

RS1G11-Q1 Single 3-Input Positive-AND Gate

1 FEATURES

- Qualified for Automotive Applications
- AEC-Q100 Qualified with the Grade 1
- Operating Voltage Range: 1.65V to 5.5V
- Low Power Consumption: 1µA (Max)
- Operating Temperature Range: -40°C to +125°C
- Inputs Accept Voltage to 5.5V
- High Output Drive: ±24mA at V_{CC}=3.0V
- Micro Size Packages: SC70-6

2 APPLICATIONS

- HEV/EV Battery Management System (BMS)
- Automotive Infotainment & Cluster
- Automotive HEV/EV Powertrain

LOGIC SYMBOL



3 DESCRIPTIONS

The RS1G11-Q1 single 3-input positive-AND gate is designed for 1.65V to 5.5V V_{CC} operation.

The RS1G11-Q1 device contains three AND gates and performs the Boolean function $Y=A \cdot B \cdot C$ or $Y=\overline{\overline{A} + \overline{B} + \overline{C}}$ in positive logic. The device 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.

The RS1G11-Q1 is available in Green SC70-6 packages. It operates over an ambient temperature range of -40°C to +125°C.

Device Information (1)

PART NUMBER	PACKAGE	BODY SIZE (NOM)
RS1G11-Q1	SC70-6	2.10mm×1.25mm

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

4 FUNCTION TABLE

INPUTS			OUTPUT
A	B	C	Y
L	L	L	L
L	L	H	L
L	H	L	L
L	H	H	L
H	L	L	L
H	L	H	L
H	H	L	L
H	H	H	H

$$Y=A \cdot B \cdot C$$

H=High Voltage Level

L=Low Voltage Level

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5 REVISION HISTORY

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

Version	Change Date	Change Item
A.0	2024/04/24	Preliminary version completed
A.1	2024/05/20	Initial version completed

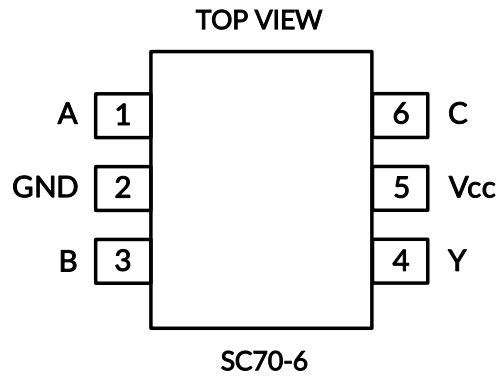
6 PACKAGE/ORDERING INFORMATION ⁽¹⁾

PRODUCT	ORDERING NUMBER	TEMPERATURE RANGE	PACKAGE LEAD	Lead finish/Ball material ⁽²⁾	MSL Peak Temp ⁽³⁾	PACKAGE MARKING ⁽⁴⁾	PACKAGE OPTION
RS1G11-Q1	RS1G11XC6-Q1	-40°C ~+125°C	SC70-6 ⁽⁵⁾	NIPDAUAG	MSL1-260°-Unlimited	1G11	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) Lead finish/Ball material. Orderable Devices 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.
- (3) MSL Peak Temp. The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.
- (4) 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.
- (5) Equivalent to SOT363.

7 PIN CONFIGURATIONS



PIN DESCRIPTION

PIN	NAME	I/O TYPE ⁽¹⁾	FUNCTION
SC70-6			
1	A	I	A Input
2	GND	P	Ground
3	B	I	B Input
4	Y	O	Output
5	V _{CC}	P	Supply Power
6	C	I	C Input

(1) I=input, O=output, P=Power.

8 SPECIFICATIONS

8.1 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
V _I	Input voltage range ⁽²⁾	-0.5	6.5	V
V _O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾	-0.5	6.5	V
V _O	Voltage range 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⁾	SC70-6	265	°C/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_{θJA}, and T_A. The maximum allowable power dissipation at any ambient temperature is P_D = (T_{J(MAX)} - T_A) / R_{θJA}. All numbers apply for packages soldered directly onto a PCB.

8.2 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), per AEC Q100-002 ⁽¹⁾	±2000	V
	Charged-Device Model (CDM), per AEC Q100-011	±1000	V
	Latch-Up (LU), per AEC Q100-004	±150	mA

- (1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.



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.

9 ELECTRICAL CHARACTERISTICS

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

9.1 Recommended Operating Conditions

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Supply voltage	V_{CC}	Operating	1.65	5.5	V
		Data retention only	1.5		
High-level input voltage	V_{IH}	$V_{CC}=1.65\text{V to }1.95\text{V}$	$0.65 \times V_{CC}$		V
		$V_{CC}=2.3\text{V to }2.7\text{V}$	1.7		
		$V_{CC}=3\text{V to }3.6\text{V}$	2.3		
		$V_{CC}=4.5\text{V to }5.5\text{V}$	$0.7 \times V_{CC}$		
Low-level input voltage	V_{IL}	$V_{CC}=1.65\text{V to }1.95\text{V}$		$0.25 \times V_{CC}$	V
		$V_{CC}=2.3\text{V to }2.7\text{V}$		0.7	
		$V_{CC}=3\text{V to }3.6\text{V}$		0.8	
		$V_{CC}=4.5\text{V to }5.5\text{V}$		$0.3 \times V_{CC}$	
Input voltage	V_I		0	5.5	V
Output voltage	V_O		0	V_{CC}	V
Input transition rise or fall	$\Delta t/\Delta v$	$V_{CC}=1.8\text{V} \pm 0.15\text{V}, 2.5\text{V} \pm 0.2\text{V}$		20	ns/V
		$V_{CC}=3.3\text{V} \pm 0.3\text{V}$		10	
		$V_{CC}=5\text{V} \pm 0.5\text{V}$		5	
Operating temperature	T_A		-40	+125	$^\circ\text{C}$

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

9.2 DC Characteristics

PARAMETER		TEST CONDITIONS	V _{CC}	TEMP	MIN ⁽²⁾	TYP ⁽³⁾	MAX ⁽²⁾	UNIT
V _{OH}		I _{OH} = -100μA	1.65V to 5.5V	Full	V _{CC} -0.1			V
		I _{OH} = -4mA	1.65V		1.2			
		I _{OH} = -8mA	2.3V		1.9			
		I _{OH} = -16mA	3V		2.4			
		I _{OH} = -24mA			2.3			
		I _{OH} = -32mA	4.5V		3.8			
V _{OL}		I _{OL} = 100μA	1.65V to 5.5V	Full			0.1	V
		I _{OL} = 4mA	1.65V				0.45	
		I _{OL} = 8mA	2.3V				0.3	
		I _{OL} = 16mA	3V				0.4	
		I _{OL} = 24mA					0.55	
		I _{OL} = 32mA	4.5V				0.55	
I _I	All inputs	V _I =5.5V or GND	0V to 5.5V	+25°C		±0.1	±1	μA
				Full			±5	
I _{off}		V _I or V _O =5.5V	0	+25°C		±0.1	±1	μA
				Full			±10	
I _{CC}		V _I =5.5V or GND, I _O =0	1.65V to 5.5V	+25°C		0.1	1	μA
				Full			10	
ΔI _{CC}		One input at V _{CC} -0.6V, Other inputs at V _{CC} or GND	3V to 5.5V	Full			500	μA
C _i (Input Capacitance)		V _I =V _{CC} or GND	3.3V	+25°C		4		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.

9.3 AC Characteristics

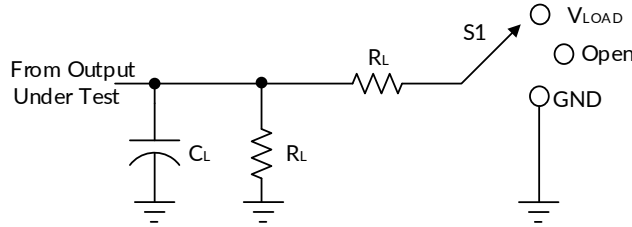
PARAMETER	SYMBOL	TEST CONDITIONS		MIN ⁽²⁾	TYP ⁽³⁾	MAX ⁽²⁾	UNIT
Propagation Delay	t _{pd}	V _{CC} =1.8V±0.15V	C _L =30pF, R _L =1KΩ	6.8	13.6	20.4	ns
		V _{CC} =2.5V±0.2V	C _L =30pF, R _L =500Ω	2.7	5.5	8.3	
		V _{CC} =3.3V±0.3V	C _L =50pF, R _L =500Ω	2.1	4.2	6.3	
		V _{CC} =5V±0.5V	C _L =50pF, R _L =500Ω	1.8	3.7	5.6	
Power dissipation capacitance	C _{pd}	V _{CC} =1.8V	f=10MHz		16		pF
		V _{CC} =2.5V			18		
		V _{CC} =3.3V			18		
		V _{CC} =5V			20		

(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.

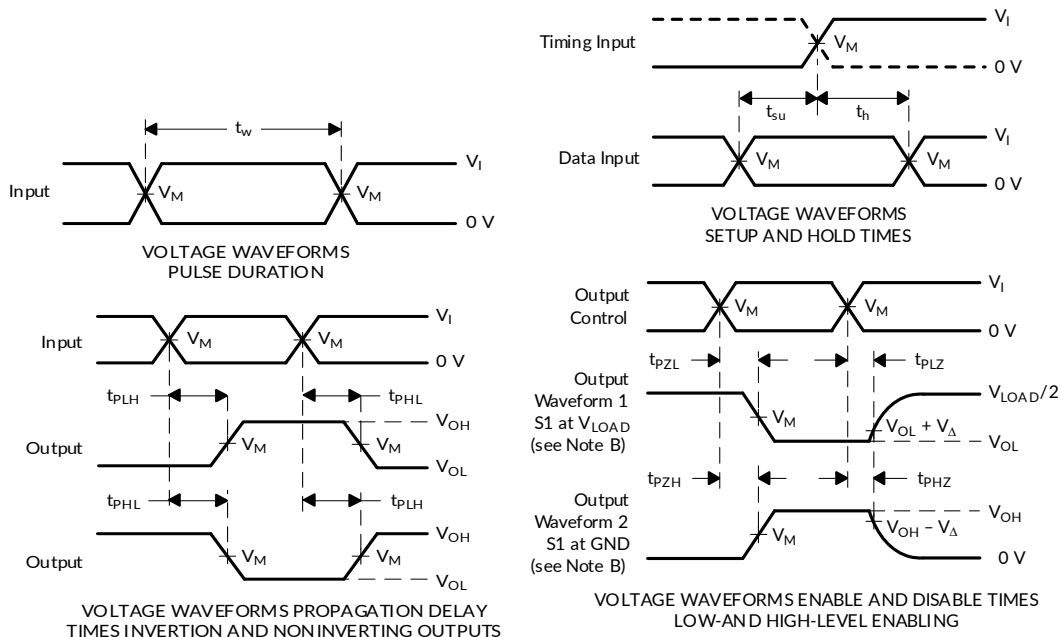
(3) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

10 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					
$1.8V \pm 0.15V$	V_{CC}	$\leq 2ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	1k Ω	0.15V
$2.5V \pm 0.2V$	V_{CC}	$\leq 2ns$	$V_{CC}/2$	$2 \times V_{CC}$	30pF	500 Ω	0.15V
$3.3V \pm 0.3V$	3V	$\leq 2.5ns$	1.5V	6V	50pF	500 Ω	0.3V
$5V \pm 0.5V$	V_{CC}	$\leq 2.5ns$	$V_{CC}/2$	$2 \times V_{CC}$	50pF	500 Ω	0.3V

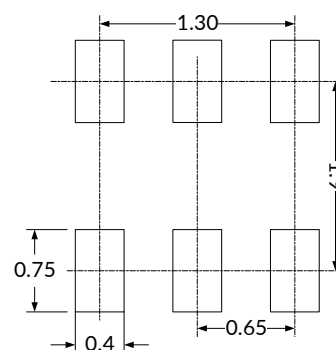
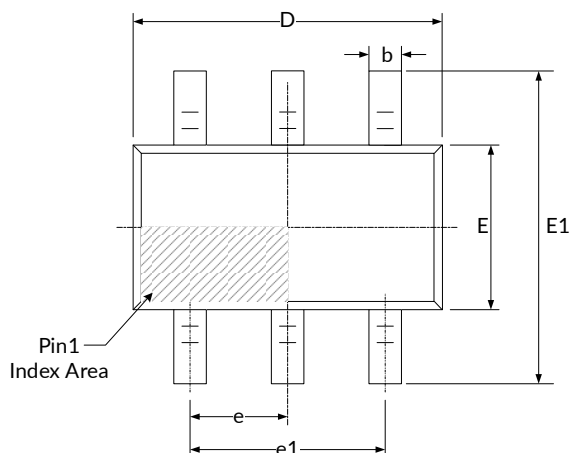


- NOTES: A. C_L includes probe and jig capacitance.
 B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
 C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10$ MHz, $Z_O = 50\Omega$.
 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.

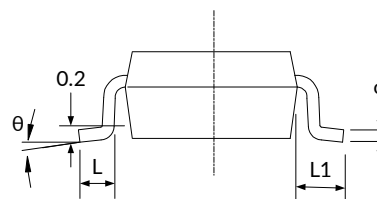
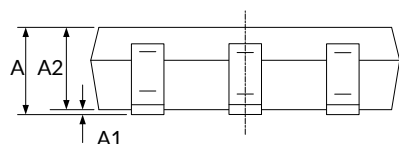
Figure 1. Load Circuit and Voltage Waveforms

11 PACKAGE OUTLINE DIMENSIONS

SC70-6⁽³⁾



RECOMMENDED LAND PATTERN (Unit: mm)



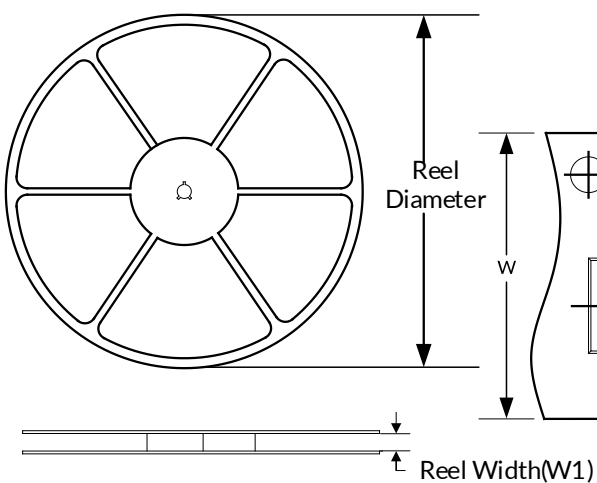
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A ⁽¹⁾	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D ⁽¹⁾	2.000	2.200	0.079	0.087
E ⁽¹⁾	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 (BSC) ⁽²⁾		0.026 (BSC) ⁽²⁾	
e1	1.300 (BSC) ⁽²⁾		0.051 (BSC) ⁽²⁾	
L	0.260	0.460	0.010	0.018
L1	0.525		0.021	
θ	0°	8°	0°	8°

NOTE:

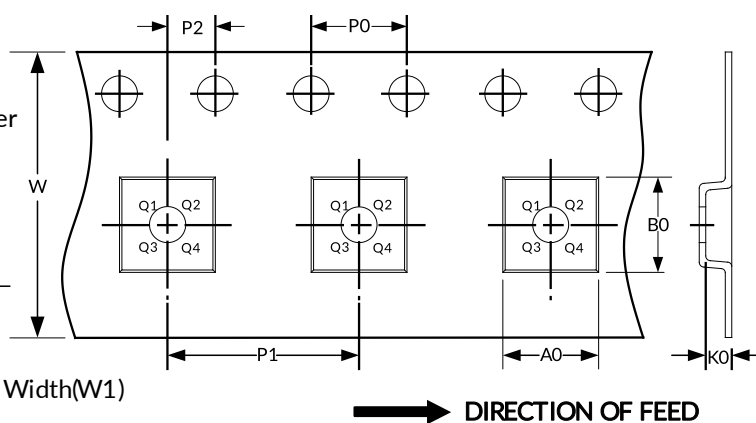
1. Plastic or metal protrusions of 0.15mm maximum per side are not included.
2. BSC (Basic Spacing between Centers), "Basic" spacing is nominal.
3. This drawing is subject to change without notice.

12 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
SC70-6	7"	9.5	2.40	2.50	1.20	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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