SGM4520
36V High Voltage, CMOS Analog Switch

GENERAL DESCRIPTION

The SGM4520 is configured as three single-pole/ double-throw (SPDT) switches. It operates from +3.2V to +36V single power supply or ±3.2V to ±18V dual power supplies.

The SGM4520 features high voltage, low on-resistance and low distortion. The high performances make it very suitable for multiple applications, such as battery-operated equipment, audio and video signal routing, etc.

TTL/CMOS logic compatibility can be guaranteed when using a single +5V or dual ±5V power supplies because the logic thresholds of all digital inputs are between 0.8V and 2.4V.

The SGM4520 is available in Green SOIC-16, SSOP-16, TSSOP-16 and TQFN-3×3-16L packages. It operates over an operating temperature range of -40℃ to +125℃.

FEATURES

- **Single Supply Voltage Range: +3.2V to +36V**
- **Dual-Supply Voltage Range: ±3.2V to ±18V**
- **High Off-Isolation: -82dB (R_L = 50Ω, f = 1MHz)**
- **On-Resistance:**
  22Ω (TYP) with Single 36V Supply
- **Low On-Resistance Flatness**
- **Low Off-Leakage Current: 0.01μA (TYP) at +25℃**
- **Low On-Leakage Current: 0.01μA (TYP) at +25℃**
- **Low Crosstalk: -88dB (TYP) (R_L = 50Ω, f = 1MHz)**
- **Low Distortion: 0.001% (R_L = 600Ω, f = 1kHz)**
- **Rail-to-Rail Input and Output Operation**
- **TTL/CMOS-Logic Compatible**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green SOIC-16, SSOP-16, TSSOP-16 and TQFN-3×3-16L Packages**

APPLICATIONS

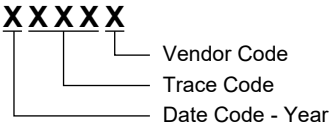
Portable Equipment
Sample-and-Hold Circuits
Battery-Powered Systems
Audio and Video Signal Routing

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM4520	SOIC-16	-40℃ to +125℃	SGM4520XS16G/TR	SGM4520XS16 XXXXX	Tape and Reel, 2500
	SSOP-16	-40℃ to +125℃	SGM4520XQS16G/TR	SGM4520 XQS16 XXXXX	Tape and Reel, 4000
	TSSOP-16	-40℃ to +125℃	SGM4520XTS16G/TR	SGM4520 XTS16 XXXXX	Tape and Reel, 4000
	TQFN-3×3-16L	-40℃ to +125℃	SGM4520XTQ16G/TR	4520TQ XXXXX	Tape and Reel, 4000

MARKING INFORMATION

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



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

Voltages Referenced to V_{EE}

V_{CC} ..... -0.3V to 40V
GND ..... -0.3V to 40V
Analog Switch I/O Voltage, V_{IS} ..... (V_{EE} - 0.3V) to (V_{CC} + 0.3V)
Digital Control Voltage ..... (GND - 0.3V) to (V_{CC} + 0.3V)
Continuous Current into Analog Switch I/O, X_, Y_, Z_ (1) or X, Y, Z ..... ±40mA
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 3000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ..... -40℃ to +125℃

NOTE:
1. X_: Analog Switch Inputs X0, X1,
   Y_: Analog Switch Inputs Y0, Y1,
   Z_: Analog Switch Inputs Z0, Z1.

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

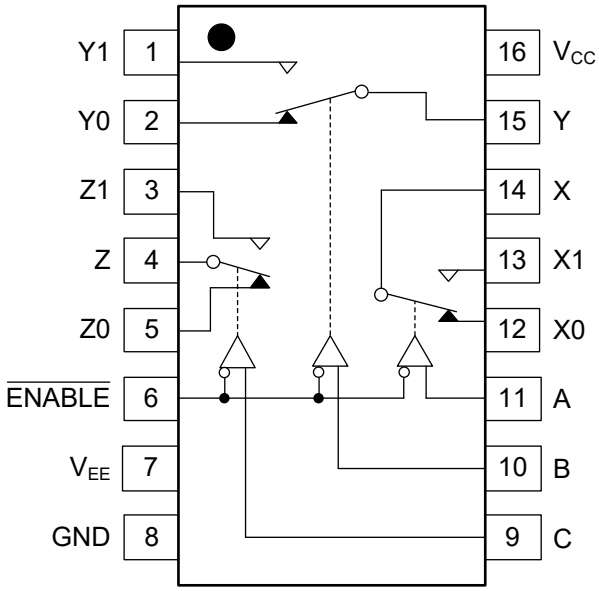
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

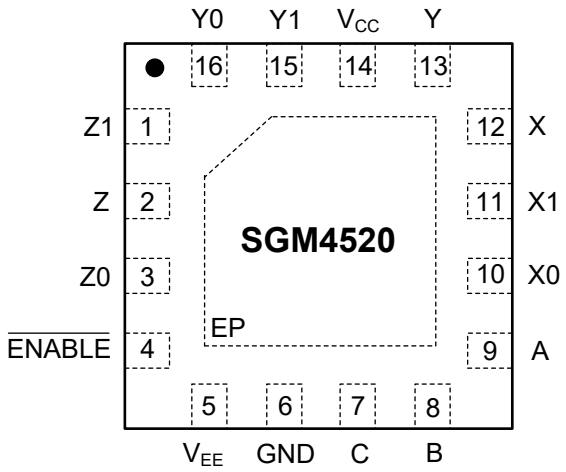
PIN CONFIGURATIONS

(TOP VIEW)



SOIC-16/SSOP-16/TSSOP-16

(TOP VIEW)



TQFN-3×3-16L

PIN DESCRIPTION

PIN		NAME	FUNCTION
SOIC-16, SSOP-16, TSSOP-16	TQFN-3×3-16L		
14	12	X	Analog Switch "X" Output Pin.
15	13	Y	Analog Switch "Y" Output Pin.
4	2	Z	Analog Switch "Z" Output Pin.
13	11	X1	Analog Switch "X" Normally Open Input Pin.
12	10	X0	Analog Switch "X" Normally Closed Input Pin.
1	15	Y1	Analog Switch "Y" Normally Open Input Pin.
2	16	Y0	Analog Switch "Y" Normally Closed Input Pin.
3	1	Z1	Analog Switch "Z" Normally Open Input Pin.
5	3	Z0	Analog Switch "Z" Normally Closed Input Pin.
16	14	V_{CC}	Positive Analog and Digital Supply Voltage Input Pin.
11	9	A	Digital Address "A" Input Pin.
10	8	B	Digital Address "B" Input Pin.
9	7	C	Digital Address "C" Input Pin.
8	6	GND	Ground.
7	5	V_{EE}	Negative Analog Supply Voltage Input Pin. Connect to GND for single-supply operation.
6	4	$\overline{ENABLE}$	Digital Enable Control Input Pin (Active Low). Normally connected to GND.
—	Exposed Pad	EP	Exposed Pad. It can be connected to V_{EE} or be left floating.

NOTE:
Any input terminal can be used as an output terminal, and any output terminal can also be used as an input terminal. Signal transmission in both directions is equally well.

FUNCTION TABLE

$\overline{\text{ENABLE}}$ Input	Select Inputs			On Switches
	C	B	A	
H	***X***	***X***	***X***	All Switches Open
L	L	L	L	X-X0, Y-Y0, Z-Z0
L	L	L	H	X-X1, Y-Y0, Z-Z0
L	L	H	L	X-X0, Y-Y1, Z-Z0
L	L	H	H	X-X1, Y-Y1, Z-Z0
L	H	L	L	X-X0, Y-Y0, Z-Z1
L	H	L	H	X-X1, Y-Y0, Z-Z1
L	H	H	L	X-X0, Y-Y1, Z-Z1
L	H	H	H	X-X1, Y-Y1, Z-Z1

X = Don't care.

DC ELECTRICAL CHARACTERISTICS

(V_{CC} = 3.2V to 36V, V_{EE} = 0V, GND = 0V, Full = -40℃ to +125℃, typical values are at T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Analog Switch							
Analog Signal Range	$V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$, V_X, V_Y, V_Z		Full	V_{EE}		V_{CC}	V
On-Resistance	R_{ON}	V_{CC} = 3.2V, I_X, I_Y, I_Z = 10mA	+25℃		26	34	Ω
			Full			44	
		V_{CC} = 5V to 36V, I_X, I_Y, I_Z = 10mA	+25℃		22	29	
			Full			45	
On-Resistance Match Between Channels	ΔR_{ON}	V_{CC} = 3.2V, I_X, I_Y, I_Z = 10mA	+25℃		0.1	4	Ω
			Full			5	
		V_{CC} = 5V to 36V, I_X, I_Y, I_Z = 10mA	+25℃		0.2	3	
			Full			4	
On-Resistance Flatness	$R_{FLAT(ON)}$	V_{CC} = 3.2V, I_X, I_Y, I_Z = 10mA	+25℃		8	14	Ω
			Full			18	
		V_{CC} = 5V to 36V, I_X, I_Y, I_Z = 10mA	+25℃		11	17	
			Full			26	
X_, Y_, Z_ Off Leakage Current	$I_{X\_(OFF)}$, $I_{Y\_(OFF)}$, $I_{Z\_(OFF)}$	V_{CC} = 18V, V_{EE} = -18V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = ±18V, V_X, V_Y, V_Z = ∓18V	Full		0.01	2	μA
X, Y, Z Off Leakage Current	$I_{X(OFF)}$, $I_{Y(OFF)}$, $I_{Z(OFF)}$	V_{CC} = 18V, V_{EE} = -18V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = ±18V, V_X, V_Y, V_Z = ∓18V	Full		0.01	2	μA
X, Y, Z On Leakage Current	$I_{X(ON)}$, $I_{Y(ON)}$, $I_{Z(ON)}$	V_{CC} = 18V, V_{EE} = -18V, V_X, V_Y, V_Z = ±18V, V_X , V_Y , V_Z = Floating	Full		0.01	1.5	μA
Digital I/O							
Input High Voltage	V_{AH}, V_{BH}, V_{CH}, $V_{\overline{ENABLEH}}$		Full	2.4			V
Input Low Voltage	V_{AL}, V_{BL}, V_{CL}, $V_{\overline{ENABLEL}}$		Full			0.8	V
High-Level Input Current	I_{AH}, I_{BH}, I_{CH}, $I_{\overline{ENABLEH}}$	V_A, V_B, V_C, $V_{\overline{ENABLE}}$ = V_{CC}	+25℃		0.3	1	μA
			Full			1.5	
Low-Level Input Current	I_{AL}, I_{BL}, I_{CL}, $I_{\overline{ENABLEL}}$	V_A, V_B, V_C, $V_{\overline{ENABLE}}$ = 0V	+25℃		0.01	1	μA
			Full			1.5	

AC ELECTRICAL CHARACTERISTICS

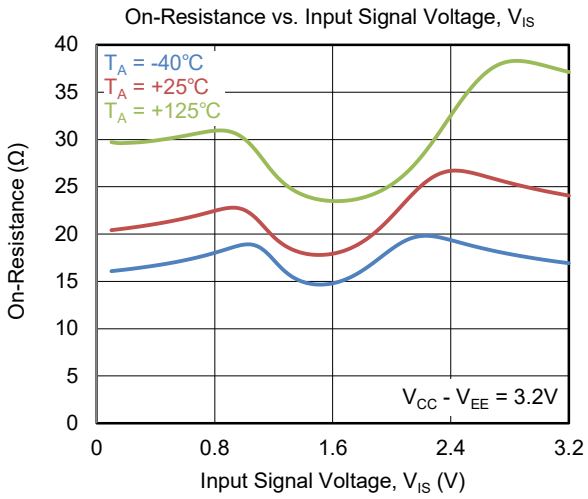
(V_{CC} = 3.2V to 36V, V_{EE} = 0V, GND = 0V, Full = -40℃ to +125℃, typical values are at T_A = +25℃, unless otherwise noted.)

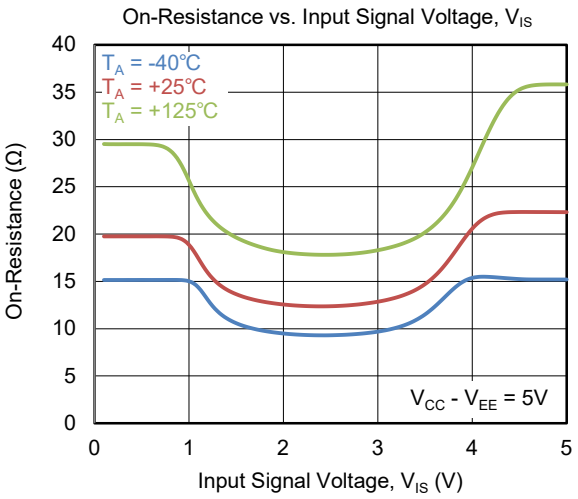
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Dynamic Characteristics							
Address Transition Time	t_{TRANS}	V_{CC} = 5V, V_{EE} = 0V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 3V, 0V, C_L = 35pF, R_L = 300Ω, Test Circuit 1	Full	**0.5**	135	**350**	ns
		V_{CC} = 18V, V_{EE} = -18V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 3V, -3V, C_L = 35pF, R_L = 300Ω, Test Circuit 1	Full	**15**	120	**250**	
Propagation Delay Time (Signal Input to Output)	t_{PD}	V_{CC} = 5V, V_{EE} = 0V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 0V to 3V Pulse, C_L = 35pF, R_L = 300Ω, Test Circuit 2	Full	**0.1**	1.8	**3**	ns
		V_{CC} = 18V, V_{EE} = -18V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 0V to 3V Pulse, C_L = 35pF, R_L = 300Ω, Test Circuit 2	Full	**0.1**	1.6	**2.5**	
$\overline{ENABLE}$ Turn-On Time	t_{ON}	V_{CC} = 5V, V_{EE} = 0V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 3V, C_L = 35pF, R_L = 300Ω, Test Circuit 3	Full	**4**	80	**185**	ns
		V_{CC} = 18V, V_{EE} = -18V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 3V, C_L = 35pF, R_L = 300Ω, Test Circuit 3	Full	**25**	70	**120**	
$\overline{ENABLE}$ Turn-Off Time	t_{OFF}	V_{CC} = 5V, V_{EE} = 0V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 3V, C_L = 35pF, R_L = 300Ω, Test Circuit 3	Full	**32**	130	**210**	ns
		V_{CC} = 18V, V_{EE} = -18V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 3V, C_L = 35pF, R_L = 300Ω, Test Circuit 3	Full	**40**	110	**165**	
Break-Before-Make Time	t_D	V_{CC} = 5V to 36V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 3V, C_L = 35pF, R_L = 300Ω, Test Circuit 4	+25℃		70		ns
Charge Injection	Q	V_{CC} = 5V, V_{EE} = 0V, R_S = 0Ω, C_L = 1nF, V_S = 0V, Test Circuit 5	+25℃		50		pC
		V_{CC} = 18V, V_{EE} = -18V, R_S = 0Ω, C_L = 1nF, V_S = 0V, Test Circuit 5	+25℃		180		
Channel-to-Channel Crosstalk	X_{TALK}	V_{CC} = 5V to 36V, R_L = 50Ω, f = 1MHz, Test Circuit 6	Full	**-75**	-88	**-95**	dB
Off Isolation	O_{ISO}	V_{CC} = 5V to 36V, R_L = 50Ω, f = 1MHz, Test Circuit 6	+25℃		-82		dB
Input Off-Capacitance	$C_{X\_(OFF)}$, $C_{Y\_(OFF)}$, $C_{Z\_(OFF)}$	V_{CC} = 5V, V_{EE} = 0V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 0V, f = 1MHz, Test Circuit 7	+25℃		10		pF
		V_{CC} = 18V, V_{EE} = -18V, $V_{X\_}$, $V_{Y\_}$, $V_{Z\_}$ = 0V, f = 1MHz, Test Circuit 7	+25℃		8		
Output Off-Capacitance	$C_{X(OFF)}$, $C_{Y(OFF)}$, $C_{Z(OFF)}$	V_{CC} = 5V, V_{EE} = 0V, V_X, V_Y, V_Z = 0V, f = 1MHz, Test Circuit 7	+25℃		20		pF
		V_{CC} = 18V, V_{EE} = -18V, V_X, V_Y, V_Z = 0V, f = 1MHz, Test Circuit 7	+25℃		10		
Output On-Capacitance	$C_{X(ON)}$, $C_{Y(ON)}$, $C_{Z(ON)}$	V_{CC} = 5V, V_{EE} = 0V, V_X, V_Y, V_Z = 0V, f = 1MHz, Test Circuit 7	+25℃		25		pF
		V_{CC} = 18V, V_{EE} = -18V, V_X, V_Y, V_Z = 0V, f = 1MHz, Test Circuit 7	+25℃		15		
-3dB Bandwidth	BW	V_{CC} = 5V, V_{EE} = 0V, R_L = 50Ω	Full	**100**	180	**300**	MHz
		V_{CC} = 18V, V_{EE} = -18V, R_L = 50Ω	Full	**220**	290	**400**	
Total Harmonic Distortion	THD	V_{CC} = 18V, V_{EE} = -18V, R_L = 600Ω, V_{OUT} = $5V_{P-P}$, f = 1kHz	+25℃		0.001		%
Power Supply							
Power Supply Range (Single Supply)	V_{CC}	V_{EE} = 0V	+25℃	+3.2		+36	V
Power Supply Range (Dual Supplies)	V_{CC}, V_{EE}		+25℃	±3.2		±18	
Power Supply Current	I_{CC}, I_{EE}	V_A, V_B, V_C, $V_{\overline{ENABLE}}$ = V_{CC} or 0V	+25℃		15	24	μA
			Full			26	

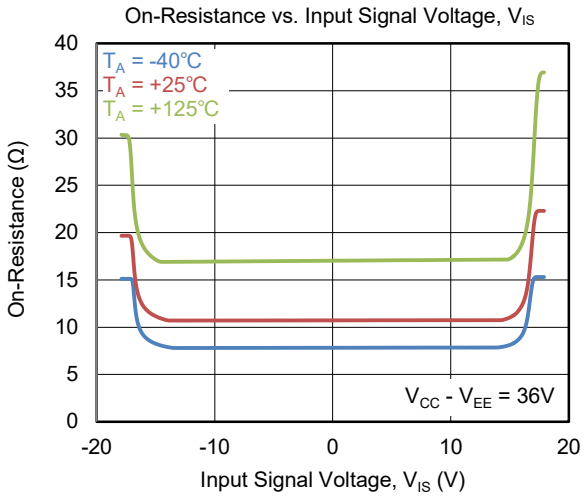
NOTE:

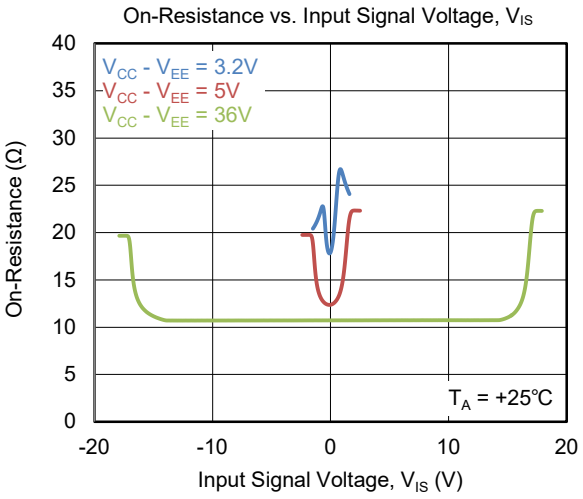
1. Bold values are specified by design and characterization; not production tested.

TYPICAL PERFORMANCE CHARACTERISTICS

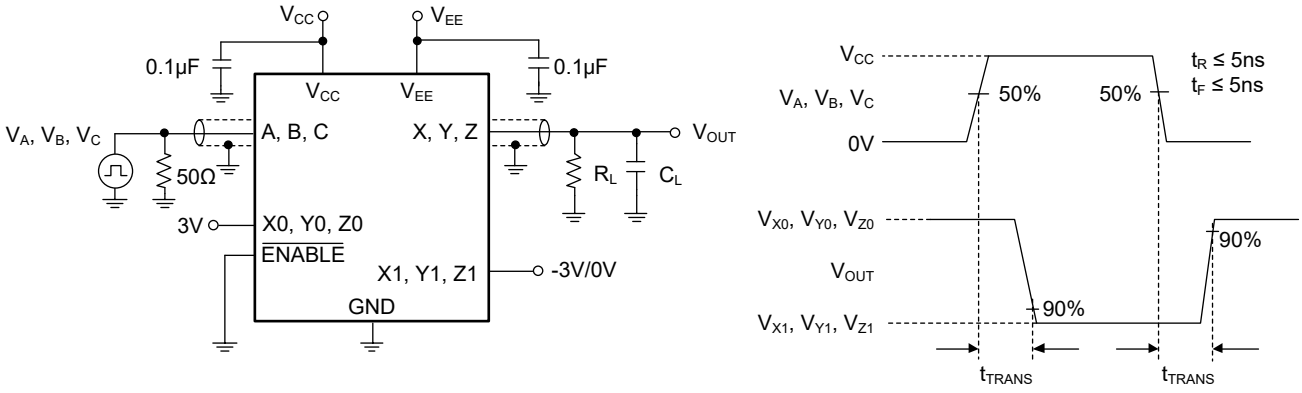




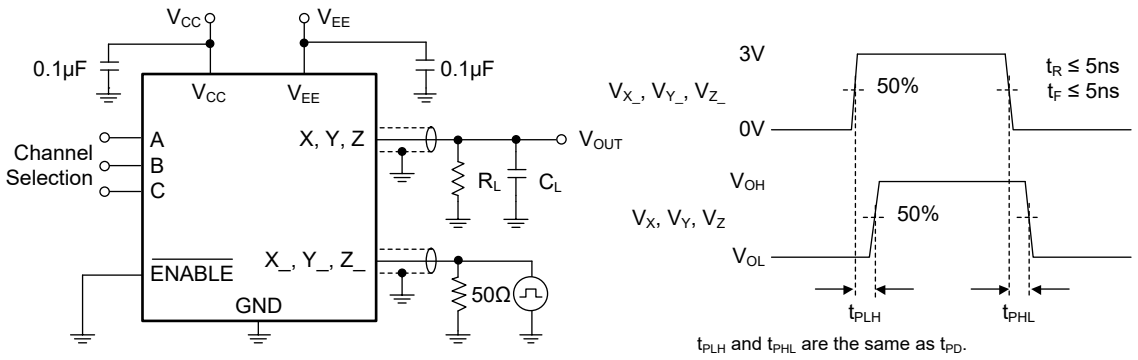




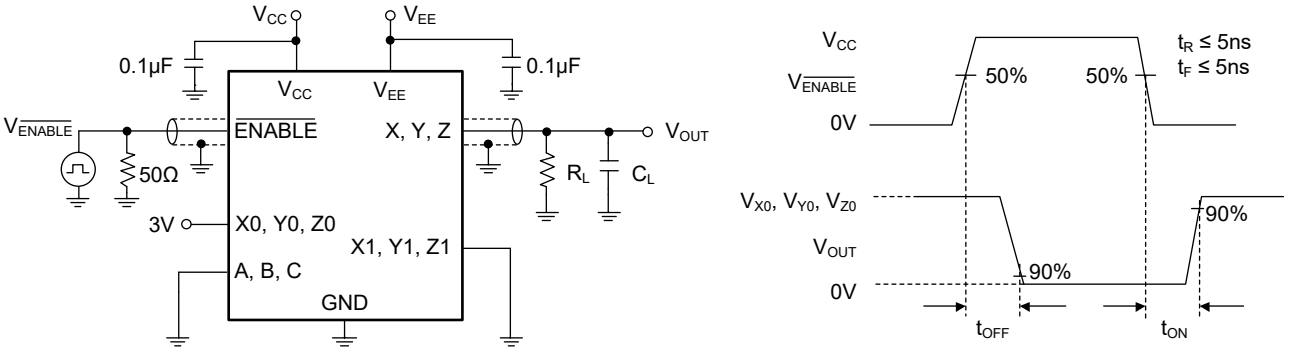
TEST CIRCUITS



Test Circuit 1. Address Transition Times (t_{TRANS})

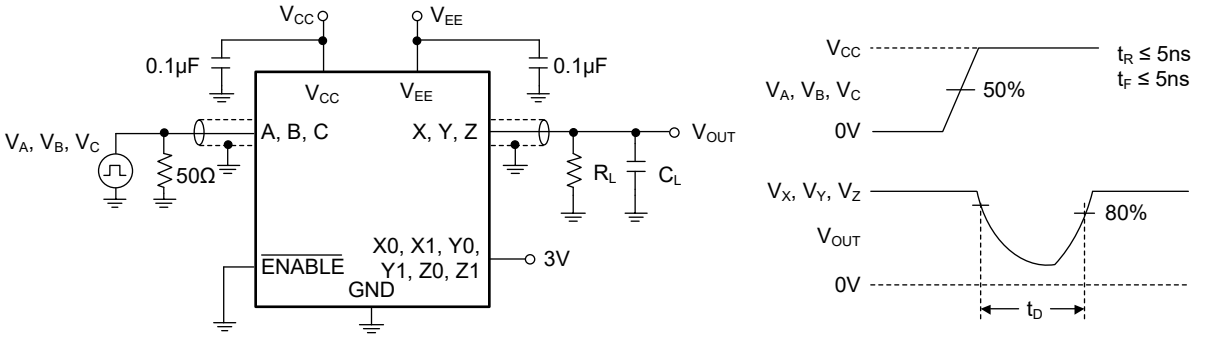


Test Circuit 2. Propagation Delay Time (t_{PD})

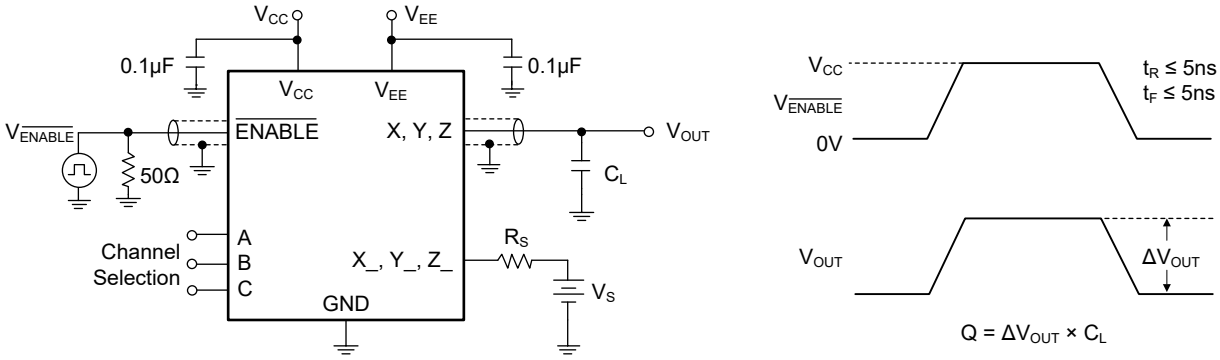


Test Circuit 3. Switching Times (t_{ON}, t_{OFF})

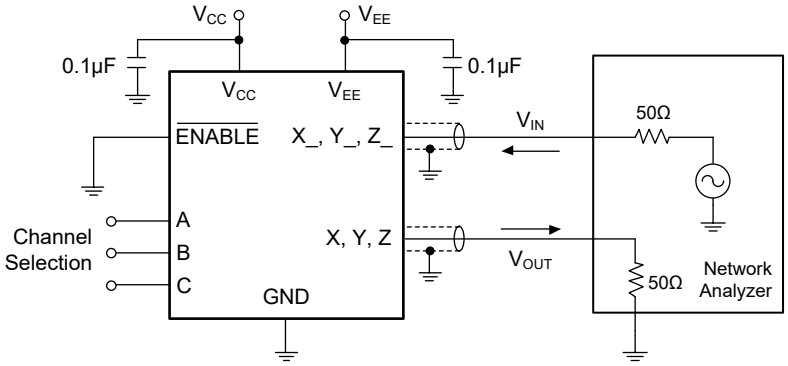
TEST CIRCUITS (continued)



Test Circuit 4. Break-Before-Make Time (t_D)



Test Circuit 5. Charge Injection (Q)



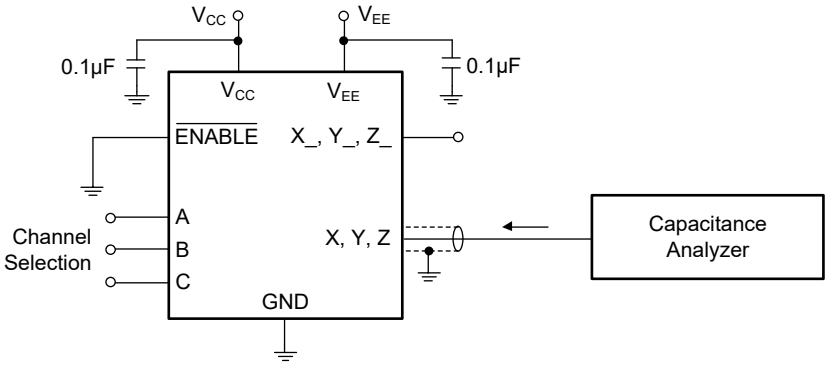
Off Isolation = 20log (V_{OUT}/V_{IN}) (Measured between X and "OFF" X_ Terminal on Each Switch)

Channel-to-Channel Crosstalk = 20log (V_{OUT}/V_{IN}) (Measured from One Channel (X, Y, Z) to All other Channels)

On Loss = 20log (V_{OUT}/V_{IN}) (Measured between X and "ON" X_ Terminal on Each Switch)

Test Circuit 6. Off Isolation, On Loss and Crosstalk

TEST CIRCUITS (continued)



Test Circuit 7. Capacitance

REVISION HISTORY

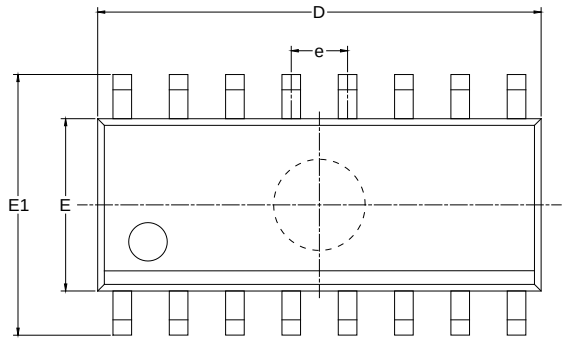
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

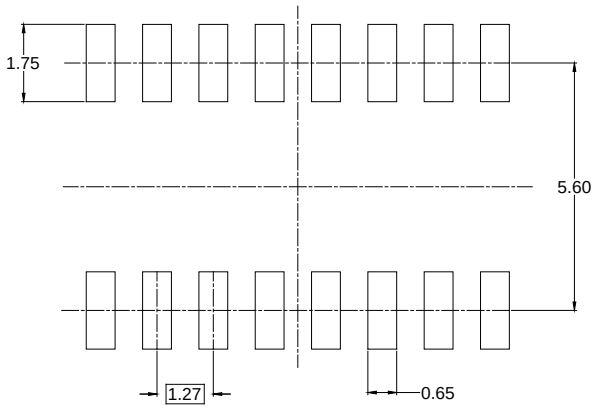
REV.A to REV.A.1	Page
Updated AC Electrical Characteristics section	6
Updated Test Circuits section	9

Changes from Original (DECEMBER 2020) to REV.A	Page
Changed from product preview to production data	All

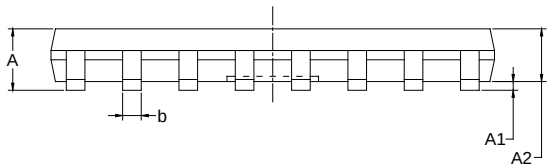
PACKAGE OUTLINE DIMENSIONS

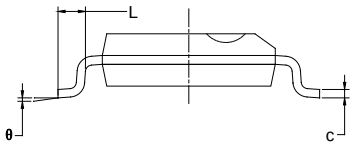
SOIC-16





RECOMMENDED LAND PATTERN (Unit: mm)



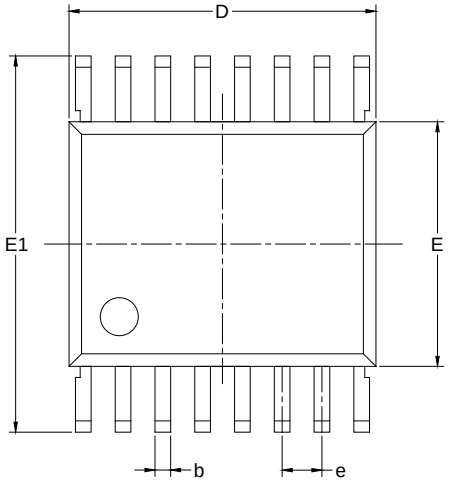


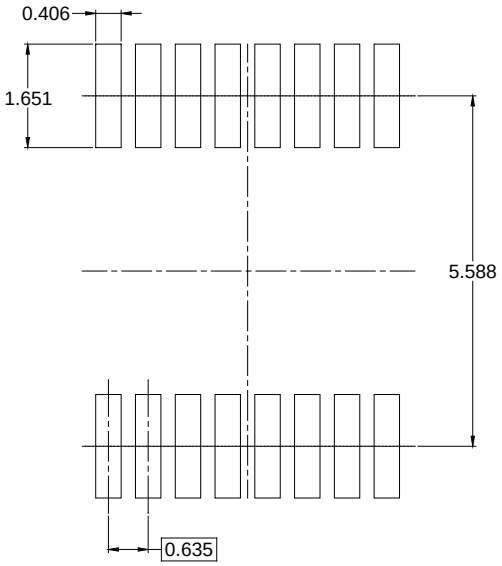
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	9.800	10.200	0.386	0.402
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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

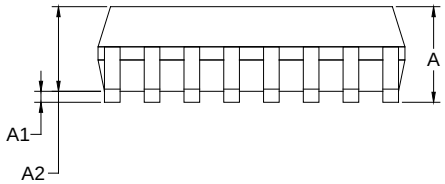
PACKAGE OUTLINE DIMENSIONS

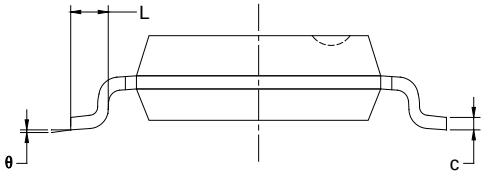
SSOP-16





RECOMMENDED LAND PATTERN (Unit: mm)



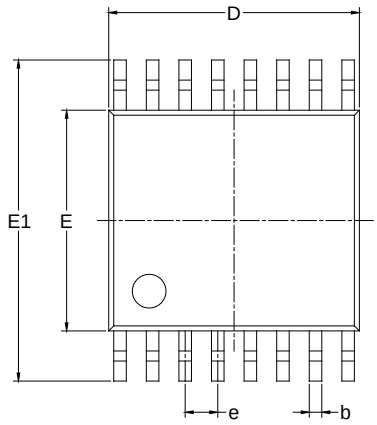


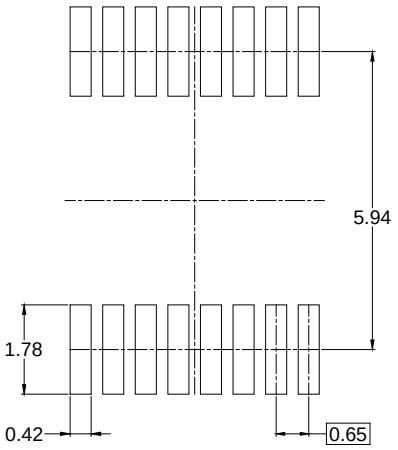
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.200	0.300	0.008	0.012
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	0.635 BSC		0.025 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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

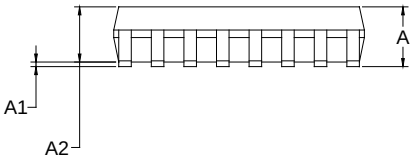
PACKAGE OUTLINE DIMENSIONS

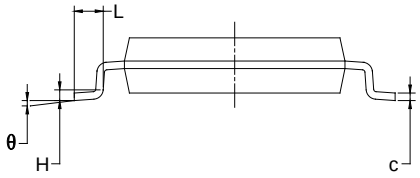
TSSOP-16





RECOMMENDED LAND PATTERN (Unit: mm)



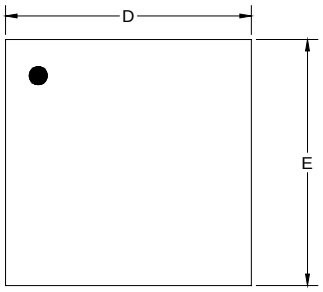


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.200	6.600	0.244	0.260
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

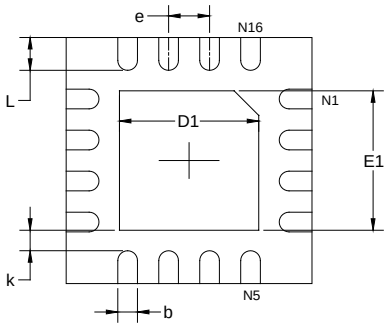
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

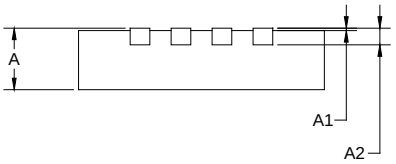
TQFN-3×3-16L



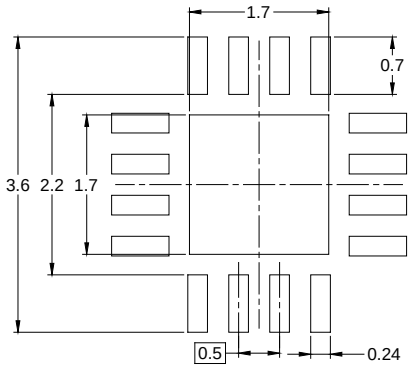
TOP VIEW



BOTTOM VIEW



SIDE VIEW



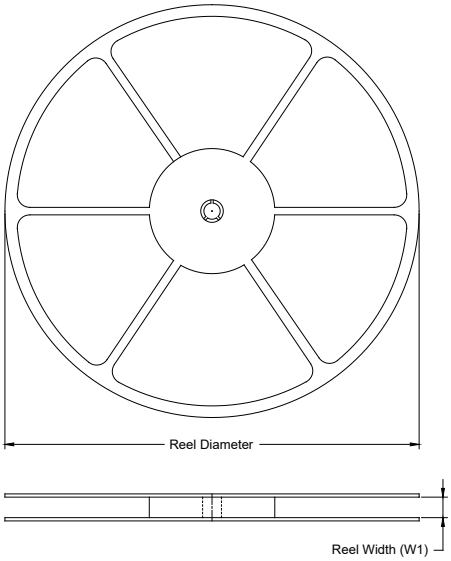
RECOMMENDED LAND PATTERN (Unit: mm)

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	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E	2.900	3.100	0.114	0.122
E1	1.600	1.800	0.063	0.071
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020

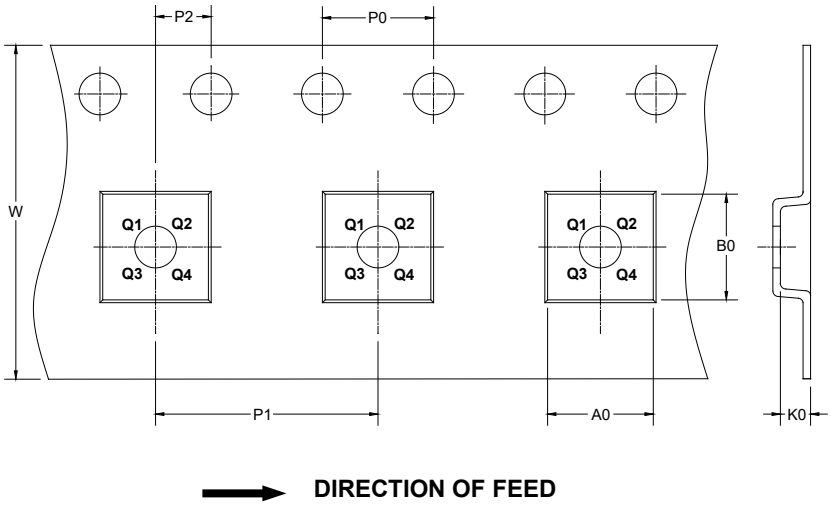
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



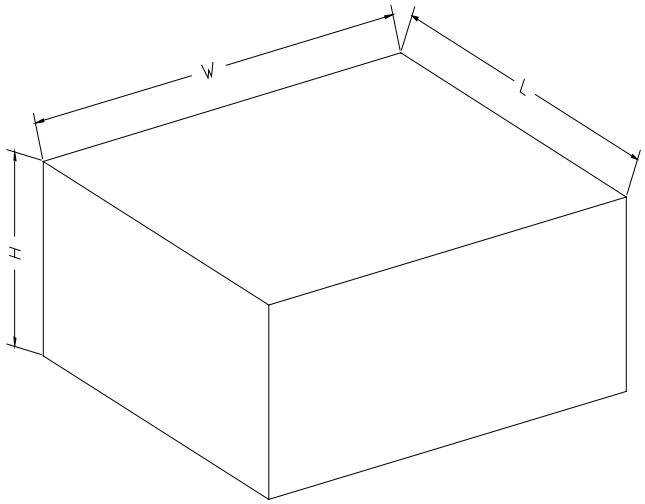
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOIC-16	13″	16.4	6.50	10.30	2.10	4.0	8.0	2.0	16.0	Q1
SSOP-16	13″	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
TSSOP-16	13″	12.4	6.90	5.60	1.20	4.0	8.0	2.0	12.0	Q1
TQFN-3×3-16L	13″	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q2

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
13″	386	280	370	5

DD0002