

DAC7724 DAC7725

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12-Bit Quad Voltage Output DIGITAL-TO-ANALOG CONVERTER

FEATURES

- LOW POWER: 250mW max
- SINGLE SUPPLY OUTPUT RANGE: +10V
- DUAL SUPPLY OUTPUT RANGE: $\pm 10V$
- SETTLING TIME: 10 μ s to 0.012%
- 12-BIT LINEARITY AND MONOTONICITY: -40°C to +85°C
- RESET TO MID-SCALE (DAC7724) OR ZERO-SCALE (DAC7725)
- DATA READBACK
- DOUBLE-BUFFERED DATA INPUTS

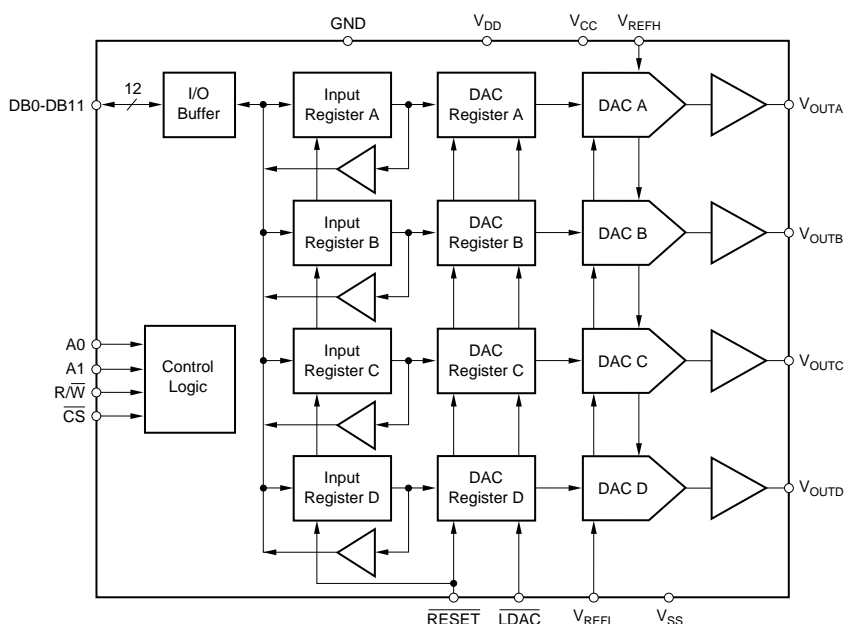
APPLICATIONS

- PROCESS CONTROL
- CLOSED-LOOP SERVO-CONTROL
- MOTOR CONTROL
- DATA ACQUISITION SYSTEMS

DESCRIPTION

The DAC7724 and DAC7725 are 12-bit quad voltage output digital-to-analog converters with guaranteed 12-bit monotonic performance over the specified temperature range. They accept 12-bit parallel input data, have double-buffered DAC input logic (allowing simultaneous update of all DACs), and provide a readback mode of the internal input registers. An asynchronous reset clears all registers to a mid-scale code of 800_H (DAC7724) or to a zero-scale of 000_H (DAC7725). The DAC7724 and DAC7725 can operate from a single +15V supply, or from +15V and -15V supplies.

Low power and small size per DAC make the DAC7724 and DAC7725 ideal for automatic test equipment, DAC-per-pin programmers, data acquisition systems, and closed-loop servo-control. The DAC7724 and DAC7725 are available in a PLCC-28 or a SO-28 package, and offer guaranteed specifications over the -40°C to +85°C temperature range.



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Twx: 910-952-1111 • Internet: <http://www.burr-brown.com/> • Cable: BBRCORP • Telex: 066-6491 • FAX: (520) 889-1510 • Immediate Product Info: (800) 548-6132

SPECIFICATION (DUAL SUPPLY)

At $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = +15\text{V}$, $V_{DD} = +5\text{V}$, $V_{SS} = -15\text{V}$, $V_{REFH} = +10\text{V}$, $V_{REFL} = -10\text{V}$, unless otherwise noted.

PARAMETER	CONDITIONS	DAC7724N, U DAC7725N, U			DAC7724NB, UB DAC7725NB, UB			UNITS			
		MIN	TYP	MAX	MIN	TYP	MAX				
ACCURACY											
Linearity Error	T _{MIN} to T _{MAX} Code = 000 _H	12	1	±2	*		±1	LSB ⁽¹⁾			
Linearity Matching ⁽²⁾				±2			±1	LSB			
Differential Linearity Error				±1			±1	LSB			
Monotonicity								Bits			
Zero-Scale Error				±2			*	LSB			
Zero-Scale Drift	Code = FFF _H			±2			±1	ppm/°C			
Zero-Scale Matching ⁽²⁾				±2			*	LSB			
Full-Scale Error				±2			*	LSB			
Full-Scale Matching ⁽²⁾	At Full Scale		10	±2			±1	LSB			
Power Supply Sensitivity							*	ppm/V			
ANALOG OUTPUT											
Voltage Output ⁽³⁾	No Oscillation	V _{REFL} ±5	500 ±20 Indefinite	V _{REFH}	*		*	V			
Output Current				*	*		mA				
Load Capacitance				*	*		pF				
Short-Circuit Current				*	*		mA				
Short-Circuit Duration				To V _{SS} , V _{CC} , or GND	*						
REFERENCE INPUT											
V _{REFH} Input Range		V _{REFL} +1.25 −10 −0.5 −3.5		+10	*		*	V			
V _{REFL} Input Range				V _{REFH} − 1.25	*		*	V			
Ref High Input Current				3.0	*		*	mA			
Ref Low Input Current				0	*		*	mA			
DYNAMIC PERFORMANCE											
Settling Time	To ±0.012%, 20V Output Step Full-Scale Step f = 10kHz		8 0.25 2 65	10		*	*	μs			
Channel-to-Channel Crosstalk							*	*	LSB		
Digital Feedthrough							*	*	nV-s		
Output Noise Voltage							*	*	nV/√Hz		
DIGITAL INPUT/OUTPUT											
Logic Family	I _{IH} ≤ ±10μA I _{IL} ≤ ±10μA I _{OH} = −0.8mA I _{OL} = 1.6mA	TTL-Compatible CMOS			*						
Logic Levels											
V _{IH}		2.4	V _{DD} +0.3 0.8 V _{DD} 0.4	*	*				V		
V _{IL}		−0.3		*	*				V		
V _{OH}		3.6		*	*				V		
V _{OL}		0.0		*	*				V		
Data Format		Straight Binary							*		
POWER SUPPLY REQUIREMENTS											
V _{DD}		+4.75	50 6 −8 180	+5.25	*		*	V			
V _{CC}		+14.25		+15.75	*		*	V			
V _{SS}		−14.25		−15.75	*		*	V			
I _{DD}							*	μA			
I _{CC}				8.5			*	mA			
I _{SS}					*		*	mA			
Power Dissipation				250			*	mW			
TEMPERATURE RANGE											
Specified Performance				−40			+85	*		*	°C

NOTES: (1) LSB means Least Significant Bit, when V_{REFH} equals +10V and V_{REFL} equals -10V, then one LSB equals 4.88mV. (2) All DAC outputs will match within the specified error band. (3) Ideal output voltage, does not take into account zero or full-scale error.

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SPECIFICATION (SINGLE SUPPLY)

At $T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$, $V_{CC} = +15\text{V}$, $V_{DD} = +5\text{V}$, $V_{SS} = \text{GND}$, $V_{REFH} = +10\text{V}$, $V_{REFL} = 0\text{V}$, unless otherwise noted.

		DAC7724N, U DAC7725N, U			DAC7724NB, UB DAC7725NB, UB					
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNITS		
ACCURACY										
Linearity Error ⁽¹⁾	T _{MIN} to T _{MAX} Code = 004 _H	12	2	±2	*	*	±1	LSB ⁽²⁾		
Linearity Matching ⁽³⁾				±2			±1	LSB		
Differential Linearity Error				±1			±1	LSB		
Monotonicity								Bits		
Zero-Scale Error				±4			*	LSB		
Zero-Scale Drift	Code = FFF _H			±4		*	±2	ppm/°C		
Zero-Scale Matching ⁽³⁾				±4			*	LSB		
Full-Scale Error				±4			*	LSB		
Full-Scale Matching ⁽³⁾	At Full Scale		20			*	±2	LSB		
Power Supply Sensitivity							ppm/V			
ANALOG OUTPUT										
Voltage Output ⁽⁴⁾	No Oscillation	V _{REFL} ±5	500 ±20 Indefinite	V _{REFH}	*	*	*	V		
Output Current					*			mA		
Load Capacitance					*			pF		
Short-Circuit Current					*			mA		
Short-Circuit Duration				To V _{CC} or GND				*		
REFERENCE INPUT										
V _{REFH} Input Range		V _{REFL} +1.25 0 −0.3 −2.0		+10	*		*	V		
V _{REFL} Input Range				V _{REFH} − 1.25	*		*	V		
Ref High Input Current				1.5	*		*	mA		
Ref Low Input Current				0	*		*	mA		
DYNAMIC PERFORMANCE										
Settling Time ⁽⁵⁾	To ±0.012%, 10V Output Step		8	10		*	*	μs		
Channel-to-Channel Crosstalk			0.25	*		LSB				
Digital Feedthrough	f = 10kHz		2			*	*	nV-s		
Output Noise Voltage			65	*		nV/√Hz				
DIGITAL INPUT/OUTPUT										
Logic Family	I _{IH} ≤ ±10μA I _{IL} ≤ ±10μA I _{OH} = −0.8mA I _{OL} = 1.6mA	TTL-Compatible CMOS			*					
Logic Levels		2.4 −0.3 3.6 0.0		V _{DD} +0.3 0.8 V _{DD} 0.4	*				*	V
V _{IH}					*				*	V
V _{IL}					*				*	V
V _{OH}					*				*	V
V _{OL}					*				*	V
Data Format	Straight Binary			*						
POWER SUPPLY REQUIREMENTS										
V _{DD}		+4.75 14.25	50 3.0 45	+5.25	*		*	V		
V _{CC}				15.75	*	*	V			
I _{DD}					*	*	μA			
I _{CC}					*	*	mA			
Power Dissipation					*	*	mW			
TEMPERATURE RANGE										
Specified Performance		−40		+85	*		*	°C		

NOTES: (1) If $V_{SS} = 0\text{V}$, specification applies at code 004_H and above. (2) LSB means Least Significant Bit, when V_{REFH} equals +10V and V_{REFL} equals 0V, then one LSB equals 2.44mV. (3) All DAC outputs will match within the specified error band. (4) Ideal output voltage, does not take into account zero or full-scale error. (5) Full-scale positive 10V step and negative step from code FFF_H to 004_H.

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

V_{CC} to V_{SS}	-0.3V to +32V
V_{CC} to GND	-0.3V to +16V
V_{SS} to GND	+0.3V to -16V
V_{DD} to GND	-0.3V to 6V
V_{REFH} to GND	-9V to +11V
V_{REFL} to GND ($V_{SS} = -15V$)	-11V to +9V
V_{REFL} to GND ($V_{SS} = 0V$)	-0.3V to +9V
V_{REFH} to V_{REFL}	-1V to +22V
Digital Input Voltage to GND	-0.3V to $V_{DD} + 0.3V$
Digital Output Voltage to GND	-0.3V to $V_{DD} + 0.3V$
Maximum Junction Temperature	+150°C
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°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.



ELECTROSTATIC DISCHARGE SENSITIVITY

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

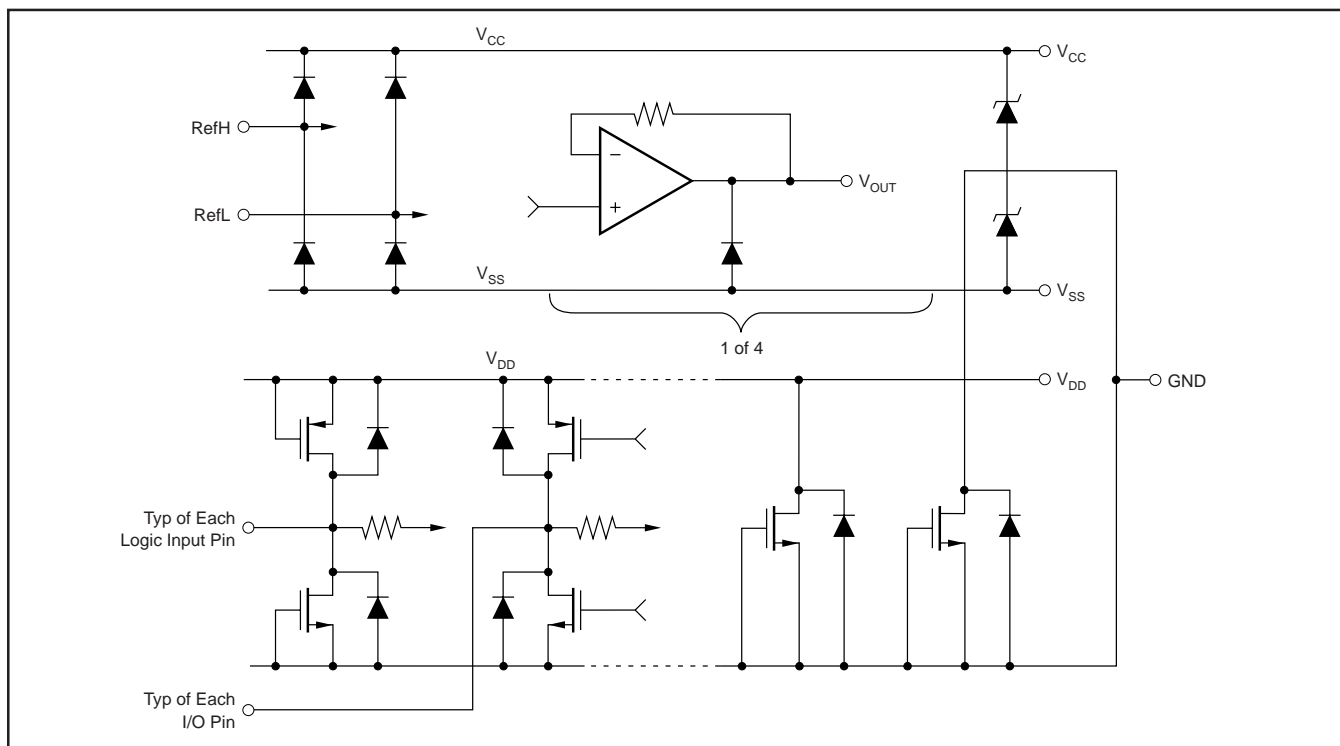
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

PACKAGE/ORDERING INFORMATION

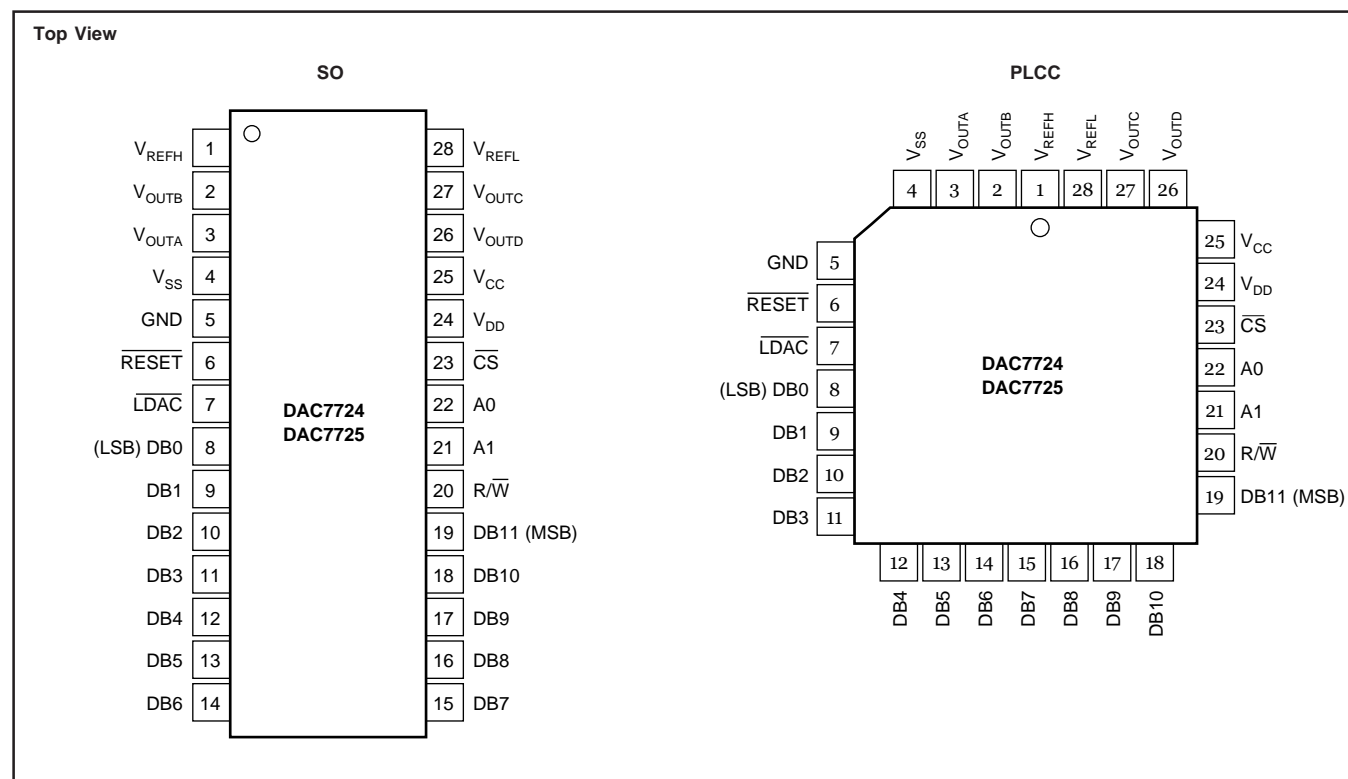
PRODUCT	MAXIMUM LINEARITY ERROR (LSB)	MAXIMUM DIFFERENTIAL NONLINEARITY ERROR (LSB)	PACKAGE	PACKAGE DRAWING NUMBER	SPECIFICATION TEMPERATURE RANGE	ORDERING NUMBER ⁽¹⁾	TRANSPORT MEDIA
DAC7724N	±2	±1	PLCC-28	251	-40°C to +85°C	DAC7724N	Rails
"	"	"	"	"	"	DAC7724N/750	Tape and Reel
DAC7724NB	±1	±1	PLCC-28	251	-40°C to +85°C	DAC7724NB	Rails
"	"	"	"	"	"	DAC7724NB/750	Tape and Reel
DAC7724U	±2	±1	SO-28	217	-40°C to +85°C	DAC7724U	Rails
"	"	"	"	"	"	DAC7724U/1K	Tape and Reel
DAC7724UB	±1	±1	SO-28	217	-40°C to +85°C	DAC7724UB	Rails
"	"	"	"	"	"	DAC7724UB/1K	Tape and Reel
DAC7725N	±2	±1	PLCC-28	251	-40°C to +85°C	DAC7725N	Rails
"	"	"	"	"	"	DAC7725N/750	Tape and Reel
DAC7725NB	±1	±1	PLCC-28	251	-40°C to +85°C	DAC7725NB	Rails
"	"	"	"	"	"	DAC7725NB/750	Tape and Reel
DAC7725U	±2	±1	SO-28	217	-40°C to +85°C	DAC7725U	Rails
"	"	"	"	"	"	DAC7725U/1K	Tape and Reel
DAC7725UB	±1	±1	SO-28	217	-40°C to +85°C	DAC7725UB	Rails
"	"	"	"	"	"	DAC7725UB/1K	Tape and Reel

NOTE: (1) Models with a slash (/) are available only in Tape and Reel in the quantities indicated (e.g., /750 indicates 750 devices per reel). Ordering 750 pieces of "DAC7724/750" will get a single 750-piece Tape and Reel.

ESD PROTECTION CIRCUITS



PIN CONFIGURATIONS



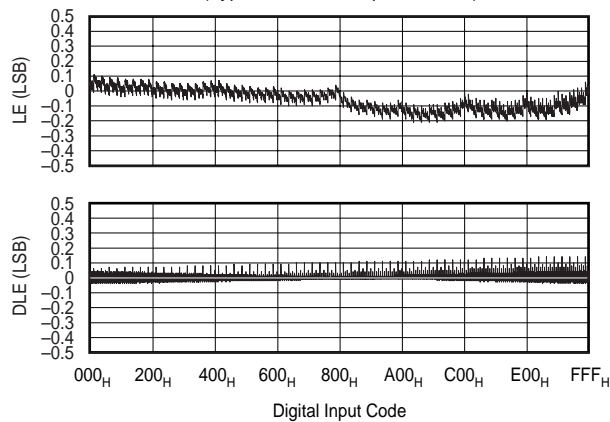
PIN DESCRIPTIONS

PIN	NAME	DESCRIPTION
1	V_{REFH}	Reference Input Voltage High. Sets maximum output voltage for all DACs.
2	V_{OUTB}	DAC B Voltage Output.
3	V_{OUTA}	DAC A Voltage Output.
4	V_{SS}	Negative Analog Supply Voltage, 0V or -15V.
5	GND	Ground.
6	\overline{RESET}	Asynchronous Reset Input. Sets DAC and input registers to either mid-scale (800 _H , DAC7724) or zero-scale (000 _H , DAC7725) when LOW.
7	\overline{LDAC}	Load DAC Input. All DAC Registers are transparent when LOW.
8	DB0	Data Bit 0. Least significant bit of 12-bit word.
9	DB1	Data Bit 1
10	DB2	Data Bit 2
11	DB3	Data Bit 3
12	DB4	Data Bit 4
13	DB5	Data Bit 5
14	DB6	Data Bit 6
15	DB7	Data Bit 7
16	DB8	Data Bit 8
17	DB9	Data Bit 9
18	DB10	Data Bit 10
19	DB11	Data Bit 11. Most significant bit of 12-bit word.
20	R/\overline{W}	Read/Write Control Input (read = HIGH, write = LOW).
21	A1	Register/DAC Select (C or D = HIGH, A or B = LOW).
22	A0	Register/DAC Select (B or D = HIGH, A or C = LOW).
23	\overline{CS}	Chip Select Input.
24	V_{DD}	Positive Digital Supply, +5V.
25	V_{CC}	Positive Analog Supply Voltage, +15V nominal.
26	V_{OUTD}	DAC D Voltage Output.
27	V_{OUTC}	DAC C Voltage Output.
28	V_{REFL}	Reference Input Voltage Low. Sets minimum output voltage for all DACs.

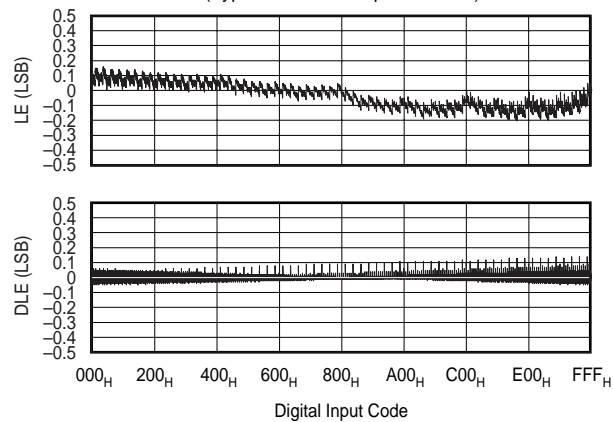
TYPICAL PERFORMANCE CURVES: $V_{SS} = 0V$

At $T_A = +25^\circ C$, $V_{CC} = +15V$, $V_{DD} = +5V$, $V_{SS} = 0V$, $V_{REFH} = +10V$, $V_{REFL} = 0V$, representative unit, unless otherwise specified.

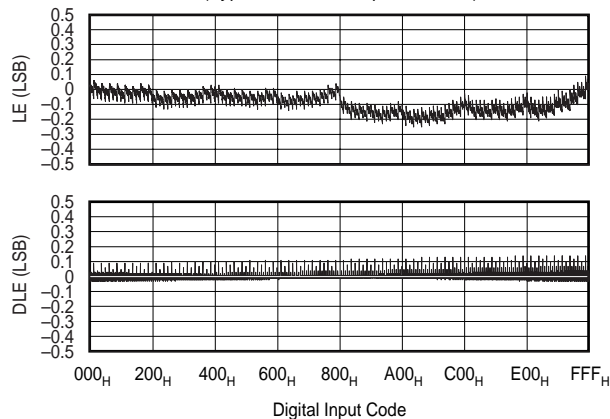
LINEARITY ERROR AND
DIFFERENTIAL LINEARITY ERROR vs CODE
Single Channel 25°C
(Typical of Each Output Channel)



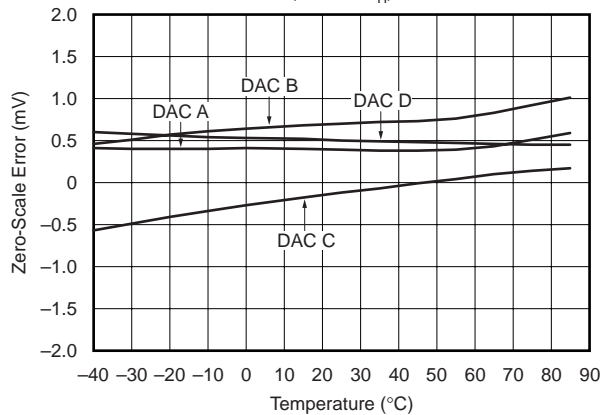
LINEARITY ERROR AND
DIFFERENTIAL LINEARITY ERROR vs CODE
Single Channel 85°C
(Typical of Each Output Channel)



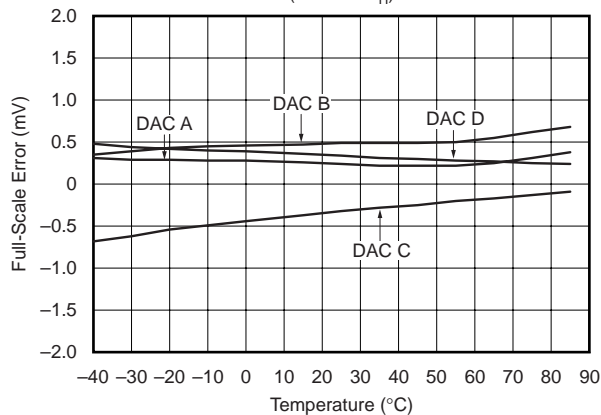
LINEARITY ERROR AND
DIFFERENTIAL LINEARITY ERROR vs CODE
Single Channel -40°C
(Typical of Each Output Channel)



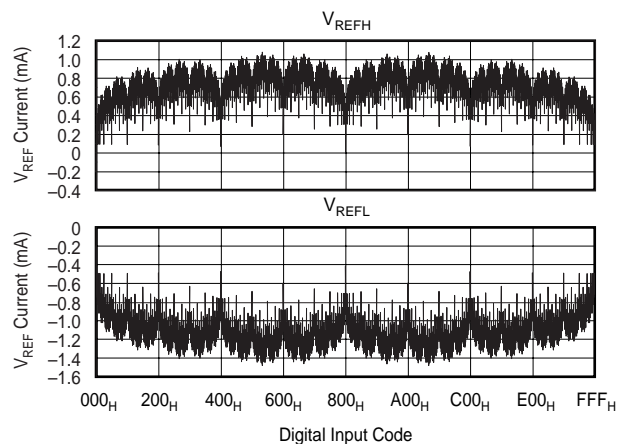
ZERO-SCALE ERROR vs TEMPERATURE
(Code 004_H)



FULL-SCALE ERROR vs TEMPERATURE
(Code FFF_H)

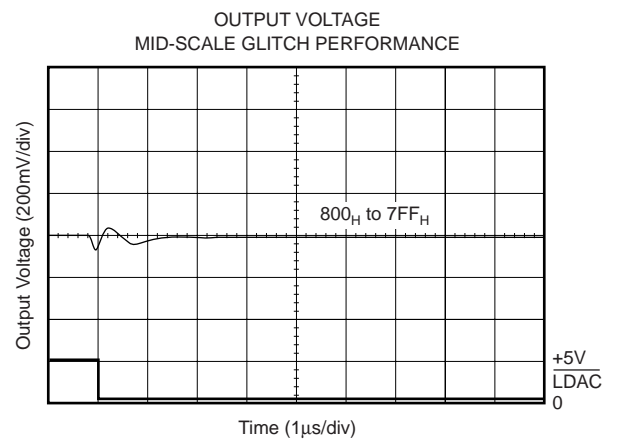
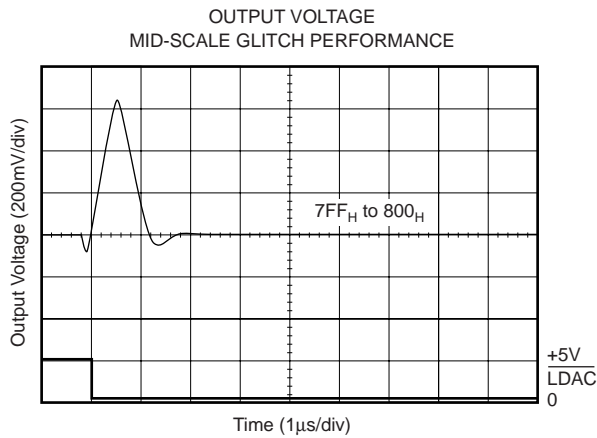
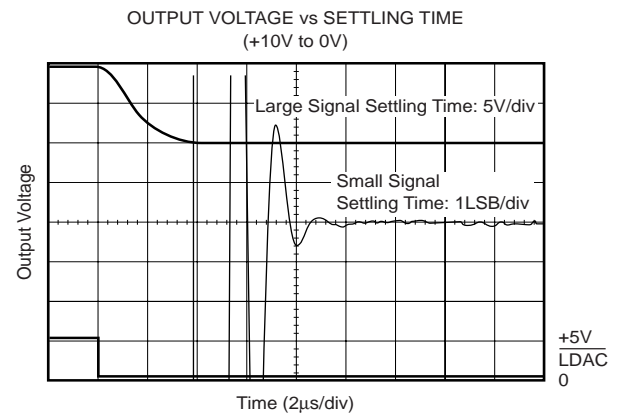
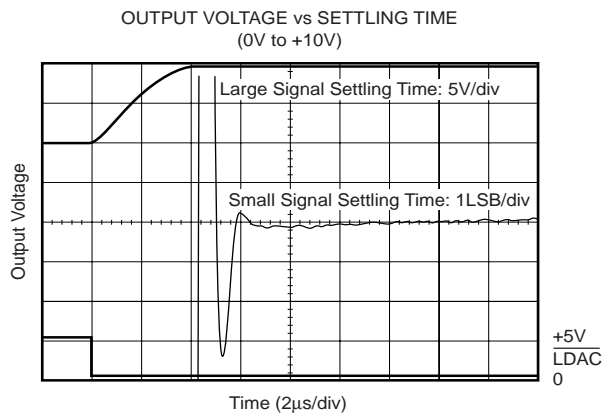
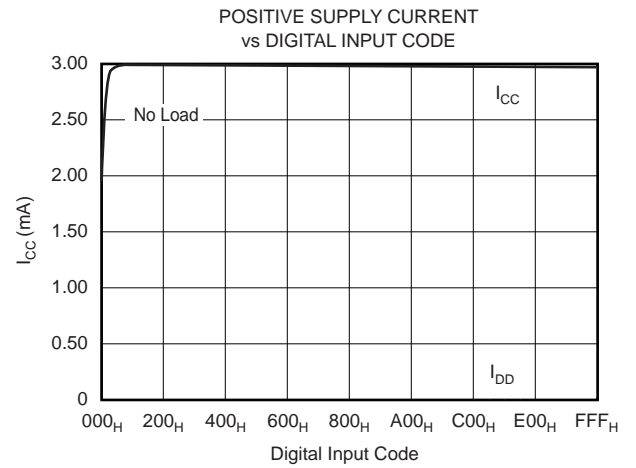
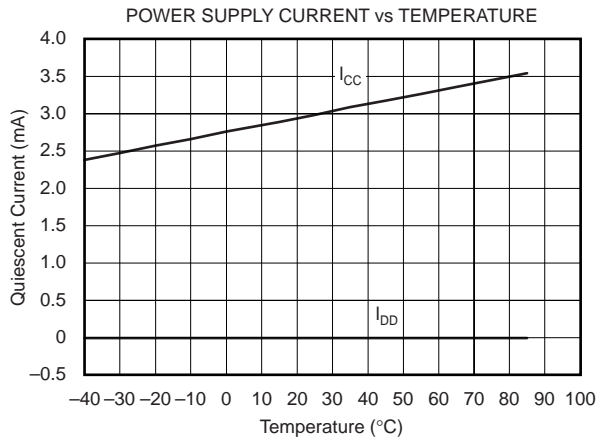


CURRENT vs CODE
All DACs Sent to Indicated Code



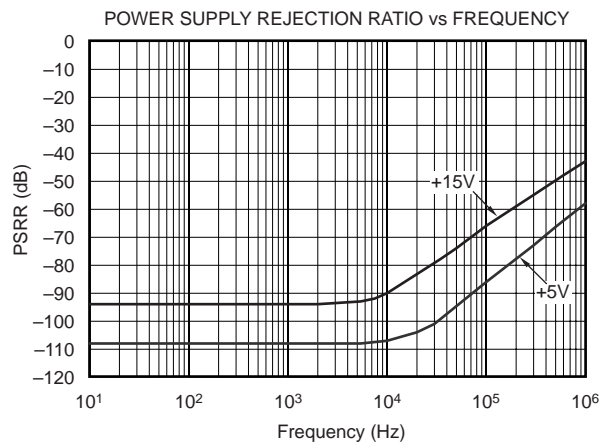
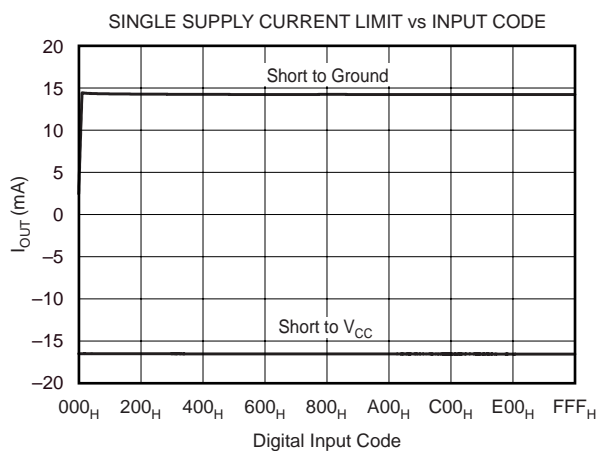
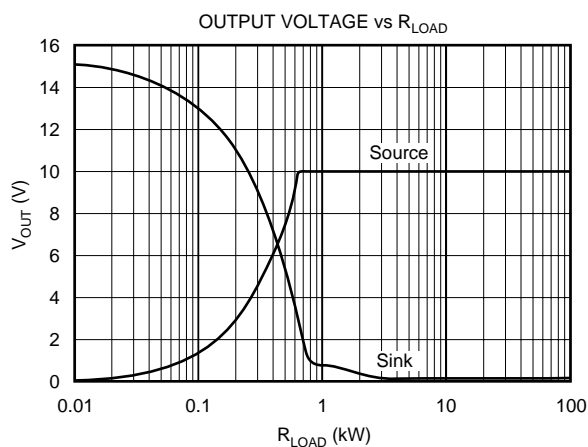
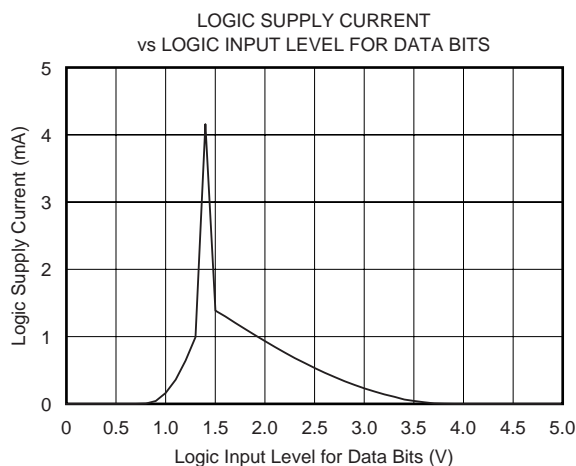
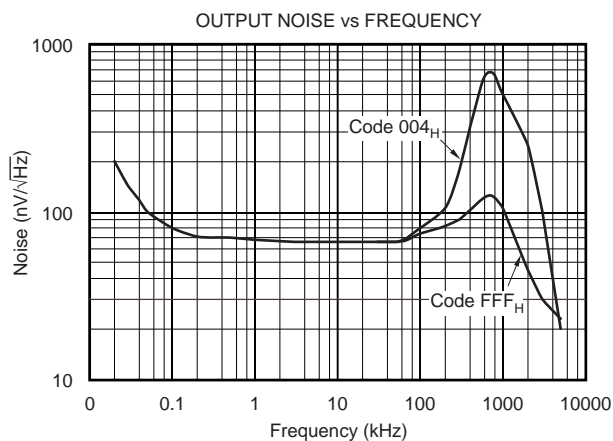
TYPICAL PERFORMANCE CURVES: $V_{SS} = 0V$ (Cont.)

At $T_A = +25^\circ C$, $V_{CC} = +15V$, $V_{DD} = +5V$, $V_{SS} = 0V$, $V_{REFH} = +10V$, $V_{REFL} = 0V$, representative unit, unless otherwise specified.



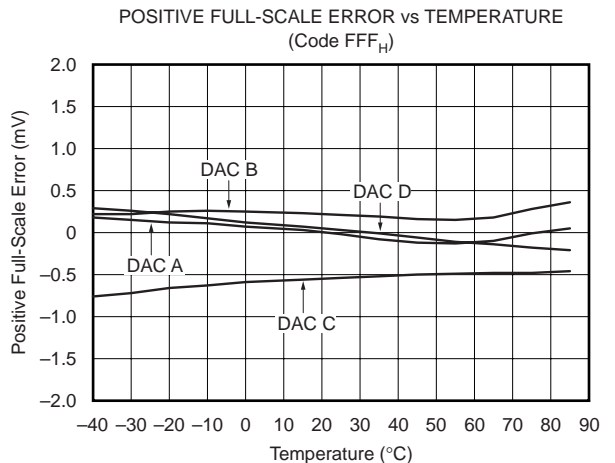
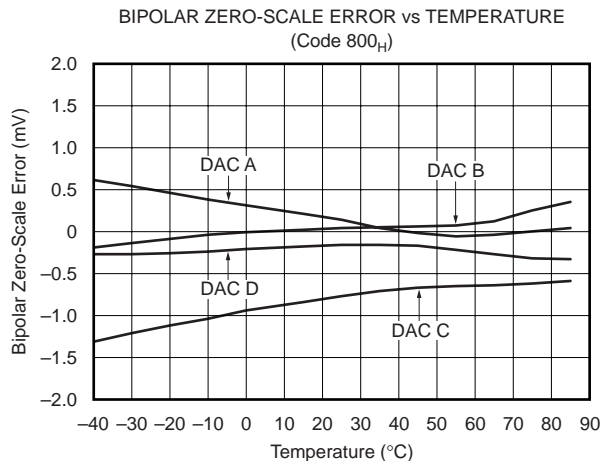
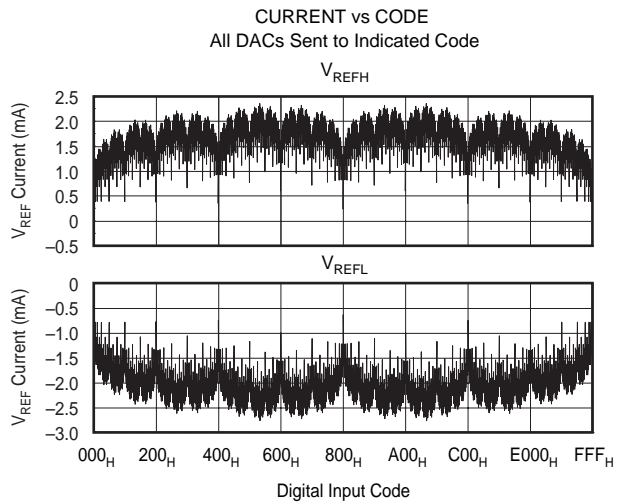
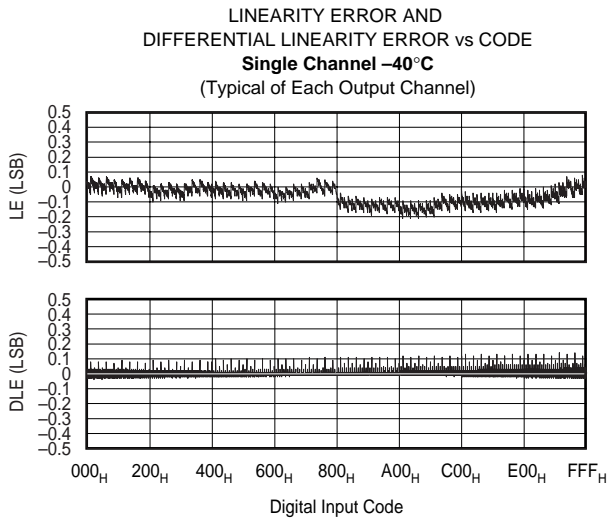
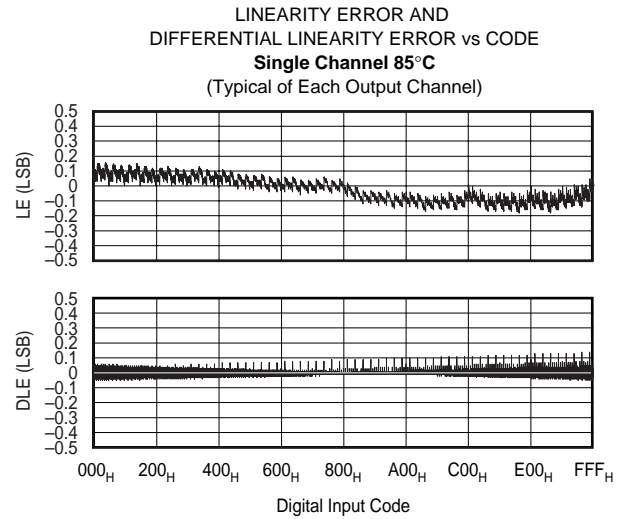
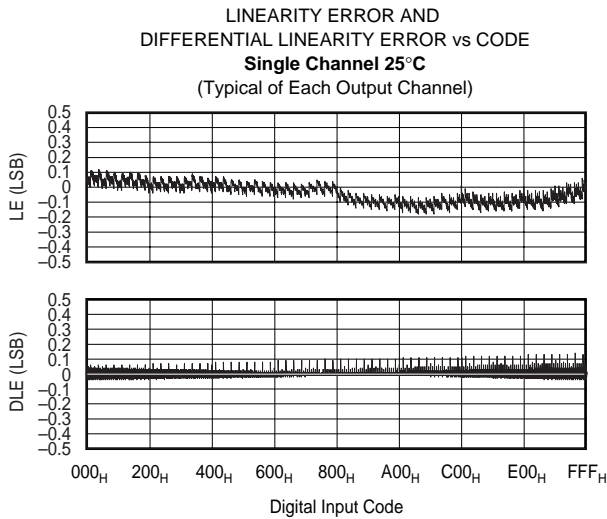
TYPICAL PERFORMANCE CURVES: $V_{SS} = 0V$ (Cont.)

At $T_A = +25^\circ C$, $V_{CC} = +15V$, $V_{DD} = +5V$, $V_{SS} = 0V$, $V_{REFH} = +10V$, $V_{REFL} = 0V$, representative unit, unless otherwise specified.



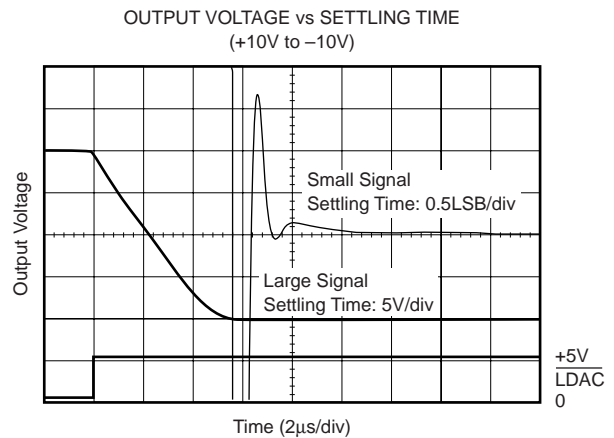
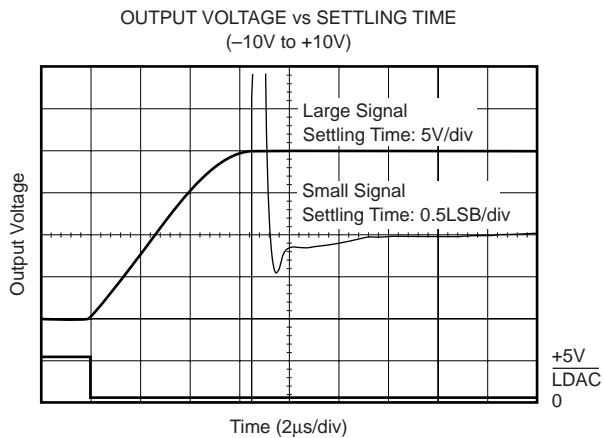
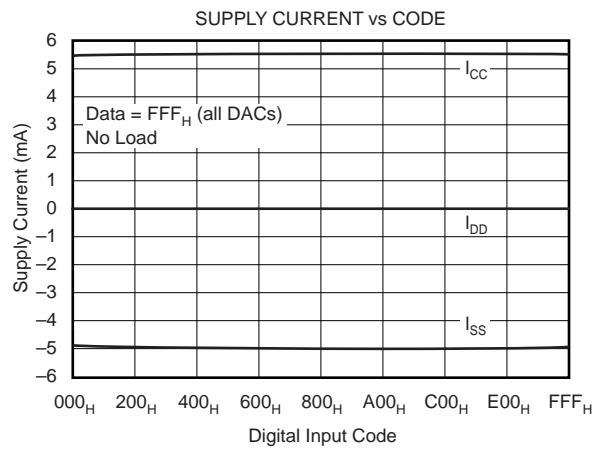
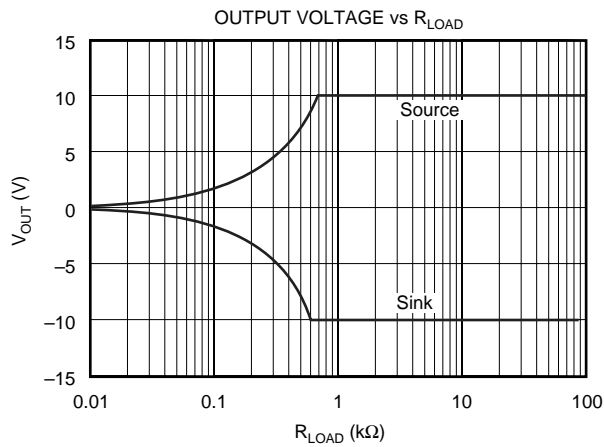
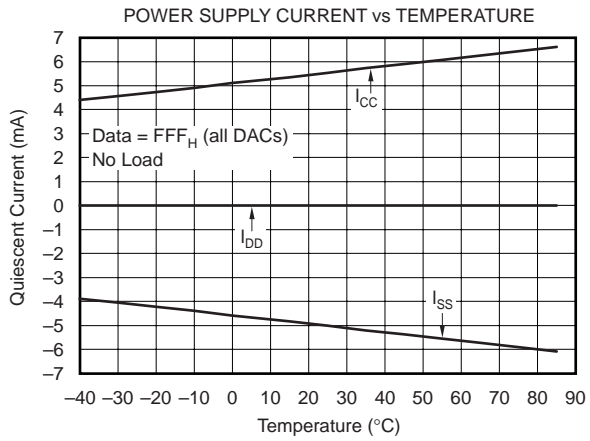
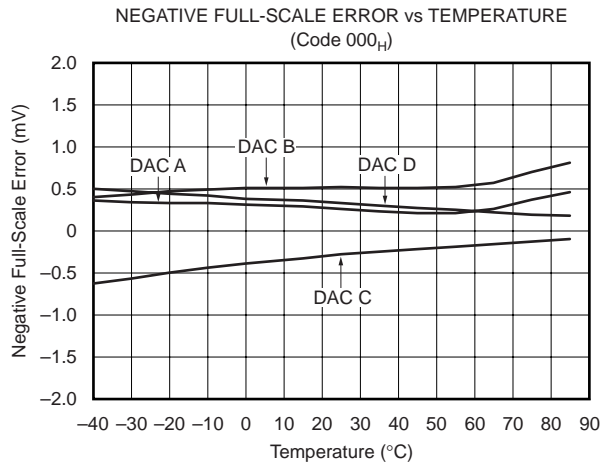
TYPICAL PERFORMANCE CURVES: $V_{SS} = -15V$

At $T_A = +25^\circ C$, $V_{CC} = +15V$, $V_{DD} = +5V$, $V_{SS} = -15V$, $V_{REFH} = +10V$, $V_{REFL} = -10V$, representative unit, unless otherwise specified.



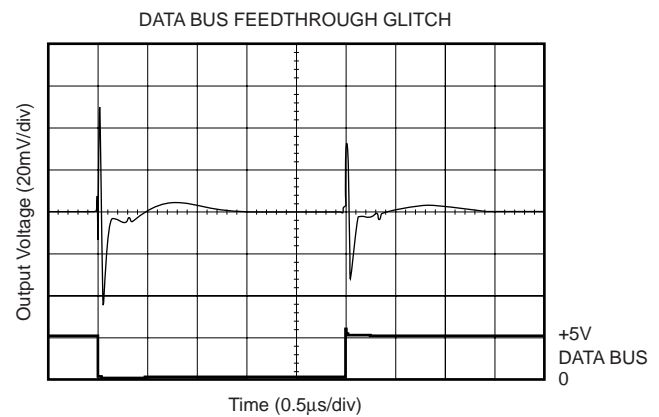
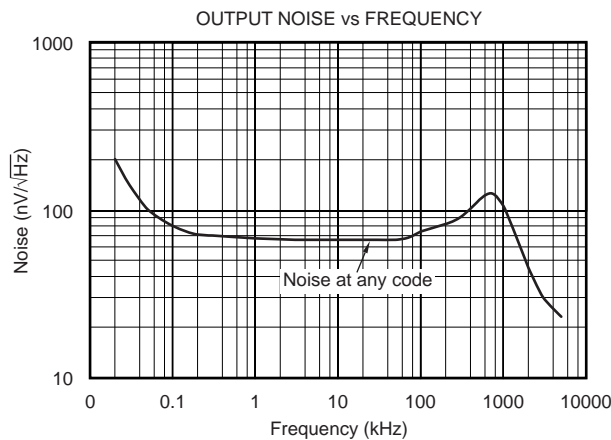
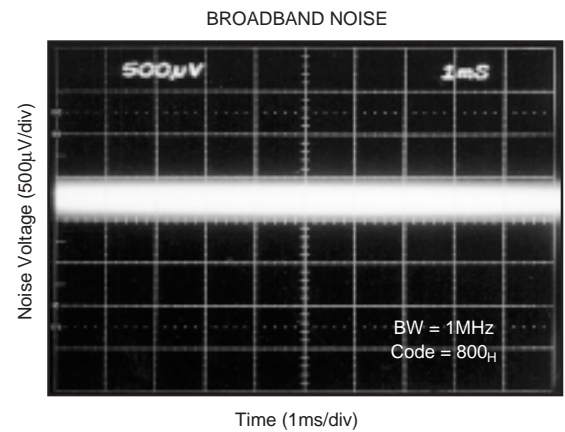
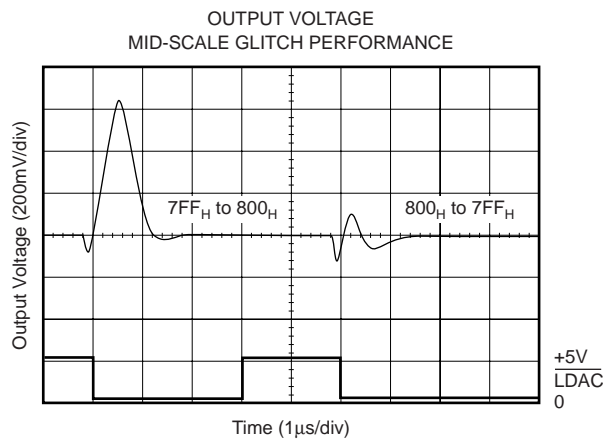
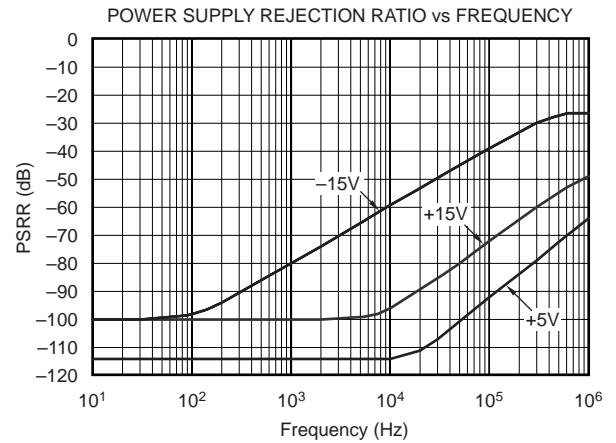
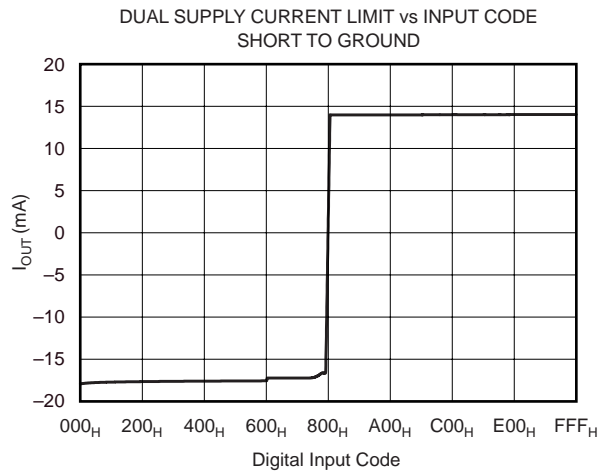
TYPICAL PERFORMANCE CURVES: $V_{SS} = -15V$ (Cont.)

At $T_A = +25^\circ C$, $V_{CC} = +15V$, $V_{DD} = +5V$, $V_{SS} = -15V$, $V_{REFH} = +10V$, $V_{REFL} = -10V$, representative unit, unless otherwise specified.



TYPICAL PERFORMANCE CURVES: $V_{SS} = -15V$ (Cont.)

At $T_A = +25^\circ C$, $V_{CC} = +15V$, $V_{DD} = +5V$, $V_{SS} = -15V$, $V_{REFH} = +10V$, $V_{REFL} = -10V$, representative unit, unless otherwise specified.



The DAC7724 and DAC7725 are quad voltage output, 12-bit digital-to-analog converters (DACs). The architecture is a classic R-2R ladder configuration followed by an operational amplifier that serves as a buffer, as shown in Figure 1. Each DAC has its own R-2R ladder network and output op-amp, but all share the reference voltage inputs. The minimum voltage output (“zero-scale”) and maximum voltage

The diagram shows a 1-bit DAC circuit. It consists of a resistor ladder with eight stages. Each stage has a resistor R in series and a resistor $2R$ in shunt to a common reference line. The reference line is connected to V_{REFH} and V_{REFL} . The output of the ladder is connected to the non-inverting input (+) of an op-amp. The op-amp has a feedback resistor R_F connected to its inverting input (-). The output of the op-amp is V_{OUT} .

DAC7724
DAC7725

Pin connections for DAC7724 and DAC7725:

- Pin 1:** V_{REFH} connected to +10.00V through a 0.1μF capacitor.
- Pin 2:** V_{OUTB} connected to 0V to +10V.
- Pin 3:** V_{OUTA} connected to 0V to +10V.
- Pin 4:** V_{SS} connected to GND.
- Pin 5:** GND.
- Pin 6:** \overline{RESET} connected to Reset DACs⁽¹⁾.
- Pin 7:** \overline{LDAC} connected to Load DAC Registers.
- Pin 8:** DB0 (Data Bus).
- Pin 9:** DB1 (Data Bus).
- Pin 10:** DB2 (Data Bus).
- Pin 11:** DB3 (Data Bus).
- Pin 12:** DB4 (Data Bus).
- Pin 13:** DB5 (Data Bus).
- Pin 14:** DB6 (Data Bus).
- Pin 15:** DB7 (Data Bus).
- Pin 16:** DB8 (Data Bus).
- Pin 17:** DB9 (Data Bus).
- Pin 18:** DB10 (Data Bus).
- Pin 19:** DB11 (Data Bus).
- Pin 20:** R/\overline{W} connected to Read/Write.
- Pin 21:** A1 (Address Bus or Decoder).
- Pin 22:** A0 (Address Bus or Decoder).
- Pin 23:** \overline{CS} connected to Chip Select.
- Pin 24:** V_{DD} connected to +5V through a 0.1μF capacitor.
- Pin 25:** V_{CC} connected to +15V through a 0.1μF capacitor.
- Pin 26:** V_{OUTD} connected to 0V to +10V.
- Pin 27:** V_{OUTC} connected to 0V to +10V.
- Pin 28:** V_{REFL} connected to GND.

Additional components and connections:

- Capacitors: 0.1μF capacitors are used for V_{REFH} , V_{DD} , and V_{CC} .
- Power supplies: +10.00V, +15V, and +5V are shown.
- Filters: 1μF to 10μF capacitors are used for the +15V and +5V supplies.

FIGURE 2. Basic Single-Supply Operation of the DAC7724/25.

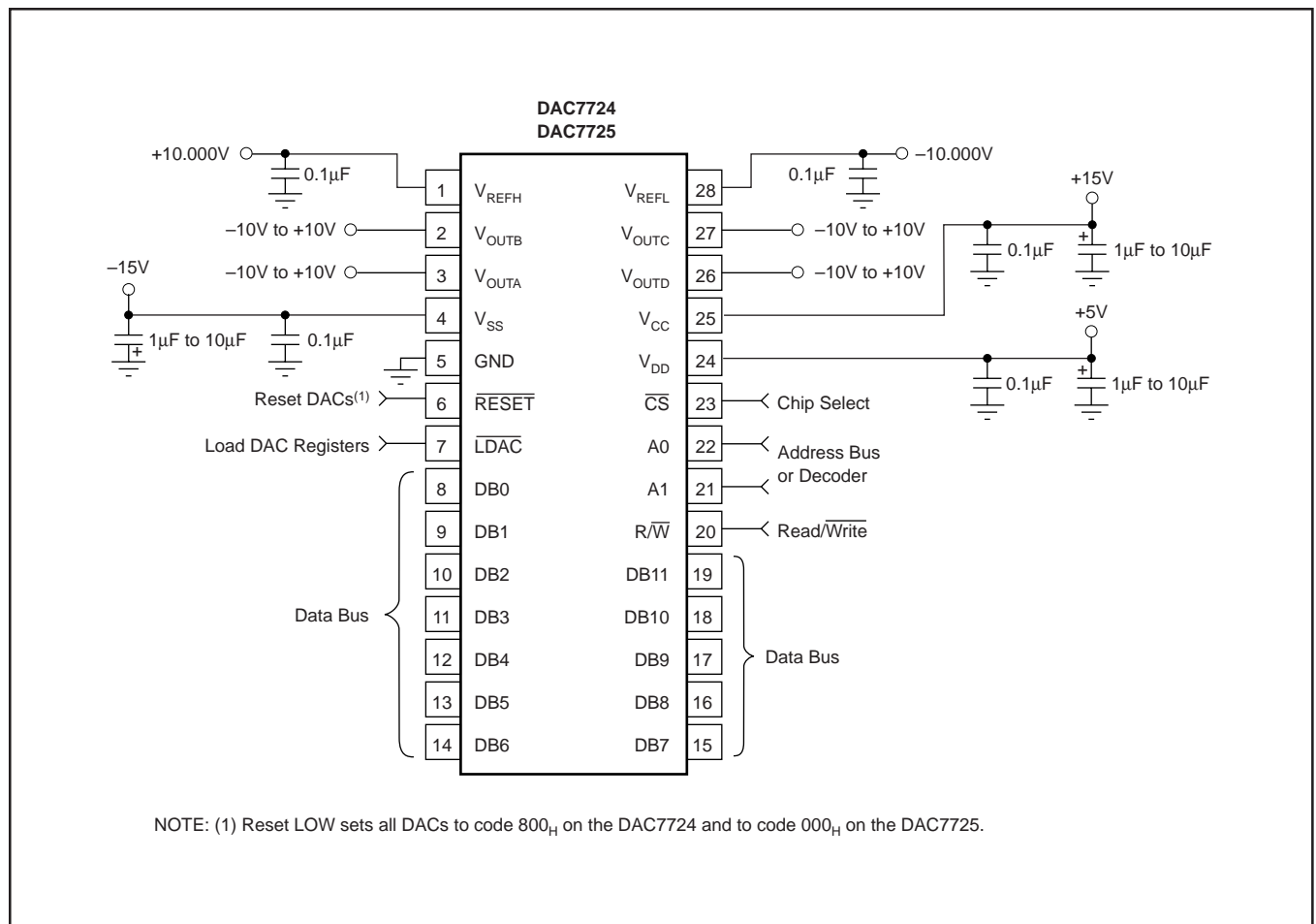


FIGURE 3. Basic Dual-Supply Operation of the DAC7724/25.

ANALOG OUTPUTS

When $V_{SS} = -15V$ (dual supply operation), the output amplifier can swing to within 4V of the supply rails, guaranteed over the $-40^{\circ}C$ to $+85^{\circ}C$ temperature range. With $V_{SS} = 0V$ (single-supply operation) and R_{LOAD} connected to ground, the output can swing to ground. Note that the settling time of the output op-amp will be longer with voltages very near ground. Additionally, care must be taken when measuring the zero-scale error when $V_{SS} = 0V$. Since the output voltage cannot swing below ground, the output voltage may not change for the first few digital input codes (000_H, 001_H, 002_H, etc.) if the output amplifier has a negative offset. At the negative offset limit of -4 LSB ($-9.76mV$), for the single-supply case, the first specified output starts at code 004_H.

REFERENCE INPUTS

For dual-supply operation, the reference inputs, V_{REFL} and V_{REFH} , can be any voltage between $V_{SS} + 4V$ and $V_{CC} - 4V$ provided that V_{REFH} is at least 1.25V greater than V_{REFL} . For single-supply operation ($V_{SS} = 0V$), V_{REFL} value can be above 0V, with the same provision that V_{REFH} is at least 1.25V greater than V_{REFL} . The minimum output of each DAC is equal to V_{REFL} plus a small offset voltage (essen-

tially, the offset of the output op-amp). The maximum output is equal to V_{REFH} plus a similar offset voltage. Note that V_{SS} (the negative power supply) must either be connected to ground or must be in the range of $-14.25V$ to $-15.75V$. The voltage on V_{SS} sets several bias points within the converter, if V_{SS} is not in one of these two configurations, the bias values may be in error and proper operation of the device is not guaranteed.

The current into the V_{REFH} input and out of V_{REFL} depends on the DAC output voltages and can vary from a few microamps to approximately 0.3mA. The reference input appears as a varying load to the reference. If the reference can sink or source the required current, a reference buffer is not required. See "Reference Current vs Code" in the Typical Performance Curves.

The analog supplies (or the analog supplies and the reference power supplies) have to come up first. If the power supplies for the references come up first, then the V_{CC} and V_{SS} supplies will be "powered from the reference via the ESD protection diodes" (see page 4).

Bypassing the reference voltage or voltages with at least a 0.1µF capacitor placed as close to the DAC7724/25 package is strongly recommended.

DIGITAL INTERFACE

Table I shows the basic control logic for the DAC7724/25. Note that each internal register is level triggered and not edge triggered. When the appropriate signal is LOW, the register becomes transparent. When this signal is returned HIGH, the digital word currently in the register is latched. The first set of registers (the Input Registers) are triggered via the A0, A1, $\overline{R/\overline{W}}$, and \overline{CS} inputs. Only one of these registers is transparent at any given time. The second set of registers (the DAC Registers) are all transparent when \overline{LDAC} input is pulled LOW.

Each DAC can be updated independently by writing to the appropriate Input Register and then updating the DAC Register. Alternatively, the entire DAC Register set can be configured as always transparent by keeping \overline{LDAC} LOW—the DAC update will occur when the Input Register is written.

The double buffered architecture is mainly designed so that each DAC Input Register can be written at any time and then all DAC output voltages updated simultaneously by pulling \overline{LDAC} LOW. It also allows a DAC Input Register to be written to at any point and the DAC voltage to be synchronously changed via a trigger signal connected to \overline{LDAC} .

DIGITAL TIMING

Figure 4 and Table II provide detailed timing for the digital interface of the DAC7724 and DAC7725.

DIGITAL INPUT CODING

The DAC7724 and DAC7725 input data is in straight binary format. The output voltage is given by the following equation:

$$V_{OUT} = V_{REFL} + \frac{(V_{REFH} - V_{REFL}) \cdot N}{4096}$$

where N is the digital input code. This equation does not include the effects of offset (zero-scale) errors.

A1	A0	$\overline{R/\overline{W}}$	\overline{CS}	\overline{RESET}	\overline{LDAC}	SELECTED INPUT REGISTER	STATE OF SELECTED INPUT REGISTER	STATE OF ALL DAC REGISTERS
L ⁽¹⁾	L	L	L	H ⁽²⁾	L	A	Transparent	Transparent
L	H	L	L	H	L	B	Transparent	Transparent
H	L	L	L	H	L	C	Transparent	Transparent
H	H	L	L	H	L	D	Transparent	Transparent
L	L	L	L	H	H	A	Transparent	Latched
L	H	L	L	H	H	B	Transparent	Latched
H	L	L	L	H	H	C	Transparent	Latched
H	H	L	L	H	H	D	Transparent	Latched
L	L	H	L	H	H	A	Readback	Latched
L	H	H	L	H	H	B	Readback	Latched
H	L	H	L	H	H	C	Readback	Latched
H	H	H	L	H	H	D	Readback	Latched
X ⁽³⁾	X	X	H	H	L	NONE	(All Latched)	Transparent
X	X	X	H	H	H	NONE	(All Latched)	Latched
X	X	X	X	L	X	ALL	Reset ⁽⁴⁾	Reset ⁽⁴⁾

NOTES: (1) L = Logic LOW. (2) H= Logic HIGH. (3) X = Don't Care. (4) DAC7724 resets to 800_H, DAC7725 resets to 000_H. When \overline{RESET} rises, all registers that are in their latched state retain the reset value.

TABLE I. DAC7724 and DAC7725 Control Logic Truth Table.

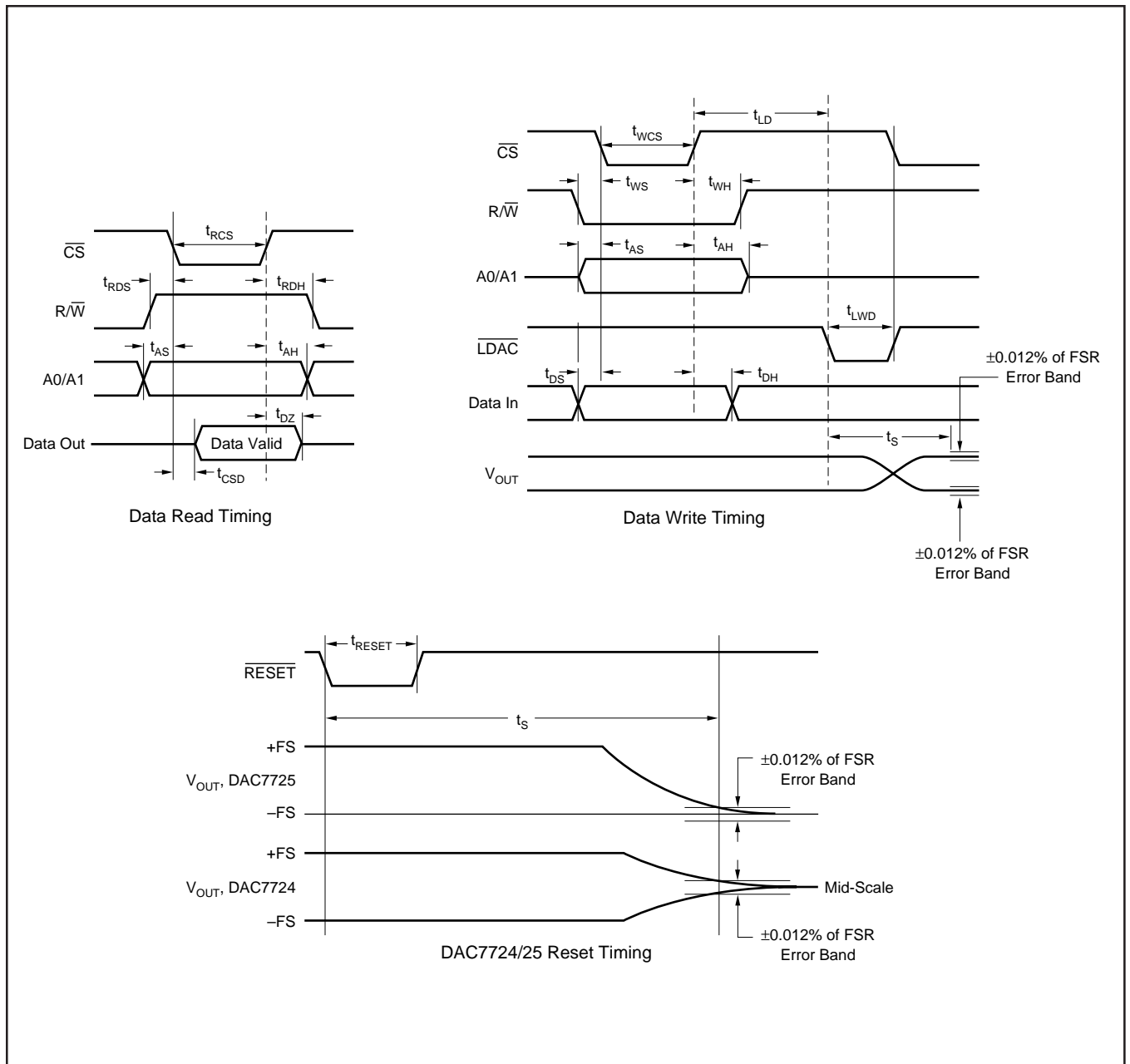


FIGURE 4. Digital Input and Output Timing.

SYMBOL	DESCRIPTION	MIN	TYP	MAX	UNITS
t_{RCS}	\overline{CS} LOW for Read	200			ns
t_{RDS}	R/\overline{W} HIGH to \overline{CS} LOW	10			ns
t_{RDH}	R/\overline{W} HIGH after \overline{CS} HIGH	10			ns
t_{DZ}	\overline{CS} HIGH to Data Bus in High Impedance		100		ns
t_{CSD}	\overline{CS} LOW to Data Bus Valid		100	160	ns
t_{WCS}	\overline{CS} LOW for Write	50			ns
t_{WS}	R/\overline{W} LOW to \overline{CS} LOW	0			ns
t_{WH}	R/\overline{W} LOW after \overline{CS} HIGH	0			ns
t_{AS}	Address Valid to \overline{CS} LOW	0			ns
t_{AH}	Address Valid after \overline{CS} HIGH	0			ns
t_{LD}	LDAC Delay from \overline{CS} HIGH	10			ns
t_{DS}	Data Valid to \overline{CS} LOW	0			ns
t_{DH}	Data Valid after \overline{CS} HIGH	0			ns
t_{LWD}	LDAC LOW	50			ns
t_{RESET}	RESET LOW Time	50			ns
t_S	Settling Time			10	μ s

TABLE II. Timing Specifications ($T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$).

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
DAC7724N	ACTIVE	PLCC	FN	28	37	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7724N	Samples
DAC7724N/750	ACTIVE	PLCC	FN	28	750	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7724N	Samples
DAC7724N/750G4	ACTIVE	PLCC	FN	28	750	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7724N	Samples
DAC7724NB	ACTIVE	PLCC	FN	28	37	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7724N B	Samples
DAC7724NB/750	ACTIVE	PLCC	FN	28	750	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7724N B	Samples
DAC7724NB/750G4	ACTIVE	PLCC	FN	28	750	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7724N B	Samples
DAC7724NBG4	ACTIVE	PLCC	FN	28	37	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7724N B	Samples
DAC7724NG4	ACTIVE	PLCC	FN	28	37	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7724N	Samples
DAC7724U	ACTIVE	SOIC	DW	28	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7724U B	Samples
DAC7724U/1K	ACTIVE	SOIC	DW	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7724U B	Samples
DAC7724U/1KG4	ACTIVE	SOIC	DW	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7724U B	Samples
DAC7724UB	ACTIVE	SOIC	DW	28	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7724U B	Samples
DAC7724UB/1K	ACTIVE	SOIC	DW	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7724U B	Samples
DAC7724UB/1KG4	ACTIVE	SOIC	DW	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7724U B	Samples
DAC7724UBG4	ACTIVE	SOIC	DW	28	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7724U B	Samples
DAC7724UG4	ACTIVE	SOIC	DW	28	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7724U B	Samples
DAC7725N	ACTIVE	PLCC	FN	28	37	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7725N	Samples

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
DAC7725NB	ACTIVE	PLCC	FN	28	37	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7725N B	Samples
DAC7725NB/750	ACTIVE	PLCC	FN	28	750	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7725N B	Samples
DAC7725NB/750G4	ACTIVE	PLCC	FN	28	750	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7725N B	Samples
DAC7725NBG4	ACTIVE	PLCC	FN	28	37	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7725N B	Samples
DAC7725NG4	ACTIVE	PLCC	FN	28	37	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-245C-168 HR	-40 to 85	DAC7725N	Samples
DAC7725U	ACTIVE	SOIC	DW	28	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7725U B	Samples
DAC7725U/1K	ACTIVE	SOIC	DW	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7725U B	Samples
DAC7725U/1KG4	ACTIVE	SOIC	DW	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7725U B	Samples
DAC7725UB	ACTIVE	SOIC	DW	28	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7725U B	Samples
DAC7725UB/1K	ACTIVE	SOIC	DW	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7725U B	Samples
DAC7725UB/1KG4	ACTIVE	SOIC	DW	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7725U B	Samples
DAC7725UBG4	ACTIVE	SOIC	DW	28	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7725U B	Samples
DAC7725UG4	ACTIVE	SOIC	DW	28	20	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-3-260C-168 HR	-40 to 85	DAC7725U B	Samples

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

ACTIVE: Product device recommended for new designs.

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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.

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OBSOLETE: TI has discontinued the production of the device.

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

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⁽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.

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*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
DAC7724N/750	PLCC	FN	28	750	330.0	24.4	12.95	12.95	5.0	16.0	24.0	Q1
DAC7724NB/750	PLCC	FN	28	750	330.0	24.4	12.95	12.95	5.0	16.0	24.0	Q1
DAC7724U/1K	SOIC	DW	28	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1
DAC7724UB/1K	SOIC	DW	28	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1
DAC7725NB/750	PLCC	FN	28	750	330.0	24.4	12.95	12.95	5.0	16.0	24.0	Q1
DAC7725U/1K	SOIC	DW	28	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1
DAC7725UB/1K	SOIC	DW	28	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
DAC7724N/750	PLCC	FN	28	750	346.0	346.0	41.0
DAC7724NB/750	PLCC	FN	28	750	346.0	346.0	41.0
DAC7724U/1K	SOIC	DW	28	1000	367.0	367.0	55.0
DAC7724UB/1K	SOIC	DW	28	1000	367.0	367.0	55.0
DAC7725NB/750	PLCC	FN	28	750	346.0	346.0	41.0
DAC7725U/1K	SOIC	DW	28	1000	367.0	367.0	55.0
DAC7725UB/1K	SOIC	DW	28	1000	367.0	367.0	55.0

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