RS1G123 Single Retriggerable Monostable Multivibrator with Schmitt-Trigger Inputs

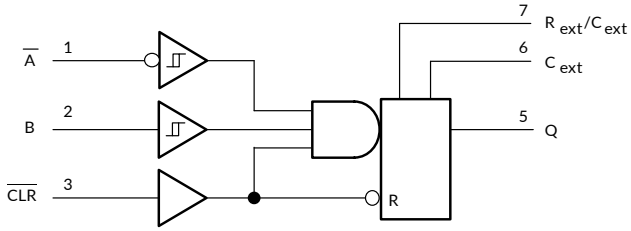
1 FEATURES

- **Operating Voltage Range: 2V to 5.5V**
- **CMOS Low Power Consumption**
- **Schmitt-Trigger Circuitry on $\overline{A}$ and B Inputs**
- **Inputs Accept Voltage to 5.5V**
- **High Output Drive: ±24mA at V_{CC}=3.0V**
- **Edge Triggered from Active-High or Active-Low Gated Logic Inputs**
- **Retriggerable for Very Long Pulses Up to 100 % Duty Factor**
- **Direct Reset Terminates Output Pulse**
- **Power-On-Reset on Outputs**
- **I_{off} Supports Live Insertion, Partial-PowerDown Mode, and Back-Drive Protection**
- **Operating Temperature Range: -40°C to 125°C**
- **Micro Size Packages: VSSOP8**

2 APPLICATIONS

- **Desktop PCs or Notebook PCs**
- **Blu-ray Player and Home Theater**
- **Embedded PCs**
- **Personal Digital Assistant (PDA)**
- **Wireless Headsets, Keyboards, and Mice**
- **Network Attached Storage (NAS)**
- **Mobile Internet Devices**

Logic Diagram (Positive Logic)



3 DESCRIPTIONS

The RS1G123 is a single retriggerable monostable multivibrator designed for 2V to 5.5V V_{CC} operation.

This monostable multivibrator features output pulse-duration control by three methods. In the first method, the $\overline{A}$ input is low, and the B input goes high. In the second method, the B input is high, and the $\overline{A}$ input goes low. In the third method, the $\overline{A}$ input is low, the B input is high, and the clear ($\overline{CLR}$) input goes high.

The output pulse duration is programmed by selecting external resistance and capacitance values. The external timing capacitor must be connected between C_{ext} and R_{ext}/C_{ext} (positive) and an external resistor connected between R_{ext}/C_{ext} and V_{CC}. To obtain variable pulse durations, connect an external variable resistance between R_{ext}/C_{ext} and V_{CC}. The output pulse duration also can be reduced by taking $\overline{CLR}$ low.

Pulse triggering occurs at a particular voltage level and is not directly related to the transition time of the input pulse. The $\overline{A}$ and B inputs have Schmitt triggers with sufficient hysteresis to handle slow input transition rates with jitter-free triggering at the outputs.

The RS1G123 is fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

This device available in Green VSSOP8 package. It operates over an ambient temperature range of -40°C to 125°C.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS1G123	VSSOP8	2.30mm×2.00mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

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4 REVISION HISTORY

Note: Page numbers for previous revisions may different from page numbers in the current version.

Version	Change Date	Change Item
A.0	2024/08/09	Preliminary version completed
A.1	2025/02/18	Initial version completed

5 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL(3)	PACKAGE OPTION
RS1G123	RS1G123XVS8	-40°C ~125°C	VSSOP8	1123	MSL3	Tape and Reel, 3000

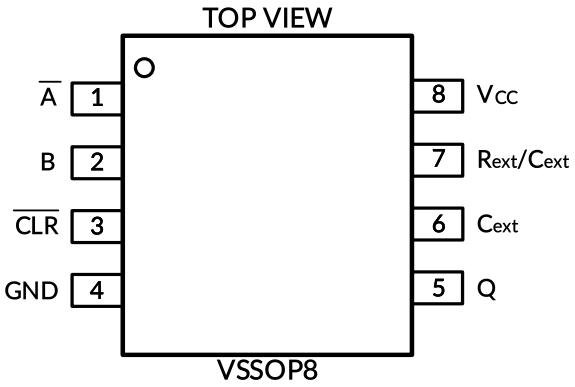
NOTE:

(1) 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 right-hand navigation.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) RUNIC classify the MSL level with using the common preconditioning setting in our assembly factory conforming to the JEDEC industrial standard J-STD-20F. Please align with RUNIC if your end application is quite critical to the preconditioning setting or if you have special requirement.

6 PIN CONFIGURATIONS



6.1 Pin Description

PIN		I/O (1)	FUNCTION
NAME	NO.		
$\overline{A}$	1	I	Falling edge sensitive input; requires B and $\overline{CLR}$ to be held high.
B	2	I	Rising edge sensitive input; requires $\overline{A}$ to be held low and $\overline{CLR}$ to be held high.
$\overline{CLR}$	3	I	Clear, Active Low; also can operate as rising edge sensitive input if $\overline{A}$ is held low and B is held high.
GND	4	-	Ground
Q	5	O	Output
C_{ext}	6	-	Connects only to the external capacitor.
R_{ext}/C_{ext}	7	-	Connects to the external capacitor and resistor.
V_{CC}	8	-	Power

(1) I=input, O=output.

6.2 Function Table

INPUTS			OUTPUT
$\overline{CLR}$	$\overline{A}$	B	Q
L	X	X	L
X	H	X	L (1)
X	X	L	L (1)
H	L	↑	⎍
H	↓	H	⎍
↑	L	H	⎍

(1) These outputs are based on the assumption that the indicated steady-state conditions at the A and B inputs have been set up long enough to complete any pulse started before the setup.

(2) H = High Voltage Level, L = Low Voltage Level, X = Irrelevant; ↑ = Transition from Low to High, ↓ = Transition from High to Low; ⎍ =One High Level Pulse.

7 SPECIFICATIONS

7.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage		-0.5	6.5	V
V_I	Input voltage (2)		-0.5	6.5	V
V_O	Voltage applied to any output in the high-impedance or power-off state (2)		-0.5	6.5	V
V_O	Voltage applied to any output in the high or low state (2) (3)		-0.5	V_{CC}+0.5	V
I_{IK}	Input clamp current	V_I<0		-50	mA
I_{OK}	Output clamp current	V_O<0		-50	mA
I_O	Continuous output current			±50	mA
	Continuous current through V_{CC} or GND			±100	mA
θ_{JA}	Package thermal impedance (4)	VSSOP8		205	K/W
T_J	Junction temperature (5)		-65	150	°C
T_{stg}	Storage temperature		-65	150	°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) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.
(3) The value of V_{CC} is provided in the Recommended Operating Conditions table.
(4) The package thermal impedance is calculated in accordance with JESD-51.
(5) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

7.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-Body Model (HBM), ANSI/ESDA/JEDEC JS001-2023	±2000	V
		Charged-Device Model (CDM), ANSI/ESDA/JEDEC JS-002-2022	±1000	V
		Machine Model (MM), JESD22-A115C(2010)	±100	V

ESD SENSITIVITY CAUTION

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.

8 ELECTRICAL CHARACTERISTICS

over recommended operating free-air temperature range (TYP values are at T_A = +25°C, Full = -40°C to 125°C, unless otherwise noted.)(1)

8.1 Recommended Operating Conditions

			MIN	MAX	UNIT
V_{CC}	Supply Voltage	Operating	2	5.5	V
		Data retention only	1.8		
V_{IH}	High-Level Input Voltage	V_{CC} = 2 V to 2.7 V	0.75×V_{CC}		V
		V_{CC} = 3 V to 3.6 V	0.7×V_{CC}		
		V_{CC} = 4.5 V to 5.5 V	0.7×V_{CC}		
V_{IL}	Low-Level Input Voltage	V_{CC} = 2 V to 2.7 V		0.25×V_{CC}	V
		V_{CC} = 3 V to 3.6 V		0.3×V_{CC}	
		V_{CC} = 4.5 V to 5.5 V		0.3×V_{CC}	
V_I	Input Voltage		0	5.5	V
V_O	Output Voltage		0	V_{CC}	V
I_{OH}	High-Level Output Current	V_{CC} = 2.3 V		-8	mA
		V_{CC} = 3 V		-16	
				-24	
		V_{CC} = 4.5 V		-32	
I_{OL}	Low-Level Output Current	V_{CC} = 2.3 V		8	mA
		V_{CC} = 3 V		16	
				24	
		V_{CC} = 4.5 V		32	
R_{ext} (2)	External Timing Resistance	2V ≤ V_{CC} < 3 V	5		kΩ
		V_{CC} ≥ 3 V	1		
C_{ext} (2)	External Timing Capacitance	2V ≤ V_{CC} < 2.5 V	10		nF
		2.5V ≤ V_{CC} < 3 V	100		pF
T_A	Operating Temperature		-40	125	°C

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.
(2) R_{ext}/C_{ext} is an I/O and must not be connected directly to GND or V_{CC}.

8.2 Electrical Characteristics

All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

PARAMETER		TEST CONDITIONS	V_{CC}	-40°C to 85°C			-40°C to 125°C			UNIT
				MIN(2)	TYP(3)	MAX(2)	MIN(2)	TYP(3)	MAX(2)	
V_{OH}		I_{OH} = –100 µA	2V to 5.5V	V_{CC} – 0.1			V_{CC} – 0.1			V
		I_{OH} = –8 mA	2.3V	1.9			1.9			
		I_{OH} = –16 mA	3 V	2.4			2.4			
		I_{OH} = –24 mA		2.2			2.2			
		I_{OH} = –32 mA	4.5V	3.8			3.8			
V_{OL}		I_{OL} = 100 µA	2V to 5.5V			0.1			0.1	V
		I_{OL} = 8 mA	2.3V			0.3			0.3	
		I_{OL} = 16 mA	3 V			0.4			0.4	
		I_{OL} = 24 mA				0.6			0.6	
		I_{OL} = 32 mA	4.5V			0.55			0.55	
I_I	R_{ext}/C_{ext} (4)	B = GND, $\overline{A}$ = $\overline{CLR}$ = V_{CC}	2V to 5.5V			±0.25			±0.25	µA
	$\overline{A}$, B, $\overline{CLR}$	V_I = 5.5 V or GND				±1			±1	
I_{off}	$\overline{A}$, B, Q, $\overline{CLR}$	V_I or V_O = 5.5 V	0			±10			±10	µA
I_{CC}	Quiescent	V_I = V_{CC} or GND, I_O = 0	5.5V			20			20	µA
I_{CC}	Active State	V_I = V_{CC} or GND, R_{ext}/C_{ext} = 0.5 V_{CC}	2V			200			200	µA
			2.3V			220			220	
			3V			280			280	
			4.5V			650			650	
			5.5V			975			975	
C_I		V_I = V_{CC} or GND	3.3V		3					pF

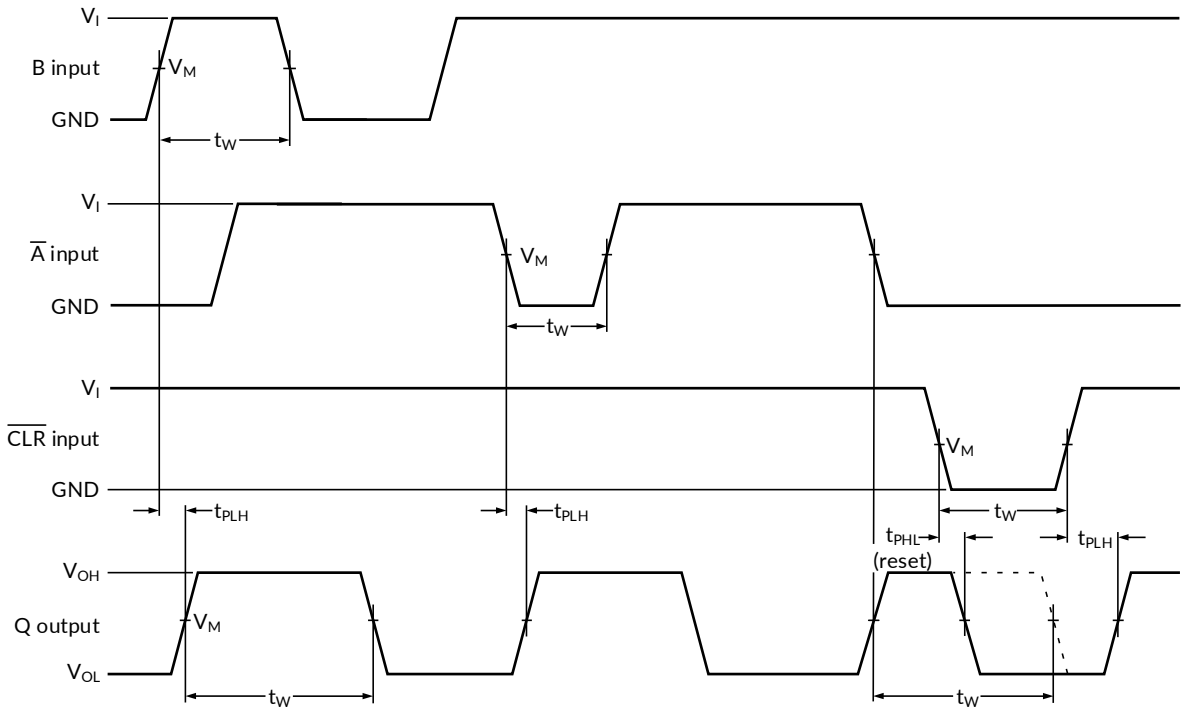
(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.
(2) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.
(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.
(4) This test is performed with the terminal in the OFF-state condition.

8.3 Timing Requirements

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

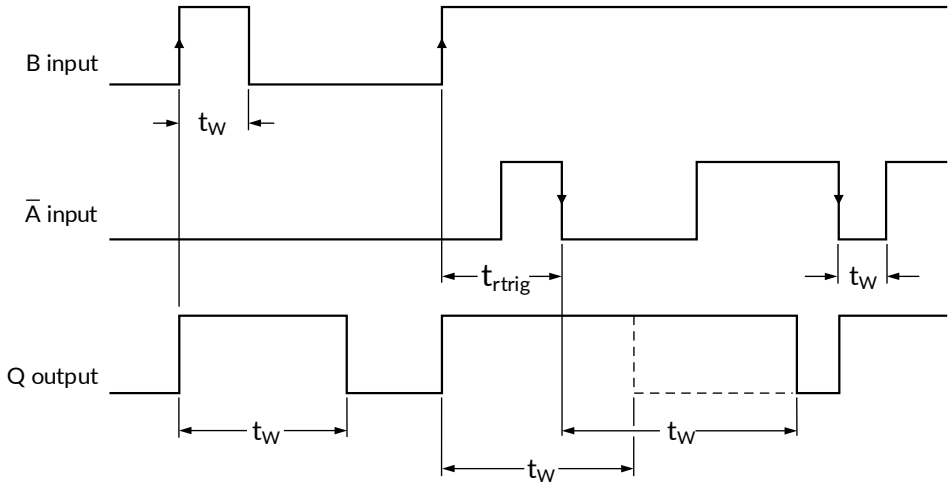
PARAMETER			TEST CONDITIONS		–40°C to 125°C						UNIT
					V_{CC} = 2.5 V ± 0.2 V		V_{CC} = 3.3 V ± 0.3 V		V_{CC} = 5 V ± 0.5 V		
					MIN	TYP	MIN	TYP	MIN	TYP	
t_w	Pulse Duration	$\overline{CLR}$			8		5		4		ns
		$\overline{A}$ or B Trigger			8		5		4		
t_{rr}	Pulse Retrigger Time		R_{ext} = 1 kΩ	C_{ext} = 100 pF				41		35	ns
				C_{ext} = 0.01 µF				2		1.7	µs
				C_{ext} = 100 µF				4.6		3	ms
			R_{ext} = 5 kΩ	C_{ext} = 100 pF		46					ns
				C_{ext} = 0.01 µF		1					µs
				C_{ext} = 100 µF		6					ms

8.4 Timing Diagram



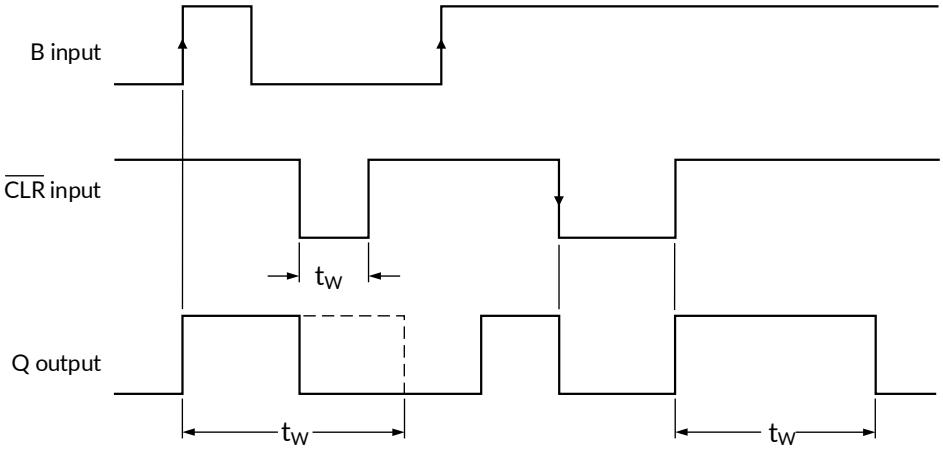
V_{OL} and V_{OH} are typical voltage output levels that occur with the output load.

Figure 1. Propagation Delays from Inputs ($\overline{A}$, B, $\overline{CLR}$) to Output (Q)



$\overline{CLR}$=HIGH

Figure 2. Output Pulse Control Using Retrigger Pulse



$\overline{A}$=LOW

Figure 3. Output Pulse Control Using Reset Input $\overline{CLR}$

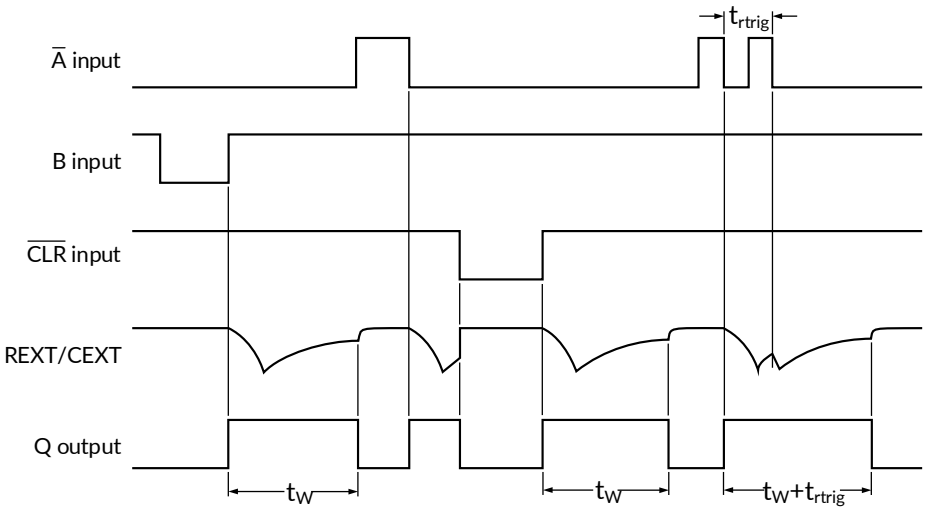


Figure 4. Input and Output Timing

8.5 Switching Characteristics

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

PARAMETER	SYMBOL	TEST CONDITIONS		V_{CC}(V)	Operating free-air temperature (T_A)							UNIT
					25°C			−40°C to 85°C		−40°C to 125°C		
					MIN(2)	TYP(3)	MAX(2)	MIN(2)	MAX(2)	MIN(2)	MAX(2)	
$\overline{A}$ or B to Q	t_{pd}	C_L=50PF		2.5		13	19.5		22		23.5	ns
		C_L=50PF		3.3		9.5	14.5		16.5		18	ns
		C_L=15PF		5		7	10.5		12		13	ns
$\overline{CLR}$ to Q	t_{pd}	C_L=50PF		2.5		15	22.5		17.5		19	ns
		C_L=50PF		3.3		10.5	16		16		16.5	ns
		C_L=15PF		5		7.5	11.5		10.5		11.5	ns
$\overline{CLR}$ Trigger	t_{pd}	C_L=50PF		2.5		10.5	16		25.5		27	ns
		C_L=50PF		3.3		9	13.5		19		19.5	ns
		C_L=15PF		5		6.5	10		13		14.5	ns
Output Pulse Width	t_w	C_{ext} = 28 pF, R_{ext} = 2 KΩ		3.3		180			240		300	ns
				5		150			200		240	ns
		C_{ext} = 0.01 µF, R_{ext} = 5 kΩ		2.5		50		45	60	45	65	µs
				3.3		50		45	60	45	65	µs
				5		50		40	60	40	60	µs
		C_{ext} = 0.01 µF, R_{ext} = 10 kΩ		2.5		100		85	115	85	125	µs
				3.3		100		85	115	85	125	µs
				5		100		80	110	80	115	µs
		C_{ext} = 0.1 µF, R_{ext} = 10 kΩ		2.5		1		0.85	1.1	0.85	1.2	ms
				3.3		1		0.85	1.1	0.85	1.2	ms
				5		1		0.8	1.1	0.8	1.1	ms
Power Capacitance Dissipation	C_{pd}	$\overline{A}$ = low, B= high, $\overline{CLR}$ =10MHz	R_{ext} = 1 kΩ, No C_{ext}	3.3		170						pF
				5		165						
			R_{ext}=5 kΩ, No C_{ext}	2.5		115						

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.
(2) This parameter is ensured by design and/or characterization and is not tested in production.
(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

8.6 Typical Characteristics

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

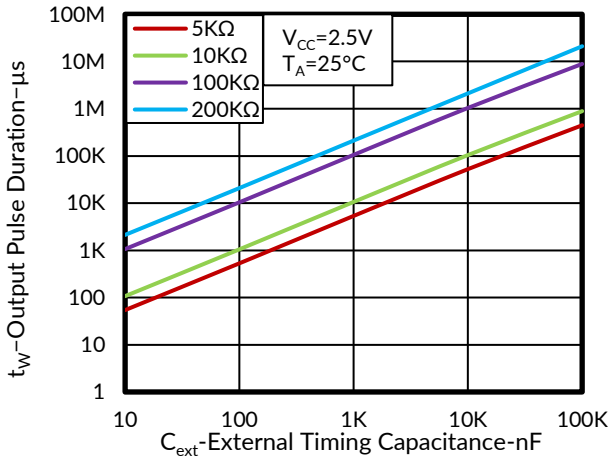


Figure 5. Output Pulse Duration vs External Timing Capacitance

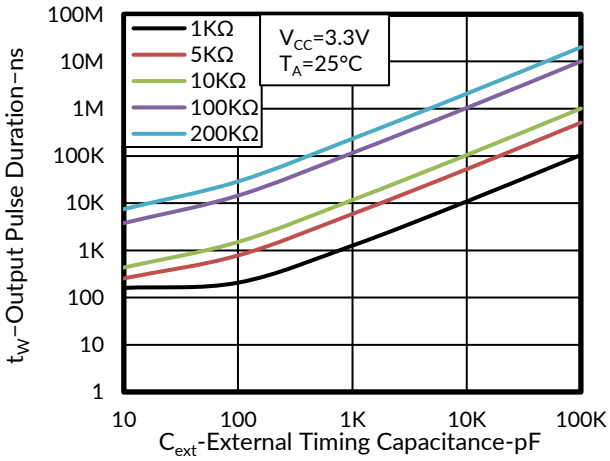


Figure 6. Output Pulse Duration vs External Timing Capacitance

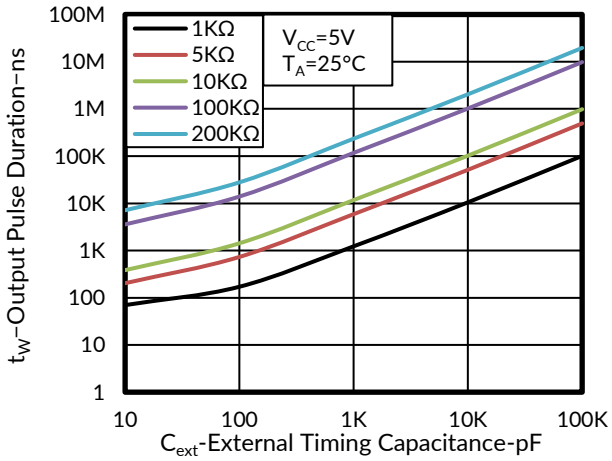


Figure 7. Output Pulse Duration vs External Timing Capacitance

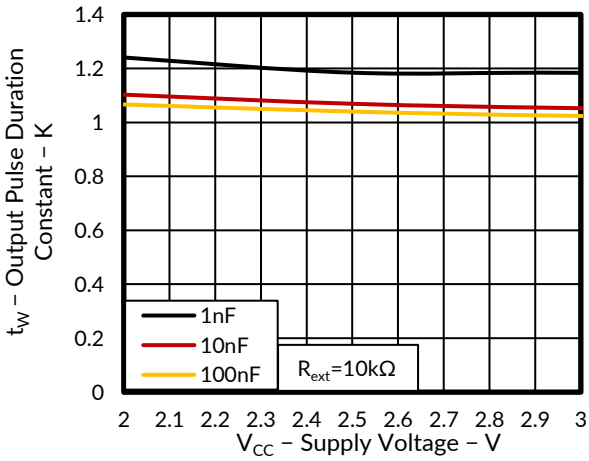


Figure 8. Output Pulse Duration Constant vs Supply Voltage

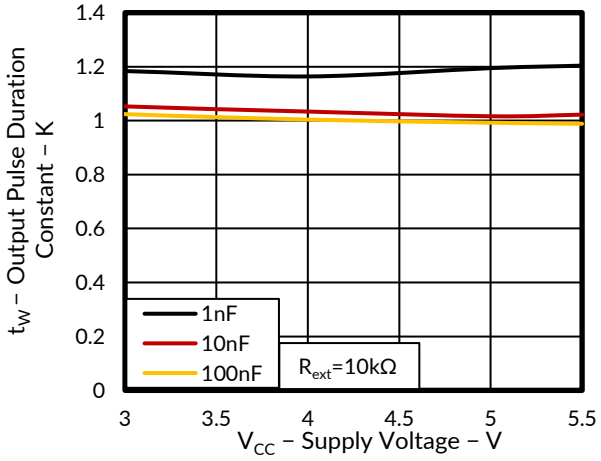
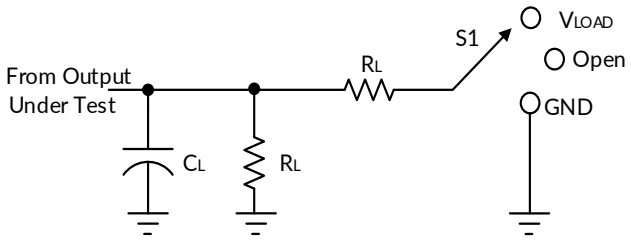


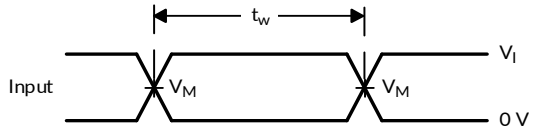
Figure 9. Output Pulse Duration Constant vs Supply Voltage

9 PARAMETER MEASUREMENT INFORMATION

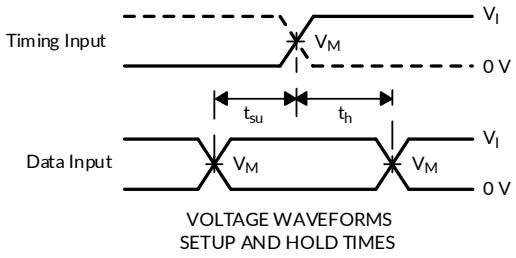


TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

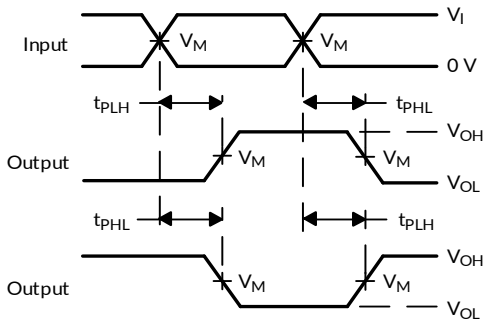
V_{CC}	INPUTS		V_M	V_{LOAD}	C_L	R_L	V_Δ
	V_I	t_r/t_f					
2.5V±0.2V	V_{CC}	≤2ns	$V_{CC}/2$	2 x V_{CC}	50pF	500Ω	0.15V
3.3V±0.3V	3V	≤2.5ns	1.5V	6V	50pF	500Ω	0.3V
5V±0.5V	V_{CC}	≤2.5ns	$V_{CC}/2$	2 x V_{CC}	15pF	1MΩ	0.3V



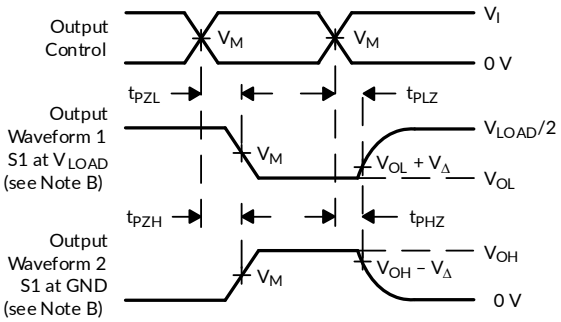
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS PROPAGATION DELAY
TIMES INVERTION AND NONINVERTING OUTPUTS



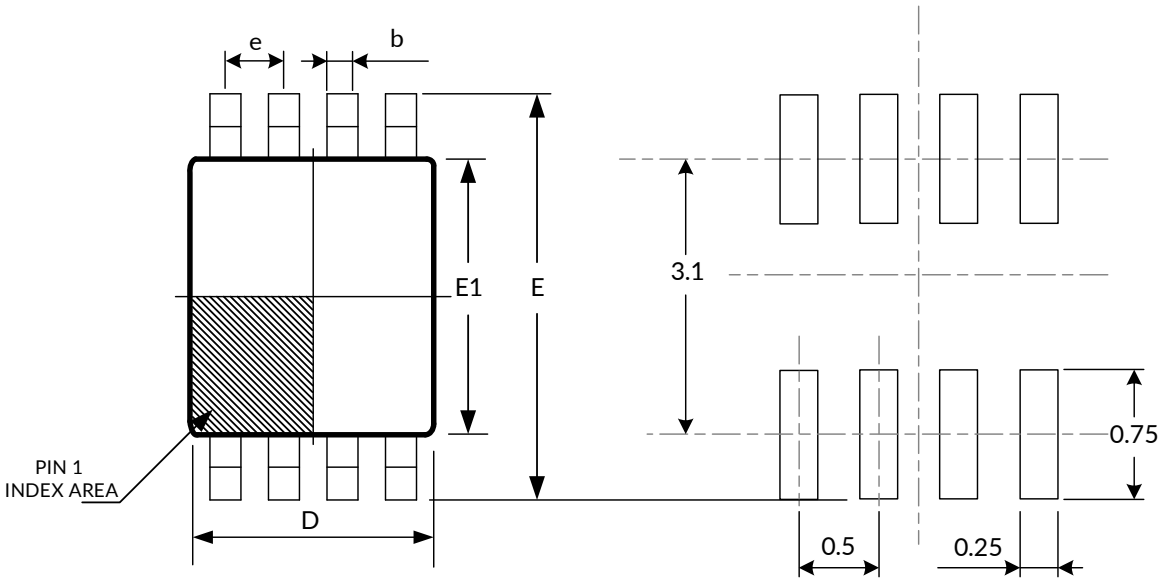
VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES
LOW-AND HIGH-LEVEL ENABLING

NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50 Ω.
D. The outputs are measured one at a time, with one transition per measurement.
E. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
F. t_{PZL} and t_{PZH} are the same as t_{en}.
G. t_{PLH} and t_{PHL} are the same as t_{pd}.
H. All parameters and waveforms are not applicable to all devices.

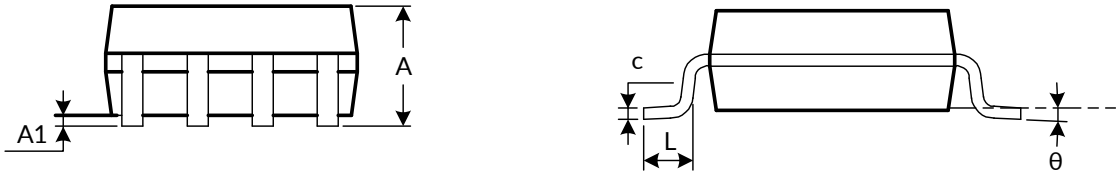
Figure 10. Load Circuit and Voltage Waveforms

10 PACKAGE OUTLINE DIMENSIONS

VSSOP8 (3)



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A (1)	0.600	0.900	0.024	0.085
A1	0.000	0.100	0.000	0.004
b	0.170	0.250	0.007	0.010
c	0.100	0.200	0.004	0.008
D (1)	1.900	2.100	0.075	0.083
e	0.500 (BSC) (2)		0.020 (BSC) (2)	
E	3.000	3.200	0.118	0.126
E1 (1)	2.200	2.400	0.087	0.095
L	0.200	0.350	0.008	0.014
θ	0°	6°	0°	6°

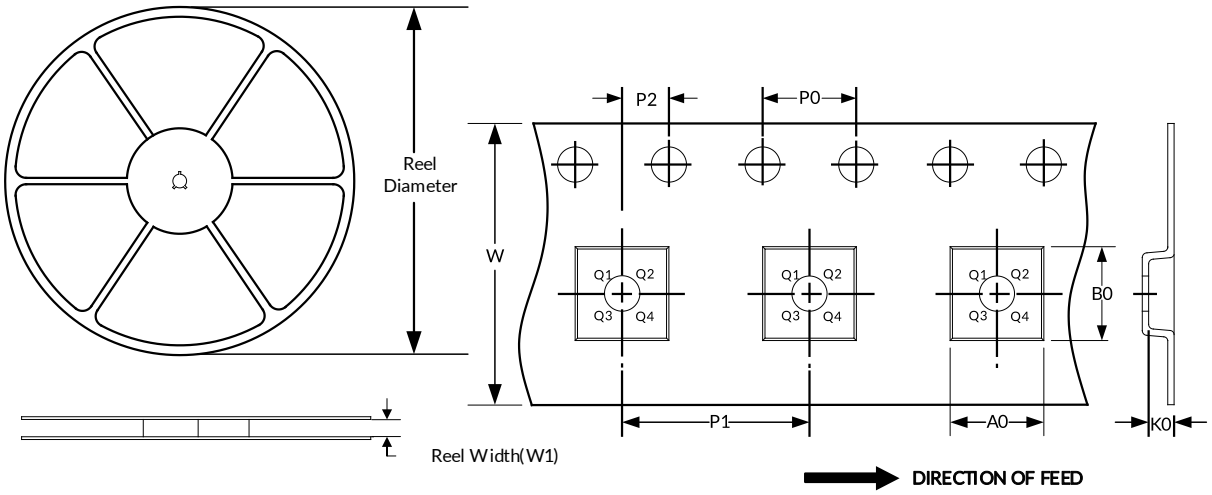
NOTE:

1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

11 TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSION



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width(mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
VSSOP8	7”	9.5	2.25	3.35	1.40	4.0	4.0	2.0	8.0	Q3

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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