

Product Datasheet - Technical Specifications



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Specifications

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Analog Input Specifications

Table 23 lists the specifications for the A/D subsystem on the DT9824 module.

Table 23: A/D Subsystem Specifications

Feature	DT9824 Specifications
Number of analog inputs	4 Differential
Number of gains	4 (1, 8, 16, 32)
Resolution	24 bits
Data encoding	Offset binary
Coupling	DC
Sample frequency per channel	1.173 Hz to 4800 Hz
System accuracy @ 10 Hz (full-scale = 10 V) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.002% 0.003% 0.005%
System accuracy @ 100 Hz (full-scale = 10 V) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.002% 0.003% 0.006%
System accuracy @ 1200 Hz (full-scale = 10 V) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.002% 0.004% 0.007%
System accuracy @ 4800 Hz (full-scale = 10 V) Gain = 1: Gain = 8: Gain = 16: Gain = 32:	0.001% 0.003% 0.005% 0.010%
Nonlinearity (integral) Gain = 1: Gain > 1:	±5 ppm full-scale maximum ±15 ppm full-scale maximum
Differential linearity	±1.0 LSB (no missing codes)
Input range Gain = 1: Gain = 8: Gain = 16: Gain = 32:	±10 V ±1.25 V ±0.625 V ±0.3125 V

Table 23: A/D Subsystem Specifications (cont.)

Feature	DT9824 Specifications
Offset drift versus temperature ≤ 600Hz: > 600Hz:	50 nV/°C 150 nV/°C
Offset drift versus time	25 nV/1000 hours typical
Gain drift versus temperature	±10 ppm/°C
Gain drift versus time	10 ppm/1000 hours typical
Input impedance Power off: Power on:	3 kΩ 10 MΩ// 3 kΩ in series with 4700 pF
Input bias current	≤ ±1 nA
Input noise (@10 Hz sample rate; gain of 1)	3.6 μV rms = 23.6 μV pp or < 1.5 ppm (see Figure 17 on page 84)
System noise	See Table 24 and Figure 18 on page 85
Analog input filter	10 kHz
Common mode rejection @ 10 Hz	> -150 dB @ 50 Hz and 60 Hz
Common mode voltage	±500 V maximum (operational)
Maximum input voltage	±40 V maximum (protection)
Channel-to-channel offset	±10 μV
Effective number of bits (ENOB) @ 10 Hz with a 1 Hz, ±9.9 V sine wave input	21 bits typical
Channel crosstalk	-150 dB @ 1 kHz
Input coupling	DC
Isolation voltage	±500 V to computer ground
Channel-to-channel isolation	±500 V
ESD protection Arc: Contact:	8 kV 4 kV
Internal reference	1.25 V ±0.001 V
-3 dB point (low pass) ^a Sample rate less than or equal to 600 Samples/s Sample greater than 600 Samples/s	f -3 dB = 0.24 x fADC f -3 dB = 0.23 x fADC
Internal clock	±100 ppm maximum (typical initial ±25 ppm) ^b
Warm-up time	1 hour

a. Refer to [page 85](#) for more information about the frequency response, input bandwidth, and correction factors.

b. This clock is derived from the crystal oscillator. The specification includes initial tolerance, power supply variations, temperature drift, and 1 year stability.

Noise

Figure 17 shows the maximum noise measurement at 10 Hz with a gain of 1.

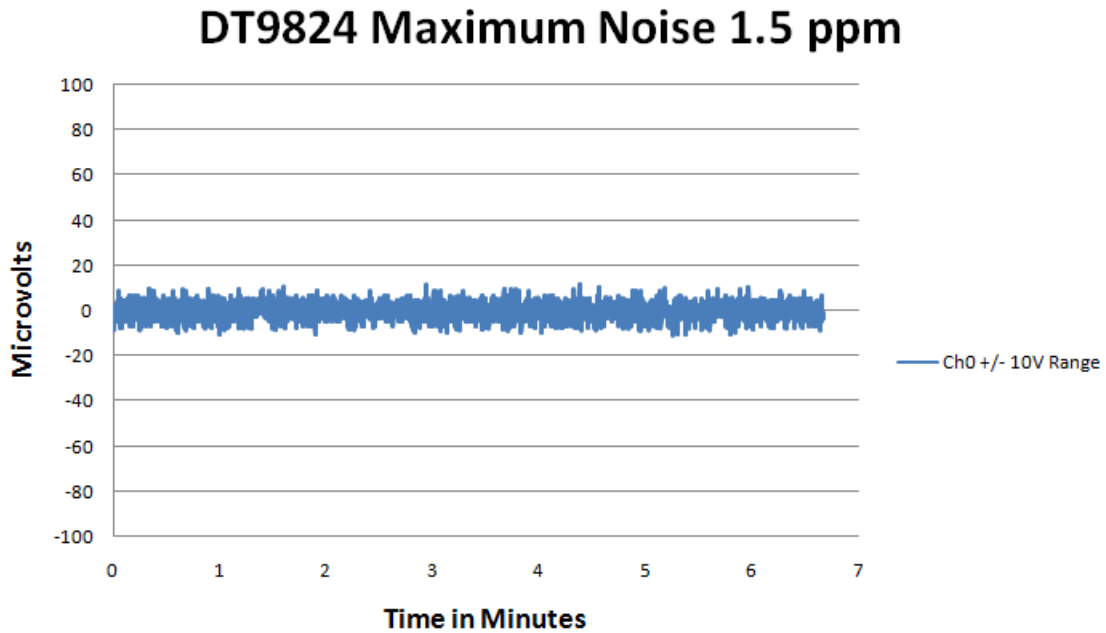


Figure 17: Maximum Noise Measurement During Typical Usage at 10 Hz with a Gain of 1

Figure 24 shows the typical RMS noise, in microvolts, of the DT9824 at sampling rates of 10 Samples/s, 100 Samples/s, 960 Samples/s, and 4800 Samples/s and gains of 1, 8, 16, and 32.

Table 24: DT9824 System Noise

Gain	10 Samples/s	100 Samples/s	960 Samples/s	4800 Samples/s
1	3.6 μ Vrms	12.0 μ Vrms	25.0 μ Vrms	63.0 μ Vrms
8	0.7 μ Vrms	2.0 μ Vrms	4.2 μ Vrms	11.0 μ Vrms
16	0.6 μ Vrms	1.8 μ Vrms	2.8 μ Vrms	7.5 μ Vrms
32	0.4 μ Vrms	1.3 μ Vrms	2.3 μ Vrms	6.5 μ Vrms

Figure 18 shows this data in graphical form.

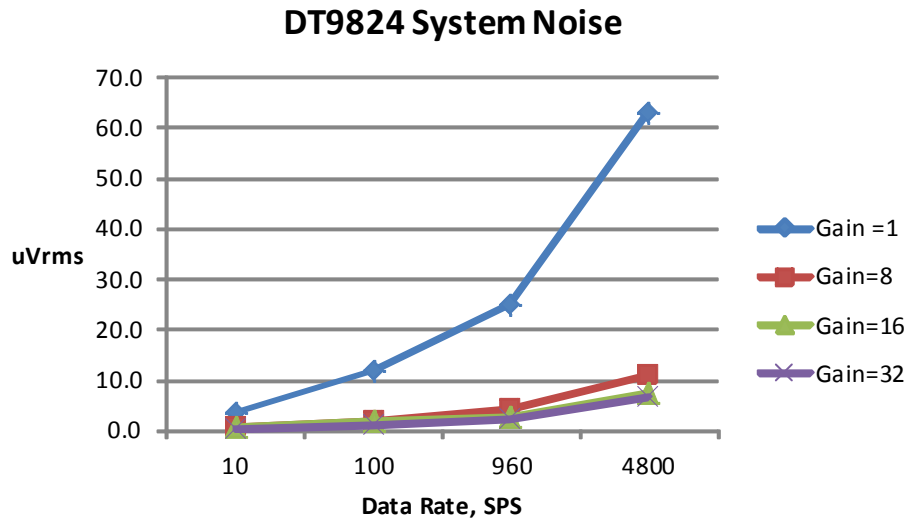


Figure 18: System Noise Specification

Frequency Response and Input Bandwidth

Each channel of the DT9824 includes a dedicated 24-bit Sigma-Delta A/D converter. The ultra-low noise and accuracy of these converters is achieved using an oversampling Sigma-Delta modulator followed by a multi-order Sinc filter and a digital low-pass filter/decimator.

The filter response has a gentle rolloff from DC with a 3 dB signal bandwidth that is determined by the user-selected sampling rate, shown in [Table 25](#).

Table 25: -3 dB Bandwidth

Sampling Frequency	-3 dB Bandwidth Point
Less than or equal to 600 Samples/s	0.24 x sample rate
Greater than 600 Samples/s	0.23 x sample rate

Figure 19 shows the frequency response using a sampling rate of 4800 Samples/s.

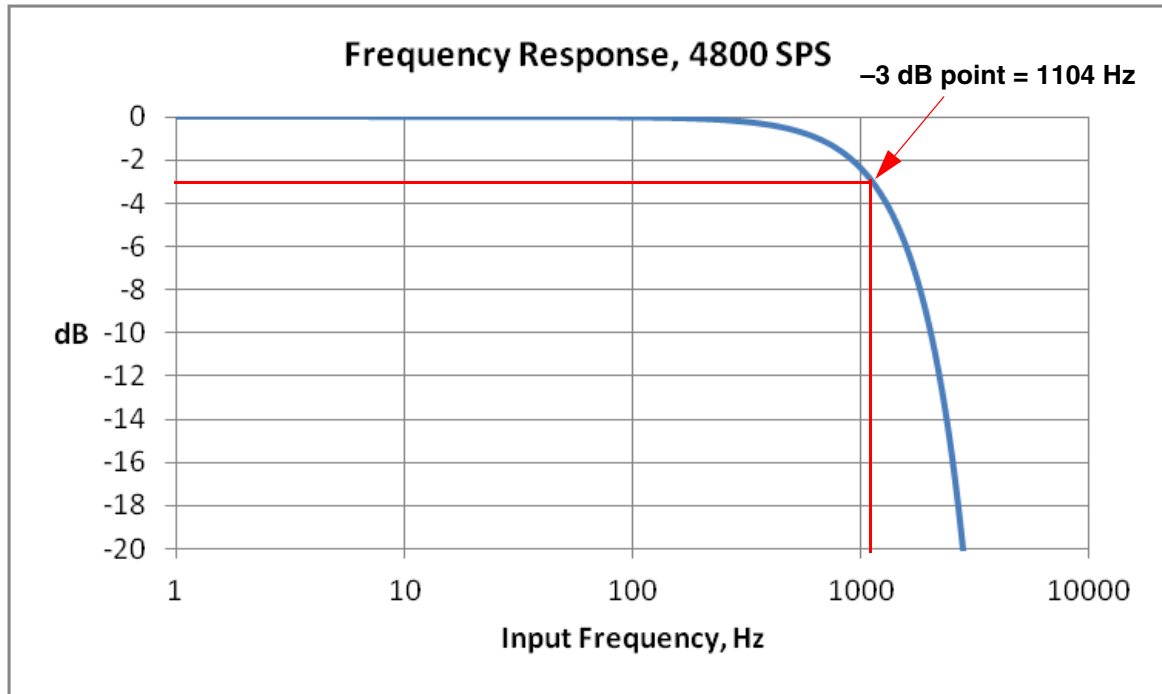


Figure 19: Frequency Response of the DT9824 When Using a Sampling Rate of 4800 Samples/s

As you can see, the frequency response of the DT9824 gently rolls off from DC due to the filtering of the Sigma-Delta A/D converter. You can use software to apply a correction factor to the acquired data to compensate for the filter response of the A/D converter. The correction factor depends on the input frequency of the signal you are trying to measure and the sampling rate of the DT9824. Table 26 shows the gain correction factors for typical input frequencies and sampling rates.

Table 26: Gain Correction Factors

Frequency of the Input Signal (Hz)	Sampling Rate of the DT9824							
	10 Samples/s	25 Samples/s	60 Samples/s	100 Samples/s	600 Samples/s	960 Samples/s	1600 Samples/s	4800 Samples/s
DC	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	1.257	1.035	1.006	1.002	1.000	1.000	1.000	1.000
10	–	3.456	1.168	1.056	1.001	1.001	1.000	1.000
50	–	–	–	–	1.038	1.017	1.006	1.001
60	–	–	–	–	1.055	1.024	1.008	1.001
100	–	–	–	–	1.167	1.068	1.023	1.003
200	–	–	–	–	2.087	1.304	1.095	1.011
500	–	–	–	–	–	6.040	1.791	1.073
1000	–	–	–	–	–	–	–	1.325
2000	–	–	–	–	–	–	–	3.158

Digital I/O Specifications

Table 27 lists the specifications for the digital input (DIN) and digital output (DOUT) subsystems on the DT9824 module.

Table 27: Digital I/O Specifications

Feature	DT9824 Specifications
Number of digital I/O lines	16 (8 Isolated Inputs, 8 Isolated Outputs)
Number of ports	2, 4-bit (1 In, 1 Out)
Inputs Input type: High input voltage: Low input voltage: High input current: Low input current: Termination:	DC +3 to +28 V < +1.5 V 2.2 k Ω resistor to 1.2 V 2.2 k Ω resistor to 1.2 V Series 2.2 k Ω
Outputs Output type: Output driver: High output: Low output: Breakdown voltage: Contact impedance:	Solid-state relay CMOS ± 30 V 0.4 V @ 400 mA ± 60 V 1 Ω
Isolation voltage To computer ground: Channel to channel	± 500 V ± 250 V ^a

- a. Determined by the pin spacing in the 37-pin digital connector. For greater channel-to-channel isolation, use every other digital I/O line; using every other digital I/O line allows ± 500 V isolation channel-to-channel.

Power, Physical, and Environmental Specifications

Table 28 lists the power, physical, and environmental specifications for the DT9824 module.

Table 28: Power, Physical, and Environmental Specifications

Feature	DT9824 Specifications
Power +5 V Standby: +5 V Enumeration: +5 V Power ON: Power Consumption:	500 μ A maximum 100 mA maximum (75 mA typical) 500 mA maximum (420 mA typical) 425 mA current draw
Physical Dimensions Width: Length: Height: Weight:	8.380 inches (212.85 mm) 9.319 inches (236.7 mm) 1.720 inches (43.69 mm) 31 ounces (880 g)
Environmental Operating temperature range: Storage temperature range: Relative humidity:	0° C to 55° C -25° C to 85° C To 95%, noncondensing

Regulatory Specifications

The DT9824 module is CE-compliant. [Table 29](#) lists the regulatory specifications for the DT9824 module.

Table 29: Regulatory Specifications

Feature	Specifications
Emissions (EMI)	FCC Part 15, Class A EN55011:2007 (Based on CISPR-11, 2003/A2, 2006)
Immunity	EN61326-1:2006 Electrical Equipment for Measurement, Control, and Laboratory Use <u>EMC Requirements</u> EN61000-4-2:2009 Electrostatic Discharge (ESD) 4 kV contact discharge, 8 kV air discharge, 4 kV horizontal and vertical coupling planes EN61000-4-3:2006 Radiated electromagnetic fields, 3 V/m, 80 to 1000 MHz; 3 V/m, 1.4 GHz to 2 GHz; 1 V/m, 2 GHz to 2.7 GHz EN61000-4-4:2004 Electrical Fast Transient/Burst (EFT) 1 kV on data cables EN61000-4-6:2009 Conducted immunity requirements, 3 Vrms on data cables 150 kHz to 80 MHz
RoHS (EU Directive 2002/95/EG)	Compliant (as of July 1st, 2006)

Connector Specifications

Table 30 lists the cable and connector specifications for the DT9824 module.

Table 30: DT9824 Cable and Connector Specifications

Feature	DT9824 Specifications
USB cable	2-meter, Type A-B, USB cable Data Translation part#17394 or AMP part# 974327-1
4-position Screw terminal block	Header: Phoenix Contact 1803293 Plug: Phoenix Contact 1803594
37-pin Digital I/O connector Connector on module: Mating connector:	37-pin D, AMP part# 5747847-4 AMP/Tyco part# 5-747916-2