GT4223
0.4 Ω, Ultra Low On-Resistance, Dual, SPDT Analog Switch

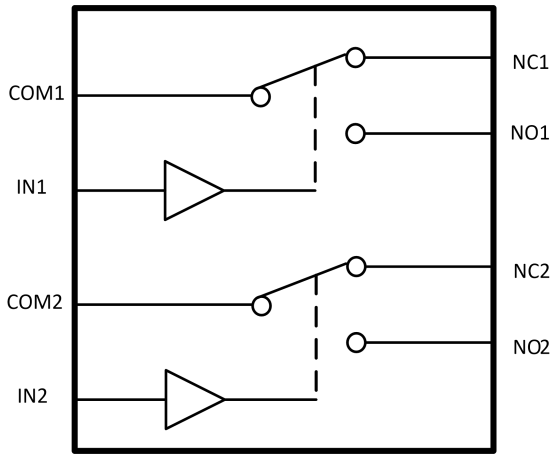
1 Features	2 Application
- Supply range: +1.65V to +5.0V - Low On-Resistance: 0.4 Ω(TYP) @+4.5V - On-Resistance Flatness: 0.045 Ω(TYP) @+4.5V - Fast Switching Times: T_{ON} 12ns T_{OFF} 7ns - Off-Isolation:-50dB@1MHz - Crosstalk:-90dB@1MHz - Break-before-make switching - Operation temperature range: -40°C to 85°C - Micro size packages: QFN1.8×1.4-10L, MSOP-10, DFN3×3-10L	- Cell Phones - PDAs - Portable Instrumentation - Battery Powered Communications - Medical Equipment

3 Description

The GT4223 is a dual-channel single-pole double-throw (SPDT) analog switch that is designed to operate from 1.65V to 5V.

The GT4223 features ultra-low on-resistance, low voltage and fast switching times. The high performances make it very suitable for multiple applications, such as portable equipment, audio and video signal routing, etc. This device is available packaged in QFN1.8×1.4-10L, MSOP-10 and DFN3×3-10L.

Circuit Diagram



4 Device Summary, Pin and Packages

Table 4-1. Device Summary(1)

Serial Name	Part Name	Package	Body Size (Nom)	Marking(2)(4)	MSL(3)	Package Qty
GT4223	GT4223QA	QFN1.8×1.4-10L	1.8mm×1.4mm×0.55mm	4223 XXXX	3	Tape and Reel,4000
	GT4223MA	MSOP-10	3.0mm×3.0mm×0.85mm	GT4223 XXXXXX	3	Tape and Reel,4000
	GT4223DSA	DFN3×3-10L	—	4223 XXXX	3	Tape and Reel,4000

(1) For all available packages, please contact product.

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

(4) "XXXXX" in Marking will be appeared as the batch code.

4 Device Summary, Pin and Packages(Continued)

Top View

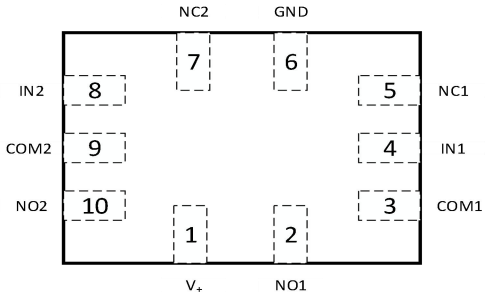


Fig.4-1. GT4223: QA (QFN1.8×1.4-10L) Package

Top View

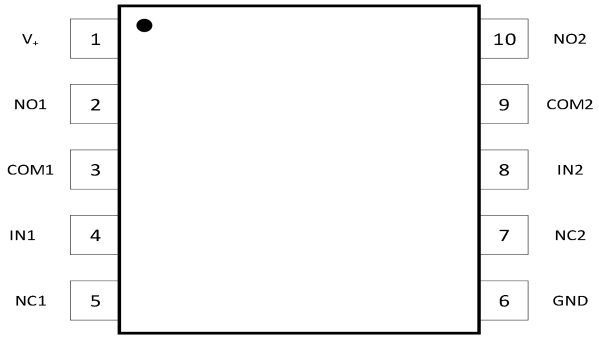


Fig.4-2. GT4223: MA (MSOP-10) Package

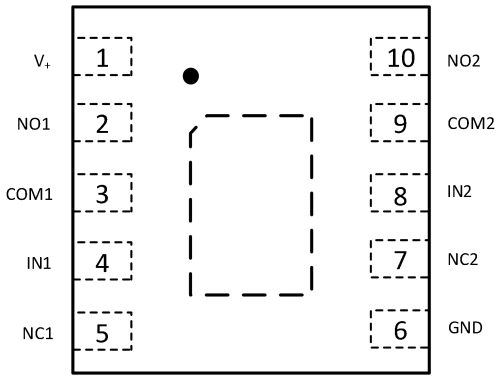


Fig.4-3. GT4223: DSA (DFN3×3-10L) Package

Table 4-1 Pin definition

Pin		Description
Name	QA MA DSA	
V_+	1	Supply Voltage
NO1	2	Normal open terminal switch 1
COM1	3	Common terminal switch 1
IN1	4	Select input, control switch 1
NC1	5	Normal closed terminal switch 1
GND	6	Ground
NC2	7	Normal closed terminal switch 2
IN2	8	Select input, control switch 2
COM2	9	Common terminal switch 2
NO2	10	Normal open terminal switch 2

Table 4-2 Function Table

LOGIC	Function
0	NC connected to COM
1	NO connected to COM

5 Voltage, Temperature, ESD and Thermal Ratings

5.1 Absolute Maximum Ratings(1)

Parameters		Min.	Max.	Unit
V_+	Supply voltage range	-0.3	6.0	V
V_{IN}	Analog, digital voltage range(2)	-0.3	(V_+)+0.3	V
	Continuous current NO,NC or COM	-300	+300	mA
I_{PEAK}	Continuous channel current	-500	+500	mA
T_J	Junction temperature under bias	-65	150	°C
T_{stg}	Storage temperature range	-65	150	°C

(1) 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 under "Recommended Operating Conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) The input and output negative-voltage ratings may be exceeded if the input and output current ratings are observed.

5.2 ESD Ratings

ESD			Value	Unit
V(ESD)	Electrostatic discharge	Human-Body Model (HBM)(1)	8 K	V
		Charged-Device Model (CDM)(2)	2 K	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

5.3 Recommended Operating Conditions(1)

Over operating free-air temperature range (unless otherwise noted)

Symbol	Parameter	Min	Max	Units
V_+	Supply voltage	1.65	5	V
V_{IN}	Control input voltage	0	V_+	V
	Switch input voltage	0	V_+	V
V_{OUT}	Output voltage	0	V_+	V
T_A	Ambient temperature	-40	125	°C

(1) All unused digital inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

6 Electrical Specifications

V_+=4.2V, Full= –40°C to +125°C, Typical values are at TA=+25°C (unless otherwise noted)

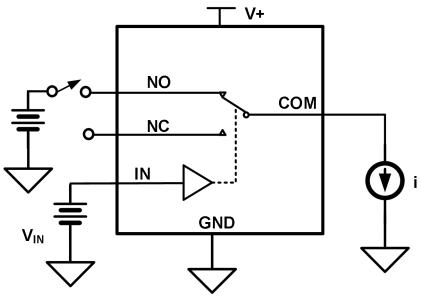
Parameter	Symbol	Conditions		V_+	Temp	Min	Typ	Max	Units
Analog switch									
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}				Full	0		V_+	V
On-Resistance	R_{ON}	V_{NO} or V_{NC}=1V, I_{COM}=-100mA		4.2V	+25°C		0.4		Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_{NO} or V_{NC}=1V, I_{COM}=-100mA		4.2V	+25°C		0.08		Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	0≤V_{NO} or V_{NC}≤V_+, I_{COM}=-100mA		4.2V	+25°C		0.06		Ω
NC, NO Off Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NO} or V_{NC}=0.3V, 3.3V, V_{COM}=3.3V, 0.3V		4.2V	Full			1	μA
NC, NO, COM On Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_{COM}=0.3V, 3.3V, V_{NO} or V_{NC}=0.3V, 3.3V, or floating		4.2V	Full			1	μA
Digital inputs									
Input High Voltage	V_{INH}			4.2V	Full	1.6			V
Input Low Voltage	V_{INL}			4.2V	Full			0.5	V
Input Leakage Current	I_{IN}	V_{IN}=V_+ or 0		4.2V	Full		0.1		μA
Dynamic characteristics									
Turn-On Time	t_{ON}	V_{NO} or V_{NC}=4.5V, V_{IH}=1.8V, V_{IL}=0, R_L=500Ω, C_L=35pF		4.5V	+25°C		12		ns
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC}=4.5V, V_{IH}=1.8V, V_{IL}=0, R_L=500Ω, C_L=35pF		4.5V	+25°C		7		ns
Break-Before-Make Time Delay	t_D	V_{NO1} or V_{NC1}=V_{NO2} or V_{NC2}=2.5V, R_L=500Ω, C_L=35pF		5V	+25°C		10		ns
Off Isolation	O_{ISO}	R_L=50Ω, C_L=5pF	f=100KHz	5V	+25°C		-70		dB
			f=1MHz	5V	+25°C		-50		dB
Channel-to-Channel Crosstalk	X_{TALK}	R_L=50Ω, C_L=5pF	f=100KHz	5V	+25°C		-90		dB
			f=1MHz	5V	+25°C		-90		dB
-3dB Bandwidth	BW	R_L=50Ω, C_L=5pF		5V	+25°C		100		MHz
Charge Injection	Q	V_G=0, R_G=0, C_L=1nF		5V	+25°C		3.4		pC
Switch ON Capacitance	C_{ON}			5V	+25°C		92		pF
Switch OFF Capacitance	C_{OFF}			5V	+25°C		32		pF
Total Harmonic Distortion	THD+N	V_{NO} or V_{NC}=5Vpp, f=20Hz to 20KHz	R_L=600Ω	5V	+25°C		0.013		%
Power requirements									
Power Supply Current	I_+	V_{IN}=GND or V_+		5 V	Full			1	μA

6 Electrical Specifications (Continued)

V_+=2.7V to 3.6V, Full= –40°C to +125°C, Typical values are at TA=+25°C (unless otherwise noted)

Parameter	Symbol	Conditions	V_+	Temp	Min	Typ	Max	Units
Analog switch								
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}			Full	0		V_+	V
On-Resistance	R_{ON}	V_{NO} or V_{NC}=1V, I_{COM}=-100mA	2.7V	+25°C		0.5		Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_{NO} or V_{NC}=1V, I_{COM}=-100mA	2.7V	+25°C		0.08		Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	0≤V_{NO} or V_{NC}≤V_+, I_{COM}=-100mA	2.7V	+25°C		0.08		Ω
NC, NO Off Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_{NO} or V_{NC}=0.3V, 3.3V, V_{COM}=3.3V, 0.3V	3.6V	Full			1	μA
NC, NO, COM On Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_{COM}=0.3V, 3.3V, V_{NO} or V_{NC}=0.3V, 3.3V, or floating	3.6V	Full			1	μA
Digital inputs								
Input High Voltage	V_{INH}		2.7V	Full	1.5			V
Input Low Voltage	V_{INL}		2.7V	Full			0.4	V
Input Leakage Current	I_{IN}	V_{IN}=V_+ or 0	2.7V	Full		0.1		μA
Dynamic characteristics								
Turn-On Time	t_{ON}	V_{NO} or V_{NC}=3V, V_{IH}=1.8V, V_{IL}=0, R_L=500Ω, C_L=35pF	3V	+25°C		25		ns
Turn-Off Time	t_{OFF}	V_{NO} or V_{NC}=3V, V_{IH}=1.8V, V_{IL}=0, R_L=500Ω, C_L=35pF	3V	+25°C		10		ns
Break-Before-Make Time Delay	t_D	V_{NO1} or V_{NC1}=V_{NO2} or V_{NC2}=1.65V, R_L=500Ω, C_L=35pF	3.3V	+25°C		13.5		ns
Off Isolation	O_{ISO}	R_L=50Ω, C_L=5pF, f=100KHz	3.3V	+25°C		-70		dB
		R_L=50Ω, C_L=5pF, f=1MHz	3.3V	+25°C		-50		dB
Channel-to-Channel Crosstalk	X_{TALK}	R_L=50Ω, C_L=5pF, f=100KHz	3.3V	+25°C		-90		dB
		R_L=50Ω, C_L=5pF, f=1MHz	3.3V	+25°C		-90		dB
-3dB Bandwidth	BW	R_L=50Ω, C_L=5pF	3.3V	+25°C		100		MHz
Charge Injection	Q	V_G=0, R_G=0, C_L=1nF	3.3V	+25°C		2.5		pC
Switch ON Capacitance	C_{ON}		3.3V	+25°C		92		pF
Switch OFF Capacitance	C_{OFF}		3.3V	+25°C		32		pF
Total Harmonic Distortion	THD+N	V_{NO} or V_{NC}=3.3Vpp, f=20Hz to 20KHz, R_L=600Ω	3.3V	+25°C		0.016		%
Power requirements								
Power Supply Current	I_+	V_{IN}=GND or V_+	2.7 V	Full			1	μA

7 Measurement Information



Channel On

Ron = (V_{NO} or V_{NC}-V_{COM}) / i

V_{IN} = V_{IH} or V_{IL}

Fig.7-1. On Resistance

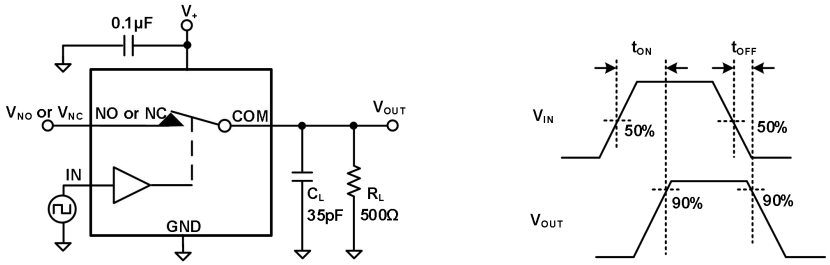


Fig.7-2. Switching Times

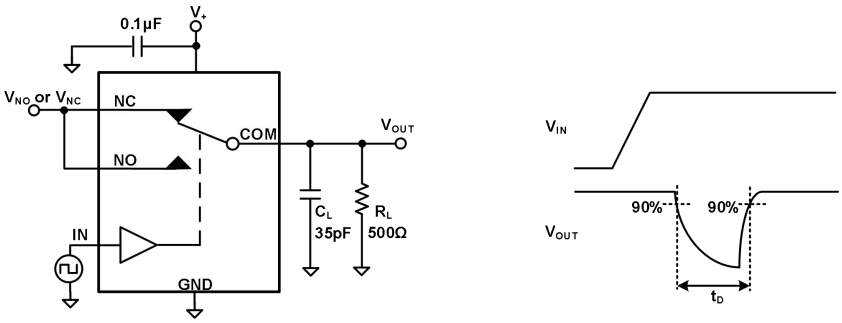


Fig.7-3. Break-Before-Make Time(t_{BBM})

7 Measurement Information (Continued)

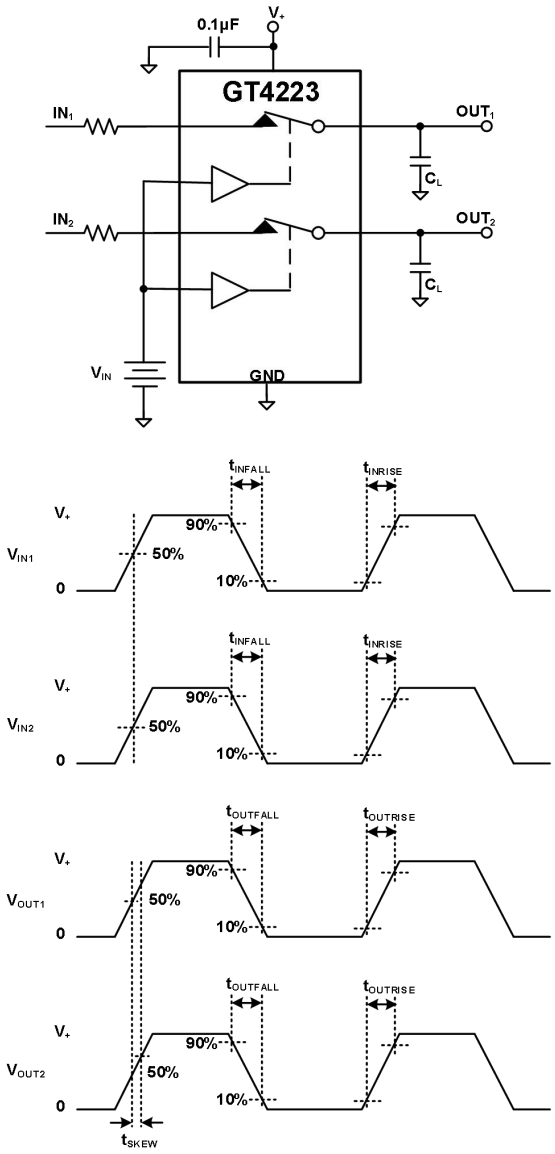


Fig.7-4. Output Signal Skew

7 Measurement Information (Continued)

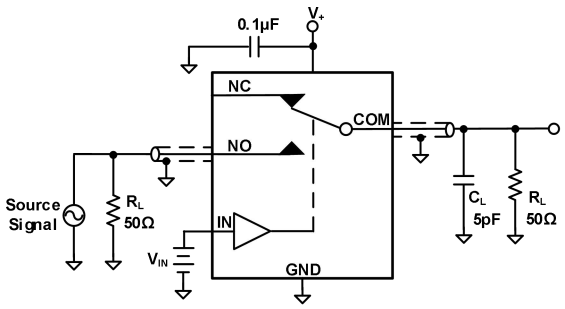


Fig.7-5. OFF Isolation (O_{ISO})

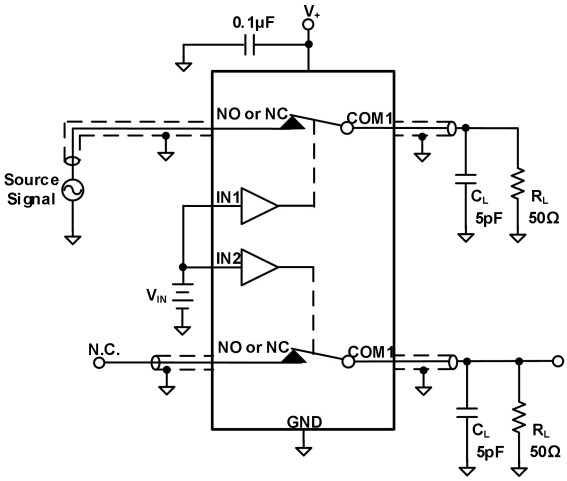


Fig.7-6. Crosstalk(X_{TALK})

7 Measurement Information(Continued)

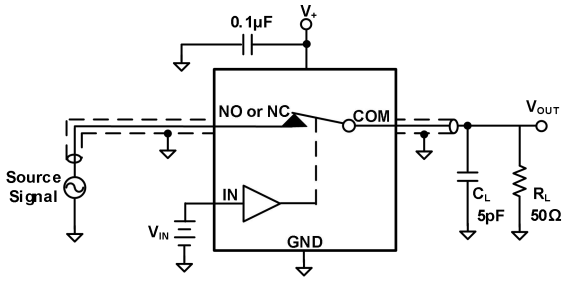


Fig.7-7. Bandwidth

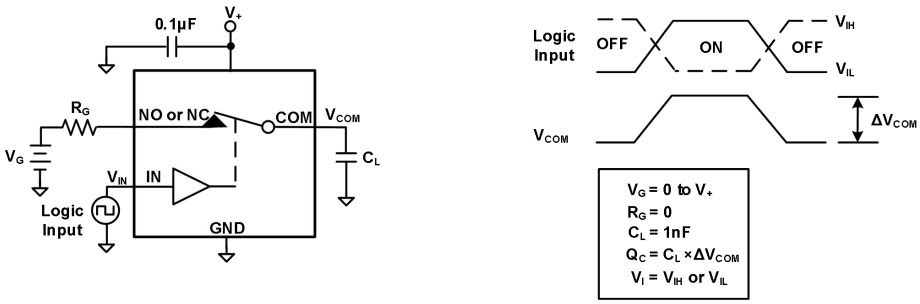


Fig.7-8. Charge Injection Test

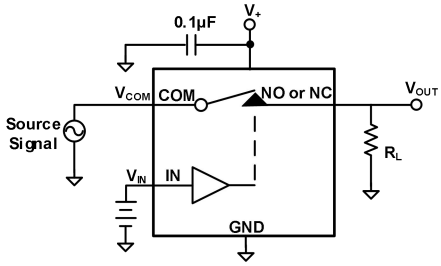
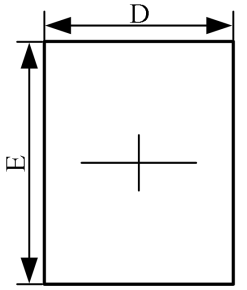


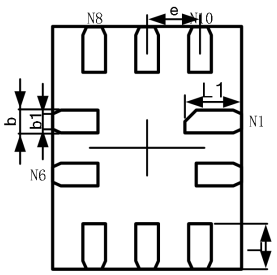
Fig.7-9. Total Harmonic Distortion(THD+N)

8 Package Outline Dimension

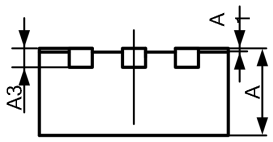
QFN1.8×1.4-10L



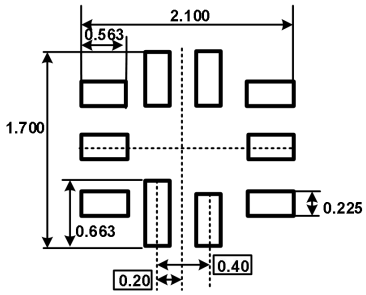
TOP VIEW



BOTTOM VIEW



SIDE VIEW

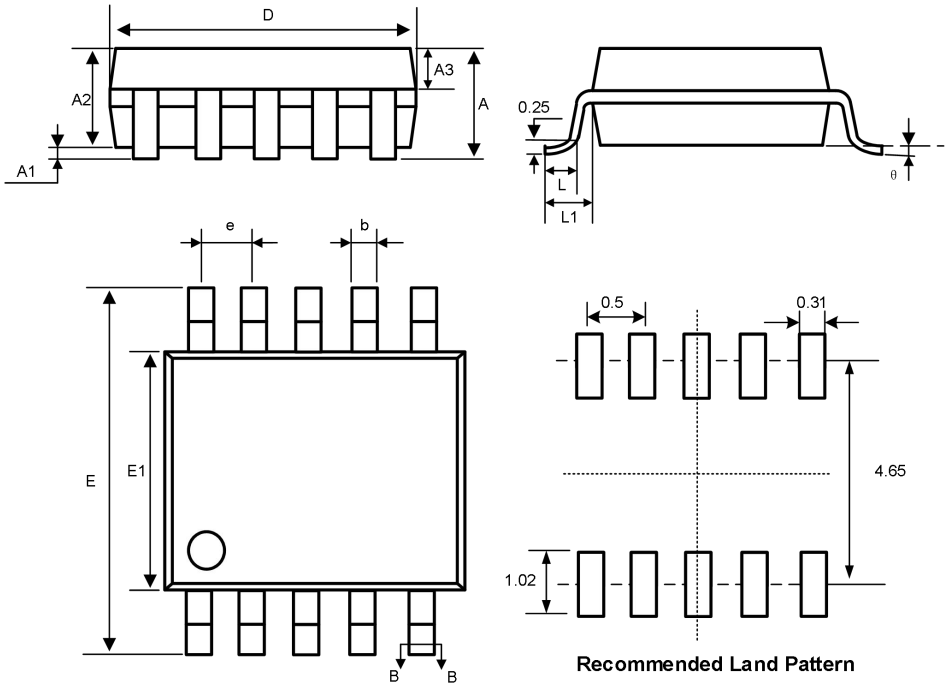


Recommended Land Pattern

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A3	0.152REF		0.006REF	
D	1.350	1.450	0.053	0.057
E	1.750	1.850	0.069	0.073
D1	—	—	—	—
E1	—	—	—	—
k	—		—	
b	0.150	0.250	0.006	0.010
b1	0.100	0.200	0.004	0.008
e	0.400TYP		0.016TYP	
L	0.350	0.450	0.014	0.018
L1	0.450	0.550	0.018	0.022

8 Package Outline Dimension(Continued)

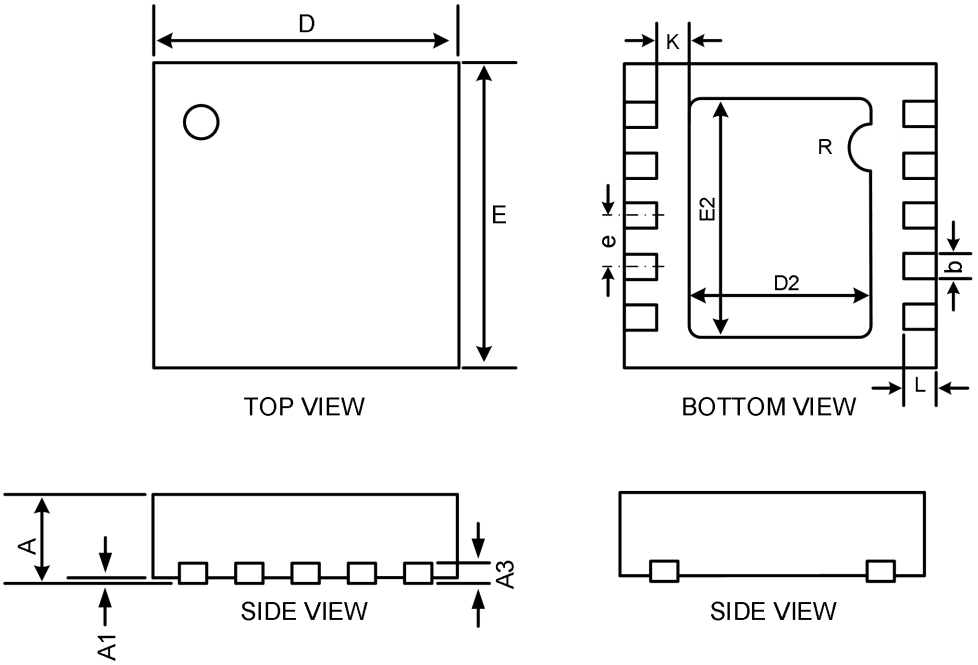
MSOP-10



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	—	—	1.10	—	—	0.043
A1	0.05	—	0.15	0.002	—	0.006
A2	1.30	1.40	1.50	0.051	0.055	0.059
A3	0.75	0.85	0.95	0.030	0.033	0.037
D	2.90	3.00	3.10	0.114	0.118	0.122
E	4.70	4.90	5.10	0.185	0.193	0.201
E1	2.90	3.00	3.10	0.114	0.118	0.122
e	0.50BSC			0.02BSC		
L	0.40	—	0.70	0.016	—	0.028
L1	0.95REF			0.037REF		
θ	0	—	8°	0	—	8°

8 Package Outline Dimension(Continued)

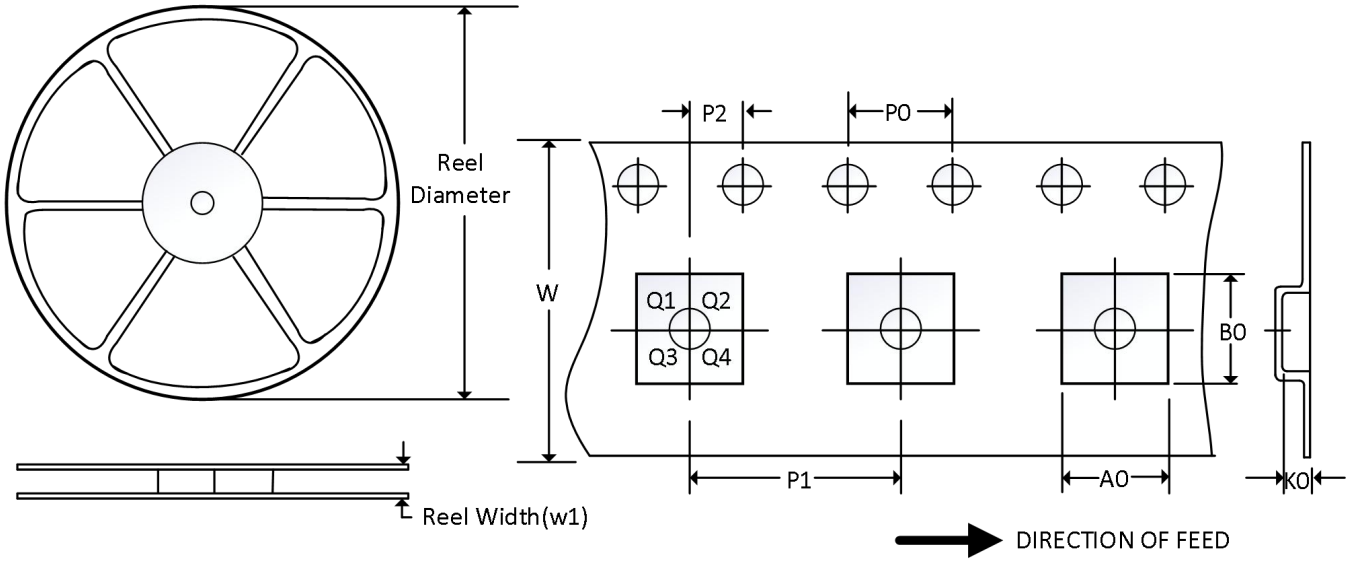
DFN3×3-10L



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
A3	0.203(TYP)		0.008(TYP)	
b	0.200	0.300	0.008	0.012
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
D2	1.550	1.750	0.061	0.069
E2	2.300	2.500	0.091	0.098
e	0.400	0.600	0.016	0.024
K	0.175	0.375	0.007	0.015
L	0.350	0.450	0.014	0.018
R	0.200(TYP)		0.008(TYP)	

9 Tape and Reel Information

Reel Dimensions **Reel 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(mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
QFN1.8×1.4-10L	7''	9	1.6	2	0.85	4.0	4.0	2.0	8.0	Q1
MSOP-10	13''	12.4	5.2	3.3	1.2	4.0	8.0	2.0	12.0	Q1
DFN3×3-10L	/	/	/	/	/	/	/	/	/	/

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.