Cisco Symmetric High-Bitrate DSL High Speed WAN Interface Cards for Cisco Integrated Services Routers

Cisco® Integrated Services Routers offer a wide variety of WAN connectivity modules to accommodate the range of application needs in customer networks. The Cisco 2- and 4-Pair Symmetric High-Bit-Rate DSL High-Speed WAN Interface Cards offer G.SHDSL based WAN connectivity for modular routers deployed in small to medium-sized businesses and enterprise branch offices.

Overview

The 2-pair (HWIC-2SHDSL) and 4-pair (HWIC-4SHDSL) symmetric high-bit-rate DSL high-speed WAN interface cards (HWICs) provide G.SHDSL connectivity to a Wide Area Network (Figures 1 and 2). The 4-pair symmetric G.SHDSL HWIC provides two ports of 4-wire or four ports of 2-wire connectivity options, whereas the 2-pair G.SHDSL HWIC provides two ports of 2-wire or one port of 4-wire connectivity options. The 4-pair symmetric G.SHDSL HWIC also allows bonding single or dual-pair G.SHDSL ports up to a single 8-wire interface with increased bandwidth by using Inverse Multiplexing over ATM (IMA) or data interleaving with M-pair mode. These cards are supported in all integrated services routers that have HWIC slots.

The 2-pair and 4-pair G.SHDSL HWICs supersede the existing G.SHDSL WAN Interface Card (part number WIC-1SHDSL-V3), which is a WIC-based G.SHDSL solution. The two new G.SHDSL HWICs provide higher performance and increased reach when compared to the G.SHDSL WIC. Table 1 compares the three interface cards.

G.SHDSL technology offers customers high-speed, symmetrical WAN connectivity at a lower monthly cost than traditional WAN circuits. The 2- and 4-pair G.SHDSL HWICs together with Cisco integrated services routers provide businesses the necessary bandwidth for critical traffic such as voice and video conferencing, and enable customers to save money by integrating voice and data traffic on the same WAN link. Service providers can increase subscriber revenue by bundling services and offering differentiated service levels through service-level agreements.

The first standardized multirate symmetric DSL, G.SHDSL has been an accepted worldwide technology standard based on ITU recommendation G.991.2. G.SHDSL is designed to transport rate-adaptive symmetrical data across a single copper pair at data rates up to 2.304 Mbps for a single pair or up to 4.608 Mbps over two pairs. Later enhancements (Annexes F and G) to the G.991.2 specification allow for increased performance up to 5.696 Mbps over a single copper pair. IMA technology allows the 4-pair G.SHDSL HWIC to offer data rates up to 2.304 Mbps per pair and up to 9.2 Mbps over four pairs. These rates cover applications traditionally served by HDSL, SDSL, T1, E1, and services beyond E1. Refer to Table 2 for the data rates supported by the 2- and 4-pair G.SHDSL HWICs (HWIC-2SHDSL and HWIC-4SHDSL) under different configurations.

Figure 1. Cisco 2-Pair G.SHDSL HWIC (HWIC-2SHDSL)

Figure 2. Cisco 4-Pair G.SHDSL HWIC (HWIC-4SHDSL)

Feature Summary

- Based on ITU Recommendation G.991.2
- Offers symmetrical WAN speeds up to 2.304 Mbps over a single copper pair and up to 4.608 Mbps over two copper pairs using ITU-T G.991.2 Annex A and Annex B
- Offers symmetrical WAN speeds from 768 kbps to 5.696 Mbps over a single copper pair and from 1.536 to 11.392 Mbps over two copper pairs using ITU-T G.991.2 Annex F and Annex G
- Offers symmetrical WAN speeds of 2.304 Mbps per pair up to 9.2 Mbps over four pairs on the 4-pair HWIC (part number HWIC-4SHDSL) by bonding with IMA Version 1.1
- Provides M-pair bonding on the 4-pair HWIC (HWIC-4SHDSL) using Annex F and Annex G with symmetrical WAN speeds of 768 kbps to 5.696 Mbps per pair for M = 2 and 768 kbps to 4.096 Mbps per pair for M = 3 and M = 4
- Supports Wetting Current (Section A.5.3.3 of G.991.2)
- Supports G.SHDSL Annex A (U.S. signaling) and Annex B (European signaling)
- Supports “Dying Gasp” on HWIC-2SHDSL; uses power status bit (section 7.1.2.5.3 of G.991.2) for signaling
- Offers ability to configure multiple G.SHDSL HWICs per Cisco 1841, 2800, and 3800 Router chassis
- Provides toll-quality voice over data through ATM Adaptation Layer 5 (AAL5) and voice over IP (VoIP) on the Cisco 1841 ISR and the Cisco 2800 and 3800 Series ISRs; note that embedded voice services with digital signal processors, voice and fax modules are supported only on the Cisco 2800 and 3800 Series ISRs.
- Offers extensive ATM class-of-service (CoS) and IP quality-of-service (QoS) support
- Sustains up to 8 permanent virtual circuits (PVCs) per HWIC

- Provides single RJ-11 connector on 2-pair HWIC (HWIC-2SHDSL) and single RJ-45 connector on 4-pair HWIC (HWIC-4SHDSL)

System Requirements

- The 2- and 4-pair G.SHDSL HWICs are supported on all modular Cisco Integrated Services Routers: the Cisco 1841, 2801, 2811, 2821, 2851, 3825, and 3845.
- The 2- and 4-pair G.SHDSL HWICs are supported in all Cisco IOS® Software feature sets.
- The routers listed previously need to run Cisco IOS Software Special Release 12.4(11)XJ to support the 2- and 4-pair G.SHDSL HWICs. They will also be supported on the Cisco IOS Software Release 12.4(6th)T and later.
- The system requires no additional flash or DRAM memory other than the specified minimum memory for the previously mentioned Cisco IOS Software releases.
- The 2- and 4-pair G.SHDSL HWICs can be inserted into any HWIC slot in the integrated services routers.

Cisco Integrated Services Router with G.SHDSL HWIC Applications

Business-Class DSL with Backup WAN

The Cisco Integrated Services Routers with the 2-pair and 4-pair G.SHDSL HWICs provide a business-class DSL solution for WAN access along with the option of a backup WAN interface (asymmetric DSL [ADSL] and ADSL2+, ISDN Basic Rate Interface [BRI], T1/E1, analog modem, cable modem, etc.) for mission-critical applications. The IMA feature offered on the 4-pair symmetric G.SHDSL HWIC allows service providers to bond two or more pairs of G.SHDSL links to offer differentiated bandwidth based on service-level agreements.

Business-Class Security

The Cisco 1841 Integrated Services Router and the Cisco 2800 and 3800 Series of Integrated Services Routers with the G.SHDSL HWICs can be optimized for Internet security with the Cisco IOS Firewall supporting stateful inspection firewall and intrusion prevention system features. These platforms can also be optimized for VPNs, which allow secure use of the Internet for communications with the same policies and levels of security and performance as a private network. VPNs provide security through encryption tunneling, and the Cisco routers support hardware-based Triple Data Encryption Standard (3DES) IP Security (IPSec), Advanced Encryption Standard (AES), and Secure Sockets Layer VPN (SSL VPN). Encryption features can be enabled on the routers with the Advanced Security or any higher feature set of the Cisco IOS Software.

Differentiated Service Offerings through IP and ATM QoS

Using Cisco QoS features including Class-Based Weighted Fair Queuing (CBWFQ), Low-Latency Queuing (LLQ), Weighted Random Early Detection (WRED), etc., the Cisco 1841 Integrated Services Router and the Cisco 2800 and 3800 Series of Integrated Services Routers with G.SHDSL HWICs help service providers and resellers offer services that can differentiate bandwidth based on a specific application or a specific user.

In addition to IP QoS features, the Cisco 1841, 2800, and 3800 Series of Integrated Services Routers with the G.SHDSL HWICs map IP QoS to ATM CoS features, including support for constant bit rate (CBR), Variable Bit Rate non-realtime (VBR-nrt), Variable Bit Rate realtime (VBR-rt), Unspecified Bit Rate (UBR), and UBR+. These features help service providers manage

their core ATM network infrastructures to deliver scalable, cost-effective services with QoS guarantees to their customers. Per-virtual-circuit traffic shaping and queuing allows further optimization of the existing bandwidth between customers and various services.

Table 3 later in this document gives a summary of the ATM features, including QoS and traffic management capabilities supported on the G.SHDSL HWICs.

Converged Platform for Small to Medium-Sized Business and Enterprise Branch Applications

The Cisco 1841, 2800, and 3800 Series of Integrated Services Router platforms with the G.SHDSL HWICs provide customers with a choice of converged platforms that offer best-of-class data, security, WAN access, and voice services in a single system. The Cisco 2800 and 3800 Series Routers embed voice functions directly inside the router ,enabling customers to deploy voice services by installing digital signal processors (DSPs) and advanced integration modules (AIMs) for IP telephony conferencing, voice gateways, and Cisco Unity® Express voicemail and automated attendant. For call processing, customers can enable the Cisco Call Manager Express solution as part of Cisco IOS Software and reconfigure the same software to support Cisco Survivable Remote Site Telephony (SRST) for centralized call processing with Cisco CallManager. Such an integrated solution rapidly enables service deployment, increases efficiency of network operations, and provides opportunities to protect, grow, and optimize the business.

G.SHDSL Feature Comparison between HWICs and WICs

Table 1 compares the features of the G.SHDSL HWICs with the older WIC solution.

Table 1. Feature Comparison

Features	WIC-1SHDSL-V3	HWIC-2SHDSL	HWIC-4SHDSL
2- and 4-wire support	Yes	Yes	Yes
8-wire support	No	No	Yes
IMA	No	No	Yes
Annex A and Annex B	Yes	Yes	Yes
Annex F and Annex G	No	Yes	Yes
M-pair bonding with Annex F and Annex G	No	No	Yes
Connecter	RJ-11	RJ-11	RJ-45
Dying Gasp	Yes	Yes	No
Wetting Current	Yes	Yes	Yes
Line coding	16-TCPAM	16-TCPAM/32-TCPAM	16-TCPAM/32-TCPAM
G.SHDSL chipset	Conexant	Infineon	Infineon

Data Rates Supported with 2- and 4-Pair G.SHDSL HWIC

Table 2 gives data rates for the 2- and 4-pair G.SHDSL HWICs.

Table 2. Data Rates for 2- and 4-Pair G.SHDSL HWICs

Note: Actual data rates depend upon factors such as loop length, line conditions, DSL Access Multiplexer (DSLAM) linecard and chipset and data rates provisioned by the service provider.

Configuration Mode	HWIC-2SHDSL	(HWIC-4SHDSL)
IMA	Not supported	192 kbps to 2.304 Mbps per pair up to 9.2 Mbps over 4 pairs
2-wire (1 pair) Annex A and Annex B	192 kbps to 2.304	192 kbps to 2.304 Mbps
4-wire (2 pair) Annex A and Annex B	384 kbps to 4.608 Mbps	384 kbps to 4.608 Mbps
M-pair mode with Annex A and Annex B	Not supported[1]	192 kbps to 2.304 Mbps per pair
2-wire (1 pair) Annex F and Annex G	768 kbps to 5.696 Mbps	768 kbps to 5.696 Mbps
4-wire (2-pair) Annex F and Annex G	1.536 to 11.392 Mbps	1.536 to 11.392 Mbps
M-pair mode with Annex F and Annex G	Not supported[1]	768 kbps to 5.696 Mbps per pair (for M = 2) 768 kbps to 4.096 Mbps per pair (for M = 3 and M = 4)

ATM Features and Benefits Summary

Table 3 gives features and benefits of the G.SHDSL HWICS.

Table 3. ATM Features and Benefits of G.SHDSL HWICS

ATM Feature	Benefits
ATM traffic UBR, UBR+, VBR-nrt, VBR-rt, and CBR with traffic shaping	Ensures QoS guarantees for real-time traffic, with ability to send traffic over the appropriate virtual circuit to provide ATM-level shaping and ensure that no head-of-line blocking occurs between circuits of different or equal traffic classes
Up to 8 permanent virtual circuits per HWIC with per-VC (virtual circuit) queuing	Enables more sessions with a rich set of Cisco IOS Software IP QoS features relevant for small and medium-sized businesses and small branch offices with 50 to 200 employees
Point-to-Point Protocol (PPP) over ATM	Ensures compatibility with existing network
F5 OAM Continuity Check (F5OAMCC)	Supports operation, administration, and maintenance support for the use of F5 segment and end-to-end continuity check cells to detect connectivity failures at the ATM layer; Simple Network Management Protocol (SNMP) notifications are generated when virtual-circuit failures are detected
Interim Local Management Interface (ILMI)	Supports setting and capturing ATM-layer and virtual-circuit parameters on ATM interfaces useful for permanent virtual circuit (PVC) autodiscovery
PPP over Ethernet Client	Meets service provider requirements and eliminates the need for additional network software on LAN-connected client PCs
RFC 1483 routing	Supports RFC 1483 routing
ATM oversubscription for DSL	Allows configuration of bandwidth oversubscription for VBR and UBR+ service classes
Multiqueue	For DSL lines, enables a priority and a regular (nonpriority) queue for traffic streams
IMA (only on HWIC-4SHDSL)	ATM Forum standard that provides a scalable and cost-effective way for service provider and end customers to expand WAN bandwidth by bonding one to four G.SHDSL links

[1] Note: The optional 4-wire mode which is supported on HWIC-2SHDSL is identical to the M-pair mode for M=2, except for the method of assigning ordinal numbers to wire pairs. In four-wire mode, the ordinal numbers (the wire pair identification number) are assigned as described in Section 6.3 of ITU-T G991.2, while in M-pair mode, the ordinal numbers are assigned to wire pairs as described in Section 7.2.1.5 of ITU-T G991.2.

Interoperability

The 2- and 4-pair G.SHDSL HWICs are based on the Infineon chipset, and they operate when connected to a DSLAM. Table 3 lists the DSLAMs that have been tested and will be supported for interoperability. This table will be updated as more DSLAMs, line cards, and firmware versions are tested and supported in the future.

Table 4 lists DSLAM interoperability information for the G.SHDSL HWICs.

Table 4. DSLAM Interoperability

DSLAM	Line Card	Firmware	HWIC-2SHDSL	HWIC-4SHDSL
Alcatel ASAM 7300	SMLT-A	LDP7AA46.017	X	X
ECI HiFocus SAM 480	STUC-16	S3_8.10.10	X	X
Lucent Stinger FS	STGR-LIM-SL-72, STGR-LIM-SL-48	9.7.3 (R3.0.2)	X	X

Platform Support

Table 5 gives platform support details for the G.SHDSL HWICs.

Table 5. Platform Support Details

	HWIC-2SHDSL	HWIC-4SHDSL
Platforms supported	Cisco 1841, 2801, 2811, 2821, 2851, 3825, and 3845	Cisco 1841, 2801, 2811, 2821, 2851, 3825, and 3845
Onboard HWIC slots on all platforms	Yes	Yes

Maximum G.SHDSL High-Speed WAN Interface Cards per Platform

Table 6 gives the maximum number of G.SHDSL HWICs per platform.

Table 6. Maximum G.SHDSL HWICs per Platform

Platform	Maximum Number of G.SHDSL HWICs per Platform
Cisco 1841 and 2801	2
Cisco 2811 through Cisco 2851, and Cisco 3825 through Cisco 3845	4

Software Requirements

The minimum Cisco IOS Software Release required for the G.SHDSL HWICs (HWIC-2SHDSL and HWIC-4SHDSL) on the Cisco 1841, 2800, and 3800 Series Routers is Cisco IOS Software Release 12.4(11)XJ as indicated in Table 7. The recommended T-train Cisco IOS Software Release is 12.4(6th)T (expected in the first half of calendar year 2007). The 2- and 4-pair G.SHDSL HWICs are supported in all Cisco IOS Software feature sets.

Table 7 gives the minimum Cisco IOS Software release.

Table 7. Minimum Cisco IOS Software Release

Platform	Minimum Cisco IOS Software Release	Recommended Cisco IOS Software Release	Cisco IOS Software Feature Set
Cisco 1841, 2801, 2811, 2821, 2851,3825, and 3845	12.4(11)XJ	12.4(6th)T	IP Base and up

Product Number and Ordering Information

Table 8 gives product ordering information.

Table 8. Ordering Information

Product Number	Description
HWIC-2SHDSL, HWIC-2SHDSL=	2-pair G.SHDSL HWIC (spare & system)
CISCO1841-2SHDSL	1841 2-pair G.SHDSL bundle, HWIC-2SHDSL, IP Base, 64F/128D
C2801-2SHDSL/K9	2801 2-pair G.SHDSL bundle, HWIC-2SHDSL, SP Services, 64F/192D
C2811-2SHDSL/K9	2811 2-pair G.SHDSL bundle, HWIC-2SHDSL, SP Services, 64F/256D
HWIC-4SHDSL, HWIC-4SHDSL=	4-pair G.SHDSL HWIC w IMA (spare & system)
CISCO1841-4SHDSL	1841 4-pair G.SHDSL bundle, HWIC-4SHDSL, IP Base, 64F/128D
C2801-4SHDSL/K9	2801 4-pair G.SHDSL bundle, HWIC-4SHDSL, SP Services, 64F/192D
C2811-4SHDSL/K9	2811 4-pair G.SHDSL bundle, HWIC-4SHDSL, SP Services, 64F/256D
C2821-4SHDSL/K9	2821 4-pair G.SHDSL bundle, HWIC-4SHDSL, SP Services, 64F/256D

2- and 4-Pair G.SHDSL HWIC Hardware Specifications

Table 9 gives product hardware specifications.

Table 9. Hardware Specifications

	HWIC-2SHDSL	HWIC-4SHDSL
G.SHDSL chipset	Infineon	Infineon
Dimensions	Width: 2.80 inches Height:.702 inches Depth: 4.046 inches	Width: 2.80 inches Height:.702 inches Depth: 4.046 inches
Firmware Version	Ver 1.1-1.5.0__004	Ver 1.1-1.5.0__004
Weight	0.18 lb	0.22 lb
LEDs	One HWIC OK LED; two Link Status LEDs (one LED per physical link pair) Link Status LED color coding: Green–Link On/Active Off–Link Disabled Blinking–Link Training/Link Alarm	One HWIC OK LED; four Link status LEDs (one LED per physical link pair) Link Status LED color coding: Green–Link On/Active Off–Link Disabled Blinking–Link Training/Link Alarm
Ports	Single RJ-11/RJ-14 connector	Single RJ-45 connector
Cabling	RJ-11 line cord	RJ-45 to dual RJ-11 breakout line cord
NEBS compliance	No	No

Safety, EMC, Telecom, Network Homologation, Power, Environmental Requirements, and Regulatory Approvals

When installed in a Cisco 1800, 2800, or 3800 Series Router, the 2- and 4-pair G.SHDSL HWICs (HWIC-2SHDSL and HWIC-4SHDSL) do not change the standards (safety, EMC, telecom, network homologation, power, environmental requirements, and regulatory approvals) of the router itself. Refer to the Cisco 1800, 2800, and 3800 data sheets for additional information about mechanical, environmental, and agency certifications.

- For Cisco 1800 Series (modular):

  http://www.cisco.com/en/US/prod/collateral/routers/ps5853/product_data_sheet0900aecd8016a59b.html
- For Cisco 2800 Series:

  http://www.cisco.com/en/US/products/ps5854/index.html

- For Cisco 3800 Series:

  http://www.cisco.com/en/US/prod/collateral/routers/ps5855/product_data_sheet0900aecd8016a8e8.html

Country Support

- Worldwide accepted technology based on ITU Recommendation 991.2
- Refer to the following URL or contact your local Cisco representative for country-specific approval status:

  http://tools.cisco.com/cse/prdapp/jsp/externalsearch.do?action=externalsearch&page=EXTERNAL_SEARCH

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