



Low-Power, Rail-to-Rail Output, 12-Bit Serial Input DIGITAL-TO-ANALOG CONVERTER

FEATURES

- **microPOWER OPERATION:** 135 μ A at 5V
- **POWER-DOWN:** 200nA at 5V, 50nA at 3V
- **POWER SUPPLY:** +2.7V to +5.5V
- **TESTED MONOTONIC BY DESIGN**
- **POWER-ON RESET TO 0V**
- **THREE POWER-DOWN FUNCTIONS**
- **LOW POWER SERIAL INTERFACE WITH SCHMITT-TRIGGERED INPUTS**
- **ON-CHIP OUTPUT BUFFER AMPLIFIER, RAIL-TO-RAIL OPERATION**
- **SYNC INTERRUPT FACILITY**
- **SOT23-6 AND MSOP-8 PACKAGES**

APPLICATIONS

- **PORTABLE BATTERY-POWERED INSTRUMENTS**
- **DIGITAL GAIN AND OFFSET ADJUSTMENT**
- **PROGRAMMABLE VOLTAGE AND CURRENT SOURCES**

DESCRIPTION

The DAC7512 is a low-power, single, 12-bit buffered voltage output Digital-to-Analog Converter (DAC). Its on-chip precision output amplifier allows rail-to-rail output swing to be achieved. The DAC7512 uses a versatile three-wire serial interface that operates at clock rates up to 30MHz and is compatible with standard SPI™, QSPI™, Microwire™, and DSP interfaces.

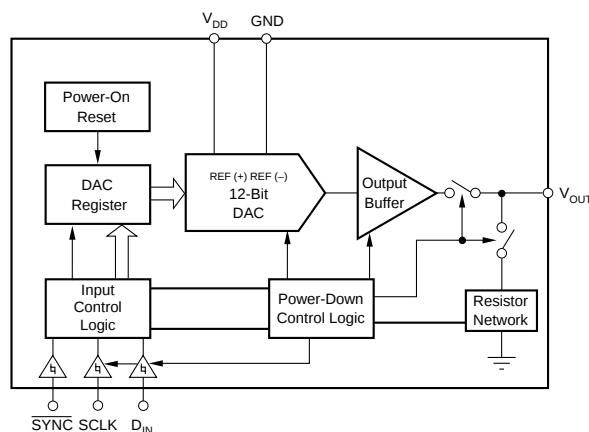
The reference for the DAC7512 is derived from the power supply, resulting in the widest dynamic output range possible. The DAC7512 incorporates a power-on reset circuit that ensures that the DAC output powers up at 0V and remains there until a valid write takes place in the device. The DAC7512 contains a power-down feature, accessed over the serial interface, that can reduce the current consumption of the device to 50nA at 5V.

The low power consumption of this part in normal operation makes it ideally suited to portable battery-operated equipment. The power consumption is 0.7mW at 5V reducing to 1 μ W in power-down mode.

The DAC7512 is available in a SOT23-6 package and an MSOP-8 package.

SPI and QSPI are registered trademarks of Motorola.

Microwire is a registered trademark of National Semiconductor.



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.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

V_{DD} to GND	-0.3V to +6V
Digital Input Voltage to GND	-0.3V to $V_{DD} + 0.3V$
V_{OUT} to GND	-0.3V to $V_{DD} + 0.3V$
Operating Temperature Range	-40°C to +105°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature Range (T_J max)	+150°C
SOT23 Package:	
Power Dissipation	$(T_J \text{ max} - T_A) / \theta_{JA}$
θ_{JA} Thermal Impedance	240°C/W
Lead Temperature, Soldering:	
Vapor Phase (60s)	+215°C
Infrared (15s)	+220°C
MSOP Package:	
Power Dissipation	$(T_J \text{ max} - T_A) / \theta_{JA}$
θ_{JA} Thermal Impedance	206°C/W
θ_{JC} Thermal Impedance	44°C/W
Lead Temperature, Soldering:	
Vapor Phase (60s)	+215°C
Infrared (15s)	+220°C

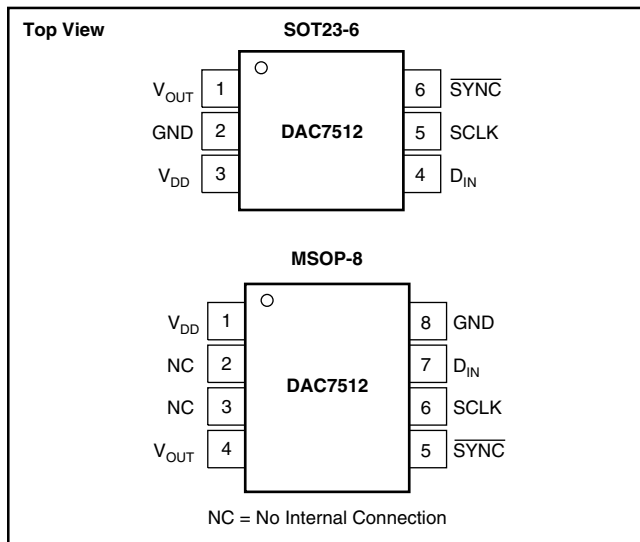
NOTE: (1) Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Exposure to absolute maximum conditions for extended periods may affect device reliability.

PACKAGE/ORDERING INFORMATION

PRODUCT	MINIMUM RELATIVE ACCURACY (LSB)	DIFFERENTIAL NONLINEARITY (LSB)	PACKAGE-LEAD	PACKAGE DESIGNATOR ⁽¹⁾	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	ORDERING NUMBER ⁽¹⁾	TRANSPORT MEDIA, QUANTITY
DAC7512E "	±8 "	±1 "	MSOP-8 "	DGK "	-40°C to +105°C "	D12E "	DAC7512E/250 DAC7512E/2K5	Tape and Reel, 250 Tape and Reel, 2500
DAC7512N "	±8 "	±1 "	SOT23-6 "	DBV "	-40°C to +105°C "	D12N "	DAC7512N/250 DAC7512N/3K	Tape and Reel, 250 Tape and Reel, 3000

NOTES: (1) For the most current specifications and package information, refer to our web site at www.ti.com. (2) Models with a slash (/) are available only in Tape and Reel in the quantities indicated (e.g., /2K5 indicates 2500 devices per reel). Ordering 2500 pieces of "DAC7512E/2K5" will get a single 2500-piece Tape and Reel.

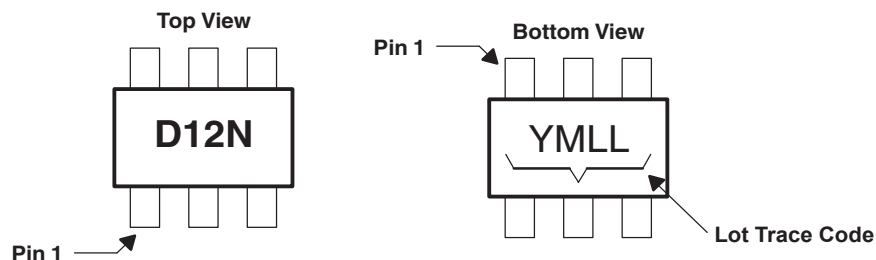
PIN CONFIGURATIONS



PIN DESCRIPTION (SOT23-6)

PIN	NAME	DESCRIPTION
1	V_{OUT}	Analog output voltage from DAC. The output amplifier has rail-to-rail operation.
2	GND	Ground reference point for all circuitry on the part.
3	V_{DD}	Power Supply Input, +2.7V to 5.5V.
4	D_{IN}	Serial Data Input. Data is clocked into the 16-bit input shift register on the falling edge of the serial clock input.
5	SCLK	Serial Clock Input. Data can be transferred at rates up to 30MHz.
6	SYNC	Level triggered control input (active LOW). This is the frame synchronization signal for the input data. When SYNC goes LOW, it enables the input shift register and data is transferred in on the falling edges of the following clocks. The DAC is updated following the 16th clock cycle unless SYNC is taken HIGH before this edge, in which case the rising edge of SYNC acts as an interrupt and the write sequence is ignored by the DAC7512.

DAC7512N LOT TRACE LOCATION



ELECTROSTATIC DISCHARGE SENSITIVITY

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

$V_{DD} = +2.7V$ to $+5.5V$; $R_i = 2k\Omega$ to GND; $C_i = 200pF$ to GND.

NOTES: (1) Linearity calculated using a reduced code range of 48 to 4047; output unloaded. (2) Guaranteed by design and characterization, not production tested.

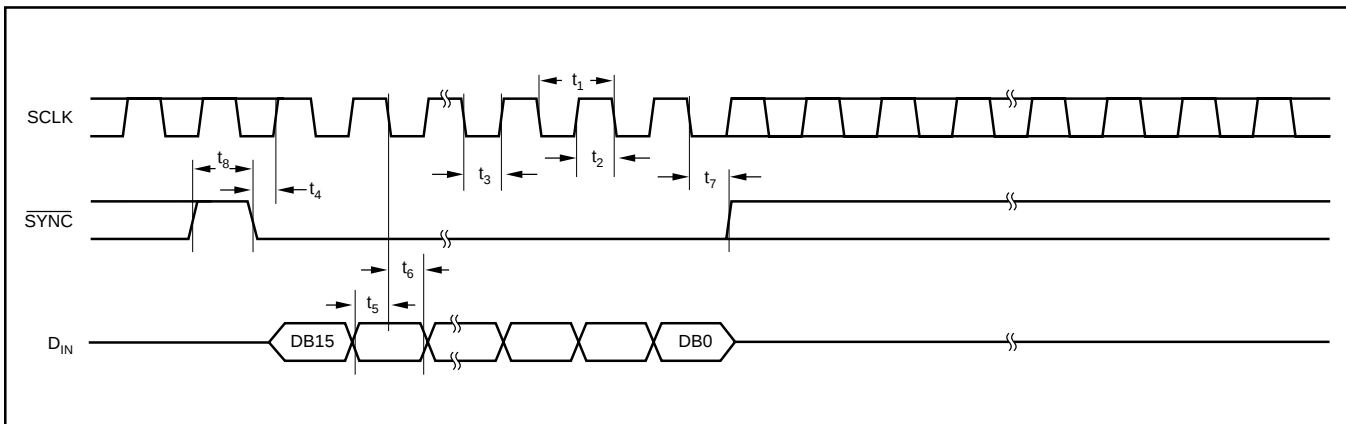
TIMING CHARACTERISTICS^(1, 2)

$V_{DD} = +2.7V$ to $+5.5V$; all specifications $-40^{\circ}C$ to $+105^{\circ}C$, unless otherwise noted.

PARAMETER	DESCRIPTION	CONDITIONS	DAC7512E, N			UNITS
			MIN	TYP	MAX	
$t_1^{(3)}$	SCLK Cycle Time	$V_{DD} = 2.7V$ to $3.6V$ $V_{DD} = 3.6V$ to $5.5V$	50 33			ns ns
t_2	SCLK HIGH Time	$V_{DD} = 2.7V$ to $3.6V$ $V_{DD} = 3.6V$ to $5.5V$	13 13			ns ns
t_3	SCLK LOW Time	$V_{DD} = 2.7V$ to $3.6V$ $V_{DD} = 3.6V$ to $5.5V$	22.5 13			ns ns
t_4	$\overline{SYNC}$ to SCLK Rising Edge Setup Time	$V_{DD} = 2.7V$ to $3.6V$ $V_{DD} = 3.6V$ to $5.5V$	0 0			ns ns
t_5	Data Setup Time	$V_{DD} = 2.7V$ to $3.6V$ $V_{DD} = 3.6V$ to $5.5V$	5 5			ns ns
t_6	Data Hold Time	$V_{DD} = 2.7V$ to $3.6V$ $V_{DD} = 3.6V$ to $5.5V$	4.5 4.5			ns ns
t_7	SCLK Falling Edge to $\overline{SYNC}$ Rising Edge	$V_{DD} = 2.7V$ to $3.6V$ $V_{DD} = 3.6V$ to $5.5V$	0 0			ns ns
t_8	Minimum $\overline{SYNC}$ HIGH Time	$V_{DD} = 2.7V$ to $3.6V$ $V_{DD} = 3.6V$ to $5.5V$	50 33			ns ns

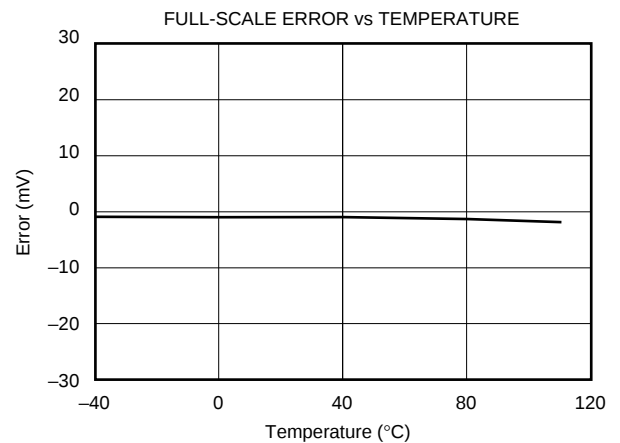
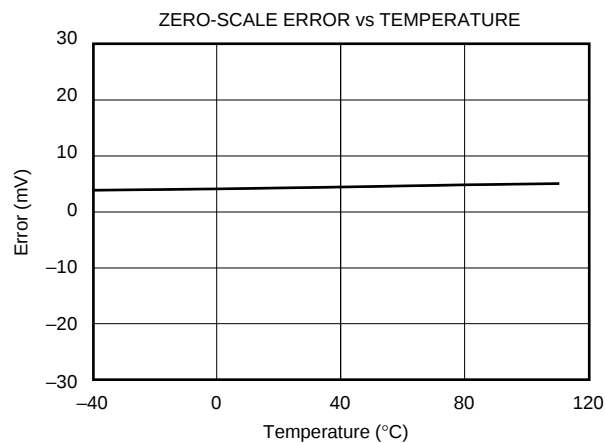
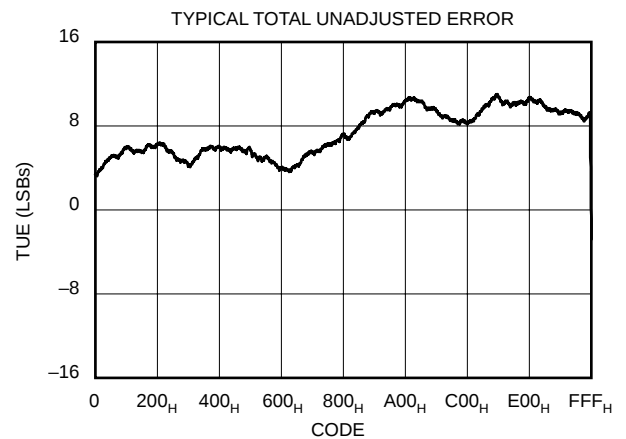
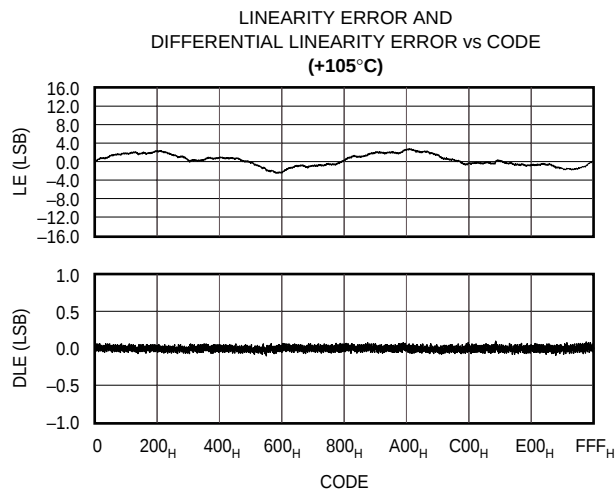
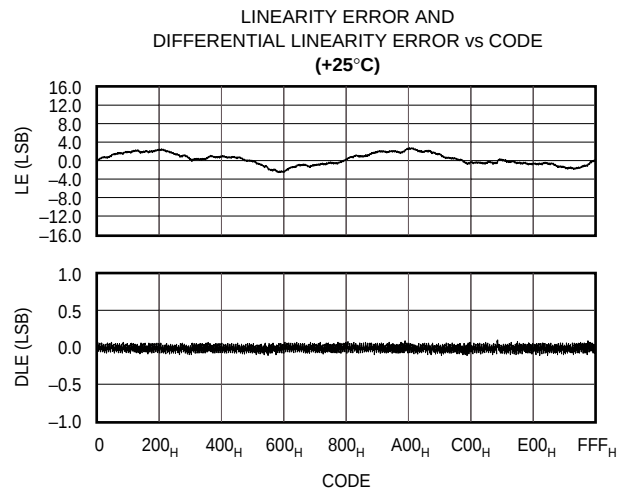
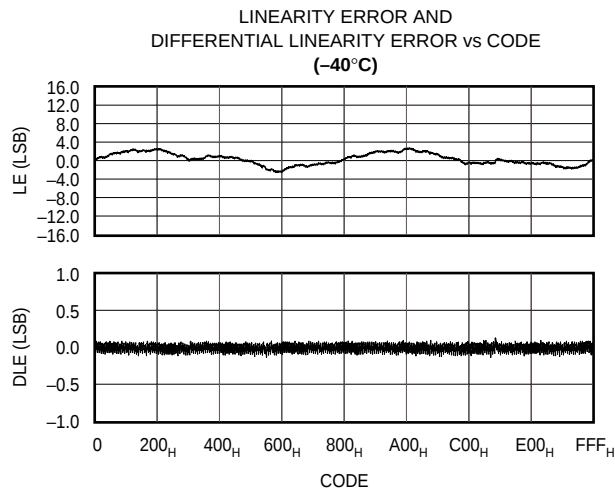
NOTES: (1) All input signals are specified with $t_R = t_F = 5ns$ (10% to 90% of V_{DD}) and timed from a voltage level of $(V_{IL} + V_{IH})/2$. (2) See Serial Write Operation timing diagram, below. (3) Maximum SCLK frequency is 30MHz at $V_{DD} = +3.6V$ to $+5.5V$ and 20MHz at $V_{DD} = +2.7V$ to $+3.6V$.

SERIAL WRITE OPERATION



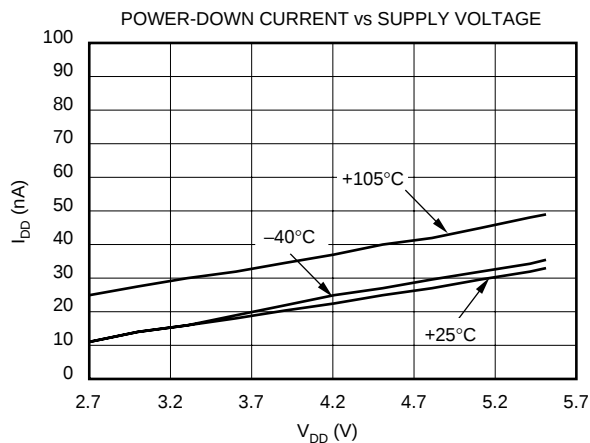
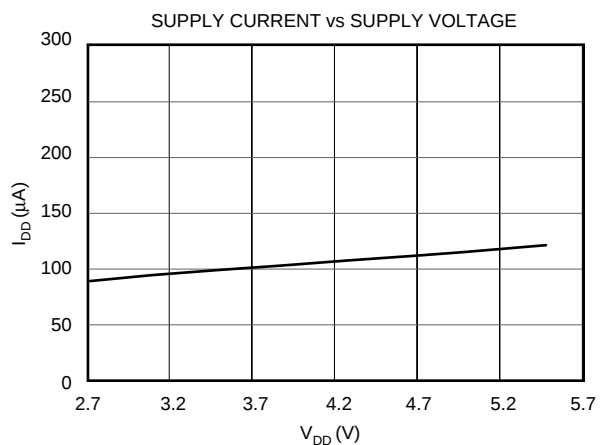
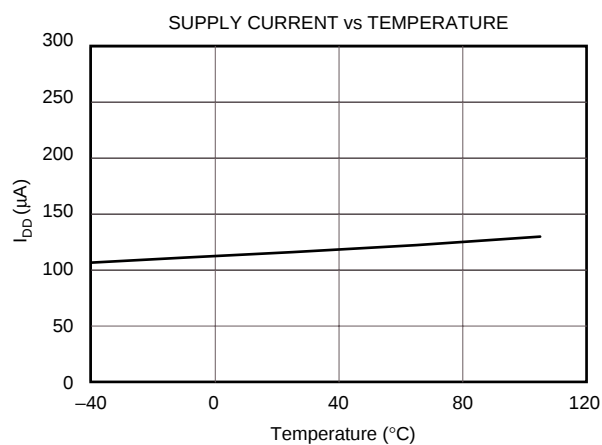
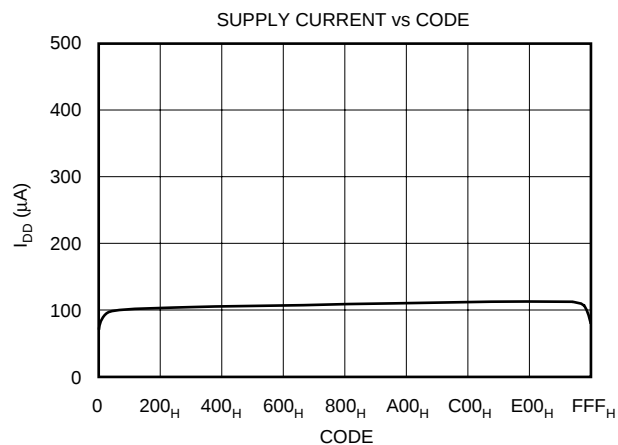
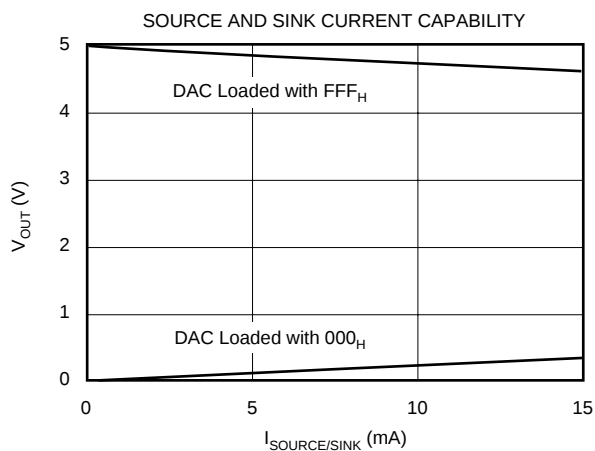
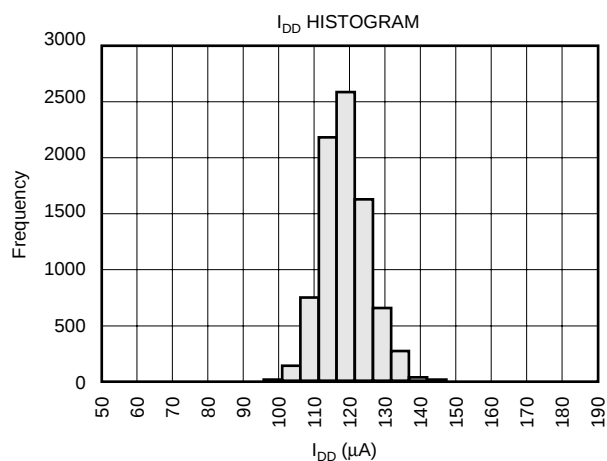
TYPICAL CHARACTERISTICS: $V_{DD} = +5V$

At $T_A = +25^\circ\text{C}$, $+V_{DD} = +5V$, unless otherwise noted.



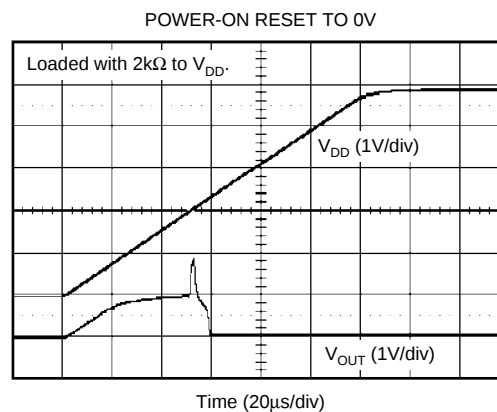
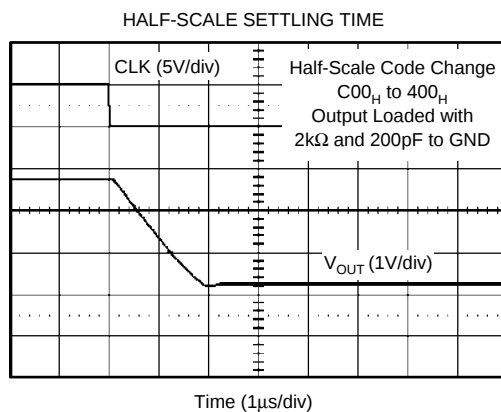
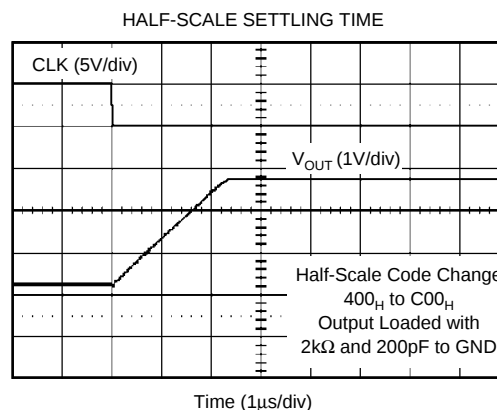
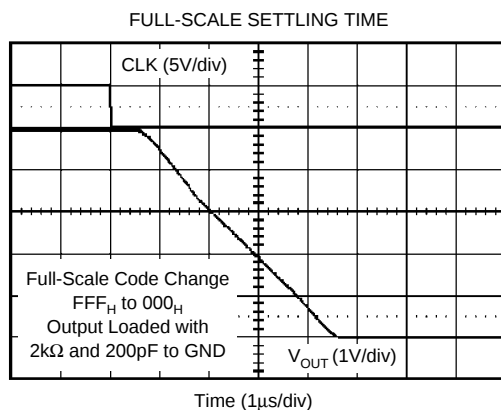
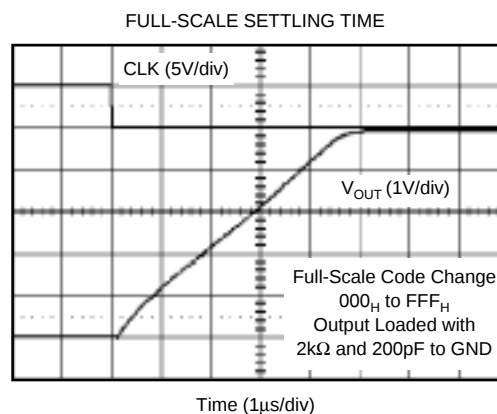
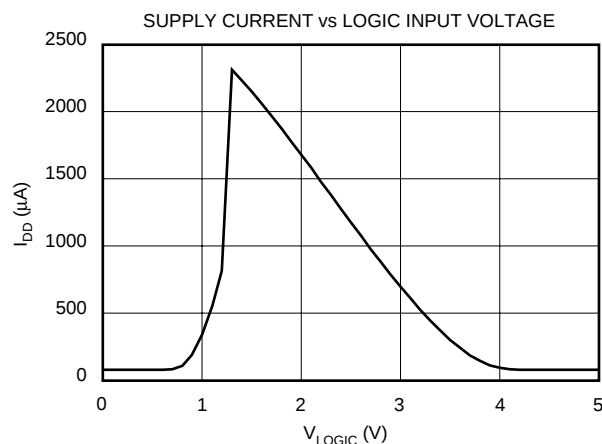
TYPICAL CHARACTERISTICS: $V_{DD} = +5V$ (Cont.)

At $T_A = +25^\circ\text{C}$, $+V_{DD} = +5V$, unless otherwise noted.



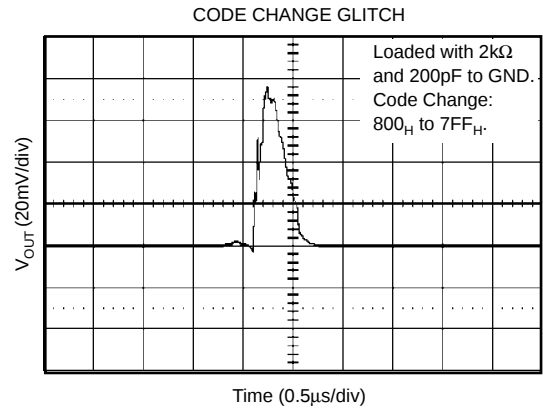
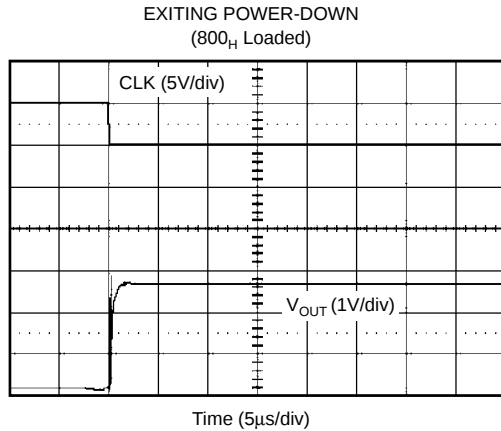
TYPICAL CHARACTERISTICS: $V_{DD} = +5V$ (Cont.)

At $T_A = +25^\circ\text{C}$, $+V_{DD} = +5V$, unless otherwise noted.



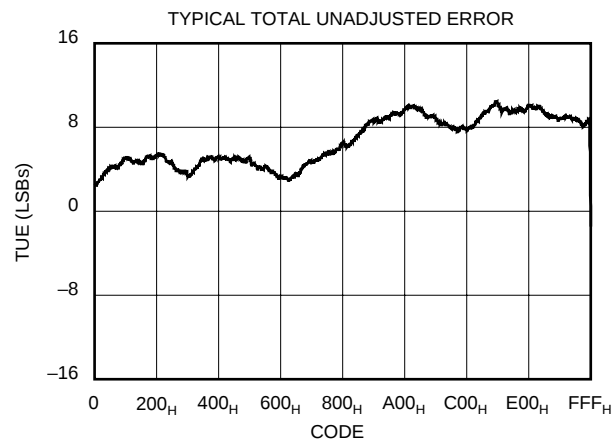
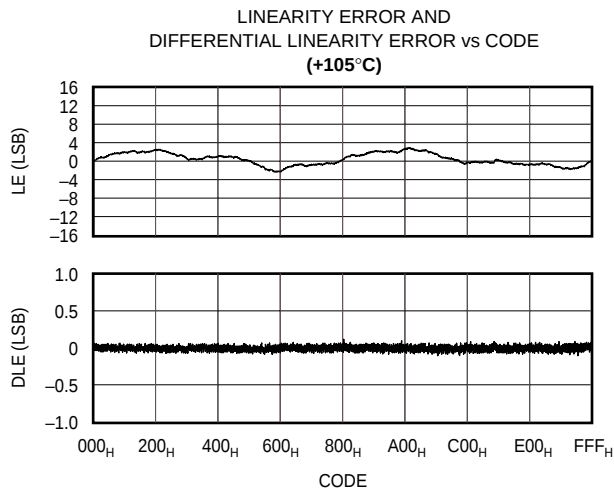
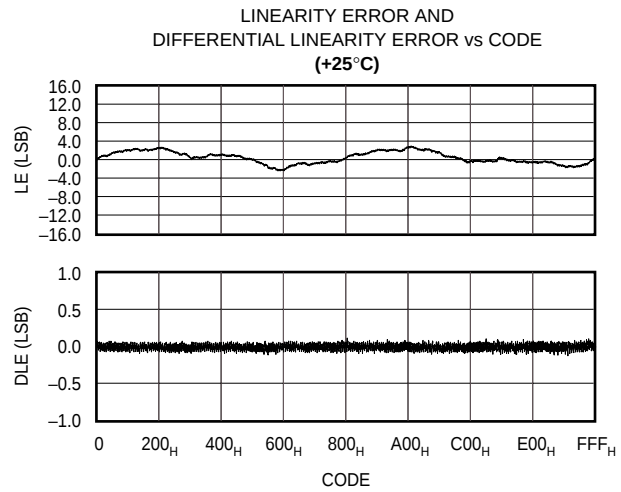
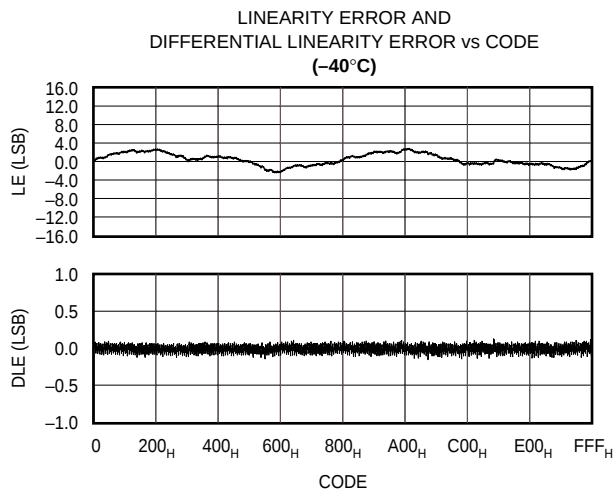
TYPICAL CHARACTERISTICS: $V_{DD} = +5V$ (Cont.)

At $T_A = +25^\circ\text{C}$, $V_{DD} = +5V$, unless otherwise noted.



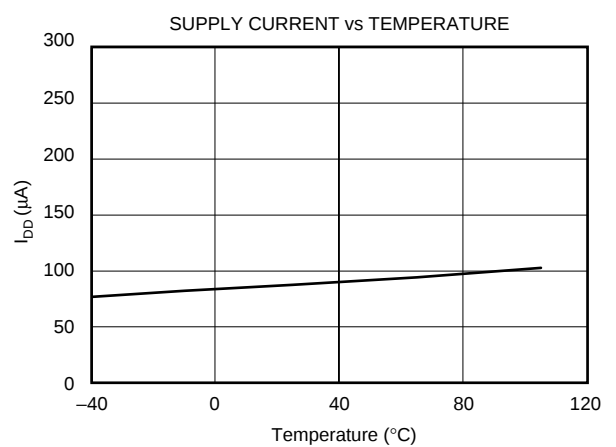
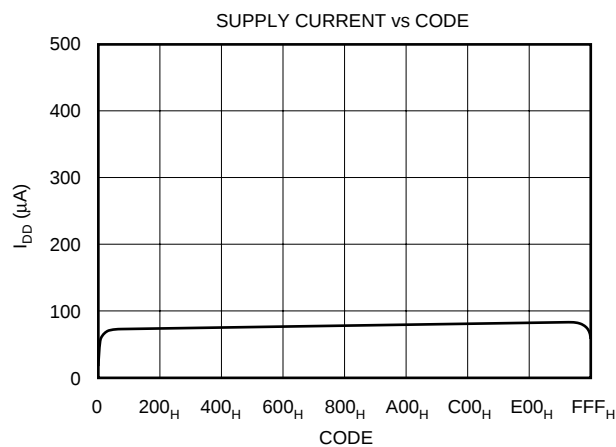
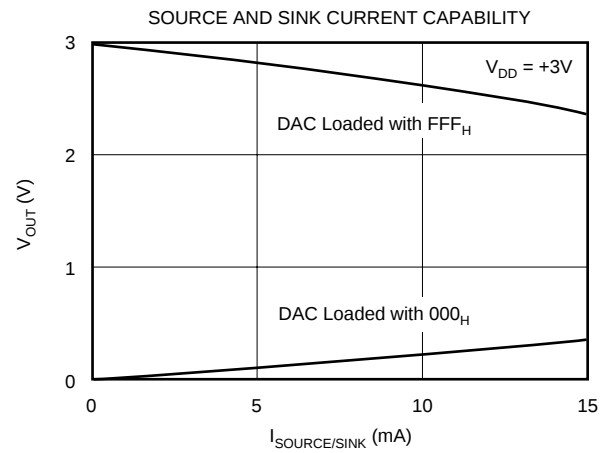
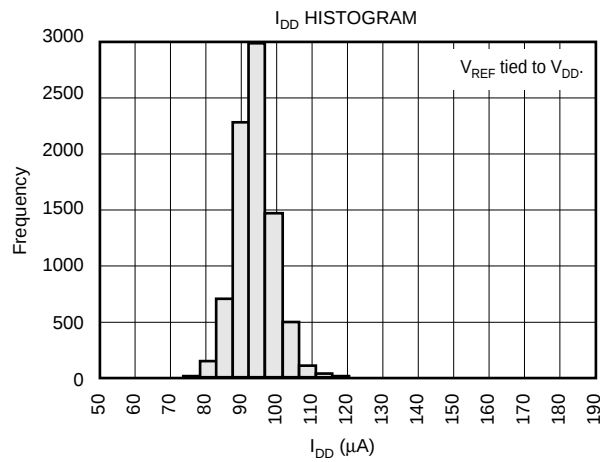
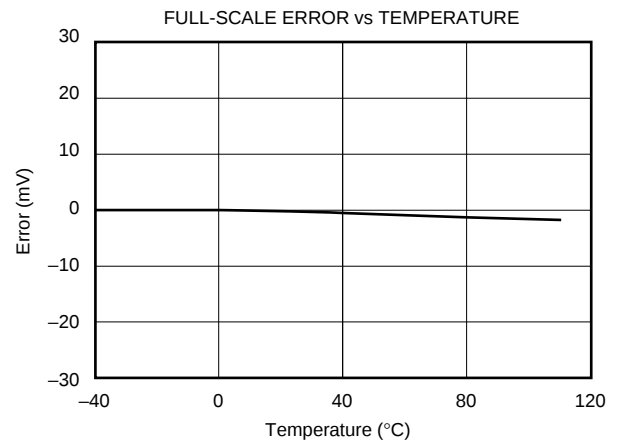
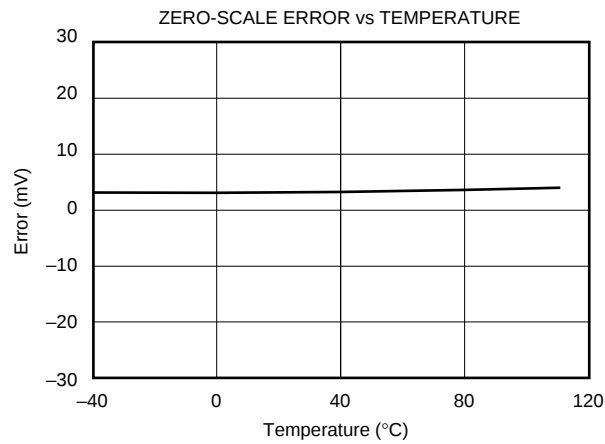
TYPICAL CHARACTERISTICS: $V_{DD} = +2.7V$

At $T_A = +25^\circ\text{C}$, $V_{DD} = +2.7V$, unless otherwise noted.



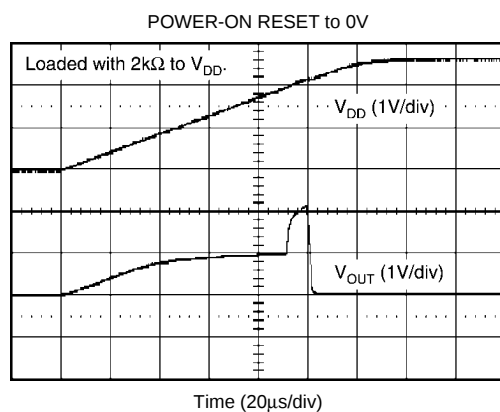
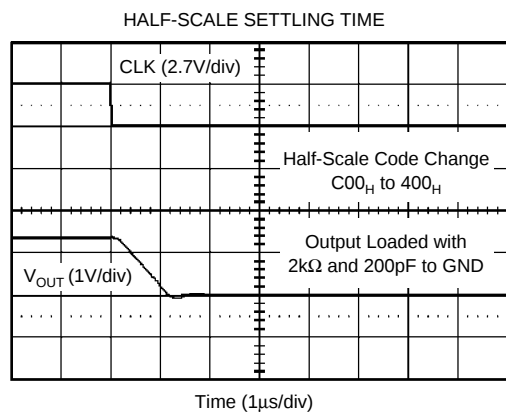
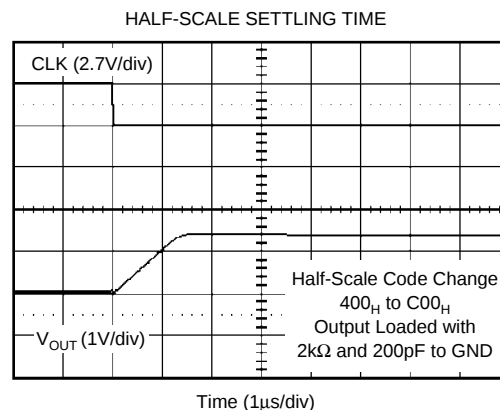
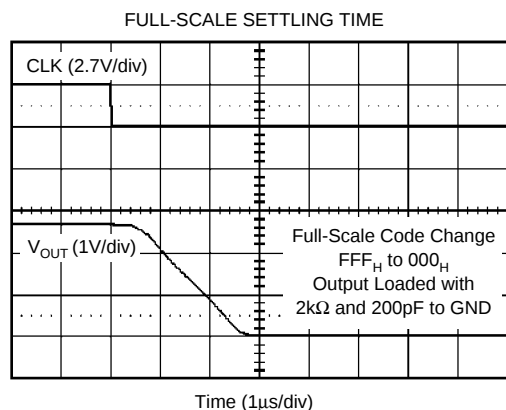
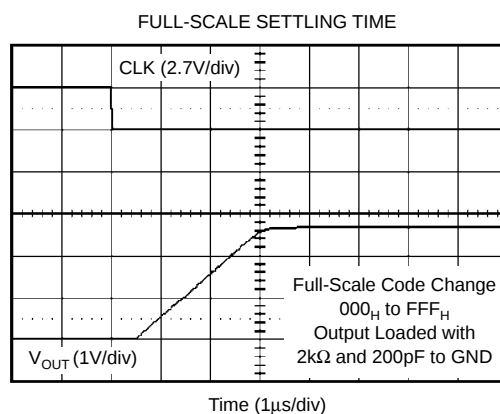
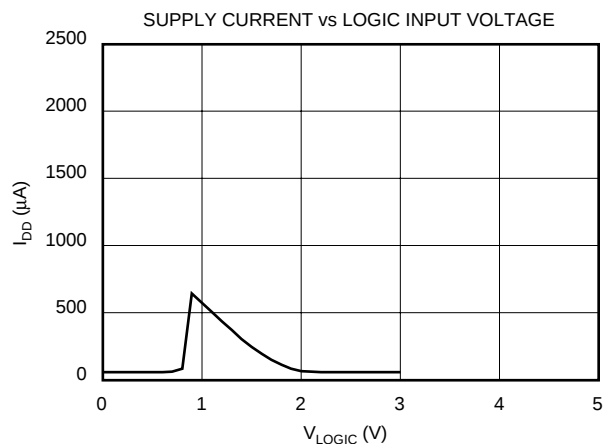
TYPICAL CHARACTERISTICS: $V_{DD} = +2.7V$ (Cont.)

At $T_A = +25^\circ C$, $+V_{DD} = +2.7V$, unless otherwise noted.



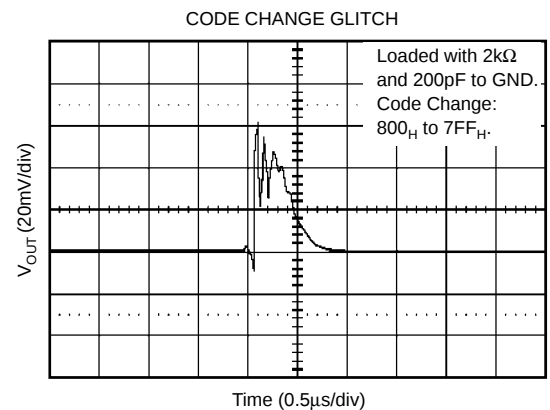
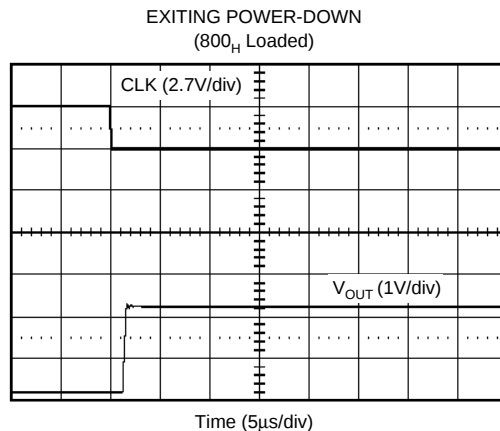
TYPICAL CHARACTERISTICS: $V_{DD} = +2.7V$ (Cont.)

At $T_A = +25^\circ C$, $+V_{DD} = +2.7V$, unless otherwise noted.



TYPICAL CHARACTERISTICS: $V_{DD} = +2.7V$ (Cont.)

At $T_A = +25^\circ C$, $+V_{DD} = +2.7V$, unless otherwise noted.



THEORY OF OPERATION

DAC SECTION

The DAC7512 is fabricated using a CMOS process. The architecture consists of a string DAC followed by an output buffer amplifier. Since there is no reference input pin, the power supply (V_{DD}) acts as the reference. Figure 1 shows a block diagram of the DAC architecture.

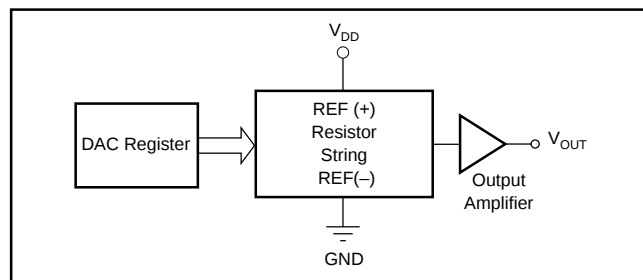


FIGURE 1. DAC7512 Architecture.

The input coding to the DAC7512 is straight binary, so the ideal output voltage is given by:

$$V_{OUT} = V_{DD} \cdot \frac{D}{4096}$$

where D = decimal equivalent of the binary code that is loaded to the DAC register; it can range from 0 to 4095.

RESISTOR STRING

The resistor string section is shown in Figure 2. It is simply a string of resistors, each of value R . The code loaded into the DAC register determines at which node on the string the voltage is tapped off to be fed into the output amplifier by closing one of the switches connecting the string to the amplifier. It is tested monotonic because it is a string of resistors.

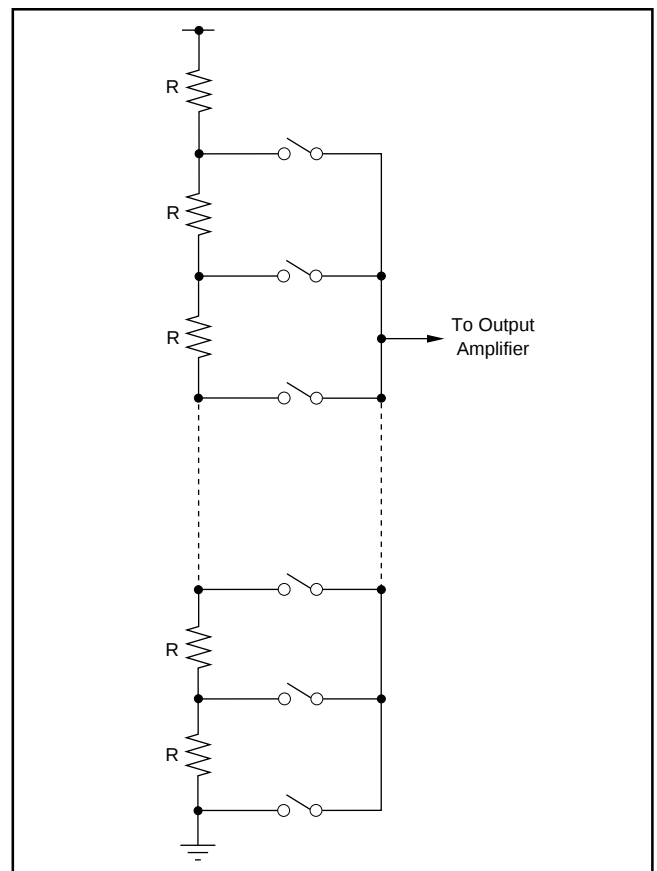


FIGURE 2. Resistor String.

OUTPUT AMPLIFIER

The output buffer amplifier is capable of generating rail-to-rail voltages on its output which gives an output range of 0V to V_{DD} . It is capable of driving a load of $2k\Omega$ in parallel with $100pF$ to GND. The source and sink capabilities of the output amplifier can be seen in the typical characteristics. The slew rate is $1V/\mu s$ with a half-scale settling time of $8\mu s$ with the output unloaded.

SERIAL INTERFACE

The DAC7512 has a three-wire serial interface ($\overline{\text{SYNC}}$, SCLK, and D_{IN}), which is compatible with SPI, QSPI, and Microwire interface standards as well as most Digital Signal Processors (DSPs). See the Serial Write Operation timing diagram for an example of a typical write sequence.

The write sequence begins by bringing the $\overline{\text{SYNC}}$ line LOW. Data from the D_{IN} line is clocked into the 16-bit shift register on the falling edge of SCLK. The serial clock frequency can be as high as 30MHz, making the DAC7512 compatible with high-speed DSPs. On the 16th falling edge of the serial clock, the last data bit is clocked in and the programmed function is executed (i.e., a change in DAC register contents and/or a change in the mode of operation).

At this point, the $\overline{\text{SYNC}}$ line may be kept LOW or brought HIGH. In either case, it must be brought HIGH for a minimum of 33ns before the next write sequence so that a falling edge of $\overline{\text{SYNC}}$ can initiate the next write sequence. Since the $\overline{\text{SYNC}}$ buffer draws more current when the $\overline{\text{SYNC}}$ signal is HIGH than it does when it is LOW, $\overline{\text{SYNC}}$ should be idled LOW between write sequences for lowest power operation of the part. As mentioned above, however, it must be brought HIGH again just before the next write sequence.

INPUT SHIFT REGISTER

The input shift register is 16 bits wide, as shown in Figure 3. The first two bits are "don't cares". The next two bits (PD1 and PD0) are control bits that control which mode of operation the part is in (normal mode or one of three power-down modes). There is a more complete description of the various modes in the Power-Down Modes section. The next 12 bits are the data bits. These are transferred to the DAC register on the 16th falling edge of SCLK.

SYNC INTERRUPT

In a normal write sequence, the $\overline{\text{SYNC}}$ line is kept LOW for at least 16 falling edges of SCLK and the DAC is updated on the 16th falling edge. However, if $\overline{\text{SYNC}}$ is brought HIGH before the 16th falling edge, this acts as an interrupt to the

write sequence. The shift register is reset and the write sequence is seen as invalid. Neither an update of the DAC register contents or a change in the operating mode occurs, as shown in Figure 4.

POWER-ON RESET

The DAC7512 contains a power-on reset circuit that controls the output voltage during power-up. On power-up, the DAC register is filled with zeros and the output voltage is 0V; it remains there until a valid write sequence is made to the DAC. This is useful in applications where it is important to know the state of the output of the DAC while it is in the process of powering up.

POWER-DOWN MODES

The DAC7512 contains four separate modes of operation. These modes are programmable by setting two bits (PD1 and PD0) in the control register. Table I shows how the state of the bits corresponds to the mode of operation of the device.

DB13	DB12	OPERATING MODE
0	0	Normal Operation
0	1	Power-Down Modes: Output 1kΩ to GND
1	0	Output 100kΩ to GND
1	1	High-Z

TABLE I. Modes of Operation for the DAC7512.

When both bits are set to 0, the part works normally with its normal power consumption of 135μA at 5V. However, for the three power-down modes, the supply current falls to 200nA at 5V (50nA at 3V). Not only does the supply current fall, but the output stage is also internally switched from the output of the amplifier to a resistor network of known values. This has the advantage that the output impedance of the part is known while the part is in power-down mode. There are three different options. The output is connected internally to GND through a 1kΩ resistor, a 100kΩ resistor, or it is left open-circuited (High-Z). See Figure 5 for the output stage.

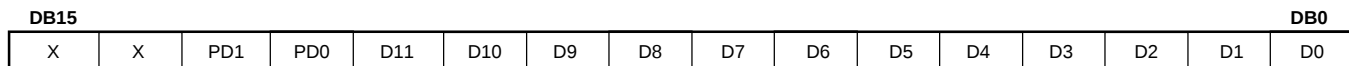


FIGURE 3. Data Input Register.

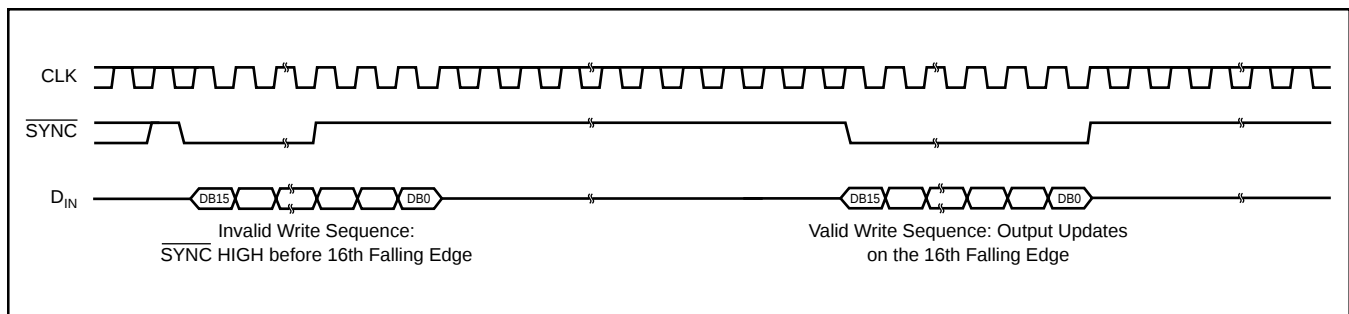


FIGURE 4. $\overline{\text{SYNC}}$ Interrupt Facility.

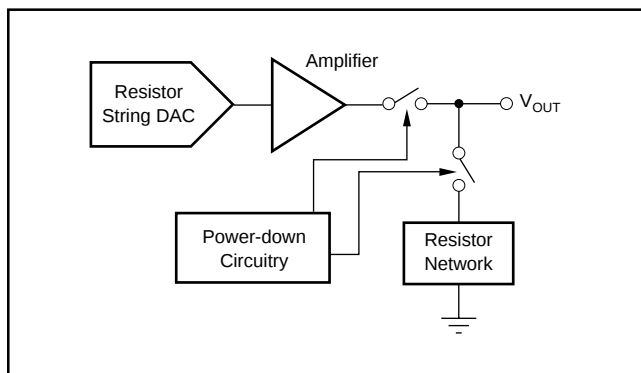


FIGURE 5. Output Stage During Power-Down.

All linear circuitry is shut down when the power-down mode is activated. However, the contents of the DAC register are unaffected when in power-down. The time to exit power-down is typically 2.5 μ s for $V_{DD} = 5V$ and 5 μ s for $V_{DD} = 3V$. See the Typical Characteristics for more information.

MICROPROCESSOR INTERFACING

DAC7512 TO 8051 INTERFACE

Figure 6 shows a serial interface between the DAC7512 and a typical 8051-type microcontroller. The setup for the interface is as follows: TXD of the 8051 drives SCLK of the DAC7512, while RXD drives the serial data line of the part. The $\overline{\text{SYNC}}$ signal is derived from a bit programmable pin on the port. In this case, port line P3.3 is used. When data is to be transmitted to the DAC7512, P3.3 is taken LOW. The 8051 transmits data only in 8-bit bytes; thus only eight falling clock edges occur in the transmit cycle. To load data to the DAC, P3.3 is left LOW after the first eight bits are transmitted, and a second write cycle is initiated to transmit the second byte of data. P3.3 is taken HIGH following the completion of this cycle. The 8051 outputs the serial data in a format which has the LSB first. The DAC7512 requires its data with the MSB as the first bit received. The 8051 transmit routine must therefore take this into account, and "mirror" the data as needed.

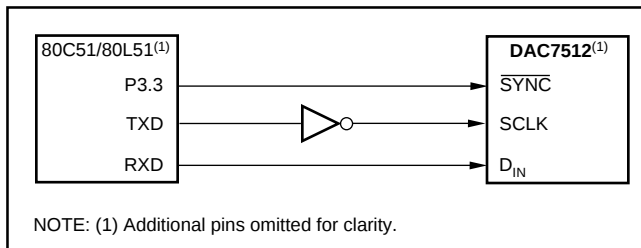


FIGURE 6. DAC7512 to 80C51/80L51 Interface.

DAC7512 TO MICROWIRE™ INTERFACE

Figure 7 shows an interface between the DAC7512 and any Microwire compatible device. Serial data is shifted out on the falling edge of the serial clock and is clocked into the DAC7512 on the rising edge of the SK signal.

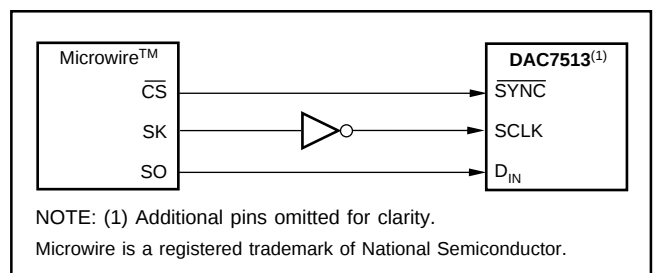


FIGURE 7. DAC7512 to Microwire Interface.

DAC7512 TO 68HC11 INTERFACE

Figure 8 shows a serial interface between the DAC7512 and the 68HC11 microcontroller. SCK of the 68HC11 drives the SCLK of the DAC7512, while the MOSI output drives the serial data line of the DAC. The $\overline{\text{SYNC}}$ signal is derived from a port line (PC7), similar to what was done for the 8051.

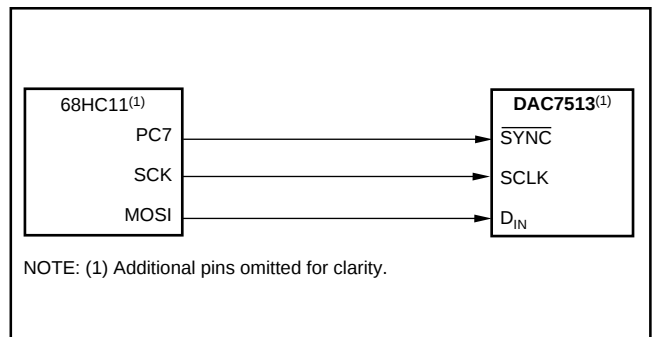


FIGURE 8. DAC7512 to 68HC11 Interface.

The 68HC11 should be configured so that its CPOL bit is a 0 and its CPHA bit is a 1. This configuration causes data appearing on the MOSI output is valid on the falling edge of SCK. When data is being transmitted to the DAC, the $\overline{\text{SYNC}}$ line is taken LOW (PC7). Serial data from the 68HC11 is transmitted in 8-bit bytes with only eight falling clock edges occurring in the transmit cycle. Data is transmitted MSB first. In order to load data to the DAC7512, PC7 is left LOW after the first eight bits are transferred, and a second serial write operation is performed to the DAC and PC7 is taken HIGH at the end of this procedure.

APPLICATIONS

USING REF02 AS A POWER SUPPLY FOR THE DAC7512

Due to the extremely low supply current required by the DAC7512, an alternative option is to use a REF02 +5V precision voltage reference to supply the required voltage to the part, see Figure 9. This is especially useful if the power supply is too noisy or if the system supply voltages are at some value other than 5V. The REF02 will output a steady supply voltage for the DAC7512. If the REF02 is used, the current it needs to supply to the DAC7512 is 135 μ A. This is with no load on the output of the DAC. When the DAC output

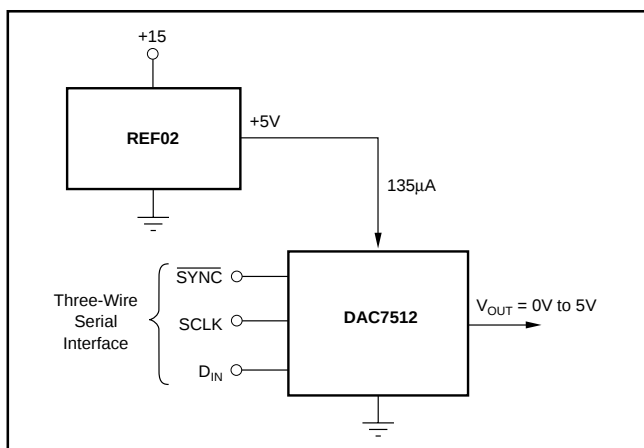


FIGURE 9. REF02 as Power Supply to DAC7512.

is loaded, the REF02 also needs to supply the current to the load. The total current required (with a 5kΩ load on the DAC output) is:

$$135\mu\text{A} + (5\text{V}/5\text{k}\Omega) = 1.14\text{mA}$$

The load regulation of the REF02 is typically 0.005%/mA, which results in an error of 285µV for the 1.14mA current drawn from it. This corresponds to a 0.2LSB error.

BIPOLAR OPERATION USING THE DAC7512

The DAC7512 has been designed for single-supply operation but a bipolar output range is also possible using the circuit in Figure 10. The circuit shown will give an output voltage range of ±5V. Rail-to-rail operation at the amplifier output is achievable using an OPA340 as the output amplifier.

The output voltage for any input code can be calculated as follows:

$$V_O = \left[V \cdot \left(\frac{D}{4096} \right) \cdot \left(\frac{R_1 + R_2}{R_1} \right) - V_{DD} \cdot \left(\frac{R_2}{R_1} \right) \right]$$

where D represents the input code in decimal (0 - 4095).

With $V_{DD} = 5\text{V}$, $R_1 = R_2 = 10\text{k}\Omega$:

$$V_O = \left(\frac{10 \cdot D}{4096} \right) - 5\text{V}$$

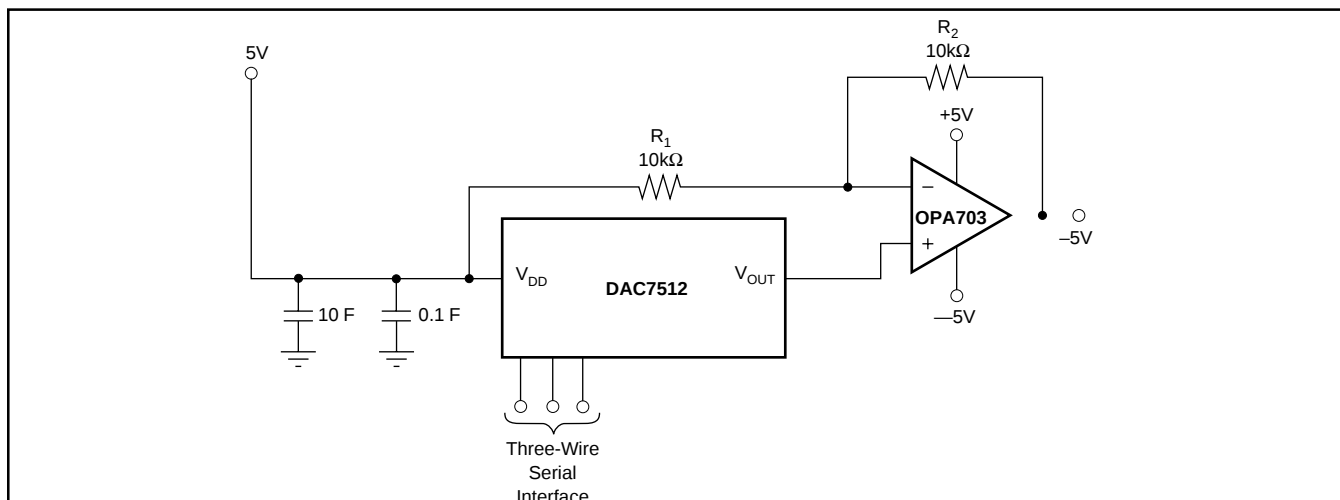


FIGURE 10. Bipolar Operation with the DAC7512.

This is an output voltage range of ±5V with 000_H corresponding to a -5V output and FFF_H corresponding to a +5V output.

LAYOUT

A precision analog component requires careful layout, adequate bypassing, and clean, well-regulated power supplies.

As the DAC7512 offers single-supply operation, it will often be used in close proximity with digital logic, microcontrollers, microprocessors, and digital signal processors. The more digital logic present in the design and the higher the switching speed, the more difficult it will be to achieve good performance from the converter.

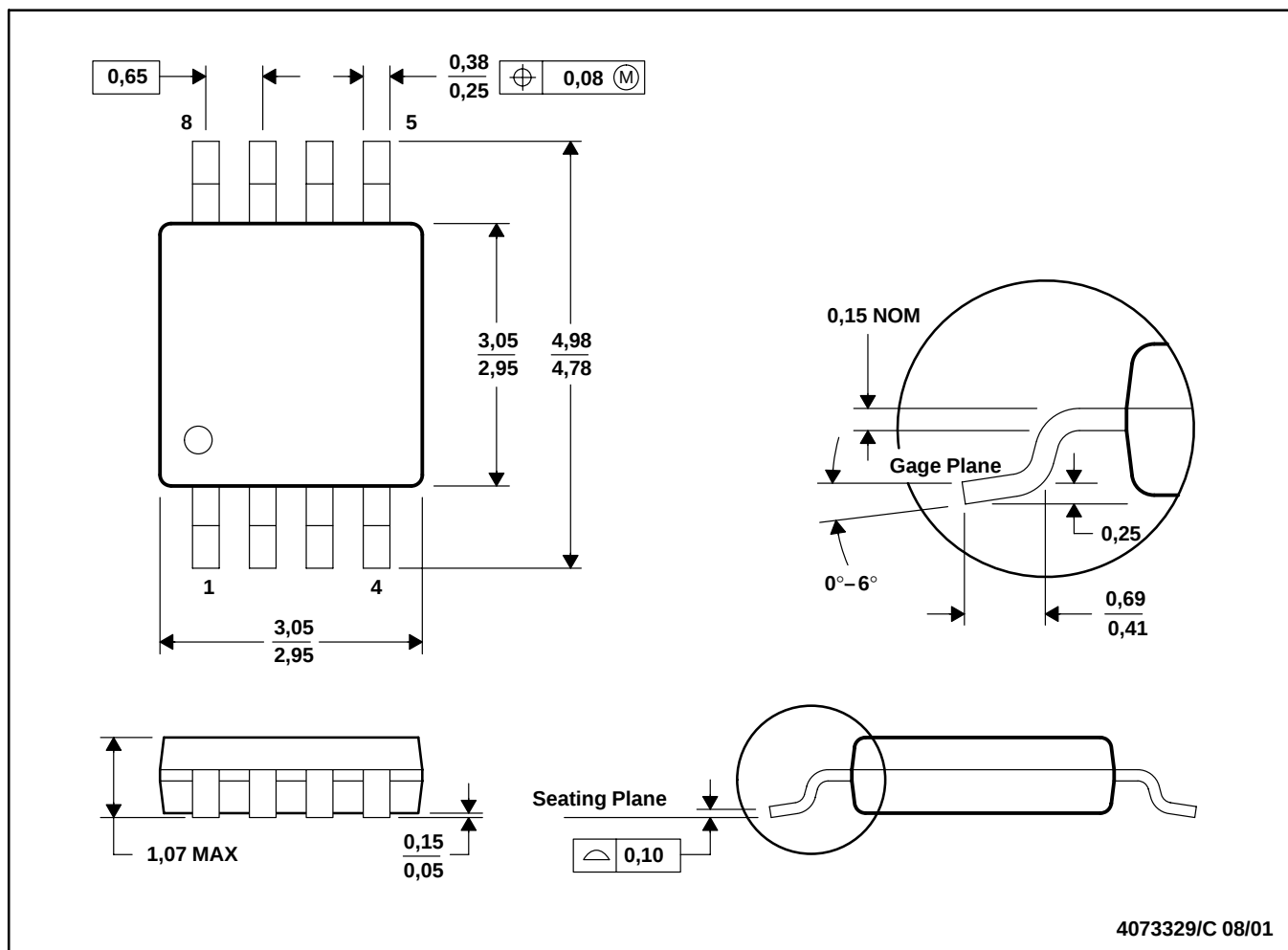
Due to the single ground pin of the DAC7512, all return currents, including digital and analog return currents, must flow through the GND pin. Ideally, GND would be connected directly to an analog ground plane. This plane would be separate from the ground connection for the digital components until they were connected at the power entry point of the system.

The power applied to V_{DD} should be well regulated and low noise. Switching power supplies and DC/DC converters will often have high-frequency glitches or spikes riding on the output voltage. In addition, digital components can create similar high-frequency spikes as their internal logic switches states. This noise can easily couple into the DAC output voltage through various paths between the power connections and analog output. This is particularly true for the DAC7512, as the power supply is also the reference voltage for the DAC.

As with the GND connection, V_{DD} should be connected to a +5V power supply plane or trace that is separate from the connection for digital logic until they are connected at the power entry point. In addition, the 1µF to 10µF and 0.1µF bypass capacitors are strongly recommended. In some situations, additional bypassing may be required, such as a 100µF electrolytic capacitor or even a "Pi" filter made up of inductors and capacitors—all designed to essentially low-pass filter the +5V supply, removing the high-frequency noise.

DGK (R-PDSO-G8)

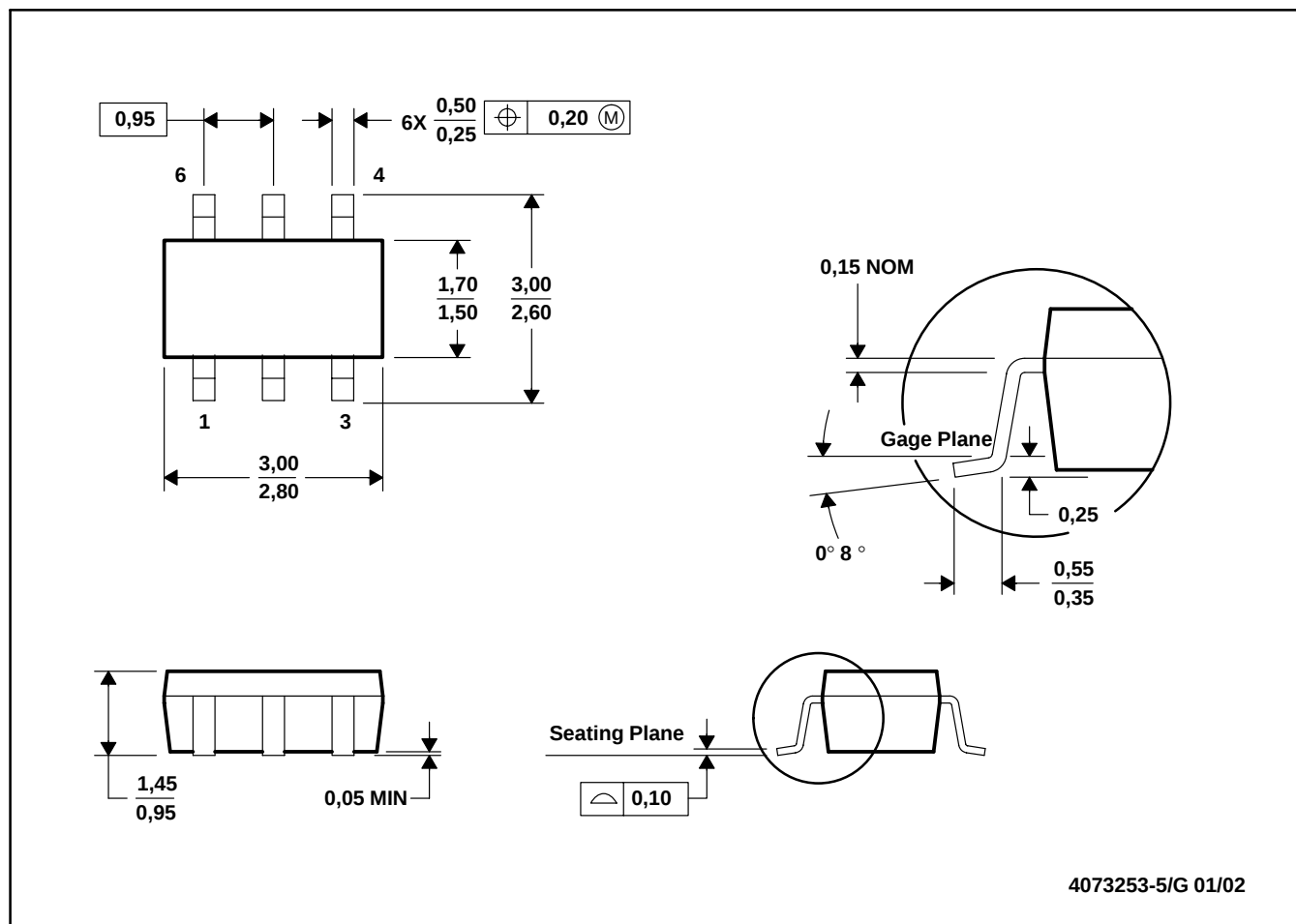
PLASTIC SMALL-OUTLINE PACKAGE



- 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.
 - D. Falls within JEDEC MO-187

DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE



- 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.
 - D. Leads 1, 2, 3 may be wider than leads 4, 5, 6 for package orientation.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
DAC7512E/250	ACTIVE	VSSOP	DGK	8	250	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-2-260C-1 YEAR	-40 to 105	D12E	Samples
DAC7512E/250G4	ACTIVE	VSSOP	DGK	8	250	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-2-260C-1 YEAR	-40 to 105	D12E	Samples
DAC7512E/2K5	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-2-260C-1 YEAR	-40 to 105	D12E	Samples
DAC7512E/2K5G4	ACTIVE	VSSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAUAG	Level-2-260C-1 YEAR	-40 to 105	D12E	Samples
DAC7512N/250	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 105	D12N	Samples
DAC7512N/250G4	ACTIVE	SOT-23	DBV	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 105	D12N	Samples
DAC7512N/3K	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 105	D12N	Samples
DAC7512N/3KG4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 105	D12N	Samples

(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.

⁽⁴⁾ Only one of markings shown within the brackets will appear on the physical device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

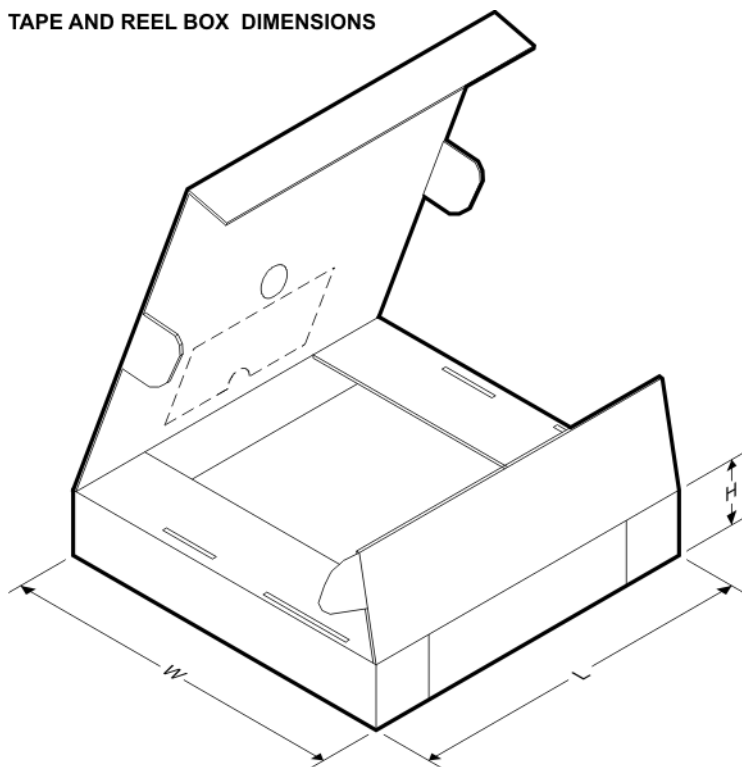
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION


*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
DAC7512E/250	VSSOP	DGK	8	250	180.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
DAC7512E/2K5	VSSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
DAC7512N/250	SOT-23	DBV	6	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
DAC7512N/3K	SOT-23	DBV	6	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS

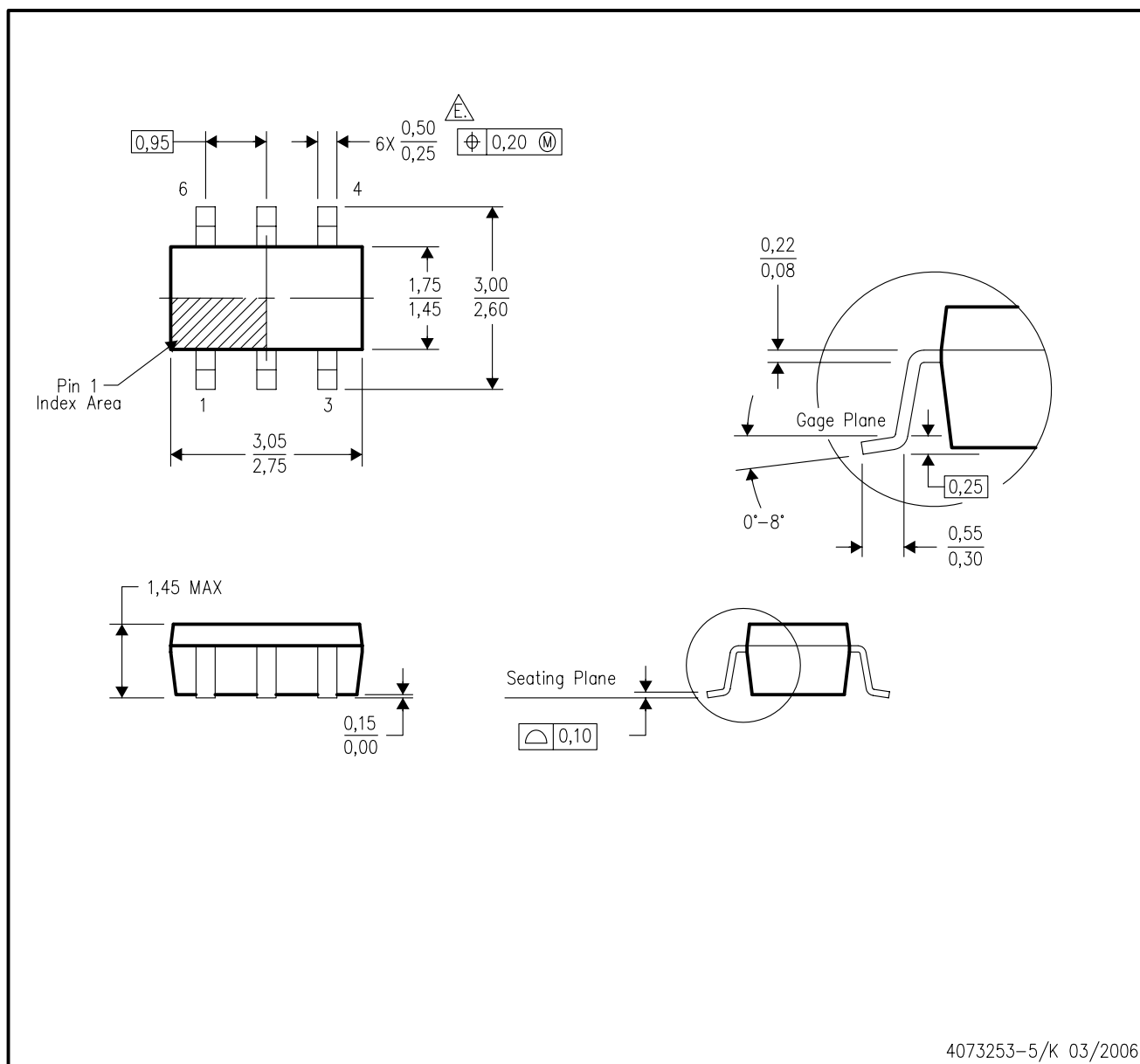


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DAC7512E/250	VSSOP	DGK	8	250	210.0	185.0	35.0
DAC7512E/2K5	VSSOP	DGK	8	2500	367.0	367.0	35.0
DAC7512N/250	SOT-23	DBV	6	250	180.0	180.0	18.0
DAC7512N/3K	SOT-23	DBV	6	3000	180.0	180.0	18.0

DBV (R-PDSO-G6)

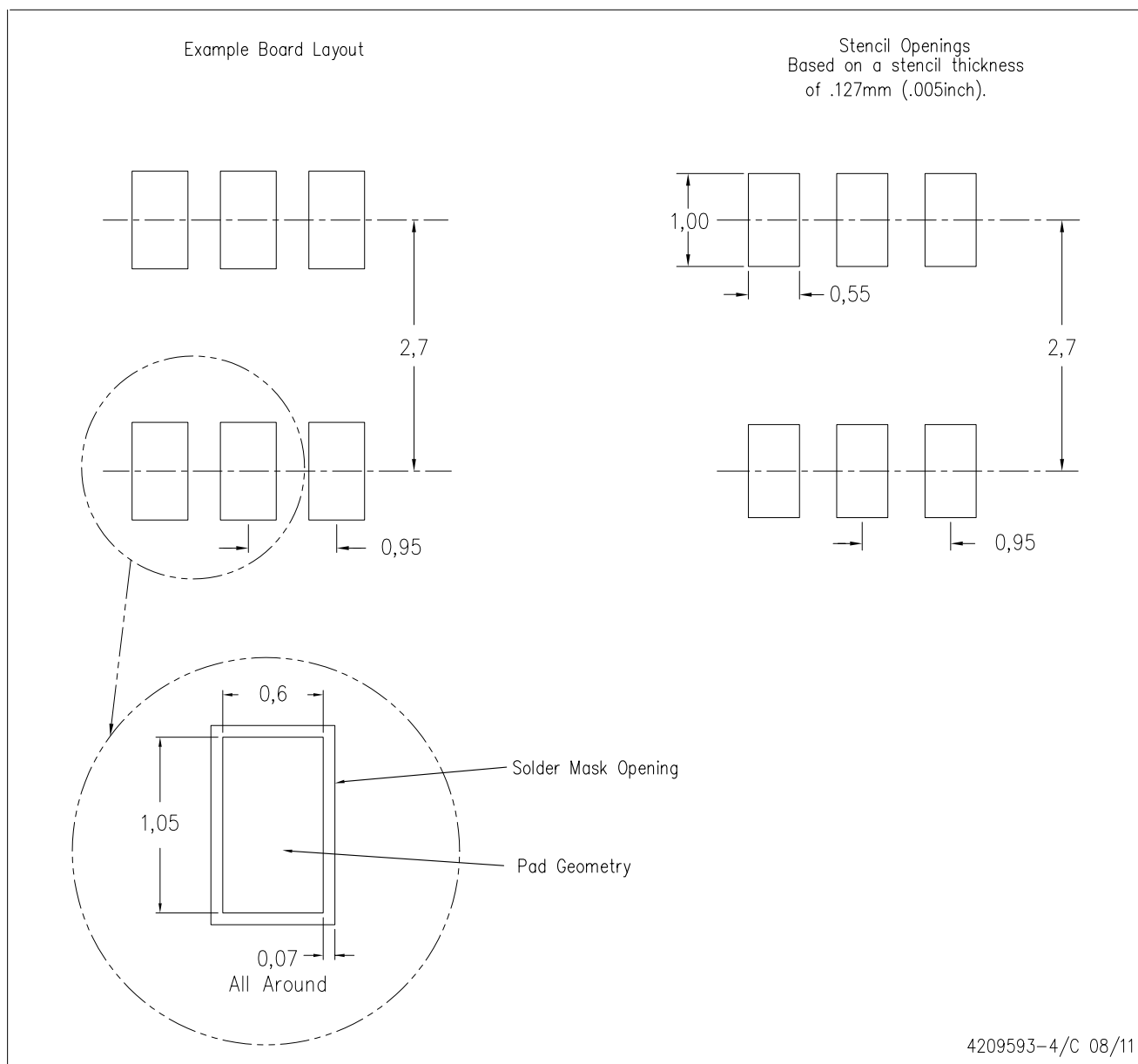
PLASTIC SMALL-OUTLINE PACKAGE



- 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.
- $\triangle$ Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DBV (R-PDSO-G6)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - D. Publication IPC-7351 is recommended for alternate designs.
 - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

DGK (S-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



4073329/E 05/06

NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 per end.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
- E. Falls within JEDEC MO-187 variation AA, except interlead flash.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com



Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.