

### IGBT-IPM R series

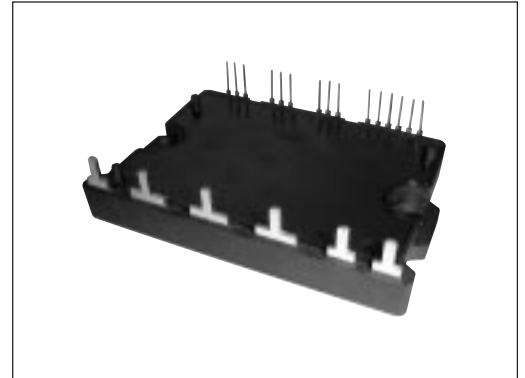
600V / 20A / 6 in one-package

#### ■ Features

- 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

#### ■ Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- UPS (Uninterruptible power supply)



#### ■ Maximum ratings and characteristics

##### ● Absolute maximum ratings (T<sub>c</sub>=25°C unless otherwise specified)

Item	Symbol	Rating	Unit
DC bus voltage	V <sub>DC</sub>	450	V
DC bus voltage (Surge)	V <sub>DC (surge)</sub>	500	V
DC bus voltage (Short operating)	V <sub>SC</sub>	400	V
Collector-Emitter voltage	V <sub>CES</sub>	600	V
Collector current	DC	I <sub>c</sub>	20
	1ms	I <sub>CP</sub>	40
	Duty=49.6%	-I <sub>c</sub>	20
Collector power dissipation	One transistor	P <sub>c</sub>	63
Junction temperature	T <sub>j</sub>	150	°C
Input voltage of power supply for pre-driver	V <sub>CC</sub>	-0.3 to 20	V
Input signal voltage	V <sub>in</sub>	V <sub>Z</sub>	V
Input signal current	I <sub>in</sub>	1	mA
Alarm signal voltage	V <sub>ALM</sub>	V <sub>CC</sub>	V
Alarm signal current	I <sub>ALM</sub>	15	mA
Storage temperature	T <sub>stg</sub>	-40 to 125	°C
Operating case temperature	T <sub>cop</sub>	-20 to 100	°C
Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.)	V <sub>iso</sub>	AC 2500	V
Screw torque	Mounting (M4)	2.0	N • m

##### ● Electrical characteristics of power circuit (T<sub>c</sub>=T<sub>j</sub>=25°C, V<sub>CC</sub>=15V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Collector current at off signal input	I <sub>CES</sub>	V <sub>CE</sub> =600V, V <sub>in</sub> open	-	-	1.0	mA
Collector-Emitter saturation voltage	V <sub>CE (sat)</sub>	I <sub>c</sub> =20A	-	-	2.7	V
Forward voltage of FWD	V <sub>F</sub>	-I <sub>c</sub> =20A	-	-	3.5	V

● Electrical characteristics of control circuit (T<sub>c</sub>=T<sub>j</sub>=25°C, V<sub>cc</sub>=15V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply current of P-line pre-driver (one unit)	I <sub>CCP</sub>	V <sub>in</sub> =H	–	2.0	5.0	mA
Power supply current of N-line pre-driver	I <sub>CCN</sub>	V <sub>in</sub> =H	–	4.0	10.0	mA
Input signal threshold voltage	V <sub>in (th)</sub>	Turn-on	1.00	1.35	1.70	V
		Turn-off	1.25	1.60	1.95	V
Input zener voltage	V <sub>Z</sub>	R <sub>in</sub> =20kΩ	–	8.0	–	V
IGBT chips overheat protection temperature level	T <sub>joH</sub>	Surface of IGBT	150	–	–	°C
Hysteresis	T <sub>jH</sub>		–	20	–	°C
Collector current protection level	I <sub>oc</sub>	N-side, (N1-N2 open)	30	37	44	A
	V <sub>oc</sub>	Between N1 and N2	190	200	210	mV
OC detecting resistance value	R <sub>oc</sub>		–	5.4	–	mΩ
Protection delay time	t <sub>DOC</sub>	T <sub>j</sub> =25°C Fig. 1, Fig. 2	–	5.0	7.0	μs
Undervoltage protection level	V <sub>UV</sub>		11.0	–	12.5	V
Hysteresis	V <sub>H</sub>		0.2	–	0.8	V
Alarm signal hold time	t <sub>ALM</sub>		1.0	2.0	–	ms

● Switching characteristics (T<sub>c</sub>=T<sub>j</sub>=25°C, V<sub>cc</sub>=15V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Switching time (IGBT) See Fig. 3	t <sub>on</sub>	I <sub>c</sub> =20A, V <sub>DC</sub> =300V	0.5	–	–	μs
	t <sub>off</sub>	Inductive-Load	–	–	3.5	μs
Switching time (FWD)	t <sub>rr</sub>		–	–	0.5	μs

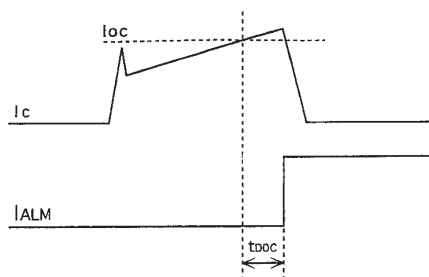


Fig.1 Definition of OC delay time

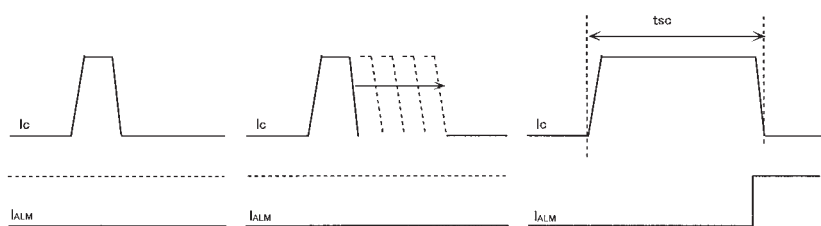


Fig.2 Definition of tsc

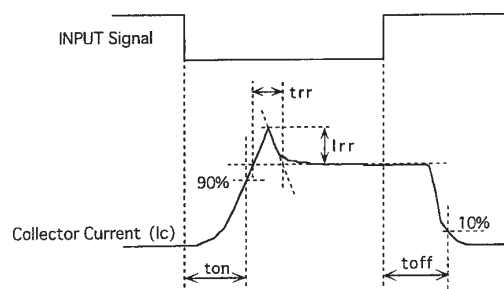


Fig.3 Definition of switching time

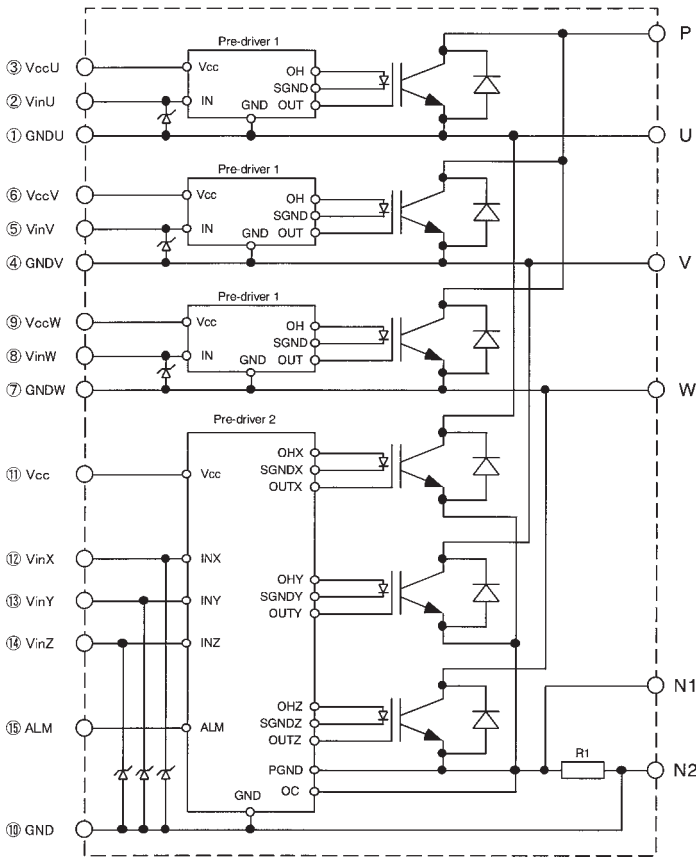
● Thermal characteristics (T<sub>c</sub>=T<sub>j</sub>=25°C, V<sub>cc</sub>=15V)

Item	Symbol	Min.	Typ.	Max.	Unit	
Junction to case thermal resistance	IGBT	R <sub>th (j-c)</sub>	–	–	2.0	°C/W
	FWD	R <sub>th (j-c)</sub>	–	–	3.6	°C/W
Case to fin thermal resistance with compound	R <sub>th (c-f)</sub>	–	0.05	–	°C/W	

● Recommendable value

Item	Symbol	Min.	Typ.	Max.	Unit
DC bus voltage	V <sub>DC</sub>	200	–	400	V
Operating power supply voltage range of pre-drive	V <sub>CC</sub>	13.5	15	16.5	V
Switching frequency	f <sub>sw</sub>	1	–	20	kHz
Flatness of heat sink	–	–100	–	100	μm
Mounting screw torque (M4)	–	1.3	–	1.7	N • m

■ Block diagram



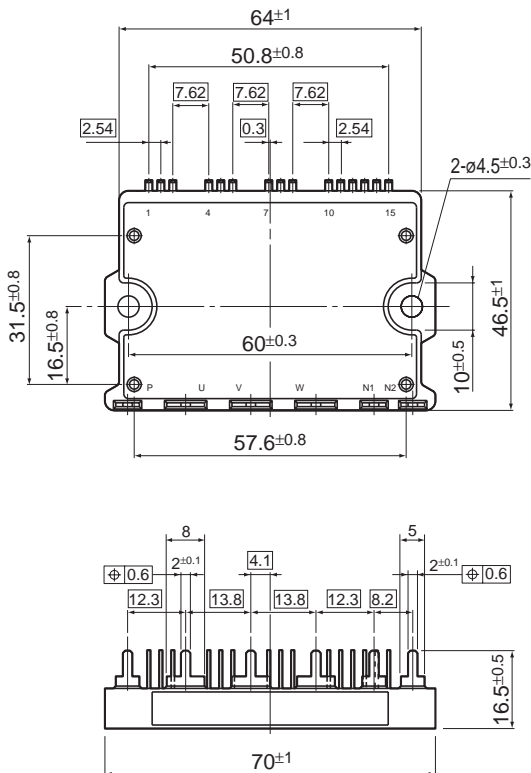
Pre-driver 1 includes following functions. (P-side)

- Amplifier for drive
- Power supply undervoltage protection
- IGBT chip overheating protection

Pre-driver 2 includes following functions. (N-side)

- Amplifier for drive
- Power supply undervoltage protection
- IGBT chip overheating protection
- Overcurrent protection
- Alarm signal output

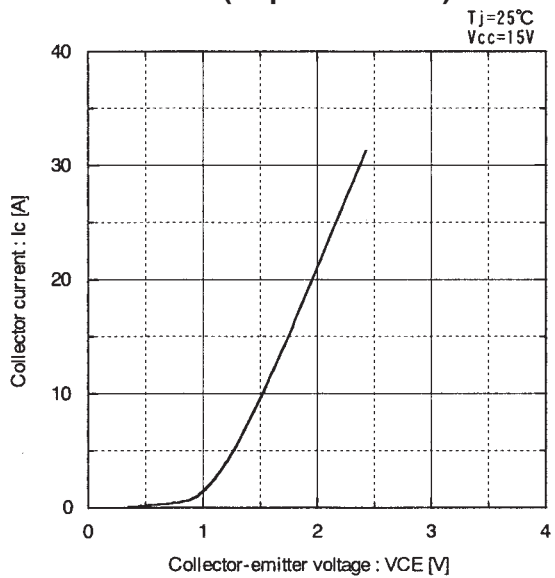
■ Outline drawings, mm



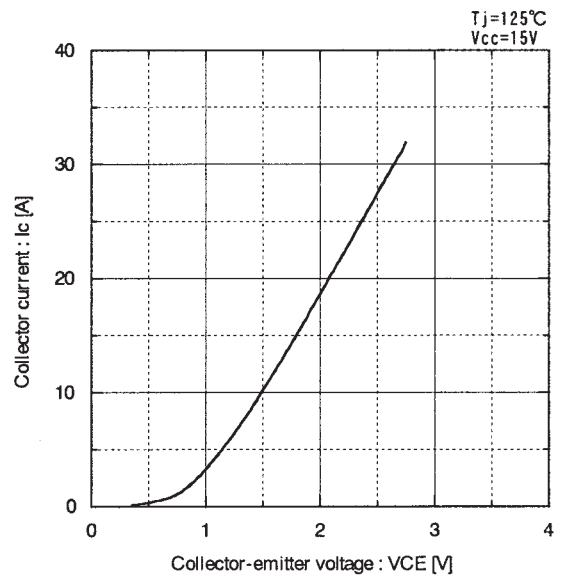
□ Shows theory dimensions

Mass: 50g

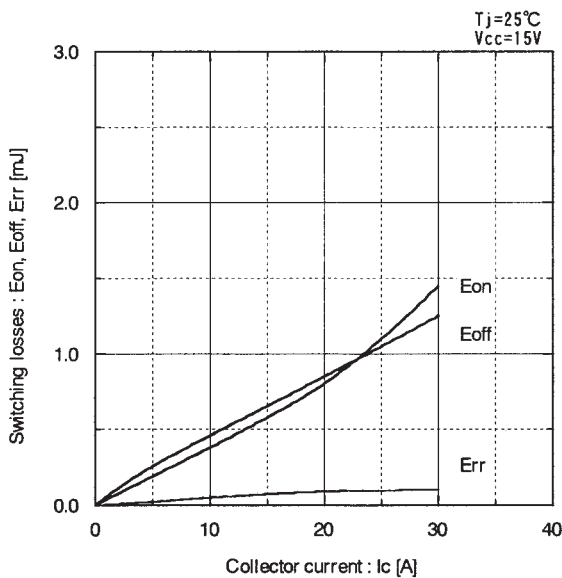
■ Characteristics (Representative)



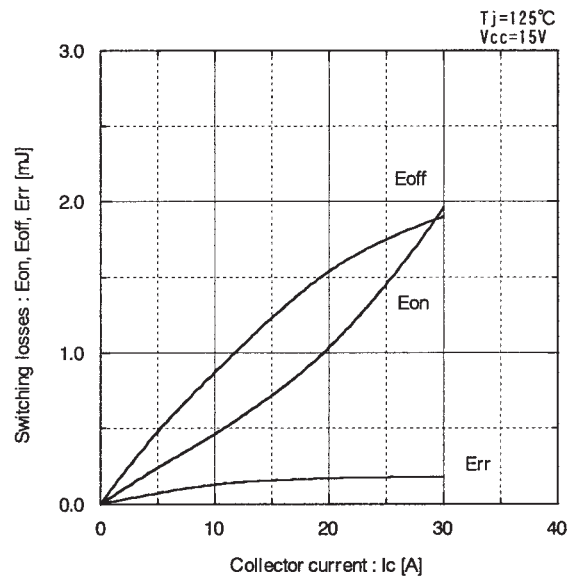
Collector current vs. Collector-emitter voltage



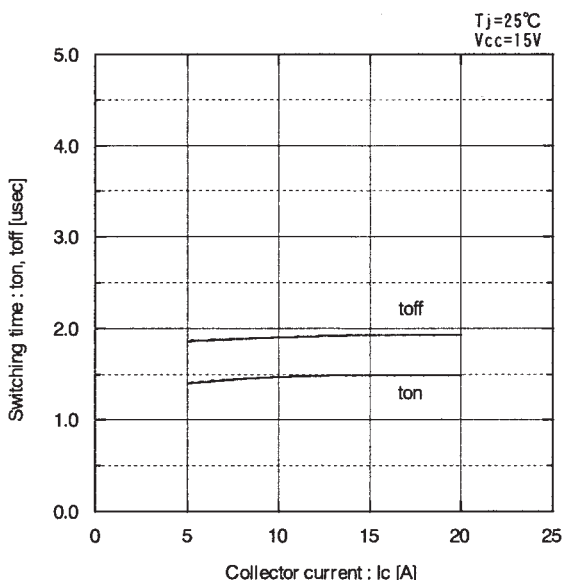
Collector current vs. Collector-emitter voltage



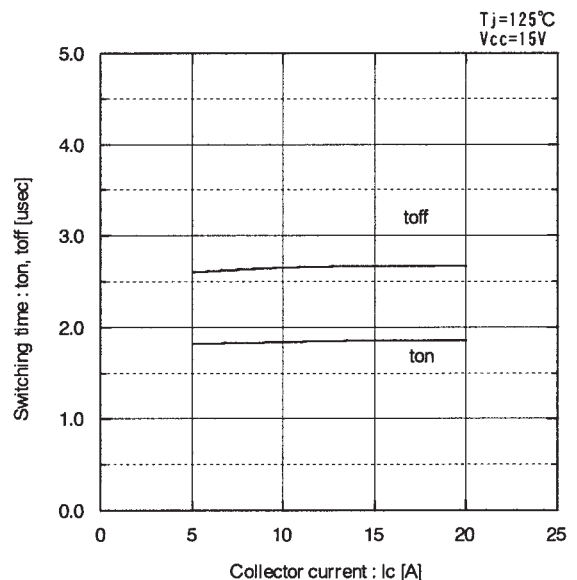
Switching losses vs. Collector current



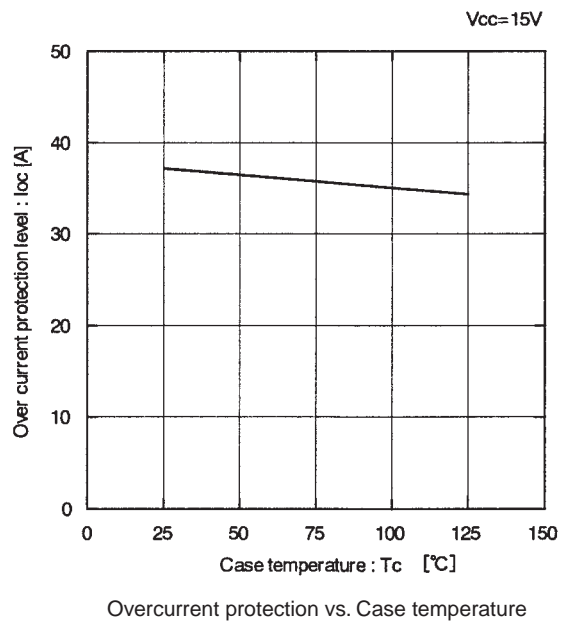
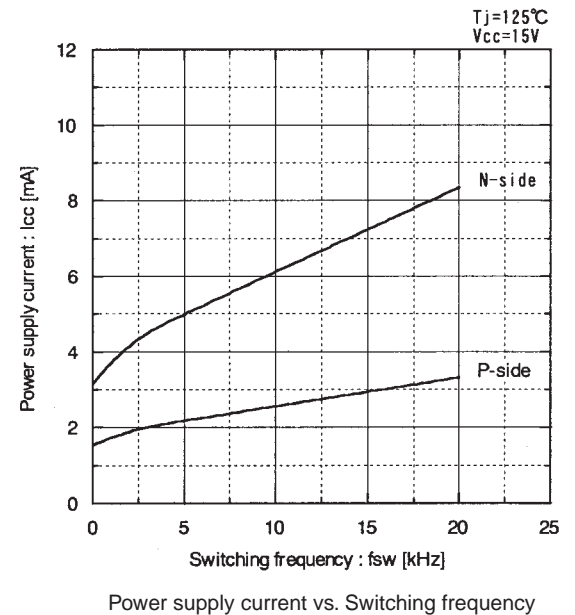
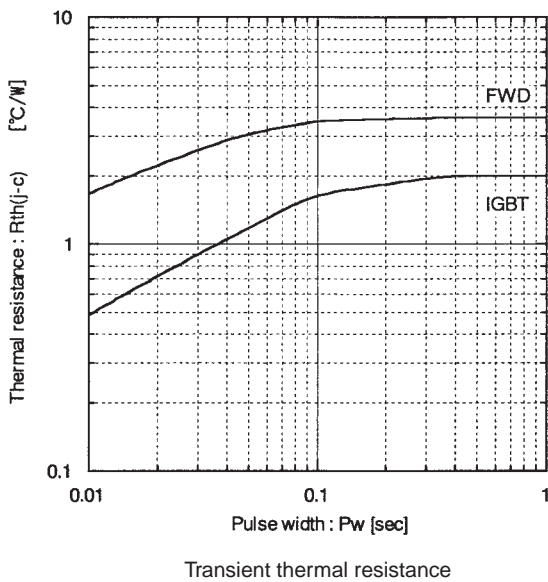
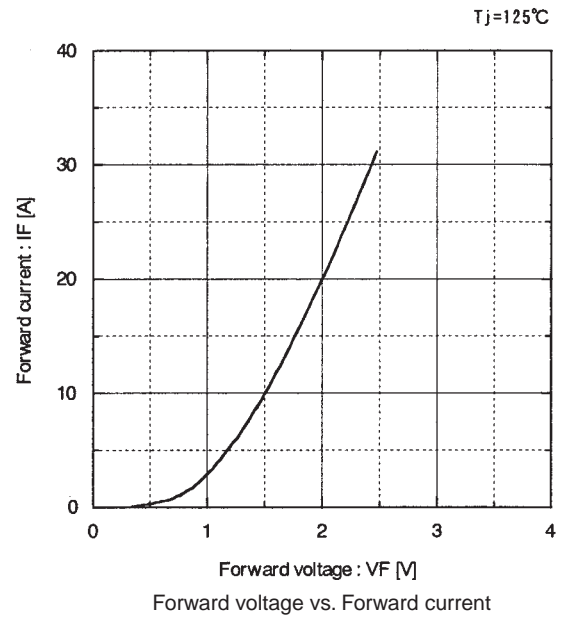
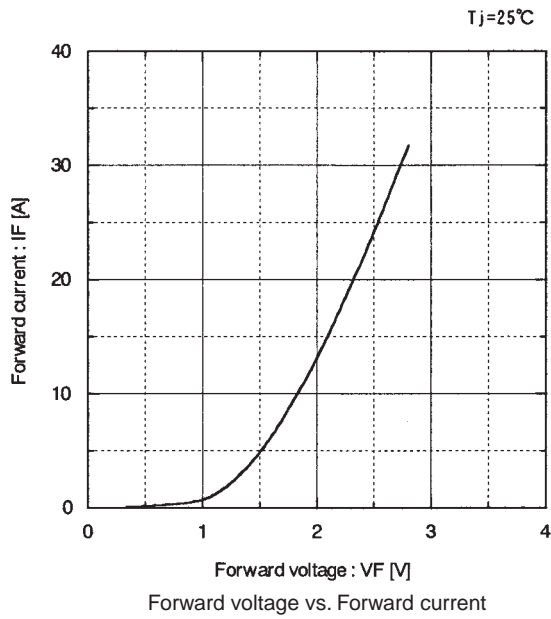
Switching losses vs. Collector current



Switching time vs. Collector current



Switching time vs. Collector current



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