

## High-Speed Dual SPDT Switch

### UM9636 QFN10 1.8×1.4

#### General Description

The UM9636 is a high-speed, low-power dual single-pole/double-throw (SPDT) analog switch that operates from a single +2.7V to +12V supply.

The UM9636 features 720MHz -3dB bandwidth, -67dB crosstalk and -58dB off-isolation at 10MHz frequency. Wide bandwidth and low on-resistance allow it to pass high-speed differential signal with good signal integrity. The switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs. Its high channel-to-channel crosstalk rejection results in minimal noise interference. Key applications for the UM9636 are logic level translation, pulse generator, and high speed or low noise signal switching in precision instrumentations and portable device designs.

The switch is available in Pb-free QFN10 1.8×1.4 package.

#### Applications

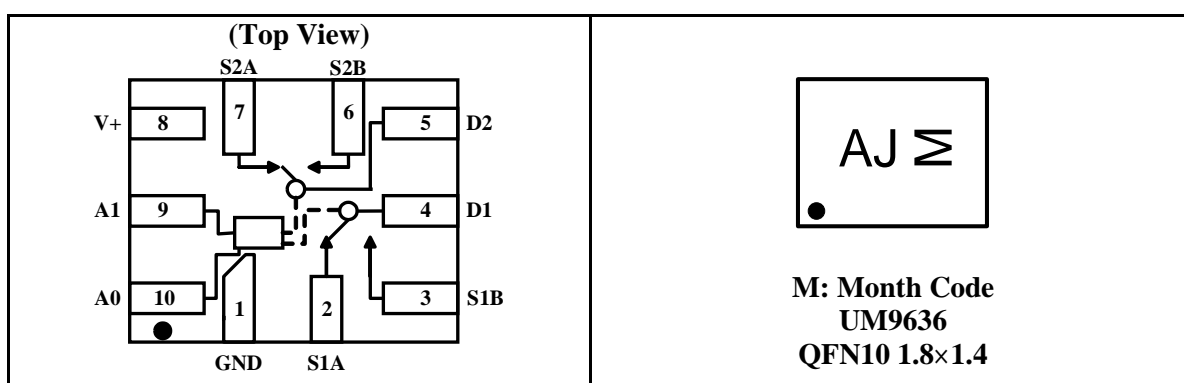
- High-End Data Acquisition
- Medical Instruments
- Precision Instruments
- High Speed Communications Applications
- Automated Test Equipment
- Sample and Hold Applications

#### Features

- Ron is Typically 83Ω at V<sub>CC</sub>=12V
- Channel On-Capacitance: 6.5pF (Typical)
- Typically 720MHz -3dB Bandwidth (or Data Frequency)
- Low Crosstalk: Typically -67dB (10MHz)
- Low Off-Isolation: Typically -58dB (10MHz)
- Low Voltage, 1.65 V CMOS/TTL Compatible
- Low Current Consumption: 1μA
- V<sub>CC</sub> Operating Range: +2.7V to +12V
- Lead(Pb)-Free QFN10 Package

#### Pin Configurations

#### Top View



#### Ordering Information

Part Number	Packaging Type	Marking Code	Shipping Qty
UM9636	QFN10 1.8×1.4	AJ	3000pcs/7 Inch Tape & Reel

**Truth Table**

Select Input		On Switches
A1	A0	UM9636
X	0	D1 to S1A
X	1	D1 to S1B
0	X	D2 to S2A
1	X	D2 to S2B

**Pin Description**

Pin	Name	Function
1	GND	Ground Connection
2	S1A	Data Ports
3	S1B	Data Ports
4	D1	Data Ports
5	D2	Data Ports
6	S2B	Data Ports
7	S2A	Data Ports
8	V+	Positive Supply Voltage
9	A1	Select Input
10	A0	Select Input

**Absolute Maximum Ratings**

Symbol	Parameter	Limit	Unit
V+	Supply Voltage	-0.5 to +14V	V
V <sub>IS</sub>	Analog Switch Input Voltage	-0.5 to (V <sub>CC</sub> +0.3)	
V <sub>IN</sub>	Digital Select Input Voltage	-0.5 to (V <sub>CC</sub> +0.3)	
I <sub>D</sub>	Continuous DC Current	50	mA
P <sub>P</sub>	Peak Current, S or D (Pulsed 1 ms, 10 % Duty Cycle)	100	
P <sub>D</sub>	Power Dissipation	0.28	W
T <sub>O</sub>	Operating Temperature Range	-40 to +85	°C
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	
ESD	HBM	4000 2000	V
	I/O to GND		
	All Pins		

## Electrical Characteristics

Symbol	Parameter	Test Conditions	V+ (V)	Temp	Limits (-40°C to 85°C)			Unit
					Min	Typ (Note 1)	Max	
<b>DC Electrical Characteristics</b>								
V <sub>ANALOG</sub>	Analog Signal Range			Full			12	V
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> =0V, or V+	12	Room Full		0.01	0.5	μA
I <sub>GND</sub>	Ground Current			Room Full	-0.5 -1	-0.01	1	
I <sub>IH</sub>	Input Leakage Current, V <sub>IN</sub> High	V <sub>AX</sub> =1.65V	12	Full	-0.1	0.01	0.1	μA
I <sub>IL</sub>	Input Leakage Current, V <sub>IN</sub> Low	V <sub>AX</sub> =0.5V	12	Full	-0.1	0.01	0.1	μA
I <sub>D(on)</sub>	Channel On Leakage Current	V <sub>+</sub> =12V, V <sub>D</sub> =V <sub>S</sub> 11V/1V	12	Room Full	-1.0	±0.01	1.0 2.0	μA
I <sub>D(off)</sub>	OFF State Leakage Current (Note 2)	V <sub>+</sub> =12V, V <sub>D</sub> =1V/11V, V <sub>S</sub> =11V/1V	12	Room Full	-11.0	±0.01	11.0 15.0	μA
I <sub>S(off)</sub>			Room Full	-11.0	±0.01	11.0 15.0		
V <sub>IH</sub>	Input High Voltage		12	Full	1.65			V
V <sub>IL</sub>	Input Low Voltage		12	Full			0.5	V
R <sub>ON</sub>	On-Resistance (Note 3)	V <sub>D</sub> =11.3V I <sub>S</sub> =1mA	12	Room Full		83	110 125	Ω
ΔR <sub>ON</sub>	On Resistance Match Between Channels (Note 3, 4, 5)	V <sub>D</sub> =11.3V I <sub>S</sub> =1mA	12	Room Full		2	4 6	Ω
R <sub>FLAT</sub>	On Resistance Flatness (Note 3, 4, 6)	V <sub>D</sub> =0.7, 6.5, 11.3V I <sub>S</sub> =1mA	12	Room Full		33	45 50	Ω
<b>AC Electrical Characteristics</b>								
t <sub>ON</sub>	Turn On Time	R <sub>L</sub> =300Ω, C <sub>L</sub> =35pF	12	Room Full		30	70 80	ns
t <sub>OFF</sub>	Turn Off Time	R <sub>L</sub> =300Ω, C <sub>L</sub> =35pF	12	Room Full		15	55 65	ns
t <sub>BBM</sub>	Break Before Make Time (Note 7)	R <sub>L</sub> =300Ω, C <sub>L</sub> =35pF	12	Room Full	5 2	15		ns
THD	Total Harmonic Distortion	Signal=1V <sub>RMS</sub> , 20Hz to 20kHz, R <sub>L</sub> =600Ω	12	Room		0.01		%
Charge Injection	Q <sub>INJ</sub>	C <sub>L</sub> =1nF, R <sub>GEN</sub> =0Ω, V <sub>GEN</sub> =0V	12	Room		23.5		pC
O <sub>IRR</sub>	Off Isolation (Note 8)	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF, f=10MHz	12	Room		-58		dB
X <sub>TALK</sub>	Crosstalk	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF, f=10MHz	12	Room		-67		dB
BW	-3dB Bandwidth	R <sub>L</sub> =50Ω	12	Room		720		MHz
<b>Capacitance</b>								
C <sub>IN</sub>	Control Pin Input Capacitance	f=1MHz		Room		3		pF
C <sub>OFF</sub>	Switch Off Capacitance	f=1MHz	12	Room		2.0		pF
C <sub>ON</sub>	Switch On Capacitance	f=1MHz	12	Room		7.7		pF

Note 1: Typically values are at T<sub>A</sub>=+25°C.

Note 2: The high OFF State Leakage Current is because of pull down resistor

Note 3: Guaranteed by design. Resistance measurements do not include test circuit or package resistance.

Note 4: Parameter is characterized but not tested in production.

Note 5: ΔR<sub>ON</sub>= | R<sub>ON(S1A/S1B)</sub> - R<sub>ON(S2A/S2B)</sub> | measured at identical V<sub>CC</sub>, temperature and voltage levels.

Note 6: Flatness is defined as the difference between the maximum and minimum value of On Resistance over the specified range of conditions.

Note 7: Guaranteed by design.

Note 8: Off Isolation=20log<sub>10</sub> [V<sub>D</sub>/V<sub>SA/SB</sub>].

## Electrical Characteristics

Symbol	Parameter	Test Conditions	V+ (V)	Temp	Limits (-40°C to 85°C)			Unit
					Min	Typ (Note 1)	Max	
<b>DC Electrical Characteristics</b>								
V <sub>ANALOG</sub>	Analog Signal Range			Full			5	V
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> =0V, or V+	5	Room Full		0.01	0.5	μA
I <sub>GND</sub>	Ground Current			Room Full	-0.5	-0.01	1	
I <sub>IH</sub>	Input Leakage Current, V <sub>IN</sub> High	V <sub>AX</sub> =1.4V	5	Full	-0.1	0.01	0.1	μA
I <sub>IL</sub>	Input Leakage Current, V <sub>IN</sub> Low	V <sub>AX</sub> =0.5V	5	Full	-0.1	0.01	0.1	μA
I <sub>D(on)</sub>	Channel On Leakage Current	V <sub>+</sub> =5.5V, V <sub>D</sub> =V <sub>S</sub> 4.5V/1V	5.5	Room Full	-1.0	±0.01	1.0	μA
I <sub>D(off)</sub>	OFF State Leakage Current (Note 2)	V <sub>+</sub> =5.5V, V <sub>D</sub> =1V/4.5V, V <sub>S</sub> =4.5V/1V	5.5	Room Full	-3.0	±0.01	3.0	μA
I <sub>S(off)</sub>			Room Full	-3.0	±0.01	3.0	5.0	
V <sub>IH</sub>	Input High Voltage		5	Full	1.4			V
V <sub>IL</sub>	Input Low Voltage		5	Full			0.5	V
R <sub>ON</sub>	On-Resistance (Note 3)	V <sub>D</sub> =4V I <sub>S</sub> =1mA	5	Room Full		300	350	Ω
ΔR <sub>ON</sub>	On Resistance Match Between Channels (Note 3, 4, 5)	V <sub>D</sub> =4V I <sub>S</sub> =1mA	5	Room Full		6	12	Ω
<b>AC Electrical Characteristics</b>								
t <sub>ON</sub>	Turn On Time	R <sub>L</sub> =300Ω, C <sub>L</sub> =35pF	5	Room Full		55		ns
t <sub>OFF</sub>	Turn Off Time	R <sub>L</sub> =300Ω, C <sub>L</sub> =35pF	5	Room Full		30		ns
t <sub>BBM</sub>	Break Before Make Time (Note 6)	R <sub>L</sub> =300Ω, C <sub>L</sub> =35pF	5	Room Full		36		ns
THD	Total Harmonic Distortion	Signal=1V <sub>RMS</sub> , 20Hz to 20kHz, R <sub>L</sub> =600Ω	5	Room		2.2		%
Charge Injection	Q <sub>INJ</sub>	C <sub>L</sub> =1nF, R <sub>GEN</sub> =0Ω, V <sub>GEN</sub> =0V	5	Room		10		pC
O <sub>IRR</sub>	Off Isolation (Note 7)	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF, f=10MHz	5	Room		-58		dB
X <sub>TALK</sub>	Crosstalk	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF, f=10MHz	5	Room		-68		dB
BW	-3dB Bandwidth	R <sub>L</sub> =50Ω	5	Room		610		MHz
<b>Capacitance</b>								
C <sub>IN</sub>	Control Pin Input Capacitance	f=1MHz		Room		3		pF
C <sub>OFF</sub>	Switch Off Capacitance	f=1MHz	5	Room		2.1		pF
C <sub>ON</sub>	Switch On Capacitance	f=1MHz	5	Room		8.1		pF

Note 1: Typically values are at T<sub>A</sub>=+25°C.

Note 2: The high OFF State Leakage Current is because of pull down resistor

Note 3: Guaranteed by design. Resistance measurements do not include test circuit or package resistance.

Note 4: Parameter is characterized but not tested in production.

Note 5: ΔR<sub>ON</sub>= | R<sub>ON(S1A/S1B)</sub>-R<sub>ON(S2A/S2B)</sub> | measured at identical V<sub>CC</sub>, temperature and voltage levels.

Note 6: Guaranteed by design.

Note 7: Off Isolation=20log<sub>10</sub> [V<sub>D</sub>/V<sub>SA/SB</sub>].

## Electrical Characteristics

Symbol	Parameter	Test Conditions	V+ (V)	Temp	Limits (-40°C to 85°C)			Unit
					Min	Typ (Note 1)	Max	
<b>DC Electrical Characteristics</b>								
V <sub>ANALOG</sub>	Analog Signal Range			Full			3	V
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> =0V, or V+	3	Room Full		0.01	0.5	μA
I <sub>GND</sub>	Ground Current			Room Full	-0.5	-0.01	1	
I <sub>IH</sub>	Input Leakage Current, V <sub>IN</sub> High	V <sub>AX</sub> =1.4V	3	Full	-0.1	0.01	0.1	μA
I <sub>IL</sub>	Input Leakage Current, V <sub>IN</sub> Low	V <sub>AX</sub> =0.5V	3	Full	-0.1	0.01	0.1	μA
I <sub>D(on)</sub>	Channel On Leakage Current	V <sub>+</sub> =3.3V, V <sub>D</sub> =V <sub>S</sub> 3V/1V	3.3	Room Full	-1.0	±0.01	1.0	μA
I <sub>D(off)</sub>	OFF State Leakage Current	V <sub>+</sub> =3.3V, V <sub>D</sub> =1V/3V, V <sub>S</sub> =3V/1V	3.3	Room Full	-1.0	±0.01	1.0	μA
I <sub>S(off)</sub>			3.3	Room Full	-1.0	±0.01	1.0	μA
V <sub>IH</sub>	Input High Voltage		3	Full	1.4			V
V <sub>IL</sub>	Input Low Voltage		3	Full			0.5	V
R <sub>ON</sub>	On-Resistance (Note 2)	V <sub>D</sub> =1.5V I <sub>S</sub> =1mA	3	Room Full		500	550	Ω
ΔR <sub>ON</sub>	On Resistance Match Between Channels (Note 2, 3, 4)	V <sub>D</sub> =1.5V I <sub>S</sub> =1mA	3	Room Full		10	14	Ω
<b>AC Electrical Characteristics</b>								
t <sub>ON</sub>	Turn On Time	R <sub>L</sub> =300Ω, C <sub>L</sub> =35pF	3	Room Full		96		ns
t <sub>OFF</sub>	Turn Off Time	R <sub>L</sub> =300Ω, C <sub>L</sub> =35pF	3	Room Full		60		ns
t <sub>BBM</sub>	Break Before Make Time (Note 5)	R <sub>L</sub> =300Ω, C <sub>L</sub> =35pF	3	Room Full		77		ns
THD	Total Harmonic Distortion	Signal=1V <sub>RMS</sub> , 20Hz to 20kHz, R <sub>L</sub> =600Ω	3	Room		2.2		%
Charge Injection	Q <sub>INJ</sub>	C <sub>L</sub> =1nF, R <sub>GEN</sub> =0Ω, V <sub>GEN</sub> =0V	3	Room		6.6		pC
O <sub>IRR</sub>	Off Isolation (Note 6)	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF, f=10MHz	3	Room		-57		dB
X <sub>TALK</sub>	Crosstalk	R <sub>L</sub> =50Ω, C <sub>L</sub> =5pF, f=10MHz	3	Room		-69		dB
BW	-3dB Bandwidth	R <sub>L</sub> =50Ω	3	Room		525		MHz
<b>Capacitance</b>								
C <sub>IN</sub>	Control Pin Input Capacitance	f=1MHz		Room		3.1		pF
C <sub>OFF</sub>	Switch Off Capacitance	f=1MHz	3	Room		2.1		pF
C <sub>ON</sub>	Switch On Capacitance	f=1MHz	3	Room		8.3		pF

Note 1: Typically values are at T<sub>A</sub>=+25°C.

Note 2: Guaranteed by design. Resistance measurements do not include test circuit or package resistance.

Note 3: Parameter is characterized but not tested in production.

Note 4: ΔR<sub>ON</sub>= | R<sub>ON(S1A/S1B)</sub> - R<sub>ON(S2A/S2B)</sub> | measured at identical V<sub>CC</sub>, temperature and voltage levels.

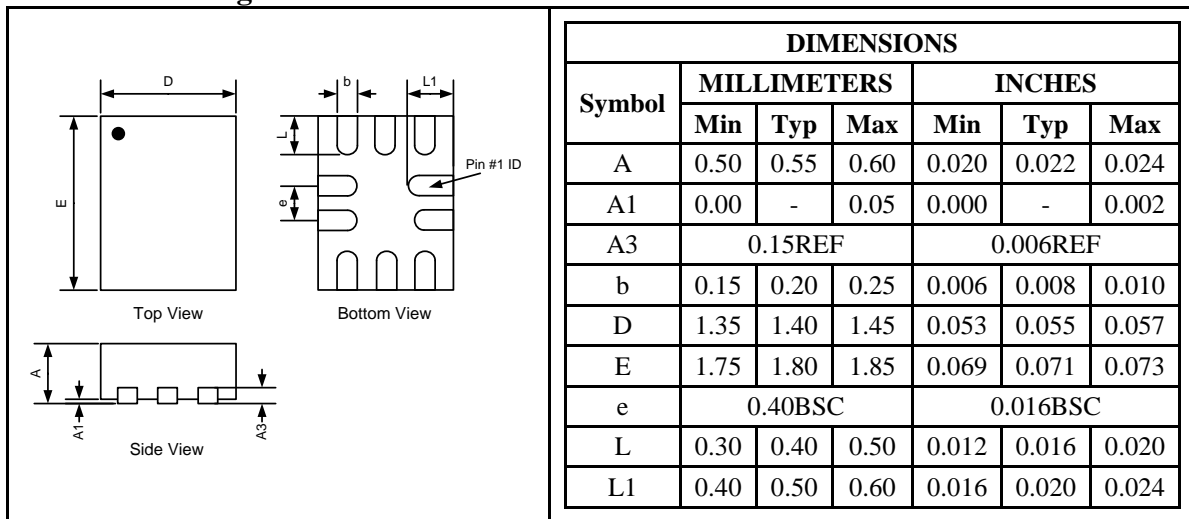
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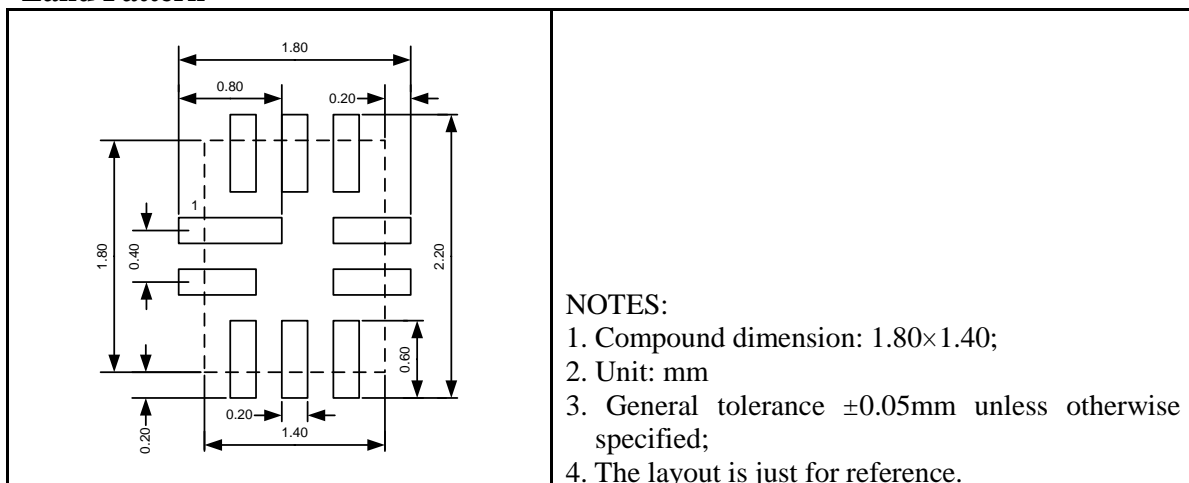
## Package Information

### UM9636: QFN10 1.80×1.40

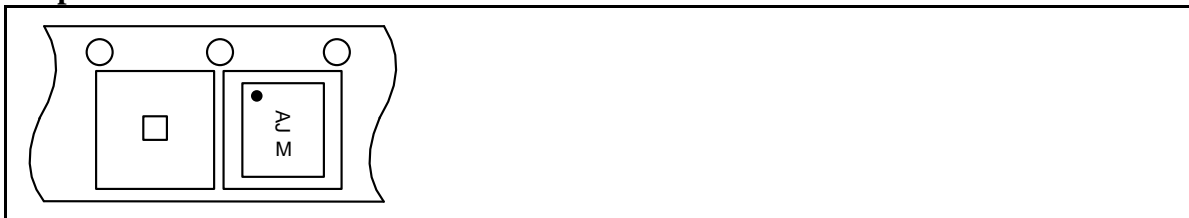
#### Outline Drawing



#### Land Pattern



#### Tape and Reel Orientation



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