

# APX393/APX339

## LOW VOLTAGE RAIL-TO-RAIL INPUT DUAL/QUAD COMPARATORS

### Features

- Guaranteed 2.7V and 5V performance
- Industrial temperature range (-40°C to +85°C)
- Low supply current: 60 µA per Channel
- Input Common Mode Voltage (V<sub>-</sub>+0.2V to V<sub>+</sub>-0.2V)
- Low output saturation voltage @ 200 mV
- Manufactured in standard CMOS process
- MSOP-8L, SOP-8L, and TSSOP-14L available in "Green" Molding Compound (No Br, Sb)
- Lead-free Finish / RoHS Compliant (Note 3)

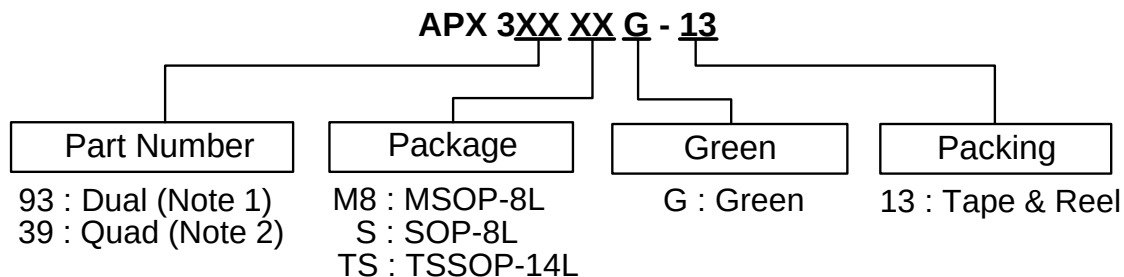
### General Description

The APX393/339 are low voltage (2.5V to 5.5V) dual and quad comparators. The APX393 is the dual version available in the 8-pin SOP and MSOP packages. The APX339 is the quad version available in 14-pin TSSOP package. The APX393/339 are designed to efficiently minimize cost, space, and power consumption for portable consumer products. They have open drain output to connect to the logic supply through a pull-up resistor and allow interfacing to a variety of logic families.

### Applications

- Mobile communications
- Notebooks and PDA's
- Battery powered electronics
- General purpose portable device
- General purpose low voltage applications

### Ordering Information



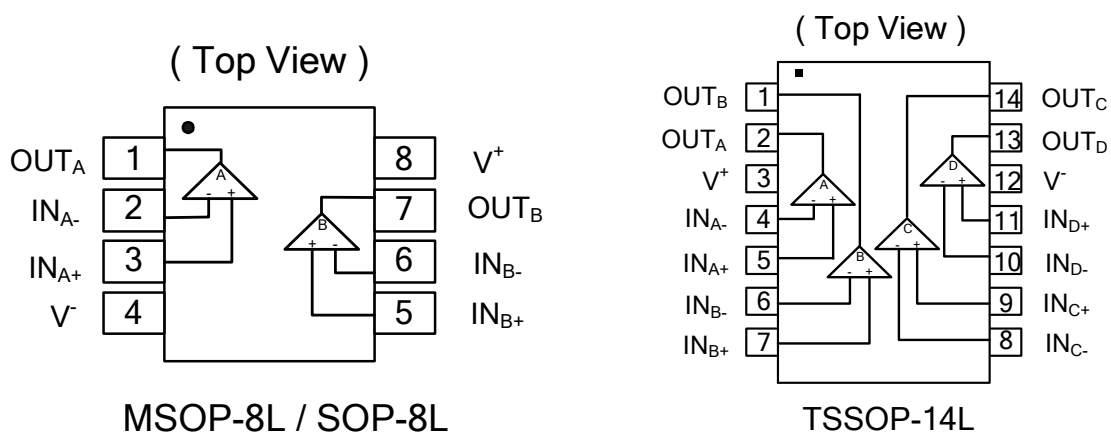
| Device                                                                                           | Package Code | Packaging (Note 4) | 13" Tape and Reel |                    |
|--------------------------------------------------------------------------------------------------|--------------|--------------------|-------------------|--------------------|
|                                                                                                  |              |                    | Quantity          | Part Number Suffix |
|  APX393M8G-13 | M8           | MSOP-8L            | 2500/Tape & Reel  | -13                |
|  APX393SG-13  | S            | SOP-8L             | 2500/Tape & Reel  | -13                |
|  APX339TSG-13 | TS           | TSSOP-14L          | 2500/Tape & Reel  | -13                |

Notes: 1. APX393 is only available for MSOP-8L and SOP-8L.  
2. APX339 is only available for TSSOP-14L.  
3. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied. Please visit our website at [http://www.diodes.com/products/lead\\_free.html](http://www.diodes.com/products/lead_free.html)  
4. Pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at <http://www.diodes.com/datasheets/ap02001.pdf>.

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## LOW VOLTAGE RAIL-TO-RAIL INPUT DUAL/QUAD COMPARATORS

### Pin Assignments



### Absolute Maximum Ratings (Note 5)

| Symbol   | Description                                | Rating               | Unit        |
|----------|--------------------------------------------|----------------------|-------------|
| ESD HBM  | Human Body Model                           | APX393               | V           |
|          |                                            | APX339               |             |
| ESD MM   | Machine Model                              | APX393               | V           |
|          |                                            | APX339               |             |
|          | Differential Input Voltage                 | $\pm$ Supply Voltage | V           |
|          | Voltage On Any Pin (Referred to $V^-$ Pin) | 5.5                  | V           |
| $T_{ST}$ | Storage Temperature                        | -65 to 150           | $^{\circ}C$ |
| $T_J$    | Maximum Junction Temperature               | 150                  | $^{\circ}C$ |

### Operating Ratings (Note 5)

| Symbol      | Description                 | Rating     | Unit        |
|-------------|-----------------------------|------------|-------------|
| $V^+ - V^-$ | Supply Voltage              | 2.5 to 5.5 | V           |
| $T_A$       | Operating Temperature Range | -40 to +85 | $^{\circ}C$ |

Notes: 5. Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performance is not guaranteed. For guaranteed specifications and the test conditions, see the Electrical Characteristics.

# APX393/APX339

## LOW VOLTAGE RAIL-TO-RAIL INPUT DUAL/QUAD COMPARATORS

### Electrical Characteristics

#### 2.7V DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for  $T_A = 25^\circ\text{C}$ ,  $V^+ = 2.7\text{V}$ ,  $V^- = 0\text{V}$ . Boldface limits apply at the temperature extremes.

| Symbol     | Parameter                             | Test Conditions                | Min<br>(Note 7) | Typ.<br>(Note 6) | Max<br>(Note 7)   | Unit                         |
|------------|---------------------------------------|--------------------------------|-----------------|------------------|-------------------|------------------------------|
| $V_{OS}$   | Input Offset Voltage                  |                                |                 | 1.7              | 7                 | mV                           |
| $TCV_{OS}$ | Input Offset Voltage<br>Average Drift |                                |                 | 5                |                   | $\mu\text{V}/^\circ\text{C}$ |
| $I_B$      | Input Bias Current                    |                                |                 | 10               | 250<br><b>400</b> | nA                           |
| $I_{OS}$   | Input Offset Current                  |                                |                 | 5                | 50<br><b>150</b>  | nA                           |
| $V_{CM}$   | Input Voltage Range                   |                                |                 | 0.2              |                   | V                            |
|            |                                       |                                |                 | 2.5              |                   | V                            |
| $V_{SAT}$  | Saturation Voltage                    | $I_{SINK} \leq 1\text{mA}$     |                 | 200              |                   | mV                           |
| $I_O$      | Output Sink Current                   | $V_O \leq 1.5\text{V}$         | 5               | 20               |                   | mA                           |
| $I_S$      | Supply Current                        | APX393<br>Both Comparators     |                 | 150              | 180               | $\mu\text{A}$                |
|            |                                       | APX339<br>All four Comparators |                 | 240              | 300               | $\mu\text{A}$                |
|            | Output Leakage Current                |                                |                 | 0.003            | <b>1</b>          | $\mu\text{A}$                |

#### 2.7V AC Electrical Characteristics

$T_A = 25^\circ\text{C}$ ,  $V^+ = 2.7\text{V}$ ,  $R_L = 5.1\text{ k}\Omega$ ,  $V^- = 0\text{V}$ .

| Symbol    | Parameter                          | Test Conditions         | Min<br>(Note 7) | Typ.<br>(Note 6) | Max<br>(Note 7) | Unit |
|-----------|------------------------------------|-------------------------|-----------------|------------------|-----------------|------|
| $T_{PHL}$ | Propagation Delay<br>(High to Low) | Input Overdrive = 10mV  |                 | 700              |                 | ns   |
|           |                                    | Input Overdrive = 100mV |                 | 150              |                 | ns   |
| $T_{PLH}$ | Propagation Delay<br>(Low to High) | Input Overdrive = 10mV  |                 | 500              |                 | ns   |
|           |                                    | Input Overdrive = 100mV |                 | 200              |                 | ns   |

### Electrical Characteristics (Continued)

#### 5V DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for  $T_A = 25^\circ\text{C}$ ,  $V^+ = 5\text{V}$ ,  $V^- = 0\text{V}$ . **Boldface** limits apply at the temperature extremes.

| Symbol        | Parameter                                  | Test Conditions                | Min<br>(Note 7) | Typ.<br>(Note 6) | Max<br>(Note 7) | Unit                         |
|---------------|--------------------------------------------|--------------------------------|-----------------|------------------|-----------------|------------------------------|
| $V_{OS}$      | Input Offset Voltage                       |                                |                 | 1.7              | 7<br>9          | mV                           |
| $TCV_{OS}$    | Input Offset Voltage<br>Average Drift      |                                |                 | 5                |                 | $\mu\text{V}/^\circ\text{C}$ |
| $I_B$         | Input Bias Current                         |                                |                 | 25               | 250<br>400      | nA                           |
| $I_{OS}$      | Input Offset Current                       |                                |                 | 2                | 50<br>150       | nA                           |
| $V_{CM}$      | Input Voltage Range                        |                                |                 | 0.2              |                 | V                            |
|               |                                            |                                |                 | 4.8              |                 | V                            |
| $A_V$         | Voltage Gain                               | $R_L = 5.1\text{ k}\Omega$     | 20              | 50               |                 | V/mV                         |
| $V_{SAT}$     | Saturation Voltage                         | $I_{SINK} \leq 4\text{mA}$     |                 | 200              | 400<br>700      | mV                           |
| $I_O$ (Sink)  | Output Sink Current                        | $V_O \leq 1.5\text{V}$         | 10              | 60               |                 | mA                           |
| $I_S$         | Supply Current                             | APX393<br>Both Comparators     |                 | 150              | 180<br>250      | $\mu\text{A}$                |
|               |                                            | APX339<br>All four Comparators |                 | 240              | 300<br>350      | $\mu\text{A}$                |
|               | Output Leakage Current                     |                                |                 | .003             | 1               | $\mu\text{A}$                |
| $\theta_{JA}$ | Thermal Resistance<br>Junction-to -Ambient | MSOP-8L (Note 8)               |                 | 203              |                 | $^\circ\text{C}/\text{W}$    |
|               |                                            | SOP-8L (Note 8)                |                 | 150              |                 | $^\circ\text{C}/\text{W}$    |
|               |                                            | TSSOP-14L (Note 8)             |                 | 100              |                 | $^\circ\text{C}/\text{W}$    |

#### 5V AC Electrical Characteristics

$T_A = 25^\circ\text{C}$ ,  $V^+ = 5\text{V}$ ,  $R_L = 5.1\text{ k}\Omega$ ,  $V^- = 0\text{V}$ .

| Symbol    | Parameter                          | Test Conditions         | Min<br>(Note 7) | Typ.<br>(Note 6) | Max<br>(Note 7) | Unit |
|-----------|------------------------------------|-------------------------|-----------------|------------------|-----------------|------|
| $T_{PHL}$ | Propagation Delay<br>(High to Low) | Input Overdrive = 10mV  |                 | 600              |                 | ns   |
|           |                                    | Input Overdrive = 100mV |                 | 200              |                 | ns   |
| $T_{PLH}$ | Propagation Delay<br>(Low to High) | Input Overdrive = 10mV  |                 | 450              |                 | ns   |
|           |                                    | Input Overdrive = 100mV |                 | 300              |                 | ns   |

Notes: 6. Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration. The typical values are not tested and are not guaranteed on shipped production material.

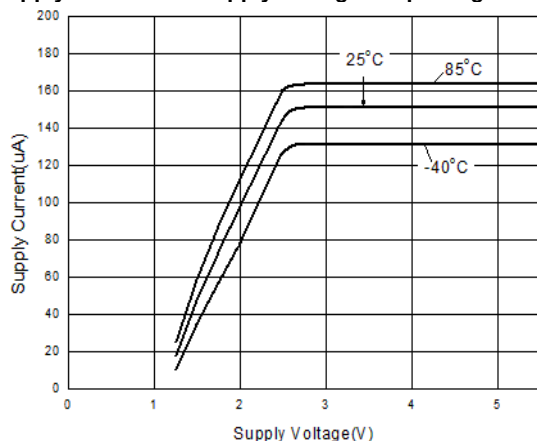
7. All limits are guaranteed by testing or statistical analysis.

8. All numbers are typical, and apply for packages soldered directly onto a PC board in still air.

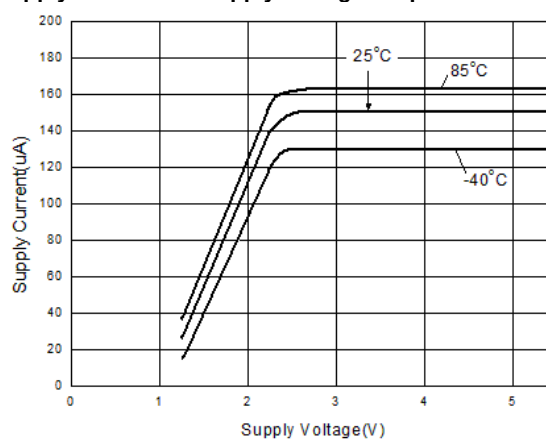
### Typical Performance Characteristics

Unless otherwise specified,  $V_s = +5V$ , single supply,  $T_A = 25^\circ C$

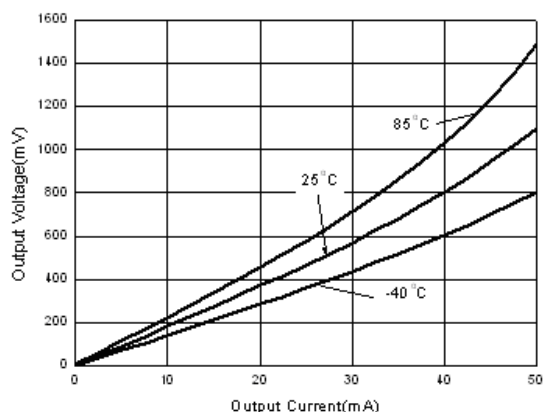
Supply Current vs. Supply Voltage Output High



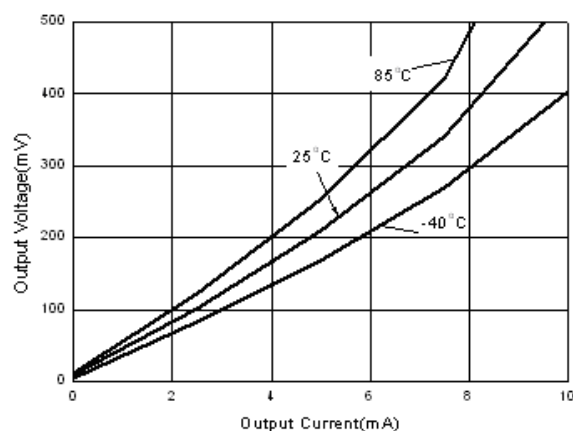
Supply Current vs. Supply Voltage Output Low



Output Voltage vs. Output Current (5V)



Output Voltage vs. Output Current (2.7V)

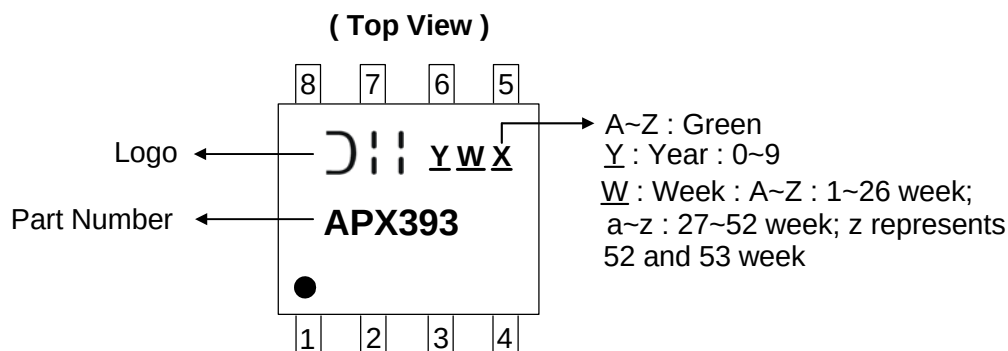


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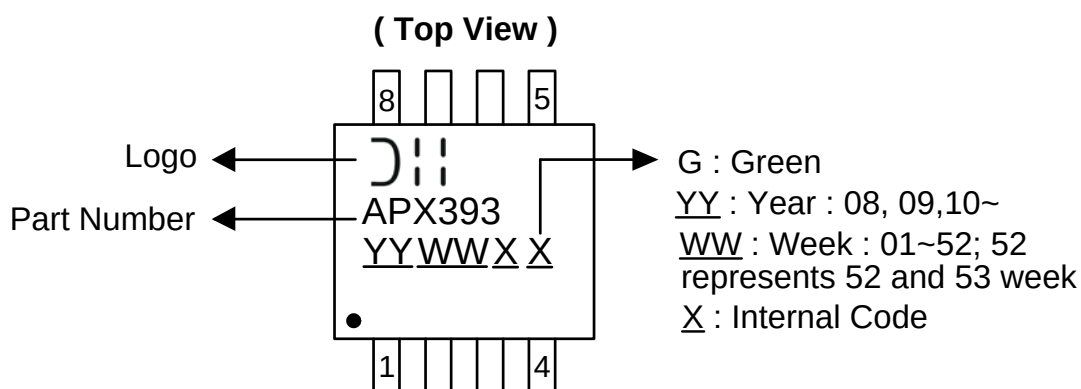
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### Marking Information

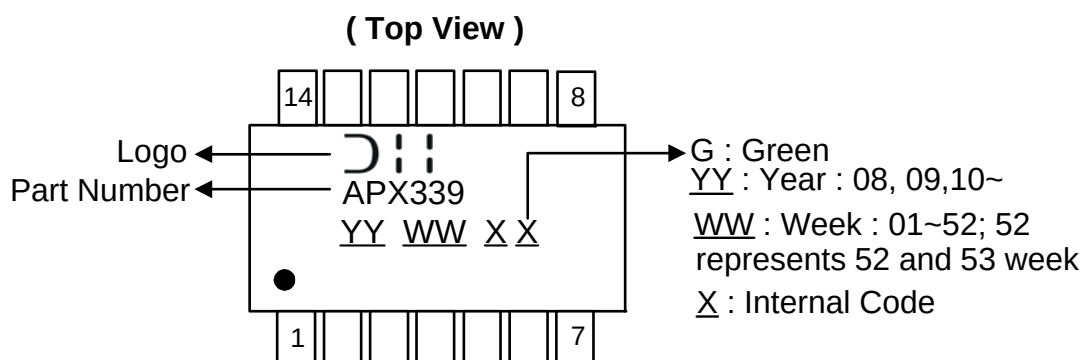
#### (1) MSOP-8L



#### (2) SOP-8L

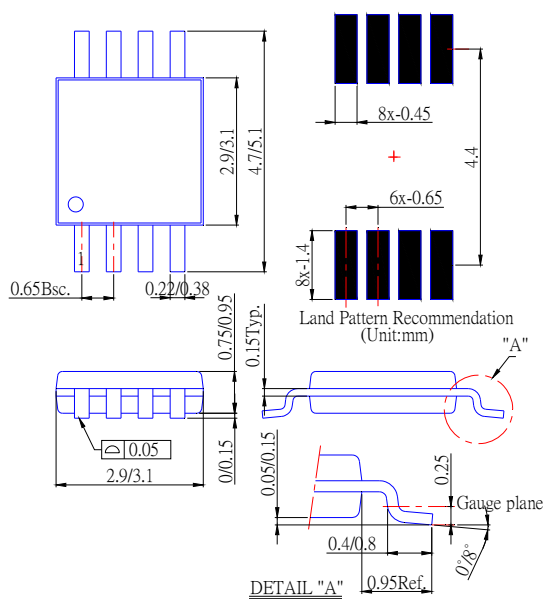


#### (3) TSSOP-14L

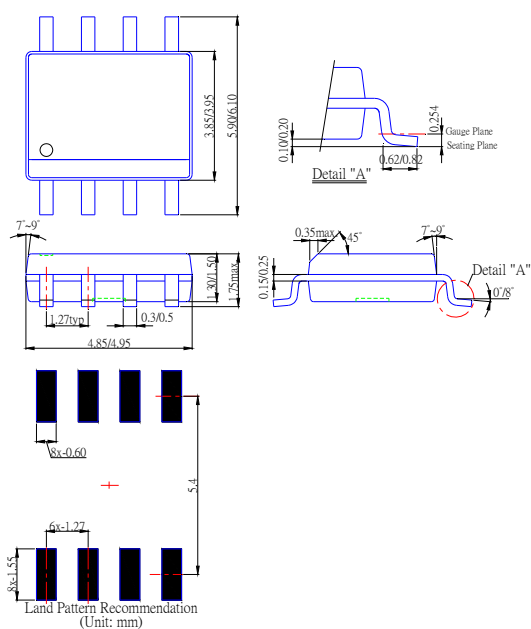


### Package Information ( All Dimensions in mm )

#### (1) Package type: MSOP-8L

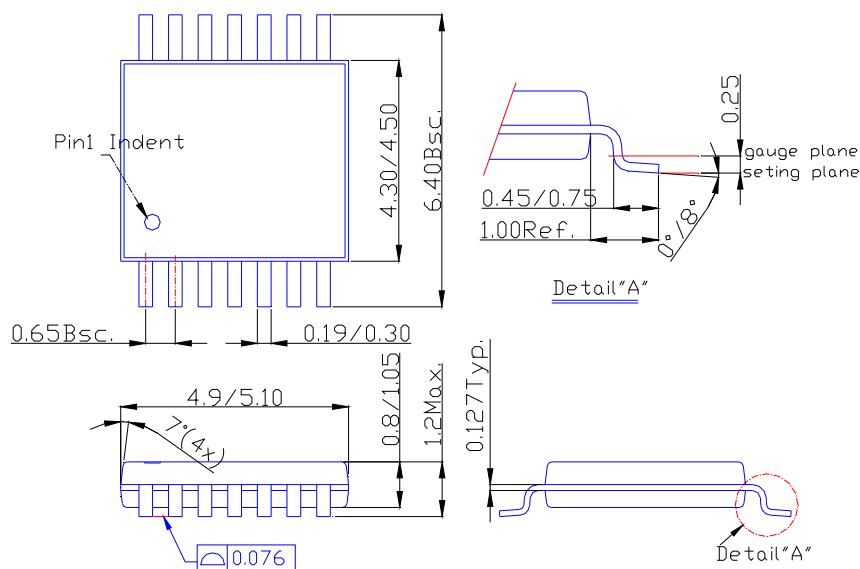


#### (2) Package type: SOP-8L



### Package Information (Continued)

#### (3) Package type: TSSOP-14L



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