

## Piezo-sounder Driver with Multi-mode charge pump

### ■ GENERAL DESCRIPTION

The NJU72501 is a switching driver with multi mode charge pump for piezo-sounder. It can drive outputs up to 18Vpp from 3V supply. For adjusting the piezoelectric sounder sound volume, the charge pump can operate in either of a 1x, 2x or 3x mode.

Because NJU72501 has the shutdown function, it is suitable for the battery application.

### ■ PACKAGE OUTLINE



NJU72501MJE

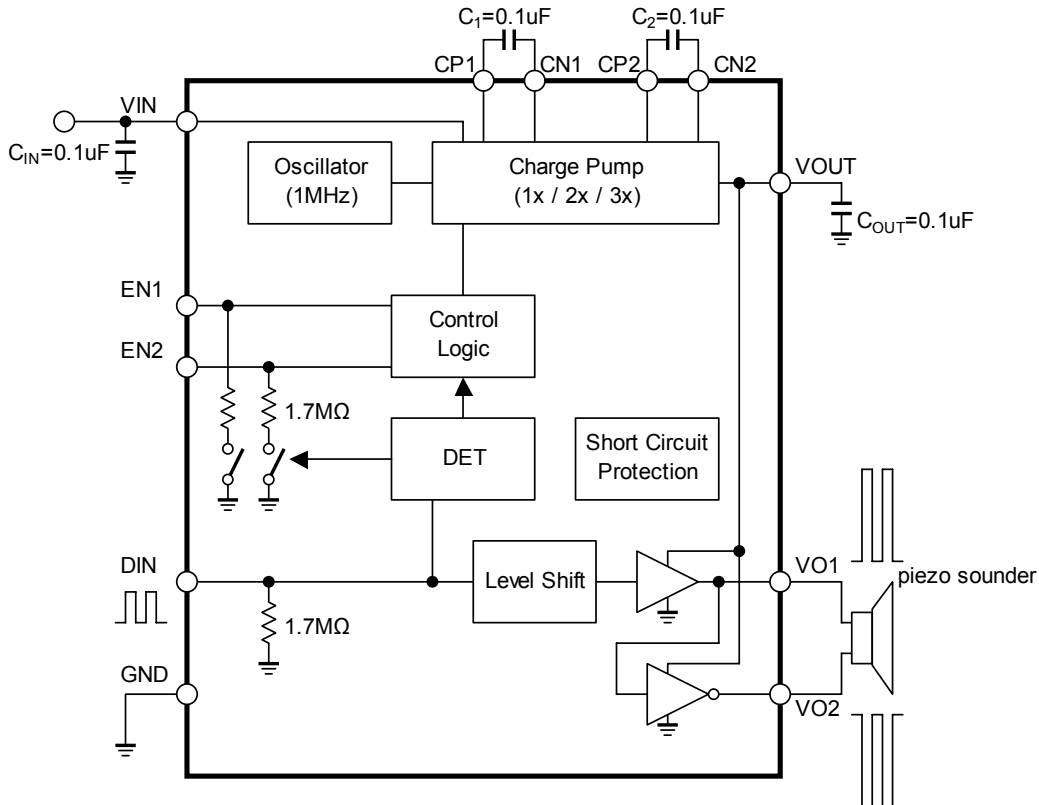
### ■ APPLICATION

Healthcare, Wrist Watches, Alarm Clocks, Handheld GPS devices, PDAs

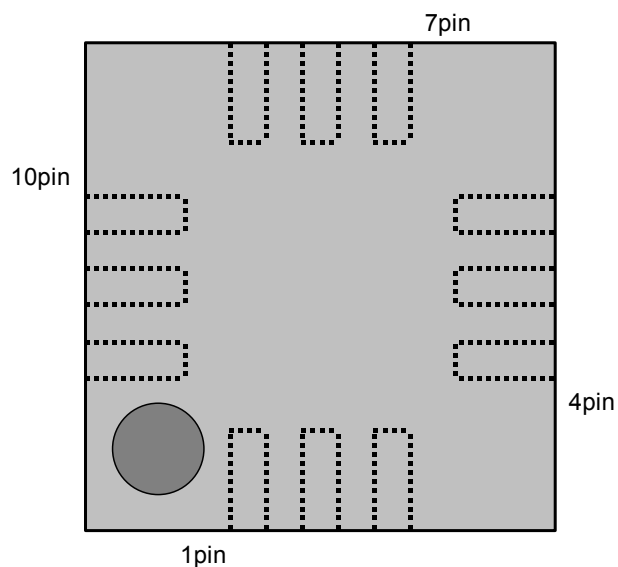
### ■ FEATURES

- Operating Voltage : 2.3 to 5.0V
- Consumption current (Active) :  $I_{DS}=0.3\text{mA}$  typ. ( $V_{IN}=3\text{V}$ ,  $DIN=4\text{kHz}$ ,  $C_{PIEZO}=15\text{nF}$ , 1x Mode)  
(Shutdown):  $I_{DS}=1\mu\text{A}$  max. ( $V_{IN}=3\text{V}$ ,  $DIN=0\text{V}$ )
- Multi-Mode Charge Pump (1x/2x/3x)
- Input Signal Detector & Shutdown Control
- Output Short-circuit Protection Circuit
- C-MOS Technology
- Package Outline : EQFN12-JE

### ■ BLOCK DIAGRAM



## ■ TERMINAL CONFIGURATION (EQFN12-JE)



## ■ PIN DESCRIPTION

Pin No.	SYMBOL	FUNCTION	Pin No.	SYMBOL	FUNCTION
1	EN1	Step-up Mode Switch Terminal 1	7	VO1	Output Terminal 1
2	EN2	Step-up Mode Switch Terminal 2	8	CN2	Capacitor Connection Terminal
3	DIN	Input Terminal	9	CP1	Capacitor Connection Terminal
4	CN1	Capacitor Connection Terminal	10	VOOUT	Charge Pump Output Terminal
5	GND	GND Terminal	11	CP2	Capacitor Connection Terminal
6	VO2	Output Terminal 2	12	VIN	Power Supply Terminal

## ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	$V_{IN}$	5.5	V
Input Voltage	$V_{DIN}$	-0.3 to $V_{IN}+0.3$	V
Power Dissipation	$P_D$	480 <sup>*1)</sup> / 1300 <sup>*2)</sup>	mW
Operating Temperature	Topr	-40 to +85	°C
Storage Temperature	Tstg	-40 to +125	°C

(Note) <sup>\*1)</sup> EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 2layers, FR-4) mounting

<sup>\*2)</sup> EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 4layers, FR-4) mounting

## ■ RECOMMENDED OPERATING CONDITION (Ta=25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Voltage	VIN	1x Mode, 2x Mode	2.3	3.0	5.0	V
		1x Mode, 2x Mode, 3x Mode	2.3	3.0	3.4	

## ■ ELECTRICAL CHARACTERISTICS

(Ta=25°C,  $V_{IN}=3V$ ,  $C_1=100nF$ ,  $C_2=100nF$ ,  $C_{OUT}=100nF$ ,  $C_{PIEZO}=15nF$ ,  $DIN=4kHz$ )

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT1}$	1x Mode	2.8	-	3	V
	$V_{OUT2}$	2x Mode	5.2	-	6	V
	$V_{OUT3}$	3x Mode	7.2	-	9	V
Operating Current 1	$I_{DD11}$	1x Mode $C_{PIEZO}$ =no load	-	140	240	μA
	$I_{DD12}$	2x Mode $C_{PIEZO}$ =no load	-	720	1200	μA
	$I_{DD13}$	3x Mode $C_{PIEZO}$ =no load	-	2500	4500	μA
Operating Current 2	$I_{DD21}$	1x Mode Single ended application	-	0.3	-	mA
	$I_{DD22}$	2x Mode Single ended application	-	1.4	-	mA
	$I_{DD23}$	3x Mode Single ended application	-	3.9	-	mA
Operating Current 3	$I_{DD31}$	1x Mode Differential application	-	0.9	-	mA
	$I_{DD32}$	2x Mode Differential application	-	3.6	-	mA
	$I_{DD33}$	3x Mode Differential application	-	7.9	-	mA
Consumption Current at Shutdown	$I_{SD}$	$DIN=0V$ , <sup>(*1)</sup>	-	-	1	μA
Input Frequency	$F_{IN}$	Rectangular pulse	0.2	4	8	kHz
Oscillating Frequency	$F_{OSC}$		0.6	1	1.8	MHz

(\*1: When 50msec or more maintains DIN, EN1, EN2 in 0

# NJU72501

## ■ ELECTRICAL CHARACTERISTICS

( $T_a=25^{\circ}\text{C}$ ,  $V_{\text{IN}}=3\text{V}$ ,  $C_1=100\text{nF}$ ,  $C_2=100\text{nF}$ ,  $C_{\text{OUT}}=100\text{nF}$ ,  $C_{\text{PIEZO}}=15\text{nF}$ ,  $\text{DIN}=4\text{kHz}$ )

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
VOUT Start Delay Time	$T_{\text{ON1}}$	1x Mode From DIN signal High to 90% VOUT steady state	-	30	100	$\mu\text{s}$
	$T_{\text{ON2}}$	2x Mode From DIN signal High to 90% VOUT steady state	-	90	200	$\mu\text{s}$
	$T_{\text{ON3}}$	3x Mode From DIN signal High to 90% VOUT steady state	-	180	350	$\mu\text{s}$
Shutdown Delay Time	$T_{\text{OFF}}$	DIN=H -> L	21	42	84	ms
Output Short-circuit Protection Limitation Current	$I_{\text{SC}}$		20	40	60	mA

## ■ CONTROL PART CHARACTERISTICS

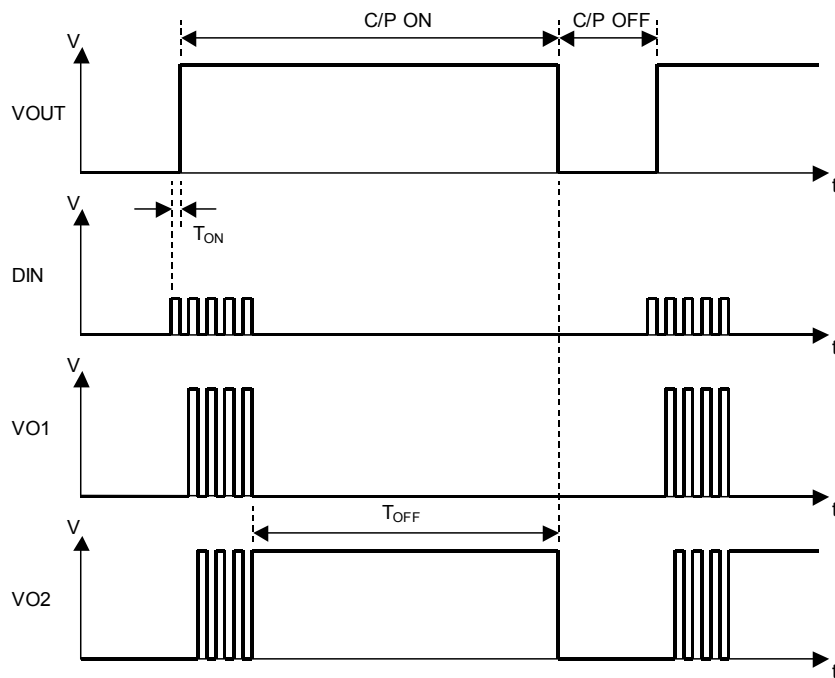
$T_a=25^{\circ}\text{C}$ ,  $V_{\text{IN}}=3\text{V}$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Control Terminal Voltage H	$V_{\text{IH}}$	EN1 , EN2 , DIN pins	$0.8 \cdot V_{\text{IN}}$	-	$V_{\text{IN}}$	V
Control Terminal Voltage L	$V_{\text{IL}}$	EN1 , EN2 , DIN pins	0	-	$0.2 \cdot V_{\text{IN}}$	V
Control Terminal Current 1	$I_{\text{IH1}}$	DIN=3V	-	1.7	3.4	$\mu\text{A}$
Control Terminal Current 2	$I_{\text{IH2}}$	$V_{\text{EN1}}, V_{\text{EN2}}=3\text{V}$ , DIN=3V	-	1.7	3.4	$\mu\text{A}$
Control Terminal Current 3	$I_{\text{IH3}}$	$V_{\text{EN1}}, V_{\text{EN2}}=3\text{V}$ , DIN=0V	-	-	1	$\mu\text{A}$

## ■ CHARGE PUMP MODE SETTING

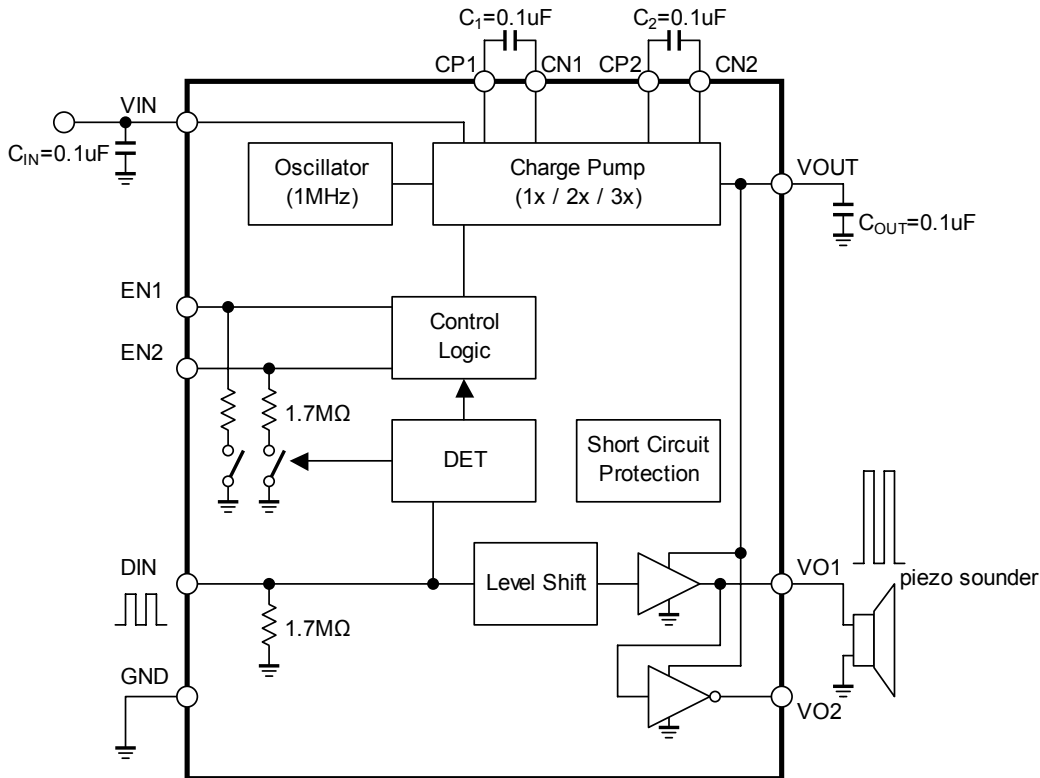
DIN	EN1	EN2	Charge Pump Mode
0	-	-	Shut Down Mode
1	0	0	Shut Down Mode
1	0	1	1x Mode
1	1	0	2x Mode
1	1	1	3x Mode

## ■ TIMING CHART



# NJU72501

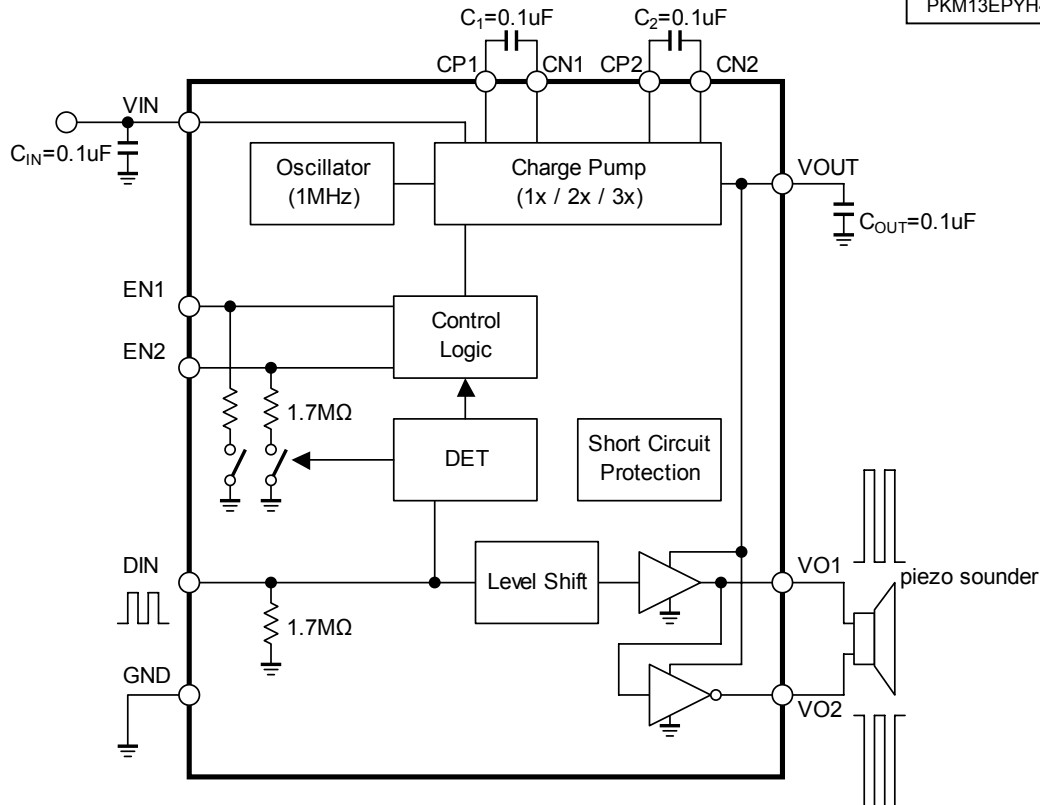
## APPLICATION CIRCUIT 1 (Single-end output)



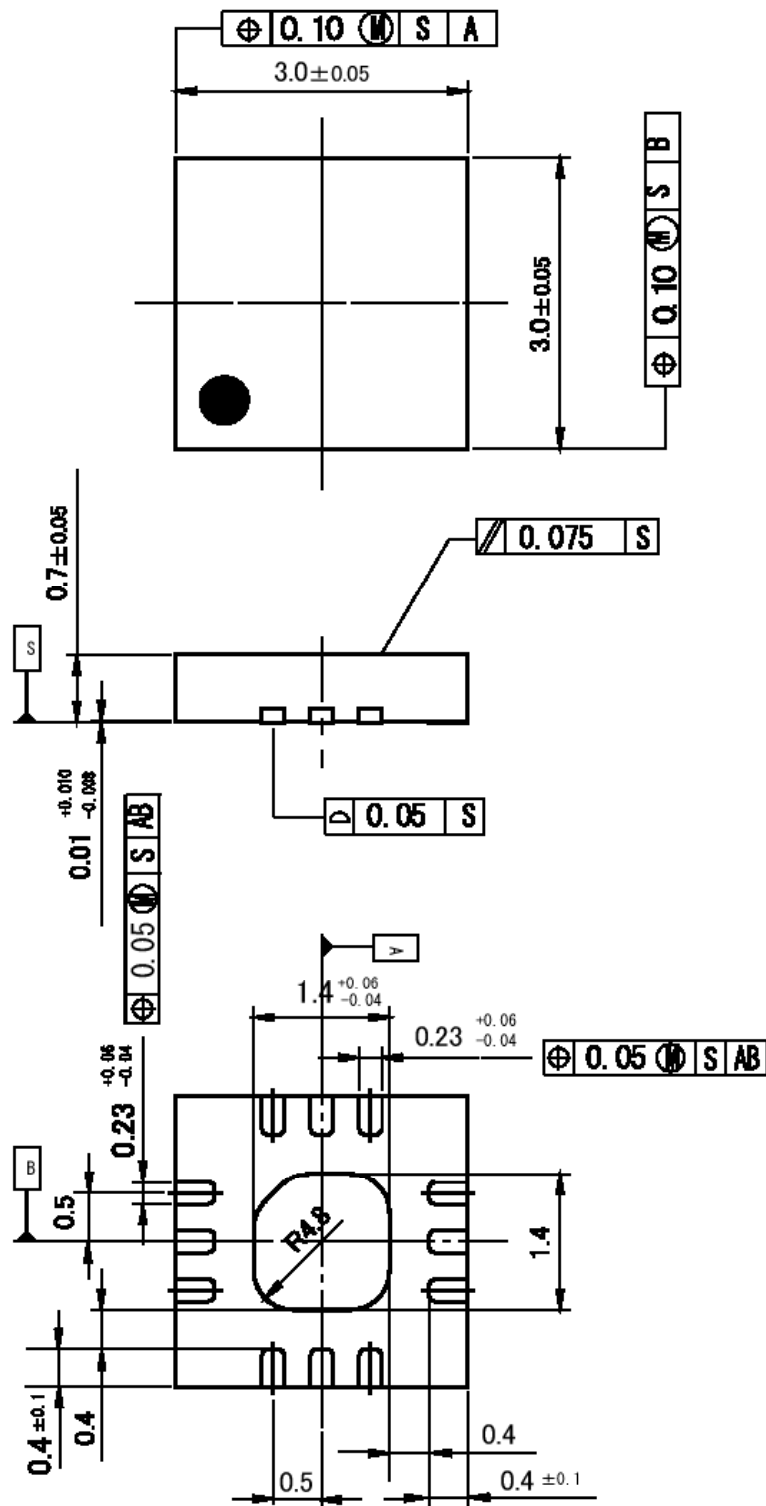
### Recommended Parts

Piezo-sounder/ Piezo-buzzer  
 PKLCS1212E2400-R1(muRata)  
 PKLCS1212E4001-R1(muRata)  
 PKM13EPYH4000-A0(muRata)

## APPLICATION CIRCUIT 2 (Differential output)



## ■ PACKAGE INFORMATION (EQFN12-JE)



**[CAUTION]**

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