Ordering number : ENA0979

LA72702NV

ON Semiconductor®

http://onsemi.com

Monolithic Linear IC

BTSC Decoder for US TV

Overview

The LA72702NV is a US TV BTSC Decoder.

Features

- With SIF circuit, alignment-free* STEREO channel separation.
  * When base band signal input, separation is adjusted by input level.
- Dual slave address(80h, 84h).

Functions

- SIF FM-Demodulator
- STEREO decoder
- dbx Noise Reduction
- STEREO detection
- STEREO detection sensitivity change function
- SAP demodulator
- SAP detection
- SAP output select 2-levels
- SAP detection sensitivity change function

Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum power supply voltage	$V_{CC}H$ max		7.0	V
Allowable power dissipation	Pd max	Ta≤85°C, Mounted on a specified board*	290	mW
Operating temperature	Topr		-20 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

* Mounted on a specified board: 114.3mm×76.1mm×1.6mm, glass epoxy board

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended operating voltage	vacate		5.0	V
Allowable operating voltage range	$V_{CC}H$ op		4.5 to 5.5	V

Electrical Characteristics at Ta = 25°C, V_{DD} = 5.0V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current dissipation	I_{CC}	No signal Inflow current at pin 19, default condition	30	40	50	mA
SIF input level (Reference)	V_ILIM	fc = 4.5MHz Deviation MONO (300Hz, Mod = 100%, Pre-emphasis ON) → ±25kHz	(80)	(90)	(100)	dBμV
Base band input level (Reference)	V_ILIMB	100% Modulation MONO(L+R) : 530mVp-p (300Hz, Pre-emphasis ON) SUB(L-R) : 380mVp-p (300Hz, dbx-NR ON), Pilot : 110mVp-p SAP : 300mVp-p (300Hz, dbx-NR ON)				
MONO output level	V_OMON	fm=1kHz, 100% Mod, 15kHz LPF	-7.0	-5.5	-4.5	dBV
MONO distortion	THDMON	fm=1kHz, 100% Mod, 15kHz LPF		0.15	0.6	%
MONO frequency characteristics	FCM1	fm=3kHz, 30% Mod, Pre-emphasis ON * Measure ratio from fm=1kHz level.	-2	0	2	dB
MONO S/N ratio	SNM	S=V_OMON, N=0% Mod, 15kHz LPF	55	65		dB
STEREO output level	V_OST	fm=1kHz, 100% Mod, 15kHz LPF	-7.0	-5.5	-4.5	dBV
STEREO distortion	THDS	fm=1kHz, 100% Mod, 15kHz LPF		0.5	1.0	%
STEREO frequency characteristics	FCS1	fm=3kHz, 30% Mod, 15kHz LPF * Measure ratio from fm=1kHz level.	-2	0	2	dB
STEREO S/N ratio	SNS	S=V_OST, N=0% Mod, 15kHz LPF	50	60		dB
STEREO separation 1	STSE1	f=300Hz (R/L), 30% Mod, 15kHz LPF	20	25		dB
STEREO separation 2	STSE2	f=3kHz (R/L), 30% Mod, 15kHz LPF	20	25		dB
STEREO Detection level-1	V_{IN}SD1	Except Stereo Detection → Stereo Detection * Serial control "SENS HI" Pilot (fH)=15.73kHz * Measure pilot level.	30	38	45	%
STEREO Detection level-2	V_{IN}SD2	Except Stereo Detection → Stereo Detection * Serial control "SENS LO"	38	47	53	%
STEREO Detection hysteresis	HYST	Input Mod. Difference at Stereo/Except Stereo Det. * Serial control "SENS HI"	10	20	30	%
SAP output level-1	V_OSA1	fm=1kHz, 100% Mod, 15kHz LPF * SAP-1 (serial control)	-14.0	-11.0	-8.0	dBV
SAP output level-2	V_OSA2	fm=1kHz, 100% Mod, 15kHz LPF * SAP-2 (serial control)	-7.5	-5.5	-3.5	dBV
SAP distortion	THDSA	fm=1kHz, 100% Mod, 15kHz LPF		0.7	1.5	%
SAP S/N ratio	SNSA	S=V_OSA2, N=0% Mod, 15kHz LPF	50	60		dB
SAP detection level-1	V_{IN}SA1	Except SAP → SAP Det. * Serial control "SENS HI" SAP Carrier=5fH only * Measure output level.	10	17	24	%
SAP detection level-2	V_{IN}SA2	Except SAP → SAP Det. * Serial control "SENS LO" * Measure output level.	17	24	31	%
SAP detection hysteresis	HYSA	Input Mod. Difference at SAP/Except SAP Det. * SAP carrier only. * Serial control "SENS HI"	2	5	10	%
MODE output MONO	MODMO	Input=MONO : f=1kHz, 0% Mod	0.7	1	1.3	V
MODE output SAP	MODSA	Input=SAP : Carrier	1.6	1.9	2.2	V
MODE output STEREO	MODST	Input=STEREO : Pilot	2.5	2.8	3.1	V
MODE output ST + SAP	MODSS	Input=STEREO : Pilot, SAP : Carrier	3.5	3.8	4.2	V
Stereo detect speed (Reference)	STDT	Input=STEREO : Pilot I^2C data no-send Measure pin 20 voltage change to 2.8V timing from Power ON		(480)	(1000)	ms
SAP detect speed (Reference)	SAPDT	SAP : Carrier I^2C data no-send Measure pin 20 voltage change to 1.9V timing from Power ON		(350)	(1000)	ms

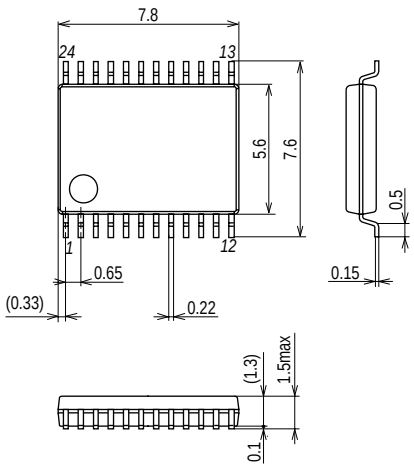
* Normally measurement condition is Input = SIF mode (90dBμV)

* " Reference " Items are reference levels, their specs are no-guarantee.

Package Dimensions

unit : mm (typ)

3175C



SSOP24(275mil)

Mode Condition

Signal	I²C data in								Output mode			I²C out		
	D8	D7	D6	D5	D4	D3	D2	D1	Lch pin18	Rch pin17	Mode condition	D8	D7	Mode pin20
Stereo	(0)	(0)	*	(0)	(0)	0	0	0	L	R	Stereo	1	1	3.8V
+ SAP	FIX	SIF	0	STEREO	SAP	0	0	1	SAP	SAP	SAP-1			
		(1)	1	SENS	SENS	0	0	1	SAP	SAP	SAP-2			
		BASE	0	Lo	Lo	0	1	0	L+R	SAP	MULTI-1			
		band	1	(1)	(1)	0	1	0	L+R	SAP	MULTI-2			
			*	Hi	Hi	1	0	0	L+R	L+R	F-MONO			
			*			1	0	1	L+R	L+R	F-MONO			
			*			1	1	0	L+R	L+R	F-MONO			
			*			*	1	1	Off	Off	MUTE			
Stereo			*			0	0	0	L	R	Stereo	1	0	2.8V
			*			0	0	1	L	R	Stereo			
			*			0	1	0	L	R	Stereo			
			*			1	0	0	L+R	L+R	F-MONO			
			*			1	0	1	L+R	L+R	F-MONO			
			*			1	1	0	L+R	L+R	F-MONO			
			*			*	1	1	Off	Off	MUTE			
Mono			*			*	0	0	L+R	L+R	MONO	0	1	1.9V
+ SAP			0			0	0	1	SAP	SAP	SAP-1			
			1			0	0	1	SAP	SAP	SAP-2			
			0			0	1	0	L+R	SAP	MULTI-1			
			1			0	1	0	L+R	SAP	MULTI-2			
			*			*	1	1	Off	Off	MUTE			
MONO			*			*	0	0	L+R	L+R	MONO	0	0	1.0V
			*			*	0	1	L+R	L+R	MONO			
			*			*	1	0	L+R	L+R	MONO			
			*			*	1	1	Off	Off	MUTE			

*** : no care**

I²C Control Table

Grp-1 (Normally use : group-1 only)

	D8	D7	D6	D5	D4	D3	D2	D1	Condition
*							0	0	Stereo
							0	1	SAP
							1	0	Both
							1	1	MUTE
*						0			Normal (Auto DET)
						1			Forced Mono
*					0				SAP SENS LO
					1				SAP SENS HI
*				0					Stereo SENS LO
				1					Stereo SENS HI
*			0						SAP Level-1
			1						SAP Level-2
*		0							SIF mode
		1							Base Band mode
*	0								Fix
	1								Prohibit (TEST MODE)

* : Shows Initial condition

Read out data

D8	D7	D6	D5	D4	D3	D2	D1	Condition
		0	0	0	0	0	0	Fixed
	0							Normal
	1							SAP det
0								Normal
1								Stereo det

Test mode condition(Reference)

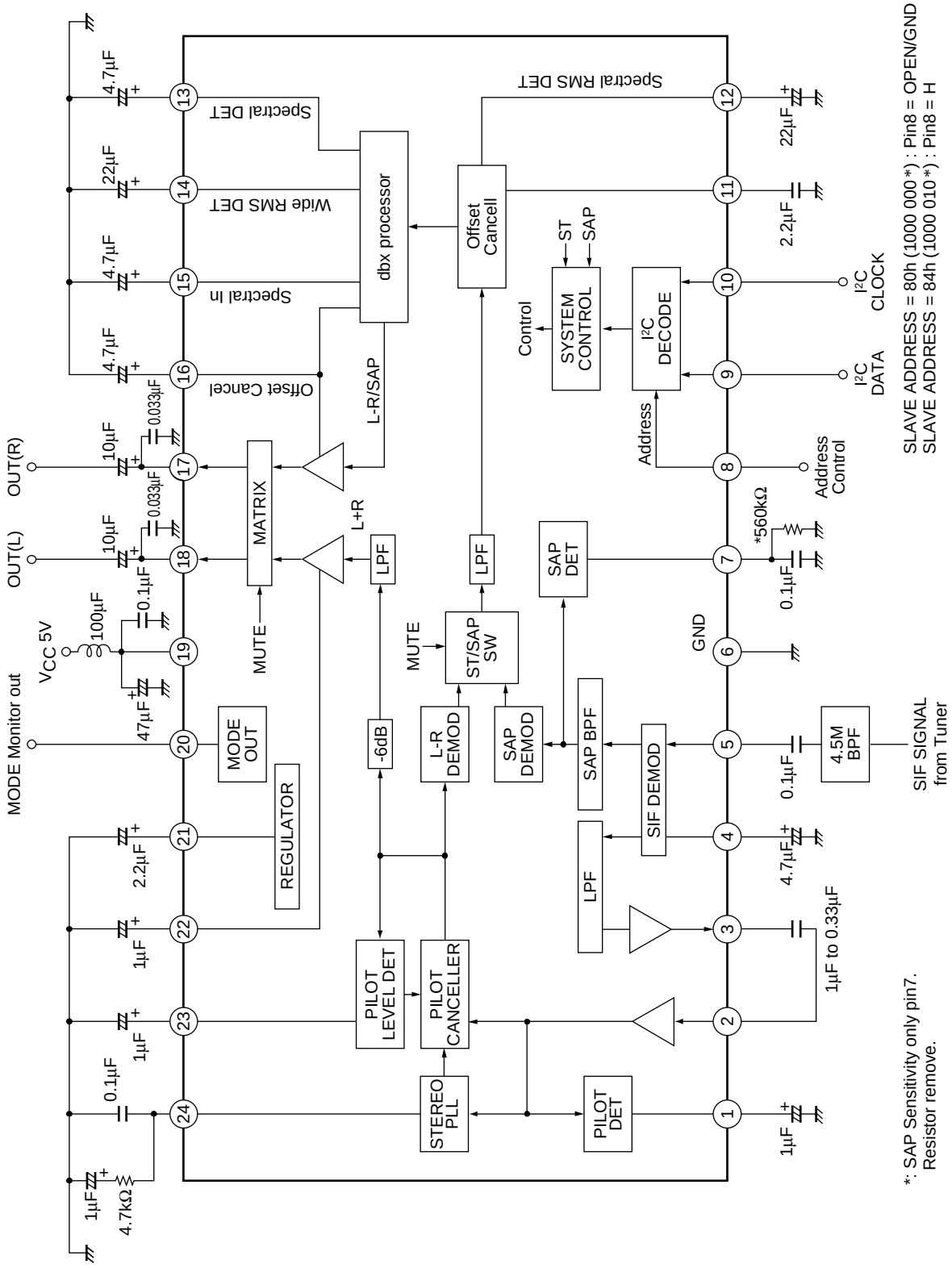
When STOP condition transform at Grp-1 data-end, controlled NORMAL mode.
Grp-2 is only test condition. Usually, these data are no-need. Their data are no guarantee, except all L condition.

D8	D7	D6	D5	D4	D3	D2	D1	Condition/Monitor position
0	0	0	0	0	0	0	0	Normal (Usually, Fixed)
				0	0	0	1	TEST-1 SIF output
				0	0	1	0	TEST-2 SAP BPF
				0	0	1	1	TEST-3 (reserved)
				0	1	0	0	TEST-4 ST VCO
				0	1	0	1	TEST-5 (reserved)
				0	1	1	0	TEST-6 SAP monitor
				0	1	1	1	TEST-7 ST monitor
				1	0	0	0	TEST-8 Pilot cancel monitor
				1	0	0	1	TEST-9 dbx 2.19k LPF
				1	0	1	0	TEST-10 dbx 408 LPF
				1	0	1	1	TEST-11 dbx DET 10k LPF
				1	1	0	0	TEST-12 dbx SPEC 7.6k LPF
				1	1	0	1	TEST-13 dbx SPEC output
				1	1	1	0	TEST-14 L+R/lL-R monitor
				1	1	1	1	TEST-15 dbx 2.09k LPF

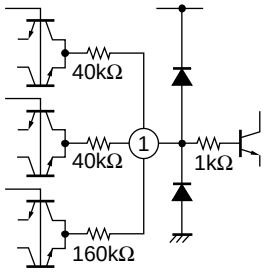
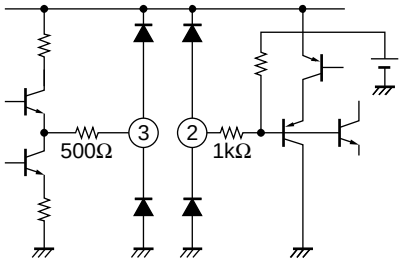
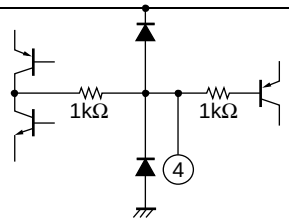
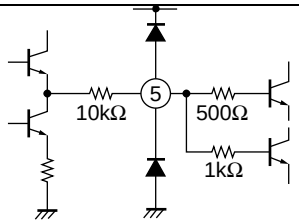
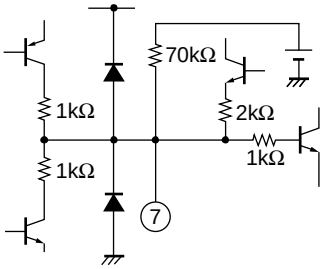
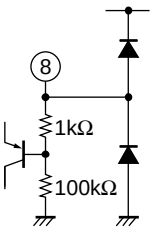
Blank Bits are no-care

Slave addresses are 80h (1000 000*, at pin8 Open/GND) and 84h (1000 010*, at pin8 H).

Block Diagram and Application



Pin Functions

Pin No.	Pin Name	Function	DC: voltage AC: level	Equivalent Circuit
1	PCPLDET	Pilot level detect for stero detection	DC : 2.4V	
2	PC_DC_IN	AC coupling (Input)	DC : 2.4V AC : 2.4Vp-p	
3	PC_DCOUT	AC coupling (Output)	DC : 2.4V AC : 2.4Vp-p	
4	PC FIL	SIF offset cancel	DC : 2.6V	
5	PISIF	Signal input Common input at SIF, Base band	DC : 3.7V	
6	GND			
7	CSAPDET	SAP carrier level detect for SAP detection	DC : 2.8V	
8	ADDSEL	Slave address change control OPEN/GND : 80h 5V : 84h	DC : 0V	

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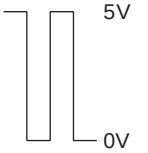
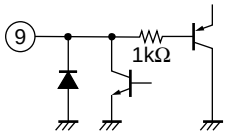
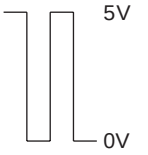
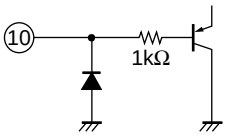
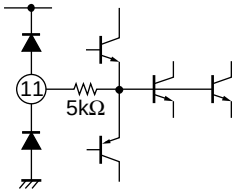
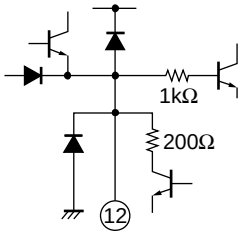
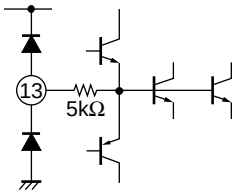
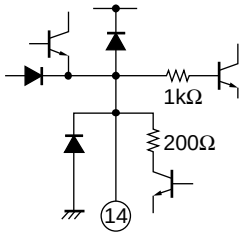
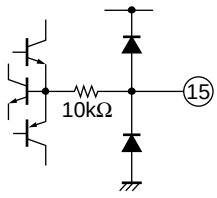
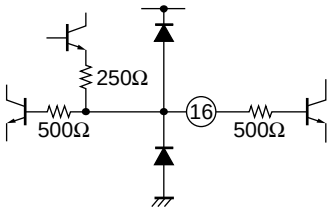
Pin No.	Pin Name	Function	DC: voltage AC: level	Equivalent Circuit
9	SDA	Serial data input		
10	SCL	Serial clock input		
11	PC DBXIN	Offset cancel feedback filter	DC: 2.4V	
12	PCDETSPE	Spectral band RMS detect	DC: 2.3V	
13	PCTIMSPE	dbx spectral detect	DC: 2.4V	
14	PCTNWID	Wide band RMS detect	DC: 2.4V	
15	PCSPECIN	dbx main signal V/I convert filter	DC: 2.4V	
16	PC KE6B	Offset cancel feedback filter	DC: 2.4V AC: 220mVp-p	

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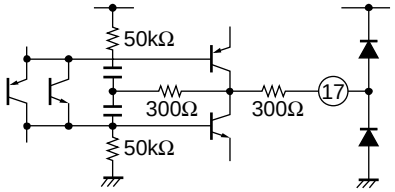
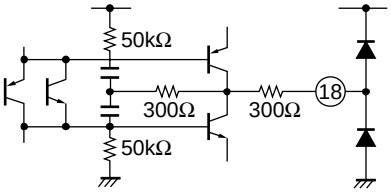
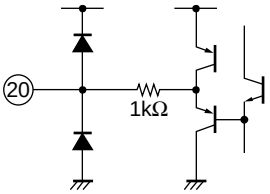
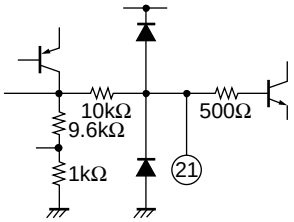
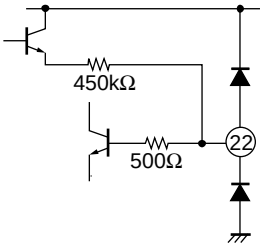
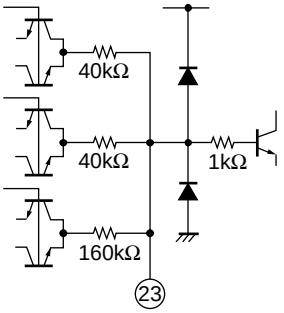
Pin No.	Pin Name	Function	DC: voltage AC: level	Equivalent Circuit
17	PORCH	Line out R	DC: 2.4V AC: 1.4Vp-p	
18	POLCH	Line out L	DC: 2.4V AC: 1.4Vp-p	
19	V_{CC}			
20	POLED	Mode out MONO = 0.9V SAP = 2.0V STEREO = 3.0V STEREO + SAP = 3.8V	DC: See Right AC: Test only	
21	PCREG	Reference voltage	DC: 2.4V	
22	PMAINOUT	Offset cancel feedback filter	DC: 1.6V	
23	PCPLC	Pilot level detect for pilot canceller	DC: 2.4V	

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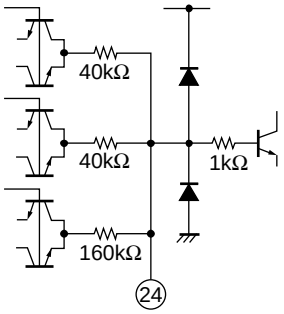
Pin No.	Pin Name	Function	DC: voltage AC: level	Equivalent Circuit
24	PCPTFILT	Pilot level detect for ST PLL filter	DC: 2.4V	

I²C BUS Serial Interface Specification

(1) Data transfer manual

This IC adopts control method (I²C-BUS) with serial data, and controlled by two terminals which called SCL (serial clock) and SDA (serial data).At first, set up[*1] the condition of starting data transfer, and after that, input 8 bit data to SDA terminal with synchronized SCL terminal clock. The order of transferring is first, MSB (the Most Scale of Bit), and save the order. The 9th bit takes ACK (Acknowledge) period, during SCL terminal takes 'H', this IC pull down the SDA terminal. After transferred the necessary data, two terminals lead to set up and of [*2] data transfer stop condition, thus the transfer comes to close.

*1 Defined by SCL rise down SDA during 'H' period.
*2 Defined by SCL rise up SDA during 'H' period.

(2) Transfer data format

After transfer start condition, transfers slave address (1000 000∗) to SDA terminal, control data, then, stop condition (See figure 1).
Slave address is made up of 7bits, [*3]8th bit shows the direction of transferring data, if it is 'L' takes write mode (As this IC side, this is input operation mode), and in case of 'H' reading mode (As this IC side, this is output operation mode). Data works with all of bit, transfer the stop condition before stop 8bit transfer, and to stop transfer, it will be canceled the transfer dates.

*3 It is called R/W bit.

Fig.1 DATA STRUCTURE "WRITE" mode

START Condition	Slave Address	R/W L	ACK	Control data	ACK	STOP condition

Fig.2 DATA STRUCTURE "READ" mode

START condition	Slave Address	R/W H	ACK	Internal Data *	ACK	STOP condition

∗ The output data synchronizes with the clock of SCL pin. Then, the ACK output is made after the output data.
bit8 is result of STERO DET (H : STEREO)
bit7 is result of SAP DET (H : SAP)
bit6 to bit1 are fixed to 'L'

(3) Initialize

This IC is initialized for circuit protection. Initial condition is "0 (All bits) ".

Reference

Parameter	Symbol	min	max	unit
LOW level input voltage	V_{IL}	-0.5	1.5	V
HIGH level input voltage	V_{IH}	2.5	5.5	V
LOW level output current	I_{OL}		3.0	mA
SCL clock frequency	f_{SCL}	0	100	kHz
Set-up time for a repeated START condition	$t_{SU : STA}$	4.7		µs
Hold time START condition. After this period, the first clock pulse is generated	$t_{HD : STA}$	4.0		µs
LOW period of the SCL clock	t_{LOW}	4.7		µs
Rise time of both SDA and SDL signals	t_R	0	1.0	µs
HIGH period of the SCL clock	t_{HIGH}	4.0		µs
Fall time of both SDA and SDL signals	t_F	0	1.0	µs
Data hold time	$t_{HD : DAT}$	0		µs
Data set-up time	$t_{SU : DAT}$	250		ns
Set-up time for STOP condition	$t_{SU : STO}$	4.0		µs
BUS free time between a STOP and START condition	t_{BUF}	4.7		µs

Definition of timing