

## IGBT-IPM R series

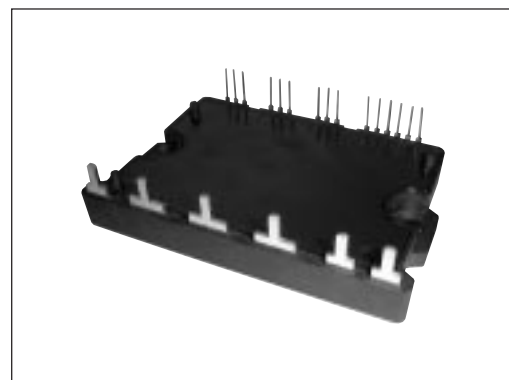
600V / 20A / 6 in one-package

## ■ 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 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 (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** ( $T_c=T_j=25^{\circ}\text{C}$ ,  $V_{cc}=15\text{V}$ )

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply current of P-line pre-driver (one unit)	$I_{CCP}$	$V_{in}=H$	—	2.0	5.0	mA
Power supply current of N-line pre-driver	$I_{CCN}$	$V_{in}=H$	—	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	$V_Z$	$R_{in}=20\text{k}\Omega$	—	8.0	—	V
IGBT chips overheat protection temperature level	$T_{joH}$	Surface of IGBT	150	—	—	$^{\circ}\text{C}$
Hysteresis	$T_{jH}$		—	20	—	$^{\circ}\text{C}$
Collector current protection level	$I_{OC}$	N-side, (N1-N2 open)	30	37	44	A
	$V_{OC}$	Between N1 and N2	190	200	210	mV
OC detecting resistance value	$R_{OC}$		—	5.4	—	$\text{m}\Omega$
Protection delay time	$t_{DOC}$	$T_j=25^{\circ}\text{C}$ Fig. 1, Fig. 2	—	5.0	7.0	$\mu\text{s}$
Undervoltage protection level	$V_{UV}$		11.0	—	12.5	V
Hysteresis	$V_H$		0.2	—	0.8	V
Alarm signal hold time	$t_{ALM}$		1.0	2.0	—	ms

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

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Switching time (IGBT) See Fig. 3	$t_{on}$	$I_c=20\text{A}$ , $V_{DC}=300\text{V}$	0.5	—	—	$\mu\text{s}$
	$t_{off}$	Inductive-Load	—	—	3.5	$\mu\text{s}$
Switching time (FWD)	$t_{rr}$		—	—	0.5	$\mu\text{s}$

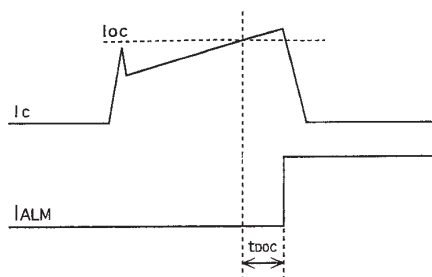


Fig.1 Definition of OC delay time

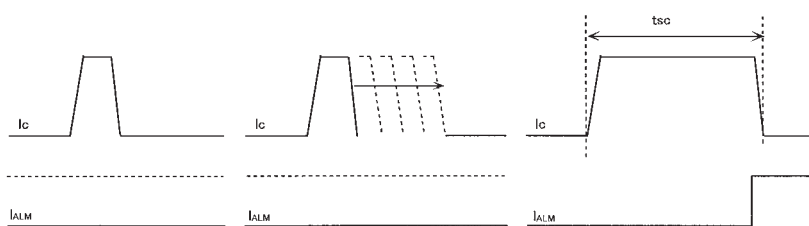
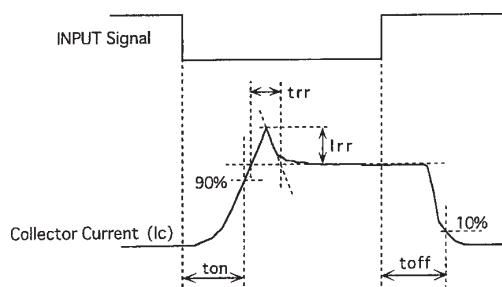
Fig.2 Definition of  $t_{sc}$ 

Fig.3 Definition of switching time

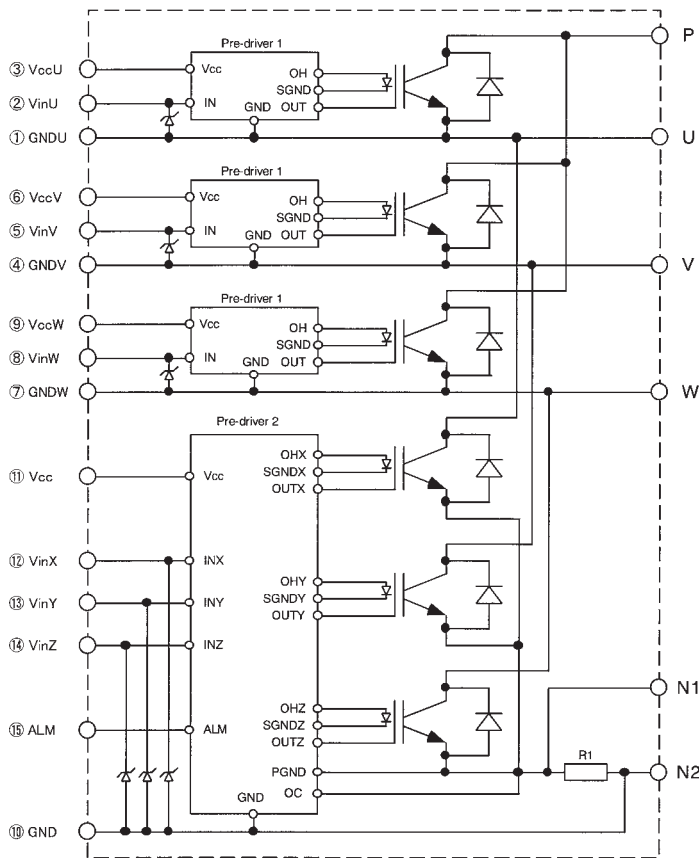
**● Thermal characteristics** ( $T_c=T_j=25^{\circ}\text{C}$ ,  $V_{cc}=15\text{V}$ )

Item	Symbol	Min.	Typ.	Max.	Unit
Junction to case thermal resistance	IGBT $R_{th(j-c)}$	—	—	2.0	$^{\circ}\text{C/W}$
	FWD $R_{th(j-c)}$	—	—	3.6	$^{\circ}\text{C/W}$
Case to fin thermal resistance with compound	$R_{th(c-f)}$	—	0.05	—	$^{\circ}\text{C/W}$

**● Recommendable value**

Item	Symbol	Min.	Typ.	Max.	Unit
DC bus voltage	$V_{DC}$	200	—	400	V
Operating power supply voltage range of pre-drive	$V_{CC}$	13.5	15	16.5	V
Switching frequency	$f_{sw}$	1	—	20	kHz
Flatness of heat sink	—	−100	—	100	$\mu\text{m}$
Mounting screw torque (M4)	—	1.3	—	1.7	N • m

## ■ Block diagram



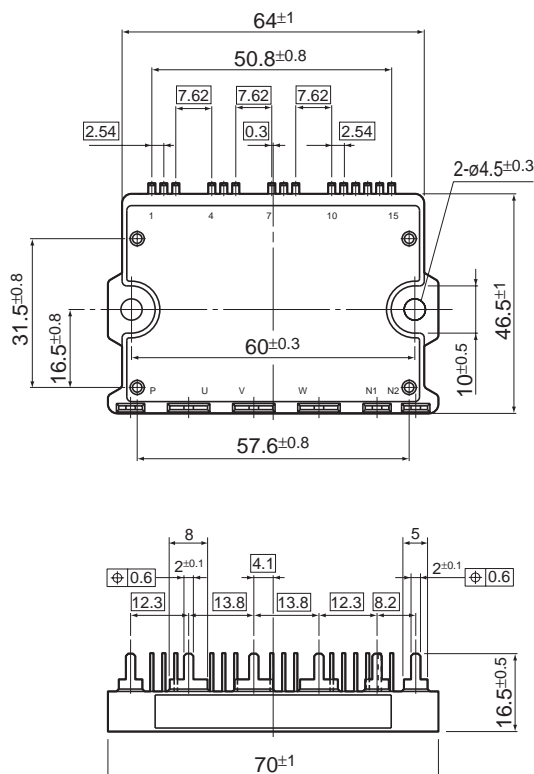
Pre-driver 1 includes following functions. (P-side)

- 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

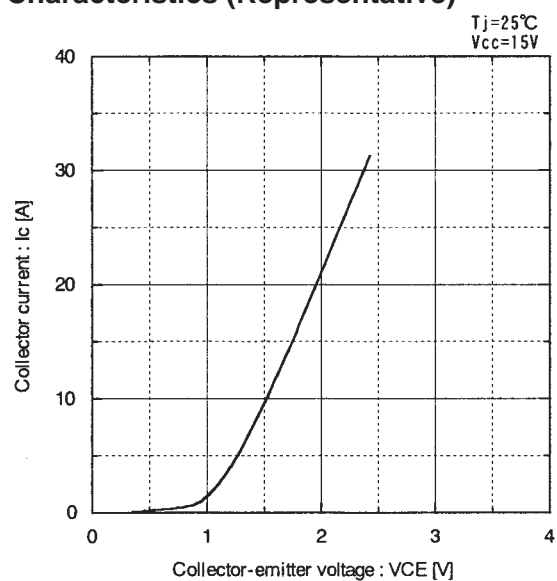
## ■ Outline drawings, mm



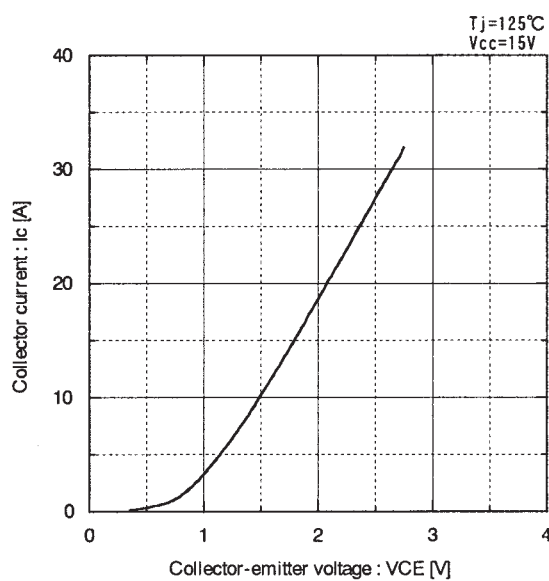
□ Shows theory dimensions

Mass: 50g

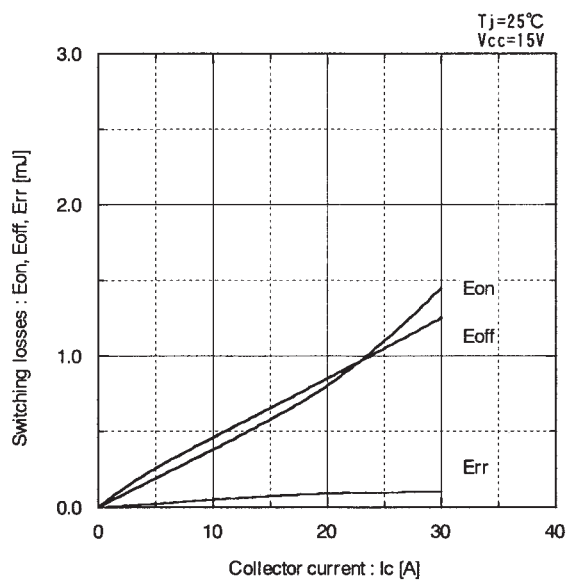
## ■ Characteristics (Representative)



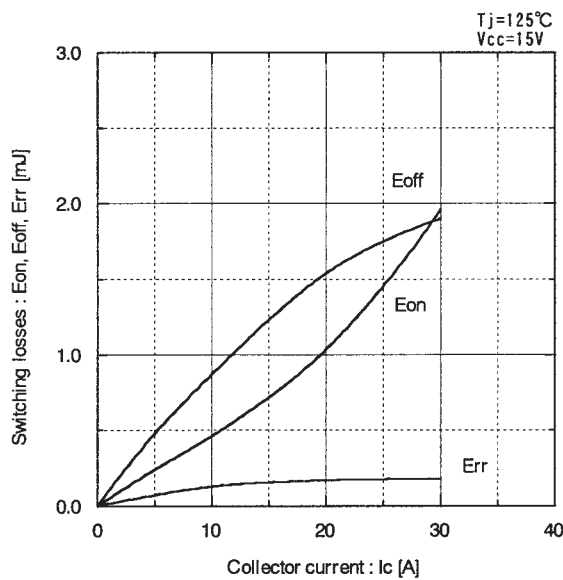
Collector current vs. Collector-emitter voltage



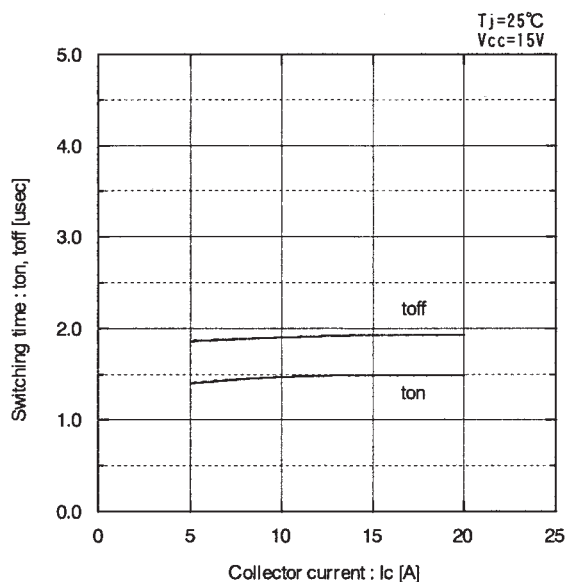
Collector current vs. Collector-emitter voltage



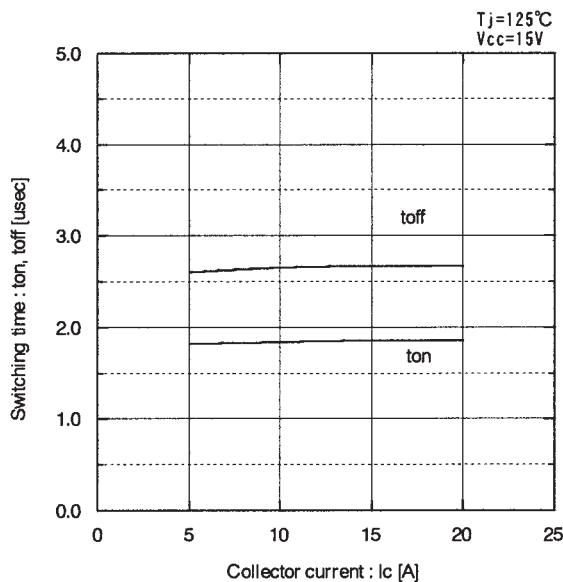
Switching losses vs. Collector current



Switching losses vs. Collector current



Switching time vs. Collector current



Switching time vs. Collector current

