

## 14-BITS, 170 MSPS ADC WITH LVDS/CMOS OUTPUTS

### FEATURES

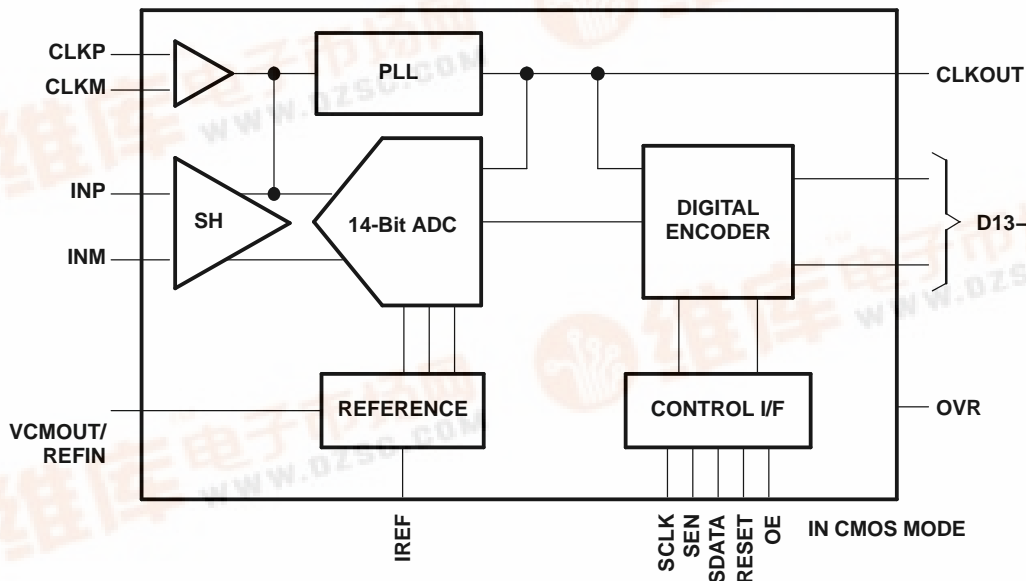
- Maximum Sample Rate: 170 MSPS
- 14-Bit Resolution
- No Missing Codes
- Power Dissipation
  - Core Power: 1 W
  - Total Power: 1.22 W
- Internal Sample and Hold
- 73.5-dBFS SNR at 70-MHz IF
- 85-dBc SFDR at 70-MHz IF
- Parallel CMOS and LVDS Output Options
- Internal Reference, External Reference Support
- 3.3-V Analog and Digital Supply
- 48-Pin QFN Package (7 mm × 7 mm)

### APPLICATIONS

- Wireless Communication
- Software Defined Radio
- Power Amplifier Linearization
- 802.16d/e
- Test and Measurement Instrumentation
- High Definition Video
- Medical Imaging
- Radar Systems

### DESCRIPTION

The ADS5545 is a high performance 14-bit 170-MSPS ADC. Using an internal sample and hold and low jitter clock buffer this ADC supports high SNR and high SFDR at high IF. With programmable options for parallel CMOS and LVDS outputs, this device is available in a compact 48-pin QFN package. The device provides internal references or can optionally be driven with an external reference. The device is specified over a -40°C to 85°C operating range.



PRODUCT PREVIEW

**PACKAG/ORDERING INFORMATION<sup>(1)</sup>**

PRODUCT	PACKAGE-LEAD	PACKAGE DESIGNATOR	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	ORDERING NUMBER	TRANSPORT MEDIA, QUANTITY
ADS5545	48-QFN	RGZ	–40°C to 85°C	ADS5545IRGZ		

(1)  $\theta_{JA}$  = TBD,  $\theta_{JC}$  = TBD

**ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>**

	VALUE	UNIT
AVDD Supply voltage range	–0.3 V to 3.9	V
DRVDD Supply voltage range	–0.3 V to 3.9	V
Voltage between AGND and DRGND	–0.3 to 0.3	V
Voltage between AVDD to DRVDD	–0.3 to 3.3	V
CM Voltage applied to external pin	–0.3 to 2	V
Voltage applied to analog input pins	–0.3 V to minimum (3.6, AVDD + 0.3 V )	V
T <sub>A</sub> Operating free-air temperature range	–40 to 85	°C
T <sub>J</sub> Operating junction temperature range	125	°C
T <sub>stg</sub> Storage temperature range	–65 to 150	°C
Lead temperature 1,6 mm (1/16 inch) from the case for 10 seconds	220	°C

(1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *recommended operating conditions* is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

**RECOMMENDED OPERATING CONDITIONS**

	MIN	NOM	MAX	UNIT
<b>SUPPLIES AND REFERENCES</b>				
AVDD Analog supply voltage	3	3.3	3.6	V
DRVDD Digital supply voltage	3	3.3	3.6	V
<b>CLOCK INPUT</b>				
Input clock sample rate	1		170	MSPS
Input clock amplitude, differential				V <sub>pp</sub>
Input clock duty cycle		50%		
Operating free-air temperature	–40		85	°C

**ELECTRICAL CHARACTERISTICS**

Typical values at 25°C, min, max values are across the full temperature range T<sub>MIN</sub> = –40°C to T<sub>MAX</sub> = 85°C, AVDD = DRVDD = 3.3 V, sampling rate = 170 MSPS, 50% clock duty cycle, –1 dBFS differential analog input, internal reference mode, LVDS data output (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>DC ACCURACY</b>					
Resolution			14		bits
No missing codes			Assured		
DNL Differential non-linearity		–0.9	0.5	TBD	LSB
INL Integral non-linearity			±3		LSB
Offset error			±10		mV
Offset temperature coefficient			TBD		ppm/°C
Gain error			±1		%FS
Gain temperature coefficient			TBD		Δ°C

**ELECTRICAL CHARACTERISTICS (continued)**

Typical values at 25°C, min, max values are across the full temperature range  $T_{MIN} = -40^{\circ}\text{C}$  to  $T_{MAX} = 85^{\circ}\text{C}$ ,  $AVDD = DRVDD = 3.3\text{ V}$ , sampling rate = 170 MSPS, 50% clock duty cycle, -1 dBFS differential analog input, internal reference mode, LVDS data output (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>POWER SUPPLY</b>						
ICC	Total supply current	$F_{IN} = \text{TBD}$		369		mA
IAVDD	Analog supply current	$F_{IN} = \text{TBD}$		315		mA
IDRVDD	Digital supply current	LVDS mode, $F_{IN} = \text{TBD}$ , $C_L = 5\text{ pF}$		54		mA
		CMOS mode, $F_{IN} = \text{TBD}$ , $C_L = 5\text{ pF}$		70		mA
	Total power dissipation	LVDS mode, $F_{IN} = \text{TBD}$		1.22		W
	Power down dissipation	Clock running		TBD		mW
<b>REFERENCE VOLTAGES</b>						
VREFB	Reference bottom			0.5		V
VREFT	Reference top			2.5		V
VCM	Common mode voltage (internal)			1.5		V
	VCM output current			$\pm 4$		mA
<b>ANALOG INPUT</b>						
	Differential input capacitance			7		pF
	Analog input common mode range			$V_{CM} \pm 0.1$		V
	Differential input voltage range			2		V <sub>pp</sub>
	Analog input bandwidth	-3 dB, source impedance 50 $\Omega$		400		MHz
<b>DYNAMIC AC CHARACTERISTICS</b>						
SFDR	Spurious free dynamic range	$F_{IN} = 10\text{ MHz}$		90		dBc
		$F_{IN} = 70\text{ MHz}$		85		
		$F_{IN} = 150\text{ MHz}$		84		
SNR	Signal-to-noise ratio	$F_{IN} = 10\text{ MHz}$		74		dBFS
		$F_{IN} = 70\text{ MHz}$		73.5		
		$F_{IN} = 150\text{ MHz}$		72		

**DIGITAL CHARACTERISTICS**

The dc specifications refer to the condition where the digital outputs are not switching, but are permanently at a valid logic level 0 or 1 AVDD = DRVDD = 3.3 V, I<sub>O</sub> = 3.5 mA, R<sub>L</sub> = 100 Ω.<sup>(1)</sup>

All LVDS and CMOS specifications are characterized, but not tested at production.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>DIGITAL INPUTS</b>					
High-level input voltage		2.4			V
Low-level input voltage				0.8	V
High-level input current			10		μA
Low-level input current			10		μA
Input capacitance			4		pF
<b>DIGITAL OUTPUTS – CMOS MODE</b>					
High-level output voltage			3.3		V
Low-level output voltage			0		V
Output capacitance	Output capacitance inside the device, from either output to ground		4		pF
<b>DIGITAL OUTPUTS – LVDS MODE</b>					
High-level output voltage			1375		mV
Low-level output voltage			1025		mV
Output differential voltage,  V <sub>OD</sub>			350		mV
V <sub>OS</sub> Output offset voltage <sup>(1)</sup>	Common-mode voltage of OUTP and OUTM		1200		mV
Output capacitance	Output capacitance inside the device, from either output to ground		4		pF
Change in  V <sub>OD</sub>  ,  ΔV <sub>OD</sub>			25		mV
Change in  V <sub>OS</sub>  ,  ΔV <sub>OS</sub>			25		mV

(1) I<sub>O</sub> refers to the LVDS buffer current setting, R<sub>L</sub> is the differential load resistance between the LVDS output pair.

PRODUCT PREVIEW

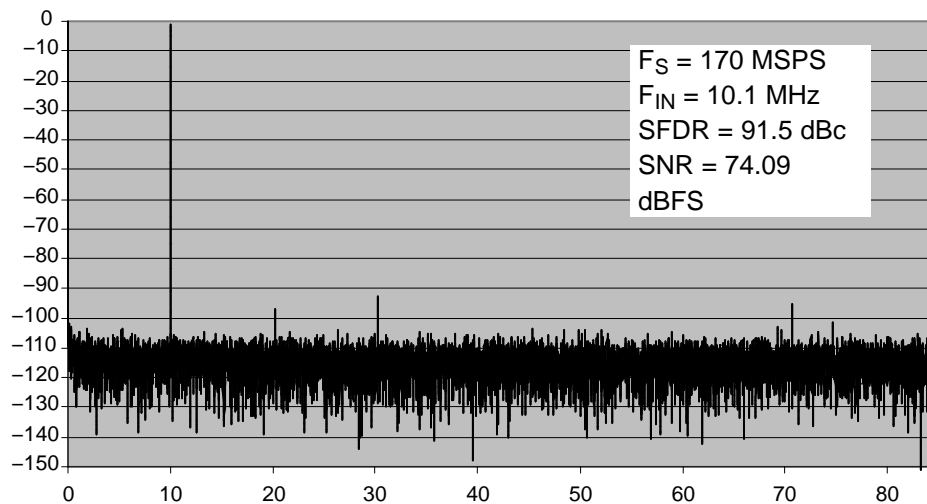
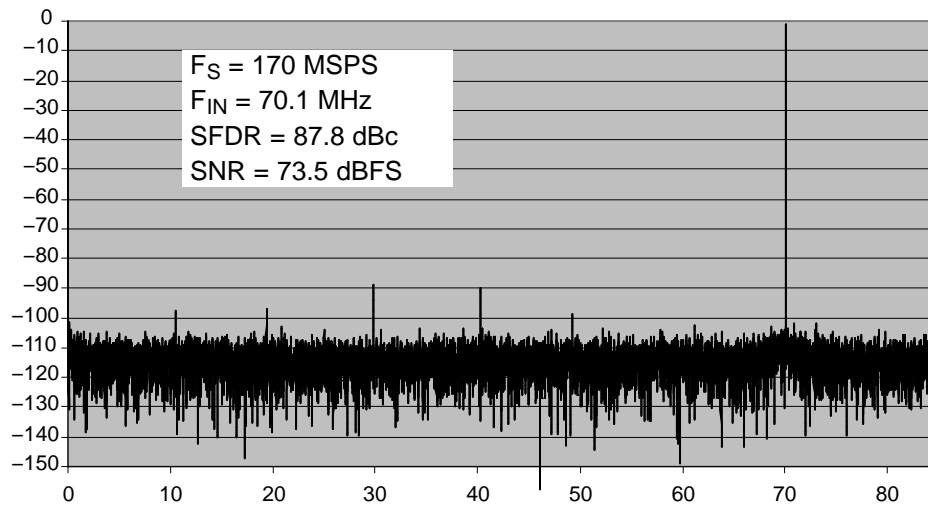


Figure 1. ADS5545 FFT Plot at 170 MSPS and 10-MHz Input



**Figure 2. ADS5545 FFT Plot at 170 MSPS and 70-MHz Input**

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
ADS5545IRGZ	PREVIEW	QFN	RGZ	48	250	TBD	Call TI	Call TI

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

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<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

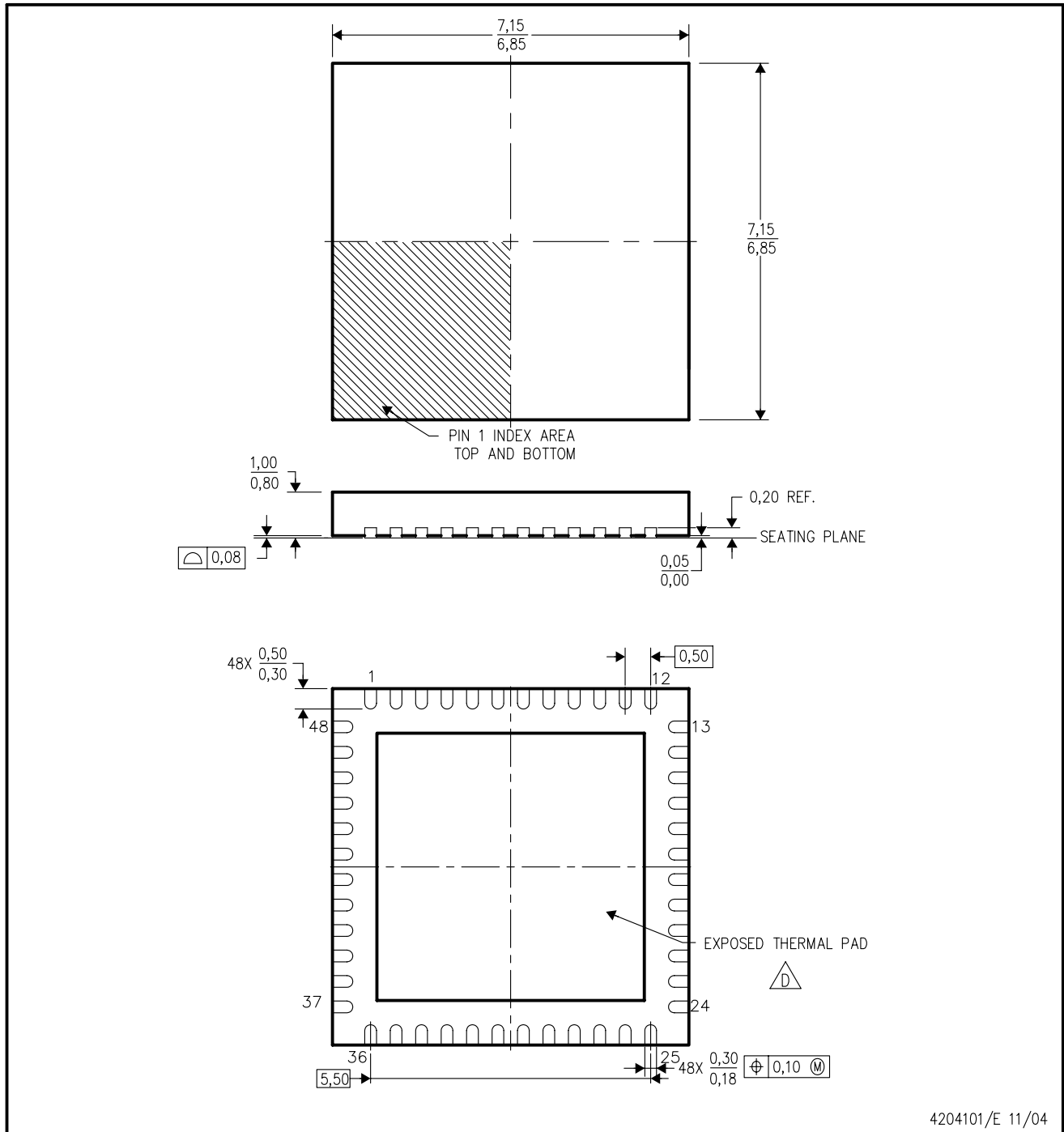
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# MECHANICAL DATA

RGZ (S-PQFP-N48)

PLASTIC QUAD FLATPACK



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Quad Flatpack, No-leads (QFN) package configuration.
  - D. The package thermal pad must be soldered to the board for thermal and mechanical performance. See the Product Data Sheet for details regarding the exposed thermal pad dimensions.
  - E. Falls within JEDEC MO-220.

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Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265