

IGBT IPM R-series 1200V class

1200V / 50A 6 in one-package

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 Tc=25°C unless otherwise specified)

Item			Symbol	Rating		Unit
				Min.	Max.	
Bus voltage	DC		V _{DC}	0	900	V
	Surge		V _{DC(surge)}	0	1000	V
	Short operating		V _{SC}	200	800	V
Collector-Emitter voltage *1			V _{CES}	0	1200	V
Inverter	Collector current	DC	I _C	-	50	A
		1ms	I _{CP}	-	100	A
		Duty=98.0% *2	-I _C	-	50	A
	Collector power dissipation	One transistor *3	P _C	-	357	W
Supply voltage of Pre-Driver *4			V _{CC}	-0.5	20	V
Input signal voltage *5			V _{in}	-0.5	V _{CC} +0.5	V
Input signal current			I _{in}	-	3	mA
Alarm signal voltage *6			V _{ALM}	-0.5	V _{CC}	V
Alarm signal current *7			I _{ALM}	-	20	mA
Junction temperature			T _j	-	150	°C
Operating case temperature			T _{opr}	-20	100	°C
Storage temperature			T _{stg}	-40	125	°C
Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.)			V _{iso}	-	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 ,u or W, N and U or V or W

*2 : $125^{\circ}\text{C}/\text{FWD } R_{\text{th(j-c)}}/(I_{\text{C}} \times V_{\text{F MAX}})=125/0.85/(50 \times 3.0) \times 100=98.0\%$

*3 : $P_{\text{C}}=125^{\circ}\text{C}/\text{IGBT } R_{\text{th(j-c)}}=125/0.35=357\text{W}$ [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, 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 Tc=Tj=25°C, Vcc=15V unless otherwise specified.)

● **Main circuit**

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	
Inverter	Collector current at off signal input	ICES	VCE=1200V Vin terminal open.	-	-	1.0	mA	
	Collector-Emitter saturation voltage	VCE(sat)	Ic=50A	Terminal	-	-	2.6	V
				Chip	-	1.9	-	
	Forward voltage of FWD	VF	-Ic=50A	Terminal	-	-	3.0	V
				Chip	-	2.3	-	
Turn-on time		ton	VDC=600V,Tj=125°C	1.2	-	-	μs	
Turn-off time		toff	IC=50A Fig.1, Fig.6	-	-	3.6		
Reverse recovery time		trr	VDC=600V, IF=50A Fig.1, Fig.6	-	-	0.3		

● **Control circuit**

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply current of P-line side pre-driver(one unit)	Iccp	Switching Frequency : 0 to 15kHz Tc=-20 to 125°C Fig.7	-	-	18	mA
Supply current of N-line side pre-driver	ICCN		-	-	65	mA
Input signal threshold voltage (on/off)	Vin(th)	ON	1.00	1.35	1.70	V
		OFF	1.25	1.60	1.95	V
Input zener voltage	VZ	Rin=20k ohm	-	8.0	-	V
Alarm signal hold time	tALM	Tc=-20°C Fig.2	1.1	-	-	ms
		Tc=25°C Fig.2	-	2.0	-	ms
		Tc=125°C Fig.2	-	-	4.0	ms
Limiting Resistor for Alarm	RALM		1425	1500	1575	ohm

● **Protection Section (Vcc=15V)**

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Over Current Protection Level of Inverter circuit	Ioc	Tj=125°C	75	-	-	A
Over Current Protection Delay time	tDOC	Tj=125°C	-	10	-	μs
SC Protection Delay time	tsc	Tj=125°C Fig.4	-	-	12	μs
IGBT Chip Over Heating Protection Temperature Level	TjOH	Surface of IGBT chips	150		-	°C
Over Heating Protection Hysteresis	TjH		-	20	-	°C
Over Heating Protection Protection Temperature Level	TcOH	VDC=0V, Ic=0A Case Temperature	110	-	125	°C
Over Heating Protection Hysteresis	TcH		-	20	-	°C
Under Voltage Protection Level	VUV		11.0	-	12.5	V
Under Voltage Protection Hysteresis	VH		0.2	0.5	-	V

● **Thermal characteristics(Tc=25°C)**

Item			Symbol	Min.	Typ.	Max.	Unit
Junction to Case thermal resistance *8	Inverter	IGBT	Rth(j-c)	-	-	0.35	°C/W
		FWD	Rth(j-c)	-	-	0.85	°C/W
Case to fin thermal resistance with compound			Rth(c-f)	-	0.05		-°C/W

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

● **Noise Immunity (VDC=300V, Vcc=15V, Test Circuit Fig.5)**

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

● **Recommendable value**

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

● **Weight**

Item	Symbol	Min.	Typ.	Max.	Unit
Weight	Wt	-	450	-	g

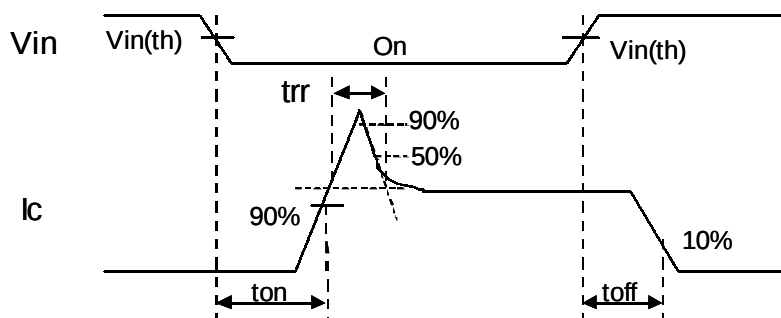
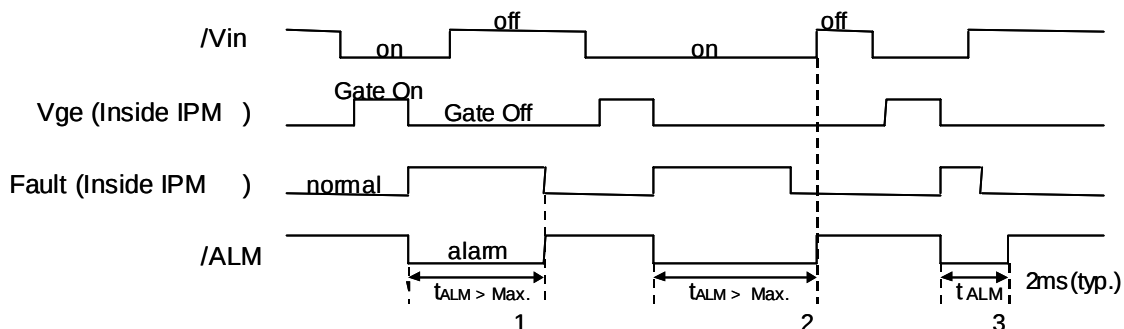


Figure 1. Switching Time Waveform Definitions



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

Figure 2. Input/Output Timing Diagram

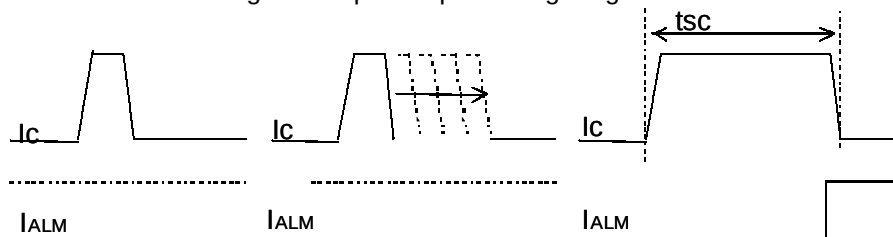


Figure.4 Definition of tsc

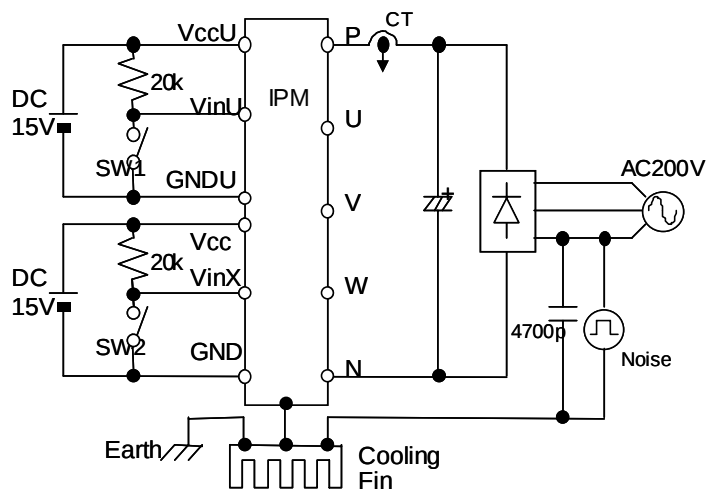


Figure 5. Noise Test Circuit

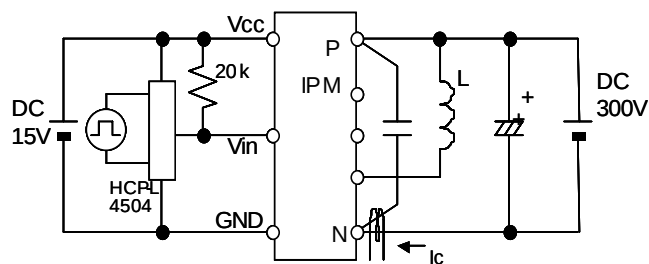


Figure 6. Switching Characteristics Test Circuit

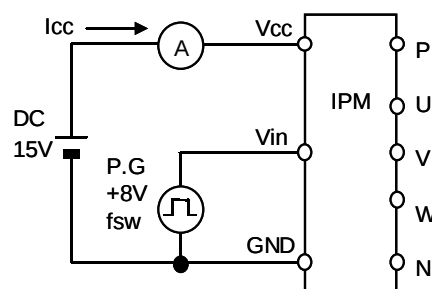
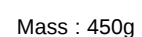
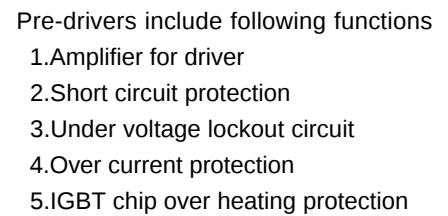
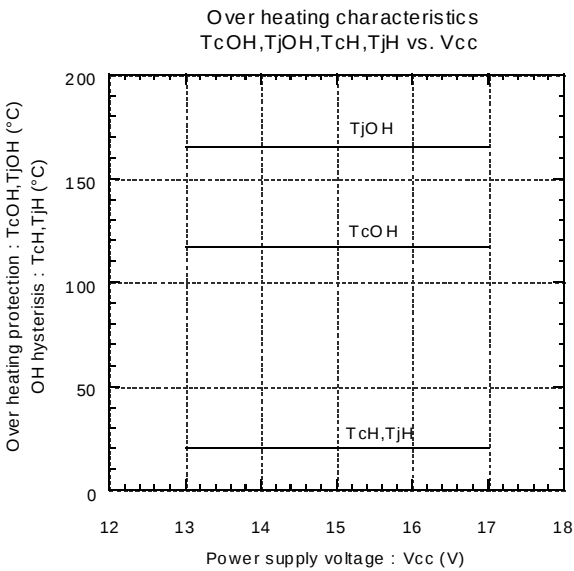
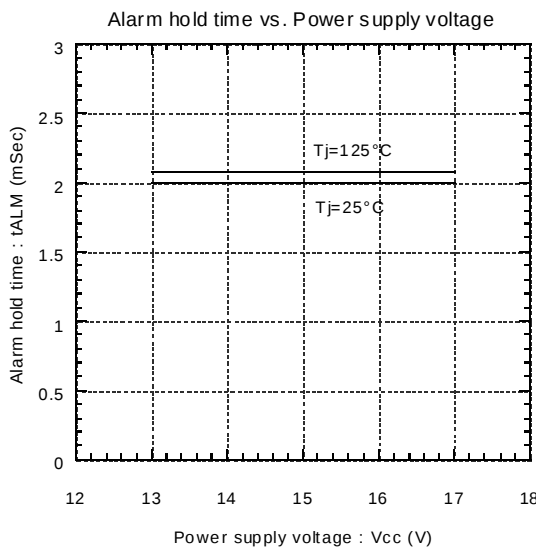
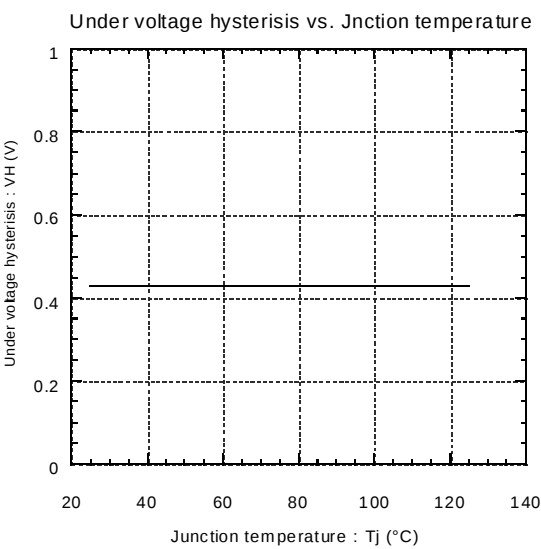
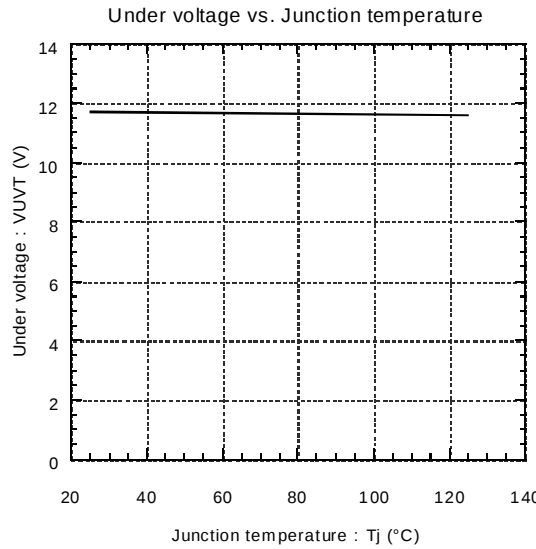
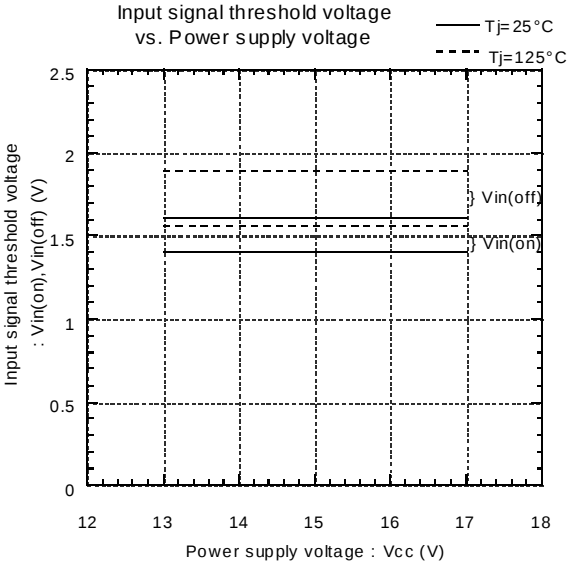
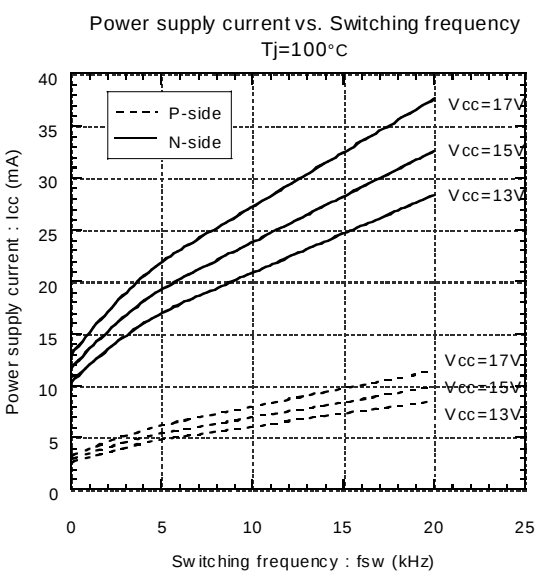


Figure 7. Icc Test Circuit



Characteristics

Control circuit characteristics (Representative)



● Main circuit characteristics (Representative)

