ISDN Terminals and Terminal Adapters

National Semiconductor
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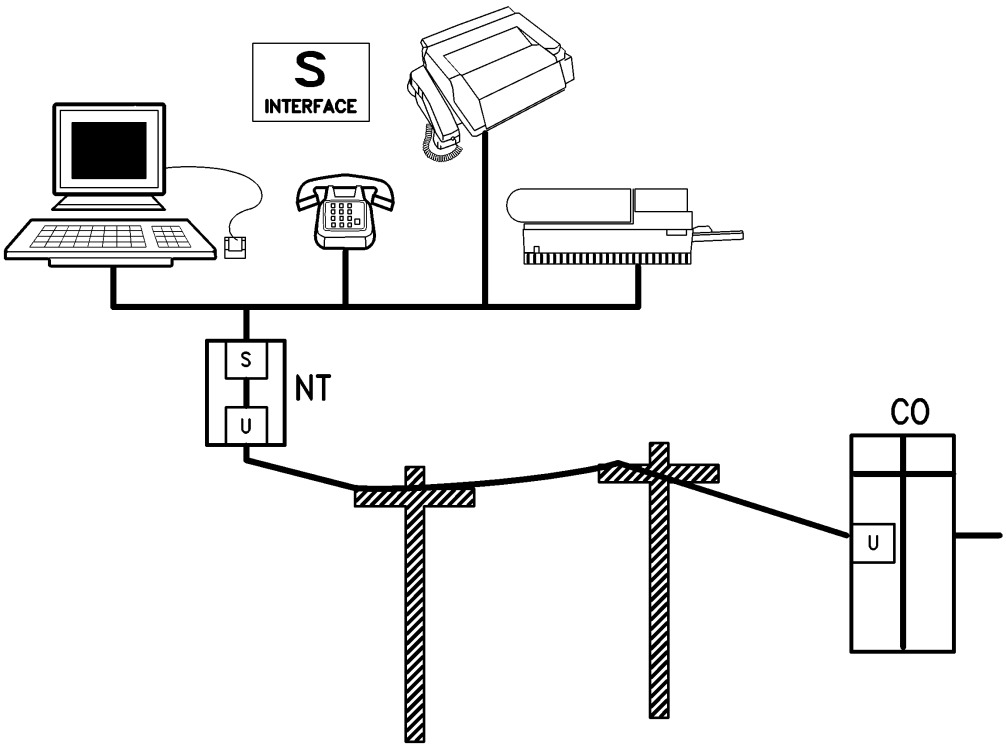

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SYSTEM DESCRIPTION

The implementation of ISDN will not only bring benefits, such as improved efficiency and bandwidth, to the operating companies, but also bring the end user new services and features that previously have not been possible.

End users of ISDN have to either adapt the non-ISDN equipment they already own to interwork with the ISDN network, or purchase new, ISDN compatible equipment. A variety of office equipment, referred to as Terminal Equipment, may be equipped for ISDN, including phones, computers, and fax machines. Terminal Adapters (TA) perform the rate adaption protocols necessary to interface non-ISDN equipment to the network, and are available as either stand-alone boxes or as PC plug in cards. All ISDN terminal equipment uses the CCITT standard S Interface four wire transceiver. This allows for either point to point or multipoint connectivity.

A basic rate ISDN connection is comprised of three separate channels, two capable of transmitting either voice or data at 64 Kbytes, and a third for signalling and data at 16 Kbytes. Accordingly, equipment will vary in implementation and use of these channels. Low end equipment will not require all three channels be active, while high end equipment may use all three for packetized data. As designs become increasingly complex, advanced silicon solutions will be required to meet the size and power constraints placed upon the equipment.

KEY DESIGN CHALLENGES

High Speed Data Transfer

Sophisticated signal processing is required to achieve the high speed data transfer and still meet the requirements for low bit error rate and electromagnetic interference.

High Integration

Keeping chip count to a minimum increases the reliability of the equipment. The telephone handset and PC plug in card are also space sensitive applications where lower chip count is a necessity while maintaining a high degree of functionality.

Flexibility

ISDN terminal equipment manufacturers will only be able to offer a broad product line with a base chipset that is flexible enough to handle both low end and high end applications. System architecture should allow the designer to apply the same chipset to all products without compromise.

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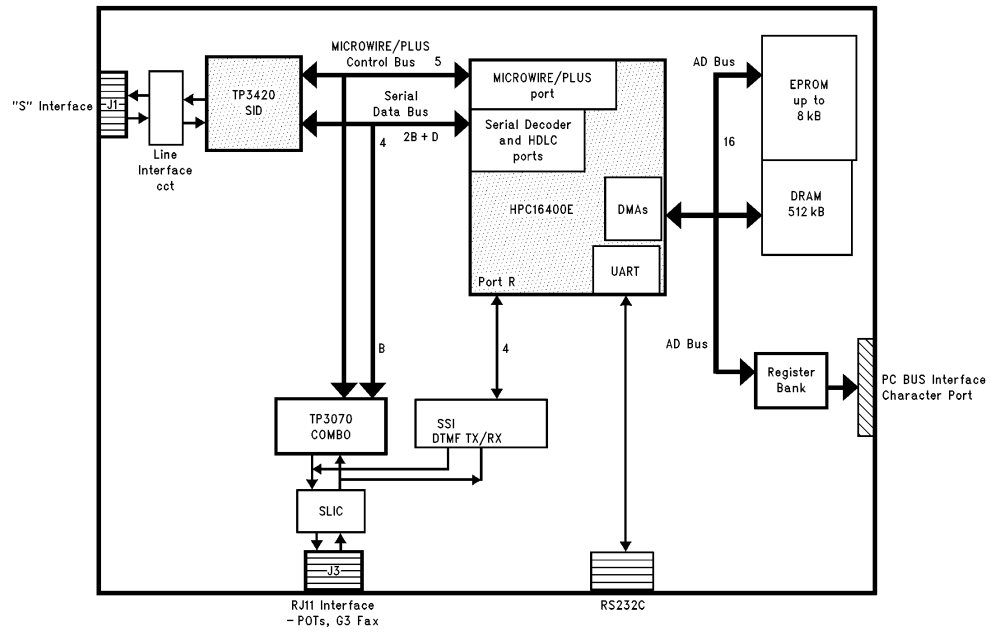
Block Diagram of ISDN PCTA



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KEY COMPONENTS

TP3420/21 International standard ISDN four wire transceiver. Offers a long loop length (1.5 km/5 kft) with low error rate and two phase lock loops on chip to minimize EMI and reduce external components. Supports both the North American and European digital system interface formats.

TP3076 Second generation combined PCM CODEC and Filter optimized for digital phone applications. The device is A-law and μ-law selectable and employ a conventional serial PCM interface capable of being clocked up to 4.096 MHz. It also features programmable gains in both Tx and Rx directions as well as four programmable latches.

TP3451 A microprocessor peripheral device designed as both a full-duplex HDLC framing and formatting controller, and a serial GCI (General Circuit Interface) frame controller. It may be used in conjunction with the HPC16400E for high end applications requiring three HDLC channels.

TP3460 A microprocessor peripheral ISDN USART which implements V.110 and V.120 rate adaption protocols for serial interface terminals. Data rates up to 19.2 Kbps and 64 Kbps are supported in asynchronous and synchronous modes respectively.

HPC16400E A highly integrated 16-bit microcontroller with two HDLC controllers and four DMA channels on chip. Includes a high performance UART that can be used for rate adaption, three independent timers, multi-input wakeup for keypad scanning and a MICROWIRE™ interface for easy interfacing to other devices. +5V CMOS with low power down modes.

LM3678A An easy to use, highly integrated switching regulator with on chip oscillator, current limit and output transistor. Used in this application to provide an efficient stepdown DC/DC converter to convert the high voltage fed down the line to the +5V needed for the terminal.

Typical Bill of Material

Function	Description	NSC Part	Other Mfg	Qty
CPU	Micro-Controller	HPC16400E		1
Transceiver	SID	TP3420		1
Audio Interface	COMBO	TP3076		1
	DTMF TX/RX		SSI 20c89	1
DC/DC Conv	Switching Regulator	LM3678A		1
Memory	DRAM		TC514258P	4
	EPROM	NSC27C256		1
Memory Control and PC Interface Logic	DRAM Control	ASIC		1

ISDN PC Terminal Adapter Alternatives

	Low End Modem Replace TA	**Middle PCTA (Data)**	**Middle PCTA (Voice + D)**	**High End PCTA (Voice + D)**	**ISDN Phone with Low sp Data**	**ISDN Phone High sp Data**
	D − data	D + B2 data	D + B2 data B1 − analog	D + B1 + B2 data, opt for B1 analog	ISDN Phone with D data	ISDN Phone with B data
"S" interface: TP3420 + prot	Y	Y	Y	Y	Y	Y
HPC16400E	Y (single ch)	Y	Y	Y	Y (single ch)	Y
TP3451	N (Y for GCI)	N (Y for GCI)	N (Y for GCI)	Y for B1 Data (Y for GCI)	N (Y for GCI)	N (Y for GCI)
TP3076	N	N	Y	Y	Y	Y
SLIC opt DTMF TX/RX	N	N	Y	Y	N	N
Handset opt DTMF TX Sidetone cct	N	N	Y (opt)	Y (opt)	Y	Y
Software: EXEC Layer 1, Q.921 (LAPD)	Y	Y	Y	Y	Y	Y
Q.931 (voice basic and supple serv)	N	N	Y	Y	Y	Y
Q.931 (data)	Y	Y	Y	Y	Y	Y
LAPB (X.25 on B)	N	Y	Y	Y	Y	Y
X.25 PLP	Y	Y	Y	Y	Y	Y
V.120	N	Y	Y	Y	N	Y
"R" = PC Interface	Y	Y	Y	Y	N	N
PC interface soft.	Y	Y	Y	Y	N	N
Memory for above: RAM ROM	 96–128 Kbytes 2 Kbytes	 160–192 Kbytes 2 Kbytes	 160–192 Kbytes 2 Kbytes	 192–224 Kbytes 2 Kbytes	 8 Kbytes 96–128 Kbytes	 16 Kbytes 128–160 Kbytes
shared RAM	4 Bytes	8 Kbytes	8 Kbytes	8 Kbytes	—	—
"R" = Asynch port	N	Y (opt)	Y	Y	Y	Y
X.28, X.29, X.3	N	Y	Y	Y	Y	Y
Add RAM	—	64 Kbytes	64 Kbytes	64 Kbytes	ROM 64 Kbytes	ROM 64 Kbytes
DMI (mode 2)	N	Y (opt)	Y (opt)	Y (opt)	N	Y (opt)
Add RAM	—	64 Kbytes	64 Kbytes	64 Kbytes	—	64 Kbytes
T-link	N	Y (opt)	Y (opt)	Y (opt)	N	Y (opt)
Add RAM	—	64 Kbytes	64 Kbytes	64 Kbytes	—	64 Kbytes
Typical soln: Total RAM Total ROM	 128 Kbytes 2 Kbytes	 192 + 8 + 64 Kbytes 2 Kbytes	 256 + 8 + 64 Kbytes 2 Kbytes	 288 + 8 + 64 Kbytes 2 Kbytes	 8 Kbytes 192 Kbytes	 16 Kbytes 224 + 64 Kbytes

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