

## Voltage Supervisory Circuits with Watchdog Timer and Manual Reset Input

### UM823/824/825 SOT23-5/SOT353

#### General Description

The UM823/824/825 series are cost effective system power supply supervisory circuits designed to monitor the power supplies in digital systems. This family provides circuit initialization and timing supervision. Independent watchdog monitoring circuitry and manual reset input are included. They significantly improve system reliability and accuracy compared to separate ICs or discrete components.

The UM823/824/825 are specifically designed to ignore fast transients on  $V_{CC}$ . Seven preprogrammed reset threshold voltages are available. All three devices have an active-low reset output, which is guaranteed to be in the correct state for  $V_{CC}$  down to 1V. The UM823 also offers a watchdog input and manual reset input. The UM824 offers a watchdog input and a complementary active-high reset. The UM825 offers a manual reset input and a complementary active-high reset.

#### Applications

- Applications Using DSPs, Microcontrollers or Microprocessors
- Programmable Controls
- Computers
- Embedded Systems
- Industrial Equipments
- Intelligent Instruments
- Wireless Communications Systems

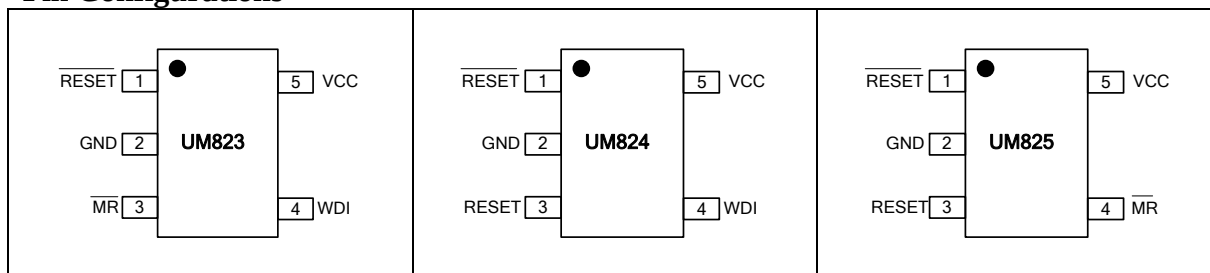
#### Features

- Wide Operation Voltage Range of 1V to 5.5V
- Correct Logic Output Guaranteed to  $V_{CC}=1.0V$
- Precision Supply-Voltage Monitor: 2.19V, 2.63V, 2.93V, 3.08V, 4.38V, 4.63V
- 200ms Reset Pulse Width
- Independent Watchdog Timer-1.6s Timeout
- Operating Current: 4 $\mu$ A for L/M, 3 $\mu$ A for T/S/R/Z/Y
- Temperature Range: -40 °C to +85 °C
- Power-Supply Transient Immunity
- SOT23-5 and SOT353 packages

#### Selection Guide

| Function           | UM823 | UM824 | UM825 |
|--------------------|-------|-------|-------|
| Active-Low Reset   | ✓     | ✓     | ✓     |
| Active-High Reset  | -     | ✓     | ✓     |
| Watchdog Input     | ✓     | ✓     | -     |
| Manual Reset Input | ✓     | -     | ✓     |

#### Pin Configurations



## Ordering Information

UM8 XX Z P

Z: Reset Threshold (V)

=L 4.63

=M 4.38

=T 3.08

=S 2.93

=R 2.63

=Z 2.32

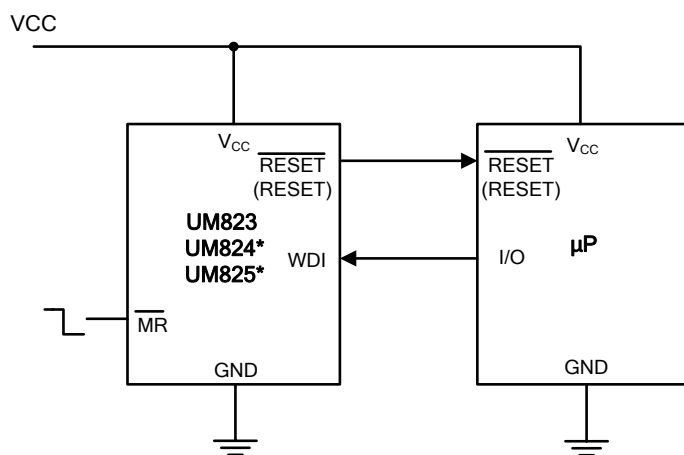
=Y 2.19

P: Package Type

=S SOT23-5

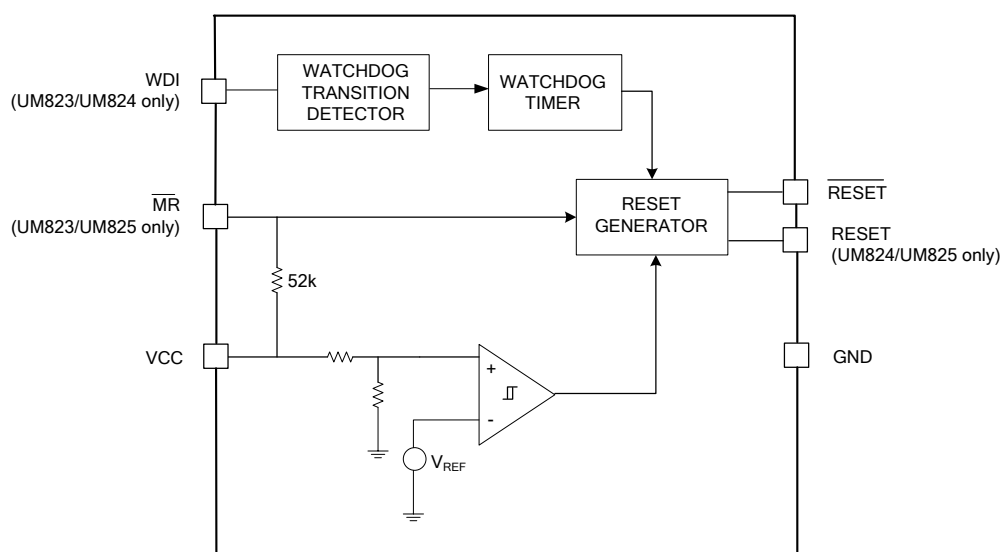
=P SOT353

## Typical Operating Circuit



UM824 has no MR and UM825 has no WDI

## Functional Diagram



## Pin Description

| Pin Name                  | Function                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GND                       | Ground Reference for all signals.                                                                                                                                                                                                                                                                                                                                                         |
| $\overline{\text{RESET}}$ | Active-Low Reset Output. Pulses low for 200ms when triggered, and remains low whenever $V_{CC}$ is below the reset threshold or when $\overline{\text{MR}}$ is a logic low. It remains low for 200ms after one of the following occurs: $V_{CC}$ rises above the reset threshold, the watchdog triggers a reset, or $\overline{\text{MR}}$ goes low to high.                              |
| RESET                     | Active-High Reset Output. Inverse of $\overline{\text{RESET}}$ .                                                                                                                                                                                                                                                                                                                          |
| $\overline{\text{MR}}$    | Manual-Reset Input triggers a reset pulse when pulled below $0.3V_{CC}$ . The active-low input has an internal $52k\Omega$ pull-up resistor. It can be driven from a TTL or CMOS logic line as well as shorted to ground with a switch. Leave open or connect to $V_{CC}$ if unused.                                                                                                      |
| WDI                       | Watchdog Input. If WDI remains either high or low for longer than the watchdog timeout period, the internal watchdog timer runs out and a reset is triggered. The internal watchdog timer clears whenever reset is asserted, or whenever WDI sees a rising or falling edge. If WDI is left unconnected or is connected to a three-stated buffer output, the watchdog feature is disabled. |
| $V_{CC}$                  | Supply Voltage                                                                                                                                                                                                                                                                                                                                                                            |

## Absolute Maximum Ratings (Note 1)

| Symbol           | Parameter                                                       |         | Value                          | Unit |
|------------------|-----------------------------------------------------------------|---------|--------------------------------|------|
| V <sub>CC</sub>  | Supply Voltage                                                  |         | -0.3 to +6.0                   | V    |
|                  | RESET, $\overline{\text{RESET}}$ , $\overline{\text{MR}}$ , WDI |         | -0.3 to (V <sub>CC</sub> +0.3) |      |
| I <sub>CC</sub>  | Input Current, V <sub>CC</sub> , $\overline{\text{MR}}$ , WDI   |         | 20                             | mA   |
| I <sub>O</sub>   | Output Current, RESET, $\overline{\text{RESET}}$                |         | 20                             | mA   |
| P <sub>D</sub>   | Continuous Power Dissipation                                    | SOT23-5 | 300                            | mW   |
|                  |                                                                 | SOT353  | 247                            |      |
| T <sub>A</sub>   | Operating Temperature Range                                     |         | -40 to +85                     | ℃    |
| T <sub>STG</sub> | Storage Temperature Range                                       |         | -65 to +150                    | ℃    |
|                  | Lead Temperature (Soldering, 10s)                               |         | +300                           | ℃    |

Note 1: Stresses beyond those listed under “Absolute maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## ESD Ratings

| Symbol | ESD Mode            | Value      | Unit |
|--------|---------------------|------------|------|
| HBM    | Human Body Mode     | $\pm 2000$ | V    |
| CDM    | Charged Device Mode | $\pm 500$  |      |

## Electrical Characteristics

( $V_{CC}=4.75V$  to  $5.5V$  for L version,  $V_{CC}=4.5V$  to  $5.5V$  for M version,  $V_{CC}=3.15V$  to  $3.6V$  for T version,  $V_{CC}=3.0V$  to  $3.6V$  for S version,  $V_{CC}=2.7V$  to  $3.6V$  for R version,  $V_{CC}=2.38V$  to  $2.75V$  for Z version,  $V_{CC}=2.25V$  to  $2.75V$  for Y version,  $T_A=-40^{\circ}C$  to  $+85^{\circ}C$  (SOT353),  $T_A=-40^{\circ}C$  to  $+125^{\circ}C$  (SOT23-5), unless otherwise noted. Typical values are at  $T_A=+25^{\circ}C$ .) (Note 2)

| Symbol    | Parameter                  | Conditions                         |                                  | Min  | Typ  | Max  | Unit             |
|-----------|----------------------------|------------------------------------|----------------------------------|------|------|------|------------------|
| $V_{CC}$  | Supply Voltage Range       | $T_A=0^{\circ}C$ to $+70^{\circ}C$ |                                  | 1.0  |      | 5.5  | V                |
|           |                            | $T_A=T_{MIN}$ to $T_{MAX}$         |                                  | 1.2  |      | 5.5  | V                |
| $I_{CC}$  | Supply Current             | WDI and MR unconnected             | UM823L/M<br>UM824L/M             |      | 4    | 6    | $\mu A$          |
|           |                            |                                    | UM823T/S/R/Z/Y<br>UM824T/S/R/Z/Y |      | 3    | 6    |                  |
|           |                            | MR unconnected                     | UM825L/M                         |      | 4    | 6    |                  |
|           |                            |                                    | UM825T/S/R/Z/Y                   |      | 3    | 6    |                  |
| $V_{TH+}$ | Reset Threshold            | L Version                          | $T_A=+25^{\circ}C$               | 4.56 | 4.63 | 4.70 | V                |
|           |                            |                                    | $T_A=T_{MIN}$ to $T_{MAX}$       | 4.50 |      | 4.75 |                  |
|           |                            | M Version                          | $T_A=+25^{\circ}C$               | 4.31 | 4.38 | 4.45 |                  |
|           |                            |                                    | $T_A=T_{MIN}$ to $T_{MAX}$       | 4.25 |      | 4.50 |                  |
|           |                            | T Version                          | $T_A=+25^{\circ}C$               | 3.04 | 3.08 | 3.11 |                  |
|           |                            |                                    | $T_A=T_{MIN}$ to $T_{MAX}$       | 3.00 |      | 3.15 |                  |
|           |                            | S Version                          | $T_A=+25^{\circ}C$               | 2.89 | 2.93 | 2.96 |                  |
|           |                            |                                    | $T_A=T_{MIN}$ to $T_{MAX}$       | 2.85 |      | 3.00 |                  |
|           |                            | R Version                          | $T_A=+25^{\circ}C$               | 2.59 | 2.63 | 2.66 |                  |
|           |                            |                                    | $T_A=T_{MIN}$ to $T_{MAX}$       | 2.55 |      | 2.70 |                  |
|           |                            | Z Version                          | $T_A=+25^{\circ}C$               | 2.28 | 2.32 | 2.35 |                  |
|           |                            |                                    | $T_A=T_{MIN}$ to $T_{MAX}$       | 2.25 |      | 2.38 |                  |
|           |                            | Y Version                          | $T_A=+25^{\circ}C$               | 2.16 | 2.19 | 2.22 |                  |
|           |                            |                                    | $T_A=T_{MIN}$ to $T_{MAX}$       | 2.13 |      | 2.25 |                  |
|           | Reset Threshold Hysteresis | L/M                                |                                  |      | 20   |      | mV               |
|           |                            | T/S/R/Z/Y                          |                                  |      | 10   |      |                  |
|           | Reset Threshold Tempco     |                                    |                                  |      | 100  |      | ppm/ $^{\circ}C$ |
| $t_{RP}$  | Reset Timeout Period       |                                    |                                  | 140  | 200  | 320  | ms               |
|           | $V_{CC}$ to RESET Delay    | $V_{RST}-V_{CC}=100mV$             |                                  |      | 20   |      | $\mu s$          |

## Electrical Characteristics (Continued)

( $V_{CC}=4.75V$  to  $5.5V$  for L version,  $V_{CC}=4.5V$  to  $5.5V$  for M version,  $V_{CC}=3.15V$  to  $3.6V$  for T version,  $V_{CC}=3.0V$  to  $3.6V$  for S version,  $V_{CC}=2.7V$  to  $3.6V$  for R version,  $V_{CC}=2.38V$  to  $2.75V$  for Z version,  $V_{CC}=2.25V$  to  $2.75V$  for Y version,  $T_A=-40^{\circ}C$  to  $+85^{\circ}C$  (SOT353),  $T_A=-40^{\circ}C$  to  $+125^{\circ}C$  (SOT23-5), unless otherwise noted. Typical values are at  $T_A=+25^{\circ}C$ .) (Note 2)

| Symbol                        | Parameter                                          | Conditions                                                                          | Min                  | Typ  | Max                 | Unit |
|-------------------------------|----------------------------------------------------|-------------------------------------------------------------------------------------|----------------------|------|---------------------|------|
| V <sub>OH</sub>               | RESET RESET<br>Output Voltage                      | UM82_L /M V <sub>CC</sub> =V <sub>RST</sub> max<br>I <sub>SOURCE</sub> =120uA       | V <sub>CC</sub> -1.5 |      |                     | V    |
|                               |                                                    | UM82_T/ S /R/Z /YV <sub>CC</sub> =V <sub>RST</sub> max<br>I <sub>SOURCE</sub> =30uA | 0.8V <sub>CC</sub>   |      |                     |      |
| V <sub>OL</sub>               |                                                    | UM82_L /M V <sub>CC</sub> =V <sub>RST</sub> min<br>I <sub>SINK</sub> =3.2mA         |                      |      | 0.4                 |      |
|                               |                                                    | UM82_T/ S /R/Z /YV <sub>CC</sub> = V <sub>RST</sub> min<br>I <sub>SINK</sub> =1.2mA |                      |      | 0.3                 |      |
| WATCHDOG INPUT(UM823/824)     |                                                    |                                                                                     |                      |      |                     |      |
| t <sub>WD</sub>               | Watchdog Timeout<br>Period                         |                                                                                     | 1.12                 | 1.60 | 2.40                | s    |
| t <sub>WDI</sub>              | WDI Pulse Width                                    | V <sub>IL</sub> <0.15V <sub>CC</sub> , V <sub>IH</sub> >0.85V <sub>CC</sub>         | 50                   |      |                     | ns   |
| V <sub>IL</sub>               | WDI Input Voltage<br>(Note 4)                      |                                                                                     |                      |      | 0.15V <sub>CC</sub> | V    |
| V <sub>IH</sub>               |                                                    |                                                                                     | 0.85V <sub>CC</sub>  |      |                     |      |
|                               | WDI Input Current                                  | WDI=V <sub>CC</sub>                                                                 | 1                    |      | 20                  | μA   |
|                               |                                                    | WDI=GND                                                                             | -20                  |      | -1                  |      |
| MANUAL RESET INPUT(UM823/825) |                                                    |                                                                                     |                      |      |                     |      |
| V <sub>IL</sub>               | MR̄ Input Voltage                                  |                                                                                     |                      |      | 0.15V <sub>CC</sub> | V    |
| V <sub>IH</sub>               |                                                    |                                                                                     | 0.85V <sub>CC</sub>  |      |                     |      |
|                               | MR̄ Pulse Width                                    |                                                                                     | 1.0                  |      |                     | μs   |
|                               | MR Noise<br>Immunity(Pulse<br>width with no reset) |                                                                                     |                      | 100  |                     | ns   |
|                               | MR̄ to Reset Delay                                 |                                                                                     |                      | 500  |                     | ns   |
|                               | MR̄ Pullup<br>Resistance(internal)                 |                                                                                     | 35                   | 52   | 75                  | k Ω  |

Note 2: Over temperature limits are guaranteed by design and not production tested.

Note 3: The RESET short-circuit current is the maximum pullup current when RESET is driven low by a  $\mu P$  bidirectional reset pin.

Note 4: WDI is internally serviced within the watchdog period if WDI is left unconnected.

## Detailed Description

### RESET Output

A Microprocessor's reset input starts the  $\mu P$  in a known state. The UM823/824/825  $\mu P$  supervisory circuits assert a reset to prevent code-execution errors during power-up, power-down, and brownout conditions. RESET is guaranteed to be a logic low for VCC down to 1V. Once VCC exceeds the reset threshold, an internal timer keeps RESET low for the specified reset timeout period, after this interval, RESET returns high.

If a brownout condition occurs(VCC dips below reset threshold), RESET goes low. Each time RESET is asserted it stays low for the reset timeout period. Any time VCC goes below the reset threshold the internal timer restarts. RESET both sources and sinks current, RESET on the UM824/825 is the inverse of RESET.

### Manual Reset Input (UM823/825)

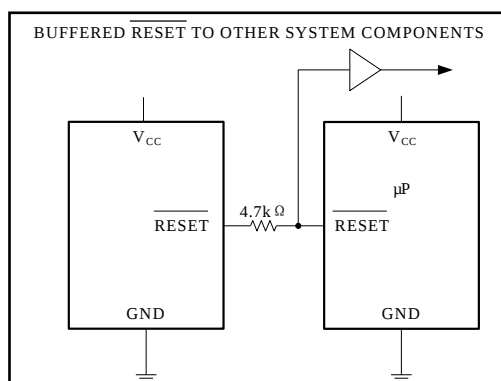
Many  $\mu P$ -based products require manual reset capability allowing the operator, a test technician, or external logic circuitry to initiate a reset. On the UM823/825, a logic low on M R asserts reset. Reset remains asserted while M R is low, and for  $t_{RP}$  (200ms nominal) after it returns high. M R has an internal  $52k\Omega$  pull up resistor, so it can be left open if not used. This input can be driven with CMOS logic levels or with open-drain/collector outputs. Connect a normally open momentary switch from M R to GND to create a manual-reset function; external debounce circuitry is not required. If M R is driven from long cables or the device is used in a noisy environment, connect a  $0.1\mu F$  capacitor from M R to GND to provide additional noise immunity.

### Watchdog Input (UM823/824)

In the UM823/824, the watchdog circuit monitors the  $\mu P$ 's activity. If the  $\mu P$  does not toggle the watchdog input (WDI) within  $t_{WD}$ (1.6s), reset asserts. The internal 1.6s timer is cleared by either a reset pulse or by toggling WDI, which detects pulses as short as 50ns. While reset is asserted, the timer remains cleared and does not count. As soon as reset is released, the timer starts counting. Disable the watchdog function by leaving WDI unconnected or by three-stating the driver connected to WDI.

### Microprocessor with Bidirectional Reset

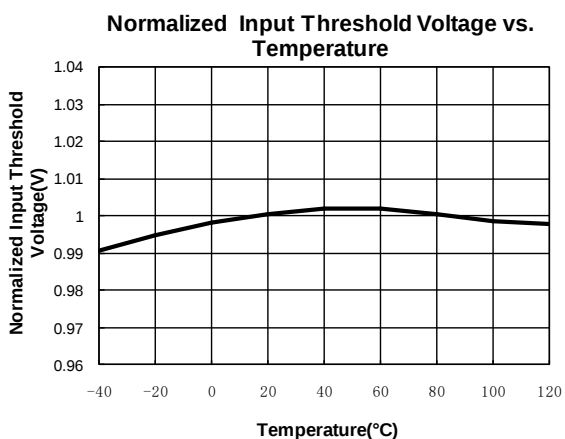
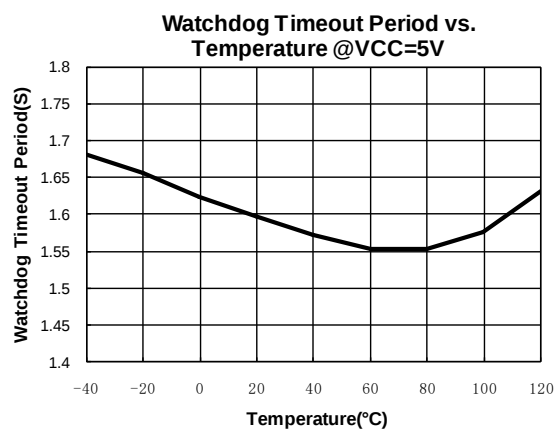
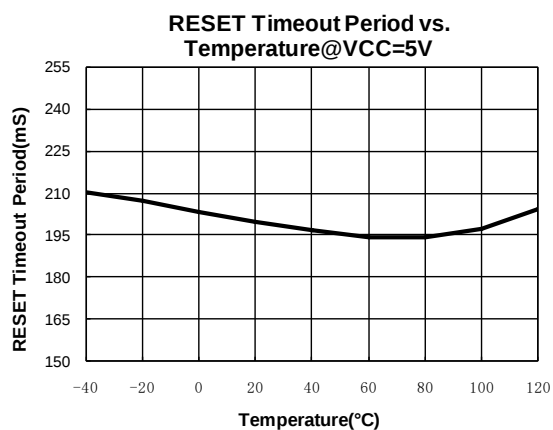
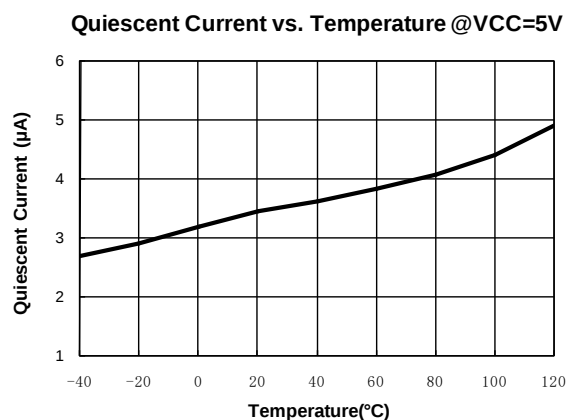
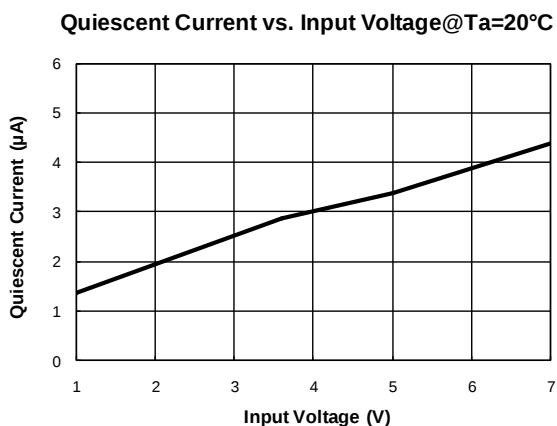
To prevent contention for microprocessor with a bidirectional reset line, a current limiting resistor is to be inserted between the RESET output pin and the microprocessor reset pin. This limits the current to a safe level if there are conflicting output reset levels. A suitable resistor value is  $4.7k\Omega$ . If the reset output is required for other uses, it should be buffered as shown in the figure below.



**Bidirectional Reset I/O**

## Typical Operating Characteristics

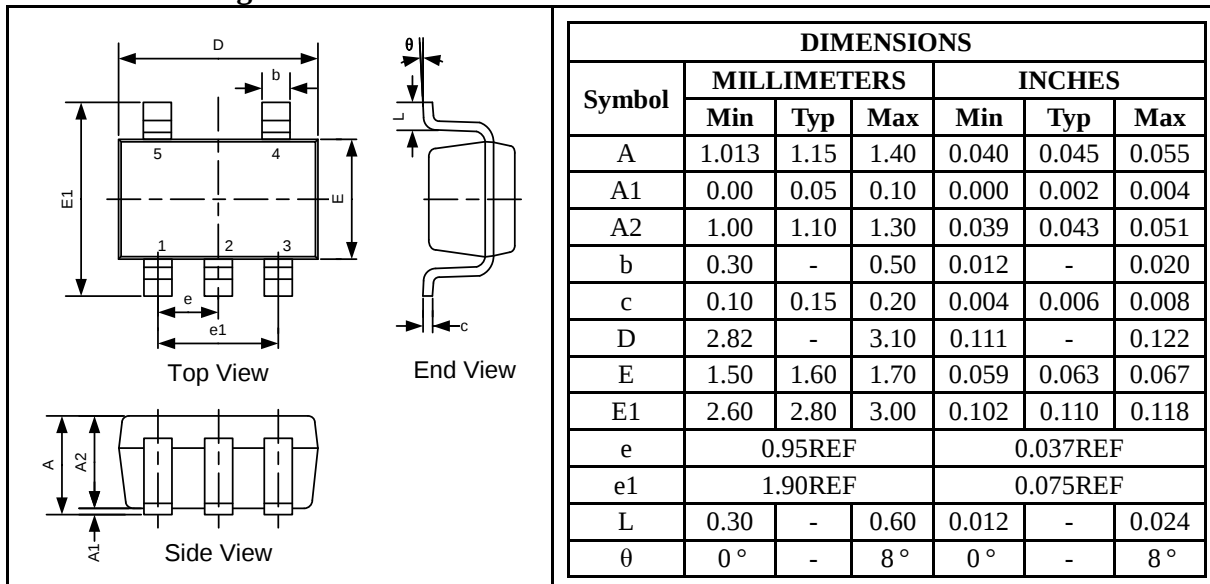
$V_{CC}=+5V$ ,  $T_A=25^{\circ}C$ , unless otherwise noted.



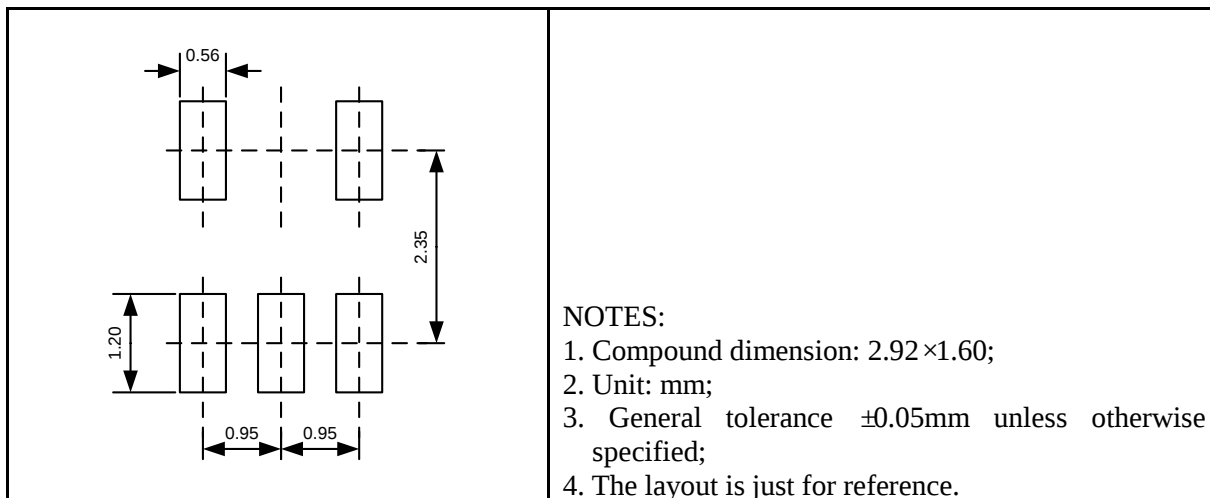
## Package Information

### UM823S/824S/825S SOT23-5

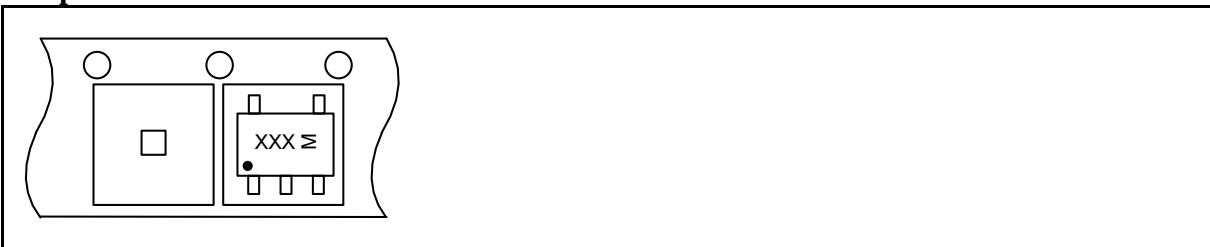
#### Outline Drawing



#### Land Pattern

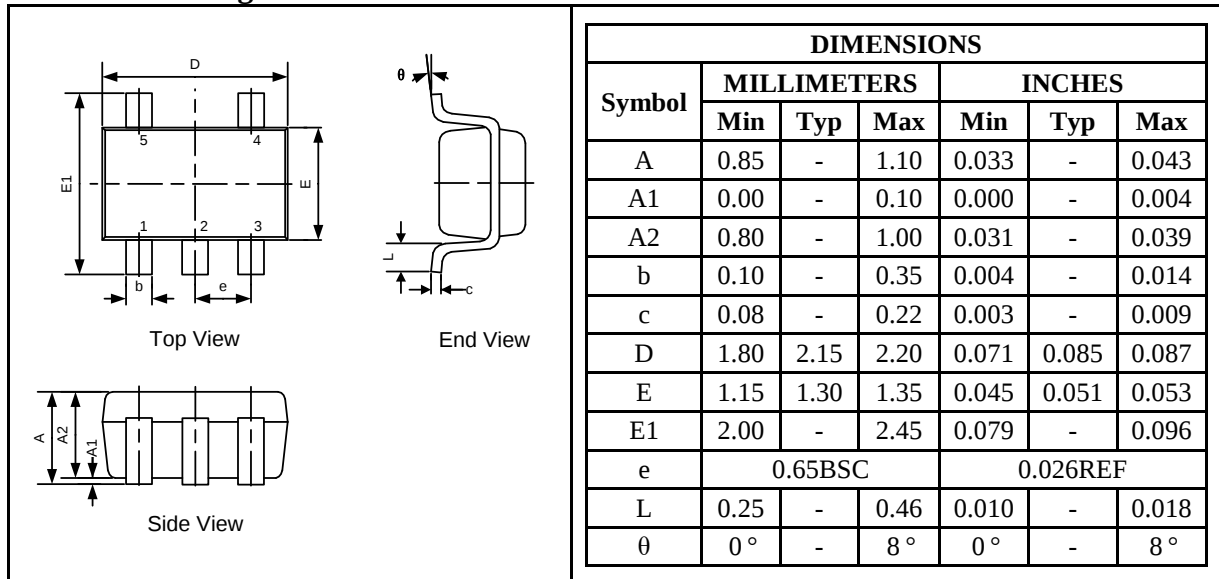


#### Tape and Reel Orientation

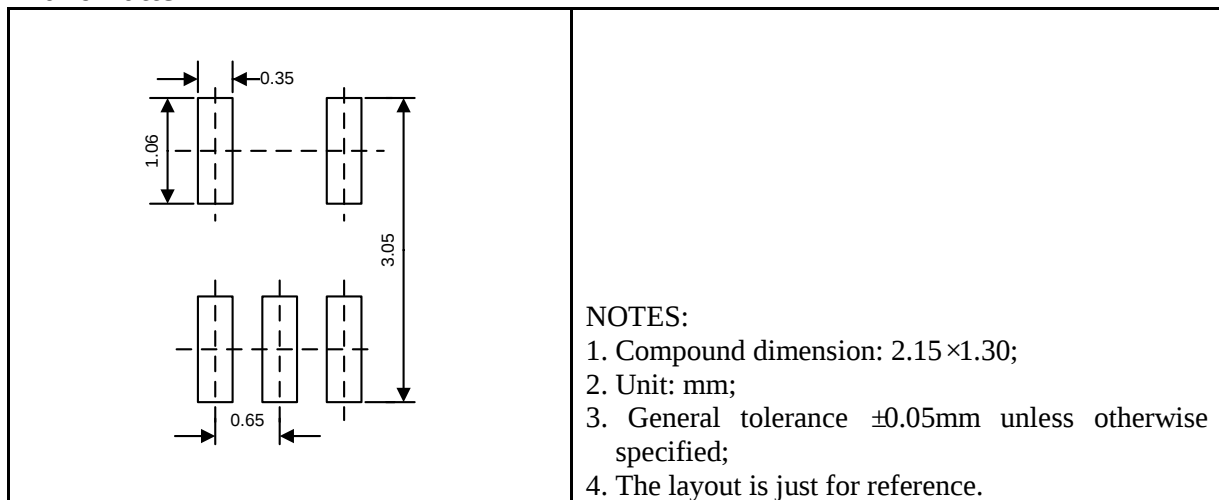


## UM823P/824P/825P SOT353

### Outline Drawing



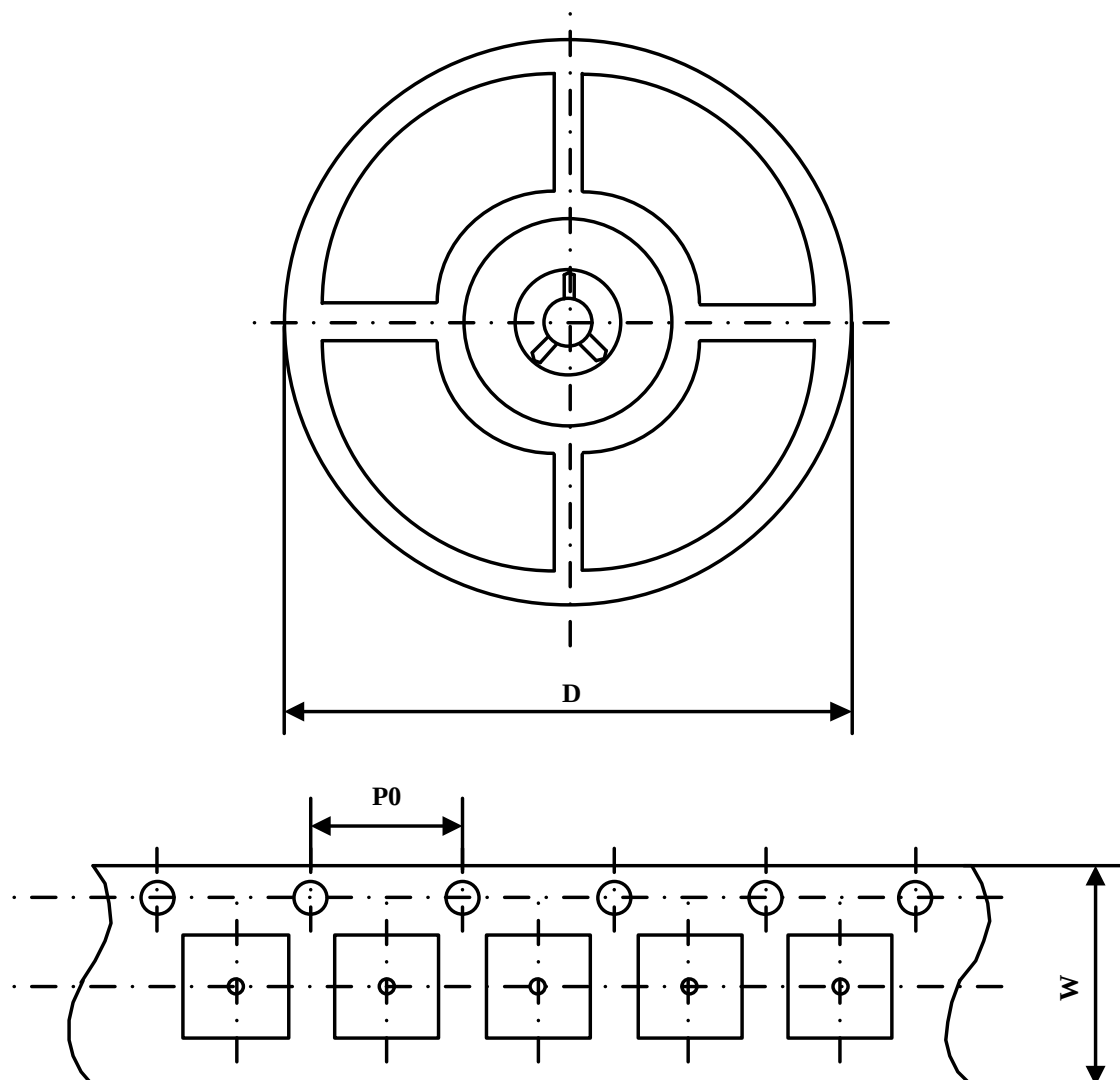
### Land Pattern



### Tape and Reel Orientation



## Packing Information



| Part Number | Package Type | Carrier Width(W) | Pitch(P0) | Reel Size(D) |
|-------------|--------------|------------------|-----------|--------------|
| UM823S      | SOT23-5      | 8 mm             | 4 mm      | 180 mm       |
| UM824S      | SOT23-5      | 8 mm             | 4 mm      | 180 mm       |
| UM825S      | SOT23-5      | 8 mm             | 4 mm      | 180 mm       |
| UM823P      | SOT353       | 8 mm             | 4 mm      | 180 mm       |
| UM824P      | SOT353       | 8 mm             | 4 mm      | 180 mm       |
| UM825P      | SOT353       | 8 mm             | 4 mm      | 180 mm       |

## Selection Table

| Part Number | RESET Threshold (V) | Top Marking | Package Type | Shipping Quantity       |
|-------------|---------------------|-------------|--------------|-------------------------|
| UM823LS     | 4.63                | 23L         | SOT23-5      | 3000pcs/7Inch Tape Reel |
| UM823MS     | 4.38                | 23M         |              |                         |
| UM823TS     | 3.08                | 23T         |              |                         |
| UM823SS     | 2.93                | 23S         |              |                         |
| UM823RS     | 2.63                | 23R         |              |                         |
| UM823ZS     | 2.32                | 23Z         |              |                         |
| UM823YS     | 2.19                | 23Y         |              |                         |
| UM823LP     | 4.63                | 3LP         | SOT353       | 3000pcs/7Inch Tape Reel |
| UM823MP     | 4.38                | 3MP         |              |                         |
| UM823TP     | 3.08                | 3TP         |              |                         |
| UM823SP     | 2.93                | 3SP         |              |                         |
| UM823RP     | 2.63                | 3RP         |              |                         |
| UM823ZP     | 2.32                | 3ZP         |              |                         |
| UM823YP     | 2.19                | 3YP         |              |                         |
| UM824LS     | 4.63                | 24L         | SOT23-5      | 3000pcs/7Inch Tape Reel |
| UM824MS     | 4.38                | 24M         |              |                         |
| UM824TS     | 3.08                | 24T         |              |                         |
| UM824SS     | 2.93                | 24S         |              |                         |
| UM824RS     | 2.63                | 24R         |              |                         |
| UM824ZS     | 2.32                | 24Z         |              |                         |
| UM824YS     | 2.19                | 24Y         |              |                         |
| UM824LP     | 4.63                | 4LP         | SOT353       | 3000pcs/7Inch Tape Reel |
| UM824MP     | 4.38                | 4MP         |              |                         |
| UM824TP     | 3.08                | 4TP         |              |                         |
| UM824SP     | 2.93                | 4SP         |              |                         |
| UM824RP     | 2.63                | 4RP         |              |                         |
| UM824ZP     | 2.32                | 4ZP         |              |                         |
| UM824YP     | 2.19                | 4YP         |              |                         |
| UM825LS     | 4.63                | 25L         | SOT23-5      | 3000pcs/7Inch Tape Reel |
| UM825MS     | 4.38                | 25M         |              |                         |
| UM825TS     | 3.08                | 25T         |              |                         |
| UM825SS     | 2.93                | 25S         |              |                         |
| UM825RS     | 2.63                | 25R         |              |                         |
| UM825ZS     | 2.32                | 25Z         |              |                         |
| UM825YS     | 2.19                | 25Y         |              |                         |
| UM825LP     | 4.63                | 5LP         | SOT353       | 3000pcs/7Inch Tape Reel |
| UM825MP     | 4.38                | 5MP         |              |                         |
| UM825TP     | 3.08                | 5TP         |              |                         |
| UM825SP     | 2.93                | 5SP         |              |                         |
| UM825RP     | 2.63                | 5RP         |              |                         |
| UM825ZP     | 2.32                | 5ZP         |              |                         |
| UM825YP     | 2.19                | 5YP         |              |                         |

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