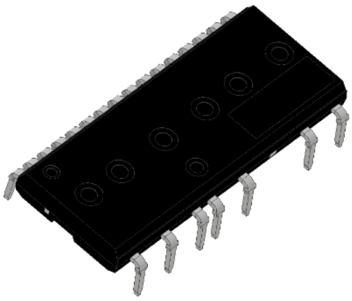
1. Descriptions

CIS06S60L2A1 is a DIP type, CIS06S60L2A1S is a SOP type three- phase Intelligent Power Modules (IPM), highly integrated in a compact package. With the embedded HVIC as the most compatible driver and protector for IGBTs, this Nano series IPM offers an efficient power inverter solution with outstanding performance for PMSM motors such as low power fan or pump for home appliances and industrial instruments.

Features

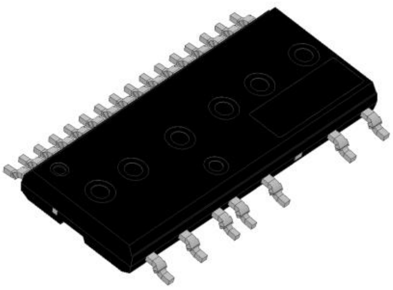
- 600V/6A three-phase DC/AC IGBT inverter.
- HVIC for gate driving, Under-Voltage Protection.
- Separate Open−Emitter Pins from Low−Side IGBTs for Three−Phase Current Sensing.
- Appropriate for 3.3v/5v logic high-active interface.
- Bootstrap diode integrated.
- Humidity sensitivity level 3(for SOP type).
- Isolation 1500V_{rms}/min.



Nano-DIP 3D Package Drawing

Applications

- low power motors for home appliances and industrial instruments.
- low power fan.
- low power pump.



Nano-SOP 3D Package Drawing

Type/Ordering Code	Package	Marking	Related Links
CIS06S60L2A1	Nano-DIP	CIS06S60L2A1 XXXXXXX*	see Appendix A
CIS06S60L2A1S	Nano-SOP	CIS06S60L2A1S XXXXXXX*	

* MFG information

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2. Maximum ratings

at T_j = 25°C, unless otherwise specified

Table 1. Inverter part

Symbol	Parameter	Ratings	Unit	Test Condition
V_{PN}	Supply Voltage	450	V	Applied between P_{IN} -NU,NV,NW
$V_{PN(surge)}$	Supply Voltage (Surge)	500	V	Applied between P_{IN} -NU,NV,NW
V_{CES}	Collector-Emitter Voltage	600	V	-
$I_{C\ 25}$	Each IGBT collector current	6	A	TC=25℃, TJ≤150℃
I_{CP}	Each IGBT collector current (peak)	12	A	TC=25℃, TJ≤150℃, under 1ms pause width
P_C	Collector dissipation	16	W	T_C=25℃

Table 2. Control part

Symbol	Parameter	Ratings	Unit	Test Condition
V_{CC}	Control supply voltage	20	V	Applied between V_{CC} and COM
V_{BS}	High side control bias voltage	20	V	Applied between V_B and V_S
V_{IN}	Input signal voltage	-0.3~ V_{CC} +0.3	V	Applied between V_{IN} and COM

Table 3. Thermal resistance

Symbol	Parameter	Ratings	Unit	Test Condition
$R_{TH(JC)I}$	Thermal resistance from junction to case	7.8	℃/W	Inverter IGBT part, (per module)
$R_{TH(JC)F}$	Thermal resistance from junction to case	8.2	℃/W	Inverter FWD, (per module)

Table 4. Total system

Symbol	Parameter	Ratings	Unit	Test Condition
T_C	Operating case temperature	-40~125	°C	-
T_J	Operating junction temperature	-40~150	°C	-
T_{STG}	Storage temperature	-40~125	°C	-
V_{ISO}	Isolation Voltage Connect Pins to Heat Sink Plate	1500	V_{rms}	60Hz, Sinusoidal, 1 Minute, Connect Pins to Heat Sink Plate

3. Pin definition

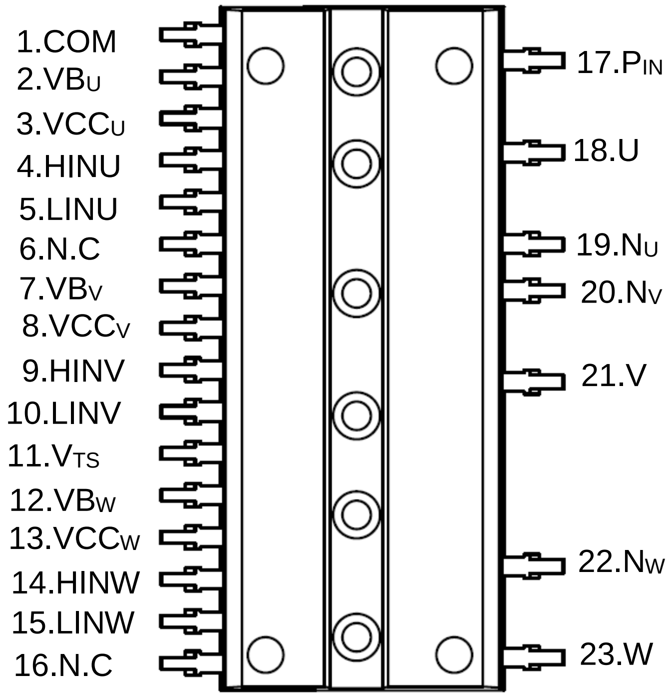


Figure1. Pin Definition (Bottom View)

Table 5. Pin Definition

Pin Number	Pin Name	Pin Description
1	COM	Common Supply Ground
2	VB_U	Bias Voltage for U phase High-Side IGBT Driving
3	VCC_U	Bias Voltage for U phase IC and Low-Side IGBT Driving
4	HIN_U	Signal Input for U phase High-Side
5	LIN_U	Signal Input for U phase Low-Side
6	N.C	No Connection
7	VB_V	Bias Voltage for V phase High-Side IGBT Driving
8	VCC_V	Bias Voltage for V phase IC and Low-Side IGBT Driving
9	HIN_V	Signal Input for V phase High-Side
10	LIN_V	Signal Input for V phase Low-Side
11	V_{TS}	Output for HVIC Temperature Sensing
12	VB_W	Bias Voltage for W phase High-Side IGBT Driving
13	VCC_W	Bias Voltage for W phase IC and Low-Side IGBT Driving
14	HIN_W	Signal Input for W phase High-Side

15	LIN_W	Signal Input for W phase Low-Side
16	N.C	No Connection
17	P_{IN}	Positive DC-Link Input
18	U	Output for U phase & Bias Voltage Ground for High-Side IGBT Driving
19	N_U	Negative DC-Link Input for U phase
20	N_V	Negative DC-Link Input for V phase
21	V	Output for V phase & Bias Voltage Ground for High-Side IGBT Driving
22	N_W	Negative DC-Link Input for W phase
23	W	Output for W phase & Bias Voltage Ground for High-Side IGBT Driving

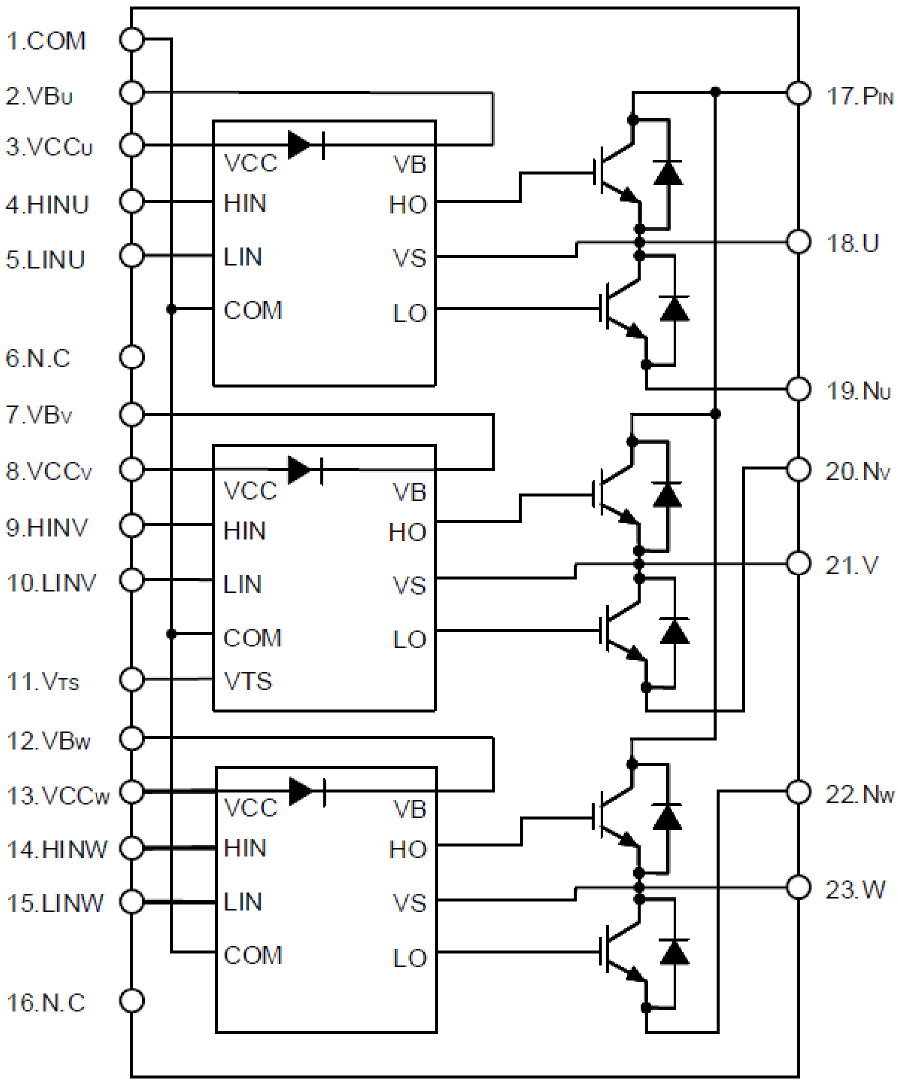


Figure2. Internal Block Diagram

4. Electrical characteristics

at Tj = 25°C, unless otherwise specified

Table 6. Inverter Part

Symbol		Parameter	Values Min.	Values Typ.	Values Max.	Unit	Test Condition
$V_{CE(SAT)}$		Collector-Emitter Saturation Voltage	-	2.10	2.50	V	V_{DD}=V_{BS}=15V,V_{IN}=5V,I_C=5A,T_J=25℃
V_F		FWD Forward Voltage	-	2.20	2.60	V	V_{DD}=V_{BS}=15V,V_{IN}=0V,I_C=-5A,T_J=25℃
HS	t_{ON}	Switching Times	-	780	-	ns	V_{PN}=300V,V_{DD}=V_{BS}=15V, V_{IN}=0~5V, I_C=5A, T_J=25℃
	$t_{C(ON)}$		-	380	-	ns	
	t_{OFF}		-	630	-	ns	
	$t_{C(OFF)}$		-	80	-	ns	
	t_{rr}		-	250	-	ns	
LS	t_{ON}		-	750	-	ns	
	$t_{C(ON)}$		-	390	-	ns	
	t_{OFF}		-	610	-	ns	
	$t_{C(OFF)}$		-	90	-	ns	
	t_{rr}		-	190	-	ns	
I_{CES}		Collector-emitter Leakage current	-	-	1	mA	V_{CE}=V_{CES}, V_{IN}=0V, T_J=25℃

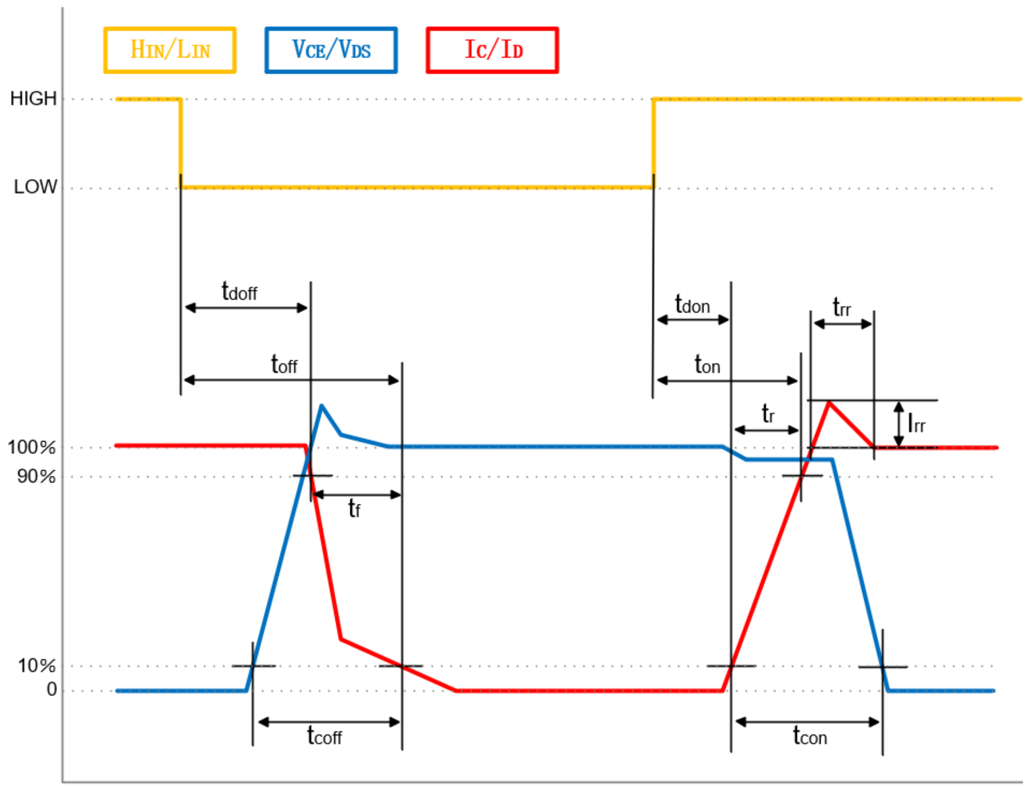


Figure3. Switching Time Chart

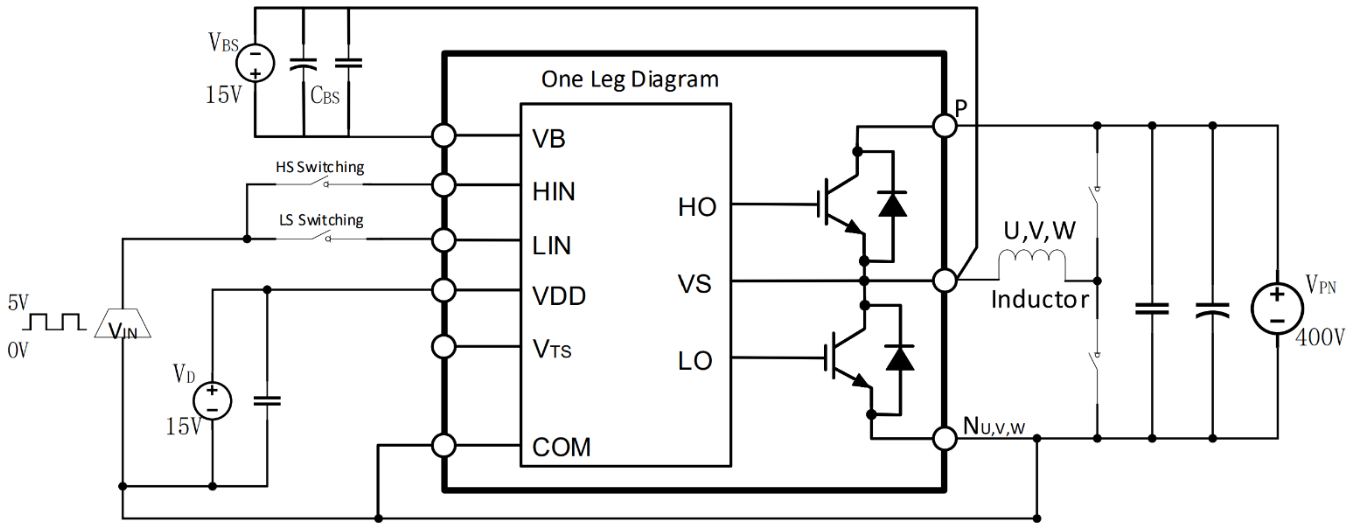


Figure4. Switching and RBSOA Test Circuit

Table 7. Control part

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
I_{QCC}	Quiescent V_{CC} Current	-	220	-	μA	V_{CC}=15V, V_{IN}=0V
I_{QBS}	Quiescent V_{BS} Current	-	70	120	μA	V_{BS}=15V, V_{IN}=0V
V_{CCUV+}	V_{CC} Supply Undervoltage Positive Going Threshold	8.0	8.8	9.8	V	V_{CC} Under-Voltage Protection Reset Level
V_{CCUV-}	V_{CC} Supply Undervoltage Negative Going Threshold	7.4	8.2	9.0	V	V_{CC} Under-Voltage Protection Detection Level
V_{BSUV+}	V_{BS} Supply Undervoltage Positive Going Threshold	8.1	9.0	9.9		V_{BS} Under-Voltage Protection Reset Level
V_{BSUV-}	V_{BS} Supply Undervoltage Negative Going Threshold	7.6	8.4	9.2		V_{BS} Under-Voltage Protection Detection Level
V_{TS}	HVIC Temperature Monitor Voltage	0.6	0.79	0.98	V	V_{CC}=15V, T_{HVIC}=25°C
V_{IH}	ON Threshold Voltage	-	-	2.9	V	Logic HIGH Level
V_{IL}	OFF Threshold Voltage	0.8	-	-	V	Logic LOW Level

Table 8. BSD part

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
R_{BS}	Bootstrap Diode Resistance	-	470	-	Ω	Vcc=15V
V_F	Bootstrap Diode Forward Voltage	-	3.3	-	V	I_F=10mA

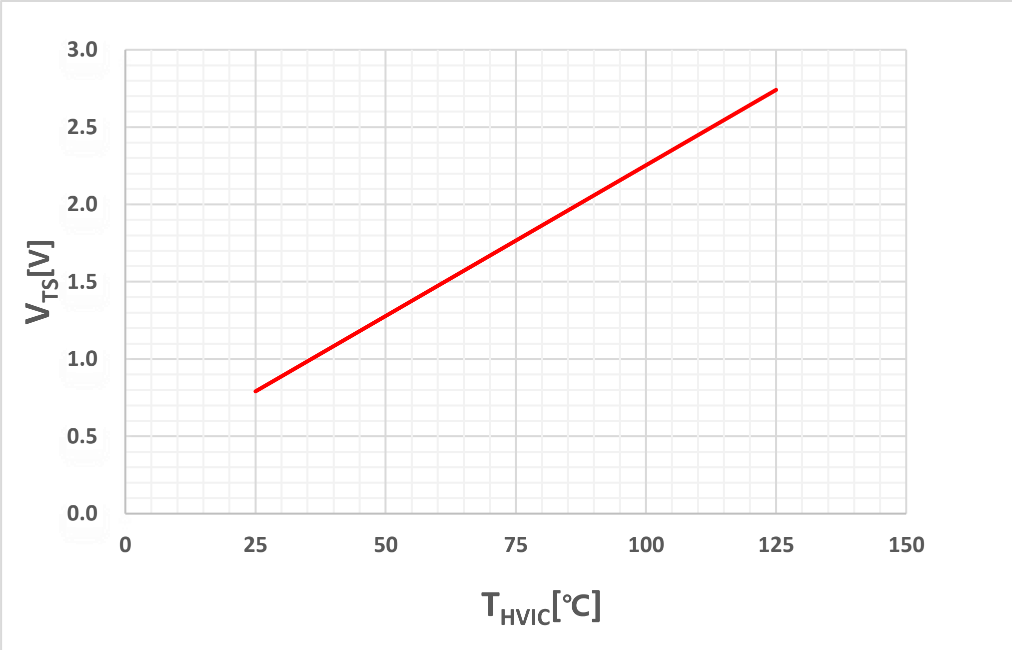


Figure5. V_{TS} Temperature Curve (Typical)

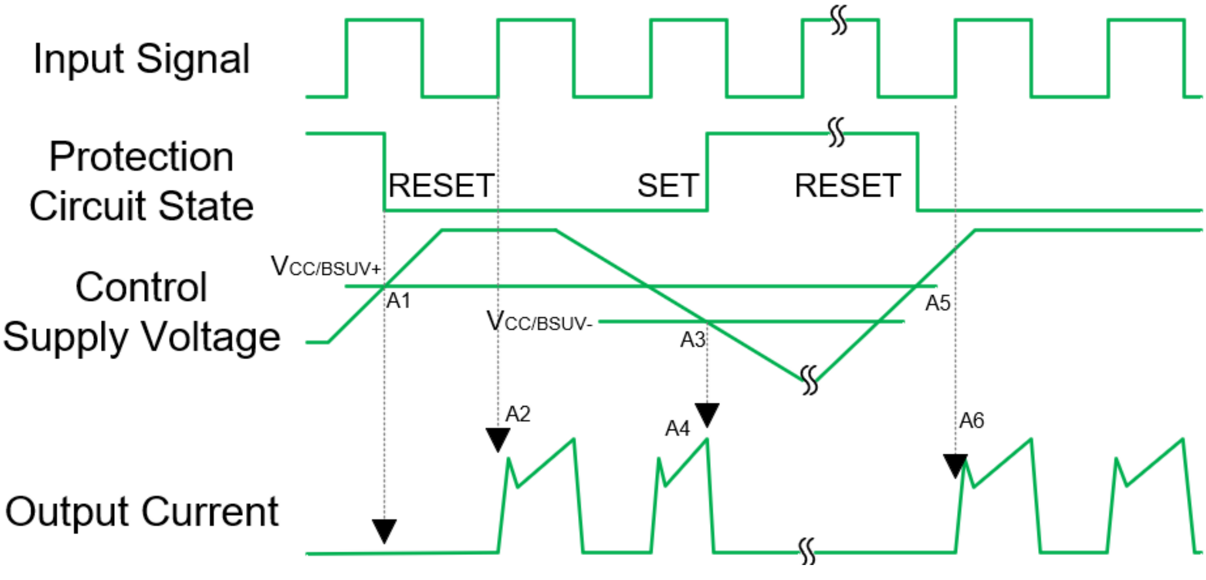


Figure6. Under−Voltage Protection

Figure6 NOTES:

A1: Control supply voltage rises: after the voltage rises $V_{CC/BSUV+}$, the circuits start to operate when next input is applied.
A2: Normal operation: IGBT ON and carrying current.
A3: Under−voltage detection ($V_{CC/BSUV-}$).
A4: IGBT OFF in spite of control input condition.
A5: Under−voltage reset ($V_{CC/BSUV+}$).
A6: Normal operation: IGBT ON and carrying current.

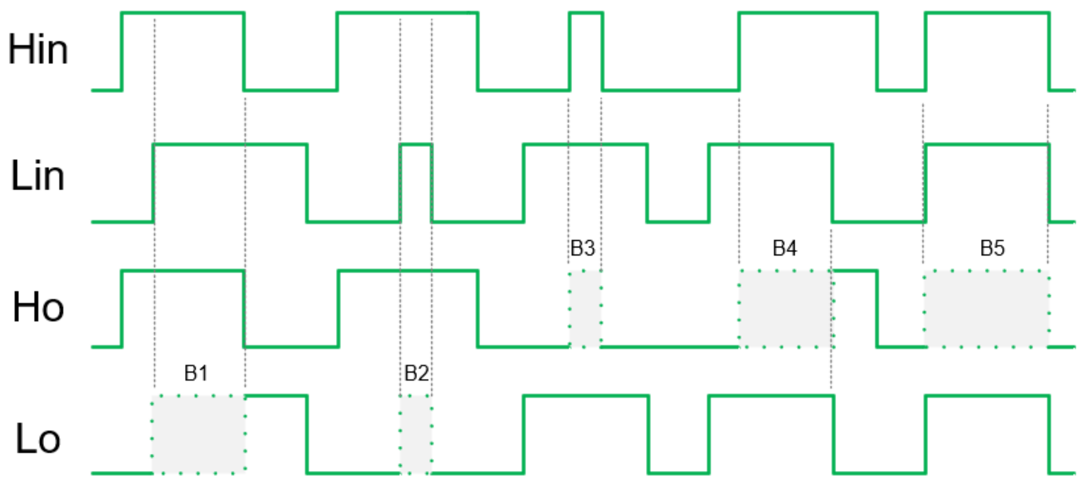


Figure7. Inter−Lock Function

Figure7 NOTES:

B1: High Side First − Input − First − Output Mode.
B2: Low Side Noise Mode: No LO.
B3: High Side Noise Mode: No HO.
B4: Low Side First − Input − First − Output Mode.
B5: IN − Phase Mode: No HO.

Table 9. Recommended operation conditions

Symbol	Parameter	Values			Unit	Test Condition
		Min.	Typ.	Max.		
V_{PN}	Supply Voltage	-	300	400	V	Applied between P and N
V_{CC}	Control Supply Voltage	13.5	15.0	16.0	V	Applied between V_{CC} and COM
V_{BS}	High-Side Bias Voltage	13.5	15.0	16.5	V	Applied between V_B and V_S
$V_{IN(ON)}$	Input ON Threshold Voltage	3.0	-	V_{CC}	V	Applied between V_{IN} and COM
$V_{IN(OFF)}$	Input OFF Threshold Voltage	0	-	0.6	V	
t_{dead}	Blanking Time for Preventing Arm-Short	1.0	-	-	μs	V_{CC}=V_{BS}=13.5~16.5V, T_J<=150°C
f_{PWM}	PWM Switch Frequency	-	15	-	kHZ	T_J<=150°C

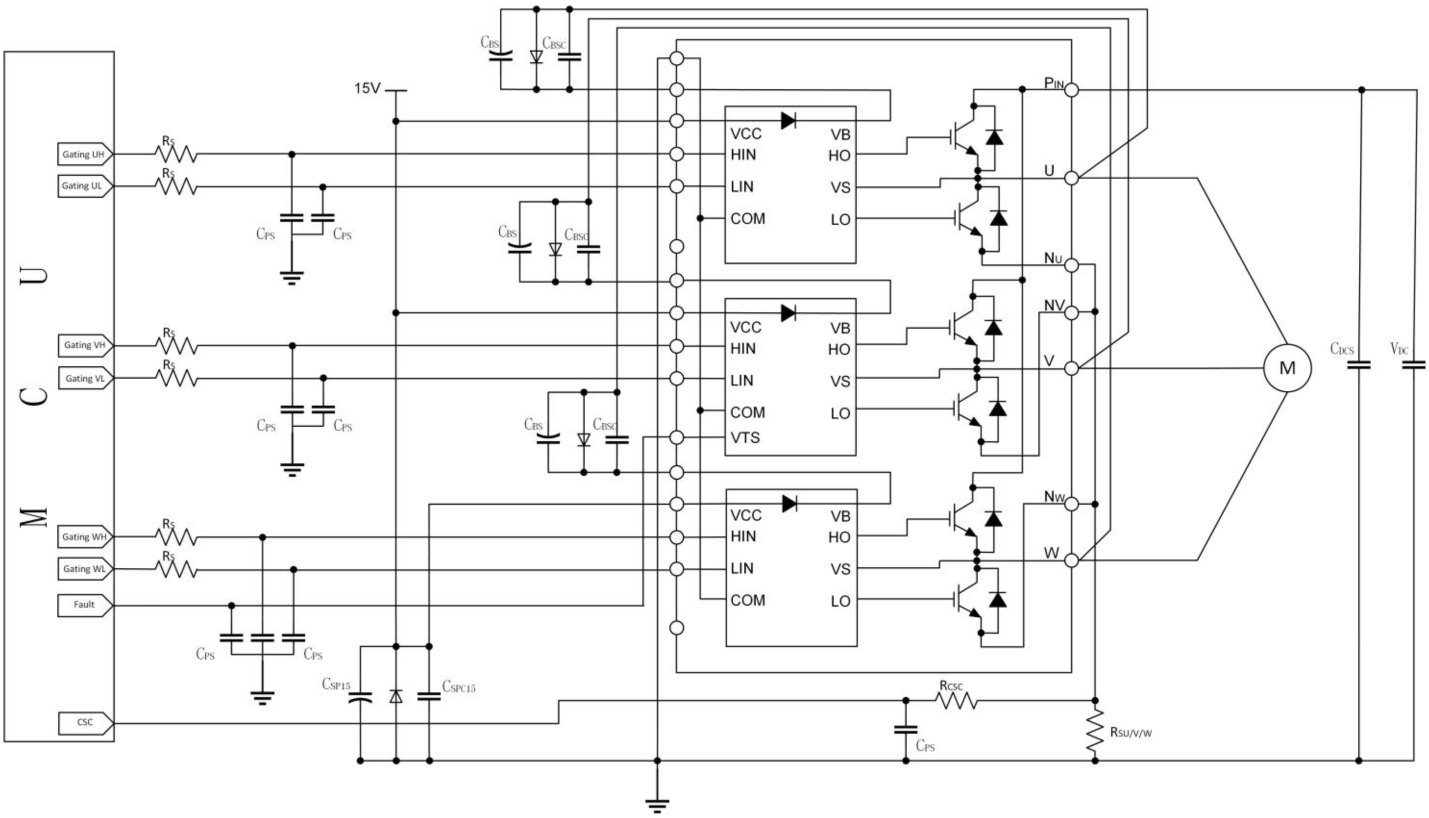


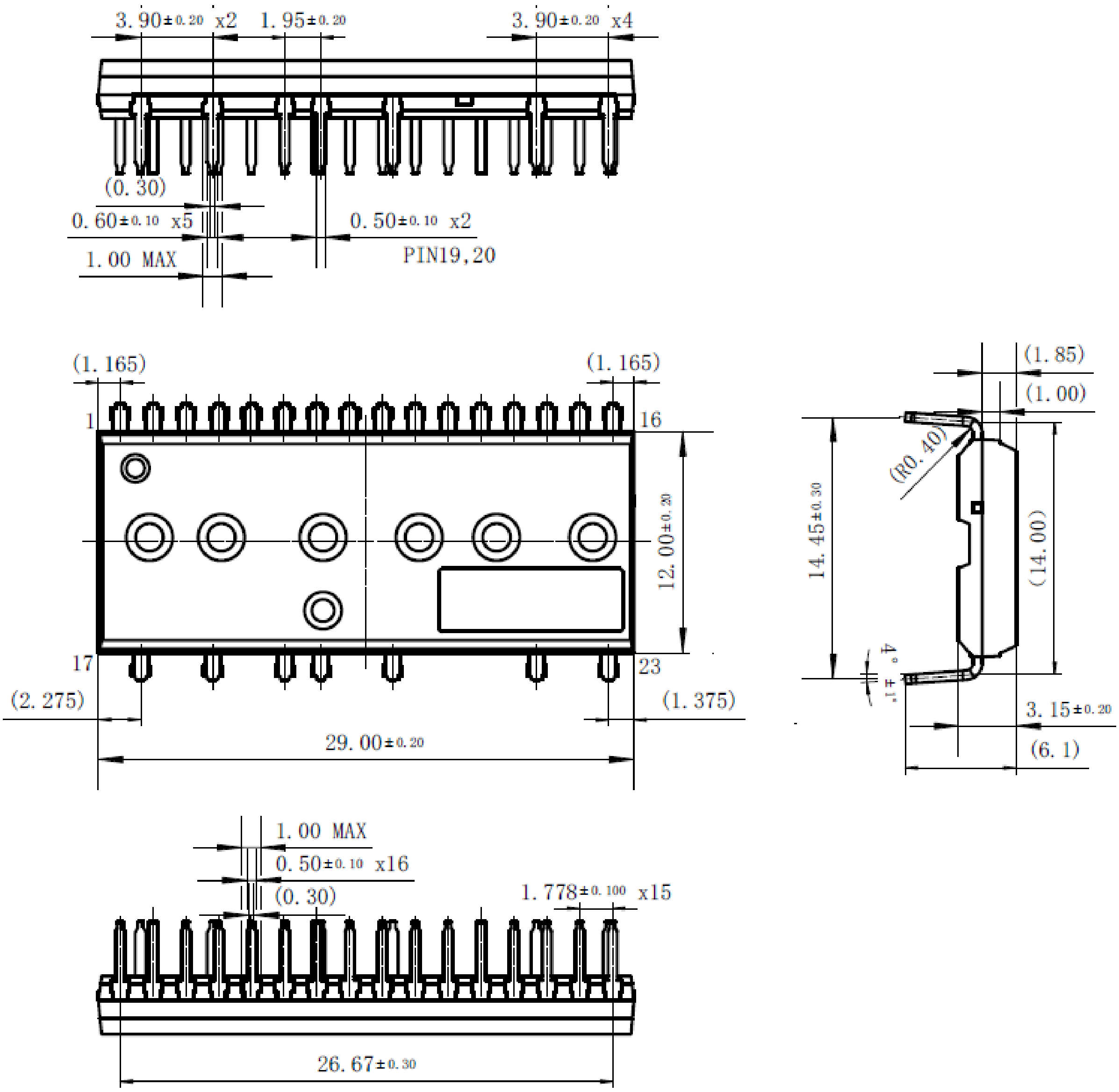
Figure8. Recommend Application Circuit

Figure8 NOTES:

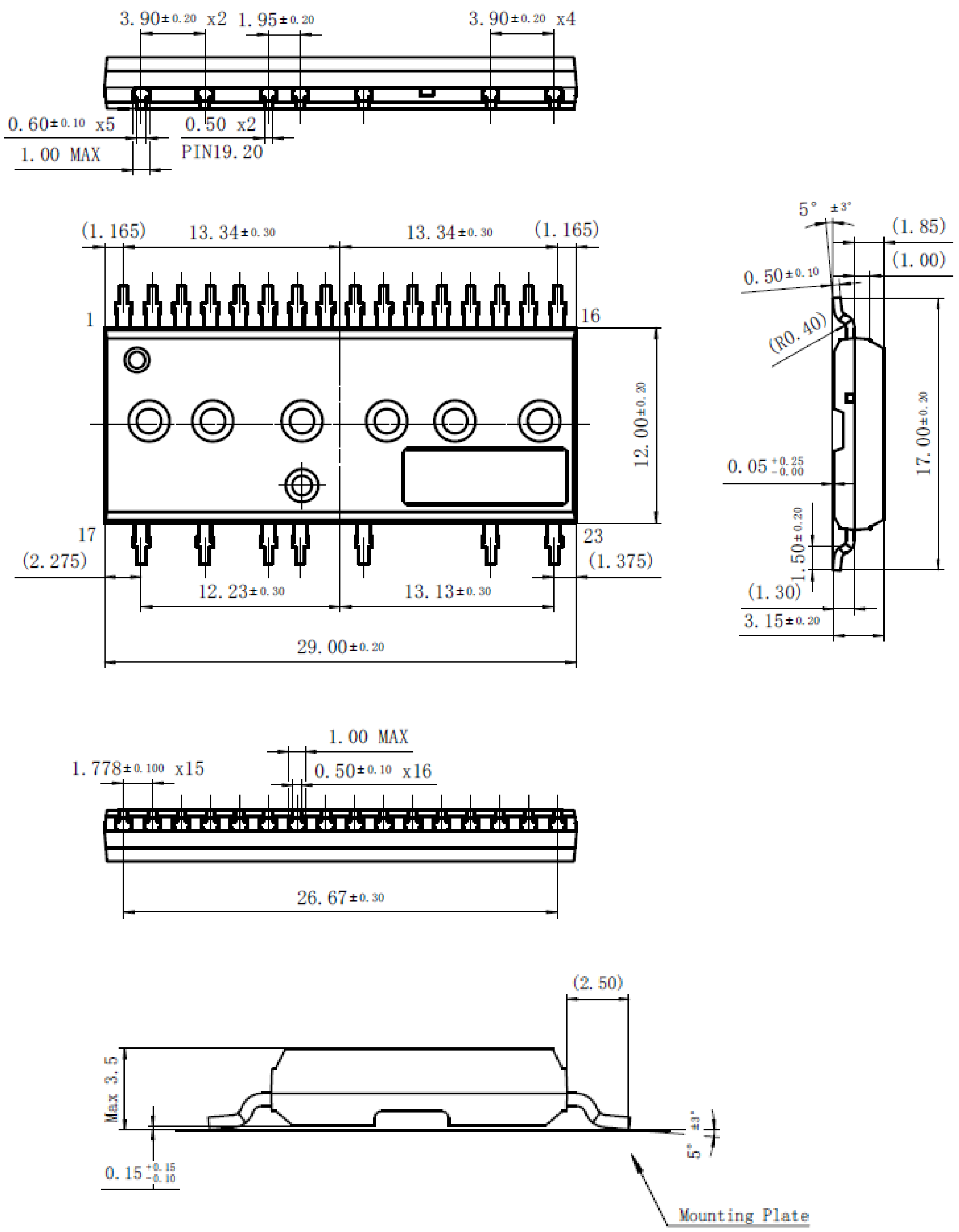
1. To avoid malfunction, the wiring of each input should be as short as possible (Less than 2 ~ 3 cm).
2. C_{SP15} of around seven times larger than bootstrap capacitor C_{BS} is recommended.
3. Input signal is active−HIGH type. There is a 5 kΩ resistor inside the IC to pull down each input signal line to GND. RC coupling circuits are recommended for the prevention of input signal oscillation. $R_S C_{PS}$ time constant should be selected in the range 50 ~ 150 ns (Recommended R_S = 100Ω, C_{PS} = 1 nF).
4. The connection between control GND line and power GND line which includes the NU, NV, NW must be connected to only one point. Please do not connect the control GND to the power GND by the broad pattern. Also, the wiring distance between control GND and power GND should be as short as possible.
5. Each capacitor should be mounted as close to the pins of the Motion product as possible.
6. To prevent surge destruction, the wiring between the smoothing capacitor and the P_{IN} and GND pins should be as short as possible. The use of a high frequency non−inductive capacitor of around 0.1 ~ 0.22 μF between the P_{IN} and GND pins is recommended.
7. Relays are used in almost every system of electrical equipment of home appliances. In these cases, there should be sufficient distance between the CPU and the relays.
8. The zener diode or transient voltage suppressor should be adapted for the protection of ICs from the surge destruction between each pair of control supply terminals (Recommended Zener diode is 22 V / 1 W, which has the lower zener impedance characteristic than about 15Ω).
9. Please choose the electrolytic capacitor with good temperature characteristic in C_{BS}. Also, choose 0.1 ~ 0.2 μF R−category ceramic capacitors with good temperature and frequency characteristics in C_{BSC}.

5. Outline Drawing

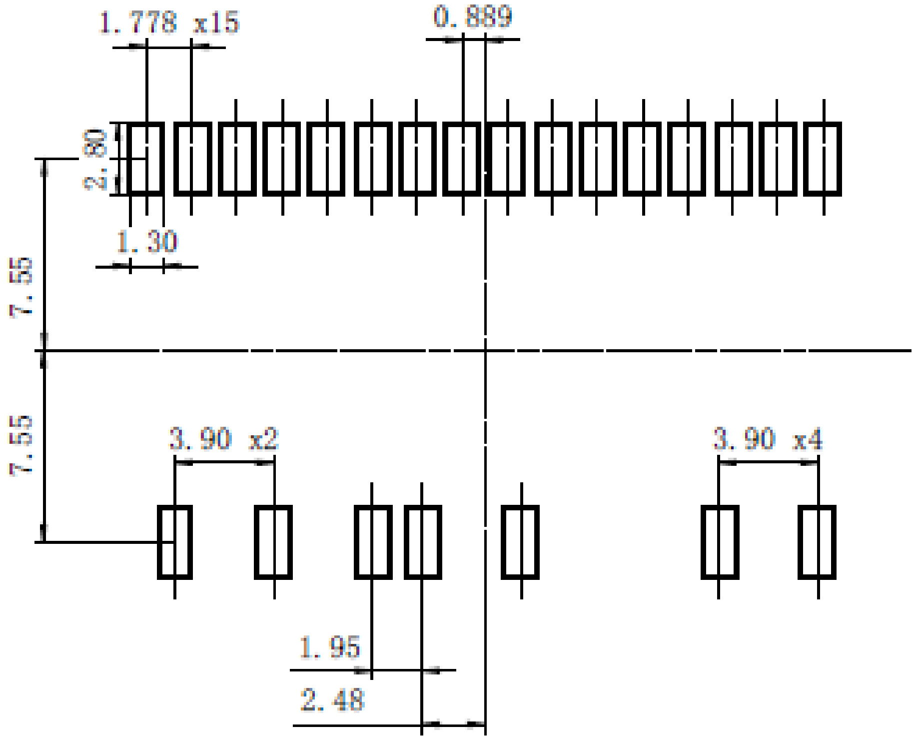
Nano-DIP（mm）



Nano-SOP（mm）


3. 90±0. 20 x2
1. 95±0. 20
3. 90±0. 20 x4
0. 60±0. 10 x5
0. 50 x2
1. 00 MAX
PIN19. 20
(1. 165)
13. 34±0. 30
13. 34±0. 30
(1. 165)
1
16
17
23
(2. 275)
(1. 375)
12. 00±0. 30
12. 23±0. 30
13. 13±0. 30
29. 00±0. 20
5° ±3°
(1. 85)
(1. 00)
0. 50±0. 10
(R0. 40)
0. 05 +0. 25 -0. 00
17. 00±0. 30
1. 50±0. 20
(1. 30)
3. 15±0. 20
1. 00 MAX
1. 778±0. 100 x15
0. 50±0. 10 x16
26. 67±0. 30
(2. 50)
Max 3. 5
0. 15 +0. 15 -0. 10
5° ±3°
Mounting Plate

Mounting Pattern Recommendations（mm）



6. Appendix

CoolSemi Webpage: www.coolsemi.com.