



## SW4684

### Ultra-Low Resistance Dual SPDT Analog Switch

#### General Description

The SW4684 is an advanced CMOS analog switch that operates from a single +1.8V to +5.5V supply. The device is a dual independent single pole double throw (SPDT) switch featuring ultra-low  $R_{ON}$  of  $0.5\Omega$  for the normally closed (NC) switch, and  $0.8\Omega$  for the normally opened switch (NO) at 2.7 V.

The switch features break-before-make switching action with  $t_{ON} = 50ns$  and  $t_{OFF} = 40ns$  at +3V. The digital logic inputs are 1.8V logic interface compatible with a +2.7V to +3.3V supply.

#### Key Specifications

- Single Supply Operation 1.8V to 5.5V
- High Isolation -66dB at 100kHz
- Low Standby Current <math><50nA</math>
- Low Crosstalk <math><-66dB</math> at 100kHz
- 3dB Bandwidth at  $V_{CC} = 5V$  10MHz(typ)

#### Features

- Ultra Low NC  $R_{ON}$ ,  $0.5\Omega$  Max at 2.7V
- Ultra Low NO  $R_{ON}$ ,  $0.8\Omega$  Max at 2.7V
- Low Distortion, <math><0.14\%</math> THD
- Full 0-Vcc Signal Handling
- High Continuous Current Capability

#### Applications

- Mobile Phones
- Speaker Switches
- Power Switches

#### Schematic Diagram

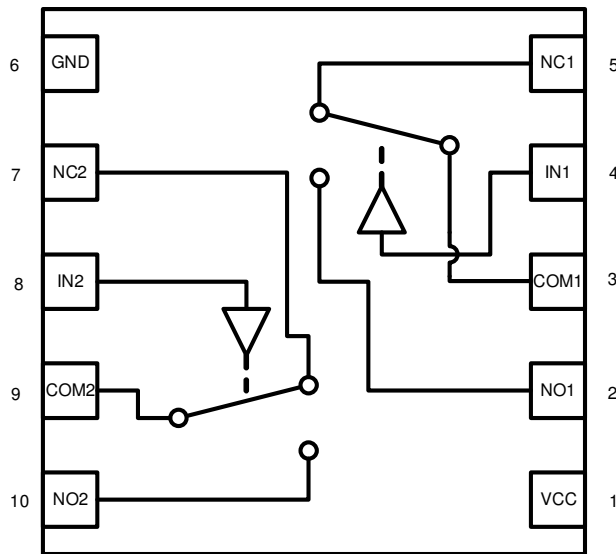


Figure 1 Ultra-Low Resistance dual SPDT Analog Switch

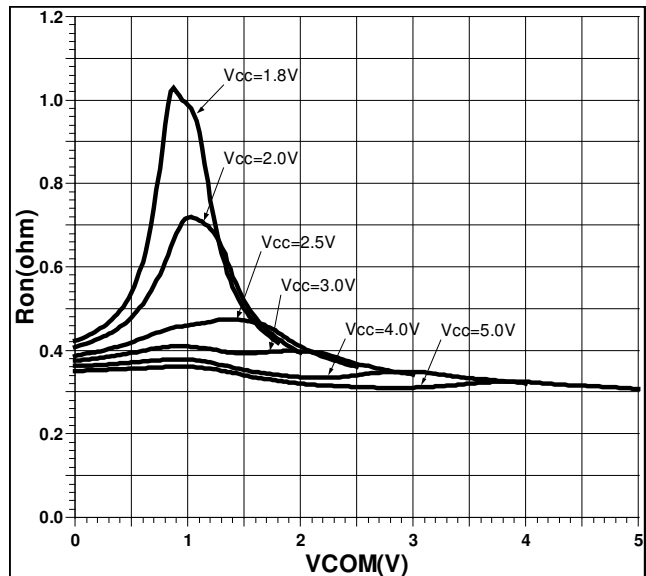
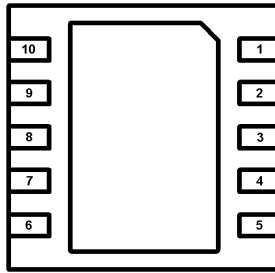


Figure 2 On-Resistance vs COM Voltage

## Pin Assignment

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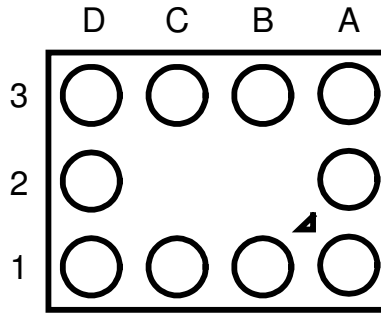


SW4684D10-3 (Bottom View)

Pin No.	Pin Name	Type	Description
1	V <sub>CC</sub>	I	Power Supply
2	NO1	I/O	Analog Switch 1 Normally Open Pin
3	COM1	I/O	Analog Switch 1 Common Pin
4	IN1	I	Analog Switch 1 Digital Control Input
5	NC1	I/O	Analog Switch 1 Normally Closed Pin
6	GND	I	Ground
7	NC2	I/O	Analog Switch 2 Normally Closed Pin
8	IN2	I	Analog Switch 2 Digital Control Input
9	COM2	I/O	Analog Switch 2 Common Pin
10	NO2	I/O	Analog Switch 2 Normally Open Pin

## Pin Assignment (Cont)

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SW4684CS10 (Ball View)

Pin No.	Pin Name	Type	Description
A1	NC1	I/O	Analog Switch 1 Normally Closed Pin
A2	GND	I	Ground
A3	NC2	I/O	Analog Switch 2 Normally Closed Pin
B1	IN1	I	Analog Switch 1 Digital Control Input
B3	IN2	I	Analog Switch 2 Digital Control Input
C1	COM1	I/O	Analog Switch 1 Common Pin
C3	COM2	I/O	Analog Switch 2 Common Pin
D1	NO1	I/O	Analog Switch 1 Normally Open Pin
D2	V <sub>CC</sub>	I	Power Supply
D3	NO2	I/O	Analog Switch 2 Normally Open Pin

## Operation Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Power Supply Voltage	V <sub>CC</sub>	1.8		5.5	V
Digital Select Input Voltage	V <sub>IN</sub>	GND		5.5	V
Analog Input voltage (NC, NO, COM)	V <sub>IS</sub>	GND		V <sub>CC</sub>	
Operating Temperature Range	T <sub>A</sub>	-55		125	°C

## Ordering Information

Part Number	Package	Marking <sup>+</sup>
SW4684D10-3	10-lead DFN 3x3 (Pb-Free)	A4684D WXYZ
SW4684CS10	10-Ball CSP10 (Pb-Free)	4684 WXYZ

+ WXYZ = assembly and date code

## Absolute Maximum Ratings

If Military/Aerospace specified devices are required, please contact the Analog Express Sales Office/Distributors for availability and specifications.

Supply Voltage $V_{CC}$	-0.5V to +7.0V	Thermal Resistance	
Storage Temperature	-65°C to +150°C	$\theta_{JC}$ (DFN10 3x3)	55°C/W
Digital Input Voltage, $V_{IN}$	$-0.5V \leq V_{IN} + 7.0V$	$\theta_{JA}$ (DFN10 3x3)	10°C/W
Continuous DC Current, COM to NC/NO	$\pm 300mA$		
Peak Passing Current, 10 duty cycle	$\pm 500mA$		
Continuous DC Current into Device	$\pm 300mA$		
Peak Current into Input Clamp Diodes at COM/NC/NO	$\pm 500mA$		

## Electrical Characteristics

The following specifications apply for the circuit shown in Parametric Measurement Information, unless otherwise specified. Limits apply for  $T_A = 25^\circ C$ .

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$V_{NO}, V_{NC}, V_{COM}$	Analog Signal Range		0		$V_{CC}$	V
$R_{ON(NC)}$	NC On-Resistance	$V_{CC} = 2.7V, I_{COM} = 100 mA, V_{NC} = 0 \text{ to } V_{CC}$		0.4	0.5	$\Omega$
$R_{ON(NO)}$	NO On-Resistance	$V_{CC} = 2.7V, I_{COM} = 100 mA, V_{NO} = 0 \text{ to } V_{CC}$		0.4	0.8	$\Omega$
$\Delta R_{ON}$	On-Resistance Match Between Channels	$V_{CC} = 2.7V, I_{COM} = 100 mA, V_{NC} \text{ or } V_{NO} = 1.5V$		1.11	60	m $\Omega$
$R_{FLAT(NC)}$	NC-On-Resistance Flatness	$V_{CC} = 2.7V, I_{COM} = 100 mA, V_{NC} = 0 \text{ to } V_{CC}, T_J = -40^\circ C \text{ to } 85^\circ C$		0.1	0.25	$\Omega$
$R_{FLAT(NO)}$	NO On-Resistance Flatness	$V_{CC} = 2.7V, I_{COM} = 100 mA, V_{NO} = 0 \text{ to } V_{CC}$		0.18	0.35	$\Omega$
$I_{NO(OFF)}$ or $I_{NC(OFF)}$	NO or NC Off Leakage Current	$V_{CC} = 3.3V, V_{NO} \text{ or } V_{NC} = 3V, 0.3V; V_{COM} = 0.3V, 3V$	-1 -10		1 10	nA
$I_{COM(ON)}$	COM On Leakage Current	$V_{CC} = 3.3V, V_{NO} \text{ or } V_{NC} = 3V, 0.3V, \text{ or floating}; V_{COM} = 3V, \text{ or floating}$	-2 -20		2 20	nA

## Dynamic Characteristics

BW	-3 dB Bandwidth	$V_{CC} = 3V, R_L = 50\Omega, V_{IN} = 0 \text{ dBm}$		10		MHz
$t_{ON}$	Turn-On Time	$V_{CC} = 2.7V, V_{NO} \text{ or } V_{NC} = 1.5V; R_L = 50\Omega; C_L = 100 \text{ pF};$			60 70	ns
$t_{OFF}$	Turn-Off Time	$V_{CC} = 2.7V, V_{NO} \text{ or } V_{NC} = 1.5V; R_L = 50\Omega; C_L = 100 \text{ pF};$			40 50	ns
$t_{BBM}$	Break-Before-Make Delay	$V_{CC} = 2.7V, V_{NO} \text{ or } V_{NC} = 1.5V; R_L = 50\Omega; C_L = 100 \text{ pF};$	2			ns
Q	Charge Injection	$COM = 0; R_S = 0; C_L = 1 \text{ nF};$		200		pC

## Electrical Characteristics

The following specifications apply for the circuit shown in Parametric Measurement Information, unless otherwise specified. Limits apply for  $T_A = 25^\circ\text{C}$ .

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### Dynamic Characteristics (continuous)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$V_{ISO}$	Off-Isolation	$R_L = 50\Omega$ ; $C_L = 5\text{ pF}$ ; $f = 100\text{ kHz}$		-66		dB
$V_{CT}$	Crosstalk			-66		dB

### Digital I/O

$V_{IH}$	Input Logic High		1.6			V
$V_{IL}$	Input Logic Low				0.5	V
$I_{IN}$	IN Input Leakage Current	$V_{IN} = 0\text{ or }V_{CC}$	-1		1	$\mu\text{A}$

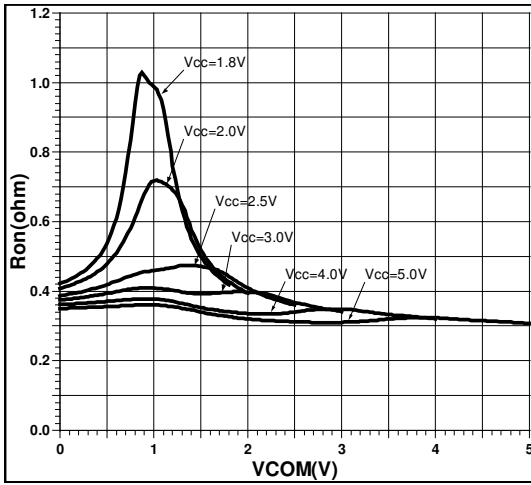
### Power Supply

$V_{CC}$	Power-Supply Range		1.8		5.5	V
$I_{CC}$	Supply Current	$V_{CC} = 5.5\text{V}$		5		nA

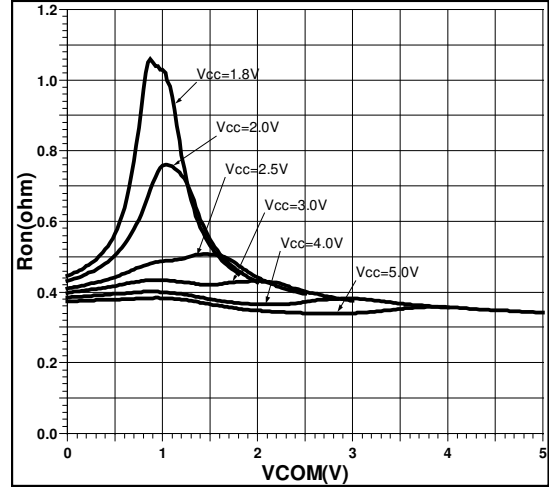
# Typical Performance Characteristics

NO ON Resistance vs. COM Voltage

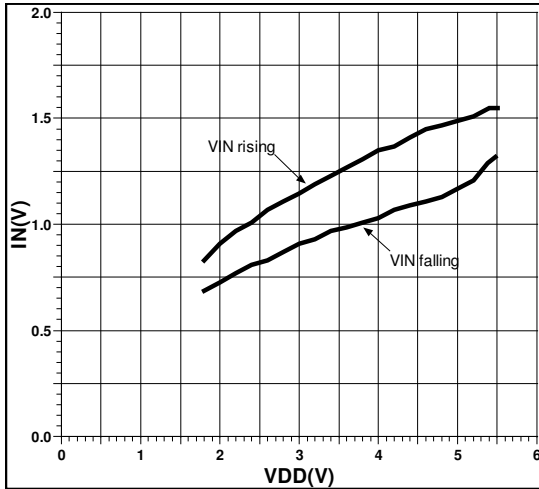
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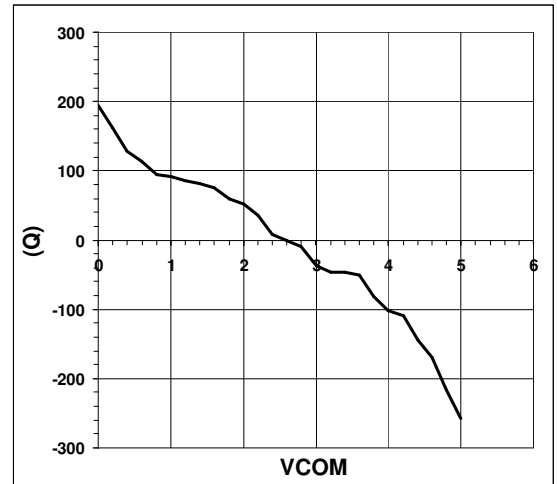
NC ON Resistance vs. COM Voltage



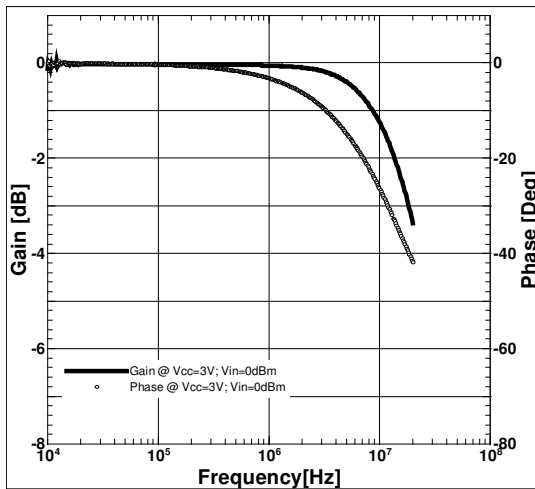
Logic Threshold Voltage vs. Supply Voltage



Charge Injection vs. COM Voltage

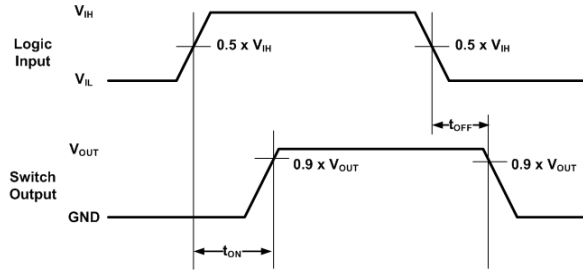
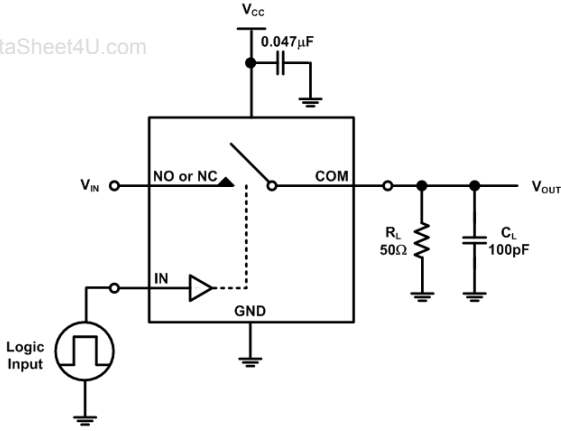


Frequency Response @ VCC = 3V



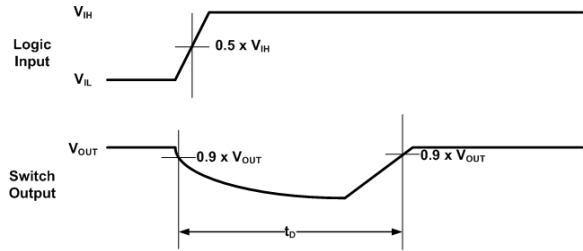
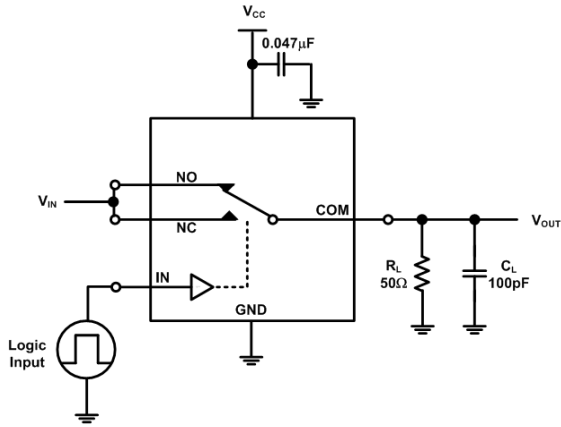
## Parametric Measurement Information

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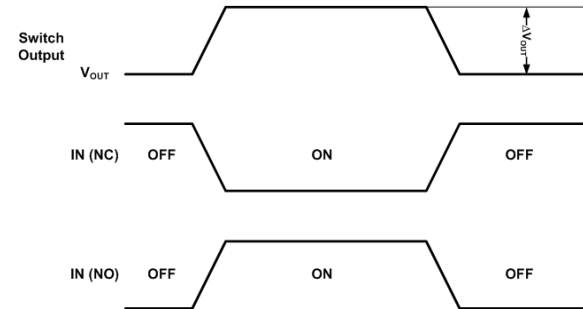
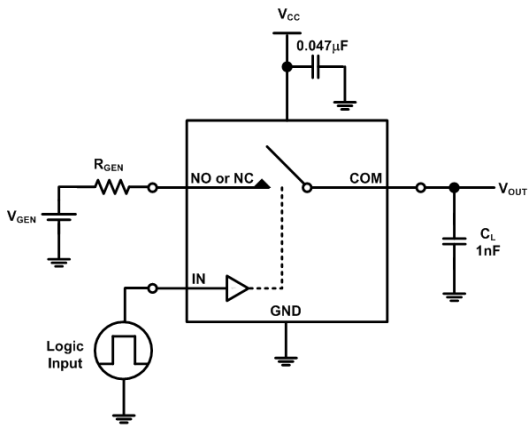
$C_L$  includes fixture and stray capacitance

Figure 3  $t_{ON} / t_{OFF}$  Time



$C_L$  includes fixture and stray capacitance

Figure 4 Break-Before Make Delay



$C_L$  excludes fixture and stray capacitance

$$Q = (\Delta V_{OUT} \times C_L)$$

Figure 5 Charge Injection

## Parametric Measurement Information

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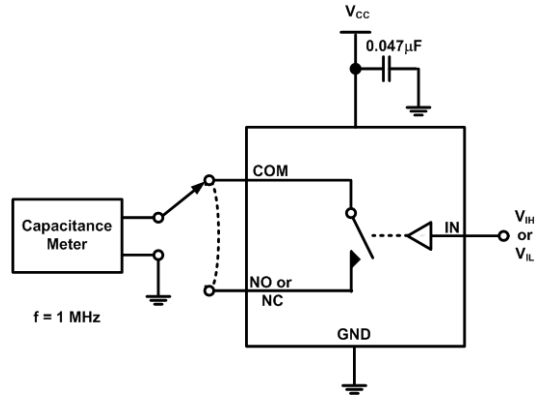


Figure 6 Channel Capacitance

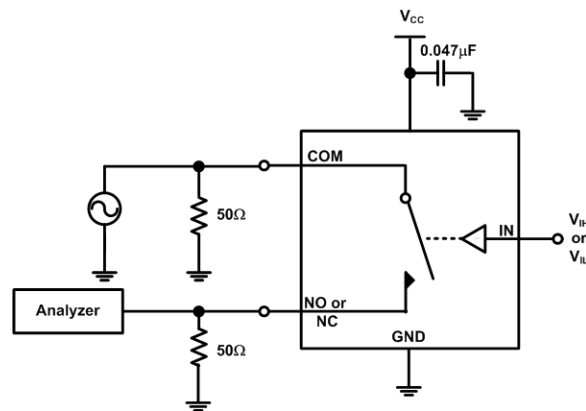


Figure 7 Off Isolation

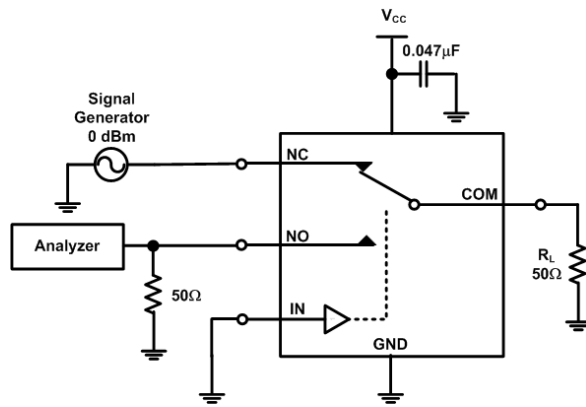


Figure 8 Cross-talk



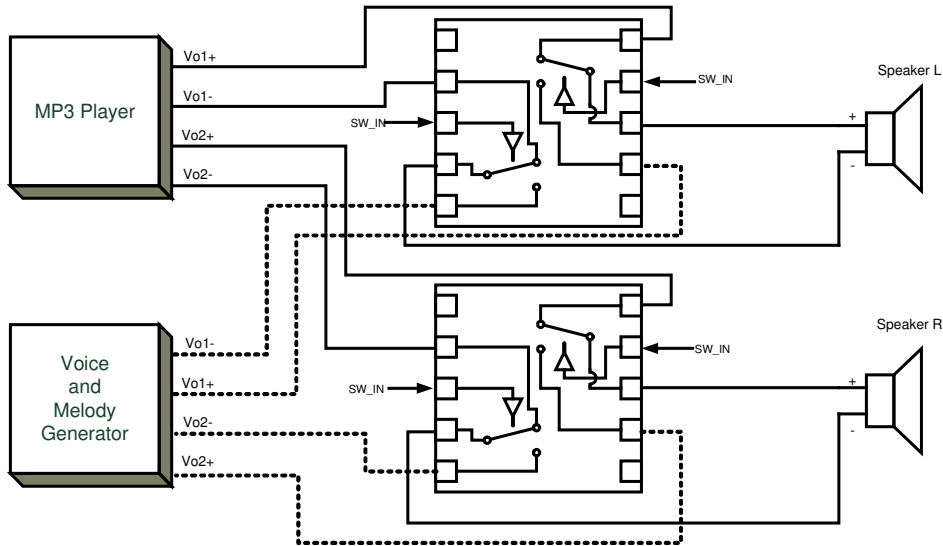
## Functional Description

The SW4684 is an Ultra-low On-Resistance Dual analog switch which can operate over a supply voltage range of 1.8V to 5.5V. In application, the SW4684 is fully characterized to operate in 1.8V to 5.5V and feature very low on resistance and fast Turn-Off and Turn-On times with break-before-make switching.

The switch operates asymmetrically; one terminal is normally closed (NC) and the other terminal normally opened (NO). Both NC and NO terminals are connected to a common terminal (COM). This configuration is ideal for applications with asymmetric loads such as speaker handsets and internal speakers.

## Application Examples

Example for Mobile phone with MP3 player



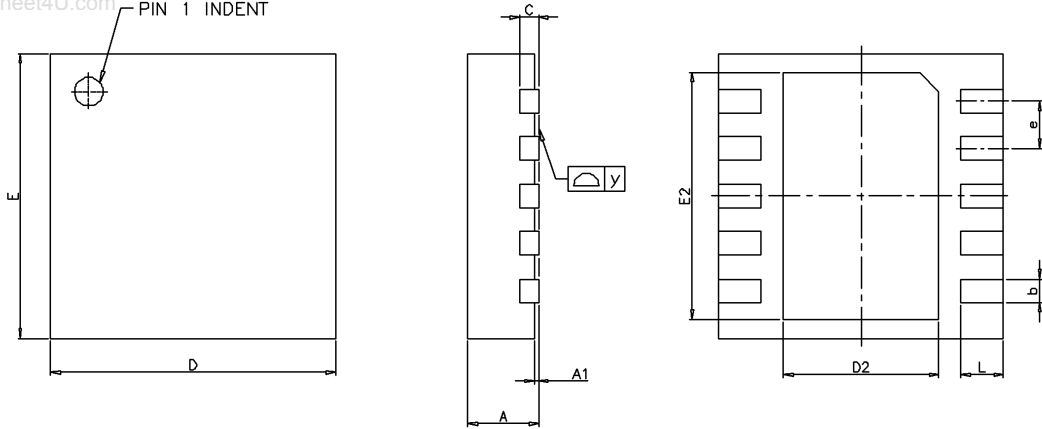
Note :

When SW\_IN = VSS, MP3 Player's Stereo output will connect to speakers.

When SW\_IN = VDD, Voice and Melody Generator will connect to speakers.

# Package Dimensions

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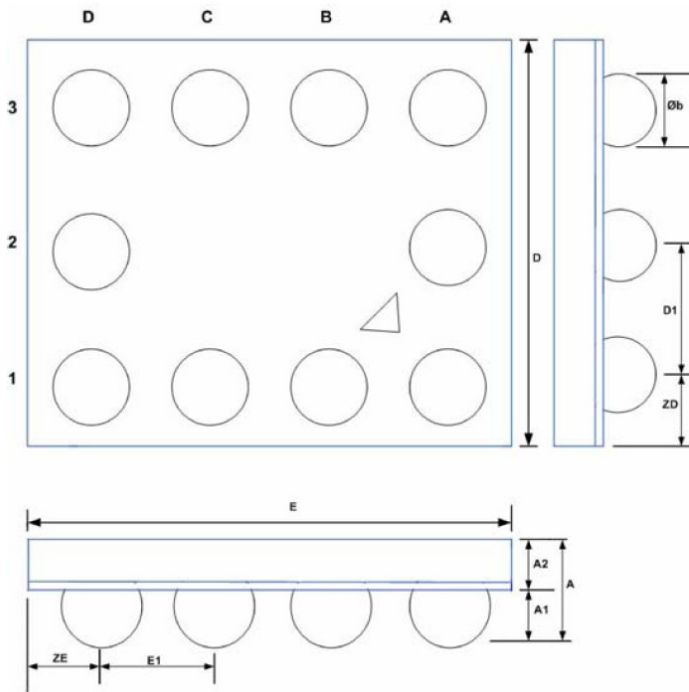
NOTE :  
1. THE TERMINAL #1 IDENTIFIER IS A LASER MARKED FEATURE.

SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.20	0.50
b	0.18	0.25	0.30
c	—	0.20REF.	—
D	2.90	3.00	3.10
D2	1.59	1.64	1.69
E	2.90	3.00	3.10
E2	2.55	2.60	2.65
e	—	0.50	—
L	0.40	0.45	0.50
y	0.00	—	0.075

ANALOG EXPRESS

TITLE:  
PACKAGE OUTLINE  
DFN10 3X3

REF NO. 070314 REV. A

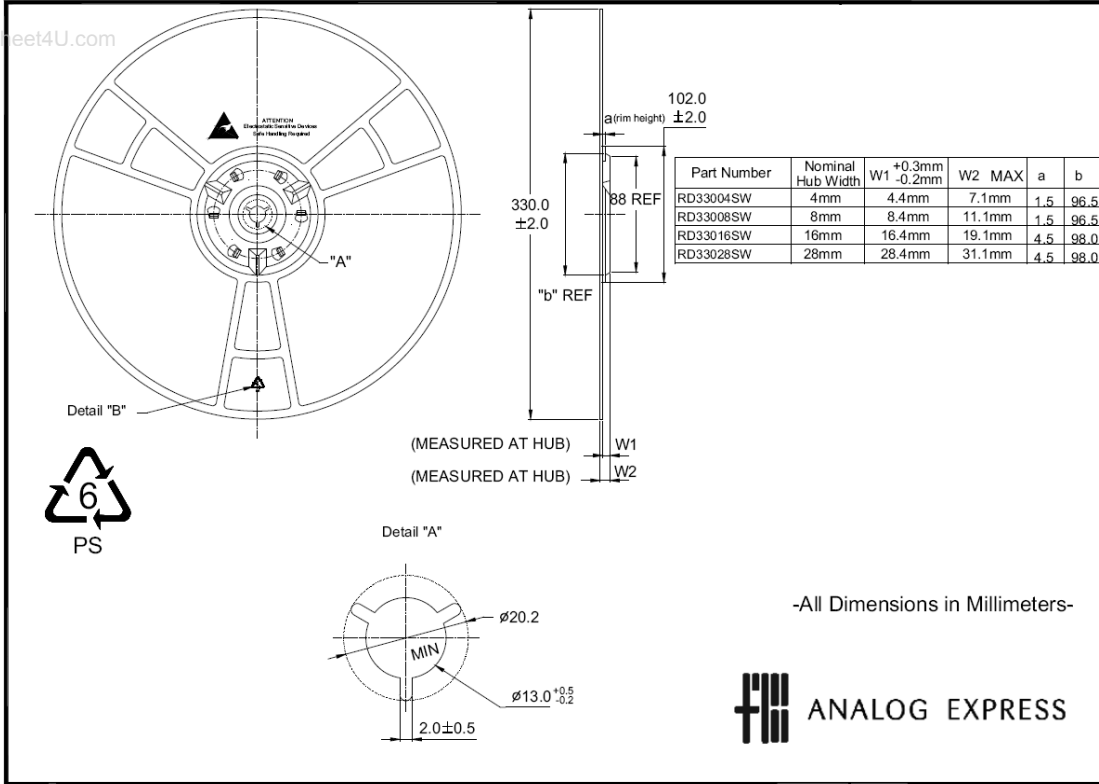


Symbol	Dimensions in Millimeter		
	Min.	Nom.	Max.
A	0.580	0.625	0.670
A1	0.215	0.235	0.255
A2	0.365	0.390	0.415
Ø b	0.280	0.300	0.320
D	1.420	1.470	1.520
D1	0.500		
E	1.870	1.920	1.970
E1	0.500		
ZD	0.210		
ZE	0.235		



# Tape and Reel Drawing

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