- **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 85°C**

- **Applications Include**
  - **Applications Using Low-Power DSPs, Microcontrollers, or Microprocessors**
  - **Portable/Battery-Powered Equipment**
  - **Intelligent Instruments**
  - **Wireless Communication Systems**
  - **Notebook Computers**
  - **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}.

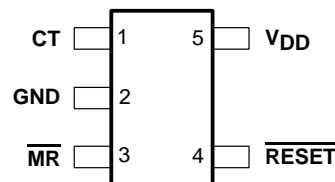TPS3836, TPS3838
DBV PACKAGE
(TOP VIEW)

TPS3837
DBV PACKAGE
(TOP VIEW)

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.

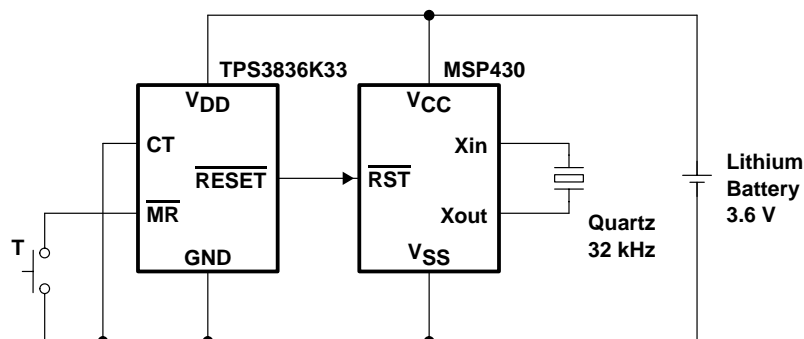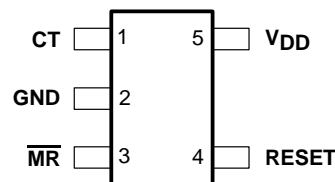All the devices of this family have a fixed-sense threshold voltage V_{IT} set by an internal voltage divider.

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.

TYPICAL OPERATING CIRCUIT

TEXAS INSTRUMENTS

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, TPS3837, TPS3838 families are characterized for operation over a temperature range of –40°C to 85°C.
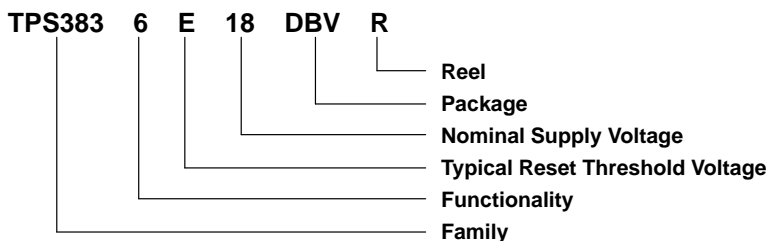
PACKAGE INFORMATION

T_A	DEVICE NAME		THRESHOLD VOLTAGE	SYMBOL
−40°C to 85°C	TPS3836E18DBVR[†]	TPS3836E18DBVT[‡]	1.71 V	PDNI
	TPS3836J25DBVR[†]	TPS3836J25DBVT[‡]	2.25 V	PDSI
	TPS3836H30DBVR[†]	TPS3836H30DBVT[‡]	2.79 V	PHRI
	TPS3836L30DBVR[†]	TPS3836L30DBVT[‡]	2.64 V	PCAI
	TPS3836K33DBVR[†]	TPS3836K33DBVT[‡]	2.93 V	PDTI
	TPS3837E18DBVR[†]	TPS3837E18DBVT[‡]	1.71 V	PDOI
	TPS3837J25DBVR[†]	TPS3837J25DBVT[‡]	2.25 V	PDRI
	TPS3837L30DBVR[†]	TPS3837L30DBVT[‡]	2.64 V	PCBI
	TPS3837K33DBVR[†]	TPS3837K33DBVT[‡]	2.93 V	PDUI
	TPS3838E18DBVR[†]	TPS3838E18DBVT[‡]	1.71 V	PDQI
	TPS3838J25DBVR[†]	TPS3838J25DBVT[‡]	2.25 V	PDPI
	TPS3838L30DBVR[†]	TPS3838L30DBVT[‡]	2.64 V	PCCI
	TPS3838K33DBVR[†]	TPS3838K33DBVT[‡]	2.93 V	PDVI

[†] The DBVR passive indicates tape and reel of 3000 parts.
[‡] The DBVT passive indicates tape and reel of 250 parts.

ORDERING INFORMATION

TPS383 6 E 18 DBV R

- Reel
- Package
- Nominal Supply Voltage
- Typical Reset Threshold Voltage
- Functionality
- Family

FUNCTION TABLE TPS3836, TPS3837, TPS3838

$\overline{\text{MR}}$	$V_{DD} > V_{IT}$	$\overline{\text{RESET}}$§	RESET¶
L	0	L	H
L	1	L	H
H	0	L	H
H	1	H	L

§ TPS3836 and TPS3838
¶ TPS3837

POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

functional block diagram
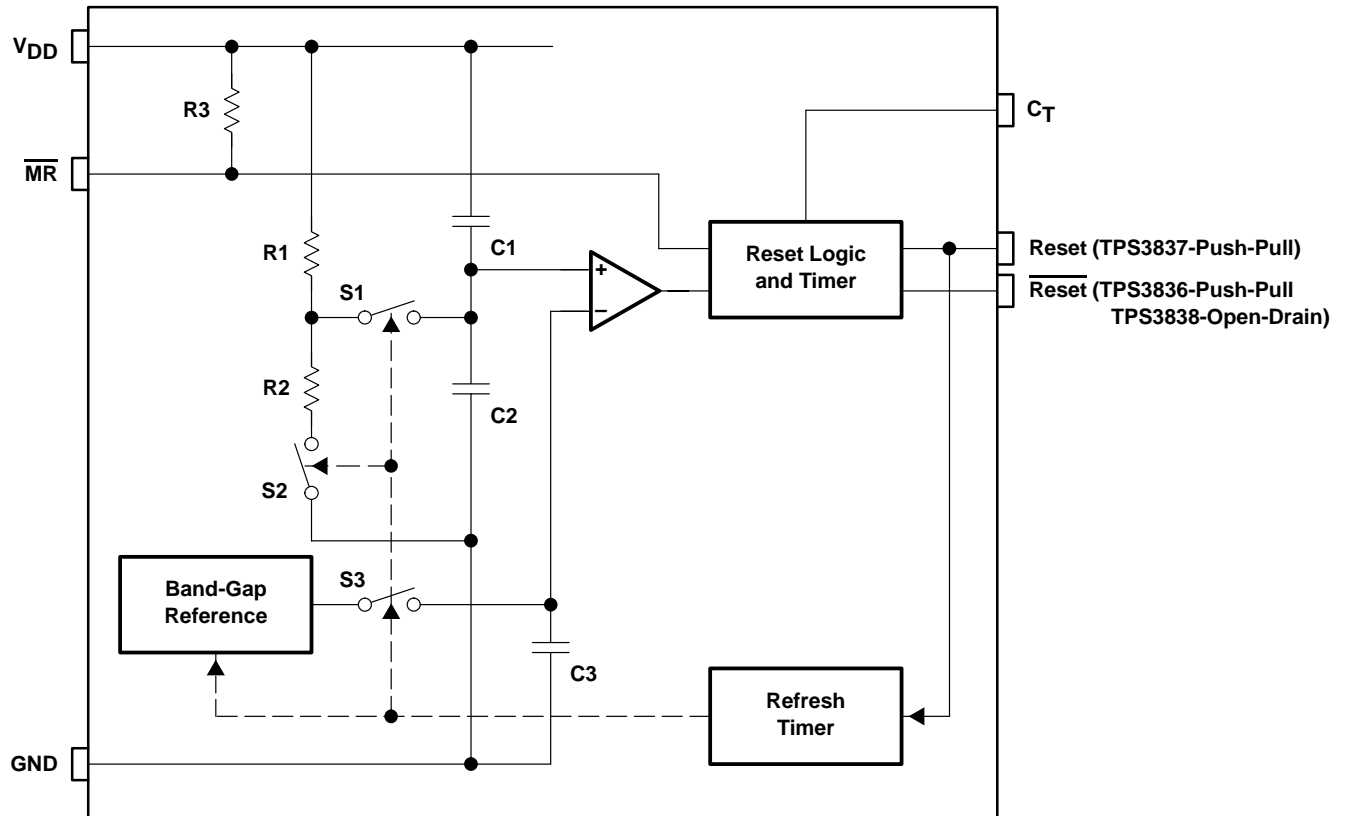
timing diagram

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†
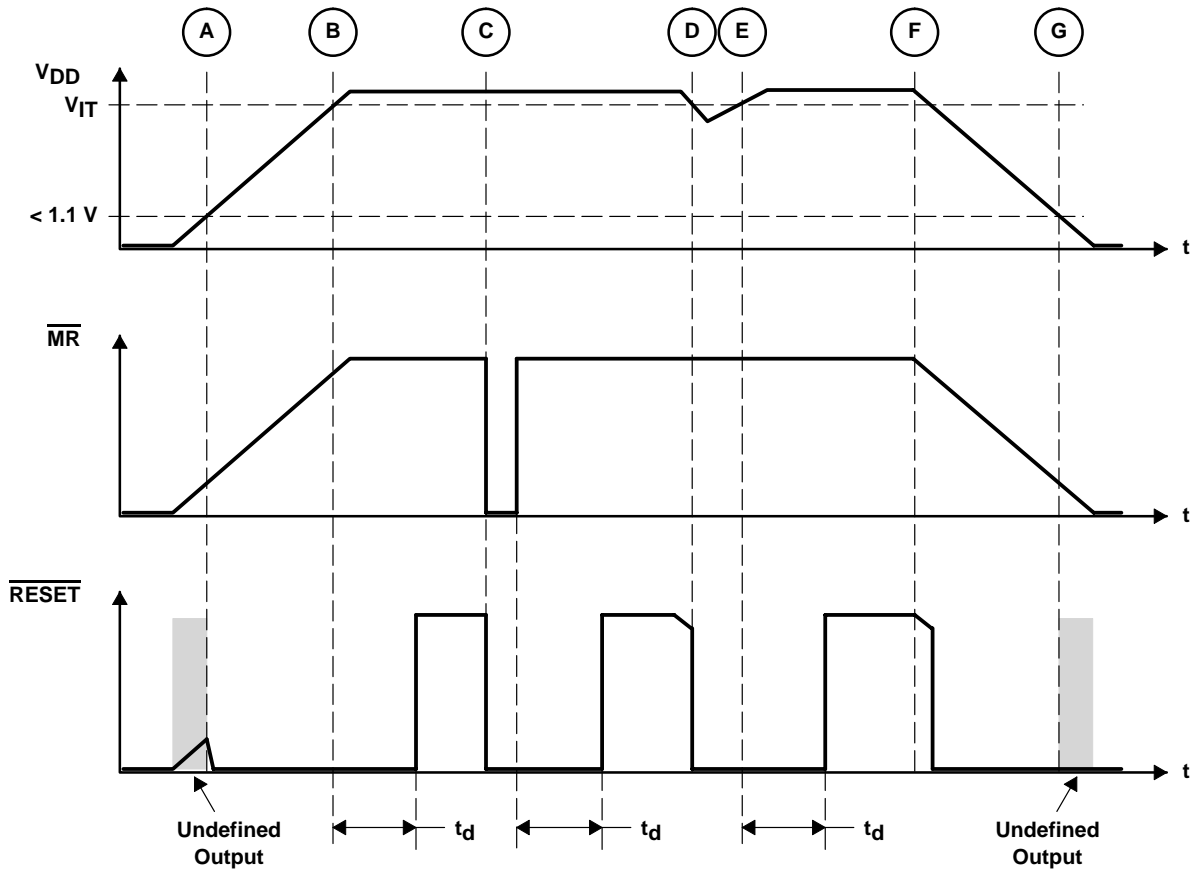
Supply voltage, V_{DD} (see Note 1)	7 V
All other pins (see Note 1)	−0.3 V to 7 V
Maximum low output current, I_{OL}	5 mA
Maximum high output current, I_{OH}	−5 mA
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{DD}$)	±10 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{DD}$)	±10 mA
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A	−40°C to 85°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°C POWER RATING	DERATING FACTOR ABOVE T_A = 25°C	T_A = 70°C POWER RATING	T_A = 85°C POWER RATING
DBV	437 mW	3.5 mW/°C	280 mW	227 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 $\overline{MR}$, $\Delta t/\Delta V$		100	ns/V
Operating free-air temperature range, T_A	−40	85	°C

TEXAS INSTRUMENTS

electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER			TEST CONDITION		MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage	$\overline{RESET}$ (TPS3836)	V_{DD} = 3.3 V,	I_{OH} = −2 mA	$0.8 \times$ V_{DD}			V
			V_{DD} = 6 V,	I_{OH} = −3 mA				
		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	$\overline{RESET}$ (TPS3836/8)	V_{DD} = 1.8 V,	I_{OL} = 1 mA			0.4	V
			V_{DD} = 3.3 V,	I_{OL} = 2 mA				
		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	$V_{DD} \geq$ 1.1 V,	I_{OL} = 50 µA			0.2	V
		TPS3837	$V_{DD} \geq$ 1.1 V,	I_{OH} = −50 µA	$0.8 \times$ V_{DD}			
V_{IT}	Negative-going input threshold voltage (see Note 3)	TPS383xE18	T_A = −40°C to 85°C		1.66	1.71	1.74	V
		TPS383xJ25			2.18	2.25	2.29	
		TPS383xH30			2.70	2.79	2.85	
		TPS383xL30			2.56	2.64	2.69	
		TPS383xK33			2.84	2.93	2.99	
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	$\overline{MR}$ (see Note 4)	$\overline{MR}$ = 0.7 × 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	$\overline{MR}$ (see Note 4)	$\overline{MR}$ = 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	400	nA
			V_{DD} > V_{IT},	V_{DD} > 3 V		250	450	
			V_{DD} < V_{IT}			10	15	µA
	Internal pullup resistor at $\overline{MR}$					30		kΩ
C_I	Input capacitance at $\overline{MR}$, CT		V_I = 0 V to V_{DD}			5		pF

NOTES: 2. The lowest voltage at which $\overline{RESET}$ output becomes active. t_r, $V_{DD} \geq$ 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, $\overline{MR}$ should be connected to V_{DD} to minimize current consumption.

TEXAS INSTRUMENTS

timing requirements at R_L = 1 MΩ, C_L = 50 pF, T_A = 25°C

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

switching characteristics at R_L = 1 MΩ, C_L = 50 pF, T_A = 25°C

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

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

TEXAS INSTRUMENTS

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

SLVS292A – JUNE 2000 – REVISED JANUARY 2002

TYPICAL CHARACTERISTICS

SUPPLY CURRENT
vs
SUPPLY VOLTAGE
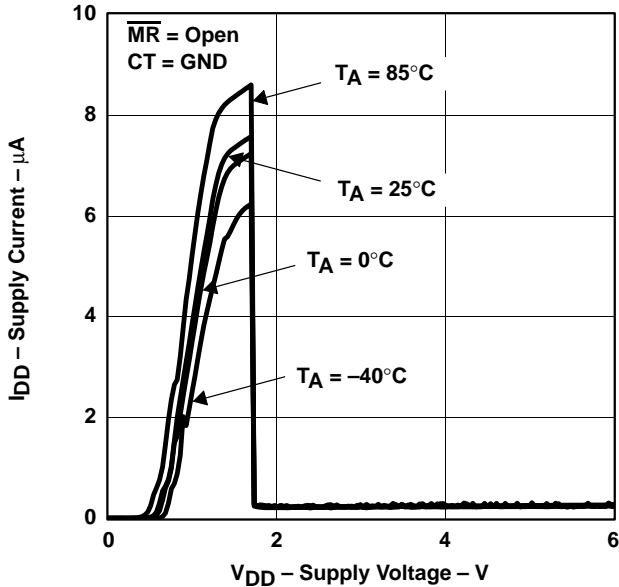
Figure 1

MANUAL RESET CURRENT
vs
MANUAL RESET VOLTAGE
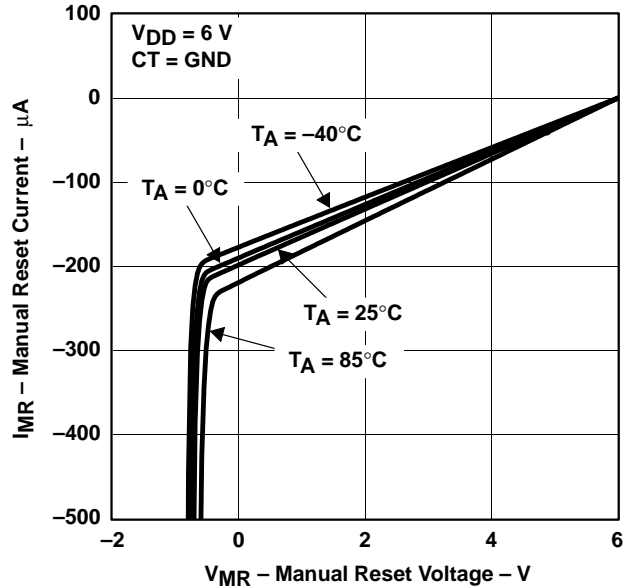
Figure 2

LOW-LEVEL OUTPUT VOLTAGE
vs
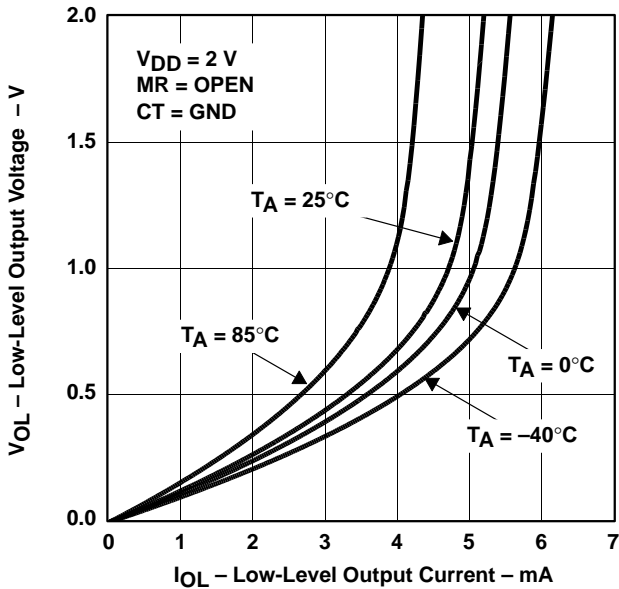**LOW-LEVEL OUTPUT CURRENT**

Figure 3

HIGH-LEVEL OUTPUT VOLTAGE
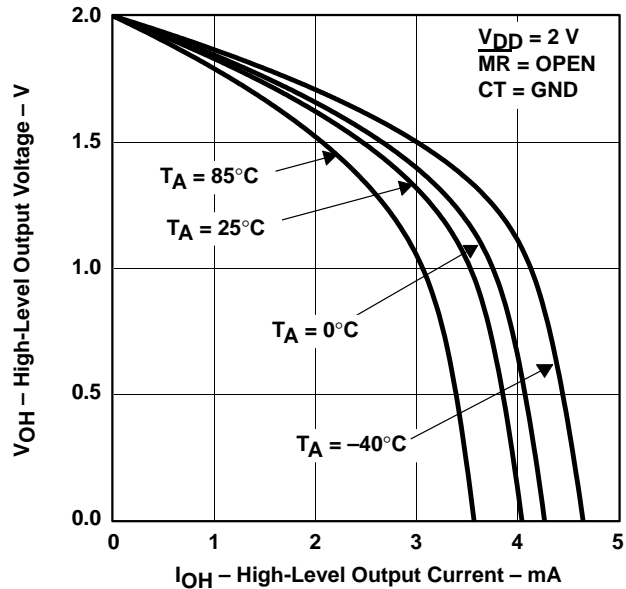**vs**
HIGH-LEVEL OUTPUT CURRENT

Figure 4

TYPICAL CHARACTERISTICS

NORMALIZED RESET THRESHOLD
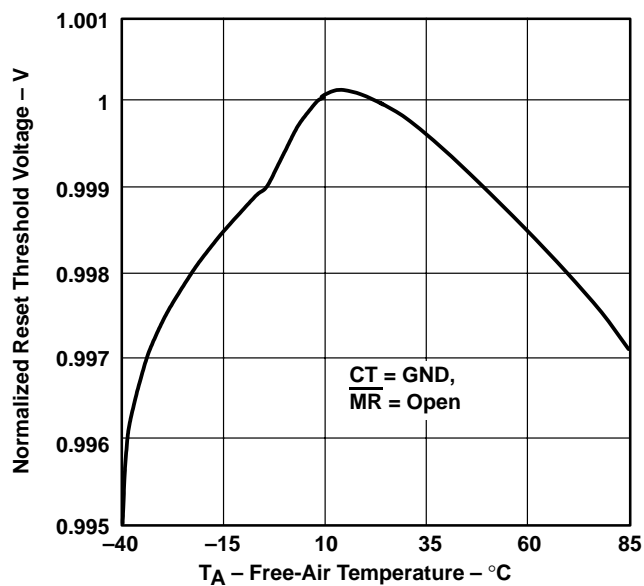VOLTAGE
vs
FREE-AIR TEMPERATURE

Figure 5

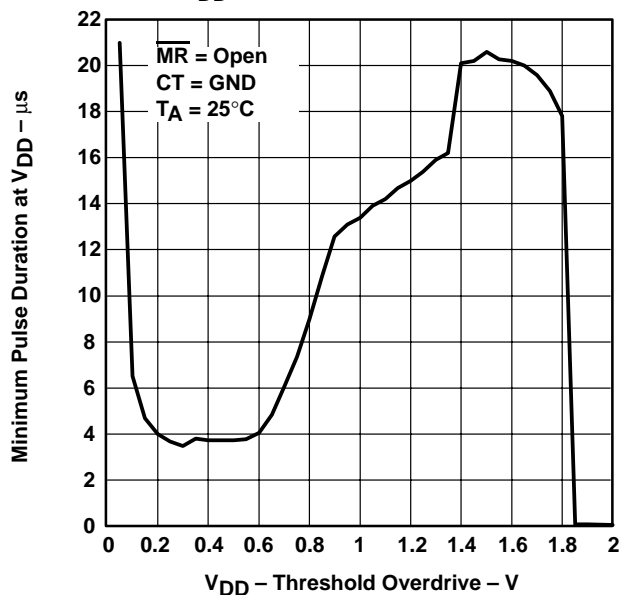MINIMUM PULSE DURATION AT V_{DD}
vs
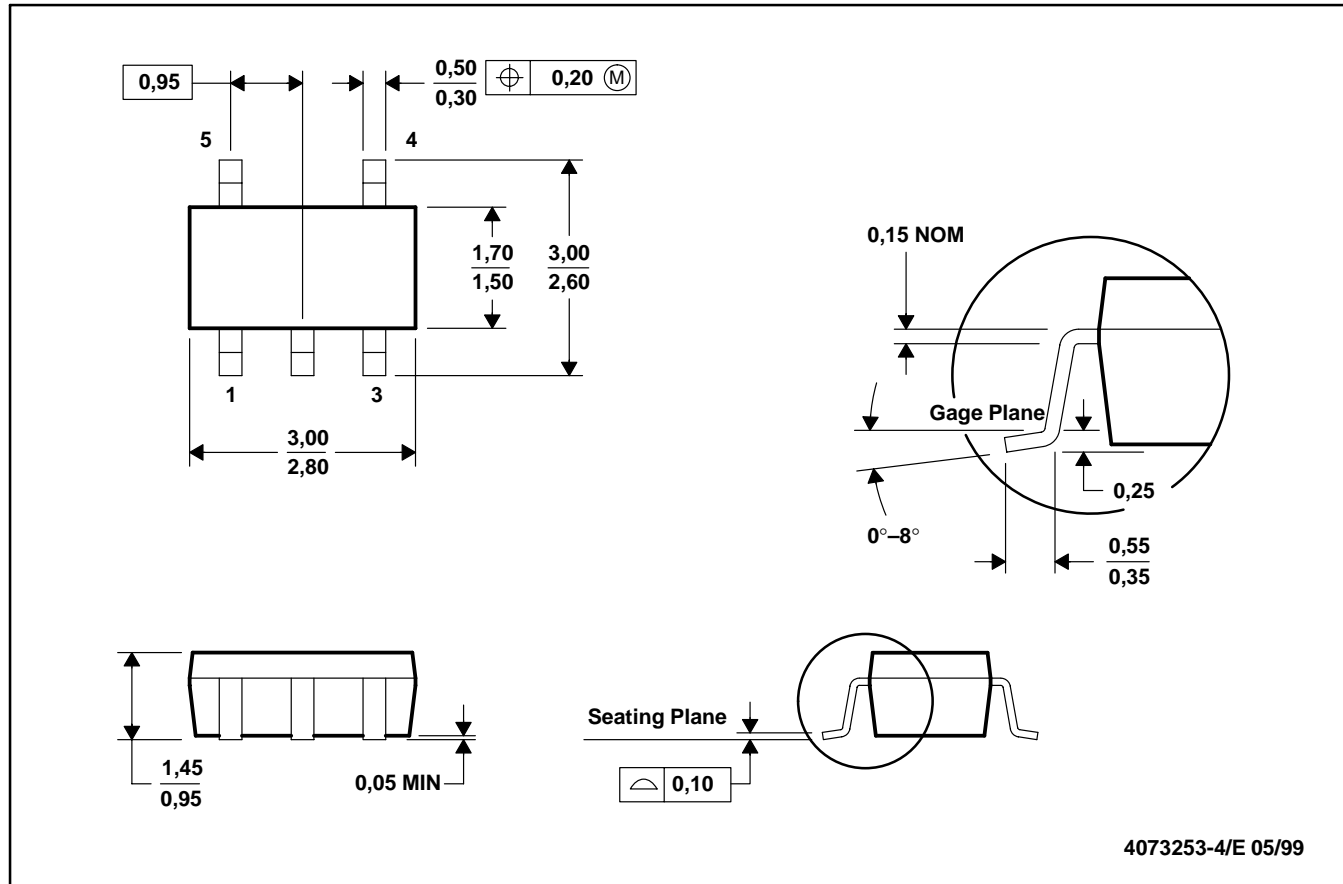V_{DD} THRESHOLD OVERDRIVE

Figure 6

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

SLVS292A – JUNE 2000 – REVISED JANUARY 2002

MECHANICAL DATA

DBV (R-PDSO-G5)   **PLASTIC SMALL-OUTLINE**

4073253-4/E 05/99

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

TEXAS
INSTRUMENTS

POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

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.

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265