TPS3423, TPS3424, Nano-Power, Push-Button Controllers With Configurable Delay to Enable Battery Freshness Seal

1 Features

- Operating voltage range: 1V to 6V
- Nano supply current: 18nA (typical)
- HBM ESD rating on push-button pin: ±8kV
- Programmable short press and long press duration
  - TPS3423, TPS3424 fixed timing options:
    - Short press duration: 50msec to 13sec
    - Long press duration: 1sec to 30sec
    - Timer accuracy (maximum): ±10%
  - TPS3424: user-programmable option (50msec to 50sec) through external capacitor
- Output configurations:
  - RESET configurations:
    - Push-pull / open-drain, active high / low
    - Latched / non-latched
    - 100msec to 10sec pulse option for non-latched version
  - $\overline{INT}$ configurations:
    - open drain, active low
    - non-latched (100msec to 1sec pulse duration)
- Kill feature: enables host to control the RESET output
- Available in pin compatible SOT-583 and SOT563 packages

2 Applications

- Wearables
- Gaming consoles
- Home theater entertainment
- Printers
- Health care
- Portable electronics
- Factory automation & control

3 Description

TPS3423 and TPS3424 are push-button controllers which offer wide range of independent detection of short press and long press functionality. These devices offer up to two outputs per push-button (RESET and $\overline{INT}$), which can be used for various use cases including enabling the voltage regulator or circuit breakers, generating a monoshot for given press duration and sending an interrupt to micro controller. The device generates an interrupt pulse both for short press and long press notifying the micro controller. RESET output changes the state based on the device configuration.

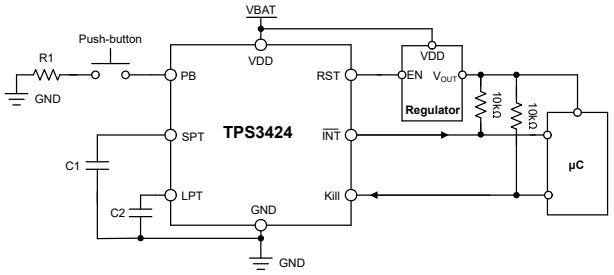
The extreme low power consumption 18nA helps to improve product shelf life for battery powered devices. The device keeps the power tree disabled until required button press is detected. This feature can be used to implement battery freshness seal.

TPS3423/4 are offered in fixed timing options for short and long press durations. To provide flexibility to the designer, TPS3424 also offers user-programmable short and long press durations through an external capacitor. Kill pin in TPS3424 enables feedback from the microcontroller to asynchronously de-assert RESET.

Device Information

PART NUMBER	PACKAGE (1)	BODY SIZE (NOM) (2)
TPS3423	DRL (SOT-583)	2.10mm × 1.60mm
	DRL (SOT-563) (3)	1.60mm × 1.20mm
TPS3424	DRL (SOT-583)	2.10mm × 1.60mm
	DRL (SOT-563) (3)	1.60mm × 1.20mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.
(3) Preview package.



TPS3424 Typical Application Diagram

An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

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4 Device Comparison

Figure 4-1 and Figure 4-3 shows the device nomenclature of the TPS3423 and TPS3424, for output / push-button input, short press and long press, interrupt, reset and kill timing options. Figure 4-2 extends nomenclature of TPS3423 to provide 2 different timing option for channels. Refer Section 7 for more details. Contact TI sales representatives or on TI's E2E forum for detail and availability of other options.

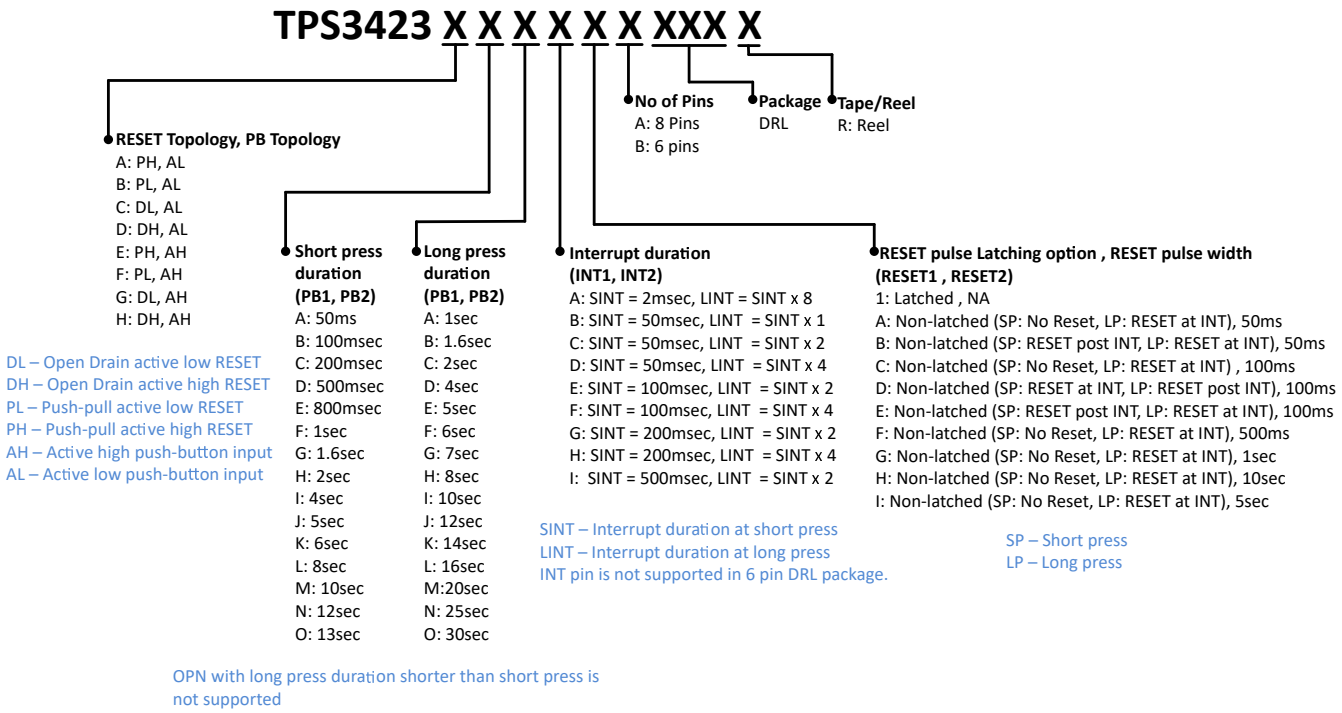


Figure 4-1. Dual Push-Button Nomenclature

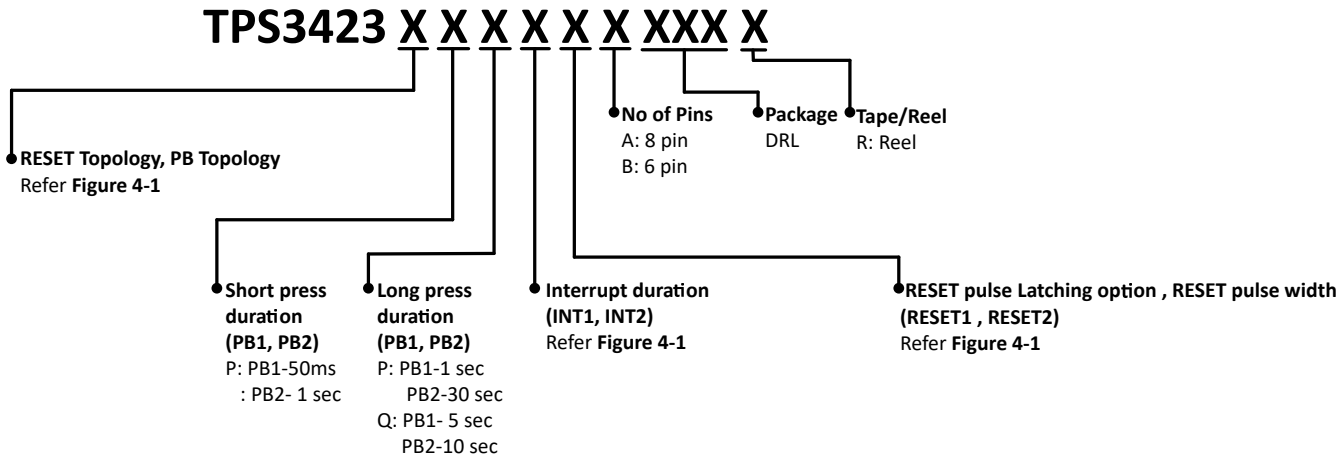


Figure 4-2. Dual Push-Button Extended Nomenclature

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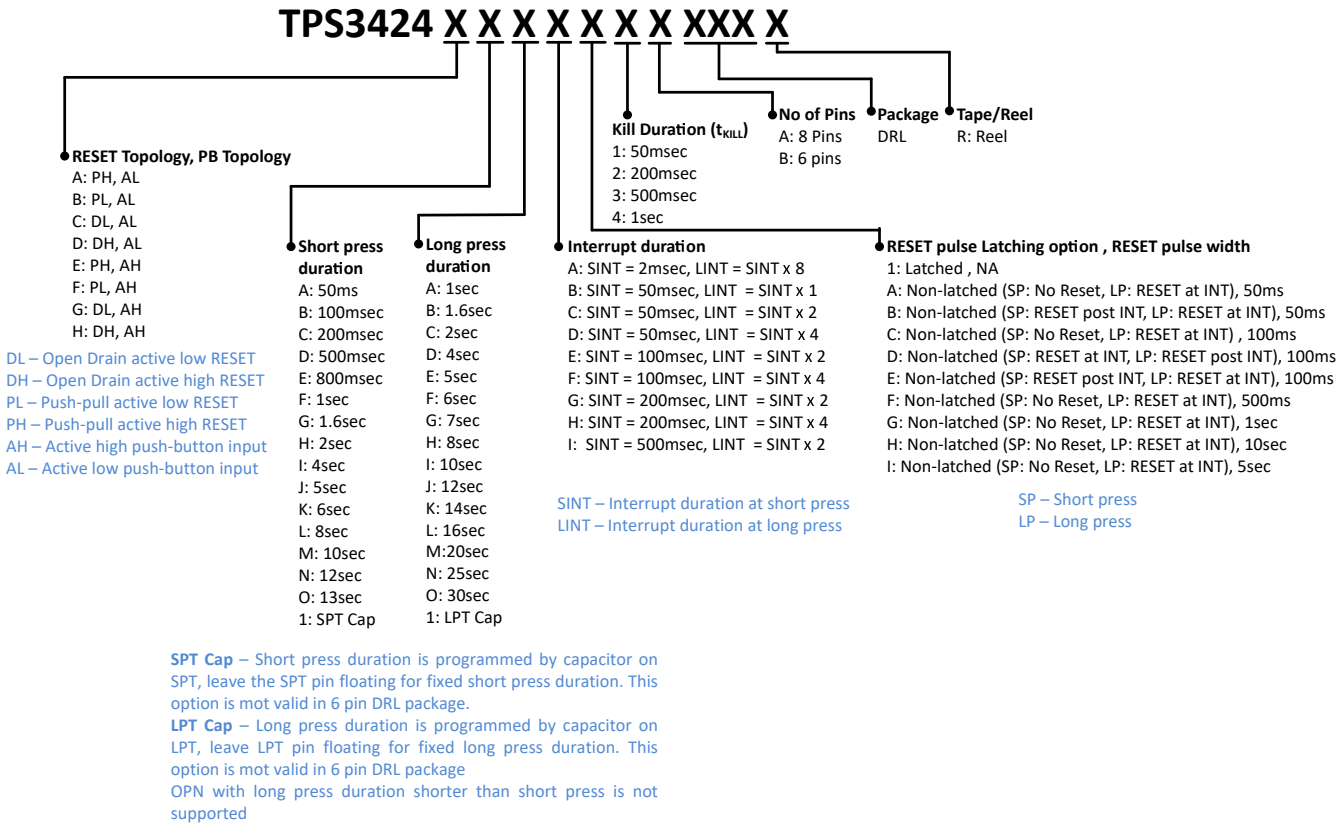


Figure 4-3. Single Push-Button Nomenclature

TPS3423/4 belongs to family of devices offering different feature sets as highlighted in Device Information.

Device Information

PART NUMBER	NO. OF PUSH-BUTTONS	PUSH-BUTTON TIMING OPTION	KILL FEATURE
TPS3423	2	Fixed	No
TPS3424	1	Fixed , programmable with external capacitor	Yes

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5 Pin Configuration and Functions

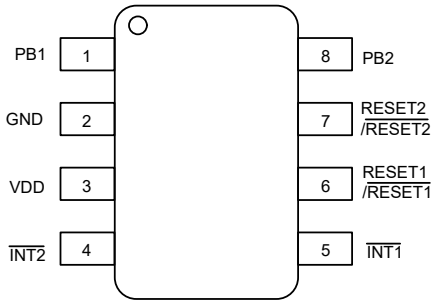


Figure 5-1. Pin Configuration Option: TPS3423
DRL Package
8-Pin SOT-5X3
Top View

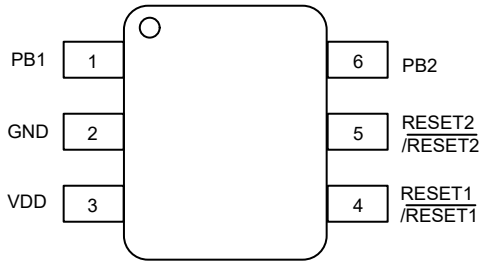


Figure 5-2. Pin Configuration Option TPS3423
DRL Package
6-Pin SOT-5X3
Top View

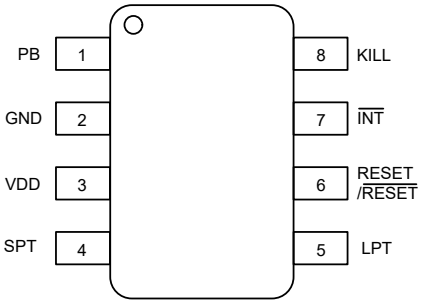


Figure 5-3. Pin Configuration Option TPS3424
DRL Package
8-Pin SOT-5X3
Top View

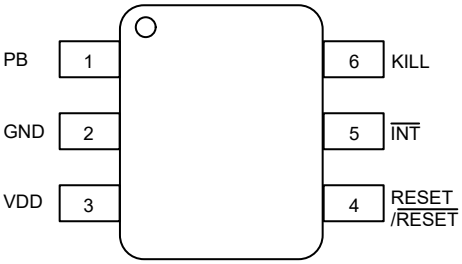


Figure 5-4. Pin Configuration Option TPS3424
DRL Package
6-Pin SOT-5X3
Top View

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Table 5-1. TPS3423 - Pin Functions

TPS3423			I/O	DESCRIPTION
PIN NAME	8 PIN SOT-5X3	6 PIN SOT-5X3		
PB1	1	1	I	Push-button input 1, refer Section 7.3.1.1 for additional details.
GND	2	2	-	Ground connection for IC.
V_{DD}	3	3	I	Supply connection, connect a 0.1µF capacitor near the pin for best performance.
$\overline{INT2}$	4		O	Interrupt output for push-button input 2, $\overline{INT2}$ is open drain active low output which toggles from every short press and long press on push-button input 2 as described in Section 7.3.2.1
$\overline{INT1}$	5		O	Interrupt output for push-button input 1, $\overline{INT1}$ is open drain active low output which toggles from every short press and long press on push-button input 1 as described in Section 7.3.2.1
RESET1/ $\overline{RESET1}$	6	4	O	RESET output for push-button input 1. The response of RESET to short press and long press is described in Section 7.3.2.2.
RESET2/ $\overline{RESET2}$	7	5	O	RESET output for push-button input 2. The response of RESET to short press and long press is described in Section 7.3.2.2.
PB2	8	6	I	Push-button input 2, refer Section 7.3.1.1 for additional details.

Table 5-2. TPS3424 - Pin Functions

TPS3424			I/O	DESCRIPTION
PIN NAME	8 PIN SOT-5X3	6 PIN SOT-5X3		
PB	1	1	I	Push-button input, refer Section 7.3.1.1 for additional details.
GND	2	2	-	Ground connection for IC.
V_{DD}	3	3	I	Supply connection, connect a 0.1µF capacitor near the pin for best performance.
SPT	4			Connect capacitor to program short press time as described in Section 7.3.1.1 for SPT Cap version.
LPT	5		O	Connect capacitor to program long press time as described in Section 7.3.1.1 for LPT Cap version.
RESET/ $\overline{RESET}$	6	4	O	RESET output for the device. The response of RESET to short press and long press is described in Section 7.3.2.2.
$\overline{INT}$	7	5	O	Interrupt output. $\overline{INT}$ is open drain active low output which toggles from every short press and long press on push-button input as described in Section 7.3.2.1
KILL	8	6	I	Kill is feedback from the host. RESET can be de-asserted in the latched version by pulling KILL low. Connect this pin to V_{DD} if not used. Please refer Section 7.3.1.3 for additional details.

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6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

		MIN	MAX	UNIT
Voltage	V_{DD}	–0.3	6.5	V
	V_{PB} (1)	–0.3	V_{DD} + 0.3	V
	V_{KILL} (1)	–0.3	V_{DD} + 0.3	V
Current	$I_{RESET/\overline{RESET}}$	-6	6	mA
Temperature(2)	Operating free-air temperature, T_A	-40	125	°C
Storage temperature range	T_{stg}	-65	150	°C

(1) Stresses beyond values listed under Absolute Maximum Ratings can cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 (PB pin only)	±8000	V
		Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±2000	
		Charged device model (CDM), per JEDEC specification JESD22-C101	±750	

(1) HBM for all the pins except PB

6.3 Recommended Operating Conditions

		MIN	NOM	MAX	UNIT
V_{DD}	Supply pin voltage	1		6	V
V_{PB}	Push-button pin input voltage	0		V_{DD}	V
V_{KILL}	KILL pin Voltage	0		V_{DD}	V
$V_{\overline{INT}}$	Interrupt pin voltage	0		V_{DD}	V
$V_{RESET/\overline{RESET}}$	Output pin voltage	0		V_{DD}	V
$I_{RESET/\overline{RESET}}$	Output pin current	0		5	mA
T_A	Ambient temperature	-40		125	℃
C_{SPT}	SPT capacitor (1)			100	nF
C_{LPT}	LPT capacitor			125	nF

(1) SPT capacitor value must be lower than LPT capacitor value

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6.4 Thermal Information

THERMAL METRIC[1]		TPS3423 / TPS3424 DRL (SOT-583) 8 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	122.8	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	68.1	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	31.1	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	2.6	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	30.5	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	NA	°C/W

(1) For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report.

6.5 Electrical Characteristics

At 1V <V_{DD} <6V, SPT = LPT = Open, KILL = VDD, C_{RESET} = 50pF, $\overline{INT}$ = 10KΩ pull up to V_{DD} and over the operating free-air temperature range of - 40°C to 125°C, unless otherwise noted. Typical values are at T_A = 25°C.

PARAMETER		TEST CONDITION		MIN	TYP	MAX	UNIT
POWER SUPPLY							
V_{DD}	Supply Voltage			1		6	V
$I_{DD(Standby)}$	Standby supply current[1]	V_{DD} = 3V	T_A = 25°C		18	24	nA
			T_A = –40°C to 85°C			90	
		V_{DD} = 6V	T_A = –40°C to 85°C		23	100	
		V_{DD} = 6V				350	
Push-button PIN							
$I_{DD(Active)}$	Supply current when $V_{\overline{PB}}$ = 0V (two push-button is pressed)[2]	V_{DD} = 3V	T_A = –40°C to 85°C			10	µA
			T_A = –40°C to 125°C			12	
	Supply current when $V_{\overline{PB}}$ = 0V (one push-button is pressed)[2]		T_A = –40°C to 85°C			6	
			T_A = –40°C to 125°C			7	
	Supply current when V_{PB} = VDD (two push buttons are pressed)[3]		T_A = –40°C to 85°C			1.8	
			T_A = –40°C to 125°C			3.5	
	Supply current when V_{PB} = VDD (one push button is pressed)[3]		T_A = –40°C to 85°C			1.8	
			T_A = –40°C to 125°C			3.5	
$V_{IH(\overline{PB}\ /\ PB)}$	PB Logic high input	V_{DD} = 3V		0.8*V_{DD}			
$V_{IL(\overline{PB}\ /\ PB)}$	PB Logic low Input					0.3*VDD	
R_{PB}	PB pin internal pull-up / pull-down resistance[2] [3]				1000		kΩ
$\overline{INT}$ and RESET							
$V_{OL(\overline{INT})}$	Low level output voltage	V_{DD} = 1V, $\overline{INT}$ = 100µA				200	mV
	Low level output voltage	V_{DD} = 3V, $\overline{INT}$ = 1mA				300	
$I_{LKG(\overline{INT})}$	Open drain output leakage current for $\overline{INT}$	V_{DD} = $V_{\overline{Pullup}}$ = 6V				70	nA

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6.5 Electrical Characteristics (continued)

At 1V <V_{DD} <6V, SPT = LPT = Open, KILL = VDD, C_{RESET} = 50pF, $\overline{INT}$ = 10KΩ pull up to V_{DD} and over the operating free-air temperature range of - 40°C to 125°C, unless otherwise noted. Typical values are at T_A = 25°C.

PARAMETER		TEST CONDITION	MIN	TYP	MAX	UNIT
$V_{OL(RESET/\overline{RESET})}$	Low level output voltage (Open Drain)	V_{DD} = 1V, $I_{(RESET/\overline{RESET})}$ = 300µA			200	mV
	Low level output voltage (Push-Pull)(4)	V_{DD} = 1V, $I_{(RESET/\overline{RESET})}$ = 300µA			200	
	Low level output voltage (Open Drain)	V_{DD} = 3V, $I_{(RESET/\overline{RESET})}$ = 5mA			300	
	Low level output voltage (Push-Pull)(4)	V_{DD} = 3V, $I_{(RESET/\overline{RESET})}$ = 5mA			300	
$V_{OH(RESET/\overline{RESET})}$	High level output voltage (Push-Pull)(4)	V_{DD} = 1V, $I_{(RESET/\overline{RESET})}$ = 200µA	0.7*V_{DD}			
	High level output voltage (Push-Pull)(4)	V_{DD} = 3V, $I_{(RESET/\overline{RESET})}$ = 5mA	0.7*$_{VDD}$			
$I_{LKG\ (RESET/\overline{RESET})}$	Open drain output leakage current for (RESET)	V_{DD} = $V_{\overline{Pullup}}$ = 6V, R_{Pullup} = 10kΩ			70	nA
KILL						
I_{KILL}	Kill Input current			25		nA
V_{KILL_L}	KILL logic low input				0.3*V_{DD}	
V_{KILL_H}	KILL logic high input		0.7*V_{DD}			

(1) PB pin not pressed.
(2) PB pin as active low.
(3) PB pin as active high.
(4) This spec holds true both for active high RESET and active low RESET.

6.6 Timing Requirements

At 1V <V_{DD} <6V, SPT = LPT = Open, KILL = VDD, C_{RESET} = 50pF, $\overline{INT}$ = 10KΩ pull up to V_{DD} and over the operating free-air temperature range of - 40°C to 125°C, unless otherwise noted. Typical values are at T_A = 25°C.

Parameter		Test Condition	MIN	TYP	MAX	UNIT
t_{SP} Accuracy	Short press duration accuracy for fixed version(1)		-10		10	%
	Short press duration accuracy for adjutable version(1)	SPT = 330pF, LPT = 4.7nF	-20		20	%
t_{LP} Accuracy	Long press duration accuracy for fixed version		-10		10	%
	Long press duration accuracy for adjutable version	SPT = 330pF, LPT = 4.7nF	-20		-20	%
t_{SINT} Accuracy	Interrupt pulse width accuracy for PB long press		-10		10	%
t_{LINT} Accuracy	Interrupt pulse width accuracy for PB short press		-10		10	%
t_{KILL} Accuracy	PB/KILL debounce accuracy when RESET deaaserts in latched version		-10		10	%
t_{RESET}	Reset pulse duration (non latched) - Accuracy		-10		10	%
$t_{GI(KILL)}$	Glitch Immunity at KILL pin			250		ns
$t_{PD(KILL)}$	KILL falling edge to RESET assert delay			300		ns

(1) t_{SPD} must always be less than t_{LPD}.

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6.7 Timing Diagrams

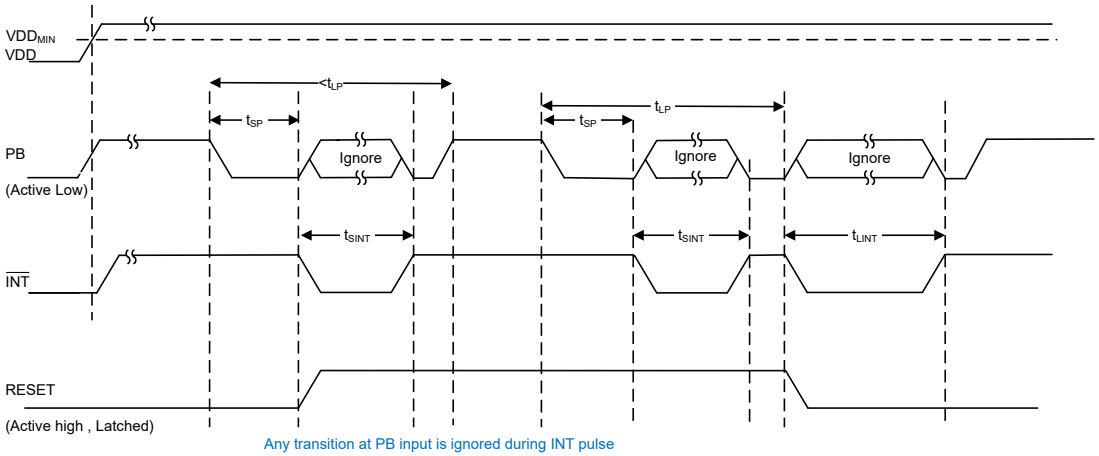


Figure 6-1. Timing Diagram: Latched RESET

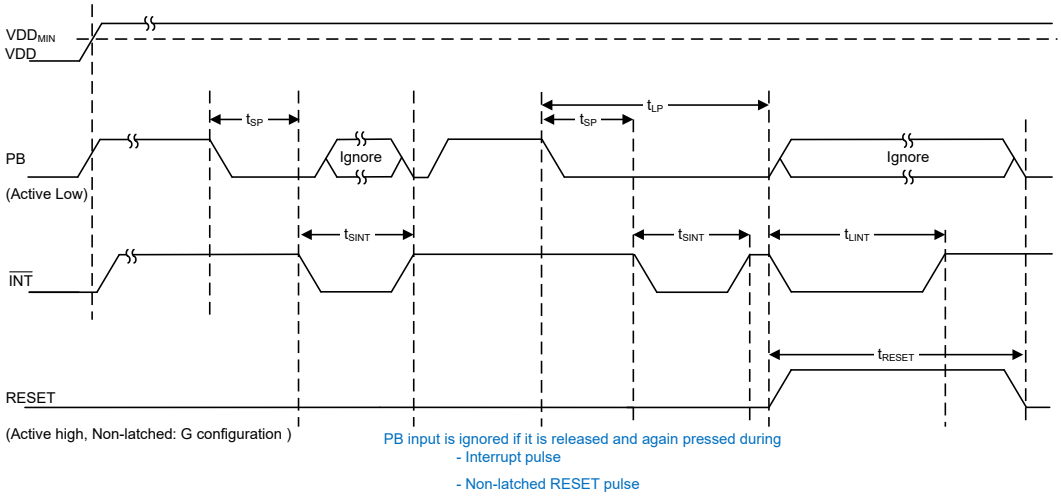


Figure 6-2. Timing Diagram: Non-Latched RESET (SP: No Reset, LP: RESET at INT)

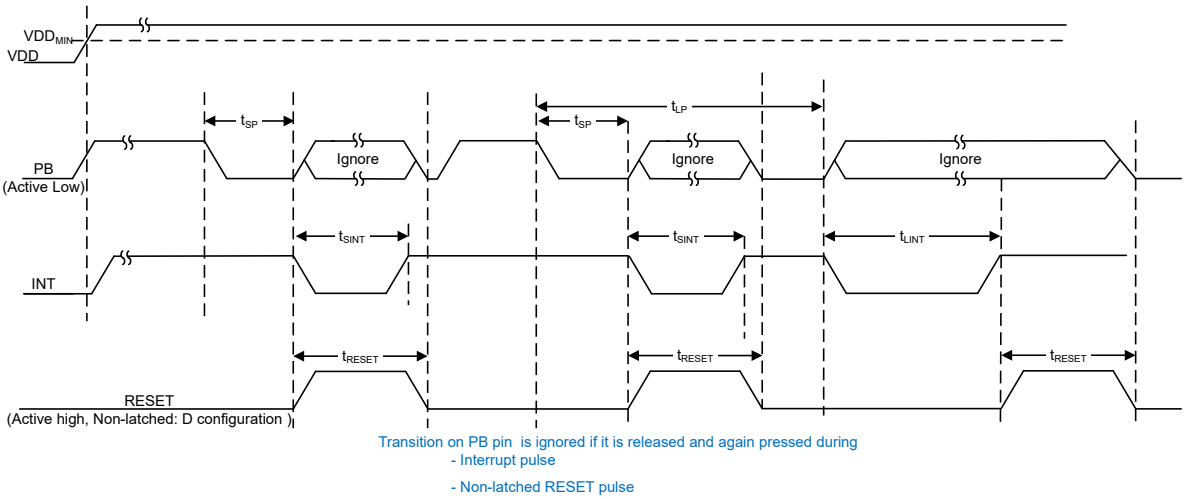


Figure 6-3. Timing Diagram: Non-Latched RESET

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(SP: RESET at INT, LP: RESET post INT)

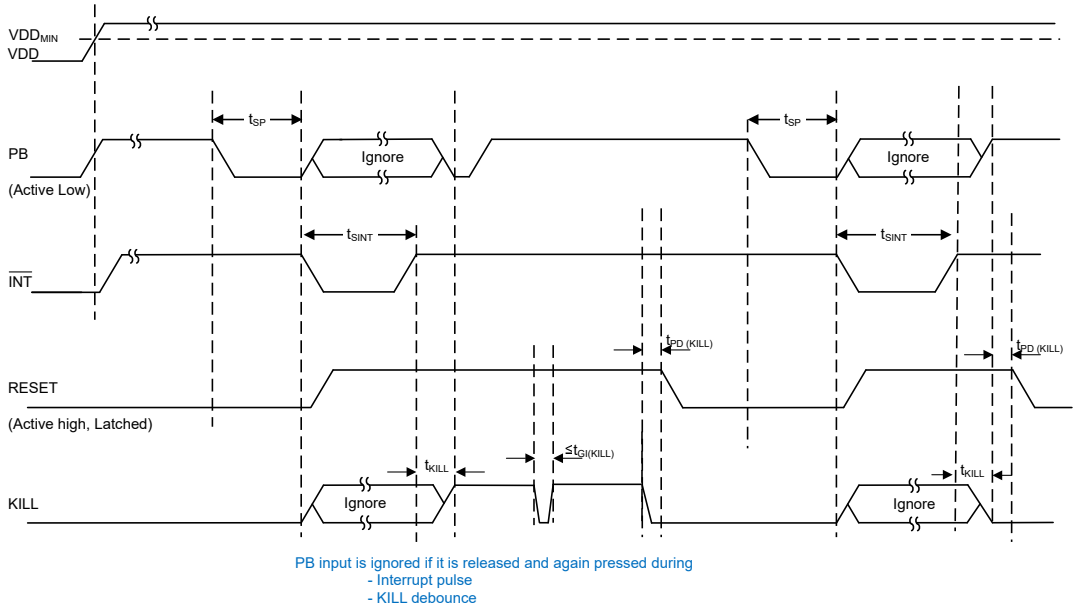


Figure 6-4. Timing Diagram: KILL

6.8 Typical Characteristics

At V_{DD} = 6V, SPT = LPT = Open, KILL = VDD, C_{RESET} = 50pF, INT = 10KΩ pull up to V_{DD} and over the operating free-air temperature range of - 40°C to 125°C, unless otherwise noted.

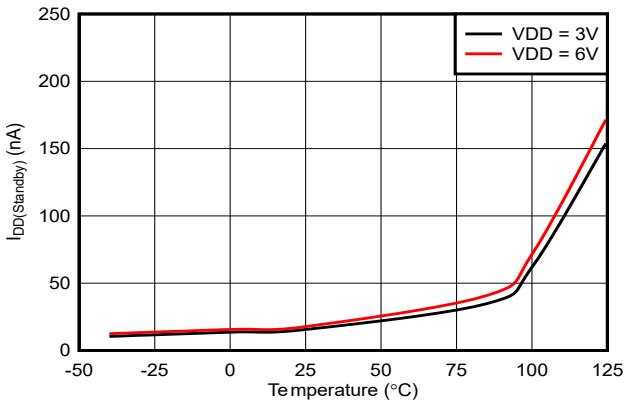


Figure 6-5. Standby Supply Current vs Temperature

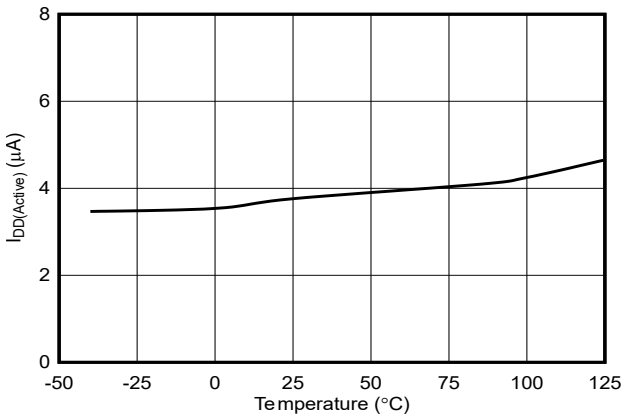


Figure 6-6. Active Current vs Temperature (Active Low Push Button Input)

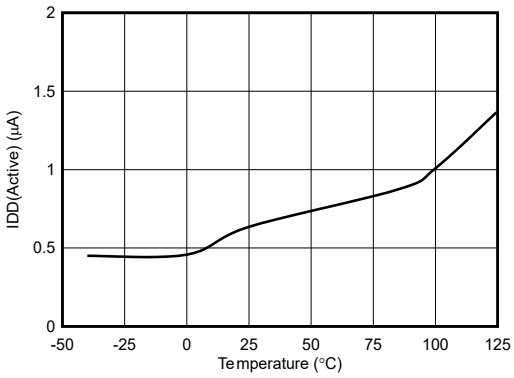


Figure 6-7. Active Current vs Temperature (Active High Push Button Input)

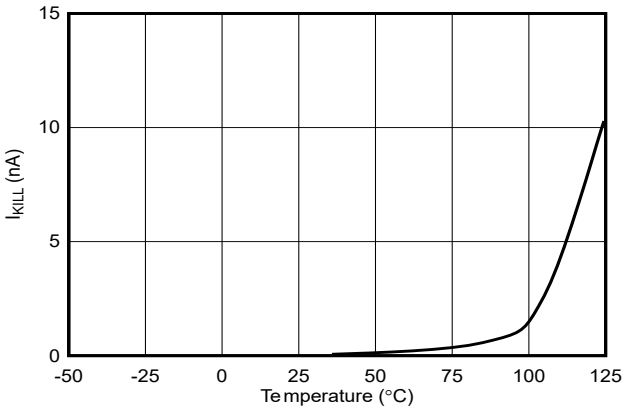


Figure 6-8. Kill Current vs Temperature

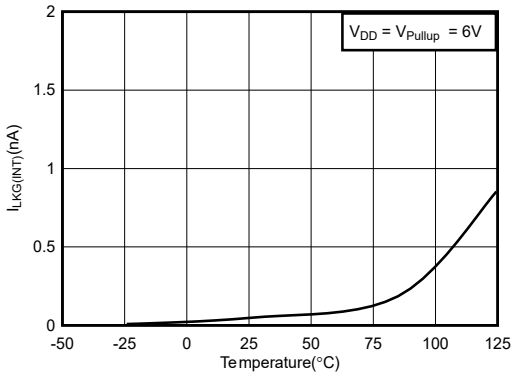


Figure 6-9. INT Leakage vs Temperature

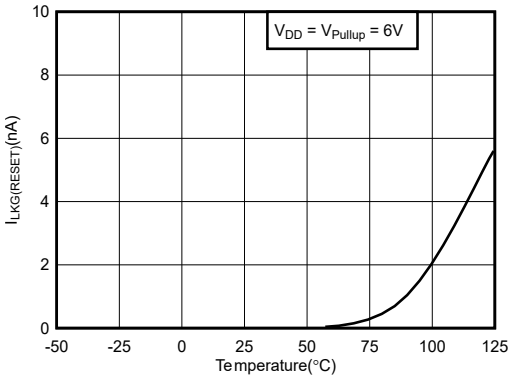


Figure 6-10. Open Drain RESET Leakage vs Temperature

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6.8 Typical Characteristics (continued)

At V_{DD} = 6V, SPT = LPT = Open, KILL = VDD, C_{RESET} = 50pF, INT = 10KΩ pull up to V_{DD} and over the operating free-air temperature range of - 40°C to 125°C, unless otherwise noted.

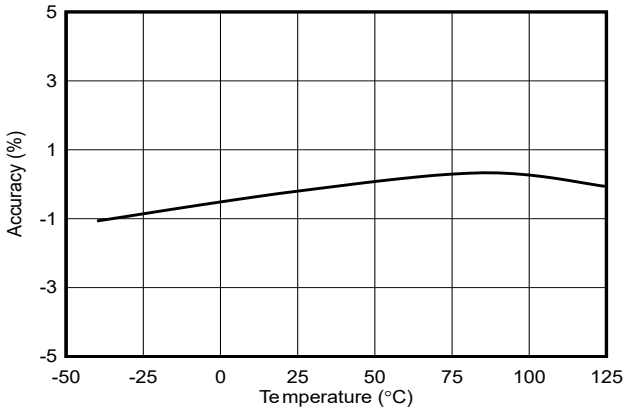


Figure 6-11. Timing Accuracy vs Temperature (Short Press, Long Press, Kill Blanking time)

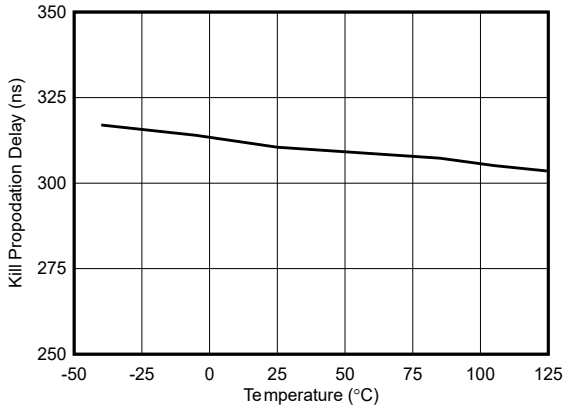


Figure 6-12. Kill Propagation Delay vs Temperature

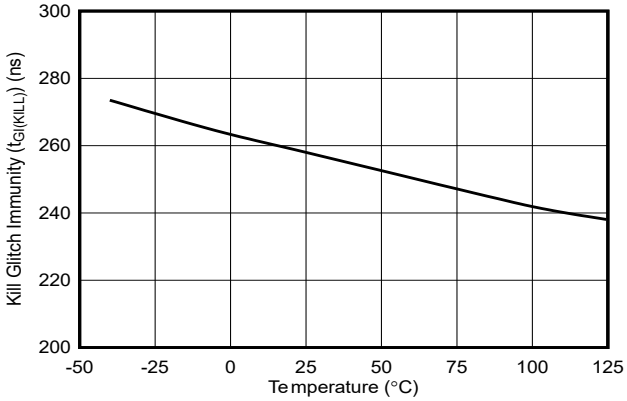


Figure 6-13. Kill Glitch Immunity vs Temperature

7 Detailed Description

7.1 Overview

The TPS3423 & TPS3424 are nano power push-button family which offer wide range of timing option for input (PB, KILL) and output (RESET, $\overline{INT}$) pins. This device family is available in two different pinout with 8 and 6 pin DRL package and various output and input configuration as per Device Comparison to support various applications. The pin placement enables use of either 6 pin or 8 pin device for a single 8 pin layout.

7.2 Functional Block Diagrams

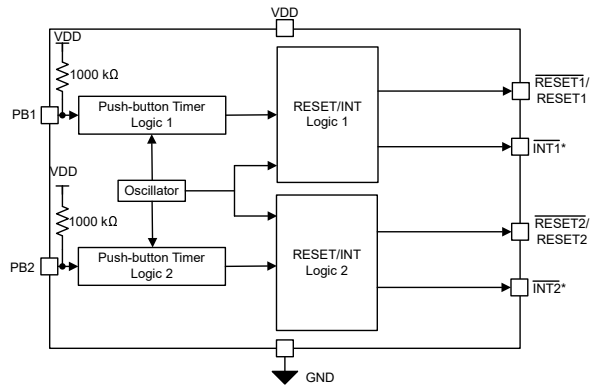


Figure 7-1. TPS3423 Block Diagram (Active Low Push-Button Input)

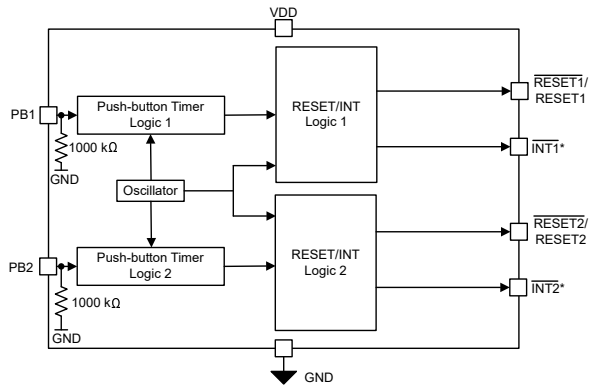


Figure 7-2. TPS3423 Block Diagram (Active High Push-Button Input)

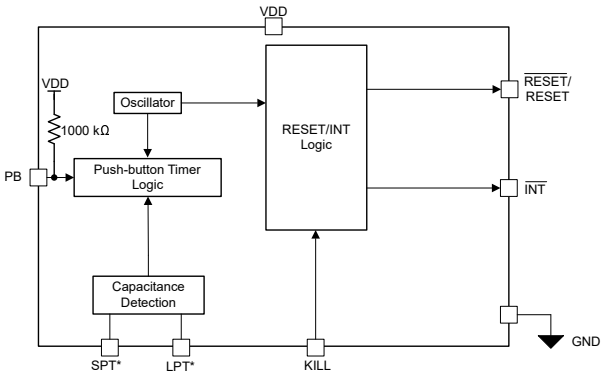


Figure 7-3. TPS3424 Block Diagram (Active Low Push-Button Input)

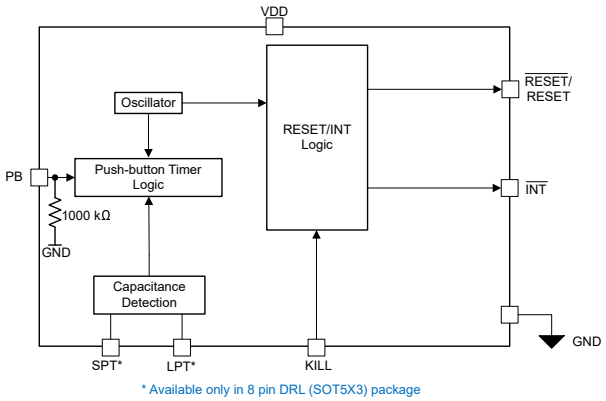


Figure 7-4. TPS3424 Block Diagram (Active High Push-Button Input)

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7.3 Feature Description

7.3.1 Inputs

This section discusses the inputs of the TPS3423 & TPS3424 devices.

7.3.1.1 Push-Button Input (PB)

Push-button input (PB) for TPS3423 and TPS3424 is available in active low and active high configuration as per Table 7-1 as shown from Figure 7-1 to Figure 7-4.

Table 7-1. Push-Button Configuration

PUSH-BUTTON CONFIGURATION	INTERNAL RESISTOR ORIENTATION	PB TRIGGER STATE
Active low	1000kΩ , pulled up to VDD	Falling edge on PB pin if INT is not asserted.
Active High	1000kΩ , pulled down to GND	Rising edge on PB pin if INT is not asserted.

PB pin must be connected to a switch with ON resistance less than 20% of the pull-up / pull-down resistance to provide the correct PB input trigger for the device.

A precise timer is activated once PB pin is triggered by rising or falling edge for active high or active low configuration respectively. The device generates the output corresponding to short press, once PB pin is kept low (for active low PB) or kept high (for active high PB) for more than short press (t_{SP}) duration. The device generates output corresponding to long press if the PB pin is held in the same state for long press (t_{LP}) duration. The timer stops and gets reset when PB pin is released. If PB is released during interrupt pulse (Figure 7-5), non-latched RESET pulse or KILL debounce time then next PB input is ignored as described in Section 6.7 and Figure 7-6.

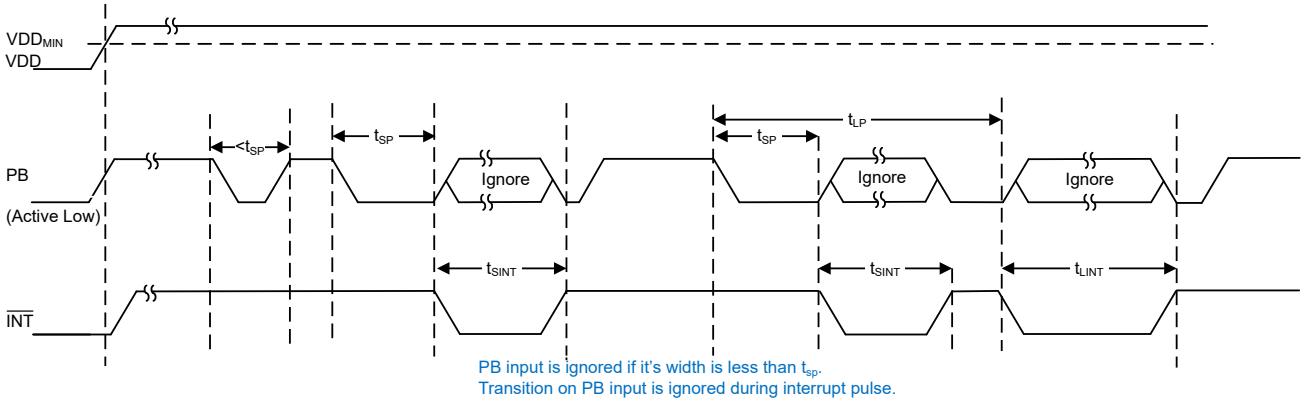


Figure 7-5. Push Button Functionality

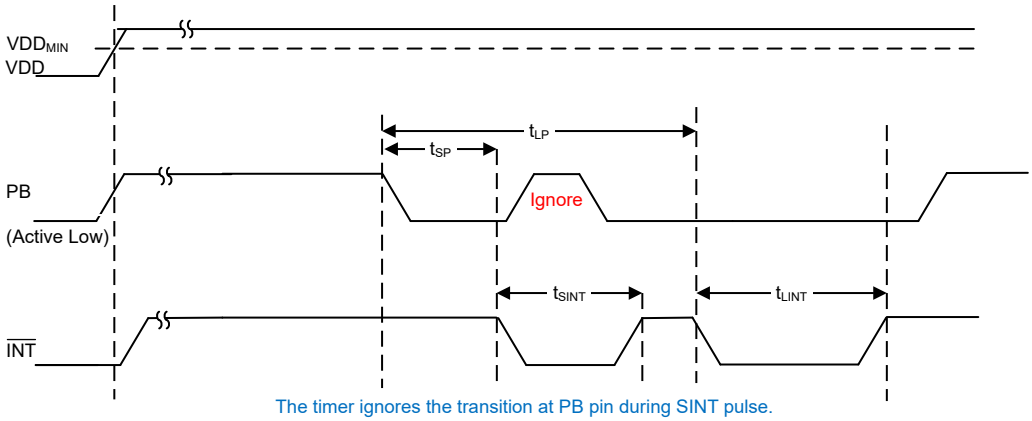


Figure 7-6. Push Button Transition Behavior at INT Pulse

TPS3423 has two independent push-button pins PB1 and PB2. These pins are factory programmed for short press (t_{SP}) and long press (t_{LP}) duration. TPS3424 has single PB pin. PB pin in TPS3424 is available both in fixed timing and user programmable option (8-pin DRL package) through capacitor connection on SPT and LPT pins. SPT and LPT pins must be floating for fixed timing option of TPS3424.

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7.3.1.2 Push-Button Timing Programmability

TPS3424x11xxx8DRLR has options to program short press duration (t_{SP}) and long press duration (t_{LP}) with capacitor on SPT pin and LPT pin respectively. Equation 1 shows the relation between the press duration and the capacitance. If the pin is left floating, the device defaults to fixed timer of 50msec. Connecting a capacitor which provides less than 50msec press duration as per Equation 1, programs to 50msec press duration. Make sure t_{LP} is greater than t_{SP} for proper device operation.

$$t_{SP} \text{ or } t_{LP}(\text{sec}) = 0.422 \times C(\text{nF}) \quad (1)$$

where

- Press duration is t_{SP} for SPT capacitor and t_{LP} for LPT capacitor.
- C is the value capacitance connected on SPT or LPT pin.

The device samples the value of capacitor at SPT and LPT at the time of power-up and stores that value. Changing the capacitor after power-up does not change the value of short press (t_{SP}) and long press (t_{LP})

7.3.1.3 KILL

KILL pin is used as a control input from the host for the latched RESET version of push-button device. A short press on PB pin asserts the RESET output of push-button in latched version. The host pulls KILL high once all the expected action from short press is completed like power tree start-up. The device ignores the KILL input for t_{SINT} + t_{KILL} after short press time (t_{SP}), this allows sufficient time for host to monitor the expected tasks for short press.

The host doesn't pull KILL high if short press doesn't perform all expected actions and the push-button device de-asserts RESET output when KILL is low after the debounce time as shown in Figure 6-4. Host can pull KILL low at any time to de-assert RESET without any long press on PB pin. Glitch immunity circuit has been implemented on the KILL pin to avoid any false RESET de-assertion. KILL input is ignored for non-latched RESET configuration. Connect KILL pin to VDD if KILL feature is not used.

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7.3.2 Outputs

This section discusses the outputs of the TPS3423/4 devices.

7.3.2.1 Interrupt ($\overline{INT}$)

$\overline{INT}$ is open drain active low output. This pin generates low pulse for short press and long press as shown in Figure 6-1. Pulse duration for short press t_{INTS} and long press t_{INTL} is factory programmed. Please refer Section 4 section for the available option for the interrupt duration.

7.3.2.2 RESET / $\overline{RESET}$

RESET output of the device supports multiple configurations as described in Table 7-2. This device is available in all combination as described in Section 4.

Table 7-2. Reset Configurations

PARAMETER	VALUE
Latching option	Latched, Non-latched
Logic	Active High (AH), Active Low (AL)
Output configuration	Open Drain (OD), Push-Pull (PP)

RESET is asserted for short press and de-asserted for long press on PB pin for latched version as shown in Figure 6-1. Pulling KILL pin low also de-asserts the RESET in latched version as described in Figure 6-4. Non-latched RESET helps in achieving complex logic function with push-button. Non-latched RESET version of device supports multiple pattern as described in Section 4. RESET pattern is always different for short press and long press. One of the non-latched RESET pattern is shown in Figure 6-3.

7.4 Device Functional Modes

Device Functional Modes summarizes the functional modes of the push-button device.

Device Functional Modes

VDD	PB (Active Low)	INT	RESET (Latched, Active high)
VDD< 1V	Not Applicable	Undefined	Undefined
1V ≤ VDD <6V	Low <t_{SP}	No Pulse	No State change
	Low >t_{SP}	Single pulse (SINT)	High
	Low >t_{LP}	Two pulse (SINT, LINT)	Low

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8 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

Push-button controllers play an important role in any human-machine interface (HMI) design. They decode user inputs from single or multiple button presses, control system power or reset, and perform other essential user interface functions. TPS3423 and TPS3424 devices are designed to extend the shelf life of battery powered applications.

8.2 Typical Applications

8.2.1 Power Button Control with TPS3424

TPS3424 is designed for power button applications which need to put the system in deep sleep mode with very small standby power. TPS3424 controls enable for load switch or DC-DC converter in latched mode of RST pin.

An application diagram is shown in Figure 8-1 with load switch TPS22919, where TPS3424 is used to control the power from HMI.

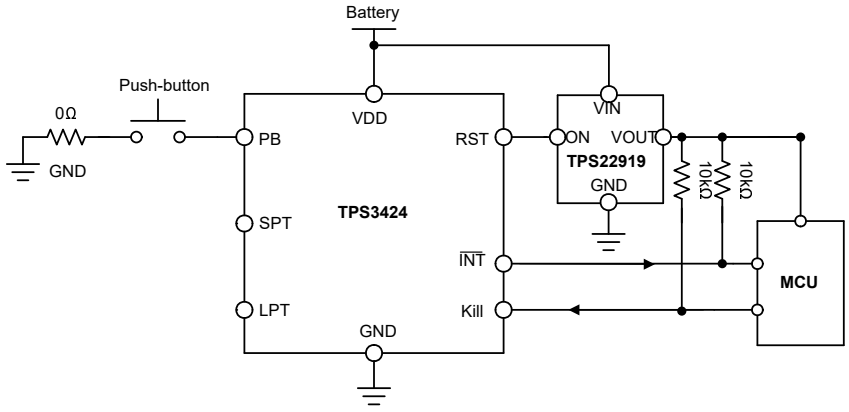


Figure 8-1. TPS3424 Application Diagram

8.2.1.1 Design Requirements

Table 8-1 lists the design requirements for Figure 8-1.

Table 8-1. Design Requirements and Results

DESIGN REQUIREMENTS	DESIGN RESULT
HMI Button	PB
Supply = 3V	VDD = 3V
T_{ON} = 50ms	t_{SP}= 50ms
T_{OFF} = 2sec	t_{LP}= 2sec
MCU IO pin current rating < 500uA	$\overline{INT}$ & KILL pull up = 10kΩ

8.2.1.2 Detailed Design Procedure

8.2.1.2.1 PB and RESET Topology

Selection of push-button input topology depends on the HMI. The button press in this application shorts PB pin to GND with a low resistor, hence active low PB topology is chosen here. Selection of RESET pin topology depends on the ON pin behaviour of the load switch or the voltage regulator in power control applications. Active high latched REST is chosen topology is chosen here to turn-on the load switch at short press and turn-off at long press.

8.2.1.2.2 Short Press Time (t_{SP}) and Long Press Time (t_{LP}) selection

t_{SP}= 50ms and t_{LP}= 2sec can be selected through the factory programmed option or placing capacitor at the SPT and LPT pin for programable option. Leave the SPT and LPT pin open as shown in Figure 8-1 for factory programmed timing option. Equation 1 and Equation 2 shows the value for capacitor at SPT and LPT pin respectively for programming t_{SP}= 50ms and t_{LP}= 2sec in cap programable option.

$$C_{SPT}(\text{nF}) = \text{Open} \tag{2}$$

$$C_{LPT}(\text{nF}) = \frac{2\ \text{sec}}{0.422} = 4.7 \tag{3}$$

8.2.1.2.3 Interrupt and Kill Feature

TPS3424 generated a pulse on $\overline{\text{INT}}$ pin for every valid short press and long press. This feature can be used as feature traverser (eg. showing different value on screen).

KILL feature enables host to control the RESET output of TPS3424 as described in Section 7.3.1.3. KILL pin enables the host to put the system in deep sleep when unused for given time. Short KILL to V_{DD} pin if KILL feature is not used.

8.2.1.3 Application Curve

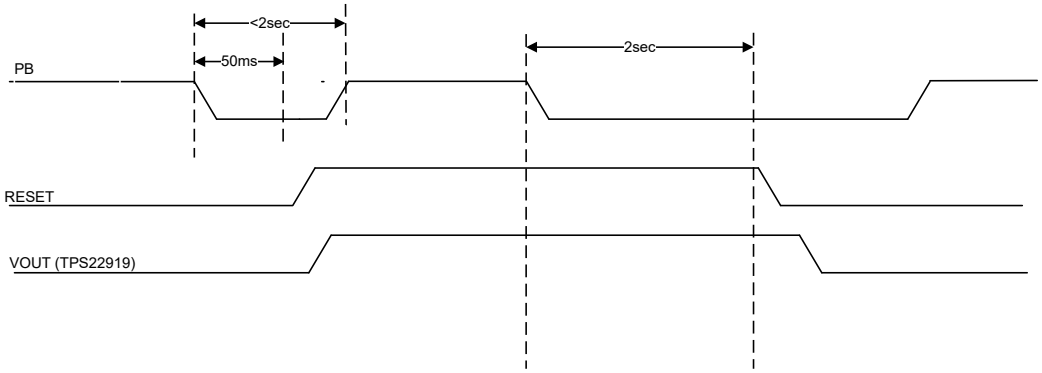


Figure 8-2. Power Control Through Load Switch

8.2.2 High Voltage Connection

Low current shunt regulator ATL431 enables the push-button to be used with 12V/24V battery powered application as shown in Figure 8-3.

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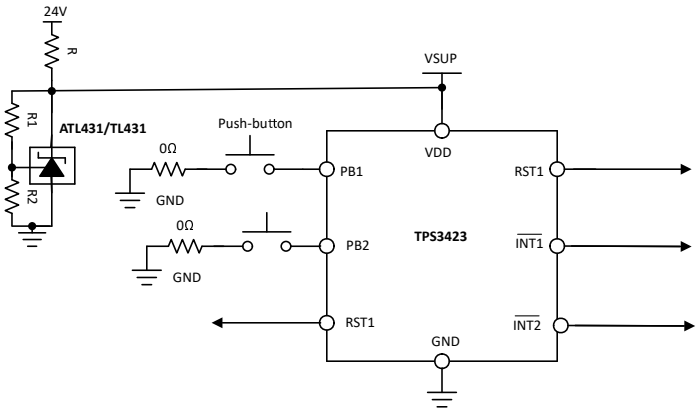


Figure 8-3. High Voltage Support With ATL431

8.3 Power Supply Recommendations

This device is designed to operate from an input supply with a voltage range between 1V and 6V. An input supply capacitor is not required for this device; however, if the input supply is noisy, then good analog practice is to place a 0.1µF capacitor between the VDD pin and the GND pin.

8.4 Layout

8.4.1 Layout Guidelines

Follow these guidelines for laying out the printed circuit board (PCB) that is used for the TPS3423 and TPS3424.

- Make sure that the connection to the VDD pin is low impedance. Good analog design practice recommends placing a 0.1µF ceramic capacitor as near as possible to the VDD pin.
- Place the external capacitor on close to LPT and SPT pin for TPS3424.
- Parasitic on LPT and SPT must be less than 50pF when these pins are floating for TPS3424.

8.4.2 Layout Example

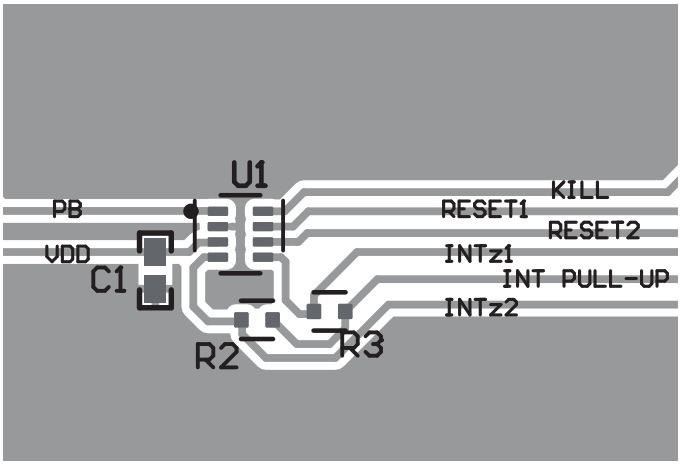


Figure 8-4. TPS3423: Layout Example (8-Pin DRL Package)

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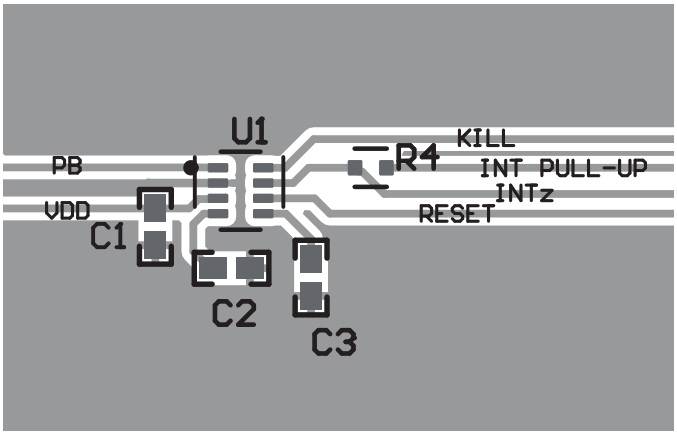


Figure 8-5. TPS3424: Layout Example (8-Pin DRL Package)

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9 Device and Documentation Support

9.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

9.2 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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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.

9.5 Glossary

TI Glossary	This glossary lists and explains terms, acronyms, and definitions.

10 Revision History

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

Changes from Revision B (March 2025) to Revision C (August 2025)	Page
• Add -40C to 85C IDD (Active) specifications for Push Button pressed event	8

Changes from Revision A (December 2024) to Revision B (March 2025)	Page
• Added information for TPS3424 release throughout the document	1
• Changed *Pin Configuration and Functions* section; updated table format, added clarification for 6 pin DR option and added 10sec RESET option	3
• Clarified the timing diagram.	10

Changes from Revision * (September 2024) to Revision A (December 2024)	Page
• Production Data Release	1

11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

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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)
TPS3423CAHDFADRLR	Active	Production	SOT-5X3 (DRL) | 8	4000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	D0003
TPS3423GAMDHADRLR	Active	Production	SOT-5X3 (DRL) | 8	4000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	D0001
TPS3423GAMDHADRLR.A	Active	Production	SOT-5X3 (DRL) | 8	4000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	D0001
TPS3423GAMDHADRLR.B	Active	Production	SOT-5X3 (DRL) | 8	4000 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
TPS3424A11C13ADRLR	Active	Production	SOT-5X3 (DRL) | 8	4000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	S0001
TPS3424C11EF2ADRLR	Active	Production	SOT-5X3 (DRL) | 8	4000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	P4SNG
TPS3424CNKAC1ADRLR	Active	Production	SOT-5X3 (DRL) | 8	4000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	S0004
TPS3424E11D11ADRLR	Active	Production	SOT-5X3 (DRL) | 8	4000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	S0007

(1) **Status:** For more details on status, see our product life cycle.

(2) **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.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **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.

(5) **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.

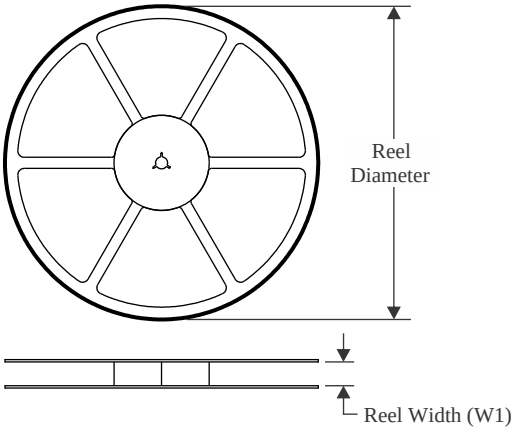
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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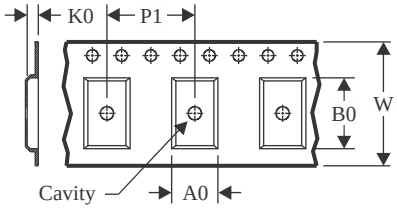
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

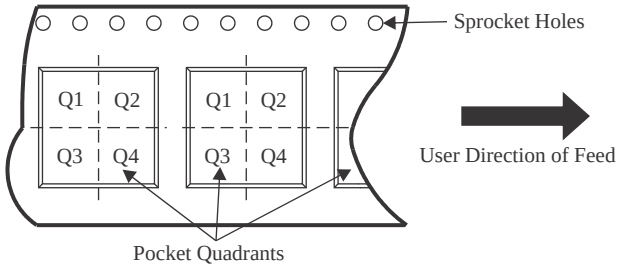


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

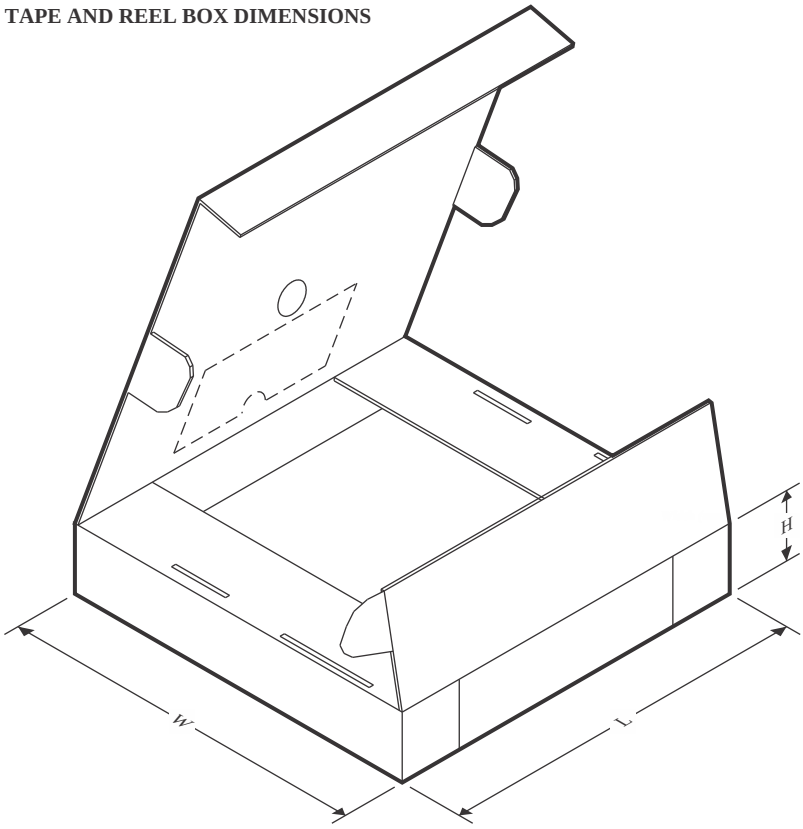
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TPS3423CAHDFADRLR	SOT-5X3	DRL	8	4000	180.0	8.4	2.75	1.9	0.8	4.0	8.0	Q3
TPS3423GAMDHADRLR	SOT-5X3	DRL	8	4000	180.0	8.4	2.75	1.9	0.8	4.0	8.0	Q3
TPS3424A11C13ADRLR	SOT-5X3	DRL	8	4000	180.0	8.4	2.75	1.9	0.8	4.0	8.0	Q3
TPS3424C11EF2ADRLR	SOT-5X3	DRL	8	4000	180.0	8.4	2.75	1.9	0.8	4.0	8.0	Q3
TPS3424CNKAC1ADRLR	SOT-5X3	DRL	8	4000	180.0	8.4	2.75	1.9	0.8	4.0	8.0	Q3
TPS3424E11D11ADRLR	SOT-5X3	DRL	8	4000	180.0	8.4	2.75	1.9	0.8	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)
TPS3423CAHDFADRLR	SOT-5X3	DRL	8	4000	210.0	185.0	35.0
TPS3423GAMDHADRLR	SOT-5X3	DRL	8	4000	210.0	185.0	35.0
TPS3424A11C13ADRLR	SOT-5X3	DRL	8	4000	210.0	185.0	35.0
TPS3424C11EF2ADRLR	SOT-5X3	DRL	8	4000	210.0	185.0	35.0
TPS3424CNKAC1ADRLR	SOT-5X3	DRL	8	4000	210.0	185.0	35.0
TPS3424E11D11ADRLR	SOT-5X3	DRL	8	4000	210.0	185.0	35.0

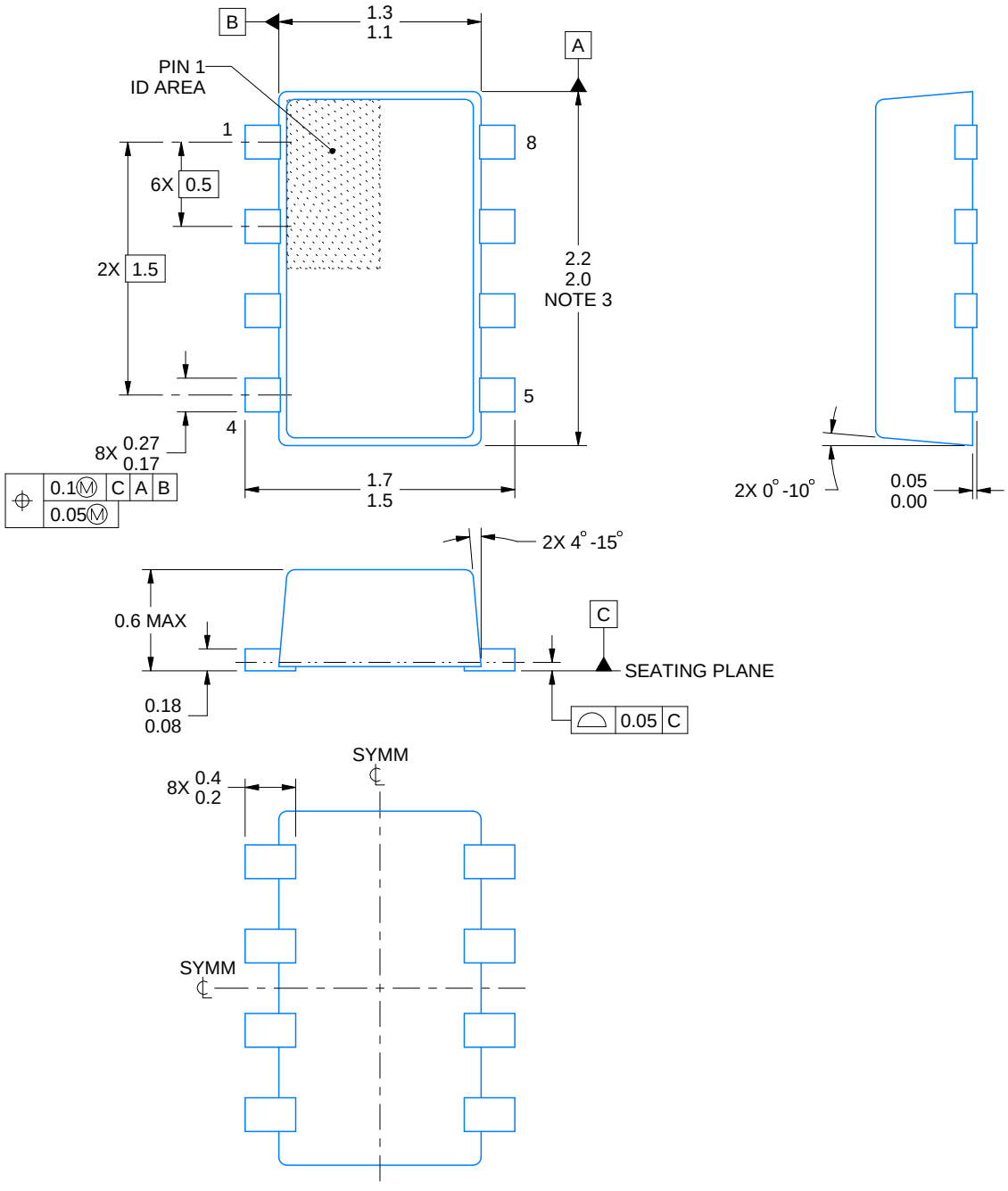


PACKAGE OUTLINE

DRL0008A

SOT-5X3 - 0.6 mm max height

PLASTIC SMALL OUTLINE



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NOTES:

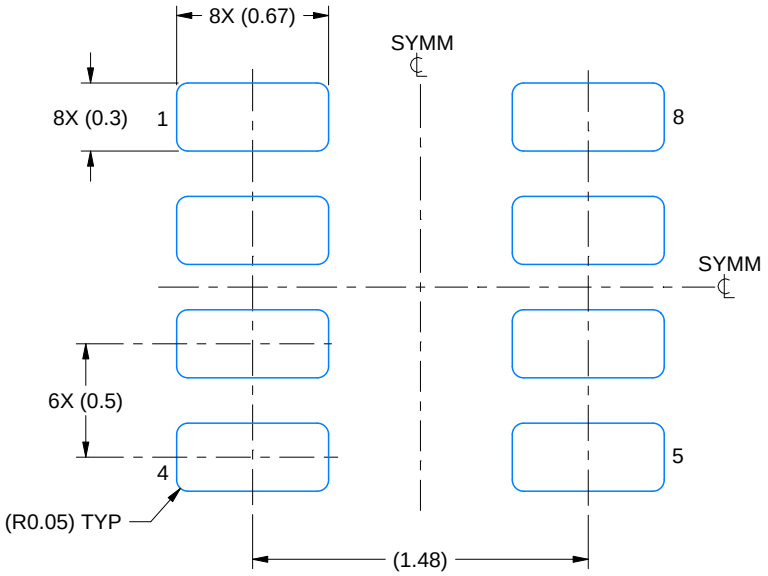
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, interlead flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC Registration MO-293, Variation UDAD

EXAMPLE BOARD LAYOUT

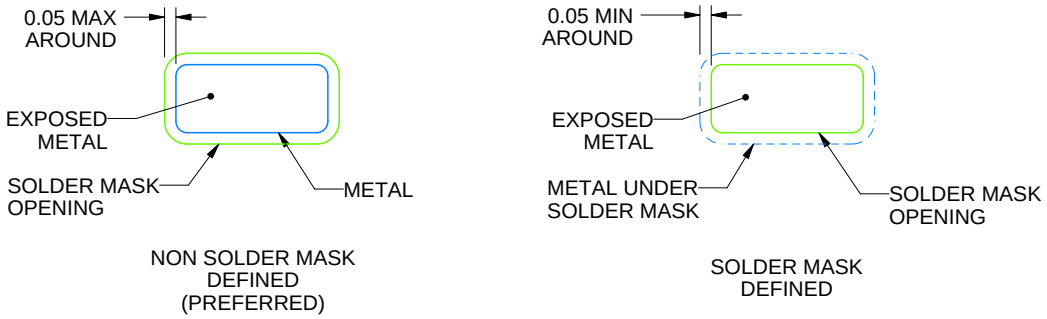
DRL0008A

SOT-5X3 - 0.6 mm max height

PLASTIC SMALL OUTLINE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:30X



SOLDERMASK DETAILS

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NOTES: (continued)

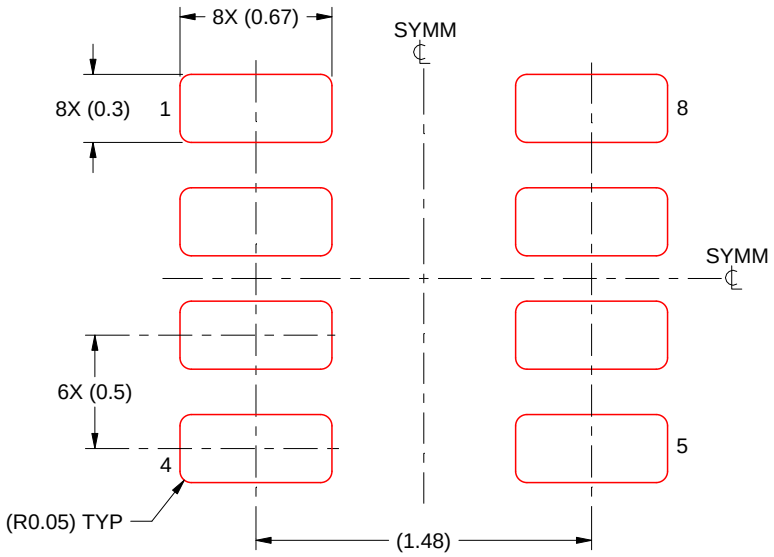
5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
7. Land pattern design aligns to IPC-610, Bottom Termination Component (BTC) solder joint inspection criteria.

EXAMPLE STENCIL DESIGN

DRL0008A

SOT-5X3 - 0.6 mm max height

PLASTIC SMALL OUTLINE



SOLDER PASTE EXAMPLE
BASED ON 0.1 mm THICK STENCIL
SCALE:30X

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NOTES: (continued)

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

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