

V29/17 Fax Modems and V32bis Data Modem LSI*

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1 Background

There is an increasing demand for the capability to transmit large amounts of data at faster rates. For fax communication, the majority of which has moved from the older G2 analog technology to the newer G3 system, the data rate of preference is 9 600 bps (bits per second), which is moving now to 14 400 bps and gives

every indication of further increases above 14 400 bps. On the other hand, data communication, which at present is mostly in V22bis (2 400 bps), has been shifting to V32 (9 600 bps) and V32bis (14 400 bps) and, in addition, faster V34 will be standard shortly.

Table 1 lists the ITU (International Telecommunication Union) Recommendation and the Bell Standard rates for modems. While all these systems are on analog

Table 1 Modem standards

ITU recommendation	Data rate (Fall back)	Modulation scheme	Baud rate	Carrier frequency (Hz)	Synchronous scheme	Mode
V21	300	FSK	300	1 080, 1 750	Asynchronous	Full duplex
V22	1 200 (600)	PSK	600	1 200, 2 400	Asynchronous, Synchronous	Full duplex
V22 bis	2 400 (1 200)	QAM	600	1 200, 2 400	Asynchronous, Synchronous	Full duplex
V27 ter	4 800 (2 400)	PSK	1 600	1 800	Synchronous	Half duplex
V32	9 600 (4 800)	QAM	2 400	1 800	Synchronous	Full duplex
V32 bis	14.4K (12K, 9 600, 7 200, 4 800)	QAM	2 400	1 800	Synchronous	Full duplex
V29	9 600 (7 200, 4 800)	QAM	2 400	1 700	Synchronous	4 wire full duplex
V17	14.4K (12K, 9 600, 7 200)	QAM	2 400	1 800	Synchronous	Fax half duplex
Bell 103	300	FSK	300	1 080, 1 750	Asynchronous	Full duplex
Bell 112	1 200	PSK	600	1 200, 2 400	Asynchronous, Synchronous	Full duplex
V24	RS232C					
V25 bis	Modem control command					
V42	Error correction					
V42 bis	Data compression					
AT command	Modem control command					
Fax class 1	Fax control command					
MNP2-4	Error correction					
MNP5	Data compression					

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telephone line networks in worldwide, the trend toward digital communications focused on ISDN (integrated service digital network) is steadily growing. It is expected that the conventional analog communication system and newer digital communication system will exist together in the future.

A V29 fax modem (KL5M96001) has been developed for the applications mentioned above. This paper will also introduce a V17 fax modem (KL5M14001) and a V32bis data modem (KL5M14141) that are under the development.

2 V29 Fax Modem

2.1 Product Profile

V29 fax modem KL5M96001 is designed to meet the requirements of ITU Recommendations with a half-duplex 9 600 bps facsimile capability (Table 2). The KL5M96001 operates on a 5 V single power supply, and it contains both analog and digital functions on one CMOS chip. It is an ideal fax modem.

2.2 Product Specification

- (1) Conforms to V29, V27ter, V21ch2
- (2) Built-in programmable tone generator/detector
- (3) Built-in DTMF (dual-tone multiple-frequency) generator/detector
- (4) Transmitting level 0: -15 dBm programmable with 1 dBm step
- (5) Receiving level 0: -50 dBm programmable with 1 dBm step
- (6) Built-in automatic equalizer, link equalizer, and cable equalizer
- (7) On-board V24 port, 8 bit microprocessor bus
- (8) Designed for low power consumption

- (9) 5 V single power supply
- (10) 44-pin PLCC package
- (11) Built-in A/D (analog-digital) and D/A (digital-analog) converters
- (12) Built-in transmission driver for direct drive of NCU (network control unit)

The function has been designed with a compact modem hardware specification. It uses the sigma delta method for an A/D converter and over-sampling system for a D/A converter, and contains a buffer which directly drives a telephone line. An external filter which eliminates outband noise or a drive amplifier is not required. It is possible to reduce the number of external components and total system cost. Figure 1 shows an outline of the chip, and Fig. 2 is an application example.

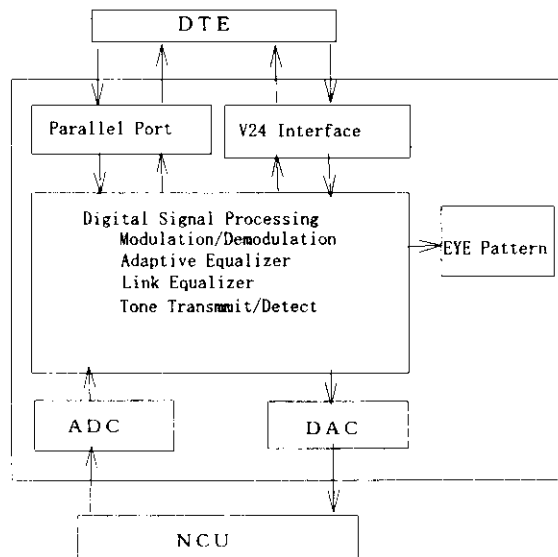


Fig. 1 V29 and V17 fax modem

Table 2 Product table

Product name	KL5M96001	KL5M14001	KL5M14141
Modem	V29 fax modem	V17 fax modem	V32 bis data modem
Features	On chip analog front end, out of band noise filter, output buffer	Same as KL5M96001 and HDLC, DMA	One chip data modem including data pump, controller and analog front end
Function	V29, V27 ter, V21 ch 2 Tone transmit and detection DTMF transmit and detection	V17, V29, V27 ter, V21 ch 2 Tone transmit and detection DTMF transmit and detect HDLC, DMA	V32 bis, V32, V22bis, V22, V21, V17, V29, V27ter Bell 212, 103 V42, V42 bis MNP 2-5 AT command, V25 FAX class 1 Tone transmit and detect DTMF transmit and detect ADPCM

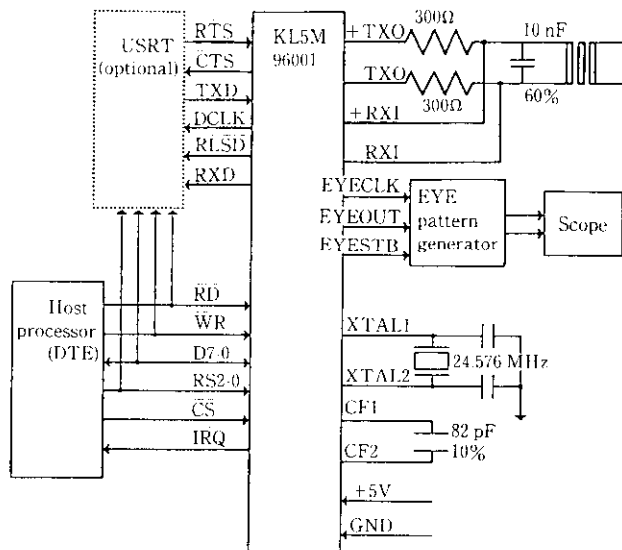


Fig. 2 KL5M96001 application

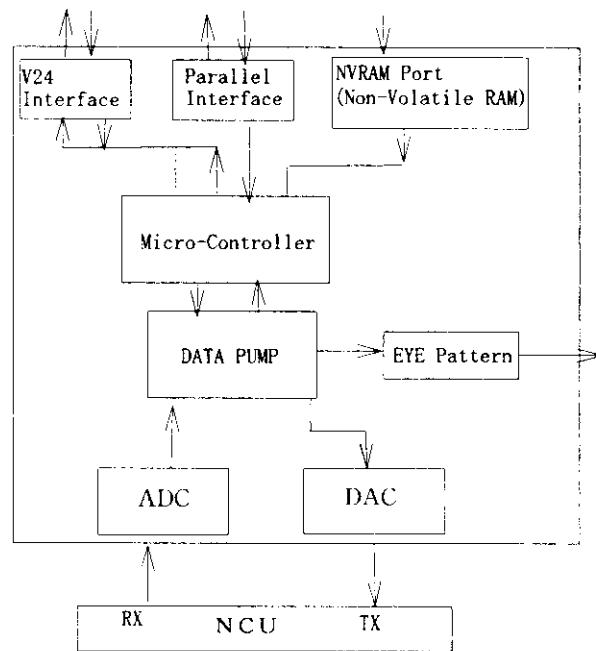


Fig. 3 V32bis data modem

3 V17 Fax Modem

3.1 Product Profile

The fax modem KL5M14001 is designed to meet V17 in a single chip. The design concept is the same as V29, therefore the device has an extremely simple external circuit, low power consumption, and an error detection mechanism by the HDLC (high-level data link control procedure) which contains framing and deframing functions. The package is a 44 pin PLCC, the same as V29 fax modem. A QFP package is possible.

3.2 Product Specification

- (1) Conforms to V17, V29, V27ter, V21ch2
- (2) HDLC framing and deframing
- (3) Built-in programmable tone generator/detector
- (4) Built-in DTMF generator/detector
- (5) Transmitting level 0: -15 dBm programmable with 1 dBm step
- (6) Receiving level 0: -50 dBm programmable with 1 dBm step
- (7) Built-in automatic equalizer, link equalizer, and cable equalizer
- (8) On-board V24 port, 8 bit microprocessor bus
- (9) Designed for low power consumption
- (10) 5 V single power supply
- (11) 44-pin PLCC package
- (12) Built-in A/D and D/A converters
- (13) Built-in transmission driver for direct drive of NCU

4 V32bis Data Modem

4.1 Product Profile

Data modem KL5M14141 is a complete one-chip

modem which conforms to V32bis, V32, V22bis, V22, V21, V17, V29 and V27ter, further supporting V42bis, MNP2-5, AT Commands, and V25bis. Power consumption is reduced by the CMOS process and power management function in a compact 144 pin QFP package. The product can cover various applications, for instance, conventional box modem and modem card for personal computer. **Figure 3** shows the outline of the chip.

4.2 Product Specification

- (1) Conforms to V32bis, V32, V22bis, V22, V21, V17, V29, V27ter, Bell212, and Bell103
- (2) Supports V42, V42bis, and MNP2-5
- (3) AT Command, V25bis, Fax Class 1
- (4) Built-in tone generator/detector, ADPCM (adaptive differential pulse code modulator) compatible
- (5) Reduced power consumption by CMOS circuit and power management function
- (6) Single 5 V power supply
- (7) Compact 144-pin QFP package

5 Summary

The three types of modem LSI's were introduced in this paper. Every LSI is targeting low power, small size, and fewer peripheral circuitry, which reduce total cost.

We will expand modem product series in future.

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