

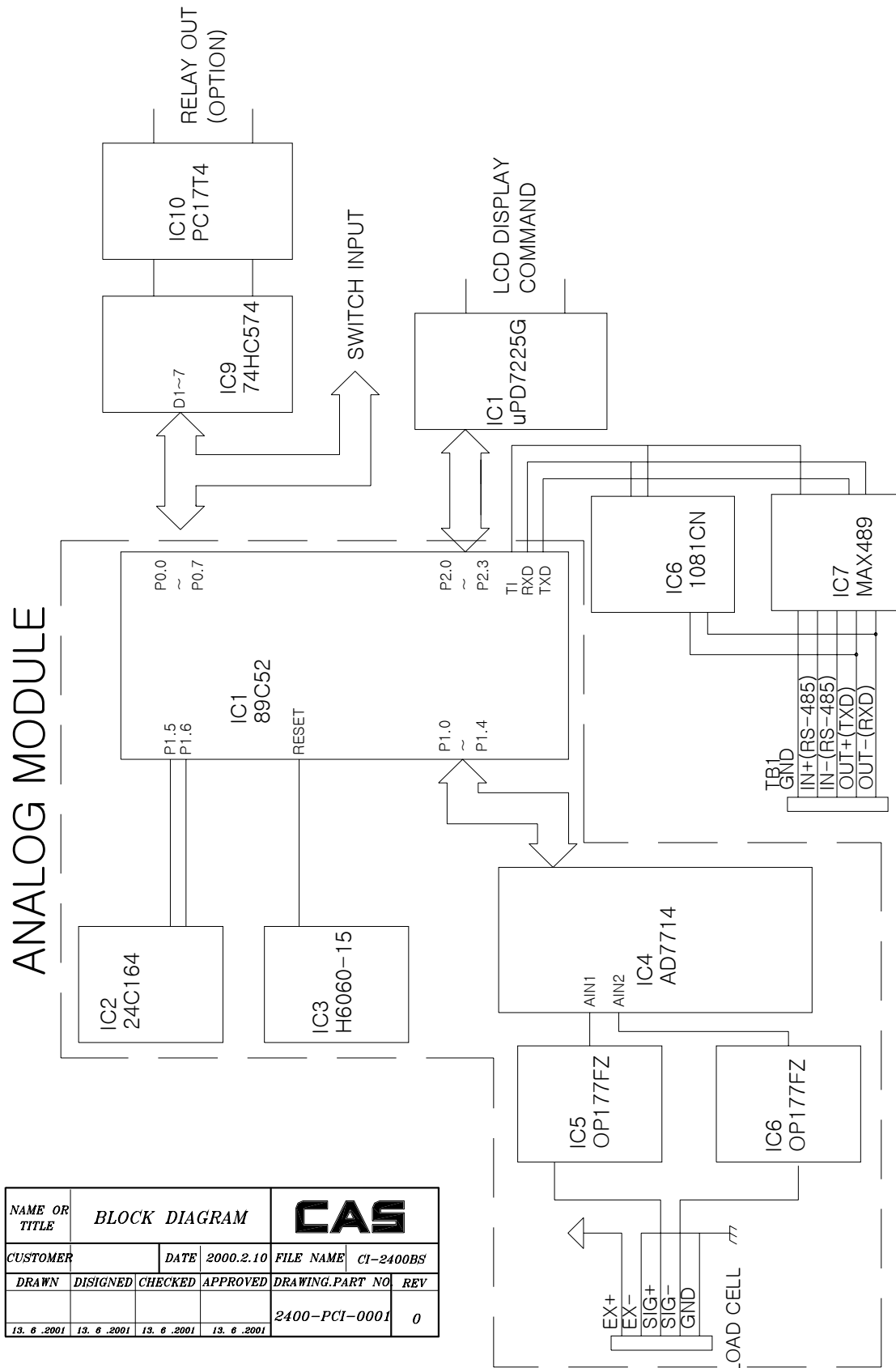
MODEL : CI-2400BS

SERVICE MANUAL

---I N D E X ---

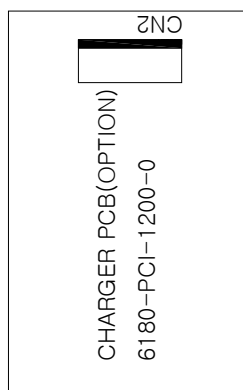
1. Block Diagram	-----	1
2. Connector Diagram	-----	2
3. Description Of Connector pin	-----	3
4. Indicator Test	-----	5
5. Indicator calibration	-----	9
6. SET Mode	-----	13
7. Schematic Diagram	-----	23
1) main Schematic		
2) Display Schematic		
3) Analog Schematic		
4) Power Schematic		
8. PCB Board Diagram	-----	27
1) Main PCB		
2) Display PCB		
3) Analog PCB		
4) Power PCB		
9. Device Specification	-----	31
10. Software Flow Chart	-----	38
11. Error message description and treatment	-----	41
12. Parts list	-----	46
13. Sealing Diagram	-----	52
14. Exploded View	-----	53

1. Block diagram



NAME OR TITLE	BLOCK DIAGRAM				CAS	
CUSTOMER		DATE	2000.2.10	FILE NAME	CI-2400BS	
DRAWN	DESIGNED	CHECKED	APPROVED	DRAWING.PART NO	REV	
				2400-PCI-0001	0	
13. 6 .2001	13. 6 .2001	13. 6 .2001	13. 6 .2001			

1. Block diagram

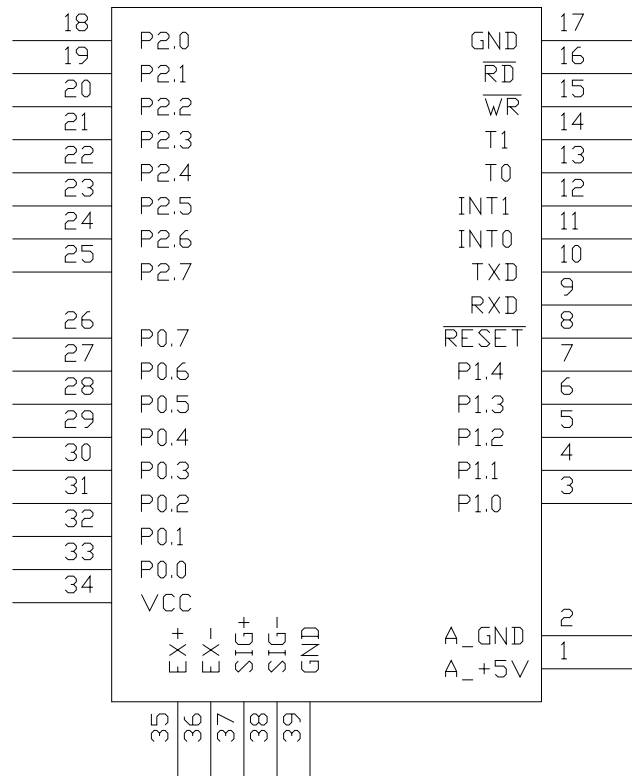


 SCALE STANDARD TOLERANCE	TITLE		Connection Diagram			
	NAME	FUNCTION	CUSTOMER	CUSTOMER DATE		FILE NAME
0.3" = 61.030303" 1/2" 1/16" = 15.875000" 1/8" 1/32" = 7.937500" 1/4" 3/32" = 23.812500" 1/2" 1/8" = 47.625000" 1" 3/16" = 142.875000" 1 1/2" 1/4" = 285.750000" 2" 3/8" = 428.625000" 2 1/2" 1/2" = 857.250000" 3" 5/8" = 1285.875000" 3 1/2" 3/4" = 1714.500000" 4" 7/8" = 2143.125000" 4 1/2" 1" = 2571.750000" 5" 1 1/8" = 3429.000000" 5 1/2" 1 1/4" = 3858.000000" 6" 1 1/2" = 4286.250000" 6 1/2" 1 3/4" = 4714.500000" 7" 2" = 5143.125000" 7 1/2" 2 1/4" = 5858.000000" 8" 2 1/2" = 6429.000000" 8 1/2" 2 3/4" = 6999.750000" 9" 3" = 7571.250000" 9 1/2" 3 1/2" = 8858.000000" 10" 4" = 10143.125000" 10 1/2" 4 1/2" = 11429.000000" 11" 5" = 12714.500000" 11 1/2" 5 1/2" = 14000.000000" 12" 6" = 15285.750000" 12 1/2" 6 1/2" = 16571.250000" 13" 7" = 17857.500000" 13 1/2" 7 1/2" = 19143.125000" 14" 8" = 20429.000000" 14 1/2" 8 1/2" = 21714.500000" 15" 9" = 23000.000000" 15 1/2" 9 1/2" = 24285.750000" 16" 10" = 25571.250000" 16 1/2" 10 1/2" = 26857.500000" 17" 11" = 28143.125000" 17 1/2" 11 1/2" = 29429.000000" 18" 12" = 30714.500000" 18 1/2" 12 1/2" = 32000.000000" 19" 13" = 33285.750000" 19 1/2" 13 1/2" = 34571.250000" 20" 14" = 35857.500000" 20 1/2" 14 1/2" = 37143.125000" 21" 15" = 38429.000000" 21 1/2" 15 1/2" = 39714.500000" 22" 16" = 41000.000000" 22 1/2" 16 1/2" = 42285.750000" 23" 17" = 43571.250000" 23 1/2" 17 1/2" = 44857.500000" 24" 18" = 46143.125000" 24 1/2" 18 1/2" = 47429.000000" 25" 19" = 48714.500000" 25 1/2" 19 1/2" = 50000.000000" 26" 20" = 51285.750000" 26 1/2" 20 1/2" = 52571.250000" 27" 21" = 53857.500000" 27 1/2" 21 1/2" = 55143.125000" 28" 22" = 56429.000000" 28 1/2" 22 1/2" = 57714.500000" 29" 23" = 59000.000000" 29 1/2" 23 1/2" = 60285.750000" 30" 24" = 61571.250000" 30 1/2" 24 1/2" = 62857.500000" 31" 25" = 64143.125000" 31 1/2" 25 1/2" = 65429.000000" 32" 26" = 66714.500000" 32 1/2" 26 1/2" = 68000.000000" 33" 27" = 69285.750000" 33 1/2" 27 1/2" = 70571.250000" 34" 28" = 71857.500000" 34 1/2" 28 1/2" = 73143.125000" 35" 29" = 74429.000000" 35 1/2" 29 1/2" = 75714.500000" 36" 30" = 77000.000000" 36 1/2" 30 1/2" = 78285.750000" 37" 31" = 79571.250000" 37 1/2" 31 1/2" = 80857.500000" 38" 32" = 82143.125000" 38 1/2" 32 1/2" = 83429.000000" 39" 33" = 84714.500000" 39 1/2" 33 1/2" = 86000.000000" 40" 34" = 87285.750000" 40 1/2" 34 1/2" = 88571.250000" 41" 35" = 89857.500000" 41 1/2" 35 1/2" = 91143.125000" 42" 36" = 92429.000000" 42 1/2" 36 1/2" = 93714.500000" 43" 37" = 95000.000000" 43 1/2" 37 1/2" = 96285.750000" 44" 38" = 97571.250000" 44 1/2" 38 1/2" = 98857.500000" 45" 39" = 100143.125000" 45 1/2" 39 1/2" = 101429.000000" 46" 40" = 102714.500000" 46 1/2" 40 1/2" = 104000.000000" 47" 41" = 105285.750000" 47 1/2" 41 1/2" = 106571.250000" 48" 42" = 107857.500000" 48 1/2" 42 1/2" = 109143.125000" 49" 43" = 110429.000000" 49 1/2" 43 1/2" = 111714.500000" 50" 44" = 113000.000000" 50 1/2" 44 1/2" = 114285.750000" 51" 45" = 115571.250000" 51 1/2" 45 1/2" = 116857.500000" 52" 46" = 118143.125000" 52 1/2" 46 1/2" = 119429.000000" 53" 47" = 120714.500000" 53 1/2" 47 1/2" = 122000.000000" 54" 48" = 123285.750000" 54 1/2" 48 1/2" = 124571.250000" 55" 49" = 125857.500000" 55 1/2" 49 1/2" = 127143.125000" 56" 50" = 128429.000000" 56 1/2" 50 1/2" = 129714.500000" 57" 51" = 131000.000000" 57 1/2" 51 1/2" = 132285.750000" 58" 52" = 133571.250000" 58 1/2" 52 1/2" = 134857.500000" 59" 53" = 136143.125000" 59 1/2" 53 1/2" = 137429.000000" 60" 54" = 138714.500000" 60 1/2" 54 1/2" = 140000.000000" 61" 55" = 141285.750000" 61 1/2" 55 1/2" = 142571.250000" 62" 56" = 143857.500000" 62 1/2"						
		DRAWN	DESIGNED	CHECKED	APPROVED	DRAWING/PART NOT REV
						2400-PC1-0002 0

|||||

3. Description Of connector pin

* MAIN MODULE *



* TERMINAL BLOCK *

TB1	
1	0V(POWER)
2	+ 12V(POWER)
3	GND
4	IN+ (RS-485)
5	IN-(RS-485)
6	OUT-(TXD)
7	OUT+ (RXD)

TB2	
1	RELAY-COM
2	RELAY OUT4
3	RELAY OUT3
4	RELAY OUT2
5	RELAY OUT1

TB3	
1	L/C GND
2	L/C SIG-
3	L/C SIG+
4	L/C EX+
5	L/C EX-

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4. Indicator Test

(1) How to Enter

- Turn on while pressing CAL switch on the back side
- Press ZERO/MODE key, and it will be moved to TEST MODE.

(2) Key Usage

-  key: Used to move to the next menu.

(3) Test Menu

- TEST 1 : LCD SCREEN TEST
- TEST 2 : A/D CONVERTER TEST
- TEST 3 : KEY TEST
- TEST 4 : SERIAL COMMUNICATION TEST

TEST 1

FUNCTION : LCD SCREEN TEST		
Key	Display	Description
 Key: Move to the next menu	zero=tEst Tare=Cal tEst 1 888888	The mode and key are displayed. Press ZERO key, and then it will be moved to Test mode. TEST 1 condition. All lamps on LCD SCREEN is turned on for testing. Press 

TEST 2

FUNCTION : A/D CONVERTER TEST(LOAD CELL TEST)		
Key	Display	Description
 KEY: Move to the next menu. ZERO KEY: Used to set the current value to '0'.	tEst 2 Digital value of current weight.	TEST 2 condition. This value means converting value under actual condition. Press 

NOTE. Check whether digital value is changing.
If the digital value is fixed or zero is displayed, please check the connection of load cell.

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TEST 3

FUNCTION : KEY TEST		
Key	Display	Description
 key: Move to the next menu. Others key : Test execution.	tEst 3 2	TEST 3 condition. Press the key to be tested and the No of key mode should be identify with code of key as the follows.

< KEY CODE >

KEY	CODE	KEY	CODE	KEY	CODE
LIGHT/PRINT	6	TARE	4	UNIT/HOLD	2
ZERO	5	NET/GROSS	3	CAL	1

NOTE. If you press UNIT/HOLD key, after checking key number, it will be automatically moved to TEST 4.

TEST 4

FUNCTION : KRS-232C test with computer(Serial port)		
Key	Display	Description
 key: Move to the next menu.	tES _t 4	TEST 4 condition.
Others keys : Execute data transmission to a computer.	-----	Waiting for transmission and reception.
	-----1	Received : none, Transmitted : 1
	2-----1	Received : 2, Transmitted : 1
	End	Press 
	8888888	When this test is completed, it is automatically moved to NORMAL MODE.

NOTE 1. Do this test after the connection of serial port of computer and serial port of indicator is done.

NOTE 2. Send No. 2 in computer keyboard and check if indicator receives No.2
Send No. 1 in indicator keyboard and check if computer receives No.1

NOTE 3. Do this test after baud rate is specified in SET MODE (F10).

5. Indicator Calibration

(1) How to enter

W

- Turn on while pressing CAL switch on the back side.
- Press TARE key and UNIT/HOLD key, and it will be moved to Calibration Mode.

(2) Key usage

- ☐  key: Increase the first place value by 1.
- ☐  key: Move to the left by 1 place.
- ☐  key: Used to be moved to the next menu.
- ☐ ZERO/MODE key: Used to set the current value to '0'.
- ☐ LIGHT/PRINT key: Used to escape at CAL mode.

(3) CAL Menu(CAL 1 - CAL 5)

- CAL 1 : Maximum Capacity
- CAL 2 : Minimum Division
- CAL 3 : Setting Weight
- CAL 4 : Zero CALibration
- CAL 5 : Span CALibration

CAL 1

FUNCTION : Maximum Capacity Set		
Range ---> From 1 to 99999		
Key	Display	Description
 key : Control division	CAL 1 ex) 100 10000	CAL 1 condition
 key : Control digit		Exgisting maximum capacity
 key : Store and move to the next menu		Setting maximum capacity
		Press  key

NOTE 1. The maximum capacity means the maximum weight that scale can measure.

NOTE 2. Do not input the resolution, there is no need to input the resolution which is automatically calculated.

NOTE 3. If you press  key, it will be moved to CAL 2.

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CAL 2

FUNCTION : Minimum Division Set		
Range ---> 0.001 ~ 50 kg		
Key	Display	Description
↑ key: Control division	CAL 2	CAL 2 condition
←key : Contorl digit	1	Existing minimum division
↵ key : Store and move to the next menu	0.01	Setting minimum division Press ↵ key

NOTE 1. The minimum division means the value of one division.

NOTE 2. External resolution is obtained by dividing the min. division

by the maximum capacity. Set the resolution to be within 1/10,000.

NOTE 3. The maximum capacity/minimum division is over 10,000, Error message ("CH 11")will occur.

NOTE 4. If you press ↵ key, it will be moved to CAL 4.

CAL 3

FUNCTION : Setting Weight In Span Calibration		
Range ---> 1 ~ Maximum Capacity of CAL 1		
Key	Display	Description
↑ key: Control division	CAL 3	CAL 3 condition
←key : Contorl digit	Maximum capacity value of CAL1. Setting maximum capacity value	
↵ key : Store and move to the next menu	ex) 100 10000 Uload	100 kg 10000 kg Press ↵ key

NOTE 1. The setting weight shall be within the range of 10% ~ 100%
of maximum weight.

NOTE 2. If the setting weight over the maximum capacity or under the 10% of the
maximum weight, Error message ("CH 12") will occur.

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CAL 4

FUNCTION : Zero Calibration		
Key	Display	Description
← key: Move to the next menu after completing zero calibration.	ULoAd — — —	Not being displayed CAL 4. Empty the platform and when LCD screen shows "ULOAD", press ← key. Under zero calibraion.

NOTE 1. After completing zero calibration, it will be automatically moved to CAL 5.

NOTE 2. If the zero value is too low or high, "CH13" will occur.

you lower the resolution and reset the zero calibration.

CAL 5

FUNCTION : Span Calibration		
Key	Display	Description
← key: Move to the initial menu	LoAd — — — END zero=tEst Tare=Cal END 888888	Load the weight which was set in CAL 3 and press ← key. Under SPAN calibration. Span calibration is terminated. It is automatically escaped from CAL mode. Press ← key. CAL mode is completed. Move to the initial menu automatically.

NOTE 1. "END" message is displayed and move to the initial menu when span calibration is completed.

NOTE 2. If the sapn value is too low or high, "CH14" will occur.

You lower the resolution and reset span calibration.

NOTE 3. After completing CAL mode, it will be moved to initail menu.

|||||

6. SET Mode

(1) How Enter

- If you press "LIGHT/PRINT" for 5 sec, it will be moved to SET MODE.
It is display "SET" message for 1 sec, and then automatically moved to F1.



(2) Available Keys

- ☐ key: Used to increase the first place of value by one.
- ☐ ← key: Used to move the inputted value to the left by one place.
- ☐ ↩ key: Used to move next menu after completing input value.
- ☐ LIGHT/PRINT : Used to escape from SET mode.

(3) Set Menu

GENERAL FUNCTION	
F1	Set weight Unit
F2	Auto Power OFF
F3	LIGHT/PRINT key usage
F4	Weight Backup
F5	Auto zero compensation range
F6	Digital Filter
RS232C COMMUNICATION FUNCTION	
F10	Designation of serial interface baud rate
F11	Designation of serial interface method
F12	Device ID
PRINTER FUNCTION	
F13	Using printer set
F14	Auto/Manual Print
F15	Print format setting
Automatic HOLD Function	
F16	Set start delay time
F17	Set initialization division
Relay Function	
F20	Relay Mode
Date, Time	
C1	Year
C2	Month
C3	Day
C4	Time
C5	Minute
C6	Second

GENERAL FUNCTION

F1

FUNCTION	Weight unit (It is set only in CAL mode)	
SET (00-01)	Display	Description
	F1-00	kg
	F1-01	lb

NOTE. Use this function depending on unit of weights which is used in CAL mode.

F2

FUNCTION	Auto power OFF function	
SET (00-03)	Display	Description
	F2-00	Auto power OFF is not used
	F2-01	Power off when the weight is not changed or no key pressing for 3 min.
	F2-02	Power off when the weight is not changed or no key pressing for 5 min.
	F2-03	Power off when the weight is not changed or no key pressing for 10 min.

NOTE. This function performs when the weight is stable or key isn't pressed.

F3

FUNCTION	LIGHT/PRINT key usage	
SET (00-04)	Display	Description
	F3-00	Only use as a BACK LIGHT key. Not use PRINT key.
	F3-01	BACK LIGHT always turns off. Only use as a PRINT key.
	F3-02	BACK LIGHT always turns on. Only use as a PRINT key.
	F3-03	If the weight change, BACK LIGHT will turn on. Only use as a PRINT key.
	F3-04	BACK LIGHT automatically operates depends on external light. Only use as a PRINT key.

F4

FUNCTION	Weight Backup	
SET (00-01)	Display	Description
	F4-00	Weight backup OFF
	F4-01	Weight backup ON

NOTE 1. In case of occurring sudden power failure, it can be memoried the moment value by this function.

NOTE 2. If the AC power is OFF suddenly and weight backup is ON, the scale recovers previous weight after the power is ON.

NOTE 3. On and Off are alternately displayed by pressing the numeric keys.

F5

FUNCTION	Automatic zero compensation	
SET (00-09)	Display	Description
	F5-00	No compensation
	F5-05	Compensation if it is gradually changed below 5 digit for 2 sec.
	F5-09	Compensation if it gradually changed below 9 digit for 2 sec.

F6

FUNCTION	Digital Filter	
SET (01-09)	Display	Description
	F6-01	high speed, weak vibration
	F6-09	low speed, strong vibration

RS232C COMMUNICATION

F10

FUNCTION	RS232C Baud rate set			
SET (00-03)	Display	Description	Display	Description
	F1000	2400	F1002	9600
	F1001	4800	F1003	19200

F11

FUNCTION	Output method	RS232C Data
SET (00-03)	Display	Description
	F1100	No data output
	F1101	Output data in state of stable & unstable
	F1102	Output data only in stable state
	F1103	Output data when data is required

NOTE 1. The default value is set to 0 at factory.

NOTE 2. It is available in case of setting 0 in F13.

NOTE 3. If Device ID(F12) is received in case of setting 3 in F11, weight data will be transmitted.

F12

FUNCTION	Device ID (Identification number of each indicator)	
SET (00-99)	Display	Description
	F1201	Device ID 01
	F1299	Device ID 99

PRINTER FUNCTION

F13

FUNCTION	Using printer set	
SET (00-02)	Display	Description
	F1300	Printer is not used
	F1301	FS-7000D, 7040P SERIAL
	F1302	ND-T102(THERMAL), ND-192(DOT)

F14

FUNCTION	Automatic print	
SET (00-01)	Display	Description
	F1400	Manual print - whenever you press the key, it will be printed.
	F1401	Automatic print - when the weight is stable or you press the key, it will be printed.

F15

FUNCTION	Print Form	
SET (00-02)	Display	Description
	F1500	Form 0
	F1501	Form 1
	F1502	Form 2

【 Form 0 】

Date, time

Weighing No, Net weight

☐1999. 1. 1 13:15 ☐
☐No.001 50.0 kg ☐
☐NO.002 100.0 kg ☐
☐NO.003 200.5 kg ☐

【 Form 1 】

Date, time

net weight

☐1999. 1. 1 13:15 ☐
☐NET : 50.0 kg ☐
☐NET : 100.0 kg ☐
☐NET : 200.5 kg ☐

【 Form 2 】

Date, time

Weighing No, Net weight

☐1999. 1. 1 13:17 ☐
☐001 : 1000.0 kg ☐
☐1999 1. 1 13:18 ☐
☐001 : 1000.0 kg ☐
☐1999 1. 1 13:19 ☐
☐001 : 2000.0 kg ☐

AUTOMATIC HOLD FUNCTION

F16

FUNCTION	Hold start start time (Only available in Automatic hold)	
SET (00-15)	Display	Description
	F1600	Hold operates without delay time
	F1607	If the weight change, Hold will operate after 14 sec
	F1615	If the weight change, Hold will operate after 30 sec

F17

FUNCTION	Set initializing division (Only available in automatic hold)	
SET (01-15)	Display	Description
	F1701	If it is swang over 2 division, it will be initialized.
	F1707	If it is swang over 14 division, it will be initialized
	F1715	If it is swang over 30 division, it will be initialized

RELAY FUNCTION

F20

FUNCTION	Relay Mode	
SET (00-01)	Display	Description
	F2000	Limit MODE
	F2001	Limit Type Checker Mode

(1) F2000 Limit Mode

Relay	Weight		Low limit	High limit	
	0 kg	80 kg	80 kg	100 kg	
ZERO (OUT 1)	 	 		 	ON OFF
LOW (OUT 2)					ON OFF
STABLE (OUT 3)	 				ON OFF
HIGH (OUT 4)	 	 		 	ON OFF

NOTE 1) ZERO RELAY(OUT 1) : If weight is under 5 division, this will be turned on.

NOTE 2) LOW, HIGH RELAY(OUT 2,3,4) : When weight is over 5 division, comparing with setting weight value and displaying weight value, it will be turned ON/OFF.

(2) F2001 Limit Type Checker Mode

Relay	Weight	Low limit High limit		
		0 kg	80 kg	100 kg
ZERO (OUT 1)	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐	☐ ☐	ON OFF
LOW (OUT 2)	☐	☐		ON OFF
NORMAL (OUT 3)	☐ ☐	☐	☐	ON OFF
HIGH (OUT 4)	☐ ☐	☐ ☐	☐	ON OFF

DATE, TIME SET

C1

FUNCTION	Set year	
SET (00-99)	Display	Description
	C1-00	2000 year

C2

FUNCTION	Set month	
SET (01-12)	Display	Description
	C2-01	January month

C3

FUNCTION	Set day	
SET (01-31)	Display	Description
	C3-01	1st day

C4

FUNCTION	Set time	
SET (00-23)	Display	Description
	C4-00	00 hour

C5

FUNCTION	Set minute	
SET (00-59)	Display	Description
	C5-59	59 minute

C6

FUNCTION	Set second	
SET (00-59)	Display	Description
	C6-59	59 second

NOTE 1. If you press "Enter"key after completing set mode, it will be moved to the initial menu of Set Mode.

NOTE 2. Press LIGHT/PRINT key, it will be moved to the NORMAL MODE.

7. Schematic Diagram

1) Analog module Schematic



- 16 - 이 문서는 한글과컴퓨터의 한글 2000으로 만들어진 문서입니다.



8. PCB Board Diagram

OF THE Board of Directors

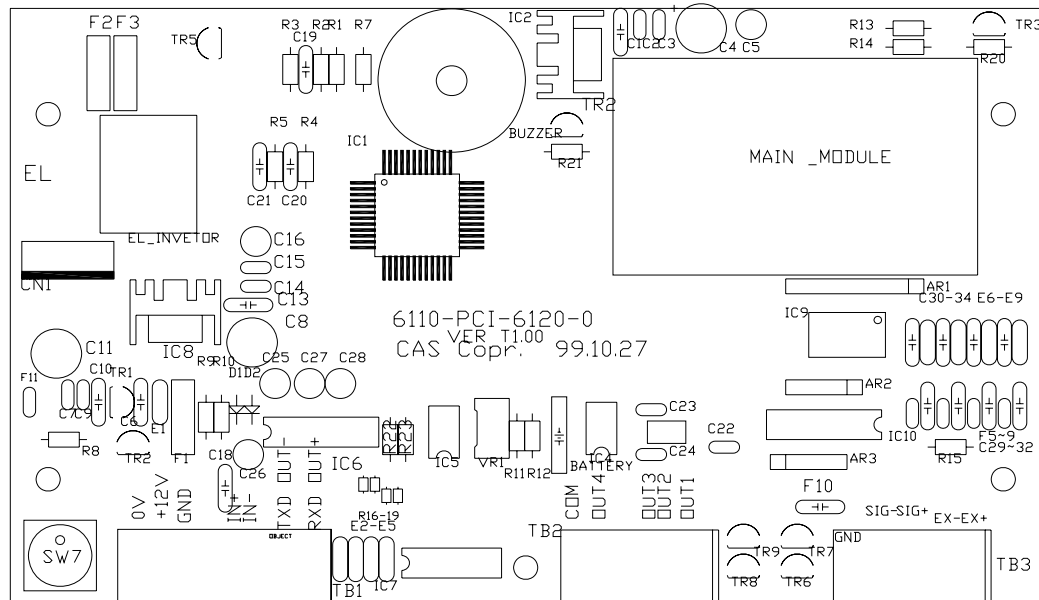
1) Main module PCB

(COMPONENT SIDE)

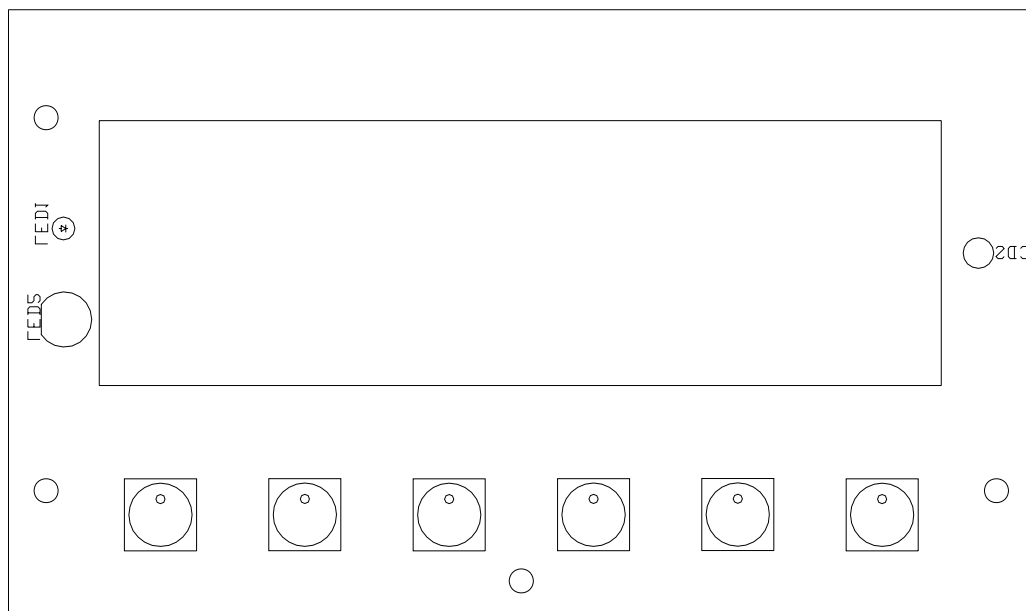


2) Display PCB

(COMPONENT SIDE)



(SOLDER SIDE)

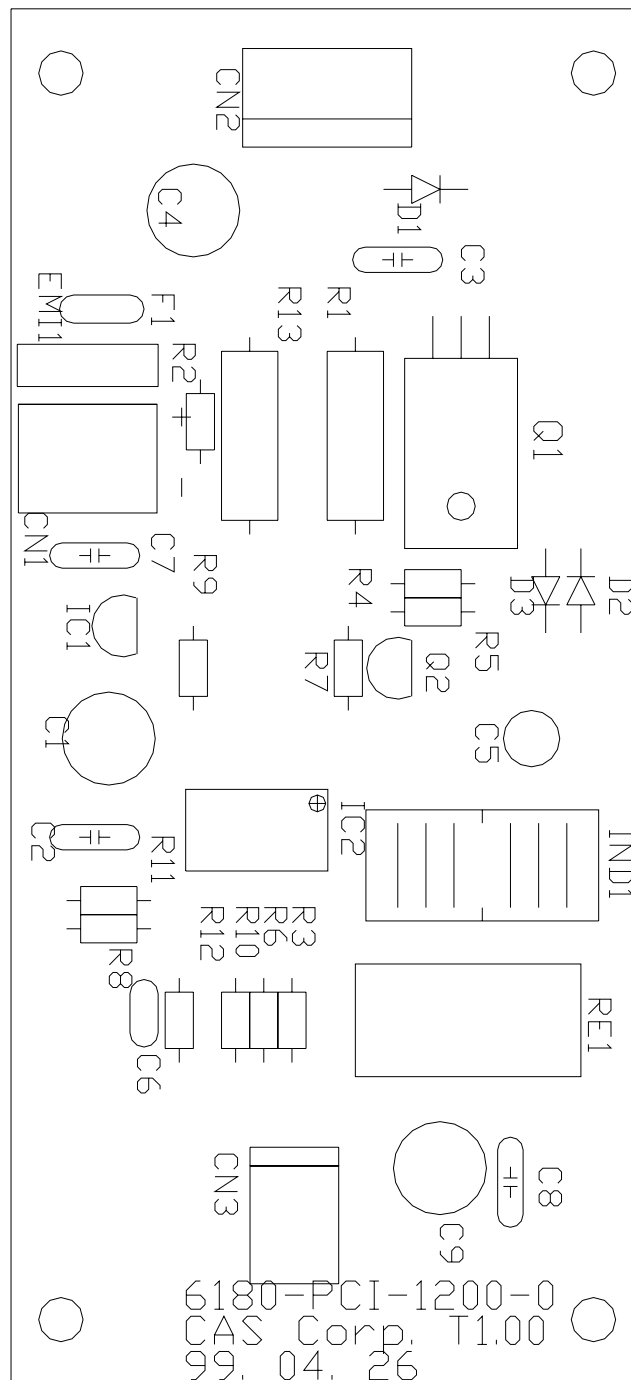


 SCALE					TITLE				DISPLAY PCB							
STANDARD TOLERANCE																
DIM	GRADE	EXACT	ORD.	ROUGH	CUSTOMER		CUSTOMER		DATE		FILE NAME				CI-2400BS	
0.5 ~	6	±0.02	±0.1	±0.2												
6 ~	30	±0.05	±0.2	±0.5												
30 ~	120	±0.08	±0.3	±0.8												
120 ~	350	±0.15	±0.5	±1.2												
350 ~	1000	±0.3	±0.8	±2.0												
1000 ~	2000		±1.2	±3.0							2400-PCI-0007				0	
2000 ~			±2.0	±5.0												





3) Charger PCB



SCALE		TITLE				CAS	
STANDARD TOLERANCE		CHAGER PCB				CI-2400BS	
BUM	GRADE	EXACT	DRD.	ROUGH	CUSTOMER	CUSTOMER	DATE
0.5 -	6	±0.02	±0.1	±0.2			
6 -	30	±0.05	±0.2	±0.5			
30 -	120	±0.08	±0.3	±0.8			
120 -	350	±0.15	±0.5	±1.2			
350 -	1000	±0.3	±0.8	±2.0			
1000 -	2000		±1.2	±3.0			
2000 -			±2.0	±5.0			
		DRAWN DESIGNED CHECKED APPROVED				DRAWING PART NO. REV	
						2400-PCI-0007 0	



9. Device Specification

1) AD 7714

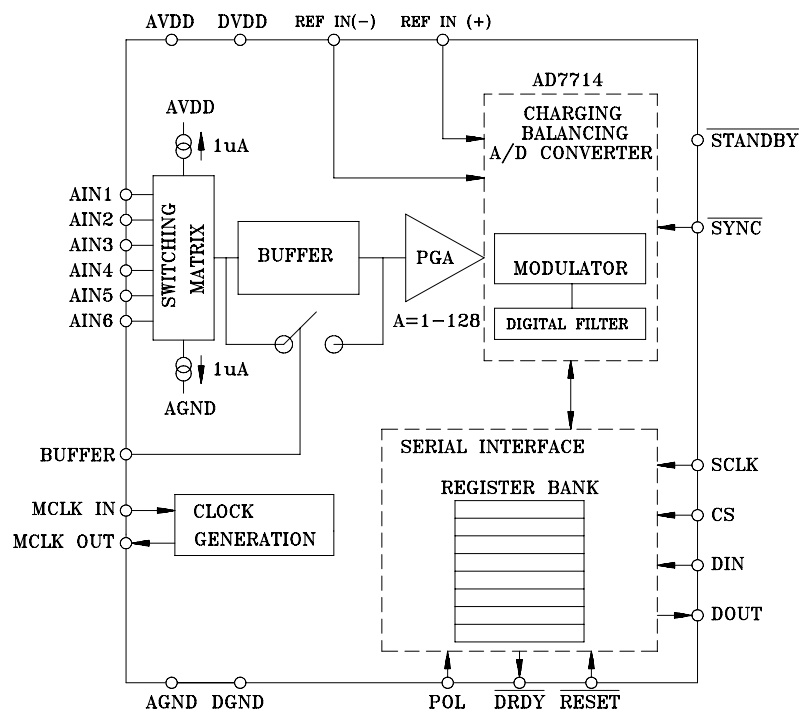
(3V/5V, CMOS, 500uA Signal Conditioning ADC)

FEATURES

Charge Balancing ADC
 24 Bits NO Missing Codes
 0.0015% Nonlinearity
 Five-Channel Programmable Gain
 Front End Gains from 1 to 128
 Can Be Configured as Three Fully
 Differential inputs or Five
 Pseudo-Differential inputs
 Three-Wire Serial interface
 3V(AD7714-3) or 5V(AD7714-5) Operation
 Low Noise(<150nV rms)
 Low Current(350μA typ)with Power-Down
 (5μA typ)
 Low-Pass Filter with Programmable Filter
 Cutoffs
 Ability to Read/Write Calibration
 Coefficients

PRODUCT HIGHLIGHTS

- 1.The AD7714 consumes less than 500μA (fCLKIN=2.5MHz)in total supply current, making it ideal for use in loop-powered systems.
- 2.The programmable gain channels allow the AD7714 to accept input signals directly from a strain gage or transducer removing a considerable amount of signal conditioning.
- 3.The AD7714 is ideal for microcontroller or DSP processor applications with a three-wire serial interface reducing the number of interconnect lines and reducing the number of opto-couplers required in isolated systems. The part contains on-chip registers that allow control over filter cutoff, input gain, channel selection, signal polarity and calibration modes.
- 4.The part features excellent static performance specifications with 24-bit no missing codes, $\pm 0.0015\%$ accuracy and low rms noise (140nV). End-point errors and the effects of temperature drift are eliminated by on-chip self-calibration, which removes zero-scale and full-scale errors.



2) LT1081

(5V Powered RS232 Driver/Receiver with Shutdown)

FEATURES

- Operates on Single 5V Power Supply
- Generates $\pm 9V$ Supplies with Only $1\mu F$ Capacitors
- Fully Protected Against Output Overloads
- RS232 Outputs can be Forced $\pm 30V$ without Damage
- Three-state Outputs are High Impedance when off
- Bipolar Circuitry; No Latch Up
- $\pm 30V$ Receiver input Range
- Can Power Additional RS232 Drivers such as LT1039
- No Supply Current in Shutdown
- Meets All RS232 Specifications
- 16Pin Version without Shutdown Available

APPLICATIONS

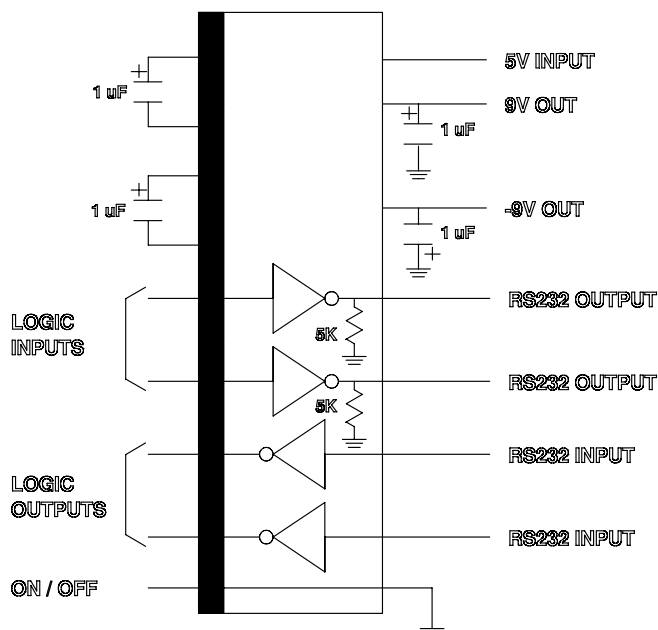
- RS232 interface
- Battery Powered Systems
- Power Supply Generator
- Terminals
- Modems

DESCRIPTION

The LT1080 is a dual RS232 driver/receiver which includes a capacitive voltage generator to supply RS232 voltage levels from a single 5V supply. Each receiver will accept up to $\pm 30V$ input and can drive either TTL or CMOS logic. The RS232 drivers accept logic inputs and output RS232 voltage levels. The driver outputs are fully protected against overload and can be shorted to ground or up to $\pm 30V$ without damage. Additionally, when the system is in the SHUTDOWN mode the driver and receiver outputs are at a high impedance allowing data line sharing. Bipolar circuitry makes this driver/receiver exceptionally rugged against overloads or ESD damage.

The power supply generator doubles the 5V input supply to obtain 9V, to obtain $-8.5V$. Up to 15mA of external current is available to power additional RS232 drivers or other external circuitry. The SHUTDOWN mode disables the supply generators and reduces input supply current to zero. A version of the LT1080, the LT1081, is available without shutdown for 16pin applications.

TYPICAL APPLICATION



PACKAGE

C1+	1	16	Vcc
V+	2	15	GND
C1-	3	14	T1OUT
C2+	4	13	R1IN
C2-	5	12	R1OUT
V-	6	11	T1IN
T2OUT	7	10	T2IN
R2IN	8	9	R2OUT



3) 74HC574

(OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS)

■ High-Current 3-state Noninverting outputs

Drive Bus Lines Directly or up to 15 LSTTL

Loads

■ Bus-Structured Pinout

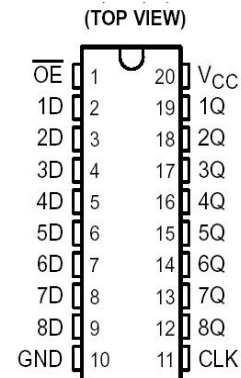
Description

These octal edge-triggered D-type flip-flops feature 3-state outputs designed specifically for bus driving.

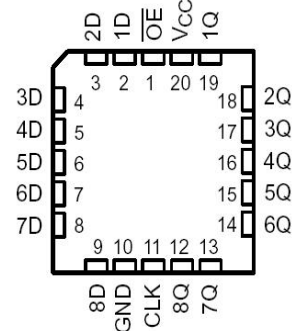
They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus driver, and working registers.

The eight flip-flops enter data on the low-to-high transition of the clock (CLK) input a buffered output-enable (OE) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or the high-impedance state. the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased provide the capability to drive bus lines without interface or pullup components.

OE does not affect the internal operation of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.



SN54HC574 ... FK PACKAGE
(TOP VIEW)

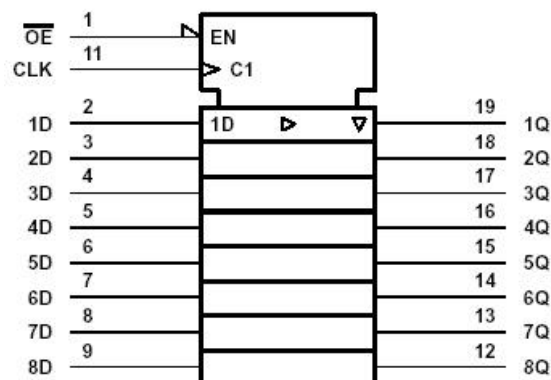


FUNCTION TABLE

(each flip-flop)

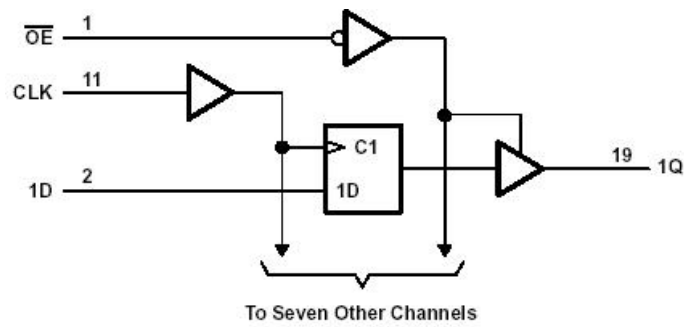
INPUTS			OUTPUTS
OE	CLK	D	
L	↑	H	H
L	↑	L	L
L	H or L	X	Q ₀
H	X	X	Z

logic symbol



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logic diagram(positive logic)



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4) H6060(Self Recovering Watchdog)

Features

- Self recovering watchdog function: reset goes active after the 1st timeout period, reset goes inactive again after the 2nd timeout period, repeated active reset signal until the system recovers
- Standard timeout period and power-on reset time(100ms), externally programmable if required.
- Unregulated DC monitoring(V_{IN}) with 3 standard or programmable trigger voltage for: power-on reset initialization, advanced power-fail warning (SAVE), reset at power-down(RES)
- Regulated DC monitoring (V_{DD}): power-on reset initialization enable only if V_{DD} 3.5V
- Internal voltage reference
- Works down to 1.6V supply voltage
- Push-pull or Open drain outputs
- Low current consumption
- Available for normal and extended temperature ranges
- DIP8 and S08 package

Description

The H6060 is a monolithic low-power CMOS device combining a programmable timer and a series of voltage comparators on the same chip. The device is specially suited for watchdog functions such as microprocessor and supply voltage monitoring. If the system malfunctions, the watchdog will recover it by issuing repeated active reset signal. The voltage monitoring part provides double security by combining both the unregulated voltage(V_{IN}) and the regulated voltage (V_{DD}) monitoring simultaneously. The H6060 initializes the power-on reset after V_{IN} reaches V_{SH} (see table 4) and V_{DD} rises above 3.v. If V_{IN} drops below V_{SL} (see table 4), the H6060 gives an advanced warning signal for register saving and if the voltage drops further below V_{RL} (see table 4), RES and RES go active. The H6060 functions at any supply voltage down to 1.6V and is therefore particularly suited for start-up and shut-down control of microprocessor systems.

Applications

- Microprocessor and microcontroller systems
- Point of sales equipment
- Telecom products
- Automotive subsystems

Typical Operating Configuration

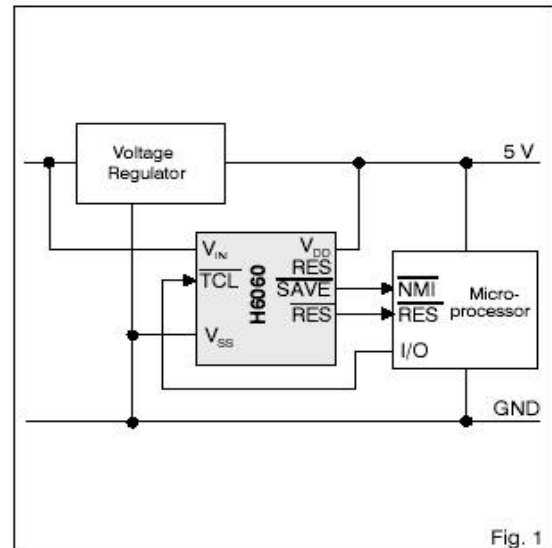


Fig. 1

Pin Assignment

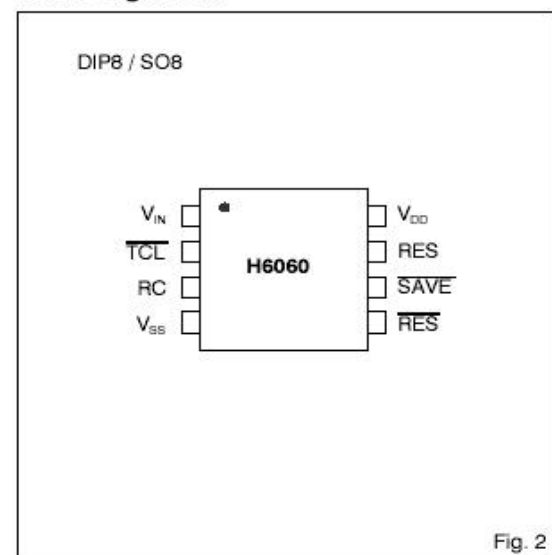


Fig. 2



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5) ICS1702

(Charge Controller for Nickel-Cadmium and Nickel-Metal Hydride Batteries)

General Description

The ICS1702 is a CMOS device designed for the intelligent charge control of either nickel-cadmium(Nicd)or nickel-metal hydride(Nimh) batteries. The controller uses a pulsed-current charging technique together with voltage slope and/or temperature slope termination. The ICS1702 employs a four stage charge sequence that provides a complete recharge without overcharging. The controller has nine user-selectable charge rates and six user-selectable auxiliary modes available for customized charging systems.

The ICS1702 monitors for the presence of a battery and begins charging when a battery is installed. Voltage and temperature are measured to ensure a battery is without fast charge conditions before charge is initiated

Applications

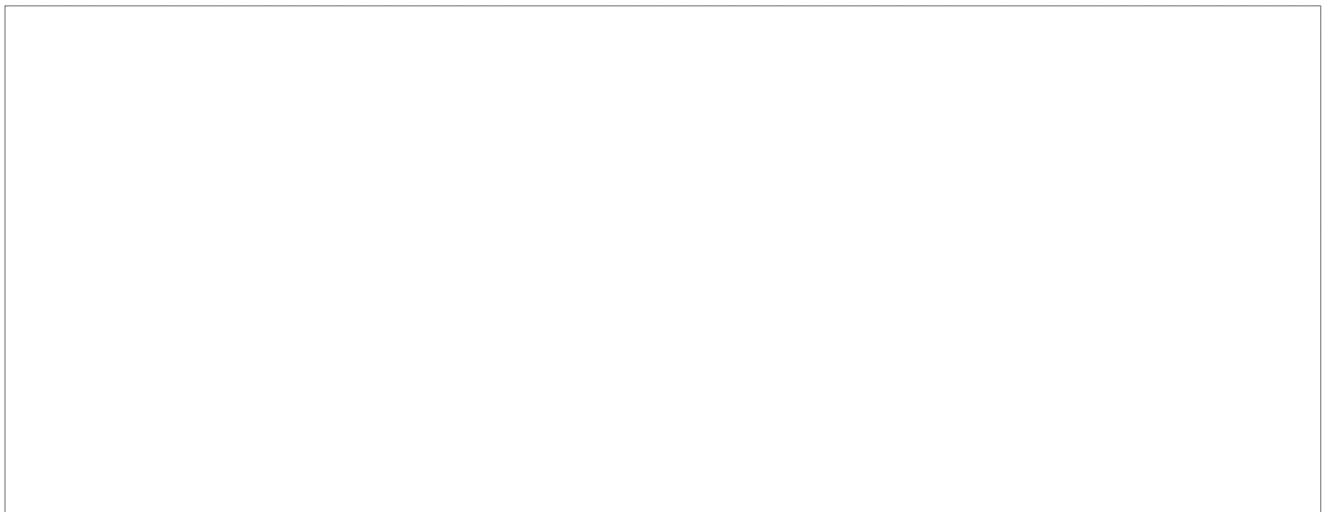
Battery charging systems for.

- Portable consumer electronics
- Power tools
- Audio/video equipment
- Communications equipment

Features

- * Multiple charge termination methods include:
 - Voltage slope
 - Temperature slope
 - Maximum temperature
 - Charge times
- * Four stage charge sequence
 - Soft start charge
 - Fast charge
 - TOPPING charge
 - maintenance charge
- * Reverse-pulse charging available in all charge stages
- * Nine programmable charge rates between 15 minutes(4C) and four hours (C/4)
- * Out-of-temperature range detection
 - Hot battery : charger shutdown
 - Cold battery : low current charge
- * Continuous polling mode for battery detection
- * Six auxiliary modes include :
 - Discharge-before-charge
 - Ten hour c/10 conditioning charge
 - Direct to c/40 maintenance charge
 - Charging systems test provided through controller
- * Adjustable open circuit (no battery) voltage reference

Block Diagram



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[illegible]

Pin Number	Pin Name	Type	Definition
1	CHG	OUT	Active high TTL compatible signal used to turn on an external current source to provide current to charge to battery
2	DCHG	OUT	Active high TTL compatible signal available to turn on a discharge circuit
3	PFN	OUT	polling detect indicator An active low turns on an external indicator to show the controller is polling for the presence of the battery
4	MMN	OUT	Maintenance mode indicator,. An active low turns on an external indicator showing the battery is either in the topping charge, maintenance charge or auxiliary condition mode. This signal is also applied with the out-of-temperature range indicator when the controller is in a cold battery charge mode. The indicator flashes during the auxiliary discharge mode.
5	CMN	OUT	Charge mode indicator. An active low turns on an external indicator to show the controller is either in a soft start charge or fast charge.
6	OTN	OUT	Out-of-temperature range indicator . An active low turns on an external indicator showing the battery is out of the normal fast charge temperature range.
7	SEL0	IN	Tri-level input used with the SEL1 pin to program the device for the desired charge rate
8	VSS		Ground
9	AVSS		Ground
10	SEL1	IN	Tri-level input used with the SEL0 pin to program the device for the desired charge rate
11	MRN	IN	Master reset signal. A logic low pulse greater than 700 ms initiates a device reset
12	RC	IN	An external resistor and capacitor sets the frequency of the internal clock.
13	DTSEL	IN	Selects temperature slope and/or voltage slope termination
14	AUX0	IN	Tri-level input used with the AUX1 pin to program the divice for an auxiliary operation mode.
15	AUX1	IN	Tri-level input used with the AUX0 pin to program the divice for an auxiliary operation mode.
16	THERM	IN	Thermistor or thermal switch input for temperature sensing.
17	OPREF	IN	Open circuit (no battery) voltage reference. An external resistor divider on this pin sets the open circuit voltage reference used to one detect the presence of a battery
18	VIN	IN	battery voltage normalized to one cell with an external resistor divider
19	unused		Ground
20	VDD		Device supply = +5.0 VDC



6) OP177 (Operational Amplifier)

FEATURES

Ultralow Offset Voltage:

$T_A = +25^\circ\text{C}$: $20\mu\text{V}$ max

-55°C T_A $+125^\circ\text{C}$: $20\mu\text{V}$ max

Outstanding Offset Voltage Drift: $0.1\mu\text{V}/^\circ\text{C}$ max

Excellent Open-Loop Gain Linearity:

$12\text{V}/\mu\text{V}$ typ

CMRR: 130dB min

PSRR: 120 dB min

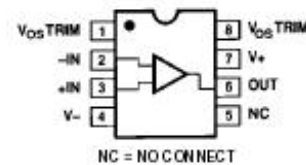
Low Supply Current : 2.0 mA max

Fits Industry Standard Precision Op Amp Sockets

PIN CONNECTIONS

Epoxy Mini-DIP
(P Suffix)

8-Pin Hermetic DIP
(Z-Suffix)
8-Pin SO
(S-Suffix)



GENERAL DESCRIPTION

The OP177 features the highest precision performance of any op amp currently available.

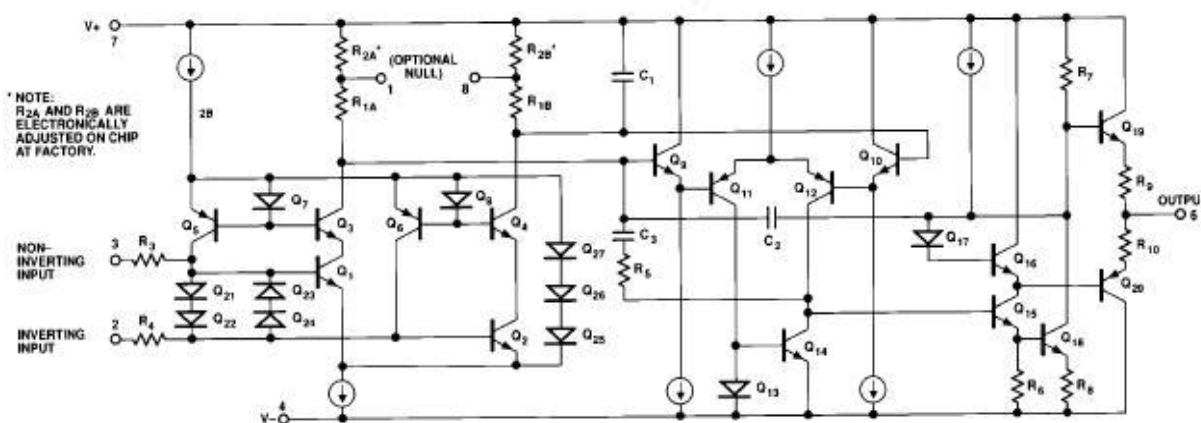
Offset voltage of the OP177 is only 10V max at room temperature and 20V max over the full military temperature range of -55°C to $+125^\circ\text{C}$. The ultralow V_{OS} of the OP177, combines with its exceptional offset voltage drift (TCV_{OS}) of $0.1\text{ V}/^\circ\text{C}$ max, to eliminate the need for external V_{OS} adjustment and increases system accuracy over temperature.

The OP177's open-loop gain of $12\text{V}/\text{V}$ is maintained over the full 10V output range CMRR of 130 dB min, PSRR of 120 dB min, and maximum supply current of 2 mA are just a few examples of the excellent performance of this operational amplifier. The OP177's combination of outstanding specifications insure accurate performance in high closed-loop gain applications.

This low noise bipolar input op amp is also a cost effective alternative to chopper-stabilized amplifiers. The OP177 provides chopper-type performance without the usual problem of high noise, low frequency chopper spikes, large physical size, limited common-mode input voltage range, and bulky external storage capacitors.

The OP177 is offered in both the -55°C to $+125^\circ\text{C}$ military, and the -40°C to $+85^\circ\text{C}$ extended industrial temperature range. The product is available in 8-pin ceramic and epoxy DIPs, as well as the space saving 8-pin Small-outline (SO) and the leadless Chip Carrier (LCC) packages.

Simplified Schematic



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7) μ PD7225 (MOS INTEGRATED CIRCUIT)

PROGRAMMABLE LCD CONTROLLER/DRIVER

The μ PD7225 is a software-programmable LCD (Liquid Crystal Display) controller/driver. The μ PD7225 can be serially interfaced with the CPU in a microcomputer and can directly drive 2,3,or 4-time division LCD.

The μ PD7225 contains a segment decoder which can generate specific segment patterns. In addition, the μ PD7225 can be used to control on/off(blinking) operation of a display

FEATURES

- * Can directly drive LCD
- * Programmable time-division multiplexing
 - Static drive
 - Divide-by-2,3, or-4 time division multiplexing
- * Number of digits displayed
 - 7-segment
 - Diviide-by-4 time division 16 digits
 - Diviide-by-3 time division 10 2/3 digits
 - Diviide-by-2 time division 8 digits
 - Static 4 digits
 - 14-segment
 - Diviide-by-4 time division 8 digits
- * Bias method
 - Static, 1/2, 1/3
- * Segment decoder output
 - 7-segment : Numeric characters 0 to 9, six symbols
 - 14-segment : 36 alphanumeric characters, 13 symbols
- * Blinking operation
- * Multi-chip configuration possible
- * 8-bit serials interface
 - 75X series and 78K compatible
- * CMOS
- * Single power supply

ORDERING INFORMATION

Part Number	Package
μ PD7225G00	52-pin plastic QFP (14 14mm)
μ PD7225G01	52-pin plastic QFP (straight) (14mm)
μ PD7225GB-3B7	56-pin plastic QFP (10 10mm)
μ PD7225GC-AB6	52-pin plastic QFP (14 14mm)

The information in this document is subject to change without notice. before using this document, please confirm that this is latest version.

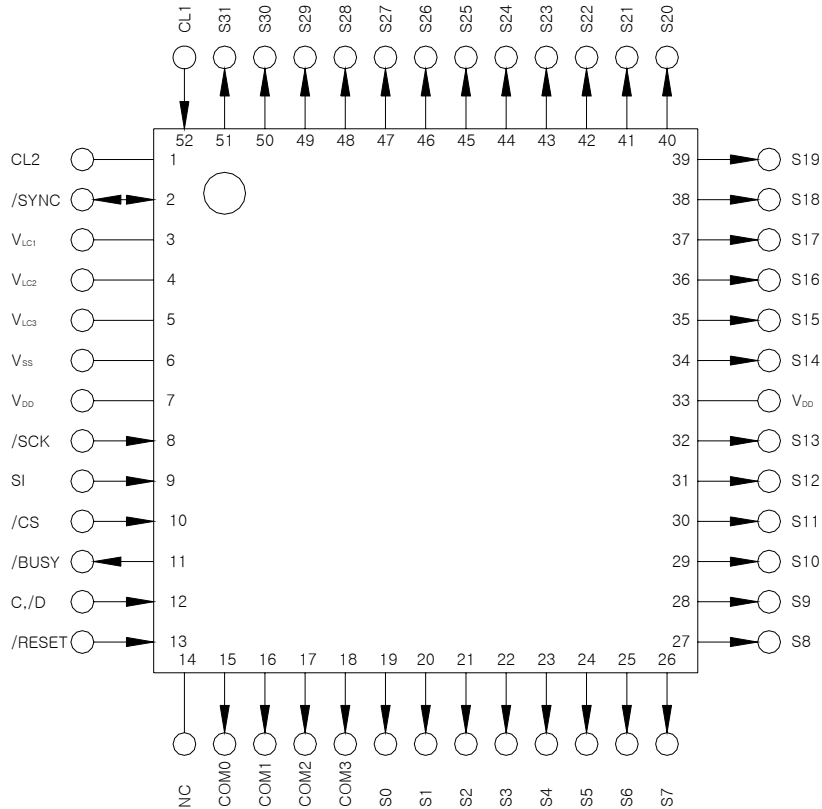
Not all devices/types available in every country, Please check with local NEC representative for availability and information.

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PIN CONFIGURATION: (Top View)

μ PD7225G00 52-pin plastic QFP (14 14mm)
 μ PD7225G01 52-pin plastic QFP (straight) (14mm)
 μ PD7225GC-AB6 52-pin plastic QFP (14 14mm)



SI	: Serial Input	CL1	: External Resistor 1(External Clock)
/SCK	: Serial Clock	CL2	: External Resistor 2
C,/D	: Command/Data	RESET	: Reset
/CS	: Chip Select	V _{LC1} ~V _{LC3}	: Power Supply for LCD Drive
/BUSY	: Busy	V _{DD}	: Power Supply
SYNC	: Sync	V _{SS}	: Ground
S0~S31	: Segment	IC	: Internally Connected
COM0~COM3	: common		
NC	: Non-connection		





8) DS1302 (Trickle Charge Timekeeping Chip)

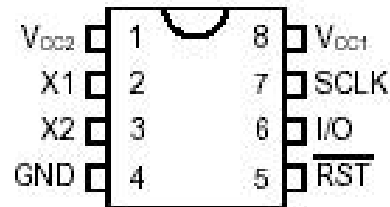
FEATURES

- Real time clock seconds, minutes hours, date of the month, day of the week, and year with leap year compensation valid up to 2100
- 31×8 RAM for scratchpad data storage
- Serial I/O for minimum pin count
- 2.0–5.5V full operation
- Uses less than 300 nA at 2.0V
- Single-byte or multiple-byte (burst mode) data transfer for read or write of clock or RAM data
- 8-pin DIP or optional 8-pin SOICs for surface mount
- Simple 3-wire interface
- TTL-compatible ($V_{CC}=5V$)
- Optional industrial temperature range $-40^{\circ}C$ to $+85^{\circ}C$
- DS1202 compatible
- Recognized by Underwriters Laboratory

PIN DESCRIPTION

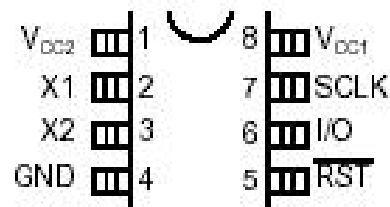
X1,X2	- 32.768 kHz Crystal Pins
GND	- Ground
RST	- Reset
I/O	- Data Input/Output
SCLK	- Serial Clock
V_{CC1} , V_{CC2}	- Power Supply Pins

PIN ASSIGNMENT



DS1302

8-Pin DIP (300 mil)



DS1302S 8-Pin SOIC (200 mil)

DS1302Z 8-Pin SOIC (150 mil)

DESCRIPTION

The DS1302 Trickle Charge Timekeeping Chip contains a real time clock/calendar and 31 bytes of static RAM. It communicates with a microprocessor via a simple serial interface. The real time clock/calendar provides seconds, minutes, hours, day, month, and year information. The end of the month date is automatically adjusted for months with less than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with an AM/PM indicator. Interfacing the DS1302 with a microprocessor is simplified by using synchronous serial communication. Only three wires are required to communicate with the clock/RAM : (1)RST (Reset), (2)I/O (Data line), and (3)SCLK (Serial clock). Data can be transferred to and from the clock/RAM 1 byte at a time or in a burst of up to 31 bytes. The DS1302 is designed to operate on very low power and retain data and clock information on less than 1 microwatt.

The DS1302 is the successor to the DS1202. In addition to the basic timekeeping functions of the DS1202, the DS1302 has the additional features of dual power pins for primary and back-up power supplies, programmable trickle charger for V_{CC1} , and seven additional bytes of scratchpad memory.

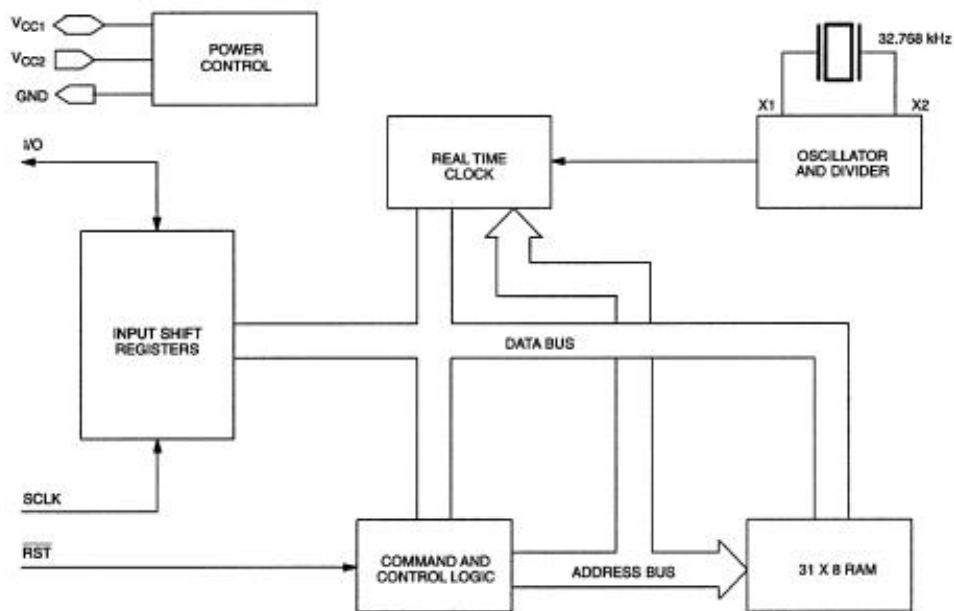
OPERATION

The main elements of the Serial Timekeeper are shown in Figure 1 : shift register, control logic, oscillator, real time clock, and RAM.



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BLOCK DIAGRAM



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9) AT24C164 (2-Wire Serial EEPROM)

FEATURES

- Low voltage and Standard Voltage Operation
 - 5.0(Vcc = 4.5V to 5.5V)
 - 2.7(Vcc = 2.7V to 5.5V)
 - 2.5(Vcc = 2.5V to 5.5V)
 - 1.8(Vcc = 1.8V to 5.5V)
- Internally Organized 2048×8(16K)
- 2-Wire Serial Interface
- Schmitt Trigger, Filtered Inputs for Noise Suppression
- Bidirectional Data Transfer Protocol
- 100 kHz (1.8V, 2.5V, 2.7V) and 400 kHz (5V) Compatibility
- Write Protect Pin for Hardware Data Protection
- Cascadable Feature Allows for Extended Densities
- 16-Byte Page Write Mode
- Partial Page Writes Are Allowed
- Self-Timed Write Cycle (10ms max)
- High Reliability
 - Endurance : 1 Million Write Cycles
 - Data Retention : 100Years
 - ESD Protection : >3,000V
- Automotive Grade and Extended Temperature Devices Available
- 8-Pin JEDEC SOIC and 8-Pin PDIP Packages

DESCRIPTION

The AT24C164 provides 16,384 bits of serial electrically erasable and programmable read only memory (EEPROM) organized as 2048 words of 8 bits each. The device's cascadable feature allows up to eight devices to share a common 2-wire bus. The device is optimized for use in many industrial and commercial applications where low power and low voltage operation are essential. The AT24C164 is available in space saving 8-pin PDIP and 8-pin SOIC packages and is accessed via a 2-wire serial interface. In addition, this device is available in 5.0V (4.5V to 5.5V), 2.7V (2.7V to 5.5V), 2.5V (2.5V to 5.5V) and 1.8V (1.8V to 5.5V) versions.

PIN CONFIGURATIONS

Pin Name	Function
A0~A2	Address Inputs
SDA	Serial Data
SCL	Serial Clock Input
WP	Write



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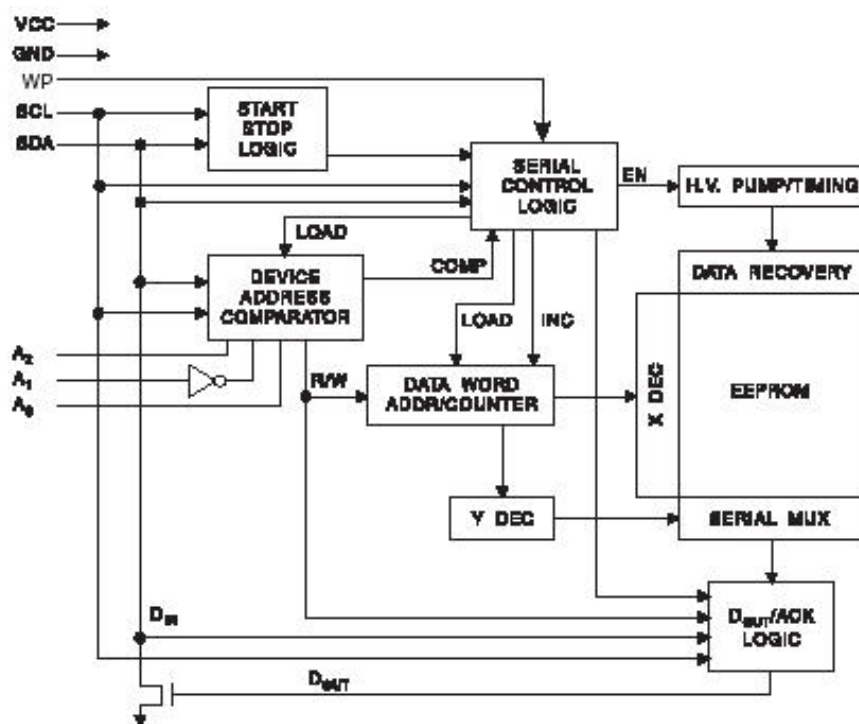


Absolute Maximum Ratings*

Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Voltage on Any Pin with Respect to Ground	-1.0V to +7.0V
Maximum Operating Voltage	6.25V
DC Output Current	5.0mA

*NOTICE : Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Block Diagram



Pin Description

SERIAL CLOCK (SCL) : The SCL input is used to positive edge clock data into each EEPROM device and negative edge clock data out of each device.

SERIAL DATA (SDA) : The SDA pin is bidirectional for serial data transfer. This pin is open-drain driven and may be wire-ORed with any number of other open-drain or open collector devices.

DEVICE SELECT (A2, A1, A0) : The A2, A1 and A0 pins are device address inputs that may be harwired or actively driven to V_{DD} or V_{SS} . These inputs allow the selection for one of eight possible devices sharing a common bus. The AT24C164 can be compatible with the AT24C16 by tying A2, A1 and A0 to V_{SS} . Device addressing is discussed in detail in the device addressing section.

WRITE PROTECT (WP) : The write protect input, when tied low to GND, allows normal write operations.

Memory Organization

The AT24C164 is internally organized with 256 pages of 8 bytes each. Random word addressing requires an 11 bit data word address.





10) BQ2031 (Lead-Acid Fast-Charge IC)

FEATURES

- ▶ Conforms to battery manufacturers' charge recommendations for cyclic and float charge
- ▶ Pin-selectable charge algorithms
 - Two-Step Voltage with temperature-compensated constant-voltage maintenance
 - Two-Step Current with constant-rate pulsed current maintenance
 - Pulsed Current Lhysteretic, on-demand pulsed current
- ▶ Pin-selectable charge termination by maximum voltage, Δ^2V , minimum current, and maximum time
- ▶ Pre-charge qualification detects shorted, or damaged cells and conditions battery
- ▶ Charging continuously qualified by temperature and voltage limits
- ▶ Internal temperature-compensated voltage reference
- ▶ Pulse-width modulation control
 - Ideal for high-efficiency switch-mode power conversion
 - Configurable for linear or gated current use
- ▶ Direct LED control outputs display charge status and fault conditions

GENERAL DESCRIPTION

The bq2031 Lead-Acid Fast Charge IC is designed to optimize charging of lead-acid chemistry batteries. A flexible pulse-width modulation regulator allows the bq2031 to control constant-voltage, constant-current, or pulsed-current, charging. The regulator frequency is set by an external capacitor for design flexibility. The switch-mode design keeps power dissipation to a minimum for high charge current applications. A charge cycle begins when power is applied or the battery is replaced. For safety, charging is inhibited until the battery voltage is within configured limits. If the battery voltage is less than the low-voltage threshold, the bq2031 provides trickle-current charging until the voltage rises into the allowed range or an internal timer runs out and places the bq2031 in a Fault condition.

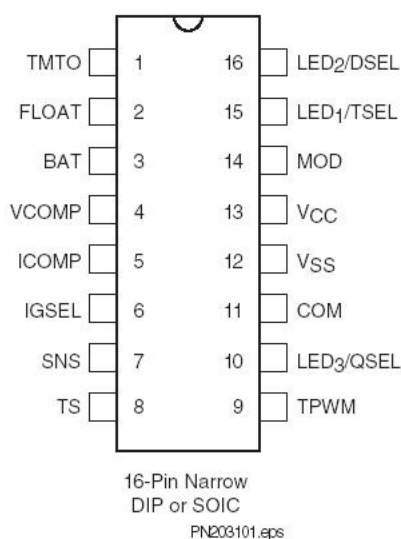
This procedure prevents high-current charging of cells that are possibly damaged or reversed. Charging is inhibited anytime the temperature of the battery is outside the configurable, allowed range. All voltage thresholds are temperature-compensated.

The bq2031 terminates fast (bulk) charging based on the following.

- Maximum voltage
- Second difference of cell voltage. (Δ^2V)
- Minimum current (in constant-voltage charging)
- Maximum time-out(MTO)

After bulk charging, the bq2031 provides temperature-compensated maintenance (float) charging to maintain battery capacity.

Pin Connections



Pin Names

TMT0	Time-out timebase input	LED ₃ /	Charge status output 3/
FLOAT	State control output	QSEL	Charge algorithm select input 1
BAT	Battery voltage input	COM	Common LED output
VCOMP	Voltage loop comp input	V _{SS}	System ground
ICOMP	Current loop comp input	V _{CC}	5.0V±10% power
IGSEL	Current gain select input	MOD	Modulation control output
SNS	Sense resistor input	LED ₁ /	Charge status output 1/
TS	Temperature sense input	TSEL	Charge algorithm select input 2
TPWN	Regulator timebase input	LED ₂ /DSEL	Charge status output 2/ Display select input





PIN DESCRIPTIONS

TMTO	Time-out timebase input This input sets the maximum charge time. The resistor and capacitor values are determined using equation 6. Figure 9 shows the resistor / capacitor connection.	TPWM	Regulation timebase input This input uses external timing capacitor to ground the pulse-width modulation (PWM) frequency. See equation 9.
	Float state control output This open-drain output uses an external resistor divider network to control the BAT input voltage threshold (V_{FLT}) for the float charge regulation. See Figure 1.		Common LED output Common output for LED1–3. This output is in a high-impedance state during initialization to read program inputs on TSEL, QSEL, and DSEL.
FLOAT	Battery voltage input BAT is the battery voltage sense input. This potential is generally developed using a high-impedance resistor divider network connected between the positive and the negative terminals of the battery. See Figure 6 and equation 2.	COM	
BAT		QSEL	Charge regulation select input With TSEL, selects the charge algorithm. See Table 1.
VCOMP	Voltage loop compensation input This input uses an external C or R–C network for voltage loop stability.	MOD	Current-switching control output MOD is a pulse-width modulated push/pull output that is used to control the charging current to the battery. MOD switches high to enable current flow and low to inhibit current flow.
IGSEL	Current gain select input This three-state input is used to set I_{MIN} for fast charge termination in the Two-Step Voltage algorithm and for maintenance current regulation in the Two-Step Current algorithm. See Tables 3 and 4.	LED _{1~3}	Charger display status 1–3 outputs These charger status output drivers are for the direct drive LED display. Display modes are shown in Table 2.
	Current loop compensation input This input uses an external C or R–C network for current loop stability.		These output are tri-stated during initialization so that QSEL, TSEL, and DSEL can be read.
ICOMP	Charging current sense input Battery current is sensed via the voltage developed on this pin by an external sense resistor, RSNS, connected in series with the low side of the battery. See equation 8.	DSEL	Display select input This three-level input controls the LED1–3 charge display modes. See Table 2.
SNS	Temperature sense input This input is for an external battery temperature monitoring thermistor or probe. An external resistor divider network sets the lower and upper temperature thresholds. See Figures 7 and 8 and equations 4 and 5.	TSEL	Termination select input With QSEL, selects the charge algorithm. See Table 1.
TS		V _{CC}	V_{CC} supply 5.0V, ±10% power
		V _{SS}	Ground

FUNCTIONAL DESCRIPTION

The bq2031 functional operation is described in terms of :

- Charge algorithms
- Charge qualification
- Charge status display
- Voltage and current monitoring



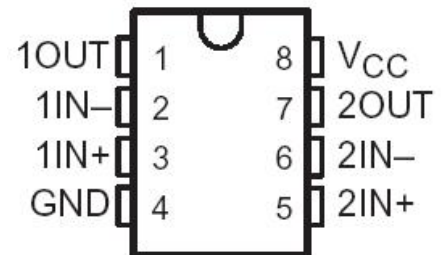
■ Temperature monitoring

11) LM393 (Dual differential comparators)

Feature

- Single Supply or Dual Supplies
- Wide Range of Supply Voltage ... 2V to 36V
- Low Supply-Current Drain Independent of Supply Voltage ... 0.4mA Typ Per Comparator
- Low Input Bias Current ... 25nA Typ
- Low Input Offset Current ... 3nA Typ (LM193)
- Low Input Offset Current ... 2mV Typ
- Common-Mode Input Voltage Range Includes Ground
- Differential Input Voltage Range Equal to Maximum-Rated Supply Voltage ... $\pm 36V$
- Low Output Saturation Voltage
- Output Compatible With TTL, MOS, and CMOS

D, JG, P, OR PW PACKAGE
(TOP VIEW)

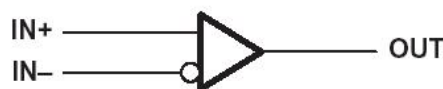


Description

These devices consist of two independent voltage comparators that are designed to operate from a single power supply over a wide range of voltages. Operation from dual supplies also is possible as long as the difference between the two supplies is 2V to 36V, and VCC is at least 1.5V more positive than the input common-mode voltage. Current drain is independent of the supply voltage. The outputs can be connected to other open-collector outputs to achieve wired -AND relationships.

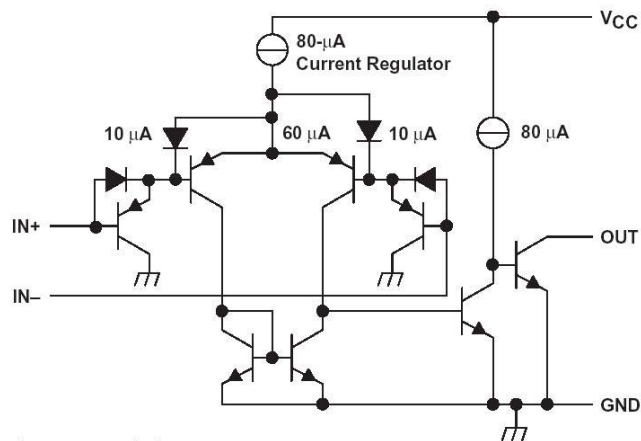
The LM193 is characterized for operation from -55°C to 125°C . The LM293 and LM293A are characterized for operation from -25°C to 85°C . The LM393 and LM393A are characterized for operation from 0°C to 70°C . The LM2903 and LM2903Q are characterized for operation from -40°C to 125°C and are manufactured to demanding automotive requirements.

Logic Diagram



Schematic (Each comparators)

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COMPONENT COUNT	
Epi-FET	1
Diodes	2
Resistors	2
Transistors	30

1 0 .
Software
Flow Chart

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11. Parts list

1) MODULE P.C.B

NO	Part Code	Part Name	Specification	Q'TY	Unit	REMARK
1	6121PCI6090A	MAIN P.C.B	6121-PCI-6090-A	1	EA	VER T1.00
2	6200IPU97580	IC (CPU)	GMS97C58	1	EA	IC1
3	6205IS024160	IC (EEP-ROM)	AT24C164	1	EA	IC5
4	6210IS060600	IC (RESET)	H6060-15	1	EA	IC6
5	6214I007714A	IC	AD-7714AN-5	1	EA	IC4
6	6240I0001770	IC (OP-AMP)	OP-177-FZ	2	EA	IC2,3
7	6260I0000400	IC SOCKET	40PIN	1	EA	SOCKET OF IC1
8	7010ZM002450	CRYSTAL	2.4576MHZ	1	EA	Y2
9	7010ZM011050	CRYSTAL	11.0592MHZ	1	EA	Y1
10	6527ID300470	RESISTOR 1/10W	RR1220P-472D(4.7k Ω)	2	EA	R1,2
11	6527ID301000	RESISTOR 1/10W	RR1220P-103D(10k Ω)	2	EA	R3,4
12	6712CHP03000	CHIP CONDENSER	CL21F 300 JBNC	4	EA	C4,5
13	6712CHP01040	CHIP CONDENSER	CL21F 104 MBNC	7	EA	C1,2,3,6,7,8,12
14	6702CAP01060	CHIP TANTAL	10MCS 106 MB TER	1	EA	C9
15	7810C0092940	CONNECTOR	929400-40 (MALE)	1	EA	CN1~5
16	6540LA300100	PRECISION RESISTOR	FLAY 1K000B	1	EA	R7
17	6540LA302050	PRECISION RESISTOR	FLAY 20K500B	2	EA	R5,6

2) DISPLAY P.C.B

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CAS INDICATOR

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NO	Part Code	Part Name	Specification	Q'TY	Unit	REMARK
17	6704C5000010	ELECTRONIC_CONDENSER	1uF/50V	4	EA	C25~28
18	6704C1602200	ELECTRONIC_CONDENSER	220uF/16V	2	EA	C4,8
19	6704C2504700	ELECTRONIC_CONDENSER	470uF/25V	1	EA	C11
20	6700C1600100	TANTAL_CONDENSER	10uF/16V	2	EA	C5,16
21	6294IS041480	SWICHING-DIODE	1N4148P	2	EA	D1,2
22	6515CJ000220	RESISTOR ¼W	CFR 2.2Ω(±5%)	1	EA	R5
23	6515CJ300200	RESISTOR ¼W	CFR 2kΩ(±5%)	1	EA	R8
24	6515CJ300470	RESISTOR ¼W	CFR 4.7kΩ(±5%)	3	EA	R7,13,21
25	6515CJ300510	RESISTOR ¼W	CFR 5.1kΩ(±5%)	3	EA	R2~4
26	6515CJ301000	RESISTOR ¼W	CFR 10kΩ(±5%)	4	EA	R11,12,22,23
27	6515CJ302000	RESISTOR ¼W	CFR 20kΩ(±5%)	1	EA	R14
28	6515CJ302200	RESISTOR ¼W	CFR 22kΩ(±5%)	1	EA	R9
29	6515CJ308200	RESISTOR ¼W	CFR 82kΩ(±5%)	1	EA	R10
30	6515CJ318000	RESISTOR ¼W	CFR 180kΩ(±5%)	1	EA	R1
31	6505MC351000	RESISTOR ¼W	MFR 510kΩ(±0.25%)-C	1	EA	R15
32	7010ZK032760	CRYSTAL	32.768KHZ	1	EA	Y1
33	1050A0002000	HEAT SINK	SY-200	2	EA	
34	6800F0035800	EMI BAED FILTER	BFS-3580 AO ψ3.5*8	9	EA	F1~3,5~8,10,11
35	6800F0002200	EMI FILTER	220pF (TDK)	9	EA	E1~9
36	7244D0000050	EL INVERTER	SPEL-I-5C	1	EA	
37	7222D0001350	EL BACK LIGHT	EL-12C	1	EA	
38	7212D001041A	LCD	90043-T/F	1	EA	
39	7600STA12120	TACT S/W	12*12	7	EA	SW
40	7520P0012200	NI-CD BATTERY	ML1220-HZ1	1	EA	BATTERY
41	7232D0003000	LED LAMP	BVL-300E5G	1	EA	LED1
42	7232DRG00030	LED LAMP	ψ3-(R,G)BL-BVT(ANODE)	1	EA	LED2
43	7002Z0000500	BUZZER	SL1I-12FsP	1	EA	BUZZER
44	6550MO902230	NETWORK RESISTOR	M9-1-223J	1	EA	AR1
45	6550MO501020	NETWORK RESISTOR	M5-1-102J	1	EA	AR2
46	6550MO504720	NETWORK RESISTOR	M5-1-472J	1	EA	AR3
47	6260I0000140	IC SOCKET	AZ-14A	1	EA	SOCKET OF IC7
48	7614S0001320	MULTI TERMINAL	USL-5VB1-5P	2	EA	TB2,3
49	7614S0001330	MULTI TERMINAL	USL-5VB1-7P	1	EA	TB1
50	7801CLW00060	CONNECTOR	LW-0640-06	1	EA	CN1
51	7632CDS00050	PHOTO TRANSISTOR	SR-20E-5S	1	EA	CDS
52	2631A0000010	VFD CUSHION	30*20*2T	4	EA	
53	6260I0000160	IC SOCKET	ZF16A	2	EA	SOCKET OF IC6,10
54	6570K6802000	POTENTIO METER	3296W20kΩ(68WR20K)	1	EA	VR1

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3) BODY ASS'Y

NO	Part Code	Part Name	Specification	Q'TY	Unit	REMARK
1	1005A000040A	FRONT COVER	CI-2001AS(HAIR LINE)	1	EA	SUS
2	1005A000041A	BACK COVER	CI-2001AS(HAIR LINE)	1	EA	SUS
3	1005A000042A	GUIDE	CI-2001AS(HAIR LINE)	1	EA	SUS
4	1005A0000430	SEALING WASHER	ψ3*1.5	9	EA	
5	1005A0000440	SEALING WASHER	ψ6*1.5	1	EA	
6	1265A0000190	SEALING BOLT	M6*14	1	EA	
7	1265A0000200	SEALING BOLT	M3*13	2	EA	
8	1502MSU03120	MACHINE SCREW (PH)	M3*12-SUS	7	EA	SUS
9	1502A0003060	MACHINE SCREW (PH)	M3*6	5	EA	
10	1563A0004200	RIVET	ψ3.2*8	2	EA	
11	1815C2A00550	SPEC PLATE	CI-2001 Series	1	EA	
12	1815I2400330	CAPA PLATE	CI-2400BS	1	EA	
13	2005A0000310	STOP BOLT	ψ38*17	2	EA	
14	2006A0000040	DISPLAY COVER	CI-2400BS(투명)	1	EA	
15	2055I2400330	KEY BOARD PAD	CI-2400BS	1	EA	
16	2605A0000390	GASKET	195*125*3	1	EA	
17	2630A0000040	O-RING	P6	1	EA	
18	2630A0000060	O-RING	P8	3	EA	
19	2630A0000450	O-RING	P3	9	EA	
20	7640S0012620	L/C BUSHING TAIL	12.5*62.5(LTF7)-3207	3	EA	
21	7510P120220C	AC ADAPTOR	AC 220V DC12V/500mA	1	EA	
22	1215A0012450	SEALING BAR	ψ6*15(MC NYLON)	0.03	M	

4) C/T BOX ASS'Y

NO	Part Code	Part Name	Specification	Q'TY	Unit	REMARK
1	9007C2400000	MANUAL	CI-2400BS	1	EA	
2	9100I2000010	PAD	385*260	1	EA	
3	9100I200130B	C/T BOX	390*265*107	1	EA	
4	9203AS001400	STYROFOAM BOX	383*261*90	1	EA	
5	9301A0000030	MANUAL POLY BAG	170*250*0.05T	1	EA	
6	9302A0000050	SET POLY BAG	270*350*0.05T	1	EA	
7	9400A0000460	SLIICAGEL	10g	1	EA	
8	9900A0000010	봉인납	수출용	1	EA	
9	9900A0000020	SEALING WIRE	300M/ROLL	0.02	M	

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5) OPTION

NO	Part Code	Part Name	Specification	Q'TY	Unit	REMARK
((CHARGER PCB OPTION))						
1	6180PCI1200A	PB CHARGER PCB	6180-PCI-1200-0	1	EA	
2	6200IPU17020	IC (CPU)	ICS1702	1	EA	IC2
3	6220IO013500	IC (REGULATOR)	S-81350 HG	1	EA	IC1
4	6280IO022360	TRANSISTOR	2SC2236A	1	EA	Q2
5	6273IO001700	FET	2SJ177	1	EA	Q1
6	6291IPO58190	POWER DIODE	1N5819	3	EA	D1~3
7	6505MB301000	RESISTOR ¼W	MFR 10kΩ (±0.1%)-B	1	EA	R3
8	6505MB302050	RESISTOR ¼W	MFR 20.5kΩ (±0.1%)-B	1	EA	R12
8	6505MD300200	RESISTOR ¼W	MFR 2kΩ (±0.5%)-D	1	EA	R6
9	6505MD300360	RESISTOR ¼W	MFR 3.6kΩ (±0.5%)-D	1	EA	R11
10	6505MF300640	RESISTOR ¼W	MFR 6.4kΩ (±1.0%)-F	1	EA	R8
11	6515CJ027000	RESISTOR ¼W	CFR 270Ω (±5.0%)	1	EA	R9
12	6515CJ075000	RESISTOR ¼W	CFR 750Ω (±5.0%)	1	EA	R2
13	6515CJ300100	RESISTOR ¼W	CFR 1kΩ (±5.0%)	2	EA	R5,10
14	6515CJ300470	RESISTOR ¼W	CFR 4.7kΩ (±5.0%)	1	EA	R7
15	6515CJ303300	RESISTOR ¼W	CFR 33kΩ (±5.0%)	1	EA	R4
16	6670T0004700	INDUCTANCE	470 uH	1	EA	IND1
17	6704C1602200	ELECTRIC_CONDENSER	220μF/16V	2	EA	C4,9
18	6704C2502200	ELECTRIC_CONDENSER	220μF/25V	1	EA	C1
19	6704C5000010	ELECTRIC_CONDENSER	1μF/50V	1	EA	C5
20	6710CAP01040	CERAMIC_CONDENSER	0.1μF/25V	4	EA	C2,3,7,8
21	6710CAPP1010	CERAMIC_CONDENSER	100pF/50V	1	EA	C6
22	6800F0002200	EMI FILTER	220pF	1	EA	EMI1
24	6800F0035800	EMI BEAD FILTER	BFS-3580 AO ψ3.5*8	1	EA	F1
25	7600SR11140	RELAY	G6B-1114P-US(12VDC)	1	EA	RE1
26	7614S0001370	MULTI TERMINAL	USL-5VB1-2P	1	EA	CN1
27	7803CLA00060	CONNECTOR(WAFER)	LA-0640-06	1	EA	CN2

((RS-485 INTERFACE))

1	6232IO004890	IC (INTERFACE)	MAX489(ESD)-DIP	1	EA	IC7
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((OUTPUT))

1	6218DPS01740	PHOTO COUPLER	PC17T4	1	EA	IC10
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