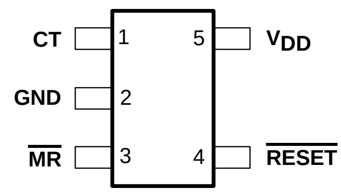
- **Qualification in Accordance With AEC-Q100†**
- **Qualified for Automotive Applications**
- **Customer-Specific Configuration Control Can Be Supported Along With Major-Change Approval†**
- **ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, 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**

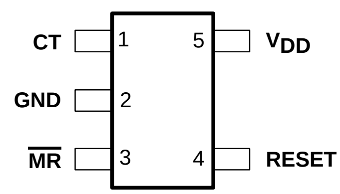
† Contact factory for details. Q100 qualification data available on request.

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

TPS3836, TPS3838
DBV PACKAGE
(TOP VIEW)



TPS3837
DBV PACKAGE
(TOP VIEW)



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}.

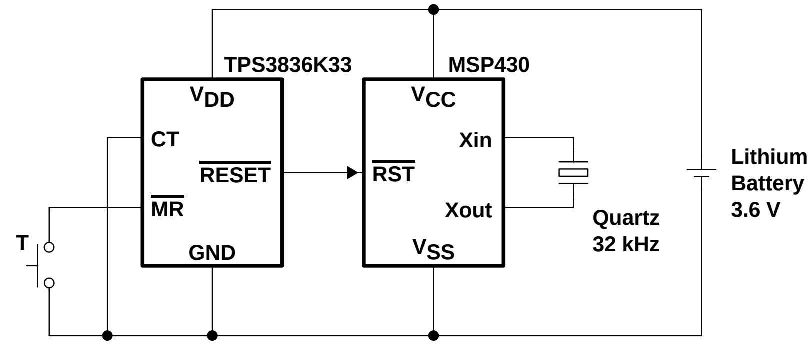
When CT is connected to GND a fixed delay time of typical 10 ms is asserted. When connected to V_{DD} the delay time is typically 200 ms.

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.

description (continued)



TYPICAL OPERATING CIRCUIT

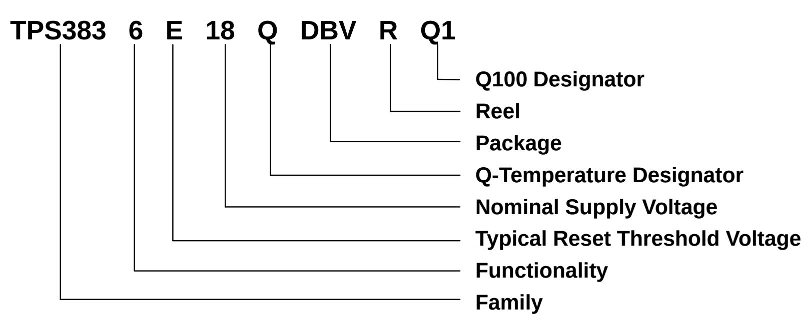
The product spectrum is designed for supply voltages of 1.8 V, 2.5 V, 3 V, and 3.3 V. The circuits are available in a 5-pin SOT-23 package. The TPS3836-Q-Q1, TPS3837-Q-Q1, TPS3838-Q-Q1 families are characterized for operation over a temperature range of –40°C to 125°C, and qualified in accordance with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

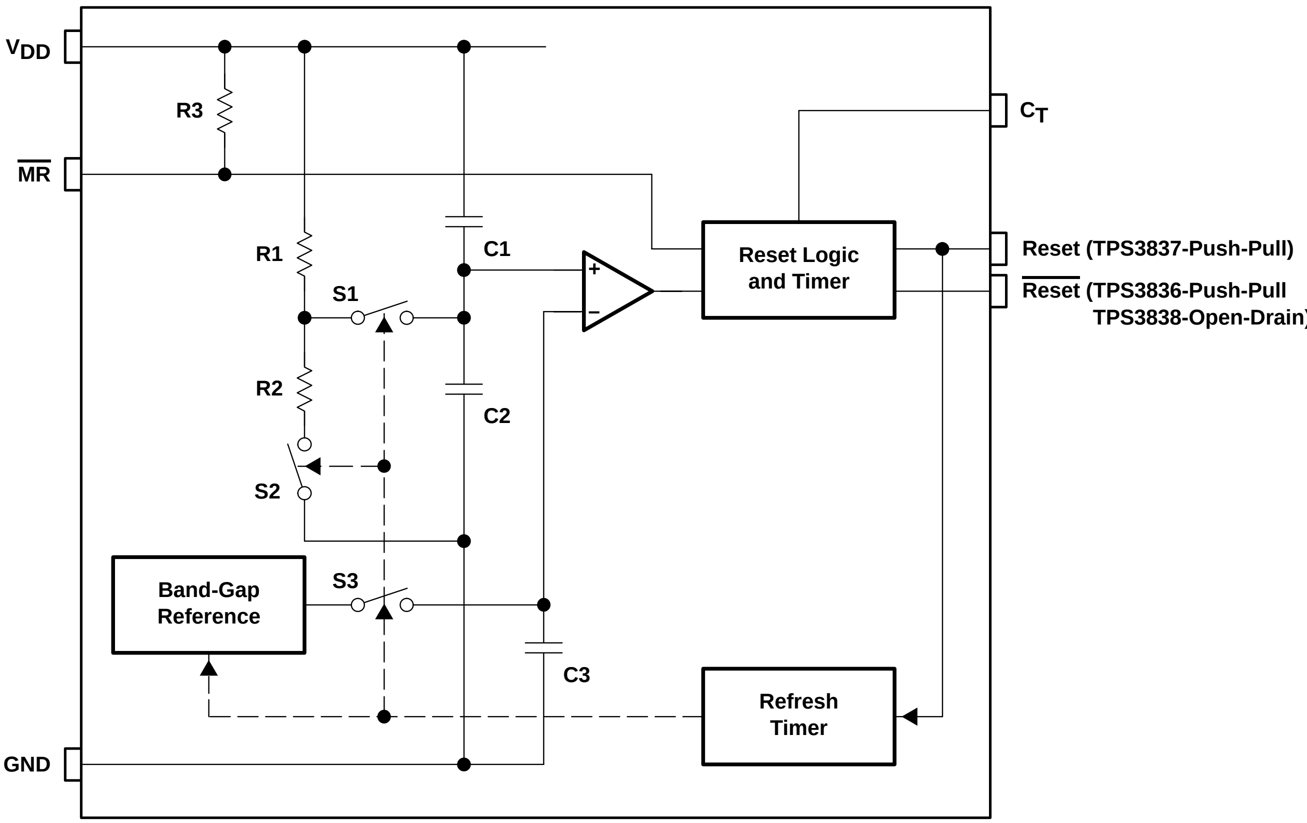


FUNCTION TABLE TPS3836, TPS3837, TPS3838

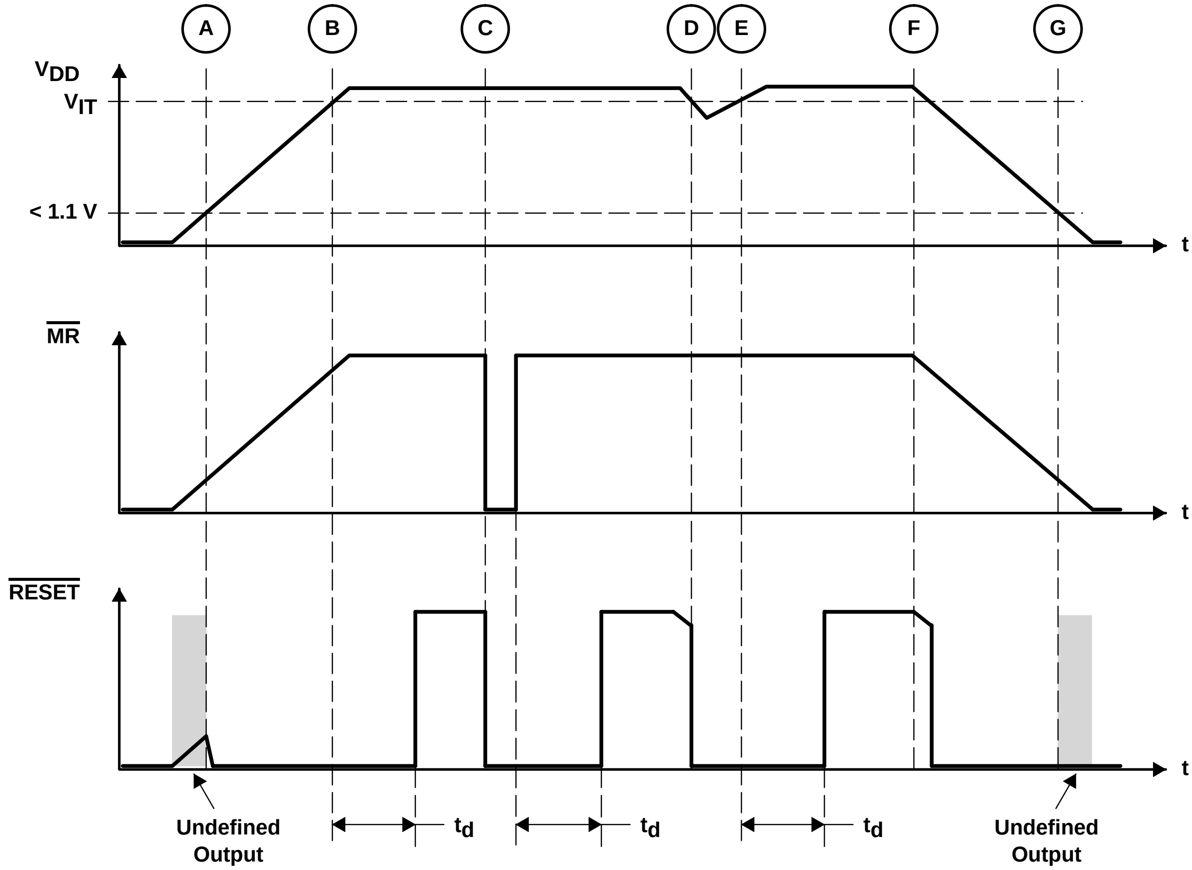
$\overline{MR}$	$V_{DD} > V_{IT}$	$\overline{RESET}$†	RESET‡
L	0	L	H
L	1	L	H
H	0	L	H
H	1	H	L

† TPS3836 and TPS3838
‡ TPS3837

functional block diagram



timing diagram



TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

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°C POWER RATING	DERATING FACTOR ABOVE T_A = 25°C	T_A = 70°C POWER RATING	T_A = 85°C POWER RATING	T_A = 125°C POWER RATING
DBV	437 mW	3.5 mW/ºC	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 $\overline{MR}$, $\Delta t/\Delta V$		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	$\overline{RESET}$ (TPS3836)	V_{DD} = 3.3 V,	I_{OH} = –2 mA	0.8 × 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} ≥ 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	$\overline{MR}$ (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	500	nA
			V_{DD} > V_{IT},	V_{DD} > 3 V		250	550	nA
			V_{DD} < V_{IT}			10	25	µA
	Internal pullup resistor at $\overline{MR}$					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} ≥ 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.

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, $V_{IL} = 0.3 \times V_{DD}$, $V_{IH} = 0.7 \times V_{DD}$	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

TYPICAL CHARACTERISTICS

SUPPLY CURRENT
vs
SUPPLY VOLTAGE

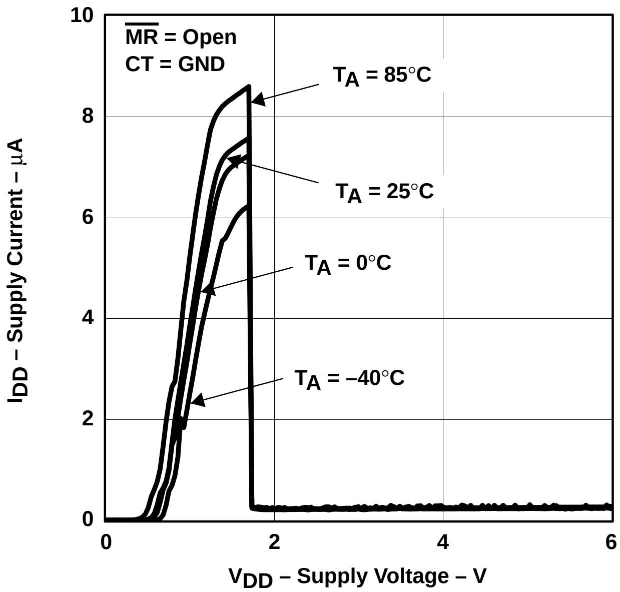


Figure 1

MANUAL RESET CURRENT
vs
MANUAL RESET VOLTAGE

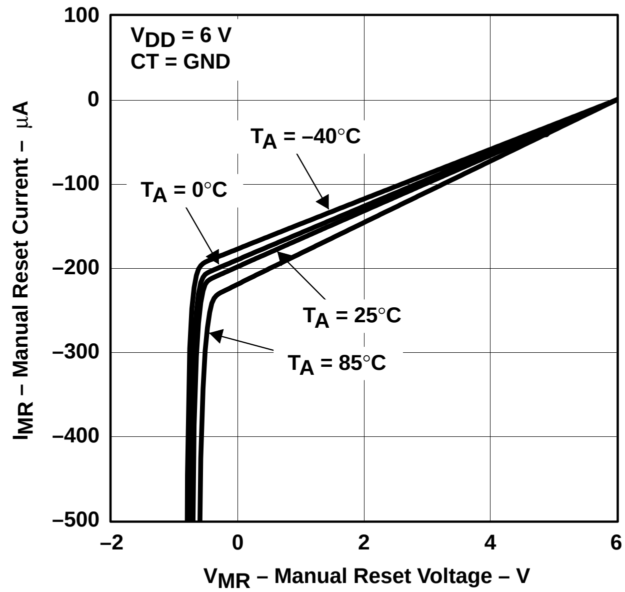


Figure 2

LOW-LEVEL OUTPUT VOLTAGE
vs
LOW-LEVEL OUTPUT CURRENT

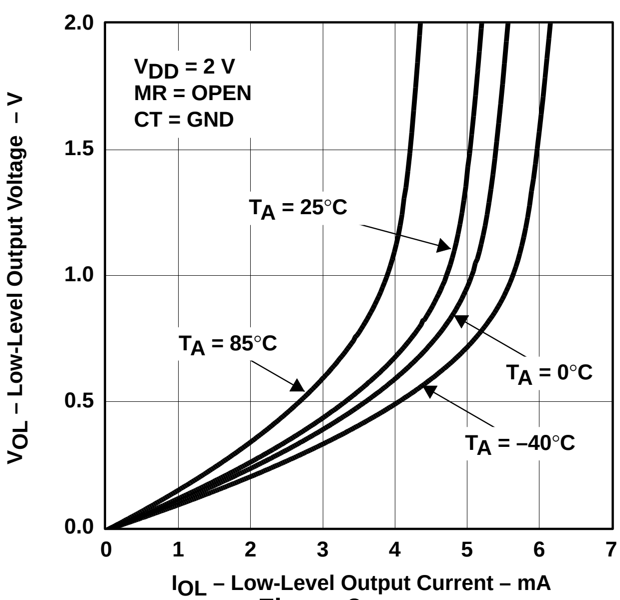


Figure 3

HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

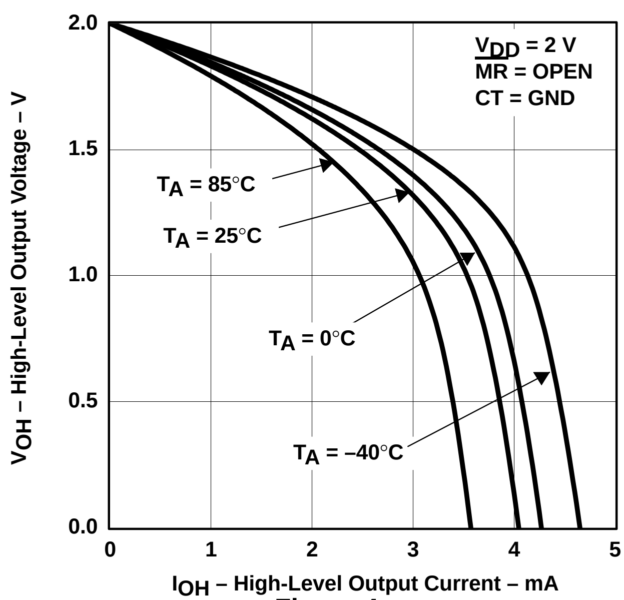


Figure 4

TYPICAL CHARACTERISTICS

NORMALIZED RESET THRESHOLD VOLTAGE vs FREE-AIR TEMPERATURE

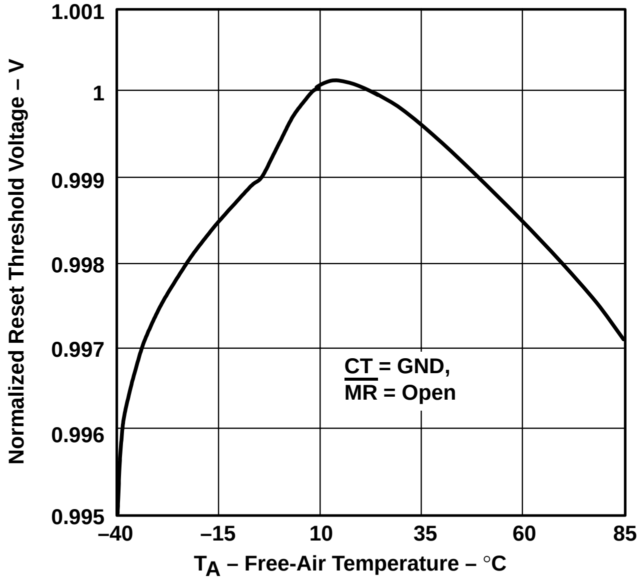


Figure 5

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

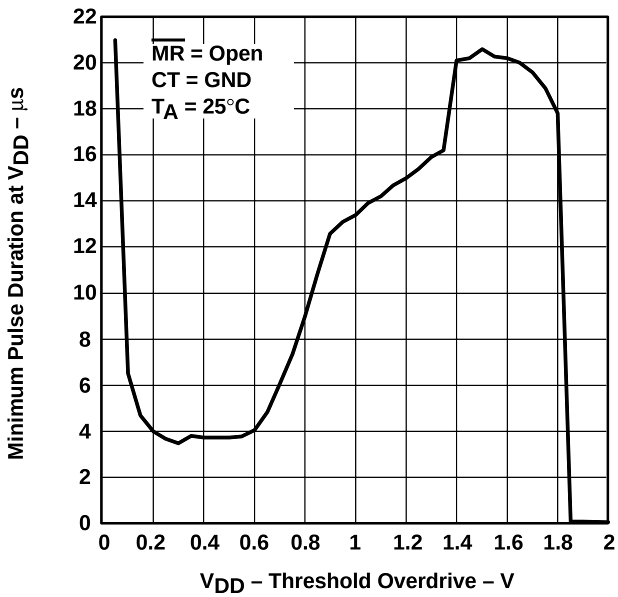
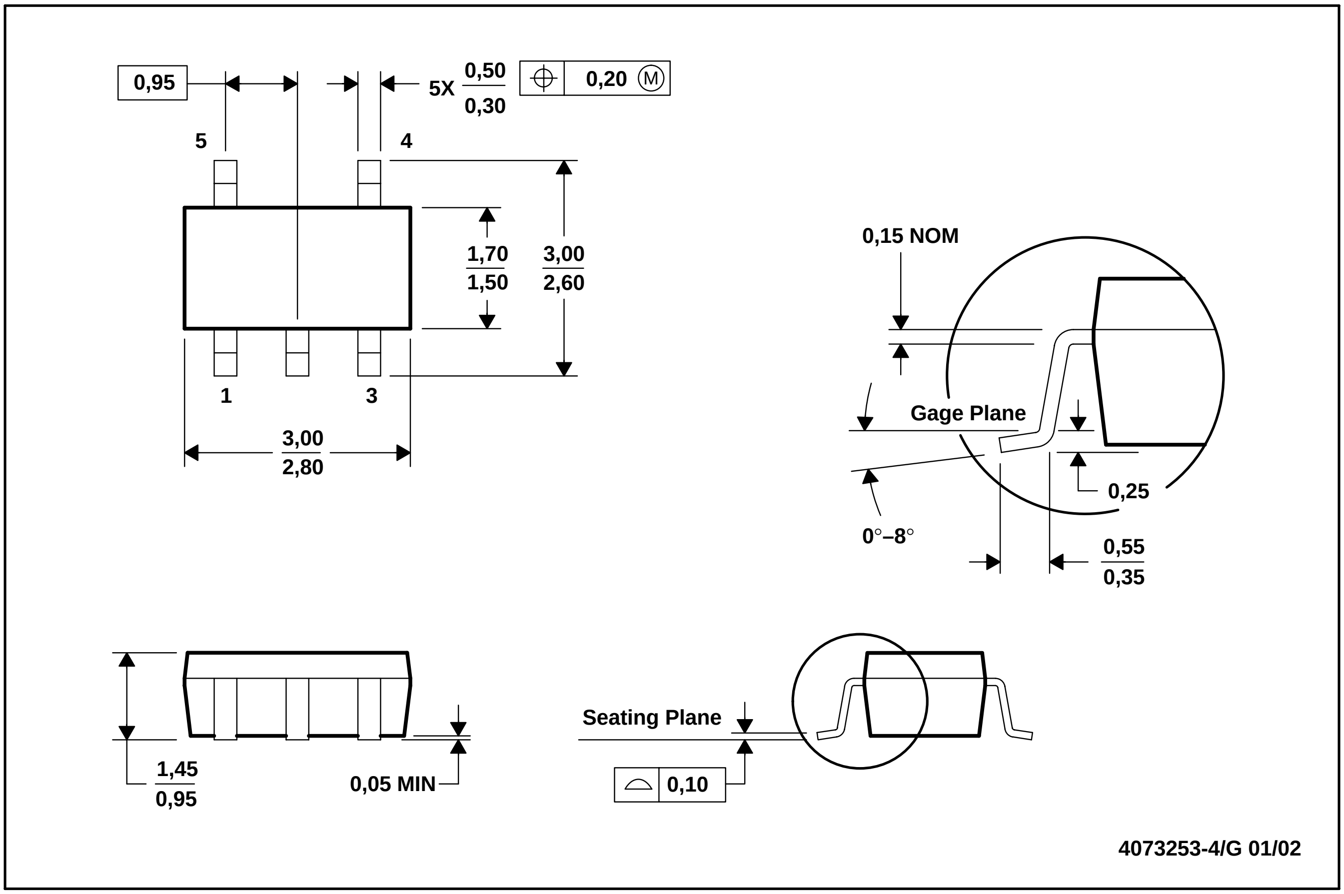


Figure 6

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

Mailing Address:

Texas Instruments
Post Office Box 655303
Dallas, Texas 75265