

Features

- 1.2V to 6V Input Voltage Range
- Low Quiescent Current : less than 1.5 mA
- 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.
- 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
- Lead Free and Green Devices Available
(RoHS Compliant)

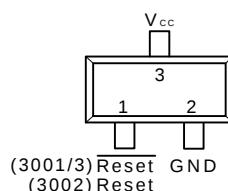
Applications

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

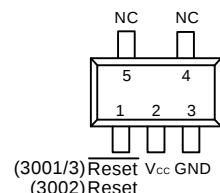
General Description

The APR3001/2/3 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 APR3001/2/3 are operated 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 APR3001/2/3 series are available with three output stage versions : APR3001 push-pull active low output, APR3002 push-pull active high output and APR3003 open drain active low output. They are also designed to reject fast line transient glitches on Vcc. The APR3001/2/3 come in a miniature SOT-23, SOT-23-5, and SOT-89 packages.

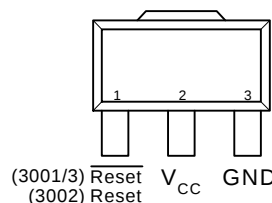
Pin Configuration



SOT-23 (Top View)



SOT-23-5 (Top View)



SOT-89 (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.

APR3001/2/3 - □□□□-□□□ Assembly Material Handling Code Temperature Range Package Code Voltage Code	Package Code A : SOT-23 B : SOT-23-5 D : SOT-89 Temperature Range I : -40 to 85 °C Handling Code TR : Tape & Reel Voltage Code : 15 : 1.5V ~ 43 : 4.38V Assembly Material L : Lead Free Device G : Halogen and Lead Free Device
APR3001/2/3 A/B : □□□□□□□□ 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	
APR3001/2/3 -15 D : □□□□□□□□ APR3001/2/3 XXXXX 15	

Absolute Maximum Ratings

Symbol	Parameter		Rating	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 _{MAX}	Maximum Continuous Input Current		20	mA
I _{RESET}	RESET/ $\overline{\text{RESET}}$ Current		20	mA
dV _{CC} /dt	Rate of Rise of V _{CC}		100	V/ μ s
T _J	Junction Temperature Range		-40 to 150	°C
T _L	Lead Soldering Temperature, 10 Seconds		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

PART NUMBER	PART DESCRIPTION
APR3001	Reset Output Push Pull Active Low with Delay
APR3002	Reset Output Push Pull Active High with Delay
APR3003	Reset Output Open Drain Active Low with Delay

Pin Description

PIN		FUNCTION
NO.	NAME	
1	RESET (APR3001/3)	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 (APR3002)	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	GND	Ground connection
3	VCC	Supply Voltage (+1.2V to +6V)

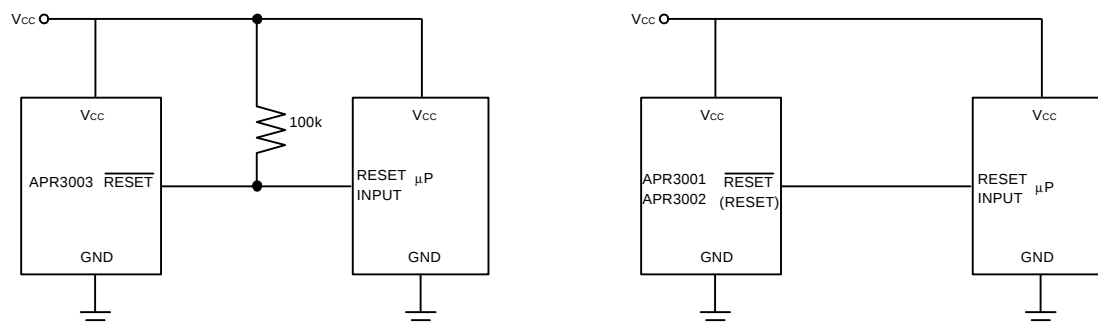
Note: The pin sequence here might not be correct for all different package types, and please refer pin configuration in page1 for correct pin assignment.

Electrical Characteristics

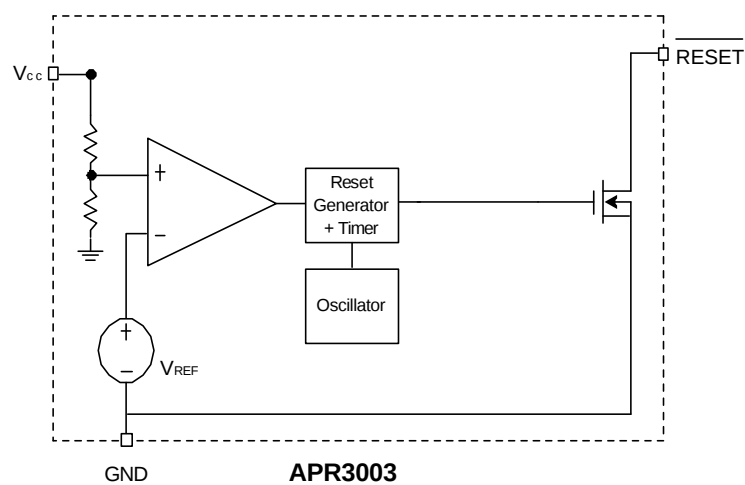
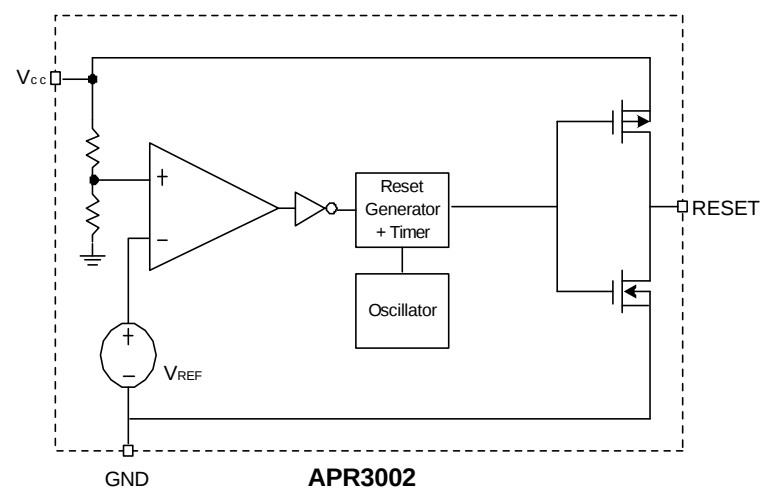
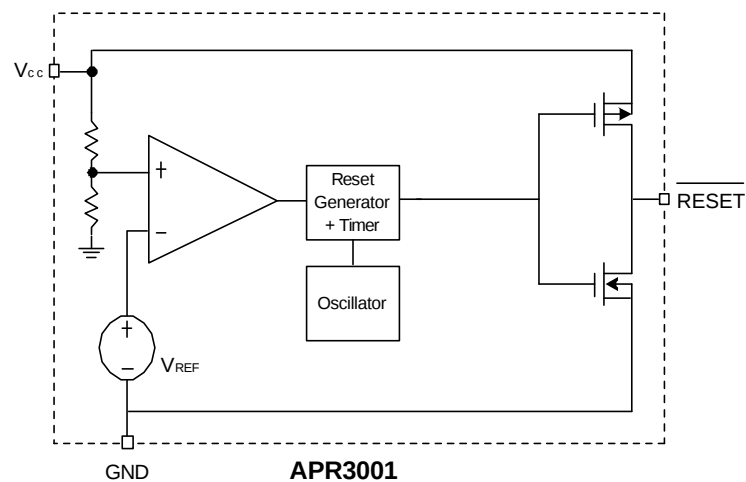
$V_{IN} = 5V$, $T_A = -40$ to $85^\circ C$ unless otherwise noted. Typical values are at $T_A = 25^\circ C$, $V_{CC} = 5V$ for 4.38V versions, $V_{CC} = 3.3V$ for 3.08/2.93V versions, $V_{CC} = 3.0V$ for 2.63V. versions and $V_{CC} = 2.5V$ for 2.32V versions, $V_{CC} = 2.0V$ for 1.75V versions, $V_{CC}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

Symbol	Parameter	Test Conditions	APR3001/2/3			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 $85^\circ C$	-	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	$I_{SOURCE}=0.6mA$	$0.8 \cdot V_{CC}$	-	-	
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

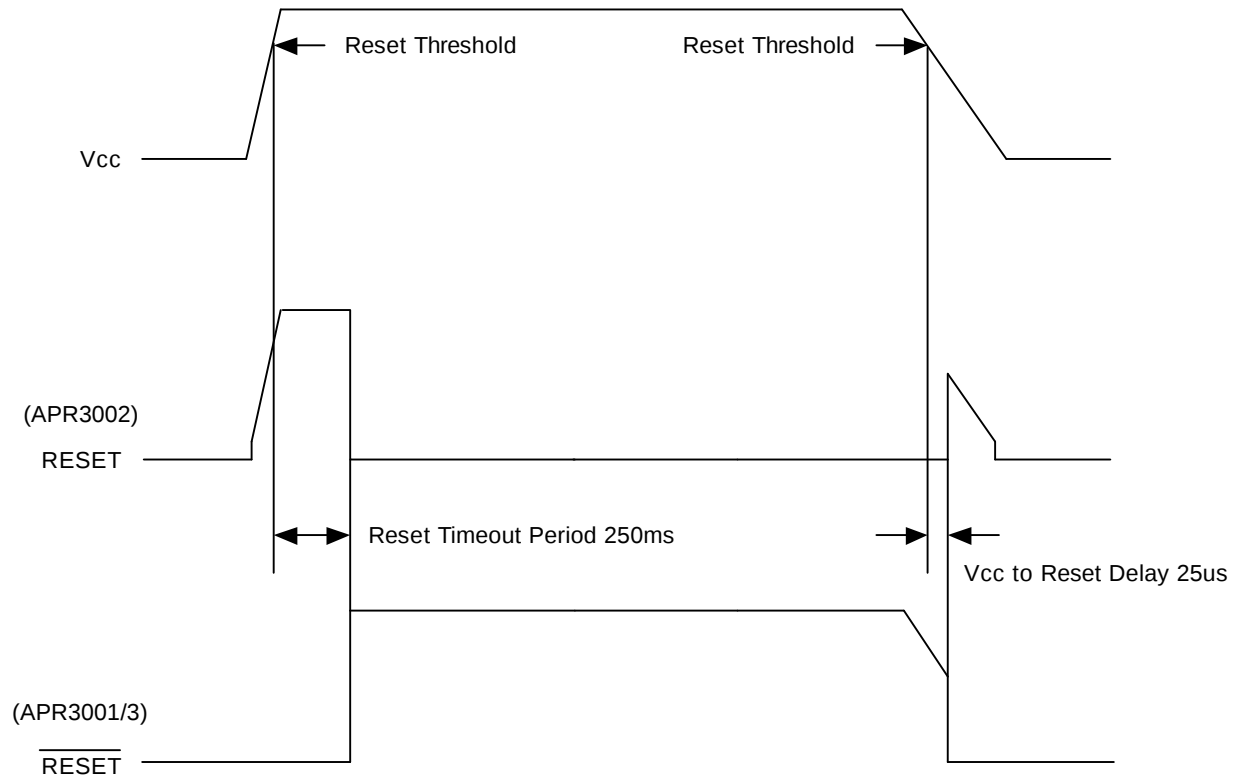
Typical Application Circuit



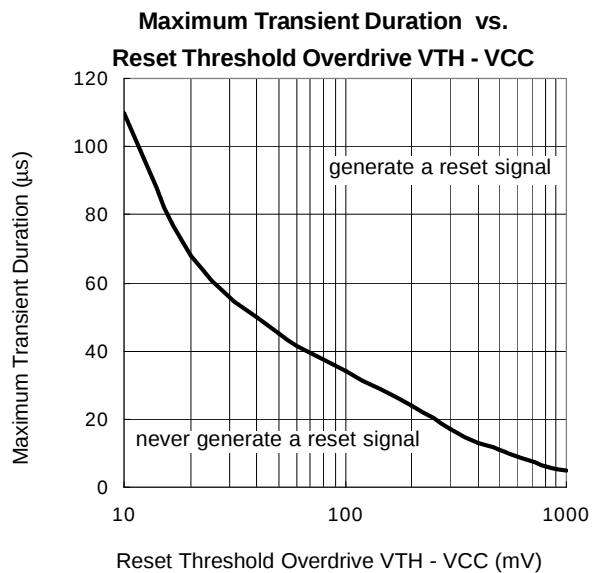
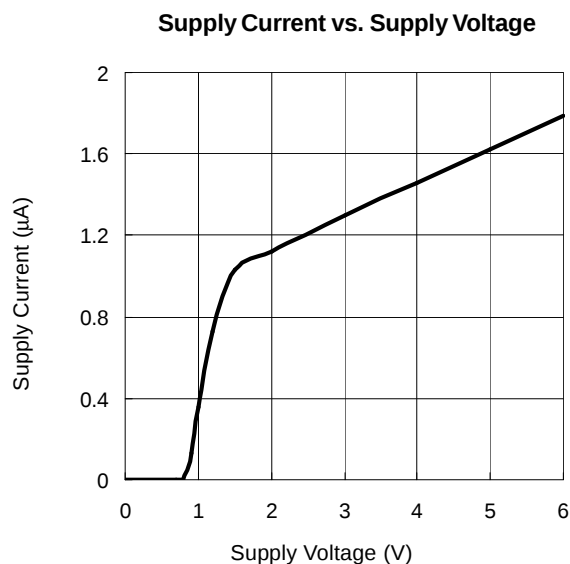
Block Diagram



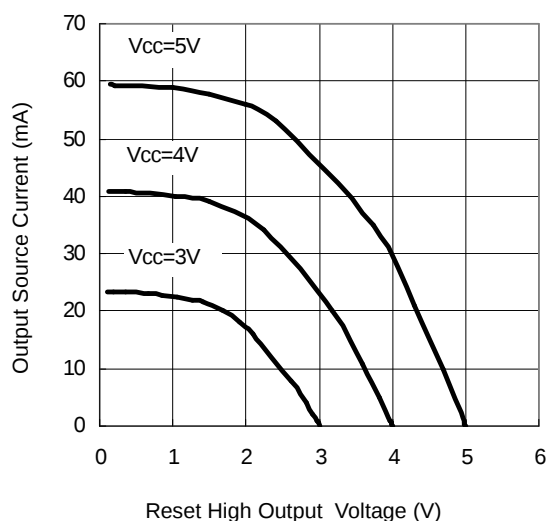
Timing Chart



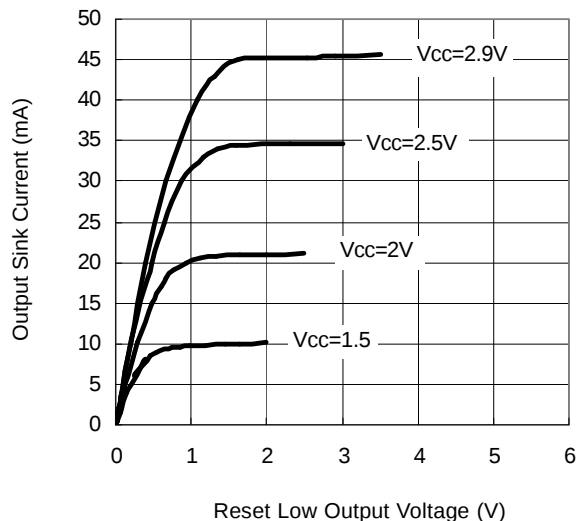
Typical Operating Characteristics



Output Source Current vs. Reset High Output Voltage

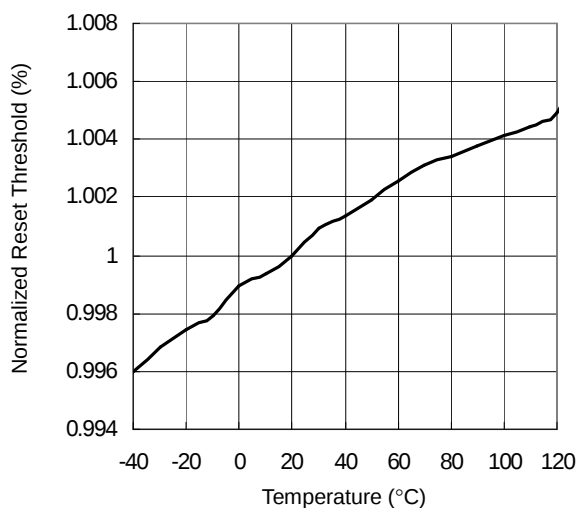


Output Sink Current vs. Reset Low Output Voltage

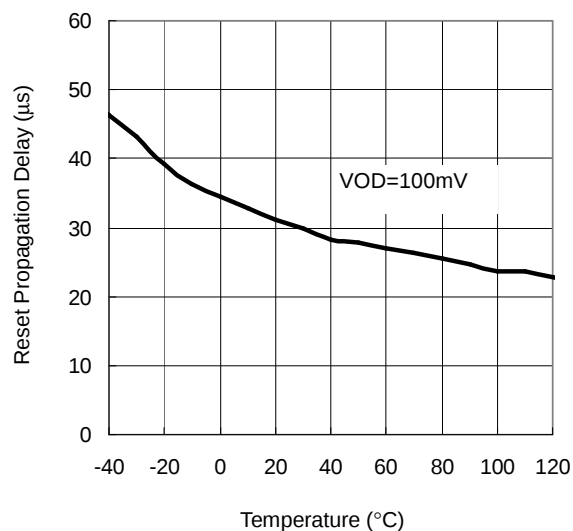


Typical Operating Characteristics (Cont.)

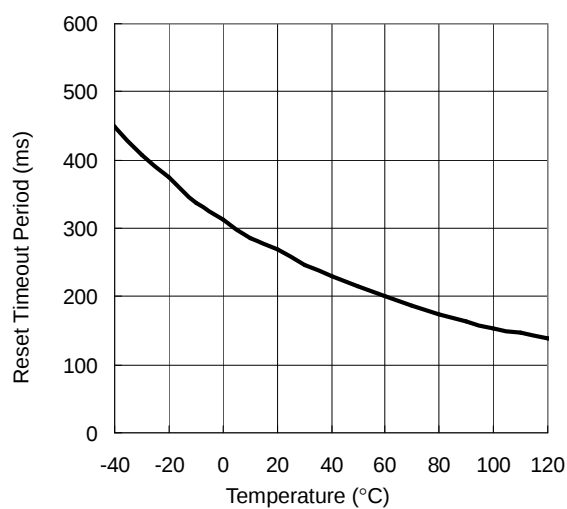
Normalized Reset Threshold vs. Temperature



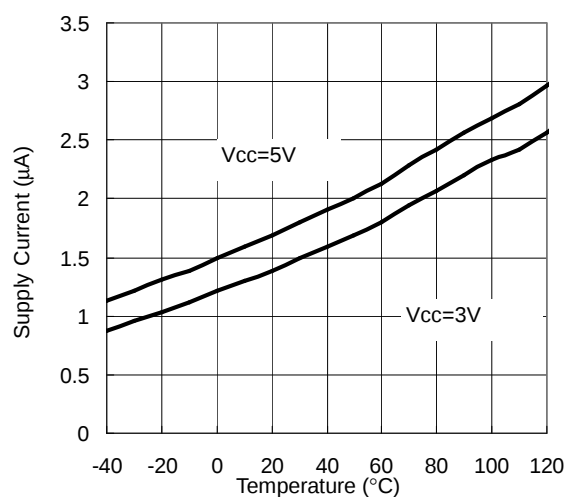
Reset Propagation Delay vs. Temperature



Reset Timeout Period vs. Temperature

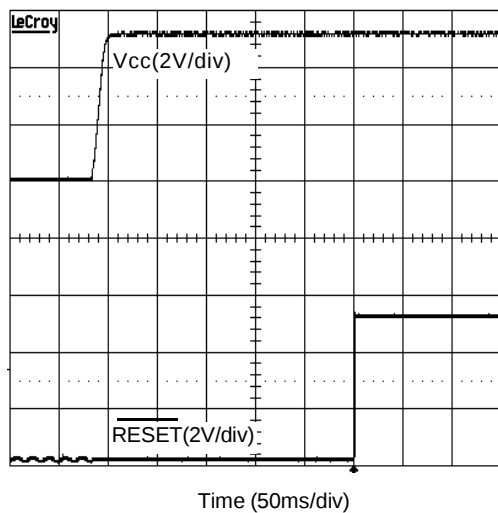


Supply Current vs. Temperature

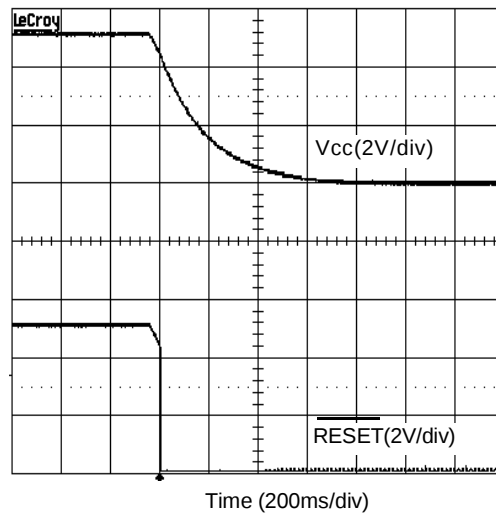


Typical Operating Characteristics (Cont.)

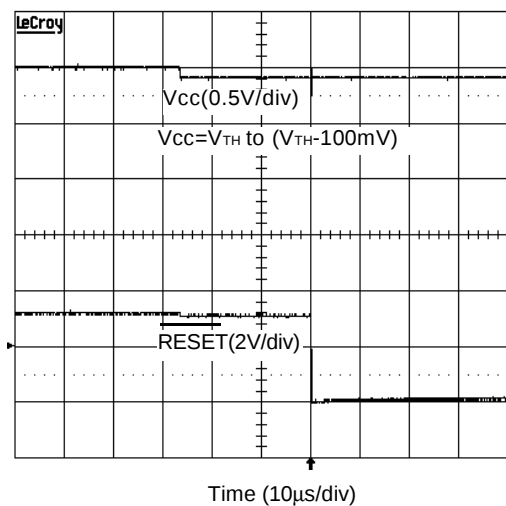
Power Up



Power Down



Vcc to RESET Delay



Application Information

VCC Transient Rejection

The APR3001/2/3 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 35 μ s, it will generate a reset signal. Connect a 0.1 μ F bypass capacitor to the VCC pin can improve the transient immunity.

Reset Output

The APR3001/2/3 have 3 output stage versions: APR3001 is an active low push-pull output. When the VCC drops below the reset threshold, the $\overline{\text{RESET}}$ output generates a low signal. APR3002 is an active high push-pull output. When the VCC drops below the reset threshold, the RESET output generates a high signal (see Timing Chart). APR3003 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 APR3001 RESET output is valid until the VCC=1.2V; when it is 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 the ground to keep the reset output low (see Figure 1). For The APR3002, a pull-up resistor to the VCC is required to keep the valid reset output for VCC below 1.2V.

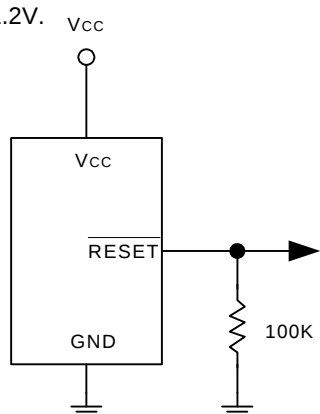


Figure 1. Ensuring RESET Valid to VCC = 0 V

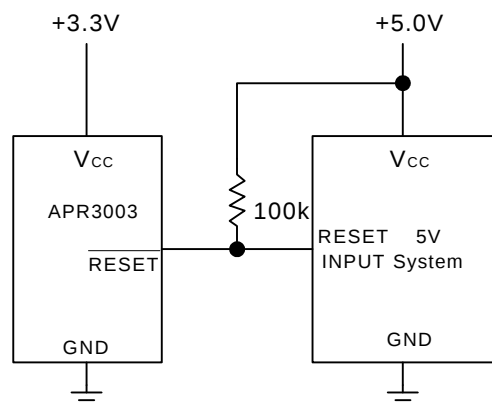
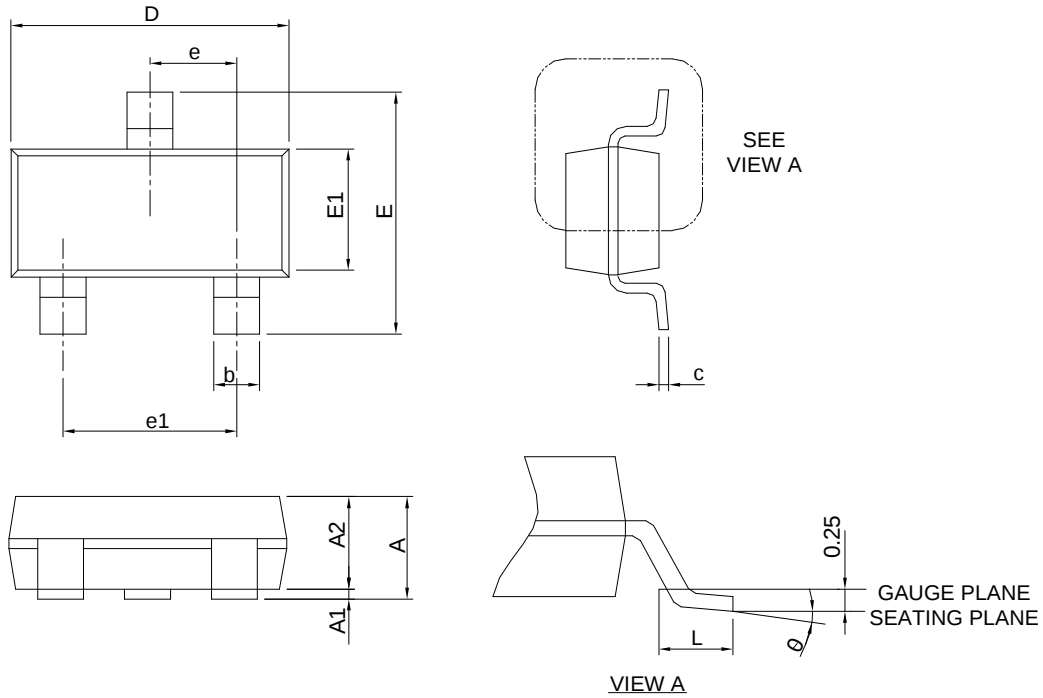


Figure 2. APR3003 Open Drain Output with Multiple Supplies

Package Information

SOT-23-3

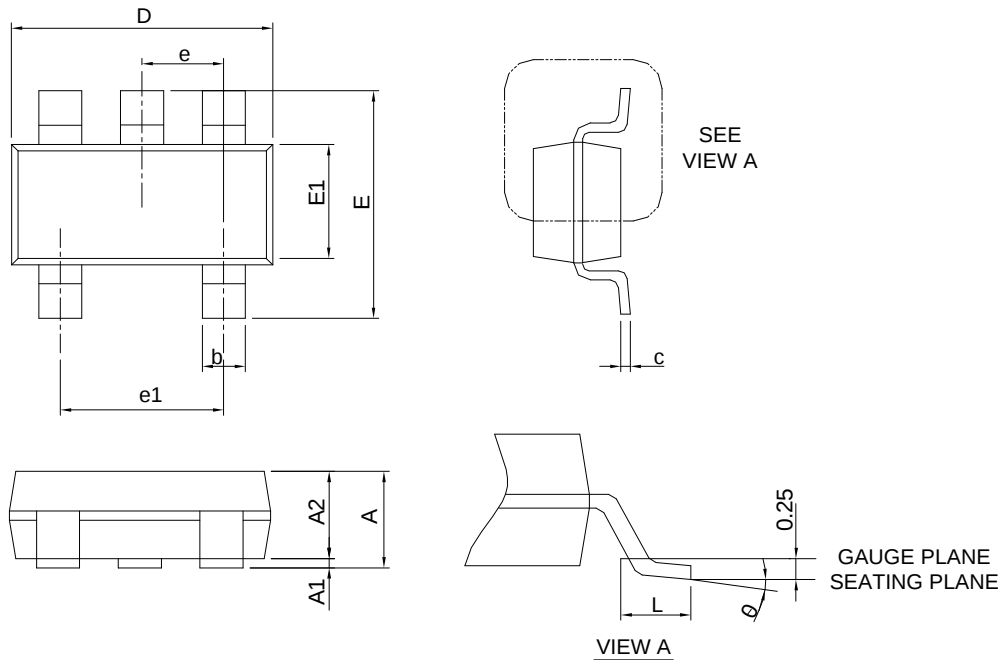


SYMBOL	SOT-23-3			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.45		0.057
A1	0.00	0.15	0.000	0.006
A2	0.90	1.30	0.035	0.051
b	0.30	0.50	0.012	0.020
c	0.08	0.22	0.003	0.009
D	2.70	3.10	0.106	0.122
E	2.60	3.00	0.102	0.118
E1	1.40	1.80	0.055	0.071
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.30	0.60	0.012	0.024
θ	0°	8°	0°	8°

Note : Dimension D and E1 do not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side.

Package Information

SOT-23-5



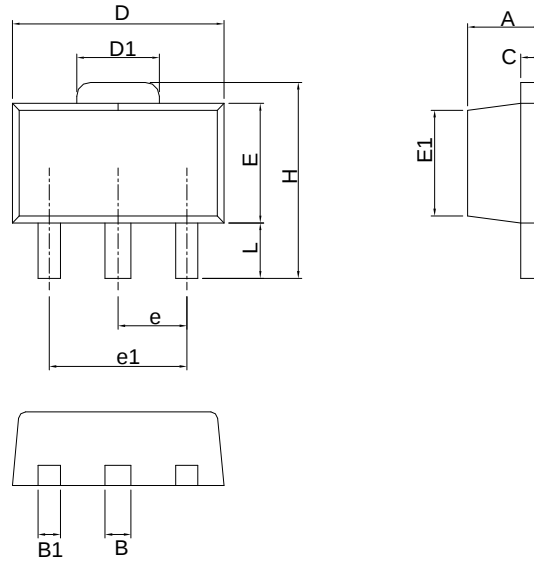
SYMBOL	SOT-23-5			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.45		0.057
A1	0.00	0.15	0.000	0.006
A2	0.90	1.30	0.035	0.051
b	0.30	0.50	0.012	0.020
c	0.08	0.22	0.003	0.009
D	2.70	3.10	0.106	0.122
E	2.60	3.00	0.102	0.118
E1	1.40	1.80	0.055	0.071
e	0.95 BSC		0.037 BSC	
e1	1.90 BSC		0.075 BSC	
L	0.30	0.60	0.012	0.024
θ	0°	8°	0°	8°

Note : 1. Follow JEDEC TO-178 AA.

2. Dimension D and E1 do not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 10 mil per side.

Package Information

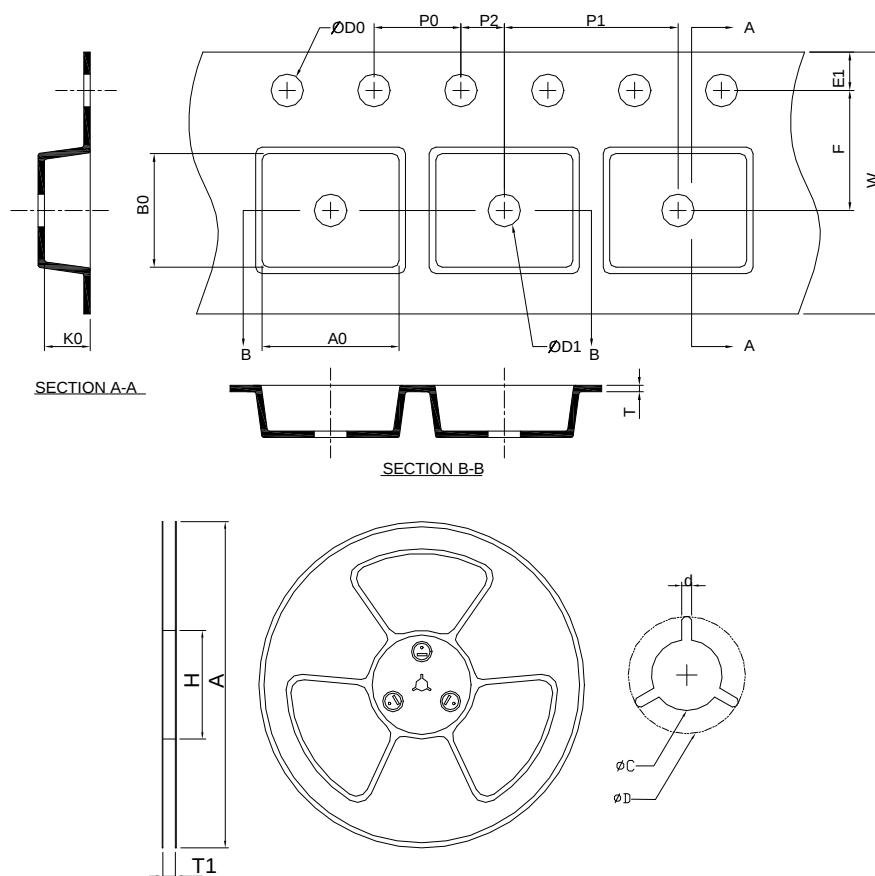
SOT-89



SYMBOL	SOT-89			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	1.40	1.60	0.055	0.063
B	0.44	0.56	0.017	0.022
B1	0.36	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	1.62	1.83	0.064	0.072
E	2.29	2.60	0.090	0.102
E1	2.13	2.29	0.084	0.090
e	1.50 BSC		0.059 BSC	
e1	3.00 BSC		0.118 BSC	
H	3.94	4.25	0.155	0.167
L	0.89	1.20	0.035	0.047

Note : Follow JEDEC TO-243 AA.

Carrier Tape & Reel Dimensions

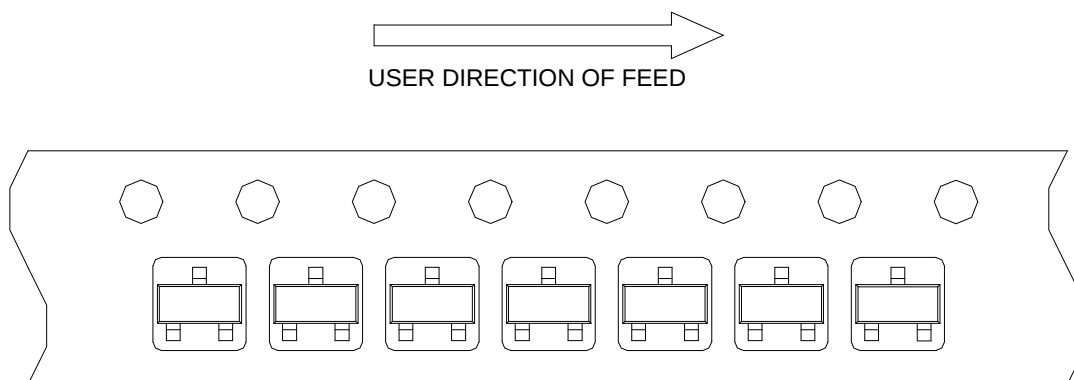
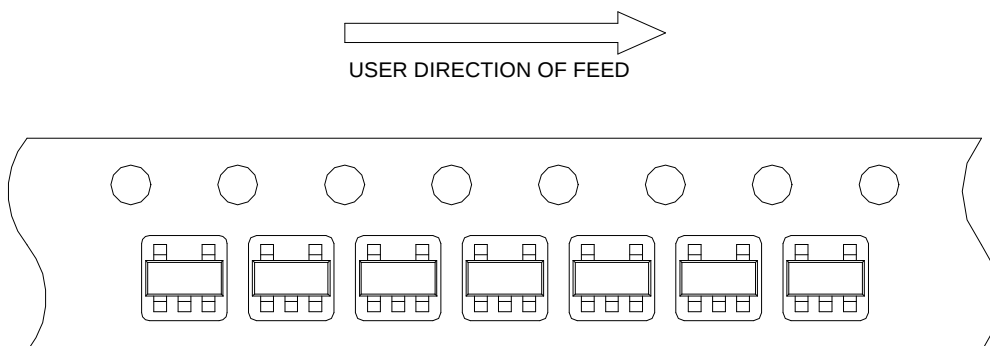
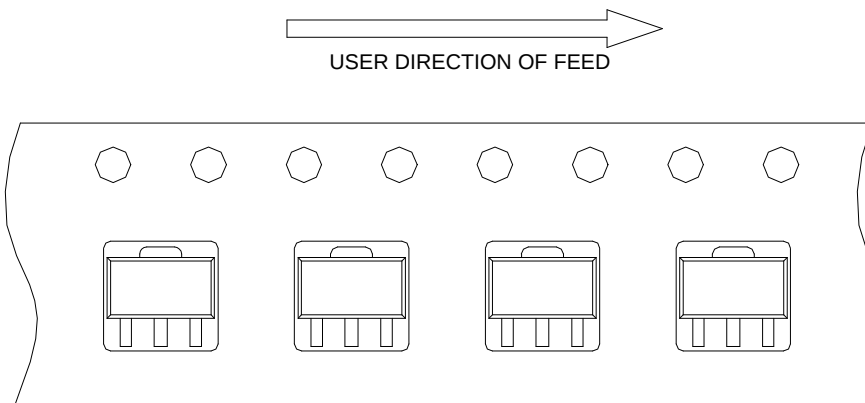


Application	A	H	T1	C	d	D	W	E1	F
SOT-23-3	178.0 ±2.00	50 MIN.	8.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	8.0 ±0.30	1.75 ±0.10	3.5 ±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0 ±0.10	4.0 ±0.10	2.0 ±0.05	1.5+0.10 -0.00	1.0 MIN.	0.6+0.00 -0.40	3.20 ±0.20	3.10 ±0.20	1.50 ±0.20
Application	A	H	T1	C	d	D	W	E1	F
SOT-23-5	178.0 ±2.00	50 MIN.	8.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	8.0 ±0.30	1.75 ±0.10	3.5 ±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0 ±0.10	4.0 ±0.10	2.0 ±0.05	1.5+0.10 -0.00	1.0 MIN.	0.6+0.00 -0.40	3.20 ±0.20	3.10 ±0.20	1.50 ±0.20
Application	A	H	T1	C	d	D	W	E1	F
SOT- 89	178.0 ±2.00	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.0 ±0.30	1.75 ±0.10	5.50 ±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.0 ±0.10	8.0 ±0.10	2.0 ±0.05	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	4.80 ±0.20	4.50 ±0.20	1.80 ±0.20

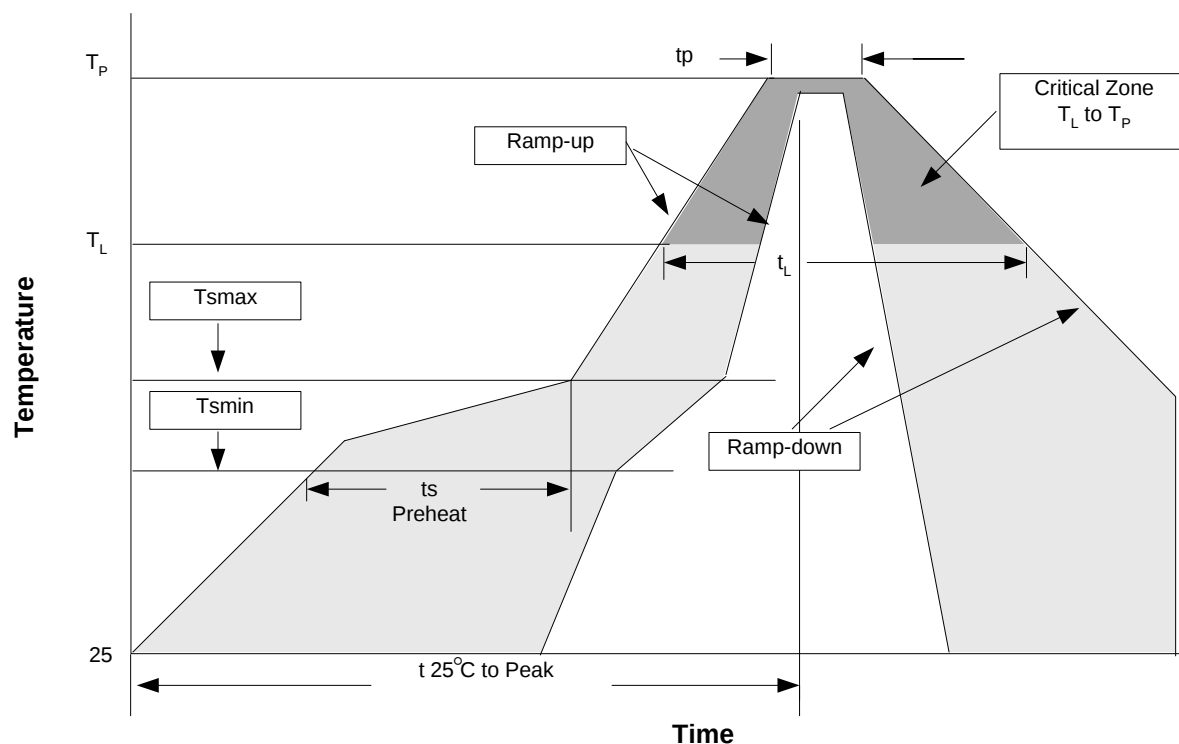
(mm)

Devices Per Unit

Package Type	Unit	Quantity
SOT-23-3	Tape & Reel	3000
SOT-23-5	Tape & Reel	3000
SOT-89	Tape & Reel	1000

Taping Direction Information**SOT-23-3****SOT-23-5****SOT-89**

Reflow Condition (IR/Convection or VPR Reflow)



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

Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T _L to T _P)	3°C/second max.	3°C/second max.
Preheat - Temperature Min (T_{min}) - Temperature Max (T_{max}) - Time (min to max) (t_s)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: - Temperature (T_L) - Time (t_L)	183°C 60-150 seconds	217°C 60-150 seconds
Peak/Classification Temperature (T _P)	See table 1	See table 2
Time within 5°C of actual Peak Temperature (t _p)	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.

Classification Reflow Profiles (Cont.)

Table 1. SnPb Eutectic Process – Package Peak Reflow Temperatures

Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	240 +0/-5°C	225 +0/-5°C
≥2.5 mm	225 +0/-5°C	225 +0/-5°C

Table 2. Pb-free Process – Package Classification Reflow Temperatures

Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*

* Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.

Customer Service

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