## DESCRIPTION

The LM393DR-CN is dual independent precision voltage comparators capable of single or split supply operation.The LM393DR-CN is designed to permit a common mode range−to−ground level with single supply operation. Input offset voltage specifications as low as 3.0 mV make this device an excellent selection for many applications in consumer, automotive, and industrial electronics.The LM393DR-CN is available in a SOP8 package .

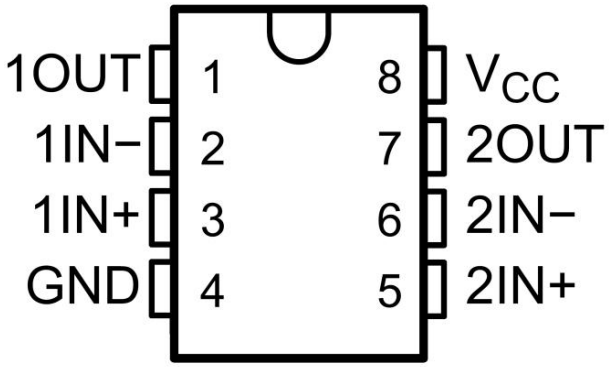
## APPLICATIONS

- Industrial Equipment
- Automotive
- Power Monitoring
- Peak Detectors
- Logic Voltage Conversion
- Electrical Appliances

## FEATURES

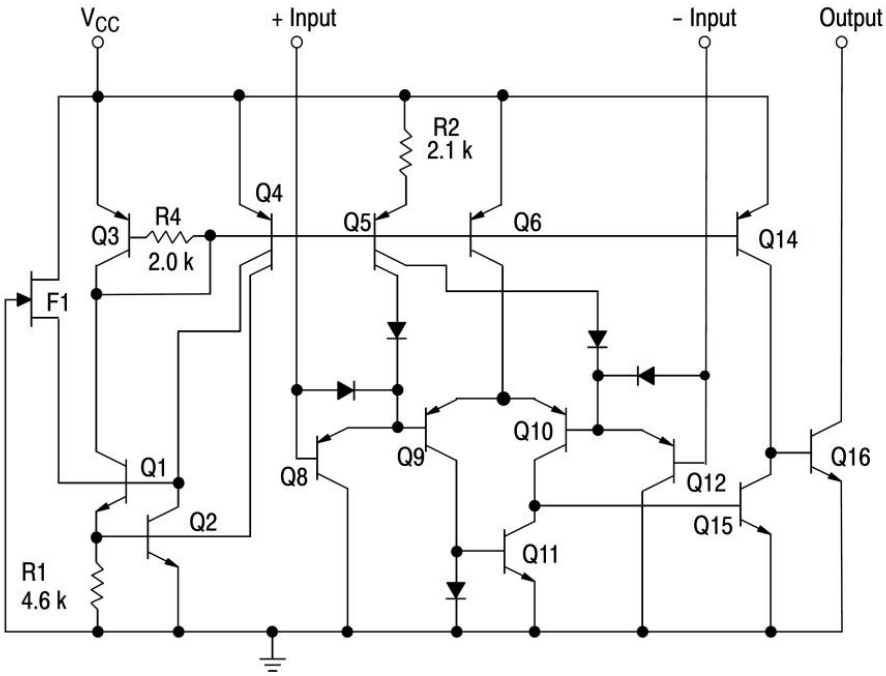
- Wide Supply Range:
  – Single Supply: 3.0V to 36V
  – Split Supply: ±1.5V to ±18V
- Low Input Bias Current: 25nA Typ
- Low Input Offset Current: ±5.0nA Typ

## Pin Configuration




SOP8

## Simplified Schematic(Each Comparator)



## Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)

| PARAMETER | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Supply Voltage | Signal-supply | | 36 | V |
| | Dual-supply | | ±18 | V |
| Differential input voltage | | | ±36 | V |
| Input voltage range | | -0.3 | 36 | V |
| Output voltage | | | 36 | V |
| Input common mode voltage | | | $V_{CC}$ - 1.5 | V |
| Output Current | | | 20 | mA |
| Maximum Junction Temperature | | | +150 | ℃ |
| Storage Temperature Range | | -65 | +150 | ℃ |
| Lead Temperature(soldering, 10sec) | | | +260 | ℃ |

## Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

| PARAMETER | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|
| Supply Voltage, Vs=(V+) - (V-) | Signal-supply | 3 | | 32 | V |
| | Dual-supply | ±1.5 | | ±16 | V |
| Operating Temperature Range | | -20 | +25 | +85 | ℃ |

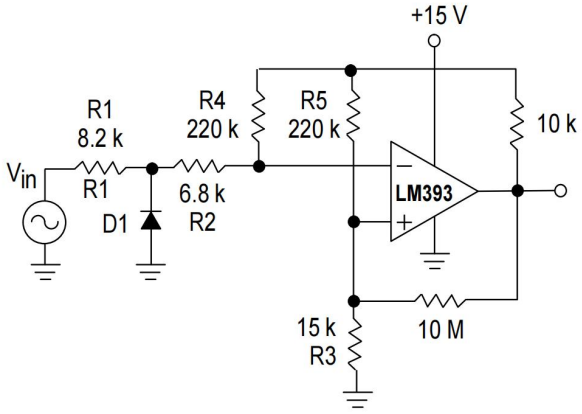
## Electrical Characteristics

(At $T_A$=+25℃, $V_{CC}$=5V, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| Input Offset Voltage | $V_{IO}$ | $T_A$=25℃ | | - | ±1 | ±5 | mV |
| | | -20℃≤ $T_A$ ≤+85℃ | | - | - | ±7 | |
| Input Offset Current | $I_{IO}$ | $T_A$=25℃ | | - | ±5 | ±50 | nA |
| | | -20℃≤ $T_A$ ≤+85℃ | | - | - | ±150 | |
| Input Bias Current | $I_{IB}$ | $T_A$=25℃ | | - | 25 | 250 | nA |
| | | -20℃≤ $T_A$ ≤+85℃ | | - | - | 400 | |
| Input common mode voltage range | $V_{ICR}$ | $T_A$=25℃ | | 0 | - | $V_{CC}$ - 1.5 | V |
| | | -20℃≤ $T_A$ ≤+85℃ | | 0 | - | $V_{CC}$ - 2.0 | |
| Supply Current | $I_{CC}$ | $R_L$=∞, $V_{CC}$=5V | | - | 0.4 | 1.0 | mA |
| | | $R_L$=∞, $V_{CC}$=30V | | - | 0.45 | 2.5 | |
| Voltage Gain | $G_V$ | RL ≥ 15KΩ, $V_{CC}$=15V | | 50 | 200 | - | V/mV |
| Response time | $t_{RES}$ | $V_{RL}$=5V, $R_L$=5.1KΩ | TTL input with $V_{REF}$=1.4V | - | 0.3 | - | us |
| | | | Input overdrive=5mV, Input step=100mV | - | 1.3 | - | |
| Input differential voltage | $V_{ID}$ | - | | -0.3 | - | $V_{CC}$ | V |

| | | | | | | |
|---|---|---|---|---|---|---|
| Low-level output current | $I_{SINK}$ | IN- ≥ 1.0V, IN+ = 0V, $V_O$ ≤ 1.5V | 6 | 16 | - | mA |
| Output saturation voltage | $V_{SAT}$ | IN- ≥ 1.0V, IN+ = 0V, $I_{SINK}$≤4.0mA, | - | 150 | 400 | mV |
| | | IN- ≥ 1.0V, IN+ = 0V, $I_{SINK}$≤4.0mA, -20℃≤ $T_A$ ≤ +85℃ | - | - | 700 | |
| Output Leakage Current | $I_{OL}$ | IN+ ≥ 1.0V, IN- = 0V, $V_O$ = 5V | - | 0.1 | - | uA |
| | | IN+ ≥ 1.0V, IN- = 0V, $V_O$ = 30V -20℃≤ $T_A$ ≤ +85℃ | - | - | 1 | |

## Typical Applications

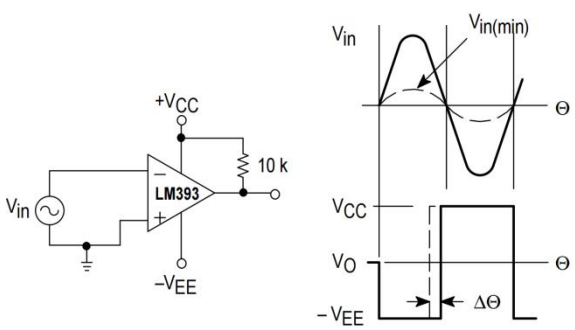



D1 prevents input from going negative by more than 0.6 V.

$R1 + R2 = R3$

$R3 \leq \frac{R5}{10}$ for small error in zero crossing.

**Figure 1. Zero Crossing Detector(Single Supply)**




$V_{in(min)} \approx$ 0.4 V peak for 1% phase distortion (ΔΘ).

**Figure 2. Zero Crossing Detector(Split Supply)**

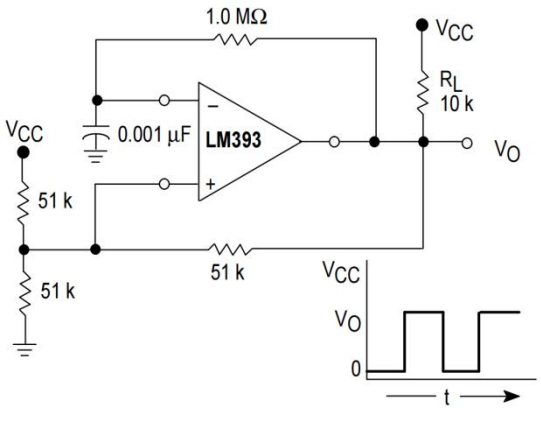



**Figure 3. Free–Running Square–Wave Oscillator**

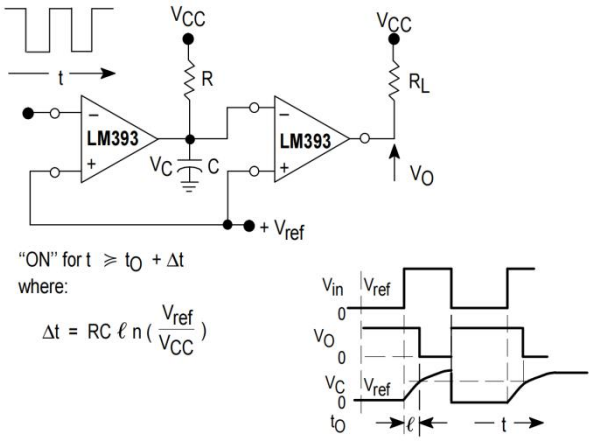
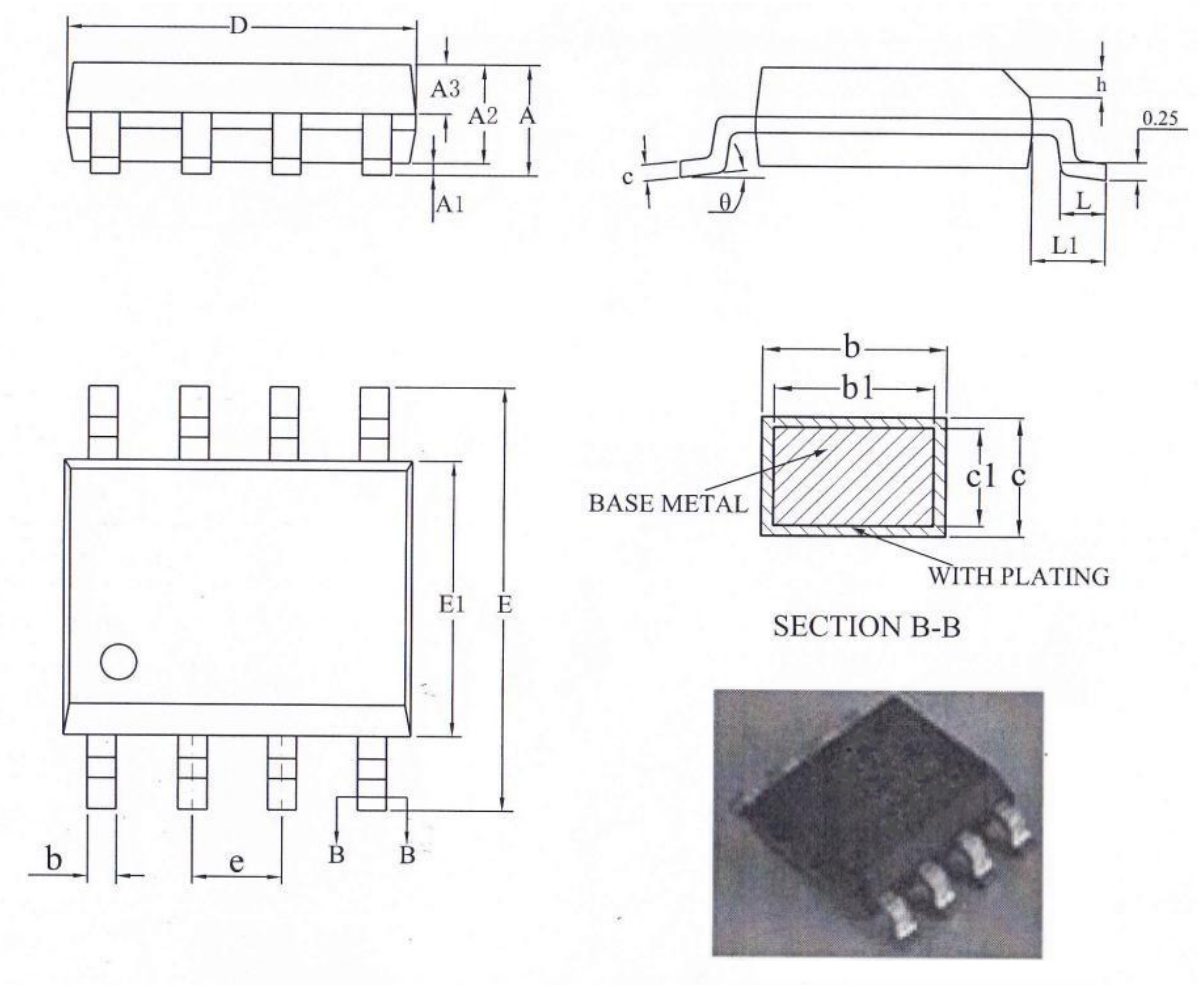



**Figure 4. Time Delay Generator**

## PACKAGE OUTLINE DIMENSIONS

### SOP8




| SYMBOL | MILLIMETER | | | SYMBOL | MILLIMETER | | |
|---|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | | MIN | NOM | MAX |
| A | - | - | 1.75 | D | 4.80 | 4.90 | 5.00 |
| A1 | 0.10 | - | 0.225 | E | 5.80 | 6.00 | 6.20 |
| A2 | 1.30 | 1.40 | 1.50 | E1 | 3.80 | 3.90 | 4.00 |
| A3 | 0.60 | 0.65 | 0.70 | e | 1.27 BSC | | |
| b | 0.39 | - | 0.47 | h | 0.25 | - | 0.50 |
| b1 | 0.38 | 0.41 | 0.44 | L | 0.50 | - | 0.80 |
| c | 0.20 | - | 0.24 | L1 | 1.05REF | | |
| c1 | 0.19 | 0.20 | 0.21 | θ | 0° | - | 8° |

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