OVERVIEW

The CF1155 series are CMOS melody LSIs that, together with a battery and piezoelectric buzzer, operate in one of 3 melody modes determined by input level or bonding options. They also feature an oscillator stop function in non-play mode and a variable pull-down resistance function that responds to input levels in order to reduce power consumption, reduce cost, and extend battery life, making them ideal in a wide range of applications including greeting cards and toys.

FEATURES

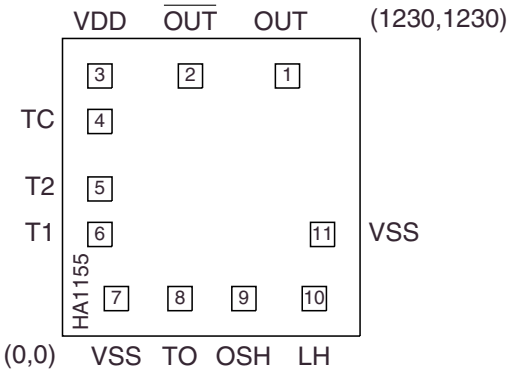
- Requires few external components
- 1.2 to 3.6V wide operating voltage range
- Low power consumption
- 3 melody modes (bonding option)
- Oscillator stop function in non-play mode
- Power saving pull-down resistor built-in
- RC oscillator circuit
- Power-ON initialization function
- 2 V_{SS} pad connections
- Wide pitch dynamic range (G_3 to D_7)
- Chip form

ORDERING INFORMATION

Device	Package
CF1155×××	Chip form

PAD LAYOUT and COORDINATES

(Unit: μm)



Chip size: 1.23 × 1.23mm
Chip thickness: 300 ± 30μm
T1, T2, TC, and TO bonding is not required.

Number	Pad	Pad dimensions (Unit: μm)	
		X	Y
1	OUT	930	1075
2	$\overline{OUT}$	529	1075
3	VDD	155	1075
4	TC	155	887
5	T2	155	608
6	T1	155	420
7	VSS	223	155
8	TO	486	155
9	OSH	750	155
10	LH	1041	155
11	VSS	1075	420

PAD DESCRIPTION

Name	Function
OSH, LH	Melody mode control inputs. Built-in pull-down resistors mean LOW-level signals are obtained when inputs are open circuit. The resistance of the pull-down resistor varies with the applied voltage, as described in the Electrical Characteristics.
OUT, $\overline{OUT}$	Piezoelectric speaker driver outputs. Both pins are LOW in non-play mode. OUT is LOW and $\overline{OUT}$ is HIGH during output for a musical rest note. Both pins are HIGH during the gap between musical notes.
VDD	Supply. The rear surface of the chip is V_{DD} level.
VSS	Ground
T1, T2, TC	Test inputs. Pull-down resistor built-in.
TO	Test output. The oscillator frequency (typ. 50kHz) is output for monitoring purposes.

SPECIFICATIONS

Absolute Maximum Ratings

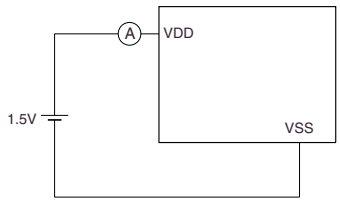
Parameter	Symbol	Condition	Rating	Unit
Supply voltage range	$V_{DD} - V_{SS}$		–0.3 to 5.0	V
Input voltage range	V_{IN}		V_{SS} – 0.2 to V_{DD} + 0.2	V
Operating temperature range	T_{opr}		–20 to 80	°C
Storage temperature range	T_{stg}		–65 to 150	°C

Electrical Characteristics

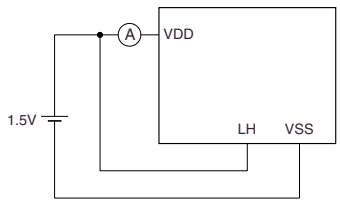
Ta = 25°C, V_{SS} = 0V, V_{DD} = 1.5V

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Operating voltage	V_{DD}		1.2	1.5	3.6	V
Current consumption[1]	I_{DD1}	Non-play mode	–	0.01	0.3	µA
Current consumption[2]	I_{DD2}	Melody modes: OUT, $\overline{OUT}$ open	–	25	50	µA
LH, OSH LOW-level input voltage	V_{IL}		–	–	V_{SS} + 0.2	V
LH, OSH HIGH-level input voltage	V_{IH}		V_{DD} – 0.2	–	–	V
LH, OSH LOW-level input current	I_{IL}	V_{IL} = 0.4V	0.7	1.5	3.0	µA
LH, OSH HIGH-level input current	I_{IH}	V_{IH} = 1.5V	0.7	1.5	3.0	µA
OUT, $\overline{OUT}$ LOW-level output current	I_{OL}	V_{OL} = 0.75V	2.0	–	–	mA
OUT, $\overline{OUT}$ HIGH-level output current	I_{OH}	V_{OH} = 0.75V	2.0	–	–	mA
TO oscillator frequency	f_{OSC}		35	50	65	kHz
TO frequency stability (relative to voltage)	$\Delta f/f_1$	V_{DD} = 1.2 to 2.0V	–	1	–	%/0.1V
	$\Delta f/f_2$	V_{DD} > 2.0V	–	2	–	%/1V
TO oscillator start voltage	V_{DOB}		–	–	1.2	V
TO oscillator stop voltage	V_{DOS}		–	–	1.2	V

1. Measurement circuit



2. Measurement circuit



FUNCTIONAL DESCRIPTION

Melody Modes

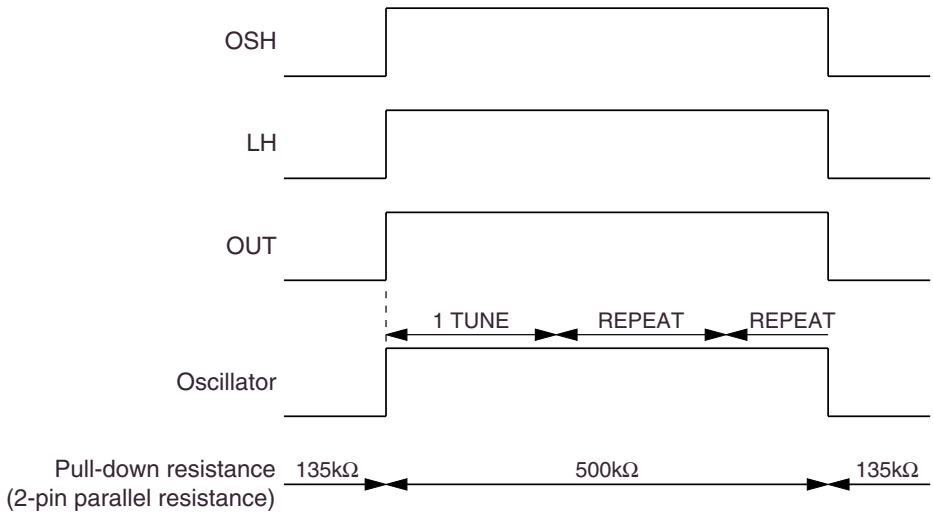
The CF1155 series melody mode is determined by the bonding options and levels on the mode control inputs OSH and LH. When either OSH or LH or both go HIGH (V_{DD}), the corresponding melody mode is selected as shown in the following table.

OSH	LH	Melody mode
HIGH	HIGH	Level hold 1
LOW	HIGH	Level hold 2
HIGH	LOW	One-shot
LOW	LOW	Non-play

Level hold 1

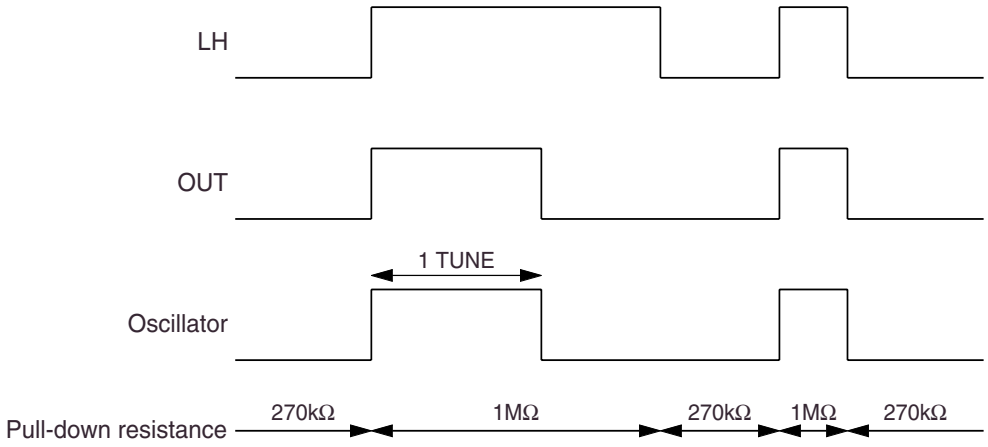
When both OSH and LH go HIGH, melody play starts and continues while both are held HIGH. When both inputs go open circuit or LOW, melody play stops, even if during mid melody.

Note that both OSH and LH inputs should be switched simultaneously using a single switch. If there is timing difference between the two inputs, then LH has priority.



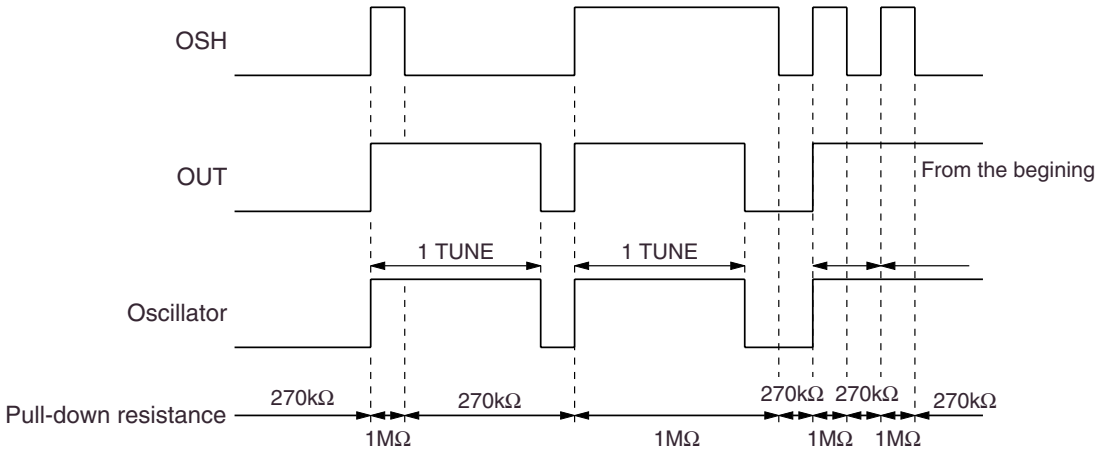
Level hold 2

When LH goes HIGH, a single melody play starts. Melody play continues until the single melody ends or LH goes open circuit or LOW, whichever occurs first.



One-shot

When OSH goes HIGH, a single melody play starts. Melody play continues until the melody ends, even if OSH goes open circuit or LOW mid melody. However, if the OSH input goes HIGH again during melody play, the melody play restarts from the beginning.



Power-save Function

As shown in the preceding timing diagrams, the oscillator stops during non-play mode and the pull-down resistance value changes in response to both HIGH-level and LOW-level inputs (power-save pull-down resistor) to reduce power consumption and extend battery life.

Non-play oscillator stop function

When melody play ends, regardless of the state of either LH or OSH, the internal oscillator stops and is placed in a standby state. In this state, the current consumption, including input pin pull-down resistor current (I_{IH} max), does not exceed 3.3μA.

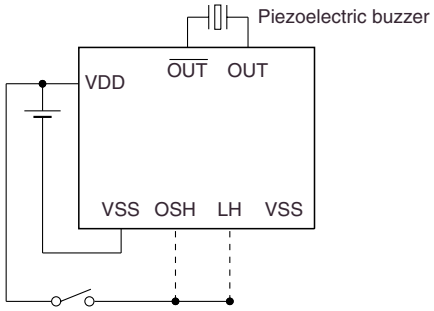
Power-save pull-down resistor

The resistance of the OSH and LH input pull-down resistor changes in response to the input voltage. The pull-down resistance is 1MΩ when the input is HIGH, and the pull-down resistance is 270kΩ when the input is LOW.

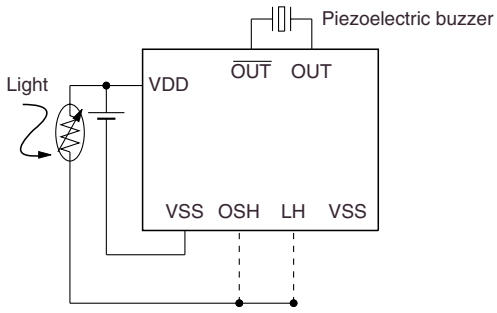
Furthermore, if a light-dependent resistor (CdS) cell is employed as a switch (the pull-down resistance is maximum when the CdS resistance is minimum (light) and the pull-down resistance is minimum when the CdS resistance is maximum (dark)), the combined resistance can be increased, decreasing current consumption.

TYPICAL APPLICATION

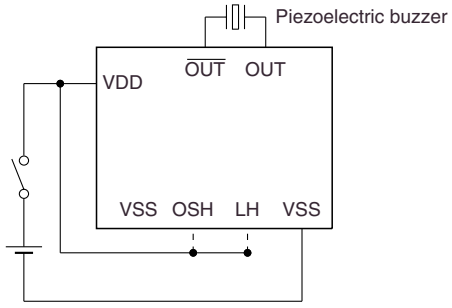
The circuits below represent the standard connections for CF1155 series devices.



Circuit 1



Circuit 3



Circuit 2

Note 1: There are 2 V_{SS} pads, and either pad can be used.
Note 2: Circuit 1 is for one-shot mode, circuit 2 for level hold 1/2 modes, and circuit 3 for CdS connection.

The bonding options for the above circuits is shown in the following table.

OSH	LH	Melody mode
Yes	Yes	Level hold 1
	Yes	Level hold 2
Yes		One-shot

SONG LIST

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Device	Song Title	Version	Composer	Time [s]
CF1155	Happy Birthday to you	AAB	Hill Mildred Junius Welch/Hill Patty Smith	15.09
CF1155	Jingle Bells Santa Claus is comin to town We wish you a merry Christmas	AAC	Pierpont James Coots J Fred –	28.88
CF1155	We wish you a merry Christmas It came upon the midnight clear Joy to the world	AAD	– Sears Edwin H/Willis Richard Storrs Haendel Georg Friedrich	51.21
CF1155	Silent Night	AAE	Gruber Franz Xaver	27.94
CF1155	Yesterday	AAF	Lennon John Winston/MC Cartney Paul James	66.21
CF1155	My favorite things	AAG	Rodgers Richard	48.49
CF1155	You are my sunshine	AAH	Davis Jimmie H/Mitchell Charles	22.07
CF1155	It's a small world	AAJ	Sherman Richard M/Sherman Robert B	22.07
CF1155	Jingle Bells	AAK	Pierpont James	33.62
CF1155	Over the rainbow	AAL	Arlen Harold	67.0
CF1155	Jingle Bells Mon Beau Sapin Rudolph the red nosed reindeer	AAS	Pierpont James – Marks John D	32.07
CF1155	White Christmas	AAT	Berlin Irving	55.25
CF1155	For Elisa	AAV	Beethoven Van Ludwig	28.27
CF1155	Hymn AL AMOUR	AAW	Monnot Margueritte Angele	36.21
CF1155	Where do I begin love story	ABA	Lai Francis Albert	43.46
CF1155	London Bridge Old Macdonald had a farm Twinkle Twinkle Little Star	ABB	– – –	25.04
CF1155	Wedding March	ABC	Mendelssohn Bartholdy felix J L	13.81
CF1155	Winnie the pooh	ABD	Sherman Richard M/Sherman Robert B	41.38

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