# DS1232
# MicroMonitor Chip

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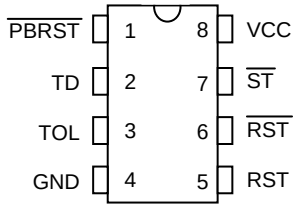
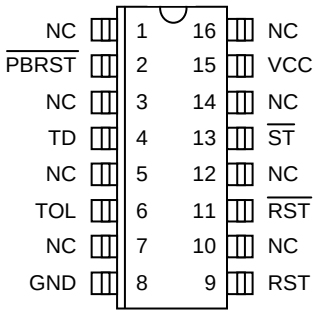
## FEATURES

- Halts and restarts an out-of-control microprocessor
- Holds microprocessor in check during power transients
- Automatically restarts microprocessor after power failure
- Monitors pushbutton for external override
- Accurate 5% or 10% microprocessor power supply monitoring
- Eliminates the need for discrete components
- Space-saving, 8-pin mini-DIP
- Optional 16-pin SOIC surface mount package
- Industrial temperature -40°C to +85°C available, designated N

## PIN ASSIGNMENT




DS1232 8-Pin DIP (300-mil)
See Mech. Drawings Section




DS1232S 16-Pin SOIC (300-mil)
See Mech. Drawings Section

## PIN DESCRIPTION

| | |
|---|---|
| $\overline{\text{PBRST}}$ | - Pushbutton Reset Input |
| TD | - Time Delay Set |
| TOL | - Selects 5% or 10% $V_{CC}$ Detect |
| GND | - Ground |
| RST | - Reset Output (Active High) |
| $\overline{\text{RST}}$ | - Reset Output (Active Low, open drain) |
| $\overline{\text{ST}}$ | - Strobe Input |
| $V_{CC}$ | - +5 Volt Power |
| NC | - No Connections |

## DESCRIPTION

The DS1232 MicroMonitor™ Chip monitors three vital conditions for a microprocessor: power supply, software execution, and external override. First, a precision temperature-compensated reference and comparator circuit monitors the status of $V_{CC}$. When an out-of-tolerance condition occurs, an internal power fail signal is generated which forces reset to the active state. When $V_{CC}$ returns to an in-tolerance condition, the reset signals are kept in the active state for a minimum of 250 ms to allow the power supply and processor to stabilize.

The second function the DS1232 performs is pushbutton reset control. The DS1232 debounces the pushbutton input and guarantees an active reset pulse width of 250 ms minimum. The third function is a watchdog timer. The DS1232 has an internal timer that forces the reset signals to the active state if the strobe input is not driven low prior to timeout. The watchdog timer function can be set to operate on timeout settings of approximately 150 ms, 600 ms, and 1.2 seconds.

## OPERATION - POWER MONITOR

The DS1232 detects out-of-tolerance power supply conditions and warns a processor-based system of impending power failure. When $V_{CC}$ falls below a preset level as defined by TOL (Pin 3), the $V_{CC}$ comparator outputs the signals RST (Pin 5) and $\overline{RST}$ (Pin 6). When TOL is connected to ground, the RST and $\overline{RST}$ signals become active as $V_{CC}$ falls below 4.75 volts. When TOL is connected to $V_{CC}$, the RST and $\overline{RST}$ signals become active as $V_{CC}$ falls below 4.5 volts. The RST and $\overline{RST}$ are excellent control signals for a microprocessor, as processing is stopped at the last possible moments of valid $V_{CC}$. On power-up, RST and $\overline{RST}$ are kept active for a minimum of 250 ms to allow the power supply and processor to stabilize.

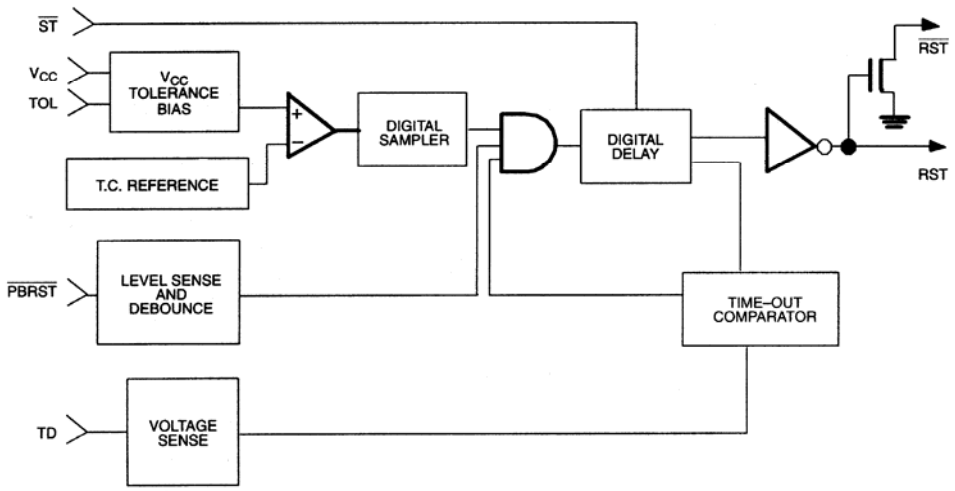
## OPERATION - PUSHBUTTON RESET

The DS1232 provides an input pin for direct connection to a pushbutton (Figure 2). The pushbutton reset input requires an active low signal. Internally, this input is debounced and timed such that RST and $\overline{RST}$ signals of at least 250 ms minimum are generated. The 250 ms delay starts as the pushbutton reset input is released from low level.

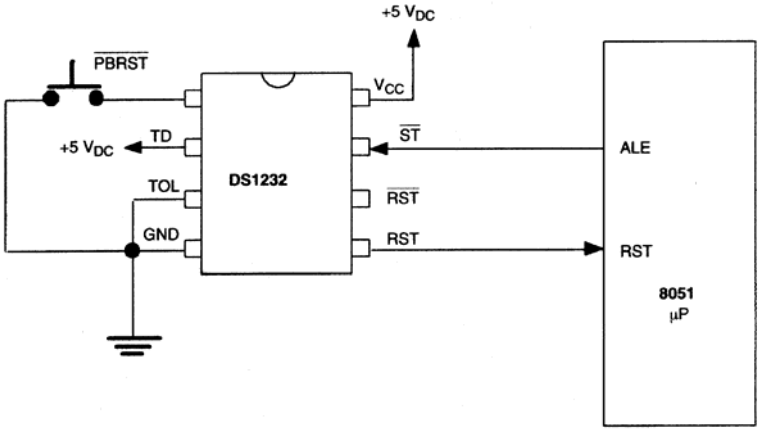
## OPERATION - WATCHDOG TIMER

A watchdog timer function forces RST and $\overline{RST}$ signals to the active state when the $\overline{ST}$ input is not stimulated for a predetermined time period. The time period is set by the TD input to be typically 150 ms with TD connected to ground, 600 ms with TD left unconnected, and 1.2 seconds with TD connected to $V_{CC}$. The watchdog timer starts timing out from the set time period as soon as RST and $\overline{RST}$ are inactive. If a high-to-low transition occurs on the $\overline{ST}$ input pin prior to timeout, the watchdog timer is reset and begins to timeout again. If the watchdog timer is allowed to timeout, then the RST and $\overline{RST}$ signals are driven to the active state for 250 ms minimum. The $\overline{ST}$ input can be derived from microprocessor address signals, data signals, and/or control signals. When the microprocessor is functioning normally, these signals would, as a matter of routine, cause the watchdog to be reset prior to timeout. To guarantee that the watchdog timer does not timeout, a high-to-low transition must occur at or less than the minimum shown in Table 1. A typical circuit example is shown in Figure 3.

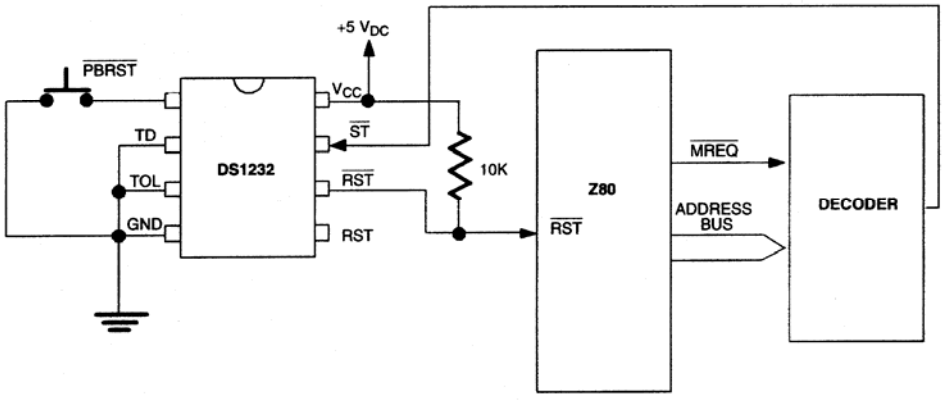
## **MICROMONITOR BLOCK DIAGRAM** Figure 1



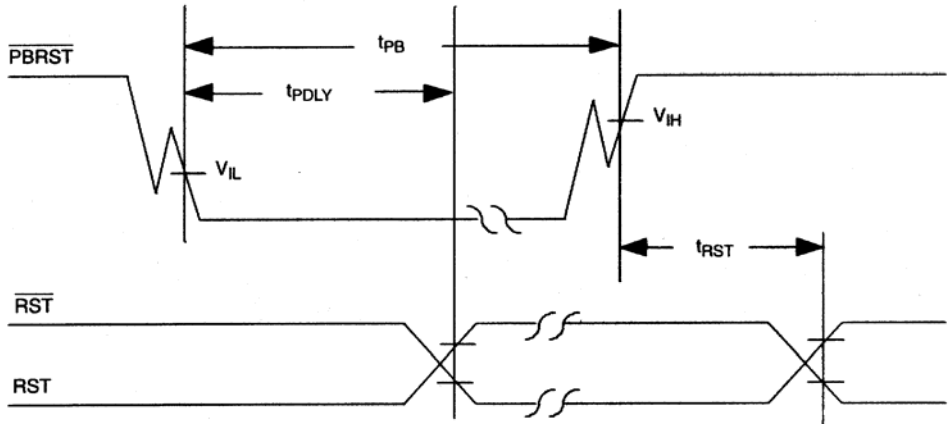

## **PUSHBUTTON RESET** Figure 2



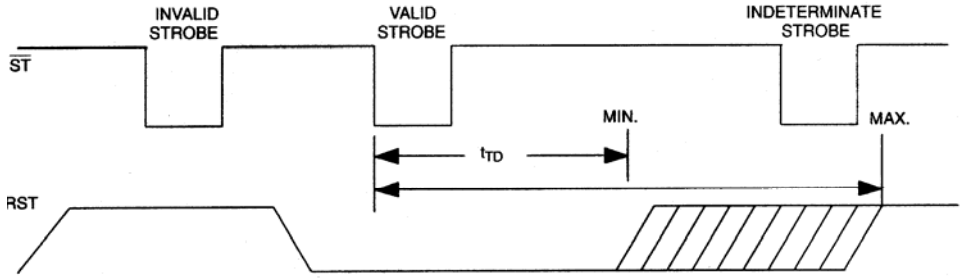

## **WATCHDOG TIMER** Figure 3



## TIMING DIAGRAM: PUSHBUTTON RESET Figure 4



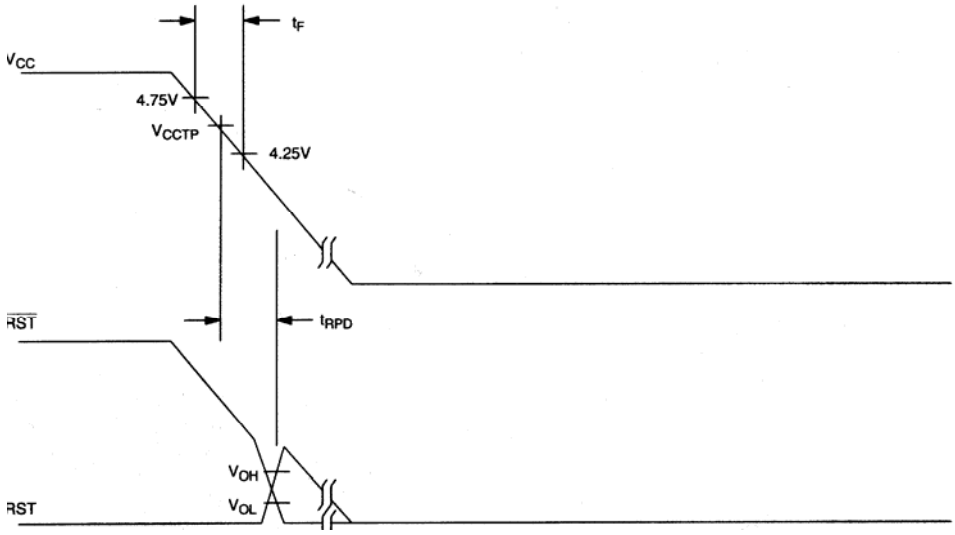

## TIMING DIAGRAM: STROBE INPUT Figure 5



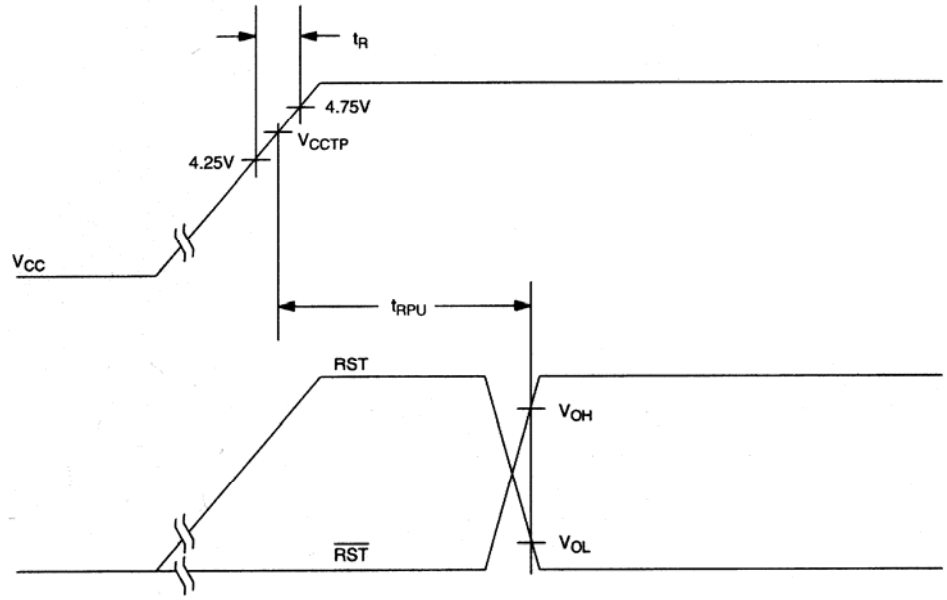

## WATCHDOG TIMEOUTS Table 1

| TD PIN | TIME-OUT | | |
|---|---|---|---|
| | MIN | TYP | MAX |
| GND | 62.5 ms | 150 ms | 250 ms |
| Float | 250 ms | 600 ms | 1000 ms |
| $V_{CC}$ | 500 ms | 1200 ms | 2000 ms |

## TIMING DIAGRAM: POWER-DOWN Figure 6




## TIMING DIAGRAM: POWER-UP Figure 7



## ABSOLUTE MAXIMUM RATINGS*

| | |
|---|---|
| Voltage on V CC Pin Relative to Ground | -0.5V to +7.0V |
| Voltage on I/O Relative to Ground | -0.5V to $V_{CC}$ + 0.5V |
| Operating Temperature | 0°C to 70°C |
| Operating Temperature (Industrial Version) | -40°C to +85°C |
| Storage Temperature | -55°C to +125°C |
| Soldering Temperature | 260°C for 10 seconds |

* This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

## RECOMMENDED DC OPERATING CONDITIONS (0°C to 70°C)

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNITS | NOTES |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{CC}$ | 4.5 | 5.0 | 5.5 | V | 1 |
| $\overline{ST}$ and $\overline{PBRST}$ Input High Level | $V_{IH}$ | 2.0 | | $V_{CC}$+0.3 | V | 1 |
| $\overline{ST}$ and $\overline{PBRST}$ Input Low Level | $V_{IL}$ | -0.3 | | +0.8 | V | 1 |

## DC ELECTRICAL CHARACTERISTICS (0°C to 70°C; $V_{CC}$=4.5 to 5.5V)

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNITS | NOTES |
|---|---|---|---|---|---|---|
| Input Leakage | $I_{IL}$ | -1.0 | | +1.0 | µA | 3 |
| Output Current @ 2.4V | $I_{OH}$ | -8 | -10 | | mA | 5 |
| Output Current @ 0.4V | $I_{OL}$ | 8 | 10 | | mA | |
| Low Level @ RST | $V_{OL}$ | | | 0.4 | V | 1 |
| Output Voltage @ -500 µA | $V_{OH}$ | $V_{CC}$ -0.5V | $V_{CC}$ -0.1V | | V | 1, 7 |
| Operating Current | $I_{CC}$ | | 0.5 | 2.0 | mA | 2 |
| $V_{CC}$ Trip Point (TOL=GND) | $V_{CCTP}$ | 4.50 | 4.62 | 4.74 | V | 1 |
| $V_{CC}$ Trip Point (TOL=$V_{CC}$) | $V_{CCTP}$ | 4.25 | 4.37 | 4.49 | V | 1 |

## CAPACITANCE ($t_A$=25°C)

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNITS | NOTES |
|---|---|---|---|---|---|---|
| Input Capacitance | $C_{IN}$ | | | 5 | pF | |
| Output Capacitance | $C_{OUT}$ | | | 7 | pF | |

## AC ELECTRICAL CHARACTERISTICS (0°C to 70°C; $V_{CC}$=5V ± 10%)

| PARAMETER | SYMBOL | MIN | TYP | MAX | UNITS | NOTES |
|---|---|---|---|---|---|---|
| $\overline{PBRST}$ = $V_{IL}$ | $t_{PB}$ | 20 | | | ms | |
| RESET Active Time | $t_{RST}$ | 250 | 610 | 1000 | ms | |
| $\overline{ST}$ Pulse Width | $t_{ST}$ | 20 | | | ns | 6, 8 |
| $V_{CC}$ Fail Detect to RST and $\overline{RST}$ | $t_{RPD}$ | | 100 | 175 | µs | |
| $V_{CC}$ Slew Rate 4.75V to 4.25V | $t_F$ | 300 | | | µs | |
| $V_{CC}$ Detect to RST and $\overline{RST}$ Transition | $t_{RPU}$ | 250 | 610 | 1000 | ms | 4 |
| $V_{CC}$ Slew Rate 4.25V to 4.75V | $t_R$ | 0 | 5 | | µs | |
| $\overline{PBRST}$ Stable Low to RST and $\overline{RST}$ | $t_{PDLY}$ | | | 20 | ms | |

## NOTES:

1. All voltages referenced to ground.
2. Measured with outputs open.
3. $\overline{PBRST}$ is internally pulled up to $V_{CC}$ with an internal impedance of 10k typical.
4. $t_R$ = 5 µs.
5. $\overline{RST}$ is an open-drain output.
6. Must not exceed $t_{TD}$ minimum. See Table 1.
7. RST remains within 0.5V of $V_{CC}$ on power-down until $V_{CC}$ drops below 2.0V. $\overline{RST}$ remains within 0.5V of GND on power-down until $V_{CC}$ drops below 2.0V.
8. Watchdog can not be disabled. It must be strobed to avoid resets.

# DS1232

## Part Number Table

Notes:

1. See the DS1232 QuickView Data Sheet for further information on this product family or download the DS1232 full data sheet (PDF, 140kB).
2. Other options and links for purchasing parts are listed at: http://www.maxim-ic.com/sales.
3. Didn't Find What You Need? Ask our applications engineers. Expert assistance in finding parts, usually within one business day.
4. Part number suffixes: T or T&R = tape and reel; + = RoHS/lead-free; # = RoHS/lead-exempt. More: See full data sheet or Part Naming Conventions.
5. * Some packages have variations, listed on the drawing. "PkgCode/Variation" tells which variation the product uses.

| Part Number | Notes | Free Sample | Buy Direct | Package: TYPE PINS SIZE DRAWING CODE/VAR * | Temp | RoHS/Lead-Free? Materials Analysis |
|---|---|---|---|---|---|---|
| DS1232 IBM CAT I | | | | PDIP;8 pin;300<br>Dwg: 56-G5005-000A (PDF)<br>Use pkgcode/variation: P8-1* | 0C to +70C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232 | | | | PDIP;8 pin;300<br>Dwg: 56-G5005-000A (PDF)<br>Use pkgcode/variation: P8-1* | 0C to +70C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232+ | | | | PDIP;8 pin;300<br>Dwg: 56-G5005-000A (PDF)<br>Use pkgcode/variation: P8+1* | 0C to +70C | RoHS/Lead-Free: Yes<br>Materials Analysis |
| DS1232N+ | | | | PDIP;8 pin;300<br>Dwg: 56-G5005-000A (PDF)<br>Use pkgcode/variation: P8+1* | -40C to +85C | RoHS/Lead-Free: Yes<br>Materials Analysis |
| DS1232N | | | | PDIP;8 pin;300<br>Dwg: 56-G5005-000A (PDF)<br>Use pkgcode/variation: P8-1* | -40C to +85C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232S-IBM | | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16-11* | 0C to +70C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232S/T&R/C01 | | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16-11* | 0C to +70C | RoHS/Lead-Free: No<br>Materials Analysis |

| | | | | | | |
|---|---|---|---|---|---|---|
| DS1232S/T&R/C06 | | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16-11* | 0C to +70C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232S/T&R/C05 | | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16-11* | 0C to +70C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232S/T&R/C11 | | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16-11* | 0C to +70C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232S/T&R/C13 | | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16-11* | 0C to +70C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232S+ | | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16+11* | 0C to +70C | RoHS/Lead-Free: Yes<br>Materials Analysis |
| DS1232S+T&R | T&R Qty 1000/Reel | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16+11* | 0C to +70C | RoHS/Lead-Free: Yes<br>Materials Analysis |
| DS1232S/T&R | T&R Qty 1000/Reel | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16-11* | 0C to +70C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232S | | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16-11* | 0C to +70C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232SN+ | | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16+3* | -40C to +85C | RoHS/Lead-Free: Yes<br>Materials Analysis |
| DS1232SN | | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16-11* | -40C to +85C | RoHS/Lead-Free: No<br>Materials Analysis |
| DS1232SN+T&R | T&R Qty 1000/Reel | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16+11* | -40C to +85C | RoHS/Lead-Free: Yes<br>Materials Analysis |
| DS1232SN/T&R | T&R Qty 1000/Reel | | | SOIC;16 pin;300<br>Dwg: 56-G4009-001B (PDF)<br>Use pkgcode/variation: W16-11* | -40C to +85C | RoHS/Lead-Free: No<br>Materials Analysis |

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