Description

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

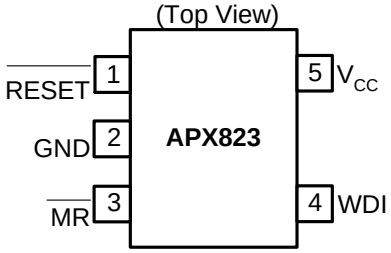
During power-on, $\overline{\text{RESET}}$ is asserted when supply voltage V_{CC} becomes higher than 1.1V. Thereafter, the supply voltage supervisor monitors V_{CC} and keeps $\overline{\text{RESET}}$ active as long as V_{CC} remains below the threshold voltage V_{TH-}. An internal timer delays the 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/APX825A 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.

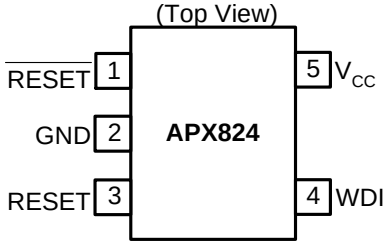
Pin Assignments

(Top View)



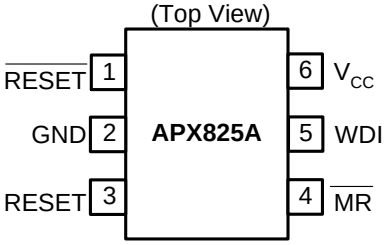
SOT25

(Top View)



SOT25

(Top View)



SOT26

Features

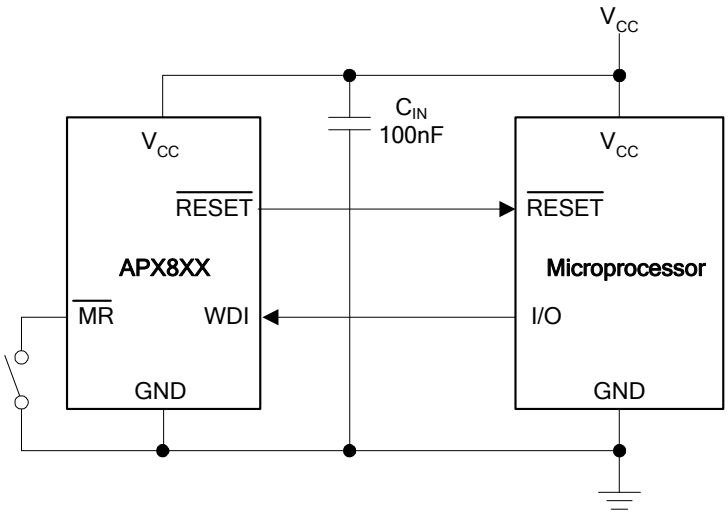
- Power-on reset generator with fixed delay time of 200ms Typ
- Manual reset input (APX823/APX825A)
- Reset output available in active-low (APX823/APX824/APX825A), active-high (APX824/APX825A)
- Supply voltage supervision range 2.5V, 3V, 3.3V, 5V
- Watchdog timer
- Supply current of 30μA (Typ.)
- Temperature range: -40°C to 85°C
- **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 or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

Applications

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

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.

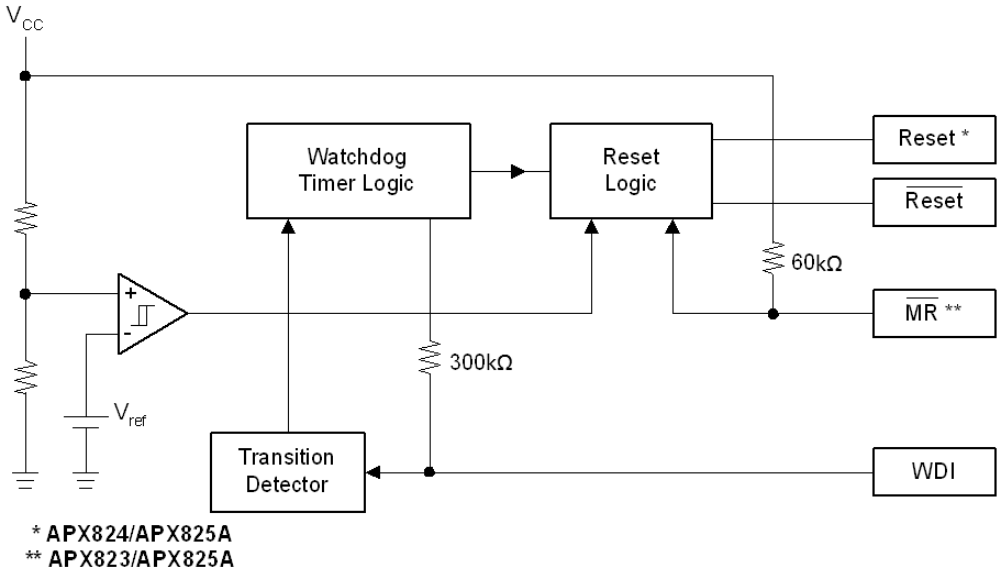
Typical Application Circuit



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



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

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 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				
		$\overline{RESET}$	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 $\overline{RESET}$ becomes active. T_R , V_{CC} ≥ 15μs/V.
5. To ensure best stability of the threshold voltage, a bypass capacitor (ceramic, 0.1μF) 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					
		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
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.

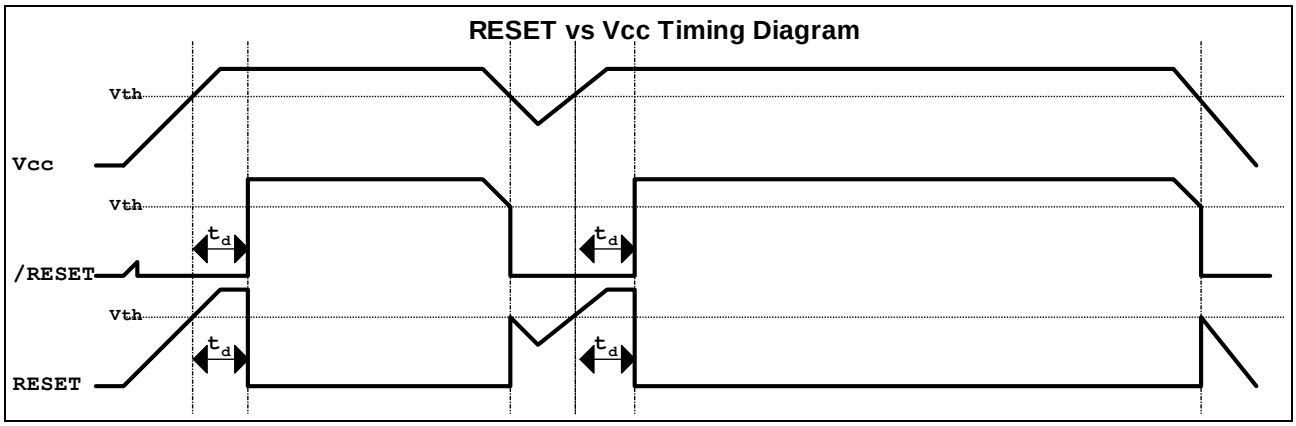
Timing Requirements (@ R_L = 1mΩ, C_L = 50pF, T_A = 25°C)

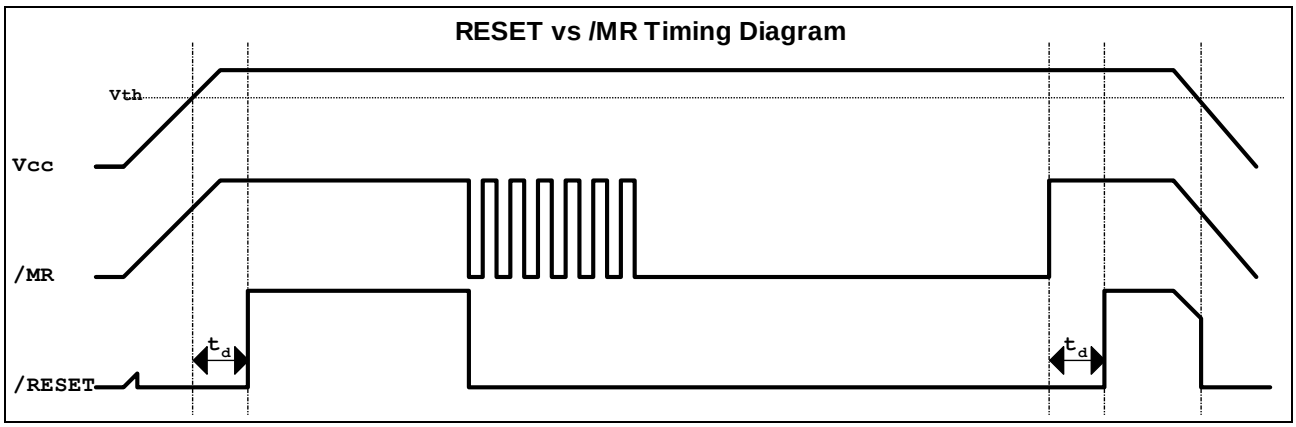
Symbol	Parameter		Test Conditions	Min	Typ.	Max	Unit
t_W	Pulse Width	at $\overline{MR}$	$V_{CC} \geq V_{TH-}$+0.2V, V_{IL}=0.3×V_{CC}, V_{IH}=0.7×V_{CC}	100	-	-	ns
		at WDI	$V_{CC} \geq V_{TH-}$+0.2V, V_{IL}=0.3×V_{CC}, V_{IH}=0.7×V_{CC}	50	-	-	ns

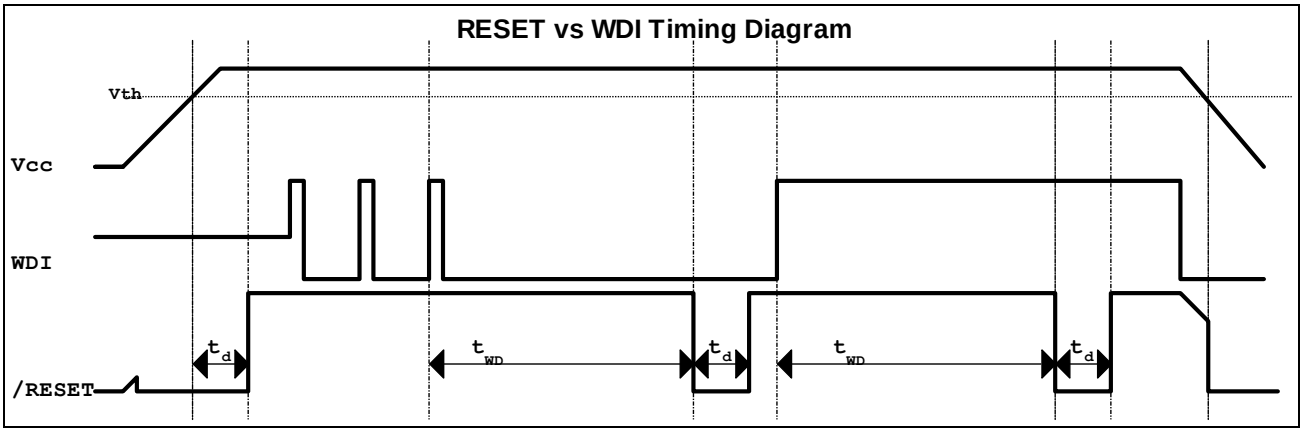
Switching Characteristics (@ R_L = 1mΩ, C_L = 50pF, T_A = 25°C)

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

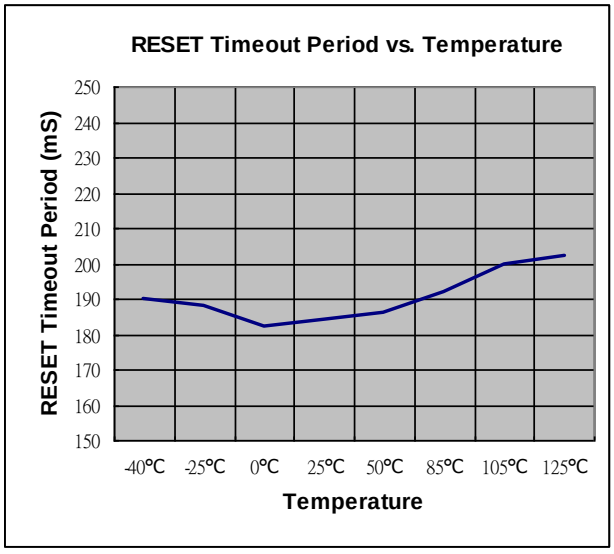
Timing Diagram

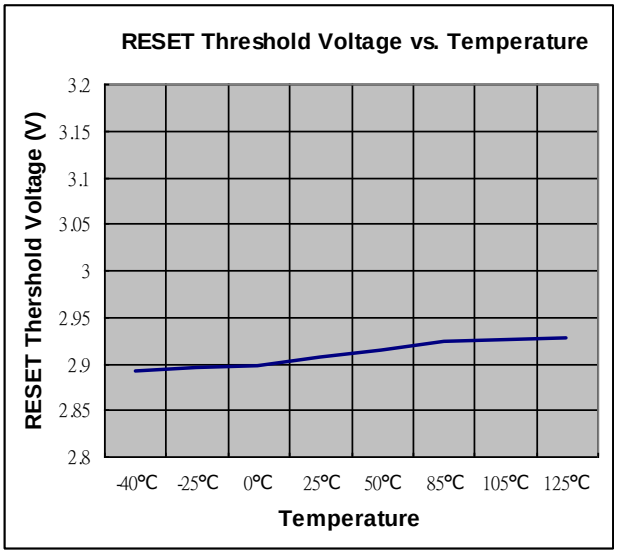


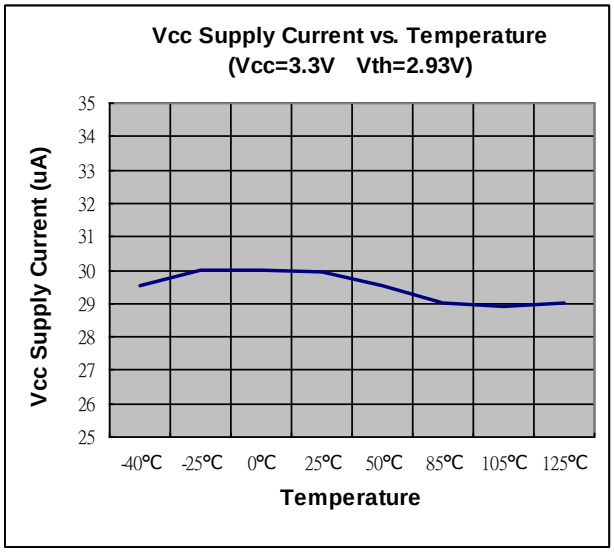


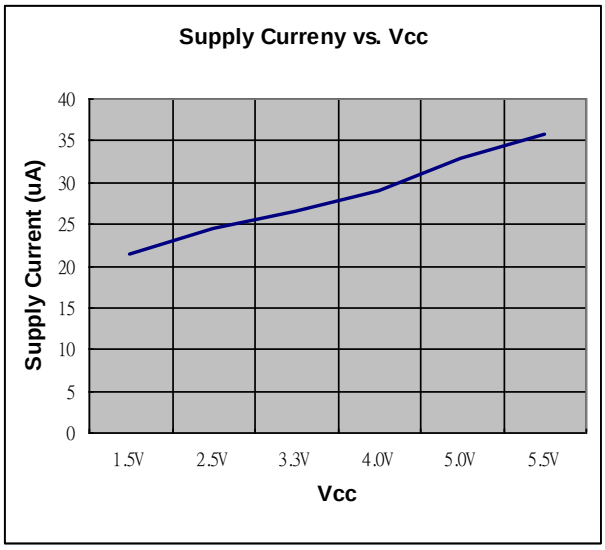


Typical Characteristics

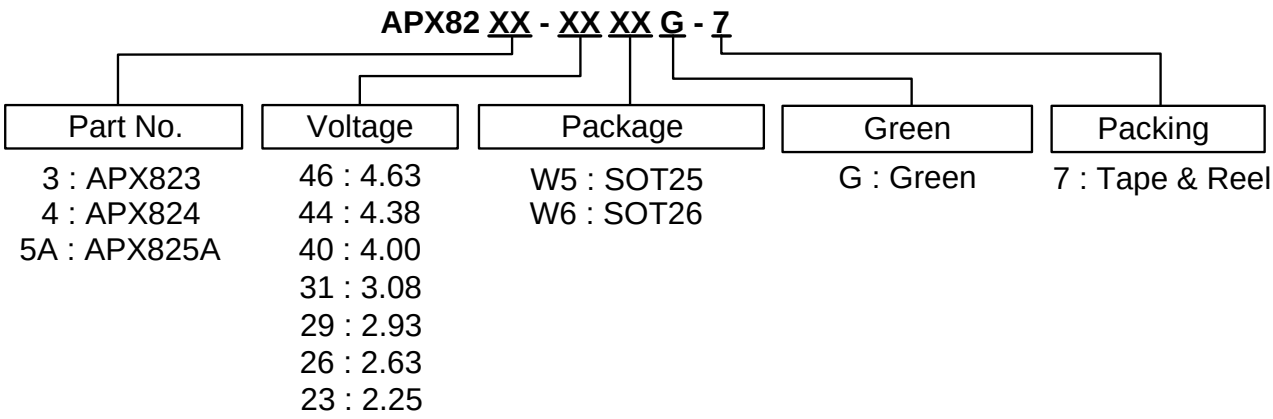








Ordering Information



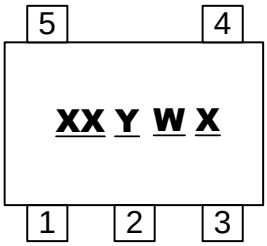
Orderable Part Number	Package Code	Package (Note 7)	Packing		
			Quantity	Carrier	Part Number Suffix
APX823-XXW5G-7	W5	SOT25	3,000	7” Tape & Reel	-7
APX824-XXW5G-7	W5	SOT25	3,000	7” Tape & Reel	-7
APX825A-XXW6G-7	W6	SOT26	3,000	7” Tape & Reel	-7

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

Marking Information

(1) SOT25

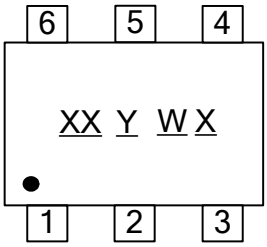
(Top View)



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

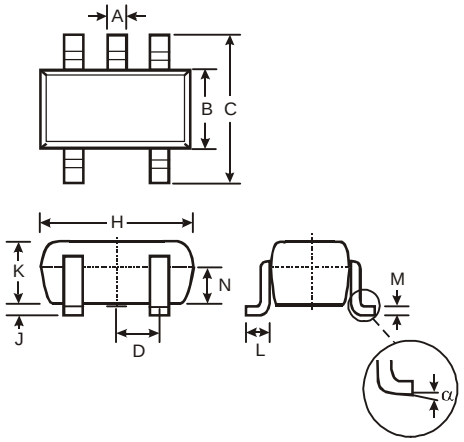
Marking Table

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

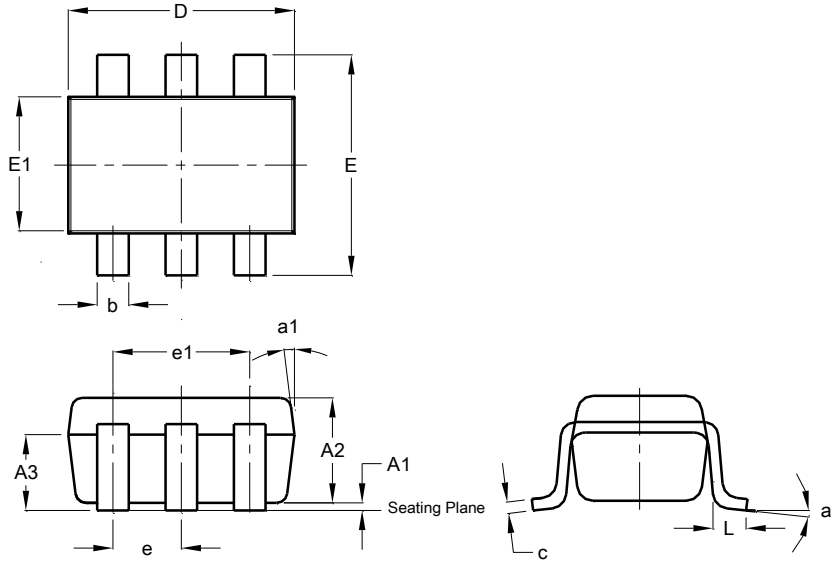
Please see http://www.diodes.com/package-outlines.html for the latest version.

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

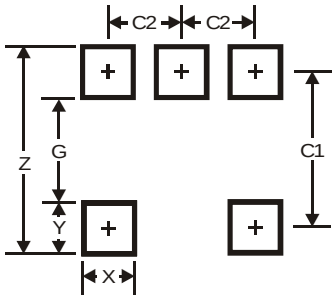


SOT26			
Dim	**Min**	**Max**	**Typ**
A1	0.013	0.10	0.05
A2	1.00	1.30	1.10
A3	0.70	0.80	0.75
b	0.35	0.50	0.38
c	0.10	0.20	0.15
D	2.90	3.10	3.00
e	-	-	0.95
e1	-	-	1.90
E	2.70	3.00	2.80
E1	1.50	1.70	1.60
L	0.35	0.55	0.40
a	-	-	8°
a1	-	-	7°
All Dimensions in mm			

Suggested Pad Layout

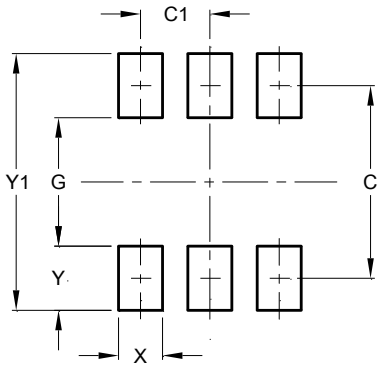
Please see http://www.diodes.com/package-outlines.html for the latest version.

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 e3
- Weight:
  - SOT25: 0.0153 grams (Approximate)
  - SOT26: 0.016 grams (Approximate)

IMPORTANT NOTICE

1. DIODES INCORPORATED (Diodes) AND ITS SUBSIDIARIES MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes' products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes' products. Diodes' products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of Diodes' products for their intended applications, (c) ensuring their applications, which incorporate Diodes' products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.

3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.

4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.

5. Diodes' products are provided subject to Diodes' Standard Terms and Conditions of Sale (https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

6. Diodes' products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes' products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.

7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.

8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.

9. This Notice may be periodically updated with the most recent version available at https://www.diodes.com/about/company/terms-and-conditions/important-notice

www.diodes.com