500MHz, Low voltage SPDT analog switch

General Description

The ET3167 is a bidirectional, SPDT (single-pole/ double-throw), CMOS analog switch. It operates from a 1.8V to 5.5V single power supply.

The ET3167 features high bandwidth, low on resistance and low distortion. The high performances make it very suitable for multiple applications, such as portable equipment, audio and video signal routing, etc. Low power consumption is also one of the important reasons that make it a good choice.

Features

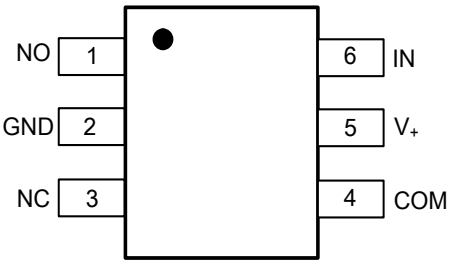
- Single Supply Voltage Range: 1.8V to 5.5V
- Low On-Resistance: 26Ω (TYP) at V_+=5V
- Low On-Resistance Flatness
- -3dB Bandwidth: 500MHz
- Fast Switch Times:
  - -- t_{ON}:20ns(TYP)
  - -- t_{OFF}:15ns(TYP)
- High Off-Isolation: -63dB at 10MHz
- Rail-to-Rail Input and Output Operation
- TTL/CMOS Compatible
- Break-Before-Make Switching
- -40℃ to +85℃ Operating Temperature Range
- Package information:

Part No.	Package	MSL
ET3167	SOT23-6 (2.9mm×2.8mm)	Level 3

Application

- Portable Equipment
- Cellular Phones
- Computer Peripherals
- Sample-and-Hold Circuits
- Personal Digital Assistants
- Battery-Powered Systems
- Audio and Video Signal Routing

Pin Configuration



Top View

Pin Function

Pin NO.	Pin Name	Description
1	NO	Normally Open Pin.
2	GND	Ground.
3	NC	Normally Closed Pin.
4	COM	Common Pin.
5	V_+	Positive Power Supply.
6	IN	Digital Control Input Pin to Connect the COM Pin to the NO or NC Pin.

Note: NO, NC and COM pin may be an input or output.

Truth Table

IN LOGIC	NO-COM	NC-COM
0	OFF	ON
1	ON	OFF

Absolute Maximum Ratings

Characteristic	Symbol	Value	Unit
Supply Voltage	V_+	-0.3~+ 6	V
Analog Input Voltage(NO, NC,COM)	V_{IS}	-0.3~V_++0.3	V
Continuous Current into Any Terminal	I_{ANL}	±20	mA
Peak Current(Pulsed at 1ms, 10% duty cycle)	I_{ANL_PK}	±40	mA
Max Junction Temperature	T_J	150	°C
Storage Temperature Range	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering, 10s)	T_L	260	°C
HBM	ESD	±2000	V
MM		±400	V

Recommended Operating Conditions

Characteristic	Symbol	Min	Max	Unit
Supply Voltage Range	V_+	1.8	5.5	V
Digital Select Input Voltage	IN	0	V_+	V
Analog Input Voltage(NO, NC,COM)	V_{IS}	0	V_+	V
Operating Temperature Range	T_A	-40	85	°C

Electrical Characteristics

(V_+ = 4.5V to 5.5V, typical values are at V+ = 5.0V, T_A = +25°C, unless otherwise noted.)

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
ANALOG SWITCH						
V_{NO}, V_{NC}, V_{COM}	Analog Signal Range		0		V_+	V
R_{ON}	On-resistance	V_+ = 4.5V, V_{NO} or V_{NC} =3.5V, I_{COM} = -10mA, Test Circuit 1		26		Ω
ΔR_{ON}	On-resistance Mismatch Between Channels	V_+ = 4.5V, V_{NO} or V_{NC} =3.5V, I_{COM} = -10mA, Test Circuit 1		0.3	0.8	Ω
R_{FLAT}	On-resistance Flatness	V+=4.5V,V_{NO} or V_{NC} =1.0V, 2.0V, 3.5V, I_{COM} = -10mA, Test Circuit 1		4	6	Ω
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Source Off State Leakage Current	V_+ = 5.5V, V_{NO} or V_{NC} = 1.0V, 4.5V, V_{COM} = 4.5V, 1.0V			1	μA
$I_{NO(ON)}$, $I_{NC(ON)}$	Channel On State Leakage Current	V_+ = 5.5V, V_{NO} or V_{NC} = 1.0V, 4.5V, V_{COM} = 4.5V, 1.0V, or floating			1	μA
DIGITAL INPUTS						
V_{INH}	Logic Voltage High		1.5			V
V_{INL}	Logic Voltage Low				0.4	V
I_{IN}	Input Leakage Current	V_+= 5.5V, V_{IN} = 0V or 5.5V			1	μA
DYNAMIC CHARACTERISTICS						
t_{ON}	Turn-On Time	V_{NO} or V_{NC} = 3.0V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300Ω, C_L =35pF, Test Circuit 2		20		ns
t_{OFF}	Turn-Off Time	V_{NO} or V_{NC} = 3.0V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300Ω, C_L =35pF, Test Circuit 2		15		ns
t_D	Break-Before-Make Time Delay	V_{NO1} or V_{NC1} = V_{NO2} or V_{NC2} = 3V, R_L = 300Ω, C_L = 35pF, Test Circuit 3		5		ns
t_{PD}	Propagation Delay Time (Signal Input to Output)	R_S = 39Ω, C_L = 50pF, Test Circuit 4		5		ns

Electrical Characteristics(continued)

V_+ = 4.5V to 5.5V, typical values are at V+ = 5.0V, T_A = +25°C, unless otherwise noted.)

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
O_{ISO}	Off-Isolation	R_L = 50Ω, V_{NO} or V_{NC} = $1V_{P-P}$, C_L = 5pF, Test Circuit 5	f=10MHz		-63		dB
			f=1MHz		-83		dB
BW	-3dB Bandwidth	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 6			500		MHz
$C_{NC(OFF)}$, $C_{NO(OFF)}$	Source Off Capacitance	f=1MHz			5.5		pF
$C_{NC(ON)}$, $C_{NO(ON)}$	Channel On Capacitance	f=1MHz			15		pF
POWER REQUIRENTS							
V+	Power Supply Range			1.8		5.5	V
I+	Power Supply Current	V+=5.5V, VIN=0V or V+				5	μA

Electrical Characteristics

V_+ = 2.7V to 3.6V, typical values are at V+ = 3.0V, T_A = +25°C, unless otherwise noted.

Symbol	Parameters	Conditions		Min	Typ	Max	Unit
ANALOG SWITCH							
V_{NO}, V_{NC}, V_{COM}	Analog Signal Range			0		V_+	V
R_{ON}	On-resistance	V_+ = 2.7V, V_{NO} or V_{NC} =1.5V, I_{COM} = -10mA, Test Circuit 1			65		Ω
ΔR_{ON}	On-resistance Mismatch Between Channels	V_+ = 2.7V, V_{NO} or V_{NC} =1.5V, I_{COM} = -10mA, Test Circuit 1			0.3	0.8	Ω
R_{FLAT}	On-resistance Flatness	V_+ = 2.7V, V_{NO} or V_{NC} =1.0V, 1.5V, 2.0V, I_{COM} = -10mA, Test Circuit 1			20		Ω
$I_{NO(OFF)}$, $I_{NC(OFF)}$	Source Off State Leakage Current	V_+ = 3.6V, V_{NO} or V_{NC} = 0.3V, 3.3V, V_{COM} = 3.3V, 0.3V				1	μA
$I_{NO(ON)}$, $I_{NC(ON)}$	Channel On State Leakage Current	V_+ = 3.6V, V_{COM} = 0.3V, 3.3V, V_{NO} or V_{NC} = 0.3V, 3.3V, or floating				1	μA
DIGITAL INPUTS							
V_{INH}	Logic Voltage High			1			V
V_{INL}	Logic Voltage Low					0.4	V
I_{IN}	Input Leakage Current	V_+= 5.5V, V_{IN} = 0V or 3.6V				1	μA
DYNAMIC CHARACTERISTICS							
t_{ON}	Turn-On Time	V_{NO} or V_{NC} = 1.5V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2			30		ns
t_{OFF}	Turn-Off Time	V_{NO} or V_{NC} = 1.5V, V_{IH} = 1.5V, V_{IL} = 0V, R_L = 300Ω, C_L = 35pF, Test Circuit 2			25		ns
t_D	Break-Before-Make Time Delay	V_{NO1} or V_{NC1} = V_{NO2} or V_{NC2} = 3V, R_L = 300Ω, C_L = 35pF, Test Circuit 3			8		ns
t_{PD}	Propagation Delay Time (Signal Input to Output)	R_S = 39Ω, C_L = 50pF, Test Circuit 4			2		ns
O_{ISO}	Off-Isolation	R_L = 50Ω, V_{NO} or V_{NC} = $1V_{P-P}$, C_L = 5pF, Test Circuit 5	f=10MHz		-63		dB
			f=1MHz		-83		dB

Electrical Characteristics(continued)

V_+ = 2.7V to 3.6V, typical values are at V+ = 3.0V, T_A = +25°C, unless otherwise noted.

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
BW	-3dB Bandwidth	Signal = 0dBm, R_L = 50Ω, C_L = 5pF, Test Circuit 6		500		MHz
$C_{NC(OFF)}$, $C_{NO(OFF)}$	Source Off Capacitance	f=1MHz		5.5		pF
$C_{NC(ON)}$, $C_{NO(ON)}$	Channel On Capacitance	f=1MHz		15		pF
POWER REQUIRENTS						
V_+	Power Supply Range		1.8		5.5	V
I_+	Power Supply Current	V_+=5.5V, V_{IN}=0V or V_+			5	μA

Typical Characteristics

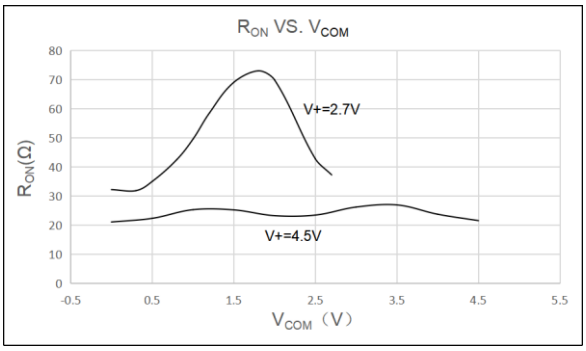


Figure 1. On-resistance vs.supply voltage

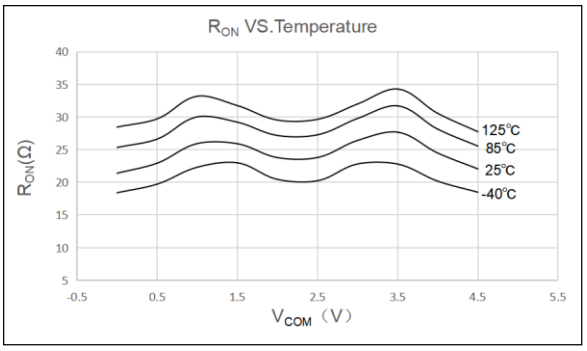


Figure 2. On-resistance vs.Temperature(V+=4.5V)

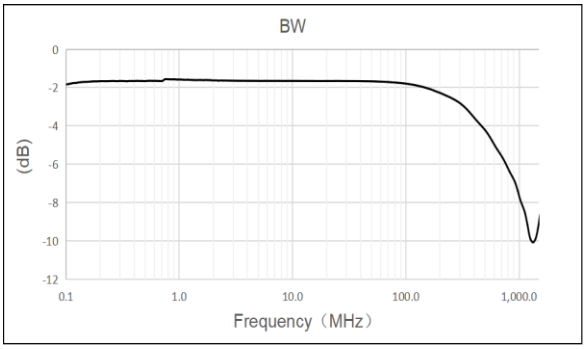


Figure 3. BW vs. Frequency(V+=4.5V)

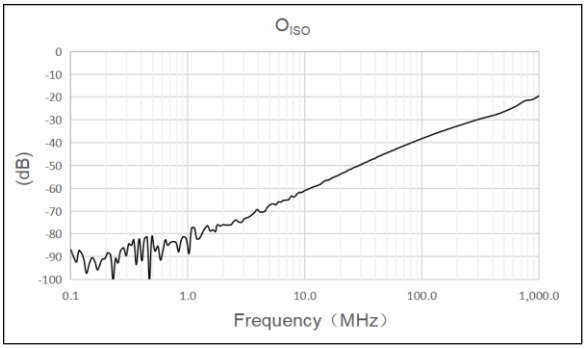
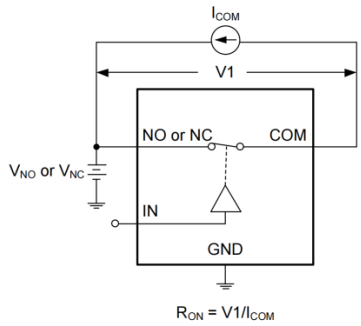
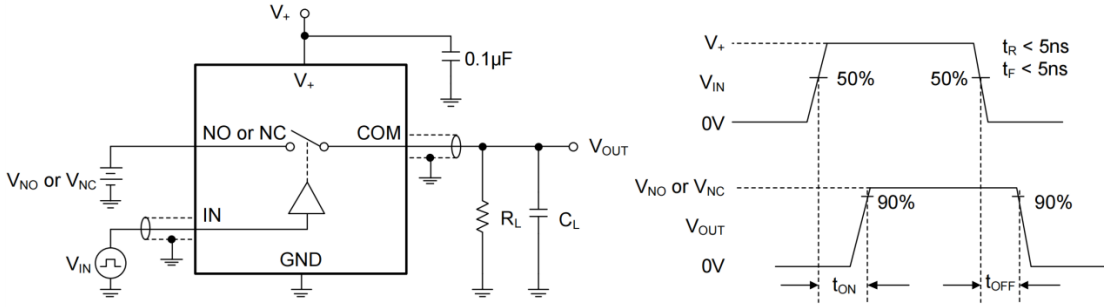


Figure 4. O_{ISO} vs. Frequency(V+=4.5V)

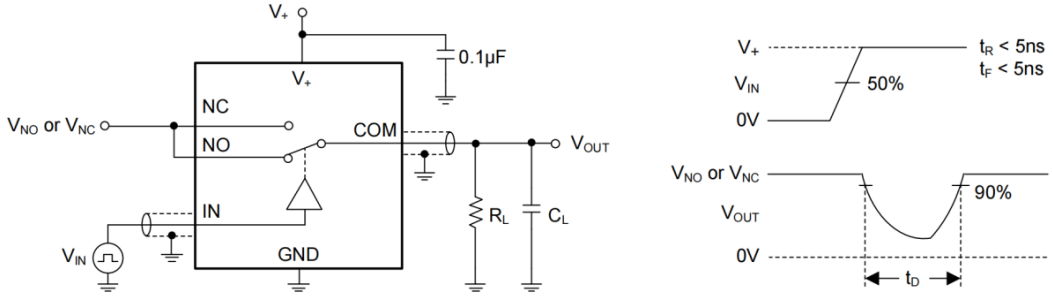
Test Circuit



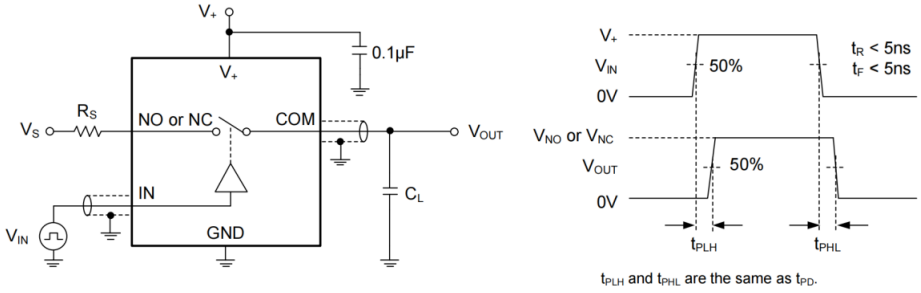
Test Circuit 1. On-Resistance



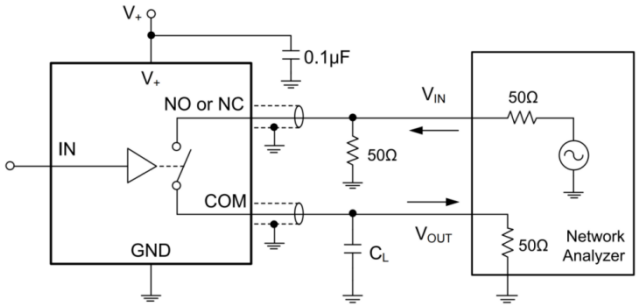
Test Circuit 2. Switching times



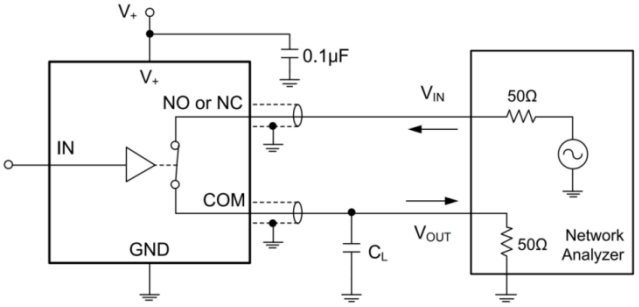
Test Circuit 3. Break-Before-Make Time Delay, t_D



Test Circuit 4. Propagation Delay Time



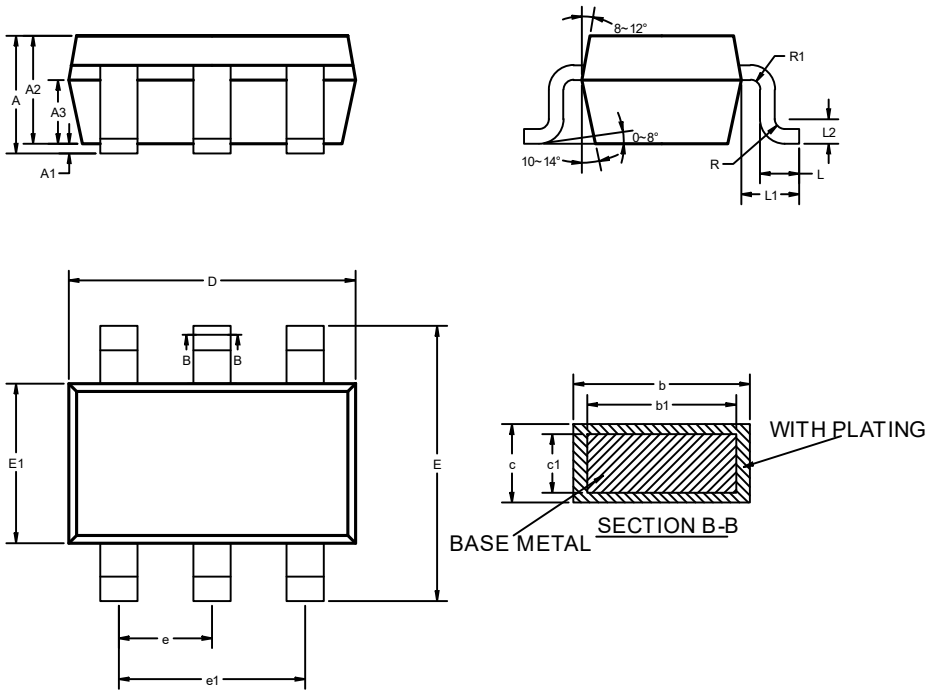
Test Circuit 5. Off Isolation



Test Circuit 6. -3dB Bandwidth

Package Dimension

SOT23-6



COMMON DIMENSIONS

(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	—	—	1.250
A1	0	—	0.150
A2	1.000	1.100	1.200
A3	0.600	0.650	0.700
b	0.360	—	0.450
b1	0.350	0.380	0.410
c	0.140	—	0.200
c1	0.140	0.150	0.160
D	2.826	2.926	3.026
E	2.600	2.800	3.000
E1	1.526	1.626	1.726
e	0.900	0.950	1.000
e1	1.800	1.900	2.000
L	0.300	0.400	0.500
L1	0.590REF		
L2	0.250BSC		
R	0.050	—	0.200
R1	0.050	—	0.200

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2023-02-20	Original Version	Chen Zuxiong	Chen Zuxiong	Liu Jia Ying