Low IF Receiver Reference Design Board

National Semiconductor RD-147 Data Conversions Applications October 2007



1.0 Design Description

The ADC14DS105KARB is a low IF receiver subsystem reference design board that utilizes a pair of LMH6552 differential drivers and a dual ADC to enable immediate evaluation of a quadrature direct conversion or near-zero IF receiver for signal frequencies from DC to 40 MHz. This receiver architecture is commonly used in WiMAX and WCDMA receiver systems. The 1 GHz input bandwidth of the ADC and the 1.5 GHz differential amplifier gain stage enable large signal-tonoise ratio (SNR) of 73.3 decibels full scale (dBFS) and spurious free dynamic range (SFDR) greater than 85 dBFS for input signals up to 40 MHz. In addition to the LMH6552, the board includes National's ADC14DS105 dual 14-bit, 105 mega-sample per second (MSPS) low-distortion, low-noise ADC with serialized low-voltage differential signaling (LVDS) outputs; LMK02000 low-jitter clock conditioner; as well as several energy-efficient power management integrated circuits (ICs).

2.0 Features

Key Features of the ADC14DS105KARB Low IF Receiver Reference Design Board

- Enables immediate evaluation of a quadrature direct conversion or near-zero IF receiver subsystem architecture
- Demonstrates a receiver architecture commonly used in WiMAX and WCDMA receiver systems
- Configured for signal frequencies from DC to 40 MHz
- Featured Products include :
- LMH6552 1.5 GHz differential current feedback amplifiers from National Semiconductor's Powerwise® family
- ADC14DS105: 14-bit, 105 MSPS, 1 GHz input bandwidth dual channel ADC with serial LVDS outputs from National Semiconductor's Powerwise® family
- LMK02000: low-jitter clock conditioner from National Semiconductor's Powerwise® family provides 128 fs jitter (100 Hz to 20 MHz integration bandwidth)
- Several energy-efficient power management integrated circuits (ICs) from National Semiconductor
- Reference design performance for input signals up to 40 MHz:
- Small-signal SNR of 74 dBFS and SFDR greater than 90 dBFS
- Large-signal SNR of 73.3 dBFS and SFDR greater than 85 dBFS $\,$

3.0 Schematic

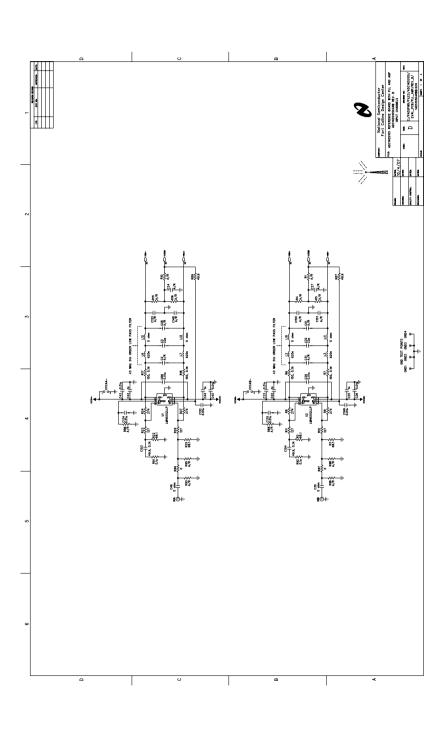


FIGURE 1. ADC14D105 SCHEMATIC

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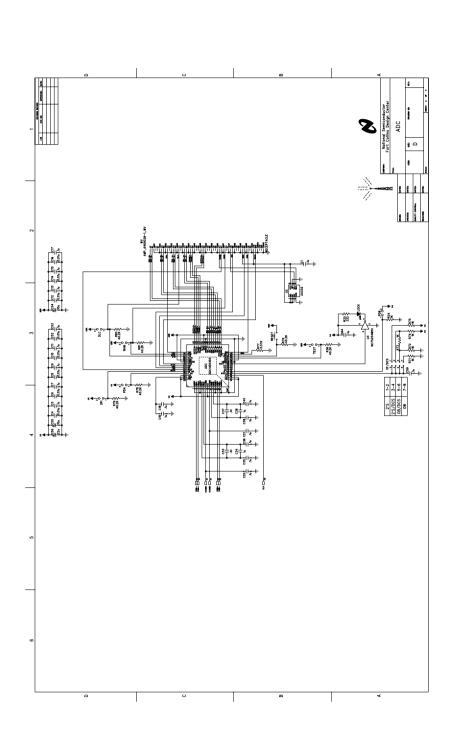
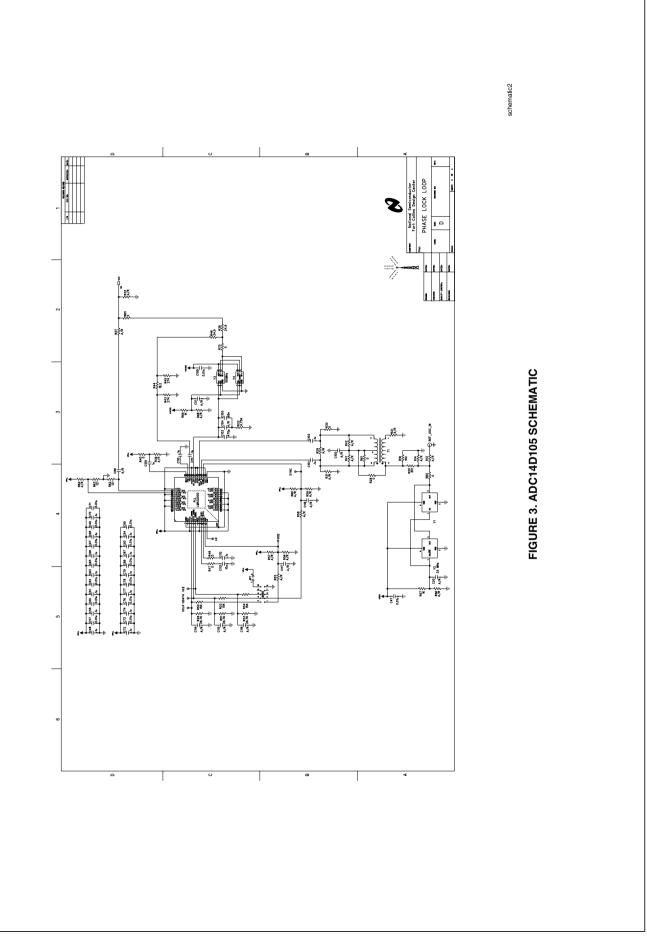


FIGURE 2. ADC14D105 SCHEMATIC

schematic1



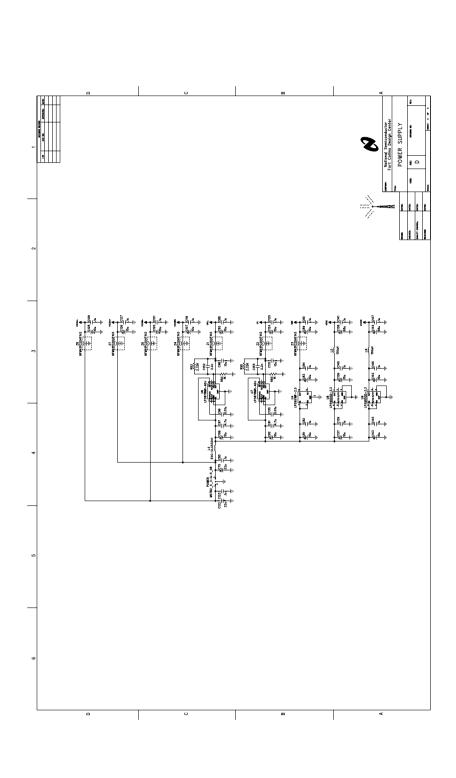


FIGURE 4. ADC14D105 SCHEMATIC

schematic3

FIGURE 5. ADC14D105 BOM

\$ 200 P		AFTER PRESS FITTING THIS CONNECTOR INTO THE BOARD IT SHOULD ALSO BE SOLDER TO THE BOARD		THIS IS A 0402 SIZE RESISTOR PLACED ON 0603 CAPACITOR PADS					THE STATE OF THE PRESENCE OF COLUMN STATE OF THE STATE OF	THE IS A 1200 SIGHT MUSICAL PROPERTY TWO ONLY WITHOUT THE STATE OF THE												THIS IS A 0805 SLIZE RESISTOR BIACED ON 1005 INDICTOR PADS		PLACE SHUNT SO IT IS ON ONE OF JP1 CONNECTOR PINS BUT DOES NOT CONNECTOR TO THE CINER PINE PLACE SHUNT ROM PINS 1-2 ON ONE OF SHAPE CONNECTOR SHAPE SHAPE PINE PINE SHAPE SHAPE POWER SHAPE POWER SHAPE POWER SHAPE POWER SHAPE POWER SHAPE POWER PINE PINE PINE SHAPE POWER POWER SHAPE POWER SHAPE POWER																								16 IN PARTS MT 5 MORE ON OR DER	PLACE BUMP ONS AT THE 4 CORNERS, ON BOTTOM OF BOARD THIS IS A 0603 SZECAPACITOR PLACED ON 0603 SIZE RESISTOR PADS			
Supplier Part Number	AT24C02BN-SHB-ND	ADC14D STOCKSSQ 42K7651	PCC2366CT-ND	RG10P49.98CT-ND F87.1469.1-ND	478-1244-14ID PCC2146CT-ND		478-1114-1-ND	POC1784CT-ND	399-1237-1-ND	PCC2178CT-ND	PCC2151CT-ND PCC19400CT-ND	PCC1893CT-ND	478-3705-1-ND	PCC2297CT-MD	490-1297-1-ND	490-1623-1-ND	495-2181-1-ND	478-1663-1-ND	PROGRESCT-ND	P9812CT-ND 616-340-1AID	DN42113JCT-ND	1006CS-621XJLB RHMD 04RC TAD	MTSW-101-07-T-D-240	68786-302LF	MTSW-104-07-T-D-240	MTSW-105-07-T-D-240	UMKOSOOISO	LP3878MR-ADJ-ND	LP5900SD-3-3CT-ND	277-1096 ND	277-1012-ND	AC78204M5XC1AD 490-25501AD	541-0.03CT-ND	52K6543 541-102HCT-ND	P121LCT-ND	541-150KLCT-ND 641-1821 CT-ND	541-1.00KLCT-ND	541-2-32KLCT-ND	541-267KLCT-ND	541-274LCT-ND	541:307KHCT-ND 541:301HCT-ND	541-332HCT-ND	541-475KLCT-ND	541-40.2KHCT-ND 341.274HBCT-ND	P100DBCT-ND	311-49.9LRCT-ND	WM8634-ND CW460CT-ND	549-CVHD-950X-100	\$J5003-0-ND 478-1244-1-ND	311-127HBCT-ND	541-68.1HCT-ND	
Supplier	Digi Key	Newark Newark	Digi Key	Dig Key Dig Key	Dig Key Dig Key		Digi Key	Digi Key	Digi Key	Digikey	Dig Key	Dig Key	Dig Key	Dig Key	Digi Key	Digi Key	Digi Key	Dig Key	Digi Key	Digi Key	Dig Key	Coloralt Diei Kev	Samboo	Arrow Electronics	Samoo	Sambo	NATIONAL SEMI	Digi Key	Digikey	Darkey	Dig Key	Did Key	Dig Key	Newark Disi Key	Digi Key	Dig Key	Dig Key	Dig Key	Dig Key	Digi Key	Doj Key	Digi Key	Digi Key	Dig Key	Digi Key	Digi Key	Digi Key	Mouser Bedronics	Dig Key Dig Key	Dial Key	Digi Key	
Manufacturer	ATMEL STREET STR	TYCO	Panasonic - EOG	Susumu Talvo Varien	AVX Corporation Panasonic - ECG		AVX Corporation	Panasonio - EOG	Kernet	Panasonic - ECG	Panasonic - EOG	Panasonic - EOG	AVX Coposition	Panaporic - ECG	TDKCorporation	Musta Electronics	Kernet	AVXCorposation	Panasonio - ECG	Panasonic - EOG	API Delevan	Colorate	Samteo	FCI Bedronic	Sarriblic	Sambec	NATIONAL SEMICONDUCTOR NATIONAL SEMICONDUCTOR	NATIONAL SEMICONDUCTOR	NATIONAL SEMICONDUCTOR	Phoenic Contact	Phoenix Contact	Munda Electronics	Vishay Dale	Vishay Dale Vishay Dale	Panasonic - EO3	Vishey Dale	Visitary Date	Vishay Dale	Vishay Dale	Vishey Dale	Vishey Dale	Vishay Dale	Vishay Dale	Vishay Dale BOHM	Parasonic - EO3	Yageo Corporation	MolecyWaldom Electronics Corp	Crystek Crystal Corpotation	3M AVX Corporation	WHOSE .	Vishay Dale	
PCB Footprint	8 PIN SOIC		amic_0201	amic_0603	sme_0402 sme_0402		ame_0402	smo_0603	amb_,1206	antc_1206	amic_0803	amic_1206	amb_0603	amc_1206	smc_0402	sm/c_0603	amtc_3216	amb_3216	3000,000		anf_1812	aml 1008		JT DOES -			UP-48	PSOP-8	LIP-6	0-67100		SOT23-5 1806	am1_0603	sm/_0402 sm/_0603	sm/_0402	amh_0402 amh_0402	amt_0402	amh_0402	ami_0402 ami_0402	SmV_0402	amt_0803	ant_0603	amh_0402	amh_0603	sm/_0603	amt_0402			RD . smh_0603		sm/_0603	
Pescription	2K SERAL EEPROM	DUAL 14-011 TO MSP'S A/O CONVENTER WITH SERVICE LVDS OF HMDz RECEPT ACLE	0.1uF SMD CAP CERAMC 6.3V XSR 10%	49.9 CHM SMD RESISTOR 1/16/V0.1% CAP CRR 10LF 10V X/R	0.1uF SMD CAP CERAMC TOV XRR 10% 0.1uF SMD CAP CERAMC TOV XRR 10%		0.01uF SMD CAP CERMIN 16V X7R 10%	0.01uF SMID CAP CERAMIC 50VX7R 10%	0.01uF SMD CAP CERAMIC 50V X7R 5%	10uF SMD CAP CERAMIC 10V XSR 20%	10000PF SMD CAP CERAMIC 50V NPO 5%	1uF SMD CAP CERAMIC 25VX7R 10%	2200pF SMD CAP CERAMIC 100V X7R 5%	4.7uF SMD CAP CERAMIC 25VXSR 10%	470pF SMD CAP CERANIC 50V COG 5%	69000pF SAID CAP CER AMIC 25V X7R 10%	10uF SMID CAP TANTALUM 6.3V 20%	22JF SMID CAP TANTALUM 10V 10%	LIGHT TOUCH SWITCH 240GF SMD	SAND FERRITE BEAD CORE 4.5X3.2X1.8 BED I ICHT EMITTING DIODIE	100UH SMID INDUCTOR UNSHIELDED	620nH Series 1008CS (2520) Ceramic Chip Inductor 0.0HM SMD RESISTOR 1/8W/Rs.	1X2 JUMPER BLOCK HEADER	PLACE SHUNT SO IT IS ON ONE OF JP1 CONNECTOR PINSBUT DOES . NOT CONNECTOR TO THE OTHER PINS PLACE SHUNT FROM PINS 1-2 ON COS 18 YOUR OTHER OWN ACCOUNT OF THE OWN DATE OF THE OWN DATE OF THE OWN DATE OF THE OWN DATE OF T	2X4 JUMPER BLOCK HEADER	2X5JUMPER BLOCK HEADER	1 GPE PULY DIfferential Amplifier PRECISION CLOCK DISTRIBUTOR WITH INTERGRATED PLL	ADJUSTABLE VOLTAGE REGULATOR	LINEAR REGULATOR FOR RF/ANALOG CIRCUITS	Vollege regulation LOW-DRAINAL BLOCK 3POS 5.08mm	TERMINAL BLOCK PLUG 2POS 5.08mm	INVENTER SGLT TINYLOGIC FILTER LC HIGH FREQ 2UF	0 OHM SMD RESISTOR 1/10W 5%	0 OHM SMD RESISTOR 1/16W 1% 102 OHM SMD RESISTOR 1/10W 1%	121 OHM SMD RESISTOR 1/16W1%	15K OHM SMD RESISTOR 1/16W 1%	1K OHM SMD RESISTOR 1/WW 1%	2.32KOHM SMD RESISTOR 1/16W 1%	26.7K OHM SMD RESISTOR 1/16W 1%	274 OHM SMD RESISTOR 1/16W1%	307 OHM SMD RESISTOR 170W 1%	332 OHM SMD RESISTOR 1/10W1%	4.75K OHM SMD RESISTOR 1/16W 1%	40.2K OHM SMD RESISTOR 1/10W 1%	100 CHM SMD RESISTOR 1/16W0.1%	49.9 OHM SMD RESISTOR 1/16W 1%	PCBMOUNTABLE SMA.CONNECTOR	100 MHz Voltage Controlled Oscillator	PLACE BUMP ONS AT THE 4 CORNERS, ON BOTTOM OF BOARD 0.1uF SMD CAP CERAMIC 25V XSR 10%	127 CHM SMD RESISTOR 1/10W/196	68.1 OHM SMD RESISTOR 1/10/1/1/	
Part Name	EEPROM	WAVEVISION CONNECTOR HMDz RECEPTACLE			106		0.014	0.014	0.01uF	our.	ų, ų				470pF	- Garl			Ш	Ferrite Bead Core	Ш				Jumper 2X4		Phase Lock Loco		Voltage Regulator	mir	Power Corrector Plug	Filtor	ш				1K ohms	2.32K ohms	26.7K ohms			Ш				49.9 ohms	SMAinput	vcxo	Bump-on Rubber Feet 0.1uF	127 olms	68.1 ohms	
NDUCTOR hematic Reference		25	13, C37	C153-154 C38, C131	C121, C127, C129 0, C11, C13, C15, 20-21, C35-36, C39-40, C35-59, C61, C63-64, C70, C72, C74, C77,	19, C87, C94, C101-102,	1, 08, 08, 010, 012, 014, 016, 17, 049, 052, 057, 090, 062, 16, 087, 071, 073, 076, 078, 16, 087, 074, 078, 076, 078,	23, C26, C29,C43, C46, O89, 32, C134-135, C149	6,0130	113	C22, C25, C42, C44	94, C82, C139-140, C145-146	152, C155	11, C97	80	90	C54-55, C81, C83, C85, C89, C92, 10uF C106-107, C120, C124, C126, C128, C136-137, C142-143	36, C75, C122	SET	20		12-3, 16-7			soo:	MRE				POWER		214.268	5 R28, R61, R64, R94, R97 0 ohms	90, R40, R65, R70, R47-48	2543	30, R52, R54	44, R67, R69, R71-75, R62, R65	13, R90	9, R51, R53	13 R45		9	22	36, R76, R78-81	17, R17-18,	57, R89	A INB		11-92	R11-R12 R23 R26	R2-3, R22, R25	
NATIONAL SEMICONDUCTOR	30 1	3 1 1/0	4 2 CS	2 2 0	8 5 5 5 5 0 10 10 10 10 10 10 10 10 10 10 10 10 1	55	తత్త ఇ ∞	5 5 5	11 2 0	13 1 51	4 4	16 6 C2	17 2 C	19 2 C91,1	20 1 C	22 1 01	22 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	24 3 Ct	26 1 RE	27 1 14	29 2 15,19	31 4 4 12	32 2 JP	33 3 JF	34 1 09	38 1 0	37 2 UI:	38 2 UE	39 2 Uk	1 1 1 1 1 1 1	42 1 -	44 7 C	45 5 R2	46 6 R:	48 2 RE	49 3 Rt	51 10 R2	52 2 RE	St 8	55 2 R4	8 6 7 - 1	58 1 R2	59 1 R2	60 6 R	62 4 RE	63 2 R6	64 2 IN	66 1 Y3	67 4 MT1 68 2 R91	69 0 ·	71 4 R	

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5.0 Board Photos



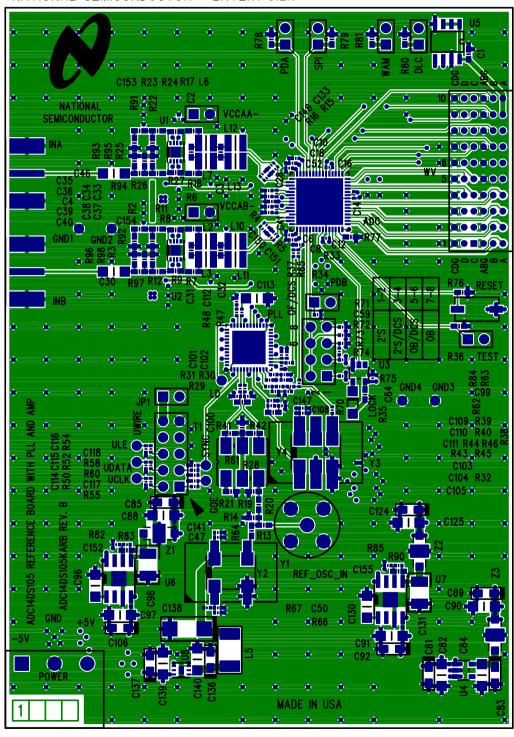
boardphoto

FIGURE 6. ADC14D105 Board Photo

6.0 Layouts

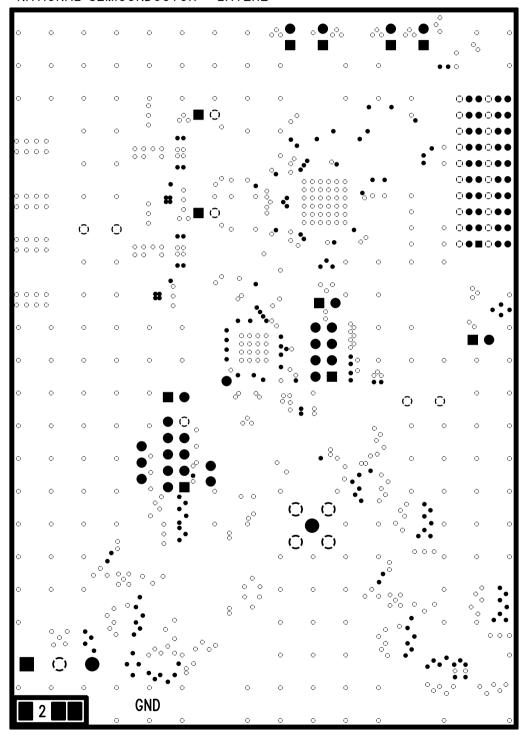
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NATIONAL SEMICONDUCTOR LAYER1 SILK



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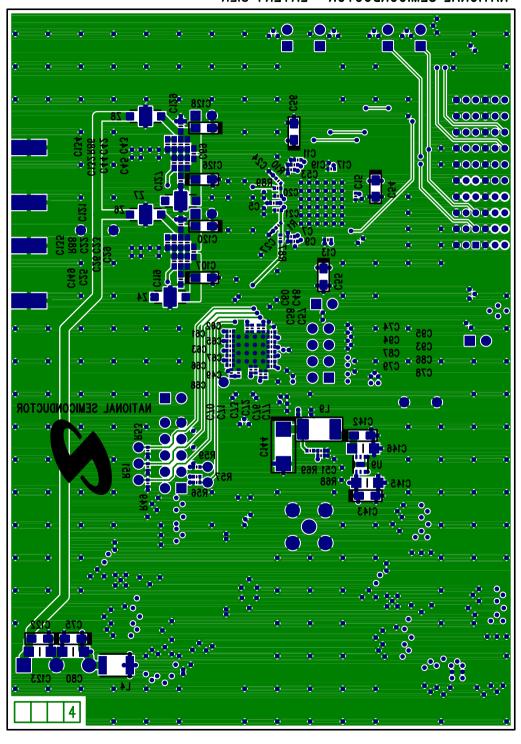
NATIONAL SEMICONDUCTOR LAYER2



NATIONAL SEMICONDUCTOR LAYER3

10

NATIONAL SEMICONDUCTOR LAYER4 SILK



11

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