

## Intelligent Power Module ( R-Series )

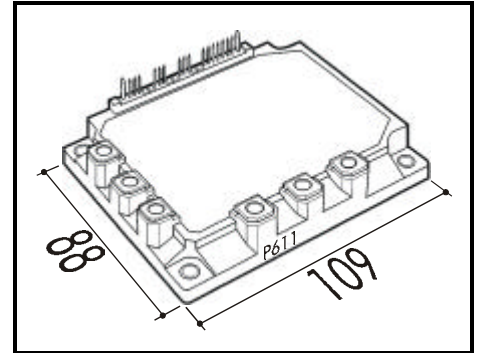
### ■ Maximum Ratings and Characteristics

• **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)	$V_{DC(Surge)}$	0	1000	
DC Bus Voltage (short operating)	$V_{SC}$	200	800	
Collector-Emitter Voltage	$V_{CES}$	0	1200	
Inverter Collector Current	Continuous	$I_C$	50	A
	1ms	$I_{CP}$	100	
	Duty=62.6%	$-I_C$	50	
Collector Power Dissipation <small>One Transistor</small>	$P_C$		400	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	°C
Operating Temperature	$T_{OP}$	-20	100	
Storage Temperature	$T_{stg}$	-40	125	
Isolation Voltage	A.C. 1min. $V_{iso}$		2500	
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	$V_{CE(Sat)}$	$I_C=50\text{A}$			2.6	V
	Forward Voltage of FWD	$V_F$	$-I_C=50\text{A}$			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	°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		$I_{OC}$	$T_j=125^\circ\text{C}$	75			A
Over Current Detecting Time		$t_{DOC}$	$T_j=25^\circ\text{C}$		10		$\mu\text{s}$
Alarm Signal Hold Time		$t_{ALM}$		1.5	2		ms
Limiting Resistor for Alarm		$R_{ALM}$		1425	1500	1575	$\Omega$
Under Voltage Protection Level		$V_{UV}$		11.0		12.5	V
Hysteresis		$V_H$		0.2			

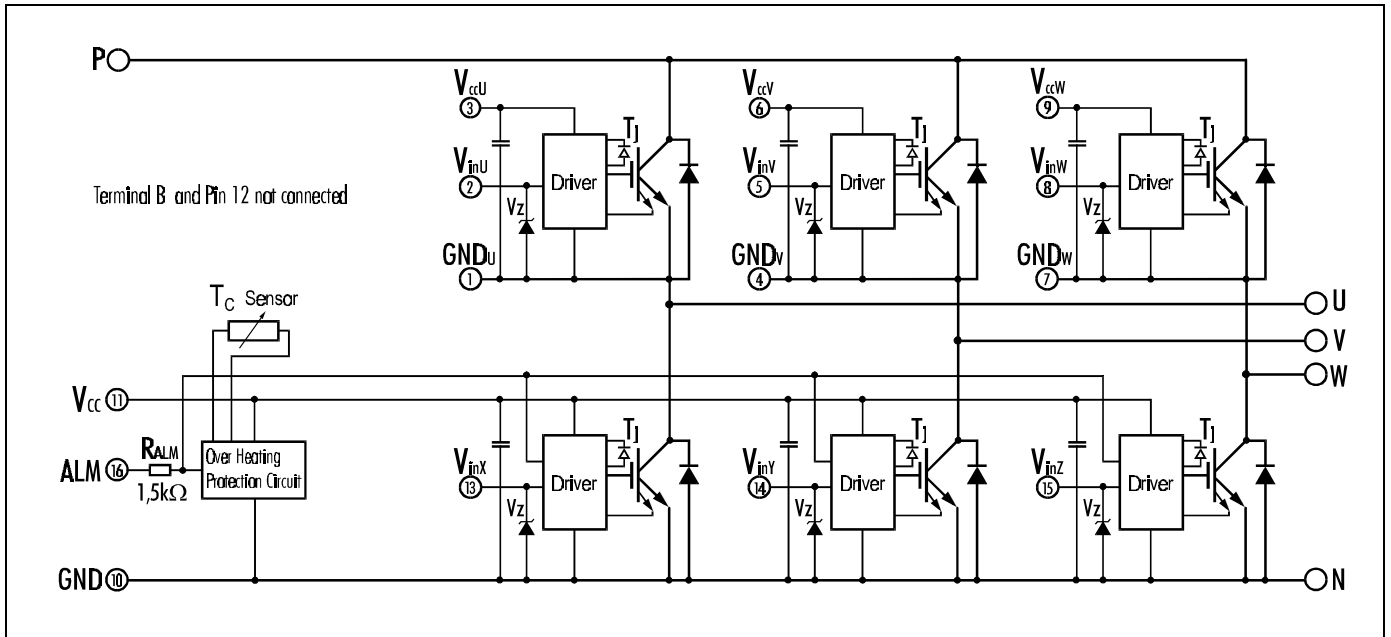
• **Dynamic Characteristics** ( at  $T_c=T_j=125^\circ\text{C}$ ,  $V_{CC}=15\text{V}$  )

Items		Symbols	Conditions	Min.	Typ.	Max.	Units
Switching Time		$t_{ON}$	$I_C=50\text{A}$ , $V_{DC}=600\text{V}$	0.3			$\mu\text{s}$
		$t_{OFF}$				3.6	
		$t_{RR}$	$I_F=50\text{A}$ , $V_{DC}=600\text{V}$			0.4	

• **Thermal Characteristics**

Items		Symbols	Conditions	Min.	Typ.	Max.	Units
Thermal Resistance		$R_{th(i-c)}$	Inverter IGBT			0.31	°C/W
		$R_{th(i-e)}$	Diode			0.70	
		$R_{th(c-f)}$	With Thermal Compound		0.05		

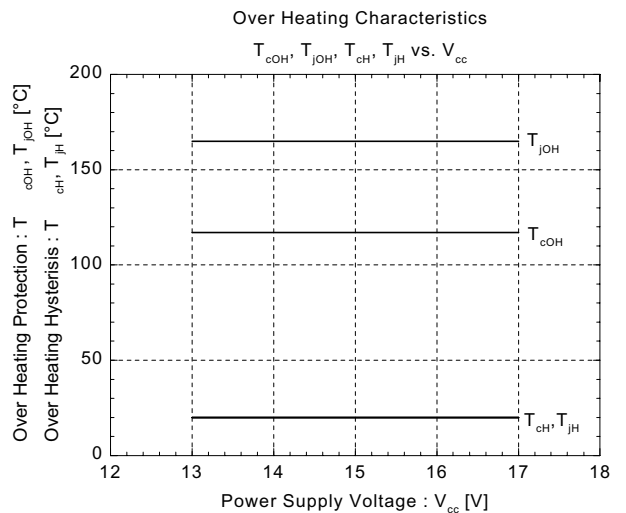
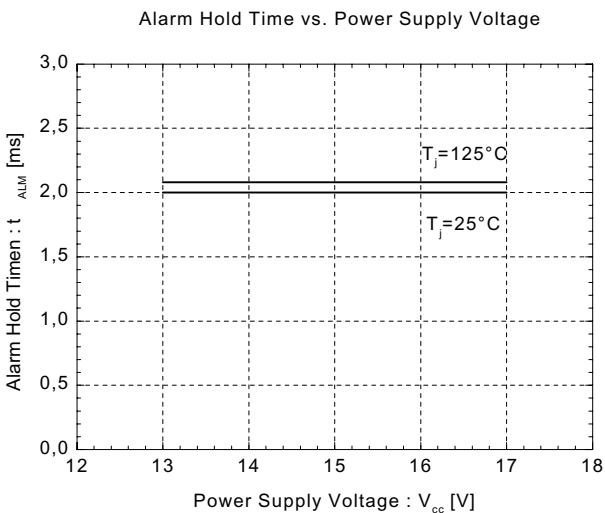
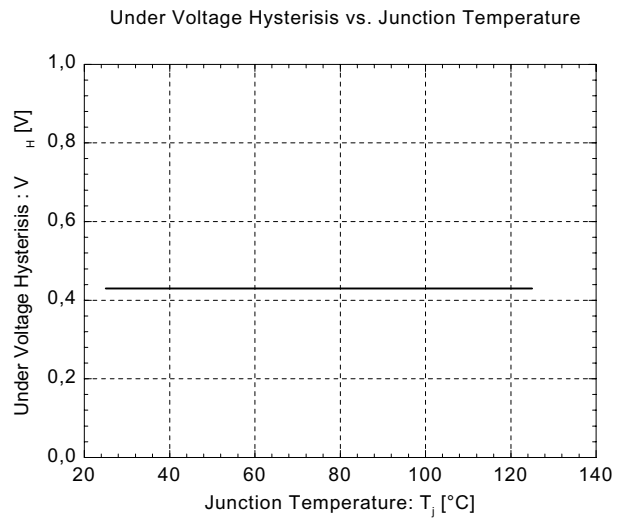
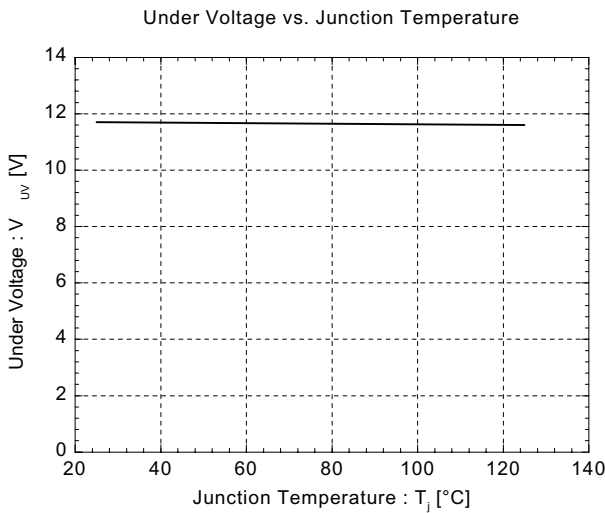
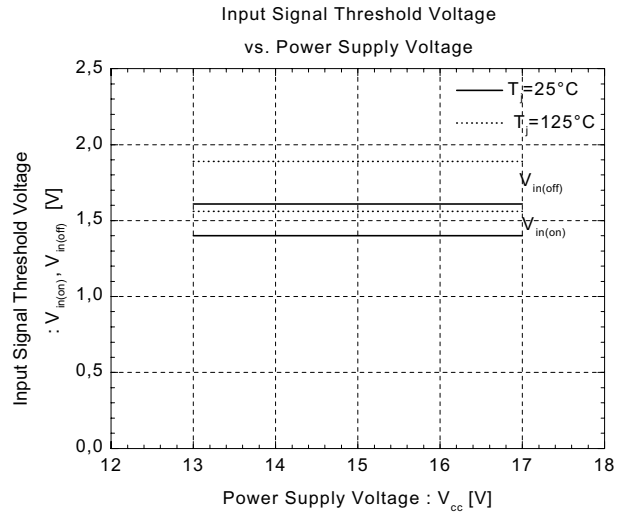
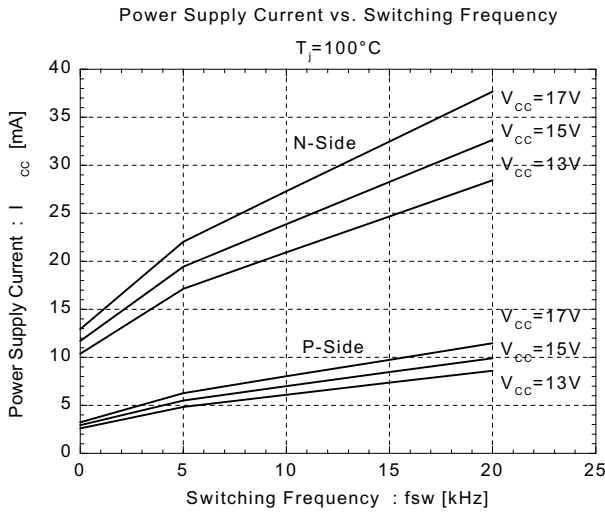
## ■ Equivalent Circuit



### Drivers include following functions

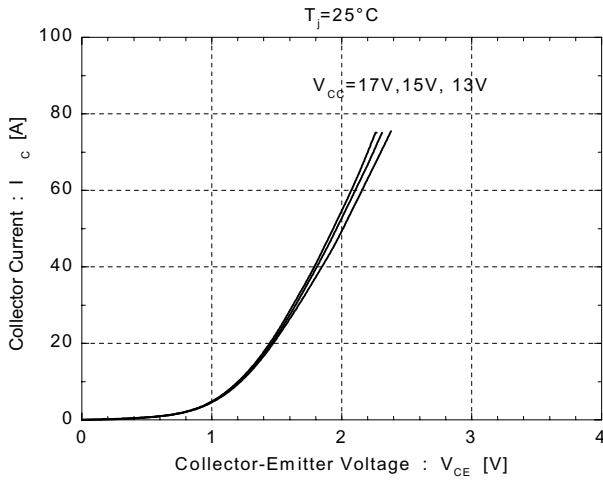
- Short circuit protection circuit
- Amplifier for driver
- Undervoltage protection circuit
- Overcurrent protection circuit
- IGBT Chip overheating protection

## Control Circuit

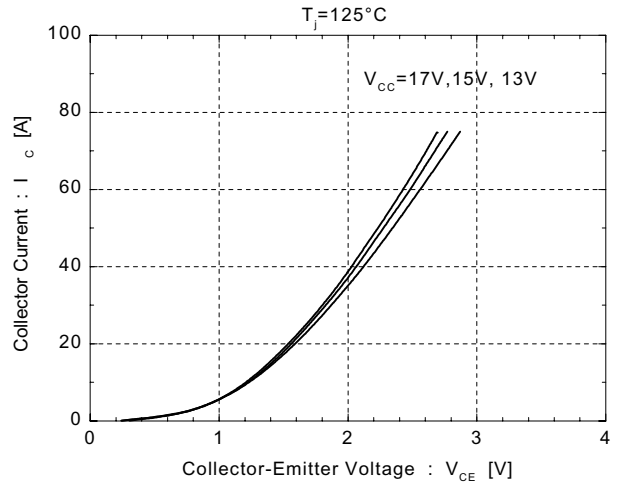


## ■ Inverter

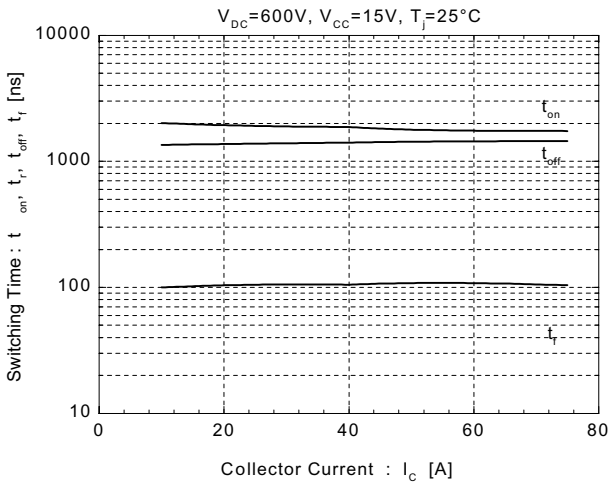
Collector Current vs. Collector-Emitter Voltage



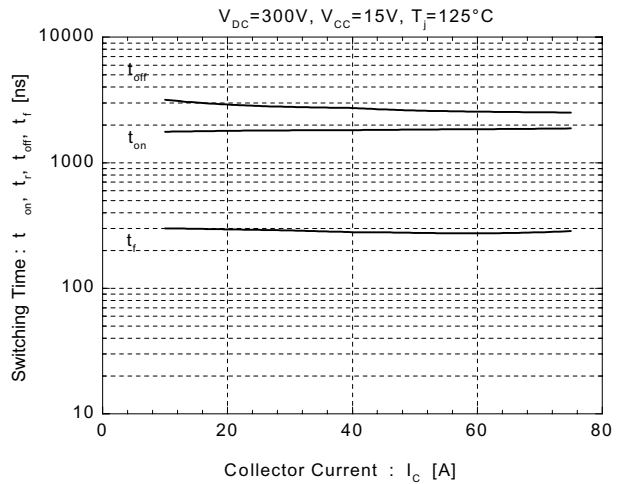
Collector Current vs. Collector-Emitter Voltage



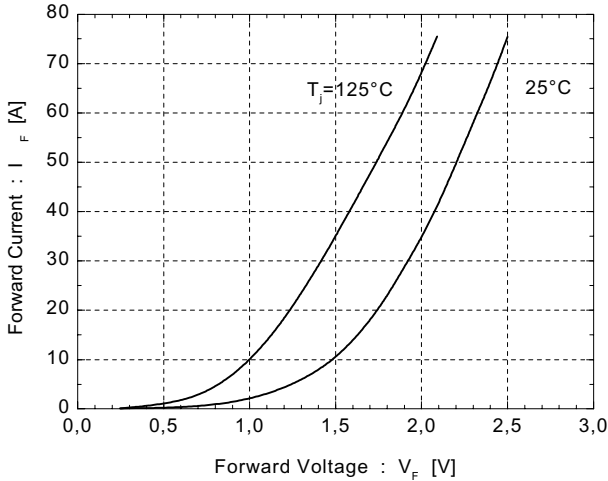
Switching Time vs. Collector Current



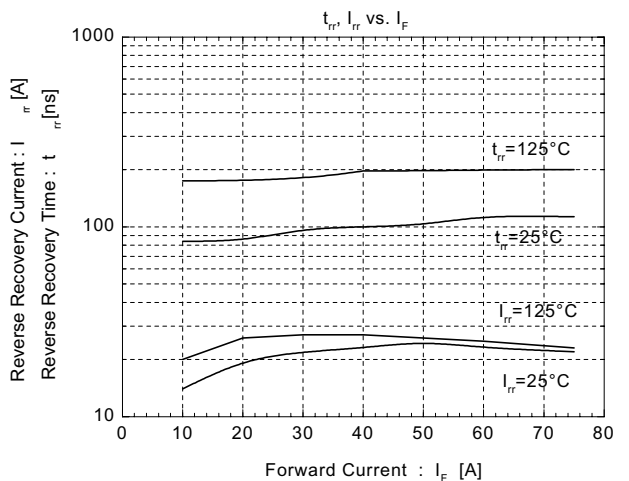
Switching Time vs. Collector Current



Forward Voltage vs. Forward Current

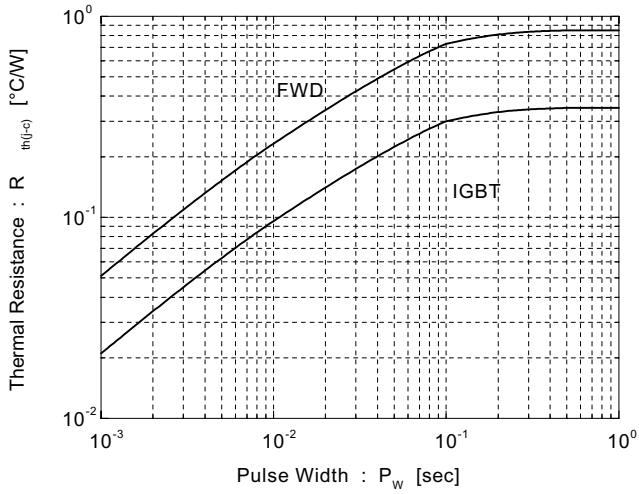


Reverse Recovery Characteristics

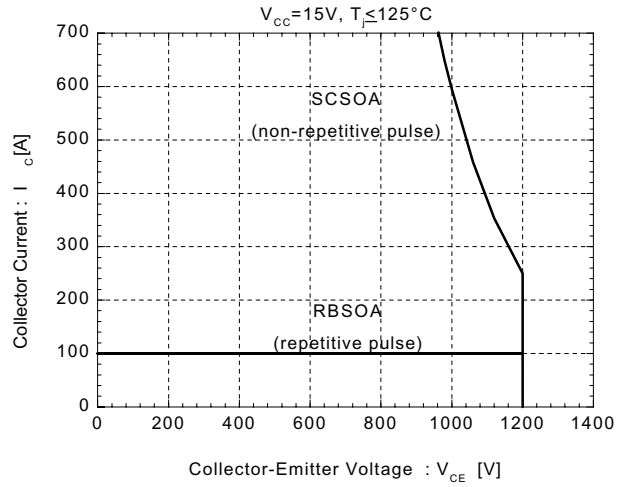


## ■ Inverter

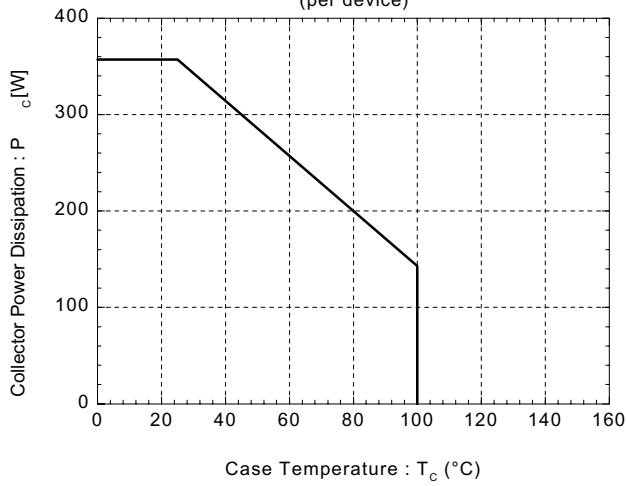
Transient Thermal Resistance



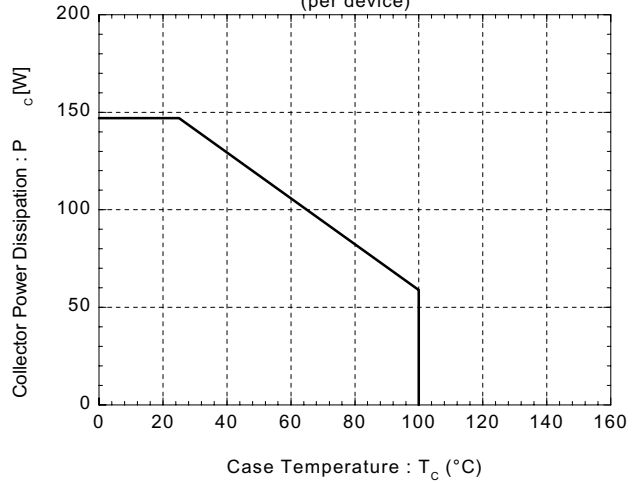
Reverse Biased Safe Operating Area



Power Derating For IGBT  
(per device)

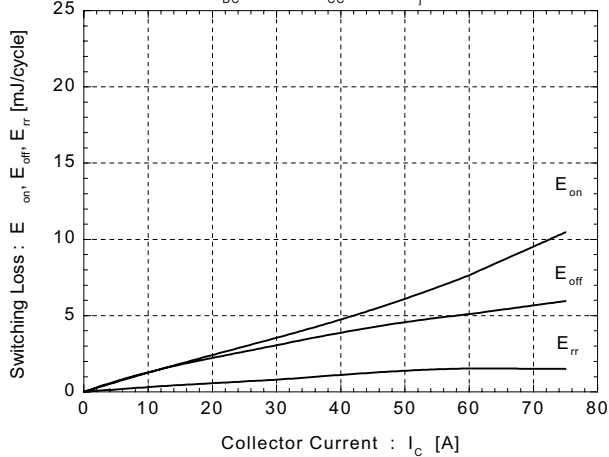


Power Derating For FWD  
(per device)



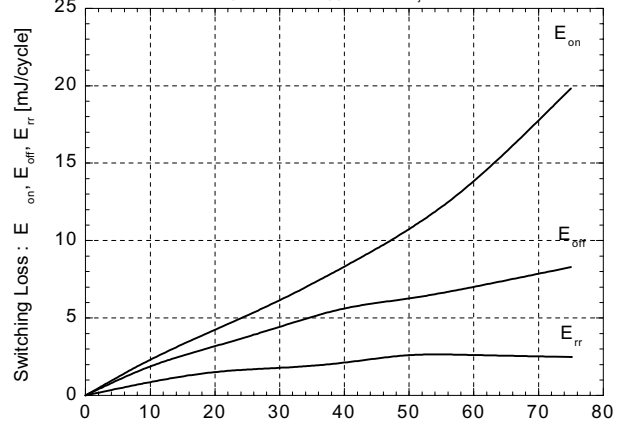
Switching Loss vs. Collector Current

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

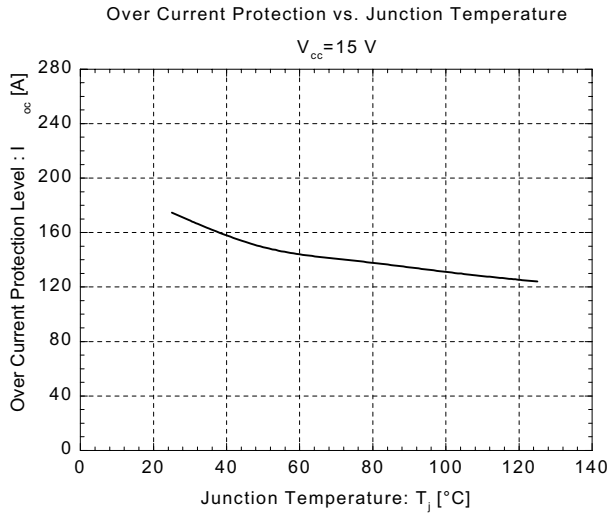


Switching Loss vs. Collector Current

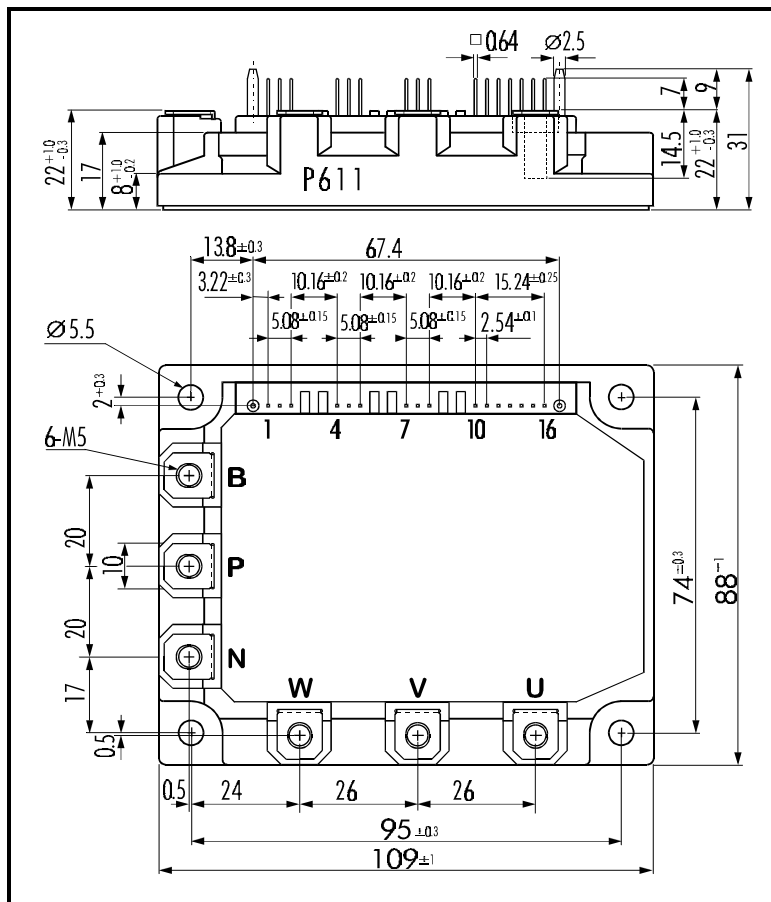
$V_{DC}=600V, V_{CC}=15V, T_j=125^\circ C$



## ■ Inverter



## ■ Outline Drawing



**Weight: 440g**