TDK

TDK SEMICONDUCTOR CORP.

April 2000

DESCRIPTION

The 73D2248A/2348A Device Sets 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 73D2248A basic modem function is provided by the 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 73M2910 controller. Modules are available for MNP4, and V.42. Compression software modules 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.

The 73D2348 differs from the 73D2248A in that it uses the 73K324L instead of the 73K224L for the data pump. The 73K324L replaces the Bell 103, 300 bps (bit/s) FSK mode of operation, with the CCITT V.23, 1200 bps (bit/s) FSK mode. The software is also modified to support V.23. The two products are otherwise identical.

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 (73K224L), 212A**

- **CCITT V.21, V.22, V.22bis, V.23 (73K324L)**

- **Error control/compression protocols Available: MNP4, MNP5, CCITT V.42, V.42bis**

- **Supports non-volatile memory to store user configurations and phone numbers**

- **CMOS design for low power consumption**

MNP5, V.42bis Datacom
Modem Device Set

RECOMMENDED
SUPPORT
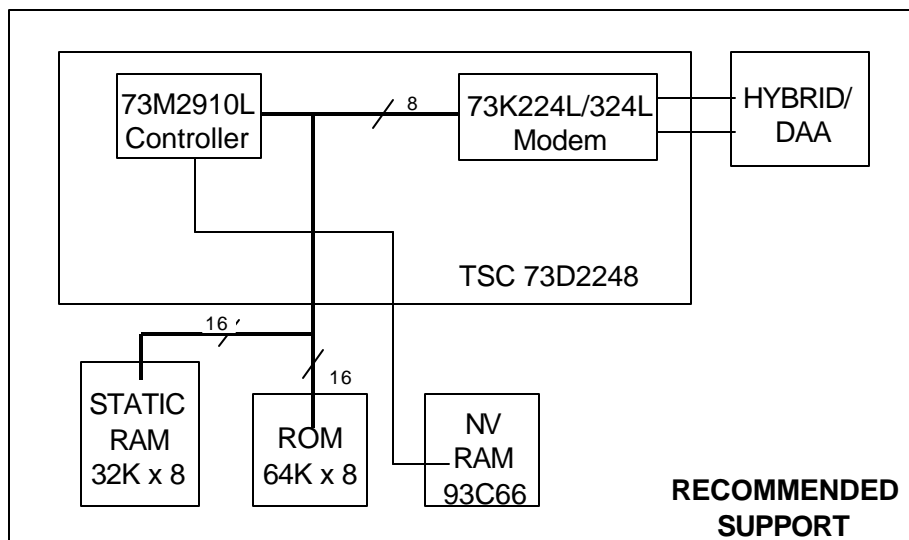
73D2248A/2348A
MNP5, V.42bis Datacom
Modem Device Set

FUNCTIONAL DESCRIPTION

The 73D2248A/2348A device 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 73K224L (73K324L) modem and the 73M2910 controller. Customization of the controller is one of the features of this device set; software modules allow the modem vendor to provide a range of features from a standard hardware platform.

The 73K224L (73K324L) 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/CCITT V.23/212A 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.

The 73M2910 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.

Basic capabilities of the modem are those found in the 73K224L (73K324L) single-chip modem and are listed in the separate 73K224L (73K324L) data sheet.

AUTOMATIC HANDSHAKE

The 73D2248A/2348A 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 73D2248A/2348A device 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 73D2248A/2348A 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

A serial NVRAM provides 256 bytes of storage for configuration information and telephone numbers.

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 (CRC) 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 TDK Semiconductor Corporation 73D2248/2348 Design Manual defines the AT commands. Please contact your local TDK Semiconductor Corporation's sales office for a copy of the TDK Semiconductor Corporation's Protocol Design Manual.

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73D2248A/2348A
MNP5, V.42bis Datacom
Modem Device Set

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 and V.21standards for 1200 and 300 bit/s communications	**&C0**	*assume data carrier always present*
		&C1	track presence of data carrier
B1	*select Bell 212A and Bell 103 standards for 1200 and 300 bit/s communicatios*	**&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
		&F	recall factory settings as active configuration
E1	*Enable character echo in command state*	**&G0**	*no guard tone*
H0	go on hook (hang up)	&G1	550 Hz guard tone
H1	go off hook; operate auxiliary relay	&G2	1800 Hz guard tone
I0	request product identification code	&K	flow control method
I1	perform checksum on firmware ROM; return checksum	**&M0**	*asynchronous mode*
I2	perform checksum on firmware ROM; returns OK or ERROR result codes	&M1	synchronous mode 1
		&M2	synchronous mode 2
L0 or L1	low speaker volume	&M3	synchronous mode 3
L2	*medium speaker volume*	&Q5	error control mode
L3	high speaker volume	&Q6	automatic speed buffering (ASB)
M0	speaker off	&T0	terminate test in progress
M1	*speaker on until carrier detected*	&T1	initiate local analog loopback
M2	speaker always on	&T3	initiate local digital loopback
M3	speaker on until carrier detected, except during dialing	**&T4**	*grant request from remote modem for RDL*
O0	go to on-line state	&T5	deny request from remote modem for RDL
O1	go to on-line state and initiate equalizer retrain at 2400 bit/s	&T6	initiate remote digital loopback
		&T7	initiate remote digital loopback with self test
Q0	*modem returns result codes*	&T8	initiate local analog loopback with self test
Q1	modem does not return result codes	&V	view active configuration, user profiles, and stored numbers
Sr	set pointer to register "r"		
Sr=n	set register "r" to value "n"	&W0	save storable parameters of active configuration
Sr?	display value stored in register "r"	**&X0**	*modem provides transmit clock signal*
V0	display result codes in numeric form	&X1	data terminal provides transmit clock signal
V1	*display result codes in verbose form (as words)*	&X2	receive carrier provides transmit clock signal
W0	*negotiation progress result codes not returned*	&Zn=x	store phone number "x" in location "n" (0-3)
W1	negotiation progress result codes returned		
X0	enable features represented by result codes 0-4		
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		

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/NUMERIC 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
S15	Unused		N/A

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

TABLE 2: S Registers Supported (continued)

Sn	FUNCTION	UNITS	DEFAULT
S16	Test register	Decimal #	000
S17	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

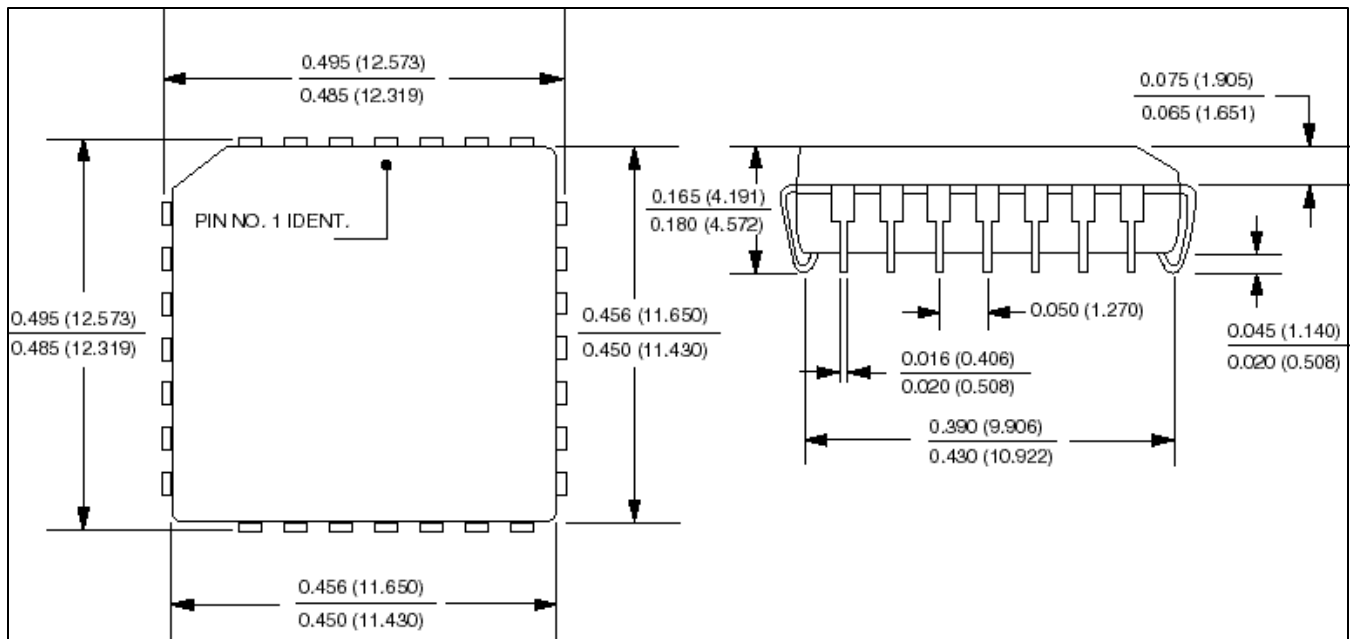*The bitmapped register functions are equivalent to normal "AT" command modem registers.

[1] Stored in NVRAM with &W command

MECHANICAL SPECIFICATIONS
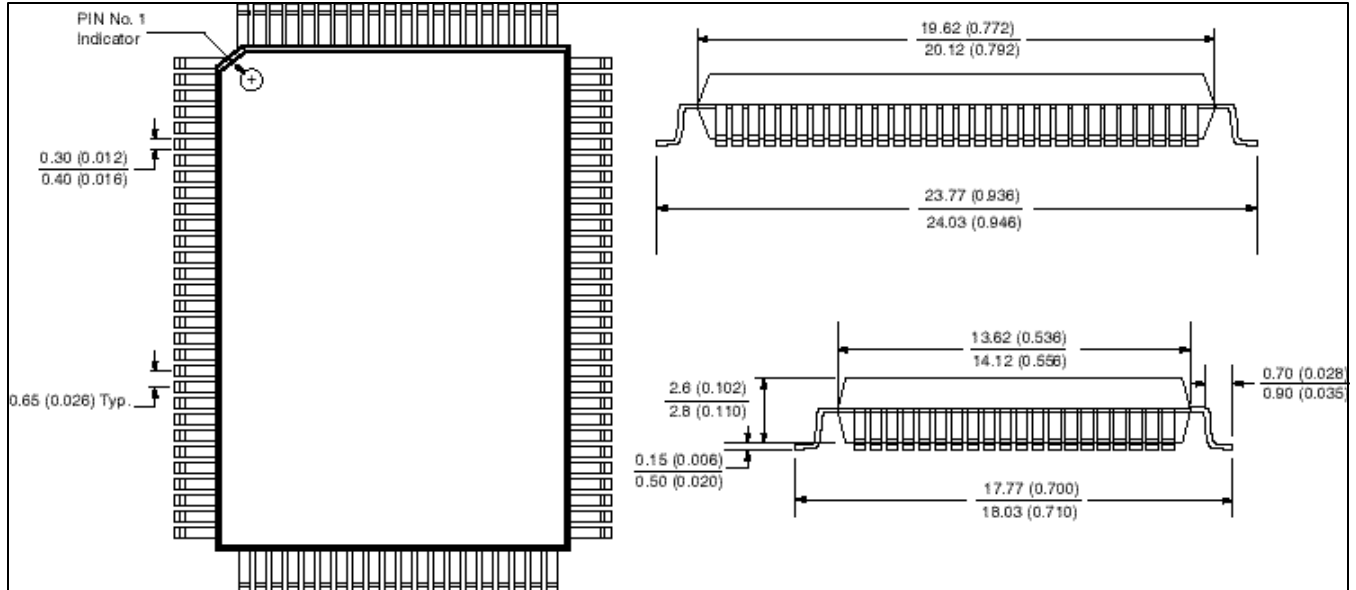
28-Pin PLCC

73D2248A/2348A
MNP5, V.42bis Datacom
Modem Device Set
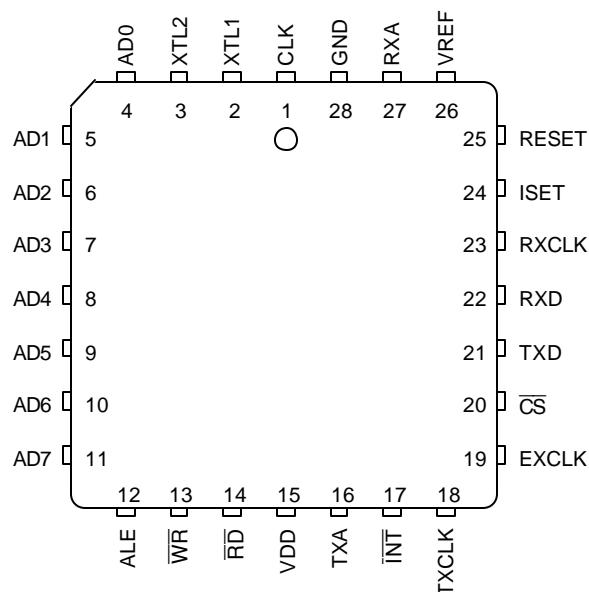
PACKAGE PIN DESIGNATIONS
(Top View)

Pin	Left Signal		Pin	Right Signal
1	N/C		80	N/C
2	N/C		79	N/C
3	N/C		78	USR50
4	N/C		77	N/C
5	N/C		76	USR51
6	A1		75	USR31
7	A2		74	USR30
8	A3		73	USR40
9	A4		72	USR41
10	A5		71	USR42
11	A6		70	USR43
12	A7		69	USR44
13	A8		68	USR45
14	A9		67	USR46
15	A10		66	USR47
16	A11		65	VND
17	A12		64	VPD
18	A13		63	USR20
19	A14		62	USR21
20	A15		61	USR22
21	$\overline{PSEN}$		60	USR23
22	RESET		59	USR24
23	VND		58	USR25
24	OSCOUT		57	USR26
25	OSCIN		56	USR27
26	N/C		55	N/C
27	N/C		54	N/C
28	CLK2OUT		53	N/C
29	N/C		52	N/C
30	N/C		51	N/C

Top pins (100–81): A0, VPD, D7, D6, D5, D4, D3, D2, D1, D0, ALE, $\overline{WR}$, $\overline{RD}$, VND, USR37, USR36, USR35, USR34, USR33, USR32

Bottom pins (31–50): VPD, CLK1OUT, TXD, RXD, PTXCLK, PTXD, PRXCLK, PRXD, $\overline{INT2}$, $\overline{INT1}$, $\overline{INT0}$, VND, USR10, USR11, USR12, USR13, USR14, USR15, USR16, USR17

73M2910L-IG
Controller
100-Lead QFP

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PACKAGE PIN DESIGNATIONS (continued)
(Top View)

Top pins (left to right): AD0 (4), XTL2 (3), XTL1 (2), CLK (1), GND (28), RXA (27), VREF (26)

Left pins (top to bottom): AD1 (5), AD2 (6), AD3 (7), AD4 (8), AD5 (9), AD6 (10), AD7 (11)

Right pins (top to bottom): RESET (25), ISET (24), RXCLK (23), RXD (22), TXD (21), $\overline{CS}$ (20), EXCLK (19)

Bottom pins (left to right): ALE (12), $\overline{WR}$ (13), $\overline{RD}$ (14), VDD (15), TXA (16), $\overline{INT}$ (17), TXCLK (18)

73K224L-28IH or 73K324L-28IH
Single Chip Modem
28-Pin PLCC

ORDERING INFORMATION

PART DESCRIPTION	ORDER NUMBER	PACKAGING MARK
73D2248 Surface Mount Packages 73K224L-IH/73M2910L-IG	73D2248	73K224L-28IH/73M2910L-IG
73D2348 Surface Mount Packages 73K324L-IH/73M2910L-IG	73D2348	73K324L-28IH/73M2910L-IG