SGM6512
High Speed, 24Ω R_{ON}, 16-Channel, ±5V, +12V, +5V and +3.3V Multiplexer

GENERAL DESCRIPTION

The SGM6512 is a high speed monolithic analog multiplexer comprising of 16 single channels. The SGM6512 switches one of 16 inputs to a common output, as determined by the 4-bit binary address lines (A0, A1, A2 and A3). An EN input enables or disables the device. When disabled, all channels switch off; when enabled, each channel conducts equally well in both directions and has an input signal range that extends to the supplies.

The 24Ω on-resistance and on-resistance flatness of these switches make them ideal solutions for data acquisition and gain switching applications where low distortion is critical.

SGM6512 is available in Green TQFN-5×5-32L and TSSOP-28 packages. It operates over an ambient temperature range of -40℃ to +85℃

FEATURES

- **24Ω Typical On-Resistance**
- **12Ω On-Resistance Flatness**
- **±3.3V to ±6V Dual Supplies Operation**
- **3.3V to 13.2V Single Supply Operation**
- **-3dB Bandwidth: 70MHz**
- **Rail-to-Rail Operation**
- **Available in Green TQFN-5×5-32L and TSSOP-28 Packages**
- **-40℃ to +85℃ Operating Temperature Range**

APPLICATIONS

Communication Systems
Medical Systems
Audio Signal Routing
Video Signal Routing
Automatic Test Equipment
Data Acquisition Systems
Battery-Powered Systems
Sample-and-Hold Systems
Relay Replacements

PACKAGE/ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM6512	TQFN-5×5-32L	-40℃ to +85℃	SGM6512YTQL32G/TR	SGM6512 YTQL32 XXXXX	Tape and Reel, 3000
	TSSOP-28	-40℃ to +85℃	SGM6512YTS28G/TR	SGM6512 YTS28 XXXXX	Tape and Reel, 2500

NOTE: **XXXXX** = Date Code and Vendor Code.

ABSOLUTE MAXIMUM RATINGS

V_{DD} to V_{SS}.....15V
V_{DD} to GND.....-0.3V to +15V
V_{SS} to GND….....+0.3V to -15V
Analog Input Voltage……..…..V_{SS} - 0.3V to V_{DD} + 0.3V
Digital Input Voltage…….…… GND - 0.3V to V_{DD} + 0.3V
Operating Temperature Range.....-40℃ to +85℃
Junction Temperature.....150℃
Storage Temperature Range.....-65℃ to +150℃
Lead Temperature (Soldering, 10s).....260℃

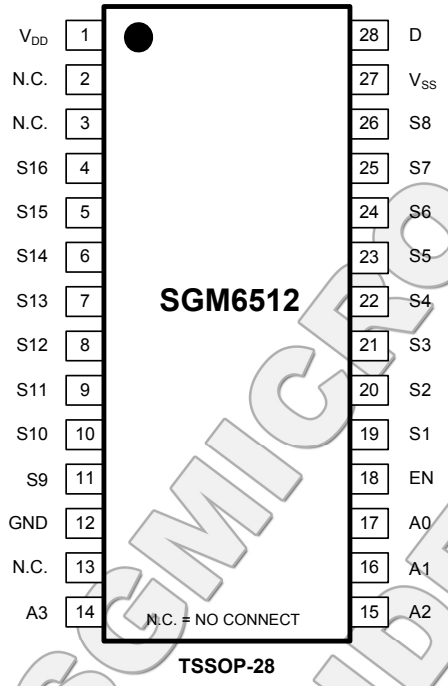
NOTE:
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

CAUTION

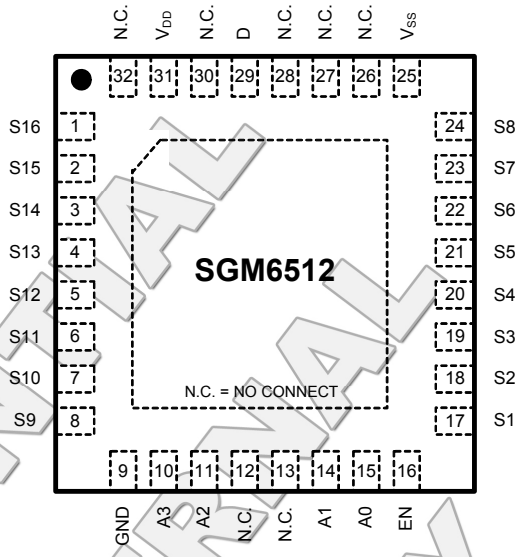
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

PIN CONFIGURATIONS (TOP VIEW)



TSSOP-28



TQFN-5×5-32L

TRUTH TABLE

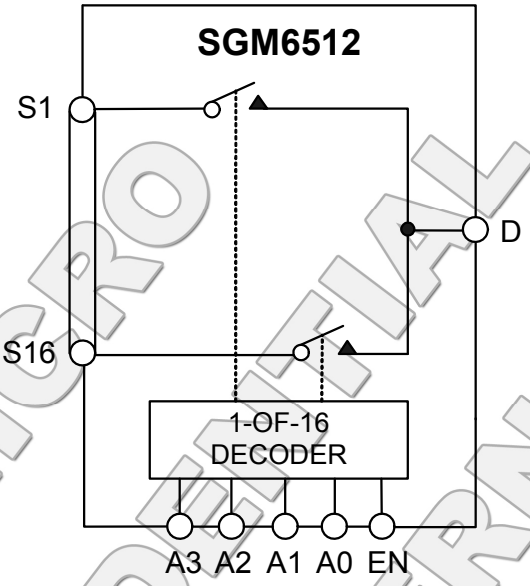
A3	A2	A1	A0	EN	ON SWITCH
X	X	X	X	0	None
0	0	0	0	1	1
0	0	0	1	1	2
0	0	1	0	1	3
0	0	1	1	1	4
0	1	0	0	1	5
0	1	0	1	1	6
0	1	1	0	1	7
0	1	1	1	1	8
1	0	0	0	1	9
1	0	0	1	1	10
1	0	1	0	1	11
1	0	1	1	1	12
1	1	0	0	1	13
1	1	0	1	1	14
1	1	1	0	1	15
1	1	1	1	1	16

X = Do not care.

PIN DESCRIPTION

PIN		NAME	FUNCTION
TSSOP-28	TQFN-5×5-32L		
1	31	V_{DD}	Most Positive Power Supply Potential.
2, 3, 13	12, 13, 26, 27, 28, 30, 32	N.C.	No Connection or Connect to V_{SS}. Must not be connected to other potential.
4	1	S16	Source Terminal 16. This pin can be an input or an output.
5	2	S15	Source Terminal 15. This pin can be an input or an output.
6	3	S14	Source Terminal 14. This pin can be an input or an output.
7	4	S13	Source Terminal 13. This pin can be an input or an output.
8	5	S12	Source Terminal 12. This pin can be an input or an output.
9	6	S11	Source Terminal 11. This pin can be an input or an output.
10	7	S10	Source Terminal 10. This pin can be an input or an output.
11	8	S9	Source Terminal 9. This pin can be an input or an output.
12	9	GND	Ground.
14	10	A3	Logic Control Input.
15	11	A2	Logic Control Input.
16	14	A1	Logic Control Input.
17	15	A0	Logic Control Input.
18	16	EN	Active High Digital Input. When this pin is low, the device is disabled and all switches are turned off. When this pin is high, the Ax logic inputs determine which switch is turned on.
19	17	S1	Source Terminal 1. This pin can be an input or an output.
20	18	S2	Source Terminal 2. This pin can be an input or an output.
21	19	S3	Source Terminal 3. This pin can be an input or an output.
22	20	S4	Source Terminal 4. This pin can be an input or an output.
23	21	S5	Source Terminal 5. This pin can be an input or an output.
24	22	S6	Source Terminal 6. This pin can be an input or an output.
25	23	S7	Source Terminal 7. This pin can be an input or an output.
26	24	S8	Source Terminal 8. This pin can be an input or an output.
27	25	V_{SS}	Most Negative Power Supply Potential. In single-supply applications, this pin can be connected to ground.
28	29	D	Drain Terminal. This pin can be an input or an output.
—	EP	Exposed Pad	The exposed pad is connected internally. For increased reliability of the solder joints and maximum thermal capability, it is recommended that the pad be soldered to the substrate, V_{SS}.

FUNCTIONAL BLOCK DIAGRAM



ELECTRICAL CHARACTERISTICS: ±5V Dual Supply

(V_{DD} = +5V ± 10%, V_{SS} = -5V ± 10%, GND = 0V, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM6512			
			+25℃	-40℃ to +85℃	UNITS	MIN/MAX
ANALOG SWITCH						
Analog Signal Range			V_{DD} to V_{SS}		V	
On-Resistance	R_{ON}	V_S = V_{SS} to V_{DD}, I_S = -10mA, V_{DD} = 4.5V, V_{SS} = -4.5V, Test Circuit 1	24		Ω	TYP
					Ω	MAX
On-Resistance Match Between Channels	ΔR_{ON}	V_S = V_{SS} to V_{DD}, I_S = -10mA, V_{DD} = 4.5V, V_{SS} = -4.5V	0.8		Ω	TYP
					Ω	MAX
On-Resistance Flatness	$R_{FLAT(ON)}$	V_S = V_{SS} to V_{DD}, I_S = -10mA, V_{DD} = 4.5V, V_{SS} = -4.5V	12		Ω	TYP
					Ω	MAX
LEAKAGE CURRENTS (V_{DD} = +5.5V, V_{SS} = -5.5V)						
Source OFF Leakage	$I_{S(OFF)}$	V_S = ±4.5V, V_D = ∓4.5V, Test Circuit 2	±1		nA	TYP
					nA	MAX
Drain OFF Leakage	$I_{D(OFF)}$	V_S = ±4.5V, V_D = ∓4.5V, Test Circuit 2	±1		nA	TYP
					nA	MAX
Channel ON Leakage	I_D, $I_{S(ON)}$	V_S or V_D = ±4.5V, V_D or V_S= ±4.5V or floating, Test Circuit 3	±150		nA	TYP
					nA	MAX
DIGITAL INPUTS						
Input High Voltage	V_{INH}				V	MIN
Input Low Voltage	V_{INL}				V	MAX
Input Current	I_{INL} or I_{INH}	V_{IN} = V_{GND} or V_{DD}	±1.5		nA	TYP
					nA	MAX
Digital Input Capacitance	C_{IN}		11		pF	TYP
DYNAMIC CHARACTERISTICS						
Transition Time	t_{TRANS}	V_S = 2.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 4	120		ns	TYP
						MAX
Break-Before-Make Time Delay	t_D	V_{S1} = V_{S2} = 2.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 5	60		ns	TYP
						MIN
EN Turn-On Time	t_{ON}	V_S = 2.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 6	60		ns	TYP
						MAX
EN Turn-Off Time	t_{OFF}	V_S = 2.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 6	90		ns	TYP
						MAX
Charge Injection	Q	C_L = 1nF, V_S = 0V, R_S = 0Ω, Test Circuit 7	40		pC	TYP

ELECTRICAL CHARACTERISTICS: ±5V Dual Supply (Cont.)

(V_{DD} = +5V ± 10%, V_{SS} = -5V ± 10%, GND = 0V, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM6512			
			+25℃	-40℃ to +85℃	UNITS	MIN/MAX
DYNAMIC CHARACTERISTICS						
Off Isolation	O_{ISO}	R_L = 50Ω, C_L = 5pF, f = 1MHz, Test Circuit 8	-90		dB	TYP
-3dB Bandwidth	BW	R_L = 50Ω, C_L = 5pF, Test Circuit 9	68		MHz	TYP
Channel-to-Channel Crosstalk	X_{TALK}	R_L = 50Ω, C_L = 5pF, f = 1MHz, Test Circuit 10	-70		dB	TYP
C_S (OFF)		V_S = 0V, f = 1MHz	13		pF	TYP
C_D (OFF)		V_S = 0V, f = 1MHz	80		pF	TYP
C_D, C_S (ON)		V_S = 0V, f = 1MHz	89		pF	TYP
POWER REQUIREMENTS (V_{DD} = +5.5V, V_{SS} = -5.5V)						
Positive Supply Current	I_{DD}	Digital Inputs = 0V or V_{DD}, V_D = V_{DD}/2	230		μA	TYP
					μA	MAX
V_{DD}/V_{SS}					V	MIN/MAX

ELECTRICAL CHARACTERISTICS: +12V Single Supply

(V_{DD} = +12V ± 10%, V_{SS} = 0V, GND = 0V, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM6512			
			+25℃	-40℃ to +85℃	UNITS	MIN/MAX
ANALOG SWITCH						
Analog Signal Range			V_{DD} to V_{SS}		V	
On-Resistance	R_{ON}	V_S = 0V to V_{DD}, I_S = -10mA, V_{DD} = 10.8V, V_{SS} = 0V, Test Circuit 1	24		Ω	TYP
					Ω	MAX
On-Resistance Match Between Channels	ΔR_{ON}	V_S = 0V to V_{DD}, I_S = -10mA	0.8		Ω	TYP
					Ω	MAX
On-Resistance Flatness	$R_{FLAT(ON)}$	V_S = 0V to V_{DD}, I_S = -10mA	12		Ω	TYP
					Ω	MAX
LEAKAGE CURRENTS (V_{DD} = 13.2V, V_{SS} = 0V)						
Source OFF Leakage	$I_{S(OFF)}$	V_S = 1V/10V, V_D = 10V/1V, Test Circuit 2	±1.5		nA	TYP
					nA	MAX
Drain OFF Leakage	$I_{D(OFF)}$	V_S = 1V/10V, V_D = 10V/1V, Test Circuit 2	±1.5		nA	TYP
					nA	MAX
Channel ON Leakage	I_D, $I_{S(ON)}$	V_S or V_D = 1V/10V, V_D or V_S = 1V/10V or floating, Test Circuit 3	±180		nA	TYP
					nA	MAX
DIGITAL INPUTS						
Input High Voltage	V_{INH}				V	MIN
Input Low Voltage	V_{INL}				V	MAX
Input Current	I_{INL} or I_{INH}	V_{IN} = V_{GND} or V_{DD}	±3		nA	TYP
					nA	MAX
Digital Input Capacitance	C_{IN}		12		pF	TYP
DYNAMIC CHARACTERISTICS						
Transition Time	t_{TRANS}	V_S = 8V, R_L = 300Ω, C_L = 35pF, Test Circuit 4	100		ns	TYP
						MAX
Break-Before-Make Time Delay	t_D	V_{S1} = V_{S2} = 8V, R_L = 300Ω, C_L = 35pF, Test Circuit 5	60		ns	TYP
						MIN
EN Turn-On Time	t_{ON}	V_S = 8V, R_L = 300Ω, C_L = 35pF, Test Circuit 6	80		ns	TYP
						MAX
EN Turn-Off Time	t_{OFF}	V_S = 8V, R_L = 300Ω, C_L = 35pF, Test Circuit 6	100		ns	TYP
						MAX
Charge Injection	Q	C_L = 1nF, V_S = 6V, R_S = 0Ω, Test Circuit 7	20		pC	TYP

ELECTRICAL CHARACTERISTICS: +12V Single Supply (Cont.)

(V_{DD} = +12V ± 10%, V_{SS} = 0V, GND = 0V, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM6512			
			+25℃	-40℃ to +85℃	UNITS	MIN/MAX
DYNAMIC CHARACTERISTICS						
Off Isolation	O_{ISO}	R_L = 50Ω, C_L = 5pF, f = 1MHz, Test Circuit 8	-90		dB	TYP
-3dB Bandwidth	BW	R_L = 50Ω, C_L = 5pF, Test Circuit 9	70		MHz	TYP
Channel-to-Channel Crosstalk	X_{TALK}	R_L = 50Ω, C_L = 5pF, f = 1MHz, Test Circuit 10	-70		dB	TYP
C_S (OFF)		V_S = 6V, f = 1MHz	16		pF	TYP
C_D (OFF)		V_S = 6V, f = 1MHz	100		pF	TYP
C_D, C_S (ON)		V_S = 6V, f = 1MHz	113		pF	TYP
POWER REQUIREMENTS (V_{DD} = 12V)						
Positive Supply Current	I_{DD}	Digital Inputs = 0V or V_{DD}, V_D = V_{DD}/2	240		μA	TYP
					μA	MAX
V_{DD}					V	MIN/MAX

ELECTRICAL CHARACTERISTICS: +5V Single Supply

(V_{DD} = +5V ± 10%, V_{SS} = 0V, GND = 0V, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM6512			
			+25℃	-40℃ to +85℃	UNITS	MIN/MAX
ANALOG SWITCH						
Analog Signal Range			V_{DD} to V_{SS}		V	
On-Resistance	R_{ON}	V_S = 0V to V_{DD}, I_S = -10mA, V_{DD} = 4.5V, V_{SS} = 0V, Test Circuit 1	26		Ω	TYP
					Ω	MAX
On-Resistance Match Between Channels	ΔR_{ON}	V_S = 0V to V_{DD}, I_S = -10mA, V_{DD} = 4.5V, V_{SS} = 0V	0.7		Ω	TYP
					Ω	MAX
On-Resistance Flatness	$R_{FLAT(ON)}$	V_S = 0V to V_{DD}, I_S = -10mA, V_{DD} = 4.5V, V_{SS} = 0V	8		Ω	TYP
					Ω	MAX
LEAKAGE CURRENTS (V_{DD} = 5.5V, V_{SS} = 0V)						
Source OFF Leakage	$I_{S(OFF)}$	V_S = 1V/4.5V, V_D = 4.5V/1V, Test Circuit 2	±0.5		nA	TYP
					nA	MAX
Drain OFF Leakage	$I_{D(OFF)}$	V_S = 1V/4.5V, V_D = 4.5V/1V, Test Circuit 2	±0.5		nA	TYP
					nA	MAX
Channel ON Leakage	I_D, $I_{S(ON)}$	V_S or V_D = 1V/4.5V, V_D or V_S = 1V/4.5V or floating, Test Circuit 3	±80		nA	TYP
					nA	MAX
DIGITAL INPUTS						
Input High Voltage	V_{INH}				V	MIN
Input Low Voltage	V_{INL}				V	MAX
Input Current	I_{INL} or I_{INH}	V_{IN} = V_{GND} or V_{DD}	±0.5		nA	TYP
					nA	MAX
Digital Input Capacitance	C_{IN}		12		pF	TYP
DYNAMIC CHARACTERISTICS						
Transition Time	t_{TRANS}	V_S = 2.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 4	130		ns	TYP
						MAX
Break-Before-Make Time Delay	t_D	V_{S1} = V_{S2} = 2.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 5	70		ns	TYP
						MIN
EN Turn-On Time	t_{ON}	V_S = 2.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 6	90		ns	TYP
						MAX
EN Turn-Off Time	t_{OFF}	V_S = 2.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 6	100		ns	TYP
						MAX
Charge Injection	Q	C_L = 1nF, V_S = 2.5V, R_S = 0Ω, Test Circuit 7	11		pC	TYP

ELECTRICAL CHARACTERISTICS: +5V Single Supply (Cont.)

(V_{DD} = +5V ± 10%, V_{SS} = 0V, GND = 0V, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM6512			
			+25℃	-40℃ to +85℃	UNITS	MIN/MAX
DYNAMIC CHARACTERISTICS						
Off Isolation	O_{ISO}	R_L = 50Ω, C_L = 5pF, f = 1MHz, Test Circuit 8	-90		dB	TYP
-3dB Bandwidth	BW	R_L = 50Ω, C_L = 5pF, Test Circuit 9	67		MHz	TYP
Channel-to-Channel Crosstalk	X_{TALK}	R_L = 50Ω, C_L = 5pF, f = 1MHz, Test Circuit 10	-70		dB	TYP
C_S (OFF)		V_S = 2.5V, f = 1MHz	16		pF	TYP
C_D (OFF)		V_S = 2.5V, f = 1MHz	107		pF	TYP
C_D, C_S (ON)		V_S = 2.5V, f = 1MHz	117		pF	TYP
POWER REQUIREMENTS (V_{DD} = 5.5V)						
Positive Supply Current	I_{DD}	Digital Inputs = 0V or V_{DD}, V_D = V_{DD}/2	80		μA	TYP
					μA	MAX
V_{DD}					V	MIN/MAX

ELECTRICAL CHARACTERISTICS: +3.3V Single Supply

(V_{DD} = +3.3V, V_{SS} = 0V, GND = 0V, unless otherwise noted.)

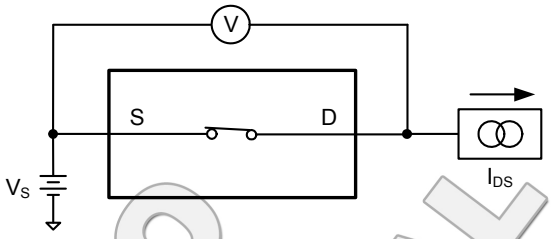
PARAMETER	SYMBOL	CONDITIONS	SGM6512			
			+25℃	-40℃ to +85℃	UNITS	MIN/MAX
ANALOG SWITCH						
Analog Signal Range			V_{DD} to V_{SS}		V	
On-Resistance	R_{ON}	V_S = 0V to V_{DD}, I_S = -10mA, V_{DD} = 3.3V, V_{SS} = 0V, Test Circuit 1	34		Ω	TYP
On-Resistance Match Between Channels	ΔR_{ON}	V_S = 0V to V_{DD}, I_S = -10mA, V_{DD} = 3.3V, V_{SS} = 0V	0.8		Ω	TYP
On-Resistance Flatness	$R_{FLAT(ON)}$	V_S = 0V to V_{DD}, I_S = -10mA, V_{DD} = 3.3V, V_{SS} = 0V	9		Ω	TYP
LEAKAGE CURRENTS (V_{DD} = 3.6V, V_{SS} = 0V)						
Source OFF Leakage	$I_{S(OFF)}$	V_S = 0.6V/3V, V_D = 3V/0.6V, Test Circuit 2	±0.5		nA	TYP
					nA	MAX
Drain OFF Leakage	$I_{D(OFF)}$	V_S = 0.6V/3V, V_D = 3V/0.6V, Test Circuit 2	±0.5		nA	TYP
					nA	MAX
Channel ON Leakage	I_D, $I_{S(ON)}$	V_S or V_D = 0.6V/3V, V_D or V_S = 0.6V/3V or floating, Test Circuit 3	±1		nA	TYP
					nA	MAX
DIGITAL INPUTS						
Input High Voltage	V_{INH}				V	MIN
Input Low Voltage	V_{INL}				V	MAX
Input Current	I_{INL} or I_{INH}	V_{IN} = V_{GND} or V_{DD}	±0.5		nA	TYP
					nA	MAX
Digital Input Capacitance	C_{IN}		12		pF	TYP
DYNAMIC CHARACTERISTICS						
Transition Time	t_{TRANS}	V_S = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 4	230		ns	TYP
						MAX
Break-Before-Make Time Delay	t_D	V_{S1} = V_{S2} = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 5	110		ns	TYP
						MIN
EN Turn-On Time	t_{ON}	V_S = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 6	160		ns	TYP
						MAX
EN Turn-Off Time	t_{OFF}	V_S = 1.5V, R_L = 300Ω, C_L = 35pF, Test Circuit 6	150		ns	TYP
						MAX
Charge Injection	Q	C_L = 1nF, V_S = 1.5V, R_S = 0Ω, Test Circuit 7	10		pC	TYP

ELECTRICAL CHARACTERISTICS: +3.3V Single Supply (Cont.)

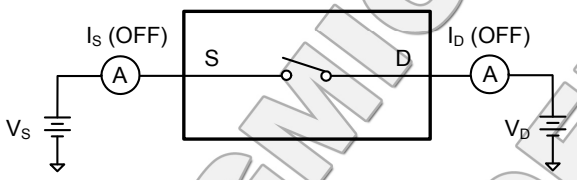
(V_{DD} = +3.3V, V_{SS} = 0V, GND = 0V, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	SGM6512			
			+25℃	-40℃ to +85℃	UNITS	MIN/MAX
DYNAMIC CHARACTERISTICS						
Off Isolation	O_{ISO}	R_L = 50Ω, C_L = 5pF, f = 1MHz, Test Circuit 8	-90		dB	TYP
-3dB Bandwidth	BW	R_L = 50Ω, C_L = 5pF, Test Circuit 9	63		MHz	TYP
Channel-to-Channel Crosstalk	X_{TALK}	R_L = 50Ω, C_L = 5pF, f = 1MHz, Test Circuit 10	-70		dB	TYP
C_S (OFF)		V_S = 1.5V, f = 1MHz	16		pF	TYP
C_D (OFF)		V_S = 1.5V, f = 1MHz	107		pF	TYP
C_D, C_S (ON)		V_S = 1.5V, f = 1MHz	124		pF	TYP
POWER REQUIREMENTS (V_{DD} = 3.6V)						
Positive Supply Current	I_{DD}	Digital Inputs = 0V or V_{DD}, V_D = V_{DD}/2	70		μA	TYP
					μA	MAX
V_{DD}					V	MIN/MAX

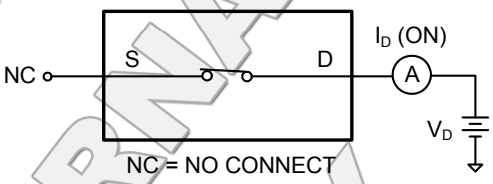
TEST CIRCUITS



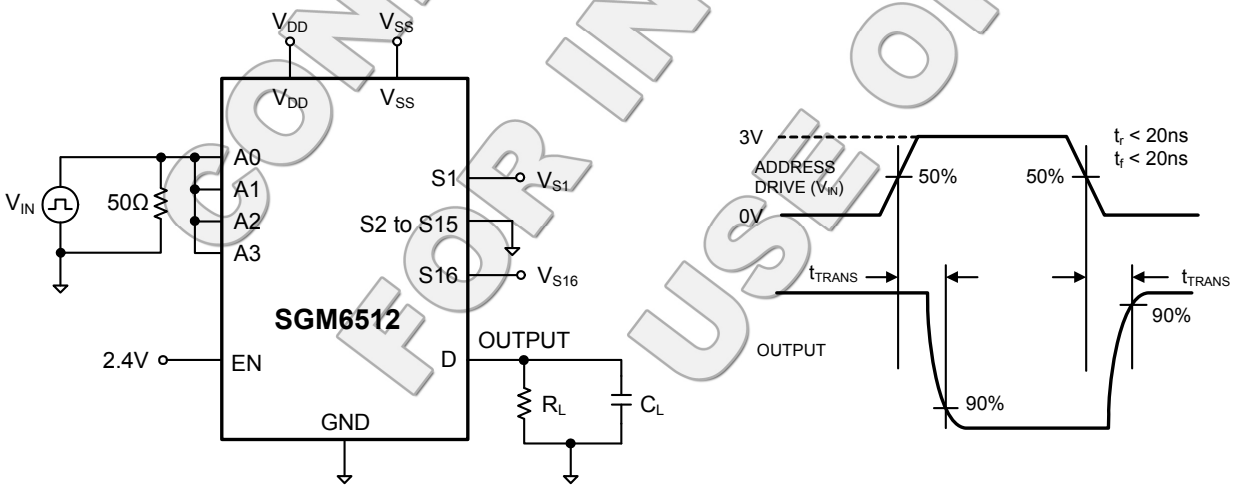
Test Circuit 1. On-Resistance



Test Circuit 2. OFF Leakage

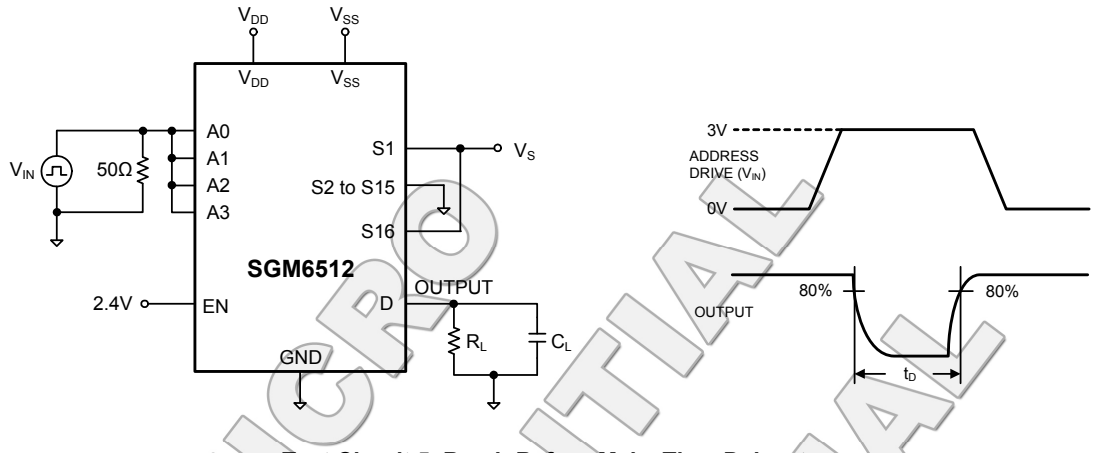


Test Circuit 3. ON Leakage

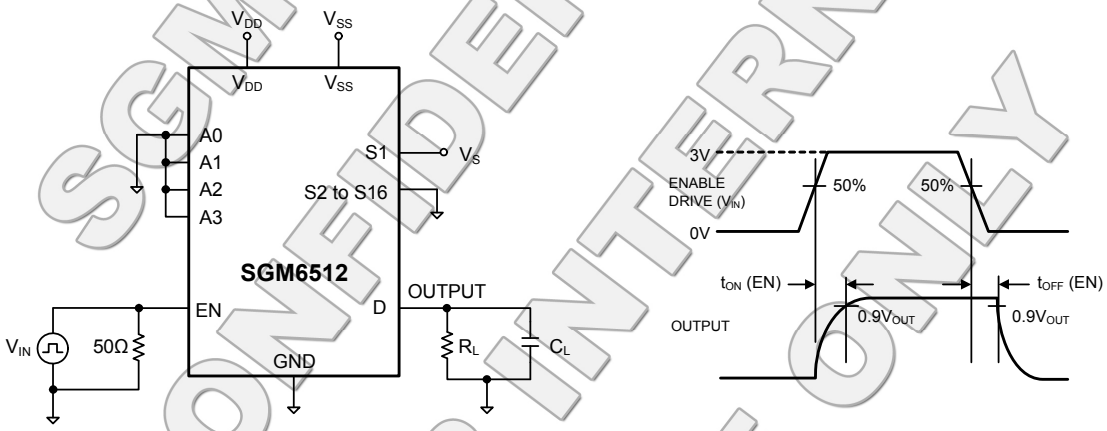


Test Circuit 4. Address to Output Switching Times, t_{TRANS}

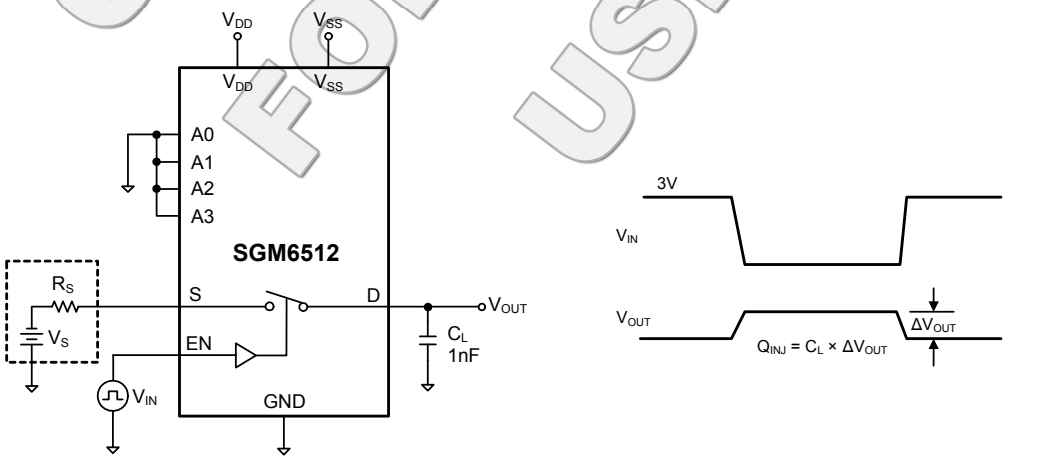
TEST CIRCUITS



Test Circuit 5. Break-Before-Make Time Delay, t_D

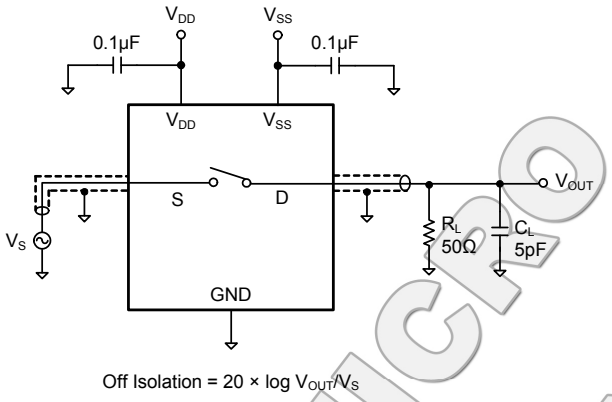


Test Circuit 6. Enable Delay, t_{ON} (EN), t_{OFF} (EN)



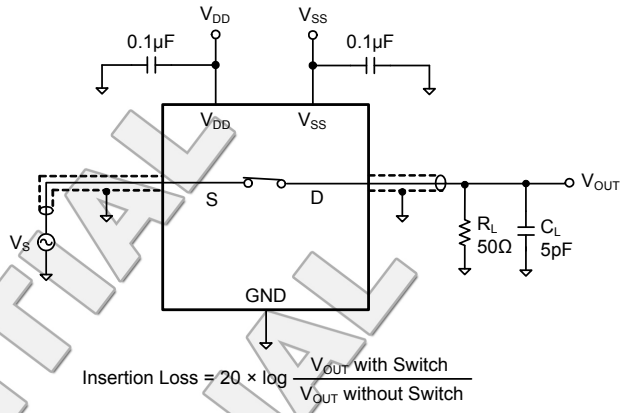
Test Circuit 7. Charge Injection

TEST CIRCUITS



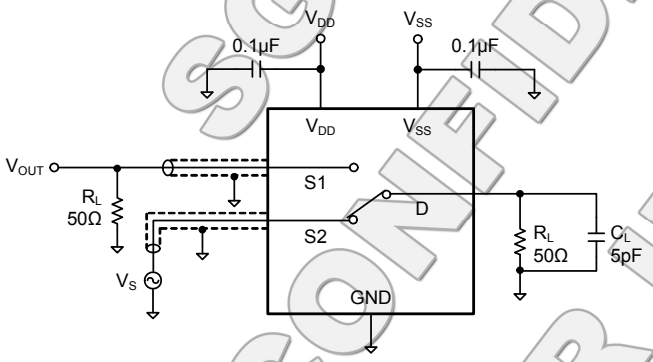
Off Isolation = 20 × log V_{OUT}/V_S

Test Circuit 8. Off Isolation



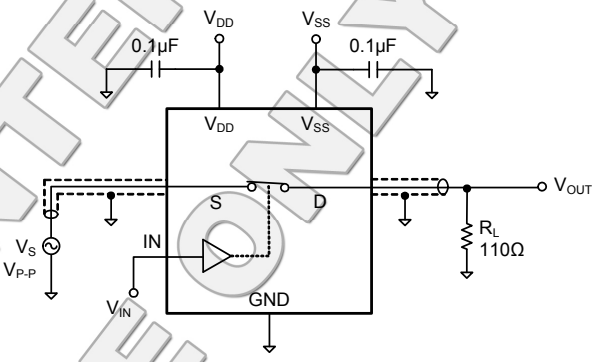
Insertion Loss = 20 × log $\frac{V_{OUT} \text{ with Switch}}{V_{OUT} \text{ without Switch}}$

Test Circuit 9. -3dB Bandwidth



Channel to Channel Crosstalk = 20 × log V_{OUT}/V_S

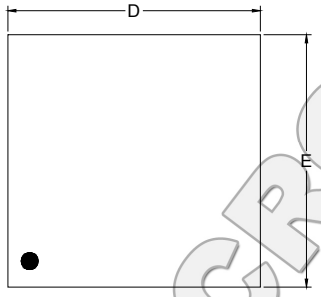
Test Circuit 10. Channel-to-Channel Crosstalk



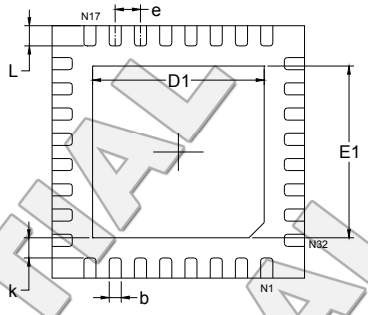
Test Circuit 11. Total Harmonic Distortion

PACKAGE OUTLINE DIMENSIONS

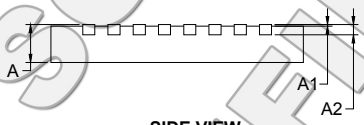
TQFN-5×5-32L



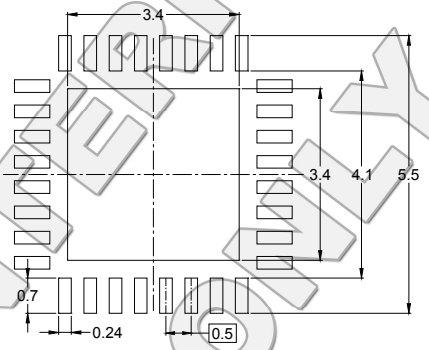
TOP VIEW



BOTTOM VIEW



SIDE VIEW

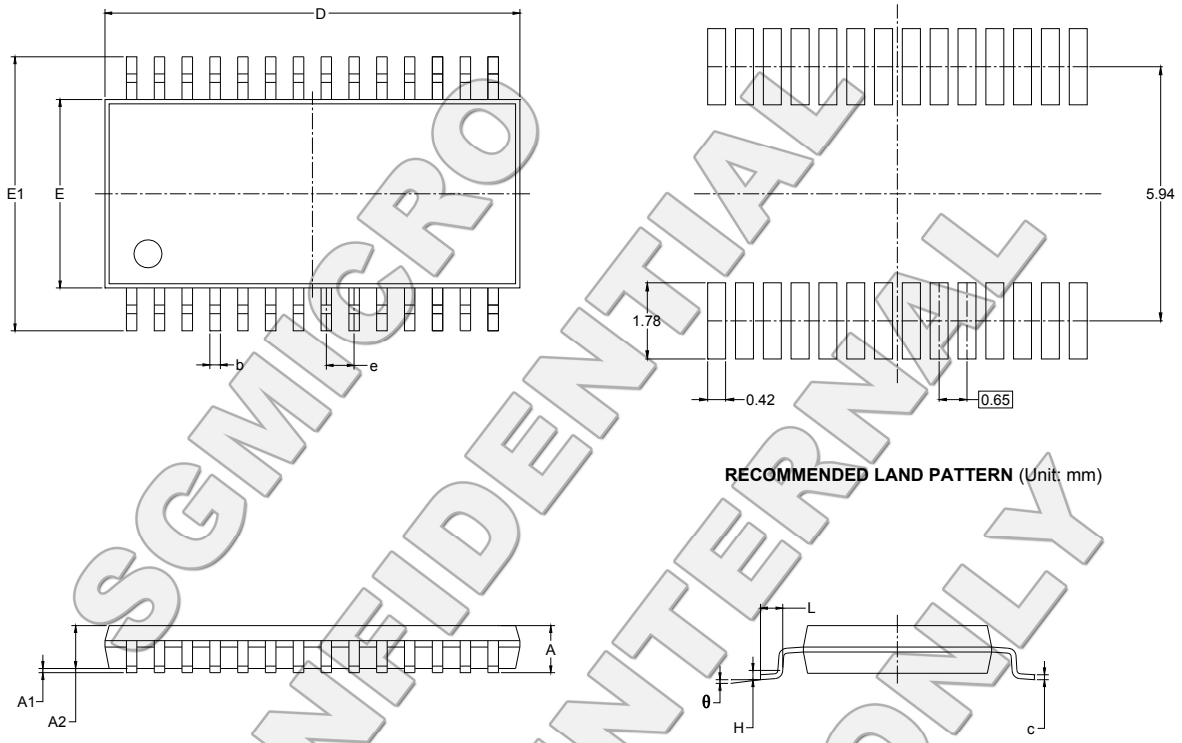


RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	4.924	5.076	0.194	0.200
D1	3.300	3.500	0.130	0.138
E	4.924	5.076	0.194	0.200
E1	3.300	3.500	0.130	0.138
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.324	0.476	0.013	0.019

PACKAGE OUTLINE DIMENSIONS

TSSOP-28

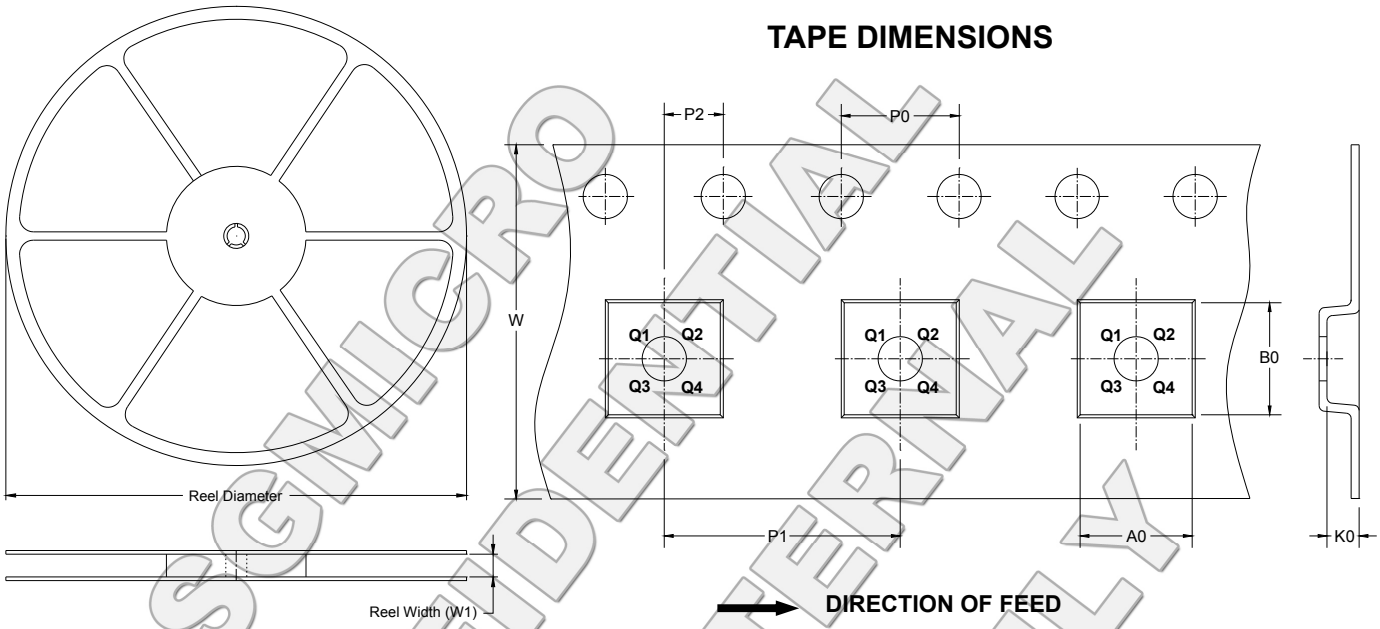


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.020	0.150	0.001	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	9.600	9.800	0.378	0.386
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS

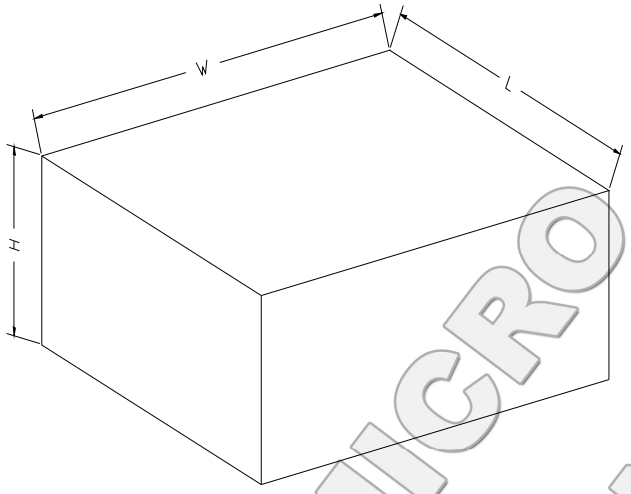


NOTE: The picture is only for reference. Please make the object as the standard.

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
TSSOP-28	13″	16.4	6.8	10.25	1.6	4.0	8.0	2.0	16.0	Q1
TQFN-5×5-32L	13″	12.4	5.30	5.30	1.10	4.00	8.00	2.00	12.00	Q1

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
13″	386	280	370	5

REVISION HISTORY

VERSION	DATE	PAGE	LOCATION	REMARK