RS1G139 2-Line to 4-Line Decoders

1 FEATURES

- **Operating Voltage Range: 1.65V to 5.5V**
- **Low Power Consumption: 15μA (Max)**
- **Operating Temperature Range: -40°C to +125°C**
- **Inputs Accept Voltage to 5.5V**
- **PACKAGES: VSSOP8**

2 APPLICATIONS

- **Solid State Drives (SSDs): Client and Enterprise**
- **TVs: LCD, Digital, and High-Definition (HD)**
- **Tablets: Enterprise**
- **Video Analytics: Serve**

3 DESCRIPTIONS

The RS1G139, a 2-to-4-line decoder is designed for 1.65V to 5.5V.

Decoder is consisting of two select inputs (A and B).

The RS1G139 is available in Green VSSOP8 packages. It operates over an ambient temperature range of -40°C to +125°C.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS1G139	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.1	2024/02/29	Initial version completed
A.2	2024/04/29	Update SPECIFICATIONS

5 PACKAGE/ORDERING INFORMATION (1)

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	PACKAGE MARKING (2)	MSL (3)	PACKAGE OPTION
RS1G139	RS1G139XVS8	-40°C ~+125°C	VSSOP8	1139	MSL3	Tape and Reel, 3000

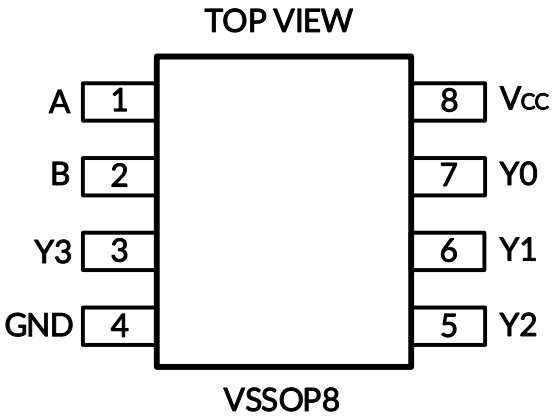
NOTE:

(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) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

6 PIN CONFIGURATIONS



PIN DESCRIPTION

PIN	NAME	I/O TYPE (1)	FUNCTION
VSSOP8			
1	A	I	Address input
2	B	I	Address input
3	Y3	O	Output
4	GND	-	Ground
5	Y2	O	Output
6	Y1	O	Output
7	Y0	O	Output
8	V_{CC}	-	Power Supply

(1) I=Input, O=Output.

7 SPECIFICATIONS

7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) (1) (2)

			MIN	MAX	UNIT
V_{CC}	Supply voltage range		-0.5	6.5	V
I_{IK}	Input clamp diode current	For V_I < 0.5V or V_I > V_{CC} + 0.5V		±20	mA
I_{OK}	Output clamp diode current	For V_O < 0.5V or V_O > V_{CC} +0.5V		±20	mA
I_O	Output source or sink current per output pin	For V_O > 0.5V or V_O < V_{CC} +0.5V		±25	mA
	Continuous current through V_{CC} or GND			±50	mA
θ_{JA}	Package thermal impedance (3)	VSSOP8		205	°C/W
T_J	Junction temperature (4)		-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 package thermal impedance is calculated in accordance with JESD-51.

(4) 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), MIL-STD-883K METHOD 3015.9	±2000	V
	Charged-device model (CDM), ANSI/ESDA/JEDEC JS-002-2018	±1000	V
	Machine Model (MM), JESD22-A115C (2010)	±200	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.

7.3 Recommended Operating Conditions

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

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	MAX	UNIT
V_{CC}	Supply voltage		1.65	5.5	V
V_I	Input voltage		0	V_{CC}	V
V_O	Output voltage		0	V_{CC}	V
t_t	Input rise and fall time	V_{CC} = 1.8V ± 0.15V, 2.5V ± 0.2V		20	ns/V
		V_{CC} = 3.3V ± 0.3V		15	
		V_{CC} = 5V ± 0.5V		10	
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.

7.4 ELECTRICAL CHARACTERISTICS

PARAMETER	TEST CONDITIONS (3)	V_{CC}	Operating free-air temperature (T_A)						UNIT
			25°C		-40°C to 85°C		-40°C to 125°C		
			MIN(2)	MAX(2)	MIN(2)	MAX(2)	MIN(2)	MAX(2)	
V_{IH}		1.65V to 1.95V	0.65 xV_{CC}		0.65 xV_{CC}		0.65 xV_{CC}		V
		2.3V to 2.7V	1.7		1.7		1.7		
		3V to 3.6V	2		2		2		
		4.5V to 5.5V	0.7xV_{CC}		0.7 xV_{CC}		0.7 xV_{CC}		
V_{IL}		1.65V to 1.95V		0.35 xV_{CC}		0.35 xV_{CC}		0.35 xV_{CC}	V
		2.3V to 2.7V		0.7		0.7		0.7	
		3V to 3.6V		0.8		0.8		0.8	
		4.5V to 5.5V		0.3 xV_{CC}		0.3 xV_{CC}		0.3 xV_{CC}	
V_{OH}	I_{OH} = −100 µA	1.65V to 5.5V	V_{CC}-0.1		V_{CC}-0.1		V_{CC}-0.1		V
	I_{OH} = −8 mA	2.3	1.8		1.66		1.52		
	I_{OH} = −16 mA	3	2.3		2.16		2.02		
	I_{OH} = −24 mA	4.5	3.8		3.66		3.52		
V_{OL}	I_{OL} = 100 µA	1.65V to 5.5V		0.1		0.1		0.1	V
	I_{OL} = 8 mA	2.3		0.3		0.37		0.41	
	I_{OL} = 16 mA	3		0.46		0.53		0.6	
	I_{OL} = 24 mA	4.5		0.51		0.58		0.65	
I_I	V_I = V_{CC} or GND	5.5V		±0.1		±1		±1	µA
I_{CC}	V_I = V_{CC} or GND	5.5V		3		10		15	µA

(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) V_I = V_{IH} or V_{IL}, unless otherwise noted.

7.5 Switching Characteristics

Input t_t = 6ns.

PARAMETER		TEST CONDITIONS	V_{CC}	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)	
t_{pd}	Address to output	C_L = 50pF	V_{CC} = 1.8V ±0.15V			99		104		105	ns
			V_{CC} = 2.5V ±0.2V			36		38		39	
			V_{CC} = 3.3V ±0.3V		13	22		24		25	
			V_{CC} = 5V ±0.5V			14		16		17	
t_t	Output transition time	C_L = 50pF	V_{CC} = 1.8V ±0.15V			69		71		76	ns
			V_{CC} = 2.5V ±0.2V			30		32		37	
			V_{CC} = 3.3V ±0.3V			21		23		24	
			V_{CC} = 5V ±0.5V			12		13		15	
C_{PD}	Power dissipation capacitance (4)	C_L = 15pF	5		36						pF
C_i	Input capacitance					10		10		10	pF

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

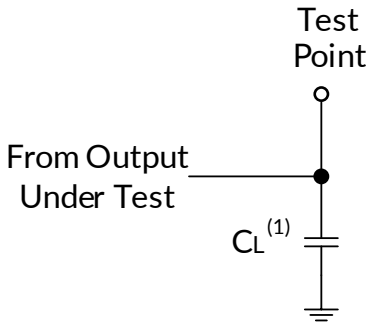
(2) This parameter is ensured by design and/or characterization and is not tested in production.

(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.

(4) C_{PD} is used to determine the dynamic power consumption, per gate.

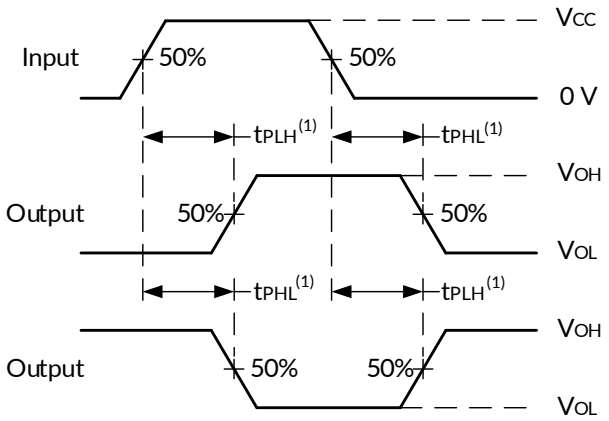
8 Parameter Measurement Information

Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_t < 6 ns.
For clock inputs, f_{max} is measured when the input duty cycle is 50%.
The outputs are measured one at a time with one input transition per measurement.



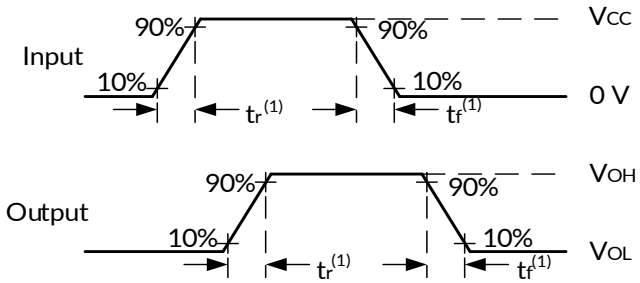
(1) C_L includes probe and test-fixture capacitance.

Figure 1. Load Circuit for Push-Pull Outputs



(1) The greater between t_{PLH} and t_{PHL} is the same as t_{pd}.

Figure 2. Voltage Waveforms, Propagation Delays for Standard CMOS Inputs



(1) The greater between t_r and t_f is the same as t_t.

Figure 3. Voltage Waveforms, Input and Output Transition Times for Standard CMOS Inputs

9 Detailed Description

9.1 Overview

The RS1G139 device decodes the 2-bit input to one of the four outputs. The B input is the most significant bit and the Y outputs are active low. The propagation delays are very short and well matched. Supply voltage from 1.65V to 5.5V is supported.

9.2 Functional Block Diagram

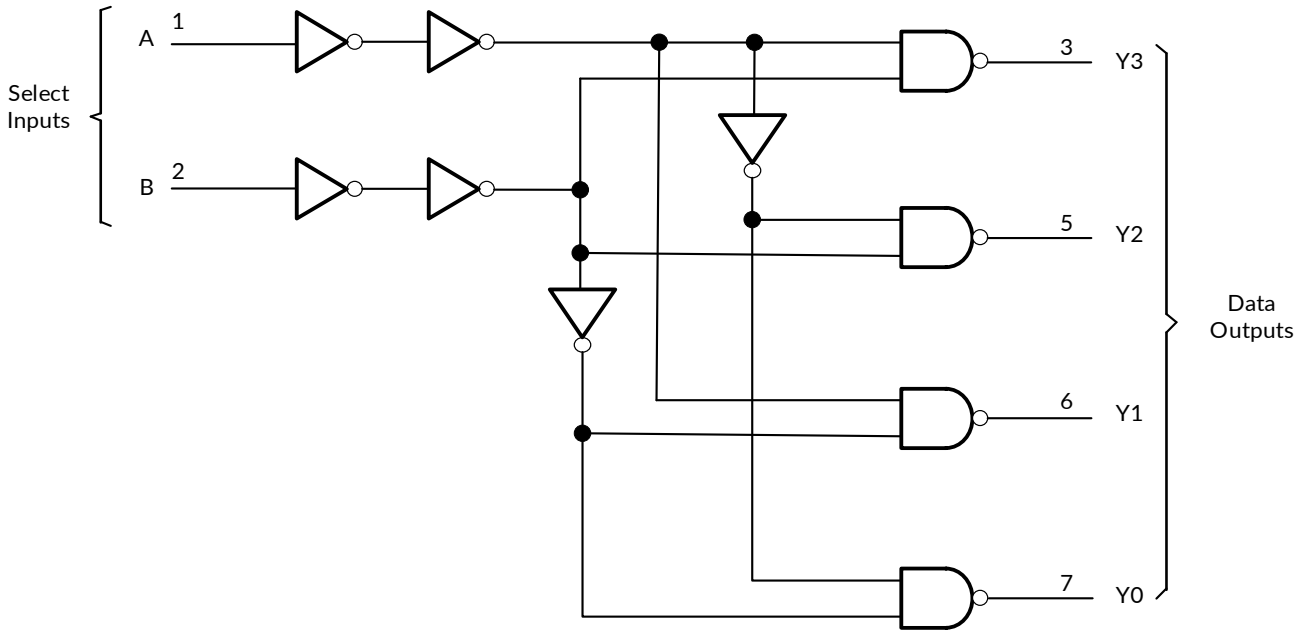


Figure 4. Functional Block Diagram

9.3 Device Functional Modes

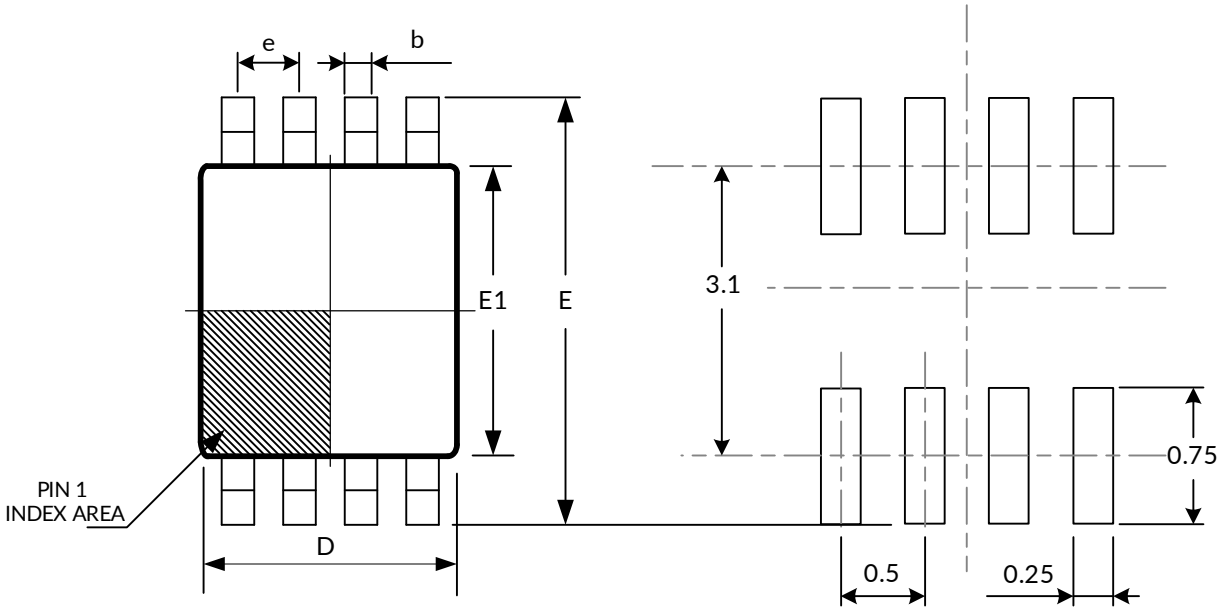
Device Function Table

SELECT INPUTS		OUTPUTS			
B	**A**	**Y3**	**Y2**	**Y1**	**Y0**
L	L	H	H	H	L
L	H	H	H	L	H
H	L	H	L	H	H
H	H	L	H	H	H
X	X	H	H	H	H

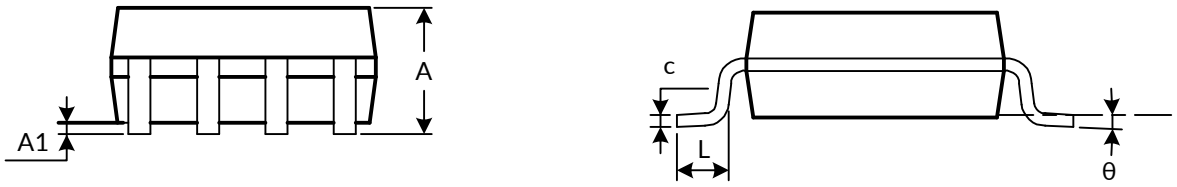
H: High Voltage Level
L: Low Voltage Level
X: Don't care

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°

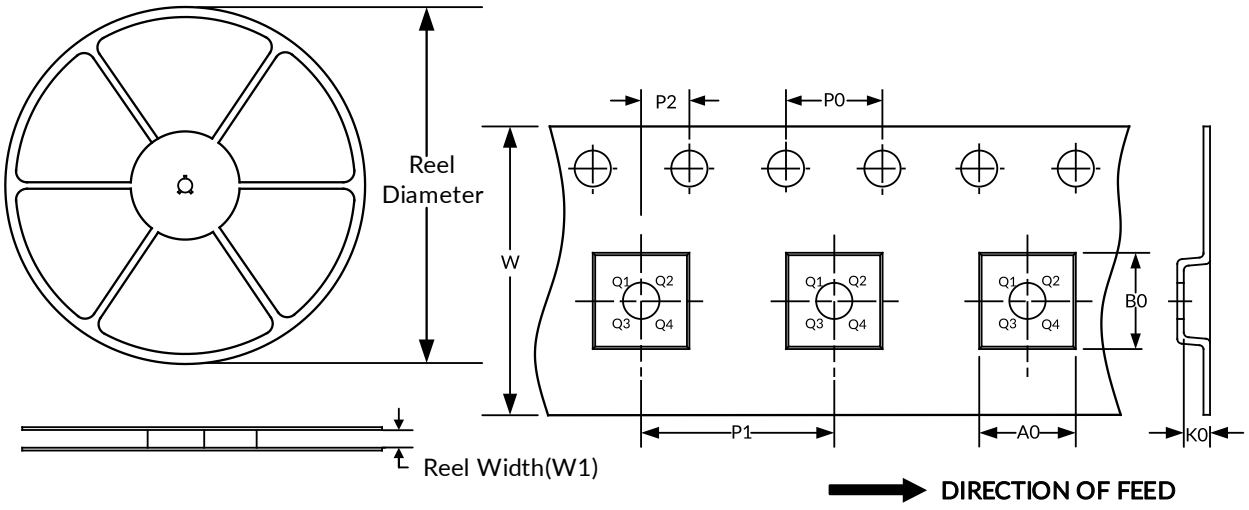
NOTE:

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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