Ordering number : ENA0973A

SANYO Semiconductors
DATA SHEET

LV2282VA — Bi-CMOS IC FM Transmitter IC with Stereo Modulation

Overview

The LV2282VA is an FM Transmitter IC. MPX block makes stereo modulated, composite signal from L and R sound inputs. RF VCO include FM modulation function. Audio AGC function keeps FM modulation well regulated. PLL synthesizer determines RF output frequency with I²C or 3-bit parallel control (selectable).

Application

- Portable Memory Player
- Portable HDD Player
- Wireless Headphone

Features

- (Audio) AGC amplifier
- (MPX) Pilot tone system stereo modulation, audio attenuation
- (RF) VCO, driver amplifier
- (PLL) 70 to 110MHz, 100kHz step available, I²C bus control, 3-bit parallel control

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max	Pin 4, 11, 15	5.0	V
Maximum input voltage	V_{IN} max		V_{CC}+0.3	V
Minimum input voltage	V_{IN} min		-0.3	V
Allowable power dissipation	Pd max	Ta ≤ 85°C, Mounted on a specified board*	500	mW
Operating temperature	Topr		-40 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

* Specified board : 114.3mm×76.1mm×1.6mm, glass epoxy circuit board.

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Recommended Operating Conditions at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}	Pin 4, 11, 15	3.3	V
Operating supply voltage range	V_{CC} op	Pin 4, 11, 15	2.6 to 4.0	V

AC Characteristics Ta = 25°C, V_{CC} = 3.3V, I²C bits = Default state, L and R input = 1kHz, 20mVrms, unless otherwise noted

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Circuit current	I_{CC}	No input signal, Pin 4, 11, 12, 15 current		10	15	mA
Standby current	ISTB	No input signal, I²C bit "STB" = "1", Pin 4, 11, 12, 15 current			10	μA

Audio and MPX Blocks

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Maximum audio input	VA max	Pin 1 and 24 input			100	mVrms
Audio input frequency	FAF	Pin 1 and 24 input	20		15k	Hz
Channel separation	SEP	Pin 5, composite output, L→R, R→L	20	30		dB
Channel balance	CB	Pin 5, composite output	-2	0	2	dB
Total harmonic distortion	THD	Pin 5, composite output		0.5	1.5	%
Maximum gain	GMAX	Pin 5/Pin 1 and 24	6	9	12	dB
AGC gain range	GR	Pin 5/Pin 1 and 24	9	11	13	dB
Pilot tone output level	PMOD	I²C bits "PA1/PA0" ="01"	2	4	6	mVrms
Composite output level	MPXOUT		19	30	48	mVrms
Audio attenuation	ATT	I²C bit "ATT" = "1"	25			dB
Crystal oscillator frequency (1)	FXOSC (1)	Pin 21 and Pin 22		76		kHz

RF Blocks

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
RF output (1)	RFOUT (1)	f = 90MHz, Pin 12 output	109	112	115	dBμV
RF output (2)	RFOUT (2)	f = 90MHz, Pin 14 output	97	100	103	dBμV
RF frequency	FRF	100kHz step	70		110	MHz

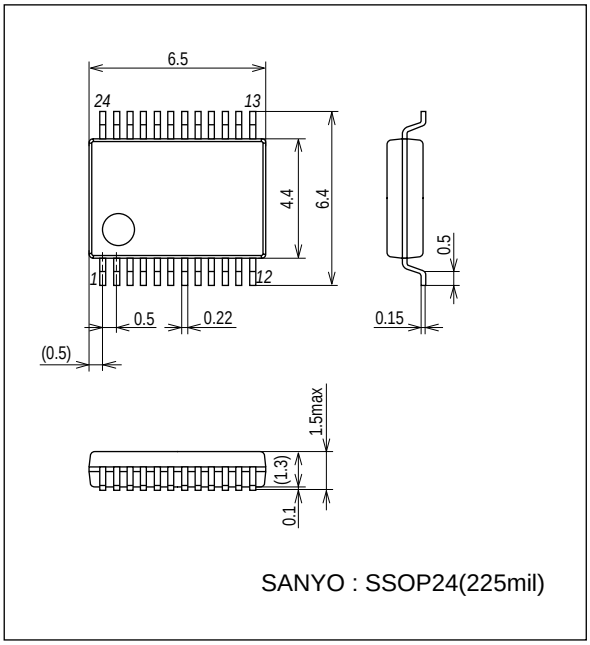
PLL Blocks

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
I²C input "High" voltage	V_H		0.8V_{CC}		V_{CC}+0.3	V
I²C input "Low" voltage	V_L		-0.3		0.2V_{CC}	V
RF input frequency 1	FPLL1	With I²C 11bit Step = 100kHz, See table 1	70		110	MHz
RF input frequency 2	FPLL2	With 3bit Parallel Step = 400kHz, See table 3	88.1		90.9	MHz
Crystal oscillator frequency (2)	FXOSC (2)	Pin 17		16		MHz
CP output current	ICP	CP voltage = 1.65V		30		μA

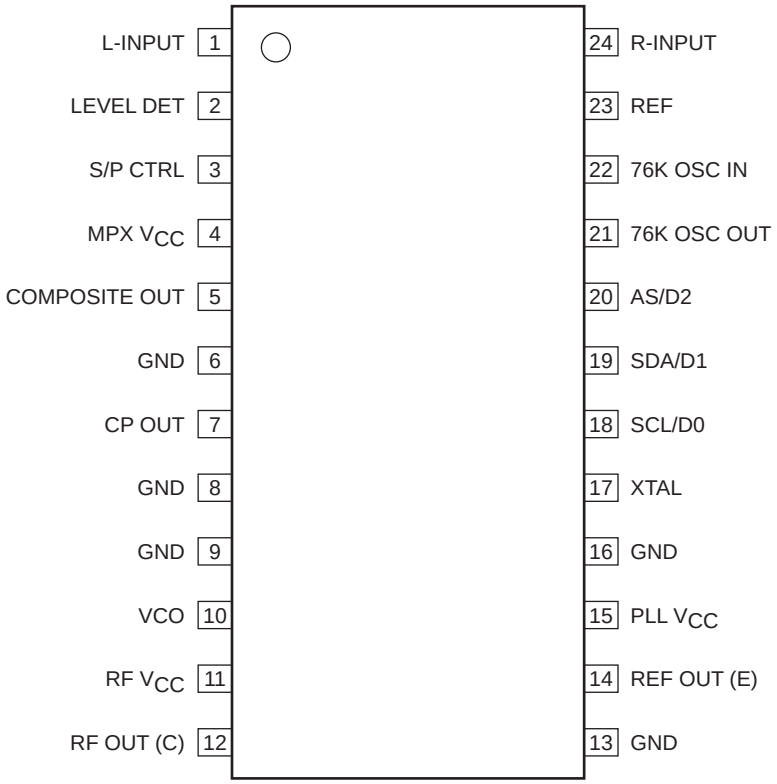
Package Dimensions

unit : mm (typ)

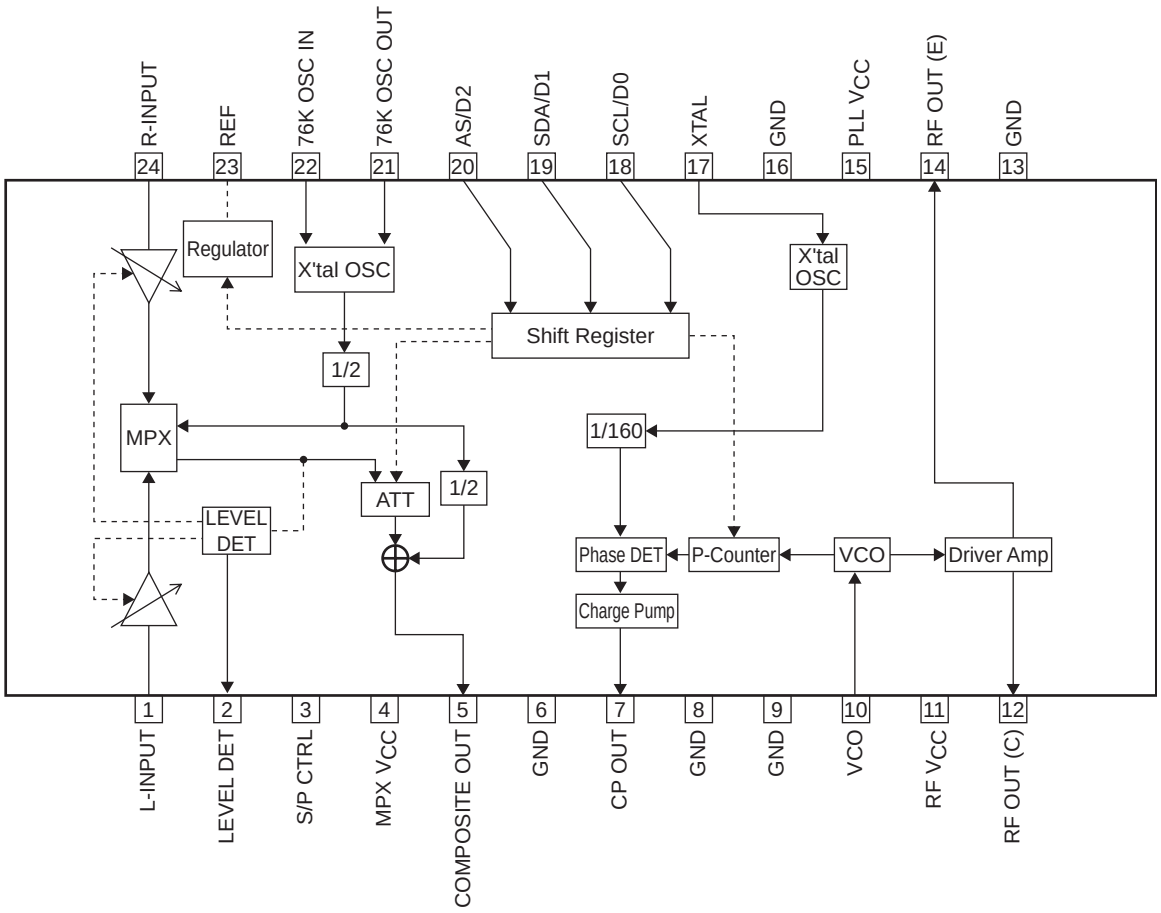
3287



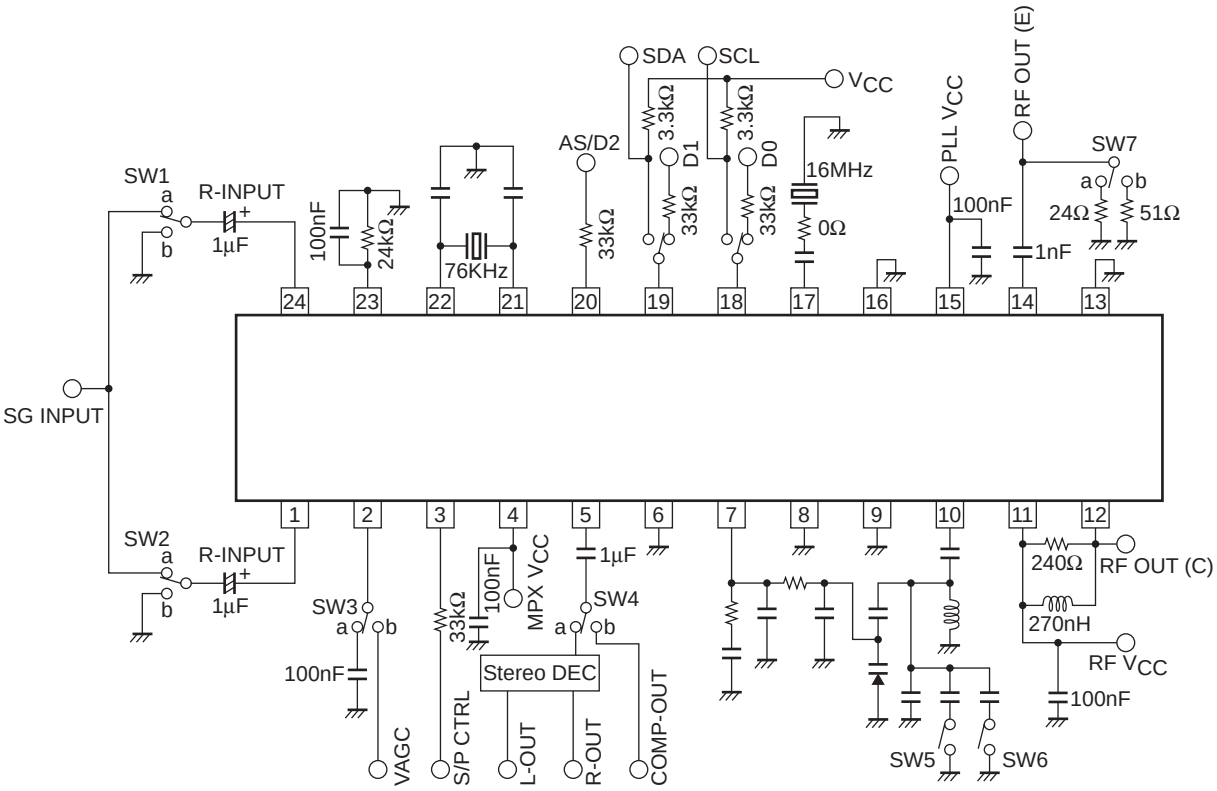
Pin Assignment



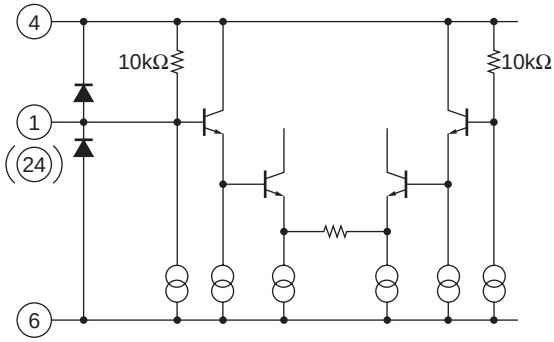
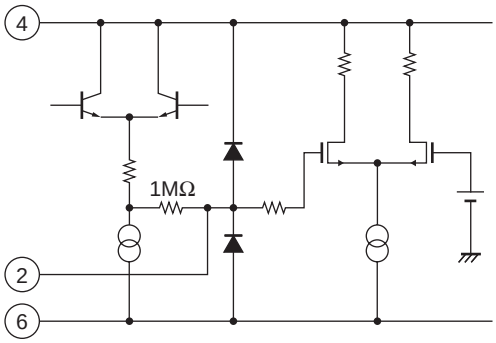
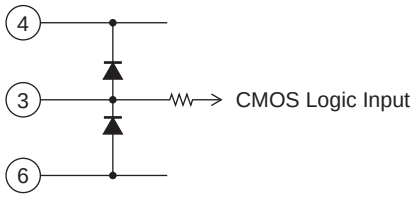
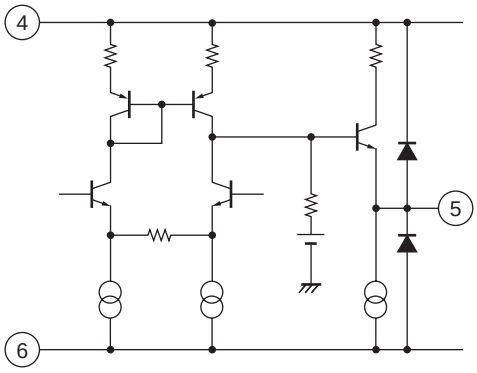
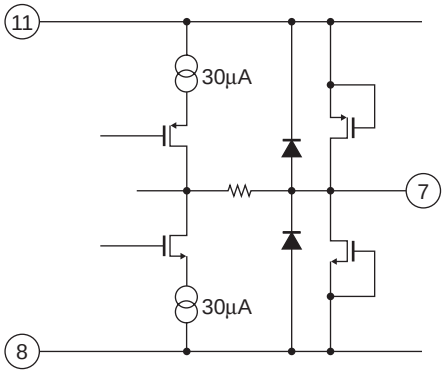
Block Diagram



AC Testing Circuit



Pin Description

Pin No.	Pin Name	DC Voltage (V)	Description	Equivalent Circuit
1	L-INPUT	2.8	Left channel input. AC coupling capacitance is required.	
2	LEVEL DET	-	For AGC time constant. Capacitance is required.	
3	S/P CTRL	-	Connect to GND for serial (I^2C) data input. Connect to V_{CC} for parallel data input.	
4	MPX V_{CC}	3.3	V_{CC} for Audio frequency and MPX Blocks.	
5	COMPOSITE OUT	1.7	Stereo modulated output.	
6	GND	0		
7	CP OUT	-	Charge pump current output.	

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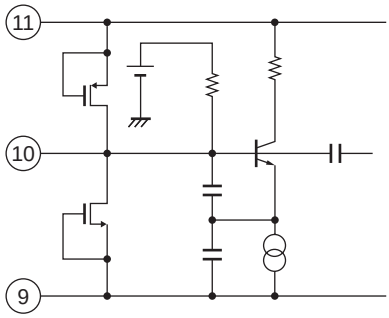
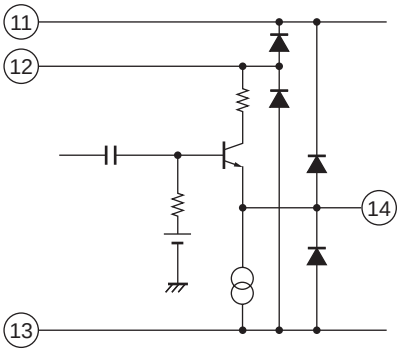
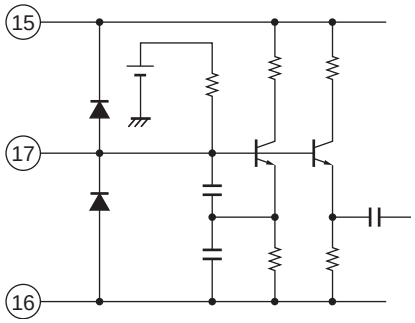
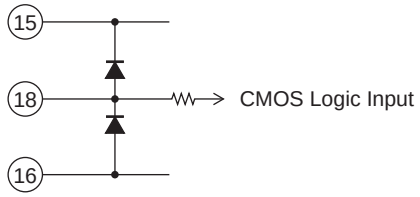
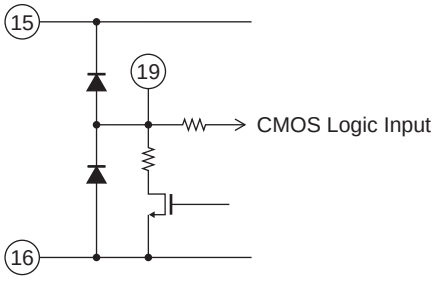
Pin No.	Pin Name	DC Voltage (V)	Description	Equivalent Circuit
8	GND	0		
9	GND	0		
10	VCO	2.8	Transistor BASE terminal for Colpitz oscillator.	
11	RF V_{CC}	3.3	V_{CC} for RF blocks.	
12	RF OUT (C)	3.3	Collector output.	
13	GND	0		
14	RF OUT (E)	2.0	Emitter follower output.	See Pin 12.
15	PLL V_{CC}	3.3	V_{CC} for digital blocks.	
16	GND	0		
17	XTAL	1.5	16MHz Crystal is needed for PLL reference frequency.	
18	SCL/D0	-	I²C clock input / Parallel LSB input.	
19	SDA/D1	-	I²C data input / Parallel input.	

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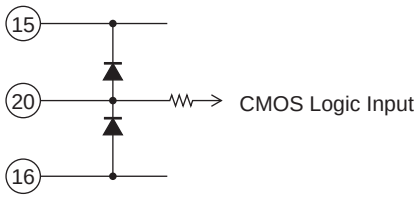
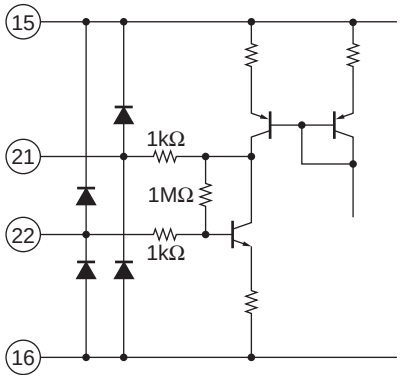
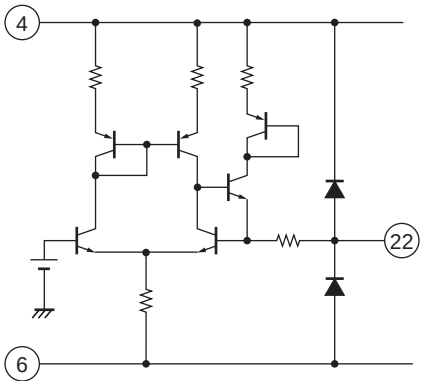
Pin No.	Pin Name	DC Voltage (V)	Description	Equivalent Circuit
20	AS/D2	-	I²C address selection (1bit)/Parallel MSB input.	
21	76K OSC OUT	0.8	For stereo modulator pilot signal and sub carrier. 76kHz crystal should be connected between Pin 21 and Pin 22	
22	76K OSC IN	0.7	See Pin 21	See Pin 21
23	REF	1.2	AC decoupling capacitance is required. External 24kΩ makes internal regulated current.	
24	R-INPUT	2.8	Right channel audio input. AC coupling capacitance is required.	See Pin 1

PLL Control by I²C Bus

The PLL block requires 3 bytes of I²C input as indicated below.

Table 1. I²C Bus Write Data Format

Name	Byte	Bit								ACK
		MSB (1)							LSB	
Address Byte	1	AD7	AD6	AD5	AD4	AD3	AD2	AS	R/W	A
		1	1	0	1	0	0	1/0	0	
Control Byte 1	2	P10	P9	P8	P7	P6	P5	P4	P3	A
		0	1	1	0	1	1	1	0	
Control Byte 2	3	P2	P1	P0	PA1	PA0	TS	STB	ATT	A
		0	0	1	0	1	0	0	0	

(1) : MSB is transmitted first.

Table 2. I²C Write Mode Description

Bit	Name	Description
AD7 – AD2	Address bit	LV2282VA requires address bits.
AS	Address Select	AS bit is decided by Pin 20. Connecting to V_{CC} = “1”, to GND = “0”
R/W	Read/Write	“0” for Write mode (Write mode only).
A	Acknowledge	
P10 – P0	Programmable counter	11 bit Programmable counter. P0 = LSB, P10 = MSB. RF Frequency = $(P10\times2^{10} + P9\times2^{9} + \ldots P1\times2^{1} + P0) \times 100kHz$ Default state = “01101110001”
PA1 – PA0	Pilot Adjust	2 bit Pilot tone output level adjust. “PA1 PA0” is set “00” for no pilot tone (monaural mode), “01”, for minimum output, “11” for maximum output. Default state = “01”
TS	Test Mode	For IC Testing. Set “0” for normal operation. TS for Counter testing. Default state = “0”
STB	Standby	“1” for Standby mode. Default state = “0” for normal operation.
ATT	Audio attenuator	“1” for Audio attenuation. Default state = “0” for normal operation.

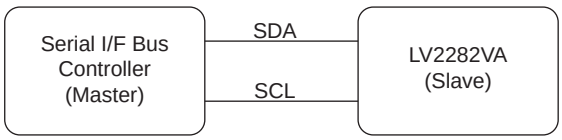
PLL Control with Parallel Data Input

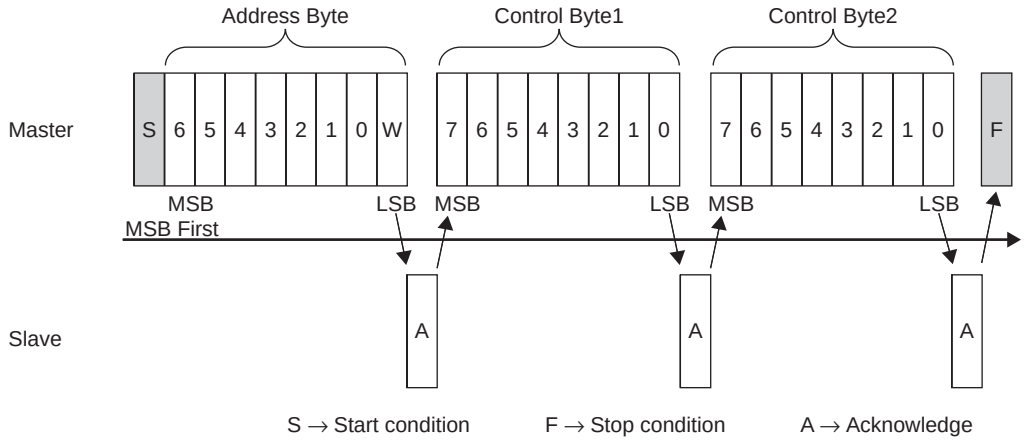
When Pin 3 S/P CTRL, is connected to V_{CC}, PLL blocks requires 3 bit parallel data input as shown below. In parallel data input mode, I²C controllable function in Table 2 is always set as (PA1, PA0, TS, STB, ATT) = (0, 1, 0, 0, 0).

Table 3. Parallel 3 bit Data Format

State	D2 (Pin 20)	D1 (Pin 19)	D1 (Pin 18)	Frequency (MHz)
0	0	0	0	88.1
1	0	0	1	88.5
2	0	1	0	88.9
3	0	1	1	89.3
4	1	0	0	89.7
5	1	0	1	90.1
6	1	1	0	90.5
7	1	1	1	90.9

I²C Bus Operation





Time chart

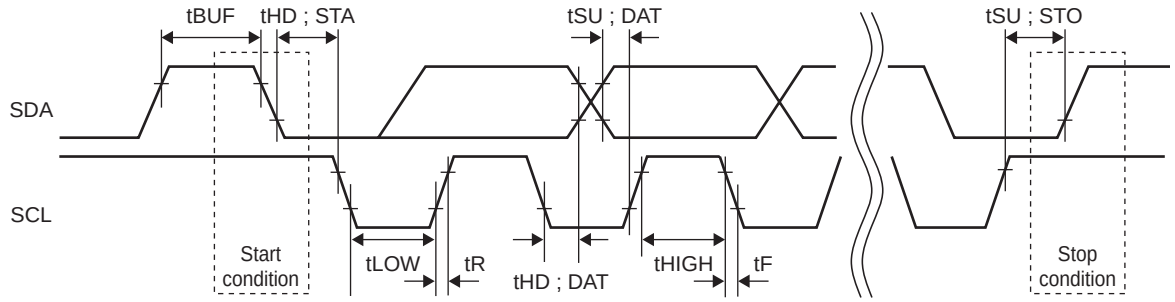


Table 4. Timing specification

Parameter	Symbol	Ratings			Unit
		min	typ	max	
SCL clock frequency	fSCL			100	kHz
Bus free time between a STOP and START condition	tBUF	4.7			µs
Hold time START condition	tHD ; STA	4.0			µs
LOW period of the SCL clock	tLOW	4.7			µs
HIGH period of the SCL clock	tHIGH	4.0			µs
Data hold time	tHD ; DAT	0.0			µs
Data set-up time	tSU ; DAT	250			ns
Rise time of both SDA and SCL signals	tR			1000	ns
Fall time of both SDA and SCL signals	tF			300	ns
Set-up time for STOP condition	tSU ; STO	4.0			µs

I²C Bus AC Characteristics : Temp=25°C V_{CC} = 3.3V

Note : I²C Bus is a registered trademark of the Philips Co..

Application Circuit