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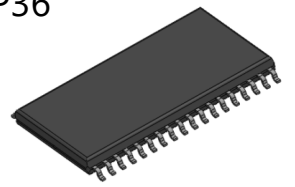
Future of Power Electronics and the Earth



# High Efficiency and High Performance, Sinusoidal Motor Driver IC SX6812xM Series

## ◆ SX6812xM Series Selection Guide

SOP36



Part Number	$V_{DSS}$	$I_D$	$R_{DS(ON)}$	Rotation Pulse Signal	Status
SX68128MA	600 V	1.5 A	3.6 $\Omega$ (max.)	3 ppr	Preview
SX68128MB		1.5 A	3.6 $\Omega$ (max.)	2.4 ppr	Active
SX68127MA		2.0 A	2.5 $\Omega$ (max.)	3 ppr	Preview

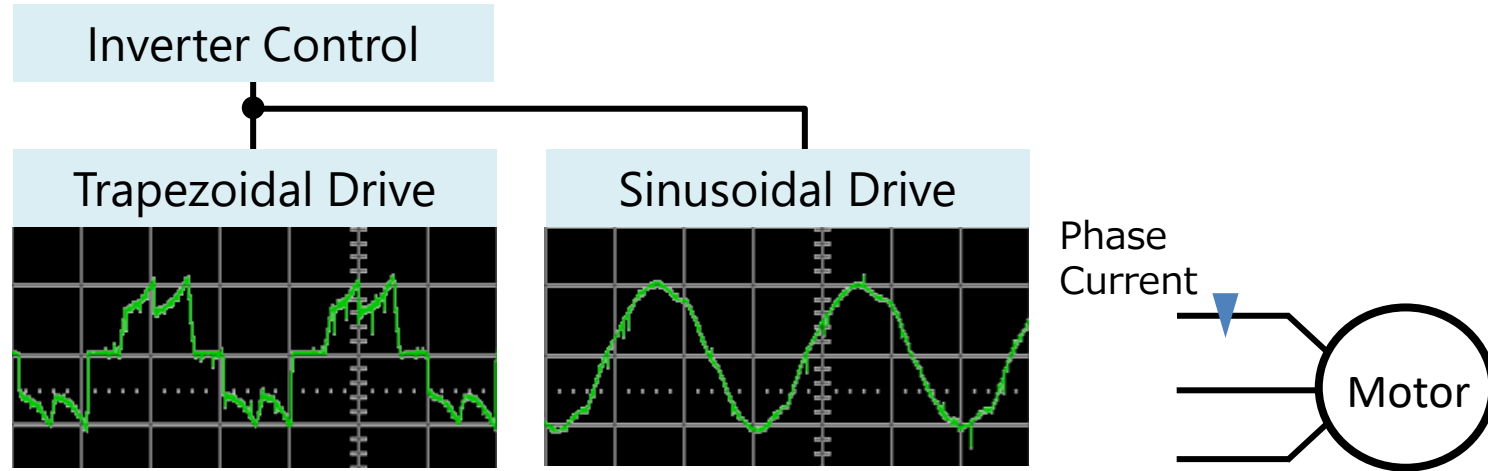
## ◆ Recommended Applications

- Air Conditioner Indoor Fan Motor
- Air Purifier Fan Motor



## ◆ Drive Method

Motor drive methods include trapezoidal and sinusoidal.



## ◆ Features

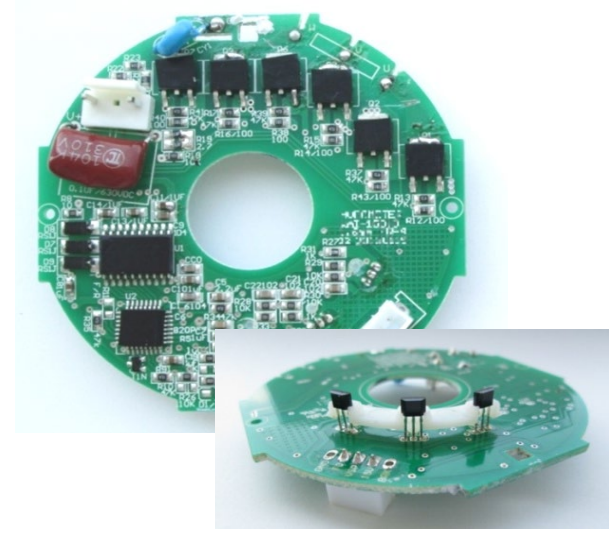
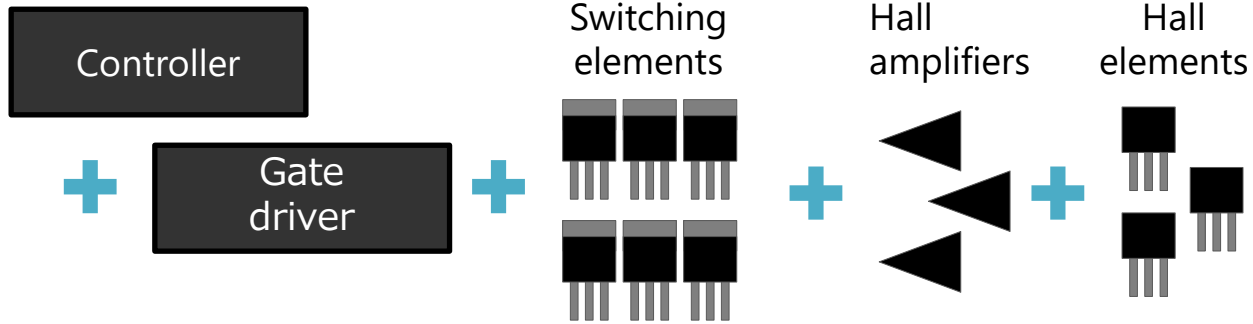
The following table shows the drive methods and the features.

The SX6812xM series use the sinusoidal drive that provides the high efficiency and low audible noise.

Drive Method	Parameter			
	Motor Efficiency	Switching Efficiency	Quietness	Torque Ripple
Trapezoidal	High	Higher	Quiet	Large
Sinusoidal	Higher	High	Quieter	Small

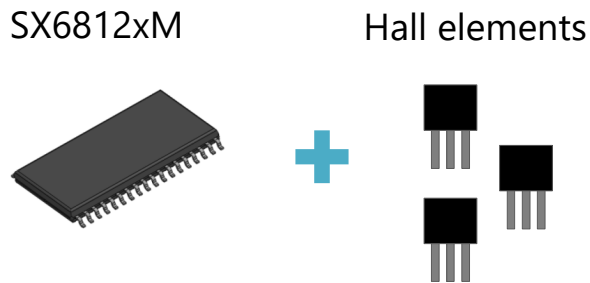
## ◆ Existing Motor Drivers

Many discrete elements are needed.



## ◆ SX6812xM Series

Only SX6812xM and hall elements are needed.

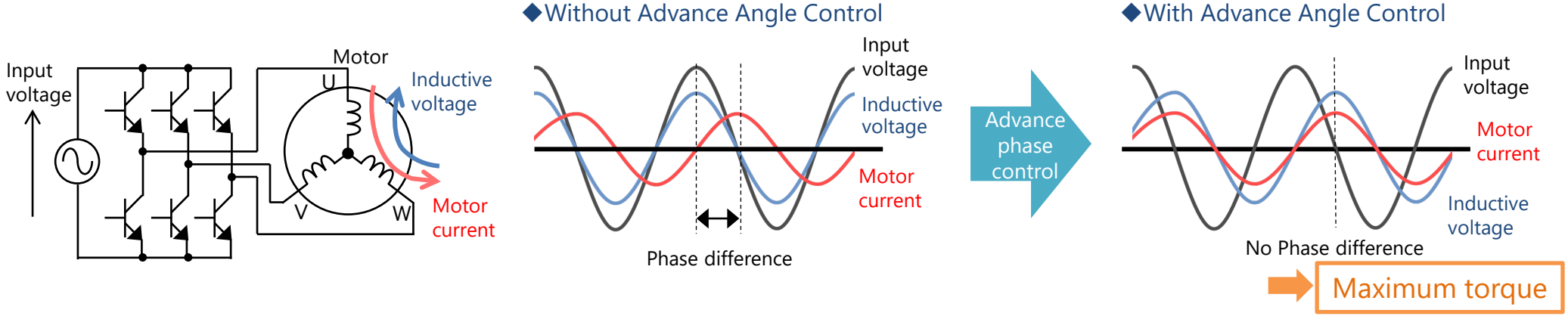


- Significant component count reduction
- PCB downsizing
- Auto-mountable SOP package

# Advance Angle Control

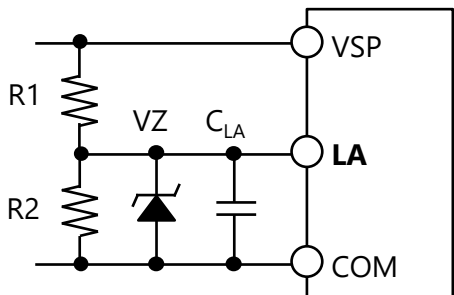
The phase of the current flowing through the motor is delayed from the phase of the inductive voltage due to the influence of the inductance of the winding.

The SX6812xM series have the advance angle control function that reduces the phase difference between the inductive voltage and the motor current. As a result, the motor can be used with the maximum torque.

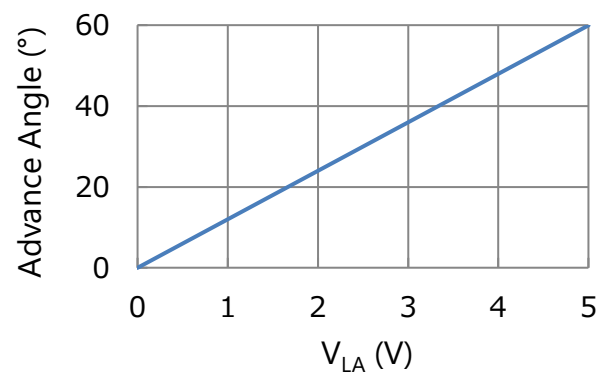


In the SX6812xM series, the phase of the inductive voltage can be adjusted by the LA pin voltage.

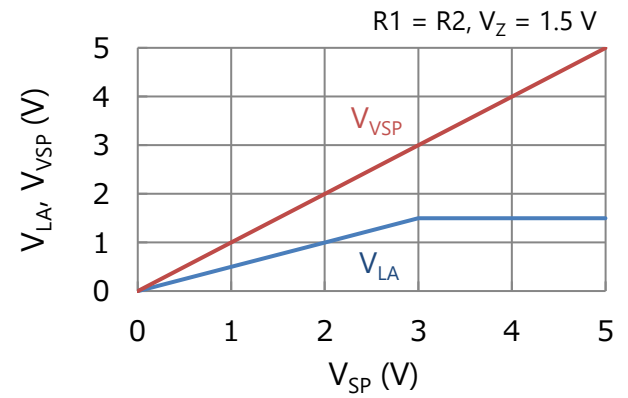
◆ LA Pin Peripheral Circuit



◆ LA Pin Voltage–Advance Angle Characteristic



◆ Example of Advance Angle Setting



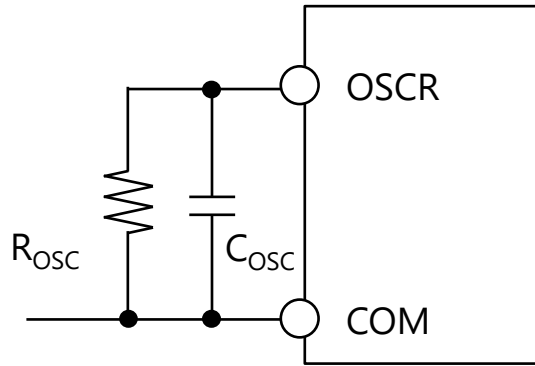
The SX6812xM series have built-in motor control parts, and can simultaneously monitor the drive signal and the motor driver state. In addition to the existing protections, the ICs also have the protections such as the locked motor protection, the inverse rotation detection, and the hall signal fault detection. Improving the performance of the ICs reduce the number of external components. This provides reducing the system size and the designing resources, and improving the system reliability.

Protection	Description
Undervoltage Lockout for Power Supply (UVLO)	Prevents the critical damage caused by increased loss of the power elements. Integrated into the VB and VCC pins.
Thermal Shutdown (TSD)	Detects the temperature of the monolithic IC, $T_j$ . When $T_j \geq 130\text{ }^\circ\text{C}$ , all switching elements are turned off. Then, when $T_j \leq 90\text{ }^\circ\text{C}$ or lower, the IC returns to the normal operation.
Overcurrent Limiting Function (OCL)	When the motor current reaches the setting value or more, the high-side switching elements are turned off by pulse-by-pulse.
Overcurrent Protection (OCP)	When the motor current reaches the setting value or more, all switching elements are turned off. The IC restarts automatically after the OCP hold time of 15 ms.
Locked Motor Protection	If the position information of the hall elements does not change for more than 6 seconds, all switching elements are turned off for 35 seconds.
Inverse Rotation Detection	If the rotation direction of the actual motor does not match that of the setting direction, the drive method becomes trapezoidal.
Hall Signal Fault Detection	If the position detection signals of three hall elements are “H, H, H” or “L, L, L”, all switching elements are turned off.

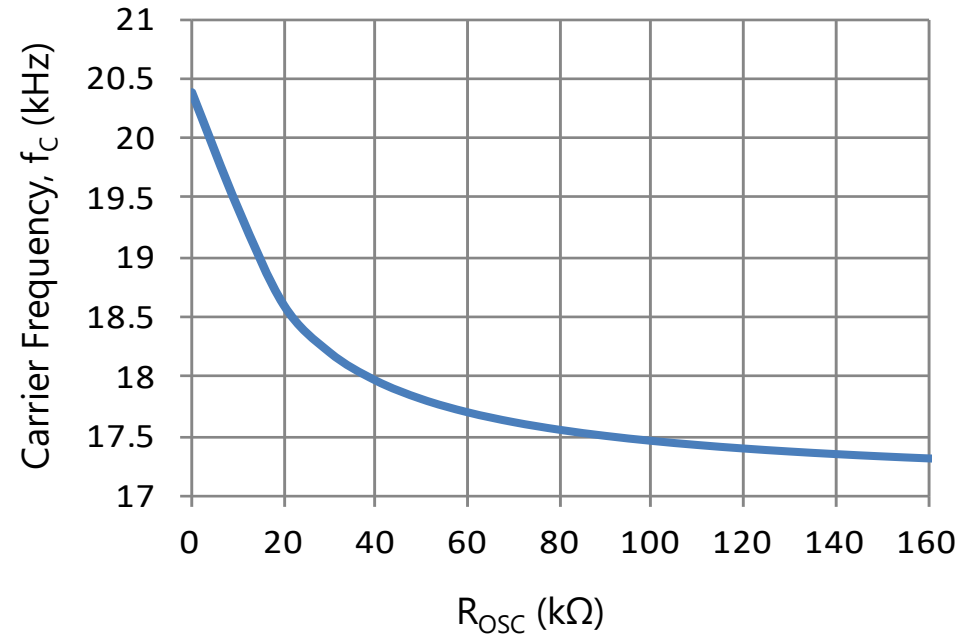
# Adjustment of Carrier Frequency

A carrier frequency is adjusted by  $R_{OSC}$  connected to the OSCR pin.

## ◆ OSCR Pin Peripheral Circuit



## ◆ Relationship of Carrier Frequency and Resistance Value



## ◆ Adjustable Range of Carrier Frequency

$R_{OSC}$ (k $\Omega$ )	Carrier Frequency, $f_c$ (kHz)
Short	20.4
Open	17.0

# Switching of Speed Control and Drive Method

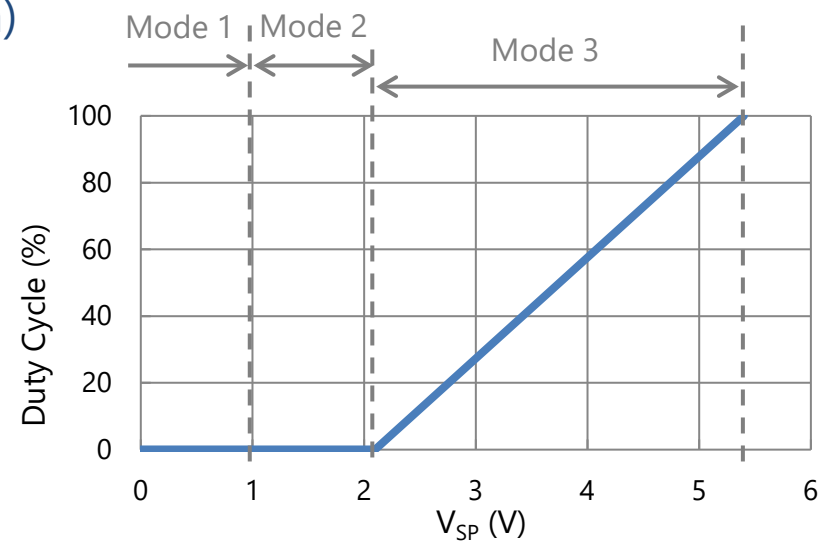
The SX6812xM series switches a drive method according to a frequency. The motor speed is detected by the VSP pin, and then the operation mode is switched according to the VSP pin voltage. This realizes a stable startup operation.

## ◆ Switching of Drive Method

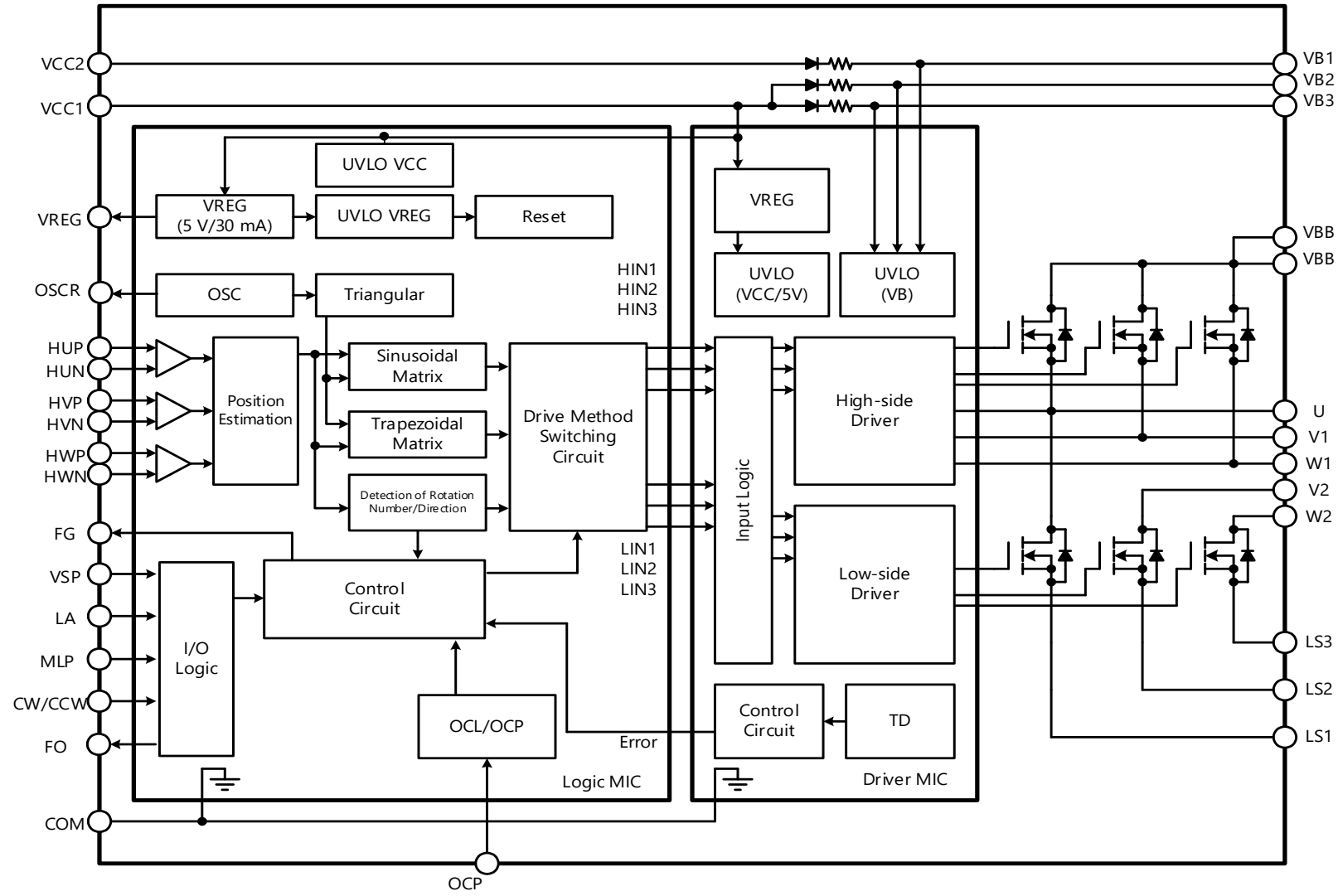
Frequency	Drive Method
Less than 1 Hz	Trapezoidal
More than 1 Hz	Sinusoidal two-phase modulation

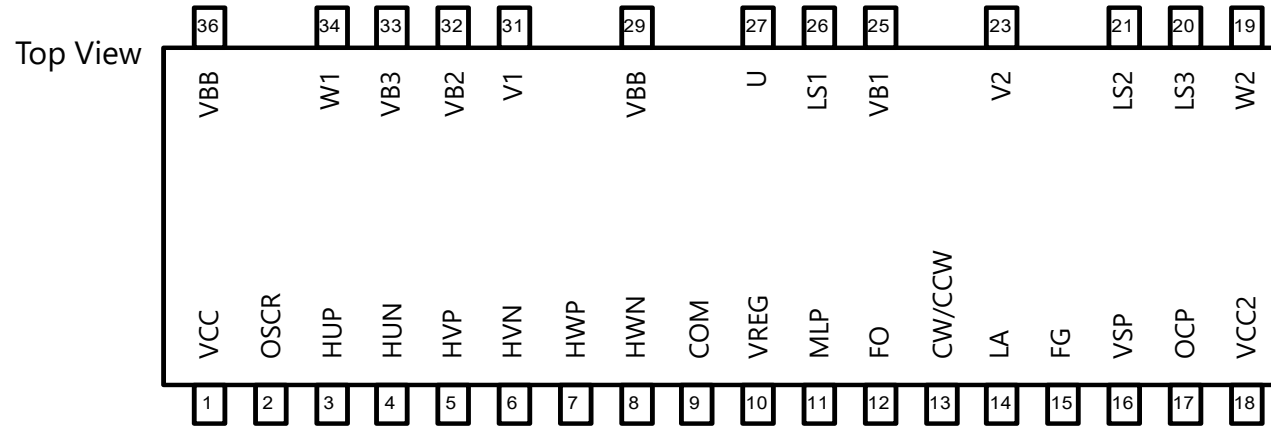
## ◆ Switching of Operation Mode (see the right graph)

Mode	VSP Pin Voltage	Operation
1	0.0 V to 1.0 V	All switching elements are turned off
2	1.0 V to 2.1 V	Boot capacitor is charged (low-side switching elements are turned on)
3	2.1 V to 5.4 V	PWM modulation



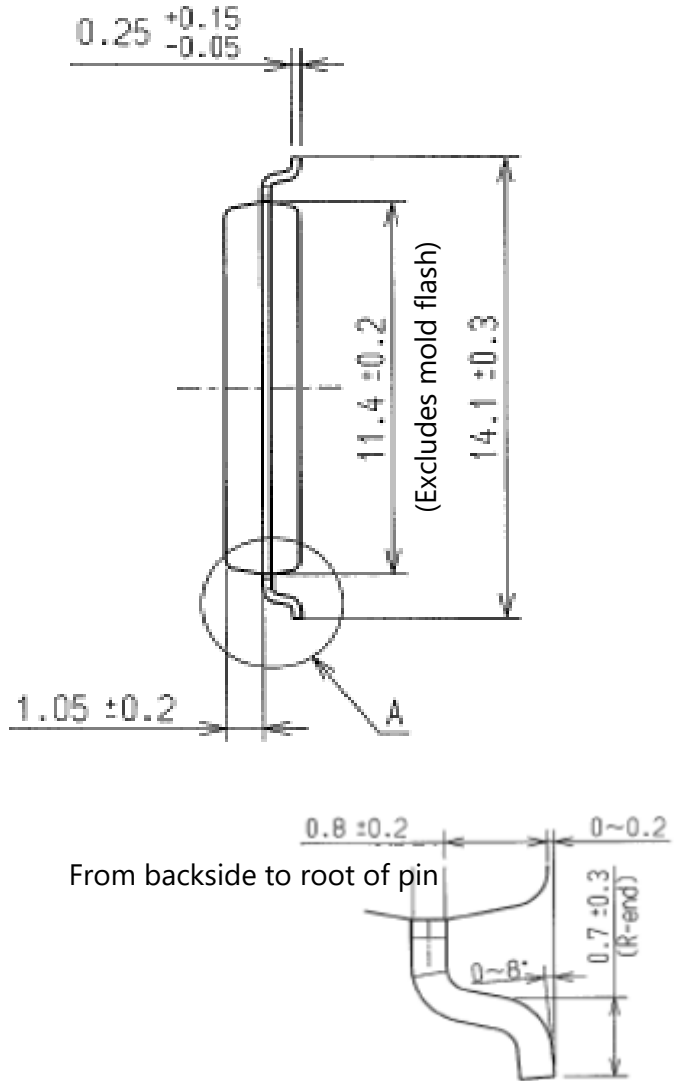
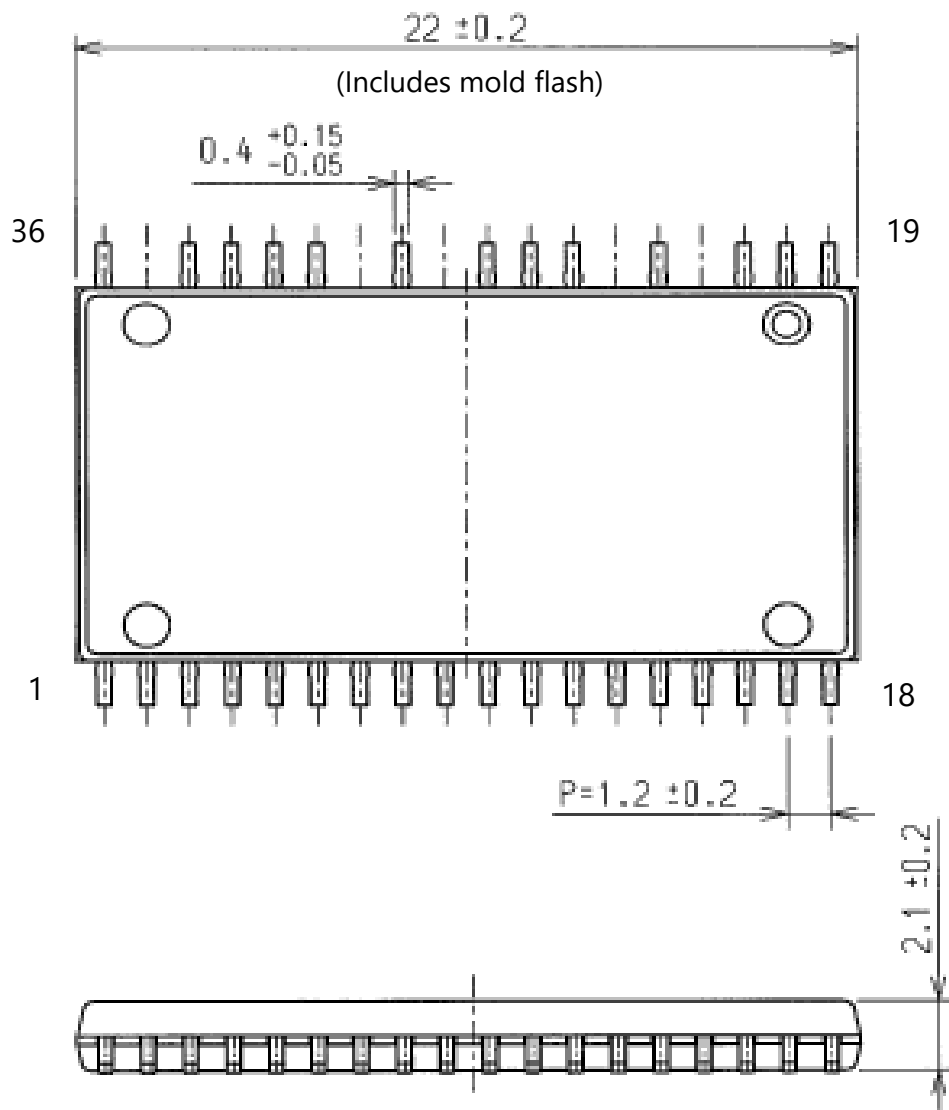






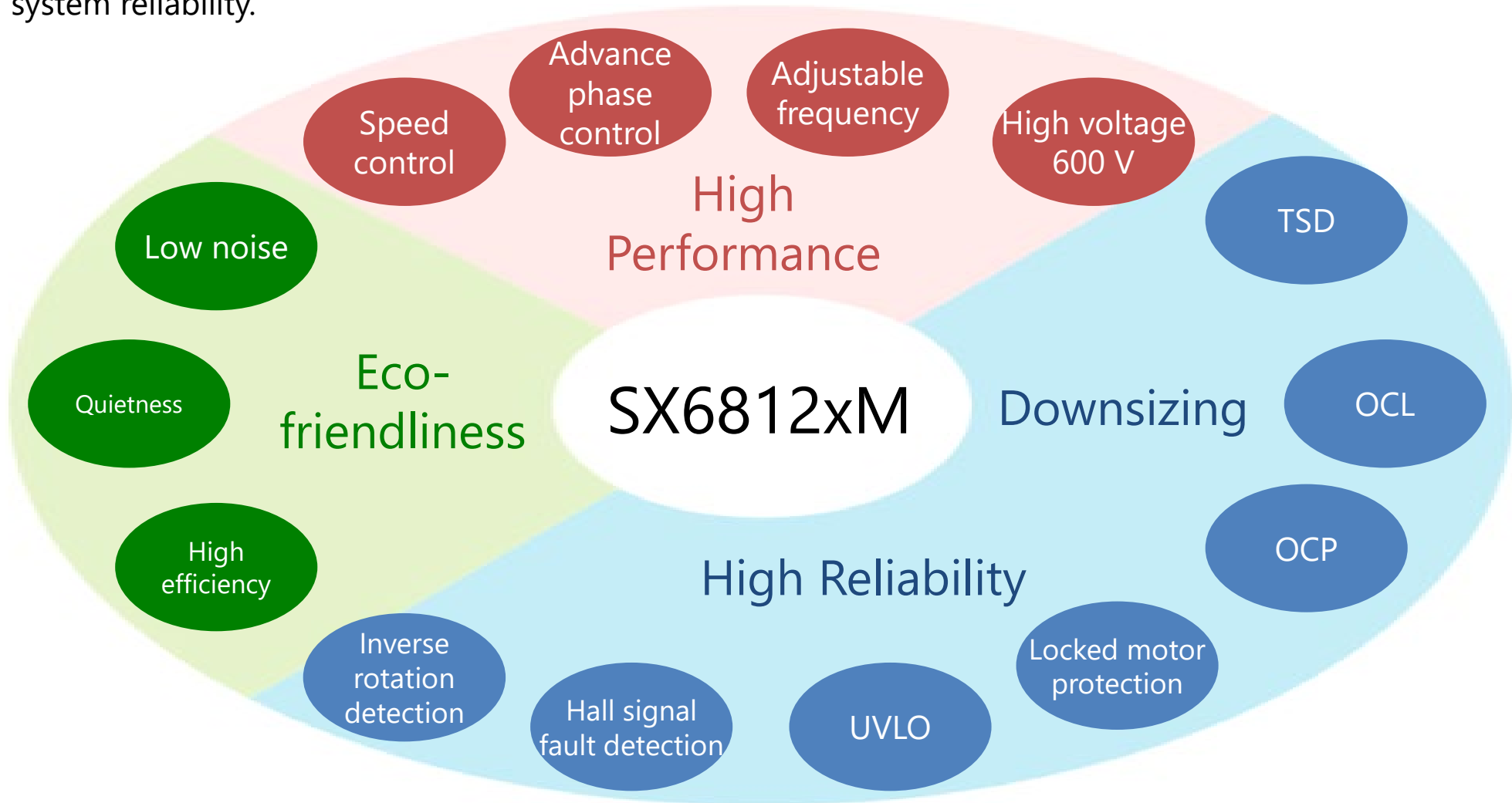
Number	Name	Description
1	VCC1	Logic supply voltage input
2	OSCR	Switching frequency adjustment input
3	HUP	U-phase hall element input (+)
4	HUN	U-phase hall element input (-)
5	HVP	V-phase hall element input (+)
6	HVN	V-phase hall element input (-)
7	HWP	W-phase hall element input (+)
8	HWN	W-phase hall element input (-)
9	COM	Logic ground
10	VREG	Built-in regulator output
11	MLP	Locked motor protection setting input
12	FO	Fault signal output
13	CW/CCW	Rotation direction switching setting input
14	LA	Advance angle and drive method setting input
15	FG	Position signal output
16	VSP	Speed control command input
17	OCP	Overcurrent detection signal input
18	VCC2	Logic supply voltage input

Number	Name	Description
19	W2	W-phase output (connected to W1 externally)
20	LS3	Low-side source 3 (connected to LS1, LS2 externally)
21	LS2	Low-side source 2 (connected to LS1, LS3 externally)
22	—	Pin removed
23	V2	V-phase output (connected to V1 externally)
24	—	Pin removed
25	VB1	U-phase high-side floating supply voltage input
26	LS1	Low-side source 1 (connected to LS2, LS3 externally)
27	U	U-phase output
28	—	Pin removed
29	VBB	Main power supply
30	—	Pin removed
31	V1	V-phase output (connected to V2 externally)
32	VB2	V-phase high-side floating supply voltage input
33	VB3	W-phase high-side floating supply voltage input
34	W1	W-phase output (connected to W2 externally)
35	—	Pin removed
36	VBB	Main power supply



# Summary

The Sinusoidal SX6812xM series provide a motor with high efficiency, quietness, and low noise. The compact SOP package includes a control circuit, drive circuit, and various protections. The high performance of the ICs realize not only the system downsizing but also the improvement of the system reliability.



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