

DIGITAL TV TUNER IC

FEATURES

- Integrated Mixer/Oscillator/PLL
- VHF-L, VHF-H, UHF 3-Band Local Oscillator
- RF AGC Detector Circuit
- I²C Bus Protocol
Bidirectional Data Transmission
- High-Voltage Tuning Voltage Output
- Four NPN-Type Band Switch Drivers
- One Auxiliary Port/5-Level ADC
- Crystal Oscillator Output
- Programmable Reference Divider Ratio
(24/28/32/64/80/128)
- Selectable Digital IFOUT and Analog IFOUT
- Standby Mode
- 5-V Power Supply
- 38-Pin Thin Shrink Small-Outline Package
(TSSOP)

APPLICATIONS

- Digital TVs
- Digital CATVs
- Set-Top Boxes

DESCRIPTION

The SN761642 is a low-phase-noise synthesized tuner IC designed for digital TV tuning systems. The circuit consists of a PLL synthesizer, three-band local oscillator and mixer, and RF AGC detector circuit. The SN761642 is available in a small-outline package.

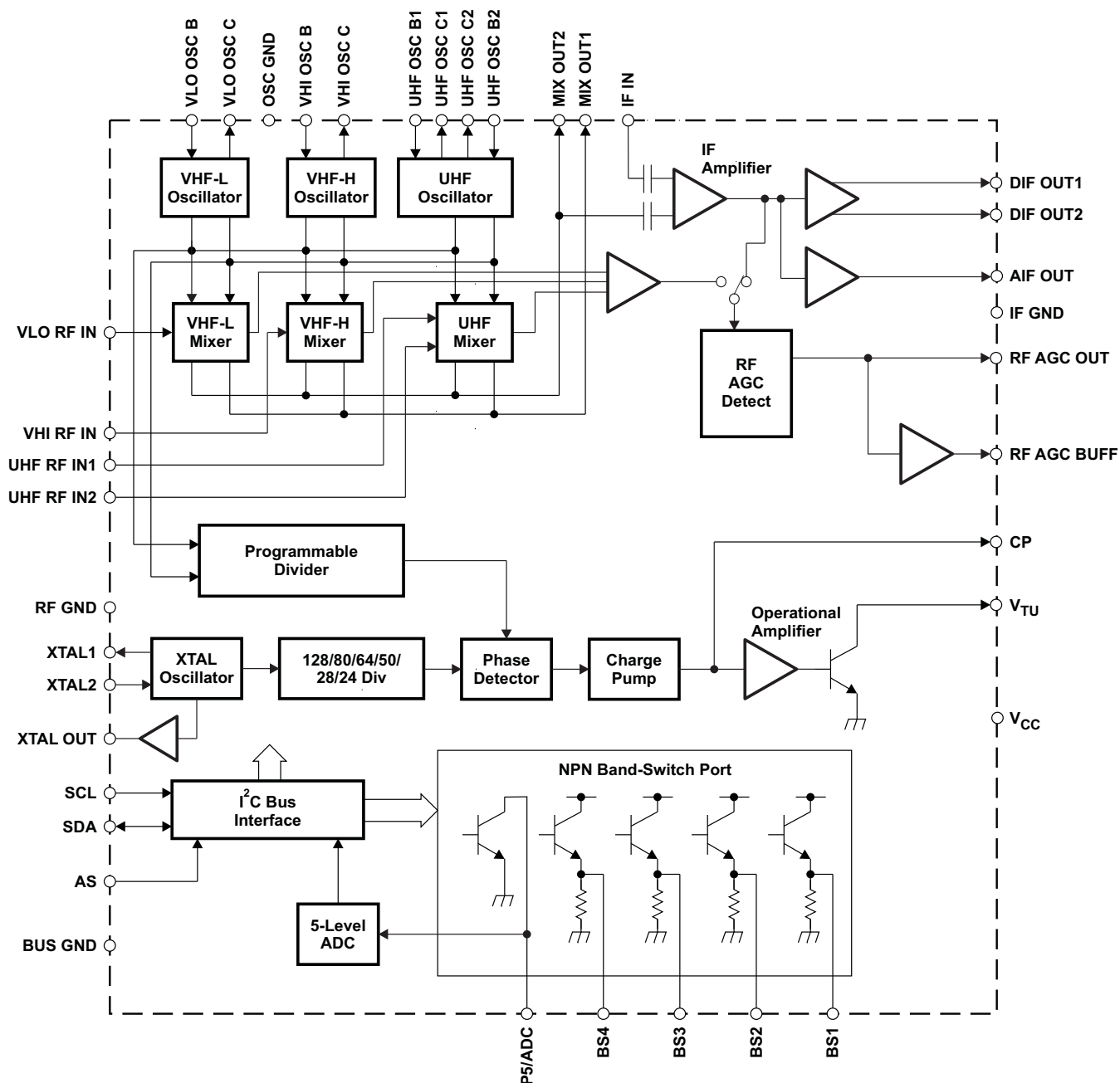
**DBT PACKAGE
(TOP VIEW)**

VLO OSC B	1	38	BS4
VLO OSC C	2	37	UHF RF IN1
VHI OSC B	3	36	UHF RF IN2
VHI OSC C	4	35	VHI RF IN
UHF OSC B1	5	34	VLO RF IN
UHF OSC C1	6	33	RF GND
UHF OSC C2	7	32	MIX OUT2
UHF OSC B2	8	31	MIX OUT1
OSC GND	9	30	IF IN
CP	10	29	RF AGC OUT
VTU	11	28	RF AGC BUF
IF GND	12	27	BS3
DIF OUT1	13	26	BS2
DIF OUT2	14	25	BS1
AIF OUT	15	24	SDA
P5/ADC	16	23	SCL
VCC	17	22	AS
XTAL1	18	21	BUS GND
XTAL2	19	20	XTAL OUT



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.

FUNCTIONAL BLOCK DIAGRAM



TERMINAL FUNCTIONS

TERMINAL		DESCRIPTION	SCHEMATIC
NAME	NO.		
AIF OUT	15	IF amplifier output (analog)	Figure 1
AS	22	Address selection input	Figure 2
BS1	25	Band switch 1 output	Figure 3
BS2	26	Band switch 2 output	Figure 3
BS3	27	Band switch 3 output	Figure 3
BS4	38	Band switch 4 output	Figure 3
BUS GND	21	BUS ground	
CP	10	Charge-pump output	Figure 4
DIF OUT1	13	IF amplifier output 1	Figure 6
DIF OUT2	14	IF amplifier output 2	Figure 6
IF GND	12	IF ground	
IF IN	30	IF amplifier input	Figure 5
MIXOUT1	31	Mixer output 1	Figure 7
MIXOUT2	32	Mixer output 2	Figure 7
OSC GND	9	Oscillator ground	
P5/ADC	16	Port-5 output/ADC input	Figure 8
RF AGC BUF	28	RF AGC buffer output	Figure 9
RF AGC OUT	29	RF AGC output	Figure 10
RF GND	33	RF ground	
SCL	23	Serial clock input	Figure 11
SDA	24	Serial data input/output	Figure 12
UHF OSC B1	5	UHF oscillator base 1	Figure 13
UHF OSC B2	8	UHF oscillator base 2	Figure 13
UHF OSC C1	6	UHF oscillator collector 1	Figure 13
UHF OSC C2	7	UHF oscillator collector 2	Figure 13
UHF RF IN1	37	UHF RF input 1	Figure 14
UHF RF IN2	36	UHF RF input 2	Figure 14
V _{CC}	17	Supply voltage	
VHI OSC B	3	VHF-H oscillator base	Figure 15
VHI OSC C	4	VHF-H oscillator collector	Figure 15
VHI RF IN	35	VHF-H RF input	Figure 16
VLO OSC B	1	VHF-L oscillator base	Figure 17
VLO OSC C	2	VHF-L oscillator collector	Figure 17
VLO RF IN	34	VHF-L RF input	Figure 18
VTU	11	Tuning voltage amplifier output	Figure 19
XTAL1	18	4-MHz crystal oscillator	Figure 20
XTAL2	19	4-MHz crystal oscillator	Figure 20
XTALOUT	20	4-MHz crystal oscillator buffer output	Figure 21

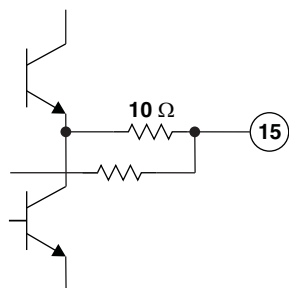


Figure 1. AIF OUT

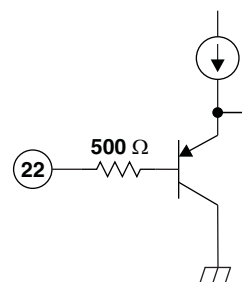


Figure 2. AS

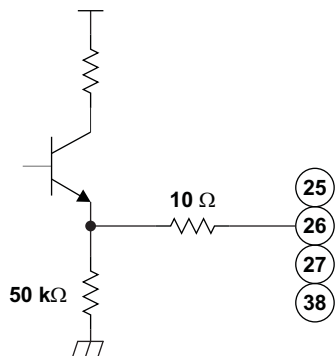


Figure 3. BS1, BS2, BS3, and BS4

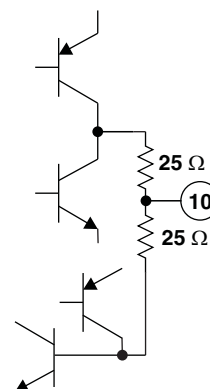


Figure 4. CP

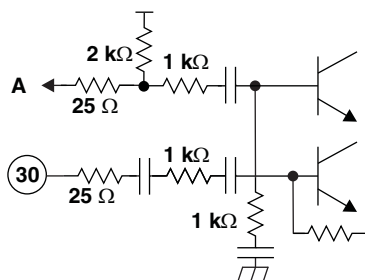


Figure 5. IF IN

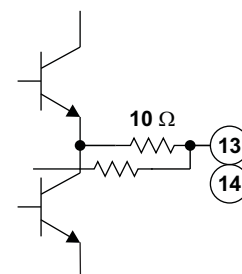


Figure 6. DIF OUT1 and DIF OUT2

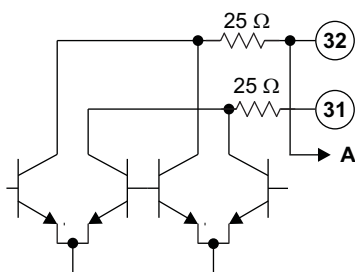


Figure 7. MIXOUT1 and MIXOUT2

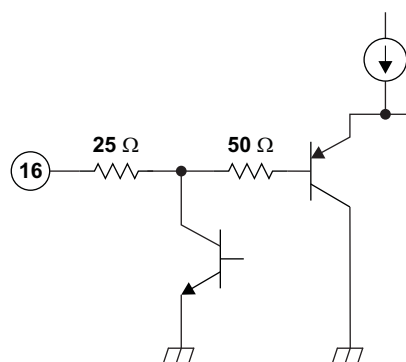


Figure 8. P5/ADC

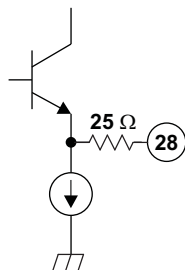


Figure 9. RF AGC BUF

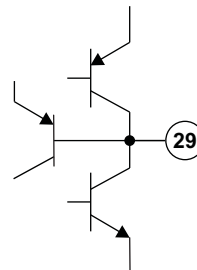


Figure 10. RF AGC OUT

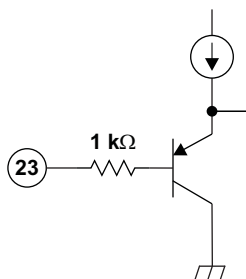


Figure 11. SCL

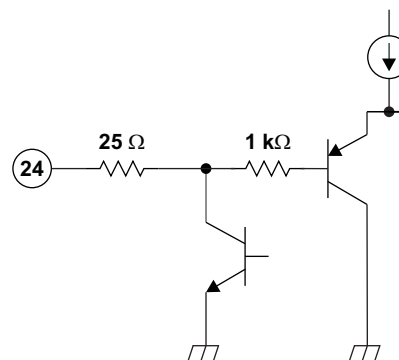


Figure 12. SDA

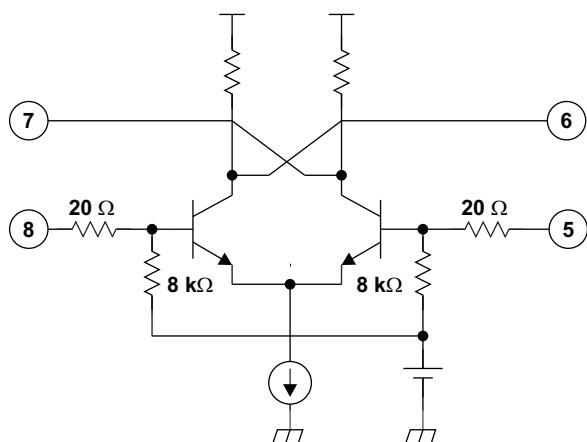


Figure 13. UHF OSC B1, UHF OSC B2, UHF OSC C1, and UHF OSC C2

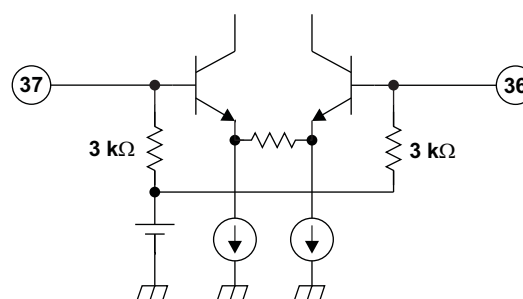


Figure 14. UHF RF IN1 and UHF RF IN2

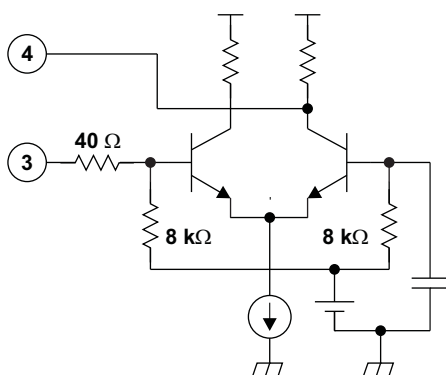


Figure 15. VHI OSC B and VHI OSC C

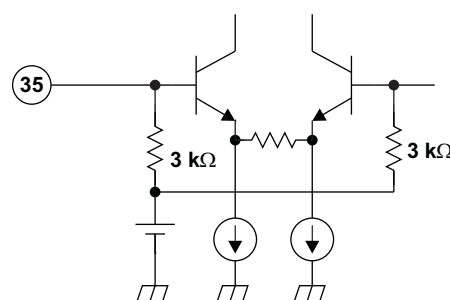


Figure 16. VHI RF IN

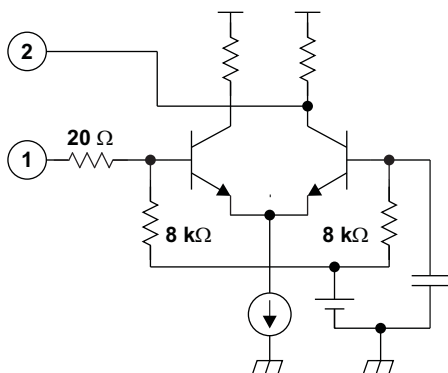


Figure 17. VLO OSC B and VLO OSC C

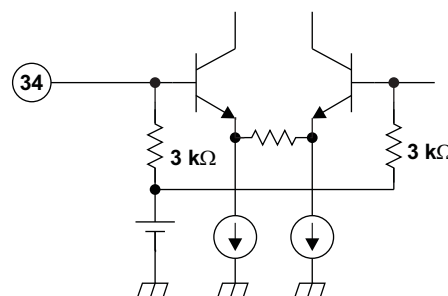


Figure 18. VLO RF IN

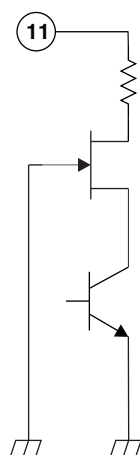


Figure 19. VTU

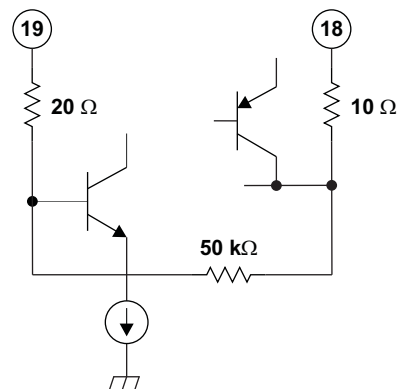


Figure 20. XTAL1 and XTAL2

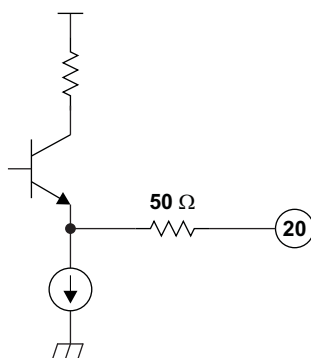


Figure 21. XTALOUT

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

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

			MIN	MAX	UNIT
V _{CC}	Supply voltage range ⁽²⁾	V _{CC}	–0.4	6.5	V
V _{GND}	Input voltage range 1 ⁽²⁾	RF GND, OSC GND	–0.4	0.4	V
VTU	Input voltage range 2 ⁽²⁾	VTU	–0.4	35	V
V _{IN}	Input voltage range 3 ⁽²⁾	Other pins	–0.4	6.5	V
P _D	Continuous total dissipation ⁽³⁾	T _A ≤ 25°C		1276	mW
T _A	Operating free-air temperature range		–20	85	°C
T _{stg}	Storage temperature range		–65	150	°C
T _J	Maximum junction temperature			150	°C
t _{SC(max)}	Maximum short-circuit time	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 10.2 mW/°C for T_A ≥ 25°C.

RECOMMENDED OPERATING CONDITIONS

			MIN	NOM	MAX	UNIT
V _{CC}	Supply voltage	V _{CC}	4.5	5	5.5	V
VTU	Tuning supply voltage	VTU		30	33	V
I _{BS}	Output current of band switch	BS1 – BS4, one bandswitch on			10	mA
I _{P5}	Output current of port 5	P5/ADC			–5	mA
T _A	Operating free-air temperature		–20		85	°C



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.

IF IN, MIXOUT1, and MIXOUT2 (pins 30–32) withstand 1.5 kV, and all other pins withstand 2 kV, according to the Human-Body Model (1.5 kΩ, 100 pF).

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	BS[1:4] = 0100, DIFOUT enabled		90	120	mA
I_{CC2}	Supply current 2	BS[1:4] = 0100, DIFOUT enabled, $I_{BS} = 10\text{ mA}$		100	130	mA
$I_{CC-STBY}$	Standby supply current	BS[1:4] = 1100		9	14	mA
V_{IH}	High-level input voltage (SCL, SDA)		2.3			V
V_{IL}	Low-level input voltage (SCL, SDA)				1.05	V
I_{IH}	High-level input current (SCL, SDA)				10	μA
I_{IL}	Low-level input current (SCL, SDA)		-10			μA
V_{POR}	Power-on-reset supply voltage (threshold of supply voltage between reset and operation mode)		2.1	2.8	3.5	V
I²C Interface						
V_{ASH}	Address-select high-input voltage (AS)	$V_{CC} = 5\text{ V}$	4.5		5	V
V_{ASM1}	Address-select mid-input 1 voltage (AS)	$V_{CC} = 5\text{ V}$	2		3	V
V_{ASM2}	Address-select mid-input 2 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)				50	μA
I_{ASL}	Address-select low-input current (AS)		-10			μA
V_{ADC}	ADC input voltage	See Table 10	0		V_{CC}	V
I_{ADH}	ADC high-level input current	$V_{ADC} = V_{CC}$			10	μA
I_{ADL}	ADC low-level input current	$V_{ADC} = 0\text{ V}$	-10			μA
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	μA
f_{SCL}	Clock frequency (SCL)			100	400	kHz
t_{HD-DAT}	Data hold time	See Figure 22	0		0.9	μs
t_{BUF}	Bus free time		1.3			μs
t_{HD-STA}	Start hold time		0.6			μs
t_{LOW}	SCL-low hold time		1.3			μs
t_{HIGH}	SCL-high hold time		0.6			μs
t_{SU-STA}	Start setup time		0.6			μs
t_{SU-DAT}	Data setup time		0.1			μs
t_r	Rise time (SCL, SDA)				0.3	μs
t_f	Fall time (SCL, SDA)				0.3	μs
t_{SU-STO}	Stop setup time		0.6			μs

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	512		32767	
f_{XTAL}	Crystal oscillator frequency	$R_{XTAL} = 25\ \Omega$ to $300\ \Omega$		4		MHz
Z_{XTAL}	Crystal oscillator input impedance		1.6	2.4		k Ω
V_{XLO}	XTALOUT output voltage	Load = $10\text{ pF}/5.1\text{ k}\Omega$, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$		0.48		Vp-p
V_{VTUL}	Tuning amplifier low-level output voltage	$R_L = 22\text{ k}\Omega$, $VTU = 30\text{ V}$	0.2	0.3	0.46	V
I_{VTUOFF}	Tuning amplifier leakage current	Tuning amplifier = off, $VTU = 30\text{ V}$			10	μA
I_{CP11}	Charge-pump current	CP[2:0] = 011	450	600	750	μA
I_{CP10}		CP[2:0] = 010	250	350	450	
I_{CP01}		CP[2:0] = 001	100	140	200	
I_{CP00}		CP[2:0] = 000	35	70	95	
I_{CP100}		CP[2:0] = 100, Mode = 1	650	900	1200	
V_{CP}	Charge-pump output voltage	PLL locked		1.95		V
I_{CPOFF}	Charge-pump leakage current	$V_{CP} = 2\text{ V}$, $T_A = 25^\circ\text{C}$	–15		15	nA
I_{BS}	Band switch driver output current (BS1–BS4)				10	mA
V_{BS1}	Band switch driver output voltage (BS1–BS4)	$I_{BS} = 10\text{ mA}$	3			V
V_{BS2}		$I_{BS} = 10\text{ mA}$, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$	3.5	3.7		
I_{BSOFF}	Band switch driver leakage current (BS1–BS4)	$V_{BS} = 0\text{ V}$			8	μA
I_{P5}	Band switch port sink current (P5/ADC)				–5	mA
V_{P5ON}	Band switch port output voltage (P5/ADC)	$I_{P5} = -2\text{ mA}$, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$			0.6	V

RF AGC⁽¹⁾

 $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, measured in [Figure 23](#) reference measurement circuit at 50- Ω system, IF = 44 MHz, IF filter characteristics: $f_{peak} = 44\text{ MHz}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{OAGC0}	RF AGC output source current	ATC = 0		300		nA
I_{OAGC1}		ATC = 1		9		μA
$I_{OAGCSINK}$	RF AGC peak sink current	ATC = 0		100		μA
V_{OAGCH}	RFAGCOUT output high voltage (max level)	ATC = 1	3.5	4	4.5	V
V_{OAGCL}	RFAGCOUT output low voltage (min level)	ATC = 1		0.3		V
I_{AGCBUF}	RFAGCBUF output current	ATC = 0		1.5		mA
$V_{OAGCBFH}$	RFAGCBUF output high voltage (max level)	ATC = 1	3.5	4	4.5	V
$V_{OAGCBFL}$	RFAGCBUF output low voltage (min level)	ATC = 1		0.3		V
$V_{AGCSP00}$	Start-point IF output level	ATP[2:0] = 000, ATC=0, AISL=0		114		dB μV
$V_{AGCSP01}$		ATP[2:0] = 001, ATC=0, AISL=0		112		
$V_{AGCSP02}$		ATP[2:0] = 010, ATC=0, AISL=0		110		
$V_{AGCSP03}$		ATP[2:0] = 011, ATC=0, AISL=0		108		
$V_{AGCSP04}$		ATP[2:0] = 100, ATC=0, AISL=0		106		
$V_{AGCSP05}$		ATP[2:0] = 101, ATC=0, AISL=0		104		
$V_{AGCSP06}$		ATP[2:0] = 110, ATC=0, AISL=0		102		

(1) When AISL=1, RF AGC function is not available at VHF-L band (output level is undefined).

Mixer, Oscillator, IF Amplifier (DIF OUT)

$V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, measured in [Figure 23](#) reference measurement circuit at 50- Ω system, IF = 44 MHz,

IF filter characteristics: $f_{\text{peak}} = 44\text{ MHz}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	TYP	UNIT
G_{C1D}	Conversion gain (mixer-IF amplifier), VHF-LOW	$f_{\text{in}} = 57\text{ MHz}^{(1)}$	35	dB
G_{C3D}		$f_{\text{in}} = 171\text{ MHz}^{(1)}$	35	
G_{C4D}	Conversion gain (mixer-IF amplifier), VHF-HIGH	$f_{\text{in}} = 177\text{ MHz}^{(1)}$	35	dB
G_{C6D}		$f_{\text{in}} = 467\text{ MHz}^{(1)}$	35	
G_{C7D}	Conversion gain (mixer-IF amplifier), UHF	$f_{\text{in}} = 473\text{ MHz}^{(1)}$	35	dB
G_{C9D}		$f_{\text{in}} = 864\text{ MHz}^{(1)}$	35	
NF_{1D}	Noise figure, VHF-LOW	$f_{\text{in}} = 57\text{ MHz}$	9	dB
NF_{3D}		$f_{\text{in}} = 171\text{ MHz}$	9	
NF_{4D}	Noise figure, VHF-HIGH	$f_{\text{in}} = 177\text{ MHz}$	9	dB
NF_{6D}		$f_{\text{in}} = 467\text{ MHz}$	10	
NF_{7D}	Noise figure, UHF	$f_{\text{in}} = 473\text{ MHz}$	10	dB
NF_{9D}		$f_{\text{in}} = 864\text{ MHz}$	12	
CM_{1D}	Input voltage causing 1% cross-modulation distortion, VHF-LOW	$f_{\text{in}} = 57\text{ MHz}^{(2)}$	79	dB μV
CM_{3D}		$f_{\text{in}} = 171\text{ MHz}^{(2)}$	79	
CM_{4D}	Input voltage causing 1% cross-modulation distortion, VHF-HIGH	$f_{\text{in}} = 177\text{ MHz}^{(2)}$	79	dB μV
CM_{6D}		$f_{\text{in}} = 467\text{ MHz}^{(2)}$	79	
CM_{7D}	Input voltage causing 1% cross-modulation distortion, UHF	$f_{\text{in}} = 473\text{ MHz}^{(2)}$	77	dB μV
CM_{9D}		$f_{\text{in}} = 864\text{ MHz}^{(2)}$	77	
V_{IFO1D}	IF output voltage, VHF-LOW	$f_{\text{in}} = 57\text{ MHz}$	117	dB μV
V_{IFO3D}		$f_{\text{in}} = 171\text{ MHz}$	117	
V_{IFO4D}	IF output voltage, VHF-HIGH	$f_{\text{in}} = 177\text{ MHz}$	117	dB μV
V_{IFO6D}		$f_{\text{in}} = 467\text{ MHz}$	117	
V_{IFO7D}	IF output voltage, UHF	$f_{\text{in}} = 473\text{ MHz}$	117	dB μV
V_{IFO9D}		$f_{\text{in}} = 864\text{ MHz}$	117	
Φ_{PLVL1D}	Phase noise, VHF-LOW	$f_{\text{in}} = 57\text{ MHz}^{(3)}$	–90	dBc/Hz
Φ_{PLVL3D}		$f_{\text{in}} = 171\text{ MHz}^{(4)}$	–85	
Φ_{PLVL4D}	Phase noise, VHF-HIGH	$f_{\text{in}} = 177\text{ MHz}^{(3)}$	–85	dBc/Hz
Φ_{PLVL6D}		$f_{\text{in}} = 467\text{ MHz}^{(4)}$	–77	
Φ_{PLVL7D}	Phase noise, UHF	$f_{\text{in}} = 473\text{ MHz}^{(3)}$	–80	dBc/Hz
Φ_{PLVL9D}		$f_{\text{in}} = 864\text{ MHz}^{(4)}$	–77	

(1) IF = 44 MHz, RF input level = 70 dB μV , differential output

(2) $f_{\text{undes}} = f_{\text{des}} \pm 6\text{ MHz}$, $P_{\text{in}} = 70\text{ dB}\mu\text{V}$, AM 1 kHz, 30%, DES/CM = S/I = 46 dB

(3) Offset = 1 kHz, CP current = 350 μA , reference divider = 64

(4) Offset = 1 kHz, CP current = 900 μA , reference divider = 64

Mixer, Oscillator, IF Amplifier (AIF OUT)

 $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, measured in [Figure 23](#) reference measurement circuit at 50- Ω system, IF = 45.75 MHz,

IF filter characteristics: $f_{\text{peak}} = 44\text{ MHz}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	TYP	UNIT
G_{C1A}	Conversion gain (mixer-IF amplifier), VHF-LOW	$f_{\text{in}} = 55.25\text{ MHz}^{(1)}$	29	dB
G_{C3A}		$f_{\text{in}} = 169.25\text{ MHz}^{(1)}$	29	
G_{C4A}	Conversion gain (mixer-IF amplifier), VHF-HIGH	$f_{\text{in}} = 175.25\text{ MHz}^{(1)}$	29	dB
G_{C6A}		$f_{\text{in}} = 465.25\text{ MHz}^{(1)}$	29	
G_{C7A}	Conversion gain (mixer-IF amplifier), UHF	$f_{\text{in}} = 471.25\text{ MHz}^{(1)}$	29	dB
G_{C9A}		$f_{\text{in}} = 862.25\text{ MHz}^{(1)}$	29	
NF_{1A}	Noise figure, VHF-LOW	$f_{\text{in}} = 55.25\text{ MHz}$	9	dB
NF_{3A}		$f_{\text{in}} = 169.25\text{ MHz}$	9	
NF_{4A}	Noise figure, VHF-HIGH	$f_{\text{in}} = 175.25\text{ MHz}$	9	dB
NF_{6A}		$f_{\text{in}} = 465.25\text{ MHz}$	10	
NF_{7A}	Noise figure, UHF	$f_{\text{in}} = 471.25\text{ MHz}$	10	dB
NF_{9A}		$f_{\text{in}} = 862.25\text{ MHz}$	12	
CM_{1A}	Input voltage causing 1% cross-modulation distortion, VHF-LOW	$f_{\text{in}} = 55.25\text{ MHz}^{(2)}$	79	dB μV
CM_{3A}		$f_{\text{in}} = 169.25\text{ MHz}^{(2)}$	79	
CM_{4A}	Input voltage causing 1% cross-modulation distortion, VHF-HIGH	$f_{\text{in}} = 175.25\text{ MHz}^{(2)}$	79	dB μV
CM_{6A}		$f_{\text{in}} = 465.25\text{ MHz}^{(2)}$	79	
CM_{7A}	Input voltage causing 1% cross-modulation distortion, UHF	$f_{\text{in}} = 471.25\text{ MHz}^{(2)}$	79	dB μV
CM_{9A}		$f_{\text{in}} = 862.25\text{ MHz}^{(2)}$	77	
V_{IFO1A}	IF output voltage, VHF-LOW	$f_{\text{in}} = 55.25\text{ MHz}$	117	dB μV
V_{IFO3A}		$f_{\text{in}} = 169.25\text{ MHz}$	117	
V_{IFO4A}	IF output voltage, VHF-HIGH	$f_{\text{in}} = 175.25\text{ MHz}$	117	dB μV
V_{IFO6A}		$f_{\text{in}} = 465.25\text{ MHz}$	117	
V_{IFO7A}	IF output voltage, UHF	$f_{\text{in}} = 471.25\text{ MHz}$	117	dB μV
V_{IFO9A}		$f_{\text{in}} = 862.25\text{ MHz}$	117	
Φ_{PLVL1A}	Phase noise, VHF-LOW	$f_{\text{in}} = 55.25\text{ MHz}^{(3)}$	–95	dBc/Hz
Φ_{PLVL3A}		$f_{\text{in}} = 169.25\text{ MHz}^{(3)}$	–95	
Φ_{PLVL4A}	Phase noise, VHF-HIGH	$f_{\text{in}} = 175.25\text{ MHz}^{(3)}$	–90	dBc/Hz
Φ_{PLVL6A}		$f_{\text{in}} = 465.25\text{ MHz}^{(3)}$	–90	
Φ_{PLVL7A}	Phase noise, UHF	$f_{\text{in}} = 471.25\text{ MHz}^{(3)}$	–85	dBc/Hz
Φ_{PLVL9A}		$f_{\text{in}} = 862.25\text{ MHz}^{(3)}$	–90	

(1) IF = 44 MHz, RF input level = 70 dB μV

(2) $f_{\text{undes}} = f_{\text{des}} \pm 6\text{ MHz}$, $P_{\text{in}} = 70\text{ dB}\mu\text{V}$, AM 1 kHz, 30%, DES/CM = S/I = 46 dB

(3) Offset = 10 kHz, CP current = 70 μA , reference divider = 128

FUNCTIONAL DESCRIPTION

I²C Bus Mode

I²C Write Mode ($R/\overline{W} = 0$)

Table 1. Write Data Format

	MSB				LSB				
Address byte (ADB)	1	1	0	0	0	MA1	MA0	$R/\overline{W} = 0$	A ⁽¹⁾
Divider byte 1 (DB1)	0	N14	N13	N12	N11	N10	N9	N8	A ⁽¹⁾
Divider byte 2 (DB2)	N7	N6	N5	N4	N3	N2	N1	N0	A ⁽¹⁾
Control byte 1 (CB1)	1	0	ATP2	ATP1	ATP0	RS2	RS1	RS0	A ⁽¹⁾
Band switch byte (BB)	CP1	CP0	AISL	P5	BS4	BS3	BS2	BS1	A ⁽¹⁾
Control byte 2 (CB2)	1	1	ATC	MODE	T3	T2/IFDA	T1/CP2	T0/XLO	A ⁽¹⁾

(1) A : acknowledge

Table 2. Write Data Symbol Description

SYMBOL	DESCRIPTION	DEFAULT													
MA[1:0]	Address-set bits (see Table 3)														
N[14:0]	Programmable counter set bits $N = N14 \times 2^{14} + N13 \times 2^{13} + \dots + N1 \times 2 + N0$	$N14 = N13 = N12 = \dots = N0 = 0$													
ATP[2:0]	RF AGC start-point control bits (see Table 4)	ATP[2:0] = 000													
RS[2:0]	Reference divider ratio-selection bits (see Table 5)	RS[2:0] = 000													
CP[1:0]	Charge-pump current-set bit (see Table 6)	CP[1:0] = 00													
AISL ⁽¹⁾	RF AGC detector input selection bit AISL = 0: IF amplifier AISL = 1: Mixer output	AISL = 0													
P5	Port output/ADC input control bit P5 = 0: ADC INPUT P5 = 1: Tr = ON	P5 = 0													
BS[4:1]	Band switch control bits BSn = 0: Tr = OFF BSn = 1: Tr = ON	BSn = 0													
	Band selection by BS[1:2] <table border="1"> <thead> <tr> <th>BS1</th><th>BS2</th><th></th></tr> </thead> <tbody> <tr> <td>1</td><td>0</td><td>VHF-LO</td></tr> <tr> <td>0</td><td>1</td><td>VHF-HI</td></tr> <tr> <td>0</td><td>0</td><td>UHF</td></tr> <tr> <td>1</td><td>1</td><td>Standby mode/stop MOP function (XTALOUT is available in standby mode)</td></tr> </tbody> </table>		BS1	BS2		1	0	VHF-LO	0	1	VHF-HI	0	0	UHF	1
BS1	BS2														
1	0	VHF-LO													
0	1	VHF-HI													
0	0	UHF													
1	1	Standby mode/stop MOP function (XTALOUT is available in standby mode)													
ATC	RF AGC current-set bit ATC = 0: Current = 300 nA ATC = 1: Current = 9 μ A	ATC = 0													
Mode T3 T2/IFDA T1/CP2 T0/XLO	Mode = 0: DIFOUT1, 2 selected T3, T2/IFDA, T1/CP2, T0/XLO are test bits and XTALOUT control bit (see Table 7) Mode = 1: T2/IFDA = 0 : DIFOUT1, 2 selected T2/IFDA = 1 : AIFOUT selected T1/CP2 : lcp control bit, See Table 6 T0/XLO = 0 : XTALOUT enabled T0/XLO = 1 : XTALOUT disabled	MODE = 0 T[3:0] = 0000													

(1) When AISL=1, RF AGC function is not available at VHF-L band (Output level is undefined.)

Table 3. Address Selection

MA1	MA0	VOLTAGE APPLIED ON AS INPUT
0	0	0 V to 0.1 V _{CC} (Low)
0	1	OPEN, or 0.2 V _{CC} to 0.3 V _{CC} (Mid2)
1	0	0.4 V _{CC} to 0.6 V _{CC} (Mid1)
1	1	0.9 V _{CC} to V _{CC} (High)

Table 4. RF AGC Start Point

ATP2	ATP1	ATP0	IFOUT LEVEL (dBμV)
0	0	0	114
0	0	1	112
0	1	0	110
0	1	1	108
1	0	0	106
1	0	1	104
1	1	0	102
1	1	1	Disabled

Table 5. Reference Divider Ratio

RS2	RS1	RS0	REFERENCE DIVIDER RATIO
0	0	0	24
0	0	1	28
0	1	0	32
0	1	1	64
1	0	0	128
1	X	1	80

Table 6. Charge-Pump Current

MODE	CP2	CP1	CP0	CHARGE PUMP CURRENT (μA)
X	0	0	0	70
X	0	0	1	140
X	0	1	0	350
X	0	1	1	600
1	1	0	0	900

Table 7. Test Bits/XTALOUT Control ⁽¹⁾

MODE	T3	T2/IFDA	T1/CP2	T0/XLO	DEVICE OPERATION	XTALOUT 4-MHz OUTPUT
0	0	0	0	0	Normal operation	Enabled
0	0	0	0	1	Normal operation	Disabled
1	X	X	X	0	Normal operation	Enabled
1	X	X	X	1	Normal operation	Disabled
0	X	1	X	X	Test mode	Not available
0	1	X	X	X	Test mode	Not available

(1) RFAGC and XTALOUT are not available in test mode.

I²C Read Mode ($R/\overline{W} = 1$)

Table 8. Read Data Format

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

(1) A : acknowledge

Table 9. Read Data Symbol Description

SYMBOL	DESCRIPTION	DEFAULT
MA[1:0]	Address set bits (see Table 3)	
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), unlocked (FL = 0)	
A[2:0]	Digital data of ADC (see Table 10) Bit P5 must be set to 0.	

Table 10. ADC Level⁽¹⁾

A2	A1	A0	VOLTAGE APPLIED ON ADC INPUT
1	0	0	0.6 V _{CC} to V _{CC}
0	1	1	0.45 V _{CC} to 0.6 V _{CC}
0	1	0	0.3 V _{CC} to 0.45 V _{CC}
0	0	1	0.15 V _{CC} to 0.3 V _{CC}
0	0	0	0 V to 0.15 V _{CC}

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

Example I²C Data Write Sequences

Telegram examples:

Start-ADB-DB1-DB2-CB1-BB-CB2-Stop

Start-ADB-DB1-DB2-Stop

Start-ADB-CB1-BB-CB2-Stop

Start-ADB-CB1-BB-Stop

Start-ADB-CB2-Stop

Abbreviations:

ADB: Address byte

BB: Band switch byte

CB1: Control byte 1

CB2: Control byte 2

DB1: Divider byte 1

DB2: Divider byte 2

Start: Start condition

Stop: Stop condition

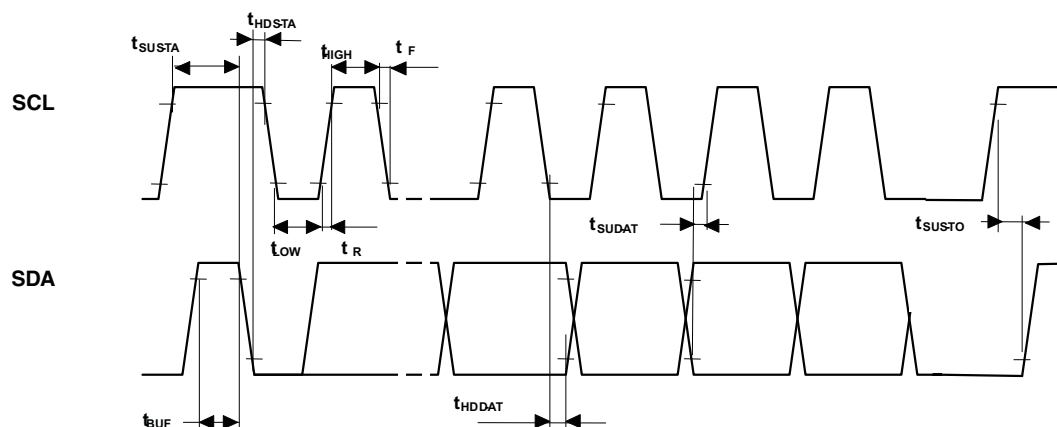
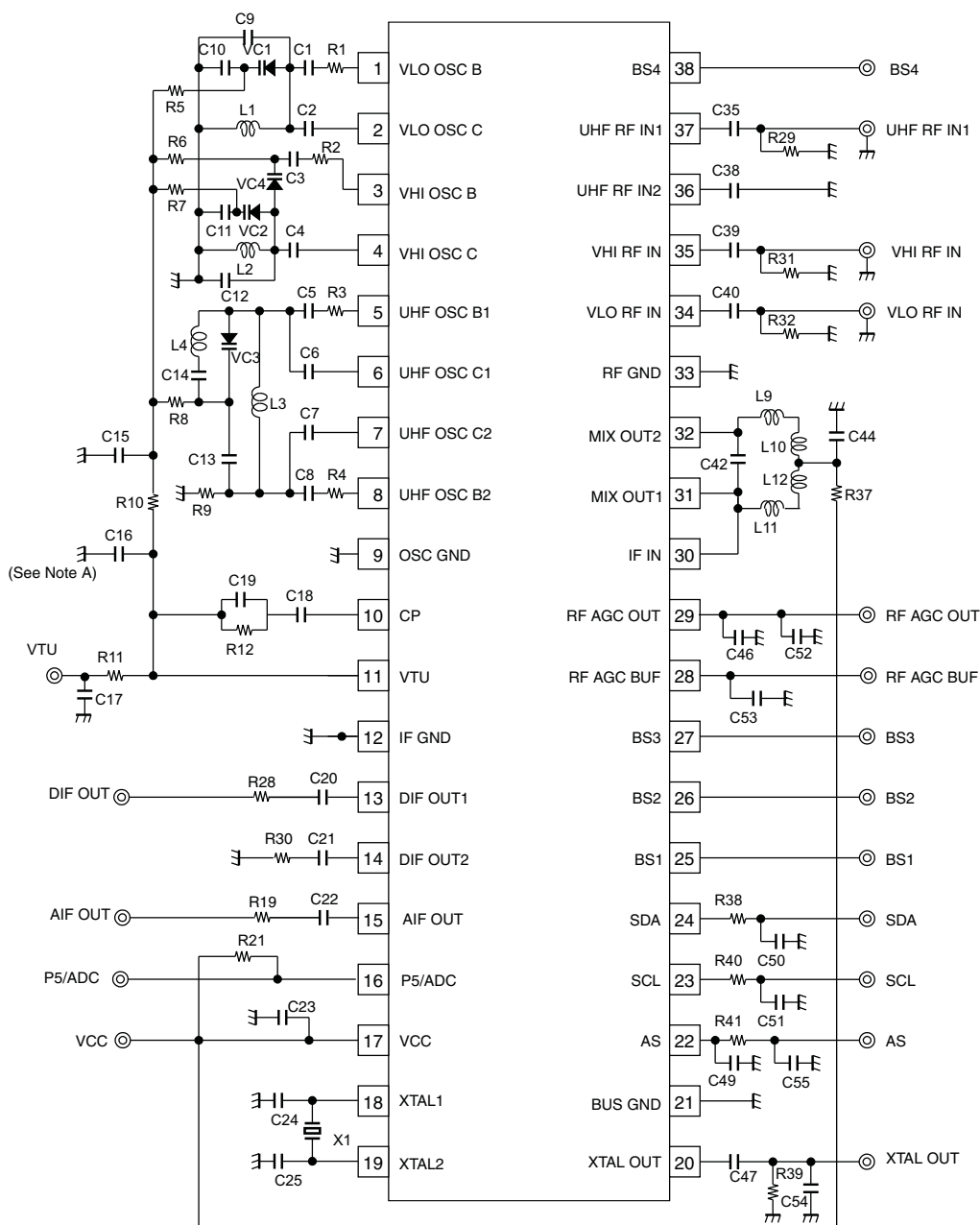


Figure 22. I²C Timing Chart

APPLICATION INFORMATION



- A. To prevent abnormal oscillation, connect C16, which does not affect a PLL.
- B. This application information is advisory and performance-check is required at actual application circuits. TI assumes no responsibility for the consequences of use of this circuit, such as an infringement of intellectual property rights or other rights, including patents, of third parties.

Figure 23. Reference Measurement Circuit

Component Values for Measurement Circuit⁽¹⁾

PARTS NAME	VALUE	PARTS NAME	VALUE
C1 (VLO OSC B)	1 pF	L1 (VLO OSC)	Φ3.0 mm, 7T, wire 0.32 mm
C2 (VLO OSC C)	2 pF	L2 (VHI OSC)	Φ2.0 mm, 3T, wire 0.4 mm
C3 (VHI OSC B)	7 pF	L3 (UHF OSC)	Φ1.8 mm, 3T, wire 0.4 mm
C4 (VHI OSC C)	5 pF	L4 (UHF OSC)	Φ1.8 mm, 3T, wire 0.4 mm
C5 (UHF OSCB1)	1.5 pF	L9 (MIX OUT2)	680 nH (LK1608R68K-T)
C6 (UHF OSCC1)	1 pF	L10 (MIX OUT2)	0 Ω
C7 (UHF OSCC2)	1 pF	L11 (MIX OUT1)	680 nH (LK1608R68K-T)
C8 (UHF OSCB2)	1.5 pF	L12 (MIX OUT1)	0 Ω
C9 (VLO OSC)	Open	R1(VLO OSC B)	0
C10(VLO OSC)	39 pF	R2 (VHI OSC B)	12 Ω
C11 (VHI OSC)	51 pF	R3 (UHF OSC B1)	4.7 Ω
C12 (VHI OSC)	0.5 pF	R4 (UHF OSC B2)	0
C13 (UHF OSC)	10 pF	R5 (VLO OSC)	3.3 kΩ
C14 (UHF OSC)	100 pF	R6 (VHI OSC)	3.3 kΩ
C15 (VTU)	2.2 nF/50 V	R7 (VHI OSC)	3.3 kΩ
C16 (CP)	150 pF/50 V	R8 (UHF OSC)	1 kΩ
C17 (VTU)	2.2 nF/50 V	R9 (UHF OSC)	2.2 kΩ
C18(CP)	0.01 u/50 V	R10 (VTU)	3 kΩ
C19(CP)	22 pF/50 V	R11 (VTU)	22 kΩ
C20 (DIF OUT1)	2.2 nF	R12 (CP)	47 kΩ
C21 (DIF OUT2)	2.2 nF	R19 (AIF OUT)	0
C22 (AIF OUT)	2.2 nF	R21 (P5/ADC)	Open
C23 (VCC)	0.1 μF	R28 (DIF OUT1)	200 Ω
C24 (XTAL)	27 pF	R29 (UHF RF IN1)	(50 Ω)
C25 (XTAL)	27 pF	R30 (DIF OUT2)	250 Ω
C35 (UHF RF IN1)	2.2 nF	R31 (VHI RF IN)	(50 Ω)
C38 (UHF RFIN2)	2.2 nF	R32 (VLO RF IN)	(50 Ω)
C39 (VHI RF IN)	2.2 nF	R37 (MIXOUT)	0
C40 (VLO RF IN)	2.2 nF	R38 (SDA)	330 Ω
C42 (MIX OUT)	6.5 pF	R39 (XTAL OUT)	5.1 kΩ
C44 (MIX OUT)	2.2 nF	R40 (SCL)	330 Ω
C46 (RF AGC OUT)	0.1 μF	R41 (AS)	Open
C47 (XTAL OUT)	0.01 μF	VC1 (VLO OSC)	MA2S374
C49 (AS)	22 pF	VC2 (VHI OSC)	MA2S374
C50 (SDA)	Open	VC3 (UHF OSC)	MA2S372
C51 (SCL)	Open	VC4 (VHI OSC)	MA2S372
C52 (RF AGC OUT)	0.047 μF	X1	4-MHz crystal
C53 (RF AGC BUF)	Open		
C54 (XTAL OUT)	10 pF		
C55 (AS)	Open		

- (1) If frequency = 44MHz,local frequency range:
VHF-LOW: 101–215 MHz
VHF-HIGH: 221–511 MHz
UHF: 517–908 MHz

APPLICATION INFORMATION (CONTINUED)

Test Circuits

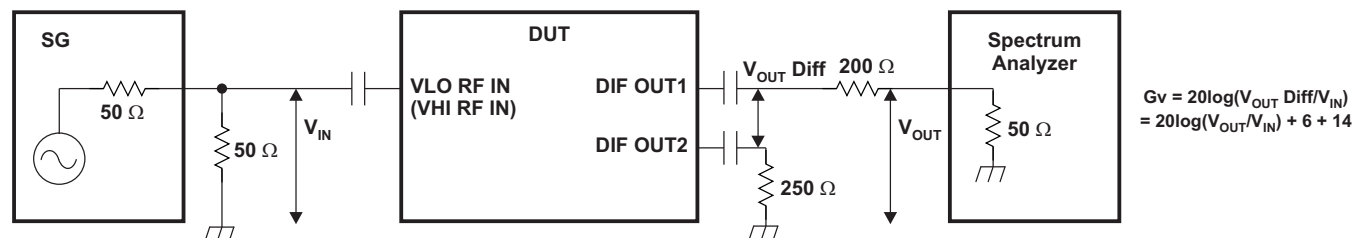


Figure 24. VHF-Conversion Gain-Measurement Circuit (at DIFOUT)

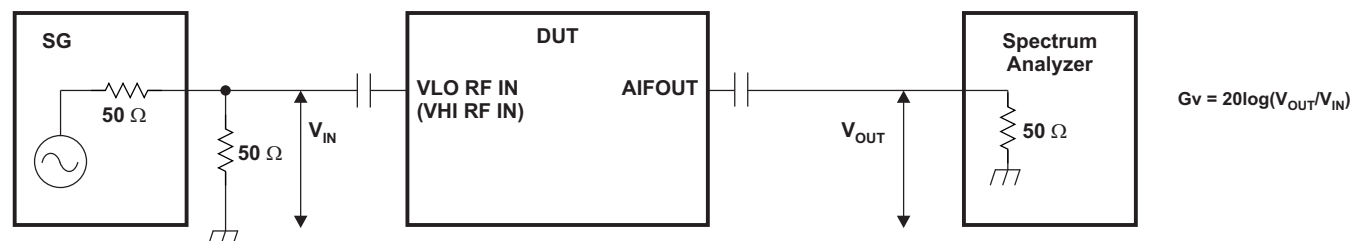


Figure 25. VHF-Conversion Gain Measurement Circuit (at AIFOUT)

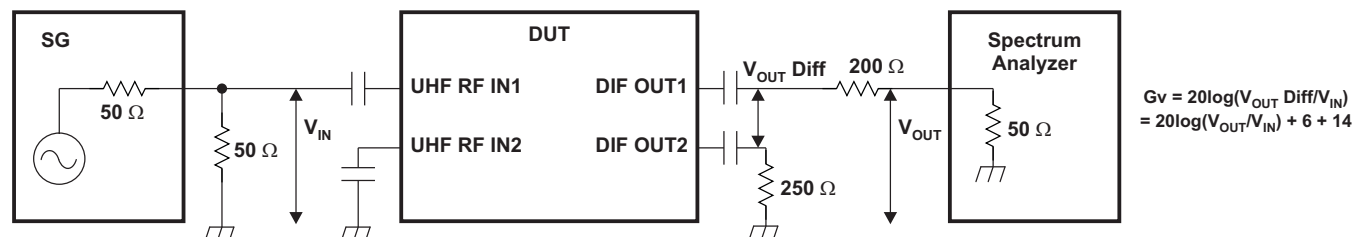


Figure 26. UHF-Conversion Gain-Measurement Circuit (at DIFOUT)

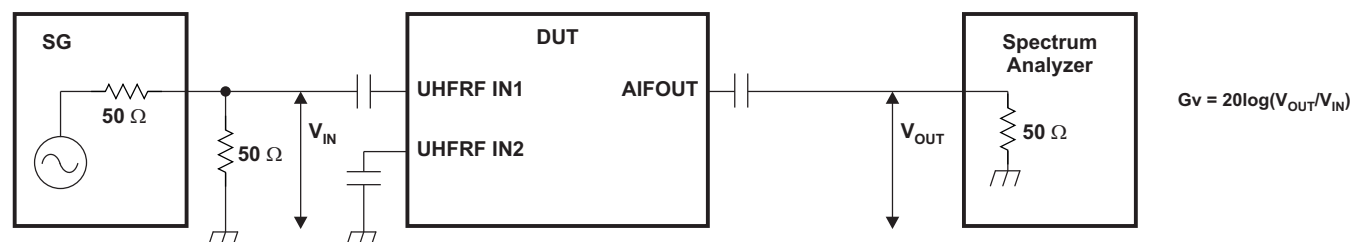


Figure 27. UHF-Conversion Gain Measurement Circuit (at AIFOUT)

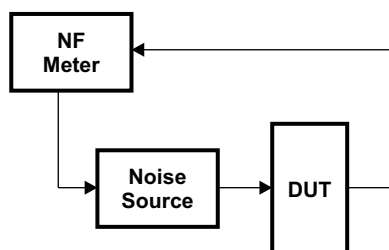


Figure 28. Noise-Figure Measurement Circuit

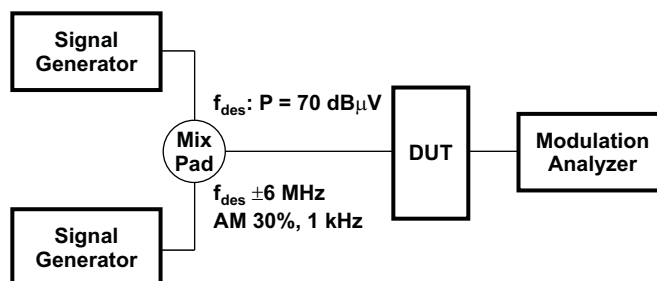


Figure 29. 1% Cross-Modulation Distortion Measurement Circuit

TYPICAL CHARACTERISTICS

Band Switch Driver Output Voltage (BS1–BS4)

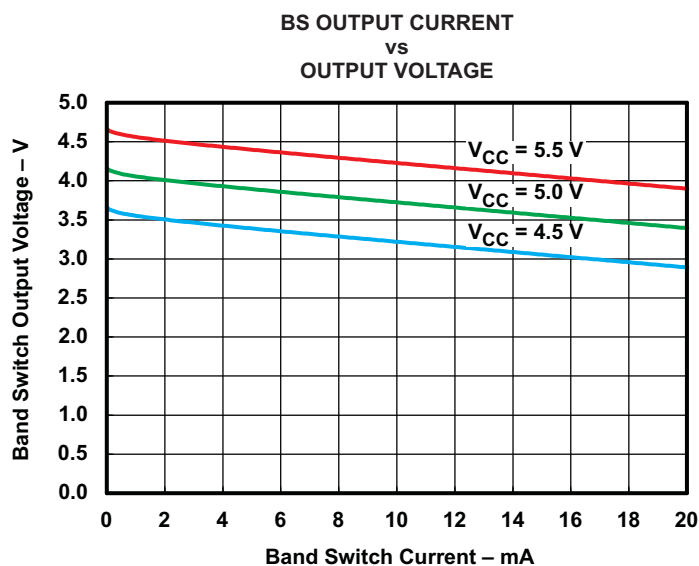


Figure 30. Band Switch Driver Output Voltage

TYPICAL CHARACTERISTICS (continued)

S-Parameter

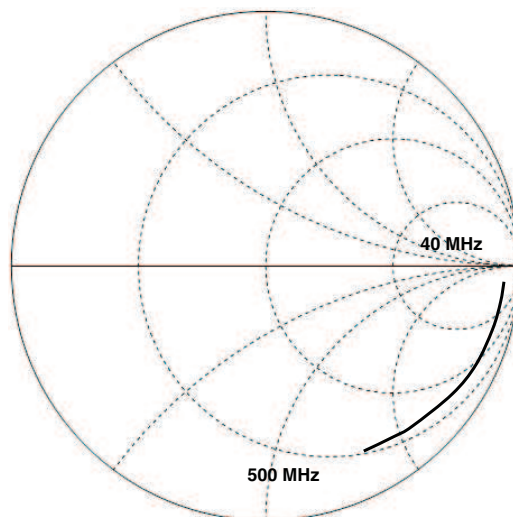


Figure 31. VLO RFIN, VHI RFIN

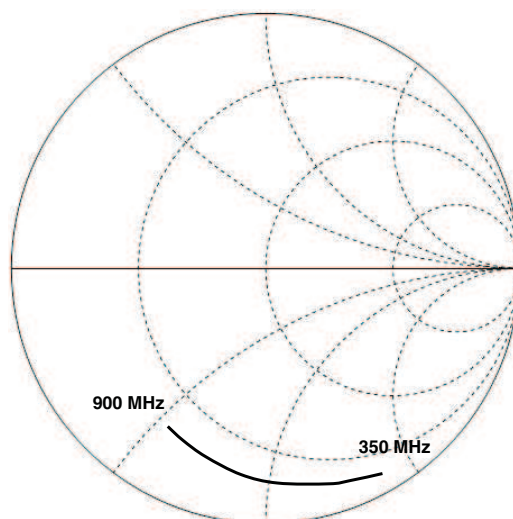


Figure 32. UHF RFIN

TYPICAL CHARACTERISTICS (continued)

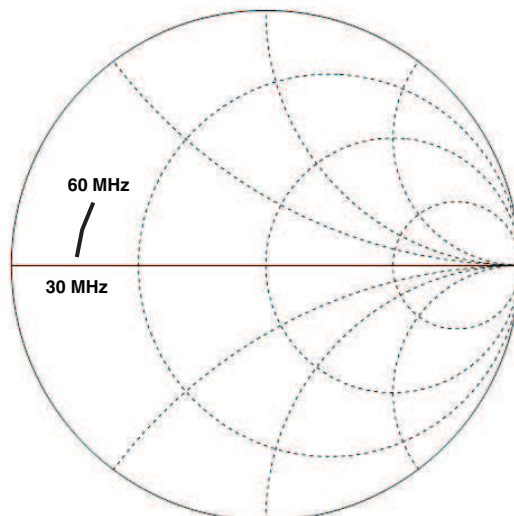


Figure 33. DIFOUT

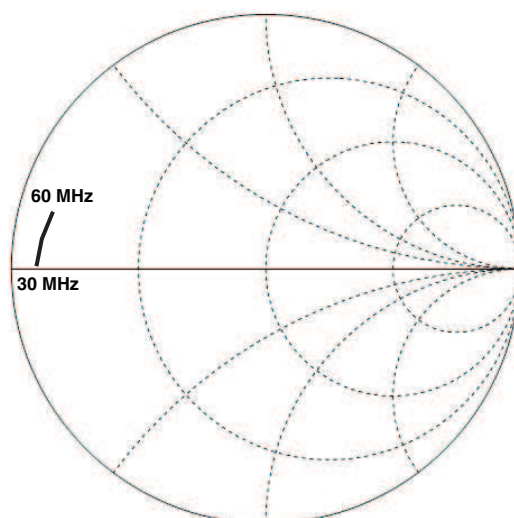
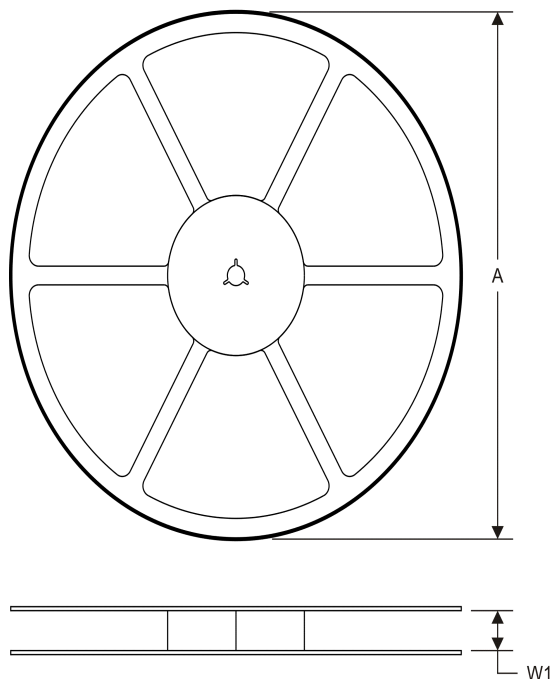
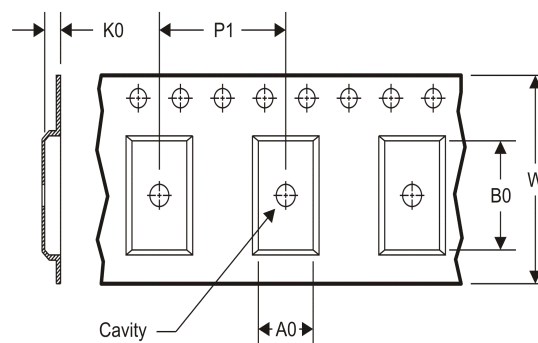


Figure 34. AIFOUT

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


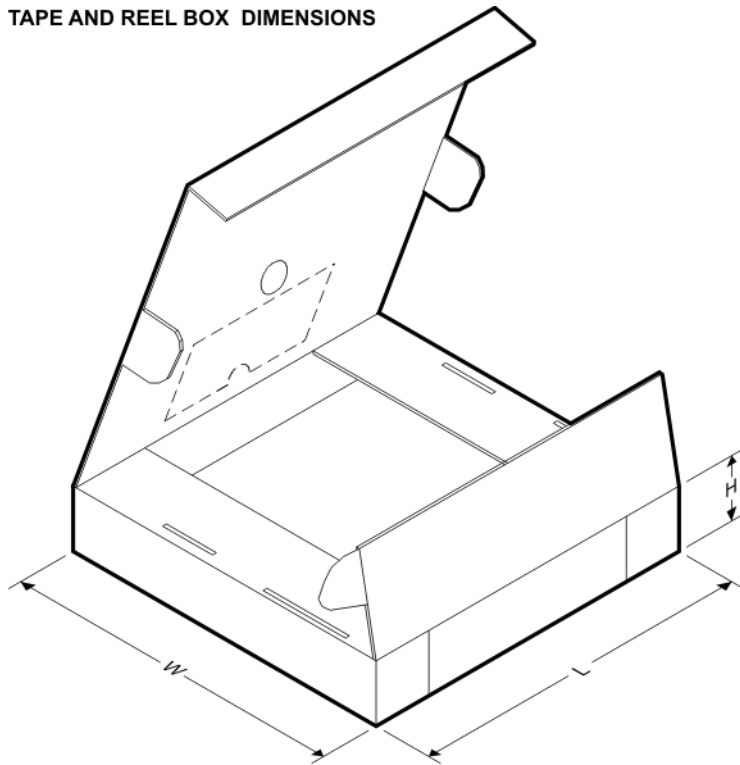
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

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
SN761642DBTR	TSSOP	DBT	38	2000	330.0	16.4	6.9	10.2	1.8	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS

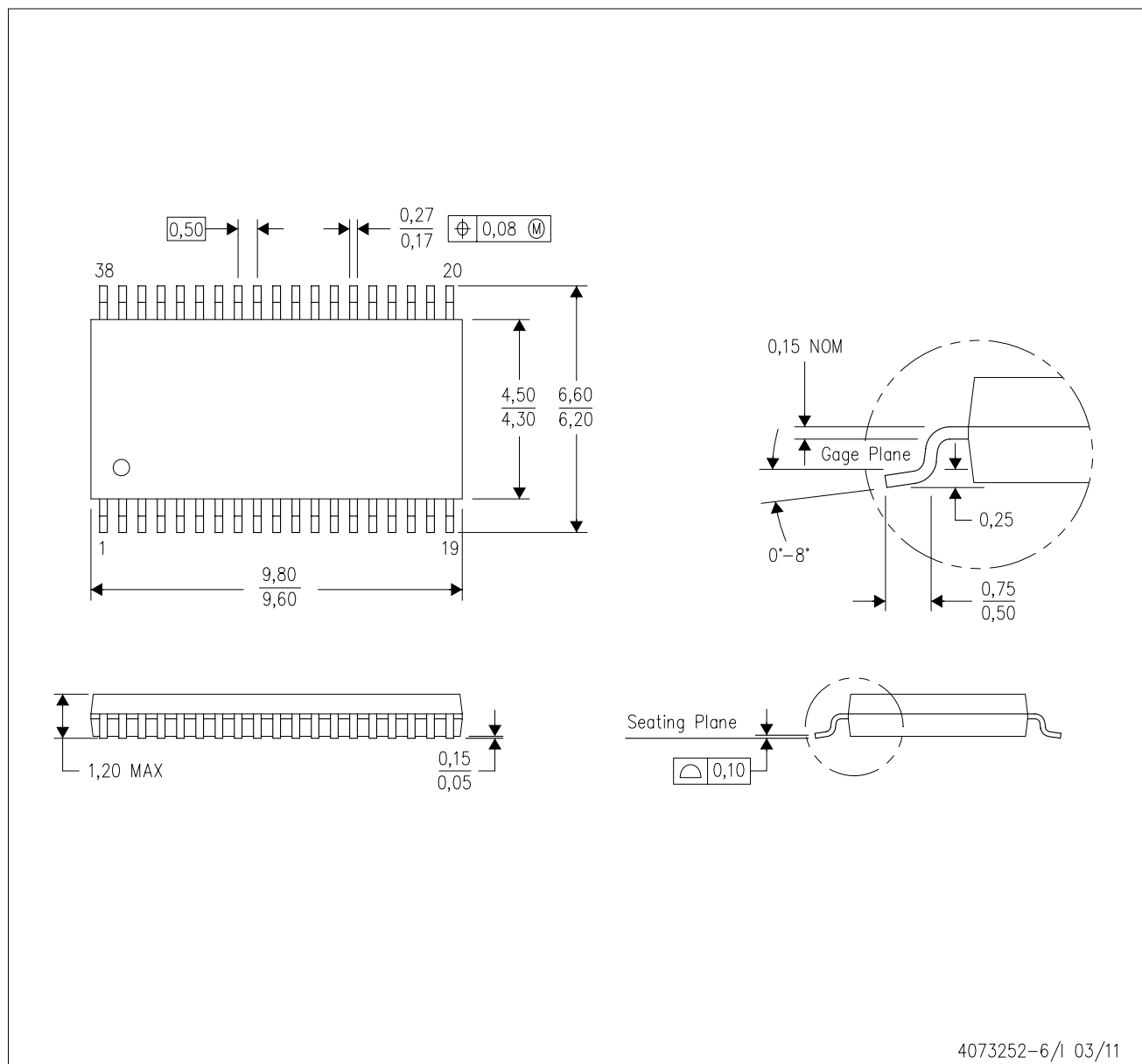


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN761642DBTR	TSSOP	DBT	38	2000	367.0	367.0	38.0

DBT (R-PDSO-G38)

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, enhancements, improvements and other changes to its semiconductor products and services per JESD46C and to discontinue any product or service per JESD48B. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license 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 significant portions 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. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components which meet ISO/TS16949 requirements, mainly for automotive use. Components which have not been so designated are neither designed nor intended for automotive use; and TI will not be responsible for any failure of such components to meet such requirements.

Products

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

Applications

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

TI E2E Community e2e.ti.com