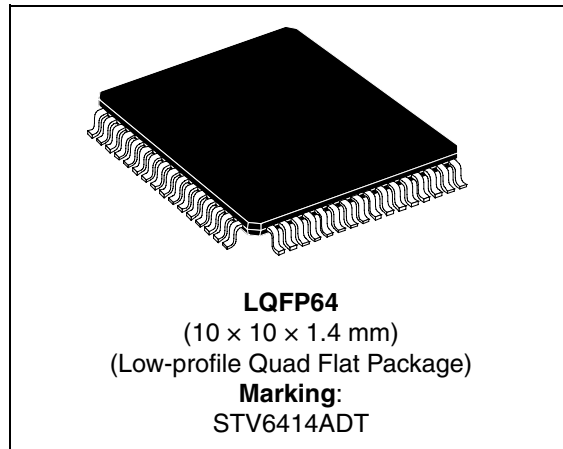


Audio/video switch matrix

Features

- I²C bus control
- Standby mode with interrupt signal output
- Video section
 - 3 CVBS inputs, 2 CVBS outputs
 - 3 Y/C inputs, 2 Y/C outputs
 - Switchable LPFs (low pass filters) on 6 inputs
 - 6 dB gain on all CVBS/Y and C outputs
 - Integrated 150 Ω buffers
 - 2 RGB/FB inputs, 1 tri-state RGB/FB output with 6 dB adjustable gain (from +3 dB to +9 dB)
 - Video muting on all outputs
 - 2 slow blanking inputs/outputs
 - Sync bottom clamp on all CVBS/Y and RGB inputs, average clamp on C inputs
 - SVHS switch on C VCR output
 - Bandwidth: 15 MHz
 - Crosstalk: 50 dB minimum
- Audio section
 - 3 stereo inputs, 3 stereo outputs
 - Stereo-to-mono sound capability
 - 0/6/9 dB selectable gain on one stereo input
 - Full range volume control with soft control
 - Audio muting on all outputs



Description

The STV6414A is a highly integrated I²C bus-controlled audio and video switch matrix, optimized for use in digital set-top box applications. It provides the audio and video routings required in a two SCART set-top box design.

In an LQFP64 (10 × 10 × 1.4 mm) package, the STV6414A is compatible with the STV6413.

Table 1. Device summary

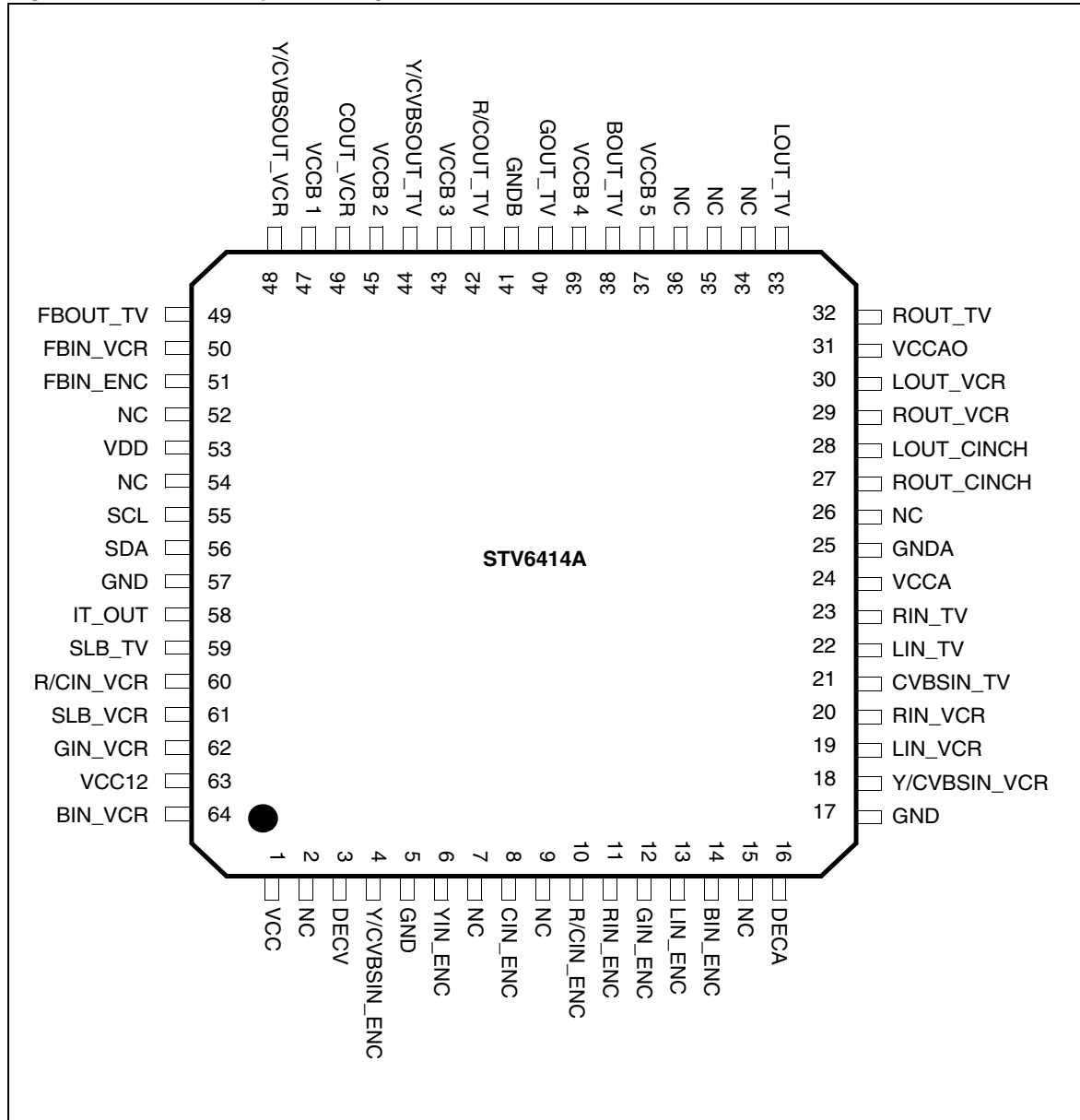
| Order code | Packaging |
|------------|---------------|
| STV6414AD | Tray |
| STV6414ADT | Tape and reel |

Contents

| | | |
|----------|--|-----------|
| 1 | General information | 3 |
| 1.1 | I/O pin description | 4 |
| 2 | Electrical characteristics | 9 |
| 2.1 | Latch-up data | 9 |
| 2.2 | Recommended operating conditions | 9 |
| 2.3 | Audio section characteristics | 10 |
| 2.4 | Video section characteristics | 12 |
| 2.5 | Chroma section characteristics | 13 |
| 2.6 | Blanking section | 14 |
| 2.7 | I ² C bus characteristics | 16 |
| 3 | I²C bus selection | 18 |
| 3.1 | I ² C bus addresses | 18 |
| 4 | Input/output groups | 25 |
| 5 | Application diagram | 28 |
| 6 | Package mechanical data | 29 |
| 6.1 | Lead-free packaging | 30 |
| | Revision history | 31 |

1 General information

Figure 1. STV6414A pinout diagram



1.1 I/O pin description

Table 2. I/O pin description

| Pin No. | Name | Function |
|---------|--------------------------------------|---|
| 1 | VCC | +5 V Supply |
| 2 | NC | Not connected |
| 3 | DECV | Video decoupling capacitor |
| 4 | Y/CVBSIN_ENC | Y/CVBS input from encoder |
| 5 | GND | Ground |
| 6 | YIN_ENC | Y input from encoder |
| 7 | NC | Not connected |
| 8 | CIN_ENC | Chroma input from encoder |
| 9 | NC | Not connected |
| 10 | R/CIN_ENC | Red/Chroma input from encoder |
| 11 | RIN_ENC | Audio right, input from encoder |
| 12 | GIN_ENC | Green input from encoder |
| 13 | LIN_ENC | Audio left, input from encoder |
| 14 | BIN_ENC | Blue input from encoder |
| 15 | NC | Not connected |
| 16 | DECA | Audio decoupling capacitor |
| 17 | GND | Ground |
| 18 | Y/CVBSIN_VCR | Y/CVBS input from VCR SCART |
| 19 | LIN_VCR | Audio left, input from VCR SCART |
| 20 | RIN_VCR | Audio right, input from VCR SCART |
| 21 | CVBSIN_TV | CVBS input from TV SCART |
| 22 | LIN_TV | Audio left, input from TV SCART |
| 23 | RIN_TV | Audio right, input from TV SCART |
| 24 | VCCA (see Figure 2) | 9V audio supply voltage output if VCCAO is used as 12V supply voltage input or 9V audio supply voltage input, VCCAO must be used as 9V supply voltage input |
| 25 | GNDA | Audio ground |
| 26 | NC | Not connected |
| 27 | ROUT_CINCH | Audio right output to CINCH |
| 28 | LOUT_CINCH | Audio left output to CINCH |
| 29 | ROUT_VCR | Audio right output to VCR SCART |
| 30 | LOUT_VCR | Audio left output to VCR SCART |

Table 2. I/O pin description (continued)

| Pin No. | Name | Function |
|---------|---------------------------------------|--|
| 31 | VCCAO (see Figure 2) | 12V supply voltage input, VCCA is regulated 9V output for decoupling or 9v Supply Voltage input, VCCA must be used as 9V supply voltage input. |
| 32 | ROUT_TV | Audio right output to TV SCART |
| 33 | LOUT_TV | Audio left output to TV SCART |
| 34 | NC | Not connected |
| 35 | NC | Not connected |
| 36 | NC | Not connected |
| 37 | VCCB5 | Video output buffer supply pin |
| 38 | BOUT_TV | Blue output to TV SCART |
| 39 | VCCB4 | Video output buffer supply pin |
| 40 | GOUT_TV | Green output to TV SCART |
| 41 | GNDB | Video buffer ground |
| 42 | R/COUT_TV | Red/Chroma output to TV SCART |
| 43 | VCCB3 | Video output buffer supply pin |
| 44 | Y/CVBSOUT_TV | Y/CVBS output to TV SCART |
| 45 | VCCB2 | Video output buffer supply pin |
| 46 | COUT_VCR | Chroma output to VCR SCART |
| 47 | VCCB1 | Video output buffer supply pin |
| 48 | Y/CVBSOUT_VCR | Y/CVBS output to VCR SCART |
| 49 | FBOUT_TV | Fast blanking output to TV SCART |
| 50 | FBIN_VCR | Fast blanking input from VCR SCART |
| 51 | FBIN_ENC | Fast blanking input from encoder |
| 52 | NC | Not connected |
| 53 | VDD | +5 V I ² C supply |
| 54 | NC | Not connected |
| 55 | SCL | I ² C bus clock |
| 56 | SDA | I ² C bus data |
| 57 | GND | Ground digital |
| 58 | IT_OUT | Interrupt output |
| 59 | SLB_TV | Slow blanking input/output from TV SCART |
| 60 | R/CIN_VCR | Red input (or C Input) from VCR SCART |
| 61 | SLB_VCR | Slow blanking input/output from VCR SCART |
| 62 | GIN_VCR | Green input from VCR SCART |

Table 2. I/O pin description (continued)

| Pin No. | Name | Function |
|---------|---------|---------------------------|
| 63 | VCC12 | +12 V supply |
| 64 | BIN_VCR | Blue input from VCR SCART |

Figure 2. Power supply configuration

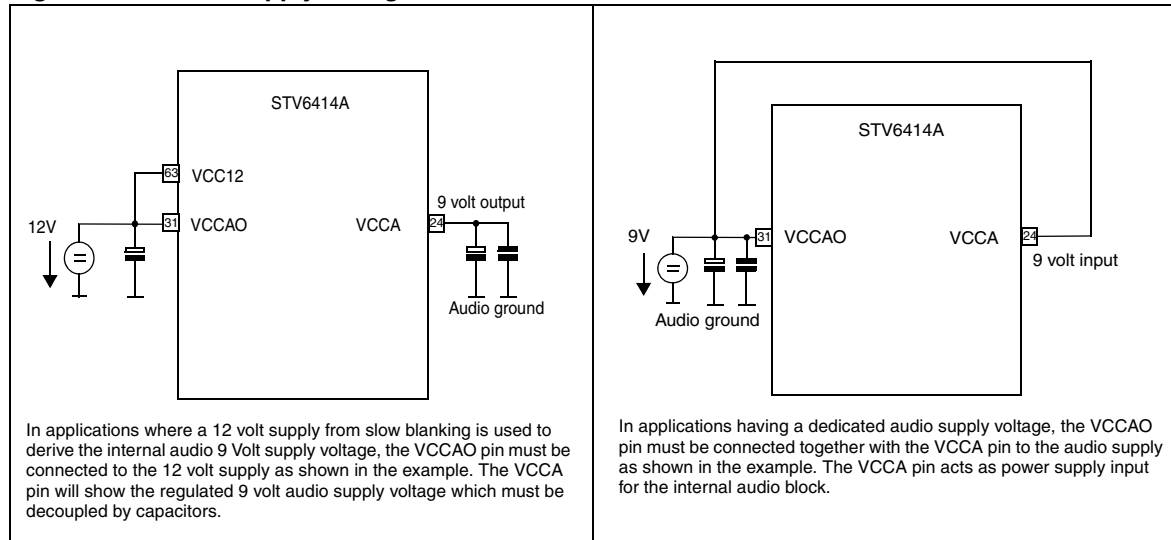


Figure 3. STV6414A block diagram

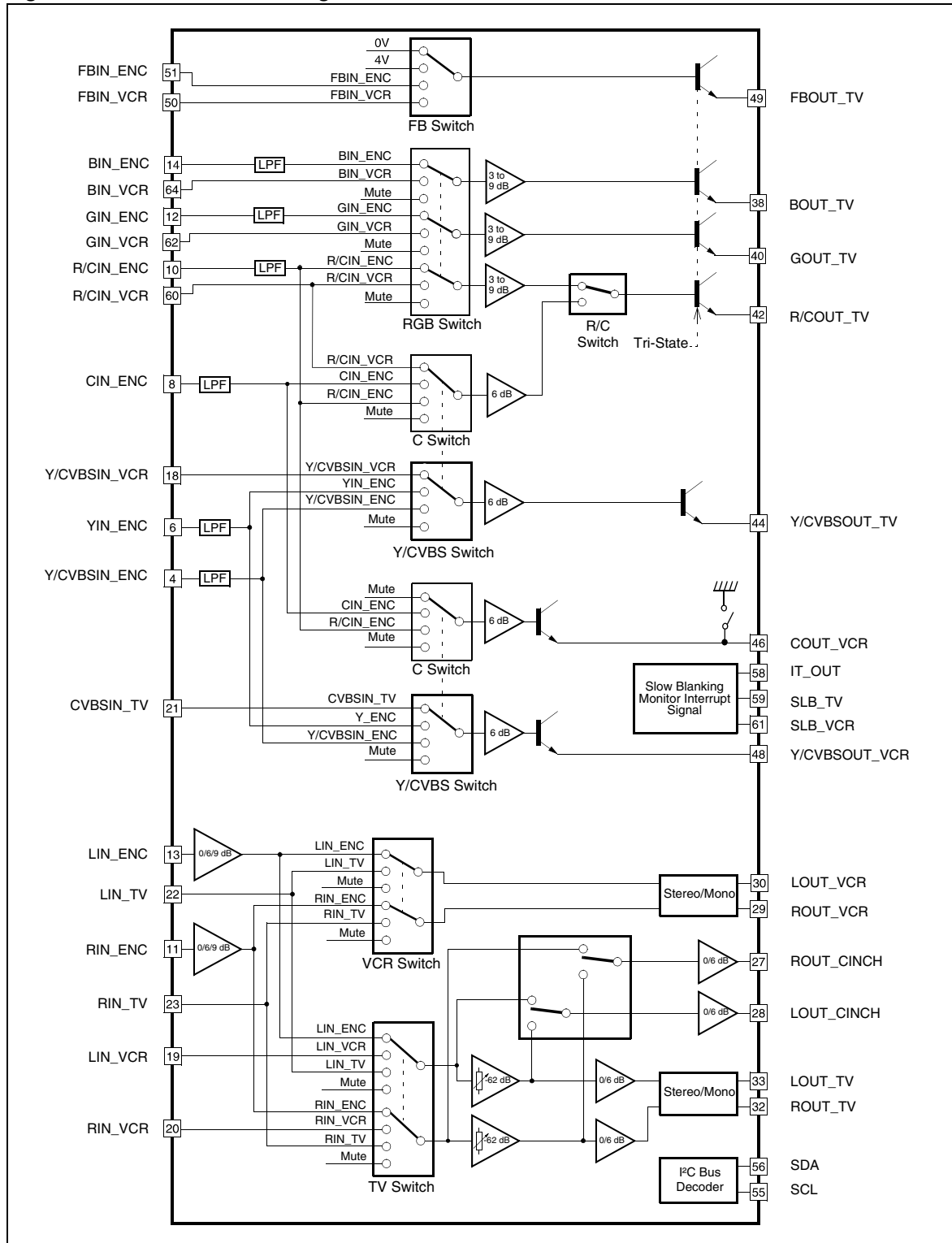
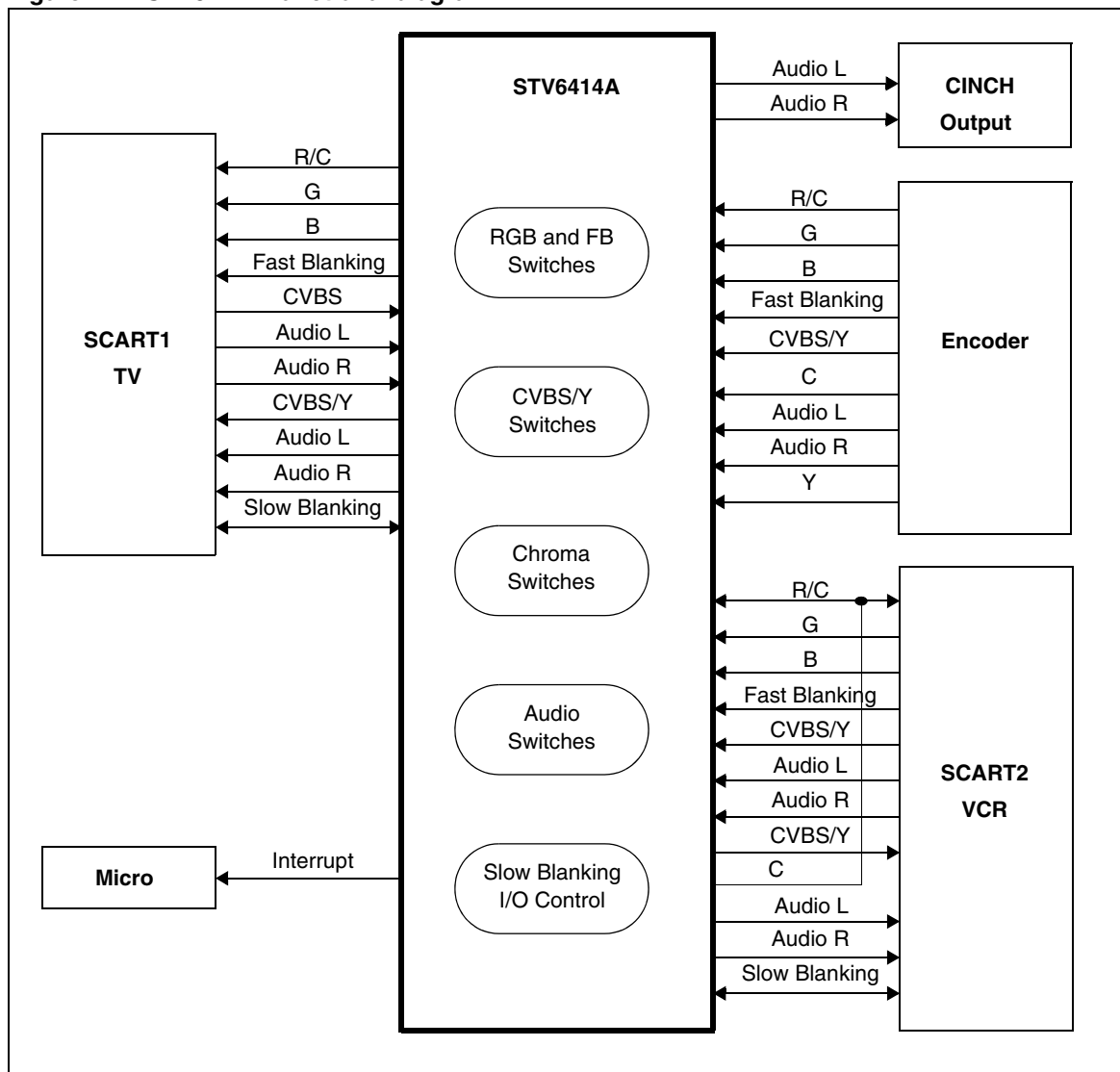


Figure 4. STV6414A functional diagram



2 Electrical characteristics

Table 3. Absolute maximum ratings

| Symbol | Parameter | Value | Unit | |
|--------------------|---|--|--|---|
| V_{CC12} | Supply voltage for slow blanking sections | 13.2 | V | |
| V_{CCAO} | Supply voltage for audio drivers | 13.2 | V | |
| V_{CCA} | Supply voltage for digital audio sections | 10 | V | |
| V_{DD} | Supply voltage for digital sections | 6 | V | |
| V_{CC}, V_{CCBI} | Supply voltage for video sections | 6 | V | |
| V_{IN} | Input voltage at pin (in reference to GND) | Audio pins Video pins Bus pins Slow Blanking pins | 0, V_{CCA} 0, V_{CC} or V_{CCBI} 0, 5.5 0, V_{CC12} | V |
| V_{ESD} | Maximum ESD Voltage allowed. (human body model: 100 pF capacitor discharged through 1.5 kOhm serial resistor) | ±4 | kV | |

Table 4. Thermal data

| Symbol | Parameter | Value | Unit |
|------------|--|-----------|------|
| R_{thJA} | Maximum junction-to-ambient thermal resistance | 58 | °C/W |
| T_{STG} | Storage temperature | -20, +150 | °C |
| T_{OPER} | Operating free air temperature range | 0 to +70 | °C |
| T_j | Maximum junction temperature | 150 | °C |

2.1 Latch-up data

At an ambient temperature of 25 °C, all pins meet the following specifications:

$$I_{trigger} = 200 \text{ mA or } I_{trigger} = -200 \text{ mA.}$$

2.2 Recommended operating conditions

$T_{AMB} = 25^\circ \text{C}$, $V_{CCAO} = 12 \text{ V}$, $V_{CC} = 5 \text{ V}$, $V_{CC12} = 12 \text{ V}$, $V_{DD} = 5 \text{ V}$, $R_{LOUTA} = 10 \text{ k}\Omega$, $R_{LOUTV} = 150 \text{ }\Omega$ (unless otherwise specified)

Table 5. Recommended operating conditions

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|------------------------|--------------------------------|---|-------------|---------|-------------|------|
| Supply voltages | | | | | | |
| V_{DD} | Digital supply voltage | | 4.75 | 5 | 5.25 | V |
| V_{CCAO} | Audio operating supply voltage | - Decoupling capacitor on V_{CCA} - Connected to V_{CCA} | 11.2 8.5 | 12 9 | 12.8 9.5 | V |

Table 5. Recommended operating conditions (continued)

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|--|---|--|------|----------------------|----------------------|------|
| V _{CC} | Video operating supply voltage | | 4.75 | 5 | 5.25 | V |
| V _{CC12} | Slow blanking control supply voltage | | 11.2 | 12 | 12.8 | V |
| Active mode (all channels ON) | | | | | | |
| I _{DD} | Digital supply current | V _{DD} = 5 V | | 6 | 10 | mA |
| I _{CCA} | Audio supply current | V _{CCA0} = 12 V, no load | | 8 | 15 | mA |
| I _{CCV} | Total video supply current (V _{CC} +V _{CCB1} +V _{CCB2} +V _{CCB3} +V _{CCB4} +V _{CCB5}) | V _{CC} = 5 V, no load, LPF OFF V _{CC} = 5 V, no load, LPF ON V _{CC} = 5 V, with load, LPF OFF V _{CC} = 5 V, with load, LPF ON | | 35 50 48 63 | 45 65 62 80 | mA |
| I _{CC12} | 12 V supply current | V _{CC12} = 12 V SLB input mode SLB output mode, no load | | 0 3 | 1 4 | mA |
| Standby mode (all channels OFF + LPF OFF) | | | | | | |
| I _{DD} | Digital supply current | V _{DD} = 5 V | | 6 | 10 | mA |
| I _{CCAst} | Audio supply current | V _{CCA0} = 12 V, no load | | 3 | | mA |
| I _{CCVstd} | Total video supply current | V _{CC} = 5 V | | 1 | | mA |

2.3 Audio section characteristics

T_{AMB} = 25°C, V_{CCA0} = 12 V, V_{CC} = 5 V, V_{CC12} = 12 V, V_{DD} = 5 V, R_{GA} = 600 Ω, R_{LOUTA} = 10 kΩ, R_{GV} = 50 Ω, R_{LOUTV} = 150 Ω, unless otherwise specified.

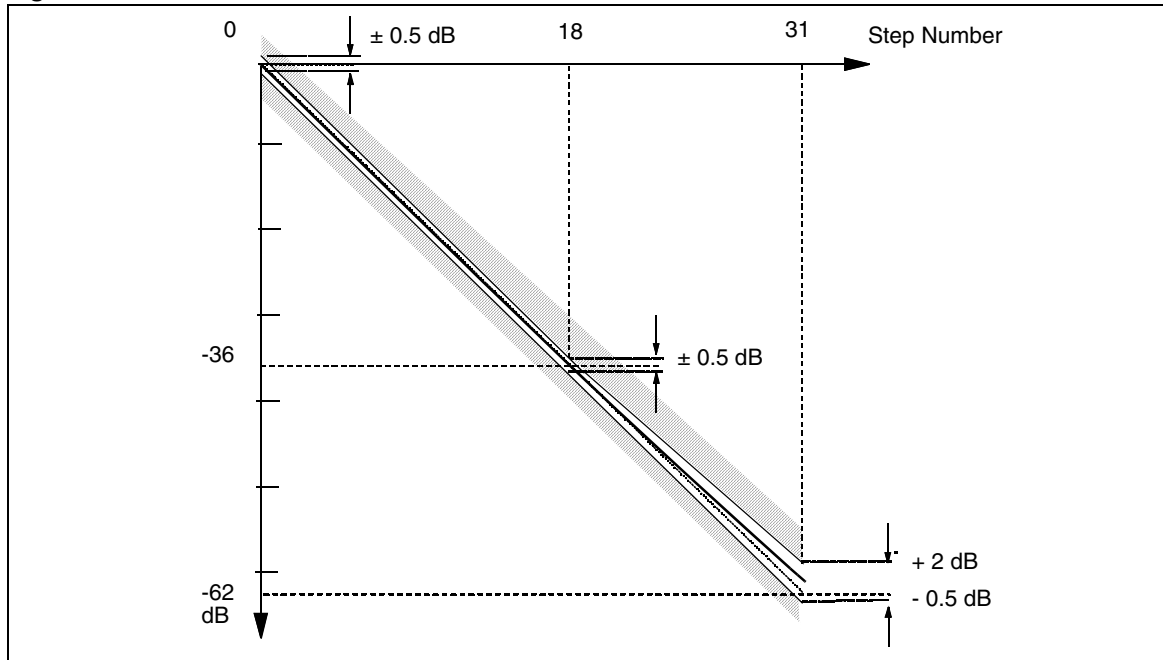
Table 6. Audio section characteristics

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|----------------------|------------------------------|--|-----|----------|-----|------------------|
| SVR100 | Supply voltage rejection | V _{RIPPLE} = 500 mV _{RMS} at 100 Hz, Gain = 0 dB DECA filter cap = 47 μF DECA filter cap = 220 μF | 60 | 70 80 | | dB |
| SVR1K | Supply voltage rejection | V _{RIPPLE} = 500 mV _{RMS} at 1 kHz, Gain = 0 dB | 70 | 80 | | dB |
| V _{INDC} | Input DC level | | | 3.2 | | V |
| V _{INAC} | Input signal amplitude | | | | 2 | V _{RMS} |
| R _{IN} | Input resistance | | 30 | 50 | | kΩ |
| R _{INmatch} | Input resistance matching | | | ±2 | ±10 | % |
| F _{RANGE} | Bandwidth | -3 dB, 0.5 V _{RMS} , R _{LOAD} = 10 kΩ, Gain = 0 dB | 50 | | | kHz |
| Flatness | Spread of gain in audio band | -0.5 V _{RMS} , 20 Hz to 20 kHz, Gain = 0 dB | | | 0.5 | dB |

Table 6. Audio section characteristics (continued)

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|----------------------|--|--|----------|----------------------|----------------------|------------------|
| CS | Channel separation, from audio inputs Between L & R of TV outputs | $V_{IN} = 0.5 V_{RMS}$ at 1 kHz on one input, $R_{LOAD} = 10\text{ k}\Omega$, Gain = 0 dB | 80 70 | 90 74 | | dB dB |
| Ci | Channel isolation from video inputs | $V_{IN} = 1 V_{PP}$ at 15 kHz on one point | | 85 | | dB |
| V_{OUT} | Output DC level | $V_{CCA} = 9\text{ V}$ | | $V_{CCA}/2$ | | V |
| V_{OFF} | DC offset change | Switching between inputs | | 1 | ± 15 | mV |
| R_{OUT} | Output resistance | | | 60 | 120 | W |
| PHD | Phase difference | 1 V_{RMS} input on each input channel at 1 kHz | | | 3 | $^{\circ}$ deg. |
| ASN | S/N ratio | $V_{IN} = 1 V_{RMS}$ at 1 kHz input weighted CCIR 468-4 quasi peak, Gain = 0 dB | 75 | 85 | | dB |
| eNI | Equivalent rms input voltage noise | BW = 20 Hz, 20 kHz Flat, Gain = 0 dB | | 5 | | μV |
| G0 | 0 dB gain | 0.5 V_{RMS} , $R_{LOAD} = 10\text{ k}\Omega$, Gain = 0 dB | -0.5 | | +0.5 | dB |
| G_{STEP} | Gain step | -62 dB to +6 dB (see Figure 5) | | 2 | | dB |
| G_{MATCH1} | Gain matching between different inputs of one output | $V_{IN} = 0.5 V_{RMS}$ at 1 kHz, Gain = 0 dB | -0.5 | | 0.5 | dB |
| G_{MATCH2} | Gain matching between left/right outputs of one input channel | $V_{IN} = 0.5 V_{RMS}$ at 1 kHz, Gain = 0 dB | -0.5 | | 0.5 | dB |
| THD0 THD6 THD9 | Total harmonic distortion ENC Input at 0 dB ENC Input at 6 dB ENC Input at 9 dB | $V_{OUT} = 0.5 V_{RMS}$ at 1 kHz, LPF at 80 kHz, Volume level adjustment = 0 dB | | 0.01 0.01 0.01 | 0.05 0.05 0.05 | % |
| V_{CL} | Output clipping level | THD = 0.2%, 1 kHz | 2.1 | 2.3 | | V_{RMS} |
| R_L | Output load resistance | $V_{IN} = 1 V_{RMS}$, THD = 0.3%, Gain = 0 dB | 2 | 2.25 | | $\text{k}\Omega$ |
| Mute | Mute suppression | $V_{IN} = 0.5 V_{RMS}$, on one point | -90 | | | dB |

Figure 5. Volume control characteristics



2.4 Video section characteristics

$T_{AMB} = 25\text{ }^{\circ}\text{C}$, $V_{CCA0} = 12\text{ V}$, $V_{CC} = 5\text{ V}$, $V_{CC12} = 12\text{ V}$, $V_{DD} = 5\text{ V}$,
 $R_{LOUTA} = 10\text{ k}\Omega$, $R_{LOUTV} = 150\text{ }\Omega$ unless otherwise specified.

Table 7. Video characteristics

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|-------------|--|--|----------|----------|------------------|---------------|
| V_{DCIN} | DC input level | Bottom sync pulse | | 2 | | V |
| I_{CLAMP} | Clamping current | at $V_{DCIN} - 400\text{ mV}$ | 1 | 2 | | mA |
| I_{LEAK} | Input leakage current | $V_{IN} = V_{DCIN} + 1\text{ V}$ | | 1 | 10 | μA |
| C_{IN} | Input capacitance | | | 2 | | pF |
| V_{IN} | Max input signal | $V_{CC} = 5\text{ V}$ | | | 1.5 | V_{PP} |
| DYN | Dynamic output signal | $V_{CC} = 5\text{ V}$ | | | 3 | V_{PP} |
| BW | Bandwidth at -3 dB - Y/CVBS - RGB | Input without low pass filter $V_{IN} = 1\text{ V}_{PP}$ $V_{IN} = 1\text{ V}_{PP}$ $V_{INC} = \text{muted}$ | 10 10 | 15 15 | | MHz |
| Flatness | Spread of gain in video band (15 kHz - 20 MHz) - Y/CVBS - RGB | Input without low pass filter $V_{IN} = 1\text{ V}_{PP}$ $V_{IN} = 1\text{ V}_{PP}$ $V_{INC} = \text{muted}$ | | | +/-0.5 +/-0.5 | dB |
| BW LPF | Low pass filter bandwidth at -3dB | $V_{IN} = 1\text{ V}_{PP}$ $CL=10\text{pF}$ | | 7.5 | | Mhz |
| ATT | Low pass filter attenuation | 27 MHz | | -47 | -36 | dB |

Table 7. Video characteristics (continued)

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|----------------------|--|---|------|-----|------|-----------------|
| CTi | Crosstalk isolation between input channel | $V_{IN} = 1 V_{PP}$ at 4.43 MHz on one point | | 60 | | dB |
| CTo | Crosstalk Isolation between output channel | $V_{IN} = 1 V_{PP}$ at $f = 4.43$ MHz, on one point, $R_{LOAD} = 150\Omega$ | | 50 | | dB |
| R _{OUT} | Output resistance | | | 5 | 10 | Ω |
| G _{RGB} | Gain at RGB outputs | $V_{IN} = 1 V_{pp}$, gain = 6 dB | 5.5 | 6 | 6.5 | dB |
| G _{RGBM} | Gain matching between R, G, B | $V_{IN} = 1 V_{pp}$, gain = 6 dB | -0.3 | 0 | 0.3 | dB |
| G _{RGBSTEP} | Step of gain | 3 dB to 6 dB | 0.75 | 1 | 1.25 | dB |
| G _{YCVBS} | Gain on Y,/CVBS channels | $V_{IN} = 1 V_{PP}$ | 5.5 | 6 | 6.5 | dB |
| G _{YCVBSM} | Gain matching between Y, CVBS inputs | $V_{IN} = 1 V_{PP}$ | -0.5 | 0 | 0.5 | dB |
| DC _{OUT} | DC output voltage | Bottom sync pulse | | 0.6 | | V |
| DPHI | Differential phase | $V_{IN} = 1 V_{PP}$ at 4.43 MHz | | 1 | 5 | $^{\circ}$ deg. |
| DG | Differential gain | $V_{IN} = 1 V_{PP}$ at 4.43 MHz | | 1 | 5 | % |
| Mute | Mute suppression | $V_{IN} = 1 V_{PP}$ at 5 MHz on one point | -55 | | | dB |
| LNL | Luminance non-linearity | | | 0.3 | 3 | % |
| VSN | Video S/N Ratio | Refer to note below | 65 | | | dB |

Note: $S/N = 20 \log (V_{OUT} \text{ black to white} = 0.7 V_{PP} / V_{Noise} (mV_{RMS}) \text{ weighted CCIR 567})$.

2.5 Chroma section characteristics

$T_{AMB} = 25^{\circ}\text{C}$, $V_{CCA0} = 12\text{ V}$, $V_{CC} = 5\text{ V}$, $V_{CC12} = 12\text{ V}$, $V_{DD} = 5\text{ V}$,
 $R_{LOUTA} = 10\text{ k}\Omega$, $R_{LOUTV} = 150\ \Omega$ unless otherwise specified.

Table 8. Chroma section characteristics

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|-------------------|---|--|-----|-----|-----|-----------------|
| V _{DCIN} | DC input level | | | 3 | | V |
| R _{IN} | Input resistance | | 30 | 50 | | k Ω |
| C _{IN} | Input capacitance | | | 2 | | pF |
| V _{IN} | Max input signal | | | | 1.5 | V _{PP} |
| DYN | Dynamic output signal | | | | 3 | V _{PP} |
| DC _{OUT} | DC output VCR voltage | | | 2.2 | | V |
| CBW | Chroma bandwidth | $C_{IN} = 1 V_{PP}$ at -3 db | 10 | 15 | | MHz |
| CTi | Crosstalk isolation between input channel | $V_{IN} = 1 V_{PP}$ at 4.43 MHz on one input | | 55 | | dB |

Table 8. Chroma section characteristics (continued)

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|-----------------------|--|---|------|-----|-----|------|
| CTo | Crosstalk isolation between output channel | $V_{IN} = 1 V_{PP}$ at 4.43 MHz on one input, $R_{LOAD} = 150 \Omega$ | | 50 | | dB |
| R _{OUT} | Output resistance | | | 5 | 10 | W |
| G _{OUTC} | Gain at OUTC | $V_{IN} = 1 V_{pp}$ | 5.5 | 6 | 6.5 | dB |
| G _{CM} | Gain matching between C inputs | $V_{IN} = 1 V_{PP}$ | -0.5 | 0 | 0.5 | dB |
| Mute | Mute suppression | $V_{IN} = 1 V_{PP}$ at 4.43 MHz on one input | 55 | | | dB |
| CToYdel | Chroma to luma delay, source Y/C | V_{PP} at 4.43 MHz | | | 20 | ns |
| Z _{COUT_VCR} | Output impedance when switched to ground | 2.7V applied to COUT_VCR with series 75Ω Resistor | | 2 | | W |

2.6 Blanking section

$T_{AMB} = 25 \text{ }^\circ\text{C}$, $V_{CCAO} = 12 \text{ V}$, $V_{CC} = 5 \text{ V}$, $V_{CC12} = 12 \text{ V}$, $V_{DD} = 5 \text{ V}$,
 $R_{LOUTA} = 10 \text{ k}\Omega$, $R_{LOUTV} = 150 \Omega$, unless otherwise specified.

Table 9. Slow blanking section

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|--------------------|---------------------------------|-----------------|-----|------|-----|------|
| Input mode | | | | | | |
| SLBlow | Input low level threshold | | 2.5 | 3.25 | 4 | V |
| SLBhigh | Input high level threshold | | 7.5 | 8.25 | 9 | V |
| I _{IN} | Input current | | | 50 | 100 | μA |
| Output mode | | | | | | |
| SLBlow | Output low level (int. TV) | | 0 | 0.02 | 1.5 | V |
| SLBmed | Output medium level (ext. 16/9) | | 5 | 5.75 | 6.5 | V |
| SLBhigh | Output high level (ext. 4/3) | | 10 | 11 | 12 | V |

Table 10. Fast blanking section

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|--------------------|--------------------------------|-------------------------|-----|-----|-----|------|
| Input mode | | | | | | |
| FBlow/high | Input low/high level threshold | | 0.4 | 0.7 | 0.9 | V |
| I _{IN} | Input current | | | 2 | 10 | μA |
| Output mode | | | | | | |
| FB _{LOW} | Output Low Level | $R_{LOAD} = 150 \Omega$ | | | 0.5 | V |
| FB _{HIGH} | Output High Level | | 3.0 | 3.4 | 3.8 | V |

Table 10. Fast blanking section (continued)

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|---------------------|---|--|-----|----------|-----|----------|
| FB _{DEL} | Fast Blanking RGB delay | At 50% on digital RGB transients, at 2 V on FB rise transient, at 1 V on FB fall, C _{LOAD} = 10pF maximum | | 15 | | ns |
| FB _{TRANS} | FB Transitions at FB output Rise Time Fall Time | C _{LOAD} = 10 pF maximum between 10% and 90% between 90% and 10% | | 10 10 | | ns ns |

Table 11. Interrupt output

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|---------|---------------------------|--|-----|-----|------------|--------|
| IT-Leak | High level leakage | External pull-up to 5 V | | | 10 | μA |
| IT-Low | Output low level (active) | I _{IN} = 0 mA I _{IN} = 1 mA | | | 0.3 0.7 | V V |

Note: The interrupt is forced low when a change is detected on slow blanking inputs. It can be used in standby mode to wake up the microprocessor. It is released when the I²C bus register is read.

Table 12. Address selection input

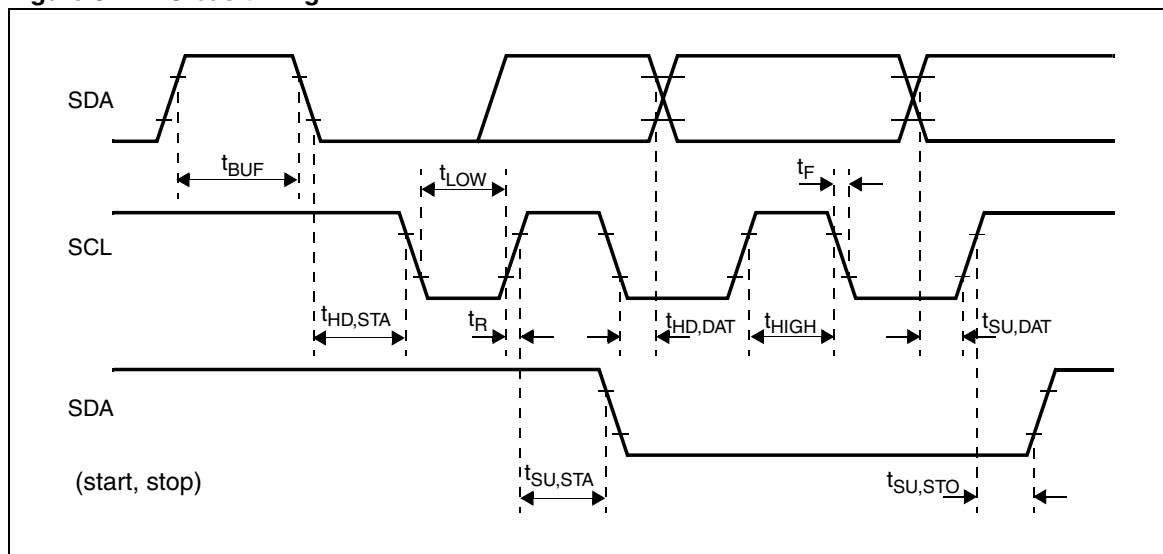
| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|---------------------|------------------------------|-----------------|-----|-----|-----------------|------|
| ADDsel _L | Address selection low level | | | 0 | 0.2 | V |
| ADDsel _H | Address selection high level | | 2.5 | | V _{DD} | V |
| I _{LEAK} | Leakage current | | | | 10 | μA |

2.7 I²C bus characteristics

$T_{AMB} = 25^{\circ}\text{C}$, $V_{CCAO} = 12\text{ V}$, $V_{CC} = 5\text{ V}$, $V_{CC12} = 12\text{ V}$, $V_{DD} = 5\text{ V}$,
 $R_{LOUTA} = 10\text{k}\Omega$, $R_{LOUTV} = 150\Omega$, unless otherwise specified.

Table 13. I²C bus characteristics

| Symbol | Parameter | Test conditions | Min | Typ | Max | Unit |
|--|---|-------------------------------------|------|-----|-----|---------------|
| SCL | | | | | | |
| V_{IL} | Low level input voltage | | -0.3 | | 1.5 | V |
| V_{IH} | High level input voltage | | 2.3 | | 5.5 | V |
| I_{LI} | Input leakage current | $V_{IN} = 0\text{ to }5.5\text{ V}$ | -10 | 0 | 10 | μA |
| f_{SCL} | Clock frequency | | | | 400 | kHz |
| t_R | Input rise time | 1.5 V to 3 V | | | 1 | μs |
| t_F | Input fall time | 1.5 V to 3 V | | | 300 | ns |
| C_I | Input capacitance | | | | 10 | pF |
| SDA | | | | | | |
| V_{IL} | Low level input voltage | | -0.3 | | 1.5 | V |
| V_{IH} | High level input voltage | | 2.3 | | 5.5 | V |
| I_{LI} | Input leakage current | $V_{IN} = 0\text{ to }5.5\text{ V}$ | -10 | 0 | 10 | μA |
| C_I | Input capacitance | | | | 10 | pF |
| t_R | Input rise time | 1.5 V to 3 V | | | 1 | μs |
| t_F | Input fall time | 3 V to 1.5 V | | | 300 | ns |
| V_{OL} | Low level output voltage | $I_{OL} = 3\text{ mA}$ | | | 0.4 | V |
| t_F | Output fall time | 3 V to 1.5 V | | | 250 | ns |
| C_L | Load capacitance | | | | 400 | pF |
| Timing: SCL frequency = 400 kHz | | | | | | |
| t_{LOW} | Clock low period | | 1.3 | | | μs |
| t_{HIGH} | clock high period | | 0.6 | | | μs |
| $t_{SU,DAT}$ | Data setup time | | 100 | | | ns |
| $t_{HD,DAT}$ | Data hold time | | 0 | | 340 | ns |
| $t_{SU,STO}$ | Setup Time from clock high to stop | | 0.6 | | | μs |
| t_{BUF} | Start setup time following a stop | | 1.3 | | | μs |
| $t_{HD,STA}$ | Start hold time | | 0.6 | | | μs |
| $t_{SU,STA}$ | Start setup time following clock low to high transition | | 0.6 | | | μs |

Figure 6. I²C bus timing

3 I²C bus selection

Data transfers follow the usual I²C format; that is, after the start condition (S), a 7-bit slave address is sent, followed by an eight-bit data direction bit (W). An 8-bit sub-address is sent to select a register, followed by an 8-bit data word to be included in the register. The IC's I²C bus decoder enables the automatic incrementation mode in write mode.

The circuit operates at clock frequencies of up to 400 kHz.

Table 14. String format

Write only mode (S = Start condition, P = Stop condition, A = Acknowledge)

| | | | | | | | | |
|---|---------------|---|---|-------------|---|------|---|---|
| S | SLAVE ADDRESS | 0 | A | SUB-ADDRESS | A | DATA | A | P |
|---|---------------|---|---|-------------|---|------|---|---|

Table 15. Read only mode

| | | | | | | |
|---|---------------|---|---|------|---|---|
| S | SLAVE ADDRESS | 1 | A | DATA | A | P |
|---|---------------|---|---|------|---|---|

Table 16. Slave address

| | | | | | | | |
|---------|----|----|----|----|----|----|----|
| Address | A6 | A5 | A4 | A3 | A2 | A1 | A0 |
| Value | 1 | 0 | 0 | 1 | 0 | 1 | X |

Table 17. Auto increment mode

| | | | | | | | | | | | | | |
|---|---------------|---|---|-------------|---|----------------|---|-----------------|---|------|-------------------|---|---|
| S | SLAVE ADDRESS | 0 | A | SUB-ADDRESS | A | DATA0 | A | DATA1 | A | | DATA _n | A | P |
| | | | | Sub-Address | | Sub-Address +1 | | Sub-Address + N | | | | | |

3.1 I²C bus addresses

Write Address: 1001 0110 = 96(hex), Read Address: 1001 0111 = 97(hex)

Table 18. Input signal summary (write mode)

| Reg add (hex) | Data | | | | | | | |
|---------------|-----------------|---------------------|--------------------------------------|------------------|-------------------------------|----|----|------------------|
| | d7 | d6 | d5 | d4 | d3 | d2 | d1 | d0 |
| Audio | | | | | | | | |
| 00h | TV Stereo Mono | TV 0/6 dB | TV Volume-62 dB to 0 dB - 2 dB steps | | | | | Soft Volume Mode |
| 01h | VCR Stereo Mono | Not Used (See Note) | VCR Audio Switch Control | CINCH Audio Gain | TV/CINCH Audio Switch Control | | | |
| Video | | | | | | | | |

Table 18. Input signal summary (write mode) (continued)

| Reg add (hex) | Data | | | | | | | |
|----------------------|------------------------|-------------------------------------|------------------|----------------------|----------------------------------|------------------------------------|------------------------------------|----------------------------|
| | d7 | d6 | d5 | d4 | d3 | d2 | d1 | d0 |
| 02h | VCR chroma muted | VCR video and chroma switch control | | | TV chroma muted | TV video and chroma switch control | | |
| 03h | RGB and FB tri-state | RGB gain | | | RGB switch control | | Fast blanking mode/input selection | |
| Miscellaneous | | | | | | | | |
| 04h | IT enable | SLB mode | LPF enable | VCR-C output control | | Not used (see Note) | Not used (see Note) | TV R or C output selection |
| 05h | VCR slow blanking | | TV slow blanking | | ENC audio input gain 0/6/9 dB | VCR R/C sub clamp | ENC R/C sub clamp | |
| Standby | | | | | | | | |
| 06h | Not used (see Note) | TV outputs | CINCH outputs | VCR outputs | Not used (see Note) | TV inputs | VCR inputs | ENC inputs |

Note: At register address 06h, bits marked "Not used" must be set to "1". All other bits from all other registers marked "Not used" must be set to "0".

Table 19. TV audio output

| Reg add (hex) | Description | Bits | Data | | | | | | | | Comments | |
|------------------|------------------------|------|--------|--------|--------|--------|--------|--------|--------|--------|----------|-----------------------------|
| | | | d7 | d6 | d5 | d4 | d3 | d2 | d1 | d0 | | |
| 00h | Soft volume change | 1 | X X | X X | X X | X X | X X | X X | X X | X X | 0 1 | Active Disabled |
| | Level adjustment | 5 | X X | X X | 0 1 | 0 1 | 0 1 | 0 1 | 0 1 | 0 1 | X X | 0 dB -62 dB (-2 dB/step) |
| | 6 dB extra gain | 1 | X X | 0 1 | X X | X X | X X | X X | X X | X X | X X | 0 dB +6 dB |
| | TV stereo or mono mode | 1 | 0 1 | X X | X X | X X | X X | X X | X X | X X | X X | 0 = stereo 1 = mono |

Table 20. Audio selection and VCR audio output

| Reg add (hex) | Description | Bits | Data | | | | | | | | Comments |
|----------------------------|--------------------------------------|------|------|----|----|----|----|----|----|-------------|----------------------|
| | | | d7 | d6 | d5 | d4 | d3 | d2 | d1 | d0 | |
| 01h | TV & CINCH audio output selection | 3 | X | X | X | X | X | 0 | 0 | 0 | Muted |
| | | | X | X | X | X | X | 0 | 0 | 1 | Encoder L/R selected |
| | | | X | X | X | X | X | 0 | 1 | 0 | VCR L/R selected |
| | | | X | X | X | X | X | 0 | 1 | 1 | Not allowed |
| | | | X | X | X | X | X | 1 | 0 | 0 | TV L/R selected |
| | | | X | X | X | X | X | 1 | 0 | 1 | Not allowed |
| | | | X | X | X | X | X | 1 | 1 | 0 | Not allowed |
| | | | X | X | X | X | X | 1 | 1 | 1 | Not allowed |
| | CINCH audio gain | 1 | X | X | X | X | 0 | X | X | X | 0 dB |
| | | | X | X | X | X | 1 | X | X | X | Follow TV gain |
| | VCR audio output selection | 2 | X | X | 0 | 0 | X | X | X | X | Muted |
| | | | X | X | 0 | 1 | X | X | X | X | Encoder L/R selected |
| | | | X | X | 1 | 0 | X | X | X | X | TV L/R selected |
| X | | | X | 1 | 1 | X | X | X | X | Not allowed | |
| VCR stereo or mono mode | 1 | 0 | X | X | X | X | X | X | X | 0 = stereo | |
| | | 1 | X | X | X | X | X | X | X | 1 = mono | |

Table 21. TV and VCR video selection

| Reg add (hex) | Description | Bits | Data | | | | | | | | Comments |
|------------------|----------------------------|------|------|----|----|----|----|----|----|----|--|
| | | | d7 | d6 | d5 | d4 | d3 | d2 | d1 | d0 | |
| 02h | TV video output selection | 3 | X | X | X | X | X | 0 | 0 | 0 | Y/CVBS muted & chroma muted Y/CVBS_ENC & R/C_ENC Y_ENC & C_ENC Y/CVBS_VCR & R/C_VCR Not allowed Not allowed Not allowed Not allowed |
| | TV chroma output control | 1 | X | X | X | X | 0 | X | X | X | Chroma defined by d2d1d0 Chroma force to mute |
| | VCR video output selection | 3 | X | 0 | 0 | 0 | X | X | X | X | Y/CVBS muted & chroma muted Y/CVBS_ENC & R/C_ENC Y_ENC & C_ENC CVBS_TV & chroma muted Not allowed Not allowed Not allowed Not allowed |
| | VCR chroma output control | 1 | 0 | X | X | X | X | X | X | X | Chroma defined by d6d5d4 Chroma force to mute |

Table 22. RGB and fast blanking outputs

| Reg add (hex) | Description | Bits | Data | | | | | | | | Comments |
|--------------------|-----------------------|------|------|----|----|----|----|----|----|---|-------------------------|
| | | | d7 | d6 | d5 | d4 | d3 | d2 | d1 | d0 | |
| 03h | Fast blanking control | 2 | X | X | X | X | X | X | 0 | 0 | FB forced to low level |
| | | | X | X | X | X | X | X | 0 | 1 | FB forced to high level |
| | | | X | X | X | X | X | X | 1 | 0 | FB from Encoder |
| | | | X | X | X | X | X | X | 1 | 1 | FB from VCR |
| | RGB selection | 2 | X | X | X | X | 0 | 0 | X | X | Muted |
| X | | | X | X | X | 0 | 1 | X | X | RGB_ENC selected | |
| X | | | X | X | X | 1 | 0 | X | X | RGB_VCR selected | |
| X | | | X | X | X | 1 | 1 | X | X | Not allowed | |
| RGB gain | 2 | X | X | 0 | 0 | X | X | X | X | +6 dB gain | |
| | | X | X | 0 | 1 | X | X | X | X | +5 dB gain | |
| | 1 | X | 0 | X | X | X | X | X | X | +4 dB gain | |
| | | X | 1 | X | X | X | X | X | X | +3 dB gain | |
| RGB and FB control | 1 | 0 | X | X | X | X | X | X | X | RGB and FB outputs high impedance state | |
| | | 1 | X | X | X | X | X | X | X | RGB and FB outputs active | |

Table 23. Miscellaneous control

| Reg add (hex) | Description | Bits | Data | | | | | | | | Comments |
|--------------------------|-------------------------|------|------|----|----|----|----|----|----|-----------------------------|---------------------------------|
| | | | d7 | d6 | d5 | d4 | d3 | d2 | d1 | d0 | |
| 04h | R/C TV output selection | 1 | X | X | X | X | X | 0 | 0 | 0 | Red signal selected |
| | | | X | X | X | X | X | 0 | 0 | 1 | Chroma signal selected |
| | Not used | 2 | X | X | X | X | X | X | X | X | Not used |
| | C_VCR output control | 2 | X | X | X | 0 | 0 | 0 | 0 | X | Grounded |
| | | | X | X | X | 0 | 1 | 0 | 0 | X | Tri-state mode (high impedance) |
| | | | X | X | X | 1 | X | 0 | 0 | X | Active |
| Low pass filters control | 1 | X | X | 0 | X | X | 0 | 0 | X | LPF enabled | |
| | | X | X | 1 | X | X | 0 | 0 | X | LPF disabled | |
| Slow blanking mode | 1 | X | 0 | X | X | X | 0 | 0 | X | Normal mode | |
| IT enable | 1 | X | 1 | X | X | X | 0 | 0 | X | SLB TV is driven by SLB VCR | |
| | | 0 | X | X | X | X | 0 | 0 | X | No interrupt flag | |
| | | | 1 | X | X | X | 0 | 0 | X | IT enable | |

Table 24. Slow blanking and inputs control

| Reg add (hex) | Description | Bits | Data | | | | | | | | Comments |
|------------------|--------------------------------|------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|--|
| | | | d7 | d6 | d5 | d4 | d3 | d2 | d1 | d0 | |
| 05h | Encoder R/Csub clamp | 1 | X X | X X | X X | X X | X X | X X | X X | 0 1 | Bottom level clamp Average level clamp |
| | VCR R/Csub clamp | 1 | X X | X X | X X | X X | X X | X X | 0 1 | X X | Bottom level clamp Average level clamp |
| | Encoder input level adjustment | 2 | X X X | X X X | X X X | X X X | 0 0 1 | 0 1 0 | X X X | X X X | 0 dB for normal audio inputs +6 dB for weak audio inputs +9 dB for weak audio inputs |
| | Slow blanking TV SCART | 2 | X X X X | X X X X | 0 0 1 1 | 0 1 0 1 | X X X X | X X X X | X X X X | X X X X | Input mode only Output < 2 V Output 16/9 format Output 4/3 format |
| | Slow blanking VCR SCART | 2 | 0 0 1 1 | 0 1 0 1 | X X X X | X X X X | X X X X | X X X X | X X X X | X X X X | Input mode only Output < 2 V Output 16/9 format Output 4/3 format |

Table 25. Standby modes

| Reg add (hex) | Description | Bits | Data | | | | | | | | Comments |
|------------------|---------------|------|--------|--------|--------|--------|--------|--------|--------|--------|---|
| | | | d7 | d6 | d5 | d4 | d3 | d2 | d1 | d0 | |
| 06h | ENC inputs | 1 | 1 1 | X X | X X | X X | 1 1 | X X | X X | 0 1 | Inputs active Inputs disabled |
| | VCR inputs | 1 | 1 1 | X X | X X | X X | 1 1 | X X | 0 1 | X X | Inputs active Inputs disabled |
| | TV inputs | 1 | 1 1 | X X | X X | X X | 1 1 | 0 1 | X X | X X | Inputs active Inputs disabled |
| | VCR outputs | 1 | 1 1 | X X | X X | 0 1 | 1 1 | X X | X X | X X | Audio & video outputs ON Audio & video outputs OFF |
| | CINCH outputs | 1 | 1 1 | X X | 0 1 | X X | 1 1 | X X | X X | X X | Audio & video outputs ON Audio & video outputs OFF |
| | TV outputs | 1 | 1 1 | 0 1 | X X | X X | 1 1 | X X | X X | X X | Audio & video outputs ON Audio & video outputs OFF |
| | Full stop | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Table 26. Output signals (read mode)

| Reg add (hex) | Description | Bits | Data | | | | | | | | Comments |
|------------------|---------------------------|------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--|
| | | | d7 | d6 | d5 | d4 | d3 | d2 | d1 | d0 | |
| | Slow blanking TV SCART | 2 | X X X | X X X | X X X | X X X | X X X | X X X | 0 1 1 | 1 0 1 | Input < 2 V Input 16/9 format Input 4/3 format |
| | Slow banking VCR SCART | 2 | X X X | X X X | X X X | X X X | 0 1 1 | 1 0 1 | X X X | X X X | Input < 2 V Input 16/9 format Input 4/3 format |
| | Interrupt flag | 1 | X X | X X | X X | 0 1 | X X | X X | X X | X X | No change since read One change has been detected (<i>refer to Note</i>) |

Note: The interrupt flag will be cleared when this register is read. To prepare for a new interrupt, a "1" must be re-written in the IT Enable bit (Reg. 04, d7).

4 Input/output groups

Figure 7. Bottom clamped video inputs (pins 2, 4, 6, 12, 14, 18, 21, 62, and 64)

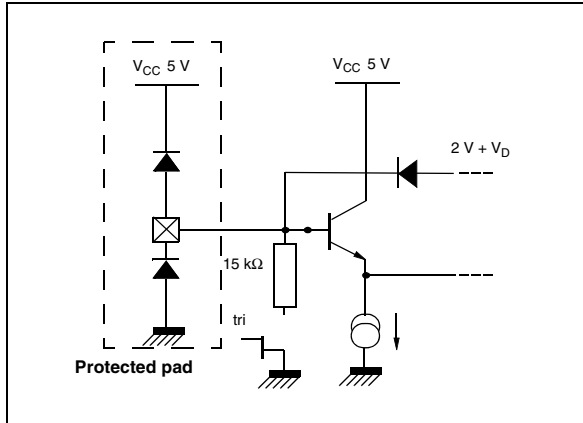


Figure 8. Average clamped video inputs (pin 8)

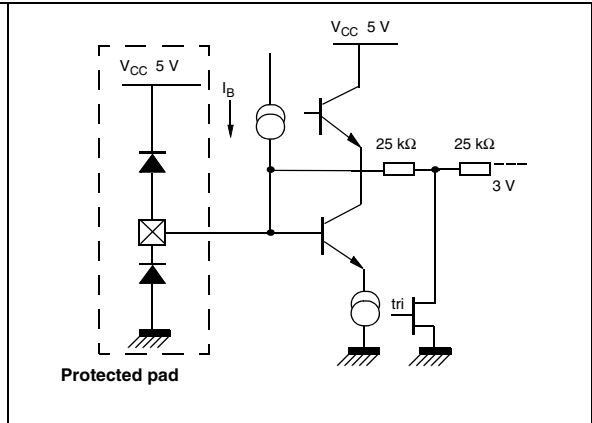


Figure 9. R/C clamped video inputs (pins 10 and 60)

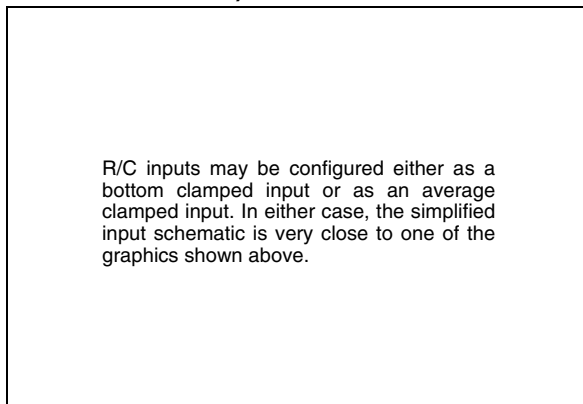


Figure 10. Fast blanking output (pin 49)

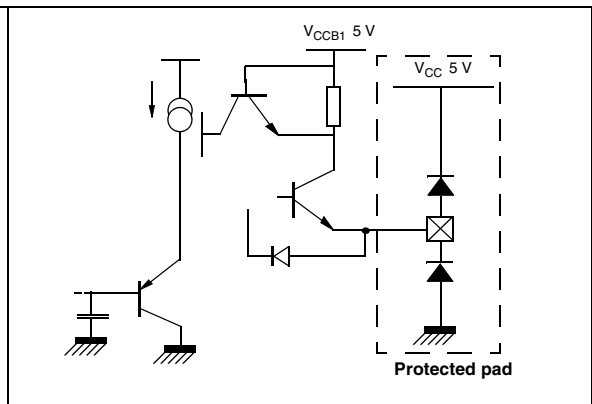


Figure 11. Fast blanking inputs (pins 50 and 51)

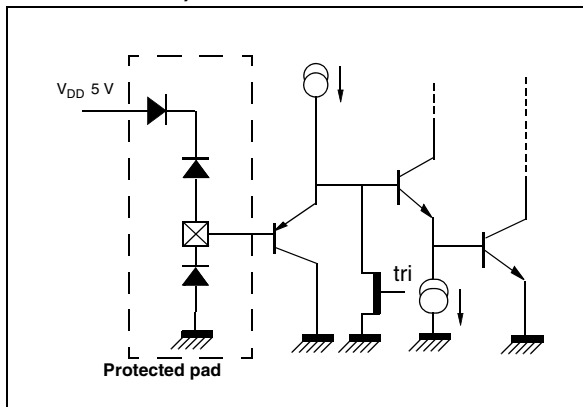


Figure 12. Video outputs (pins 36, 38, 40, 42, 44, 46, and 48)

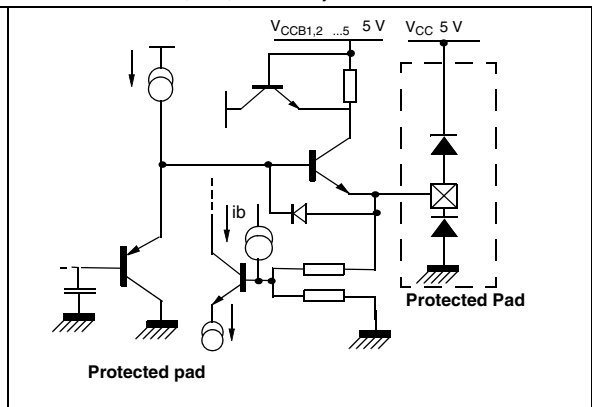


Figure 13. Audio inputs (pins 7, 9 11, 13, 19, 20, 22, and 23)

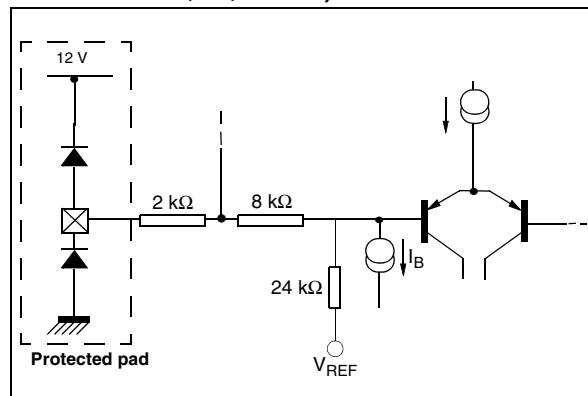


Figure 14. Audio outputs (pins 27, 28, 29, 30, 32, 33, and 35)

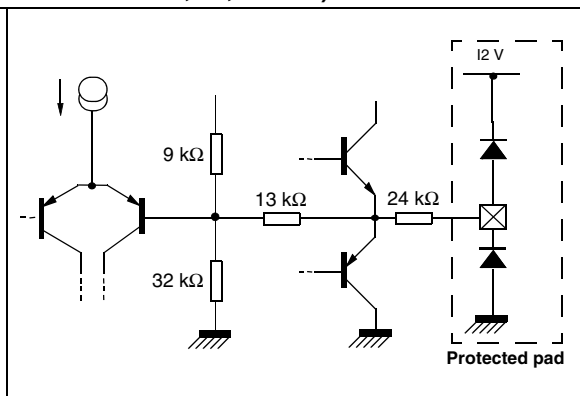


Figure 15. Slow blanking I/O (pins 59 and 61)

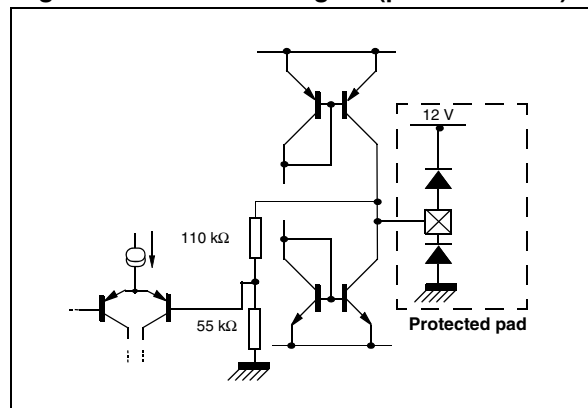


Figure 16. Interrupt output (pin 58)

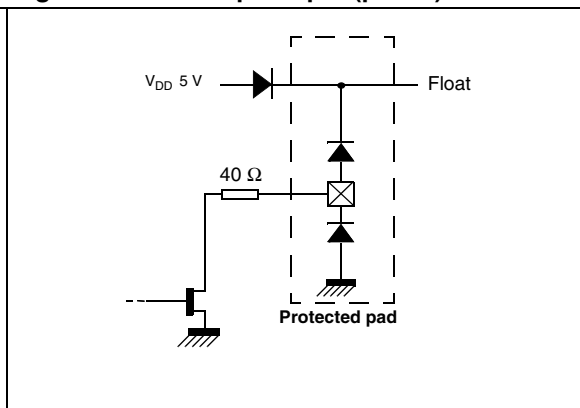


Figure 17. Trap filter (pin 34)

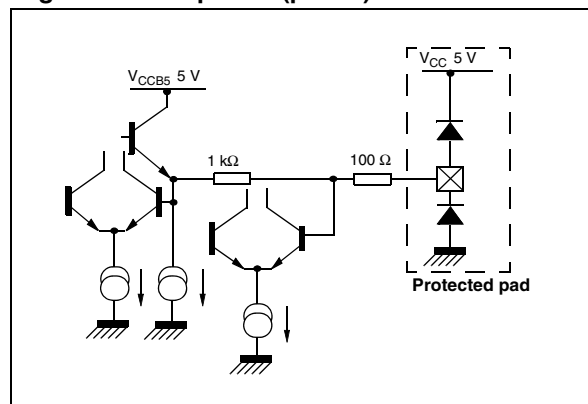


Figure 18. I²C bus (SDA) (Pin 56)

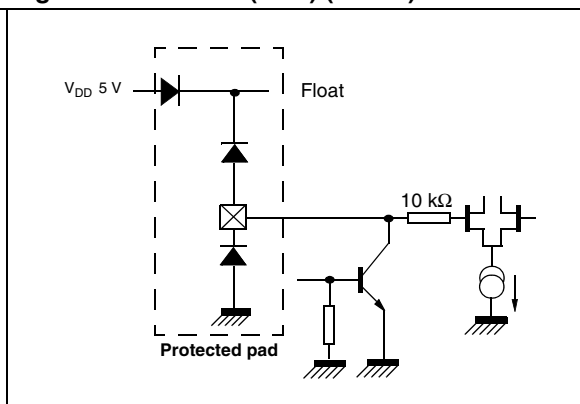


Figure 19. I²C bus (ADD) (pin 54)

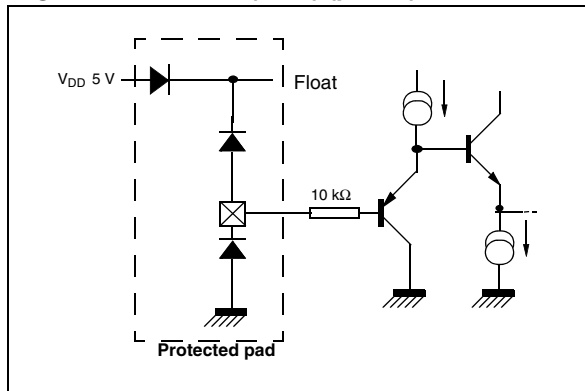


Figure 20. I²C bus (SCL) (pin 55)

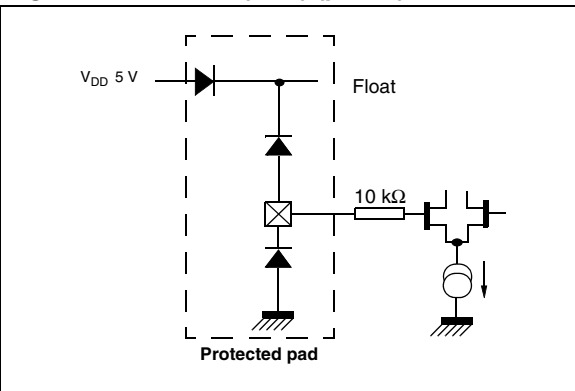
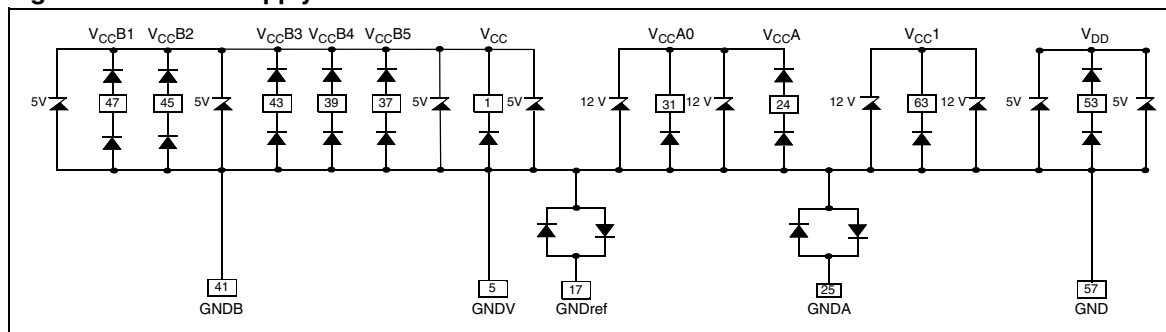


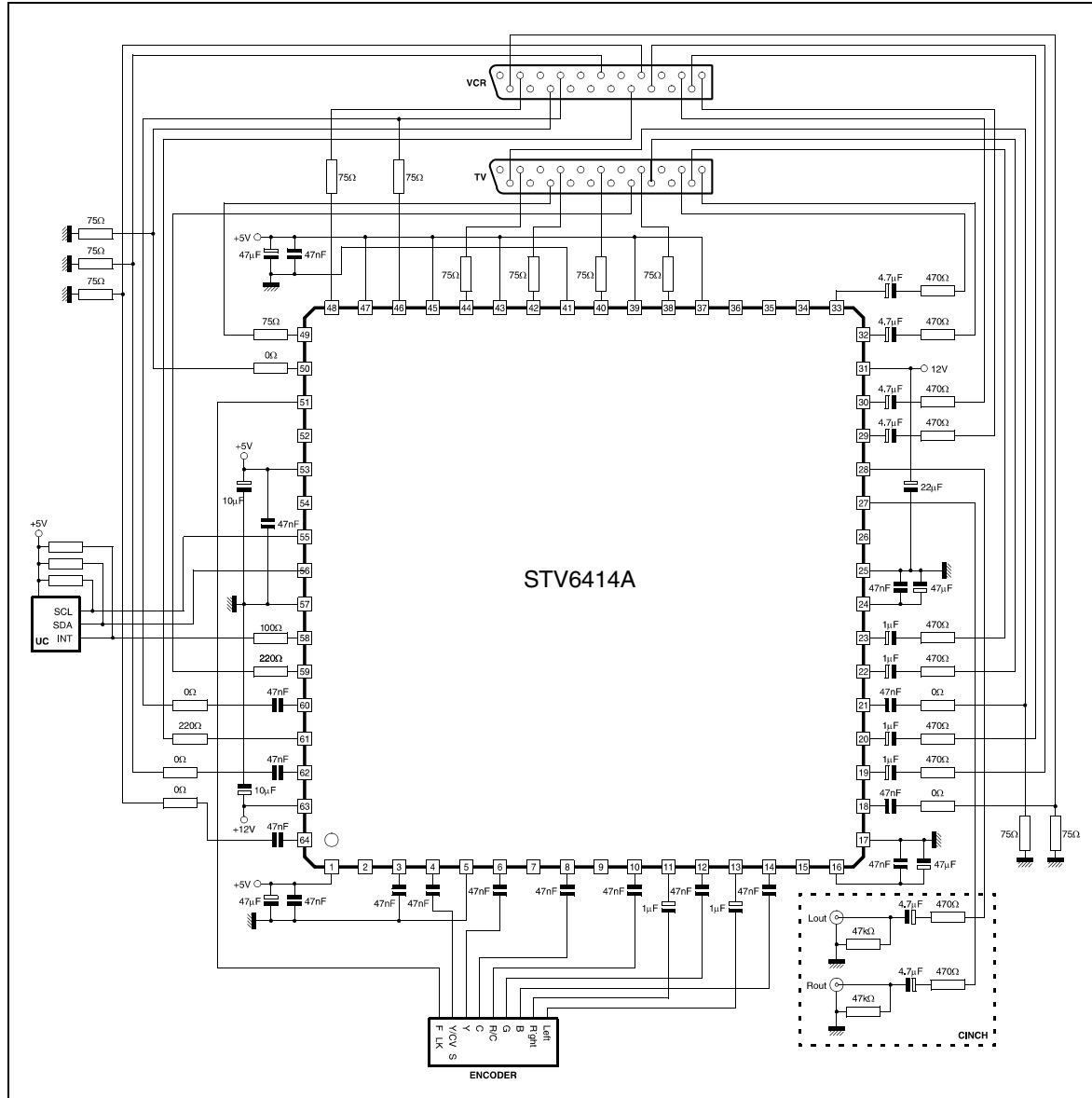
Figure 21. Power supply connection



5 Application diagram

Note: The application diagram presented here is an example only and is subject to change without notice. The real application diagram will depend on application conditions and constraints.

Figure 22. STV6414A application diagram



6 Package mechanical data

Figure 23. 64 pin, LQFP64 (low-profile quad flat package) 10 x10 x 1.4 mm

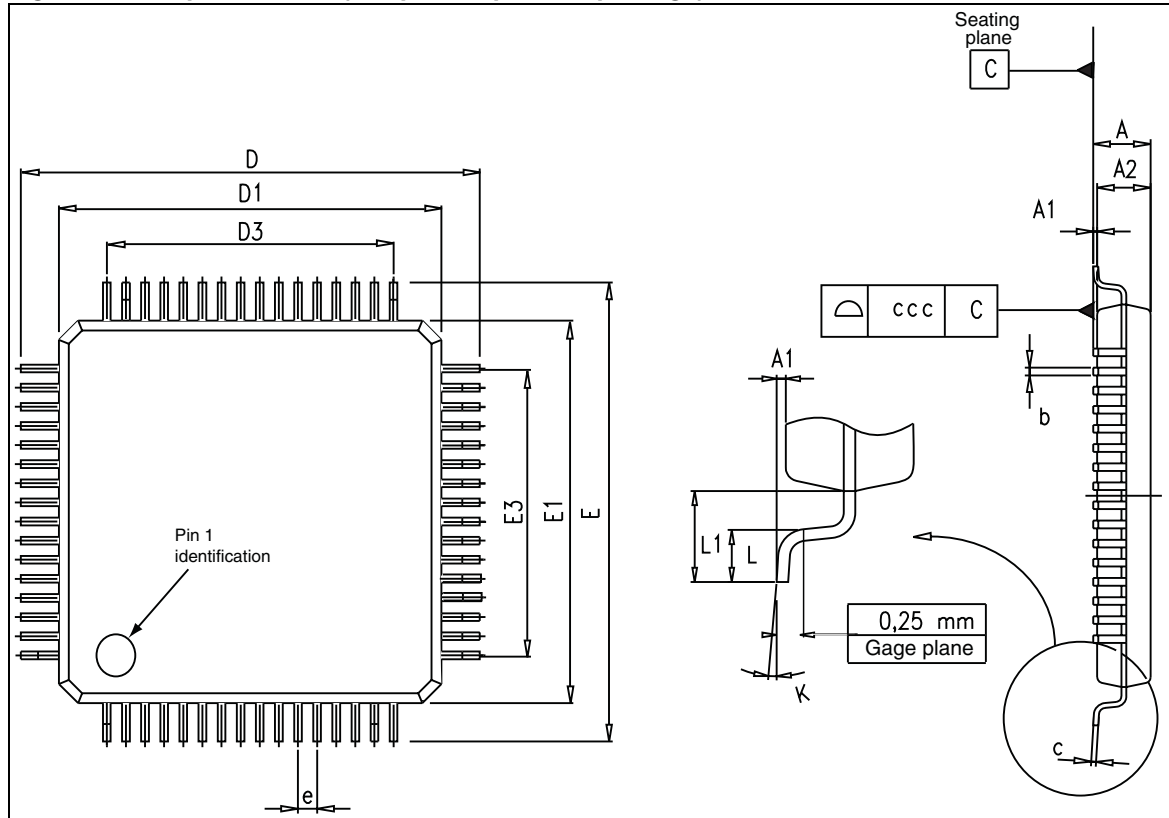


Table 27. LQFP64 package dimensions

| Dimension | Millimeters | | | Inches | | |
|-----------|-------------|---------|---------|---------|---------|---------|
| | Minimum | Typical | Maximum | Minimum | Typical | Maximum |
| A | | | 1.60 | | | 0.063 |
| A1 | 0.05 | | 0.15 | 0.002 | | 0.005 |
| A2 | 1.35 | 1.40 | 1.45 | 0.053 | 0.055 | 0.057 |
| b | 0.17 | 0.22 | 0.27 | 0.006 | 0.008 | 0.010 |
| c | 0.09 | | 0.20 | 0.003 | | 0.0078 |
| ccc | | | 0.08 | | | 0.0031 |
| D | 11.80 | 12.00 | 12.20 | 0.464 | 0.472 | 0.48 |
| D1 | 9.80 | 10.00 | 10.20 | 0.385 | 0.393 | 0.401 |
| D3 | | 7.50 | | | 0.295 | |
| E | 11.0 | 12.00 | 12.20 | 0.464 | 0.472 | 0.480 |
| E1 | 9.80 | 10.00 | 10.20 | 0.385 | 0.393 | 0.401 |

Table 27. LQFP64 package dimensions (continued)

| Dimension | Millimeters | | | Inches | | |
|----------------|------------------------------------|---------|---------|---------|---------|---------|
| | Minimum | Typical | Maximum | Minimum | Typical | Maximum |
| E3 | | 7.50 | | | 0.295 | |
| e | | 0.50 | | | 0.019 | |
| L | 0.45 | 0.60 | 0.75 | 0.017 | 0.023 | 0.029 |
| L1 | | 1.00 | | | 0.039 | |
| Degrees | | | | | | |
| K | 0° minimum 3.5° typical 7° maximum | | | | | |

6.1 Lead-free packaging

To meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label.

ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

Revision history

Table 28. Document revision history

| Date | Revision | Changes |
|-------------|----------|-----------------|
| 26-Jun-2008 | 1 | Initial release |

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2008 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com