Low Voltage, SPDT 1Ω Analog Switch

DESCRIPTION

The SUM3005 is low on-resistance (1 Ω), fast single-pole double-throw (SPDT) CMOS switch with operation range +1.8 V ~ +5.5 V. The SUM3005 is designed for low operating voltage, high current switching of signal gating, chopping, modulation or demodulation (modem), and speaker output for cell phone applications.

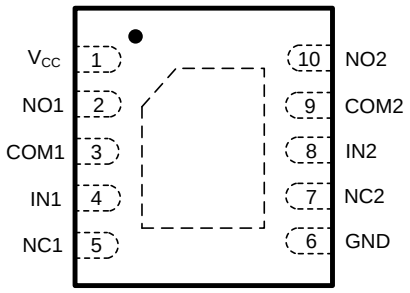
The device contains a break-before-make (BBM) feature. The control input, IN, tolerates input drive signals up to 5.5 V, independent of supply voltage.

All devices are specified for the temperature range of -40°C to +125°C. The SUM3005 Dual is available in Green DFN3 × 3-10 and MSOP-10 packages.

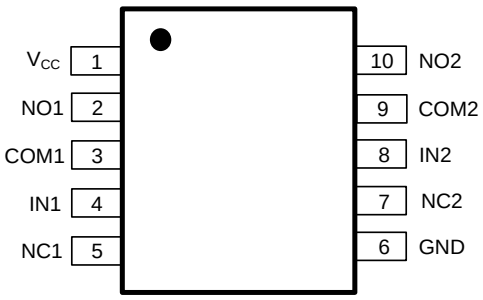
FEATURES

- On-Resistance: 1 Ω (TYP)
- -3dB Bandwidth: 100 MHz
- Single-Supply Operation: +1.8 V ~ +5.5 V
- Break-Before-Make Switching
- Rail-to-Rail Operation
- Low Standby Current
- TTL/CMOS Compatible
- Operating Temperature: -40°C ~ +125°C
- ESD: Human Body Model 3500 V
- Small Package: DFN3 × 3-10 and MSOP-10

PIN CONFIGURATION (Top View)



DFN3 × 3-10



MSOP-10

ORDER INFORMATION

Model	Package	Ordering Number	Packing Option
SUM3005	DFN3 × 3-10	SUM3005DNB10	Tape and Reel, 3000
	MSOP-10	SUM3005MS10	Tape and Reel, 3000

PIN DESCRIPTIONS

Pin	Symbol	Description
1	V_{CC}	Power Supply
2	NO1	Independent Channels
3	COM1	Common Channels
4	IN1	Controls
5	NC1	Independent Channels
6	GND	Ground (V)
7	NC2	Independent Channels
8	IN2	Controls
9	COM2	Common Channels
10	NO2	Independent Channels

TRUTH TABLE

IN1, IN2	NO1, NO2	NC1, NC2
0	OFF	ON
1	ON	OFF

ABSOLUTE MAXIMUM RATINGS

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.5 to +7.5	V
Analog Input Voltage	V_{IS}	-0.5 to V_{CC} + 0.5	V
Digital Select Input Voltage	V_{IN}	-0.5 to +7.5	V

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. SUMSEMI 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.

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

ELECTRICAL CHARACTERISTICS

V_+ = 4.5 V to 5.5 V, GND = 0 V, Full = -40°C to +85°C. Typical values are at T_A = +25°C, unless otherwise noted.

Parameter	Symbol	Conditions	Temp	Min	Typ	Max	Units
Analog Switch							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		+25°C	0		V_+	V
On-Resistance	R_{ON}	V_+ = 4.5 V, 0 V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100 mA, Test Circuit 1	+25°C		1		Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 4.5 V, 0 V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100 mA, Test Circuit 1	+25°C		0.02	0.2	Ω
			Full			0.3	
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 4.5 V, 0 V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100 mA, Test Circuit 1	+25°C		0.25	0.45	Ω
			Full			0.6	
Source Off Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 5.5 V, V_{NO} or V_{NC} = 4.5V / 1V, V_{COM} = 1V / 4.5V	+25°C		0.1		µA
			Full			1	
Channel On Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_+ = 5.5 V, V_{COM} = 1V / 4.5V, V_{NO} or V_{NC} = floating	+25°C		0.1		µA
			Full			1	
Digital Inputs							
Input High Voltage	V_{INH}	V_+ = 4.5 V	+25°C	1.6			V
Input Low Voltage	V_{INL}	V_+ = 4.5 V	+25°C			0.4	V
Input Leakage Current	I_{IN}	V_+ = 4.5 V, V_{IN} = 0 V or V_+	+25°C		0.1		µA
Dynamic Characteristics							
Turn-On Time	t_{ON}	V_+ = 4.5 V, V_{NO} or V_{NC} = 3 V, R_L = 300 Ω, C_L = 35 pF, Test Circuit 2	+25°C		56		ns
Turn-Off Time	t_{OFF}	V_+ = 4.5 V, V_{NO} or V_{NC} = 3 V, R_L = 300 Ω, C_L = 35 pF, Test Circuit 2	+25°C		32		ns
Break-Before-Make Time Delay	t_D	V_+ = 4.5 V, V_{NO} or V_{NC} = 3 V, R_L = 300 Ω, C_L = 35 pF, Test Circuit 3	+25°C		28		ns
Skew	t_{SKEW}	R_S = 39 Ω, C_L = 50 pF, Test Circuit 4	+25°C		7		ns
Off Isolation	O_{ISO}	V_+ = 4.5 V, R_L = 50 Ω, Signal = 0 dBm, Test Circuit 5 — 10 MHz	+25°C		-45		dB
		1 MHz	+25°C		-65		dB
-3dB Bandwidth	BW	V_+ = 4.5 V, Signal = 0 dBm,	+25°C		100		MHz
Channel On Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$	V_+ = 4.5 V, f = 1 MHz	+25°C		40		pF
Channel Off Capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{COM(OFF)}$	V_+ = 4.5 V, f = 1 MHz	+25°C		8.5		pF
Power Requirements							
Power Supply Range	V_+		+25°C	1.8		5.5	V
Power Supply Current	I_+	V_+ = 5.5 V, V_{IN} = 0 V or V_+	+25°C		0.1		µA

ELECTRICAL CHARACTERISTICS (continued)

V_+ = 2.7 V to 3.6 V, GND = 0 V, Full = -40°C to +85°C. Typical values are at T_A = +25°C, unless otherwise noted.

Parameter	Symbol	Conditions	Temp	Min	Typ	Max	Units
Analog Switch							
Analog Signal Range	V_{NO}, V_{NC}, V_{COM}		+25°C	0		V+	V
On-Resistance	R_{ON}	V_+ = 2.7 V, 0 V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100 mA, Test Circuit 1	+25°C		1.4		Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_+ = 2.7 V, 0 V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100 mA, Test Circuit 1	+25°C		0.03	0.3	Ω
			Full			0.31	
On-Resistance Flatness	$R_{FLAT(ON)}$	V_+ = 2.7 V, 0 V ≤ V_{NO} or V_{NC} ≤ V_+, I_{COM} = -100 mA, Test Circuit 1	+25°C		0.9	1.2	Ω
			Full			1.25	
Source Off Leakage Current	$I_{NC(OFF)}$, $I_{NO(OFF)}$	V_+ = 3.6 V, V_{NO} or V_{NC} = 3.3V / 0.3V, V_{COM} = 0.3V / 3.3V	+25°C		0.1		µA
			Full			1	
Channel On Leakage Current	$I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$	V_+ = 3.6 V, V_{COM} = 0.3V / 3.3V, V_{NO} or V_{NC} = floating	+25°C		0.1		µA
			Full			1	
Digital Inputs							
Input High Voltage	V_{INH}	V_+ = 2.7 V	+25°C	1.4			V
Input Low Voltage	V_{INL}	V_+ = 2.7 V	+25°C			0.4	V
Input Leakage Current	I_{IN}	V_+ = 2.7 V, V_{IN} = 0 V or V_+	+25°C		0.1		µA
Dynamic Characteristics							
Turn-On Time	t_{ON}	V_+ = 3 V, V_{NO} or V_{NC} = 1.5 V, R_L = 300 Ω, C_L = 35 pF, Test Circuit 2	+25°C		88		ns
Turn-Off Time	t_{OFF}	V_+ = 3 V, V_{NO} or V_{NC} = 1.5 V, R_L = 300 Ω, C_L = 35 pF, Test Circuit 2	+25°C		46		ns
Break-Before-Make Time Delay	t_D	V_+ = 3 V, V_{NO} or V_{NC} = 1.5 V, R_L = 300 Ω, C_L = 35 pF, Test Circuit 3	+25°C		43		ns
Skew	t_{SKEW}	R_S = 39 Ω, C_L = 50 pF, Test Circuit 4	+25°C		7		ns
Off Isolation	O_{ISO}	V_+ = 3 V, R_L = 50 Ω, Signal = 0 dBm, Test Circuit 5 — 10 MHz	+25°C		-45		dB
		1 MHz	+25°C		-65		dB
-3dB Bandwidth	BW	V_+ = 3 V, Signal = 0 dBm, R_L = 50 Ω, Test Circuit 6	+25°C		100		MHz
Channel On Capacitance	$C_{NC(ON)}$, $C_{NO(ON)}$, $C_{COM(ON)}$	V_+ = 3 V, f = 1 MHz	+25°C		40		pF
Channel Off Capacitance	$C_{NC(OFF)}$, $C_{NO(OFF)}$, $C_{COM(OFF)}$	V_+ = 3 V, f = 1 MHz	+25°C		8.5		pF
Power Requirements							
Power Supply Current	I_+	V_+ = 3.6 V, V_{IN} = 0 V or V_+	+25°C		0.1		µA

Note:

1. Guaranteed by design in -40℃.
2. Resistance measurements do not include test circuit or package resistance.
3. $\Delta R_{ON} = R_{ON\,(MAX)} - R_{ON\,(MIN)}$ between NC1 and NC2 or between NO1 and NO2.
4. Flatness is defined as the difference between the maximum and minimum value of on−resistance as measured over the specified analog signal ranges.

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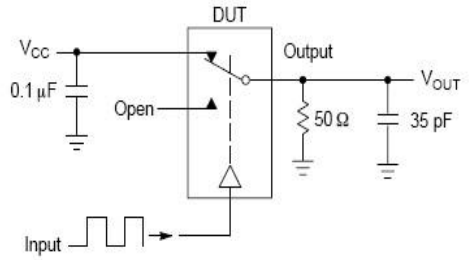
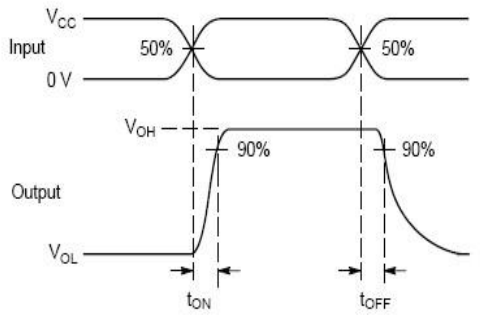
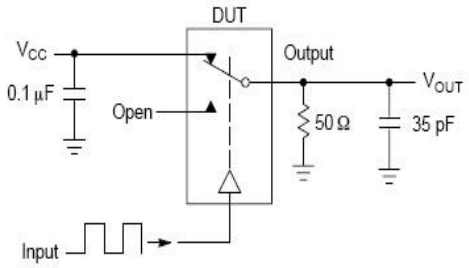
TEST CIRCUITS







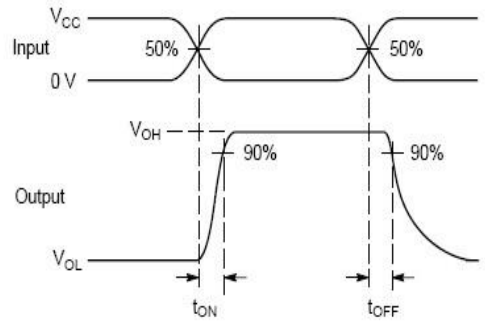
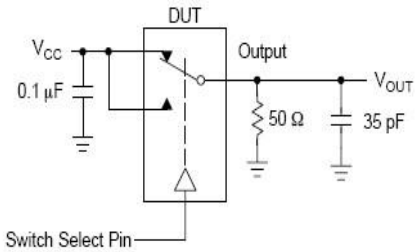


Figure1: t_{ON}/t_{OFF}



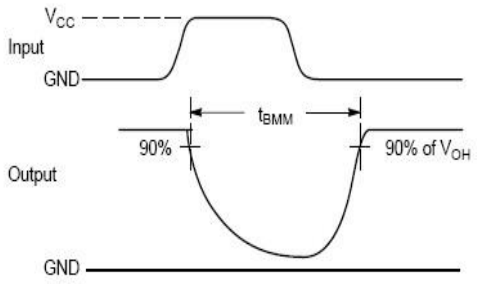
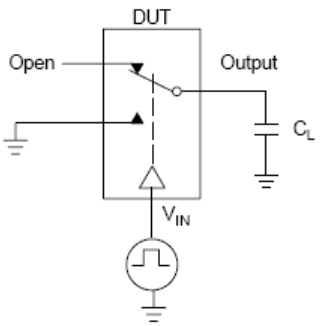


Figure2: t_{BBM}



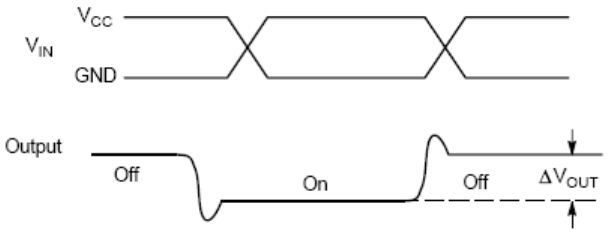
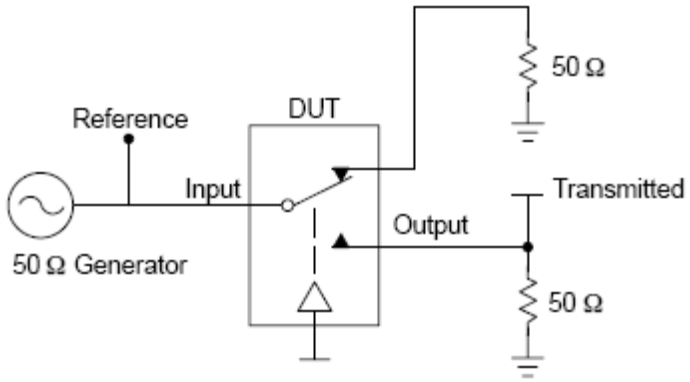


Figure3: Charge Injection

TEST CIRCUITS (Continued)



$V_{ISO} = 20\log (V_{OUT}/V_{IN})$

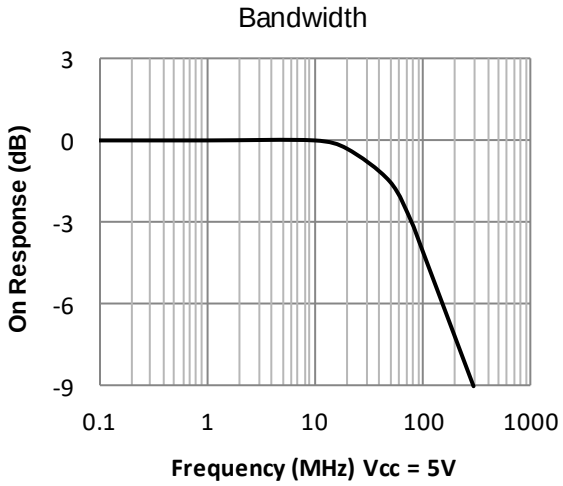
$V_{ONL} = 20\log (V_{OUT}/V_{IN})$

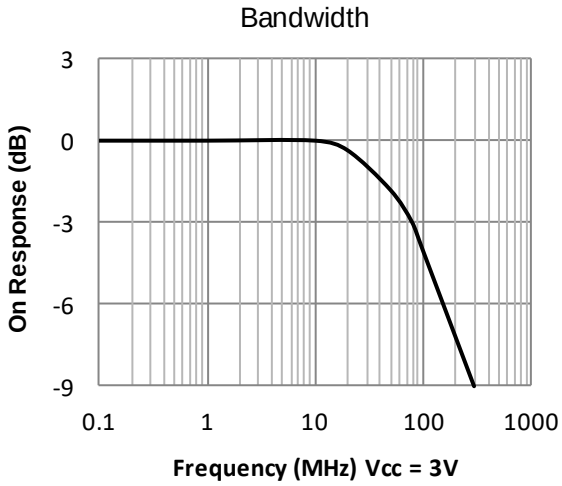
$V_{CT} = 20\log (V_{OUT}/V_{IN})$

BW = the frequency 3dB below V_{ONL}

Figure 4. -3dB Bandwidth/Off Channel Isolation/On Channel Loss(BW)/Crosstalk (On Channel to Off Channel)/V_{ONL}

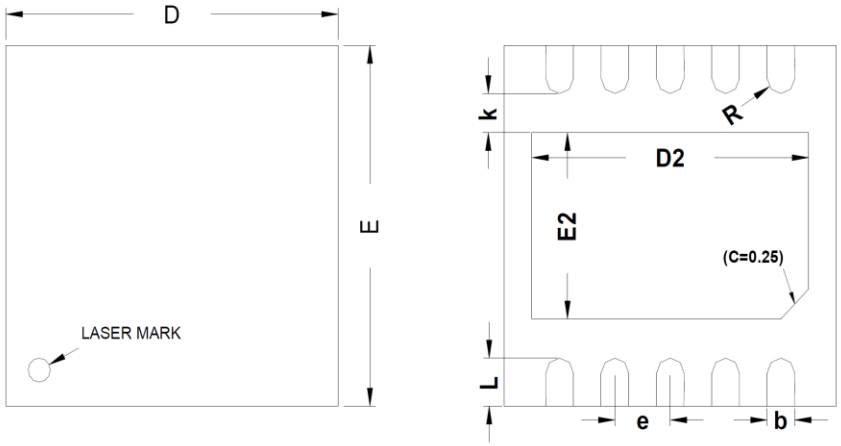
TYPICAL PERFORMANCE CHARACTERISTICS





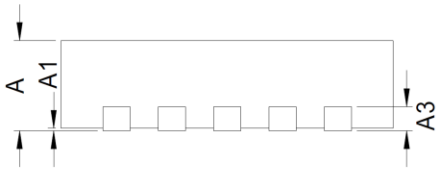
PACKAGE OUTLINE

DFN3 × 3-10



TOP VIEW

BOTTOM VIEW

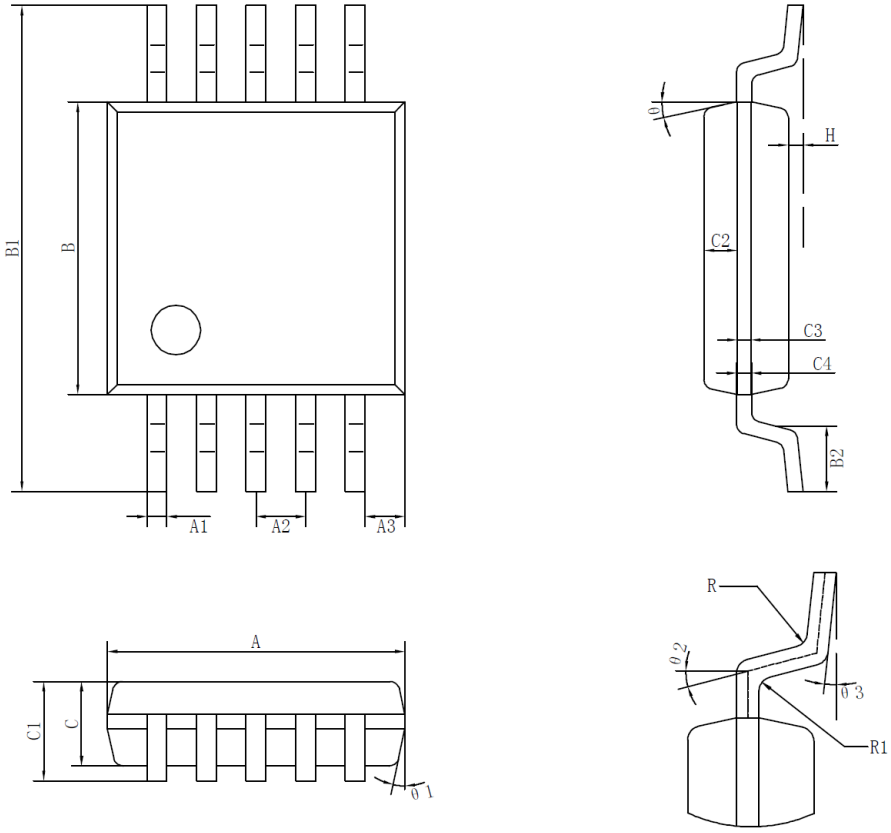


SIDE VIEW

Symbol	Dimensions In Millimeters (mm)	
	Min.	Max.
A	0.700	0.800
A1	0.000	0.050
A3	0.203REF	
b	0.180	0.300
D	2.900	3.100
D2	2.450	2.550
e	0.400	0.600
E	2.900	3.100
E2	1.450	1.650
L	0.350	0.450
k	0.150	
R	0.090	

PACKAGE OUTLINE

MSOP-10



Symbol	Dimensions In Millimeters (mm)		Symbol	Dimensions In Millimeters (mm)	
	Min.	Max.		Min.	Max.
A	2.90	3.10	C3	0.152	
A1	0.18	0.25	C4	0.15	0.23
A2	0.50 TYP		H	0.00	0.09
A3	0.40 TYP		θ	15°TYP4	
B	2.90	3.10	θ1	12°TYP4	
B1	4.70	5.10	θ2	14°TYP	
B2	0.45	0.75	θ3	0° ~ 6°	
C	0.75	0.95	R	0.15TYP	
C1	-	1.100	R1	0.15TYP	
C2	0.328 TYP				