Voltage Output (\(V_{\text{OUT}}\)) DACs

Single-Channel to 8-Channel, Low Voltage, Single-Supply \(V_{\text{OUT}}\) DACs

Analog Devices offers the broadest portfolio of low voltage single-supply DACs in the industry, serving a wide class of applications due to the low power, smallest solution footprint, and robust range of features, with flexible SPI or I2C interfaces. 40+ Analog Devices® products offer enhanced features such as higher accuracy, improved dc performance, increased robustness, and lower glitch energy, among other advantages.

**Featured Product:**
AD5678R-12:
- Octal, 12-Bit, nanoDAC+ with 2 ppm/°C Reference
- High relative accuracy (INL ± 0.12% maximum at 16 Bits)
- Total unadjusted error (TUE) ±14% of FS maximum
- Low drift 2.7 V reference: ±14% of FS maximum
- \(200 \mu\text{W} \text{ to } 2.7 \text{ V output range}
- 10-lead TSSOP and 4 mm × 4 mm LF CSP

Voltage Output (\(V_{\text{OUT}}\)) DACs

Analogue Devices offers a comprehensive family of resistive string and R-2R voltage output (\(V_{\text{OUT}}\)) digital-to-analog converters. From eight bits up to an industry-leading 20 bits of resolution, a single channel to as many as 40 channels in high-density packages, flexible I2C, high dc precision, and lowest glitch, we have a DAC to suit your application.

Fast Precision DACs

For test & measurement and Hardware-in-the-Loop (HIL) applications demanding both DC and AC performance, Analogue Devices fast precision digital-to-analog converter (DAC) enable higher speed waveform generation up to 33 MSPS with 4x oversampling delivering clean signal spectra.
12-Channel to 40-Channel Voltage Output DACs

Targeted at optical communications including Mach-Zehnder modulator bias control, as well as LED displays, analog output modules, antenna arrays, and system biasing, these high-density, high-channel count DACs offer high-output current capability, output monitoring multiplexers, and output span flexibility for ease of reuse in the industry’s smallest footprints.

**Featured Products:**
- LTC2688: 16-Channel, 16-/12-Bit Voltage Output DAC with 10 ppm/°C Max Reference
  - 16 DACs in a small 6 mm × 6 mm LFCSP package
  - Internal precision reference: ±5 ppm/°C (max)
  - Independently programmable output ranges: 0 V to 5 V, 0 V to 10 V, ±5 V, ±10 V
  - Total unadjusted error (TUE): 0.1% FSR maximum
  - Maximum INL error: ±3 LSB (16 bits), ±1 LSB (12 bits)
  - Output buffers drive ±20 mA and 1000 pF loads
- AD5766/AD5767: 16-Channel, 16-/12-Bit Voltage Output DACs
  - 16 DACs in a small 6 mm × 6 mm LFCSP package
  - Integrated reference buffers
  - Channel monitoring multiplexer
  - 10 V to 5 V SPI serial interface
  - –40°C to +125°C operation

**12-Channel to 40-Channel Voltage Output DACs**

<table>
<thead>
<tr>
<th>Output Type</th>
<th>Interface</th>
<th>12-Channel</th>
<th>16-Channel</th>
<th>20-Channel</th>
<th>32-Channel</th>
<th>40-Channel</th>
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<tr>
<td>Bipolar</td>
<td>SPI</td>
<td>AD5760</td>
<td>AD5761</td>
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</tbody>
</table>

**AD5767**
- 16 DACs in a small 6 mm × 6 mm LFCSP package
- Internal precision reference: ±5 ppm/°C (max)
- Independently programmable output ranges: 0 V to 5 V, 0 V to 10 V, ±5 V, ±10 V
- Total unadjusted error (TUE): 0.1% FSR maximum
- Maximum INL error: ±3 LSB (16 bits), ±1 LSB (12 bits)
- Output buffers drive ±20 mA and 1000 pF loads
- Integrated reference buffers
- Channel monitoring multiplexer
- 10 V to 5 V SPI serial interface
- –40°C to +125°C operation

---

**Single-Channel to 16-Channel, Bipolar Voltage Output DACs**

Analog Devices’ family of bipolar voltage output DACs offers exceptional 1 ppm level accuracy at up to 20-bit resolutions and robust output drive, capable of driving a variety of demanding loads. SoftSpan® versions enable each output range to be individually configured via software or pin-strapping. This provides flexibility in reuse across multiple product platforms and reduces the complexity of board design and layout, in addition to providing a more accurate signal chain, resulting in higher system performance and faster design times.

**Featured Product:**
AD7561R: Multiple Range, 16-Bit, Bipolar Voltage Output DACs with 2 ppm/°C Reference
- Eight software-programmable output ranges: 0 V to 5 V, 0 V to 10 V, 0 V to 20 V, ±5 V, ±10 V, ±15 V, and ±25 V to ±5 V (±5 V, ±10 V range is overrange)
- Total unadjusted error (TUE): ±2.5 LSB typical
- Low drift 2.5 V reference: ±2 ppm/°C typical

**Single-Channel to 16-Channel, Bipolar Voltage Output DACs**

<table>
<thead>
<tr>
<th>Output Type</th>
<th>Interface</th>
<th>1-Channel</th>
<th>2-Channel</th>
<th>4-Channel</th>
<th>8-Channel</th>
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**AD5761R-EP** supports defense and aerospace applications
### Parallel Interface Voltage Output DACs

<table>
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<th>Interface</th>
<th>1-Channel</th>
<th>2-Channel</th>
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</tbody>
</table>

### Multiplying DACs

A multiplying P×R current output DAC differs from a fixed-reference DAC in that it can apply a high resolution, digitally set gain to a varying wideband analog signal at the reference input, making it inherently suitable for ac signal processing applications. The SoftSpan feature allows software selectable output spans that reduce the solution size by eliminating the need to add precision gain stages and the associated external jumpers, costly precision resistors, and amplifier circuitry. Integrated precision resistors allow reference inversion, bipolar offset, offset, and gain adjustment.

#### Featured Product:

**LTC2756/LTC2758: 18-Bit, Single and Dual Current Output DACs with SoftSpan Outputs**

- Maximum 18-bit INL error: ±1 LSB over temperature
- Program or pin-strap six output ranges: 0 V to 5 V, 0 V to 10 V, -2.5 V to +7.5 V, ±2.5 V, ±5 V, ±10 V
- glitch impulse: 0.4 nV/s (3 V), 2 nV/s (5 V)
- 18-bit settling time: 2.5 μs
- 2.7 V to 5.5 V single supply operation
- 1 μA maximum supply current
- Voltage controlled offset and gain trims
- Serial interface with readback of all registers

#### Multiplying DACs

<table>
<thead>
<tr>
<th>Output Type</th>
<th>Interface</th>
<th>1-Channel</th>
<th>2-Channel</th>
<th>4-Channel</th>
<th>8-Channel</th>
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</tbody>
</table>

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Suggested part

* Requires 2-wire or 4-wire options

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Multiplying DACs
### Special Function DACs

**PWM to Voltage Output DACs**
- Analog Devices’ LTC2645 and LTC2644 PWM to voltage converters convert a PWM (pulse width modulation) input to an accurate, stable, buffered voltage without the ripple, slew rate, settling, and noise issues associated with traditional linear electronic switches. These families of products provide a simple bolt-on solution to accurately set and adjust up to four voltages without a single line of code required. Applications include isolated motor control, automotive headlights, industrial lighting, flight telemetry, medical monitors, and many other applications that benefit from the simple control interface.

#### Key Features:
- No latency PWM-to-voltage conversion
- Voltage output updates and settles within 8 µs
- 100 kHz to 30 Hz PWM input frequency
- ±2.5 LSB INL, ±1 LSB max DNL (12-bit)
- Pin-selectable internal or external reference
- ±2 V to 5 V supply range
- 1.7 V to 5.5 V input voltage range
- Low power: 4 mA at 3 V, <1 µA power down
- ~42°C to +125°C operation

**Micropower Voltage Output DACs**
- Micropower DACs are ideal for portable battery-operated equipment, and for generating bias or control voltages in a variety of space-constrained and power-sensitive applications.

#### Featured Product:
- **AD5641**: 2.7 V to 5.5 V, <100 µA, 14-Bit Voltage Output DAC
  - Single 14-bit voltage output DAC
  - Pin-selectable internal or external reference
  - ±2.5 LSB max INL; ±1 LSB max DNL
  - 100 kHz to 30 Hz PWM input frequency
  - Voltage output updates and settles within 8 µs
  - Low power: 4 mA at 3 V, <1 µA power down
  - ~42°C to +125°C operation

**Current Source-Sink DACs**
- Analog Devices’ current source DAC portfolio is ideal for photonics control applications where low current noise density, low dropout voltage, and high power efficiency is critical. In addition to high channel density, they are critical to system performance. The flexibility of the configurable current source DAC outputs, and 300 mA current delivery, make them suitable for commercial, medical, and industrial applications. The multichannel precision IDACs AD5770R and LTC2662 are widely used in optical communications applications for tunable laser biasing, semiconductors optical amplifiers, and Raman modulators.

#### Featured Product:
- **LTC2662**: 5-Channel, 300 mA Current Source Output 16-/12-Bit SoftSpan DAC
  - Eight per-channel programmable output ranges:
    - Channel 0: 0 mA to 300 mA, –60 mA to +300 mA, –60 mA to 0 mA
    - Channel 1 to 5: 0 mA to 150 mA, –30 mA to +150 mA, –30 mA to 0 mA
  - Programmable current ranges:
    - Channel 0: 0 mA to 150 mA, –30 mA to +150 mA, –30 mA to 0 mA
    - Channel 1 to 5: 0 mA to 75 mA, 0 mA to 150 mA, –15 mA to +150 mA, –15 mA to 0 mA
  - Programmable current ranges:
    - Channel 0: 0 mA to 75 mA, 0 mA to 150 mA, –15 mA to +150 mA, –15 mA to 0 mA
  - Current source scale back by 0.5×
  - Die temperature monitor along with integrated thermal shutdown
  - Current monitoring on each DAC channel via mux out pin
  - Compliance voltage monitor
  - Integrated precision reference
High Voltage DACs
High voltage DACs are targeted at optical MEMS (microelectromechanical systems), micropositioning applications for piezo actuators, and level setting for automotive test and measurement.

Featured Product
AD45335: 32-Channel, 14-Bit \( V_{\text{OUT}} \) DAC with Full-Scale Programmable Output from 50 V to 200 V

- 32-channel, 14-bit denseDAC® with integrated high voltage output amplifier
- 15 mm × 15 mm CSP_BGA package
- Full-scale output voltage programmable from 50 V to 200 V via reference input
- 100 μA drive capability
- Integrated silicon diode for temperature monitoring
- 12 MHz channel update rate
- -10°C to +85°C operation

Fast Precision DACs (>30 MSPS)
For test and measurement applications demanding both dc and ac performance, our fast precision DACs enable higher speed waveform generation of up to 12.5 MSPS with 4-oversampling with clean signal spectrums.

Featured Product:
AD3551R/AD3541R, ADM3552R/AD3542R: 1-/2-Channel, \( V_{\text{OUT}} \) DAC 1-/2-Channel, 16-/12-Bit Fast DAC

- Current Out, 5 mm × 5 mm QSPI package (AD3551R/AD3552R)
- Voltage Out, 4 mm × 4 mm LFCSP package (AD3541R/AD3542R)
- 100 ns settling time with 2 V step
- Unipolar and bipolar output ranges
- 16.5 MSPS/33 MSPS channel update rate
- -40°C to +105°C operation

4 mA to 20 mA Loop DACs
4 mA to 20 mA loop DACs are employed in process control and factory automation applications. Combined with ADI’s family of HART® modems like the AD5700, the 4 mA to 20 mA converters can be used together to realize a robust, accurate, and HART Foundation registered solution.

Analog Devices’ portfolio extends from the highly integrated AD5454, a loop-powered device that offers an internal regulator and output driver, to devices such as the AD5413/AD5413R, offering voltage outputs with forced/zero capability to ensure that the correct voltage is applied across the load, along with a compensation pin for driving large capacitive loads. The quad-channel AD4354-1 offers a unique dynamic power control mode to minimize power dissipation and improve thermal management in current mode.

4 mA to 20 mA Loop DACs

<table>
<thead>
<tr>
<th>Current Output Range Low (mA)</th>
<th>Interface</th>
<th>Voltage Output Range</th>
<th>1-Channel</th>
<th>4-Channel</th>
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<tbody>
<tr>
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<tr>
<td>4 to 20</td>
<td>SPI</td>
<td>0 V to 5 V, 0 V to 10 V, ±5 V, ±10 V</td>
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<td>0 V to 12.5 V</td>
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</table>

- Suggested part
- Lower glitch
- *With Voltage, Current, Resistance, Temperature Detector, and Thermocouple measurement capability through Sigma Delta ADC
- **Loop Powered
- 3 With Dynamic Power Control
- 4 Functional Safety Approved
- 5 With HART Connectivity/Compatibility or with Integrated HART modem
ADC/DAC Combos

Analog Devices’ comprehensive portfolio of integrated monitoring and control components combine ADCs, DACs, temperature sensors, GPIOs, and current sensing technologies in a wide range of configurations. These integrated solutions save space over discrete implementations and provide greater versatility and configurability for applications requiring general system monitoring and control.

Featured Products:

**AD5592R/AD5593R: 8-Channel, 12-Bit, Configurable ADC/DAC with On-Chip Reference**

- 8-channel, configurable ADC/DAC/GPIO
- Configurable as any combination of
  - 8 × 12-bit DAC channels
  - 8 × 12-bit ADC channels
  - 8 × general-purpose digital input/output pins
- Integrated temperature sensor
- SPI (AD5592R) or I2C (AD5593R) interface
- Available in
  - 16-ball, 2 mm × 2 mm WLCSP
  - 16-lead, 3 mm × 3 mm LFCSP and TSSOP

### ADC/DAC Combos

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<th>Resolution</th>
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