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A TDK Group Company

SSI 73D2247
MNP5, V.42bis Datacom
Modem Device Set

T- 75- 33- 90

January 1993

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DESCRIPTION

The SSI 73D2247 Chip Set consists of two CMOS integrated circuits which provide the data pump and protocol functions required to implement a high performance 2400 bit/s modem with error control and data compression. The basic modem function is provided by the SSI 73K224L modem chip and is compatible with CCITT V.21, V.22, V.22bis and Bell 103 and 212A protocols. The error control functions are provided by modular software running in the SSI 73D630 controller. Modules are available for MNP4, and V.42. Compression software modules can be can be added to the controller; MNP5 and V.42bis are available. Provisions for customization of the Command Set are provided, forming the basis for an International Modem.

FEATURES

- **Combines Modem and Protocol Controller**
- **Supports 0 - 300, 1200 and 2400 bit/s with both Sync and Async Modes**
- **Modular Software Design Allows Customization**
- **Modem Protocols:**
    Bell 103, 212A
    CCITT V.22, V.22bis
- **Error Control/Compression Protocols Available: MNP4, MNP5, CCITT V.42, V.42bis**
- **Supports Non-volatile Memory to Store User Configurations and Phone Number Blacklists**
- **CMOS Design for Low Power Consumption**

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CAUTION: Use handling procedures necessary for a static sensitive component.
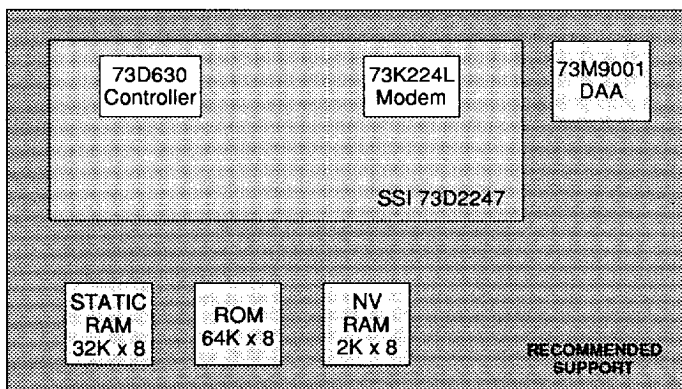
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FUNCTIONAL DESCRIPTION

The SSI 73D2247 chip set forms the basis for an international modem design incorporating the most advanced error control and compression algorithms. The set consists of two chips, the SSI 73K224L modem and the 73D630 controller. Customization of the controller is one of the features of this chip set; software modules allow the modem vendor to provide a range of features from a standard hardware platform.

The 73K224L provides the QAM, PSK and FSK modulator and demodulator functions, call progress and handshake tone monitors, test modes and a tone generator capable of producing DTMF, answer and CCITT guardtones. This single-chip modem supports the V.22bis, V.22, V.21 and Bell 103/212A operating protocols in both sync and async modes. Low level functions of the controller provide for automatic detection of DTE speed, auto-dial, auto-answer, handshake with fallback and call progress detection.

A coded version of the 73K224L modem chip is used with the 73D2247 chip set firmware provided by Silicon Systems. Different versions of the controller code can be generated by the modem manufacturer, with "AT" commands only, MNP5 with 8K SRAM, and V.42bis with 32K SRAM as examples.

The 73D630 controller handles both the low level modem functions as well as protocol negotiation and protocol operation. Software modules can be chosen to provide the desired protocols for product customization and differentiation. In addition, the "AT" command set source code will be available for those desiring to provide unique or country dependent features.

QAM Modulator/Demodulator

PSK Modulator/Demodulator

FSK Modulator/Demodulator

Passband Filters and Equalizers

Adaptive Equalization with Retrain

Basic capabilities of the modem are those found in the 73K224L Single-Chip Modem and are listed in the separate 73K224L data sheet.

AUTOMATIC HANDSHAKE

The 73D2247 will automatically perform a complete handshake with a called or calling modem and enter the data transfer mode. After the link between the two modems has been established, the modems may remain in the normal data mode or negotiate a link which has error control and data compression. Commands are provided to inform the modem which action is appropriate.

TEST MODES

The 73D2247 chip set has provisions for three test modes: analog loopback, digital loopback and remote digital loopback. Analog loopback allows data to be sent into the local modem, have it modulated and then demodulated and returned to the local terminal. Digital loopback requires the cooperation of the user at the remote end and allows data to be sent to the remote modem, demodulated, then remodulated and returned to the local end. Remote digital loopback allows the same capability, without the need for a remote operator; signals are sent to the remote modem which perform the switching task that a remote operator would have done.

AT COMMAND INTERPRETER

The SSI 73D2247 includes an AT Command Interpreter which is a superset of the Hayes 2400 Smartmodem™ command set. Common application software will be able to control the modem though this interpreter. Additional commands have been added to provide for control of the MNP and CCITT V.42 modes.

NON-VOLATILE MEMORY

Two modes of operation depend on the use of non-volatile memory: end user configuration storage and telephone number blacklisting. Current hardware provides for a 2K byte memory of which about 400 bytes are used for setup and telephone number storage. The remaining 1600 bytes are avaliable. Memory address space allocated to non-volatile RAM is 8K, so an expansion factor of 4 is available. Alternatively, the address space could be decoded for more hardware functionality.

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PROTOCOLS

Microcom Networking Protocol (MNP)

MNP4 is a protocol offering error control while MNP5 offers data compression. Data to be transmitted is broken into blocks of varying sizes, depending on line conditions, and sent to the remote modem along with a 16-bit Cyclic Redundancy Check word. If the algorithm used to derive the CRC word at the transmitter does not produce an identical word when exercised on the received data, a line error is assumed, and the block is repeated. Data compression is obtained by transmitting a short set of characters for a longer redundant set. At the receiver, the short string is replaced with the longer string that it represented, and the data stream is returned to its original state.

CCITT V.42 and V.42bis

The CCITT has ratified a set of protocols which operate in a manner similar to MNP. MNP4 corresponds to V.42 while MNP5 corresponds with V.42bis. Greater efficiency is offered, but the tradeoff is a larger memory space requirement. MNP5 requires an 8K buffer, while V.42bis requires 32K. Data files which show compression ratios approaching 2:1 with MNP5 may show ratios of nearly 4:1 with V.42bis.

ADDITIONAL INFORMATION

The SSI 73D2247 Design Manual completely defines the AT commands, gives a description of the hardware and provides instructions for modifying the code for customization. Please contact your local Silicon Systems sales office or Silicon Systems headquarters in Tustin for a copy of the SSI 73D2247 Design Manual.

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AT COMMAND SUMMARY

Command	Description	Command	Description
AT	command prefix – precedes command line	*X4*	*enable features represented by result codes 0-7, 10-12*
<CR>	carriage return character – terminates command line	*Y0*	*disable long space disconnect*
A	go into answer mode; attempt to go to on-line state	Y1	enable long space disconnect
A/	re-execute previous command line; not preceded by AT nor followed by <CR>	Z0	reset modem
B0	select CCITT V.22 standard for 1200 bit/s communication	*&C0*	*assume data carrier always present*
		&C1	track presence of data carrier
B1	*select Bell 212A standard for 1200 bit/s communication*	*&D0*	*ignore DTR signal*
D	dial number that follows; attempt to go to on-line state, originate mode	&D1	assume command state when an on-to-off transition of DTR occurs
DS=n	dial stored number in location "n" (0-3)	&D2	hang up and assume command state when an on-to-off transition of DTR occurs
E0	Disable character echo in command state	&D3	reset when an on-to-off transition of DTR occurs
E1	*Enable character echo in command state*	&F	recall factory settings as active configuration
H0	go on hook (hang up)	*&G0*	*no guard tone*
H1	go off hook; operate auxiliary relay	&G1	550 Hz guard tone
I0	request product indentification code	&G2	1800 Hz guard tone
I1	perform checksum on firmware ROM; return checksum	&K	flow control method
I2	perform checksum on firmware ROM; returns OK or ERROR result codes	*&M0*	*asynchronous mode*
		&M1	synchronous mode 1
L0 or L1	low speaker volume	&M2	synchronous mode 2
L2	*medium speaker volume*	&M3	synchronous mode 3
L3	high speaker volume	&Q5	error control mode
M0	speaker off	&Q6	automatic speed buffering (ASB)
M1	*speaker on until carrier detected*	&T0	terminate test in progress
M2	speaker always on	&T1	initiate local analog loopback
M3	speaker on until carrier detected, except during dialing	&T3	initiate local digital loopback
O0	go to on-line state	*&T4*	*grant request from remote modem for RDL*
O1	go to on-line state and initiate equalizer retrain at 2400 bit/s	&T5	deny request from remote modem for RDL
Q0	*modem returns result codes*	&T6	initiate remote digital loopback
Q1	modem does not return result codes	&T7	initiate remote digital loopback with self test
Sr	set pointer to register "r"	&T8	initiate local analog loopback with self test
Sr=n	set register "r" to value "n"	&V	view active configuration, user profiles, and stored numbers
Sr?	display value stored in register "r"	&W0	save storable parameters of active configuration
V0	display result codes in numeric form		
V1	*display result codes in verbose form (as words)*	*&X0*	*modem provides transmit clock signal*
W0	*negotiation progress result codes not returned*	&X1	data terminal provides transmit clock signal
W1	negotiation progress result codes returned	&X2	receive carrier provides transmit clock signal
X0	enable features represented by result codes 0-4	&Zn=x	store phone number "x" in location "n" (0-3)
X1	enable features represented by result codes 0-5, 10-12		
X2	enable features represented by result codes 0-6, 10-12		
X3	enable features represented by result codes 0-5, 7, 10-12		

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Dial string arguments:

, = delay	@ = silent answer	! = flash
; = return to command	s = dial stored number	W = wait for tone R=reverse mode

If the NovRAM has not been initialized it may be necessary to Power down/Power up and type *AT&F&W<cr>* to properly initialize modem state.

TABLE 1: Result Codes

Xn	VERBOSE/TERSE RESULT CODES
X0	OK/0, CONNECT/1, RING/2, NO CARRIER/3, ERROR/4
X1	All functions of X0 + CONNECT (RATE)/1 = 300, 5 = 1200, 10 = 2400
X2	All functions of X1 + NO DIAL TONE/6
X3	All functions of X1 + BUSY/7
X4	All functions of X3 + NO DIAL TONE/6, NO ANSWER/8

TABLE 2: S Registers Supported

Sn	FUNCTION	UNITS	DEFAULT
S0[1]	Answer on ring	No. of rings on which to answer	000[2]
S1	Ring counter	No. of rings accumulated	000
S2	Escape code	ASCII CHR Decimal 0-127	043
S3	Carriage return	ASCII CHR Decimal 0-127	013
S4	Line feed	ASCII CHR Decimal 0-127	010
S5	Back space	ASCII CHR	008
S6	Wait for dial tone	Seconds	002
S7	Wait for carrier	Seconds	030
S8	Pause time	Seconds	002
S9	Carrier valid	100 milliseconds (0.1 sec)	006
S10	Carrier drop out	100 milliseconds (0.1 sec)	014
S11	DTMF tone duration	1 millisecond (0.001 sec)	070
S12	Escape guard time	20 milliseconds (0.05 sec)	050
S13	Unused		N/A
*S14[1]	Bit mapped register	Decimal 0-255	170

[1]   Stored in NVRAM with &W command.
[2]   Modem will not answer until value is changed to 1 or greater.

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TABLE 2: S Registers Supported (Continued)

NUMBER	FUNCTION	UNITS	DEFAULT
S15	Unused		N/A
S16	Test register	Decimal #	000
S17	SSi Special test register	Decimal 0-255	096
S18	Test timer	Decimal 0-255	000
S19	Unused		N/A
S20	Unused		N/A
*S21[1]	Bitmapped register	Decimal 0-255	000
*S22[1]	Bitmapped register	Decimal 0-255	118
*S23[1]	Bitmapped register	Decimal 0-255	007
S24	Unused		N/A
S25[1]	DTR delay	10 milliseconds (0.01 sec)	005
S26[1]	CTS delay	10 milliseconds (0.01 sec)	001
*S27[1]	Bitmapped register	Decimal 0-255	064
S36	Negotiation failure treatment		5
S37	Desired modem line speed	Decimal 0-9	000
S38	Hang-up timeout		20
S39	Current flow control setting		3
S43	Current DCE speed		0
S46	Protocol/Compression selection		2
S48	Feature negotiation action		7
S49	ASB Buffer low limit	1-249	8
S50	ASB Buffer high limit	2-250	16
S82	Break select register		128
S95	Extended result code bit map		0

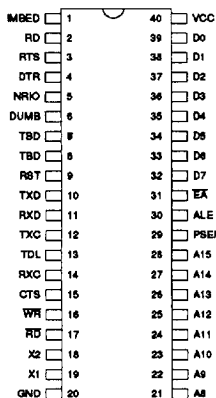* The bitmapped register functions are equivalent to normal "AT" command modem registers.
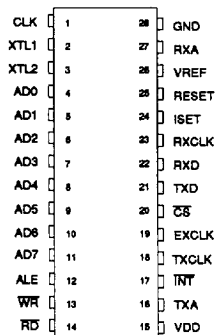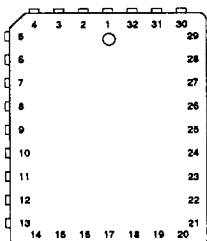
[1] Stored in NVRAM with &W command
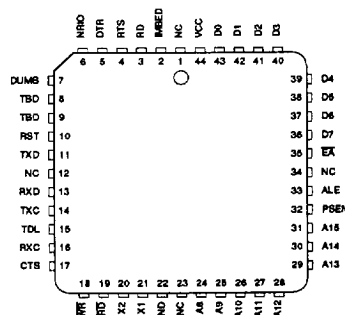
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PACKAGE PIN DESIGNATIONS (Top View)

SSI 73D630/631
40-PIN DIP

SSI 73K224
28-PIN DIP

SSI 73K224
32-PIN PLCC

SSI 73D630/631
44-PIN PLCC

ORDERING INFORMATION

PART DESCRIPTION	ORDER NUMBER	PACKAGE MARK		
		Data Modem	Controller	Fax Modem
AT, MNP2-5, V.42, V.42bis Device Set				
Plastic Dual In-Line	73D2247Z-IP	73K224LZ-IP	11 MHz: 73D630-IP 22 MHz: 73D631-IP	N/A
Plastic Leaded Chip Carrier	73D2247Z-IH	73K224LZ-IH	11 MHz: 73D630-IH 22 MHz: 73D631-IH	N/A
SSI 73D2247 with FAX				
Plastic Dual In-Line	73D2247ZF-IP	73K224LZ-IP	11 MHz: 73D631-IP	Yamaha YTM401D
Plastic Leaded Chip Carrier	73D2247ZF-IH	73K224LZ-IH	11 MHz: 73D631-IH	Yamaha YTM401J

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