Microprocessors and Interfacing Design Assignment for Semester II, 2022-23

Report on
Batch Weighing Machine

In partial fulfillment of the course MICROPROCESSOR PROGRAMMING AND INTERFACING

Batch no. 62 members

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Acknowledgement

We would like to express our deepest gratitude to Dr K.R.Anupama for not only providing us with an opportunity to work on this project but also for her invaluable guidance throughout the project. This opportunity has helped us better understand the concepts taught in the course Microprocessors and Interfacing lectures and put them into a practical application. After completing this project we feel we have gained a lot of knowledge and become confident in the concepts of microprocessors and interfacing. We would also like to extend our sincere thanks to all the instructors and teaching assistants of this course for their guidance. The instructors' expertise and vast knowledge in the field of microprocessors and interfacing have been a constant source of inspiration and motivation for us.

Lastly, we would like to express our gratitude to our friends for their unwavering encouragement and support throughout this project.

Table of Contents

Problem Statement

Batch Weighing Machine

A microprocessor-based system is to be designed as a batch weighing machine.

The system is interfaced to three load cells by means of an 8-bit A/D converter.

The conditioned output of the load cells is given by the equation: Vout = 0.025 x weight (Kgs.)

The system monitors the output of the load cells and finds out the total weight by taking the average of the three values that are sensed by each load cell.

This value is displayed on a seven-segment display.

When this value exceeds 99 kgs, an output port, which is connected to a relay, is switched on to sound an alarm.

Once the objects are placed on the load cell user presses a switch labelled ***weigh***.

User Requirements and Technical Specifications

● A Batch Weighing machine that measures the weight of an object on 3 different load cells and displays the average weight in kg.

● A '*weigh*' switch enables the user to begin the weighing.

● If the average weight crosses 99 kg a buzzer is switched on which can be turned off by a switch.

● Design has a weight restriction of 100 kg and just 1 decimal precision in weight display. Additionally, the procedure only begins when a switch is pressed until the microprocessor is in the polling state, waiting for the interrupt sent by the switch.

Assumptions

- The weights measured are less than 100 kg and thus load cell with a capacity of 100 kg was used.
- Load cell output through OP-AMP matches the specified 0.02V/kg required by ADC0808 with 5.12V.

Justifications

- Multiplexing is not used in 7-segment displays to reduce idle CPU consumption. Even though there are only 3 inputs of ADC being used, 8 channel IC was used over 4 channel one to avoid possible implementation errors.
- The ADC resolution in terms of weight is 0.5kg, and with an average of 3 load cells can give a resolution of $\frac{1}{6}$ kg, which can be represented with just one digit after the decimal.
- Using remainder during division (in average), it is possible to avoid using 8087 co-processor for floating point operations since there are only 6 possible remainders which can be compensated in the code.

Components Used

- **8086**
  - 1 unit
  - It is the main processor and is used to control all the other devices in the system.

- **8254**
  - 1 unit
  - Used to generate a 1 MHz clock for the ADC0808.

- **8284**
  - 1 unit
  - It generates the clock signal for the 8086 and other clock-based devices in the system.

- **8255**
  - 2 units
  - $8255_{(1)}$ is used to interface the ADC which connects the load cell and $8255_{(2)}$ is used to interface the FND 507 7-segment Display and Buzzer.

- **2716 (ROM)**
  - 4 units
  - We need to provide 2 ROMs at each location as one is the even bank while the
  - other is the odd bank.
  - 2 x 2716 at address 00000H for the IVT.
  - 2 x 2716 at address FF000H to supply instructions at the reset address of the 8086.

- **6116 (RAM)**
  - 2 units
  - We need to provide 2 RAMs at each location as one is the even bank while the other is the odd bank.
  - 2 x 6116 is used to store data and stack.

- **LS373**
  - 3 units
  - Used to de-multiplex and latch the Address Bus of the 8086.

- **LS245**
    - 2 units
    - Used to de-multiplex and latch the Data Bus of the 8086.

- **ADC0808**
    - 1 unit
    - Used to convert the analog output of the load cell to digital signals for the
    - microprocessor.

- **Switch**
    - 2 units
    - Used to start the weighing process
    - Used to start the buzzer acknowledge

- **8259**
    - Used it for the interrupts provided by the switch *weigh*, EOC from ADC and stop buzzer switch.

- **7447**
    - 4 units
    - Used to decode the BCD value received from Microprocessors to 7-segment display

- **FND 507**
    - Used to display the calculated weight

- **Buzzer**
    - Used to ring the alarm when the weight exceeds 99 kgs

- **Relay**
    - 2 units
    - This electrically operated switch used to interface with the buzzer

- **Load cells**
    - 3 units
    - Used to calculate the weight and send analog signals to ADC

- **Or gates wherever necessary**

Address Map

Memory Map

A_{19}	A_{18}	A_{17}	A_{16}	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0	Address	Memory
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	00000_H	ROM1
0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	$00FFF_H$	
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	01000_H	RAM1
0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	$01FFF_H$	
1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	$FF000_H$	ROM2
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	$FFFFF_H$	

The highlighted address lines A_{14}, A_{13} and A_{12} can be used to decide the memory.

I/O Map

A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0	Address	Memory
0	0	1	0	0	0	0	0	20_H	$8255_{(1)}$
0	0	1	0	0	1	1	0	26_H	
0	0	1	0	1	0	0	0	28_H	$8255_{(2)}$
0	0	1	0	1	1	1	0	$2E_H$	
0	0	1	1	0	0	0	0	30_H	8254
0	0	1	1	0	1	1	0	36_H	
0	0	1	1	1	0	0	0	38_H	8259
0	0	1	1	1	0	1	0	$3A_H$	

The highlighted address lines A_5, A_4 and A_3 can be used to decide the I/O.

8255 Ports

$8255_{(1)}$

Port	Address	Purpose
Port A	20_H	Unused
Port B	22_H	Interfaces the ADC Outputs (D_0-D_7 of the ADC) to the data bus of 8086
Port C	24_H	Interfaces the ADC Inputs (Control signals - ALE, SOC, OE and AD_0-AD_2)
Control Register	26_H	Used to initialise $8255_{(1)}$ ports

$8255_{(2)}$

Port	Address	Purpose
Port A	28_H	Interfaces the BCD input of 7447
Port B	$2A_H$	Interfaces the BCD input of 7447
Port C	$2C_H$	C0 is interfaced to set Buzzer On
Control Register	$2E_H$	Used to initialise $8255_{(2)}$ ports

Load cell

The load cell is a transducer that converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. A load cell is made up of four strain gauges arranged in a Wheatstone pattern.

The load cell used is INDUSTRIAL GRADE LOAD CELL BEAM TYPE 100 KG WEIGHT SENSOR STRAIGHT BAR

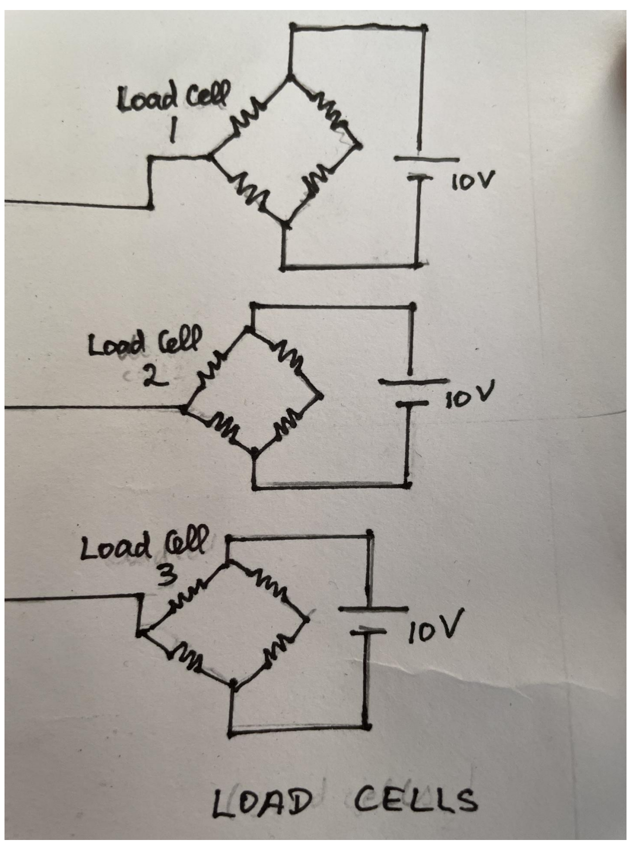
Specifications :

Capacity: 100 kg

Rated output(MV/V): 2.0±0.15

Output voltage of cells = rated output * excitation value

Output voltage of cells = 2(mv/v)*10 =20 mV



Working of the design

The load cell is used to measure the weight and send the signal to the amplifier to amplify the signal and thus send to the 8-bit ADC.

We have a load cell with sensitivity of 2mv/v thus if the input is V voltage then the output is k*W*V where W is weight. V_{ref}+ for the ADC is taken as 5.12 V and V_{ref}- is grounded.

As ADC is 8-bit resolution, we need to measure about 100 kg and the closest power of 2 is 128 so 256/128 = 2 units/kg which is 0.04 v/kg for V_{ref} = 5.12 V. Thus each load cell can measure up to 0.5kg resolution with LSB of ADC.

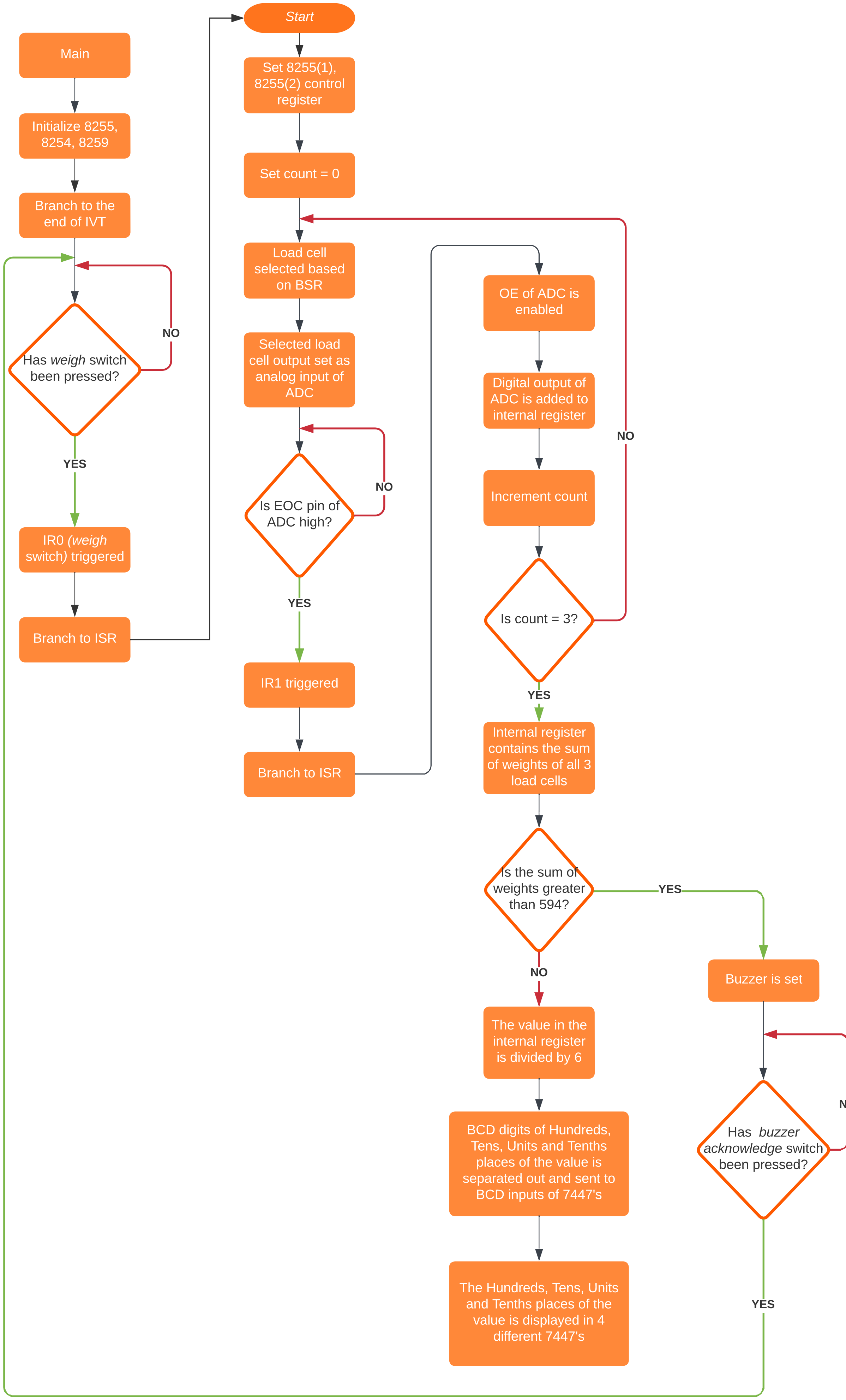
0.04 = k*v* A (A is Amplifier gain)

1 unit is 0.5 kg

As 1 level is 0.5 kg thus an average of three weights (W1+W2+W3)/3 is equivalent to (L1+L2+L3)/6

The calculated weight is displayed using the 7-segment display and if weight is more then 99 kg then buzzer starts to ring.

Flowchart



Main
Initialize 8255, 8254, 8259
Branch to the end of IVT
Has *weigh* switch been pressed?
NO
YES
IR0 *(weigh* switch*)* triggered
Branch to ISR
Start
Set 8255(1), 8255(2) control register
Set count = 0
Load cell selected based on BSR
Selected load cell output set as analog input of ADC
Is EOC pin of ADC high?
NO
YES
IR1 triggered
Branch to ISR
OE of ADC is enabled
Digital output of ADC is added to internal register
Increment count
Is count = 3?
NO
YES
Internal register contains the sum of weights of all 3 load cells
Is the sum of weights greater than 594?
YES
NO
The value in the internal register is divided by 6
BCD digits of Hundreds, Tens, Units and Tenths places of the value is separated out and sent to BCD inputs of 7447's
The Hundreds, Tens, Units and Tenths places of the value is displayed in 4 different 7447's
Buzzer is set
Has *buzzer acknowledge* switch been pressed?
NO
YES

Appendix

Datasheets and links

1. 8086
   https://pdf1.alldatasheet.com/datasheet-pdf/view/130012/INTEL/8086.html
2. 8254
   https://pdf1.alldatasheet.com/datasheet-pdf/view/130012/INTEL/8086.html
3. 8255
   https://pdf1.alldatasheet.com/datasheet-pdf/view/66100/INTEL/8255A.html
4. 2716 (ROM)
   https://datasheetspdf.com/pdf-file/957635/Intel/2716/1
5. 6116 (RAM)
   https://datasheetspdf.com/pdf-file/957635/Intel/2716/1
6. 7447
   https://pdf1.alldatasheet.com/datasheet-pdf/view/82663/ETC/7447.html
7. FND 507 (7 Segment display)
   https://www.alldatasheet.com/view.jsp?Searchword=Fnd507%20datasheet&gclid=Cj0KCQjwxYOiBhC9ARIsANiEIfahYgIhkpCPSZRMoindjyUDsVAhCjatuCIHkW2Llc2fc5yK3odYdBgaAp7IEALw_wcB
8. Relay
   https://pdf1.alldatasheet.com/datasheet-pdf/view/43479/SHARP/S202S01.html
9. Amplifier
   https://www.ti.com/product/LM741-MIL?utm_source=supplyframe&utm_medium=SEP&utm_campaign=not_alldatasheet&DCM=yes&dclid=CMP2m43Guv4CFVE5aAodaSoPVA#params
10. Load cell
    https://probots.co.in/load-cell-100-kg-weight-sensor-straight-bar-electronic.html
11. Buzzer
    https://www.sunrom.com/download/598.pdf
12. ADC0808
    https://pdf1.alldatasheet.com/datasheet-pdf/download/929603/TI1/ADC0808.html

ADC0808/ADC0809 8-Bit µP Compatible A/D Converters with 8-Channel Multiplexer

Check for Samples: ADC0808-N, ADC0809-N

FEATURES

- **Easy Interface to All Microprocessors**
- **Operates Ratiometrically or with 5 V_{DC} or Analog Span Adjusted Voltage Reference**
- **No Zero or Full-Scale Adjust Required**
- **8-Channel Multiplexer with Address Logic**
- **0V to V_{CC} Input Range**
- **Outputs meet TTL Voltage Level Specifications**
- **ADC0808 Equivalent to MM74C949**
- **ADC0809 Equivalent to MM74C949-1**

KEY SPECIFICATIONS

- **Resolution: 8 Bits**
- **Total Unadjusted Error: ±½ LSB and ±1 LSB**
- **Single Supply: 5 VDC**
- **Low Power: 15 mW**
- **Conversion Time: 100 µs**

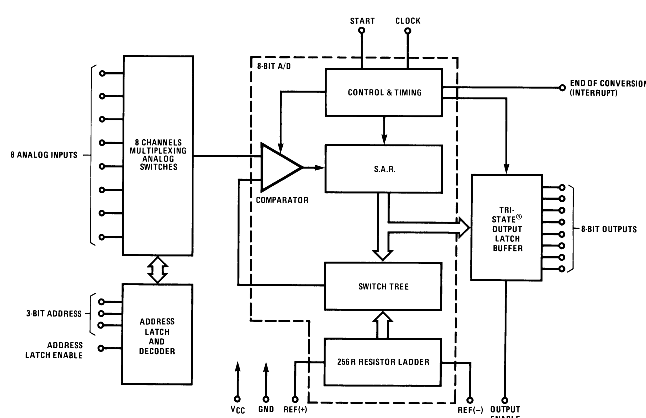
DESCRIPTION

The ADC0808, ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals.

The device eliminates the need for external zero and full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and latched TTL TRI-STATE outputs.

The design of the ADC0808, ADC0809 has been optimized by incorporating the most desirable aspects of several A/D conversion techniques. The ADC0808, ADC0809 offers high speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. These features make this device ideally suited to applications from process and machine control to consumer and automotive applications. For 16-channel multiplexer with common output (sample/hold port) see ADC0816 data sheet. (See AN-247 (Literature Number SNOA595) for more information.)

Block Diagram



Connection Diagrams

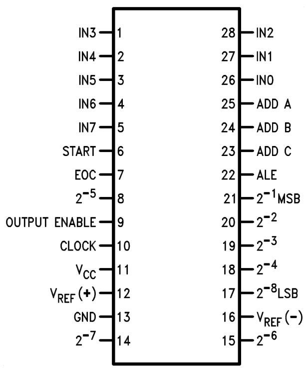


Figure 1. PDIP Package See Package N0028E

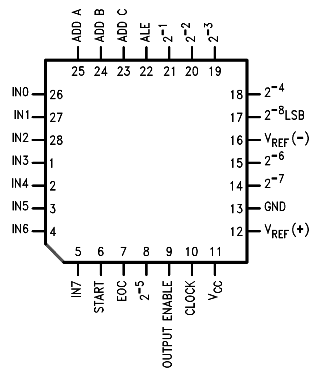


Figure 2. PLCC Package See Package FN0028A

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings[(1)(2)(3)]

Supply Voltage (V_{CC})[(4)]			6.5V
Voltage at Any Pin Except Control Inputs			−0.3V to (V_{CC}+0.3V)
Voltage at Control Inputs (START, OE, CLOCK, ALE, ADD A, ADD B, ADD C)			−0.3V to +15V
Storage Temperature Range			−65°C to +150°C
Package Dissipation at T_A=25°C			875 mW
Lead Temp. (Soldering, 10 seconds)	PDIP Package (plastic)		260°C
	PLCC Package	Vapor Phase (60 seconds)	215°C
		Infrared (15 seconds)	220°C
ESD Susceptibility[(5)]			400V

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications do not apply when operating the device beyond its specified operating conditions.
(2) All voltages are measured with respect to GND, unless otherwise specified.
(3) If Military/Aerospace specified devices are required, please contact the TI Sales Office/Distributors for availability and specifications.
(4) A Zener diode exists, internally, from V_{CC} to GND and has a typical breakdown voltage of 7 V_{DC}.
(5) Human body model, 100 pF discharged through a 1.5 kΩ resistor.

Operating Conditions [(1)(2)]

Temperature Range	$T_{MIN} \le T_A \le T_{MAX}$ $-40°C \le T_A \le +85°C$
Range of V_{CC}	4.5 V_{DC} to 6.0 V_{DC}

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. DC and AC electrical specifications do not apply when operating the device beyond its specified operating conditions.
(2) All voltages are measured with respect to GND, unless otherwise specified.

Electrical Characteristics – Converter Specifications

Converter Specifications: V_{CC}=5 V_{DC}=V_{REF+}, $V_{REF(-)}$=GND, $T_{MIN} \le T_A \le T_{MAX}$ and f_{CLK}=640 kHz unless otherwise stated.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
	ADC0808 Total Unadjusted Error[(1)]	25°C			±½	LSB
		T_{MIN} to T_{MAX}			±¾	LSB

(1) Total unadjusted error includes offset, full-scale, linearity, and multiplexer errors. See Figure 5. None of these A/Ds requires a zero or full-scale adjust. However, if an all zero code is desired for an analog input other than 0.0V, or if a narrow full-scale span exists (for example: 0.5V to 4.5V full-scale) the reference voltages can be adjusted to achieve this. See Figure 15.

Figure 6 shows a typical error curve for the ADC0808.

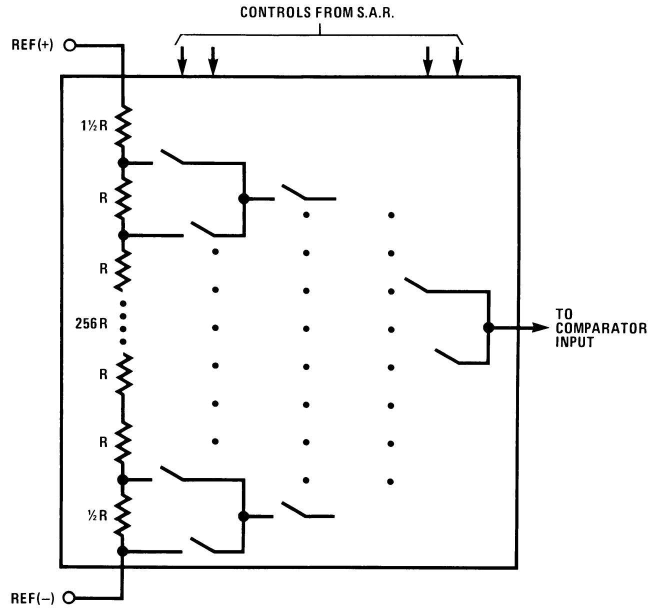


Figure 3. Resistor Ladder and Switch Tree

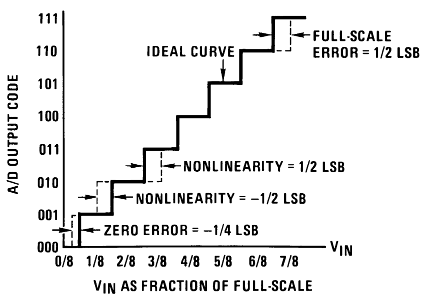


Figure 4. 3-Bit A/D Transfer Curve

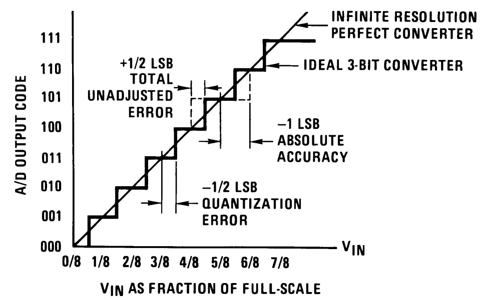


Figure 5. 3-Bit A/D Absolute Accuracy Curve

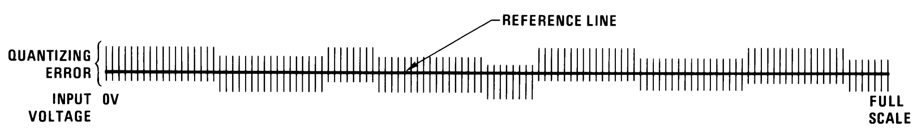


Figure 6. Typical Error Curve

Timing Diagram

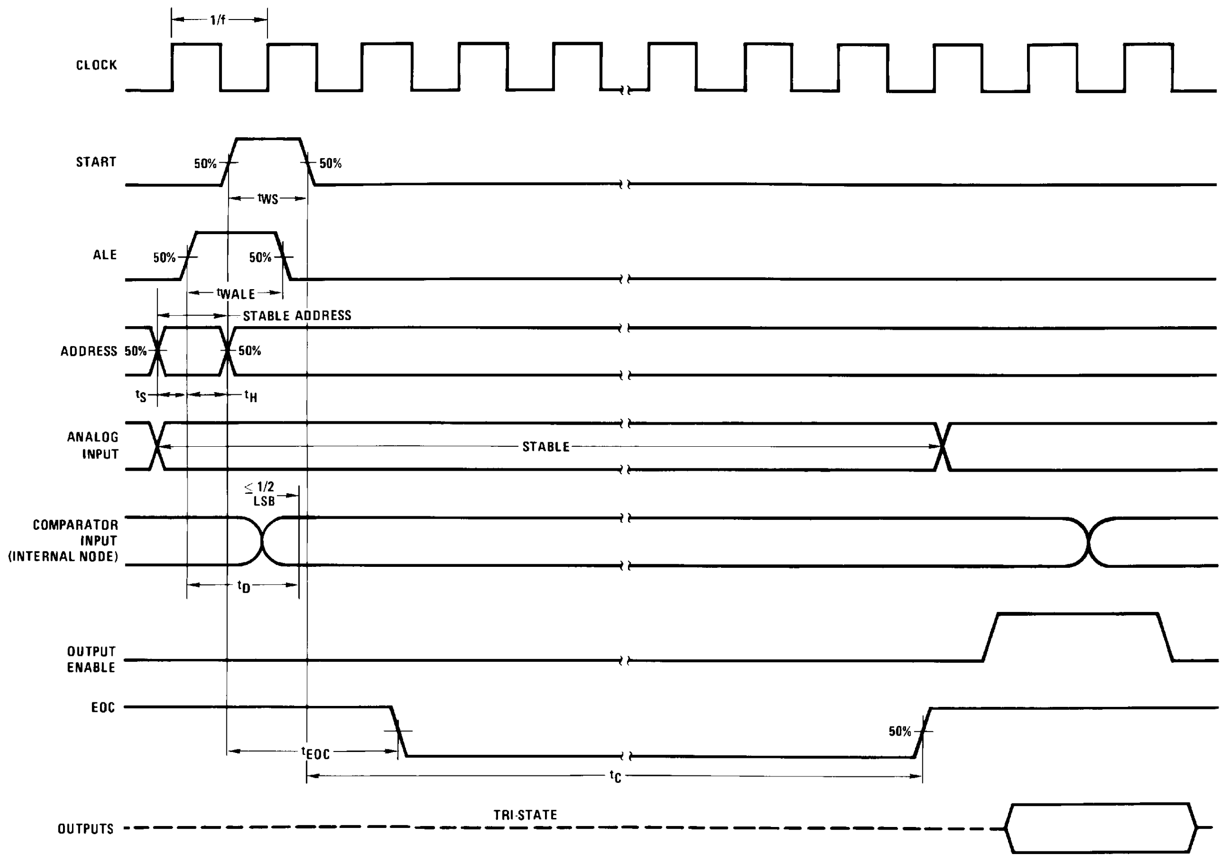


Figure 7.

APPLICATIONS INFORMATION

OPERATION

RATIOMETRIC CONVERSION

The ADC0808, ADC0809 is designed as a complete Data Acquisition System (DAS) for ratiometric conversion systems. In ratiometric systems, the physical variable being measured is expressed as a percentage of full-scale which is not necessarily related to an absolute standard. The voltage input to the ADC0808 is expressed by the equation

$$\frac{V_{IN}}{V_{fs}-V_Z}=\frac{D_X}{D_{MAX}-D_{MIN}}$$

- V_{IN}= Input voltage into the ADC0808
- V_{fs}= Full-scale voltage
- V_Z= Zero voltage
- D_X= Data point being measured
- D_{MAX}= Maximum data limit
- D_{MIN}= Minimum data limit (1)

A good example of a ratiometric transducer is a potentiometer used as a position sensor. The position of the wiper is directly proportional to the output voltage which is a ratio of the full-scale voltage across it. Since the data is represented as a proportion of full-scale, reference requirements are greatly reduced, eliminating a large source of error and cost for many applications. A major advantage of the ADC0808, ADC0809 is that the input voltage range is equal to the supply range so the transducers can be connected directly across the supply and their outputs connected directly into the multiplexer inputs, (Figure 11).

Ratiometric transducers such as potentiometers, strain gauges, thermistor bridges, pressure transducers, etc., are suitable for measuring proportional relationships; however, many types of measurements must be referred to an absolute standard such as voltage or current. This means a system reference must be used which relates the full-scale voltage to the standard volt. For example, if V_{CC}=V_{REF}=5.12V, then the full-scale range is divided into 256 standard steps. The smallest standard step is 1 LSB which is then 20 mV.

RESISTOR LADDER LIMITATIONS

The voltages from the resistor ladder are compared to the selected into 8 times in a conversion. These voltages are coupled to the comparator via an analog switch tree which is referenced to the supply. The voltages at the top, center and bottom of the ladder must be controlled to maintain proper operation.

The top of the ladder, Ref(+), should not be more positive than the supply, and the bottom of the ladder, Ref(−), should not be more negative than ground. The center of the ladder voltage must also be near the center of the supply because the analog switch tree changes from N-channel switches to P-channel switches. These limitations are automatically satisfied in ratiometric systems and can be easily met in ground referenced systems.

Figure 12 shows a ground referenced system with a separate supply and reference. In this system, the supply must be trimmed to match the reference voltage. For instance, if a 5.12V is used, the supply should be adjusted to the same voltage within 0.1V.

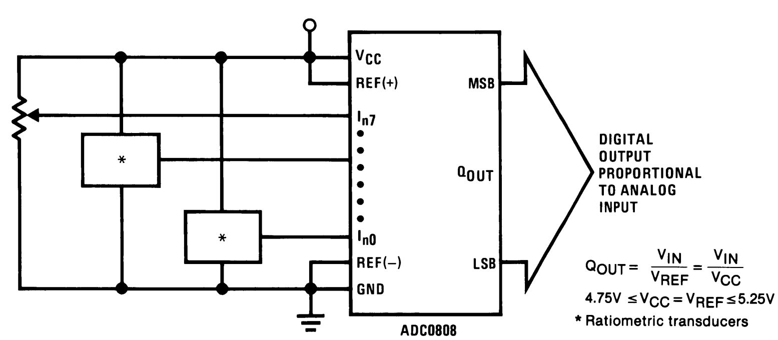


Figure 11. Ratiometric Conversion System

ANALOG COMPARATOR INPUTS

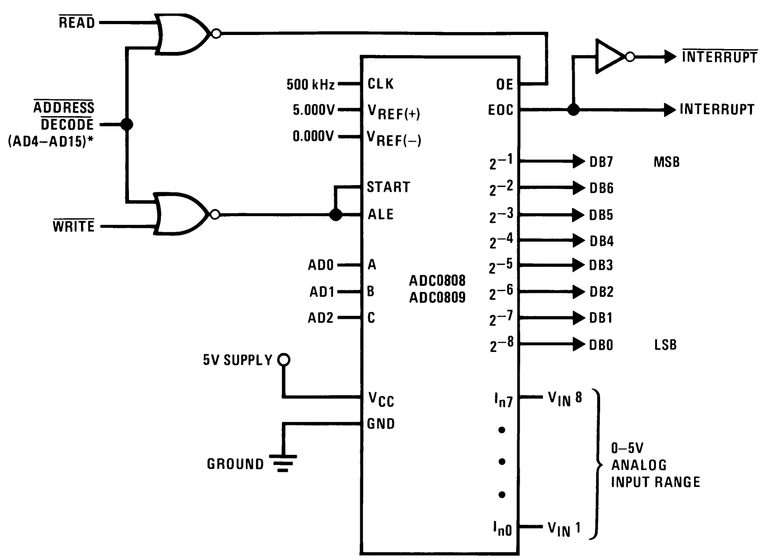
The dynamic comparator input current is caused by the periodic switching of on-chip stray capacitances. These are connected alternately to the output of the resistor ladder/switch tree network and to the comparator input as part of the operation of the chopper stabilized comparator.

The average value of the comparator input current varies directly with clock frequency and with V_{IN} as shown in Figure 8.

If no filter capacitors are used at the analog inputs and the signal source impedances are low, the comparator input current should not introduce converter errors, as the transient created by the capacitance discharge will die out before the comparator output is strobed.

If input filter capacitors are desired for noise reduction and signal conditioning they will tend to average out the dynamic comparator input current. It will then take on the characteristics of a DC bias current whose effect can be predicted conventionally.

Typical Application



*Address latches needed for 8085 and SC/MP interfacing the ADC0808 to a microprocessor

Table 2. Microprocessor Interface Table

PROCESSOR	$\overline{\text{READ}}$	$\overline{\text{WRITE}}$	INTERRUPT (COMMENT)
8080	$\overline{\text{MEMR}}$	$\overline{\text{MEMW}}$	INTR (Thru RST Circuit)
8085	$\overline{\text{RD}}$	$\overline{\text{WR}}$	INTR (Thru RST Circuit)
Z-80	$\overline{\text{RD}}$	$\overline{\text{WR}}$	$\overline{\text{INT}}$ (Thru RST Circuit, Mode 0)
SC/MP	NRDS	NWDS	SA (Thru Sense A)
6800	VMA•φ2•R/W	VMA•φ•$\overline{\text{R/W}}$	$\overline{\text{IRQA}}$ or $\overline{\text{IRQB}}$ (Thru PIA)

Red GaAsP 0.5-Inch 7-Segment Numeric LED Displays

Optoelectronic Products

FND500, FND507 FND560, FND567

General Description

The FND500, FND507, FND560 and FND567 are red GaAsP single-digit 7-Segment LED displays with a 0.5-inch character height. These displays are designed for applications in which the viewer is within twenty feet of the display.

Low Forward Voltage—Typically V_F = 1.7 V
Fits Standard DIP Sockets with 0.6-Inch Pin Row
Maximized Contrast Ratio With Integral Lens Cap
Horizontal Stacking 0.6-Inch Minimum, 1-Inch Typical
FND560/567 Suitable For Use In High Ambient Light
FND500 Common Cathode, Right-Hand Decimal Point
FND507 Common Anode, Right-Hand Decimal Point
FND560 Common Cathode, Right-Hand Decimal Point, High Brightness
FND567 Common Anode, Right-Hand Decimal Point, High Brightness

Absolute Maximum Ratings

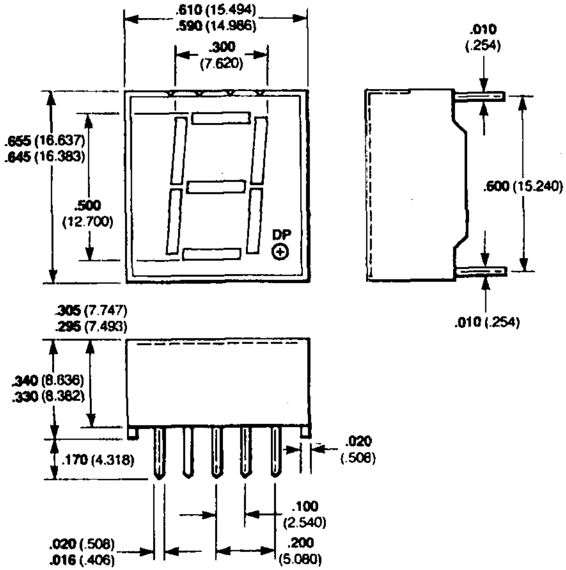
Maximum Temperature and Humidity

Storage Temperature	−25°C to +85°C
Operating Temperature	−25°C to +85°C
Pin Temperature (Soldering, 5 s)	260°C
Relative Humidity at 65°C	98%

Maximum Voltage and Currents

V_R	Reverse Voltage	3.0 V
I_F	Average Forward dc Current/Segment or Decimal Point	25 mA
	Derate from 25°C Ambient Temperature	0.3 mA/°C
I_{pk}	Peak Forward Current Segment or Decimal Point (100 μs pulse width) 1000 pps, T_A = 25°C	200 mA

Package Outline

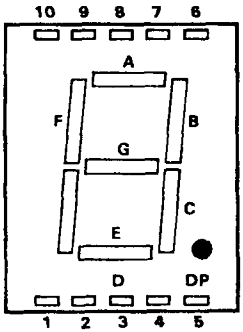


Notes
All dimensions in inches bold and millimeters (parentheses)
Tolerance unless specified = ±.015 (±.381)

Connection Diagram Typical Electrical Characteristics

FND500, FND507 FND560, FND567

Pin Connections (Front View)



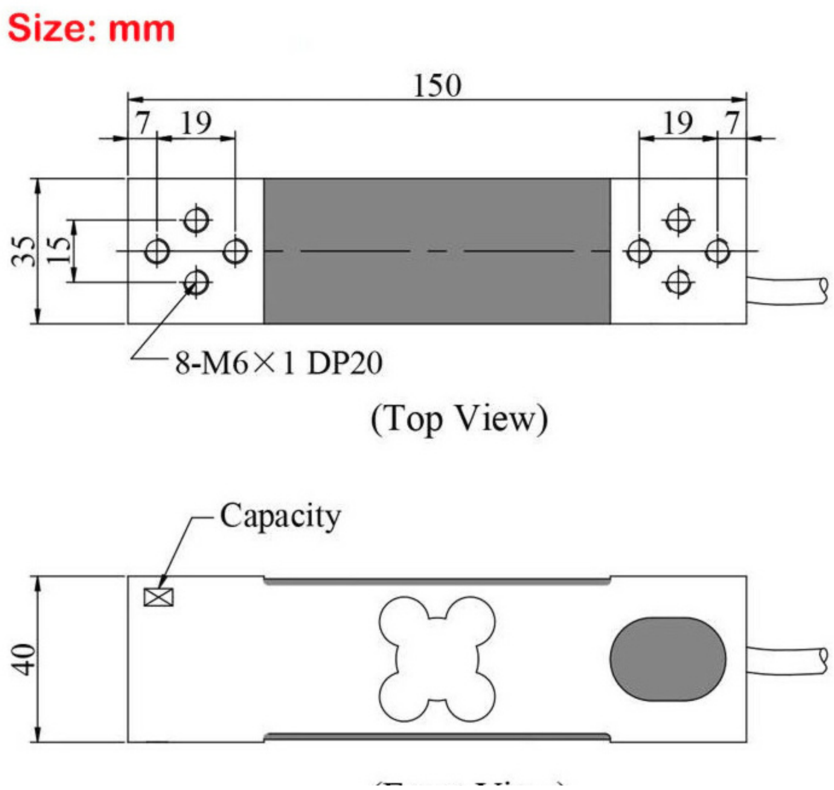
Pin	FND507/567	FND500/560
1	Segment E	Segment E
2	Segment D	Segment D
3	Common Anode	Common Cathode
4	Segment C	Segment C
5	Decimal Point	Decimal Point
6	Segment B	Segment B
7	Segment A	Segment A
8	Common Anode	Common Cathode
9	Segment F	Segment F
10	Segment G	Segment G

Electrical and Radiant Characteristics $T_A = 25°C$

Symbol	Characteristic	Min	Typ	Max	Units	Test Conditions
V_F	Forward Voltage	1.5	1.7	2.0	V	$I_F = 20$ mA
BV_R	Reverse Breakdown Voltage	3.0	12		V	$I_R = 1.0$ mA
I_O	Axial Luminous Intensity, Average Each Segment					
	FND500, FND507	300	600		μcd	$I_F = 20$ mA
	FND560, FND567	740	1200		μcd	$I_F = 20$ mA
ΔI_O	Intensity Matching, Segment-to-Segment		±33		%	$I_F = 20$ mA
	Intensity Matching Within One Intensity Class		±20		%	$I_F = 20$ mA, all segments at once
L_O	Average Segment Luminance					
	FND500, FND507		35		ftL	$I_F = 20$ mA
	FND560, FND567		70		ftL	$I_F = 20$ mA
$\theta_{1/2}$	Viewing Angle to Half Intensity		±27		degrees	
λ_{pk}	Peak Wavelength		665		nm	$I_F = 20$ mA

INDUSTRIAL GRADE LOAD CELL BEAM TYPE 100 KG WEIGHT SENSOR STRAIGHT BAR

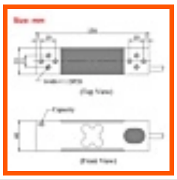
The load cell is a transducer that converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. These Load cells are designed with high-grade elements and construction materials for good environmental sealing and performance, this suits both Industrial and Commercial applications.



(Front View)








Details

)escription:

'his Load cell can be used to measure the weight of objects between 0 and 100 kg. This straight bar load cell sometimes called a strain gauge) can translate up to 100 kg of pressure (force) into an electrical signal. Each oad cell is able to measure the electrical resistance that changes in response to and is proportional to, the ;train (e.g. pressure or force) applied to the bar. With this gauge, you will be able to tell just how heavy an ›bject is, if an object's weight changes over time, or if you simply need to sense the presence of an object by neasuring strain or load applied to a surface.

:ach straight bar load cell is made from an aluminum alloy and is capable of reading a capacity of 100 kg. 'hese load cells have four strain gauges that are hooked up in a Wheatstone bridge formation. The color :ode on the wiring is as follows: red = E+, green = O+, black = E-, and white = O-. Additionally, these load cells eature through holes for mounting purposes.

Jse this sensor using our HX711 Breakout Board to amplify its signal and connect it directly to an \rduino/Raspberry pi or any other general-purpose microcontroller.

\pplications :

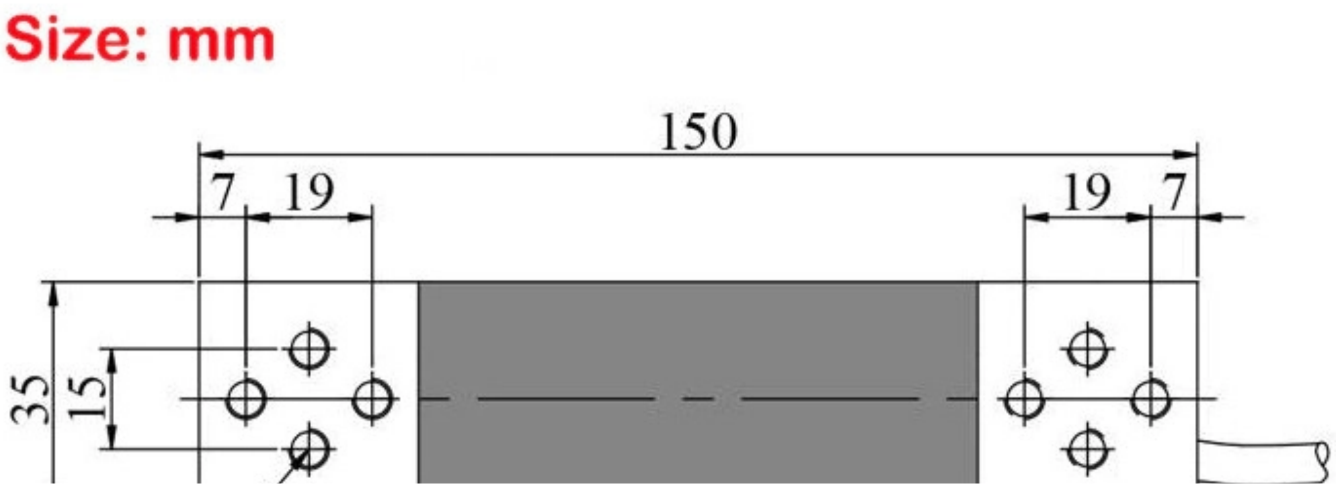
- Electronic platform scale
- Digital scale
- Parcel post scale
- Electronic balance

;pecifications :

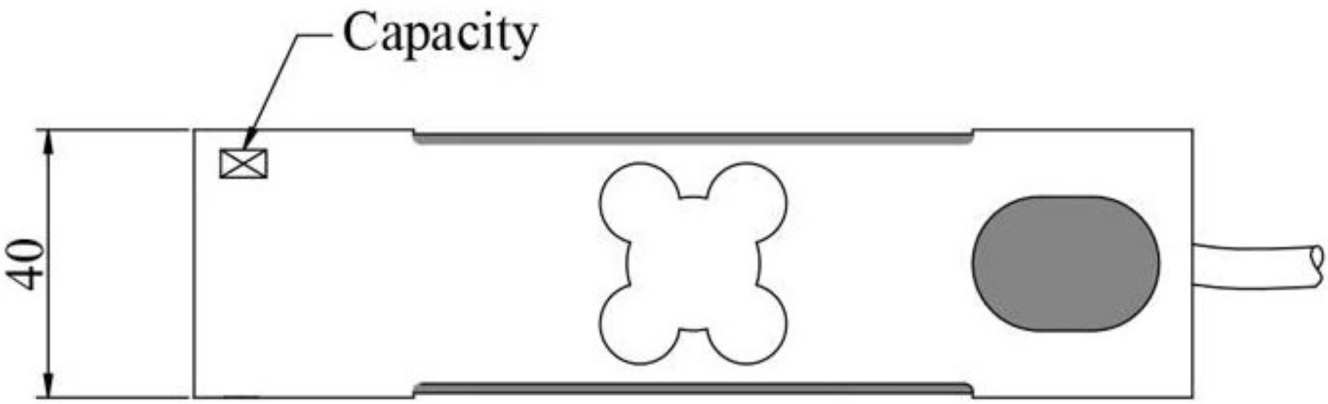
- Capacity: 100KG

- Rated output(MV/V): 2.0±0.15
- Accuracy class: C2
- Maximum number of load cell verification intervals(N max): 2000
- Minimum number of load cell verification intervals(Vmin): EMax/5000
- Combined error(%RO): <±0.030
- Creep(%RO/30min): 0.03
- Temperature effect on sensitivity(%RO/°C): 0.0016
- Temperature effect on zero(%RO/°C): 0.003
- Zero balance(%RO): 1.0
- Input resistance(O): 402±6
- Output resistance(O): 350±3
- Insulation resistance(MO<50V>): 5000
- Recommended excitation voltage(V): 10~15
- Compensated temperature range(°C): -10~+40
- Operating temperature range(°C): -35~+80
- Safe overload(%RO): 150
- Ultimate overload(%RO): 200
- Load cell material: Aluminium
- Connecting cable: ø4.2x350mm
- Method of connecting wire: Red(+),Black(-),Green(+),White(-)

* Product Images are shown for illustrative purposes only and may differ from the actual product.

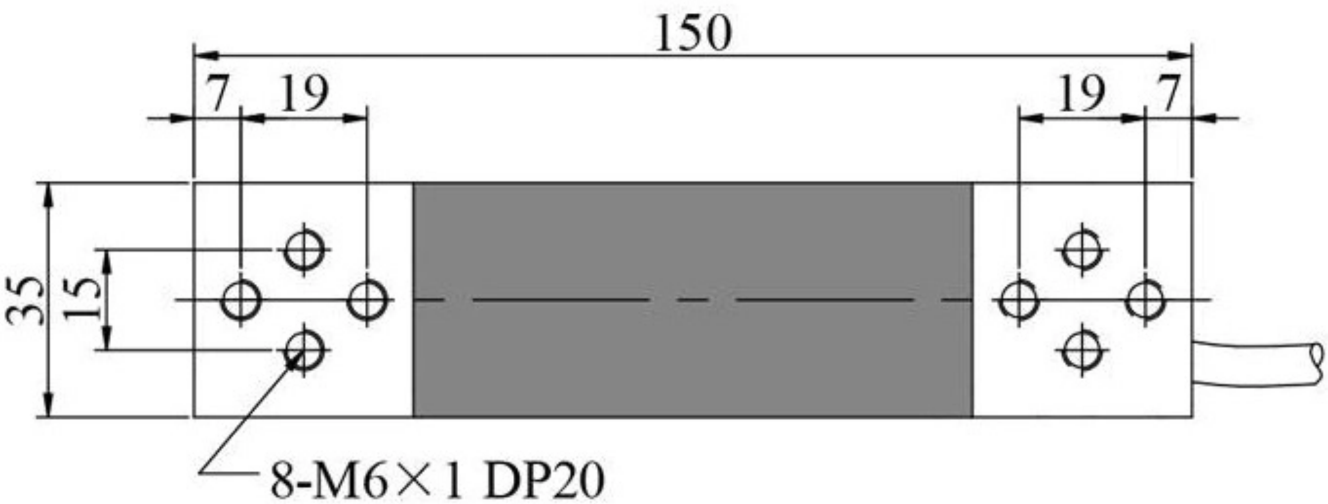


(Top View)

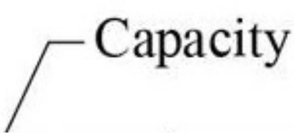


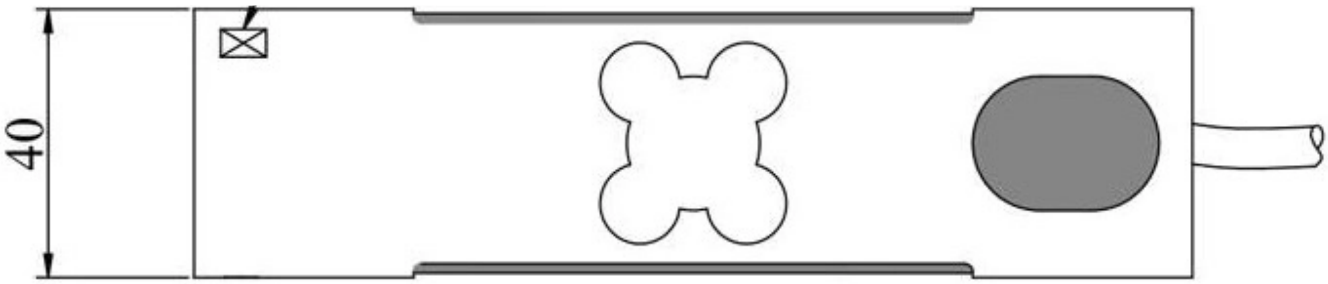
(Front View)

Size: mm



(Top View)





(Front View)

More Information

Reviews

Shipping & Delivery

Bulk & B2B Orders

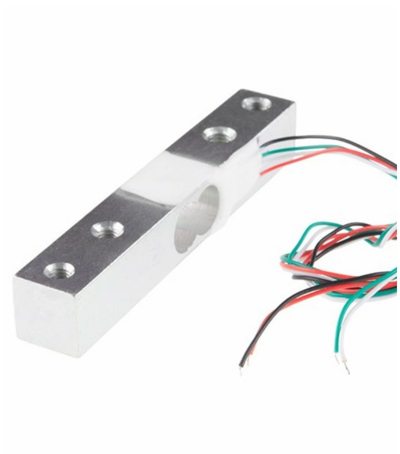
RELATED PRODUCTS

Industrial Grade Load Cell Beam Type 350 kg Weight Sensor Straight Bar

₹3,999.00

Industrial Grade Load Cell Beam Type 500 kg Weight Sensor Straight Bar

₹3,999.00



Mini Load Cell Beam Type 1 kg W Sensor Straight Bar

₹275.00

LM741-MIL Operational Amplifier

1 Features

- Overload Protection on the Input and Output
- No Latch-Up When the Common-Mode Range is Exceeded

2 Applications

- Comparators
- Multivibrators
- DC Amplifiers
- Summing Amplifiers
- Integrator or Differentiators
- Active Filters

3 Description

The LM741-MIL is a general-purpose operational amplifier which features improved performance over industry standards such as the LM709. It is a direct, plug-in replacement for the 709C, LM201, MC1439, and 748 in most applications.

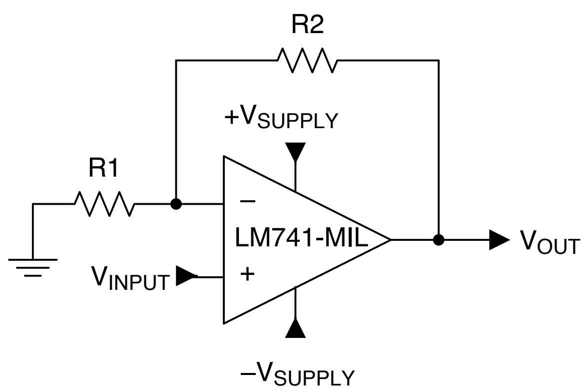
The amplifier offers many features which make applications nearly foolproof such as overload protection on the input and output, no latch-up when the common-mode range is exceeded, and freedom from oscillations.

Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
LM741-MIL	TO-99 (8)	9.08 mm × 9.08 mm
	CDIP (8)	10.16 mm × 6.502 mm
	PDIP (8)	9.81 mm × 6.35 mm

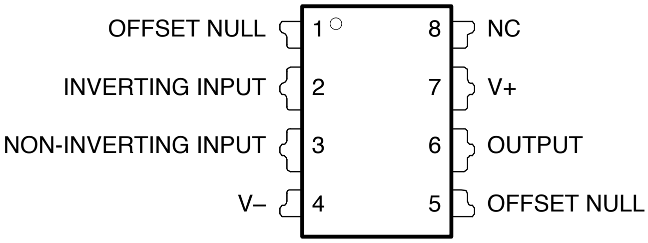
(1) For all available packages, see the orderable addendum at the end of the data sheet.

Simplified Application

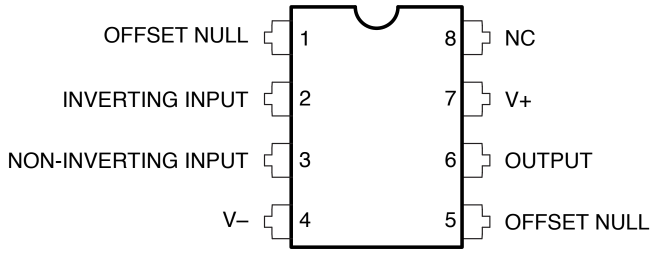


5 Pin Configuration and Functions

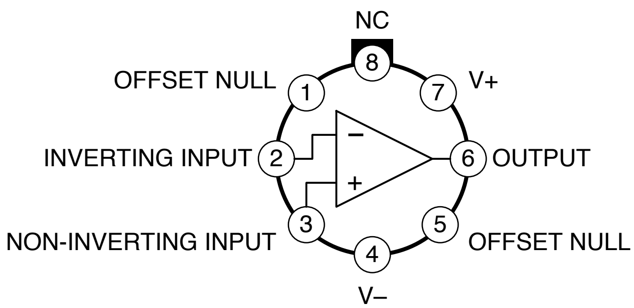
P Package
8-Pin PDIP
Top View



NAB Package
8-Pin CDIP
Top View



LMC Package
8-Pin TO-99
Top View



Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
INVERTING INPUT	2	I	Inverting signal input
NC	8	N/A	No Connect, leave floating
NONINVERTING INPUT	3	I	Noninverting signal input
OFFSET NULL	1	I	Offset null pin used to eliminate the offset voltage and balance the input voltages.
OFFSET NULL	5		
OUTPUT	6	O	Amplified signal output
V+	7	I	Positive supply voltage
V–	4	I	Negative supply voltage

S102S01/S102S02 S202S01/S202S02

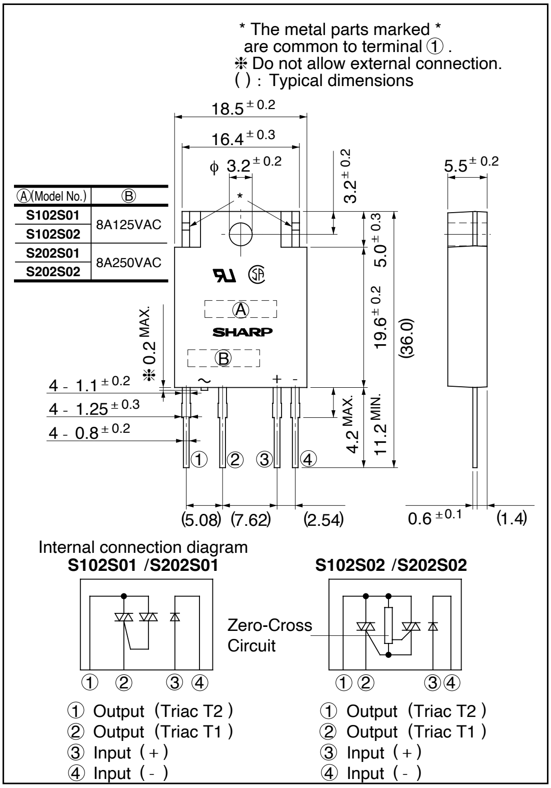
SIP Type SSR for Medium Power Control

■ Features

1. High radiation resin mold package
2. RMS ON-state current
   I_T : 8 Arms at T_C <= 80°C
   (With heat sink)
3. Built-in zero-cross circuit
   (S102S02/S202S02)
4. High repetitive peak OFF-state voltage
   S102S01/S102S02 V_{DRM} : MIN. 400V
   S202S01/S202S02 V_{DRM} : MIN. 600V
5. Isolation voltage between input and output
   (V_{iso} : 4 000V_{rms})
6. Approved by CSA, No. LR63705
   Recognized by UL, file No. E94758

■ Outline Dimensions

(Unit : mm)



■ Applications

1. Automatic vending machines, programmable controllers
2. Amusement equipment

■ Model Line-ups

	For 100V lines	For 200V lines
For phase control No built-in zero-cross circuit	**S102S01**	**S202S01**
Built-in zero-cross circuit	**S102S02**	**S202S02**

■ Absolute Maximum Ratings

(T_a = 25°C)

Parameter		Symbol	Rating S102S01 S102S02	Rating S202S01 S202S02	Unit
Input	Forward current	I_F	50		mA
	Reverse voltage	V_R	6		V
Output	*1 RMS ON-state current	I_T	8		A_{rms}
	*2 Peak one cycle surge current	I_{surge}	80		A
	Repetitive peak OFF-state voltage	V_{DRM}	400	600	V
	Non-repetitive peak OFF-state voltage	V_{DSM}	400	600	V
	Critical rate of rise of ON-state current	dI/dt	50		A/μ s
	Operating frequency	f	45 to 65		Hz
*3 Isolation voltage		V_{iso}	4 000		V_{rms}
Operating temperature		T_{opr}	- 25 to + 100		°C
Storage temperature		T_{stg}	- 30 to + 125		°C
*4 Soldering temperature		T_{sol}	260		°C

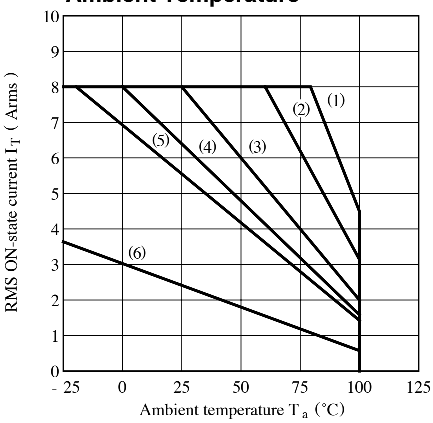
*1 T_C <= 80°C
*2 50Hz sine wave, T_j = 25°C start
*3 60Hz AC for 1 minute, 40 to 60% RH, Apply voltages between input and output, by the dielectric withstand voltage tester with zero-cross circuit. (Input and output shall be shorted respectively).
(Note)
When the isolation voltage is necessary at using external heat sink, please use the insulation sheet.
*4 For 10 seconds

■ Electro-optical Characteristics

(Ta = 25°C)

Parameter			Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Input	Forward voltage		V_F	I_F = 20mA	-	1.2	1.4	V
	Reverse current		I_R	V_R = 3V	-	-	10^{-4}	A
Output	Repetitive peak OFF-state current		I_{DRM}	$V_D = V_{DRM}$	-	-	10^{-4}	A
	ON-state voltage		V_T	Resistance load I_F= 20mA, I_T= 2Arms	-	-	1.5	V_{rms}
	Holding current		I_H	-	-	-	50	mA
	Critical rate of rise of OFF-state voltage		dV/dt	V_D = 2/3 • V_{DRM}	30	-	-	V/μ s
	Critical rate of rise of commutating OFF-state voltage		$(dV/dt)_C$	T_j = 125°C, dI_T/dt= - 4.0A/ms, V_D = 400V	5	-	-	V/μ s
	Zero-cross voltage	S102S02 S202S02	V_{OX}	I_F = 8mA	-	-	35	V
Transfer charac-teristics	Minimum trigger current	S102S01 S202S01	I_{FT}	V_D = 12V, R_L = 30Ω	-	-	8	mA
		S102S02 S202S02		V_D = 6V, R_L = 30Ω	-	-	8	mA
	Isolation resistance		R_{ISO}	DC500V, 40 to 60 % RH	10^{10}	-	-	Ω
	Turn-on time	S102S01 S202S01	t_{on}	AC 50Hz	-	-	1	ms
		S102S02 S202S02			-	-	10	ms
	Turn-off time		t_{off}	-	-	-	10	ms
Thermal resistance (Between junction and case)			$R_{th(j-c)}$	-	-	4.5	-	°C/W
Thermal resistance (Between junction and ambience)			$R_{th(j-a)}$	-	-	40	-	°C/W

Fig. 1 RMS ON-state Current vs. Ambient Temperature



(1) With infinite heat sink
(2) With heat sink (200 x 200 x 2 mm Al plate)
(3) With heat sink (100 x 100 x 2 mm Al plate)
(4) With heat sink (75 x 75 x 2 mm Al plate)
(5) With heat sink (50 x 50 x 2 mm Al plate)
(6) Without heat sink
(Note) With the Al heat sink set up vertically,tighten the device at the center of the Al heat sink with a torque of 0.4N • m and apply thermal conductive silicone grease on the heat sink mounting plate. Forcible cooling shall not be carried out.

Fig. 2 RMS ON-state Current vs. Case Temperature

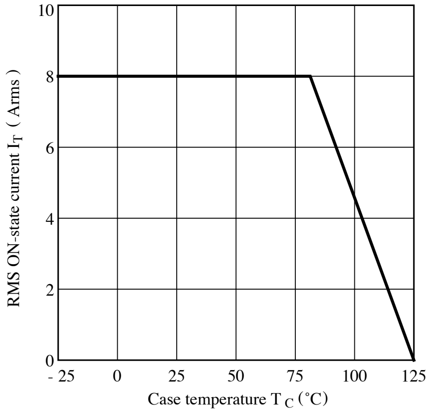


Fig. 3 Forward Current vs. Ambient Temperature

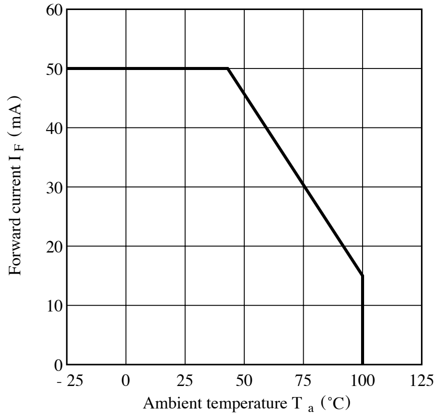


Fig. 4 Forward Current vs. Forward Voltage

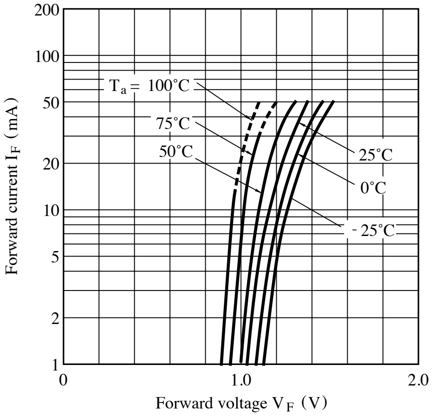


Fig. 5 Surge Current vs. Power-on Cycle

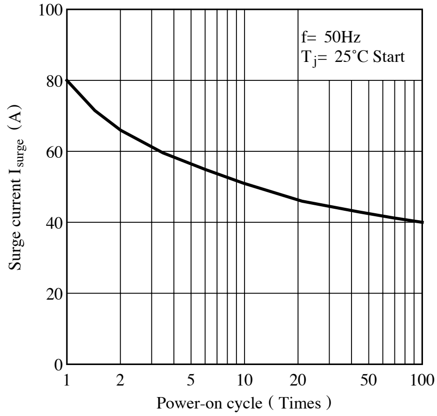


Fig. 6 Maximum ON-state Power Dissipation vs. RMS ON-state Current (Typical Value)

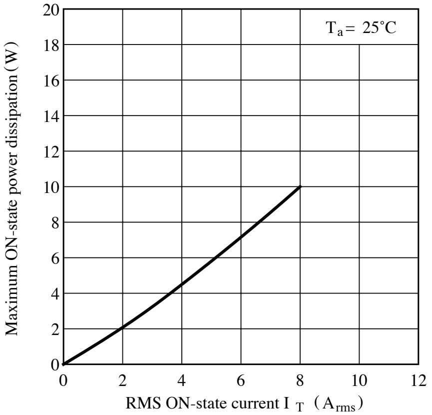


Fig. 7 Minimum Trigger Current vs. Ambient Temperature (Typical Value)

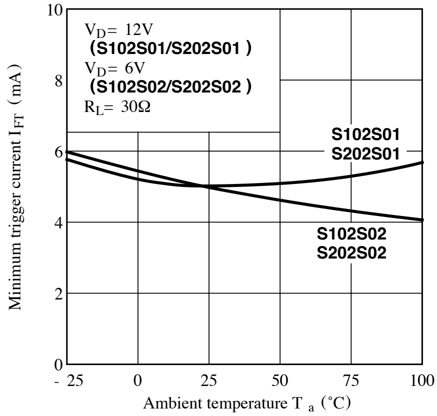
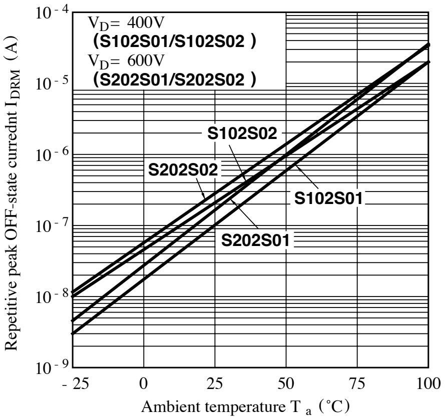


Fig. 8 Repetitive Peak OFF-state Current vs. Ambient Temperature（Typical Value）



● Please refer to the chapter “Precautions for Use”

PIEZO PASSIVE BUZZER - VERTICAL

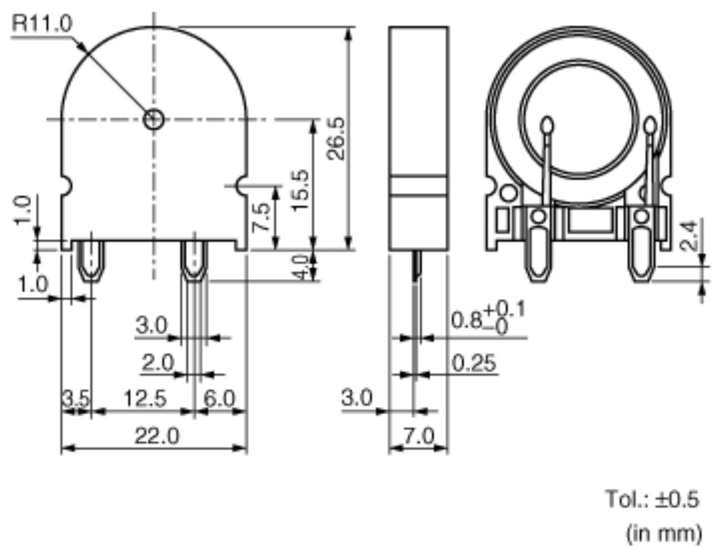
Externally driven piezoelectric sounders are used in washing machines, keyboard, timer, digital watches, electronic calculators, telephones and other consumer equipment. They are driven by a signal (ex.: 2048Hz or 4096Hz) from an LSI/MCU and provide melodious sound. Also, if the source is like a melody IC, you can also sound melody. Equivalent to Murata PKM22EPTH2001-B0.

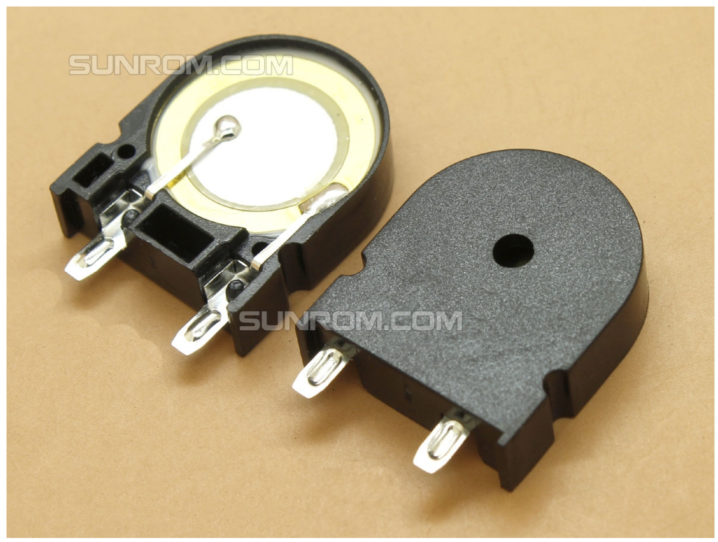
Features

1. Low power consumption
2. No noise and high reliability
3. No electric noise and little influence on peripheral circuits
4. It complies with the JEITA standard (RC - 8180A)

DIMENSIONS

PCB Holes we suggest of 3.2mm dia. with 12.5mm space apart





SPECIFICATIONS

Size	22.0×7.0×26.5 mm
Frequency	2 kHZ
Sound Pressure Level	70dB (min.)
Measure Condition of Sound Pressure Level	[3.0Vp-p,2.0kHz,square wave,10cm]
Capacitance	19nF
Capacitance Tolerance	±30%
Measurement Condition of Capacitance	[120Hz]
Maximum input voltage	±12.5Vo-p max. or 25.0Vo-p max
Operating Temperature Range	-20℃ to 70℃
Storage Temperature Range	-40℃ to 80℃
Shape	Lead
Lead Shape	Pin Type
Lead length	Lead length:4.0mm
Drive Type	External Drive
EIAJ Part Number	PS-RP2-V27-20

Figure 1 Frequency Characteristics (sine wave)

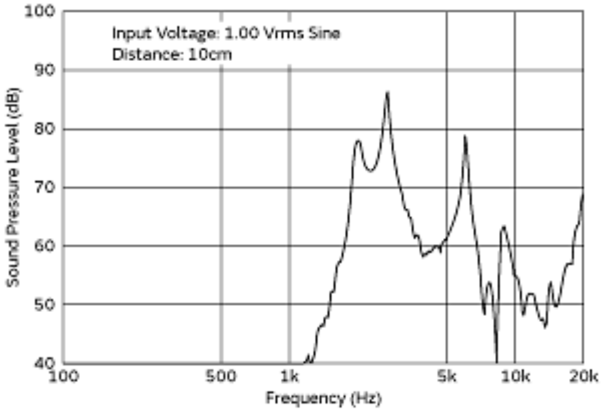


Figure 2 Frequency Characteristics (square wave)

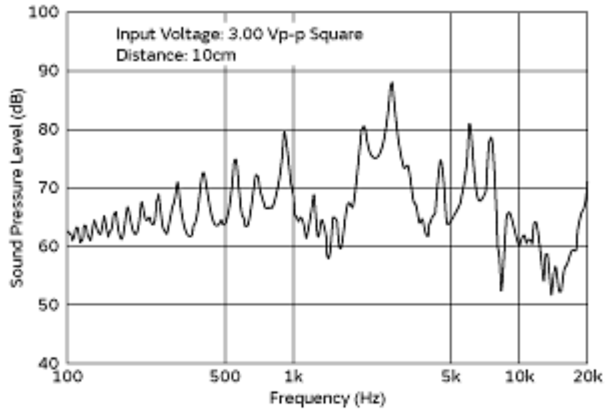
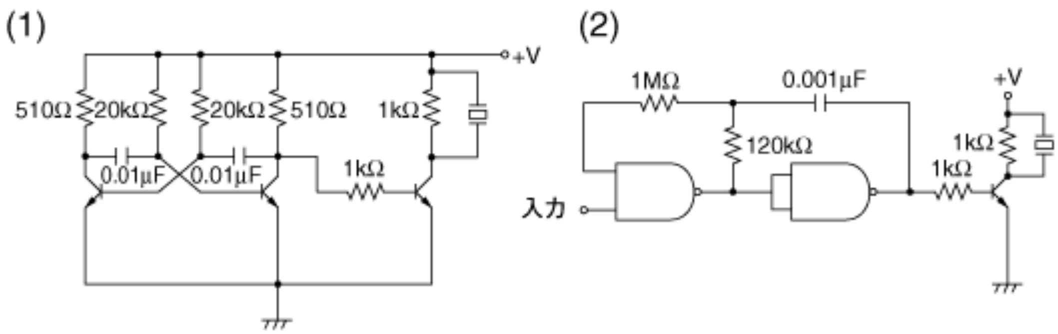


Figure 3 Typical Externally Driving circuit, Astable, NAND, Inverter gates



NOTES

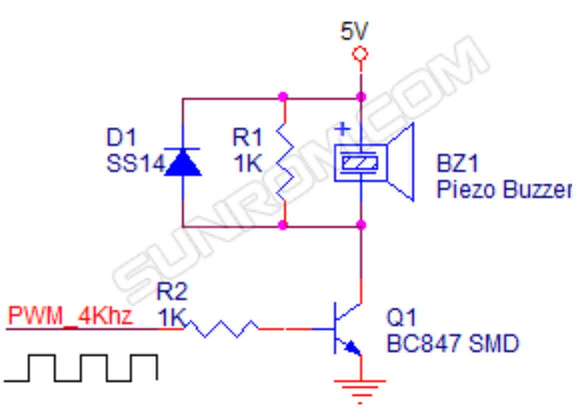
Please note, Unlike electromagnetic types which has coil, This buzzer does not contains internal driving circuit, so do not expect to just power on and hear something. It needs square wave of 4Khz to drive. The black case provides cavity for resonance and protection. You can vary its frequency to create tones just like you hear from microwave or washing machine.

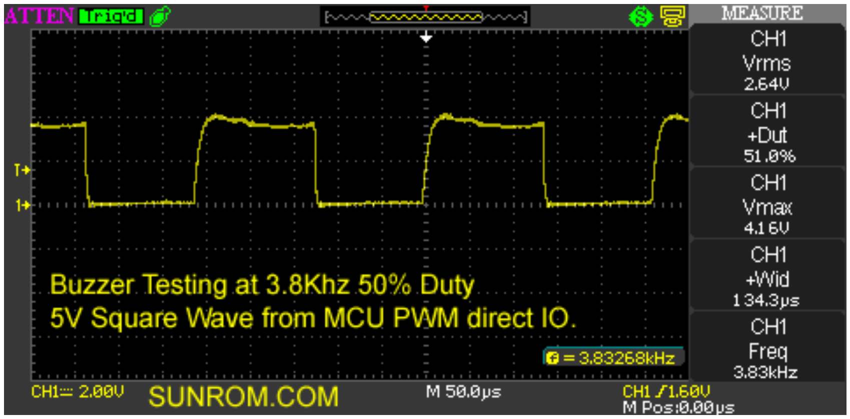
When compared to low cost electromagnetic type buzzer this piezo consumes only 2-3mA, while coil type can take upto 100mA. Low current consumption makes it ideal for battery operation. While electromagnetic type is high on EMI, this piezo's emi noise is very neglible.

Buzzer Comparison

Parameter	Piezo Buzzer This model	Other Electromagnetic Coil Type
Current	2-3mA	150-200mA
Moisture	Proof	Sensitive to moisture
Operation Life	Long, No moving parts	Coil heats and life is around 2 years
Operation Temp	High upto 150 deg C	approx 50 deg C
Noise	Does not emit	Emit high EMI noise over driving voltage
Technology	Piezo Vibration	Coil Oscillation
Frequency	Variable 1-10Khz	Fixed

You can use frequency from 1 Khz to 10 Khz but highest amplitude you will get around 4 Khz. Please see graph of frequency response above.
This is how we use it in our designs at Sunrom.





ORDERING DETAILS

Sunrom Part#	Ordering Page
5288	http://www.sunrom.com/m/5288