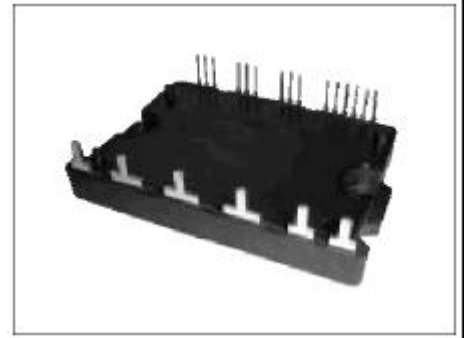


## IGBT-IPM R series

600V/15A/6 in one-package

### ■ Features

- Low power loss and soft switching
- High performance and high reliability IGBT with overheating protection
- Higher reliability because of 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 ( $T_c=25$  unless otherwise specified)

Items	Symbol	Ratings	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	$I_C$	15	A
	1 ms	$I_{CP}$	30	A
	Duty=44.1%	$-I_C$	15	A
Collector power dissipation	One Transistor	$P_c$	40	W
Junction temperature	$T_j$	150		
Input voltage of power supply for pre-driver	$V_{cc}$	-0.3~20	V	
Input signal current	$I_{in}$	20	mA	
Alarm signal voltage	$V_{ALM}$	$V_{cc}$	V	
Alarm signal current	$I_{ALM}$	15	mA	
Storage temperature	$T_{stg}$	-40~125		
Operating case temperature	$T_{cop}$	-20~100		
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

- Electrical characteristics of power circuit ( $T_c=T_j=25$  ,  $V_{cc}=15V$ )

Items	Symbol	Condition	Min.	Typ.	Max.	Unit
Collector current at off signal input	$I_{CES}$	$V_{CE}=600V$ $I_{in}=0mA$	-	-	1.0	mA
Collector-Emitter saturation voltage	$V_{CE(sat)}$	$I_C=15A$	-	-	2.7	V
Forward voltage of FWD	$V_F$	$-I_C=15A$	-	-	3.5	V

· Electrical characteristics of control circuit (Tc=Tj=25 , Vcc=15V)

Items	Symbol	Condition	Min.	Typ.	Max.	Unit
Power supply current of P-line pre-driver (one unit)	I <sub>CCP</sub>	I <sub>in</sub> =0mA	-	2.0	5.0	mA
Power Supply Current of N-line pre-driver	I <sub>CCN</sub>	I <sub>in</sub> =0mA	-	4.0	10.0	mA
Input signal threshold current	I <sub>in(th)</sub>	Turn-on	-	1.8	2.3	mA
		Turn-off	0.8	1.3	-	mA
Hysteresis of input signal threshold current	I <sub>inH</sub>	-	-	0.5	-	mA
Input signal saturation voltage	V <sub>in(sat)</sub>	I <sub>in</sub> =20mA	-	0.8	2.0	mV
Over heating protection						
IGBT chips overheat protection temperature level	T <sub>JOH</sub>	Surface of IGBT	150	-		
Hysteresis	I <sub>JH</sub>	-	-	20	-	
Collector current protection level	I <sub>oc</sub>	N-side only	20	24	-	A
	V <sub>oc</sub>	Between N1 and N2	190	200	210	mV
OC detecting resistor value	R <sub>oc</sub>		-	8.0	-	mΩ
Protection delay time	t <sub>DOC</sub>	T <sub>j</sub> =25 Fig.1 Fig.2	-	5.0	7.0	μs
Under voltage 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 (Tc=Tj=25 , Vcc=15V)

Items	Symbol	Condition	Min.	Typ.	Max.	Unit
Switching time(IGBT)	t <sub>on</sub>	I <sub>c</sub> =15A, V <sub>DC</sub> =300V I <sub>in</sub> =10mA	0.5	-	-	μs
	t <sub>off</sub>					
Switching time(FWD)	t <sub>rr</sub>	Inductive-Load. Fig.3	-	-	0.5	μs

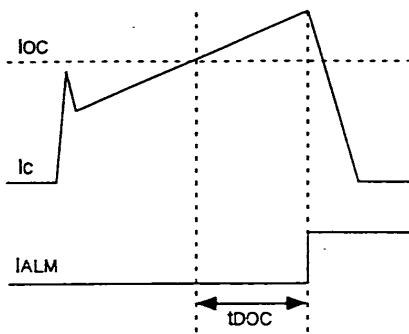


Fig.1 Definition of switching

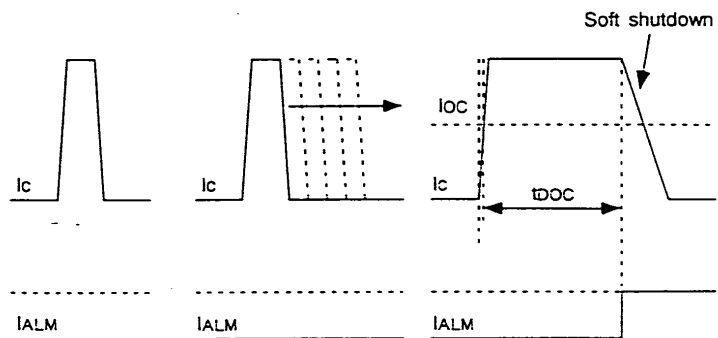


Fig.2 Definition of tsc

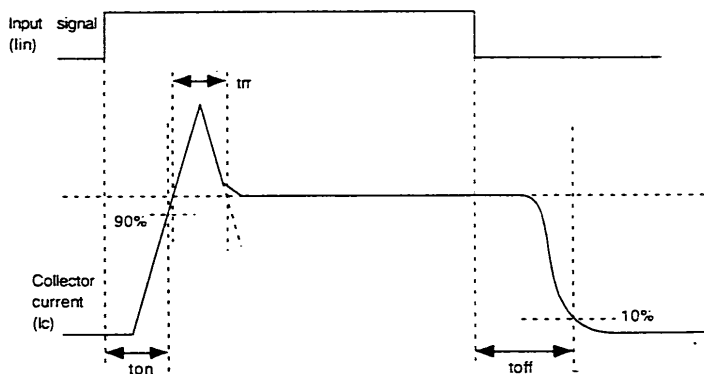


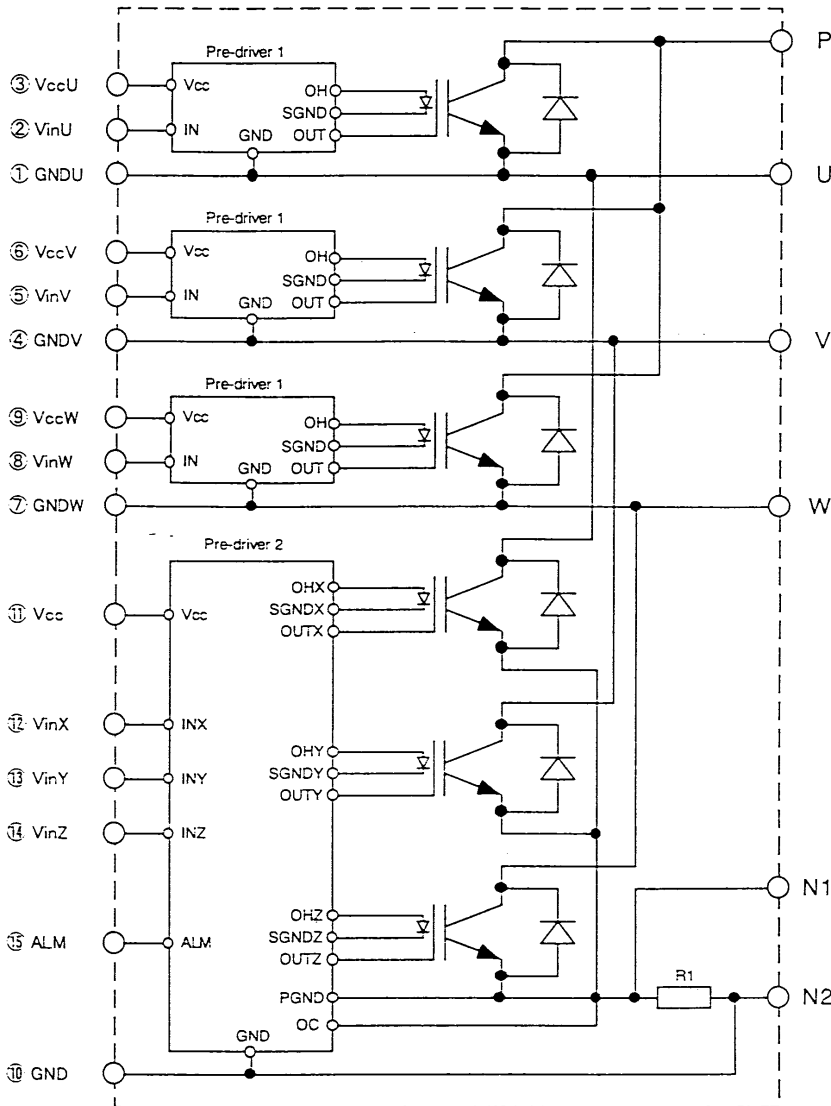
Fig.3 Definition of switching time

• Thermal characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	
Junction to case thermal resistance	IGBT	$R_{th(j-c)}$	-	-	3.1	/W
	FWD	$R_{th(j-c)}$	-	-	5.4	/W
Case to fin thermal resistance with compound	$R_{th(c-f)}$	-	0.05	-	/W	

• Recommendable value

Items	Symbol	Condition	Min.	Typ.	Max.	Unit
DC bus voltage	$V_{DC}$	-	200	-	400	V
Operating power supply voltage	$V_{CC}$	-	13.5	15	16.5	V
Range of pre-drive						
Input signal current	$I_{in(o n)}$	CTR= 100~200%	8	-	10	mA
Switching frequency	$f_{sw}$	-	1	3	5	kHz
Flatness of heat sink		-	-100	-	100	$\mu m$
Mounting screw torque (M4)		-	1.3	-	1.7	N · m



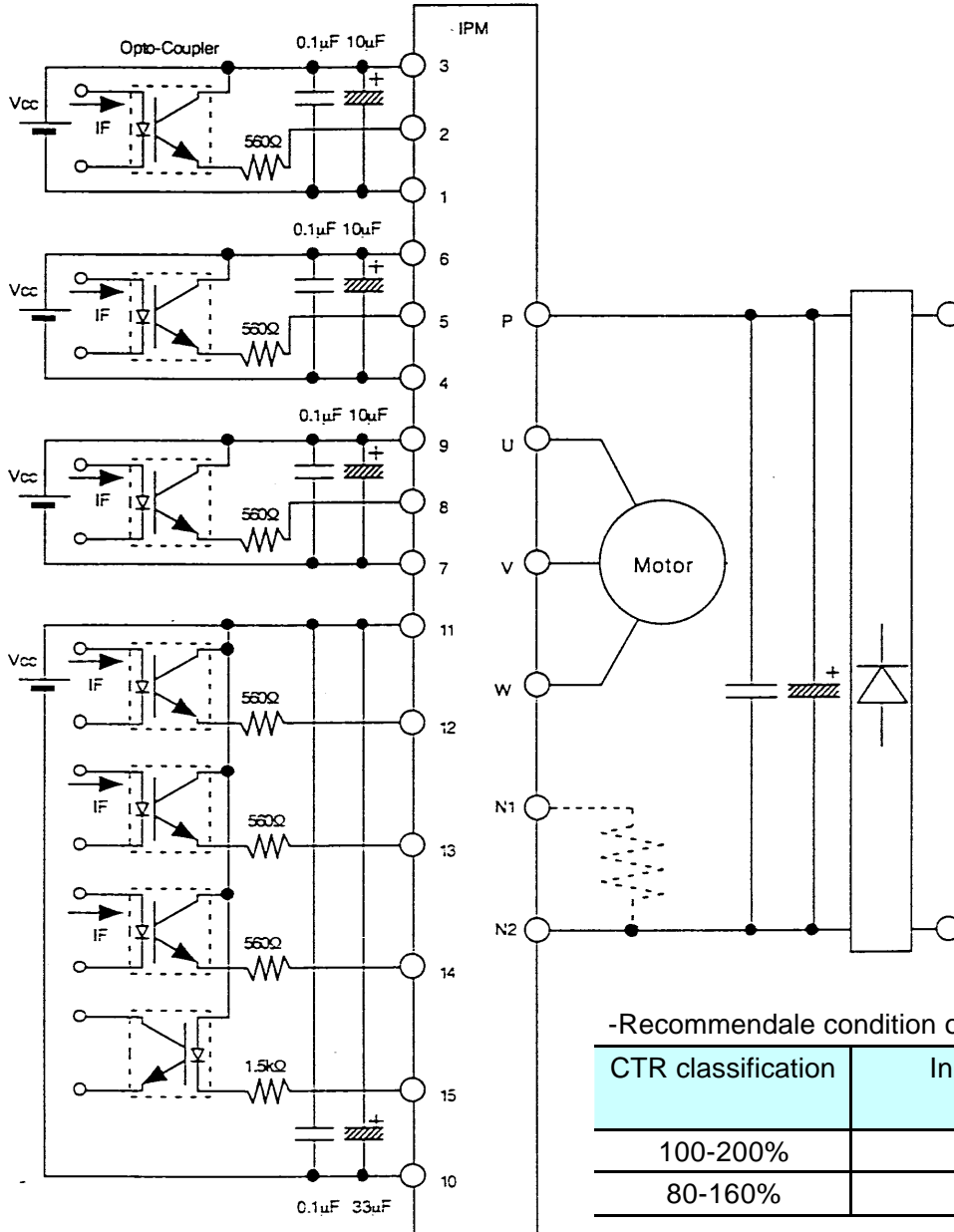
**Pre-driver 1 includes following functions. (P-side)**

- (1) Amplifier for drive
- (2) Power supply under voltage protection
- (3) IGBT chip over heating protection

**Pre-driver 1 includes following functions. (N-side)**

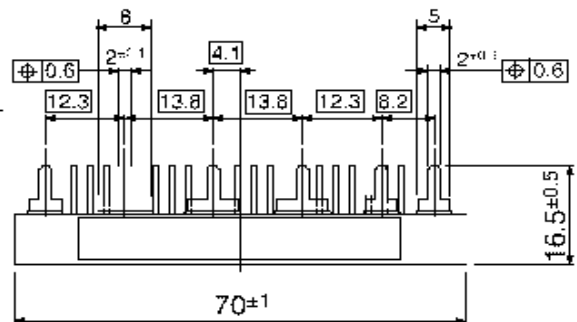
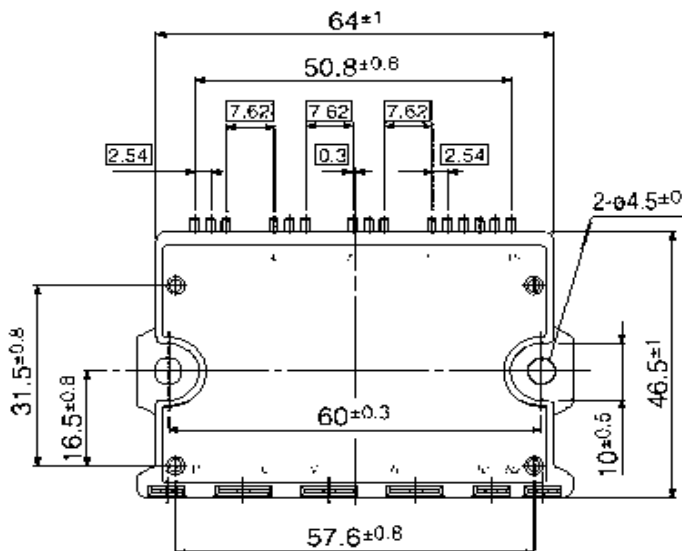
- (1) Amplifier for drive
- (2) Power supply under voltage protection
- (3) IGBT chip over heating protection
- (4) Over current protection
- (5) Alarm signal output

· Typical application circuit



-Recommendable condition of opto-coupler

CTR classification	Input forward current of opto-coupler
100-200%	8-10mA
80-160%	10-12.5mA



Items	Min.	Type.	Max.	Unit
Weight	-	50	-	g

- Application guideline
  - The wiring between the opto-couplers and the input terminals of the IPM should be as short as possible. The stray capacitance between primary and secondary side of the opto-couplers should not be increased by pattern lay-out of the control circuits.
  - Capacitors should be connected between Vcc and GND terminals of the opto-coupler as closely as possible.
  - Each power supplies for drive circuits should not have transient voltage fluctuation. Four power supplies which are isolated should be applied individually.
  - In order to prevent noise from AC line, connect capacitor (approx. 4.7nF) between three-phase line and earth.
  - Do not connect N2-terminal of main circuit to ground (GND) of the control circuit.
  
- Heat sink mounting precautions
  - A mounting surface of a heat sink should be finished to a roughness below  $10\ \mu\text{m}$  and a flatness between screw holes below  $100\ \mu\text{m}$ . If the flatness is below  $-100\ \mu\text{m}$ , a thermal resistance between an IPM and a heat sink is increased. If the flatness is over  $+100\ \mu\text{m}$ , there is the danger of the isolation failure.
  - Apply a thermal compound between an IPM and a heat sink to reduce a contact thermal resistance.
  - Mount a IPM in parallel with extruded direction of a heat sink to reduce an influence of a change of a heat sink, when a heat sink which is made by a extruder is applied.
  
- Storage and transportation notes
  - The IGBT-IPM should be stored at a standard temperature of 5 to 35 and humidity of 45 to 75%.
  - Store modules in a place with few temperature changes in order to avoid condensation on the module surface.
  - Avoid exposure to corrosive gases and dust.
  - Avoid excessive external force on the modules.
  - Store modules with unprocessed terminals.
  - Don't drop and shock the modules during transportation.
  
- Operation environment
  - Avoid exposure to corrosive gases.
  
- Applicable category
  - This specification (tentative) is applied to the IGBT-IPM named 6MBP15RY060.

