

# VOLTAGE DETECTOR

## FEATURES

- Single Voltage Detector (TPS3803): Adjustable/1.5 V
- Dual Voltage Detector (TPS3805): Adjustable/3.3 V
- High  $\pm 1.5\%$  Threshold Voltage Accuracy
- Supply Current: 3  $\mu\text{A}$  Typical at  $V_{DD} = 3.3\text{ V}$
- Push/Pull Reset Output (TPS3805) Open-Drain Reset Output (TPS3803)
- Temperature Range:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- 5-Pin SC-70 Package

## DESCRIPTION

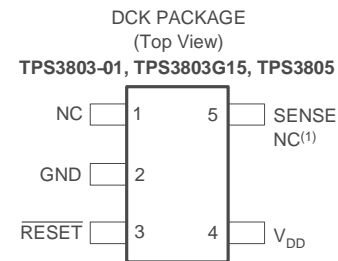
The TPS3803 and TPS3805 families of supervisory circuits provide circuit initialization and timing supervision, primarily for DSPs and processor-based systems.

The TPS3803G15 device has a fixed-sense threshold voltage  $V_{IT}$  set by an internal voltage divider, whereas the TPS3803-01 has an adjustable SENSE input that can be configured by two external resistors. In addition to the fixed sense threshold monitored at  $V_{DD}$ , the TPS3805 devices provide a second adjustable SENSE input.  $\overline{\text{RESET}}$  is asserted in case any of the two voltages drops below  $V_{IT}$ .

During power on,  $\overline{\text{RESET}}$  is asserted when supply voltage  $V_{DD}$  becomes higher than 0.8 V. Thereafter, the supervisory circuit monitors  $V_{DD}$  (and/or SENSE) and keeps  $\overline{\text{RESET}}$  active as long as  $V_{DD}$  or SENSE remains below the threshold voltage  $V_{IT}$ . As soon as  $V_{DD}$  (SENSE) rises above the threshold voltage  $V_{IT}$ ,  $\overline{\text{RESET}}$  is deasserted again. The product spectrum is designed for 1.5 V, 3.3 V, and adjustable supply voltages. The devices are available in a 5-pin SC-70 package. The TPS3803 and TPS3805 devices are characterized for operation over a temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

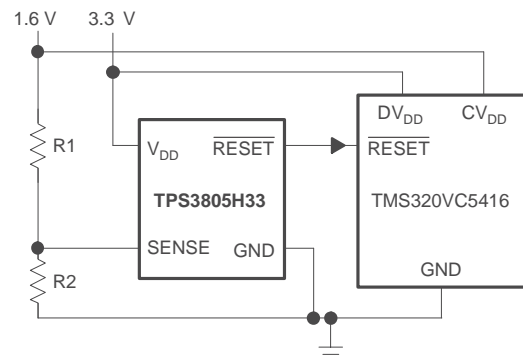
## APPLICATIONS

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



(1) NC = No Connection on TPS3803G15

## Typical Operating Circuit



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This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

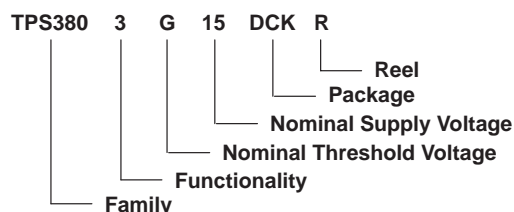
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

**PACKAGE INFORMATION**

T <sub>A</sub>	DEVICE NAME	THRESHOLD VOLTAGE		MARKING
		V <sub>DD</sub>	SENSE	
-40°C to +85°C	TPS3803-01DCKR <sup>(1)</sup>	NA	1.226 V	AWG
	TPS3803G15DCKR <sup>(1)</sup>	1.40 V	NA	AWI
	TPS3805H33DCKR <sup>(1)</sup>	3.05 V	1.226 V	AWK

<sup>(1)</sup> The DCKR passive indicates tape and reel containing 3000 parts.

**ORDERING INFORMATION**

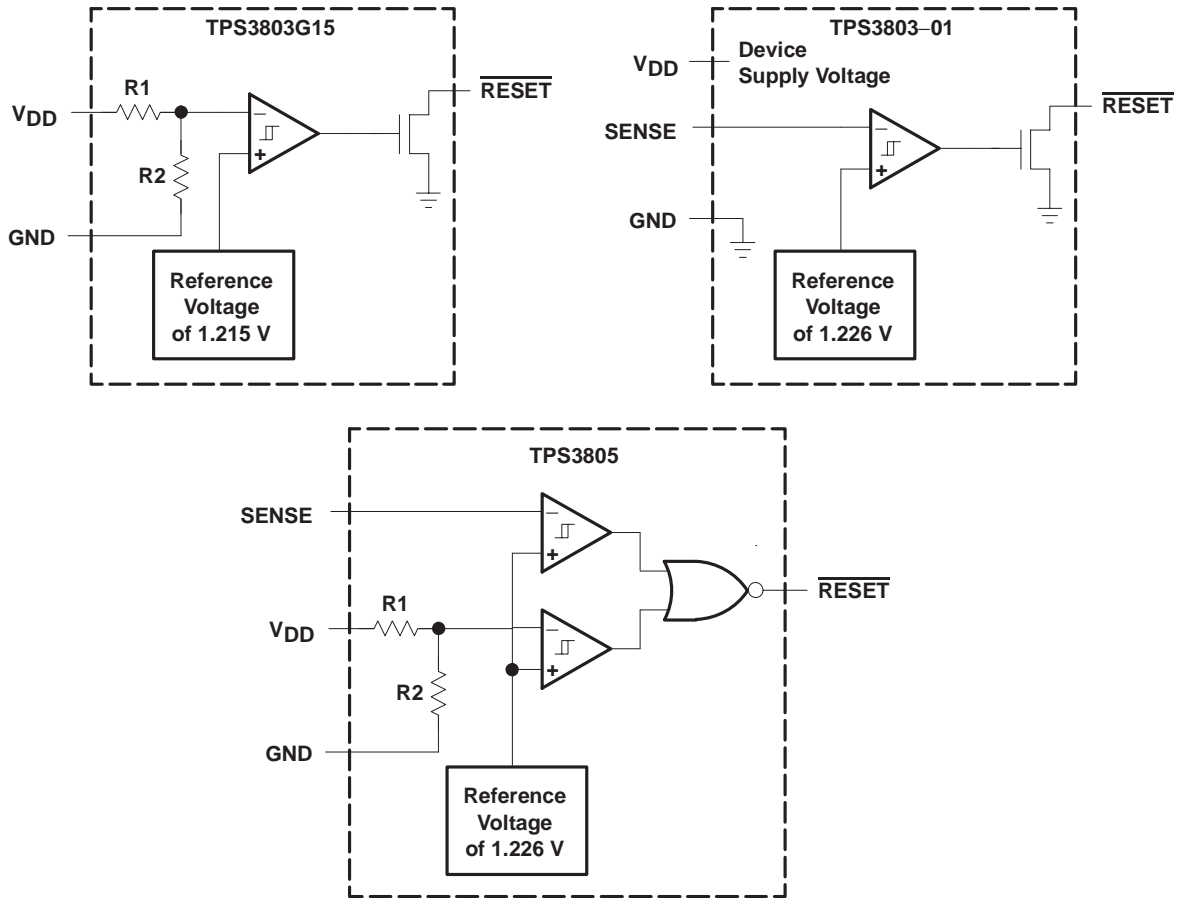


**Function/Truth Tables**

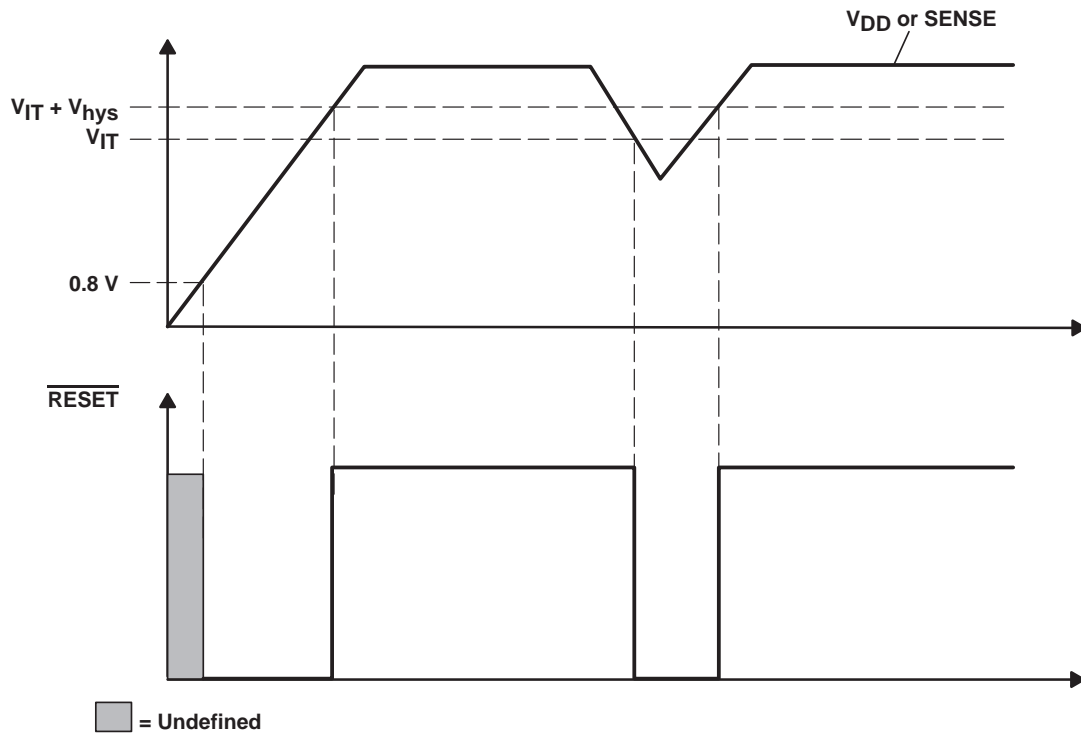
TPS3803-01		TPS3803G15	
SENSE > V <sub>IT</sub>	RESET	V <sub>DD</sub> > V <sub>IT</sub>	RESET
0	L	0	L
1	H	1	H

TPS3805H33		
V <sub>DD</sub> > V <sub>IT</sub>	SENSE > V <sub>IT</sub>	RESET
0	0	L
0	1	L
1	0	L
1	1	H

**FUNCTIONAL BLOCK DIAGRAM**



**TIMING REQUIREMENTS**



**Terminal Functions**

TERMINAL NAME	NO.	I/O	DESCRIPTION
GND	2	I	Ground
RESET	3	O	Active-low reset output (TPS3803—open-drain, TPS3805—push/pull)
SENSE	5	I	Adjustable sense input
NC	1		No internal connection
NC (TPS3803G15)	5		No internal connection
V <sub>DD</sub>	4	I	Input supply voltage, fixed sense input for TPS3803G15 and TPS3805

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

Over operating free-air temperature range, unless otherwise noted.

Supply voltage, $V_{DD}$ <sup>(2)</sup> .....	+7 V
All other pins <sup>(2)</sup> .....	-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 $V_I > V_{DD}$ ) .....	$\pm 10$ 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

(1) 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.

(2) All voltage values are with respect to GND. For reliable operation the device should not be continuously operated at 7 V for more than  $t = 1000$  h.

DISSIPATION RATING TABLE

PACKAGE	$T_A < +25^\circ\text{C}$ 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
DCK	321 mW	2.6 mW/°C	206 mW	167 mW

## RECOMMENDED OPERATING CONDITIONS

	MIN	MAX	UNIT
Supply voltage, $V_{DD}$	1.3	6	V
Input voltage, $V_I$	0	$V_{DD} + 0.3$	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 <sub>OH</sub>	High-level output voltage (TPS3805 only)	V <sub>DD</sub> = 1.5 V, I <sub>OH</sub> = -0.5 mA	0.8 x V <sub>DD</sub>			V	
		V <sub>DD</sub> = 3.3 V, I <sub>OH</sub> = -1.0 mA					
		V <sub>DD</sub> = 6 V, I <sub>OH</sub> = -1.5 mA					
V <sub>OL</sub>	Low-level output voltage	V <sub>DD</sub> = 1.5 V, I <sub>OL</sub> = 1.0 mA			0.3	V	
		V <sub>DD</sub> = 3.3 V, I <sub>OL</sub> = 2 mA					
		V <sub>DD</sub> = 6 V, I <sub>OL</sub> = 3 mA					
Power-up reset voltage <sup>(1)</sup>	V <sub>IT</sub> > 1.5 V, T <sub>A</sub> = 25°C		0.8			V	
	V <sub>IT</sub> ≤ 1.5 V, T <sub>A</sub> = 25°C		1.0			V	
V <sub>IT</sub>	Negative-going input threshold voltage <sup>(2)</sup>	T <sub>A</sub> = -40°C to +85°C	SENSE			V	
			TPS3803G15				
			TPS3805H33				
V <sub>hys</sub>	Hysteresis	1.2 V < V <sub>IT</sub> < 2.5 V	15			mV	
		2.5 V < V <sub>IT</sub> < 3.5 V	30				
I <sub>I</sub>	Input current	SENSE	-25		25	nA	
I <sub>OH</sub>	High-level output current at $\overline{\text{RESET}}$	Open drain only	V <sub>DD</sub> = V <sub>IT</sub> + 0.2V, V <sub>OH</sub> = V <sub>DD</sub>		300	nA	
I <sub>DD</sub>	Supply current	TPS3803-01	V <sub>DD</sub> = 3.3 V, output unconnected		2	4	μA
		TPS3805, TPS3803G15			3	5	
		TPS3803-01	V <sub>DD</sub> = 6 V, output unconnected		2	4	
		TPS3805, TPS3803G15			4	6	
C <sub>I</sub>	Input capacitance	V <sub>I</sub> = 0 V to V <sub>DD</sub>			1	pF	

(1) The lowest supply voltage at which  $\overline{\text{RESET}}$  (V<sub>OL(max)</sub> = 0.2 V, I<sub>OL</sub> = 50 μA) becomes active. t<sub>r</sub>(V<sub>DD</sub>) ≥ 15 μs/V.

(2) To ensure the best stability of the threshold voltage, place a bypass capacitor (ceramic, 0.1 μF) near the supply terminals.

## TIMING REQUIREMENTS

AT R<sub>L</sub> = 1 MΩ, C<sub>L</sub> = 50 PF, T<sub>A</sub> = -40°C TO +85°C.

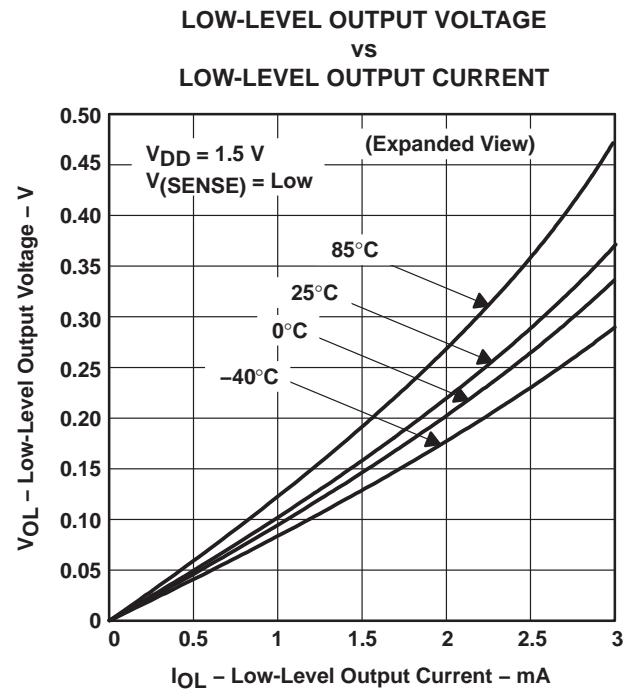
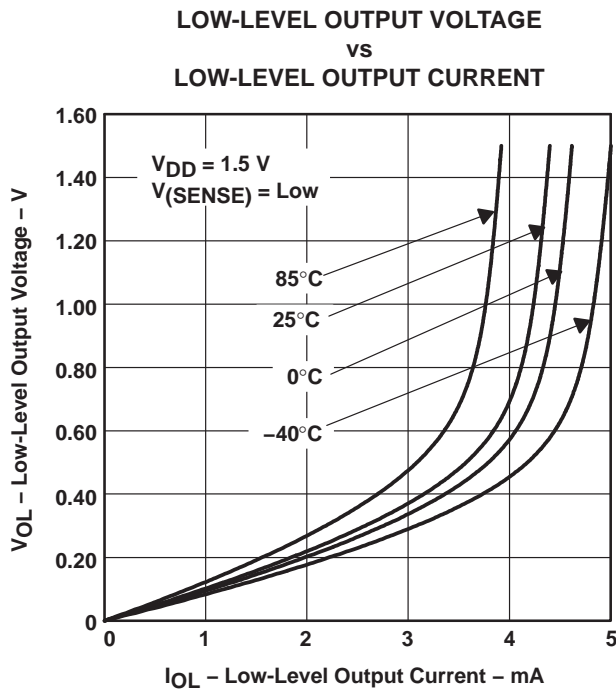
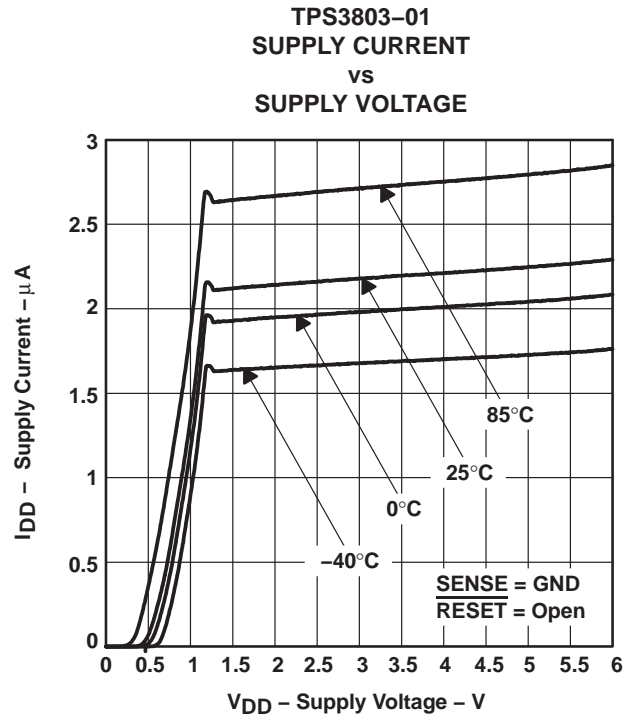
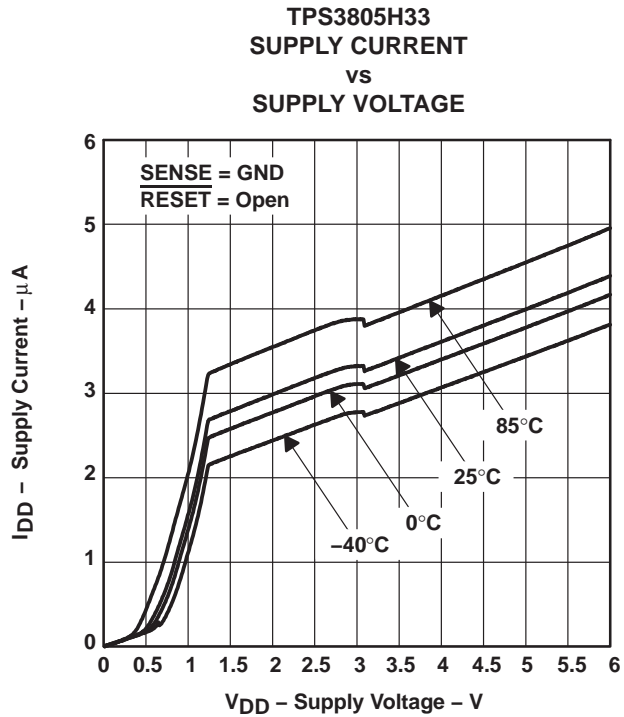
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>w</sub>	At V <sub>DD</sub>	V <sub>IH</sub> = 1.05 x V <sub>IT</sub> , V <sub>IL</sub> = 0.95 x V <sub>IT</sub>	5.5			μs
	At SENSE					

## SWITCHING CHARACTERISTICS

AT R<sub>L</sub> = 1 MΩ, C<sub>L</sub> = 50 PF, T<sub>A</sub> = -40°C TO +85°C.

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PHL</sub>	Propagation (delay) time, high-to-low-level output	V <sub>DD</sub> to $\overline{\text{RESET}}$ delay	V <sub>IH</sub> = 1.05 x V <sub>IT</sub> , V <sub>IL</sub> = 0.95 x V <sub>IT</sub>	5	100	μs
		SENSE to $\overline{\text{RESET}}$ delay				
t <sub>PLH</sub>	Propagation (delay) time, low-to-high-level output	V <sub>DD</sub> to $\overline{\text{RESET}}$ delay		5	100	
		SENSE to $\overline{\text{RESET}}$ delay				

TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS (continued)

LOW-LEVEL OUTPUT VOLTAGE  
 vs  
 LOW-LEVEL OUTPUT CURRENT

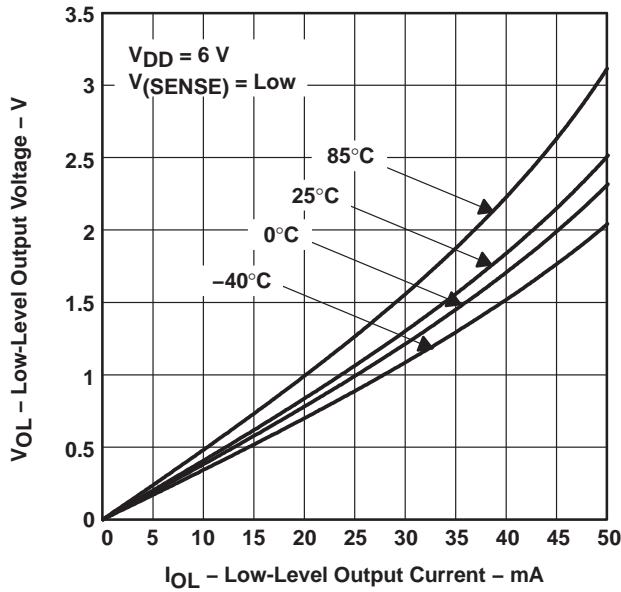


Figure 5

LOW-LEVEL OUTPUT VOLTAGE  
 vs  
 LOW-LEVEL OUTPUT CURRENT

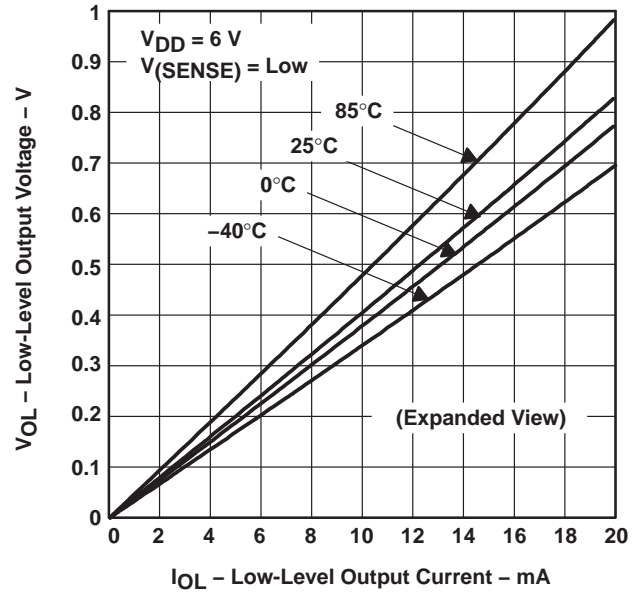


Figure 6

TPS3805H33  
 HIGH-LEVEL OUTPUT VOLTAGE  
 vs  
 HIGH-LEVEL OUTPUT CURRENT

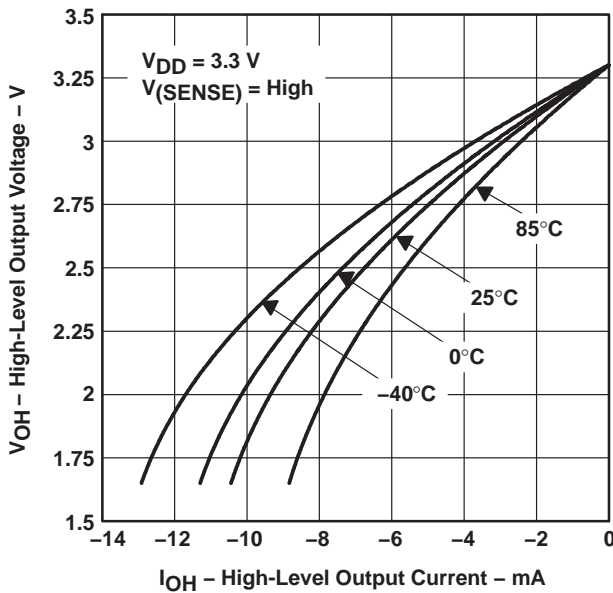


Figure 7

TPS3805H33  
 HIGH-LEVEL OUTPUT VOLTAGE  
 vs  
 HIGH-LEVEL OUTPUT CURRENT

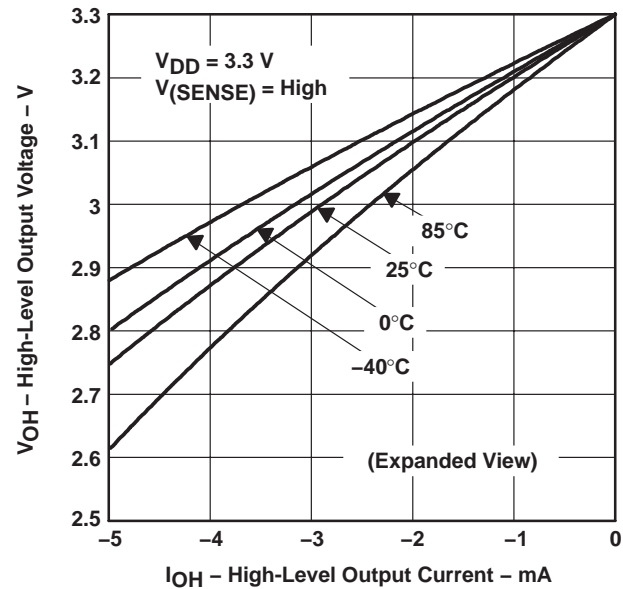


Figure 8



TYPICAL CHARACTERISTICS (continued)

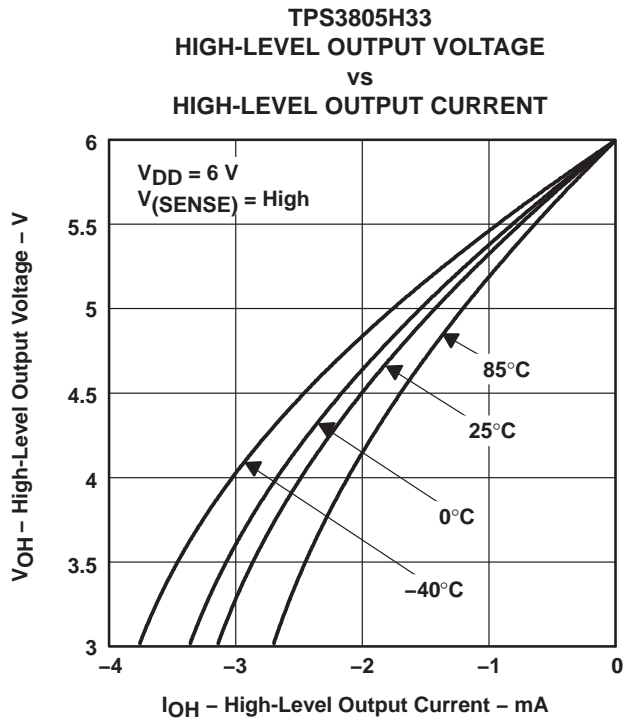


Figure 9

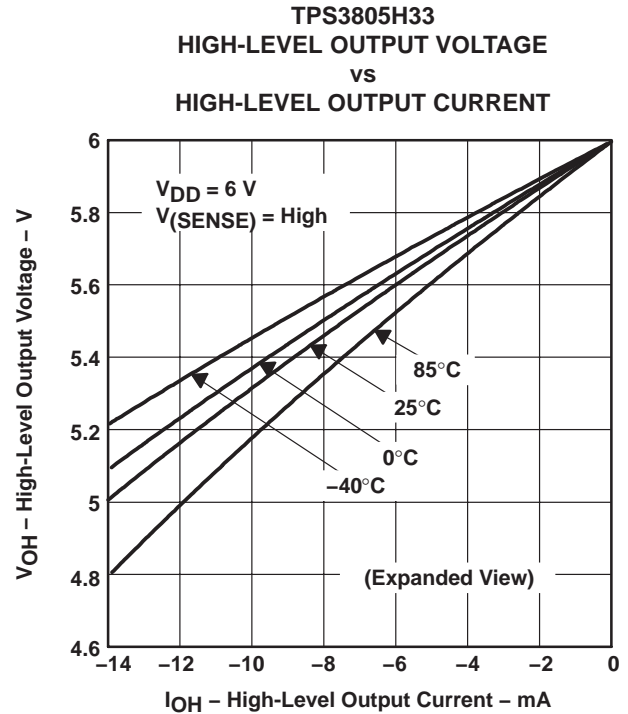


Figure 10

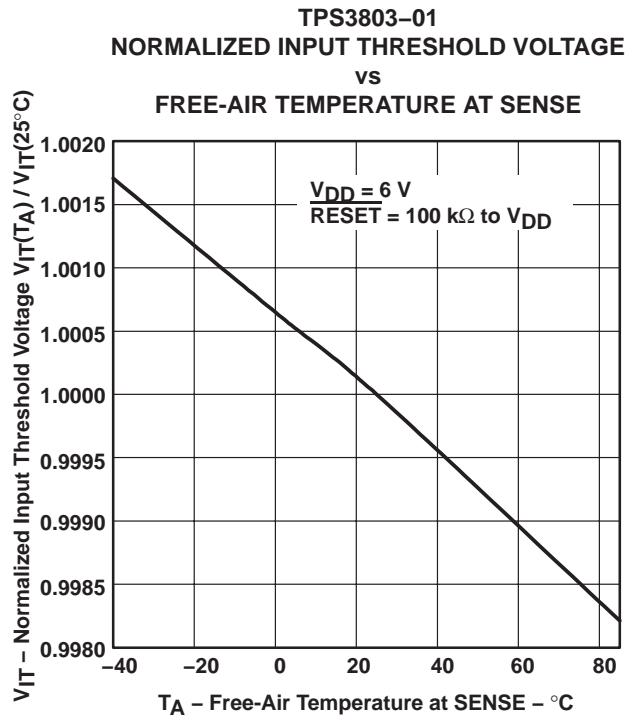


Figure 11

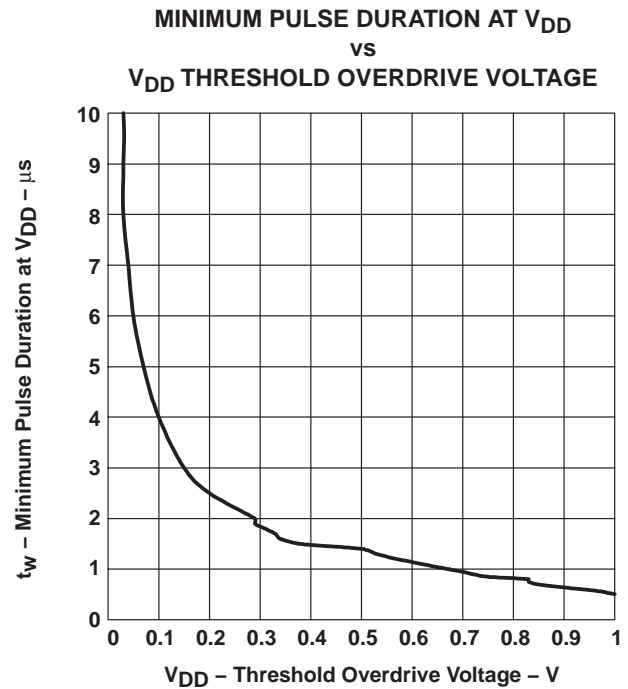


Figure 12

TYPICAL CHARACTERISTICS (continued)

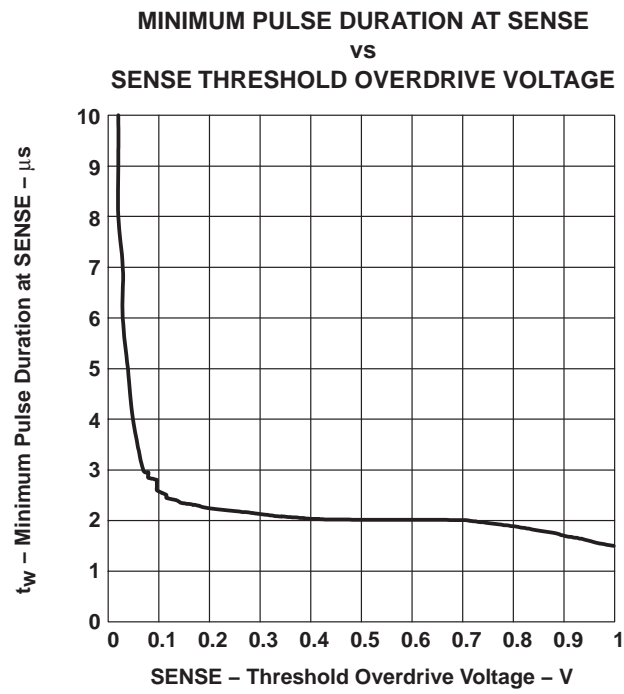


Figure 13

## Revision History

DATE	REV	PAGE	SECTION	DESCRIPTION
6/07	A	Front Page	—	Updated front page.
		3	—	Functional block diagram change.

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
TPS3803-01DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3803-01DCKRG4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3803G15DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3803G15DCKRG4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3805H33DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TPS3805H33DCKRG4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**OTHER QUALIFIED VERSIONS OF TPS3803-01, TPS3803G15, TPS3805H33 :**

- Automotive: [TPS3803-01-Q1](#), [TPS3803G15-Q1](#), [TPS3805H33-Q1](#)
- Enhanced Product: [TPS3803-01-EP](#), [TPS3803G15-EP](#), [TPS3805H33-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

**TAPE AND REEL INFORMATION**



**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TPS3803-01DCKR	SC70	DCK	5	3000	180.0	9.2	2.24	1.22	2.34	4.0	8.0	Q3
TPS3803G15DCKR	SC70	DCK	5	3000	180.0	9.2	2.24	1.22	2.34	4.0	8.0	Q3
TPS3805H33DCKR	SC70	DCK	5	3000	180.0	9.2	2.24	1.22	2.34	4.0	8.0	Q3

**TAPE AND REEL BOX DIMENSIONS**



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS3803-01DCKR	SC70	DCK	5	3000	180.0	180.0	85.0
TPS3803G15DCKR	SC70	DCK	5	3000	180.0	180.0	85.0
TPS3805H33DCKR	SC70	DCK	5	3000	180.0	180.0	85.0

DCK (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 do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Falls within JEDEC MO-203 variation AA.

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DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
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Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
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