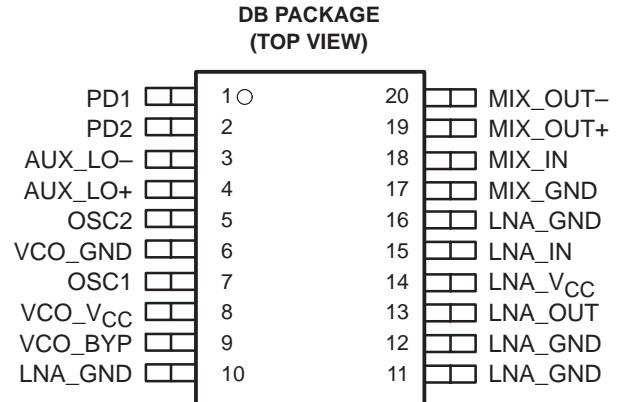- **Low-Noise Amplifier (LNA), Radio Frequency (RF) Mixer, and Voltage-Controlled Oscillator (VCO)**
- **Improved Compression Mode**
- **Conversion From RF to Intermediate Frequency (IF) on a Single Chip**
- **Suitable for Portable 900-MHz Cellular and Cordless Telephones**
- **Low-Current Consumption Mode**
- **20-Pin Plastic Shrink Small Outline (SSOP) Package**
- **Application-Selectable Internal or External Oscillator**

DB PACKAGE
(TOP VIEW)

PD1	1	20	MIX_OUT–
PD2	2	19	MIX_OUT+
AUX_LO–	3	18	MIX_IN
AUX_LO+	4	17	MIX_GND
OSC2	5	16	LNA_GND
VCO_GND	6	15	LNA_IN
OSC1	7	14	LNA_V_{CC}
VCO_V_{CC}	8	13	LNA_OUT
VCO_BYP	9	12	LNA_GND
LNA_GND	10	11	LNA_GND

description

The Texas Instruments (TI™) TRF1015 is a single-chip RF downconverter suitable for 900-MHz receiver applications. It combines a low-noise amplifier (LNA), a buffered voltage-controlled oscillator (VCO), and an RF mixer into a 20-pin SSOP package requiring very few external components.

Minimal power consumption can be further reduced by placing the required modules into operate mode and the remaining modules into standby mode.

Three modes of operation are provided for both the LNA and the mixer: standby, low current, and improved compression. The improved compression mode is suitable for applications that require full duplex capability. The improved compression mode is suitable for maintaining receiver sensitivity in the presence of large interfering signals and provides a low bit-error rate (BER) in digital modulation systems. The three modes of operation are selectable in accordance with the presence of a high or low signal on PD1 and PD2, as shown in Table 1.

Table 1. Mode Control

MODE	PD1	PD2
Standby	L	L
Low current	H	H
Improved compression	L	H

The LNA has a gain of 13 dB and a noise figure of 2.2 dB. LNA input and output characteristic impedances are 50 Ω. The single balanced RF mixer has a gain of 9 dB with a single-sideband (SSB) noise figure of 10 dB. The VCO has a typical tuning range of 25 MHz using an external varactor and resonator. The VCO gain and tuning range can be adjusted to meet the phase-locked loop (PLL) design requirement, with an external shunt and feedback capacitors in series with the resonator. A buffered output of the VCO provides phase locking capability and can be configured for single-ended or differential operation.

The TRF1015 is offered in the 20-pin SSOP (DB) package and is characterized for operation from −40°C to 85°C free-air temperature.

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

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.

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TEXAS INSTRUMENTS

functional block diagram
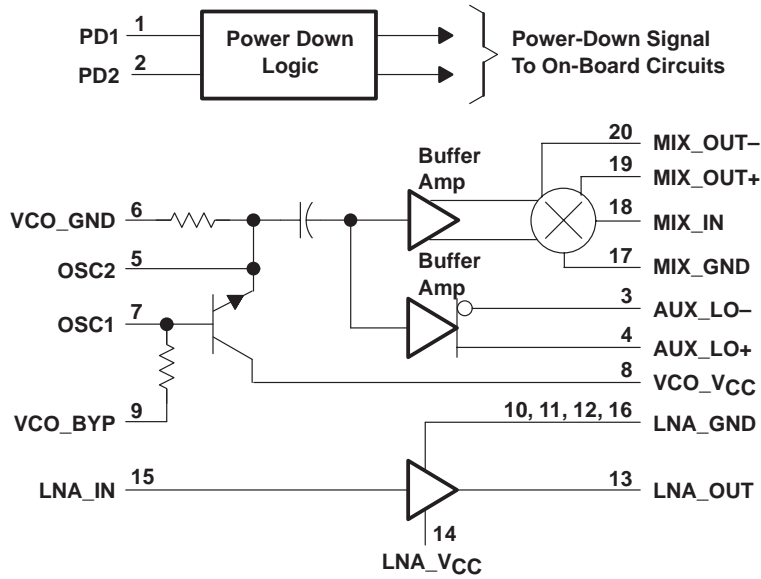
Terminal Functions

TERMINAL NAME	NO.	I/O	DESCRIPTION
AUX_LO−	3	O	PLL auxiliary local oscillator (LO) output (inverting). AUX_LO− is the inverted output from the auxiliary local oscillator.
AUX_LO+	4	O	PLL auxiliary LO output (noninverting). AUX_LO+ is the noninverted output from the auxiliary local oscillator.
LNA_GND	10		LNA ground
LNA_GND	11		LNA ground
LNA_GND	12		LNA ground
LNA_GND	16		LNA ground
LNA_IN	15	I	LNA RF input. LNA_IN is the RF input signal to the LNA.
LNA_OUT	13	O	LNA RF output. LNA_OUT is the RF output from the LNA.
LNA_V_{CC}	14		LNA voltage supply. The power supply voltage required to operate the LNA is connected to LNA_V_{CC}. See Application Information section.
MIX_GND	17		Mixer ground
MIX_IN	18	I	Mixer RF input. MIX_IN is the RF input to the mixer.
MIX_OUT−	20	O	Mixer IF output (inverting). MIX_OUT− is the inverted intermediate frequency (IF) output from the mixer.
MIX_OUT+	19	O	Mixer IF output (noninverting). MIX_OUT+ is the noninverted intermediate frequency (IF) output from the mixer.
OSC1	7		VCO tank port. A coaxial resonator and other tuning components are connected to OSC1 to form the local oscillator (see Application Information section).
OSC2	5		External oscillator input. An external oscillator can be connected to OSC2. See Application Information section.
PD1	1	I	Power down 1 LSB. PD1, along with PD2, determines which sections of the TRF1015 are placed in standby or operate mode.
PD2	2	I	Power down 2 MSB. PD2, along with PD1, determines which sections of the TRF1015 are placed in standby or operate mode.
VCO_BYP	9		VCO bypass port. An external capacitor can be connected to VCO_BYP when the TRF1015 is configured for local oscillator operation.
VCO_GND	6		VCO ground
VCO_V_{CC}	8		VCO voltage supply. The power supply voltage required to operate the VCO is connected to VCO_V_{CC} (see Application Information section).

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage range, V_{CC} .... −0.3 V to 6 V
Input voltage range, V_I .... −0.3 V to V_{CC} + 0.3 V
Power dissipation at or below $T_A = 25°C$ .... 200 mW
Operating virtual-junction temperature, T_J .... 150°C
Operating free-air temperature range, T_A .... −40°C to 85°C
Storage temperature range, T_{stg} .... −65°C to 125°C

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, V_{CC}	3.5	3.75	5.5	V
High-level input voltage, V_{IH}	V_{CC}−0.5		V_{CC}	V
Low-level input voltage, V_{IL}	−0.3		0.5	V
Operating free-air temperature, T_A	−40		85	°C
Operating virtual-junction temperature, T_J	−30		105	°C

TRF1015
RF DOWNCONVERTER

electrical characteristics at 881 MHz, T_A = 25°C, LO = 926 MHz, V_{CC} = 3.75 V; measured in recommended application circuit board (see Application Information)

cascade (LNA/SAW†/mixer) (IF = 45 MHz)

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
Power conversion gain	PD1 = L,	PD2 = H	18	19	21	dB
SSB noise figure	PD1 = L,	PD2 = H		4.2	5	dB
Input 1-dB compression point	PD1 = L,	PD2 = H		−26		dBm
Input 3rd-order intercept point, $2f_2 - f_1$	PD1 = L,	PD2 = H	−19	−14		dBm
LO feedthrough to RF				−45		dBm

† Surface acoustic wave (SAW)

LNA

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
RF frequency range			869		894	MHz
Power gain	PD1 = H,	PD2 = H		12		dB
	PD1 = L,	PD2 = H		13		
Noise figure	PD1 = H,	PD2 = H		2		dB
	PD1 = L,	PD2 = H		2.2		
Reverse isolation	PD1 = L,	PD2 = H		−25		dB
Input return loss	Z_I = 50 Ω,	PD1 = L, PD2 = H		−10		dB
Output return loss	Z_O = 50 Ω,	PD1 = L, PD2 = H		−12		dB
Input 1-dB compression	PD1 = H,	PD2 = H		−19		dBm
	PD1 = L,	PD2 = H		−14		
Input 3rd-order intercept point, $2f_2 - f_1$	PD1 = H,	PD2 = H		−12		dBm
	PD1 = L,	PD2 = H		−4		

RF mixer

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNIT
RF frequency range			869		894	MHz
LO frequency range			914		939	MHz
IF frequency				45		MHz
Power conversion gain	PD1 = L,	PD2 = H		9		dB
SSB noise figure	PD1 = L,	PD2 = H		10		dB
RF input impedance				50		Ω
LO input impedance	External VCO			50		Ω
RF input return loss	OSC1 = Z_I = 50 Ω			−10		dB
LO input return loss	OSC1 = Z_I = 50 Ω			−6		dB
IF output return loss	OSC1 = Z_O = 50 Ω	PD1 = L, PD2 = H		−15		dB
Input 1-dB compression point	PD1 = L,	PD2 = H		−10		dBm
Input 3rd-order intercept point, $2f_2 - f_1$	PD1 = L,	PD2 = H		1		dBm

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electrical characteristics at 881 MHz, T_A = 25°C, LO = 926 MHz, V_{CC} = 3.75 V; measured in recommended application circuit board (see Application Information) (continued)

VCO

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Auxiliary LO output power	R_L = 50 Ω		−11		dBm
Phase noise	Offset = 60 kHz		−114		dBc/Hz
Harmonics			−20		dBc

standby mode requirements over recommended operating free-air temperature range and V_{CC} = 3.75 V; (PD1 = L, PD2 = L)

	MIN	TYP	MAX	UNIT
LNA		28	100	μA
RF mixer and buffer amplifier			100	μA
VCO			100	μA

low current mode requirements over recommended operating free-air temperature range and V_{CC} = 3.75 V; (PD1 = H, PD2 = H)

	MIN	TYP	MAX	UNIT
LNA		2	3	mA
RF mixer and buffer amplifier		14	17	mA
VCO		4	5	mA

improved compression mode requirements over recommended operating free-air temperature range and V_{CC} = 3.75 V; (PD1 = L, PD2 = H)

	MIN	TYP	MAX	UNIT
LNA		5	7	mA
RF mixer and buffer amplifier		15	19	mA
VCO		3.75	4.5	mA

TRF1015
RF DOWNCONVERTER

APPLICATION INFORMATION

Figure 1 shows the TRF1015 configured using an external oscillator. Figure 2 shows the TRF1015 configured for an internal oscillator. Table 2 contains a list of the component part numbers and electrical values for the components shown in Figure 1 and Figure 2. Figure 3 through Figure 6 illustrate the typical performance for mode control when PD1 = L and PD2 = H.
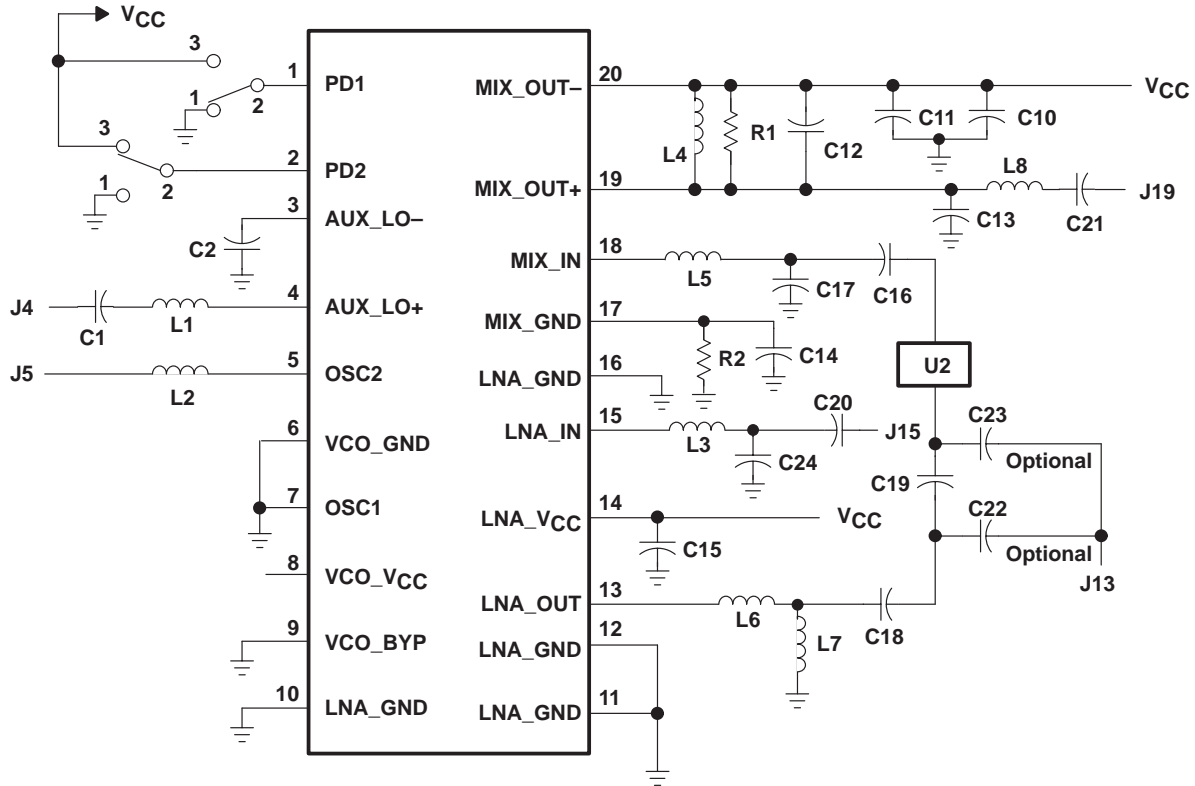

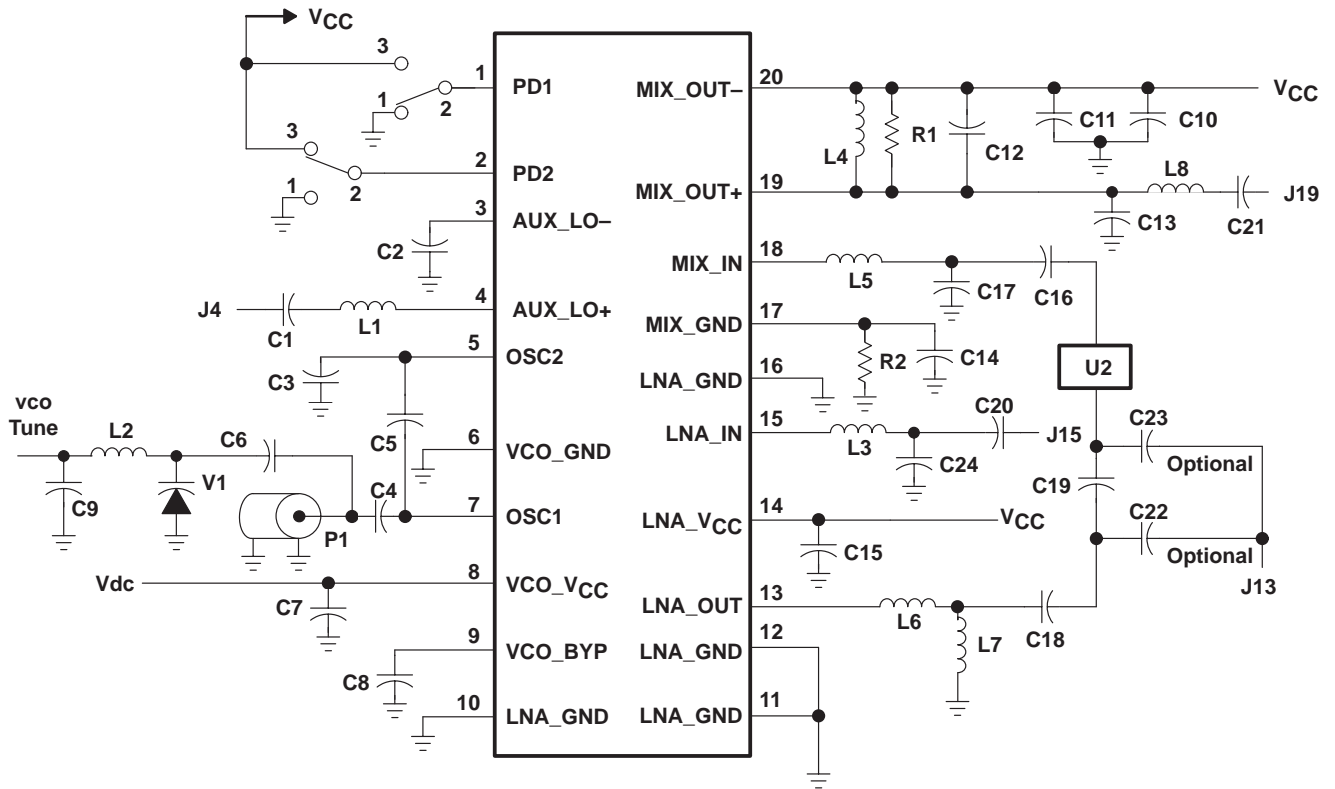**Figure 1. Recommended Application Circuit With External Oscillator**

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APPLICATION INFORMATION

Figure 2. Recommended Application Circuit With Internal Oscillator

APPLICATION INFORMATION

Table 2. TRF1015 External Components List

DESIGNATORS	DESCRIPTION	VALUE	MANUFACTURER	MANUFACTURER P/N
C1	Capacitor	22 pF	Murata	GRM36VOG220C50
C2	Capacitor	10 pF	Murata	GRM36VOG100C50
C3	Capacitor	1 pF	Murata	GRM36VOG010C50
C4	Capacitor	1 pF	Murata	GRM36VOG010C50
C5	Capacitor	0.5 pF	Murata	GRM36VOG05RC50
C6	Capacitor	1.5 pF	Venkel Corp	CO42COG001ZINB
C7	Capacitor	100 pF	Murata	GRM36VOG101C50
C8	Capacitor	100 pF	Murata	GRM36VOG101C50
C9	Capacitor	68 pF	Murata	GRM36VOG680C50
C10	Capacitor	1000 pF	Murata	GRM36VOG102C50
C11	Capacitor	100 pF	Murata	GRM36VOG101C50
C12	Capacitor	56 pF	Murata	GRM36VOG560C50
C13	Capacitor	18 pF	Murata	GRM36VOG180C50
C14	Capacitor	12 pF	Murata	GRM36VOG120C50
C15	Capacitor	100 pF	Murata	GRM36VOG101C50
C16	Capacitor	22 pF	Murata	GRM36VOG220C50
C17	Capacitor	3 pF	Murata	GRM36VOG030C50
C18	Capacitor	22 pF	Murata	GRM36VOG220C50
C19	Capacitor	100 pF	Murata	GRM36VOG101C50
C20	Capacitor	22 pF	Murata	GRM36VOG220C50
C21	Capacitor	68 pF	Murata	GRM36VOG680C50
C22[†]	Capacitor	100 pF	Murata	GRM36VOG101C50
C23[‡]	Capacitor	100 pF	Murata	GRM36VOG101C50
C24	Capacitor	1 pF	Murata	GRM36VOG010C50
L1	Coil	10 nH	Toko	LL1608-F10NJ
L2	Coil	10 nH	Toko	LL1608-F10NJ
L3	Coil	12 nH	Toko	LL1608-F12NJ
L4	Coil	220 nH	Coilcraft	0805HS-221
L5	Coil	12 nH	Toko	LL1608-F12NJ
L6	Coil	12 nH	Toko	LL1608-F12NJ
L7	N/A	N/A	N/A	N/A
L8	Coil	680 nH	Murata	LQH3NR68M04M00
R1	Resistor	1.5 kΩ	Panasonic	ERJ-2GEJ152
R2	Resistor	22 Ω	Pansonic	ERJ-2GEJ220
P1	Coaxial resonator		Trans-Tech	SR8800LPQ1050BY
U2	Surface acoustic wave (SAW) bandpass filter		Murata	SAEC881-5MA70N
V1	Varactor diode		Siemens	BBY5L-03W

[†] Remove C19 and populate C22 to test the LNA.
[‡] Remove C19 and populate C23 to test the mixer.

TYPICAL CHARACTERISTICS

CASCADE POWER CONVERSION GAIN
vs
TEMPERATURE

V_{CC} = 3.75 V
RFIN = –40 dBm @ 881.5 MHz
IF = 45 MHz
PD1 = L
PD2 = H

G – Cascade Power Conversion Gain – dB

T – Temperature – °C

Figure 3

CASCADE SSB NOISE FIGURE
vs
TEMPERATURE

V_{CC} = 3.75 V
FREQUENCY = 881.5 MHz
IF = 45 MHz
PD1 = L
PD2 = H

Cascade SSB Noise Figure – dB

T – Temperature – °C

Figure 4

INPUT THIRD ORDER INTERCEPT POINT
vs
TEMPERATURE

V_{CC} = 3.75 V
FREQUENCY = 881.5 MHz
PD1 = L
PD2 = H

IP3 – Input Third Order Intercept Point – dBm

T – Temperature – °C

Figure 5

VCO TUNING VOLTAGE
vs
TEMPERATURE

V_{CC} = 3.75 V
PD1 = L
PD2 = H

939 MHz

926.5 MHz

914 MHz

VCO Tuning Voltage – V

T – Temperature – °C

Figure 6

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TYPICAL CHARACTERISTICS

LNA MAXIMUM AVAILABLE GAIN
vs
FREQUENCY

Figure 7

Table 3. LNA Maximum Available Gain
(PD1 = L, PD2 = H)

FREQUENCY MHz	GMAX dB
200.000	27.86
250.000	26.25
300.000	25.56
350.000	24.92
400.000	23.17
450.000	21.57
500.000	20.39
550.000	19.29
600.000	18.36
650.000	17.55
700.000	16.84
750.000	16.22
800.000	15.71
850.000	15.28
900.000	14.88
950.000	14.54
1000.000	14.28
1050.000	13.97
1100.000	13.68

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TYPICAL CHARACTERISTICS

LNA MAXIMUM AVAILABLE GAIN
vs
FREQUENCY
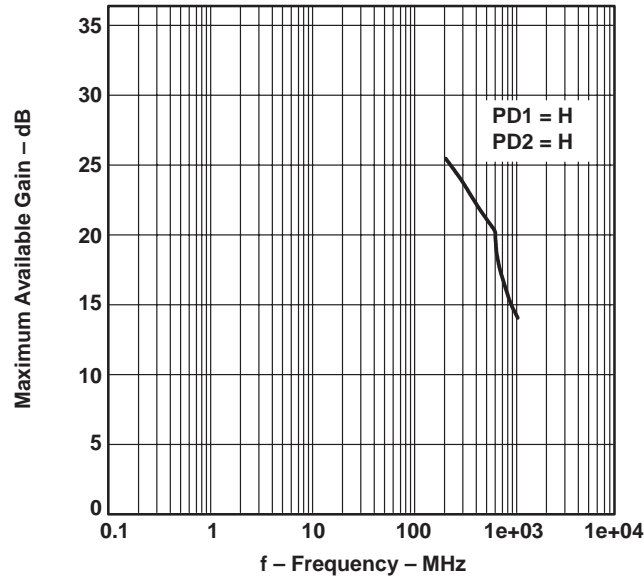
Figure 8

**Table 4. LNA Maximum Available Gain
(PD1 = H, PD2 = H)**

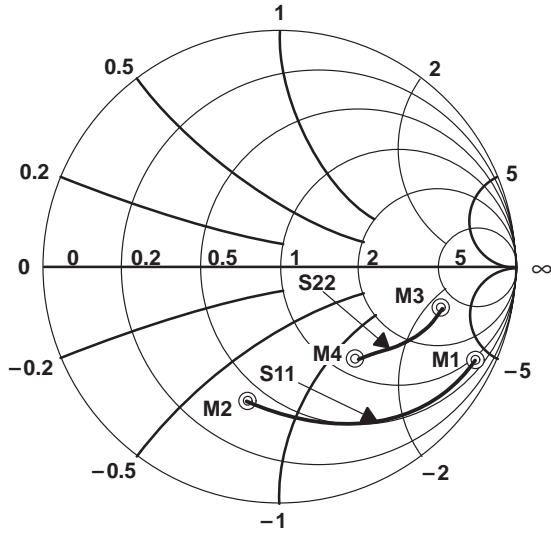| FREQUENCY MHz	GMAX dB
200.000	24.98
250.000	23.97
300.000	23.04
350.000	22.38
400.000	21.64
450.000	21.25
500.000	20.79
550.000	20.30
600.000	19.99
650.000	18.72
700.000	17.52
750.000	16.73
800.000	15.99
850.000	15.33
900.000	14.89
950.000	14.47
1000.000	14.20
1050.000	13.72
1100.000	13.49

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TYPICAL CHARACTERISTICS
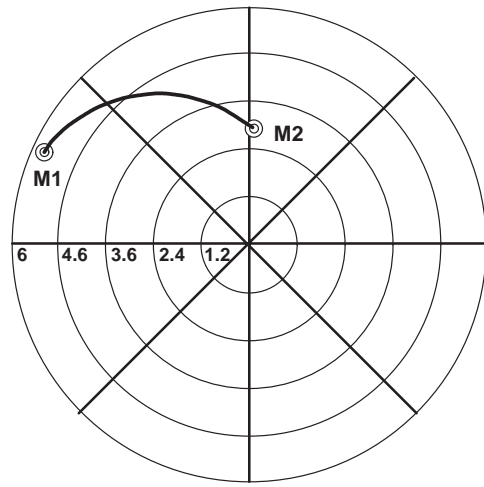
LNA S–Parameters (S11, S22); PD1 = H, PD2 = H

Frequency 200 to 1100 MHz

M1 Frequency = 200 MHz
M2 Frequency = 1100 MHz
M3 Frequency = 200 MHz
M4 Frequency = 1100 MHz

Figure 9

LNA S–Parameter (S21); PD1 = H, PD2 = H
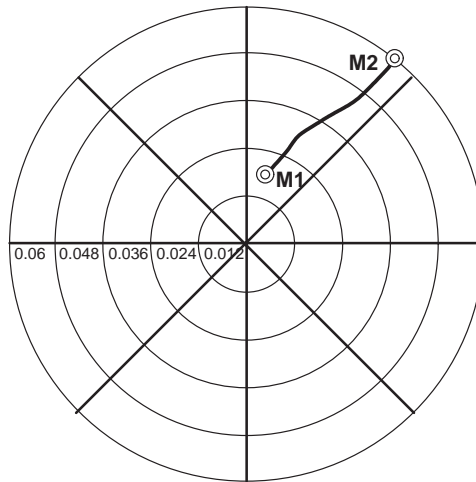

Frequency 200 to 1100 MHz

M1 Frequency = 200 MHz
M2 Frequency = 1100 MHz

Figure 10

LNA S–Parameter (S12); PD1 = H, PD2 = H

Frequency 200 to 1100 MHz

M1 Frequency = 200 MHz
M2 Frequency = 1100 MHz

Figure 11

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TYPICAL CHARACTERISTICS

Table 5. LNA S-Parameters (PD1 = H, PD2 = H)

FREQUENCY MHz	S11 Mag	S11 Ang/Deg	S21 Mag	S21 Ang/Deg	S12 Mag	S12 Ang/Deg	S22 Mag	S22 Ang/Deg
200.000	0.9161	−25.3740	5.7502	155.0000	0.0183	75.7670	0.7078	−13.7230
250.000	0.8978	−31.1611	5.5760	149.3856	0.0024	70.3898	0.6956	−16.5954
300.000	0.8746	−36.9489	5.3813	144.1056	0.0267	68.0219	0.6818	−19.2064
350.000	0.8505	−42.4277	5.1920	138.8600	0.0300	65.1007	0.6673	−21.9170
400.000	0.8268	−47.6840	5.0138	134.1978	0.0344	62.9150	0.6534	−24.6232
450.000	0.7971	−52.5767	4.8099	129.3022	0.0360	60.6094	0.6366	−27.0642
500.000	0.7710	−57.3827	4.6077	125.0000	0.0384	57.6460	0.6228	−29.5297
550.000	0.7445	−61.7972	4.4172	120.7844	0.0413	56.4048	0.6072	−31.7974
600.000	0.7237	−65.9348	4.2476	117.0256	0.0425	55.9867	0.5934	−33.5836
650.000	0.6990	−70.0200	4.0650	113.2600	0.0435	54.2110	0.5782	−35.9930
700.000	0.6796	−73.8781	3.8898	109.8389	0.0464	52.3697	0.5665	−37.4491
750.000	0.6654	−77.2861	3.7258	106.6278	0.0480	53.5603	0.5548	−39.1324
800.000	0.6505	−80.9020	3.5840	103.7567	0.0490	52.3890	0.5461	−40.7757
850.000	0.6363	−84.4913	3.4536	100.8822	0.0503	51.1741	0.5369	−42.1322
900.000	0.6232	−88.1152	3.3373	98.0539	0.0528	52.6742	0.5284	−43.6353
950.000	0.6115	−91.9600	3.2330	95.5650	0.0539	52.7493	0.5247	−45.0560
1000.000	0.6036	−95.2078	3.1581	93.2986	0.0561	52.4254	0.5793	−46.7002
1050.000	0.5896	−99.2981	3.0540	90.2556	0.0584	51.8791	0.5136	−47.7220
1100.000	0.5808	−102.8000	2.9963	87.9460	0.0601	52.6700	0.5098	−48.9450

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TYPICAL CHARACTERISTICS

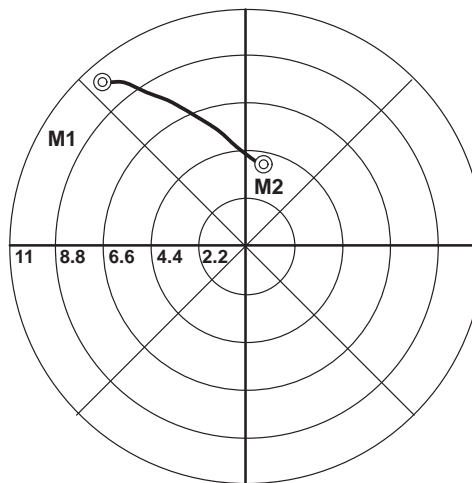**LNA S–Parameters (S11, S22); PD1 = L, PD2 = H**
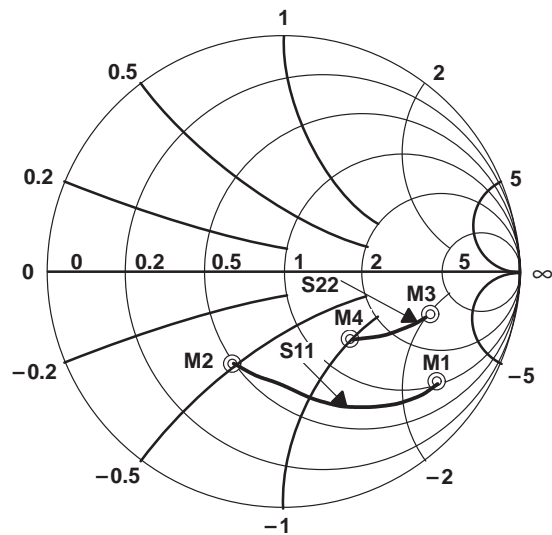
Frequency 200 to 1100 MHz

M1 Frequency = 200 MHz
M2 Frequency = 1100 MHz
M3 Frequency = 200 MHz
M4 Frequency = 1100 MHz

Figure 12

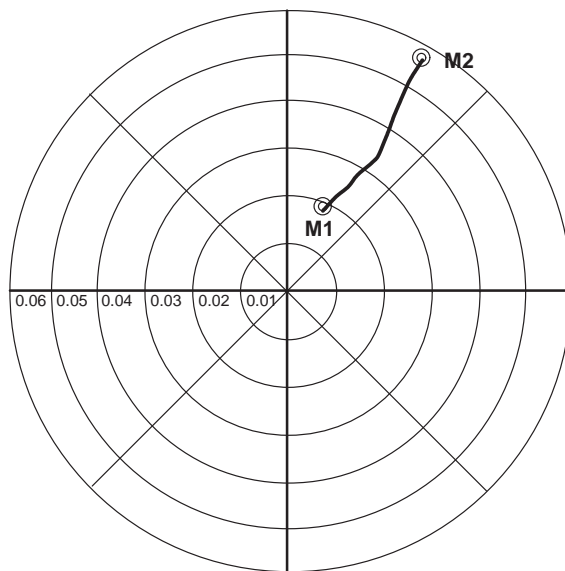**LNA S–Parameter (S21); PD1 = L, PD2 = H**

Frequency 200 to 1100 MHz

M1 Frequency = 200 MHz
M2 Frequency = 1100 MHz

Figure 13

LNA S–Parameter (S12); PD1 = L, PD2 = H

Frequency 200 to 1100 MHz
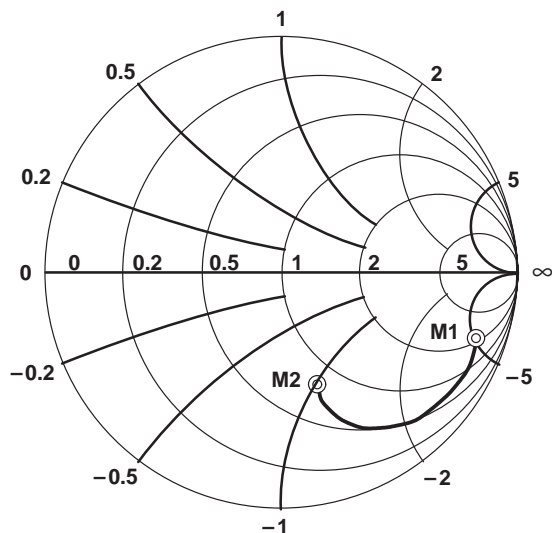
M1 Frequency = 200 MHz
M2 Frequency = 1100 MHz

Figure 14

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TYPICAL CHARACTERISTICS

Table 6. LNA S-Parameters (PD1 = L, PD2 = H)

FREQUENCY MHz	S11 Mag	S11 Ang/Deg	S21 Mag	S21 Ang/Deg	S12 Mag	S12 Ang/Deg	S22 Mag	S22 Ang/Deg
200.000	0.8184	−37.1670	10.1790	143.9800	0.0167	72.9150	0.6334	−18.5750
250.000	0.7767	−45.0520	9.5611	136.6800	0.0227	66.1208	0.6068	−21.9252
300.000	0.7297	−52.2266	8.9451	129.9789	0.0248	62.2804	0.5838	−24.5579
350.000	0.6862	−58.5890	8.3266	123.9900	0.0268	61.3593	0.5600	−27.0387
400.000	0.6468	−64.2456	7.7678	118.8544	0.0286	58.3873	0.5396	−29.2259
450.000	0.6077	−69.4464	7.2199	113.9089	0.0319	57.1011	0.5189	−31.3796
500.000	0.5784	−74.0750	6.7222	109.5833	0.0335	58.0690	0.5029	−33.4613
550.000	0.5488	−78.5661	6.2707	105.6556	0.0352	57.6446	0.4863	−34.9911
600.000	0.5255	−82.2168	5.8843	102.1911	0.0365	55.5490	0.4744	−36.0988
650.000	0.5066	−85.7060	5.5023	98.9850	0.0372	57.7150	0.4606	−37.9700
700.000	0.4908	−89.3091	5.1689	96.1968	0.0407	56.8278	0.4478	−38.9564
750.000	0.4810	−92.3593	4.8897	93.5827	0.0406	57.3591	0.4404	−40.0151
800.000	0.4733	−95.6787	4.6458	91.2930	0.0429	58.0943	0.4324	−41.3110
850.000	0.4681	−99.0036	4.4381	89.0728	0.0435	59.6353	0.4287	−42.3419
900.000	0.4637	−102.5756	4.2488	86.7164	0.0461	60.9984	0.4228	−43.5259
950.000	0.4580	−106.6767	4.0818	84.7387	0.0499	60.9513	0.4211	−44.7310
1000.000	0.4565	−110.5256	3.9597	82.7031	0.0509	60.4970	0.4198	−45.9854
1050.000	0.4505	−114.3411	3.8157	80.3111	0.0562	60.9322	0.4152	−46.8147
1100.000	0.4462	−118.1800	3.6975	78.4010	0.0571	61.4270	0.4150	−48.2590

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TRF1015
RF DOWNCONVERTER

TYPICAL CHARACTERISTICS

Mixer RF Input (MIX_IN) S–Parameter (S11)
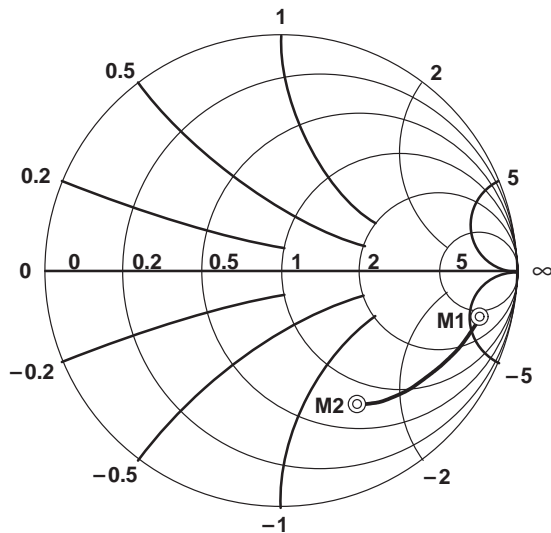

Frequency 200 to 1100 MHz

M1 Frequency = 200 MHz
M2 Frequency = 1100 MHz

Figure 15

Table 7. Mixer RF Input (MIX_IN) S-Parameter (S11)

FREQUENCY MHz	S11 Mag	S11 Ang/Deg
200.000	0.8735	−17.8209
250.000	0.8848	−22.7093
300.000	0.8802	−27.3606
350.000	0.8800	−33.2514
400.000	0.8696	−38.4946
450.000	0.8511	−44.2309
500.000	0.8288	−50.4016
550.000	0.7883	−56.4141
600.000	0.7484	−62.1003
650.000	0.6921	−66.5583
700.000	0.6333	−69.8291
750.000	0.5913	−71.9388
800.000	0.5444	−72.4816
850.000	0.5133	−72.4310
900.000	0.4948	−71.8818
950.000	0.4915	−70.6215
1000.000	0.4914	−69.6679
1050.000	0.5013	−69.7537
1100.000	0.5133	−69.6625

Mixer LO Input (OSC2) S–Parameter (S11)

Frequency 200 to 1100 MHz

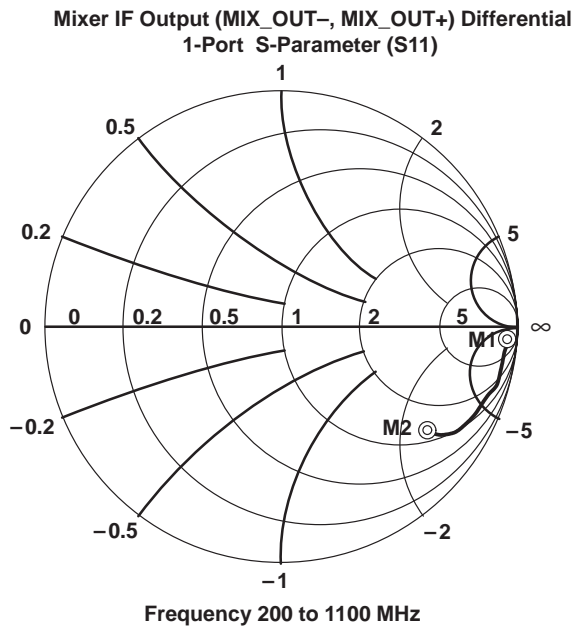**M1 Frequency = 200 MHz**
M2 Frequency = 1100 MHz

Figure 16

Table 8. Mixer LO Input (OSC2) S-Parameter (S11)

FREQUENCY MHz	S11 Mag	S11 Ang/Deg
200.000	0.8607	−13.8790
250.000	0.8494	−16.7136
300.000	0.8343	−19.4041
350.000	0.8242	−22.1589
400.000	0.8123	−24.8431
450.000	0.8015	−27.4343
500.000	0.7917	−30.0491
550.000	0.7805	−32.5775
600.000	0.7701	−35.0397
650.000	0.7591	−37.6443
700.000	0.7504	−40.1119
750.000	0.7402	−42.4656
800.000	0.7297	−45.1661
850.000	0.7191	−47.5184
900.000	0.7074	−49.9772
950.000	0.6965	−52.2767
1000.000	0.6832	−54.8612
1050.000	0.6741	−56.9238
1100.000	0.6606	−59.3890

TYPICAL CHARACTERISTICS

**Mixer IF Output (MIX_OUT–, MIX_OUT+) Differential
1-Port S-Parameter (S11)**

Frequency 200 to 1100 MHz

M1 Frequency = 200 MHz
M2 Frequency = 1100 MHz

Figure 17

**Table 9. Mixer IF Output (MIX_OUT–, MIX_OUT+)
Differential 1-Port S-Parameter (S11)**

FREQUENCY MHz	S11 Mag	S11 Ang/Deg
200.000	0.9779	−3.6814
250.000	0.9608	−8.7853
300.000	0.9610	−12.4887
350.000	0.9606	−15.1696
400.000	0.9396	−17.8656
450.000	0.9225	−19.9763
500.000	0.9195	−22.4088
550.000	0.9101	−24.5839
600.000	0.9037	−26.2246
650.000	0.8929	−28.0952
700.000	0.8808	−29.8886
750.000	0.8825	−30.3742
800.000	0.8498	−32.8607
850.000	0.8296	−33.9195
900.000	0.8034	−34.7265
950.000	0.7947	−34.7224
1000.000	0.7837	−35.2351
1050.000	0.7732	−35.4152
1100.000	0.7645	−35.6687

TYPICAL CHARACTERISTICS

OSC1 and OSC2 S–Parameters (S11)

M1 Frequency = 200 MHz
M2 Frequency = 1100 MHz
M3 Frequency = 200 MHz
M4 Frequency = 1100 MHz

Frequency 200 to 1100 MHz
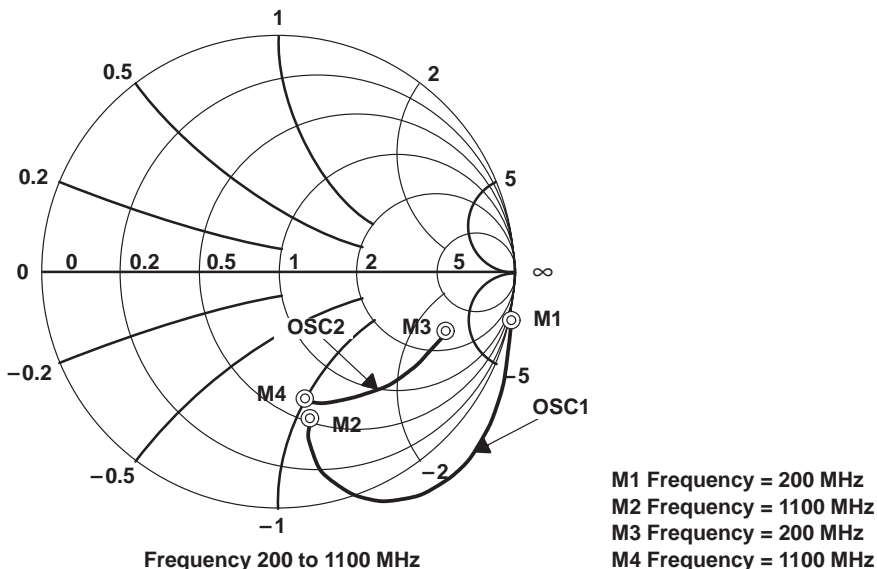
Figure 18

Table 10. OSC1 and OSC2 S-Parameters (S11)

FREQUENCY MHz	OSC1		OSC2	
	S11 Mag	S11 Ang/Deg	S11 Mag	S11 Ang/Deg
200.000	1.0001	−11.1803	0.7619	−18.2426
250.000	1.0091	−14.1781	0.7490	−22.3585
300.000	1.0186	−17.1156	0.7335	−26.1657
350.000	1.0318	−20.3634	0.7222	−30.0057
400.000	1.0466	−23.8789	0.7086	−33.7792
450.000	1.0645	−27.5708	0.6952	−37.5559
500.000	1.0880	−31.8085	0.6852	−41.2834
550.000	1.1065	−36.5770	0.6663	−45.3924
600.000	1.1245	−42.2143	0.6533	−47.4515
650.000	1.1390	−48.8065	0.6464	−51.3596
700.000	1.1247	−56.1964	0.6357	−54.8598
750.000	1.0790	−64.0879	0.6250	−58.3133
800.000	0.9931	−71.3472	0.6122	−61.6874
850.000	0.8886	−76.6167	0.6022	−65.1014
900.000	0.7913	−78.8757	0.5919	−68.1511
950.000	0.7180	−79.4862	0.5820	−71.2731
1000.000	0.6717	−78.4849	0.5735	−74.3303
1050.000	0.6468	−77.7310	0.5634	−77.2926
1100.000	0.6362	−76.7557	0.5556	−80.1574

TYPICAL CHARACTERISTICS

Buffer Amplifier (AUX_LO, AUX_LO+) Differential
1–Port S–Parameter (S11)

Frequency 200 to 1100 MHz

M1 Frequency = 200 MHz
M2 Frequency = 1100 MHz

Figure 19

**Table 11. Buffer Amplifier (AUX_LO–, AUX_LO+)
Differential 1-Port S-Parameter (S11)**

FREQUENCY MHz	S11 Mag	S11 Ang/Deg
200.000	0.9113	−4.6025
250.000	0.9116	−5.6696
300.000	0.9096	−6.9046
350.000	0.9074	−8.0997
400.000	0.9068	−9.2593
450.000	0.9042	−10.3757
500.000	0.9037	−11.6629
550.000	0.9010	−12.9567
600.000	0.8994	−14.1240
650.000	0.8969	−15.4441
700.000	0.8951	−16.6305
750.000	0.8935	−18.0071
800.000	0.8890	−19.1919
850.000	0.8868	−20.4675
900.000	0.8834	−21.7876
950.000	0.8809	−22.9685
1000.000	0.8769	−24.2356
1050.000	0.8740	−25.4904
1100.000	0.8706	−26.6875
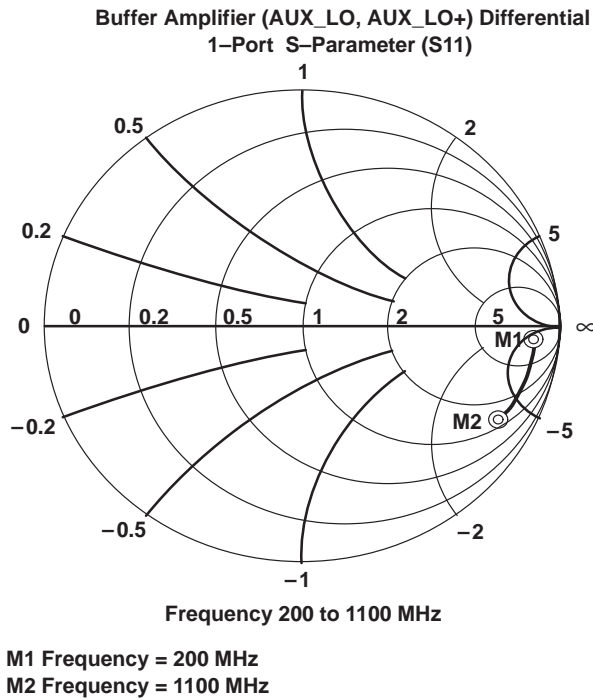
MECHANICAL DATA

DB (R-PDSO-G**)   **PLASTIC SMALL-OUTLINE PACKAGE**

28 PIN SHOWN

PINS ** DIM	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 / D 02/98
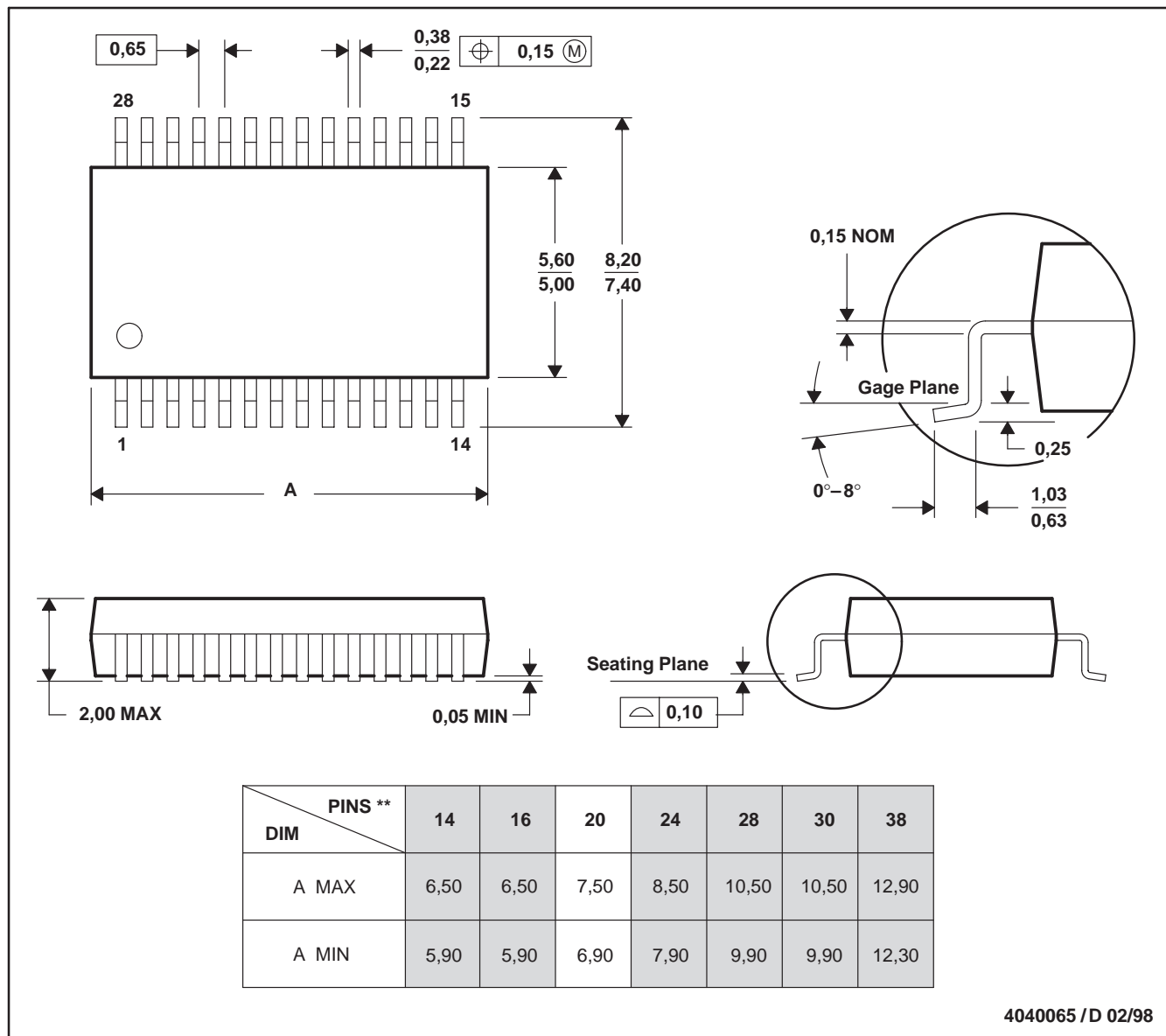
NOTES: A. All linear dimensions are in millimeters.
        B. This drawing is subject to change without notice.
        C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
        D. Falls within JEDEC MO-150

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