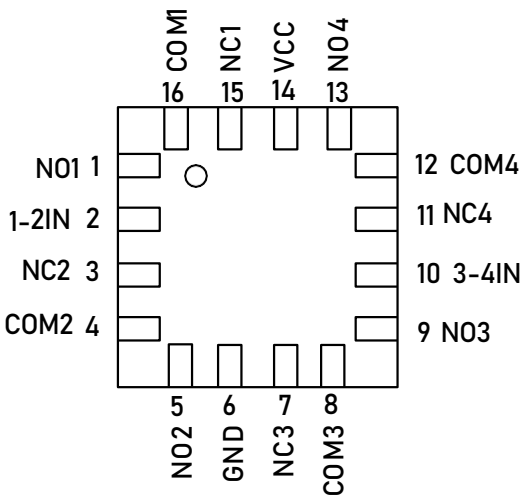
General Description

The LTC2467 is a dual independent ultra–low RON 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 LTC2467 can handle a balanced microphone /speaker /ring–tone generator in a mono phone mode. The device contains a break–make feature.

Features

- Single Supply Operation
  - 1.65 to 4.7V V_{CC}
  - Function Directly from Single-Cell Battery
- Guaranteed On-Resistance Maximum 0.5 Ω with 4.7 V Supply
- Maximum Breakdown Voltage: 5.0 V
- Low Static Power
- QFN3×3-16L

Applications



Top view

Order Information

MODEL	PACKAGE	ORDERING NUMBER
LTC2467	QFN3×3-16L	LTC2467XF16

Pin Description

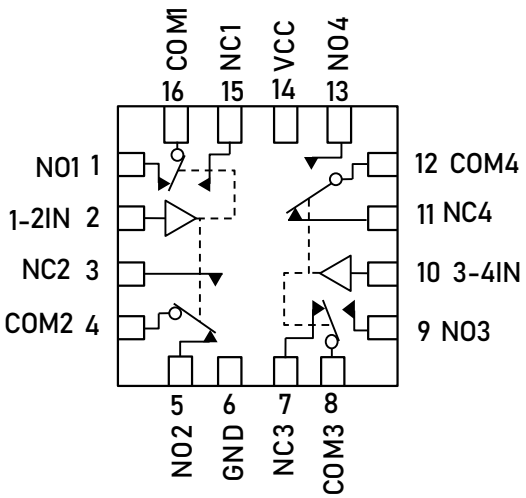
Pin #	Symbol	I/O	Pin Function
1,5,9,13,15,3,7,11	NC1 to NC4, NO1 to NO4	I/O	Independent Channels
2, 10	1–2IN, 3–4IN	I	Controls
16,4,8,12	COM1 to COM4	I/O	Common Channels
6	GND	-	Ground (V)
14	V_{CC}	-	Positive Supply Voltage

Truth Table

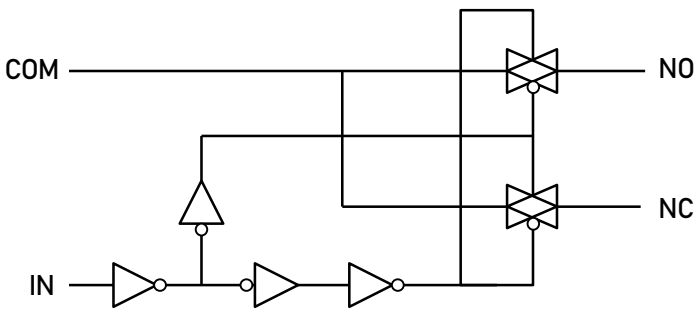
IN	NC	NO
H	ON	OFF(*)
L	OFF(*)	ON

*High impedance

Block Diagram



Input Equivalent Circuit(Figure 1)



Absolute Maximum Ratings

Characteristic	Symbol	Value	Unit
Supply Voltage	V_{CC}	-0.5～+5.0	V
Analog Input Voltage (V_{NO}, V_{NC}, or V_{COM})	V_{IS}	-0.5～V_{CC}+0.5	V
Digital Select Input Voltage	V_{IN}	-0.5～+5.0	V
Continuous DC Current from COM to NC/NO	I_{anl1}	±300	mA
Peak Current from COM to NC/NO, 10 duty cycle (Note 1)	$I_{anl-pk1}$	±500	mA
Continuous DC Current into COM/NO/NC with respect to V_{CC} or GND	I_{clmp}	±300	mA

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.

1. 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	-55	+125	℃
Input Rise or Fall Time, SELECT	t_r , t_f			ns/V
V_{CC} = 1.6 V – 2.7V			20	
V_{CC} = 3.0 V – 4.7V			10	

Recommended Operating Conditions

DC- Characteristics – Digital Section(Voltages Referenced to GND)

Symbol	Parameter	Test Conditions	V_{CC}±10%	Guaranteed Limit			Unit
				-55℃to 25℃	<85℃	<125℃	
V_{IH}	Minimum High–Level Input Voltage, Select Inputs		1.8	1.2	1.2	1.2	V
			2.5	1.5	1.5	1.5	
			4.3	1.65	1.65	1.65	
V_{IL}	Maximum Low–Level Input Voltage, Select Inputs		1.8	0.4	0.4	0.4	V
			2.5	0.5	0.5	0.5	
			4.3	1.0	1.0	1.0	
I_{IN}	Maximum Input Leakage Current, Select Inputs	V_{IN} = 5.0 V or GND	4.7	±0.1	±1.0	±1.0	µA
I_{OFF}	Power Off Leakage Current	V_{IN} = 5.0 V or GND	0	±0.5	±2.0	±2.0	µA
I_{CC}	Maximum Quiescent Supply Current (Note 2)	Select and V_{IS} = V_{CC} or GND	1.65 to 4.7	±1.0	±2.0	±2.5	µA

DC- Electrical Characteristics – Analog Section

Symbol	Parameter	Test Conditions	V_{CC}± 10%	Guaranteed Maximum Limit						Unit
				-55℃to 25℃		<85℃		<125℃		
				Min	Max	Min	Max	Min	Max	
R_{ON}	NC/NO On–Resistance (Note 2)	V_{IN}< V_{IL} or V_{IN}>V_{IH} V_{IS} = GND or V_{CC} I_{IN}I<100 mA	2.5		0.6		0.6		0.7	Ω
			3.0		0.5		0.5		0.6	
			4.7		0.5		0.5		0.5	
R_{FLAT}	NC/NO On–Resistance Flatness (Notes 2, 4)	I_{COM} = 100 mA V_{IS} = 0 to VCC	2.5		0.15		0.15		0.15	Ω
			3.0		0.15		0.15		0.15	
			4.7		0.15		0.15		0.15	
Δ_{RON}	On–Resistance Match Between Channels (Notes 2 and 3)	V_{IS}= 1.3 V, I_{COM}=100 mA ; V_{IS} = 1.5 V, I_{COM} = 100 mA ; V_{IS} = 2.8 V, I_{COM} = 100 mA	2.5		0.06		0.06		0.06	Ω
			3.0		0.05		0.05		0.05	
			4.7		0.05		0.05		0.05	
$I_{NC(OFF)}$ $I_{NO(OFF)}$	NC or NO Off Leakage Current (Note 2)	V_{IN} = V_{IL} or V_{IH} V_{NO} or V_{NC} = 0.8 V V_{COM} = 3.7 V	4.7	-5.0	5.0	-10	10	-100	100	nA
$I_{COM(ON)}$	COM ON Leakage Current (Note 2)	V_{IN} = V_{IL} or V_{IH} V_{NO}=0.8V or 3.7V with V_{NC} floating or V_{NC}=0.8 V or3.7 V with V_{NO} floating V_{COM} = 0.8V or 3.7V	4.7	-10	10	-100	100	-1000	1000	nA

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

3. ΔR_{ON} = $R_{ON(MAX)}$ – $R_{ON(MIN)}$ between NC1 and NC2 or between NO1 and NO2.

4. 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(Input t_r=t_f=3.0ns)

Symbol	Parameter	Test Conditions	V_{CC} (V)	V_{IS} (V)	Guaranteed Maximum Limit							Unit
					-55℃to 25℃			<85℃		<125℃		
					Min	Typ*	Max	Min	Max	Min	Max	
t_{ON}	Turn–On Time	R_L = 50Ω, C_L = 35 pF, (Figures 3 and 4)	2.3~4.7	1.5			50		60		60	ns
t_{OFF}	Turn–Off Time	R_L = 50Ω, C_L = 35 pF, (Figures 3 and 4)	2.3~4.7	1.5			50		40		40	ns
t_{BBM}	Minimum Break–Before–Make Time	V_{IS} = 3.0 R_L = 300Ω, C_L = 35 pF(Figure 2)	3.0	1.5	2	15						ns

*Typical Characteristics are at 25℃

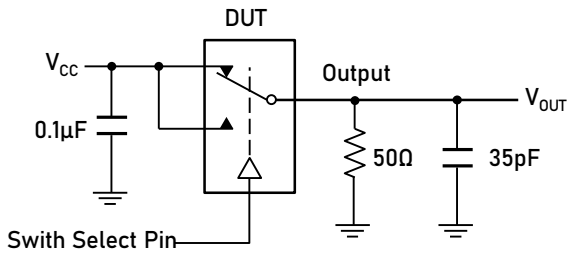
		Typical @25℃,V_{CC}=5.0V	
C_{IN}	Control Pin Input Capacitance	2.5	pF
C_{SN}	SN Port Capacitance	72	pF
C_D	D Port Capacitance When Switch is Enabled	230	pF

Additional Application Characteristics

(Voltages Referenced to GND Unless Noted)

Symbol	Parameter	Condition	V_{CC} (V)	25℃ Typical	Unit
BW	Maximum On–Channel –3dB Bandwidth or Minimum Frequency Response (Figure 12)	V_{IN} centered between VCC and GND (Figure 5)	1.65~4.7	50	MHz
V_{ONL}	Maximum Feed–through On Loss	V_{IN} = 0 dBm @ 100 kHz to 50 MHz V_{IN} centered between V_{CC} and GND (Figure 5)	1.65~4.7	-0.06	dB
V_{ISO}	Off–Channel Isolation (Figure 13)	f = 100 kHz; V_{IS} = 1 V 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 = 1 nF Q = CL×ΔV_{OUT} (Figure 6)	1.65~4.7	50	pC
THD	Total Harmonic Distortion THD + Noise (Figure 7)	F_{IS} = 20 Hz to 20 kHz, R_L = Rgen = 600Ω, C_L = 50 pF V_{IS} = 2 VRMS	4.3	0.01	%
VCT	Channel–to–Channel Crosstalk	f=100kHz; V_{IS} = 1V RMS, C_L =5 pF, R_L =50Ω V_{IN} centered between V_{CC} and GND (Figure 5)	1.65~4.7	-62	dB

5. Off–Channel Isolation = 20log10 (Vcom/Vno), Vcom = output, Vno = input to off switch.



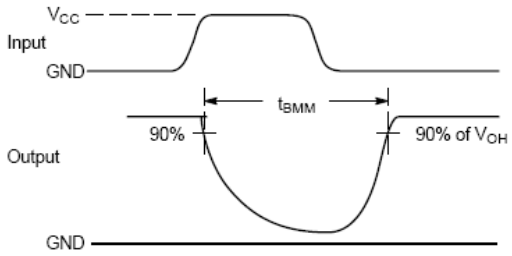
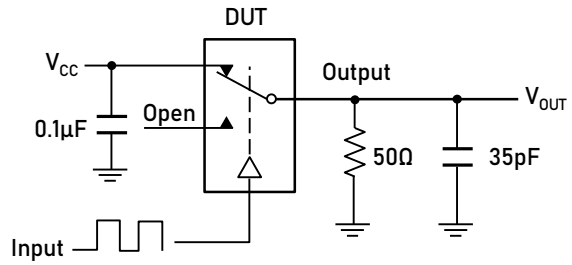


Figure 2. t_{BBM}(Time Break-Before-Make)



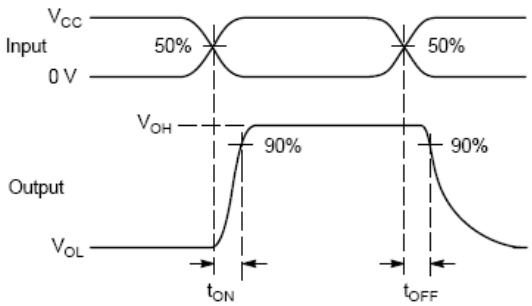
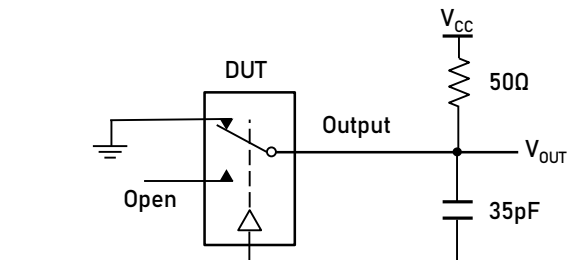


Figure 3. t_{ON}/t_{OFF}



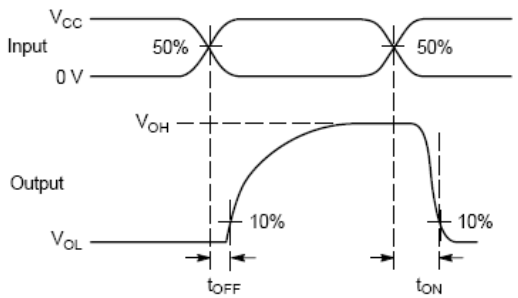
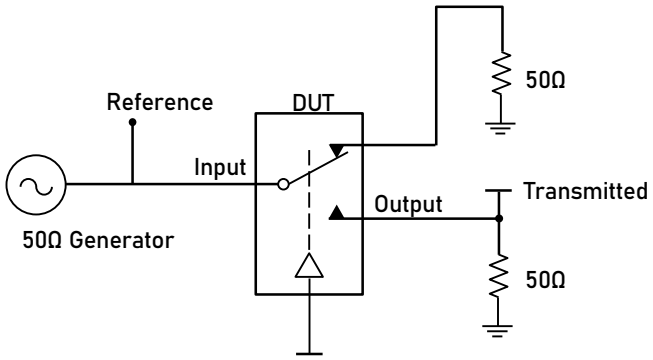


Figure 4. t_{ON}/t_{OFF}



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

V_{IOS} = Off Channel Isolation = 20 Log $\left(\frac{V_{OUT}}{V_{IN}}\right)$ for V_{IN} at 100 kHz

V_{ONL} = Off Channel loss = 20 Log $\left(\frac{V_{OUT}}{V_{IN}}\right)$ for V_{IN} at 100 kHz to 50MHz

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

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

Figure 5. Off Channel Isolation/On Channel Loss(BW)/Crosstalk (On Channel to Off Channel)/V_{ONL}

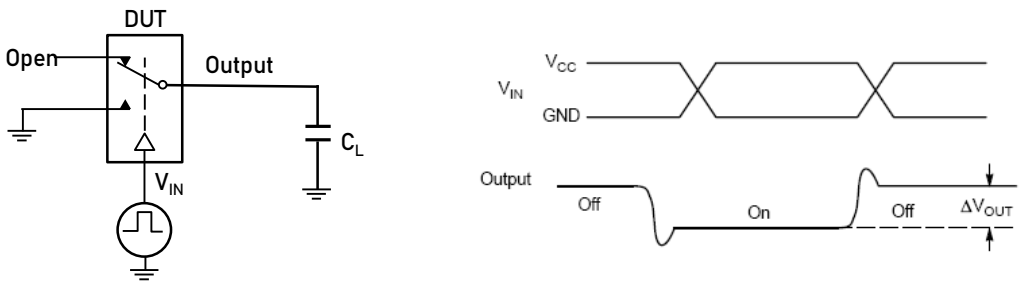


Figure 6. Charge Injection：(Q)

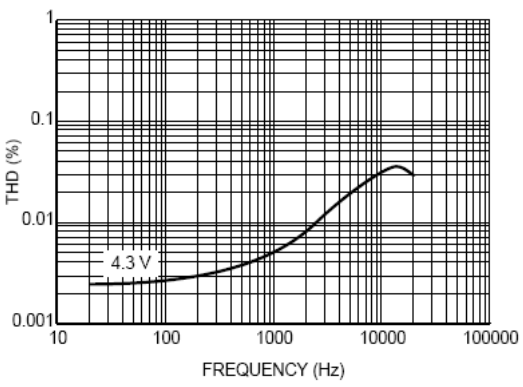


Figure 7. Total Harmonic Distortion Plus Noise Figure versus Frequency

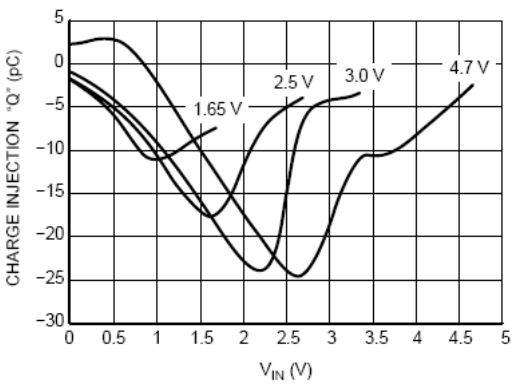


Figure 8. Charge Injection versus Vis

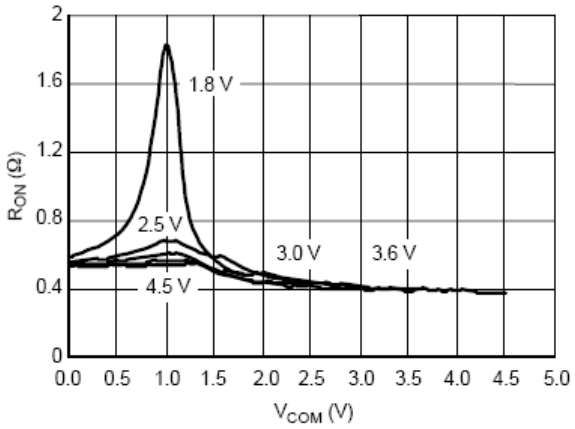


Figure 9. On-Resistance vs. COM Voltage

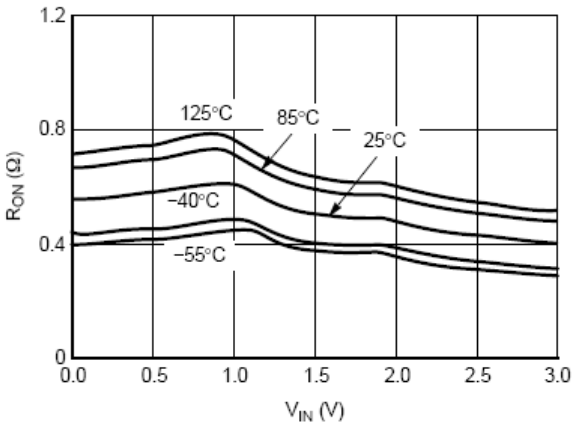


Figure 10. RON vs. VIN vs. Temperature @VCC=3.0V

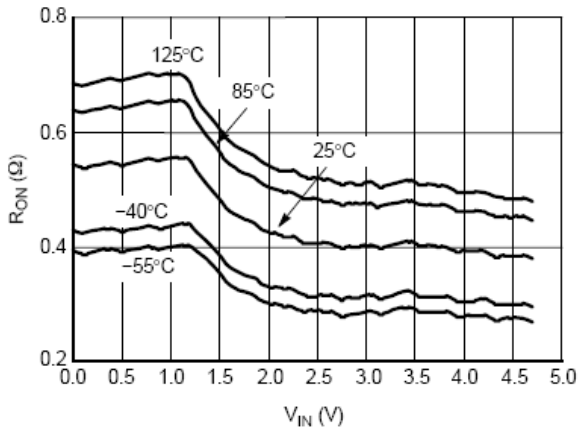


Figure 11. RON vs. VIN vs. Temperature @VCC=4.7V

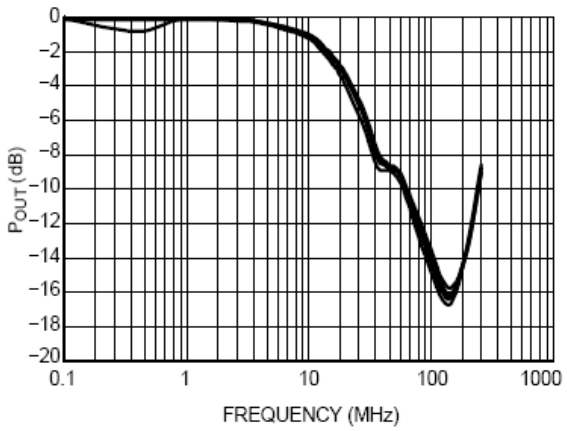


Figure 12. Bandwidth vs. Frequency @VCC=1.65V to 4.7V

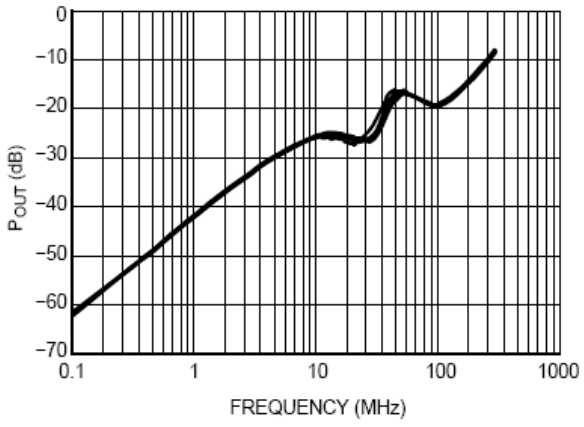


Figure 13. Off-Isolation vs. Frequency @VCC=1.65V to 4.7V

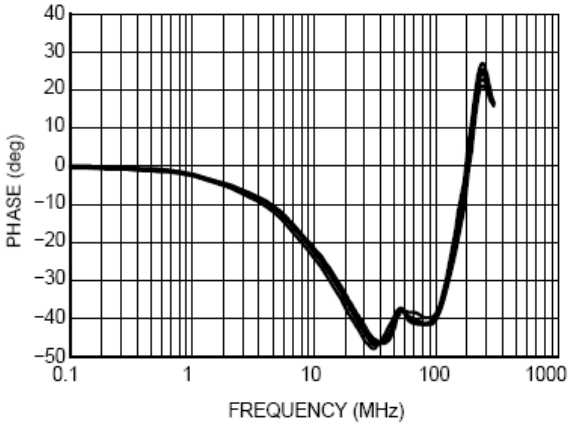


Figure 14. Phase Angle vs. Frequency @VCC=1.65V to 4.7V

Package Dimension

QFN3×3-16