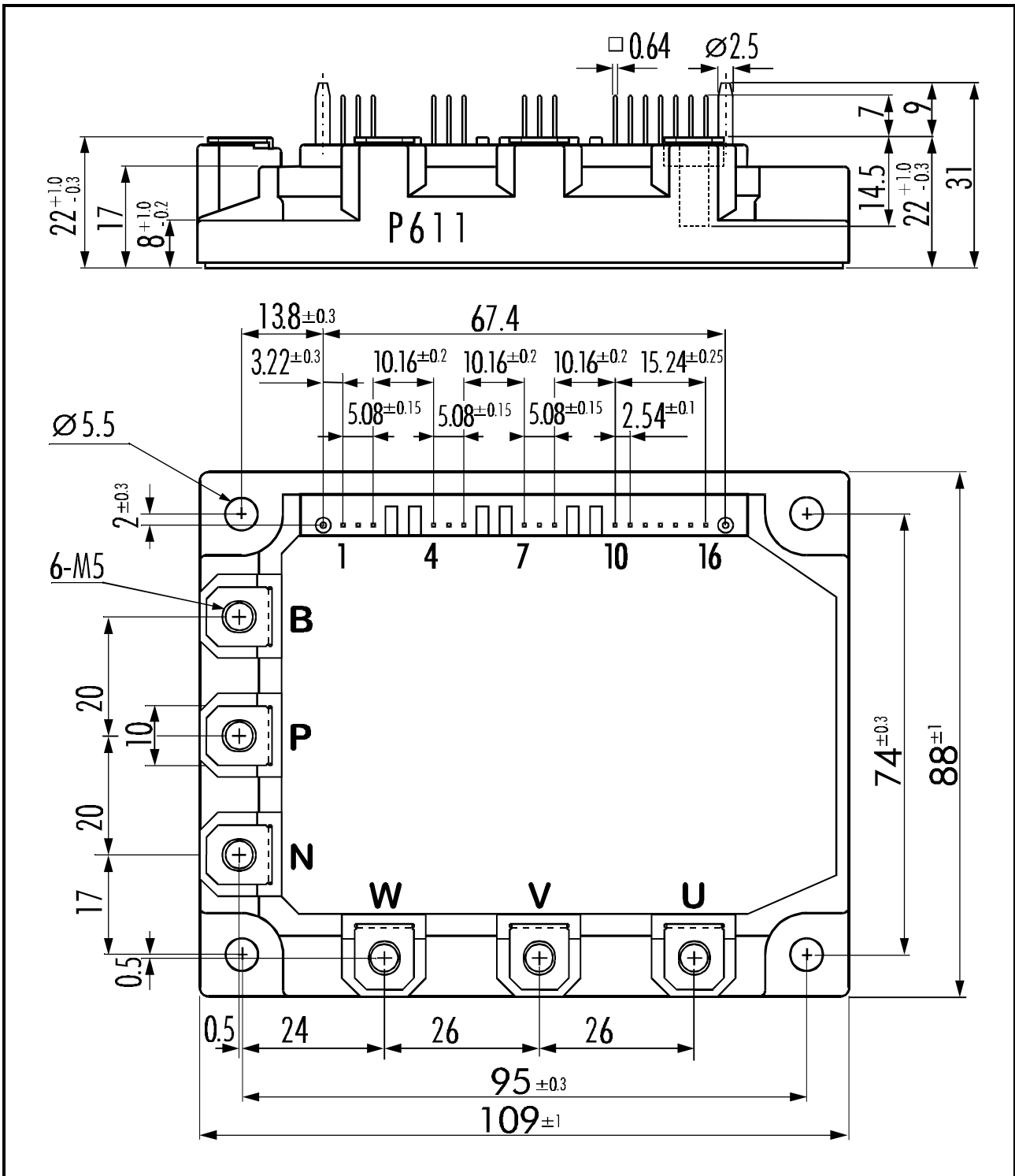
Switching Loss vs. Collector Current

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





■ Outline Drawing



Weight: 440g