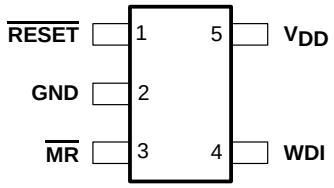
features

- 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
- Temperature Range . . . –40°C to 85°C

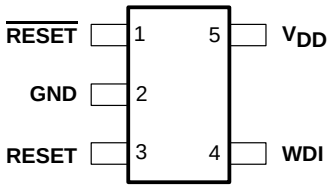
applications

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

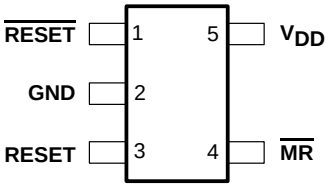
TPS3820, TPS3823, TPS3828 . . . DBV PACKAGE
(TOP VIEW)



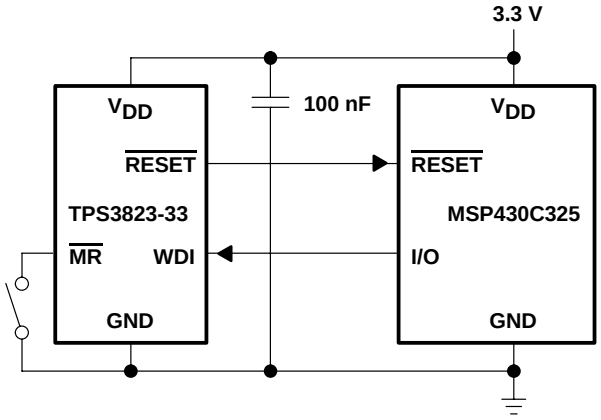
TPS3824 . . . DBV PACKAGE
(TOP VIEW)



TPS3825 . . . DBV PACKAGE
(TOP VIEW)



typical application



description

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

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.

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This document contains information on products in more than one phase of development. The status of each device is indicated on the page(s) specifying its electrical characteristics.

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description (continued)

The TPS3820/3/5/8 devices incorporate a manual reset input, $\overline{MR}$. A low level at $\overline{MR}$ causes $\overline{RESET}$ 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}, $\overline{RESET}$ 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 $\overline{RESET}$, the TPS3820/3/4/8 does not return to a non-reset state when the input voltage is above Vt. If the application requires that input to WDI is active when $\overline{RESET}$ 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 $\overline{RESET}$ output as shown in Figure 1.

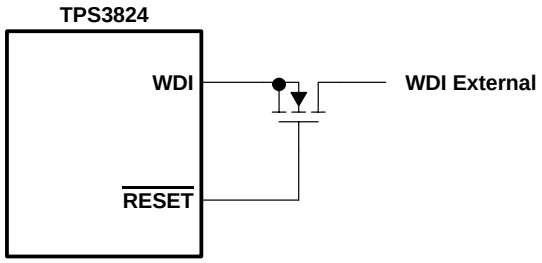


Figure 1

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 devices are characterized for operation over a temperature range of -40°C to 85°C.

PACKAGE INFORMATION

DEVICE NAME	DEVICE NAME	THRESHOLD VOLTAGE§	MARKING
TPS3820-33DBVT†	TPS3820-33DBVR‡	2.93 V	PDEI
TPS3820-50DBVT†	TPS3820-50DBVR‡	4.55 V	PDDI
TPS3823-25DBVT†	TPS3823-25DBVR‡	2.25 V	PAPI
TPS3823-30DBVT†	TPS3823-30DBVR‡	2.63 V	PAQI
TPS3823-33DBVT†	TPS3823-33DBVR‡	2.93 V	PARI
TPS3823-50DBVT†	TPS3823-50DBVR‡	4.55 V	PASI
TPS3824-25DBVT†	TPS3824-25DBVR‡	2.25 V	PATI
TPS3824-30DBVT†	TPS3824-30DBVR‡	2.63 V	PAUI
TPS3824-33DBVT†	TPS3824-33DBVR‡	2.93 V	PAVI
TPS3824-50DBVT†	TPS3824-50DBVR‡	4.55 V	PAWI
TPS3825-33DBVT†	TPS3825-33DBVR‡	2.93 V	PDGI
TPS3825-50DBVT†	TPS3825-50DBVR‡	4.55 V	PDFI
TPS3828-33DBVT†	TPS3828-33DBVR‡	2.93 V	PDII
TPS3828-50DBVT†	TPS3828-50DBVR‡	4.55 V	PDHI

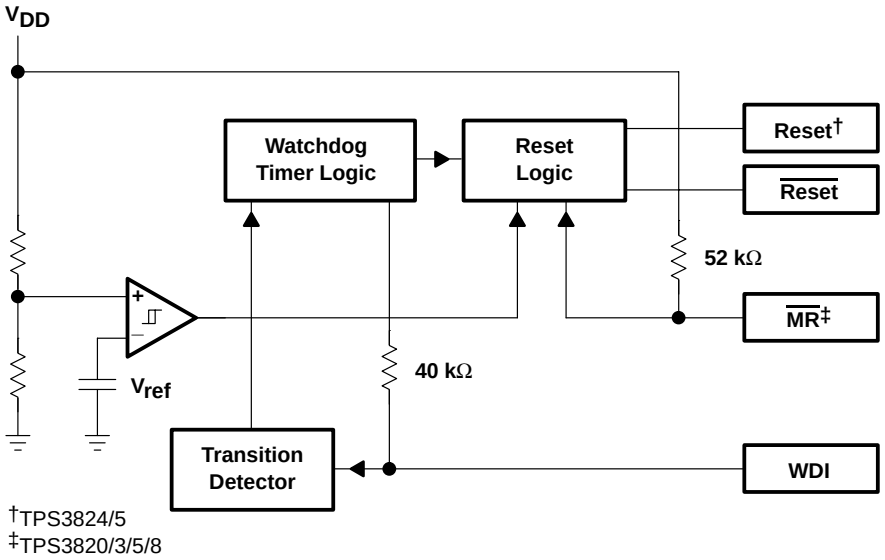
† The DBVT package indicates tape and reel of 250 parts.
‡ The DBVR package indicates tape and reel of 3000 parts.
§ For other threshold voltage versions, please contact the local TI sales office.

FUNCTION/TRUTH TABLE

INPUTS		OUTPUTS	
$\overline{MR}$¶	$V_{DD}>V_{IT}$	$\overline{RESET}$	RESET#
L	0	L	H
L	1	L	H
H	0	L	H
H	1	H	L

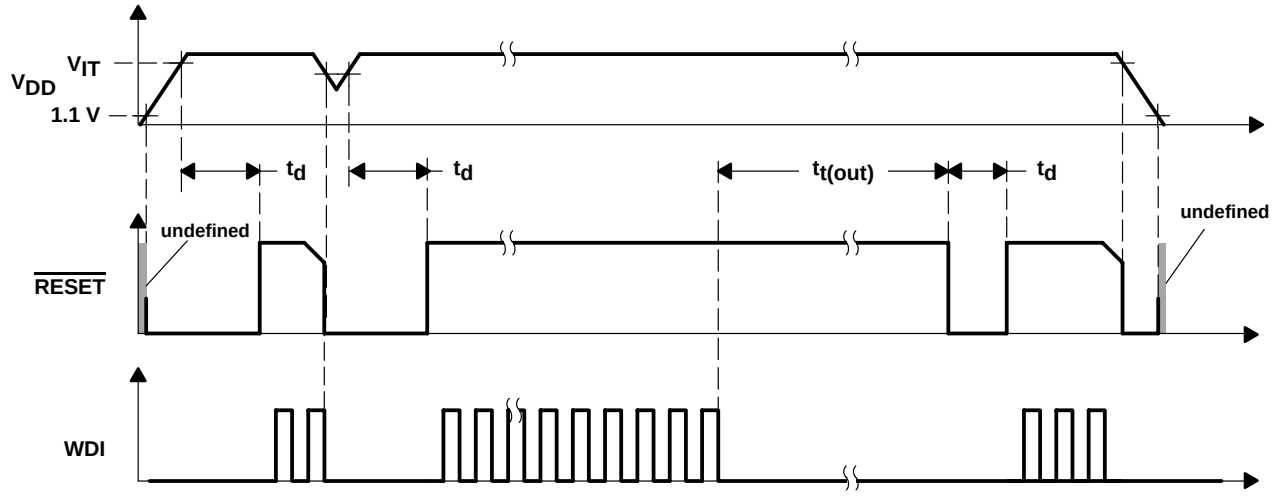
¶ TPS3820/3/5/8
# TPS3824/5

functional block diagram



†TPS3824/5
‡TPS3820/3/5/8

timing diagram



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

Supply voltage, V_{DD} (see Note 1) . . . . . 6 V
RESET, $\overline{\text{RESET}}$, $\overline{\text{MR}}$, 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 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.

DISSIPATION RATING TABLE

PACKAGE	$T_A \le 25°C$ POWER RATING	OPERATING 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

	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 × V_{DD}		V
Low-level input voltage, V_{IL}		0.3 × 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	85	°C

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	$0.8 \times V_{DD}$			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	$V_{DD} \geq 1.8$ V, $I_{OH} = -100$ µA	$0.8 \times V_{DD}$			V
			TPS3824-30 TPS3825-30	$V_{DD} \geq 1.8$ 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			0.4	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)			$V_{DD} \geq 1.1$ V, $I_{OL} = 20$ µA			0.4	V
V_{IT-}	Negative-going input threshold voltage (see Note 3)		TPS382x-25	$T_A = 0°C – 85°C$	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	$T_A = –40°C – 85°C$	2.20	2.25	2.30	V
			TPS382x-30		2.57	2.63	2.69	
			TPS382x-33		2.86	2.93	3	
			TPS382x-50		4.46	4.55	4.64	
V_{hys}	Hysteresis at V_{DD} input		TPS382x-25					mV
			TPS382x-30			30		
			TPS382x-33					
			TPS382x-50			50		

NOTES: 2. The lowest supply voltage at which $\overline{\text{RESET}}$ becomes active. $t_{r,\ VDD} \geq 15$ µs/V
3. To ensure best stability of the threshold voltage, a bypass capacitor (ceramic, 0.1 µF) should be placed near the supply terminals.

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	WDI = 0.3 V, V_{DD} = 5.5 V time average (dc = 12%)		–15		µA
I_{IH}	High-level input current		WDI	WDI = V_{DD}		140	190	µA
			$\overline{MR}$	$\overline{MR}$ = V_{DD} × 0.7, V_{DD} = 5.5 V		–40	–60	µA
I_{IL}	Low-level input current		WDI	WDI = 0.3 V, V_{DD} = 5.5 V		140	190	µA
			$\overline{MR}$	$\overline{MR}$ = 0.3 V, V_{DD} = 5.5 V		–110	–160	µA
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			–400	µA
			TPS382x-30				–400	µA
			TPS382x-33				–400	µA
			TPS382x-50				–800	µA
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 MΩ, C_L = 50 pF, T_A = 25°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} ≥ $V_{IT–}$ + 0.2 V, V_{IL} = 0.3 x V_{DD}, V_{IH} = 0.7 x V_{DD}	1		µs
		at WDI	V_{DD} ≥ $V_{IT–}$ + 0.2 V, V_{IL} = 0.3 x V_{DD}, V_{IH} = 0.7 x V_{DD}	100		ns

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

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

TYPICAL CHARACTERISTICS

NORMALIZED INPUT THRESHOLD VOLTAGE vs FREE-AIR TEMPERATURE AT V_{DD}

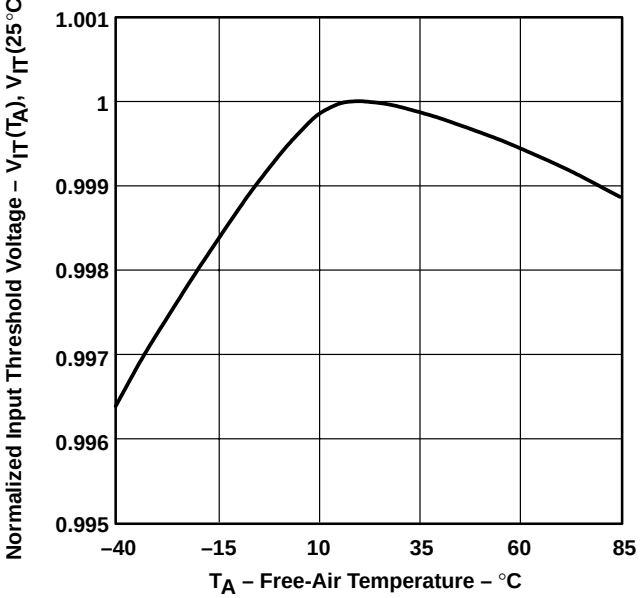


Figure 2

SUPPLY CURRENT vs SUPPLY VOLTAGE

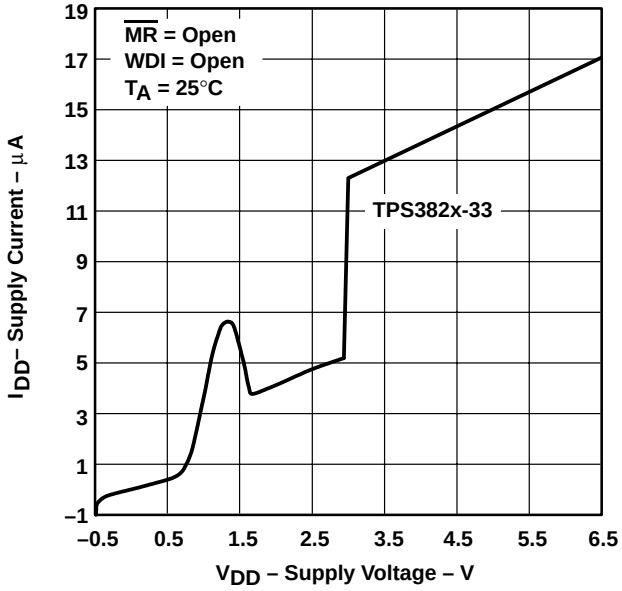


Figure 3

INPUT CURRENT vs INPUT VOLTAGE AT $\overline{MR}$

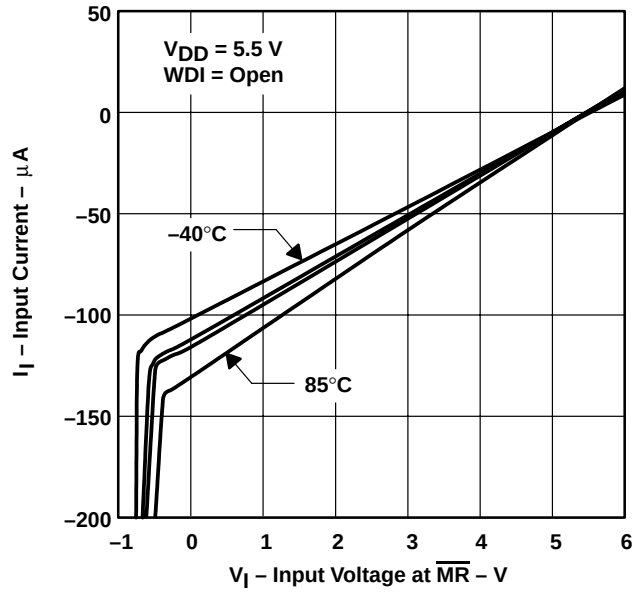


Figure 4

LOW-LEVEL OUTPUT VOLTAGE vs LOW-LEVEL OUTPUT CURRENT

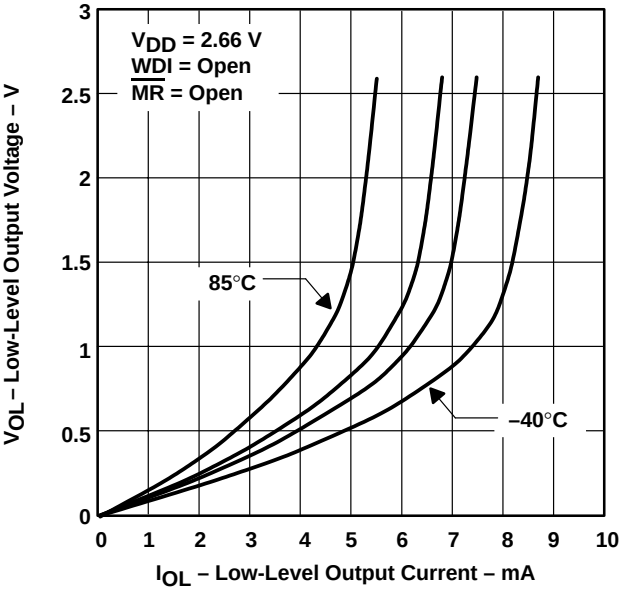


Figure 5

TYPICAL CHARACTERISTICS

HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

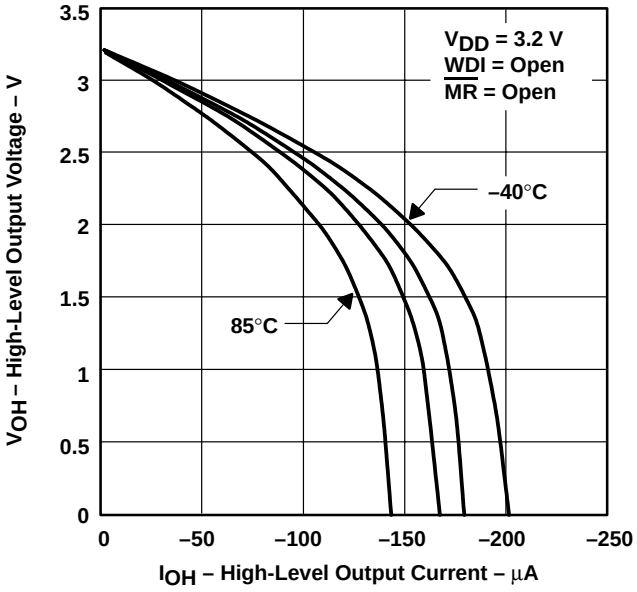


Figure 6

HIGH-LEVEL OUTPUT VOLTAGE
vs
HIGH-LEVEL OUTPUT CURRENT

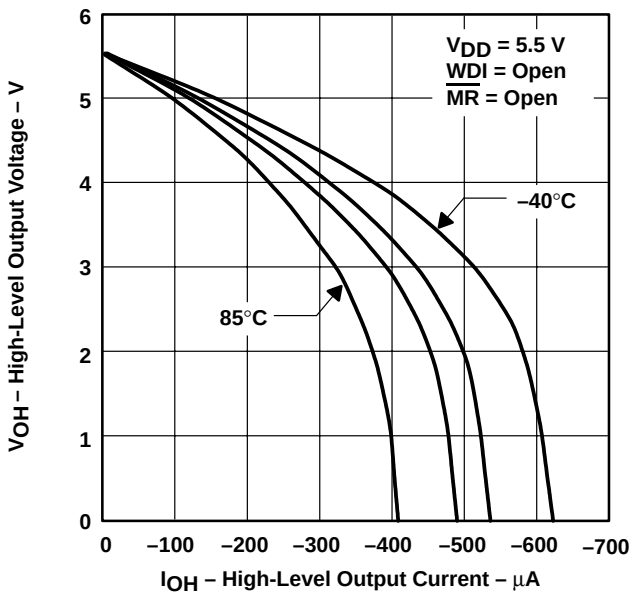


Figure 7

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

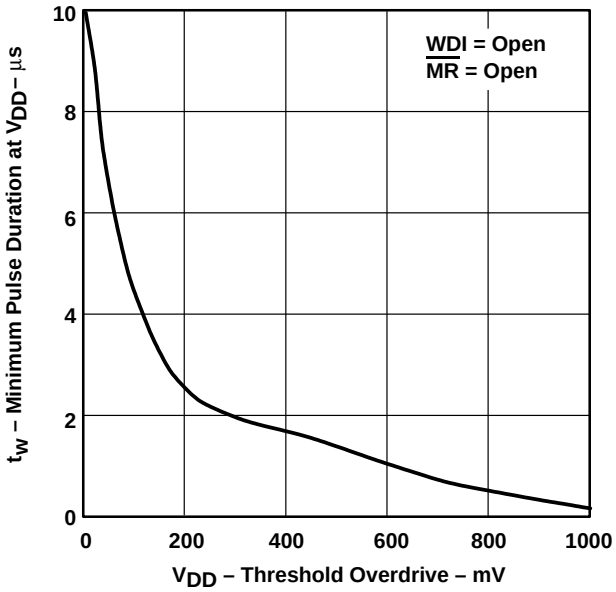
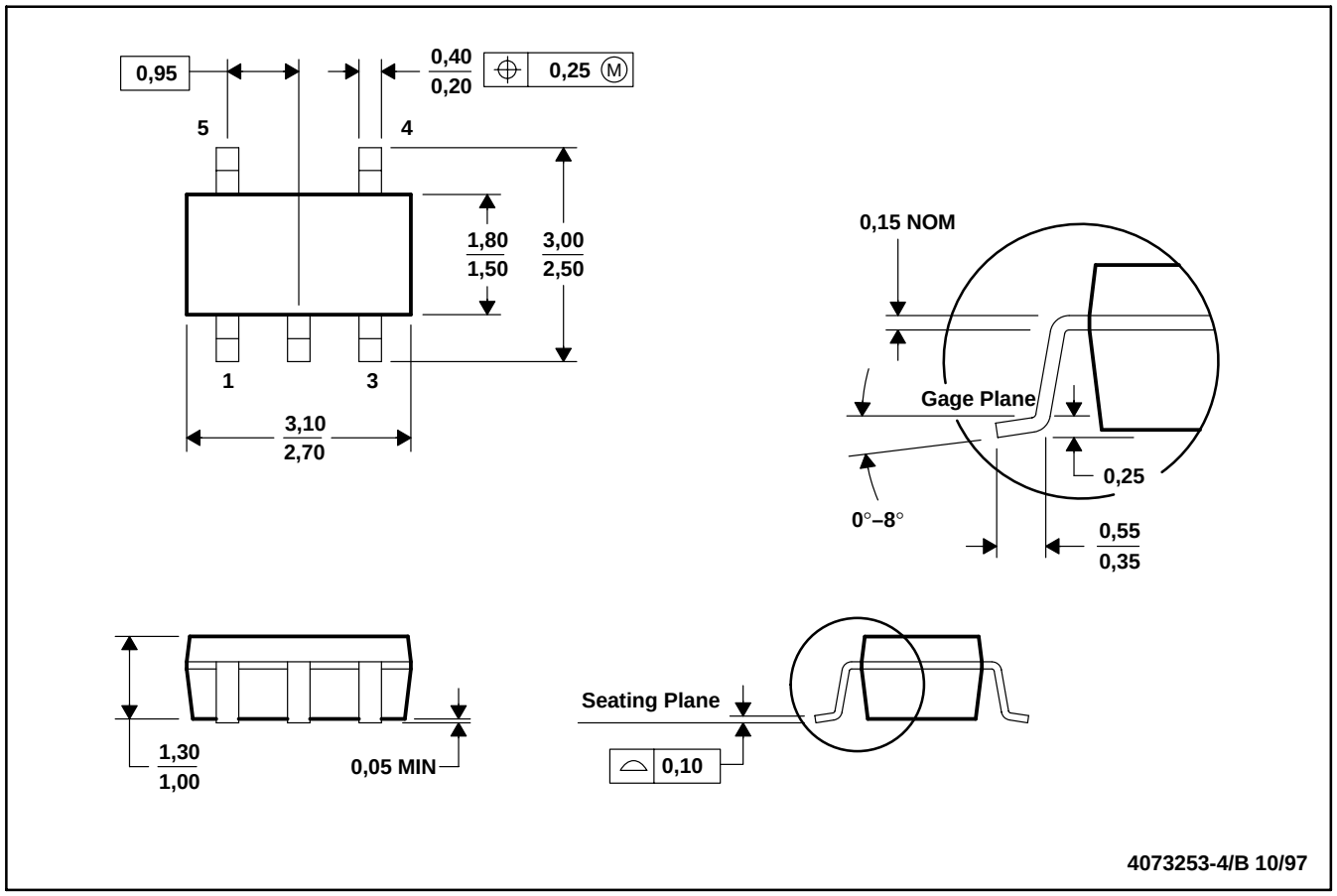


Figure 8

MECHANICAL DATA

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 include mold flash or protrusion.

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