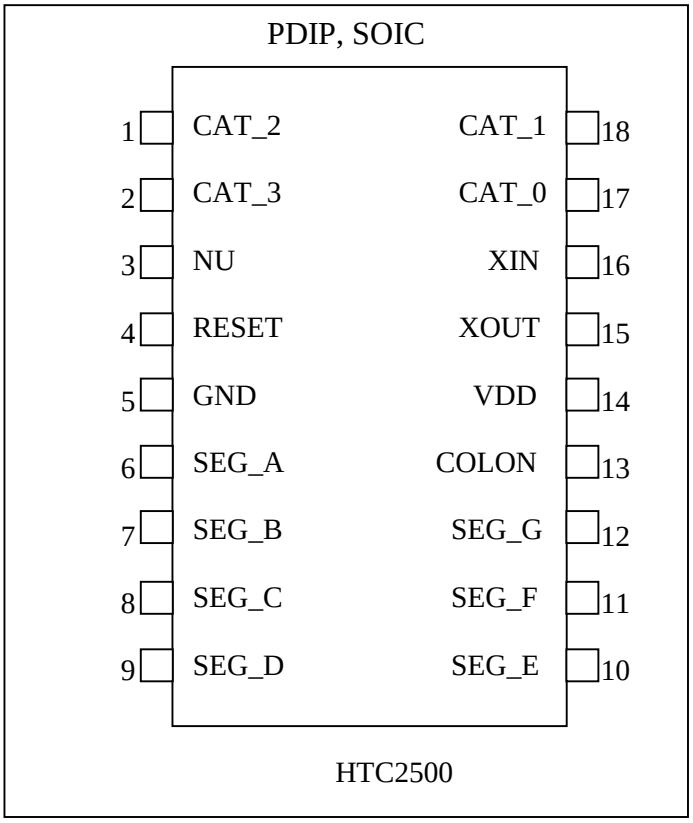
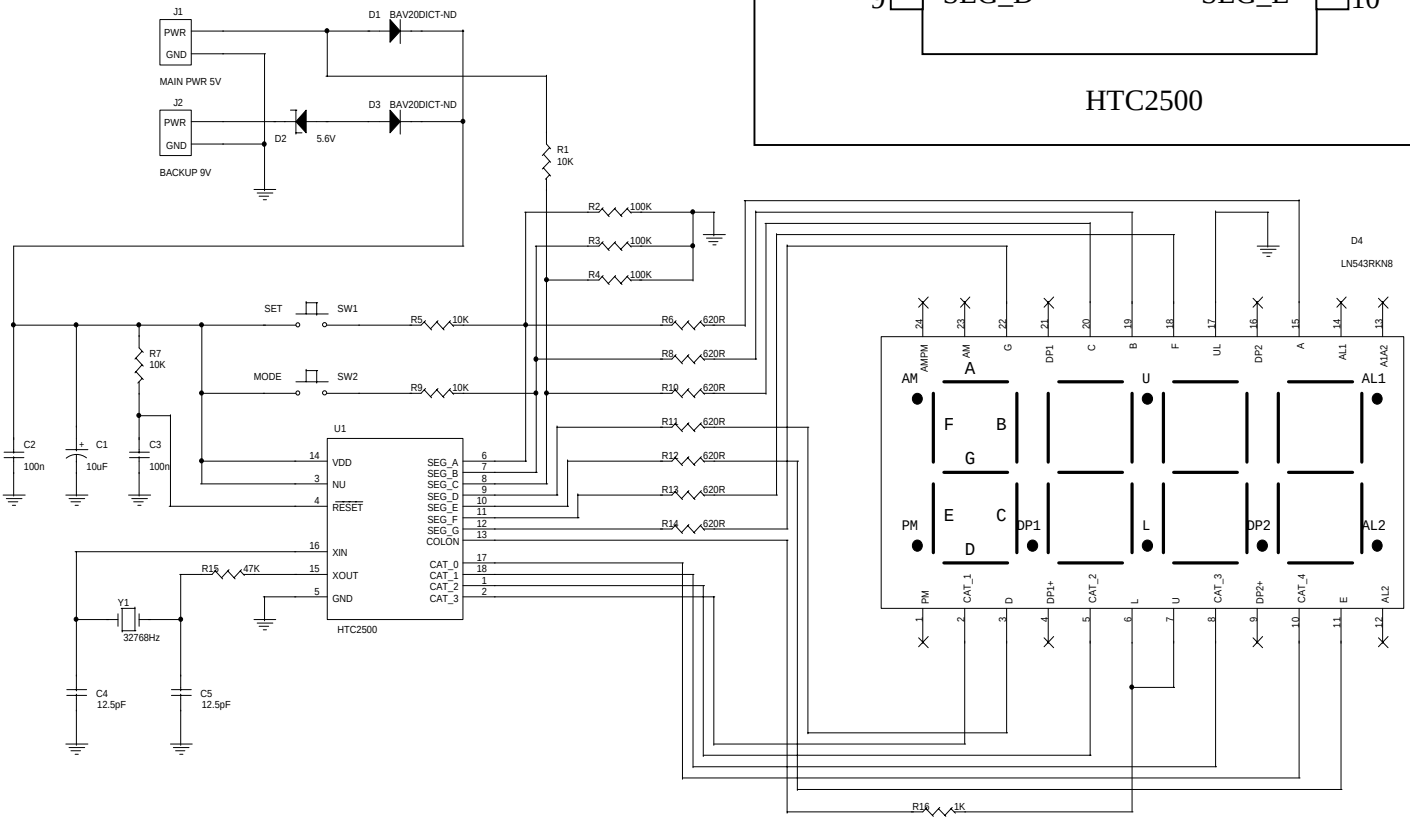
General Description

HTC2500 is simple clock IC built by using our micro RTOS.
Features:

- Operation from low cost low power 32768Hz crystal.
- Supports backup power supply in case of main power failure.
- Simple intuitive interface for adjusting clock.
- Minimum external components.

Schematics below show typical connection diagram. HTC2500 uses four digits common cathode seven segment display.





Crystal Selection

Please note that R15, C4 and C5 values shown in schematics above are for reference only. Consult manufacturer of Y1 crystal used for recommended values. Precision of clock depends on crystal used and values selected for above components. When choosing crystal make sure that it has +-20PPM tolerance in temperature range used. For example crystal rated +-20 PPM in temperature range of –10 to +60 degrees Celsius is a good choice.

Switch Selection

Set and Mode switch inputs are internally de-bounced. This eases switch selection. You can even use two wires laid out in parallel and conductivity of your skin would be enough to make it work as a switch. Also conductive rubber could be used to design your own decorative switch.

Display Selection

Several factors should be considered in seven-segment LED display selection.

1. Average Luminous Intensity (in uCd) at 3.5ma. This parameter determines brightness of display and varies widely even in one device family.
2. Forward voltage: HTC2500 can drive LED displays with forward voltage rating from 1.6 to 4.2V(this range covers most of LED’s and seven segment displays). This rating corresponds to number of LED’s used in each segment and color of LED. For example red LED has typical 2.0V forward voltage. This means we can use two red LED’s in series for each segment if we are building our own custom display.

Main and Backup Power Selection

Voltage on VDD pin should be in range from +3.0 to +6.2V. Example of good Backup power might be Lithium battery (3V). In case of using 9V battery for backup we should replace D1 in schematics above with Zener connected backwards. We use Zener for voltage drop. Voltage rating for Zener in this case should be 9V-MPV-0.5V volts minimum (MPV stands for main power voltage and 0.5 is D1 diode forward drop voltage). HTC2500 is using about 0.12mA current from 5V(depends on crystal selection) in power down mode. If we are using 9V alkaline battery with 500mA/H capacity for backup power it will keep HTC2500 alive for about 138 days. Please note that we don’t guaranty this value because it depends on clock design specifications and component selection that are out of our control.

R5 and C3 value selection

Values of R5 and C3 are for reference only. It might need adjustment and depends on Crystal selection. Basic rule of thumb is that Reset line should be held below 0.85*VDD until clock generator is started (depends on crystal used). R5 value could be in the range of 0 to 720K.

Modes of operation

Mode	Display characters	Notes	Key Behavior
Start up	**HI**	Says Hi for one second. We are still investigating if it means High Tech Chips or just Hi.	Ignored
Normal	**HH : MM**	Lading zero in HH is not displayed.	Set: Ignored. Mode: Go to Set Hour mode.
Set Hour	**HH : - -**	- - characters indicates that clock is in one of setting modes.	Set: increment HH. Mode: Go to Set Minute mode
Set Minute	**- - : MM**	Same As Above.	Set: increment MM. Mode: Go to Set Second mode
Set Second	**- - : SS**	Same As Above.	Set: zero SS. Mode: Go to Normal mode
Power Saving	**None!**	Requires backup battery.	None! Wakes up in Normal mode once main power is restored.

Abbreviations used

HI Still under investigation. We would like to hear from you on this subject. Please use Feedback form from our web site (www.hightechips.com) for replay.

MM Minutes.

HH Hours. Please note that we are using 12-hour format in our clock. Leading zeroes are not displayed in HH.

SS Seconds.

-- G elements of seven segment display.

Set and Mode key behavior

In all modes of operation display is changed when key is released. This is true for both keys. If you hold any key for more then 2 seconds display will change much faster. This functionality is useful when setting minutes and hours.

Signal description:

Abbreviations used: O - output, I - input, P - power.

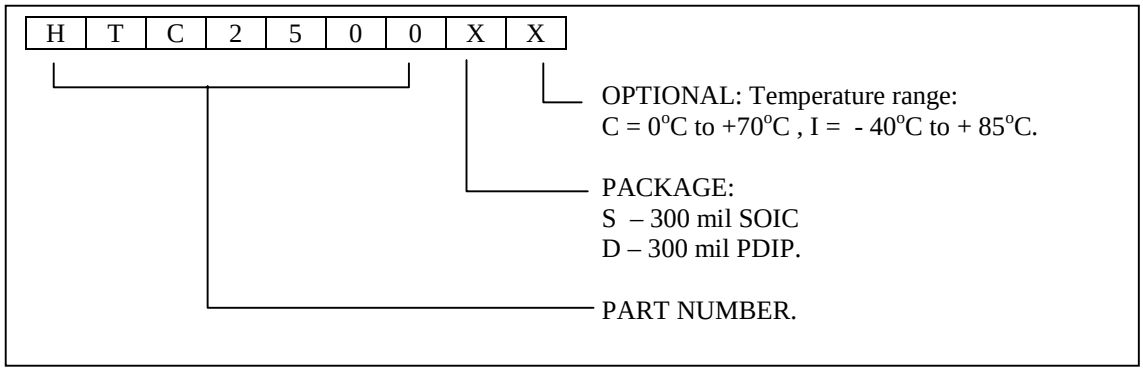
Name	Pin	I / O	Description	Name	Pin	I / O	Description
CAT_ 2	1	O	Cathode 2 NOTE 1	SEG_E	10	O	Display Segment E NOTE 2
CAT_3	2	O	Cathode 3 NOTE 1	SEG_F	11	O	Display Segment F NOTE 2
NU	3	I	Not used. Connect to VCC.	SEG_G	12	O	Display Segment G NOTE 2
#RESET	4	I	Reset NOTE 4	COLON	13	O	Colon output NOTE 2
GND	5	P	Power ground	VDD	14	P	Power NOTE 5
SEG_A/ SET	6	I/O	Display Segment A NOTE 2	XOUT	15	O	Clock generator output.
SEG_B/ MODE	7	I/O	Display Segment B NOTE 2	XIN	16	I	Clock generator input.
SEG_C/ PWR_OK	8	I/O	Display Segment C NOTE 3	CAT_ 1	17	O	Cathode 1 NOTE 1
SEG_D	9	O	Display Segment D NOTE 2	CAT_0	18	O	Cathode 0 NOTE 1

Note 1:
This outputs can sink up to 25mA current. Voltage on this pin at 25mA is 1V.
Note 2:
This output can source up to 20mA. Limiting resistors should be used with these outputs. When number eight is displayed we consume maximum power and CAT_N sink current should be limited to maximum 25mA. So each output should source no more then 25mA/7=3.6mA. In order to find appropriate values for those resistors
We subtract Forward Voltage rating value of our display from VCC and divide that by 3.6mA. Forward Voltage value is depending on display used. Please consult manufacturers data sheet for chosen display.
Note 3:
This output can source up to 20mA. Limiting resistor should be used with this output. This output should not source more then 5mA. PWR_OK (Power OK) pin should be connected to Main power via resistor. Value of resistor should be from 1K to 100K. If this pin connected to VCC without power limiting resistor excessive damage to the part will result.
Note 4:
Values of R5 and C3 are for reference only. It might need adjustment and depends on Crystal selection. Basic rule of thumb is that Reset line should be held below 0.85*VDD until clock generator is started (depends on crystal used). R5 value could be in the range of 0 to 720K.

Note 5:
Voltage on this pin should be in range of +3.0V to +6.2V.

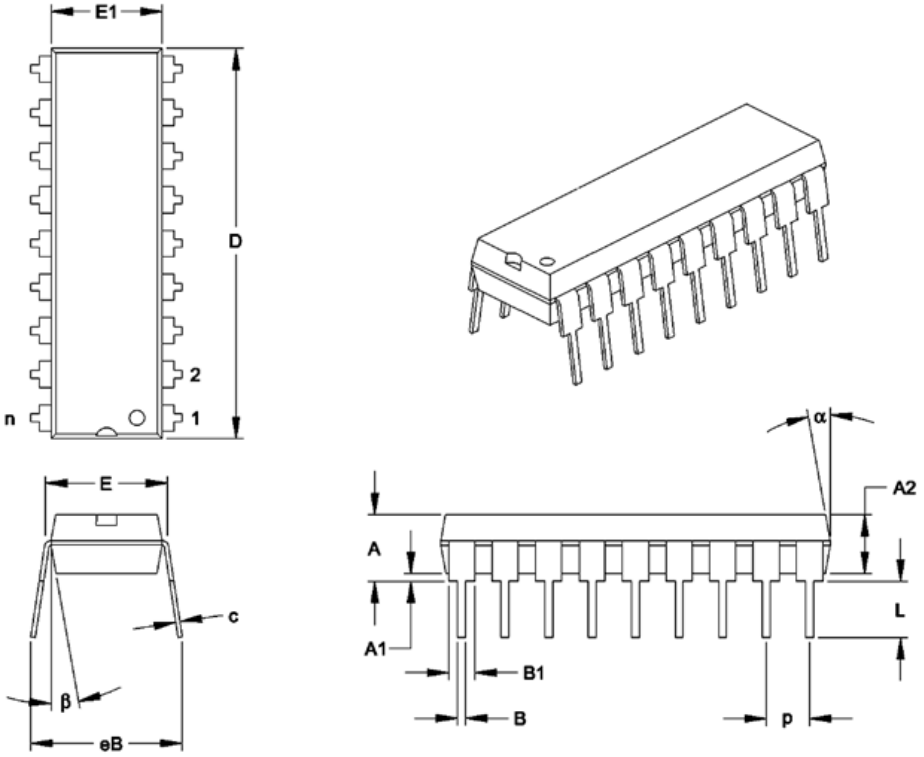
Ordering Information

When ordering please use part numbering scheme below.



Mechanical information.

18-Lead Plastic Dual In-line (P) – 300 mil (PDIP)



Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		18			18	
Pitch	p		.100			2.54	
Top to Seating Plane	A	.140	.155	.170	3.56	3.94	4.32
Molded Package Thickness	A2	.115	.130	.145	2.92	3.30	3.68
Base to Seating Plane	A1	.015			0.38		
Shoulder to Shoulder Width	E	.300	.313	.325	7.62	7.94	8.26
Molded Package Width	E1	.240	.250	.260	6.10	6.35	6.60
Overall Length	D	.890	.898	.905	22.61	22.80	22.99
Tip to Seating Plane	L	.125	.130	.135	3.18	3.30	3.43
Lead Thickness	c	.008	.012	.015	0.20	0.29	0.38
Upper Lead Width	B1	.045	.058	.070	1.14	1.46	1.78
Lower Lead Width	B	.014	.018	.022	0.36	0.46	0.56
Overall Row Spacing	eB	.310	.370	.430	7.87	9.40	10.92
Mold Draft Angle Top	α	5	10	15	5	10	15
Mold Draft Angle Bottom	β	5	10	15	5	10	15

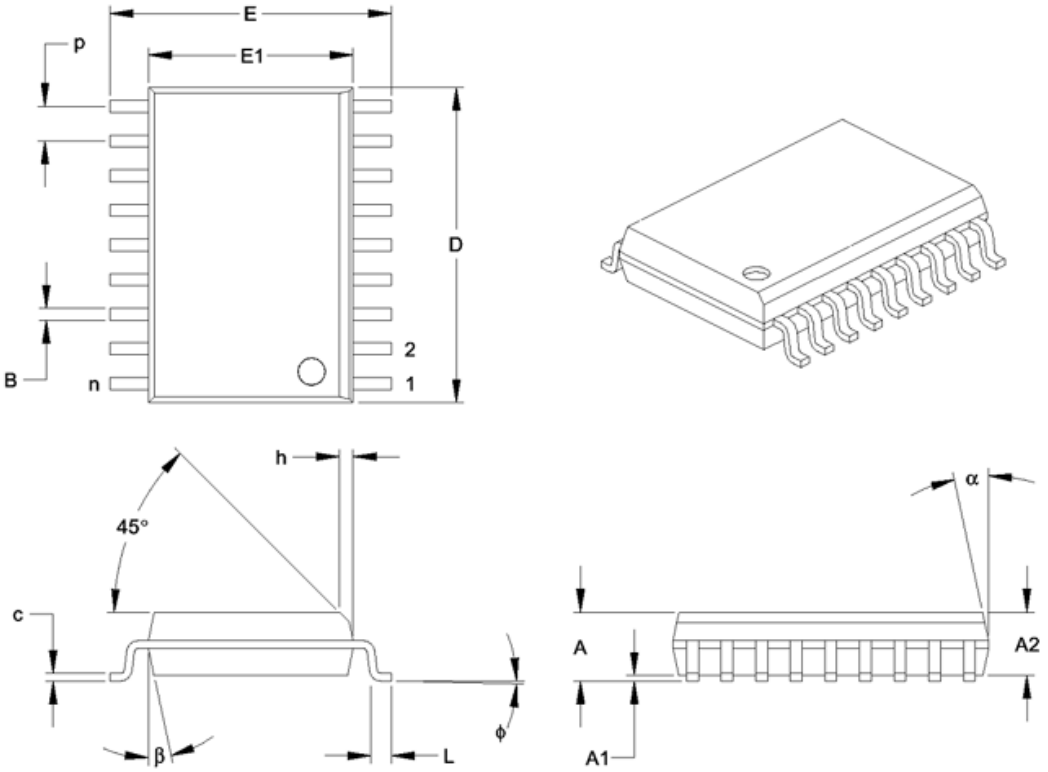
*Controlling Parameter

Notes:

Dimensions D and E1 do not include mold flash protrusions. Mold flash or protrusions shell not exceed .010” (0.254mm)per side.

JEDEC Equivalent:MS-001

18-Lead Plastic Small Outline (SO) – Wide, 300 mil (SOIC)



Units		INCHES*			MILLIMETERS		
Dimension Limits		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		18			18	
Pitch	P		.050			1.27	
Overall Height	A	.093	.099	.104	2.36	2.50	2.64
Molded Package Thickness	A2	.088	.091	.094	2.24	2.31	2.39
Standoff	A1	.004	.008	.012	0.10	0.20	0.30
Overall Width	E	.394	.407	.420	10.01	10.34	10.67
Molded Package Width	E1	.291	.295	.299	7.39	7.49	7.59
Overall Length	D	.446	.454	.462	11.33	11.53	11.73
Chamfer Distance	h	.010	.020	.029	0.25	0.50	0.74
Foot Length	L	.016	.033	.050	0.41	0.84	1.27
Foot Angle	ϕ	0	4	8	0	4	8
Lead Thickness	c	.009	.011	.012	0.23	0.27	0.30
Lead Width	B	.014	.017	.020	0.36	0.42	0.51
Mold Draft Angle Top	α	0	12	15	0	12	15
Mold Draft Angle Bottom	β	0	12	15	0	12	15

*Controlling Parameter

Notes:

Dimensions D and E1 do not include mold flash protrusions. Mold flash or protrusions shell not exceed .010” (0.254mm)per side.

JEDEC Equivalent:MS-013

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