Dual DPDT Ultra-Low R_{ON} Switch

General Description

The ET2467 is a dual independent ultra−low R_{ON} DPDT analog switch. This device is designed for low operating voltage, high current switching of speaker output for cell phone applications. It can switch a balanced stereo output. The ET2467 can handle a balanced microphone/speaker/ring−tone generator in a monophone mode. The device contains a break−make feature.

Features

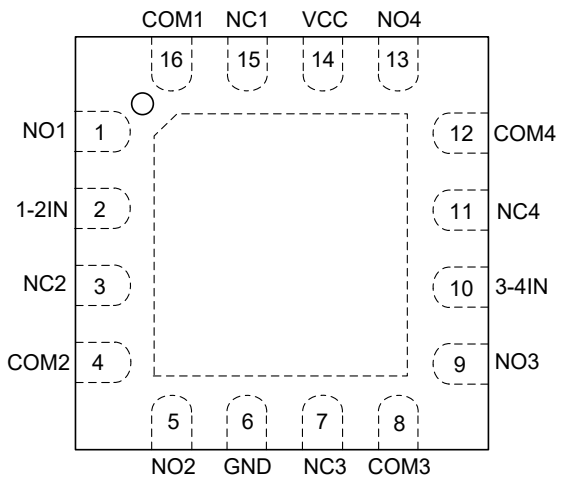
- Single Supply Operation
  - V_{CC}: 1.65 to 4.7 V
  - Function Directly from LiON Battery
- Maximum Breakdown Voltage: 5.5V
- Low Static Power
- Package information:

Part No.	Package	MSL
ET2467Y	QFN16 (3mm×3mm)	Level 1
ET2467Y1	QFN16L (2.6mm×1.8mm)	Level 1

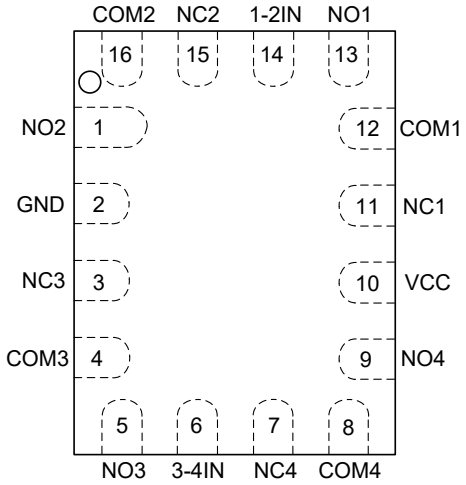
Application

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

Pin Configuration



ET2467Y（Top View）



ET2467Y1（Top View）

Pin Function

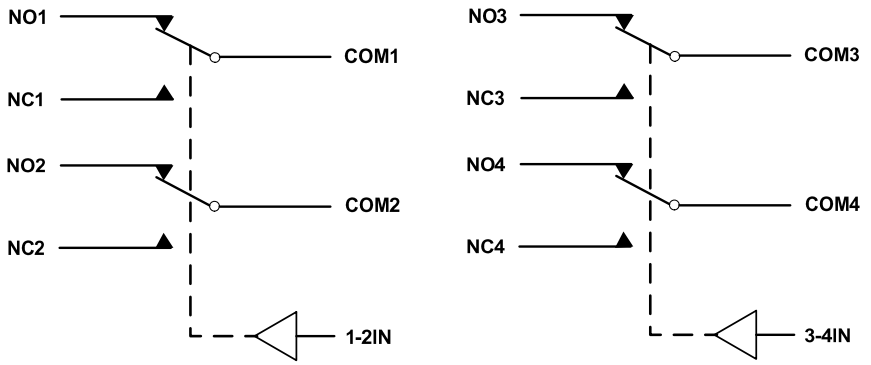
Pin No.		Pin Name	Description
ET2467Y	ET2467Y1		
1	13	NO1	Independent Channels
2	14	1-2IN	Controls
3	15	NC2	Independent Channels
4	16	COM2	Common Channels
5	1	NO2	Independent Channels
6	2	GND	Ground (V)
7	3	NC3	Independent Channels
8	4	COM3	Common Channels
9	5	NO3	Independent Channels
10	6	3-4IN	Controls
11	7	NC4	Independent Channels
12	8	COM4	Common Channels
13	9	NO4	Independent Channels
14	10	VCC	Positive Supply Voltage
15	11	NC1	Independent Channels
16	12	COM1	Common Channels

Truth Table

1-2IN / 3-4IN	NC	NO
H	ON	OFF(*)
L	OFF(*)	ON

* : High impedance

Analog Symbol



Input Equivalent Circuit

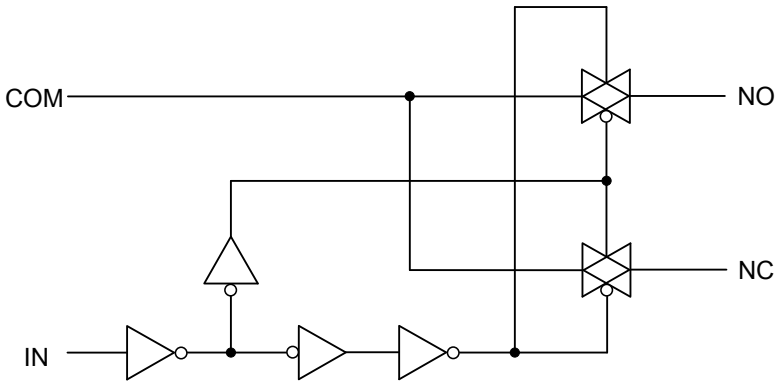


Figure 1. Input Equivalent Circuit

Absolute Maximum Ratings

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.

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.5～+5.5	V
Analog Input Voltage (V_{NO}, V_{NC}, or V_{COM})	V_{IS}	-0.5～V_{CC}+0.3	V
Digital Select Input Voltage	V_{IN}	-0.5～+5.0	V
Continuous DC Current from COM to NC/NO	I_{ANL1}	±350	mA
Peak Current from COM to NC/NO, 10 duty cycle (1)	$I_{ANL-PK1}$	±500	mA
Continuous DC Current into COM/NO/NC with respect to V_{CC} or GND	I_{CLMP}	±350	mA
Storage Temperature Range	T_{STG}	-65～+150	°C
Max Junction Temperature	T_{JMAX}	150	°C

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

Recommended Operating Conditions

Characteristic		Symbol	Min	Max	Unit
DC Supply Voltage		V_{CC}	1.65	4.7	V
Digital Select Input Voltage		V_{IN}	0	V_{CC}	V
Analog Input Voltage (NC, NO, COM)		V_{IS}	0	V_{CC}	V
Operating Temperature Range		T_A	-40	+85	°C
Input Rise or Fall Time, SELECT	V_{CC} = 1.6 V − 2.7 V	t_r, t_f		20	ns/V
	V_{CC} = 3.0 V − 4.7 V			10	

DC Electrical Characteristics

DC Characteristics – Digital Section(Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V_{CC} ±10%	Guaranteed Limit		Unit
				-40°C to 25°C	< 85°C	
V_{IH}	Minimum High−Level Input Voltage, Select Inputs		1.8	1.2	1.2	V
			2.5	1.5	1.5	
			4.3	1.8	1.8	
V_{IL}	Maximum Low−Level Input Voltage, Select Inputs		1.8	0.4	0.4	V
			2.5	0.5	0.5	
			4.3	1.0	1.0	
I_{IN}	Maximum Input Leakage Current, Select Inputs	V_{IN} = 5.0V or GND	4.7	±0.1	±1.0	μA
I_{OFF}	Power Off Leakage Current	V_{IN} = 5.0V or GND	0	±0.5	±2.0	μA
I_{CC}	Maximum Quiescent Supply Current (2)	Select and V_{IS} = V_{CC} or GND	1.65 to 4.7	±1.0	±2.0	μA

DC Electrical Characteristics – Analog Section

Symbol	Parameter	Test Conditions	V_{CC} ±10%	Guaranteed Maximum Limit				Unit
				-40°C to 25°C		<85°C		
				Min	Max	Min	Max	
R_{ON}	NC/NO On−Resistance (2)	V_{IN}< V_{IL} or V_{IN} > V_{IH} V_{IS} = GND or V_{CC} I_{COM} = 100mA	2.5		0.8		0.9	Ω
			3.0		0.8		0.9	
			4.7		0.7		0.8	
R_{FLAT}	NC/NO On−Resistance Flatness (2)(4)	V_{IS} = 0 to V_{CC} I_{COM} = 100mA	2.5		0.25		0.3	Ω
			3.0		0.25		0.3	
			4.7		0.25		0.3	
ΔR_{ON}	On−Resistance Match Between Channels (2)(3)	V_{IS} = 1.3V, V_{IS} = 1.5V, V_{IS} = 2.8V, I_{COM} = 100mA	2.5		0.1		0.15	Ω
			3.0		0.1		0.15	
			4.7		0.1		0.15	
$I_{NC(OFF)}$ $I_{NO(OFF)}$	NC or NO Off Leakage Current (2)	V_{IN} = V_{IL} or V_{IH} V_{NO} or V_{NC} = 0.8V V_{COM} = 3.7V	4.7	-5.0	5.0	-10	10	nA
$I_{COM(ON)}$	COM ON Leakage Current (2)	V_{IN} = V_{IL} or V_{IH} , V_{COM} = 0.8V or 3.7V , V_{NO}=0.8V or 3.7V with V_{NC} floating; or V_{NC}=0.8V or 3.7V with V_{NO} floating	4.7	-10	10	-100	100	nA

Note2. Guaranteed by design. Resistance measurements do not include test circuit or package resistance.

Note3. $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$ between NC1 and NC2 or between NO1 and NO2.

Note4. Flatness is defined as the difference between the maximum and minimum value of on−resistance as measured over the specified analog signal ranges.

AC Electrical Characteristics

Symbol	Parameter	Test Conditions	V_{CC} (V)	V_{IS} (V)	Guaranteed Maximum Limit					Unit
					-40°C to 25°C			<85°C		
					Min	Typ	Max	Min	Max	
t_{ON}	Turn−On Time	R_L = 50Ω, C_L = 35pF (Figures 3 and 4)	2.3~4.7	1.5			100		120	ns
t_{OFF}	Turn−Off Time	R_L = 50Ω, C_L = 35pF (Figures 3 and 4)	2.3~4.7	1.5			50		40	ns
t_{BBM}	Minimum (Break−Before−Make) Time	R_L = 50Ω, C_L = 35pF (Figure 2)	3.0	1.5	2	30				ns

Capacitance Characteristics

Symbol	Parameter	Typical @25°C,V_{CC}=5.0V	Unit
C_{IN}	Control Pin Input Capacitance	2.5	pF
C_{OFF}	NC,NO Port Capacitance When Switch is Disabled	32	pF
C_{ON}	COM Port Capacitance When Switch is Enabled	118	pF

Additional Application Characteristics (Voltages Referenced to GND Unless Noted)

Symbol	Parameter	Test Conditions	V_{CC}(V)	25°C	Unit
				Typical	
BW	Maximum On−Channel −3dB Bandwidth or Minimum Frequency Response (Figure12)	V_{IN} centered between V_{CC} and GND (Figure 5)	1.65~4.7	50	MHz
V_{ONL}	Maximum Feed−through On Loss	V_{IN} = 0dBm @ 100 kHz to 50MHz, V_{IN} centered between V_{CC} and GND (Figure 5)	1.65~4.7	-0.06	dB
V_{ISO}	Off−Channel Isolation (Figure 13) (5)	f = 100 kHz; V_{IS} = $1V_{RMS}$ C_L = 5nF; V_{IN} centered between V_{CC} and GND (Figure 5)	1.65~4.7	-62	dB
Q	Charge Injection Select Input To Common I/O (Figure 8)	V_{IN} = V_{CC} to GND, R_{IS} = 0Ω, C_L = 1nF $Q = C_L \times \Delta V_{OUT}$ (Figure 6)	1.65~4.7	50	pC
THD	Total Harmonic Distortion THD +Noise (Figure 7)	F_{IS} = 20Hz to 20kHz, R_L = 600Ω, C_L = 50pF V_{IS} = $2V_{RMS}$	4.3	0.01	%

Additional Application Characteristics (Continued)

Symbol	Parameter	Test Conditions	V_{CC}(V)	25°C Typical	Unit
V_{CT}	Channel−to−Channel Crosstalk	f=100kHz; V_{IS} = 1V_{RMS}, C_L =5pF, R_L = 50Ω V_{IN} centered between V_{CC} and GND (Figure 5)	1.65~4.7	-62	dB

Note5. Off−Channel Isolation = 20 lg (V_{COM}/ V_{NO}) ,V_{COM}= output, V_{NO} = input to off switch.

Test Circuit and Waveform

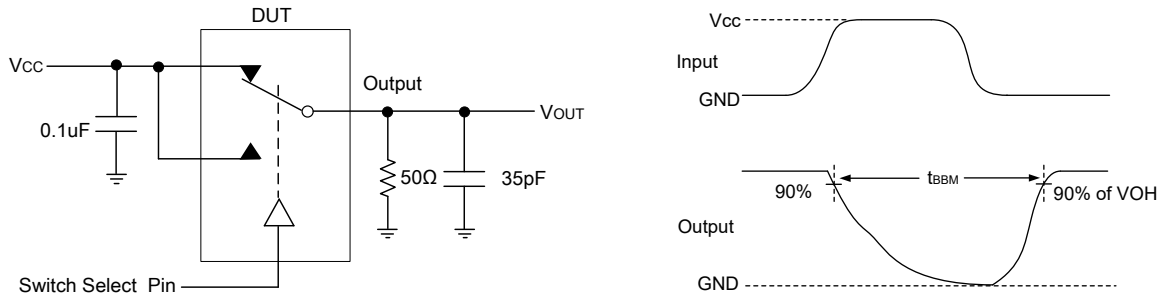


Figure 2. t_{BBM} (Time Break-Before-Make)

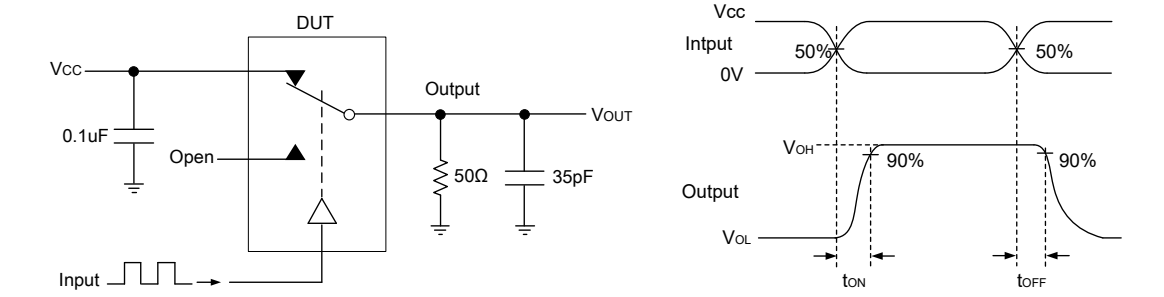


Figure 3.t_{ON}/t_{OFF}

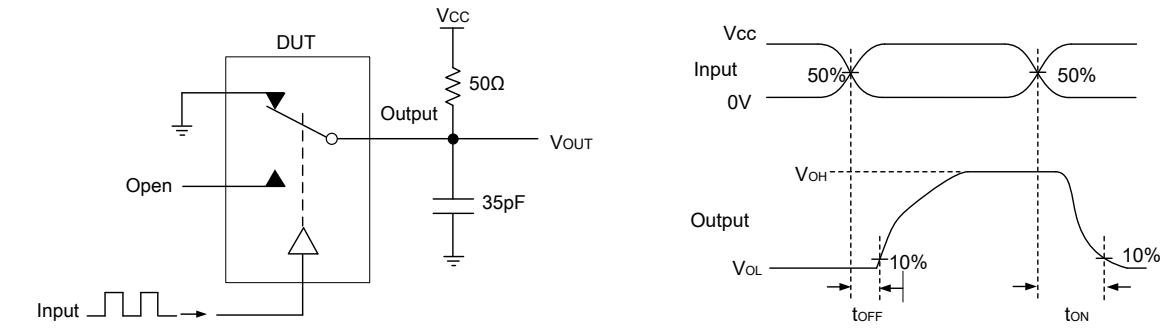


Figure 4. t_{ON} / t_{OFF}

Test Circuit and Waveform (Continued)

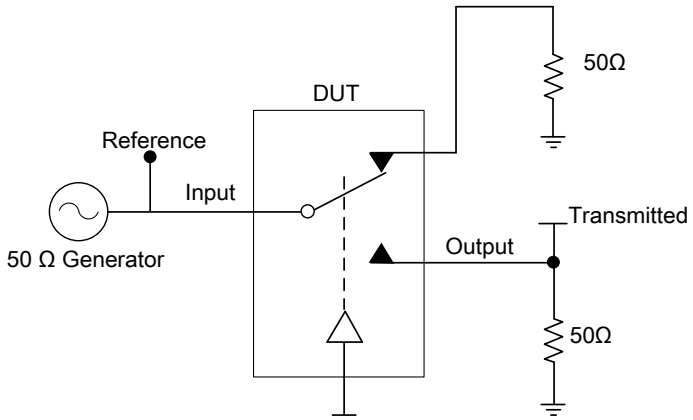


Figure 5. Off Channel Isolation/On Channel Loss(BW)/Crosstalk

(On Channel to Off Channel)/V_{ONL}

Channel switch control/s test socket is normalized. Off isolation is measured across an off channel. On loss is the bandwidth of an On switch. V_{ISO}, Bandwidth and V_{ONL} are independent of the input signal direction.

V_{ISO} = Off Channel Isolation = 20 lg (V_{OUT} / V_{IN}) for V_{IN} at 100 kHz.

V_{ONL} = On Channel Loss = 20 lg (V_{OUT} / V_{IN}) for V_{IN} at 100 kHz to 50 MHz.

Bandwidth (BW) = the frequency 3 dB below V_{ONL}.

V_{CT} = Use V_{ISO} setup and test to all other switch analog input/outputs terminated with 50 Ω.

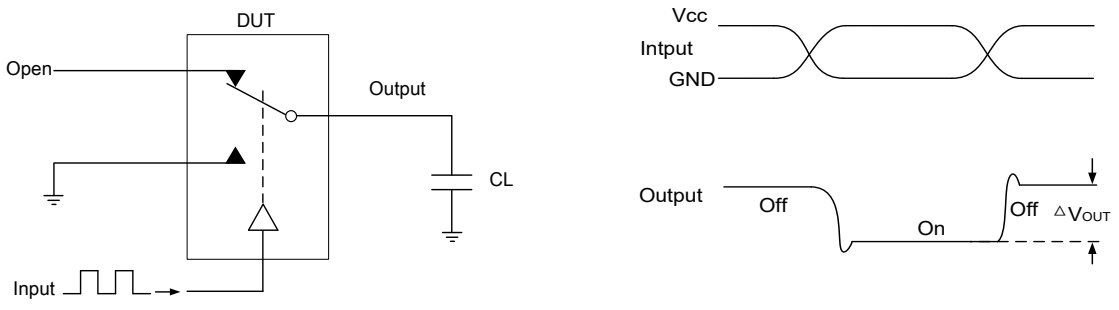


Figure 6. Charge Injection：(Q)

Typical Characteristics

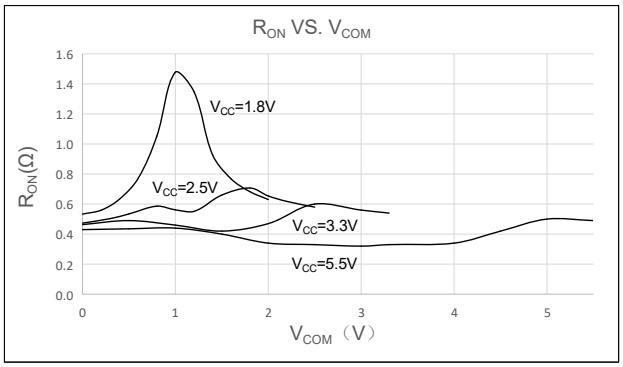


Figure 7. On-Resistance vs. V_{COM} Voltage

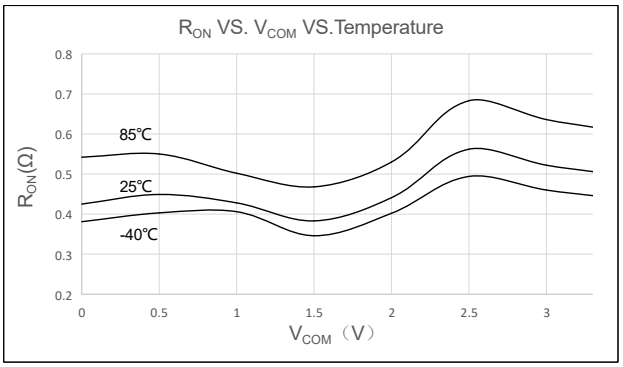


Figure 8. R_{ON} vs. V_{COM} vs. Temperature @V_{CC}=3.3V

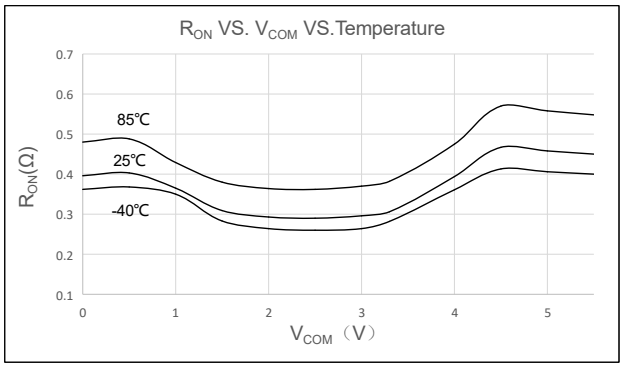


Figure 9. R_{ON} vs. V_{COM} vs. Temperature @V_{CC}=5.5V

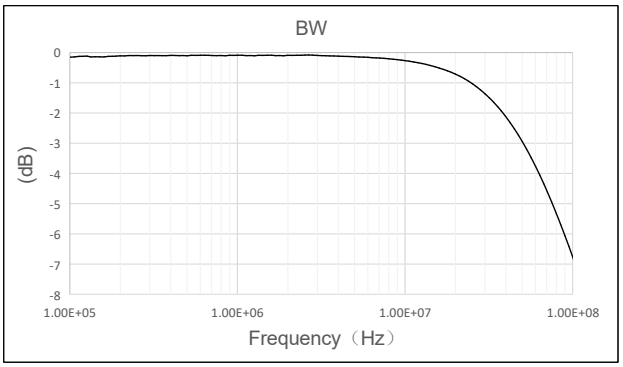


Figure 10. Bandwidth vs. Frequency @V_{CC}=3.3V

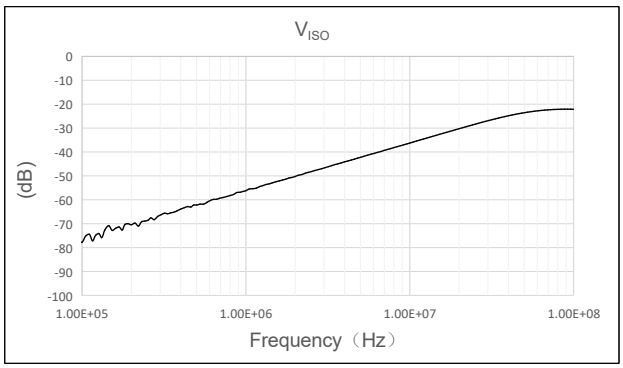


Figure 11. V_{ISO} vs. Frequency @V_{CC}=3.3V

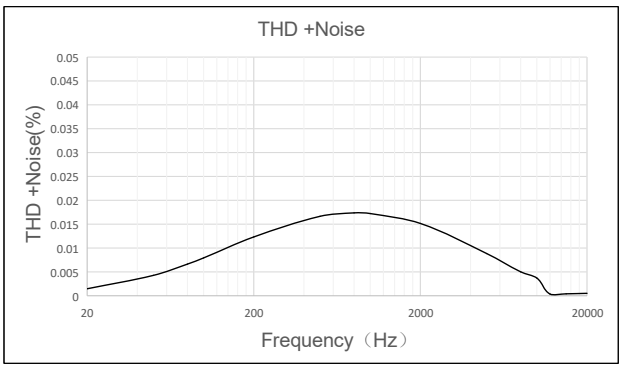
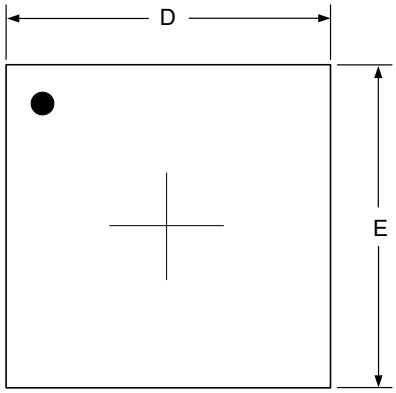


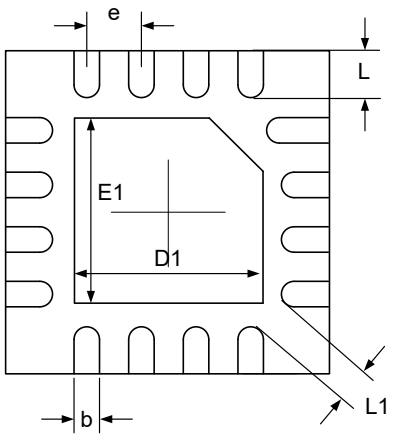
Figure 12. THD +Noise vs. Frequency @V_{CC}=3.3V

Package Dimension

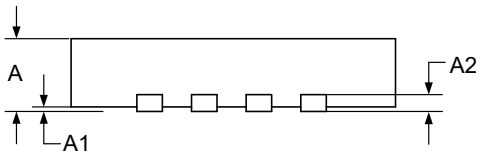
QFN16 (3mm×3mm)



TOP VIEW



BOTTOM VIEW

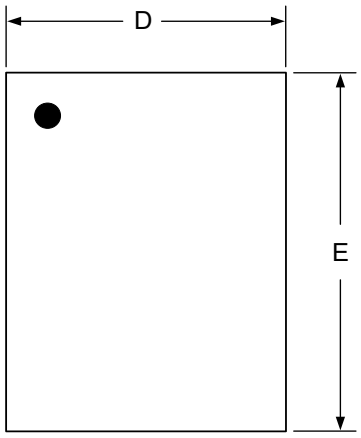


SIDE VIEW

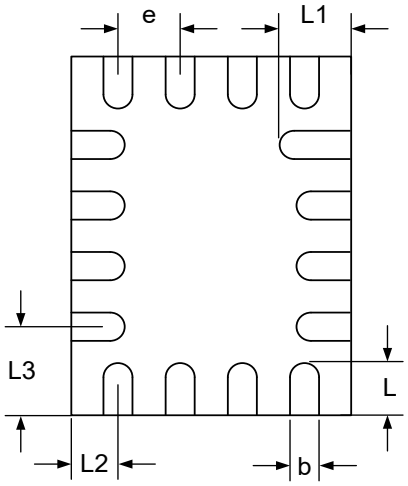
COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A2	0.153	0.203	0.253
b	0.18	0.23	0.30
D	2.91	3.00	3.10
E	2.91	3.00	3.10
e	0.45	0.50	0.55
L	0.30	0.40	0.50
L1	0.40	0.45	0.50
D1	1.60	1.70	1.80
E1	1.60	1.70	1.80

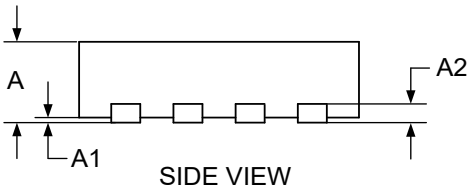
QFN16L (2.6mm×1.8mm)



TOP VIEW



BOTTOM VIEW



SIDE VIEW

COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.50	0.55	0.60
A1	0.00	—	0.05
A2		0.15 TYP	
b	0.15	0.20	0.25
D	1.75	1.80	1.85
E	2.55	2.60	2.65
e		0.40 TYP	
L	0.30	0.40	0.50
L1		0.50 TYP	
L2		0.30 TYP	
L3		0.70 TYP	

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.2	2016-04-20	1.Max Breakdown Voltage: Change from 5V to 5.5V 2.Ianl1: Change from ±300mA to ±350mA 3.Change from CSN/CD to COFF/CON	Zhu Jun Li	Liu Xiao Min	Zhu Jun Li
1.3	2016-08-02	Update some parameters	Zhu Jun Li	Liu Xiao Min	Zhu Jun Li
1.4	2016-08-23	Update pins shape	Zhu Jun Li	Liu Xiao Min	Zhu Jun Li
1.5	2017-03-30	Updated pin position	Zhu Jun Li	Wu Xiang Jun	Zhu Jun Li
1.6	2022-10-10	Update Typeset / Add Y1 package	Yin peng	Yin peng	Zhu Jun Li
1.7	2022-11-16	Update EC table and Characteristics curve according to the test data	Yin peng	Yin peng	Zhu Jun Li