## Description

The APX823/APX824/APX825A family of supervisors provides circuit initialization and timing supervision, primarily for DSP and processor-based systems.

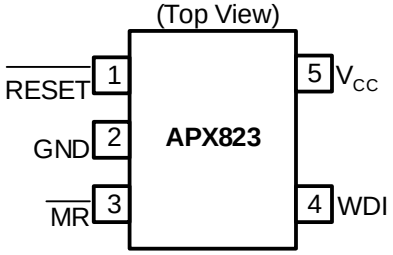
During power-on, $\overline{\text{RESET}}$ is asserted when supply voltage $V_{CC}$ becomes higher than 1.1V. Thereafter, the supply voltage supervisor monitors $V_{CC}$ and keeps $\overline{\text{RESET}}$ active as long as $V_{CC}$ remains below the threshold voltage $V_{TH-}$. An internal timer delays the return of the output to the inactive state (high) to ensure proper system reset. The delay time, $t_d$ starts after $V_{CC}$ has risen above the threshold voltage $V_{TH-}$. When the supply voltage drops below the threshold voltage $V_{TH-}$, the output becomes active (low) again. No external components are required. All the devices of this family have a fixed-sense threshold voltage $V_{TH-}$ set by an internal voltage divider.

The APX823/APX825A devices incorporate a manual reset input, $\overline{\text{MR}}$ . A low level at $\overline{\text{MR}}$ causes $\overline{\text{RESET}}$ to become active. The APX824/APX825A devices include a high-level output RESET. APX823/APX824/APX825A have a watchdog timer that is periodically triggered by a positive or negative transition at WDI. When the supervising system fails to retrigger the watchdog circuit within the time-out interval, ttout, $\overline{\text{RESET}}$ becomes active for the time period td. This event also reinitializes the watchdog timer. Leaving WDI unconnected disables the watchdog.

In applications where the input to the WDI pin may be active (transitioning high and low) when the APX823/APX824/APX8 25A asserting $\overline{\text{RESET}}$ the APX823/APX824/APX825A does not return to a non-reset state when the input voltage is above Vt. The product spectrum is designed for supply voltage of 2.5V, 3V, 3.3V and 5V. The circuits are available in a SOT25 and SOT26 packages. The APX823/APX824/APX825A devices are characterized for operation over a temperature range of -40°C to 105°C.

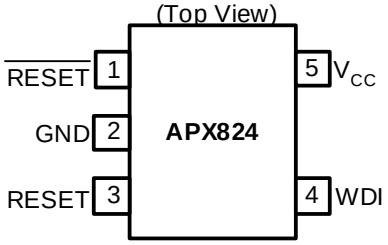
## Pin Assignments

(Top View)



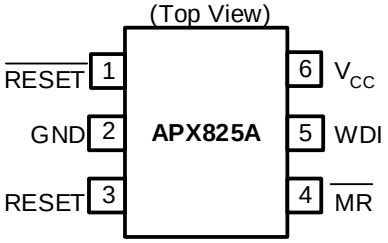

**SOT25**

(Top View)




**SOT25**

(Top View)




**SOT26**

## Features

- Power-on reset generator with fixed delay time of 200ms Typ
- Manual reset input (APX823/APX825A)
- Reset output available in active-low (APX823/APX824/APX825A), active-high (APX824/APX825A)
- Supply voltage supervision range 2.5V, 3V, 3.3V, 5V
- Watchdog timer
- Supply current of 30µA (Typ.)
- Temperature range: -40°C to 85°C
- SOT25 and SOT26: Available in "Green" Molding Compound (No Br, Sb)
- Lead Free Finish/RoHS Compliant (Note 1)

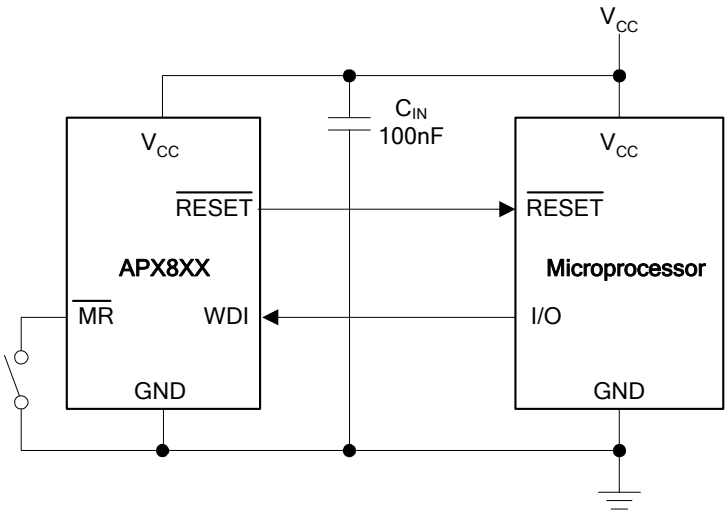
## Applications

- Applications Using DSPs, Microcontrollers, or Microprocessors
- Industrial Equipment
- Programmable Controls
- Automotive Systems
- Portable/Battery-Powered Equipment
- Intelligent Instruments
- Wireless Communications Systems
- Notebook/Desktop Computers

Note: 1. EU Directive 2002/95/EC (RoHS). All applicable RoHS exemptions applied, see *EU Directive 2002/95/EC Annex Notes*.


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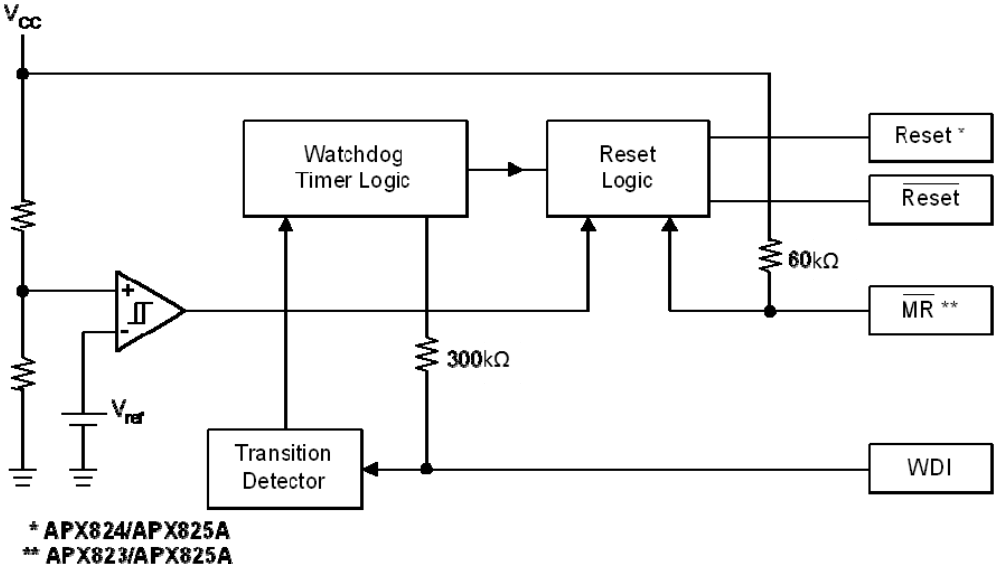
## Typical Application Circuit




## Pin Descriptions

| Pin Name | Description |
|---|---|
| GND | Ground |
| $\overline{\text{RESET}}$ (RESET) | Reset output pin |
| $V_{CC}$ | Operating voltage input |
| WDI | Watchdog input |
| $\overline{\text{MR}}$ | Manual reset |

## Functional Block Diagram





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## Absolute Maximum Ratings (Over operating ambient temperature range, unless otherwise noted)*

| Symbol | Parameter | | | Rating | Unit |
|---|---|---|---|---|---|
| ESD HBM | Human Body Model ESD Protection | | | 5 | KV |
| ESD MM | Machine Model ESD Protection | | | 200 | V |
| $V_{CC}$ | Supply Voltage | | | 6.0 | V |
| $V_{RESET}$ | RESET, $\overline{RESET}$ , $\overline{MR}$ , WDI | | | -0.3 to ($V_{CC}$+0.3) | V |
| $I_{CC}$ | Input Current $V_{CC}$ | | | 20 | mA |
| $I_O$ | Maximum High Output Current | | | 20 | mA |
| $P_D$ | Continuous Total Power Dissipation | Derating Factor Above $T_A$ = 25°C | SOT25 | 6.2 | mW/°C |
| | | | SOT26 | 5.8 | |
| | | $T_A$ = 25°C Power Rating | SOT25 | 500 | mW |
| | | | SOT26 | 470 | |
| | | $T_A$ = 70°C Power Rating | SOT25 | 220 | mW |
| | | | SOT26 | 210 | |
| | | $T_A$ = 85°C Power Rating | SOT25 | 125 | mW |
| | | | SOT26 | 120 | |
| $T_{OP}$ | Operating Junction Temperature Range | | | -40 to 105 | °C |
| $T_{ST}$ | Storage Temperature Range | | | -65 to 150 | °C |

***** 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 under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## Recommended Operating Conditions

| Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 1.1 | 5.5 | V |
| $V_{IN}$ | Input Voltage | 0 | ($V_{CC}$+0.3) | V |
| $V_{IH}$ | High-level Input Voltage at $\overline{MR}$ and WDI | 0.7×$V_{CC}$ | - | V |
| $V_{IL}$ | Low-level Voltage | - | 0.3×$V_{CC}$ | V |
| Δt/ΔV | Input Transition Rise and Fall Rate at $\overline{MR}$ or WDI | - | 100 | ns/V |
| $T_A$ | Operating Ambient Temperature Range | -40 | 85 | °C |
| $T_R$ | $V_{CC}$ Rising Time ($V_{CC}$ = 0~VT) | - | 100 | V/ uS |


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## Electrical Characteristics (Over recommended operating ambient temperature range, unless otherwise noted)

| Symbol | Parameter | | | Test Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| $V_{OH}$ | High-level Output Voltage | $\overline{RESET}$ | APX823/APX824/APX825A -29/26/23 | $V_{CC}$= $V_{TH-}$+0.2V<br>$I_{OH}$=-20μA | 0.8×$V_{CC}$ | - | - | V |
| | | | APX823/APX824/APX825A -40/31 | $V_{CC}$= $V_{TH-}$+0.2V<br>$I_{OH}$=-30μA | | | | |
| | | | APX823/APX824/APX825A –46/44 | $V_{CC}$= $V_{TH-}$+0.2V<br>$I_{OH}$=-120μA | $V_{CC}$-1.5V | - | - | V |
| | | RESET | APX824/APX825A -29/26/23 | $V_{CC}$ ≥ 1.8V,<br>$I_{OH}$ = -100μA | 0.8×$V_{CC}$ | - | - | V |
| | | | APX824/APX825A -46/44/40/31 | $V_{CC}$ ≥ 1.8V,<br>$I_{OH}$ = -150μA | | | | |
| $V_{OL}$ | Low-level Output Voltage | RESET | APX824/APX825A -29/26/23 | $V_{CC}$= $V_{TH-}$+0.2V<br>$I_{OL}$=1mA | - | - | 0.4 | V |
| | | | APX824/APX825A -40/31 | $V_{CC}$= $V_{TH-}$+0.2V<br>$I_{OL}$=1.2mA | | | | |
| | | | APX824/APX825A -46/44 | $V_{CC}$= $V_{TH-}$+0.2V<br>$I_{OL}$=3mA | | | | |
| | | $\overline{RESET}$ | APX823/APX824/APX825A -29/26/23 | $V_{CC}$= $V_{TH-}$-0.2V<br>$I_{OL}$=1mA | - | - | 0.4 | V |
| | | | APX823/APX824/APX825A -40/31 | $V_{CC}$= $V_{TH-}$-0.2V<br>$I_{OL}$=1.2mA | | | | |
| | | | APX823/APX824/APX825A -46/44 | $V_{CC}$= $V_{TH-}$-0.2V<br>$I_{OL}$=3mA | | | | |
| $V_{RESET}$ | Power-up Reset Voltage (see Note 2) | | | $V_{CC}$ ≥ 1.1V,<br>$I_{OL}$=20μA | - | - | 0.4 | V |
| $V_{TH-}$ | Negative-going Input Threshold Voltage (see Note 3) | | APX823/APX824/APX825A -23 | $T_A$ = 0°C -85°C | 2.21 | 2.25 | 2.30 | V |
| | | | APX823/APX824/APX825A -26 | | 2.59 | 2.63 | 2.69 | |
| | | | APX823/APX824/APX825A -29 | | 2.88 | 2.93 | 3.00 | |
| | | | APX823/APX824/APX825A -31 | | 3.02 | 3.08 | 3.15 | |
| | | | APX823/APX824/APX825A -40 | | 3.93 | 4.00 | 4.08 | |
| | | | APX823/APX824/APX825A -44 | | 4.31 | 4.38 | 4.47 | |
| | | | APX823/APX824/APX825A -46 | | 4.56 | 4.63 | 4.72 | |
| | | | APX823/APX824/APX825A -23 | $T_A$= -40°C -85°C | 2.20 | 2.25 | 2.30 | V |
| | | | APX823/APX824/APX825A -26 | | 2.57 | 2.63 | 2.69 | |
| | | | APX823/APX824/APX825A -29 | | 2.86 | 2.93 | 3.00 | |
| | | | APX823/APX824/APX825A -31 | | 3.00 | 3.08 | 3.15 | |
| | | | APX823/APX824/APX825A -40 | | 3.92 | 4.00 | 4.08 | |
| | | | APX823/APX824/APX825A -44 | | 4.29 | 4.38 | 4.47 | |
| | | | APX823/APX824/APX825A -46 | | 4.54 | 4.63 | 4.72 | |

Note: 2. The lowest supply voltage at which $\overline{RESET}$ becomes active. $T_R$ , $V_{CC}$ ≥ 15μs/V.
3. To ensure best stability of the threshold voltage, a bypass capacitor (ceramic, 0.1μF) should be placed near the supply terminals.


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## Electrical Characteristics (cont.)

| Symbol | Parameter | | Test Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| $V_{hys}$ | Hysteresis at $V_{CC}$ Input | APX823/APX824/APX825A -23 | | - | 50 | - | mV |
| | | APX823/APX824/APX825A -26 | | | | | |
| | | APX823/APX824/APX825A -29 | | | | | |
| | | APX823/APX824/APX825A -31 | | | | | |
| | | APX823/APX824/APX825A -40 | | - | 50 | - | |
| | | APX823/APX824/APX825A -44 | | | | | |
| | | APX823/APX824/APX825A -46 | | | | | |
| $T_S$ | Set-up Time | $V_{CC}$ = $V_{TH}$ to ($V_{TH}$ – 100mV) | | | 20 | | µs |
| $I_{IH(AV)}$ | Average High-level Input Current | WDI | WDI=$V_{CC}$, Time average (dc=88%) | - | 120 | - | µA |
| $I_{IL(AV)}$ | Average Low-level Input Current | | WDI=0.3V, $V_{CC}$=5.5V time average (dc=12%) | - | -15 | - | µA |
| $I_{IH}$ | High-level Input Current | WDI | WDI=$V_{CC}$ | - | 120 | 160 | µA |
| $I_{IL}$ | Low-level Input Current | WDI | WDI=0.3V, $V_{CC}$=5.5V | - | 120 | 160 | µA |
| $I_{CC}$ | Supply Current | WDI and $\overline{MR}$ Unconnected, Outputs unconnected | $V_{CC}$ = $V_{TH}$+0.2V | - | 30 | 40 | µA |
| | Internal Pull-up Resistor at $\overline{MR}$ | | | - | 60 | - | kΩ |
| TC | $V_{OUT}$ Temperature Coefficient | | | | 50 | - | ppm/°C |
| $C_i$ | Input Capacitance at $\overline{MR}$, WDI | | $V_I$ = 0V to 5.5V | - | 5 | - | pF |
| $\theta_{JA}$ | Thermal Resistance Junction-to-Ambient | | SOT25 (Note 4) | | 161 | | °C/W |
| | | | SOT26 (Note 4) | | 169 | | |
| $\theta_{JC}$ | Thermal Resistance Junction-to-Case | | SOT25 (Note 4) | | 27 | | °C/W |
| | | | SOT26 (Note 4) | | 28 | | |

Note: 4. Test condition for SOT25 and SOT26: Devices mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.


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## Timing Requirements (@ $R_L$ = 1mΩ, $C_L$ = 50pF, $T_A$ = 25°C)

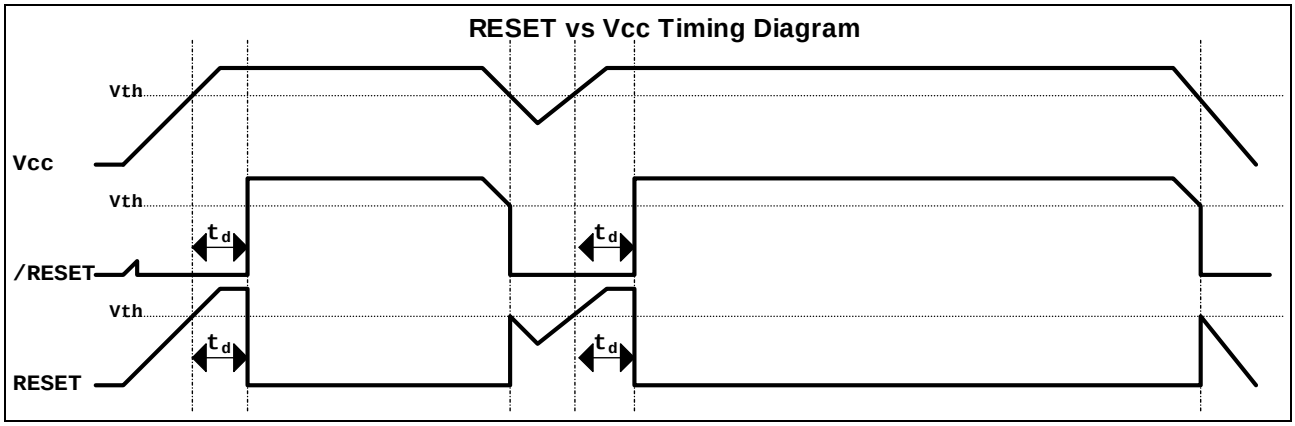
| Symbol | Parameter | | Test Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| $t_W$ | Pulse Width | at $\overline{MR}$ | $V_{CC} \geq V_{TH-}$+0.2V, $V_{IL}$=0.3×$V_{CC}$, $V_{IH}$=0.7×$V_{CC}$ | 100 | - | - | ns |
| | | at WDI | $V_{CC} \geq V_{TH-}$+0.2V, $V_{IL}$=0.3×$V_{CC}$, $V_{IH}$=0.7×$V_{CC}$ | 50 | - | - | ns |

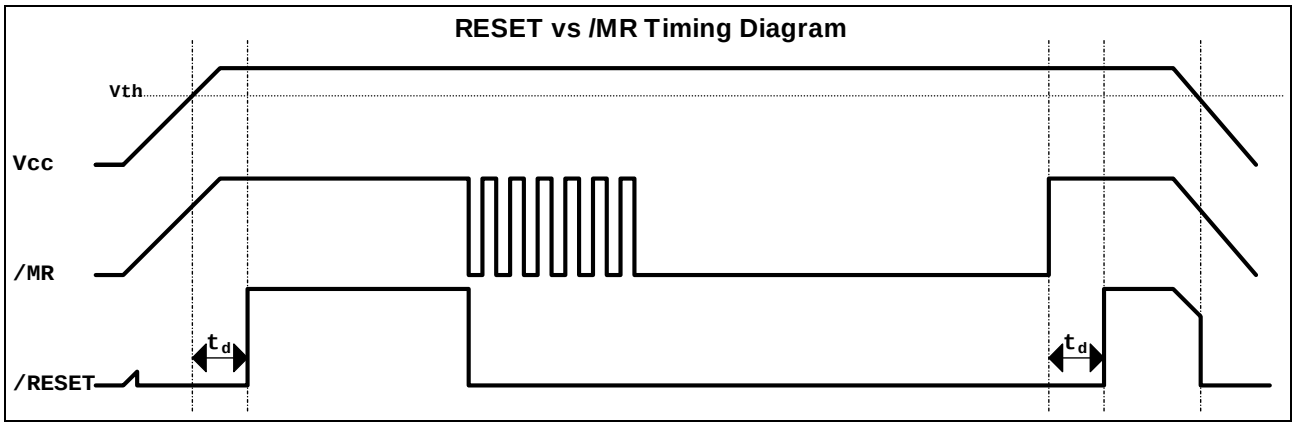
## Switching Characteristics (@ $R_L$ = 1mΩ, $C_L$ = 50pF, $T_A$ = 25°C)

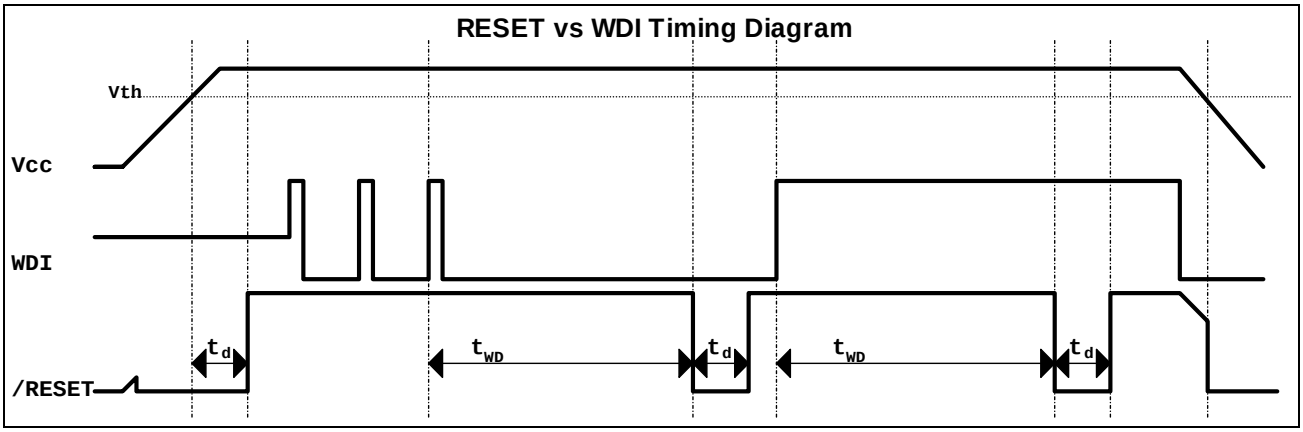
| Symbol | Parameter | | Test Conditions | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|---|
| $t_{tout}$ | Watchdog Time Out | APX823/APX824/APX825A | $V_{CC} \geq V_{TH-}$+0.2V, See timing diagram | 1.12 | 1.6 | 2.4 | s |
| $t_d$ | Delay Time | APX823/APX824/APX825A | $V_{CC} \geq V_{TH-}$+0.2V, See timing diagram | 140 | 200 | 280 | ms |
| $t_{PHL}$ | Propagation (Delay) Time, High-to-low-level Output | $\overline{MR}$ to $\overline{RESET}$ delay (APX823/APX825A) | $V_{CC} > V_{TH-}$+0.2V, $V_{IL}$=0.3×$V_{CC}$, $V_{IH}$=0.7×$V_{CC}$ | - | - | 0.1 | µs |
| | | $V_{CC}$ to $\overline{RESET}$ delay | $V_{IL}$= $V_{TH-}$-0.2V, $V_{IH}$= $V_{TH-}$+0.2V | - | - | 25 | µs |
| $t_{PLH}$ | Propagation (Delay) Time, Low-to-high-level Output | $\overline{MR}$ to RESET delay (APX824/APX825A) | $V_{CC} > V_{TH-}$+0.2V, $V_{IL}$=0.3×$V_{CC}$, $V_{IH}$=0.7×$V_{CC}$ | - | - | 0.1 | µs |
| | | $V_{CC}$ to RESET delay (APX824/APX825A) | $V_{IL}$= $V_{TH-}$-0.2V, $V_{IH}$= $V_{TH-}$+0.2V | - | - | 25 | µs |


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## Timing Diagram



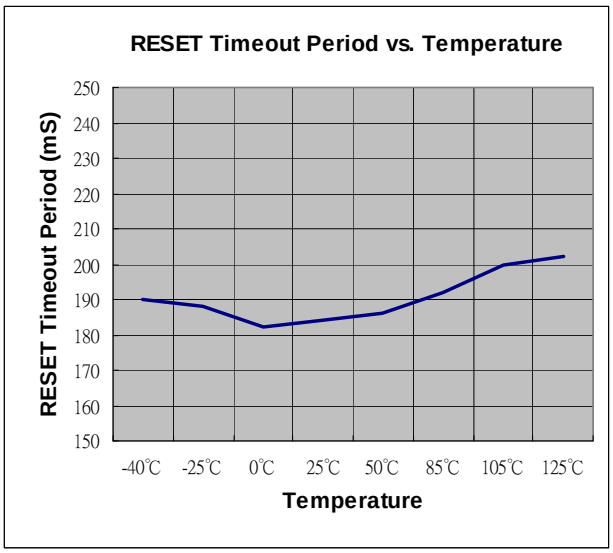



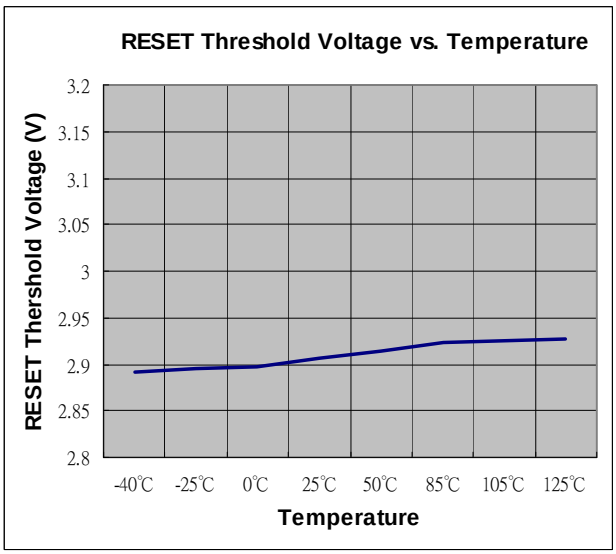



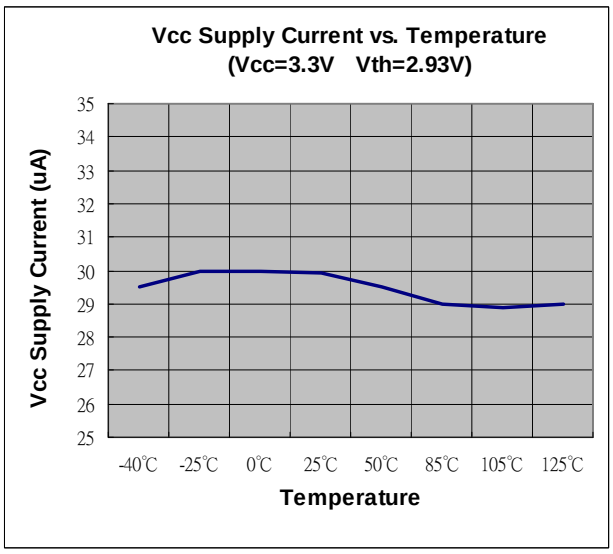


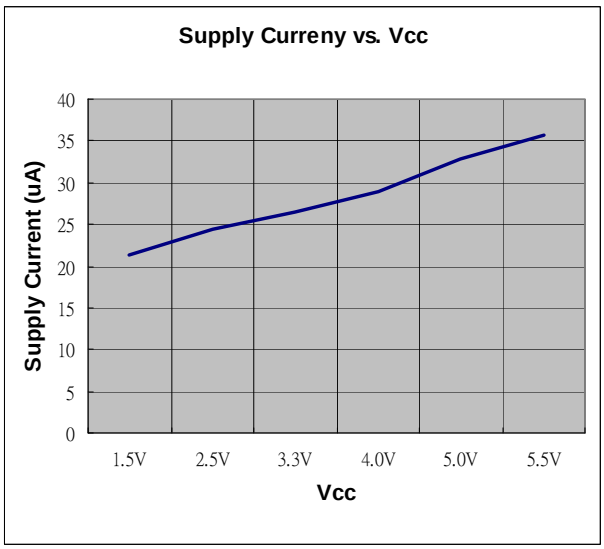
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## Typical Characteristics





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## Ordering Information

**APX82 XX - XX XX G - 7**

| Part No. | Voltage | Package | Green | Packing |
|---|---|---|---|---|
| 3 : APX823<br>4 : APX824<br>5A : APX825A | 46 : 4.63<br>44 : 4.38<br>40 : 4.00<br>31 : 3.08<br>29 : 2.93<br>26 : 2.63<br>23 : 2.25 | W5 : SOT25<br>W6 : SOT26 | G : Green | 7 : Tape & Reel |

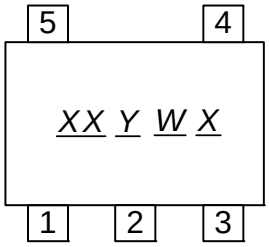
| Device | Package Code | Packaging (Note 5) | 7" Tape and Reel | |
|---|---|---|---|---|
| | | | Quantity | Part Number Suffix |
| APX823-XXW5G-7 | W5 | SOT25 | 3000/Tape & Reel | -7 |
| APX824-XXW5G-7 | W5 | SOT25 | 3000/Tape & Reel | -7 |
| APX825A-XXW6G-7 | W6 | SOT26 | 3000/Tape & Reel | -7 |

Notes: 5. 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.

## Marking Information

**(1) SOT25**

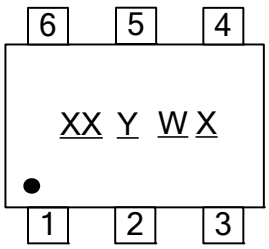
**( Top View )**




XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents 52 and 53 week
X : A~Z : Green

**(2) SOT26**

**( Top View )**




XX : Identification code
Y : Year 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents 52 and 53 week
X : A~Z : Green


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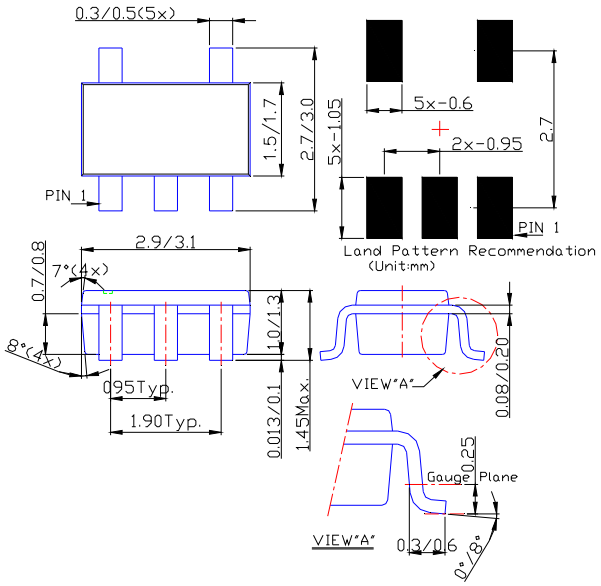
## Marking Information (cont.)

### Marking Table

| Device | Package Type | Identification Code |
|---|---|---|
| APX823-46W5 | SOT25 | W1 |
| APX823-44W5 | SOT25 | W2 |
| APX823-40W5 | SOT25 | W3 |
| APX823-31W5 | SOT25 | W4 |
| APX823-29W5 | SOT25 | W5 |
| APX823-26W5 | SOT25 | W6 |
| APX823-23W5 | SOT25 | W7 |
| APX824-46W5 | SOT25 | T2 |
| APX824-44W5 | SOT25 | T3 |
| APX824-40W5 | SOT25 | T4 |
| APX824-31W5 | SOT25 | T5 |
| APX824-29W5 | SOT25 | T6 |
| APX824-26W5 | SOT25 | T7 |
| APX824-23W5 | SOT25 | T8 |
| APX825A-46W6 | SOT26 | T9 |
| APX825A-44W6 | SOT26 | TA |
| APX825A-40W6 | SOT26 | TB |
| APX825A-31W6 | SOT26 | TC |
| APX825A-29W6 | SOT26 | TD |
| APX825A-26W6 | SOT26 | TE |
| APX825A-23W6 | SOT26 | TF |

## Package Outline Dimensions (All Dimensions in mm)

### (1) Package Type: SOT25

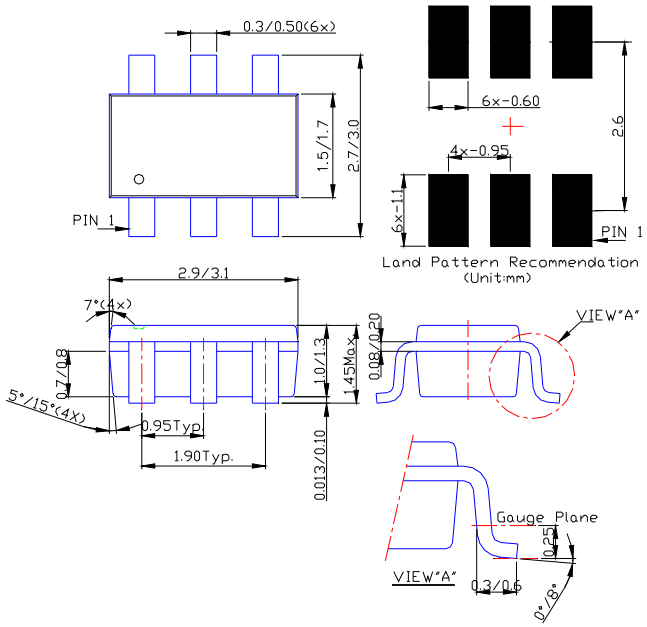




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## Package Outline Dimensions (cont.) (All Dimensions in mm)

### (2) Package Type: SOT26




Notes: 6. Package outline dimensions as shown on Diodes Inc. package outline dimensions document AP02002, which can be found on our website at http://www.diodes.com/datasheets/ap02002.pdf


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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

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