



10-/8-BIT, 3-MSPS, MICRO-POWER, MINIATURE SAR ANALOG-TO-DIGITAL CONVERTERS

FEATURES

- 3-MHz Sample Rate Serial Device
- 10-Bit Resolution – ADS7884
- 8-Bit Resolution – ADS7885
- Zero Latency
- 48-MHz Serial Interface
- Supply Range: 2.7 V to 5.5 V
- Low Power Dissipation:
 - 6.8 mW at 3-V V_{DD} , 2.5 MSPS
 - 15 mW at 5-V V_{DD} , 3 MSPS
- ± 0.3 LSB INL, ± 0.3 LSB DNL – ADS7884
- ± 0.15 LSB INL, ± 0.1 LSB DNL – ADS7885
- 61.7 dB SINAD, –81 dB THD – ADS7884
- 49.8 dB SINAD, –68 dB THD – ADS7885
- Unipolar Input Range: 0 V to V_{DD}
- Powerdown Current: 1 μ A
- Wide Input Bandwidth: 30 MHz at 3 dB
- 6-Pin SOT23 Package

APPLICATIONS

- Base Band Converters in Radio Communication
- Motor Current/Bus Voltage Sensors in Digital Drives
- Optical Networking (DWDM, MEMS Based Switching)
- Optical Sensors
- Battery Powered Systems
- Medical Instrumentations
- High-Speed Data Acquisition Systems
- High-Speed Closed-Loop Systems

DESCRIPTION

The ADS7884 is a 10-bit, 3-MSPS analog-to-digital converter (ADC), and the ADS7885 is a 8-bit, 3-MSPS ADC. The devices include a capacitor based SAR A/D converter with inherent sample and hold. The serial interface in each device is controlled by the \overline{CS} and SCLK signals for glueless connections with microprocessors and DSPs. The input signal is sampled with the falling edge of \overline{CS} , and SCLK is used for conversion and serial data output.

The devices operate from a wide supply range from 2.7 V to 5.5 V. The low power consumption of the devices make them suitable for battery-powered applications. The devices also include a power saving powerdown feature for when the devices are operated at lower conversion speeds.

The high level of the digital input to the device is not limited to device V_{DD} . This means the digital input can go as high as 5.5 V when device supply is 2.7 V. This feature is useful when digital signals are coming from other circuit with different supply levels. Also this relaxes restriction on power up sequencing.

The ADS7884 and ADS7885 are available in a 6-pin SOT23 package and are specified for operation from –40°C to 125°C.

Micro-Power Miniature SAR Converter Family

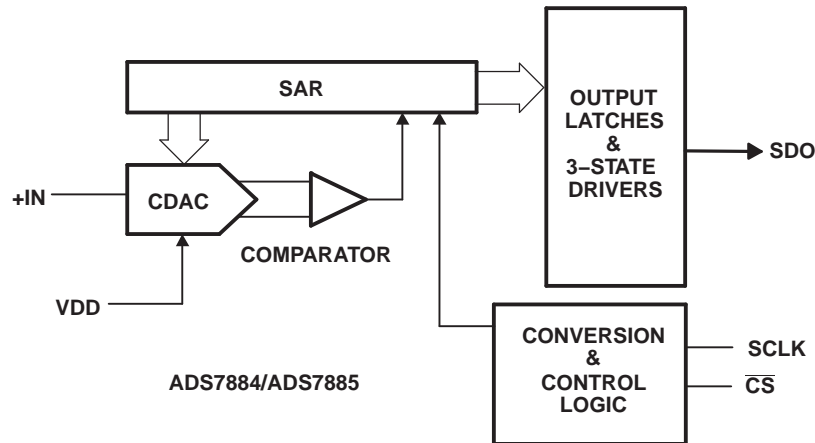
| BIT | < 300 KSPS | 300 KSPS – 1.25 MSPS | 3 MSPS |
|--------|---|---|---|
| 12-Bit | ADS7866 (1.2 V_{DD} to 3.6 V_{DD}) | ADS7886 (2.35 V_{DD} to 5.25 V_{DD}) | — |
| 10-Bit | ADS7867 (1.2 V_{DD} to 3.6 V_{DD}) | ADS7887 (2.35 V_{DD} to 5.25 V_{DD}) | ADS7884 (2.7 V_{DD} to 5.5 V_{DD}) |
| 8-Bit | ADS7868 (1.2 V_{DD} to 3.6 V_{DD}) | ADS7888 (2.35 V_{DD} to 5.25 V_{DD}) | ADS7885 (2.7 V_{DD} to 5.5 V_{DD}) |



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.



PACKAGE/ORDERING INFORMATION⁽¹⁾

| DEVICE | MAXIMUM INTEGRAL LINEARITY (LSB) | MAXIMUM DIFFERENTIAL LINEARITY (LSB) | NO MISSING CODES AT RESOLUTION (BIT) | PACKAGE TYPE | PACKAGE DESIGNATOR | TEMPERATURE RANGE | PACKAGE MARKING | ORDERING INFORMATION | TRANSPORT MEDIA QUANTITY |
|---------|----------------------------------|--------------------------------------|--------------------------------------|--------------|--------------------|-------------------|-----------------|----------------------|--------------------------|
| ADS7884 | ±0.8 | ±0.8 | 10 | 6-Pin SOT23 | DBV | -40°C to 125°C | 7884 | ADS7884SDBVT | Tape and reel 250 |
| | | | | | | | 7884 | ADS7884SDBVR | Tape and reel 3000 |
| ADS7885 | ±0.4 | ±0.4 | 8 | 6-Pin SOT23 | DBV | -40°C to 125°C | 7885 | ADS7885SDBVT | Tape and reel 250 |
| | | | | | | | 7885 | ADS7885SDBVR | Tape and reel 3000 |

(1) For most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

| | UNIT |
|---|--|
| +IN to AGND | -0.3 V to +V _{DD} +0.3 V |
| +V _{DD} to AGND | -0.3 V to 7.0 V |
| Digital input voltage to GND | -0.3V to (7.0 V) |
| Digital output to GND | -0.3 V to (+V _{DD} + 0.3 V) |
| Operating temperature range | -40°C to 125°C |
| Storage temperature range | -65°C to 150°C |
| Junction temperature (T _J Max) | 150°C |
| Power dissipation, SOT23 package | (T _J Max - T _A) / θ _{JA} |
| Thermal impedance, θ _{JA} | SOT23 |
| Lead temperature, soldering | Vapor phase (60 sec) |
| | Infrared (15 sec) |

(1) Stresses above those listed under *absolute maximum ratings* may cause permanent damage to the device. Exposure to absolute maximum conditions for extended periods may affect device reliability.

ADS7884 SPECIFICATIONS

+V_{DD} = 2.7 V to 5.5 V, T_A = -40°C to 125°C, f_{sample} = 2.5 MSPS for V_{DD} = 2.7 V to 3.6 V, f_{sample} = 3 MSPS for V_{DD} = 3.6 V to 5.5 V

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|--|---|----------------------|------|-----------------------|--------------------|
| ANALOG INPUT | | | | | | |
| Full-scale input voltage span ⁽¹⁾ | | | 0 | | V _{DD} | V |
| Absolute input voltage range | | +IN | -0.20 | | V _{DD} +0.20 | V |
| C _i | Input capacitance ⁽²⁾ | | | 27 | | pF |
| I _{Ilkg} | Input leakage current | T _A = 125°C | | 40 | | nA |
| SYSTEM PERFORMANCE | | | | | | |
| Resolution | | | | 10 | | Bits |
| No missing codes | | | 10 | | | Bits |
| INL | Integral nonlinearity | | -0.8 | ±0.3 | 0.8 | LSB ⁽³⁾ |
| DNL | Differential nonlinearity | | -0.8 | ±0.3 | 0.8 | LSB |
| E _O | Offset error ⁽⁴⁾⁽⁵⁾⁽⁶⁾ | | -1 | ±0.2 | 1 | LSB |
| E _G | Gain error ⁽⁵⁾ | | -1 | ±0.2 | 1 | LSB |
| SAMPLING DYNAMICS | | | | | | |
| Conversion time | | 48-MHz SCLK, V _{DD} = 5 V | 224 | 240 | | ns |
| Acquisition time | | | | 93.3 | | ns |
| Maximum throughput rate | | 48-MHz SCLK, V _{DD} = 5 V | | | 3 | MHz |
| Aperture delay | | | | 10 | | ns |
| DYNAMIC CHARACTERISTICS | | | | | | |
| THD | Total harmonic distortion ⁽⁷⁾ | 100 kHz | | -81 | | dB |
| SINAD | Signal-to-noise and distortion | 100 kHz | 60 | 61.7 | | dB |
| SFDR | Spurious free dynamic range | 100 kHz | | 81 | | dB |
| Full power bandwidth | | At -3 dB | 30 | | | MHz |
| DIGITAL INPUT/OUTPUT | | | | | | |
| Logic family — CMOS | | | | | | |
| V _{IH} | High-level input voltage | V _{DD} = 2.7 V to 3.6 V | 1.5 | | 5.5 | V |
| | | V _{DD} = 3.6 V to 5.5 V | 2.2 | | 5.5 | |
| V _{IL} | Low-level input voltage | V _{DD} = 5 V | | | 0.8 | V |
| | | V _{DD} = 3 V | | | 0.4 | |
| V _{OH} | High-level output voltage | At I _{source} = 200 μA | V _{DD} -0.2 | | | V |
| V _{OL} | Low-level output voltage | At I _{sink} = 200 μA | | | 0.4 | |
| POWER SUPPLY REQUIREMENTS | | | | | | |
| +V _{DD} | Supply voltage | | 2.7 | 3.3 | 5.5 | V |
| | Supply current (normal mode) | At V _{DD} = 3.0 V, 2.5-MSPS throughput | | 2.25 | 3 | mA |
| | | At V _{DD} = 3.0 V, static state | | 1.8 | | |
| | | At V _{DD} = 5.0 V, 3-MSPS throughput | | 3 | 4 | |
| | | At V _{DD} = 5.0 V, static state | | 2 | | |
| | Power down state supply current | SCLK off | | | 1 | μA |
| | | SCLK on (48 MHz) | | 90 | 200 | |
| | Power dissipation | V _{DD} = 5 V, 3 MSPS | | 15 | 20 | mW |
| | | V _{DD} = 3 V, 2.5 MSPS | | 6.8 | | |

- (1) Ideal input span; does not include gain or offset error.
- (2) Refer to [Figure 43](#) for details on sampling circuit
- (3) LSB means least significant bit
- (4) Measured relative to an ideal full-scale input
- (5) Offset error and gain error ensured by characterization.
- (6) First transition of 000H to 001H at (V_{ref}/2¹⁰)
- (7) Calculated on the first nine harmonics of the input frequency

ADS7884 SPECIFICATIONS (continued)

+V_{DD} = 2.7 V to 5.5 V, T_A = -40°C to 125°C, f_{sample} = 2.5 MSPS for V_{DD} = 2.7 V to 3.6 V, f_{sample} = 3 MSPS for V_{DD} = 3.6 V to 5.5 V

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------------------|-----------------------|-----|-----|-----|------|
| Power dissipation in static state | V _{DD} = 5 V | | 10 | | mW |
| | V _{DD} = 3 V | | 5.4 | | |
| Powerdown time | | | | 0.1 | μs |
| Powerup time | | | | 0.8 | μs |
| TEMPERATURE RANGE | | | | | |
| Specified performance | | -40 | | 125 | °C |

ADS7885 SPECIFICATIONS

+V_{DD} = 2.7 V to 5.5 V, T_A = –40°C to 125°C, f_{sample} = 2.5 MSPS for V_{DD} = 2.7 V to 3.6 V, f_{sample} = 3 MSPS for V_{DD} = 3.6 V to 5.5 V

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|--|---|----------------------|-------|-----------------------|--------------------|
| ANALOG INPUT | | | | | | |
| Full-scale input voltage span ⁽¹⁾ | | | 0 | | V _{DD} | V |
| Absolute input voltage range | | +IN | –0.20 | | V _{DD} +0.20 | V |
| C _i | Input capacitance ⁽²⁾ | | | 27 | | pF |
| I _{ilkq} | Input leakage current | T _A = 125°C | | 40 | | nA |
| SYSTEM PERFORMANCE | | | | | | |
| Resolution | | | | 8 | | Bits |
| No missing codes | | | 8 | | | Bits |
| INL | Integral nonlinearity | | –0.4 | ±0.15 | 0.4 | LSB ⁽³⁾ |
| DNL | Differential nonlinearity | | –0.4 | ±0.1 | 0.4 | LSB |
| E _O | Offset error ⁽⁴⁾⁽⁵⁾⁽⁶⁾ | | –0.4 | ±0.1 | 0.4 | LSB |
| E _G | Gain error ⁽⁵⁾ | | –0.5 | ±0.1 | 0.5 | LSB |
| SAMPLING DYNAMICS | | | | | | |
| Conversion time | | 48-MHz SCLK, V _{DD} = 5 V | 182 | 198 | | ns |
| Acquisition time | | 3 MSPS mode | | 135 | | ns |
| Maximum throughput rate | | 48-MHz SCLK, V _{DD} = 5 V | | | 3 | MHz |
| Aperture delay | | | | 10 | | ns |
| DYNAMIC CHARACTERISTICS | | | | | | |
| THD | Total harmonic distortion ⁽⁷⁾ | 100 kHz | | –68 | | dB |
| SINAD | Signal-to-noise and distortion | 100 kHz | 49 | 49.8 | | dB |
| SFDR | Spurious free dynamic range | 100 kHz | | 74 | | dB |
| Full power bandwidth | | At –3 dB | 30 | | | MHz |
| DIGITAL INPUT/OUTPUT | | | | | | |
| Logic family — CMOS | | | | | | |
| V _{IH} | High-level input voltage | V _{DD} = 2.7 V to 3.6 V | 1.5 | | 5.5 | V |
| | | V _{DD} = 3.6 V to 5.5 V | 2.2 | | 5.5 | |
| V _{IL} | Low-level input voltage | V _{DD} = 5 V | | | 0.8 | V |
| | | V _{DD} = 3 V | | | 0.4 | |
| V _{OH} | High-level output voltage | At I _{source} = 200 μA | V _{DD} –0.2 | | | V |
| V _{OL} | Low-level output voltage | At I _{sink} = 200 μA | | | 0.4 | |
| POWER SUPPLY REQUIREMENTS | | | | | | |
| +V _{DD} | Supply voltage | | 2.7 | 3.3 | 5.5 | V |
| | Supply current (normal mode) | At V _{DD} = 3.0 V, 2.5-MSPS throughput | | 2.25 | 3 | mA |
| | | At V _{DD} = 3.0 V, static state | | 1.8 | | |
| | | At V _{DD} = 5.0 V, 3-MSPS throughput | | 3 | 4 | |
| | | At V _{DD} = 5.0 V, static state | | 2 | | |
| | Power down state supply current | SCLK off | | | 1 | μA |
| | | SCLK on (48 MHz) | | 90 | 200 | |
| | Power dissipation | V _{DD} = 5 V, 3 MSPS | | 15 | 20 | mW |
| | | V _{DD} = 3 V, 2.5 MSPS | | 6.8 | | |

- (1) Ideal input span; does not include gain or offset error.
- (2) Refer to [Figure 43](#) for details on sampling circuit
- (3) LSB means least significant bit
- (4) Measured relative to an ideal full-scale input
- (5) Offset error and gain error ensured by characterization.
- (6) First transition of 000H to 001H at (V_{ref}/2⁸)
- (7) Calculated on the first nine harmonics of the input frequency

ADS7885 SPECIFICATIONS (continued)

+V_{DD} = 2.7 V to 5.5 V, T_A = –40°C to 125°C, f_{sample} = 2.5 MSPS for V_{DD} = 2.7 V to 3.6 V, f_{sample} = 3 MSPS for V_{DD} = 3.6 V to 5.5 V

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------------------------------|-----------------------|-----|-----|-----|------|
| Power dissipation in static state | V _{DD} = 5 V | | 10 | | mW |
| | V _{DD} = 3 V | | 5.4 | | |
| Powerdown time | | | | 0.1 | μs |
| Powerup time | | | | 0.8 | μs |
| TEMPERATURE RANGE | | | | | |
| Specified performance | | –40 | | 125 | °C |

TIMING REQUIREMENTS (see Figure 1)

All specifications typical at T_A = –40°C to 125°C, V_{DD} = 2.7 V to 5.5 V, unless otherwise specified.

| PARAMETER | TEST CONDITIONS ⁽¹⁾ | MIN | TYP | MAX | UNIT |
|---|--------------------------------|--------------------------|-----|--------------------------|------|
| t _{conv} Conversion time | ADS7884 | V _{DD} = 3 V | | 11.5 × t _{SCLK} | ns |
| | | V _{DD} = 5 V | | 11.5 × t _{SCLK} | |
| | ADS7885 | V _{DD} = 3 V | | 9.5 × t _{SCLK} | |
| | | V _{DD} = 5 V | | 9.5 × t _{SCLK} | |
| t _{acq} Acquisition time | V _{DD} = 3 V | 62.5 | | | ns |
| | V _{DD} = 5 V | 52 | | | |
| t _q Minimum quiet time needed from bus 3-state to start of next conversion | V _{DD} = 3 V | 10 | | | ns |
| | V _{DD} = 5 V | 10 | | | |
| t _{d1} Delay time, \overline{CS} low to first data (0) out | V _{DD} = 3 V | | 9 | 15 | ns |
| | V _{DD} = 5 V | | 8 | 11 | |
| t _{su1} Setup time, \overline{CS} low to SCLK low | V _{DD} = 3 V | 7 | | | ns |
| | V _{DD} = 5 V | 5 | | | |
| t _{d2} Delay time, SCLK falling to SDO | V _{DD} = 3 V | | 11 | 20 | ns |
| | V _{DD} = 5 V | | 9 | 12 | |
| t _{h1} Hold time, SCLK falling to data valid ⁽²⁾ | V _{DD} < 3 V | 5.5 | | | ns |
| | V _{DD} > 5 V | 4 | | | |
| t _{d3} Delay time, 16th SCLK falling edge to SDO 3-state | V _{DD} = 3 V | | 9 | 15 | ns |
| | V _{DD} = 5 V | | 8 | 11 | |
| t _{w1} Pulse duration, \overline{CS} | V _{DD} = 3 V | 10 | | | ns |
| | V _{DD} = 5 V | 10 | | | |
| t _{d4} Delay time, \overline{CS} high to SDO 3-state, | V _{DD} = 3 V | | 9 | 15 | ns |
| | V _{DD} = 5 V | | 8 | 11 | |
| t _{wH} Pulse duration, SCLK high | V _{DD} = 3 V | 0.45 × t _{SCLK} | | | ns |
| | V _{DD} = 5 V | 0.45 × t _{SCLK} | | | |
| t _{wL} Pulse duration, SCLK low | V _{DD} = 3 V | 0.45 × t _{SCLK} | | | ns |
| | V _{DD} = 5 V | 0.45 × t _{SCLK} | | | |
| Frequency, SCLK | V _{DD} = 3 V | | | 40 | MHz |
| | V _{DD} = 5 V | | | 48 | |
| t _{d5} Delay time, second falling edge of clock and \overline{CS} to enter in powerdown (use min spec not to accidentally enter in powerdown) Figure 3 | V _{DD} = 3 V | –2 | | 4 | ns |
| | V _{DD} = 5 V | –2 | | 3 | |

(1) 3-V Specifications apply from 2.7 V to 3.6 V, and 5-V specifications apply from 4.5 V to 5.5 V.

(2) With 10-pf load.

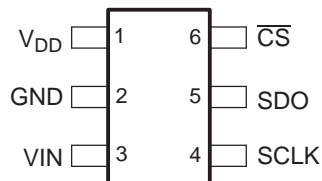
TIMING REQUIREMENTS (see Figure 1) (continued)

All specifications typical at $T_A = -40^\circ\text{C}$ to 125°C , $V_{DD} = 2.7\text{ V}$ to 5.5 V , unless otherwise specified.

| PARAMETER | TEST CONDITIONS ⁽¹⁾ | MIN | TYP | MAX | UNIT |
|---|--------------------------------|-----|-----|-----|------|
| t_{d6} Delay time, $\overline{\text{CS}}$ and 10th falling edge of clock to enter in powerdown (use max spec not to accidentally enter in powerdown) Figure 3 | $V_{DD} = 3\text{ V}$ | -2 | | 4 | ns |
| | $V_{DD} = 5\text{ V}$ | -2 | | 3 | |

DEVICE INFORMATION

SOT23 PACKAGE (TOP VIEW)



TERMINAL FUNCTIONS

| TERMINAL | I/O | DESCRIPTION |
|--------------------------|-----|--|
| NAME NO. | | |
| V_{DD} 1 | – | Power supply input also acts like a reference voltage to ADC. |
| GND 2 | – | Ground for power supply, all analog and digital signals are referred with respect to this pin. |
| VIN 3 | I | Analog signal input |
| SCLK 4 | I | Serial clock |
| SDO 5 | O | Serial data out |
| $\overline{\text{CS}}$ 6 | I | Chip select signal, active low |

ADS7884 NORMAL OPERATION

The cycle begins with the falling edge of $\overline{\text{CS}}$. This point is indicated as **a** in Figure 1. With the falling edge of $\overline{\text{CS}}$, the input signal is sampled and the conversion process is initiated. The device outputs data while the conversion is in progress. The data word contains 2 leading zeros, followed by 10-bit data in MSB first format and padded by 4 lagging zeros.

The falling edge of $\overline{\text{CS}}$ clocks out the first zero, and a second zero is clocked out on FIRST falling edge of the clock. Data is in MSB first format with the MSB being clocked out on the 2nd falling edge. Data is padded with four lagging zeros as shown in Figure 1. The conversion ends on the first rising edge of SCLK after the 11th falling edge. At this point the device enters the acquisition phase. This point is indicated by **b** in Figure 1.

Figure 1 shows device data is read in a sixteen clock frame. However, $\overline{\text{CS}}$ can be asserted (pulled high) any time after 11 clocks have elapsed. SDO goes to 3-state with the $\overline{\text{CS}}$ high level. The next conversion should not be started (by pulling $\overline{\text{CS}}$ low) until the end of the quiet sampling time (t_q) after SDO goes to 3-state or until the minimum acquisition time (t_{acq}) has elapsed. To continue normal operation, it is necessary that $\overline{\text{CS}}$ is not pulled high until point **b**. Without this, the device does not enter the acquisition phase and no valid data is available in the next cycle. (Also refer to the Powerdown Mode section for more details.) $\overline{\text{CS}}$ going high any time after the conversion start aborts the ongoing conversion and SDO goes to 3-state.

The high level of the digital input to the device is not limited to device V_{DD} . This means the digital input can go as high as 5.5 V when the device supply is 2.7 V. This feature is useful when digital signals are coming from another circuit with different supply levels. Also, this relaxes the restriction on powerup sequencing. However, the digital output levels (V_{OH} and V_{OL}) are governed by V_{DD} as listed in the Specifications table.

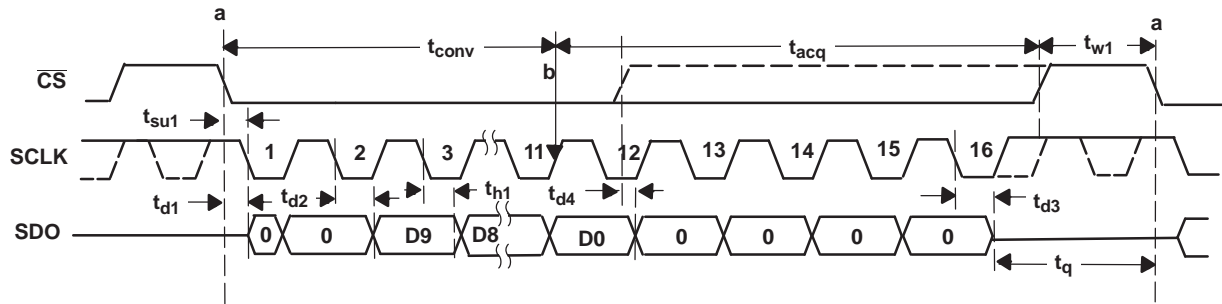


Figure 1. ADS7884 Interface Timing Diagram

ADS7885 NORMAL OPERATION

The cycle begins with the falling edge of \overline{CS} . This point is indicated as **a** in Figure 2. With the falling edge of \overline{CS} , the input signal is sampled and the conversion process is initiated. The device outputs data while the conversion is in progress. The data word contains 2 leading zeros, followed by 8-bit data in MSB first format and padded by 6 lagging zeros.

The falling edge of \overline{CS} clocks out the first zero, and a second zero is clocked out on FIRST falling edge of the clock. Data is in MSB first format with the MSB being clocked out on the 3rd falling edge. Data is padded with six lagging zeros as shown in Figure 2. On the 16th falling edge of SCLK, SDO goes to the 3-state condition. The conversion ends on the first rising edge of SCLK after the 9th falling edge. At this point the device enters the acquisition phase. This point is indicated by **b** in Figure 2.

Figure 2 shows device data is read in a sixteen clock frame. However, \overline{CS} can be asserted (pulled high) any time after 9 clocks have elapsed (after the 10th falling edge of SCLK). SDO goes to 3-state with the \overline{CS} high level. The next conversion should not be started (by pulling \overline{CS} low) until the end of the quiet sampling time (t_q) after SDO goes to 3-state or until the minimum acquisition time (t_{acq}) has elapsed. To continue normal operation, it is necessary that \overline{CS} is not pulled high until point **b**. Without this, the device does not enter the acquisition phase and no valid data is available in the next cycle. (Also refer to the Powerdown Mode section for more details.) \overline{CS} going high any time after the conversion start aborts the ongoing conversion and SDO goes to 3-state.

The high level of the digital input to the device is not limited to device V_{DD} . This means the digital input can go as high as 5.5 V when the device supply is 2.7 V. This feature is useful when digital signals are coming from another circuit with different supply levels. Also, this relaxes the restriction on powerup sequencing. However, the digital output levels (V_{OH} and V_{OL}) are governed by V_{DD} as listed in the Specifications section.

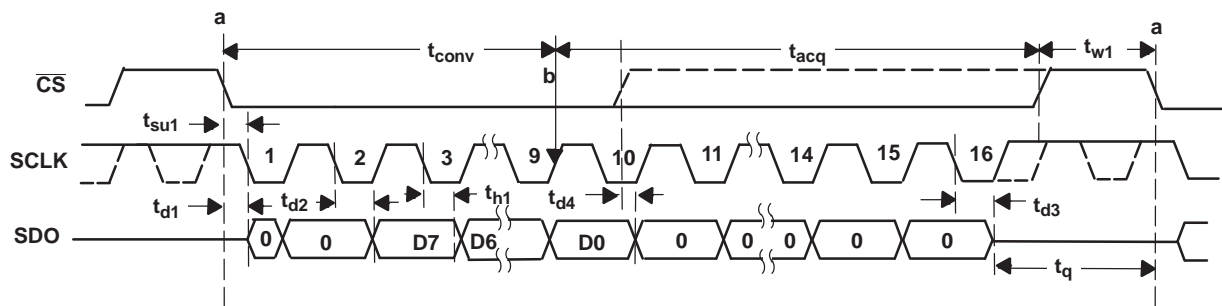


Figure 2. ADS7885 Interface Timing Diagram

POWER DOWN MODE

The device enters powerdown mode if \overline{CS} goes high anytime after the 2nd SCLK falling edge to before the 10th SCLK falling edge. Ongoing conversion stops and SDO goes to 3-state under this powerdown condition as shown in Figure 3.

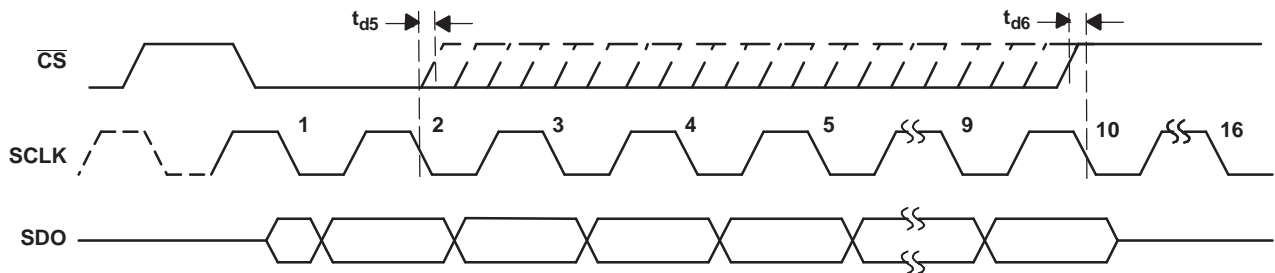


Figure 3. Entering Power Down Mode

A dummy cycle with \overline{CS} low for more than 10 SCLK falling edges brings the device out of powerdown mode. For the device to come to the fully powered up condition it takes 0.8 μs . \overline{CS} can be pulled high any time after the 10th falling edge as shown in Figure 4. Note that the powerup time of 0.8 μsec is more than a single conversion cycle at 3 MSPS speed. This means the device requires three dummy conversion frames at 3 MSPS speed or one elongated dummy conversion frame. The data during dummy conversion frames is invalid.

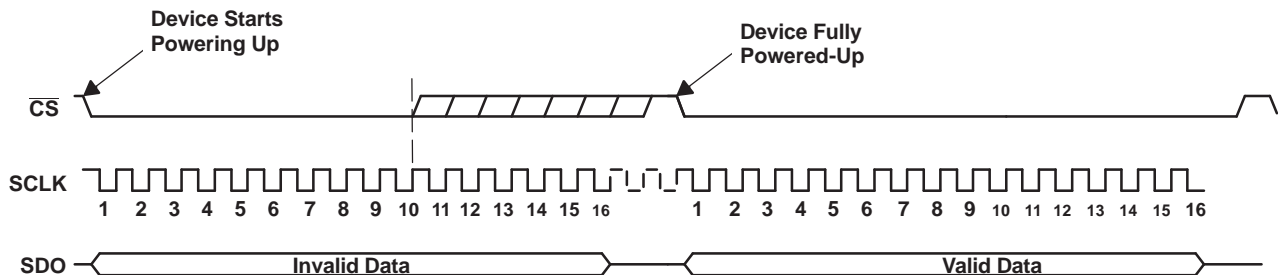


Figure 4. Exiting Power Down Mode

TYPICAL CHARACTERISTICS ADS7884

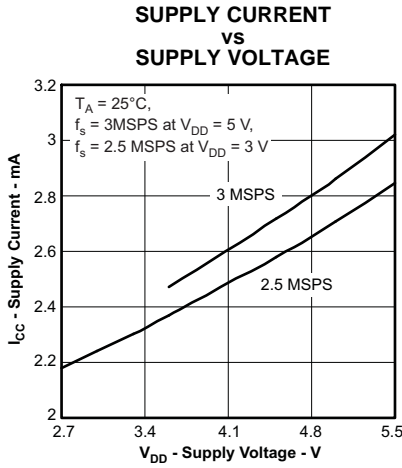


Figure 5.

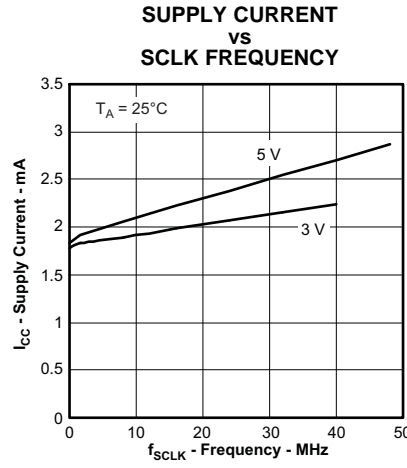


Figure 6.

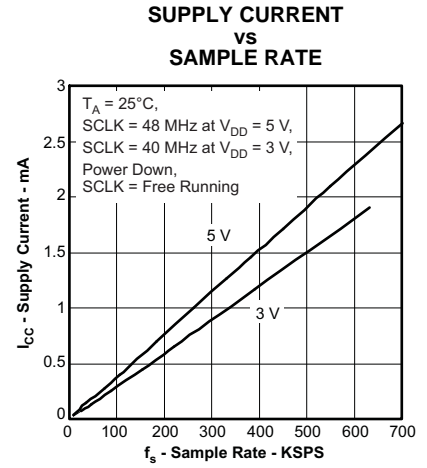


Figure 7.

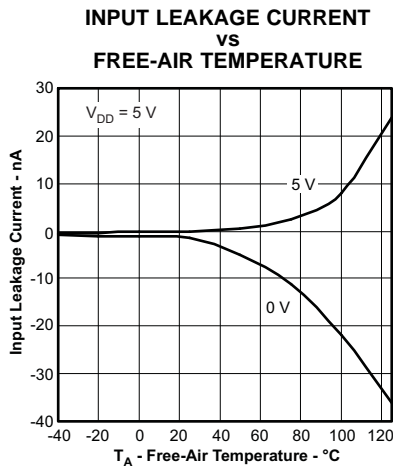


Figure 8.

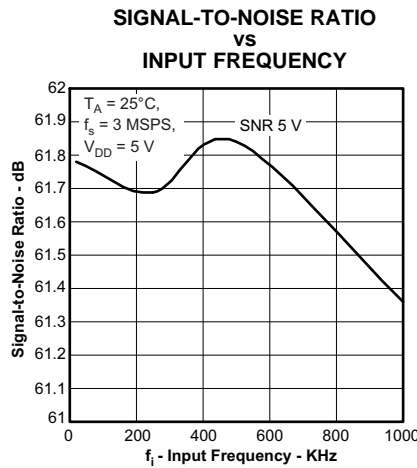


Figure 9.

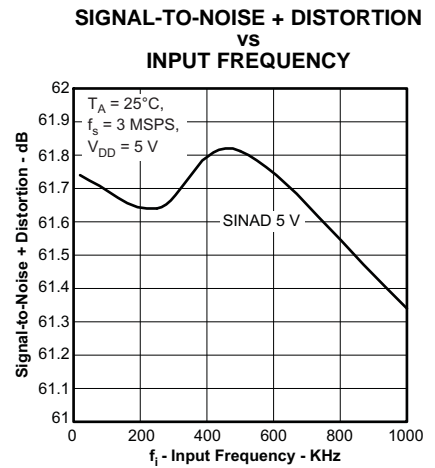


Figure 10.

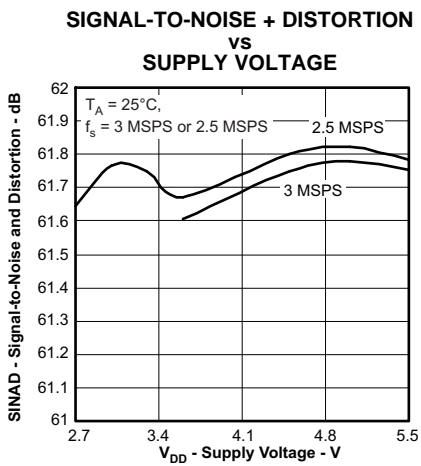


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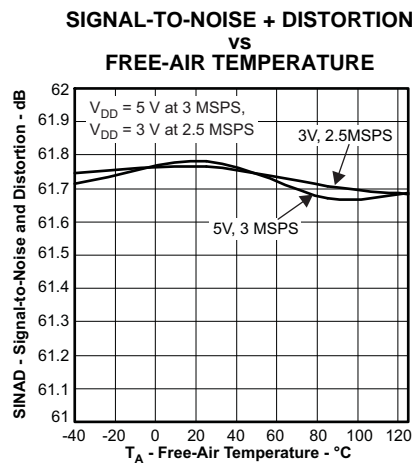


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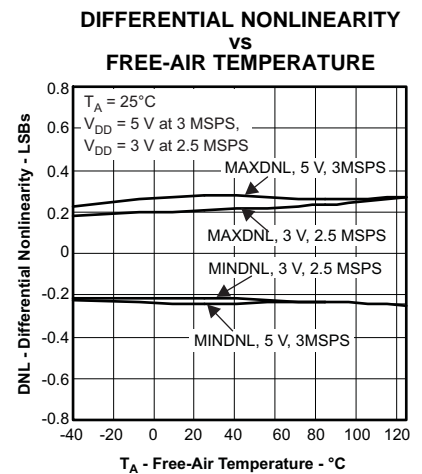


Figure 13.

TYPICAL CHARACTERISTICS ADS7884 (continued)

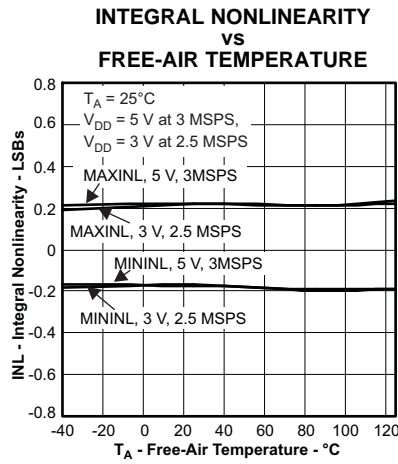


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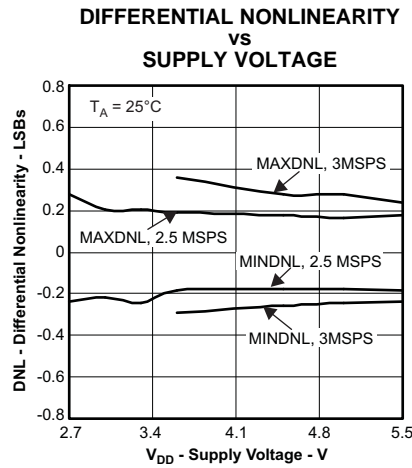


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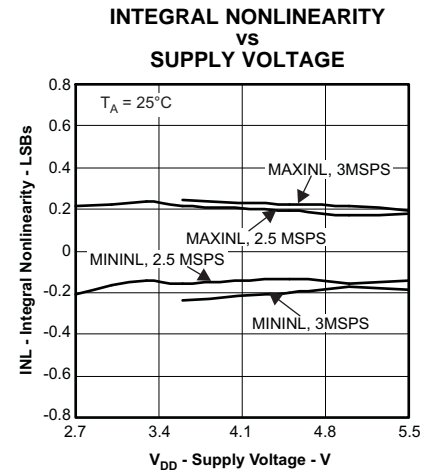


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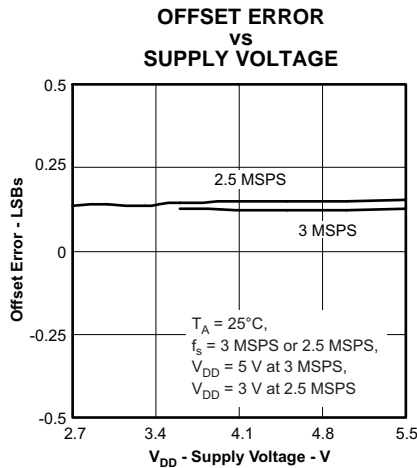


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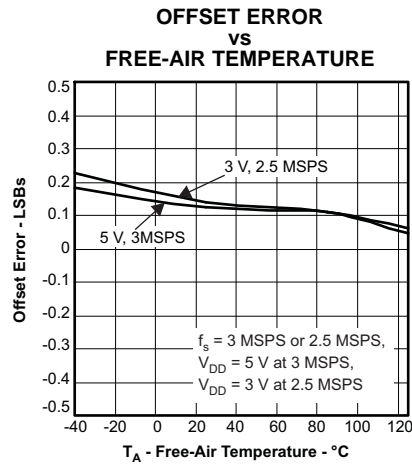


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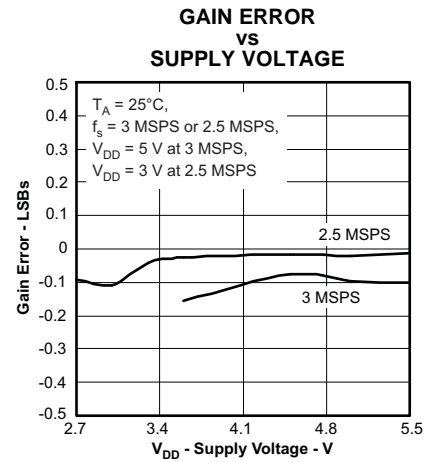


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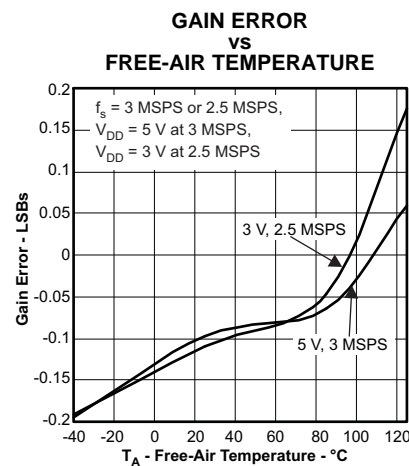


Figure 20.

TYPICAL CHARACTERISTICS ADS7884 (continued)

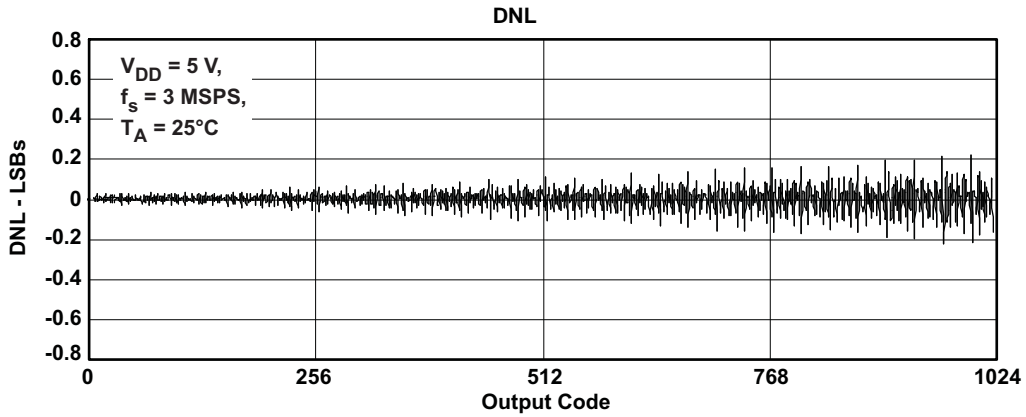


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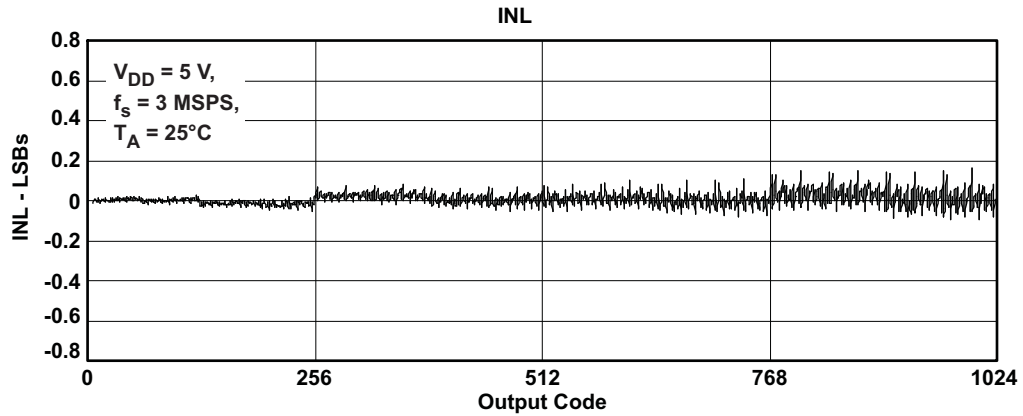


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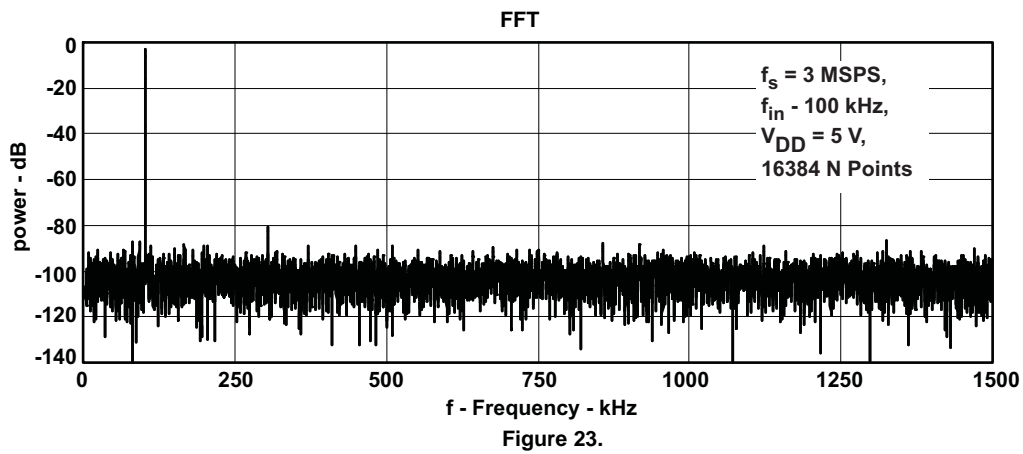


Figure 23.

TYPICAL CHARACTERISTICS ADS7885

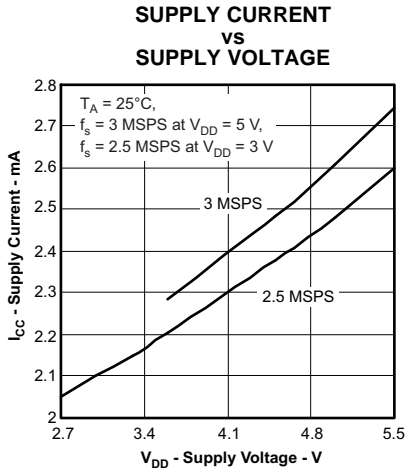


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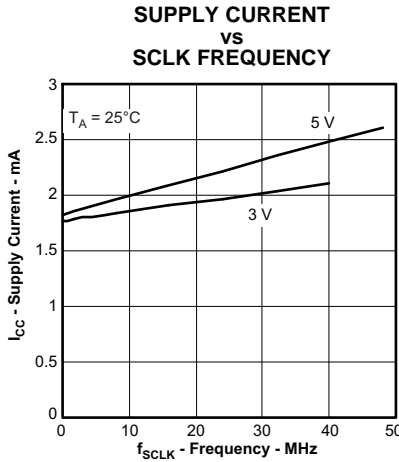


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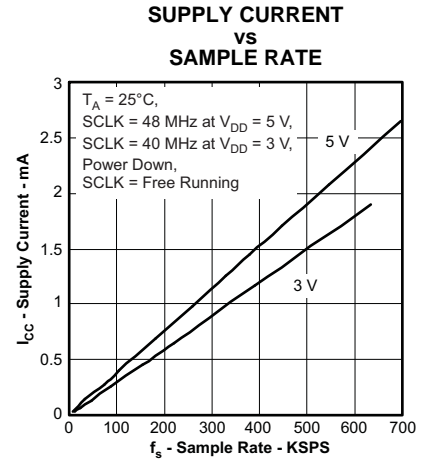


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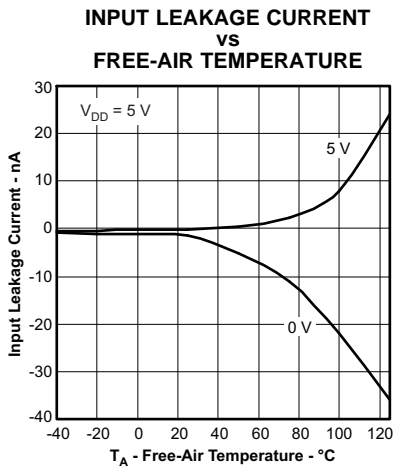


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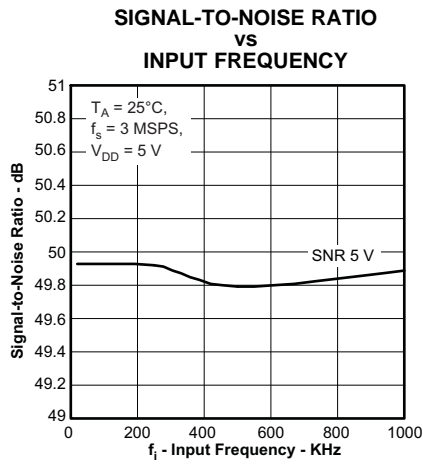


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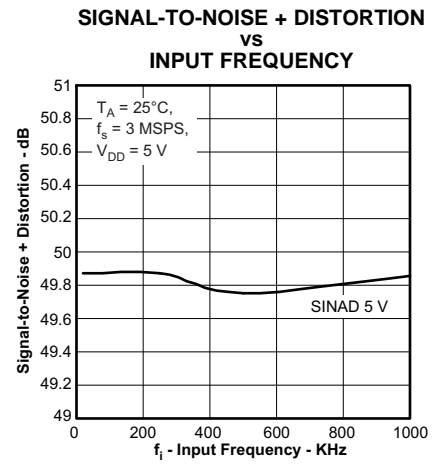


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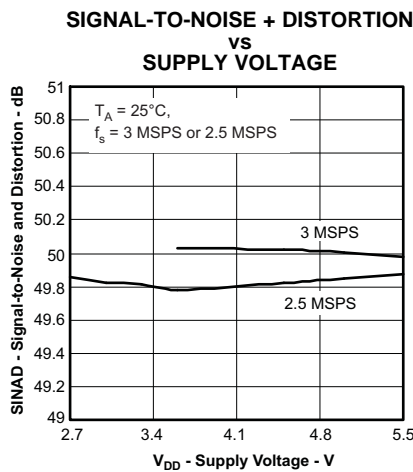


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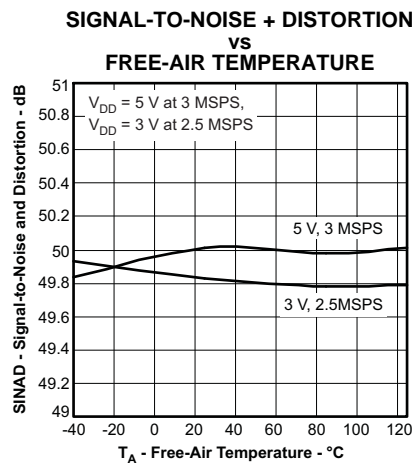


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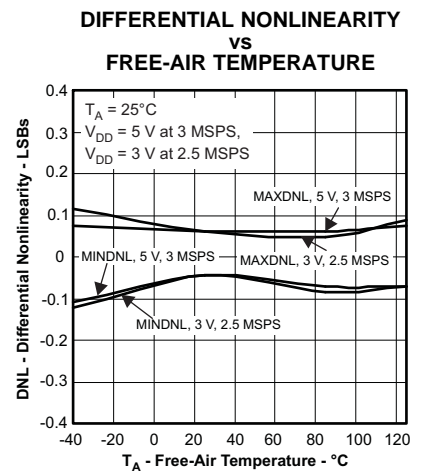


Figure 32.

TYPICAL CHARACTERISTICS ADS7885 (continued)

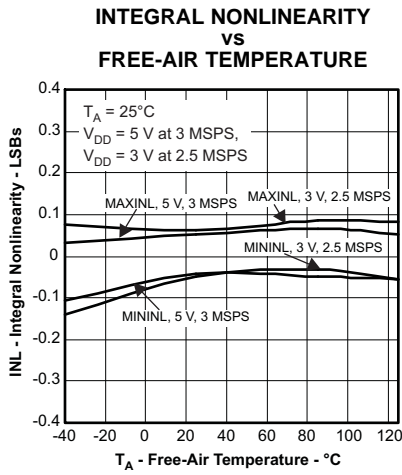


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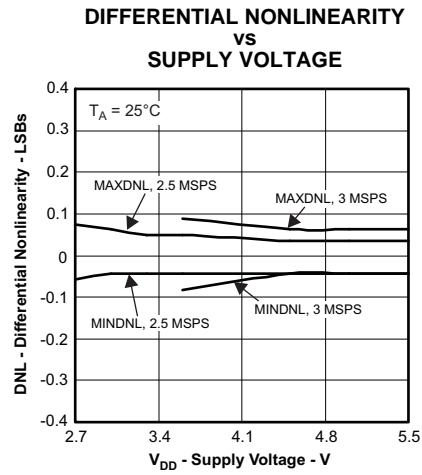


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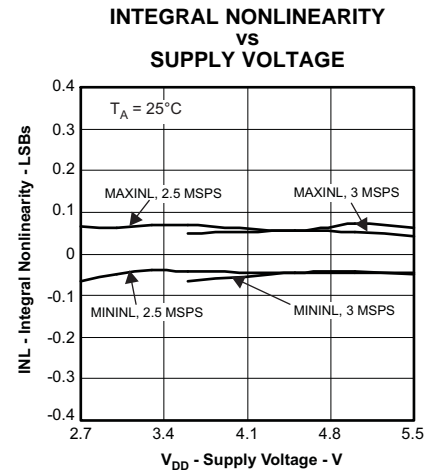


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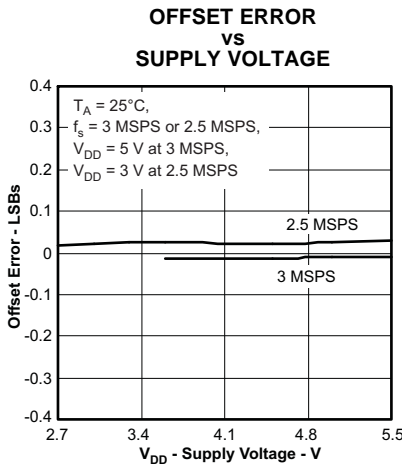


Figure 36.

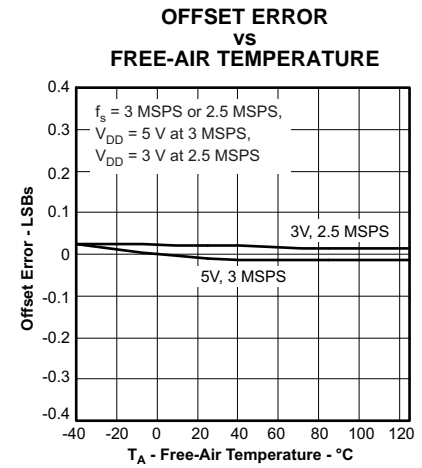


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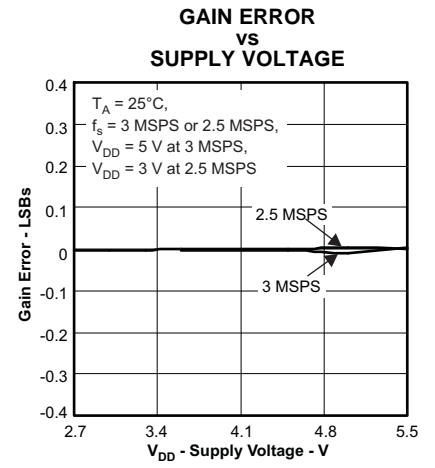


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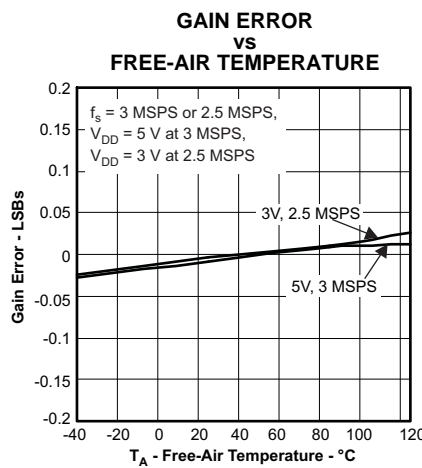


Figure 39.

TYPICAL CHARACTERISTICS ADS7885 (continued)

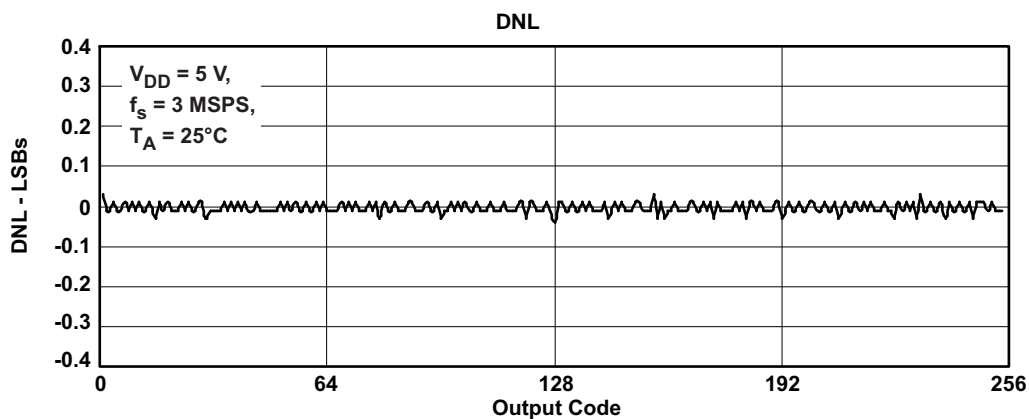


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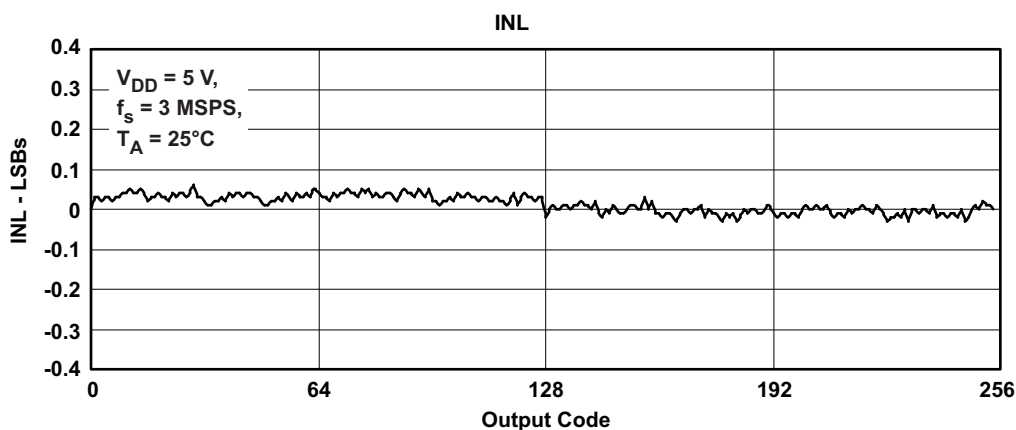


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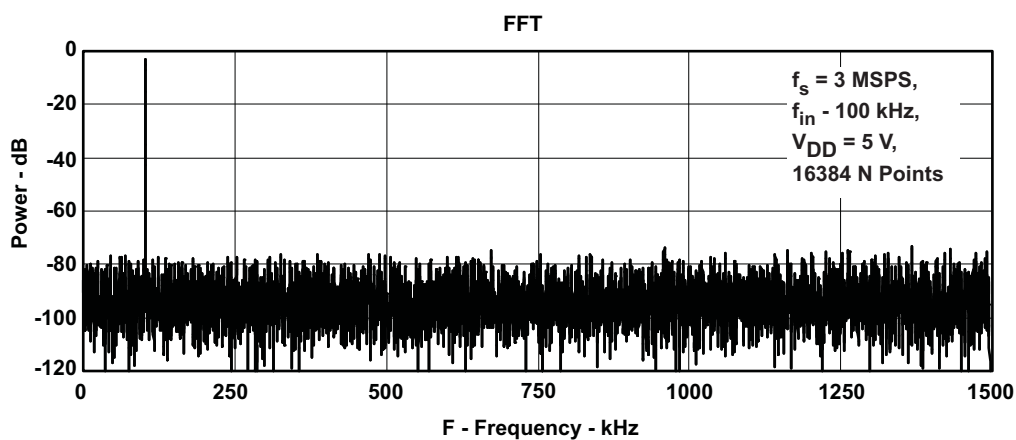


Figure 42.

APPLICATION INFORMATION

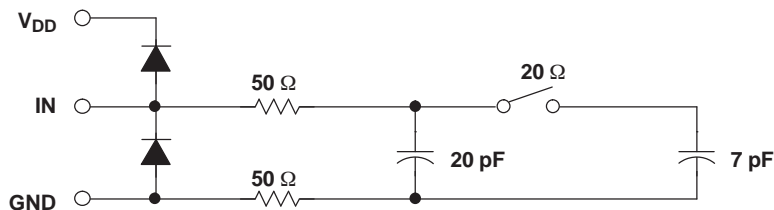


Figure 43. Typical Equivalent Sampling Circuit

Driving the VIN and V_{DD} Pins of the ADS7884 and ADS7885

The VIN input to the ADS7884 and ADS7885 should be driven with a low impedance source. In most cases additional buffers are not required. In cases where the source impedance exceeds 200 Ω , using a buffer would help achieve the rated performance of the converter. The THS4031 is a good choice for the driver amplifier buffer.

The reference voltage for the ADS7884 and ADS7885 A/D converters are derived from the supply voltage internally. The devices offer limited low-pass filtering functionality on-chip. The supply to these converters should be driven with a low impedance source and should be decoupled to the ground. A 1- μ F storage capacitor and a 10-nF decoupling capacitor should be placed close to the device. Wide, low impedance traces should be used to connect the capacitor to the pins of the device. The ADS7884 and ADS7885 draw very little current from the supply lines. The supply line can be driven by either:

- Directly from the system supply.
- A reference output from a low drift and low drop out reference voltage generator like REF3030 or REF3130. The ADS7884 and ADS7885 can operate off a wide range of supply voltages. The actual choice of the reference voltage generator would depend upon the system. Figure 45 shows one possible application circuit.
- A low-pass filtered version of the system supply followed by a buffer like the zero-drift OPA735 can also be used in cases where the system power supply is noisy. Care should be taken to ensure that the voltage at the V_{DD} input does not exceed 7 V (especially during power up) to avoid damage to the converter. This can be done easily using single supply CMOS amplifiers like the OPA735. Figure 46 shows one possible application circuit.

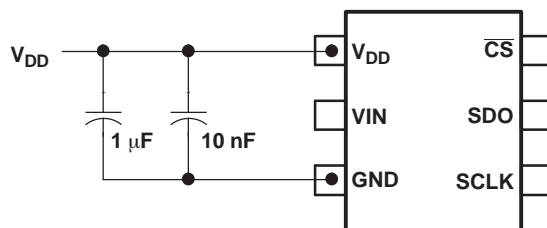


Figure 44. Supply/Reference Decoupling Capacitors

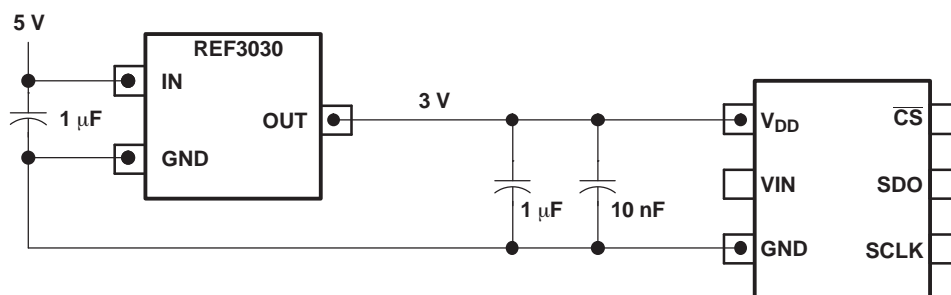


Figure 45. Using the REF3030 Reference

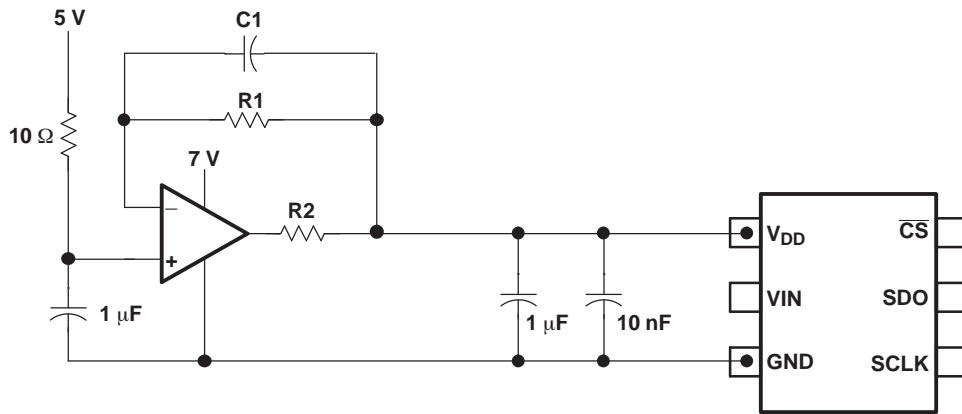


Figure 46. Buffering with the OPA735

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| ADS7884SDBVR | ACTIVE | SOT-23 | DBV | 6 | 3000 | Pb-Free (RoHS Exempt) | CU NIPDAU | Level-2-260C-1 YEAR |
| ADS7884SDBVT | ACTIVE | SOT-23 | DBV | 6 | 250 | Pb-Free (RoHS Exempt) | CU NIPDAU | Level-2-260C-1 YEAR |
| ADS7885SDBVR | ACTIVE | SOT-23 | DBV | 6 | 3000 | Pb-Free (RoHS Exempt) | CU NIPDAU | Level-2-260C-1 YEAR |
| ADS7885SDBVT | ACTIVE | SOT-23 | DBV | 6 | 250 | Pb-Free (RoHS Exempt) | CU NIPDAU | Level-2-260C-1 YEAR |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

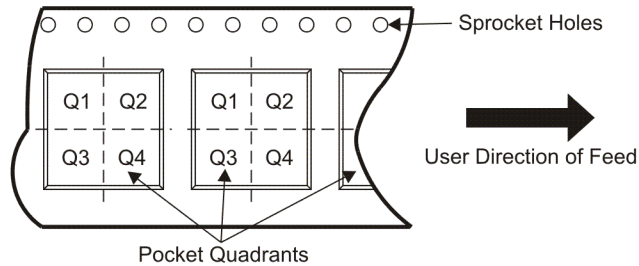
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TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| ADS7884SDBVR | SOT-23 | DBV | 6 | 3000 | 177.8 | 9.7 | 3.2 | 3.1 | 1.39 | 4.0 | 8.0 | Q3 |
| ADS7884SDBVT | SOT-23 | DBV | 6 | 250 | 177.8 | 9.7 | 3.2 | 3.1 | 1.39 | 4.0 | 8.0 | Q3 |
| ADS7885SDBVR | SOT-23 | DBV | 6 | 3000 | 177.8 | 9.7 | 3.2 | 3.1 | 1.39 | 4.0 | 8.0 | Q3 |
| ADS7885SDBVT | SOT-23 | DBV | 6 | 250 | 177.8 | 9.7 | 3.2 | 3.1 | 1.39 | 4.0 | 8.0 | Q3 |

TAPE AND REEL BOX DIMENSIONS

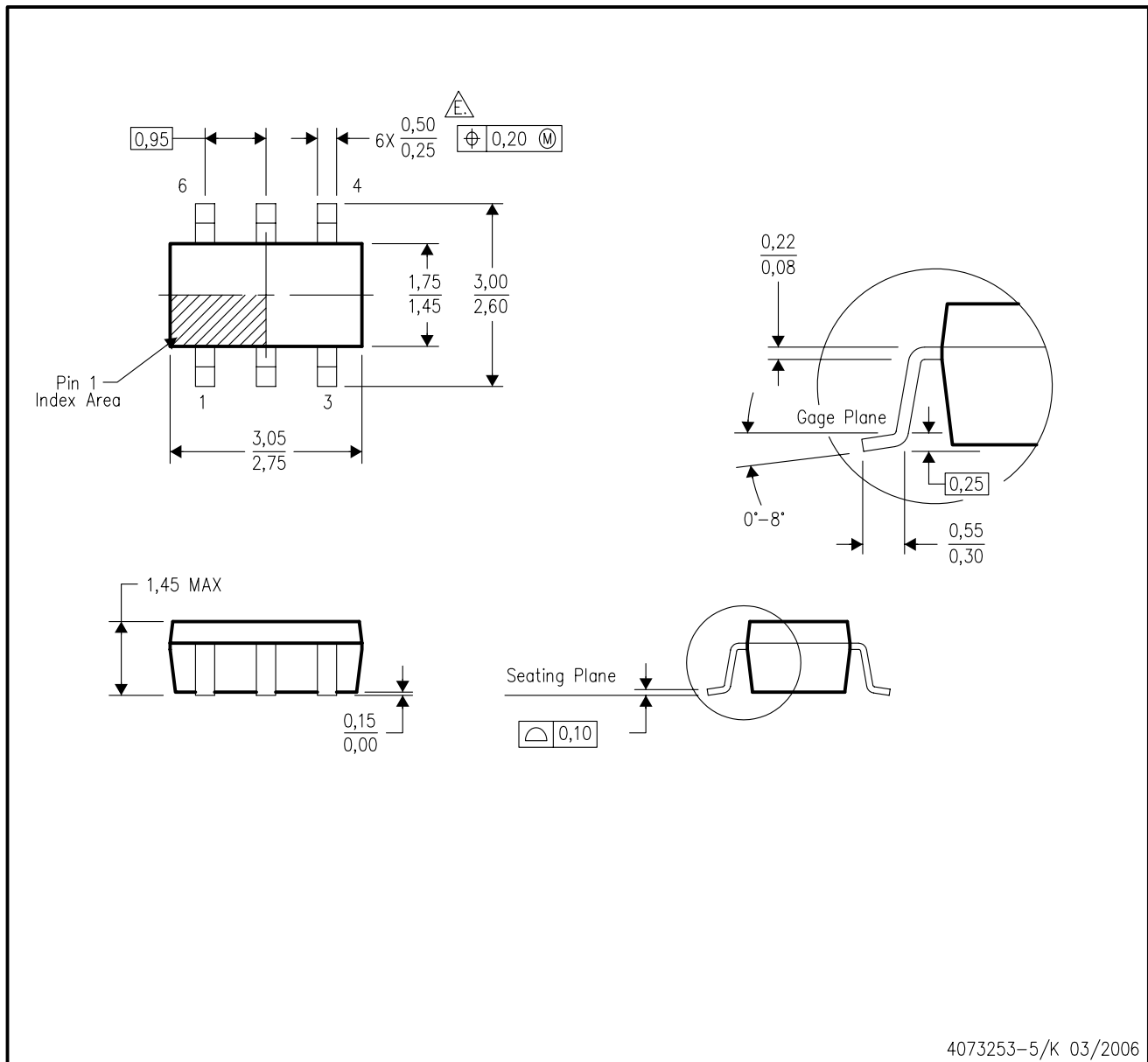


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| ADS7884SDBVR | SOT-23 | DBV | 6 | 3000 | 184.0 | 184.0 | 50.0 |
| ADS7884SDBVT | SOT-23 | DBV | 6 | 250 | 184.0 | 184.0 | 50.0 |
| ADS7885SDBVR | SOT-23 | DBV | 6 | 3000 | 184.0 | 184.0 | 50.0 |
| ADS7885SDBVT | SOT-23 | DBV | 6 | 250 | 184.0 | 184.0 | 50.0 |

DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
 - D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
- $\triangle E$ Falls within JEDEC MO-178 Variation AB, except minimum lead width.

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