Atlas

Saitek™

ST28C

Project : ST28C (Atlas)
Doc. No. : ST28C-PG-009
Rev. : 0
Date : 3 March, 1998

GENERAL PRODUCT SPECIFICATIONS FOR ATLAS

A. Battery requirement : 1.5 Volt (size 'AA' or 'UM-3') x 4 pcs

B. Operating Voltage : 4.5 ~ 6.8 Volts

D. Current consumption :
1) Normal mode at battery = 6V
1.5mA typical
2.5mA max.

2) Memory current
for units using MCU P/N 861392-0AB28
0.5μA typical
20μA max.

E. Power consumption : 15mW max.

F. System clock frequency : 4 MHz ± 5% (V=6V) at pin 37 of U1.
(Resonator)

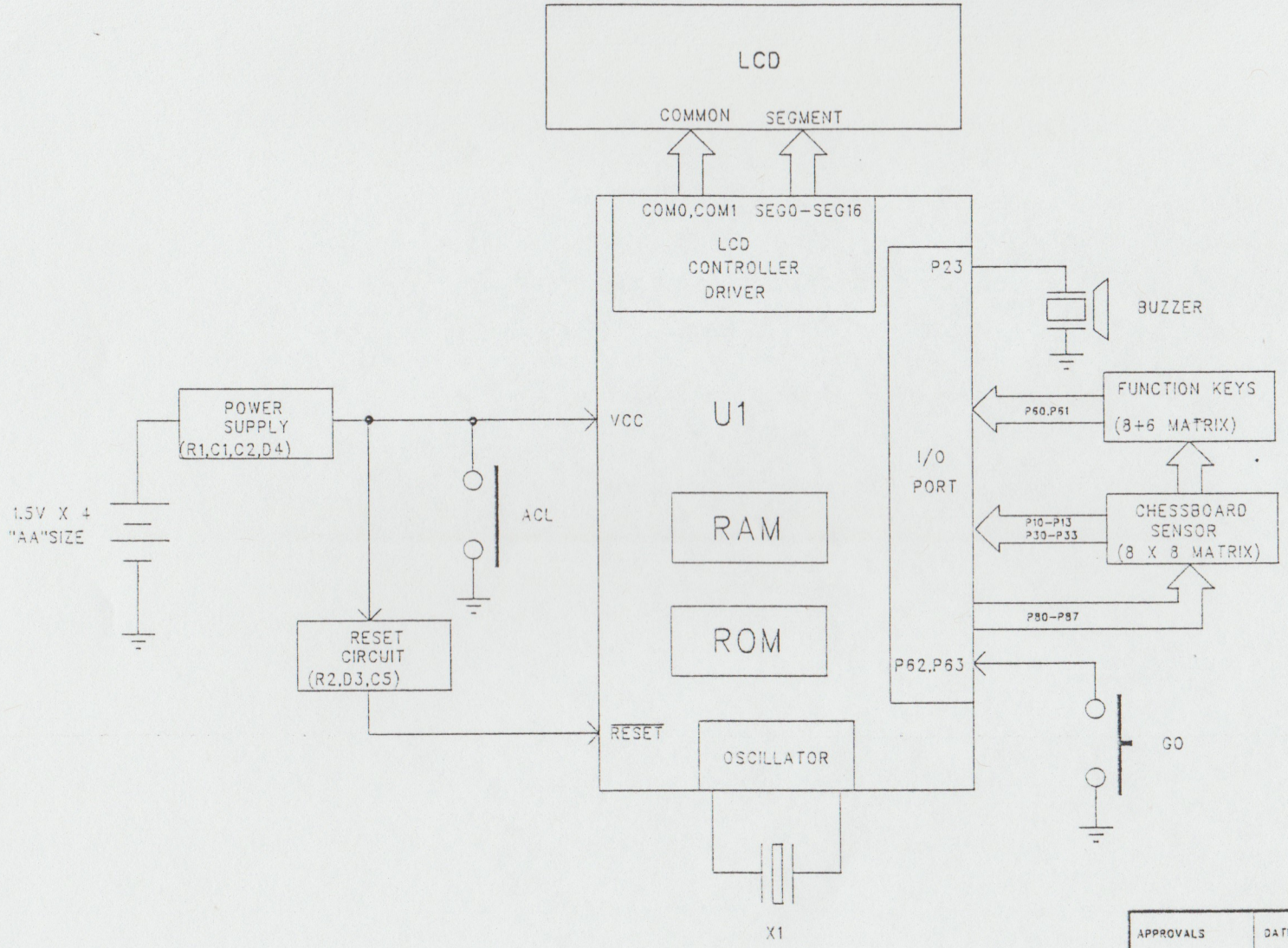
PREPARED BY : _____ W. K. Cheng

APPROVED BY : _____ BDM

DIST : BDM, QAM, SED, PE

Filename : /BDD/ST28C-PS.Doc

REVISION			
DATE	DESCRIPTION	ECN NO.	REV. NO.



APPROVALS	DATE	Saitek Ltd.	
DRAWN		BLOCK DIAGRAM	
B.D.D. Richard	27/4/98	TITLE: K11 ATLAS	
Q.A.	27/4/98	DWG. NO. ST28C-PE-013	REV. 0

Dist. SDM, SPM, SED, PE

Project : ST28C (Atlas)
Doc No. : ST28C-PS-008
Rev. : 0
Date : 3 March, 1998

ADJUSTMENT PROCEDURE FOR ATLAS

Object : To adjust system clock frequency.

Equipment needed :

1. Frequency counter or Oscilloscope capable of frequency measurement up to 20 MHz.
2. Digital voltmeter capable of DC voltage measurement up to 10 Vdc.

System clock frequency : 4 MHz ± 5% (V. Batt = 6V) at pin 37 of U1.

Procedure :

To adjust system clock frequency :

1. Disassemble unit by removing screws on cabinet base.
2. Power on unit with voltage at battery contact = 6V.
3. Place probe of counter/scope at X1 pin (pin 37 of U1). If frequency measured is out of specified range (3.8 ~ 4.2 MHz), replace X1 until counter/scope reading is within specification.

Prepared by : W. K. Cheng

Approved by : BDM

Dist : QAM, SED, PE

Filename : /BDD/ST28C-PS.Doc

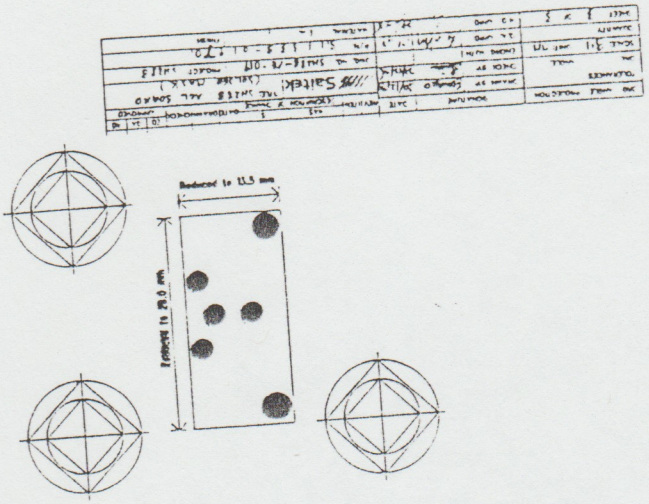
Project : ST28C
Rev : 0
Date : 24 April, 1998

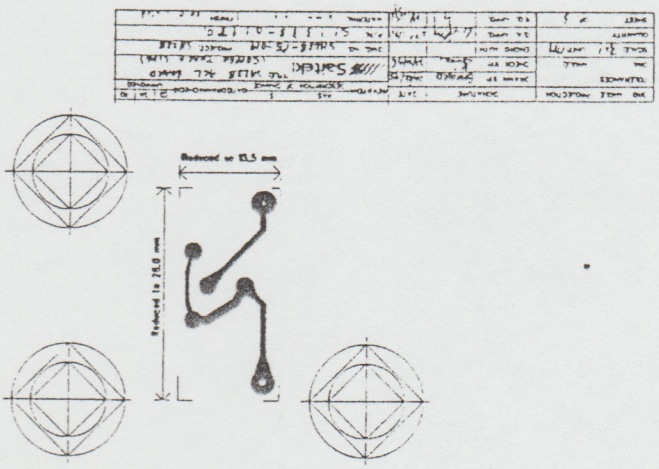
Richard Liu.

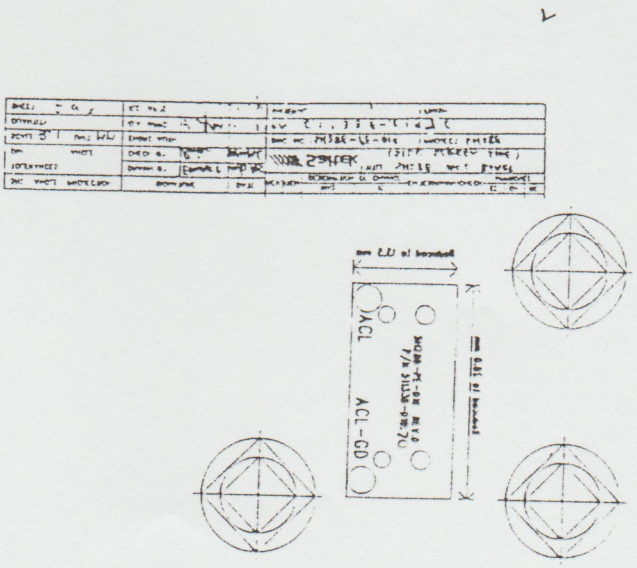
ATLAS Trouble Shooting Chart

SYMPTOMS		POSSIBLE CAUSES
Unit cannot be turned ON	1.	Check if Vcc within the range from 4.5V to 6.8V. If Vcc is not within this range, check for: i) Dead or weak batteries. ii) Broken connections in battery wiring. iii) Open or shorted circuit in Ground and Vcc traces. iv) Check if ACL switch is shorted to Ground. v) Defective components in power supply circuit (i.e. R1, C1, C2, D4).
	2.	Check for clock signal: Look for 4MHz +/- 5% (battery voltage = 6V) at U1 pin 37/38. If not, check if X1, C3, C4 are defective.
	3.	Check for reset signal: Check for U1 pin 34 is logic 'HIGH'. If not, check if C5, R2, D3 are defective.
	4.	Check if U1 is defective.
	5.	Check if GO circuit components are defective (i.e. C6, GO key).
No sound	1.	Check for broken wiring from buzzer to PCB.
	2.	Check if buzzer is defective.
	3.	Check if D1, D2 are defective.
	4.	Check for pulse output from U1 pin 45 when 'SOUND ON'.
LCD missing or turn on when it should not	1.	Check for broken or shorted traces on PCB.
	2.	Check if LCD is defective or misalignment.
	3.	Check for dust or oxide on gold finger of PCB.
	4.	Check if U1 is defective.
No response or improper response to command keys or chessboard	1.	Check for loose contacts or misalignment between sensor and PCB traces.
	2.	Check for bad contacts in sensor connectors.
	3.	Check for broken or shorted traces on PCB or sensor.
	4.	Check for logic 'HIGH' at U1 pin 28, 29, 30-33 and 41-44 when no key is pressed.
	5.	Check if U1 is defective.
No memory function	1.	Check if batteries are dead or weak.
	2.	Defective U1.
Excessive current drain Current > 2.5mA when 'ON' Current > 20μA when 'MEMORY'	1.	Check for component wiring or shorted traces on PCB.
	2.	Check for contamination and/or foreign particles on PCB.
	3.	Check for no leakage on C1 and C2.
	4.	Check if U1 is defective.
Generates illegal moves	1.	Check if batteries are exhausted.
	2.	Check if U1 is defective.

Dist : BDM, QAM, ~~PM~~, PjE(Richard Liu)

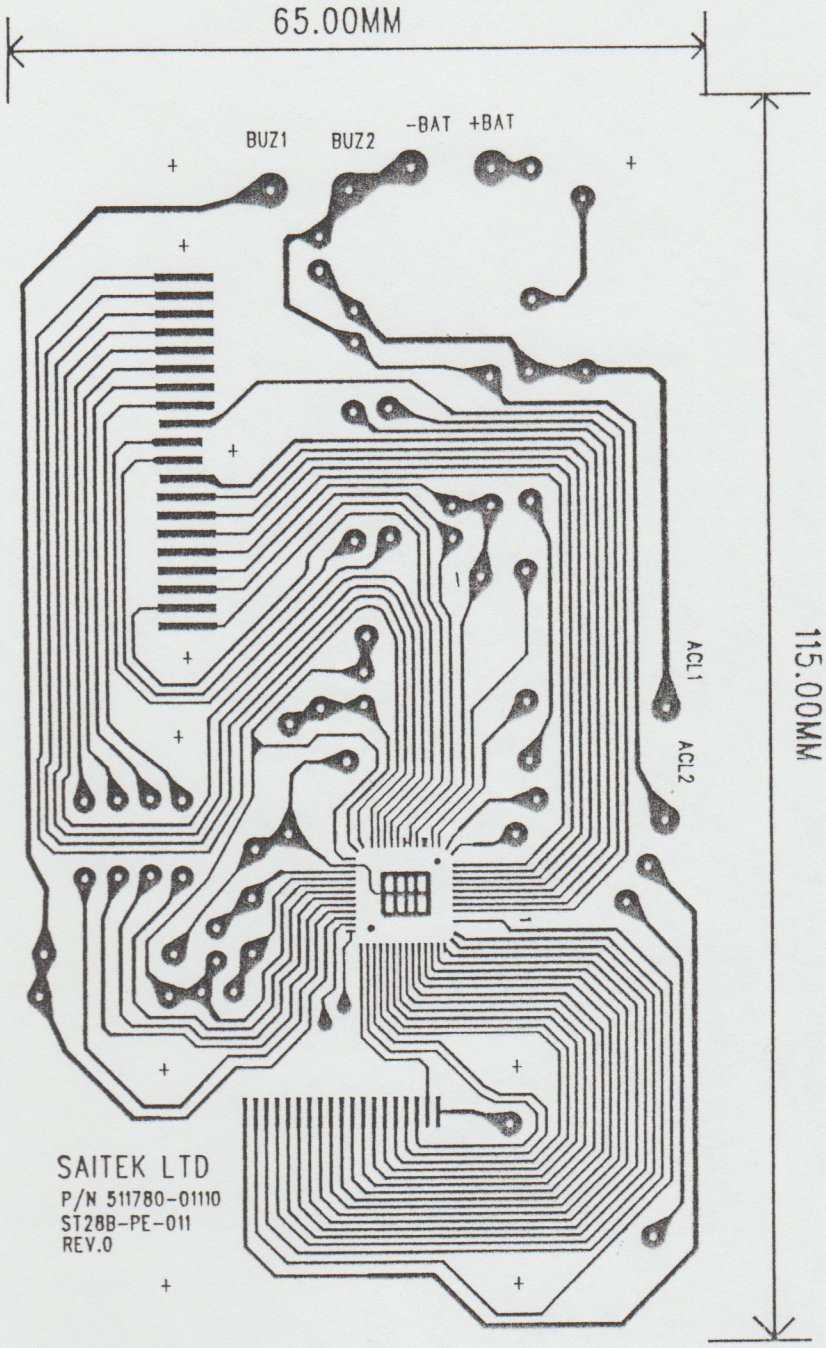






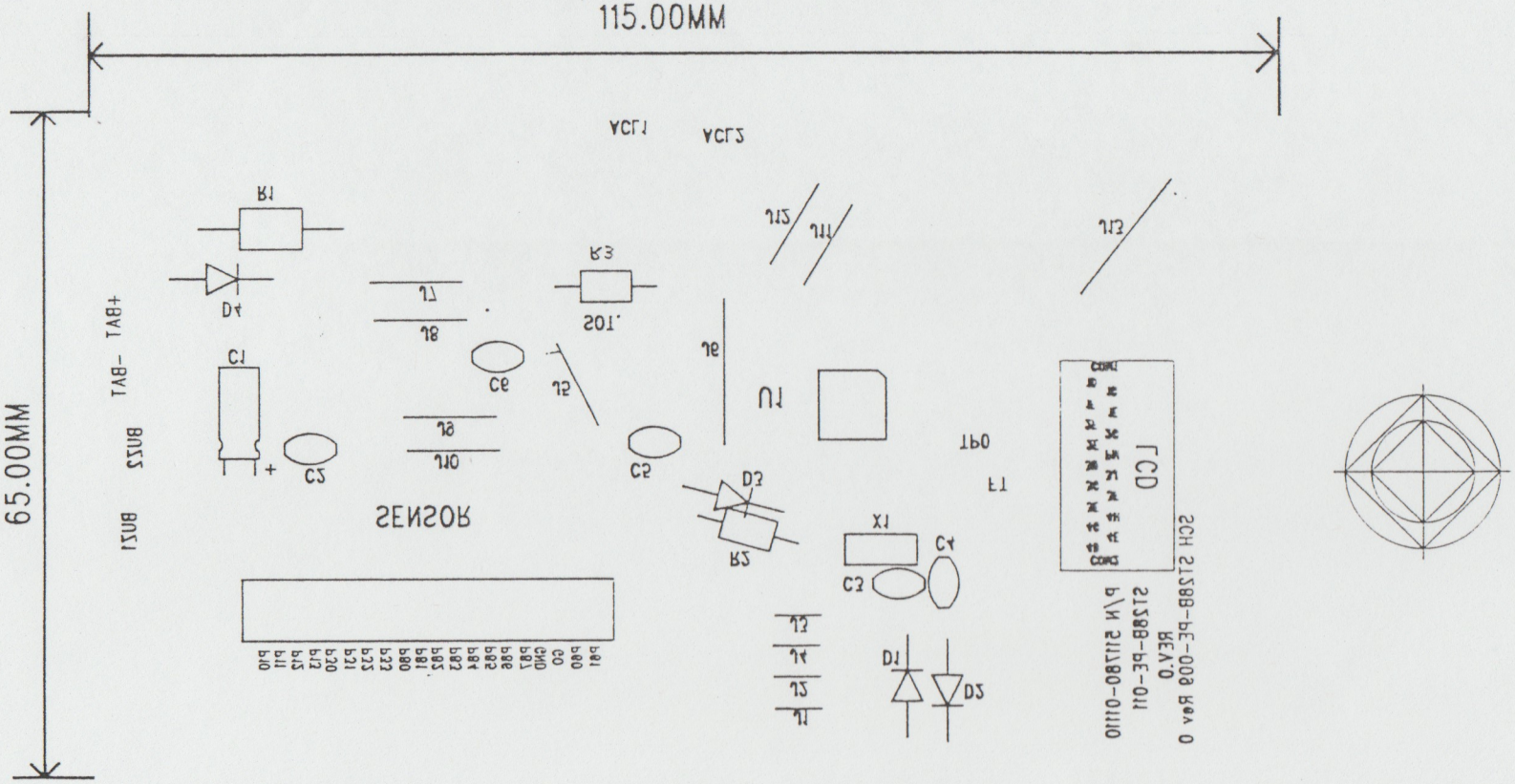
ST28C
ACL PCB

ST28C
Logic PCB



APPROVALS	DATE		Saitek Ltd.
DRAWN BY	11/7/96	TITLE:	PCB LAYOUT
CHECK BY/SEE	28/10/96	178	ELITE
Q.A.	30.10.96	DWG. NO. ST28B - PE - 011	REV. 0
B.D.D.			

APPROVALS	DATE	Saitek Ltd.	
DRAWN BY	11/7/96	PCB LAYOUT	
CHECK BY/SEE	28/10/96	TITLE: ELITE	
Q.A.	29.10.96	178	
B.D.D.		DWG. NO. ST28B - PE - 011	REV. 0



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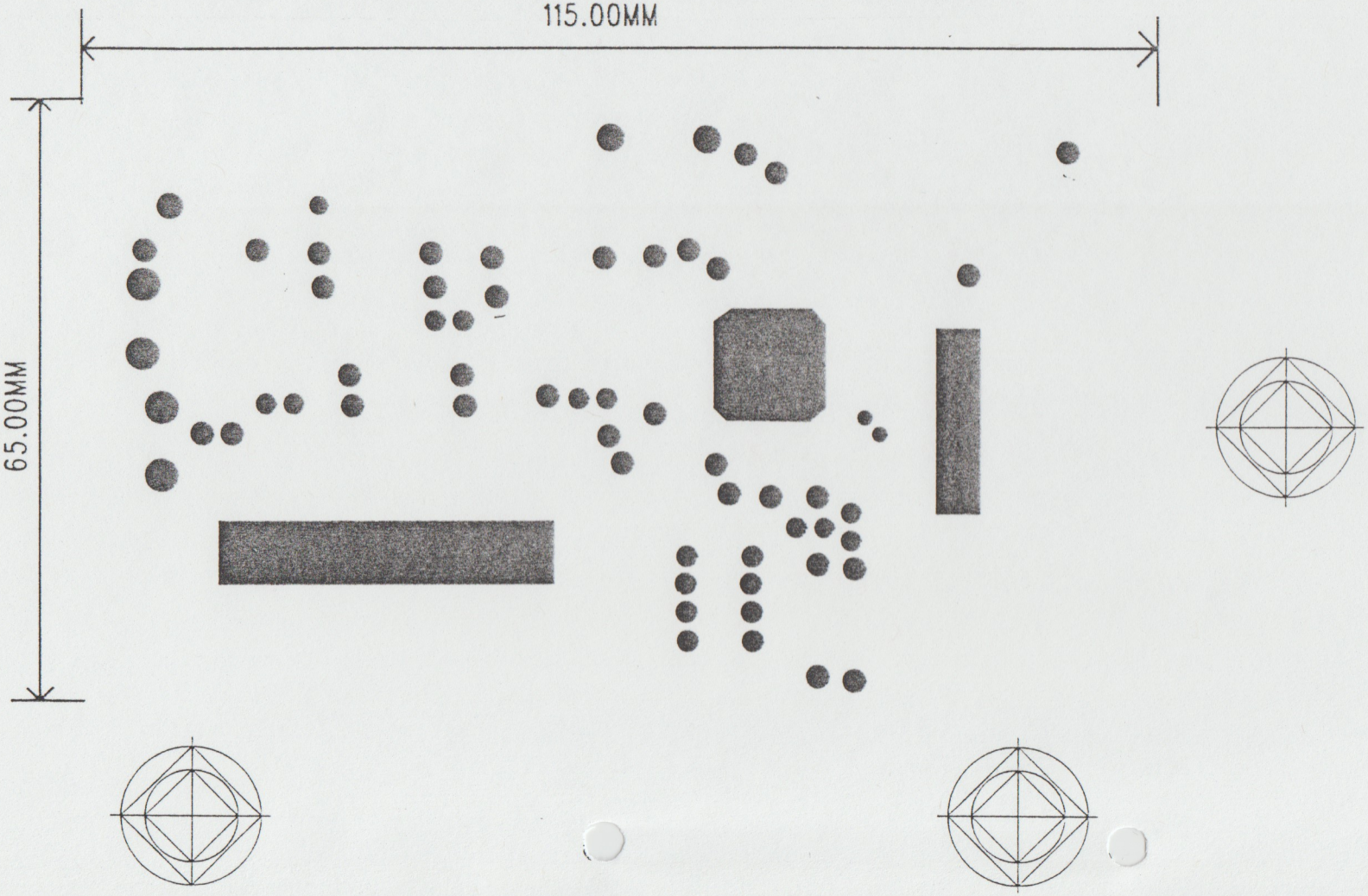

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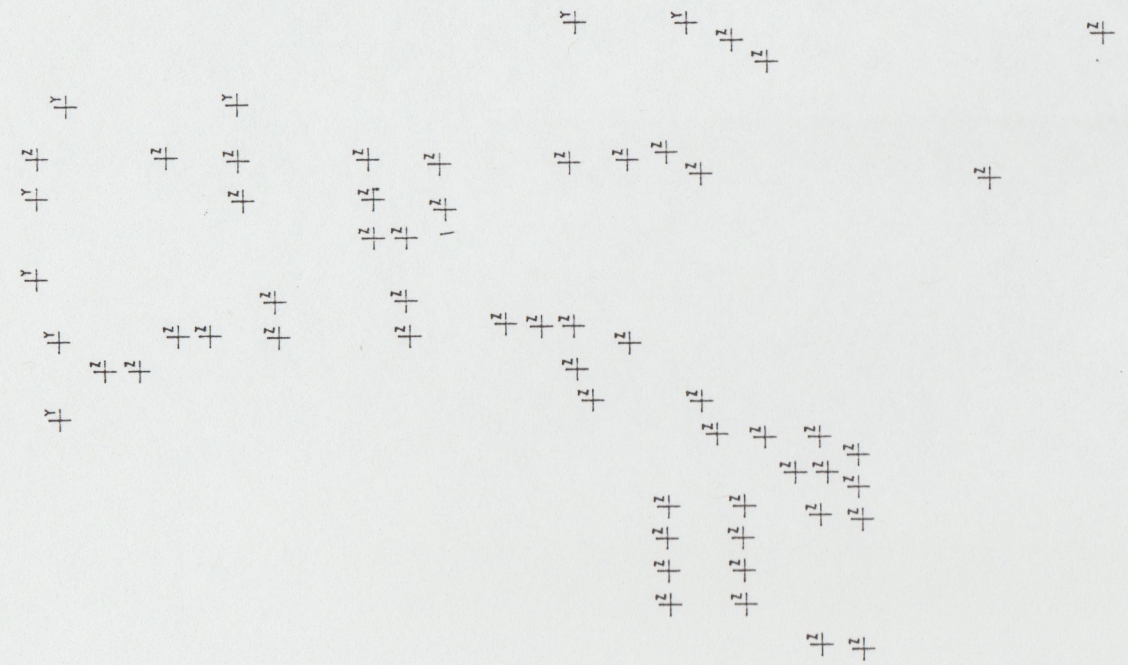
DRAWN BY	11/7/96	PCB LAYOUT	
CHECK BY/SEE		TITLE: ELITE	
Q.A.	29.10.96	178	
B.D.D.		DWG. NO. ST28B - PE - 011	REV. 0

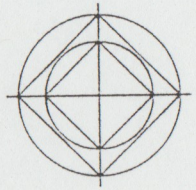
115.00MM

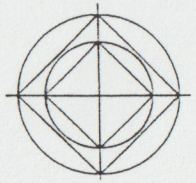
65.00MM

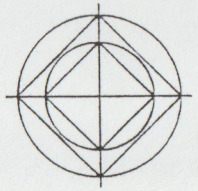
Z = 0.8mm

Y = 1.0mm









REVISION			
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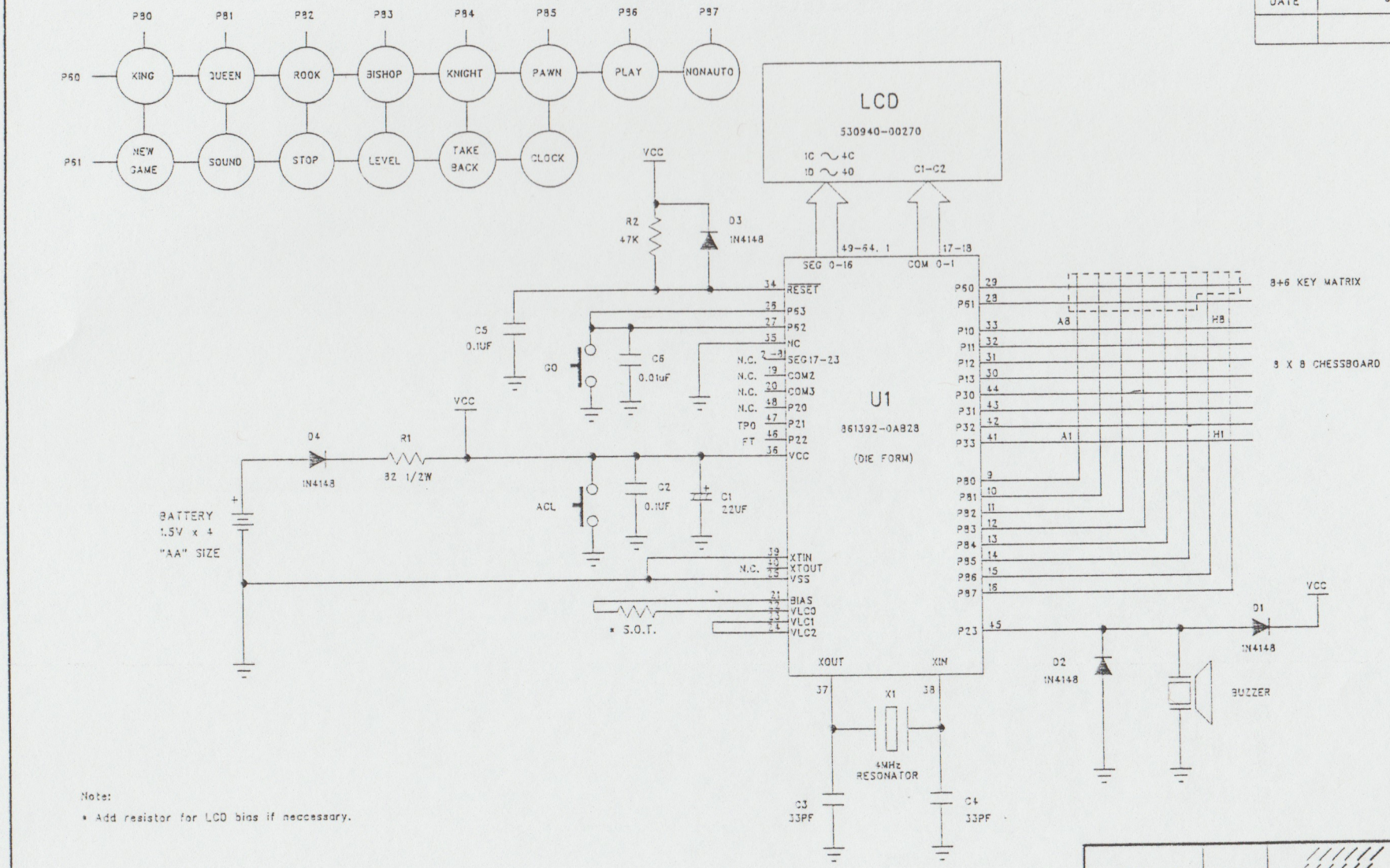

Note:

* Add resistor for LCD bias if neccessary.

APPROVALS	DATE	Saitek Ltd.	
DRAWN:		SCHEMATIC DIAGRAM	
CHECK:	27/6/98	TITLE: ATLAS	
B.D.D.:	27.6.98	K11	
Q.A.:	27.6.98	DWG. NO. ST28C-PE-012	REV. 0

1/01

Dist.: BDM, QAM, SED, PE

SAITEK

BILL OF MATERIALS

PROJECT	:	ST28C	Atlas
ART.NO.	:	K11	
REVISION	:	P1	FILENAME : \BDD#P02B\ST28C

REVISION HISTORY

REVISION	DATE	BY	DESCRIPTION OF CHANGES
P1	24.12.97	W.K. Cheng	Preliminary BOM.

RELATED DOCUMENTS REV

Schematic dwg :

Prepared by : _____ W.K. Cheng

Approved by : _____ BDM

Distribution :
+1.00 [X] MMM, FAM, QAM, SED
+0.10 [ ] MMM, FAM, QAM, SED
+0.01 [ ] MMM, SED

Date issue : 31 DEC 1997

CHG MOD : NW=new component; *=desc/PN/ref changed; +/-=cost up/down; C/NC=consigned/non-consigned; +/-Q=qty up/down
$=estimated cost

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SAITEK LTD. REPORTS BILL OF MATERIAL - SAITEK Run : 29/12/97 16:36 Page 1

Prog: KPSPC/6B03

99K110 - ST28C, ATLAS Rev :P.1

Level	Item	Chg	Stock Code	Rev	Cons	Description	Qty Per	Reference
1			98K110-00000	1		UNIT ASSEMBLY,ST28C	1.000	
2			911780-00001	1		GUTS ASSEMBLY - LOGIC,ST28B	1.000	
			921780-01230	1		MODULE,MCU DIE BONDING ASSEMBLY,ST28B	1.000	
4	1		511780-01110		RC	PCB,LOGIC,S.S,1.6MM,PAPER PHENOLIC,ST28B	1.000	
4	2		861392-0AB28		RC	MICROPROCESSOR,SX28,DIE,REV.A	1.000	U1
4	3		921780-01230C			BONDING CHARGE,ST28B	1.000	
3	4		654148-10000		RC	DIODE,SWITCHING,1N4148	4.000	D1-D4
3	5		614735-31102		RC	RESISTOR,FIXED C-FILM,47K,5%,1/4W	1.000	R2
3	6		618205-41102		RC	RESISTOR,FIXED C-FILM,82,5%,1/2W	1.000	R1
3	7		614745-31102		RC	RESISTOR,FIXED C-FILM,470K,5%,1/4W	1.000	S.O.T.
3	8		62226Z-01616		RC	CAPACITOR,E-CAP,22UF,+80-20%,16V,L.L	1.000	C1
3	9		62330M-01611		RC	CAPACITOR,C-CAP,33PF,+/-20%,16V	2.000	C3,C4
3	10		62103M-01611		RC	CAPACITOR,C-CAP,0.01UF,+/-20%,16V	1.000	C6
3	11	NW	62104M-01611		RC	CAPACITOR,C-CAP,0.1UF,+/-20%,16V	2.000	C2,C5
3	12		644000-02250		RC	CERAMIC RESONATOR,4MHZ,50 PPM	1.000	X1
3	13		000050-70155		RC	JUMPER,L=7MM,LL=15MM,D=.5MM	4.000	J1-J4
3	14		000051-20155		RC	JUMPER,L=12MM,LL=15MM,D=0.5MM	7.000	J5,J7-J12
3	15		000051-70155		RC	JUMPER,L=17MM,LL=15MM,D=0.5MM	2.000	J6,J13
2			911780-00007	1		GUTS ASSEMBLY,ACL	1.000	
3	16		511338-01970		RC	PCB,ACL,S.S,1.2MM,PAPER PHENOLIC	1.000	
3	17		000010-00100		RC	ACL,RESET CONTACT,D=10MM,CR STEEL	1.000	
2			96K110-00000	1		CASING ASSEMBLY,ST28C	1.000	
3	18		000130-00270		RC	BUZZER,D=27MM	1.000	
3	19		530940-00270		RC	LCD,FOR ST13/JH1	1.000	
3	20		000090-00270		RC	FOAM PAD, ST13 20X12X4.2MM	1.000	FOR LCD
3	21		222510-03602		RC	METAL,B-CONT."-",PH.BRONZE,NI-PLT,ST3	1.000	
3	22		220800-03800		RC	METAL,B-CONT,"+",PH.BRONZE,NI-PLT,BS	1.000	
3	23		000073-12434		RC	SCREW,S/T,+BIND,M2.6X8MM,BT	5.000	FOR CABINET
3	24		000073-22414		RC	SCREW,S/T PAN BT M2.6 X 5MM	8.000	LOGIC PCB
3	25	-	000073-21124		RC	SCREW,S/T,+PAN,M2.0X6MM,NICKLE	2.000	ACL PCB
3	26		000064-06043		RC	STRAND WIRE,YELLOW,L=60MM,E=3.5MM,AWG28	2.000	ACL PCB
3	27		000061-08043		RC	STRAND WIRE,BROWN,L=80MM,E=3.4MM,AWG28	2.000	BUZZER
3	28		000060-22043		RC	STRAND WIRE,BLACK,L=220MM,E=3.5MM,AWG28	1.000	BATT.'-'
3	29		000062-13043		RC	STRAND WIRE,RED,L=130MM,E=3.5MM,AWG28	1.000	BATT.'+'
3	30		321780-01210		RC	OVERLAY,ST28C,C.B.,COMBO,LEXAN	1.000	
3	31		31K110-00300		RC	SENSOR,CHESSBOARD,DOT,ST28C	1.000	
3	32		250000-00154		RC	RUBBER ROD,36X2.9X2.8MM,COMPRESS KE951U	1.000	
3	33		250000-00526		RC	ZEBRA CONNECTOR,S,20.5*1*5.5MM,P=.18MM	1.000	
3	34		000022-00090		RC	RUBBER FT,NON-3M,D10.5X3MM,ADHESIVE	4.000	
3	35		000106-01205		RC	SPONGE,60X12X5MM	1.000	
3			95K110-00000	1		CABINET SET,ST28C	1.000	
4	36		211780-00210		RC	PLASTIC,TOP CABINET,HIPS,DARK GREY	1.000	ECN97018
4	37		211780-01510		RC	PLASTIC,BOTTOM CAB,HIPS,D.GREY,ENGRAVING	1.000	ECN97018
4	38		211620-00320		RC	PLASTIC,BATT.LID,HIPS,DARK GREY	1.000	

12/21

99K110 - ST28C, ATLAS Rev : P.1

Level	Item	Chg	Stock Code	Rev	Cons	Description	Qty Per	Reference
1			94K110-10000	1		PACKING ASSEMBLY,ST28C	1.000	
2	39		360000-00200		RC	LABEL,FOR SERIAL NO, ADHESIVE	1.000	
2	40		000122-50160		RC	POLYBAG,250X160X0.045MM	1.000	FOR MANUAL
2	41		000123-60280		RC	POLYBAG,360X280X0.045MM	1.000	FOR UNIT
2	42		451780-01600		RC	INSERT,FOR ST28B,CORRUGATED PAPER	2.000	
2	43		46A133-00400		RC	ACCESSORY,BUBBLE BAG FOR ST13A,35X27CM	1.000	
2	44		451780-01300		RC	CARTON,FOR ST28B.10PCS/CTN	.100	
2			24K110-31200	1		CHESSMEN SET,ST28C	1.000	
3	45		261620-02010		RC	CHESSMEN,ST1,16,L.GREY,NO MAG,SEAL PACK	1.000	
3	46		261620-02030		RC	CHESSMEN,ST1,16,D.GREY,NO MAG,SEAL PACK	1.000	
1			97K110-00000	1		OPTIONS ASSEMBLY,ST28C	1.000	
2	47		41K110-01000		RC	MANUAL,ST28C,ENGLISH,SWL	1.000	
2	48		42K110-61000		RC	GIFTBOX,ST28C,E/G/F/D/S/I.SWL	1.000	
2	49		41K110-03100		RC	MANUAL,ST28C,FRENCH,SWL	.000	
2	50		41K110-46200		RC	MANUAL,ST28C,G/D/S/I,SWL	.000	
2	51		430126-61000		RC	CARD,SCORE,E/F/G/D/I/S,SELF-RATING SYS.	1.000	
2	52		430127-61000		RC	BOOKLET,INSTR'N,E/F/G/D/I/S.SELF-RATING	1.000	
2	53		361750-02310		RC	STICKER,SELF-RATING SYS.PAPER,6-LANG.	1.000	
2			490000-00010	1		WARRANTY CARD LISTING ASSEMBLY	1.000	
3	54		430004-51000		RC	CARD,WARRANTY,E/G/F/D/S,SWL,CHESS	1.000	CHESS PRODUCT
3	55		430008-51000		RC	CARD,WARRANTY,E/G/F/D/S,SWL,NON CHESS	.000	NON-CHESS
3	56		430064-02000		RC	CARD,GUARANTEE,SCHNEIDER,G	.000	SCHNEIDER
3	57		430048-01004		RC	CARD,GUARANTEE,E,CONTEMPORARY GAMES	.000	CCC,ECN-97194
3	58		430048-01003		RC	CARD,GUARANTEE,E,CONTEMPORARY GAMES	.000	USE-UP
3	59		430113-02002		RC	CARD,GUARANTEE,GERMAN,H+G	.000	ECN-97219
3	60		430113-02001		RC	CARD,GUARANTEE,GERMAN,H&G	.000	ECN-97219
3	61		370000-09200		RC	CARD,COM#92,GUARANTEE,TRANSECOM	.000	TRANSECOM
3	62		430120-01000		RC	CARD,WARRANTY,ENGLISH,SCI	.000	SCI
3	63		430162-02000		RC	CARD.GUARANTEE CARD,FOR H+G,PCP,GERMAN	.000	
3	64		430165-01001		RC	CARD,GUARANTEE,PCP,ENGLISH.SP	.000	ECN:97241
2			490000-00000	1		CONSUMER LEAFLET LISTING ASSEMBLY	1.000	
3	65		430016-01006		RC	LEAFLET,CONSUMER,1995,ENGLISH,SWL	1.000	ENG. COUNTRIES
3	66		430017-02007		RC	LEAFLET,CONSUMER,1995,GERMAN,SWL	.000	GERMAN
3	67		430021-01004		RC	LEAFLET,CONSUMER,1994,ENGLISH,DIXONS	.000	DIXONS
2			490000-00020	1		RULE OF CHESS LISTING ASSEMBLY	1.000	
3	68		430156-01000		RC	BOOK,RULES OF CHESS,ENGLISH,SWL	1.000	
3	69		430157-03000		RC	BOOK,RULES OF CHESS,FRENCH,SWL	.000	
3	70		430158-46000		RC	BOOK,RULES OF CHESS,G/D/I/S,SWL	.000	
2			370000-00000	1		LABEL ASSEMBLY	1.000	
3	71		370000-00104		RC	LABEL,COM#1,FOR SWL,ENGLISH,CE LABEL	.000	ECN-96049
3	72		370000-00103		RC	LABEL,COM#1,FOR SWL,ENGLISH,CE LABEL	.000	RUNNING CHANGE
3	73		370000-19801		RC	LABEL,FOR ALL PRODUCTS EXC.PCP TO FRANCE	.000	ECN-97122
3	74		370000-19800		RC	LABEL,COM#198,MADE IN CHINA,TRANSECOM	.000	ECN97122,USE-UP
3	75		370000-18200		RC	LABEL,MADE&PRINTED IN CHINA,ADHESIVE	.000	ECN 96235
3	76		370000-20100		RC	STICKER,COM#201,"AGES 8 AND UP"	.000	

9K1 - ST28C. ATLAS Rev : P.1

Level	Item	Chg	Stock Code	Rev	Cons	Description	Qty Per	Reference
3	77		370000-01001		RC	LABEL,COM#10,FOR OTTO GIFTBOX	.000	OTTO
3	78		370000-01100		RC	LABEL,COMMON,NO:11,FOR PLATETIME BOX	.000	PLATETIME
3	79		370000-01200		RC	LABEL,COMMON,NO:12,FOR SEARS,CAN	.000	SEARS
3	80		370000-01300		RC	LABEL,COMMON,NO:13,DICK SMITH ON BOX	.000	DICK SMITH
3	81		370000-07600		RC	STICKER,COM#78,GREEN POINT,GERMAN,20MM	.000	GERMAN
3	82		370000-08600		RC	ADDENDUM,COM#86,FOR ALL,RECYCLE,QUELLE	.000	QUELLE
3	83		430063-01000		RC	ADDENDUM,E,FOR SUKL SHIPMENT,HELP LINE	.000	SYSTEMA
3	84		370000-11204		RC	ADDENDUM,DISTRIBUTORS LIST 97,ENGLISH	.000	ECN97066
3	85		370000-14100		RC	STICKER,COM#141,FOR L'WOODS CARTON,PAPER	.000	L'WOODS QTY=3
3	86		370000-17500		RC	STICKER,COM#175,TOY SYMBOL	.000	FOR NO TOY SYMB
3	87		370000-04900		RC	STICKER,COM#49,GREEN POINT,GERMAN LARGE	.000	
3	88		430026-01004		RC	CARD,ACCESSORY ORDER,E,SCI	.000	SCI,CHESS ONLY
3	89		430100-61000		RC	ADDENDUM,ADAPTOR WARNING,E/G/F/D/S/I	.000	ECN 95199
3	90		370000-15900		RC	ADDENDUM,COM#159,TOY SYMBOL,H+G	.000	ECN 95201
3	91		370000-20200		RC	STICKER,COM#202,USCF,FOR CHESS TO SCI	.000	
3	92		430123-01000		RC	CARD,USCF,FOR CHESS PRODUCTS TO SCI,E	.000	
3	93		370000-20401		RC	STICKER,H&G HOTLINE ON BACK OF UNIT	.000	GERMAN,ECN97228
3	94		430124-02001		RC	ADDENDUM,INFO FOR CHESS,GERMAN,H+G	.000	ECN-97220
3	95		430124-02000		RC	ADDENDUM,INFO FOR CHESS,GERMAN,H&G	.000	ECN-97220
3	96		370000-21000		RC	STICKER,COM#210,RECYCLE PAPER,3 SUISSES	.000	ECN-96109
3	97		370000-21100		RC	STICKER,COM#211,ADDRESS LABEL,FOR SEARS	.000	ECN-96161
3	98		370000-21800		RC	ADDENDUM,COM#218,BAT.WARNING,E/F/G/D/S/I	.000	ECN-97119

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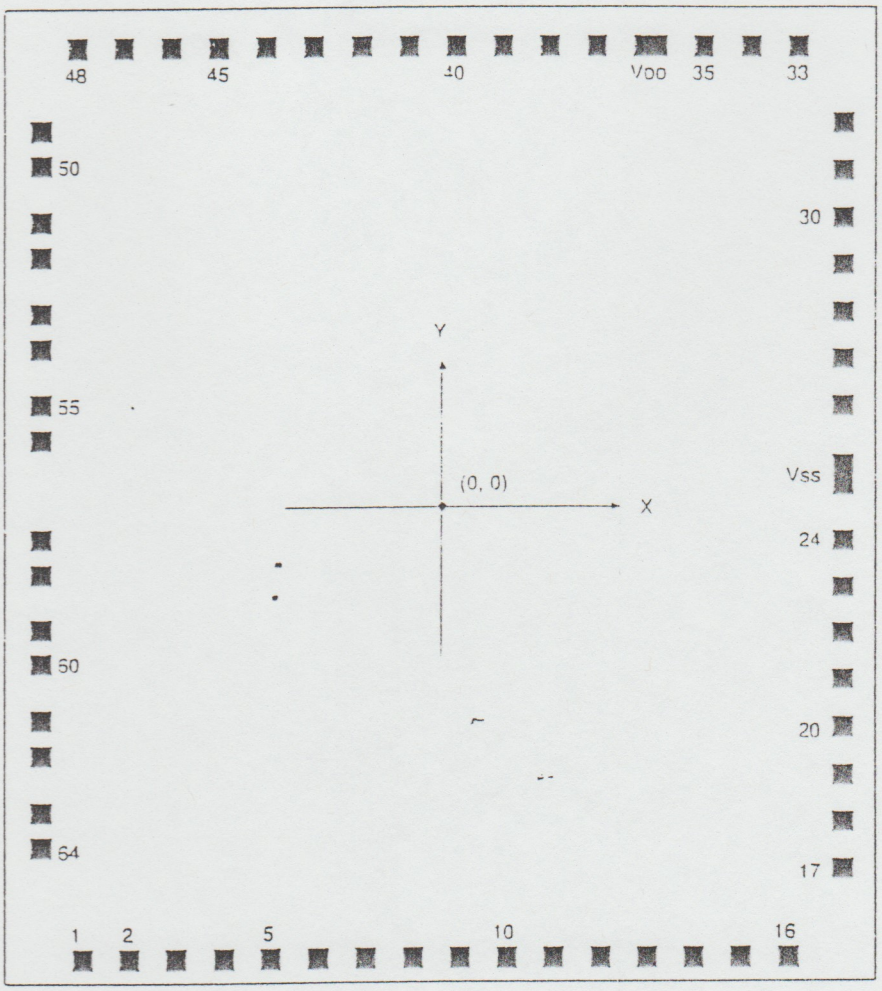
STDPC



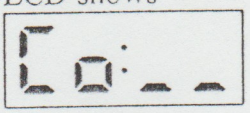
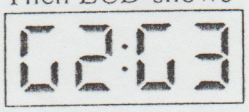
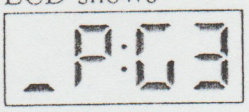
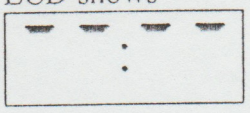
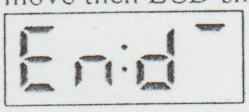
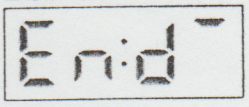
- Chip size : 3800 x 4500 μm^2
- Pad size : 90 x 90 μm except Voo and Vss.
  Voo and Vss : 140 (X) x 90 (Y) μm

Pad No.	Name	X (μm)	Y (μm)	Pad No.	Name	X (μm)	Y (μm)
1	SEG16	-1527.50	-2090.00	33	P1.0	1577.00	2089.50
2	SEG17	-1347.50	-2090.00	34	RESET	1367.00	2089.50
3	SEG18	-1113.50	-2090.00	35	NC	1161.00	2089.50
4	SEG19	-933.50	-2090.00	36	V_{DD}	921.00	2089.50
5	SEG20	-699.50	-2090.00	37	Xout	708.50	2089.50
6	SEG21	-519.50	-2090.00	38	Xin	502.50	2089.50
7	SEG22	-285.50	-2090.00	39	XTin	292.50	2089.50
8	SEG23	-105.50	-2090.00	40	XTout	86.50	2089.50
9	SEG24/P8.0	128.50	-2090.00	41	P3.3	-123.50	2089.50
10	SEG25/P8.1	308.50	-2090.00	42	P3.2	-329.50	2089.50
11	SEG26/P8.2	542.50	-2090.00	43	P3.1/LCDSY	-539.50	2089.50
12	SEG27/P8.3	722.50	-2090.00	44	P3.0/LCDCK	-745.50	2089.50
13	SEG28/P8.4	956.50	-2090.00	45	P2.3/BUZ	-955.50	2089.50
14	SEG29/P8.5	1136.50	-2090.00	46	P2.2/CLO	-1161.50	2089.50
15	SEG30/P8.6	1370.50	-2090.00	47	P2.1	-1371.50	2089.50
16	SEG31/P8.7	1550.50	-2090.00	48	P2.0/TCLO	-1577.50	2089.50
17	COM0	1740.00	-1602.00	49	SEG0	-1740.00	1606.00
18	COM1	1740.00	-1422.00	50	SEG1	-1740.00	1426.00
19	COM2	1740.00	-1188.00	51	SEG2	-1740.00	1192.00
20	COM3	1740.00	-1008.00	52	SEG3	-1740.00	1012.00
21	BIAS	1740.00	-774.00	53	SEG4	-1740.00	778.00
22	V_{LC0}	1740.00	-594.00	54	SEG5	-1740.00	598.00
23	V_{LC1}	1740.00	-360.00	55	SEG6	-1740.00	364.00
24	V_{LC2}	1740.00	-155.00	56	SEG7	-1740.00	184.00
25	Vss	1740.00	182.50	57	SEG8	-1740.00	-264.00
26	P6.3//KS3	1740.00	511.50	58	SEG9	-1740.00	-426.00
27	P6.2/KS2	1740.00	717.50	59	SEG10	-1740.00	-660.00
28	P6.1/KS1	1740.00	927.50	60	SEG11	-1740.00	-840.00
29	P6.0/KS0	1740.00	1133.50	61	SEG12	-1740.00	-1074.00
30	P1.3/TCL	1740.00	1343.50	62	SEG13	-1740.00	-1254.00
31	P1.2/INT2	1740.00	1549.50	63	SEG14	-1740.00	-1488.00
32	P1.1/INT1	1740.00	1767.00	64	SEG15	-1740.00	-1668.00

8. FUNCTIONAL TEST PROCEDURE FOR ST28C

Purpose	Procedure	Observation
1. Power up	- Insert 4 AA size batteries into the battery compartment.	- LCD is scanned as in Table 1 - Beep Beep Beep sound is given out. - LCD shows
2. Check LEVEL and chessboard	- Press LEVEL	- LCD shows
	- Press 64 chessboard squares	- Corresponding square coordinate is shown in LCD (in the format "L : XX" where XX is the square coordinate).
	- Press LEVEL	- LCD shows
3. Check verify	- Press ♔	- LCD shows
	- Press ♕	- LCD shows
	- Press ♖	- LCD shows

Purpose	Procedure	Observation
	- Press ♗	- LCD shows _b:c 1
	- Press ♘	- LCD shows _n:b 1
	- Press ♟	- LCD shows _P:A2
4. Reset unit	- Press ACL	- Same as step 1
5. Check multimove	- Press NONAUTO	
	- Press F2, F4	- LCD shows corresponding move - After about 2 seconds, LCD shows 00:00 and counts up.
	- Press CLOCK and wait for 2 seconds or more	- LCD shows - - : - -
	- Press E7, E5, H2, H3, D8, H4	- LCD shows corresponding moves - Then LCD shows ch:_ _

Purpose	Procedure	Observation
	- Press PLAY	- LCD shows 
		- Then LCD shows 
	- Press G2	- LCD shows 
	- Press G3	- LCD shows 
	- Press H4, G3	- LCD shows corresponding move then LCD shows 
6. Check memory	- Press STOP	- LCD turns off
	- Press NEWGAME twice	- No response
	- Press GO	- LCD shows 
7. Check sound	- Press SOUND	- Beep sound is given out

Note: Beep sound is given out on each keypress on or before step 7.
No beep sound is emitted on keypress after step 7.

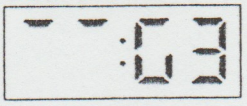
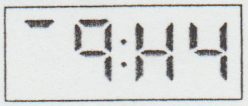
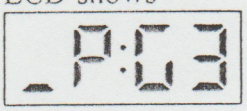
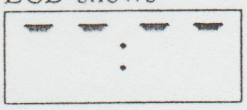
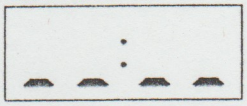
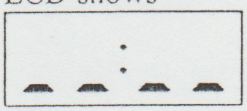
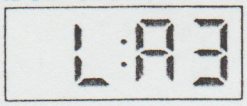
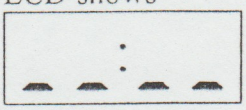
Purpose	Procedure	Observation
8. Check TAKEBACK	- Press TAKEBACK	- LCD shows 
	- Press G3	- LCD shows 
	- Press H4	- LCD shows 
	- Press G3	- LCD shows 
	- Press NEWGAME	- LCD shows 
9. Check High-low voltage	- Remove the batteries from the battery compartment. Insert a dummy battery and set the terminal voltage to 6.8V	- LCD shows 
	- Press LEVEL	- LCD shows 
	- Set the terminal voltage to 4.5V	- Same as above
	- Press LEVEL	- LCD shows 
10. Test finished	- Remove the batteries from the compartment.	

Table 1

1	0 :
2	00:
3	00:0
4	00:00