

features

- Qualification in Accordance With AEC-Q100†
- Qualified for Automotive Applications
- Customer-Specific Configuration Control Can Be Supported Along With Major-Change Approval†
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Using Human Body Model (C = 100 pF, R = 1500 Ω)
- Power-On Reset Generator With Fixed Delay Time of 200 ms (TPS3823/4/5/8) or 25 ms (TPS3820)
- Manual Reset Input (TPS3820/3/5/8)
- Reset Output Available in Active-Low (TPS3820/3/4/5), Active-High (TPS3824) and Open-Drain (TPS3828)
- Supply Voltage Supervision Range 2.5 V, 3 V, 3.3 V, 5 V
- Watchdog Timer (TPS3820/3/4/8)
- Supply Current of 15 µA (Typ)
- SOT23-5 Package

applications

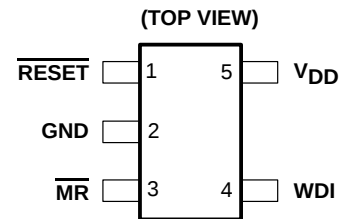
- Applications Using Automotive DSPs, Microcontrollers, or Microprocessors
- Industrial Equipment
- Programmable Controls
- Automotive Systems
- Battery-Powered Equipment
- Intelligent Instruments
- Wireless Communications Systems

† Contact factory for details. Q100 qualification data available on request.

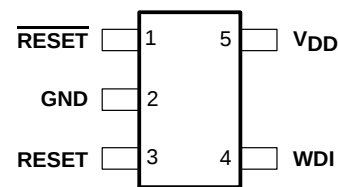
description

The TPS382x family of supervisors provides circuit initialization and timing supervision, primarily for DSP and processor-based systems.

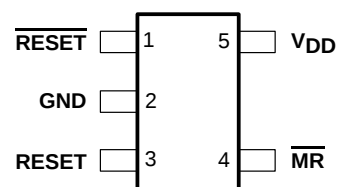
TPS3820, TPS3823, TPS3828 . . . DBV PACKAGE



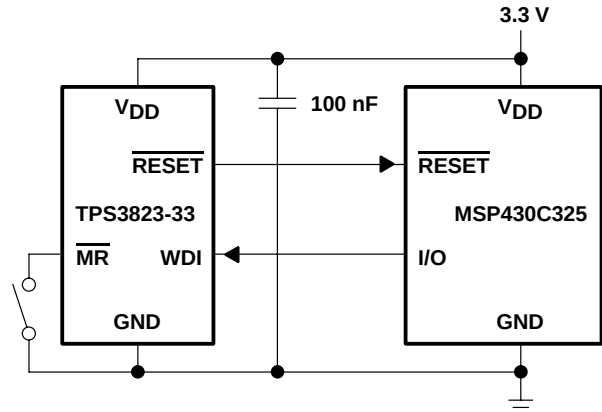
TPS3824 . . . DBV PACKAGE
(TOP VIEW)



TPS3825 . . . DBV PACKAGE
(TOP VIEW)



typical application



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2002 – 2003, Texas Instruments Incorporated

TPS3820-xx-Q1, TPS3823-xx-Q1, TPS3824-xx-Q1, TPS3825-xx-Q1, TPS3828-xx-Q1 PROCESSOR SUPERVISORY CIRCUITS

SGLS143A – DECEMBER 2002 – REVISED JANUARY 2003

description (continued)

During power-on, $\overline{\text{RESET}}$ is asserted when supply voltage V_{DD} becomes higher than 1.1 V. Thereafter, the supply voltage supervisor monitors V_{DD} and keeps $\overline{\text{RESET}}$ active as long as V_{DD} remains below the threshold voltage V_{IT-} . 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_{DD} has risen above the threshold voltage V_{IT-} . When the supply voltage drops below the threshold voltage V_{IT-} , the output becomes active (low) again. No external components are required. All the devices of this family have a fixed-sense threshold voltage V_{IT-} set by an internal voltage divider.

The TPS3820/3/5/8 devices incorporate a manual reset input, $\overline{\text{MR}}$. A low level at $\overline{\text{MR}}$ causes $\overline{\text{RESET}}$ to become active. The TPS3824/5 devices include a high-level output RESET. TPS3820/3/4/8 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, t_{tout} , $\overline{\text{RESET}}$ becomes active for the time period t_d . 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 TPS3820/3/4/8 is asserting $\overline{\text{RESET}}$, the TPS3820/3/4/8 does not return to a non-reset state when the input voltage is above V_t . If the application requires that input to WDI is active when $\overline{\text{RESET}}$ is asserted, WDI must be decoupled from the active signal. This can be accomplished by using an N-channel FET in series with the WDI pin, with the gate of the FET connected to the $\overline{\text{RESET}}$ output as shown in Figure 1.

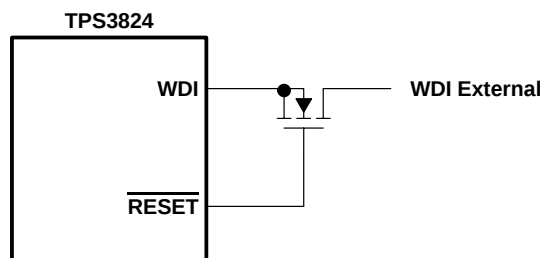


Figure 1

The product spectrum is designed for supply voltages of 2.5 V, 3 V, 3.3 V, and 5 V. The circuits are available in a 5-pin SOT23-5 package. The TPS382x-xxQ-Q1 devices are characterized for operation over a temperature range of -40°C to 125°C , and are qualified in accordance with AEC-Q100 stress test qualification for integrated circuits.

TPS3820-xx-Q1, TPS3823-xx-Q1, TPS3824-xx-Q1, TPS3825-xx-Q1, TPS3828-xx-Q1 PROCESSOR SUPERVISORY CIRCUITS

SGLS143A – DECEMBER 2002 – REVISED JANUARY 2003

PACKAGE INFORMATION

DEVICE NAME	THRESHOLD VOLTAGE	MARKING
TPS3820-33QDBVRQ1 [†]	2.93 V	PDEQ
TPS3820-50QDBVRQ1 [†]	4.55 V	PDDQ
TPS3823-25QDBVRQ1 [†]	2.25 V	PAPQ
TPS3823-30QDBVRQ1 [†]	2.63 V	PAQQ
TPS3823-33QDBVRQ1 [†]	2.93 V	PARQ
TPS3823-50QDBVRQ1 [†]	4.55 V	PASQ
TPS3824-25QDBVRQ1 [†]	2.25 V	PATQ
TPS3824-30QDBVRQ1 [†]	2.63 V	PAUQ
TPS3824-33QDBVRQ1 [†]	2.93 V	PAVQ
TPS3824-50QDBVRQ1 [†]	4.55 V	PAWQ
TPS3825-33QDBVRQ1 [†]	2.93 V	PDGQ
TPS3825-50QDBVRQ1 [†]	4.55 V	PDFQ
TPS3828-33QDBVRQ1 [†]	2.93 V	PDIQ
TPS3828-50QDBVRQ1 [†]	4.55 V	PDHQ

[†] The DBVR package indicates tape and reel of 3000 parts.

FUNCTION/TRUTH TABLE

INPUTS		OUTPUTS	
$\overline{MR}^{\ddagger}$	$V_{DD} > V_{IT}$	$\overline{RESET}$	$RESET^{\S}$
L	0	L	H
L	1	L	H
H	0	L	H
H	1	H	L

[‡] TPS3820/3/5/8

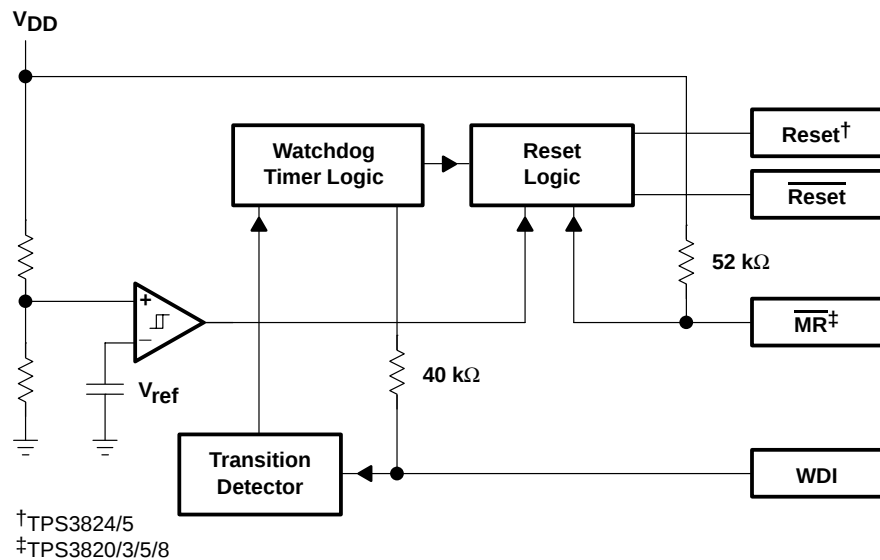
[§] TPS3824/5



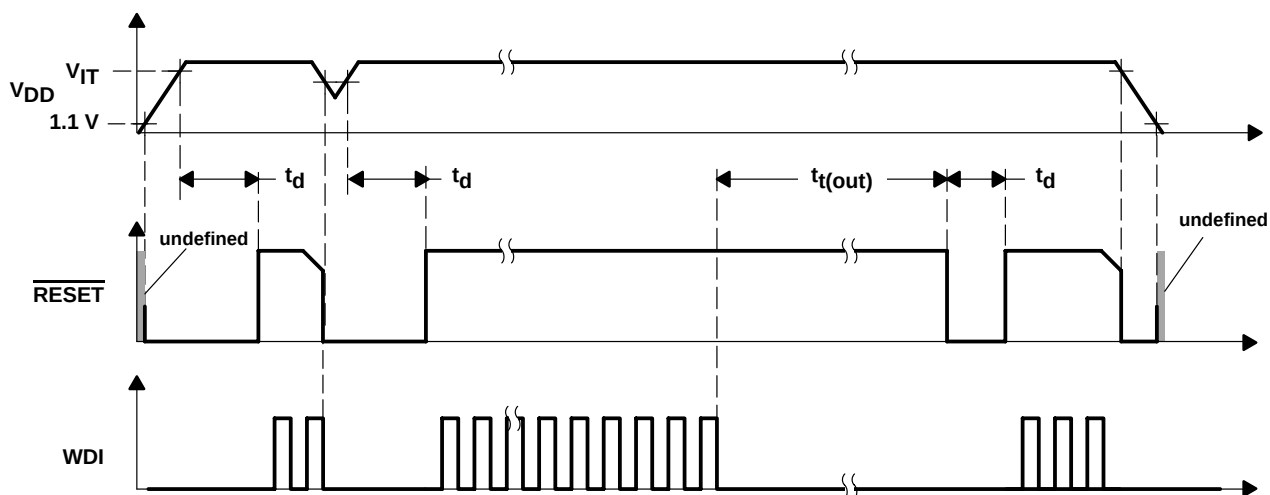
TPS3820-xx-Q1, TPS3823-xx-Q1, TPS3824-xx-Q1, TPS3825-xx-Q1, TPS3828-xx-Q1
PROCESSOR SUPERVISORY CIRCUITS

SGLS143A – DECEMBER 2002 – REVISED JANUARY 2003

functional block diagram



timing diagram



TPS3820-xx-Q1, TPS3823-xx-Q1, TPS3824-xx-Q1, TPS3825-xx-Q1, TPS3828-xx-Q1 PROCESSOR SUPERVISORY CIRCUITS

SGLS143A – DECEMBER 2002 – REVISED JANUARY 2003

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage, V_{DD} (see Note 1)	6 V
RESET, $\overline{\text{RESET}}$, MR, WDI (see Note 1)	–0.3 V to ($V_{DD} + 0.3$ V)
Maximum low output current, I_{OL}	5 mA
Maximum high output current, I_{OH}	–5 mA
Input clamp current range, I_{IK} ($V_I < 0$ or $V_I > V_{DD}$)	± 10 mA
Output clamp current range, I_{OK} ($V_O < 0$ or $V_O > V_{DD}$)	± 10 mA
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A	–40°C to 125°C
Storage temperature range, T_{Stg}	–65°C to 150°C
Soldering temperature	260°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.

NOTE 1: All voltage values are with respect to GND.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	OPERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
DBV	437 mW	3.5 mW/°C	280 mW	227 mW	87 mW

recommended operating conditions

	MIN	MAX	UNIT
Supply voltage, V_{DD}	1.1	5.5	V
Input voltage, V_I	0	$V_{DD} + 0.3$	V
High-level input voltage at $\overline{\text{MR}}$ and WDI, V_{IH}	$0.7 \times V_{DD}$		V
Low-level input voltage, V_{IL}		$0.3 \times V_{DD}$	V
Input transition rise and fall rate at $\overline{\text{MR}}$ or WDI, $\Delta t/\Delta V$		100	ns/V
Operating free-air temperature range, T_A	–40	125	°C



TPS3820-xx-Q1, TPS3823-xx-Q1, TPS3824-xx-Q1, TPS3825-xx-Q1, TPS3828-xx-Q1 PROCESSOR SUPERVISORY CIRCUITS

SGLS143A – DECEMBER 2002 – REVISED JANUARY 2003

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT	
V _{OH} High-level output voltage	$\overline{\text{RESET}}$	TPS382x-25	V _{DD} = V _{IT−} + 0.2 V I _{OH} = −20 μA	0.8 × V _{DD}			V	
		TPS382x-30 TPS382x-33	V _{DD} = V _{IT−} + 0.2 V I _{OH} = −30 μA					
		TPS382x-50	V _{DD} = V _{IT−} + 0.2 V I _{OH} = −120 μA	V _{DD} − 1.5 V				
	RESET	TPS3824-25 TPS3825-25	V _{DD} ≥ 1.8 V, I _{OH} = −100 μA	0.8 × V _{DD}			V	
		TPS3824-30 TPS3825-30	V _{DD} ≥ 1.8 V, I _{OH} = −150 μA					
		TPS3824-33 TPS3825-33						
		TPS3824-50 TPS3825-50						
	V _{OL} Low-level output voltage	RESET	TPS3824-25 TPS3825-25	V _{DD} = V _{IT−} + 0.2 V I _{OL} = 1 mA	0.4			V
TPS3824-30 TPS3825-30			V _{DD} = V _{IT−} + 0.2 V I _{OL} = 1.2 mA					
TPS3824-33 TPS3825-33								
TPS3824-50 TPS3825-50			V _{DD} = V _{IT−} + 0.2 V I _{OL} = 3 mA					
$\overline{\text{RESET}}$		TPS382x-25	V _{DD} = V _{IT−} − 0.2 V I _{OL} = 1 mA	0.45			V	
		TPS382x-30 TPS382x-33	V _{DD} = V _{IT−} − 0.2 V I _{OL} = 1.2 mA					
		TPS382x-50	V _{DD} = V _{IT−} − 0.2 V I _{OL} = 3 mA					
		Power-up reset voltage (see Note 2)						
V _{IT−} Negative-going input threshold voltage (see Note 3)			TPS382x-25	T _A = 0°C to 85°C	2.21	2.25	2.30	V
			TPS382x-30		2.59	2.63	2.69	
			TPS382x-33		2.88	2.93	3	
			TPS382x-50		4.49	4.55	4.64	
			TPS382x-25	T _A = −40°C to 125°C	2.19	2.25	2.30	V
			TPS382x-30		2.55	2.63	2.69	
			TPS382x-33		2.84	2.93	3	
			TPS382x-50		4.44	4.55	4.65	
V _{hys} Hysteresis at V _{DD} input			TPS382x-25		30			mV
			TPS382x-30					
			TPS382x-33					
		TPS382x-50		50				

NOTES: 2. The lowest supply voltage at which $\overline{\text{RESET}}$ becomes active. $t_r, V_{DD} \geq 15 \mu\text{s/V}$

3. To ensure best stability of the threshold voltage, a bypass capacitor (ceramic, $0.1 \mu\text{F}$) should be placed near the supply terminals.



TPS3820-xx-Q1, TPS3823-xx-Q1, TPS3824-xx-Q1, TPS3825-xx-Q1, TPS3828-xx-Q1 PROCESSOR SUPERVISORY CIRCUITS

SGLS143A – DECEMBER 2002 – REVISED JANUARY 2003

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted) (continued)

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
I _{IH(AV)}	Average high-level input current	WDI	WDI = V _{DD} , time average (dc = 88%)		120		μA
I _{IL(AV)}	Average low-level input current		WDI = 0.3 V, V _{DD} = 5.5 V time average (dc = 12%)		−15		
I _{IH}	High-level input current	WDI	WDI = V _{DD}		140	190	
		$\overline{MR}$	$\overline{MR}$ = V _{DD} × 0.7, V _{DD} = 5.5 V		−40	−60	
I _{IL}	Low-level input current	WDI	WDI = 0.3 V, V _{DD} = 5.5 V		140	190	
		$\overline{MR}$	$\overline{MR}$ = 0.3 V, V _{DD} = 5.5 V		−110	−160	
I _{OS}	Output short-circuit current (see Note 4)	$\overline{RESET}$	TPS382x-25	V _{DD} = V _{IT} , max + 0.2 V, V _O = 0 V			μA
			TPS382x-30				
			TPS382x-33				
			TPS382x-50				
I _{DD}	Supply current		WDI and $\overline{MR}$ unconnected, Outputs unconnected		15	25	μA
	Internal pullup resistor at $\overline{MR}$				52		kΩ
C _i	Input capacitance at $\overline{MR}$, WDI		V _I = 0 V to 5.5 V		5		pF

NOTE 4: The $\overline{RESET}$ short-circuit current is the maximum pullup current when $\overline{RESET}$ is driven low by a μP bidirectional reset pin.

timing requirements at $R_L = 1 M\Omega$, $C_L = 50 pF$, $T_A = 25^\circ C$

PARAMETER		TEST CONDITIONS	MIN	MAX	UNIT
t_w	Pulse width	at V_{DD}	$V_{DD} = V_{IT-} + 0.2 V$, $V_{DD} = V_{IT-} - 0.2 V$		6 μs
		at $\overline{MR}$	$V_{DD} \geq V_{IT-} + 0.2 V$, $V_{IL} = 0.3 \times V_{DD}$, $V_{IH} = 0.7 \times V_{DD}$		1 μs
		at WDI	$V_{DD} \geq V_{IT-} + 0.2 V$, $V_{IL} = 0.3 \times V_{DD}$, $V_{IH} = 0.7 \times V_{DD}$		100 ns

switching characteristics at $R_L = 1 M\Omega$, $C_L = 50 pF$, $T_A = 25^\circ C$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{out}	Watchdog time out	TPS3820	112	200	310	ms
		TPS3823/4/8	0.9	1.6	2.5	s
t_d	Delay time	TPS3820	15	25	37	ms
		TPS3823/4/5/8	120	200	300	
t_{PHL}	Propagation (delay) time, high-to-low-level output	$\overline{MR}$ to $\overline{RESET}$ delay (TPS3820/3/5/8)	$V_{DD} \geq V_{IT-} + 0.2 V$, $V_{IL} = 0.3 \times V_{DD}$, $V_{IH} = 0.7 \times V_{DD}$		0.1	μs
		V_{DD} to $\overline{RESET}$ delay	$V_{IL} = V_{IT-} - 0.2 V$, $V_{IH} = V_{IT-} + 0.2 V$		25	
t_{PLH}	Propagation (delay) time, low-to-high-level output	$\overline{MR}$ to $\overline{RESET}$ delay (TPS3824/5)	$V_{DD} \geq V_{IT-} + 0.2 V$, $V_{IL} = 0.3 \times V_{DD}$, $V_{IH} = 0.7 \times V_{DD}$		0.1	μs
		V_{DD} to $\overline{RESET}$ delay (TPS3824/5)	$V_{IL} = V_{IT-} - 0.2 V$, $V_{IH} = V_{IT-} + 0.2 V$		25	



TPS3820-xx-Q1, TPS3823-xx-Q1, TPS3824-xx-Q1, TPS3825-xx-Q1, TPS3828-xx-Q1 PROCESSOR SUPERVISORY CIRCUITS

SGLS143A – DECEMBER 2002 – REVISED JANUARY 2003

TYPICAL CHARACTERISTICS

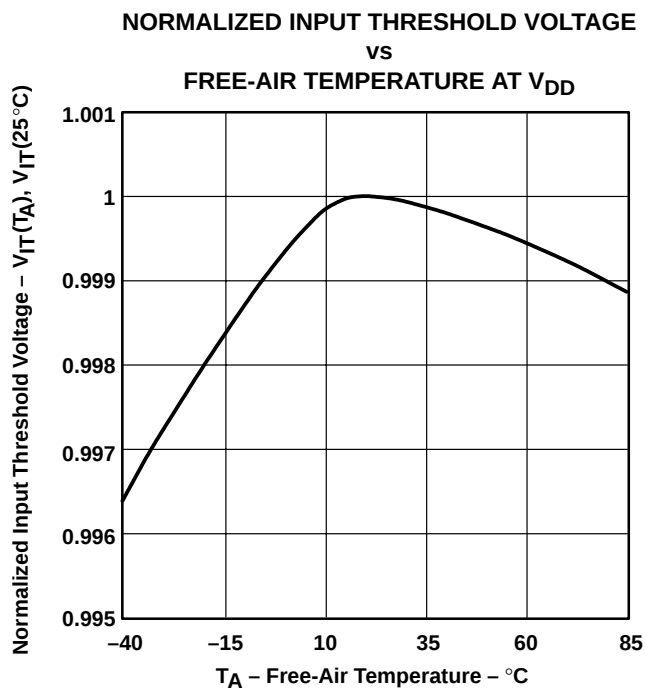


Figure 2

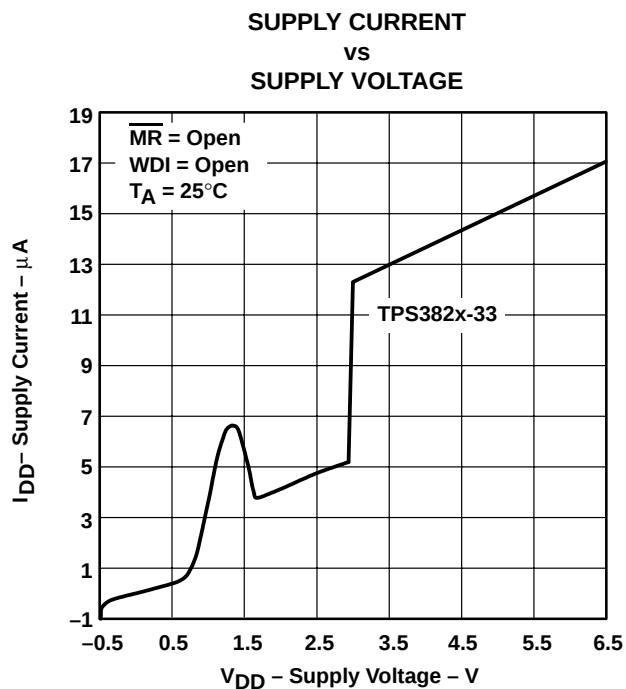


Figure 3

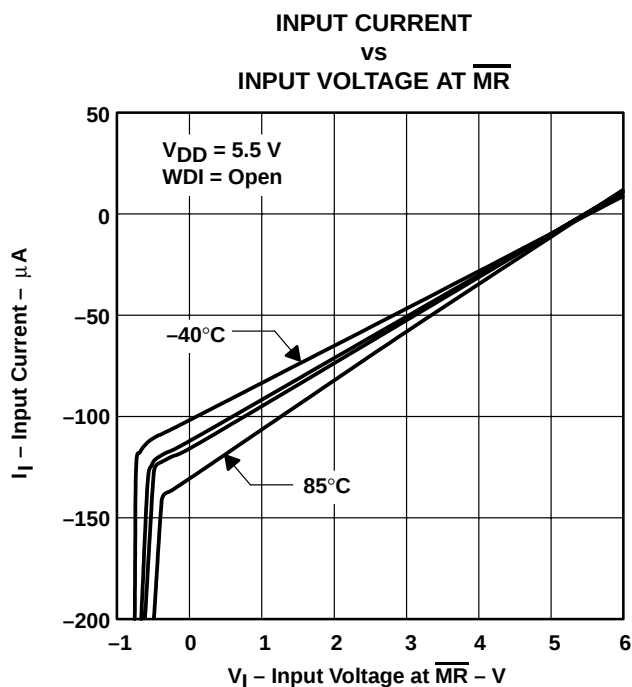


Figure 4

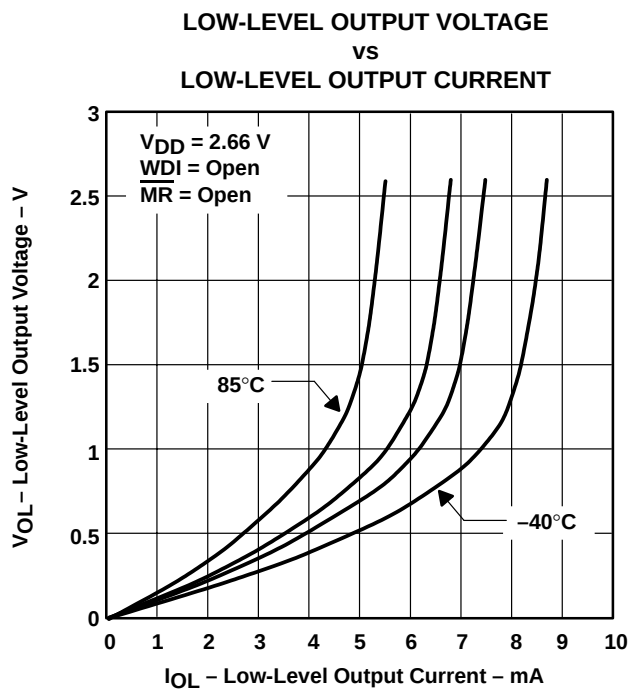


Figure 5

TYPICAL CHARACTERISTICS

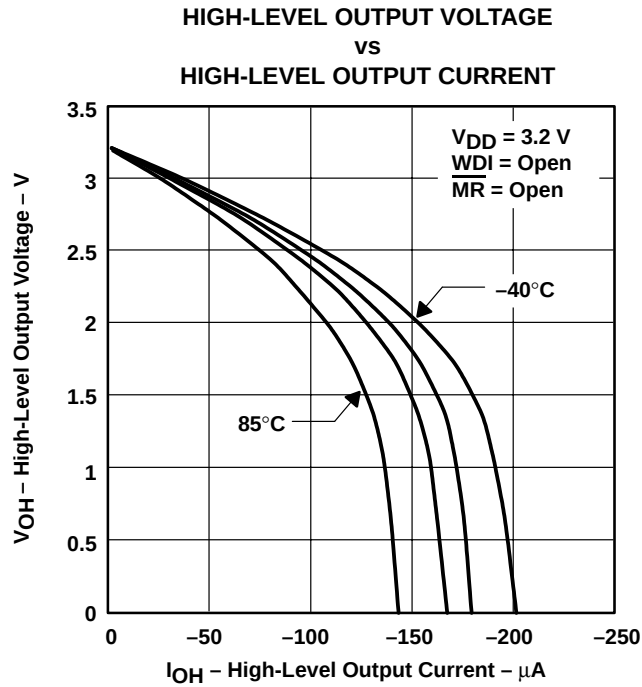


Figure 6

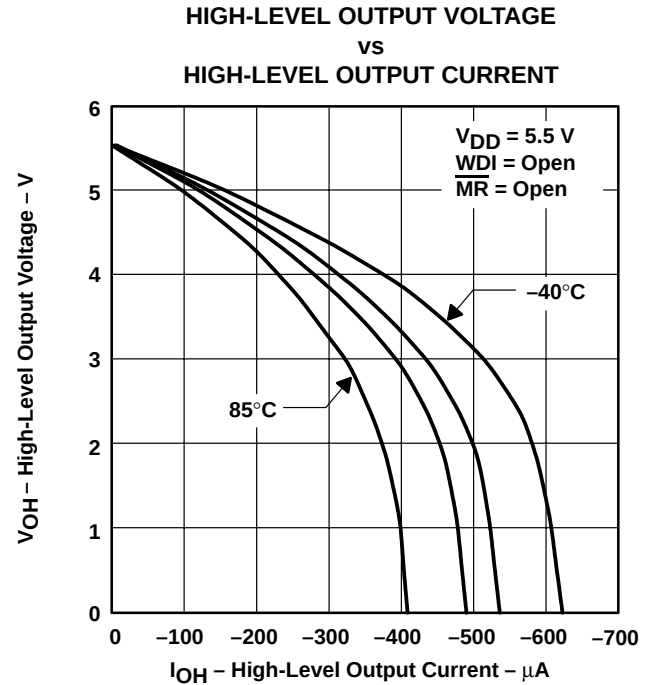


Figure 7

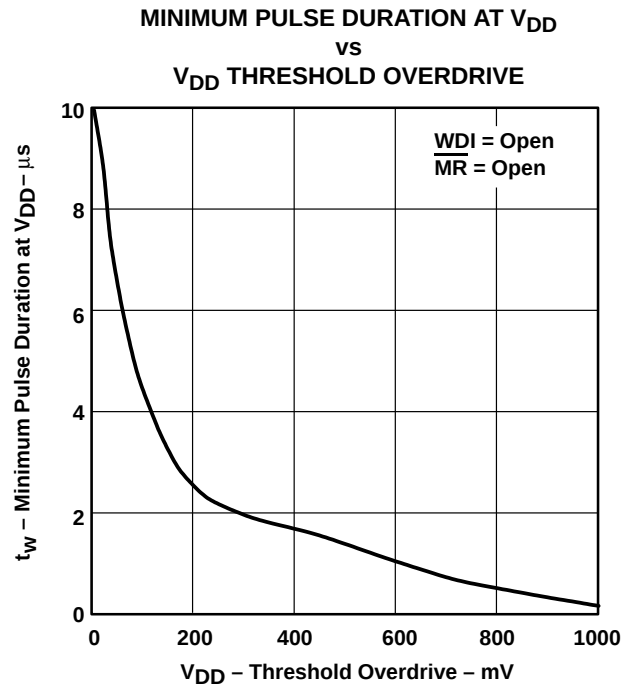


Figure 8

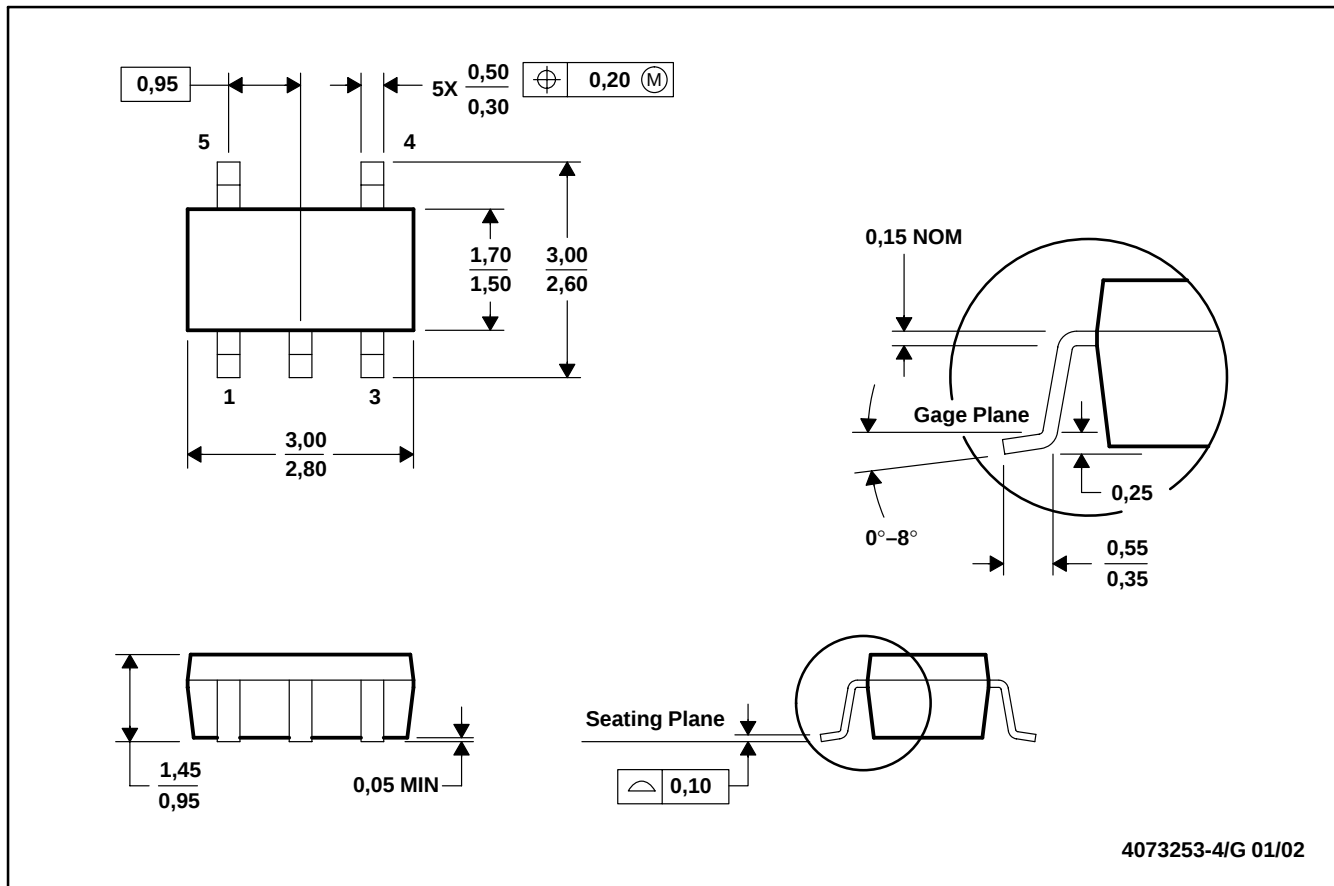
TPS3820-xx-Q1, TPS3823-xx-Q1, TPS3824-xx-Q1, TPS3825-xx-Q1, TPS3828-xx-Q1
PROCESSOR SUPERVISORY CIRCUITS

SGLS143A – DECEMBER 2002 – REVISED JANUARY 2003

MECHANICAL DATA

DBV (R-PDSO-G5)

PLASTIC SMALL-OUTLINE



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
D. Falls within JEDEC MO-178

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TPS3820-33QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3820-50QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3823-25QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3823-30QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3823-33QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3823-50QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3824-25QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3824-30QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3824-33QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3824-50QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3825-33QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3825-50QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3828-33QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3828-50QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBsolete: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Green (RoHS & no Sb/Br): TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

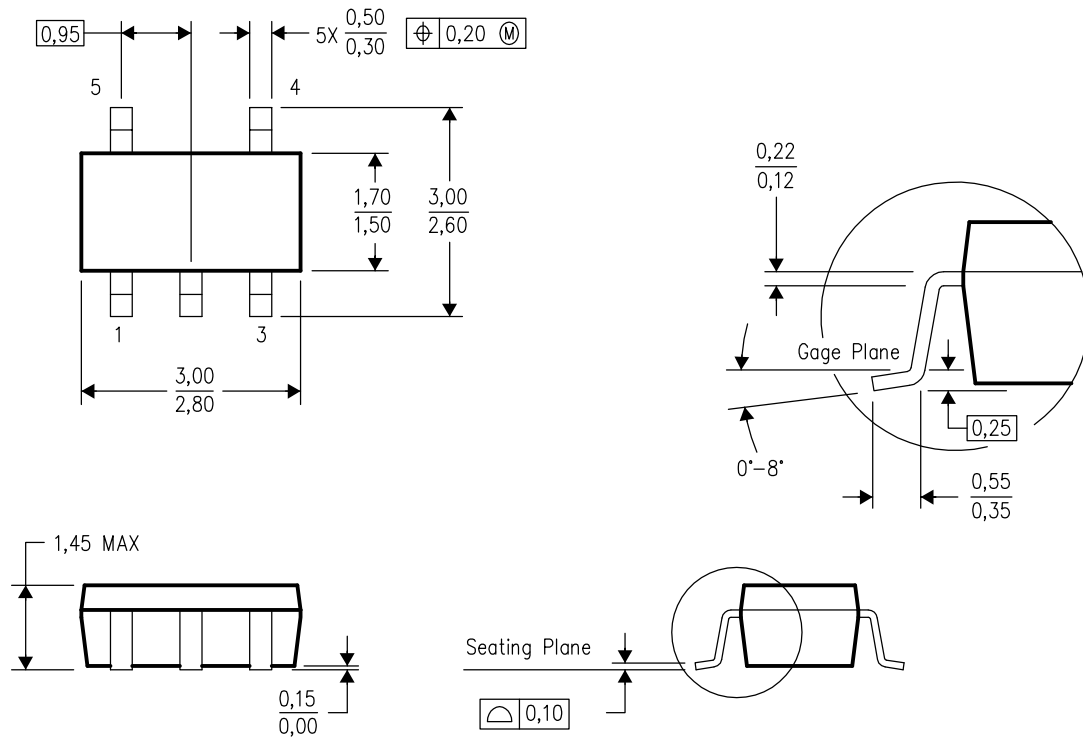
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

DBV (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE



4073253-4/H 10/2003

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion.
 - D. Falls within JEDEC MO-178 Variation AA.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

Copyright © 2005, Texas Instruments Incorporated