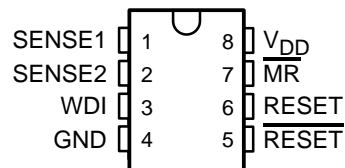


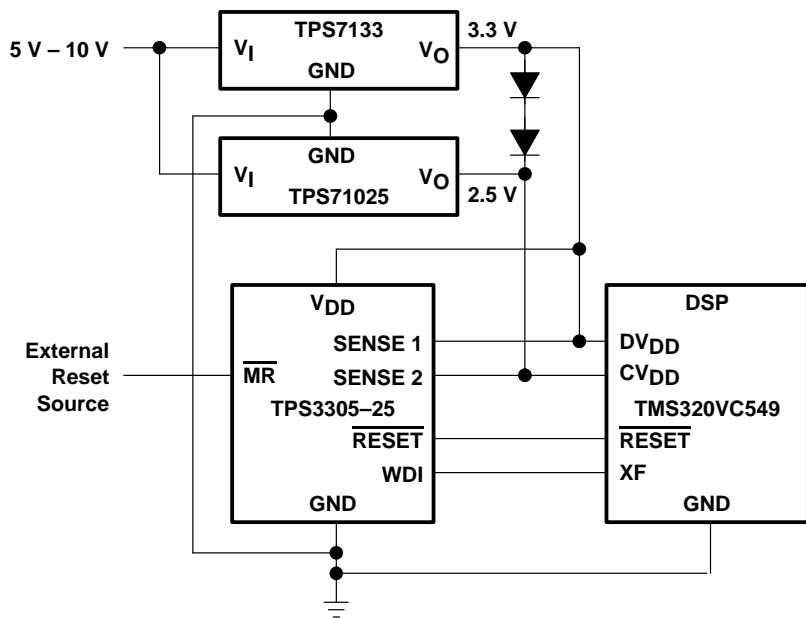
- Dual Supervisory Circuits for DSP and Processor-Based Systems
- Power-On Reset Generator With Fixed Delay Time of 200 ms, no External Capacitor Needed
- Watchdog Timer Retriggeres the  $\overline{\text{RESET}}$  Output at  $\text{SENSE}_n \geq V_{IT+}$
- Temperature-Compensated Voltage Reference
- Maximum Supply Current of 40  $\mu\text{A}$
- Supply Voltage Range . . . 2.7 V to 6 V
- Defined  $\overline{\text{RESET}}$  Output From  $V_{DD} \geq 1.1 \text{ V}$
- MSOP-8 and SO-8 Packages
- Temperature Range . . . – 40°C to 85°C

D OR DGN PACKAGE  
(TOP VIEW)



## typical applications

Figure 1 lists some of the typical applications for the TPS3305 family, and a schematic diagram for a TI DSP-based system application. This application uses TI part numbers TPS3305–25, TPS7133, TPS71025, and TMS320VC549.



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

Figure 1. Applications Using the TPS3305 Family

## description

The TPS3305 family is a series of micropower supply voltage supervisors designed for circuit initialization, primarily in DSP and processor-based systems, which require two supply voltages.



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.

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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# TPS3305-18, TPS3305-25, TPS3305-33 DUAL PROCESSOR SUPERVISORS

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## description (continued)

The product spectrum of the TPS3305 is designed for monitoring two independent supply voltages of 3.3 V/1.8 V, 3.3 V/2.5 V or 3.3 V/5 V.

The various supply voltage supervisors are designed to monitor the nominal supply voltage, as shown in the following supply voltage monitoring table.

SUPPLY VOLTAGE MONITORING

DEVICE	NOMINAL SUPERVISED VOLTAGE		THRESHOLD VOLTAGE (TYP)	
	SENSE1	SENSE2	SENSE1	SENSE2
TPS3305-18	3.3 V	1.8 V	2.93 V	1.68 V
TPS3305-25	3.3 V	2.5 V	2.93 V	2.25 V
TPS3305-33	5 V	3.3 V	4.55 V	2.93 V

During power-on,  $\overline{\text{RESET}}$  is asserted when the supply voltage  $V_{DD}$  becomes higher than 1.1 V. Thereafter, the supply voltage supervisor monitors the SENSEn inputs and keeps  $\overline{\text{RESET}}$  active as long as SENSEn remains below the threshold voltage  $V_{IT+}$ .

An internal timer delays the return of the  $\overline{\text{RESET}}$  output to the inactive state (high) to ensure proper system reset. The delay time,  $t_{d\text{typ}} = 200$  ms, starts after SENSE1 and SENSE2 inputs have risen above the threshold voltage  $V_{IT+}$ . When the voltage at SENSE1 or SENSE2 input drops below the threshold voltage  $V_{IT-}$ , the  $\overline{\text{RESET}}$  output becomes active (low) again.

The TPS3305-xx devices integrate a watchdog timer that is periodically triggered by a positive or negative transition of WDI. When the supervising system fails to retrigger the watchdog circuit within the time-out interval,  $t_{t(\text{out})} = 1.6$  s,  $\overline{\text{RESET}}$  becomes active for the time period  $t_d$ . This event also reinitializes the watchdog timer. Leaving WDI unconnected disables the watchdog.

The TPS3305-xx family of devices incorporates a manual reset input,  $\overline{\text{MR}}$ . A low level at  $\overline{\text{MR}}$  causes  $\overline{\text{RESET}}$  to become active. In addition to the active-low  $\overline{\text{RESET}}$  output, the TPS3305-xx family includes an active-high RESET output.

The TPS3305-xx devices are available in either 8-pin MSOP or standard 8-pin SO packages.

The TPS3305-xx family is characterized for operation over a temperature range of  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGED DEVICES		MARKING DGN PACKAGE	CHIP FORM (Y)
	SMALL OUTLINE (D)	PowerPAD™ μ-SMALL OUTLINE (DGN)		
$-40^{\circ}\text{C}$ to $85^{\circ}\text{C}$	TPS3305-18D	TPS3305-18DGN	TIAAM	TPS3305-18Y
	TPS3305-25D	TPS3305-25DGN	TIAAN	TPS3305-25Y
	TPS3305-33D	TPS3305-33DGN	TIAAO	TPS3305-33Y

PowerPAD is a trademark of Texas Instruments Incorporated.



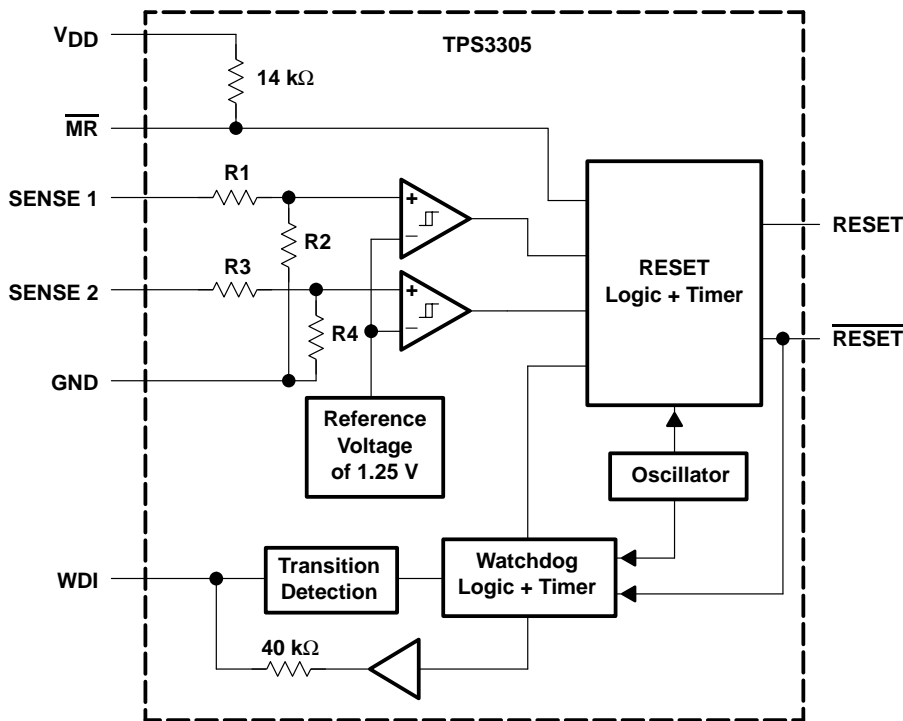
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FUNCTION/TRUTH TABLES

$\overline{\text{MR}}$	SENSE1>V <sub>IT1</sub>	SENSE2>V <sub>IT2</sub>	$\overline{\text{RESET}}$	RESET
L	X†	X†	L	H
H	0	0	L	H
H	0	0	L	H
H	0	1	L	H
H	0	1	L	H
H	1	0	L	H
H	1	0	L	H
H	1	1	L	H
H	1	1	H	L

† X = Don't care

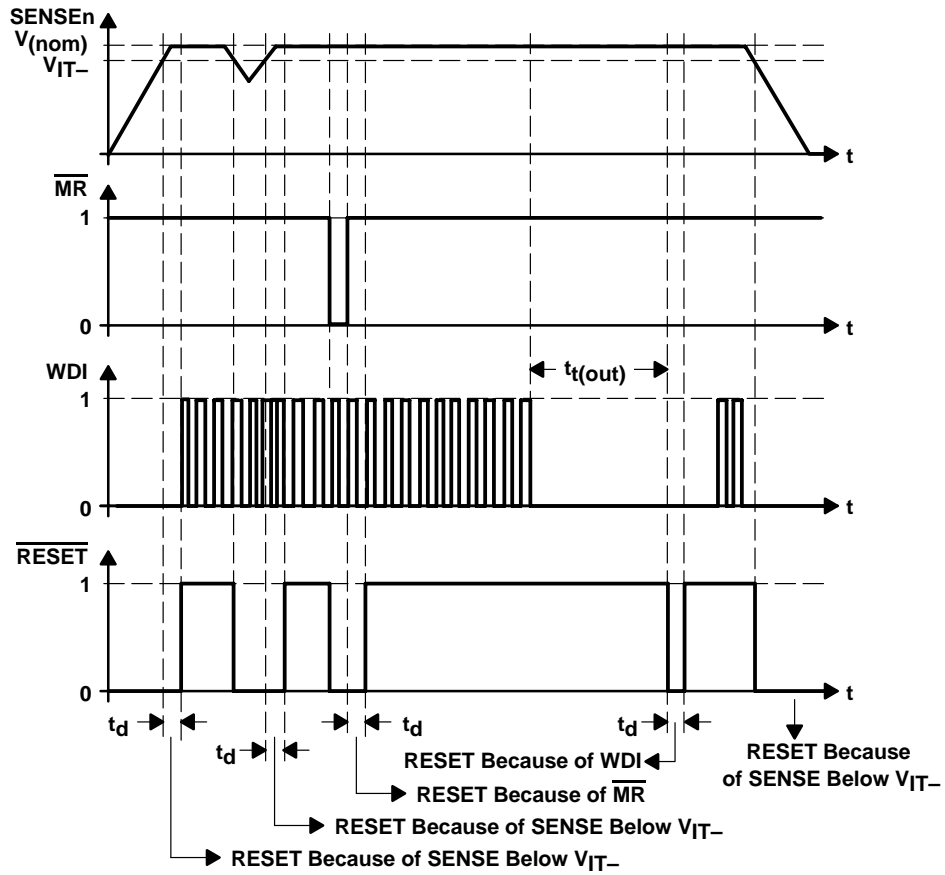
functional block diagram



# TPS3305-18, TPS3305-25, TPS3305-33 DUAL PROCESSOR SUPERVISORS

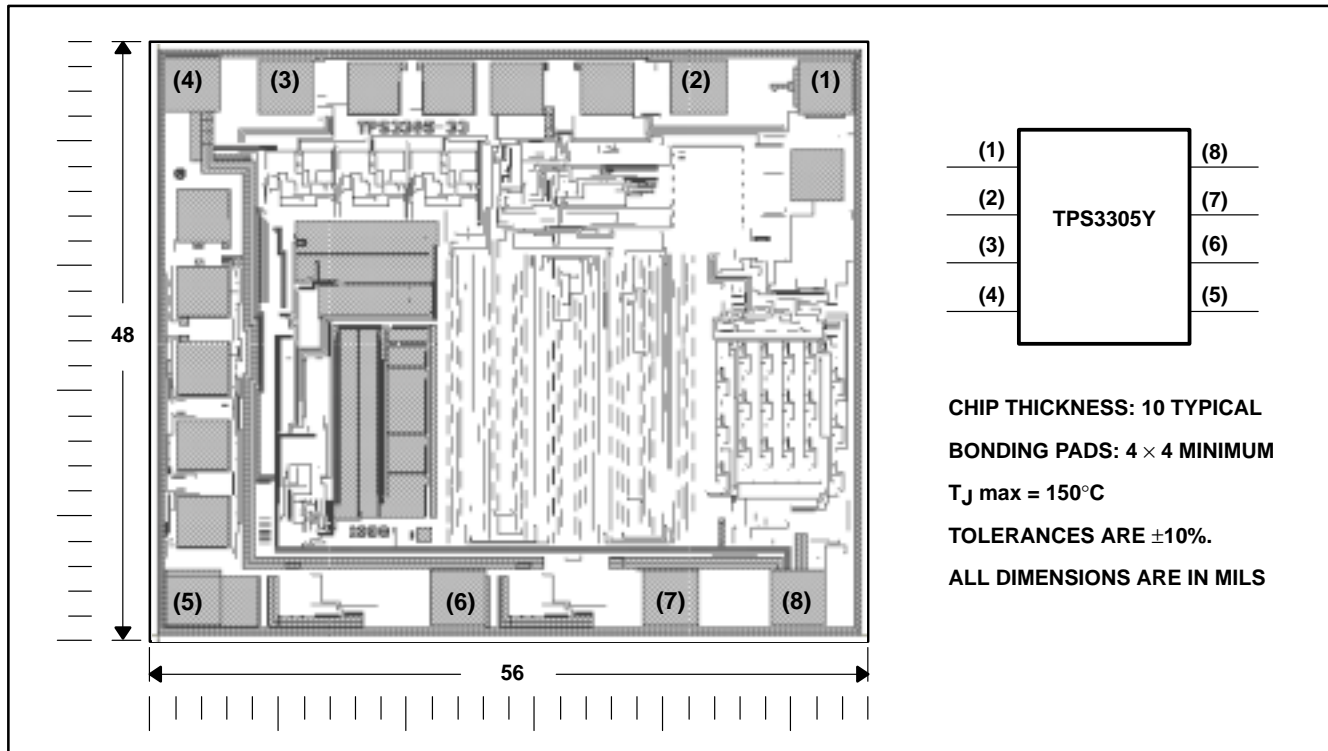
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## timing diagram



**TPS3305Y chip information**

These chips, when properly assembled, display characteristics similar to those of the TPS3305. Thermal compression or ultrasonic bonding may take place on the doped aluminium bonding pads. The chips may be mounted with conductive epoxy or a gold-silicon preform.



**Terminal Functions**

TERMINAL NAME	NO.	I/O	DESCRIPTION
GND	4		Ground
$\overline{\text{MR}}$	7	I	Manual reset
$\overline{\text{RESET}}$	5	O	Active-low reset output
RESET	6	O	Active-high reset output
SENSE1	1	I	Sense voltage input 1
SENSE2	2	I	Sense voltage input 2
WDI	3	I	Watchdog timer input
VDD	8		Supply voltage

# TPS3305-18, TPS3305-25, TPS3305-33 DUAL PROCESSOR SUPERVISORS

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

Supply voltage, $V_{DD}$ (see Note1)	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 $V_I > V_{DD}$ )	±20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{DD}$ )	±20 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	$T_A \leq 25^\circ\text{C}$ 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
DGN	2.14 W	17.1 mW/°C	1.37 W	1.11 W
D	725 mW	5.8 mW/°C	464 mW	377 mW

## recommended operating conditions at specified temperature range

	MIN	MAX	UNIT
Supply voltage, $V_{DD}$	2.7	6	V
Input voltage at $\overline{MR}$ and WDI, $V_I$	0	$V_{DD}+0.3$	V
Input voltage at SENSE1 and SENSE2, $V_I$	0	$(V_{DD}+0.3)V_{IT}/1.25V$	V
High-level input voltage at $\overline{MR}$ and WDI, $V_{IH}$	$0.7 \times V_{DD}$		V
Low-level input voltage at $\overline{MR}$ and WDI, $V_{IL}$	$0.3 \times V_{DD}$		V
Input transition rise and fall rate at $\overline{MR}$ , $\Delta t/\Delta V$	50		ns/V
Operating free-air temperature range, $T_A$	–40	85	°C



# TPS3305-18, TPS3305-25, TPS3305-33 DUAL PROCESSOR SUPERVISORS

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT	
V <sub>OH</sub>	High-level output voltage	V <sub>DD</sub> = 2.7 V to 6 V, I <sub>OH</sub> = -20 μA	V <sub>DD</sub> - 0.2V			V	
		V <sub>DD</sub> = 3.3 V, I <sub>OH</sub> = -2 mA	V <sub>DD</sub> - 0.4V				
		V <sub>DD</sub> = 6 V, I <sub>OH</sub> = -3 mA	V <sub>DD</sub> - 0.4V				
V <sub>OL</sub>	Low-level output voltage	V <sub>DD</sub> = 2.7 V to 6 V, I <sub>OL</sub> = 20 μA	0.2			V	
		V <sub>DD</sub> = 3.3 V, I <sub>OL</sub> = 2 mA	0.4				
		V <sub>DD</sub> = 6 V, I <sub>OL</sub> = 3 mA	0.4				
Power-up reset voltage (see Note 2)		V <sub>DD</sub> ≥ 1.1 V, I <sub>OL</sub> = 20 μA	0.4			V	
V <sub>IT-</sub>	Negative-going input threshold voltage (see Note 3)	V <sub>DD</sub> = 2.7 V to 6 V, T <sub>A</sub> = 0°C to 85°C	1.64	1.68	1.72	V	
			2.20	2.25	2.30		
			2.86	2.93	3		
			4.46	4.55	4.64		
			V <sub>DD</sub> = 2.7 V to 6 V, T <sub>A</sub> = -40°C to 85°C	1.64	1.68	1.73	V
				2.20	2.25	2.32	
				2.86	2.93	3.02	
				4.46	4.55	4.67	
V <sub>hys</sub>	Hysteresis at VSENSEn input	V <sub>IT-</sub> = 1.68 V	15			mV	
		V <sub>IT-</sub> = 2.25 V	20				
		V <sub>IT-</sub> = 2.93 V	30				
		V <sub>IT-</sub> = 4.55 V	40				
I <sub>H(AV)</sub>	Average high-level input current	WDI	WDI = V <sub>DD</sub> = 6 V Time average (dc = 88%)		100	150	μA
I <sub>L(AV)</sub>	Average low-level input current		WDI = 0 V, V <sub>DD</sub> = 6 V, Time average (dc = 12%)		-15	-20	
I <sub>H</sub>	High-level input current	WDI	WDI = V <sub>DD</sub> = 6 V,		120	170	μA
		$\overline{\text{MR}}$	$\overline{\text{MR}} = 0.7 \times V_{DD}$ , V <sub>DD</sub> = 6 V		-130	-180	
		SENSE1	VSENSE1 = V <sub>DD</sub> = 6 V		5	8	
		SENSE2	VSENSE2 = V <sub>DD</sub> = 6 V		6	9	
I <sub>L</sub>	Low-level input current	WDI	WDI = 0 V, V <sub>DD</sub> = 6 V		-120	-170	μA
		$\overline{\text{MR}}$	$\overline{\text{MR}} = 0V$ , V <sub>DD</sub> = 6 V		-430	-600	
		SENSEn	VSENSE1,2 = 0 V		-1	1	
I <sub>DD</sub>	Supply current					40	μA
C <sub>i</sub>	Input capacitance	V <sub>I</sub> = 0 V to V <sub>DD</sub>				10	pF

NOTES: 2. The lowest supply voltage at which RESET becomes active. t<sub>r</sub>, V<sub>DD</sub> ≥ 15 μs/V.  
3. To ensure best stability of the threshold voltage, a bypass capacitor (ceramic 0.1 μF) should be placed close to the supply terminals.



# TPS3305-18, TPS3305-25, TPS3305-33 DUAL PROCESSOR SUPERVISORS

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## timing requirements at $V_{DD} = 2.7\text{ V to }6\text{ V}$ , $R_L = 1\text{ M}\Omega$ , $C_L = 50\text{ pF}$ , $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_w$	Pulse width					
	SENSE <sub>n</sub>	$V_{SENSEnL} = V_{IT-} - 0.2\text{ V}$ , $V_{SENSEnH} = V_{IT+} + 0.2\text{ V}$	6			$\mu\text{s}$
	$\overline{\text{MR}}$	$V_{IH} = 0.7 \times V_{DD}$ , $V_{IL} = 0.3 \times V_{DD}$	100			ns
WDI	100				ns	

## switching characteristics at $V_{DD} = 2.7\text{ V to }6\text{ V}$ , $R_L = 1\text{ M}\Omega$ , $C_L = 50\text{ pF}$ , $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{t(out)}$	Watchdog time out	$V_{I(SENSEn)} \geq V_{IT+} + 0.2\text{ V}$ , $\overline{\text{MR}} \geq 0.7 \times V_{DD}$ , See timing diagram	1.1	1.6	2.3	s
$t_d$	Delay time	$V_{I(SENSEn)} \geq V_{IT+} + 0.2\text{ V}$ , $\overline{\text{MR}} \geq 0.7 \times V_{DD}$ , See timing diagram	140	200	280	ms
$t_{PHL}$	Propagation (delay) time, high-to-low level output	$\overline{\text{MR}}$ to $\overline{\text{RESET}}$ , $\overline{\text{MR}}$ to RESET				
$t_{PLH}$	Propagation (delay) time, low-to-high level output	$\overline{\text{MR}}$ to $\overline{\text{RESET}}$ , $\overline{\text{MR}}$ to RESET		200	500	ns
$t_{PHL}$	Propagation (delay) time, high-to-low level output	SENSE <sub>n</sub> to $\overline{\text{RESET}}$ , SENSE <sub>n</sub> to RESET				
$t_{PLH}$	Propagation (delay) time, low-to-high level output	SENSE <sub>n</sub> to $\overline{\text{RESET}}$ , SENSE <sub>n</sub> to RESET		1	5	$\mu\text{s}$



TYPICAL CHARACTERISTICS

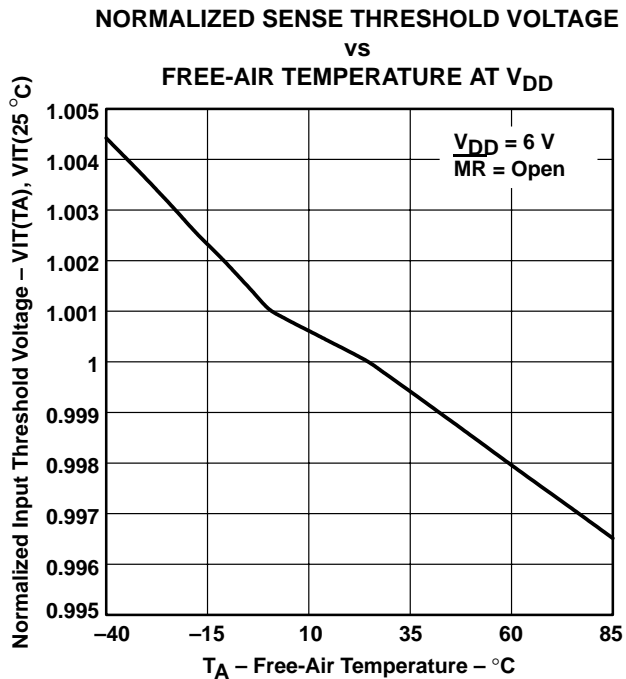


Figure 2

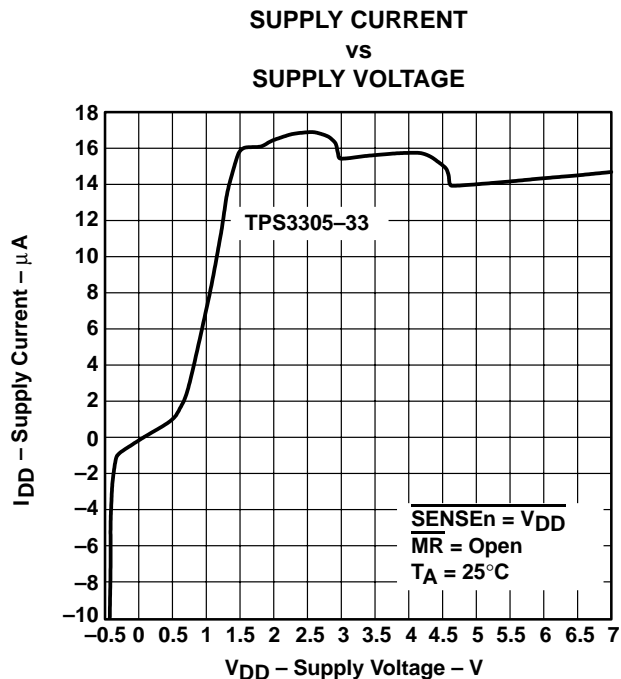


Figure 3

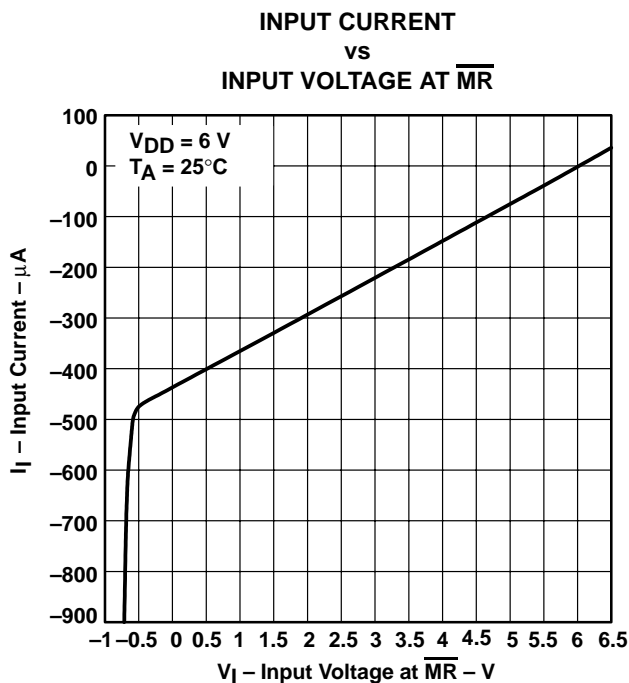


Figure 4

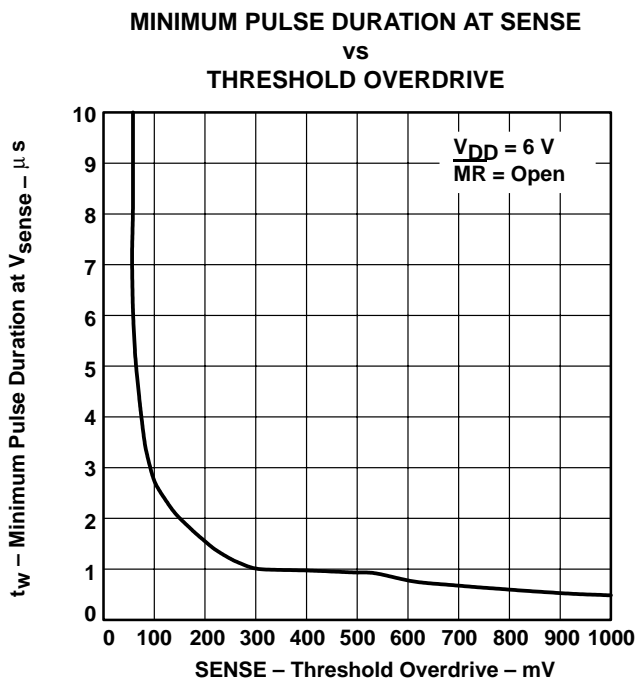


Figure 5

# TPS3305-18, TPS3305-25, TPS3305-33 DUAL PROCESSOR SUPERVISORS

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## TYPICAL CHARACTERISTICS

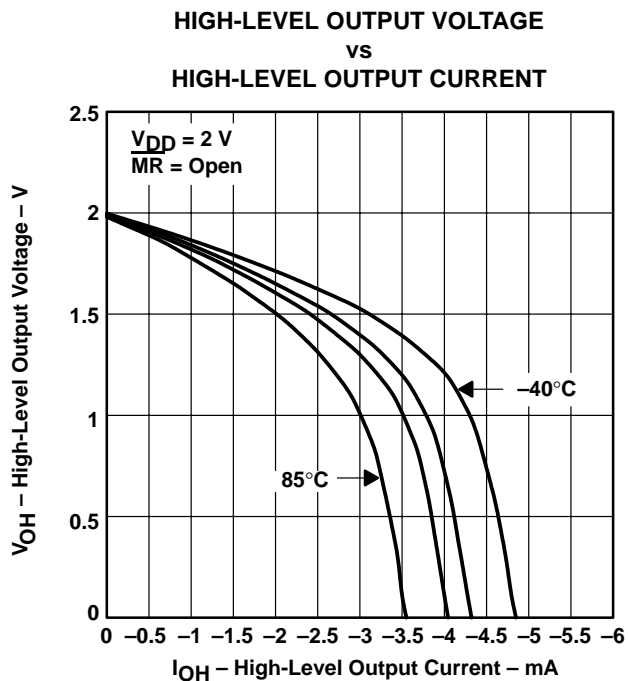


Figure 6

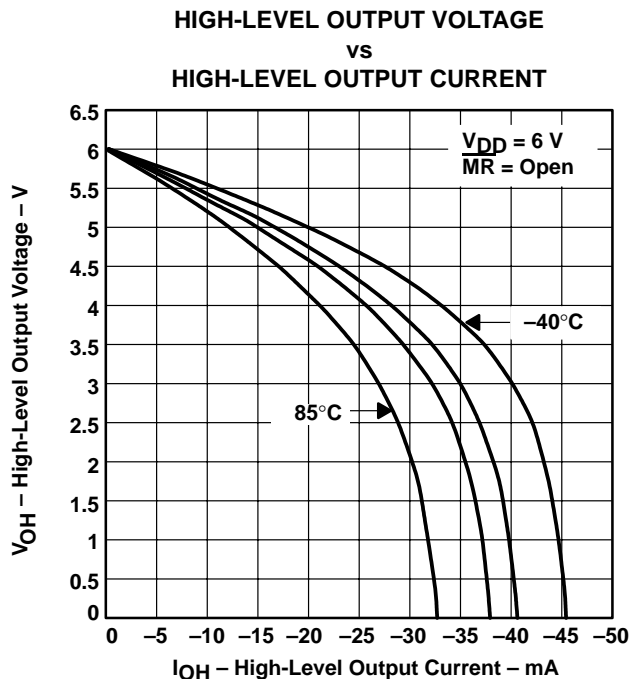


Figure 7

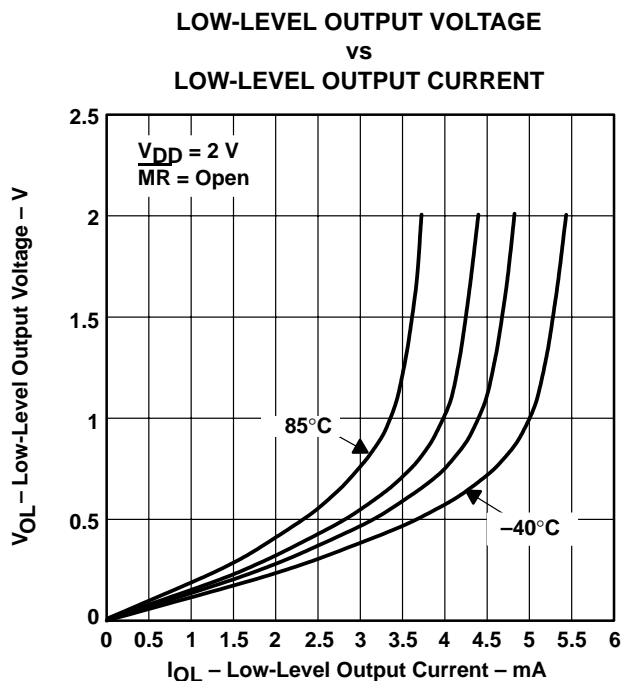


Figure 8

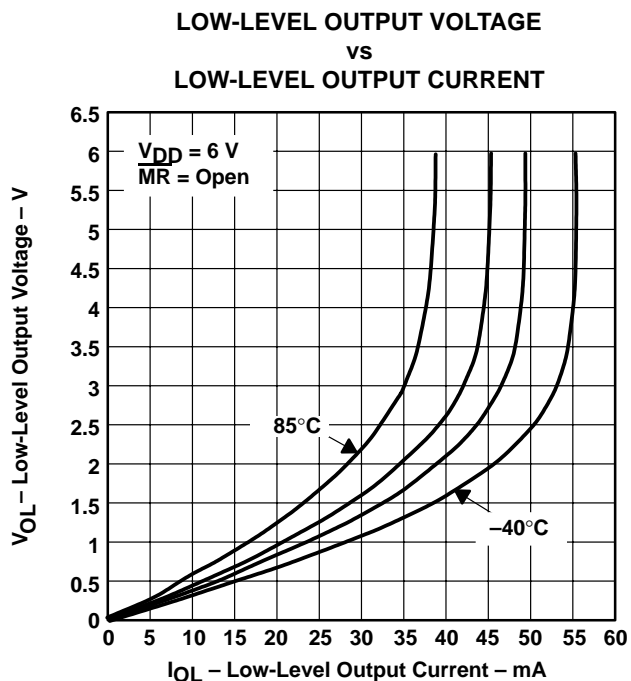


Figure 9

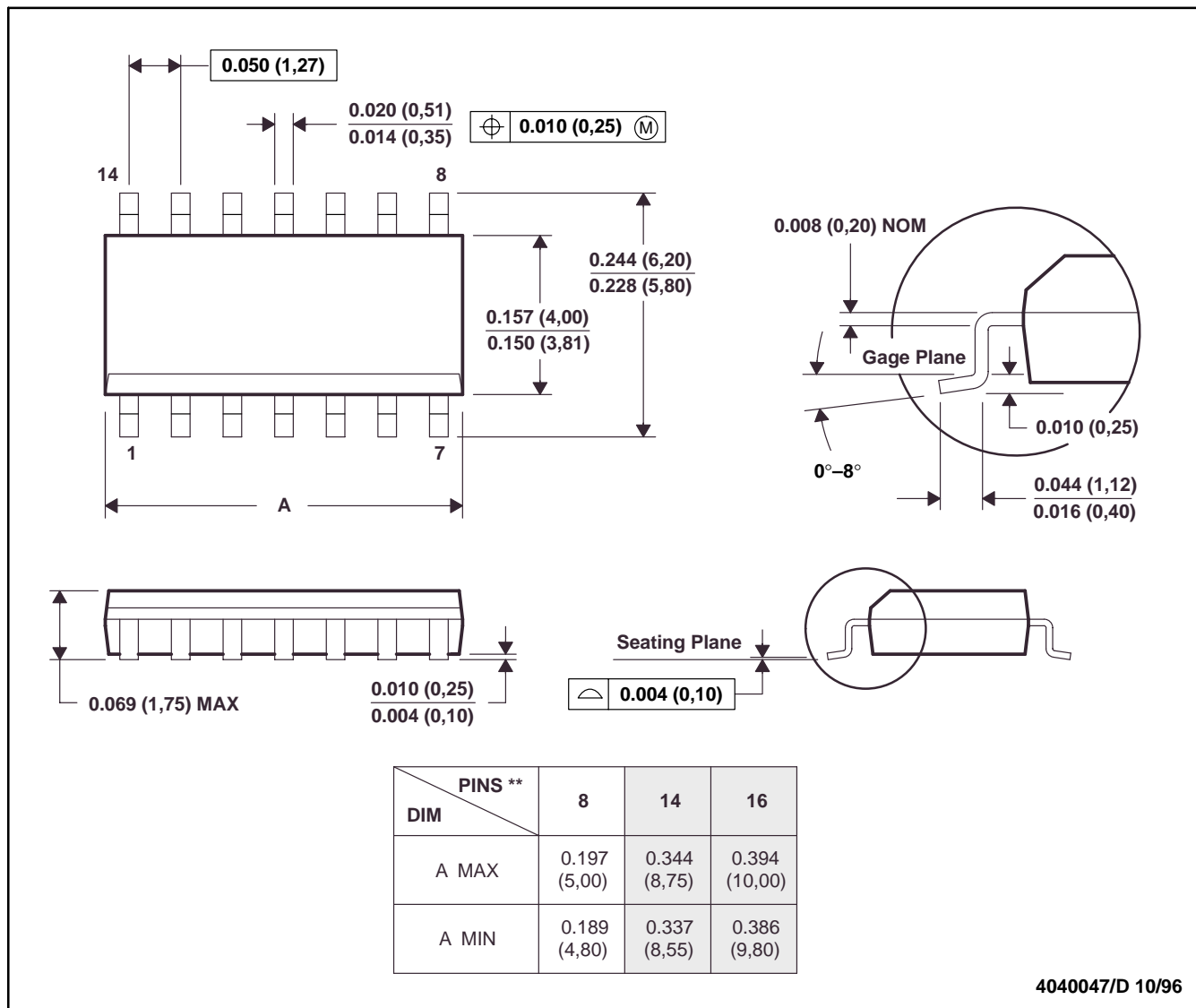


MECHANICAL DATA

D (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).  
 D. Falls within JEDEC MS-012

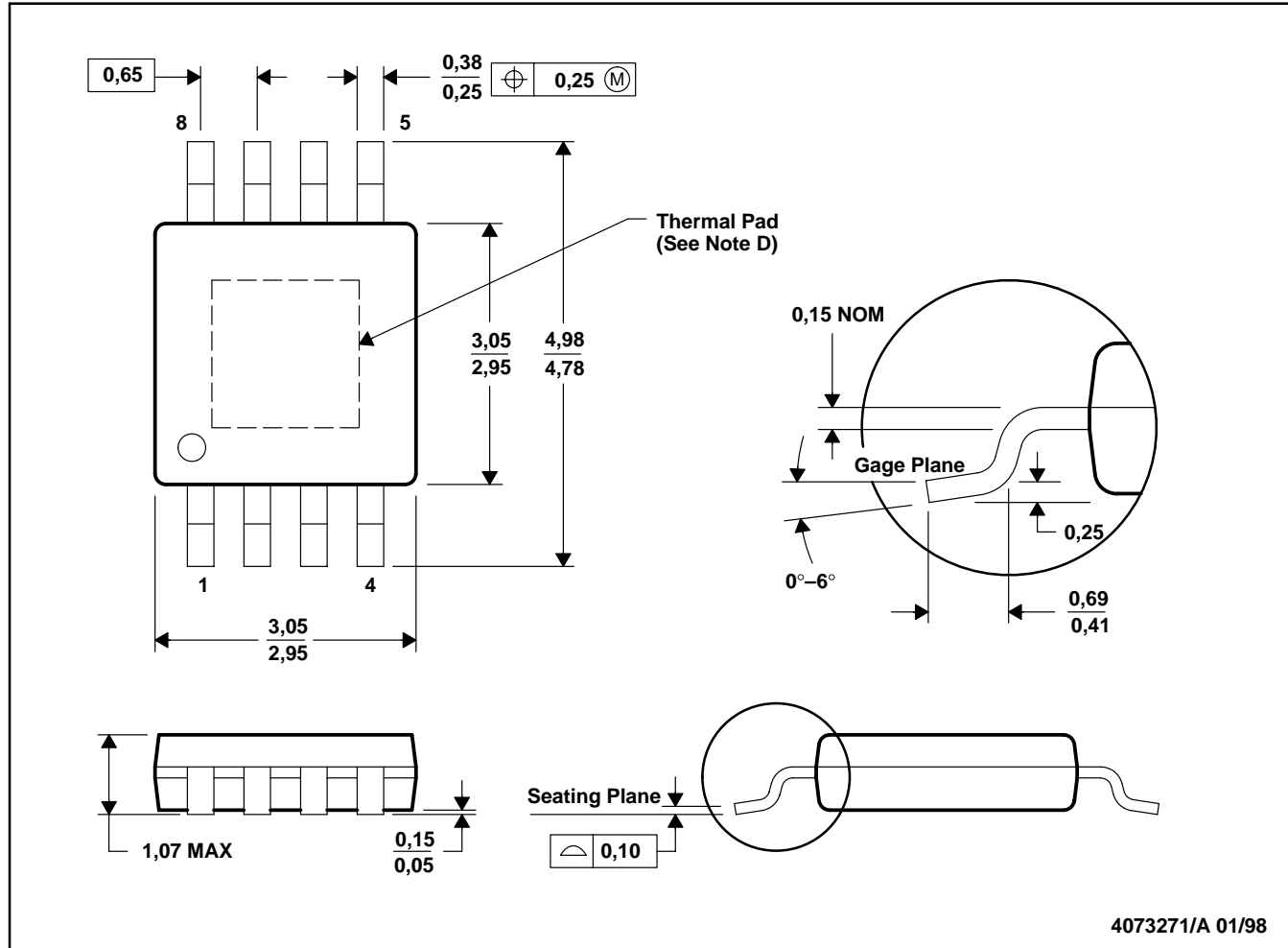
# TPS3305-18, TPS3305-25, TPS3305-33 DUAL PROCESSOR SUPERVISORS

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## MECHANICAL DATA

DGN (S-PDSO-G8)

PowerPAD™ 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 protrusions.
  - D. The package thermal performance may be enhanced by attaching an external heat sink to the thermal pad. This pad is electrically and thermally connected to the backside of the die and possibly selected leads.
  - E. Falls within JEDEC MO-187

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