

### 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
- Higher reliability because of a big decrease in number of parts in built-in control circuit



### Maximum ratings and characteristics

- Absolute maximum ratings(at Tc=25°C unless otherwise specified)

Item	Symbol	Rating		Unit		
		Min.	Max.			
Bus voltage	DC	V <sub>DC</sub>	0	450	V	
	Surge	V <sub>DC(surge)</sub>	0	500	V	
	Short operating	V <sub>sc</sub>	200	400	V	
Collector-Emitter voltage *1	V <sub>CES</sub>	0	600	V		
Inverter	Collector current	DC	I <sub>C</sub>	-	75	A
		1ms	I <sub>CP</sub>	-	150	A
		Duty=75.0% *2	-I <sub>C</sub>	-	75	A
Collector power dissipation	One transistor *3	P <sub>C</sub>	-	198	W	
Forward current diode	Collector current	DC	I <sub>C</sub>	-	50	A
		1ms	I <sub>CP</sub>	-	100	A
	Forward current diode	I <sub>F</sub>	-	50	A	
	Collector power dissipation	One transistor *3	P <sub>C</sub>	-	198	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		
Solder temperature *8	T <sub>sol</sub>	-	260	°C		
Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.)	V <sub>iso</sub>	-	AC2500	V		
Screw torque	Mounting (M5)	-	3.5	N·m		

#### Note

\*1 : V<sub>CES</sub> shall be applied to the input voltage between terminal P and U or ,u or W, N and U or V or W

\*2 : 125°C/FWD R<sub>th(j-c)</sub>/(I<sub>C</sub> x V<sub>F</sub> MAX)=125/0.855/(75 x 2.6) x 100=75.0%

\*3 : P<sub>C</sub>=125°C/IGBT R<sub>th(j-c)</sub>=125/0.63=198W [Inverter]

P<sub>C</sub>=125°C/IGBT R<sub>th(j-c)</sub>=125/0.63=198W [Breake]

\*4 : V<sub>CC</sub> shall be applied to the input voltage between terminal No.4 and 1, 8 and 5, 12 and 9, 14 and 13

\*5 : V<sub>in</sub> shall be applied to the input voltage between terminal No.3 and 1, 7 and 5, 11 and 9, 16,17,18 and 13.

\*6 : V<sub>ALM</sub> shall be applied to the voltage between terminal No.2 and 1, No6 and 5, No10 and 9, No.19 and 13.

\*7 : I<sub>ALM</sub> shall be applied to the input current to terminal No.2,6,10 and 19.

\*8 : Immersion time 10±1sec.

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	ICES	$V_{CE}=600\text{V}$ $V_{in}$ terminal open.	-	-	1.0	mA	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	$I_C=75\text{A}$	Terminal	-	-	2.4	V
				Chip	-	2.0	-	
	Forward voltage of FWD	$V_F$	$-I_C=75\text{A}$	Terminal	-	-	2.6	V
Chip				-	1.6	-		
Brake	Collector current at off signal input	ICES	$V_{CE}=600\text{V}$ $V_{in}$ terminal open.	-	-	1.0	mA	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$	$I_C=50\text{A}$	Terminal	-	-	2.2	V
				Chip	-	1.75	-	
	Forward voltage of Diode	$V_F$	$-I_C=50\text{A}$	Terminal	-	-	3.3	V
Chip				-	1.9	-		
Turn-on time	$t_{on}$	$V_{DC}=300\text{V}, T_j=125^\circ\text{C}$		1.2	-	-	$\mu\text{s}$	
Turn-off time	$t_{off}$	$I_C=75\text{A}$ Fig.1, Fig.6		-	-	3.6		
Reverse recovery time	$t_{rr}$	$V_{DC}=300\text{V}, I_C=75\text{A}$ Fig.1, Fig.6		-	-	0.3		
Maximum Avalanche Energy (A non-repetition)	$P_{AV}$	Internal wiring inductance=50nH Main circuit wiring inductance=54nH		40	-	-	mJ	

## ● 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	$V_Z$	$R_{in}=20\text{k}\Omega$	-	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
Current limit resistor	$R_{ALM}$	Alarm terminal	1425	1500	1575	$\Omega$

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

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Over Current Protection Level of Inverter circuit	$I_{OC}$	$T_j=125^\circ\text{C}$	113	-	-	A
Over Current Protection Level of Brake circuit	$I_{OC}$	$T_j=125^\circ\text{C}$	75	-	-	A
Over Current Protection Delay time	$t_{DOC}$	$T_j=125^\circ\text{C}$	-	5	-	$\mu\text{s}$
SC Protection Delay time	$t_{SC}$	$T_j=125^\circ\text{C}$ Fig.4	-	-	8	$\mu\text{s}$
IGBT Chip Over Heating	$T_{jOH}$	Surface of IGBT chips	150	-	-	$^\circ\text{C}$
Over Heating Protection Hysteresis	$T_{jH}$		-	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 *9	Inverter	IGBT	$R_{th(j-c)}$	-	-	0.63	$^\circ\text{C/W}$
		FWD	$R_{th(j-c)}$	-	-	0.855	$^\circ\text{C/W}$
	Brake	IGBT	$R_{th(j-c)}$	-	-	0.63	$^\circ\text{C/W}$
Case to fin thermal resistance with compound	$R_{th(c-f)}$		-	0.05	-	$^\circ\text{C/W}$	

\*9 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 $\pm$ , 10minuets 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	$V_{DC}$	-	-	400	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	$W_t$	-	270	-	g

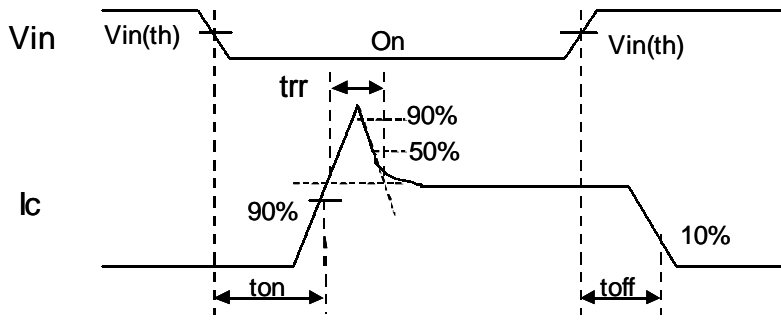
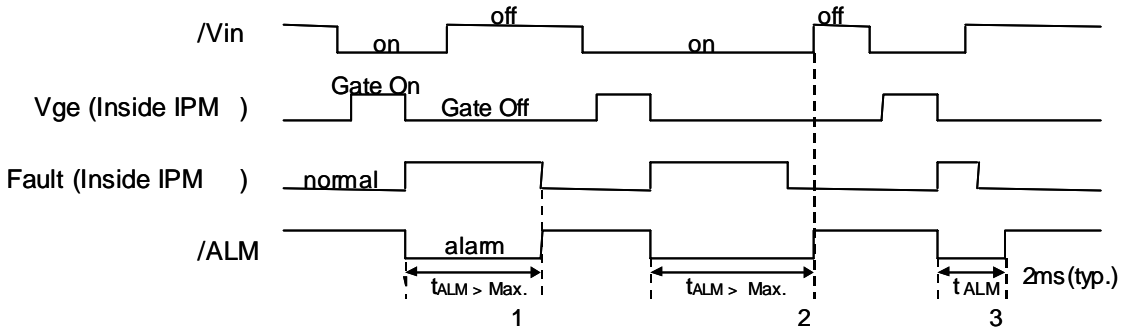


Figure 1. Switching Time Waveform Definitions



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

Figure 2. Input/Output Timing Diagram

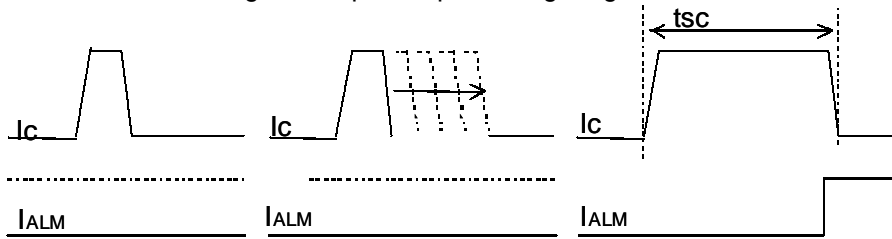


Figure.4 Definition of tsc

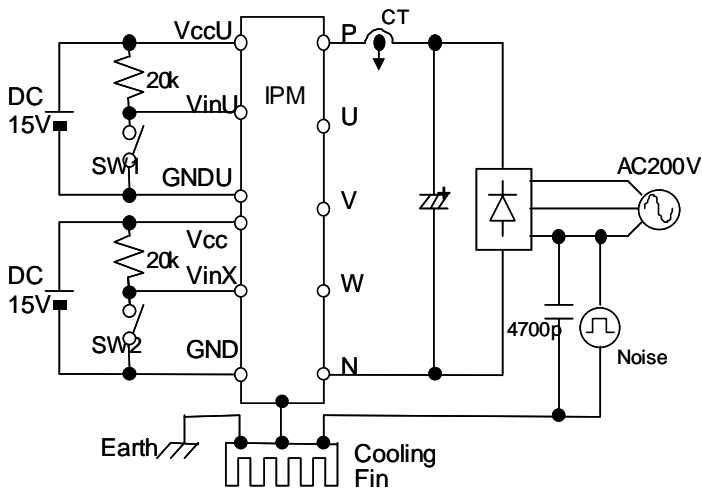


Figure 5. Noise Test Circuit

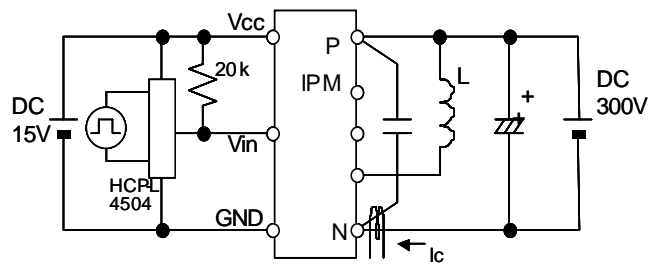


Figure 6. Switching Characteristics Test Circuit

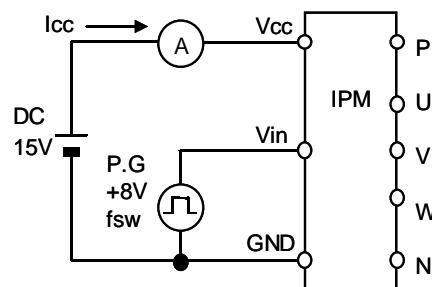
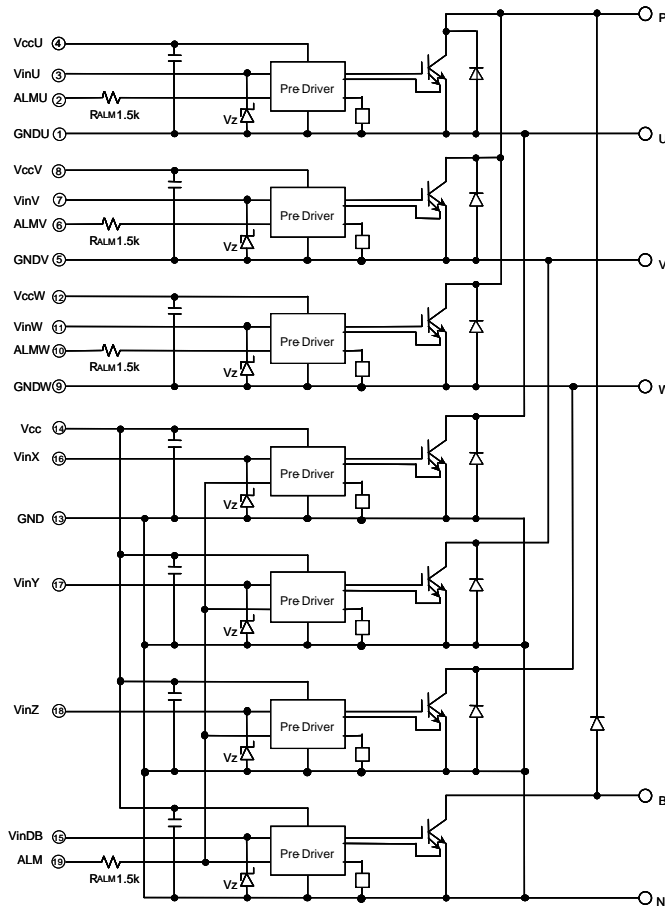


Figure 7. Icc Test Circuit

Block diagram

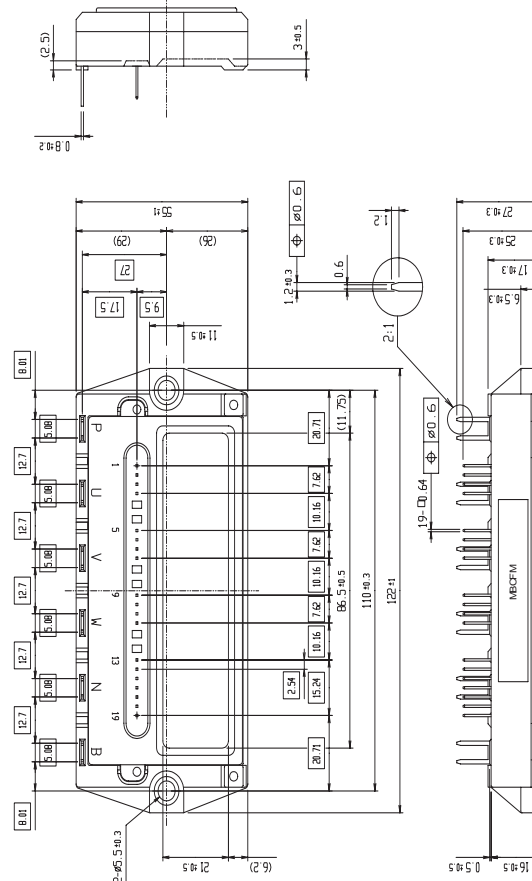


Pre-drivers include following functions

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

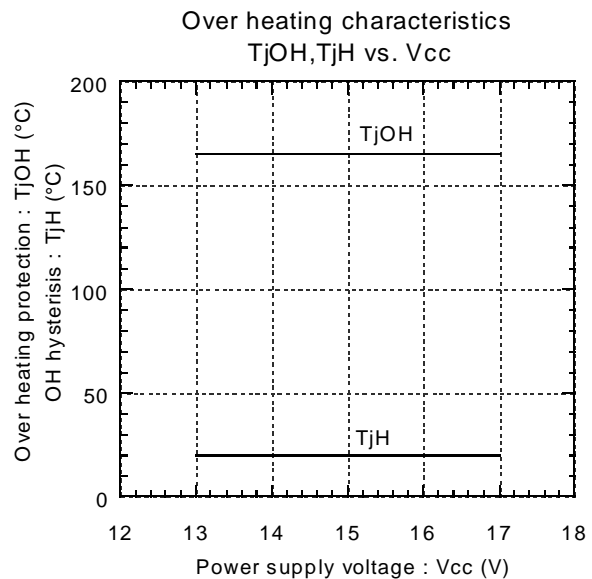
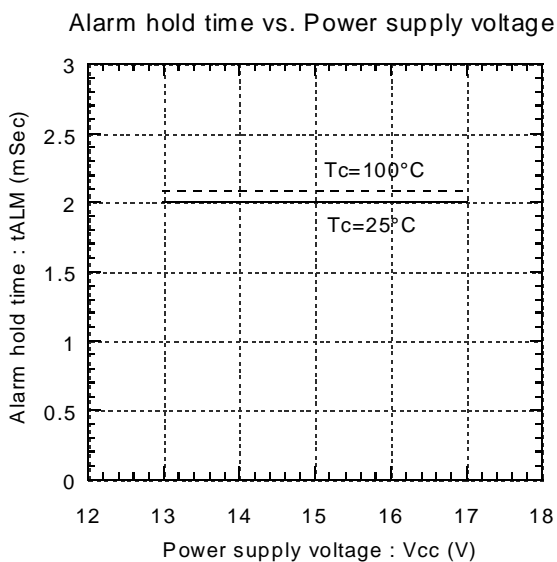
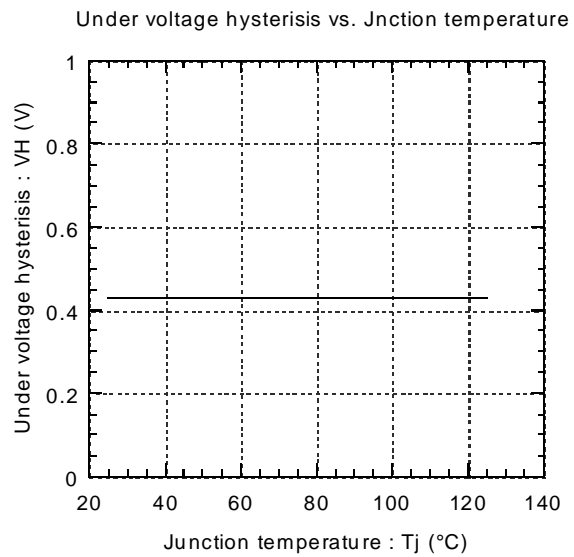
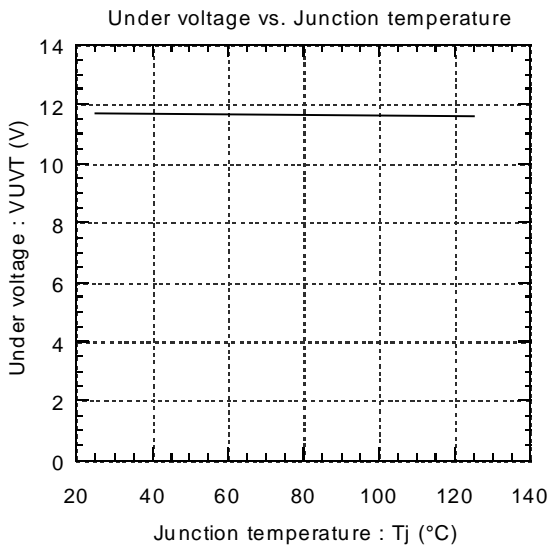
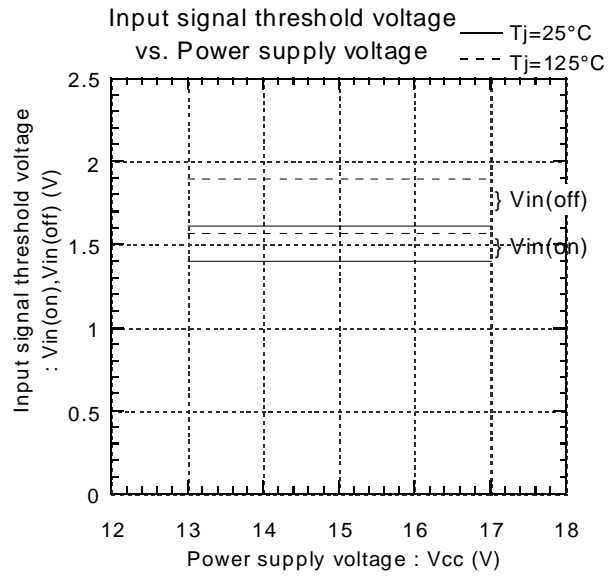
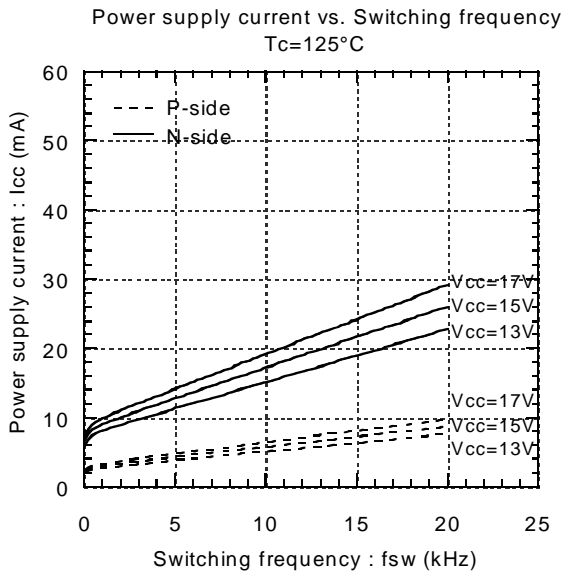
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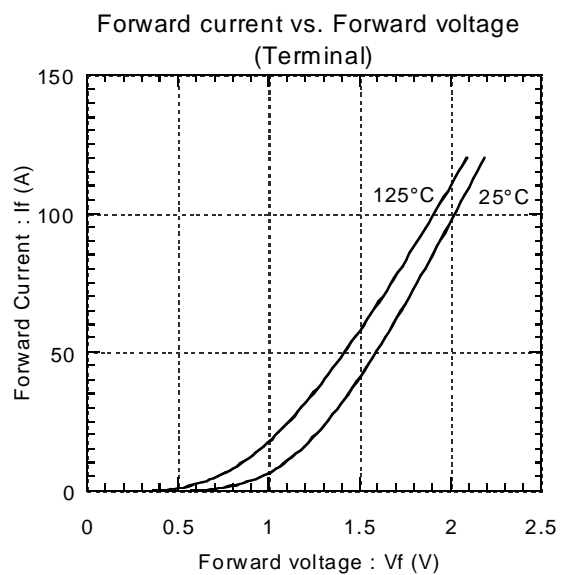
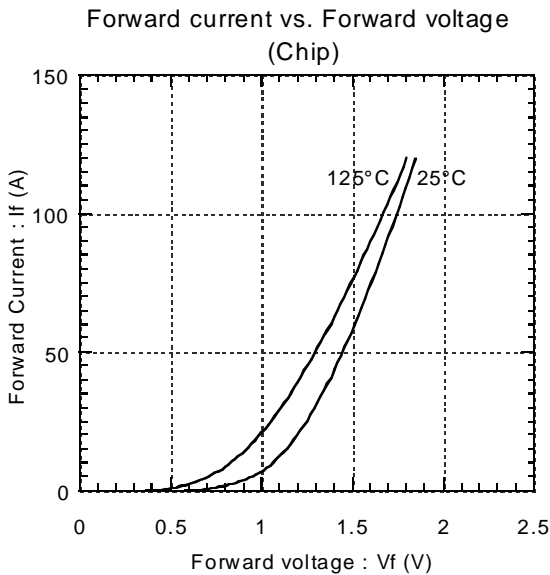
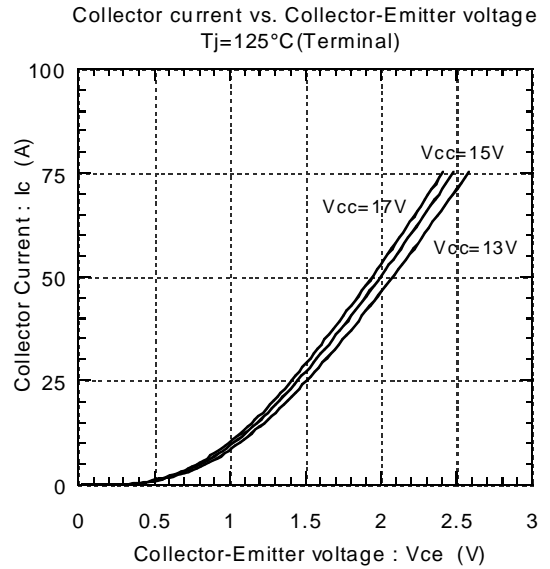
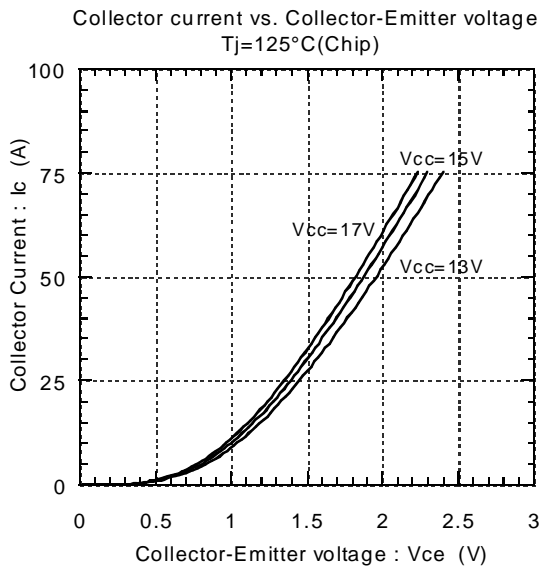
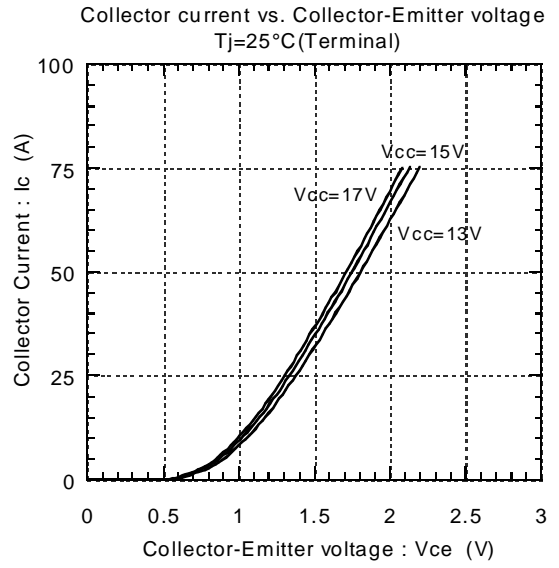
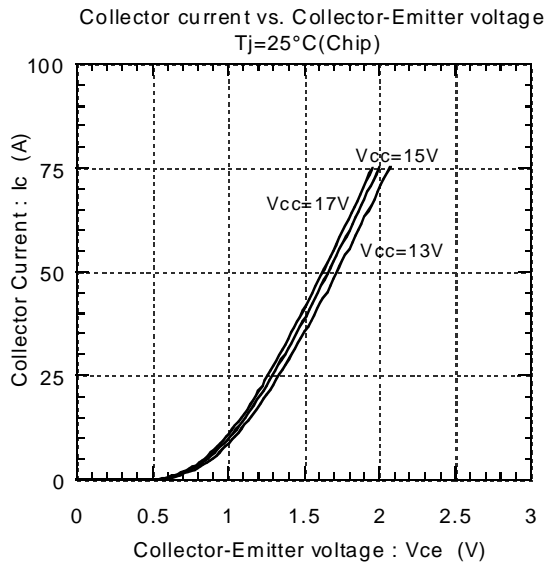
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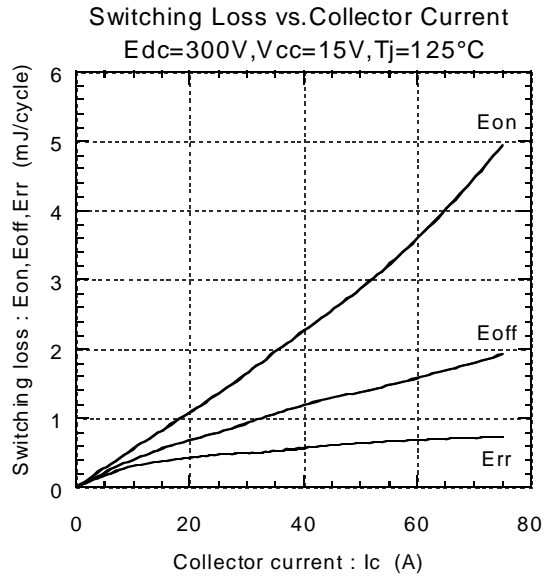
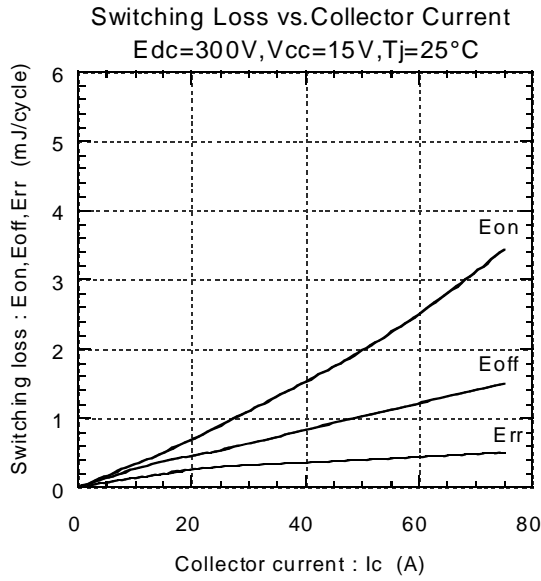
Characteristics

Control circuit characteristics (Representative)

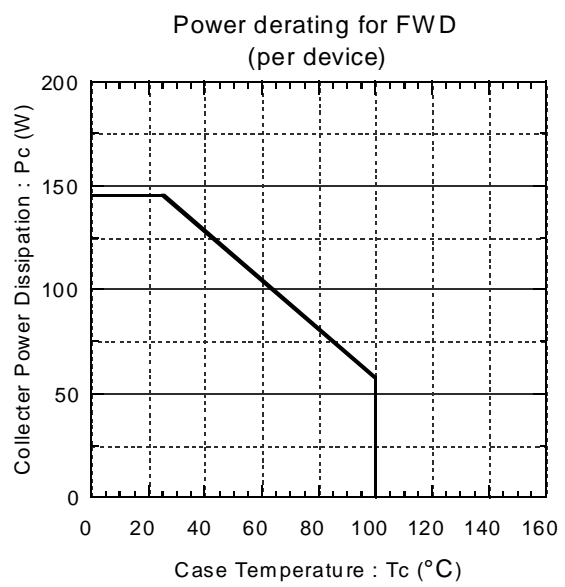
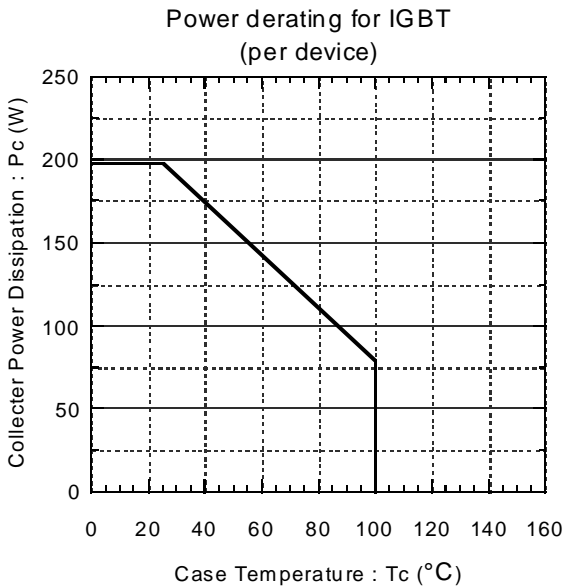
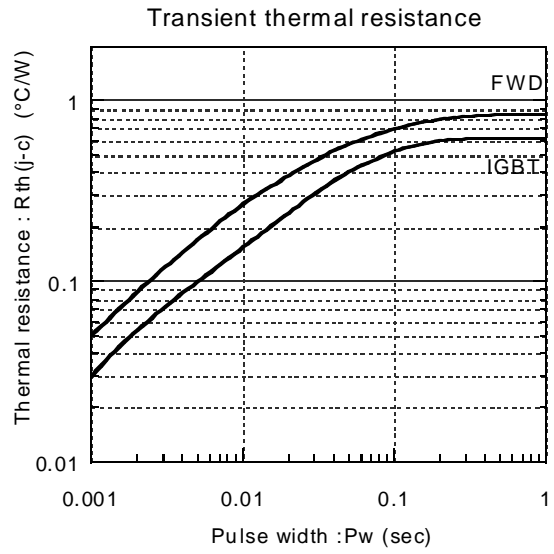
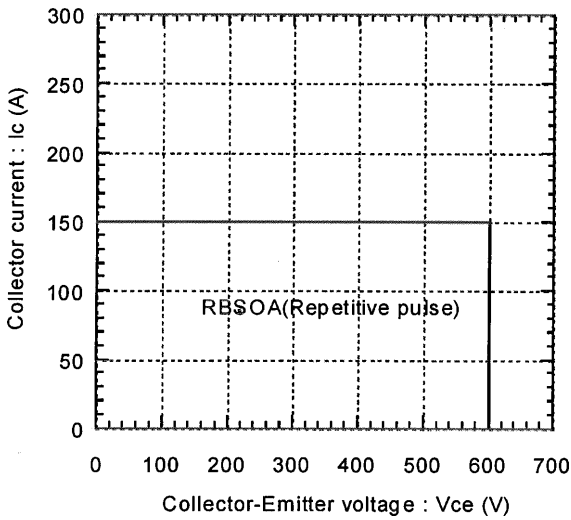


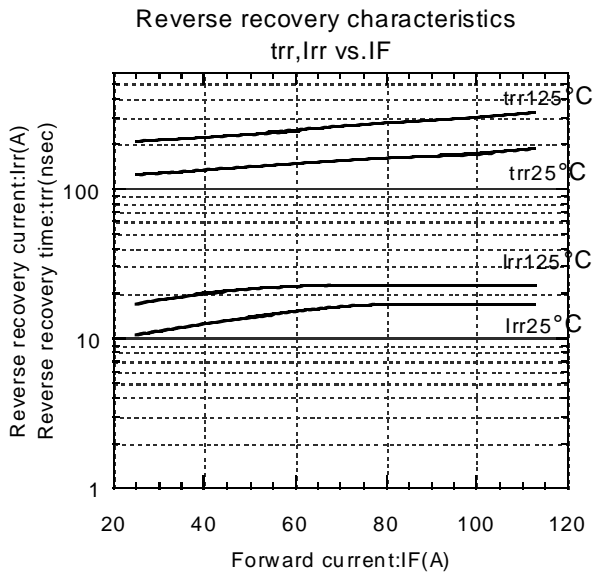
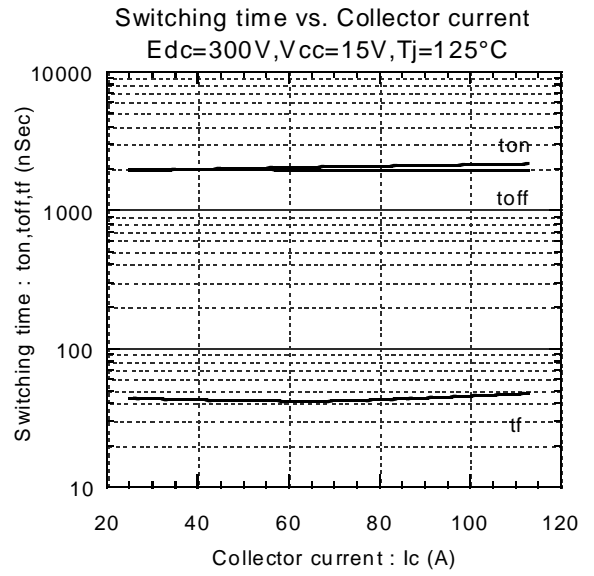
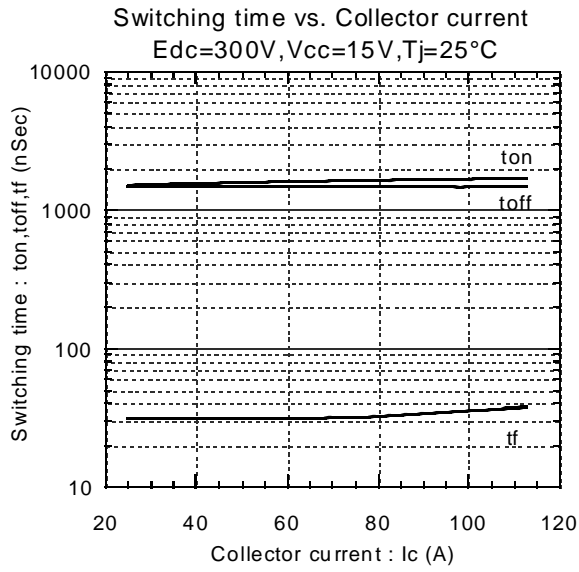
● Main circuit characteristics (Representative)





Reversed biased safe operating area  
 $V_{cc}=15V, T_j \le 125^\circ C$



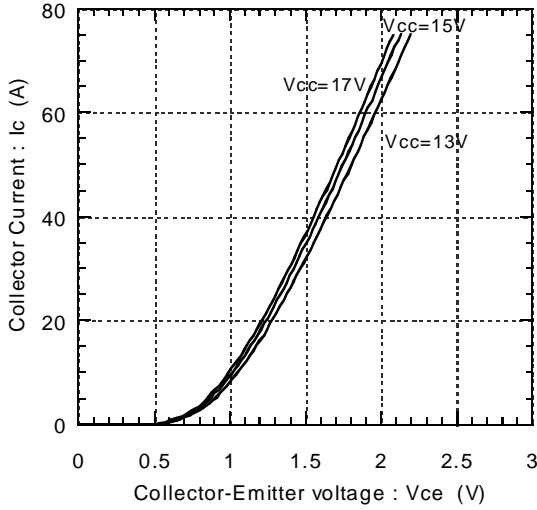




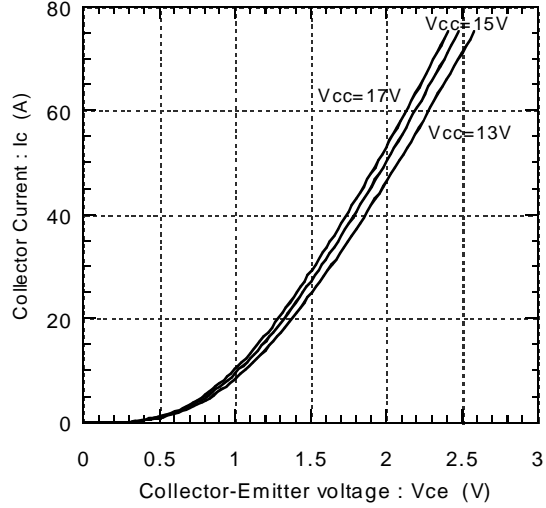
Characteristics

Dynamic Brake Characteristics (Representative)

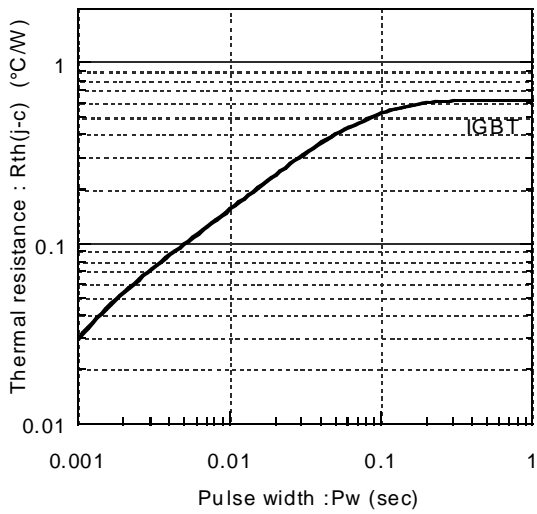
Collector current vs. Collector-Emitter voltage  
T<sub>j</sub>=25°C



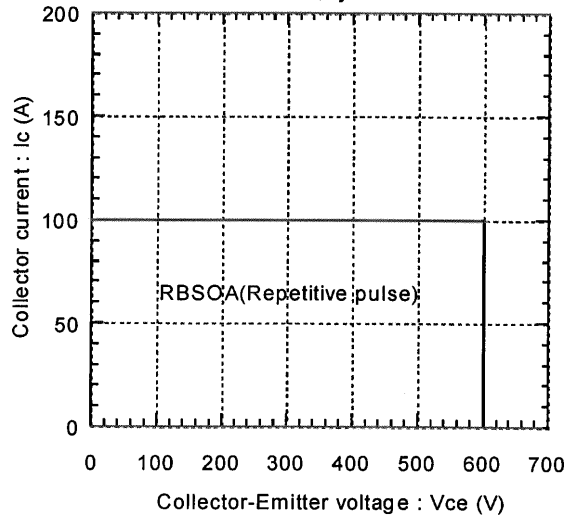
Collector current vs. Collector-Emitter voltage  
T<sub>j</sub>=125°C



Transient thermal resistance



Reversed biased safe operating area  
V<sub>cc</sub>=15V, T<sub>j</sub> ≤ 125°C



Power derating for IGBT  
(per device)

