

## Description

The PT7M823/824/825 family micro-processor (μP) supervisory circuits are targeted to improve reliability and accuracy of power-supply circuitry in μP's systems. These devices reduce the complexity and number of components required to monitor power-supply and battery functions.

The main functions are:

1. Asserting reset output during power-up, power-down and brownout conditions for μP system.
2. Watchdog functions
3. Manual reset

## Features

- Precision Supply-Voltage Monitor
  - 4.63V (PT7M82xL)
  - 4.38V (PT7M82xM)
  - 3.08V (PT7M82xT)
  - 2.93V (PT7M82xS)
  - 2.63V (PT7M82xR)
  - 2.32V (PT7M82xZ)
  - 2.19V (PT7M82xY)
- 200ms Reset Pulse Width
- Debounced CMOS-Compatible Manual-Reset Input (PT7M823/825)
- Reset Output Signal for Watchdog and Power Abnormal, Manual Reset
- Reset Push-Pull Output
- Voltage Monitor for Power-Fail or Low Battery Warning
- Guaranteed  $\overline{\text{RESET}}/\text{RESET}$  Valid at  $V_{CC} = 1V$
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

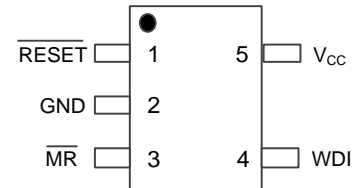
## Applications

- Power-Supply Circuitry in μP Systems
- Networking
- Security System
- Server/Storage
- Embedded System

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> 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.

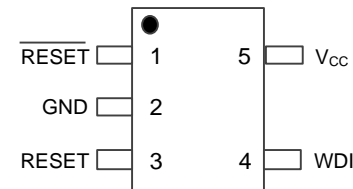
## Pin Assignments

(Top View)



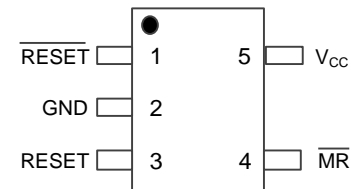
SOT25/SOT353 (PT7M823)

(Top View)



SOT25/SOT353 (PT7M824)

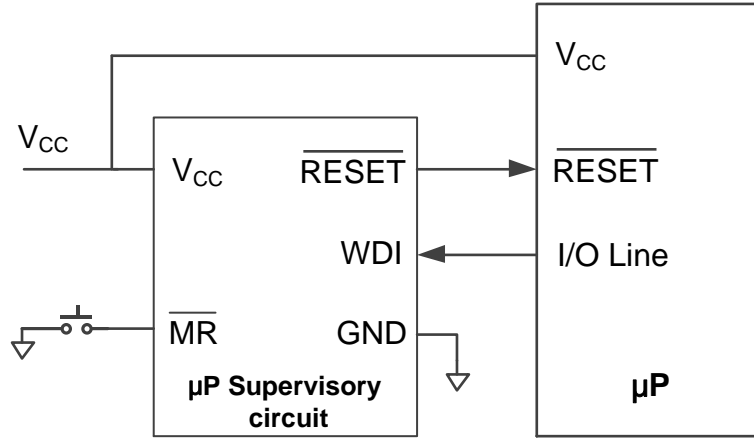
(Top View)



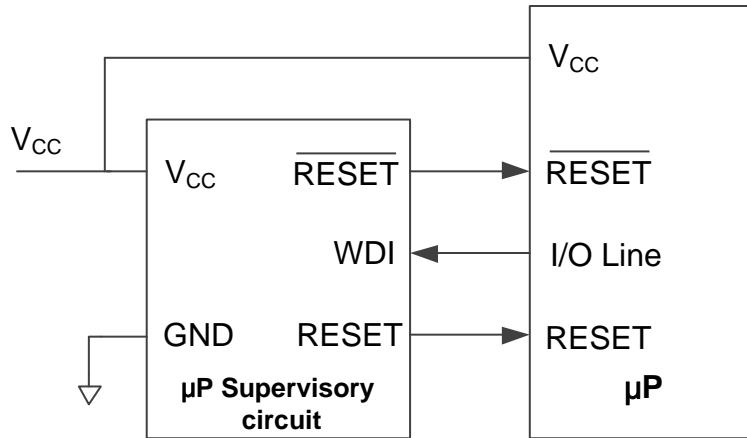
SOT25/SOT353 (PT7M825)

**Typical Applications Circuit**

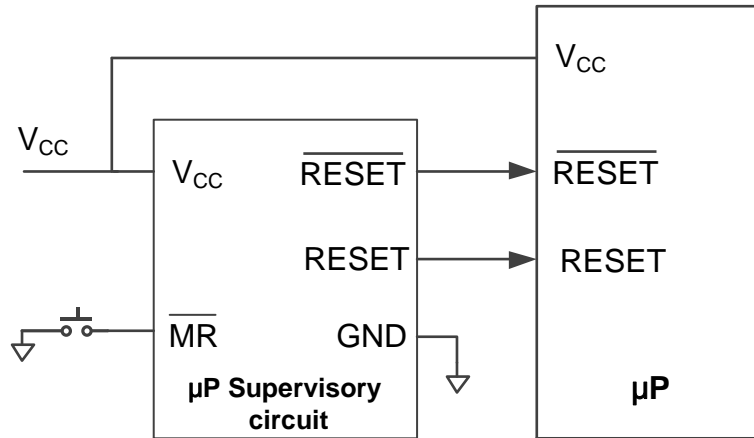
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Application Circuit of PT7M823



Application Circuit of PT7M824



Application Circuit of PT7M825

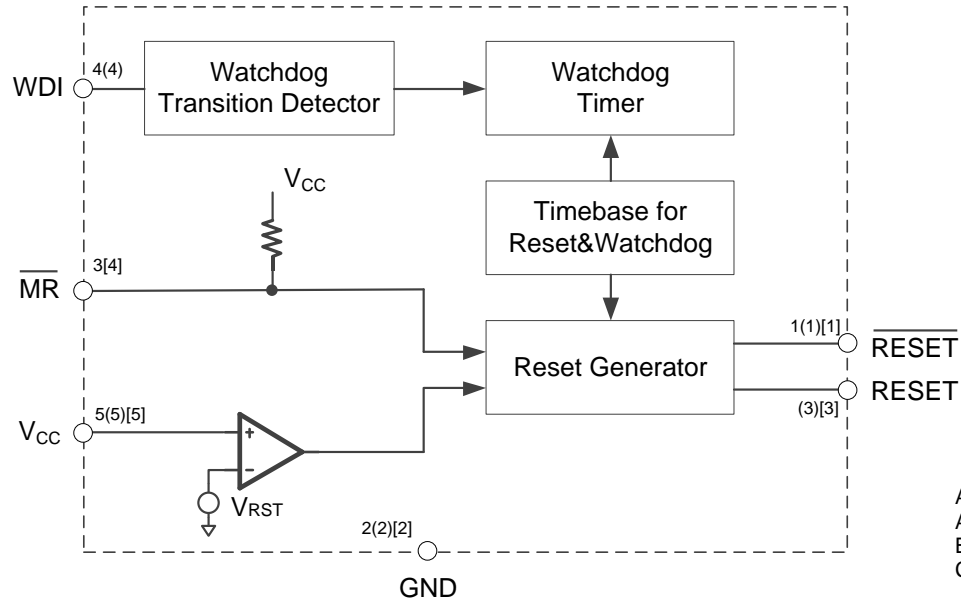
## Function Comparison Table

Part Number	RESET Output (Push-Pull)	RESET Output (Push-Pull)	Manual Reset Input	Watchdog Input
PT7M823	√	—	√	√
PT7M824	√	√	—	√
PT7M825	√	√	√	—

## Pin Descriptions

Pin Number			Pin Name	Type	Description
PT7M823	PT7M824	PT7M825			
SOT25/ SOT353	SOT25/ SOT353	SOT25/ SOT353			
1	1	1	RESET	O	<b>Active-Low Reset Output:</b> It goes low when $V_{CC}$ is below the reset threshold. It remains low for about 200ms after one of following occurs: $V_{CC}$ rises above the reset threshold ( $V_{RST}$ ), the watchdog triggers a reset or $\overline{MR}$ goes from low to high.
2	2	2	GND	—	<b>Ground Reference</b> for all signals.
3	—	4	$\overline{MR}$	I	<b>Manual-Reset:</b> Active low. Pull low to force a reset. Reset remains asserted for the duration of the Reset Timeout Period after $\overline{MR}$ transitions from low to high. Leave unconnected or connected to $V_{CC}$ if not used.
4	4	—	WDI	I	<b>Watchdog Input:</b> If WDI remains high or low for the duration of the watchdog timeout period ( $t_{WD}$ ), the internal watchdog timer trigger a reset output. Floating WDI or connecting WDI to a high-impedance three-state buffer disables the watchdog feature. The internal watchdog timer clears whenever reset is asserted or WDI occurs a rising or falling edge.
5	5	5	$V_{CC}$	—	<b>Supply Voltage.</b> Reset is asserted when $V_{CC}$ drops below the Reset Threshold Voltage ( $V_{RST}$ ). Reset remains asserted until $V_{CC}$ rises above $V_{RST}$ and keeps asserted for the duration of the Reset Timeout Period ( $t_{RS}$ ) once $V_{CC}$ rises above $V_{RST}$ .
—	3	3	RESET	O	<b>Active High Reset Output. The inverse of <math>\overline{RESET}</math>.</b> Whenever $\overline{RESET}$ is high, RESET is low.

**Functional Block Diagram**



**Maximum Ratings** (Note 4)

Parameter	Rating	Unit
Supply Voltage to Ground Potential ( $V_{CC}$ to GND)	-0.3 to +6.0	V
DC Input Voltage (All Inputs Except $V_{CC}$ and GND)	-0.3 to $V_{CC} + 0.3$	V
DC Output Current (All Output)	20	mA
Power Dissipation (Depend on Package)	320	mW
Ambient Temperature with Power Applied	-40 to +85	°C
Storage Temperature Range	-65 to +150	°C

Note: 4. Stresses greater than those listed under *Maximum Ratings* can cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

**ESD Ratings**

Symbol	Parameter	Rating	Unit
ESD HBM	Human Body Model ESD Protection	5	kV
ESD CDM	Charged Device Model ESD Protection	1	kV

**Recommended Operating Conditions** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Parameter	Min	Typ	Max	Unit
$V_{CC}$	Supply Voltage for PT7M82xL/M	4.5	5.0	5.5	V
	Supply Voltage for PT7M82xT/S	3.0	3.3	5.5	V
	Supply Voltage for PT7M82xR/Z/Y	2.7	3.0	5.5	V
$T_A$	Operating Temperature Range	-40	—	+85	°C

**DC Electrical Characteristics** ( $V_{CC} = V_{RN} + 5\%$  to  $5.5V$ ,  $T_A = -40$  to  $+85^\circ C$ , unless otherwise noted.) (Note 5)

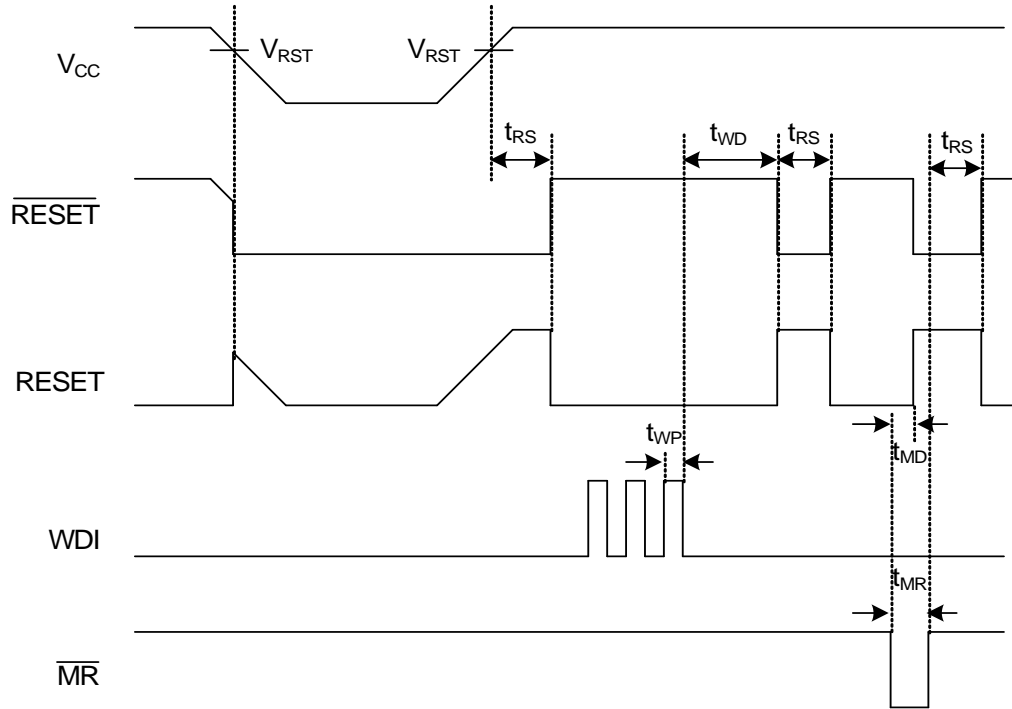
Symbol	Description	Test Conditions	Min	Typ	Max	Unit
$V_{CC}$	Operating Voltage Range	—	1.0	—	5.5	V
$I_{CC}$	Supply Current	$V_{CC} = 5V$ , No Load	—	10	36	$\mu A$
$V_{IH}$	Input High Voltage	$\overline{MR}$ , WDI	$0.7V_{CC}$	—	—	V
$V_{IL}$	Input Low Voltage	$\overline{MR}$ , WDI	—	—	$0.3V_{CC}$	V
$V_{RST}$	Reset Threshold Voltage (Note 6)	$T_A = +25^\circ C$	$V_{RN} - 1.0\%$	$V_{RN}$	$V_{RN} + 1.0\%$	V
		$T_A = -40^\circ C$ to $+85^\circ C$	$V_{RN} - 2.0\%$	$V_{RN}$	$V_{RN} + 2.0\%$	
$V_{HYS}$	Reset Threshold Hysteresis (Note 6)	—	—	0.80	—	$\%V_{RN}$
$V_{OH}$	$\overline{RESET}$ Output High Voltage	PT7M823/824/825L/M, $V_{CC} = V_{RST(MAX)}$ , $I_{SOURCE} = 120\mu A$	$V_{CC} - 1.5$	—	—	V
		PT7M823/824/825T/S/R/Z/Y, $V_{CC} = V_{RST(MAX)}$ , $I_{SOURCE} = 30\mu A$	$0.8 \times V_{CC}$	—	—	
	RESET Output High Voltage	$V_{CC} > 1.8V$ , $I_{SOURCE} = 150\mu A$	$0.8 \times V_{CC}$	—	—	
$V_{OL}$	$\overline{RESET}$ Output Low Voltage	PT7M823/824/825L/M, $V_{CC} = V_{RST(MIN)}$ , $I_{SINK} = 3.2mA$	—	—	0.4	V
		PT7M823/824/825T/S/R/Z/Y, $V_{CC} = V_{RST(MIN)}$ , $I_{SINK} = 1.2mA$	—	—	0.3	
		$V_{CC} = 1.2V$ , $I_{SINK} = 100\mu A$	—	—	0.3	
$V_{OL}$	RESET Output Low Voltage	PT7M823/824/825L/M, $V_{CC} = V_{RST(MAX)}$ , $I_{SINK} = 3.2mA$	—	—	0.4	V
		PT7M823/824/825T/S/R/Z/Y, $V_{CC} = V_{RST(MAX)}$ , $I_{SINK} = 1.2mA$	—	—	0.3	
$I_{SOURCE}$	$\overline{RESET}$ Output Short Circuit Current	PT7M823/824/825L/M, $RESET = 0V$ , $V_{CC} = 5.5V$	—	—	800	$\mu A$
		PT7M823/824/825T/S/R/Z/Y, $RESET = 0V$ , $V_{CC} = 5.5V$	—	—	400	
$I_{WDI}$	WDI Input Current (Note 7)	WDI = 0, time average	-20	-15	—	$\mu A$
		WDI = $V_{CC}$ , time average	—	120	160	
$R_{MR}$	$\overline{MR}$ Pull-Up Resistor	PT7M823/825	35	52	75	k $\Omega$

- Notes:
- Parameters of room temperature guaranteed by production test and parameters of full-temperature guaranteed by design.
  - Valid for both  $\overline{RESET}$  and RESET.  $V_{RST}$  ( $V_{RTH}$ ) is the Reset threshold voltage when  $V_{CC}$  from high to low level, and  $V_{RTH+}$  is the Reset threshold voltage when  $V_{CC}$  from low to high level.  $V_{RN}$  is nominal reset threshold voltage.
  - WDI is internally serviced within the watchdog period if WDI is left unconnected.

**AC Electrical Characteristics**

Symbol	Description	Test Conditions	Min	Typ	Max	Unit
$t_{RS}$	Reset Pulse Width	—	140	200	280	ms
$t_{WD}$	Watchdog Timeout Period	—	1.12	1.6	2.25	s
$t_{MR}$	$\overline{MR}$ Pulse Width	—	1.0	—	—	$\mu s$
—	$\overline{MR}$ Noise Immunity (Pulse Width With No Reset)	—	—	100	—	ns
$t_{MD}$	$\overline{MR}$ to RESET Delay	—	—	500	—	ns
$t_{WP}$	WDI Pulse Width	—	50	—	—	ns
—	$V_{CC}$ to RESET Delay	$V_{RST} - V_{CC} = 100mV$	—	20	—	$\mu s$

**Timing Diagram**



Watchdog Timing Diagram

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## Functional Description

### Reset Output

A microprocessor ( $\mu\text{P}$ ) reset input starts the  $\mu\text{P}$  in a known state. Whenever the  $\mu\text{P}$  is in an unknown state, it should be held in reset. The supervisory circuits assert reset during power-up and prevent code execution errors during power-down or brownout conditions.

On power-up, once  $V_{\text{CC}}$  reaches about 1.0V,  $\overline{\text{RESET}}$  is a guaranteed logic low of 0.4V or less. As  $V_{\text{CC}}$  rises,  $\overline{\text{RESET}}$  stays low. When  $V_{\text{CC}}$  rises above the reset threshold, an internal timer releases  $\overline{\text{RESET}}$  after about 200ms.  $\overline{\text{RESET}}$  pulses low whenever  $V_{\text{CC}}$  drops below the reset threshold, i.e. brownout condition. If brownout occurs in the middle of a previously initiated reset pulse, the pulse continues for at least another 200ms. On power-down, once  $V_{\text{CC}}$  falls below the reset threshold,  $\overline{\text{RESET}}$  stays low and is guaranteed to be 0.4V or less until  $V_{\text{CC}}$  drops below 1.0V. Watchdog Timing Diagram shows the timing relationship.

The active-high RESET output is simply the inverse of the  $\overline{\text{RESET}}$  output, and is guaranteed to be valid with  $V_{\text{CC}}$  down to 1.0V.

### Watchdog Timer

The PT7M823/825 watchdog circuit monitors the  $\mu\text{P}$  activity. If the  $\mu\text{P}$  does not toggle the watch-dog input (WDI) within 1.6s, reset asserts. As long as reset is asserted or the WDI input is toggled, the watchdog timer will stay clear and will not count. As soon as reset is released, the timer will start counting. WDI input pulses as short as 150ns can be detected.

Disable the watchdog function by leaving WDI unconnected or by three-stating driver connected to WDI.

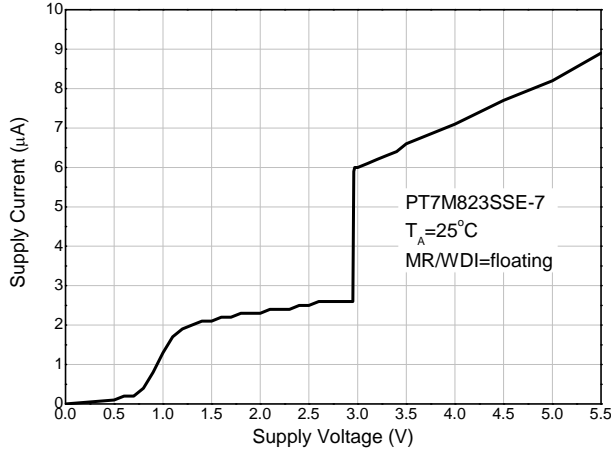
### Manual Reset

The manual-reset input ( $\overline{\text{MR}}$ ) allows reset to be triggered by a push button switch.  $\overline{\text{MR}}$  has an internal pull-up resistor, so it can be left open when not used.

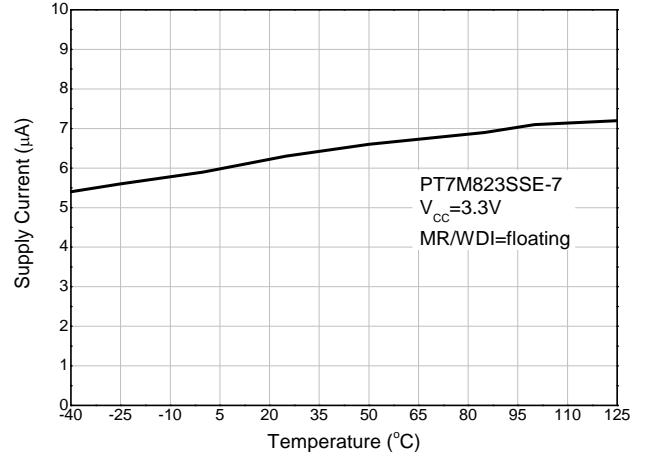
**Performance Characteristics**

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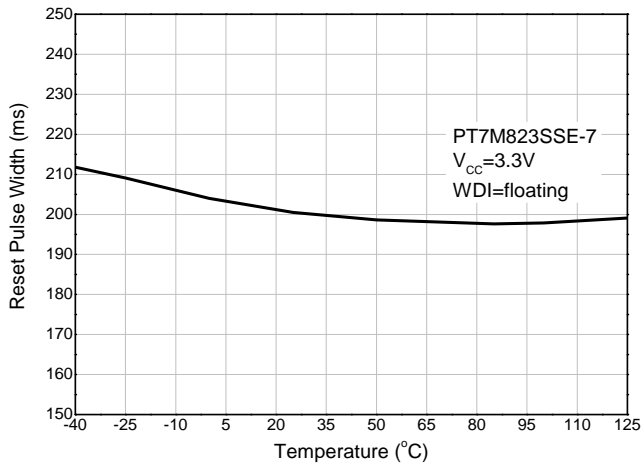
**Supply Current vs. Supply Voltage**



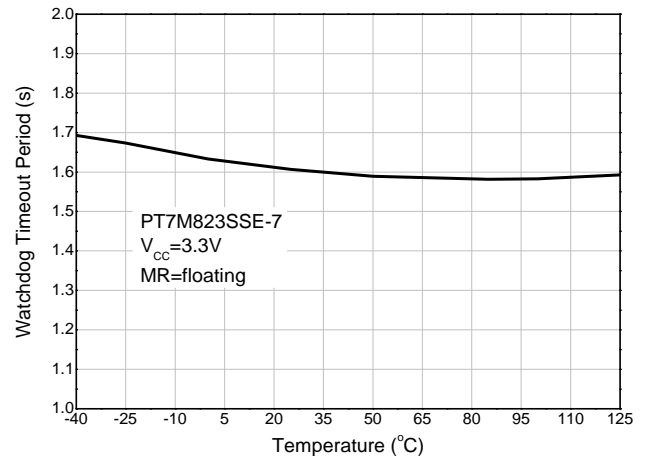
**Supply Current vs. Temperature**



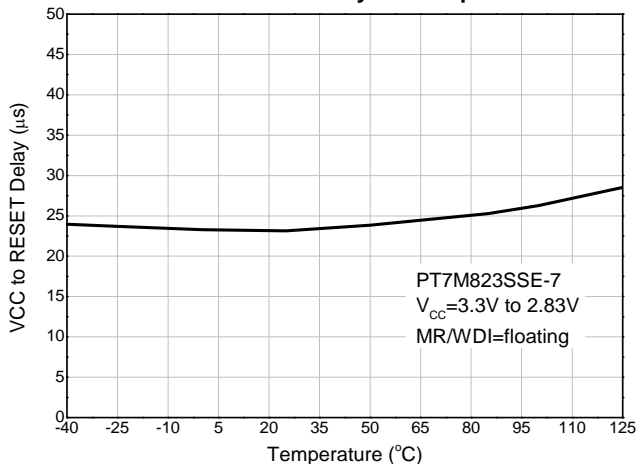
**Reset Pulse Width vs. Temperature**



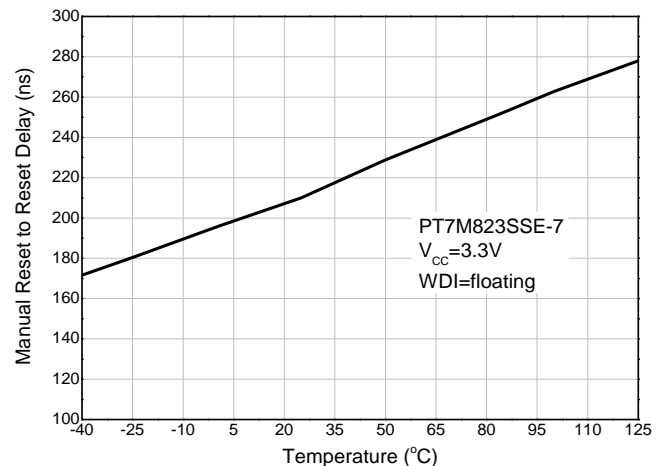
**Watchdog Timeout Period vs. Temperature**



**VCC to RESET Delay vs. Temperature**



**Manual Reset to Reset Propagation Delay vs. Temperature**

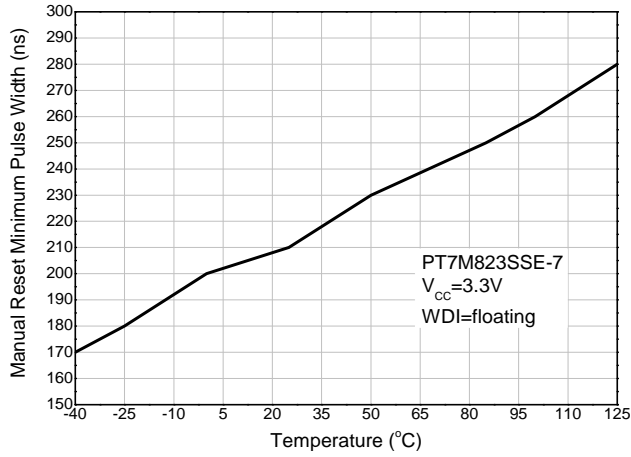




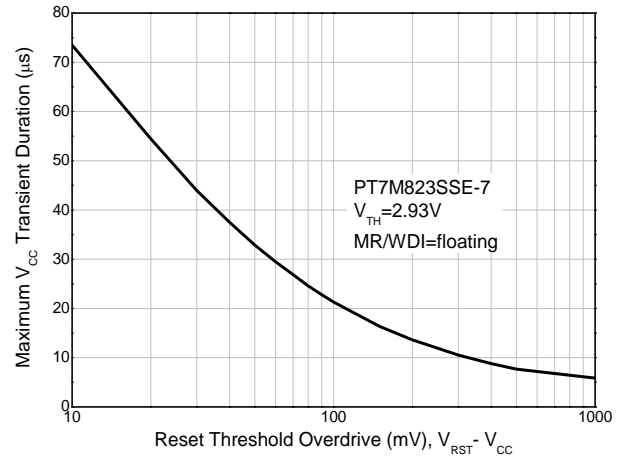
**Performance Characteristics** (continued)

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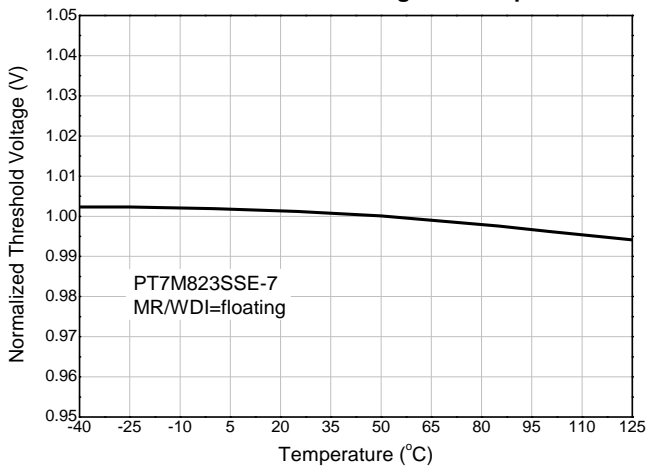
**Manual Reset Minimum Pulse Width vs. Temperature**



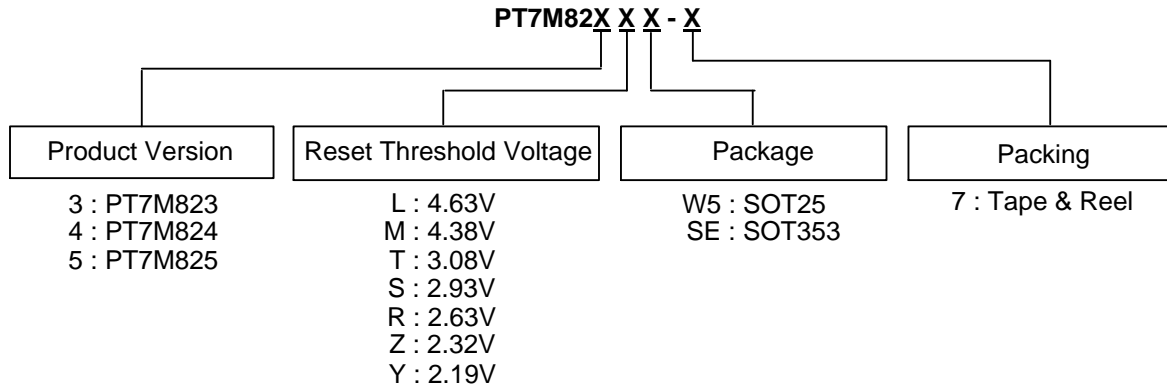
**Maximum V<sub>CC</sub> Transient Duration vs. Reset Threshold Overdrive**



**Normalized Threshold Voltage vs. Temperature**



**Ordering Information**



Part Number	Package Code	Package (Note 8)	7" Tape and Reel	
			Quantity	Part Number Suffix
PT7M823XW5-7	W5	SOT25	3000/Tape & Reel	-7
PT7M824XW5-7	W5	SOT25	3000/Tape & Reel	-7
PT7M825XW5-7	W5	SOT25	3000/Tape & Reel	-7
PT7M823XSE-7	SE	SOT353	3000/Tape & Reel	-7
PT7M824XSE-7	SE	SOT353	3000/Tape & Reel	-7
PT7M825XSE-7	SE	SOT353	3000/Tape & Reel	-7

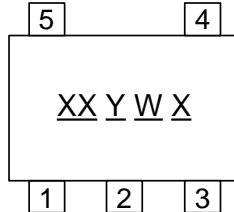
Note: 8. Pad layout as shown in Diodes Incorporated's package outline PDFs, which can be found on our website at <http://www.diodes.com/package-outlines.html>.

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**Marking Information**

(1) SOT25/SOT353

(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 : Internal code

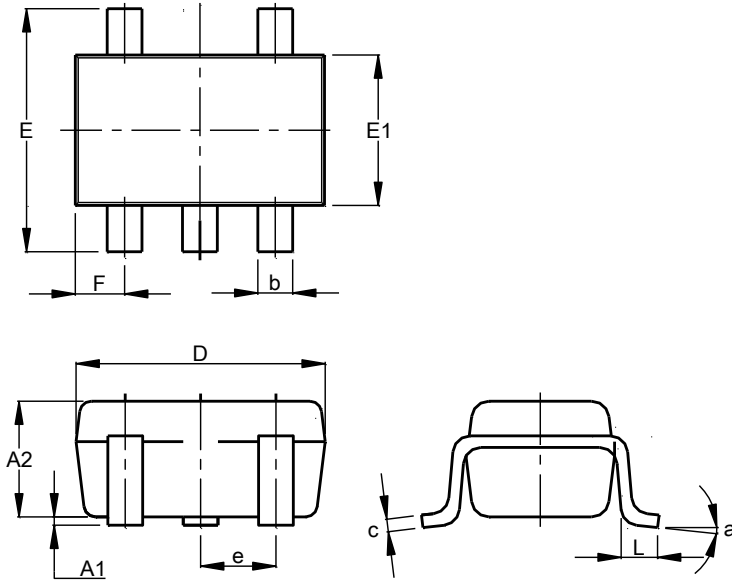
Part Number	Package	Identification Code
PT7M823LW5-7	SOT25	2A
PT7M823MW5-7	SOT25	2B
PT7M823TW5-7	SOT25	2C
PT7M823SW5-7	SOT25	2D
PT7M823RW5-7	SOT25	2E
PT7M823ZW5-7	SOT25	2F
PT7M823YW5-7	SOT25	2G
PT7M824LW5-7	SOT25	2H
PT7M824MW5-7	SOT25	2J
PT7M824TW5-7	SOT25	2K
PT7M824SW5-7	SOT25	2M
PT7M824RW5-7	SOT25	2N
PT7M824ZW5-7	SOT25	2P
PT7M824YW5-7	SOT25	2R
PT7M825LW5-7	SOT25	3A
PT7M825MW5-7	SOT25	3B
PT7M825TW5-7	SOT25	3C
PT7M825SW5-7	SOT25	3D
PT7M825RW5-7	SOT25	3E
PT7M825ZW5-7	SOT25	3F
PT7M825YW5-7	SOT25	3G
PT7M823LSE-7	SOT353	3H
PT7M823MSE-7	SOT353	3J
PT7M823TSE-7	SOT353	3K
PT7M823SSE-7	SOT353	3M
PT7M823RSE-7	SOT353	3N
PT7M823ZSE-7	SOT353	3P
PT7M823YSE-7	SOT353	3R
PT7M824LSE-7	SOT353	4A
PT7M824MSE-7	SOT353	4B
PT7M824TSE-7	SOT353	4C
PT7M824SSE-7	SOT353	4D
PT7M824RSE-7	SOT353	4E
PT7M824ZSE-7	SOT353	4F
PT7M824YSE-7	SOT353	4G
PT7M825LSE-7	SOT353	4H
PT7M825MSE-7	SOT353	4J
PT7M825TSE-7	SOT353	4K
PT7M825SSE-7	SOT353	4M
PT7M825RSE-7	SOT353	4N
PT7M825ZSE-7	SOT353	4P
PT7M825YSE-7	SOT353	4R

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**Package Outline Dimensions**

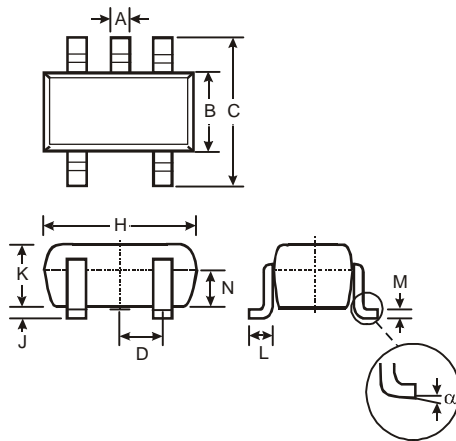
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(1) Package Type: SOT353



SOT353			
Dim	Min	Max	Typ
A1	0.00	0.10	0.05
A2	0.90	1.00	0.95
b	0.10	0.30	0.25
c	0.10	0.22	0.11
D	1.80	2.20	2.15
E	2.00	2.20	2.10
E1	1.15	1.35	1.30
e	0.650 BSC		
F	0.40	0.45	0.425
L	0.25	0.40	0.30
a	0°	8°	--
All Dimensions in mm			

(2) Package Type: SOT25



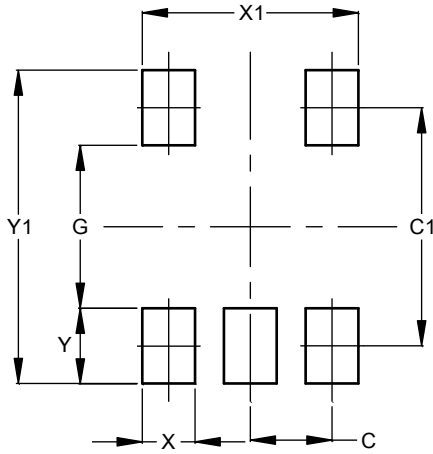
SOT25			
Dim	Min	Max	Typ
A	0.35	0.50	0.38
B	1.50	1.70	1.60
C	2.70	3.00	2.80
D	-	-	0.95
H	2.90	3.10	3.00
J	0.013	0.10	0.05
K	1.00	1.30	1.10
L	0.35	0.55	0.40
M	0.10	0.20	0.15
N	0.70	0.80	0.75
α	0°	8°	-
All Dimensions in mm			

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### Suggested Pad Layout

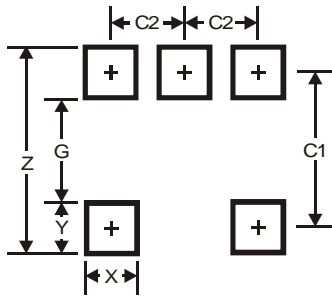
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(1) Package Type: SOT353



Dimensions	Value (in mm)
C	0.650
C1	1.900
G	1.300
X	0.420
X1	1.720
Y	0.600
Y1	2.500

(2) Package Type: SOT25



Dimensions	Value (in mm)
Z	3.20
G	1.60
X	0.55
Y	0.80
C1	2.40
C2	0.95

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A. Life support devices or systems are devices or systems which:

1. are intended to implant into the body, or
2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

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