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}=0.3mA typ. (VIN=3V, DIN=4kHz, C_{PIEZO}=15nF, 1x Mode)
                                  (Shutdown): I_{DS}=1uA max. (VIN=3V , DIN=0V)
● 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**

NJU72501
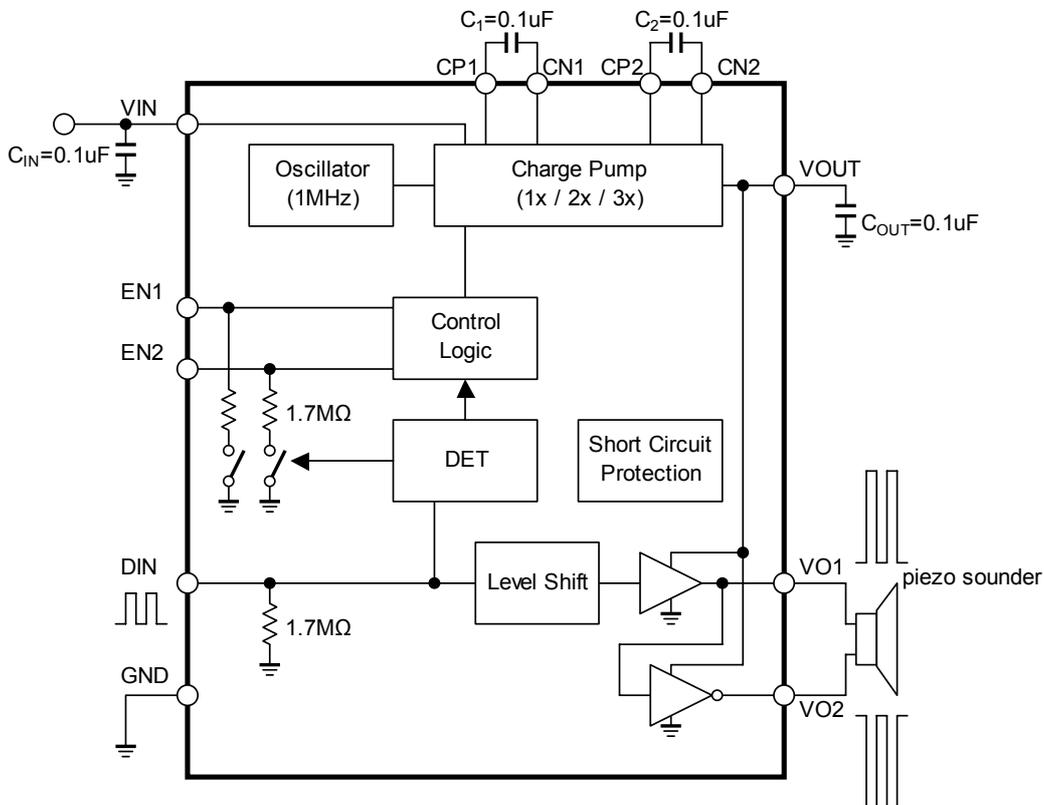
■ TERMINAL CONFIGURATION (EQFN12-JE)
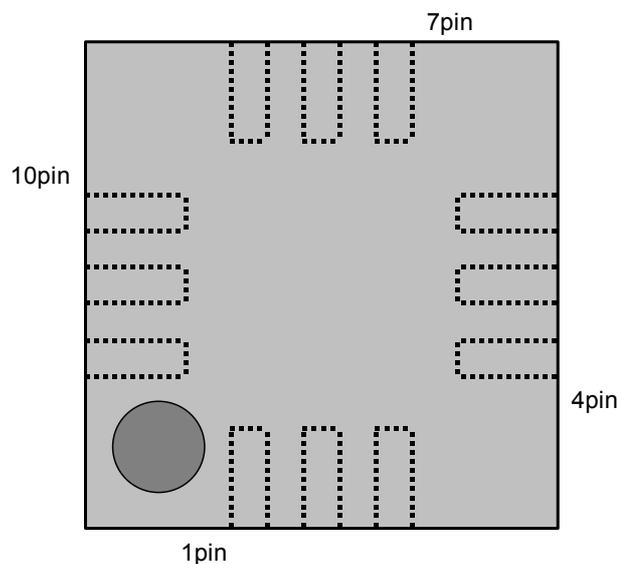
■ PIN DESCRIPTION

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	VOUT	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 VIN+0.3	V
Power Dissipation	P_D	480 *[1] / 1300 *[2]	mW
Operating Temperature	Topr	-40 to +85	°C
Storage Temperature	Tstg	-40 to +125	°C

(Note) *[1] EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 2layers, FR-4) mounting
*[2] EIA/JEDEC STANDARD Test board (76.2 x 114.3 x 1.6mm, 4layers, FR-4) mounting

■ RECOMMENDED OPEARATING 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 , (*1	-	-	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

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■ 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
VOUT Start Delay Time	T$_{ON1}$	1x Mode From DIN signal High to 90% VOUT steady state	-	30	100	μs
	T$_{ON2}$	2x Mode From DIN signal High to 90% VOUT steady state	-	90	200	μs
	T$_{ON3}$	3x Mode From DIN signal High to 90% VOUT steady state	-	180	350	μs
Shutdown Delay Time	T$_{OFF}$	DIN=H -> L	21	42	84	ms
Output Short-circuit Protection Limitation Current	I$_{SC}$		20	40	60	mA

■ CONTROL PART CHARACTERISTICS

Ta=25°C, V$_{IN}$=3V

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Control Terminal Voltage H	V$_{IH}$	EN1 , EN2 , DIN pins	0.8*VIN	-	VIN	V
Control Terminal Voltage L	V$_{IL}$	EN1 , EN2 , DIN pins	0	-	0.2*VIN	V
Control Terminal Current 1	I$_{IH1}$	DIN=3V	-	1.7	3.4	μA
Control Terminal Current 2	I$_{IH2}$	V$_{EN1}$, V$_{EN2}$=3V , DIN=3V	-	1.7	3.4	μA
Control Terminal Current 3	I$_{IH3}$	V$_{EN1}$, V$_{EN2}$=3V , DIN=0V	-	-	1	μA

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■ 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
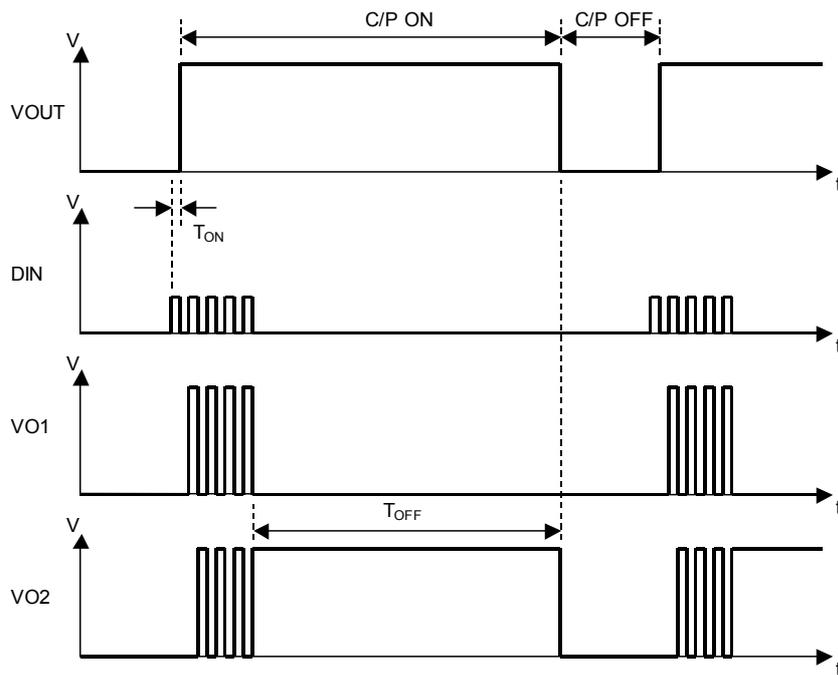
NJU72501

■ APPLICATION CIRCUIT 1 (Single-end output)
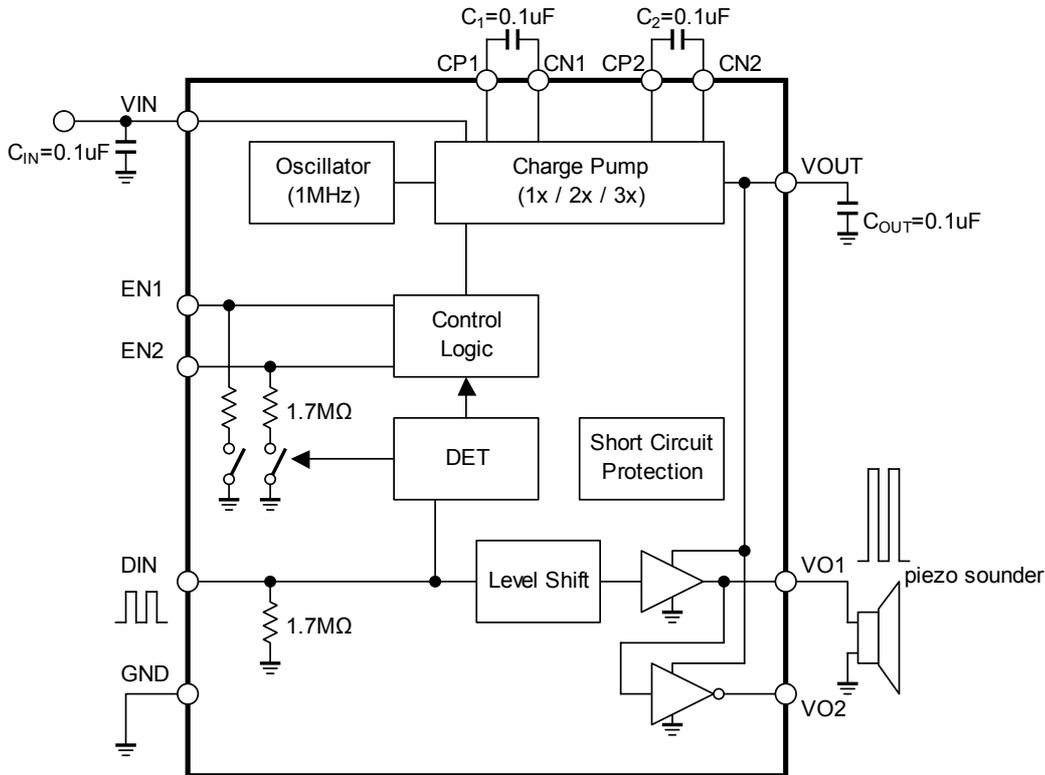
■ Recommended Parts
Piezo-sounder/ Piezo-buzzer
PKLCS1212E2400-R1(muRata)
PKLCS1212E4001-R1(muRata)
PKM13EPYH4000-A0(muRata)

■ APPLICATION CIRCUIT 2 (Differential output)
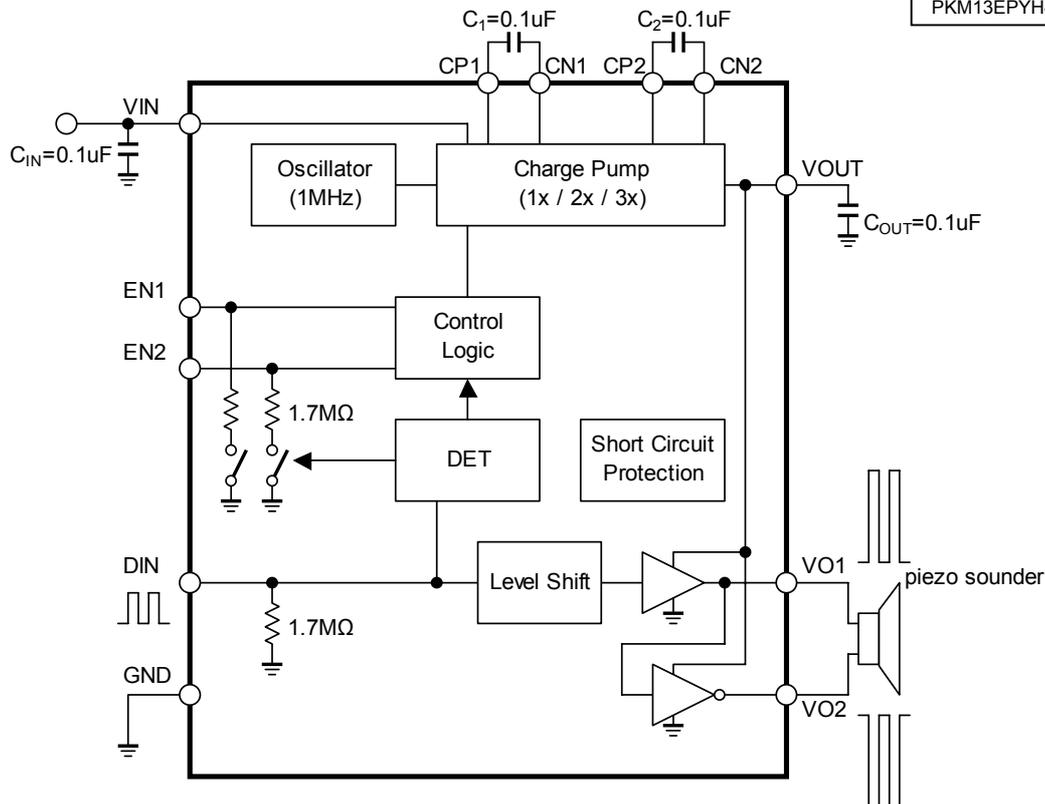
■ **PACKAGE INFORMATION (EQFN12-JE)**
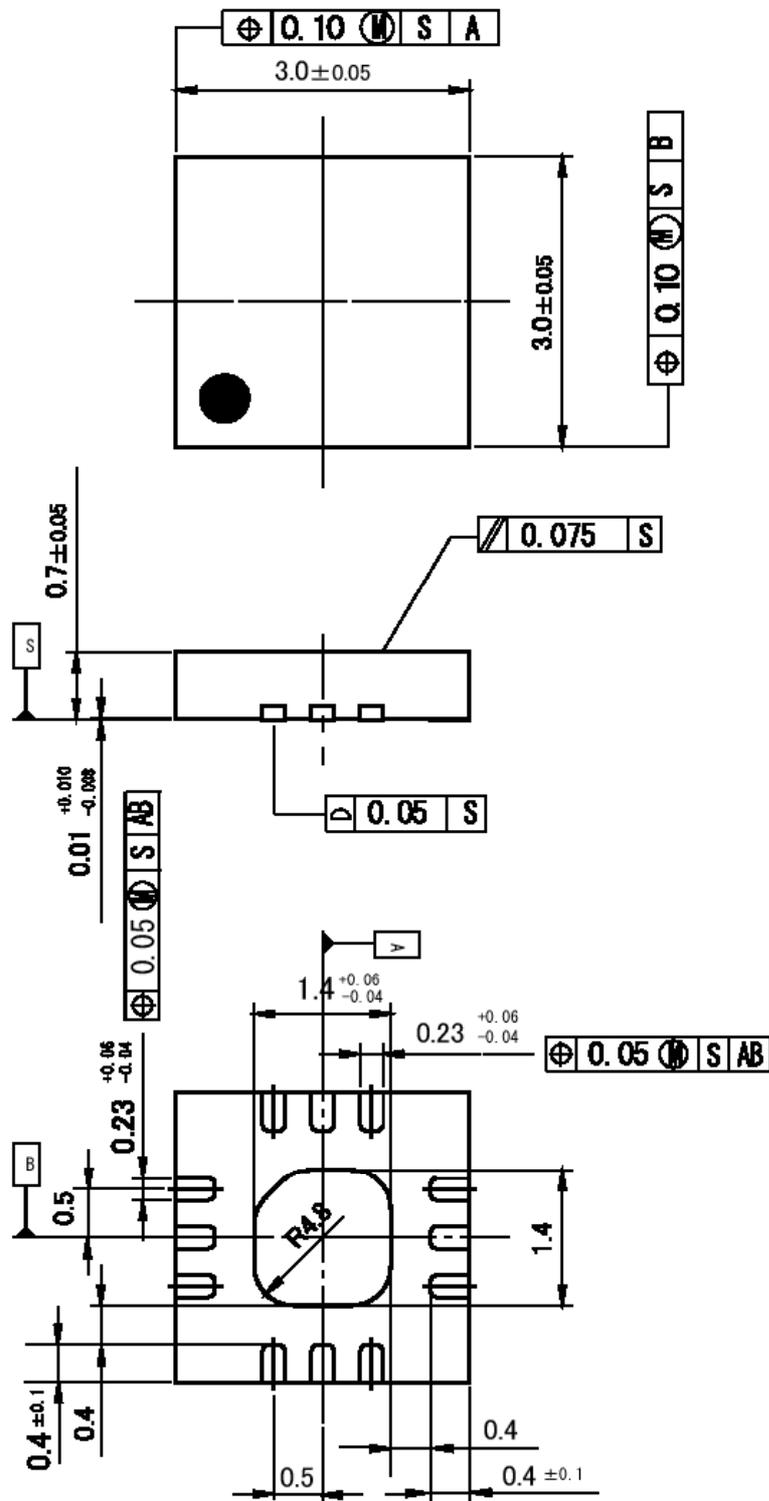
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