

## features

- Minimum Supply Voltage of 0.75 V
- Supply Voltage Supervision Range:
  - 1.2 V, 1.5 V, 1.8 V (TPS3123, TPS3124, TPS3125)
  - 3 V (TPS3125 Devices only)
- Power-On Reset Generator With Fixed Delay Time of 180 ms
- Manual Reset Input (TPS3123 and TPS3125)
- Watchdog Timer Retriggeres the  $\overline{\text{RESET}}$  Output at  $V_{DD} \geq V_{IT}$
- Supply Current of 14  $\mu\text{A}$  (Typ)
- SOT23–5 Package
- Temperature Range . . .  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

## typical applications

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

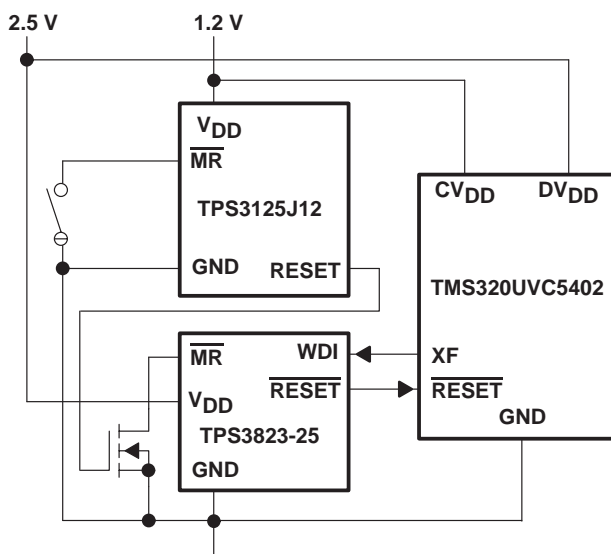
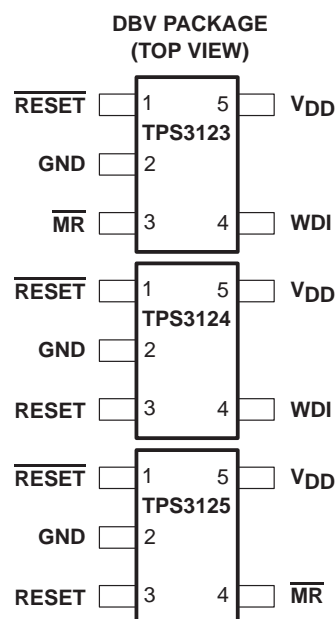


Figure 1. Typical Dual-Voltage DSP Application



## description

The TPS3123, TPS3124, TPS3125 family of ultra-low voltage processor supervisory circuits provides 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 0.75 V. Thereafter, the supply voltage supervisor 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,  $t_{d\text{typ}} = 180$  ms starts after  $V_{DD}$  has risen above the threshold voltage  $V_{IT}$ .



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.

TPS3123J12, TPS3123G15, TPS3123J18, TPS3124J12, TPS3124G15  
 TPS3124J18, TPS3125J12, TPS3125G15, TPS3125J18, TPS3125L30  
 ULTRA-LOW VOLTAGE PROCESSOR SUPERVISORY CIRCUITS

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**description (continued)**

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 TPS3123-xx and TPS3125-xx devices incorporate a manual reset input,  $\overline{MR}$ . A low level at  $\overline{MR}$  causes  $\overline{RESET}$  to become active. The TPS3124-xx devices do not have the input  $\overline{MR}$ , but include a high-level output  $\overline{RESET}$  same as the TPS3125-xx devices. In addition the TPS3123-xx and TPS3124-xx have a watchdog timer that need to be triggered periodically by a positive or negative transition at  $WDI$ . When the supervising system fails to retrigger the watchdog circuit within the time-out interval  $t_{out} = 0.8\text{ s}$ ,  $\overline{RESET}$  output becomes active for the time period  $t_d$ . This event also reinitializes the watchdog timer.

The circuits are available in a 5-pin SOT23-5 package. The TPS3123, TPS3124, TPS3125 devices are characterized for operation over a temperature range of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

**PACKAGE INFORMATION STANDARD VERSIONS**

$T_A$	DEVICE NAME		THRESHOLD VOLTAGE	MARKING
-40°C to 85°C	TPS3123J12DBVR†	TPS3123J12DBVT‡	1.08 V	PBNI
	TPS3123G15DBVR†	TPS3123G15DBVT‡	1.40 V	PBOI
	TPS3123J18DBVR†	TPS3123J18DBVT‡	1.62 V	PBPI
	TPS3124J12DBVR†	TPS3124J12DBVT‡	1.08 V	PBQI
	TPS3124G15DBVR†	TPS3124G15DBVT‡	1.40 V	PBRI
	TPS3124J18DBVR†	TPS3124J18DBVT‡	1.62 V	PBSI
	TPS3125J12DBVR†	TPS3125J12DBVT‡	1.08 V	PBTI
	TPS3125G15DBVR†	TPS3125G15DBVT‡	1.40 V	PBUI
	TPS3125J18DBVR†	TPS3125J18DBVT‡	1.62 V	PBVI
	TPS3125L30DBVR†	TPS3125L30DBVT‡	2.64 V	PBXI

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

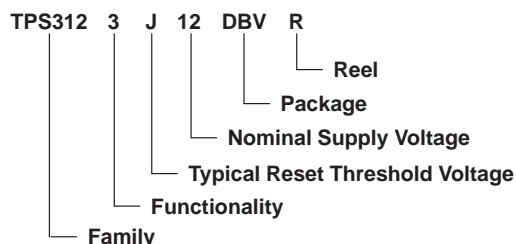
‡ The DBVT passive indicates tape and reel of 250 parts.



TPS3123J12, TPS3123G15, TPS3123J18, TPS3124J12, TPS3124G15  
 TPS3124J18, TPS3125J12, TPS3125G15, TPS3125J18, TPS3125L30  
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ordering information application specific versions



DEVICE NAME	NOMINAL SUPPLY VOLTAGE, $V_{NOM}$
TPS312xx12DBV	1.2 V
TPS312xx15DBV	1.5 V
TPS312xx18DBV	1.8 V
TPS312xx30DBV	3.0 V

DEVICE NAME	TYPICAL RESET THRESHOLD VOLTAGE- $V_{IT-}$
TPS312xAxxDBV	$V_{NOM}-1\%$
TPS312xBxxDBV	$V_{NOM}-2\%$
TPS312xCxxDBV	$V_{NOM}-3\%$
TPS312xDxxDBV	$V_{NOM}-4\%$
TPS312xExxDBV	$V_{NOM}-5\%$
TPS312xFxxDBV	$V_{NOM}-6\%$
TPS312xGxxDBV	$V_{NOM}-7\%$
TPS312xHxxDBV	$V_{NOM}-8\%$
TPS312xIxxDBV	$V_{NOM}-9\%$
TPS312xJxxDBV	$V_{NOM}-10\%$
TPS312xKxxDBV	$V_{NOM}-11\%$
TPS312xLxxDBV	$V_{NOM}-12\%$
TPS312xMxxDBV	$V_{NOM}-13\%$
TPS312xNxxDBV	$V_{NOM}-14\%$
TPS312xOxxDBV	$V_{NOM}-15\%$

NOTE: Ten standard versions will be available at product introduction.  
 For the application specific versions contact the local TI sales office for availability and lead time.

Function Tables

TPS3123

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

TPS3124

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

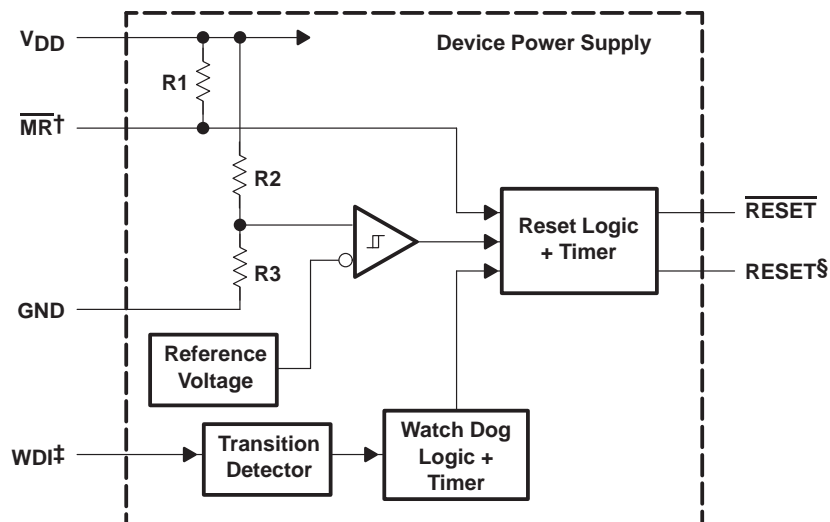
TPS3125

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

TPS3123J12, TPS3123G15, TPS3123J18, TPS3124J12, TPS3124G15  
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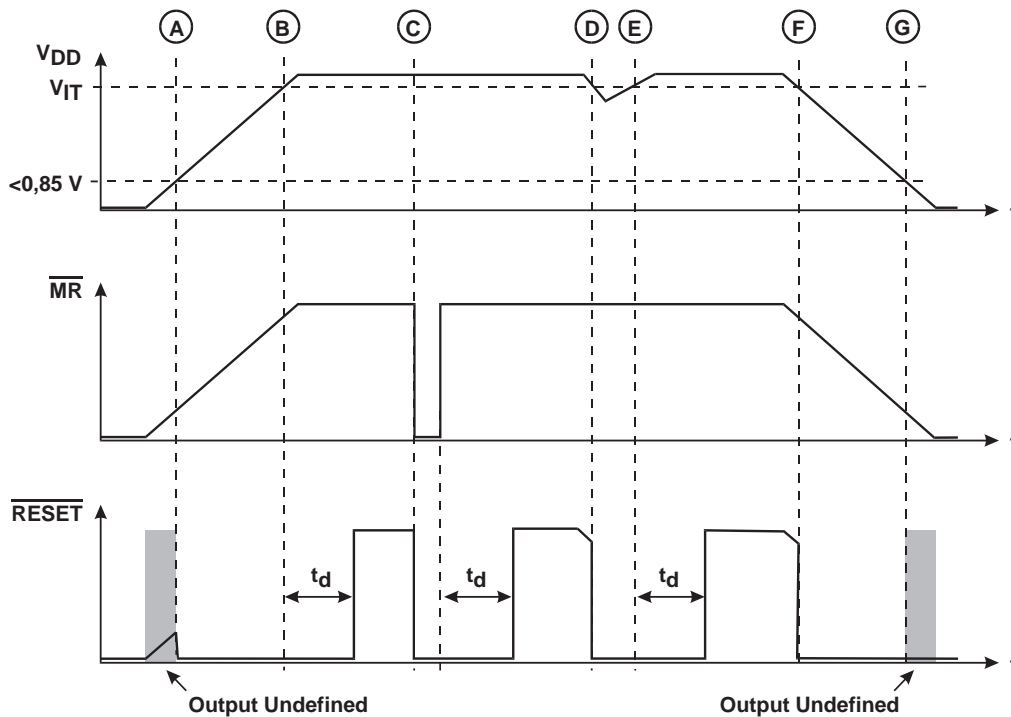
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functional block diagram

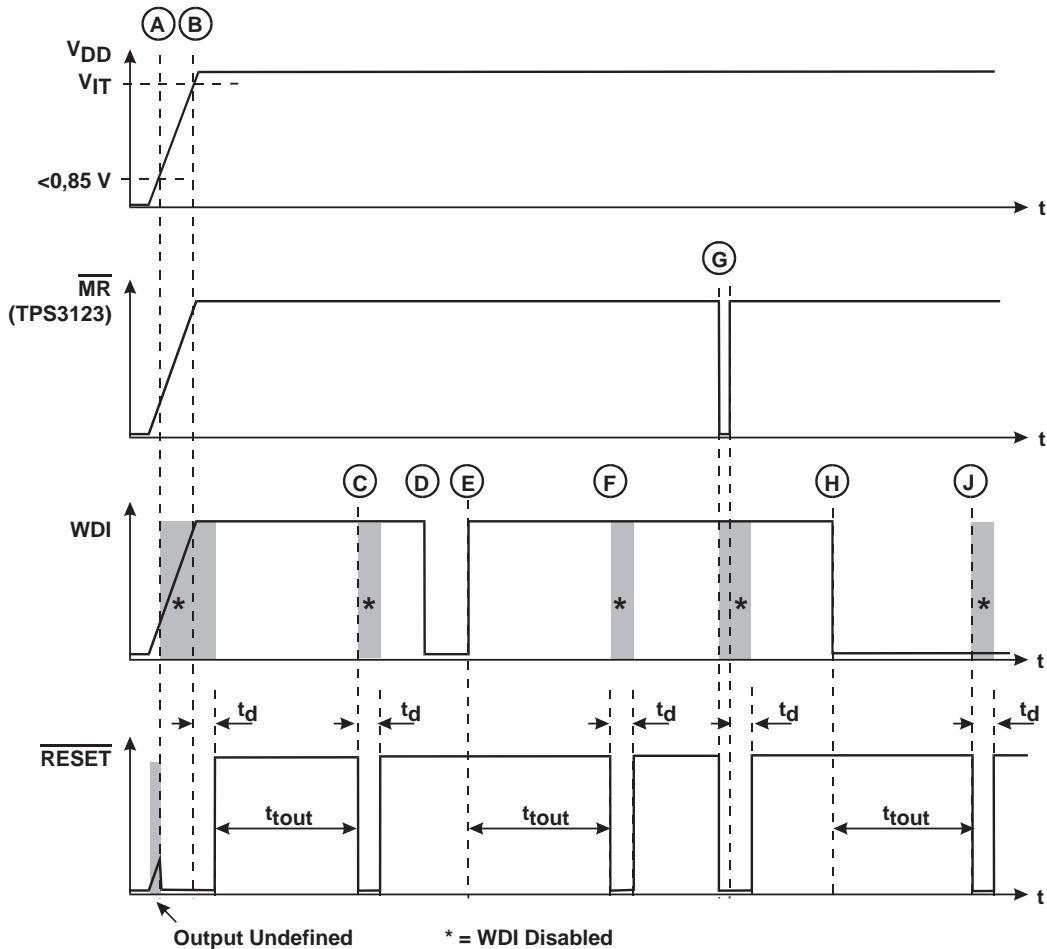


† TPS3123 and TPS3125 Only  
 ‡ TPS3123 and TPS3124 Only  
 § TPS3124 and TPS3125 Only

timing diagram TPS3123 and TPS3125



timing diagram TPS3123 and TPS3124



TPS3123J12, TPS3123G15, TPS3123J18, TPS3124J12, TPS3124G15  
 TPS3124J18, TPS3125J12, TPS3125G15, TPS3125J18, TPS3125L30  
**ULTRA-LOW VOLTAGE PROCESSOR SUPERVISORY CIRCUITS**

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

Supply voltage, $V_{DD}$ (see Note 1)	3.6 V
All other pins (see Note 1)	-0.3 V to 3.6 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 $V_I > V_{DD}$ )	$\pm 10$ mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{DD}$ )	$\pm 10$ 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	$T_A \leq 25^\circ\text{C}$ 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
DBV	437 mW	3.5 mW/°C	280 mW	227 mW

**recommended operating conditions at specified temperature range**

		MIN	MAX	UNIT
Supply voltage, $V_{DD}$	$T_A = 0^\circ\text{C}$ to $85^\circ\text{C}$	0.75	3.3	V
	$T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$	0.85	3.3	
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 WDI, $\Delta t/\Delta V$			1	$\mu\text{s}/\text{V}$
Operating free-air temperature range, $T_A$		-40	85	°C



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

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
$\overline{\text{MR}}$ pullup resistor (internal)				27			k $\Omega$
$I_{IH}$	High-level input current	WDI	WDI = $V_{DD}$ = 3.3 V	-1		1	$\mu\text{A}$
		$\overline{\text{MR}}$	$\overline{\text{MR}}$ = $0.7 \times V_{DD}$ , $V_{DD}$ = 3.3 V	-20		-55	
$I_{IL}$	Low-level input current	WDI	WDI = 0 V, $V_{DD}$ = 3.3 V	-1		1	$\mu\text{A}$
		$\overline{\text{MR}}$	$\overline{\text{MR}}$ = 0 V, $V_{DD}$ = 3.3 V	-80		-170	
$V_{OH}$	High-level output voltage	$\overline{\text{RESET}}$	$V_{DD}$ = 1.5 V, $I_{OH}$ = -1 mA	0.8 $\times V_{DD}$			V
			$V_{DD}$ = 3.3 V, $I_{OH}$ = -4.5 mA				
		RESET	$V_{DD}$ = 0.75 V, $I_{OH}$ = -8 $\mu\text{A}$				
			$V_{DD}$ = 1.5 V, $I_{OH}$ = -1 mA				
$V_{OL}$	Low-level output voltage	RESET	$V_{DD}$ = 0.75 V, $I_{OL}$ = 15 $\mu\text{A}$	0.2 $\times V_{DD}$			V
			$V_{DD}$ = 1.5 V, $I_{OL}$ = 1.4 mA				
		RESET	$V_{DD}$ = 1.5 V, $I_{OL}$ = 1.4 mA				
			$V_{DD}$ = 3.3 V, $I_{OL}$ = 3 mA				
$V_{IT-}$	Negative-going input threshold voltage (see Note 2)	TPS312xJ12	$T_A$ = -40°C to 85°C	1.04	1.08	1.12	V
		TPS312xG15		1.35	1.40	1.45	
		TPS312xJ18		1.56	1.62	1.68	
		TPS312xL30		2.57	2.64	2.71	
$V_{hys}$	Hysteresis at $V_{DD}$ input	1 V < $V_{IT-}$ < 1.4 V		15			mV
		1.4 V < $V_{IT-}$ < 2 V		20			
		2 V < $V_{IT-}$ < 3 V		30			
$I_{DD}$	Supply current	TPS3123-xx TPS3124-xx	WDI = $V_{DD}$ , $\overline{\text{MR}}$ unconnected	$V_{DD}$ = 0.75 V	14		$\mu\text{A}$
				$V_{DD}$ = 3.3 V	22	30	
		TPS3125-xx (see Note 3)	$\overline{\text{MR}}$ unconnected	$V_{DD}$ = 0.75 V	14		
				$V_{DD}$ = 3.3 V	18	25	
$C_i$	Input capacitance at $\overline{\text{MR}}$ , WDI	$V_I$ = 0 V to 3.3 V		5			pF

- NOTES: 2. To ensure best stability of the threshold voltage, a bypass capacitor (ceramic, 0.1  $\mu\text{F}$ ) should be placed near the supply terminal.  
 3. The supply current during delay time  $t_d$  is typical 5  $\mu\text{A}$  higher.

TPS3123J12, TPS3123G15, TPS3123J18, TPS3124J12, TPS3124G15  
 TPS3124J18, TPS3125J12, TPS3125G15, TPS3125J18, TPS3125L30  
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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	$V_{IH} = V_{IT-} + 0.2\text{ V}$ , $V_{IL} = V_{IT-} - 0.2\text{ V}$ $V_{DD} \geq V_{IT-} + 0.2\text{ V}$ , $V_{IL} = 0.3 \times V_{DD}$ , $V_{IH} = 0.7 \times V_{DD}$	6			$\mu\text{s}$
	At $V_{DD}$		1			
	At $\overline{\text{MR}}$		0.1			

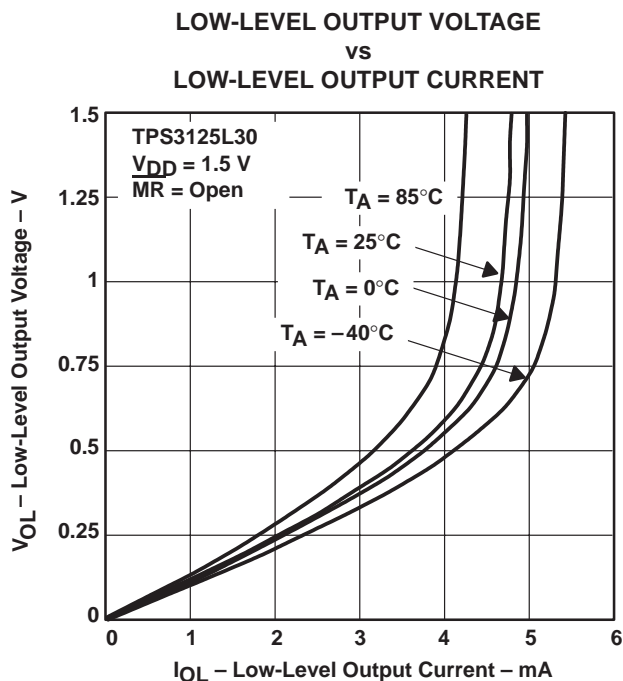
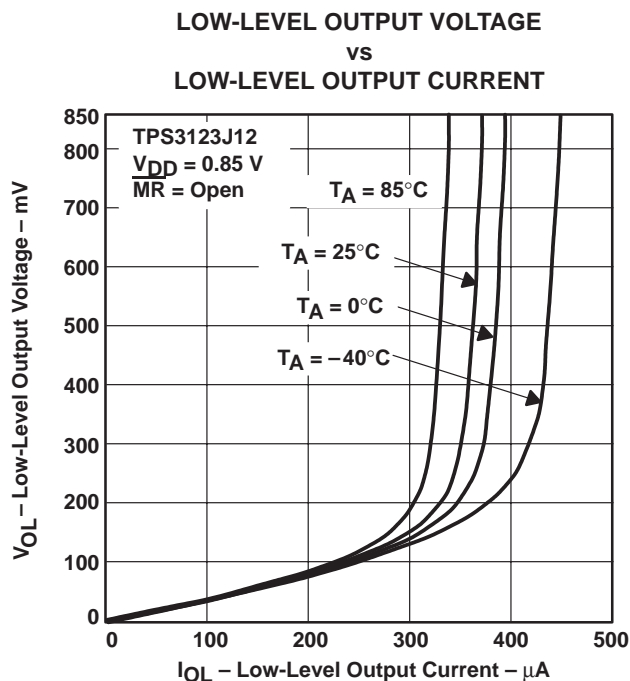
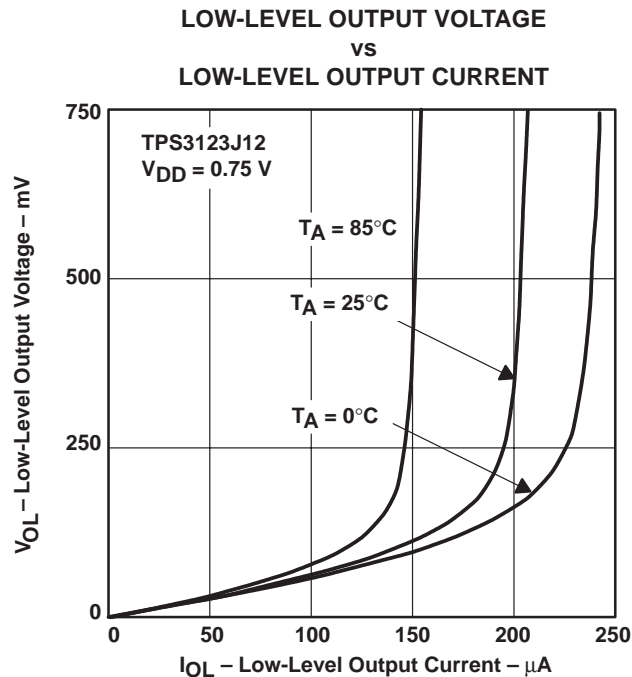
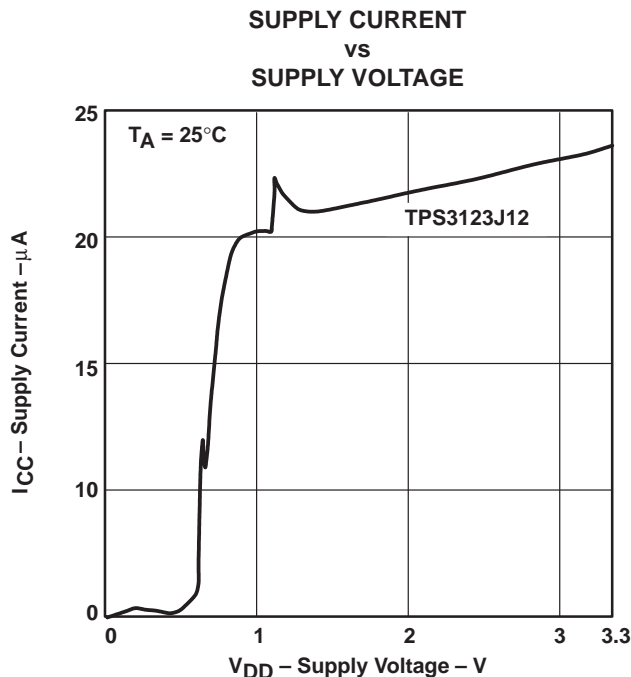
switching characteristics at  $R_L = 1\text{ M}\Omega$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{\text{tout}}$	Watchdog time out	$V_{DD} \geq V_{IT-} + 0.2\text{ V}$ , See timing diagram	0.8	1.4	2.1	s
$t_d$	Delay time	$V_{DD} > V_{IT-} + 0.2\text{ V}$ , See timing diagram	100	180	260	ms
$t_{\text{PHL}}$	Propagation delay time, high-to-low-level output	$\overline{\text{MR}}$ to $\overline{\text{RESET}}$ delay (TPS3123/25 only)			0.1	$\mu\text{s}$
$t_{\text{PLH}}$	Propagation delay time, low-to-high-level output	$\overline{\text{MR}}$ to $\overline{\text{RESET}}$ delay (TPS3125 only)			0.1	
$t_{\text{PHL}}$	Propagation delay time, high-to-low-level output	$V_{DD}$ to $\overline{\text{RESET}}$ delay			10	$\mu\text{s}$
$t_{\text{PLH}}$	Propagation delay time, low-to-high-level output	$V_{DD}$ to $\overline{\text{RESET}}$ delay (TPS3124/25 only)			10	





TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS

LOW-LEVEL OUTPUT VOLTAGE  
 vs  
 LOW-LEVEL OUTPUT CURRENT

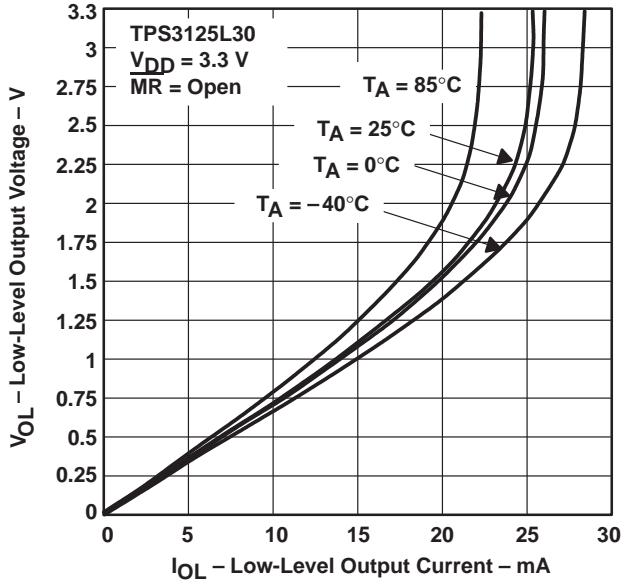


Figure 6

HIGH-LEVEL OUTPUT VOLTAGE  
 vs  
 HIGH-LEVEL OUTPUT CURRENT

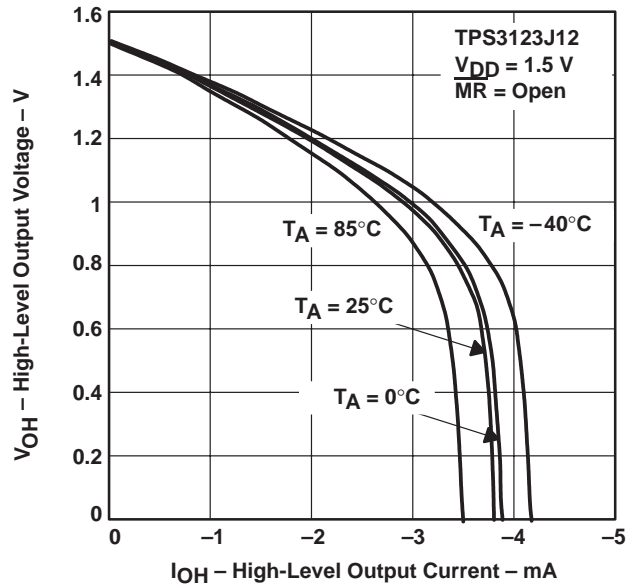


Figure 7

HIGH-LEVEL OUTPUT VOLTAGE  
 vs  
 HIGH-LEVEL OUTPUT CURRENT

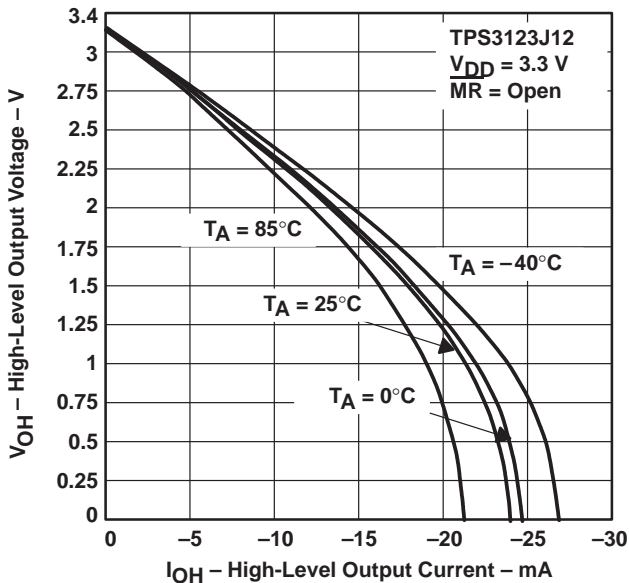


Figure 8

NORMALIZED INPUT THRESHOLD VOLTAGE  
 vs  
 FREE-AIR TEMPERATURE

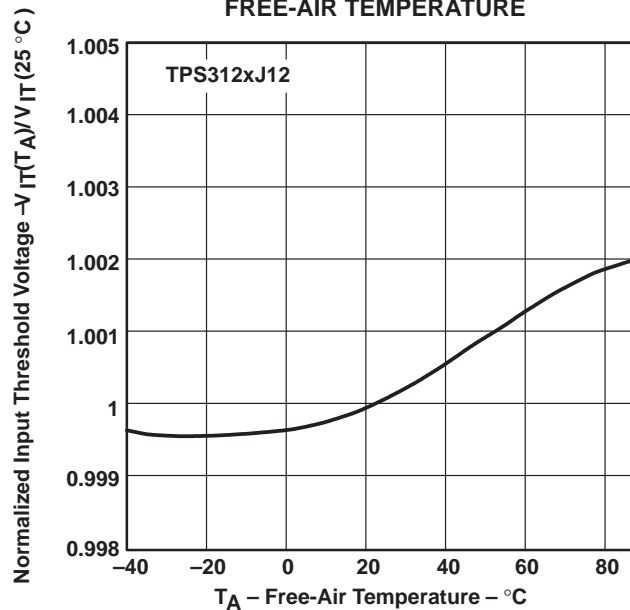


Figure 9

TYPICAL CHARACTERISTICS

NORMALIZED INPUT THRESHOLD VOLTAGE  
 vs  
 FREE-AIR TEMPERATURE

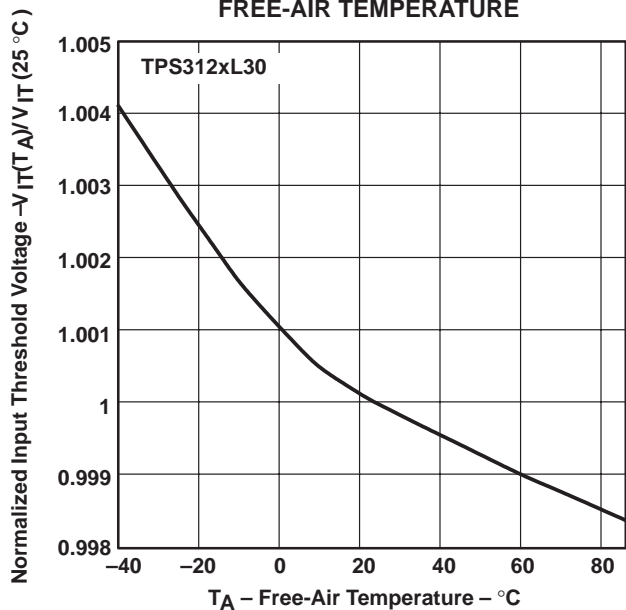


Figure 10

MINIMUM PULSE DURATION  
 vs  
 THRESHOLD OVERDRIVE

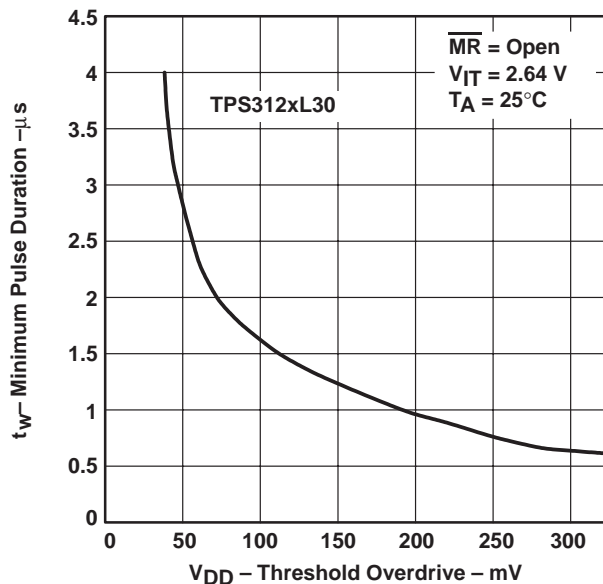


Figure 11

MINIMUM PULSE DURATION  
 vs  
 THRESHOLD OVERDRIVE

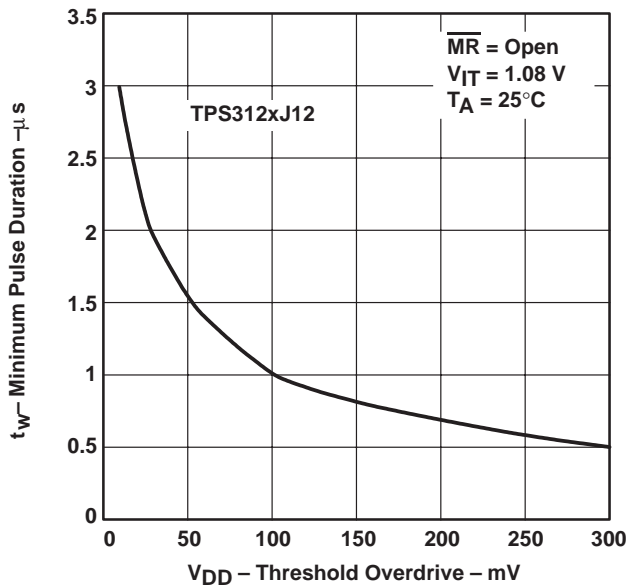


Figure 12

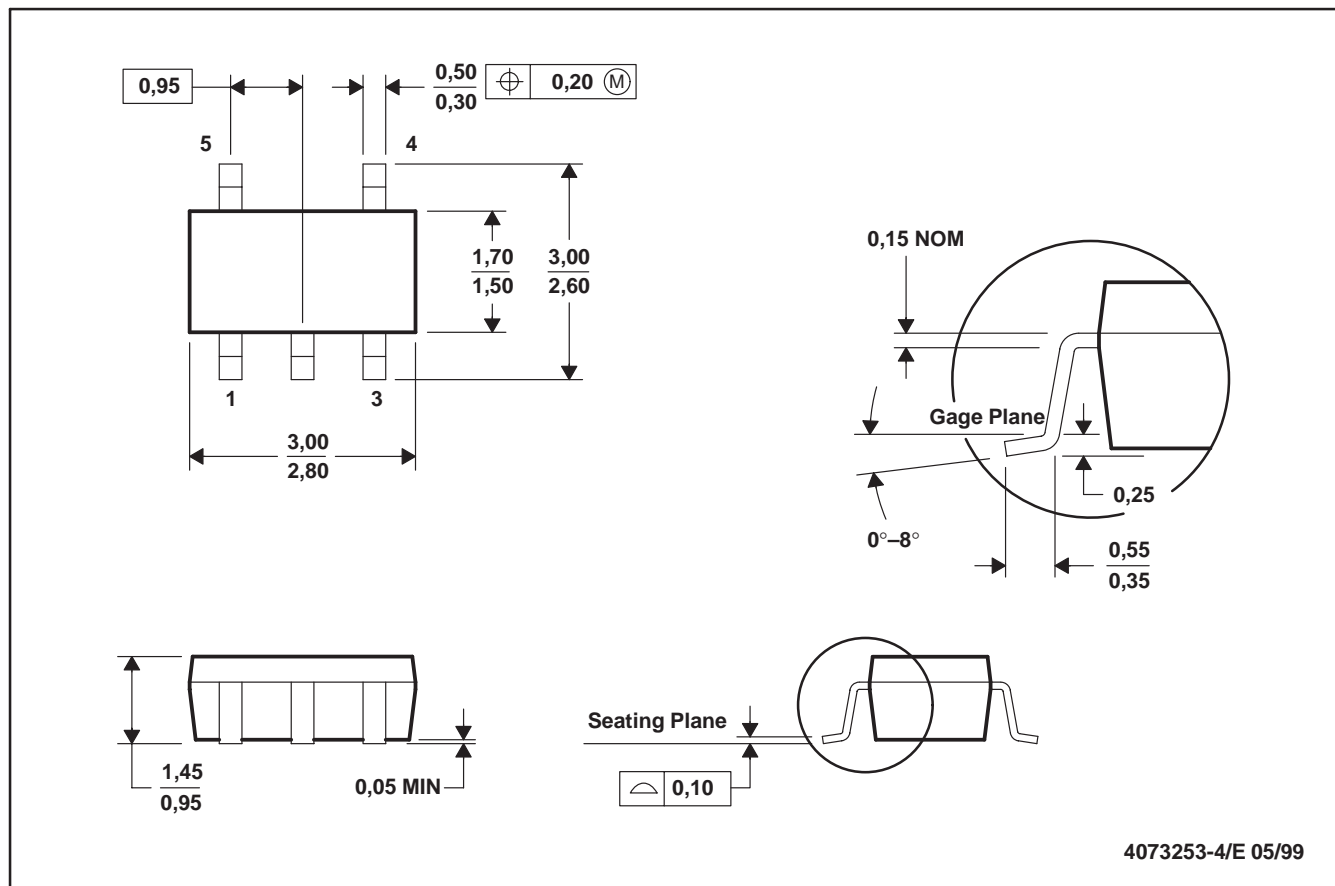
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MECHANICAL DATA

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

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