

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

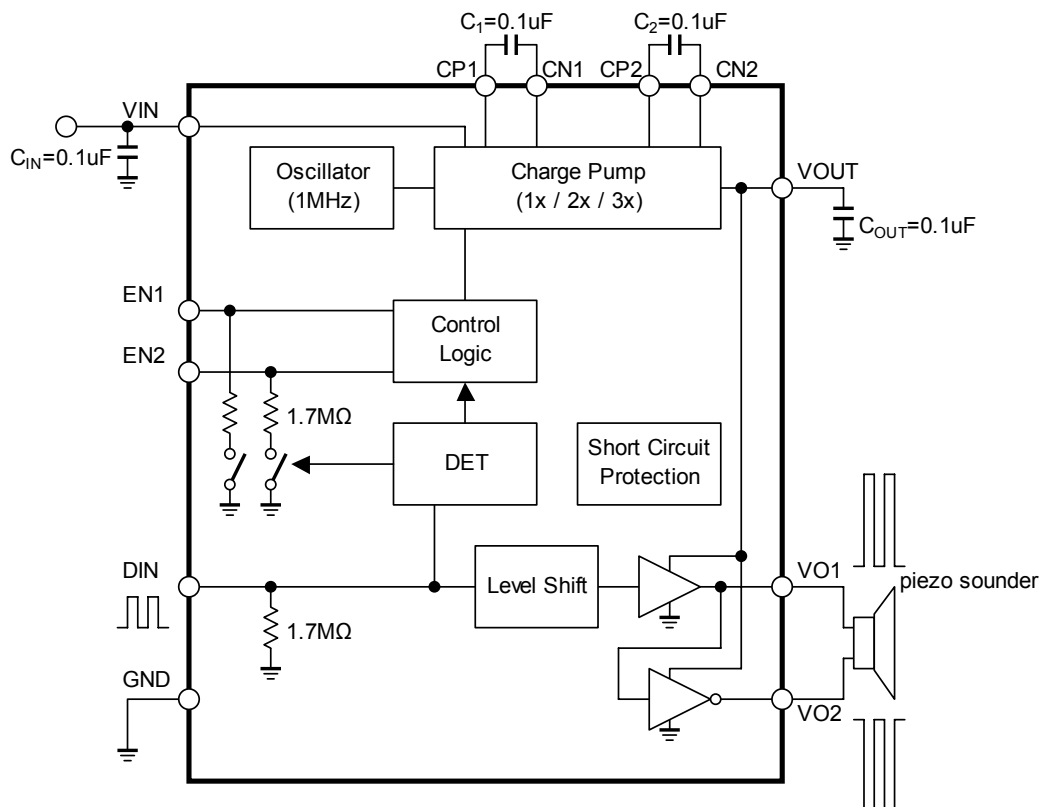
■ APPLICATION

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

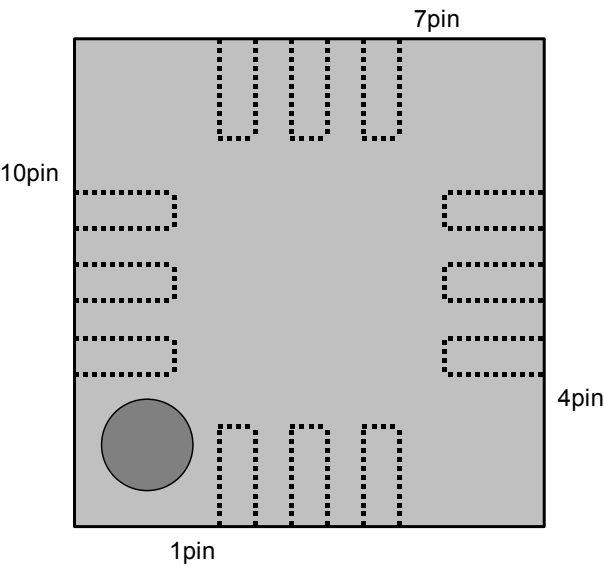
■ FEATURES

- 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 ^{*1)} / 1300 ^{*2)}	mW
Operating Temperature	T_{opr}	-40 to +85	°C
Storage Temperature	T_{stg}	-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 OPERATING CONDITION ($T_a=25^{\circ}\text{C}$)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Voltage	V_{IN}	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

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

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 $C_{PIEZO}=\text{no load}$	-	140	240	μA
	I_{DD12}	2x Mode $C_{PIEZO}=\text{no load}$	-	720	1200	μA
	I_{DD13}	3x Mode $C_{PIEZO}=\text{no load}$	-	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}	$DIN=0\text{V}$, ^(*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

■ ELECTRICAL CHARACTERISTICS

(Ta=25°C, V_{IN}=3V, C₁=100nF, C₂=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

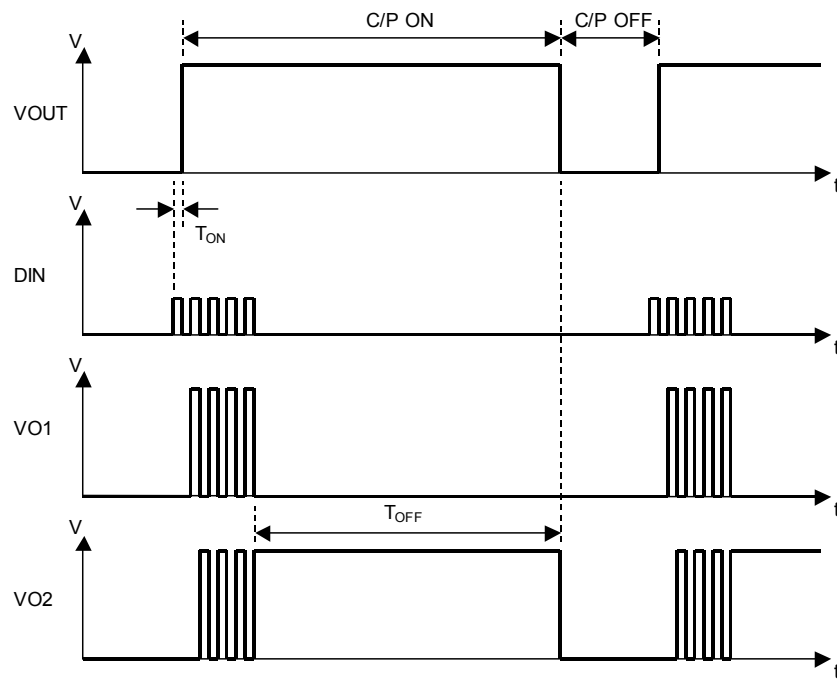
Ta=25°C, V_{IN}=3V

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Control Terminal Voltage H	V _{IH}	EN1, EN2, DIN pins	0.8*V _{IN}	-	V _{IN}	V
Control Terminal Voltage L	V _{IL}	EN1, EN2, DIN pins	0	-	0.2*V _{IN}	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

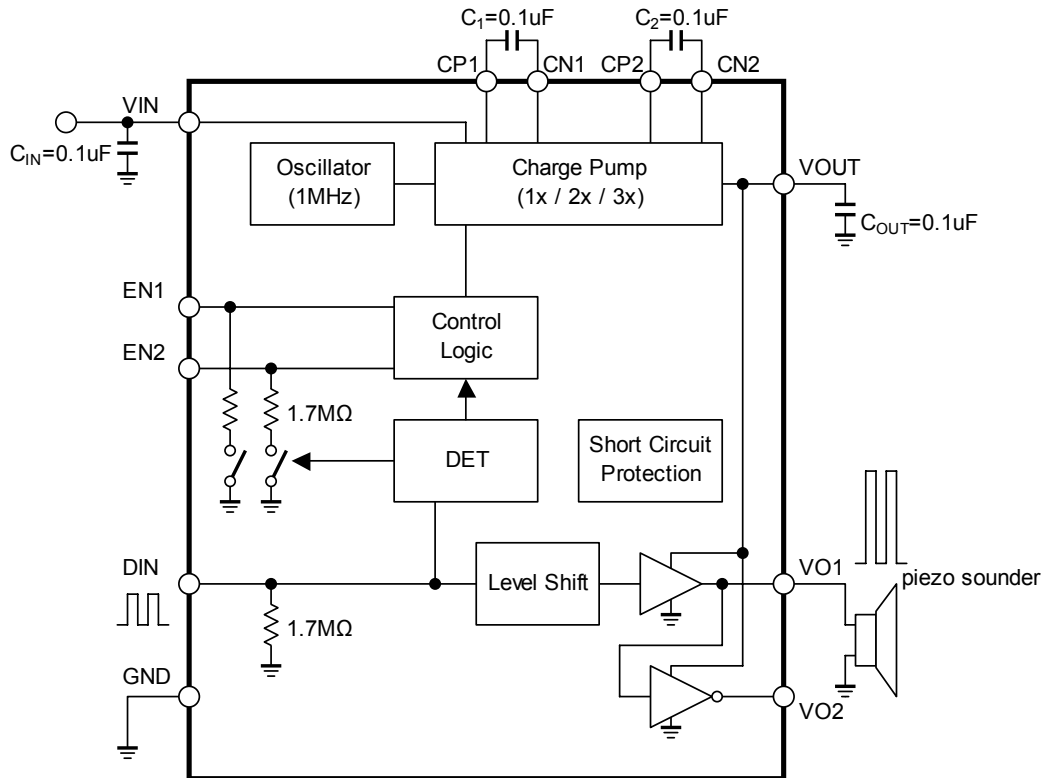
■ CHARGE PUMP MODE SETTING

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

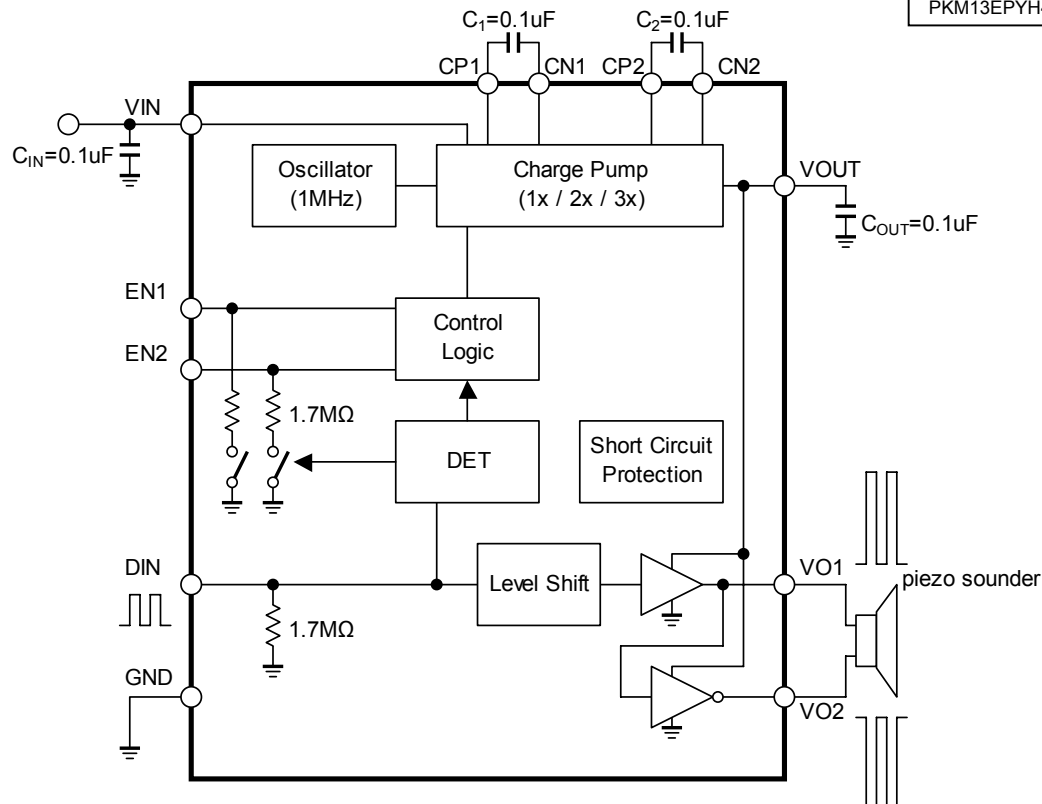
■ TIMING CHART



■ APPLICATION CIRCUIT 1 (Single-end output)



■ APPLICATION CIRCUIT 2 (Differential output)



■ Recommended Parts

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



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