MIC/AGND Cross-Point Switch and SENSE SPDT Switch For Type-C analog headphones applications

General Description

The ET74522Y is a MIC/AGND cross-point switch and sense SPDT switch for Type-C analog headphones applications. The ET74522Y operates from a signal 2.3V to 5.5V supply. The MIC/AGND channels features an ultra-low on resistance of 0.55Ω at 3.3V supply.

The ET74522Y protects the system components behind the switch with overvoltage fault protection up to 12V.

The ET74522Y is available in QFN1.6*1.6-12 package, which makes it a perfect solution for mobile applications.

Features

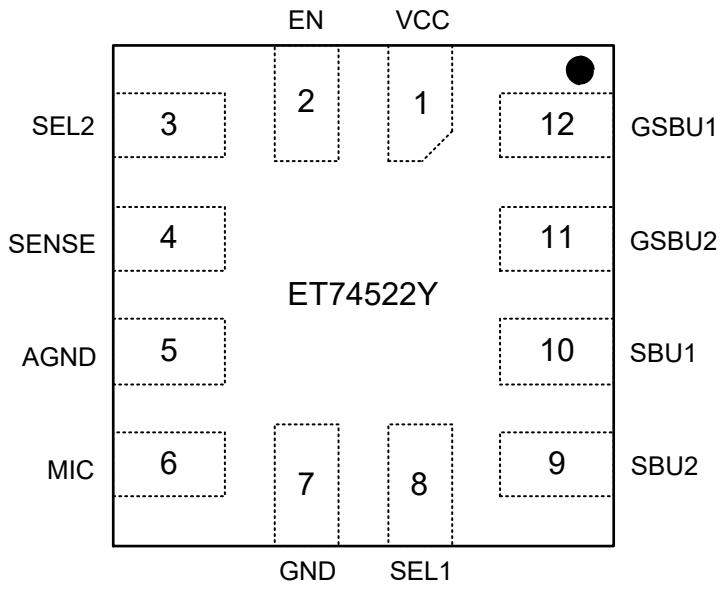
- Operating V_{CC} range: 2.3V to 5.5V
- High performance switch:
  - Bandwidth(-3dB): 150MHz for MIC Switch and 400MHz for SENSE Switch
  - R_{ON} (MIC/AGND): 0.55Ω
  - R_{ON} (SENSE): 1Ω
  - THD+N= -95dB @ f=20Hz~20kHz, R_L= 32Ω, V_{SW}= $1V_{RMS}$
  - Off-isolation= -100dB @ f=1kHz, R_L= 32Ω, V_{SW}= $0.35V_{RMS}$
  - Crosstalk= -90dB @ f=1kHz, R_L= 50Ω, V_{SW}= $0.35V_{RMS}$
- GSBU1/2 and SBU1/2 pins OVP: 4.2V
- GSBU1/2 and SBU1/2 pins up to 12V DC
- Support 1.2V GPIO control
- Active supply current: 33uA
- Operating temperature range: -40°C to 85°C
- Package Information:

Part No.	Package	Packing Option	MSL
ET74522Y	QFN12 (1.6mm×1.6mm)	Tape and Reel ,3K	Level 1

Application

- Mobile Phone
- PC/Notebook

Pin Configuration



Top View

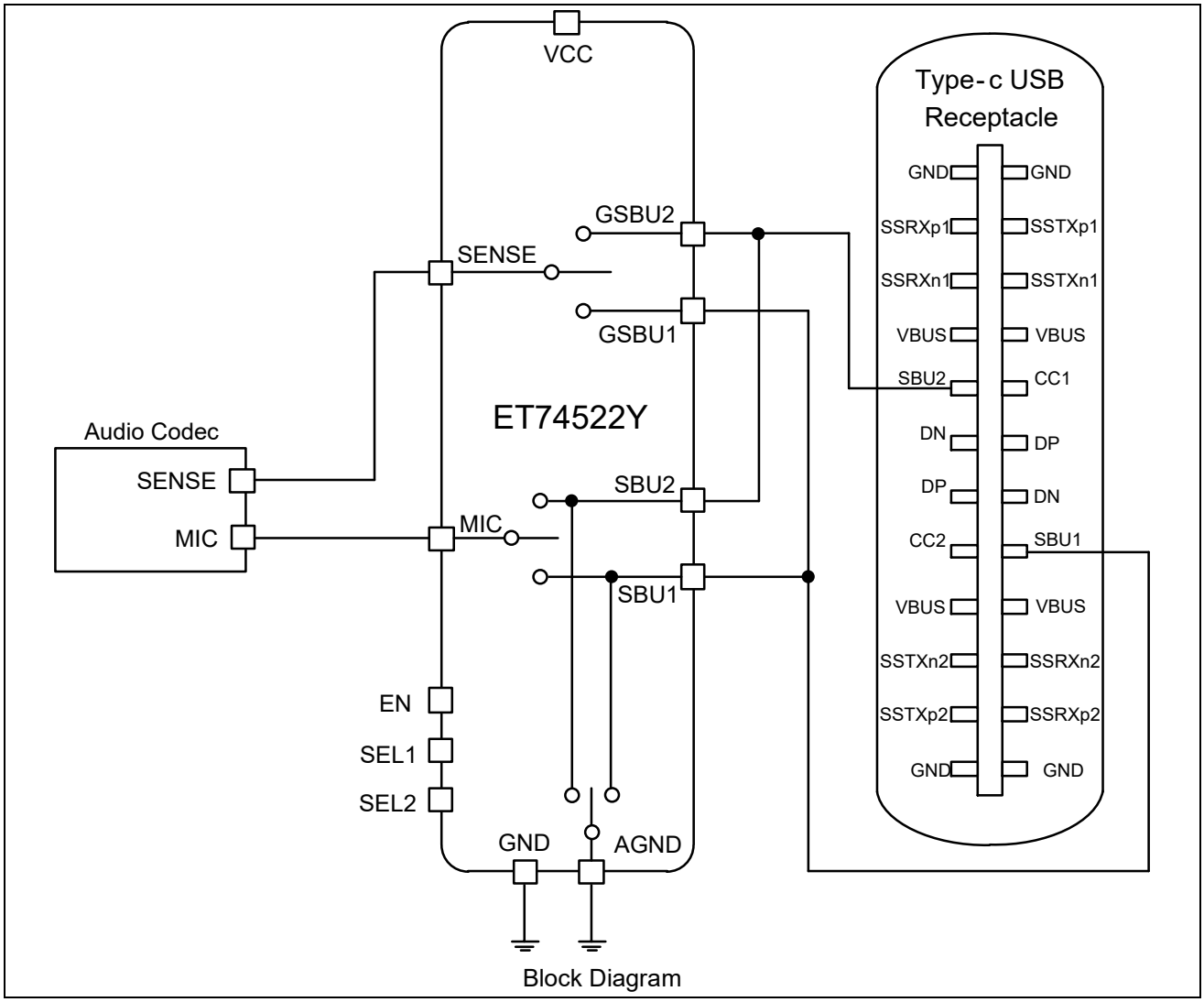
Pin Function

Pin No.	Pin Name	Description
1	VCC	Power supply
2	EN	Enable pin, Active high
3	SEL2	Switch selection 2
4	SENSE	Audio ground reference output
5	AGND	Audio signal ground
6	MIC	Microphone signal
7	GND	Ground
8	SEL1	Switch selection 1
9	SBU2	Sideband use wire 2
10	SBU1	Sideband use wire 1
11	GSBU2	Audio sense path 2 to headset jack ground
12	GSBU1	Audio sense path 1 to headset jack ground

Truth Table

EN	SEL1	SEL2	MIC/AGND, SBU1/SBU2
Low	X	X	All OFF
High	Low	Low	SENSE to GSBU1, MIC/AGND switch OFF
High	High	Low	SENSE to GSBU2, MIC/AGND switch OFF
High	High	High	SENSE to GSBU2, MIC to SBU1, AGND to SBU2
High	Low	High	SENSE to GSBU1, MIC to SBU2, AGND to SBU1

Block Diagram



Block Diagram

Absolute Maximum Ratings

Symbol	Parameter		Max	Unit
V_{CC}	Supply Voltage		-0.5～+6.5	V
V_{SW_MIC}	V_{SW_MIC} to GND		-0.5～+6.5	V
V_{SW_SENSE}	V_{SW_SENSE} to GND		-0.5～+6.5	V
V_{SW_AGND}	V_{SW_AGND} to GND		-0.5～+6.5	V
V_{SW_GSBUx}	V_{SW_GSBU1} to GND, V_{SW_GSBU2} to GND		-0.5～+13.2	V
V_{SW_SBUx}	V_{SW_SBU1} to GND, V_{SW_SBU2} to GND		-0.5～+13.2	V
T_{STG}	Storage temperature		-65 to 150	°C
V_{ESD}	ESD Classification	Human Body Model (1)	±6000	V
		Charged Device Model (2)	±2000	
I_{LU}	Max Latch Up Current Above V_{CC} and GND at 85°C (3)		±150	mA

Exceeding the maximum ratings listed under Absolute Maximum Ratings when designing is likely to damage the device permanently. Do not design to the maximum limits because long-time exposure to them might impat the device's reliability. The ratings are obtained over an operating free-air temperature range unless otherwise specified.

Note1: HBM tested per JEDEC JS-001;

Note2: CDM tested per JEDEC JS-002;

Note3: Latch up Current Maximum Rating tested per JEDEC JESD78F.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	2.3	5.5	V
V_{SW_MIC}	Analog input/output voltage	0	3.6	V
V_{SW_SENSE}		0	3.6	V
V_{SW_AGND}		0	3.6	V
V_{SW_GSBUx}		0	12	V
V_{SW_SBUx}		0	12	V
T_A	Operating temperature	-40	85	°C
T_J	Junction temperature	-40	125	°C

Electrical Characteristics

T_A= -40°C to 85°C, V_{CC}=2.3V to 5.5V, typical values are at V_{CC}= 3.3V, T_A=25°C, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Power Supply						
V_{CC}	Power supply voltage		2.3		5.5	V
I_{CC}	Active supply current	V_{CC}=2.3V to 5.5V, EN=V_{CC}, SEL1=SEL2=0V		33	45	uA
	Supply current during OVP condition	V_{CC}=2.3V to 5.5V, EN=V_{CC}, SEL1=SEL2=0V		31	40	
I_{SD}	Standby Powered down supply current	V_{CC}=2.3V to 5.5V, EN=0V, SEL1=SEL2=V_{CC}		0.1	5	uA
DC Characteristics (MIC Switch)						
I_{ON}	ON Leakage Current of MIC switch	V_{CC}=2.3V to 5.5V, SBUx=0V to 3.6V, MIC is floating	-3		3	uA
I_{OZ}	Off Leakage Current of MIC switch	V_{CC}=2.3V to 5.5V, MIC=0V to 3.6V		0.1		uA
I_{OFF}	Power off Leakage Current of MIC switch	V_{CC}=0V, MIC=0V to 3.6V		0.1		uA
R_{ON}	On-state Resistance of MIC	V_{CC}=3.3V, V_{SW}=0 to 3.6V, I_{SW}=100mA		0.55		Ω
ΔR_{ON}	On-state Resistance Match between Channels			0.02		Ω
R_{FLAT}	On-state Resistance Match Flatness			0.01		Ω
DC Characteristics (SENSE Switch)						
I_{ON}	ON Leakage Current of SENSE switch	V_{CC}=2.3V to 5.5V, GSBUx=0V to 3.6V, SENSE is floating	-3		3	uA
I_{OZ}	Off Leakage Current of SENSE switch	V_{CC}=2.3V to 5.5V, SENSE=0V to 3.6V		0.1		uA
I_{OFF}	Power off Leakage Current of SENSE switch	V_{CC}=0V, SENSE=0V to 3.6V		0.1		uA
R_{ON}	On-state Resistance of SENSE	V_{CC}=3.3V, V_{SW}=0 to 3.6V, I_{SW}=100mA		1		Ω
ΔR_{ON}	On-state Resistance Match between Channels			0.02		Ω
R_{FLAT}	On-state Resistance Match Flatness			0.01		Ω

Electrical Characteristics (Continued)

T_A= -40°C to 85°C, V_{CC}=2.3V to 5.5V, typical values are at V_{CC}= 3.3V, T_A=25°C, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
DC Characteristics (AGND Switch)						
I_{ON}	ON Leakage Current of AGND switch	V_{CC}=2.3V to 5.5V, SBUx=0V to 3.6V, AGND is floating	-3		3	uA
I_{OZ}	Off Leakage Current of AGND switch	V_{CC}=2.3V to 5.5V, AGND=0V to 3.6V		0.1		uA
I_{OFF}	Power off Leakage Current of AGND switch	V_{CC}=0V, AGND=0V to 3.6V		0.1		uA
R_{ON}	On-state Resistance of AGND	V_{CC}=3.3V, V_{SW}=0 to 3.6V, I_{SOURCE}=100mA on SBUx		0.55		Ω
ΔR_{ON}	On-state Resistance Match between Channels			0.02		Ω
R_{FLAT}	On-state Resistance Match Flatness			0.01		Ω
DC Characteristics (SBUx and GSBUx Pins)						
I_{OZ}	Off Leakage Current of SBUx	V_{CC}=2.3V to 5.5V, SBUx=0V to 3.6V		0.5		uA
	Off Leakage Current of GSBUx	V_{CC}=2.3V to 5.5V, GSBUx=0V to 3.6V		0.5		uA
I_{OFF}	Power off Leakage Current of SBUx	V_{CC}=0V, SBUx=0V to 3.6V		0.5		uA
	Power off Leakage Current of GSBUx	V_{CC}=0V, GSBUx=0V to 3.6V		0.5		uA
Digital Inputs						
V_{IH}	Input Logic High	SELn, EN	0.825			V
V_{IL}	Input Logic Low				0.35	V
I_{IH_EN}	Input High Leakage Current	EN=1.2V, 1.8V, V_{CC}	-3		3	uA
I_{IL_EN}	Input Low Leakage Current	EN=0V		0		uA
R_{PD}	Internal pull-down resistor on EN pin			3		MΩ
I_{IH_SELn}	Input High Leakage Current	SELn=1.2V, 1.8V, V_{CC}	-2		2	uA
I_{IL_SELn}	Input Low Leakage Current	SELn=0V	-2		2	uA
R_{PU}	Internal pull-up resistor on SELn pin			5		MΩ

Electrical Characteristics (Continued)

T_A= -40°C to 85°C, V_{CC}=2.3V to 5.5V, typical values are at V_{CC}= 3.3V, T_A=25°C, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Protection						
V_{OVP}	Common Pins OVP Threshold		3.8	4.2	4.6	V
V_{OVP_HYST}	OVP Threshold Hysteresis			50		mV
V_{CLAMP_V}	Maximum Voltage to Appear on SBUx Pins During OVP Condition	V_{SBUx}=0 to 16V, t_{RISE} and t_{FALL} (10% to 90%) =100ns, R_L=open, switch ON or OFF, EN=High	0		9	V
	Maximum Voltage to Appear on GSBUx Pins During OVP Condition	V_{GSBUx}=0 to 16V, t_{RISE} and t_{FALL} (10% to 90%) =100ns, R_L=open, switch ON or OFF, EN=High	0		9	V
Dynamic Characteristics						
C_{ON}	ON Capacitance	V_{SBUx}=0 or 3.3V, EN=V_{CC}, f=1MHz, switch ON		40		pF
		V_{GSBUx}=0 or 3.3V, EN=V_{CC}, f=1MHz, switch ON		15		pF
C_{OFF}	OFF Capacitance	V_{SBUx}=0 or 3.3V, EN=V_{CC}, f=1MHz, switch OFF		20		pF
		V_{GSBUx}=0 or 3.3V, EN=V_{CC}, f=1MHz, switch OFF		10		pF
O_{ISO}	OFF-Isolation	f=1kHz, R_L=32Ω, V_{SW}=0.35V_{RMS}		-100		dB
X_{TALK}	Crosstalk	f=1kHz, R_L=50Ω, V_{SW}=0.35V_{RMS}		-90		dB
BW	-3dB Bandwidth	MIC Switch,R_L=50Ω		150		MHz
		SENSE Switch,R_L=50Ω		400		MHz
THD+N	Total Harmonic Distortion	f=20Hz to 20kHz, R_L=32Ω V_{SW}=1V_{RMS}		-95		dB

Electrical Characteristics (Continued)

T_A= -40°C to 85°C, V_{CC}=2.3V to 5.5V, typical values are at V_{CC}= 3.3V, T_A=25°C, unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Timing requlrements (MIC Switch)						
t_{SW}	Switching Time Between Channels (SELn to Output)	V_{SBUx}=0.8V, R_L=50Ω		30		us
t_{ON}	Device Turn ON Time (EN to Output)	V_{SBUx}=0.8V, C_L=5pF		200		us
t_{OFF}	Device Turn OFF Time (EN to Output)	V_{SBUx}=0.8V, C_L=5pF		100		ns
Timing requlrements (SENSE Switch)						
t_{SW}	Switching Time Between Channels (SELn to Output)	V_{GSBUx}=0.8V, R_L=50Ω		30		us
t_{ON}	Device Turn ON Time (EN to Output)	V_{GSBUx}=0.8V, C_L=5pF		200		us
t_{OFF}	Device Turn OFF Time (EN to Output)	V_{GSBUx}=0.8V, C_L=5pF		100		ns
Timing requlrements (AGND Switch)						
t_{SW}	Switching Time Between Channels (SELn to Output)	V_{SBUx}=0.8V, R_L=50Ω		30		us
t_{ON}	Device Turn ON Time (EN to Output)	V_{SBUx}=0.8V, C_L=5pF		200		us
t_{OFF}	Device Turn OFF Time (EN to Output)	V_{SBUx}=0.8V, C_L=5pF		100		ns
Timing requlrements (SBUx and GSBUx Pins)						
t_{OVP}	SBUx Pins OVP Response Time	V_{SW}=3.5V to 5.5V		0.1		us
	GSBUx Pins OVP Response Time	V_{SW}=3.5V to 5.5V		0.1		us

Typical Characteristics

T_A=25°C, unless otherwise stated

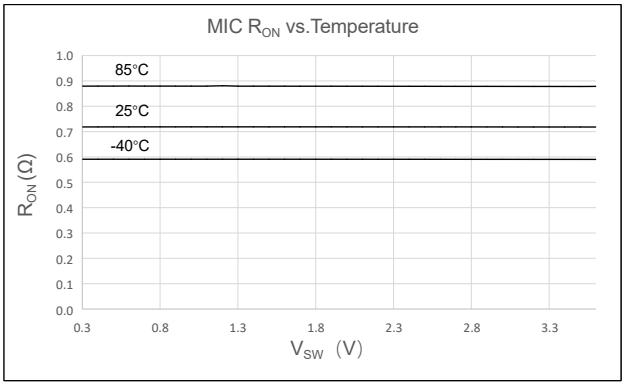


Figure 1 R_{ON} vs. V_{SW} vs. Temperature @V_{CC}=3.3V

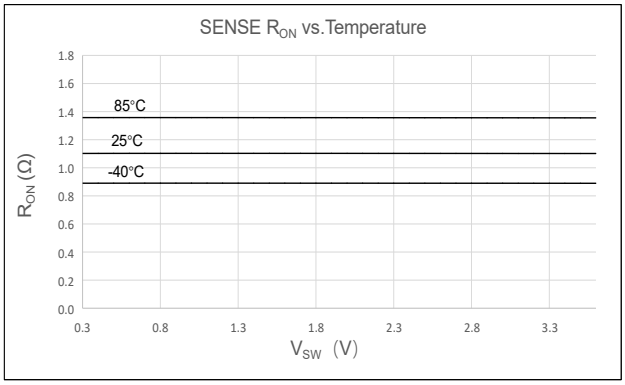


Figure 2 R_{ON} vs. V_{SW} vs. Temperature @V_{CC}=3.3V

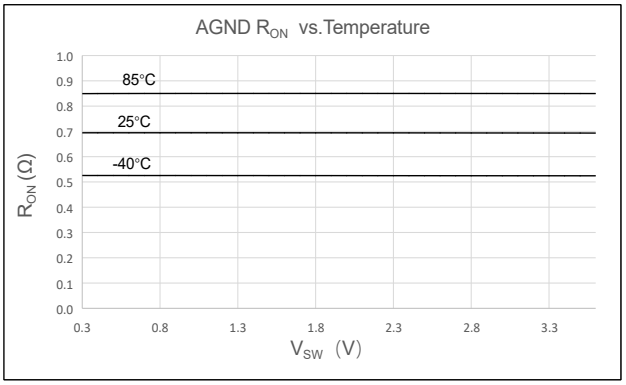


Figure 3.R_{ON} vs. V_{SW} vs. Temperature @V_{CC}=3.3V

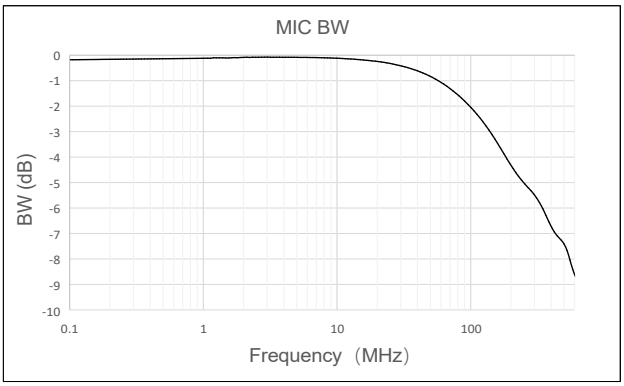


Figure 4. Bandwidth vs. Frequency @V_{CC}=3.3V

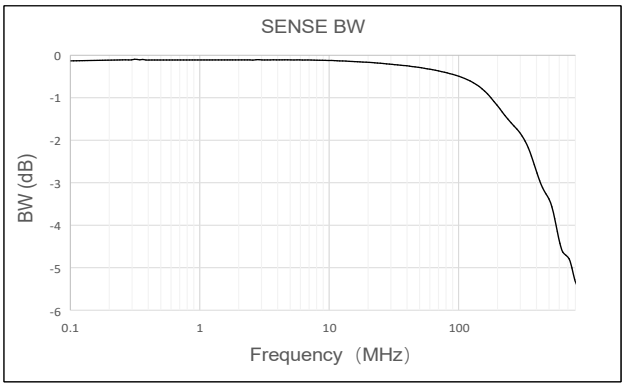


Figure 5. Bandwidth vs. Frequency @V_{CC}=3.3V

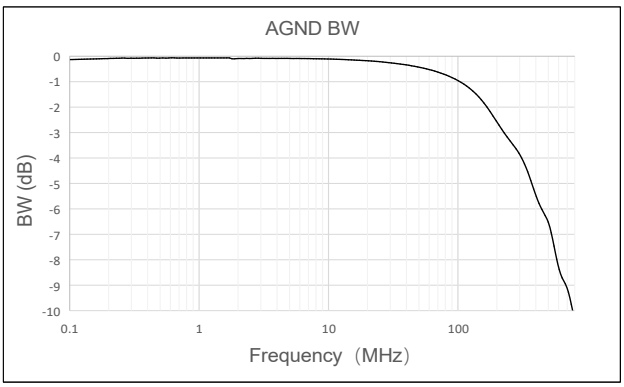


Figure 6. Bandwidth vs. Frequency @V_{CC}=3.3V

Typical Characteristics

T_A=25°C, unless otherwise stated

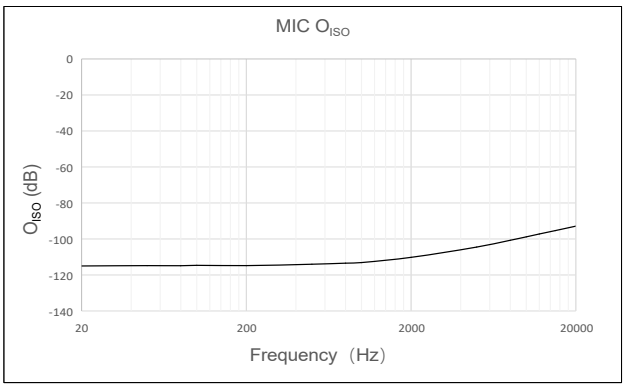


Figure 7. O_{ISO} vs. Frequency @V_{CC}=3.3V

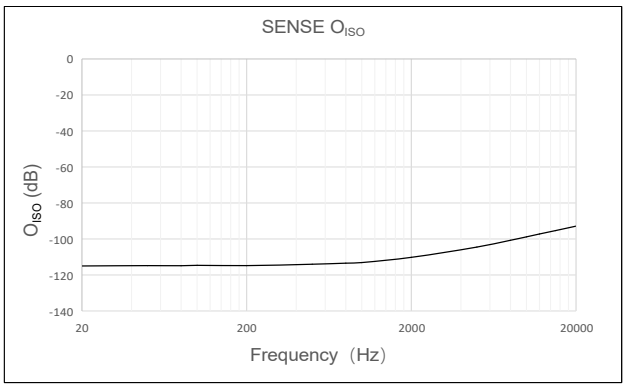


Figure 8. O_{ISO} vs. Frequency @V_{CC}=3.3V

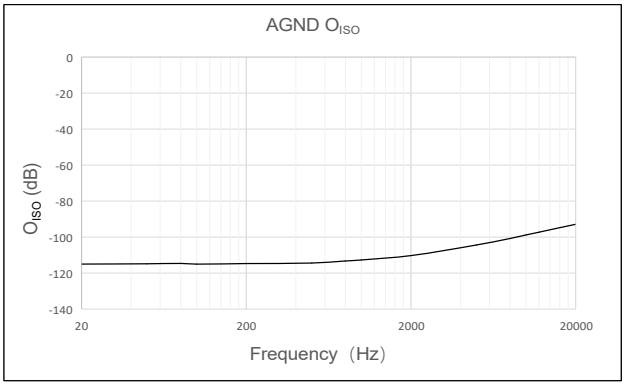


Figure 9. O_{ISO} vs. Frequency @V_{CC}=3.3V

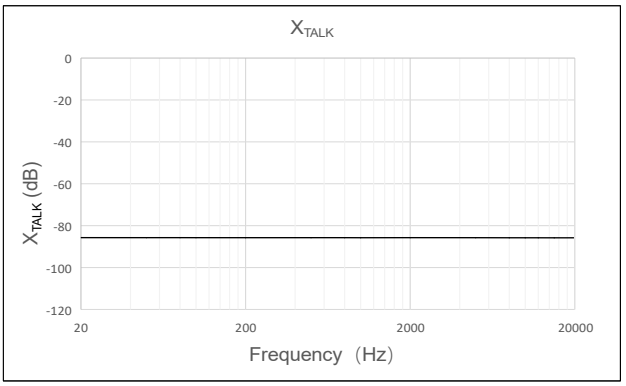


Figure 10. X_{TALK} vs. Frequency @V_{CC}=3.3V

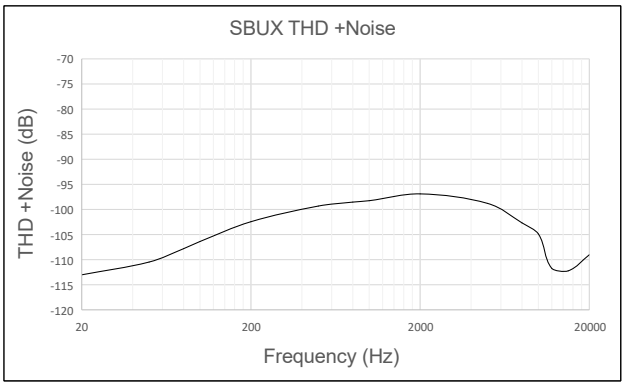


Figure 11.THD+N vs Frequency

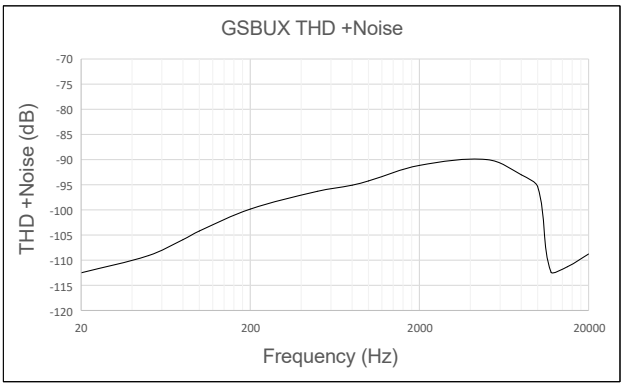
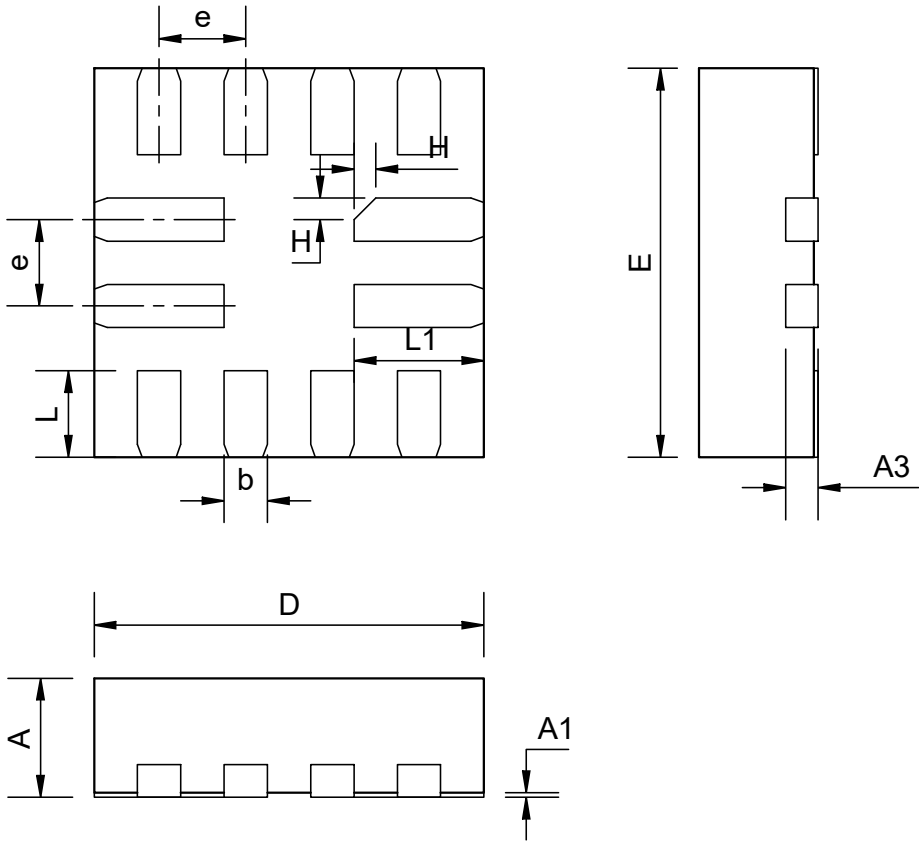


Figure 12.THD+N vs Frequency

Package Dimension

QFN12L(1.6mm*1.6mm)

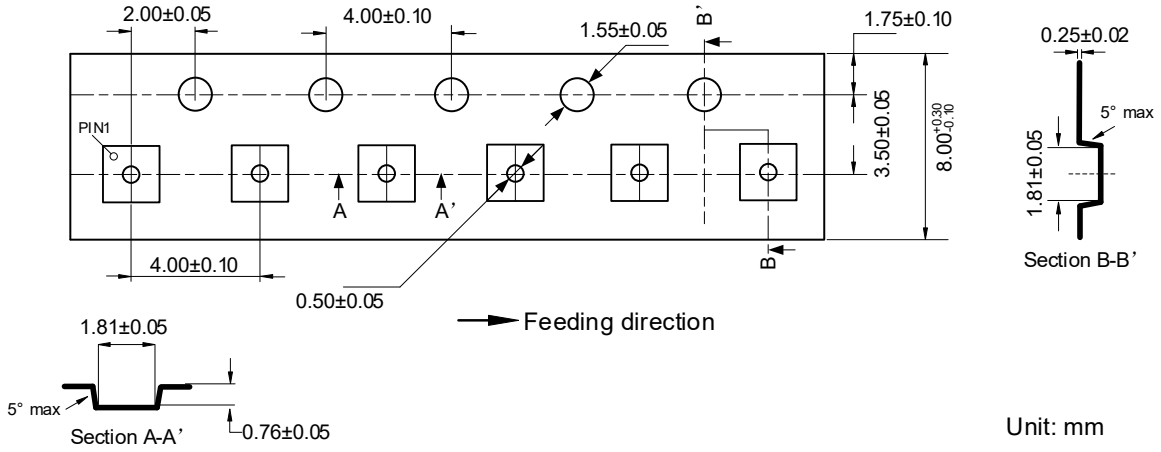


COMMON DIMENSIONS

(UNITS OF MEASURE=MILLIMETER)

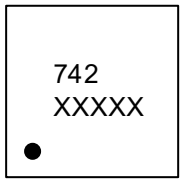
SYMBOL	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3		0.152 REF	
b	0.15	0.20	0.25
D	1.55	1.60	1.65
E	1.55	1.60	1.65
e	0.35	0.40	0.45
H		0.10 REF	
L	0.25	0.30	0.35
L1	0.45	0.50	0.55

Tape Information



Marking Information

QFN12L



742 - Part Number

XXXXX - Tracking Number

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

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
0.0	2024-10-21	Preliminary Version	Pansy	Luh	Liujy
1.0	2025-09-25	Original Version	Zhangjq	Luh	Liujy
1.1	2025-12-29	Update ESD and Latch up Parameters	Pansy	Luh	Liujy