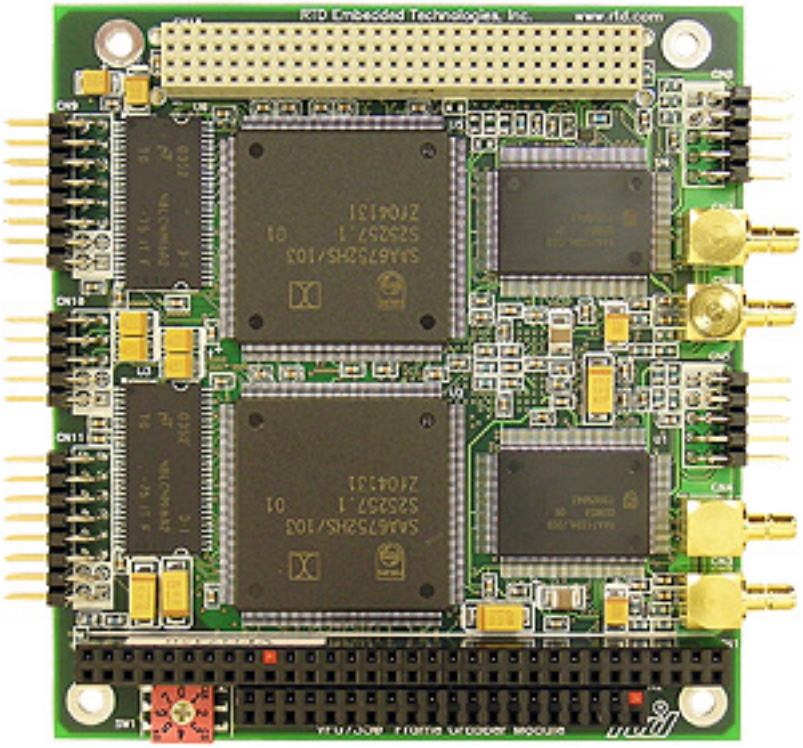
VFG7350ER Dual-Channel Video Frame Grabber with Onboard MPEG Compression



User's Manual

BDM-610020047 Revision A

www.rtd.com

An ISO9001:2000 Company

"Accessing the Analog World®"

VFG7350ER Video Frame Grabber User's Manual

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Contents and specifications within this manual are subject to change without notice.

Revision History

Revision	Date	Reason for Change
A	1/18/06	Initial release.

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Chapter 1 Introduction

This manual provides comprehensive hardware and software information for users developing with the VFG7350ER PC/104-*Plus* video frame grabber.

This manual is organized as follows:

Chapter 1	***Introduction*** introduces main features and specifications
Chapter 2	***Installing the Video Frame Grabber*** describes the connectors, external I/O connections, and installation of the VFG7350ER
Appendix A	***Reference Information*** provides operating system considerations and physical dimensions of the VFG7350ER
Appendix B	***Limited Warranty***

VFG7350ER Video Frame Grabbers

Supporting NTSC, PAL, and SECAM input standards, the VFG7350ER is designed to allow simultaneous video decoding on two independent channels. The chipset supports auto-detection of video format, which must also be supported by the software.

Both channels support optional MPEG-2 video compression and MPEG-1 layer 2 audio compression. When enabled, MPEG compression is performed through hardware, and no special software is required.

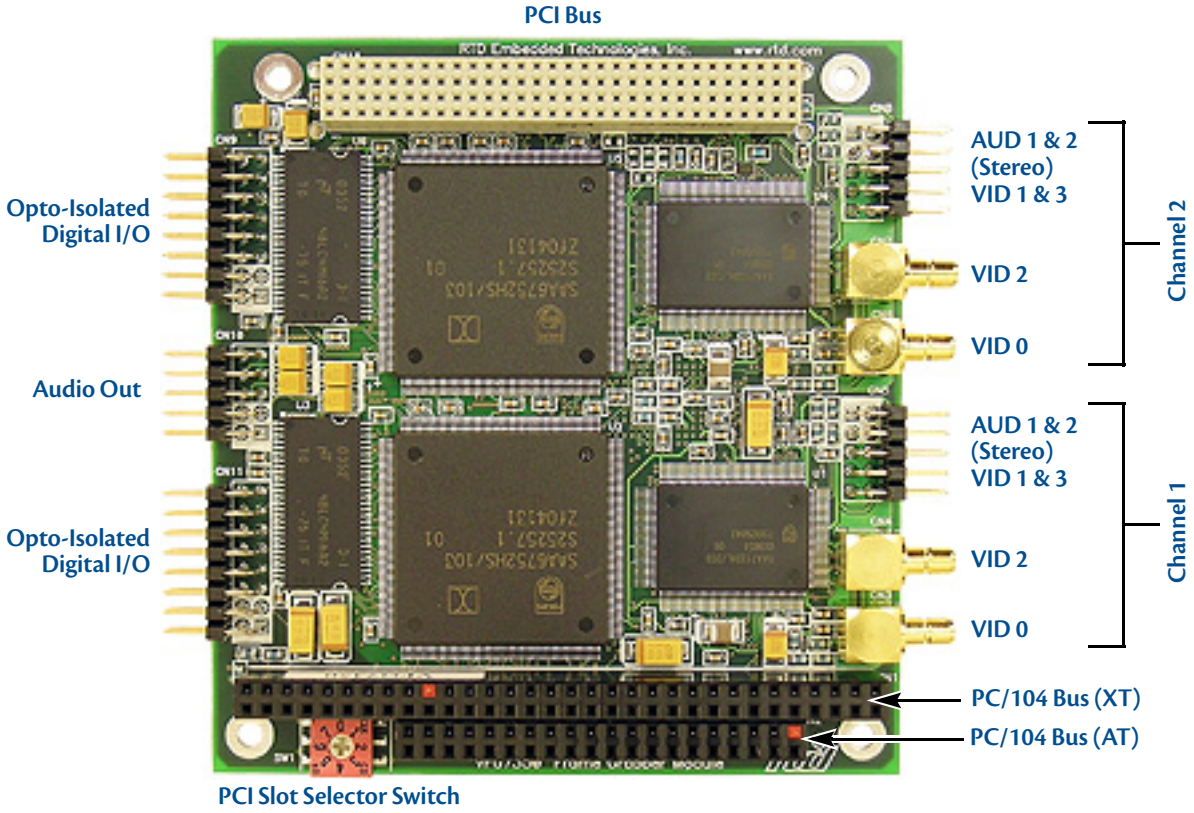

Figure 1 VFG7350ER Video Frame Grabber (top view)

Ordering Information

The VFG7350ER is a dual-channel video frame grabber with onboard MPEG compression. The VFG7350ER can also be purchased as part of an Intelligent Data Acquisition Node (IDAN™) building block, which consists of the video frame grabber and a milled aluminum IDAN frame. The IDAN building block can be used in just about any combination with other IDAN building blocks to create a simple but rugged PC/104 stack. The video frame grabber can also be purchased as part of a custom-built RTD HiDAN™ or HiDAN*plus* High Reliability Intelligent Data Acquisition Node. Contact RTD for more information on its high reliability PC/PCI-104 systems.

Cable Kit

In addition to the items included in your VFG7350ER package, several software and hardware accessories are available. Hardware accessories include IDAN frames, power supplies, terminal boards, and other connection systems. Contact RTD or your distributor, or visit the RTD website at www.rtd.com, for more information and for advice on selecting the most appropriate application software, drivers, and hardware accessories to support your control system.

For maximum flexibility, RTD does not provide cables with the video frame grabber. Cables with 75Ω impedance should be used when connecting to the composite video inputs on the VFG7350ER. You may wish to purchase the VFG7350ER video frame grabber cable kit (P/N XK-CM44), which contains:

- One 75Ω SMB lug connector to bulkhead mount BNC female connector

Board Features

The following sections describe the major features of the VFG7350ER video frame grabber.

General Features

- Dual capture/compression channels
  - Capture two video/audio streams simultaneously
  - Each channel operates independently
  - Interface decoded from PC/104-*Plus* bus
  - Supports simultaneous output of compressed and uncompressed video feeds
  - MPEG compression is channel independent
  - MPEG compression can be enabled or disabled via software
- NTSC, PAL, and SECAM inputs supported
- 4 switched video inputs per channel
  - 2 Snap-Lock SMB video inputs
  - Single 0.1-inch DIL input with two composite video inputs
  - S-Video supported by combining 2 composite inputs (provides luminance and chrominance)
- 2 stereo audio inputs available per channel (4 total)
- One selectable stereo audio output for each channel
- Opto-isolated digital I/O
  - 4 inputs per channel (8 total)
  - 4 outputs per channel (8 total)
- PCI interface
  - PCI to PCI bridge
  - Uses only one PCI slot
  - ACPI D0–D3 power-saving modes
  - Bus mastering
  - +5 V tolerant

Video Decoders (Philips SAA7133HL)

- Two Philips SAA7133HL decoders (one per channel)
- Supports NTSC, PAL, and SECAM inputs
  - Automatic detection of video input (must also be supported by software)
  - Up to 30 frames/s @ 640 x 480 under NTSC
  - Up to 25 frames/s @ 768 x 576 under PAL/SECAM
- Automatic detection of TV standard (must also be supported by software)
- Dual 9-bit analog to digital converters
- Adaptive multi-line comb filter

Onboard MPEG-2 Encoders (Philips SAA6752HS)

- Two Philips SAA6752HS MPEG-2 encoders (one per channel)
- MPEG-2 video compression
- MPEG-1 layer 2 audio compression
- All compression done onboard—no special software is required
- 8 MB dedicated SDRAM per channel
- Encoders may be enabled or disabled

Opto-Isolated Digital I/O (Philips PCF8574T)

- Two Philips PCF8574T I/O expanders for I^2C bus (one per channel)
- 4 inputs per channel (8 total)
- 4 outputs per channel (8 total)

Note *For more information about the Philips SAA7133HL, SAA6752HS, and PCF8574T devices, contact Philips or refer to the Philips Semiconductor website (www.semiconductors.philips.com).*

Physical Characteristics

- Size: 3.6 x 3.8 x 0.6 inches (90 x 96 x 15 mm)
- Weight: 0.14 lbs (0.06 Kg)
- Operating Temperature: 0 to +70° C
- Storage Temperature: –40 to +85° C
- Power Requirements, simultaneous decoding on two channels (with no MPEG compression)
  - 4.5 W @ +5 VDC

Block Diagram

The VFG7350ER is designed on the PC/104 form factor for an easy mechanical interface to PC/104 systems. Refer to *External I/O Connections* on page 13 for a detailed discussion of video frame grabber external I/O connections. The next figure shows a simplified block diagram of the VFG7350ER video frame grabber. Primary board components are in bold, while external I/O connections are italicized.

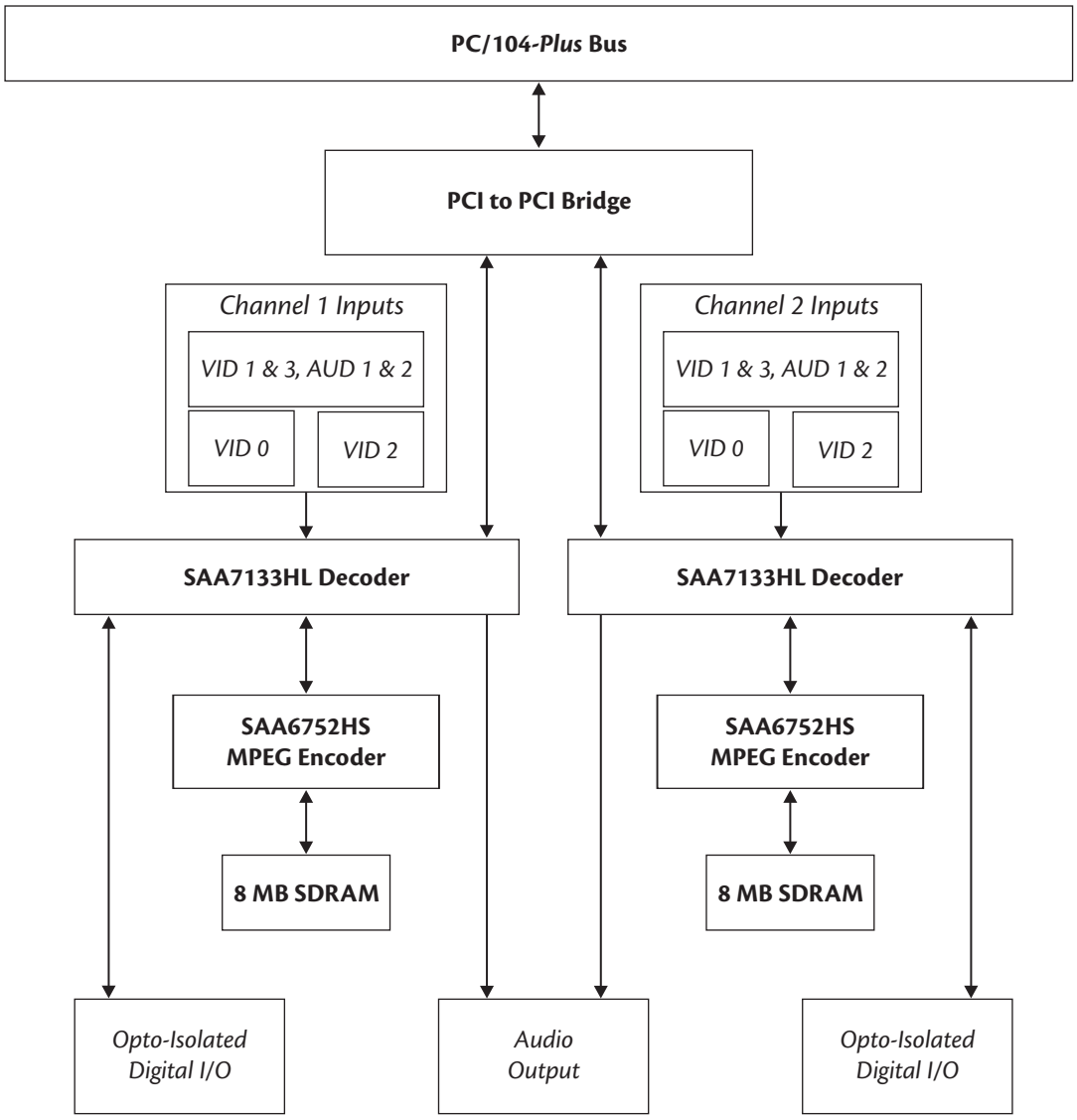

Figure 2 VG7350ER Video Frame Grabber Simplified Block Diagram

Contact Information

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Be sure to check the RTD web site (www.rtd.com) frequently for product updates, including newer versions of application software and this manual.

Chapter 2 Installing the Video Frame Grabber

The VFG7350ER video frame grabber interfaces easily to PC/104 systems. This chapter shows the external I/O connections and connector pinouts, and provides module installation instructions.

VFG7350ER Connectors

Figure 3 shows the connectors and PCI Slot Selector Switch of the VFG7350ER video frame grabber.

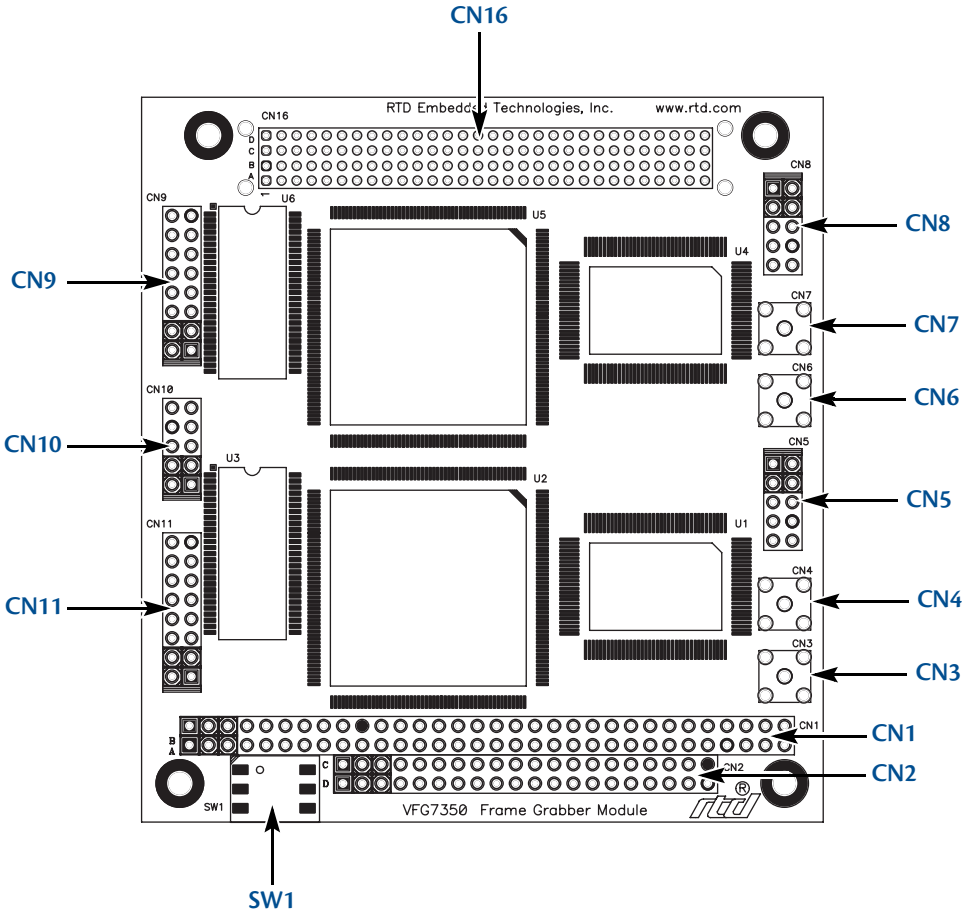

Figure 3 VFG7350ER Connector Locations (top view)

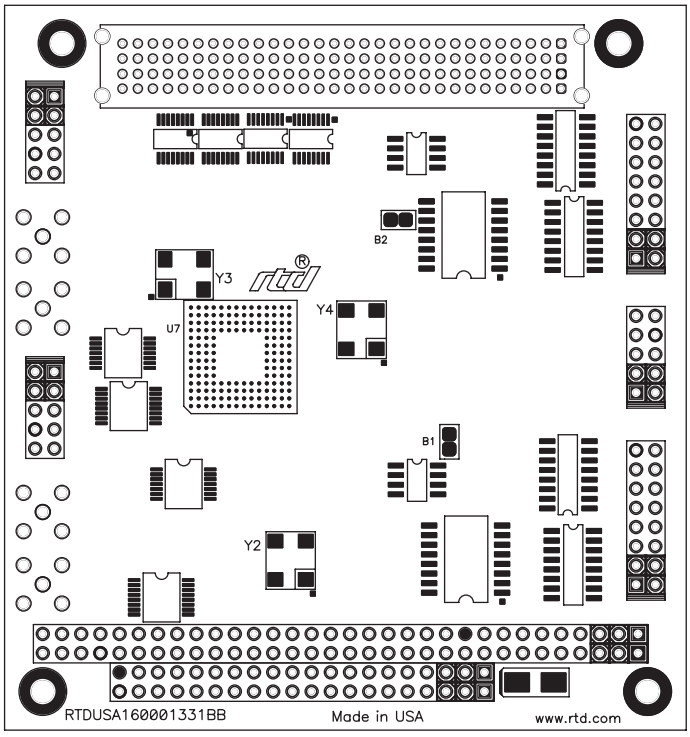

Figure 4 VFG7350ER Connector Locations (bottom view)

Note *Pin 1 of each connector is indicated by a square within a white square on both the top and bottom of the board. Pin 1 of the XT and AT connectors match when stacking with other PC/104 modules.*

Table 1 VFG7350ER Connectors

Connector	Function	Size
CN1	PC/104 Bus (XT)	64-pin
CN2	PC/104 Bus (AT)	40-pin
CN3	Channel 1: VID 0	Snap-Lock SMB
CN4	Channel 1: VID 2	Snap-Lock SMB
CN5	Channel 1: VID 1 &3; AUD 1 & 2	10-pin
CN6	Channel 2: VID 0	Snap-Lock SMB
CN7	Channel 2: VID 2	Snap-Lock SMB
CN8	Channel 2: VID 1 &3; AUD 1 & 2	10-pin
CN9	Opto-Isolated Digital I/O (channel 2)	16-pin
CN10	Audio Output (channels 1 & 2)	10-pin
CN11	Opto-Isolated Digital I/O (channel 1)	16-pin
CN16	PCI Bus	120-pin
SW1	PCI Slot Selector Switch	—

External I/O Connections

The following sections describe the external I/O connections of the VFG7350ER. Each channel provides 4 switched video inputs and 2 stereo audio inputs via two Snap-Lock SMB video inputs and one 10-pin DIL connector.

Note that channel 1 and channel 2 each have the same set of connectors. Connectors **CN3**, **CN4**, **CN5**, and **CN11** of channel 1 correspond to connectors **CN6**, **CN7**, **CN8**, and **CN9** of channel 2 respectively. Connector **CN10** (audio output) is shared between the two channels.

Channel 1: Video Input 0 Connector (CN3)

A Snap-Lock SMB connector is used to connect a composite video signal from an external video source.

Table 2 Channel 1: Video Input 0 (CN3)

Pin	Signal	Function
1	CV0_Y	Composite video input 0 (or S-Video Y component)

Channel 1: Video Input 2 Connector (CN4)

A Snap-Lock SMB connector is used to connect a composite video signal from an external video source.

Table 3 Channel 1: Video Input 2 (CN4)

Pin	Signal	Function
1	CV2_C	Composite video input 2 (or S-Video C component)

Channel 1: Video/Audio Input Connector (CN5)

A 10-pin DIL input connector supports two composite video inputs (VID 1, 3) and two stereo audio inputs (AUD 1, 2).

Table 4 Channel 1: Video/Audio Input (CN5)

Pin	Signal	Pin	Signal	Function
1	AUDIO1_IN_L1	2	AUDIO1_IN_R1	Channel 1 stereo audio input 1 (L + R)
3	DGND	4	DGND	Pin 3: Audio input 1 ground Pin 4: Audio input 2 ground
5	AUDIO1_IN_L2	6	AUDIO1_IN_R2	Channel 1 stereo audio input 2 (L + R)
7	DGND	8	CV1_Y	Channel 1 composite video input 1 (or S-Video Y component)
9	DGND	10	CV3_C	Channel 1 composite video input 3 (or S-Video C component)

Channel 2: Video Input 0 Connector (CN6)

A Snap-Lock SMB connector is used to connect a composite video signal from an external video source.

Table 5 Channel 2: Video Input 0 (CN6)

Pin	Signal	Function
1	CV0_Y	Composite video input 0 (or S-Video Y component)

Channel 2: Video Input 2 Connector (CN7)

A Snap-Lock SMB connector is used to connect a composite video signal from an external video source.

Table 6 Channel 2: Video Input 2 (CN7)

Pin	Signal	Function
1	CV2_C	Composite video input 2 (or S-Video C component)

Channel 2: Video/Audio Input Connector (CN8)

A 10-pin DIL input connector supports two composite video inputs (VID 1, 3) and two stereo audio inputs (AUD 1, 2).

Table 7 Channel 2: Video/Audio Input (CN8)

Pin	Signal	Pin	Signal	Function
1	AUDIO2_IN_L1	2	AUDIO2_IN_R1	Channel 2 stereo audio input 1 (L + R)
3	DGND	4	DGND	Pin 3: Audio input 1 ground Pin 4: Audio input 2 ground
5	AUDIO2_IN_L2	6	AUDIO2_IN_R2	Channel 2 stereo audio input 2 (L + R)
7	DGND	8	CV1_Y	Channel 2 composite video input 1 (or S-Video Y component)
9	DGND	10	CV3_C	Channel 2 composite video input 3 (or S-Video C component)

Channels 1 and 2: Audio Outputs (CN10)

One 10-pin audio output connector is shared between channels 1 and 2. This connector provides two stereo audio outputs—one output for each channel. Audio captured through the stereo audio inputs of **CN3** and **CN6** can be routed to a PC sound card via the audio output connector.

Table 8 Channels 1–2: Audio Outputs (CN10)

Pin	Signal	Pin	Signal	Function
1	DGND	2	DGND	Ground
3	AUDIO1_OUT_L	4	AUDIO1_OUT_R	Channel 1 stereo audio output (select from channel 1 stereo audio input 1 or 2)
5	DGND	6	DGND	Ground
7	AUDIO2_OUT_L	8	AUDIO2_OUT_R	Channel 2 stereo audio output (select from channel 2 stereo audio input 1 or 2)
9	DGND	10	DGND	Ground

Channels 1 and 2: Digital I/O (CN11/CN9)

The VFG7350ER has four opto-isolated inputs and four opto-isolated outputs that provide a direct interface to digital signals. These opto-isolated digital I/O lines are provided through two 16-pin DIL connectors. These pins can be read and written to via the I^2C bus.

Table 9 Channels 1 and 2: Digital I/O (CN11/CN9)

Pin	Signal	Pin	Signal
1	Output 3 (collector)	2	Output 3 (emitter)
3	Output 2 (collector)	4	Output 2 (emitter)
5	Output 1 (collector)	6	Output 1 (emitter)
7	Output 0 (collector)	8	Output 0 (emitter)
9	Input 3 (LED anode)	10	Input 3 (LED cathode)
11	Input 2 (LED anode)	12	Input 2 (LED cathode)
13	Input 1 (LED anode)	14	Input 1 (LED cathode)
15	Input 0 (LED anode)	16	Input 0 (LED cathode)

S-Video Support

S-Video is supported by combining pairs of composite video inputs. When these signals are used for S-Video, one signal provides luminance (Y) while the other provides chrominance (C). Two S-Video input pairs are supported by each channel, as shown in the following table:

Table 10 S-Video Support

Channel	Luminance (Y)	Chrominance (C)	Function
1	CV0_Y (CN3)	CV2_C (CN4)	S-Video pair 1
1	CV1_Y (CN5)	CV3_C (CN5)	S-Video pair 2
2	CV0_Y (CN6)	CV2_C (CN7)	S-Video pair 3
2	CV1_Y (CN8)	CV3_C (CN8)	S-Video pair 4

Switch SW1—PCI Slot Selector

This rotary switch is used to set the positioning of the VFG7350ER with respect to the CPU module and other PC/104-*Plus* or PCI/104 cards in the stack.

Note *All PC/104-Plus and PCI/104 modules (including the VFG7350ER) must be on the same side of the CPU module.*

If the video frame grabber is the first module from the CPU module, set the switch to position "0". If it is the second module from the CPU module, set the switch to position "1". Similarly, position "2" refers to the third module and position "3" refers to the fourth module away from the CPU module.

The PCI slot number can be configured as follows:

Table 11 PCI Slot Selector Switch

Switch Position	PCI Slot Number
0	Slot 0 (closest to CPU)
1	Slot 1
2	Slot 2
3	Slot 3
4	undefined
5	undefined
6	undefined
7	undefined

VFG7350ER I²C Bus

I²C Devices

Refer to the the I²C slave addresses in Table 12 when programming the VFG7350ER devices.

Table 12 I²C Bus Addresses

Device	I²C Slave Address (hex)
Channel 1 Digital I/O	0x40h
Channel 1 MPEG (write)	0x42h
Channel 1 MPEG (read)	0x43h
Channel 1 EEPROM	0xA0h
Channel 2 Digital I/O	0x40h
Channel 2 MPEG (write)	0x42h
Channel 2 MPEG (read)	0x43h
Channel 2 EEPROM	0xA0h

Device Identification

Each channel of the VFG7350ER has an EEPROM that identifies the board devices. The first four bytes of each EEPROM are used for device identification.

Note *For more information on the I²C bus, refer to a copy of the I²C specification, which can be downloaded from the Philips Semiconductor website (www.semiconductor.philips.com).*

Installation Considerations

Consider the following points before integrating the VFG7350ER into a PC/104-*Plus* stack.

1. The VFG7350ER is a PC/104-*Plus* module with an ISA bus (PC XT and AT connectors) and a PCI bus. Therefore, the VFG7350ER should be installed with a PC/104-*Plus* or PCI/104 cpuModule and other PC/104-*Plus* or PCI/104 peripheral modules.
2. RTD recommends building your PC/104-*Plus* or PCI/104 computer by stacking the power supply module and cpuModule on the ends of the stack. These two modules produce heat, and stacking them on the top and bottom maximizes heat dissipation. Placing the cpuModule on one end of the stack also minimizes reflections. RTD-built PC/104-*Plus* systems, such as the Intelligent Data Acquisition Node (IDAN™), normally have a power supply module on the bottom and a cpuModule on the top. Any other combination of PC/104-*Plus* or PCI/104 modules, including the VFG7350ER, can be integrated into the stack.

Before You Begin

CAUTION *Keep your VFG7350ER in the antistatic bag until you are ready to install it to your system!*

When removing the VFG7350ER from the antistatic bag, hold it at the edges and do not touch the components or connectors. Please handle the module in an antistatic environment and use a grounded workbench for testing and handling.

Installing the VFG7350ER in a PC/104-*Plus* Stack

1. Turn off power to your PC/104-*Plus* or PCI/104 system and unplug the cord.
2. Ground yourself with an anti-static strap.
3. Check that the keying pins in the PC/104 bus connector are properly positioned. Two keying pins should reside in pins C19 and B10.
4. Use the PCI slot selector switch **SW1** to set the positioning of the VFG7350ER with respect to the CPU module and other PC/104-*Plus* or PCI/104 cards in the stack.

Note *All PC/104-Plus and PCI/104 modules (including the VFG7350ER) must be on the same side of the CPU module.*

If VFG7350ER is the first module from the CPU module, set the switch to position "0". If it is the second module from the CPU module, set the switch to position "1". Similarly, position "2" refers to the third module and position "3" refers to the fourth module away from the CPU module.

CAUTION *The VFG7350ER should slide into the matching PC/104 connector easily. Do not force the connection. Doing so might bend or break pins.*

5. Line up the pins of the VFG7350ER's PC/104 connector with the PC/104 bus of the stack and gently press the module onto the stack. The module should slide into the matching PC/104-*Plus* and PCI connectors easily. Do not attempt to force the module, as this can lead to bent/broken pins.

Note *If the VFG7350ER does not press into place, check modules in your stack for bent pins or out-of-place keying pins, and try again.*

6. If any modules are to be installed above the VFG7350ER, install them. If the other modules are PC/104-*Plus* or PCI/104 devices, set the PCI slot selector switches on these modules based on their position away from the CPU module.
7. Attach any necessary cables to the PC/104-*Plus* stack.
8. Reconnect the power cord and apply power to the stack.
9. Boot the system and verify that all of the hardware is working properly.

Appendix A Reference Information

This appendix provides reference information for the VFG7350ER video frame grabber.

Operating System Considerations

Linux

The Video4Linux2 kernel subsystem provides VFG7350ER device support. For a general overview of setting up and using the Video4Linux2 SAA7134 driver, refer to RTD Application Note, *Using Video4Linux2 SAA7134 Driver with VFG73xx*, part number SWM-640020017, which is available at RTD's website (www. rtd.com).

Installation and configuration procedures depend on your Linux distribution. Consult your distribution's documentation for more information.

Other Operating Systems

For information on support for other operating systems, see the Philip's website at:

www.semiconductor.philips.com.

Performance Limitations

PCI Bandwidth

The theoretical maximum bandwidth of the PCI bus is 132 MB/s, but the actual bandwidth is limited by the amount of PCI bus activity on the system. All PCI devices in a system share the total bandwidth. As more PCI devices are added to a system, it creates a bottleneck and reduces the bandwidth used for transferring video and audio data streams to disk.

Disk Controller

When transferring video and audio data streams (and other file types), it is not possible for the transfer to occur at a rate faster than the disk technology allows. The performance for all storage types is limited by the drive and drive controller used in the system. Such limitations include the transfer modes supported by the disk controller and mechanical latencies.

Physical Dimensions

Figure 5 shows the mechanical dimensions of the VFG7350ER video frame grabber (in inches).

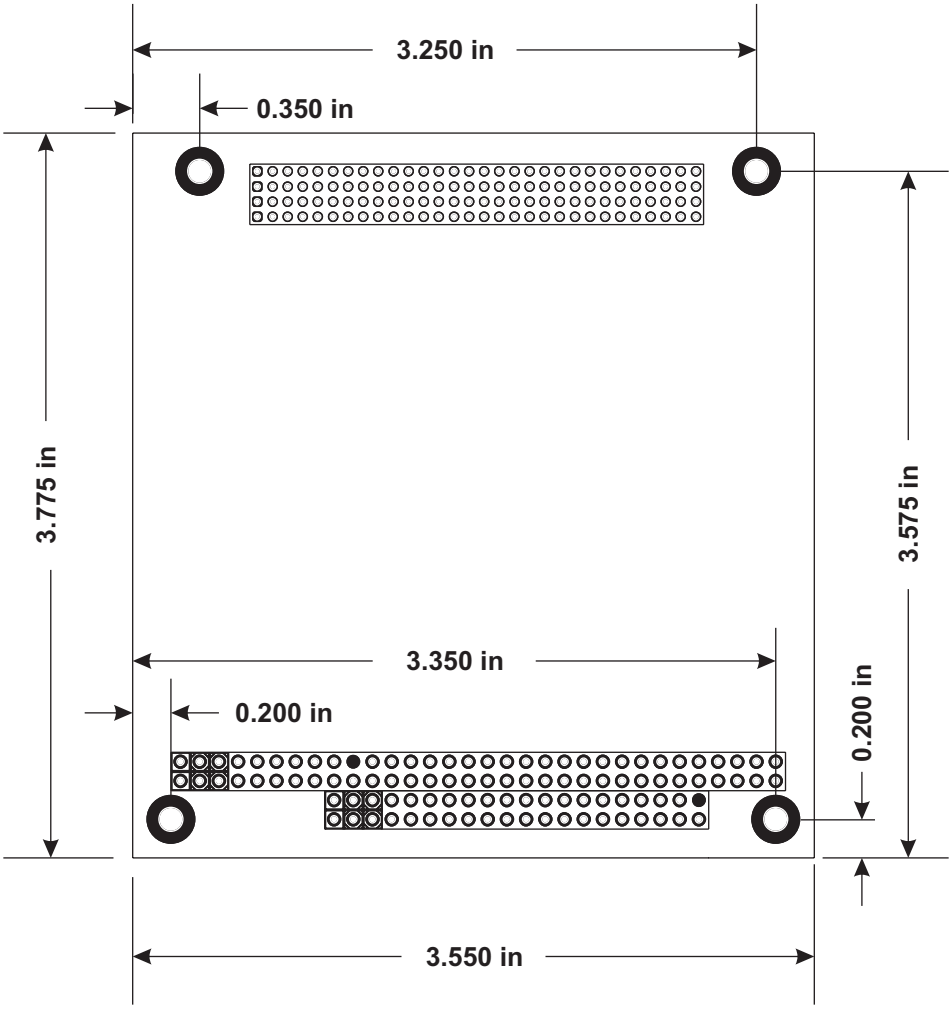

Figure 5 VFG7350ER Physical Dimensions (±0.005 inches)

Appendix B Limited Warranty

RTD Embedded Technologies, Inc. warrants the hardware and software products it manufactures and produces to be free from defects in materials and workmanship for one year following the date of shipment from RTD Embedded Technologies, Inc. This warranty is limited to the original purchaser of product and is not transferable.

During the one year warranty period, RTD Embedded Technologies will repair or replace, at its option, any defective products or parts at no additional charge, provided that the product is returned, shipping prepaid, to RTD Embedded Technologies. All replaced parts and products become the property of RTD Embedded Technologies. Before returning any product for repair, customers are required to contact the factory for a Return Material Authorization number.

This limited warranty does not extend to any products which have been damaged as a result of accident, misuse, abuse (such as: use of incorrect input voltages, improper or insufficient ventilation, failure to follow the operating instructions that are provided by RTD Embedded Technologies, "acts of god" or other contingencies beyond the control of RTD Embedded Technologies), or as a result of service or modification by anyone other than RTD Embedded Technologies. Except as expressly set forth above, no other warranties are expressed or implied, including, but not limited to, any implied warranties of merchantability and fitness for a particular purpose, and RTD Embedded Technologies expressly disclaims all warranties not stated herein. All implied warranties, including implied warranties for merchantability and fitness for a particular purpose, are limited to the duration of this warranty. In the event the product is not free from defects as warranted above, the purchaser's sole remedy shall be repair or replacement as provided above. Under no circumstances will RTD Embedded Technologies be liable to the purchaser or any user for any damages, including any incidental or consequential damages, expenses, lost profits, lost savings, or other damages arising out of the use or inability to use the product.

Some states do not allow the exclusion or limitation of incidental or consequential damages for consumer products, and some states do not allow limitations on how long an implied warranty lasts, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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