

- 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; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Supply Current of 220 nA (Typ)
- Precision Supply Voltage Supervision Range: 1.8 V, 2.5 V, 3.0 V, 3.3 V
- Power-On Reset Generator With Selectable Delay Time of 10 ms or 200 ms
- Push/Pull $\overline{\text{RESET}}$ Output (TPS3836), RESET Output (TPS3837), or Open-Drain $\overline{\text{RESET}}$ Output (TPS3838)
- Manual Reset
- 5-Pin SOT-23 Package
- Temperature Range -40°C to 125°C

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

- Applications Include
 - Applications Using Automotive Low-Power DSPs, Microcontrollers, or Microprocessors
 - Battery-Powered Equipment
 - Intelligent Instruments
 - Wireless Communication Systems
 - Automotive Systems

description

The TPS3836, TPS3837, TPS3838 families of supervisory circuits provide circuit initialization and timing supervision, primarily for DSP and processor-based systems.

During power on, $\overline{\text{RESET}}$ is asserted when the supply voltage V_{DD} becomes higher than 1.1 V. Thereafter, the supervisory circuit monitors V_{DD} and keeps $\overline{\text{RESET}}$ output 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 starts after V_{DD} has risen above the threshold voltage V_{IT} .

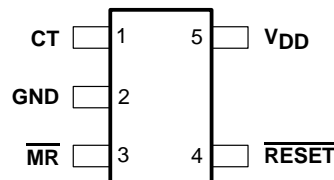
When CT is connected to GND a fixed delay time of typical 10 ms is asserted. When connected to V_{DD} the delay time is typically 200 ms.

When the supply voltage drops below the threshold voltage V_{IT} , the output becomes active (low) again.

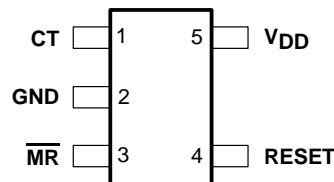
All the devices of this family have a fixed-sense threshold voltage V_{IT} set by an internal voltage divider.

The TPS3836 has an active-low push-pull $\overline{\text{RESET}}$ output. The TPS3837 has active-high push-pull RESET, and TPS3838 integrates an active-low open-drain $\overline{\text{RESET}}$ output.

TPS3836, TPS3838
 DBV PACKAGE
 (TOP VIEW)



TPS3837
 DBV PACKAGE
 (TOP VIEW)

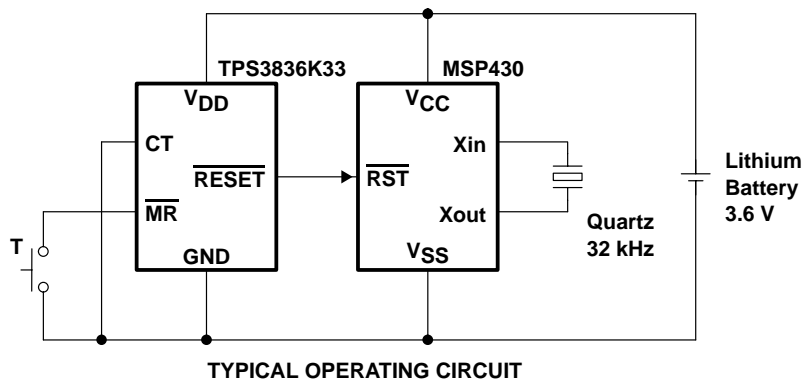


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

TPS3836E18-Q1 / J25-Q1 / H30-Q1 / L30-Q1 / K33-Q1
TPS3837E18-Q1 / J25-Q1 / L30-Q1 / K33-Q1, TPS3838E18-Q1 / J25-Q1 / L30-Q1 / K33-Q1
NANOPOWER SUPERVISORY CIRCUITS

SGLS141 – DECEMBER 2002

description (continued)



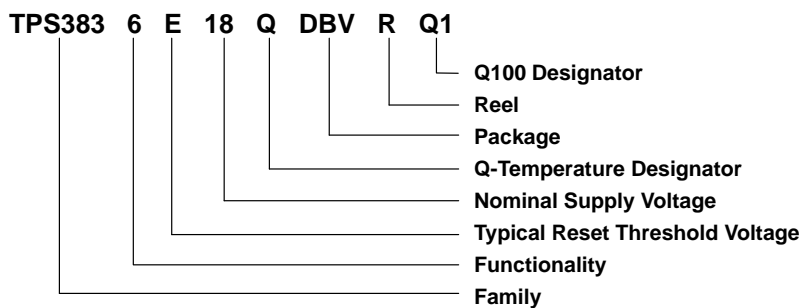
The product spectrum is designed for supply voltages of 1.8 V, 2.5 V, 3 V, and 3.3 V. The circuits are available in a 5-pin SOT-23 package. The TPS3836-Q-Q1, TPS3837-Q-Q1, TPS3838-Q-Q1 families are characterized for operation over a temperature range of -40°C to 125°C , and qualified in accordance with AEC-Q100 stress test qualification for integrated circuits.

PACKAGE INFORMATION

T_A	DEVICE NAME	THRESHOLD VOLTAGE	SYMBOL
-40°C to 125°C	TPS3836E18QDBVRQ1†	1.71 V	PDNQ
	TPS3836J25QDBVRQ1†	2.25 V	PDSQ
	TPS3836H30QDBVRQ1†	2.79 V	PHRQ
	TPS3836L30QDBVRQ1†	2.64 V	PCAQ
	TPS3836K33QDBVRQ1†	2.93 V	PDTQ
	TPS3837E18QDBVRQ1†	1.71 V	PDOQ
	TPS3837J25QDBVRQ1†	2.25 V	PDRQ
	TPS3837L30QDBVRQ1†	2.64 V	PCBQ
	TPS3837K33QDBVRQ1†	2.93 V	PDUQ
	TPS3838E18QDBVRQ1†	1.71 V	PDQQ
	TPS3838J25QDBVRQ1†	2.25 V	PDPQ
	TPS3838L30QDBVRQ1†	2.64 V	PCCQ
	TPS3838K33QDBVRQ1†	2.93 V	PDVQ

† The DBVR passive indicates tape and reel of 3000 parts.

ORDERING INFORMATION



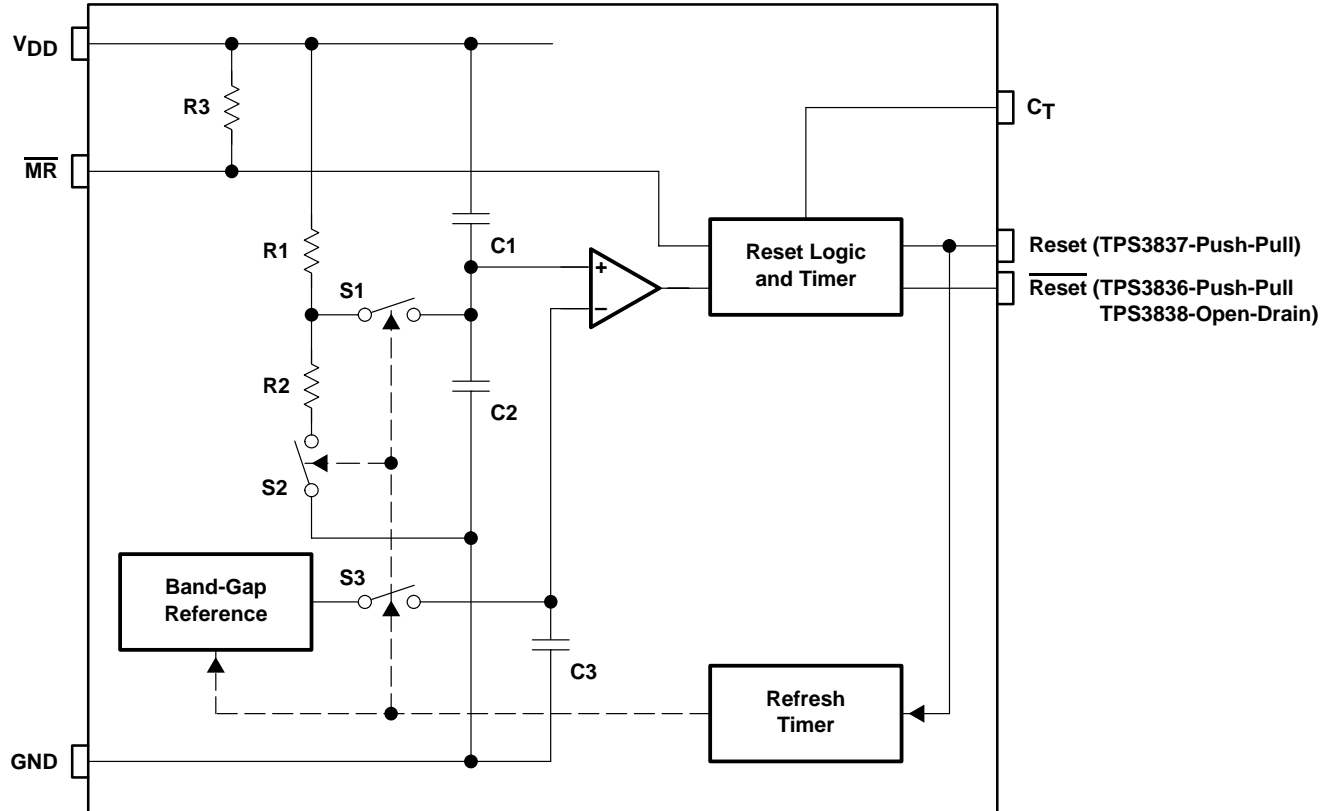
FUNCTION TABLE TPS3836, TPS3837, TPS3838

$\overline{\text{MR}}$	$V_{\text{DD}} > V_{\text{IT}}$	$\overline{\text{RESET}}^\dagger$	RESET^\ddagger
L	0	L	H
L	1	L	H
H	0	L	H
H	1	H	L

† TPS3836 and TPS3838

‡ TPS3837

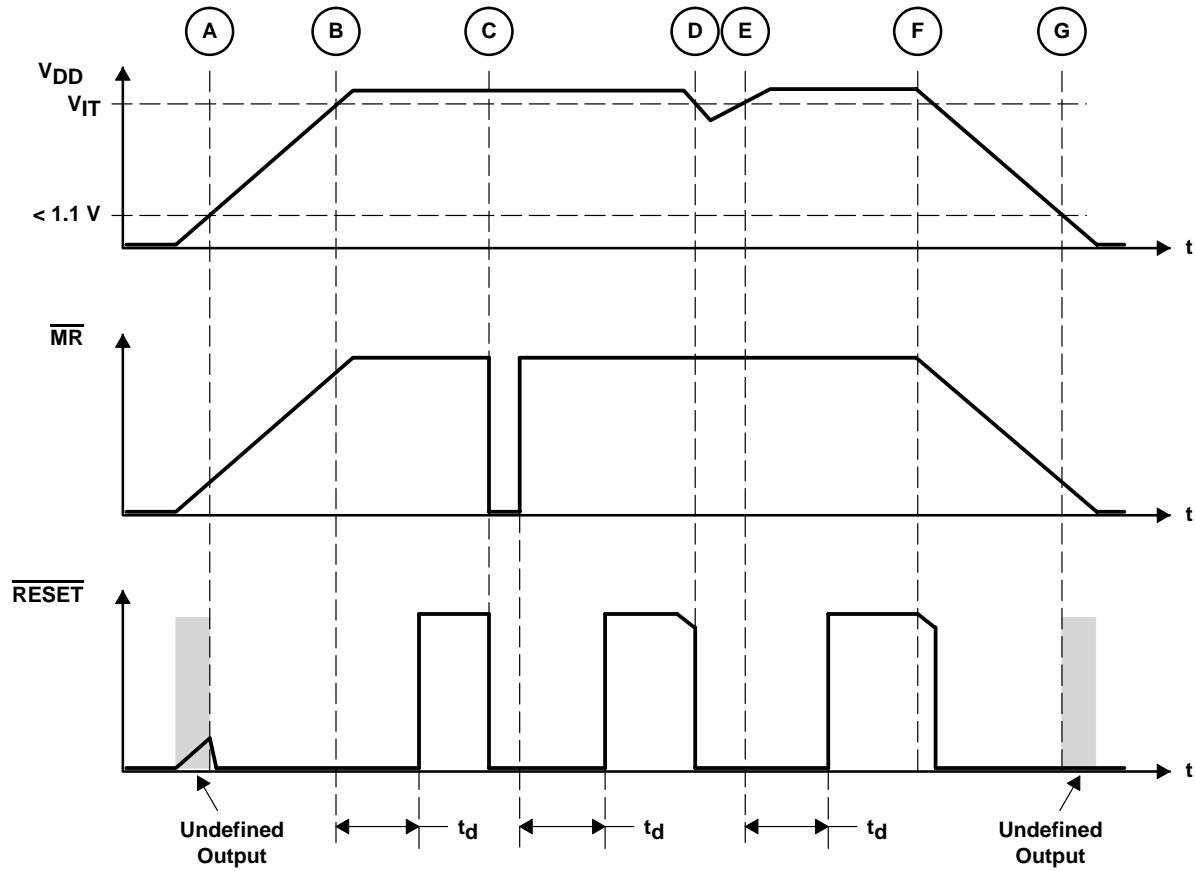
functional block diagram



TPS3836E18-Q1 / J25-Q1 / H30-Q1 / L30-Q1 / K33-Q1
 TPS3837E18-Q1 / J25-Q1 / L30-Q1 / K33-Q1, TPS3838E18-Q1 / J25-Q1 / L30-Q1 / K33-Q1
 NANOPOWER SUPERVISORY CIRCUITS

SGLS141 – DECEMBER 2002

timing diagram



TPS3836E18-Q1 / J25-Q1 / H30-Q1 / L30-Q1 / K33-Q1
TPS3837E18-Q1 / J25-Q1 / L30-Q1 / K33-Q1, TPS3838E18-Q1 / J25-Q1 / L30-Q1 / K33-Q1
NANOPOWER SUPERVISORY CIRCUITS

SGLS141 – DECEMBER 2002

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

Supply voltage, V_{DD} (see Note 1)	7 V
All other pins (see Note 1)	–0.3 V to 7 V
Maximum low output current, I_{OL}	5 mA
Maximum high output current, I_{OH}	–5 mA
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{DD}$)	±10 mA
Output clamp current, 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. For reliable operation, the device must not be operated at 7 V for more than $t=1000$ h continuously

DISSIPATION RATING TABLE

PACKAGE	$T_A < 25^\circ\text{C}$ POWER RATING	DERATING 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 at specified temperature range

	MIN	MAX	UNIT
Supply voltage, V_{DD}	1.6	6	V
Input voltage, V_I	0	$V_{DD} + 0.3$	V
High-level input voltage, 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 MR, $\Delta t/\Delta V$		100	ns/V
Operating free-air temperature range, T_A	–40	125	°C



electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITION		MIN	TYP	MAX	UNIT
V _{OH}	High-level output voltage	$\overline{\text{RESET}}$ (TPS3836)	V _{DD} = 3.3 V, I _{OH} = -2 mA	0.8 × V _{DD}			V
			V _{DD} = 6 V, I _{OH} = -3 mA				
		$\overline{\text{RESET}}$ (TPS3837)	V _{DD} = 1.8 V, I _{OH} = -1 mA				
			V _{DD} = 3.3 V, I _{OL} = -2 mA				
V _{OL}	Low-level output voltage	$\overline{\text{RESET}}$ (TPS3836/8)	V _{DD} = 1.8 V, I _{OL} = 1 mA			0.4	V
			V _{DD} = 3.3 V, I _{OL} = 2 mA				
		$\overline{\text{RESET}}$ (TPS3837)	V _{DD} = 3.3 V, I _{OL} = 2 mA				
			V _{DD} = 6 V, I _{OL} = 3 mA				
Power-up reset voltage (see Note 2)		TPS3836/8	V _{DD} ≥ 1.1 V, I _{OL} = 50 μA			0.2	V
		TPS3837	V _{DD} ≥ 1.1 V, I _{OH} = -50 μA	0.8 × V _{DD}			
V _{IT}	Negative-going input threshold voltage (see Note 3)	TPS383xE18		1.64	1.71	1.76	V
		TPS383xJ25		2.16	2.25	2.30	
		TPS383xH30		2.70	2.79	2.85	
		TPS383xL30		2.54	2.64	2.71	
		TPS383xK33		2.82	2.93	3.10	
V _{hys}	Hysteresis at V _{DD} input		1.7 V < V _{IT} < 2.5 V		30		mV
			2.5 V < V _{IT} < 3.5 V		40		
			3.5 V < V _{IT} < 5 V		50		
I _{IH}	High-level input current	$\overline{\text{MR}}$ (see Note 4)	$\overline{\text{MR}} = 0.7 \times V_{DD}$, V _{DD} = 6 V	-40	-60	-100	μA
		CT	CT = V _{DD} = 6 V	-25		25	nA
I _{IL}	Low-level input current	$\overline{\text{MR}}$ (see Note 4)	$\overline{\text{MR}} = 0$ V, V _{DD} = 6 V	-130	-200	-340	μA
		CT	CT = 0 V, V _{DD} = 6 V	-25		25	nA
I _{OH}	High-level output current	TPS3838	V _{DD} = V _{IT} + 0.2 V, V _{OH} = V _{DD}			25	nA
I _{DD}	Supply current		V _{DD} > V _{IT} , V _{DD} < 3 V		220	500	nA
			V _{DD} > V _{IT} , V _{DD} > 3 V		250	550	nA
			V _{DD} < V _{IT}		10	25	μA
	Internal pullup resistor at $\overline{\text{MR}}$				30		kΩ
C _I	Input capacitance at $\overline{\text{MR}}$, CT		V _I = 0 V to V _{DD}		5		pF

- NOTES: 2. The lowest voltage at which $\overline{\text{RESET}}$ output becomes active. t_r, V_{DD} ≥ 15 μs/V
 3. To ensure best stability of the threshold voltage, a bypass capacitor (ceramic, 0.1 μF) should be placed near the supply terminal.
 4. If manual reset is unused, $\overline{\text{MR}}$ should be connected to V_{DD} to minimize current consumption.



TPS3836E18-Q1 / J25-Q1 / H30-Q1 / L30-Q1 / K33-Q1
TPS3837E18-Q1 / J25-Q1 / L30-Q1 / K33-Q1, TPS3838E18-Q1 / J25-Q1 / L30-Q1 / K33-Q1
NANOPOWER SUPERVISORY CIRCUITS

SGLS141 – DECEMBER 2002

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_w	Pulse width	$V_{IH} = V_{IT} + 0.2\text{ V}$, $V_{IL} = V_{IT} - 0.2\text{ V}$	6			μs
		$V_{DD} \geq V_{IT} + 0.2\text{ V}$, $V_{IL} = 0.3 \times V_{DD}$, $V_{IH} = 0.7 \times V_{DD}$	1			μs

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_d	Delay time	$V_{DD} \geq V_{IT} + 0.2\text{ V}$, $MR = 0.7 \times V_{DD}$, $CT = \text{GND}$, See timing diagram	5	10	15	ms
		$V_{DD} \geq V_{IT} + 0.2\text{ V}$, $MR = 0.7 \times V_{DD}$, $CT = V_{DD}$, See timing diagram	100	200	300	
t_{PHL}	Propagation (delay) time, high-to-low-level output	V_{DD} to $\overline{\text{RESET}}$ delay (TPS3836, TPS3838)			10	μs
		$V_{IL} = 1.6\text{ V}$			50	
t_{PLH}	Propagation (delay) time, low-to-high-level output	V_{DD} to $\overline{\text{RESET}}$ delay (TPS3837)			10	μs
		$V_{IL} = 1.6\text{ V}$			50	
t_{PHL}	Propagation (delay) time, high-to-low-level output	\overline{MR} to $\overline{\text{RESET}}$ delay (TPS3836, TPS3838)	$V_{DD} \geq V_{IT} + 0.2\text{ V}$, $V_{IL} = 0.3 \times V_{DD}$,		0.1	μs
		\overline{MR} to $\overline{\text{RESET}}$ delay (TPS3837)	$V_{IL} = 0.7 \times V_{DD}$		0.1	

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
I_{DD}	Supply current	vs Supply voltage	1
I_{MR}	Manual reset current	vs Manual reset voltage	2
V_{OL}	Low-level output voltage	vs Low-level output current	3
V_{OH}	High-level output voltage	vs High-level output current	4
	Normalized reset threshold voltage	vs Free-air temperature	5
	Minimum pulse duration at V_{DD}	vs V_{DD} Threshold overdrive	6



TYPICAL CHARACTERISTICS

SUPPLY CURRENT
 vs
 SUPPLY VOLTAGE

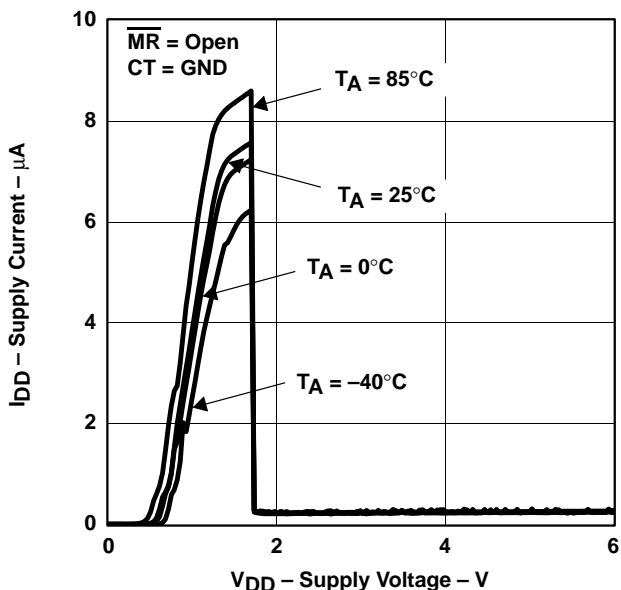


Figure 1

MANUAL RESET CURRENT
 vs
 MANUAL RESET VOLTAGE

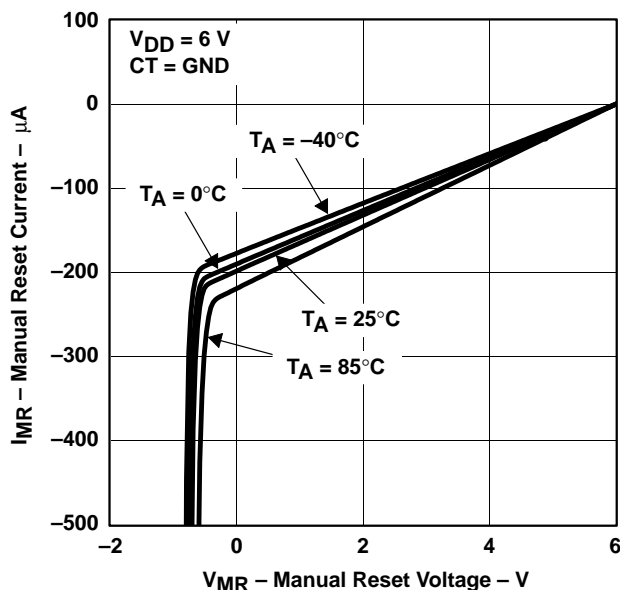


Figure 2

LOW-LEVEL OUTPUT VOLTAGE
 vs
 LOW-LEVEL OUTPUT CURRENT

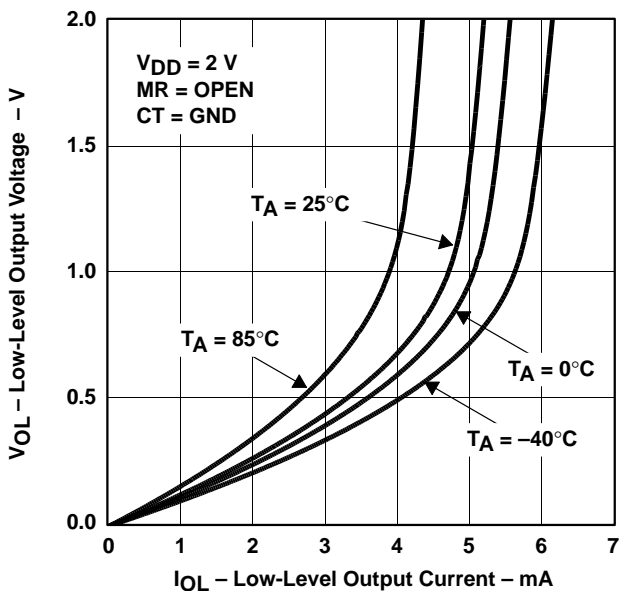


Figure 3

HIGH-LEVEL OUTPUT VOLTAGE
 vs
 HIGH-LEVEL OUTPUT CURRENT

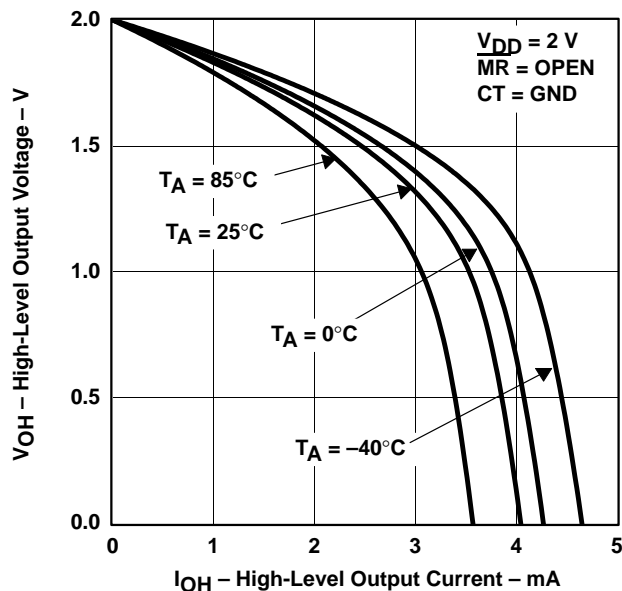


Figure 4

TYPICAL CHARACTERISTICS

NORMALIZED RESET THRESHOLD
 VOLTAGE
 vs
 FREE-AIR TEMPERATURE

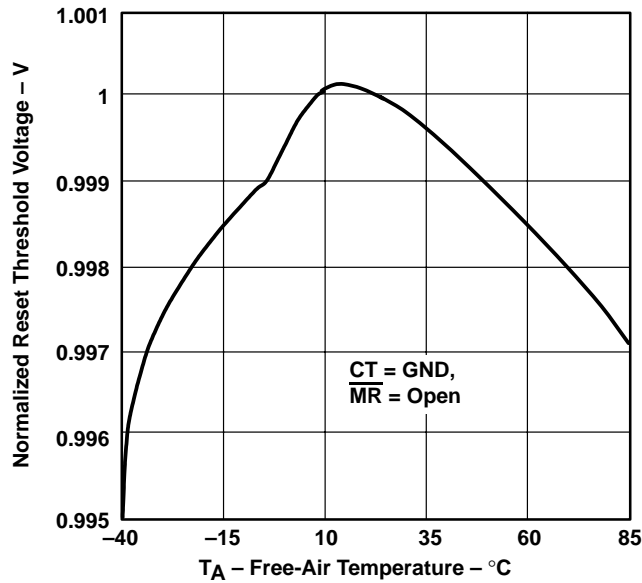


Figure 5

MINIMUM PULSE DURATION AT V_{DD}
 vs
 V_{DD} THRESHOLD OVERDRIVE

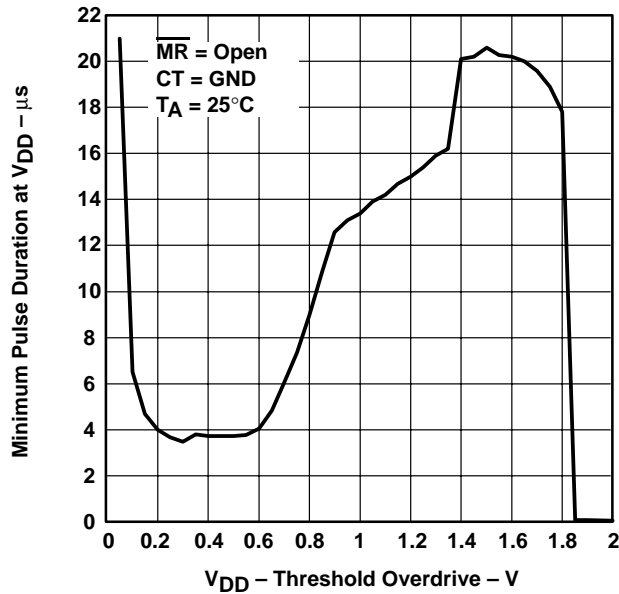


Figure 6

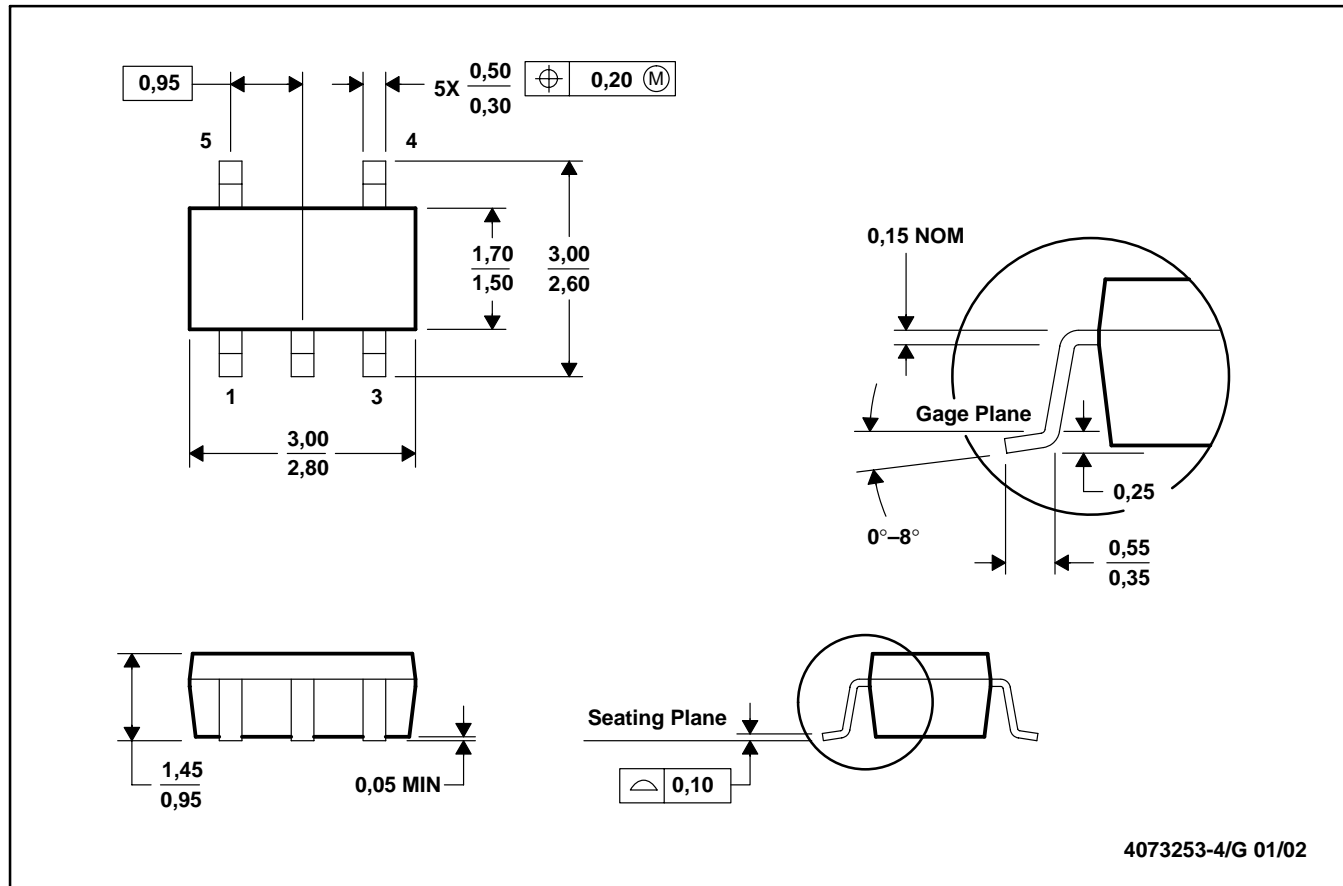
TPS3836E18-Q1 / J25-Q1 / H30-Q1 / L30-Q1 / K33-Q1
 TPS3837E18-Q1 / J25-Q1 / L30-Q1 / K33-Q1, TPS3838E18-Q1 / J25-Q1 / L30-Q1 / K33-Q1
 NANOPOWER SUPERVISORY CIRCUITS

SGLS141 – DECEMBER 2002

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⁾
TPS3836E18QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3836H30QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3836J25QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3836K33QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3836L30QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3837E18QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3837J25QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3837K33QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3837L30QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3838E18QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3838J25QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3838K33QDBVRQ1	ACTIVE	SOT-23	DBV	5	3000	None	Call TI	Level-1-220C-UNLIM
TPS3838L30QDBVRQ1	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.

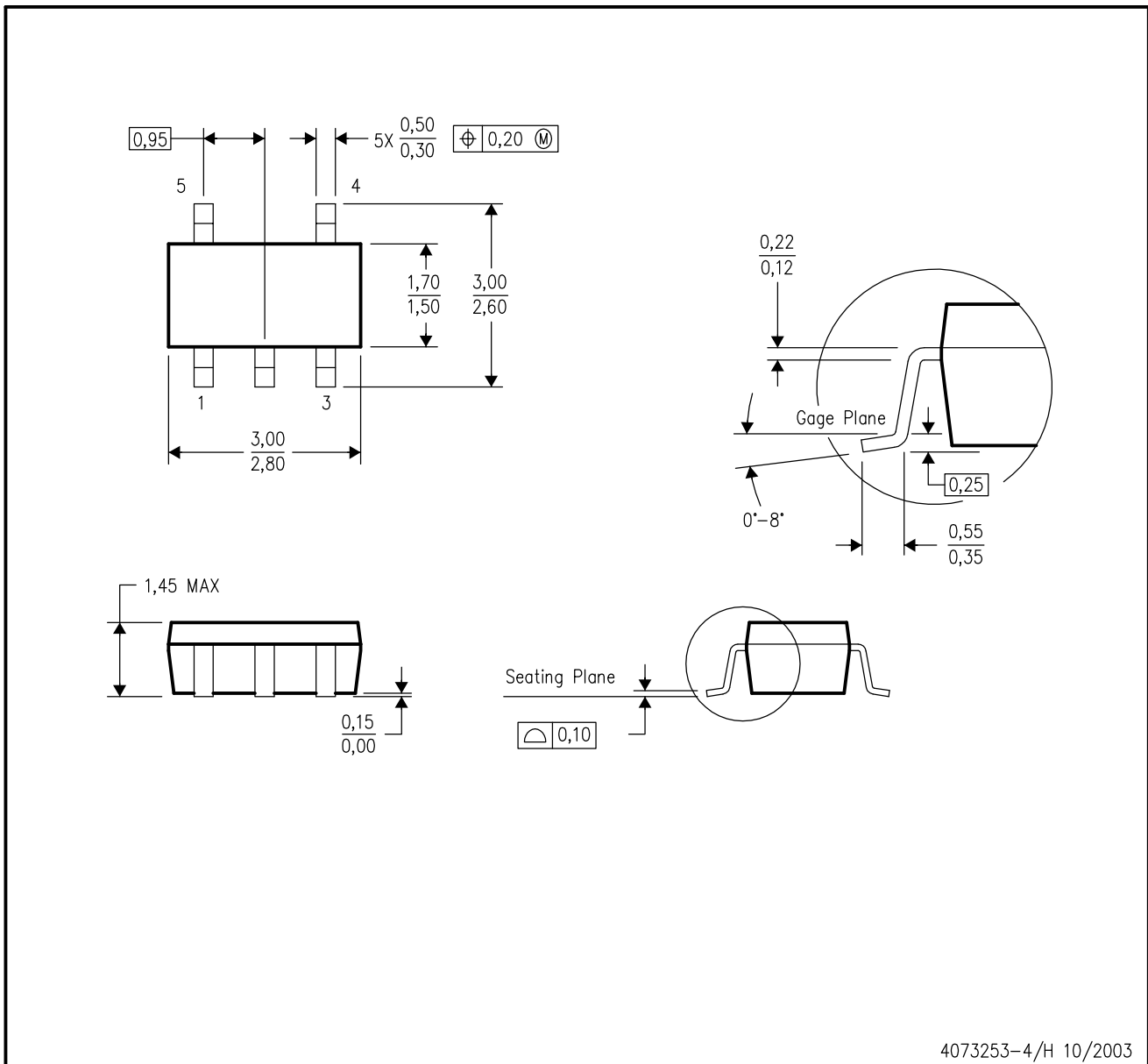
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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



- 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