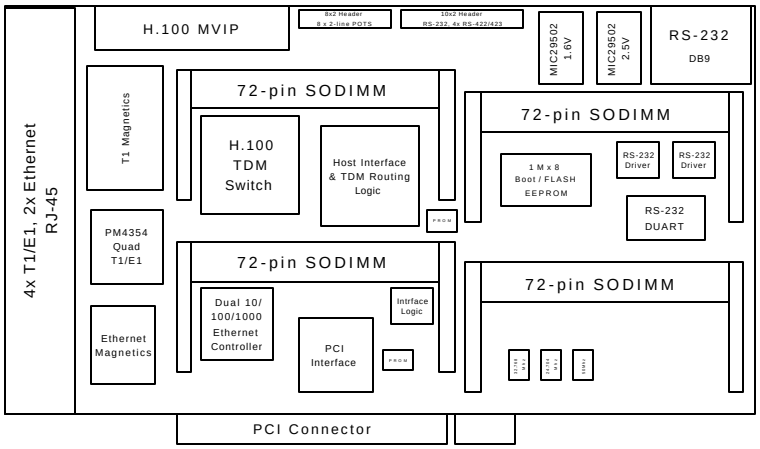
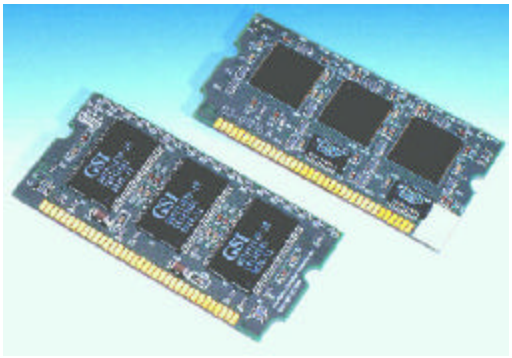
SigC54/55xx-PCI

Data Sheet

Multiple DSP and Telephony/Analog I/O Board



SigC54/55xx-PCI board mechanical layout shown above, including 4x SODIMM sites for C54xx/C55xx processor and I/O modules



SigC5409-SODIMM modules shown above. Various C54xx and C55xx SODIMM module types are available.

Features

- Up to four (4) SODIMM sites may be populated with C54xx/C55xx DSP processor or I/O modules
- Up to 7.2 GIPS total processing power with all DSP modules installed
- Standard “short form” PCI card with 33 MHz 32-bit PCI host interface
- Quad T1/E1 telephony interface (integrated framers and transceivers), available both at RJ-45 connectors on board backplate and MVIP H.100 connector
- Dual 10/100/1000 Ethernet interface
- 8-line POTS telephony interface
- Supports multichannel analog I/O interface with SigSD4 Audio Module or other analog I/O modules are installed
- Flexible onboard TDM stream routing, via programmable PLD switch matrix under host software control
- Dual RS-232 asynchronous serial ports
- Four (4) RS-422/423 synchronous serial ports
- Boot/FLASH EEPROM
- Global Bus expansion header
- 1149.1 JTAG header
- Supported by SigC5xxx Development System under Win9x, Win2K, and Linux. Software support includes IDS, DirectDSP®, Hypersignal®-Macro, and C5xxx SCI, which provides a framework for use with Texas Instruments Code Composer Studio (CCS) software

Summary

The SigC54/55xx-PCI board uses a modular approach to provide up to 7.2 GIPS in a single PCI card slot. The board accepts modules with Texas Instruments C54xx and C55xx DSP processors and modules with 16-bit audio and speech analog I/O. It is suitable for embedded telecom and Internet infrastructure applications where space is at a premium.

Applications

Applications for the SigC54/55xx-PCI board include base-station processing, VoIP (voice-over Internet protocol) networking functions, VoDSL (voice-over DSL), Internet routing, multiple-channel speech or audio code / decode (e.g. G.729A or MELP speech compression and MP3 audio compression), modem banks, echo cancellation, and speech recognition.

Advantages

The modular approach used by the SigC54/55xx-PCI board is particularly well suited to providing a scalable solution for telecom and Internet equipment applications that require multiple DSP devices. For example, channel capacity is highly configurable and upgradeable.

The modular approach to multiple DSP processing offers higher density and performance, lower-cost, and several advantages for OEM products and applications:

- base board design is simplified and fabrication risk is decreased
- modules can be upgraded easily, as faster and more capable TI DSP devices become available
- for custom applications, specifying modules with different processors and memory configurations is straightforward
- SigC54xx and SigC55xx modules are supported by standard, off-the-shelf software tools, including DirectDSP™, DSPower®, and Hypersignal®-Macro software

SIGNALOGIC®

Processors

The Texas Instruments C54xx and C55xx DSP device families offer high performance, low power consumption, and extremely small size.

The TMS320C549, C5402, C5409, C5416, and C5510 digital signal processors range from 100 to 200 MHz (100 to 200 MIPS) in processing capability. They offer a complete set of onchip peripherals depending on processor type, including serial ports, host port, PLL, timers, DMA channels, and from 32k x 16 to 192k x 16 onchip memory. There are several cost/performance tradeoff possibilities. For example, the C5409 is an extremely cost effective solution, and offers a clear upgrade path to TI devices with more performance or less power consumption, such as C5416 and C5421. As another example, the C5402 is an extremely low-cost solution, but has less onchip memory.

Host PC Interface

The host PC interface is through a PLX 9056 non-transparent bridge device, and supports both bus master and slave transfers. Host software can access multiple C54/55xx HPIs, quad T1/E1 interface, serial/TDM routing PLD, boot/FLASH EEPROM, RS-232 DUART, and internal PLD registers.

The HPI interface allows host software to view onchip C54/55xx memory as dual-access and fully supports multiplexed-mode HPI features, such as auto-increment. This method allows efficient data transfers between host PC software and the SigC54/55xx-PCI board while the processors continue to run, and fully complies with DirectDSP software support.

Multiple C54/55xx HPIs can be accessed simultaneously by the host during write transfers; for example, COFF files can be downloaded to any combination of DSPs simultaneously.

Using the DirectDSP software interface, C54/55xx processors do not need to be held or otherwise delayed when host software accesses onchip SRAM, and DSP source code does not need to be altered or “instrumented” in any way. The DirectDSP software interface to multiple DSPs is complimentary to JTAG debugging tools such as Code Composer Studio software, and may be used at the same time.

DirectDSP software provides Plug-N-Play compatible Win9x and WinXP drivers.

An I2C serial “cookie data” EEPROM provides the PLX 9056 PCI interface bridge with hardware configuration, product and vendor type, firmware version, and other board information.

T1/E1 Quad Telephony Interface

The SigC54/55xx-PCI board contains a PMC Sierra PM4354 quad T1/E1 device with integrated framers and transceivers that provides a telephony interface available on both a standard MVIP H.100 connector and four (4) RJ-45 connectors (located at the board backplate, using RJ-48C electrical wiring specification).

In addition to the RJ-45 connectors, the telephony interface includes onboard magnetics and activity/status indicators (LEDs).

Command, control, and status information is available to the host interface, and all TDM data is routed to the DSP module sites, via the programmable PLD switch matrix.

Dual 10/100/1000 Ethernet Interface

The SigC54/55xx-PCI board contains a PMC Sierra PM3386 dual 10/100/1000 Mbps Ethernet device, and provides external interface on two (2) RJ-45 headers at the board backplate.

In addition to the RJ-45 connectors, the Ethernet interface includes onboard transceivers, magnetics and activity/status indicators (LEDs built into the RJ-45 connectors).

POTS Telephony Interface

The SigC54/55xx-PCI contains 2x quad-SLAC devices (2x “QSLAC” devices) and 8x SLIC devices and associated circuitry, to allow connection to four (4) sets of 2-line POTS connections (8 POTS lines total). Magnetics and RJ-11 connectors are not located on the board; instead, 8x2 dual inline headers are provided at the top of the board for ribbon cable connection to four (4) external RJ-11 connectors

Command, control, and status and all TDM data are routed to the DSP module sites, via the programmable PLD switch matrix.

TDM Routing PLD

The SigC54/55xx-PCI board contains an onboard PLD logic device that allows flexible serial port/TDM routing capabilities. For example, PLD logic is used to multiplex both quad SLAC devices into a single TDM stream to fit the natural architecture of the C54xx and C55xx DSP families and facilitate DSP software development. As another example, the PLD logic allows quad T1/E1 data to be routed to any combination of DSP module sites.

Analog I/O

Combined with SigC54/55xx processor modules, the SigSD4-SODIMM Audio Module offers multichannel 16-bit sigma-delta analog I/O as an integrated component in the modular solution. Audio Module features include:

- sigma-delta converters that provide sharp anti-alias and reconstruction filter roll-off, and nearly linear phase response
- sampling rates and filter cutoff frequencies are software programmable; all channels are sampled simultaneously
- TDM (time division multiplex) serial output allows distribution of multichannel audio data to one or more DSP processors; audio data can be replicated among processors, or distributed uniformly, as needed

- analog input/output signals are routed directly to the module using a small-outline Mictor 38-pin connector that supports individually shielded conductors

More Information
http://www.signalogic.com/sigsd.htm

Serial I/O Interface

The SigC54/55xx-PCI board provides four (4) synchronous serial channels and two (2) RS-232 asynchronous serial channels. All serial I/O signals are available at board edge; routing is software-programmable and levels are software-programmable for either RS-422 or RS-423 (balanced or unbalanced).

Boot EEPROM

The SigC54/55xx-PCI board contains a 1M x 8 FLASH EEPROM device site for storage of boot code and nonvolatile application data. Using the EEPROM for program code storage, the board also supports a “power only”, or stand-alone mode of operation.

Digital Parallel I/O and Interboard Communication

The SigC54/55xx-PCI board contains a 16-bit parallel digital I/O “Global Bus”, brought out via high-density dual-row protected header.

If the SigSD4-SODIMM audio module is used, an additional 8 bits of parallel digital I/O are provided for each module installed on the board. These bits are directly accessible to C54xx processors using output instructions to the audio modules.

Physical Specifications

The SigC54/55xx-PCI board is a “short form” PCI format board, fully compliant with PCI specification v2.2 (PCISIG, “Conventional PCI”) both electrically and mechanically. The dimensions of the board are 170 mm (length) x 97 mm (height, not including PCI edge connector).

In addition to RJ-45 connectors, the SigC54/55xx-PCI backplate has a bank of eight (8) tri-color LEDs that provide board and DSP status.

DSPower™, DirectDSP™, and Hypersignal® Software Support

The SigC54/55xx-PCI board, as well as other C54xx and C55xx platforms such as the Texas Instruments DSK C5402 board and SigC54xx-PC/104 board, are supported by Signalogic off-the-shelf DSP software products designed for DSP-based real-time processing and C54/55xx DSP code development, including:

- Hypersignal®-Macro and Hypersignal-Acoustic software series, which offer a number of simulation and real-time instrument functions. Simulation functions include DSP and math functions, time domain display (including waterfall, contour, magnitude, unwrapped phase), difference equation, digital FIR and IIR filter design, sampling rate conversion, frequency zoom, wavelet transform, minimum phase calculation, and many more. Instrument functions include spectrum analyzer, digital oscilloscope, stimulus & response measurement, continuous signal generation, real-time; "snap-in"; filtering, continuous disk record and generate, and more.

- DirectDSP™ is a Windows library that provides low-level and high-level calls for user-defined C/C++, Visual Basic, MATLAB®, or LabVIEW® programs. The DirectDSP API includes low-level hardware control functions such as reset/run/hold, register access, block memory transfer, DSP executable file download, etc. High-level functions include waveform file acquire/generate, continuous signal generation and execution of any arbitrary Hypersignal DSP or math function. DirectDSP includes strip-chart recorder, digital oscilloscope and digital tape recorder demo program and source code examples.

  Using the DirectDSP software interface, C54/55xx processors do not need to be held or otherwise delayed when host software accesses onchip SRAM, and DSP source code does not need to be altered or “instrumented” in any way. The DirectDSP software interface to multiple DSPs is complimentary to JTAG debugging tools such as Code Composer Studio software, and may be used at the same time.

  DirectDSP software provides Plug-N-Play compatible Win9x and WinXP drivers

- The C54/55xx Source Code Interface software contains numerous C54/55xx algorithms and functions in source and binary form, such as optimized FFTs, filters, matrix, transcendental, trig, signal manipulation function, processor and card initialization and analog I/O examples, etc. These functions form the basis of higher-level software functions and instruments; modification can be used to customize Hypersignal or DirectDSP software operation. User-defined C routine entry points are provided for real-time algorithm development. The C54/55xx Source Code Interface can be used as a basic foundation for user-defined, real-time DSP systems and products.

- Real-Time Composer™ and DSPower®-Block Diagram are Windows programs which offer a block-diagram, based design environment that allows both block-diagram simulation and interactive display and instrument functions, including control over individual Hypersignal and MATLAB blocks. Real Time Composer includes complete visual IDE for Texas Instruments C54/55xx development tools, and allows C source code generation from block diagram, with generated programs compiled and downloaded to the SigC54/55xx modules for real-time execution.

More Information
http://www.signalogic.com/ti_320/sigtools.htm

Module Edge Connector Definition

Edge connector pin assignments for the SigC54/55xx-SODIMM module are shown below.

Pin No.	Signal Name	Pin No.	Signal Name
1	+3.3v	37	HD8
2	GND	38	HD9
3	/HCS	39	HD10
4	/HDS	40	HD11
5	HINT	41	HD12
6	HRDY	42	BFS1
7	/RST	43	/EINT
8	BFS0	44	BIO
9	GND	45	BCLK
10	DSPCLK	46	XF [2]
11	GND	47	BDR0
12	+2.5v	48	+3.3v
13	GND	49	GND
14	BDX0	50	BDX2
15	HD0	51	GND
16	HD1	52	BFS3
17	HD2	53	GND
18	HD3	54	HD13
19	HD4	55	HD14
20	HD5	56	HD15
21	HD6	57	HHWIL [3]
22	HD7	58	HMODE
23	+5.0v [1]	59	BFS2
24	+3.3v	60	+2.5v
25	GND	61	GND
26	-5.0v [1]	62	EMU1
27	NC	63	EMU0
28	HR/W*	64	/TRST
29	A0	65	TMS
30	HCNTL0/A1	66	TCK
31	HCNTL1/A2	67	TDI
32	BDX1	68	TDO
33	GND	69	BDR2
34	BDR1	70	BDX3
35	GND	71	BDR3
36	+2.5v	72	GND

Notes

[1] Not connected on standard SigC54/55xx-SODIMM processor module. May be used by non-processor modules, including Audio Modules.

[2] Not connected on standard SigC54/55xx-SODIMM processor module. Typically jumpered to XF Flag test-point on processor module when used in system with Audio Modules.

[3] HHWIL signal not used on SigC54/55xx modules. Used on SigC67xx modules.

Module Absolute Maximum Ratings

Rating	Symbol	Value	Units
Device Supply Voltage, I/O	DV_{DD}	-0.3 to +4.6	V
Device Supply Voltage, Core	CV_{DD}	-0.3 to +3.75	V
Input Voltage	V_{IN}	-0.3 to +4.6	V
Output Voltage	V_{OUT}	-0.3 to +4.6	V
Power Dissipation	P_D	0.7	W
Operating Temperature	T_C	0 to +70	°C
Storage Temperature	T_{STG}	-55 to +150	°C

Notes

Stresses beyond the absolute maximum ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or other conditions beyond those indicated in the operational sections of this specification is not implied. Operations beyond the recommended conditions may affect reliability of the device.

Module DC Operating Range

Parameter	Symbol	Min	Typical	Max	Units
Device Supply Voltage, I/O	DV_{DD}	3.0	3.3	3.6	V
Device Supply Voltage, Core	CV_{DD}	2.4	2.5	2.75	V
Input High Voltage	V_{IH}	2.0	–	V_{DD} +0.3	V
Input Low Voltage	V_{IL}	-0.3	–	0.8	V

Module DC Characteristics

Parameter	Symbol	Min	Max	Units
Output Low Voltage (I_{OL} = + 6.7 mA)	V_{OL}	--	0.4	V
Output High Voltage (I_{OH} = - 4.0 mA)	V_{OH}	2.4	--	V

Module Capacitance

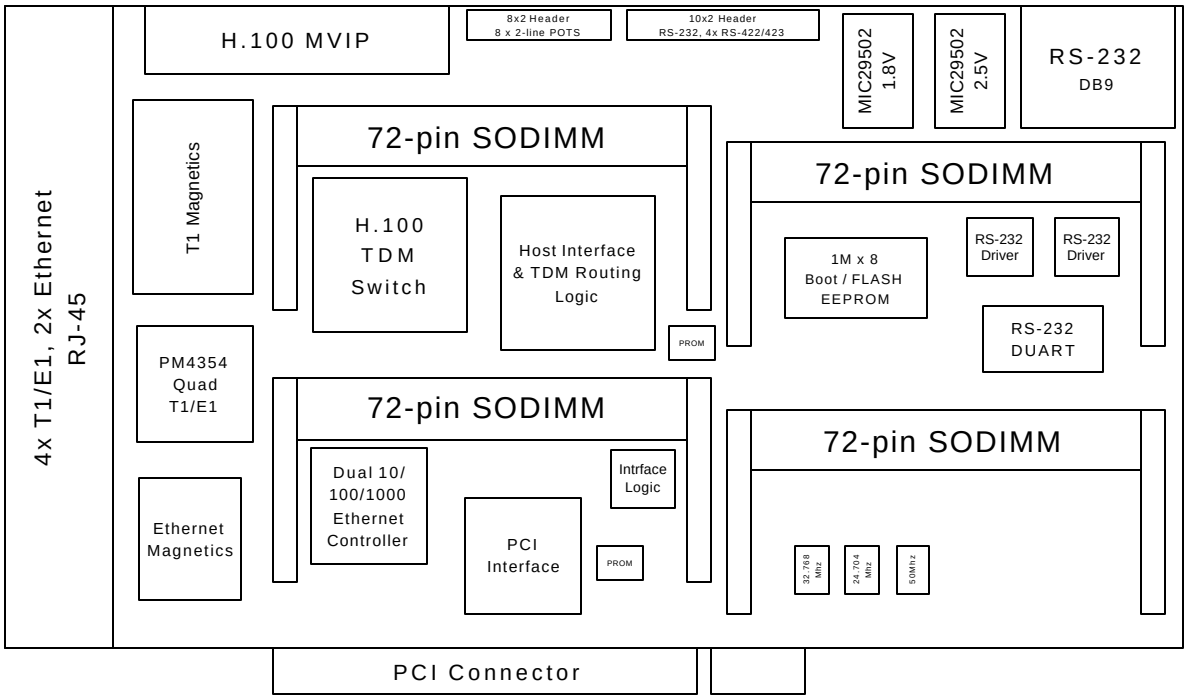
Parameter	Symbol	Typical	Max	Units
Input Capacitance	C_{IN}	--	5	pF
Output Capacitance	C_{OUT}	--	7	pF

Notes

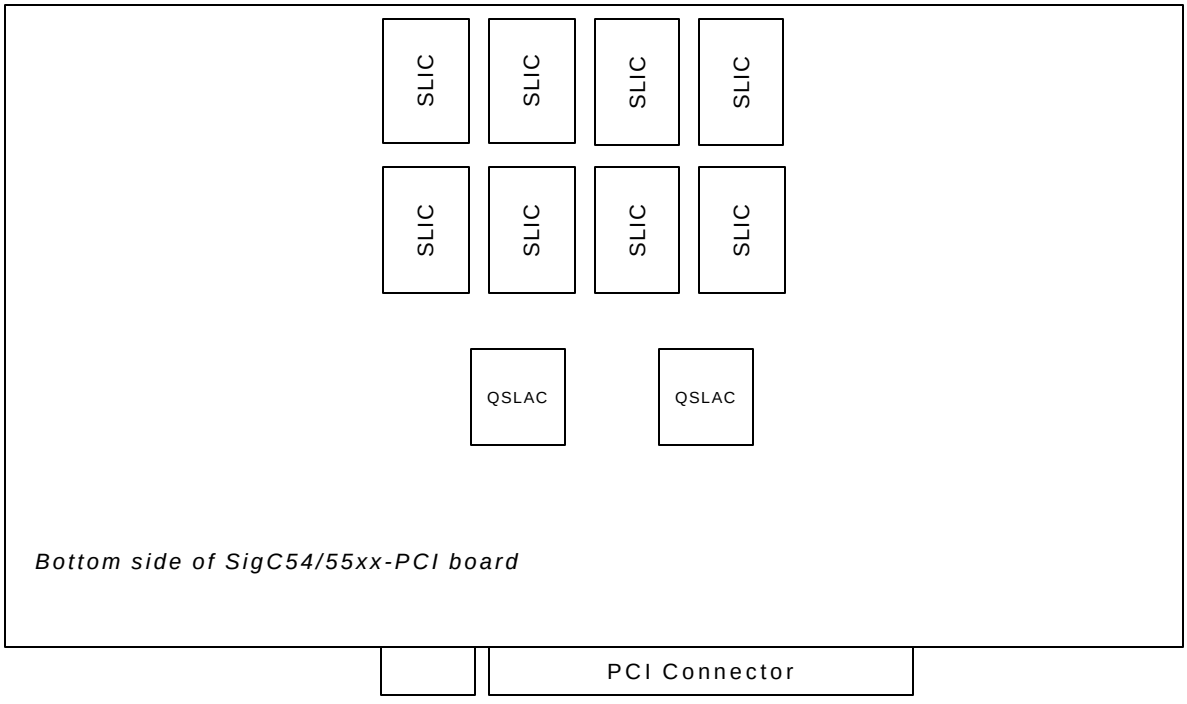
1. Capacitance is characterized and is not 100% tested

SigC54/55xx-PCI Board Mechanical Drawings

Dimensions and physical specifications for the SigC54/55xx-PCI board are shown below.



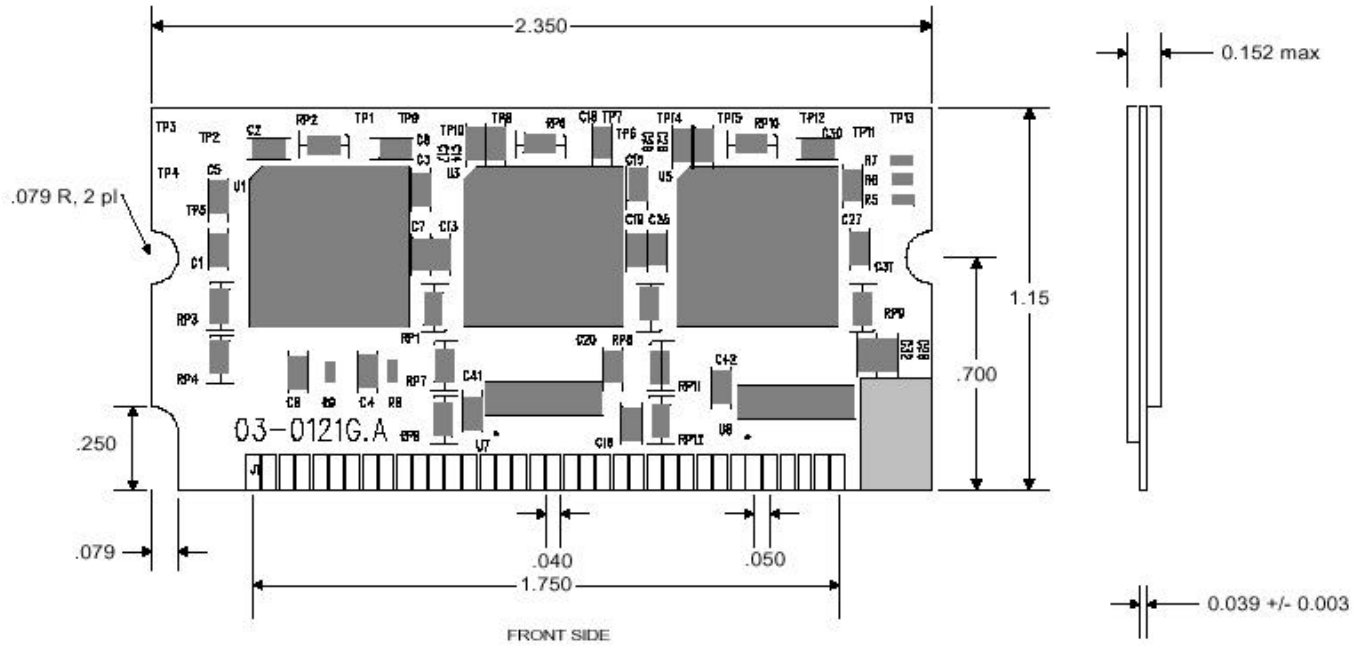
Top side of SigC54/55xx-PCI board



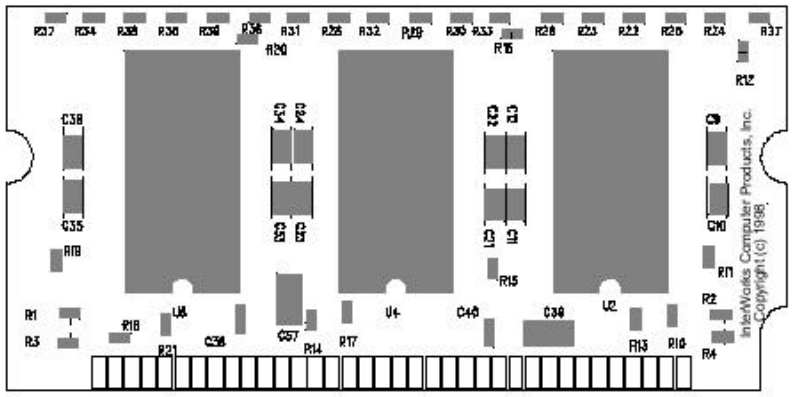
Bottom side of SigC54/55xx-PCI board

Module Mechanical Drawings

Precise module dimensions and physical specifications for SigC54xx modules are shown below.



FRONT SIDE



BACK SIDE