

### Features

- Temperature protection provided by directly detecting the junction temperature of the IGBTs.
- Low power loss and soft switching.
- High performance and high reliability IGBT with overheating protection.
- Both P-side and N-side alarm output available.
- Higher reliability because of a big decrease in number of parts in built-in control circuit.

### Maximum ratings and characteristics

- Absolute maximum ratings(at  $T_c=25^{\circ}\text{C}$  unless otherwise specified)

Item			Symbol	Rating		Unit
				Min.	Max.	
Bus voltage		DC	V <sub>DC</sub>	0	900	V
		Surge	V <sub>DC(surge)</sub>	0	1000	V
		Short operating	V <sub>SC</sub>	200	800	V
Collector-Emitter voltage *1			V <sub>CES</sub>	0	1200	V
Inverter	Collector current	DC	I <sub>C</sub>	-	25	A
		1ms	I <sub>CP</sub>	-	50	A
		DC	-I <sub>C</sub>	-	25	A
	Collector power dissipation	One transistor *3	P <sub>C</sub>	-	198	W
Brake	Collector current	DC	I <sub>C</sub>	-	15	A
		1ms	I <sub>CP</sub>	-	30	A
	Forward Current of Diode		I <sub>F</sub>	-	15	A
	Collector power dissipation	One transistor *3	P <sub>C</sub>		120	W
Supply voltage of Pre-Driver *4			V <sub>CC</sub>	-0.5	20	V
Input signal voltage *5			V <sub>in</sub>	-0.5	V <sub>CC</sub> +0.5	V
Input signal current			I <sub>in</sub>	-	3	mA
Alarm signal voltage *6			V <sub>ALM</sub>	-0.5	V <sub>CC</sub>	V
Alarm signal current *7			I <sub>ALM</sub>	-	20	mA
Junction temperature			T <sub>j</sub>	-	150	°C
Operating case temperature			T <sub>opr</sub>	-20	100	°C
Storage temperature			T <sub>stg</sub>	-40	125	°C
Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.)			V <sub>iso</sub>	-	AC2500	V
Screw torque		Terminal (M5)		-	3.5	N·m
		Mounting (M5)		-	3.5	N·m

### Note

\*1 :  $V_{CES}$  shall be applied to the input voltage between terminal P and U or V or W or DB, N and U or V or W or DB.

\*3 :  $P_C=125^{\circ}\text{C}/\text{IGBT } R_{th(j-c)}=125/0.63=198\text{W}$  [Inverter]

$P_C=125^{\circ}\text{C}/\text{IGBT } R_{th(j-c)}=125/1.04=120\text{W}$  [Inverter]

\*4 :  $V_{CC}$  shall be applied to the input voltage between terminal No.4 and 1, 8 and 5, 12 and 9, 14 and 13

\*5 :  $V_{in}$  shall be applied to the input voltage between terminal No.3 and 1, 7 and 5, 11 and 9, 15,16,17,18 and 13.

\*6 :  $V_{ALM}$  shall be applied to the voltage between terminal No.2 and 1, No6 and 5, No10 and 9, No.19 and 13.

\*7 :  $I_{ALM}$  shall be applied to the input current to terminal No.2,6,10 and 19.

**Electrical characteristics** (at  $T_c=T_j=25^\circ\text{C}$ ,  $V_{cc}=15\text{V}$  unless otherwise specified.)

● **Main circuit**

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Inverter	Collector current at off signal input	$I_{CES}$ $V_{CE}=1200\text{V}$ $V_{in}$ terminal open.	-	-	1.0	mA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ $I_c=25\text{A}$	-	-	2.6	V
	Forward voltage of FWD	$V_F$ $-I_c=25\text{A}$	-	-	3.0	V
Brake	Collector current at off signal input	$I_{CES}$ $V_{CE}=1200\text{V}$ $V_{in}$ terminal open.	-	-	1.0	mA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ $I_c=15\text{A}$ Terminal	-	-	2.6	V
	Forward voltage of Diode	$V_F$ $-I_c=15\text{A}$ Terminal	-	-	3.3	V
Turn-on time			0.3	-	-	$\mu\text{s}$
Turn-off time			-	-	3.6	
Reverse recovery time			-	-	0.3	

● **Control circuit**

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current of P-line side pre-driver(one unit)	$I_{ccp}$	Switching Frequency : 0 to 15kHz $T_c=-20$ to $125^\circ\text{C}$ Fig.7	-	-	18	mA
Supply current of N-line side pre-driver	$I_{ccn}$		-	-	65	mA
Input signal threshold voltage (on/off)	$V_{in(th)}$	ON	1.00	1.35	1.70	V
		OFF	1.25	1.60	1.95	V
Input zener voltage	$V_Z$	$R_{in}=20\text{k ohm}$	-	8.0	-	V
Alarm signal hold time	$t_{ALM}$	$T_c=-20^\circ\text{C}$ Fig.2	1.1	-	-	ms
		$T_c=25^\circ\text{C}$ Fig.2	-	2.0	-	ms
		$T_c=125^\circ\text{C}$ Fig.2	-	-	4.0	ms
Limiting Resistor for Alarm	$R_{ALM}$		1425	1500	1575	ohm

● **Protection Section** ( $V_{cc}=15\text{V}$ )

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Over Current Protection Level of Inverter circuit	$I_{oc}$	$T_j=125^\circ\text{C}$	38	-	-	A
Over Current Protection Level of Brake circuit	$I_{oc}$	$T_j=125^\circ\text{C}$	23	-	-	A
Over Current Protection Delay time	$t_{doc}$	$T_j=125^\circ\text{C}$	-	10	-	$\mu\text{s}$
SC Protection Delay time	$t_{sc}$	$T_j=125^\circ\text{C}$ Fig.4	-	-	12	$\mu\text{s}$
IGBT Chip Over Heating Protection Temperature Level	$T_{jOH}$	Surface of IGBT chips	150		-	$^\circ\text{C}$
Over Heating Protection Hysteresis	$T_{jH}$		-	20	-	$^\circ\text{C}$
Over Heating Protection Protection Temperature Level	$T_{cOH}$	$V_{dc}=0\text{V}$ , $I_c=0\text{A}$ Case Temperature	110	-	125	$^\circ\text{C}$
Over Heating Protection Hysteresis	$T_{cH}$		-	20	-	$^\circ\text{C}$
Under Voltage Protection Level	$V_{UV}$		11.0	-	12.5	V
Under Voltage Protection Hysteresis	$V_H$		0.2	0.5	-	V

● **Thermal characteristics**( $T_c=25^\circ\text{C}$ )

Item		Symbol	Min.	Typ.	Max.	Unit
Junction to Case thermal resistance *8	Inverter	IGBT	$R_{th(j-c)}$	-	0.63	$^\circ\text{C/W}$
		FWD	$R_{th(j-c)}$	-	1.33	$^\circ\text{C/W}$
	Brake	IGBT	$R_{th(j-c)}$	-	1.04	$^\circ\text{C/W}$
Case to fin thermal resistance with compound			$R_{th(c-f)}$	-	0.05	-

\*8 : (For 1 device, Case is under the device)

● **Noise Immunity** ( $V_{DC}=300\text{V}$ ,  $V_{cc}=15\text{V}$ , Test Circuit Fig.5)

Item	Condition	Min.	Typ.	Max.	Unit
Common mode rectangular noise	Pulse width $1\mu\text{s}$ , polarity $\pm 10\text{minuets}$ Judge : no over-current, no miss operating	$\pm 2.0$	-	-	kV
Common mode lightning surge	Rise time $1.2\mu\text{s}$ , Fall time $50\mu\text{s}$ Interval 20s, 10 times Judge : no over-current, no miss operating	$\pm 5.0$	-	-	kV

● **Recommendable value**

Item	Symbol	Min.	Typ.	Max.	Unit
DC Bus Voltage	$V_{DC}$	-	-	800	V
Operating Supply Voltage of Pre-Driver	$V_{cc}$	13.5	15.0	16.5	V
Screw torque (M5)	-	2.5	-	3.0	Nm

● **Weight**

Item	Symbol	Min.	Typ.	Max.	Unit
Weight	$W_t$	-	450	-	g

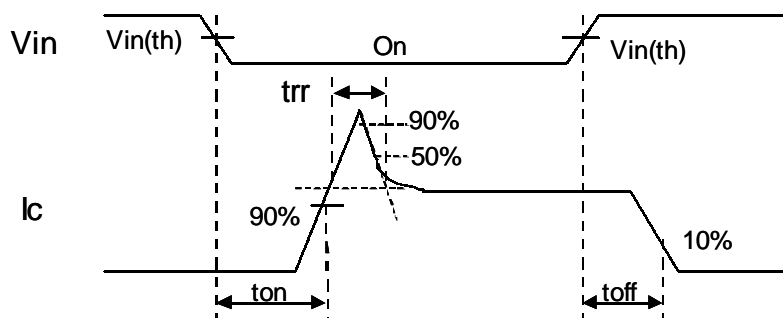
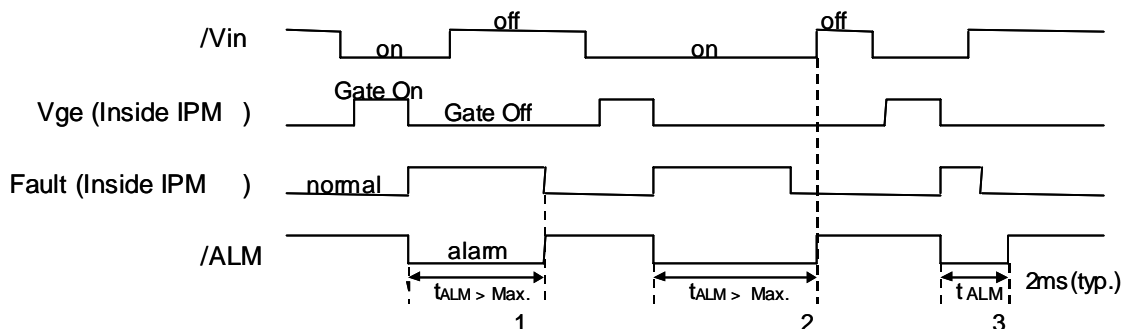


Figure 1. Switching Time Waveform Definitions



Fault : Over-current, Over-heat or Under-voltage

Figure 2. Input/Output Timing Diagram

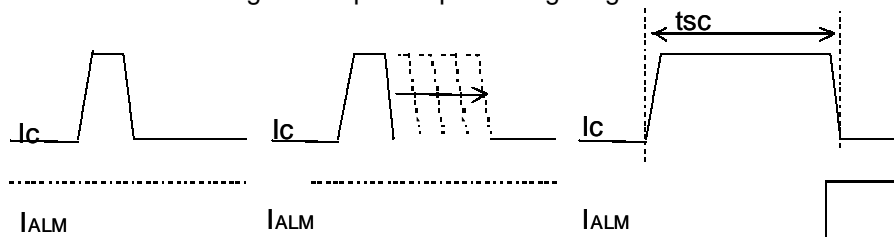


Figure.4 Definition of tsc

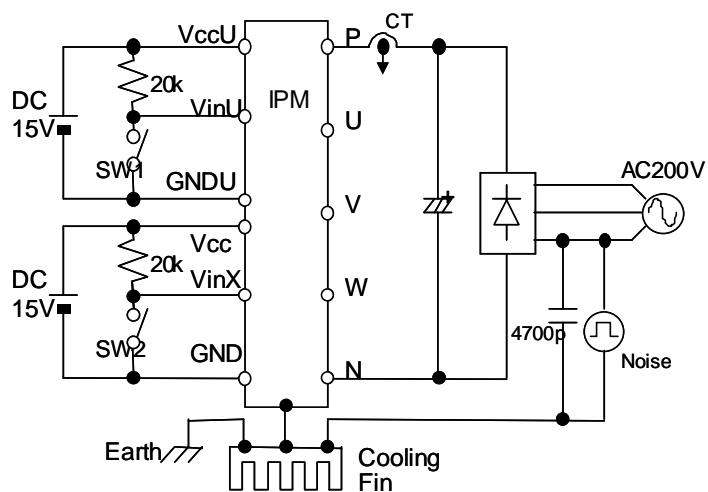


Figure 5. Noise Test Circuit

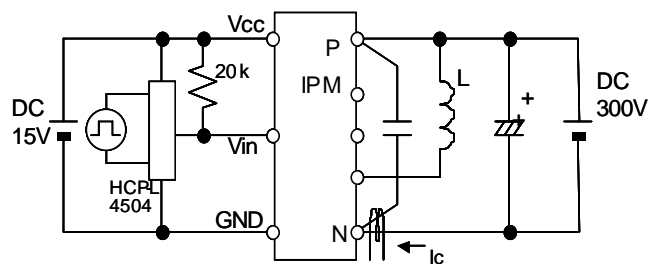


Figure 6. Switching Characteristics Test Circuit

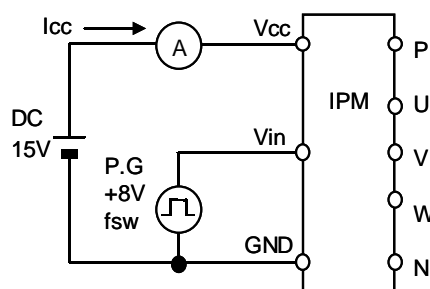
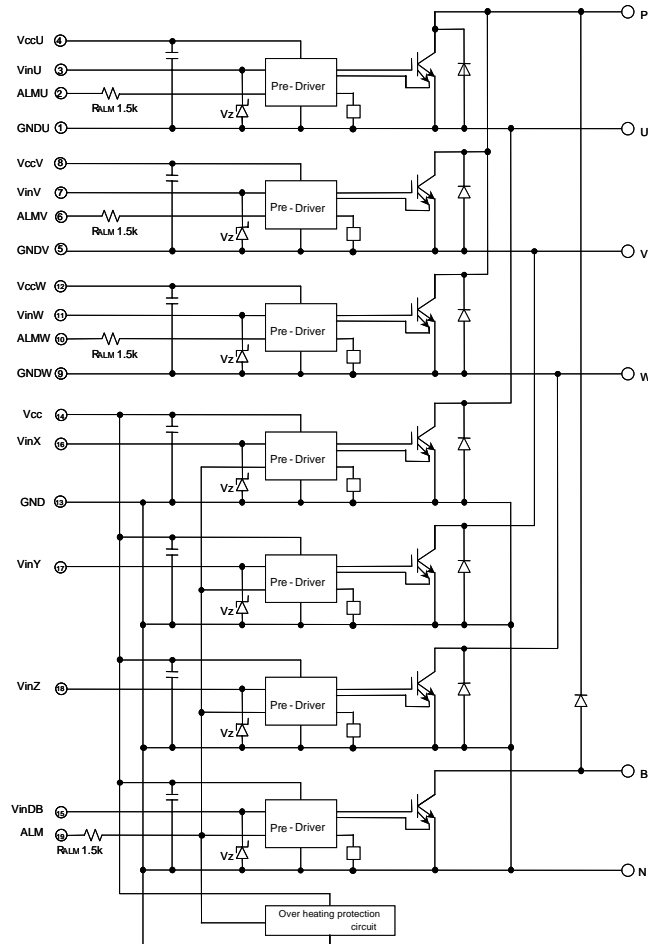


Figure 7. Icc Test Circuit

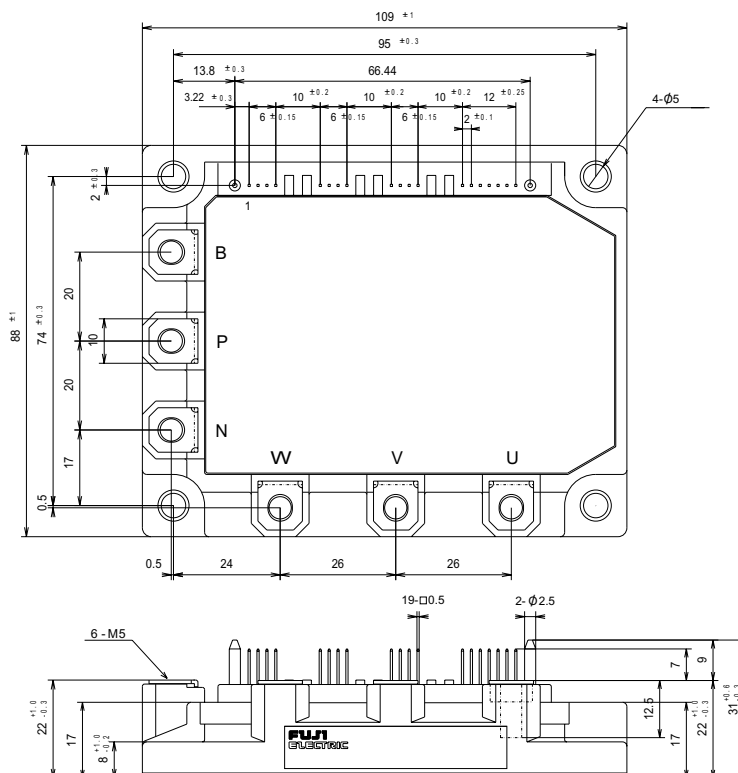
## Block diagram



Pre-drivers include following functions

1. Amplifier for driver
2. Short circuit protection
3. Under voltage lockout circuit
4. Over current protection
5. IGBT chip over heating protection

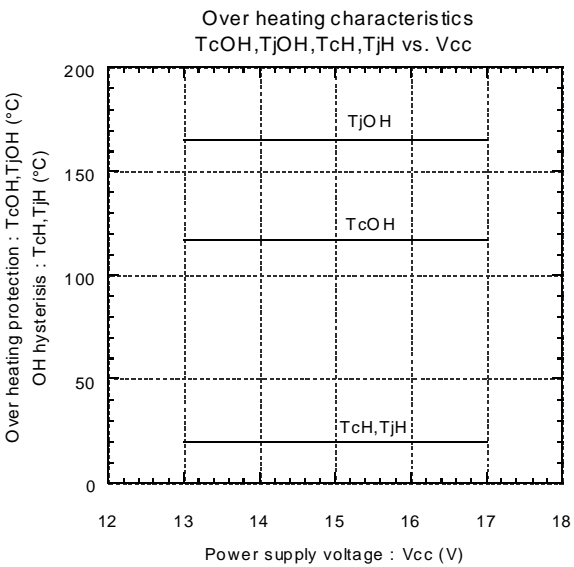
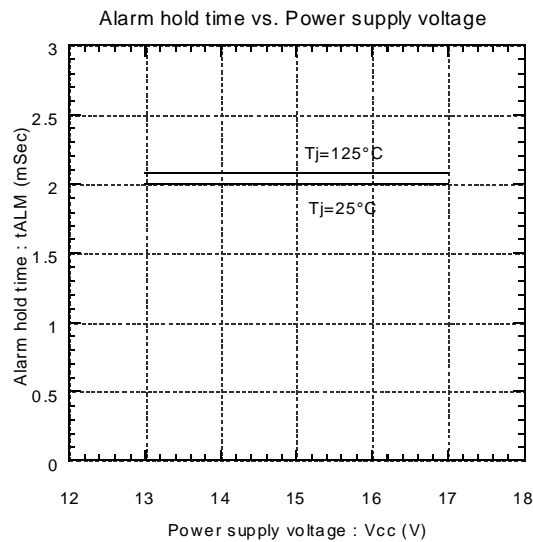
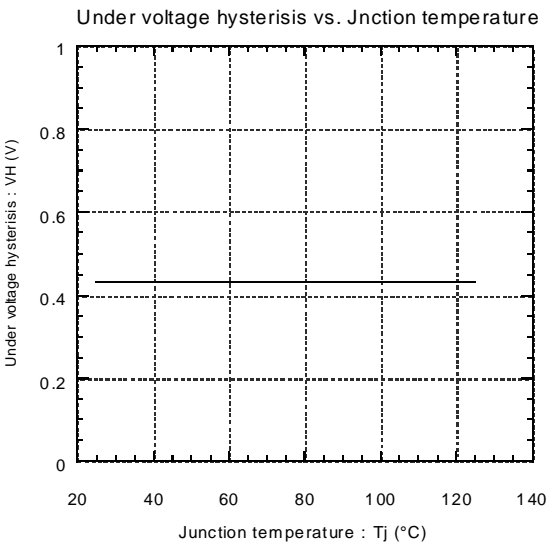
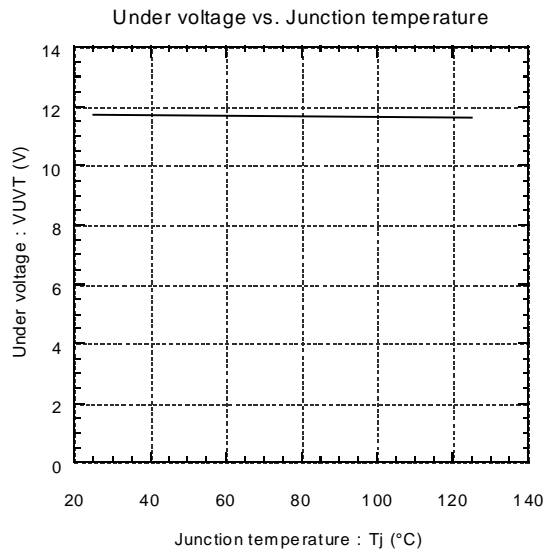
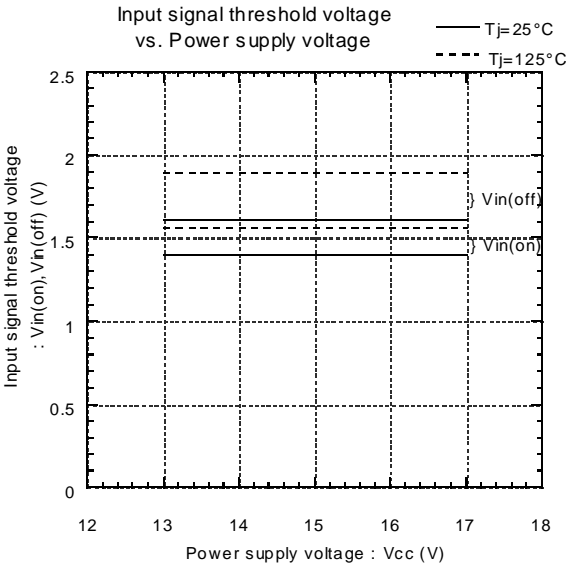
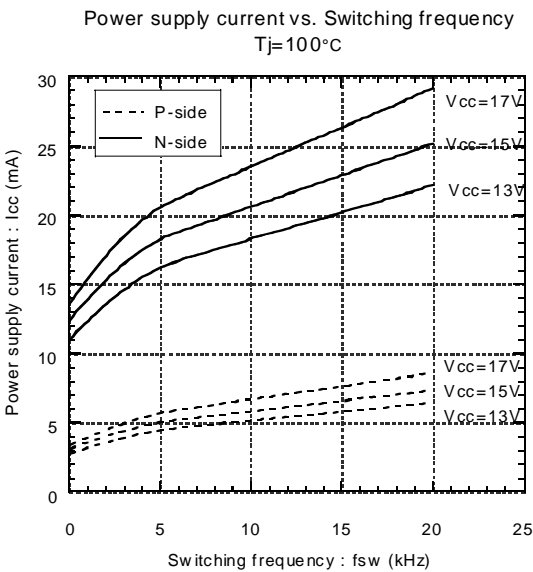
## Outline drawings, mm



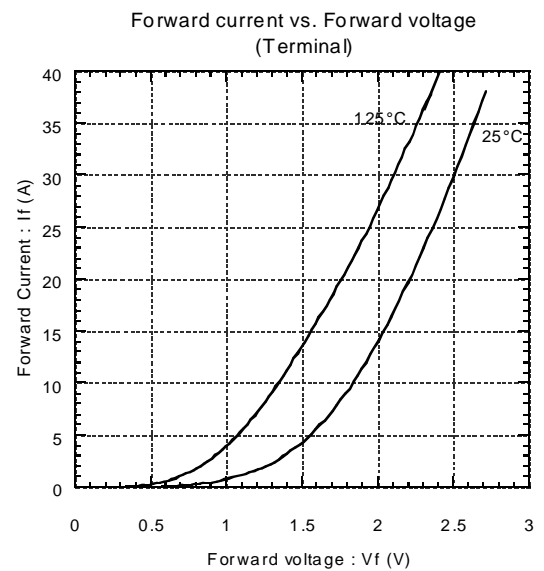
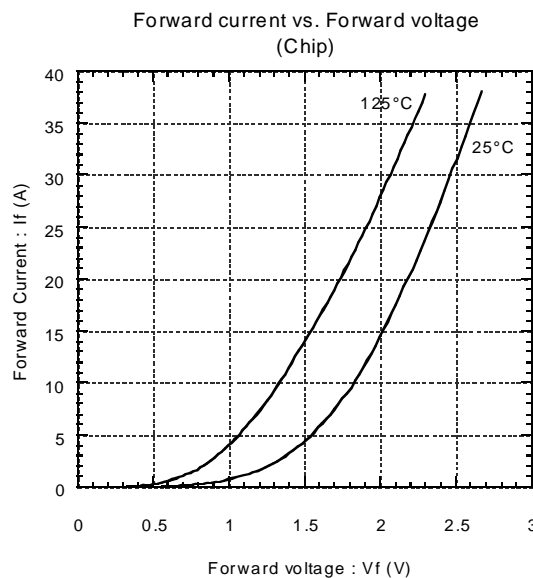
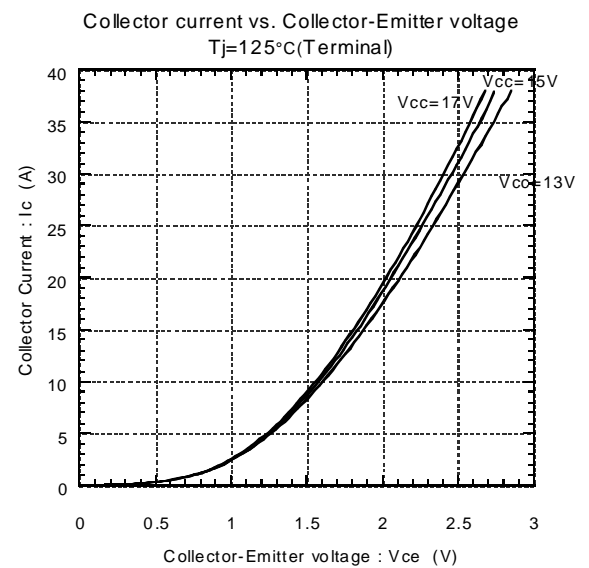
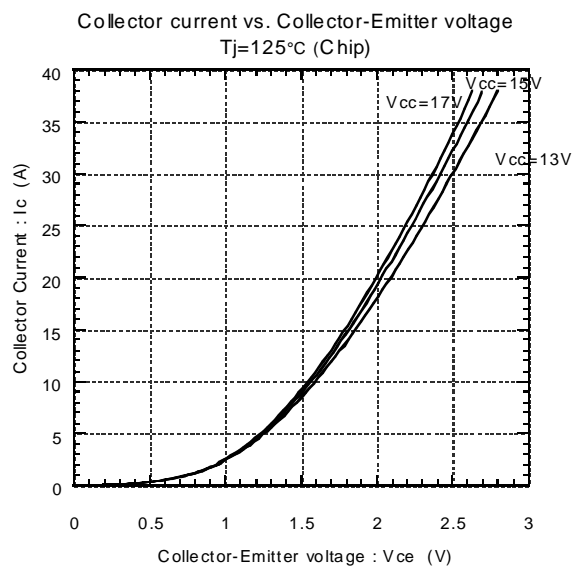
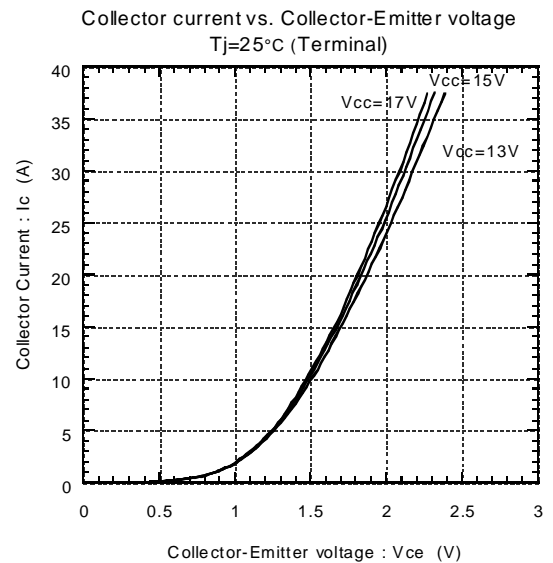
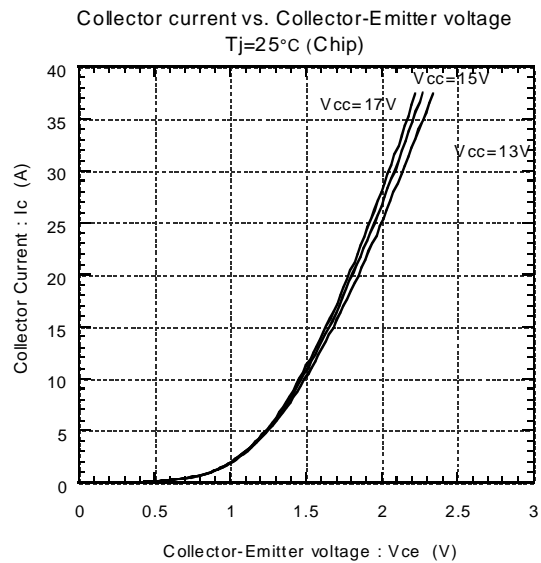
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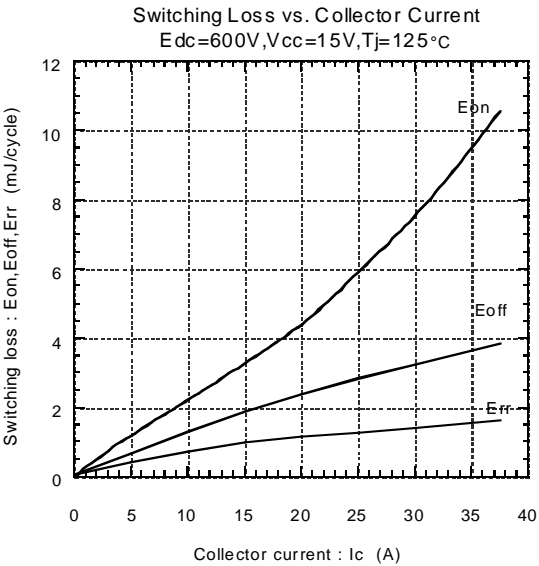
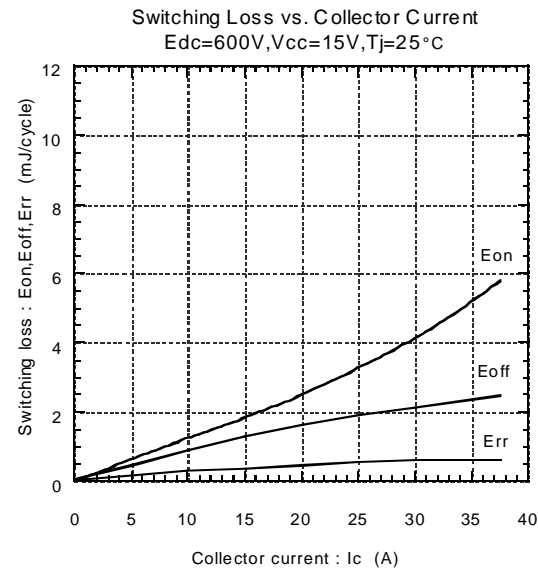
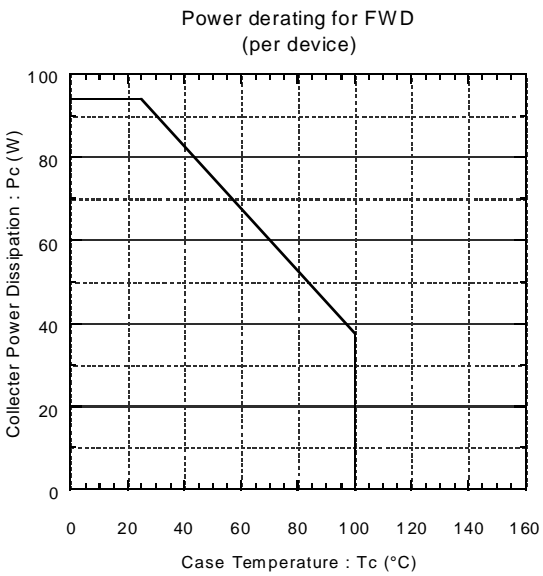
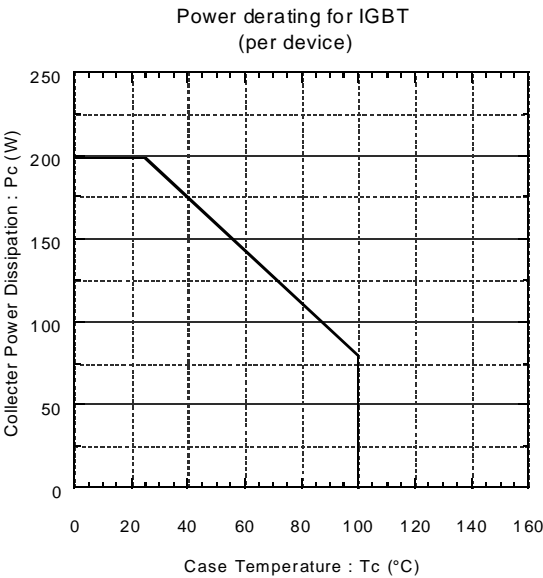
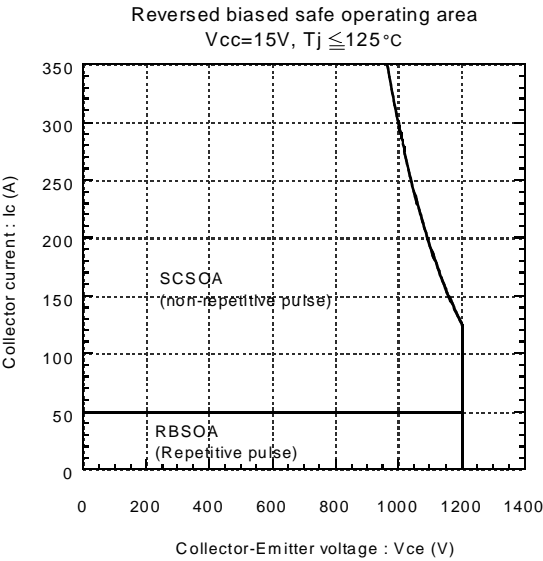
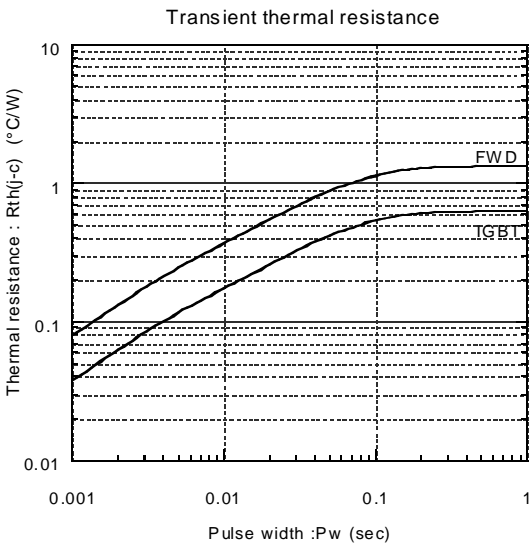
Characteristics

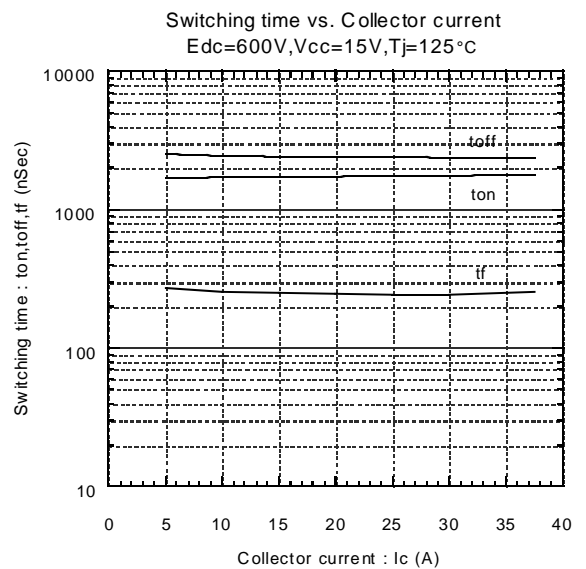
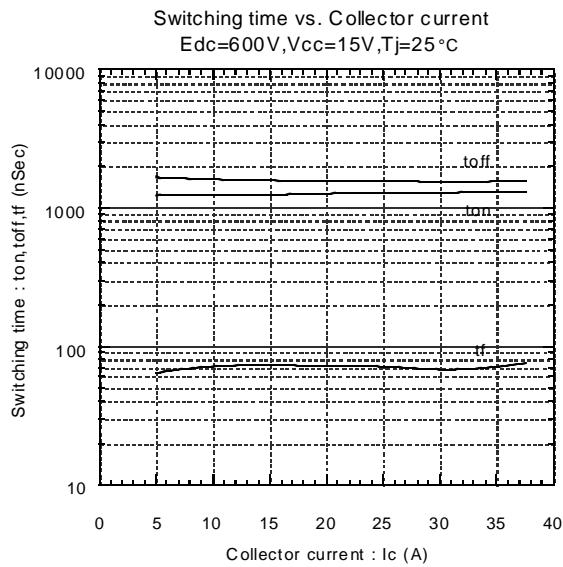
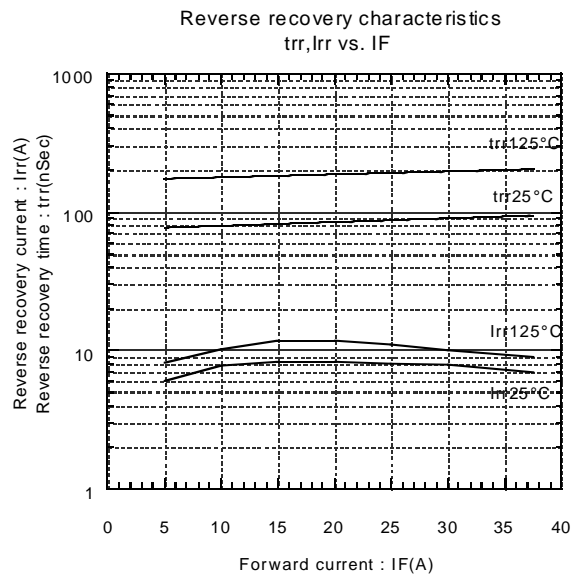
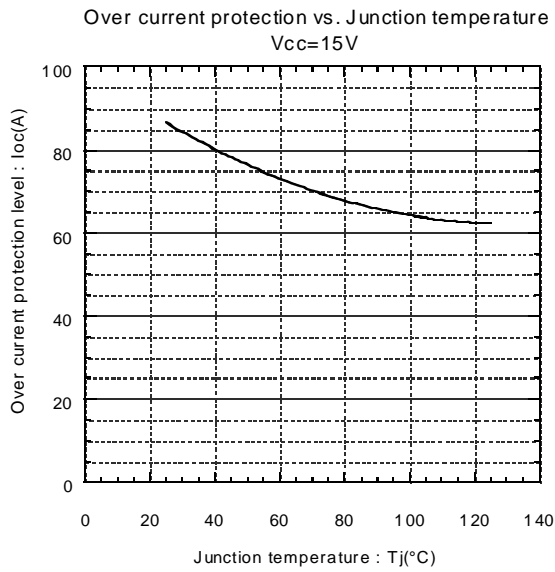
Control circuit characteristics (Representative)



● Main circuit characteristics (Representative)









● Dynamic Brake Characteristics (Representative)

