

0.4Ω Dual SPDT Negative Signal Handling Analog Switch

General Description

The ET5228A 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. The switches can handle negative signal down to -2V.

Features

- Low R_{ON} : typical 0.4Ω @ $V_{CC} = 4.3V$
- Single Supply Operation from 1.65V to 5.5V
- Full -2V to V_{CC} Signal Handling Capability
- High Off-Channel Isolation
- Low Standby Current
- Low Distortion
- Break-Before-Make(BBM) switching
- High Continuous Current Capability: ±300 mA Through Each Switch
- Part No. and package

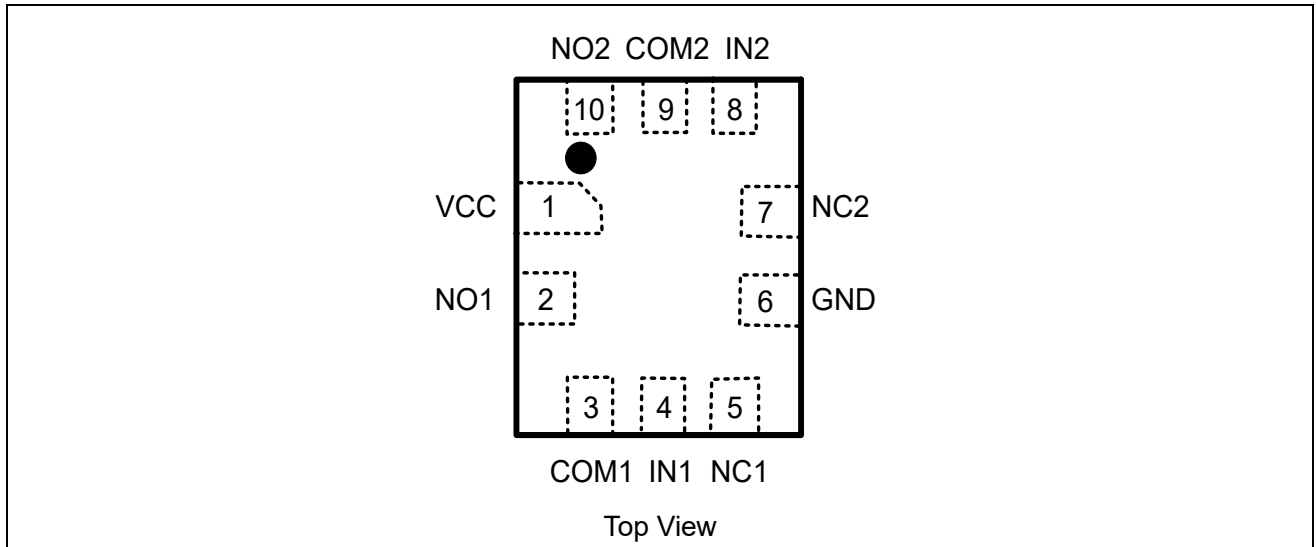
Part No.	Package	Packing Option	MSL
ET5228A	QFN10L (1.8mm×1.4mm)	Tape and Reel , 3K	Level 1

Applications

- Cell Phone Audio Block/ Speaker
- Earphone Switching Ring-Tone Chip
- Amplifier Switching/Modems

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Pin Configuration



Pin Function

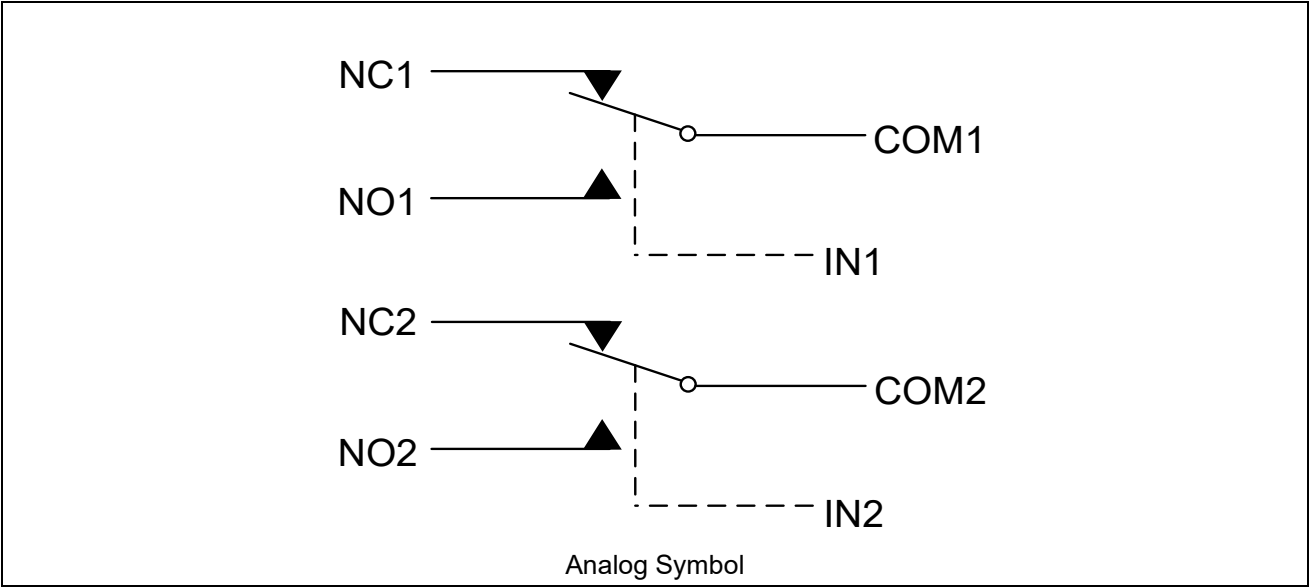
Pin NO.	Pin Name	Description
1	VCC	Power supply
2	NO1	Independent Channels
3	COM1	Common Channels
4	IN1	Controls
5	NC1	Independent Channels
6	GND	Ground (V)
7	NC2	Independent Channels
8	IN2	Controls
9	COM2	Common Channels
10	NO2	Independent Channels

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Truth Table

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

Analog Symbol



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Absolute Maximum Ratings

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.5~+6.5	V
Analog Input Voltage	V_{IS}	-2.5~ $V_{CC}+0.3$ $ V_{CC}-V_{IS} < 6.5V$	V
Digital Select Input Voltage	V_{IN}	-0.5~+6.5	V
Output Voltage	V_O	-2.5~ $V_{CC}+0.3$ $ V_{CC}-V_O < 6.5V$	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 VCC or GND	I_{clmp}	±100	mA
Storage Temperature	T_S	-55 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}	1.65	5.5	V
Digital Select Input Voltage	V_{IN}	GND	5.5	V
Analog Input Voltage	V_{IS}	-2	V_{CC}	V
Operating Temperature Range	T_A	-40	+85	°C

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Electrical Characteristics

Symbol	Parameter	Test Conditions	T _A =25°C			T _A =-40~85°C		Unit
			Min	Typ	Max	Min	Max	
V _{IH}	High-Level Input Voltage, Select Inputs	V _{CC} =1.65~5.5V	0.95			1.2		V
V _{IL}	Low-Level Input Voltage, Select Inputs	V _{CC} =1.65~5.5V			0.4		0.35	V
I _{IN}	Maximum Input Leakage Current, Select Inputs	V _{IN} =V _{CC} or GND V _{CC} =5.5V			±0.3		±1.0	uA
I _{OFF}	Power Off Leakage Current	V _{IN} =5.5V V _{CC} =0V			±0.5		±1.0	uA
I _{CC}	Maximum Quiescent Supply Current	V _{CC} =5.5V, I _{OUT} =0 V _{IN} = V _{CC} or GND			±0.5		±1.0	uA
I _{CC} T	Increase in I _{CC} per Input	IN1=2.6V, IN2=0V, or IN2=2.6V, IN1=0V, V _{CC} =4.3V		1.5	3.0		10	uA
		IN1=1.8V, IN2=0V, or IN2=1.8V, IN1=0V, V _{CC} =4.3V		4.0	7.0		20	
I _{COM(ON)}	COM ON leakage Current ⁽³⁾	V _{IN} = V _{IL} or V _{IH} , V _{NO} =0.3V or 4.7V V _{NC} floating V _{NC} =0.3V or 4.7V V _{NO} floating V _{COM} =0.3V or 4.7V V _{CC} =5.5V	-100		100	-700	700	nA
R _{ON}	On-Resistance ⁽³⁾	I _{COM} = 100mA V _{IS} = -2V, -1V, 0V, 0.7V, 3.6V, 4.3V V _{CC} =4.3V		0.4	0.8		1.0	Ω
		I _{COM} = 100mA V _{IS} = -2V, -1V, 0V, 0.7V, 2.3V, 3V V _{CC} =3.0V		0.5	1.0		1.3	
R _{FLAT}	On-Resistance Flatness ^{(3) (5)}	I _{COM} = 100mA V _{IS} =GND to V _{CC} V _{CC} =4.3V			0.3		0.4	Ω
ΔR _{ON}	On-Resistance Match Between Channels ^{(3) (4)}	I _{COM} = 100mA V _{IS} =1.5V V _{CC} =4.3V		0.1	0.2		0.3	Ω

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Electrical Characteristics (Continued)

Symbol	Parameter	Test Conditions	T _A =25°C			T _A =-40~85°C		Unit
			Min	Typ	Max	Min	Max	
t _{ON}	Turn-On Time ⁽²⁾ (Figure 1)	V _{IS} =1.5V, V _{CC} =2.5~3.3V		65	140		300	ns
		V _{IS} =1.5V, V _{CC} =3.3~5.5V		40	90		200	
t _{OFF}	Turn-Off Time ⁽²⁾ (Figure 1)	V _{IS} =1.5V, V _{CC} =2.5~3.3V		30	70		120	ns
		V _{IS} =1.5V, V _{CC} =3.3~5.5V		20	50		100	
t _{BBM}	Break-Before-Make Time ⁽²⁾ (Figure 2)	C _L =35pF, R _L =50Ω V _{IS} =1.5V, V _{CC} =2.5~3.3V		40		30		ns
		C _L =35pF, R _L =50Ω V _{IS} =1.5V, V _{CC} =3.3~5.5V		20		15		
BW	On-Channel -3dB Bandwidth or Frequency Response ⁽²⁾ (Figure 4)	R _{IS} =50Ω		130				MHz
V _{ISO}	Off-Channel Isolation ⁽²⁾ (Figure 5)	F _{IS} = 100kHz, V _{IN} =GND to V _{CC} C _L =5pF, R _L = 50Ω V _{IS} =1V RMS		-70				dB
Q	Charge Injection Select Input to Common I/O ⁽²⁾ (Figure 3)	V _{IN} = 0 or V _{CC} R _{IS} =0Ω, C _L =100pF R _L =1MΩ Q=C _L ×ΔV _{OUT}		3.5				pC
THD	Total HarmonicDistortion THD +Noise ⁽²⁾	F _{IS} =20Hz to20KHz R _L =50Ω, C _L =5pF V _{IS} =2V RMS V _{CC} =3.6V		0.06				%
V _{CT}	Channel-to-Channel Crosstalk ⁽²⁾ (Figure 6)	F _{IS} = 100KHz, V _{IN} =GND to V _{CC} R _L = 50Ω, C _L =5pF V _{IS} =1V RMS		-85				dB
C _{IN}	Control Pin Input Capacitance ⁽²⁾	V _{CC} =3.6V		2.0				pF
C _{NC} /C _{NO}	NC/NO Port Capacitance ⁽²⁾	V _{CC} =3.6V		20.0				pF
C _{COM}	COM Port Capacitance When Switch is Enabled ⁽²⁾	V _{CC} =3.6V		60.0				pF

Note2. Guaranteed by design.

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

Note4. $\Delta R_{ON} = R_{ON(NC1)} - R_{ON(NC2)}$ or $R_{ON(NO1)} - R_{ON(NO2)}$ when V_{IS} is same.

Note5. 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 Circuit

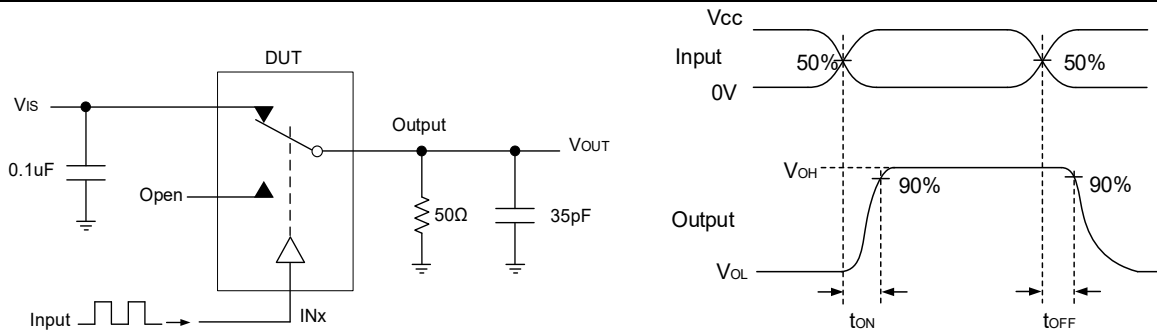


Figure1. t_{ON} / t_{OFF}

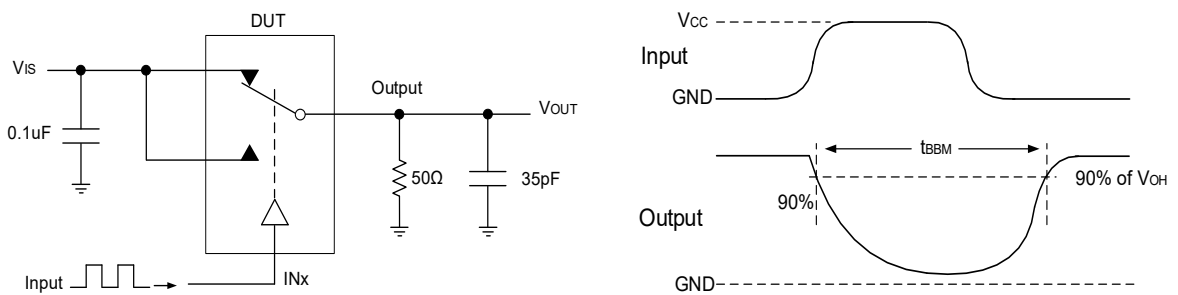


Figure2. t_{BBM}

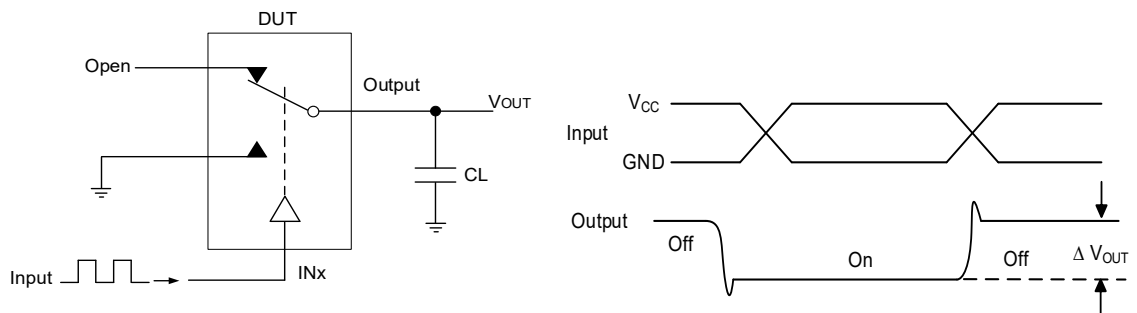


Figure3. Charge Injection

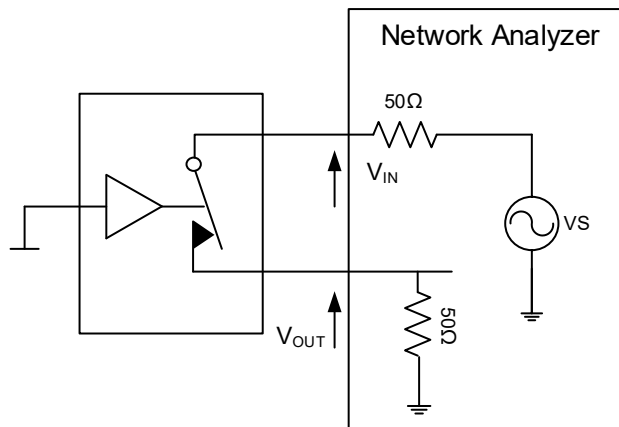


Figure4. Bandwidth

Test Circuit (Continued)

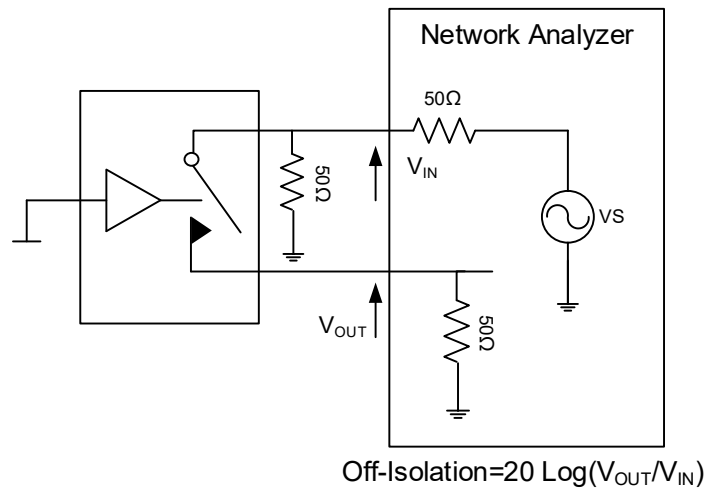


Figure5. Channel Off Isolation

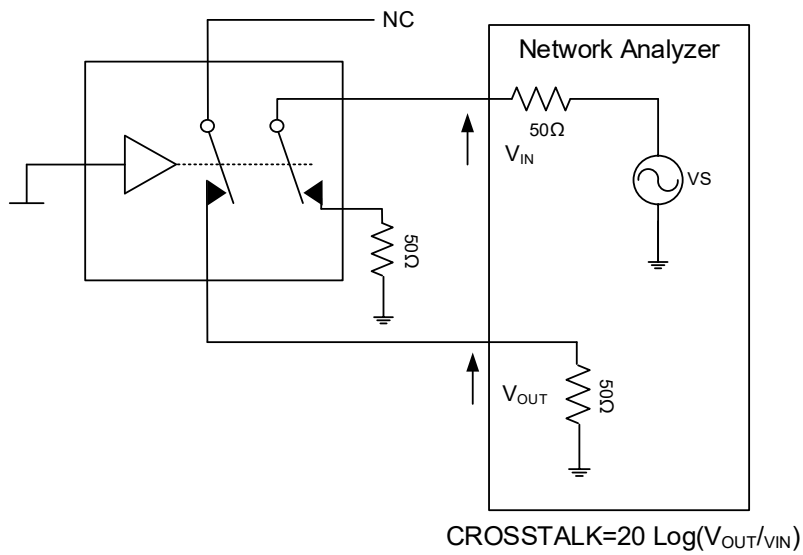


Figure6. Non-Adjacent Channel-to-Channel Crosstalk

Typical Characteristics

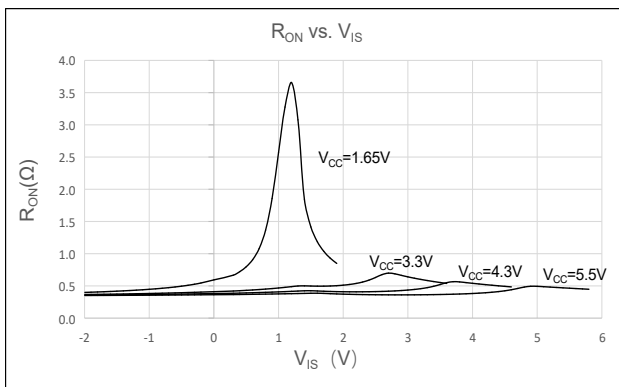


Figure 7. On-Resistance vs. V_{IS}

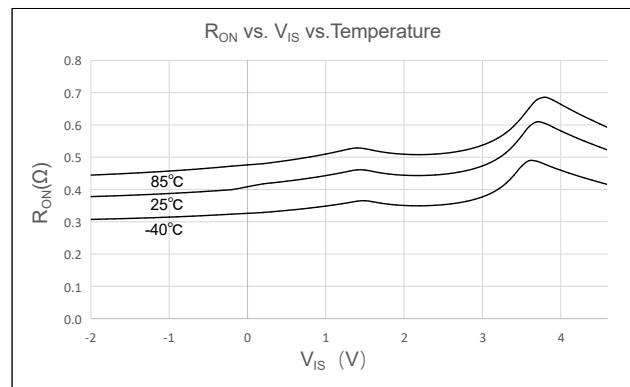


Figure 8. R_{ON} vs. V_{IS} vs. Temperature @ $V_{CC}=4.3V$

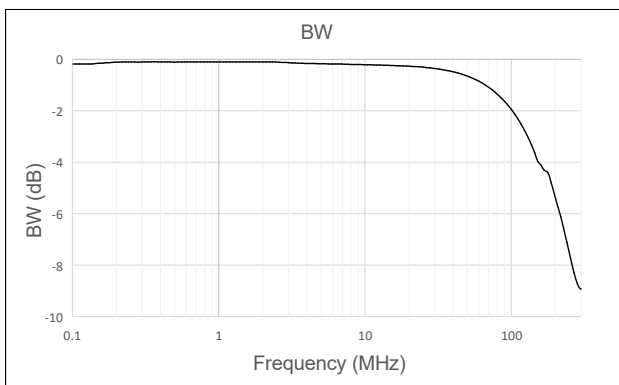


Figure 9. Bandwidth vs. Frequency @ $V_{CC}=4.3V$

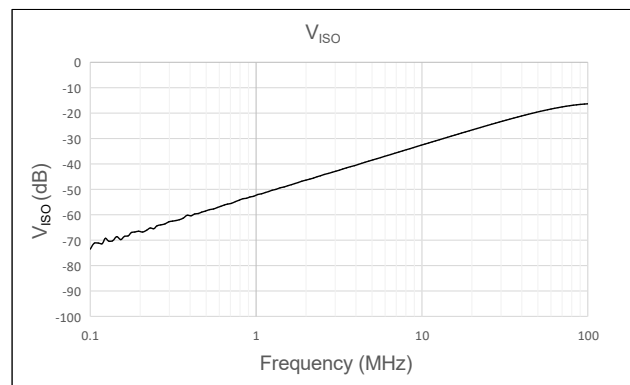


Figure 10. V_{ISO} vs. Frequency @ $V_{CC}=4.3V$

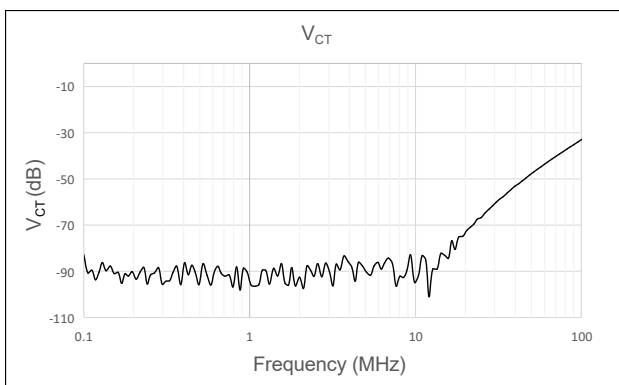


Figure 11. V_{CT} vs. Frequency @ $V_{CC}=4.3V$

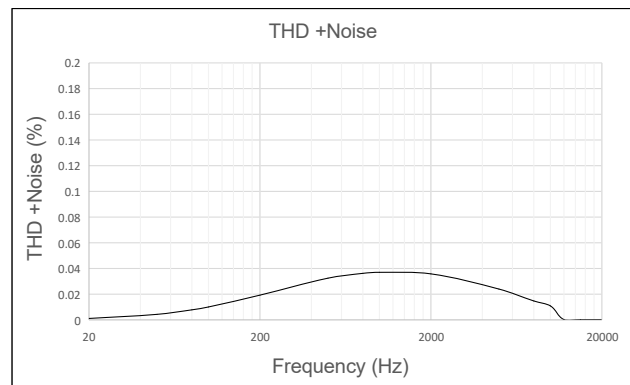
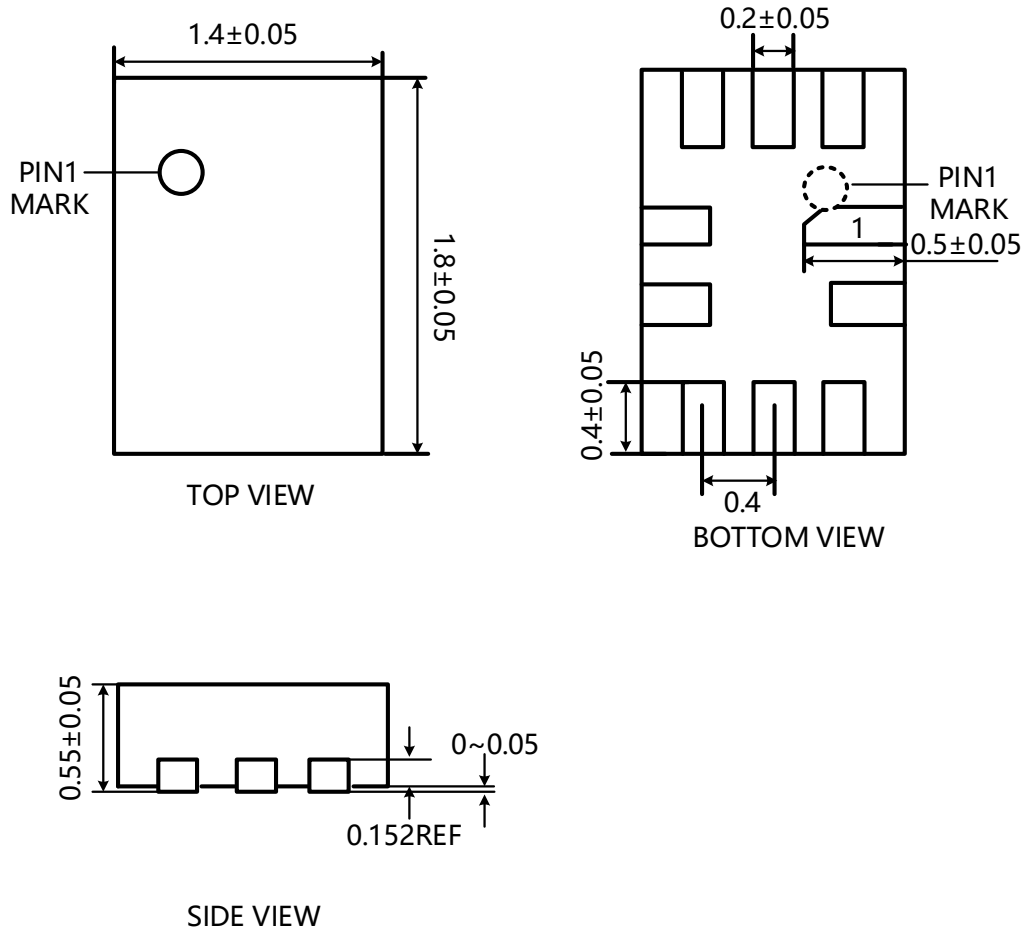


Figure 12. THD + Noise vs. Frequency @ $V_{CC}=3.6V$

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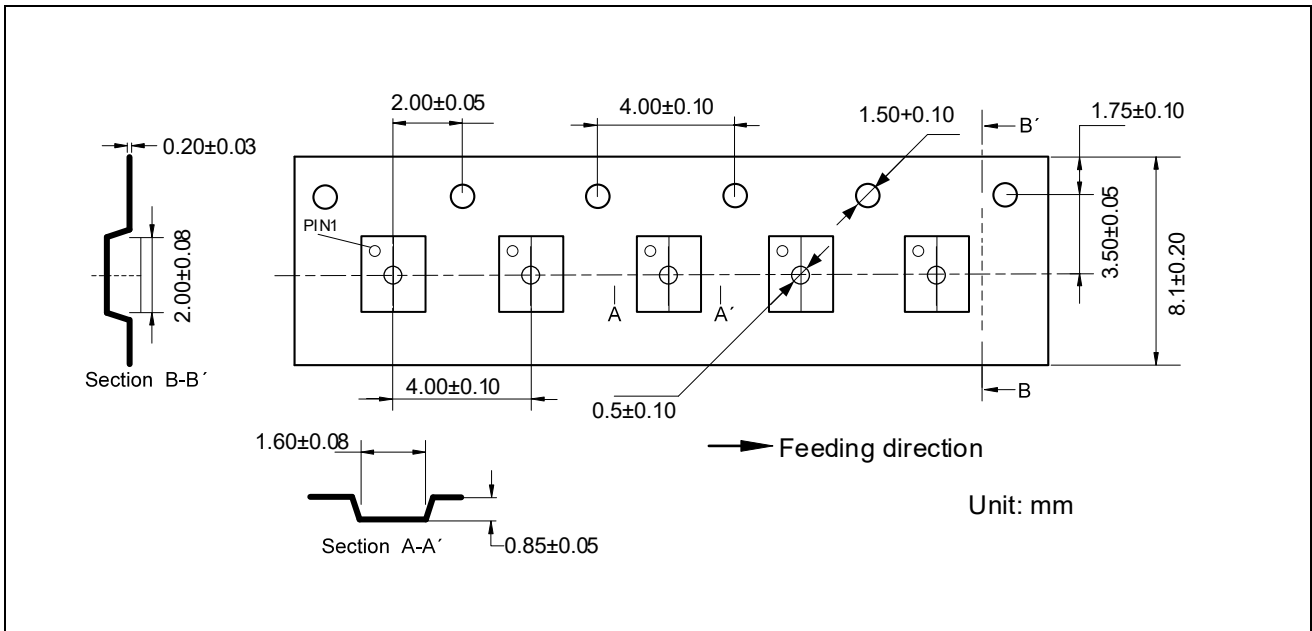
Package Dimension

QFN10L

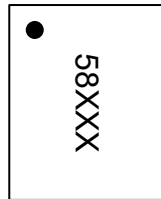


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Tape Information



Marking Information



58: Part Number

XXX: Tracking Number

Note: XXX (Tracking Number) is variable, according to the wafer lot number.

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Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2024-01-30	Original Version	Pan Shun Ye	Lu hao	Liu Jia Ying
1.1	2025-08-01	Add Tape and Marking Information	Qin Pei Long	Lu hao	Liu Jia Ying