Ordering number : ENA1181

SANYO Semiconductors
DATA SHEET

LA74303FN — Monolithic Linear IC
Audio Interface for DSC

Overview

The LA74303FN is a SPEAKER AMP and MIC AMP built-in audio interface for DSC.

Functions

- Three-wire type SERIAL communication, MIC AMP
- MIC power supply incorporated (with buit-in pull-up resistor), ALC AMP
- PB input method: Compatible with analog or digital (ΔΣ) signal input
- 3rd order LPF(compatible with REC/PB changeover, fc=4kHz or 11kHz selectable)
- SPEAKER AMP (compatible with BEEP input MIX)
- Electronic VOLUME (compatible with SERIAL communication control)
- LINE output (with SERIAL MUTE), compatible with STANDBY control

Specifications

Maximum Ratings at Ta=25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage 1	V_{CC}A max		5.0	V
Maximum supply voltage 2	V_{CC}SP max		5.0	V
Allowable power dissipation	Pd max	Ta≤85°C *	500	mW
Operating temperature	Topr		-15 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

* Substrate mounting condition (30mm × 50mm × 0.8mm: glass epoxy) 2S2P

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Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}A$		3.0	V
	$V_{CC}SP$		3.3	V
Allowable operating voltage range	$V_{CC}A$		2.7 to 3.6	V
	$V_{CC}SP$	Take care not to exceed Pd max.	2.7 to 3.6	V

Electrical Characteristics at Ta=25°C, $V_{CC}A$=3.0V, $V_{CC}SP$=3.3V, f=1kHz, with the VREF capacitance charging circuit in the OFF MODE

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Circuit current						
$V_{CC}A$ current dissipation at no signal 1	$I_{CC}A1$	$V_{CC}A$=3.0V	7	9.4	11.8	mA
$V_{CC}A$ current dissipation at no signal 2	$I_{CC}A2$	$V_{CC}A$=3.0V: REC BLOCK (MIC/ALC/REC AMP) POWER SAVE MODE	5	6.7	8.4	mA
$V_{CC}A$ current dissipation at no signal 3	$I_{CC}A3$	$V_{CC}A$=3.0V: LINE AMP POWER SAVE MODE	6.5	8.7	10.9	mA
$V_{CC}A$ standby current dissipation	$I_{CC}AS$	$V_{CC}A$=3.0V: during standby control (4PIN=0V application)			1	μA
Current dissipation at no signal 5	$I_{CC}SP1$	$V_{CC}SP$=3.3V: SPK POWER ON MODE	1.2	2.5	5	mA
Current dissipation at no signal 6	$I_{CC}SP2$	$V_{CC}SP$=3.3V: SPK POWER SAVE MODE		0.05	0.1	mA
$V_{CC}SP$ standby current dissipation	$I_{CC}SPS$	$V_{CC}SP$=3.3V: during standby control (4PIN=0V application)		5.5	10	μA
REC output system						
REC reference output LEVEL	VOR	ALC IN, V_{IN}=-49dBV	-16.5	-15.5	-14.5	dBV
REC reference output distortion	HDR	ALC IN, V_{IN}=-49dBV, THD: from 2nd to 5th harmonic		0.05	0.1	%
ALC characteristics 1	ALM1	ALC IN, V_{IN}=-33dBV (standard+16dB)	-11	-8	-5	dBV
ALC distortion 1	ALMD1	ALC IN, V_{IN}=-33dBV (standard+16dB), THD: from 2nd to 5th harmonic		0.15	0.5	%
ALC characteristics 2	ALM2	ALC IN, V_{IN}=-17dBV (standard+32dB)	-11	-8	-5	dBV
ALC distortion 2	ALMD2	ALC IN, V_{IN}=-17dBV (standard+32dB), THD: from 2nd to 5th harmonic		0.2	1	%
ALC IN max input level	VINRMX	ALC IN LEVEL at which REC output THD (from 2nd to 5th harmonic) becomes 3% or less.			-10	dBV
REC output noise voltage	VNOR	ALC IN, no input, JIS-A Filter		-77	-68	dBV
REC output frequency characteristics 1	FEQR1	ALC IN, V_{IN}=-33dBV, comparison of f=4kHz/1kHz	-5	-3.5	-2	dB
REC output frequency characteristics 2	FEQR2	ALC IN, V_{IN}=-33dBV, comparison of f=22kHz/1kHz		-33	-25	dB
REC output frequency characteristics 3	FEQR3	ALC IN, V_{IN}=-33dBV, comparison of f=100kHz/1kHz		-60	-55	dB
LINE output system						
LINE reference output LEVEL	VOL	PB IN, V_{IN}=-15dBV	-12	-11	-10	dBV
LINE reference output distortion rate	HDL	PB IN, V_{IN}=-15dBV, THD: from 2nd to 5th harmonic		0.1	0.2	%
LINE reference output noise voltage	VNOL	PB IN, no input, JIS-A Filter		-85	-77	dBV
PB IN max input LEVEL	VINPMX	PB IN LEVEL at which LINE output THD (from 2nd to 5th harmonic) becomes 3% or less.			-5	dBV
LINE output frequency characteristics 1	FEQP1	PB IN, V_{IN}=-8dBV, comparison of f=4kHz/1kHz	-5	-3.5	-2	dB
LINE output frequency characteristics 2	FEQP2	PB IN, V_{IN}=-8dBV, comparison of f=22kHz/1kHz		-33	-25	dB
LINE output frequency characteristics 3	FEQP3	PB IN, V_{IN}=-8dBV, comparison of f=100kHz/1kHz		-65	-60	dB

Continued on next page.

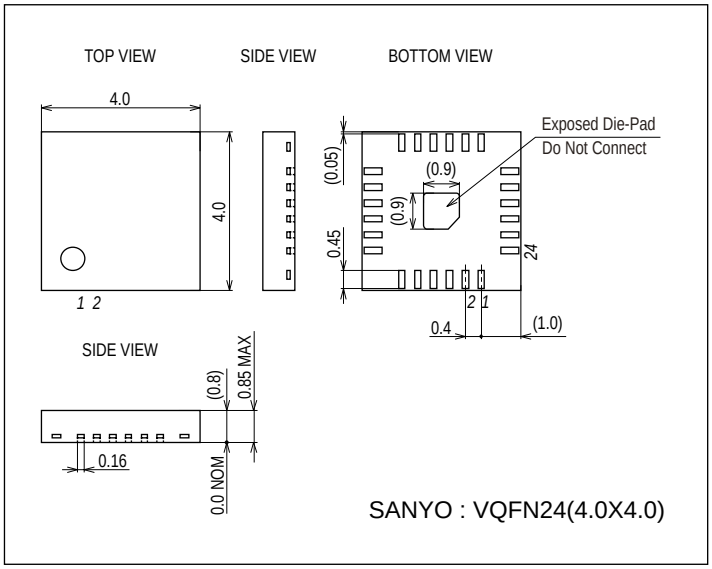
Continued from preceding page.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
SP output system (SP load = as measured at both ends of 8Ω)						
SP reference output LEVEL1 (Vol.MAX)	VOSP1	PB IN, V_{IN}=-15dBV, Vol=MAX (Serial DATA=31)	-5	-2	1	dBV
SP reference output distortion	THDSP	PB IN, V_{IN}=-15dBV, Vol=MAX, THD: from 2nd to 5th harmonic		0.4	1	%
SP reference output LEVEL2 (Vol.TYP)	VOSP2	PB IN, V_{IN}=-15dBV, Vol=TYP (Serial DATA=17)	-19	-13	-7	dBV
SP reference output LEVEL3 (Vol.MIN)	VOSP3	PB IN, V_{IN}=-15dBV, Vol=MIN (Serial DATA=0), JIS-A Filter		-80	-70	dBV
SP reference output noise voltage	VNOSP	PB IN, no input, Vol=MAX, JIS-A Filter		-76	-70	dBV
SP maximum ratings output	VOMSP	PB IN, Vol=MAX, LEVEL at which THD=10%	200	340		mW
MIC output system						
MIC voltage gain	VGMIC	MIC IN, V_{IN}=-39dBV	19	20	21	dB
MIC output distortion	HDMIC	MIC IN, V_{IN}=-39dBV, THD: from 2nd to 5th harmonic		0.02	0.1	%
MIC output noise voltage	VNOMIC	MIC IN, no input, JIS-A Filter		-94	-83	dBV
MIC IN max input level	VINMMX	MIC IN LEVEL at which the MIC output THD (from 2nd to 5th harmonic) becomes 3% or less.			-22	dBV
MIC V_{CC} output voltage	VMIC	At 6.2kΩ load	1.5	1.7	1.9	V
Control system						
Serial CLOCK frequency	FCLK			1.25	1.5	MHz
Serial input LOW level	SERLO		0		0.7	V
Serial input HIGH level	SERHI		2.3		3.5	V

Package Dimensions

unit : mm (typ)

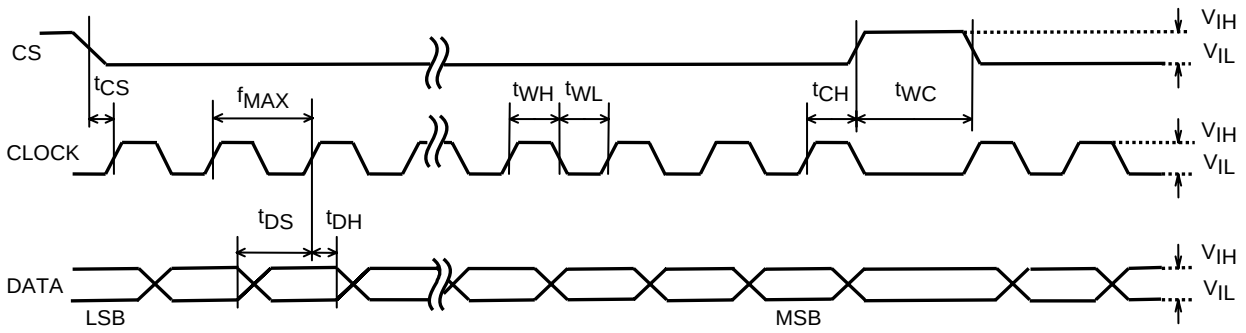
3364



Description of the Content of Serial Communication

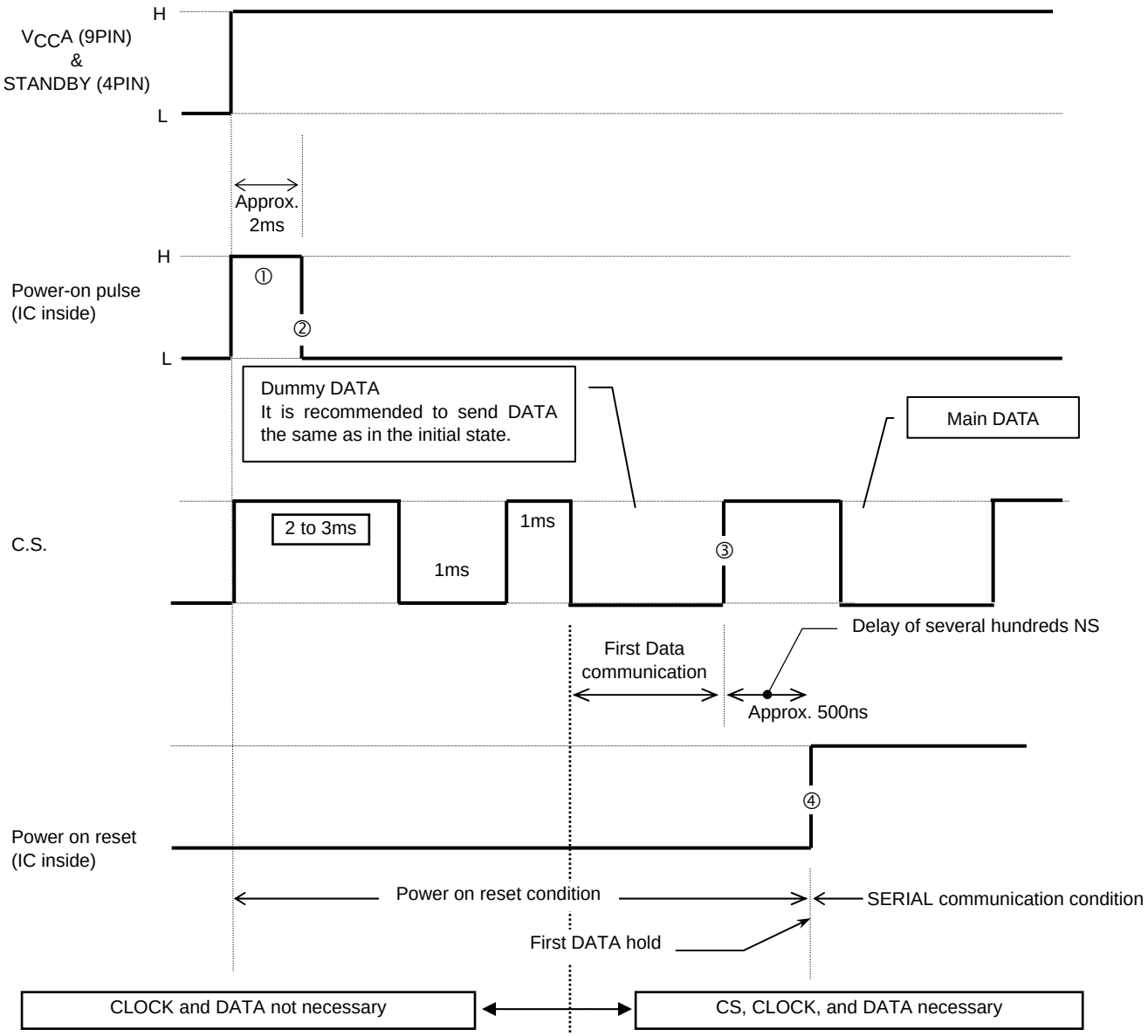
DATA No.	Parameter		Default
0	DUMMY		0
1	LPF Cut-off frequency SW	0:11kHz, 1:4kHz	1
2	VREF capacitor charging circuit control SW	0:ON, 1:OFF	0
3	MIC AMP POWER SW	0:ON, 1:OFF	0
4	ALC AMP POWER SW	0:ON, 1:OFF	0
5	LPF1 MODE SW	0:PB MODE1, 1:REC MODE	0
6	LPF1/LPF2 selection SW	0:LPF1, 1:LPF2	0
7	REC BLOCK POWER SW	0:ON, 1:OFF	0
8	LINE OUT POWER SW	0:ON, 1:OFF	1
9	LINE MUTE SW	0:ON, 1:OFF	0
10	SPK POWER SW	0:ON, 1:OFF	1
11	DATA=1	1 1 1 1 1: VOL MAX	0
12	DATA=2	to	0
13	DATA=4	0 0 0 0 0: VOL MIN (MUTE)	0
14	DATA=8	* EVR setting (the numeral shown in the left is decimal.	0
15	DATA=16	For characteristics, see P18.)	0

Serial Transmission Timing



- f_{MAX} (Max clock frequency) 1.5MHz
- t_{WL} (Clock pulse width: Low) 333ns or more
- t_{WH} (Clock pulse width: High) 333ns or more
- t_{CS} (Chip enable setup time) 333ns or more
- t_{CH} (Chip enable hold time) 333ns or more
- t_{DS} (Data setup time) 333ns or more
- t_{DH} (Data hold time) 333ns or more
- t_{WC} (Chip enable pulse width) 333ns or more
- V_{IH} (High voltage lower limit) 2.3V to 3.5V
- V_{IL} (Low voltage upper limit) 0V to 0.7V

POWER ON Condition (SERIAL communication)



The POWER ON RESET state covers a period up to the rise ③ of the second C.S. input after fall ② of POWER ON PULSE ① generated inside IC when the power is applied and the STANDBY control is canceled. ③ is the dummy communication. (It is recommended to send DATA the same as in the initial state.)
Actually, because of delay of several hundreds ns in the IC, the first DATA condition begins in ④ and the normal SERIAL communication condition begins after ④.

Method of Measuring Electric Characteristics at Ta=25°C, $V_{CC}A$=3.0V, $V_{CC}SP$=3.3V, f=1kHz VREF capacitor charging circuit OFF MODE

No.	Symbol	Input		Output		STANDBY pin	Serial control setting														
		Pin	Conditions	Pin	Major conditions (for the serial control setting, see the table in the right)	Voltage applied to pin 4	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
							DMY	LPF C SW	CHRG P SW	MIC P SW	ALC P SW	LPF MODESW (1,*):REC	(0,0):PB Analog	REC P SW	LINE P SW	LINE Mute	SPK P SW	EVR1 DATA	EVR2 DATA	EVR4 DATA	EVR8 DATA	EVR16 DATA
							* *	0:11kHz 1:4kHz	0:ON 1:OFF	0:ON 1:OFF	0:ON 1:OFF	(0,1):PB Digital		0:ON 1:OFF	0:ON 1:OFF	0:ON 1:OFF	0:ON 1:OFF	0:OFF 1:ON	0:OFF 1:ON	0:OFF 1:ON	0:OFF 1:ON	0:OFF 1:ON
Circuit current																					
1	I_{CCA1}	9	$V_{CC}A$=3.0V No input	9	VREF capacitance charging circuit in the OFF MODE	3.3V	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0
2	I_{CCA2}	9	$V_{CC}A$=3.0V No input	9	VREF capacitance charging circuit in the OFF MODE MIC/ALC/REC AMP POWER SAVE MODE	3.3V	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
3	I_{CCA3}	9	$V_{CC}A$=3.0V No input	9	VREF capacitance charging circuit in the OFF MODE LINE AMP POWER SAVE MODE	3.3V	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0
4	I_{CCAS}	9	$V_{CC}A$=3.0V No input	9	With the STANDBY pin (4PIN)=0V	0V	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
5	I_{CCS1}	22	$V_{CC}SP$=3.3V No input	22	VREF capacitance charging circuit in the OFF MODE SPK AMP ON MODE	3.3V	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
6	I_{CCS2}	22	$V_{CC}SP$=3.3V No input	22	VREF capacitance charging circuit in the OFF MODE SPK AMP POWER SAVE MODE	3.3V	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0
7	I_{CCSPS}	22	$V_{CC}SP$=3.3V No input	22	With the STANDBY pin (4PIN)=0V	0V	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
REC output system																						
8	VOR	14	V_{IN}=-49dBV f=1kHz	12	400 to 20kHz LPF used	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
9	HDR1	14	V_{IN}=-49dBV f=1kHz	12	400 to 20kHz LPF used THD: from 2nd to 5th harmonic	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
10	ALM1	14	V_{IN}=-33dBV f=1kHz	12	400 to 20kHz LPF used	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
11	ALMD1	14	V_{IN}=-33dBV f=1kHz	12	400 to 20kHz LPF used THD: from 2nd to 5th harmonic	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
12	ALM2	14	V_{IN}=-17dBV f=1kHz	12	400 to 20kHz LPF used	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
13	ALMD2	14	V_{IN}=-17dBV f=1kHz	12	400 to 20kHz LPF used THD: from 2nd to 5th harmonic	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
14	VINRMX	14	f=1kHz	12&14	400 to 20kHz LPF used Pin 14 level at which pin 14 becomes THD = 3% (from 2nd to 5th harmonic)	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
15	VNOR	14	No input	12	JIS-A FILTER used	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
16	FEQR1	14	V_{IN}=-33dBV f=4kHz	12	f=4kHz/1kHz level ratio	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
17	FEQR2	14	V_{IN}=-33dBV f=22kHz	12	f=22kHz/1kHz level ratio	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
18	FEQR3	14	V_{IN}=-33dBV f=100kHz	12	f=100kHz/1kHz level ratio	3.3V	0	1	1	0	0	1	0	0	1	0	1	0	0	0	0	0

No.	Symbol	Input		Output		STANDBY pin	Serial control setting														
		Pin	Conditions	Pin	Major conditions (for the serial control setting, see the table in the right)	Voltage applied to pin 4	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
							DMY	LPF C SW	CHRG P SW	MIC P SW	ALC P SW	LPF MODESW (1,*):REC		REC P SW	LINE P SW	LINE Mute	SPK P SW	EVR1 DATA	EVR2 DATA	EVR4 DATA	EVR8 DATA	EVR16 DATA
							* *	0:11kHz 1:4kHz	0:ON 1:OFF	0:ON 1:OFF	0:ON 1:OFF	(0,0):PB Analog (0,1):PB Digital		0:ON 1:OFF	0:ON 1:OFF	0:ON 1:OFF	0:ON 1:OFF	0:OFF 1:ON	0:OFF 1:ON	0:OFF 1:ON	0:OFF 1:ON	0:OFF 1:ON
LINE output system																					
19	VOL1	10	V_{IN}=-15dBV f=1kHz	5	400 to 20kHz LPF used	3.3V	0	1	1	1	1	0	0	1	0	1	1	0	0	0	0	0
20	HDL	10	V_{IN}=-15dBV f=1kHz	5	400 to 20kHz LPF used THD: from 2nd to 5th harmonic	3.3V	0	1	1	1	1	0	0	1	0	1	1	0	0	0	0	0
21	VNOL	10	No input	5	JIS-A FILTER used	3.3V	0	1	1	1	1	0	0	1	0	1	1	0	0	0	0	0
22	VINPMX	10	f=1kHz	5	400 to 20kHz LPF used Pin 10 level at which pin 5 becomes THD = 3% (from 2nd to 5th harmonic)	3.3V	0	1	1	1	1	0	0	1	0	1	1	0	0	0	0	0
23	FEQP1	10	V_{IN}=-8dBV f=4kHz	5	f=4kHz/1kHz level ratio	3.3V	0	1	1	1	1	0	0	1	0	1	1	0	0	0	0	0
24	FEQP2	10	V_{IN}=-8dBV f=22kHz	5	f=22kHz/1kHz level ratio	3.3V	0	1	1	1	1	0	0	1	0	1	1	0	0	0	0	0
25	FEQP3	10	V_{IN}=-8dBV f=100kHz	5	f=100kHz/1kHz level ratio	3.3V	0	1	1	1	1	0	0	1	0	1	1	0	0	0	0	0
SPK output system (both ends of SPK: measured with 8Ω)																					
26	VOSP1	10	V_{IN}=-15dBV f=1kHz	21 23	400 to 20kHz LPF used Vol.=MAX	3.3V	0	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1
27	THDSP	10	V_{IN}=-15dBV f=1kHz	21 23	400 to 20kHz LPF used Vol.=MAX, THD: from 2nd to 5th harmonic	3.3V	0	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1
28	VOSP2	10	V_{IN}=-15dBV f=1kHz	21 23	400 to 20kHz LPF used Vol.=TYP	3.3V	0	1	1	1	1	0	0	1	1	0	0	1	0	0	0	1
29	VOSP3	10	V_{IN}=-15dBV f=1kHz	21 23	JIS-A FILTER used Vol.=MIN	3.3V	0	1	1	1	1	0	0	1	1	0	0	0	0	0	0	0
30	VNOSP	10	No input	21 23	JIS-A FILTER used Vol.=MAX	3.3V	0	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1
31	VOSSP	10	f=1kHz	21 23	400 to 20kHz LPF used Level at which Vol=MAX and THD=10% (from 2nd to 5th harmonic)	3.3V	0	1	1	1	1	0	0	1	1	0	0	1	1	1	1	1
MIC output system																					
32	VGMIC	17	V_{IN}=-39dBV f=1kHz	15	400 to 20kHz LPF used	3.3V	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0
33	HDMIC	17	V_{IN}=-39dBV f=1kHz	15	400 to 20kHz LPF used THD: from 2nd to 5th harmonic	3.3V	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0
34	VNOMIC	17	No input	15	JIS-A FILTER used	3.3V	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0
35	VINMMX	17	f=1kHz	15	400 to 20kHz LPF used Pin 17 level at which pin 15 becomes THD = 3% (from 2nd to 5th harmonic)	3.3V	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0
36	VMIC	17	No input	18	PIN 18: Measurement of output voltage (under 6.2kΩ load)	3.3V	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0

Description of Pin Functions

Pin No.	Pin Description
1	Speaker input
2	MIX output
3	BEEP input
4	STANDBY control
5	LINE output
6	C.S. input
7	CLOCK input
8	DATA input
9	$V_{CC}A$
10	PB input
11	A GND
12	REC output
13	ALC detection
14	ALC input
15	MIC output
16	MIC GND
17	MIC input
18	INT power supply for MIC
19	Ripple rejection for VREFL
20	SPK GND
21	Speaker positive-phase output
22	$V_{CC}SP$
23	Speaker negative-phase output
24	SPK GND

LA74303FN Internal Equivalent Diagram and Recommended Circuit Diagram

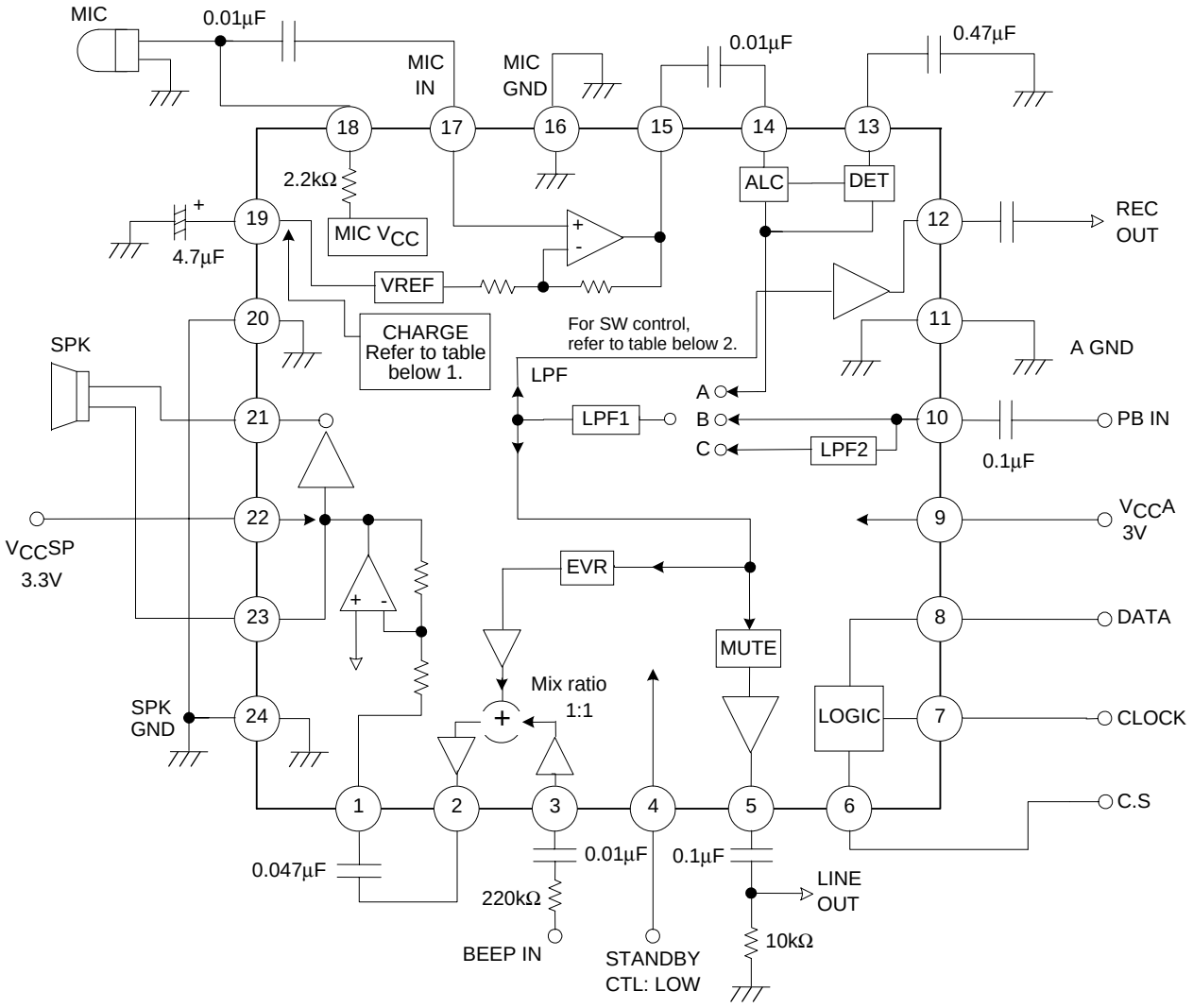


Table 1: Logic of external capacitor charging circuit

SERIAL	No.2
ON	0
OFF	1

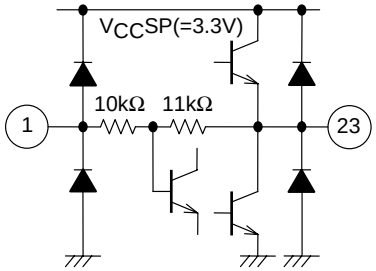
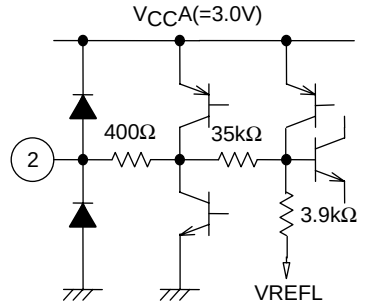
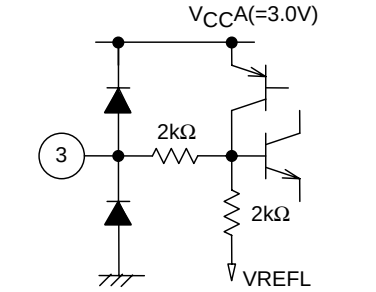
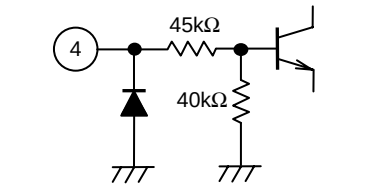
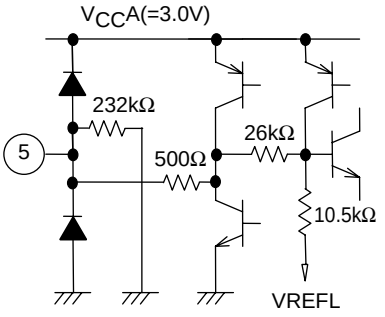
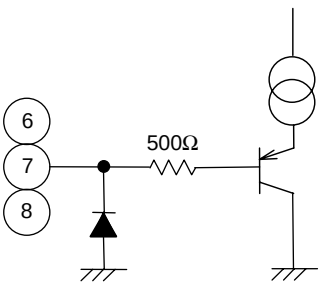
Initially “ON”

Table 2: LPF SW control logic

SERIAL	No.5	No.6
A	1	*
B	0	0
C	0	1

*) Don’t care.

Table of Input/Output Forms of LA74303FN

Pin No.	Pin Name	DC voltage	AC voltage	Description of functions	Equivalent circuit diagram in pin
1	SP IN	1.27V	At PB reference input Output level = -8dBV (EVR MAX)	Speaker input pin	
23	SPK OUT-	1.27V	At PB reference input Output level = -8dBV (EVR MAX)	Pin for output of speaker reversed phase	
2	MIX OUT	1.58V	At PB reference input Output level = -8dBV	EVR output pin	
3	BEEP IN	1.64V	Maximum input level = -8dBV		
4	STANDBY L			STANDBY control pin 2V or more: STANDBY canceled	
5	LINE OUT	1.52V	At PB reference input Output level = -11dBV	LINE output pin	
6	CS			CS input pin	
7	CLOCK			CLOCK input pin	
8	DATA			DATA input pin	

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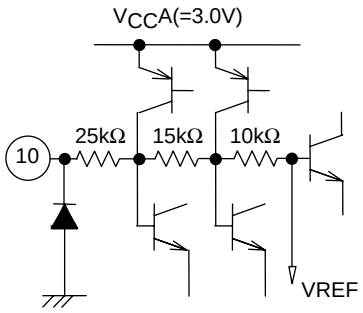
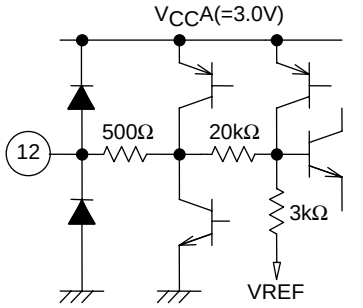
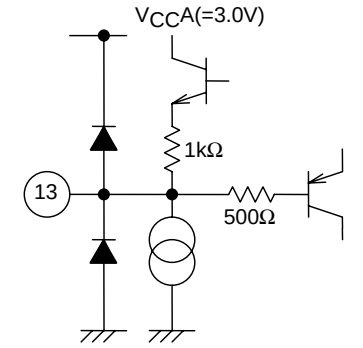
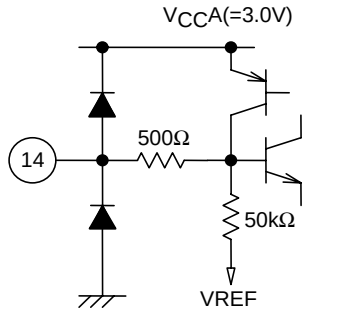
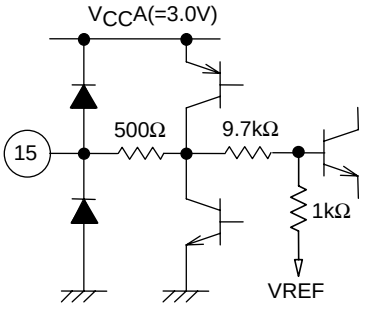
Pin No.	Pin Name	DC voltage	AC voltage	Description of functions	Equivalent circuit diagram in pin
9	$V_{CC}A$	3.0V		Power pin for analog signal part	
10	PB IN	1.64V	Reference input level =-15dBV Maximum input level = -5dBV In analog input mode = 3.465Vpp In ΔΣ input mode	PB input pin	
11	A GND	0V		GND pin for analog signal part	
12	REC OUT	1.50V	At PB reference input Output level = -15dBV	REC output pin	
13	ALC DET			ALC detection pin	
14	ALC IN	1.64V	At MIC reference input Output level = -49dBV Max input level =-10dBV	ALC input pin	
15	MIC OUT	1.6V	At MIC reference input Output level = -49dBV	MIC output pin	

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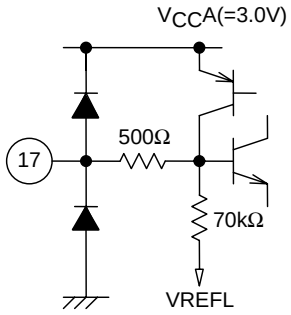
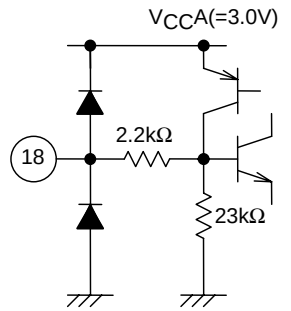
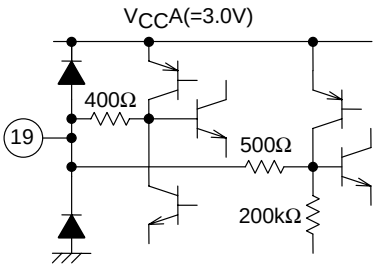
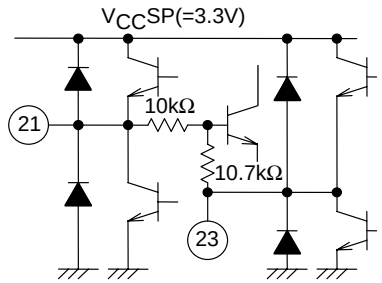
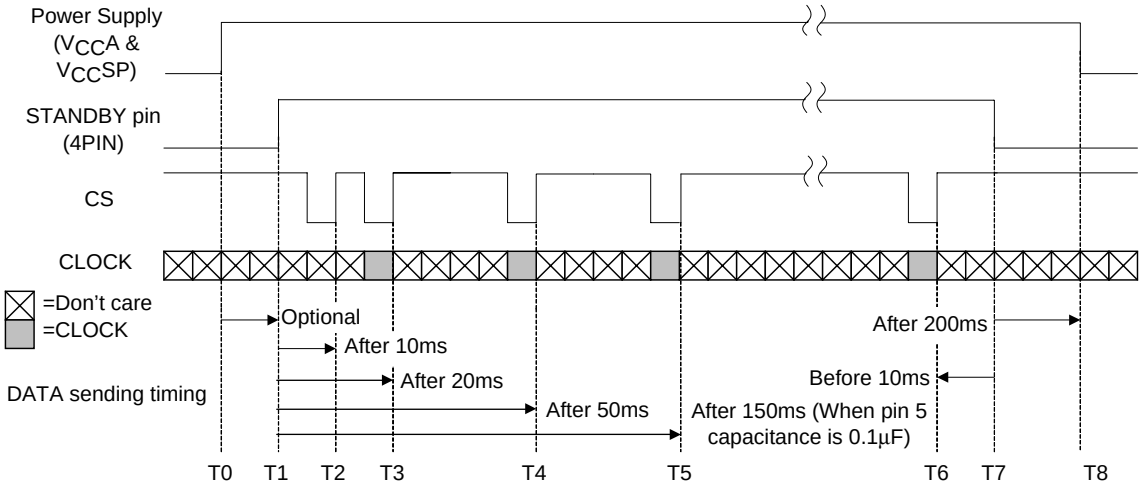
Pin No.	Pin Name	DC voltage	AC voltage	Description of functions	Equivalent circuit diagram in pin
16	MIC GND	0V		For MIC Amp blocking GND pin	
17	MIC IN	1.64V	Reference input level =-69dBV Maximum input level =-30dBV	MIC input pin	
18	MIC V_{CC}	2.30V		MIC power pin	
19	VREFL	2.30V		MIC V_{CC} and VREFL ripple rejection pin	
20 24	SP GND	0V		Speaker GND pin	
21	SPK OUT+	1.27V	At PB reference input Output level = -8dBV (EVR MAX)	Speaker positive-phase output pin	
22	V_{CC}SP	3.3V		Speaker power pin	

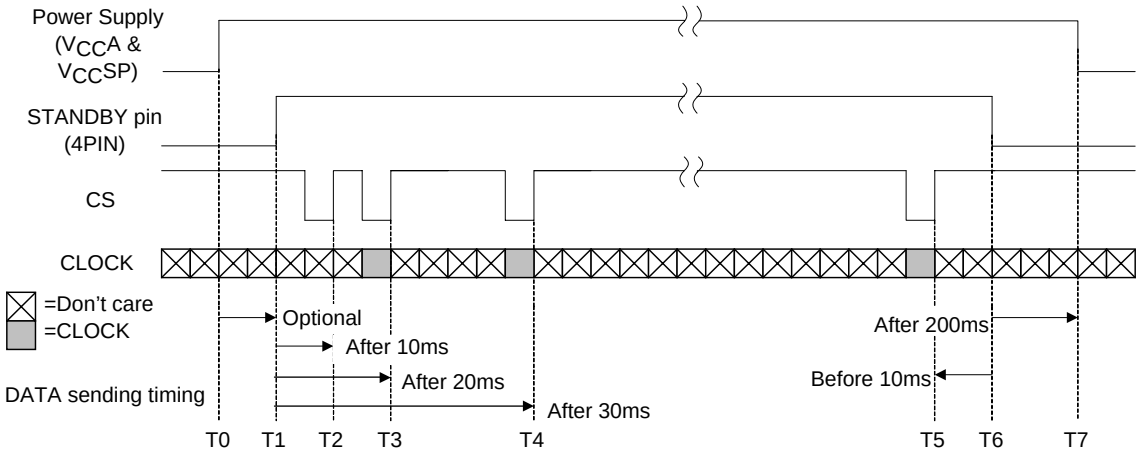
POP Sound Avoiding Sequence

①Upon STANDBY cancellation & control (PBMODE)

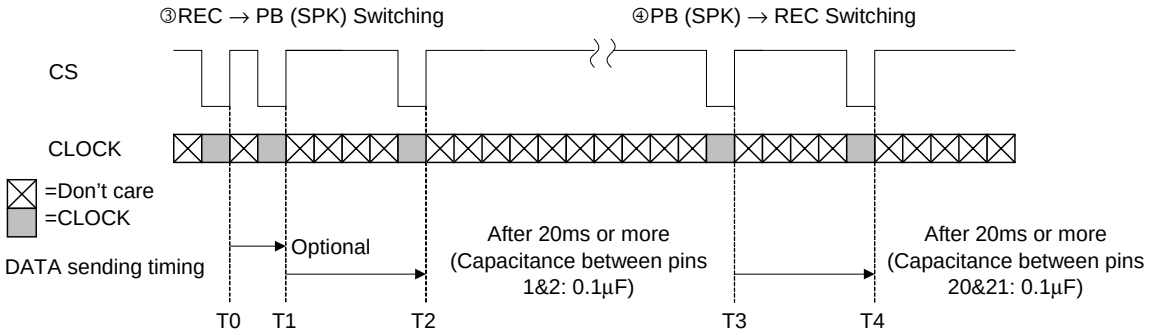


Timing	Communication content	Recommended serial control settings															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		DMY	LPF C SW	CHRG P SW	MIC P SW	ALC P SW	LPF MODESW (1, *): REC		REC P SW	LINE P SW	LINE MUTE	SPK P SW	EVR1 DATA	EVR2 DATA	EVR4 DATA	EVR8 DATA	EVR16 DATA
		*	0:11kHz	0:ON	0:ON	0:ON	(0, 0): PB Analog		0:ON	0:ON	0:ON	0:ON	0:OFF	0:OFF	0:OFF	0:OFF	0:OFF
		*	1:4kHz	1:OFF	1:OFF	1:OFF	(0, 1): PB Digital		1:OFF	1:OFF	1:OFF	1:OFF	1:ON	1:ON	1:ON	1:ON	1:ON
T1	Standby cancellation (3.3 V applied to pin 4)	DATA unnecessary															
T2	Dummy communication (only CS)																
T3	VREF charging circuit: OFF	0	0/1	1	1	1	0	0/1	1	1	0	1	0	0	0	0	0
T4	Speaker AMP: ON	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	0	0	0
T5	Line AMP: ON	0	0/1	1	1	1	0	0/1	1	0	1	0	0	0	0	0	0
T6	Return to the initial state	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0
T7	Standby control (0 V applied to pin 4)	DATA unnecessary															

②Upon STANDBY cancellation & control (RECMODE)

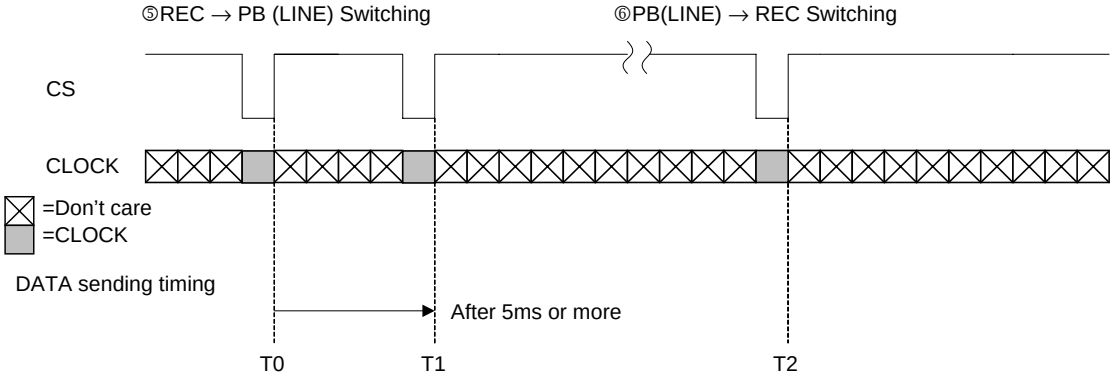


Timing	Communication content	Recommended serial control settings															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		DMY	LPF C SW	CHRG P SW	MIC P SW	ALC P SW	LPF MODESW (1, *): REC		REC P SW	LINE P SW	LINE MUTE	SPK P SW	EVR1 DATA	EVR2 DATA	EVR4 DATA	EVR8 DATA	EVR16 DATA
		*	0:11kHz	0:ON	0:ON	0:ON	(0, 0): PB Analog		0:ON	0:ON	0:ON	0:ON	0:OFF	0:OFF	0:OFF	0:OFF	0:OFF
		*	1:4kHz	1:OFF	1:OFF	1:OFF	(0, 1): PB Digital		1:OFF	1:OFF	1:OFF	1:OFF	1:ON	1:ON	1:ON	1:ON	1:ON
T1	Standby cancellation (3.3 V applied to pin 4)	DATA unnecessary															
T2	Dummy communication (only CS)																
T3	Charging circuit & ALC: OFF, LPF: REC	0	0/1	1	0	1	1	0	0	1	0	1	0	0	0	0	0
T4	ALC: ON	0	0/1	1	0	0	1	0	0	1	0	1	0	0	0	0	0
T5	Return to the initial state	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0
T6	Standby control (0 V applied to pin 4)	DATA unnecessary															



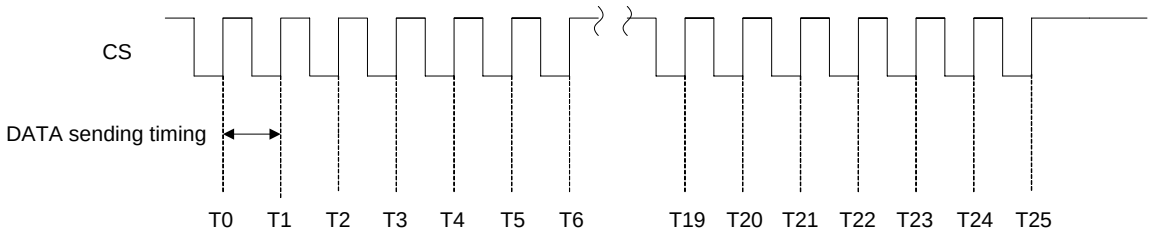
Timing	Communication content	Recommended serial control settings															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		DMY	LPF C SW	CHRG P SW	MIC P SW	ALC P SW	LPF MODESW (1, *): REC		REC P SW	LINE P SW	LINE MUTE	SPK P SW	EVR1 DATA	EVR2 DATA	EVR4 DATA	EVR8 DATA	EVR16 DATA
		*	0:11kHz	0:ON	0:ON	0:ON	(0, 0): PB Analog		0:ON	0:ON	0:ON	0:ON	0:OFF	0:OFF	0:OFF	0:OFF	0:OFF
		*	1:4kHz	1:OFF	1:OFF	1:OFF	(0, 1): PB Digital		1:OFF	1:OFF	1:OFF	1:OFF	1:ON	1:ON	1:ON	1:ON	1:ON
T0	Speaker AMP: OFF	0	0/1	1	0	0	1	0/1	0	1	0	1	0	0	0	0	0
T1	PBMODE: switching EVR: setting	0	0/1	1	1	1	0	0/1	1	1	0	1	a	a	a	a	a
T2	Speaker AMP: ON	0	0/1	1	1	1	0	0/1	1	1	0	0	a	a	a	a	a
T3	RECMODE: switching EVR: MUTE Speaker AMP: OFF	0	0/1	1	0	0	1	0/1	0	1	0	1	0	0	0	0	0
T4	Speaker AMP: ON	0	0/1	1	0	0	1	0/1	0	1	0	0	0	0	0	0	0

Note) a=EVR in user setting.



Timing	Communication content	Recommended serial control settings															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		DMY	LPF C SW	CHRG P SW	MIC P SW	ALC P SW	LPF MODESW (1, *): REC		REC P SW	LINE P SW	LINE MUTE	SPK P SW	EVR1 DATA	EVR2 DATA	EVR4 DATA	EVR8 DATA	EVR16 DATA
		*	0:11kHz	0:ON	0:ON	0:ON	(0, 0): PB Analog		0:ON	0:ON	0:ON	0:ON	0:OFF	0:OFF	0:OFF	0:OFF	0:OFF
		*	1:4kHz	1:OFF	1:OFF	1:OFF	(0, 1): PB Digital		1:OFF	1:OFF	1:OFF	1:OFF	1:ON	1:ON	1:ON	1:ON	1:ON
T0	PBMODE: switching	0	0/1	1	1	1	0	0/1	1	1	0	1	0	0	0	0	0
T1	Line AMP: ON Line MUTE: OFF	0	0/1	1	1	1	0	0/1	1	0	1	1	0	0	0	0	0
T2	RECMODE: switching Line AMP: ON Line MUTE: OFF	0	0/1	1	0	0	1	0/1	0	1	0	1	0	0	0	0	0

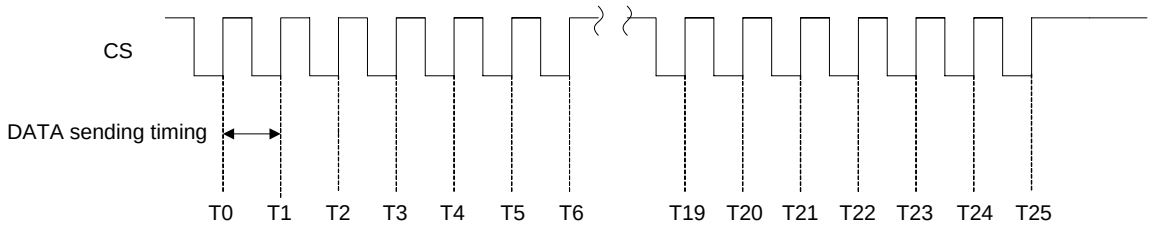
⑦EVR Switching (min → max) 0.25ms/CS



Timing	Communication content	Recommended serial control settings															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		DMY	LPF C SW	CHRG P SW	MIC P SW	ALC P SW	LPF MODESW (1, *): REC		REC P SW	LINE P SW	LINE MUTE	SPK P SW	EVR1 DATA	EVR2 DATA	EVR4 DATA	EVR8 DATA	EVR16 DATA
		*	0:11kHz	0:ON	0:ON	0:ON	(0, 0): PB Analog		0:ON	0:ON	0:ON	0:ON	0:OFF	0:OFF	0:OFF	0:OFF	0:OFF
		*	1:4kHz	1:OFF	1:OFF	1:OFF	(0, 1): PB Digital		1:OFF	1:OFF	1:OFF	1:OFF	1:ON	1:ON	1:ON	1:ON	1:ON
T0	EVRDATA=0	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	0	0	0
T1	EVRDATA=7	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	1	0	0
T2	EVRDATA=8	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	0	1	0
T3	EVRDATA=9	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	0	1	0
T4	EVRDATA=10	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	0	1	0
T5	EVRDATA=11	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	0	1	0
T6	EVRDATA=12	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	1	1	0
T7	EVRDATA=13	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	1	1	0
T8	EVRDATA=14	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	1	1	0
T9	EVRDATA=15	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	1	1	0
T10	EVRDATA=16	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	0	0	1
T11	EVRDATA=17	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	0	0	1
T12	EVRDATA=18	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	0	0	1
T13	EVRDATA=19	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	0	0	1
T14	EVRDATA=20	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	1	0	1
T15	EVRDATA=21	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	1	0	1
T16	EVRDATA=22	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	1	0	1
T17	EVRDATA=23	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	1	0	1
T18	EVRDATA=24	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	0	1	1
T19	EVRDATA=25	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	0	1	1
T20	EVRDATA=26	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	0	1	1
T21	EVRDATA=27	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	0	1	1
T22	EVRDATA=28	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	1	1	1
T23	EVRDATA=29	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	1	1	1
T24	EVRDATA=30	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	1	1	1
T25	EVRDATA=31	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	1	1	1

Note) DATA1 to 6 are the mute area of EVR characteristics and jumped due to no generation of POP noise.

⑧EVR Switching (max → min) 0.25ms/CS



Timing	Communication content	Recommended serial control settings															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		DMY	LPF C SW	CHRG P SW	MIC P SW	ALC P SW	LPF MODESW (1, *): REC		REC P SW	LINE P SW	LINE MUTE	SPK P SW	EVR1 DATA	EVR2 DATA	EVR4 DATA	EVR8 DATA	EVR16 DATA
		*	0:11kHz	0:ON	0:ON	0:ON	(0, 0): PB Analog		0:ON	0:ON	0:ON	0:ON	0:OFF	0:OFF	0:OFF	0:OFF	0:OFF
		*	1:4kHz	1:OFF	1:OFF	1:OFF	(0, 1): PB Digital		1:OFF	1:OFF	1:OFF	1:OFF	1:ON	1:ON	1:ON	1:ON	1:ON
T0	EVRDATA=31	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	1	1	1
T1	EVRDATA=30	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	1	1	1
T2	EVRDATA=29	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	1	1	1
T3	EVRDATA=28	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	1	1	1
T4	EVRDATA=27	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	0	1	1
T5	EVRDATA=26	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	0	1	1
T6	EVRDATA=25	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	0	1	1
T7	EVRDATA=24	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	0	1	1
T8	EVRDATA=23	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	1	0	1
T9	EVRDATA=22	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	1	0	1
T10	EVRDATA=21	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	1	0	1
T11	EVRDATA=20	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	1	0	1
T12	EVRDATA=19	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	0	0	1
T13	EVRDATA=18	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	0	0	1
T14	EVRDATA=17	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	0	0	1
T15	EVRDATA=16	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	0	0	1
T16	EVRDATA=15	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	1	1	0
T17	EVRDATA=14	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	1	1	0
T18	EVRDATA=13	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	1	1	0
T19	EVRDATA=12	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	1	1	0
T20	EVRDATA=11	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	0	1	0
T21	EVRDATA=10	0	0/1	1	1	1	0	0/1	1	1	0	0	0	1	0	1	0
T22	EVRDATA=9	0	0/1	1	1	1	0	0/1	1	1	0	0	1	0	0	1	0
T23	EVRDATA=8	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	0	1	0
T24	EVRDATA=7	0	0/1	1	1	1	0	0/1	1	1	0	0	1	1	1	0	0
T25	EVRDATA=0	0	0/1	1	1	1	0	0/1	1	1	0	0	0	0	0	0	0

Note) DATA1 to 6 are the mute area of EVR characteristics and jumped due to no generation of POP noise.