



# THE DATASHEET OF LMV339IDT





# LMV331, LMV393, LMV339

## General-purpose low voltage comparators

### Features

- Supply operation from 2.7 to 5 V
- Low current consumption: 20  $\mu$ A
- Input common mode range includes ground
- Wide temperature range: -40°C to +85°C
- Low output saturation voltage
- Propagation delay: 200 ns
- Open drain output
- ESD tolerance: 2 kV HBM / 200 V MM
- SMD packages

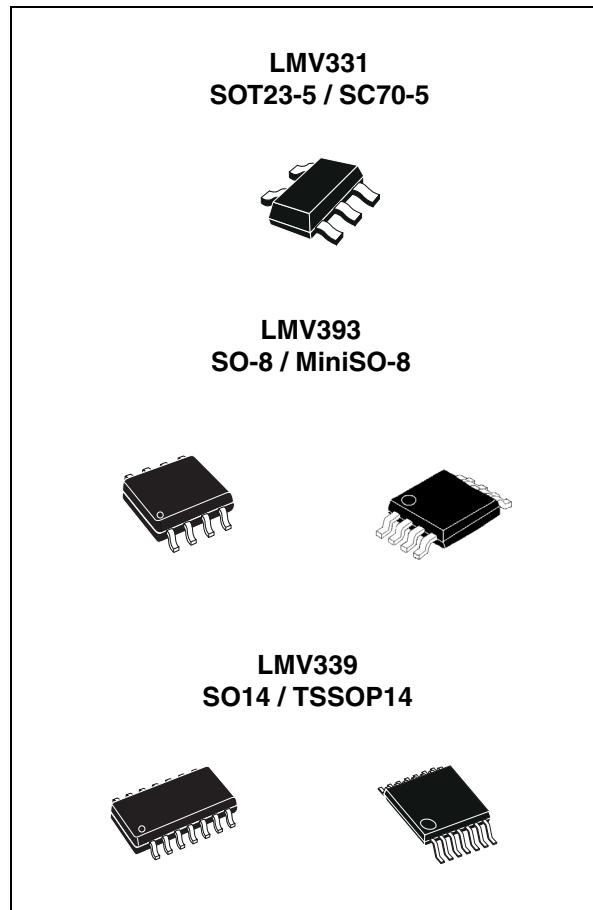
### Applications

- Mobile phones
- Notebooks and PDAs
- Battery supplied electronics
- General-purpose portable devices
- General-purpose low voltage applications

### Description

The LMV331, LMV393 and LMV339 are the single/dual/quad and low voltage versions of the industry standard LM339 and LM393. They can operate with a supply voltage ranging from 2.7 to 5 V, and exhibit a lower current consumption than their predecessors LM339 and LM393. These devices are a perfect choice for low-voltage applications.

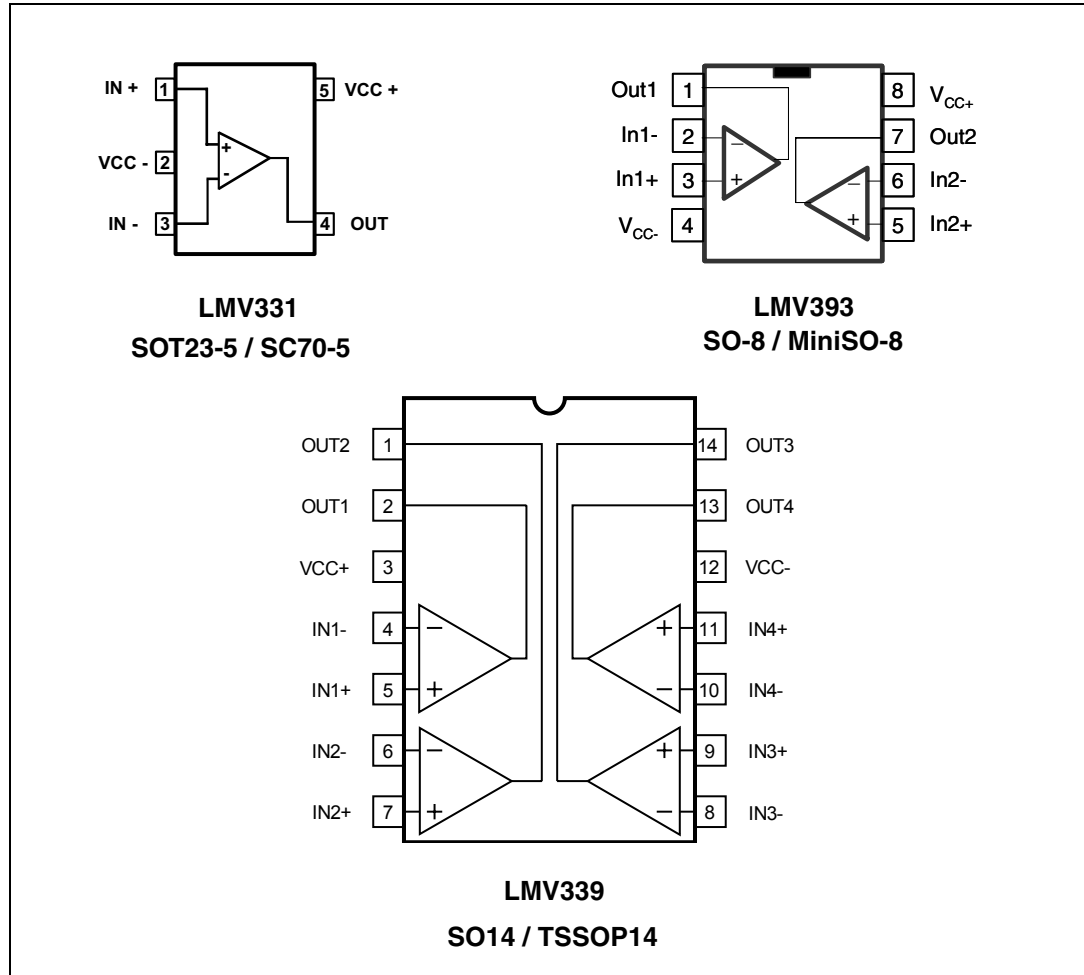
The LMV3xx are available in tiny packages, making them ideal for applications where space saving is a constraint.



The devices are designed to operate in the temperature range of -40°C to +85°C and are suitable for a variety of applications.

# 1 Package pin connections

Figure 1. Pin connections for each package (top view)



## 2 Absolute maximum ratings and operating conditions

**Table 1. Absolute maximum ratings**

| Symbol     | Parameter   | Value                                  | Unit |
|------------|---|--|------|
| $V_{CC}$   | Supply voltage <sup>(1)</sup>                         | 5.5                                    | V    |
| $V_{ID}$   | Differential input voltage                            | ± 5.5                                  | V    |
| $V_{IN}$   | Input voltage range                                   | $(V_{CC-}) - 0.3$ to $(V_{CC+}) + 0.3$ | V    |
| $V_{out}$  | Output voltage <sup>(1)</sup>                         | 5.5                                    | V    |
| $R_{thja}$ | Thermal resistance junction to ambient <sup>(2)</sup> |  | °C/W |
|            | SC70-5  | 205                                    |      |
|            | SOT23-5   | 250                                    |      |
|            | SO-8  | 125                                    |      |
|            | MiniSO-8  | 190                                    |      |
|            | SO14  | 105                                    |      |
| $R_{thjc}$ | Thermal resistance junction to case <sup>(2)</sup>    |  | °C/W |
|            | SC70-5  | 172                                    |      |
|            | SOT23-5   | 81                                     |      |
|            | SO-8  | 40                                     |      |
|            | MiniSO-8  | 39                                     |      |
|            | SO14  | 31                                     |      |
| $T_{stg}$  | Storage temperature                                   | -65 to +150                            | °C   |
| $T_j$      | Junction temperature                                  | 150                                    | °C   |
| $T_{LEAD}$ | Lead temperature (soldering 10 seconds)               | 260                                    | °C   |
| ESD        | Human body model (HBM) <sup>(3)</sup>                 | 2000                                   | V    |
|            | Machine model (MM) <sup>(4)</sup>                     | 200                                    |      |
|            | Charged device model (CDM) <sup>(5)</sup>             | 1500                                   |      |
|            | Latch-up immunity                                     | 200                                    | mA   |

1. All voltage values, except the differential voltage, are referenced to  $V_{CC-}$ .
2. Short-circuits can cause excessive heating. These values are typical.
3. Human body model: a 100 pF capacitor is charged to the specified voltage, then discharged through a 1.5 k $\Omega$  resistor between two pins of the device. This is done for all couples of connected pin combinations while the other pins are floating.
4. Machine model: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5  $\Omega$ ). This is done for all couples of connected pin combinations while the other pins are floating.
5. Charged device model: all pins and package are charged together to the specified voltage and then discharged directly to ground through only one pin. This is done for all pins.

**Table 2. Operating conditions**

| Symbol     | Parameter                                   | Value      | Unit |
|------------|---|------------|------|
| $T_{oper}$ | Operating temperature range                 | -40 to +85 | °C   |
| $V_{CC}$   | Supply voltage<br>-40°C < $T_{amb}$ < +85°C | 2.7 to 5.0 | V    |

### 3 Electrical characteristics

**Table 3.**  $V_{CC}^+ = +2.7\text{ V}$ ,  $V_{CC}^- = 0\text{ V}$ ,  $T_{amb} = +25^\circ\text{ C}$ , full  $V_{ICM}$  range (unless otherwise specified)<sup>(1)</sup>

| Symbol          | Parameter                                     | Test conditions   | Min. | Typ.        | Max.       | Unit                         |
|-----------------|---|---|------|-------------|------------|------------------------------|
| $V_{IO}$        | Input offset voltage                          |   |      | 1           | 7          | mV                           |
| $\Delta V_{IO}$ | Input offset voltage drift                    | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$   |      | 5           |            | $\mu\text{V}/^\circ\text{C}$ |
| $I_{IB}$        | Input bias current <sup>(2)</sup>             | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$   |      | 25          | 250<br>400 | nA                           |
| $I_{IO}$        | Input offset current <sup>(2)</sup>           | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$   |      | 1           | 50<br>150  | nA                           |
| $V_{ICM}$       | Common mode input voltage                     |   |      | -0.1<br>2.0 |            | V                            |
| $V_{OL}$        | Output voltage low                            | $I_{SINK} = 1\text{ mA}$  |      | 20          |            | mV                           |
| $I_{SINK}$      | Output sink current                           | $V_{OUT} = 1.5\text{ V}$  | 5    | 47          |            | mA                           |
| $I_{CC}$        | Supply current                                | No load, output high, $V_{ICM} = 0\text{ V}$  |      | 20          | 100        | $\mu\text{A}$                |
| $I_{OH}$        | Output current leakage                        | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$   |      | 0.003       | 1          | $\mu\text{A}$                |
| $TP_{HL}$       | Propagation delay<br>High to low output level | $V_{ICM} = 0\text{ V}$ , $R_L = 5.1\text{ k}\Omega$ , $C_L = 50\text{ pF}$<br>Overdrive = 10 mV<br>Overdrive = 100 mV |      | 300<br>200  |            | ns                           |
| $TP_{LH}$       | Propagation delay<br>Low to high output level | $V_{ICM} = 0\text{ V}$ , $R_L = 5.1\text{ k}\Omega$ , $C_L = 50\text{ pF}$<br>Overdrive = 10 mV<br>Overdrive = 100 mV |      | 550<br>400  |            | ns                           |

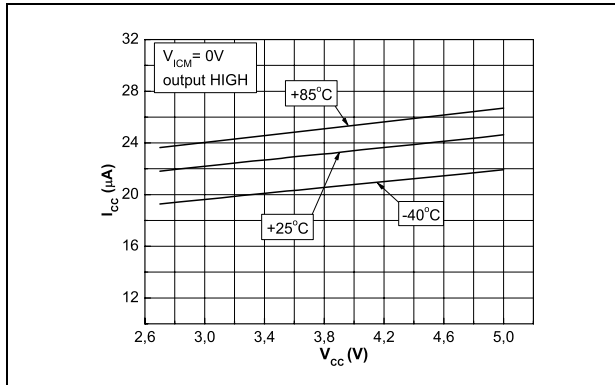
1. All values over the temperature range are guaranteed through correlation and simulation. No production tests have been performed at the temperature range limits.
2. Maximum values include unavoidable inaccuracies of the industrial tests.

Table 4.  $V_{CC}^+ = +5\text{ V}$ ,  $V_{CC}^- = 0\text{ V}$ ,  $T_{amb} = +25^\circ\text{C}$ , full  $V_{ICM}$  range (unless otherwise specified)<sup>(1)</sup>

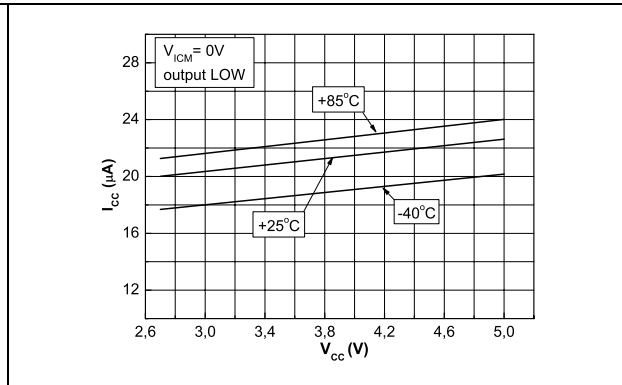
| Symbol          | Parameter                                     | Test conditions   | Min. | Typ.  | Max.       | Unit                         |
|-----------------|---|---|------|-------|------------|------------------------------|
| $V_{IO}$        | Input offset voltage                          | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$   |      | 1     | 7<br>9     | mV                           |
| $\Delta V_{IO}$ | Input offset voltage drift                    | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$   |      | 5     |            | $\mu\text{V}/^\circ\text{C}$ |
| $I_{IB}$        | Input bias current <sup>(2)</sup>             | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$   |      | 25    | 250<br>400 | nA                           |
| $I_{IO}$        | Input offset current <sup>(2)</sup>           | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$   |      | 2     | 50<br>150  | nA                           |
| $V_{ICM}$       | Common mode input voltage                     |   |      | -0.1  |            | V                            |
|                 |   |   |      | 4.2   |            |                              |
| $A_V$           | Voltage gain                                  |   | 20   | 50    |            | V/mV                         |
| $V_{OL}$        | Output voltage low                            | $I_{SINK} < 4\text{ mA}$<br>$-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$   |      | 50    | 400<br>700 | mV                           |
| $I_{SINK}$      | Output sink current                           | $V_{OUT} < 1.5\text{ V}$  | 10   | 93    |            | mA                           |
| $I_{CC}$        | Supply current                                | No load, output high, $V_{ICM} = 0\text{ V}$<br>$-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$                     |      | 25    | 120<br>150 | $\mu\text{A}$                |
| $I_{OH}$        | Output current leakage                        | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$   |      | 0.003 | 1          | $\mu\text{A}$                |
| $TP_{HL}$       | Propagation delay<br>High to low output level | $V_{ICM} = 0\text{ V}$ , $R_L = 5.1\text{ k}\Omega$ , $C_L = 50\text{ pF}$<br>Overdrive = 10 mV<br>Overdrive = 100 mV |      | 375   |            | ns                           |
|                 |   |   |      | 275   |            |                              |
| $TP_{LH}$       | Propagation delay<br>Low to high output level | $V_{ICM} = 0\text{ V}$ , $R_L = 5.1\text{ k}\Omega$ , $C_L = 50\text{ pF}$<br>Overdrive = 10 mV<br>Overdrive = 100 mV |      | 550   |            | ns                           |
|                 |   |   |      | 425   |            |                              |

1. All values over the temperature range are guaranteed through correlation and simulation. No production tests have been performed at the temperature range limits.
2. Maximum values include unavoidable inaccuracies of the industrial tests.

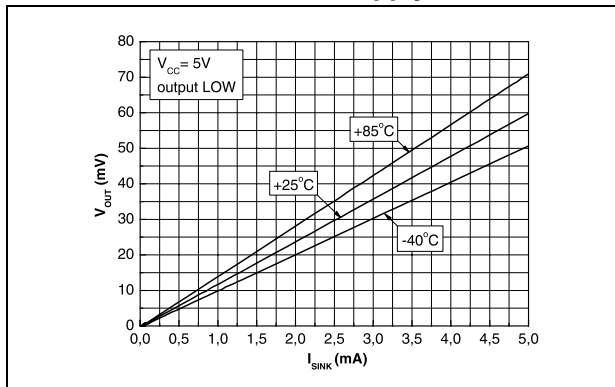
**Figure 2. Supply current versus supply voltage with output high**



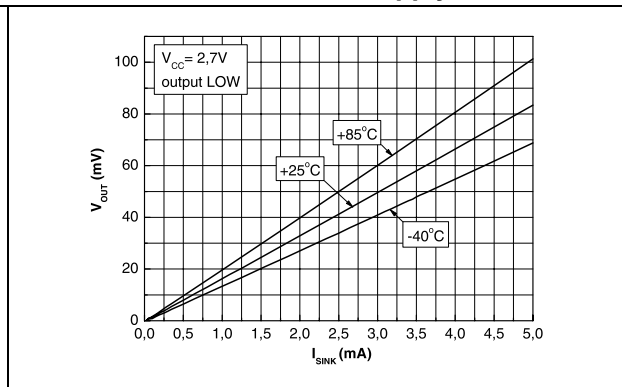
**Figure 3. Supply current versus supply voltage with output low**



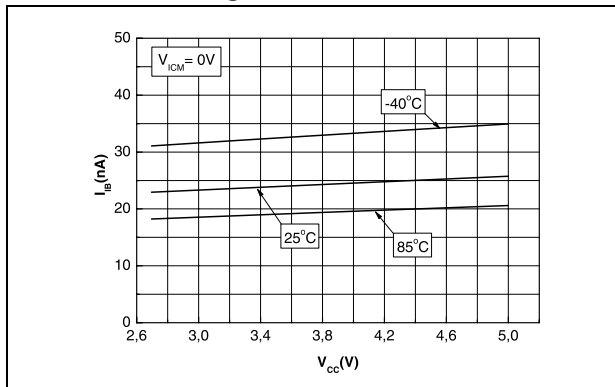
**Figure 4. Output voltage versus output current at 5 V supply**



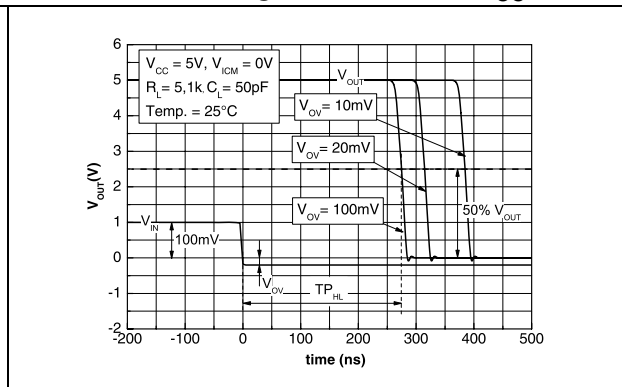
**Figure 5. Output voltage versus output current at 2.7 V supply**



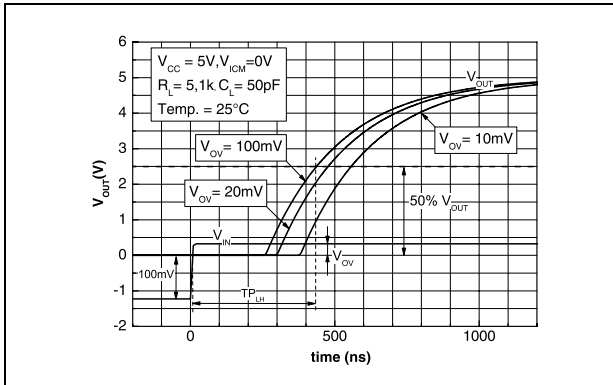
**Figure 6. Input bias current versus supply voltage**



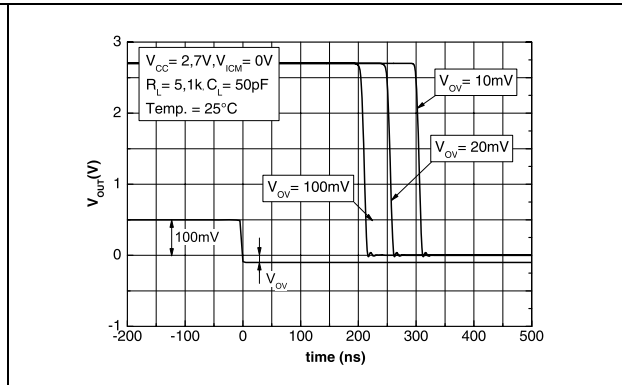
**Figure 7. Response time versus overdrive with negative transition, V<sub>CC</sub> = 5 V**



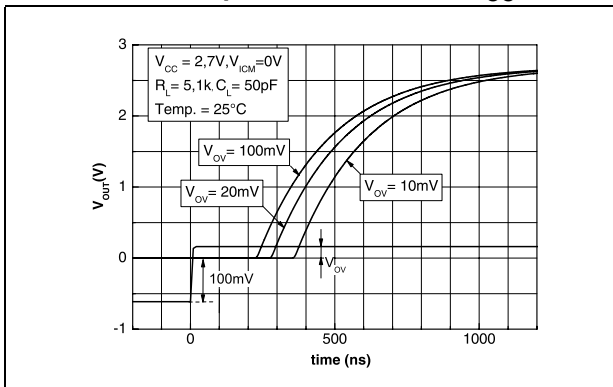
**Figure 8. Response time versus overdrive with positive transition,  $V_{CC} = 5\text{ V}$**



**Figure 9. Response time versus overdrive with negative transition,  $V_{CC} = 2.7\text{ V}$**



**Figure 10. Response time versus overdrive with positive transition,  $V_{CC} = 2.7\text{ V}$**



## 4 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

### 4.1 SOT23-5 package

Figure 11. SOT23-5 package mechanical drawing

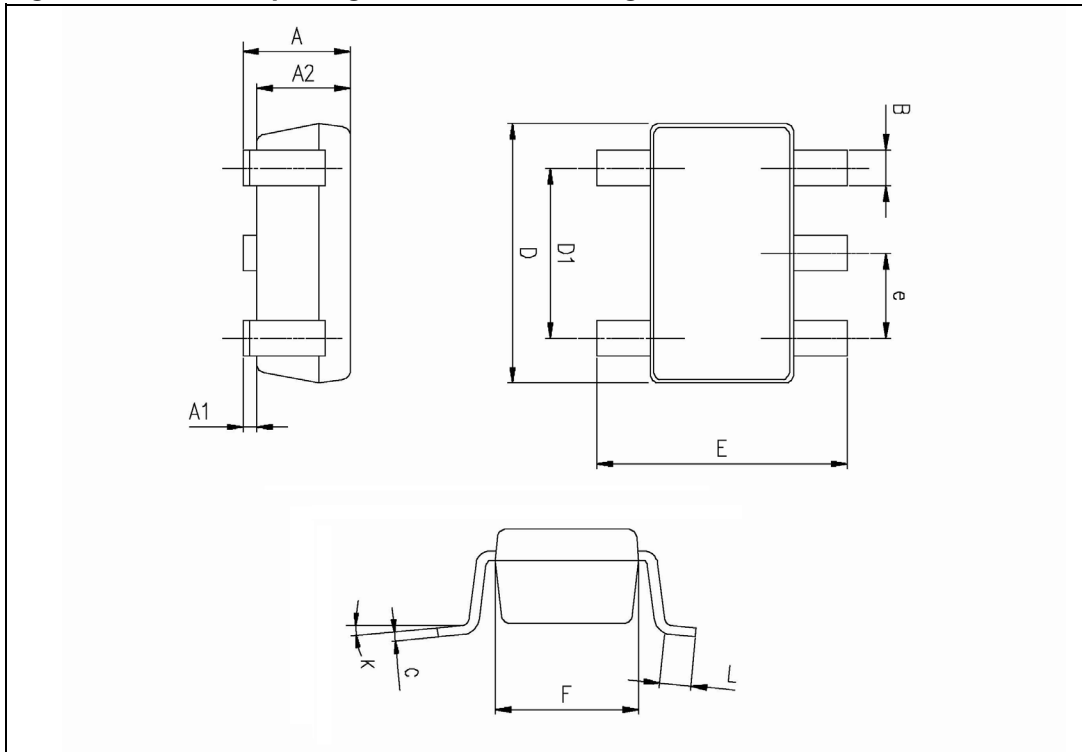


Table 5. SOT23-5 package mechanical data

| Ref. | Dimensions  |      |            |        |       |       |
|------|-------------|------|------------|--------|-------|-------|
|      | Millimeters |      |            | Inches |       |       |
|      | Min.        | Typ. | Max.       | Min.   | Typ.  | Max.  |
| A    | 0.90        | 1.20 | 1.45       | 0.035  | 0.047 | 0.057 |
| A1   |             |      | 0.15       |        |       | 0.006 |
| A2   | 0.90        | 1.05 | 1.30       | 0.035  | 0.041 | 0.051 |
| B    | 0.35        | 0.40 | 0.50       | 0.013  | 0.015 | 0.019 |
| C    | 0.09        | 0.15 | 0.20       | 0.003  | 0.006 | 0.008 |
| D    | 2.80        | 2.90 | 3.00       | 0.110  | 0.114 | 0.118 |
| D1   |             | 1.90 |            |        | 0.075 |       |
| e    |             | 0.95 |            |        | 0.037 |       |
| E    | 2.60        | 2.80 | 3.00       | 0.102  | 0.110 | 0.118 |
| F    | 1.50        | 1.60 | 1.75       | 0.059  | 0.063 | 0.069 |
| L    | 0.10        | 0.35 | 0.60       | 0.004  | 0.013 | 0.023 |
| K    | 0 degrees   |      | 10 degrees |        |       |       |

## 4.2 SC70-5 (SOT323-5) package

Figure 12. SC70-5 (SOT323-5) package mechanical drawing

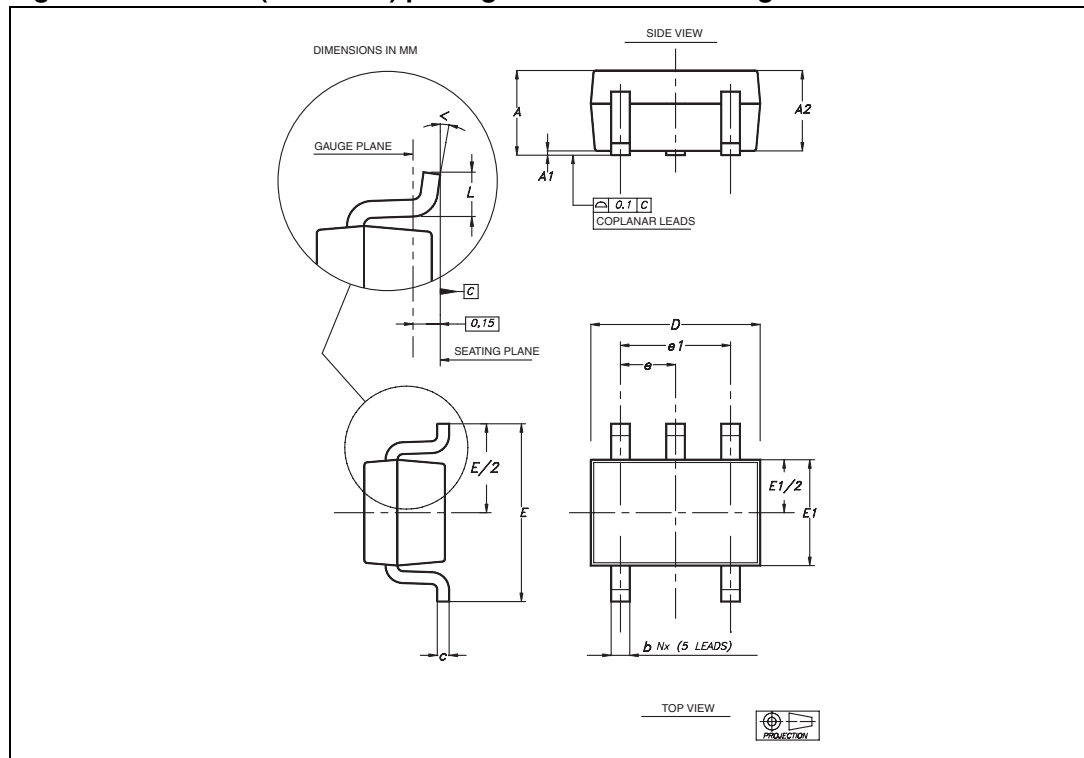


Table 6. SC70-5 (or SOT323-5) package mechanical data

| Ref      | Dimensions  |      |      |        |       |       |
|----------|-------------|------|------|--------|-------|-------|
|          | Millimeters |      |      | Inches |       |       |
|          | Min         | Typ  | Max  | Min    | Typ   | Max   |
| A        | 0.80        |      | 1.10 | 0.315  |       | 0.043 |
| A1       |             |      | 0.10 |        |       | 0.004 |
| A2       | 0.80        | 0.90 | 1.00 | 0.315  | 0.035 | 0.039 |
| b        | 0.15        |      | 0.30 | 0.006  |       | 0.012 |
| c        | 0.10        |      | 0.22 | 0.004  |       | 0.009 |
| D        | 1.80        | 2.00 | 2.20 | 0.071  | 0.079 | 0.087 |
| E        | 1.80        | 2.10 | 2.40 | 0.071  | 0.083 | 0.094 |
| E1       | 1.15        | 1.25 | 1.35 | 0.045  | 0.049 | 0.053 |
| e        |             | 0.65 |      |        | 0.025 |       |
| e1       |             | 1.30 |      |        | 0.051 |       |
| L        | 0.26        | 0.36 | 0.46 | 0.010  | 0.014 | 0.018 |
| $\alpha$ | 0°          |      | 8°   |        |       |       |

### 4.3 SO-8 package information

Figure 13. SO-8 package mechanical drawing

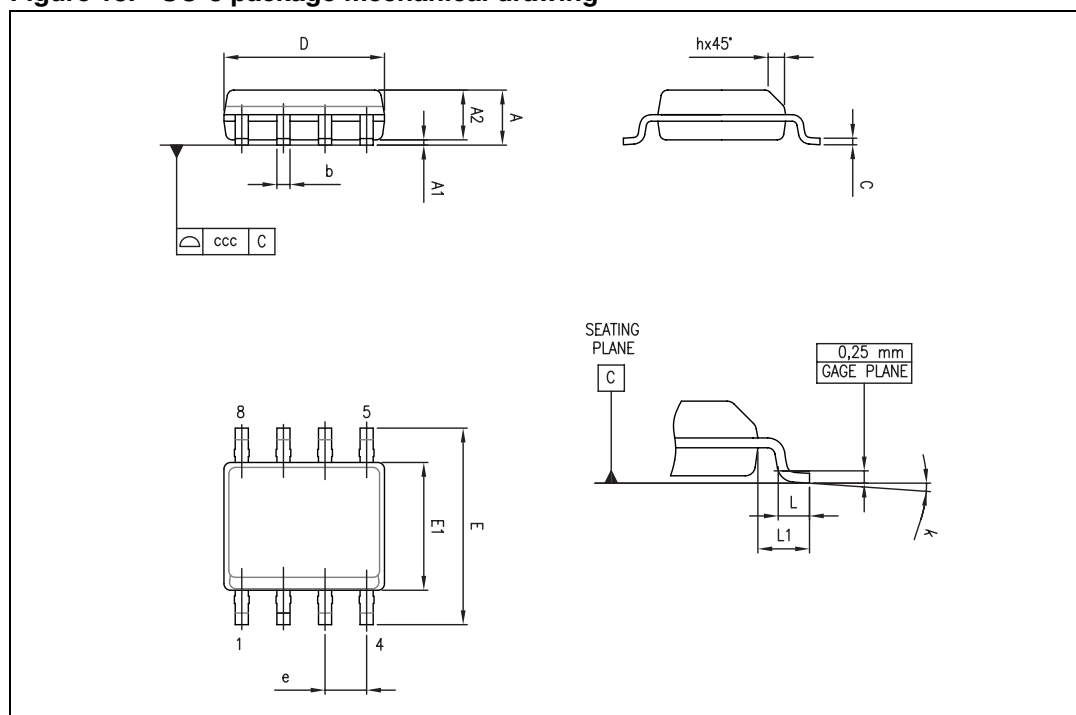


Table 7. SO-8 package mechanical data

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    |             |      | 1.75 |        |       | 0.069 |
| A1   | 0.10        |      | 0.25 | 0.004  |       | 0.010 |
| A2   | 1.25        |      |      | 0.049  |       |       |
| b    | 0.28        |      | 0.48 | 0.011  |       | 0.019 |
| c    | 0.17        |      | 0.23 | 0.007  |       | 0.010 |
| D    | 4.80        | 4.90 | 5.00 | 0.189  | 0.193 | 0.197 |
| E    | 5.80        | 6.00 | 6.20 | 0.228  | 0.236 | 0.244 |
| E1   | 3.80        | 3.90 | 4.00 | 0.150  | 0.154 | 0.157 |
| e    |             | 1.27 |      |        | 0.050 |       |
| h    | 0.25        |      | 0.50 | 0.010  |       | 0.020 |
| L    | 0.40        |      | 1.27 | 0.016  |       | 0.050 |
| L1   |             | 1.04 |      |        | 0.040 |       |
| k    | 0           |      | 8°   | 1°     |       | 8°    |
| ccc  |             |      | 0.10 |        |       | 0.004 |

### 4.4 MiniSO-8 package information

Figure 14. MiniSO-8 package mechanical drawing

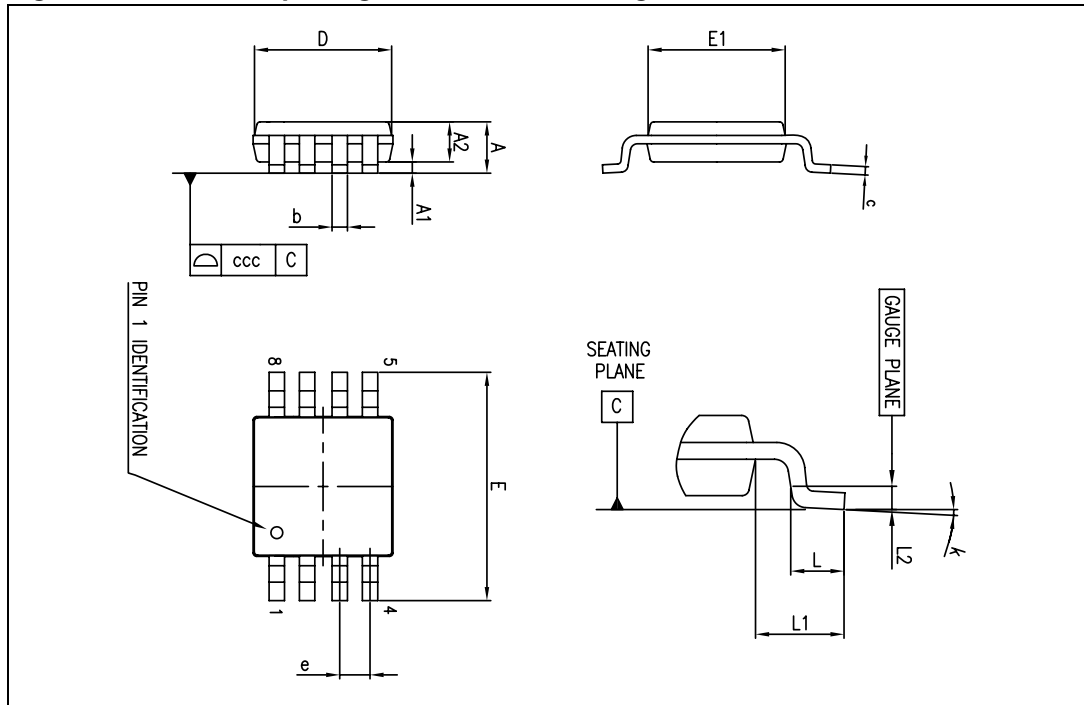


Table 8. MiniSO-8 package mechanical data

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    |             |      | 1.1  |        |       | 0.043 |
| A1   | 0           |      | 0.15 | 0      |       | 0.006 |
| A2   | 0.75        | 0.85 | 0.95 | 0.030  | 0.033 | 0.037 |
| b    | 0.22        |      | 0.40 | 0.009  |       | 0.016 |
| c    | 0.08        |      | 0.23 | 0.003  |       | 0.009 |
| D    | 2.80        | 3.00 | 3.20 | 0.11   | 0.118 | 0.126 |
| E    | 4.65        | 4.90 | 5.15 | 0.183  | 0.193 | 0.203 |
| E1   | 2.80        | 3.00 | 3.10 | 0.11   | 0.118 | 0.122 |
| e    |             | 0.65 |      |        | 0.026 |       |
| L    | 0.40        | 0.60 | 0.80 | 0.016  | 0.024 | 0.031 |
| L1   |             | 0.95 |      |        | 0.037 |       |
| L2   |             | 0.25 |      |        | 0.010 |       |
| k    | 0°          |      | 8°   | 0°     |       | 8°    |
| ccc  |             |      | 0.10 |        |       | 0.004 |

### 4.5 SO-14 package information

Figure 15. SO-14 package mechanical drawing

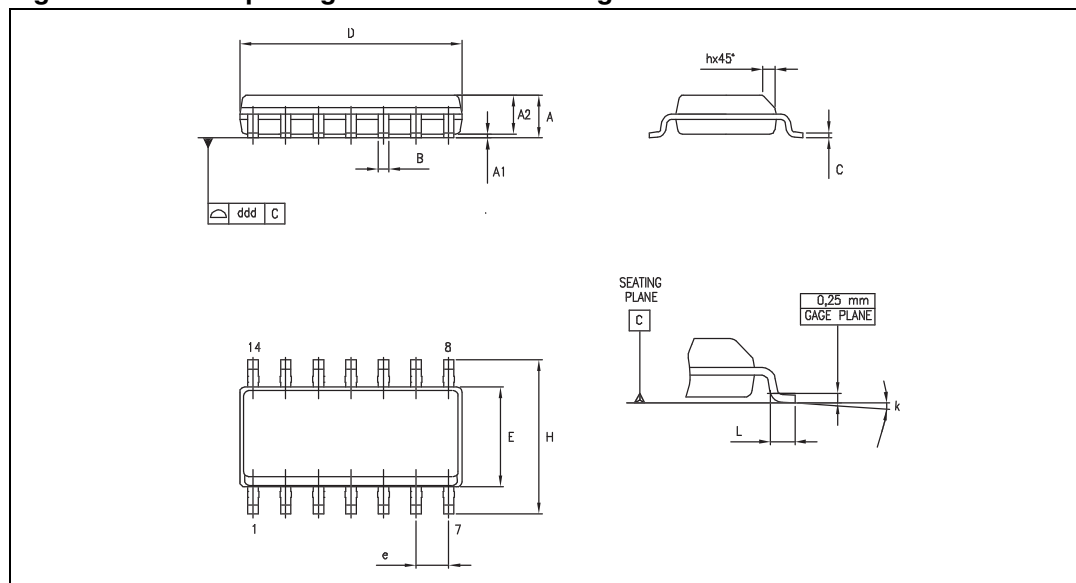


Table 9. SO-14 package mechanical data

| Dimensions |             |      |      |        |      |       |
|------------|-------------|------|------|--------|------|-------|
| Ref.       | Millimeters |      |      | Inches |      |       |
|            | Min.        | Typ. | Max. | Min.   | Typ. | Max.  |
| A          | 1.35        |      | 1.75 | 0.05   |      | 0.068 |
| A1         | 0.10        |      | 0.25 | 0.004  |      | 0.009 |
| A2         | 1.10        |      | 1.65 | 0.04   |      | 0.06  |
| B          | 0.33        |      | 0.51 | 0.01   |      | 0.02  |
| C          | 0.19        |      | 0.25 | 0.007  |      | 0.009 |
| D          | 8.55        |      | 8.75 | 0.33   |      | 0.34  |
| E          | 3.80        |      | 4.0  | 0.15   |      | 0.15  |
| e          |             | 1.27 |      |        | 0.05 |       |
| H          | 5.80        |      | 6.20 | 0.22   |      | 0.24  |
| h          | 0.25        |      | 0.50 | 0.009  |      | 0.02  |
| L          | 0.40        |      | 1.27 | 0.015  |      | 0.05  |
| k          | 8° (max.)   |      |      |        |      |       |
| ddd        |             |      | 0.10 |        |      | 0.004 |

### 4.6 TSSOP14 package information

Figure 16. TSSOP14 package mechanical drawing

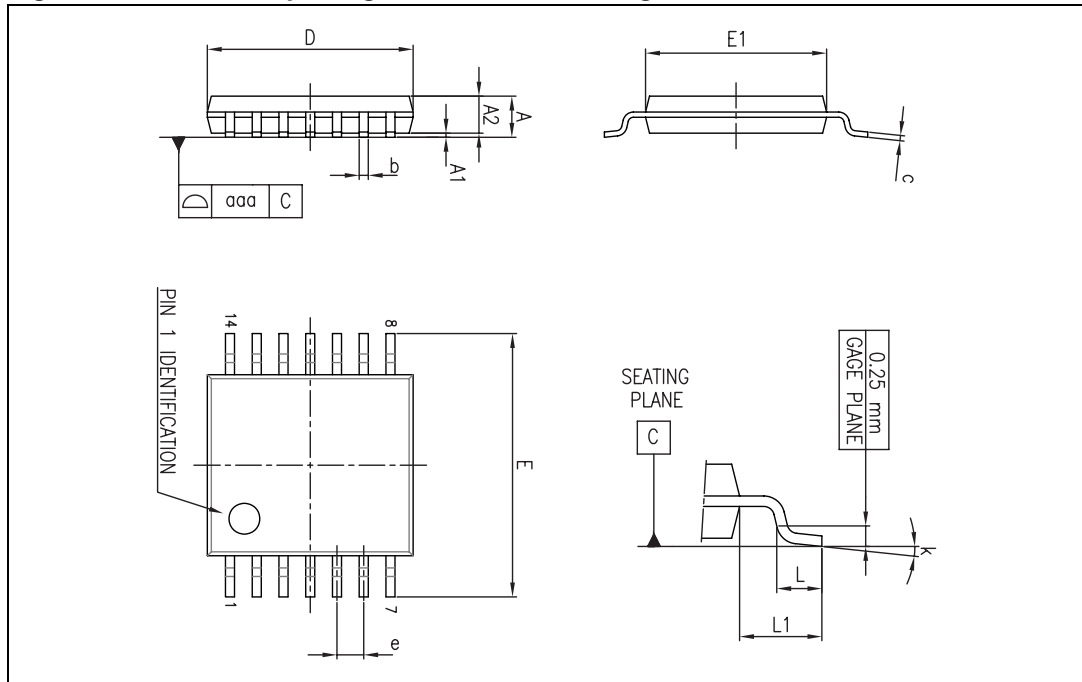


Table 10. TSSOP14 package mechanical data

| Ref. | Dimensions  |      |      |        |        |        |
|------|-------------|------|------|--------|--------|--------|
|      | Millimeters |      |      | Inches |        |        |
|      | Min.        | Typ. | Max. | Min.   | Typ.   | Max.   |
| A    |             |      | 1.20 |        |        | 0.047  |
| A1   | 0.05        |      | 0.15 | 0.002  | 0.004  | 0.006  |
| A2   | 0.80        | 1.00 | 1.05 | 0.031  | 0.039  | 0.041  |
| b    | 0.19        |      | 0.30 | 0.007  |        | 0.012  |
| c    | 0.09        |      | 0.20 | 0.004  |        | 0.0089 |
| D    | 4.90        | 5.00 | 5.10 | 0.193  | 0.197  | 0.201  |
| E    | 6.20        | 6.40 | 6.60 | 0.244  | 0.252  | 0.260  |
| E1   | 4.30        | 4.40 | 4.50 | 0.169  | 0.173  | 0.176  |
| e    |             | 0.65 |      |        | 0.0256 |        |
| L    | 0.45        | 0.60 | 0.75 | 0.018  | 0.024  | 0.030  |
| L1   |             | 1.00 |      |        | 0.039  |        |
| k    | 0°          |      | 8°   | 0°     |        | 8°     |
| aaa  |             |      | 0.10 |        |        | 0.004  |

## 5 Ordering information

Table 11. Order codes

| Part number | Temperature range | Package  | Packaging   | Marking |
|-------------|-------------------|----------|-------------|---------|
| LMV331ILT   | -40°C, +85°C      | SOT23-5  | Tape & reel | K503    |
| LMV331ICT   |                   | SC70-5   |             | K50     |
| LMV393IDT   |                   | SO-8     |             | 393I    |
| LMV393IST   |                   | MiniSO-8 |             | K508    |
| LMV339IDT   |                   | SO14     |             | 339I    |
| LMV339IPT   |                   | TSSOP14  |             | 339I    |

## 6 Revision history

**Table 12. Document revision history**

| Date        | Revision | Changes   |
|-------------|----------|---|
| 08-Dec-2009 | 1        | Initial release.  |
| 03-May-2010 | 2        | Corrected I <sub>cc</sub> unit in <a href="#">Figure 2</a> and <a href="#">Figure 3</a> .   |
| 12-Dec-2011 | 3        | <ul style="list-style-type: none"><li>– Added LMV393 and LMV339 devices to the datasheet.</li><li>– Added V<sub>out</sub> parameter in <a href="#">Table 1: Absolute maximum ratings</a>.</li><li>– Removed note "The magnitude of input and output voltages must never exceed the supply rail ±0.3 V." from <a href="#">Table 1</a>.</li></ul> |

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