

### IGBT-IPM R series

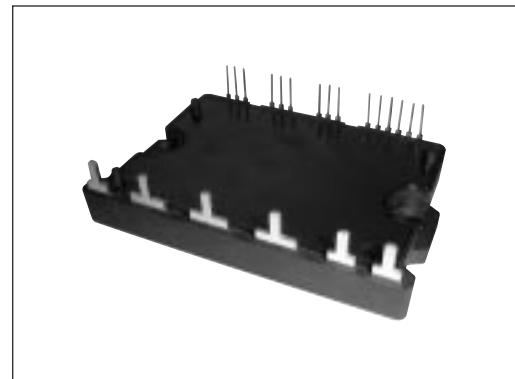
600V / 20A / 6 in one-package

#### ■ 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 (Tc=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</sub> (surge)	500	V
DC bus voltage (Short operating)	V <sub>sc</sub>	400	V
Collector-Emitter voltage	V <sub>CES</sub>	600	V
Collector current	I <sub>c</sub>	20	A
	I <sub>CP</sub>	40	A
	-I <sub>c</sub>	20	A
Collector power dissipation	P <sub>c</sub>	63	W
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 singal 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 (Tc=Tj=25°C, Vcc=15V)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Collector current at off signal input	I <sub>CES</sub>	V <sub>CE</sub> =600V, Vin open	-	-	1.0	mA
Collector-Emitter saturation voltage	V <sub>CE</sub> (sat)	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 ( $T_c=T_j=25^\circ C$ ,  $V_{cc}=15V$ )

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply current of P-line pre-driver (one unit)	I <sub>CCP</sub>	$V_{in}=H$	—	2.0	5.0	mA
Power supply current of N-line pre-driver	I <sub>CCN</sub>	$V_{in}=H$	—	4.0	10.0	mA
Input signal threshold voltage	$V_{in}$ (th)	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>	$R_{in}=20k\Omega$	—	8.0	—	V
IGBT chips overheat protection temperature level	T <sub>j0H</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>	$T_j=25^\circ C$ 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 ( $T_c=T_j=25^\circ C$ ,  $V_{cc}=15V$ )

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

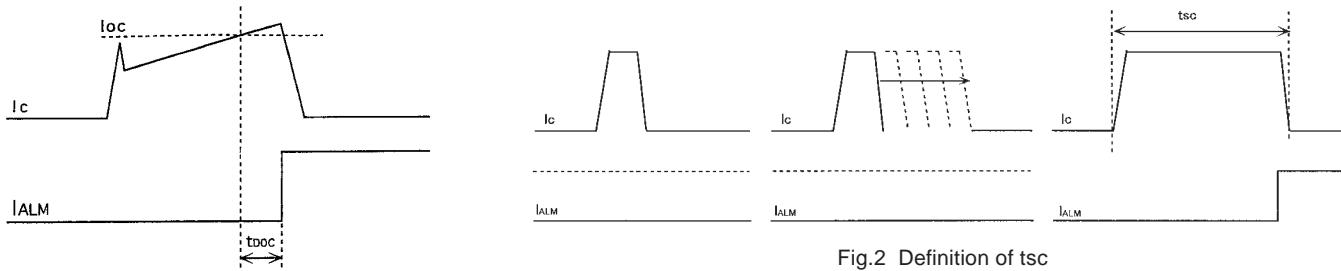


Fig.1 Definition of OC delay time

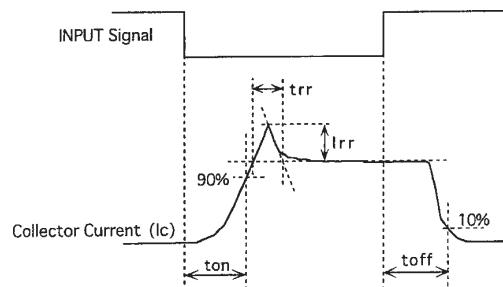


Fig.3 Definition of switching time

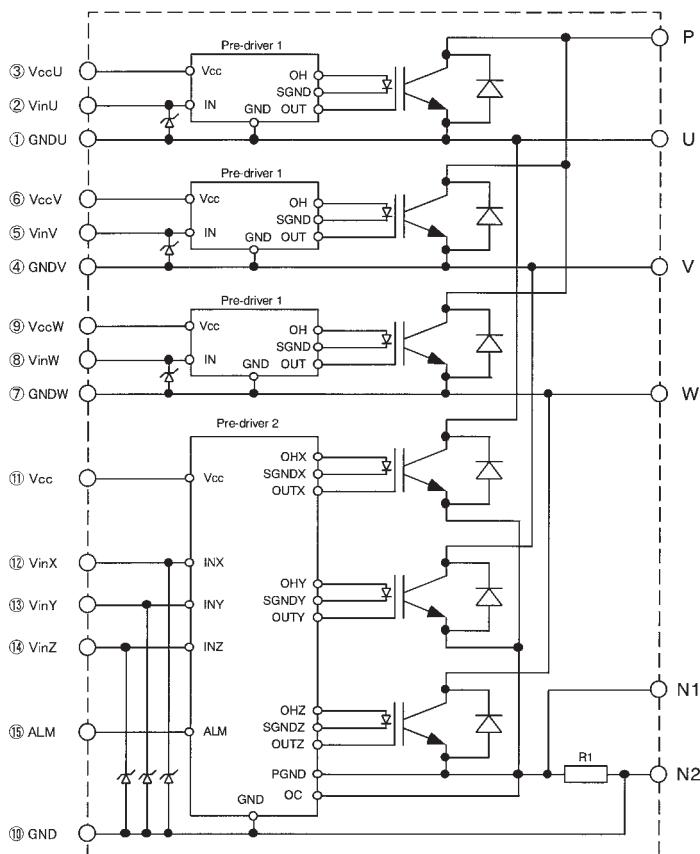
● Thermal characteristics ( $T_c=T_j=25^\circ C$ ,  $V_{cc}=15V$ )

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



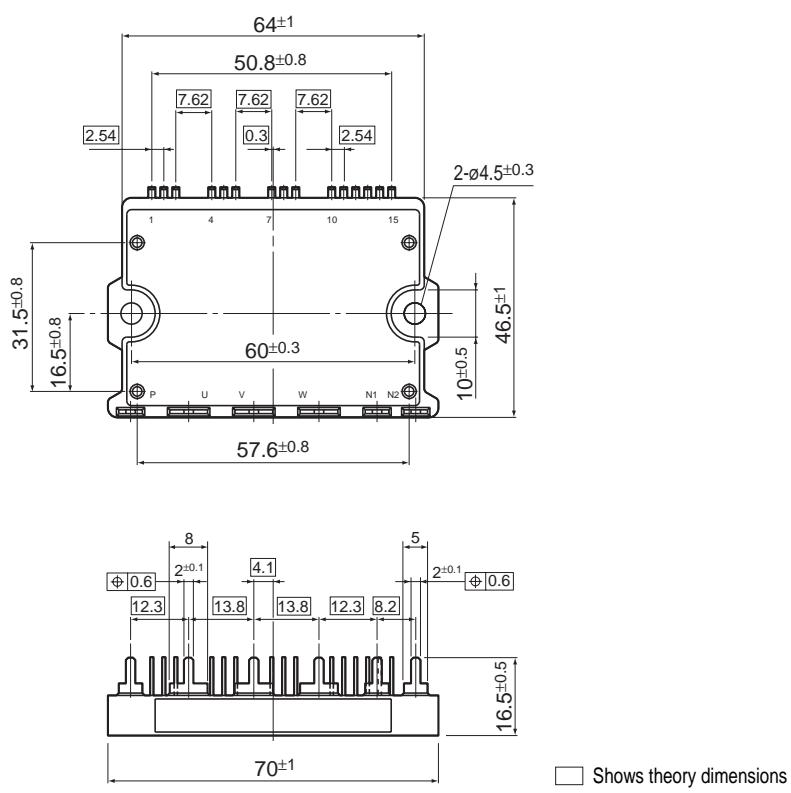
Pre-driver 1 includes following functions. (P-side)

- 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

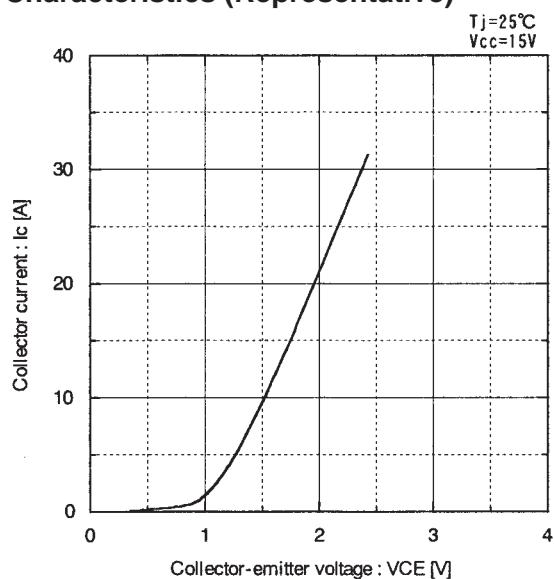
## ■ Outline drawings, mm



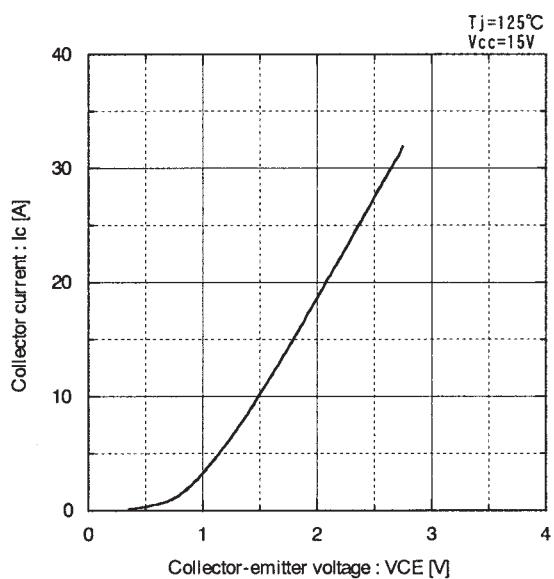
Shows theory dimensions

Mass: 50g

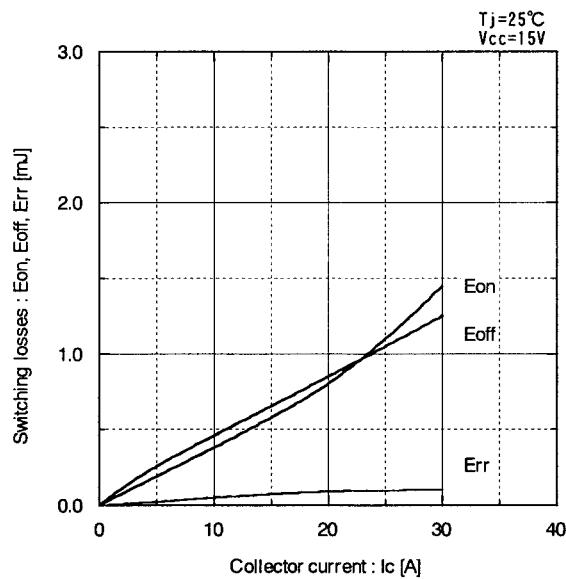
### ■ Characteristics (Representative)



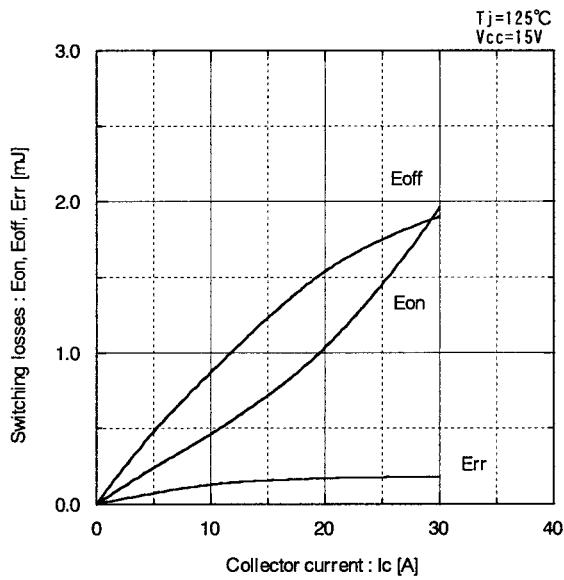
Collector current vs. Collector-emitter voltage



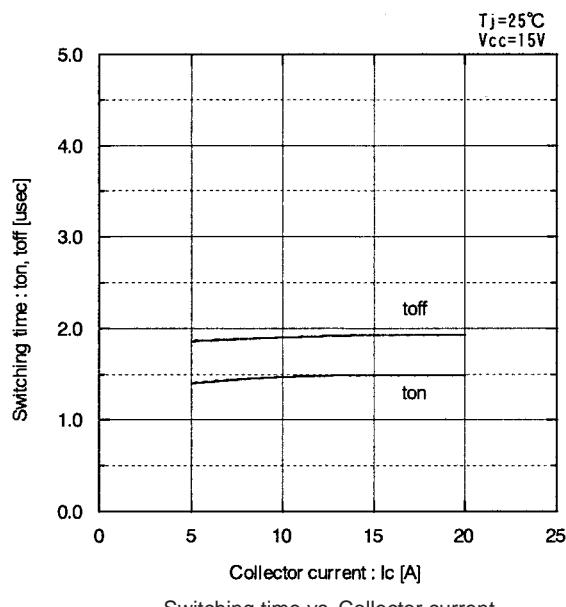
Collector current vs. Collector-emitter voltage



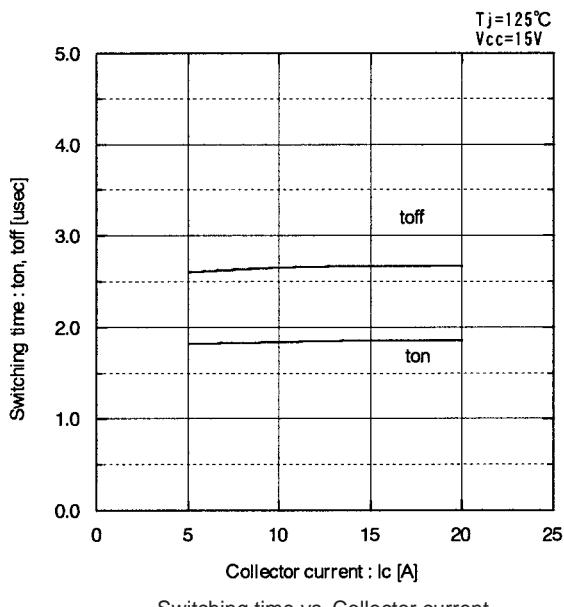
Switching losses vs. Collector current



Switching losses vs. Collector current



Switching time vs. Collector current



Switching time vs. Collector current

