

Ultra Low On-Resistance Low Voltage Dual SPDT Analog Switch

General Description

The LN3005 is a dual, low on-resistance, low voltage, bidirectional, single-pole/double-throw (SPDT) CMOS analog switches designed to operate from a single +1.8V to +5.5V supply. Targeted applications include battery powered equipment that benefit from low R_{ON} (0.5 Ω) and fast switching speeds ($t_{ON} = 16$ ns, $t_{OFF} = 15$ ns). The on resistance profile is very flat over the full analog signal range. This ensures excellent linearity and low distortion when switching audio signals.

The LN3005 is a committed dual single-pole/double-throw (SPDT) that consist of two normally open (NO) and two normally close (NC) switches. This configuration can be used as a dual 2-to-1 multiplexer.

Features

- Low voltage operation : 1.8 V to 5.5 V
- Low on-resistance: 0.5 Ω (TYP)
- Low on-resistance flatness
- -3 dB bandwidth: 30 MHz
- Fast switching time : $t_{on}=16$ ns , $t_{OFF}=15$ ns
- Rail-to-rail operation
- Typical power consumption (<0.01 μ W)
- TTL/CMOS compatible
- Microsize package

Applications

- Battery powered, handheld and portable equipments
- Cellular/mobile phones

Ordering Information

LN3005 ①②

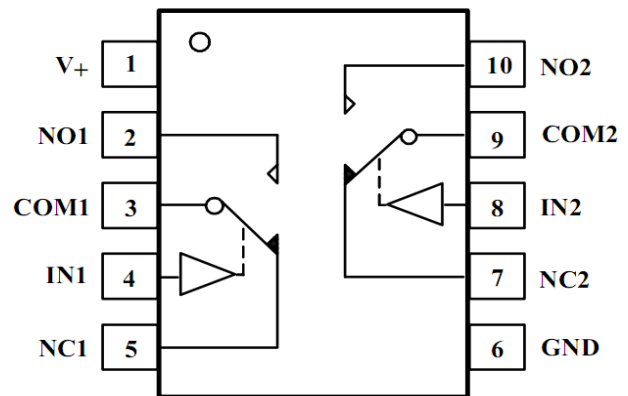
Designator	Symbol	Description
①	M	MSOP-10L
	X	Others
②	R	Embossed tape : standard feed
	L	Embossed tape : reverse feed

- Laptops, notebooks, palmtops
- Communication systems
- Sample-and-hold Circuits
- Audio signal routing
- Audio and video switching
- Portable test and measurement
- Medical equipment

Package

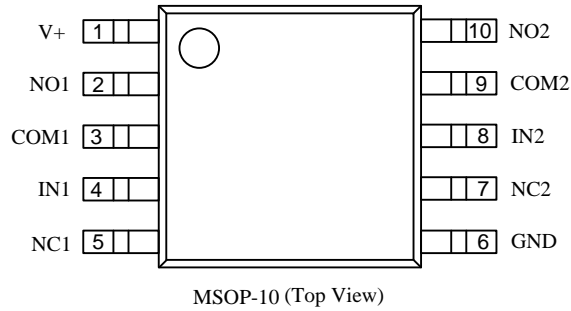
- MSOP-10L

Block Diagram



LOGIC	NC1, NC2	NO1, NO2
0	ON	OFF
1	OFF	ON

Pin Configuration



Pin Assignment

Pin Name	Pin Number	Function Description
V+	1	Power Supply
GND	6	Ground
IN1,IN2	4,8	Digital control pin to connect the COM terminal to the NO or NC terminals
COM1,COM2	3,9	Common terminal
NO1,NO2	2,10	Normally-open terminal
NC1,NC2	5,7	Normally-closed terminal

Absolute Maximum Ratings

V+ to GND	-0.3V to 6V
Analog, digital voltage range	-0.3V to V ₊ +0.3V
Continuous current NO,NC,COM	±300mA
Peak current NO, NC, or COM	±500mA
Operating temperature range	-40°C ~ 125°C
Junction temperature	150°C
Storage temperature	-65°C ~ 150°C
Lead temperature(soldering, 10s)	+300°C
ESD	4000V

Electrical Characteristics

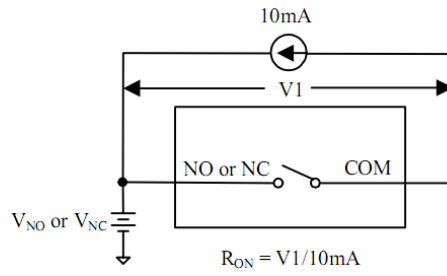
(V+ = +5 V ± 10%, GND = 0 V, TA = - 40°C to +125°C, unless otherwise noted. Typical values are at TA = + 25°C.)

Parameter	Symbol	Conditions	+25°C	-40°C~+125°C	Max/Min	Unit
Analog Signal Range	V _{COM}			0	MIN	V
	V _{NC} , V _{NO}			V+	MAX	V
On-Resistance	R _{ON}	0 ≤ V _{NO} or V _{NC} ≤ V+, I _{COM} = -10mA TEST Circuit 1	0.5		TYP	Ω
			0.9	1.1	MAX	Ω
On-Resistance Match Between Channels	ΔR _{ON}	0 ≤ V _{NO} or V _{NC} ≤ V+, I _{COM} = -10mA TEST Circuit 1	0.05		TYP	Ω
			0.10	0.13	MAX	Ω
On-Resistance Flatness	R _{FLAT (ON)}	0 ≤ V _{NO} or V _{NC} ≤ V+, I _{COM} = -10mA TEST Circuit 1	0.25		TYP	Ω
			0.3	0.4	MAX	Ω
Source OFF Leakage current	I _{NC(OFF)}	V _{NO} or V _{NC} = 4.5V/1V, V+ = 5.5V, V _{COM} = 1V/4.5V Test Circuit 2	±4		TYP	nA
	I _{NO(OFF)}		±10	±1000	MAX	nA
Channel ON Leakage current	I _{NC(ON)}	V _{NO} or V _{NC} = V _{COM} = 1V/4.5V V+ = 5.5V, Test Circuit 3	±4		TYP	nA
	I _{NO(ON)} , I _{COM(ON)}		±10	±1000	MAX	nA
Input High Voltage	V _{INH}			2.4	MIN	V
Input Low Voltage	V _{INL}			0.8	MAX	V
Input Current	I _{INH} or I _{INL}	V _{IN} = V _{INH} or V _{INL}	±0.01		TYP	μA
			±0.1	±1	MAX	μA
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = 3V, R _L = 300Ω, C _L = 35pF, Test Circuit 4	16		TYP	ns
Turn-Off Time	t _{OFF}	V _{NO} or V _{NC} = 3V, R _L = 300Ω, C _L = 35pF, Test Circuit 4	15		TYP	ns
Bandwidth-3dB	BW	R _L = 50Ω, C _L = 5pF, Test Circuit 5	30		TYP	MHz
Source OFF Capacitance	C _{NC(OFF)}		82		TYP	pF
	C _{NO(OFF)}					
Channel ON Capacitance	C _{NC(ON)}		380		TYP	pF
	C _{NO(ON)}					
	C _{COM(ON)}					
Power Supply Current	I ₊	V+ = 5.5V, V _{IN} = 0V or V+	0.001		TYP	μA
			0.1	1	MAX	μA

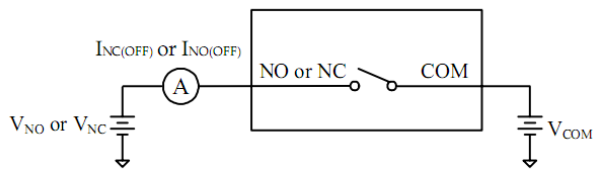
(V+ = +3 V ± 10%, GND = 0 V, TA = - 40°C to +125°C, unless otherwise noted. Typical values are at TA = + 25°C.)

Parameter	Symbol	Conditions	+25°C	-40°C~+125°C	Max/Min	Unit
Analog Signal Range	V_{COM}			0	MIN	V
	V_{NC}, V_{NO}			V+	MAX	V
On-Resistance	R_{ON}	$0 \leq V_{NO}$ or $V_{NC} \leq V+$, $I_{COM} = -10mA$ TEST Circuit 1	0.6		TYP	Ω
			1.0	1.3	MAX	Ω
On-Resistance Match Between Channels	ΔR_{ON}	$0 \leq V_{NO}$ or $V_{NC} \leq V+$, $I_{COM} = -10mA$ TEST Circuit 1	0.05		TYP	Ω
			0.10	0.13	MAX	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	$0 \leq V_{NO}$ or $V_{NC} \leq V+$, $I_{COM} = -10mA$ TEST Circuit 1	0.25		TYP	Ω
			0.3	0.4	MAX	Ω
Source OFF Leakage current	$I_{NC(OFF)}$	V_{NO} or $V_{NC} = 3V/1V$, $V+ = 3.3V$, $V_{COM} = 1V/3V$ Test Circuit 2	± 5		TYP	nA
	$I_{NO(OFF)}$		± 11	± 1000	MAX	nA
Channel ON Leakage current	$I_{NC(ON)}, I_{NO(ON)}$	V_{NO} or $V_{NC} = V_{COM} = 1V/3V$ $V+ = 3.3V$, Test Circuit 3	± 5		TYP	nA
	$I_{COM(ON)}$		± 11	± 1000	MAX	nA
Input High Voltage	V_{INH}			2.4	MIN	V
Input Low Voltage	V_{INL}			0.5	MAX	V
Input Current	I_{INH} or I_{INL}	$V_{IN} = V_{INH}$ or V_{INL}	± 0.01		TYP	μA
			± 0.1	± 1	MAX	μA
Turn-On Time	t_{ON}	V_{NO} or $V_{NC} = 2V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 4	17		TYP	ns
Turn-Off Time	t_{OFF}	V_{NO} or $V_{NC} = 2V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 4	16		TYP	ns
Bandwidth-3dB	BW	$R_L = 50\Omega$, $C_L = 5pF$, Test Circuit 5	30		TYP	MHz
Source OFF Capacitance	$C_{NC(OFF)}$		82		TYP	μF
	$C_{NO(OFF)}$					
Channel ON Capacitance	$C_{NC(ON)}$		380		TYP	μF
	$C_{NO(ON)}$					
	$C_{COM(ON)}$					
Power Supply Current	I_+	$V+ = 3.3V, V_{IN} = 0V$ or $V+$	0.001		TYP	μA
			0.1	1	MAX	μA

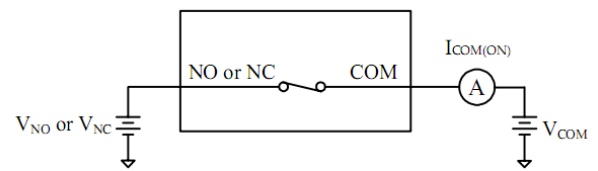
■ Test Circuits



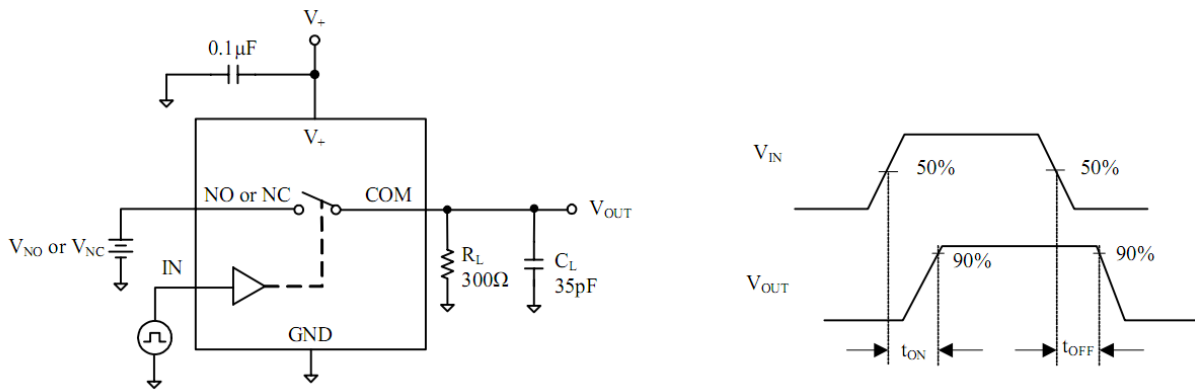
Test Circuit 1. On Resistance



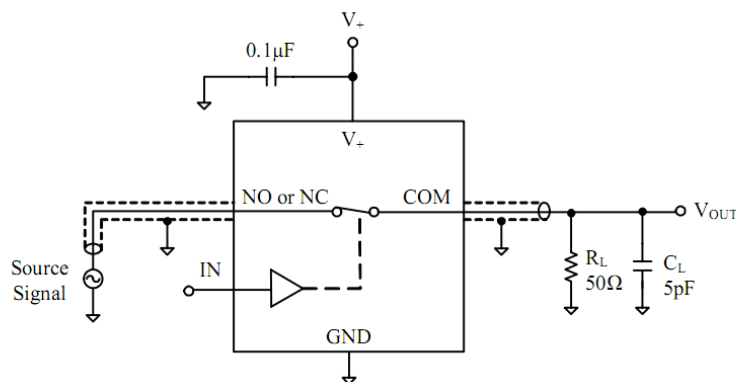
Test Circuit 2: Off Leakage



Test Circuit 3: On Leakage



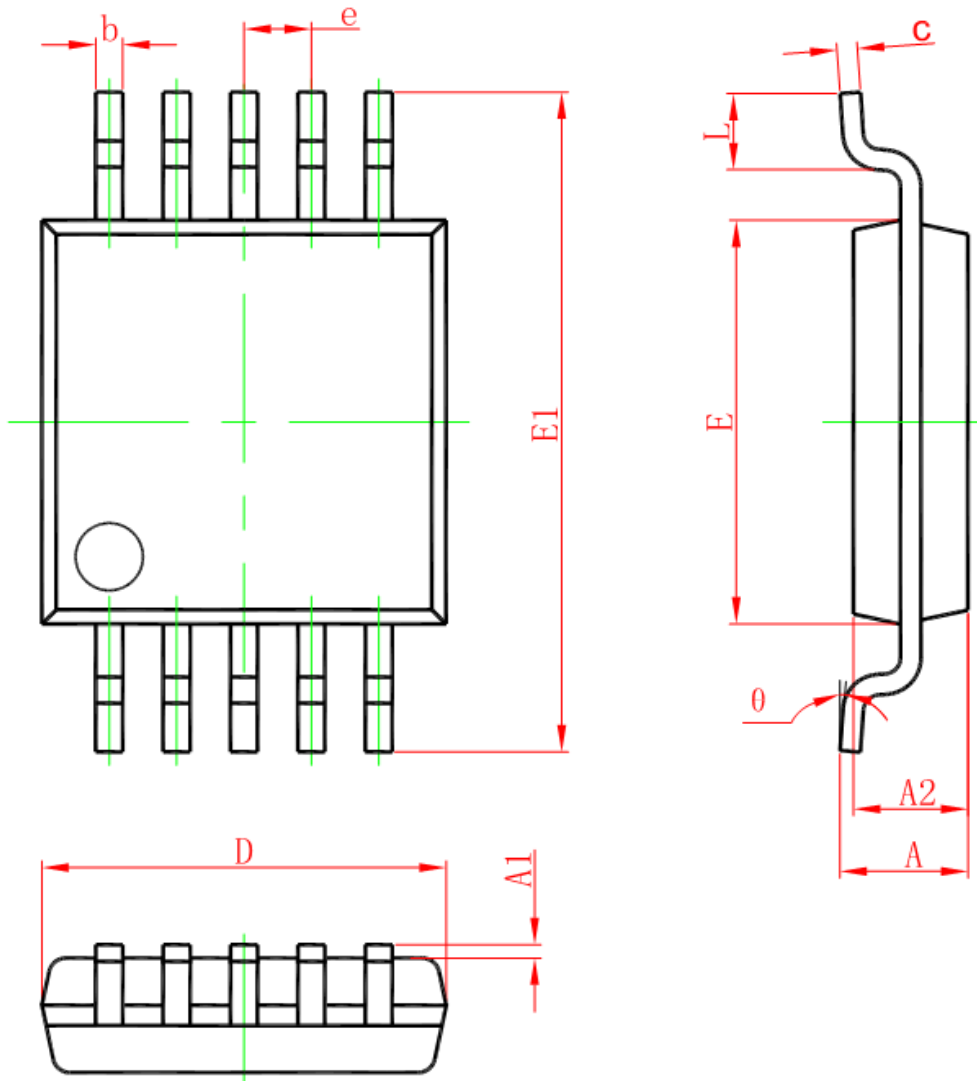
Test Circuit 4: Switching Times



Test Circuit 5: Bandwidth

■ Package Information

- MSOP-10L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.280	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.50(BSC)		0.020(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°