

## Audio Jack Detector with Send / End Detect

### DESCRIPTION

The DG2592 is an audio jack detector and pop noise control switch IC. It integrates the circuits necessary to detect the presence of a stereo headset with a microphone and send / end control button.

When there is no ear phone detected, the DG2592 connects the microphone bias line to ground through the MIC pin. The DG2592 also gives a logic high signal to the baseband controller through the DET pin.

The DG2592 senses the DC levels at both L\_Detect and GND\_Detect. When an ear phone is plugged in, the voltage at both pins will go low. The DG2592 will indicate the presence of the ear phone by pulling DET low and the MIC switch will turn off.

The DG2592 is available in small miniQFN10 of 1.4 mm x 1.8 mm x 0.55 mm and ultra thin UTMQFN10 of 0.35 mm thickness.

### FEATURES

- Wide operating voltage range: 1.6 V to 5.5 V
- Low quiescent current of 10  $\mu$ A, max. at  $V_{DD} = 1.8$  V
- Integrated sense comparator for audio L of 1.4 V  $\pm$  5 % threshold
- 1.2  $\Omega$ /max. MIC bias switch provides quick discharge and clamping
- ESD Protected
  - Human body model > 8 kV
  - Charged device model > 2 kV
  - IEC 61000-4-2 air discharge > 15 kV
  - IEC 61000-4-2 contact discharge > 8 kV
- Ultra thin and compact miniQFN10 and UTMQFN10
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
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### APPLICATIONS

- Cellular phones
- Tablet devices
- Portable media players
- Digital cameras

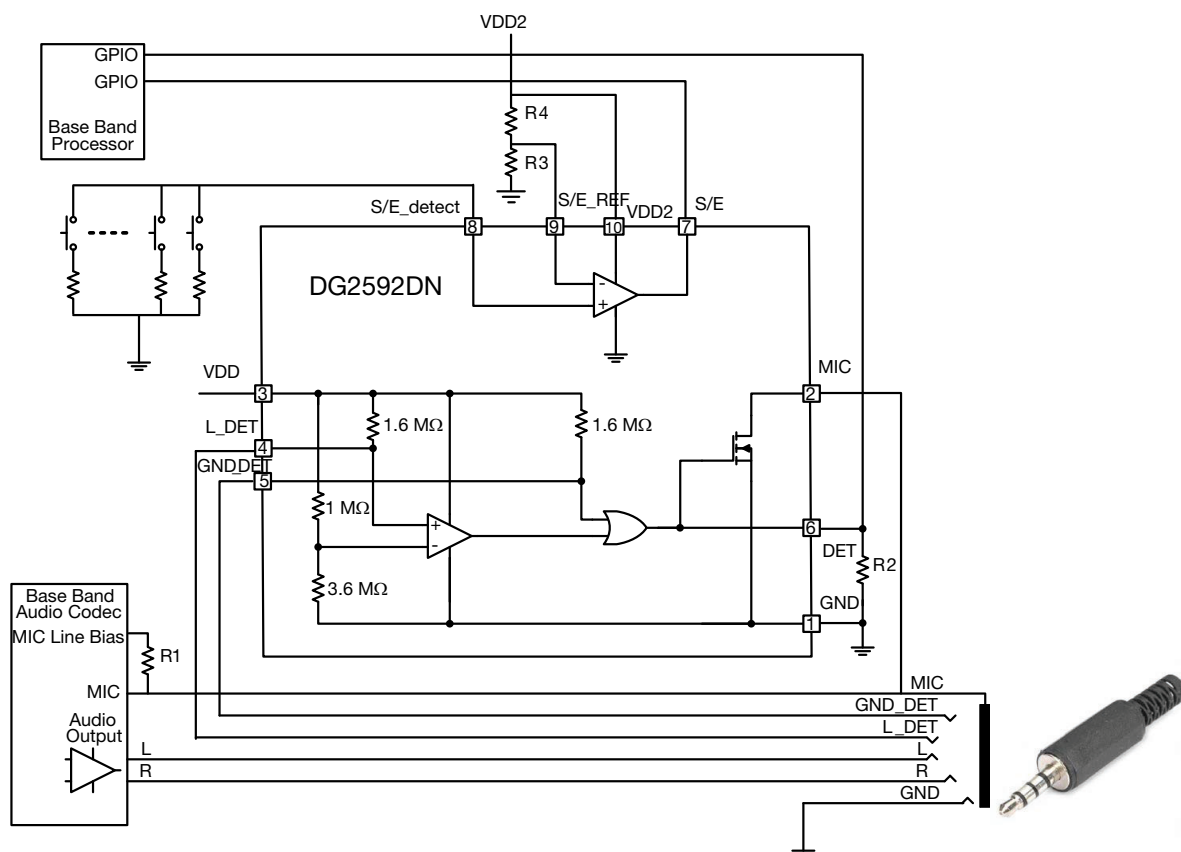


Fig. 1 - Typical Application Circuit

## PACKAGE OUTLINE

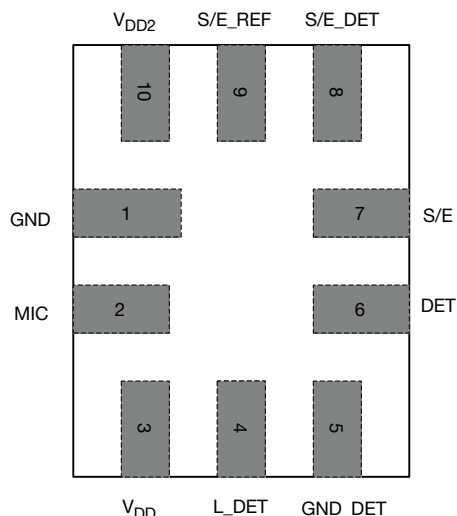
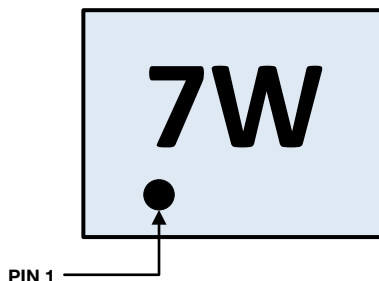


Fig. 2 - Device Pin Out miniQFN10 Top View, Pin 1 Dot Marking is on Top of the Device

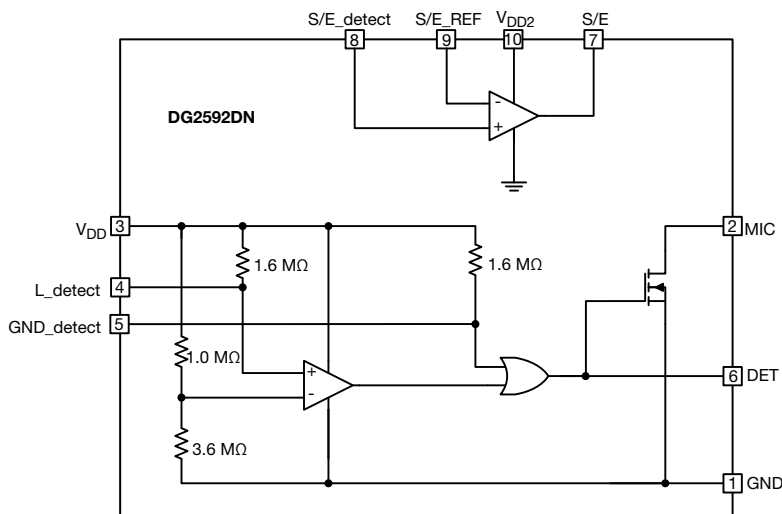
| PIN DESCRIPTION |                  |        |                                                                                                                                        |
|-----------------|------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------|
| PIN#            | NAME             | TYPE   | FUNCTION                                                                                                                               |
| 1               | GND              | Power  | Ground                                                                                                                                 |
| 2               | MIC              | Output | Microphone bias switch input                                                                                                           |
| 3               | V <sub>DD</sub>  | Power  | Power supply for ear jack plug in detection circuit. A bypass capacitor of 0.1 $\mu$ F is recommended as close as possible to this pin |
| 4               | L_DET            | Input  | Connected to L_DET pin at audio jack                                                                                                   |
| 5               | GND_DET          | Input  | Connect to GND_DET pin at audio jack                                                                                                   |
| 6               | DET              | Output | Detect logic output connected to baseband controller                                                                                   |
| 7               | S/E              | Output | S/E detect comparator output                                                                                                           |
| 8               | S/E_DET          | Input  | Non-inverting input of S/E press detection comparator                                                                                  |
| 9               | S/E_REF          | Input  | Inverting input of S/E press detection comparator. External voltage is provided as press detection reference threshold                 |
| 10              | V <sub>DD2</sub> | Power  | Power supply pin for the S/E detection circuit. A bypass capacitor of 0.1 $\mu$ F is recommended as close as possible to this pin      |

| ORDERING INFORMATION |                                     |                   |            |                           |               |
|----------------------|-------------------------------------|-------------------|------------|---------------------------|---------------|
| PART NUMBER          | FUNCTION                            | TEMPERATURE RANGE | PACKAGE    | SIZE                      | REEL QUANTITY |
| DG2592DN-T1-GE4      | Audio jack detector with S/E detect | -40 °C to 85 °C   | miniQFN-10 | 1.4 mm x 1.8 mm x 0.55 mm | 3000          |
| DG2592DN1-T1-GE4     |                                     |                   | UTMQFN-10  | 1.4 mm x 1.8 mm x 0.35 mm | 3000          |

## DEVICE MARKING



7 = DG2592 Marking Code, W = Date / Lot Traceability Code


**Fig. 3 - Functional Block Diagram**
**TRUTH TABLE**

| INPUTS |         | OUTPUTS |      | AUDIO JACK   |
|--------|---------|---------|------|--------------|
| L_DET  | GND_DET | DET     | MIC  |              |
| 0      | 0       | Low     | High | Detected     |
| 1      | 0       | High    | Low  | Not detected |
| 0      | 1       | High    | Low  | Not detected |
| 1      | 1       | High    | Low  | Not detected |

**ABSOLUTE MAXIMUM RATINGS**

| PINS OR PARAMETERS                 | CONDITIONS                                              | LIMITS                     | UNIT  |
|------------------------------------|---------------------------------------------------------|----------------------------|-------|
| V <sub>DD</sub> , V <sub>DD2</sub> | Reference to GND                                        | -0.3 to 6                  | V     |
| L_Detect, GND_Detect, DET          | Reference to GND                                        | -0.3 V to V <sub>DD</sub>  |       |
| S/E_DET, S/E_REF, S/E              | Reference to GND                                        | -0.3 V to V <sub>DD2</sub> |       |
| MIC                                |                                                         | -0.3 to 6                  |       |
| Storage Temperature                |                                                         | -65 to +150                | °C    |
| MSL                                | Moisture sensitivity level (JEDEC® J-STD-020)           | 1                          | Level |
| I <sub>MIC</sub>                   | Switch DC current                                       | 200                        | mA    |
| I <sub>MICPEAK</sub>               | Switch peak current (pulsed at 1 ms, < 10 % duty cycle) | 500                        |       |
| Latch Up Current                   | JESD78                                                  | ± 600                      |       |
| ESD                                | Human body model; ANSI / ESDA / JEDEC JS-001            | > 8000                     | V     |
|                                    | Charged device model; JESD22-C101                       | > 2000                     |       |
|                                    | Machine model; JESD22-A115                              | > 400                      |       |
|                                    | IEC61000-2-4, level 4                                   | > 8000                     |       |
|                                    | L_DET, GND_DET, MIC and GND pins                        | > 15 000                   |       |

**RECOMMENDED OPERATING CONDITION**

|                                    |                       |    |
|------------------------------------|-----------------------|----|
| V <sub>DD</sub> , V <sub>DD2</sub> | 1.6 to 5.5            | V  |
| Ear Jack Detection Input Pins      | 0 to V <sub>DD</sub>  | V  |
| S/E Press Detection Input Pins     | 0 to V <sub>DD2</sub> | V  |
| MIC Bias Voltage                   | 0 to 5.5              | V  |
| Operating Junction Temperature     | -40 to +125           | °C |

**Note**

- The control logic pins should not float and should be set to either high or low logic levels.

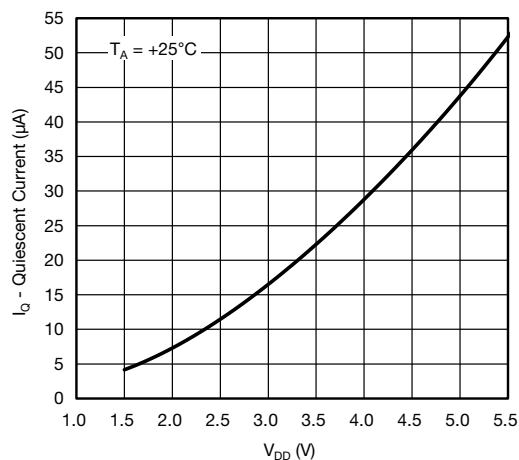
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

**ELECTRICAL CHARACTERISTICS**

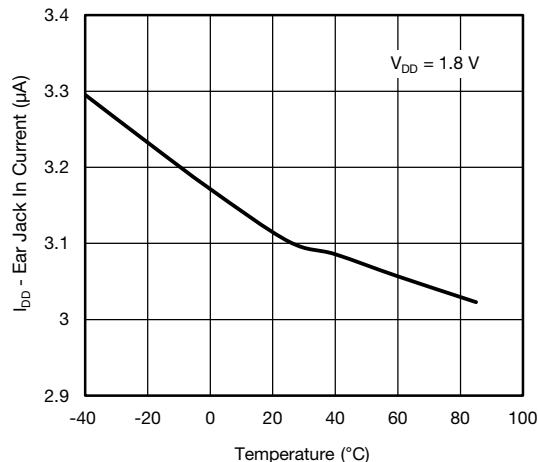
| PARAMETER                        | SYMBOL          | TEST CONDITION                                                                                                                                                                                                  | LIMITS |      |      | UNIT          |
|----------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|------|---------------|
|                                  |                 | UNLESS OTHERWISE SPECIFIED,<br>$V_{DD} = 1.8\text{ V}$ , $V_{DD2} = 2.1\text{ V}$ , $T_A = -40\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$ ,<br>TYPICAL VALUES are at $25\text{ }^{\circ}\text{C}$ | MIN.   | TYP. | MAX. |               |
| Quiescent Current                | $I_Q$           | L_DETECT, GND_DETECT are open                                                                                                                                                                                   | -      | 6    | 10   | $\mu\text{A}$ |
| Ear Jack In Current              | $I_{DD}$        | L_DETECT, GND_DETECT are connected with $10\text{ k}\Omega$ to GND                                                                                                                                              | -      | 3    | 6    |               |
| S/E Detection Current            | $I_{DD2}$       | S/E_DET = $0\text{ V}$ , S/E_REF = $1.05\text{ V}$                                                                                                                                                              | -      | 2    | 3.5  |               |
| L_DETECT Reference Voltage       | $V_{TH\_L}$     | L_DET switching low to high                                                                                                                                                                                     | 1.33   | 1.4  | 1.5  | V             |
| Propagation Delay to DET         | $t_{PLH}$       | $C_{OUT} = 15\text{ pF}$ , GND_DET = $0\text{ V}$ ,<br>L_DET = $1.52\text{ V}$ to DET = $0.9\text{ V}$                                                                                                          | 80     | 149  | 300  | ns            |
| Propagation Delay to DET         | $t_{PHL}$       | $C_{OUT} = 15\text{ pF}$ , GND_DET = $0\text{ V}$ ,<br>L_DET = $1.31\text{ V}$ to DET = $0.9\text{ V}$                                                                                                          | 130    | 325  | 550  |               |
| Low Voltage L_DET Leakage        | $I_{L\_DET}$    | L_DET = $0\text{ V}$                                                                                                                                                                                            | -      | 0.84 | 2    | $\mu\text{A}$ |
| High Voltage L_DET Leakage       | $I_{H\_DET}$    | L_DET = $1.8\text{ V}$                                                                                                                                                                                          | -      | 30   | -    | pA            |
| L_DET Input Capacitance          | $C_{L\_DET}$    |                                                                                                                                                                                                                 | -      | 4    | -    | pF            |
| GND_DETECT Logic Low Voltage     | $V_{IL\_GND}$   |                                                                                                                                                                                                                 | 0.63   | 0.86 | -    | V             |
| GND_DETECT Logic High Voltage    | $V_{IH\_GND}$   |                                                                                                                                                                                                                 | -      | 0.89 | 1.17 |               |
| GND_DET Propagation Delay to DET | $t_{PGND\_DET}$ | $C_{OUT} = 15\text{ pF}$ , $R_L = 1\text{ M}\Omega$ , L_DET = $0\text{ V}$ ,<br>GND_DET switches between $0\text{ V}$ and $1.8\text{ V}$                                                                        | -      | 10   | -    | ns            |
| Low Voltage GND_DET Leakage      | $I_{IL}$        | GND_DET = $0\text{ V}$                                                                                                                                                                                          | -      | 0.93 | 2    | $\mu\text{A}$ |
| High Voltage GND_DET Leakage     | $I_{IH}$        | GND_DET = $1.8\text{ V}$                                                                                                                                                                                        | -      | 80   | -    | pA            |
| GND_DET Input Capacitance        | $C_{G\_DET}$    | $f = 1\text{ MHz}$                                                                                                                                                                                              | -      | 3.5  | -    | pF            |
| MIC Pull Down Resistance         | $R_{MIC}$       | $I_{MIC} = 1\text{ mA}$ L_DETECT, GND_DETECT = open                                                                                                                                                             | -      | -    | 1.25 | $\Omega$      |
| MIC Leakage                      |                 | $V_{MIC} = 2.4\text{ V}$                                                                                                                                                                                        | -1     | -    | 1    | $\mu\text{A}$ |
| DET Pull Up Resistance           | $R_{OUTH}$      | L_DETECT, GND_DETECT = open                                                                                                                                                                                     | -      | 135  | 200  | $\Omega$      |
| DET Pull Down Resistance         | $R_{OUTL}$      | L_DETECT, GND_DETECT are connected with $10\text{ k}\Omega$ to GND                                                                                                                                              | -      | 120  | 200  |               |
| DET High Logic Voltage           | $V_{OUTH}$      | $I_{DET} = 0.1\text{ mA}$ , L_DETECT, GND_DETECT = open                                                                                                                                                         | 1.6    | -    | -    | V             |
| DET Low Logic Voltage            | $V_{OUTL}$      | $I_{DET} = 0.1\text{ mA}$ , L_DETECT, GND_DETECT are connected with<br>$10\text{ k}\Omega$ to GND                                                                                                               | -      | -    | 0.3  |               |
| DET Rise Time                    | $t_{DET\_R}$    | $C_{OUT} = 15\text{ pF}$ , $R_L = 1\text{ M}\Omega$ , DET = $10\%$ to $90\%$                                                                                                                                    | -      | 14   | -    | ns            |
| DET Fall Time                    | $t_{DET\_F}$    | $C_{OUT} = 15\text{ pF}$ , $R_L = 1\text{ M}\Omega$ , DET = $90\%$ to $10\%$                                                                                                                                    | -      | 4.4  | -    |               |
| Propagation Delay to S/E         | $t_{PS/E}$      | $C_{OUT} = 15\text{ pF}$ , $R_L = 1\text{ M}\Omega$ , $V_{CM} = \text{mid-supply}$ ,<br>$100\text{ mV}$ overdrive                                                                                               | 50     | 170  | 500  |               |
| Input Leakage                    | $I_{SE\_IN}$    | $V_{CM} = 0.9\text{ V}$                                                                                                                                                                                         | -      | 4    | -    | pA            |
| Input Capacitance                | $C_{SE\_IN}$    | $f = 1\text{ MHz}$                                                                                                                                                                                              | -      | 3.5  | -    | pF            |
| Voltage Output Low               | $V_{OL}$        | $I_{OL} = 0.1\text{ mA}$                                                                                                                                                                                        | -      | -    | 0.2  | V             |
| Voltage Output High              | $V_{OH}$        | $I_{OH} = 0.1\text{ mA}$                                                                                                                                                                                        | 1.9    | -    | -    |               |
| Rise Time                        | $t_{S/E\_R}$    | $C_{OUT} = 15\text{ pF}$ , $R_L = 1\text{ M}\Omega$ , S/E = $10\%$ to $90\%$                                                                                                                                    | -      | 16   | -    | ns            |
| Fall Time                        | $t_{S/E\_F}$    | $C_{OUT} = 15\text{ pF}$ , $R_L = 1\text{ M}\Omega$ , S/E = $90\%$ to $10\%$                                                                                                                                    | -      | 12.1 | -    |               |



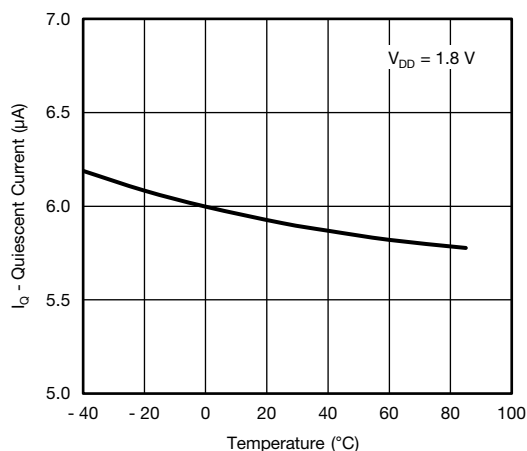
**TYPICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)



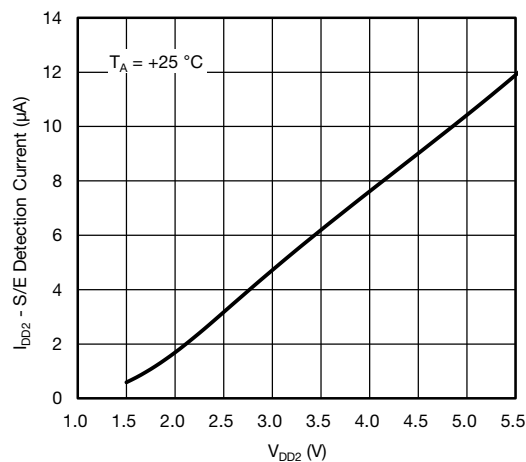
Quiescent Current vs.  $V_{DD}$



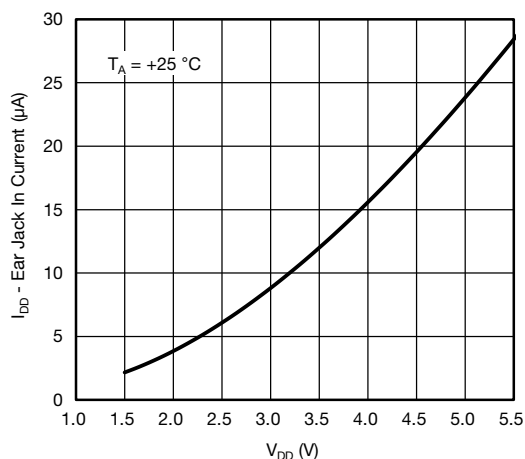
Ear Jack In Current vs. Temperature



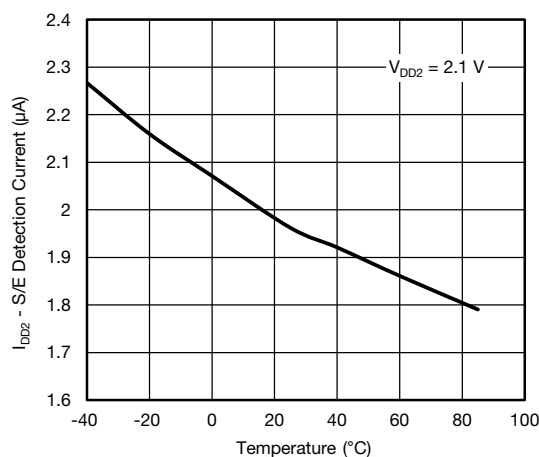
Quiescent Current vs. Temperature



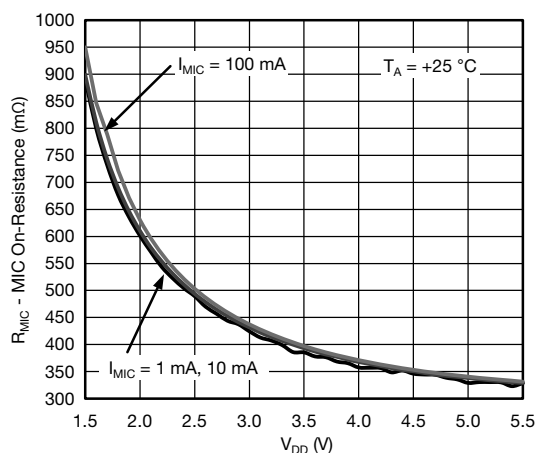
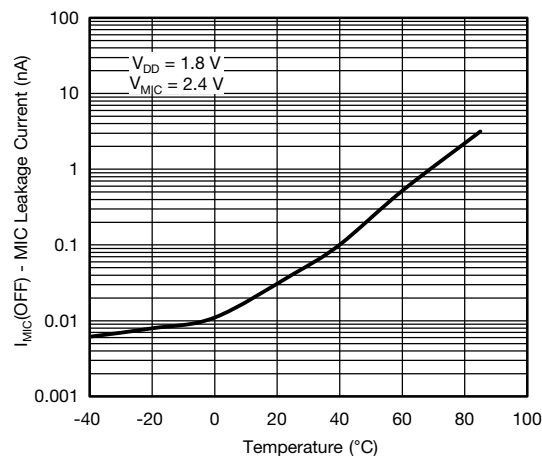
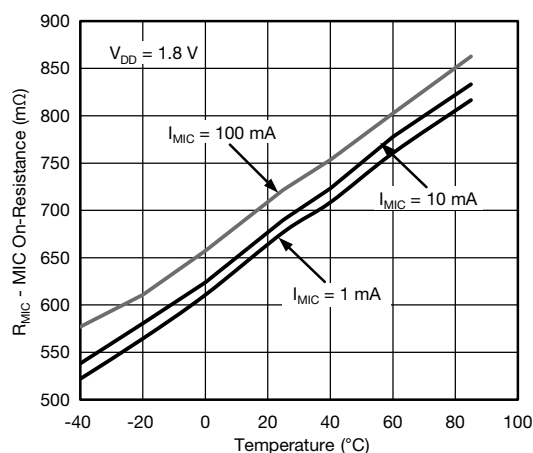
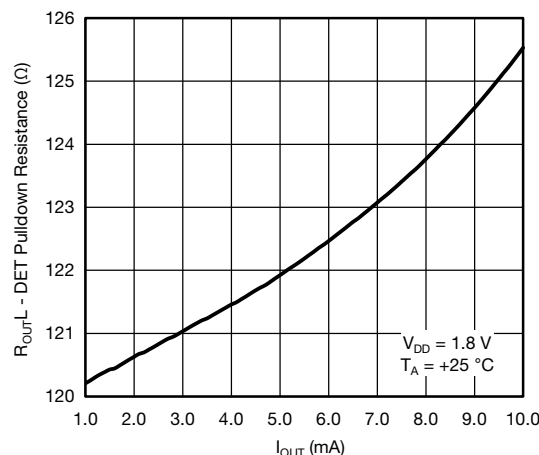
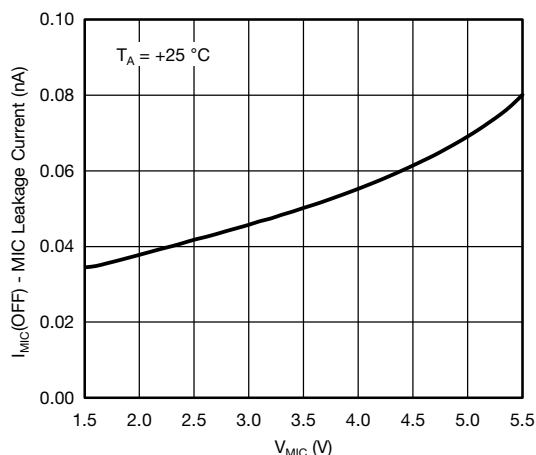
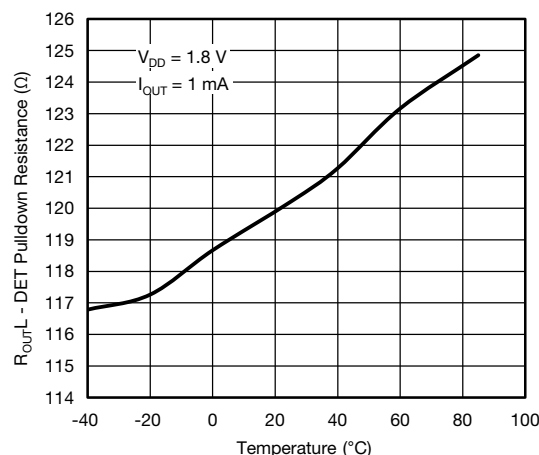
S/E Detection Current vs.  $V_{DD2}$

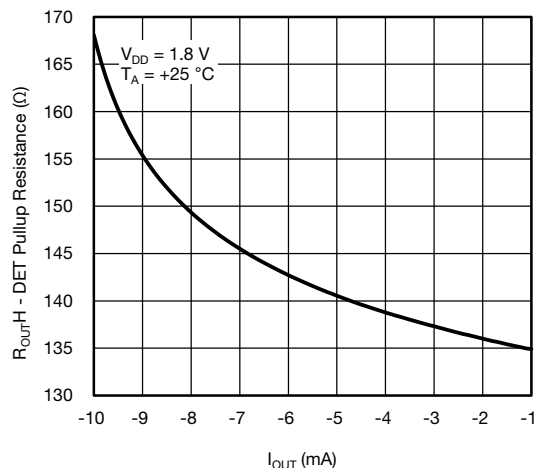
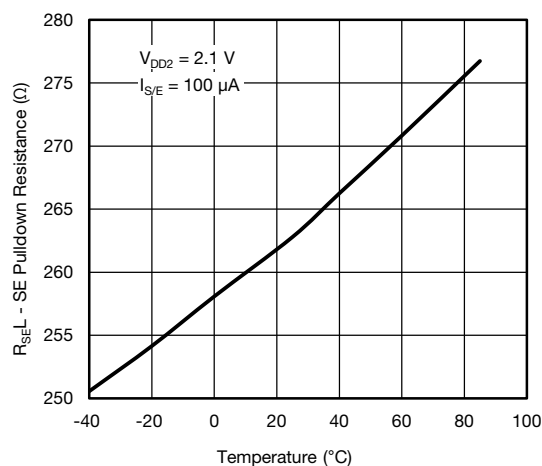
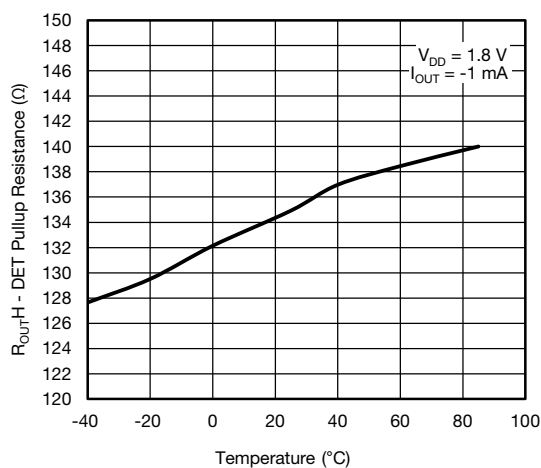
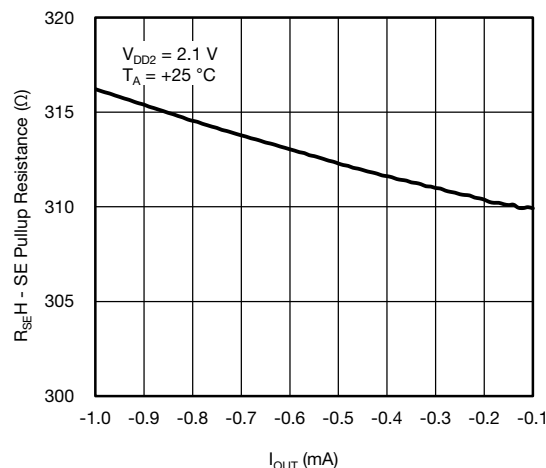
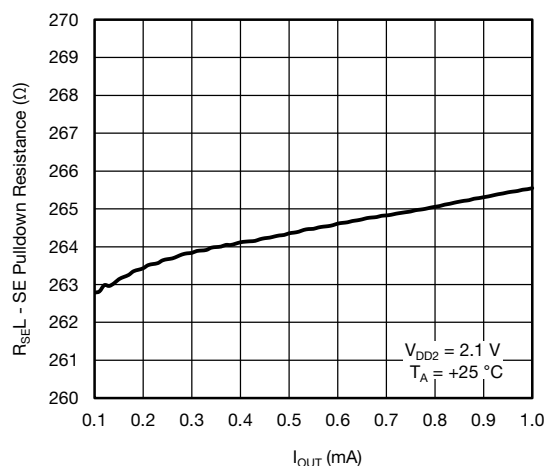
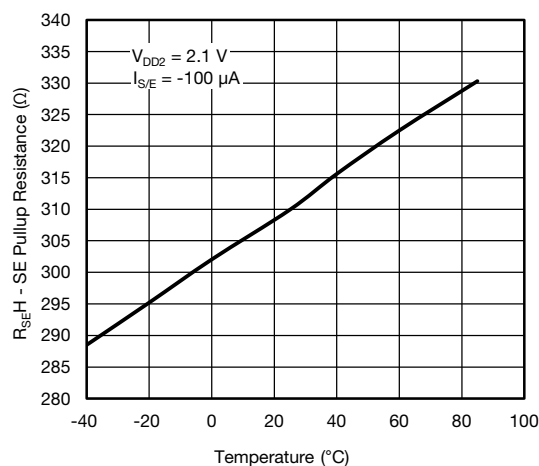


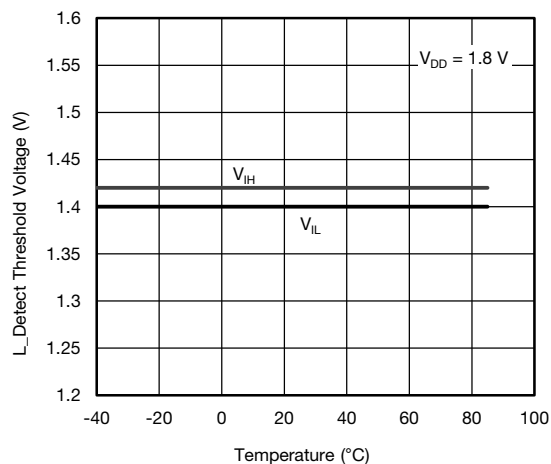
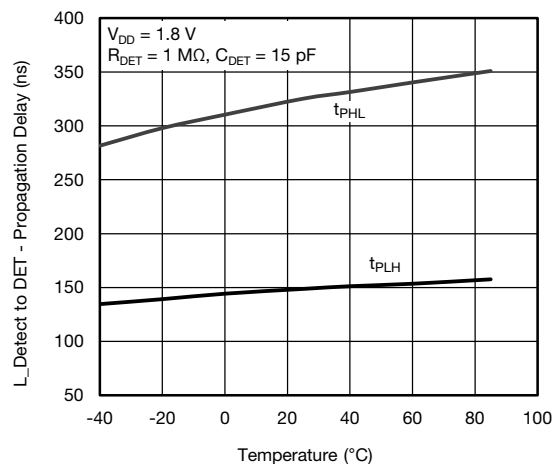
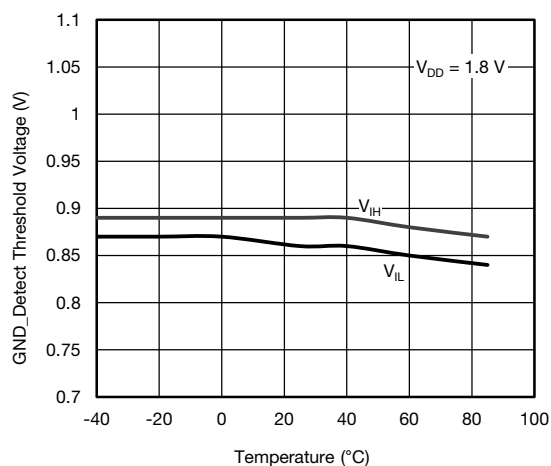
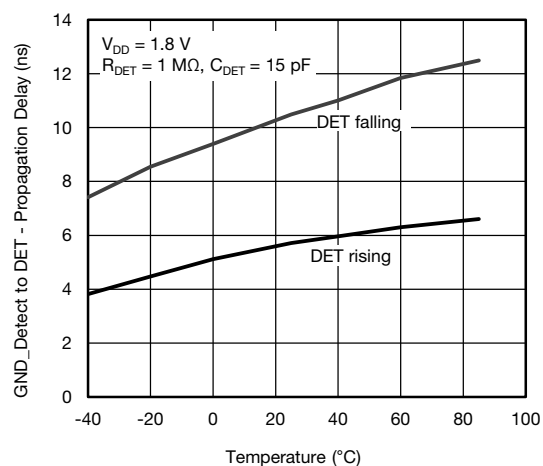
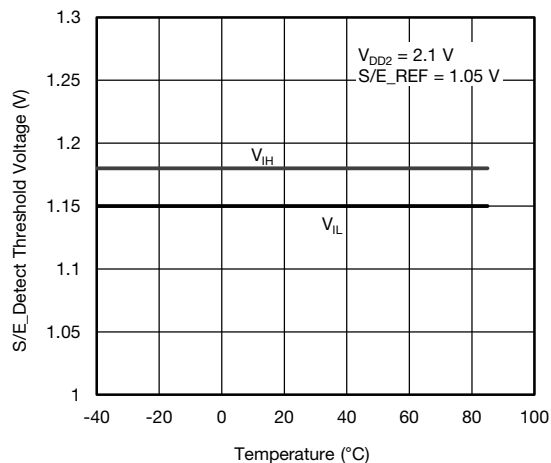
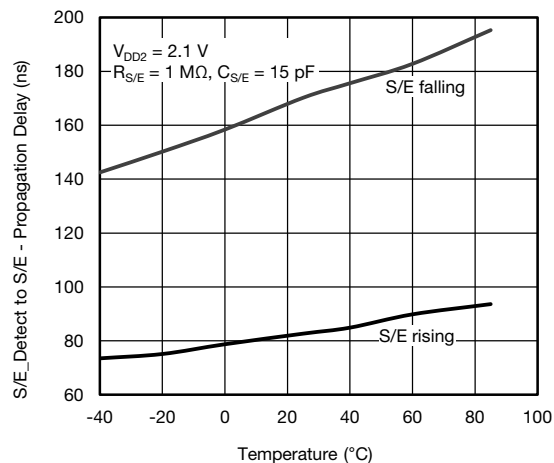
Ear Jack In Current vs.  $V_{DD}$



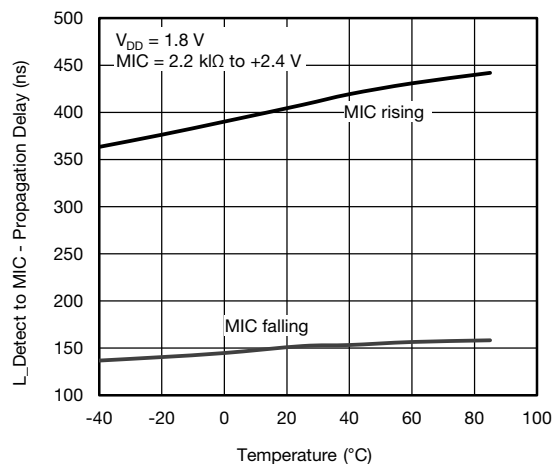
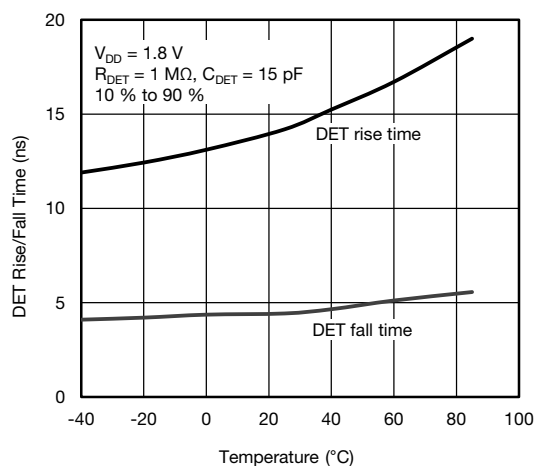
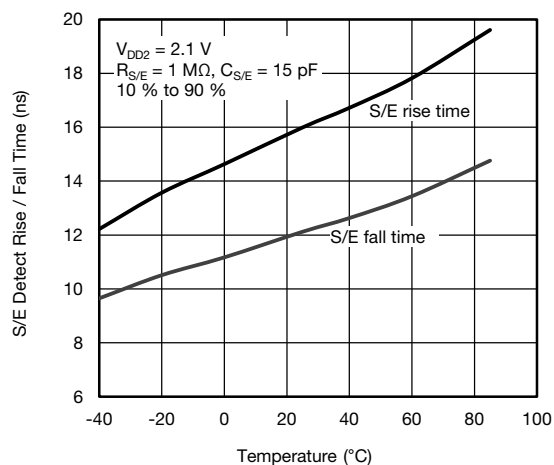
S/E Detection Current vs. Temperature

**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

**MIC On Resistance vs.  $V_{DD}$** 

**MIC Leakage Current vs. Temperature**

**MIC On Resistance vs. Temperature**

**DET Pulldown Resistance vs.  $I_{OUT}$** 

**MIC Leakage Current vs.  $V_{MIC}$** 

**DET Pulldown Resistance vs. Temperature**

**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

**DET Pullup Resistance vs.  $I_{OUT}$** 

**SE Pulldown Resistance vs. Temperature**

**DET Pullup Resistance vs. Temperature**

**SE Pullup Resistance vs.  $I_{OUT}$** 

**SE Pulldown Resistance vs.  $I_{OUT}$** 

**SE Pullup Resistance vs. Temperature**

**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

**L\_Detect Threshold Voltage vs. Temperature**

**L\_Detect to DET Propagation Delay vs. Temperature**

**GND\_Detect Threshold Voltage vs. Temperature**

**GND\_Detect to DET Propagation Delay vs. Temperature**

**S/E\_Detect Threshold Voltage vs. Temperature**

**S/E\_Detect to S/E Propagation Delay vs. Temperature**



**TYPICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)

**L\_Detect to MIC Propagation Delay vs. Temperature**

**DET Rise / Fall Time vs. Temperature**

**S/E\_Detect to Rise / Fall Time vs. Temperature**

## TEST CIRCUIT

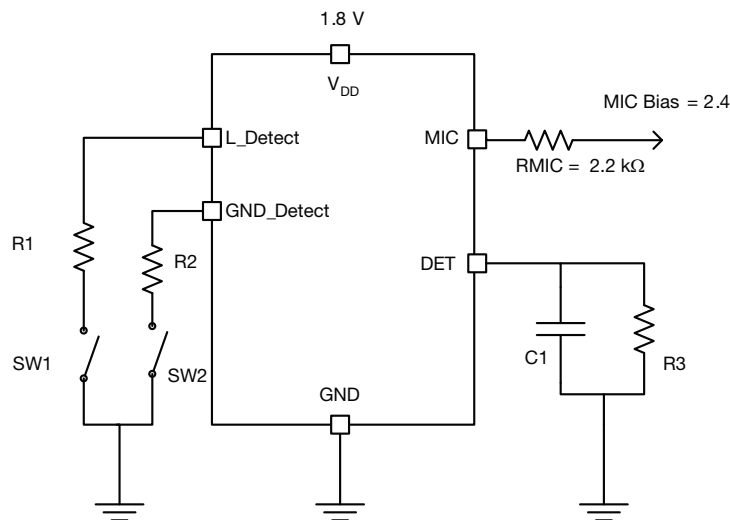


Fig. 4 - Test Circuit

## TIMING DIAGRAM

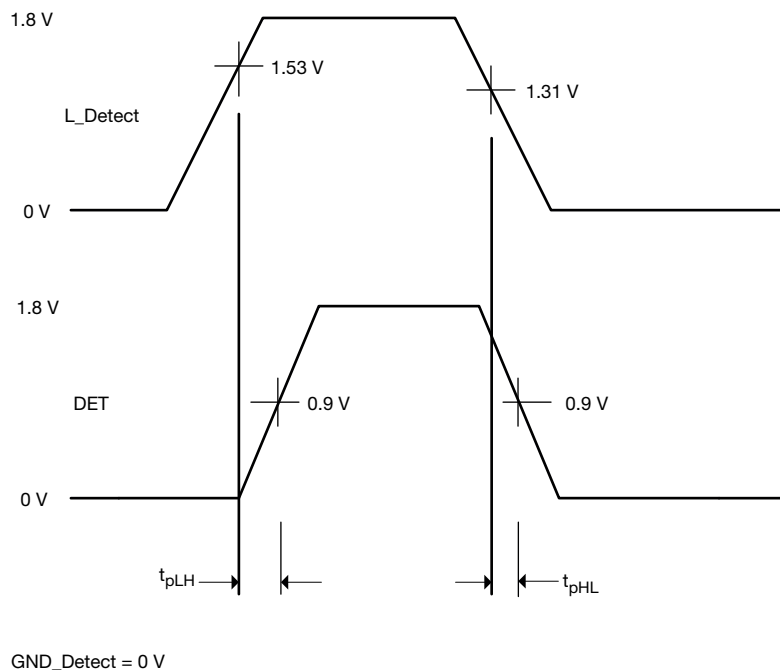


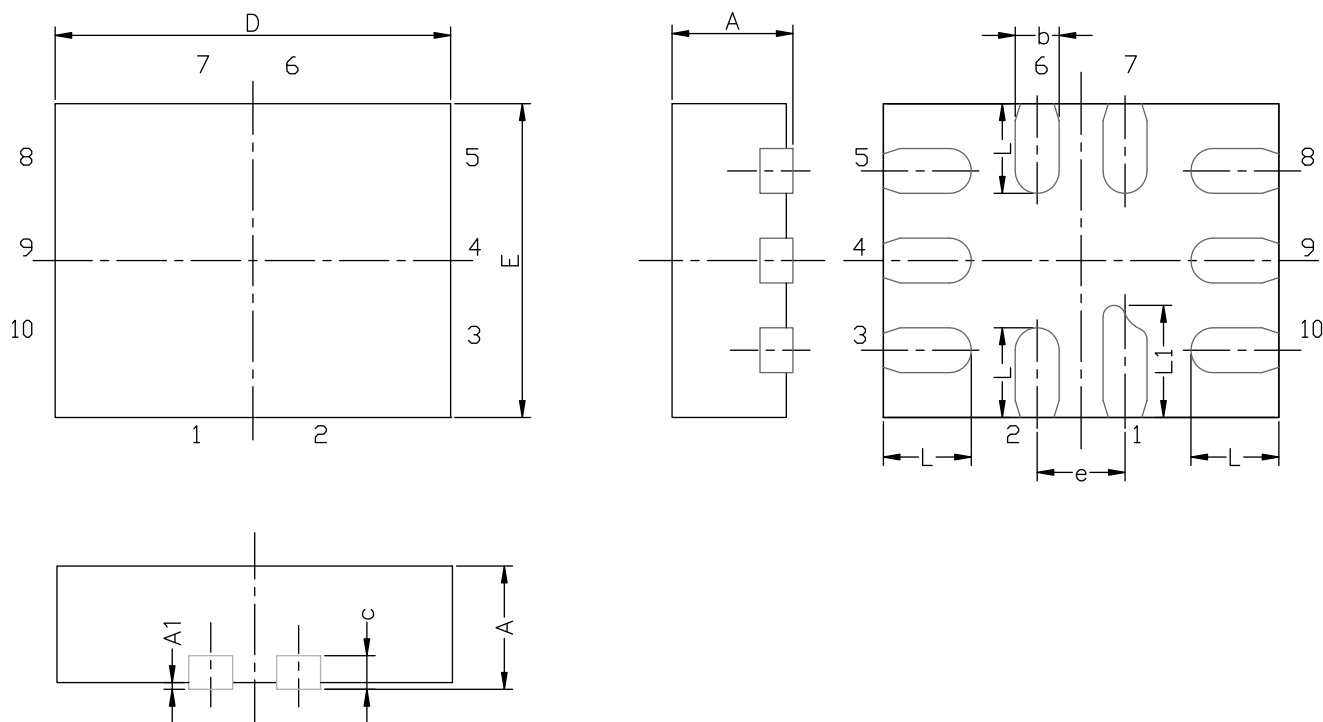
Fig. 5 - Timing Diagram



| PRODUCT SUMMARY                   |                      |
|-----------------------------------|----------------------|
| Part number                       | DG2592               |
| Status code                       | 2                    |
| Configuration                     | Audio jack detection |
| Single supply min. (V)            | 1.6                  |
| Single supply max. (V)            | 5.5                  |
| Dual supply min. (V)              | -                    |
| Dual supply max. (V)              | -                    |
| On-resistance ( $\Omega$ )        | -                    |
| Charge injection (pC)             | -                    |
| Source on capacitance (pF)        | -                    |
| Source off capacitance (pF)       | -                    |
| Leakage switch on typ. (nA)       | -                    |
| Leakage switch off max. (nA)      | -                    |
| -3 dB bandwidth (MHz)             | -                    |
| Package                           | miniQFN-10           |
| Functional circuit / applications | Audio                |
| Interface                         | Binary               |
| Single supply operation           | Yes                  |
| Dual supply operation             | No                   |
| Turn on time max. (ns)            | -                    |
| Crosstalk and off isolation       | -                    |

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?62970](http://www.vishay.com/ppg?62970).

## MINI QFN-10L CASE OUTLINE



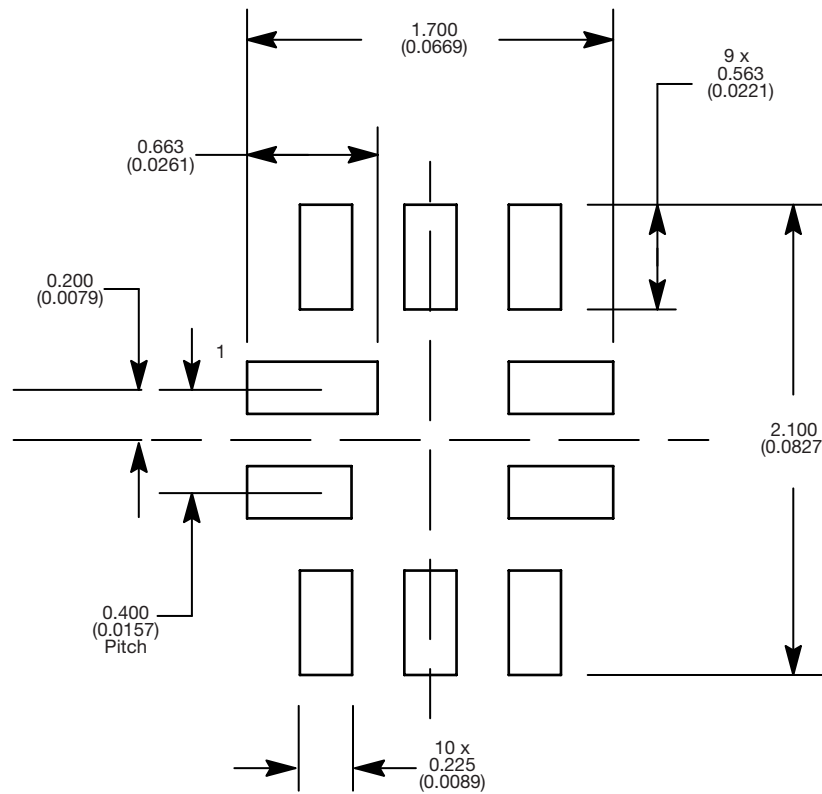
| DIM | MILLIMETERS                       |      |      | INCHES                            |        |        |
|-----|-----------------------------------|------|------|-----------------------------------|--------|--------|
|     | MIN.                              | NAM. | MAX. | MIN.                              | NAM.   | MAX.   |
| A   | 0.45                              | 0.55 | 0.60 | 0.0177                            | 0.0217 | 0.0236 |
| A1  | 0.00                              | -    | 0.05 | 0.000                             | -      | 0.002  |
| b   | 0.15                              | 0.20 | 0.25 | 0.006                             | 0.008  | 0.010  |
| c   | 0.150 or 0.127 REF <sup>(1)</sup> |      |      | 0.006 or 0.005 REF <sup>(1)</sup> |        |        |
| D   | 1.70                              | 1.80 | 1.90 | 0.067                             | 0.071  | 0.075  |
| E   | 1.30                              | 1.40 | 1.50 | 0.051                             | 0.055  | 0.059  |
| e   | 0.40 BSC                          |      |      | 0.016 BSC                         |        |        |
| L   | 0.35                              | 0.40 | 0.45 | 0.014                             | 0.016  | 0.018  |
| L1  | 0.45                              | 0.50 | 0.55 | 0.0177                            | 0.0197 | 0.0217 |

### Note

<sup>(1)</sup> The dimension depends on the leadframe that assembly house used.

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## RECOMMENDED MINIMUM PADS FOR MINI QFN 10L



Mounting Footprint  
Dimensions in mm (inch)



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