Ordering number : ENA2213

LV8806QA

Bi-CMOS IC

3-phase sensor-less

Motor Driver IC

ON Semiconductor®

http://onsemi.com

Overview

LV8806QA is a 3-phase sensor-less motor driver IC.
3-phase driver allows low power consumption and low vibration. And Hall sensor-less drive allows reduction of the size of a motor system.
This IC is suitable for use in products which require high reliability and long life such as note PC fan.

Function

- Built-in current limit circuit (Operates when RF resistance is 0.5Ω and Io=0.53A)
- 3-phase full-wave sensor-less driver
- Direct PWM input
- FG (rotation count) output signal pin
- RD (lock detection) output signal pin
- Built-in lock protection and auto-recovery circuit
- Built-in TSD (thermal shutdown) circuit

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
V_{CC} maximum supply voltage	V_{CC} max		7	V
OUT pin maximum output current	I_{OUT} max		0.7	A
OUT(VO, VO, WO) pin withstand voltage	$V_{OU}T$ max		7	V
FG output pin maximum sink current	I_{FG} max		5	mA
FG output pin withstand voltage	V_{FG} max		7	V
RD output pin maximum sink current	I_{RD} max		5	mA
RD output pin withstand voltage	V_{RD} max		7	V
Allowable power dissipation	Pd max	With specified board *1	800	mW
Operating temperature	Topr	*2	-40 to 95	°C
Storage temperature	Tstg		-55 to 150	°C

*1: With specified board: 50mm×50mm×1.6mm, grass epoxy board / single layer.

*2: Tjmax must not exceed 150°C

Caution 1) Absolute maximum ratings represent the value which cannot be exceeded for any length of time.

Caution 2) Even when the device is used within the range of absolute maximum ratings, as a result of continuous usage under high temperature, high current, high voltage, or drastic temperature change, the reliability of the IC may be degraded. Please contact us for the further details.

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
V_{CC} supply voltage	V_{CC}		5.0	V
Operating V_{CC} supply voltage range	V_{CC} op		2.0 to 6.0	V
PWM input frequency range	f_{PWM}		20 to 50	kHz

Electrical Characteristics at Ta = 25°C, V_{CC} = 5.0V

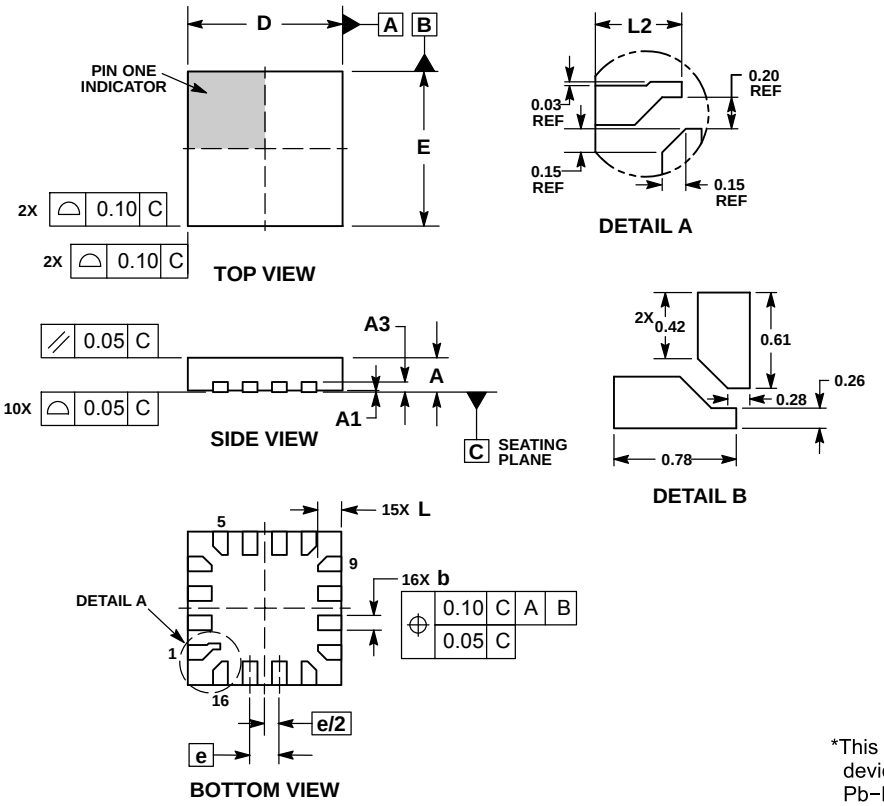
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Circuit current	$I_{CC}1$	PWM=5V		1.5	2.5	mA
	$I_{CC}2$	PWM=0V		10	50	μA
Output circuit						
ON-resistance of high-side output transistor	$R_{ON}(H)$	I_O=500mA		0.5	0.9	Ω
ON-resistance of low-side output transistor	$R_{ON}(L)$	I_O=500mA		0.5	0.9	Ω
Sum of the ON-resistance of high/low-side output transistor	$R_{ON}(H+L)$	I_O=500mA		1.0	1.8	Ω
Startup oscillation (OSC) pin						
OSC pin charge current	$I_{OSC}C$	OSC=0V	-3.25	-2.50	-1.75	μA
OSC pin discharge current	$I_{OSC}D$	OSC=1.2V	1.75	2.50	3.25	μA
OSC pin High level threshold voltage	$V_{OSC}THH$		1.0	1.1	1.2	V
OSC pin Low level threshold voltage	$V_{OSC}THL$		0.5	0.6	0.7	V
PWM input (PWM) pin						
PWM pin High level input voltage	$V_{PWM}H$		2.5		V_{CC}	V
PWM pin Low level input voltage	$V_{PWM}L$		0		1.0	V
PWM pin current	I_{PWM}	PWM pin=0V	-50	-10		μA
Forward/reverse switching (F/R) pin						
F/R pin High level input voltage	V_FRH		2.5		V_{CC}	V
F/R pin Low level input voltage	$V_{FR}L$		0		1.0	V
F/R pin current	I_{FR}	FR pin=5V		10	50	μA
FG, RD output pin						
FG pin Low level voltage	V_{FG}	I_{FG}=3mA		0.2	0.3	V
FG pin leakage current	I_{FG}	V_{FG}=7V			10	μA
RD pin Low level voltage	V_RD	I_{RD}=3mA		0.2	0.3	V
RD pin leakage current	I_{RD}	V_{RD}=7V			10	μA
Current limiter circuit						
Limiter voltage	V_{RF}	Operating when RF=0.5Ω, I_O=0.53A	0.238	0.265	0.291	V
Lock protection circuit						
Output ON-time	LT1		0.35	0.50	0.65	S
Output OFF-time	LT2		3.2	4.5	5.9	S
Output ON/OFF ratio	LRTO	LRTO=LT2/LT1	4.9	9.0	16.8	
Thermal shutdown circuit						
Operating temperature	TSD	*Design guarantee	150	180		°C
Hysteresis width	ΔTSD	*Design guarantee		30		°C

*Design guarantee: This is a design target value, which will not be measured independently.

Package Dimensions

unit : mm (typ)

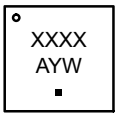
UQFN16 2.6x2.6, 0.5P
CASE 523AU
ISSUE A



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.25mm FROM THE TERMINAL TIP.

	MILLIMETERS	
DIM	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13 REF	
b	0.20	0.30
D	2.60 BSC	
E	2.60 BSC	
e	0.50 BSC	
L	0.30	0.50
L1	---	0.15
L2	0.40	0.70

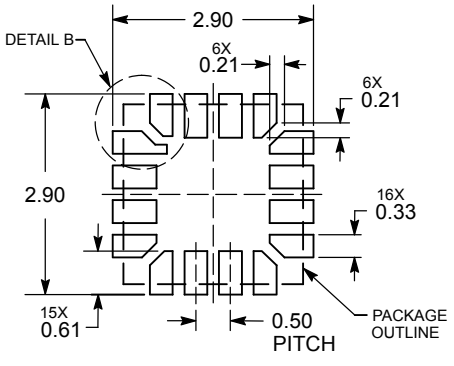
GENERIC MARKING DIAGRAM*



XXXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb-Free Package

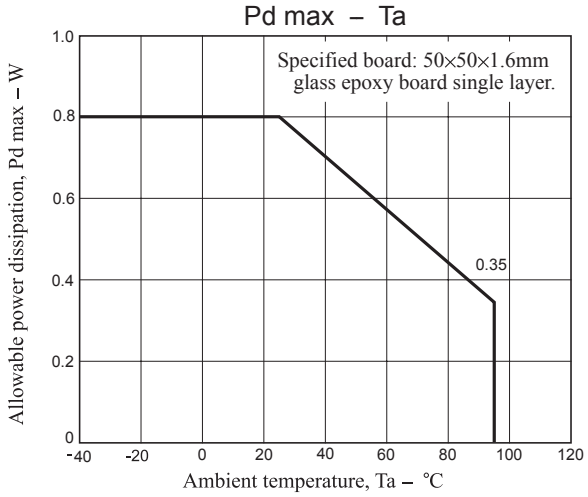
*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present.

RECOMMENDED SOLDERING FOOTPRINT*

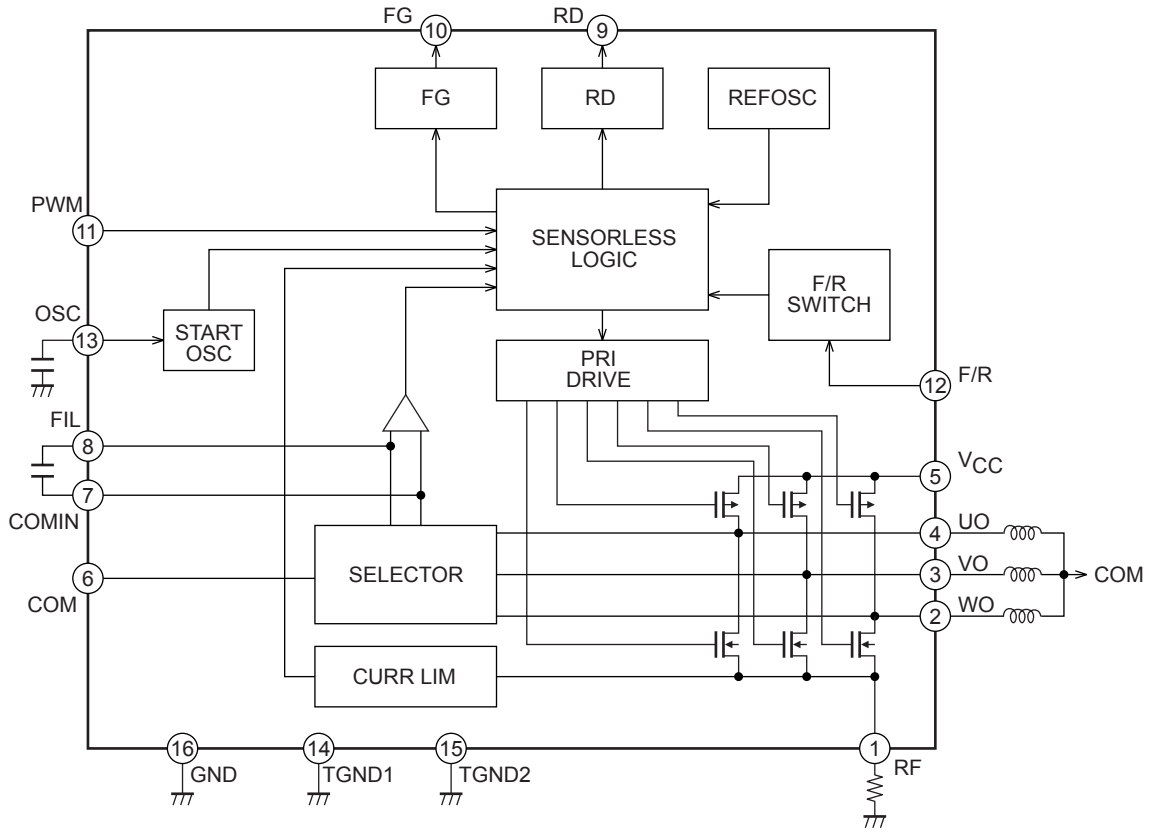


DIMENSIONS: MILLIMETERS

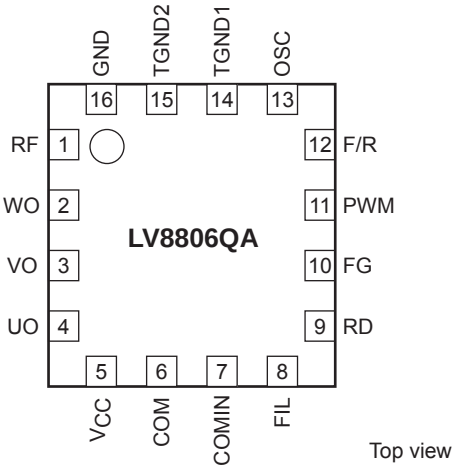
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



Block Diagram

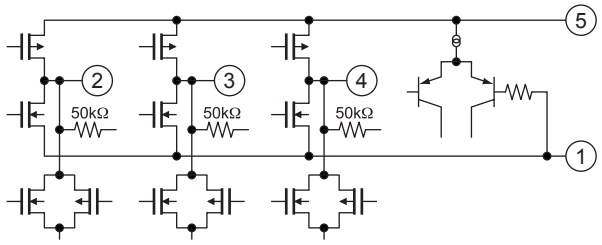
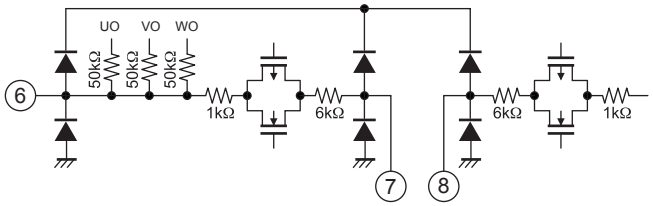
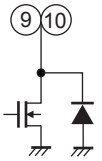
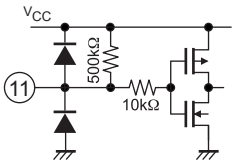
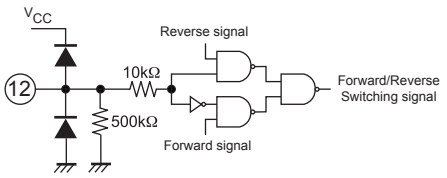


Pin Assignment



Top view

Pin function

Pin No.	Symbol	Function	Equivalent circuit
1	RF	Output current detection pin. Drive current is detectable with resistors connected to GND.	
2 3 4	UO VO WO	Output pin. Connected to motor coil.	
5	V_{CC}	IC power supply pin and motor power supply pin. A capacitor is connected between GND and this pin.	
6	COM	Connected to the midpoint of the motor.	
7	COMIN	Motor position detection comparator filter pin. A capacitor is connected between FIL (PIN8) and this pin.	
8	FIL	Motor position detection comparator filter pin. A capacitor is connected between COMIN (PIN7) and this pin.	
9	RD	Motor lock detection output pin. Outputs High when motor is locked.	
10	FG	FG pulse output pin. This pin outputs pulse equivalent to one Hall sensor system pulse output.	
11	PWM	PWM signal input pin. When input voltage is High, output transistor turns on. When input voltage is Low, output transistors turn off, and motor stop. By controlling duty of input signal, motor rotation count is adjustable. Motor is full-speed when pin is open.	
12	F/R	Switches motor rotation direction. High level voltage input: U→W→V, Low level voltage input: U→V→W. Current flow into the motor according to the above order. Motor rotates reversely when the order of energization is changed.	

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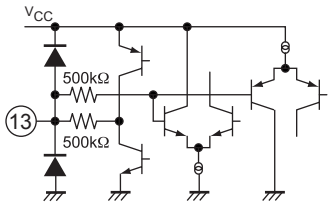
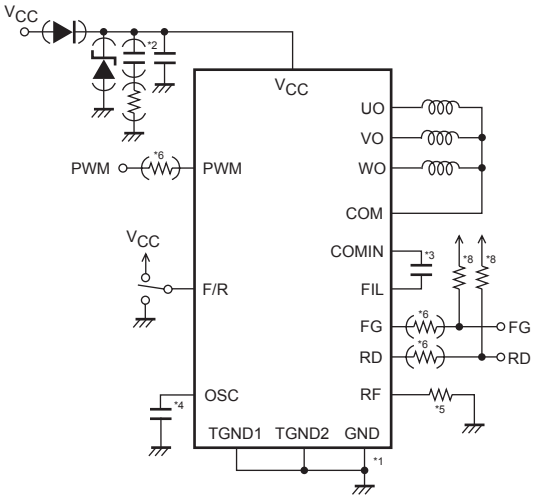
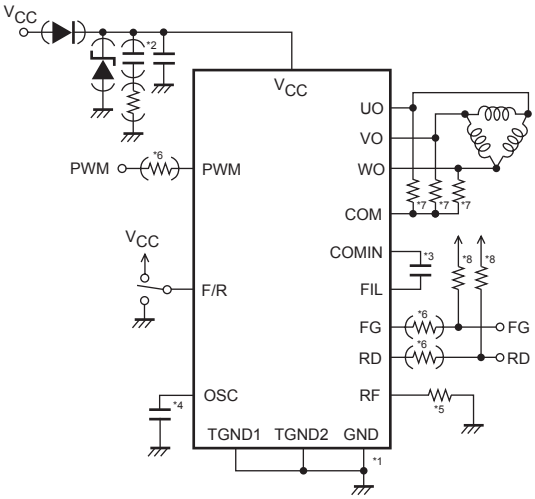
Pin No.	Symbol	Function	Equivalent circuit
13	OSC	Motor start-up frequency setting pin. A capacitor is connected between this pin and GND. The start-up frequency is adjustable with a capacitor and charge/discharge current (2.5μA).	
14 15 16	TGND2 TGND1 GND	GND pin of the IC	

Application Circuit Example

(1)Application to Y-Connector Motor



(2)Application to Delta-Connector Motor



*1. [Connection of power supply and GND]

GND is connected to the power supply line of control circuit.

*2. [Power supply stabilizer capacitor]

The power supply stabilizer capacitor needs to be 4.7μA or higher. Connect V_{CC} and GND as wide and short as possible. If the supply voltage increases due to the kickback of coil as a result of using reverse connection protector diode, make sure to connect Zener diode between the power supply and GND.

LV8806QA uses synchronous rectification for high efficiency drive. Synchronous rectification is effective for heat reduction and higher efficiency. However, it may increase supply voltage under the following conditions:

*When output duty is reduced rapidly.

*PWM input frequency is low.

If the supply voltage shall increase, make sure that it does not exceed the maximum ratings with the following measures:

*Select an optimal capacitor between power supply and GND.

*Insert a zener diode between power supply and GND.

*3. [COMIN and FIL]

COMIN and FIL are the filter capacitor connection pins. LV8806QA detects the position of rotor using BEMF signal generated during motor rotation. Based on the information, current-carrying timing of the output is determined. By inserting a filter capacitor of about 1000 to 10000pF (recommendation) between COMIN and FIL, start-up failure caused by noise is alleviated. However, if the capacitance is too high, timing of current-carrying for output may be delayed during high-speed rotation and efficiency may be degraded.

Make sure that the filter capacitor is connected between COMIN and FIL as short as possible to avoid influence of noise.

*4. [OSC]

Capacitor connection pin for setting boot frequency.
Make sure to connect a capacitor of 500pF to 2200pF (recommendation) between this pin and GND. The capacitor is required to determine boot frequency to start motor.

How to define capacitance:
The capacitance should allow the shortest boot time for the target rotation count and less variation. The higher the capacitance is, the more likely the variation occurs in boot time. On the other hand, the lower the capacitance is, the more likely an idling occurs. Since an optimum value for OSC pin constant varies depends on motor characteristics and boot current, make sure to confirm the constant when motor or circuit specification are changed.

*5. [RF]

Current limit setting pin.
When a pin voltage exceeds 0.265V, current limiter operates and the mode shifts to regeneration mode.
The calculation formula is as follows.
RF resistance value = 0.265V / desired current limit value

*6. [Pin protection resistor]

It is recommended that resistors higher than 1kΩ are connected serially to protect pins against misconnection such as GND open and reverse connection.

*7. [Resistor for pseudo midpoint]

Delta connector motor does not have midpoint. Therefore, we need to create a pseudo midpoint by external resistor. Please note that the amplitude of BEMF signal generated during motor rotation varies depends on motor types. Some motors require the external pseudo midpoint and others do not.

*8. [FG, RD pull-up resistor]

Since FG and RD are open-drain output, make sure to use pull-up resistors.
It is recommended that the pull-up resistor is approximately 10kΩ.

ORDERING INFORMATION

Device	Package	Shipping (Qty / Packing)
LV8806QA-MH	UQFN16 (2.6×2.6) (Pb-Free / Halogen Free)	3000 / Tape & Reel

AMEYA360
Components Supply Platform

Authorized Distribution Brand :

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