



SANYO Semiconductors

# DATA SHEET

## LA73024AV — Monolithic Linear IC Double Scart Interface IC

### Overview

This LA73024AV is a double scart interface IC.

### Functions

- AV switches,
- Changeable Gain AMP
- 6dB AMP+driver
- FSS output

### Specifications

Maximum Ratings at  $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CCV}$ max	24, 29 pin	6.0	V
	$V_{CCA}$ max	14 pin	13.0	V
Allowable power dissipation	$P_d$ max	$T_a \leq 80^\circ\text{C}^*$	760	mW
Operating temperature	$T_{opr}$		-20 to +80	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

\* When mounted on a  $114.3 \times 76.1 \times 1.6\text{mm}^3$  glass epoxy board.

Operating Conditions at  $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Recommending operation voltage	$V_{CCV}$	pins 24 and 29	5.0	V
	$V_{CCA}$	pin 14	12.0	V
Operating voltage range	$V_{CCV}$ op	pins 24 and 29	4.5 to 5.5	V
	$V_{CCA}$ op	pin 14	11.5 to 12.5	V

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**Electrical Characteristics** at Ta = 25°C, VCC = ±5.0V, VCCA = 12.0V

Parameter	Symbol	Conditions	Ratings			Unit	
			min	typ	max		
Current dissipation 1	ICCV1	Pin 24 Flow in current when non-signal	16.0	24.0	32.0	mA	
Current dissipation 2	ICCV2	Pin 29 Flow in current when non-signal	12.0	18.0	24.0	mA	
Current dissipation 3	ICCA	Pin 14 Flow in current when non-signal	17.0	25.0	33.0	mA	
FSS output H voltage	VHFSS	Serial control select FSS OUT H	VCCA-1.0	VCCA-0.5	VCCA	V	
FSS output M voltage	VMFSS	Serial control select FSS OUT M	5.0	6.0	7.0	V	
FSS output L voltage	VL FSS	Serial control select FSS OUT L	0	0.1	0.5	V	
FSS output cut off current	ICUTOFF	Flow out current when Pin 20 connecting to GND.	M	2.0	3.61	10.0	mA
			H	2.0	3.78	10.0	mA
External control terminal H voltage	VEXTH	RL = 1.8kΩ, VCC3 < 13V	VCC3-0.2	VCC3		V	
External control terminal L voltage	VEXTL	RL = 1.8kΩ, VCC3 = 5V	0	0.7	1.0	V	
		RL = 10kΩ, VCC3 = 5V	0	0.15	1.0	V	
External control terminal drive current	IDR	RL = 1.8kΩ, VCC3 = 5V	2.2	2.4	2.78	mA	
		RL = 10kΩ, VCC3 = 5V	400	485	500	μA	
External mute control H	VMUTECLH	External mute H, control voltage of Pin 9.	4.0		VCCV	V	
External mute control L	VMUTECLL	External mute L, control voltage of Pin 9.	0		1.0	V	
<b>Video switches part</b>							
Voltage gain V1	VG1V	Pins 25 and 26 output, 100% white	5.6	6.1	6.6	dB	
Voltage gain V2	VG2V	Pin 5 output G2 D6-L, 100% white	-0.4	0.1	0.6	dB	
Voltage gain V3	VG3V	Pin 5 output G2 D6-H, 100% white	5.6	6.1	6.6	dB	
Frequency characteristics	VF	f = 100kHz/7MHz	-0.5	-0.0	0.5	dB	
DG differential gain	DG	VIN = 1Vp-p	-1.0	0.0	1.0	%	
DP differential phase	DP	VIN = 1Vp-p	-1.5	0.0	1.5	deg	
Output voltage	VOOUT	Pins 25 and 26 DC voltage when non-signal.		1.15	2.0	V	
<b>Audio switches part</b>							
Voltage gain 1A	VG1A	Serial control select 0dB.	-0.3	0.2	0.7	dB	
Voltage gain 2A	VG2A	Serial control select 2dB.	1.7	2.2	2.7	dB	
Voltage gain 3A	VG3A	Serial control select 4dB.	2.7	4.2	4.7	dB	
Voltage gain 4A	VG4A	Serial control select 6dB.	5.7	6.2	6.7	dB	
Voltage gain 5A	VG5A	Serial control select 6dB.	11.7	12.2	12.7	dB	
Maximum output level	VOMAX	Output level at the time of f = 1kHz, THD = 2%	2	3.0		Vrms	
Total harmonic distortion	THD	VIN = 1Vrms, f = 1kHz, AMP 0dB		0.06	0.20	%	
Output noise voltage	VONOISE	Rg = 1kΩ, JIS-A FILTER		-100	-90	dBm	
Cross talk between channel	VCTKA	VIN = 1Vrms, f = 1kHz		-90	-75	dB	
Mute attenuation	VMUTEA	VIN = 1Vrms, f = 1kHz		-90	-75	dB	
Input impedance	ZIN		40	50	60	kΩ	
Output off set voltage	VOFSET	Off set voltage at the time of changeover SW.	-20	0	20	mV	

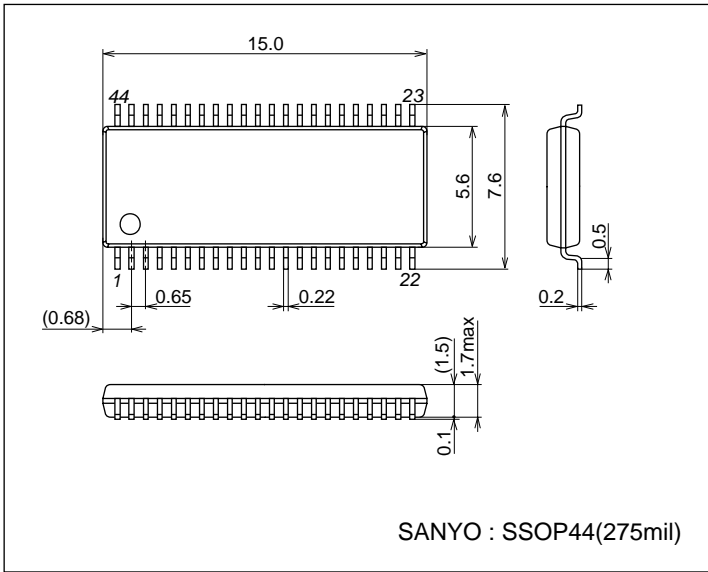
## Design guarantee Items

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Mute attenuation	VMUTEV	VIN = 1Vp-p, f = 4.43MHz		-60	-50	dB
Cross-talk between channel	VCTKV	VIN = 1Vp-p, f = 4.43MHz Driver output terminated with 75Ω.		-60	-50	dB

Package Dimensions

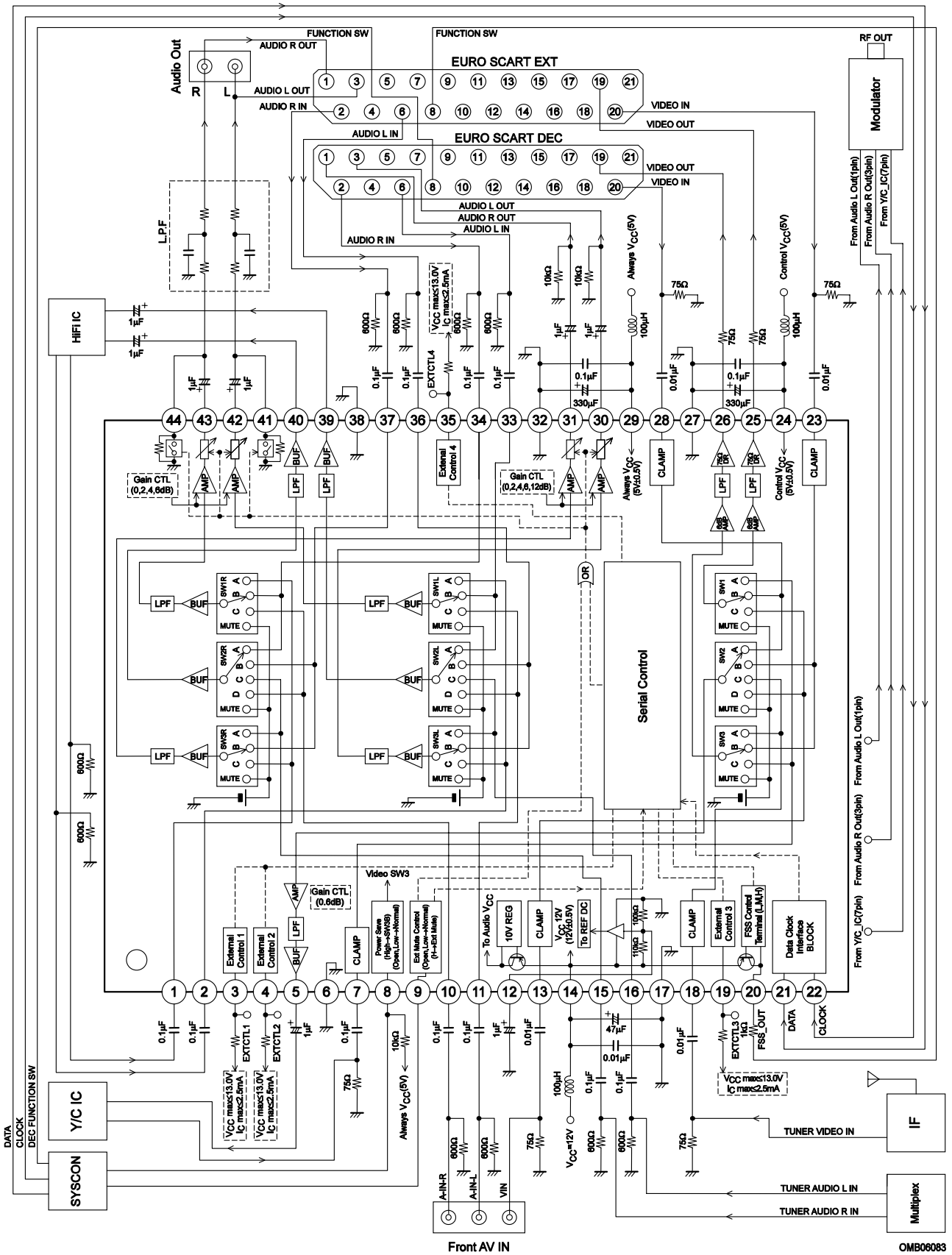
unit : mm

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## Block Diagram and Sample Application Circuit



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## Pin Functions

Pin No.	Pin name	Function	DC voltage	Equivalent circuit
1 2 10 11 15 16 33 34 36 37	A <sub>IN</sub> 1R A <sub>IN</sub> 1L A <sub>IN</sub> 2R A <sub>IN</sub> 2L A <sub>IN</sub> 3R A <sub>IN</sub> 3L A <sub>IN</sub> 4L A <sub>IN</sub> 4R A <sub>IN</sub> 5L A <sub>IN</sub> 5R	Audio input terminal.	5.58V	
3 4 19 35	EXTCTL1 EXTCTL2 EXTCTL3 EXTCTL4	General purpose output. Open collector.	2.5mA, ON → 0.75V  OFF → OPEN	
5	V <sub>OUT</sub>	Video output terminal. Push-pull output Low-impedance.	1.10V	<div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;"> <p><b>Output Pin DC Signal wave form (AmpGain 0dB)</b></p> </div> <div style="text-align: center;"> <p><b>Output Pin DC Signal wave form (AmpGain 6dB)</b></p> </div> </div>
6 17 27 32 38	GND GND GND GND GND	(EXT-75Ω Driver) (DEC-75Ω Deiver)	0V	

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Pin No.	Pin name	Function	DC voltage	Equivalent circuit
7 13 18 23 28	$V_{IN1}$ $V_{IN2}$ $V_{IN3}$ $V_{IN4}$ $V_{IN5}$	Video input terminal. Sync-tip clamp input Hi-impedance.	1.8V	
		<p><b>Input Signal wave form</b></p> <p>1.0Vp-p</p>		<p><b>Input Pin DC Signal wave form</b></p> <p>3.8V 2.0Vp-p 1.8V</p>
8	PWRSAV	Power save mode select pin. OPEN: L	0.2V	
9	AUMUTE	Control terminal for audio mute. OPEN: LOW	0.05V	
12	REFFIL	Terminal for Ref_DC ripple removing.	4.94V	
14	$V_{CC12}$	$V_{CC}$ for audio.		

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Pin No.	Pin name	Function	DC voltage	Equivalent circuit
20	FSSOUT	FSS control terminal. Output H, M, L 3 values with serial control.	H: $V_{CC}-0.5V$  M: 6V  L: 0V	
21	DATA	Serial data input terminal. Conformed to I <sup>2</sup> C BUS.		
22	CLOCK	Serial clock input terminal. Conformed to I <sup>2</sup> C BUS.		
24	$V_{CC5A}$	Control $V_{CC}$ for Video. Power save → open		
25 26	$V_{OUT75A}$ $V_{OUT75B}$	Video driver output terminal. Push-pull output Low-impedance.	1.10V	
				<p style="text-align: center;"><b>Output Pin DC Signal wave form</b></p>
29	$V_{CC5B}$	Always $V_{CC}$ for Video.		

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Pin No.	Pin name	Function	DC voltage	Equivalent circuit
30 31 42 43	AOUT2L AOUT2R AOUT3L AOUT3R	Audio output terminal Push-pull output Low-Impedance	4.91V	
39 40	AOUT1L AOUT1R	Audio output terminal Push-pull output Low-Impedance	4.91V	
41 44	PWRMUTE1 PWRMUTE2	Output terminal of audio muting	0V	

## Power Save

LA73024AV has two supplies 5V for Video part and 12V for audio part and FSS output. LA73024AV separates perfectly 5V system from 12V system, so it can be individually movement. For example when in the stand-by mode, if you open 14 pins but 5V supplies 24 and 29 pins, Video part and serial control part work normally. In this case audio part and FSS output don't work normally. And when you pull up 8pin and open 24 pin, IC chooses automatically video sw3-B. Consequently Ext input and Decoder output only move, you can save more power dissipation.

## Audio Mute

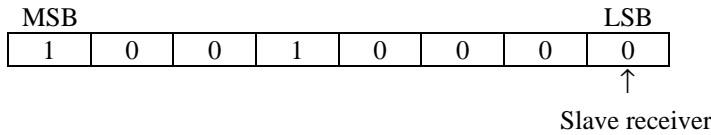
LA73024AV builds in two mute transistors for reduce audio pop-noise when occur at power on and off. You can control both on serial control and on external parallel control for audio mute.



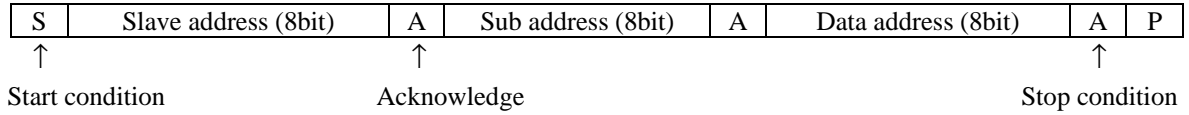
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## Serial Control Specification

### Slave address



### Data format



### Sub address and data byte table

Sub address Hexadecimal	Data byte (Underline is initial setting.)							
	D8	D7	D6	D5	D4	D3	D2	D1
01 (0000 0001)	SW1 00: C <u>01: B</u> 10: A 11: A		SW2 00: D 01: C 10: B <u>11: A</u>		SW3 00: C <u>01: B</u> 10: A 11: *		FSSOUT 00: HIGH 01: HIGH 10: MID 11: LOW	
02 (0000 0010)	EXT CTL1 <u>0: L</u> 1: H	EXT CTL2 <u>0: L</u> 1: H	AMP GAIN VPS OUT <u>0: 0dB</u> 1: 6dB	AUDIO AMP GAIN1 (DEC OUT) 000: 0dB <u>001: 2dB</u> 010: 4dB 011: 6dB 100: 12dB		AUDIO AMP GAIN2 (EXT OUT) 00: 0dB <u>01: 2dB</u> 10: 4dB 11: 6dB		
03 (0000 0011)	MUTE1 VSW1 OUT <u>0: through</u> 1: MUTE	MUTE2 VSW2 OUT <u>0: through</u> 1: MUTE	MUTE3 VSW3 OUT <u>0: through</u> 1: MUTE	MUTE4 ASW1 OUT <u>0: through</u> 1: MUTE	MUTE5 ASW2 OUT <u>0: through</u> 1: MUTE	MUTE6 ASW3 OUT <u>0: through</u> 1: MUTE	EXT CTL3 <u>0: L</u> 1: H	EXT CTL4 <u>0: L</u> 1: H

### Data transfer

I<sup>2</sup>C-BUS control system is adopted in SW IC and SW IC is controlled by SCL (Serial Clock) and SDA (Serial Data) At first, please set up the START condition<sup>\*1</sup> by these two terminals (SCL and SDA). And next, please input the 8bits data which should be synchronized with SCL into SDA terminal. Still more, please give priority to high rank bit at data transfer order (MSB → LSB). The 9th bit is called as ACK (Acknowledge), SW IC sends [0] to the SDA terminal during SCL [1] period. So, please open the port of micro-processor during this period. LA73024AV adopt auto-increment, so you input only first sub-address data (called as Group) and you can transfer data in order. As thus the Data transfer Stop condition<sup>\*2</sup> is finished.

<sup>\*1</sup> SDA rise up during SCI is [1]

<sup>\*2</sup> SDA fall down during SCL is [1]

## Transfer data format

The transfer data is composed by START condition, Slave address data<sup>\*3</sup>, and STOP condition.

After setting up the START condition, please transfer the Slave Address (regulated as “1001000” in SW IC). Group and next control data (Please see the Fig. 1)

Slave Address is composed by 7bits, and this bit 8th bit<sup>\*4</sup> should be set as [0].

But SW IC is not equipped with such a data out function, please keep this bit as [0].

The both of Group data and control data are composed by 8bits, and the one control action is defined with combination of these two data. And if you want to control 2 or more groups at the same mode, you can realize it by sending some control data together.

The data makes meaning with all bits, so you cannot stop the sending until all data transfer is over. But LA73024AV adopt auto-increment, for example you can stop to transfer STOP condition after group 2 data . If you want to stop transfer action, please transfer the STOP condition without fail.

<sup>\*3</sup> There are 3 control groups.

<sup>\*4</sup> This 8th bit called as R/W bit, and this bit shows the data transmission direction. [0] means send mode (accept mode with SW IC) and [1] means accept mode (send mode with SW IC) fundamentally.

## Data structure

START condition	Slave Address	R/W	ACK	Group	ACK	Control data	ACK	...	STOP condition
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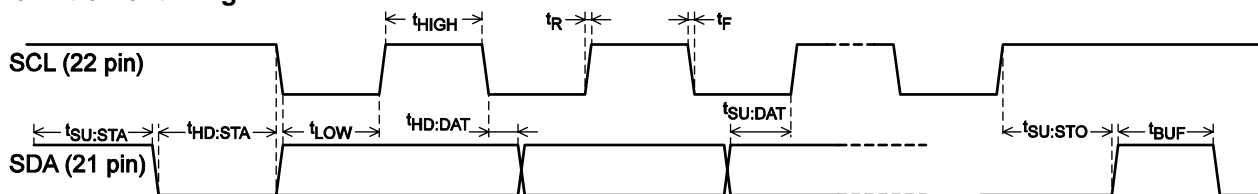
## Initialize

SW IC is initialized as the following mode for circuit protection. Please see “Sub address and data byte table” on page 9.

## Characteristics of the SDA and SCL 1/0 stages for SW IC

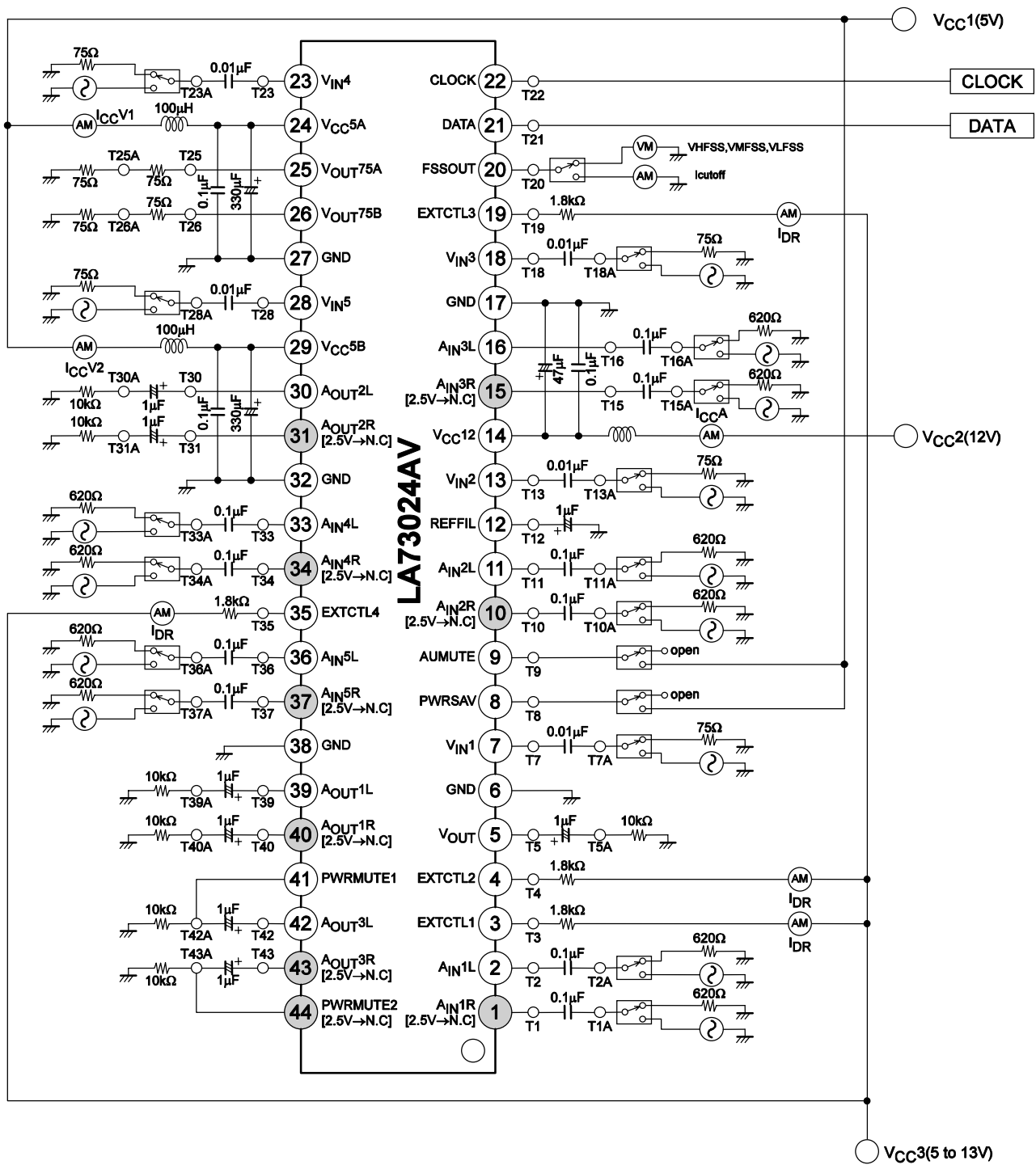
Parameter	Symbol	min	max	unit
LOW level input voltage	$V_{IL}$	0	1.5	V
HIGH level input voltage	$V_{IH}$	3.5	5.0	V
LOW level output current	$I_{OL}$		3.0	mA
SCL clock frequency	$f_{SCL}$		100	kHz
Set-up time for a repeated START condition	$t_{SU: STA}$	4.7		$\mu s$
Hold time START condition. After this period, the first clock pulse is generated.	$t_{HD: STA}$	4.0		$\mu s$
LOW period of the SCL clock	$t_{LOW}$	4.7		$\mu s$
Rise time of both SDA and SDL signals	$t_R$	0	1.0	$\mu s$
HIGH period of the SCL clock	$t_{HIGH}$	4.0		$\mu s$
Fall time of both SDA and SDL signals	$t_F$	0	1.0	$\mu s$
Data hold time	$t_{HD: DAT}$	0		$\mu s$
Data set-up time	$t_{SU: DAT}$	250		ns
Set-up time for STOP condition	$t_{SU: STO}$	4.0		$\mu s$
BUS free time between a STOP and START condition	$t_{BUF}$	4.7		$\mu s$

## Definition of timing



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## Test Circuit



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