

## BACKUP-BATTERY SUPERVISORS FOR RAM RETENTION

### FEATURES

- Supply Current of 40  $\mu$ A (Max)
- Battery-Supply Current of 100 nA (Max)
- Precision Supply Voltage Monitor 3.3 V, 5 V, Other Options on Request
- Backup-Battery Voltage Can Exceed  $V_{DD}$
- Power On Reset Generator With Fixed 100-ms Reset Delay Time
- Voltage Monitor For Power-Fail or Low-Battery Monitoring
- Battery Freshness Seal (TPS3619)
- Pin-For-Pin Compatible With MAX819, MAX703, and MAX704
- 8-Pin MSOP Package
- Temperature Range  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

### APPLICATIONS

- Fax Machines
- Set-Top Boxes
- Advanced Voice Mail Systems
- Portable Battery-Powered Equipment
- Computer Equipment
- Advanced Modems
- Automotive Systems
- Portable Long-Time Monitoring Equipment
- Point-of-Sale Equipment

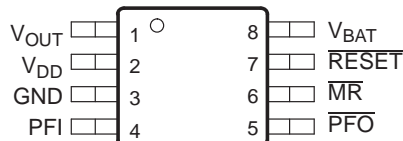
### DESCRIPTION

The TPS3619 and TPS3620 families of supervisory circuits monitor and control processor activity by providing backup-battery switchover for data retention of CMOS RAM.

During power on,  $\overline{\text{RESET}}$  is asserted when the supply voltage ( $V_{DD}$  or  $V_{BAT}$ ) becomes higher than 1.1 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 starts after  $V_{DD}$  has risen above  $V_{IT}$ . When the supply voltage drops below  $V_{IT}$ , the output becomes active (low) again.

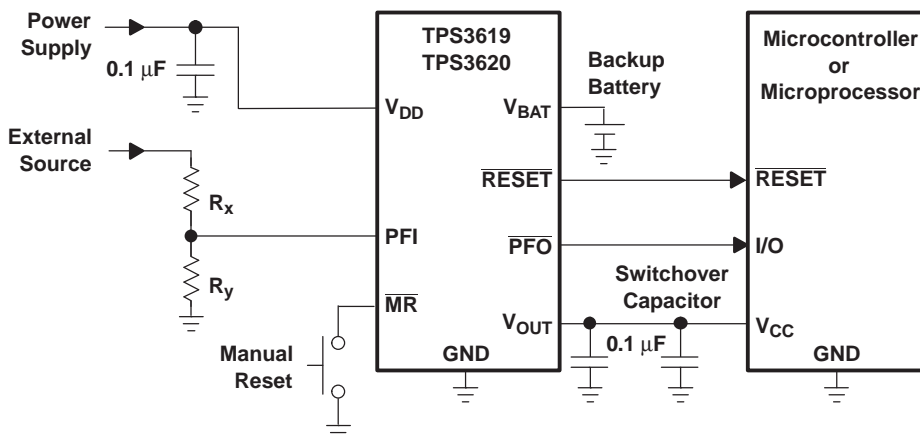
The product spectrum is designed for supply voltages of 3.3 V and 5 V. The TPS3619 and TPS3620 are available in an 8-pin MSOP package and are characterized for operation over a temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

DGK PACKAGE  
(TOP VIEW)



 **ACTUAL SIZE**  
3,05 mm x 4,98 mm

### TYPICAL OPERATING CIRCUIT



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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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.

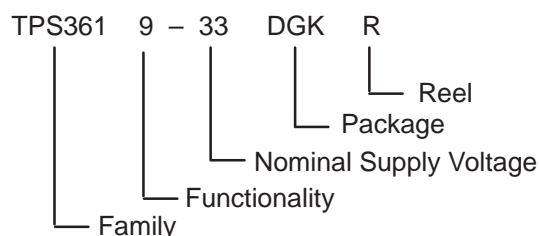
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## PACKAGE INFORMATION<sup>(1)</sup>

PRODUCT	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	ORDERING NUMBER	TRANSPORT MEDIA, QUANTITY
TPS3619-33	–40°C to +85°C	AFL	TPS3619-33DGK	Tube, 80
			TPS3619-33DGKR	Tape and Reel, 2500
TPS3619-50		AFM	TPS3619-50DGK	Tube, 80
			TPS3619-50DGKR	Tape and Reel, 2500
TPS3620-33		ANL	TPS3620-33DGKT	Tape and Reel, 250
			TPS3620-33DGKR	Tape and Reel, 2500
TPS3620-50		ANM	TPS3620-50DGKT	Tape and Reel, 250
			TPS3620-50DGKR	Tape and Reel, 2500

(1) For the most current specifications and package information, see the Package Option Addendum located at the end of this data sheet or refer to our web site at [www.ti.com](http://www.ti.com).

## STANDARD AND APPLICATION SPECIFIC VERSIONS



DEVICE NAME	NOMINAL VOLTAGE <sup>(1)</sup> , V <sub>NOM</sub>
TPS3619-33 DGK	3.3 V
TPS3619-50 DGK	5.0 V
TPS3620-33 DGK	3.3 V
TPS3620-50 DGK	5.0 V

(1) For other threshold voltage versions, contact the local TI sales office for availability and lead-time.

## ABSOLUTE MAXIMUM RATINGS

Over operating free-air temperature (unless otherwise noted).<sup>(1)</sup>

		UNIT
Supply voltage:	V <sub>DD</sub> <sup>(2)</sup>	7 V
	MR and PFI pins <sup>(2)</sup>	–0.3 V to (V <sub>DD</sub> + 0.3 V)
Continuous output current:	V <sub>OUT</sub> , I <sub>O</sub>	400 mA
	All other pins, I <sub>O</sub> <sup>(2)</sup>	±10 mA
Continuous total power dissipation		See Dissipation Rating Table
Operating free-air temperature range, T <sub>A</sub>		–40°C to +85°C
Storage temperature range, T <sub>stg</sub>		–65°C to +150°C
Lead temperature soldering 1,6 mm (1/16 inch) from case for 10 seconds		+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 must not be operated at 7 V for more than t = 1000h continuously.

## DISSIPATION RATING TABLE

PACKAGE	θ <sub>JC</sub>	θ <sub>JA</sub> (LOW-K)	θ <sub>JA</sub> (HIGH-K)	T <sub>A</sub> < 25°C POWER RATING	DERATING FACTOR ABOVE T <sub>A</sub> = +25°C	T <sub>A</sub> = +70°C POWER RATING	T <sub>A</sub> = +85°C POWER RATING
DGK	55°C/W	266°C/W	180°C/W	470 mW	3.76 mW/°C	301 mW	241 mW

## RECOMMENDED OPERATING CONDITIONS

At specified temperature range.

	MIN	MAX	UNIT
Supply voltage, $V_{DD}$	1.65	5.5	V
Battery supply voltage, $V_{BAT}$	1.5	5.5	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
Continuous output current at $V_{OUT}$ , $I_O$		300	mA
Input transition rise and fall rate at $\overline{MR}$		100	ns/V
Slew rate at $V_{DD}$ or $V_{BAT}$ , $\Delta t/\Delta V$		1	V/ $\mu$ s
Operating free-air temperature range, $T_A$	–40	+85	°C

## ELECTRICAL CHARACTERISTICS

Over recommended operating conditions (unless otherwise noted).

PARAMETER			TEST CONDITIONS		MIN	TYP	MAX	UNIT
V <sub>OH</sub>	High-level output voltage	RESET	V <sub>DD</sub> = 1.8 V, I <sub>OH</sub> = −400 μA		V <sub>DD</sub> − 0.2 V			V
			V <sub>DD</sub> = 3.3 V, I <sub>OH</sub> = −2 mA		V <sub>DD</sub> − 0.4 V			
			V <sub>DD</sub> = 5 V, I <sub>OH</sub> = −3 mA		V <sub>DD</sub> − 0.4 V			
		PFO	V <sub>DD</sub> = 1.8 V, I <sub>OH</sub> = −20 μA		V <sub>DD</sub> − 0.3 V			V
			V <sub>DD</sub> = 3.3 V, I <sub>OH</sub> = −80 μA		V <sub>DD</sub> − 0.4 V			
			V <sub>DD</sub> = 5 V, I <sub>OH</sub> = −120 μA		V <sub>DD</sub> − 0.4 V			
V <sub>OL</sub>	Low-level output voltage	RESET PFO	V <sub>DD</sub> = 1.8 V, I <sub>OL</sub> = −400 μA				0.2	V
			V <sub>DD</sub> = 3.3 V, I <sub>OL</sub> = 2 mA				0.4	
			V <sub>DD</sub> = 5 V, I <sub>OL</sub> = 3 mA				0.4	
V <sub>res</sub>	Power-up reset voltage (see <sup>(1)</sup> )		I <sub>OL</sub> = 20 μA, V <sub>BAT</sub> > 1.1 V or V <sub>DD</sub> > 1.1 V				0.4	V
V <sub>OUT</sub>	Normal mode	I <sub>OUT</sub> = 8.5 mA, V <sub>BAT</sub> = 0 V		V <sub>DD</sub> = 1.8 V	V <sub>DD</sub> − 50 mV			V
		I <sub>OUT</sub> = 125 mA, V <sub>BAT</sub> = 0 V		V <sub>DD</sub> = 3.3 V	V <sub>DD</sub> − 150 mV			
		I <sub>OUT</sub> = 200 mA, V <sub>BAT</sub> = 0 V		V <sub>DD</sub> = 5 V	V <sub>DD</sub> − 200 mV			
	Battery-backup mode	I <sub>OUT</sub> = 0.5 mA, V <sub>BAT</sub> = 1.5 V		V <sub>DD</sub> = 0 V	V <sub>BAT</sub> − 20 mV			V
		I <sub>OUT</sub> = 7.5 mA, V <sub>BAT</sub> = 3.3 V		V <sub>BAT</sub> − 113 mV				
r <sub>DS(on)</sub>	V <sub>DD</sub> to V <sub>OUT</sub> on-resistance		V <sub>DD</sub> = 5 V		0.6		1	Ω
	V <sub>BAT</sub> to V <sub>OUT</sub> on-resistance		V <sub>DD</sub> = 3.3 V		8		15	
V <sub>IT−</sub>	Negative-going input threshold voltage (see <sup>(2)</sup> )	TPS3619-33	T <sub>A</sub> = −40°C to 85°C		2.88	2.93	3	V
		TPS3619-50			4.46	4.55	4.64	
V <sub>PFI</sub>		PFI			1.13	1.15	1.17	
V <sub>hys</sub>	Hysteresis	V <sub>IT</sub>	1.65 V < V <sub>IT</sub> < 2.5 V		20			mV
			2.5 V < V <sub>IT</sub> < 3.5 V		40			
			3.5 V < V <sub>IT</sub> < 5.5 V		60			
		PFI			12			
		VBSW (see <sup>(3)</sup> )	V <sub>DD</sub> = 1.8 V		55			

(1) The lowest supply voltage at which RESET becomes active.  $t_{r,VDD} \geq 15 \mu\text{s/V}$ .

(2) To ensure the best stability of the threshold voltage, a bypass capacitor (ceramic, 0.1  $\mu\text{F}$ ) should be placed near the supply terminals.

(3) For  $V_{DD} < 1.6 \text{ V}$ ,  $V_{OUT}$  switches to  $V_{BAT}$  regardless of  $V_{BAT}$ .

## ELECTRICAL CHARACTERISTICS (continued)

Over recommended operating conditions (unless otherwise noted).

PARAMETER			TEST CONDITIONS		MIN	TYP	MAX	UNIT
$I_{IH}$	High-level input current	$\overline{MR}$	$\overline{MR} = 0.7 \times V_{DD}$	$V_{DD} = 5\text{ V}$	–33		–76	$\mu\text{A}$
$I_{IL}$	Low-level input current		$\overline{MR} = 0\text{ V}$		–110		–255	
$I_I$	Input current	PFI			–25		25	nA
$I_{OS}$	Short-circuit current	$\overline{PFO}$	$\overline{PFO} = 0\text{ V}$	$V_{DD} = 1.8\text{ V}$			–0.3	mA
				$V_{DD} = 3.3\text{ V}$			–1.1	
				$V_{DD} = 5\text{ V}$			–2.4	
$I_{DD}$	$V_{DD}$ supply current		$V_{OUT} = V_{DD}$				40	$\mu\text{A}$
			$V_{OUT} = V_{BAT}$				40	
$I_{(BAT)}$	$V_{BAT}$ supply current		$V_{OUT} = V_{DD}$		–0.1		0.1	$\mu\text{A}$
			$V_{OUT} = V_{BAT}$				0.5	
$C_i$	Input capacitance		$V_I = 0\text{ V to } 5\text{ V}$			5		pF

## TIMING REQUIREMENTS

At  $R_L = 1\text{ M}\Omega$ ,  $C_L = 50\text{ pF}$ ,  $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ .

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_w$	Pulse width	at $V_{DD}$	$V_{IH} = V_{IT} + 0.2\text{ V}$ , $V_{IL} = V_{IT} - 0.2\text{ V}$	6			$\mu\text{s}$
		at $\overline{MR}$	$V_{DD} = V_{IT} + 0.2\text{ V}$ , $V_{IL} = 0.3 \times V_{DD}$ , $V_{IH} = 0.7 \times V_{DD}$	100			ns

## SWITCHING CHARACTERISTICS

At  $R_L = 1\text{ M}\Omega$ ,  $C_L = 50\text{ pF}$ ,  $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ .

PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_d$	Delay time		$V_{DD} \geq V_{IT} + 0.2\text{ V}$ , $\overline{MR} \geq 0.7 \times V_{DD}$ See <a href="#">timing diagram</a>	60	100	140	ms
$t_{PHL}$	Propagation (delay) time, high-to-low level output	$V_{DD}$ to $\overline{RESET}$	$V_{IL} = V_{IT} - 0.2\text{ V}$ , $V_{IH} = V_{IT} + 0.2\text{ V}$		2	5	$\mu\text{s}$
		PFI to $\overline{PFO}$ delay	$V_{IL} = V_{PFI} - 0.2\text{ V}$ , $V_{IH} = V_{PFI} + 0.2\text{ V}$		3	5	
		$\overline{MR}$ to $\overline{RESET}$	$V_{DD} \geq V_{IT} + 0.2\text{ V}$ , $V_{IL} = 0.3 \times V_{DD}$ , $V_{IH} = 0.7 \times V_{DD}$		0.1	1	

### TIMING DIAGRAM

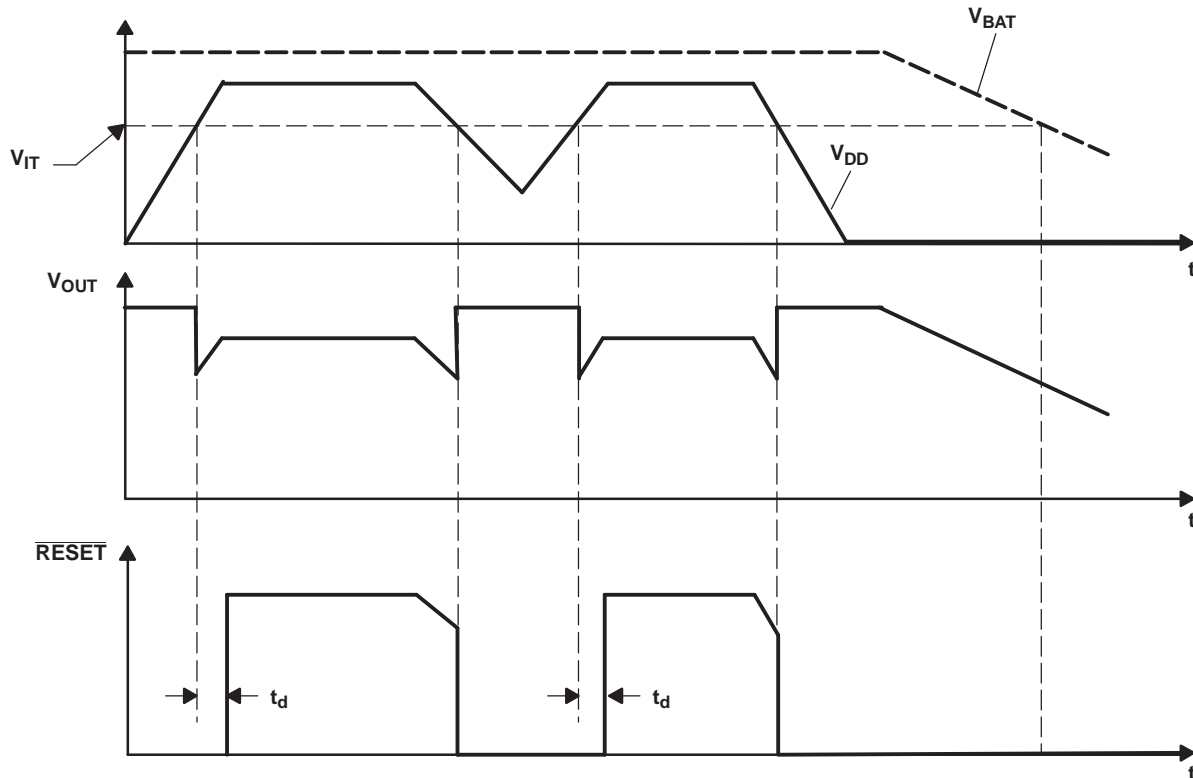


Table 1. FUNCTION TABLE

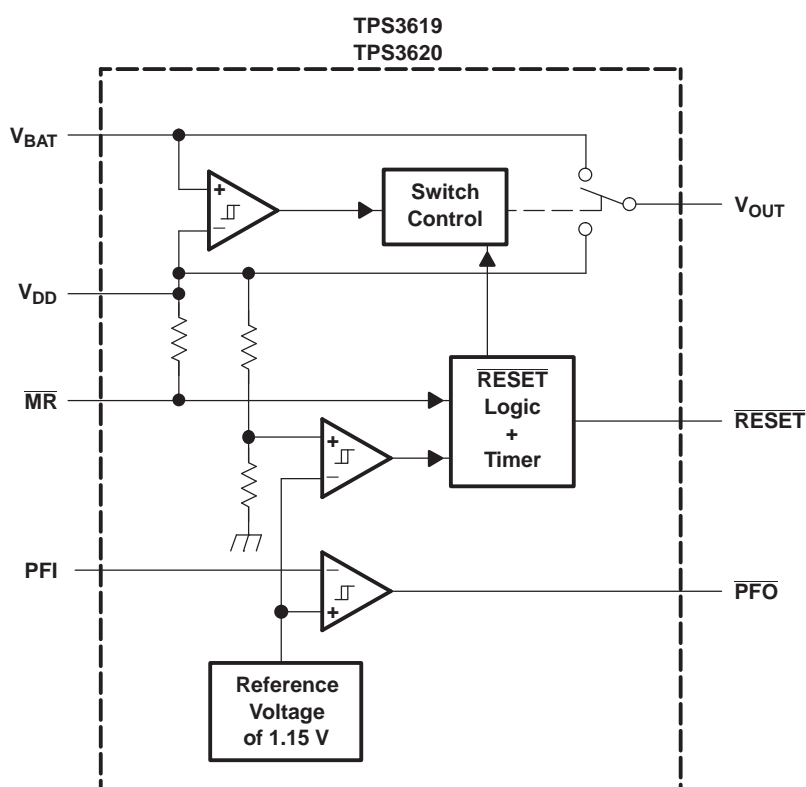
$V_{DD} > V_{IT}$	$V_{DD} > V_{BAT}$	$\overline{MR}$	$V_{OUT}$	RESET
0	0	0	$V_{BAT}$	0
0	0	1	$V_{BAT}$	0
0	1	0	$V_{DD}$	0
0	1	1	$V_{DD}$	0
1	0	0	$V_{DD}$	0
1	0	1	$V_{DD}$	1
1	1	0	$V_{DD}$	0
1	1	1	$V_{DD}$	1

$PFI > V_{PFI}$	$PFO$
0	0
1	1
CONDITION.: $V_{DD} > V_{DD\_MIN}$	

**Table 2. TERMINAL FUNCTIONS**

TERMINAL		I/O	DESCRIPTION
NAME	NO.		
GND	3	I	Ground
$\overline{\text{MR}}$	6	I	Manual reset input
PFI	4	I	Power-fail comparator input
$\overline{\text{PFO}}$	5	O	Power-fail comparator output
$\overline{\text{RESET}}$	7	O	Active-low reset output
$\text{V}_{\text{BAT}}$	8	I	Backup-battery input
$\text{V}_{\text{DD}}$	2	I	Input supply voltage
$\text{V}_{\text{OUT}}$	1	O	Supply output

**FUNCTIONAL BLOCK DIAGRAM**



## TYPICAL CHARACTERISTICS

STATIC DRAIN-SOURCE ON-STATE RESISTANCE  
( $V_{DD}$  to  $V_{OUT}$ )  
vs  
OUTPUT CURRENT

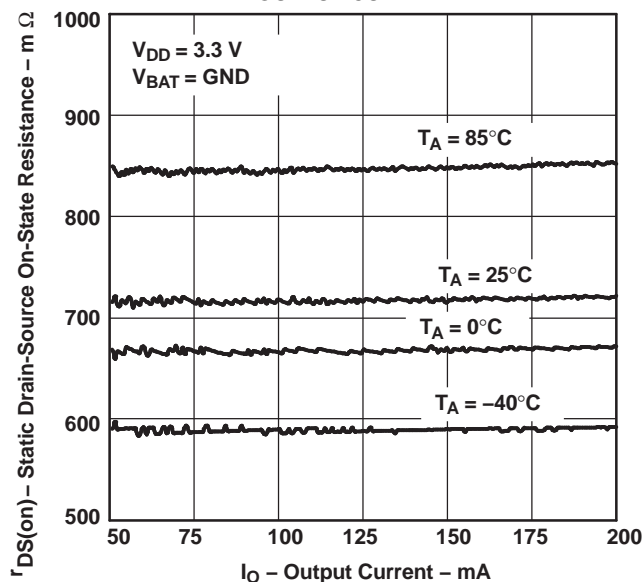


Figure 1.

STATIC DRAIN-SOURCE ON-STATE RESISTANCE  
( $V_{BAT}$  to  $V_{OUT}$ )  
vs  
OUTPUT CURRENT

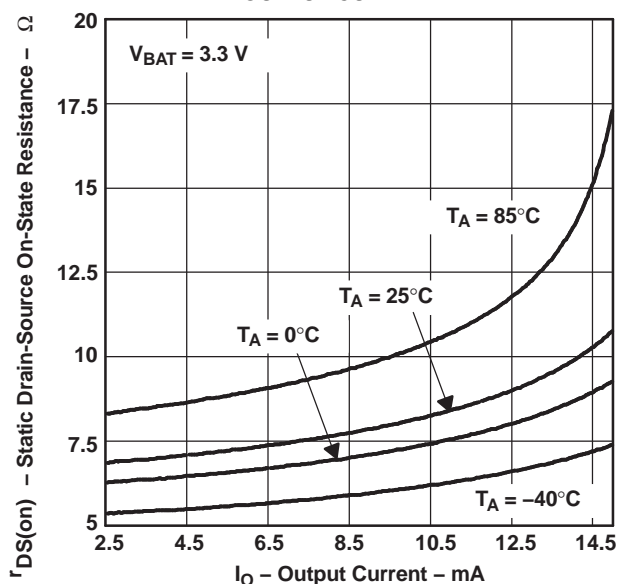


Figure 2.

SUPPLY CURRENT  
vs  
SUPPLY VOLTAGE

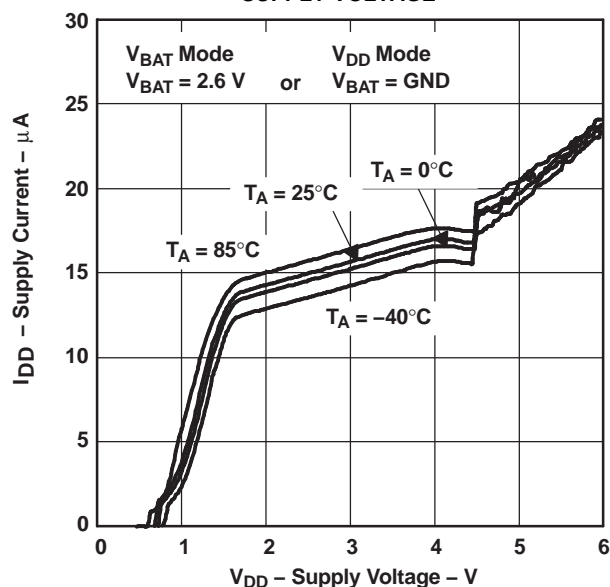


Figure 3.

NORMALIZED THRESHOLD AT RESET  
vs  
FREE-AIR TEMPERATURE

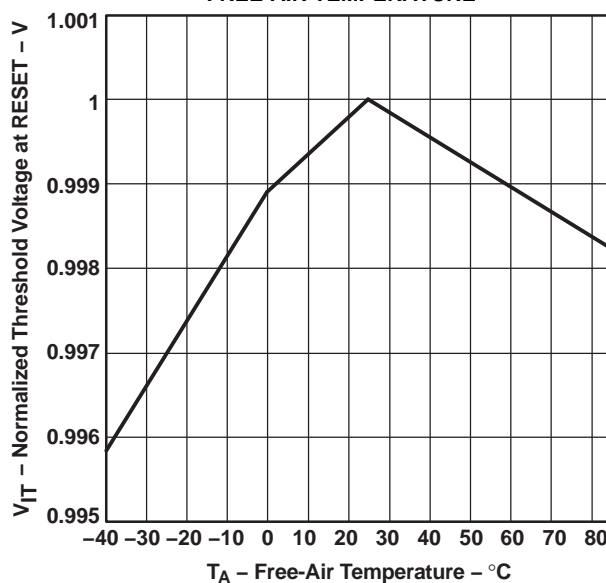


Figure 4.

## TYPICAL CHARACTERISTICS (continued)

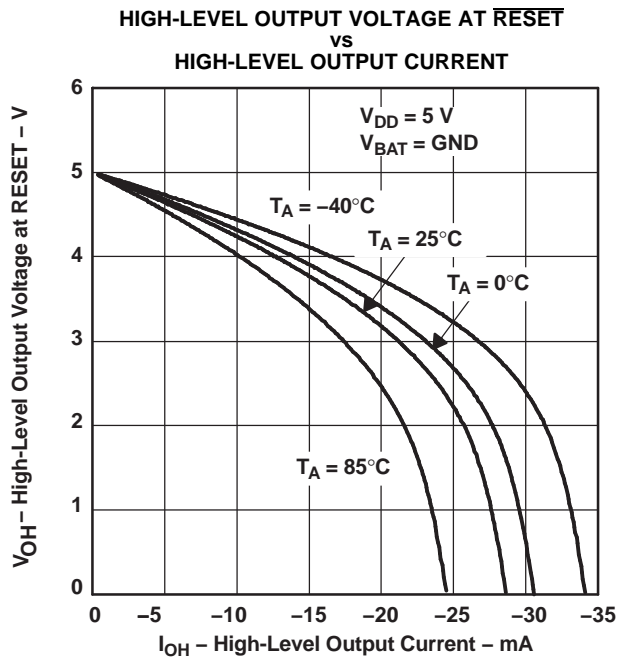


Figure 5.

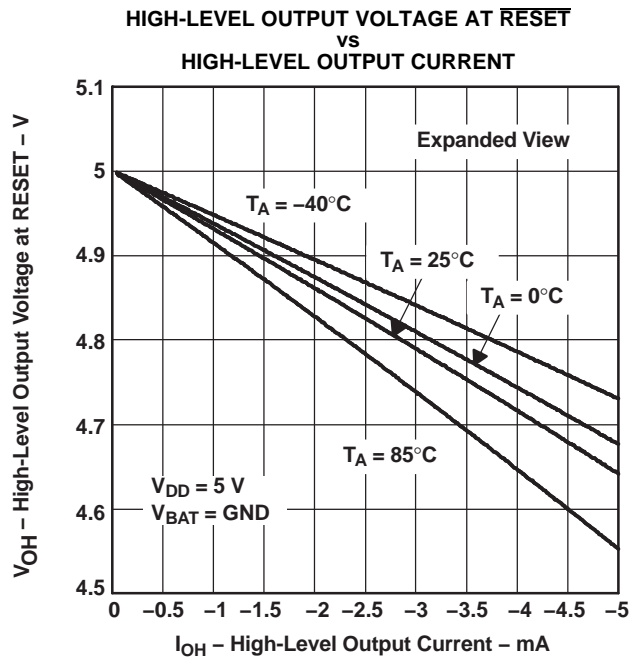


Figure 6.

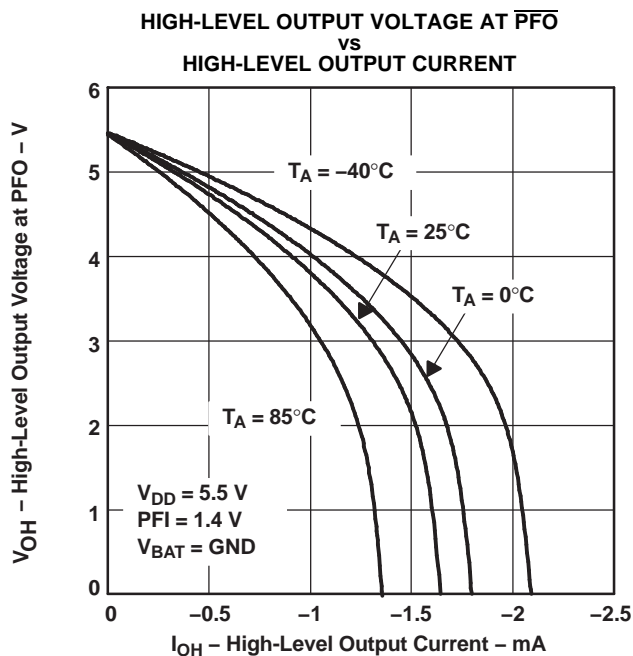


Figure 7.

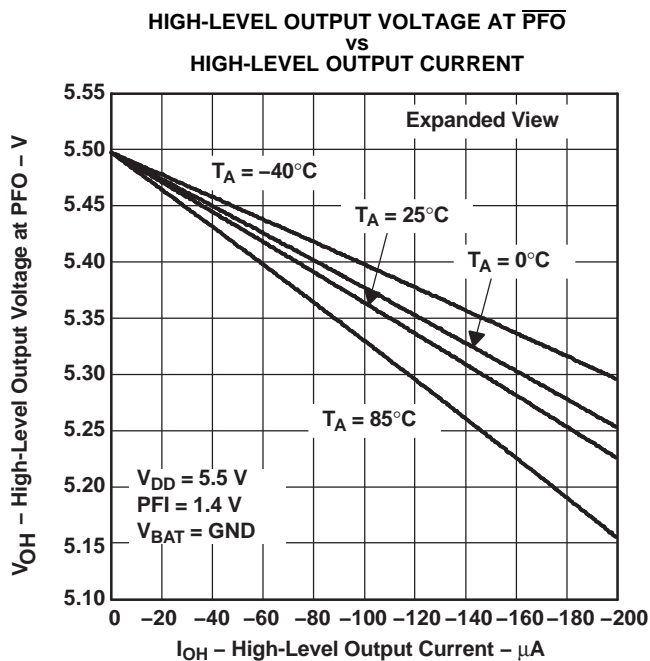


Figure 8.



## TYPICAL CHARACTERISTICS (continued)

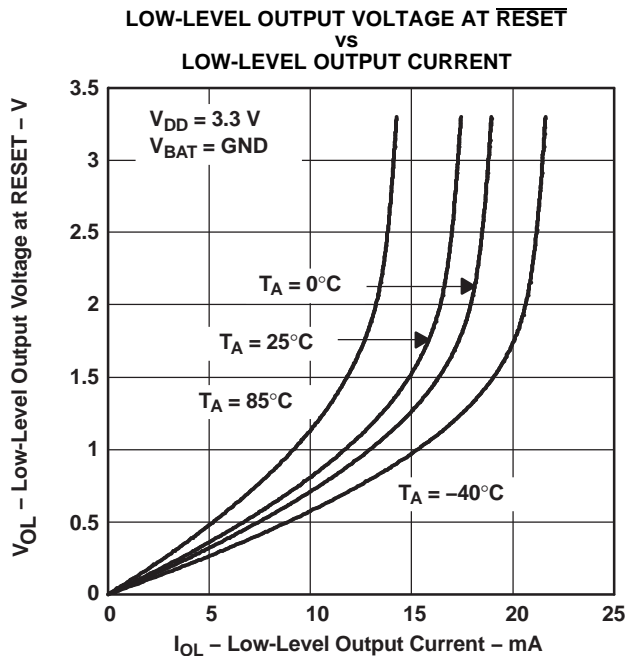


Figure 9.

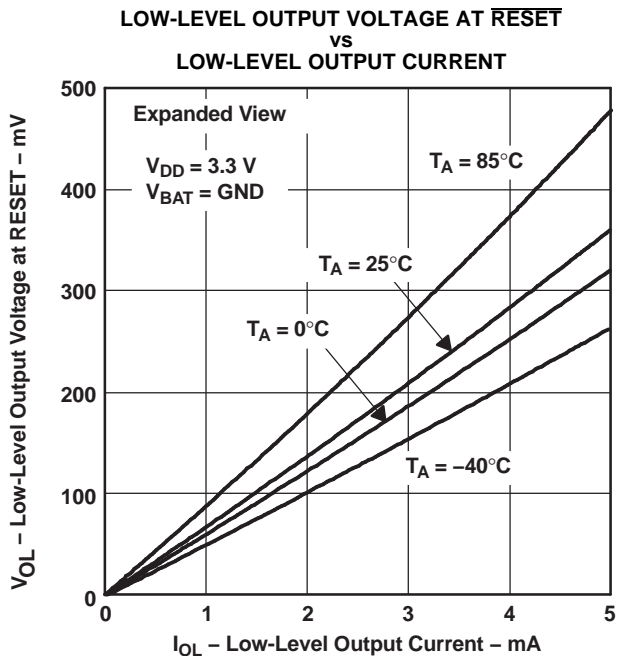


Figure 10.

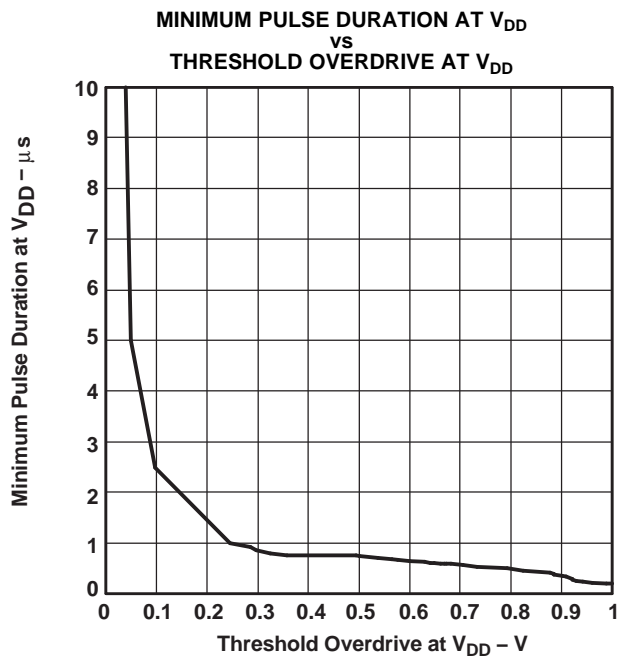


Figure 11.

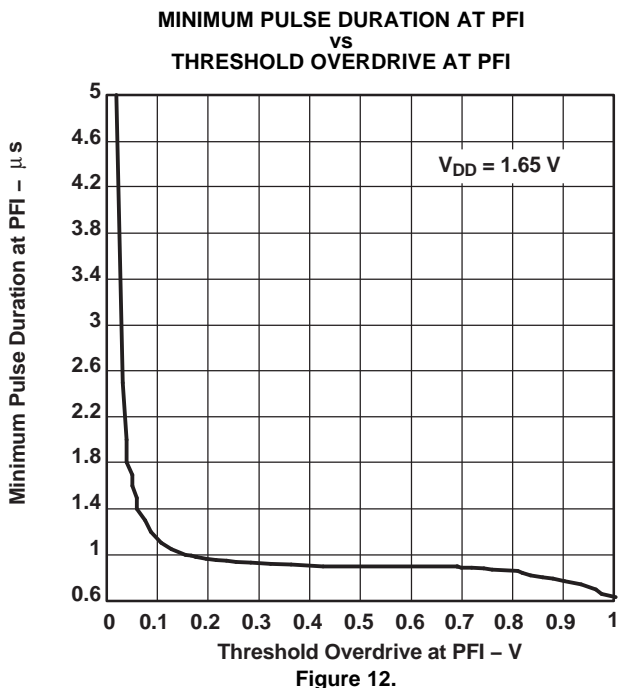


Figure 12.

## DETAILED DESCRIPTION

### Battery Freshness Seal (TPS3619)

The battery freshness seal of the TPS3619 family disconnects the backup-battery from internal circuitry until it is needed. This function prevents the backup-battery from being discharged until the final product is put to use. The following steps explain how to enable the freshness seal mode.

1. Connect  $V_{BAT}$  ( $V_{BAT} > V_{BAT\ min}$ )
2. Ground  $\overline{PFO}$
3. Connect PFI to  $V_{DD}$  ( $PFI = V_{DD}$ )
4. Connect  $V_{DD}$  to power supply ( $V_{DD} > V_{IT}$ ) and keep connected for  $5\ ms < t < 35\ ms$

The battery freshness seal mode is automatically removed by the positive-going edge of  $\overline{RESET}$  when  $V_{DD}$  is applied.

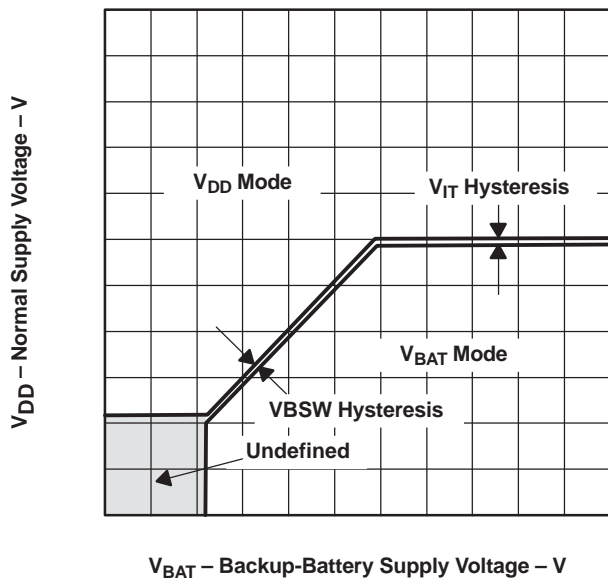
### Power-Fail Comparator (PFI and $\overline{PFO}$ )

An additional comparator is provided to monitor voltages other than the nominal supply voltage. The power-fail-input (PFI) is compared with an internal voltage reference of 1.15 V. If the input voltage falls below the power-fail threshold  $V_{IT(PFI)}$  of typical 1.15 V, the power-fail output ( $\overline{PFO}$ ) goes low. If  $V_{IT(PFI)}$  goes above  $V_{(PFI)}$ , plus about 12-mV hysteresis, the output returns to high. By connecting two external resistors, it is possible to supervise any voltages above  $V_{(PFI)}$ . The sum of both resistors should be about 1 M $\Omega$ , to minimize power consumption and also to assure that the current in the PFI pin can be ignored compared with the current through the resistor network. The tolerance of the external resistors should be not more than 1% to ensure minimal variation of sensed voltage. If the power-fail comparator is unused, PFI should be connected to ground and  $\overline{PFO}$  left unconnected.

### Backup-Battery Switchover

In case of a brownout or power failure, it may be necessary to preserve the contents of RAM. If a backup battery is installed at  $V_{BAT}$ , the device automatically switches the connected RAM to backup power when  $V_{DD}$  fails. In order to allow the backup battery (e.g., a 3.6-V lithium cell) to have a higher voltage than  $V_{DD}$ , these supervisors do not connect  $V_{BAT}$  to  $V_{OUT}$  when  $V_{BAT}$  is greater than  $V_{DD}$ .  $V_{BAT}$  only connects to  $V_{OUT}$  (through a 15- $\Omega$  switch) when  $V_{DD}$  falls below  $V_{IT}$  and  $V_{BAT}$  is greater than  $V_{DD}$ . When  $V_{DD}$  recovers, switchover is deferred either until  $V_{DD}$  crosses  $V_{BAT}$ , or until  $V_{DD}$  rises above the reset threshold  $V_{IT}$ .  $V_{OUT}$  connects to  $V_{DD}$  through a 1- $\Omega$  (max) PMOS switch when  $V_{DD}$  crosses the reset threshold.

FUNCTION TABLE		
$V_{DD} > V_{BAT}$	$V_{DD} > V_{IT}$	$V_{OUT}$
1	1	$V_{DD}$
1	0	$V_{DD}$
0	1	$V_{DD}$
0	0	$V_{BAT}$



**Figure 13. Normal Supply Voltage vs Backup-Battery Supply Voltage**

## PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">TPS3619-33DGK</a>	Active	Production	VSSOP (DGK)   8	80   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AFL
TPS3619-33DGK.A	Active	Production	VSSOP (DGK)   8	80   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AFL
TPS3619-33DGK.B	Active	Production	VSSOP (DGK)   8	80   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AFL
TPS3619-33DGKG4	Active	Production	VSSOP (DGK)   8	80   TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AFL
<a href="#">TPS3619-33DGKR</a>	Active	Production	VSSOP (DGK)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AFL
TPS3619-33DGKR.A	Active	Production	VSSOP (DGK)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AFL
TPS3619-33DGKR.B	Active	Production	VSSOP (DGK)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AFL
TPS3619-33DGKRG4	Active	Production	VSSOP (DGK)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AFL
<a href="#">TPS3619-50DGK</a>	Obsolete	Production	VSSOP (DGK)   8	-	-	Call TI	Call TI	-40 to 85	AFM
<a href="#">TPS3619-50DGKR</a>	Active	Production	VSSOP (DGK)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AFM
TPS3619-50DGKR.A	Active	Production	VSSOP (DGK)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AFM
<a href="#">TPS3620-33DGKR</a>	Active	Production	VSSOP (DGK)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ANL
TPS3620-33DGKR.A	Active	Production	VSSOP (DGK)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ANL
<a href="#">TPS3620-33DGKT</a>	Active	Production	VSSOP (DGK)   8	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ANL
TPS3620-33DGKT.A	Active	Production	VSSOP (DGK)   8	250   SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ANL
<a href="#">TPS3620-50DGKR</a>	Active	Production	VSSOP (DGK)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ANM
TPS3620-50DGKR.A	Active	Production	VSSOP (DGK)   8	2500   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	ANM

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

**(6) Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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## TAPE AND REEL INFORMATION



\*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
TPS3619-33DGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TPS3619-50DGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TPS3620-33DGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TPS3620-33DGKT	VSSOP	DGK	8	250	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TPS3620-50DGKR	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPS3619-33DGKR	VSSOP	DGK	8	2500	358.0	335.0	35.0
TPS3619-50DGKR	VSSOP	DGK	8	2500	358.0	335.0	35.0
TPS3620-33DGKR	VSSOP	DGK	8	2500	358.0	335.0	35.0
TPS3620-33DGKT	VSSOP	DGK	8	250	358.0	335.0	35.0
TPS3620-50DGKR	VSSOP	DGK	8	2500	358.0	335.0	35.0

**DGK0008A****PACKAGE OUTLINE****VSSOP - 1.1 mm max height**

SMALL OUTLINE PACKAGE



4214862/A 04/2023

**NOTES:**

PowerPAD is a trademark of Texas Instruments.

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-187.



# EXAMPLE BOARD LAYOUT

DGK0008A

™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 15X



SOLDER MASK DETAILS

4214862/A 04/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.
9. Size of metal pad may vary due to creepage requirement.

## EXAMPLE STENCIL DESIGN

DGK0008A

™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
SCALE: 15X

4214862/A 04/2023

NOTES: (continued)

11. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
12. Board assembly site may have different recommendations for stencil design.

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