

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: 26 Ω (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°C to +85°C Operating Temperature Range
- Package information:

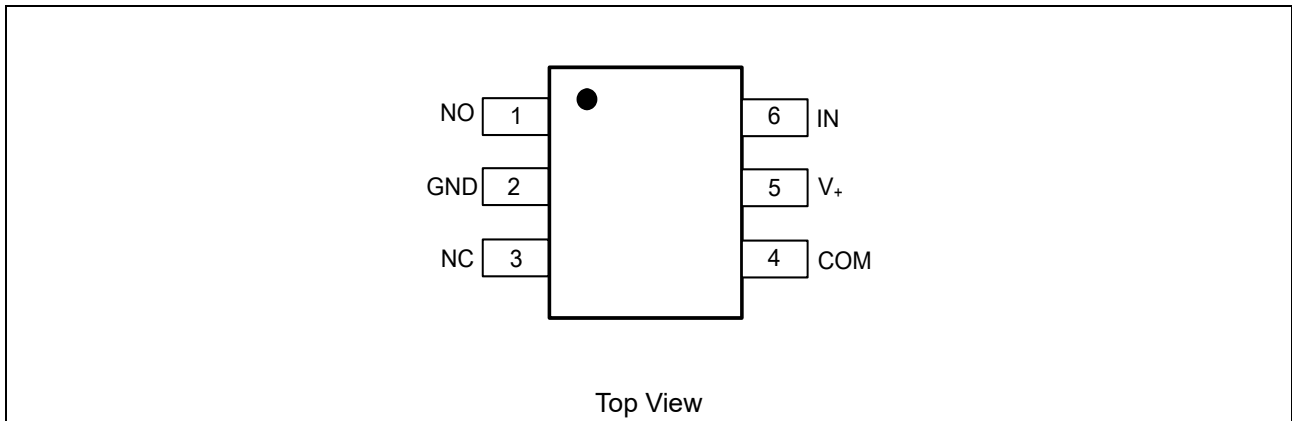
Part No.	Package	MSL
ET3167	SOT23-6 (2.9mm×2.8mm)	Level 3

Application

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

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Pin Configuration



Pin Function

Pin NO.	Pin Name	Description
1	NO	Normally Open Pin.
2	GND	Ground.
3	NC	Normally Open 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

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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	I _N	0	V ₊	V
Analog Input Voltage(NO, NC,COM)	V _{IS}	0	V ₊	V
Operating Temperature Range	T _A	-40	85	°C

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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

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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 REQUIREMENTS						
V ₊	Power Supply Range		1.8		5.5	V
I ₊	Power Supply Current	V ₊ =5.5V, V _{IN} =0V or V ₊			5	μA

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Electrical Characteristics

$V_+ = 2.7V$ to $3.6V$, typical values are at $V_+ = 3.0V$, $T_A = +25^\circ C$, 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 $V_{NC} = 1.5V$, $V_{IH} = 1.5V$, $V_{IL} = 0V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 2		30		ns
t_{OFF}	Turn-Off Time	V_{NO} or $V_{NC} = 1.5V$, $V_{IH} = 1.5V$, $V_{IL} = 0V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 2		25		ns
t_D	Break-Before-Make Time Delay	V_{NO1} or $V_{NC1} = V_{NO2}$ or $V_{NC2} = 3V$, $R_L = 300\Omega$, $C_L = 35pF$, Test Circuit 3		8		ns
t_{PD}	Propagation Delay Time (Signal Input to Output)	$R_S = 39\Omega$, $C_L = 50pF$, Test Circuit 4		2		ns
O_{ISO}	Off-Isolation	$R_L = 50\Omega$, V_{NO} or $V_{NC} = 1V_{P-P}$, $C_L = 5pF$, Test Circuit 5	$f=10MHz$		-63	dB
			$f=1MHz$		-83	dB

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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 _{NCOFF} , C _{NCOFF}	Source Off Capacitance	f=1MHz		5.5		pF
C _{NCON} , C _{NCON}	Channel On Capacitance	f=1MHz		15		pF
POWER REQUIREMENTS						
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

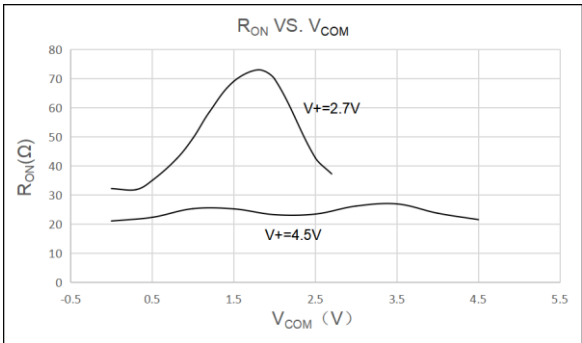


Figure 1. On-resistance vs. supply voltage

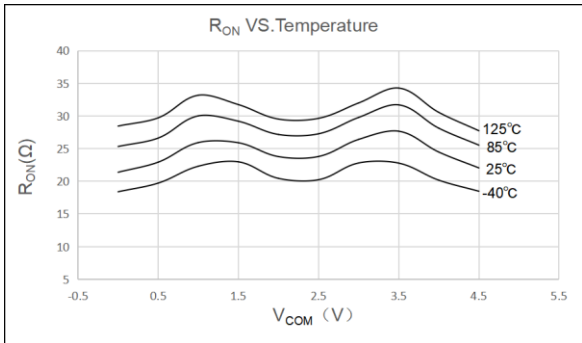


Figure 2. On-resistance vs. Temperature (V+=4.5V)

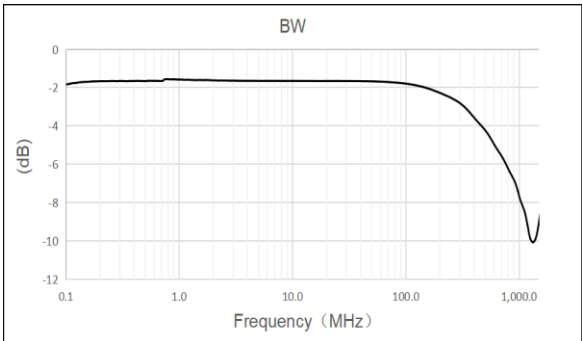


Figure 3. BW vs. Frequency (V+=4.5V)

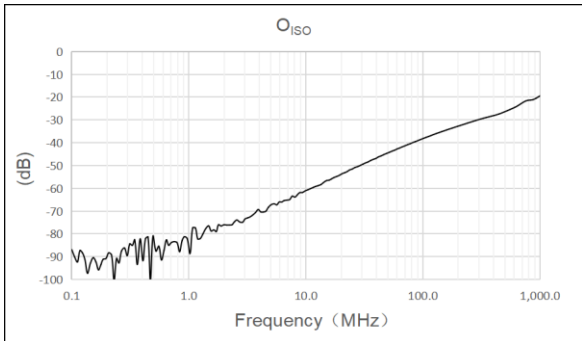
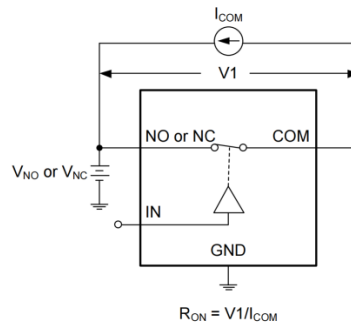
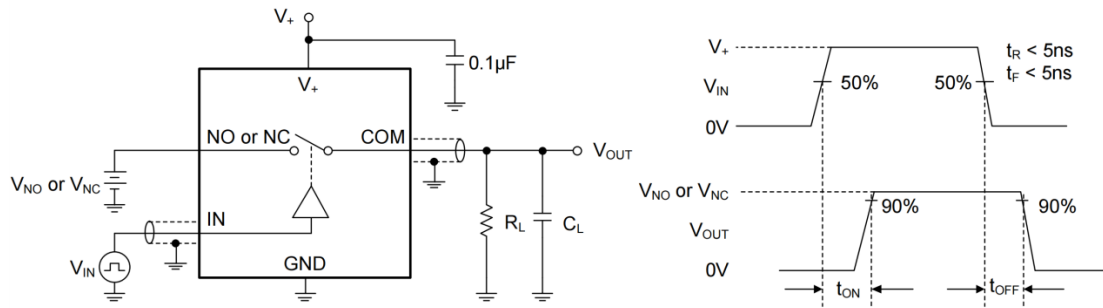


Figure 4. O_{ISO} vs. Frequency (V+=4.5V)

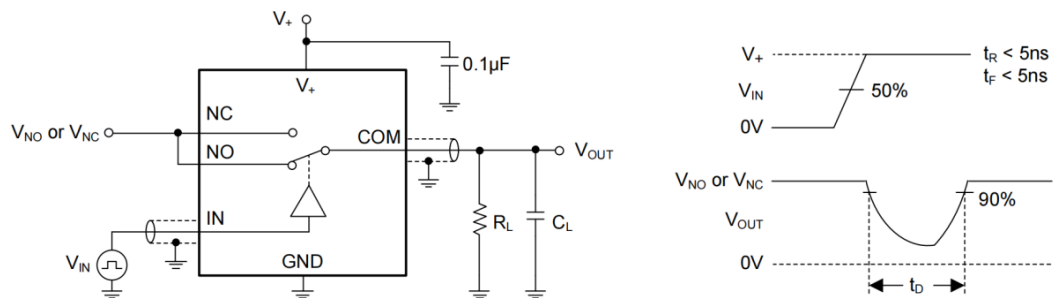
Test Circuit



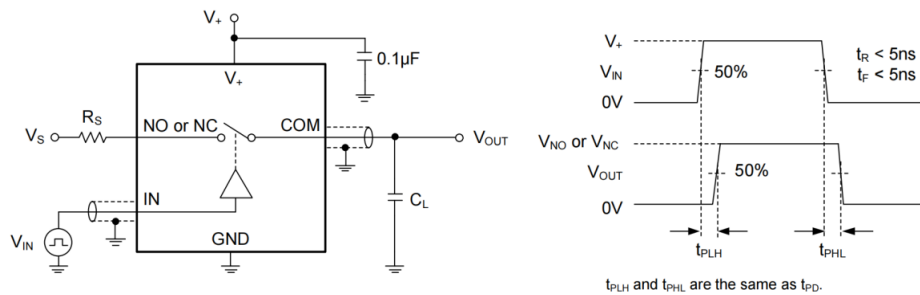
Test Circuit 1. On-Resistance



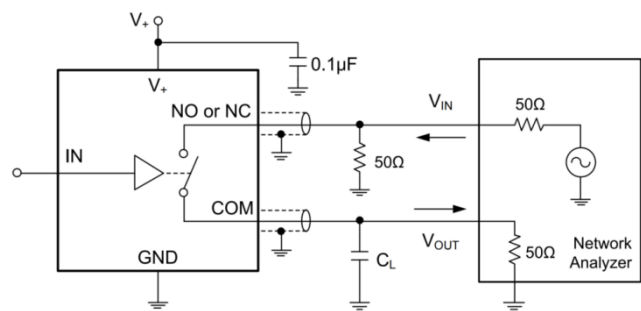
Test Circuit 2. Switching times



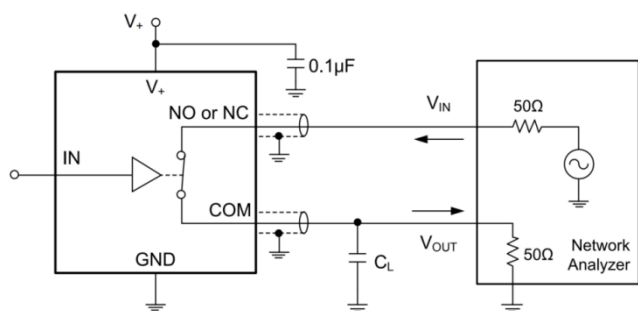
Test Circuit 3. Break-Before-Make Time Delay, t_D



Test Circuit 4. Propagation Delay Time



Test Circuit 5. Off Isolation

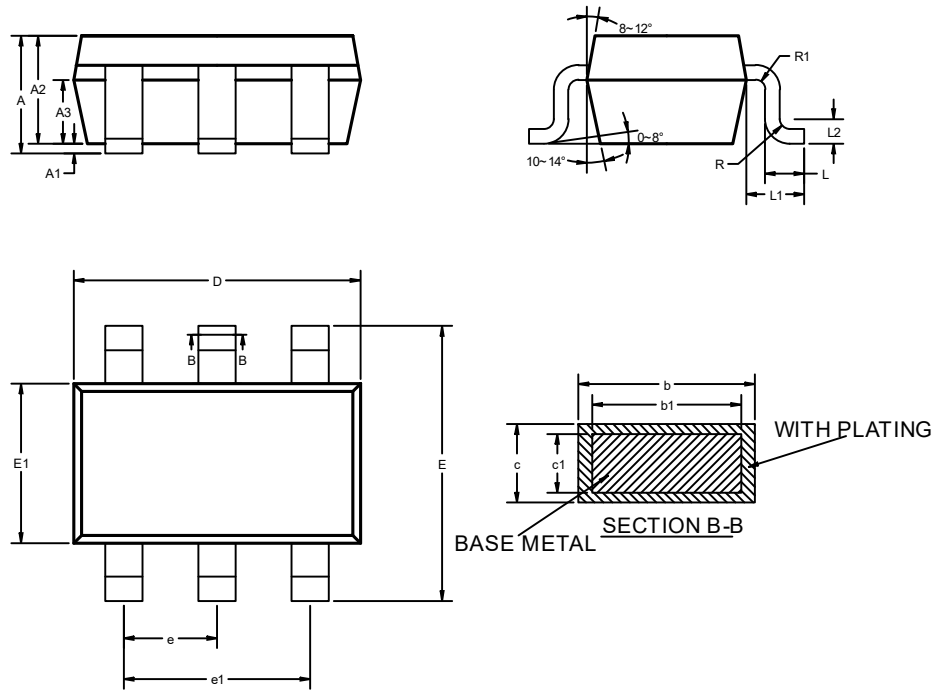


Test Circuit 6. -3dB Bandwidth

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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