HP7501
Ultra320 LVD/SE SCSI Terminator

FEATURES

- **Fully compliant with Ultra320 (SPI-4), Ultra3/Ultra160 (SPI-3), Ultra2/Fast-40 (SPI-2) and Ultra/Fast-20 Standards.**

- **Auto Selection Multi-Mode SE or LVD Termination for 9 signal line pairs.**

- **Built-in SPI-4 Mode Change Filter**

- **2.7V to 5.25V Operation**

- **Built in Current Limit and Thermal shutdown Protection Circuitry.**

- **Support Master/Slave input.**

- **SCSI bus hot plug compatible.**

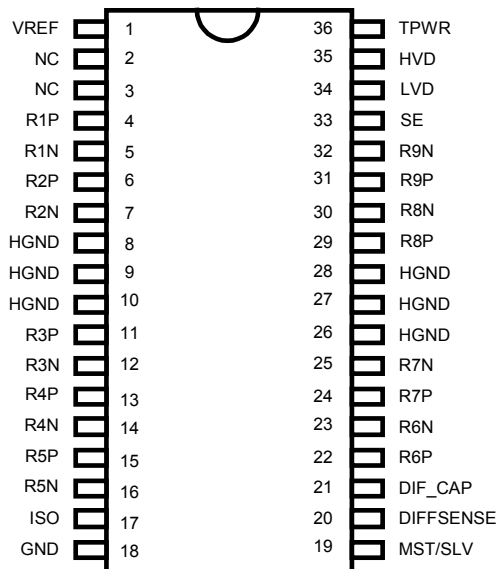- **Support active negation drive.**

- **28 and 36 pin package.**

DESCRIPTION

The HP7501 is a multi-mode SCSI terminator that conforms to the SCSI (SPI-4) specification which is designed for the low voltage differential (LVD) termination. The HP7501 provides backward compatibility to the SCSI-2, SCSI-1 and a Single-Ended specifications.
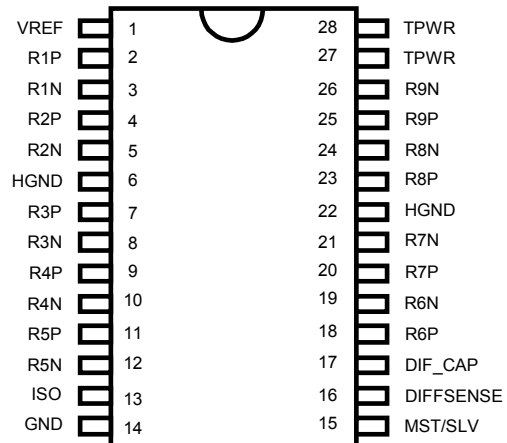
Multi-mode function set up the use of legacy devices on the bus without changing any hardware setting. Automatic selection is made by voltage detection on the DIFFSEN line. If the device is connected in an LVD only bus, the HP7501 will use LVD termination. If the device is connected in a Single Ended mode, the HP7501 will connect in a SE termination.

HiMARK's SCSI termination architecture uses high speed elements for the design, therefore providing the fast response time.

PACKAGE PINOUT

HP7501-A36		HP7501-A36	
VREF	1	36	TPWR
NC	2	35	HVD
NC	3	34	LVD
R1P	4	33	SE
R1N	5	32	R9N
R2P	6	31	R9P
R2N	7	30	R8N
HGND	8	29	R8P
HGND	9	28	HGND
HGND	10	27	HGND
R3P	11	26	HGND
R3N	12	25	R7N
R4P	13	24	R7P
R4N	14	23	R6N
R5P	15	22	R6P
R5N	16	21	DIF_CAP
ISO	17	20	DIFFSENSE
GND	18	19	MST/SLV

HP7501-A36

HP7501-T28			
VREF	1	28	TPWR
R1P	2	27	TPWR
R1N	3	26	R9N
R2P	4	25	R9P
R2N	5	24	R8N
HGND	6	23	R8P
R3P	7	22	HGND
R3N	8	21	R7N
R4P	9	20	R7P
R4N	10	19	R6N
R5P	11	18	R6P
R5N	12	17	DIF_CAP
ISO	13	16	DIFFSENSE
GND	14	15	MST/SLV

HP7501-T28

ORDERING INFOMATION

PART NUMBER	PIN - PACKAGE
HP7501-A36	SSOP-36 pin
HP7501-T28	TSSOP-28 pin

FUNCTIONAL DESCRIPTION

HP 7501 is a multi-mode active terminator with automatically switching on LVD/SE/HVD mode. The DIFFSENS* is on one of three voltage levels to indicate LVD/SE/HVD mode. If the voltage on DIFFSESE** is above 2.16V, below 0.6V or between, that indicates the bus mode to be HVD, SE, or LVD.

In Figure 1, a bandgap reference is fed into an buffer to generate reference voltages. A voltage selected by the control logic through a MUX is used to generate 2.85V or 1.25V reference voltages. A voltage 2.85V and 1.25V is used in SE mode and LVD mode respectively. The voltage for a specific mode is sent out through an op buffer. In SE mode, the RxP pin is switched to ground.

DIFF_CAP with a RC low pass filter monitors the voltage on DIFFSENS to determine the termination mode used on bus. The DIFFERENSE CIRCUITRY decodes the trinary voltage on DIFF_CAP and generates three control logic signals internally. The control logic will change the total termination resistance and switch to one of three termination modes based on the voltage on DIFFSENS.

SE Mode: The voltage on DIFFSENSE is between 0V - 0.5V. RxP pin is grounded. When the external driver for a given line turns off, the active terminator will pull that signal line to 2.85V (quiescent state). When operated in an active negation driver, the power amp can sink 22mA per line and the reference voltage won't change over 100mV. The termination resistors maintain 110ohm.

HVD Mode: The voltage on DIFFSENSE is above 2.4V. HP7501 will identify that there is an HVD (high voltage differential) device on the SCSI bus and isolate the termination pins from the bus.

LVD Mode: The voltage on DIFFSENSE is between 0.7–1.9V. A precious resistor string between two current sources provides LVD termination. It offers a 105 ohm differential mode impedance and a 125 ohm common mode impedance. A fail-safe bias of 112mV is maintained when no driver is connected to the SCSI bus.

During high temperature (>150℃), HP7501 would thermal shutdown. The termination pins are isolated from SCSI bus and Vref becomes high impedance. When ISO=1, the termination pins are isolated from the SCSI bus, but the bus mode indicators (SE/LVD/HVD) and Vref remain active. In the above two cases, the DIFFSENSE driver is shut down and in high impedance.

The TPWR pin is connected to the SCSI bus TERMPWR line to power up the HP7501. The TERMPWR line should be bypassed locally. A 2.2uF capacitor and a 0.01uF high frequency capacitor between TPWR and ground are suggested for different frequency noise. Capacitors should be placed as close as possible to the HP7501. The HP7501 should be placed as close as possible to the SCSI connector to minimize input signal trace length and result in less reflections and better performance.

To maintain the specified voltage, a 4.7uF capacitor is recommended between the Vref (pin36) and ground. A high frequency capacitor (0.1uF ceramic recommended) can also be placed on the Vref pin in applications the use fast rise/fall time drivers. It is also recommended to place a RC low pass filter between DIFFSENSE and DIF_CAP to lower noise from the SCSI bus.

DIFFSENS Noise Filtering: The HP7501 incorporates a digital filter to remove high frequency transients on the DIFFSENS control line. The external filter may be used as well in addition to the internal digital filter.

A typical SCSI bus configuration is shown in Figure 2.

NOTE:
* DIFFSENS: Refers to the SCSI bus signal
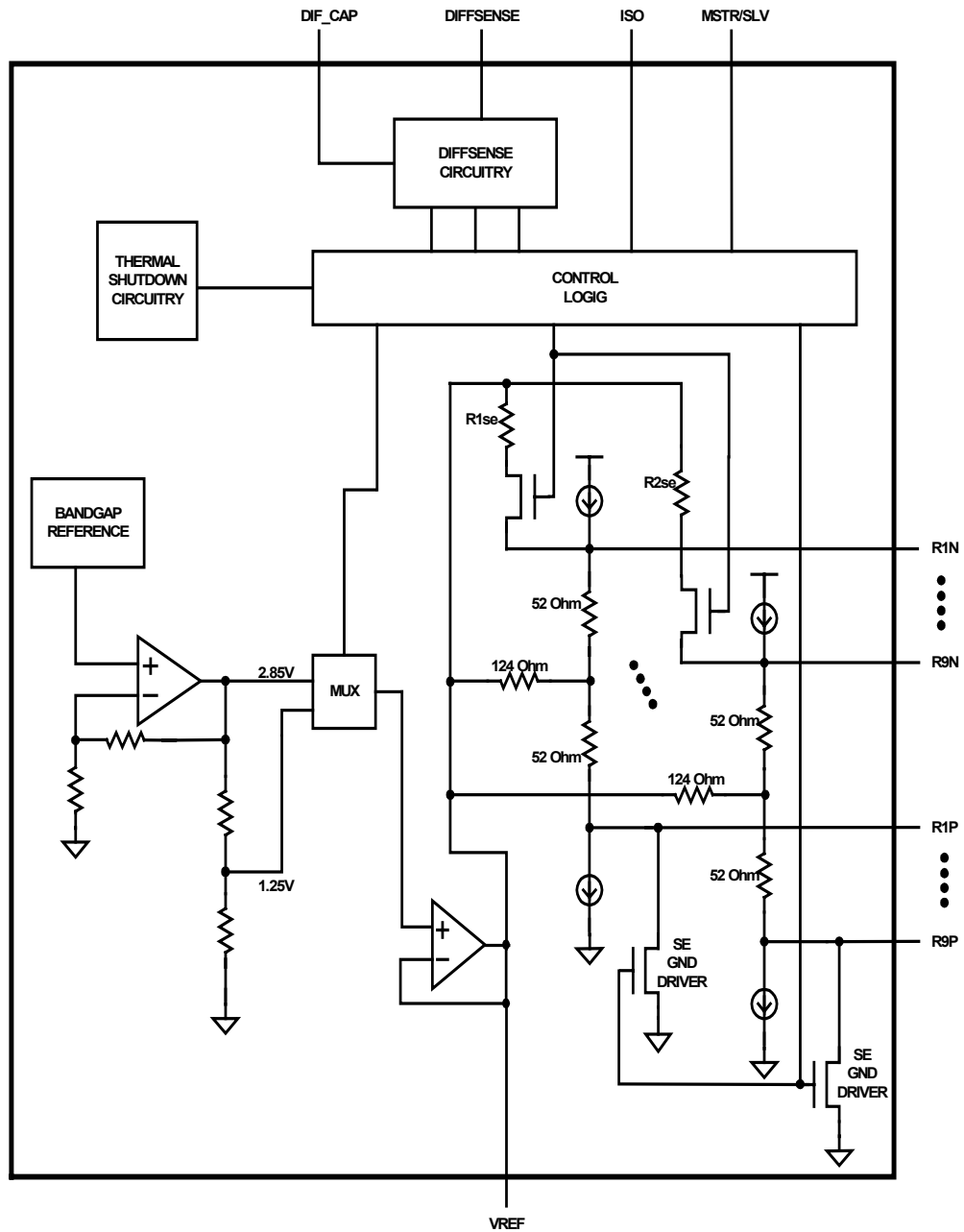** DIFFSENSE: Refers to the pin name in HP7501.

BLOCK DIAGRAM

Figure 1. Block Diagram of HP7501

PIN DESCRIPTION (for 36pin SSOP)

PIN	SYMBOL	DESCRIPTION
36	TPWR	2.7V to 5.25V power input pin. Connect to SCSI bus power line. A 4.7µF capacitor and a 0.1µF high frequency capacitor are recommended between TPWR and ground
1	VREF	Reference Voltage. Must be decoupled with a 4.7uF as shown in Figure 1.
2,3	NC	Do not connect any signal to this pin.
8,9,10 26,27,28	HGND	Heat Sink Ground. Connect to large area PC board ground trace in order to increase power dissipation.
4,6,11,13,15 22,24,29,31	RxP	Termination lines. These lines switch to hard ground in SE mode and are the positive lines for LVD mode. All lines are in high impedance when HVD is detected.
5,7,12,14,16 23,25,30,32	RxN	Termination lines. These lines switch to the active lines in SE mode and are the negative lines for LVD mode. All lines are in high impedance when HVD is detected.
17	ISO	Isolation pin. This pin is used to shut down the terminator if the terminator is not connected at the end of the bus. Connect the pin to ground will activate the terminator in normal operation. The terminator will be disabled when the pin is in high state. An internal pull-down resistor assures that the HP7501 will operate as normal if the ISO pin is left floating.
18	GND	Signal Ground.
19	MST/SLV	Mode select pin. When pull high, master mode will enable the DIFFSEN drive SCSI bus. The DIFFSENSE driver is off when this pin is connected to ground.
20	DIFFSENSE	This signal will drive 1.3V to the SCSI bus during the Master mode in order to detect which type of device is connected to the SCSI bus. On power up, the HP7501 will try to deliver LVD level to the DIFFSENSE line. If only LVD SCSI devices are on the bus, the DIFFSENSE signal will be successfully driven to 1.3V and the terminator will configure the system for LVD operation. If any SE device is on the bus, it will present a grounding level to the DIFFSENSE line. This will indicate HP7501 to configure into SE operation. HP7501 will be in shut down mode if DIFFSENSE detects a high voltage level.
21	DIF_CAP	This pin should be connected to a 0.1uF capacitor to ground and 20K resistor to SCSI bus DIFFSENS line for DIFFSEN filter.
33	SE	Single ended. Indicates SE device is on the SCSI bus when this pin is active.
34	LVD	Low Voltage Differential. Indicates the terminator is in LVD operation.
35	HVD	High Voltage Differential. Indicates the HVD device is detected and terminator is in shut down mode.

PIN DESCRIPTION (for 28pin TSSOP)

PIN	SYMBOL	DESCRIPTION
27,28	TPWR	2.7V to 5.25V power input pin. Connect to SCSI bus power line. A 4.7µF capacitor and a 0.1µF high frequency capacitor are recommended between TPWR and ground.
1	VREF	Reference Voltage. Must be decoupled with a 4.7uF as shown in Figure 1.
6,22	HGND	Heat Sink Ground. Connect to large area PC board ground trace in order to increase power dissipation.
2,4,7,9,11 18,20,23,25	RxP	Termination lines. These lines switch to hard ground in SE mode and are the positive lines for LVD mode. All lines are in high impedance when HVD is detected.
3,5,8,10,12 19,21,24,26	RxN	Termination lines. These lines switch to the active lines in SE mode and are the negative lines for LVD mode. All lines are in high impedance when HVD is detected.
13	ISO	Isolation pin. This pin is used to shut down the terminator if the terminator is not connected at the end of the bus. Connect the pin to ground will activate the terminator in normal operation. The terminator will be disabled when the pin is in high state. An internal pull-down resistor assures that the HP7501 will operate as normal if the ISO pin is left floating.

14	GND	Signal Ground.
15	MST/SLV	Mode select pin. When pull high, master mode will enable the DIFFSEN drive SCSI bus. The DIFFSENSE driver is off when this pin is connected to ground.
16	DIFFSENSE	This signal will drive 1.3V to the SCSI bus during the Master mode in order to detect which type of device is connected to the SCSI bus. On power up, the HP7501 will try to deliver LVD level to the DIFFSENSE line. If only LVD SCSI devices are on the bus, the DIFFSENSE signal will be successfully driven to 1.3V and the terminator will configure the system for LVD operation. If any SE device is on the bus, it will present a grounding level to the DIFFSENSE line. This will indicate HP7501 to configure into SE operation. HP7501 will be in shut down mode if DIFFSENSE detects a high voltage level.
17	DIF_CAP	This pin should be connected to a 0.1uF capacitor to ground and 20K resistor to SCSI bus DIFFSENS line for DIFFSEN filter.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Termpower Voltage (SE)	Vtpwr	4.0		5.25	V	
Termpower Voltage (LVD)		2.7		5.25	V	
Logic 0 (Low)	V_{il}	-0.3		+0.8	V	
Logic 1 (High)	V_{ih}	2.0		Vtpwr+0.3	V	
Operating Temperature	Ta	0		70	℃	

DC CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
TPWR Current (SE)	Itpwr		15		mA	*1
TPWR Current (LVD)	Itpwr		25		mA	
Input Leakage Current High	Iih	0			uA	
Input Leakage Current Low	Iil			1.0	uA	
Output Current High Vout = 2.4 V	Ioh	0			mA	
Output Current Low Vout = 0.4V	Iol	4.0			mA	
DIFFSEN Output Voltage	Vov	1.2		1.4	V	
DIFFSEN Source Current	Isc		5	15	mA	
DIFFSEN Sink Current	Isi	20		200	uA	
DIFFSEN SE Voltage Range	Vse	-0.3		0.5	V	
DIFFSEN LVD Voltage Range	Vlvd	0.7		1.9	V	
DIFFSEN HVD Voltage Range	Vhvd	2.4		Vtpwr+0.3	V	

SINGLE ENDED CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
SE Termination Resistance	Rse	104.5	110	115.5	Ω	
SE Voltage Reference	Vref	2.70		3.00	V	
SE Output Current	Ioc			25.4	mA	*2

LVD CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Differential Mode Termination Resistance	Rdm	100		110	Ω	
Common Mode Termination Resistance	Rcm	110	125	150	Ω	
Differential Mode Bias All lines open	Vdb	100	112	125	mV	
Common Mode Bias	Vcb	1.125	1.250	1.375	V	

REGULATOR CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Source Current	Isour		200	230	mA	*3
Sink Current	Isink	100	200		mA	

NOTE: Unless otherwise specified, these specifications apply over the operating ambient temperature range from 0 ℃ to 70℃.

*1. All lines open.
*2. Vline = 0.2V
*3. Vref = 0.2V

TYPICAL OPERATING CIRCUIT
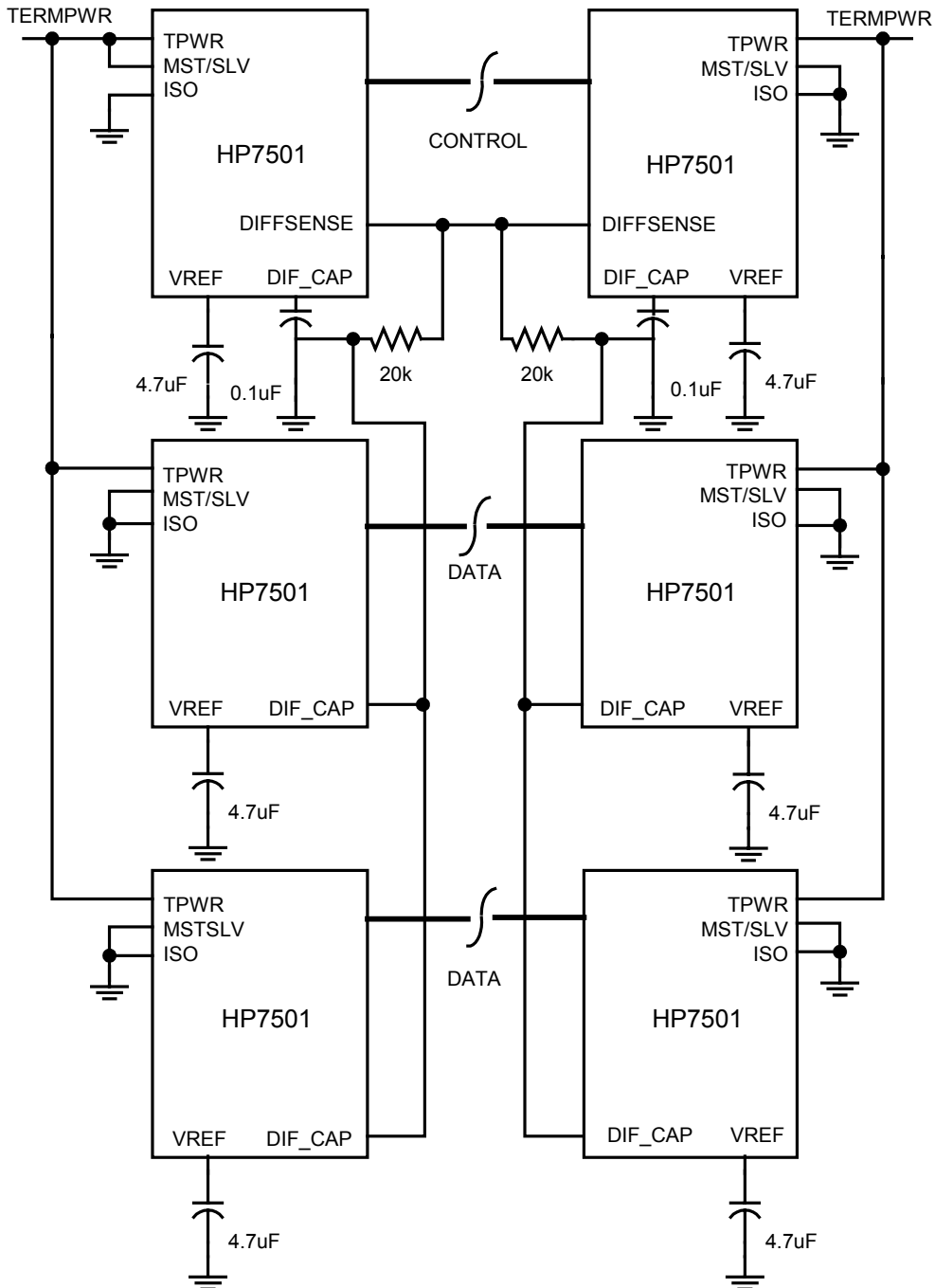
Figure 2. SCSI BUS Configuration

PACKAGE DIMENSION

The package of HP7501-A36 is SSOP-36
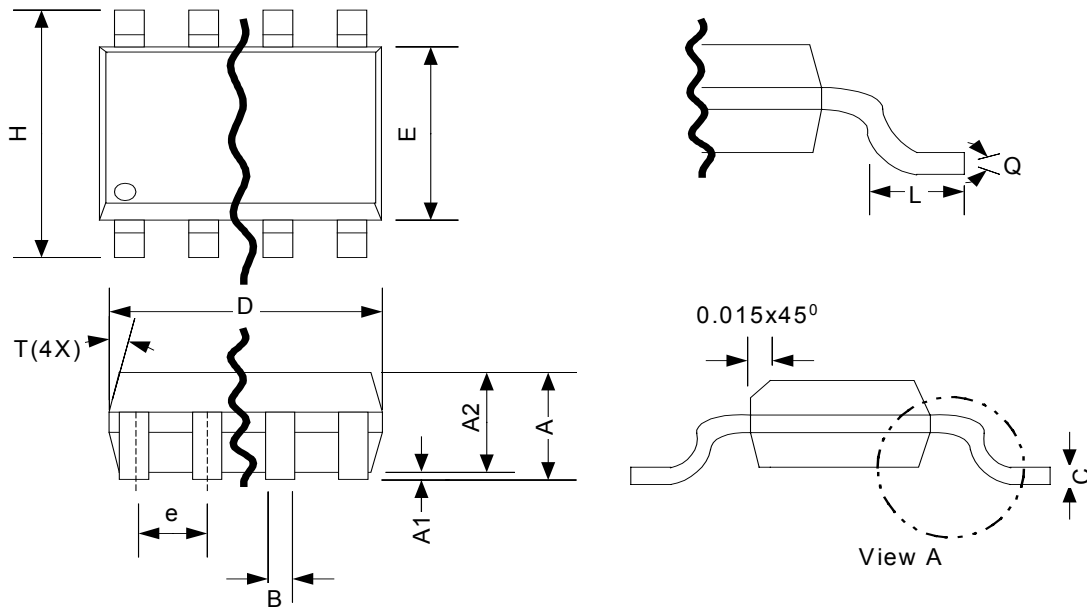
SSOP-36

SYMBOL	DIMENSIONS IN MILLIMETERS		DIMENSIONS IN INCHES	
	MIN	MAX	MIN	MAX
A	2.41	2.59	0.095	0.110
A1	0.20	0.40	0.008	0.016
A2	2.26	2.52	0.089	0.099
B	0.30	0.45	0.012	0.018
C	0.127	0.254	0.005	0.010
D	15.75	16.00	0.620	0.630
E	7.391	7.595	0.291	0.299
e	0.8BSC		0.032BSC	
H	10.033	10.668	0.395	0.420
L	0.508	1.016	0.020	0.040
T	----	0.10	----	0.004
Θ	0°	8°	0°	8°

The package of HP7501-T28 is TSSOP-28
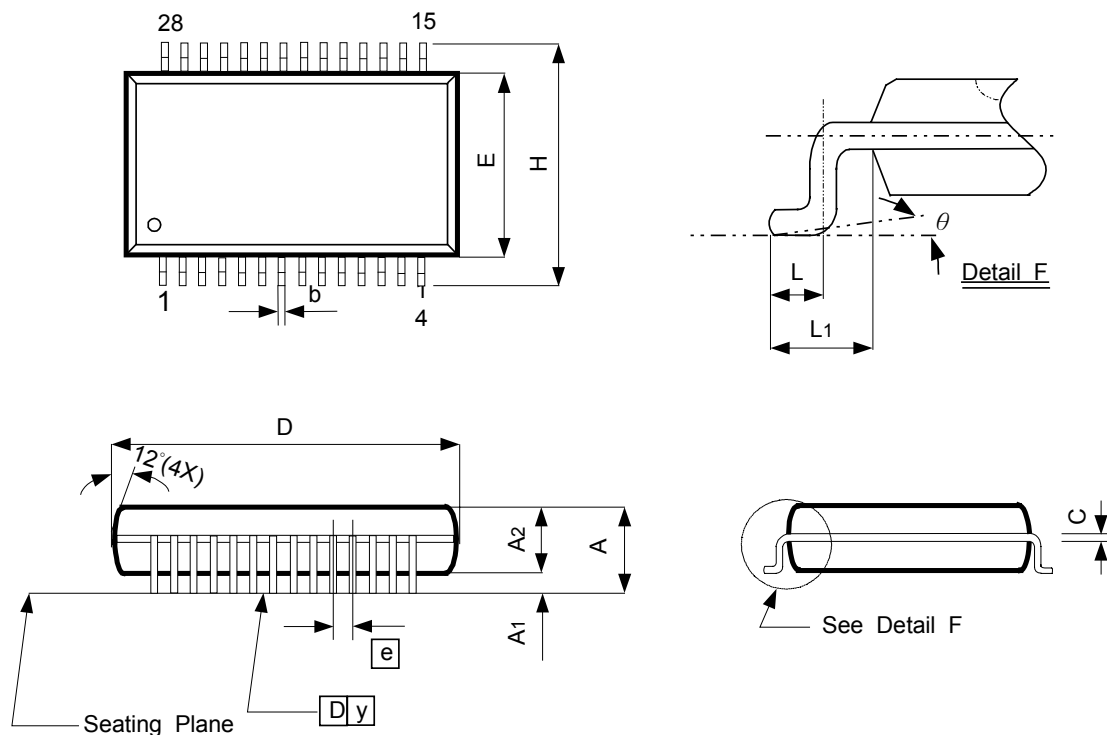
TSSOP-28

SYMBOLS	DIMENSIONS IN MILIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	——	——	1.20	——	——	0.047
A1	0.05	——	0.15	0.002	——	0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19	——	0.30	0.007	——	0.012
C	0.09	——	0.20	0.004	——	0.008
D	9.60	9.70	9.80	0.378	0.382	0.385
H	——	6.40	——	——	0.252	——
E	4.30	4.40	4.50	0.169	0.173	0.177
e	——	0.65	——	——	0.026	——
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	——	1.00	——	——	0.039	——
y	——	——	0.076	——	——	0.003
θ	0°	——	8°	0°	——	8°

HMARK reserves the right to make changes without further notice herein.