

# LM392

## Low Power Operational Amplifier and Comparator

The LM392 contains two functions: an op amp and a comparator. Both devices can operate on single-supply power and both have a common-mode range down to ground. Operation from split power supplies is also possible. Low power-supply current is independent of the supply voltage level. The output of the comparator interfaces directly with either TTL or CMOS logic. Low quiescent current makes the LM392 ideal for portable equipment.

### Features

- Wide Power-Supply Range: 3 V to 32 V
- Low Input Offset Voltage: 2 mV
- Low Quiescent Current: 600  $\mu$ A
- Input CMV Range includes GND
- Op Amp is Unity Gain Stable
- These Devices are Pb-Free and are RoHS Compliant

### Typical Applications

- Level Detectors
- Voltage Controlled Oscillators
- Transducer Amplifiers



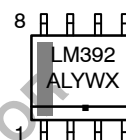
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### MARKING DIAGRAM



SOIC-8 NB  
CASE 751



XXXXX = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
• = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

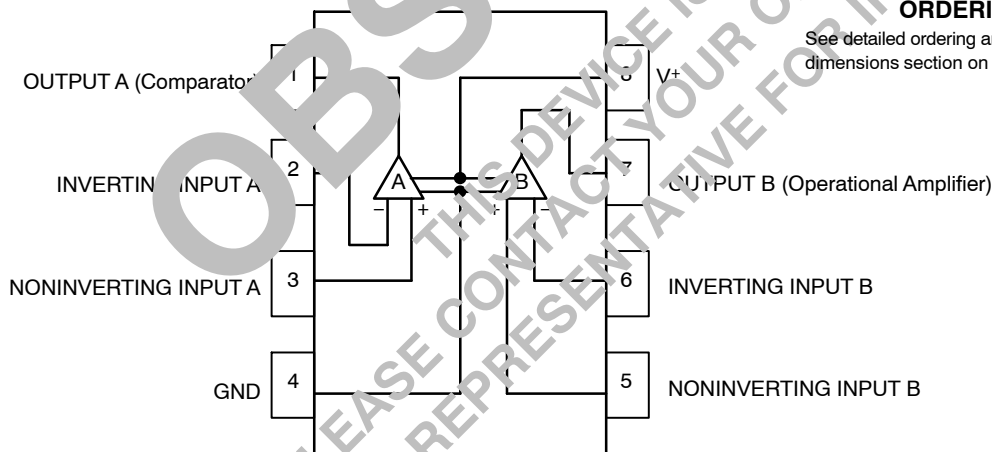


Figure 1. Logic Diagram and Pinout

## LM392

### MAXIMUM RATINGS

| Rating                                   | Symbol        | Value          | Unit                        |
|------------------------------------------|---------------|----------------|-----------------------------|
| Supply Voltage                           | $V_S$         | 32 or $\pm 16$ | V                           |
| Differential Input Voltage               | $V_{IDR}$     | 32             | V                           |
| Input Voltage                            | $V_I$         | 0.3 to 32      | V                           |
| Output Short – Circuit to Ground         | $t_{SO}$      | Continuous     |                             |
| Thermal Impedance                        | $\theta_{JA}$ | 160            | $^{\circ}\text{C}/\text{W}$ |
| Storage Temperature Range                | $T_{stg}$     | -65 to 150     | $^{\circ}\text{C}$          |
| Lead Temperature (Soldering, 10 Seconds) |               | 260            | $^{\circ}\text{C}$          |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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# LM392

## ELECTRICAL CHARACTERISTICS (Both Amplifiers) ( $V^+ = 5\text{ V}$ , $T_A = 25^\circ\text{C}$ unless otherwise stated)

| Parameter                       | Conditions                                                                                                                                              | $T_A$                                   | LM392 |         |             | Unit |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-------|---------|-------------|------|
|                                 |                                                                                                                                                         |                                         | Min   | Typ     | Max         |      |
| Input Offset Voltage            | At output switch point, $V_O = 1.4\text{ V}$ ,<br>$R_S = 0\ \Omega$ , $V^+ = 5\text{ V}$ to $30\text{ V}$ , $V_{CM} = 0$ to<br>( $V^+ - 1.5\text{ V}$ ) | $25^\circ\text{C}$                      |       | $\pm 2$ | $\pm 5$     | mV   |
|                                 |                                                                                                                                                         | $0^\circ\text{C}$ to $70^\circ\text{C}$ |       |         | $\pm 7$     |      |
| Input Bias Current              | $IN(+)$ or $IN(-)$ , $V_{CM} = 0\text{ V}$                                                                                                              | $25^\circ\text{C}$                      |       | 50      | 205         | nA   |
|                                 | $IN(+)$ or $IN(-)$                                                                                                                                      | $0^\circ\text{C}$ to $70^\circ\text{C}$ |       |         | 400         |      |
| Input Offset Current            | $IN(+)$ or $IN(-)$                                                                                                                                      | $25^\circ\text{C}$                      |       | $\pm 5$ | $\pm 50$    | nA   |
|                                 |                                                                                                                                                         | $0^\circ\text{C}$ to $70^\circ\text{C}$ |       |         | $\pm 150$   |      |
| Input Common-Mode Voltage Range | $V^+ = 30\text{ V}$<br>(Note 1)                                                                                                                         | $25^\circ\text{C}$                      | 0     |         | $V^+ - 1.5$ | V    |
|                                 |                                                                                                                                                         | $0^\circ\text{C}$ to $70^\circ\text{C}$ | 0     |         | $V^+ - 2$   |      |
| Supply Current                  | No Load                                                                                                                                                 | $V^+ = 30\text{ V}$                     |       | 1       | 2           | mA   |
|                                 |                                                                                                                                                         | $V^+ = 5\text{ V}$                      |       | 0.5     | 1           |      |
| Amplifier-to-Amplifier Coupling | $f = 1\text{ kHz}$ to $20\text{ kHz}$ , Input Referred                                                                                                  | $25^\circ\text{C}$                      |       | -78     |             | dB   |
| Differential Input Voltage      | All $V_{IN} \geq V$ (or $V^-$ , if $U_{IN} = V^-$ )                                                                                                     | $0^\circ\text{C}$ to $70^\circ\text{C}$ |       |         | 32          | V    |

## ELECTRICAL CHARACTERISTICS ( $V^+ = 5\text{ V}$ , $T_A = 25^\circ\text{C}$ unless otherwise stated)

| Parameter                                     | Conditions                                                                                            | T <sub>A</sub> | LM392                |     |     | Unit  |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------|----------------------|-----|-----|-------|
|                                               |                                                                                                       |                | Min                  | Typ | Max |       |
| OP AMP ONLY                                   |                                                                                                       |                |                      |     |     |       |
| Large Signal Voltage Gain                     | V <sup>+</sup> = 5 V, V <sub>O</sub> Swing = 1 V to 11 V,<br>R <sub>L</sub> = 2 kΩ                    | 25°C           | 20                   | 100 |     | V/mV  |
| Output Voltage Swing, High (V <sub>OH</sub> ) | R <sub>L</sub> = 2 kΩ                                                                                 | 25°C           | V <sup>+</sup> - 1.7 |     |     | V     |
| Output Voltage Swing, Low (V <sub>OL</sub> )  | R <sub>L</sub> = 2 kΩ                                                                                 | 25°C           |                      |     | 20  | mV    |
| Common-Mode Rejection Ratio                   | V <sub>CM</sub> = 0 to V <sup>+</sup> - 1.5 V                                                         | 25°C           | 65                   | 70  |     | dB    |
| Power Supply Rejection Ratio                  |                                                                                                       | 25°C           | 65                   | 100 |     | dB    |
| Output Current Source                         | V <sub>IN(+)</sub> = 1 V, V <sub>IN(-)</sub> = 0 V,<br>V <sup>+</sup> = 15 V, V <sub>O</sub> = 2 V    | 25°C           | 20                   | 40  |     | mA    |
| Output Current Sink                           | V <sub>IN(+)</sub> = 1 V, V <sub>IN(-)</sub> = 0 V,<br>V <sup>+</sup> = 15 V, V <sub>O</sub> = 2 V    | 25°C           | 10                   | 20  |     | mA    |
|                                               | V <sub>IN(+)</sub> = 1 V, V <sub>IN(-)</sub> = 0 V,<br>V <sup>+</sup> = 15 V, V <sub>O</sub> = 200 mV | 25°C           | 12                   | 50  |     | μA    |
| Input Offset Voltage Drift                    | R <sub>S</sub> = 0 Ω (0°C to 70°C)                                                                    | 0°C to 70°C    |                      | 7   |     | μV/°C |
| Input Offset Current Drift                    | R <sub>S</sub> = 0 Ω (0°C to 70°C)                                                                    | 0°C to 70°C    |                      | 10  |     | pA/°C |

## COMPARATOR ONLY

|                            |                                                                                                                      |                                         |    |     |     |               |
|----------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----|-----|-----|---------------|
| Voltage Gain               | $R_L \geq 15\text{ k}\Omega$ , $V^+ = 15\text{ V}$                                                                   | $25^\circ\text{C}$                      | 50 | 200 |     | V/mV          |
| Large Signal Response Time | $V_{IN} = \text{TTL Logic Swing}$ , $V_{REF} = 1.4\text{ V}$ ,<br>$V_{RL} = 5\text{ V}$ , $R_L = 5.1\text{ k}\Omega$ | $25^\circ\text{C}$                      |    | 200 |     | ns            |
| Response Time              | $V_{RL} = 5\text{ V}$ , $R_L = 5.1\text{ k}\Omega$                                                                   | $25^\circ\text{C}$                      |    | 600 |     | ns            |
| Output Sink Current        | $V_{IN(-)} = 1\text{ V}$ , $V_{IN(+)} = 0\text{ V}$ , $V_O \geq 1.5\text{ V}$                                        | $25^\circ\text{C}$                      | 6  | 16  |     | mA            |
| Saturation Voltage         | $V_{IN(-)} \geq 1\text{ V}$ , $V_{IN(+)} = 0$ , $I_{SINK} \leq 4\text{ mA}$                                          | $25^\circ\text{C}$                      |    | 250 | 400 | mV            |
|                            | $V_{IN(-)} \geq 1\text{ V}$ , $V_{IN(+)} = 0$ , $I_{SINK} \leq 4\text{ mA}$                                          | $0^\circ\text{C}$ to $70^\circ\text{C}$ |    |     | 700 | mV            |
| Output Leakage Current     | $V_{IN(-)} = 0$ , $V_{IN(+)} \geq 1\text{ V}$ , $V_O = 5\text{ V}$                                                   | $25^\circ\text{C}$                      |    | 0.1 |     | nA            |
|                            | $V_{IN(-)} = 0$ , $V_{IN(+)} \geq 1\text{ V}$ , $V_O = 30\text{ V}$                                                  | $25^\circ\text{C}$                      |    |     | 1.0 | $\mu\text{A}$ |

1. The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than  $0.3\text{ V}$ . The upper end of the common-mode voltage range is  $V^+ - 1.5\text{ V}$ , but either or both inputs can go to  $32\text{ V}$  without damage.

## LM392

### ORDERING INFORMATION

| Device    | Operating Temperature Range | Package             | Shipping <sup>†</sup> |
|-----------|-----------------------------|---------------------|-----------------------|
| LM392DR2G | 0°C to +70°C                | SOIC-8<br>(Pb-Free) | 2500 / Tape & Reel    |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SCALE 1:1

SOIC-8 NB  
CASE 751-07  
ISSUE AK

DATE 16 FEB 2011



## NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.80        | 5.00 | 0.189     | 0.197 |
| B   | 3.80        | 4.00 | 0.150     | 0.157 |
| C   | 1.35        | 1.75 | 0.053     | 0.069 |
| D   | 0.33        | 0.51 | 0.013     | 0.020 |
| G   | 1.27 BSC    |      | 0.050 BSC |       |
| H   | 0.10        | 0.25 | 0.004     | 0.010 |
| J   | 0.19        | 0.25 | 0.007     | 0.010 |
| K   | 0.40        | 1.27 | 0.016     | 0.050 |
| M   | 0°          | 8°   | 0°        | 8°    |
| N   | 0.25        | 0.50 | 0.010     | 0.020 |
| S   | 5.80        | 6.20 | 0.228     | 0.244 |

## GENERIC MARKING DIAGRAM\*



SCALE 6:1 (mm/inches)



XXXXXX = Specific Device Code  
A = Assembly Location  
L = Wafer Lot  
Y = Year  
W = Work Week  
▪ = Pb-Free Package

XXXXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## STYLES ON PAGE 2

|                  |             |                                                                                                                                                                                  |
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**SOIC-8 NB**  
**CASE 751-07**  
**ISSUE AK**

DATE 16 FEB 2011

|                                                                                                                                                                                                   |                                                                                                                                                                                          |                                                                                                                                                                                    |                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>STYLE 1:</b><br>PIN 1. EMITTER<br>2. COLLECTOR<br>3. COLLECTOR<br>4. EMITTER<br>5. EMITTER<br>6. BASE<br>7. BASE<br>8. EMITTER                                                                 | <b>STYLE 2:</b><br>PIN 1. COLLECTOR, DIE, #1<br>2. COLLECTOR, #1<br>3. COLLECTOR, #2<br>4. COLLECTOR, #2<br>5. BASE, #2<br>6. EMITTER, #2<br>7. BASE, #1<br>8. EMITTER, #1               | <b>STYLE 3:</b><br>PIN 1. DRAIN, DIE #1<br>2. DRAIN, #1<br>3. DRAIN, #2<br>4. DRAIN, #2<br>5. GATE, #2<br>6. SOURCE, #2<br>7. GATE, #1<br>8. SOURCE, #1                            | <b>STYLE 4:</b><br>PIN 1. ANODE<br>2. ANODE<br>3. ANODE<br>4. ANODE<br>5. ANODE<br>6. ANODE<br>7. ANODE<br>8. COMMON CATHODE                                                                           |
| <b>STYLE 5:</b><br>PIN 1. DRAIN<br>2. DRAIN<br>3. DRAIN<br>4. DRAIN<br>5. GATE<br>6. GATE<br>7. SOURCE<br>8. SOURCE                                                                               | <b>STYLE 6:</b><br>PIN 1. SOURCE<br>2. DRAIN<br>3. DRAIN<br>4. SOURCE<br>5. SOURCE<br>6. GATE<br>7. GATE<br>8. SOURCE                                                                    | <b>STYLE 7:</b><br>PIN 1. INPUT<br>2. EXTERNAL BYPASS<br>3. THIRD STAGE SOURCE<br>4. GROUND<br>5. DRAIN<br>6. GATE 3<br>7. SECOND STAGE Vd<br>8. FIRST STAGE Vd                    | <b>STYLE 8:</b><br>PIN 1. COLLECTOR, DIE #1<br>2. BASE, #1<br>3. BASE, #2<br>4. COLLECTOR, #2<br>5. COLLECTOR, #2<br>6. EMITTER, #2<br>7. EMITTER, #1<br>8. COLLECTOR, #1                              |
| <b>STYLE 9:</b><br>PIN 1. EMITTER, COMMON<br>2. COLLECTOR, DIE #1<br>3. COLLECTOR, DIE #2<br>4. EMITTER, COMMON<br>5. EMITTER, COMMON<br>6. BASE, DIE #2<br>7. BASE, DIE #1<br>8. EMITTER, COMMON | <b>STYLE 10:</b><br>PIN 1. GROUND<br>2. BIAS 1<br>3. OUTPUT<br>4. GROUND<br>5. GROUND<br>6. BIAS 2<br>7. INPUT<br>8. GROUND                                                              | <b>STYLE 11:</b><br>PIN 1. SOURCE 1<br>2. GATE 1<br>3. SOURCE 2<br>4. GATE 2<br>5. DRAIN 2<br>6. DRAIN 2<br>7. DRAIN 1<br>8. DRAIN 1                                               | <b>STYLE 12:</b><br>PIN 1. SOURCE<br>2. SOURCE<br>3. SOURCE<br>4. GATE<br>5. DRAIN<br>6. DRAIN<br>7. DRAIN<br>8. DRAIN                                                                                 |
| <b>STYLE 13:</b><br>PIN 1. N.C.<br>2. SOURCE<br>3. SOURCE<br>4. GATE<br>5. DRAIN<br>6. DRAIN<br>7. DRAIN<br>8. DRAIN                                                                              | <b>STYLE 14:</b><br>PIN 1. N-SOURCE<br>2. N-GATE<br>3. P-SOURCE<br>4. P-GATE<br>5. P-DRAIN<br>6. P-DRAIN<br>7. N-DRAIN<br>8. N-DRAIN                                                     | <b>STYLE 15:</b><br>PIN 1. ANODE 1<br>2. ANODE 1<br>3. ANODE 1<br>4. ANODE 1<br>5. CATHODE, COMMON<br>6. CATHODE, COMMON<br>7. CATHODE, COMMON<br>8. CATHODE, COMMON               | <b>STYLE 16:</b><br>PIN 1. EMITTER, DIE #1<br>2. BASE, DIE #1<br>3. EMITTER, DIE #2<br>4. BASE, DIE #2<br>5. COLLECTOR, DIE #2<br>6. COLLECTOR, DIE #2<br>7. COLLECTOR, DIE #1<br>8. COLLECTOR, DIE #1 |
| <b>STYLE 17:</b><br>PIN 1. VCC<br>2. V2OUT<br>3. V1OUT<br>4. TXE<br>5. RXE<br>6. VEE<br>7. GND<br>8. ACC                                                                                          | <b>STYLE 18:</b><br>PIN 1. ANODE<br>2. ANODE<br>3. SOURCE<br>4. GATE<br>5. DRAIN<br>6. DRAIN<br>7. CATHODE<br>8. CATHODE                                                                 | <b>STYLE 19:</b><br>PIN 1. SOURCE 1<br>2. GATE 1<br>3. SOURCE 2<br>4. GATE 2<br>5. DRAIN 2<br>6. MIRROR 2<br>7. DRAIN 1<br>8. MIRROR 1                                             | <b>STYLE 20:</b><br>PIN 1. SOURCE (N)<br>2. GATE (N)<br>3. SOURCE (P)<br>4. GATE (P)<br>5. DRAIN<br>6. DRAIN<br>7. DRAIN<br>8. DRAIN                                                                   |
| <b>STYLE 21:</b><br>PIN 1. CATHODE 1<br>2. CATHODE 2<br>3. CATHODE 3<br>4. CATHODE 4<br>5. CATHODE 5<br>6. COMMON ANODE<br>7. COMMON ANODE<br>8. CATHODE 6                                        | <b>STYLE 22:</b><br>PIN 1. I/O LINE 1<br>2. COMMON CATHODE/VCC<br>3. COMMON CATHODE/VCC<br>4. I/O LINE 3<br>5. COMMON ANODE/GND<br>6. I/O LINE 4<br>7. I/O LINE 5<br>8. COMMON ANODE/GND | <b>STYLE 23:</b><br>PIN 1. LINE 1 IN<br>2. COMMON ANODE/GND<br>3. COMMON ANODE/GND<br>4. LINE 2 IN<br>5. LINE 2 OUT<br>6. COMMON ANODE/GND<br>7. COMMON ANODE/GND<br>8. LINE 1 OUT | <b>STYLE 24:</b><br>PIN 1. BASE<br>2. EMITTER<br>3. COLLECTOR/ANODE<br>4. COLLECTOR/ANODE<br>5. CATHODE<br>6. CATHODE<br>7. COLLECTOR/ANODE<br>8. COLLECTOR/ANODE                                      |
| <b>STYLE 25:</b><br>PIN 1. VIN<br>2. N/C<br>3. REXT<br>4. GND<br>5. IOUT<br>6. IOUT<br>7. IOUT<br>8. IOUT                                                                                         | <b>STYLE 26:</b><br>PIN 1. GND<br>2. dv/dt<br>3. ENABLE<br>4. ILIMIT<br>5. SOURCE<br>6. SOURCE<br>7. SOURCE<br>8. VCC                                                                    | <b>STYLE 27:</b><br>PIN 1. ILIMIT<br>2. OVLO<br>3. UVLO<br>4. INPUT+<br>5. SOURCE<br>6. SOURCE<br>7. SOURCE<br>8. DRAIN                                                            | <b>STYLE 28:</b><br>PIN 1. SW_TO_GND<br>2. DASIC_OFF<br>3. DASIC_SW_DET<br>4. GND<br>5. V_MON<br>6. VBULK<br>7. VBULK<br>8. VIN                                                                        |
| <b>STYLE 29:</b><br>PIN 1. BASE, DIE #1<br>2. EMITTER, #1<br>3. BASE, #2<br>4. EMITTER, #2<br>5. COLLECTOR, #2<br>6. COLLECTOR, #2<br>7. COLLECTOR, #1<br>8. COLLECTOR, #1                        | <b>STYLE 30:</b><br>PIN 1. DRAIN 1<br>2. DRAIN 1<br>3. GATE 2<br>4. SOURCE 2<br>5. SOURCE 1/DRAIN 2<br>6. SOURCE 1/DRAIN 2<br>7. SOURCE 1/DRAIN 2<br>8. GATE 1                           |                                                                                                                                                                                    |                                                                                                                                                                                                        |

|                         |                    |                                                                                                                                                                                     |
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**North American Technical Support:**

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**

Phone: 00421 33 790 2910

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