

General-purpose low voltage comparator

Features

- Supply operation from 2.7 to 5 V
- Low current consumption: 20 μ 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: SC70-5 and SOT23-5

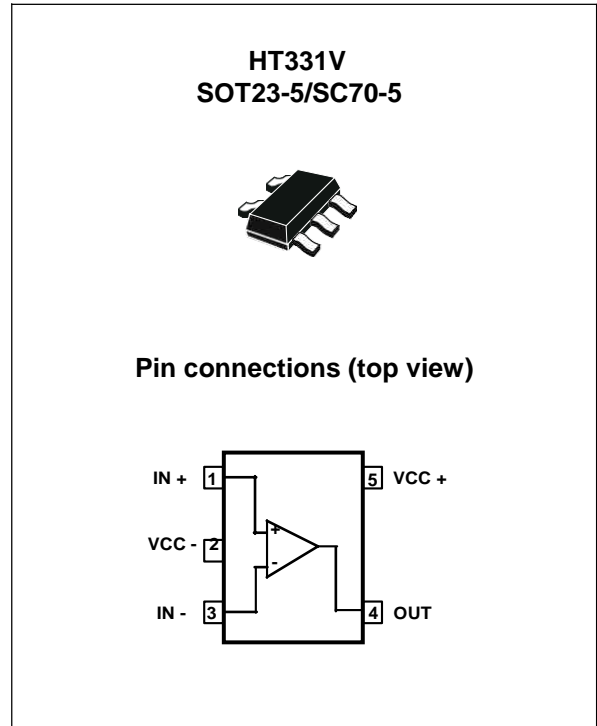
Applications

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

Description

The HT331V is a single and low voltage version of industry standard HT339V and HT393V. It can operate with a supply voltage ranging from 2.7 to 5 V, and exhibits a lower current consumption than its predecessors HT339V and HT393V. This device is a perfect choice for low-voltage applications.

The device is available in both SOT23-5 and SC70-5 packages, making it ideal for applications where space saving is a constraint. The SC70-5 package is approximately half the size of the SOT23-5.



The HT331V is designed to operate in the temperature range of -40°C to +85°C. It is then suitable for a large variety of applications.

1 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|------------|---|--|------|
| V_{CC} | Supply voltage ⁽¹⁾ | 5.5 | V |
| V_{ID} | Differential input voltage ⁽²⁾ | ± 5.5 | V |
| V_{IN} | Input voltage range | $(V_{CC-}) - 0.3$ to $(V_{CC+}) + 0.3$ | V |
| R_{thja} | Thermal resistance junction to ambient ⁽³⁾ | | °C/W |
| | SC70-5 SOT23-5 | 205 250 | |
| R_{thjc} | Thermal resistance junction to case ⁽³⁾ | | °C/W |
| | SC70-5 SOT23-5 | 172 81 | |
| 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) ⁽⁴⁾ | 2000 | V |
| | Machine model (MM) ⁽⁵⁾ | 200 | |
| | Charged device model (CDM) ⁽⁶⁾ | 1500 | |
| | Latch-up immunity | 200 | mA |

1. All voltage values, except differential voltage, are referenced to V_{CC-} .
2. The magnitude of input and output voltages must never exceed the supply rail ± 0.3 V.
3. Short-circuits can cause excessive heating. These values are typical.
4. Human body model: a 100 pF capacitor is charged to the specified voltage, then discharged through a 1.5 k Ω resistor between two pins of the device. This is done for all couples of connected pin combinations while the other pins are floating.
5. 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 Ω). This is done for all couples of connected pin combinations while the other pins are floating.
6. 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 -40°C < T_{amb} < +85°C | 2.7 to 5.0 | V |

2 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) ⁽¹⁾

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|------------------|---|---|------|-------|------------|------------------------------|
| V_{IO} | Input offset voltage | | | 1 | 7 | mV |
| $\otimes V_{IO}$ | 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 ⁽²⁾ | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$ | | 25 | 250 400 | nA |
| I_{IO} | Input offset current ⁽²⁾ | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$ | | 1 | 50 150 | nA |
| V_{ICM} | Common mode input voltage | | | -0.1 | | V |
| | | | | 2.0 | | |
| 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 | μA |
| I_{OH} | Output current leakage | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$ | | 0.003 | 1 | μA |
| TP_{HL} | Propagation delay High to low output level | $V_{ICM} = 0\text{ V}$, $R_L = 5.1\text{ k}\Omega$, $C_L = 50\text{ pF}$ Overdrive = 10 mV Overdrive = 100 mV | | 300 | | ns |
| | | | | 200 | | |
| TP_{LH} | Propagation delay Low to high output level | $V_{ICM} = 0\text{ V}$, $R_L = 5.1\text{ k}\Omega$, $C_L = 50\text{ pF}$ Overdrive = 10 mV Overdrive = 100 mV | | 550 | | ns |
| | | | | 400 | | |

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)⁽¹⁾

| 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 9 | mV |
| $\otimes V_{IO}$ | 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 ⁽²⁾ | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$ | | 25 | 250 400 | nA |
| I_{IO} | Input offset current ⁽²⁾ | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$ | | 2 | 50 150 | 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 | $I_{SINK} < 4\text{ mA}$ $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$ | | 50 | 400 700 | mV |
| I_{SINK} | Output sink current | $V_{OUT} < 1.5\text{ V}$ | 10 | 93 | | mA |
| I_{CC} | Supply current | No load, output high, $V_{ICM} = 0\text{ V}$ $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$ | | 25 | 120 150 | μA |
| I_{OH} | Output current leakage | $-40^\circ\text{C} < T_{amb} < +85^\circ\text{C}$ | | 0.003 | 1 | μA |
| TP_{HL} | Propagation delay High to low output level | $V_{ICM} = 0\text{ V}$, $R_L = 5.1\text{ k}\Omega$, $C_L = 50\text{ pF}$ Overdrive = 10 mV Overdrive = 100 mV | | 375 275 | | ns |
| | | | | | | |
| TP_{LH} | Propagation delay Low to high output level | $V_{ICM} = 0\text{ V}$, $R_L = 5.1\text{ k}\Omega$, $C_L = 50\text{ pF}$ Overdrive = 10 mV Overdrive = 100 mV | | 550 425 | | 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.

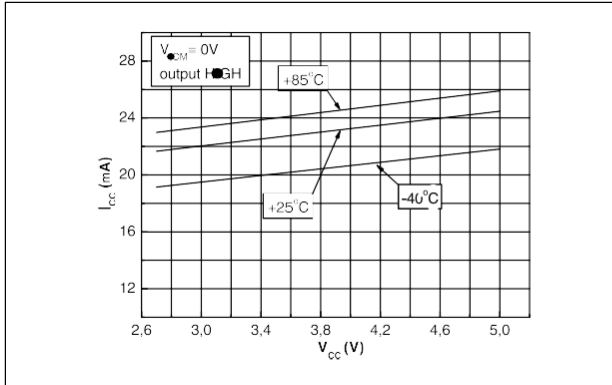
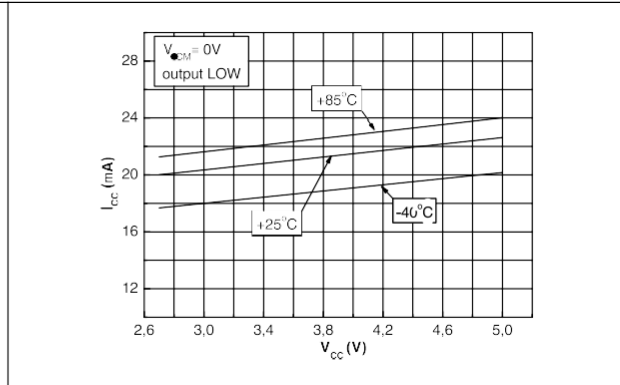
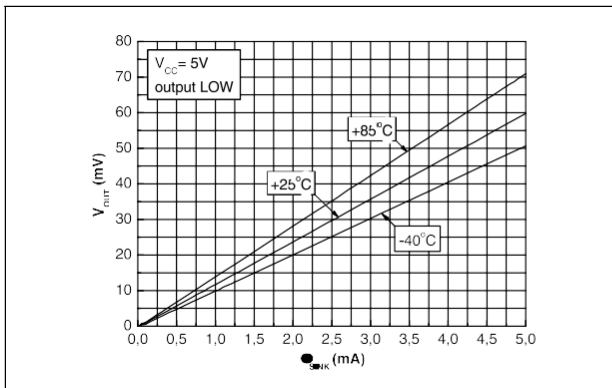
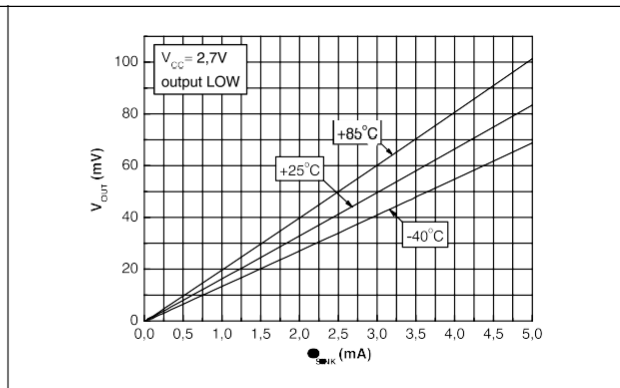
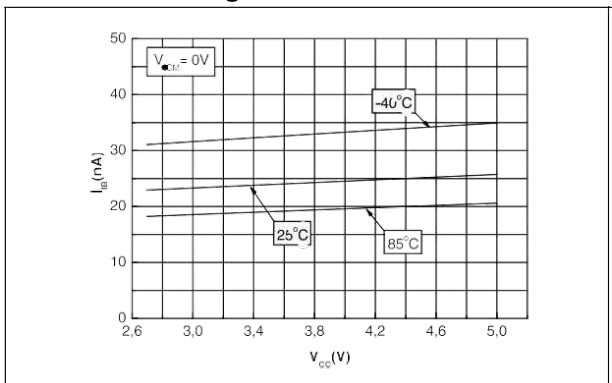
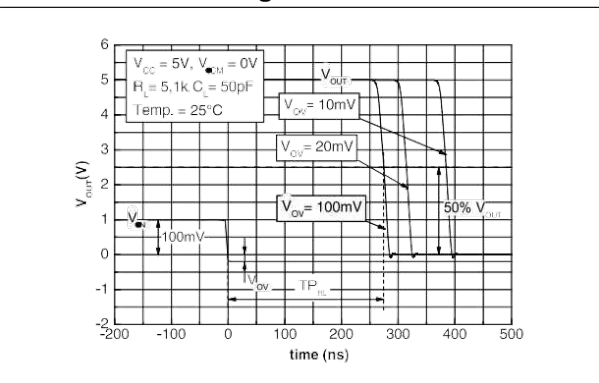
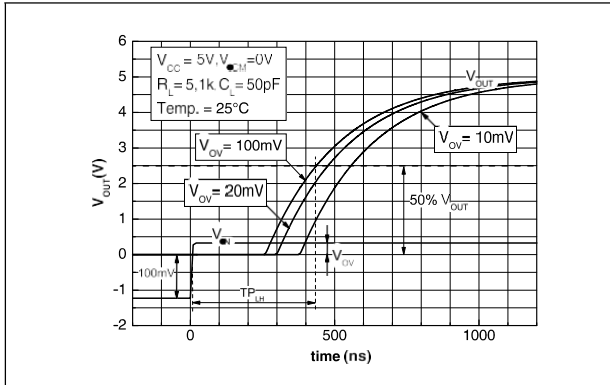
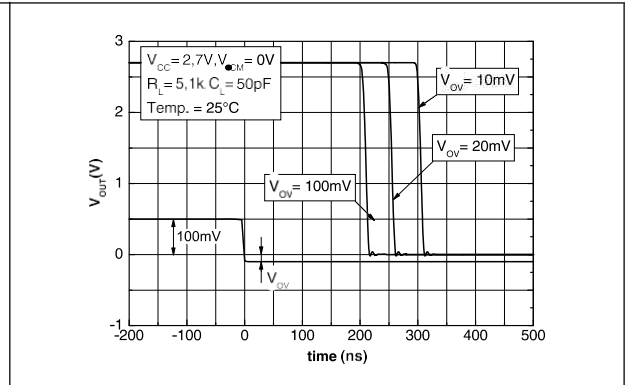
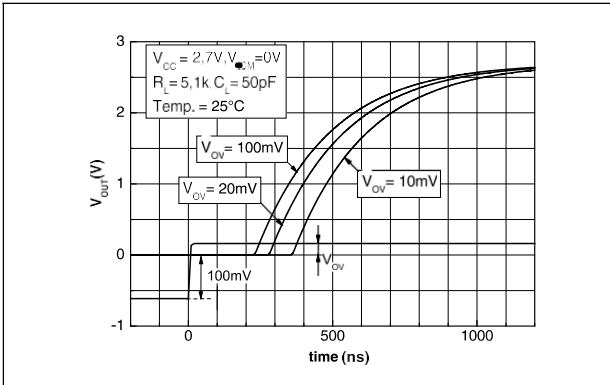
Figure 1. Supply current versus supply voltage with output high

Figure 2. Supply current versus supply voltage with output low

Figure 3. Output voltage versus output current at 5 V supply

Figure 4. Output voltage versus output current at 2.7 V supply

Figure 5. Input bias current versus supply voltage

Figure 6. Response time versus overdrive with negative transition


Figure 7. Response time versus overdrive with positive transition

Figure 8. Response time versus overdrive with negative transition

Figure 9. Response time versus overdrive with positive transition


3.0 SOT23-5 package

Figure 10. SOT23-5 package mechanical drawing

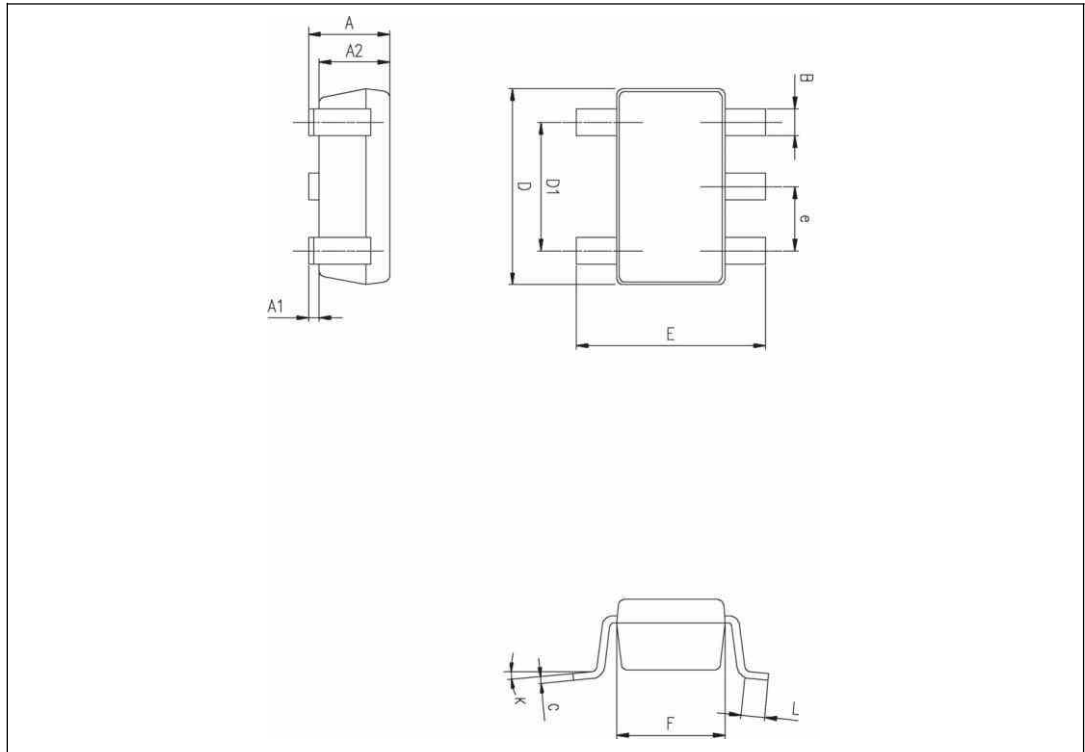
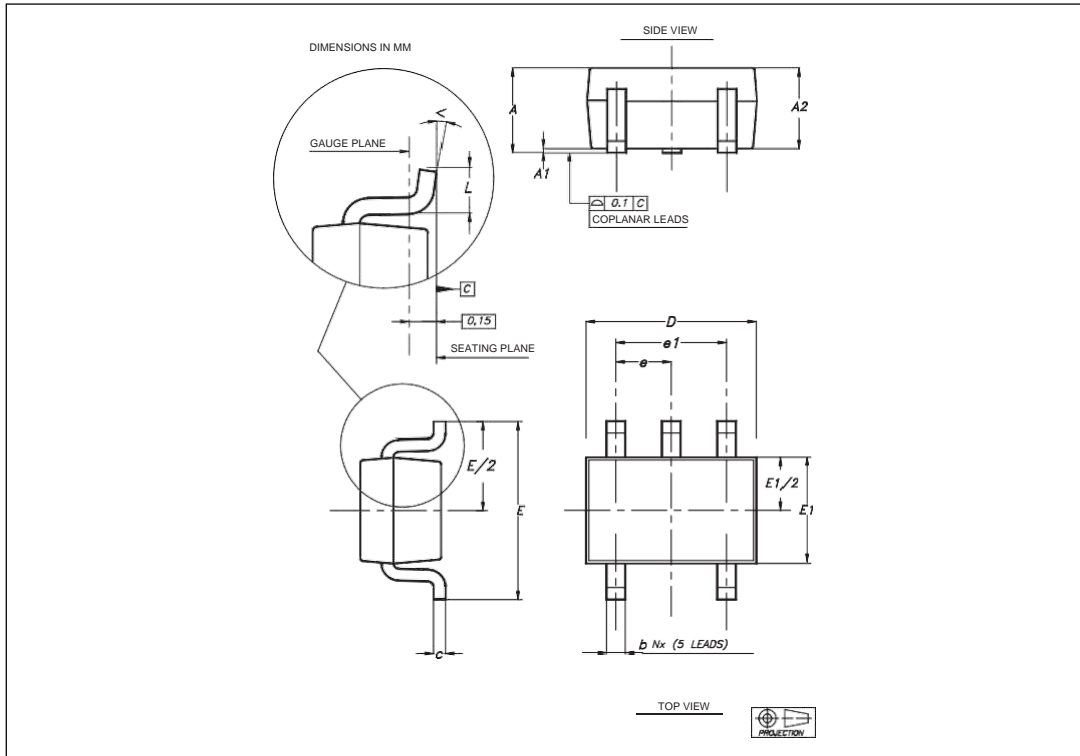


Table 5. SOT23-5 package mechanical data

| 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 | | | |

3.1 SC70-5 (SOT323-5) package
Figure 11. 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 |
| < | 0° | | 8° | | | |

4 Ordering information

Table 7. Order codes

| Part number | Temperature range | Package | Packaging | Marking |
|-------------|-------------------|---------|-------------|---------|
| HT331VRTZ | -40°C, +85°C | SOT23-5 | Tape & reel | R11 |
| HT331VRCZ | | SC70-5 | Tape & reel | R12_ |

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