ISDN Network Terminators and Repeaters

National Semiconductor
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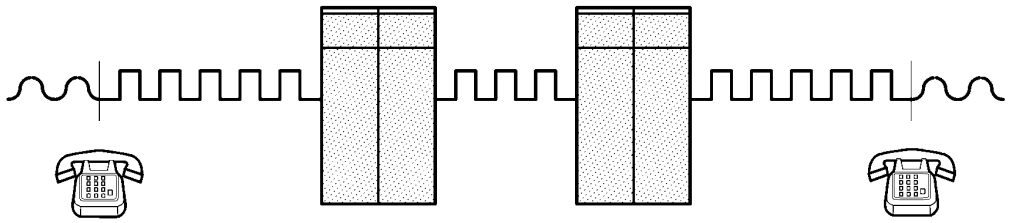

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SYSTEM DESCRIPTION

The ISDN subscriber loop represents the conversion of the ''last mile'' of telephone cable from analog signaling to digital signaling. Today's homes and offices typically receive their phone service from a Central Office (CO) Switch. This telephone network provides voice services, but cannot provide similar data services without the use of high speed modems. ISDN digitizes all of the information passed on the subscriber loop, enabling new services and features, such as Automatic Number Identification, Automatic Call Distribution, and Computer Screen Sharing and File Transfer to take place simultaneously with voice transmission. As ISDN is an international standard, users will have access to the same features and capabilities worldwide.

In order to digitize the subscriber loop new equipment must be installed. The analog CO linecards are replaced, and a new Network Termination, called an NT-1, is installed at the customer premises. These two pieces of equipment enable full duplex 160 Kbps transmission over the existing twisted pair copper lines.

Until recently the availability of advanced silicon solutions and the establishment of tariffs has impeded the implementation of ISDN. Advances in mixed mode analog/digital circuitry has enabled semiconductor manufacturers to introduce single chip U Interface solutions. The U Interface transceiver is placed on either end of the subscriber loop, one in the linecard and one in the NT-1. Multiple U Interface transceivers may be used in repeaters or regenerators between the CO and the NT-1. Sophisticated echo cancelling techniques are used to achieve the high transmission and low error rates required by the ISDN specification.

KEY DESIGN CHALLENGES

High Speed Data Transfer

In order to achieve the high transmission rates required over a single twisted pair of wire, an echo cancellation technique must be implemented which cancels the transmitted signal from the received signal. Intersymbol interference must also be eliminated through the use of advanced signal processing techniques.

Low Power Consumption

In many cases the NT-1 or a Repeater may need to be powered off the line by the CO. As the circuitry for an ISDN system is relatively complex, low power consumption is critical.

Minimizing System Cost

ISDN equipment must not only be cost effective, it must also abide by the space constraints of the existing analog equipment. A minimum of components will also increase reliability of the system.

Flexibility for Multiple Designs

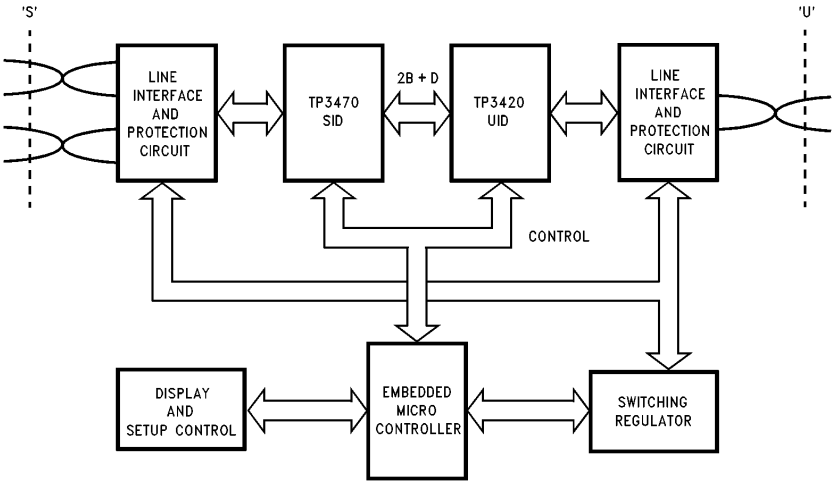
Manufacturers are likely to become broad based suppliers of ISDN, often providing multiple versions of various network components. It is important that the devices used within initial product offerings have features and capabilities that may easily be applied to other applications in the future.

KEY COMPONENTS

TP3410	A high performance transceiver for use on standard telephone wiring with full duplex data rates up to 160 Kbps at distances up to 18k ft. Features include two on chip phase lock loops, a programmable time slot assigner, a separate D channel port, and support for both North American and European digital system interface formats.
TP3420/21	International standard ISDN four wire transceiver. Offers a long loop length (1.5 km/5k ft) 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.
COP822	Low cost 8-bit microcontroller containing all system timing, interrupt logic, 1k ROM, 64 bytes RAM, and I/O neccessary to implement dedicated control functions.

 TL/F/10853 RRD-B30M105/Printed in U. S. A.

Block Diagram of NT-1



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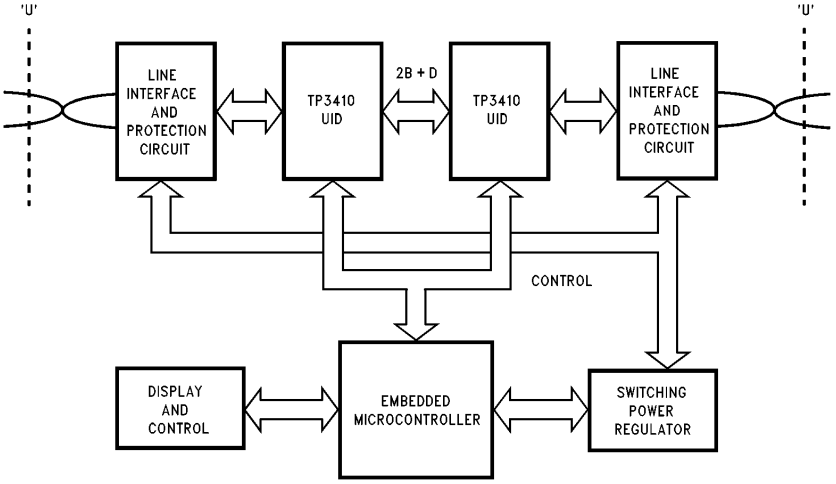
Block Diagram of a U Regenerator or Repeater



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Typical Bill of Materials for Network Terminator

Function	Description	NSC Part	Other Mfg	Qty
CPU	Microcontroller	COP822		1
Transceiver	U Interface Dev	TP3410		
	S Interface Dev	TP3420		
LED Driver		HC595		1
Miss Gate		HC7400		1
Transformer	Line Trans for U		✓	1
	Line Trans for S		✓	1
Switching Regulator				1
Diodes			✓	6
Resistors				STE
LEDs				6
DIP Switch				1
RIP				1
Capacitors				20
Crystal			15.36 MHz	1
RJ45	Connector			2

Typical Bill of Materials for ISDN Repeater

Function	Description	NSC Part	Other Mfg	Qty
CPU	Microcontroller	COP822		1
Transceiver	U Interface Dev	TP3410		2
Transformer			✓	2
Switching Regulator			✓	1
Diodes				15
Resistors				15
LEDs				6
DIP Switch				1
Capacitors				16
Crystal			15.36 MHz	1
RJ45	Connector			2

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National Semiconductor Corporation
1111 West Bardin Road
Arlington, TX 76017
Tel: 1(800) 272-9959
Fax: 1(800) 737-7018

National Semiconductor Europe
Fax: (+49) 0-180-530 85 86
Email: cnjwge@tevm2.nsc.com
Deutsch Tel: (+49) 0-180-530 85 85
English Tel: (+49) 0-180-532 78 32
Français Tel: (+49) 0-180-532 93 58
Italiano Tel: (+49) 0-180-534 16 80

National Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: (852) 2737-1600
Fax: (852) 2736-9960

National Semiconductor Japan Ltd.
Tel: 81-043-299-2309
Fax: 81-043-299-2408