Dual 4-channel CMOS Analog Multiplexer

General Description

The ET48752 is a CMOS analog multiplexer which consists of two 4-channel multiplexers. It operates from 2.5V to 5.5V single power supply and all digital inputs support 1.8V logic control.

The ET48752 features low voltage, low on-resistance and low off-leakage current. The high performances make it very suitable for multiple applications, such as cellular phones, audio and video signal routing, etc.

The ET48752 is available in Green TSSOP16 and TQFN16L packages. It operates over an ambient temperature range of -40˚C to +85˚C.

Features

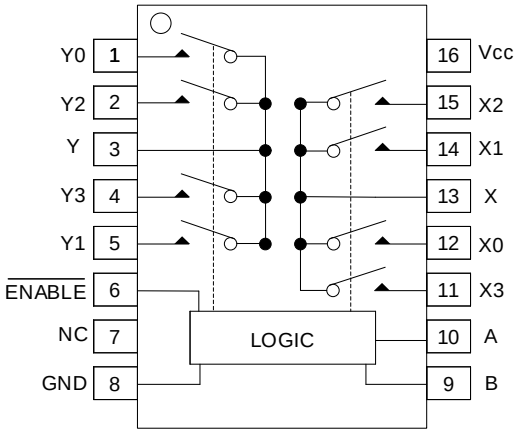
- Single Supply Voltage Range: 2.5V to 5.5V
- On-Resistance: 48Ω(TYP) with 5V Supply
- Internal A, B Rise Time: 45ns (TYP), V_{CC} = 5V
- Internal A, B Fall Time: 50ns (TYP), V_{CC} = 5V
- 1.8V Logic Compatible
- Low On-Resistance Flatness
- Low Crosstalk: -90dB (f = 1MHz)
- High Off-Isolation: -85dB (R_L = 50Ω, f = 1MHz)
- Low Off-Leakage Current: 1nA (TYP) at +25°C
- Low On-Leakage Current: 1nA (TYP) at +25°C
- Low Distortion: 0.7% (R_L = 600Ω, f = 20Hz to 20kHz)
- -40°C to +85°C Operating Temperature Range
- Package information:

Part No.	Package	MSL
ET48752V	TSSOP16 (5mm×6.4mm)	Level 1
ET48752Y	TQFN16L (3mm×3mm)	Level 1

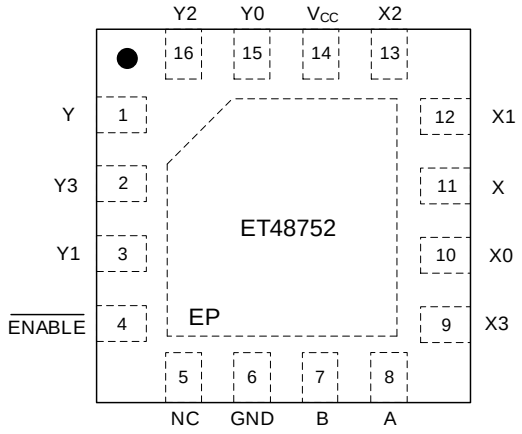
Application

- Automotive
- Portable Equipment
- Sample-and-Hold Circuits
- Data-Acquisition Systems
- Battery-Powered Systems
- Audio and Video Signal Routing

Pin Configuration



ET47852V (Top View)



ET48752Y (Top View)

Pin Function

Pin No.		Pin Name	Description
ET48752V	ET48752Y		
1, 5, 2, 4	15, 3, 16, 2	Y0, Y1, Y2, Y3	Analog Switch “Y” Inputs 0-3.
3	1	Y	Analog Switch “Y” Output Pin.
6	4	$\overline{\text{ENABLE}}$	Digital Enable Control Pin. Normally connected to GND.
7	5	NC	No Connect.
8	6	GND	Ground. Connect to digital ground.
9	7	B	Digital Address “B” Input Pin.
10	8	A	Digital Address “A” Input Pin.
12, 14, 15, 11	10, 12, 13, 9	X0, X1, X2, X3	Analog Switch “X” Inputs 0-3.
13	11	X	Analog Switch “X” Output Pin.
16	14	VCC	Positive Analog and Digital Supply Voltage Input Pin.
-	Exposed Pad	EP	Exposed Pad. Connect exposed pad to GND.

Note: Any input terminal can be used as an output terminal, and any output terminal can also be used as an input terminal. Signal transmission in both directions is equally well.

Truth Table

$\overline{\text{ENABLE}}$	SELECT INPUTS		ON SWITCHES
	B	A	
H	X	X	All Switches OFF
L	L	L	X-X0, Y-Y0
L	L	H	X-X1, Y-Y1
L	H	L	X-X2, Y-Y2
L	H	H	X-X3, Y-Y3

Note: X Don't care.

Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)

Symbol	Characteristic	Value	Unit
V_{CC}	V_{CC} to GND	-0.3~ 6	V
V_{IO} (X,Y,X0~X3,Y0~Y3) V_A, V_B, V_{ENABLE}	Voltage into Any Terminal (1)	-0.3~ V_{CC} +0.3	V
I_{IO}	Continuous Current into Any Terminal	±20	mA
I_{IO_PEAK}	Peak Current, X_, Y_ (Pulsed at 1ms, 10% duty cycle)	±40	mA
T_{JMAX}	Max Junction Temperature	150	°C
T_L	Lead Temperature (Soldering,10s)	260	°C
T_{STG}	Storage temperature range	-65~150	°C
V_{ESD}	HBM ESD Susceptibility	2000	V

Note1: Voltages exceeding V_{CC} or GND on any signal terminal are clamped by internal diodes. Limit forward-diode current to maximum current rating.

Recommended Operating Conditions

Symbol	Characteristic	Min	Max	Unit
V_{CC}	Supply Voltage Range	2.5	5.5	V
T_A	Operating Temperature Range	-40	85	°C

Electrical Characteristics

(V_{CC} = 5.0V, Full = -40°C to +85°C, typical values are at T_A = +25°C, unless otherwise noted.)

Parameter	Symbol	Conditions	Temp	Min	Typ	Max	Unit
ANALOG SWITCH							
Analog Signal Range	$V_{X\_}$,$V_{Y\_}$, V_X,V_Y		Full	GND		V_{CC}	V
On-Resistance	R_{ON}	V_{CC} = 5.0V, I_X,I_Y = 1mA	25°C		48	58	Ω
			Full			67	
On-Resistance Match Between Channels	ΔR_{ON}	V_{CC} = 5.0V, I_X,I_Y = 1mA	25°C		1.5	5	Ω
			Full			5.3	
On-Resistance Flatness	$R_{FLAT(ON)}$	V_{CC} = 5.0V, I_X = 1mA	25°C		17	25	Ω
			Full			28	
X_,Y_ Off Leakage Current	$I_{X\_(OFF)}$, $I_{Y\_(OFF)}$	V_{CC} = 5.0V, $V_{X\_}$,$V_{Y\_}$ = 1V, 4.5V, V_X,V_Y = 4.5V, 1V	25°C		1	1000	nA
X,Y Off Leakage Current	$I_{X(OFF)}$, $I_{Y(OFF)}$	V_{CC} = 5.0V, $V_{X\_}$,$V_{Y\_}$ = 1V, 4.5V, V_X,V_Y = 4.5V, 1V	25°C		1	1000	nA
X,Y On Leakage Current	$I_{X(ON)}$, $I_{Y(ON)}$	V_{CC} = 5.0V, V_X,V_Y = 4.5V, 1V	25°C		1	1000	nA
DIGITAL I/O							
Logic Input Logic Threshold High	V_{AH},V_{BH}, V_{ENH}		25°C	1.7			V
Logic Input Logic Threshold Low	V_{AL},V_{BL}, V_{ENL}		25°C			0.5	V
Input-Current High	I_{AH},I_{BH}, I_{ENH}	V_A, V_B, V_{EN} = V_{CC}	25°C		1	1000	nA
Input-Current Low	I_{AL},I_{BL}, I_{ENL}	V_A, V_B, V_{EN} = 0V	25°C		1	1000	nA
DYNAMIC CHARACTERISTICS							
Address Transition Time	t_{TRANS}	$V_{X\_}$,$V_{Y\_}$ = 3V/0V, R_L = 300Ω,C_L = 35pF, Figure 1	25°C		85		ns
ENABLE Turn-On Time	t_{ON}	$V_{X\_}$,$V_{Y\_}$ = 3V, R_L = 300Ω,C_L = 35pF, Figure 2	25°C		60		ns
ENABLE Turn-Off Time	t_{OFF}	$V_{X\_}$,$V_{Y\_}$ = 3V, R_L = 300Ω,C_L = 35pF, Figure 2	25°C		20		ns

Electrical Characteristics(Continued)

V_{CC} = 5.0V, Full = -40°C to +85°C, typical values are at T_A = +25°C, unless otherwise noted.)

Parameter	Symbol	Conditions	Temp	Min	Typ	Max	Unit
Internal A, B Rise Time	t_R		25°C		45		ns
Internal A, B Fall Time	t_F		25°C		50		ns
Break-Before-Make Time Delay	t_D	$V_{X\_}$,$V_{Y\_}$ = 3V, R_L = 300Ω,C_L = 35pF, Figure 3	25°C		50		ns
Charge Injection	Q	R_S = 0Ω, C_L = 1nF, Figure 4	25°C		3		pC
Off Isolation	V_{ISO}	R_L = 50Ω, f = 1MHz, Figure 5	25°C		-85		dB
Crosstalk	X_{TALK}	f = 1MHz, Figure 5	25°C		-90		dB
Input Off-Capacitance	$C_{X\_(OFF)}$, $C_{Y\_(OFF)}$	f = 1MHz, Figure 6	25°C		5		pF
Output Off-Capacitance	$C_{X(OFF)}$, $C_{Y(OFF)}$	f = 1MHz, Figure 6	25°C		9		pF
Output On-Capacitance	$C_{X(ON)}$, $C_{Y(ON)}$	f = 1MHz, Figure 6	25°C		13		pF
-3dB Bandwidth	BW	R_L = 50Ω	25°C		180		MHz
Total Harmonic Distortion	THD	R_L = 600Ω, $5V_{P-P,}$ f = 20Hz to 20kHz	25°C		0.7		%
POWER SUPPLY							
Power Supply Range	V_{CC}		Full	2.5		5.5	V
Power Supply Current	I_{CC}	V_{CC} = 5.5V, V_A, V_B, V_{EN} = V_{CC} or 0	25°C		0.001	6	μA

Electrical Characteristics

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

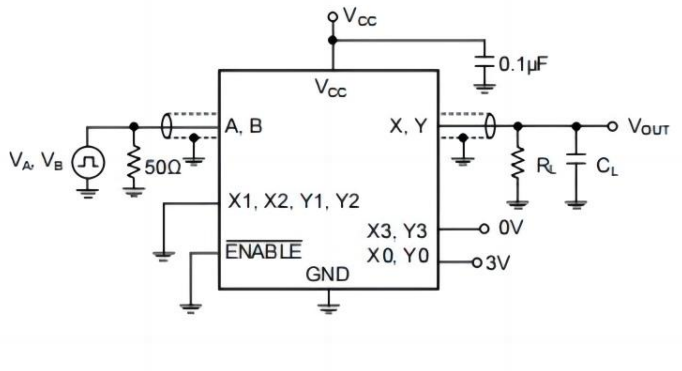
Parameter	Symbol	Conditions	Temp	Min	Typ	Max	Unit
ANALOG SWITCH							
Analog Signal Range	$V_{X\_}$,$V_{Y\_}$, V_X,V_Y		Full	GND		V_{CC}	V
On-Resistance	R_{ON}	I_X,I_Y = 1mA	25°C		80	110	Ω
			Full			126	
X_,Y_ Off Leakage Current	$I_{X\_(OFF)}$, $I_{Y\_(OFF)}$	$V_{X\_}$,$V_{Y\_}$ = 1V, 3V, V_X,V_Y = 3V, 1V	25°C		1	1000	nA
X,Y Off Leakage Current	$I_{X(OFF)}$, $I_{Y(OFF)}$	$V_{X\_}$,$V_{Y\_}$ = 1V, 3V, V_X,V_Y = 3V, 1V	25°C		1	1000	nA
X,Y On Leakage Current	$I_{X(ON)}$, $I_{Y(ON)}$	V_X,V_Y = 3V, 1V	25°C		1	1000	nA
DIGITAL I/O							
Logic Input Logic Threshold High	V_{AH},V_{BH}, V_{ENH}		25°C	1.7			V
Logic Input Logic Threshold Low	V_{AL},V_{BL}, V_{ENL}		25°C			0.5	V
Input-Current High	I_{AH},I_{BH}, I_{ENH}	V_A, V_B, V_{EN} = V_{CC}	25°C		1	1000	nA
Input-Current Low	I_{AL},I_{BL}, I_{ENL}	V_A, V_B, V_{EN} = 0V	25°C		1	1000	nA
DYNAMIC CHARACTERISTICS							
Address Transition Time	t_{TRANS}	$V_{X\_}$,$V_{Y\_}$ = 3V/0V, R_L = 300Ω,C_L = 35pF, Figure 1	25°C		150		ns
ENABLE Turn-On Time	t_{ON}	$V_{X\_}$,$V_{Y\_}$ = 3V, R_L = 300Ω,C_L = 35pF, Figure 2	25°C		110		ns
ENABLE Turn-Off Time	t_{OFF}	$V_{X\_}$,$V_{Y\_}$ = 3V, R_L = 300Ω,C_L = 35pF, Figure 2	25°C		50		ns
Internal A, B Rise Time	t_R		25°C		80		ns
Internal A, B Fall Time	t_F		25°C		85		ns
Break-Before-Make Time Delay	t_D	$V_{X\_}$,$V_{Y\_}$ = 3V, R_L = 300Ω,C_L = 35pF, Figure 3	25°C		80		ns
-3dB Bandwidth	BW	R_L = 50Ω	25°C		180		MHz

Electrical Characteristics(Continued)

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

Parameter	Symbol	Conditions	Temp	Min	Typ	Max	Unit
Charge Injection	Q	R_S = 0Ω, C_L = 1nF, V_S = 2.5V, Figure 4	25°C		3		pC
POWER SUPPLY							
Power Supply Current	I_{CC}	V_{CC} = 3.6V, V_A, V_B, V_{EN} = V_{CC} or 0	25°C		0.001	3	μA

Test Circuit and Waveform



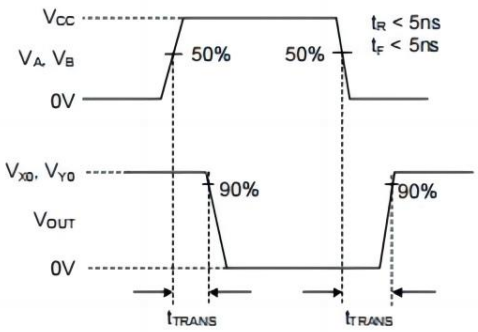
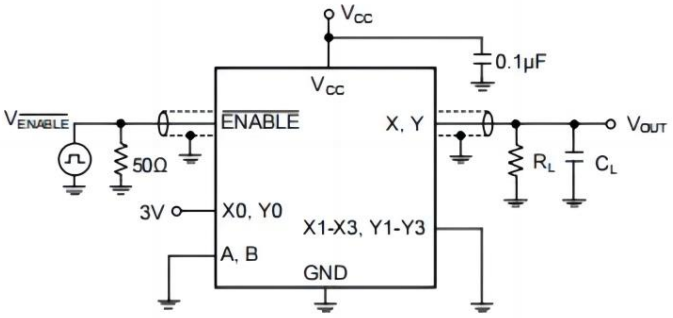


Figure 1. Address Transition Times (t_{TRANS})



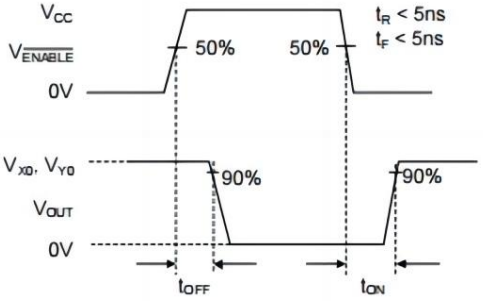
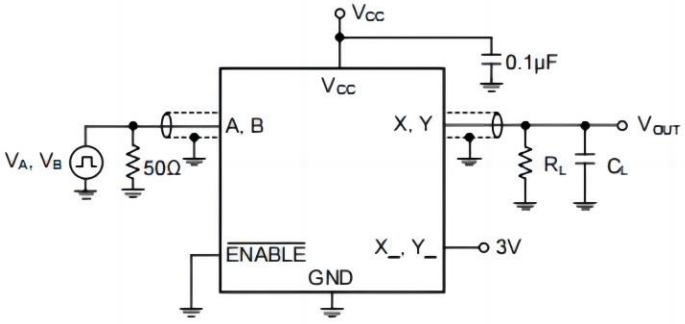


Figure 2. Switching Times (t_{ON}, t_{OFF})



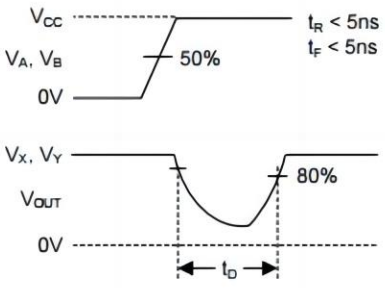


Figure 3. Break-Before-Make Time Delay (t_D)

Test Circuit and Waveform(Continued)

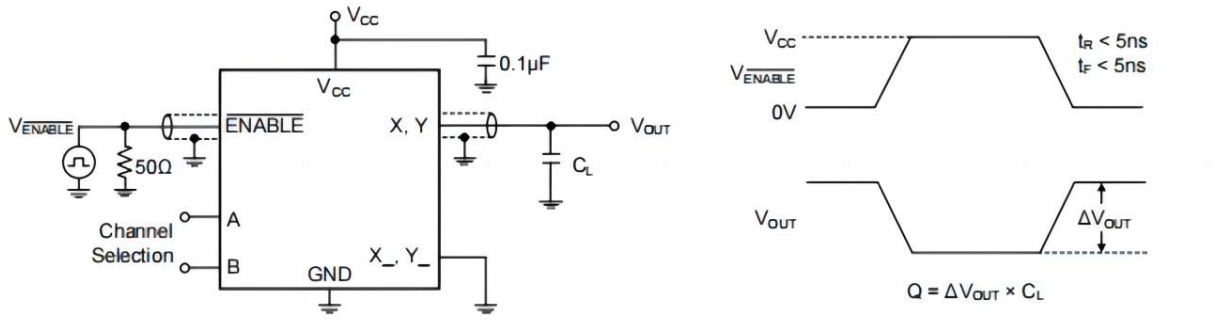
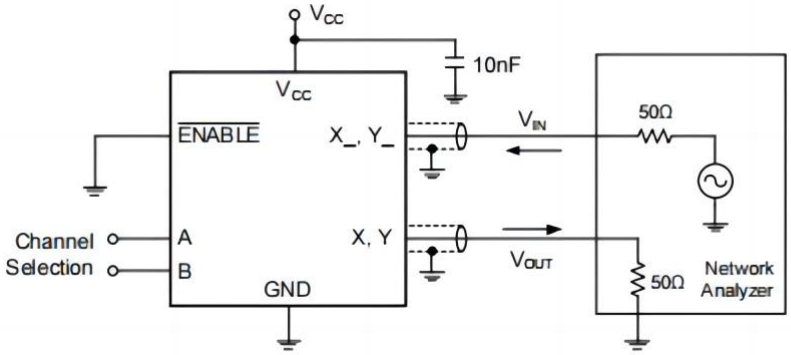


Figure 4. Charge Injection (Q)



Off Isolation = 20log (V_{OUT}/V_{IN}) (Measured between X and "OFF" X_ Terminal on Each Switch)

On Loss = 20log (V_{OUT}/V_{IN}) (Measured between X and "ON" X_ Terminal on Each Switch)

Figure 5. Off Isolation, On Loss

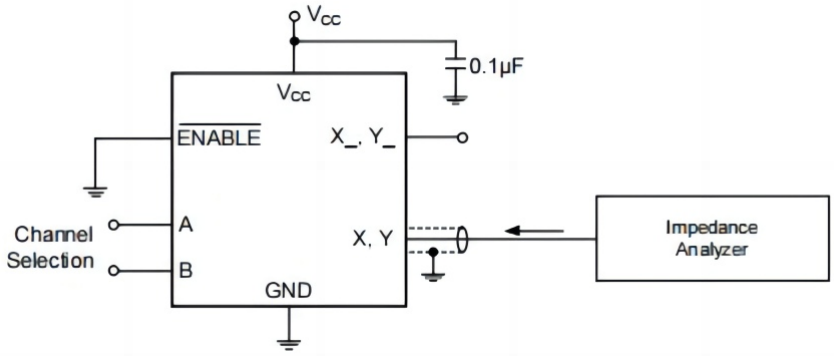


Figure 6. Capacitance

Typical Characteristics

V_{CC} = 5.0V, unless otherwise noted.

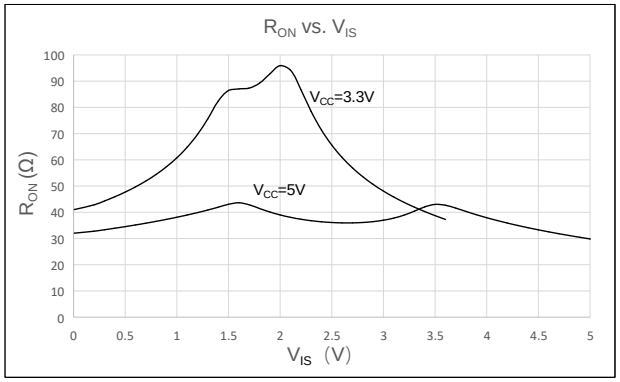


Figure 7. On-Resistance vs. V_{IS}

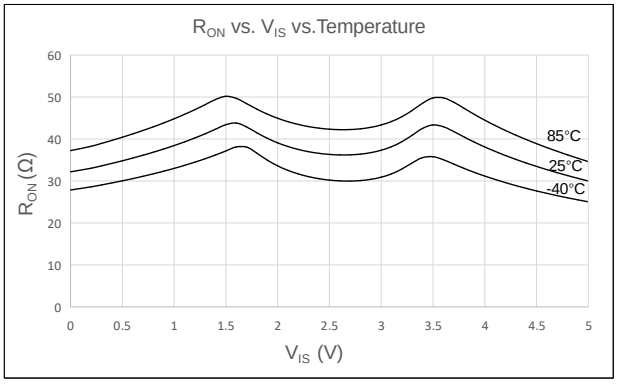


Figure 8. On-Resistance vs. V_{IS} vs. Temp

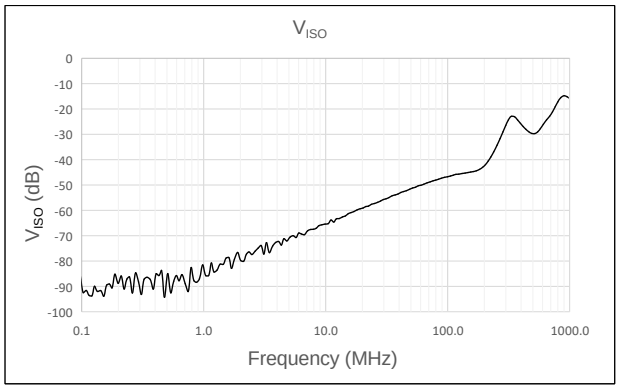


Figure 9. V_{ISO} vs. Frequency

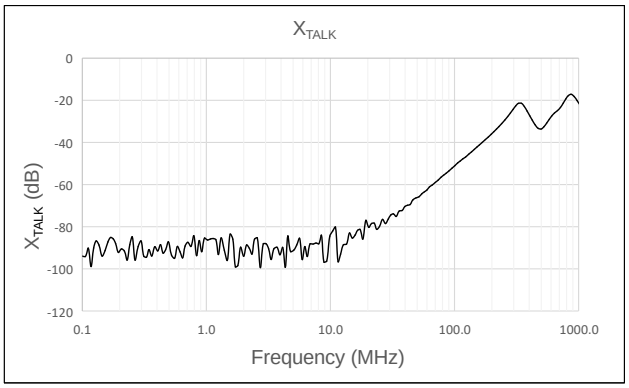
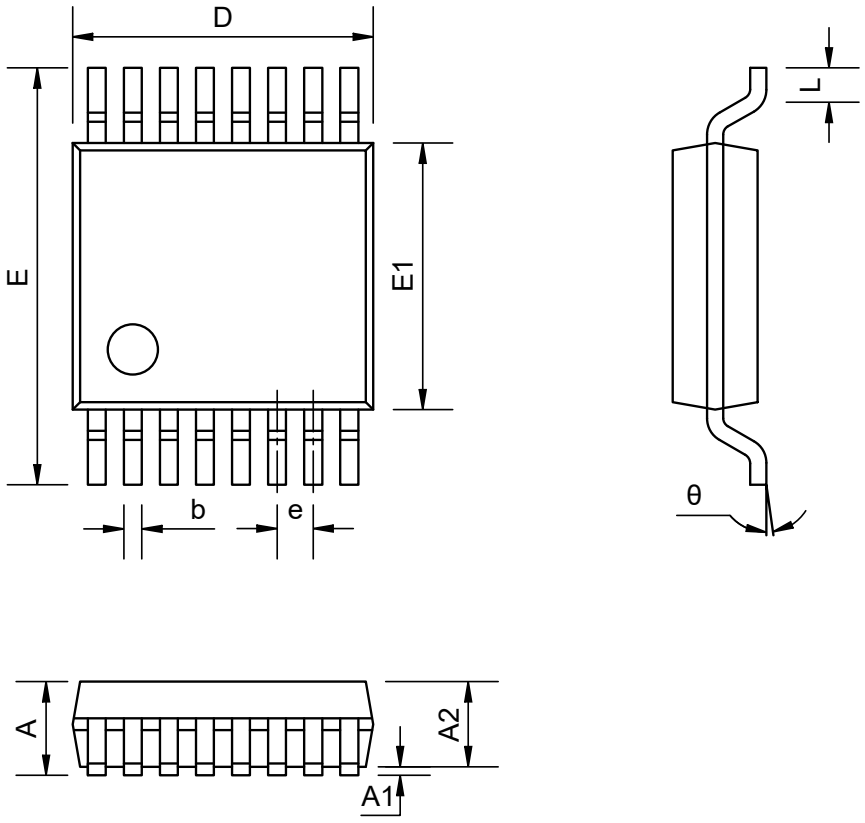


Figure 10. X_{TALK} vs. Frequency

Package Dimension

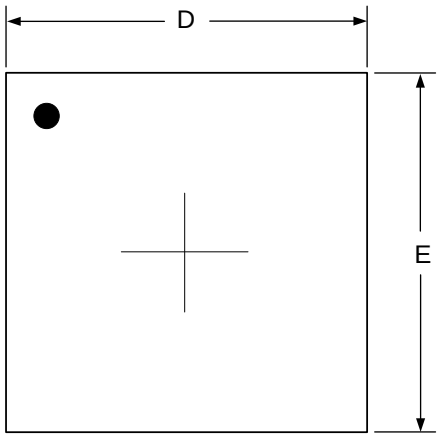
TSSOP16



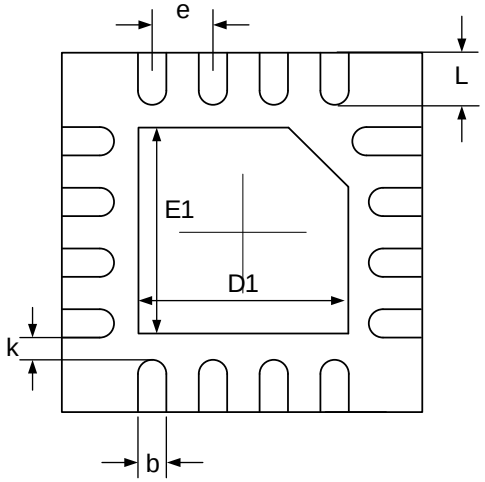
Dimensions Table (Units:mm)

Symbol	Min	Nom	Max
A	--	--	1.20
A1	0.05	--	0.15
A2	0.80	--	1.05
b	0.19	--	0.30
D	4.86	4.98	5.1
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65BSC		
L	0.50	0.60	0.70
θ	1°	--	7°

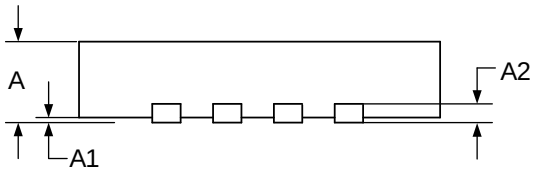
TQFN16L



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Dimensions Table (Units:mm)

Symbol	Min	Nom	Max
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A2		0.203 REF	
b	0.18	0.23	0.30
D	2.90	3.00	3.10
E	2.90	3.00	3.10
e		0.50 TYP	
L	0.30	0.40	0.50
k		0.20 MIN	
D1	1.60	1.70	1.80
E1	1.60	1.70	1.80

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2023-02-10	Preliminary Version	Qinpl	Gonglf	Qinpl
1.1	2023-02-17	Official edition	Qinpl	Gonglf	Qinpl
1.2	2025-02-19	Add TQFN16L package And update Typical Characteristics	Pansy	Gonglf	Liujy