

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 $\overline{\text{RESET}}$. APX823/APX824/APX825A have a watchdog timer that is periodically triggered by a positive or negative transition at $\overline{\text{WDI}}$. When the supervising system fails to retrigger the watchdog circuit within the time-out interval, t_{tout} , $\overline{\text{RESET}}$ becomes active for the time period t_d . This event also reinitializes the watchdog timer. Leaving $\overline{\text{WDI}}$ unconnected disables the watchdog.

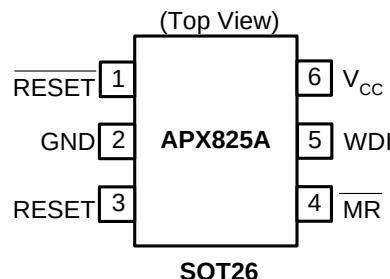
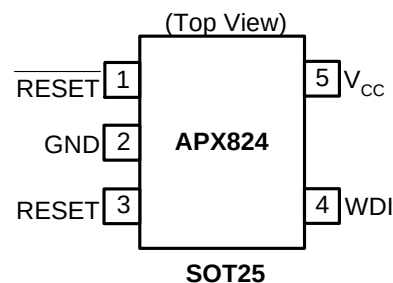
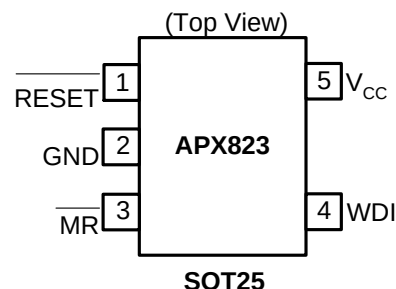
In applications where the input to the $\overline{\text{WDI}}$ pin may be active (transitioning high and low) when the APX823/APX824/APX825A asserting $\overline{\text{RESET}}$ the APX823/APX824/APX825A does not return to a non-reset state when the input voltage is above V_t . The product spectrum is 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.

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
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](https://www.diodes.com/contact-us) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>**

Notes: 1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

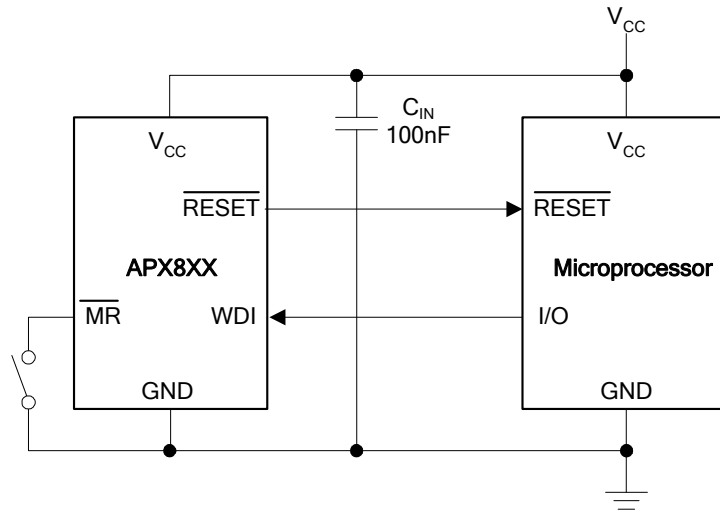
Pin Assignments



Applications

- Applications using DSPs, microcontrollers, or microprocessors
- Industrial equipment
- Programmable controls
- Portable/battery-powered equipment
- Intelligent instruments
- Wireless communications systems
- Notebook/desktop computers

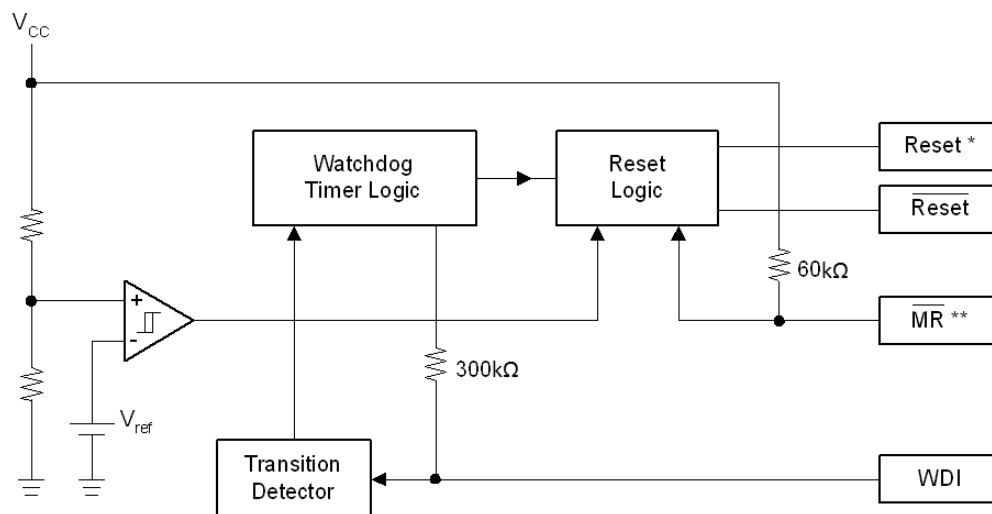
Typical Application Circuit



Pin Descriptions

Pin Name	Description
GND	Ground
RESET (RESET)	Reset output pin
V _{CC}	Operating voltage input
WDI	Watchdog input
MR	Manual reset

Functional Block Diagram



* APX824/APX825A

** APX823/APX825A

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, $\overline{\text{RESET}}$, $\overline{\text{MR}}$, 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 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 MR or WDI	-	100	ns/V
T _A	Operating Ambient Temperature Range	-40	85	°C
T _R	V _{CC} Rising Time (V _{CC} = 0~V _T)	-	100	V/ μS

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	RESET	APX823/APX824/APX825A - 29/26/23	V _{CC} = V _{TH} +0.2V I _{OH} =-20μA	0.8×V _{CC}	-	-	V
			APX823/APX824/APX825A - 40/31	V _{CC} = V _{TH} +0.2V I _{OH} =-30μA				
			APX823/APX824/APX825A -46/44	V _{CC} = V _{TH} +0.2V I _{OH} =-120μA	V _{CC} -1.5V	-	-	V
		RESET	APX824/APX825A -29/26/23	V _{CC} ≥ 1.8V, I _{OH} = -100μA	0.8×V _{CC}	-	-	V
			APX824/APX825A - 46/44/40/31	V _{CC} ≥ 1.8V, I _{OH} = -150μA				
V _{OL}	Low-level Output Voltage	RESET	APX824/APX825A -29/26/23	V _{CC} = V _{TH} +0.2V I _{OL} =1mA	-	-	0.4	V
			APX824/APX825A -40/31	V _{CC} = V _{TH} +0.2V I _{OL} =1.2mA				
			APX824/APX825A -46/44	V _{CC} = V _{TH} +0.2V I _{OL} =3mA				
		RESET	APX823/APX824/APX825A - 29/26/23	V _{CC} = V _{TH} -0.2V I _{OL} =1mA	-	-	0.4	V
			APX823/APX824/APX825A - 40/31	V _{CC} = V _{TH} -0.2V I _{OL} =1.2mA				
			APX823/APX824/APX825A - 46/44	V _{CC} = V _{TH} -0.2V I _{OL} =3mA				
V _{RESET}	Power-up Reset Voltage (Note 4)			V _{CC} ≥ 1.1V, I _{OL} =20μA	-	-	0.4	V
V _{TH-}	Negative-going Input Threshold Voltage (Note 5)	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	2.15	2.25	2.34	V
		APX823/APX824/APX825A -26			2.51	2.63	2.74	
		APX823/APX824/APX825A -29			2.80	2.93	3.05	
		APX823/APX824/APX825A -31			2.94	3.08	3.20	
		APX823/APX824/APX825A -40			3.82	4.00	4.16	
		APX823/APX824/APX825A -44			4.19	4.38	4.56	
		APX823/APX824/APX825A -46			4.43	4.63	4.82	

Notes: 4. The lowest supply voltage at which RESET becomes active. T_R , $V_{CC} \geq 15\mu s/V$.
5. To ensure best stability of the threshold voltage, a bypass capacitor (ceramic, 0.1 μF) should be placed near the supply terminals.

Electrical Characteristics (continued)

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		-	50	-	
		APX823/APX824/APX825A -40					
		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 MR Unconnected, Outputs unconnected	V _{CC} = <u>V_{TH}</u> +0.2V	-	30	40	μA
	Internal Pull-up Resistor at MR			-	60	-	kΩ
TC	V _{OUT} Temperature Coefficient				50	-	ppm/°C
C _i	Input Capacitance at <u>MR</u> , WDI		V _I = 0V to 5.5V	-	5	-	pF
θ _{JA}	Thermal Resistance Junction-to-Ambient		SOT25 (Note 6)		161		°C/W
			SOT26 (Note 6)		169		
θ _{JC}	Thermal Resistance Junction-to-Case		SOT25 (Note 6)		27		°C/W
			SOT26 (Note 6)		28		

Note: 6. Test condition for SOT25 and SOT26: Devices mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.

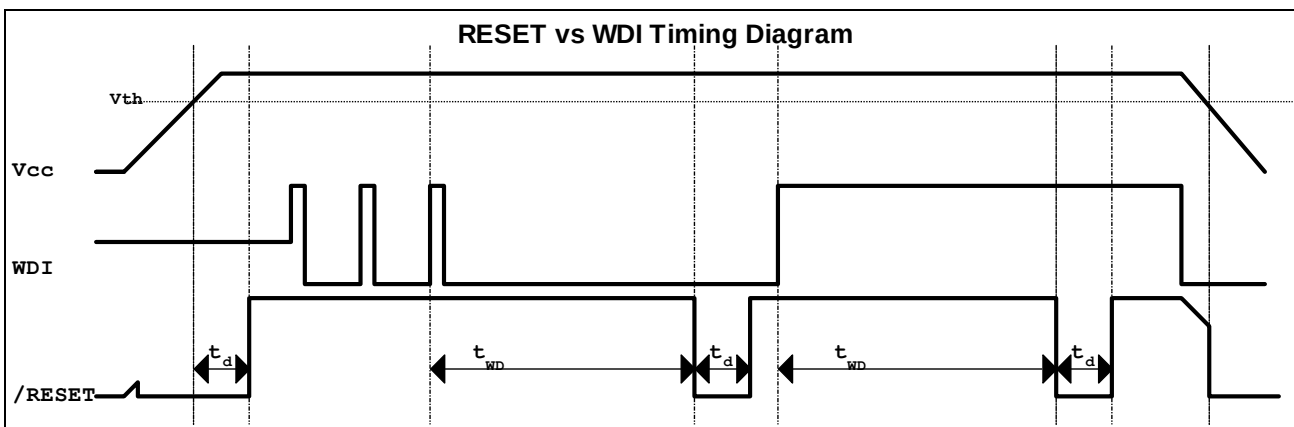
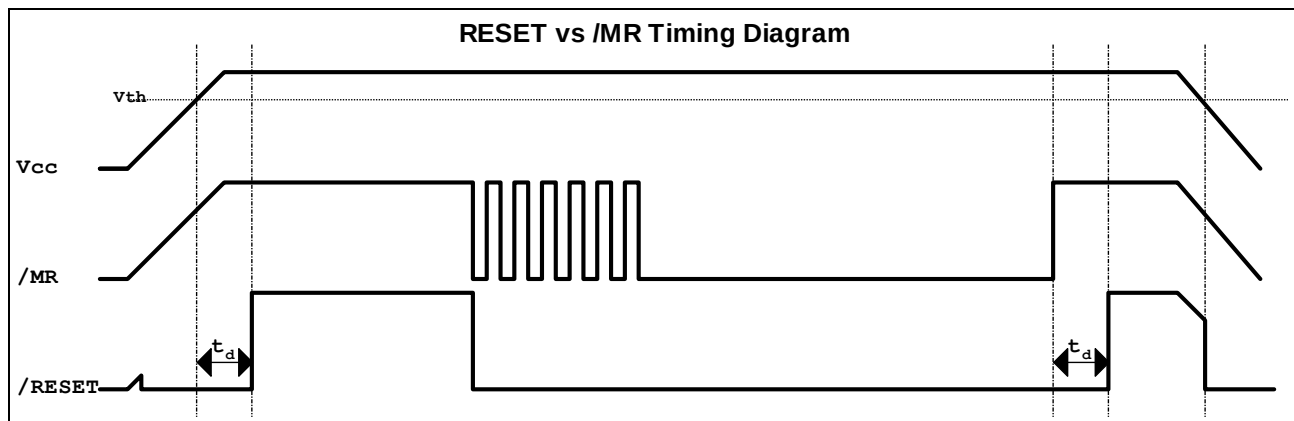
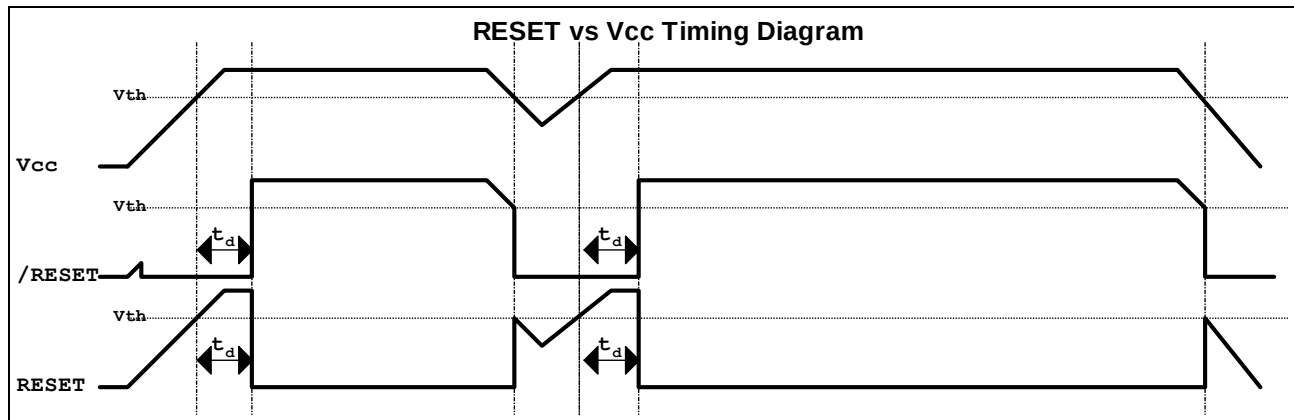
Timing Requirements (@ $R_L = 1\text{m}\Omega$, $C_L = 50\text{pF}$, $T_A = 25^\circ\text{C}$)

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Unit
t_w	Pulse Width	at MR $V_{CC} \geq \underline{V_{TH}} + 0.2\text{V}$, $\underline{V_{IL}} = 0.3 \times V_{CC}$, $\underline{V_{IH}} = 0.7 \times \underline{V_{CC}}$	<u>100</u>	-	-	<u>ns</u>
		at WDI $V_{CC} \geq \underline{V_{TH}} + 0.2\text{V}$, $\underline{V_{IL}} = 0.3 \times V_{CC}$, $\underline{V_{IH}} = 0.7 \times V_{CC}$	<u>50</u>	-	-	ns

Switching Characteristics (@ $R_L = 1\text{m}\Omega$, $C_L = 50\text{pF}$, $T_A = 25^\circ\text{C}$)

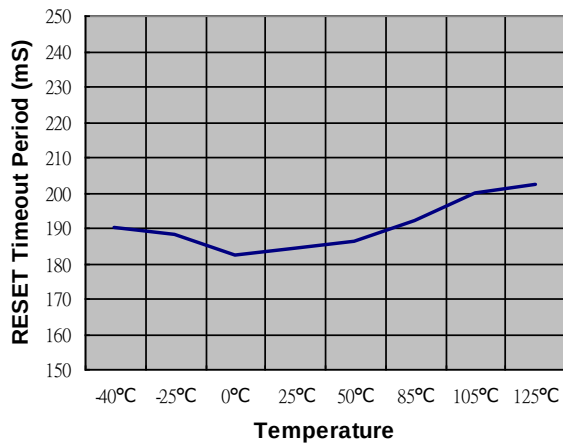
Symbol	Parameter	Test Conditions	Min	Typ.	Max	Unit
t_{out}	Watchdog Time Out	APX823/APX824/APX825A $V_{CC} \geq \underline{V_{TH}} + 0.2\text{V}$, See timing diagram	<u>1.12</u>	1.6	<u>2.4</u>	s
t_d	Delay Time	APX823/APX824/APX825A $V_{CC} \geq \underline{V_{TH}} + 0.2\text{V}$, See timing diagram	140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

Timing Diagram

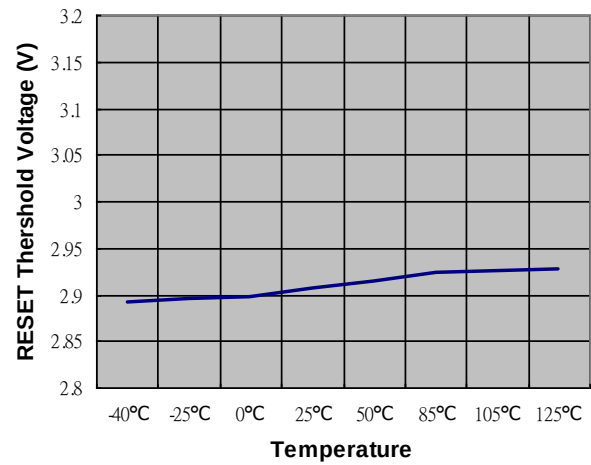


Typical Characteristics

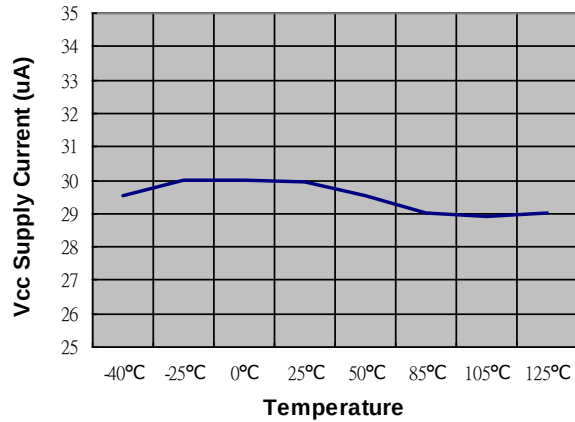
RESET Timeout Period vs. Temperature



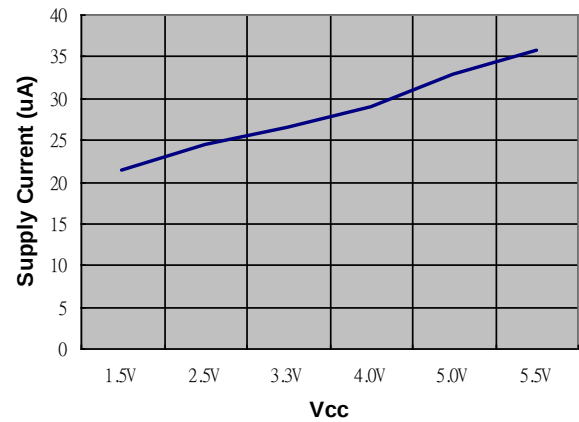
RESET Threshold Voltage vs. Temperature



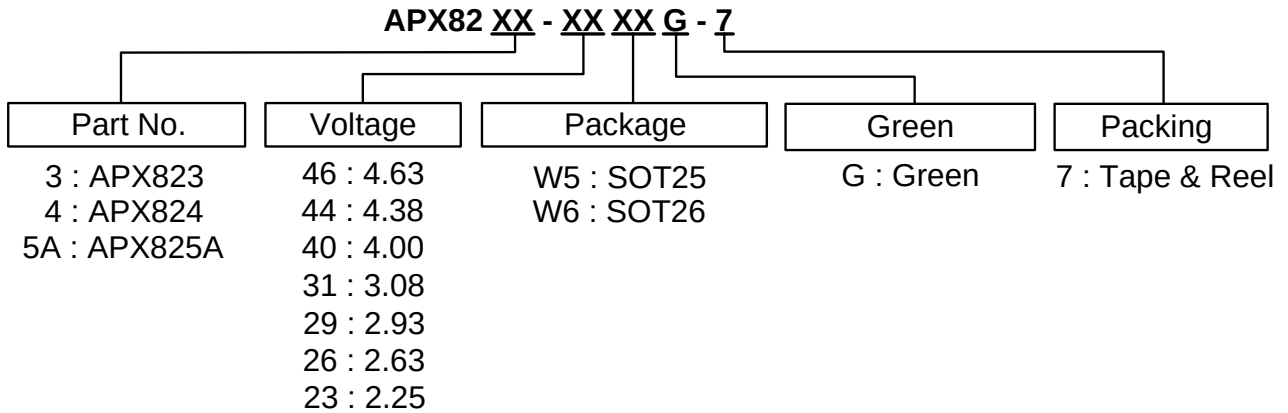
Vcc Supply Current vs. Temperature
(Vcc=3.3V Vth=2.93V)



Supply Current vs. Vcc



Ordering Information



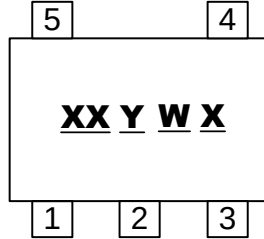
Orderable Part Number	Package Code	Package (Note 7)	Packing		
			Quantity	Carrier	Part Number Suffix
APX823-XXW5G-7	W5	SOT25	3,000	7" Tape & Reel	-7
APX824-XXW5G-7	W5	SOT25	3,000	7" Tape & Reel	-7
APX825A-XXW6G-7	W6	SOT26	3,000	7" Tape & Reel	-7

Note: 7. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information

(1) SOT25

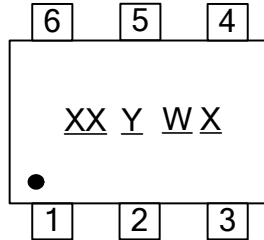
(Top View)



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

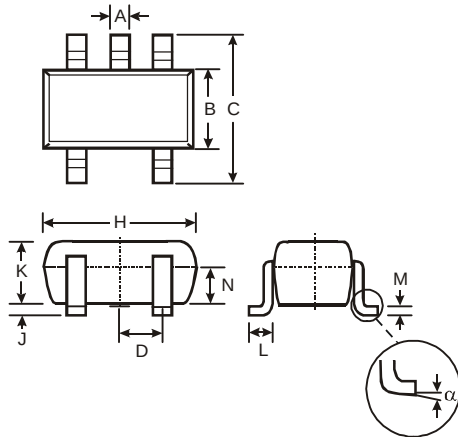
Marking Table

Device	Package	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

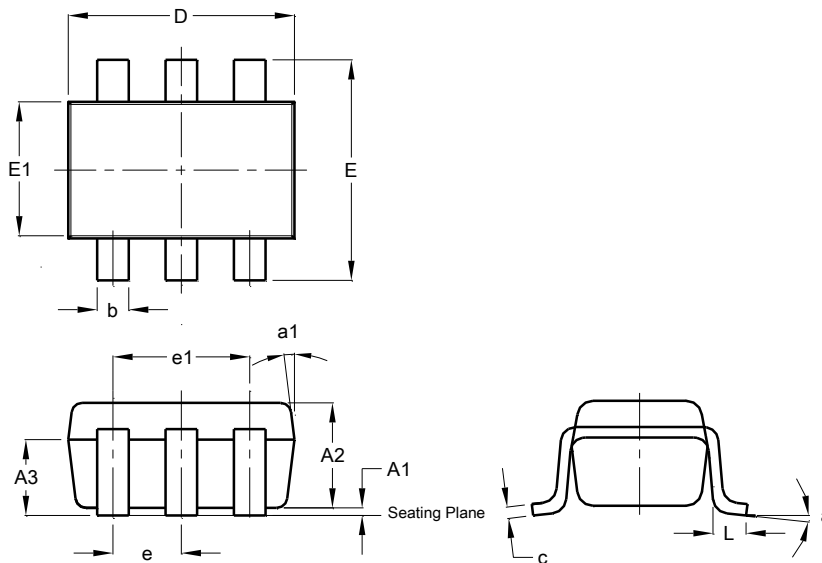
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

SOT25



SOT25			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	-	-	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	-
All Dimensions in mm			

SOT26

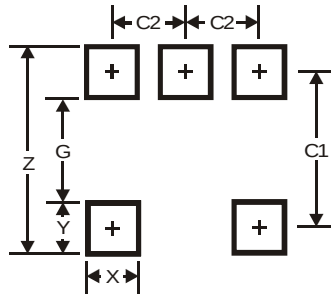


SOT26			
Dim	Min	Max	Typ
A1	0.013	0.10	0.05
A2	1.00	1.30	1.10
A3	0.70	0.80	0.75
b	0.35	0.50	0.38
c	0.10	0.20	0.15
D	2.90	3.10	3.00
e	-	-	0.95
e1	-	-	1.90
E	2.70	3.00	2.80
E1	1.50	1.70	1.60
L	0.35	0.55	0.40
a	-	-	8°
a1	-	-	7°
All Dimensions in mm			

Suggested Pad Layout

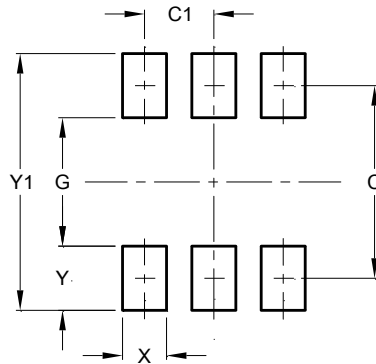
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

SOT25



Dimensions	Value
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

SOT26



Dimensions	Value (in mm)
C	2.40
C1	0.95
G	1.60
X	0.55
Y	0.80
Y1	3.20

Mechanical Data

- Moisture Sensitivity:
 - SOT25 Level 3 per J-STD-020
 - SOT26 Level 3 per J-STD-020
- Terminals: Finish — Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 ③
- Weight:
 - SOT25: 0.0153 grams (Approximate)
 - SOT26: 0.016 grams (Approximate)

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