

# NL3S325

## Audio Jack GND/MIC Configuration Switch

The NL3S325 is an audio jack configuration switch device. It allows reconfiguration of the GND, microphone-bias contact to comply with the American Headset Jack (AHJ) and the Open Mobile Terminal Platform (OMTP) pinout. It also provides a GND sense path that supports quasi-differential audio amplifier architectures.

### Features

- AHJ and OMTP Headset Jack Pinout Support
- Wide  $V_{DD}$  Range: 1.6 V to 3.7 V
- Low Supply Current
- Sense Path to GND for Quasi Differential Audio Amplifier Configuration
- Low THD and Noise Microphone Pass-through Channel
- Ultra-low  $R_{ON}$  of Ground and Sense Switches
- High Power Supply Ripple Rejection
- ESD Performance:
  - 8 kV HBM on SBU<sub>n</sub>, SENSE<sub>n</sub>, SENSE,  $V_{DD}$ , GND
  - 3 kV HBM on MIC, SEL
- Available in 1.19 mm x 1.19 mm WLCSP9
- This Device is Pb-Free, Halogen Free/BFR Free and RoHS Compliant

### Applications

- Headsets with Integrated MIC and Remote Control Buttons
- USB Type-C Switching



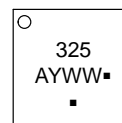
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WLCSP9  
FC SUFFIX  
CASE 567MD

### MARKING DIAGRAM



325 = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

Device	Package	Shipping†
NL3S325FCT2G	WLCSP9 (Pb-Free)	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# NL3S325

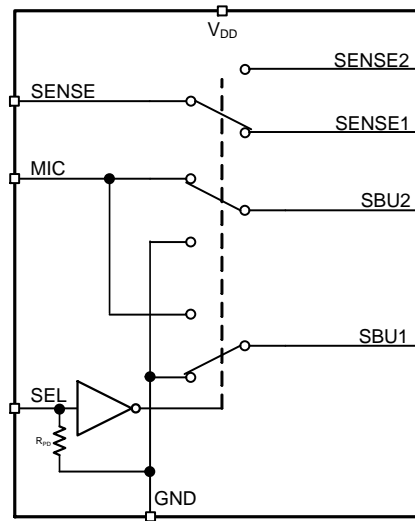


Figure 1. Block Diagram

Table 1. FUNCTION TABLE

V <sub>DD</sub>	SEL	Connections	Mode
0 V	X	All I/O Ports Hi-Z	Disabled
1.6 V to 3.6 V	0	SBU2=MIC; SBU1=GND; SENSE1=SENSE	AHJ
1.6 V to 3.6 V	1	SBU1=MIC; SBU2=GND; SENSE2=SENSE	OMTP

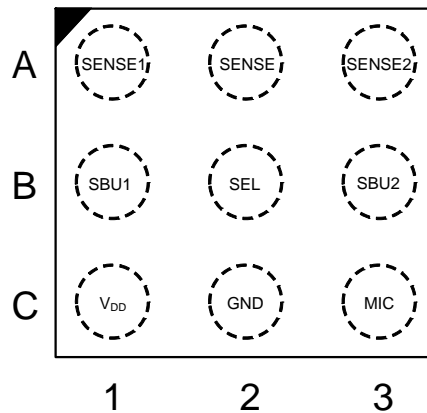
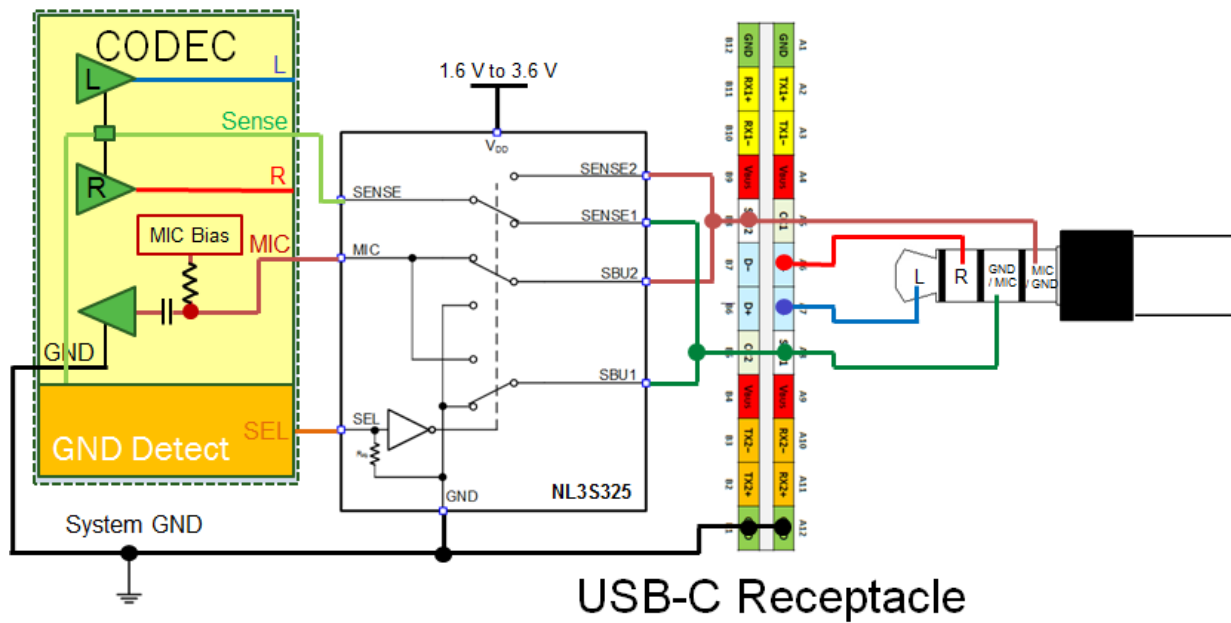


Figure 2. WLCSP9 – Top Through View

Table 2. PIN DESCRIPTIONS

Pin Name	Ball	Description
SENSE1	A1	Sense Path 1 to Headset Jack GND
SENSE	A2	Sense Path for GND Sensing
SENSE2	A3	Sense Path 2 to Headset Jack GND
SBU1	B1	USB Type-C SBU1 Connection
SEL	B2	Configuration Select
SBU2	B3	USB Type-C SBU2 Connection
V <sub>DD</sub>	C1	Power Supply
GND	C2	Ground
MIC	C3	MIC Bias Path CODEC Side

# NL3S325



The default configuration (SEL = 0) is for AHJ-compliant headsets.

**Figure 3. Typical Application**

NOTE: When  $V_{DD}$  is not powered, all the FETs become open by default. Thus, the ground return path becomes floating. Noise might be heard if a speaker (with external powered amplifier) is plugged in the audio jack. It is highly recommended when the audio jack detects a plug-in, the NL3S325 is kept powered until unplug.

**Table 3. MAXIMUM RATINGS**

Symbol	Rating	Value	Unit	
$V_{DD}$	Positive DC Supply Voltage	-0.5 to +4.5	V	
$V_{IS}$	Analog Input/Output Voltage	-0.5 to +4.5	V	
$V_{IN}$	Digital Control Pin Voltage, SEL	-0.5 to +4.5	V	
$I_{SW(GND)}$	Continuous SBU1 or SBU2 to GND Current	100	mA	
$I_{SW(MIC)}$	Continuous MIC to SBU1 or SBU2 Current	50	mA	
$I_{SW(SNS)}$	Continuous SENSE to SENSE1 or SENSE2 Current	50	mA	
$T_s$	Storage Temperature	-55 to +150	°C	
$T_L$	Lead Temperature, 1 mm from Case for 10 seconds	260	°C	
$T_J$	Junction Temperature Under Bias	150	°C	
MSL	Moisture Sensitivity (Note 1)	Level 1		
$I_{LU}$	Latchup Current (Note 2)	±100	mA	
ESD	ESD Protection (Note 3)		V	
	Human Body Model	SENSE, SENSEn, SBU1, $V_{DD}$ , GND		8000
		MIC, SEL		3000
	Machine Model			All Pins
Charged Device Model		All Pins	1000	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Moisture Sensitivity Level (MSL): 1 per IPC/JEDEC standard: J-STD-020A.
2. Latch up Current Maximum Rating: ±100 mA per JEDEC standard: JESD78.
3. This device series contains ESD protection and passes the following tests:  
 Human Body Model (HBM) per JEDEC standard: JESD22-A114.  
 Machine Model (MM) per JEDEC standard: JESD22-A115.

# NL3S325

**Table 4. RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Min	Max	Unit
V <sub>DD</sub>	Positive DC Supply Voltage	1.6	3.7	V
V <sub>IS</sub>	Switch Input / Output Voltage	GND	3.6	V
V <sub>IN</sub>	Digital Control Input Voltage	GND	3.6	V
T <sub>A</sub>	Operating Temperature Range	-40	+85	°C

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

**Table 5. DC ELECTRICAL CHARACTERISTICS** (Typical values are at V<sub>DD</sub> = +3.0 V and T<sub>A</sub> = +25°C unless otherwise specified.)

Symbol	Parameter	Test Conditions	V <sub>DD</sub> (V)	-40°C to 85°C			Unit
				Min	Typ	Max	

**POWER SUPPLY**

I <sub>DD</sub>	Supply Current	T <sub>A</sub> = 25°C	3.0	-	0.1	1	μA
		T <sub>A</sub> = 85°C	3.0	-	-	5	

**CONTROL LOGIC (SEL)**

V <sub>IH</sub>	Input High Voltage		3.0	1.0	-	-	V
V <sub>IL</sub>	Input Low Voltage		3.0	-	-	0.4	V
R <sub>PD</sub>	Pull-down Resistor		1.6 – 3.6	-	550	-	kΩ
I <sub>OFF</sub>	Power OFF Leakage	V <sub>IN</sub> = 3.6 V	0	-	-	1	μA

**MIC BIAS SWITCH (MIC to SBU1 or SBU2)**

R <sub>ON</sub>	ON-Resistance	V <sub>IS</sub> = 850 mV, I <sub>O</sub> = 30 mA	1.8	-	1.6	2.0	Ω
			3.0	-	0.5	0.9	Ω
			3.6	-	0.46	0.8	Ω
R <sub>ON(FLAT)</sub>	ON-Resistance Flatness	V <sub>IS</sub> = 0.8 V to 1.2 V, I <sub>O</sub> = 30 mA	1.8	-	-	0.6	Ω
			3.0	-	-	0.2	Ω
			3.6	-	-	0.1	Ω
I <sub>S</sub>	Switch Leakage Current	V <sub>MIC</sub> = 850 mV, SBU <sub>n</sub> Open, SEL = H or L	1.6 to 3.6	-	-	1.5	μA
C <sub>S</sub>	Switch Capacitance	MIC, SBU <sub>n</sub> Open, SEL = H or L	3.0	-	250	-	pF
THD	Total Harmonic Distortion of Conducting Switch	R <sub>S</sub> = R <sub>L</sub> = 600 Ω, f <sub>AC</sub> = 20 kHz, V <sub>AC</sub> = 0.5 V <sub>PP</sub> , V <sub>DC</sub> = 1.7 V, SEL = H or L	3.0	-	0.002	-	%
PSRR	Power Supply Rejection Ratio of Conducting Switch	R <sub>S</sub> = R <sub>L</sub> = 600 Ω, f = 217 Hz, V <sub>AC</sub> = 0.3 V <sub>PP</sub> , V <sub>DC</sub> = 2.1 V, SEL = H or L	3.0	-	-103	-	dB

**GND SWITCH (SBU1 or SBU2 to GND)**

R <sub>ON</sub>	ON-Resistance	I <sub>ISBU<sub>n</sub></sub> = 100 mA	1.8	-	70	130	mΩ
			3.0	-	60	110	mΩ
			3.6	-	57	105	mΩ
R <sub>ON(FLAT)</sub>	ON-Resistance	I <sub>ISBU<sub>n</sub></sub> = 10 mA	1.8 to 3.6	-	-	50	mΩ
	Flatness	I <sub>ISBU<sub>n</sub></sub> = 1 mA	1.8 to 3.6	-	-	30	mΩ
PSRR	Power Supply Rejection Ratio of Conducting Switch	R <sub>S</sub> = 8 Ω, V <sub>S</sub> = 1 V, f = 217 Hz, V <sub>AC</sub> = 0.3 V <sub>PP</sub> , SEL = H or L	3.0	-	-88	-	dB

# NL3S325

**Table 5. DC ELECTRICAL CHARACTERISTICS** (Typical values are at  $V_{DD} = +3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$  unless otherwise specified.)

Symbol	Parameter	Test Conditions	$V_{DD}$ (V)	-40°C to 85°C			Unit
				Min	Typ	Max	
<b>SENSE SWITCH (SENSE to SENSE1 or SENSE2)</b>							
$R_{ON}$	ON-Resistance	$I_{SENSE} = 30\text{ mA}$ , $SENSE_n = 0\text{ V}$	1.8	–	80	130	$m\Omega$
			3.0	–	60	90	
			3.6	–	57	82	
$R_{ON(FLAT)}$	ON-Resistance	$I_{SENSE} = 10\text{ mA}$ , $SENSE_n = 0\text{ V}$	1.8 to 3.6	–	–	50	$m\Omega$
	Flatness	$I_{SENSE} = 1\text{ mA}$ , $SENSE_n = 0\text{ V}$	1.8 to 3.6	–	–	40	
$I_S$	Switch Leakage Current	$V_{SENSE} = 1\text{ V}$ , $SEL = L$ , $SENSE1$ Open, $SENSE2 = GND$	1.6 to 3.6	–	–	1	$\mu\text{A}$
		$V_{SENSE} = 1\text{ V}$ , $SEL = H$ , $SENSE1 = GND$ , $SENSE2$ Open		–	–	1	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## Test Circuit and Graphs

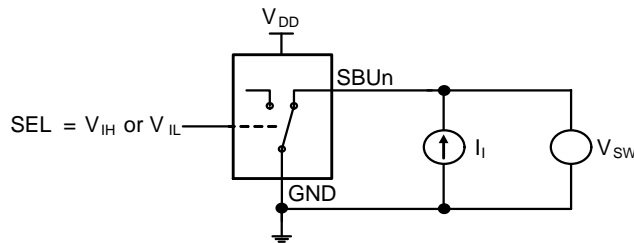


Figure 4. ON Resistance

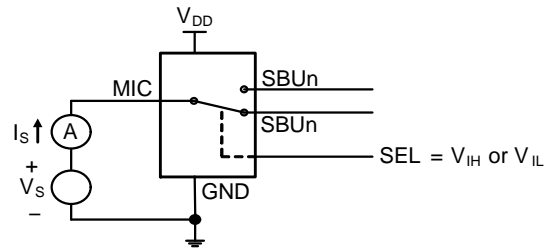


Figure 5. Leakage Current

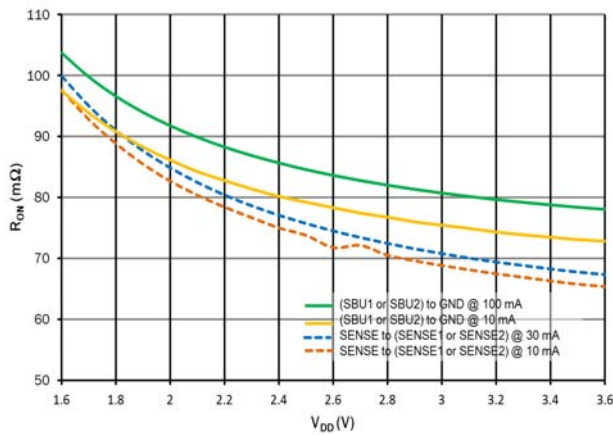


Figure 6.  $R_{ON}$  (GND/SENSE @  $I_I = 1\text{ mA}$ )

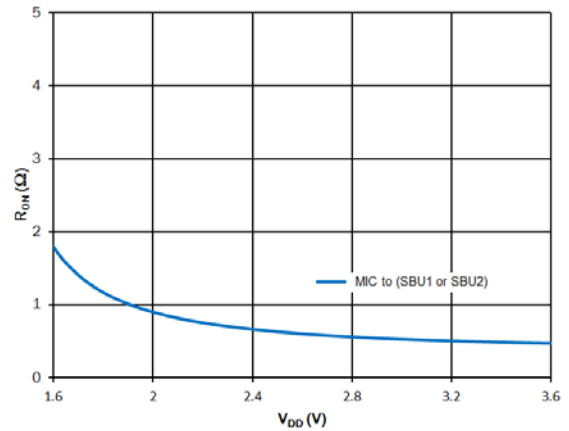


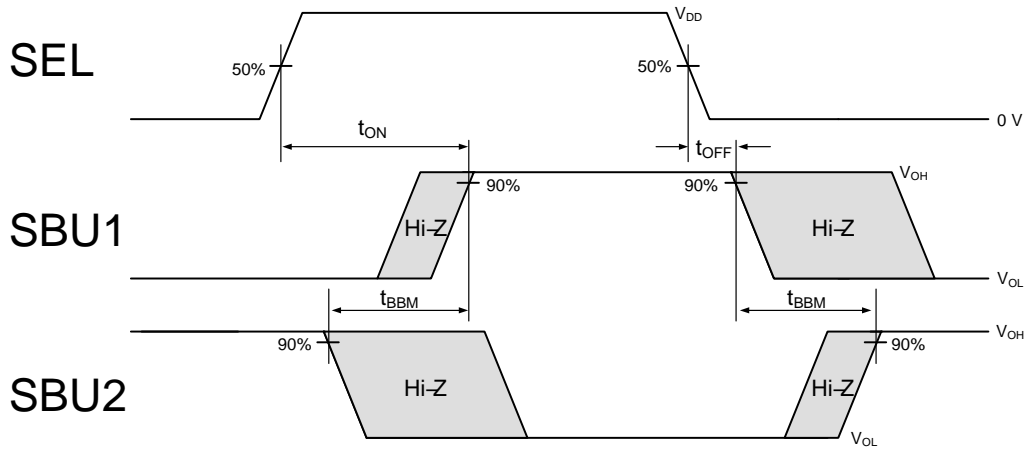
Figure 7.  $R_{ON}$  (MIC @  $I_I = 30\text{ mA}$ )

# NL3S325

**Table 6. AC ELECTRICAL CHARACTERISTICS** (Typical values are at  $V_{DD} = +3.0\text{ V}$  and  $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Parameter	Test Conditions	$V_{CC}$ (V)	-40°C to 85°C			Unit
				Min	Typ	Max	
$t_{ON}$	Turn-On Time	$V_{MIC} = V_{DD}$ , $V_{SENSE} = 0\text{ V}$ , $R_L = 50\ \Omega$ , $C_L = 35\text{ pF}$	3.0	-	215	400	ns
$t_{OFF}$	Turn-Off Time	$V_{MIC} = V_{DD}$ , $V_{SENSE} = 0\text{ V}$ , $R_L = 50\ \Omega$ , $C_L = 35\text{ pF}$	3.0	-	80	140	ns
$t_{BBM}$	Break-before-make Time	$V_{MIC} = V_{DD}$ , $V_{SENSE} = 0\text{ V}$ , $R_L = 50\ \Omega$ , $C_L = 35\text{ pF}$	3.0	70 (Note 4)	100	320	ns

4. Guaranteed by design.

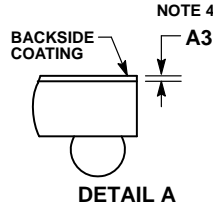
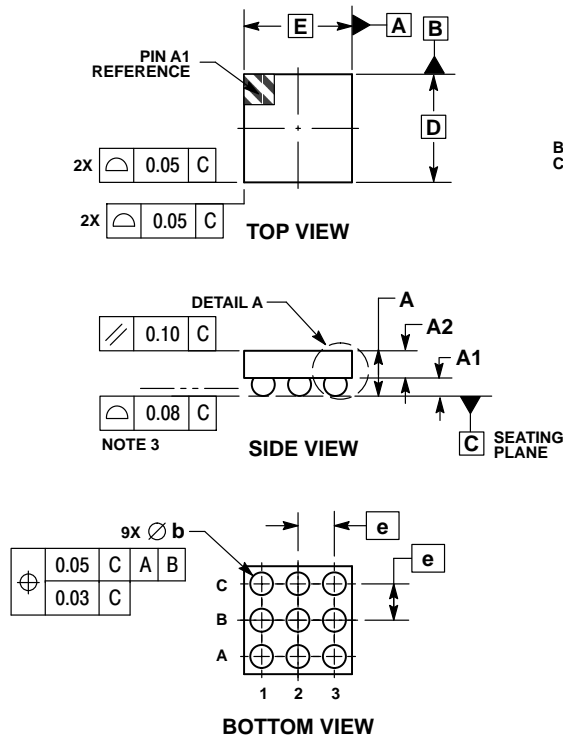


**Figure 8.  $t_{ON}$ ,  $t_{OFF}$ ,  $t_{BBM}$  Waveform**

# NL3S325

## PACKAGE DIMENSIONS

### WLCSP9, 1.19x1.19 CASE 567MD ISSUE A

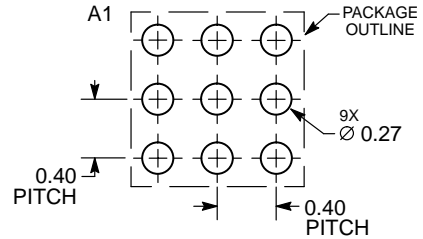


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO THE SPHERICAL CROWNS OF THE SOLDER BALLS.
4. BACKSIDE COATING IS OPTIONAL.

DIM	MILLIMETERS	
	MIN	MAX
A	—	0.52
A1	0.18	0.22
A2	0.26	0.29
A3	0.000	0.027
b	0.24	0.28
D	1.19 BSC	
E	1.19 BSC	
e	0.40 BSC	

### RECOMMENDED SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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