

Three Phase Sensorless Sinusoidal Fan driver

Chip description:

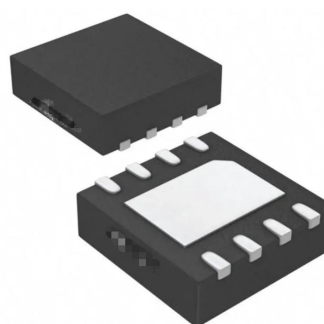
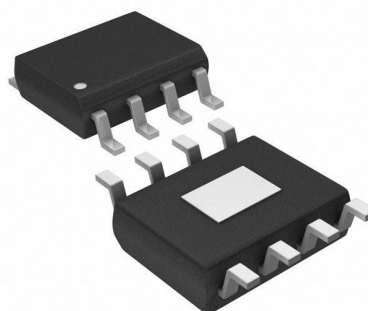
The GC5845 and GC5849 is a three phase motor driver incorporate sinusoidal drive to minimize audible noise and vibration for medium power fans. A speed input is provided to control motor speed. This allows system cost savings by eliminating an external variable power supply. Alternatively, power supply modulation down to 4 V can be used to adjust motor speed.

Chip features:

- 180° sinusoidal drive for low audible noise
- High efficiency control algorithm Support
- Sensorless operation
- Analog speed input (GC5845)
- PWM speed input (GC5849)
- Wide supply voltage range: 4~20V
- FG speed output
- Lock detection
- Thermal breakdown protection,
Over current protection,
Short circuit protection
- Soft start
- eSOP8 Package

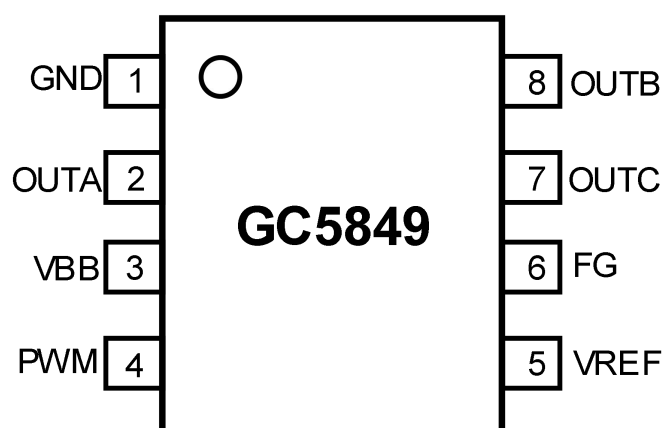
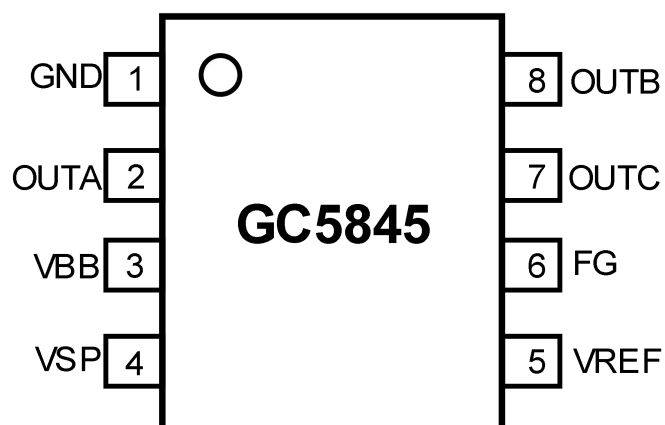
Chip application:

- CPU cooling Fans
- VGA cooling Fans
- Water Pump Motor



Product name	Package Type	Detail description	Per Tray	Per Box	Per Case
GC5845	eSOP8	4.9x3.9,e=1.27	4K	8K	64K
GC5849	eSOP8	4.9x3.9,e=1.27	4K	8K	64K
GC5849D	DFN8L(4*4)	4.0x4.0,e=0.8	4K	8K	64K

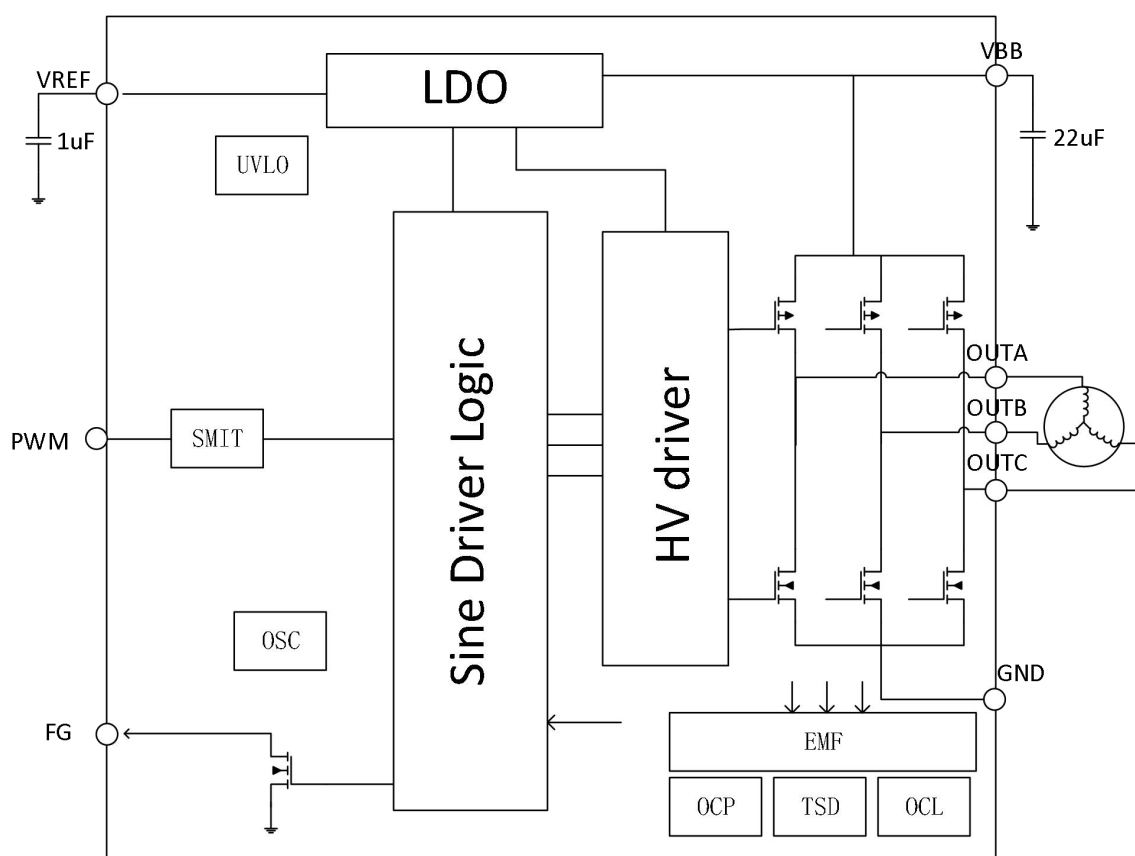
Pin Map:



Pin Description:

Pin No.	Pin Name	I/O	Pin Function
1	GND	gnd	Ground
2	OUTA	O	Motor out A
3	VBB	Power	Power supply
4	VSP	I	Speed (analog) logic input (GC5845)
	PWM	I	Speed (PWM) logic input (GC5849)
5	VREF	O	LDO output
6	FG	O	Speed output signal
7	OUTC	O	Motor out C
8	OUTB	O	Motor out B

Block Diagram :



Absolute Maximum Ratings:

(over operating free-air temperature range (unless otherwise noted))

Symbol	Parameter	Rating	Unit
VBB	Logic power supply range	0~30	V
PWM	Logic input voltage range	-0.5~6	V
I _{max}	Peak current	±2.0	A
V _{FGmax}	FG Output MAX	30	V
T _{jmax}	Maximum junction temperatures	150	°C
T _{stg}	Storage Temperature	-60~150	°C
ESD	ESD (HBM)	±7000	V

Electrical Characteristics:

Recommended Operating Conditions

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Logic power supply	VBB		4		20	V
Motor current	I _{OUT}	RMS	0		1.0	A
	I _{OUTMAX}	MAX			1.6	A
Externally applied PWM frequency	f _{PWM}		0.1		100	KHZ
Operating ambient temperature	T _a		-40		100	°C
FG Output Leakage	I _{FG(LKG)}	V _{FG} = 15V			1	uA
Output Saturation Voltage (FG Pin)	V _{FG(sat)}	I _{FG} = 5 mA			0.3	V
Reference Voltage (VREF pin)	V _{REF}	I _{VERF} = 5mA	3.2	3.3	3.4	V

Electrical Characteristics: (unless otherwise specified , T=25°C, VBB=12V)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
VBB current 1	I _{VCC1}	sleep mode			1	uA
VBB current2	I _{VCC2}	PWM 50kHz		3	5	mA
OUT H-bridge driver						
R _{dson,up+down}	R _{dsON1}	I _o =500mA;T=25° ,VBB=12V		0.9	1.2	Ω
	R _{dsON2}	I _o =500mA;T=25° ,VBB=4V		1.2	1.4	Ω
When off leakage current	I _{OFF}	V _{out} =0V	-10		10	uA
Logic inputs (VSP Pin or PWM Pin)						
Input logic-low voltage falling threshold	V _{IL}				1.28	V
Input logic-high voltage rising threshold	V _{IH}		1.58			V
input logic hysteresis	V _{HY}			300		mV
Input logic low current	I _{IL}	V _{in} =0	-5		5	uA
Input logic high current	I _{IH}	V _{in} =3.3V		30		uA
Pulldown resistance	R _{pd}			100		kΩ
GC5845 SPEED INPUT (VSP Pin)						
VSP On Threshold	V _{on}		0.45	0.9	1.2	V
VSP On Time	t _{on}		100			us
VSP Disable Threshold	V _{thoff}		195	230	260	mV
VSP Accuracy	ERR _{VSP}			±6		LSB
VSP Maximum Level	V _{SP(MAX)}		2.9	3	3.05	V

GC5849 SPEED INPUT (PWM Pin)						
PWM On Threshold	D_{on}		9.5	10	10.5	%
PWM Off Threshold	D_{off}		7	7.5	8	%
PWM Input Frequency Range	f_{pwm}		0.1		100	kHz
PROTECTION CIRCUITS						
Over temperature protection	TSD		155	169	180	°C
Over temperature protection hysteresis	Δ TSD			26		°C
Under voltage lockout	V_{UVLO}	VBB down		3.7		V
Under voltage lockout hysteresis	ΔV_{UVLO}	VBB		0.3		V
Overcurrent protection	I_{OCP}	Up side and Down side		2.4		A
Lock Protection time	t_{OFF}			9.3		second

Function Description

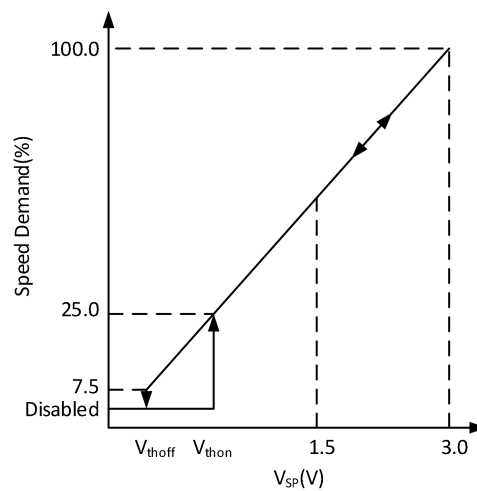
The GC5845/GC5849 targets fan applications to meet the objectives of low audible noise, minimal vibration, and high efficiency. Internal proprietary control algorithm results in a sinusoidal current wave shape that adapts to a variety of motor characteristics to dynamically optimize efficiency across a wide range of speeds.

The speed of the fan can be controlled by voltage mode (control of power supply amplitude), via an adjustable analog input (GC5845 only), or variable duty cycle PWM input (GC5849 only). Use of the analog or PWM input allows overall system cost savings by eliminating the requirement of an external variable power supply. Operation down to 4V can be achieved to allow the IC to fit into legacy systems with voltage mode operation.

A BEMF detection “window” is opened on phase A modulation profile in order to measure the rotor position so as to define the modulation timing. The control system maintains the window to a small level in order to minimize the disturbance and approximate the ideal sinusoidal current waveform as much as possible

GC5845 - VSP Pin Analog Input

An internal ADC translates the input voltage to a demand value to control speed of the fan. The motor drive will be disabled if the VSP pin voltage is lower than V_{thoff} . Upon startup, VIN must exceed V_{thon} for t_{on} . The t_{on} delay is required to allow internal reference supply and analog circuits to properly power-up. After this short delay, V_{SP} can be adjusted below V_{thoff} to allow full scale operation (7.5% to 100%).

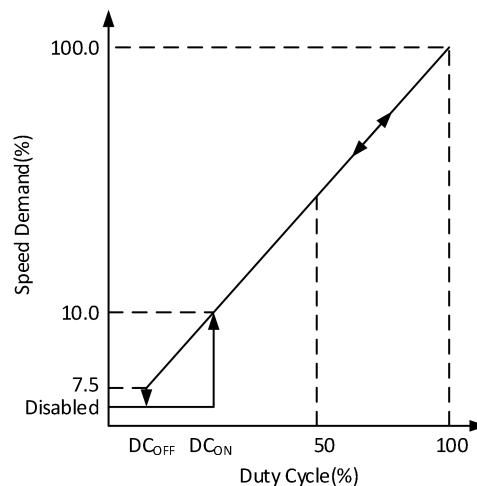


GC5845 Analog Speed Input Characteristic

GC5849 - PWM Pin Duty Cycle Input

A duty cycle measurement circuit converts the applied duty cycle to a demand value to control speed of the fan. The motor drive will be enabled if the duty cycle is greater than DON (10% (typ)). The PWM input is filtered to prevent spurious noise from turning the IC on or off unexpectedly.

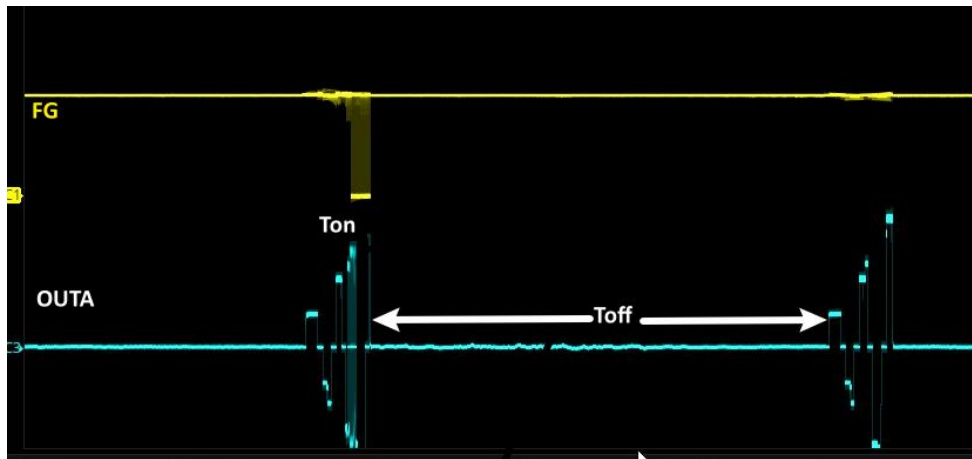
There is an internal pulldown resistor (100 k Ω) on the PWM pin that turns the motor off if the input signal is disconnected. If 100% speed demand is required, such as for an open PWM condition, connect a 50 k Ω pull up resistor to the VBB pin.



GC5849 PWM Speed Input Characteristic

Lock Protection and Auto Restart

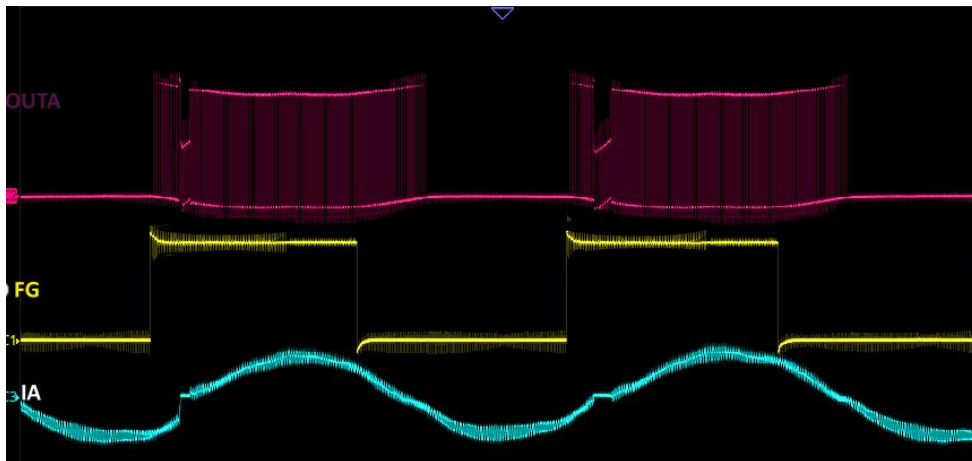
The GC5845/GC5849 provides the lock protection and automatic restart functions to prevent the coil burnout while the fan is locked. As the fan is locked, the IC will come into startup operation for **1.24** seconds. Then, the IC will switch to lock protection mode to turn off output driver for **9.3** seconds. After lock protection mode, the IC switches to start-up operation again. If the locked condition still remains, the lock-and-restart process will be recurrent until the locked condition is released



FG Output

Open drain output provides speed information to the system. FG changes state one period per electrical revolution of the motor.

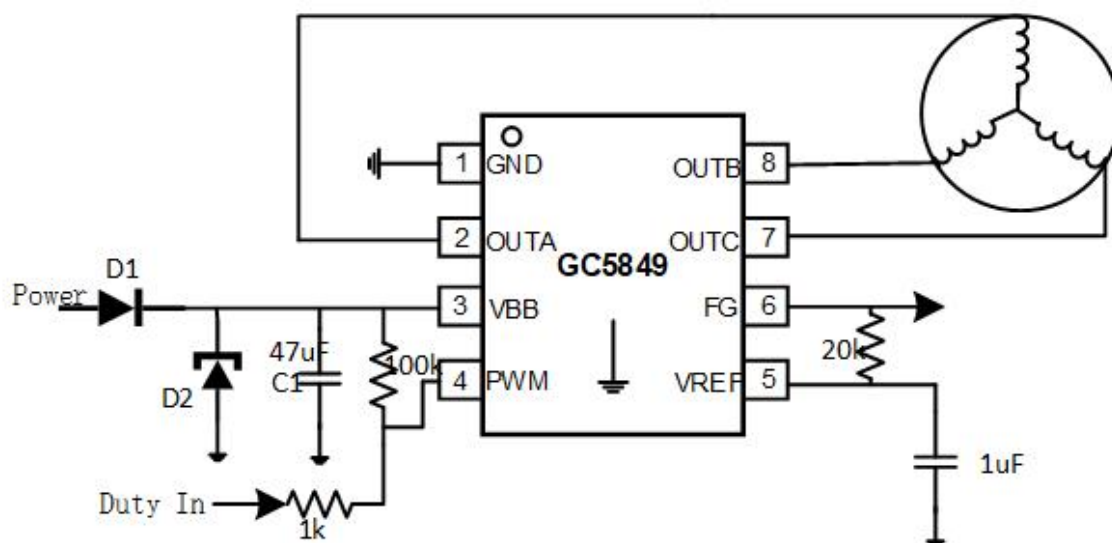
Rising edge of FG is aligned with the voltage excitation of Phase A.



ROTOR POSITION SENSING USING MOTOR BEMF

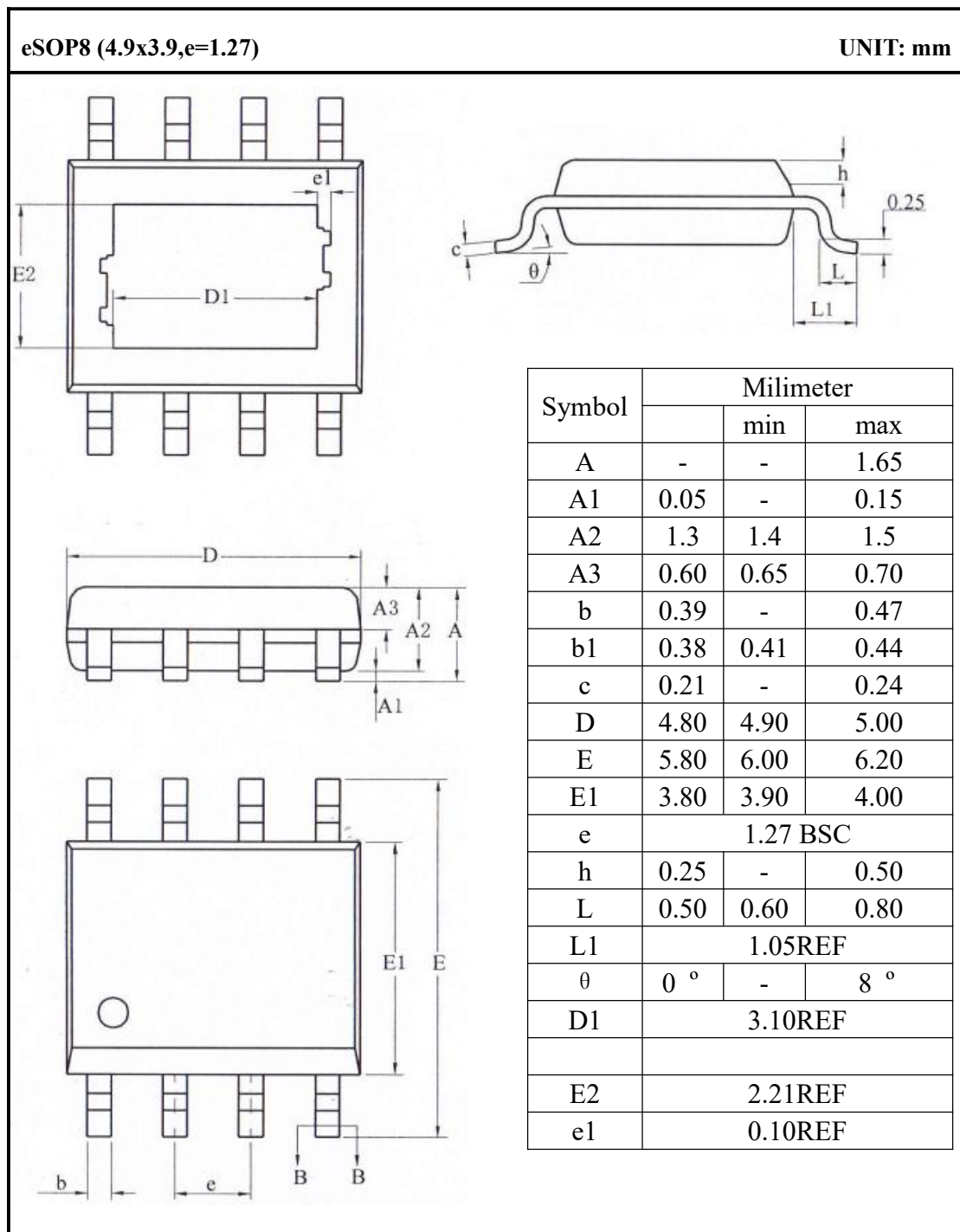
The phase sequences create a rotating magnetic field around the rotor against which the permanent magnets in the rotor can react to produce torque at the motor output shaft causing the motor to rotate. For the motor to run with low torque ripple the three phase drive has to be synchronized to the motor phase position. That is the position of the magnetic poles of the rotor in relation to the poles of the stator. This phase angle is determined by a closed loop commutation controller consisting of a position estimator and commutation timer. This controller uses the output of a complete self-contained BEMF sensing scheme to determine the actual position of the motor, and adjusts the estimated position and commutation frequency to synchronize with the rotor poles in the motor.

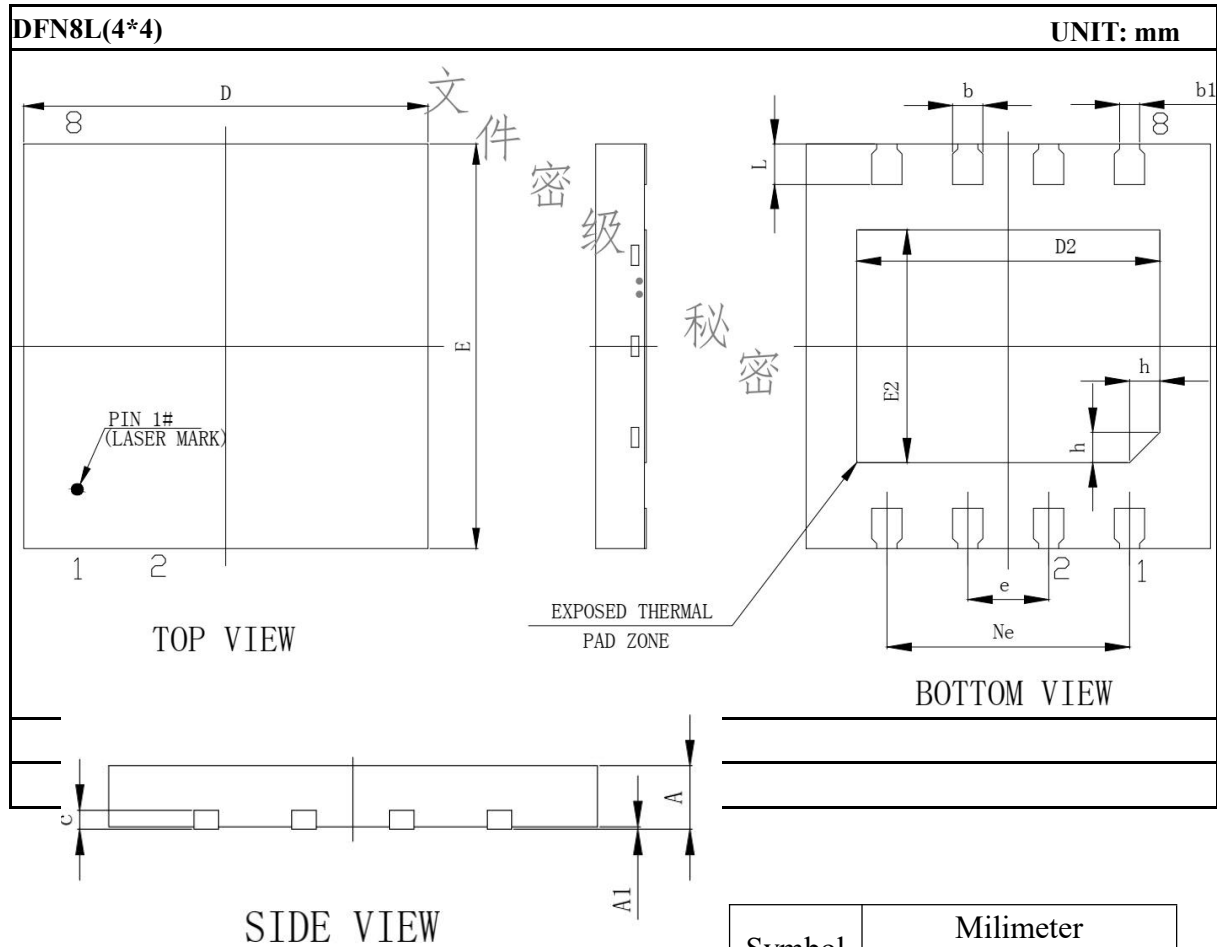
Typical Application



- Note:
1. Clamp diode D2 is typically needed when blocking diode D1 is used
 2. Capacity C1 needs to place close to VBB
 3. PCB place bottom heat sink for high current applications

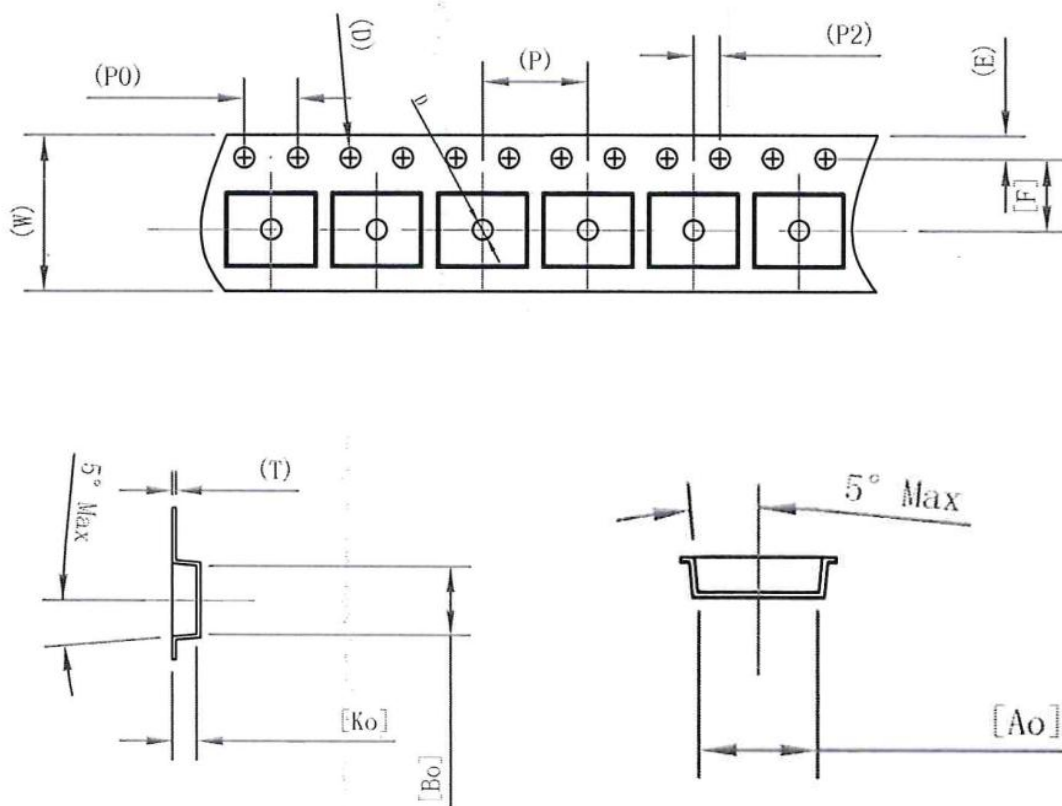
Package Information





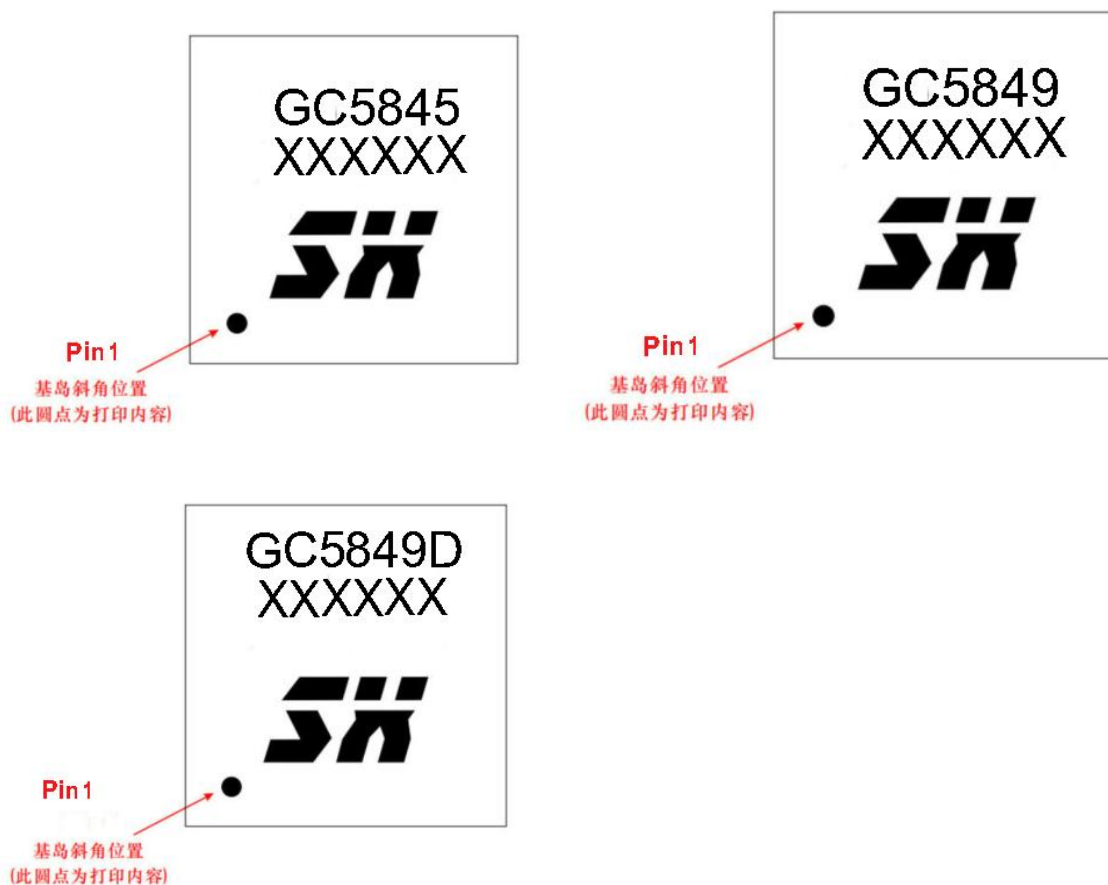
Symbol	Milimeter		
	min	nom	max
A	0.50	0.55	0.60
A1	0	0.02	0.05
b	0.25	0.30	0.35
b1	0.15	0.20	0.25
c	0.10	0.15	0.25
D	3.90	4.00	4.10
D2	2.90	3.00	3.10
Ne	2.40BSC		
e	0.80BSC		
E	3.90	4.00	4.10
E2	2.90	3.00	3.10
h	0.25	0.30	0.35
L	0.35	0.40	0.45

Packaging Introduction for GC5845/GC5849



ITEM	W	A0	A1	B0	B1	K0	K1
DIM	12.0	6.55	0.00	5.40	0.00	1.90	0.00
TOLE	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10
E	F	P	P0	P2	D0	D1	T
1.75	5.50	8.0	4.0	2.0	1.50	1.50	0.25
±0.10	±0.10	±0.10	±0.10	±0.10	+0.10 -0.00	+0.10 -0.00	±0.05

Description of Lot Code



Printing instructions:

- 1.The first line GC5845、GC5849、GC5849D represents the product model;
- 2.The second line represents the traceability code;

Release Notes

Revision	Description
1.0	Initial version
1.1	Corrected ambiguity in some descriptions ;
1.2	Added some content;
1.3	Added packaging instructions;
1.4	modify DFN8 packaging information;