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KA393 / KA393A, KA2903 Dual Differential Comparator

Features

- Single Supply Operation: 2V to 36V
- Dual Supply Operation: $\pm 1V$ to $\pm 18V$
- Allow Comparison of Voltages Near Ground Potential
- Low Current Drain: 800 μA Typical
- Compatible with all Forms of Logic
- Low Input Bias Current: 25nA Typical
- Low Input Offset Current: $\pm 5nA$ Typical
- Low Offset Voltage: $\pm 1mV$ Typical

Description

The KA393 / KA393A / KA2903 series consists of two independent voltage comparators designed to operate from a single power supply over a wide voltage range.

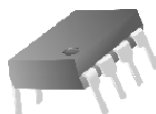


Figure 1. DIP Package



Figure 2. SOIC Package

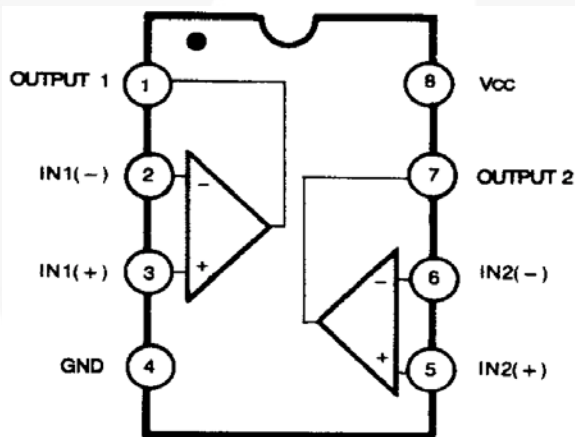


Figure 3. Block Diagram

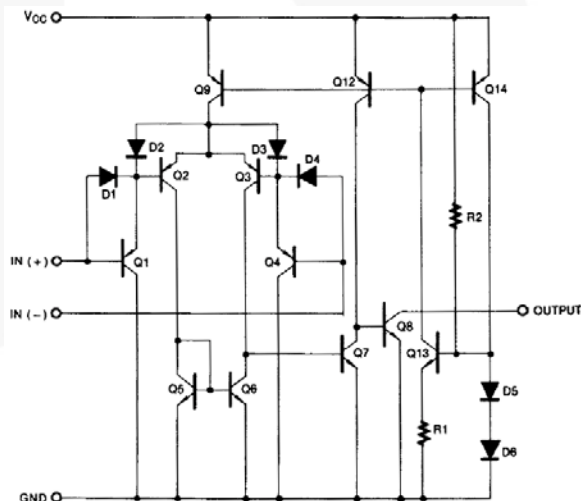


Figure 4. Schematic

Ordering Information

| Part Number | Operating Temperature Range | Package | Packing Method |
|-------------|-----------------------------|-------------|----------------|
| KA393 | 0 to 70°C | 8-Lead DIP | Tube |
| KA393A | 0 to 70°C | | Tube |
| KA393DTF | 0 to 70°C | 8-Lead SOIC | Tape and Reel |
| KA393ADTF | 0 to 70°C | | Tape and Reel |
| KA2903DTF | -40 to 85°C | | Tape and Reel |

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol | Parameter | | Min. | Max. | Unit |
|----------------|--|-----------------------------------|------------|-------|---------------------------|
| V_{CC} | Power Supply Voltage | | ± 18 | 36 | V |
| $V_{I(DIFF)}$ | Differential Input Voltage | | | 36 | V |
| V_I | Input Voltage | | -0.3 | +36.0 | V |
| | Output Short Circuit to GND | | Continuous | | |
| P_D | Power Dissipation, $T_A = 25^\circ\text{C}$ | 8-DIP | | 1040 | mW |
| | | 8-SOIC | | 480 | |
| T_{OPR} | Operating Temperature | KA393 / KA393A | 0 | +70 | $^\circ\text{C}$ |
| | | KA2903 | -40 | +85 | |
| T_{STG} | Storage Temperature | | -65 | +150 | $^\circ\text{C}$ |
| $R\theta_{JA}$ | Thermal Resistance, Junction-to-Ambient | 8-DIP | | 120 | $^\circ\text{C}/\text{W}$ |
| | | 8-SOIC | | 260 | |
| ESD | Electrostatic Discharge Capability | Human Body Model, JESD22-A114 | | 1000 | V |
| | | Charged Device Model, JESD22-C101 | | 2000 | |

Electrical Characteristics

$V_{CC} = 5V$ and $T_A = 25^\circ C$, Unless otherwise specified.

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit | |
|--------------|---------------------------------|---|--|---------|----------------|---------|----|
| V_{IO} | Input Offset Voltage | KA393 | $V_{O(P)} = 1.4V, R_S = 0\Omega$ | | ± 1 | ± 5 | mV |
| | | | $V_{CM} = 0$ to $1.5V, T_A = 0$ to $+70^\circ C$ | | | ± 9 | |
| | | KA393A | $V_{O(P)} = 1.4V, R_S = 0\Omega$ | | ± 1 | ± 2 | |
| | | | $V_{CM} = 0$ to $1.5V, T_A = 0$ to $+70^\circ C$ | | | ± 4 | |
| I_{IO} | Input Offset Current | $T_A = 25^\circ C$ | | ± 5 | ± 50 | nA | |
| | | $T_A = 0$ to $+70^\circ C$ | | | ± 150 | | |
| I_{BIAS} | Input Bias Current | $T_A = 25^\circ C$ | | 65 | 250 | nA | |
| | | $T_A = 0$ to $+70^\circ C$ | | | 400 | | |
| $V_{I(R)}$ | Input Common-Mode Voltage Range | $T_A = 25^\circ C$ | 0 | | $V_{CC} - 1.5$ | V | |
| | | $T_A = 0$ to $+70^\circ C$ | 0 | | $V_{CC} - 2.0$ | | |
| I_{CC} | Supply Current | $R_L = \infty, V_{CC} = 5V$ | | 0.6 | 1.0 | mA | |
| | | $R_L = \infty, V_{CC} = 30V$ | | 0.8 | 2.5 | | |
| V_G | Voltage Gain | $V_{CC} = 15V, R_L \geq 15K\Omega$, (for Large $V_{O(P-P)}$ Swing) | 50 | 200 | | V/mV | |
| t_{LRES} | Large Signal Response Time | $V_I = \text{TTL Logic Swing } V_{REF} = 1.4V$, $V_{RL} = 5V, R_L = 5.1K\Omega$ | | 350 | | ns | |
| t_{RES} | Response Time | $V_{RL} = 5V, R_L = 5.1K\Omega$ | | 1.4 | | μs | |
| I_{SINK} | Output Sink Current | $V_{I(-)} \geq 1V, V_{I(+)} = 0V, V_{O(P)} \leq 1.5V$ | 6 | 18 | | mA | |
| V_{SAT} | Output Saturation Voltage | $V_{I(-)} \geq 1V, V_{I(+)} = 0V$ | | 160 | 400 | mV | |
| | | $I_{SINK} = 4mA, T_A = 0$ to $+70^\circ C$ | | | 700 | | |
| $I_{O(LKG)}$ | Output Leakage Current | $V_{I(-)} = 0V, V_{I(+)} = 1V, V_{O(P)} = 5V$ | | 0.1 | | nA | |
| | | $V_{I(-)} = 0V, V_{I(+)} = 1V, V_{O(P)} = 30V$ | | | 1.0 | μA | |

KA2903

| | | | | | | |
|--------------|---------------------------------|---|----|----------|----------------|---------|
| V_{IO} | Input Offset Voltage | $V_{O(P)} = 1.4V, R_S = 0\Omega$ | | ± 1 | ± 7 | mV |
| | | $V_{CM} = 0$ to $1.5V, T_A = -40$ to $+85^\circ C$ | | ± 9 | ± 15 | |
| I_{IO} | Input Offset Current | $T_A = 25^\circ C$ | | ± 5 | ± 50 | nA |
| | | $T_A = -40$ to $+85^\circ C$ | | ± 50 | ± 200 | |
| I_{BIAS} | Input Bias Current | $T_A = 25^\circ C$ | | 65 | 250 | nA |
| | | $T_A = -40$ to $+85^\circ C$ | | | 500 | |
| $V_{I(R)}$ | Input Common-Mode Voltage Range | $T_A = 25^\circ C$ | 0 | | $V_{CC} - 1.5$ | V |
| | | $T_A = -40$ to $+85^\circ C$ | 0 | | $V_{CC} - 2.0$ | |
| I_{CC} | Supply Current | $R_L = \infty, V_{CC} = 5V$ | | 0.6 | 1.0 | mA |
| | | $R_L = \infty, V_{CC} = 30V$ | | 1.0 | 2.5 | |
| V_G | Voltage Gain | $V_{CC} = 15V, R_L \geq 15K\Omega$, (for Large $V_{O(P-P)}$ Swing) | 25 | 100 | | V/mV |
| t_{LRES} | Large Signal Response Time | $V_I = \text{TTL Logic Swing } V_{REF} = 1.4V$, $V_{RL} = 5V, R_L = 5.1K\Omega$ | | 350 | | ns |
| t_{RES} | Response Time | $V_{RL} = 5V, R_L = 5.1K\Omega$ | | 1.5 | | μs |
| I_{SINK} | Output Sink Current | $V_{I(-)} \geq 1V, V_{I(+)} = 0V, V_{O(P)} \leq 1.5V$ | 6 | 16 | | mA |
| V_{SAT} | Output Saturation Voltage | $V_{I(-)} \geq 1V, V_{I(+)} = 0V$ | | 160 | 400 | mV |
| | | $I_{SINK} = 4mA, T_A = -40$ to $+85^\circ C$ | | | 700 | |
| $I_{O(LKG)}$ | Output Leakage Current | $V_{I(-)} = 0V, V_{I(+)} = 1V, V_{O(P)} = 5V$ | | 0.1 | | nA |
| | | $V_{I(-)} = 0V, V_{I(+)} = 1V, V_{O(P)} = 30V$ | | | 1.0 | μA |

Typical Performance Characteristics

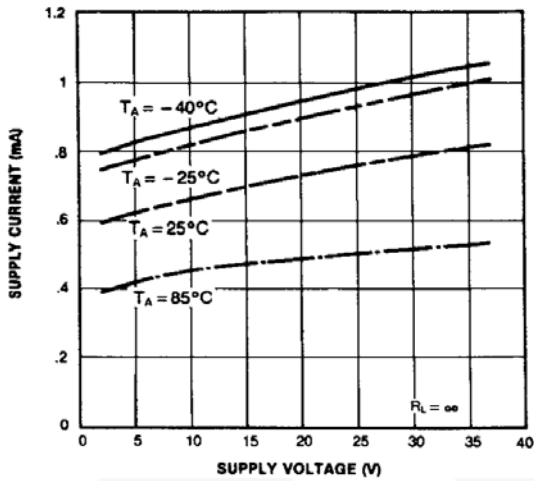


Figure 5. Supply Current vs. Supply Voltage

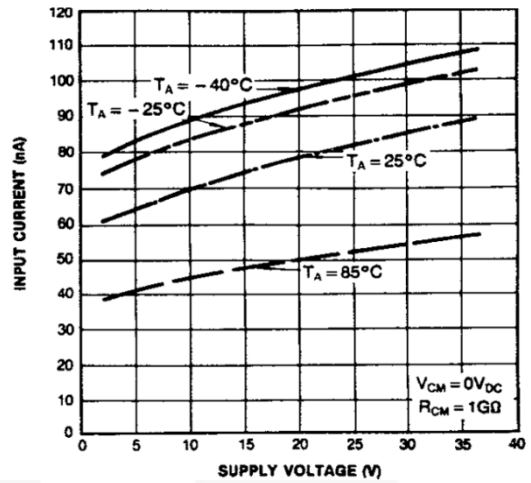


Figure 6. Input Current vs. Supply Voltage

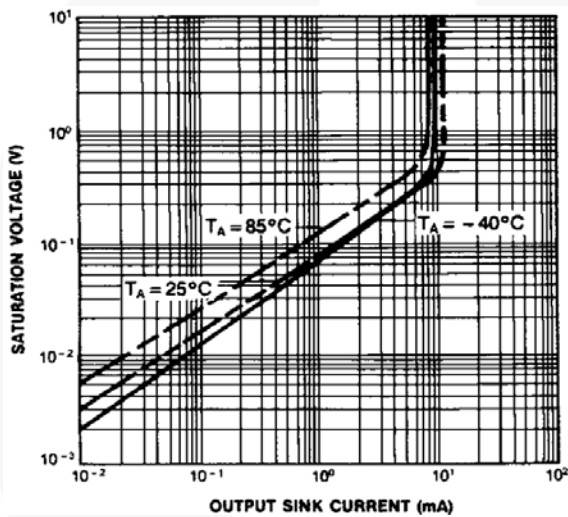


Figure 7. Output Saturation Voltage vs. Sink Current

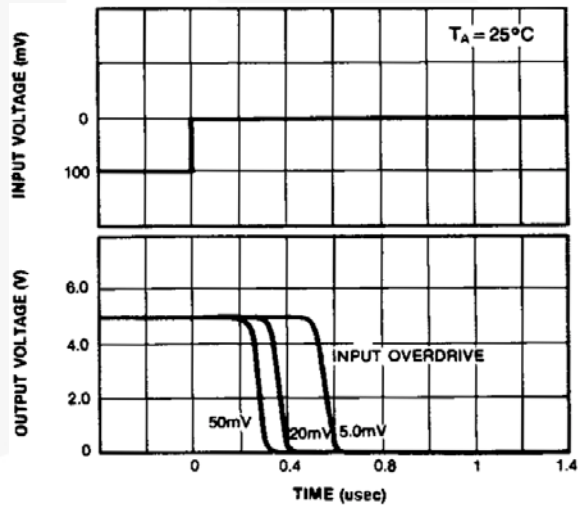


Figure 8. Response Time for Various Input Overdrive-Negative Transitions

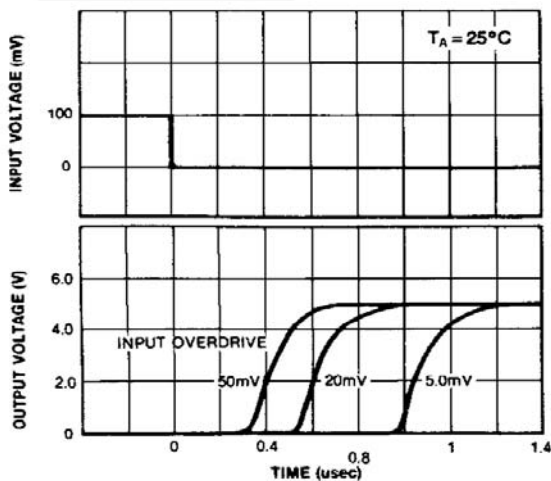
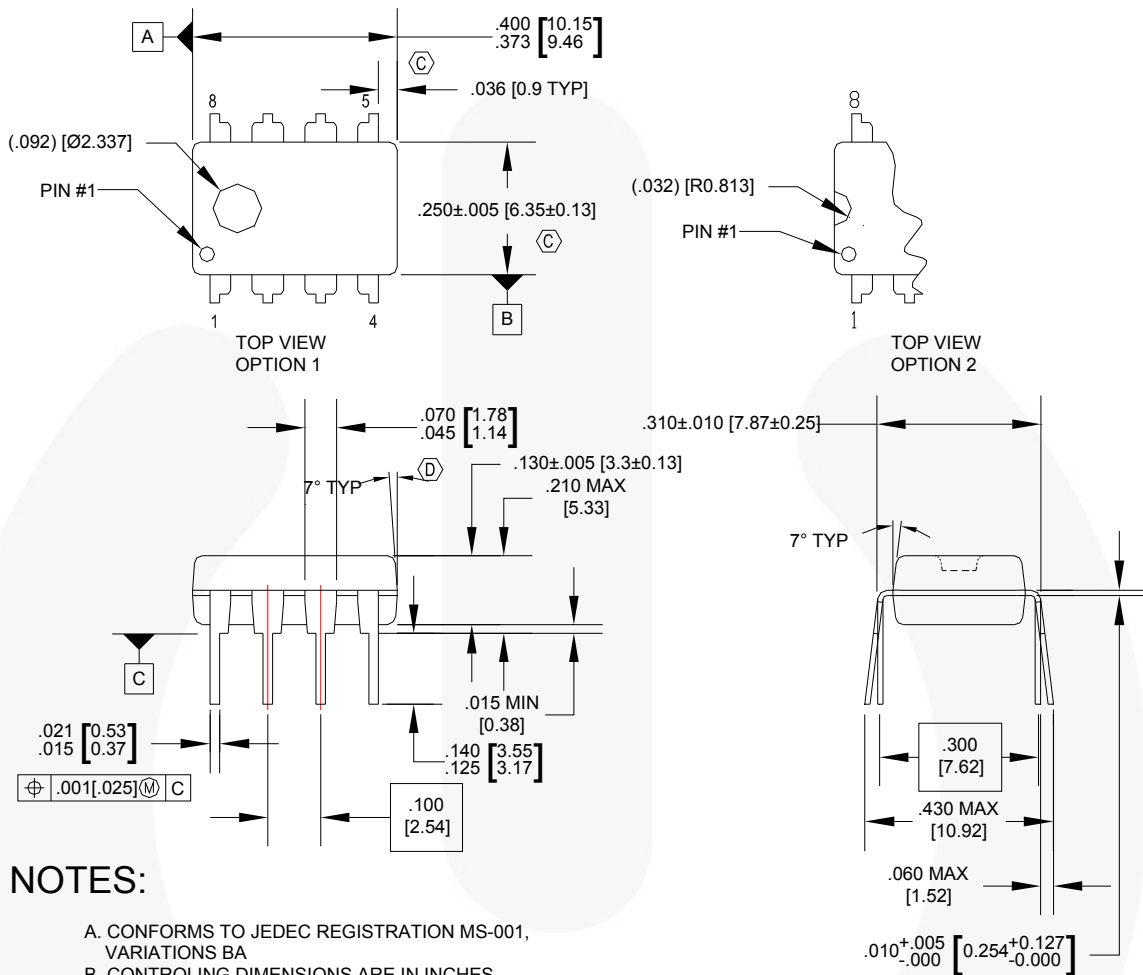


Figure 9. Response Time for Various Input Overdrive-Positive Transitions

Physical Dimensions



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MS-001, VARIATIONS BA
- B. CONTROLLING DIMENSIONS ARE IN INCHES
REFERENCE DIMENSIONS ARE IN MILLIMETERS
- C. DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS.
MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010 INCHES OR 0.25MM.
- D. DOES NOT INCLUDE DAMBAR PROTRUSIONS.
DAMBAR PROTRUSIONS SHALL NOT EXCEED .010 INCHES OR 0.25MM.
- E. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

N08EREVG

Figure 1. 8-Lead, DIP, JEDEC MS-001, .300" Wide






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