Low Power Audio Jack Detector with SEND/END Detection in Miniaturized Package

NEW PRODUCT

Description

The AZV5002 is a low power and cost effective headset detection IC with a comparator with internal hysteresis, OR gate, and N-channel MOSFET integrated designed to detect the assertion of a headset with a microphone.

Pull-up resistors for the detection pins are internalized, a built in resistor divider provides the reference voltage for detecting the left audio channel. The logic low output of the OR gate indicates the headset has been connected properly.

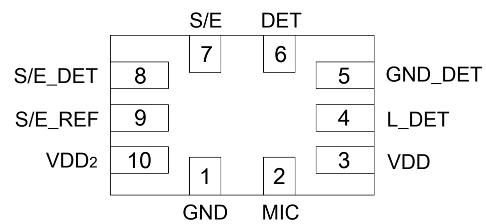
The AZV5002 is available in miniaturized package, U-QFN1418-10 which helps reduce the space needed on PCB boards.

Features

- Low Supply Current: 5µA (Typical) @ V_{DD} = 1.8V
- Supply Voltage Range: 1.6~5.5V
- Comparator, OR Gate, N-Channel MOSFET Integrated
- Open Drain Output for MIC Pin
- U-QFN1418-10: Available in “Green” Molding Compound (No Br. Sb.)
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. “Green” Device(Note 3)**

Pin Assignments

AZV5002



Top View
(U-QFN1418-10)
Fig. 1

Applications

- Mobile Phones
- Tablet
- Battery Powered Devices
- Alarm and Security Systems

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated’s definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green” products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Typical Applications Circuit

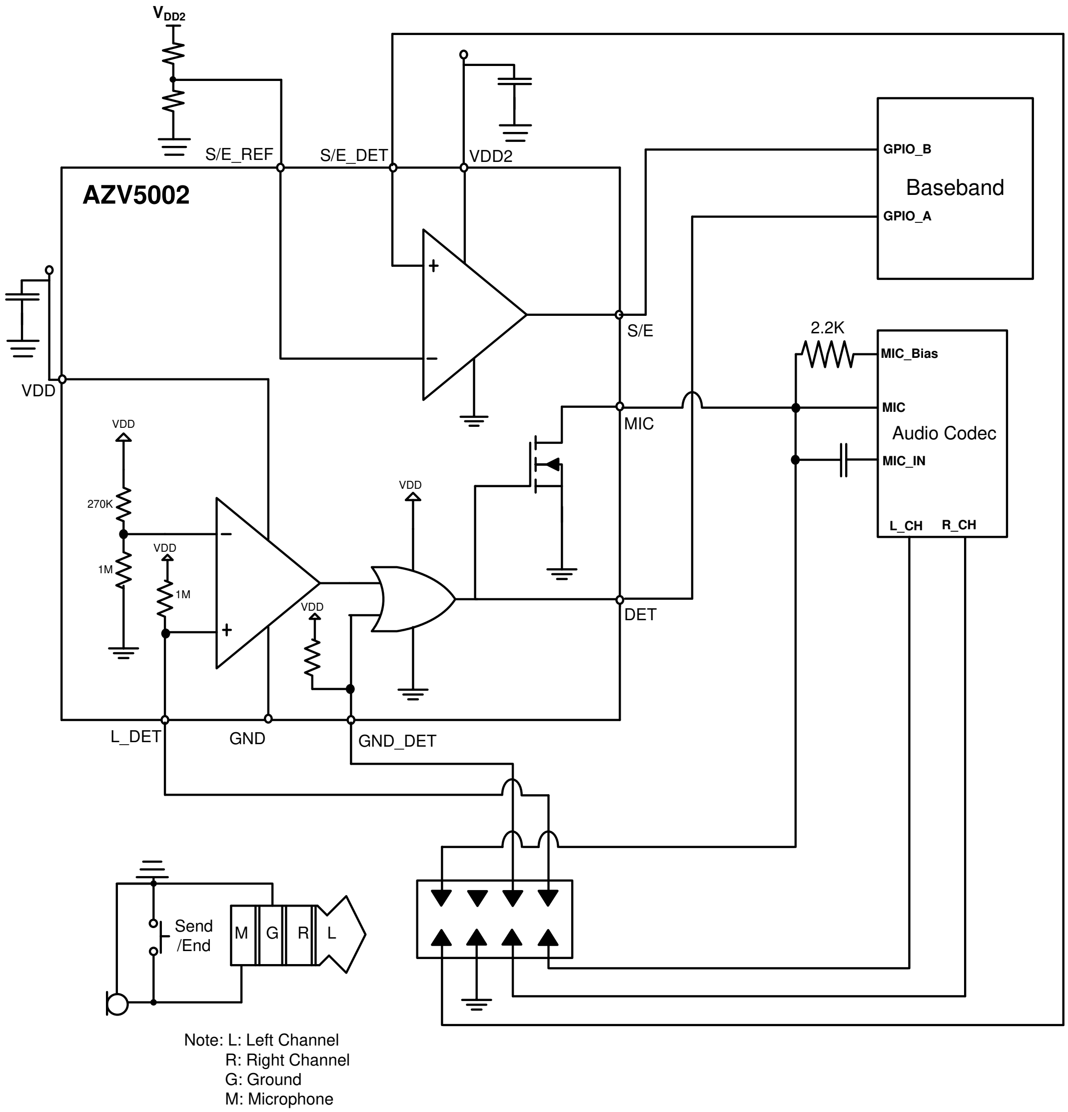


Fig. 2

Output Logic

Inputs		Outputs		Headset
L_DET	GND_DET	DET	MIC	
0	0	0	1 (External Pull-Up)	Detected
0	1	1	0	Not Detected
1	0	1	0	Not Detected
1	1	1	0	Not Detected

Pin Descriptions

AZV5002			
Pin Name	**Pin Number**	**Type**	**Function**
GND	1	Power	Connects to system ground.
MIC	2	Output	MIC output pin with open drain output type. When the headset is asserted, then MIC is pulled up to the MIC bias voltage with a pull-up resistor. When the headset is not asserted, then MIC is pulled low.
VDD	3	Power	System power supply. A bypass capacitor of 0.1μF is recommended as close as possible to the pin.
L_DET	4	Input	Left channel detection pin. Connect to audio jack L_DET, this pin is pulled low when the headset is present.
GND_DET	5	Input	Ground pin detection pin. Connect to audio jack GND_DET, this pin is pulled low when the headset is present.
DET	6	Output	DET is a logic output that indicates whether the headset has been properly inserted.
S/E	7	Output	S/E is an output port indicates SEND/END button condition. When SEND/END button press is detected, S/E output is at low level.
S/E_DET	8	Input	Non-inverting input of the comparator detects whether the SEND/END button has been pressed.
S/E_REF	9	Input	Inverting input of the comparator to set a voltage reference with an external resistor divider.
VDD2	10	Power	System power supply for the S/E detection comparator. A bypass capacitor of 0.1 μF is recommended as close as possible to the pin.

Functional Block Diagram

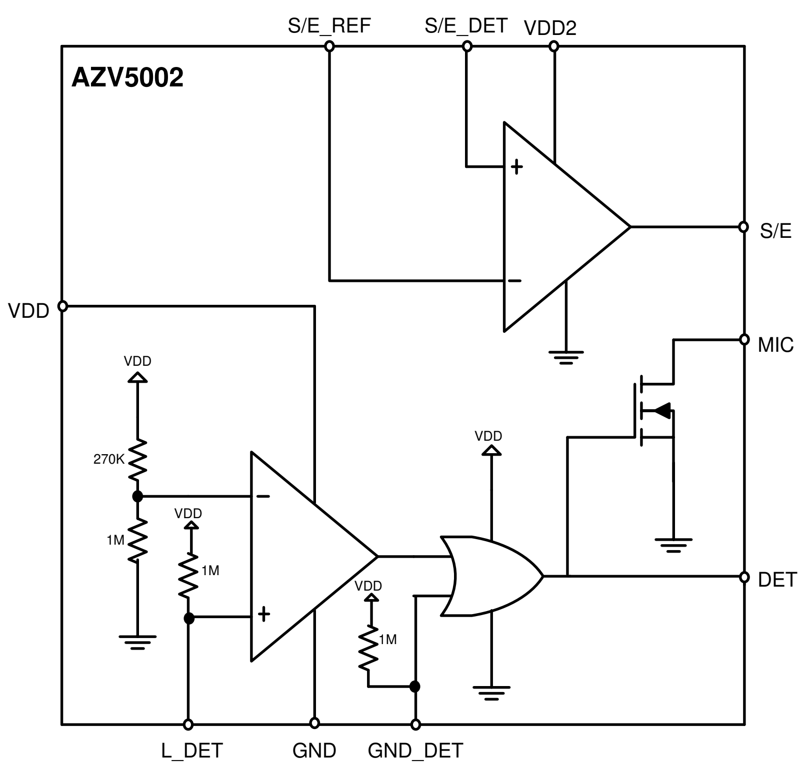


Fig.3

NEW PRODUCT

Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Min	Max	Unit
V_{DD} / V_{DD2}	Supply Voltage	0	6	V
V_{IN}	Input Pin Voltage Range (L_DET, GND_DET)	-0.1	V_{DD}+0.1	V
V_{IN}	I Input Pin Voltage Range (S/E_REF, S/E_DET)	-0.1	V_{DD2}+0.1	V
V_{MIC}	MIC Output Pin Voltage Range	0	6	V
I_{MIC}	Max Current on MIC Pin	-	2	mA
T_J	Junction Temperature	-40	+150	°C
T_{STG}	Storage Temperature	-65	+150	°C
ESD	HBM	8000		V
	MM	200		V
$I_{LATCH-UP}$	Latch-Up Current (Note 4)	800		mA

Note 4: Latch-up test at V_{DD}/V_{DD2} = 3V condition.

Recommended Operating Ratings (@T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Condition	Min	Max	Unit
V_{DD}	Power Supply Voltage	Headset Detection Circuit	1.6	5.5	V
V_{DD2}		S/E Detection Comparator	1.6	5.5	V
V_{IN}	Input Voltage	L_DET, GND_DET	0	V_{DD}	V
		S/E_DET, S/E_REF	0	V_{DD2}	V
V_{MIC_BIAS}	MIC Bias Voltage	-	0	5.5	V
T_A	Ambient Temperature	-	-40	+85	°C
T_J	Junction Temperature	-	-40	+125	°C

NEW PRODUCT

Electrical Characteristics

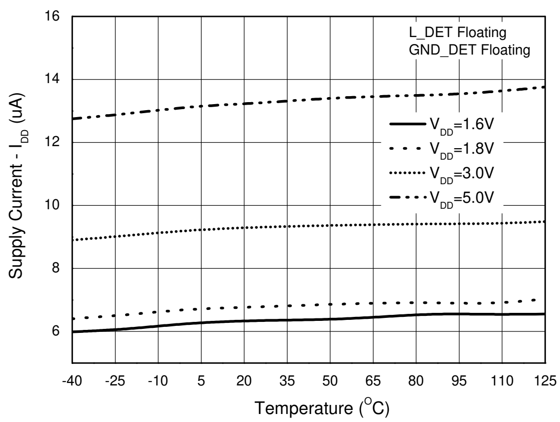
(Typical Values are referenced to T_A = +25°C, V_{DD} = 1.8V, V_{DD2} = 2.1V, unless otherwise noted. Min/max values apply from T_A = -40 to +85°C, unless otherwise noted.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{DD}	Headset Detection Circuit	$V_{GND\text{-}Det}$ = 1.8V, V_{L_Det} = 1.8V	-	5	8	µA
I_{DD2}	S/E Detection Comparator	V_{DD} = 1.8V, V_{DD2} = 2.1V	-	4	6	µA
Input Characteristics of L_Det						
V_{IH}	Input Logic High	V_{DD} = 1.8V	1.5	-	-	V
V_{IL}	Input Logic Low	V_{DD} = 1.8V	-	-	1.33	V
t_{pLH}	Propagation Delay to DET_ t_{pLH}	C_{OUT} = 15pF, $V_{GND\text{-}Det}$ = 0V, V_{L_Det} = 1.31~1.52V	-	250	-	ns
t_{pHL}	Propagation Delay to DET_ t_{pHL}	C_{OUT} = 15pF, $V_{GND\text{-}Det}$ = 0V, V_{L_Det} = 1.31~1.52V	-	450	-	ns
C_{IN}	Input Capacitance	f = 1MHz	-	3	-	pF
I_{IH}	Low Voltage Input Leakage	V_{L_Det} = 0V	-	0.8	-	µA
I_{IL}	High Voltage Input Leakage	V_{L_Det} = 1.8V	-	2.4	-	nA
Input Characteristics of GND_Det						
V_{IH}	Input Logic High	V_{DD} = 1.8V	1.17	-	-	V
V_{IL}	Input Logic Low	V_{DD} = 1.8V	-	-	0.63	V
t_{pLH}	Propagation Delay to DET_ t_{pLH}	C_{OUT} = 15pF, V_{L_Det} = 0V, $V_{GND\text{-}Det}$ = 0~1.8V, R_L = 1MΩ	-	10	-	ns
t_{pHL}	Propagation Delay to DET_ t_{pHL}	C_{OUT} = 15pF, V_{L_Det} = 0V, $V_{GND\text{-}Det}$ = 0~1.8V, R_L = 1MΩ	-	10	-	ns
C_{IN}	Input Capacitance	f = 1MHz	-	3	-	pF
I_{IH}	Low Voltage Input Leakage	V_{L_Det} = 0V	-	0.8	-	µA
I_{IL}	High Voltage Input Leakage	V_{L_Det} = 1.8V	-	2.7	-	nA
Output Characteristics of DET						
V_{OH}	Voltage Output High	V_{DD} = 1.8V, I_{OH} = -0.1mA	1.6	-	-	V
V_{OL}	Voltage Output Low	V_{DD} = 1.8V, I_{OL} = 0.1mA	-	-	0.1	V
T_{RISE}	Rise Time	C_{OUT} = 15pF, R_L =1MΩ	-	5	-	ns
T_{FALL}	Fall Time	C_{OUT} = 15pF, R_L =1MΩ	-	5	-	ns
Input Characteristics of S/E_REF & S/E_DET						
t_{pLH}	Propagation Delay to S/E_ t_{pLH}	C_{OUT} = 15pF, V_{CM} = mid−supply, 100 mV overdrive	-	300	-	ns
t_{pHL}	Propagation Delay to S/E_ t_{pHL}	C_{OUT} = 15pF, V_{CM} = mid−supply, 100 mV overdrive	-	200	-	ns
I_{IL}	Input Leakage	V_{CM} = 0.9V	-	150	-	pA

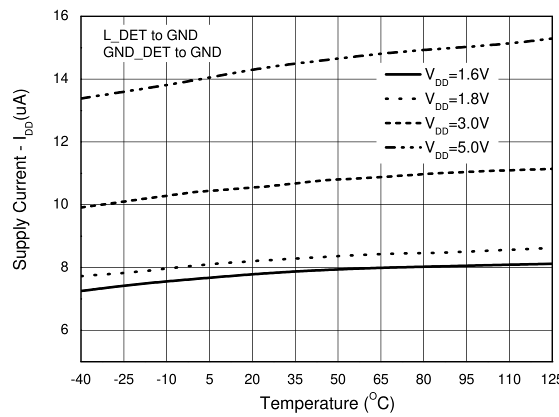
Electrical Characteristics (Cont. Typical Values are referenced to T_A = +25°C, V_{DD} = 1.8V, V_{DD2} = 2.1V, unless otherwise noted. Min/max values apply from T_A = -40 to +85°C, unless otherwise noted.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
C_{IN}	Input Capacitance	S/E_DET, f = 1MHz	-	3	-	pF
		S/E_REF, f = 1MHz	-	11	-	
Output Characteristics of S/E						
V_{OH}	Voltage Output High	V_{DD} = 1.8V, I_{OH} = -0.1mA	1.9	-	-	V
V_{OL}	Voltage Output Low	V_{DD} = 1.8V, I_{OH} = 0.1mA	-	-	0.1	V
T_{RISE}	Rise Time	C_{OUT} = 15pF, R_L = 1MΩ	-	10	-	ns
T_{FALL}	Fall Time	C_{OUT} = 15pF, R_L = 1MΩ	-	10	-	ns
Characteristics of MIC						
t_{pLH}	Propagation Delay to MIC_ t_{pLH}	C_{OUT} = 15pF, $V_{GND\text{-}Det}$ = 0, V_{L_Det} =1.31V to 1.52V RPU = 2.2K, MIC Bias = 2.3V	-	1000	-	ns
t_{pHL}	Propagation Delay to MIC_ t_{pHL}	C_{OUT} = 15pF, $V_{GND\text{-}Det}$ = 0, V_{L_Det} =1.31V to 1.52V RPU = 2.2K, MIC Bias = 2.3V	-	350	-	ns
$R_{DS(ON)}$	Drain-Source On Resistor of NMOS	I_{MIC} = 1mA	-	0.55	1.3	Ω

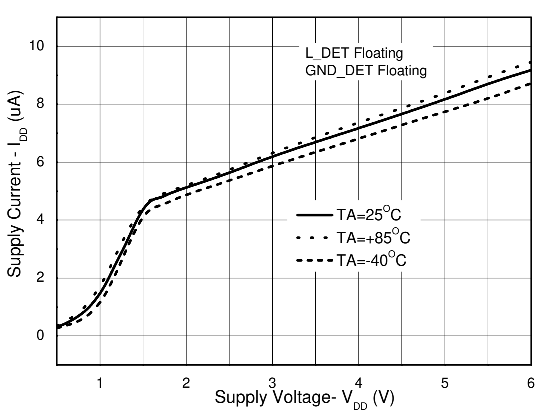
Performance Characteristics (Typical Values are referenced to V_{DD} = 1.8V, V_{DD2} = 2.1V, unless otherwise noted.)



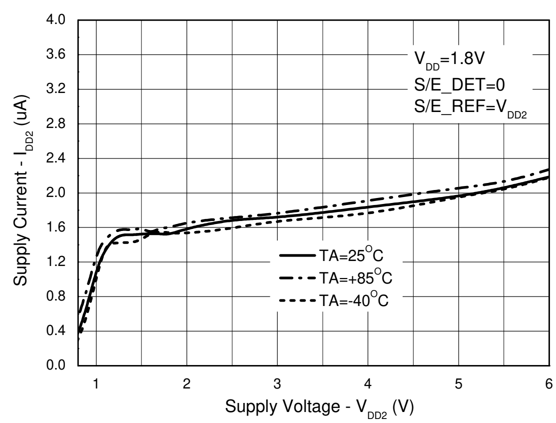
Supply Current vs. Temperature



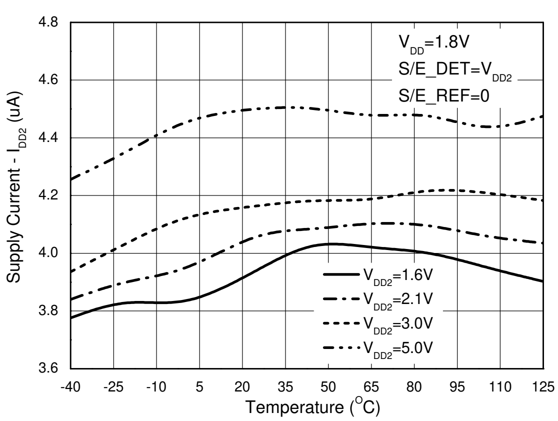
Supply Current vs. Temperature



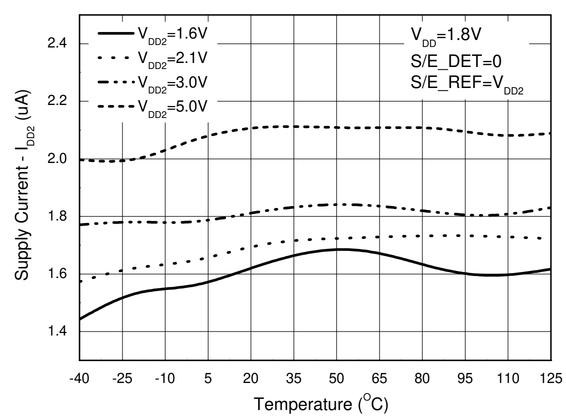
Supply Current vs. Supply Voltage



Supply Current vs. Supply Voltage

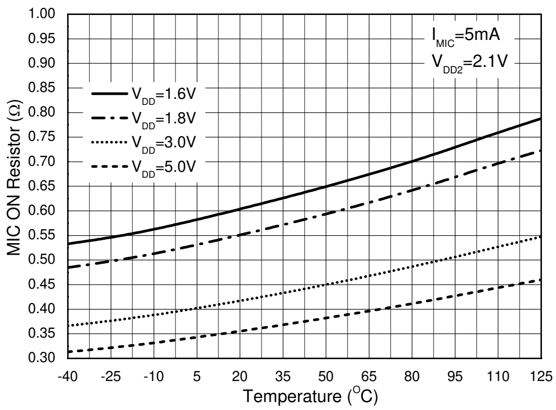


Supply Current vs. Temperature

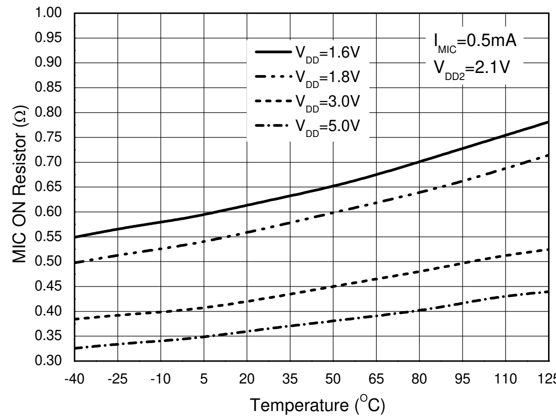


Supply Current vs. Temperature

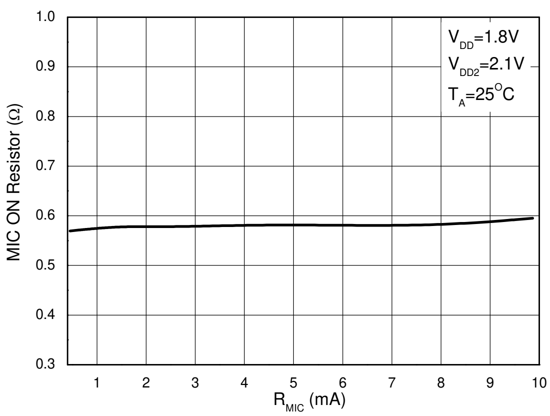
Performance Characteristics (Cont.) (Typical Values are referenced to V_{DD} = 1.8V, V_{DD2} = 2.1V, unless otherwise noted.)



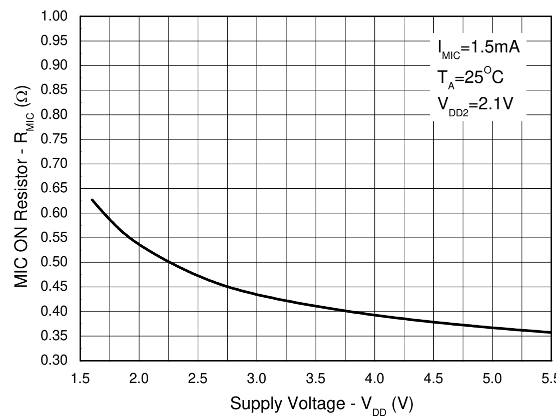
MIC ON Resistor vs. Temperature



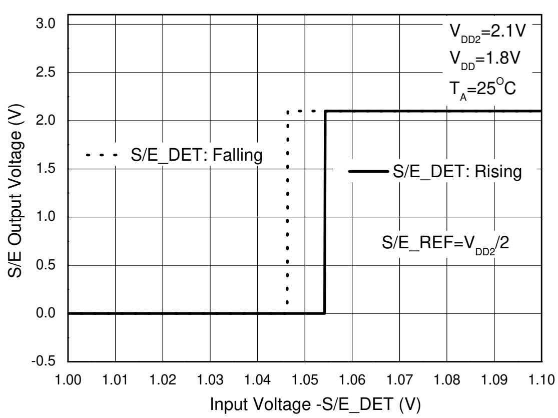
MIC ON Resistor vs. Temperature



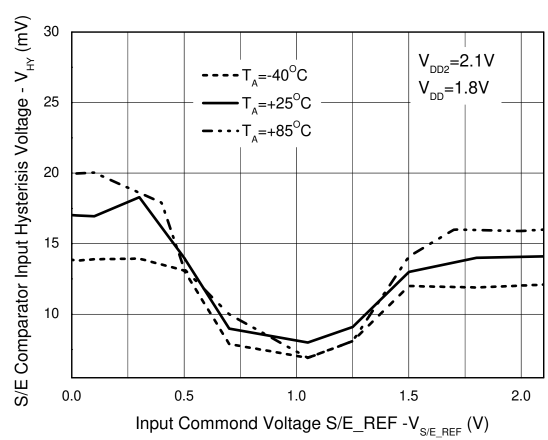
MIC ON Resistor vs. Drain Current



MIC ON Resistor vs. Supply Voltage

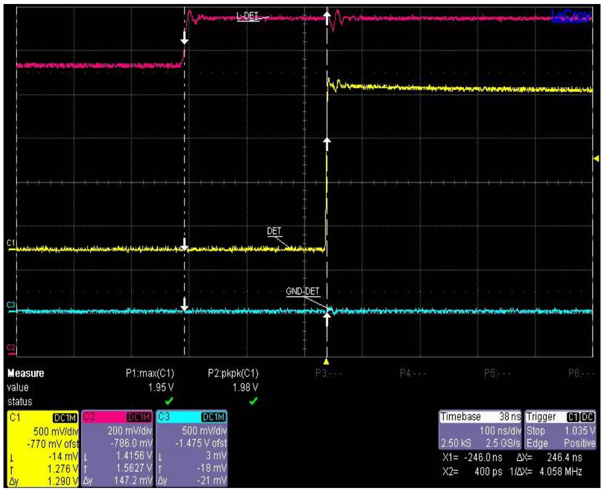


S/E Comparator Input Internal Hysteresis Voltage

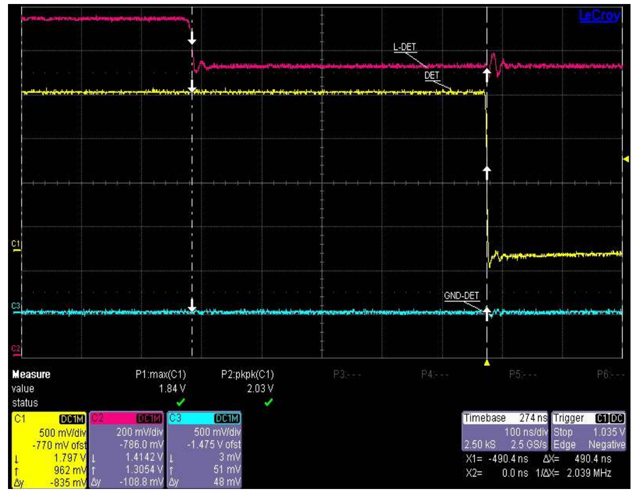


S/E Comparator Input Internal Hysteresis Voltage Characteristics

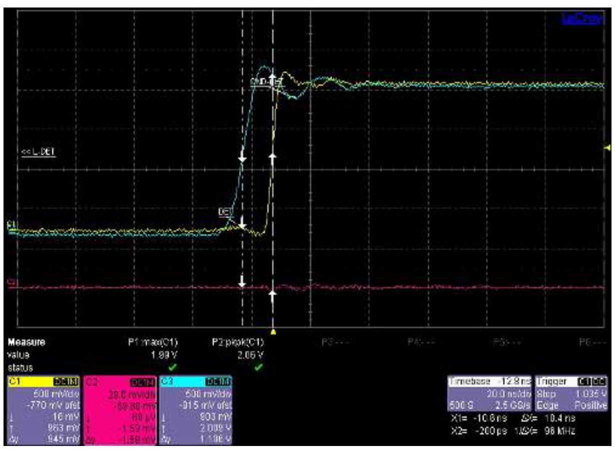
Performance Characteristics (Cont.) (Typical Values are referenced to V_{DD} = 1.8V, V_{DD2} = 2.1V, unless otherwise noted.)

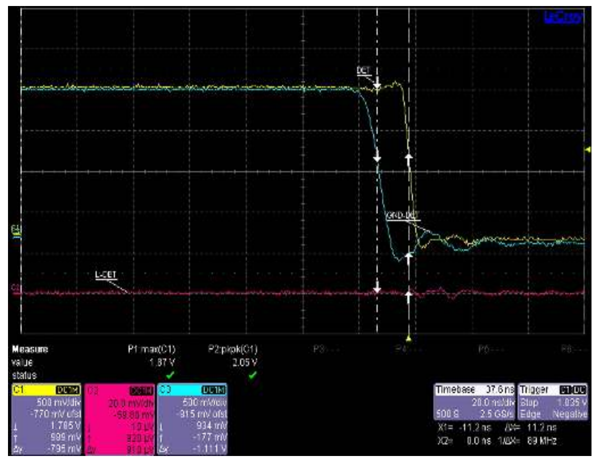


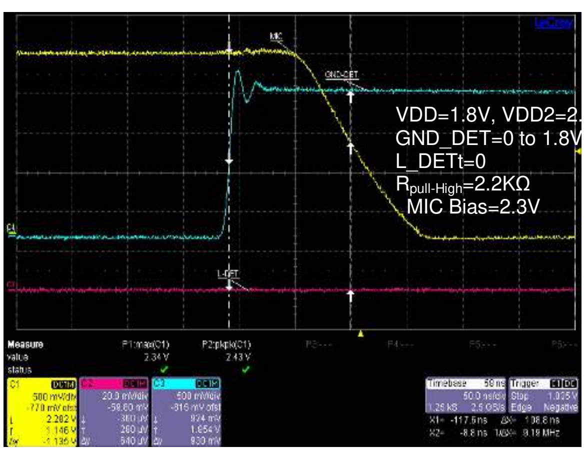
L_DET to DET Propagation Delay



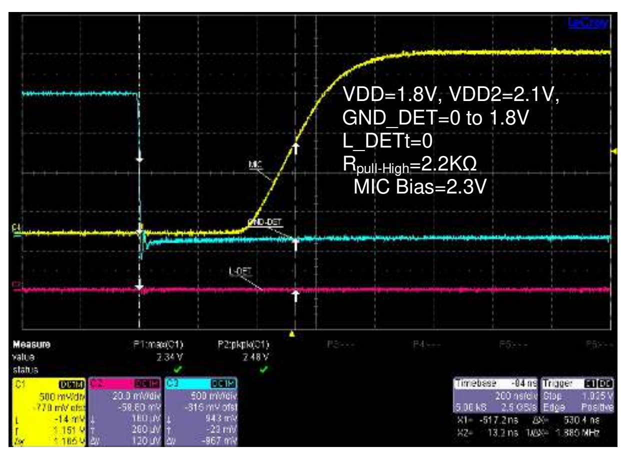
L_DET to DET Propagation Delay


GND_DET to DET Propagation Delay


GND_DET to DET Propagation Delay

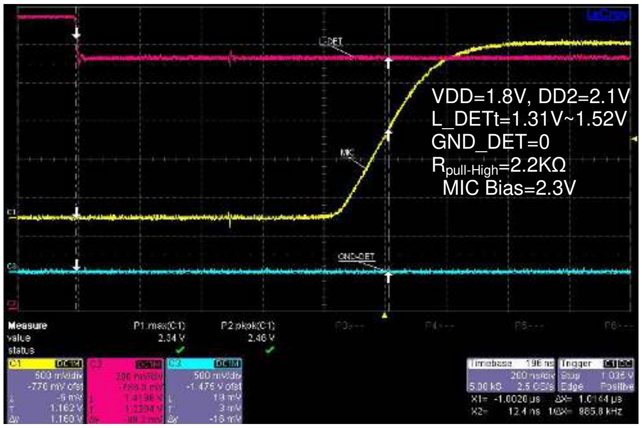


GND_DET to MIC Propagation Delay

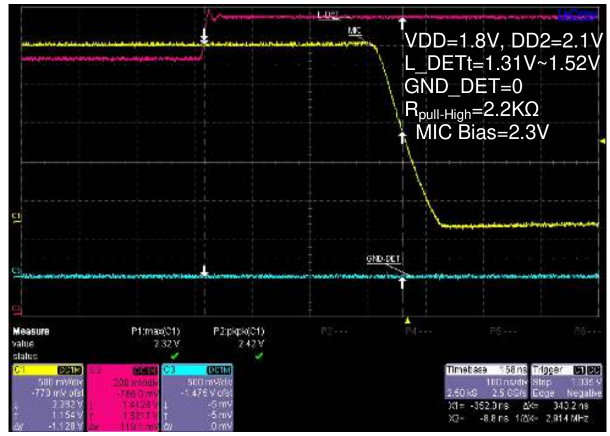


GND_DET to MIC Propagation Delay

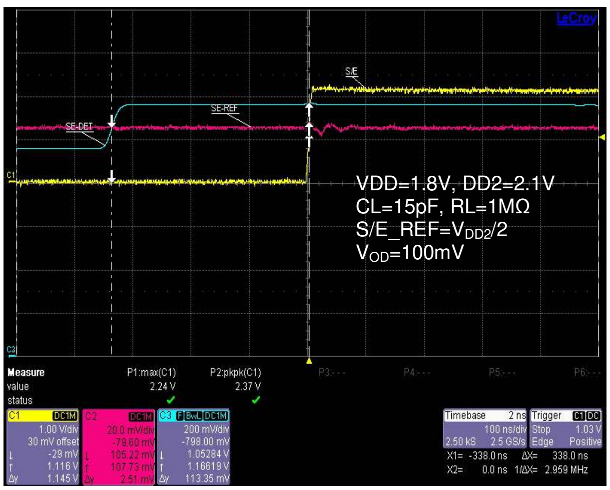
Performance Characteristics (Cont.) (Typical Values are referenced to V_{DD} = 1.8V, V_{DD2} = 2.1V, unless otherwise noted.)



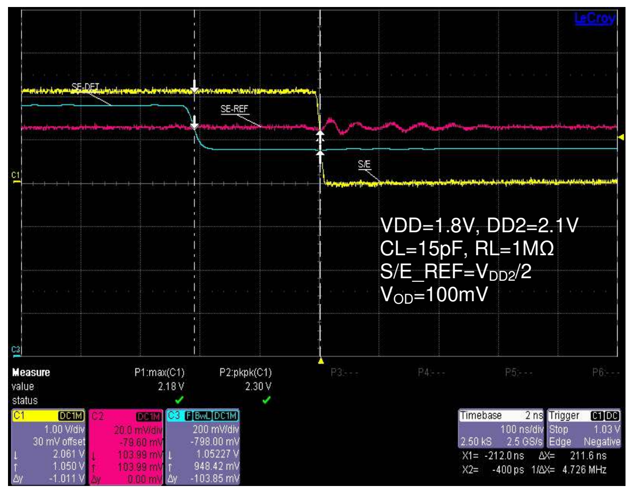
L_DET to MIC Propagation Delay



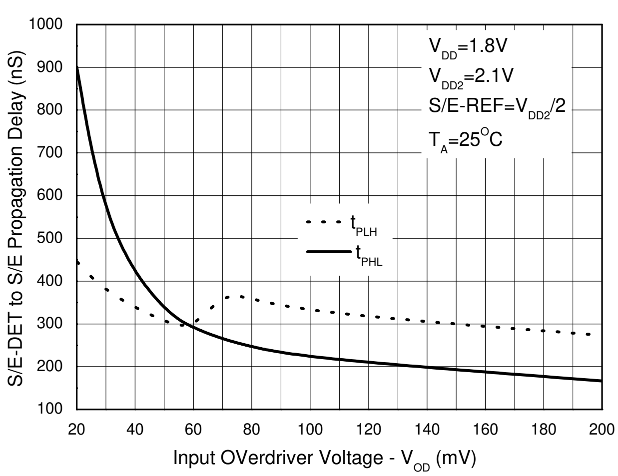
L_DET to MIC Propagation Delay



S/E Output Propagation Delay



S/E Output Propagation Delay



S/E Comparator Output Propagation Delay

Application Information

Supply Voltages

The AZV5002 works with a wide supply voltages range from 1.6V to 5.5V. V_{DD} should be powered up before V_{DD2}. The send/end detection comparator will not be functional unless V_{DD} and V_{DD2} are both applied. V_{DD2} can be connected to V_{DD} or to a separate supply voltage, such as the MIC bias voltage. Decoupling capacitors of 0.1uF should be placed as close as possible to each power supply pin.

Audio Jack Detection

TheAZV5002 is designed to simplify the detection of a stereo audio connector with a microphone contact. When the headset is not connected, the internal pull−up resistors on L_DET and GND_DET pull those pins high. When the headset is connected to the switched audio jack, the headset ground and left audio channel trigger L_DET and GND_DET to logic low.

The AZV5002 can work with either the CTIA or OMTP standard. In order to support both standards simultaneously, a cross point switch and additional circuitry is necessary to detect and swap the ground and microphone pins.

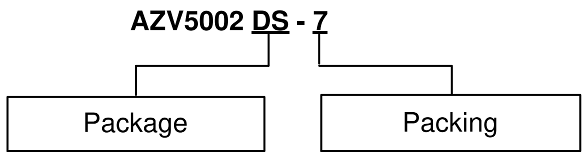
Send/End Button Press Detection

A second integrated comparator allows the send/end signal to be compared with a reference voltage to detect whether the send/end button has been pressed.

MIC Pin Biasing

The AZV5002 typical application circuit in Figure 2 shows the recommended 2.2KΩ pull-up resistor to the MIC bias voltage under supply voltage 1.8V condition. While the headset is not detected, the internal NMOS transistor is enabled to mute the MIC signal. If the MIC sink current is 1mA under system application, the MIC pin is pulled near 5.5mV when the headset is not present. The internal NMOS transistor is optimized to sink up to 2mA of current, allowing some flexibility in the selection of the pull-up resistor and MIC bias voltage.

Ordering Information (Note 5)



DS : U-QFN1418-10   7 : Tape & Reel

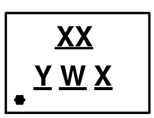
Part Number	Package Code	Packaging	7” Tape and Reel	
			Quantity	Part Number Suffix
AZV5002DS-7	DS	U-QFN1418-10	3000/Tape & Reel	-7

Note: 5. Pad layout as shown in Diodes Incorporated’s package outline PDFs, which can be found on our website at http://www.diodes.com/package-outlines.html.

Marking Information

U-QFN1418-10

(Top View)



XX : Identification Code
Y : Year : 0~9
W : Week : A~Z : 1~26 week;
a~z : 27~52 week; z represents 52 and 53 week
X : Internal Code

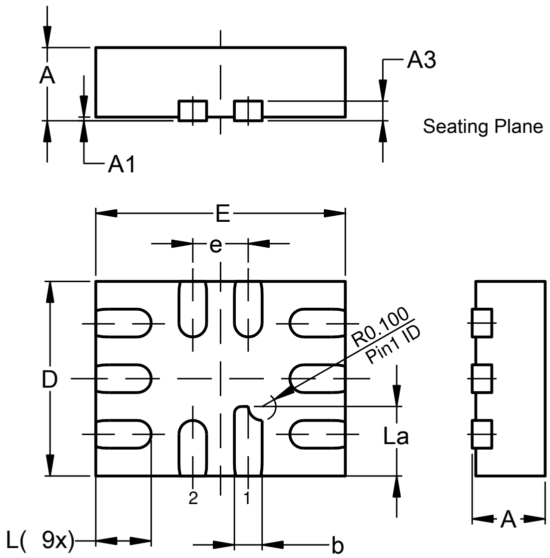
Part Number	Package	Identification Code
AZV5002DS-7	U-QFN1418-10	KG

NEW PRODUCT

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

U-QFN1418-10

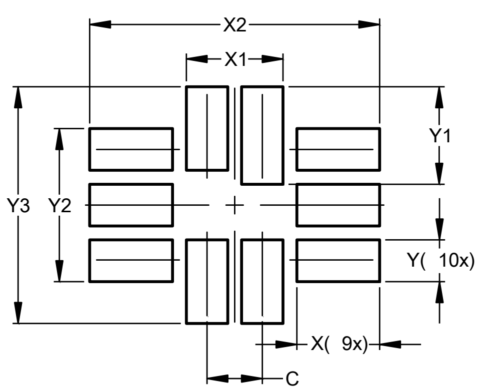


U-QFN1418-10			
Dim	**Min**	**Max**	**Typ**
A	0.45	0.55	0.50
A1	0.00	0.05	0.02
A3	--	--	0.13
b	0.15	0.25	0.20
D	1.35	1.45	1.40
E	1.75	1.85	1.80
e	--	--	0.40
L	0.35	0.45	0.40
La	0.45	0.55	0.50
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

U-QFN1418-10



Dimensions	Value (in mm)
C	0.400
X	0.600
X1	0.700
X2	2.100
Y	0.300
Y1	0.700
Y2	1.100
Y3	1.700

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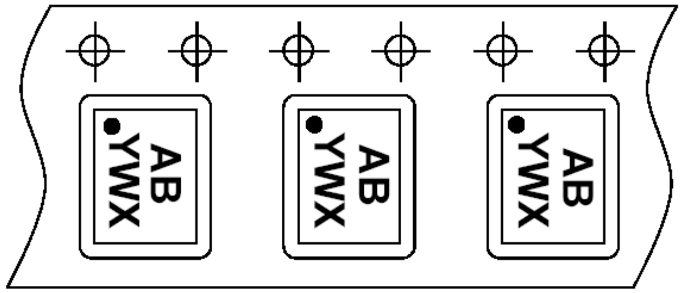
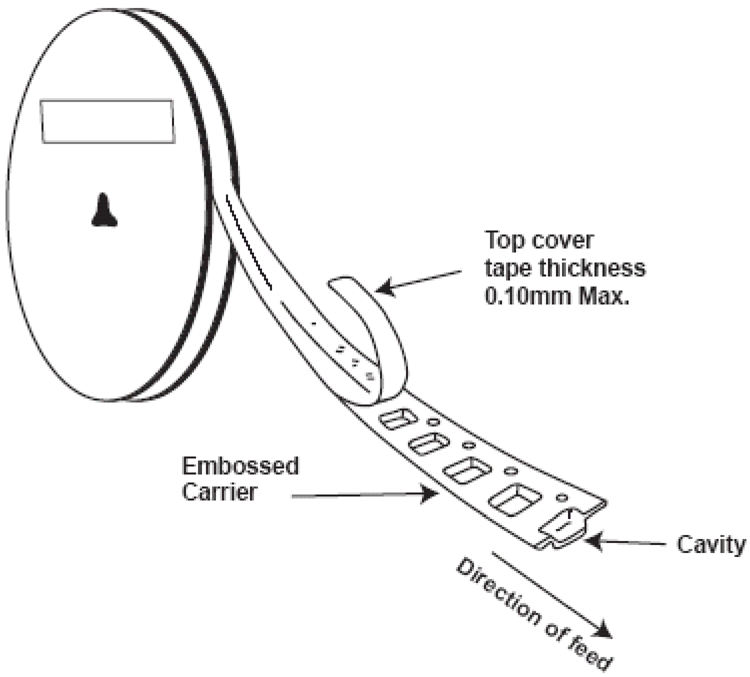
Taping Orientation (Note 6)

For U-QFN1418-10





Note: 6. The taping orientation of the other package type can be found on our website at http://www.diodes.com/datasheets/ap02007.pdf

NEW PRODUCT

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