

# LV8862JA



ON Semiconductor®

www.onsemi.com

Bi-CMOS LSI

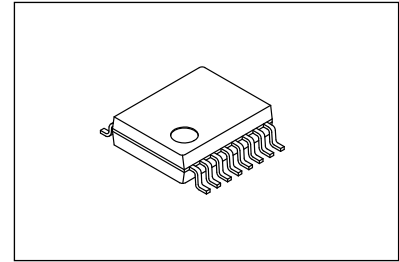
## Single-phase FAN Motor Driver

### Overview

LV8862JA is a driver IC used for single-phase fan motor. High-efficiency and low-noise are realized by reducing reactive power using Silent PWM. This IC's feature is low on-resistance  $0.6\Omega$  & High-efficiency. Therefore, it is optimal for high power fan motor and home appliance equipment.

### Feature

- Single-phase full wave operation by Silent PWM drive
- Speed is controllable by PWM input
- Hall bias output pin
- Integrated Quick Start Circuit
- FG (rotation detection)/ RD (lock detection) output pin (open drain output)
- Integrated current limiter circuit (limit at  $I_o=500\text{mA}$  with  $R_L=0.5\Omega$  connection, limit value is determined based on  $R_f$ )
- Integrated lock protector circuit and automatic recovery circuit
- Integrated thermal shut-down (TSD) circuit



SSOP16 (225mil)

### Typical Applications

- Fan motor units
- Desk top PCs
- Refrigerator
- Projectors

### Specifications

**Absolute Maximum Ratings** at  $T_a = 25^\circ\text{C}$ ,  $\text{GND} = 0\text{V}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	VCC max		20	V
OUT pin output current	IOUT max		1.5	A
Output withstand	VOUT max		20	V
RD/FG output pin withstand	VRD/FG max		18	V
RD/FG output maximum current	IRD/FG max		10	mA
RGL output maximum current	IRGL max		5	mA
HB output maximum current	IHB max		10	mA
PWM input pin withstand	VPWM max		6	V
Allowable power dissipation	Pd max	On a specified board *1	0.8	W
Operating temperature	Topr	*2	-40 to + 95	$^\circ\text{C}$
Storage temperature	Tstg		-55 to + 150	$^\circ\text{C}$

\*1 Specified board: 76.1mm x 114.3mm x 1.6mm, glass epoxy board

\*2 Do not exceed  $T_{jmax}=150^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### ORDERING INFORMATION

See detailed ordering and shipping information on page 12 of this data sheet.

# LV8862JA

## Recommended Operating Conditions at Ta = 25°C, GND = 0V

Parameter	Symbol	Conditions	Ratings	Unit
Operating supply voltage range	VCC op1	Recommended supply voltage range	3.6 to 16	V
Hall input common phase input voltage range	VICM		0.3 to VRGL-1.5	V
PWM pin input voltage range	PWM		0 to 5.5	V
SSW pin input voltage range	SSW		0 to VRGL	V
Input PWM frequency range	PWMF		20 to 50	kHz

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

## Electrical Characteristics at Ta = 25°C, VCC = 12V, GND = 0V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Circuit consumption current	ICC	Active		2.5	3.5	mA
	ICCo	Stand-by		2.0	3.0	mA
RGL pin output voltage	VRGL		3.0	3.15	3.3	V
HB pin output voltage	VHB	IHB=5mA	1.16	1.25	1.28	V
Output ON resistance	Ron	Io=1.0A, upper + lower ON resistance		0.6	0.8	Ω
Hall input bias current	IHIN				1.0	μA
Current limiter	VRF		220	250	280	mV
PWM pin input Low level	VPWML		0		1.0	V
PWM pin input High level	VPWMH		2.0		VRGL	V
PWM input minimum pulse width	TPWM		1			μSec
RD/FG output pin Low voltage	VRD/FG	IRD/FG=3mA		0.22	0.30	V
FG output leakage current	IRDL/FGL	VRD/FG=18V			10	μA
FG comparator hysteresis width	ΔVHYS	including offset	±5	±12	±18	mV
Output ON time in Lock-detection	TACT		0.6	0.8	1.0	Sec
Output OFF time in Lock-detection	TDET		6	7.2	9	Sec
Output ON/OFF ratio in Lock-detection	TRTO	TRTO=TDET/TACT	7.5	9.0	11.0	
Thermal shutdown operating temperature	TSD	*Design guarantee		180		°C
Thermal shutdown hysteresis width	ΔTSD	*Design guarantee		40		°C

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

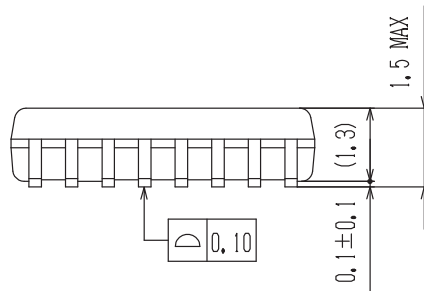
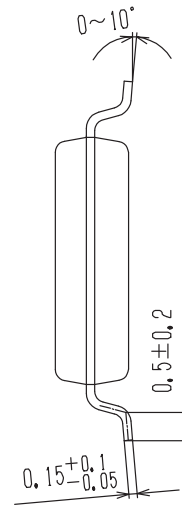
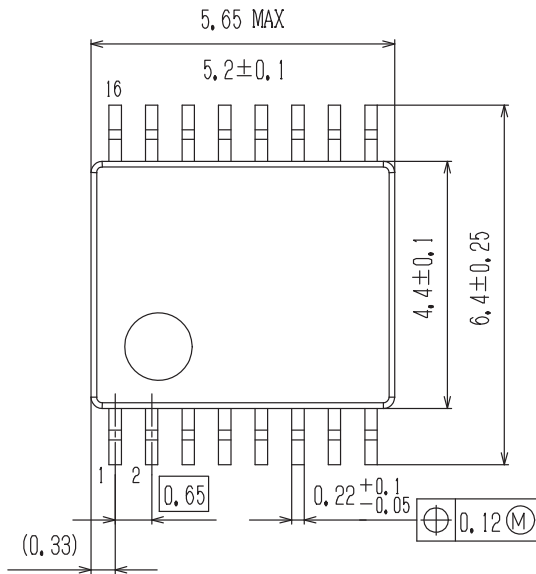
### Truth table

Operating state	IN1	IN2	PWM	OUT1	OUT2	FG	RD
Rotation – drive mode	L	H	H	H	L	L	L
	H	L		L	H	OFF	L
Rotation – regeneration mode	L	H	L	L	L	L	L
	H	L		L	L	OFF	L
Lock protector	L	H	-	OFF	L	L	OFF
	H	L		L	OFF	OFF	OFF

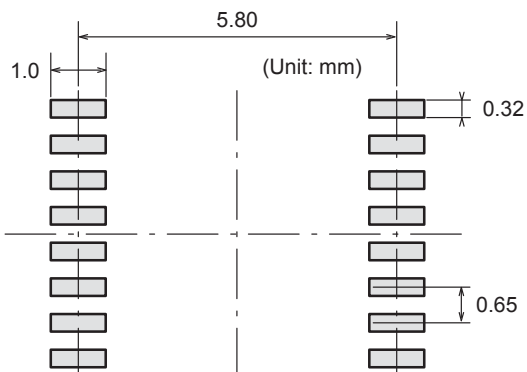
Package Dimensions

unit : mm

SSOP16 (225mil)  
CASE 565AM  
ISSUE A



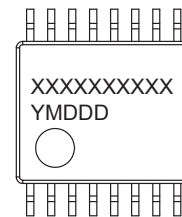
SOLDERING FOOTPRINT\*



NOTE: The measurements are not to guarantee but for reference only.

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

GENERIC MARKING DIAGRAM\*

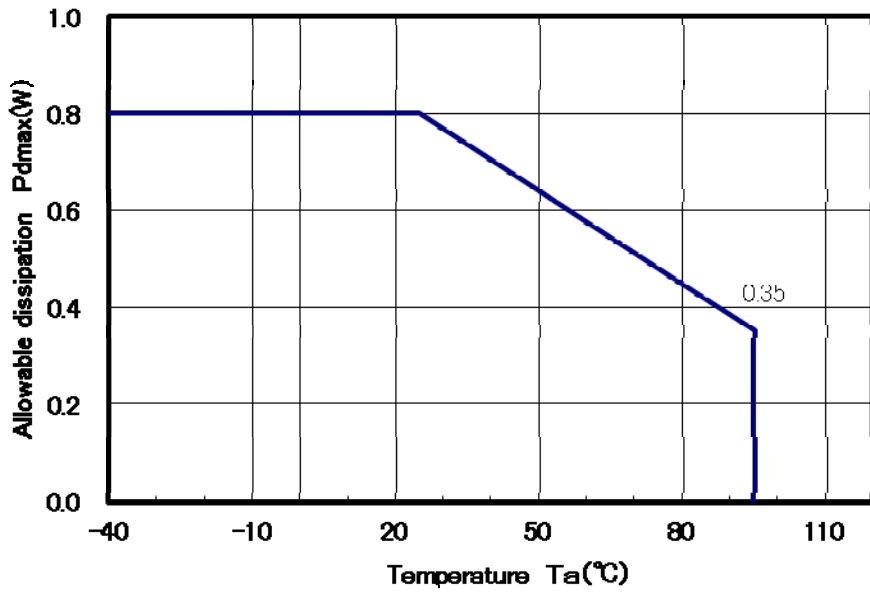


XXXXX = Specific Device Code  
Y = Year  
M = Month  
DDD = Additional Traceability Data

\*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.

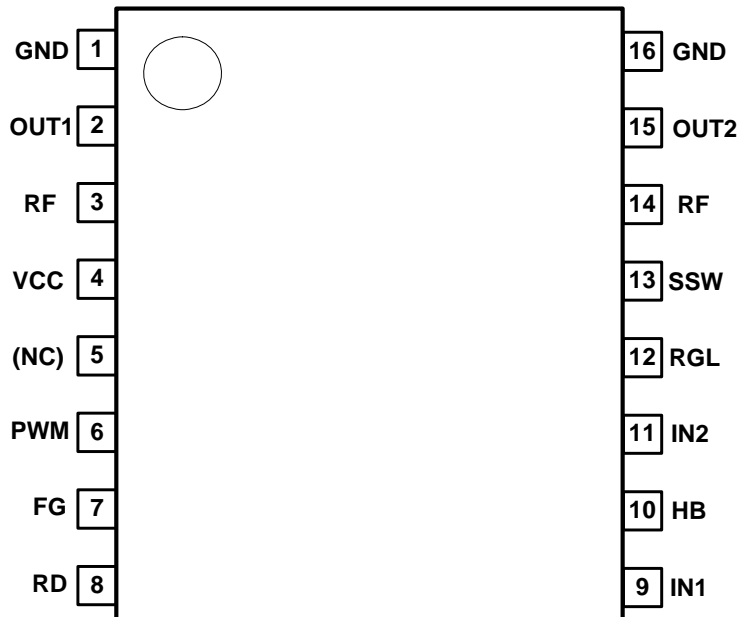
Pdmax-Ta

Specified board: 76.1mm x 114.3mm x 1.6mm, glass epoxy board

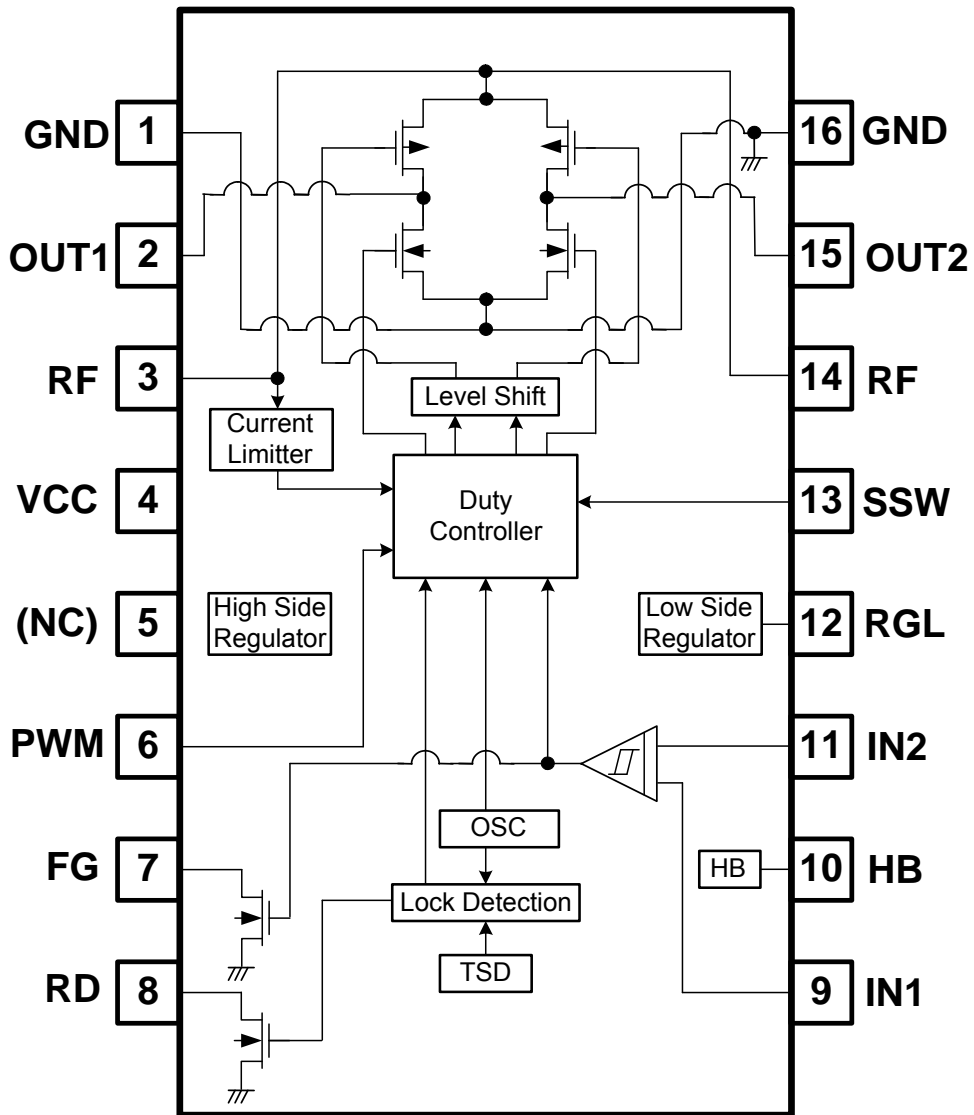


Pin Assignment

SSOP16(225mil)  
Top view



Block diagram



**Pin function**

\*On circuit board,  $\triangle$  means VCC,  $\uparrow$  means RGL.

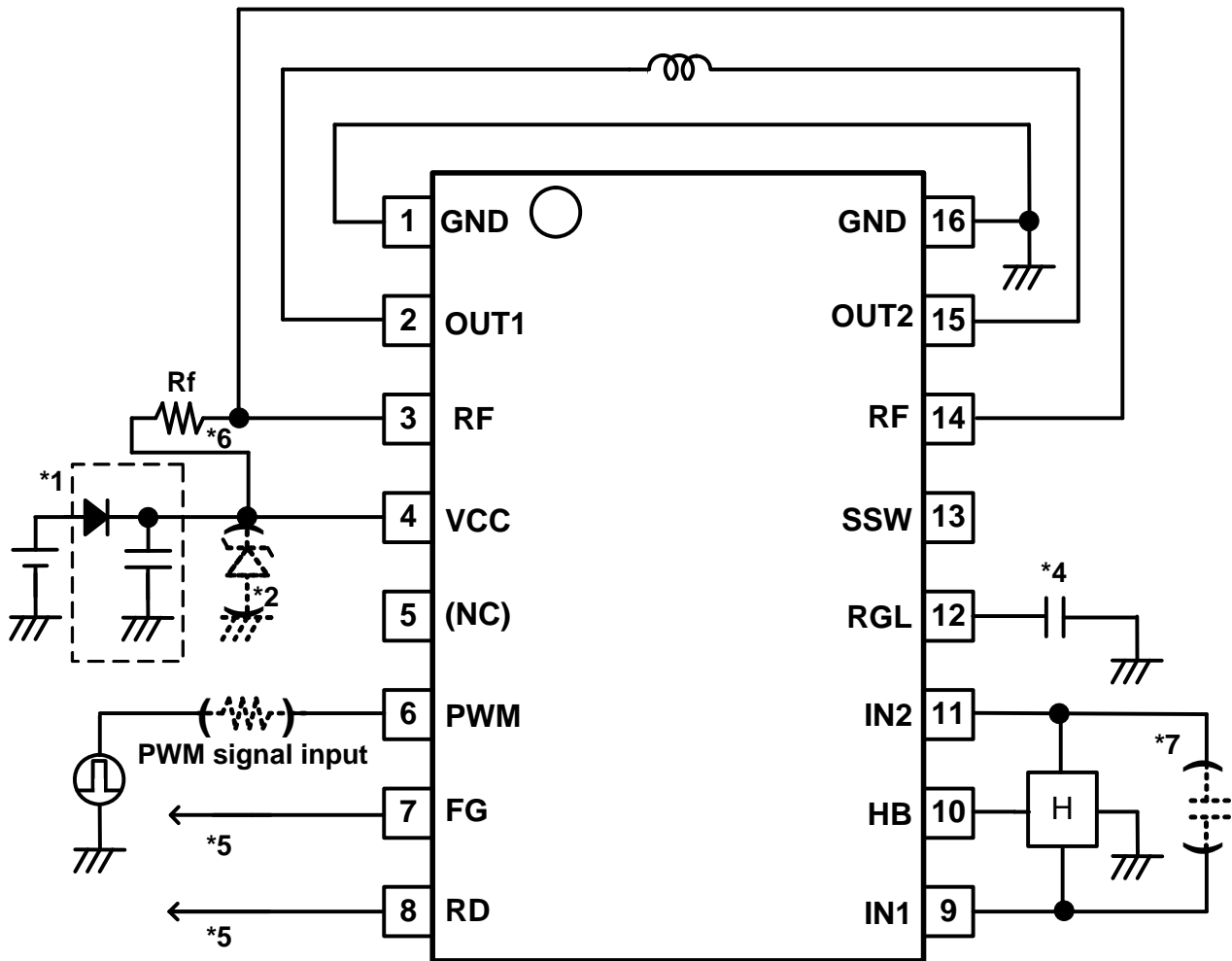
No.	Pin name	Function	Equivalent circuit
2	OUT1	Output pin for motor driver	
15	OUT2		
3 14	RF	Resistive connection pin for current limiter	
4	VCC	Power supply pin	
6	PWM	Input pin for PWM control *OPEN: pull up to High * When input is High → output is High When input is Low → output is Low	
7	FG	FG (rotation detection) pulse output pin	
8	RD	RD (lock detection) signal output pin *During rotation → output is Low During lock → output is High	
9	IN1	Hall input + pin	
11	IN2	Hall input - pin	

Continue to the next page

From the previous page

No.	Pin name	Function	Equivalent circuit
10	HB	Hall bias output pin	
12	RGL	Regulator voltage output pin for internal circuit and lower output Tr driver	
13	SSW	Voltage input pin for control between soft switches *OPEN: pin voltage is middle. *Soft switch zone is changed by short to RGL or GND.	
1 16	GND	Ground pin	
3 14	RF	Resistive connection pin for current limiter	

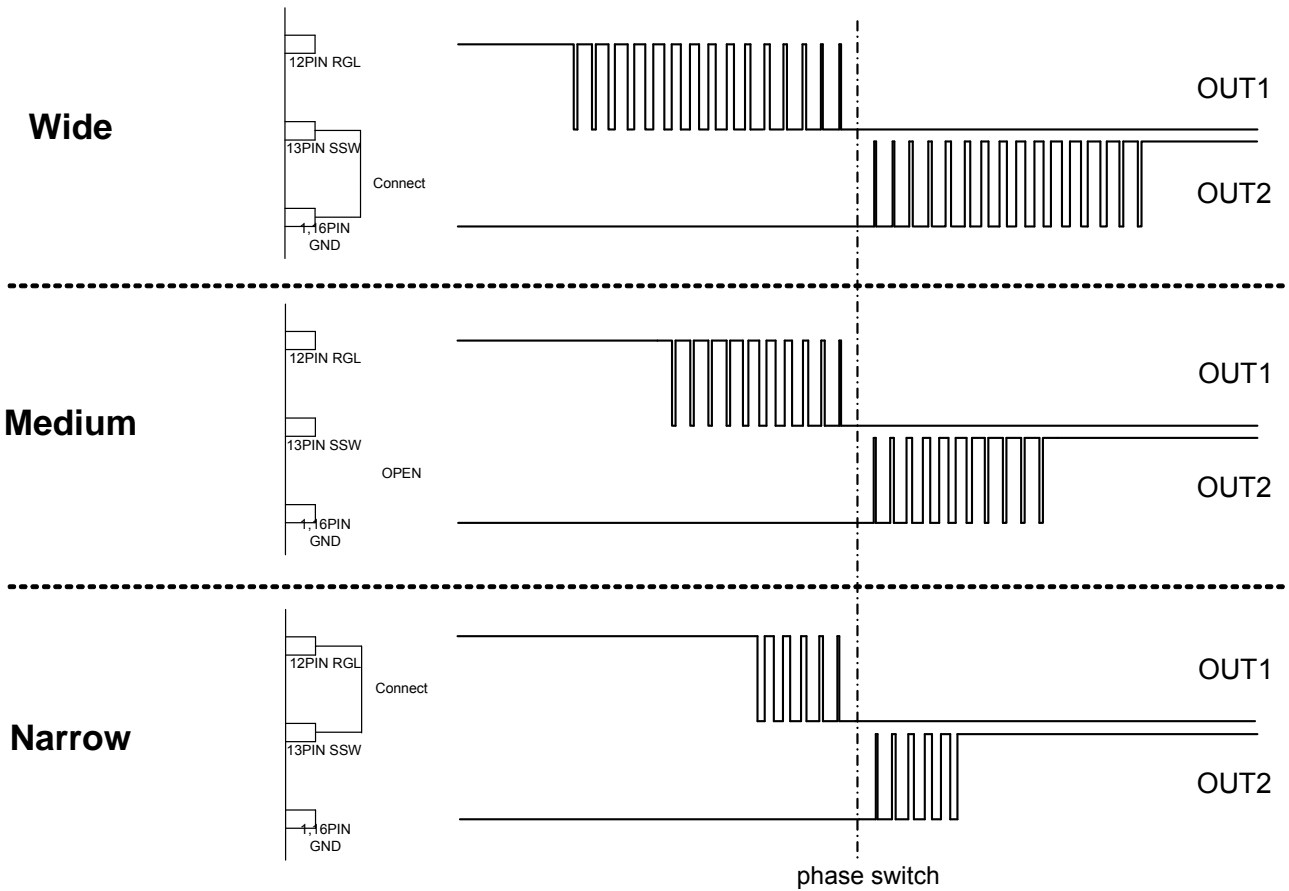
Sample application circuit



- \*1 When diode  $D_1$  is used to prevent destruction of IC from reverse connection, make sure to implement the large capacitor  $C_1$  to secure regenerative current route.
- \*2 If kickback at a phase change is greater, insert zener diode between GND and VCC or implement the larger capacitor between GND and VCC mentioned in \*1.
- \*4 Make sure to implement enough capacitance 0.1 $\mu$ F or higher between RGL pin and GND pin for stable performance.
- \*5 FG pin and RD pin are open drain output. Keep the pins open when unused.
- \*6 The current limiter is activated when the current detection resistor voltage exceeds 250mV between RF and VCC. Where  $R_L=0.5\Omega$ , current limiter is activated at  $I_o=500mA$ . Setting is made using  $R_f$  resistance.
- \*7 Hall element outputs stable hall signal with good temperature characteristic when it is biased with constant voltage from HB pin. If you wish to alleviate heating of IC, do not use HB pin. When you do not use this Pin (Pin HB), pull down with resistor of around 10k $\Omega$ (recommended).  
To defend signal against the noise, it is necessary to wire as short as possible from hall sensor to each pin and to connect the capacitor between IN1 and IN2. Value from 1,000pF to 10,000pF is recommended for the capacitor. But its value should be selected in consideration with the actual motor action.



**Adjustment of soft-switching width**  
**LV8862JA soft-switching wide select**



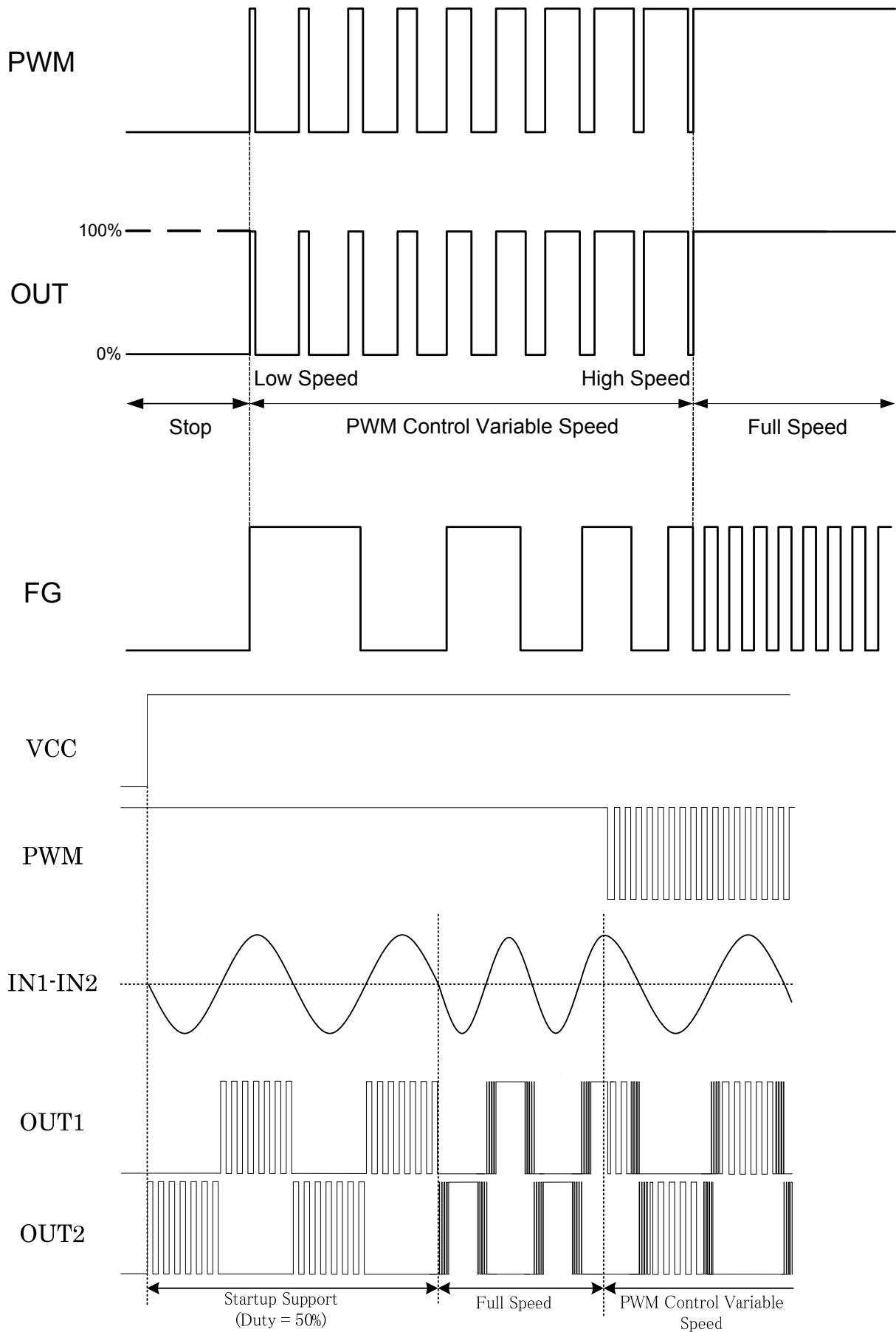
LV8862JA realizes high efficiency and low noise by controlling reactive power using soft switch before and after phase switch by variable PWM-duty.

The width of soft switch before and after switching is controlled by SSW pin voltage. Therefore, it is adjustable by connecting to SSW and RGL or GND or open. .

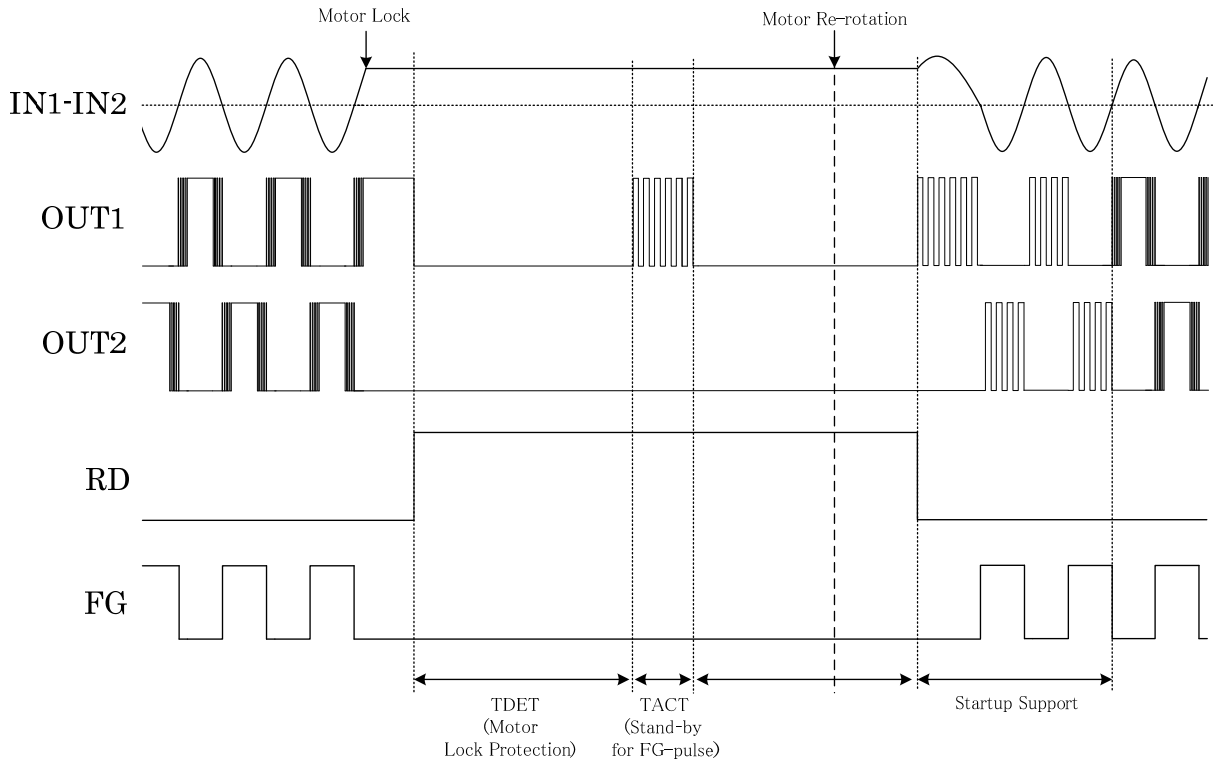
When the motor rotation speed is very high, there is possibility to show unstable soft-switching waveform.

**Description of operation**

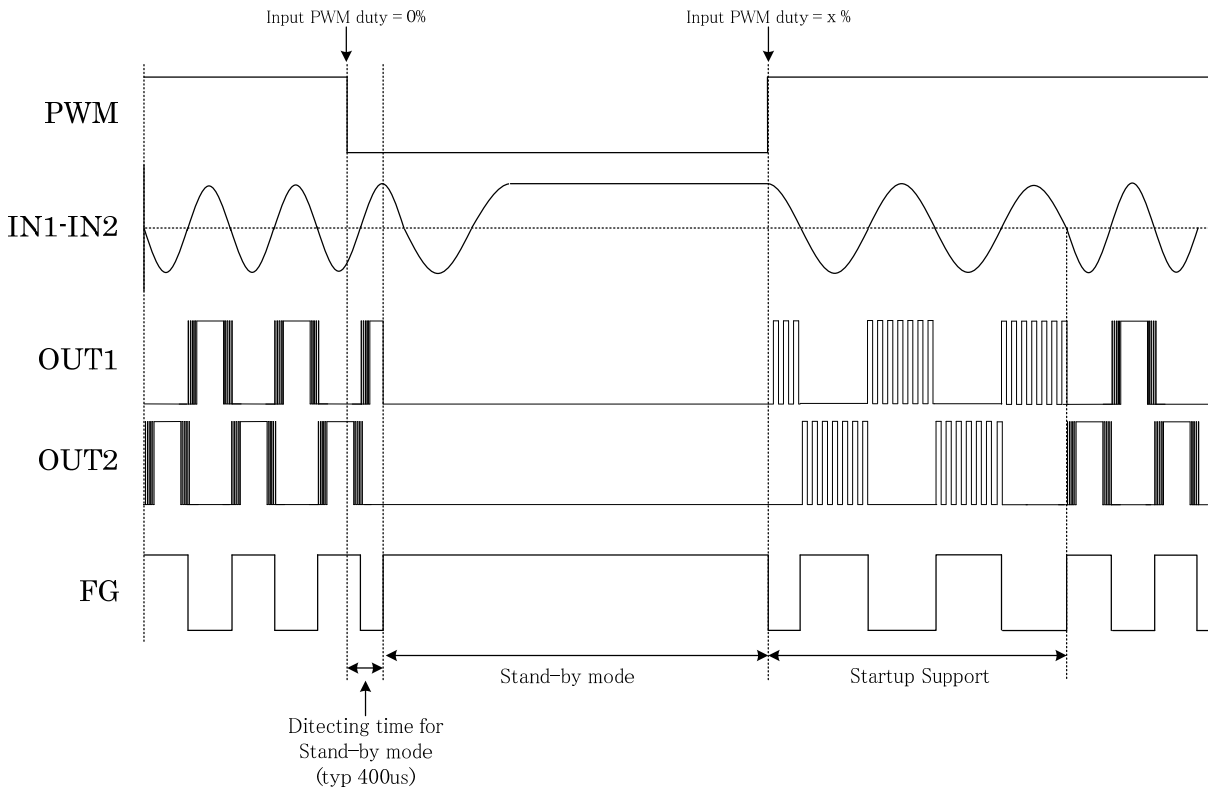
•PWM speed control waveform



•Lock protection operation waveform



•Stand-by mode operation waveform



**ORDERING INFORMATION**

Device	Package	Shipping (Qty / Packing)
LV8862JA-AH	SSOP16 (225mil) (Pb-Free / Halogen Free)	2000 / Tape & Reel

ON Semiconductor and the ON logo are registered trademarks of Semiconductor Components Industries, LLC (SCILLC) or its subsidiaries in the United States and/or other countries. SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.