

FEATURES

- Integrated Precision Reference
 2.5V Full-Scale 10ppm/°C (LTC2632-L)
 4.096V Full-Scale 10ppm/°C (LTC2632-H)
- Maximum INL Error: ± 1 LSB (LTC2632A-12) ± 1.5
- Low Noise: 0.75mV_{P-P} 0.1Hz to 200kHz
- Guaranteed Monotonic -40°C to 125°C Automotive Temperature Range
- Selectable Internal or External Reference
- 2.7V to 5.5V Supply Range (LTC2632-L)
- Low Power Operation 0.4mA at 3V
- Power-On-Reset to Zero-Scale/Mid-Scale
- Double-Buffered Data Latches
- 8-Lead ThinSOT™ Package

APPLICATIONS

- Mobile Communications
- Process Control and Industrial Automation
- Automatic Test Equipment
- Portable Equipment
- Automotive

DESCRIPTION

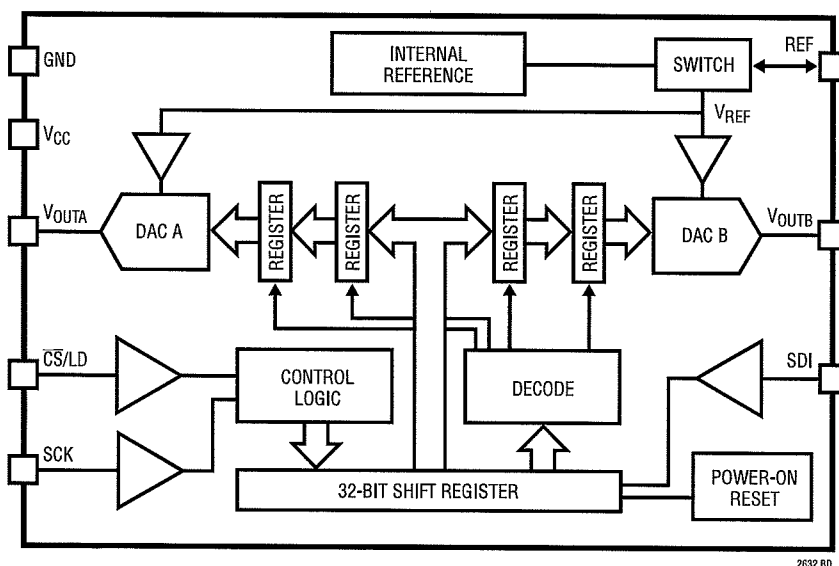
The LTC®2632 is a family of dual 12-, 10-, and 8-bit voltage-output DACs with an integrated, high-accuracy, low-drift reference in an 8-lead TSOT-23 package. It has rail-to-rail output buffers and is guaranteed monotonic.

The LTC2632-L has a full-scale output of 2.5V, and operates from a single 2.7V to 5.5V supply. The LTC2632-H has a full-scale output of 4.096V, and operates from a 4.5V to 5.5V supply. Each DAC can also operate with an external reference, which sets the full-scale output to the external reference voltage.

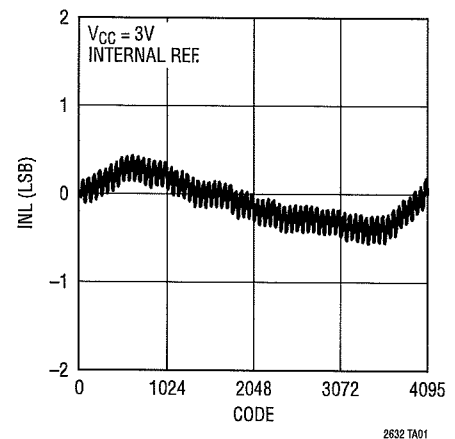
These DACs communicate via a simple SPI/MICROWIRE compatible 3-wire serial interface which operates at clock rates up to 50MHz. The LTC2632 incorporates a power-on reset circuit. Options are available for reset to zero-scale or reset to mid-scale in internal reference mode, or reset to mid-scale in external reference mode after power-up.

LT, LTC, LTM, Linear Technology and the Linear logo are registered trademarks of Linear Technology Corporation. ThinSOT is a trademark of Linear Technology Corporation. All other trademarks are the property of their respective owners. Protected by U.S. Patents including 5396245, 5859606, 6891433, and 6937178.

BLOCK DIAGRAM



Integral Nonlinearity (LTC2632A-LZ12)



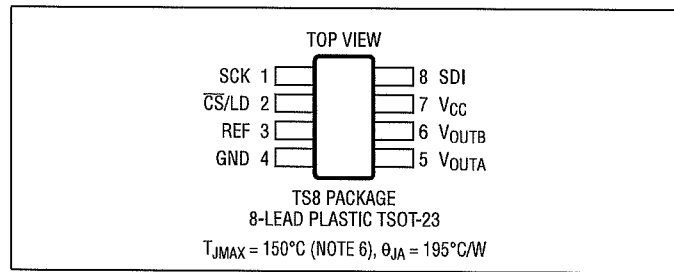
LTC2632

ABSOLUTE MAXIMUM RATINGS

(Notes 1, 2)

Supply Voltage (V_{CC})	-0.3V to 6V
SCK, SDI	-0.3V to 6V
\overline{CS}/LD (Note 11)	-0.3V to Min ($V_{CC} + 0.3V, 6V$)
V_{OUTA}, V_{OUTB}	-0.3V to Min ($V_{CC} + 0.3V, 6V$)
REF	-0.3V to Min ($V_{CC} + 0.3V, 6V$)
Operating Temperature Range	
LTC2632C	0°C to 70°C
LTC2632H (Note 3)	-40°C to 125°C
Maximum Junction Temperature	150°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (Soldering, 10 sec)	300°C

PIN CONFIGURATION



ORDER INFORMATION

LTC2632 A C TS8 -L Z 12 #TRM PBF

LEAD FREE DESIGNATOR

TAPE AND REEL

TR = 2,500-Piece Tape and Reel

TRM = 500-Piece Tape and Reel

RESOLUTION

12 = 12-Bit

10 = 10-Bit

8 = 8-Bit

POWER-ON RESET

I = Reset to Mid-Scale in Internal Reference Mode

X = Reset to Mid-Scale in External Reference Mode (2632-L Only)

Z = Reset to Zero-Scale in Internal Reference Mode

FULL-SCALE VOLTAGE, INTERNAL REFERENCE MODE

L = 2.5V

H = 4.096V

PACKAGE TYPE

TS8 = 8-Lead Plastic TSOT-23

TEMPERATURE GRADE

C = Commercial Temperature Range (0°C to 70°C)

H = Automotive Temperature Range (-40°C to 125°C)

ELECTRICAL GRADE (OPTIONAL)

A = ± 1.5 LSB Maximum INL (12-Bit)

PRODUCT PART NUMBER

Consult LTC Marketing for information on non-standard lead based finish parts.

For more information on lead free part marking, go to: <http://www.linear.com/leadfree/>

For more information on tape and reel specifications, go to: <http://www.linear.com/tapeandreeel/>

2632fa

PRODUCT SELECTION GUIDE

PART NUMBER	PART MARKING*	V _{FS} WITH INTERNAL REFERENCE	POWER-ON RESET TO CODE	POWER-ON REFERENCE MODE	RESOLUTION	V _{CC}	MAXIMUM INL
LTC2632A-LI12	LTFSJ	2.5V • (4095/4096)	Mid-Scale	Internal	12-Bit	2.7V to 5.5V	±1.5 ±1LSB
LTC2632A-LX12	LTFSH	2.5V • (4095/4096)	Mid-Scale	External	12-Bit	2.7V to 5.5V	±1.5 ±1LSB
LTC2632A-LZ12	LTFSG	2.5V • (4095/4096)	Zero	Internal	12-Bit	2.7V to 5.5V	±1.5 ±1LSB
LTC2632A-HI12	LTFSM	4.096V • (4095/4096)	Mid-Scale	Internal	12-Bit	4.5V to 5.5V	±1.5 ±1LSB
LTC2632A-HZ12	LTFSK	4.096V • (4095/4096)	Zero	Internal	12-Bit	4.5V to 5.5V	±1.5 ±1LSB
LTC2632-LI12	LTFSJ	2.5V • (4095/4096)	Mid-Scale	Internal	12-Bit	2.7V to 5.5V	±2.5LSB
LTC2632-LI10	LTFSQ	2.5V • (1023/1024)	Mid-Scale	Internal	10-Bit	2.7V to 5.5V	±1LSB
LTC2632-LI8	LTFSW	2.5V • (255/256)	Mid-Scale	Internal	8-Bit	2.7V to 5.5V	±0.5LSB
LTC2632-LX12	LTFSH	2.5V • (4095/4096)	Mid-Scale	External	12-Bit	2.7V to 5.5V	±2.5LSB
LTC2632-LX10	LTFSQ	2.5V • (1023/1024)	Mid-Scale	External	10-Bit	2.7V to 5.5V	±1LSB
LTC2632-LX8	LTFSV	2.5V • (255/256)	Mid-Scale	External	8-Bit	2.7V to 5.5V	±0.5LSB
LTC2632-LZ12	LTFSG	2.5V • (4095/4096)	Zero	Internal	12-Bit	2.7V to 5.5V	±2.5LSB
LTC2632-LZ10	LTFSN	2.5V • (1023/1024)	Zero	Internal	10-Bit	2.7V to 5.5V	±1LSB
LTC2632-LZ8	LTFSW	2.5V • (255/256)	Zero	Internal	8-Bit	2.7V to 5.5V	±0.5LSB
LTC2632-HI12	LTFSM	4.096V • (4095/4096)	Mid-Scale	Internal	12-Bit	4.5V to 5.5V	±2.5LSB
LTC2632-HI10	LTFSQ	4.096V • (1023/1024)	Mid-Scale	Internal	10-Bit	4.5V to 5.5V	±1LSB
LTC2632-HI8	LTFSY	4.096V • (255/256)	Mid-Scale	Internal	8-Bit	4.5V to 5.5V	±0.5LSB
LTC2632-HZ12	LTFSK	4.096V • (4095/4096)	Zero	Internal	12-Bit	4.5V to 5.5V	±2.5LSB
LTC2632-HZ10	LTFSR	4.096V • (1023/1024)	Zero	Internal	10-Bit	4.5V to 5.5V	±1LSB
LTC2632-HZ8	LTFSX	4.096V • (255/256)	Zero	Internal	8-Bit	4.5V to 5.5V	±0.5LSB

* The temperature grade is identified by a label on the shipping container.
Above options are available in an 8-lead TSOT package (LTC2632xTS8).

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ\text{C}$. $V_{CC} = 2.7\text{V}$ to 5.5V , V_{OUT} unloaded unless otherwise specified.

LTC2632-LI12/-LI10/-LI8/-LX12/-LX10/-LX8/-LZ12/-LZ10/-LZ8, LTC2632A-LI12/-LX12/-LZ12 ($V_{FS} = 2.5\text{V}$)

SYMBOL	PARAMETER	CONDITIONS	LTC2632-8			LTC2632-10			LTC2632-12			LTC2632A-12			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
DC Performance															
	Resolution		●	8		10		12		12				Bits	
	Monotonicity	$V_{CC} = 3\text{V}$, Internal Ref. (Note 4)	●	8		10		12		12				Bits	
DNL	Differential Nonlinearity	$V_{CC} = 3\text{V}$, Internal Ref. (Note 4)	●		± 0.5		± 0.5		± 1		± 1			LSB	
INL	Integral Nonlinearity	$V_{CC} = 3\text{V}$, Internal Ref. (Note 4)	●	± 0.05	± 0.5	± 0.2	± 1	± 1	± 2.5	± 0.5	± 1.5			LSB	
ZSE	Zero-Scale Error	$V_{CC} = 3\text{V}$, Internal Ref., Code = 0	●	0.5	5	0.5	5	0.5	5	0.5	5			mV	
V_{OS}	Offset Error	$V_{CC} = 3\text{V}$, Internal Ref. (Note 5)	●	± 0.5	± 5	± 0.5	± 5	± 0.5	± 5	± 0.5	± 5			mV	
V_{OSTC}	V_{OS} Temperature Coefficient	$V_{CC} = 3\text{V}$, Internal Ref.		± 10		± 10		± 10		± 10				$\mu\text{V}/^\circ\text{C}$	
GE	Gain Error	$V_{CC} = 3\text{V}$, Internal Ref.	●	0.2	0.8	0.2	0.8	0.2	0.8	0.2	0.8			%FSR	
GE_{TC}	Gain Temperature Coefficient	$V_{CC} = 3\text{V}$, Internal Ref. (Note 10) C-Grade H-Grade		10 10		10 10		10 10		10 10				ppm/ $^\circ\text{C}$ ppm/ $^\circ\text{C}$	
	Load Regulation	Internal Ref., Mid-Scale, $V_{CC} = 3\text{V} \pm 10\%$, $-5\text{mA} \leq I_{OUT} \leq 5\text{mA}$ $V_{CC} = 5\text{V} \pm 10\%$, $-10\text{mA} \leq I_{OUT} \leq 10\text{mA}$	● ●	0.009 0.009	0.016 0.016	0.035 0.035	0.064 0.064	0.14 0.14	0.256 0.256	0.14 0.14	0.256 0.256			LSB/mA LSB/mA	
R_{OUT}	DC Output Impedance	Internal Ref., Mid-Scale, $V_{CC} = 3\text{V} \pm 10\%$, $-5\text{mA} \leq I_{OUT} \leq 5\text{mA}$ $V_{CC} = 5\text{V} \pm 10\%$, $-10\text{mA} \leq I_{OUT} \leq 10\text{mA}$	● ●	0.09 0.09	0.156 0.156	0.09 0.09	0.156 0.156	0.09 0.09	0.156 0.156	0.09 0.09	0.156 0.156			Ω Ω	

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{OUT}	DAC Output Span	External Reference Internal Reference		0 to V_{REF} 0 to 2.5		V V
PSR	Power Supply Rejection	$V_{CC} = 3\text{V} \pm 10\%$ or $5\text{V} \pm 10\%$		-80		dB
I_{SC}	Short-Circuit Output Current (Note 6) Sinking Sourcing	$V_{FS} = V_{CC} = 5.5\text{V}$ Zero-Scale; V_{OUT} Shorted to V_{CC} Full-Scale; V_{OUT} Shorted to GND	● ●	27 -28	48 -48	mA mA

Power Supply

V_{CC}	Positive Supply Voltage	For Specified Performance	●	2.7	5.5	V
I_{CC}	Supply Current (Note 7)	$V_{CC} = 3\text{V}$, $V_{REF} = 2.5\text{V}$, External Reference $V_{CC} = 3\text{V}$, Internal Reference $V_{CC} = 5\text{V}$, $V_{REF} = 2.5\text{V}$, External Reference $V_{CC} = 5\text{V}$, Internal Reference	● ● ● ●	0.3 0.4 0.3 0.4	0.5 0.6 0.5 0.6	mA mA mA mA
I_{SD}	Supply Current in Power-Down Mode (Note 7)	$V_{CC} = 5\text{V}$	●	0.5	2	μA

ELECTRICAL CHARACTERISTICS

The ● denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 25^\circ\text{C}$. $V_{CC} = 4.5\text{V}$ to 5.5V , V_{OUT} unloaded unless otherwise specified.

LTC2632-HI12/-HI10/-HI8/-HZ12/-HZ10/-HZ8, LTC2632A-HI12/-HZ12 ($V_{FS} = 4.096\text{V}$)

SYMBOL	PARAMETER	CONDITIONS	LTC2632-8			LTC2632-10			LTC2632-12			LTC2632A-12			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
DC Performance															
	Resolution		●	8		10		12		12				Bits	
	Monotonicity	$V_{CC} = 5\text{V}$, Internal Ref. (Note 4)	●	8		10		12		12				Bits	
DNL	Differential Nonlinearity	$V_{CC} = 5\text{V}$, Internal Ref. (Note 4)	●		± 0.5		± 0.5		± 1		± 1			LSB	
INL	Integral Nonlinearity	$V_{CC} = 5\text{V}$, Internal Ref. (Note 4)	●	± 0.05	± 0.5		± 0.2	± 1		± 1	± 2.5		± 0.5	± 1.5 LSB	
ZSE	Zero-Scale Error	$V_{CC} = 5\text{V}$, Internal Ref., Code = 0	●	0.5	5		0.5	5		0.5	5		0.5	5	
V _{OS}	Offset Error	$V_{CC} = 5\text{V}$, Internal Ref. (Note 5)	●	± 0.5	± 5		± 0.5	± 5		± 0.5	± 5		± 0.5	± 5	
V _{OSTC}	V _{OS} Temperature Coefficient	$V_{CC} = 5\text{V}$, Internal Ref.		± 10		± 10		± 10		± 10			± 10	$\mu\text{V}/^\circ\text{C}$	
GE	Gain Error	$V_{CC} = 5\text{V}$, Internal Ref.	●	0.2	0.8		0.2	0.8		0.2	0.8		0.2	0.8	
GE _{TC}	Gain Temperature Coefficient	$V_{CC} = 5\text{V}$, Internal Ref. (Note 10) C-Grade H-Grade		10 10		10 10		10 10		10 10			10 10	ppm/ $^\circ\text{C}$ ppm/ $^\circ\text{C}$	
	Load Regulation	$V_{CC} = 5\text{V} \pm 10\%$, Internal Ref. Mid-Scale, $-10\text{mA} \leq I_{OUT} \leq 10\text{mA}$	●	0.006	0.01		0.022	0.04		0.09	0.16		0.09	0.16	
R _{OUT}	DC Output Impedance	$V_{CC} = 5\text{V} \pm 10\%$, Internal Ref. Mid-Scale, $-10\text{mA} \leq I_{OUT} \leq 10\text{mA}$	●	0.09	0.156		0.09	0.156		0.09	0.156		0.09	0.156	

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V _{OUT}	DAC Output Span	External Reference		0 to V _{REF}		V
		Internal Reference		0 to 4.096		V
PSR	Power Supply Rejection	$V_{CC} = 5\text{V} \pm 10\%$		-80		dB
I _{SC}	Short-Circuit Output Current (Note 6) Sinking Sourcing	$V_{FS} = V_{CC} = 5.5\text{V}$ Zero-Scale; V _{OUT} Shorted to V _{CC}	●	27	48	mA
		Full-Scale; V _{OUT} Shorted to GND	●	-28	-48	mA

Power Supply

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V _{CC}	Positive Supply Voltage	For Specified Performance	●	4.5	5.5	V
I _{CC}	Supply Current (Note 7)	$V_{CC} = 5\text{V}$, V _{REF} = 4.096V, External Reference	●	0.4	0.6	mA
		$V_{CC} = 5\text{V}$, Internal Reference	●	0.5	0.7	mA
I _{SD}	Supply Current in Power-Down Mode (Note 7)	$V_{CC} = 5\text{V}$	●	0.5	2	μA