MicroPower Microprocessor Reset Circuit

Features

- 1.2V to 5.5V Input Voltage Range
- Low Quiescent Current : less Than 1.5 µA
- High accuracy detection threshold : ±1.5%
- Fixed trimmed reset thresholds for 1.5V, 1.75V, 2.32V, 2.63V, 2.93V, 3.08V, 3.9V, 4.38V.
- Reset Timeout Period 250ms
- Available output configurations
  - Open-drain output
  - CMOS active high output
  - CMOS active low output
- SOT-23 , SOT-23-5 and SOT-89 packages
- No external components

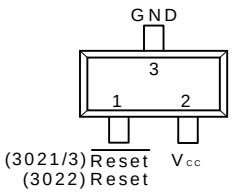
Applications

- Computers
- Cell Phones
- Portable Electronics
- µP Power Supply Monitoring

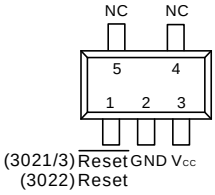
General Description

The APR3021/2/3 are designed to monitor voltage supplies in µP and digital systems. The quiescent current is extremely low, typically 1.5 µA, making it ideal for portable battery operated equipment. The APR3021/2/3 operate by monitoring the system power supply voltage. When the input voltage drops below a fixed threshold, the device asserts a reset signal for a fixed time period after Vcc rises above the fixed threshold. The APR3021/2/3 series is available with three output stage versions : APR3021 push-pull active low output, APR3022 push-pull active high output and APR3023 open drain active low output. They are also designed to reject fast line transient glitches on Vcc. The APR3021/2/3 are come in a miniature SOT-23, SOT-23-5, SOT-89 packages.

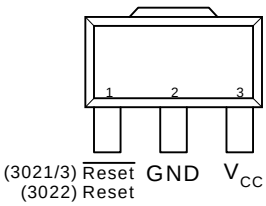
Pin Configuration



SOT-23 (Top View)



SOT-23-5 (Top View)



SOT-89 (Top View)

Ordering and Marking Information

APR3021/2/3 - □□ □□ - □□ □

- Lead Free Code
- Handling Code
- Temp. Range
- Package Code
- Voltage Code

Package Code
A : SOT-23 B : SOT-23-5 D : SOT-89
Temp. Range
I : -40 to 85°C
Handling Code
TR : Tape & Reel
Voltage Code :
15 : 1.5V ~ 43 : 4.38V
Lead Free Code
L : Lead Free Device Blank : Original Device

APR3021/2/3 A/B : 21/2/3 X X
- 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

APR3021/2/3 -15 D : APR3021/2/3 XXXXX 15 XXXXX - Date Code ; 15 - 1.5V

Absolute Maximum Ratings

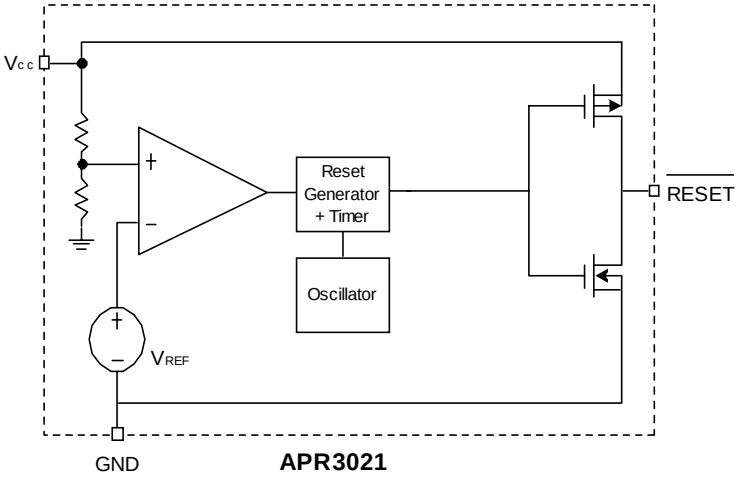
Symbol	Parameter		Value	Unit
V_{CC}	V_{CC} to GND		-0.3 to 6	V
V_{RESET}	RESET to GND (Push-Pull Output)		-0.3 to V_{CC} +0.3	V
	$\overline{RESET}$ to GND (Open Drain Output)		-0.3 to 6	
I_{MAX}	Maximum Continuous Input Current		20	mA
I_{RESET}	RESET/$\overline{RESET}$ Current		20	mA
dVcc/dt	Rate of Rise of V_{CC}		100	V/µs
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	SOT-23	357	°C/W
		SOT-23-5	357	
		SOT-89	180	
P_D	Power Dissipation		Internally Limited	W

Pin Descrpition

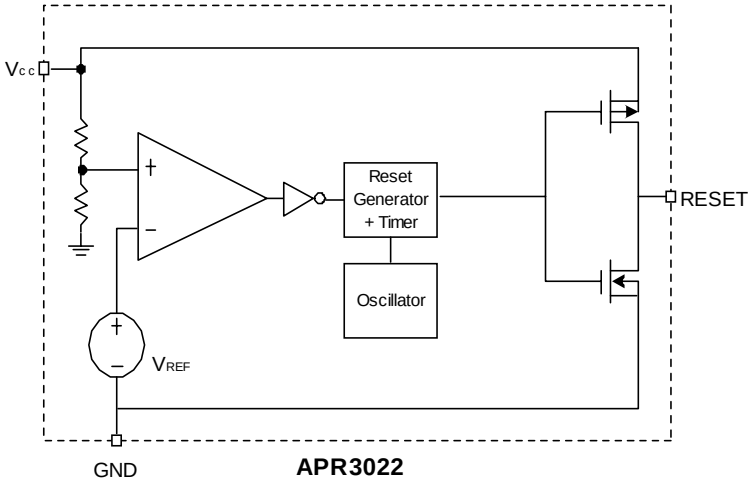
PIN		Description
No.	Name	
1	$\overline{RESET}$ (APR3021/3)	$\overline{RESET}$ output remains low while Vcc is below the reset threshold and remains so for a fixed time period after Vcc raises above the reset threshold
	RESET (APR3022)	RESET output remains high while Vcc is below the reset threshold and remains so for a fixed time period after Vcc raises above the reset threshold.
2	Vcc	Supply Voltage (+1.2V to +6V)
3	GND	Ground connection

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.

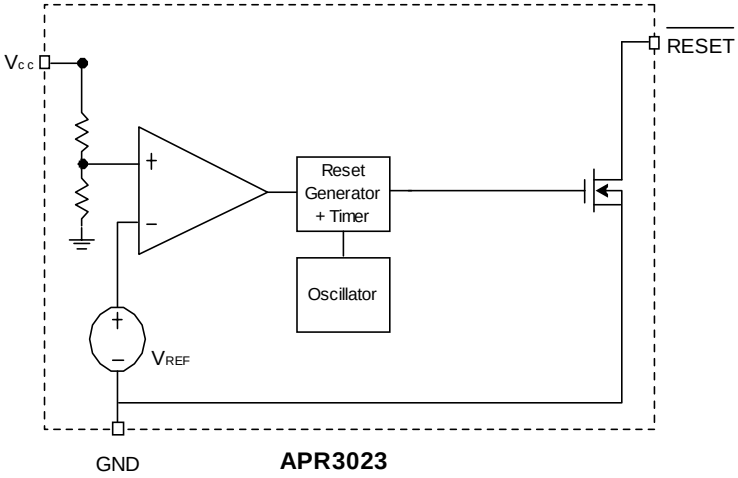
Block Diagram



APR3021



APR3022



APR3023

Part Number Description

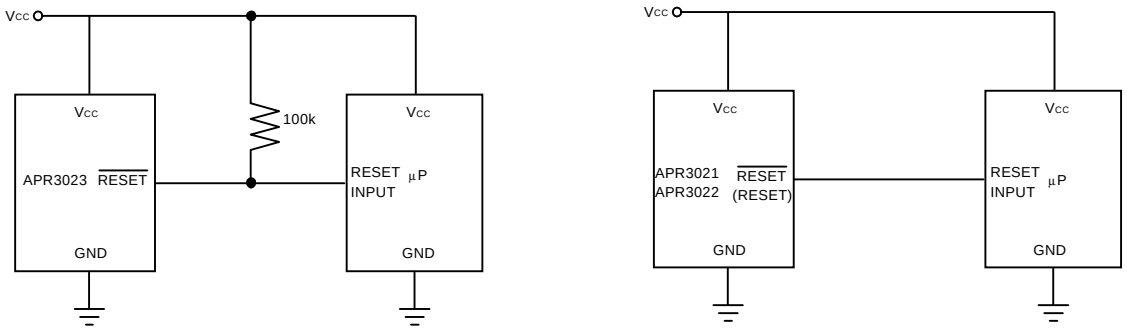
Part Number	Part Description
APR3021	Reset Output Push Pull Active Low with Delay
APR3022	Reset Output Push Pull Active High with Delay
APR3023	Reset Output Open Drain Active Low with Delay

Electrical Characteristics

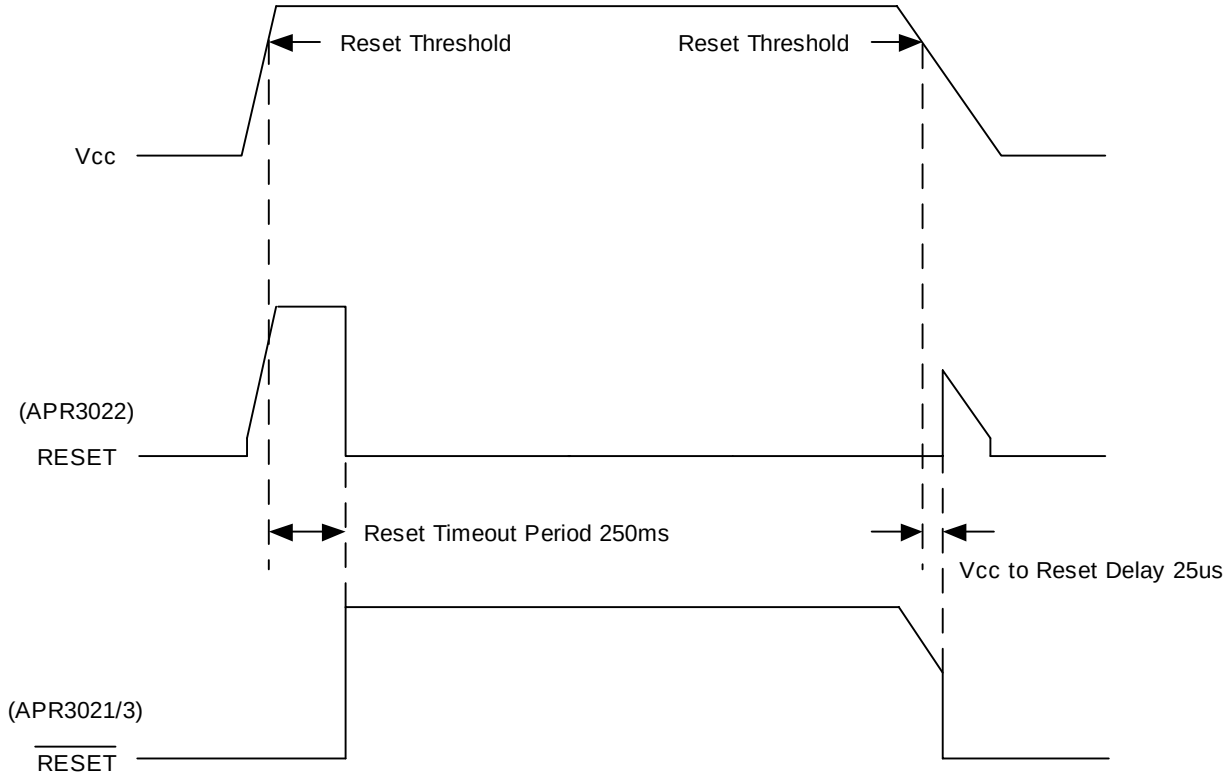
V_{IN} = 5V, T_A = -40 to 85°C unless otherwise noted. Typical values are at T_A=25°C, V_{CC} = 5V for 4.38V versions, V_{CC} = 3.3V for 3.08/2.93V versions, V_{CC} = 3.0V for 2.63V. versions and V_{CC} = 2.5V for 2.32V versions, V_{CC} = 2.0V for 1.75V versions , V_{CC} = 1.8V for 1.5V versions.

Symbol	Parameter	Test Conditions	APR3021/2/3			Unit
			Min.	Typ.	Max.	
V_{CC}	Supply Voltage		1.2		6	V
I_{CC}	Supply Current	V_{CC}=1.5V~6V		1.5	4	µA
		T_A=-40 to 85°C		3	5	
V_{TH}	Reset Threshold	T_A=25°C		±1.5%		
		T_A=-40 to 85°C		±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

Application Circuit

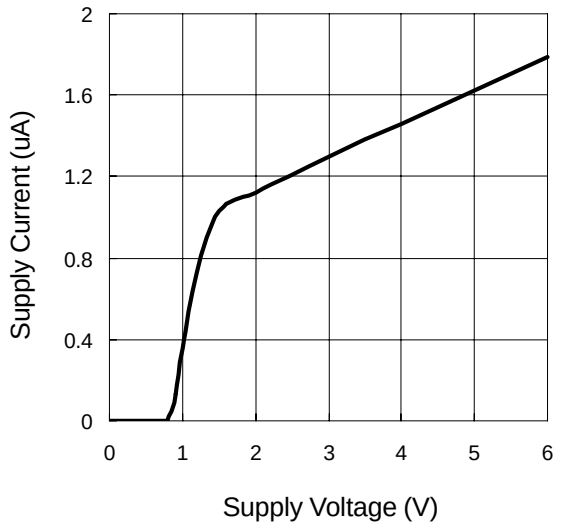


Timing Chart

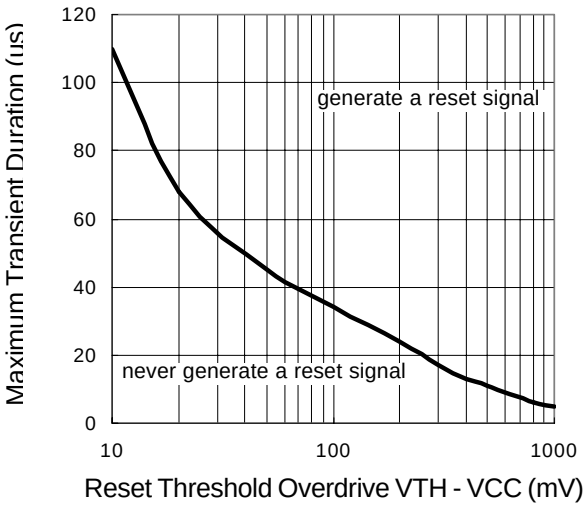


Typical Characteristics

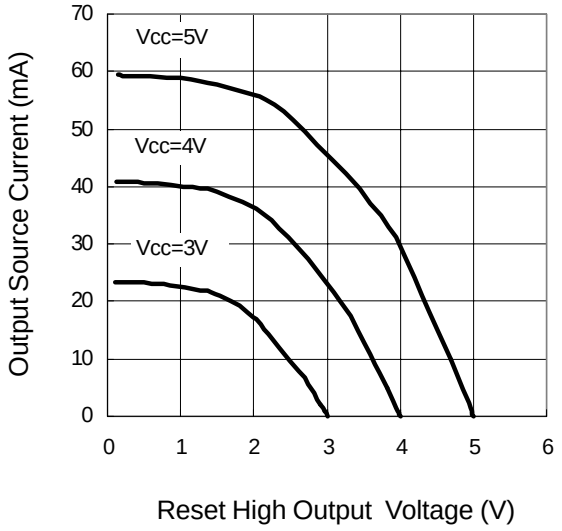
Supply Current vs. Supply Voltage



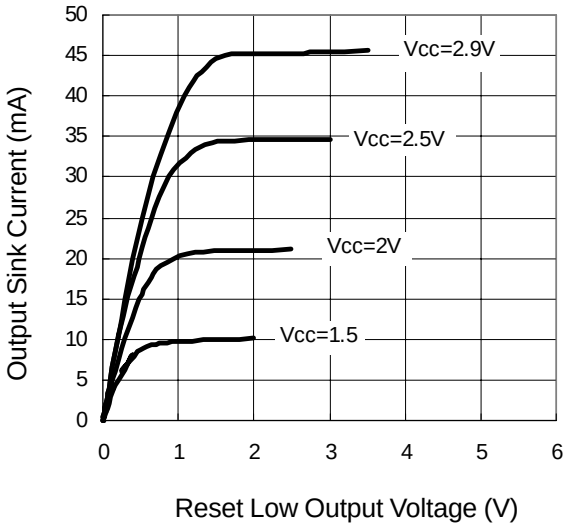
Maximum Transient Duration vs.
Reset Threshold Overdrive VTH - VCC



Output Source Current vs. Reset High Output Voltage

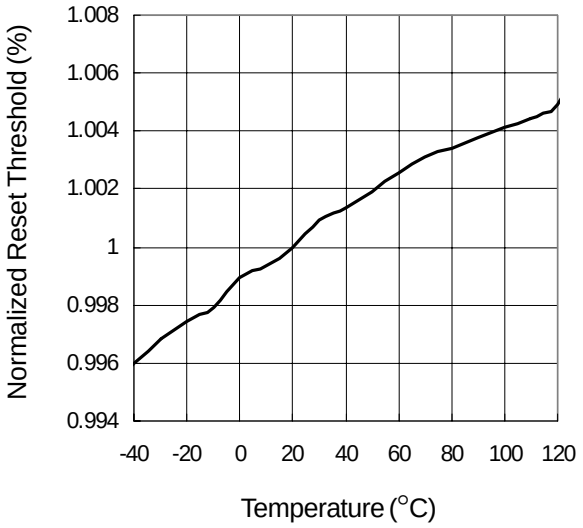


Output Sink Current vs. Reset Low Output Voltage

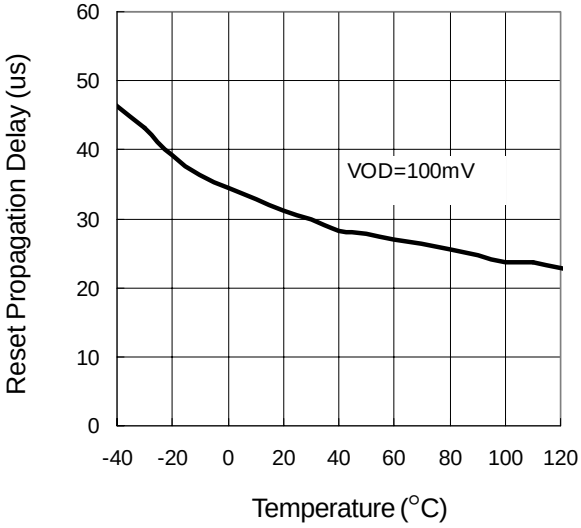


Typical Characteristics

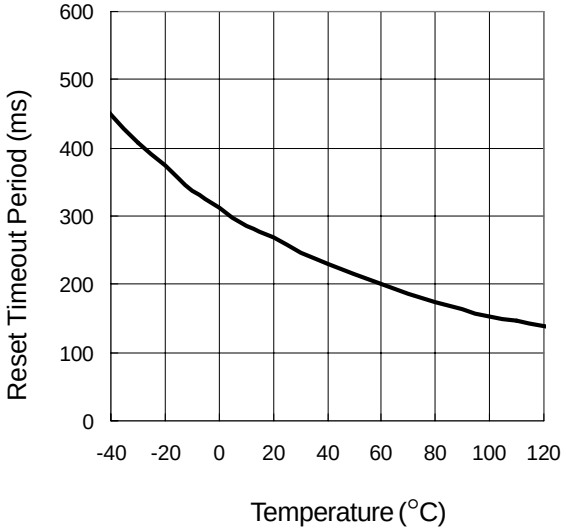
Normalized Reset Threshold vs. Temperature



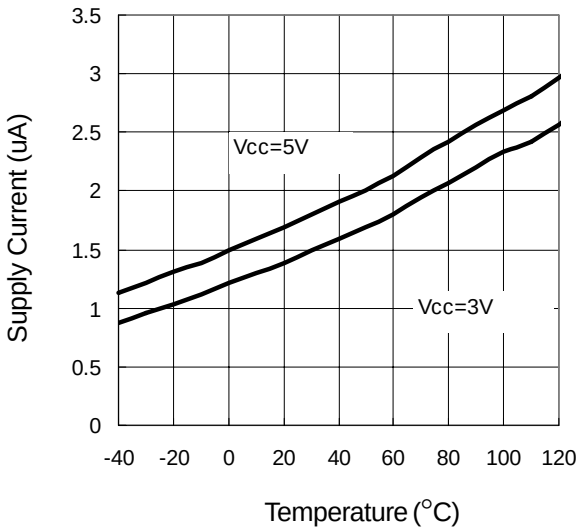
Reset Propagation Delay vs. Temperature



Reset Timeout Period vs. Temperature

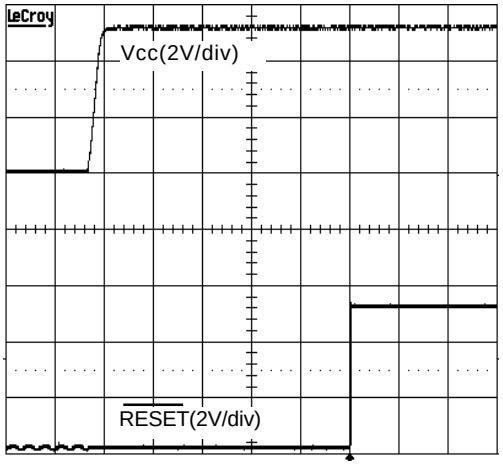


Supply Current vs. Temperature



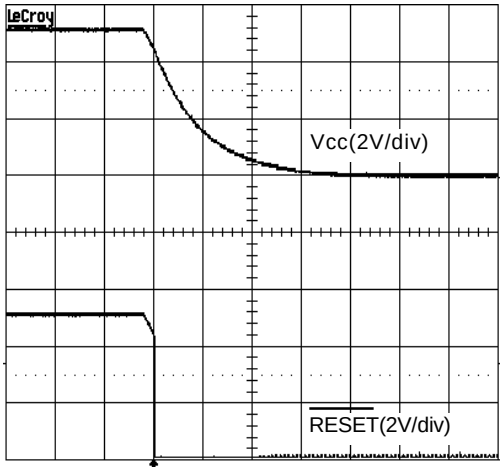
Typical Characteristics

Power Up



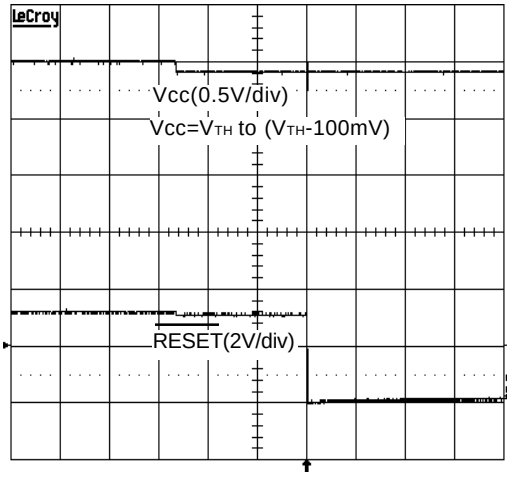
Time (50ms/div)

Power Down



Time (200ms/div)

Vcc to RESET Delay



Time (10us/div)

Application Information

V_{CC} Transient Rejection

The APR3021/2/3 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.

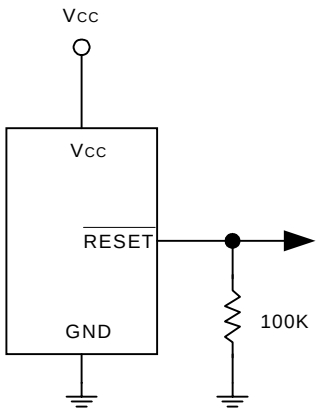


Figure 1. Ensuring $\overline{\text{RESET}}$ Valid to V_{CC} = 0 V

Reset Output

The APR3021/2/3 have 3 output stage versions: APR3001 is an active low push-pull output, when the V_{CC} drops below the reset threshold, the $\overline{\text{RESET}}$ output generates a low signal. APR3022 is an active high push-pull output, when the V_{CC} drops below the reset threshold, the RESET output generates a high signal (see Timing Chart). APR3023 is an active low open drain output, the $\overline{\text{RESET}}$ 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 APR3021 $\overline{\text{RESET}}$ 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 APR3022, a pull-up resistor to V_{CC} is required to keep the valid reset output for V_{CC} below 1.2V.

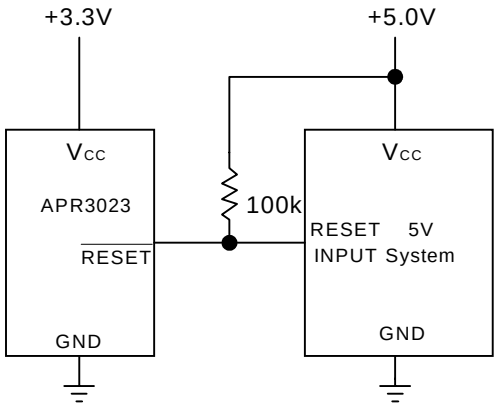
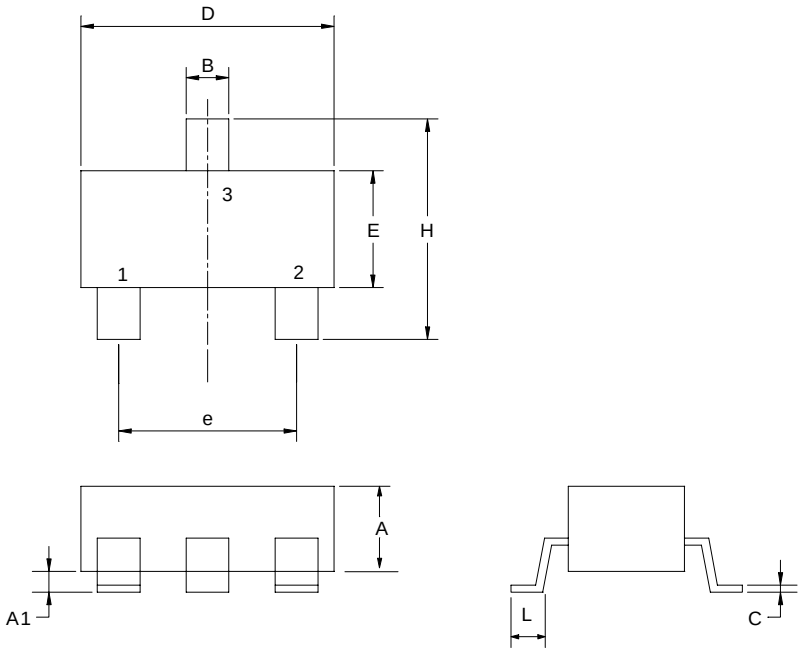


Figure 2. APR3023 Open Drain Output with Multiple Supplies

Packaging Information

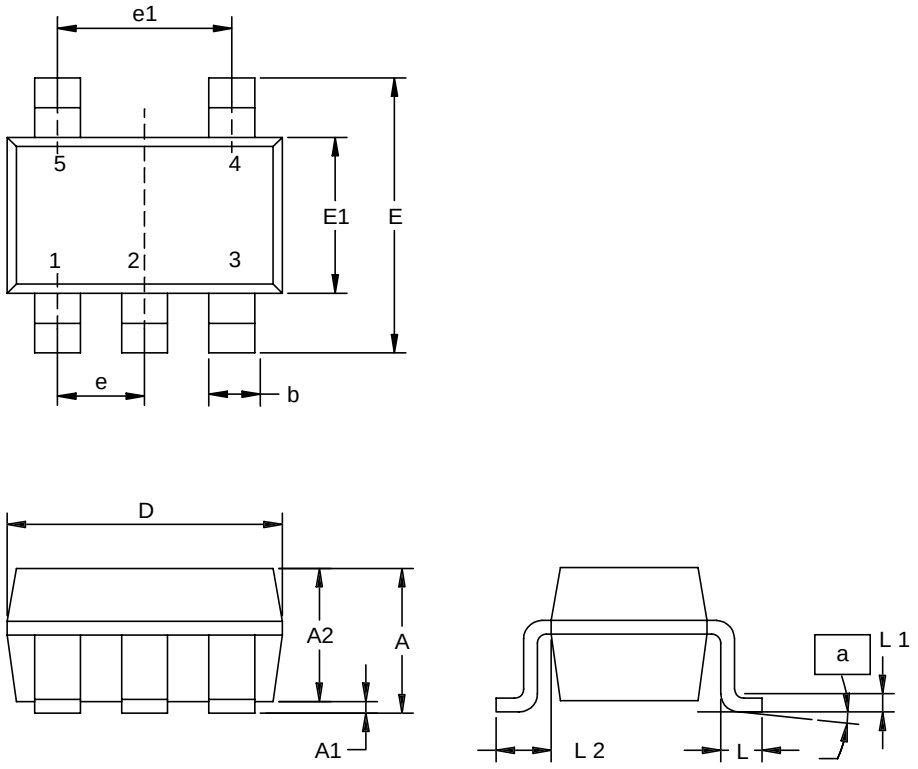
SOT-23



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.00	1.30	0.039	0.051
A1	0.00	0.10	0.000	0.004
B	0.35	0.51	0.014	0.020
C	0.10	0.25	0.004	0.010
D	2.70	3.10	0.106	0.122
E	1.40	1.80	0.055	0.071
e	1.90/2.1 BSC		0.075/0.083 BSC	
H	2.40	3.00	0.094	0.118
L	0.37		0.015	

Packaging Information

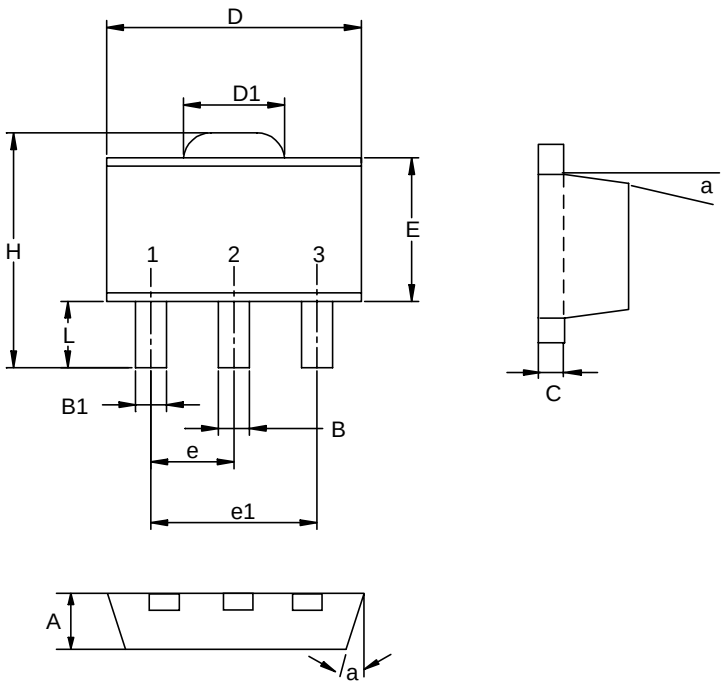
SOT-23-5



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°

Packaging Information

SOT-89 (Reference EIAJ ED-7500A Reg stration SC-62)

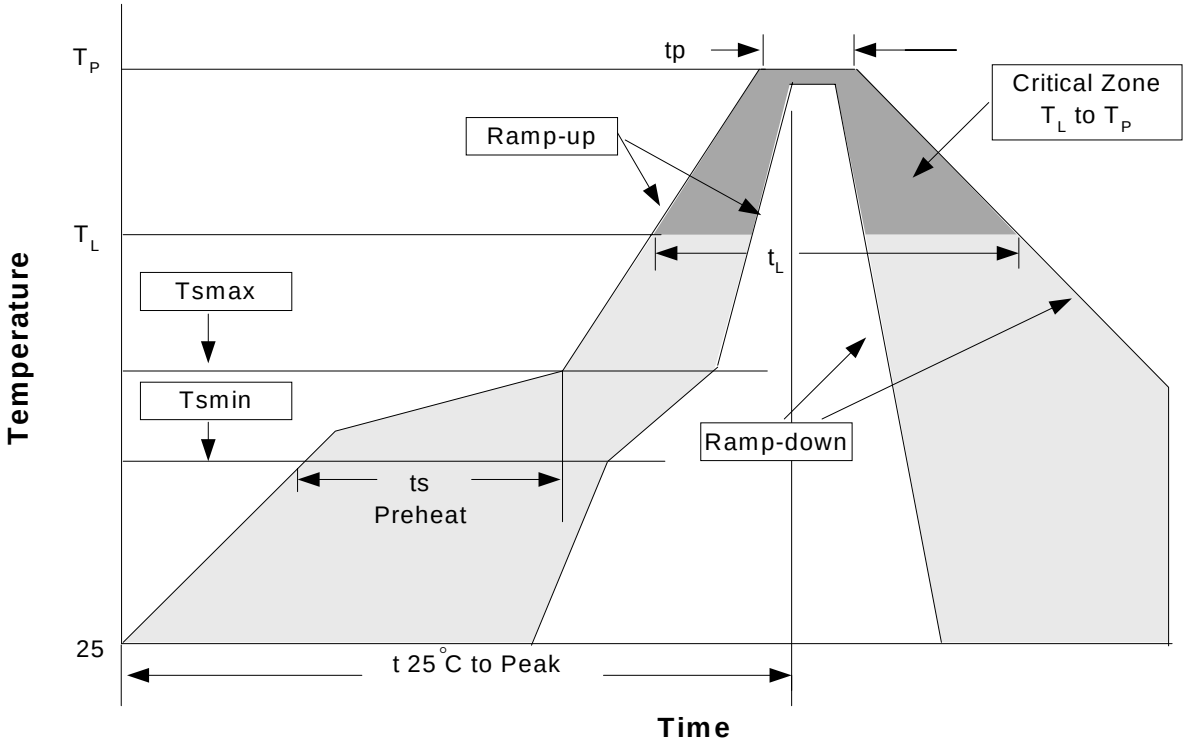


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.40	1.60	0.055	0.063
B	0.40	0.56	0.016	0.022
B1	0.35	0.48	0.014	0.019
C	0.35	0.44	0.014	0.017
D	4.40	4.60	0.173	0.181
D1	1.35	1.83	0.053	0.072
e	1.50 BSC		0.059 BSC	
e1	3.00 BSC		0.118 BSC	
E	2.29	2.60	0.090	0.102
H	3.75	4.25	0.148	0.167
L	0.80	1.20	0.031	0.047
α		10°		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)



Classificatin Reflow Profiles

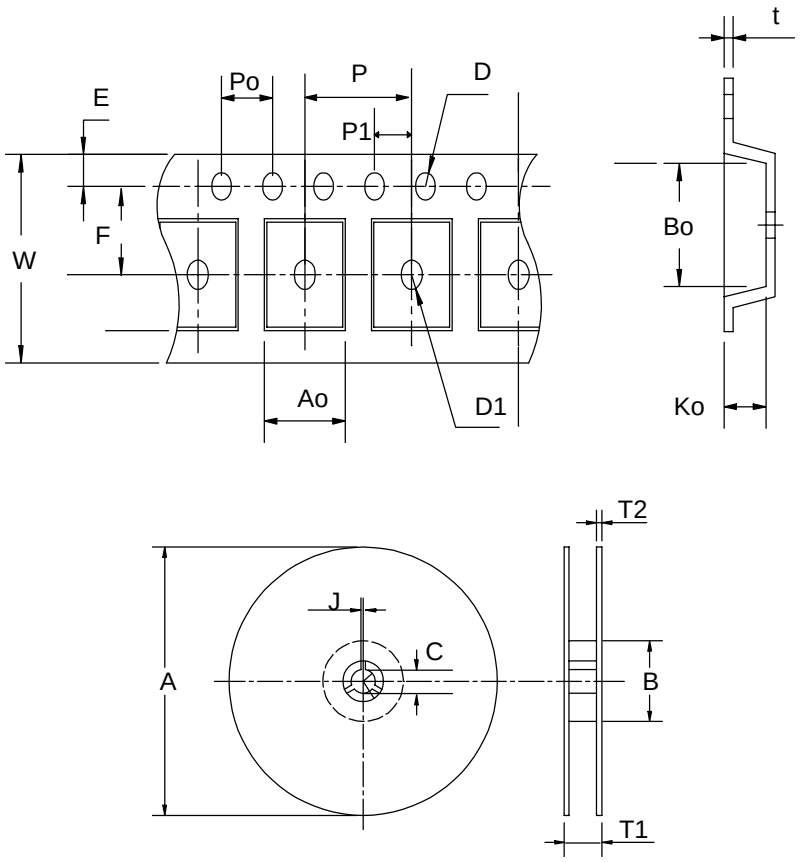
Profile Feature	Sn-Pb Eutectic Assembly		Pb-Free Assembly	
	Large Body	Small Body	Large Body	Small Body
Average ramp-up rate (T_L to T_P)	3°C/second max.		3°C/second max.	
Preheat - Temperature Min (Tsmin) - Temperature Mix (Tsmax) - Time (min to max)(ts)	100°C 150°C 60-120 seconds		150°C 200°C 60-180 seconds	
Tsmax to T_L - Ramp-up Rate			3°C/second max	
Tsmax to T_L - Temperature(T_L) - Time (t_L)	183°C 60-150 seconds		217°C 60-150 seconds	
Peak Temperature(Tp)	225 +0/-5°C	240 +0/-5°C	245 +0/-5°C	250 +0/-5°C
Time within 5°C of actual Peak Temperature(tp)	10-30 seconds	10-30 seconds	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.		6°C/second max.	
Time 25°C to Peak Temperature	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, 1_{tr} > 100mA

Carrier Tape & Reel Dimensions



Carrier Tape & Reel Dimensions

Application	A	B	C	J	T1	T2	W	P	E
SOT-23	178±1	60 ± 1.0	12.0	2.5 ± 0.15	9.0 ± 0.5	1.4	8.0+ 0.3 - 0.3	4.0	1.75
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	3.5 ± 0.05	1.5 +0.1	φ 0.1MIN	4.0	2.0 ± 0.05	3.1	3.0	1.3	0.2±0.03
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	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±0.033
Application	A	B	C	J	T1	T2	W	P	E
SOT-89	178 ±1	70 ± 2	13.5 ± 0.15	3 ± 0.15	14 ± 2	1.3 ± 0.3	12 + 0.3 12 - 0.1	8 ± 0.1	1.75± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	5.5 ± 0.05	1.5± 0.1	1.5± 0.1	4.0 ± 0.1	2.0 ± 0.1	4.8 ± 0.1	4.5± 0.1	1.80± 0.1	0.3±0.013

(mm)

Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
SOT- 23	8	5.3	3000
SOT- 23-5	8	5.3	3000
SOT- 89	12	9.3	1000

Customer Service

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