



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 | P _d max | Ta ≤ 85°C, Mounted on a specified board* | 500 | mW |
| Operating temperature | T _{opr} | | -40 to +85 | °C |
| Storage temperature | T _{stg} | | -55 to +150 | °C |

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

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LV2282VA

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, I ² C 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 | I ² C bits "PA1/PA0" = "01" | 2 | 4 | 6 | mVrms |
| Composite output level | MPXOUT | | 19 | 30 | 48 | mVrms |
| Audio attenuation | ATT | I ² C 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

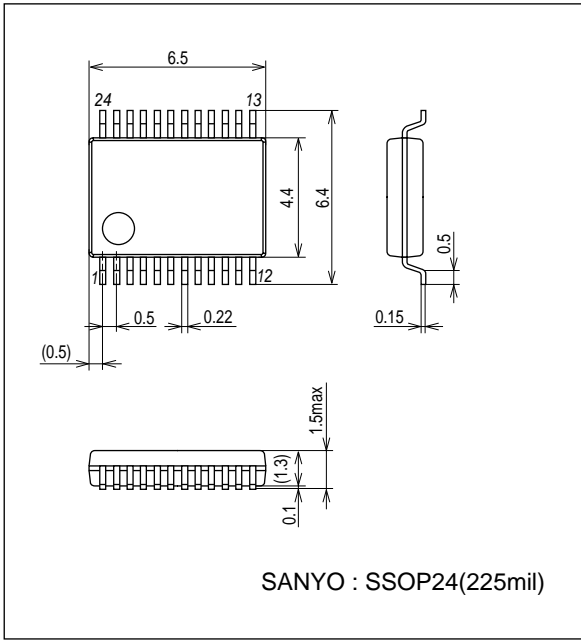
| Parameter | Symbol | Conditions | Ratings | | | Unit |
|---------------------------------------|----------------|---|--------------------|-----|----------------------|------|
| | | | min | typ | max | |
| I ² C input "High" voltage | V _H | | 0.8V _{CC} | | V _{CC} +0.3 | V |
| I ² C input "Low" voltage | V _L | | -0.3 | | 0.2V _{CC} | V |
| RF input frequency 1 | FPLL1 | With I ² C 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 |

LV2282VA

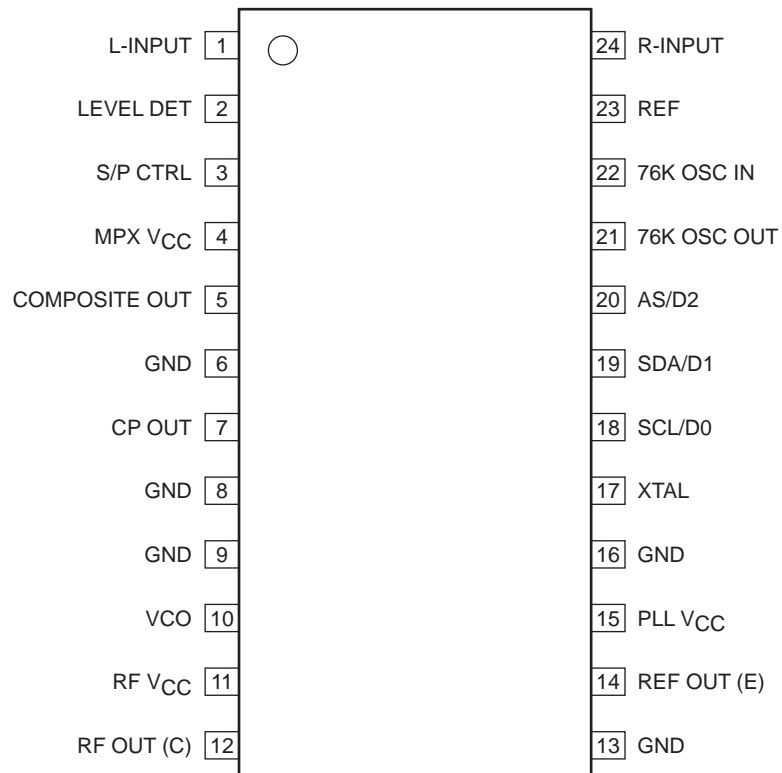
Package Dimensions

unit : mm (typ)

3287

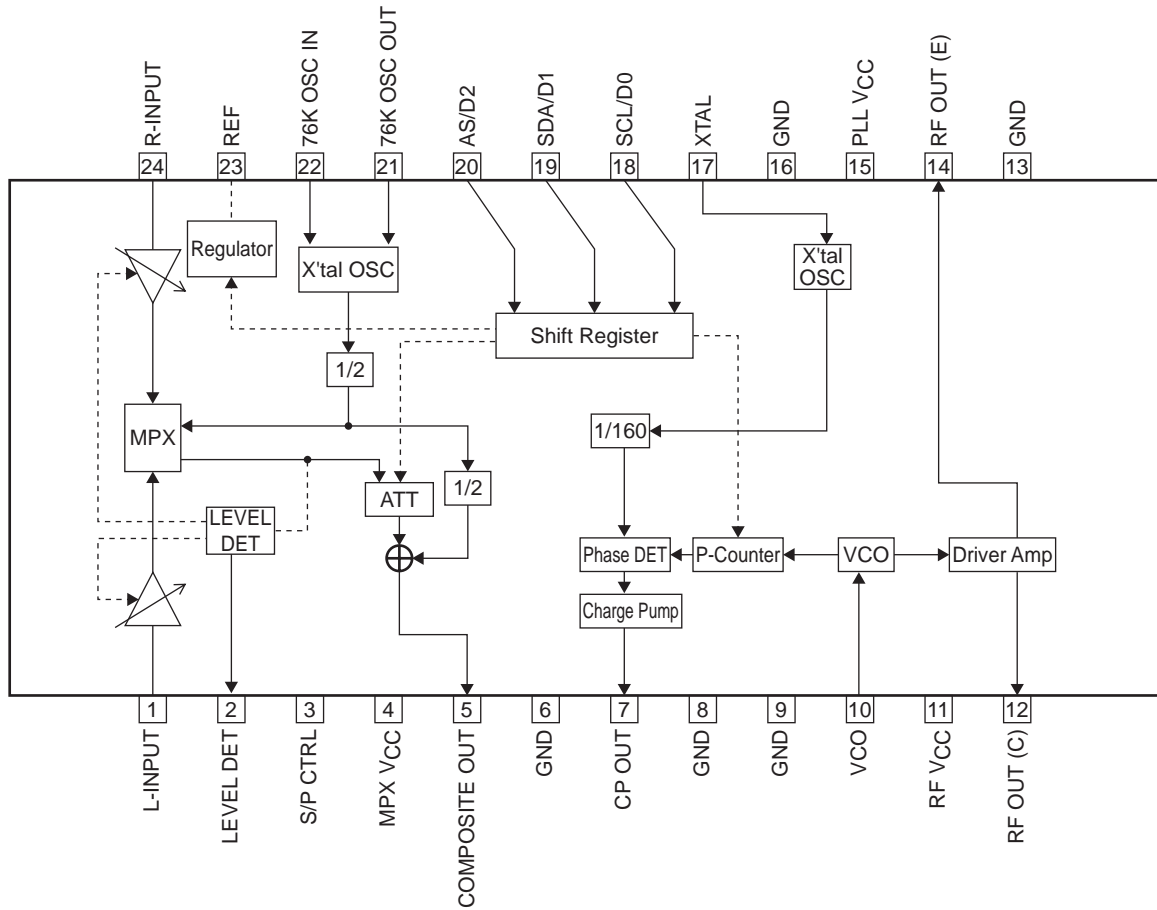


Pin Assignment

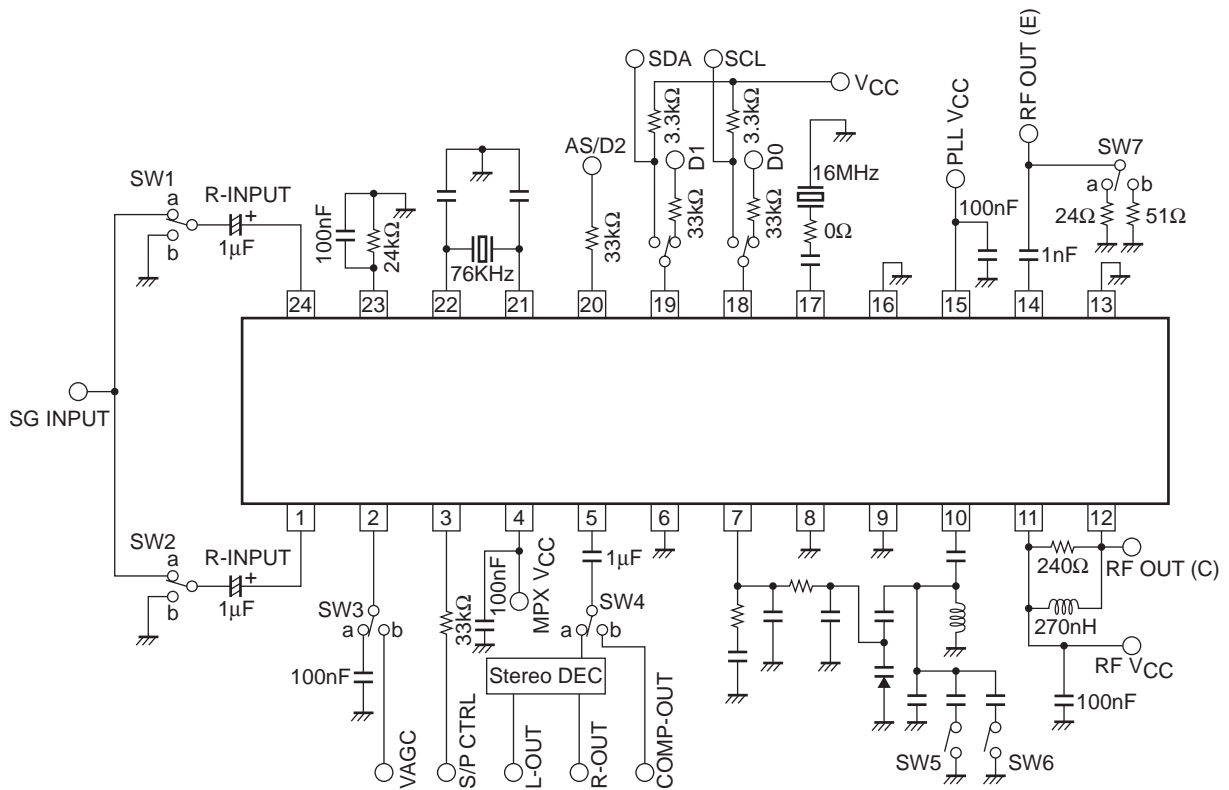


LV2282VA

Block Diagram



AC Testing Circuit



LV2282VA

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 ² C) 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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LV2282VA

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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 | - | I ² C clock input / Parallel LSB input. | |
| 19 | SDA/D1 | - | I ² C data input / Parallel input. | |

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LV2282VA

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| Pin No. | Pin Name | DC Voltage (V) | Description | Equivalent Circuit |
|---------|-------------|----------------|--|--------------------|
| 20 | AS/D2 | - | I ² C 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 |

LV2282VA

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 = (P10×2 ¹⁰ + P9×2 ⁹ + ... P1×2 ¹ + P0) × 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

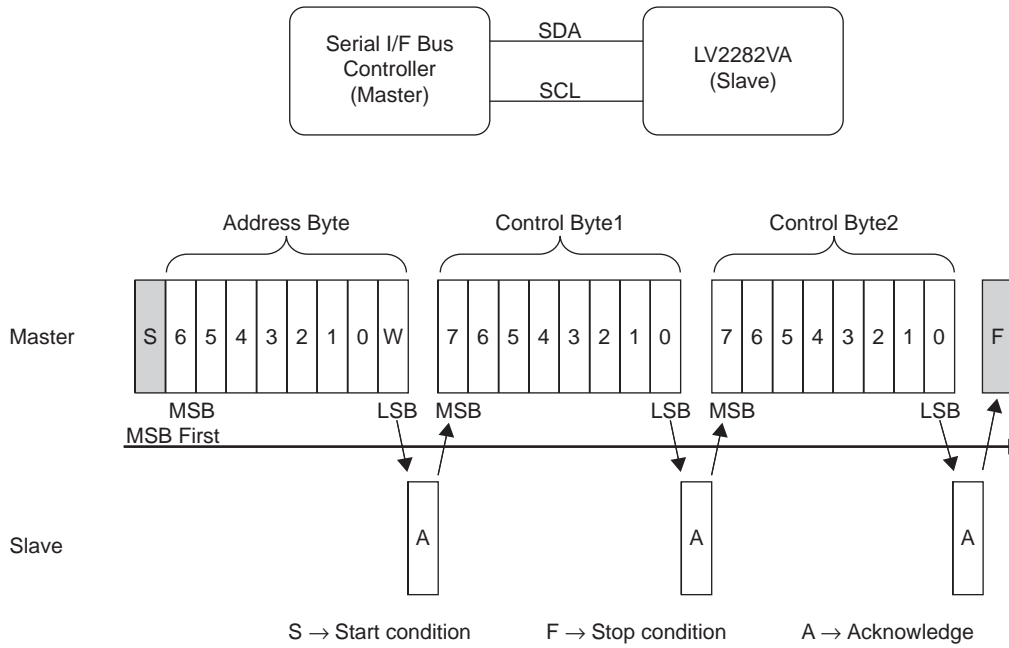
When Pin 3 S/P CTRL, is connected to V_{CC}, PLL blocks requires 3 bit parallel data input as shown below. In parallel data input mode, I²C controllable function in Table 2 is always set as (PA1, PA0, TS, STB, ATT) = (0, 1, 0, 0, 0).

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 |

LV2282VA

I²C Bus Operation



Time chart

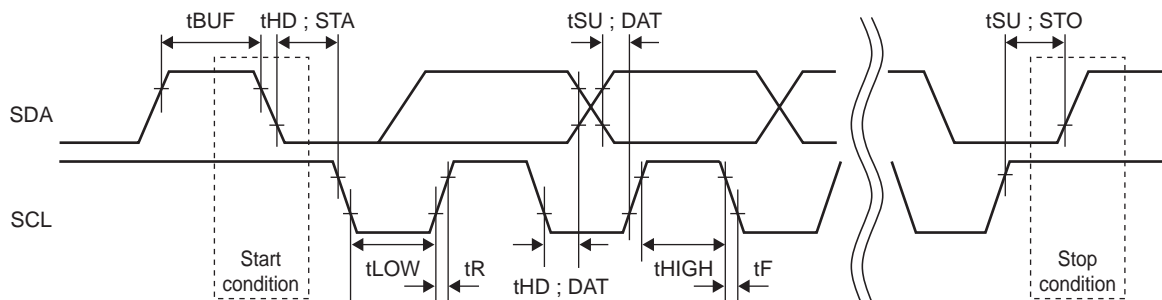


Table 4. Timing specification

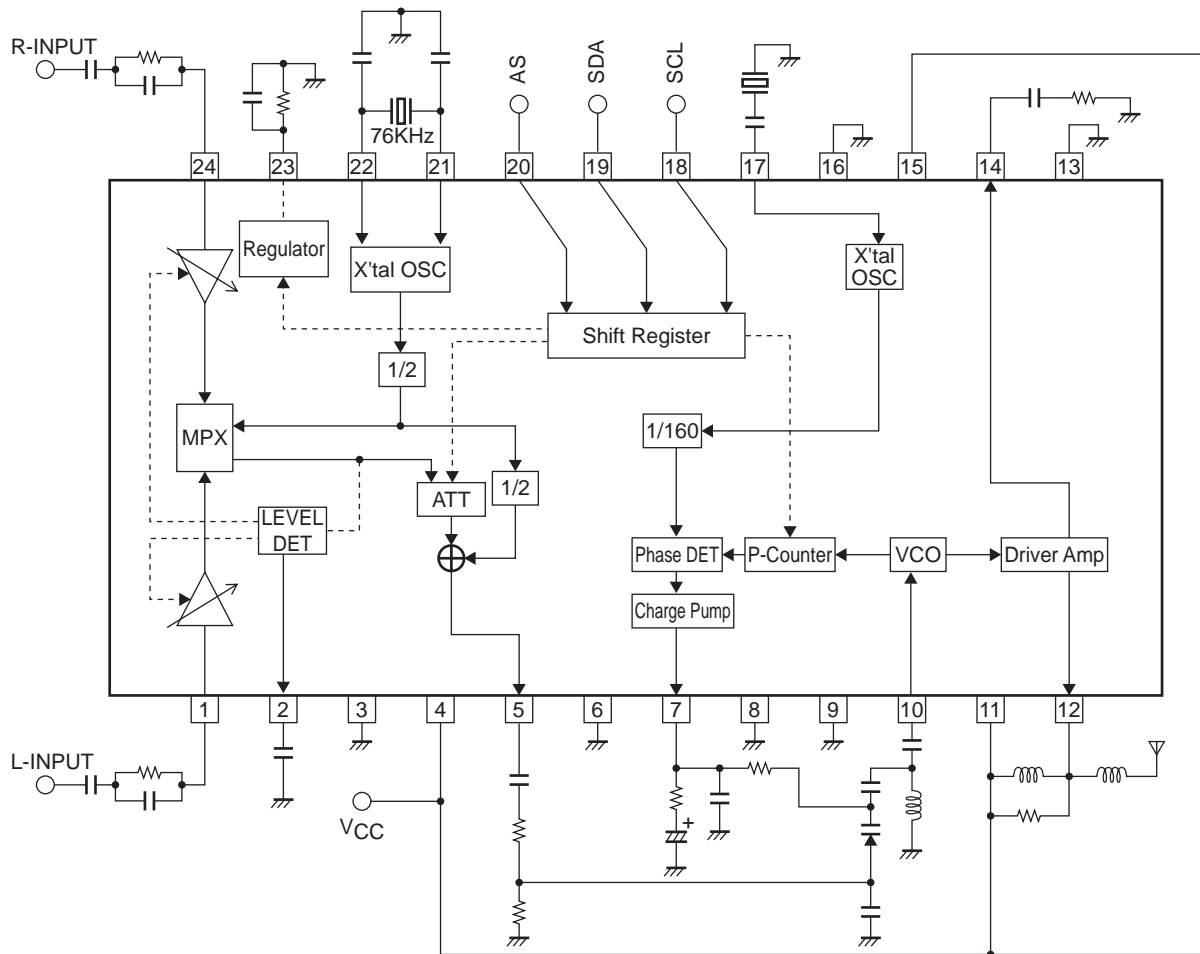
| Parameter | Symbol | Ratings | | | Unit |
|--|-----------|---------|-----|------|------|
| | | min | typ | max | |
| SCL clock frequency | fSCL | | | 100 | kHz |
| Bus free time between a STOP and START condition | tBUF | 4.7 | | | μs |
| Hold time START condition | tHD ; STA | 4.0 | | | μs |
| LOW 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..

LV2282VA

Application Circuit



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