SB-101

SB-101 Digital PBX Linecard and Terminal

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Digital PBX Linecard and Terminal

National Semiconductor
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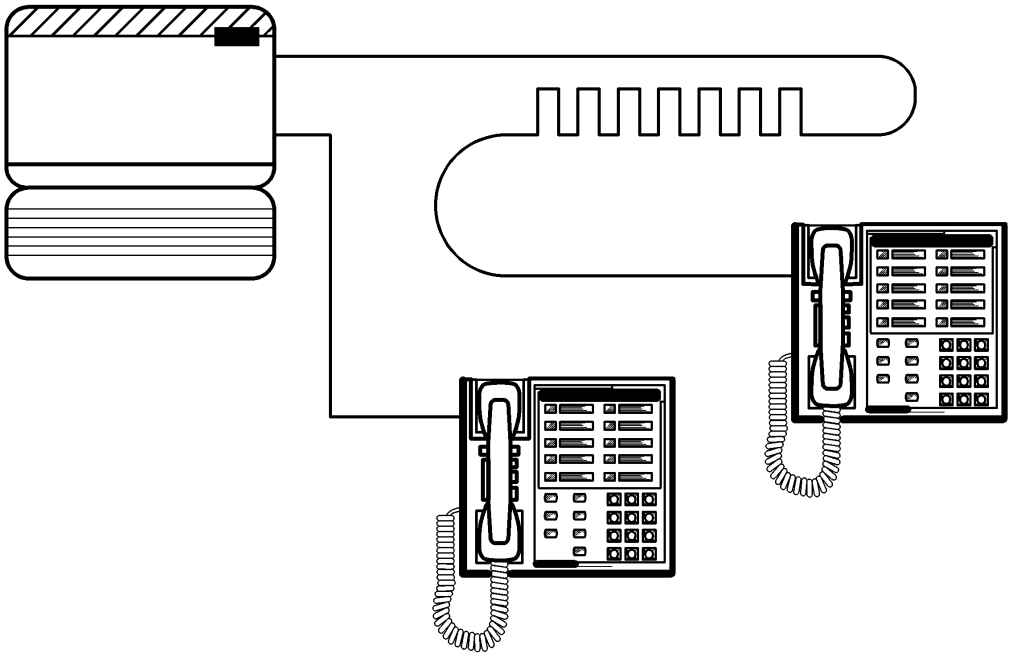


TL/F/10851–1

SYSTEM DESCRIPTION

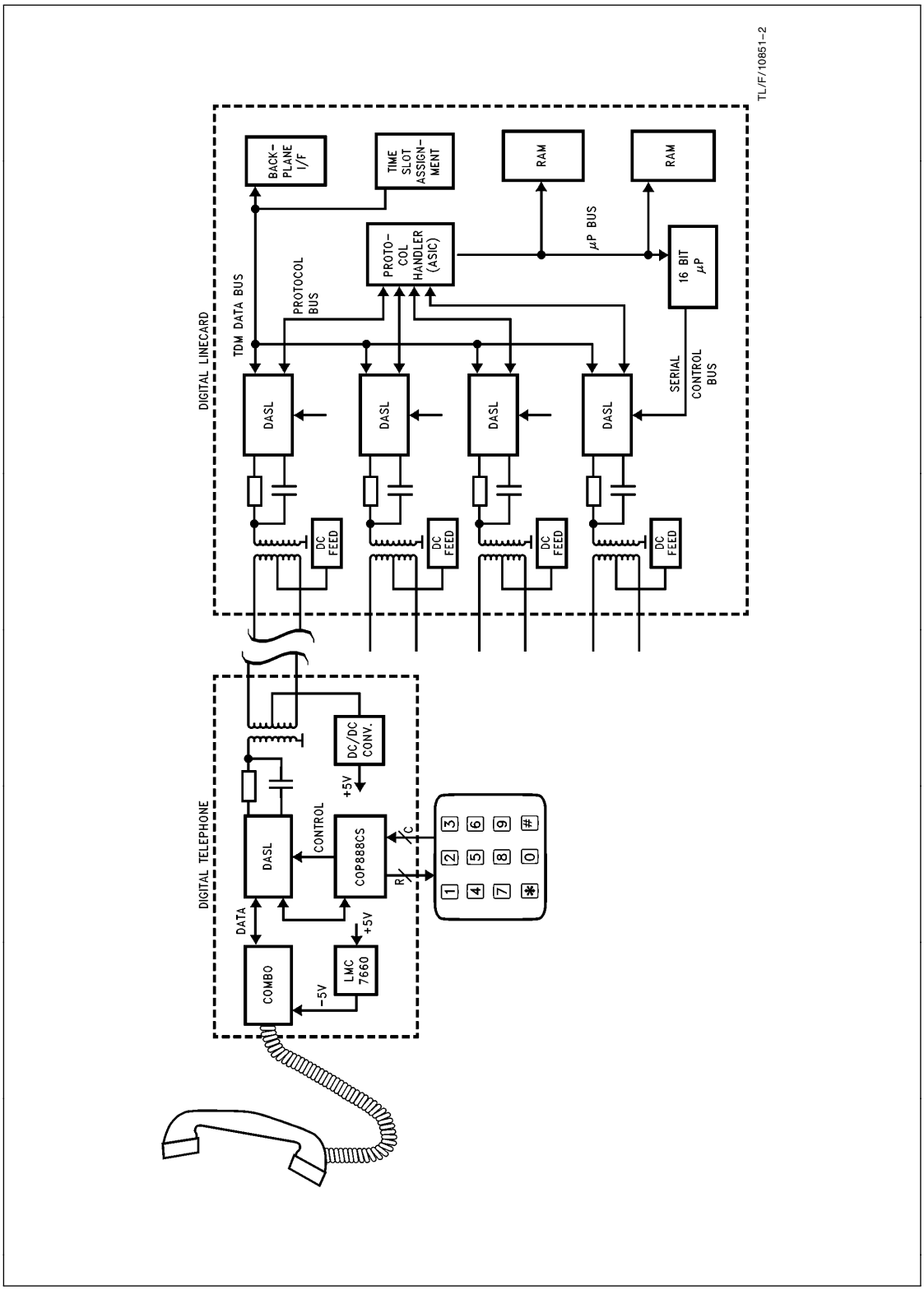
A Private Branch eXchange (PBX) is a small telecommunications switch that is located in the user's premises. Traditionally it carried voice traffic only and its main benefits to the user were free calls between extensions and a reduction in the number of outside lines (trunk lines) that the local operating company charged for. As technology improved it was realized that digital transmission could add the benefit of data transmission over the already present telephone wiring and that the improved signalling capabilities could be used to add additional features such as messaging, call forwarding and incoming call indication.

The term ''Terminal'' is used here to refer to all ''Terminal Equipment'' that may be connected to a digital PBX. This includes everything from a basic voice only telephone to a Personal Computer connected by a PC plug-in card.

The increasing sophistication and cost competitiveness of mixed technology analog and digital integrated circuits has led to the situation where digital PBXs can now compete directly on cost with the traditional analog version. The added benefits of being able to carry voice, data and images at the same time as providing enhanced signalling capabilities has created a dynamic market for digital PBXs.

Cost effectiveness is achieved by using a 2 Wire transmission scheme that doubles the capacity of standard telephone wiring, while at the same time using a simple communications protocol that can be implemented with a simple 8-bit microcontroller in the terminals. A sophisticated high speed digital transceiver is used that controls both ends of the extension loop and provides two high speed 64-Kbyte channels for voice and data and an additional channel for signalling information at 16 Kbytes.

RRD-B30M105/Printed in U. S. A.


DIGITAL LINECARD
TDM DATA BUS
PROTOCOL BUS
BACK-PLANE I/F
TIME SLOT ASSIGN-MENT
PROTO-COL HANDLER (ASIC)
RAM
RAM
μP BUS
16 BIT μP
SERIAL CONTROL BUS
DASL
DASL
DASL
DASL
DC FEED
DC FEED
DC FEED
DC FEED
DIGITAL TELEPHONE
DC/DC CONV.
+5V
DASL
CONTROL
COP888CS
I/C
R
DATA
+5V
COMBO
LMC 7660
-5V
1 2 3 4 5 6 7 8 9 0 * #
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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.

Low Power Consumption

In most cases the telephone handset will be powered from the telephone line. To achieve this all components must use as little power as possible, both when active and inactive.

Minimizing System Cost

The digital PBX will often be in direct competition with systems that use analog handsets. While the high end phones and data capabilities offer significant benefits to the user, the basic voice telephone may well run in the highest volumes and is therefore extremely cost sensitive.

Adding Additional Capabilities

There will always be a need for several different types of terminals. The chosen solution for the basic digital telephone should not be viewed in isolation but as part of an expandable family, each with a different requirement for power consumption, processing power, memory and price sensitivity. To achieve this comfortably, it's important that all chip-chip interfaces are as simple to use and as flexible as possible.

KEY COMPONENTS

TP3401 "DASL": A high performance digital transmitter/receiver for use on standard telephone wiring. Offers a long loop length (1.8 km/6 kft) with low error rate and has filtering and PLLs on chip to minimize EMI and reduce external components. The data, signalling and control information each have their own interface for added flexibility. +5V CMOS with power down mode.

COP888CG: A highly integrated 8-bit microcontroller with 4 Kbyte of ROM and 192 bytes of RAM on chip. Includes a high performance UART that can be used for the signalling protocol, 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.

TP3054/3057: The industry standard COMBO® device. Handles the digitization and filtering of voice signals to D3/D4 and CCITT standards respectively. Low power down mode when not active.

HPC46004: A member of the high performance 16-bit microcontroller family that is ideal for protocol processing on digital linecards. Low power, fast instruction execution and highly integrated with many peripherals on chip.

LMC7660: A switched capacitor voltage converter. Ideal for providing the −5V supply to the COMBO as it can provide 95% power efficiency.

LM3578A: 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 on the line to the +5V needed for the terminal.

Typical Bill of Material

Function	Description	NSC Part	Other Mfg	Qty
DIGITAL TELEPHONE				
CPU	Microcontroller	COP888CG		1
Speech Interface	COMBO	TP3057/TP3054		1
Digital Transceiver	DASL	TP3401		1
DC/DC Converter	Switching Reg.	LM3578A		1
−5V Supply	Switched Cap Reg.	LMC7660		1
DIGITAL LINECARD (4 lines)				
CPU	16-Bit Micro	HPC46004		1
ROM	64 Kbytes EPROM	27C512-150		1
RAM	16 Kbytes SRAM		6264-15	2
Digital Transceiver	DASL	TP3401		4
TDM Bus Controller	TSAC	TP3155		1
Protocol Handler and Glue Logic	ASIC	SCX6B31		1
Backplane Interface	Futurebus tcvr	DS3897		1

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