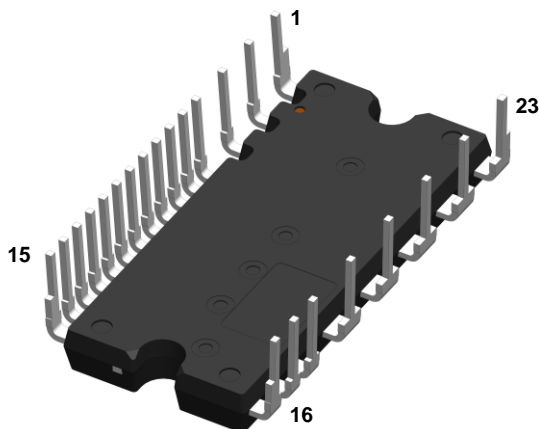


## External View



Size: 33.4 x 15 x 3.6 mm



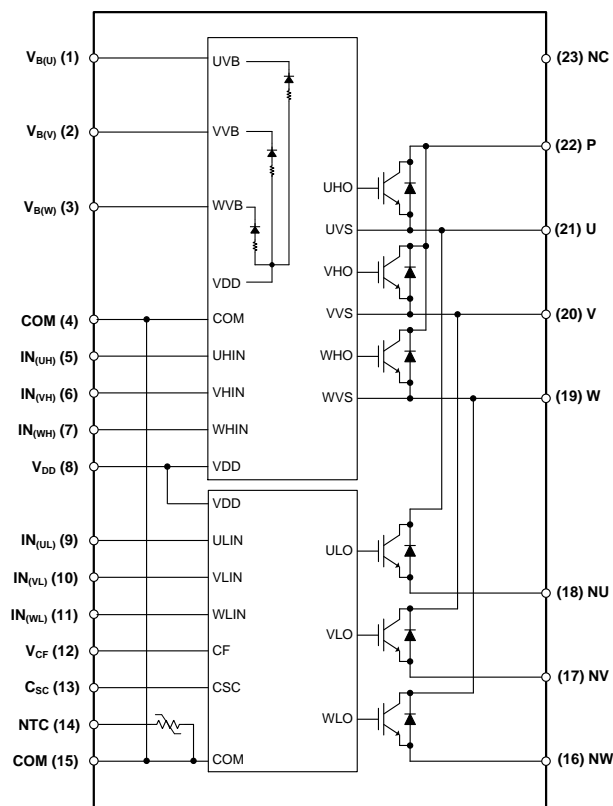
## Features

- 600V-5A (Trench Shielded Planar Gate IGBT)
- 3 phase Inverter module including HVIC drivers
- Built-in bootstrap diodes with integrated current-limiting resistor
- Control supply under-voltage lockout protection (UVLO)
- Over-temperature (OT) protection
- Temperature monitoring (NTC)
- Short-circuit current protection ( $C_{SC}$ )
- Controllable fault out signal ( $V_{CF}$ ) corresponding to SC, UV and OT fault
- Wide input interface (3-18V), Schmitt trigger receiver circuit (Active High)
- Very good EMI behavior
- Isolation ratings of 2000Vrms/min

## Applications

- AC 100-240Vrms class low power motor drives
- Washing Machines, Compressors, Fan Motors, Refrigerators and Dishwashers

## Internal Equivalent Circuit / Pin Configuration



## Ordering Information

Part Number	Temperature Range	Package	Pin Length Description
AIP5N05E060Q4	-40°C to 150°C	IPM-5	Normal
AIP5N05E060Q4S	-40°C to 150°C	IPM-5A	Short



AOS Green Products use reduced levels of Halogens, and are also RoHS compliant. Please visit [www.aosmd.com/media/AOSGreenPolicy.pdf](http://www.aosmd.com/media/AOSGreenPolicy.pdf) for additional information.

## Pin Description

Pin Number	Pin Name	Pin Function
1	V <sub>B(U)</sub>	High-Side Bias Voltage for U-Phase IGBT Driving
2	V <sub>B(V)</sub>	High-Side Bias Voltage for V-Phase IGBT Driving
3	V <sub>B(W)</sub>	High-Side Bias Voltage for W-Phase IGBT Driving
4	COM	Common Supply Ground
5	IN <sub>(UH)</sub>	Signal Input for High-Side U-Phase
6	IN <sub>(VH)</sub>	Signal Input for High-Side V-Phase
7	IN <sub>(WH)</sub>	Signal Input for High-Side W-Phase
8	V <sub>DD</sub>	Common Bias Voltage for IC and IGBTs Driving
9	IN <sub>(UL)</sub>	Signal Input for Low-Side U-Phase
10	IN <sub>(VL)</sub>	Signal Input for Low-Side V-Phase
11	IN <sub>(WL)</sub>	Signal Input for Low-Side W-Phase
12	V <sub>CF</sub>	Controllable Fault Output
13	C <sub>SC</sub>	Capacitor (Low-Pass Filter) for Short-circuit Current Detection Input
14	NTC	Thermistor (Temperature Monitoring)
15	COM	Common Supply Ground
16	NW	Negative DC-Link Input for W-Phase
17	NV	Negative DC-Link Input for V-Phase
18	NU	Negative DC-Link Input for U-Phase
19	W	Output for W-Phase
20	V	Output for V-Phase
21	U	Output for U-Phase
22	P	Positive DC-Link Input
23	NC	No Connection

## Absolute Maximum Ratings

$T_J = 25^{\circ}\text{C}$ , unless otherwise specified.

Symbol	Parameter	Conditions	Ratings	Units
<b>Inverter</b>				
$V_{PN}$	Supply Voltage	Applied between P - NU,NV,NW	450	V
$V_{PN(surge)}$	Supply Voltage (surge)	Applied between P - NU,NV,NW	500	V
$V_{CES}$	Collector-Emitter Voltage		600	V
$I_C$	Output Phase Current	$T_C=25^{\circ}\text{C}$ , $T_J<150^{\circ}\text{C}$	5	A
		$T_C=100^{\circ}\text{C}$ , $T_J<150^{\circ}\text{C}$	3	A
$\pm I_{PK}$	Output Peak Phase Current	$T_C=25^{\circ}\text{C}$ , less than 1ms pulse width	10	A
$t_{SC}$	Short Circuit Withstand Time <sup>(1)</sup>		5	$\mu\text{s}$
$P_C$	Collector Dissipation	$T_C=25^{\circ}\text{C}$ , per chip	18.9	W
$T_J$	Operating Junction Temperature		-40 to 150	$^{\circ}\text{C}$
<b>Control (Protection)</b>				
$V_{DD}$	Control Supply Voltage	Applied between $V_{DD}$ -COM	20	V
$V_{DB}$	High-Side Control Bias Voltage	Applied between $V_{B(U)}$ -U, $V_{B(V)}$ -V, $V_{B(W)}$ -W	20	V
$V_{IN}$	Input Voltage	Applied between $IN_{(UH)}$ , $IN_{(VH)}$ , $IN_{(WH)}$ , $IN_{(UL)}$ , $IN_{(VL)}$ , $IN_{(WL)}$ - COM	-0.5 ~ $V_{DD}+0.5$	V
$V_{CF}$	Fault Output Supply Voltage	Applied between $V_{CF}$ -COM	-0.5 ~ 5.5	V
$I_{CF}$	Fault Output Current	Sink current at $V_{CF}$ terminal	1	mA
$V_{SC}$	Current Sensing Input Voltage	Applied between $C_{SC}$ -COM	-0.5 ~ 5.5	V
<b>Total System</b>				
$V_{PN(PROT)}$	Self Protection Supply Voltage Limit (Short-Circuit Protection Capability)	$V_{DD}=13.5\text{-}16.5\text{V}$ , Inverter part $T_J=150^{\circ}\text{C}$ , Non-repetitive, less than 2 $\mu\text{s}$	400	V
$T_C$	Module Case Operation Temperature	Measurement point of $T_C$ is provided in Figure 1	-30 to 125	$^{\circ}\text{C}$
$T_{STG}$	Storage Temperature		-40 to 150	$^{\circ}\text{C}$
$V_{ISO}$	Isolation Voltage	60Hz, sinusoidal, AC 1min, between connected all pins and heat sink plate	2000	$V_{rms}$

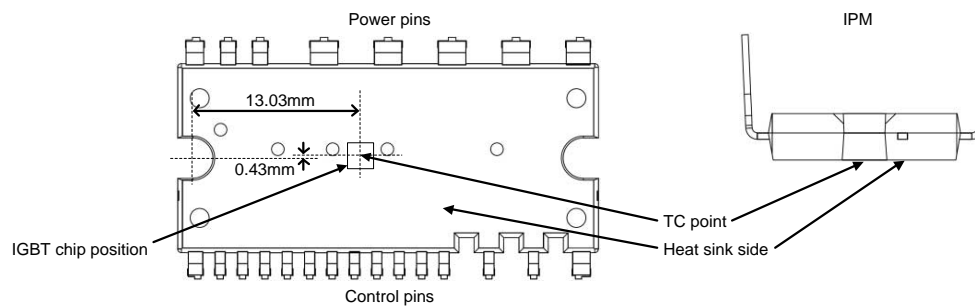


Figure 1.  $T_C$  Measurement Point

## Thermal Resistance

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$R_{th(j-c)Q}$	Junction to Case Thermal Resistance <sup>(2)</sup>	Inverter IGBT (per 1/6 module)	-	-	6.6	K/W
$R_{th(j-c)F}$		Inverter FWD (per 1/6 module)	-	-	8.5	K/W

### Note:

1. Tested under specific condition.
2. For the measurement point of case temperature ( $T_C$ ), please refer to Figure 1.

## Electrical Characteristics

$T_J = 25^\circ\text{C}$ , unless otherwise specified.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
Inverter							
V <sub>CE(SAT)</sub>	Collector-Emitter Saturation Voltage	V <sub>DD</sub> =V <sub>DB</sub> =15V, V <sub>IN</sub> =5V	I <sub>C</sub> =2.5A, T <sub>J</sub> =25°C	-	1.48	1.85	V
			I <sub>C</sub> =2.5A, T <sub>J</sub> =125°C	-	1.69	-	V
V <sub>F</sub>	FWD Forward Voltage	V <sub>IN</sub> =0	I <sub>F</sub> =2.5A, T <sub>J</sub> =25°C	-	1.75	2.15	V
t <sub>ON</sub>	Switching Times	V <sub>PN</sub> =300V, V <sub>DD</sub> =V <sub>DB</sub> =15V I <sub>C</sub> =2.5A, T <sub>J</sub> =25°C, V <sub>IN</sub> =0V ↔ 5V Inductive load (high-side)		0.40	0.80	1.40	μs
t <sub>C(ON)</sub>				-	0.25	0.50	μs
t <sub>OFF</sub>				-	1.00	1.60	μs
t <sub>C(OFF)</sub>				-	0.14	0.40	μs
t <sub>rr</sub>				-	0.20	-	μs
I <sub>CES</sub>	Collector-Emitter Leakage Current	V <sub>CE</sub> =V <sub>CES</sub>	T <sub>J</sub> =25°C	-	-	1	mA
			T <sub>J</sub> =125°C	-	-	10	mA
Control (Protection)							
I <sub>QDD</sub>	Quiescent V <sub>DD</sub> Supply Current	V <sub>DD</sub> =15V, IN(UH,VH,WH,UL,VL,WL)=0V	V <sub>DD</sub> -COM	-	-	1.5	mA
I <sub>QDB</sub>	Quiescent V <sub>DB</sub> Supply Current	V <sub>DB</sub> =15V, IN(UH, VH, WH)=0V	V <sub>B(U)</sub> -U, V <sub>B(V)</sub> -V, V <sub>B(W)</sub> -W	-	-	0.3	mA
V <sub>SC(ref)</sub>	Short-Circuit Trip Level	V <sub>DD</sub> =15V <sup>(3)</sup>		0.45	0.48	0.51	V
UV <sub>DT</sub>	Supply Circuit Under-Voltage Protection	Trip Level		10.3	11.4	12.5	V
UV <sub>DR</sub>		Reset Level		10.8	11.9	13.0	V
UV <sub>DBT</sub>		Trip Level		9.0	10.0	11.0	V
UV <sub>DBR</sub>		Reset Level		10.0	11.0	12.0	V
OT <sub>T</sub>	Over-Temperature Protection <sup>(4)</sup>	V <sub>DD</sub> =15V, Detect LVIC Temperature	Trip Level	110	130	150	°C
OT <sub>HYS</sub>			Hysteresis of Trip Reset	-	30	-	°C
V <sub>CFH</sub>	Fault Output Voltage	V <sub>SC</sub> =0V, V <sub>CF</sub> Circuit: 10kΩ to 5V pull-up		4.9	-	-	V
V <sub>CFL</sub>		V <sub>SC</sub> =1V, V <sub>CF</sub> Circuit: 10kΩ to 5V pull-up		-	-	0.5	V
V <sub>CF+</sub>	CF positive going threshold			-	1.9	2.2	V
V <sub>CF-</sub>	CF negative going threshold			0.8	1.1	-	V
t <sub>FO</sub>	Fault Output Pulse Width <sup>(5)</sup>			20	-	-	μs
I <sub>IN</sub>	Input Current	V <sub>IN</sub> =5V		-	0.69	-	mA
V <sub>th(on)</sub>	ON Threshold Voltage	Applied between IN <sub>(UH)</sub> , IN <sub>(VH)</sub> , IN <sub>(WH)</sub> , IN <sub>(UL)</sub> , IN <sub>(VL)</sub> , IN <sub>(WL)</sub> -COM		-	2.3	2.6	V
V <sub>th(off)</sub>	OFF Threshold Voltage			0.8	1.2	-	V
V <sub>th(hys)</sub>	ON/OFF Threshold Hysteresis Voltage			-	1.1	-	V
V <sub>F(BSD)</sub>	Bootstrap Diode Forward Voltage	I <sub>F</sub> =10mA Including Voltage Drop by Limiting Resistor <sup>(6)</sup>		-	3.0	-	V
R <sub>BSD</sub>	Built-in Limiting Resistance	Included in Bootstrap Diode		-	300	-	Ω

### Notes:

- Short-circuit protection works only for low sides.
- When the LVIC temperature exceeds OT trip temperature level ( $OT_T$ ), OT protection is triggered and fault outputs.
- Fault signal ( $F_O$ ) outputs when SC, UV or OT protection is triggered.  $F_O$  pulse width is different for each protection mode. At SC failure,  $F_O$  pulse width is a fixed width (minimum 20 $\mu\text{s}$ ), but at UV or OT failure,  $F_O$  outputs continuously until recovering from UV or OT state. (But minimum  $F_O$  pulse width is 20 $\mu\text{s}$ ).
- The characteristics of bootstrap diodes are described in Figure 2.

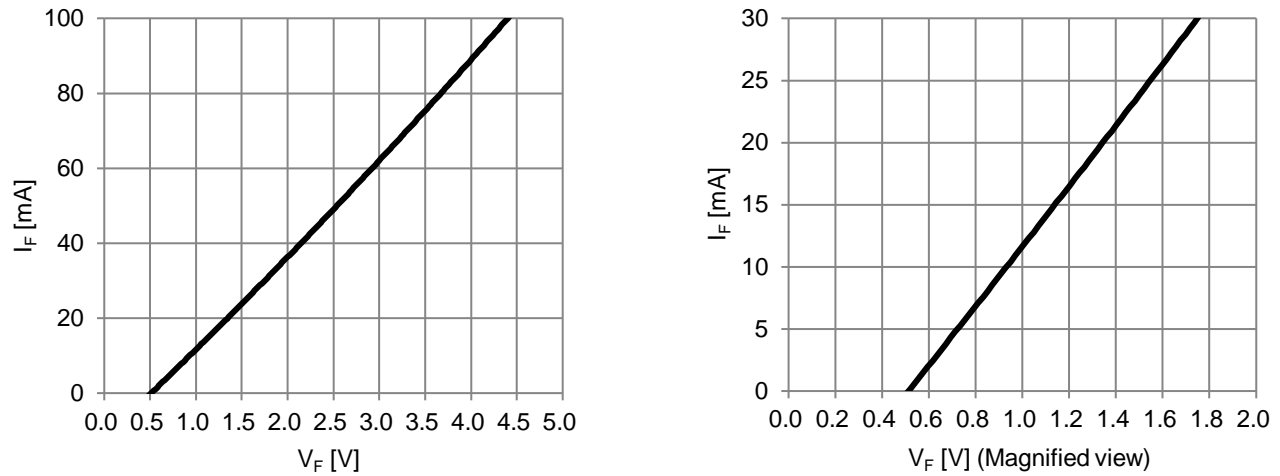


Figure 2. Built-in Bootstrap Diode  $V_F$ - $I_F$  Characteristics

## NTC Thermistor

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$R_{25}$	Resistance	$T_{NTC}=25^{\circ}\text{C}$	-	84.83	-	$\text{k}\Omega$
$B(25/100)$	C-constant		-	4092	-	K

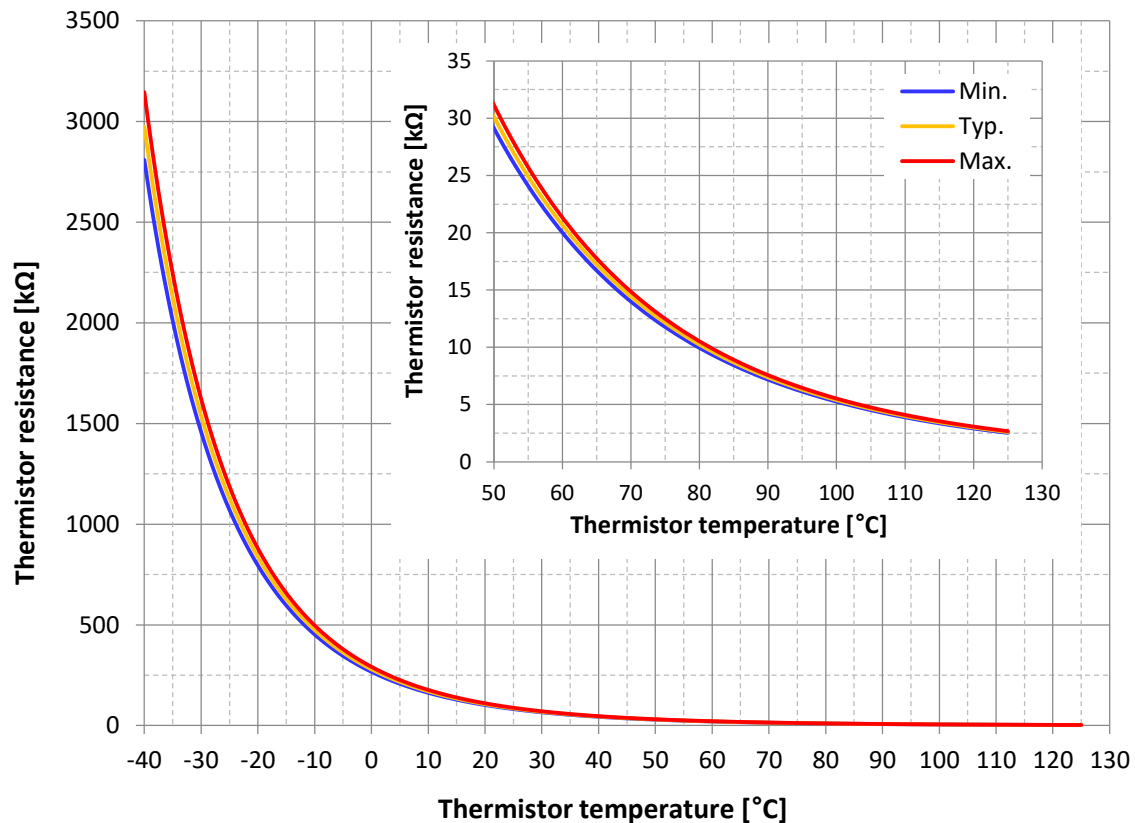
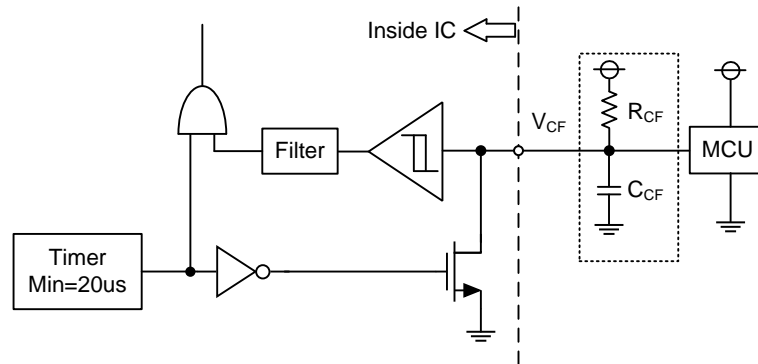


Figure 3. Thermistor Resistance vs. Temperature Curve



**Figure 4. V<sub>CF</sub> Output Circuit**

- (1) The V<sub>CF</sub> pin provides an enable functionality that allows it to shut down the all low-side IGBTs. When the V<sub>CF</sub> pin is in the high state the IPM is able to operate normally. If the V<sub>CF</sub> pin is in a low state, the low-side IGBTs are turned off until the enable condition is restored. In addition, the V<sub>CF</sub> pin can provide the fault output signal with the fixed or controlled fault out pulse width.
- (2) If only a pull-up resistor of 10kΩ connected to the V<sub>CF</sub> pin, the fault output pulse width is fixed at minimum 20us.
- (3) If a capacitor is connected with a pull-up resistor together, the fault output pulse width can be controlled according to the resistor and the capacitor values. The length of fault output pulse width is determined by the following formula ;
  - $t_{FO} = -(R_{CF} \cdot C_{CF}) \cdot \ln(1 - V_{CF}/V_{DD}) + 20\mu s(\text{min.})$
  - ex)  $V_{DD}=5V$ ,  $R_{CF}=2.2M\Omega$ ,  $C_{CF}=1nF$ ,  $t_{FO} \approx 1.07ms$ . Recommended parameters in the design are C<sub>CF</sub> of ≤ 1nF and R<sub>CF</sub> of 0.1M to 2.2MΩ.

## Mechanical Characteristics and Ratings

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Mounting Torque	Mounting Screw: M3 <sup>(6)</sup>		0.59	0.69	0.78	N m
Weight			-	5.25	-	g
Flatness	Refer to Figure 5		-50	-	100	μm

**Note:**

6. Plain washers (ISO 7089-7094) are recommended.

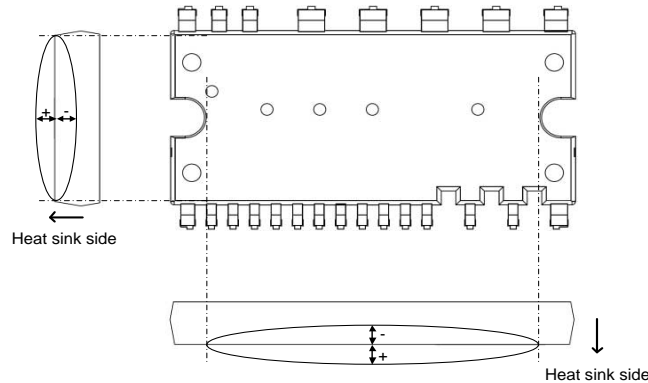


Figure 5. Flatness Measurement Positions

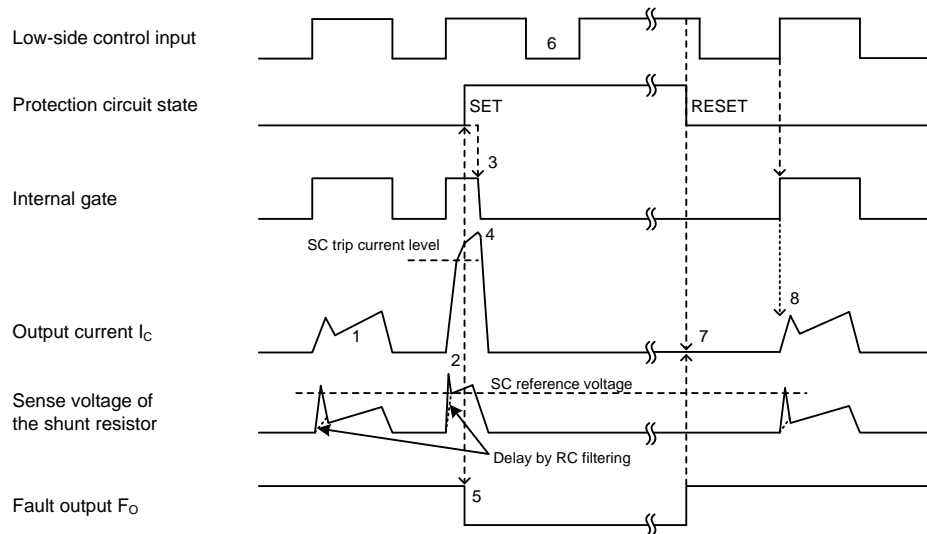
## Recommended Operation Conditions

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
V <sub>PN</sub>	Supply Voltage	Applied between P-NU, NV, NW	0	300	400	V
V <sub>DD</sub>	Control Supply Voltage	Applied between V <sub>DD</sub> -COM	13.5	15.0	16.5	V
V <sub>DB</sub>	High-Side Bias Voltage	Applied between V <sub>B(U)</sub> -U, V <sub>B(V)</sub> -V, V <sub>B(W)</sub> -W	13.5	15.0	18.5	V
dV <sub>DD</sub> /dt, dV <sub>DB</sub> /dt	Control Supply Variation		-1	-	1	V/μs
t <sub>dead</sub>	Arm Shoot-Through Blocking Time	For each input signal	1.0	-	-	μs
f <sub>PWM</sub>	PWM Input Frequency	-40°C < T <sub>J</sub> < 150°C	-	-	20	kHz
PW <sub>IN(ON)</sub>	Minimum Input Pulse Width <sup>(7)</sup>		0.5	-	-	μs
PW <sub>IN(OFF)</sub>			0.5	-	-	μs
COM	COM Variation	Between COM-NU, NV, NW (including surge)	-5.0	-	5.0	V

**Note:**

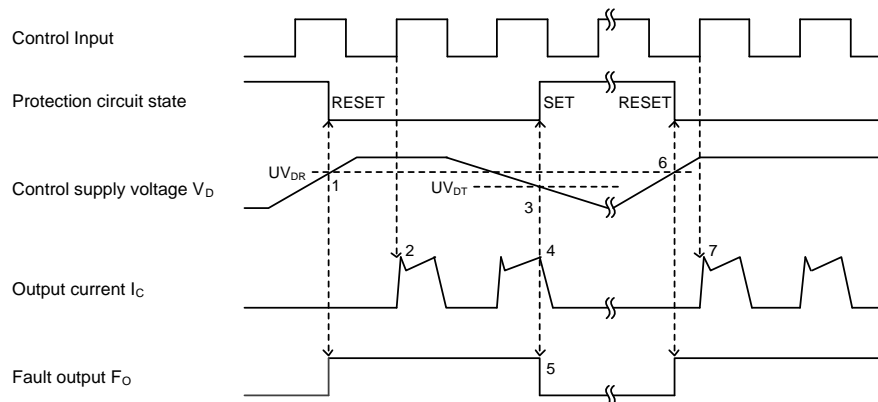
7. IPM may not respond if the input pulse width is less than PW<sub>IN(ON)</sub>, PW<sub>IN(OFF)</sub>.

## Time Charts of the IPM Protective Function



**Figure 6. Short-Circuit Protection**  
(Low-side Operation Only with the External Shunt Resistor and RC Filter)

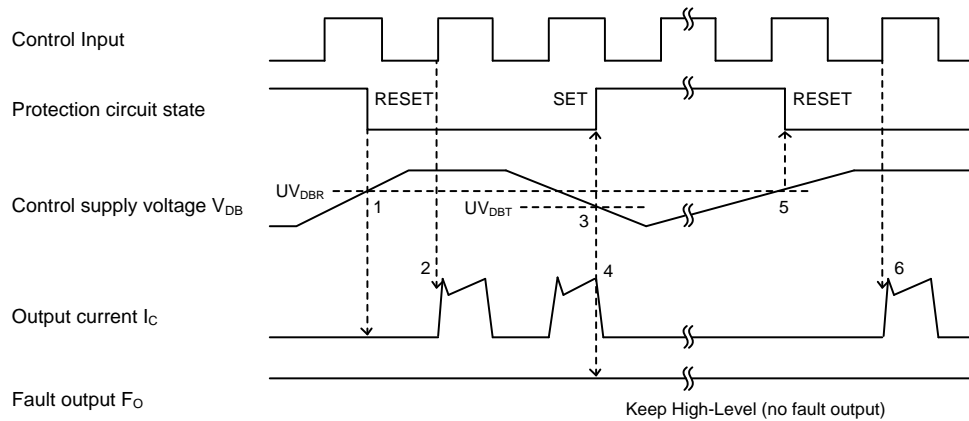
- (1) Normal operation: IGBT turns on and outputs current.
- (2) Short-circuit current detection (SC triggered).
- (3) All low-side IGBTs' gates are hard interrupted.
- (4) All low-side IGBTs turn OFF.
- (5)  $F_O$  output time ( $t_{FO}$ )=minimum 20 $\mu$ s.
- (6) Input = "L" : IGBT OFF.
- (7) Fault output finishes, but output current will not turn on until next ON signal (L→H).
- (8) Normal operation: IGBT turns on and outputs current.



**Figure 7. Under-Voltage Protection (Low-side, UV<sub>D</sub>)**

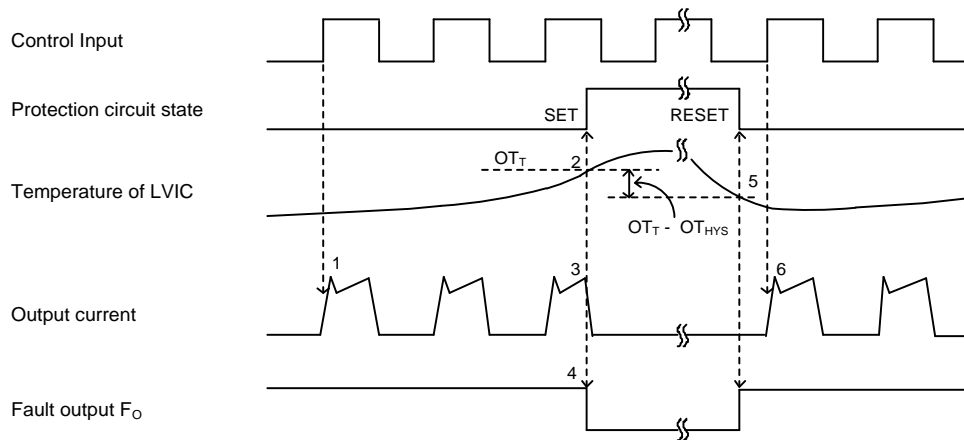
- (1) Control supply voltage  $V_{DD}$  exceeds under voltage reset level ( $UV_{DR}$ ), but IGBT turns on by next ON signal (L→H).
- (2) Normal operation: IGBT turns on and outputs current.
- (3)  $V_{DD}$  level drops to under voltage trip level ( $UV_{DT}$ ).
- (4) All low-side IGBTs turn OFF regardless of control input condition.
- (5)  $F_O$  output time ( $t_{FO}$ )=minimum 20 $\mu$ s, and  $F_O$  stays low as long as  $V_{DD}$  is below  $UV_{DR}$ .
- (6)  $V_{DD}$  level reaches  $UV_{DR}$ .
- (7) Normal operation: IGBT turns on and outputs current.





**Figure 8. Under-Voltage Protection (High-side,  $UV_{DB}$ )**

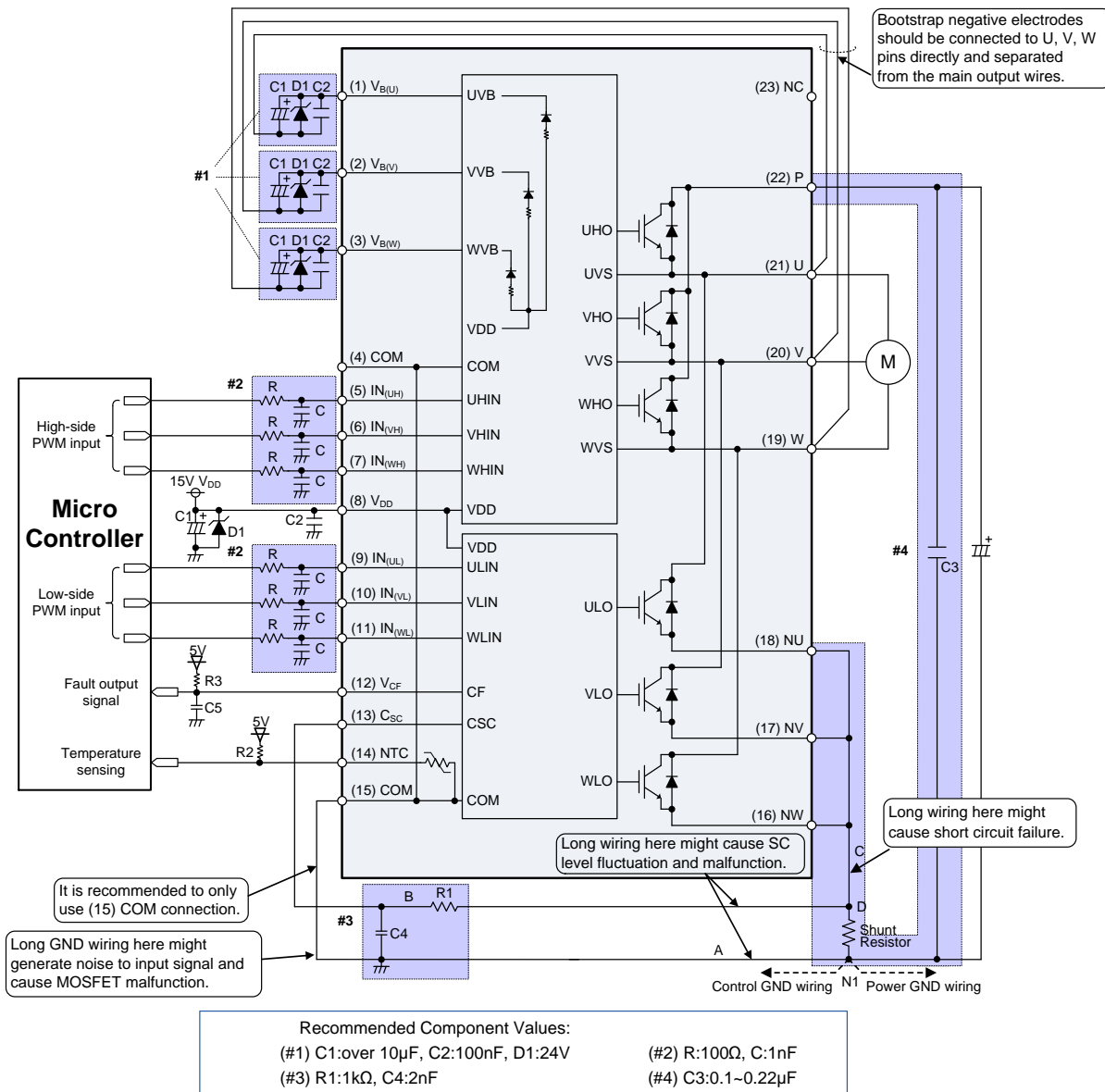
- (1) Control supply voltage  $V_{DB}$  rises. After the voltage reaches under voltage reset level  $UV_{DBR}$ , IGBT turns on by next ON signal (L→H).
- (2) Normal operation: IGBT turns on and outputs current.
- (3)  $V_{DB}$  level drops to under voltage trip level ( $UV_{DBT}$ ).
- (4) All high-side IGBTs turn OFF regardless of control input condition, but there is no  $F_o$  signal output.
- (5)  $V_{DB}$  level reaches  $UV_{DBR}$ .
- (6) Normal operation: IGBT turns on and outputs current.



**Figure 9. Over-Temperature Protection (Low-side, Detecting LVIC Temperature)**

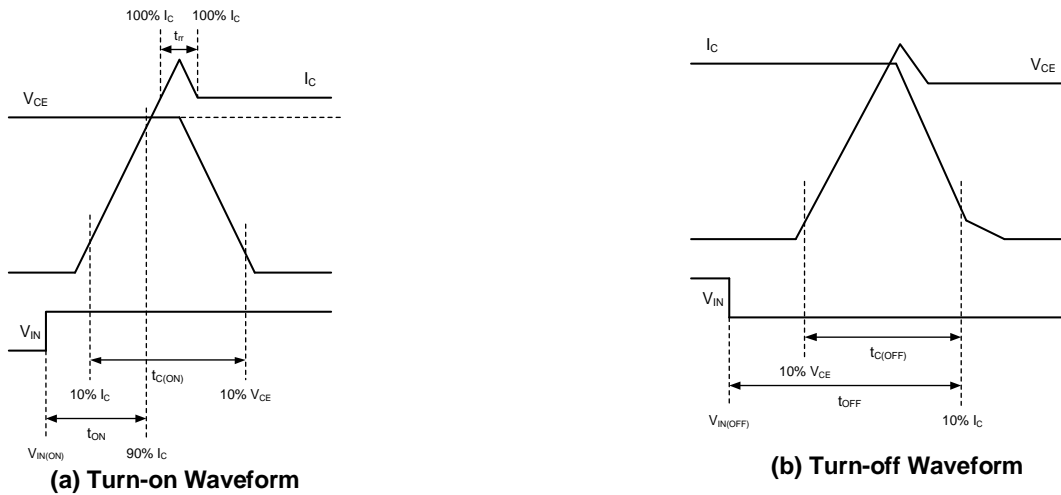
- (1) Normal operation: IGBT turns on and outputs current.
- (2) LVIC temperature exceeds over-temperature trip level ( $OT_T$ ).
- (3) All low-side IGBTs turn off regardless of control input condition.
- (4)  $F_o$  output time ( $t_{FO}$ )=minimum 20 $\mu$ s, and  $F_o$  stays low as long as LVIC temperature is over  $OT_T$ .
- (5) LVIC temperature drops to over-temperature reset level ( $OT_T - OT_{HYS}$ ).
- (6) Normal operation: IGBT turns on by the next ON signal (L→H).

## Example of Application Circuit



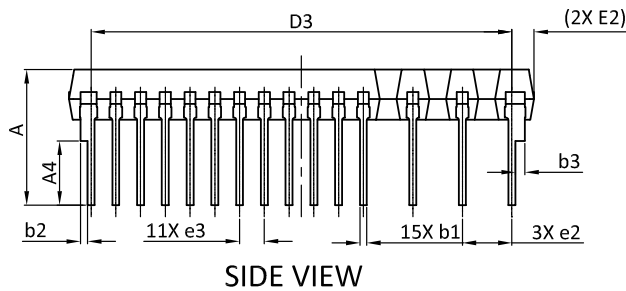
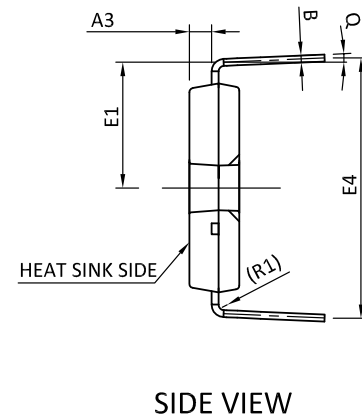
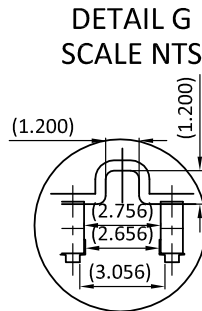
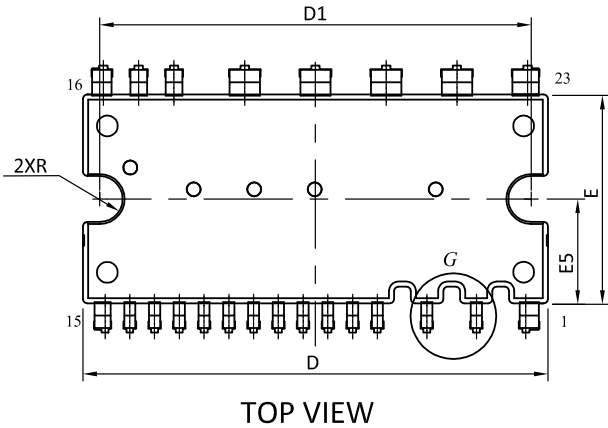
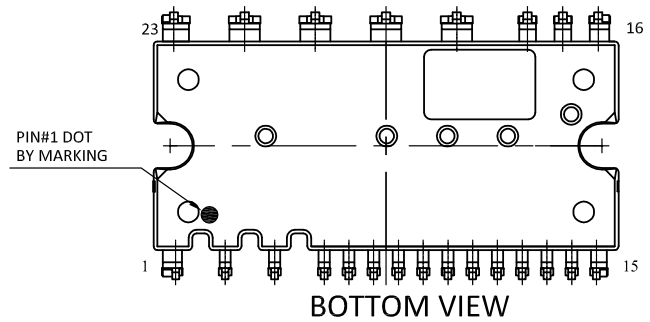
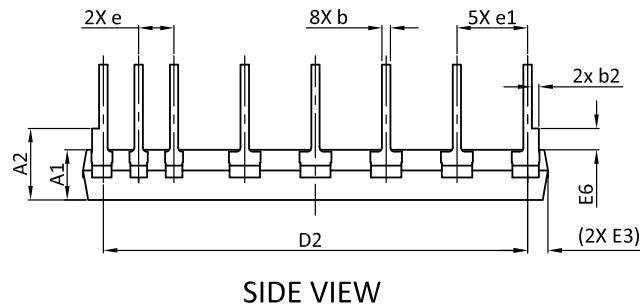
- (1) If the control GND is connected with the power GND by common broad pattern, it may cause malfunction by power GND fluctuation. It is recommended to connect the control GND and power GND at a single point (N1), near the terminal of the shunt resistor.
- (2) There are two COM pins in the IPM but it is recommended to only use the (15) COM pin to minimize SC detection noise.
- (3) A zener diode D1 (24V/1W) is recommended between each pair of control supply pins to prevent surge destruction.
- (4) Prevention of surge destruction can further be improved by placing the bus capacitor as close to pin P and N1 as possible. Generally a 0.1~0.22 $\mu$ F snubber capacitor C3 between the P-N1 terminals is recommended.
- (5) Selection of the R1\*C4 filter components for short-circuit protection is recommended to have tight tolerance, and is temperature-compensated type. The R1\*C4 time constant should be set such that SC current is shut down within 2 $\mu$ s; (typically 1.5~2 $\mu$ s). R1 and C4 should be placed as close as possible to the C<sub>SC</sub> pin. SC interrupting time may vary with layout patterns and components selection, therefore thorough evaluation in the system is necessary.
- (6) NTC signal line should be pull up to the positive side of the 5V/3.3V logic power supply with a proper resistor R2.
- (7) To prevent malfunction, traces A, B, and C should be as short as possible.
- (8) It is recommended that all capacitors are mounted as close to the IPM as possible. (C1: electrolytic type with good temperature and frequency characteristics. C2: ceramic type with 0.1~2 $\mu$ F, good temperature, frequency and DC bias characteristics.)

- (9) Input drives are active-high. There is a minimum 3.5kΩ pull-down resistor in the input circuit of IC. To prevent malfunction, the layout to each input should be as short as possible. When using RC coupling circuit, make sure the input signal levels meet the required turn-on and turn-off threshold voltages.
- (10)  $V_{CF}$  output is open drain type. It should be pulled up to MCU or control power supply (max=  $5\pm 0.5V$ ), limiting the current ( $I_{CF}$ ) to no more than 1mA.  $I_{CF}$  is estimated roughly by the formula of control power supply voltage divided by the pull-up resistor R3. For example, if control supply is 5V, a 10kΩ (over 5kΩ) pull-up resistor R3 is recommended.
- (11) If only a pull-up resistor R3 of 10kΩ connected to  $V_{CF}$  pin, the fault output pulse width is fixed at minimum 20μs. If a capacitor C5 is connected with a pull-up resistor R3, the fault output pulse width can be controlled according to the resistor value and capacitor value. For the design guide, please refer to the Figure 4.
- (12) Direct drive of the IPM from the MCU is possible without having to use opto-coupler or isolation transformer.
- (13) The IPM may malfunction and erroneous operations may occur if high frequency noise is superimposed to the supply line. To avoid such problems, line ripple voltage is recommended to have  $dV/dt \leq \pm 1V/\mu s$ , and  $V_{ripple} \leq 2V_{p-p}$ .
- (14) It is not recommended to use the IPM to drive the same load in parallel with another IPM or inverter types.

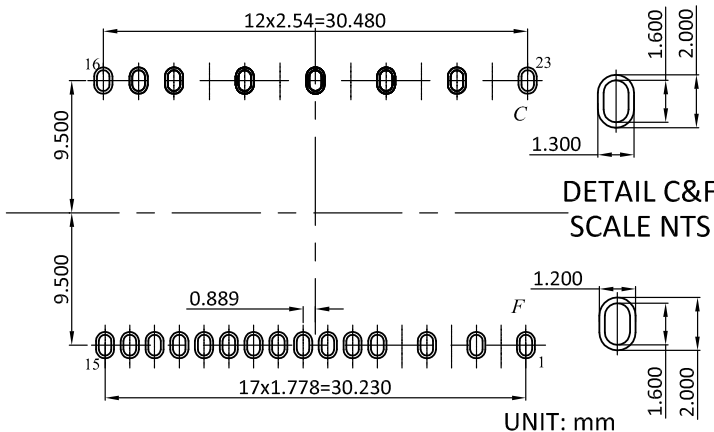


**Figure 10. Switching Times Definition**

## Package Dimensions, IPM-5



### LAND PATTERN RECOMMENDATIONS

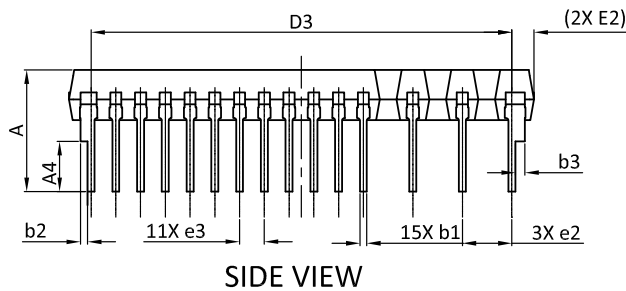
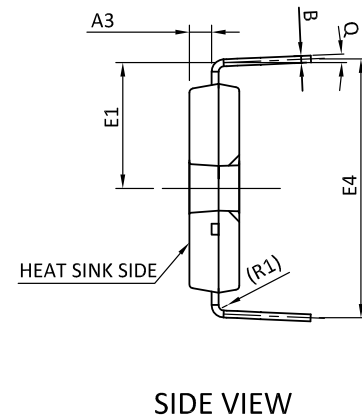
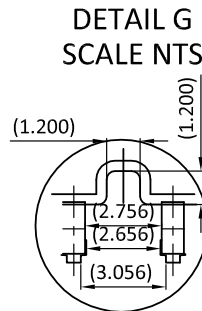
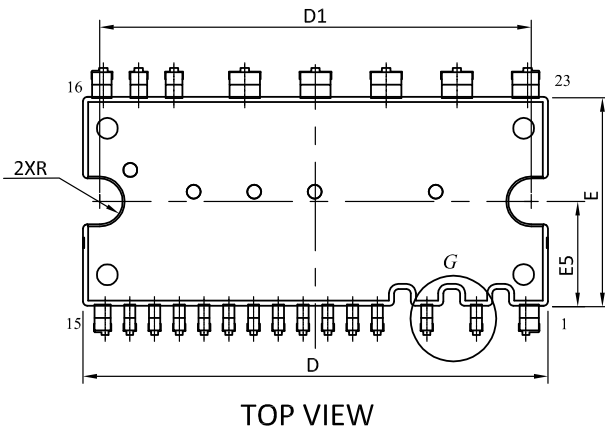
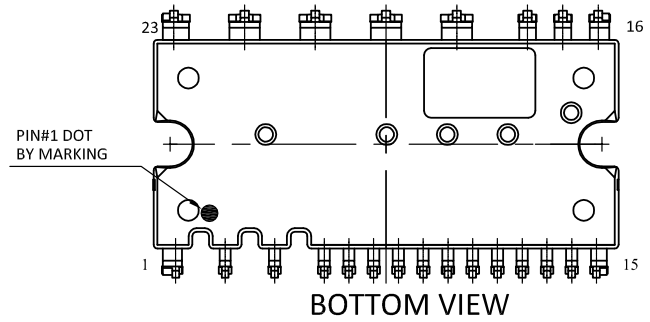
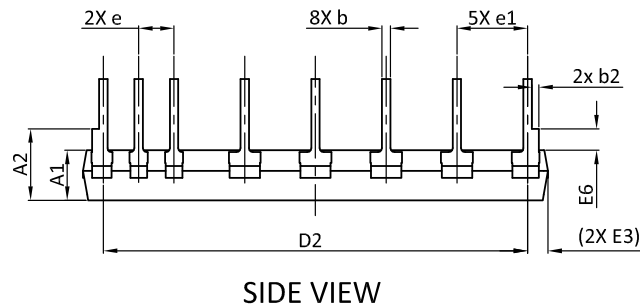


SYMBOLS	DIMENSION IN MILLIMETRES			DIMENSION IN INCHS		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	9.300	9.700	10.100	0.366	0.382	0.398
A1	3.300	3.600	3.900	0.130	0.142	0.154
A2	4.700	5.100	5.500	0.185	0.201	0.217
A3	1.500	1.600	1.700	0.059	0.063	0.067
A4	4.200	4.600	5.000	0.165	0.181	0.197
B	0.400	0.500	0.600	0.016	0.020	0.024
b	0.500	0.600	0.700	0.020	0.024	0.028
b1	0.400	0.500	0.600	0.016	0.020	0.024
b2	0.400	0.500	0.600	0.016	0.020	0.024
b3	0.600	0.700	0.800	0.024	0.028	0.031
D	33.100	33.400	33.700	1.303	1.315	1.327
D1	30.800	31.000	31.200	1.213	1.220	1.228
D2	30.180	30.480	30.780	1.188	1.200	1.212
D3	29.930	30.230	30.530	1.178	1.190	1.202
E	14.700	15.000	15.300	0.579	0.591	0.602
E1	8.600	9.000	9.400	0.339	0.354	0.370
E2	1.600REF			0.063REF		
E3	1.500REF			0.059REF		
E4	18.300	18.700	19.100	0.720	0.736	0.752
E5	7.300	7.500	7.700	0.287	0.295	0.303
E6	1.100	1.500	1.900	0.043	0.059	0.075
e	2.340	2.540	2.740	0.092	0.100	0.108
e1	4.880	5.080	5.280	0.192	0.200	0.208
e2	3.356	3.556	3.756	0.132	0.140	0.148
e3	1.578	1.778	1.978	0.062	0.070	0.078
R	1.500	1.600	1.700	0.059	0.063	0.067
R1	0.400REF			0.016REF		
Q	2° - 6°			2° - 6°		

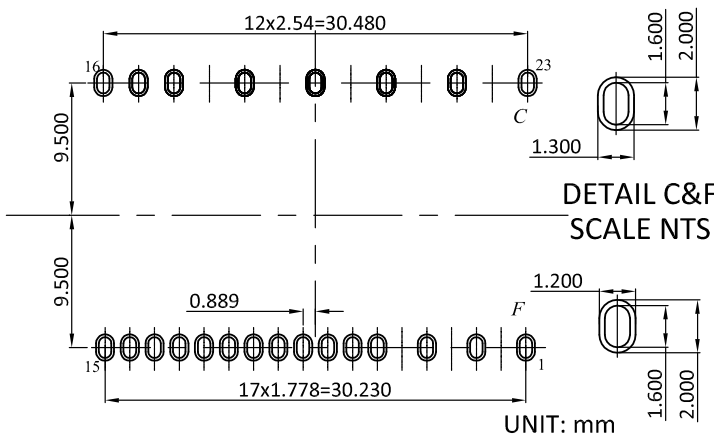
### NOTES

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS, MOLD FLASH SHOULD BE LESS THAN 6 MIL.
2. TOLERANCE 0.100 MILLIMETERS UNLESS OTHERWISE SPECIFIED.
3. CONTROLLING DIMENSION IS MILLIMETER, CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
4. ( ) IS REFERENCE.

## Package Dimensions, IPM-5A



### LAND PATTERN RECOMMENDATIONS



SYMBOLS	DIMENSION IN MILLIMETRES			DIMENSION IN INCHS		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	8.300	8.700	9.100	0.327	0.343	0.358
A1	3.300	3.600	3.900	0.130	0.142	0.154
A2	4.700	5.100	5.500	0.185	0.201	0.217
A3	1.500	1.600	1.700	0.059	0.063	0.067
A4	3.200	3.600	4.000	0.126	0.142	0.157
B	0.400	0.500	0.600	0.016	0.020	0.024
b	0.500	0.600	0.700	0.020	0.024	0.028
b1	0.400	0.500	0.600	0.016	0.020	0.024
b2	0.400	0.500	0.600	0.016	0.020	0.024
b3	0.600	0.700	0.800	0.024	0.028	0.031
D	33.100	33.400	33.700	1.303	1.315	1.327
D1	30.800	31.000	31.200	1.213	1.220	1.228
D2	30.180	30.480	30.780	1.188	1.200	1.212
D3	29.930	30.230	30.530	1.178	1.190	1.202
E	14.700	15.000	15.300	0.579	0.591	0.602
E1	8.600	9.000	9.400	0.339	0.354	0.370
E2	1.600REF			0.063REF		
E3	1.500REF			0.059REF		
E4	18.200	18.600	19.000	0.717	0.732	0.748
E5	7.300	7.500	7.700	0.287	0.295	0.303
E6	1.100	1.500	1.900	0.043	0.059	0.075
e	2.340	2.540	2.740	0.092	0.100	0.108
e1	4.880	5.080	5.280	0.192	0.200	0.208
e2	3.356	3.556	3.756	0.132	0.140	0.148
e3	1.578	1.778	1.978	0.062	0.070	0.078
R	1.500	1.600	1.700	0.059	0.063	0.067
R1	0.400REF			0.016REF		
Q	2° - 6°			2° - 6°		

### NOTES

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS, MOLD FLASH SHOULD BE LESS THAN 6 MIL.
2. TOLERANCE 0.100 MILLIMETERS UNLESS OTHERWISE SPECIFIED.
3. CONTROLLING DIMENSION IS MILLIMETER, CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
4. ( ) IS REFERENCE.

## **LEGAL DISCLAIMER**

Applications or uses as critical components in life support devices or systems are not authorized. AOS does not assume any liability arising out of such applications or uses of its products. AOS reserves the right to make changes to product specifications without notice. It is the responsibility of the customer to evaluate suitability of the product for their intended application. Customer shall comply with applicable legal requirements, including all applicable export control rules, regulations and limitations.

AOS' products are provided subject to AOS' terms and conditions of sale which are set forth at:

[http://www.aosmd.com/terms\\_and\\_conditions\\_of\\_sale](http://www.aosmd.com/terms_and_conditions_of_sale)

## **LIFE SUPPORT POLICY**

ALPHA & OMEGA SEMICONDUCTOR PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.