

# LC898302AXA

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## Advance Information

CMOS LSI

## Linear Vibrator Driver



**ON Semiconductor®**

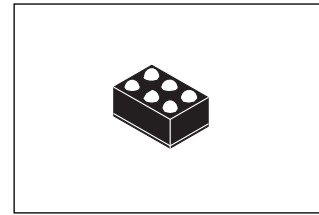
[www.onsemi.com](http://www.onsemi.com)

### Overview

LC898302AXA is a LRA (Linear Resonant Actuator) & ERM (Eccentric Rotating Mass) Driver IC dedicated to haptic feedback actuator and vibrator employed in mobile equipment. Due to the product superior technology, the drive frequency is automatically adjusted to the resonance frequency of the linear vibrator without the use of other external parts. As a result of this very effective drive, the vibration is as powerful as possible using very limited amount of energy compared to classical solutions

The drive and brake are fully configurable through the PWM-IF setting.

Finally, the original driving waveform allows you to reduce power consumption and it is useful to maintain battery lifetime.



WLCSP6, 0.78x1.18

### Features

- 1) Automatic adjustment to the resonance frequency for LRA
- 2) Automatic braking (EN mode only)
- 3) Adjustable Drive voltage through PWM-IF setting
- 4) Adjustable Brake voltage through PWM-IF setting
- 5) EN/PWM-IF driving mode available by automatic detection
- 6) low standby current
- 7) Low power consumption thanks to the highly effective drive
- 8) Low driving noise (EMI, Audible band)
- 9) Thermal shutdown protection
- 10) Available to drive a LRA or ERM.
- 11) VBAT compliant

### Applications

- 1) Mobile Phone
- 2) Portable Game
- 3) Mobile equipment with haptics function

This document contains information on a new product. Specifications and information herein are subject to change without notice.

### ORDERING INFORMATION

See detailed ordering and shipping information on page 9 of this data sheet.

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## 1 Block Diagram

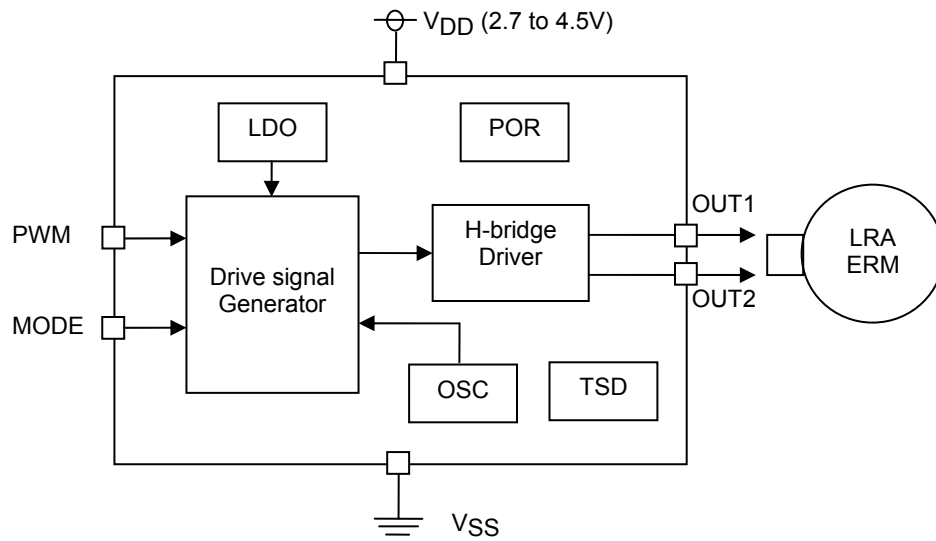


Fig. 1

## 2 Absolute Maximum Ratings / $V_{SS} = 0V$

Parameter	Symbol	condition	Rating	Unit
Supply voltage range	$V_{DD}$ max		-0.3 to 6.0	V
Input voltage	$V_{I1}$	*1	-0.3 to $V_{DD}+0.3$	V
H-bridge Drive current	$I_O$ max		200	mA
Allowable power dissipation	$P_d$ max	$T_a=85^{\circ}C$ , *2	TBD	mW
Operating temperature range	$T_a$		-30 to 85	$^{\circ}C$
Storage temperature range	$T_{stg}$		-55 to 125	$^{\circ}C$

\*1 PWM,MODE pin

\*2 glass epoxy (50mm x 40mm, t=0.9mm, FR-4)

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.

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### 3 Recommended Operating Conditions/ Ta = -30 to 85 °C, VSS = 0V

Parameter	Symbol	condition	Min	Typ	Max	Unit
Supply voltage range	VDD		2.7	-	4.5	V
Input voltage range	VIN1	*1	0	-	VDD	V

\*1 MODE ,PWM pin

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.

### 4 Electric characteristics

#### 4.1 DC characteristics

[VSS = 0V, VDD = 2.7 to 4.5V, Ta = -30 to 85 °C]

Parameter	Symbol	Condition	Min	Typ	Max	Unit	Applied pin
High level Input voltage	V <sub>IH</sub>	CMOS	1.40	-	-	V	PWM
Low level Input voltage	V <sub>IL</sub>		-	-	0.36	V	
High level Input voltage	V <sub>IH</sub>	CMOS	0.7V <sub>DD</sub>	-	-	V	MODE
Low level Input voltage	V <sub>IL</sub>		-	-	0.3V <sub>DD</sub>	V	
Input leakage current	I <sub>IL</sub>	V <sub>I</sub> =V <sub>DD</sub> ,V <sub>SS</sub>	-10	-	+10	μA	PWM, MODE

#### 4.2 AC input characteristics

[VSS = 0V, VDD = 2.7 to 4.5V, Ta = -30 to 85 °C]

Parameter	Symbol	Min	Typ	Max	Unit	Condition
Input PWM frequency	f <sub>frq</sub>	10.0	-	50.0	kHz	1%<PWM Duty<99% *1

\*1) PWM carrier frequency must be set to 128 times of resonant frequency in case of LRA mode.

#### 4.3 Standby current

[VSS = 0V, VDD = 3.7V, Ta = 25 °C]

Parameter	Symbol	Min	Typ	Max	Unit	Condition
Stand-by current	Pstb	-	1.0	3.0	μA	PWM="0"
Idle current	Pidle	-	2.5	-	mA	PWM=Duty 50%

#### 4.4 Analog characteristics

[VSS = 0V, VDD = 3.7V, Ta = 25 °C]

Parameter	Symbol	Min	Typ	Max	Unit	Condition
Output Voltage Difference OUT1 and OUT2	V <sub>OUT12</sub>	-	2.8	-	V <sub>pp</sub>	MODE="0" Input PWM Duty=99%
		-	2.9	-	V <sub>pp</sub>	MODE="1" Input PWM Duty=99%
H-Bridge ON resistance Pch	R <sub>onp</sub>	-	2.5	-	Ω	I <sub>F</sub> =100mA
H-Bridge ON resistance Nch	R <sub>onn</sub>	-	1.0	-	Ω	I <sub>S</sub> =100mA
Adjustable resonance frequency range	F <sub>mo</sub>	-10	-	+10	%	vs Input value

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.

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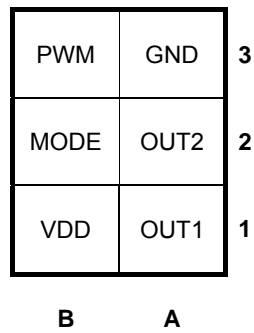
## 5 Pin Assignment

### 5.1 Pin list

I/O -> I : input, O: output, B: bi-direction, P: power supply, NC: not connected

NO	NAME	I/O	NO	NAME	I/O
1A	OUT1	O	1B	VDD	P
2A	OUT2	O	2B	MODE	I
3A	GND	P	3B	PWM	I

### 5.2 Pin layout (PKG: WLCSP6, 0.4mm pitch)



< Bottom View >

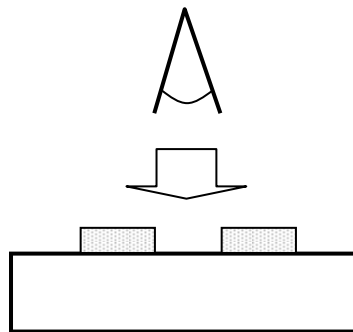


Fig. 2

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## 6 Pin description

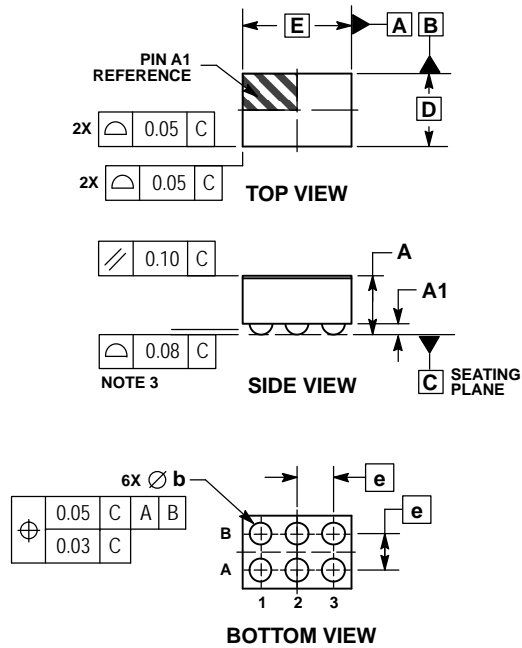
I/O -> I: input, O: output, B: bi-direction, P: power supply, NC: not connected

Signal name	I/O	Function	Remarks
OUT1	O	Motor drive pin	H-bridge output
OUT2	O	Motor drive pin	H-bridge output
MODE	I	Motor select pin	L : LRA, H : ERM
PWM	I	Driving control pin	EN control or PWM control input
VDD	P	Power supply pin	
VSS	P	GND pin	

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## 7 Package Dimensions unit : mm

**WLCSP6, 0.78x1.18**  
CASE 567KP  
ISSUE O

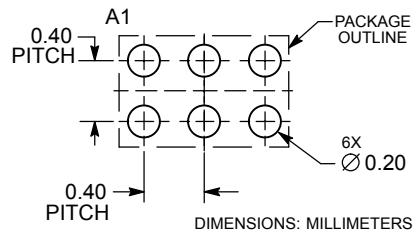


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

DIM	MILLIMETERS	
	MIN	MAX
A	---	0.65
A1	0.07	0.17
b	0.15	0.25
D	0.78 BSC	
E	1.18 BSC	
e	0.40 BSC	

**RECOMMENDED SOLDERING FOOTPRINT\***



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

Fig. 3

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## 8 AC Characteristic

### 8.3 AC Characteristic (V<sub>DD</sub>)

[V<sub>SS</sub> = 0V, V<sub>DD</sub> = 2.7 to 4.5V, T<sub>a</sub> = -30 to +85 °C]

Parameter	Symbol	Min	Typ	Max	Unit	comment
V <sub>DD</sub> Rising Time	T <sub>VDDUP</sub>	-	-	100	ms	-

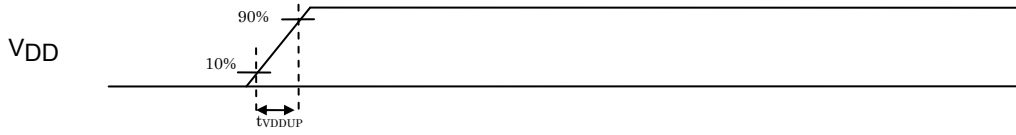


Fig. 4

### 8.4 AC Characteristics (Start Up Time)

[V<sub>SS</sub> = 0V, V<sub>DD</sub> = 2.7 to 4.5V, T<sub>a</sub> = -30 to +85 °C]

Parameter	Symbol	Min	Typ	Max	Unit	comment
Start Up Time	t <sub>stup</sub>	-	0.55	-	ms	-

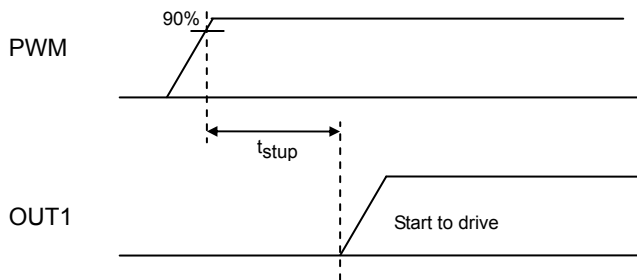
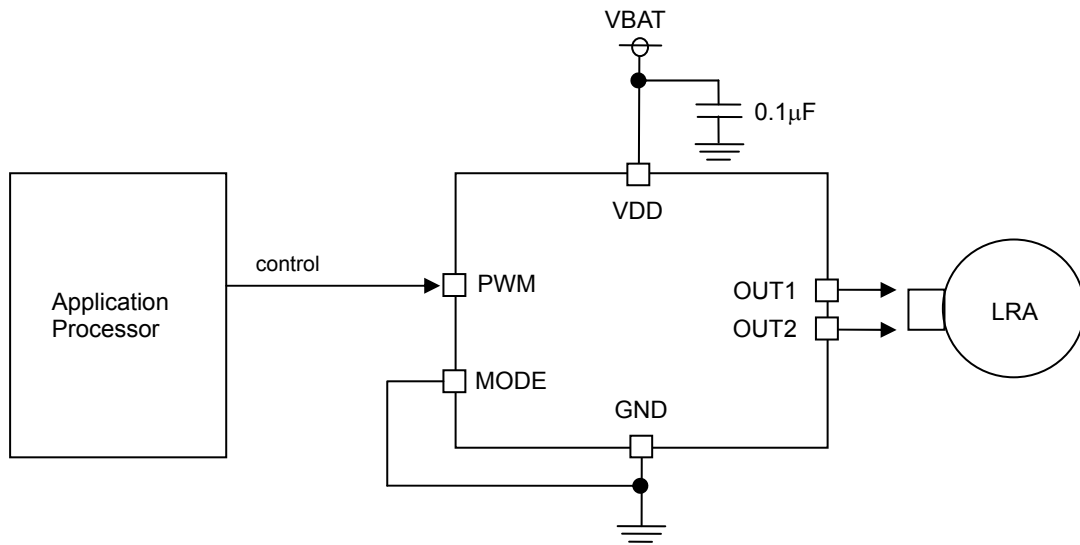


Fig. 5

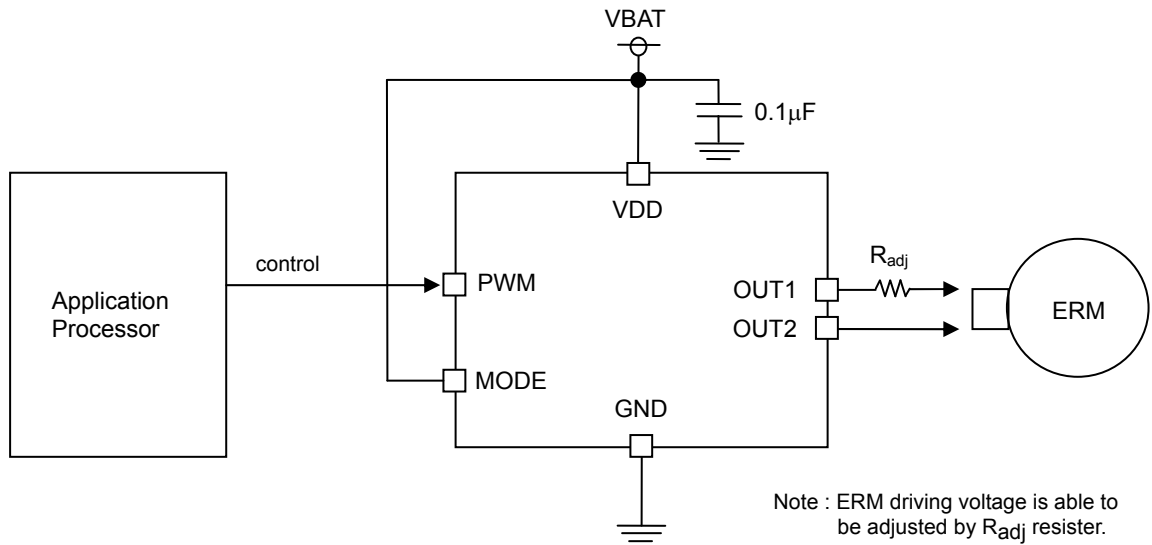
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## 9 Application Information

### 9.1 LRA mode



### 9.2 ERM mode





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## ORDERING INFORMATION

Device	Package	Shipping (Qty / Packing)
LC898302AXA-MH	WLCSP6, 0.78x1.18 (Pb-Free / Halogen Free)	5000 / Tape & Reel

† For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D. [http://www.onsemi.com/pub\\_link/Collateral/BRD8011-D.PDF](http://www.onsemi.com/pub_link/Collateral/BRD8011-D.PDF)

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