

## FEATURES

- Single-Chip Mixer/Oscillator and PLL Synthesizer
- Three-Band Local Oscillator
- I<sup>2</sup>C Bus Protocol (Bidirectional Data Transmission)
- 30-V Tuning Voltage Output
- Four NPN-Type Band-Switch Drivers
- Programmable Reference Divider Ratio (512, 640, or 1024 )
- 5-V Power Supply
- 30-Pin TSSOP Package

## APPLICATIONS

- TV
- VCR/DVD Recorder
- Set-Top Box

## DESCRIPTION

The SN761681 is a synthesized tuner IC designed for TV tuning systems. The circuit consists of a PLL synthesizer, three-band local oscillator and mixer, 30-V output tuning amplifier, four NPN band-switch drivers, and is available in a small-outline package. A 15-bit programmable counter and reference divider are controlled by I<sup>2</sup>C bus protocol. Tuning step frequency is selectable by this reference divider ratio for a crystal oscillator.

**DBT PACKAGE  
(TOP VIEW)**

VHI OSC C	1	30	UHF RF IN2
VHI OSC B	2	29	UHF RF IN1
OSC GND	3	28	VHF RF IN
VLO OSC C	4	27	RF GND
VLO OSC B	5	26	MIX OUT2
UHF OSC B1	6	25	MIX OUT1
UHF OSC C1	7	24	BS4
UHF OSC C2	8	23	BS2
UHF OSC B2	9	22	BS1
IF GND	10	21	BS3
VCC	11	20	ADC
IF OUT1	12	19	AS
IF OUT2	13	18	SDA
CP	14	17	SCL
VTU	15	16	XTAL

P0038-01

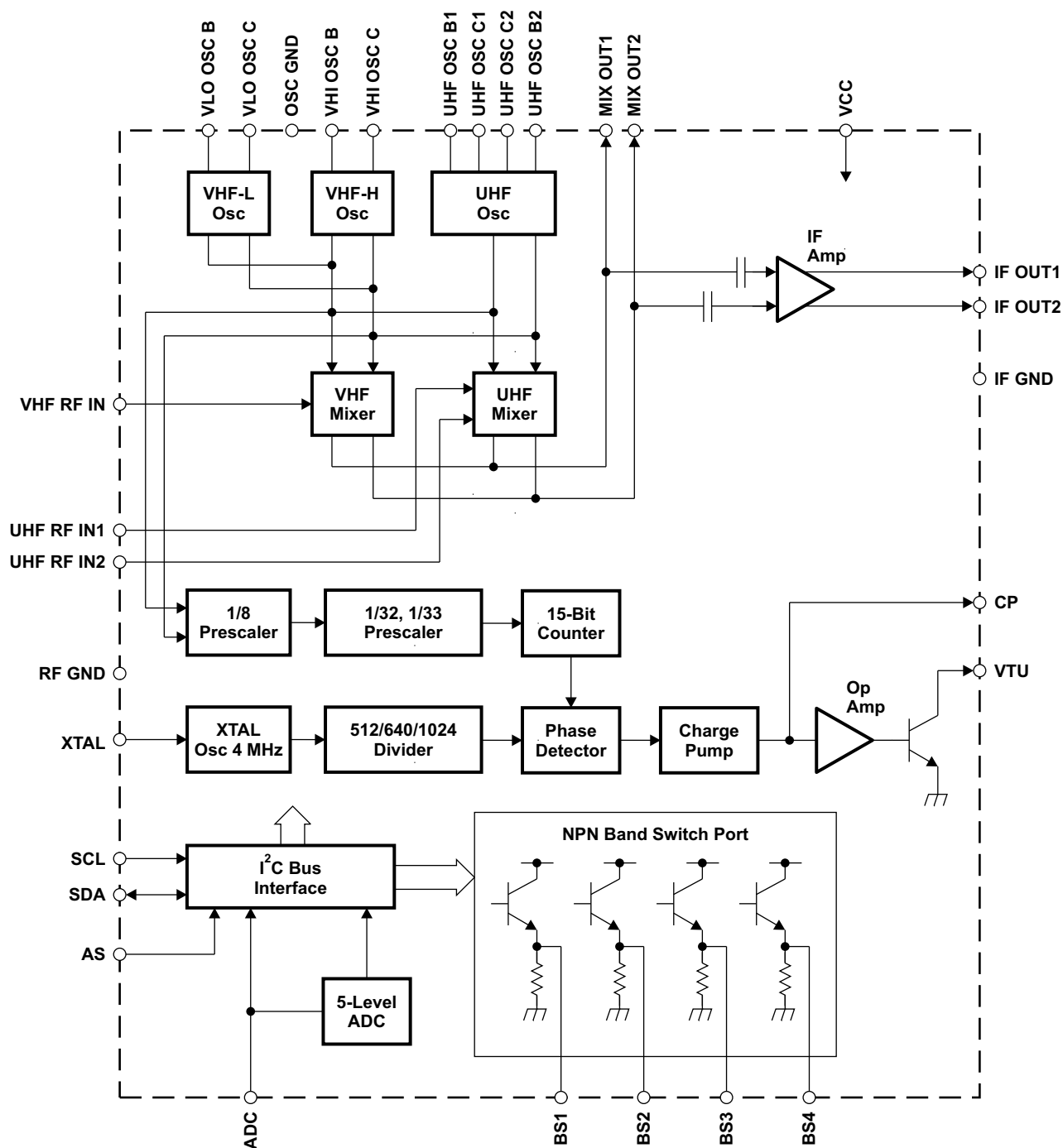


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



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

## Functional Block Diagram



B0089-02

## Pin Assignments

### Pin Description

TERMINAL		DESCRIPTION	SCHEMATIC
NAME	NO.		
ADC	20	ADC input	<a href="#">Figure 1</a>
AS	19	Address selection input	<a href="#">Figure 2</a>
BS1	22	Band switch1 output (NPN emitter follower)	<a href="#">Figure 3</a>
BS2	23	Band switch2 output (NPN emitter follower)	<a href="#">Figure 3</a>
BS3	21	Band switch3 output (NPN emitter follower)	<a href="#">Figure 3</a>
BS4	24	Band switch4 output (NPN emitter follower)	<a href="#">Figure 3</a>
CP	14	Charge pump output	<a href="#">Figure 4</a>
IF GND	10	IF ground	
IF OUT1	12	IF output	<a href="#">Figure 5</a>
IF OUT2	13	IF output	<a href="#">Figure 5</a>
MIX OUT1	25	Mixer output	<a href="#">Figure 6</a>
MIX OUT2	26	Mixer output	<a href="#">Figure 6</a>
OSC GND	3	Oscillator ground	
RF GND	27	RF ground	
SCL	17	Serial clock input	<a href="#">Figure 7</a>
SDA	18	Serial data input/output	<a href="#">Figure 8</a>
UHF OSC B1	6	UHF oscillator base1	<a href="#">Figure 9</a>
UHF OSC B2	9	UHF oscillator base2	<a href="#">Figure 9</a>
UHF OSC C1	7	UHF oscillator collector1	<a href="#">Figure 9</a>
UHF OSC C2	8	UHF oscillator collector2	<a href="#">Figure 9</a>
UHF RF IN1	29	UHF RF input	<a href="#">Figure 10</a>
UHF RF IN2	30	UHF RF input	<a href="#">Figure 10</a>
VCC	11	Supply voltage for mixer/oscillator/PLL: 5-V	
VHF RF IN	28	VHF RF input	<a href="#">Figure 11</a>
VHI OSC B	2	VHF HIGH oscillator base	<a href="#">Figure 12</a>
VHI OSC C	1	VHF HIGH oscillator collector	<a href="#">Figure 12</a>
VLO OSC B	5	VHF LOW oscillator base	<a href="#">Figure 13</a>
VLO OSC C	4	VHF LOW oscillator collector	<a href="#">Figure 13</a>
VTU	15	Tuning voltage amplifier output	<a href="#">Figure 14</a>
XTAL	16	4-MHz crystal oscillator input	<a href="#">Figure 15</a>

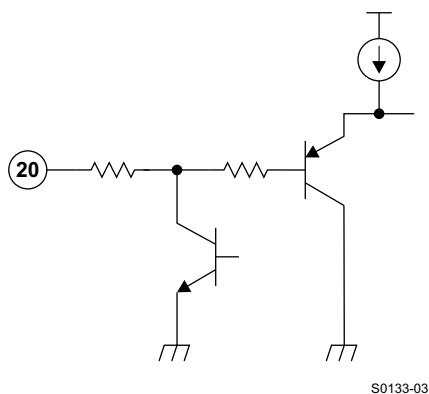


Figure 1.

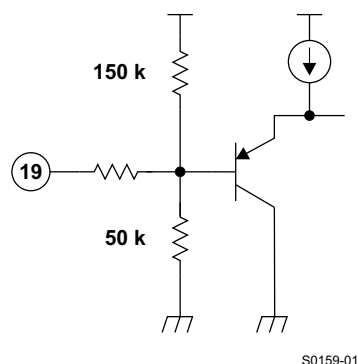


Figure 2.

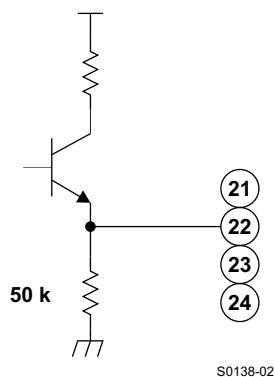


Figure 3.

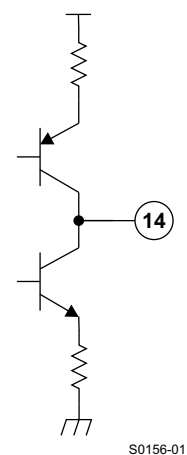


Figure 4.

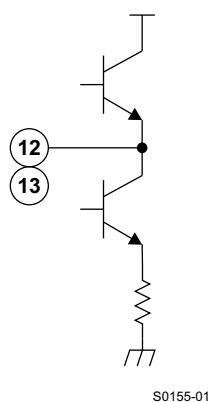


Figure 5.

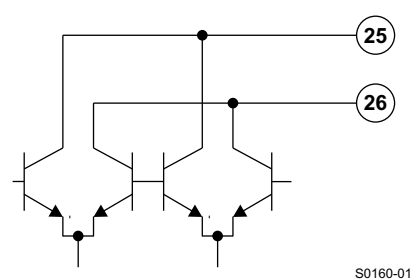


Figure 6.

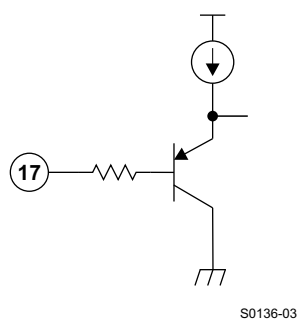


Figure 7.

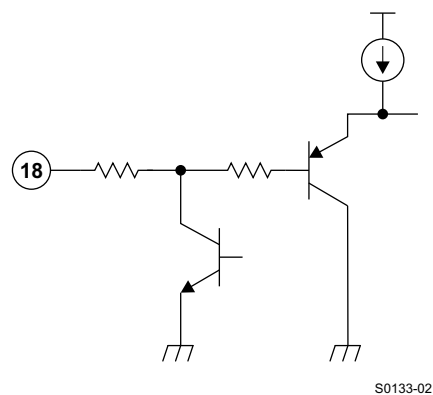
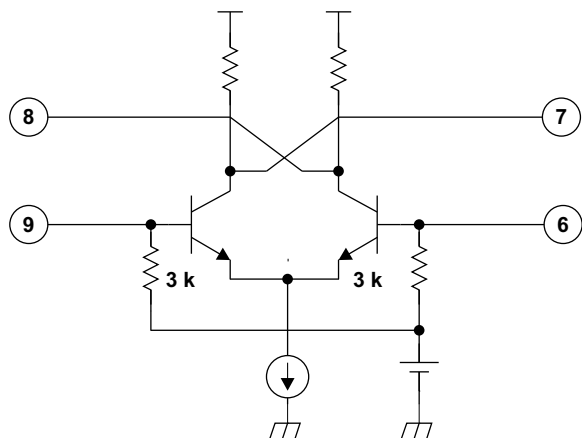
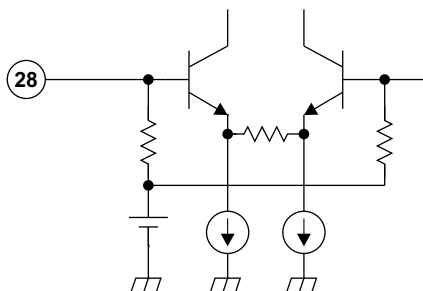


Figure 8.



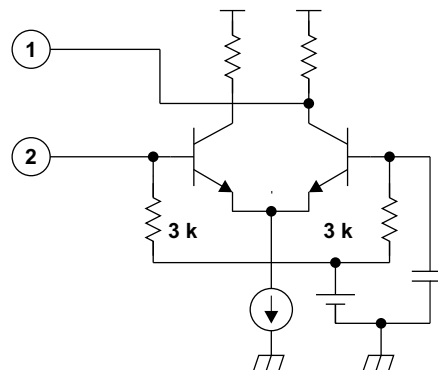
S0130-01

Figure 9.



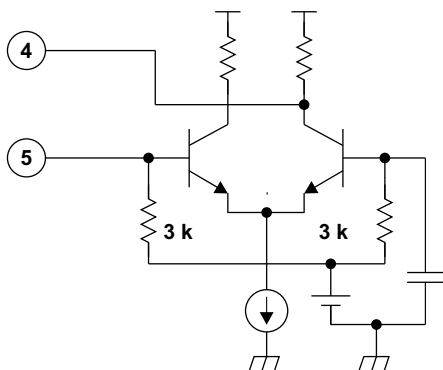
S0142-04

Figure 10.



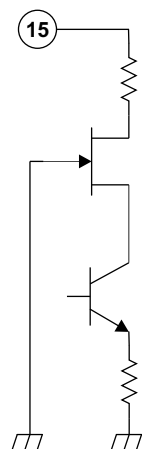
S0129-01

Figure 11.



S0129-02

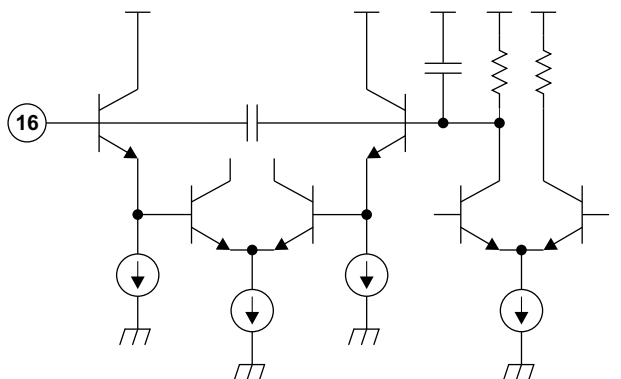
Figure 12.



S0157-01

Figure 13.

Figure 14.



S0158-01

Figure 15.

## ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) <sup>(1)</sup>

Supply voltage, $V_{CC}$ <sup>(2)</sup>	$V_{CC}$ (Pin 11)	–0.4 V to 6.5 V
Input voltage 1, $V_{GND}$ <sup>(2)</sup>	RF GND, OSC GND (Pins 3, 27)	–0.4 V to 0.4 V
Input voltage 2, $V_{VTU}$ <sup>(2)</sup>	VTU	–0.4 V to 35 V
Input voltage 3, $V_{IN}$ <sup>(2)</sup>	Other pins (Pins 1, 2, 4–9, 12–14, 16–26, 28–30)	–0.4 V to 6.5 V
Continuous total dissipation, $P_D$ <sup>(3)</sup>	$T_A \leq 25^\circ\text{C}$	1071 mW
Operating free-air temperature, $T_A$		–20°C to 85°C
Storage temperature range, $T_{stg}$		–65°C to 150°C
Maximum junction temperature, $T_J$		150°C
Maximum short-circuit time, $t_{SC(max)}$	Each pin to $V_{CC}$ or to GND	10 s

- (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.
- (2) Voltage values are with respect to the IF GND of the circuit.
- (3) Derating factor is 8.57 mW/°C for  $T_A \geq 25^\circ\text{C}$ .

## RECOMMENDED OPERATING CONDITIONS

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

		MIN	NOM	MAX	UNIT
Supply voltage, $V_{CC}$		4.5	5	5.5	V
Tuning supply voltage, $V_{TU}$			30	33	V
Output current of band switch, $I_{BS}$	One port on			10	mA
Operating free-air temperature, $T_A$		–20		85	°C

## ELECTRICAL CHARACTERISTICS, Total Device and Serial Interface

$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ,  $T_A = -20^\circ\text{C to }85^\circ\text{C}$ , unless otherwise noted

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{CC1}$	Supply current 1			60		mA
$I_{CC2}$	Supply current 2	One band switch on ( $I_{BS} = 10\text{ mA}$ )		70		mA
$V_{IH}$	High-level input voltage (SCL, SDA)		2.8		$V_{CC}$	V
$V_{IL}$	Low-level input voltage (SCL, SDA)				1.4	V
$I_{IH}$	High-level input current (SCL, SDA)				10	$\mu\text{A}$
$I_{IL}$	Low-level input current (SCL, SDA)		-10			$\mu\text{A}$
$V_{POR}$	Power-on-reset supply voltage (threshold of supply voltage between reset and operation mode)		2.1	2.8	3.5	V
<b>I<sup>2</sup>C INTERFACE</b>						
$V_{ASH}$	Address-select high-input voltage (AS)	$V_{CC} = 5\text{ V}$	4.5		5	V
$V_{ASM1}$	Address-select mid1-input voltage (AS)	$V_{CC} = 5\text{ V}$	2		3	V
$V_{ASM2}$	Address-select mid2-input voltage (AS)	$V_{CC} = 5\text{ V}$	1		1.5	V
$V_{ASL}$	Address-select low-input voltage (AS)	$V_{CC} = 5\text{ V}$			0.5	V
$I_{ASH}$	Address-select high-input current (AS)				140	$\mu\text{A}$
$I_{ASL}$	Address-select low-input current (AS)		-50			$\mu\text{A}$
$V_{ADC}$	ADC input voltage	See <a href="#">Table 8</a>	0		$V_{CC}$	V
$I_{ADH}$	ADC high-level input current	$V_{ADC} = V_{CC}$			10	$\mu\text{A}$
$I_{ADL}$	ADC low-level input current	$V_{ADC} = 0\text{ V}$	-50			$\mu\text{A}$
$V_{OL}$	Low-level output voltage (SDA)	$V_{CC} = 5\text{ V}$ , $I_{OL} = 3\text{ mA}$			0.4	V
$I_{SDAH}$	High-level output leakage current (SDA)	$V_{SDA} = 5.5\text{ V}$			10	$\mu\text{A}$
$f_{SCL}$	Clock frequency (SCL)			100	400	kHz
<b>I<sup>2</sup>C Timing (see timing chart, <a href="#">Figure 16</a>)</b>						
$t_{hd(DAT)}$	Data hold time		0			$\mu\text{s}$
$t_{(BUF)}$	Bus free time		1.3			$\mu\text{s}$
$t_{hd(STA)}$	Start hold time		0.6			$\mu\text{s}$
$t_{(Low)}$	SCL-low hold time		1.3			$\mu\text{s}$
$t_{(High)}$	SCL-high hold time		0.6			$\mu\text{s}$
$t_{su(STA)}$	Start setup time		0.6			$\mu\text{s}$
$t_{su(DAT)}$	Data setup time		0.1			$\mu\text{s}$
$t_r$	SCL, SDA rise time				0.3	$\mu\text{s}$
$t_f$	SCL, SDA fall time				0.3	$\mu\text{s}$
$t_{su(STO)}$	Stop setup time		0.6			$\mu\text{s}$

## ELECTRICAL CHARACTERISTICS, PLL and Band Switch

$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ ,  $T_A = -20^\circ\text{C to }85^\circ\text{C}$ , unless otherwise noted

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
N	Divider ratio	15-bit frequency word	256		32767	
$f_{XTAL}$	Crystal oscillator frequency	$R_{XTAL} = 25\ \Omega \text{ to } 300\ \Omega$	3.2	4	4.48	MHz
$Z_{XTAL}$	Crystal oscillator input impedance			1.6		k $\Omega$
$V_{IXTAL2}$	Minimum reference input sensitivity (XTAL)	4 MHz, ac coupling with 0.1 $\mu\text{F}$ capacitor			100	mVp-p
$V_{VTUL}$	Tuning amplifier low-level output voltage	$R_L = 22\text{ k}\Omega$ , $V_{TU} = 33\text{ V}$	0.3	0.4	0.5	V
$I_{VTUOFF}$	Tuning amplifier leakage current (off)	OS = 1, $V_{TU} = 33\text{ V}$			10	$\mu\text{A}$
$I_{CPH}$	Charge-pump high-level input current	CP = 1		280		$\mu\text{A}$
$I_{CPL}$	Charge-pump low-level input current	CP = 0		60		$\mu\text{A}$
$V_{CP}$	Charge-pump output voltage	PLL locked		1.95		V
$I_{CPOFF}$	Charge-pump leakage current	T2 = 0, T1 = 1, $V_{CP} = 2\text{ V}$ , $T_A = 25^\circ\text{C}$	-15		15	nA
$I_{BS}$	Band-switch driver output current				10	mA
$V_{BS1}$	Band-switch driver output voltage	$I_{BS} = 10\text{ mA}$	3			V
$V_{BS2}$		$I_{BS} = 10\text{ mA}$ , $V_{CC} = 5\text{ V}$ , $T_A = 25^\circ\text{C}$	3.5	3.9		
$I_{BSOFF}$	Band-switch driver leakage current	$V_{BS} = 0\text{ V}$			3	$\mu\text{A}$



## ELECTRICAL CHARACTERISTICS, Mixer, Oscillator, IF Amplifier

$V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , measured in [Figure 17](#) reference measurement circuit at 50- $\Omega$  system,  
IF filter characteristics:  $f_{\text{peak}} = 43\text{ MHz}$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
G <sub>c1</sub>	Conversion gain (mixer-IF amplifier), VHF-LOW	f <sub>in</sub> = 58 MHz <sup>(1)</sup>	22	25	28	dB
G <sub>c3</sub>		f <sub>in</sub> = 130 MHz <sup>(1)</sup>	22	25	28	
G <sub>c4</sub>	Conversion gain (mixer-IF amplifier), VHF-HIGH	f <sub>in</sub> = 136 MHz <sup>(1)</sup>	22	25	28	dB
G <sub>c6</sub>		f <sub>in</sub> = 364 MHz <sup>(1)</sup>	22	25	28	
G <sub>c7</sub>	Conversion gain (mixer-IF amplifier), VHF-UHF	f <sub>in</sub> = 370 MHz <sup>(1)</sup>	26	29	32	dB
G <sub>c9</sub>		f <sub>in</sub> = 804 MHz <sup>(1)</sup>	25	28	31	
NF <sub>1</sub>	Noise figure, VHF-LOW	f <sub>in</sub> = 55.25 MHz		9.5		dB
NF <sub>3</sub>		f <sub>in</sub> = 127.25 MHz		9.5		
NF <sub>4</sub>	Noise figure, VHF-HIGH	f <sub>in</sub> = 133.25 MHz		10		dB
NF <sub>6</sub>		f <sub>in</sub> = 361.25 MHz		10		
NF <sub>7</sub>	Noise figure, UHF	f <sub>in</sub> = 367.25 MHz		11		dB
NF <sub>9</sub>		f <sub>in</sub> = 801.25 MHz		11		
CM <sub>1</sub>	1% cross-modulation distortion, VHF-LOW	f <sub>in</sub> = 55.25 MHz <sup>(2)</sup>		89		dBμV
CM <sub>3</sub>		f <sub>in</sub> = 127.25 MHz <sup>(2)</sup>		89		
CM <sub>4</sub>	1% cross-modulation distortion, VHF-HIGH	f <sub>in</sub> = 133.25 MHz <sup>(2)</sup>		86		dBμV
CM <sub>6</sub>		f <sub>in</sub> = 361.25 MHz <sup>(2)</sup>		86		
CM <sub>7</sub>	1% cross-modulation distortion, UHF	f <sub>in</sub> = 367.25MHz <sup>(2)</sup>		87		dBμV
CM <sub>9</sub>		f <sub>in</sub> = 801.25 MHz <sup>(2)</sup>		87		
V <sub>IFO1</sub>	IF output voltage, VHF-LOW	f <sub>in</sub> = 55.25 MHz <sup>(3)</sup>		117		dBμV
V <sub>IFO3</sub>		f <sub>in</sub> = 127.25 MHz <sup>(3)</sup>		117		
V <sub>IFO4</sub>	IF output voltage, VHF-HIGH	f <sub>in</sub> = 133.25 MHz <sup>(3)</sup>		117		dBμV
V <sub>IFO6</sub>		f <sub>in</sub> = 361.25 MHz <sup>(3)</sup>		117		
V <sub>IFO7</sub>	IF output voltage, UHF	f <sub>in</sub> = 367.25MHz <sup>(3)</sup>		117		dBμV
V <sub>IFO9</sub>		f <sub>in</sub> = 801.25 MHz <sup>(3)</sup>		117		
Φ <sub>OSC1</sub>	Phase noise, VHF-LOW	f <sub>in</sub> = 55.25 MHz <sup>(4)</sup>		88		dBc/Hz
Φ <sub>OSC3</sub>		f <sub>in</sub> = 127.25 MHz <sup>(4)</sup>		88		
Φ <sub>OSC4</sub>	Phase noise, VHF-HIGH	f <sub>in</sub> = 133.25 MHz <sup>(4)</sup>		86		dBc/Hz
Φ <sub>OSC6</sub>		f <sub>in</sub> = 361.25 MHz <sup>(4)</sup>		86		
Φ <sub>OSC7</sub>	Phase noise, UHF	f <sub>in</sub> = 367.25MHz <sup>(4)</sup>		84		dBc/Hz
Φ <sub>OSC9</sub>		f <sub>in</sub> = 801.25 MHz <sup>(4)</sup>		84		
Prescaler beat <sup>(5)</sup>					25	dBμV

- (1) IF = 43 MHz, RF input level = 80 dB $\mu$ V
- (2)  $f_{\text{undes}} = f_{\text{des}} \pm 6\text{ MHz}$ ,  $P_{\text{in}} = 80\text{ dB}\mu\text{V}$ , AM 1 kHz, 30%, DES/CM = S/I = 46 dB
- (3) IF = 45.75 MHz
- (4) Offset = 10 kHz, RF input level = 70 dB $\mu$ V
- (5) Design parameter, not tested

## Functional Description

### I<sup>2</sup>C Bus Mode

#### I<sup>2</sup>C Write Mode ( $R/\overline{W} = 0$ )

**Table 1. Write Data Format**

	MSB							LSB	(1)
Address byte (ADB)	1	1	0	0	0	MA1	MA0	$R/\overline{W} = 0$	A
Divider byte 1 (DB1)	0	N14	N13	N12	N11	N10	N9	N8	A
Divider byte 2 (DB2)	N7	N6	N5	N4	N3	N2	N1	N0	A
Control byte (CB)	1	CP	T2	T1	T0	RSA	RSB	OS	A
Band-switch byte (BB)	X	X	X	X	BS4	BS3	BS2	BS1	A

(1) A: Acknowledge

**Table 2. Description of Data Symbols**

SYMBOL	DESCRIPTION	DEFAULT
MA[1:0]	Address-set bits (see <a href="#">Table 3, Address Selection</a> )	
N[14:0]	Programmable counter set bits $N = N14 \times 2^{14} + N13 \times 2^{13} + \dots + N1 \times 2 + N0$ Oscillation frequency = $f_r \times 8 \times N$ $f_r$ = Reference frequency = 4 MHz/Reference divider	$N14 = N13 = N12 = \dots = N0 = 0$
CP	Charge-pump current-set bit 60 $\mu$ A (CP = 0), 280 $\mu$ A (CP = 1)	CP = 1
T[2:0]	TEST bits (see <a href="#">Table 4, Test Bits</a> ) Normal mode: T2 = 0, T1 = 0, T0 = 1/0	T[2:0] = 001
RSA, RSB	Reference divider ratio selection bits See Table 6, Reference Divider Ratio.	RSA = 0, RSB = 1
OS	Tuning amplifier control bit Tuning voltage on (OS = 0) Tuning voltage off, high impedance (OS = 1)	OS = 0
BS[4:1]	Band-switch control bits $BSn = 0: Tr = OFF \quad BSn = 1: Tr = ON$ Band selection by BS1, BS2, BS4 <b>BS1(VL)   BS2(VH)   BS4(U)</b> 1        0        0    VHF-LO X        1        0    VHF-HI X        X        1    UHF	$BSn = 0$
X	Don't care	

**Table 3. Address Selection**

MA1	MA0	Voltage Applied on AS Input
0	0	LOW: 0 V to 0.1 V <sub>CC</sub>
0	1	MID2: open, or 0.2 V <sub>CC</sub> to 0.3 V <sub>CC</sub>
1	0	MID1: 0.4 V <sub>CC</sub> to 0.6 V <sub>CC</sub>
1	1	HIGH: 0.9 V <sub>CC</sub> to V <sub>CC</sub>

**Table 4. Test Bits <sup>(1)</sup>**

T2	T1	T0	Device Operation	Note
0	0	0	Normal operation	
0	0	1	Normal operation	Default
0	1	X	Charge pump is off.	
1	1	0	Charge pump is sink.	
1	1	1	Charge pump is source.	
1	0	X	Test mode	ADC not available

(1) Not used for other bit patterns

**Table 5. Reference Divider Ratio**

RSA	RSB	Reference Divider Ratio
X	0	640
0	1	1024
1	1	512

## I<sup>2</sup>C Read Mode (R/W = 1)

**Table 6. Read Data Format**

	MSB							LSB	(1)
Address byte (ADB)	1	1	0	0	0	MA1	MA0	R/W = 1	A
Status byte (SB)	POR	FL	1	1	1	A2	A1	A0	–

(1) A: Acknowledge

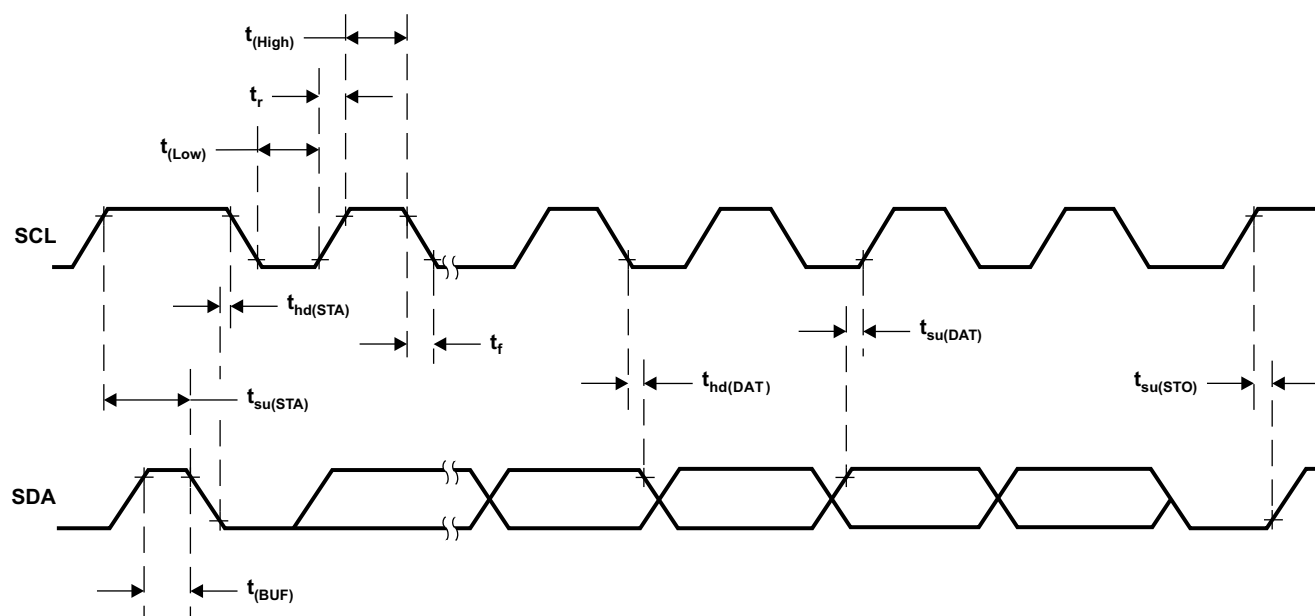
**Table 7. Description of Data Symbols**

SYMBOL	DESCRIPTION	DEFAULT
MA[1:0]	Address-set bits (see <a href="#">Table 3</a> , <i>Address Selection</i> )	
POR	Power-on-reset flag POR set: Power on POR reset: End-of-data transmission procedure	POR = 1
FL	In-lock flag PLL locked (FL = 1), PLL unlocked (FL = 0)	
A[2:0]	Digital data of ADC (see <a href="#">Table 8</a> , <i>ADC Level</i> )	

**Table 8. ADC Level**

A2	A1	A0	Voltage Applied on ADC Input <sup>(1)</sup>
1	0	0	0.6 V <sub>CC</sub> to V <sub>CC</sub>
0	1	1	0.45 V <sub>CC</sub> to 0.6 V <sub>CC</sub>
0	1	0	0.3 V <sub>CC</sub> to 0.45 V <sub>CC</sub>
0	0	1	0.15 V <sub>CC</sub> to 0.3 V <sub>CC</sub>
0	0	0	0 V to 0.15 V <sub>CC</sub>

(1) Accuracy is  $0.03 \times V_{CC}$ .

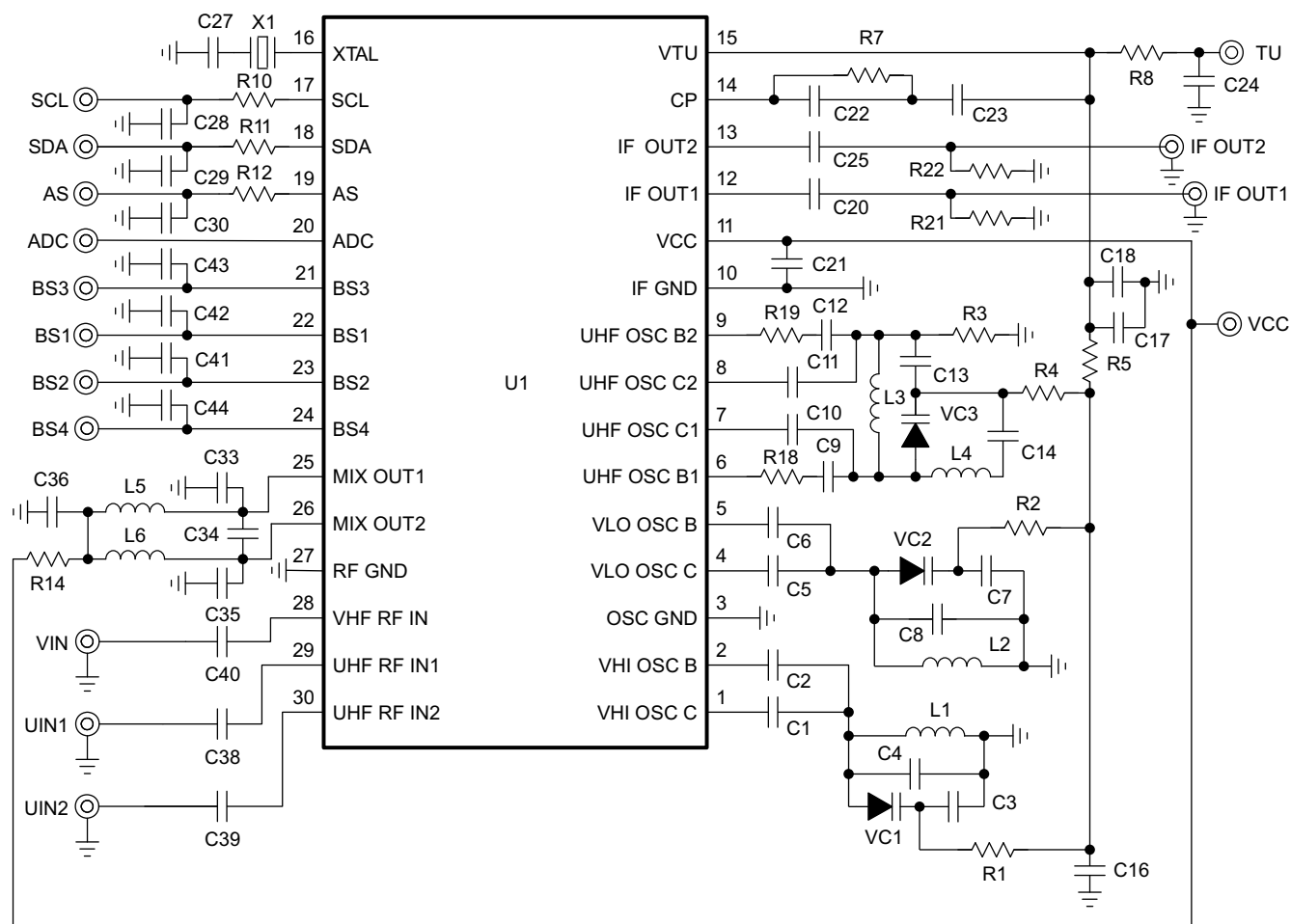


T0101-01

**Figure 16. I²C Timing Chart**

## APPLICATION INFORMATION

### Reference Measurement Circuit



S0161-01

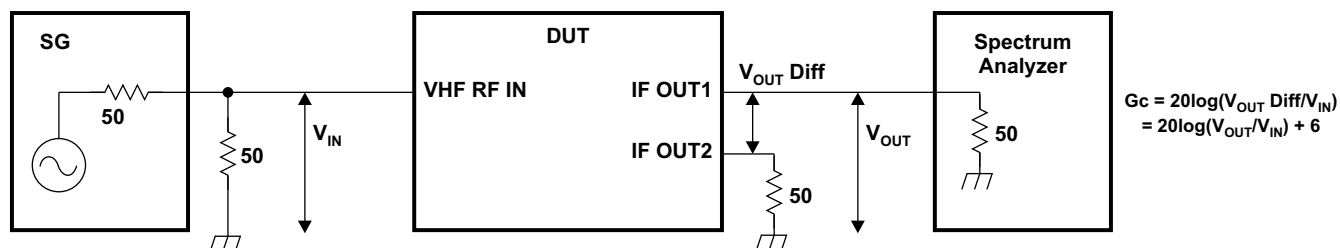
NOTE: This application information is advisory and a performance check is required for actual application circuits. TI assumes no responsibility for the consequences of the use of this circuit nor for any infringement of patent or patent rights of third parties which may result from its use.

**Figure 17. Reference Measurement Circuit**

**APPLICATION INFORMATION (continued)**
**Component Values for Measurement Circuit**

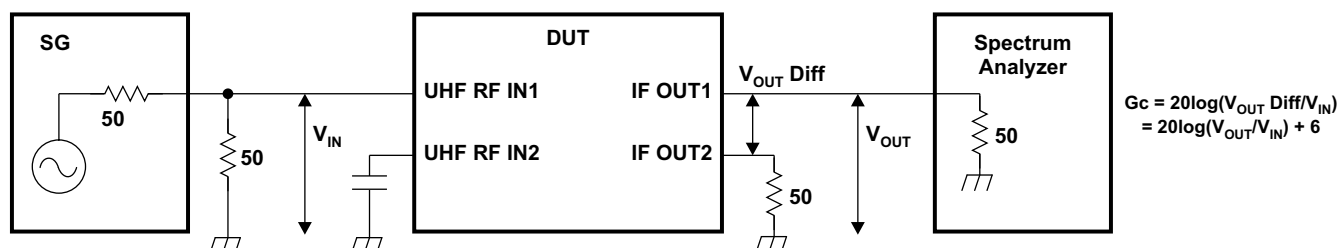
PART NAME	VALUE	PART NAME	VALUE
C1 (VHI OSC C)	3 pF	C39 (UIN2)	2.2 nF
C2 (VHI OSC B)	2 pF	C40 (VIN)	2.2 nF
C3 (VHI OSC)	68 pF	C41 (BS2)	2.2 nF
C4 (VHI OSC)	Open	C42 (BS1)	2.2 nF
C5 (VLO OSC C)	1 pF	C43 (BS3)	2.2 nF
C6 (VLO OSC B)	1 pF	C44 (BS4)	2.2 nF
C7 (VLO OSC)	47 pF	L1 (VHI OSC)	φ2,4 mm, 4T, wire 0,4 mm
C8 (VLO OSC)	3 pF	L2 (VLO OSC)	φ3 mm, 8T, wire 0,32 mm
C9 (UHF OSC B1)	1.5 pF	L3 (UHF OSC)	φ3 mm, 2T, wire 0,4 mm
C10 (UHF OSC C1)	1.5 pF	L4 (UHF OSC)	φ2 mm, 3T, wire 0,4 mm
C11 (UHF OSC C2)	1.5 pF	L5 (MIXOUT)	φ2,4 mm, 16T, wire 0,26 mm
C12 (UHF OSC B2)	1.5 pF	L6 (MIXOUT)	φ2,4 mm, 16T, wire 0,26 mm
C13 (UHF OSC)	12 pF	R1(VHI OSC)	33 kΩ
C14 (UHF OSC)	100 pF	R2 (VLO OSC)	33 kΩ
C16 (VTU)	2.2 nF/50 V	R3 (UHF OSC)	22 kΩ
C17 (VTU)	2.2 nF/50 V	R4 (UHF OSC)	33 kΩ
C18 (VTU)	2.2 nF/50 V	R5 (VTU)	22 kΩ
C20 (IF OUT1)	2.2 nF	R7 (CP)	22 kΩ
C21 (VCC)	4.7 nF	R8 (VTU)	22 kΩ
C22 (CP)	2.2 nF	R10 (SCL)	330 Ω
C23 (CP)	0.1 μF/50 V	R11 (SDA)	330 Ω
C24 (VTU)	2.2 nF/50 V	R12 (AS)	330 Ω
C25 (IF OUT2)	2.2 nF	R14 (MIXOUT)	0
C27 (XTAL)	68 pF	R18 (UHF OSC)	0
C28 (SCL)	Open	R19 (UHF OSC)	0
C29 (SDA)	Open	R21 (IF OUT1)	Open
C30 (AS)	Open	R22 (IF OUT2)	51 Ω
C33 (MIXOUT)	Open	U1	SN761681
C34 (MIXOUT)	22 pF	VC1 (VHI OSC)	1T363A
C35 (MIXOUT)	Open	VC2 (VLO OSC)	1T363A
C36 (MIXOUT)	4.7 nF	VC3 (UHF OSC)	1T363A
C38 (UIN1)	2.2 nF	X1	4-MHz crystal

## Test Circuits



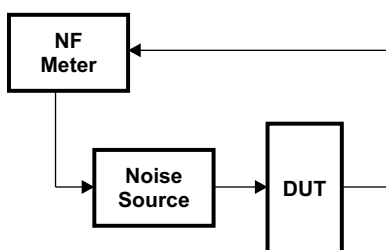
S0144-02

Figure 18. VHF-Conversion Gain-Measurement Circuit



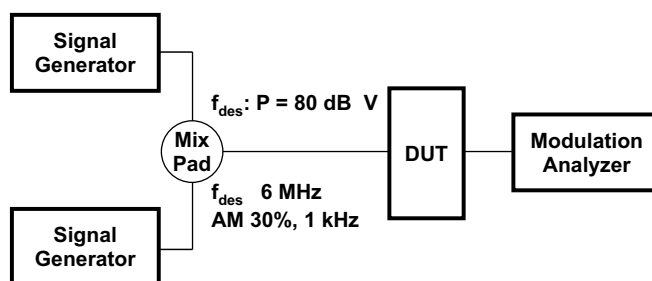
S0145-01

Figure 19. UHF-Conversion Gain-Measurement Circuit



B0090-01

Figure 20. Noise-Figure Measurement Circuit



B0091-01

Figure 21. 1% Cross-Modulation Distortion Measurement Circuit

## TYPICAL CHARACTERISTICS

### Band-Switch Driver Output Voltage (BS1–BS4)

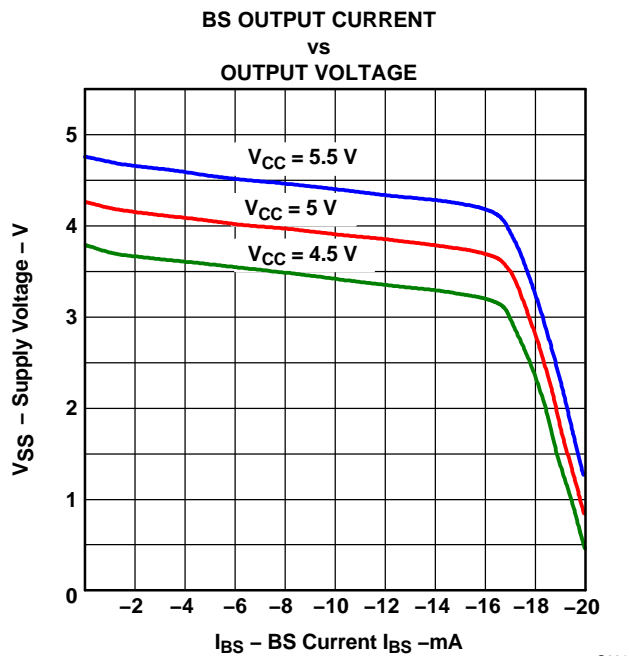


Figure 22. Band-Switch Driver Output Voltage

### S-Parameter

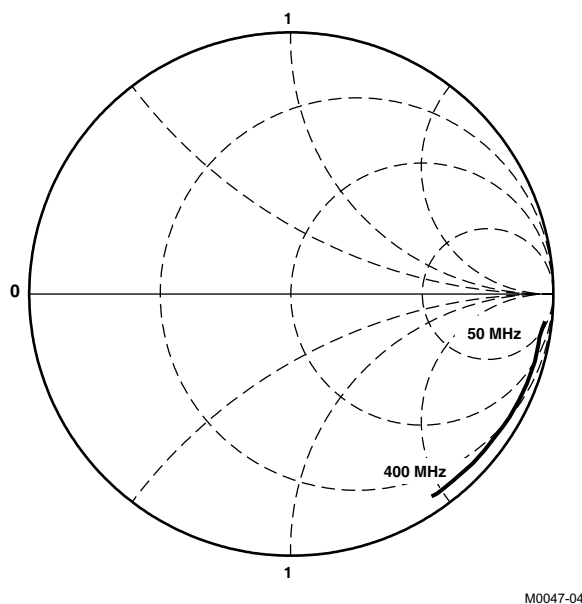
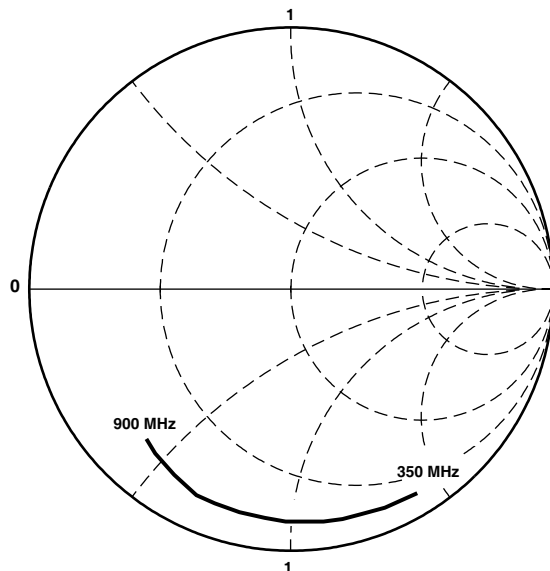


Figure 23. VHF Input

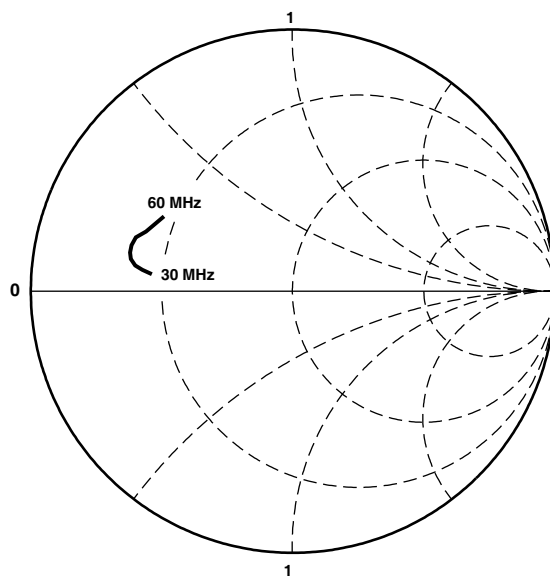


# TYPICAL CHARACTERISTICS (continued)



M0047-05

Figure 24. UHF Input



M0047-06

Figure 25. IF Output

**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>	Samples (Requires Login)
SN761681DBT	ACTIVE	TSSOP	DBT	30		TBD	Call TI	Call TI	
SN761681DBTG4	ACTIVE	TSSOP	DBT	30		TBD	Call TI	Call TI	
SN761681DBTR	ACTIVE	TSSOP	DBT	30	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	
SN761681DBTRG4	ACTIVE	TSSOP	DBT	30	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	

<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), Pb-Free (RoHS Exempt), 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.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**TAPE AND REEL INFORMATION**


\*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
SN761681DBTR	TSSOP	DBT	30	2000	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1

## TAPE AND REEL BOX DIMENSIONS

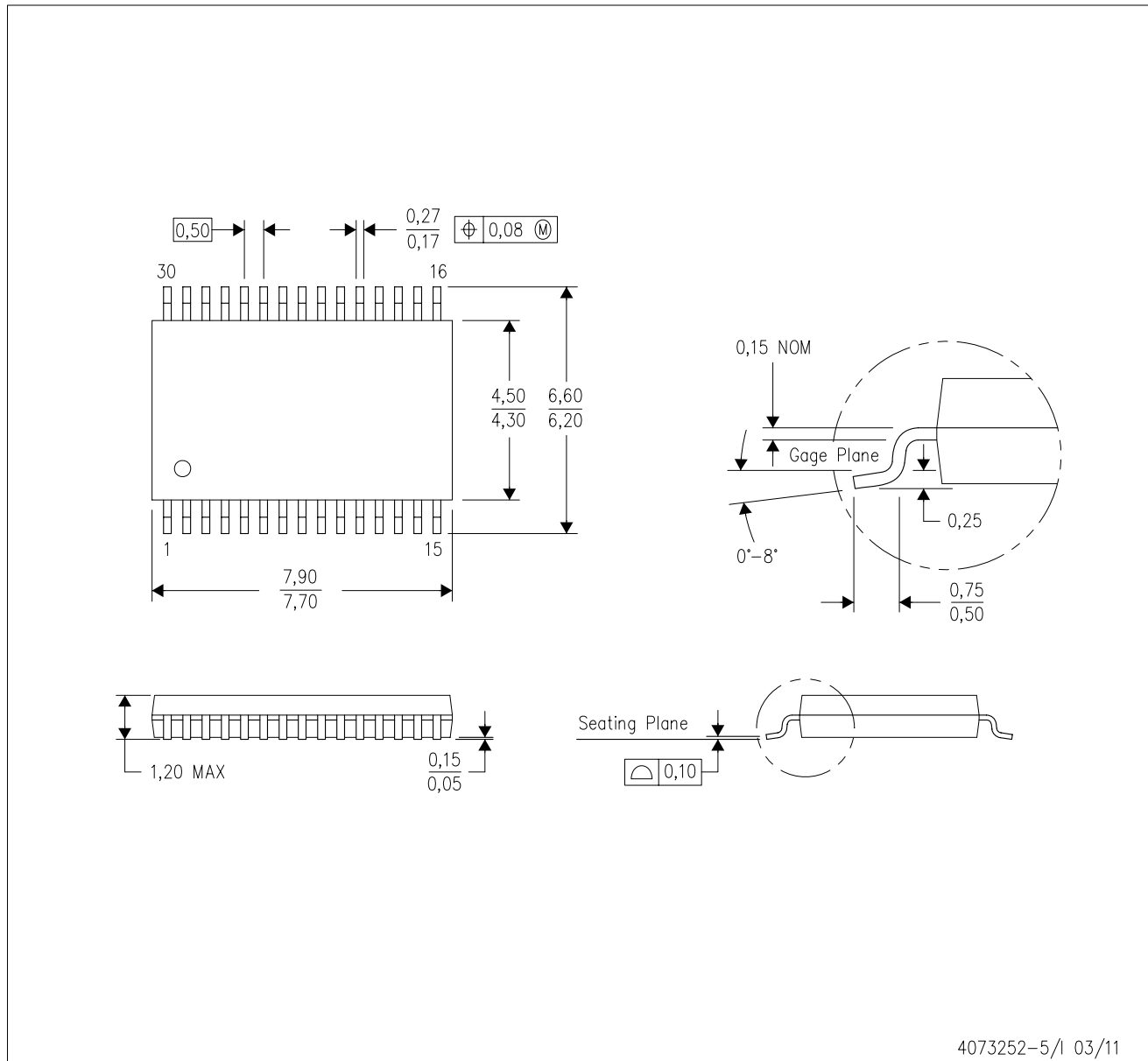


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN761681DBTR	TSSOP	DBT	30	2000	346.0	346.0	33.0

DBT (R-PDSO-G30)

PLASTIC SMALL OUTLINE



- 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. Body dimensions do not include mold flash or protrusion.
  - D. Falls within JEDEC MO-153.

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Mobile Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Transportation and Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

TI E2E Community Home Page

[e2e.ti.com](http://e2e.ti.com)

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2011, Texas Instruments Incorporated