Ultra-Low Resistance Dual SPDT Analog Switch

General Description

The ET5224 is an advanced CMOS analog switch fabricated in Sub-micron silicon gate CMOS technology. The part also features guaranteed Break Before Make (BBM) switching, assuring the switches never short the driver.

ET5224 is offered DFN10 and MSOP10 package, which is ideal for small form factor portable equipment.

Features

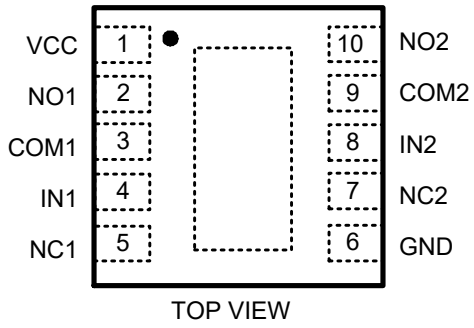
- Single Supply Operation from 1.8 to 5.5 V
- Ultra−Low R_{ON} : 0.5Ω (Typical) @ V_{CC} =4.3V
- Flatness of R_{ON} : 0.15Ω (Typical)
- −3dB Bandwidth : 30MHz
- Full 0 to VCC Signal Handling Capability
- Low Crosstalk : 83dB at 100kHz
- High Off−Channel Isolation: -65dB at 100kHz
- Low Standby Current <50nA
- Low Distortion ： THD < 0.14%
- High Continuous Current Capability: ±300mA Through Each Switch
- Package information:

Part No.	Package	Size
ET5224Y	DFN10	3mm×3mm
ET5224U	MSOP10	3mm×3mm

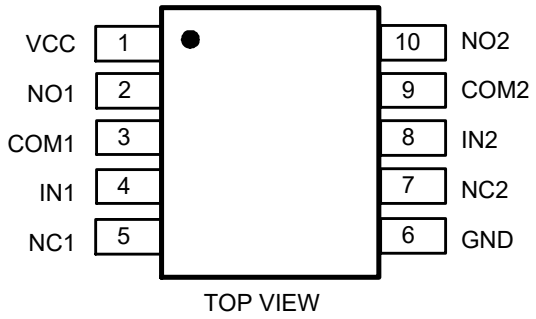
Application

- Smart Phones and Cellular Phones
- Cell Phone Audio Block/ Speaker
- Earphone Switching Ring-Tone Chip
- Amplifier Switching/Modems

Pin Configuration



ET5224Y (DFN10)



ET5224U (MSOP10)

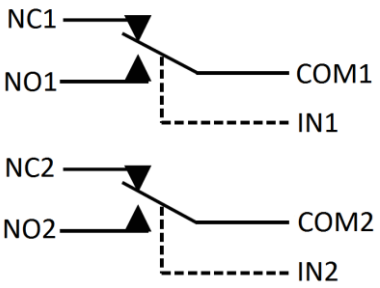
Pin Function

Pin NO.	Pin Name	Description
1	VCC	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

IN1/2	NO1/2 to COM1/2	NC1/2 to COM1/2
0	OFF	ON
1	ON	OFF

Analog Symbol



Absolute Maximum Ratings

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.5～+7.0	V
Analog Input Voltage	V_{IS}	-0.5～V_{CC}+0.5	V
Digital Select Input Voltage	V_{IN}	-0.5～+7.0	V
Output Voltage	V_O	-0.5～V_{CC}+0.5	V
Continuous DC Current from COM to NC/NO	I_{AN1}	±300	mA
Peak Current from COM to NC/NO, 10 duty cycle (1)	I_{AN-PK1}	±500	mA
Continuous DC Current into COM/NO/NC with respect to V_{CC} or GND	I_{CLMP}	±300	mA
Max DC Current into COM/NO/NC with respect to V_{CC} or GND	I_{CLMP1}	±500	mA
Storage Temperature	T_S	-65 to 150	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

Note1.Defined as 10% ON, 90% off duty cycle.

Recommended Operating Conditions

Characteristic	Symbol	Min	Max	Unit
DC Supply Voltage	V_{CC}	1.8	5.5	V
Digital Select Input Voltage	V_{IN}	GND	5.5	V
Analog Input Voltage	V_{IS}	GND	V_{CC}	V
Operating Temperature Range	T_A	-40	+85	°C
Input Rise or Fall Time, SELECT	tr, tf V_{CC} = 3.3V±0.3V V_{CC} = 5.0V±0.5V	 0 0	 100 20	ns/V

DC Electrical Characteristics

Symbol	Parameter	Test Conditions	V_{CC}± 10%	T_A=25°C			T_A=-40°C～+85°C		Unit
				Min	Typ	Max	Min	Max	
V_{IH}	High−Level Input Voltage, Select Inputs		2	1.4			1.4		V
			2.5	1.4			1.4		
			3.0	1.4			1.4		
			5.0	2.0			2.0		
V_{IL}	Low−Level Input Voltage, Select Inputs		2.0			0.5		0.5	V
			2.5			0.5		0.5	
			3.0			0.5		0.5	
			5.0			0.8		0.8	
I_{IN}	Maximum Input Leakage Current, Select Inputs	V_{IN} =5.5V or GND	5.5			±1.0		±1.0	uA
I_{OFF}	Power Off Leakage Current	V_{IN} =5.5V or GND	0			±10		±10	uA
I_{CC}	Maximum Quiescent Supply Current (2)	SELECT, V_{IS}= V_{CC} or GND	5.5			±1		±2	uA
$I_{NO(OFF)}$ $I_{NC(OFF)}$	NC or NO Off Leakage Current	V_{IN} = V_{IL} or V_{IH} V_{NO} or V_{NC}=1.0V V_{COM}=4.5V	5.5	-1		1	-10	10	nA
$I_{COM(ON)}$	COM ON Leakage Current (3)	V_{IN} = V_{IL} or V_{IH}, V_{NO}=1.0Vor 4.5V V_{NC} floating V_{NC}=1.0V or 4.5V V_{NO} floating V_{COM}=1.0V or 4.5V	5.5	-2		2	-20	20	nA
R_{ON}	On−Resistance (3)	V_{IN} <= V_{IL} V_{IS}=GND to VCC I_{IN}<=100mA	2.5			0.5		0.55	Ω
			3.0			0.4		0.45	
			5.0			0.3		0.35	
R_{FLAT}	On−Resistance Flatness(3)(5)	I_{COM}=100mA V_{IS}=GND to VCC	2.5			0.25		0.25	Ω
			3.0			0.25		0.25	
			5.0			0.25		0.25	
ΔR_{ON}	On−Resistance Match Between Channels(3)(4)	I_{COM}=100mA V_{IS}=1.3V	2.5			0.18		0.18	Ω
		I_{COM}=100mA V_{IS}=1.5V	3.0			0.06		0.06	
		I_{COM}=100mA V_{IS}=2.8V	5.0			0.06		0.06	

AC Electrical Characteristics

Symbol	Parameter	Test Conditions	V_{CC}±10%		T_A=25°C			T_A=-40°C～+85°C		Unit
					Min	Typ	Max	Min	Max	
t_{ON}	Turn−On Time (Figure 1)	R_L=50Ω , C_L=35pF	V_{CC}	V_{IS}						ns
			2.5	1.3			60		70	
			3.0	1.5			50		60	
			5.0	2.8			30		35	
t_{OFF}	Turn−Off Time (Figure 1)	R_L=50Ω , C_L=35pF	2.5	1.3			50		55	ns
			3.0	1.5			40		50	
			5.0	2.8			30		35	
t_{BBM}	Break−Before − Make Time[6] (Figure 2)	V_{IS}=3.0V R_L=50Ω, C_L=35pF	3.0	1.5	2	15				ns
BW	−3dB Bandwidth (Figure 4)	V_{IN} =0dB V_{IN} =GND to V_{CC}	3.0			30				MHz
V_{ONL}	Maximum Feed-through On Loss (Figure 4)	V_{IN}=0dB@100kHz to 50 MHz V_{IN}=GND to V_{CC}	3.0			-0.05				dB
V_{ISO}	Off−Channel Isolation (Figure 5)	F = 100kHz, V_{IN} =GND to V_{CC} C_L=5nF V_{IS}=1V RMS	3.0			-65				dB
Q	Charge Injection Select Input to Common I/O (Figure 3)	V_{IN} = 0 or V_{CC} R_{IS}=0Ω,C_L=1nF Q=C_L×ΔV_{OUT}	3.0			15				pC
THD	Total Harmonic Distortion	F_{IS}=20Hz to 100KHz,R_L=600, C_L=50pF, V_{IS}=1V_{RMS}	3.0			0.14				%
V_{CT}	Channel−to−Channel Crosstalk (Figure 6)	F_{IS}= 100KHz, V_{IN} =GND to V_{CC} R_L=50Ω,C_L=50pF V_{IS}=1V RMS	3.0			-83				dB
C_{NC}/C_{NO} ON	NC/NO Port Capacitance when is ON	f=1MHz	5.0			330				pF
C_{NC}/C_{NO} OFF	NC/NO Port Capacitance when is OFF	f=1MHz	5.0			102				pF

Note2. Guaranteed by design

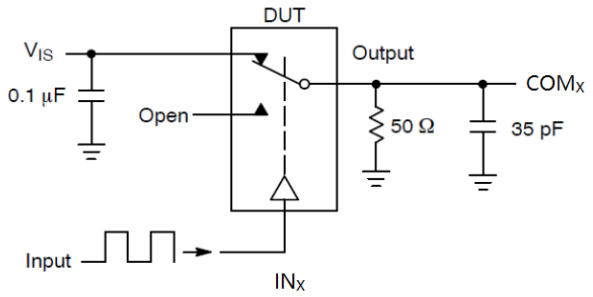
Note3. Guaranteed by design. Resistance measurements do not include test circuit or package resistance

Note4. $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$ between NC1 and NC2 or between NO1 and NO2.

Note5. Flatness is defined as the difference between the maximum and minimum value of on−resistance as measured over the specified analog signal ranges.

Note6. Guaranteed by design in -40˚C.

Test Circuit



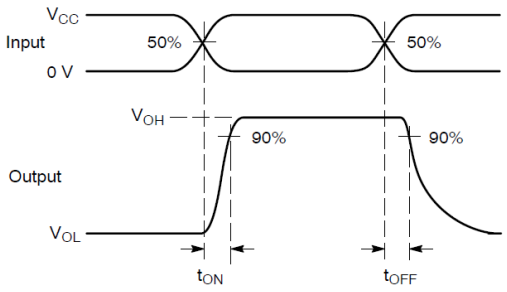
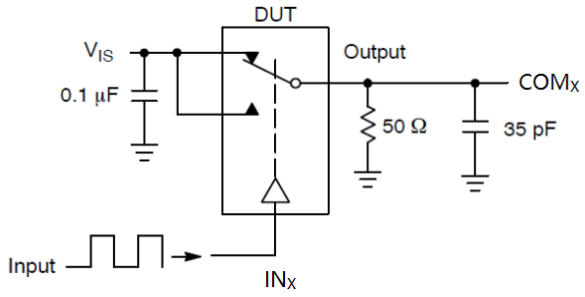


Figure1. t_{ON} /t_{OFF}



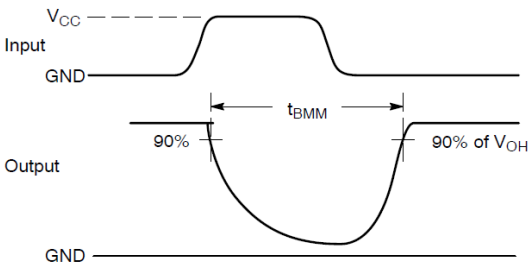
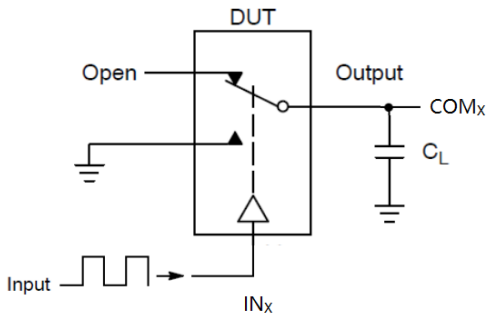


Figure2. t_{BBM}



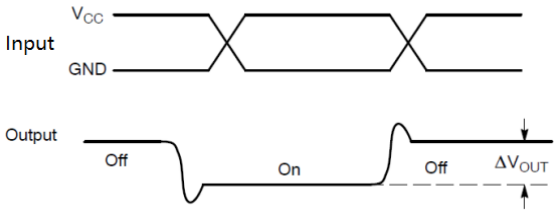


Figure3. Charge Injection

Test Circuit (Continued)

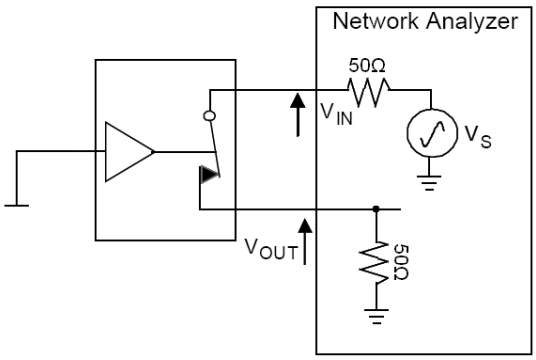


Figure4. Bandwidth

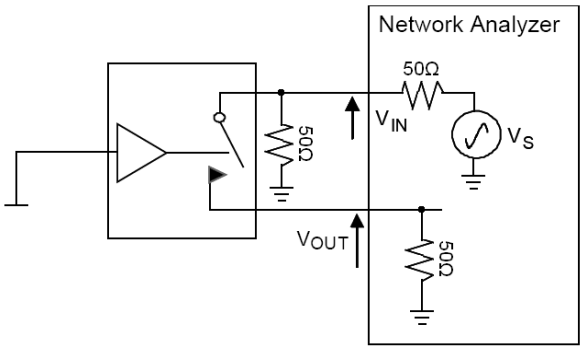


Figure5. Channel Off Isolation

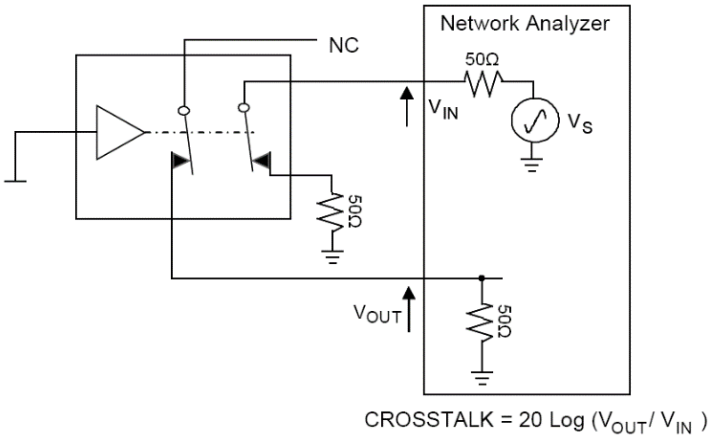
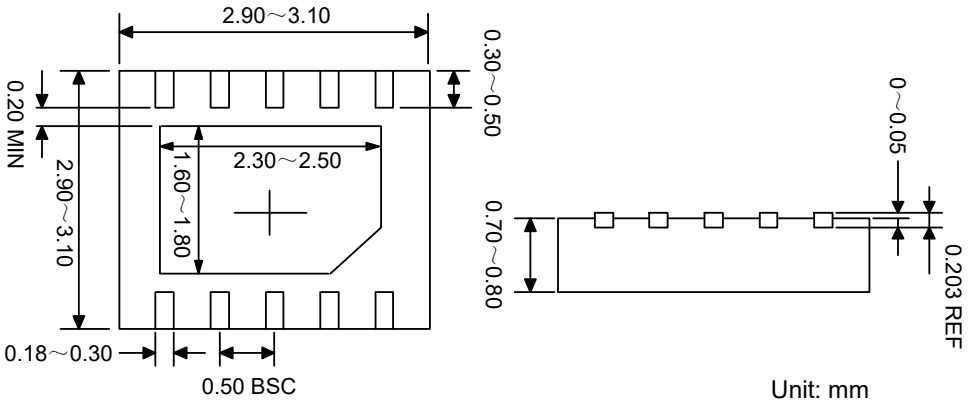


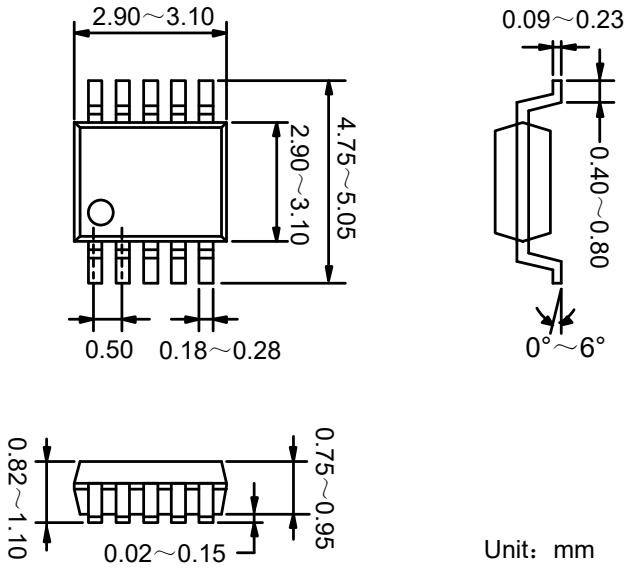
Figure6. Non-Adjacent Channel-to-Channel Crosstalk

Package Dimension

DFN10



MSOP10



Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2013-03-10	Original Version	Wuxj	Wuxj	Zhujl
1.1	2023-06-29	Update Typeset	Huyt	Liujy	Liujy