SGM48759
Dual Bilateral Analog Switch

GENERAL DESCRIPTION

SGM48759 is dual bilateral analog switch which is designed for 1.65V to 5.5V V_{CC} operation. The device can support up to 5.5V bidirectional signal transmission. It can be flexibly applied to digital and analog signal processing systems.

The SGM48759 is a dual channel single-pole/single-throw (SPST) switch. Each channel of SGM48759 is completely independent and can be controlled by its own enable-input control pin (C).

The SGM48759 is available in Green VSSOP-8 and MSOP-8 packages.

FEATURES

- **Supply Voltage Range: 1.65V to 5.5V**
- **Low On-Resistance: 4.5Ω (TYP) at V_{CC} = 4.5V**
- **With No V_{CC} Connected in the System, the Control Pins can Accept Voltages up to 5.5V**
- **Propagation Delay Time, t_{PD}:**
  0.65ns (TYP) at V_{CC} = 3.3V
- **High On-Off Output Voltage Ratio**
- **High Degree of Linearity**
- **Rail-to-Rail Input and Output Operation**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green VSSOP-8 and MSOP-8 Packages**

APPLICATIONS

Computer Peripherals
Portable Equipment
Sample-and-Hold Circuits

LOGIC DIAGRAM

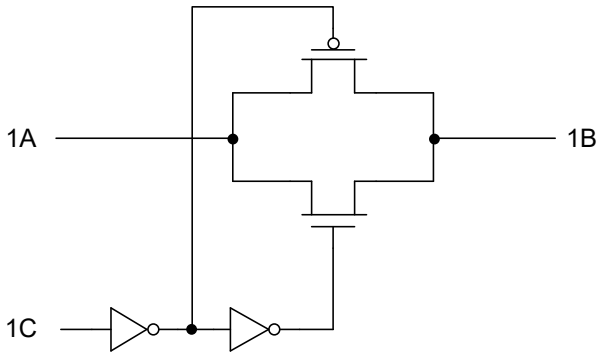


Figure 1. Logic Diagram

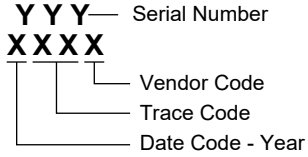
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM48759	VSSOP-8	-40℃ to +125℃	SGM48759XVS8G/TR	041 XXXX	Tape and Reel, 3000
	MSOP-8	-40℃ to +125℃	SGM48759XMS8G/TR	SGM03Y XMS8 XXXXX	Tape and Reel, 4000

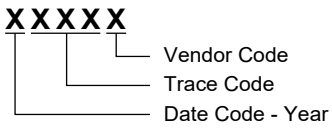
MARKING INFORMATION

NOTE: XXXX = Date Code, Trace Code and Vendor Code. XXXXX = Date Code, Trace Code and Vendor Code.

VSSOP-8



MSOP-8



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, V_{CC} (1) ..... -0.5V to 6.5V
Control Input Voltage, V_{IN} (1) (2) ..... -0.5V to 6.5V
Switch I/O Voltage, $V_{I/O}$ (1) (2) (3) ..... -0.5V to (V_{CC} + 0.5V)
Control Input Clamp Current, I_{IK}, V_{IN} < 0V .....-50mA
I/O Port Diode Current, $I_{I/OK}$, $V_{I/O}$ < 0V .....-50mA
On-State Switch Current, I_T, $V_{I/O}$ = 0V to V_{CC}.....±50mA
Junction Temperature.....+150℃
Storage Temperature Range .....-65℃ to +150℃
Lead Temperature (Soldering, 10s).....+260℃
ESD Susceptibility
HBM.....7000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage, V_{CC}.....1.65V to 5.5V
I/O Port Voltage, $V_{I/O}$..... 0V to V_{CC}
Control Input Voltage, V_{IN} .....0V to 5.5V
Input Transition Rise or Fall Time, Δt/ΔV
V_{CC} = 1.65V to 1.95V 20ns/V
V_{CC} = 2.3V to 2.7V 20ns/V
V_{CC} = 3.0V to 3.6V 10ns/V
V_{CC} = 4.5V to 5.5V 10ns/V
Operating Temperature Range, T_A .....-40℃ to +125℃

NOTES:
1. All voltages reference ground, unless otherwise noted.
2. If the input and output clamp-current ratings are observed, the input and output negative voltage ratings may be exceeded.
3. The maximum value is 6.5V.

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

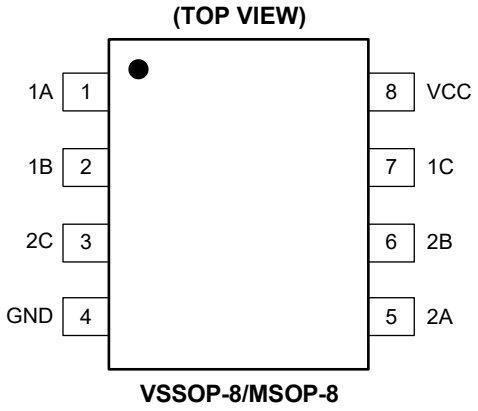
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO 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 even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS



PIN DESCRIPTION

PIN	NAME	I/O	FUNCTION
1	1A	I/O	Analog Switch 1A Input/Output Port.
2	1B	I/O	Analog Switch 1B Input/Output Port.
3	2C	I	Control Signal Input Port of Channel 2.
4	GND	—	Ground Pin.
5	2A	I/O	Analog Switch 2A Input/Output Port.
6	2B	I/O	Analog Switch 2B Input/Output Port.
7	1C	I	Control Signal Input Port of Channel 1.
8	VCC	—	Power Supply Input Pin.

FUNCTION TABLE

CONTROL INPUT (C)	SWITCH
L	OFF
H	ON

ELECTRICAL CHARACTERISTICS

(Full = -40℃ to +125℃, typical values are at T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Control Input High Voltage	V_{INH}	V_{CC} = 1.65V to 1.95V		Full	0.65 × V_{CC}			V
		V_{CC} = 2.3V to 2.7V		Full	1.6			
		V_{CC} = 3.0V to 3.6V		Full	2.0			
		V_{CC} = 4.5V to 5.5V		Full	0.65 × V_{CC}			
Control Input Low Voltage	V_{INL}	V_{CC} = 1.65V to 1.95V		Full			0.35 × V_{CC}	V
		V_{CC} = 2.3V to 2.7V		Full			0.85	
		V_{CC} = 3.0V to 3.6V		Full			1.1	
		V_{CC} = 4.5V to 5.5V		Full			0.3 × V_{CC}	
On-Resistance	R_{ON}	V_I = 0V to V_{CC}, V_{IN} = V_{INH}, Test Circuit 1	I_S = 4mA, V_{CC} = 1.65V	+25℃		55	80	Ω
				Full			100	
			I_S = 8mA, V_{CC} = 2.3V	+25℃		12	18	
				Full			20	
			I_S = 24mA, V_{CC} = 3.0V	+25℃		7	10	
				Full			12	
			I_S = 32mA, V_{CC} = 4.5V	+25℃		4.5	8	
				Full			10	
On-Resistance Flatness	$R_{FLAT(ON)}$	V_I = 0V to V_{CC}, V_{IN} = V_{INH}, Test Circuit 1	I_S = 4mA, V_{CC} = 1.65V	+25℃		45	70	Ω
				Full			95	
			I_S = 8mA, V_{CC} = 2.3V	+25℃		6	9	
				Full			10	
			I_S = 24mA, V_{CC} = 3.0V	+25℃		2	3	
				Full			3.5	
			I_S = 32mA, V_{CC} = 4.5V	+25℃		1.2	1.6	
				Full			1.8	
On-Resistance Match between Channels	ΔR_{ON}	V_I = 0V to V_{CC}, V_{IN} = V_{INH}, Test Circuit 1	I_S = 4mA, V_{CC} = 1.65V	+25℃		1	15	Ω
				Full			16	
			I_S = 8mA, V_{CC} = 2.3V	+25℃		0.1	1.4	
				Full			1.5	
			I_S = 24mA, V_{CC} = 3.0V	+25℃		0.1	0.6	
				Full			0.8	
			I_S = 32mA, V_{CC} = 4.5V	+25℃		0.1	0.4	
				Full			0.5	
Off Leakage Current	$I_{S(OFF)}$	V_{CC} = 5.5V, V_I = V_{CC} and V_O = 0V or V_I = 0V and V_O = V_{CC}, V_{IN} = V_{INL}, Test Circuit 2		Full		±0.05	±1	μA
On Leakage Current	$I_{S(ON)}$	V_{CC} = 5.5V, V_I = V_{CC} or 0V, V_{IN} = V_{INH}, V_O = Open, Test Circuit 3		Full		±0.05	±1	μA
Control Input Current	I_{IN}	V_{CC} = 5.5V, V_{IN} = V_{CC} or 0V		Full		±0.05	±1	μA
Supply Current	I_{CC}	V_{CC} = 5.5V, V_{IN} = V_{CC} or 0V		Full		0.05	1	μA
Supply Current Change	ΔI_{CC}	V_{CC} = 5.5V, V_{IN} = V_{CC} - 0.6V		Full		0.05	1	μA
Control Input Capacitance	C_{INC}	V_{CC} = 5.0V, f = 1MHz		+25℃		3		pF
Switch Input/Output Capacitance	$C_{IO(OFF)}$	V_{CC} = 5.0V, f = 1MHz		+25℃		6		pF
Switch Input/Output Capacitance	$C_{IO(ON)}$	V_{CC} = 5.0V, f = 1MHz		+25℃		13		pF

ANALOG SWITCH CHARACTERISTICS

(T_A = +25℃, unless otherwise noted.)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Frequency Response (Switch On)	A or B	B or A	C_L = 20pF, R_L = 600Ω, f = sine wave, Test Circuit 4	V_{CC} = 1.65V	+25℃		100		MHz
				V_{CC} = 2.3V	+25℃		170		
				V_{CC} = 3.0V	+25℃		190		
				V_{CC} = 4.5V	+25℃		205		
			C_L = 5pF, R_L = 50Ω, f = sine wave, Test Circuit 4	V_{CC} = 1.65V	+25℃		310		
				V_{CC} = 2.3V	+25℃		320		
				V_{CC} = 3.0V	+25℃		325		
				V_{CC} = 4.5V	+25℃		335		
Crosstalk (between Switches)	A or B	B or A	C_L = 50pF, R_L = 600Ω, f = 1MHz (sine wave), Test Circuit 5	V_{CC} = 1.65V	+25℃		-85		dB
				V_{CC} = 2.3V	+25℃		-85		
				V_{CC} = 3.0V	+25℃		-85		
				V_{CC} = 4.5V	+25℃		-85		
			C_L = 5pF, R_L = 50Ω, f = 1MHz (sine wave), Test Circuit 5	V_{CC} = 1.65V	+25℃		-110		
				V_{CC} = 2.3V	+25℃		-110		
				V_{CC} = 3.0V	+25℃		-110		
				V_{CC} = 4.5V	+25℃		-110		
Crosstalk (Control Input to Signal Output)	C	A or B	C_L = 50pF, R_L = 600Ω, f = 1MHz (square wave), Test Circuit 6	V_{CC} = 1.65V	+25℃		35		mV
				V_{CC} = 2.3V	+25℃		55		
				V_{CC} = 3.0V	+25℃		85		
				V_{CC} = 4.5V	+25℃		140		
Feedthrough Attenuation (Switch Off)	A or B	B or A	C_L = 50pF, R_L = 600Ω, f = 1MHz (sine wave), Test Circuit 7	V_{CC} = 1.65V	+25℃		-50		dB
				V_{CC} = 2.3V	+25℃		-50		
				V_{CC} = 3.0V	+25℃		-50		
				V_{CC} = 4.5V	+25℃		-50		
			C_L = 5pF, R_L = 50Ω, f = 1MHz (sine wave), Test Circuit 7	V_{CC} = 1.65V	+25℃		-75		
				V_{CC} = 2.3V	+25℃		-75		
				V_{CC} = 3.0V	+25℃		-75		
				V_{CC} = 4.5V	+25℃		-75		
Sine-Wave Distortion	A or B	B or A	C_L = 50pF, R_L = 10kΩ to V_{CC}/2, f = 1kHz (sine wave), Test Circuit 8	V_{CC} = 1.65V	+25℃		0.07		%
				V_{CC} = 2.3V	+25℃		0.015		
				V_{CC} = 3.0V	+25℃		0.005		
				V_{CC} = 4.5V	+25℃		0.002		
			C_L = 50pF, R_L = 10kΩ to V_{CC}/2, f = 10kHz (sine wave), Test Circuit 8	V_{CC} = 1.65V	+25℃		0.07		
				V_{CC} = 2.3V	+25℃		0.015		
				V_{CC} = 3.0V	+25℃		0.005		
				V_{CC} = 4.5V	+25℃		0.003		

SWITCHING CHARACTERISTICS

(Full = -40℃ to +125℃, typical values are at T_A = +25℃, unless otherwise noted.)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	TEMP	V_{CC} = 1.8V ± 0.15V			V_{CC} = 2.5V ± 0.2V			V_{CC} = 3.3V ± 0.3V			V_{CC} = 5.0V ± 0.5V			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
t_{PD}	A or B	B or A	Full	0.05	0.45	2	0.05	0.35	1.5	0.05	0.65	1.5	0.05	0.6	1.5	ns
t_{EN}	C	A or B	Full	1	6.5	12	1	3.5	6.5	1	3	5.5	1	2.7	4.5	ns
t_{DIS}	C	A or B	Full	1	7.3	11	1	4	6.5	1	3.5	6	1	3	6	ns

OPERATING CHARACTERISTICS

(T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	V_{CC} = 1.8V	V_{CC} = 2.5V	V_{CC} = 3.3V	V_{CC} = 5.0V	UNITS
				TYP	TYP	TYP	TYP	
Power Dissipation Capacitance	C_{PD} (1)	f = 10MHz	+25℃	6	6.2	6.5	7	pF

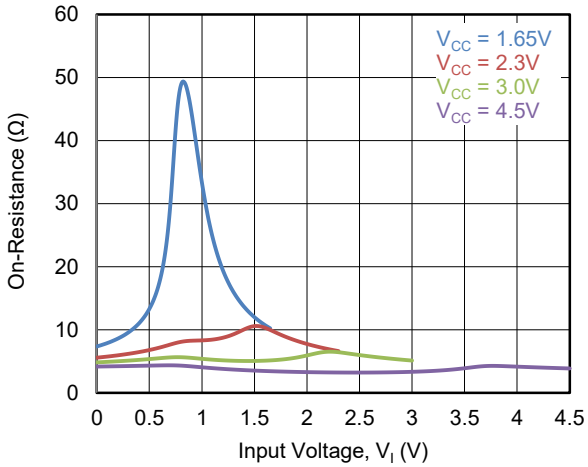
NOTE:

1. C_{PD} is used to determine the dynamic power dissipation (P_D in μW).
   $P_D = C_{PD} \times V_{CC}^2 \times f \times N + \{(C_L + C_S) \times V_{CC} \times f_O\}$
   where:
   f = input frequency in MHz.
   f_O = output frequency in MHz.
   C_L = output load capacitance in pF.
   C_S = switch capacitance in pF.
   V_{CC} = supply voltage in V.
   N = total load switching outputs.
   The condition is V_I = GND to V_{CC}.

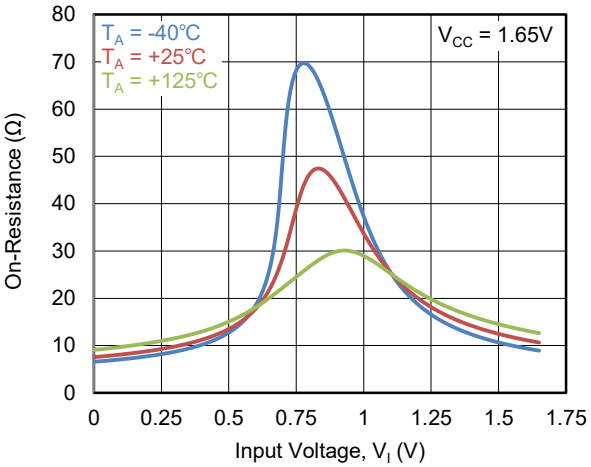
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = +25℃, V_{CC} = 3.0V, unless otherwise noted.

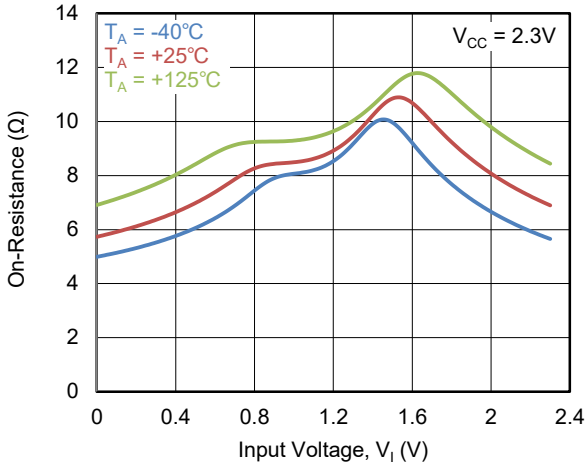
On-Resistance vs. Input Voltage, V_I



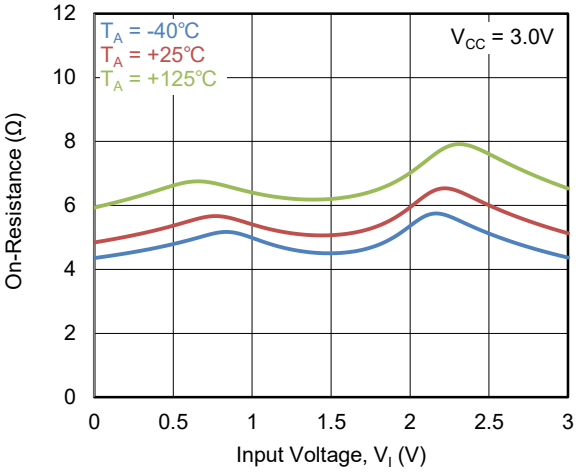
On-Resistance vs. Input Voltage, V_I



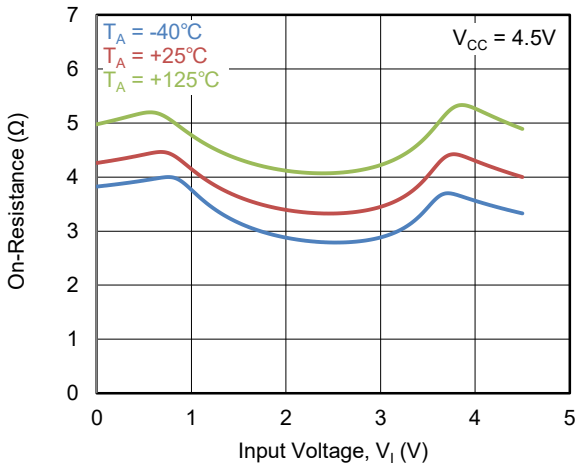
On-Resistance vs. Input Voltage, V_I



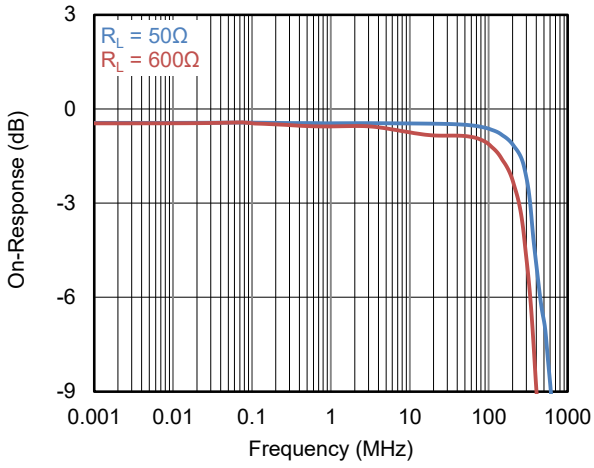
On-Resistance vs. Input Voltage, V_I



On-Resistance vs. Input Voltage, V_I



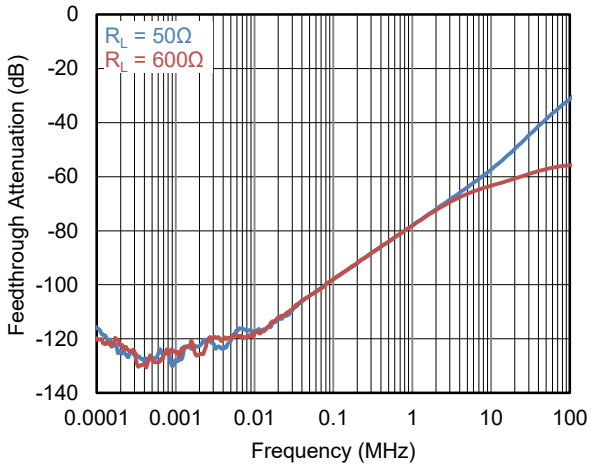
On-Response vs. Frequency



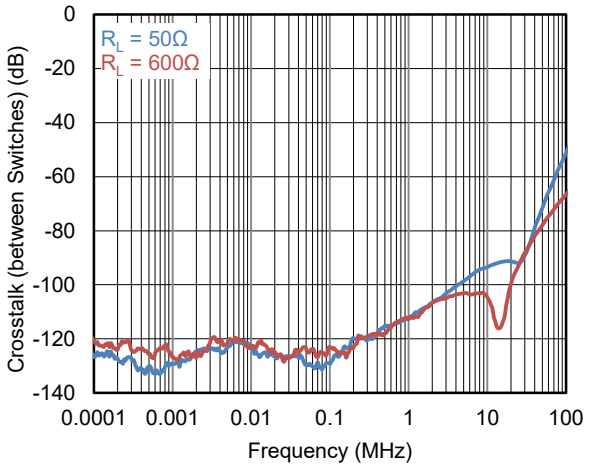
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{CC} = 3.0V, unless otherwise noted.

Feedthrough Attenuation vs. Frequency



Crosstalk (between Switches) vs. Frequency



TEST CIRCUITS

Table 1. Parameter Test Information

PARAMETER	V_{CC}	S1	INPUTS			V_M	C_L	R_L	V_Δ
			V_I	V_{IN}	t_R/t_F				
t_{PLH}/t_{PHL}	1.8V ± 0.15V	Open	0 to V_{CC}	V_{CC}	≤ 2ns	$V_{CC}/2$	30pF	1kΩ	0.15V
	2.5V ± 0.2V	Open	0 to V_{CC}	V_{CC}	≤ 2ns	$V_{CC}/2$	30pF	500Ω	0.15V
	3.3V ± 0.3V	Open	0 to V_{CC}	V_{CC}	≤ 2.5ns	$V_{CC}/2$	50pF	500Ω	0.3V
	5.0V ± 0.5V	Open	0 to V_{CC}	V_{CC}	≤ 2.5ns	$V_{CC}/2$	50pF	500Ω	0.3V
t_{PLZ}/t_{PZL}	1.8V ± 0.15V	2 × V_{CC}	GND	0 to V_{CC}	≤ 2ns	$V_{CC}/2$	30pF	1kΩ	0.15V
	2.5V ± 0.2V	2 × V_{CC}	GND	0 to V_{CC}	≤ 2ns	$V_{CC}/2$	30pF	500Ω	0.15V
	3.3V ± 0.3V	2 × V_{CC}	GND	0 to V_{CC}	≤ 2.5ns	$V_{CC}/2$	50pF	500Ω	0.3V
	5.0V ± 0.5V	2 × V_{CC}	GND	0 to V_{CC}	≤ 2.5ns	$V_{CC}/2$	50pF	500Ω	0.3V
t_{PHZ}/t_{PZH}	1.8V ± 0.15V	GND	V_{CC}	0 to V_{CC}	≤ 2ns	$V_{CC}/2$	30pF	1kΩ	0.15V
	2.5V ± 0.2V	GND	V_{CC}	0 to V_{CC}	≤ 2ns	$V_{CC}/2$	30pF	500Ω	0.15V
	3.3V ± 0.3V	GND	V_{CC}	0 to V_{CC}	≤ 2.5ns	$V_{CC}/2$	50pF	500Ω	0.3V
	5.0V ± 0.5V	GND	V_{CC}	0 to V_{CC}	≤ 2.5ns	$V_{CC}/2$	50pF	500Ω	0.3V

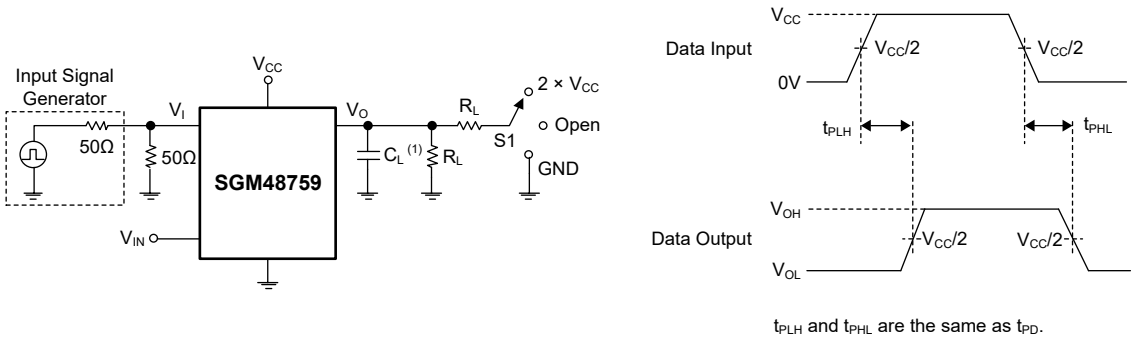


Figure 2. Voltage Waveforms & Propagation Delay Time (t_{PD})

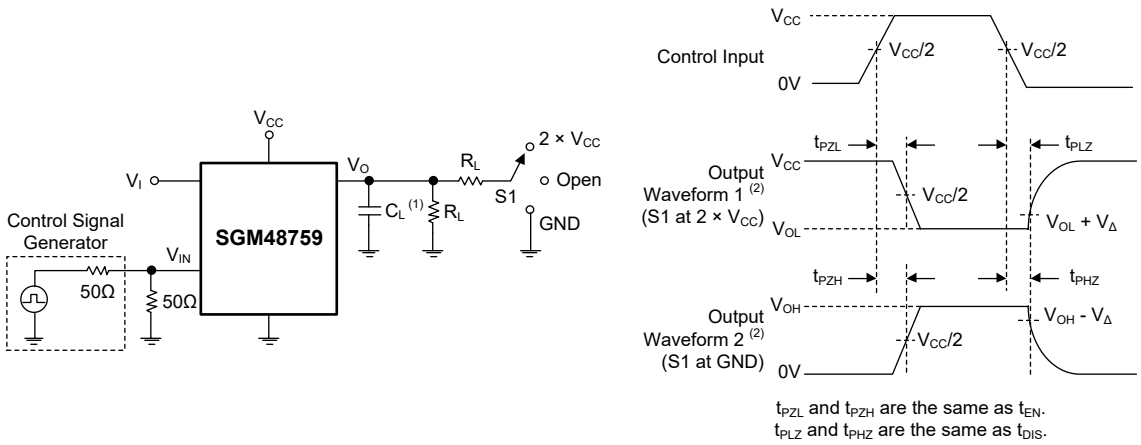
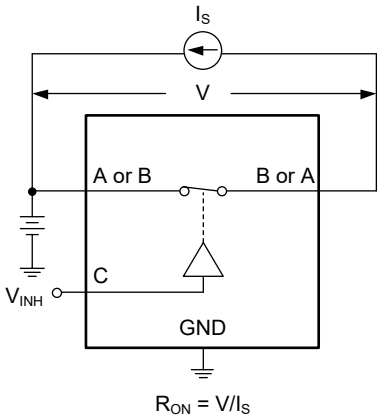


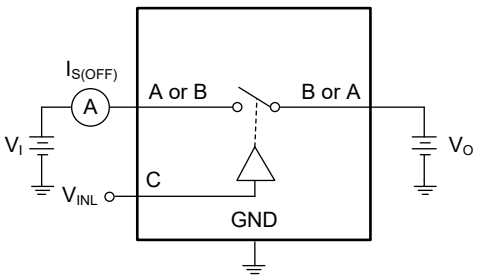
Figure 3. Voltage Waveforms & Enable and Disable Times (t_{EN}, t_{DIS})

NOTES:
1. The C_L includes probe capacitance and clamp capacitance.
2. Waveform 1 indicates the output when internal conditions force the output to low, except the output port is disabled through the output control. Waveform 2 indicates the output when internal conditions force the output to high, except the output port is disabled through the output control.
3. For all input signals from signal generator equipment, the following conditions are required: PRR ≤ 10MHz, Z_O = 50Ω.
4. Only one output port is measured with one transition at a time.

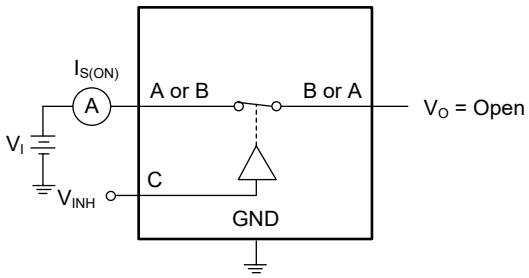
TEST CIRCUITS (continued)



Test Circuit 1. On-Resistance

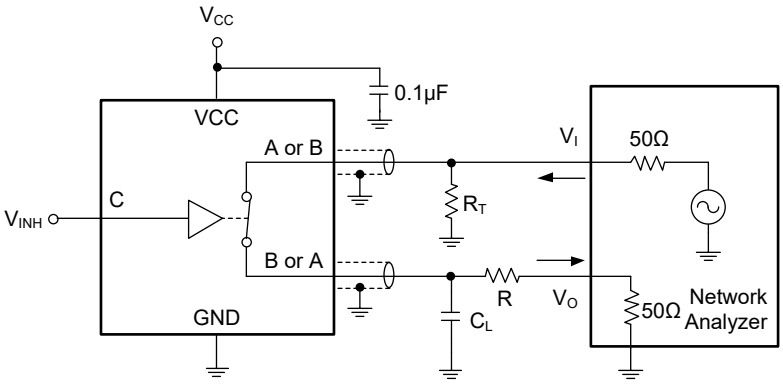


Test Circuit 2. Off Leakage Current



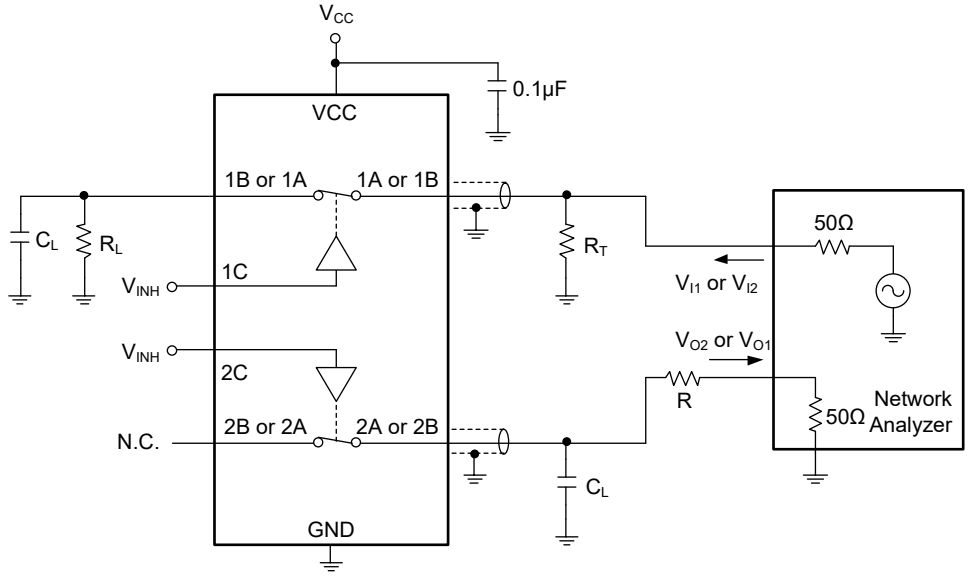
Test Circuit 3. On Leakage Current

TEST CIRCUITS (continued)



R_L = 600Ω: R = 550Ω, R_T = 50Ω
R_L = 50Ω: R = 0Ω, R_T = Open

Test Circuit 4. Frequency Response (Switch On)

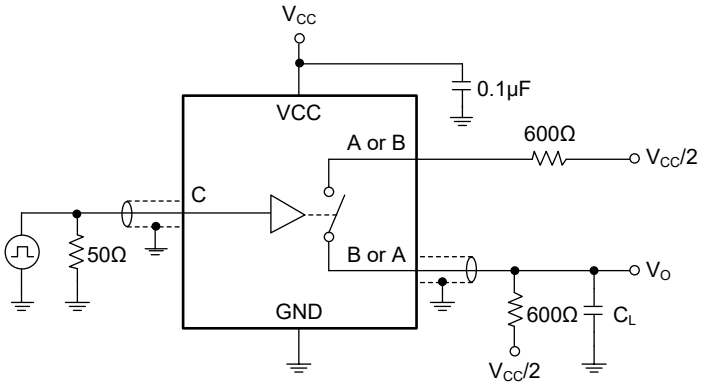


R_L = 600Ω: R = 550Ω, R_T = 50Ω
R_L = 50Ω: R = 0Ω, R_T = Open

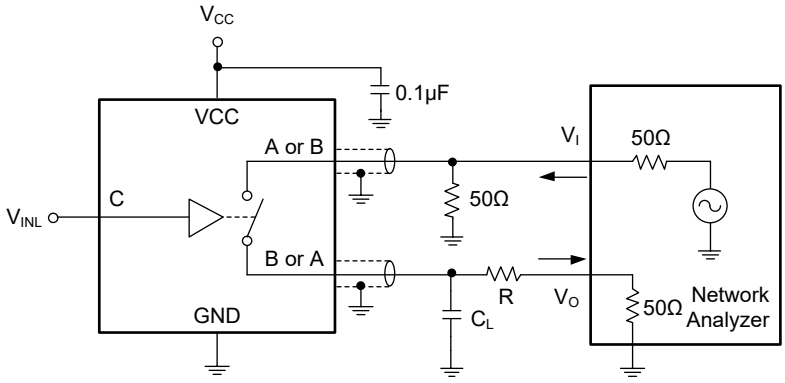
Crosstalk (between Switches) = 20log(V_{O2}/V_{I1} or V_{O1}/V_{I2})

Test Circuit 5. Crosstalk (between Switches)

TEST CIRCUITS (continued)

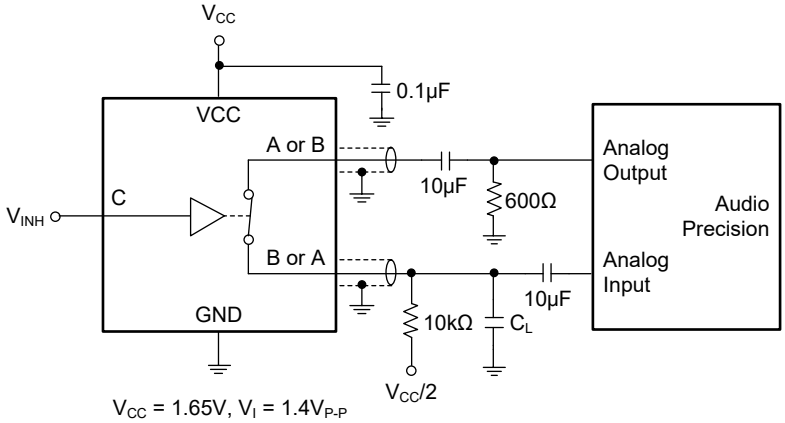


Test Circuit 6. Crosstalk (Control Input to Signal Output)



R_L = 600Ω: R = 550Ω
R_L = 50Ω: R = 0Ω

Test Circuit 7. Feedthrough Attenuation (Switch Off)



V_{CC} = 1.65V, V_I = 1.4V_{P-P}
V_{CC} = 2.3V, V_I = 2V_{P-P}
V_{CC} = 3.0V, V_I = 2.5V_{P-P}
V_{CC} = 4.5V, V_I = 4V_{P-P}

Test Circuit 8. Sine-Wave Distortion

DETAILED DESCRIPTION

The SGM48759 operates power supply voltage range from 1.65V to 5.5V. Each analog switch in the SGM48759 can support up to 5.5V bidirectional signal transmission. When the input control pin (C) accepts a high-level voltage, the analog switch is turned on and the signal transmission is started. When the input control pin (C) accepts a low-level voltage, the analog switch is turned off and the signal transmission is prohibited. Each analog switch in the SGM48759 is completely independent and can be controlled by its own input control pin (C).

Feature Description

The SGM48759 has low on-resistance of 4.5Ω (TYP) at V_{CC} = 4.5V and low t_{PD} of 0.65ns (TYP) at V_{CC} = 3.3V, so that it can be applied to high-speed signal transmission. Besides, its quick enable and disable times make this device suitable for high-speed signal switching applications. In particular, the control pin can accept a higher voltage than V_{CC} because the SGM48759 has no equivalent diodes between the control pin and VCC pin. The maximum input voltage of control pin can reach to 5.5V when V_{CC} is 0V. This feature allows the SGM48759 to be used in applications where the control pin voltage is higher than the power supply.

REVISION HISTORY

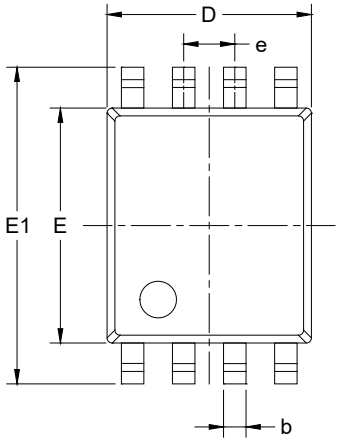
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

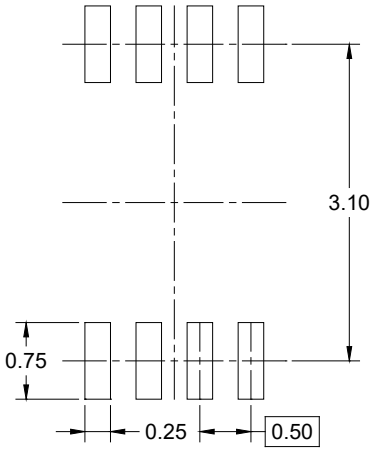
AUGUST 2023 – REV.A to REV.A.1	Page
Updated Electrical Characteristics section	4

Changes from Original (MARCH 2023) to REV.A	Page
Changed from product preview to production data	All

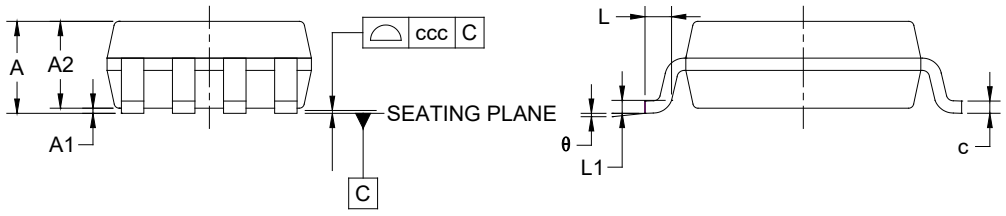
PACKAGE OUTLINE DIMENSIONS

VSSOP-8





RECOMMENDED LAND PATTERN (Unit: mm)

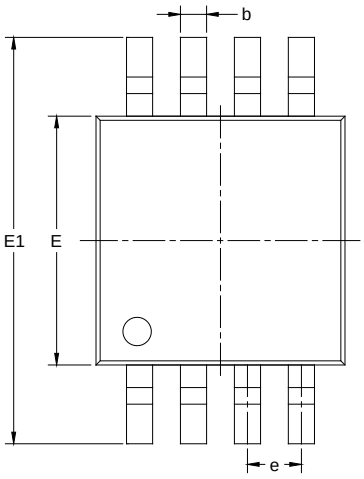


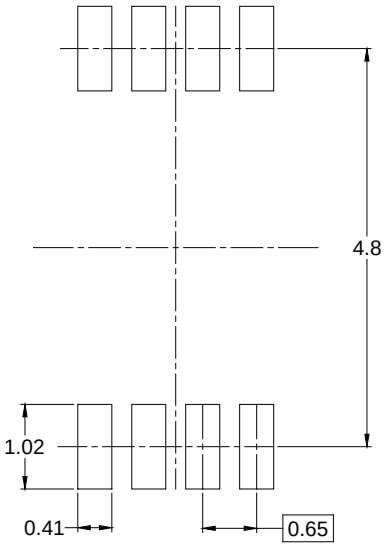
Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	-	-	0.900
A1	0	-	0.100
A2	0.650		0.800
b	0.170	-	0.270
c	0.100		0.180
D	1.900	-	2.100
E	2.200	-	2.400
E1	3.000	-	3.200
e	0.500 BSC		
L	0.200	-	0.350
L1	0.120 BSC		
θ	0°	-	6°
ccc	0.100		

NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-187 CA.

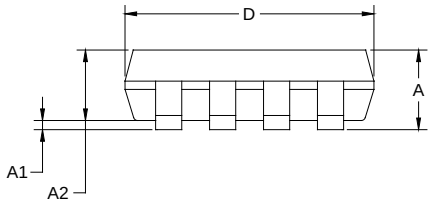
PACKAGE OUTLINE DIMENSIONS

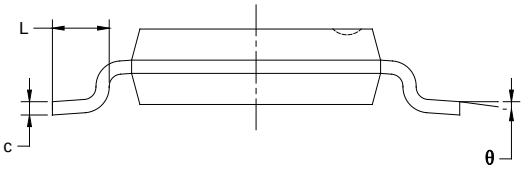
MSOP-8





RECOMMENDED LAND PATTERN (Unit: mm)



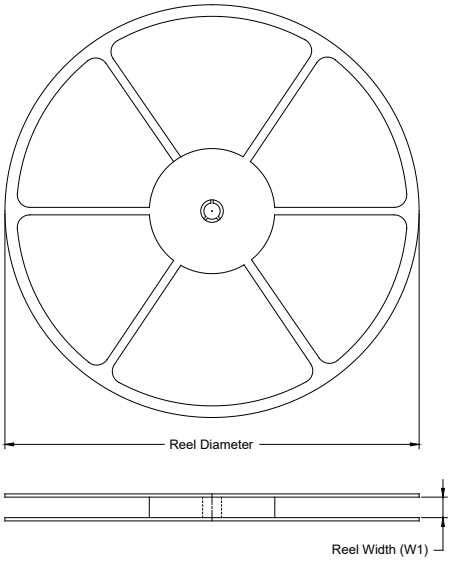


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

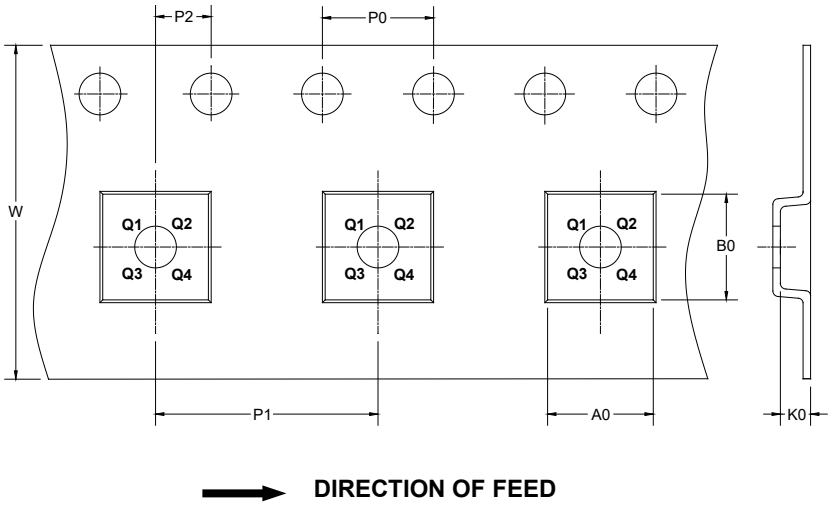
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

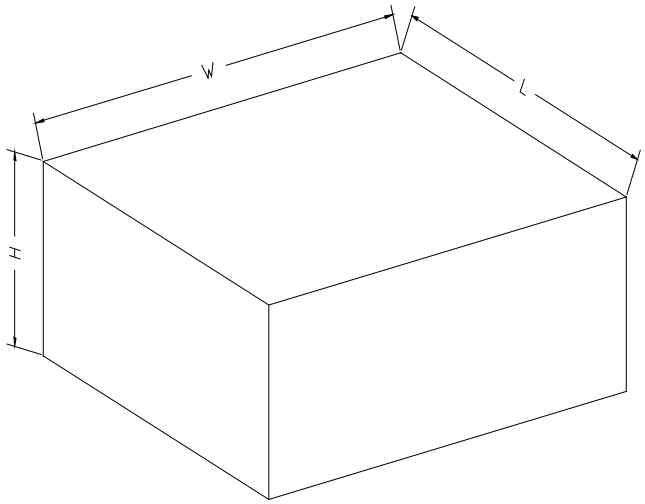
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
VSSOP-8	7″	9.5	2.25	3.35	1.05	4.0	4.0	2.0	8.0	Q3
MSOP-8	13″	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1

DD0001

CARTON BOX DIMENSIONS



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

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7″ (Option)	368	227	224	8
7″	442	410	224	18
13″	386	280	370	5

DD0002