

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		75	A
	1ms	I_{CP}		150	
	Duty=61.7%	$-I_C$		75	
Collector Power Dissipation One Transistor		P_C		320	W
Dynamic Brake	Continuous	I_C		50	A
	1ms	I_{CP}		100	
Forward Current of Diode		I_F		50	
Collector Power Dissi. DB One Transistor		P_C		198	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
		Mounting *1		3.5	Nm
Screw Torque		Terminals *1		3.5	

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

■ Outline Drawing

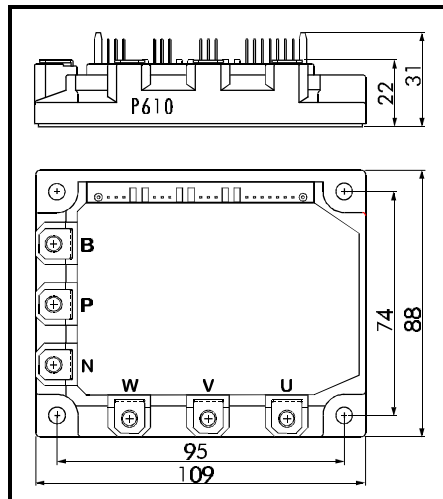


Fig. 1

• 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	$V_{CE(\text{Sat})}$	$I_C=75\text{A}$			2.8	V
	Forward Voltage of FWD	V_F	$-I_C=75\text{A}$			3.0	V
DB	Collector Current At Off Signal Input	I_{CES}	$V_{CE}=600\text{V}$, Input Terminal Open			1.0	mA
	Collector-Emitter Saturation Voltage	$V_{CE(\text{Sat})}$	$I_C=50\text{A}$			2.8	V
	Forward Voltage of FWD	V_F	$-I_C=50\text{A}$			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}	$T_J=125^\circ\text{C}$	75			
	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			

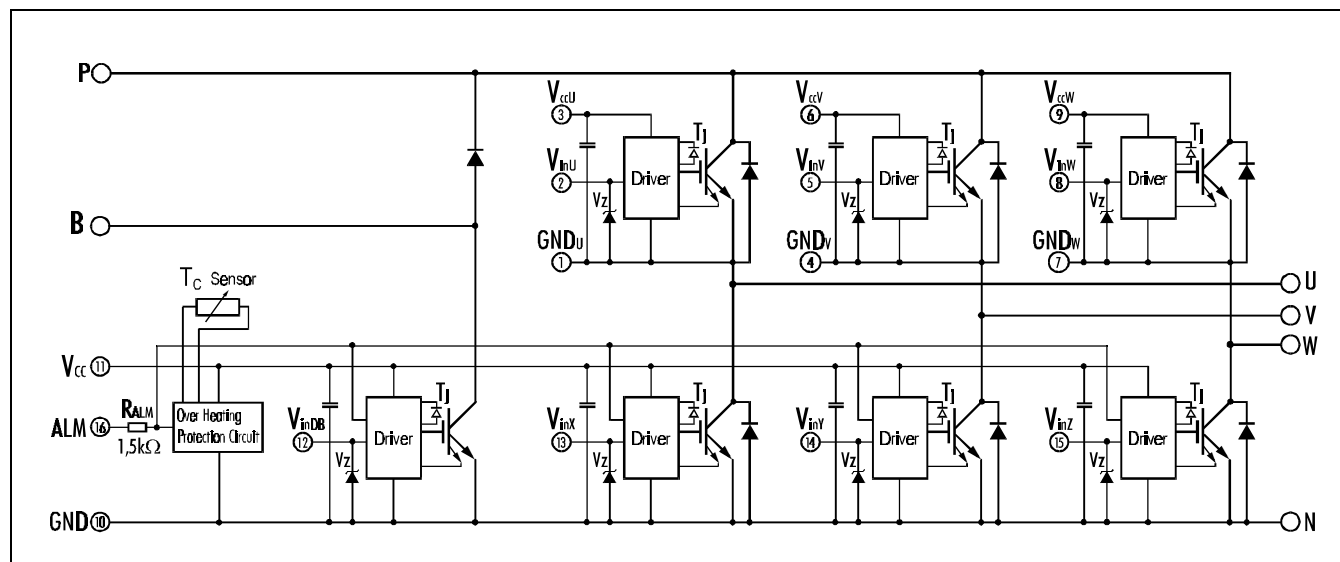
• Dynamic Characteristics (at $T_c=T_J=125^\circ\text{C}$, $V_{CC}=15\text{V}$)

	Items	Symbols	Conditions	Min.	Typ.	Max.	Units
Switching Time		t_{ON}	$I_C=75\text{A}$, $V_{DC}=300\text{V}$	0.3			μs
		t_{OFF}				3.6	
		t_{RR}	$I_F=75\text{A}$, $V_{DC}=300\text{V}$			0.4	

• Thermal Characteristics

Items	Symbols	Conditions	Min.	Typ.	Max.	Units
Thermal Resistance	$R_{th(j-c)}$	Inverter IGBT			0.39	°C/W
	$R_{th(j-c)}$	Diode			0.90	
	$R_{th(j-c)}$	DB IGBT			0.63	
	$R_{th(c-f)}$	With Thermal Compound		0.05		

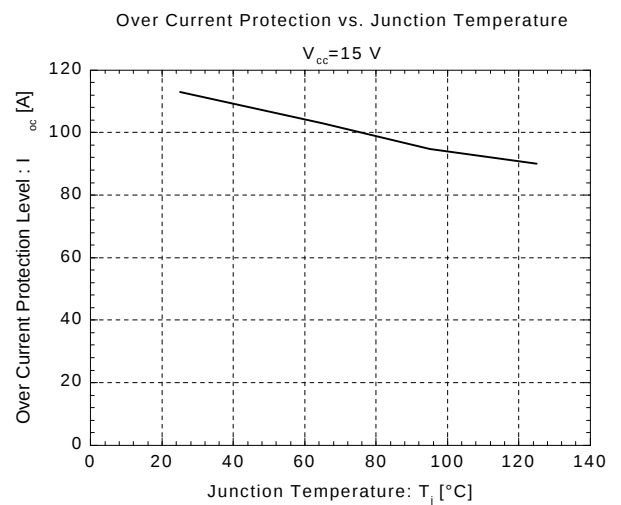
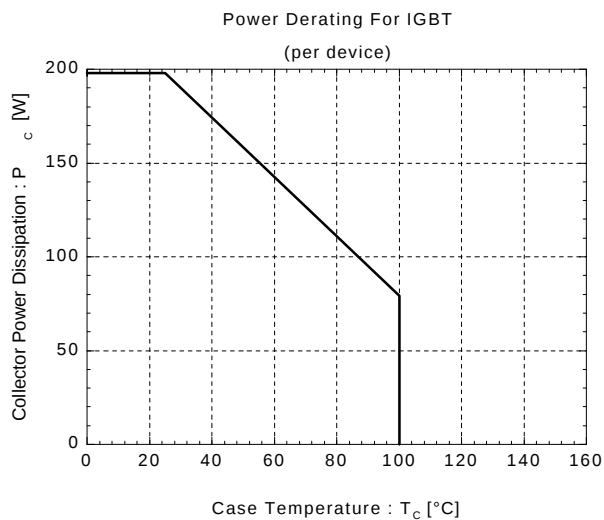
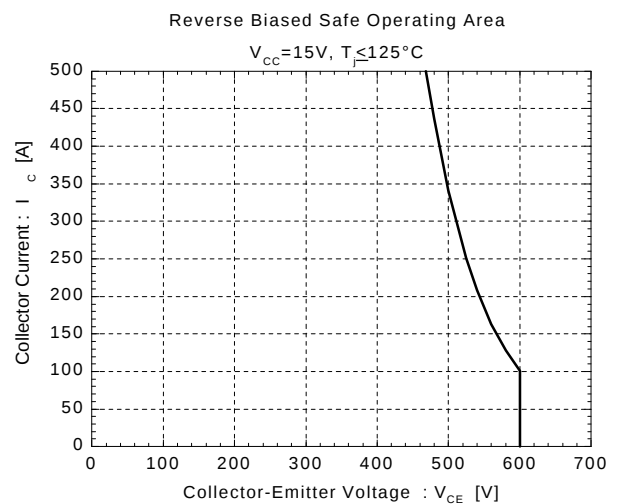
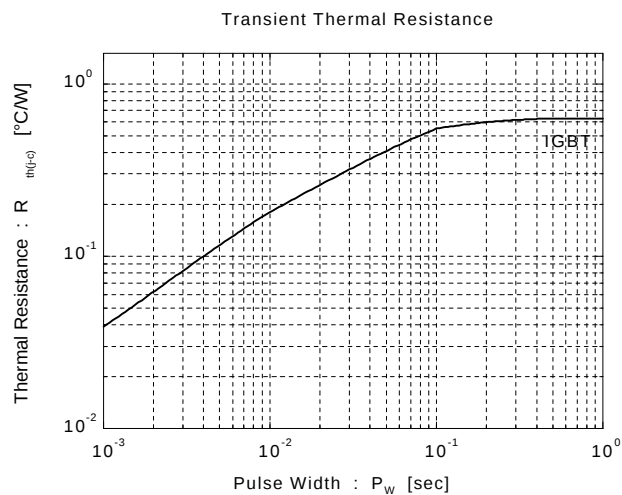
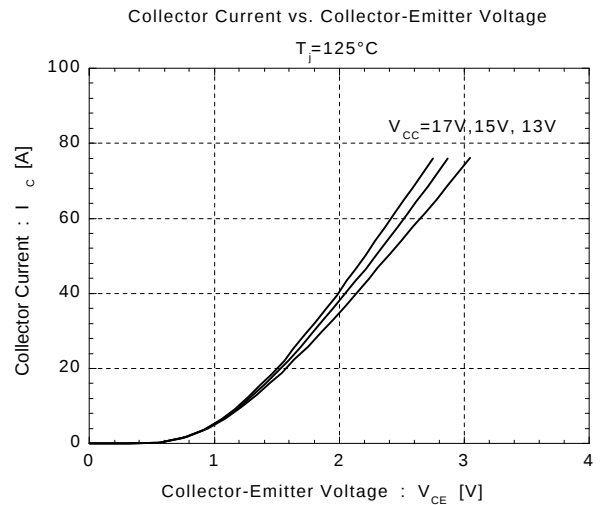
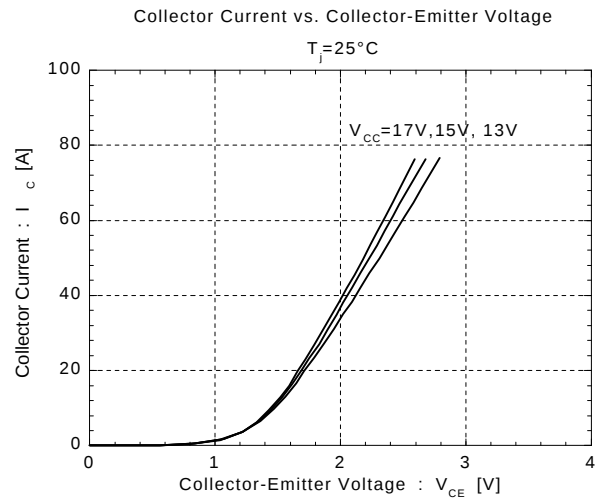
■ Equivalent Circuit



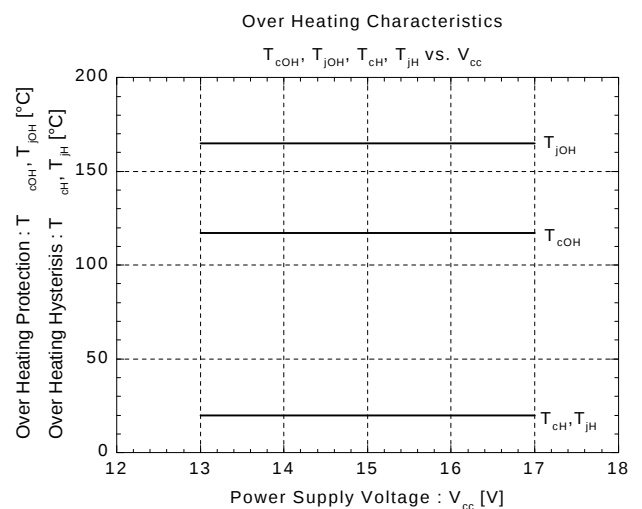
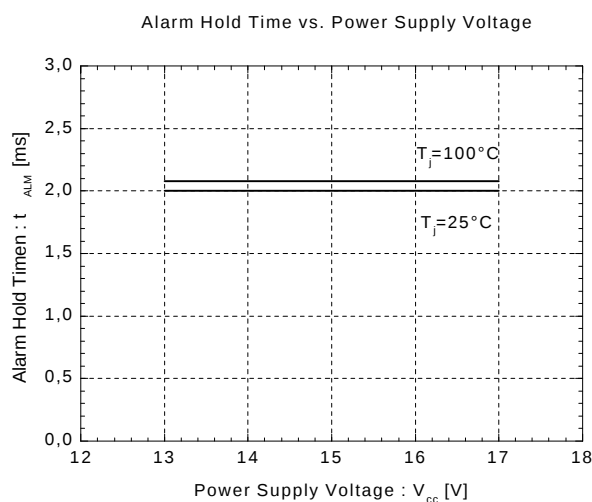
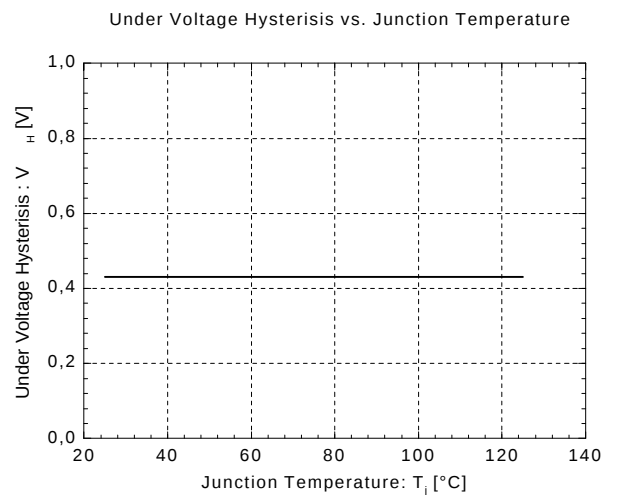
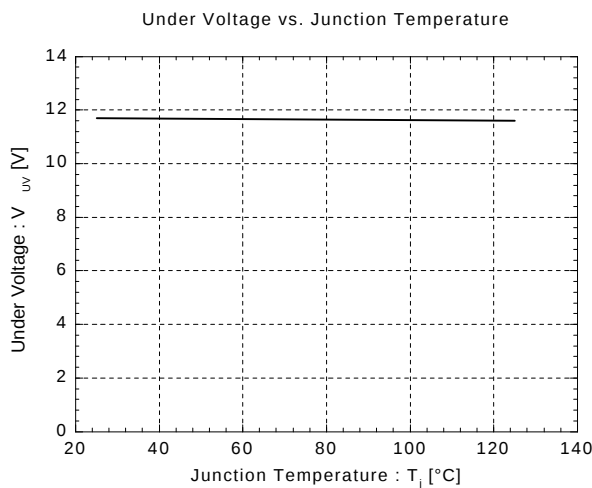
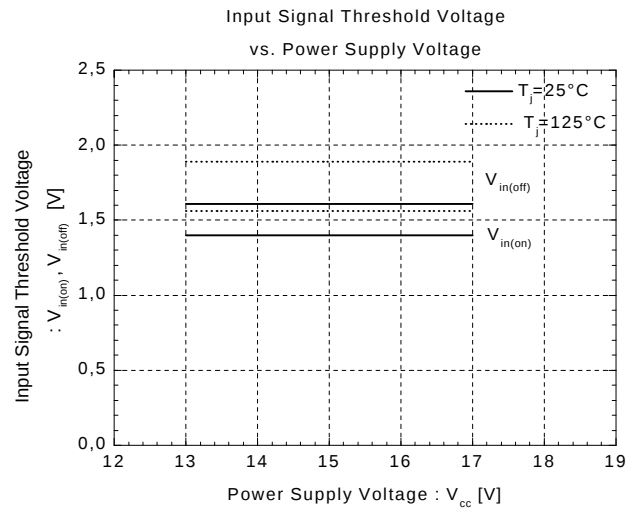
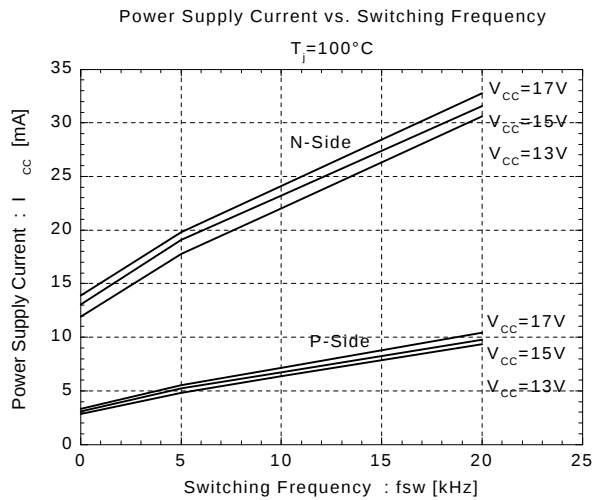
Drivers include following functions

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

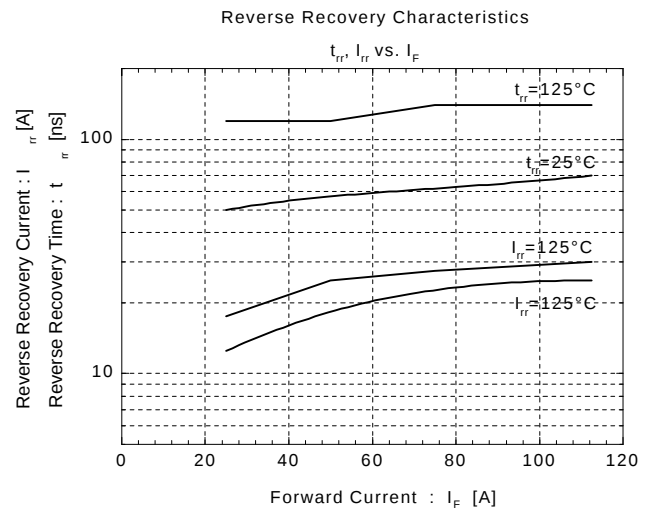
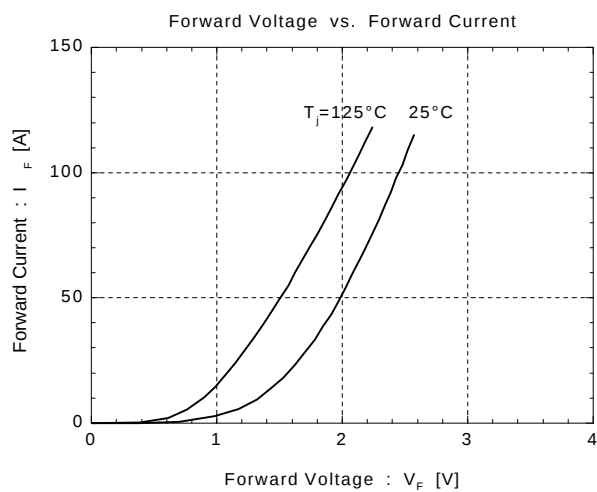
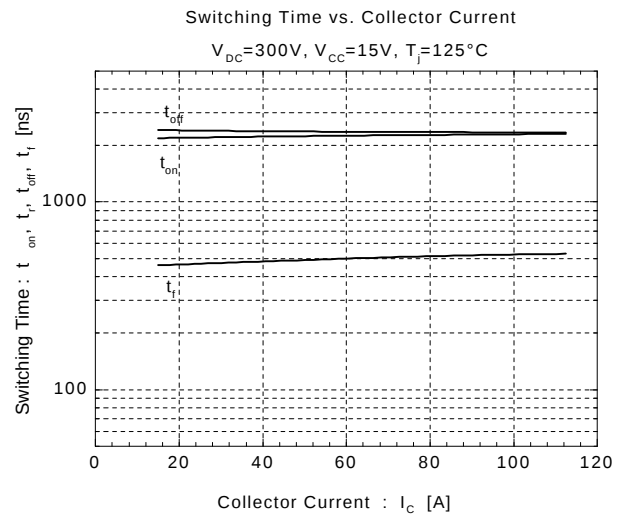
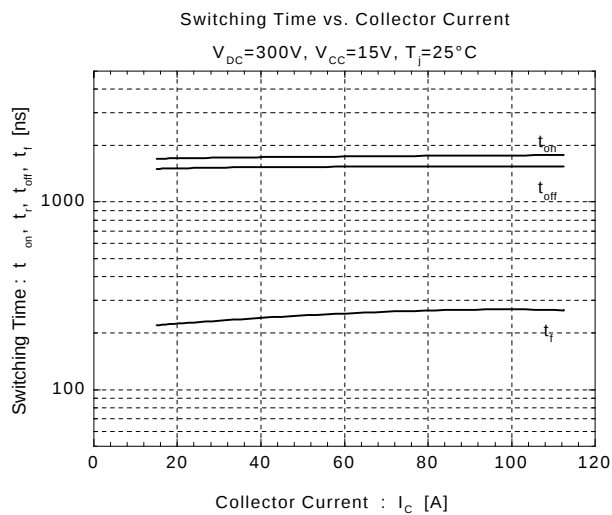
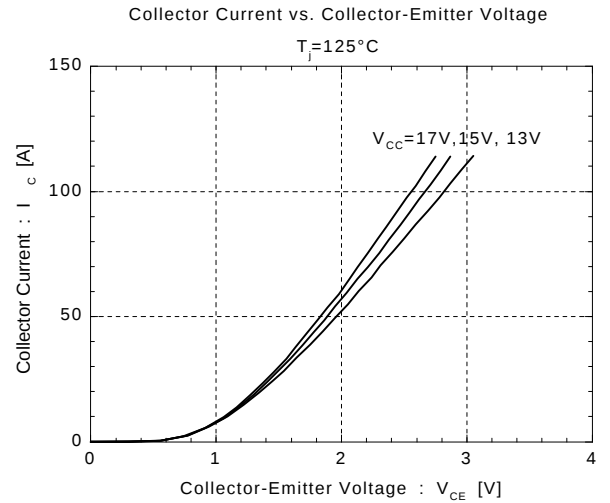
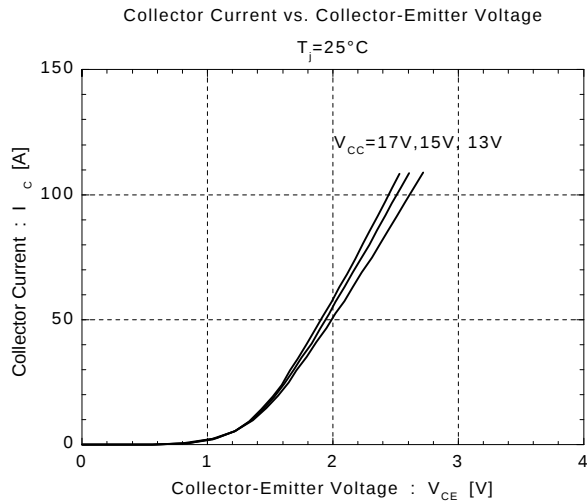
■ Dynamic Brake



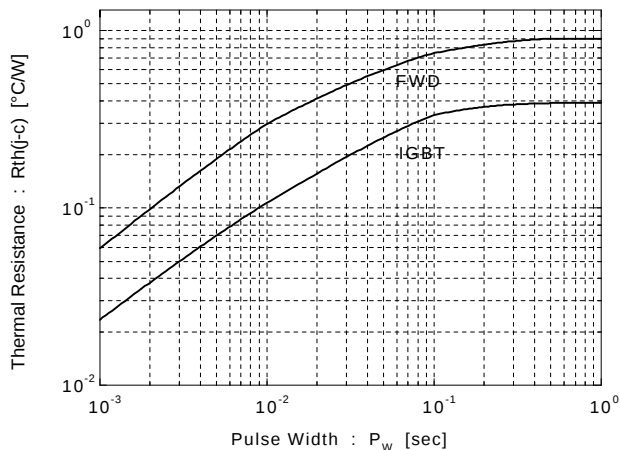
■ Control Circuit



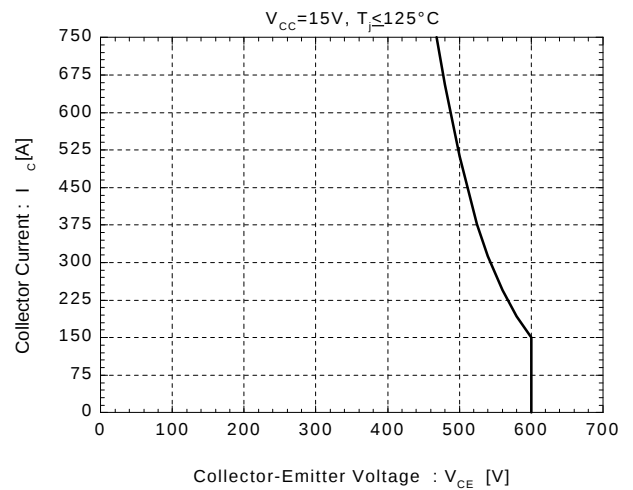
■ Inverter



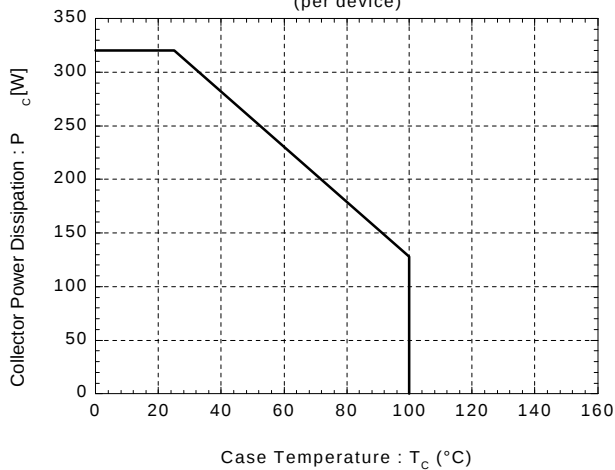
Transient Thermal Resistance



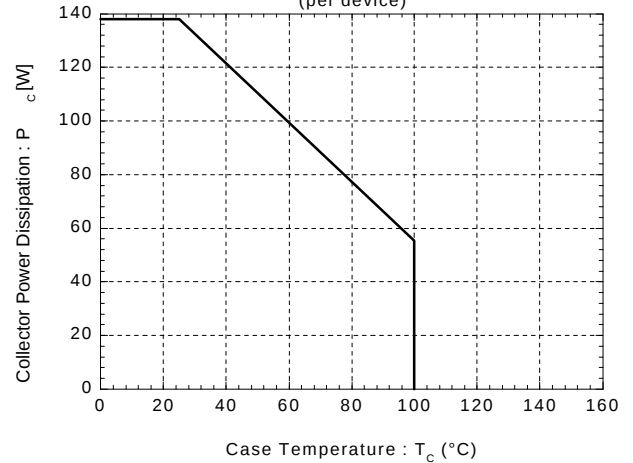
Reverse Biased Safe Operating Area



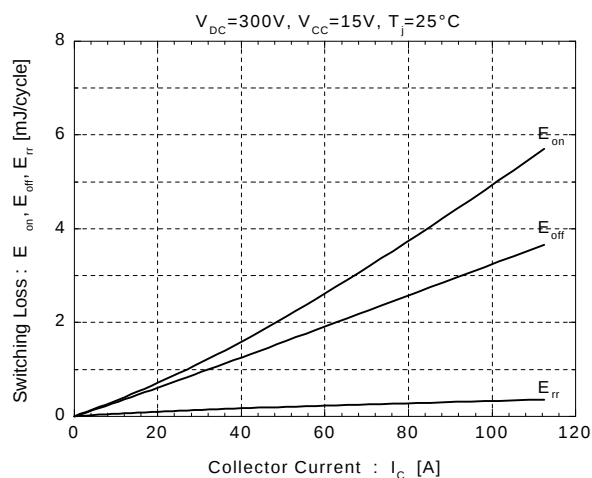
Power Derating For IGBT
(per device)



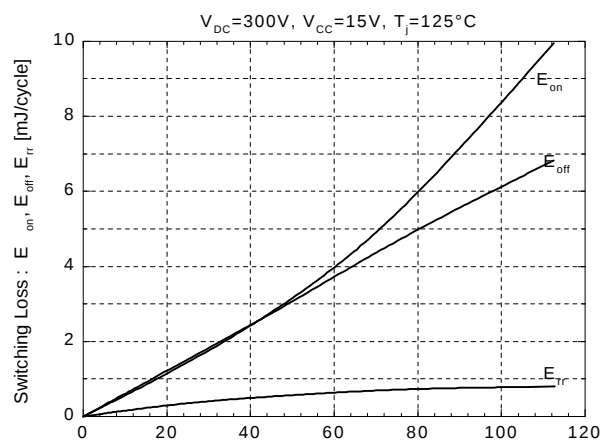
Power Derating For FWD
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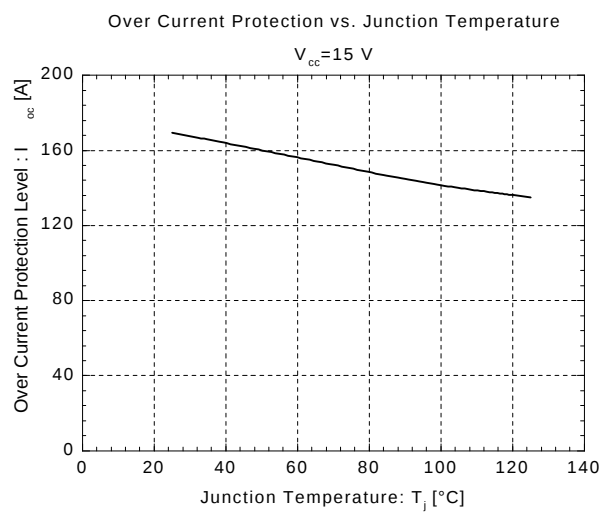


Switching Loss vs. Collector Current

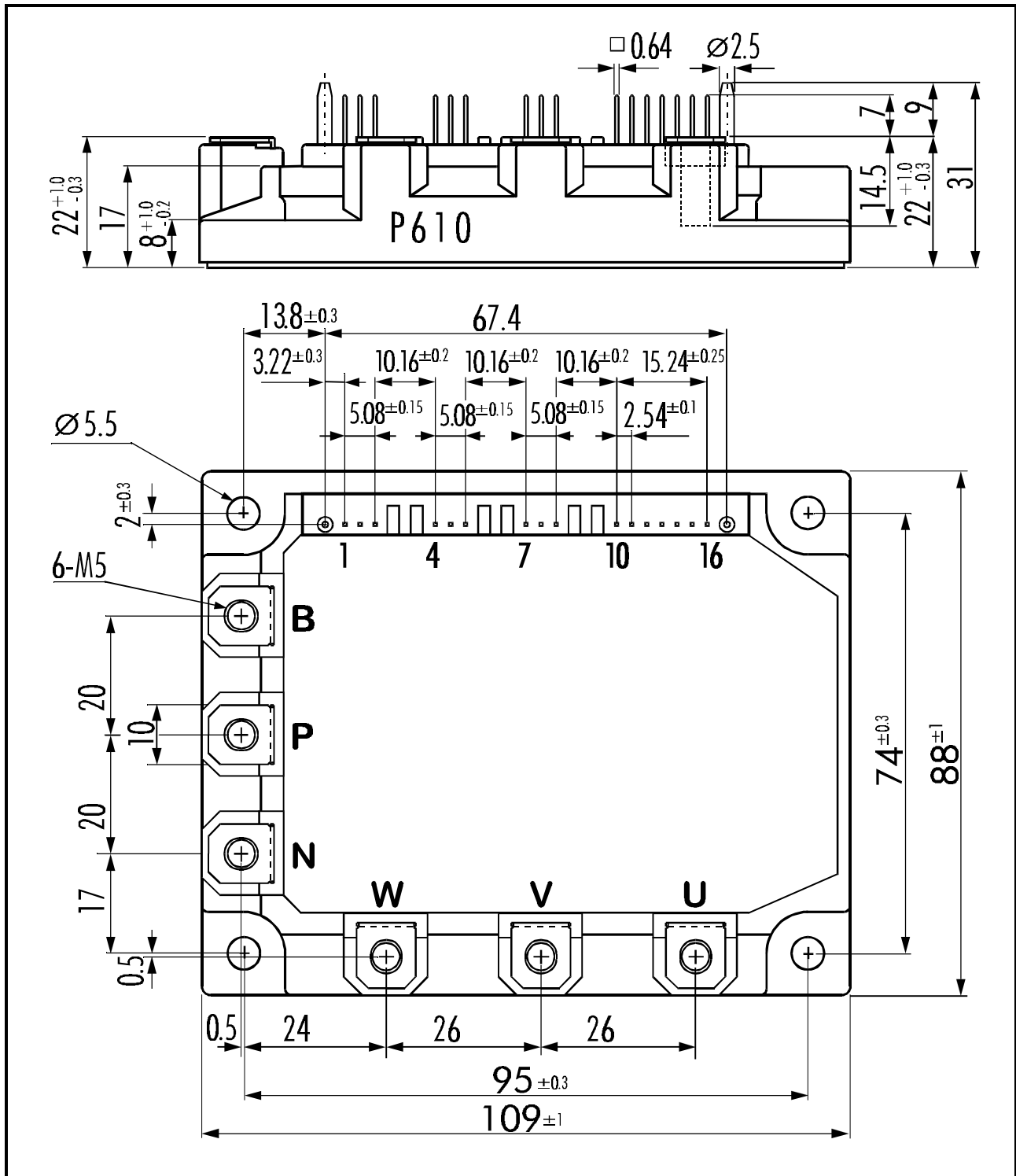


Switching Loss vs. Collector Current





■ Outline Drawing



Weight: 440g

For more information, contact:

Collmer Semiconductor, Inc.

P.O. Box 702708

Dallas, TX 75370

972-233-1589

972-233-0481 Fax

<http://www.collmer.com>