# STLC5046

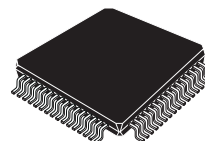## PROGRAMMABLE FOUR CHANNEL CODEC AND FILTER

- PROGRAMMABLE MONOLITHIC 4 CHANNEL CODEC/FILTER
- SINGLE +3.3V SUPPLY
- PIN STRAP / MCU CONTROL MODE
- A/$\mu$ LAW PROGRAMMABLE
- LINEAR CODING (16 BITS) OPTION
- PCM HIGHWAY FORMAT AUTOMATICALLY DETECTED: 1.536 or 1.544MHz; 2.048, 4.096, 8192 MHz
- TX GAIN PROGRAMMING: 16dB RANGE; <0.1dB STEP
- RX GAIN PROGRAMMING: 26dB RANGE; <0.1dB STEP
- PROGRAMMABLE TIME SLOT ASSIGNMENT
- DIGITAL AND ANALOG LOOPBACKS
- SLIC CONTROL PORT
  STATIC MODE (16 I/Os)
  DYNAMIC MODE (12 I/Os + 4 CS)
- 64 TQFP PACKAGE
- PCM IN HI-Z MODE

**TQFP64**

**ORDERING NUMBER:** STLC5046

### DESCRIPTION

The STLC5046 is a monolithic programmable 4 channel codec and filter. It operates with a single +3.3V supply. The analog interface is based on a receive output buffer driving the SLIC RX input and on an amplifier input stage. Due to the single supply voltage a proper midsupply reference level is generated internally by the device and all analog signals are referred to this level (AGND). The PCM interface uses one common 8KHz frame sync. pulse for transmit and receive direction. The bit clock can be selected between four standards: 1.536/1.544MHz, 2.048MHz, 4.096MHz, 8192MHz. Device programmability is achieved by means of 41 registers allowing to set the different parameters like TX/RX gains, encoding law (A/$\mu$), time slot assignment, independent channels power up/down, loopbacks, PCM bits offset. Thanks to pinstrap option, the most significant of the above parameters can be set by hardware connection of dedicated pins. This allow to use this device also on line card without MCU on board. When pin strap option is selected different pins of the device will change their function (see pin description).

In MCU control mode the STLC5046 can be programmed via serial interface running up to 4MHz.

One interrupt output pin is also provided.

## BLOCK DIAGRAM
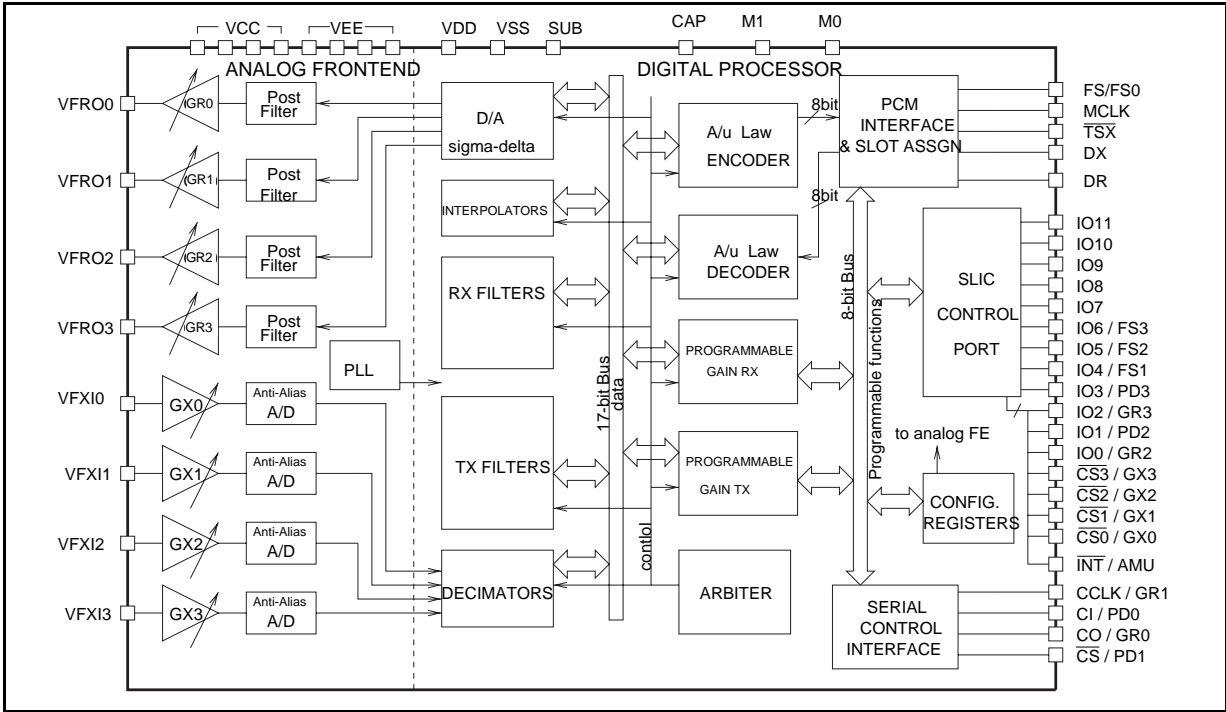


## ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CC}$ | $V_{CC}$ to $V_{EE}$ | -0.5 to 4.6 | V |
| $V_{DD}$ | $V_{DD}$ to $V_{SS}$ | -0.5 to 4.6 | V |
| $V_{DI}$ | Digital Input Input Pin Voltage | -0.5 to 5.5 | V |
| $I_{OUT}$ | Output Pin Current | ±1 | mA |
| $T_{STG}$ | Storage Temperature Range | -65 to +150 | °C |
| $T_{LEAD}$ | Lead Temperature (soldering, 10s) | 300 | °C |
| $V_{AI}$ | Analog Pin Input Voltage | -0.5 to 4.6 | V |

## OPERATING RANGE

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CC}$, $V_{DD}$ | Supply Voltage | 3.3 ±5% | V |
| $T_{OP}$ | Operating Temperature Range | -40 to +85 | °C |

## THERMAL DATA

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{th\,j-amb}$ | Thermal Resistance Junction-Ambient | 70 | °C/W |

**PIN CONNECTION** (Top view)
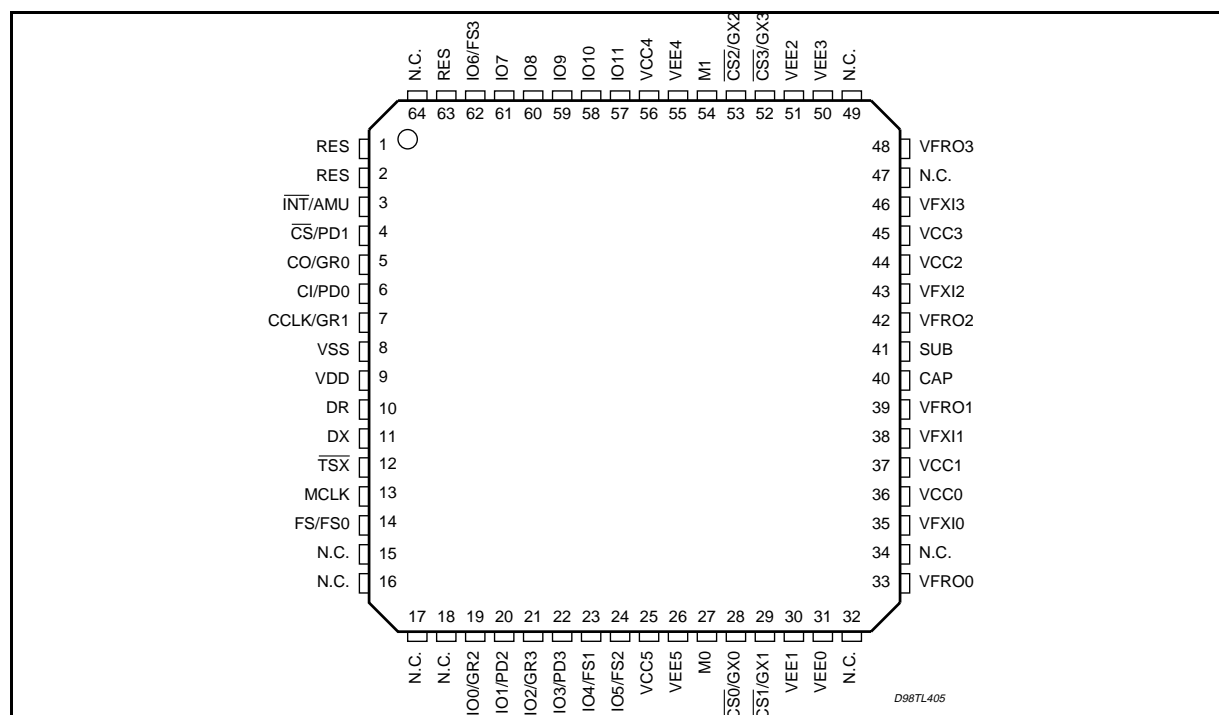


**PIN DESCRIPTION**

I/O DEFINITION

| Type | Definition |
|------|------------|
| AI | Analog Input |
| AO | Analog Output |
| ODO | Open Drain Output |
| DI | Digital Input |
| DO | Digital Output |
| DIO | Digital Input/Output |
| DTO | Digital Tristate Output |
| DPS | Digital Power Supply |
| APS | Analog Power Supply |

ANALOG

| N. | Name | Type | Function |
|----|------|------|----------|
| 33 | VFRO0 | AO | Receive analog amplifier output channel 0. PCM data received on the programmed Time Slot on DR input is decoded and appears at this output. |
| 39 | VFRO1 | AO | Receive analog amplifier output channel 1. PCM data received on the programmed Time Slot on DR input is decoded and appears at this output. |
| 42 | VFRO2 | AO | Receive analog amplifier output channel 2. PCM data received on the programmed Time Slot on DR input is decoded and appears at this output. |
| 48 | VFRO3 | AO | Receive analog amplifier output channel 3. PCM data received on the programmed Time Slot on DR input is decoded and appears at this output. |

## PIN DESCRIPTION (continued)

### ANALOG

| N. | Name | Type | Function |
|---|---|---|---|
| 35 | VFXI0 | AI | TX Input Amplifier channel 0.  Typ 1MΩ input impedance |
| 38 | VFXI1 | AI | TX Input Amplifier channel 1.  Typ 1MΩ input impedance |
| 43 | VFXI2 | AI | TX Input Amplifier channel 2.  Typ 1MΩ input impedance |
| 46 | VFXI3 | AI | TX Input Amplifier channel 3.  Typ 1MΩ input impedance |
| 40 | CAP | AI | AGND Voltage filter pin. A 100nF capacitor must be connected between ground and this pin. |

### POWER SUPPLY

| N. | Name | Type | Function |
|---|---|---|---|
| 25, 36, 37, 44, 45, 56, | VCC/0/1/2/3/4/5 | APS | Total 6 pins: 3.3V analog power supplies, should be shorted together, require 100nF decoupling capacitor to VEE. |
| 26,30, 31, 50, 51,55 | VEE/0/1/2/3/4/5 | APS | Total 6 pins: analog ground, should be shorted together. |
| 9 | VDD | DPS | Digital Power supply 3.3V, require 100nF decoupling capacitor to VSS. |
| 8 | VSS | DPS | Digital Ground |
| 41 | SUB | DPS | Substrate connection. Must be shorted together with VEE and VSS pins as close as possible the chip. |

### NOT CONNECTED

| N. | Name | Type | Function |
|---|---|---|---|
| 15, 16, 17, 18, 32, 34, 47, 49, 64 | N.C. | | Not Connected. |
| 1,2,63 | RES | | Reserved: must be left not connected. |

### DIGITAL

| N. | Name | Type | Function |
|---|---|---|---|
| 27 | M0 | DI | Mode select, see M1 |
| 54 | M1 | DI | <table><tr><td>M1</td><td>M0</td><td>Mode Select</td></tr><tr><td>0</td><td>1</td><td>Pin-strap mode: Basic functions selected by proper pin strapping</td></tr><tr><td>1</td><td>0</td><td>MCU mode: Device controlled via serial interface</td></tr><tr><td>0</td><td>0</td><td>Reset status</td></tr><tr><td>1</td><td>1</td><td>Not Allowed</td></tr></table> |
| 13 | MCLK | DI | Master Clock Input. Four possible frequencies can be used: 1.536/1.544 MHz; 2.048 MHz; 4.096 MHz; 8.192 MHz. The device automatically detect the frequency applied. This signal is also used as bit clock and it is used to shift data into and out of the DR and DX pins. |
| 12 | TSX | ODO | Transmit Time Slot (open drain output, 3.2mA). Normally it is floating in high impedance state except when a time slot is active on the DX output. In this case TSX output pulls low to enable the backplane line driver. |
| 11 | DX | DTO | Transmit PCM interface. It remains in high impedance state except during the assigned time slots during wich the PCM data byte is shifted out on the rising edge of MCLK. |
| 10 | DR | DI | Receive PCM interface. It remains inactive except during the assigned receive time slots during which the PCM data byte is shifted in on the falling edge of MCLK. |
| 61 | IO7 | DIO | Slic control I/O pin #7. Can be programmed as input or output via DIR register. Depending on content of CONF register can be a static input/output or a dynamic input/output synchronized with the CSn output signals controlling the SLICs. |

**PIN DESCRIPTION** (continued)

DIGITAL

| N. | Name | Type | Function |
|---|---|---|---|
| 60 | IO8 | DIO | Slic control I/O pin #8. (see IO7 description). |
| 59 | IO9 | DIO | Slic control I/O pin #9. (see IO7 description). |
| 58 | IO10 | DIO | Slic control I/O pin #10. (see IO7 description). |
| 57 | IO11 | DIO | Slic control I/O pin #11. (see IO7 description). |

DIGITAL (DUAL MODE)

| N. | Name | Type | Function |
|---|---|---|---|
| 14 | FS/FS0 | DI | MCU control mode: FS.<br>Frame Sync. Pulse. A pulse or a squarewave waveform with an 8kHz repetition rate is applied to this pin to define the start of the receive and transmit frame. Effective start of the frame can be then shifted of up to 7 clock pulses indipendently in receive and transmit directions by proper programming of the PCMSH register.<br>Pin-strap control mode: FS0.<br>Frame Sync. pulse of channel #0. One MCLK cycle long , starts PCM data transfer in the Time Slot following its falling edge (Short Frame Delayed Timing). |
| 19 | IO0/GR2 | DIO/DI | MCU control mode: IO0.<br>Slic control I/O pin #0. Can be programmed as input or output via DIR register. Depending on content of CONF register can be a static input/output or a dynamic input/output synchronized with the CSn output signals controlling the SLICs.<br>Pin-strap control mode: GR2.<br>Receive gain programming channel 2:<br>1: Receive gain = = -0.8dB<br>0: Rec. gain = -4.3dB |
| 20 | IO1/PD2 | DIO/DI | MCU control mode: IO1.<br>Slic control I/O pin #1. (see IO0 description).<br>Pin-strap control mode: PD2.<br>Power Down command channel 2:<br>1: Channel 2 Codec is in power down.<br>(equivalent to CONF reg bit2 = 1)<br>0: Channel 2 Codec is in power up.<br>(equivalent to CONF reg. bit2 = 0) |
| 21 | IO2/GR3 | DIO/DI | MCU control mode: IO2.<br>Slic control I/O pin #2. (see IO0 description)<br>Pin-strap control mode: GR3.<br>Receive gain programming channel 3. (see GR2 description) |
| 22 | IO3/PD3 | DIO/DI | MCU control mode: IO3.<br>Slic control I/O pin #3. (see IO0 description).<br>Pin-strap control mode: PD3.<br>Power Down command channel 3. (see PD2 description) |
| 23 | IO4/FS1 | DIO/DI | MCU control mode: IO4<br>Slic control I/O pin #4. (see IO0 description).<br>Pin-strap control mode: FS1.<br>Frame Sync. pulse of channel #1. One MCLK cycle long , starts PCM data transfer in the Time Slot following its falling edge (Short Frame Delayed Timing). |
| 24 | IO5/FS2 | DIO/DI | MCU control mode: IO4.<br>Slic control I/O pin #5. (see IO0 description).<br>Pin-strap control mode: FS2.<br>Frame Sync. pulse of channel #1. One MCLK cycle long , starts PCM data transfer in the Time Slot following its falling edge (Short Frame Delayed Timing). |
| 62 | IO6/FS3 | DIO/DI | MCU control mode: IO4.<br>Slic control I/O pin #6. (see IO0 description).<br>Pin-strap control mode: FS3.<br>Frame Sync. pulse of channel #1. One MCLK cycle long , starts PCM data transfer in the Time Slot following its falling edge (Short Frame Delayed Timing). |

**PIN DESCRIPTION** (continued)

| N. | Name | Type | Function |
|---|---|---|---|
| 28 | $\overline{CS0}$/GX0 | DO/DI | MCU control mode: $\overline{CS0}$.<br>Slic CS control #0.<br>Depending on CONF reg. content can be a CS output for SLIC #0 or a static I/O.<br>When configured as CS output it is automatically generated by the Codec with a repetition time of 31.25µs. In this mode also the $IO_{11..0}$ are synchronized and carry proper data in and out synchronous with CS.<br>Pin-strap control mode: GX0.<br>Transmit gain programming channel 0:<br>1: Transmit gain = 0dB<br>0: Transmit gain = - 3.5dB |
| 29 | $\overline{CS1}$/GX1 | DO/DI | MCU control mode: $\overline{CS1}$:<br>Slic CS control #1, (see $\overline{CS0}$ description).<br>Pin-strap control mode: GX1.<br>Transmit gain programming channel 1 (see GX0 description) |
| 53 | $\overline{CS2}$/GX2 | DO/DI | MCU control mode: $\overline{CS2}$.<br>Slic CS control #2, (see $\overline{CS0}$ description).<br>Pin-strap control mode: GX2.<br>Transmit gain programming channel 2 (see GX0 description) |
| 52 | $\overline{CS3}$/GX3 | DO/DI | MCU control mode: $\overline{CS3}$.<br>Slic CS control #3, (see $\overline{CS0}$ description).<br>Pin-strap control mode: GX3.<br>Transmit gain programming channel 3 (see GX0 description) |
| 4 | $\overline{CS}$/PD1 | DI/DI | MCU control mode: $\overline{CS}$.<br>Chip Select of Serial Control Bus. When this pin is low control information can be written to or read from the device via the CI and CO pins.<br>Pin-strap control mode: PD1.<br>Power Down command channel 1. (see PD2 description). |
| 7 | CCLK/GR1 | DI/DI | MCU control mode: CCLK.<br>Clock of Serial Control Bus. This clock shifts serial control ilnformation into or out of CI or CO when CS input is low depending on the current instruction. CCLK may be asyncronous with the other system clocks.<br>Pin-strap control mode: GR1.<br>Receive gain programming ch. 1, (see GR2 description). |
| 6 | CI/PD0 | DI/DI | MCU control mode: CI.<br>Control Data Input of Serial Control Bus. Control data is shifted in the device when CS is low and clocked by CCLK.<br>Pin-strap control mode: PD0.<br>Power Down command channel 0. (see PD2 description). |
| 5 | CO/GR0 | DTO/DI | MCU control mode: CO.<br>Control Data Output of Serial Control Bus. Control data is shifted out the device when CS is low and clocked by CCLK. During the first 8 CCLK pulses the CO pin is H. I., valid data are shifted out during the following 8 CCLK pulses.<br>Pin-strap control mode: GR0.<br>Receive gain programming ch. 0, (see GR2 description). |
| 3 | $\overline{INT}$/AMU | ODO/DI | MCU control mode: $\overline{INT}$.<br>Interrupt output (open drain), goes low when a data change has been detected in the I/O pins. One mask registers allow to mask any I/O pin. Interrupt is reset when the I/O register is read.<br>Pin-strap control mode: AMU.<br>A/µ law selection:<br>AMU=0: µ law<br>AMU=1: A law, even bit inverted |

## FUNCTIONAL DESCRIPTION

### POWER ON INITIALIZATION

When power is first applied it is recommended to reset the device by forcing the condition M1.0=00, in order to to clear all the internal registers.

In MCU mode M0 is set steadily Low and the device is reset by applying a negative pulse to M1 (its operative level in MCU mode is High); same result can be obtained by writing an High level into the control bit RES of the CONF register.

In Pin-strap mode M1 is set steadily Low and the device is reset by applying a negative pulse to M0 (its operative level in Pin-strap mode is High); at the end of the Reset phase (M0=High) the device is programmed according to the logical configuration of the control pins.

During the Reset condition all the I/On and CS_n pins are set as inputs , DX is set in high impedance and all VFROn outputs are forced to AGND.

### POWER DOWN STATE

Each of the four channel may be put into power down mode by setting the appropriate bit in the CONF register or strapping to VDD the proper pin. In this mode the eventual programmed DX channel is set in high impedance while the VFRO outputs are forced to AGND. In Pin strap mode the value forced on the input pin is internally updated every FS signal.

### TRANSMIT PATH

The analog VFXI signal through  an amplifier stage is applied to a PCM converter and the cor-

responding digital signal is sent to  DX output.

In MCU mode, the amplifier gain can be programmed with two different values by means of TXG Reg. : 0dB or +3.52 dB.

A programmable gain block after the A/D conversion allows to set transmit gain in 12dB range, with steps <0.1dB by writing proper code into GTXn register.

Setting GTXn=00h , the transmitted signal is muted,  i.e. an idle PCM signal is generated on DX.

A/$\mu$ coding Law is selected by bit5 (AMU) of CONF reg.

Setting LIN=1 (bit6 of CONF reg.) the Linear coding Law is selected (16bits); in this case the signal sent on DX will take two adjacent PCM time slots.

In Pin-strap mode, the amplifier gain is set to 0dB; only two values  of Transmit gain can be selected according to the level of GXn control input (in Pin-strap):

GXn=1 selects the gain corresponding to GTXn=FFh  (0dB)

GXn=0 selects the gain corresponding to GTXn=8Fh  ( -3.5dB)

Different gain value is obtained  through  proper voltage divider.

A/$\mu$ coding Law is selected according to AMU pin level:

AMU=0    $\mu$-Law selected.

AMU=1    A-Law selected.

VFXI  input   must be AC coupled to the signal source;  the voltage   swing  allowed  is 1.0Vpp
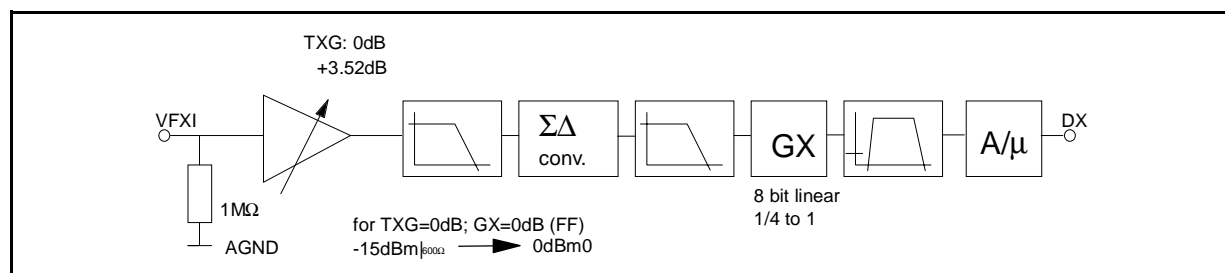
**Figure 1. Transmit path.**
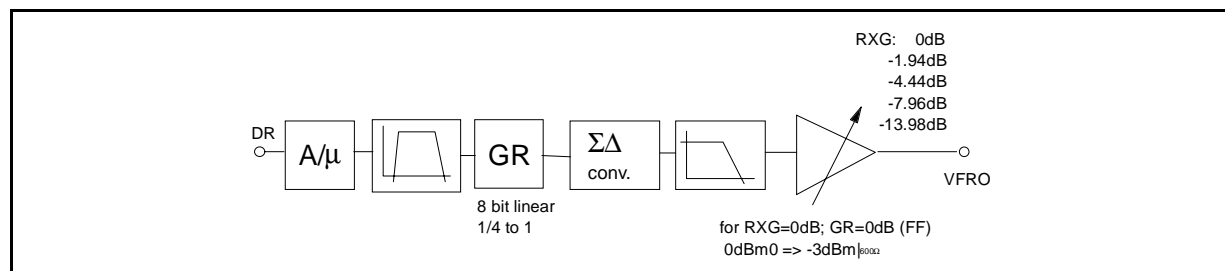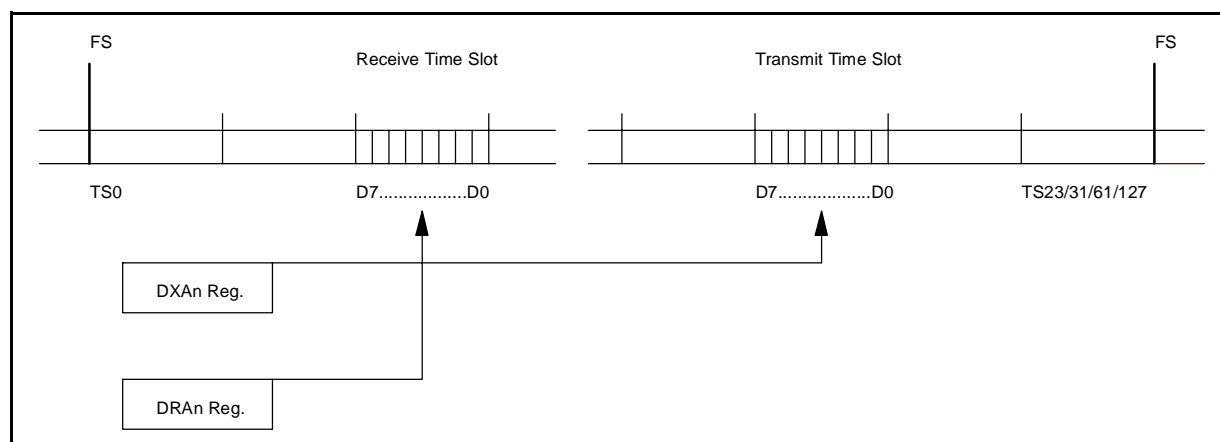


**Figure 2. Receive path.**

**Figure 3. MCU mode: Time - Slot Assignment**



when the preamplifier gain is set 0dB or 0.66Vpp if the gain is set to 3.52dB (MCU mode only); higher levels must be reduced through proper dividers.

Typical impedance of VFXI input is 1Mohm.

RECEIVE PATH

The received PCM signal DR through the decoder section, the gain select block and the D/A converter is converted in an analog signal which is transfered to VFRO output through an amplifier stage.

In MCU mode a programmable gain block before the A/D conversion allows to set receive gain in 12dB range, with steps <0.1dB by writing proper code into GRXn register.

The amplifier gain can be programmed with five different values by means of RXG Register:
0dB -1.94dB -4.44dB -7.96dB -13.98dB.

Setting GRXn=00h , the receive signal is muted and VFRO output is set to AGND.

A/$\mu$ coding Law is selected by bit5 (AMU) of CONF reg.

Setting LIN = 1 (bit6 of CONF reg.) the Linear coding Law is selected (16bits); in this case the signal received on DR will take two adjacent PCM time slots.

in pin Strap mode only two values of Receive Gain can be selected according to the level of GRn control input (in Pin Strap)

GRn = 1 selects the gain corresponding to GRXn = E2h, RXG = 0dB (-0.8dB)

GRn = 0 selects the gain corresponding to GRXn = AFh, RXG = -1.94dB (-4.3dB)

Different gain value is obtained through proper voltage divider.

A/$\mu$ coding Law is selected according to AMU pin level:

AMU=0   $\mu$-Law selected.

AMU=1   A-Law selected.

VFRO output, referred to AGND  must be AC coupled to the load, referred to VSS,  to prevent a DC current flow.

VFRO has a drive capability of   1.0mA (peak value), with a max AC swing of 2Vpp.

In order to get the best noise performances it is recommended to keep the GRX value as close as possible to the maximum (FFh) setting properly the additional attenuation by means of RXG.

PCM INTERFACE

The STLC5046 dedicate five pins (six in pin strap mode) to the interface with the PCM highways.

MCLK represents the bit clock and is also used by the device as a source for the clock of the internal Sigma Delta converter timings. Four possible frequencies can be used: 1.536/1.544MHz (24 channels PCM frame); 2048MHz (32 channels PCM frame); 4.096MHz (64 channels PCM frame); 8.192MHz  (128 channels PCM frame). The operating frequency is automatically detected by the device when both MCLK and FS are applied. MCLK is synchronizing both the transmit data (DX) and the receive data (DR).

**MCU mode:**

The Frame Sync. signal  FS is the common time base for all the four channels; Short (one MCLK period) or Long (more than one MCLK period) FS are allowed.

Transmit and Receive programmable Time-Slots are framed to an internal sync. signal that can be coincident with FS or delayed of 1 to 7 MCLK cycles depending on the programming of PCMSH

**Figure 4. Pin Strap mode: Time Slot Assignment**
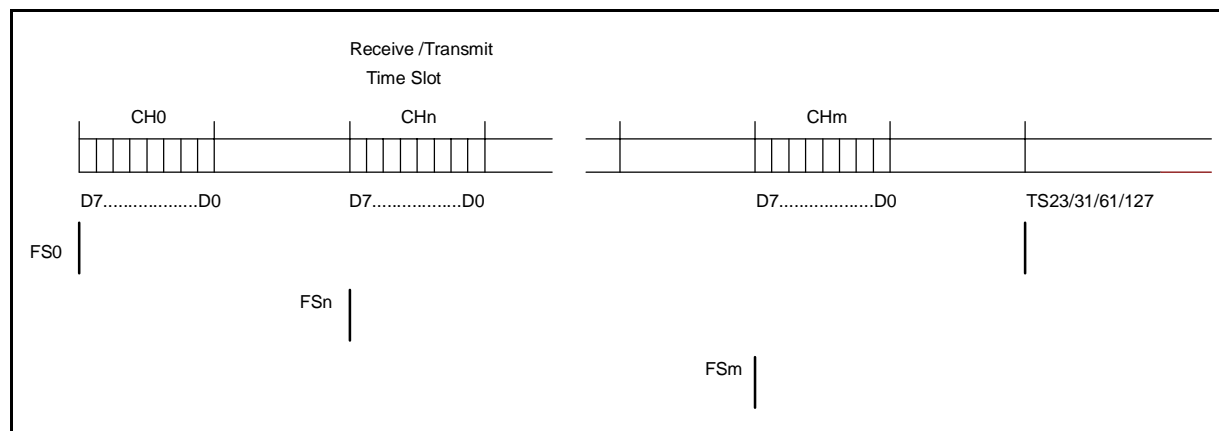


register.

DX represent the transmit PCM interface. It remains in high impedance state except during the assigned time slots during which the PCM data byte is shifted out on the rising edge of MCLK. The four channels can be shifted out in any possible timeslot as defined by the DXA0 to DXA3 registers. If one codec is set in Power Down by software programming the corresponding timeslot is set in High Impedance. When linear coding mode is selected by CONF register programming the output channel will need two consecutive timeslots (see register description).

DR represent the receive PCM interface. It remains inactive except during the assigned time slots during wich the PCM data byte is shifted in on the falling edge of MCLK. The four channels are shifted in any possible timeslot as defined by the DRA0 to DRA3 registers.

**Pin Strap Mode**

When pinstrap mode is selected, dedicated Frame Sync. FS3..0 are provided on dual function pins:

| MCU | Pin-strap | Pin |
|-----|-----------|-----|
| FS | FS0 | 14 |
| IO4 | FS1 | 23 |
| IO5 | FS2 | 24 |
| IO6 | FS3 | 62 |

The PCMSH register cannot be accessed, therefore the beginning of the transmit and receive frame is identified by the rising edge of the FSn signal.

Each channel has its dedicated Frame Sync. signal FSn. Short or Long frame timing is automatically selected; depending on the FS signal applied to FS0 input. The assigned Time Slot

(Transmit and Receive) takes place in the 8 MCLK cycles following the falling edge of FSn in case of Short Frame or the rising edge in case of Long Frame. If one codec is set in Power Down by proper pin strap configuration the corresponding timeslot is not loaded and the VFRO output is kept at steady AGND level.

Finally by means of the LOOPB register is possible to implement a digital or analog loopback on any of the selected channels.

$\overline{\text{TSX}}$ represent the Transmit Time Slot (open drain output, 3.2mA). Normally it is floating in high impedance state except when a time slot is active on the DX output. In this case TSX output pulls low to enable the backplane line driver. Should be strapped to VSS when not used.

**Table 1. Control byte structure.**

| First Byte (Address) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| R/$\overline{\text{W}}$ | D/$\overline{\text{S}}$ | A5 | A4 | A3 | A2 | A1 | A0 |
| D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |

R/$\overline{\text{W}}$ = 0: Write Register
R/$\underline{\text{W}}$ = 1: Read Register
D/$\underline{\text{S}}$ = 0: Single byte
D/$\overline{\text{S}}$ = 1: Two bytes
A5..A0: Register Address

CONTROL INTERFACE

STLC5046 has two control modes, a microprocessor control mode and a pin strap control mode. The two modes are selected by M0 and M1 pins. When M0 = low, M1 = high (MCU control mode) the MCU port is activated; and the 41 registers of the device can be programmed. When M0 = high, M1 = low (Pin-strap mode) the microprocessor control port is disabled and some of the digital pins change their function allowing to perform a very basic programming of the device.

In pin-strap mode the status of the control pins is entered at power-on reset and refreshed at any Frame Sync. cycle.

In MCU mode the control information is written to or read from STLC5046 via the serial four wires control bus :

CCLK : Control Clock

$\overline{CS}$ : Chip Select input

CI : Serial Data input

CO : Serial Data output

All control instructions require 2 bytes, with the exception of the single byte for command synchronization. The first byte specify the register address, and the type of access (Read or Write).

The second byte contain the data to be loaded into the register (on CI wire) or carried out the register content (on CO wire) depending on the R/W bit of the first byte. CO wire is normally in High Impedance and goes to low impedance only during the second byte in case of Read operation. This allows to use a common wire for both CI/CO.

Serial data CI is shifted to the serial input register on the rising edge of CCLK and CO is shifted out on the falling.

CS, normally High, is set Low during the transmission / reception of a byte, lasting 8CCLK pulses .

Though, in general, two bytes of the same instruction take two CS separated cycles , STLC5046 can handle the data transfer in a single 16 CCLK CS cycle, in both the directions.

One additional wire provided to the control interface is an open drain interrupt output (INT) that goes low when a change of status is detected on the I/O pins.

SLIC CONTROL INTERFACE

The device provides 12 I/O pins plus 4 CS signals. The interface can work in dynamic or static mode: it can be selected by means of DIR register.

- Dynamic Mode: the I/O pins are configured as input or output by means of DIR register. The CS signals are used to select the different SLIC interface. In this case the I/O pin can be multiplexed. The data loaded from SLIC#n via I/O pins configured as input can be read in the DATAn register. The data written in a DATAn register will be loaded on the I/O pins configured as output when the Csn signal will be active.

- Static Mode: The CS signal can be used as I/O pins. They can be configured as input or output I/O by means of DATA1 register. The data corresponding to the CS signal can be read or written by means of DATA2 register. All data related to th other I/O pins can be read or written by means of DATA0 register.

**REGISTERS ADDRESSES (only MCU mode)**

| Addr. | Name | Description |
|---|---|---|
| 00h | CONF | Configuration Register |
| 01h | DIR-L | I/O Direction (bit 7-0) |
| 02h | DIR-H | I/O Direction (bit 11-8) |
| 03h | DATA0-L | I/O Data ch#0/ Static Data; (bit 7-0) |
| 04h | DATA0-H | I/O Data ch#0/ Static Data ; (bit 11-8) |
| 05h | DATA1-L | I/O Data ch#1 (bit 7-0) / CS Direction |
| 06h | DATA1-H | I/O Data ch#1 (bit 11-8) |
| 07h | DATA2-L | I/O Data ch#2 (bit 7-0) / CS Data |
| 08h | DATA2-H | I/O Data ch#2 (bit 11-8) |
| 09h | DATA3-L | I/O Data ch#3 (bit 7-0) |
| 0Ah | DATA3-H | I/O Data ch#3 (bit 11-8) |
| 0Bh | GTX0 | Transmit Gain ch#0 |
| 0Ch | GTX1 | Transmit Gain ch#1 |
| 0Dh | GTX2 | Transmit Gain ch#2 |
| 0Eh | GTX3 | Transmit Gain ch#3 |
| 0Fh | GRX0 | Receive Gain ch#0 |
| 10h | GRX1 | Receive Gain ch#1 |
| 11h | GRX2 | Receive Gain ch#2 |
| 12h | GRX3 | Receive Gain ch#3 |
| 13h | DXA0 | Transmit Timeslot ch#0 |
| 14h | DXA1 | Transmit Timeslot ch#1 |
| 15h | DXA2 | Transmit Timeslot ch#2 |
| 16h | DXA3 | Transmit Timeslot ch#3 |
| 17h | DRA0 | Receive Timeslot ch#0 |
| 18h | DRA1 | Receive Timeslot ch#1 |
| 19h | DRA2 | Receive Timeslot ch#2 |
| 1Ah | DRA3 | Receive Timeslot ch#3 |
| 1Bh | PCMSH | PCM Shift Register |
| 1Ch | DMASK-L | Interrupt Mask I/O Port (03h) |
| 1Dh | DMASK-H | Interrupt Mask I/O Port (04h) |
| 1Eh | CMASK | Interrupt Mask I/O Port (07h) |
| 1Fh | PCHK-A | Persistency Check Time for Input A |
| 20h | PCHK-B | Persistency Check Time for Input B |
| 21h | INT | Interrupt Register |
| 22h | ALARM | Alarm Register |
| 23h | AMASK | Interrupt Mask for Alarm |
| 24h | LOOPB | Loopback Register |
| 25h | TXG | Transmit preamp. Gain |
| 26h | RXG-1,0 | Receive preamp. Gain (ch1 ch0) |
| 27h | RXG-3,2 | Receive preamp. Gain (ch3 ch2) |
| 31h | SRID | Silicon revision identification code |

REGISTERS DESCRIPTION

**Configuration Register (CONF)**

Addr=00h; Reset Value=3Fh

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| RES | LIN | AMU | STA | PD3 | PD2 | PD1 | PD0 |

RES=0 Normal Operation

RES=1 Device Reset: I/0n and $\overline{CSn}$ are all inputs, DX is H.I. (equivalent to Hw. reset).

LIN=0    A or $\mu$ law PCM encoding

LIN=1    Linear encoding (16 bits), two's complement.

AMU=0 $\mu$ law selection

AMU=1 A law selection (even bits inverted)

STA=0 $\overline{CS0}$ to $\overline{CS3}$ scan the four SLICs connected to the I/O control port, each CS has a 31.25$\mu$s repetition time.

STA=1; I/O are static, $\overline{CS0}$ to $\overline{CS3}$ are configured as generic static I/O

PD3..0=0 Codec 3..0 is active

PD3..0=1 Codec 3..0 is in power Down. When one codec is in Power Down the corresponding VFRO output is forced to AGND. and the corresponding transmit time slot on DX is set in H.I.

Pin strap value:

| RES | 0 | AMU | 0 | PD3 | PD2 | PD1 | PD0 |
|-----|---|-----|---|-----|-----|-----|-----|

**I/O Direction Register (DIR)**

Addr=01h; Reset Value=00h
Addr=02h; Reset Value=X0h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| $IO_7$ | $IO_6$ | $IO_5$ | $IO_4$ | $IO_3$ | $IO_2$ | $IO_1$ | $IO_0$ |
| | | | | $IO_{11}$ | $IO_{10}$ | $IO_9$ | $IO_8$ |

$IO_{11..0} = 0$; I/O pin 11..0 is an input, data on the I/O input is written in DATAn register bit 11..0.

$IO_{11..0} = 1$; I/O pin 11..0 is an output, data contained in DATAn register bit11..0 is transferred to the I/O output.

Pin strap value:

| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**I/O Data Register channel #0 (DATA0)**

Addr=03h; Reset Value=00h
Addr=04h; Reset Value=X0h

If bit 4 of CONF register (STA)=0
Dynamic I/O mode:

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| $D0_7$ | $D0_6$ | $D0_5$ | $D0_4$ | $D0_3$ | $D0_2$ | $D0_1$ | $D0_0$ |
| | | | | $D0_{11}$ | $D0_{10}$ | $D0_9$ | $D0_8$ |

When $\overline{CS0}$ is active $D0_{11..0}$ are transferred to the corresponding I/O pins configured as outputs (see DIR register). For the I/O pins configured as inputs the corresponding $D0_{11..0}$ will be written by the values applied to those pins while CS0 is low.

If bit 4 of CONF register (STA)=1
Static I/O mode:

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| $DS_7$ | $DS_6$ | $DS_5$ | $DS_4$ | $DS_3$ | $DS_2$ | $DS_1$ | $DS_0$ |
| | | | | $DS_{11}$ | $DS_{10}$ | $DS_9$ | $DS_8$ |

$D_{11..0}$ are transferred to the corresponding I/O pins configured as outputs (see DIR register). For the I/O pins configured as inputs the corresponding $D_{11..0}$ will be written by the values applied to those pins.

Pin strap value:

| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|
| | | | | 0 | 0 | 0 | 0 |

**I/O Data Register channel #1 (DATA1)**

Addr=05h; Reset Value=00h
Addr=06h; Reset Value=X0h

If bit 4 of CONF register (STA)=0
Dynamic I/O mode:

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| $D1_7$ | $D1_6$ | $D1_5$ | $D1_4$ | $D1_3$ | $D1_2$ | $D1_1$ | $D1_0$ |
| | | | | $D1_{11}$ | $D1_{10}$ | $D1_9$ | $D1_8$ |

When $\overline{CS1}$ is active $D1_{11..0}$ are transferred to the corresponding I/O pins configured as outputs (see DIR register). For the I/O pins configured as inputs the corresponding $D1_{11..0}$ will be written by the values applied to those pins while CS1 is low.

If bit 4 of CONF register (STA)=1

Static I/O mode:

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|      |      |      |      | $CIO_3$ | $CIO_2$ | $CIO_1$ | $CIO_0$ |
|      |      |      |      |      |      |      |      |

$CIO0..3=0$ The $\overline{CS0..3}$ is a static input, DATA is written in DATA2 register bits 0..3.

$CIO0..3=1$ The $\overline{CS0..3}$ is a static output, DATA is taken from DATA2 register bits 0..3.

Pin strap value:

| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|
|   |   |   |   | 0 | 0 | 0 | 0 |

## I/O Data Register channel #2 (DATA2)

Addr=07h; Reset Value=00h
Addr=08h; Reset Value=X0h

If bit 4 of CONF register (STA)=0
Dynamic I/O mode:

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| $D2_7$ | $D2_6$ | $D2_5$ | $D2_4$ | $D2_3$ | $D2_2$ | $D2_1$ | $D2_0$ |
|      |      |      |      | $D2_{11}$ | $D2_{10}$ | $D2_9$ | $D2_8$ |

When $\overline{CS2}$ is active $D2_{11..0}$ are transferred to the corresponding I/O pins configured as outputs (see DIR register). For the I/O pins configured as inputs the corresponding D11..0 will be written by the values applied to those pins while CS2 is low.

If bit 4 of CONF register (STA)=1
Static I/O mode:

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|      |      |      |      | $CD_3$ | $CD_2$ | $CD_1$ | $CD_0$ |
|      |      |      |      |      |      |      |      |

$CD_{3..0}$ are transferred to the corresponding $\overline{CS}$ pin if configured as static output (see register DATA1). For the $\overline{CS}$ pins configured as static inputs the corresponding $CD_{3..0}$ will be written by the values applied to those pins.

Pin strap value:

| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|
|   |   |   |   | 0 | 0 | 0 | 0 |

## I/O Data Register channel #3 (DATA3)

Addr=09h; Reset Value=00h
Addr=0Ah; Reset Value=X0h

Used only if bit 4 of CONF register (STA)=0; Dynamic I/O mode:

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| $D3_7$ | $D3_6$ | $D3_5$ | $D3_4$ | $D3_3$ | $D3_2$ | $D3_1$ | $D3_0$ |
|      |      |      |      | $D3_{11}$ | $D3_{10}$ | $D3_9$ | $D3_8$ |

When $\overline{CS3}$ is active D11..0 are transferred to the corresponding I/O pins configured as outputs (see DIR register). For the I/O pins configured as inputs the corresponding D11..0 will be written by the values applied to those pins while CS3 is low.

If bit4 of CONF register (STA)=1

Static I/O mode:

can be used as general purpose R/W registers, without any direct action on the control of the device.

Pin strap value:

| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|
|   |   |   |   | 0 | 0 | 0 | 0 |

## Transmit Gain channel #0 (GTX0)

Addr=0Bh; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|      |      |      |      |      |      |      |      |

00h:Stop any trasmit signal, null level is transmitted in the corresponding timeslot on DX output.

>00h:Digital gain is inserted in the TX path equal to:

$$20\log[0.25+0.75*(\text{progr. value}/256)]$$

Pin strap values:

GX0=1: 0dB gain (value = FFh):

| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

GX0=0: -3.5dB gain (value = 8Fh):

| 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

## Transmit Gain channel #1 (GTX1)

Addr=0Ch; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|      |      |      |      |      |      |      |      |

00h:Stop any trasmit signal, null level is transmit-

ted in the corresponding timeslot on DX output.

>00h:Digital gain is inserted in the TX path equal to:

20log[0.25+0.75*(progr. value/256)]

Pin strap values:

GX0=1: 0dB gain (value = FFh):

| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

GX0=0: -3.5dB gain (value = 8Fh):

| 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

### Transmit Gain channel #2 (GTX2)

Addr=0Dh; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|      |      |      |      |      |      |      |      |

00h: Stop any trasmit signal, null level is transmitted in the corresponding timeslot on DX output.

>00h:Digital gain is inserted in the TX path equal to:

20log[0.25+0.75*(progr. value/256)]

Pin strap values:

GX0=1: 0dB gain (value = FFh):

| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

GX0=0: -3.5dB gain (value = 8Fh):

| 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

### Transmit Gain channel #3 (GTX3)

Addr=0Eh; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|      |      |      |      |      |      |      |      |

00h:Stop any trasmit signal, null level is transmitted in the corresponding timeslot on DX output.

>00h:Digital gain is inserted in the TX path equal to:

20log[0.25+0.75*(progr. value/256)]

Pin strap values:

GX0=1: 0dB gan (value = FFh):

| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

GX0=0: -3.5dB gain (value = 8Fh):

| 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

### Receive Gain channel #0 (GRX0)

Addr=0Fh; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|      |      |      |      |      |      |      |      |

00h:Stop any received signal, AGND level is forced on the VFRO0 analog output.

>00h:Digital gain is inserted in the RX path equal to:

20log[0.25+0.75*(progr. value/256)]

Pin strap values:

GR0=1: -0.8dB gain (value = E2h):

| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
|---|---|---|---|---|---|---|---|

GR0=0: -2.36dB gain (value = AFh):

| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

Overall gain including also RXG:

GR0 = 1:-0.8dB; GR0 = 0: -4.3dB

### Receive Gain channel #1 (GRX1)

Addr=10h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|      |      |      |      |      |      |      |      |

00h:Stop any received signal, AGND level is forced on the VFRO1 analog output.

>00h:Digital gain is inserted in the RX path equal to:

20log[0.25+0.75*(progr. value/256)]

Pin strap values:

GR1=1: -0.8dB gain (value = E2h):

| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
|---|---|---|---|---|---|---|---|

GR1=0: -2.36dB gain (value = AFh):

| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

Overall gain including also RXG:

GR1= 1:-0.8dB; GR1 = 0: -4.3dB

### Receive Gain channel #2 (GRX2)

Addr=11h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|      |      |      |      |      |      |      |      |

00h:Stop any received signal, AGND level is forced on the VFRO2 analog output.

>00h:Digital gain is inserted in the RX path equal to:

20log[0.25+0.75*(progr. value/256)]

Pin strap values:

GR2=1: -0.8dB gain (value = E2h):

| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
|---|---|---|---|---|---|---|---|

GR2=0: -2.36dB gain (value = AFh):

| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

Overall gain including also RXG:

GR2 = 1:-0.8dB; GR2 = 0: -4.3dB

**Receive Gain channel #3 (GRX3)**

Addr=12h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|      |      |      |      |      |      |      |      |

00h:Stop any received signal, AGND level is forced on the VFRO3 analog output.

>00h:Digital gain is inserted in the TX path equal to:

20log[0.25+0.75*(progr. value/256)]

Pin strap values:

GR3=1: -0.8dB gain (value = E2h):

| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
|---|---|---|---|---|---|---|---|

GX3=0: -4.3dB gain (value = AFh):

| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

Overall gain including also RXG:

GR3 = 1:-0.8dB; GR3 = 0: -4.3dB

**Transmit Time Slot channel #0 (DXA0)**

Addr=13h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| EN0  | T06  | T05  | T04  | T03  | T02  | T01  | T00  |

EN0=0: Selected transmit time slot on DX output is in H.I.

EN0=1: Selected transmit time slot on DX output is active carrying out the PCM encoded signal of VFXI0.

T06..0: Define time slot number (0 to 127) on which PCM encoded signal of VFXI0 is carried out.

If linear mode is selected (LIN=1 of CONF register) the 16 bits will be carried out as follows: the 8 most significative bits in the programmed time slot, the 8 least significative bits in the following timeslot.

Example: if T06..T00=00:

| TS0 | | | | | | | | TS1 | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Pin strap value (value 80h):

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

Referred to FS0.

**Transmit Time Slot channel#1 (DXA1)**

Addr=14h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| EN1  | T16  | T15  | T14  | T13  | T12  | T11  | T10  |

EN1=0: Selected transmit time slot on DX output is in H.I.

EN1=1: Selected transmit time slot on DX output is active carrying out the PCM encoded signal of VFXI1.

T16..0:Define time slot number (0 to 127) on which PCM encoded signal of VFXI1 is carried out.

If linear mode is selected (LIN=1 of CONF register) the 16 bits will be carried out as follows: the 8 most significative bits in the programmed time slot, the 8 least significative bits in the following timeslot.

Example: if T16..T10=00:

| TS0 | | | | | | | | TS1 | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Pin strap value (value=80h)

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

Referred to FS1.

**Transmit Time Slot channel #2 (DXA2)**

Addr=15h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| EN2  | T26  | T25  | T24  | T23  | T22  | T21  | T20  |

EN2=0: Selected transmit time slot on DX output is in H.I.

EN2=1: Selected transmit time slot on DX output is active carrying out the PCM encoded signal of VFXI2.

T26..0:Define time slot number (0 to 127) on which PCM encoded signal of VFXI2 is carried out.

If linear mode is selected (LIN=1 of CONF regis-

ter) the 16 bits will be carried out as follows: the 8 most significative bits in the programmed time slot, the 8 least significative bits in the following timeslot.

Example: if T26..T20=00:

| TS0 | | | | | | | | TS1 | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Pin strap value (value=80h)

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

Referred to FS2.

### Transmit Time Slot channel #3 (DXA3)

Addr=16h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| EN3 | T36 | T35 | T34 | T33 | T32 | T31 | T30 |

EN3=0: Selected transmit time slot on DX output is in H.I.

EN3=1: Selected transmit time slot on DX output is active carrying out the PCM encoded signal of VFXI3.

T36..0:Define time slot number (0 to 127) on which PCM encoded signal of VFXI3 is carried out.

If linear mode is selected (LIN=1 of CONF register) the 16 bits will be carried out as follows: the 8 most significative bits in the programmed time slot, the 8 least significative bits in the following timeslot.

Example: if T36..T30=00:

| TS0 | | | | | | | | TS1 | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Pin strap value (value=80h)

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

Referred to FS3.

### Receive Time Slot channel #0 (DRA0)

Addr=17h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| EN0 | R06 | R05 | R04 | R03 | R02 | R01 | R00 |

EN0=0: Disable reception of selected time slot.

EN0=1: Selected receive time slot on DR input is PCM decoded and tranferred to VFRO0 output.

R06..0:Define receive time slot number (0 to 127)

on carrying the PCM signal to be decoded and tranferred to VFRO0 output.If linear mode is selected (LIN=1 of CONF register) the 16 bits will be used as linear code as follows: the 8most significative bits in the programmed time slot, the 8 least significative bits in the following timeslot.

Example: if R06..R00=00:

| TS0 | | | | | | | | TS1 | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Pin strap value (value 80h):

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

Referred to FS0.

### Receive Time Slot channel #1 (DRA1)

Addr=18h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| EN0 | R16 | R15 | R14 | R13 | R12 | R11 | R10 |

EN1=0: Disable reception of selected time slot.

EN1=1: Selected receive time slot on DR input is PCM decoded and tranferred to VFRO1 output.

R16..0:Define receive time slot number (0 to 127) on carrying the PCM signal to be decoded and tranferred to VFRO1 output.If linear mode is selected (LIN=1 of CONF register) the 16 bits will be used as linear code as follows: the 8most significative bits in the programmed time slot, the 8 least significative bits in the following timeslot.

Example: if R16..R10=00:

| TS0 | | | | | | | | TS1 | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Pin strap value (value=80h)

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

Referred to FS1.

### Receive Time Slot channel #2 (DRA2)

Addr=19h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| EN2 | R26 | R25 | R24 | R23 | R22 | R21 | R20 |

EN2=0: Disable reception of selected time slot.

EN2=1: Selected receive time slot on DR input is PCM decoded and tranferred to VFRO1 output.

R26..0:Define receive time slot number (0 to 127)

on carrying the PCM signal to be decoded and tranferred to VFRO2 output.If linear mode is selected (LIN=1 of CONF register) the 16 bits will be used as linear code as follows: the 8most significative bits in the programmed time slot, the 8 least significative bits in the following timeslot.

Example: if R26..R20=00:

| TS0 | | | | | | | | TS1 | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Pin strap value (value=80h)

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

Referred to FS2.

### Receive Time Slot channel #3 (DRA3)
Addr=1Ah; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| EN3 | R36 | R35 | R34 | R33 | R32 | R31 | R30 |

EN3=0:  Disable reception of selected time slot.

EN3=1:  Selected receive time slot on DR input is PCM decoded and tranferred to VFRO1 output.

R36..0:Define receive time slot number (0 to 127) on carrying the PCM signal to be decoded and tranferred to VFRO2 output.If linear mode is selected (LIN=1 of CONF register) the 16 bits will be used as linear code as follows: the 8most significative bits in the programmed time slot, the 8 least significative bits in the following timeslot.

Example: if R36..R30=00:

| TS0 | | | | | | | | TS1 | | | | | | | |
|----|----|----|----|----|----|---|---|---|---|---|---|---|---|---|---|
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

Pin strap value (value=80h)

| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

Referred to FS3.

### PCM Shift Register (PCMSH)
Addr=1Bh; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|  | XS2 | XS1 | XS0 |  | RS2 | RS1 | RS0 |

XS2..0:Effective start of the TX frame is the programmed values of clock pulses (0 to 7) after the FS rising edge.

RS2..0:Effective start of the RX frame is the programmed values of clock pulses (0 to 7) after the

FS rising edge.

Pin strap value (value=00h):

| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

### Interrupt Mask Register for I/O port (DMASK)
Addr=1Ch; Reset Value=FFh
Addr=1Dh; Reset Value=XFh

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| MD7 | MD6 | MD5 | MD4 | MD3 | MD2 | MD1 | MD0 |
|  |  |  |  | MD11 | MD10 | MD9 | MD8 |

MD11..0=1: The corresponding I/O doesn't generate interrupt.

MD11..0=0: The corresponding I/O (programmed as Input) generate interrupt if a change of status is detected.
Input lines with persistency check generate interrupt if  the changed status remains stable longer than the  time programmed in the persistency check registers  PCHKA/B. Lines without persistance check generate an immediate interrupt request.

Mask register has no effect on those pins configured as outputs, those pins will not generate interrupt.

Pin strap value.

| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|
|  |  |  |  | 1 | 1 | 1 | 1 |

### Interrupt Mask Register for CD port (CMASK)
Addr=1Eh; Reset Value=XFh

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|  |  |  |  | MC3 | MC2 | MC1 | MC0 |

In MCU mode, dynamic I/O configuration, MCn bits are the disable/enable  interrupt related to the channel n :

MC3..0= 0  Any I/O line of the related channel is enabled to generate interrupt depending on DMASK setting.
MC3..0=1   Any I/O line of the related chanel is disabled to generate interrupt indipendently of DMASK setting.

In MCU mode, static I/O configuration, MCn bits are the interrupt mask bits related  to CSn that are configured as I/O lines.

MC3..0=1: The corresponding I/O doesn't generate interrupt.
MC3..0=0: The corresponding I/O  generate interrupt if a change of status is detected.

Input lines with persistency check generate interrupt if the changed status remains stable longer than the time programmend in the persistency check registers PCHKA/B

Lines without persistency check generate an immediate interrupt request.

Mask register has no effect on those pins configured as outputs, those pins will not generate interrupt.

Pin strap value (value=00h):

| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|---|---|---|

### Persistency Check Register (PCHK-A/B)

Two input signals per channel , labeled A and B, are submitted to persistency check.

In dynamic mode (STA=0), A and B inputs of the four channels, are sampled on the multiplexed lines IO0 (pin13) and IO1 (pin14).

In static mode (STA=1) the persistency check is performed on four pairs of lines, assigned to each channel according to the table:

| CHAN# | Input A | Input B |
|-------|---------|---------|
| 0 | IO0 (pin 19) | IO1 (pin 20) |
| 1 | IO4 (pin 17) | IO5 (pin 18) |
| 2 | IO6 (pin 48) | IO7 (pin 47) |
| 3 | IO10 (pin 44) | IO11 (pin 43) |

Addr=1Fh;    Reset Value=00h
Addr=20h;    Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
| TA7 | TA6 | TA5 | TA4 | TA3 | TA2 | TA1 | TA0 |
| TB7 | TB6 | TB5 | TB4 | TB3 | TB2 | TB1 | TB0 |

TA7..0 and TB7..0, content of PCHKA and PCHKB registers, define the minimum duration of input A and B to generate interrupt ; spurious transitions shorter than the programmed value are ignored.

The time width can be calculated according to the formula:

Time-Width A = (TA7..0) x 64µs

Time-Width B = (TB7..0) x 64µs

If PCHKA/B is programmed to 00h the persistency check is not performed and any detected transition will generate interrupt.

All the inputs, with or without persistency check, are sampled with a repetition rate of 32µs

Pin strap value:

| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

### Interrupt Register (INT)

Addr=21h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|  |  |  | ICKF | ID3 | ID2 | ID1 | ID0 |

ICKF = 1: If interrupt is generated by a change of bit 0 in register ALARM.

In dynamic I/O configuration the ID3..0 bits latch the interrupt request from the related channel.

Any single bit IDn is cleared after reading related I/O register or by setting MCn bit High (i.e. when channel n is disabled to generate interrupt ).

In static I/O configuration ID0 and ID2 bits latch the interrupt request from I/O11..0 and CS3..0 respectively:

ID0 : is set High when the interrupt is requested from any the I/O11..0 lines.
ID2: is set High when the interrupt is requested from any of the CS3..0 (configured as I/O).
ID0 and ID2 are cleared after reading related I/O register.

ID1 and ID3 are don't care.

Pin strap value (value=00b):

|  |  |  | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

### Alarm Register (ALARM)

Addr=22h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|  |  |  |  |  |  | POR | CKF |

CKF=1: If number of PCM clock pulses in one frame period does not match expected value.
POR=1: If a Power On Reset is detected during operation.

The register ALARM is cleared after reading operation only if signals are inactive.

Pin strap value (value=00h):

|  |  |  |  |  |  | 0 | 0 |
|---|---|---|---|---|---|---|---|

### Interrupt Mask Register for Alarm (AMASK)

Addr=23h; Reset Value=11b

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|------|------|------|------|------|------|------|------|
|  |  |  |  |  |  |  | MCF |

MCF=1: The corresponding alarm bit (CKF) doesn't generate interrupt.

MCF=0: The corresponding alarm bit (CKF) generates interrupt.

Pin strap value (value=00h):

| | | | | | | | 1 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

### Loopback Register (LOOPB)

Addr=24h; Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|
| DL3 | DL2 | DL1 | DL0 | AL3 | AL2 | AL1 | AL0 |

DL3..0=0: Normal Operation

DL3..0=1: Codec #3..0 is set in Digital Loopback mode, this means that the receive PCM signal applied to the programmed Receive Time Slot is transferred to the programmed Transmit Time Slot.

AL3..0=0: Normal Operation

AL3..0=1: Codec #3..0 is set in Analog Loopback mode, this means that the VFRO signal is tranferred to the VFXI input internally into the Codec.

When loopbacks are enabled the signal appears also at the corresponding VFRO output. It is possible to have no signal on the VFRO output programming the GR register to 00h in case of digital loopback.

Pin strap value (value=00h):

| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

### Transmit Preamplifier Gain Register (TXG)

Addr=25h; Reset Value=X0h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|
| | | | | XG3 | XG2 | XG1 | XG0 |

XG3..0=0: Transmit preamplifier gain ch. 3..0 = 0dB

XG3..0=1: Transmit preamplifier gain ch. 3..0 = 3.52dB

Overall transmit gain depends on combination of TXG and GTXn registers. For XGn=0 and GTXn=FF 0dBm0 at DX output correspond to -15dBm$|_{600\Omega}$ (137mVrms) at VFXI input.

Pin strap value (value=00h):

| | | | | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

### Receive Amplifier Gain Registers (RXG-10/32)

Addr: 26h;  Reset Value=00h
Addr: 27h;  Reset Value=00h

| Bit7 | Bit6 | Bit5 | Bit4 | Bit3 | Bit2 | Bit1 | Bit0 |
|---|---|---|---|---|---|---|---|
| | | R12 | R11 | R10 | R02 | R01 | R00 |
| | | R32 | R31 | R30 | R22 | R21 | R20 |

| Rn2 | Rn1 | Rn0 | Receive Amplifier Gain Ch#n  (dB) |
|---|---|---|---|
| 0 | 0 | 0 | Mute |
| 0 | 0 | 1 | -13.98 |
| 0 | 1 | 0 | -7.96 |
| 0 | 1 | 1 | -4.44 |
| 1 | 0 | 0 | -1.94 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 0 |

Overall receive gain depends on the receive amplifier gain (Rn2..0 setting in RXG reg.) and

digital gain (GRXn reg. setting).

As a reference : when Rn2..0 is set for 0dB gain and GRXn=FFh (max. gain) 0dBm0 at DR input correspond to a level at VFRO output equal to 547mVrms (e.g. -3dBm 600ohm)

Pin strap value :

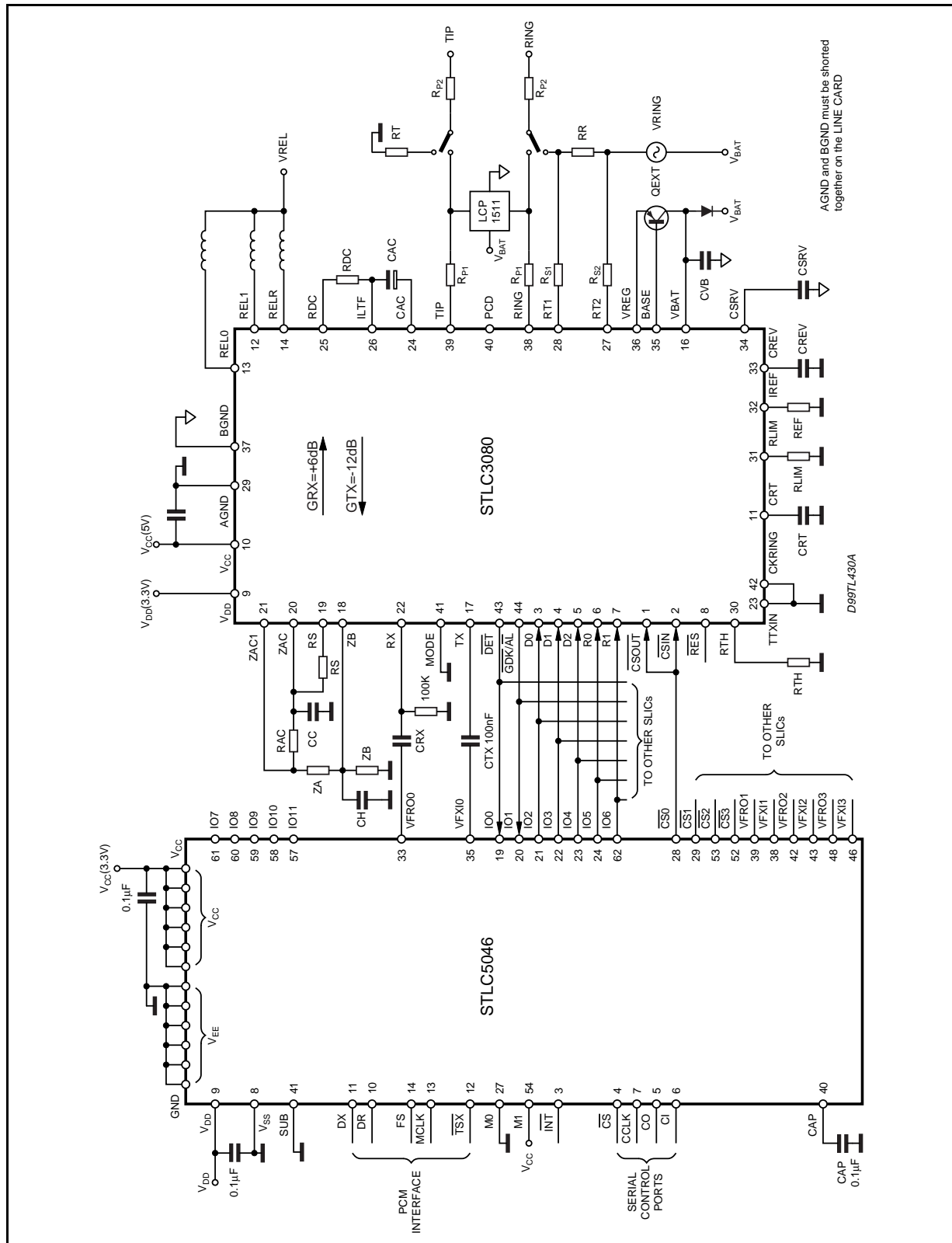| | Rn2 | Rn1 | Rn0 |
|---|---|---|---|
| GRn = 1 | 1 | 1 | 1 |
| GRn = 0 | 1 | 0 | 0 |

Overall gain including also GRXn;

GRn = 1: -0.8dB; GRn = 0: -4.3dB.

### Silicon Revision Identification Code (SR=D)

Addr: 31h; Read Only.

| X | X | X | X | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|

**Figure 5. Typical Application Circuit with STLC3080 without Metering Pulse injection and I/O pins in dynamic mode.**

## ELECTRICAL CHARACTERISTICS

(Typical value 25°C and nominal supply voltage. Minimum and maximum value are guaranteed over the temperature 0 to 70°C range by production testing and supply voltage range shown in the Operating Ranges. Performances over -40 to +85°C are guaranteed by product characterisation unless otherwise specified.)

DIGITAL INTERFACE

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|--------|-----------|----------------|------|------|------|------|
| Vil | Input Voltage Low DI pins | | 0 | | $0.2V_{DD}$ | V |
| Vih | Input Voltage High DI pins (1) | | $0.8V_{DD}$ | | 5.5 | V |
| Iil | Input Current Low DI pins | | -10 | | 10 | µA |
| Iih | Input Current High DI pins | | -10 | | 10 | µA |
| Ci | Input Capacitance (all dig. inp.) | | | 5 | | pF |
| Vol | Output Voltage Low DX, TSX pins | Iol = 3.2mA (other pins Iol = 1mA) | 0 | | 0.4 | V |
| Voh | Output Voltage High DX pinn | Ioh = -3.2mA (other pins Iol = 1mA) | $0.85V_{DD}$ | | VDD | V |

ANALOG INTERFACE

| | | | | | | |
|--------|-----------|----------------|------|------|------|------|
| RIX | Transmit Input Amplifier Input Impedance (VFXI) | | | 1000 | | MΩ |
| ROR | Receive Output Impedance (-1.0V < VFRO < 1.0V, IVFRO = 1mA | | | 1 | | Ω |

POWER DISSIPATION

| | | | | | | |
|--------|-----------|----------------|------|------|------|------|
| Idd (pd) | Power down Current | | | 9 | 11 | mA |
| Idd | Active Current | | | 48 | 60 | mA |

MASTER CLOCK TIMING

| | | | | | | |
|--------|-----------|----------------|------|------|------|------|
| $f_{MCLK}$ | Frequency of MCLK | frequency is automatically detected | | 1.536<br>1.544<br>2.048<br>4.096<br>8.192 | | MHz<br>MHz<br>MHz<br>MHz<br>MHz |
| $t_{WMH}$ | Period of MCLK high | Measured from $V_{IH}$ to $V_{IH}$ | 40 | | | ns |
| $t_{WML}$ | Period of MCLK low | Measured from $V_{IL}$ to $V_{IL}$ | 40 | | | ns |
| $t_{RM}$ | Rise Time of MCLK | Measured from $V_{IL}$ to $V_{IH}$ | | | 15 | ns |
| $t_{FM}$ | Fall Time of MCLK | Measured from $V_{IH}$ to $V_{IL}$ | | | 15 | ns |

PCM INTERFACE TIMING

| | | | | | | |
|--------|-----------|----------------|------|------|------|------|
| $t_{HMF}$ | Hold Time MCLK low to FS low | | 10 | | | ns |
| $t_{SFM}$ | Setup Time, FS high to MCLK low | | 10 | | | ns |
| $t_{DMD}$ | Delay Time, MCLK high to data valid | | | | 10 | ns |
| $t_{DMZ}$[2] | Delay Time, MCLK low to DX disabled | Pull up resistor = 1kΩ $C_{load}$ = 30pF | 5 | | 40 | ns |
| $t_{SDM}$ | Setup Time, $D_R$ valid to MCLK low | | 15 | | | ns |
| $t_{HMD}$ | Hold Time, MCLK low to $D_R$ invalid | | 5 | | | ns |
| $t_{DZC}$[2] | Delay Time, MCLK low to TSX high | Pull up resistor = 1kΩ $C_{load}$ = 30pF | | | 40 | ns |
| $t_{XDP}$ | Delay Time, MCLK high to TSX low | | | | 10 | ns |

(1) All the digital input are five-volt tollerant
 - maximum DC voltage 5.5V
 - maximum peak voltage 6.5V

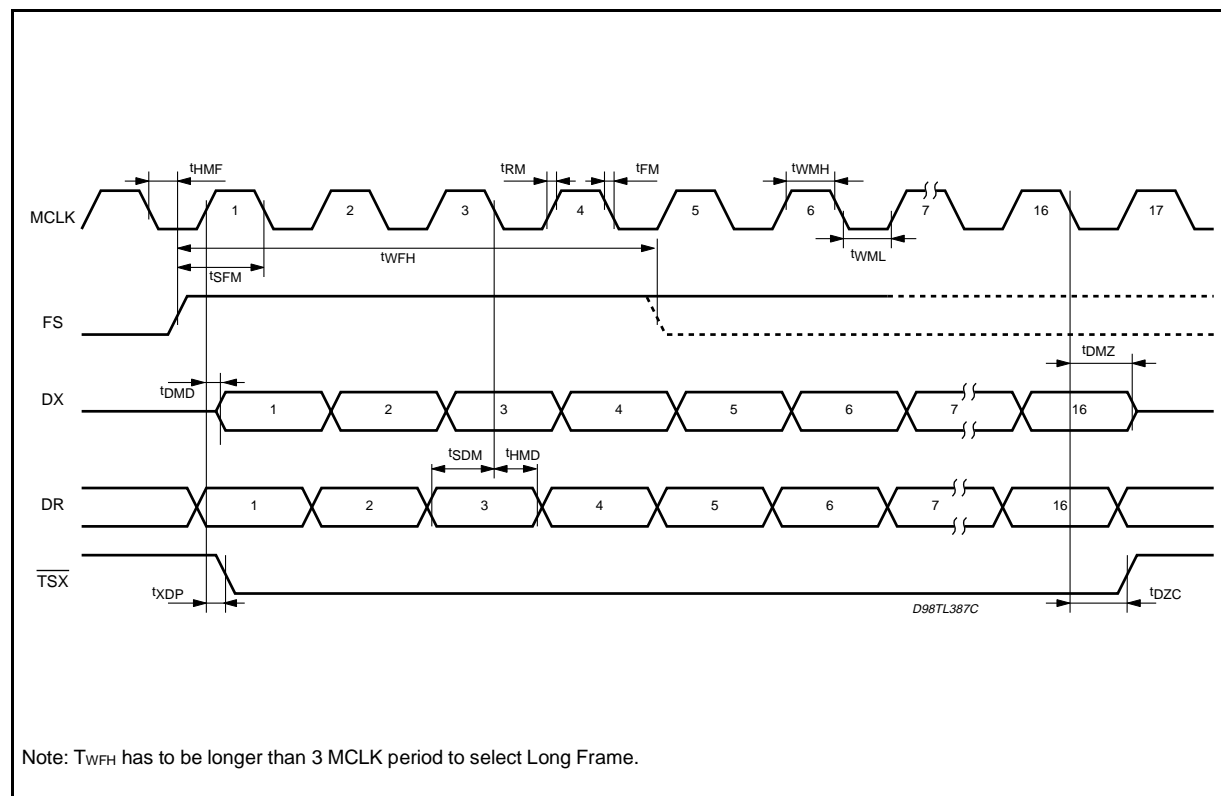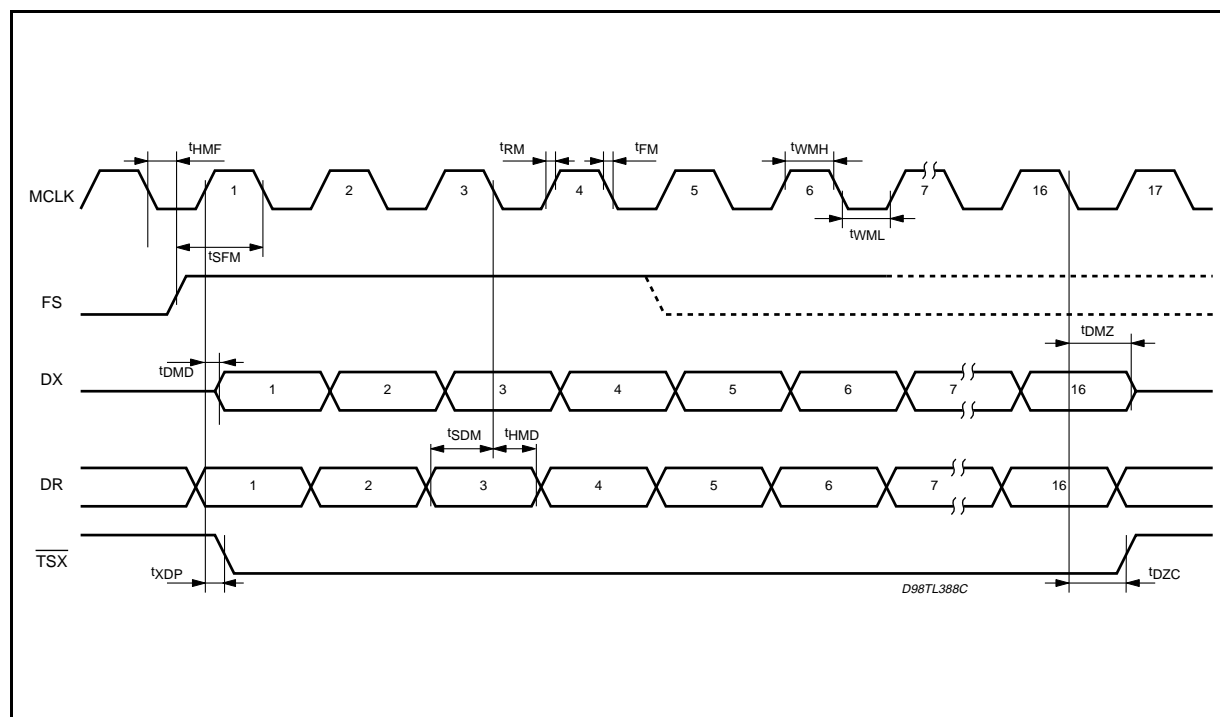(2) It is defined as the time at which the output achivies the off state.

**Figure 6a. Pin-strap mode Short Frame Sync. Timing.**



Note: T$_{WFH}$ has to be shorter than or equal to 3 MCLK period to select Short Frame.

**Figure 6b. Pin Strap mode Long Frame Sync. Timing.**



Note: T$_{WFH}$ has to be longer than 3 MCLK period to select Long Frame.

**Figure 6c. MCU Mode Frame Sync. Timing.**



D98TL388C

## ELECTRICAL CHARACTERISTICS (continued)

SERIAL CONTROL PORT TIMING

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $f_{CCLK}$ | Frequency of CCLK | | | | 4.096 | MHz |
| $t_{WCH}$ | Period of CCLK high | Measured from $V_{IH}$ to $V_{IH}$ | 100 | | | ns |
| $t_{WCL}$ | Period of CCLK low | Measured from $V_{IL}$ to $V_{IL}$ | 100 | | | ns |
| $t_{RC}$ | Rise Time of CCLK | Measured from $V_{IL}$ to $V_{IH}$ | | | 20 | ns |
| $t_{FC}$ | Fall Time of CCLK | Measured from $V_{IH}$ to $V_{IL}$ | | | 20 | ns |
| $t_{HCS}$ | Hold Time, CCLK high to CS– low | | 5 | | | ns |
| $t_{SSC}$ | Setup Time, CS– low to CCLK high | | 10 | | | ns |
| $t_{SDC}$ | Setup Time, CI valid to CCLK high | | 20 | 10 | | ns |
| $t_{HCD}$ | Hold Time, CCLK high to CI invalid | | 10 | | | ns |
| $t_{DCD}$ | Delay Time, CCLK low to CO data valid | | | | 30 | ns |
| $t_{DSD}$ | Delay Time, CS–low to CO data valid | | | | 20 | ns |
| $t_{DDZ}$[1] | Delay Time CS–high or 8th CCLK low to CO high impedance whichever comes first | Pull up resistor = 1kΩ $C_{load}$ = 30pF | | | 50 | ns |
| $t_{HSC}$ | Hold Time, 8th CCLK high to CS– high | | 10 | | | ns |
| $t_{SCS}$ | Set up Time, CS– high to CCLK high | | 10 | | | ns |

(1) It is defined as the time at which the output achivies the off state.

**Figure 7. Serial control port timing.**



*D99TL454*

**ELECTRICAL CHARACTERISTICS** (continued)

SLIC CONTROL INTERFACE TIMING

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|--------|-----------|----------------|------|------|------|------|
| TCS | Chip Select repetition rate | | | 31.25 | | µs |
| tcsw | Chip select pulse width | | | 3.90 | | µs |
| $t_{DIV}$ | Time CS low to data input valid | | | | 1.65 | µs |
| $t_{DII}$ | Time data input invalid to CS high | | | | 1.65 | µs |
| $t_{DOA}$ | Time data output available to CS low | | 1.8 | | | µs |
| $t_{DON}$ | Time CS high to data output not available | | 1.8 | | | µs |

**Figure 8. SLIC Control port timing.**



*D99TL460*
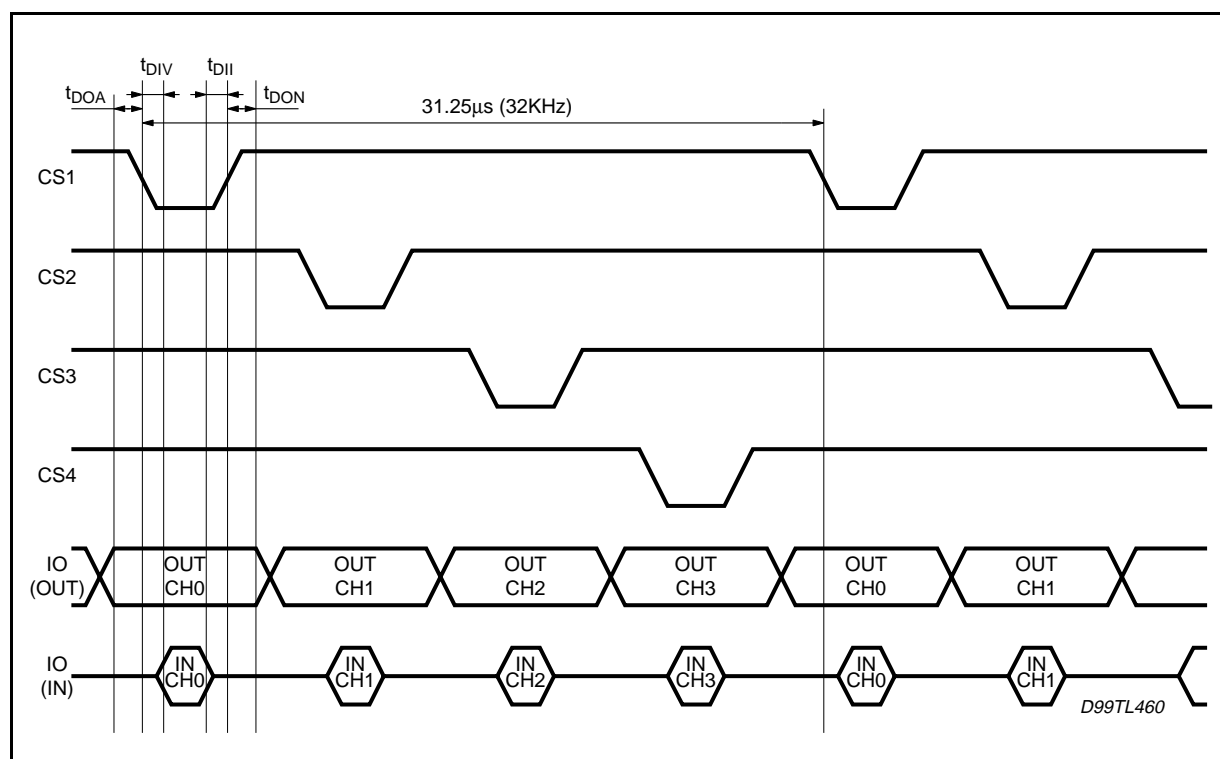
## TRANSMISSION CHARACTERISTICS

TRANSMISSION TRANSFER CHARACTERISTICS

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|--------|-----------|----------------|------|------|------|------|
| | Absolute levels (see Table 19) The nominal 0dBm0 levels are: TXG = 0dB, GTXn = 0dB (FF) | | | 137 | | mVrms |
| GXA | Transmit gain Absolute accuracy | Referred to 0dB level | -0.15 | | 0.15 | dB |
| GXAG | Transmit gain variation with programmed gain (within 3dB from max. dig. level) | | -0.15 | | +0.15 | dB |
| GFX | Gain variation with frequency (relative to gain at 1004Hz); 0dBm0 input signal<br>50Hz<br>60Hz<br>200Hz<br>300-3000Hz<br>3400Hz<br>4000Hz<br>4600Hz and above | | <br><br><br>-1.8<br>-0.15<br>-0.7 | | <br>-20<br>-20<br>0<br>0.15<br>0<br>-14.0<br>-32.0 | dB |
| GAXT | Gain variation with temperature | | -0.10 | | 0.10 | dB |
| GAXE | Gain variation with Supplies ±5% 0dBm0 Input Signal | | -0.05 | | 0.05 | dB |
| GTX | Gain Tracking with Tone (1004Hz μ Law, 820Hz ALaw) | GSX = 3 to -40dBm0<br>GSX = -40 to -50dBm0<br>GSX = -50 to -55dBm0 | -0.2<br>-0.4<br>-1.2 | | 0.2<br>0.4<br>1.2 | dB |
| QDX | Quantization Distortion with Tone (1004Hz μ Law, 820Hz ALaw) | VFXI = +3dbm0<br>VFXI = 0 to -30dBm0<br>VFXI = -40dBm0<br>VFXI = -45dBm0<br>VFXI = -50 to -55dBm0 | 33<br>36<br>30<br>25<br>15 | | | dB |
| NCT | Transmit Noise C Message Weighted (μ Law) | | | 17 | 22 | dBrnCo |
| NPT | Transmit Noise Psophometric Weighted (A Law) | | | -73 | -68 | dBm0p |
| DDX[1] | Differential Envelope Delay (1 to 2.56KHz Input Sinewave @ 0dBm0) | 500Hz<br>604Hz<br>1000Hz<br>1792Hz<br>2604Hz<br>2792Hz | | | 170<br>110<br>25<br>0<br>70<br>95 | μs |
| DAX[1] | Absolute Delay @ 1KHz 500 to 2800Hz | | | | 420 | μs |
| DPXM | Single Frequency Distortion (Mu Law 0dBm0 Sinewave @ 1004Hz) | | | | -46 | dB |
| DPXA | Single Frequency Distortion (A Law 0dBm0 Sinewave @ 820Hz) | | | | -46 | dB |

RECEIVE TRANSFER CHARACTERISTICS

| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|--------|-----------|----------------|------|------|------|------|
| | Absolute levels The nominal 0dBm) levels are VFRO: RGX = 0dB, GRXn = 0db (FF) | | | 547 | | mVrms |
| GRA | Transmit gain Absolute accuracy (within 3dB from max. dig. level) | Referred to 0dB level | -0.15 | | 0.15 | dB |

(1) Typical value not tested in production.
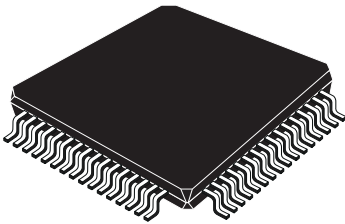
**TRANSMISSION CHARACTERISTICS**

RECEIVE TRANSFER CHARACTERISTICS (continued)

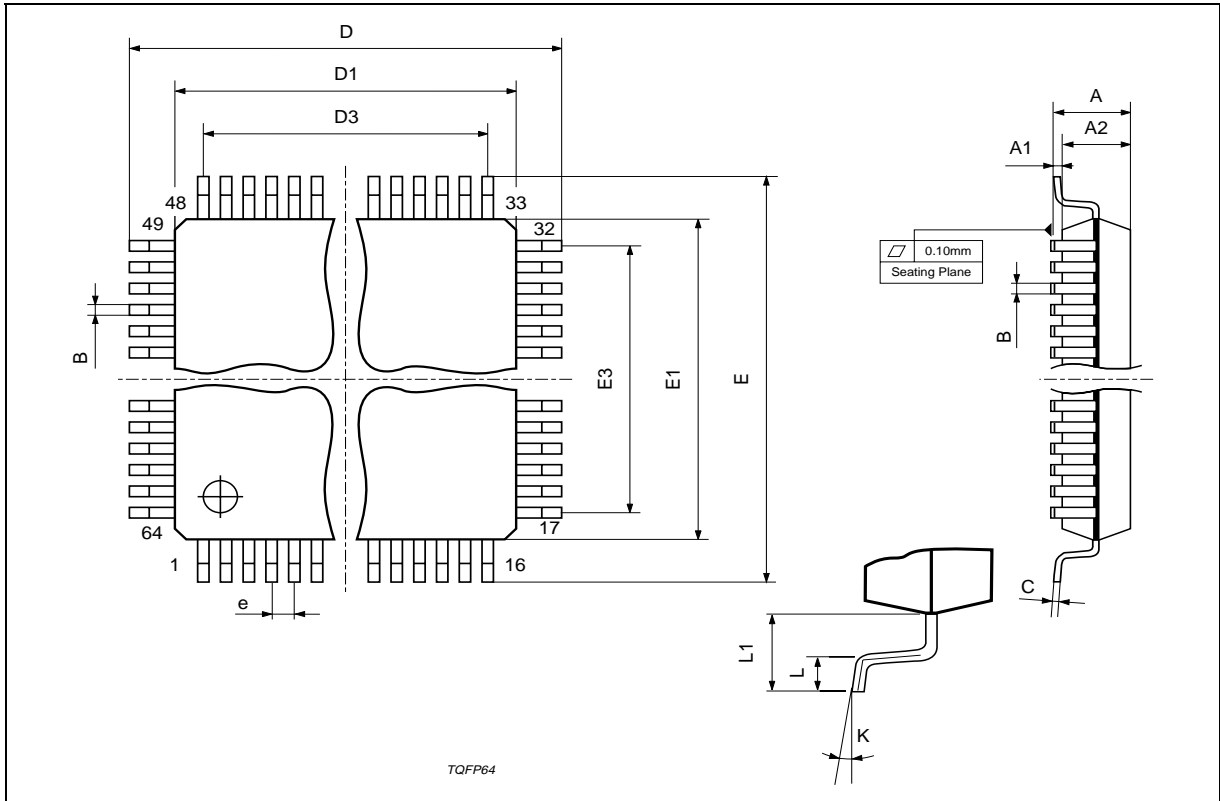| Symbol | Parameter | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| GRAG | Receive Gain Variation with programmed gain | | -0.18 | | +0.18 | dB |
| GFR | Gain variation with frequency (relative to gain at 1004Hz); 0dBm0 input signal. | Below 200Hz<br>200Hz<br>300-3000Hz<br>3400Hz<br>4000Hz | -0.25<br>-0.15<br>-0.7 | | 0.15<br>0.15<br>0.15<br>0<br>-14 | dB |
| GART | Gain variation with temperature | | -0.1 | | +0.1 | dB |
| GARE | Gain variation with supplies | 0dBm0 Input Signal<br>$V_{CC} = V_{DD} = 3.3V \pm 5\%$ | -0.05 | | 0.05 | dB |
| GTR | Gain Tracking with Tone (1004Hz Mu Law, 820Hz A Law) | DR = 3 to -40dBm0<br>DR = -40 to -50dBm0<br>DR = -50 to -55dBm0 | -0.2<br>-0.4<br>-1.2 | | 0.2<br>0.4<br>1.2 | dB |
| QDR | Quantization Distortion with Tone (1004Hz Mu Law, 820Hz A law) | DR = 3 dBm0<br>DR = 0 to -30dBm0<br>DR = -40dBm0<br>DR = -45dBm0<br>DR = -50 to -55dBm0 | 33<br>36<br>30<br>25<br>15 | | | dB |
| GSPR | Out of band spourious Noise 0dBm0 180 to 3400Hz Sinewave at DR | | | | 32 | dB |
| NCR | Receive Noise C Message Weighted (μ Law) | | | 5 | 11 | dBrnCo |
| NPR | Receive Noise Psophometric Weighted (A Law) | | | -85 | -79 | dBm0p |
| DDR[1] | Differential Envelope Delay (1 to 2.56kHz Input Sinewave @ 0dBm0) | 500Hz<br>604Hz<br>1000Hz<br>1792Hz<br>2604Hz<br>2792Hz | | | 25<br>0<br>0<br>0<br>90<br>115 | μs |
| DAR[1] | Absolute Delay @ 1kHz 500 to 2800Hz | | | | 440 | μs |
| DPR1 | Single Frequency Distortion (0dBm0 Sinewave @ 1004Hz) | | | | -46 | dB |
| PSRR | Power Supply Rejection Ratio 1kHz, 50mVrms | | 30 | | | dB |
| CTX-R | Transmit to Receive Crosstalk (input signal 200Hz to 3450Hz at 0dBm0) | | | | -76 | dB |
| CTR-X | Receive to Transmit Crosstalk (input signal 200Hz to 3450Hz at 0dBm0) | | | | -76 | dB |
| CT-ICH | Inter Channel Crosstalk, TX and TX direction. | Input 200 to 3450Hz at 0dBm0 at VFXI of one channel; all other VFXI inputs and all DR inputs receive idle signal. Output is measured at DX of the 3 idle channels.<br><br>Input 200 to 3450Hz at 0dBm0 at DR of one channel; all other DR inputs and all VFXI inputs receive idle signal. Output is measured at VFRO of the 3 idle channels. | | | -78 | dB |

(1) Typical value not tested in production.

| DIM. | mm | | | inch | | |
|------|------|------|------|------|------|------|
| | **MIN.** | **TYP.** | **MAX.** | **MIN.** | **TYP.** | **MAX.** |
| A | | | 1.60 | | | 0.063 |
| A1 | 0.05 | | 0.15 | 0.002 | | 0.006 |
| A2 | 1.35 | 1.40 | 1.45 | 0.053 | 0.055 | 0.057 |
| B | 0.18 | 0.23 | 0.28 | 0.007 | 0.009 | 0.011 |
| C | 0.12 | 0.16 | 0.20 | 0.0047 | 0.0063 | 0.0079 |
| D | | 12.00 | | | 0.472 | |
| D1 | | 10.00 | | | 0.394 | |
| D3 | | 7.50 | | | 0.295 | |
| e | | 0.50 | | | 0.0197 | |
| E | | 12.00 | | | 0.472 | |
| E1 | | 10.00 | | | 0.394 | |
| E3 | | 7.50 | | | 0.295 | |
| L | 0.40 | 0.60 | 0.75 | 0.0157 | 0.0236 | 0.0295 |
| L1 | | 1.00 | | | 0.0393 | |
| K | 0°(min.), 7°(max.) | | | | | |

## OUTLINE AND MECHANICAL DATA



## TQFP64



TQFP64