



SGM6504

High Speed, Quad, 2×2 Crosspoint Switch

GENERAL DESCRIPTION

The SGM6504 is a high-speed, quad, 2×2 crosspoint switch which is designed to operate from a single 1.8V to 5.5V power supply. It features high-bandwidth (400MHz).

SGM6504 is available in Green TQFN-3×3-20L package.

FEATURES

- **Low Voltage Operation:** 1.8V to 5.5V
- **Low On Capacitance:** 12pF
- **Low On Resistance:** 12Ω
- **High -3dB Bandwidth:** 400MHz
- **Rail-to-Rail Input and Output Operation**
- **High Off-Isolation:** -75dB at 1MHz
- **Low Crosstalk:** -80dB at 1MHz
- **Power Supply Current:** < 10μA
- **TTL/CMOS Compatible**
- **Available in Green TQFN-3×3-20L Package**
- **Extended Industrial Temperature Range:**
-40°C to +85°C



PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM6504	TQFN-3×3-20L	-40°C to +85°C	SGM6504YTQG20G/TR	SGM 6504QG XXXXX	Tape and Reel, 3000

NOTE: XXXXX = Date 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

V_{CC} to GND -0.3V to 6.0V
 Analog, Digital Voltage Range -0.3V to V_{CC} + 0.3V
 Continuous Current NO, NC, or COM 30mA
 Operating Temperature Range -40°C to +85°C
 Junction Temperature 150°C
 Storage Temperature Range -65°C to +150°C
 Lead Temperature (Soldering, 10s) 260°C
 ESD Susceptibility
 HBM 7000V
 MM 400V

NOTE:

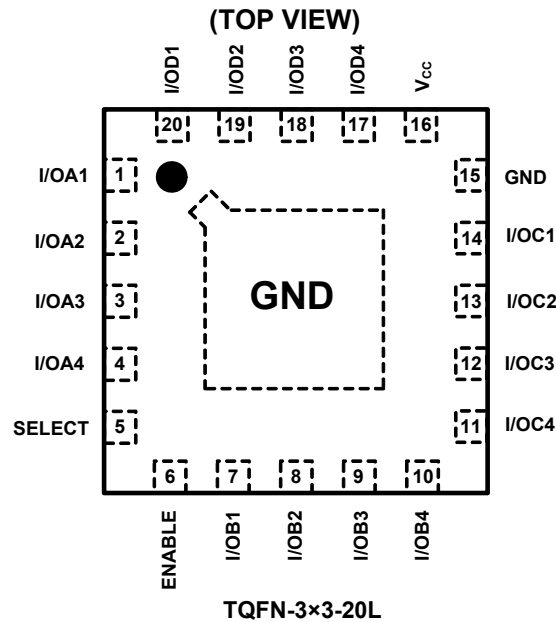
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



PIN DESCRIPTION

PIN	NAME	FUNCTION
1, 2, 3, 4	I/OA1, I/OA2, I/OA3, I/OA4	Data I/O of Data Bus A.
5	SELECT	Bus Switching Control.
6	ENABLE	Enable = "0": chip is disabled; input and output are isolated. Enable = "1": bus input and output are connected according to the logic input of "select" pin.
7, 8, 9, 10	I/OB1, I/OB2, I/OB3, I/OB4	Data I/O of Data Bus B.
14, 13, 12, 11	I/OC1, I/OC2, I/OC3, I/OC4	Data I/O of Data Bus C.
15	GND	Ground.
16	V _{CC}	Power Supply.
20, 19, 18, 17	I/OD1, I/OD2, I/OD3, I/OD4	Data I/O of Data Bus D.
Exposed Pad	GND	Exposed pad should be soldered to PCB board and connected to GND or left floating.

FUNCTION TABLE

ENABLE	SELECT	FUNCTION
0	X	Chip is disabled.
1	0	Bus A is connected with Bus D; Bus B is connected with Bus C.
1	1	Bus A is connected with Bus C; Bus B is connected with Bus D.

1. Bus A is connected with Bus D; Bus B is connected to Bus C:

I/OA1 = I/OD1; I/OA2 = I/OD2; I/OA3 = I/OD3; I/OA4 = I/OD4
I/OB1 = I/OC1; I/OB2 = I/OC2; I/OB3 = I/OC3; I/OB4 = I/OC4

2. Bus A is connected with Bus C; Bus B is connected with Bus D:

I/OA1 = I/OC1; I/OA2 = I/OC2; I/OA3 = I/OC3; I/OA4 = I/OC4
I/OB1 = I/OD1; I/OB2 = I/OD2; I/OB3 = I/OD3; I/OB4 = I/OD4

ELECTRICAL CHARACTERISTICS

($V_{CC} = 4.5V$ to $5.5V$, $V_{IH} = 1.6V$, $V_{IL} = 0.5V$, Full = $-40^{\circ}C$ to $+85^{\circ}C$. Typical values are at $V_{CC} = 5.0V$, $T_A = +25^{\circ}C$, unless otherwise noted.)

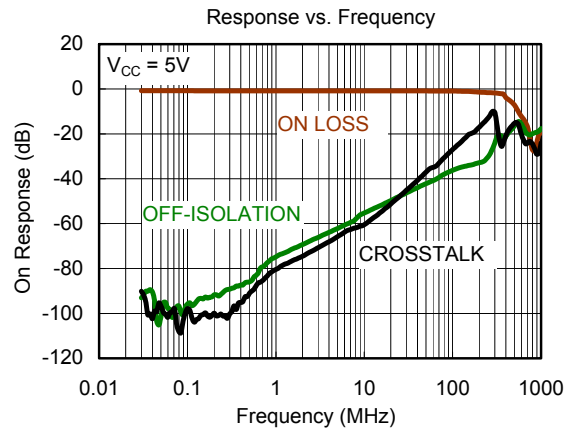
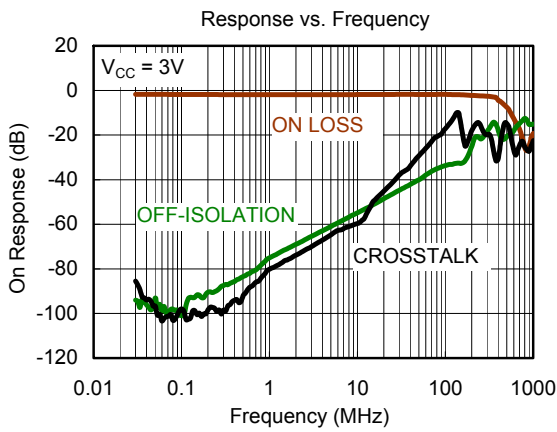
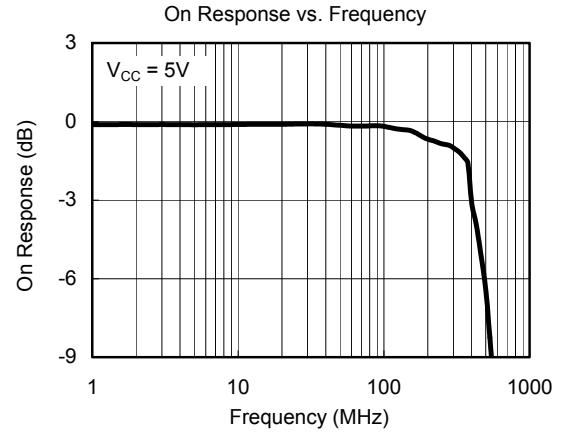
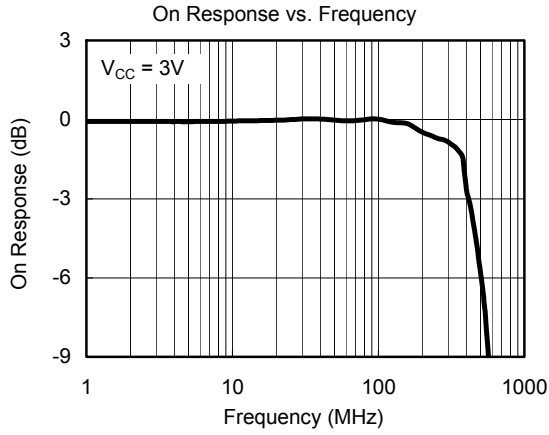
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		Full	0		V_{CC}	V
On-Resistance	R_{ON}	$V_{CC} = 4.5V, 0V \leq V_{NO} \text{ or } V_{NC} \leq V_{CC}, I_{COM} = -10mA$, Test Circuit 1	+25°C		12	20	Ω
			Full			23	
On-Resistance Match Between Channels	ΔR_{ON}	$V_{CC} = 4.5V, 0V \leq V_{NO} \text{ or } V_{NC} \leq V_{CC}, I_{COM} = -10mA$, Test Circuit 1	+25°C		2	3.15	Ω
			Full			3.85	
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_{CC} = 4.5V, 0V \leq V_{NO} \text{ or } V_{NC} \leq V_{CC}, I_{COM} = -10mA$, Test Circuit 1	+25°C		3.5	5.35	Ω
			Full			6	
Source OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{CC} = 5.5V, V_{NO} \text{ or } V_{NC} = 3.3V/0.3V, V_{COM} = 0.3V/3.3V$	Full			1	μA
Channel ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{CC} = 5.5V, V_{COM} = 0.3V/3.3V, V_{NO} \text{ or } V_{NC} = 0.3V/3.3V$ or floating	Full			1	μA
DIGITAL INPUTS							
Input High Voltage	V_{INH}		Full	1.6			V
Input Low Voltage	V_{INL}		Full			0.5	V
Input Leakage Current	I_{IN}	$V_{CC} = 5.5V, V_{IN} = 0V$ or $5.5V$	Full			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	$V_{NC} \text{ or } V_{NO} = 3.0V, R_L = 300\Omega, C_L = 35pF$, Test Circuit 2	+25°C		35		ns
Turn-Off Time	t_{OFF}		+25°C		25		ns
Break-Before-Make Time Delay	t_D	$V_{NC} \text{ or } V_{NO} = 3.0V, R_L = 300\Omega, C_L = 35pF$, Test Circuit 3	+25°C		7		ns
Charge Injection	Q	$V_G = GND, R_G = 0\Omega, C_L = 0.1nF, Q = C_L \times V_{OUT}$, Test Circuit 4	+25°C		2.5		pC
Off Isolation	O_{ISO}	Signal = 0dBm, $R_L = 50\Omega$, Test Circuit 5	f = 1MHz	+25°C		-75	dB
			f = 10MHz	+25°C		-55	
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, $R_L = 50\Omega$, Test Circuit 6	f = 1MHz	+25°C		-80	dB
			f = 10MHz	+25°C		-60	
-3dB Bandwidth	BW	Signal = 0dBm, $R_L = 50\Omega$, Test Circuit 7	+25°C		400		MHz
Channel ON Capacitance	$C_{NC(ON)}, C_{NO(ON)}, C_{COM(ON)}$		+25°C		12		pF
POWER REQUIREMENTS							
Power Supply Range	V_{CC}		Full	1.8		5.5	V
Power Supply Current	I_{CC}	$V_{CC} = 5.5V, V_{IN} = 0V$ or V_{CC}	Full			10	μA

ELECTRICAL CHARACTERISTICS

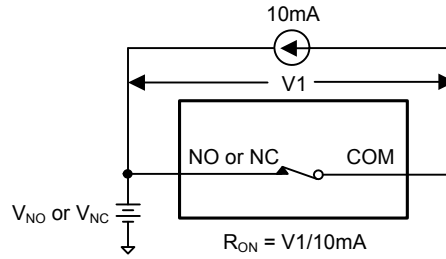
($V_{CC} = 2.7V$ to $3.6V$, $V_{IH} = 1.5V$, $V_{IL} = 0.4V$, Full = $-40^{\circ}C$ to $+85^{\circ}C$. Typical values are at $V_{CC} = 3.0V$, $T_A = +25^{\circ}C$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
ANALOG SWITCH							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		Full	0		V_{CC}	V
On-Resistance	R_{ON}	$V_{CC} = 2.7V, 0V \leq V_{NO} \text{ or } V_{NC} \leq V_{CC}, I_{COM} = -10mA$, Test Circuit 1	+25°C		21	46	Ω
			Full			49	
On-Resistance Match Between Channels	ΔR_{ON}	$V_{CC} = 2.7V, 0V \leq V_{NO} \text{ or } V_{NC} \leq V_{CC}, I_{COM} = -10mA$, Test Circuit 1	+25°C		2.3	5.1	Ω
			Full			5.5	
On-Resistance Flatness	$R_{FLAT(ON)}$	$V_{CC} = 2.7V, 0V \leq V_{NO} \text{ or } V_{NC} \leq V_{CC}, I_{COM} = -10mA$, Test Circuit 1	+25°C		20	30	Ω
			Full			34	
Source OFF Leakage Current	$I_{NC(OFF)}, I_{NO(OFF)}$	$V_{CC} = 3.6V, V_{NO} \text{ or } V_{NC} = 3.3V/0.3V, V_{COM} = 0.3V/3.3V$	Full			1	μA
Channel ON Leakage Current	$I_{NC(ON)}, I_{NO(ON)}, I_{COM(ON)}$	$V_{CC} = 3.6V, V_{COM} = 0.3V/3.3V, V_{NO} \text{ or } V_{NC} = 0.3V/3.3V \text{ or floating}$	Full			1	μA
DIGITAL INPUTS							
Input High Voltage	V_{INH}		Full	1.5			V
Input Low Voltage	V_{INL}		Full			0.4	V
Input Leakage Current	I_{IN}	$V_{CC} = 3.6V, V_{IN} = 0V \text{ or } 3.6V$	Full			1	μA
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	$V_{NC} \text{ or } V_{NO} = 1.5V, R_L = 300\Omega, C_L = 35pF$, Test Circuit 2	+25°C		50		ns
Turn-Off Time	t_{OFF}		+25°C		40		ns
Break-Before-Make Time Delay	t_D	$V_{NC} \text{ or } V_{NO} = 1.5V, R_L = 300\Omega, C_L = 35pF$, Test Circuit 3	+25°C		12		ns
Charge Injection	Q	$V_G = GND, R_G = 0\Omega, C_L = 0.1nF, Q = C_L \times V_{OUT}$, Test Circuit 4	+25°C		3		pC
Off Isolation	O_{ISO}	Signal = 0dBm, $R_L = 50\Omega$, Test Circuit 5	f = 1MHz	+25°C		-75	dB
			f = 10MHz	+25°C		-55	dB
Channel-to-Channel Crosstalk	X_{TALK}	Signal = 0dBm, $R_L = 50\Omega$, Test Circuit 6	f = 1MHz	+25°C		-80	dB
			f = 10MHz	+25°C		-60	dB
-3dB Bandwidth	BW	Signal = 0dBm, $R_L = 50\Omega$, Test Circuit 7	+25°C		400		MHz
Channel ON Capacitance	$C_{NC(ON)}, C_{NO(ON)}, C_{COM(ON)}$		+25°C		12		pF

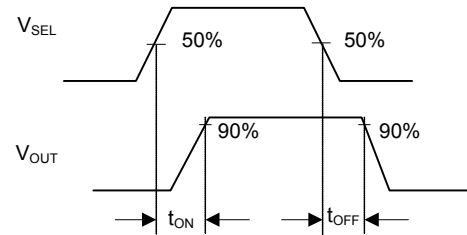
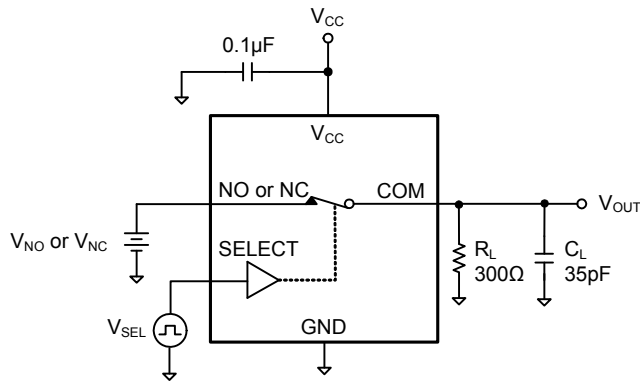
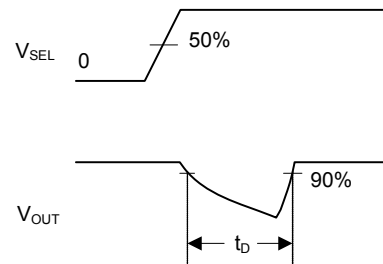
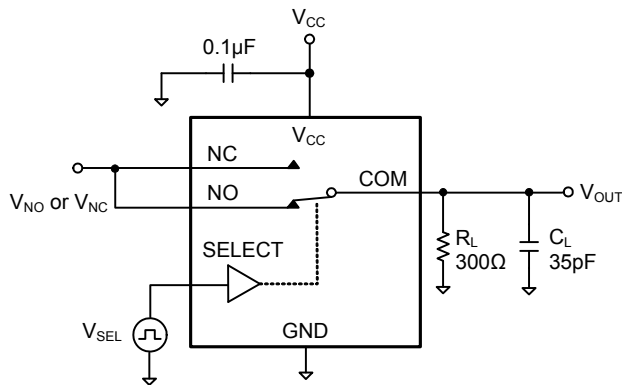
TYPICAL PERFORMANCE CHARACTERISTICS



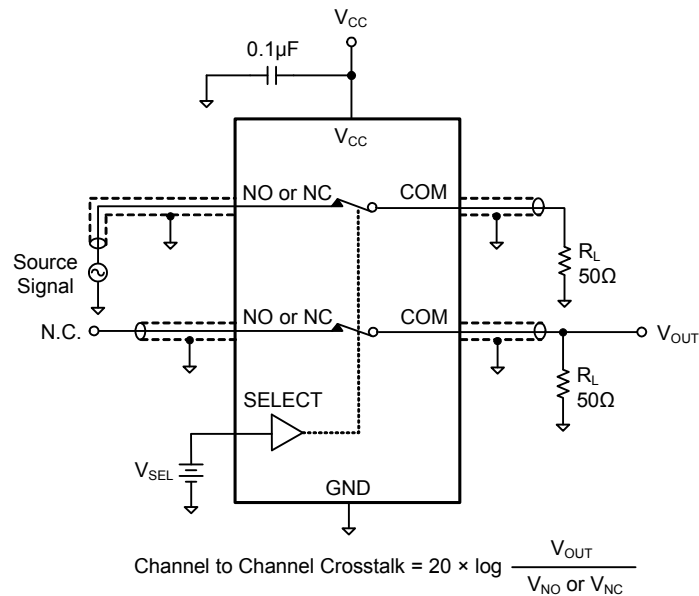
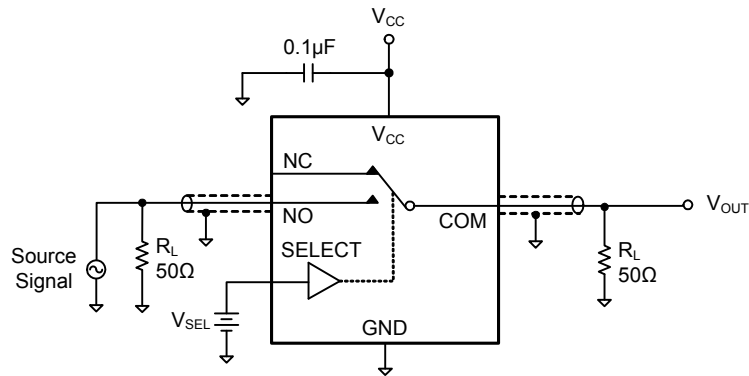
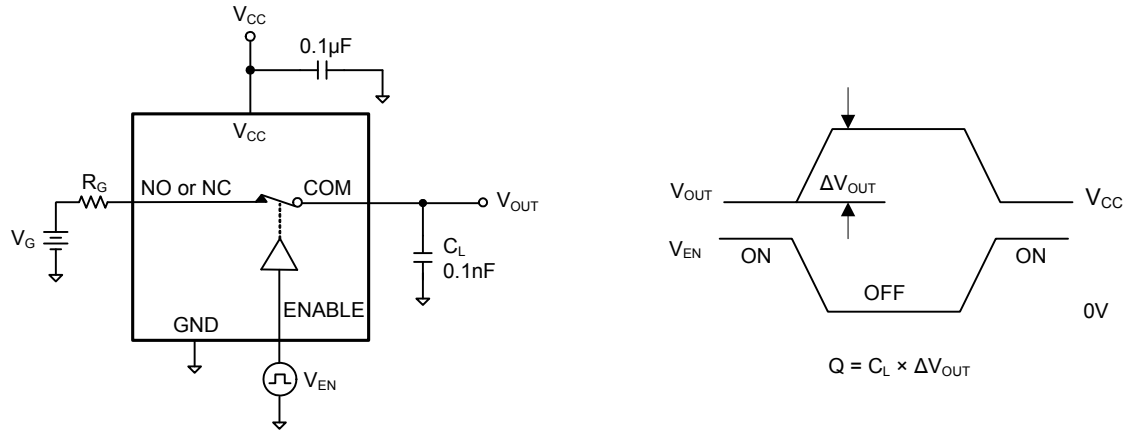
TEST CIRCUITS



Test Circuit 1. On Resistance

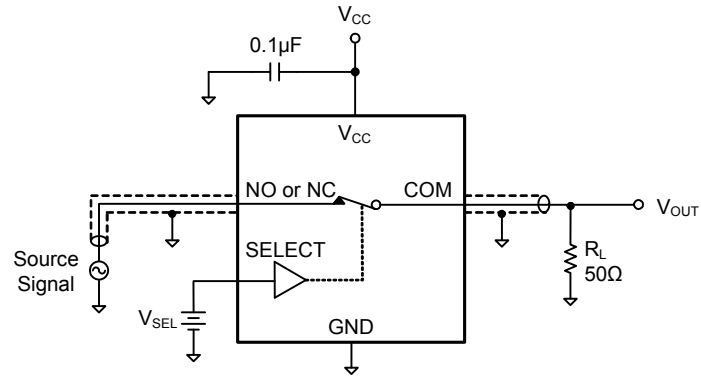
Test Circuit 2. Switching Times (t_{ON} , t_{OFF})Test Circuit 3. Break-Before-Make Time Delay (t_D)

TEST CIRCUITS (Cont.)



Test Circuit 6. Channel-to-Channel Crosstalk

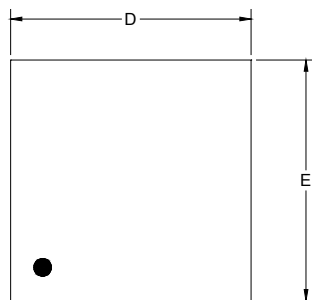
TEST CIRCUITS (Cont.)



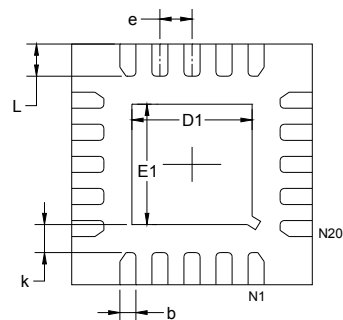
Test Circuit 7. -3dB Bandwidth

PACKAGE OUTLINE DIMENSIONS

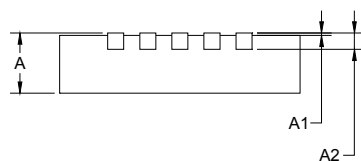
TQFN-3×3-20L



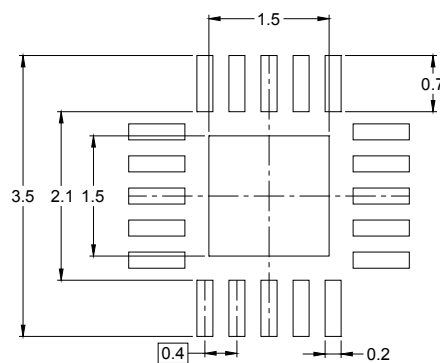
TOP VIEW



BOTTOM VIEW



SIDE VIEW

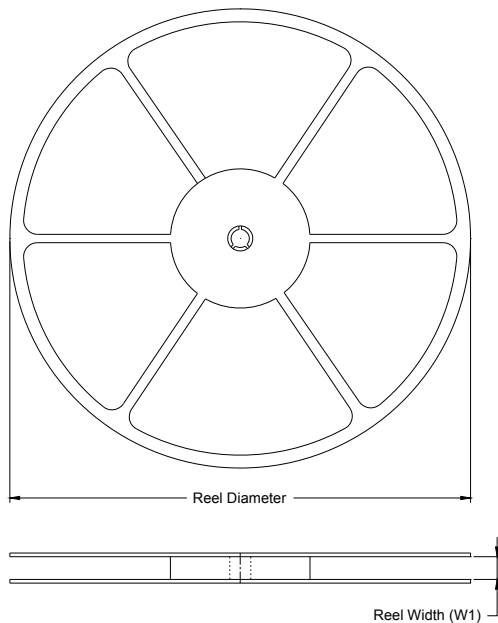


RECOMMENDED LAND PATTERN (Unit: mm)

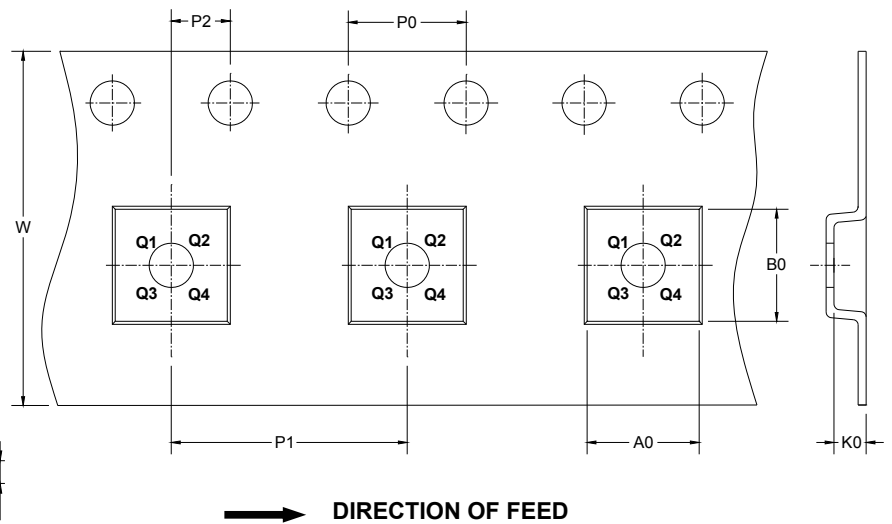
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.924	3.076	0.115	0.121
D1	1.400	1.600	0.055	0.063
E	2.924	3.076	0.115	0.121
E1	1.400	1.600	0.055	0.063
k	0.200 MIN		0.008 MIN	
b	0.150	0.250	0.006	0.010
e	0.400 TYP		0.016 TYP	
L	0.324	0.476	0.013	0.019

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS

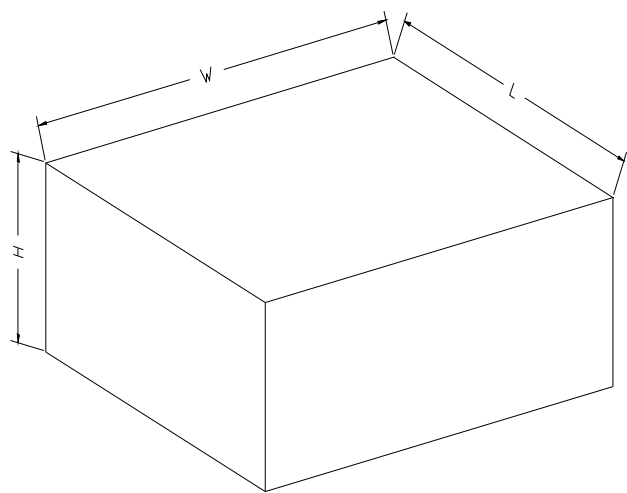


NOTE: The picture is only for reference. Please make the object as the standard.

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
TQFN-3×3-20L	13"	12.4	3.3	3.3	1.1	4.0	4.0	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