

IGBT-IPM R series

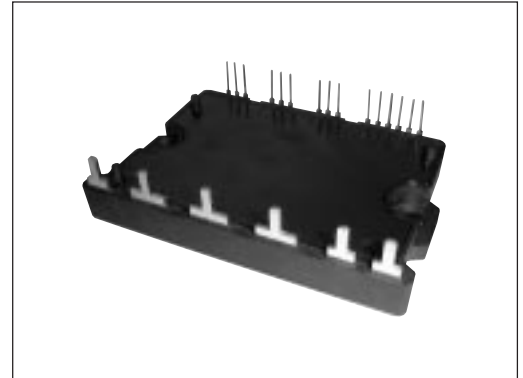
600V / 20A / 6 in one-package

■ 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 _{DC}	450	V
DC bus voltage (Surge)	V _{DC (surge)}	500	V
DC bus voltage (Short operating)	V _{SC}	400	V
Collector-Emitter voltage	V _{CES}	600	V
Collector current	DC	I _C	20
	1ms	I _{CP}	40
	Duty=49.6%	–I _C	20
Collector power dissipation	One transistor	P _C	63
Junction temperature	T _j	150	°C
Input voltage of power supply for pre-driver	V _{CC}	–0.3 to 20	V
Input signal voltage	V _{in}	V _Z	V
Input singal current	I _{in}	1	mA
Alarm signal voltage	V _{ALM}	V _{CC}	V
Alarm signal current	I _{ALM}	15	mA
Storage temperature	T _{stg}	–40 to 125	°C
Operating case temperature	T _{cop}	–20 to 100	°C
Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.)	V _{iso}	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 _{CES}	V _{CE} =600V, V _{in} open	–	–	1.0	mA
Collector-Emitter saturation voltage	V _{CE (sat)}	I _C =20A	–	–	2.7	V
Forward voltage of FWD	V _F	–I _C =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	μs
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	—	—	μs
	t_{off}	Inductive-Load	—	—	3.5	μs
Switching time (FWD)	t_{rr}		—	—	0.5	μs

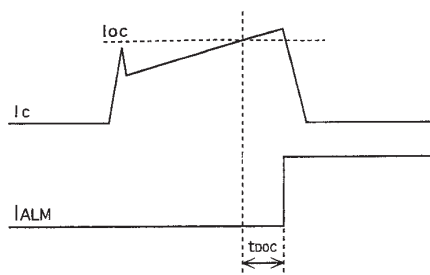


Fig.1 Definition of OC delay time

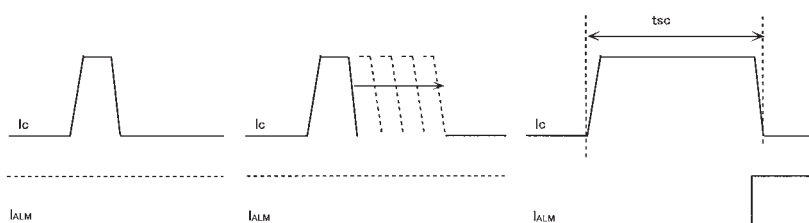
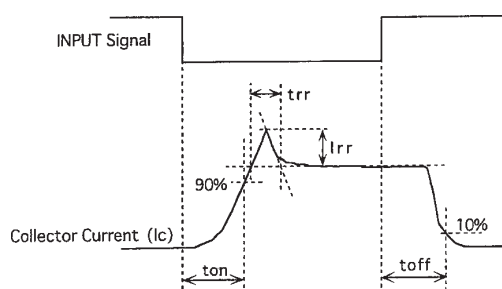
Fig.2 Definition of t_{sc} 

Fig.3 Definition of switching time

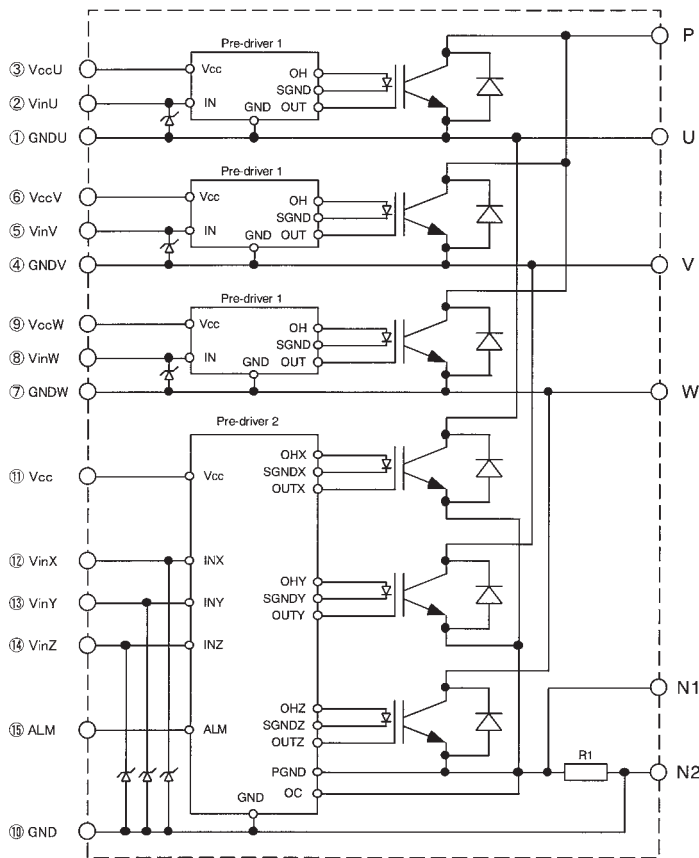
● Thermal characteristics ($T_c=T_j=25^{\circ}\text{C}$, $V_{cc}=15\text{V}$)

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	μm
Mounting screw torque (M4)	—	1.3	—	1.7	N • m

■ Block diagram



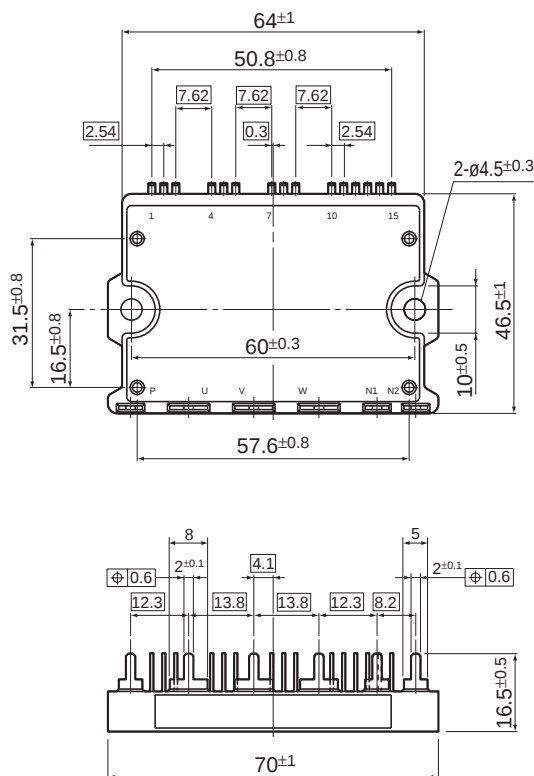
Pre-driver 1 includes following functions. (P-side)

- 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

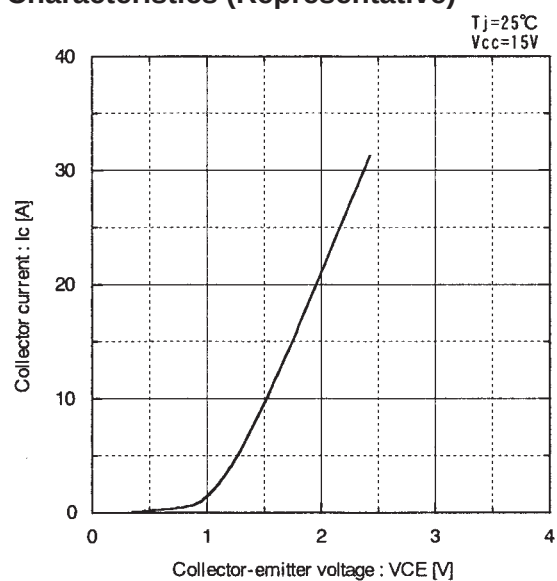
■ Outline drawings, mm



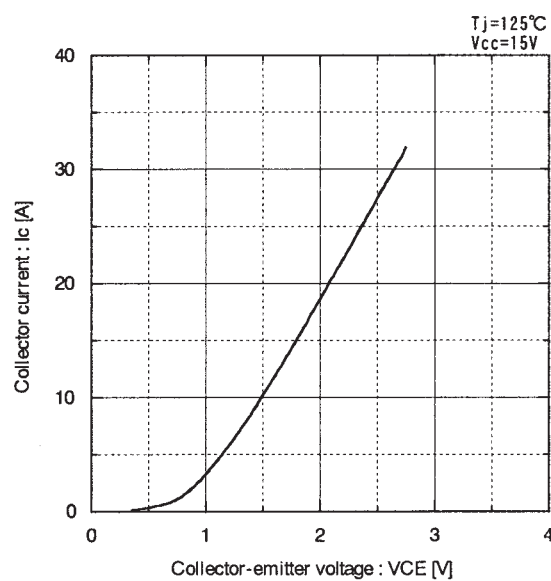
□ Shows theory dimensions

Mass: 50g

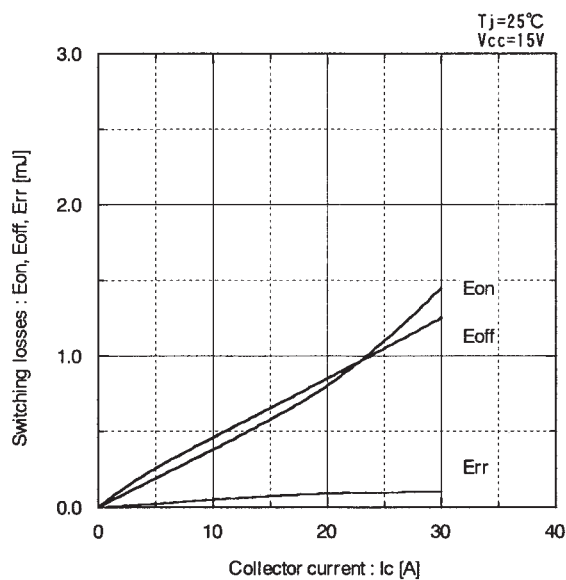
■ Characteristics (Representative)



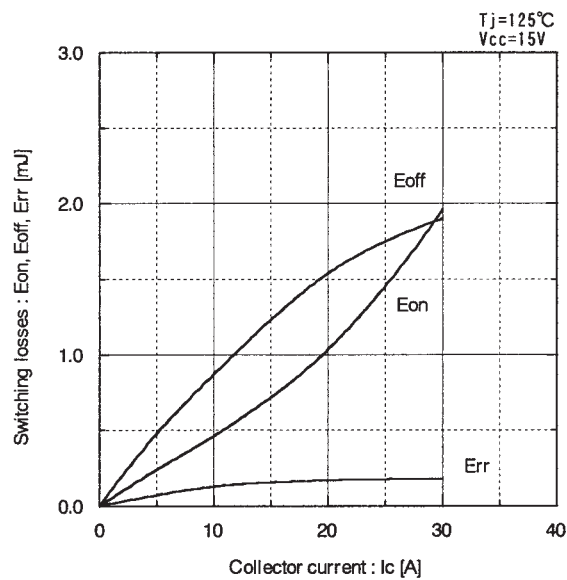
Collector current vs. Collector-emitter voltage



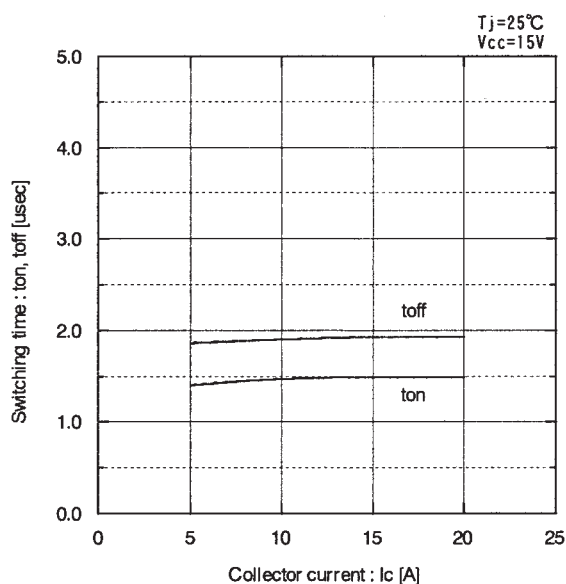
Collector current vs. Collector-emitter voltage



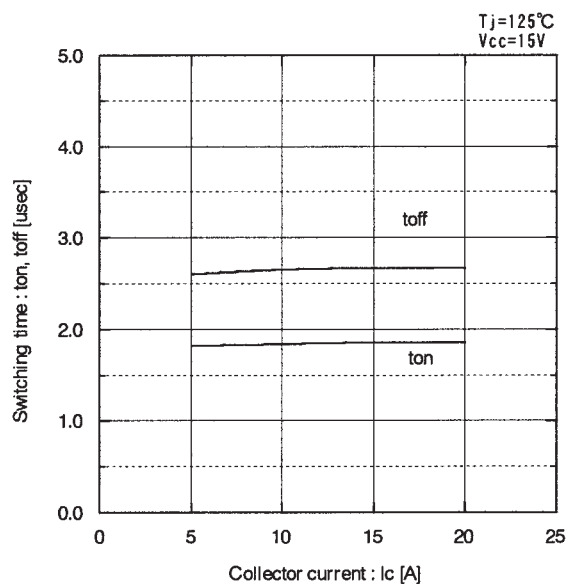
Switching losses vs. Collector current



Switching losses vs. Collector current



Switching time vs. Collector current



Switching time vs. Collector current

