



SG2010 Data Sheet

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Preface



Revision History

Revision Number	Date mm/dd/yy	Description
4	04/04/04	Power Pins M12,U4,U8,U13,U17 add to table 4.3 in Power Pin section of data sheet
5	04/16/04	Change to operating specification to -40 to 85 Degree C and add Appendix A Update electrical specification Update CDR test pins Add lead free part number
6	9/3/04	Change PCI Cycle spec from 50ns to 40ns
6.1	10/19/04	Fixed bookmarks. Removed copy from the top of the files
6.2	10/29/04	Added Internal Pullup section (5.4) to Electrical Specs
6.3	1/17/2012	Add Thermal Specfication, update document to Dolphin Format



Introduction

The StarGen SG2010 is a PCI peripheral chip that bridges StarFabric's serial interface to PCI devices for communication and embedded systems. The SG2010 expands the capabilities of PCI by providing higher levels of scalability and reliability to PCI based systems, along with the advanced features of StarFabric. Working in conjunction with the SG1010 StarFabric Switch, the SG2010 supports flexible topologies that can be designed to fit specific application bandwidth, reliability, and endpoint or slot requirements. System designers are able to support next generation system requirements while maintaining their investments in peripherals, applications, and software.

The SG2010 is a multifunction device. Unlike a traditional PCI peripheral, the SG2010 supports both address routing as well as path and multicast routing. A PCI-to-PCI bridge function in the SG2010 supports legacy address routed traffic, which provides 100% compatibility with PCI drivers, application software, BIOS, OSs, configuration code, etc. The interconnect looks like a collection of PCI-to-PCI bridges. The Gateway function of the SG2010 is used to enable the fabric's advanced features, such as path routing, class of service, bandwidth selection, redundancy for fail-over path routing, and channels. Additional software is necessary to take advantage of these advanced features. StarGen provides a set of software enablers to minimize this effort. System designers can choose their rate of migration to these advanced features.

In order to shorten design cycles and time to market, the SG2010 employs a well-understood physical layer technology, a serial interconnect with 622Mbps low voltage differential signaling (LVDS). This technology is extensively applied and thoroughly understood by industry professionals. Four transmit and receive differential pairs are used to provide 2.5Gbps full duplex link bandwidth or 5Gbps of total bandwidth per StarFabric link. Unlike some other technologies, designers don't have to deal with significant physical interface issues. In conjunction with the SG1010 switch, designs can span from chip-to-chip to room area networks. Designs using inexpensive twisted pair copper cable can work with distances of up to 10 meters. 8B/10B-encoding algorithms allows AC coupling and assists in clock recovery. The PCI interface supports 64-bit or 32-bit PCI buses operating at 66MHz or 33 MHz. A bundled link (two StarFabric links) can support the full bandwidth of a 64bit/66MHz PCI bus.

The SG2010 was designed to work with other StarFabric devices. The StarFabric protocol integrates both control and data traffic within a single protocol. Most other interconnects are designed for either control or data traffic. StarFabric, from its beginning, has been developed to meet the specific requirements of next generation systems.



Features

2.1 Scalability and Performance

- 2 Starfabric links, 2.5 Gbps, full duplex
- Links can be bundled to create a 5.0 Gbps, full duplex point to point link
- 64-bit, 66MHz capable PCI bus

2.2 Compatibility

- Standard PCI-to-PCI addressing support: 100% PCI software compatibility
- Support for PCI transactions plus enhanced capabilities including: write combining, read data retention, and fast back-to-back support
- Compliant with the PCI Local Bus Specification Revision 2.2, the PCI to PCI Bridge Architecture Specification Revision 1.1, and the CompactPCI Hot Swap Specification
- Physical layer interface is compliant with the IEEE 1596.3 and TIA/EIA-644 Low-Voltage Differential Signaling (LVDS) standards.

2.3 Quality of Service

- Support for three routing methods: Standard PCI addressing (address routing), path routing, and multicast routing
- 4 Classes of service: Asynchronous, Isochronous, Multicast, and Provisioning
- Credit based flow control

2.4 Reliability, Availability, Serviceability features

- Link-by-link CRC checking on all traffic
- 8b/10b error correction
- Fault detection and isolation
- Redundant path routing capability, optional automatic fail-over
- Path protection capability for secure operation
- Hot-pluggable links

- CPCI Hot Swap support

2.5 Advanced Features

- Advanced event generation and handling
- Prescriptive read support
- Write with acknowledge support

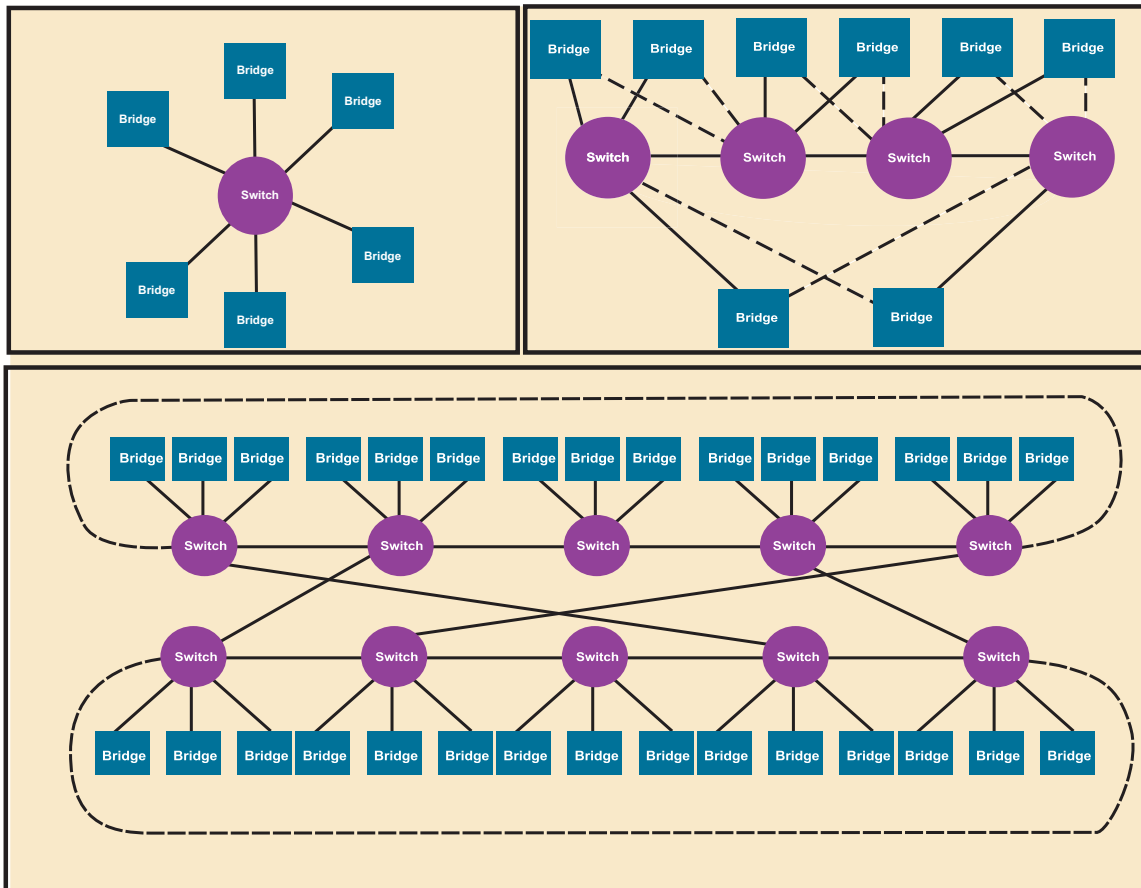
2.6 Additional features

- Supports software generated StarFabric frames
- Supports software generated PCI transactions
- SROM & Flash ROM interfaces for power-up configuration and code pre-load
- LED indicators for each differential pair
- 3.3-V PCI operation with 5.0 tolerant I/O



StarFabric Features

3.1 Scalability



StarFabric provides a scalable switched interconnect. The SG1010 switch has 30Gbps of switching capacity. When cascaded, the device enables systems to scale to gigabytes per second of capacity. The initial physical layer implemented provides 2.5 Gbps full-duplex bandwidth per link. Two links can be aggregated to create a 'fat pipe' with double the bandwidth. The links are well suited for chip-to-chip, backplane, and rack-to-rack interconnect. Using standard category 5 unshielded copper cables the links can extend to over 10 meters in length enabling the creation of room scale equipment.

3.2 Component Types

The two component types in StarFabric are edge nodes and switches. Switches forward traffic through the StarFabric. Edge nodes provide the connection between the fabric and other protocols or devices. Bridges are edge nodes that translate other protocols (e.g., PCI, H.110) into serial StarFabric traffic. An edge node is further classified into either a root or a leaf. The root initiates fabric resets and enumeration.

3.3 Routing Methods

- Address Routing
 - Provides full compatibility with PCI standard
- Path and Multicast routing
 - Provides Quality of service, reliability, and high availability

3.4 Traffic Classes

StarFabric supports 7 traffic classes. The initial parts support 4 traffic classes.

- Asynchronous / address routed class
- Isochronous Class
- Multicast Class
- High Priority Class/provisioning

3.5 Fault Tolerant Strategies

- Parallel Fabrics
 - A second fabric provides redundancy. Redundant switches are used so that if any switch fails end nodes remain connected. If a particular path fails, packets can be re-routed by silicon or software over the remaining functional paths.
- Fragile links
 - Automatic re-striping of data over functioning differential pairs in a link when one to three pairs fail.

3.6 Flow Control

Line credits manage flow control. Line credits counters are used to track available buffer storage between link partners. Each transmission point in the fabric has buffers for each class of traffic for each outgoing port. Traffic is sent only when the source has line credits for the output buffer on the next node for an entire frame. A switch is non-blocking because edge node congestion does not impact traffic flow to any other edge node or even to the same edge node in a different class of service. Line credits are used when a node sends a frame and restored when the node's link partner forwards the frame.

3.7 Bandwidth Reservation

Isochronous and multicast transmissions can use bandwidth reservation to allocate anticipated bandwidth requirements prior to starting data transfer. Bandwidth reservation is fully distributed and is initiated at the origin of the traffic.

3.8 Usage Models

Current StarFabric components support 3 usage models, PCI legacy, Fabric-native, and mixed legacy / Fabric-native. PCI legacy enables use of existing PCI drivers and initialization software with no modification. the interconnect looks like a collection of PCI-to-PCI bridges. This usage model amounts to a plug-and-play mode that extends the capabilities of existing systems.

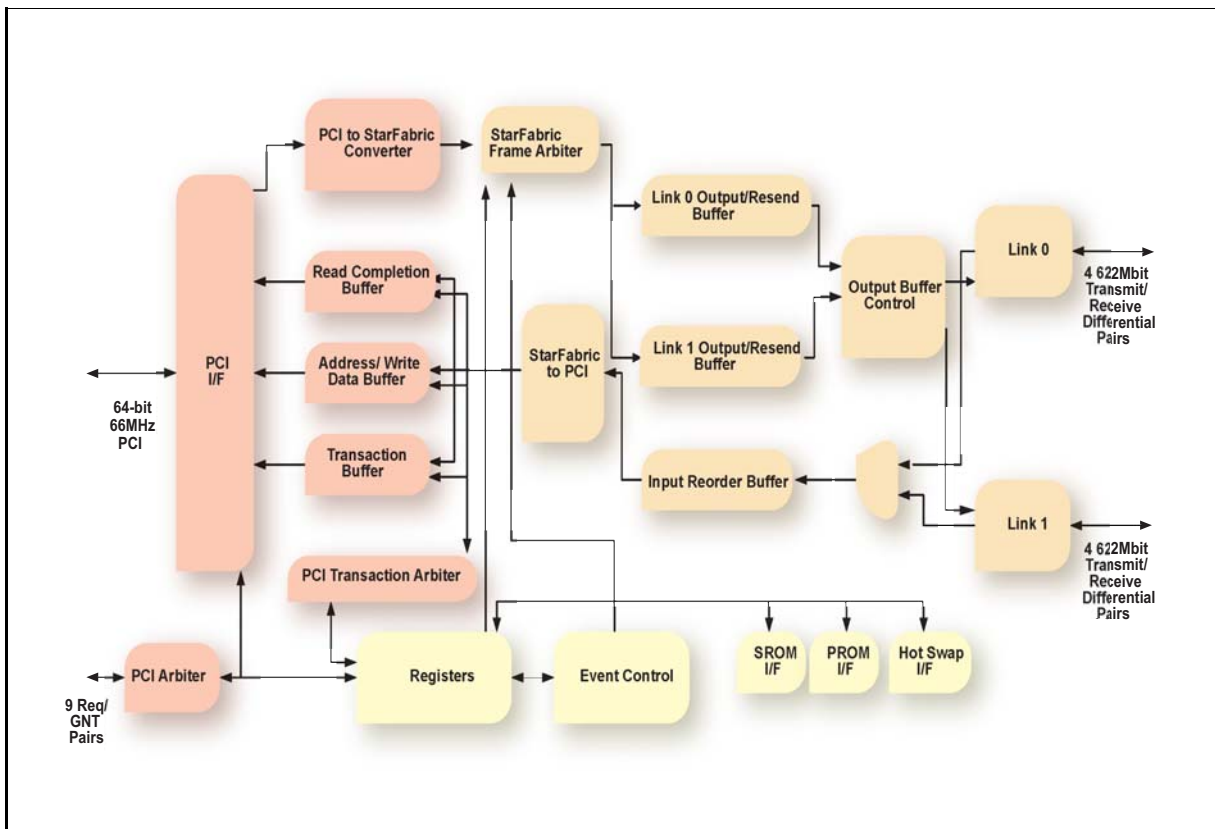
The Fabric-native usage unleashes some of StarFabric's advanced features such as path routing, class of service, bandwidth reservation, redundancy for fail-over path routing, and channels. Fabric-native use also provides the isolation and mechanisms required for inter-processor communication. This enables distributed computing applications. It is possible to use a mixture of legacy and fabric-native capabilities. Developers can start with legacy and add enhanced fabric-native capability over time.

To use advanced features, additional software is necessary. StarGen provides software tools to take advantage of StarFabric's advanced features. Sample software includes enumeration and routing, bandwidth reservation, as well as routines for optimizing performance, API integration layers, BIOS initial setup, and generating statistics. StarGen supplies tools and utilities for ROM programming, fabric access tools, and fabric topology viewers.



Specifications

4.1 Block Diagram



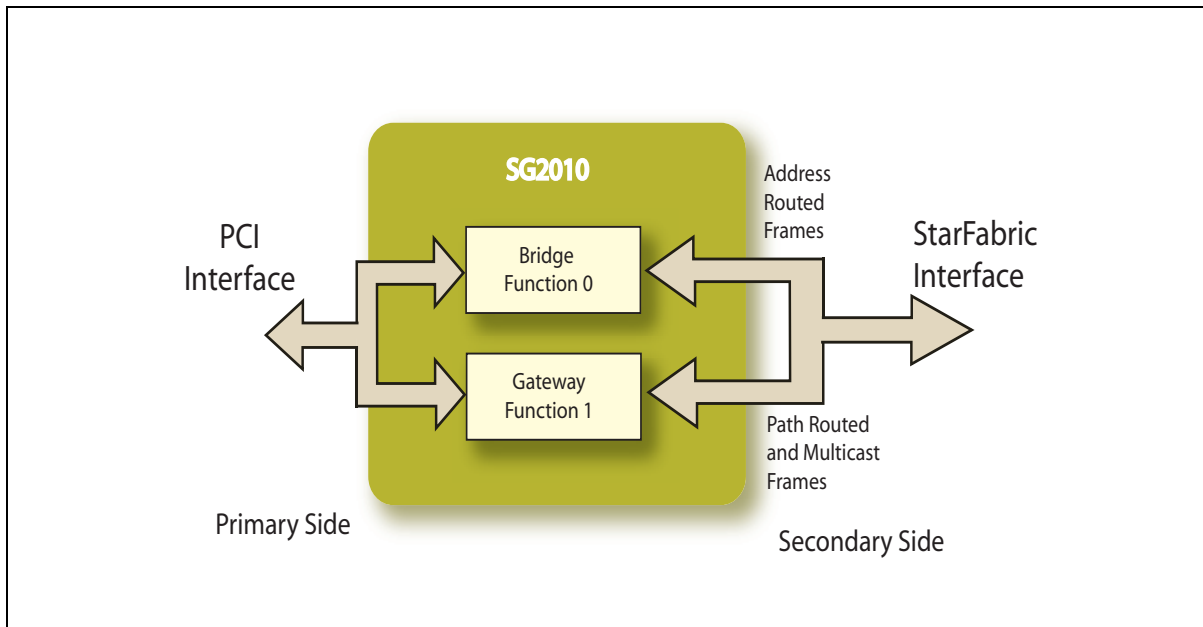
4-1 SG2010 Block Diagram

4.2 Usage Models

The SG2010 supports two addressing models - a StarFabric addressing model and a PCI addressing model. To support these two addressing models, the SG2010 implements two major functions - a PCI-to-PCI bridge function and a PCI-to-StarFabric Gateway function. The Bridge function supports the PCI addressing model within the fabric and the Gateway function performs translations between the PCI and StarFabric addressing models. The Bridge function can be disabled, but the Gateway function is always present. The SG2010 can be used in one of three basic functional modes:

- Gateway - Root mode, Bridge function is enabled.
- Gateway - Leaf mode, Bridge function is enabled
- Gateway - Bridge function is disabled;

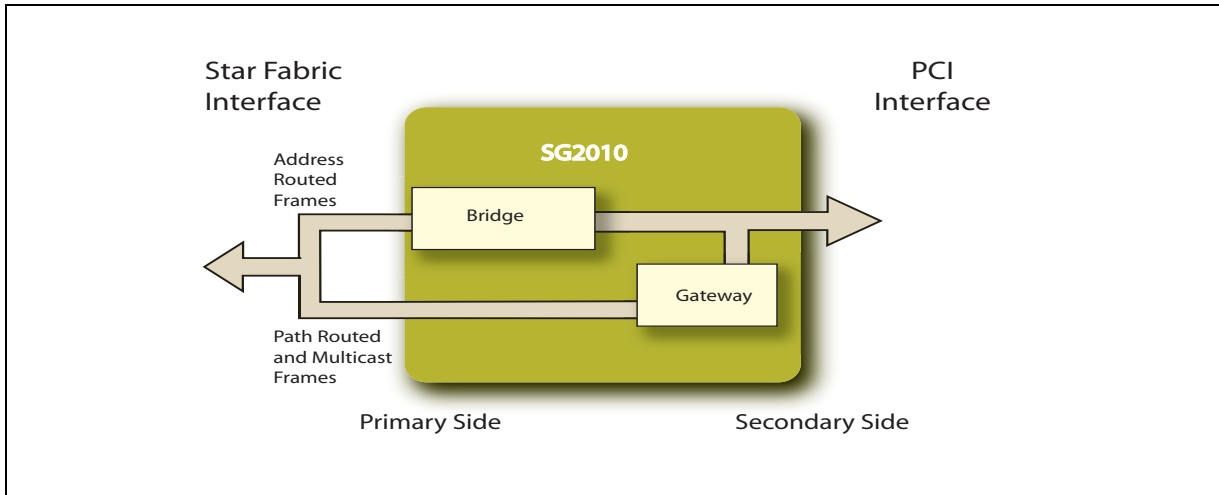
4.2.1 Root mode with Bridge function enabled



4-2 SG2010 Root Mode with Bridge function enabled diagram

The block diagram of the SG2010 shows a root mode configuration with a bridge function enabled. It shows the type of traffic supported on each interface. The PCI interface is connected to the primary bus and the StarFabric interface represents the secondary bus. In root mode, the Gateway and the Bridge form a multifunction device on the PCI bus. The configuration space of both functions is accessed from the PCI bus using a Type0 configuration transaction. Configuration accesses of function 0 select the Bridge and accesses of function 1 select the Gateway. The root is responsible for initiating fabric enumeration. Fabric enumeration is important in the PCI addressing model as it identifies which links in the fabric are branches in the PCI hierarchical tree. The root is considered to be the most upstream bridge in the fabric's PCI hierarchy.

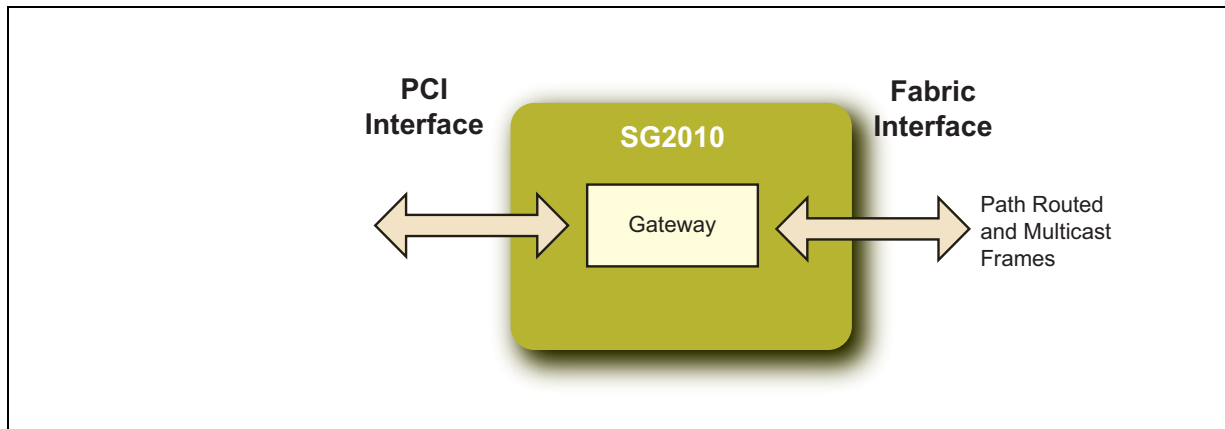
4.2.2 Leaf Mode with Bridge Function enabled



4–3 SG2010 Leaf mode with Bridge function enabled diagram

When the SG2010 is a leaf and the bridge function is enabled, the PCI interface is connected to the secondary bus and one of the ports on the StarFabric interface is the primary bus. The block diagram shows the SG2010 in leaf mode. The Gateway is logically represented as a separate PCI device located on the Bridge's secondary PCI bus. By default, the Bridge is fully transparent. Every PCI device downstream of the bridge including the gateway is fully visible to the host and their resources are mapped into the global PCI memory map. The SG2010 can also be configured to hide devices from the host.

4.2.3 Gateway-only usage model



4–4 SG2010 Gateway with Bridge function disabled diagram

In Gateway-only usage model, the Gateway is visible for PCI configuration from the PCI bus only. Since the Bridge function is required to create a PCI hierarchy in the fabric, using the Gateway-only usage model at the root prevents a PCI address-routed hierarchy from being constructed, and isolates the entire fabric from the root's PCI bus. Using the Gateway function at a leaf isolates a PCI subsystem from the PCI host.

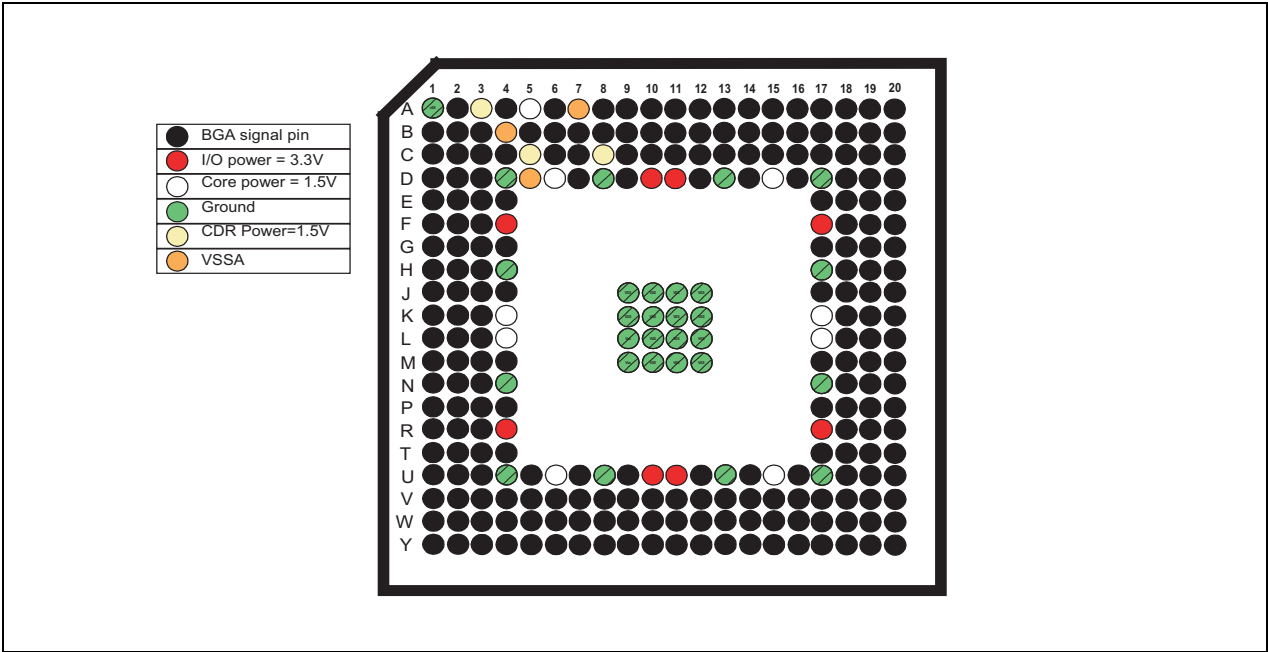
The only way to forward PCI transactions in Gateway-with bridge disabled is to translate between PCI transactions and path-routed or multicast frames. If the SG2010 is in gateway-only usage model and receives an address-routed frame, it drops the frame, signals an Address Routing Failure event, and if a response frame is required, returns a SoftwareThe Gateway translates PCI transactions into path-routed or multicast frames.

4.2.4 SG2010 Functional Modes

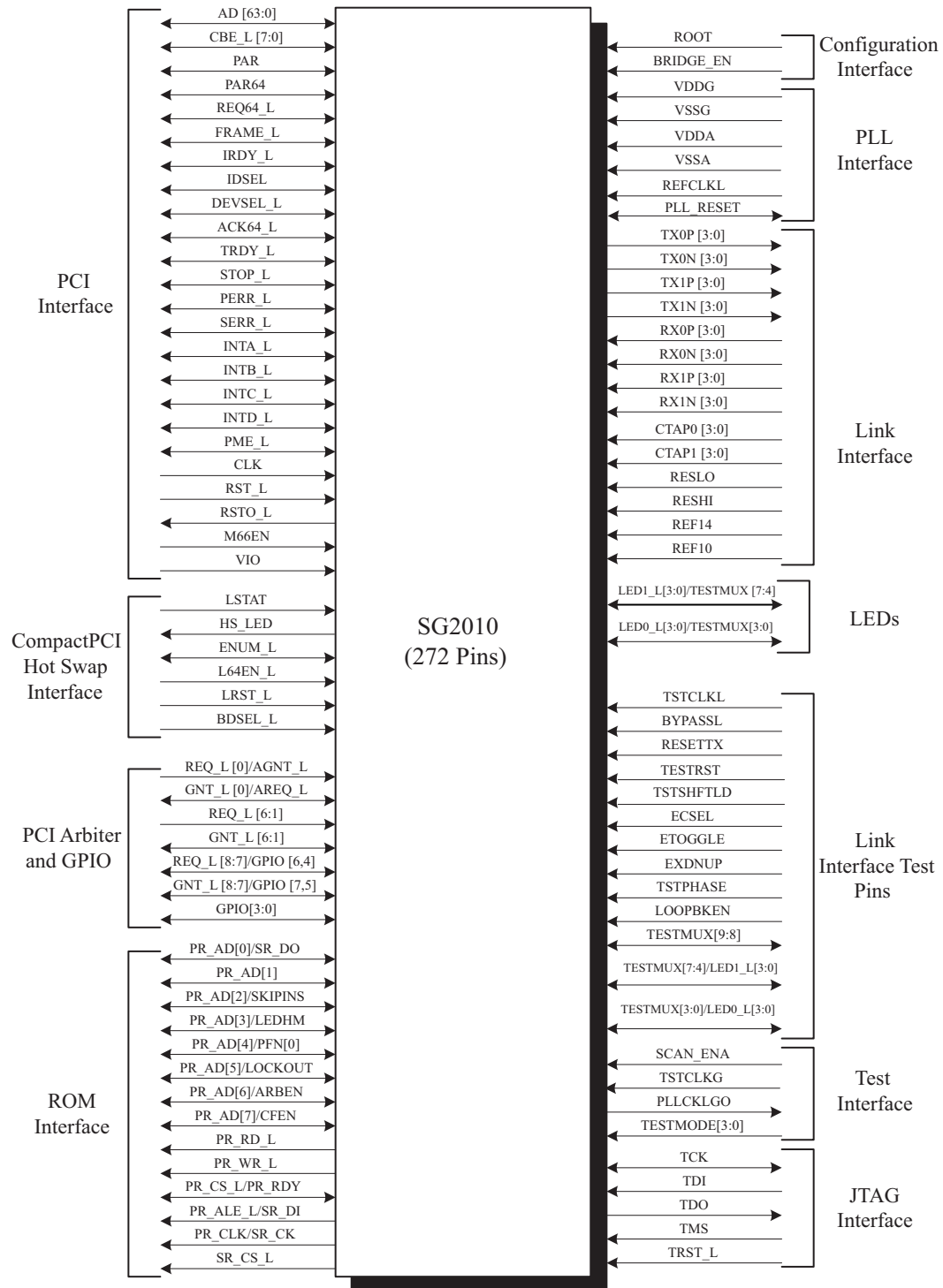
4–1 Functional Modes

Mode	PCI Configuration	Notes
Bridge Enabled Root Mode (Multifunction)	PCI is primary bus; fabric is secondary bus. Bridge and Gateway provide a multifunction configuration interface to the host.	Only one node in the system can be configured as root. Initiates fabric enumeration
Bridge Enabled Leaf Mode (Secondary subordinate)	PCI in secondary bus; fabric is primary bus. Bridge and Gateway provide a hierarchical configuration model to the host. Gateway is a PCI device on the secondary bus of the Bridge. Enhanced addressing modes can be enabled on the Bridge.	Gateway must be able to respond to address-routed frames from the fabric addressing BAR0 or BAR1 (CSRs) Gateway BARs have three modes of visibility to the host: ² All BARs visible ² Only BAR0 and 1 Visible ² Gateway not visible
Gateway-only	Provides no address-routing support into or out of the fabric. Provides private local addressing support.	All frames translated are path-routed/multicast frames.

4.3 Package Diagram



4.3.1 Pinout Diagram



4.4 Pin List

4-2 Pin List

Pin	Signal Name	Type
B1	tstshftld	I
C2	ecsel	I
D2	etoggle	I
D3	exdnup	I
E4	tstphase	I
C1	testmux[9]	IO
D1	testmux[8]	IO
E3	led1_l[3]/testmux[7]	IO
E2	led1_l[2]/testmux[6]	IO
E1	led1_l[1]/testmux[5]	IO
F3	led1_l[0]/testmux[4]	IO
G4	led0_l[3]/testmux[3]	IO
F2	led0_l[2]/testmux[2]	IO
F1	led0_l[1]/testmux[1]	IO
G3	led0_l[0]/testmux[0]	IO
G2	reserved[4]	IO
G1	PLL-Reset	IO
H3	reserved[2]	IO
H2	reserved[1]	IO
H1	reserved[0]	IO
J4	enum_l	O
J3	hs_led	O
J2	lstat	I
J1	lrst_l	I
K2	l64en_l	I
K3	bdsel_l	I
K1	root	I
L1	bridge_en	I
L2	rsto_l	O
L3	scan_ena	I
M1	gnt_l[0]/areq_l	IO
M2	req_l[0]/agnt_l	IO
M3	gnt_l[1]	IO
M4	req_l[1]	IO

4-2 Pin List

N1	gnt_l[2]	IO
N2	req_l[2]	IO
N3	gnt_l[3]	IO
P1	req_l[3]	IO
P2	gnt_l[4]	IO
R1	req_l[4]	IO
P3	gnt_l[5]	IO
R2	req_l[5]	IO
T1	gnt_l[6]	IO
P4	req_l[6]	IO
R3	gnt_l[7]/gpio[5]	IO
T2	req_l[7]/gpio[4]	IO
U1	gnt_l[8]/gpio[7]	IO
T3	req_l[8]/gpio[6]	IO
U2	gpio[3]	IO
V1	gpio[2]	IO
T4	gpio[1]	IO
U3	gpio[0]	IO
V2	trst_l	I
W1	tck	I
V3	tms	I
W2	tdo	O
Y1	tdi	I
W3	inta_l	O
Y2	intb_l	O
W4	intc_l	O
V4	intd_l	O
U5	rst_l	I
Y3	clk	I
Y4	pme_l	O
V5	ad[31]	IO
W5	ad[30]	IO
Y5	ad[29]	IO
V6	ad[28]	IO
U7	ad[27]	IO
W6	ad[26]	IO
Y6	ad[25]	IO
V7	ad[24]	IO
W7	cbe_l[3]	IO

4-2 Pin List

Y7	idsel	I
V8	ad[23]	IO
W8	ad[22]	IO
Y8	ad[21]	IO
U9	ad[20]	IO
V9	ad[19]	IO
W9	ad[18]	IO
Y9	ad[17]	IO
W10	ad[16]	IO
V10	cbe_l[2]	IO
Y10	frame_l	IO
Y11	irdy_l	IO
W11	trdy_l	IO
V11	devsel_l	IO
Y12	stop_l	IO
W12	perr_l	IO
V12	serr_l	O
U12	par	IO
Y13	cbe_l[1]	IO
W13	ad[15]	IO
V13	ad[14]	IO
Y14	ad[13]	IO
W14	ad[12]	IO
Y15	ad[11]	IO
V14	ad[10]	IO
W15	m66en	I
Y16	ad[9]	IO
U14	ad[8]	IO
V15	cbe_l[0]	IO
W16	ad[7]	IO
Y17	ad[6]	IO
V16	ad[5]	IO
W17	ad[4]	IO
Y18	ad[3]	IO
U16	ad[2]	IO
V17	ad[1]	IO
W18	ad[0]	IO
Y19	ack64_l	IO
V18	req64_l	IO

4-2 Pin List

W19	cbe_l[7]	IO
Y20	cbe_l[6]	IO
W20	cbe_l[5]	IO
V19	cbe_l[4]	IO
U19	par64	IO
U18	ad[63]	IO
T17	ad[62]	IO
V20	ad[61]	IO
U20	ad[60]	IO
T18	ad[59]	IO
T19	ad[58]	IO
T20	ad[57]	IO
R18	ad[56]	IO
P17	ad[55]	IO
R19	ad[54]	IO
R20	ad[53]	IO
P18	ad[52]	IO
P19	ad[51]	IO
P20	ad[50]	IO
N18	ad[49]	IO
N19	ad[48]	IO
N20	ad[47]	IO
M17	ad[46]	IO
M18	ad[45]	IO
M19	ad[44]	IO
M20	ad[43]	IO
L19	ad[42]	IO
L18	ad[41]	IO
L20	ad[40]	IO
K20	ad[39]	IO
K19	ad[38]	IO
K18	ad[37]	IO
J20	vio	I
J19	ad[36]	IO
J18	ad[35]	IO
J17	ad[34]	IO
H20	ad[33]	IO
H19	ad[32]	IO
H18	testmode[3]	I

4-2 Pin List

G20	testmode[2]	I
G19	testmode[1]	I
F20	testmode[0]	I
G18	pr_ad[7]/CFEN	IO
F19	pr_ad[6]/ARBEN	IO
E20	pr_ad[5]/LOCKOUT	IO
G17	pr_ad[4]/PFN[0]	IO
F18	pr_ad[3]/LEDHM	IO
E19	pr_ad[2]/SKIPINS	IO
D20	pr_ad[1]	IO
E18	pr_ad[0]/SR_DO	IO
D19	pr_rd_l	O
C20	pr_wr_l	O
E17	pr_cs_l	IO
D18	pr_ale_l	O
C19	pr_clk	O
B20	sr_cs_l	O
C18	tstclk	I
B19	pllclkgo	O
A20	testrst	I
A19	rx0p[0]	I
B18	rx0n[0]	I
B17	ctap0[0]	I
C17	rx0p[1]	I
D16	rx0n[1]	I
A18	ctap0[1]	I
A17	ctap0[2]	I
C16	rx0p[2]	I
B16	rx0n[2]	I
A16	ctap0[3]	I
C15	rx0p[3]	I
D14	rx0n[3]	I
B15	rx1p[0]	I
A15	rx1n[0]	I
C14	ctap1[0]	I
B14	rx1p[1]	I
A14	rx1n[1]	I
C13	ctap1[1]	I
B13	rx1p[2]	I

4-2 Pin List

A13	rx1n[2]	I
D12	ctap1[2]	I
C12	rx1p[3]	I
B12	rx1n[3]	I
A12	ctap1[3]	I
B11	tx0p[0]	O
C11	tx0n[0]	O
A11	tx0p[1]	O
A10	tx0n[1]	O
B10	tx0p[2]	O
C10	tx0n[2]	O
A9	tx0p[3]	O
B9	tx0n[3]	O
C9	reslo	I
D9	reshi	I
A8	ref14	I
B8	ref10	I
B7	tx1p[0]	O
A6	tx1n[0]	O
C7	tx1p[1]	O
B6	tx1n[1]	O
D7	tx1p[2]	O
C6	tx1n[2]	O
B5	tx1p[3]	O
A4	tx1n[3]	O
C4	tstclk	I
B3	refclk	I
B2	bypassl	I
A2	resettx	I
C3	loopbken	I

4.4.1 Power Pins**4-3 Power Pins**

Ground	A1,D4,D8,D13,D17,H4,H17,J9,J10,J11,J12,K9,K10,K11,K12,L9,L10,L11,L12,M9,M10,M11,M12,N4,N17,U4,U8,U13,U17
Vdd 3.3V	D10,D11,F4,F17,R4,R17,U10,U11
Vdd 1.5V	D6, D15, K4, K17, L4 ,L17,U6,U15,A5

4–3 Power Pins

CDR Vdda 1.5	C5,A3
CDR Vssa	B4,D5
Global PLL Vddg 1.5	C8
Global PLL Vssg	A7

4.5 Pin Descriptions**4–4 Pin Description**

AD [63:0]	PCI multiplexed address/data bus.
CBE_L [7:0]	PCI multiplexed command/byte enable bus
PAR	PCI parity pin
PAR 64	PCI 64-bit extension parity pin.
REQ64_L	PCI 64 bit transaction request
FRAME_L	PCI transaction frame.
IRDY_L	PCI initiator ready
IDSEL	PCI configuration device select
DEVSEL_L	PCI target device select
ACK64_L	PCI 64 -bit transaction acknowledge
TRDY_L	PCI target ready
STOP_L	PCI target transaction termination
PERR_L	PCI parity error detected
SERR_L	PCI system error
INTA_L	PCI device interrupt signal A
INTB_L	PCI device interrupt signal B
INTC_L	PCI device interrupt signal C
INTD_L	PCI device interrupt signal D
PME_L	PCI power management interrupt
CLK	PCI clock input
RST_L	PCI Platform reset input
M66EN	PCI 66MHz enable
VIO	PCI I/O voltage bias
LSTAT	CompactPCI Hot Swap ejector handle switch status.
HS_LED	CompactPCI Hot Swap LED Control
ENUM_L	CompactPCI Hot Swap interrupt
L64EN_L	CompactPCI Hot Swap local 64-bit extension enable
LRST_L	CompactPCI Hot Swap local reset
BDSEL_L	CompactPCI Hot Swap board seated
REQ_L[0]/AGNT_L	PCI Arbiter input/SG2010 PCI GNT INPUT

4-4 Pin Description

GNT_L [0]/AREQ_L	PCI arbiter output/SG2010 PCI REQ OUTPUT
REQ_L[6:1]	PCI arbiter dedicated request inputs
GNT_L [6:1]	PCI arbiter dedicated grant outputs
REQ_L[8:7]/GPIO[6,4]	PCI Arbiter shared request inputs. PCI bus arbiter is used and these pins are enabled as arbiter pins, these pins are PCI request inputs for up to two PCI bus masters/General purpose I/O pins
GPIO [7,5]/ GNT_L[8:7]	General purpose I/O pins/ PCI arbiter shared grant outputs. PCI bus arbiter is used and these pins are enabled as arbiter pins, these pins are PCI request.
GPIO[3:0]	General purpose I/O pins
PR_AD[0:7]	Shared pins between the parallel ROM multiplexed address/data bus, serial ROM data output signal
SR_DO	Serial ROM Data output signal
SKIPINS	SKIPINS causes hot swap controller to skip an insertion interrupt on power-up
PR_RD_L	Parallel ROM read strobe
PR_WR_L	Parallel ROM write strobe
PR_CS_L	Parallel ROM chip select output/device ready input. When the parallel ROM interface is not in multi-function mode.
PR_RDY	When the parallel ROM interface is in multi-function mode, the SG2010 samples this signal as a device ready signal.
PR_ALE_L	Parallel ROM address latch enable
SR_DI	Serial ROM data input
PR_CLK	Parallel ROM address latch clock
SR_CK	Serial ROM clock
SR_CS_L	Serial ROM chip select
ROOT	When ROOT is high, the SG2010 is configured as a root
BRIDGE_EN	When BRIDGE_EN is high, the SG2010 Bridge function is enabled
VDDG	VDD for 78MHz Global PLL
VSSG	VSS for 78MHz Global PLL
TSTCLKG	Reference clock and bypass clock for 78MHz PLL
PLLCLKGO	78MHz PLL output
TX0P[3:0]	Link 0 LVDS transmit positive
TX0N [3:0]	Link 0 LVDS transmit negative
TX1P [3:0]	Link 1 LVDS transmit positive
TX1N [3:0]	Link 1 LVDS transmit negative
RX0P [3:0]	Link 0 LVDS receive positive
RX0N [3:0]	Link 0 LVDS receive negative

4–4 Pin Description

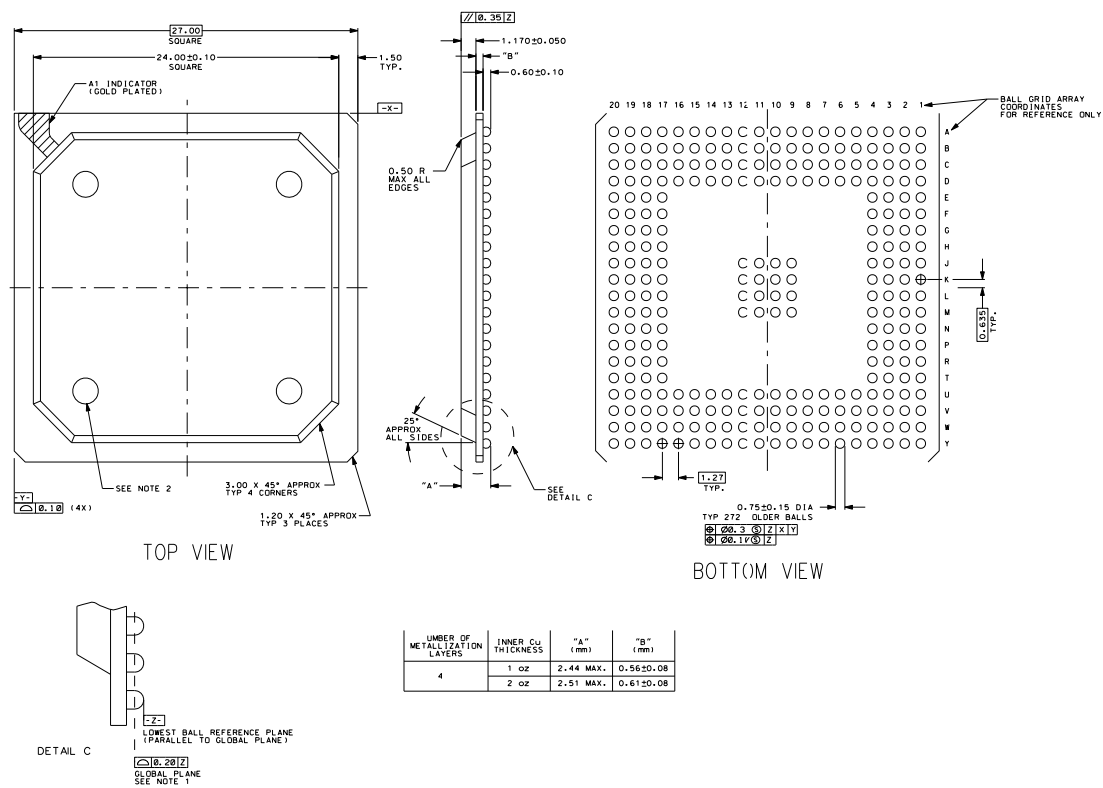
RX1P [3:0]	Link 1 LVDS receive positive
RX1N [3:0]	Link 1 LVDS receive negative
REFCLKL	Reference clock for clock and data recovery (CDR) PLL
CTAP0 [3:0]	Link 0 LVDS center taps for external reference voltages
CTAP1 [3:0]	Link 1 LVDS center taps for external reference voltages
RESLO	LVDS 100W reference low
RESHI	LVDS REF14
REF10	LVDS 1.0V reference
VDDA	Analog VDD for CDR's
VSSA	Analog VSS for CDR's
TSTCLKL	Bypass clock for CDR PLL
BYPASSL	Bypass enable for CDR
RESETTX	Tx clock divide reset for CDR PLL bypass
TESTRST	CDR Bist test reset
TSTSHFTLD	CDR test mode shift enable
ECSEL	Manual CDR phase shift
ETOGGLE	CDR clock phase change
EXDNUP	CDR clock phase direction
TSTPHASE	Bypass phase control
LOOPBKEN	Loop back enable
TESTMUX [9:8]	CDR Bist test pins
LED1_L [3:0]/TESTMUX [7:4]	Transmit state LEDs/CDR Bist test pins
RESET_PLL	Relocks 78MHz PLL to REFCLK
LED0_L[3:0]/TESTMUX[3:0]	Transmit state LEDs/CDR Bist test pins
TESTMODE[3:0]	Defines test modes
TCK	JTAG clock
TDI	JTAG data in
TDO	JTAG data out
TMS	JTAG mode select
TRST_L	JTAG reset
SCAN_ENA	Scan enable input

4.5.1 Strapping Pins

4–5 Strapping Pins

SKIPINS	SKIPINS causes the hot swap controller to ship an insertion interrupt on power up. Shared with PR_AD[2]
LEDHM	Sets mode for the LEDx[3:0] signals. Shared with PR_AD[3]
PFN [0]	Set the value of this bit when SG2010 is a root during hardware fabric enumeration. Shared with PR_AD[4]
LOCKOUT	Controls link access to registers in leaf mode. Shared with PR_AD[5]
ARBEN	Enables or disables PCI arbiter. Shared with PR_AD[6]
CFEN	Enables or disables PCI central functions. Shared with PR_AD[7]

4.6 Package Specification





Electrical Specifications

5.1 Absolute Maximum Ratings

Table 0–1 Absolute Maximum Ratings

Max Junction Temperature	125 degrees C
Core Supply Voltage	1.5V +/-5%
I/O Supply Voltage	3.3V +/-5%
Storage Temperature	-55 to 125 degrees C
Operating Temperature	-40 to Max Junction Temp 125 degrees C
Theta-Jb	14.2 C/W
Theta-Jc	7.9 C/W
Theta-Ja	22.8C /W
Theta-Jma at 1.0 m/s (~200ft/min):	18.4 C/W
Theta-Jma at 2.5 m/s (~500 ft/min)	16.7 C/W
Power dissipation	2.15W maximum

5.2 DC Specifications

Table 0–2 DC Specifications (non-LVDS signals)

Symbol	Parameter	Condition	Min	Max
V_{ih}	Input high voltage	–	.5V _{cc}	.5V _{cc} + .5V
V_{il}	Input low voltage	–	-0.5V	.3V _{cc}
V_{ipu}	Input Pull-up voltage	–	.7V _{cc}	–
V_{oh}	Output high voltage	I _{oh} = -500μA	.9V _{cc}	–
V_{ol}	Output low voltage	I _{ol} = 1500μA	–	.1V _{cc}
I_{in}	Input leakage current	0 ≤ V _{in} ≤ V _{io}	–	± 10 μA
I_{in-pme}	PME_L input leakage	V _o ≤ 3.6V V _{cc} off	–	-1 mA
C_{in}	Pin capacitance	–	–	10 pF

Table 0–3 DC Supply Current

Symbol	Conditions	Max Current (mA)
I _{core}	1.5V +/- 5%	342
I _{io}	3.3V +/- 5%	479

* Refer to appendix A for application note relating to industrial temperature operation.

5.3 Timing Specifications

5.3.1 PCI Interface

The PCI interface AC specifications are compliant to the *PCI Local Bus Specification, Revision 2.2*

Table 0–4 PCI Signal AC Specifications

Signal	Symbol	Parameter	Min	Max
CLK	T _{cyc}	Cycle time	15ns	40ns
CLK	T _{high}	Time high	6ns	–
CLK	T _{low}	Time low	6ns	–
CLK		Slew rate	1.5 V/ns	4 V/ns
Bused PCI outputs	T _{val}	CLK to valid	2ns	6ns
Point-to-point PCI outputs	T _{val(ptp)}	CLK to valid	2ns	6ns
All PCI outputs	T _{on}	Hi-Z to driven	2ns	–
All PCI outputs	T _{off}	Driven to Hi-Z	–	14ns
Bused PCI inputs	T _{su}	Setup to CLK	3ns	–
Point-to-point PCI Inputs	T _{su(ptp)}	Setup to CLK	5ns	–
All PCI inputs	T _h	Hold from CLK	0ns	–
RST_L	T _{rst}	Active after power stable	1ms	–
RST_L	T _{rst-clk}	Active after clocks stable	100μs	–
All PCI outputs, tri-stated	T _{rst-off}	RST_L to Hi-Z	–	40ns
REQ64_L	T _{rrsu}	Setup to RST_L	10T _{cyc} ns	–
REQ64_L	T _{rrh}	Hold from RST_L	0ns	50ns
PR_AD[7:2]	T _{srh}	Hold from RST_L	0ns	50ns
FRAME# for cfg access	T _{rhfa}	From RST_L deasserted	2 ²⁵ clocks	–
Any FRAME# assertion	T _{rhff}	From RST_L deasserted	5 clocks	–
INTx_L, ENUM_L, PME_L, SERR_L		Asynchronous		

5.3.2 Parallel and Serial ROM Interface

Table 0–5 Parallel and Serial ROM AC Specifications

Signal	Symbol	Parameter	Min	Max
PR_AD[7:0]	T_{adsu}	Setup to PR_RD_L rising	30ns	—
PR_AD[7:0]	T_{adh}	Hold from PR_RD_L rising	30ns	—
PR_AD[7:0]	T_{adval}	Valid from PR_CLK falling	0ns	8ns
PR_CS_L	T_{pcsl} (1)	Time low	480ns	15.36 μ s
PR_CS_L	T_{pcss} (1)	Setup to PR_RD_L or PR_WR_L falling	T_{prcyc}	—
PR_ALE_L	T_{asu}	Setup to PR_CLK rising	$.5 * T_{\text{prcyc}}$	—
PR_ALE_L	T_{asucs}	Setup to PR_CS_L falling	T_{prcyc}	—
PR_CLK	T_{prcyc}	Cycle time	60ns	1.92 μ s
SR_CLK	T_{scyc}	Cycle time	510ns	—
SR_CS_L	T_{scl}	Minimum time low	$56.5 * T_{\text{scyc}}$	—
SR_CS_L	T_{scssu}	Setup to SR_CLK rising	$.5 * T_{\text{scyc}}$	—
SR_DO	T_{sdosu}	Setup to SR_CLK rising	30ns	—
SR_DO	T_{sdoh}	Hold from SR_CLK rising	30ns	—
SR_DI	T_{sdivalb}	Valid before SR_CLK rising	$.5 * T_{\text{scyc}}$	—
SR_DI	T_{sdivala}	Valid from SR_CLK rising	$.5 * T_{\text{scyc}}$	—

(1) Programmable by software

5.3.3 Reference ClockTiming

Table 0–6 Reference Clock AC Specifications

Signal	Symbol	Parameter	Min	Max
REFCLKL	F_{xtal}	Frequency	62.208MHz - 25ppm	62.208MHz + 25ppm
REFCLKL		peak-to-peak jitter		100ps
REFCLKL		Duty Cycle	40%	60%
REFCLKL		78MHz PLL Reset after 1.5VDD > 1.32V	3ms	

5.3.4 Global PLL Bypass Clock

Table 0–7 Global PLL Bypass Clock AC Specifications

Signal	Symbol	Parameter	Min	Max
TSTCLKG	F_{xtal}	Frequency	77.76MHz - 100ppm	77.76MHz + 100ppm
TSTCLKG		peak-to-peak jitter		150ps
TSTCLKG		Duty Cycle	45%	55%

5.3.5 StarFabric Interface Timing

The LVDS transmitters and receivers are compliant to the IEEE 1596.3 and EIA/TIA-644 LVDS specifications.

Table 0–8 StarFabric LVDS Interface AC timing

Signal	Symbol	Parameter	Min	Max
TXnP, TXnN	T_{tdpsk}	Differential skew	—	50ps
TXnP, TXnN	T_{tdpr} (2)	Low to high time	100ps	210ps
TXnP, TXnN	T_{tdpf} (2)	High to low time	100ps	210ps
TXnP, TXnN	T_{jtr} (3)	Output Jitter, Generated 250 kHz to 5 MHz	—	.18 UI p-p
RXnP, RXnN	T_{rjtr} (3)	Jitter Tolerance 250 kHz 25 kHz 2 kHz	—	0.6 UI p-p 6 UI p-p 60 UI p-p
RXnP, RXnN	T_{rppsk}	Pair to pair skew	—	2ns
RXnP, RXnN	T_{reye} (3)	Eye Opening	0.4 UI p-p	
RXnP, RXnN	T_{rsntb} (4)	Stream of non-transitional bits	—	60 bits

(2) Test conditions: ZL=100Ohm±1%, Cpad=3.0pF, Cpadn=3.0pF

(3) UI = Unit Interval, which is 1.6075ns for 622.208 Mbit/s data

(4) This should not occur more than once per minute

5.3.6 JTAG Timing

Table 0–9 JTAG Signal AC Timing Specifications

Signal	Symbol	Parameter	Min	Max
TCK	F_{tck}	Frequency	–	10MHz
TCK	T_{tckl}	Time low	50ns	–
TCK	T_{tckh}	Time high	50ns	–
TDI, TMS	T_{tsu}	Setup to TCK	40ns	–
TDI, TMS	T_{th}	Hold from TCK	40ns	–
TDO	T_{tval}	Valid from TCK	–	30ns
TDO	T_{tz}	Hi-Z from TCK	5ns	40ns

5.3.7 Asynchronous and Static Signals

Table 0–10 Asynchronous and Static Signals

Signal	Note
GPIO[7:0]	Under software control
INTx_L, PME_L, ENUM_L	Interrupt inputs/outputs. Assume asynchronous to PCI CLK
LSTAT, L64EN_L, BDSEL_L	Hot swap signals. Static or asynchronous
M66EN	66Mhz Enable. Static.
ROOT, BRIDGE_EN	Static
CTAP0[3:0], CTAP1[3:0], RESLO, RESHI	LVDS control. Static.
BYPASSL, RESETTX, RESETRX, TSTSHFTLD, ECSEL, ETOGGLE, EXDNUP, TSTPHASE, LOOPBKEN	Asynchronous
TESTMODE[3:0]	Static

0.1 Internal Pull-up and Pull-down Resistors

Table 5–1 describes the internal pull-down and pull-up resistors on the SG2010. All internal pull-down and pull-up resistors are 50 k Ω . At the board level, these pins can either be left unconnected or connected through a smaller resistor to override the internal value, if needed for test or diagnostic purposes.

5–1 Internal Pull-up and Pull-down Resistors

Signal Name	Internal pull-up/pull-down	Functional Value
BYPASSL	0	0
ECSEL	0	0
ETOGGLE	0	0
EXDNUP	0	0
PLL_RESET	0	0
LOOPBKEN	0	0
RESETTX	0	0
SCAN_ENA	0	0
TESTRST	0	0
TSTCLKG	0	0
TSTCLKL	0	0
TSTPHASE	0	0
TSTSHFTLD	0	0
TCK	1	1
TDI	1	1
TMS	1	1
TRST_L	1	0



Industrial Temperature

6.1 Abstract

To ensure that the SG2010 PCI to StarFabric bridge operates properly in industrial temperature range applications, the use of an external 77.76 MHz clock source is required. The external clock source provides the SG2010 with appropriate clocking at temperatures ranging from -40°C to +85°C. The existing internal PLL supports a temperature range from 0°C to 70°C. This application note outlines the modifications required to implement the external clock source.

6.2 Clock Details

The SG2010 bridge has two distinct types of PLLs, one associated with the clock-data recovery (CDR) in the SERDES, and a global PLL that generates a clock for internal logic. Both the CDR and global PLLs use the 62.208 MHz reference input clock.

The global PLL implements a multiply/divide clock multiplication function. The resulting internal global clock is roughly 78 MHz in the SG2010. This PLL goes through an auto-trimming process to optimize its performance. The synthesized 78 MHz clock is appropriate for all applications rated for a temperature range from 0°C to 70°C.

However when using the SG2010 in an environment outside of the commercial 0°C to +70°C specification, the global PLL is not guaranteed to function properly. An external clock source is required for these applications. Note that the 62.208 MHz reference clock is still required for the CDR when the global PLL is being bypassed.

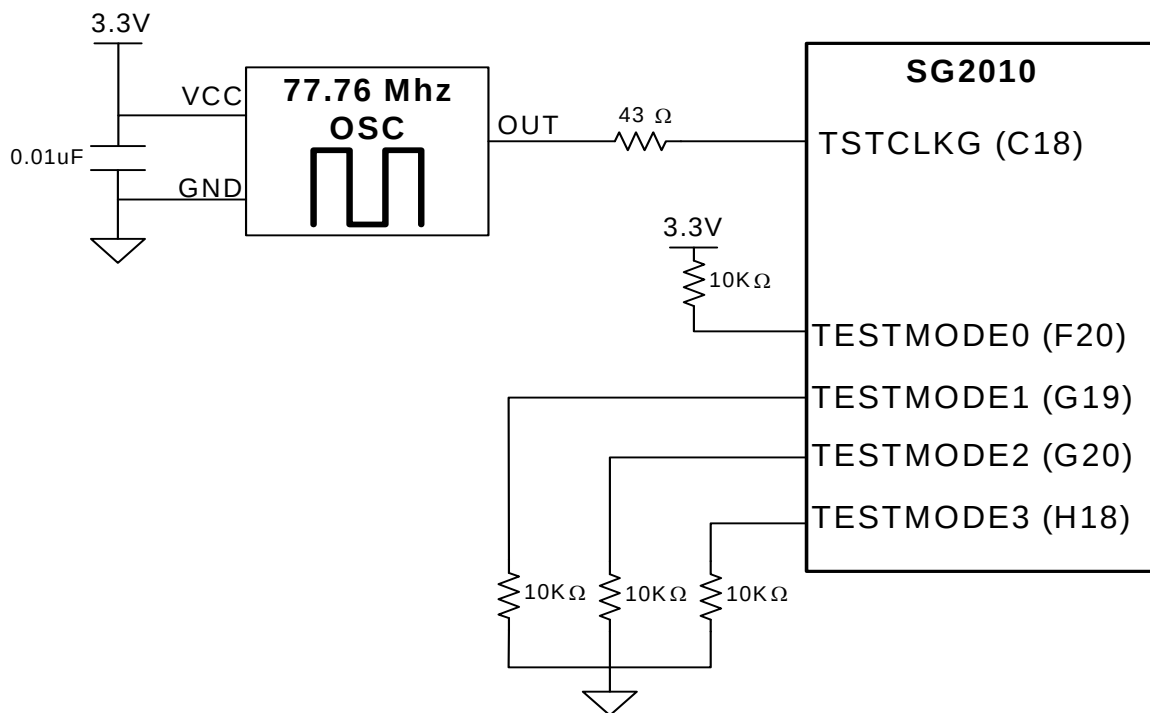
6.3 Design Guidelines

When using the SG2010 above the 70 degree C commercial specification, the internal global PLL needs to be bypassed and an external 77.76 MHz clock source is to be used. The hardware implementation is shown in Figure 0–1 and described below:

1. Set the SG2010 into PLL bypass mode by setting the TESTMODE<3:0> inputs to a <0001>, thereby forcing the SG2010 to use an external 77.76 MHz oscillator instead of the internally generated clock. The TESTMODE<3:0> signals are located at BGA ball positions H18, G20, G19, and F20 respectively. TESTMODE<3:1> can be signaled low with pull-down resistors and TESTMODE<0> can be signaled high with a pull-up resistor.

2. Connect a 77.76 MHz clock oscillator to the TSTCLKG signal pin (BGA ball C18) of the device. Include an appropriate value series damping resistor between the clock oscillator's output and the SG2010's TSTCLKG input. This resistor should be placed close to the source of the clock.

Figure 0-1 Recommended Modification



Oscillator Specifications

Frequency: 77.76 MHz 100ppm

Jitter: 150ps peak-to-peak max

Duty Cycle: 45/55% min/max

Voltage Supply: 3.3 Volts DC

Operating Temperature: -40°C to 85°C



Contact Information

7.1 Ordering Information

7-1 Part Numbers

Part Number	Description
SG2010-A4	PCI to StarFabric Bridge
L-SG2010-A4	PCI to StarFabric Bridge Lead Free Package

7.2 Headquarters

Dolphin Inc.

7 Boomhower Rd.

Woodsville, NH 03785

Voice: (603) 747-4100

Fax: (603) 747-4101

Web: www.dolphinics.com

Email: [Info@ dolphinics.com](mailto:Info@dolphinics.com)