

SB-105

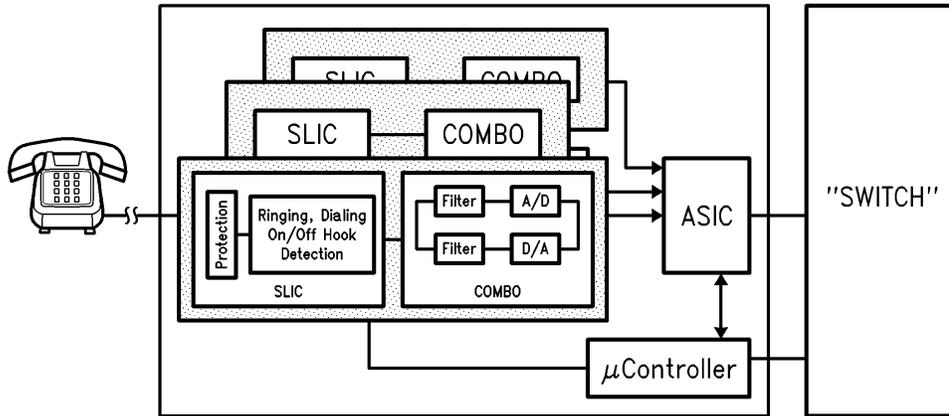
SB-105 Programmable Central Office and Private Branch Exchange Linecards



Literature Number: SNOA166

Programmable Central Office and Private Branch Exchange Linecards

National Semiconductor
System Brief 105
May 1990



TL/F/10855-1

SYSTEM DESCRIPTION

In a Central Office (CO) or Private Branch Exchange (PBX), each subscriber's telephone line is interfaced to the switching equipment through electronics on linecards in the switch. These electronics are required to provide the basic BORSCHT functions as described below.

- B** – Battery feed to power the subscriber's telephone in the local loop
- O** – Overvoltage protection from lightning surges and induced or short circuit voltages from utility power lines
- R** – Ringing signal to the subscribers telephone
- S** – Supervision to detect caller off-hook, calls in progress, calls terminated
- C** – Coding of voice (analog) signals into serial digital codes that are placed into PCM timeslots for digital transmission. Encoding is performed at the sending end; signal recovery and decoding is performed at the receiving end
- H** – Hybrid transformer for conversion from two-wire to four-wire, and filtering to provide impedance match to remove or minimize echoes.

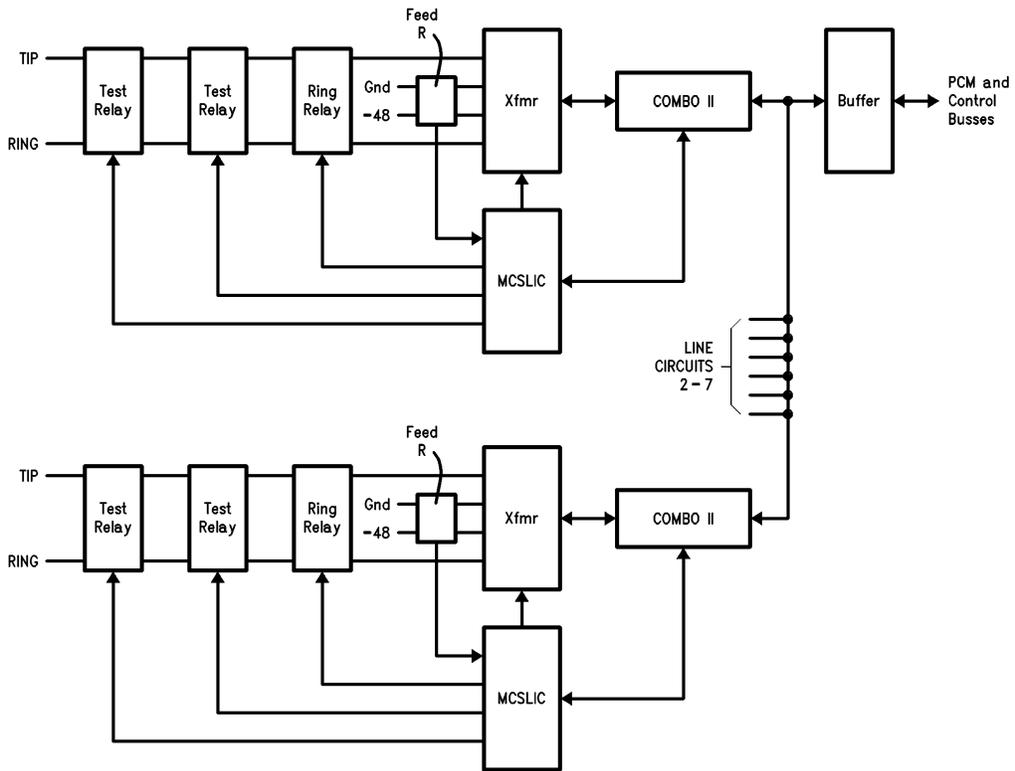
T – Testing of the local loop and circuits of the switching equipment to detect faults and provide maintenance

On the linecard, SLICs and CODEC/filters are the main devices which are used to provide the above functions. SLIC is an acronym for Subscriber Line Interface Circuit, and may be transformer-based, electronic, or some combination of the two technologies. CODEC is an acronym for CODER/DE-CODER. CODECs and filters may be used as separate devices, or may be combined into devices such as National's COMBO® series of combined CODEC/filter systems.

A microcontroller or microprocessor may also be on a linecard, but is not shown in the block diagram since there is typically one micro for a whole shelf or frame of linecards. Additional circuitry is also required to interface between the complex backplane and the electronics on the linecard. Each manufacturer implements this interface in a unique way, and typically this logic is contained in a custom ASIC device.

COMBO® and TRI-STATE® are registered trademarks of National Semiconductor Corporation.
COMBO II™ is a trademark of National Semiconductor Corporation.

Typical Block Diagram for an 8-Line COMBO II Based Line Card



TL/F/10855-2

Key Design Challenges

PERFORMANCE

Telephone switch linecards are required to meet a variety of specifications, depending on the country in which they are to be installed. Among the specifications are the Comite Consultatif International Telegraphique et Telephonique CCITT International specifications and Bell Communications Research (Bellcore) Lata Switching System General Requirements (LSSGR). Bellcore is an independent research lab upon which the Regional Bell Operating companies in the U.S. depend for specifications. Each country will have its own requirements from the local telecommunications authority. Use of circuits which do not meet these specifications requires the switch maker to obtain waivers from their customers (and the Telecom authorities) before the customer is allowed to put the equipment into service.

PROGRAMMABILITY

Several functions on a linecard are programmed. Chief among them is the hybrid balance filter, for the cancellation of echo from the 4-wire receive path towards the 4-wire transmit path introduced by the 2- to 4-wire conversion via the subscriber line interface transformer and circuitry. Hybrid balance needs to be adjusted to suit a wide range of local loop conditions. An additional programmable area is the transmit and receive gain. It is also useful to have one device which is selectable between A-law and μ -law coding if the switch is to be sold in many different countries.

COST

The market for telephone switching equipment is very competitive and continues to be so with increasing deregulation. Linecards can typically represent 65% of the cost of a

switch and as a result, manufacturers take special care in designing the linecard to optimally meet the market requirements, and in the selection of linecard components to optimally implement the design. Tradeoffs include use of separate CODEC/filters versus a combined device such as the COMBO, use of a highly programmable device such as COMBO II versus implementing the functions off-chip with external components, use of an electronic versus a transformer-based subscriber line interface circuit, or some combination of the two. Consideration is given to flexibility, manufacturing costs, availability of alternate sources, and basic volume availability of the critical components.

Key Components

TP3070/71 COMBO II CODEC/FILTER

The COMBO II meets or exceeds Bellcore and CCITT requirements. It is a complete CODEC and filtering system, including high-pass and low-pass filtering and A-law or μ -law compatible coder and decoder. Channel gains are programmable over a 25.4 dB range, in 0.1 dB steps, in both the transmit and receive directions. A programmable filter is included for Hybrid Balancing. Up to 65,536 filter combinations can be programmed for impedance match.

TP3200/3204 MAGNETIC COMPENSATION SLICs

This series of devices meet or exceed Bellcore and CCITT requirements. They provide hook-switch detect, ringing detect and dial a pulse replication. Use of the TP32XX SLIC allows use of a ferrite core transformer which is smaller and cheaper than a conventional transformer. This also allows higher density, lower profile cards which can be closer together in the switch.

Typical Bill of Materials for an 8-Line COMBO II™ Based Line Card

Function	Description	NSC Part	Other Mfg.	Qty.
A/D, D/A	COMBO II™	TP3070		8
Line Interface	MCSLIC	TP3204		8
	Line Transformer		✓	8
	Line Coupling Capacitor		✓	8
	Battery Feed Resistors		✓	32
	Ring and Test Relays		✓	24
	Speech Filter Capacitor		✓	8
	Compensation Current Set Resistor		✓	8
	Transformer Matching Resistor		✓	8
Backplane I/F	TRI-STATE® Quad Buffer	DM74LS125A		5
Protection	Relay Clamp Diode		✓	24
	Compensation Winding Clamp—62V Zener Diode		✓	8
	Line Transient Clamp—3.9V Zener Diode	1N4730A		16
	Line Current Limiting Resistor		✓	16
	Transient Suppressor		✓	16
	Schottky Diode		✓	1
Supply Decoupling	Ceramic Capacitor		✓	42
	Electrolytic Capacitor		✓	2
	Resistor		✓	8

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



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: onjwge@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.
 19th 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

National does not assume any responsibility for use of any circuitry described, no circuit patent licenses are implied and National reserves the right at any time without notice to change said circuitry and specifications.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Transportation and Automotive	www.ti.com/automotive
Video and Imaging	www.ti.com/video

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2011, Texas Instruments Incorporated