

MicroPower Microprocessor Reset Circuit with Manual Reset

Features

- 1.2V to 6V Input Voltage Range
- Low Quiescent Current : less Than 1.5 μ A
- High accuracy detection threshold : $\pm 1.5\%$
- Fixed trimmed reset thresholds for 1.5V, 1.75V, 2.32V, 2.63V, 2.93V, 3.08V, 3.9V, 4.38V.
- Manual Reset Input
- Reset Timeout Period 250ms
- Available output configurations
 - Open-drain output
 - CMOS active high output
 - CMOS active low output
- SOT-23-5 package
- No external components

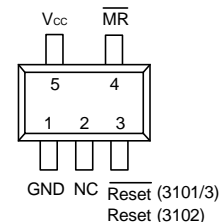
Applications

- Computers
- Cell Phones
- Portable Electronics
- μ P Power Supply Monitoring

General Description

The APR3101/2/3 are designed to monitor voltage supplies in μ P and digital systems. The quiescent current is extremely low, typically 1.5 μ A, making it ideal for portable battery operated equipment. The APR3101/2/3 operate by monitoring the system power supply voltage. When the input voltage drops below a fixed threshold or whenever manual reset is asserted, the device asserts a reset signal for a fixed time period after Vcc rises above the fixed threshold or manual reset is deasserted. The APR3101/2/3 series is available with three output stage versions: APR3101 push-pull active low output, APR3102 push-pull active high output and APR3103 open drain active low output. The APR3101/2/3 also have a debounced manual reset input that is provided to override the reset monitor. They are also designed to reject fast line transient glitches on Vcc. The APR3101/2/3 are come in a miniature SOT-23-5 package.

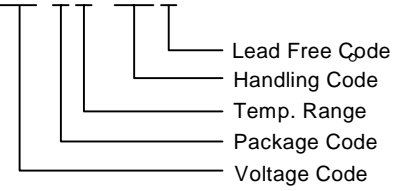
Pin Configuration



SOT-23-5 (Top View)

ANPEC reserves the right to make changes to improve reliability or manufacturability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

Ordering and Marking Information

| | |
|---|--|
| <p>APR3101/2/3 - □□ □□ - □□□□</p>  | <p>Package Code B : SOT-23-5 Temp. Range I : -40 to 85°C Handling Code TR : Tape & Reel Voltage Code : 15 : 1.5V ~ 50 : 5.0V Lead Free Code L : Lead Free Device Blank : Original Device</p> |
| <p>APR3101/2/3 B : A1/2/3 XX Date Code Voltage Code A:1.5V B:1.75V C:2.32V D:2.63V E:2.93V F:3.08V G:3.9V H:4.38V</p> | |

Absolute Maximum Ratings

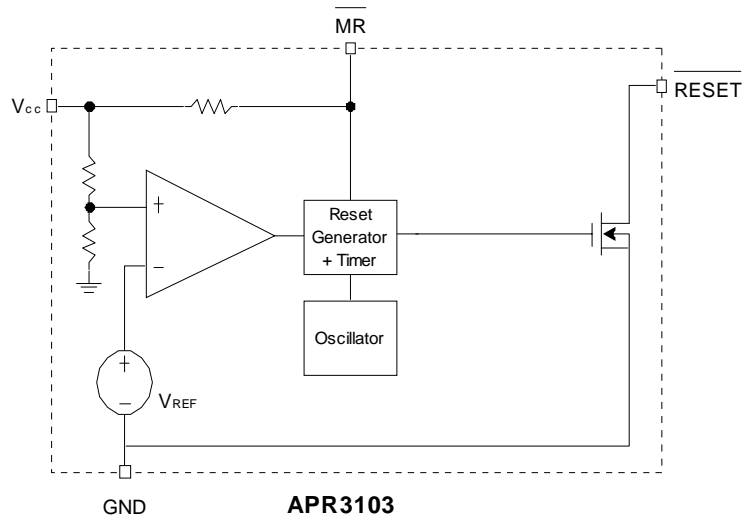
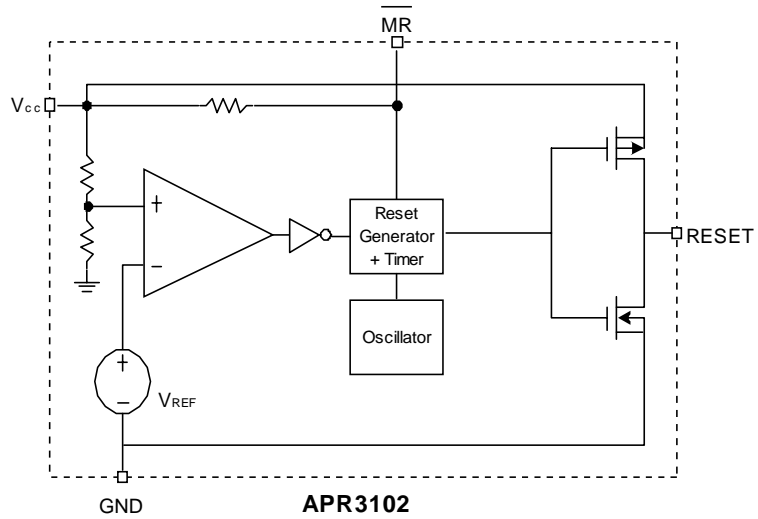
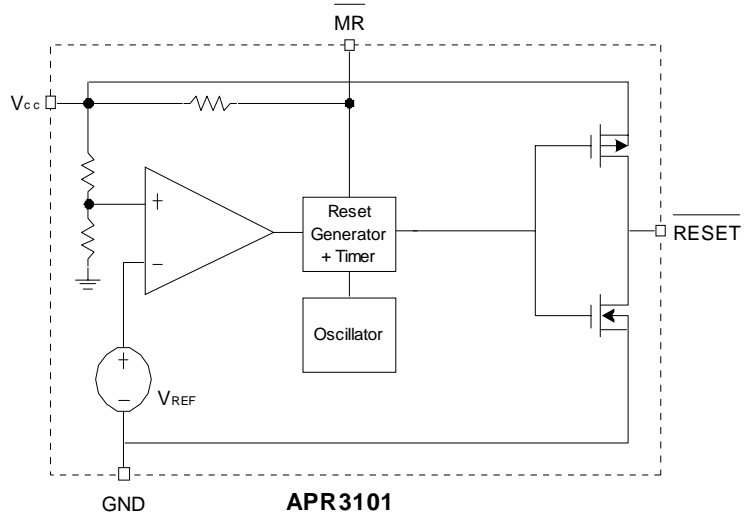
| Symbol | Parameter | Value | Unit |
|------------------|--|------------------------|------------|
| V_{CC} | V_{CC} to GND | -0.3 to 6 | V |
| V_{RESET} | RESET to GND (Push-Pull Output) | -0.3 to $V_{CC} + 0.3$ | V |
| | RESET to GND (Open Drain Output) | -0.3 to 6 | |
| I_{CC}, I_{MR} | Maximum Continuous Input Current | 20 | mA |
| I_{RESET} | RESET/RESET Current | 20 | mA |
| dVcc/dt | Rate of Rise of V_{CC} | 100 | V/ μ s |
| T_J | Junction Temperature Range | -40 to 150 | °C |
| T_L | Lead Temperature (Soldering, 10 second) | 260 | °C |
| $R_{TH,JA}$ | Thermal Resistance – Junction to Ambient | 357 | °C/W |
| P_D | Power Dissipation | Internally Limited | W |
| TSTG | Storage Temperature Range | -65 to +150 | °C |

Pin Function Description

| PIN | | Description |
|-----|-------------------|---|
| No. | Name | |
| 1 | GND | Ground connection |
| 2 | NC | No internal connection |
| 3 | RESET (APR3101/3) | RESET output remains low while V_{CC} is below the reset threshold and remains so for a fixed time period after V_{CC} raises above the reset threshold. |
| | RESET (APR3102) | RESET output remains high while V_{CC} is below the reset threshold and remains so for a fixed time period after V_{CC} raises above the reset threshold. |
| 4 | \overline{MR} | Manual Reset active low input. A logic low signal on \overline{MR} asserts a reset condition. Asserted reset continues as long as MR is low and for a fixed time period after \overline{MR} returns high. |
| 5 | V_{CC} | Supply Voltage (+1.2V to +6V) |

Note: The pin sequence here might not be correct for all different package types, and please refer pin configuration in page1 for correct pin assignment.

Block Diagram



Part Number Description

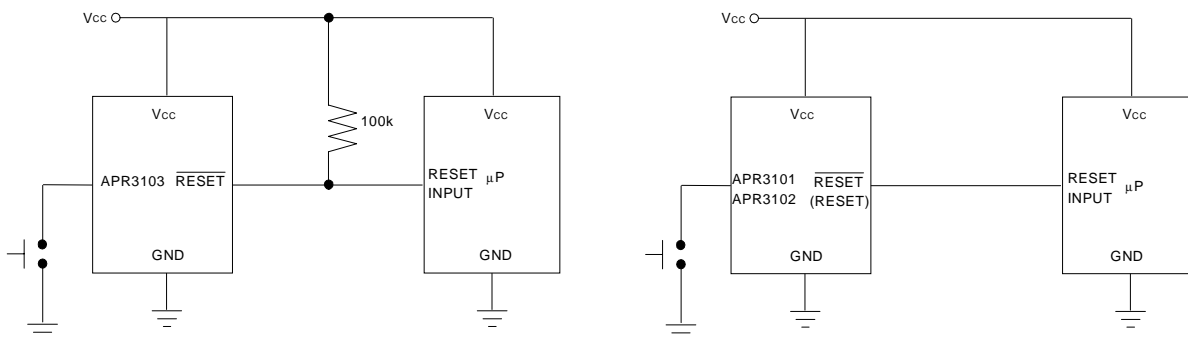
| Part Number | Part Description |
|-------------|---|
| APR3101 | Reset Output Push Pull Active Low with Delay |
| APR3102 | Reset Output Push Pull Active High with Delay |
| APR3103 | Reset Output Open Drain Active Low with Delay |

Electrical Characteristics

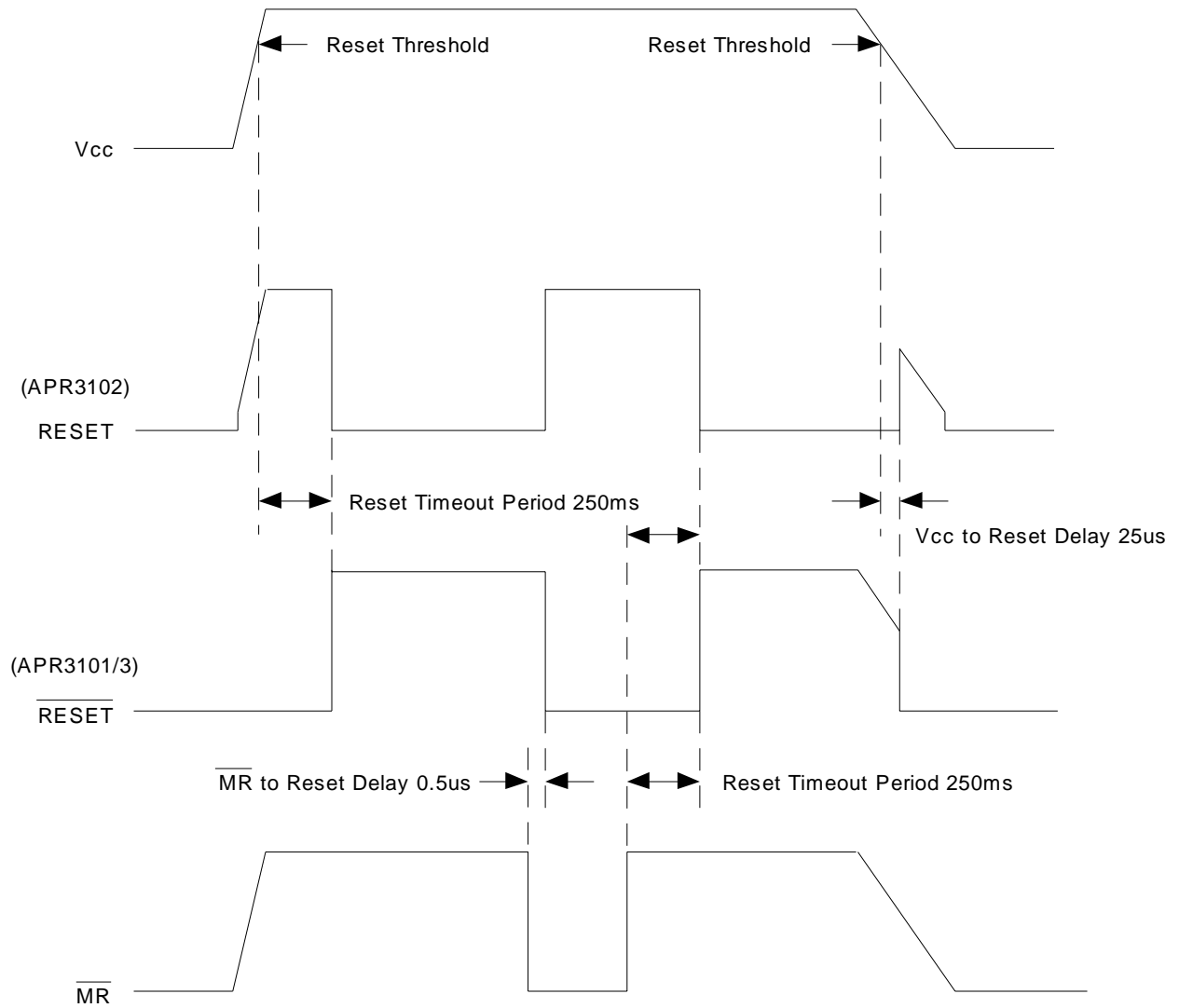
$V_{IN} = 5V$, $T_A = -40$ to $85^\circ C$ unless otherwise noted. Typical values are at $T_A = 25^\circ C$, $V_{CC} = 5V$ for 4.38V versions, $V_{CC} = 3.3V$ for 3.08/2.93V versions, $V_{CC} = 3.0V$ for 2.63V. versions and $V_{CC} = 2.5V$ for 2.32V versions, $V_{CC} = 2.0V$ for 1.75V versions, $V_{CC} = 1.8V$ for 1.5V versions.

| Symbol | Parameter | Test Conditions | APR3101/2/3 | | | Unit |
|------------|--------------------------------------|---|----------------|-------------|----------------|------------|
| | | | Min. | Typ. | Max. | |
| V_{CC} | Supply Voltage | | 1.2 | | 6 | V |
| I_{CC} | Supply Current | $V_{CC} = 1.5V \sim 6V$ | | 1.5 | 4 | μA |
| | | $T_A = -40$ to $85^\circ C$ | | 3 | 5 | |
| V_{TH} | Reset Threshold | $T_A = 25^\circ C$ | | $\pm 1.5\%$ | | |
| | | $T_A = -40$ to $85^\circ C$ | | $\pm 2\%$ | | |
| V_{HYST} | Hysteresis Range | | | 20 | | mV |
| T_{RTP} | Reset Timeout Period | | 150 | 250 | 350 | ms |
| V_{OL} | Reset Output Low | $I_{SINK} = 1.2mA$ | | | 0.5 | V |
| V_{OH} | Reset Output High | $I_{SOURCE} = 0.6mA$ | $0.8 * V_{CC}$ | | | |
| T_D | V_{CC} to Reset Delay | $V_{CC} = V_{TH}$ to $(V_{TH} - 100mV)$ | | 25 | | μS |
| I_{LE} | Reset Output Leakage | | | | 0.5 | μA |
| T_{MPW} | \overline{MR} Minimum Pulse Width | | 10 | | | μS |
| T_{MRD} | \overline{MR} to Reset Delay | | | 0.5 | | μS |
| V_{MIL} | \overline{MR} Input Low Threshold | | | | $0.4 * V_{CC}$ | V |
| V_{MIH} | \overline{MR} Input High Threshold | | $0.5 * V_{CC}$ | | | |
| R_{MR} | \overline{MR} Pull-Up resistance | | 30 | 47 | 70 | K Ω |

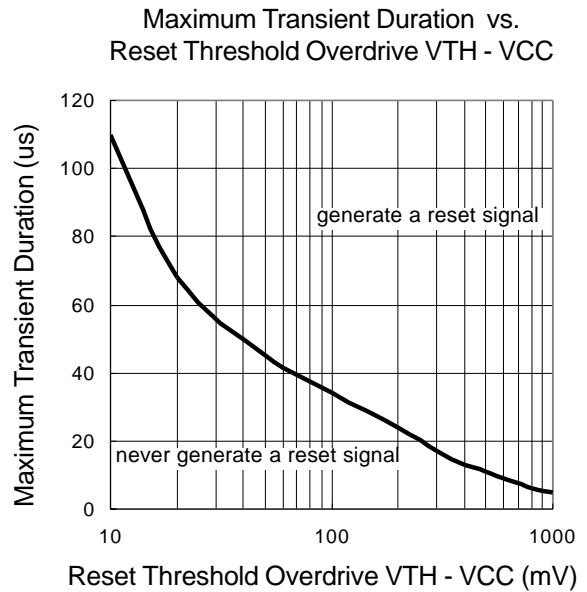
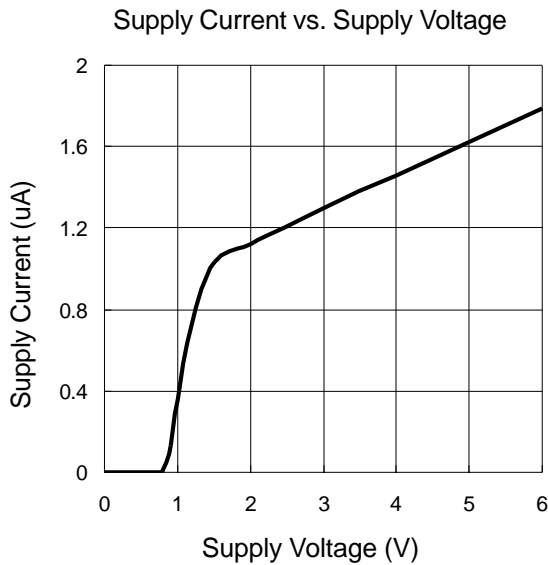
Application Circuit



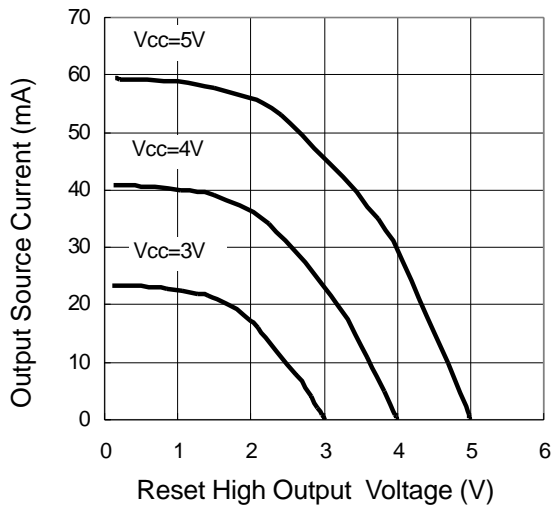
Timing Chart



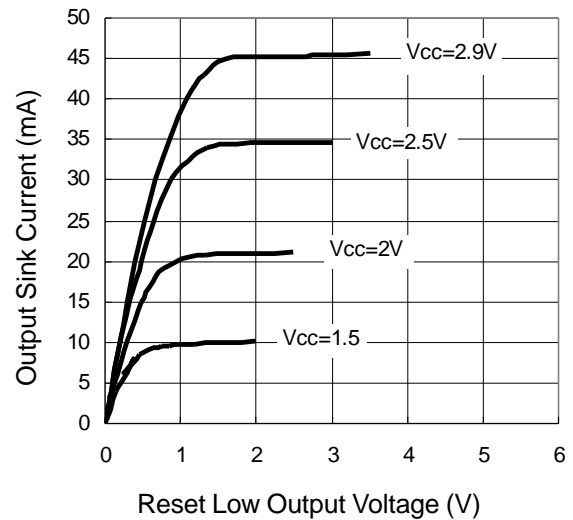
Typical Characteristics



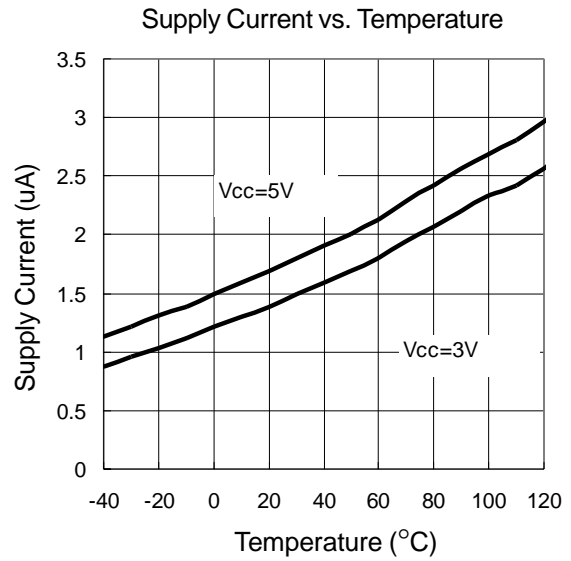
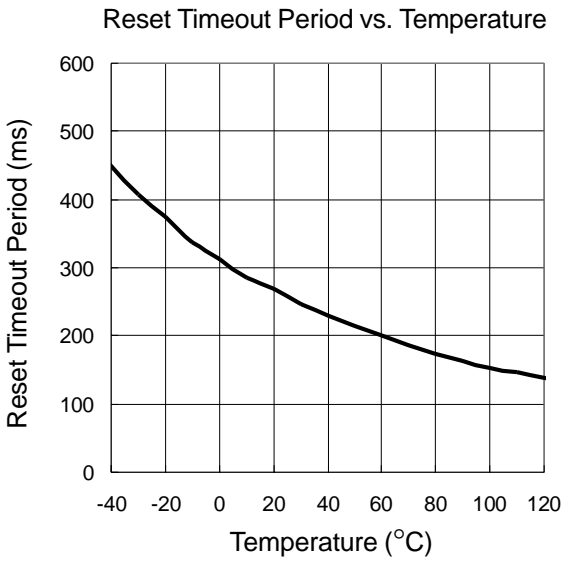
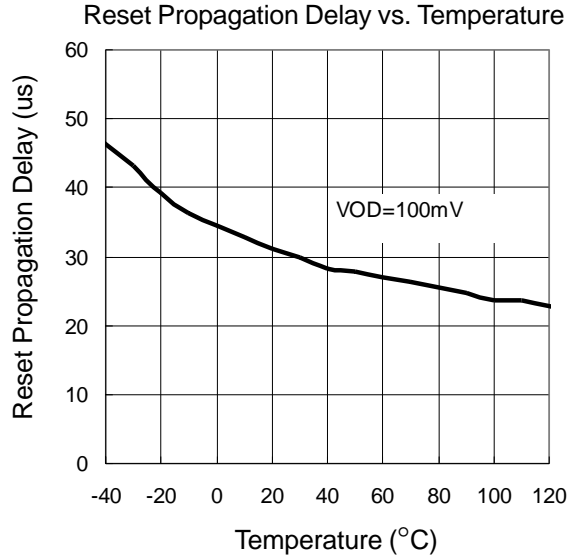
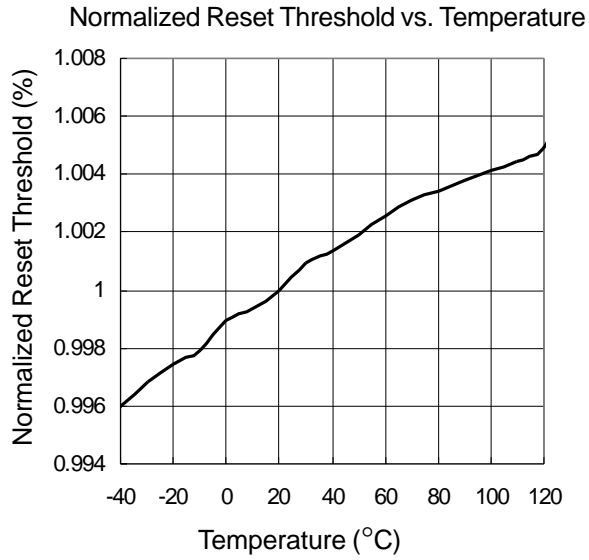
Output Source Current vs. Reset High Output Voltage



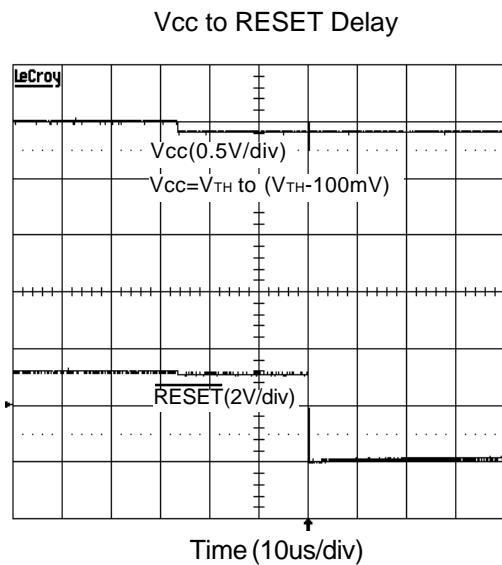
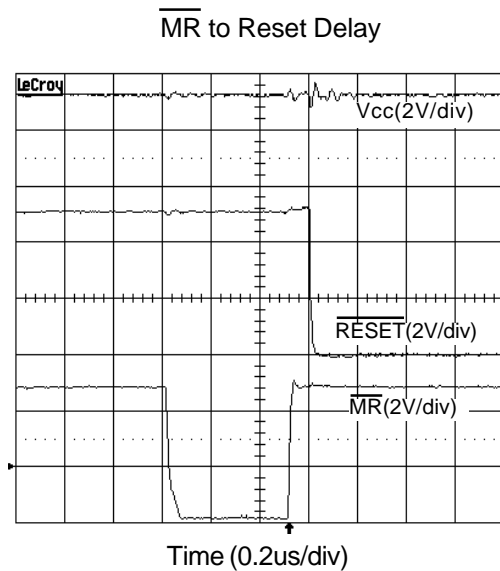
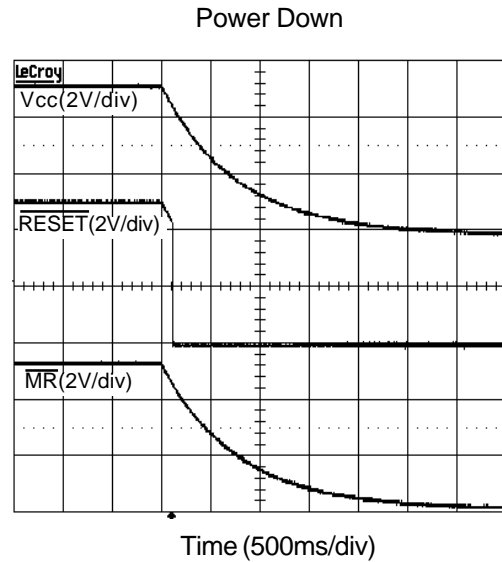
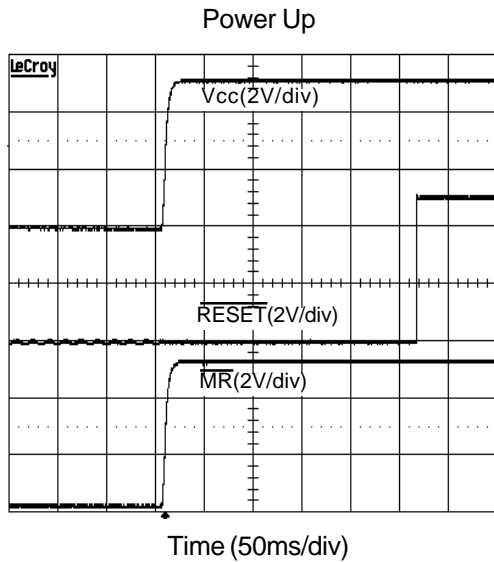
Output Sink Current vs. Reset Low Output Voltage



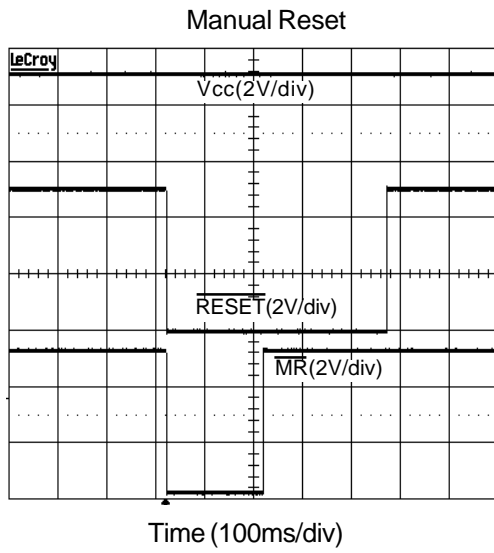
Typical Characteristics



Typical Characteristics



Typical Characteristics



Application Information

V_{CC} Transient Rejection

The APR3101/2/3 have the function to reject the transient glitches from the power line. The Maximum Transient Duration vs. Reset Threshold Overdrive shows at Typical Characteristics. The transient voltage with the duration under the curve will not generate a reset signal, e.g. a transient of 100mV below the reset threshold voltage have the duration more than 35us, it will generate a reset signal. Connect a 0.1uF bypass capacitor to the V_{CC} pin can improve the transient immunity.

Manual Reset Input

Force the $\overline{\text{MR}}$ low asserts the reset signal, asserted reset continues as long as $\overline{\text{MR}}$ is low and after the $\overline{\text{MR}}$ goes high the reset signal is maintained for a fixed timeout period. The $\overline{\text{MR}}$ is internally connected a 47k Ω resistor to V_{CC}, so it can be floating if $\overline{\text{MR}}$ is not used. The MR input also has a debounce time 500ns to avoid the glitches. It allows use of a mechanical switch or a TTL, and CMOS logic signal.

Reset Output

The APR3101/2/3 have 3 output stage versions: APR3101 is an active low push-pull output, when the V_{CC} drops below the reset threshold or $\overline{\text{MR}}$ goes low, the RESET output generates a low signal. APR3102 is an active high push-pull output, when the V_{CC} drops below the reset threshold or $\overline{\text{MR}}$ goes low; the RESET output generates a high signal (see Timing Chart). APR3103 is an active low open drain output, the RESET output must be connected a pull-up resistor to a supply voltage that is lower than 6V, it suits to use in multiple voltage systems (see Figure 2). The APR3101 RESET output is valid until the V_{CC}=1.2V, below 1.2V

the IC is shutdown, and the output becomes a floating state. If it is a trouble, a resistor should be connected from reset output to ground to keep the reset output low (see Figure 1). For The APR3102, a pull-up resistor to V_{CC} is required to keep the valid reset output for V_{CC} below 1.2V. ¶@

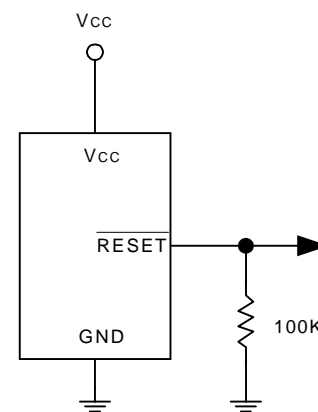


Figure 1. Ensuring $\overline{\text{RESET}}$ Valid to V_{CC} = 0 V

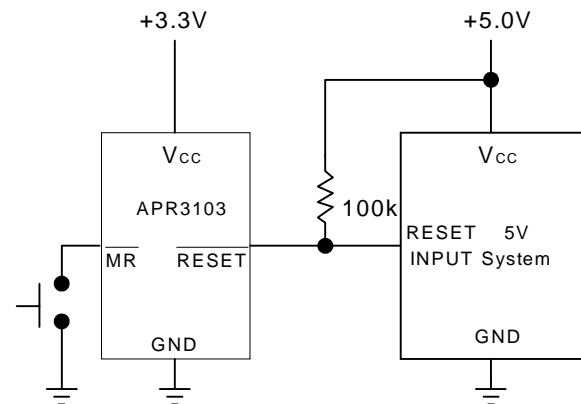
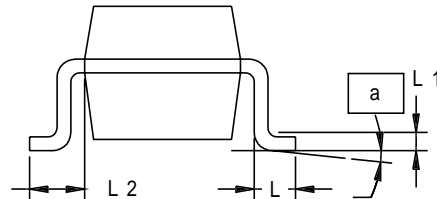
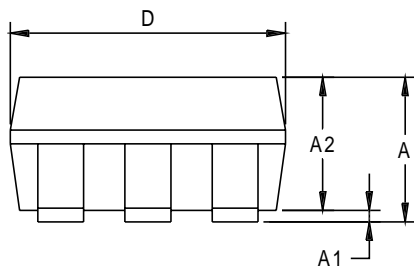
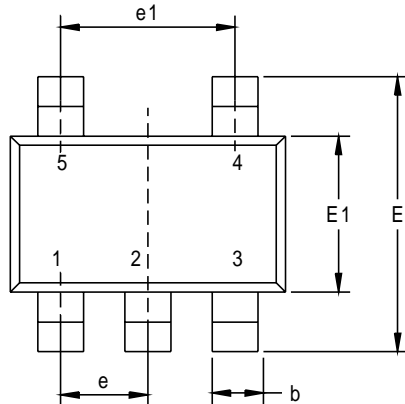


Figure 2. APR3103 Open Drain Output with Multiple Supplies

Packaging Information

SOT-23-5

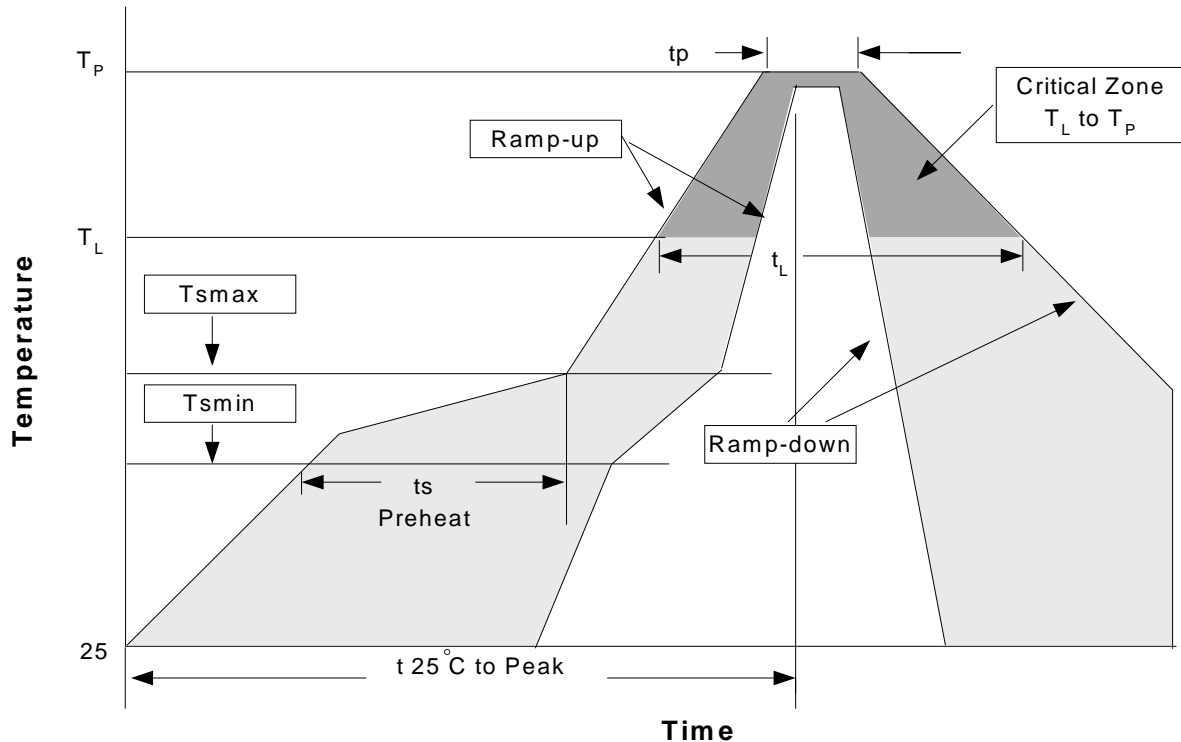


| Dim | Millimeters | | Inches | |
|-----|-------------|------|-----------|-------|
| | Min. | Max. | Min. | Max. |
| A | 0.95 | 1.45 | 0.037 | 0.057 |
| A1 | 0.05 | 0.15 | 0.002 | 0.006 |
| A2 | 0.90 | 1.30 | 0.035 | 0.051 |
| b | 0.30 | 0.50 | 0.011 | 0.019 |
| D | 2.8 | 3.00 | 0.110 | 0.118 |
| E | 2.6 | 3.00 | 0.102 | 0.118 |
| E1 | 1.5 | 1.70 | 0.059 | 0.067 |
| e | 0.95BSC | | 0.037BSC | |
| e1 | 1.90BSC | | 0.074BSC | |
| L | 0.35 | 0.55 | 0.014 | 0.022 |
| L1 | 0.20 BSC | | 0.008 BSC | |
| L2 | 0.5 | 0.7 | 0.020 | 0.028 |
| N | 5 | | 5 | |
| α | 0° | 10° | 0° | 10° |

Physical Specifications

| | |
|--------------------|--|
| Terminal Material | Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn |
| Lead Solderability | Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3. |

Reflow Condition (IR/Convection or VPR Reflow)



Classification Reflow Profiles

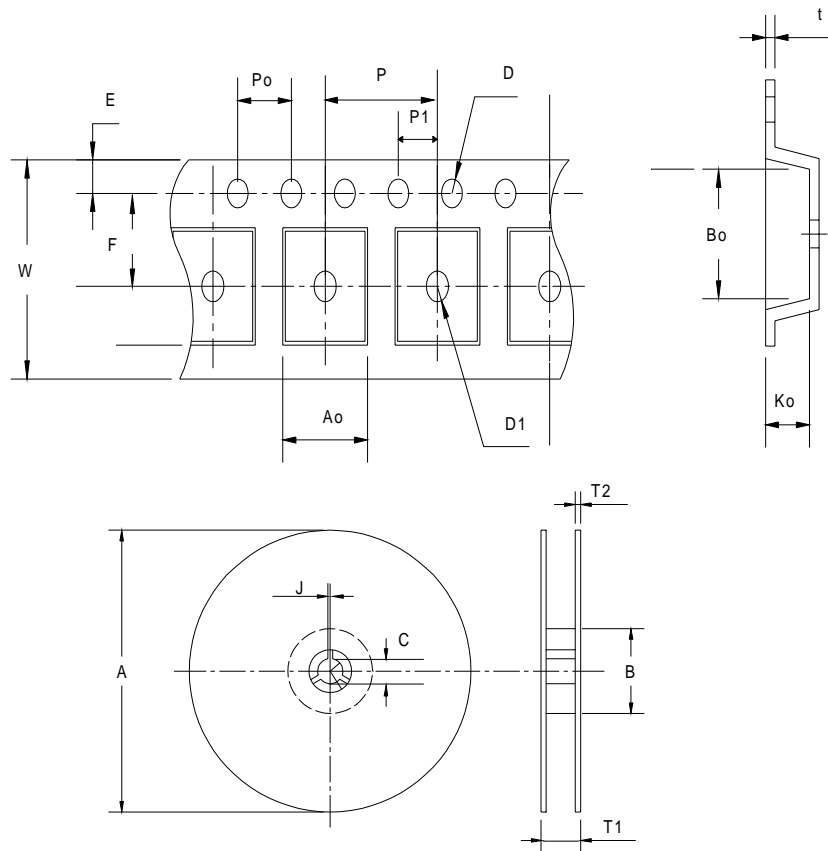
| Profile Feature | Sn-Pb Eutectic Assembly | | Pb-Free Assembly | |
|---|-------------------------|---------------|------------------|---------------|
| | Large Body | Small Body | Large Body | Small Body |
| Average ramp-up rate (T_L to T_P) | 3°C/second max. | | 3°C/second max. | |
| Preheat | 100°C | | 150°C | |
| - Temperature Min (T_{smin}) | 150°C | | 200°C | |
| - Temperature Mix (T_{smax}) | 60-120 seconds | | 60-180 seconds | |
| - Time (min to max)(t_s) | | | | |
| T_{smax} to T_L | | | 3°C/second max | |
| - Temperature(T_L) | | | | |
| - Time (t_L) | | | | |
| Peak Temperature(T_p) | 183°C | | 217°C | |
| | 60-150 seconds | | 60-150 seconds | |
| Time within 5°C of actual Peak Temperature(t_p) | 225 +0/-5°C | 240 +0/-5°C | 245 +0/-5°C | 250 +0/-5°C |
| Ramp-down Rate | 10-30 seconds | 10-30 seconds | 10-30 seconds | 20-40 seconds |
| Time 25°C to Peak Temperature | 6°C/second max. | | 6°C/second max. | |
| | 6 minutes max. | | 8 minutes max. | |

Note: All temperatures refer to topside of the package. Measured on the body surface.

Reliability test program

| Test item | Method | Description |
|---------------|---------------------|--------------------------------|
| SOLDERABILITY | MIL-STD-883D-2003 | 245°C , 5 SEC |
| HOLT | MIL-STD-883D-1005.7 | 1000 Hrs Bias @ 125 °C |
| PCT | JESD-22-B, A102 | 168 Hrs, 100 % RH , 121°C |
| TST | MIL-STD-883D-1011.9 | -65°C ~ 150°C, 200 Cycles |
| ESD | MIL-STD-883D-3015.7 | VHBM > 2KV, VMM > 200V |
| Latch-Up | JESD 78 | 10ms , I _{tr} > 100mA |

Carrier Tape



| Application | A | B | C | J | T1 | T2 | W | P | E |
|-------------|------------|-----------|------------|------------|-----------|------------|-------------------------------------|-----------|------------|
| SOT-23-5 | 178±1 | 72 ± 1.0 | 13.0 + 0.2 | 2.5 ± 0.15 | 8.4 ± 2 | 1.5 ± 0.3 | 8.0 ^{+0.3} _{-0.3} | 4 ± 0.1 | 1.75 ± 0.1 |
| | F | D | D1 | Po | P1 | Ao | Bo | Ko | t |
| | 3.5 ± 0.05 | 1.5 + 0.1 | 1.5 + 0.1 | 4.0 ± 0.1 | 2.0 ± 0.1 | 3.15 ± 0.1 | 3.2 ± 0.1 | 1.4 ± 0.1 | 0.2 ± 0.03 |

(mm)

Cover Tape Dimensions

| Application | Carrier Width | Cover Tape Width | Devices Per Reel |
|-------------|---------------|------------------|------------------|
| SOT- 23 | 8 | 5.3 | 3000 |

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