SGM6505
6-Bit, 1-of-2 Multiplexer/Demultiplexer with 1.8V Logic Compatible Control Inputs

GENERAL DESCRIPTION

The SGM6505 is a 6-bit 1-of-2 Mux/Demux designed to operate from 2.0V to 5.0V. This device can handle both digital and analog signals, and signals up to V_{CC} can be transmitted in either direction. The SGM6505 has two control pins, each controlling three 1-of-2 muxes at the same time, and an enable pin that is used to put all outputs in high-impedance mode. The control pins are compatible with 1.8V logic thresholds and are backward compatible with 2.5V and 3.3V logic thresholds as well.

The SGM6505 allows any SD, SDIO, and multimedia card host controllers to be expanded out to multiple cards or peripherals since the SDIO interface consists of 6-bits: CMD, CLK, and Data [0:3] signals. The SGM6505 has two control pins that give additional flexibility to the user. For example, the ability to mux two different audio-video signals in equipment such as an LCD television, an LCD monitor, or a notebook docking station.

The SGM6505 is available in Green TSSOP-24 and TQFN-4×4-24L packages. It operates over an ambient temperature range of -40℃ to +85℃.

FEATURES

- **Single-Supply Range: 2.0V to 5.0V**
- **Low Capacitance Switches: 15pF (TYP)**
- **On-State Resistance: 8.5Ω (TYP) at 3V**
- **-3dB Bandwidth: 450MHz**
- **Low Crosstalk: -55dB at 10MHz**
- **High Off-Isolation: -57dB at 10MHz**
- **1.8V Logic Threshold Compatibility for Control Inputs**
- **Available in Green TSSOP-24 and TQFN-4×4-24L Packages**
- **Extended Industrial Temperature Range: -40℃ to +85℃**

APPLICATIONS

SD/SDIO and MMC Two Port MUX
PC VGA Video MUX/Video Systems
Audio and Video Signal Routing

PACKAGE/ORDERING INFORMATION

MODEL	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM6505	TSSOP-24	-40℃ to +85℃	SGM6505YTS24G/TR	SGM6505YTS24	Tape and Reel, 2500
	TQFN-4×4-24L	-40℃ to +85℃	SGM6505YTQF24G/TR	SGM6505YTQF24	Tape and Reel, 3000

ABSOLUTE MAXIMUM RATINGS

Supply Voltage Range, V_{CC} ..... -0.3V to 5.5V
Analog Voltage Range, V_{NC}, V_{NO}, V_{COM} ..... -0.3V to 5.5V
Analog Port Diode Current, I_K
(V_{CC} < V_{NC}, V_{NO}, V_{COM} < 0) ..... -50mA
ON-State Switch Current, I_{NC}, I_{NO}, I_{COM}
(V_{NC}, V_{NO}, V_{COM} = 0 to V_{CC}) ..... -50mA to 50mA
Digital Input Voltage Range, V_I ..... -0.3V to 5.5V
Digital Input Clamp Current, I_{IK}
(V_{IO} < V_I < 0) ..... -50mA
Continuous Current through V_{CC}, I_{CC} 100mA
Continuous Current through GND, I_{GND} ..... -100mA
Storage Temperature Range ..... -65℃ to +150℃
Junction Temperature ..... 150℃
Operating Temperature Range ..... -40℃ to +85℃
Lead Temperature (Soldering, 10s) …….....260℃
ESD Susceptibility
HBM 8000V
MM 400V

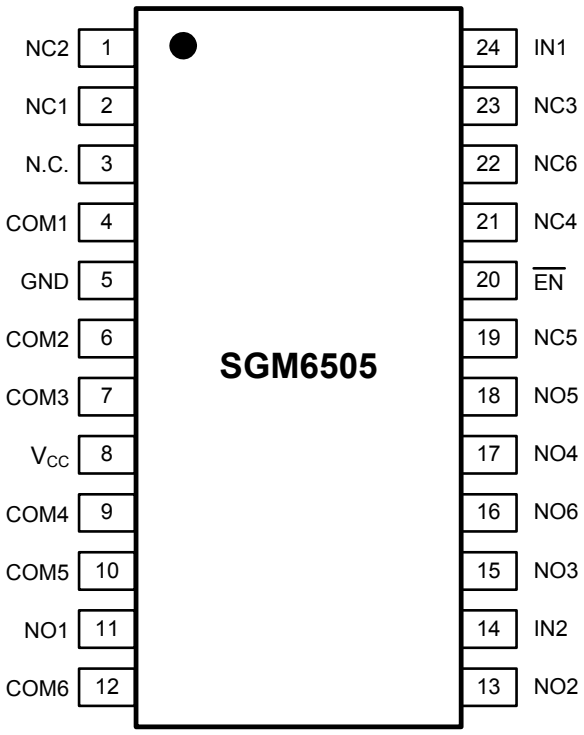
NOTE:
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. 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.

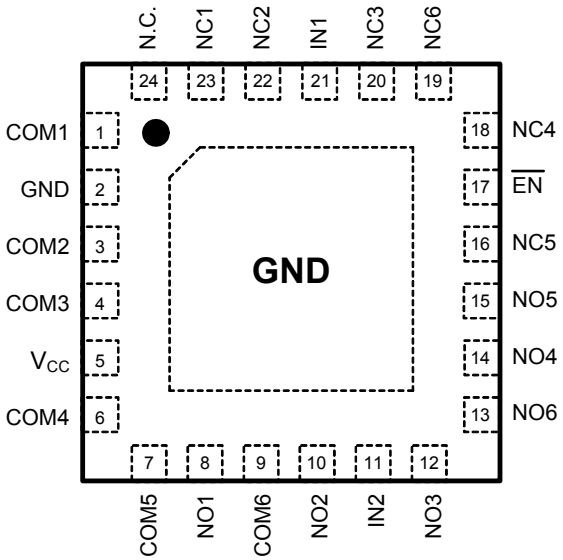
SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

PIN CONFIGURATIONS (TOP VIEW)



TSSOP-24

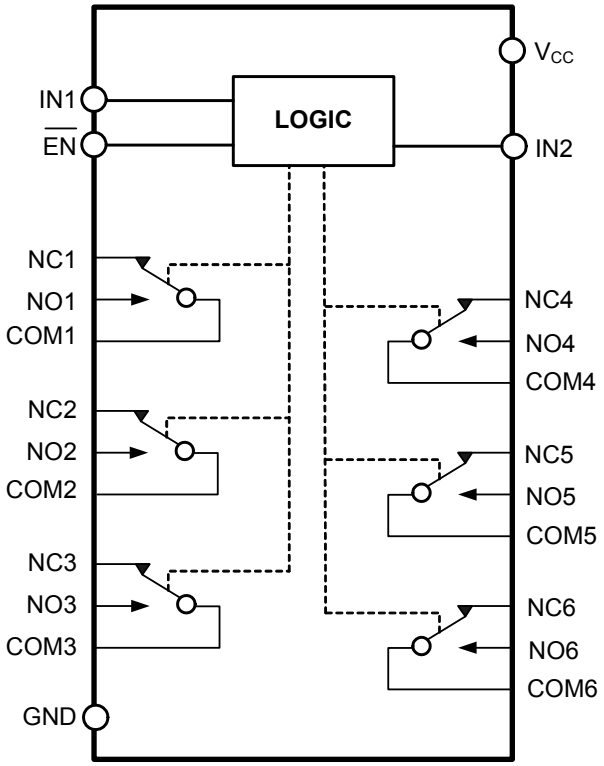
N.C. – No Internal Connection



TQFN-4×4-24L

N.C. – No Internal Connection

LOGIC DIAGRAM



FUNCTION TABLE

$\overline{EN}$	IN1	IN2	NC1/2/3 TO COM1/2/3 COM1/2/3 TO NC1/2/3	NC4/5/6 TO COM4/5/6 COM4/5/6 TO NC4/5/6	NO1/2/3 TO COM1/2/3 COM1/2/3 TO NO1/2/3	NO4/5/6 TO COM4/5/6 COM4/5/6 TO NO4/5/6
H	X	X	OFF	OFF	OFF	OFF
L	L	L	ON	ON	OFF	OFF
L	H	L	OFF	ON	ON	OFF
L	L	H	ON	OFF	OFF	ON
L	H	H	OFF	OFF	ON	ON

X = Don't Care.

ELECTRICAL CHARACTERISTICS

(V_{CC} = 3.0V to 5.0V, Full = -40℃to +85℃. Typical values are at T_A = +25℃, unless otherwise noted.)

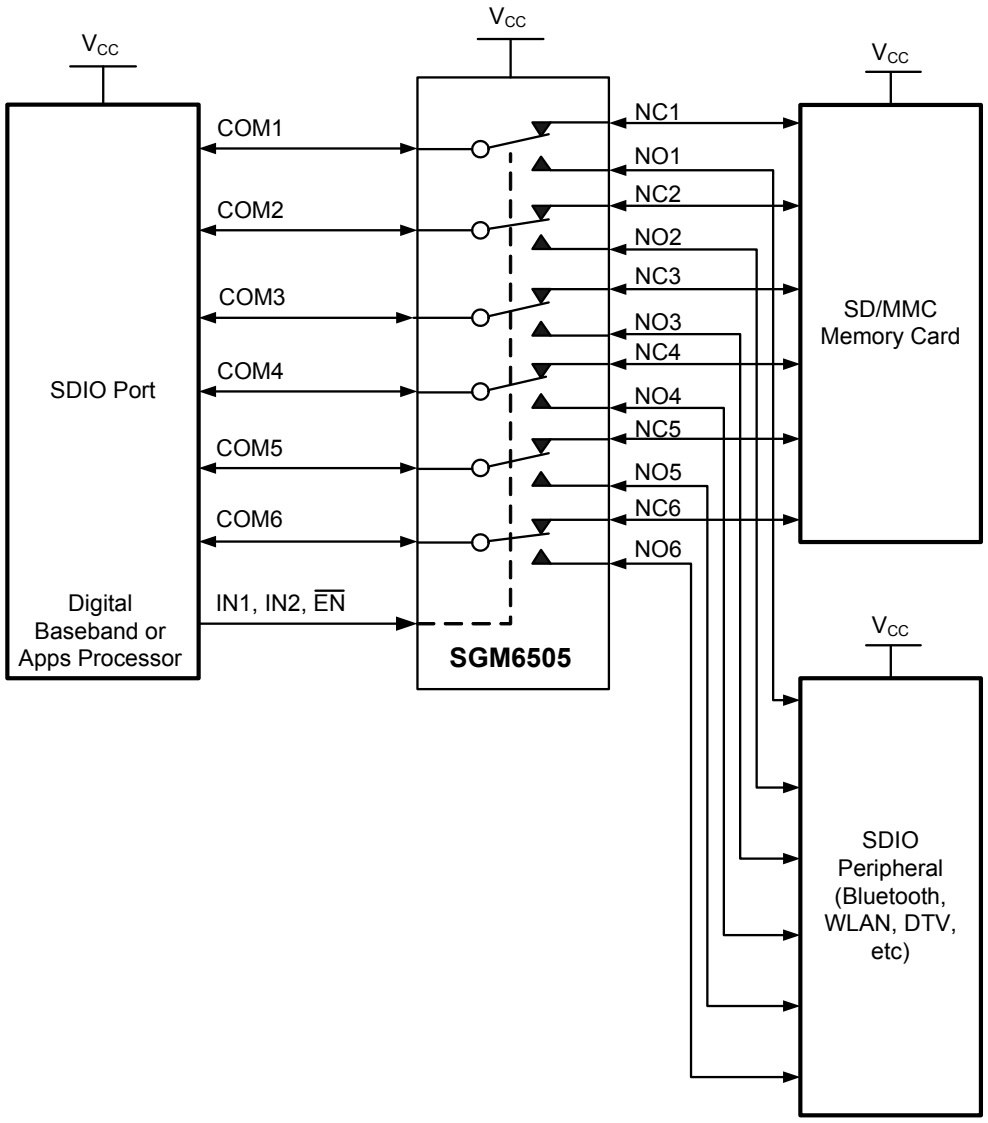
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{COM}, V_{NO}, V_{NC}				0		V_{CC}	V
ON-State Resistance	R_{ON}	V_{CC} = 3.0V, 0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = -32mA, Switch ON, Test Circuit 1		+25℃		8.5	12.8	Ω
				Full			14	
ON-State Resistance Match Between Channels	ΔR_{ON}	V_{CC} = 3.0V, V_{NC} or V_{NO} = 2.1V, I_{COM} = -32mA, Switch ON, Test Circuit 1		+25℃		0.75	1.9	Ω
				Full			2.2	
ON-State Resistance Flatness	$R_{FLAT(ON)}$	V_{CC} = 3.0V, 0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = -32mA, Switch ON, Test Circuit 1		+25℃		4.5	6.2	Ω
				Full			6.5	
NC, NO OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{CC} = 3.6V, V_{NC} or V_{NO} = 1V, V_{COM} = 3V, or V_{NC} or V_{NO} = 3V, V_{COM} = 1V, Switch OFF, Test Circuit 2		Full	-1	0.05	1	μA
COM OFF Leakage Current	$I_{COM(OFF)}$	V_{CC} = 3.6V, V_{NC} or V_{NO} = 3V, V_{COM} = 1V, or V_{NC} or V_{NO} = 1V, V_{COM} = 3V, Switch OFF, Test Circuit 2		Full	-1	0.05	1	μA
NC, NO ON Leakage Current	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{CC} = 3.6V, V_{NC} or V_{NO} = 1V, V_{COM} = Open, or V_{NC} or V_{NO} = 3V, V_{COM} = Open, Switch ON, Test Circuit 3		Full	-1	0.05	1	μA
COM ON Leakage Current	$I_{COM(ON)}$	V_{CC} = 3.6V, V_{NC} or V_{NO} = Open, V_{COM} = 1V, or V_{NC} or V_{NO} = Open, V_{COM} = 3V, Switch ON, Test Circuit 3		Full	-1	0.05	1	μA
DIGITAL CONTROL INPUTS (IN1, IN2, $\overline{EN}$)								
Input Logic High	V_{IH}	V_{CC} = 3.6V		Full	1.5			V
Input Logic Low	V_{IL}	V_{CC} = 3.6V		Full			0.6	V
Input Leakage Current	I_{IH}, I_{IL}	V_{CC} = 3.6V, V_I = V_{CC} or 0		Full	-1	0.05	1	μA
DYNAMIC (V_{CC} = 3.3V)								
Turn-On Time	t_{ON}	V_{COM} = V_{CC}, R_L = 50Ω, C_L = 35pF, Test Circuit 4	NC	+25℃		25		ns
			NO	+25℃		17		
Turn-Off Time	t_{OFF}	V_{COM} = V_{CC}, R_L = 50Ω, C_L = 35pF, Test Circuit 4	NC	+25℃		8		ns
			NO	+25℃		12.5		
Break-Before-Make Time Delay	t_D	V_{NC} = V_{NO} = V_{CC}/2, R_L = 50Ω, C_L = 35pF, Test Circuit 5		+25℃		12		ns
NC, NO OFF Capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_{CC} or GND, Switch OFF, Test Circuit 6		+25℃		4		pF
COM OFF Capacitance	$C_{COM(OFF)}$	V_{NC} or V_{NO} = V_{CC} or GND, Switch OFF, Test Circuit 6		+25℃		9		pF
NC, NO ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_{CC} or GND, Switch ON, Test Circuit 6		+25℃		15		pF
COM ON Capacitance	$C_{COM(ON)}$	V_{COM} = V_{CC} or GND, Switch ON, Test Circuit 6		+25℃		15		pF
Digital Input Capacitance	C_I	V_I = V_{CC} or GND, Test Circuit 6		+25℃		4.5		pF
-3dB Bandwidth	BW	R_L = 50Ω, Switch ON, Test Circuit 7		+25℃		450		MHz
OFF Isolation	O_{ISO}	R_L = 50Ω, f = 10MHz, Switch OFF, Test Circuit 8		+25℃		-57		dB
Crosstalk	X_{TALK}	R_L = 50Ω, f = 10MHz, Switch ON, Test Circuit 9		+25℃		-55		dB
Crosstalk Adjacent	$X_{TALK(ADJ)}$	R_L = 50Ω, f = 10MHz, Switch ON, Test Circuit 9		+25℃		-57		dB
Charge Injection	Q_C	V_{GEN} = 0, R_{GEN} = 0, C_L = 0.1nF, Test Circuit 10		+25℃		1.2		pC
Total Harmonic Distortion	THD	R_L = 600Ω, C_L = 50pF, f = 20Hz to 20kHz, Test Circuit 11		+25℃		0.07		%
SUPPLY								
Positive Supply Current	I_{CC}	V_{CC} = 3.6V, V_I = V_{CC} or GND, Switch ON or OFF		Full		0.1	5	μA

ELECTRICAL CHARACTERISTICS

(V_{CC} = 2.3V to 2.7V, Full = -40℃to +85℃. Typical values are at T_A = +25℃, unless otherwise noted.)

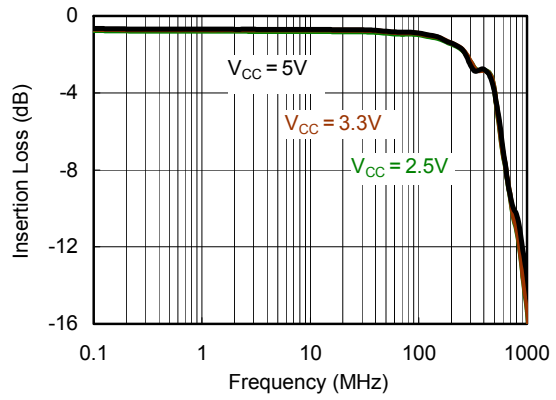
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	V_{COM}, V_{NO}, V_{NC}				0		V_{CC}	V
ON-State Resistance	R_{ON}	V_{CC} = 2.3V, 0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = -32mA, Switch ON, Test Circuit 1		+25℃		11.5	25.5	Ω
				Full			27	
ON-State Resistance Match Between Channels	ΔR_{ON}	V_{CC} = 2.3V, V_{NC} or V_{NO} = 1.6V, I_{COM} = -32mA, Switch ON, Test Circuit 1		+25℃		0.95	2.5	Ω
				Full			2.9	
ON-State Resistance Flatness	$R_{FLAT(ON)}$	V_{CC} = 2.3V, 0 ≤ (V_{NC} or V_{NO}) ≤ V_{CC}, I_{COM} = -32mA, Switch ON, Test Circuit 1		+25℃		11	18	Ω
				Full			20.5	
NC, NO OFF Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{CC} = 2.7V, V_{NC} or V_{NO} = 0.5V,V_{COM} = 2.3V, or V_{NC} or V_{NO} = 2.3V, V_{COM} = 0.5V, Switch OFF, Test Circuit 2		Full	-1	0.05	1	μA
COM OFF Leakage Current	$I_{COM(OFF)}$	V_{CC} = 2.7V, V_{NC} or V_{NO} = 0.5V, V_{COM} = 2.3V, or V_{NC} or V_{NO} = 2.3V, V_{COM} = 0.5V, Switch OFF, Test Circuit 2		Full	-1	0.05	1	μA
NC, NO ON Leakage Current	$I_{NO(ON)}$, $I_{NC(ON)}$	V_{CC} = 2.7V, V_{NC} or V_{NO} = 0.5V or 2.3V, V_{COM} = Open, Switch ON, Test Circuit 3		Full	-1	0.05	1	μA
COM ON Leakage Current	$I_{COM(ON)}$	V_{CC} = 2.7V, V_{NC} or V_{NO} = Open, V_{COM} = 0.5V, or V_{NC} or V_{NO} = Open, V_{COM} = 2.3V, Switch ON, Test Circuit 3		Full	-1	0.05	1	μA
DIGITAL CONTROL INPUTS (IN1, IN2, $\overline{EN}$)								
Input Logic High	V_{IH}	V_{CC} = 2.7V		Full	1.3			V
Input Logic Low	V_{IL}	V_{CC} = 2.7V		Full			0.5	V
Input Leakage Current	I_{IH}, I_{IL}	V_{CC} = 2.7V, V_I = V_{CC} or 0		Full	-1	0.05	1	μA
DYNAMIC (V_{CC} = 2.5V)								
Turn-On Time	t_{ON}	V_{COM} = V_{CC}, R_L = 50Ω, C_L = 35pF, Test Circuit 4	NC	+25℃		34		ns
			NO	+25℃		21		
Turn-Off Time	t_{OFF}	V_{COM} = V_{CC}, R_L = 50Ω, C_L = 35pF, Test Circuit 4	NC	+25℃		10		ns
			NO	+25℃		20		
Break-Before-Make Time Delay	t_D	V_{NC} = V_{NO} = V_{CC}/2, R_L = 50Ω, C_L = 35pF, Test Circuit 5		+25℃		17		ns
NC, NO OFF Capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$	V_{NC} or V_{NO} = V_{CC} or GND, Switch OFF, Test Circuit 6		+25℃		4		pF
COM OFF Capacitance	$C_{COM(OFF)}$	V_{NC} or V_{NO} = V_{CC} or GND, Switch OFF, Test Circuit 6		+25℃		10		pF
NC, NO ON Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$	V_{NC} or V_{NO} = V_{CC} or GND, Switch ON, Test Circuit 6		+25℃		15		pF
COM ON Capacitance	$C_{COM(ON)}$	V_{COM} = V_{CC} or GND, Switch ON, Test Circuit 6		+25℃		15		pF
Digital Input Capacitance	C_I	V_I = V_{CC} or GND, Test Circuit 6		+25℃		4		pF
-3dB Bandwidth	BW	R_L = 50Ω, Switch ON, Test Circuit 7		+25℃		450		MHz
OFF Isolation	O_{ISO}	R_L = 50Ω, f = 10MHz, Switch OFF, Test Circuit 8		+25℃		-55		dB
Crosstalk	X_{TALK}	R_L = 50Ω, f = 10MHz, Switch ON, Test Circuit 9		+25℃		-55		dB
Crosstalk Adjacent	$X_{TALK(ADJ)}$	R_L = 50Ω, f = 10MHz, Switch ON, Test Circuit 9		+25℃		-55		dB
Charge Injection	Q_C	V_{GEN} = 0, R_{GEN} = 0, C_L = 0.1nF, Test Circuit 10		+25℃		0.9		pC
Total Harmonic Distortion	THD	R_L = 600Ω, C_L = 50pF, f = 20Hz to 20kHz, Test Circuit 11		+25℃		0.11		%
SUPPLY								
Positive Supply Current	I_{CC}	V_{CC} = 2.7V, V_I = V_{CC} or GND, Switch ON or OFF		Full		0.1	3	μA

APPLICATION BLOCK DIAGRAM

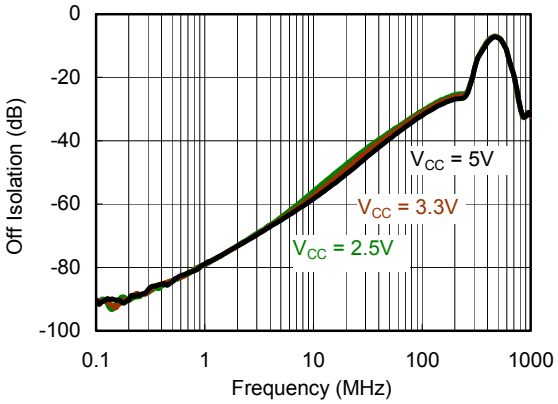


TYPICAL PERFORMANCE CHARACTERISTICS

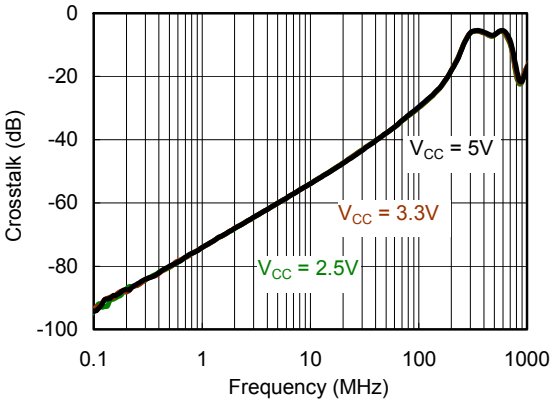
Insertion Loss vs. Frequency



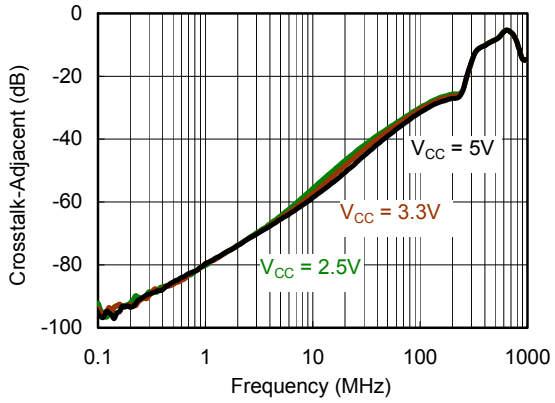
Off Isolation vs. Frequency



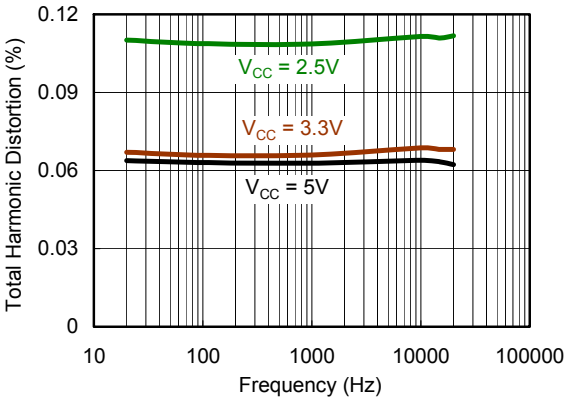
Crosstalk vs. Frequency



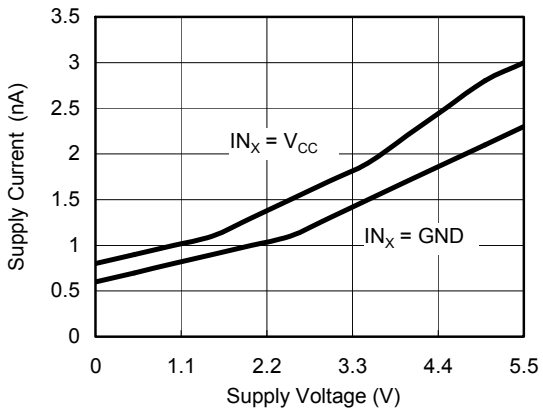
Crosstalk-Adjacent vs. Frequency



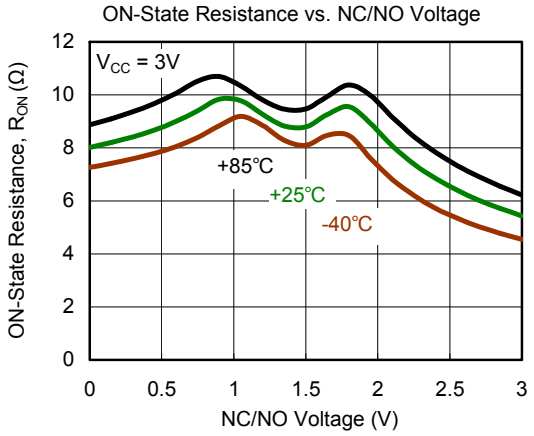
Total Harmonic Distortion vs. Frequency

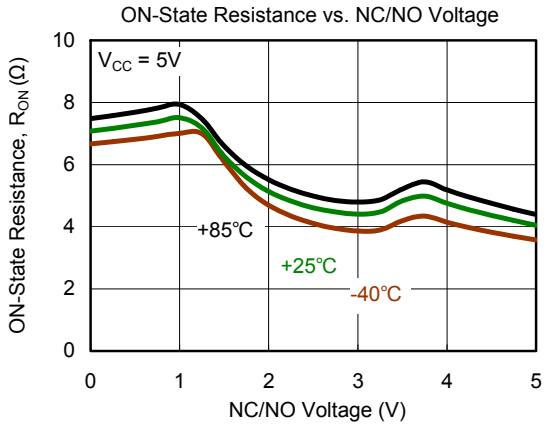


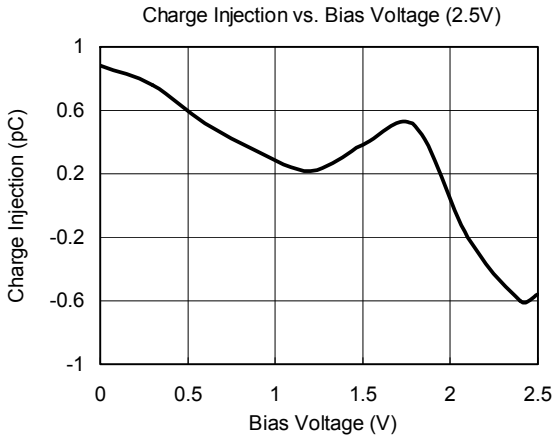
Supply Current vs. Supply Voltage

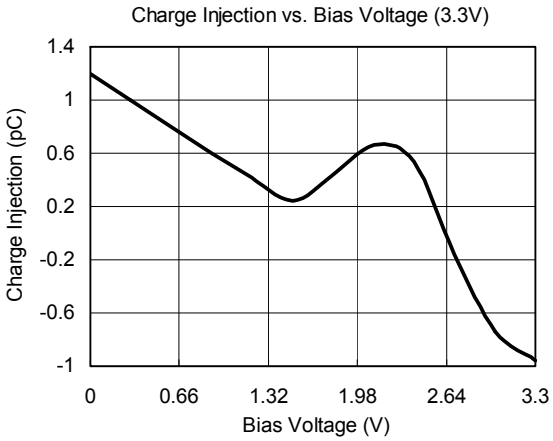


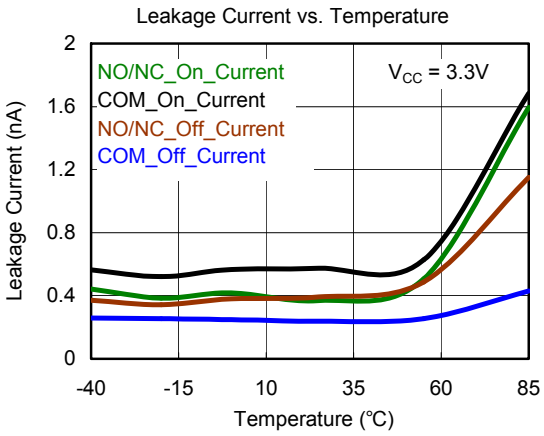
TYPICAL PERFORMANCE CHARACTERISTICS

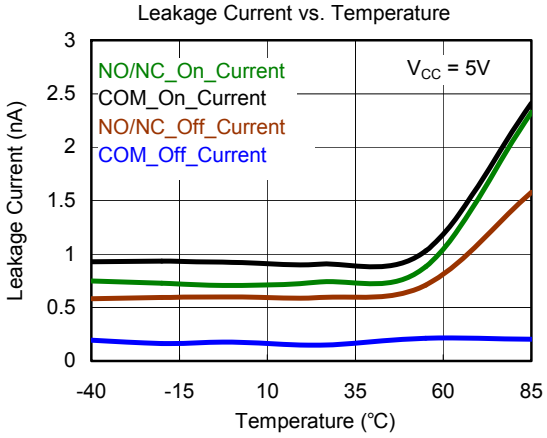




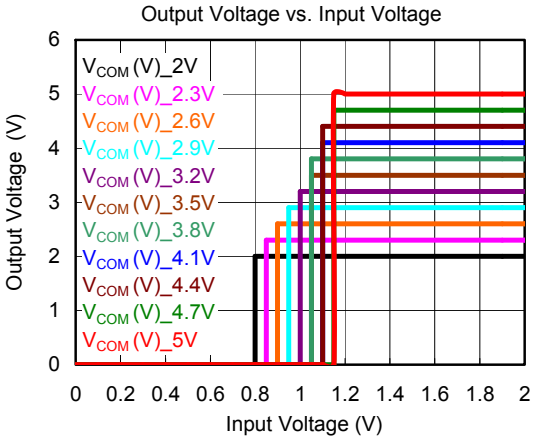




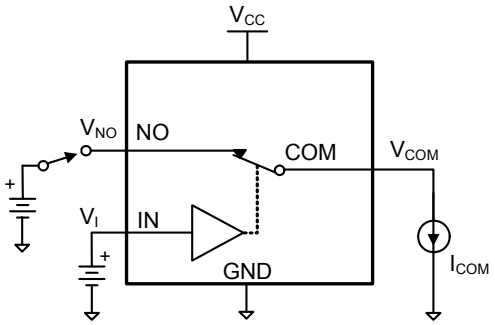




TYPICAL PERFORMANCE CHARACTERISTICS



TEST CIRCUITS

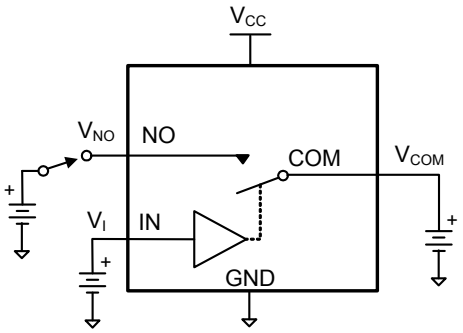


Channel ON

$R_{ON} = \frac{V_{COM} - V_{NO}}{I_{COM}}$ Ω

$V_I = V_{IH}$ or V_{IL}

Test Circuit 1. ON-State Resistance (R_{ON})

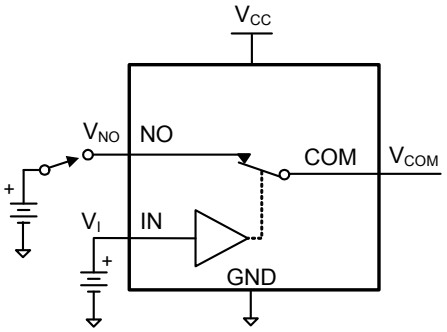


OFF-State Leakage Current

Channel OFF

$V_I = V_{IH}$ or V_{IL}

Test Circuit 2. OFF-State Leakage Current



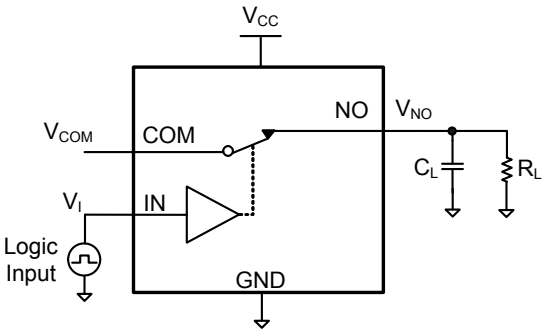
ON-State Leakage Current

Channel ON

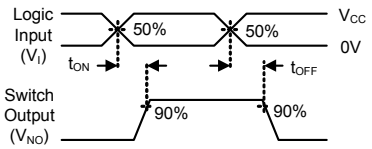
$V_I = V_{IH}$ or V_{IL}

Test Circuit 3. ON-State Leakage Current

TEST CIRCUITS (Cont.)

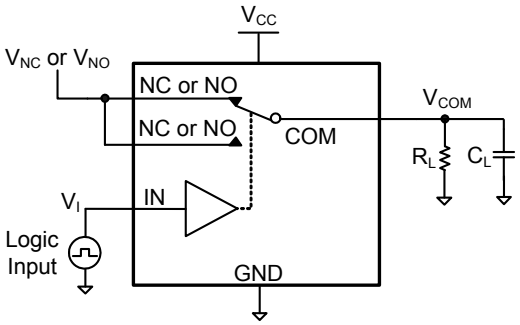


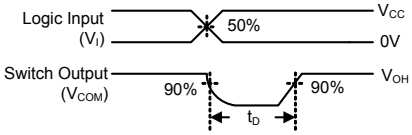
TEST	R_L	C_L	V_{COM}
t_{ON}	50Ω	35pF	V_{CC}
t_{OFF}	50Ω	35pF	V_{CC}



A. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz, Z_O = 50Ω, t_r < 5ns, t_f < 5ns.
B. C_L includes probe and jig capacitance.

Test Circuit 4. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

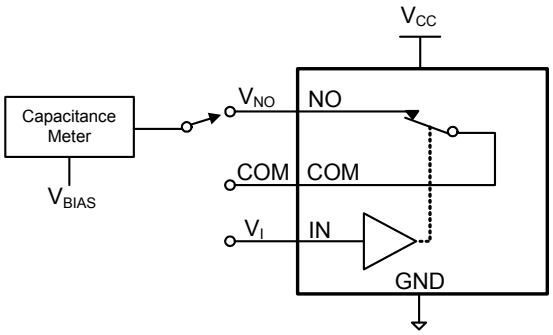




V_{NC} or V_{NO} = V_{CC}/2
R_L = 50Ω
C_L = 35pF

A. C_L includes probe and jig capacitance.
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz, Z_O = 50Ω, t_r < 5ns, t_f < 5ns.

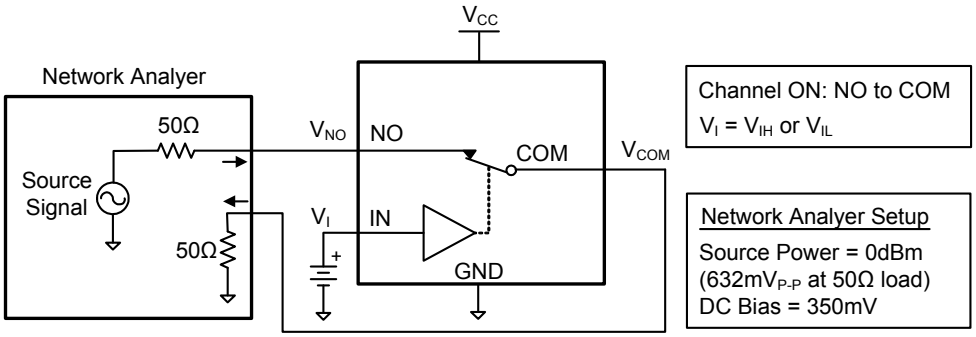
Test Circuit 5. Break-Before-Make Time Delay (t_D)



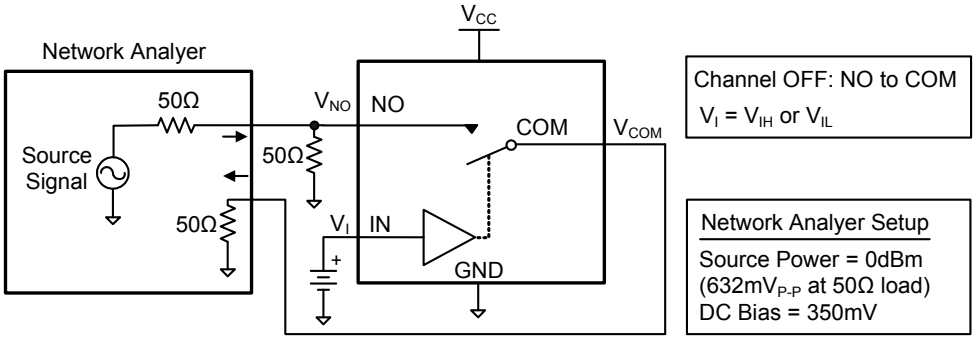
V_{BIAS} = V_{CC} or GND and
V_I = V_{IH} or V_{IL}
Capacitance is measured at NO, COM, and IN inputs during ON and OFF conditions.

Test Circuit 6. Capacitance

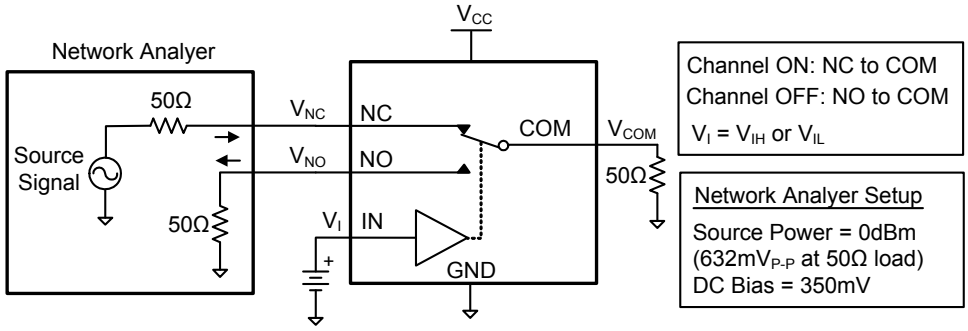
TEST CIRCUITS (Cont.)



Test Circuit 7. -3dB Bandwidth (BW)

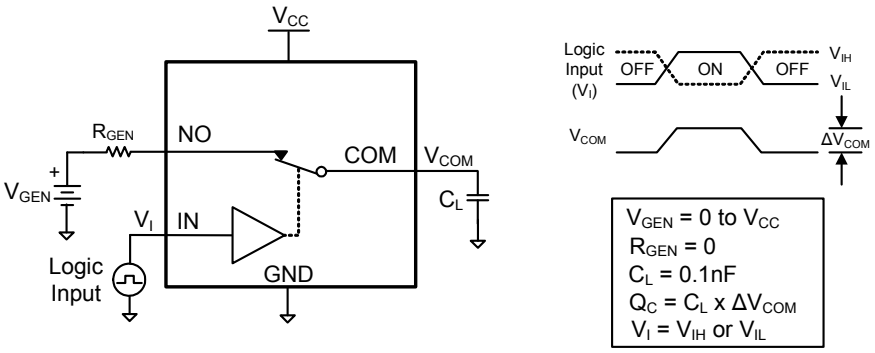


Test Circuit 8. Off Isolation (O_{ISO})



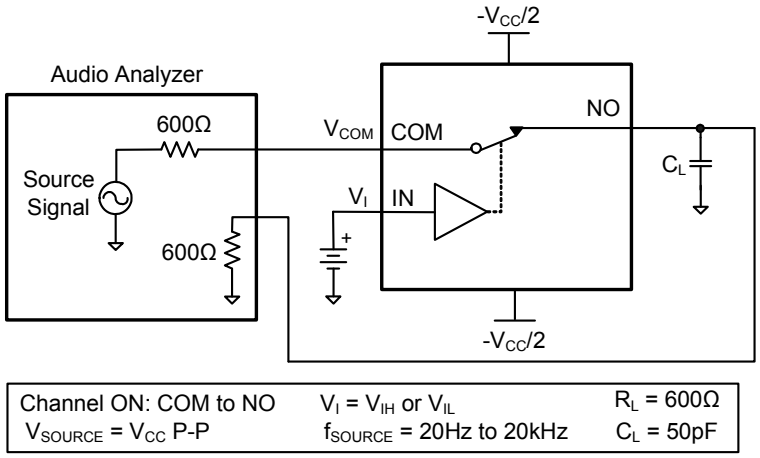
Test Circuit 9. Crosstalk (X_{TALK})

TEST CIRCUITS (Cont.)



A. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz, Z_O = 50Ω, t_r < 5ns, t_f < 5ns.
B. C_L includes probe and jig capacitance.

Test Circuit 10. Charge Injection (Q_C)

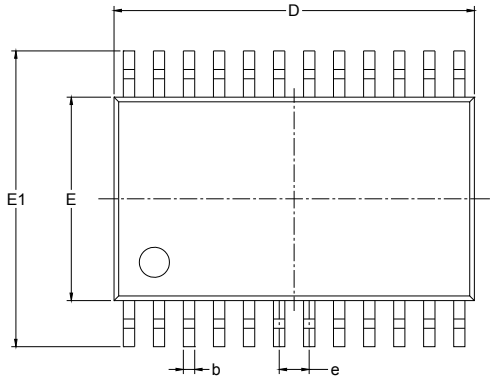


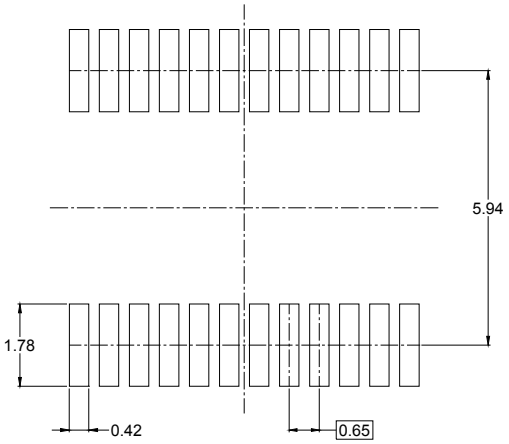
A. C_L includes probe and jig capacitance.

Test Circuit 11. Total Harmonic Distortion (THD)

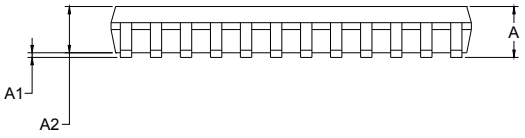
PACKAGE OUTLINE DIMENSIONS

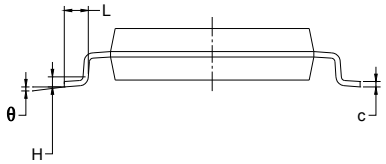
TSSOP-24





RECOMMENDED LAND PATTERN (Unit: mm)

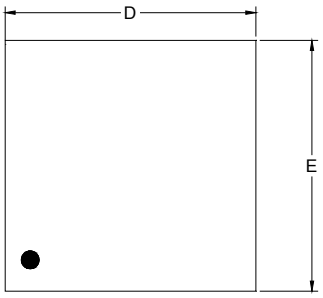




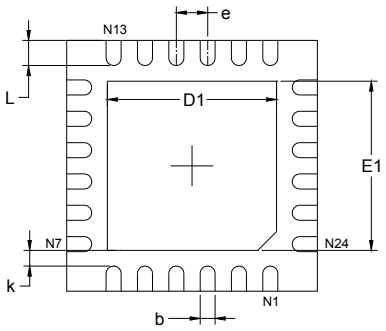
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.020	0.150	0.001	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	7.700	7.900	0.303	0.311
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

PACKAGE OUTLINE DIMENSIONS

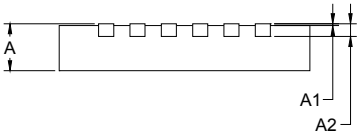
TQFN-4×4-24L



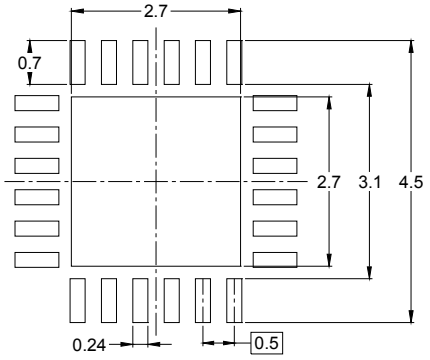
TOP VIEW



BOTTOM VIEW



SIDE VIEW

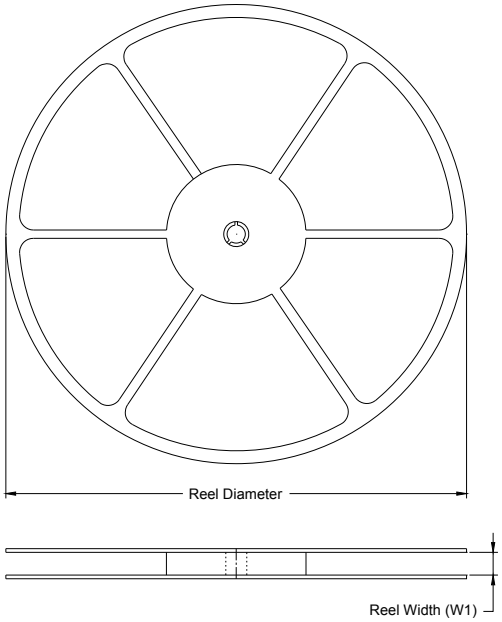


RECOMMENDED LAND PATTERN (Unit: mm)

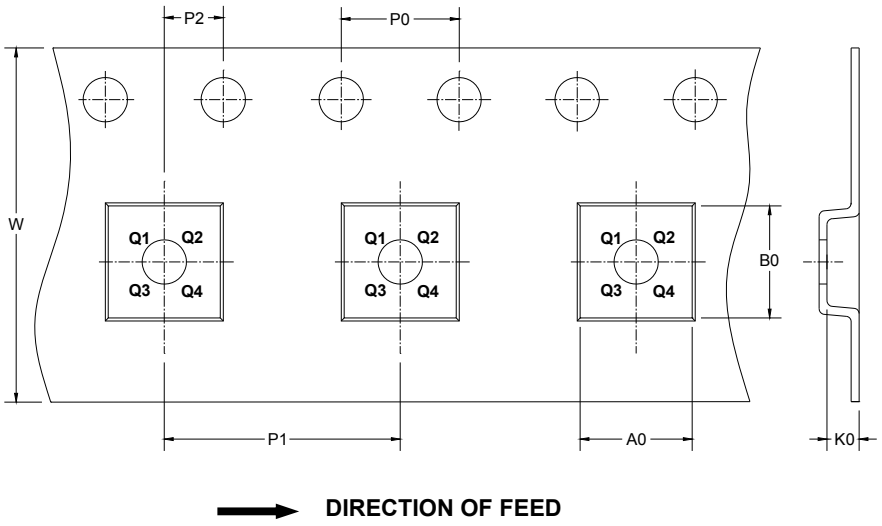
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	3.900	4.100	0.154	0.161
D1	2.600	2.800	0.102	0.110
E	3.900	4.100	0.154	0.161
E1	2.600	2.800	0.102	0.110
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS

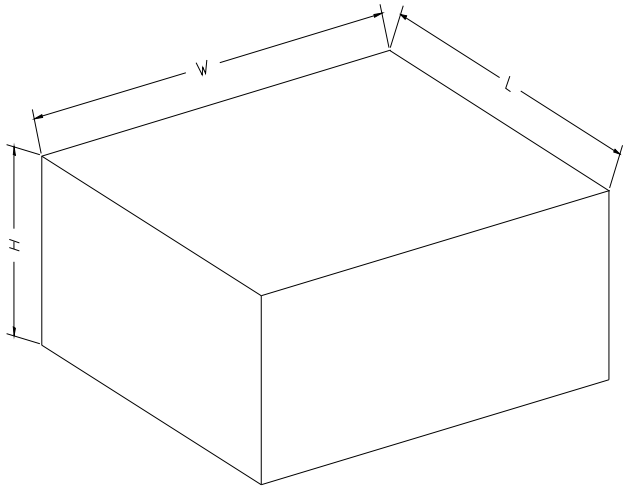


NOTE: The picture is only for reference. Please make the object as the standard.

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-24	13″	16.4	6.8	8.3	1.6	4.0	8.0	2.0	16.0	Q1
TQFN-4×4-24L	13″	12.4	4.3	4.3	1.1	4.0	8.0	2.0	12.0	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