

5V Capable Low-Voltage DPDT Analog Switch

General Description

RT9737 is a 5V high quality low-voltage double-pole double-throw (DPDT) analog switch. RT9737 supply voltage is designed to operate from 2.5V to 5.5V. Supply voltage can be smaller than input voltage while keeping 5V input range. With 70mΩ turn-on resistance, power-loss and signal distortion can be minimized. RT9737 is ideal for switching audio signal from outputs of audio amplifiers. The break-before-make feature prevents signal distortion during the transferring of a signal from one path to another for audio applications.

Ordering Information

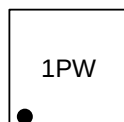
RT9737□
 Package Type
 WSC : WL-CSP-9B 1.24x1.24 (BSC)

Note :

Richtek products are :

- ▶ RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- ▶ Suitable for use in SnPb or Pb-free soldering processes

Marking Information



1P : Product Code

W : Date Code

Features

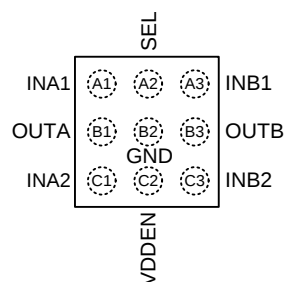
- Maximum Input Signal Range 0 to 5.5V
- 70mΩ Turn-On Resistance
- 2.5V to 5.5V Supply Voltage
- 40μA Quiescent Current
- Break-Before-Make Between Channel Transition
- Available in 9Ball WL-CSP Package

Applications

- Smartphone
- Tablet

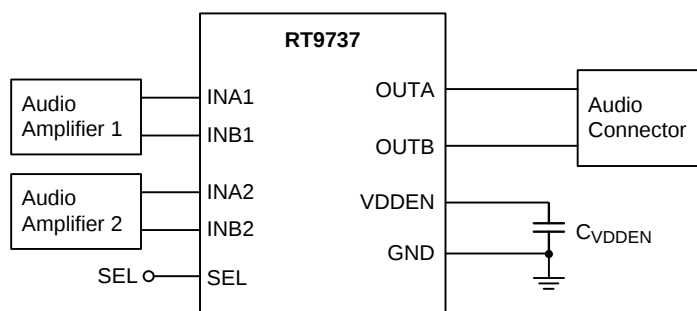
Pin Configurations

(TOP VIEW)



WL-CSP-9B 1.24x1.24 (BSC)

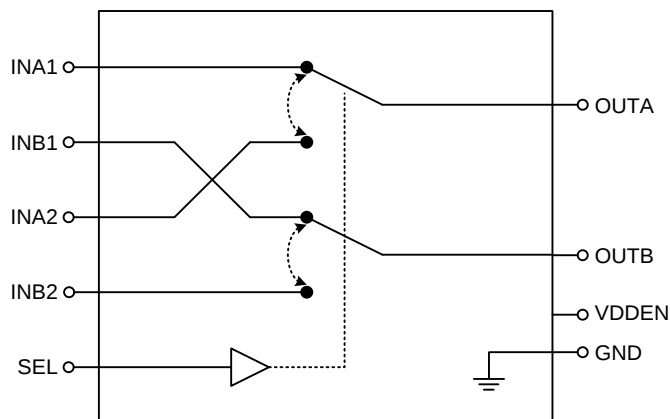
Simplified Application Circuit



Functional Pin Description

Pin No.	Pin Name	Pin Function
A1	INA1	Input 1 of Channel A.
A2	SEL	Selection for Input 1or 2.
A3	INB1	Input 1 of Channel B.
B1	OUTA	Output of Channel A.
B2	GND	Ground.
B3	OUTB	Output of Channel B.
C1	INA2	Input 2 of Channel A.
C2	VDDEN	Supply Voltage.
C3	INB2	Input 2 of Channel B.

Function Block Diagram



Operation

The switches are fully specified to operate from a single 2.5V to 5.5V power supply. RT9737 via internal design, be able to handle when the input signal is greater than the supply voltage range and don't cause the signal distortion. RT9737 control the switches with a control pin, SEL. When SEL voltage under low level, internal switch is thrown to position 1. Audio signal are

via INA1 and INB1 to IC OUTA and OUTB. And then OUTA, OUTB output to the load and Audio connector. When SEL voltage above high level, internal switch is thrown to position 2. When the supply voltage VDDEN under operation range, the switches impedance are risen and all analog signal ports can keep out signals from 0V to 5.5V.

Absolute Maximum Ratings (Note 1)

- VDDEN, INA1, INA2, INB1, INB2, OUTA, OUTB, SEL----- -0.3 to 6V
- Power Dissipation, P_D @ $T_A = 25^\circ\text{C}$
 WL-CSP-9B 1.24x1.24 (BSC)----- 1.28W
- Package Thermal Resistance (Note 2)
 WL-CSP-9B 1.24x1.24 (BSC), θ_{JA} ----- 78.1°C/W
- Lead Temperature (Soldering, 10 sec.) ----- 260°C
- Junction Temperature ----- 150°C
- Storage Temperature Range ----- -65°C to 150°C
- ESD Susceptibility (Note 3)
 HBM (Human Body Model) ----- 2kV
 MM (Machine Model)----- 200V

Recommended Operating Conditions (Note 4)

- Supply Input Voltage, VDDEN----- 2.5V to 5.5V
- Junction Temperature Range----- -40°C to 125°C
- Ambient Temperature Range----- -40°C to 85°C

Electrical Characteristics

($V_{DDEN} = 2.5\text{V}$, $C_{VDDEN} = 0.1\mu\text{F}$, $T_A = 25^\circ\text{C}$, for each LDO unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Power Supply						
Power Supply Range	V_{DDEN}		2.5	--	5.5	V
Power Supply Rejection Ratio	PSRR	$V_{p-p} = 200\text{mV}$, $f = 20\text{kHz}$, $R_L = 32\Omega$ (Note 5)	--	80	--	dB
Quiescent Current	I_Q	$V_{DDEN} = 2.5\text{V to } 5.5\text{V}$	--	40	60	μA
Analog Switch						
Input Signal Range			0	--	5.5	V
Turn-On Resistance	$R_{DS(ON)}$	$V_{DDEN} = 2.5\text{V}$, $\text{OUT} = 0\text{V}$, $I_{OUT} = 100\text{mA}$	--	90	125	$\text{m}\Omega$
		$V_{DDEN} = 3.6\text{V}$, $\text{OUT} = 0\text{V}$, $I_{OUT} = 100\text{mA}$	--	70	100	$\text{m}\Omega$
Off-State Leakage Current		INA, INB, OUTA, OUTB, $V_{DDEN} = 5.5\text{V}$	--	1.2	1.5	μA
		INA, INB, OUTA, OUTB = 5.5V, $V_{DDEN} = 0\text{V}$		0.12	0.2	μA
Turn-On Time	t_{ON}	INA, INB = 0V	--	5	10	ms
Turn-Off Time	t_{OFF}	INA, INB = 0V (Note 5)	--	--	100	μs
Break-Before-Make Time	t_{BBM}	INA, INB = 0V	--	5	10	ms
Off-Isolation (Note 5)		$V_{DDEN} = 0\text{V}$, $R_L = 50\Omega$, INA/INB = 0.5Vpp, 20kHz	--	-50	--	dB
Crosstalk (Note 5)		$R_L = 50\Omega$, INA/INB = 0.5Vpp, 20kHz	--	-80	--	dB
THD+N (Note 5)		$R_L = 50\Omega$, INA/INB = 0.5Vpp, 1kHz, DC bias = 0.25V	--	0.001	--	%
-3dB Bandwidth (Note 5)		$R_L = 50\Omega$	--	2	--	MHz
INA/INB Capacitance		INA /INB = 0.5V _{P-P} , $f = 1\text{MHz}$ (Note 5)	--	70	--	pF
OUTA/OUTB Capacitance		INA /INB = 0.5V _{P-P} , $f = 1\text{MHz}$ (Note 5)	--	120	--	pF

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Digital I/O						
Input Logic-Hi Threshold	V_{IH}		1.4	--	--	V
Input Logic-Low Threshold	V_{IL}		--	--	0.4	V
Input Leakage Current		SEL = 0V or VDDEN	-0.1	--	0.1	μ A

Note 1. Stresses beyond those listed “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions may affect device reliability.

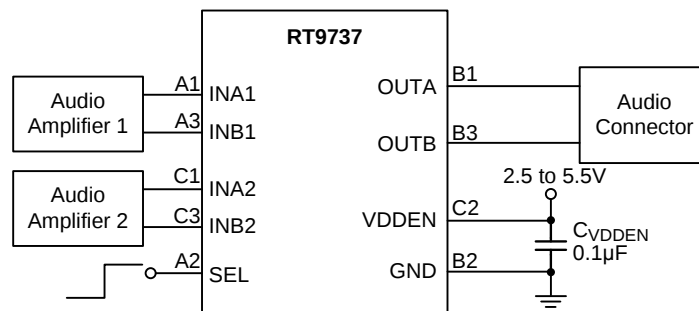
Note 2. θ_{JA} is measured at $T_A = 25^\circ\text{C}$ on a high effective thermal conductivity four-layer test board per JEDEC 51-7.

Note 3. Devices are ESD sensitive. Handling precaution is recommended.

Note 4. The device is not guaranteed to function outside its operating conditions.

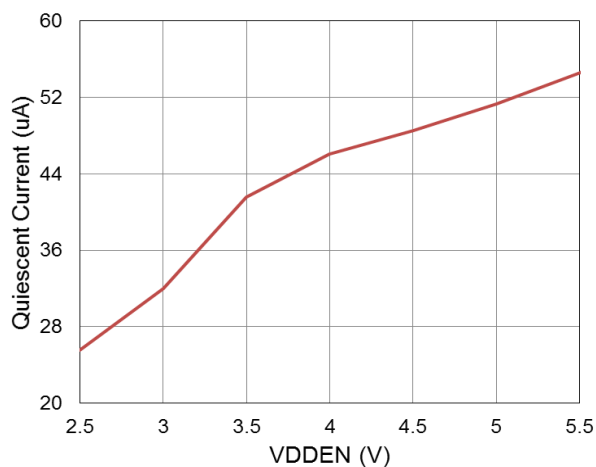
Note 5. Guarantee by design.

Typical Application Circuit

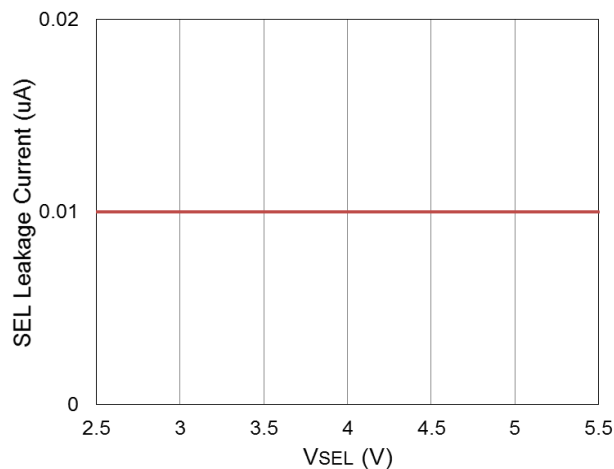


Typical Operating Characteristics

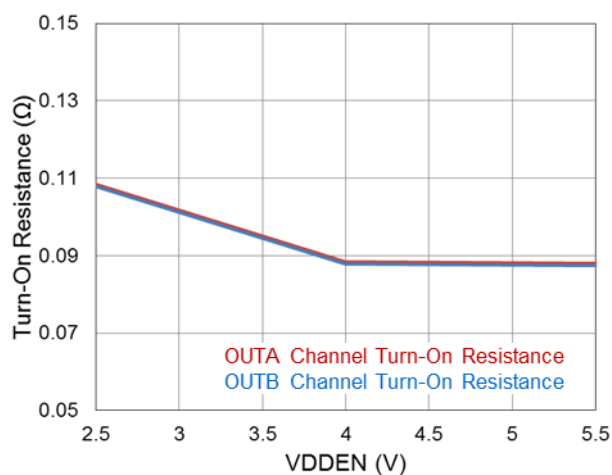
Quiescent Current vs. VDDEN



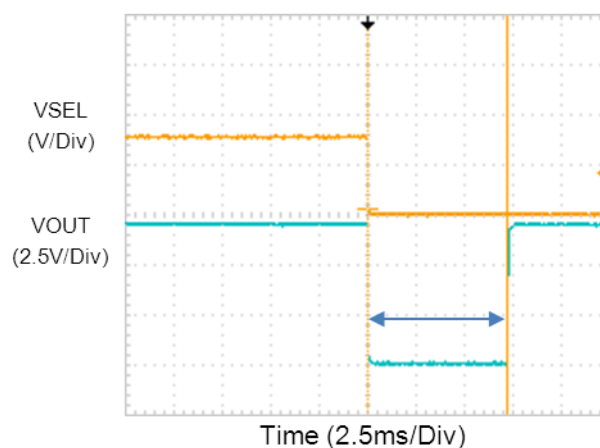
SEL Leakage Current vs. VSEL



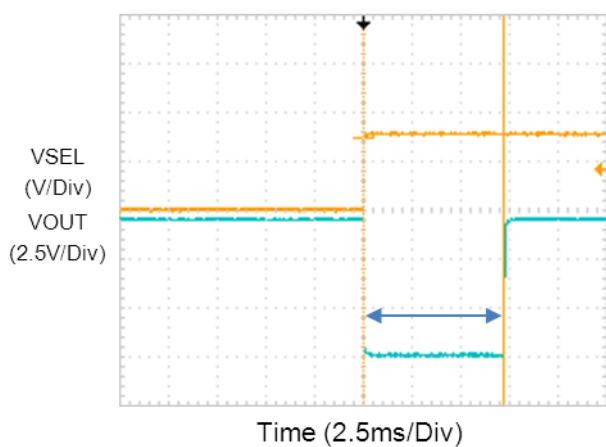
Turn-On Resistance vs. VDDEN



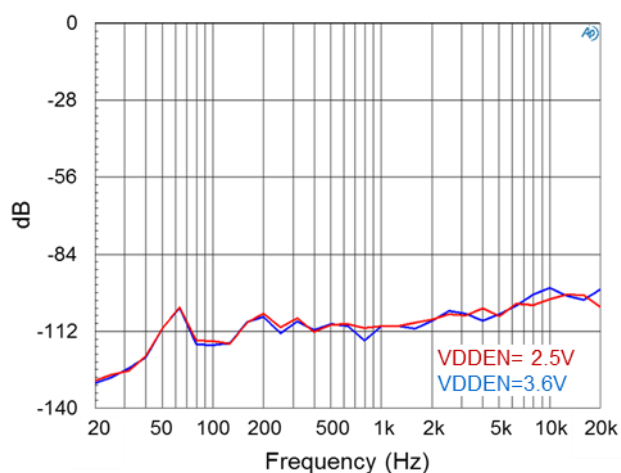
t_{BBM} V_{SEL} High to Low



t_{BBM} V_{SEL} Low to High



Cross talk vs. Frequency



Application Information

RT9737 is a 5V high quality low-voltage double-pole double-throw (DPDT) analog switch. RT9737 supply voltage is designed to operate from 2.5 to 5.5V. Supply voltage can be smaller than input voltage while keeping 5V input range. With 70mΩ turn-on resistance, power-loss and signal distortion can be minimized. RT9737 is ideal for switching audio signal from outputs of audio amplifiers. The break-before-make feature prevents signal distortion during the transferring of a signal from one path to another for audio applications.

Analog Input

RT9737 internal topology design for input and output voltage level can be greater than supply voltage.

Low turn-on resistance and excellent channel to channel matching are ideal for audio applications.

Switch Logic Control

RT9737 can use SEL pin to control internal switches position for another audio source application. SEL pin input current is very low.

Thermal Considerations

For continuous operation, do not exceed absolute maximum junction temperature. The maximum power dissipation depends on the thermal resistance of the IC package, PCB layout, rate of surrounding airflow, and difference between junction and ambient temperature. The maximum power dissipation can be calculated by the following formula :

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction to ambient thermal resistance.

For recommended operating condition specifications, the maximum junction temperature is 125°C. The junction to ambient thermal resistance, θ_{JA} , is layout dependent. For WL-CSP-9B 1.24x1.24 (BSC) packages, the thermal resistance, θ_{JA} , is 78.1°C/W on

a standard JEDEC 51-7 four-layer thermal test board.

The maximum power dissipation at $T_A = 25^\circ\text{C}$ can be calculated by the following formula :

$$P_{D(MAX)} = (125^\circ\text{C} - 25^\circ\text{C}) / (78.1^\circ\text{C/W}) = 1.28\text{W for WL-CSP-9B 1.24x1.24 (BSC) package}$$

The maximum power dissipation depends on the operating ambient temperature for fixed $T_{J(MAX)}$ and thermal resistance, θ_{JA} . The derating curve in Figure 1 allows the designer to see the effect of rising ambient temperature on the maximum power dissipation.

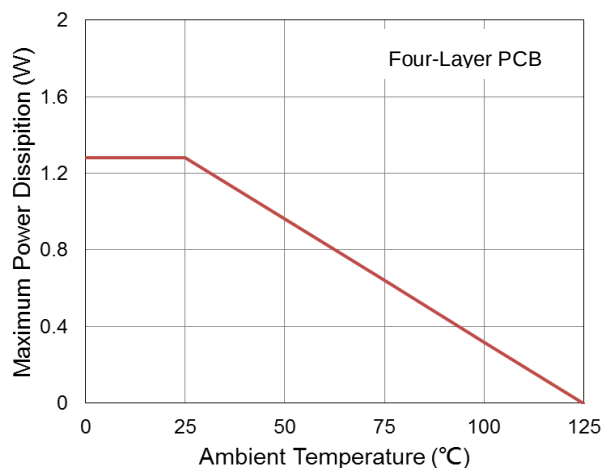


Figure 1. Derating Curve of Maximum Power Dissipation

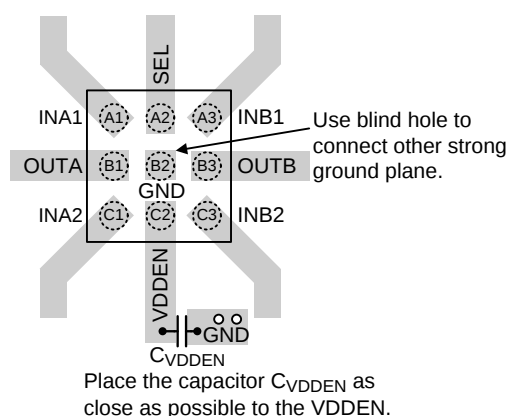
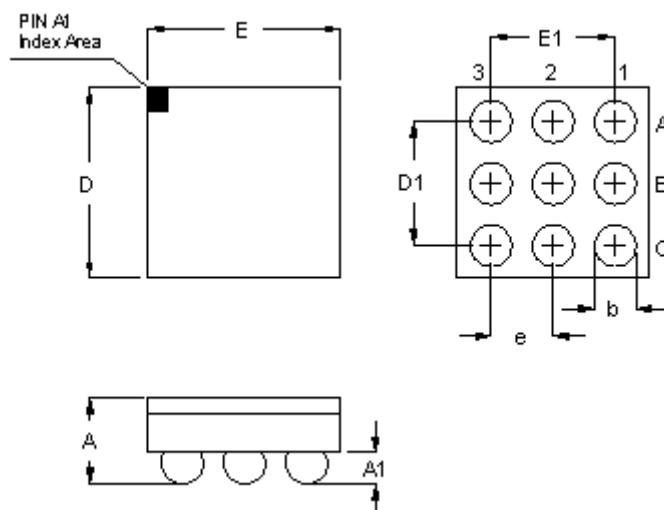


Figure 2. PCB Layout Guide

Outline Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.500	0.600	0.020	0.024
A1	0.170	0.230	0.007	0.009
b	0.240	0.300	0.009	0.012
D	1.190	1.290	0.047	0.051
D1	0.800		0.031	
E	1.190	1.290	0.047	0.051
E1	0.800		0.031	
e	0.400		0.016	

WL-CSP-9B 1.24x1.24 (BSC) Package

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