

### GENERAL DESCRIPTION

C9318C1 is a CMOS LSI calculator chip with 8 digits arithmetic operations, single memory, percentage and extraction-of-square-root calculations, designed for triplex LCD application with solar cell power supply.

### FUNCTIONS

- Four standard functions (+, -, x, /).
- Auto-constant calculations (constant : multiplicand, divisor, addend and subtrahend).
- Square and reciprocal calculations.
- Mark-up and mark-down calculations.
- Extraction of square root.
- Percentage calculations.
- Chain multiplication and division.
- Power calculations.
- Rough estimate calculations.

### APPLICATION

This specification contains complete informations of functional operations, electrical characteristics, packaging, and crating requirements of C9318C1.

### FEATURES

- Accumulating memory : M+, M-, RM, CM, RM/CM.
- Rollover capability.
- Floating decimal.
- Overflow indication.
- 8-digit LCD triplex.
- Automatic power off function.

### FUNCTIONAL DESCRIPTION

#### a. Floating point system

- i) 8 digits floating decimal point system, with leading zero suppression, Zero shift.
- ii) Symbols : '-' negative number indicator.  
: 'E' Error status indicator.  
: 'M' Non-zero memory indicator.

#### b. Error Detections

- i) System errors occur when :
  - The integral part of any calculation result exceeds 8 digits.
  - The integral part of any memory calculation result exceeds 8 digits.
  - The integral part of any addend or subtrahend to memory exceed 8 digits.
  - The integral part of a mark-up or mark-down calculation result exceeds 8 digits.
  - The division by zero.
  - The extraction of square root of a negative number.

- ii) Rough estimate calculation error

- The integral part of the result of any standard functions, percentage, square, reciprocal or power calculations exceeds 8 digits and is equal to 16 digits or less.

#### c. Error Indication

- i) System error

'0' is indicated in the 1-digit position and 'E' in the sign indicator position.

ii) Rough estimate calculation error

The high-order 8 digits of a calculation result is indicated together with 'E'. The decimal point is indicated in the position corresponding to a calculation result times  $10^{-8}$ , and no zero shift is performed.

d. Error Release

- i) System error can be released by the ON/C or ON/CE key.
- ii) Rough estimate calculation error can be released by the ON/C, ON/CE, CE key.

e. Number Entry

Numerical can be entered up to 8 digits, entries that equal to 9 digits or more will be ignored.

f. Memory Protection

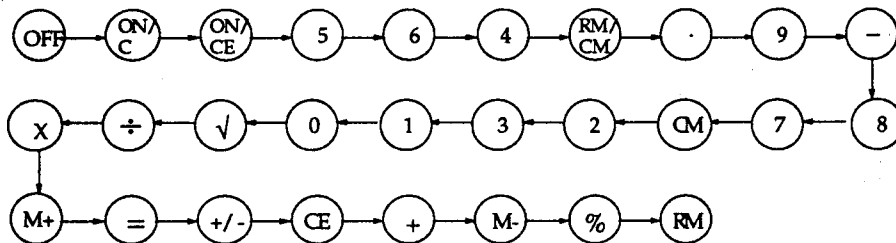
The memory contents before any error detection are protected.

g. Memory Indication

If the memory contents is non-zero, 'M' is indicated in the memory indicator position.

h. Double Key Depression

The order of priority when two keys are being depressed simultaneously is as follows :



When the OFF and ON/C key are depressed simultaneously, the OFF key is given priority.

i. Key bounce protection

- i) Front edge : down to 1 word and up to about 3 words.
- ii) Trailing edge : 9 words. ( 1 word is 3.3ms when display frequency is  $F_d=100\text{Hz}$ .)

j. Auto Power Off

Power automatically turns off after 9 - 11 minutes pass from the last key press.

k. Clear Operation

All operations except memory content are cleared by ON/C key.

**ABSOLUTE MAXIMUM RATINGS**

Parameters	Symbol	Value	Unit	Note
Terminal voltage	VDD	- 0.3 ~ + 2.0	V	1
	VIN	- 0.3 ~ VDD + 0.3	V	1
Solar Supply Voltage	VSB	1.1 ~ 3.0	V	2
	VGG (LIM)	1.1 ~ 1.8	V	3
Operating temperature range	TOPR	0 ~ + 50	°C	--
Storage temperature range	TSTG	- 55 ~ + 125	°C	--

Note 1 : Maximum voltage on any pin is referenced to GND.

Note 2 :VSB is solar supply voltage.

Note 3 :VGG (lim) is limited voltage.

**ELECTRICAL CHARACTERISTICS**

( Ta = 25°C, VDD = 1.5V unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test Condition	Note
Input Voltage	V <sub>IH</sub>	V <sub>DD</sub> -0.4	--	--	V	--	4
	V <sub>IL</sub>	--	--	0.4	V	--	
Input Current	I <sub>IH</sub>	--	--	1	μA	V <sub>IN</sub> = V <sub>DD</sub>	5
	I <sub>IL</sub>	0.3	1	3	μA	V <sub>IN</sub> = 0V	
Output Voltage 1	V <sub>OH</sub>	V <sub>DD</sub> -0.15	--	--	V	No load	6
	V <sub>OL</sub>	--	--	0.15	V	I <sub>OUT</sub> = 15μA	
Output Voltage 2	V <sub>OA</sub>	2.8	2.95	--	V	No load	7
	V <sub>OB</sub>	1.3	1.5	1.7	V	No load	
	V <sub>OC</sub>	--	0	0.2	V	No load	
Display Frequency	F <sub>d</sub>	40	55	65	Hz	V <sub>DD</sub> = 1.3V while display is ON.	7
Dissipation Current	I <sub>OFF</sub>	--	--	0.1	μA	Display is OFF	8
	I <sub>DIS</sub>	--	4.2	6	μA	V <sub>DD</sub> = 1.3V while display is on.	9
	I <sub>OP</sub>	--	6.8	--	μA	V <sub>DD</sub> = 1.1V , while operation.	10

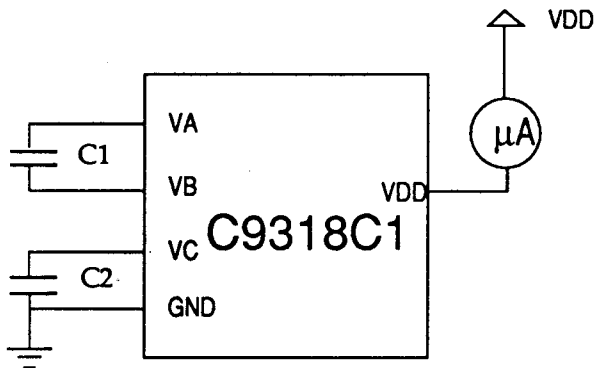
Note 4 : Applies to Pins K2 ~ K6.

Note 5 : Applies to Pins K2 ~ K6.

Note 6 : Applies to P1,P2, A2X ~ A5X.

Note 7 : Applies to H1 ~ H3, A1 ~ A8, B1 ~ B8, C1 ~ C8.

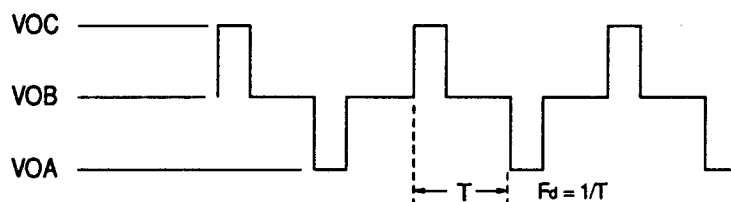
Note 8 : Measured by the test circuit below after power supply automatically turns off.



Note 9 : Measured by the test circuit while "0" is being displayed after auto - clear operation and while key is not being depressed.

Note 10 : Measured by the test circuit while operation is being made by ON/C key and while key is not being depressed.

**LCD BACKPLANE OUTPUT WAVEFORM**

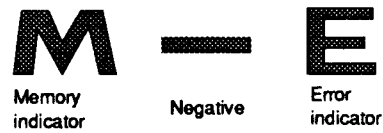


DISPLAY FONTS

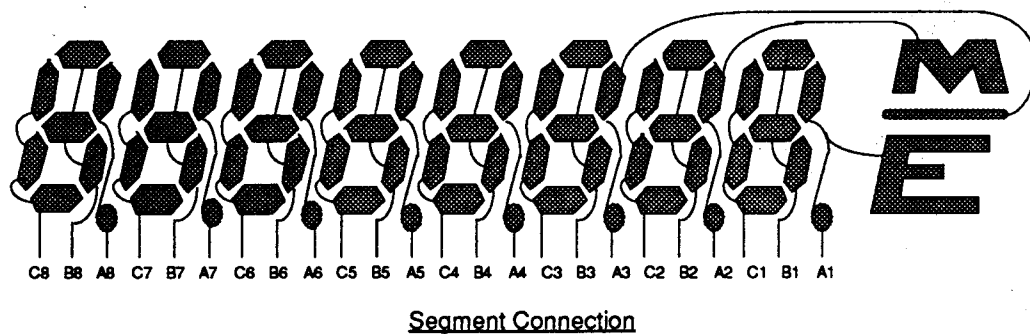
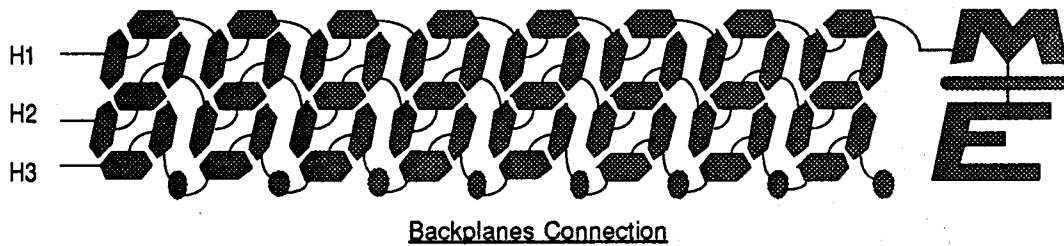
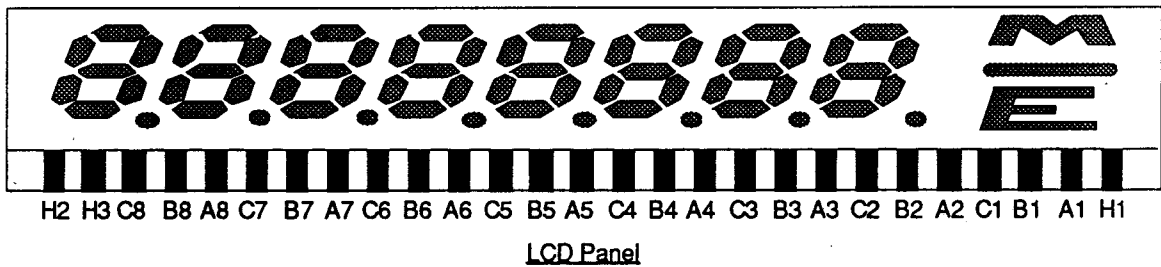
a. Numerical Font



b. Sign Font



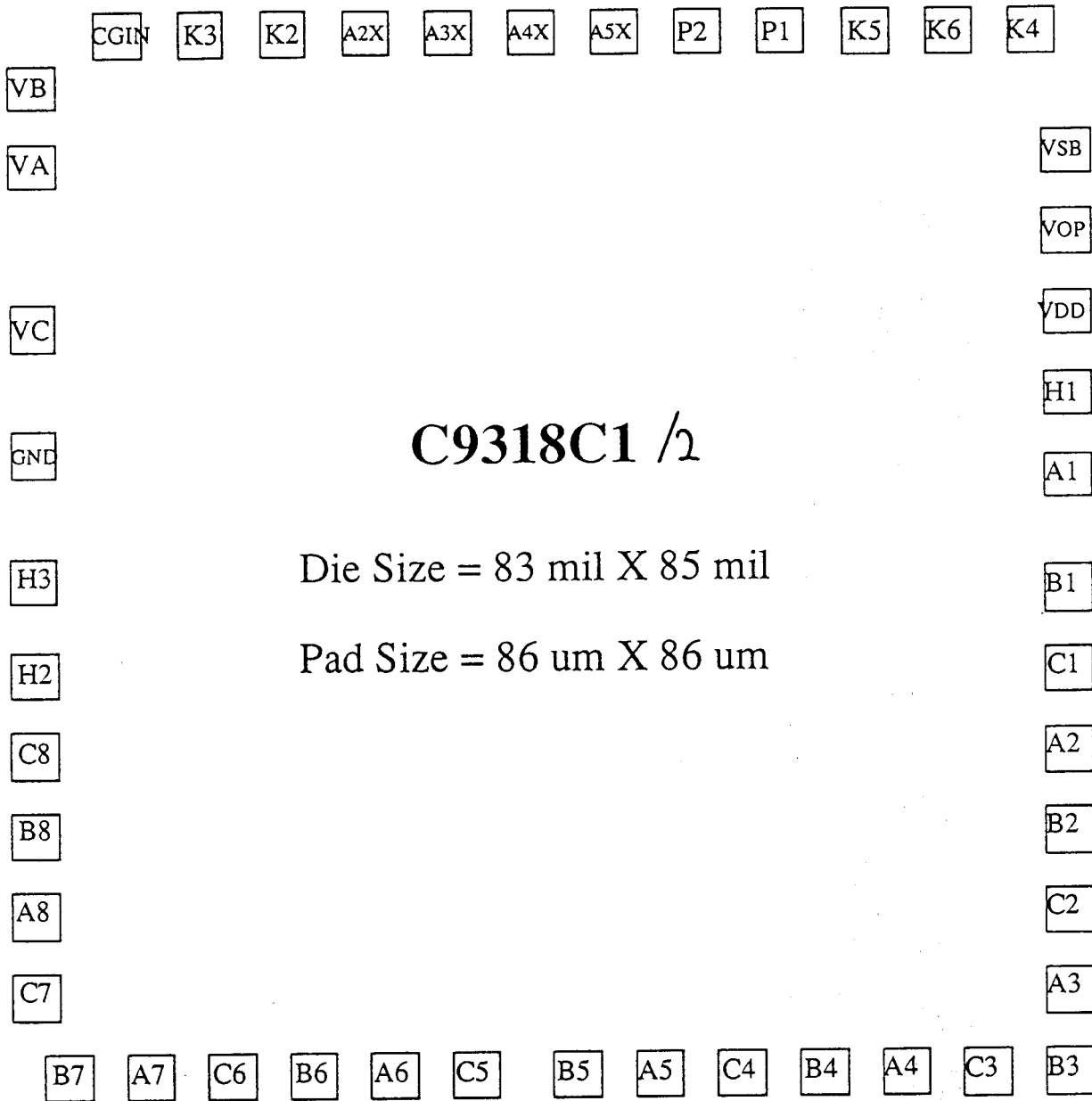
LCD CONNECTOR



## PIN DESCRIPTION

Pin No.	Signal	I/O	Description	Pin No.	Signal	I/O	Description
1	VSB	1	Solar Battery	25	B7	O	Display output.
2	Vop	1	Option Pin	26	C7	O	Display output.
3	VDD		Power supply.	27	A8	O	Display output.
4	H1	O	Display output.	28	B8	O	Display output.
5	A1	O	Display output.	29	C8	O	Display output.
6	B1	O	Display output.	30	H2	O	Display output.
7	GND		Ground.	31	H3	O	Display output.
8	C1	O	Display output.	32	GND		Ground.
9	A2	O	Display output.	33	VC	O	Cap terminal for voltage step-up.
10	B2	O	Display output.	34	VA	O	Cap terminal for voltage step-up.
11	C2	O	Display output.	35	VB	O	Cap terminal for voltage step-up.
12	A3	O	Display output.	36	NC	-	
13	B3	O	Display output.	37	CGin	I	Input terminal for CG.
14	C3	O	Display output.	38	K3	I	Key input.
15	A4	O	Display output.	39	K2	I	Key input.
16	B4	O	Display output.	40	A2X	O	Strobe output.
17	C4	O	Display output.	41	A3X	O	Strobe output.
18	A5	O	Display output.	42	A4X	O	Strobe output.
19	B5	O	Display output.	43	A5X	O	Strobe output.
20	C5	O	Display output.	44	P2	O	Strobe output.
21	A6	O	Display output.	45	P1	O	Strobe output.
22	B6	O	Display output.	46	K5	I	Key input.
23	C6	O	Display output.	47	K6	I	Key input.
24	A7	O	Display output.	48	K4	I	Key input.

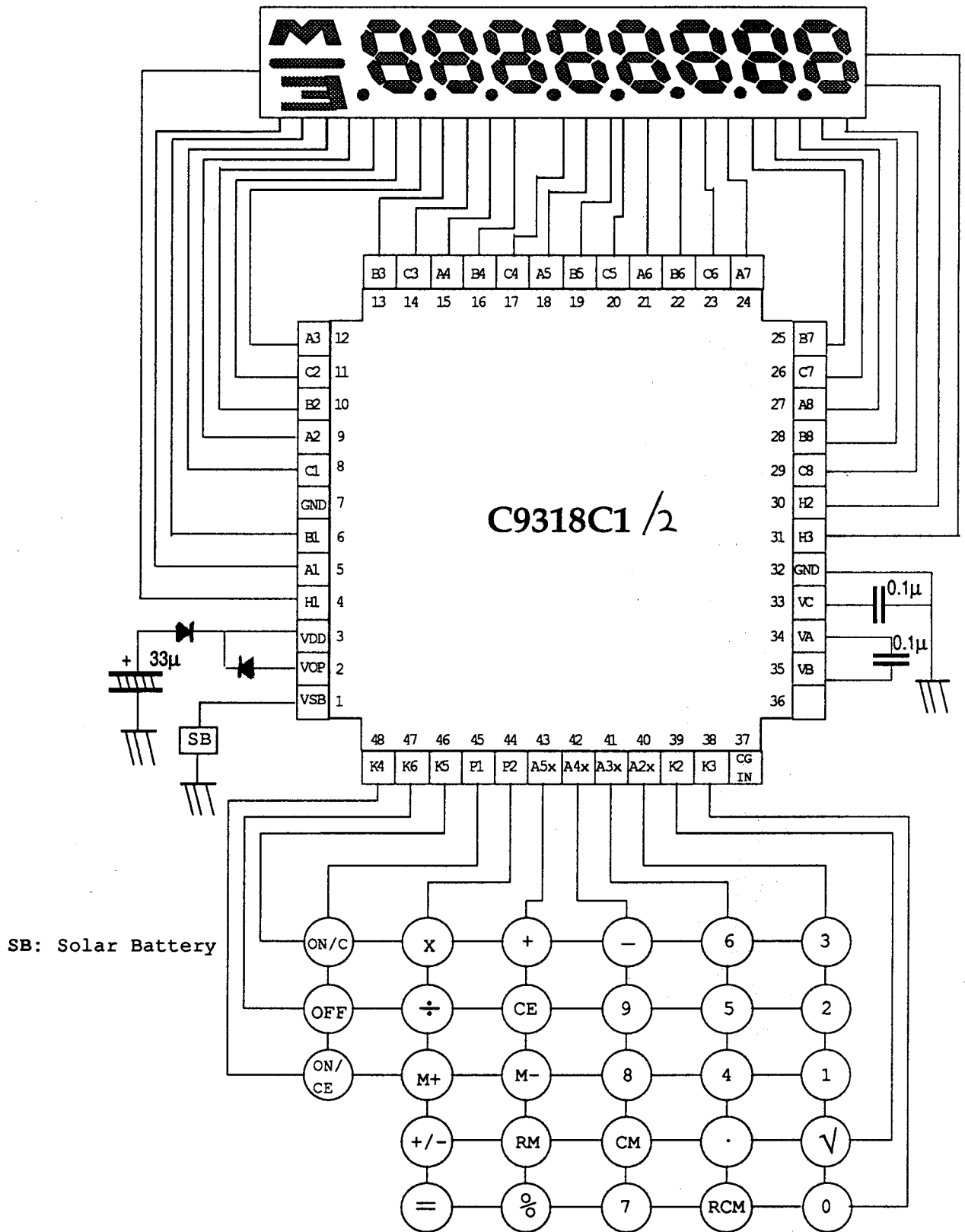
C9318C1 / PAD DIAGRAM



The Coordinate for Low Left Corner of Each Pad

B7 (-905.70, -990.10)	B3 (882.20, -990.15)	K4 (818.70, 906.10)	VB (-964.20, 811.60)
A7 (-759.55, -990.10)	A3 (882.20, -843.95)	K6 (671.20, 906.10)	VA (-964.20, 665.40)
C6 (-613.50, -990.10)	C2 (882.20, -697.65)	K5 (523.70, 906.10)	VC (-964.20, 370.80)
B6 (-467.40, -990.10)	B2 (882.20, -551.30)	P1 (370.50, 906.10)	GND (-964.20, 142.00)
A6 (-321.35, -990.10)	A2 (882.20, -404.95)	P2 (223.50, 906.10)	H3 (-964.20, -89.40)
C5 (-175.05, -990.10)	C1 (882.20, -258.70)	A5X (76.50, 906.10)	H2 (-964.20, -258.10)
B5 (3.85, -990.10)	B1 (882.20, -112.60)	A4X (-70.50, 906.10)	C8 (-964.20, -404.20)
A5 (150.15, -990.10)	A1 (882.20, 94.50)	A3X (-217.50, 906.10)	B8 (-964.20, -550.25)
C4 (296.50, -990.10)	H1 (882.20, 244.70)	A2X (-364.50, 906.10)	A8 (-964.20, -696.60)
B4 (442.85, -990.10)	VDD(882.20, 390.80)	K2 (-514.60, 906.10)	C7 (-964.20, -842.75)
A4 (589.10, -990.10)	VOP(881.20, 537.80)	K3 (-661.60, 906.10)	
C3 (735.45, -990.10)	VSB(881.20, 683.80)	CGIN(-808.60, 906.10)	

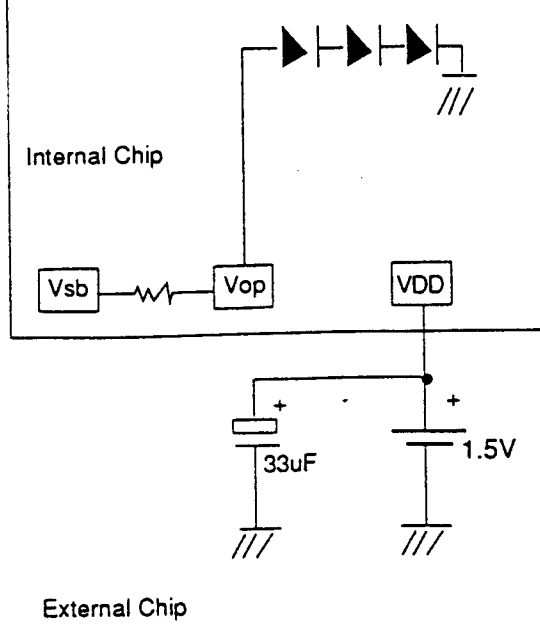
APPLCIATION DIAGRAM



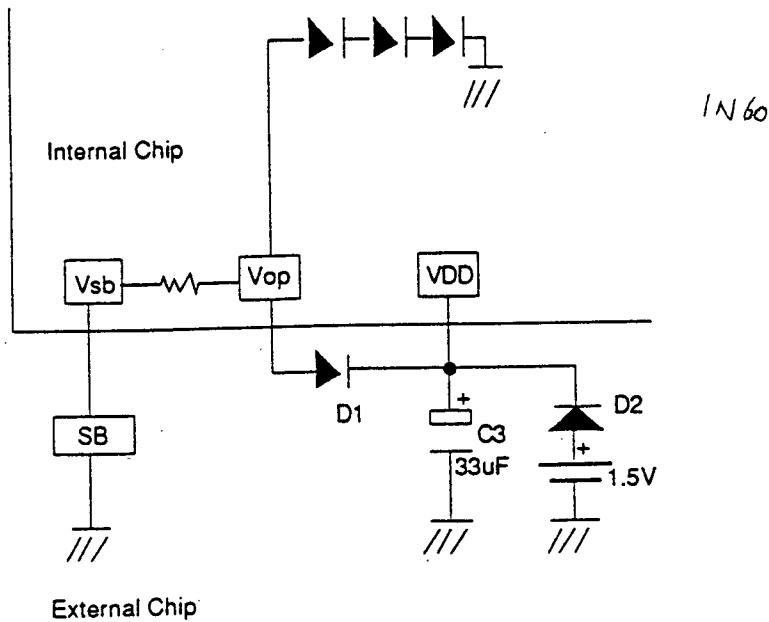
SB: Solar Battery

Note : Chip substract must be floating or connected to GND.

APPLICATION DIAGRAM FOR EXTERNAL BATTERY POWER SUPPLY



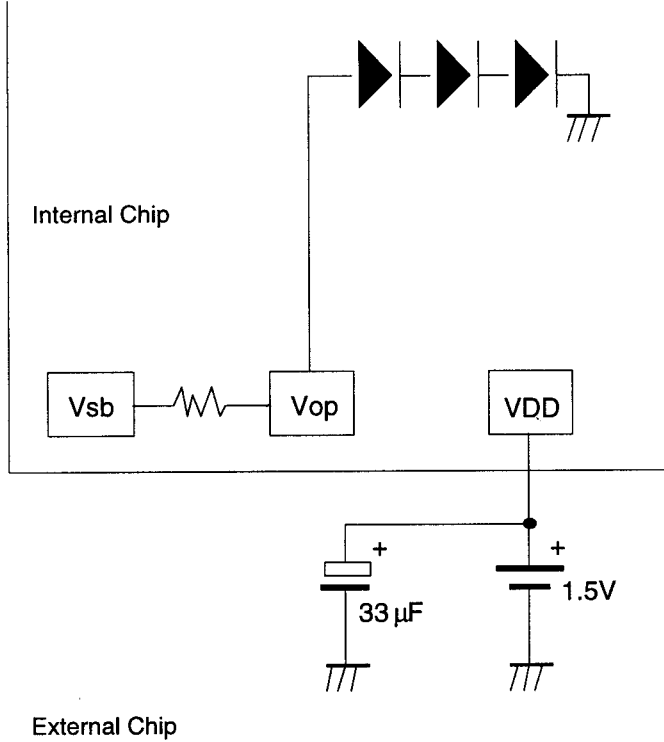
APPLICATION DIAGRAM FOR <sup>DUAL</sup> ~~DUAL~~ POWER SUPPLY



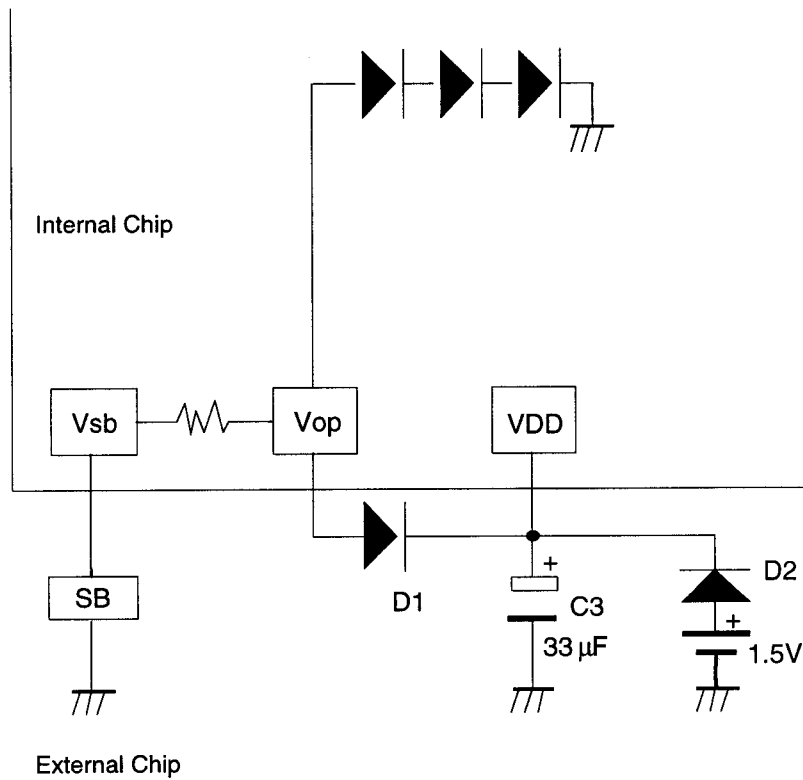
**NOTE:** D1 --- Cutting voltage (0.2~0.3V). It should be a Germanium diode.  
 D2 --- Cutting voltage (0.2~0.3V). It should be a Germanium diode.  
 SB --- Solar Battery



APPLICATION DIAGRAM FOR EXTERNAL BATTERY POWER SUPPLY



APPLICATION DIAGRAM FOR DUAL POWER SUPPLY



**NOTE:** D1 --- Cutting Voltage (0.2~0.3V). It should be a Germanium diode (Model No. 1N60).  
 D2 --- Cutting Voltage (0.2~0.3V). It should be a Germanium diode (Model No. 1N60).  
 SB --- Solar Battery