



**THE DATASHEET OF
SN761645DBTR**



DIGITAL TV TUNER IC

 Check for Samples: [SN761645](#)

FEATURES

- Integrated Mixer/Oscillator/PLL and IF GCA
- VHF-L, VHF-H, UHF 3-Band Local Oscillator
- RF AGC Detector Circuit
- I2C Bus Protocol
- Seven-Step Charge Pump Current
- Four NPN Emitter-Follower Type Band Switch Drivers
- One Auxiliary Port/5-Level ADC
- Programmable Reference Divider Ratio
- Crystal Oscillator 4-MHz/16-MHz Support
- Selectable Digital IFOUT and Analog IFOUT
- Standby Mode
- 5-V Power Supply
- 38-Pin TSSOP Package

APPLICATIONS

- Digital TV
- Digital CATV
- Set-Top Box

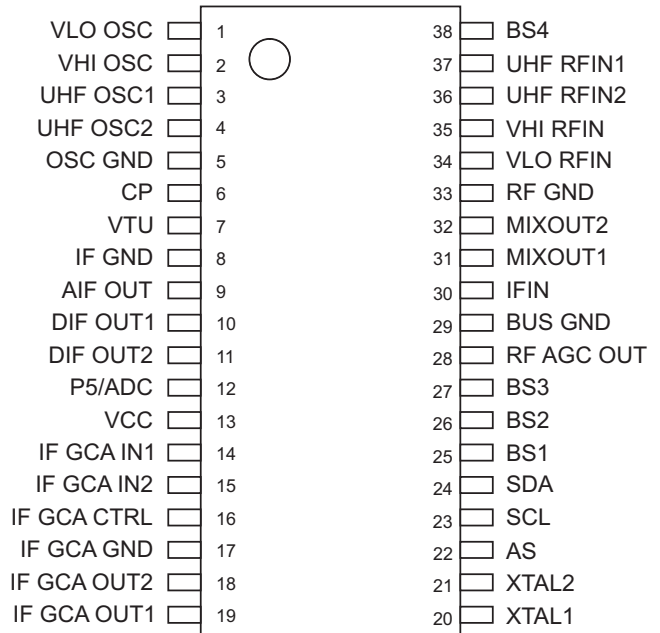
DESCRIPTION

The SN761645 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, RF AGC detector circuit, and IF gain controlled amplifier, and is available in a small outline package.

ORDERING INFORMATION

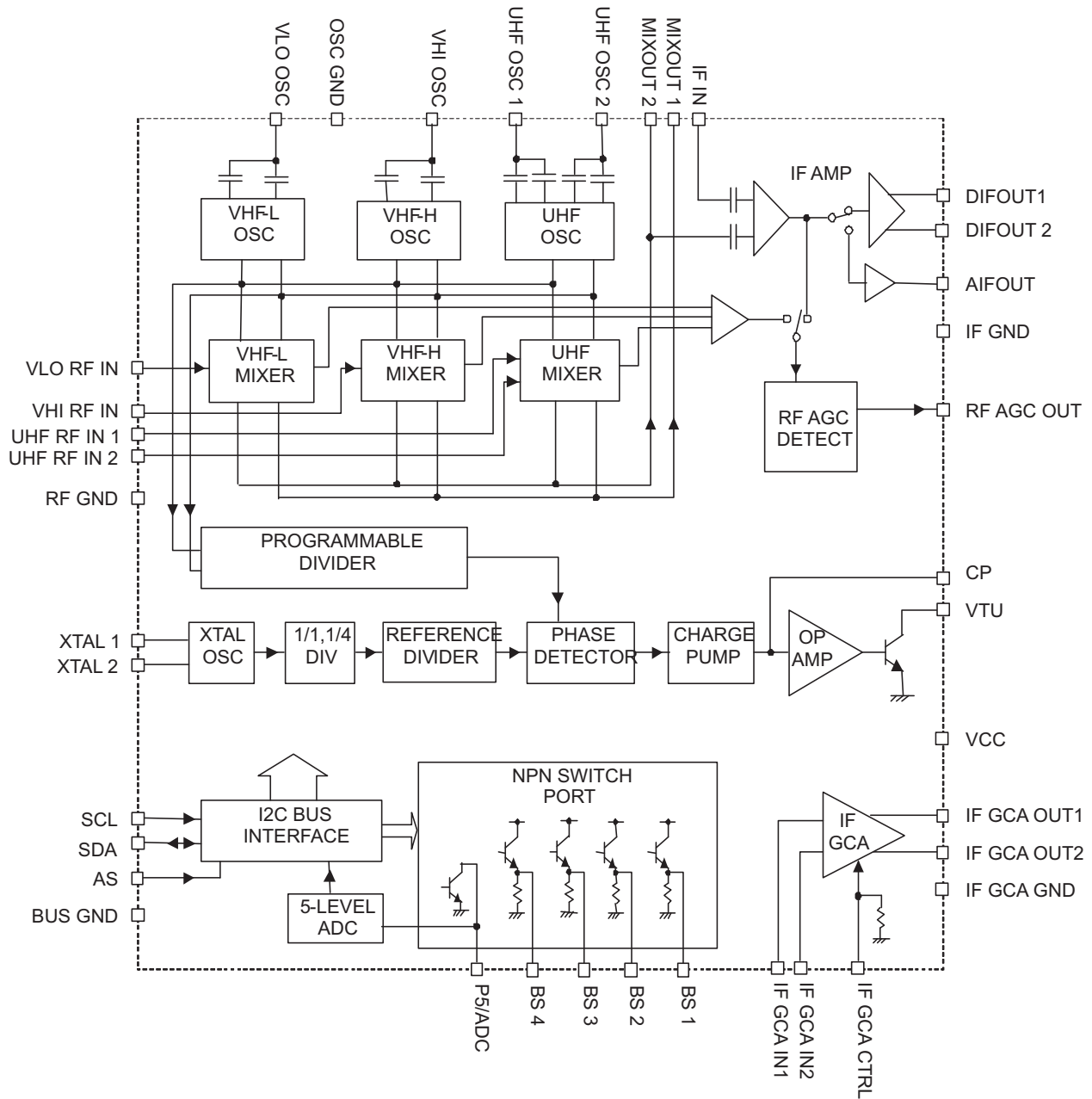
For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.

Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.

**DBT PACKAGE
(TOP VIEW)**


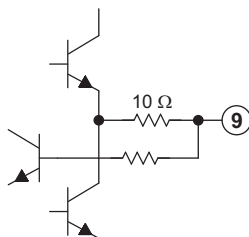
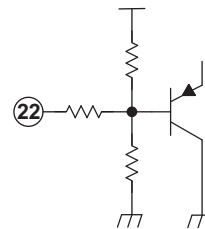
Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

FUNCTIONAL BLOCK DIAGRAM



TERMINAL FUNCTIONS

TERMINAL		DESCRIPTION	SCHEMATIC
NAME	NO.		
AIF OUT	9	IF amplifier output (unbalanced)	Figure 1
AS	22	Address selection input (open or connection to GND)	Figure 2
BS1	25	Band-switch 1 output (emitter follower)	Figure 3
BS2	26	Band-switch 2 output (emitter follower)	Figure 3
BS3	27	Band-switch 3 output (emitter follower)	Figure 3
BS4	38	Band-switch 4 output (emitter follower)	Figure 3
BUS GND	29	BUS ground	
CP	6	Charge pump output	Figure 4
DIF OUT1	10	IF amplifier balance output 1	Figure 5
DIF OUT2	11	IF amplifier balance output 2	Figure 5
IF GCA CTRL	16	IF GCA control voltage input	Figure 6
IF GCA GND	17	IF GCA ground	
IF GCA IN1	14	IF GCA input 1	Figure 7
IF GCA IN2	15	IF GCA input 2	Figure 7
IF GCA OUT1	19	IF GCA output 1	Figure 8
IF GCA OUT2	18	IF GCA output 2	Figure 8
IF GND	8	IF ground	
IF IN	30	IF amplifier input	Figure 9
MIX OUT1	31	Mixer output 1	Figure 10
MIX OUT2	32	Mixer output 2	Figure 10
OSC GND	5	Oscillator ground	
P5/ADC	12	Port-5 output/ADC input	Figure 11
RF AGC OUT	28	RF AGC output	Figure 12
RF GND	33	RF ground	
SCL	23	Serial clock input	Figure 13
SDA	24	Serial data input/output	Figure 14
UHF OSC1	3	UHF oscillator 1	Figure 15
UHF OSC2	4	UHF oscillator 2	Figure 15
UHF RF IN1	37	UHF RF input 1	Figure 16
UHF RF IN2	36	UHF RF input 2	Figure 16
VCC	13	Supply voltage	
VHI OSC	2	VHF HIGH oscillator	Figure 17
VHI RF IN	35	VHF HIGH RF input	Figure 18
VLO OSC	1	VHF LOW oscillator	Figure 19
VLO RF IN	34	VHF LOW RF input	Figure 20
VTU	7	Tuning voltage amplifier output	Figure 21
XTAL1	20	Crystal oscillator	Figure 22
XTAL2	21	Crystal oscillator	Figure 22


Figure 1. AIF OUT

Figure 2. AS

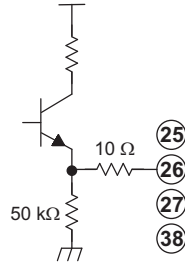


Figure 3. BS1, BS2, BS3, BS4

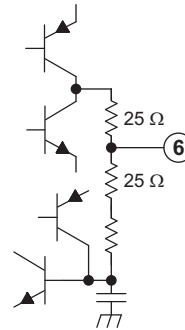


Figure 4. CP

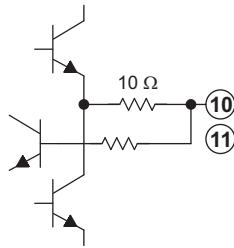


Figure 5. DIF OUT1, DIF OUT2

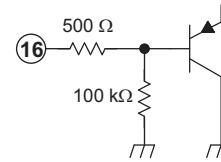


Figure 6. IF GCA CTRL

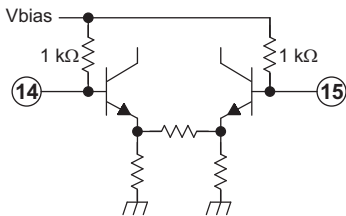


Figure 7. IF GCA IN1, IF GCA IN2

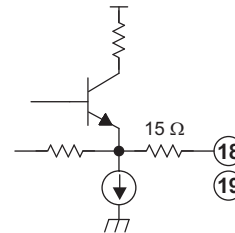


Figure 8. IF GCA OUT1, IF GCA OUT2

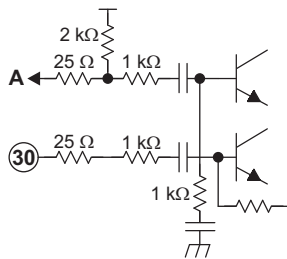


Figure 9. IF IN

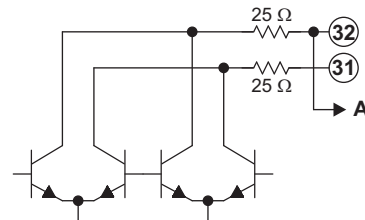


Figure 10. MIXOUT1, MIXOUT2

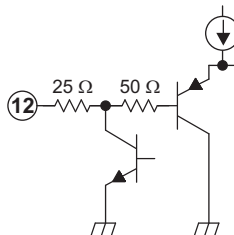


Figure 11. P5/ADC

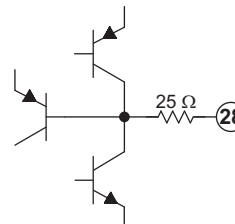


Figure 12. RF AGC OUT

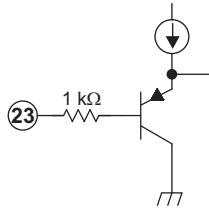


Figure 13. SCL

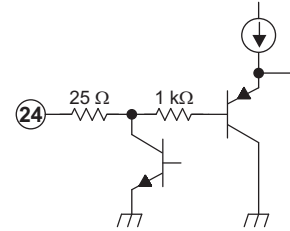


Figure 14. SDA

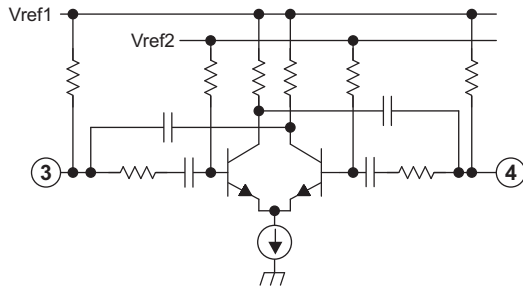


Figure 15. UHF OSC 1, UHF OSC 2

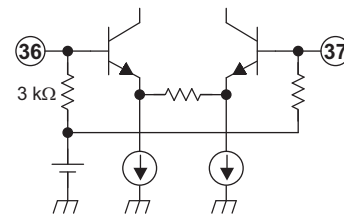


Figure 16. UHF RF IN1, UHF RF IN2

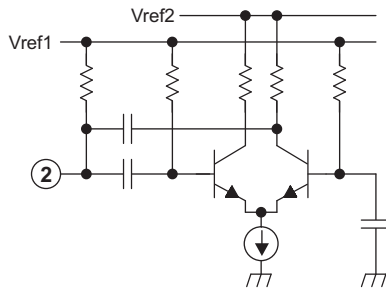


Figure 17. VHI OSC

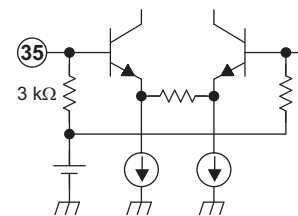


Figure 18. VHI RF IN

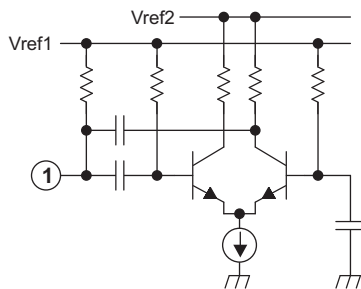


Figure 19. VLO OSC

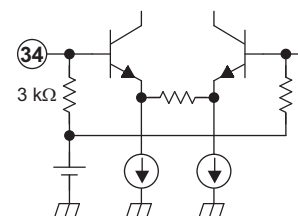


Figure 20. VLO RF IN

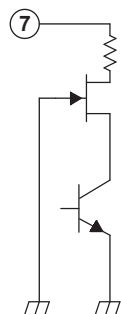


Figure 21. VTU

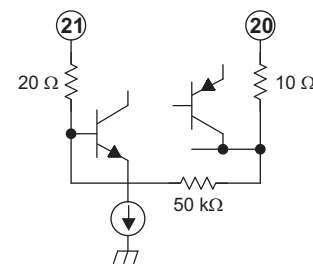


Figure 22. XTAL1, XTAL2

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, BUS 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		1277	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	5.3	V
VTU	Tuning supply voltage	VTU		30	33	V
I _{BS}	Output current of band switch	BS1 to BS4, one band switch on			10	mA
I _{P5}	Output current of port 5	P5			-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.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

IF IN1, MIX OUT 1, and MIX OUT 2 (pins 30, 31, and 32, respectively) 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

$V_{CC} = 4.5\text{ V to }5.3\text{ V}$, $T_A = -20^\circ\text{C to }85^\circ\text{C}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{CC1}	Supply current 1	BS[1:4] = 0100, IFGCA disabled		90		mA
I_{CC2}	Supply current 2	BS[1:4] = 0100, IFGCA enabled		110		mA
$I_{CC-STBY}$	Standby supply current	BS[1:4] = 1100		9		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_{ADC}	ADC input voltage	See Table 11	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)	$V_{SDA} = 5.3\text{ V}$			10	μA
f_{SCL}	Clock frequency (SCL)			100	400	kHz
t_{HD-DAT}	Data hold time	See Figure 23	0		3.45	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)				1	μs
t_f	Fall time (SCL, SDA)				0.3	μs
t_{SU-STO}	Stop setup time		0.6			μs

PLL and Band Switch

$V_{CC} = 4.5\text{ V to }5.3\text{ V}$, $T_A = -20^\circ\text{C to }85^\circ\text{C}$ (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	16	MHz
Z_{XTAL}	Crystal oscillator input impedance	4-MHz crystal, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$		2		k Ω
V_{VTUL}	Tuning amplifier low-level output voltage	$R_L = 20\text{ k}\Omega$, $VTU = 33\text{ V}$	0.2	0.45	0.6	V
I_{VTUOFF}	Tuning amplifier leakage current	Tuning amplifier = off, $VTU = 33\text{ V}$			10	μA
I_{CP000}	Charge-pump current	CP[2:0] = 000		35		μA
I_{CP001}		CP[2:0] = 001		70		
I_{CP010}		CP[2:0] = 010		140		
I_{CP011}		CP[2:0] = 011		210		
I_{CP100}		CP[2:0] = 100		280		
I_{CP101}		CP[2:0] = 101		350		
I_{CP110}		CP[2:0] = 110		420		
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)	$I_{BS} = 10\text{ mA}$		2.9		V
V_{BS2}		$I_{BS} = 10\text{ mA}$, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$		3.4	3.6	
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 24](#) reference measurement circuit at 50- Ω system, $IF = 36.15\text{ MHz}$ (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	3.7	4.2	4.7	V	
V_{OAGCL}	RFAGCOUT output low voltage (min level)	ATC = 1		0.3		V	
$V_{AGCSP00}$	Start-point IF output level	AISL = 0		ATP[2:0] = 000		114	dB μV
$V_{AGCSP01}$				ATP[2:0] = 001		112	
$V_{AGCSP02}$				ATP[2:0] = 010		110	
$V_{AGCSP03}$				ATP[2:0] = 011		108	
$V_{AGCSP04}$				ATP[2:0] = 100		106	
$V_{AGCSP05}$				ATP[2:0] = 101		104	
$V_{AGCSP06}$				ATP[2:0] = 110		102	

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

Mixer, Oscillator, IF Amplifier (DIF OUT)

$V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, measured in [Figure 24](#) reference measurement circuit at 50- Ω system, IF = 36.15 MHz (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
GC _{1D}	Conversion gain (mixer - IF amplifier), VHF-LOW	$f_{IN} = 50.85\text{ MHz}^{(1)}$		35		dB
GC _{3D}		$f_{IN} = 149.85\text{ MHz}^{(1)}$		35		dB
GC _{4D}	Conversion gain (mixer - IF amplifier), VHF-HIGH	$f_{IN} = 156.85\text{ MHz}^{(1)}$		35		dB
GC _{6D}		$f_{IN} = 425.85\text{ MHz}^{(1)}$		35		dB
GC _{7D}	Conversion gain (mixer - IF amplifier), UHF	$f_{IN} = 433.85\text{ MHz}^{(1)}$		35		dB
GC _{9D}		$f_{IN} = 857.85\text{ MHz}^{(1)}$		35		dB
NF _{1D}	Noise figure, VHF-LOW	$f_{IN} = 50.85\text{ MHz}$		9		dB
NF _{3D}		$f_{IN} = 149.85\text{ MHz}$		9		dB
NF _{4D}	Noise figure, VHF-HIGH	$f_{IN} = 156.85\text{ MHz}$		9		dB
NF _{6D}		$f_{IN} = 425.85\text{ MHz}$		10		dB
NF _{7D}	Noise figure, UHF	$f_{IN} = 433.85\text{ MHz}$		10		dB
NF _{9D}		$f_{IN} = 857.85\text{ MHz}$		11		dB
CM _{1D}	Input voltage causing 1% cross modulation distortion, VHF-LOW	$f_{IN} = 50.85\text{ MHz}^{(2)}$		92		dB μ V
CM _{3D}		$f_{IN} = 149.85\text{ MHz}^{(2)}$		92		dB μ V
CM _{4D}	Input voltage causing 1% cross modulation distortion, VHF-HIGH	$f_{IN} = 156.85\text{ MHz}^{(2)}$		92		dB μ V
CM _{6D}		$f_{IN} = 425.85\text{ MHz}^{(2)}$		92		dB μ V
CM _{7D}	Input voltage causing 1% cross modulation distortion, UHF	$f_{IN} = 433.85\text{ MHz}^{(2)}$		92		dB μ V
CM _{9D}		$f_{IN} = 857.85\text{ MHz}^{(2)}$		92		dB μ V
V _{IF01D}	IF output voltage, VHF-LOW	$f_{IN} = 50.85\text{ MHz}$		117		dB μ V
V _{IF03D}		$f_{IN} = 149.85\text{ MHz}$		117		dB μ V
V _{IF04D}	IF output voltage, VHF-HIGH	$f_{IN} = 156.85\text{ MHz}$		117		dB μ V
V _{IF06D}		$f_{IN} = 425.85\text{ MHz}$		117		dB μ V
V _{IF07D}	IF output voltage, UHF	$f_{IN} = 433.85\text{ MHz}$		117		dB μ V
V _{IF09D}		$f_{IN} = 857.85\text{ MHz}$		117		dB μ V
Φ_{PLVL1D}	Phase noise, VHF-LOW	$f_{IN} = 50.85\text{ MHz}^{(3)}$		-92		dBc/Hz
Φ_{PLVL3D}		$f_{IN} = 149.85\text{ MHz}^{(4)}$		-91		dBc/Hz
Φ_{PLVL4D}	Phase noise, VHF-HIGH	$f_{IN} = 156.85\text{ MHz}^{(3)}$		-86		dBc/Hz
Φ_{PLVL6D}		$f_{IN} = 425.85\text{ MHz}^{(4)}$		-83		dBc/Hz
Φ_{PLVL7D}	Phase noise, UHF	$f_{IN} = 433.85\text{ MHz}^{(3)}$		-79		dBc/Hz
Φ_{PLVL9D}		$f_{IN} = 857.85\text{ MHz}^{(4)}$		-77		dBc/Hz

(1) RF input level = 70 dB μ V, differential output

(2) $f_{undes} = f_{des} \pm 7\text{ MHz}$, Pin = 70 dB μ V, AM 1 kHz, 30%, DES/CM = S/I = 46 dB

(3) Offset = 1 kHz, CP current = 70 μ A, reference divider = 24

(4) Offset = 1 kHz, CP current = 420 μ A, reference divider = 24

Mixer, Oscillator, IF Amplifier (AIF OUT)

$V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, measured in Figure 24 reference measurement circuit at 50- Ω system, IF = 36.15 MHz (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
GC _{1A}	Conversion gain (mixer - IF amplifier), VHF-LOW	$f_{IN} = 50.85\text{ MHz}^{(1)}$		29		dB
GC _{3A}		$f_{IN} = 149.85\text{ MHz}^{(1)}$		29		dB
GC _{4A}	Conversion gain (mixer - IF amplifier), VHF-HIGH	$f_{IN} = 156.85\text{ MHz}^{(1)}$		29		dB
GC _{6A}		$f_{IN} = 425.85\text{ MHz}^{(1)}$		29		dB
GC _{7A}	Conversion gain (mixer - IF amplifier), UHF	$f_{IN} = 433.85\text{ MHz}^{(1)}$		29		dB
GC _{9A}		$f_{IN} = 857.85\text{ MHz}^{(1)}$		29		dB
NF _{1A}	Noise figure, VHF-LOW	$f_{IN} = 50.85\text{ MHz}$		9		dB
NF _{3A}		$f_{IN} = 149.85\text{ MHz}$		9		dB
NF _{4A}	Noise figure, VHF-HIGH	$f_{IN} = 156.85\text{ MHz}$		9		dB
NF _{6A}		$f_{IN} = 425.85\text{ MHz}$		10		dB
NF _{7A}	Noise figure, UHF	$f_{IN} = 433.85\text{ MHz}$		10		dB
NF _{9A}		$f_{IN} = 857.85\text{ MHz}$		11		dB
CM _{1A}	Input voltage causing 1% cross modulation distortion, VHF-LOW	$f_{IN} = 50.85\text{ MHz}^{(2)}$		87		dB μ V
CM _{3A}		$f_{IN} = 149.85\text{ MHz}^{(2)}$		87		dB μ V
CM _{4A}	Input voltage causing 1% cross modulation distortion, VHF-HIGH	$f_{IN} = 156.85\text{ MHz}^{(2)}$		87		dB μ V
CM _{6A}		$f_{IN} = 425.85\text{ MHz}^{(2)}$		87		dB μ V
CM _{7A}	Input voltage causing 1% cross modulation distortion, UHF	$f_{IN} = 433.85\text{ MHz}^{(2)}$		87		dB μ V
CM _{9A}		$f_{IN} = 857.85\text{ MHz}^{(2)}$		87		dB μ V
V _{IF01A}	IF output voltage, VHF-LOW	$f_{IN} = 50.85\text{ MHz}$		117		dB μ V
V _{IF03A}		$f_{IN} = 149.85\text{ MHz}$		117		dB μ V
V _{IF04A}	IF output voltage, VHF-HIGH	$f_{IN} = 156.85\text{ MHz}$		117		dB μ V
V _{IF06A}		$f_{IN} = 425.85\text{ MHz}$		117		dB μ V
V _{IF07A}	IF output voltage, UHF	$f_{IN} = 433.85\text{ MHz}$		117		dB μ V
V _{IF09A}		$f_{IN} = 857.85\text{ MHz}$		117		dB μ V
Φ_{PLVL1A}	Phase noise, VHF-LOW	$f_{IN} = 50.85\text{ MHz}^{(3)}$		-92		dBc/Hz
Φ_{PLVL3A}		$f_{IN} = 149.85\text{ MHz}^{(3)}$		-96		dBc/Hz
Φ_{PLVL4A}	Phase noise, VHF-HIGH	$f_{IN} = 156.85\text{ MHz}^{(3)}$		-85		dBc/Hz
Φ_{PLVL6A}		$f_{IN} = 425.85\text{ MHz}^{(3)}$		-88		dBc/Hz
Φ_{PLVL7A}	Phase noise, UHF	$f_{IN} = 433.85\text{ MHz}^{(3)}$		-80		dBc/Hz
Φ_{PLVL9A}		$f_{IN} = 857.85\text{ MHz}^{(3)}$		-85		dBc/Hz

(1) RF input level = 70 dB μ V

(2) $f_{undes} = f_{des} \pm 7\text{ MHz}$, Pin = 70 dB μ V, AM 1 kHz, 30%, DES/CM = S/I = 46 dB

(3) Offset = 10 kHz, CP current = 35 μ A, reference divider = 64

IF Gain Controlled Amplifier

$V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$, measured in [Figure 24](#) reference measurement circuit at 50- Ω system, $f_{IF} = 36.15\text{ MHz}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{IFGCA}	Input current (IF GCA CTRL)	$V_{IFGCA} = 3\text{ V}$		60	90	μA
$V_{IFGCAMAX}$	Maximum gain control voltage	Gain maximum	3		V_{CC}	V
$V_{IFGCAMIN}$	Minimum gain control voltage	Gain minimum	0		0.2	V
$G_{IFGCAMAX}$	Maximum gain	$V_{IFGCA} = 3\text{ V}$		67		dB
$G_{IFGCAMIN}$	Minimum gain	$V_{IFGCA} = 0\text{ V}$		3		dB
GCR_{IFGCA}	Gain control range	$V_{IFGCA} = 0\text{ V to }3\text{ V}$		64		dB
$V_{IFGCAOUT}$	Output voltage	Single-ended output, $V_{IFGCA} = 3\text{ V}$		2.1		V _{pp}
NF_{IFGCA}	Noise figure	$V_{IFGCA} = 3\text{ V}$		11		dB
$IM3_{IFGCA}$	Third order intermodulation distortion	$f_{IFGCAIN1} = 35.65\text{ MHz}$, $f_{IFGCAIN2} = 36.65\text{ MHz}$, $V_{IFGCAOUT} = -2\text{ dBm}$, $V_{IFGCA} = 3\text{ V}$		-50		dBc
$IIP3_{IFGCA}$	Input intercept point	$V_{IFGCA} = 0\text{ V}$		11		dBm
$R_{IFGCAIN}$	Input resistance (IF GCA IN1, IF GCA IN2)			1		k Ω
$R_{IFGCAOUT}$	Output resistance (IF GCA OUT1, IF GCA OUT2)			25		Ω

FUNCTIONAL DESCRIPTION

I²C Bus Mode

I²C Write Mode ($\overline{R/W} = 0$)

Table 1. Write Data Format

	MSB						LSB		
Address Byte (ADB)	1	1	0	0	0	0	MA	R/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	DISGCA	IFDA	CP2	IXD4	A ⁽¹⁾

(1) A = acknowledge

Table 2. Write Data Symbol Description

SYMBOL	DESCRIPTION	DEFAULT													
MA	Address set bit MA = 0 : AS pin = 0 V (connection to GND) MA = 1 : AS pin = Open														
N[14:0]	Programmable counter set bits $N = N14 \times 2^{14} + N13 \times 2^{13} + \dots + N1 \times 2 + N0$	N14 = N13 = N12 = ... = N0 = 0													
ATP[2:0]	RF AGC start-point control bits (see Table 3)	ATP[2:0] = 000													
RS[2:0]	Reference divider ratio-selection bits (see Table 4)	RS[2:0] = 000													
CP[2:0]	Charge-pump current set bits (see Table 5)	CP[2:0] = 000													
P5	Port output / ADC input control bit P5 = 0 : ADC input P5 = 1 : Tr = ON	P5 = 0													
BS[4:1]	Band-switch driver output control bits BSn = 0: Tr = OFF BSn = 1: Tr = ON	BS[4:1] = 0000													
	Band selection and standby function control bits <table border="0"> <tr> <td>BS2</td> <td>BS1</td> <td></td> </tr> <tr> <td>0</td> <td>1</td> <td>VHF-LO</td> </tr> <tr> <td>1</td> <td>0</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</td> </tr> </table>		BS2	BS1		0	1	VHF-LO	1	0	VHF-HI	0	0	UHF	1
BS2	BS1														
0	1	VHF-LO													
1	0	VHF-HI													
0	0	UHF													
1	1	Standby mode / stop MOP function													
ATC	RFAGC output current-set bit ATC = 0: Source current = 300nA ATC = 1: Source current = 9uA	ATC = 0													
MODE	Device mode selection bit MODE = 0 : Test mode MODE = 1 : Normal operation	MODE = 0													
DISGCA	Other control bits DISGCA IF GCA control bit (see Table 6)	DISGCA = 0													
IFDA	IFDA AIF/DIF OUT selection bit (see Table 7)	IFDA = 0													
AISL	AISL RFAGC detector input selection bit (see Table 8)	AISL = 0													
IXD4	IXD4 Reference divider control bit (see Table 4)	IXD4 = 0													

Table 3. RF AGC Start Point

MODE	ATP2	ATP1	ATP0	IFOUT LEVEL	
				(dB μ V)	(mVp-p)
1	0	0	0	114	1417
1	0	0	1	112	1126
1	0	1	0	110	894
1	0	1	1	108	710
1	1	0	0	106	564
1	1	0	1	104	448
1	1	1	0	102	356
1	1	1	1	Disabled	

Table 4. Reference Divider Ratio

MODE	IXD4	RS2	RS1	RS0	REFERENCE DIVIDER RATIO
1	0	0	0	0	96
1	0	0	0	1	112
1	0	0	1	0	128
1	0	0	1	1	256
1	0	1	0	0	512
1	0	1	0	1	320
1	1	0	0	0	24
1	1	0	0	1	28
1	1	0	1	0	32
1	1	0	1	1	64
1	1	1	0	0	128
1	1	1	0	1	80
1	X	1	1	1	Forbidden

Table 5. Charge-Pump Current

MODE	CP2	CP1	CP0	CHARGE PUMP CURRENT (μ A)
1	0	0	0	35
1	0	0	1	70
1	0	1	0	140
1	0	1	1	210
1	1	0	0	280
1	1	0	1	350
1	1	1	0	420
1	1	1	1	Forbidden

Table 6. IF GCA Control

MODE	DISGCA	IF GCA FUNCTION
1	0	IF GCA enabled
1	1	IF GCA disabled

Table 7. AIF / DIF OUT Selection

MODE	IFDA	IF OUT FUNCTION
1	0	DIF OUT 1,2 selected
1	1	AIF OUT selected

Table 8. RF AGC Detector Input Selection

MODE	AISL	RF AGC DETECTOR INPUT
1	0	IF amplifier selected
1	1 ⁽¹⁾	Mixer selected

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

I²C Read Mode (R/W = 1)**Table 9. Read Data Format**

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

- (1) A = acknowledge

Table 10. Read Data Symbol Description

SYMBOL	DESCRIPTION	DEFAULT
MA	Address set bit MA = 0 : VLO OSC/AS pin = 0 V (connection to GND) MA = 1 : VLO OSC/AS pin = Open	
POR	Power-on-reset flag POR set: power on POR reset: end-of-data transmission procedure	POR = 1
FL	In-lock flag ⁽¹⁾ FL = 0 : PLL unlocked FL = 1 : PLL locked	
A[2:0]	Digital data of ADC (see Table 11) Bit P5 must be set to 0.	

- (1) Lock detector works by using phase error pulse at the phase detector. Lock flag (FL) is set or reset according to this pulse-width discriminator. Hence, instability of the PLL may cause the lock detection circuit to malfunction. To stabilize the PLL, it is required to evaluate application circuit in various condition of loop-gain (loop filter, CP current) and to verify under operation of the actual application.

Table 11. 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 × 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

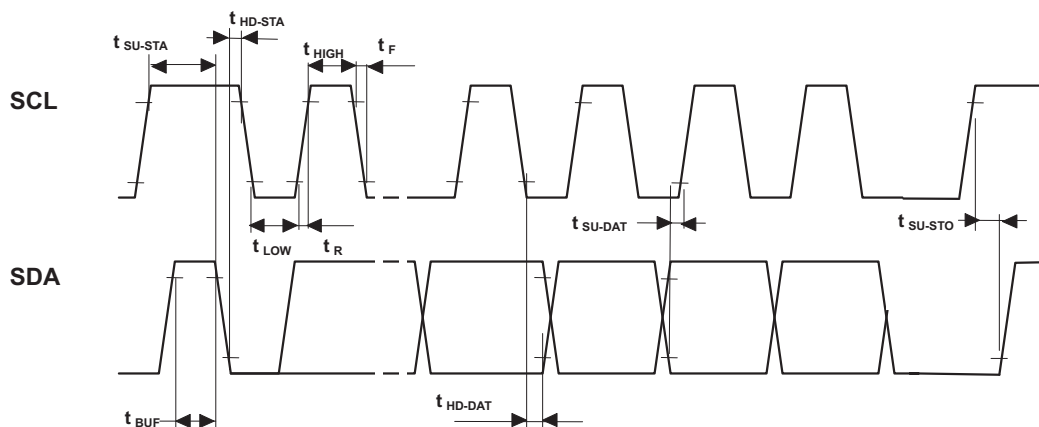
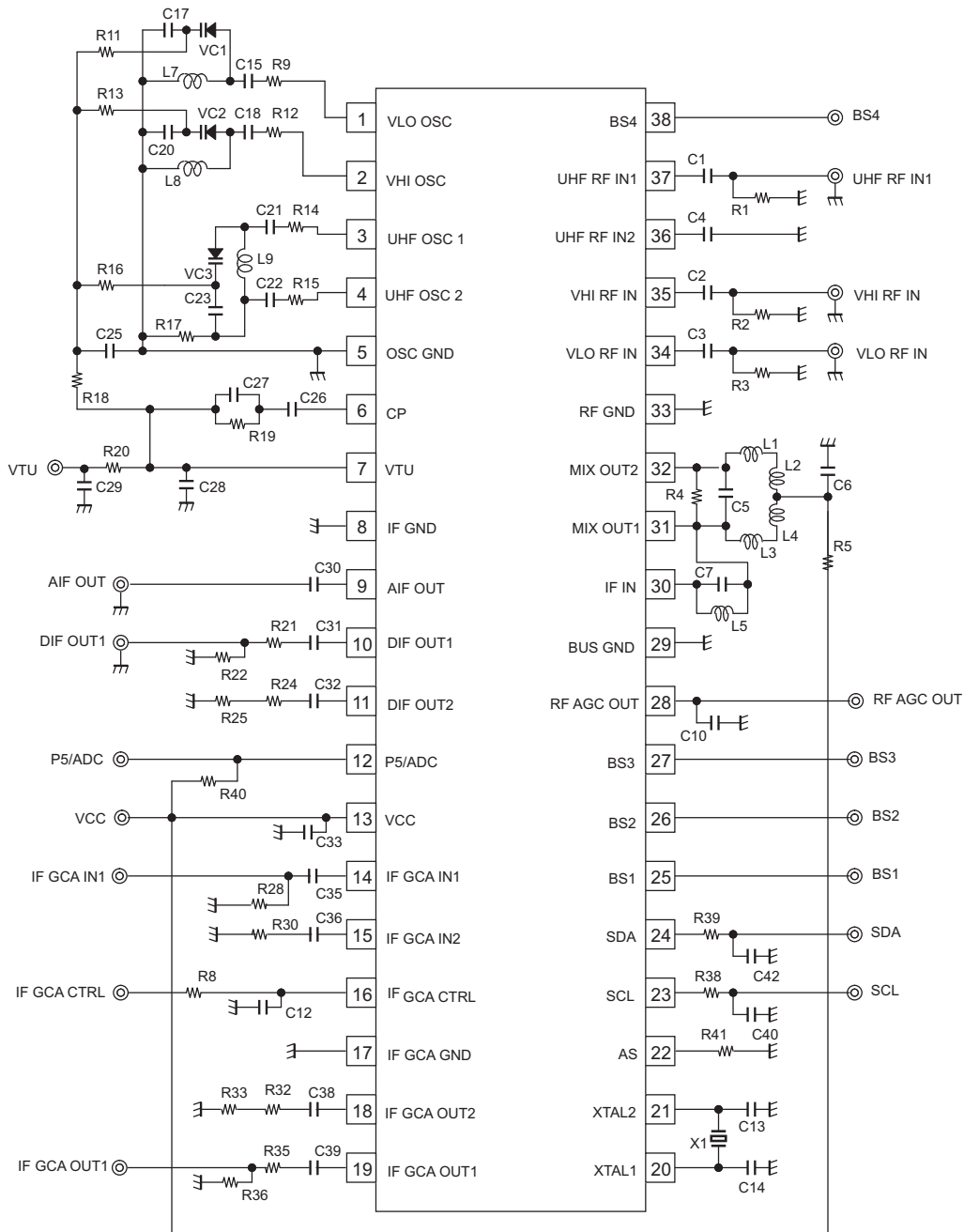


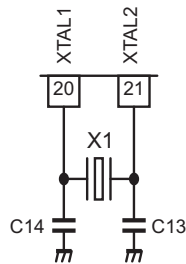
Figure 23. I²C Timing

APPLICATION INFORMATION



NOTE: 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 24. Reference Measurement Circuit



Crystal X1		Capacitors	
Frequency	Type	C13	C14
4 MHz	HC49SFNB04000H0 (Kyocera)	27 pF	27 pF
16 MHz	CX3225GB16000D0 (Kyocera)	14 pF	14 pF

Figure 25. Reference Crystal Oscillation Circuit

Table 12. Component Values for Measurement Circuit

PART NAME	VALUE	PART NAME	VALUE
C1 (UHF RFIN1)	2.2nF	R1 (UHF RFIN1)	Open (51Ω)
C2 (VHI RFIN)	2.2nF	R2 (VHI RFIN)	Open (51Ω)
C3 (VLO RFIN)	2.2nF	R3 (VLO RFIN)	Open (51Ω)
C4 (UHF RFIN)	2.2nF	R4 (MIXOUT)	Open
C5 (MIXOUT)	5.5pF	R5 (MIXOUT)	0Ω
C6 (MIXOUT)	2.2nF	R8 (IF GCA CTRL)	0Ω
C7 (IF IN)	0Ω	R9 (VLO OSC)	0Ω
C10 (RF AGC OUT)	0.15μF	R11 (VLO OSC)	3.3kΩ
C12 (IF GCA CTRL)	0.1μF	R12 (VHI OSC)	10Ω
C13 (XTAL2)	27pF	R13 (VHI OSC)	3.3kΩ
C14 (XTAL1)	27pF	R14 (UHF OSC)	4.7Ω
C15 (VLO OSC)	4pF	R15 (UHF OSC)	4.7Ω
C17 (VLO OSC)	68pF	R16 (UHF OSC)	1kΩ
C18 (VHI OSC)	10pF	R17 (UHF OSC)	2.2kΩ
C20 (VHI OSC)	130pF	R18 (VTU)	3.3kΩ
C21 (UHF OSC)	6pF	R19 (CP)	82kΩ
C22 (UHF OSC)	6pF	R20 (VTU)	22kΩ
C23 (UHF OSC)	20pF	R21 (DIF OUT1)	200Ω
C25 (VTU)	2.2nF/50V	R22 (DIF OUT1)	Open
C26 (CP)	3.9nF/50V	R24 (DIF OUT2)	200Ω
C27 (CP)	10pF/50V	R25 (DIF OUT2)	51Ω
C28 (VTU)	150pF/50V	R28 (IF GCA IN1)	(51Ω)
C29 (VTU)	2.2nF/50V	R30 (IF GCA IN2)	(0Ω)
C30 (AIF OUT)	2.2nF	R32 (IF GCA OUT2)	200Ω
C31 (DIF OUT1)	2.2nF	R33 (IF GCA OUT2)	51Ω
C32 (DIF OUT2)	2.2nF	R35 (IF GCA OUT1)	200Ω
C33 (VCC)	0.1μF	R36 (IF GCA OUT1)	Open
C35 (IF GCA IN1)	2.2nF	R38 (SCL)	330Ω
C36 (IF GCA IN2)	2.2nF	R39 (SDA)	330Ω
C38 (IF GCA OUT2)	2.2nF	R40 (P5)	Open
C39 (IF GCA OUT1)	2.2nF	R41 (AS)	Open
C40 (SCL)	Open		
C42 (SDA)	Open	VC1 (VLO OSC)	KDV270E
		VC2 (VHI OSC)	KDV270E
		VC3 (UHF OSC)	KDV216E
		X1	4MHz crystal

Table 12. Component Values for Measurement Circuit (continued)

PART NAME	VALUE	PART NAME	VALUE
L1 (MIXOUT)	470nH (LK1608R47KT Taiyo Yuden)		
L2 (MIXOUT)	560nH (LK1608R56KT Taiyo Yuden)		
L3 (MIXOUT)	470nH (LK1608R47KT Taiyo Yuden)		
L4 (MIXOUT)	560nH (LK1608R56KT Taiyo Yuden)		
L5 (IFIN)	Open		
L7 (VLO OSC)	φ3.0mm, 9T, wire0.32mm		
L8 (VHI OSC)	φ1.8mm, 4T, wire0.4mm		
L9 (UHF OSC)	φ1.8mm, 2T, wire0.4mm		

IF frequency: 36 MHz
 Local frequency range: VHF-LOW: 87 to 186 MHz
 VHF-HIGH: 193 to 462 MHz
 UHF: 470 to 894 MHz

Test Circuits

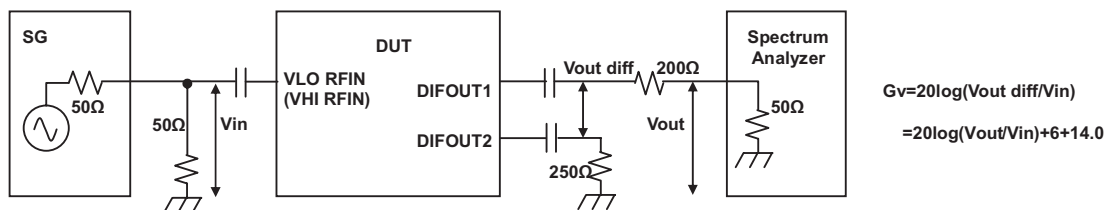


Figure 26. VHF Conversion Gain Measurement Circuit (at DIFOUT)

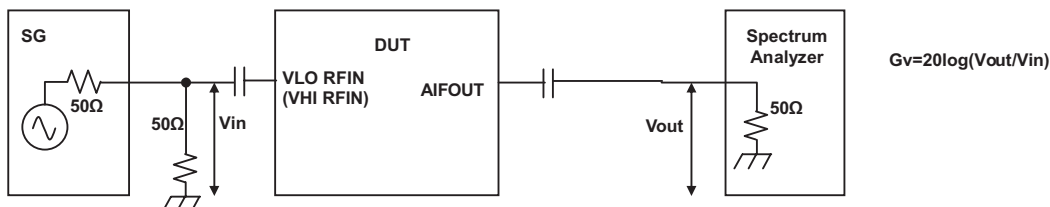


Figure 27. VHF Conversion Gain Measurement Circuit (at AIFOUT)

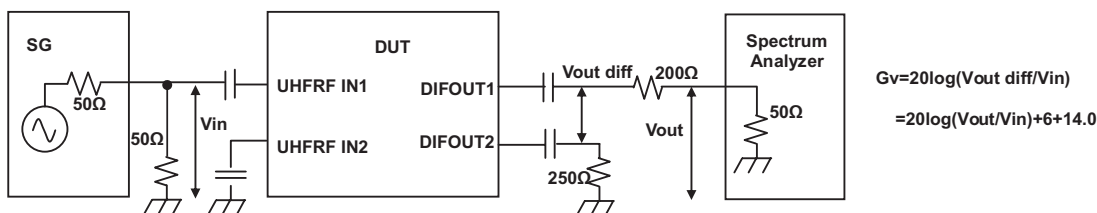


Figure 28. UHF Conversion Gain Measurement Circuit (at DIFOUT)

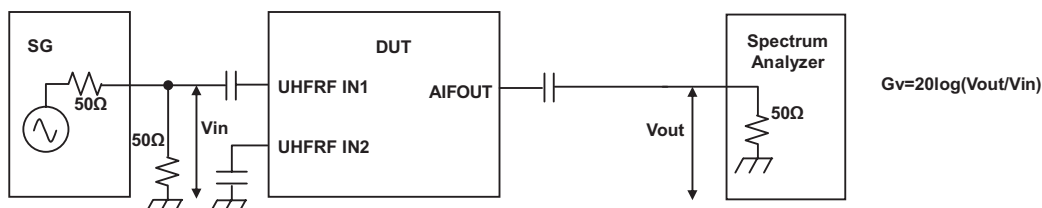


Figure 29. UHF Conversion Gain Measurement Circuit (at AIFOUT)

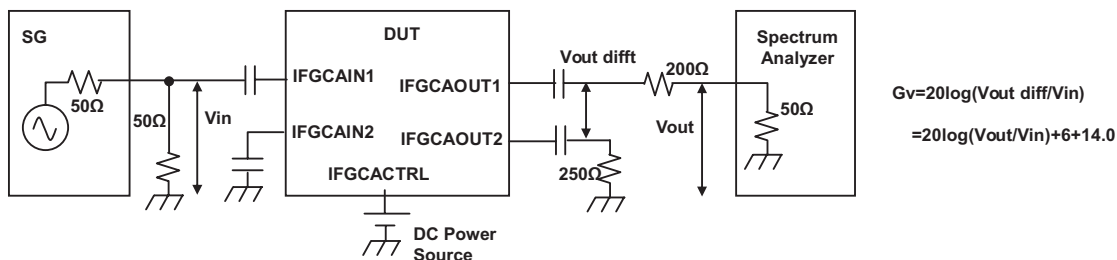


Figure 30. IF GCA Gain Measurement Circuit

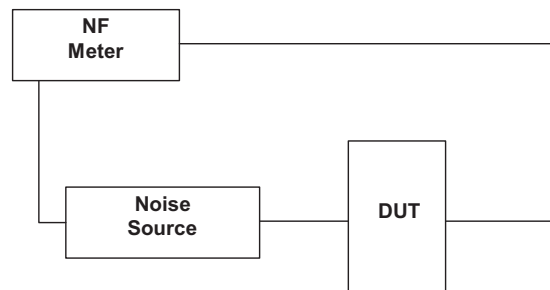


Figure 31. Noise Figure Measurement Circuit

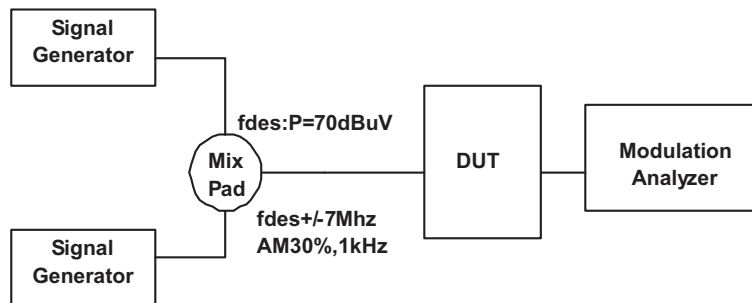


Figure 32. 1% Cross Modulation Distortion Measurement Circuit

TYPICAL CHARACTERISTICS

Band Switch Driver Output Voltage (BS1-BS4)

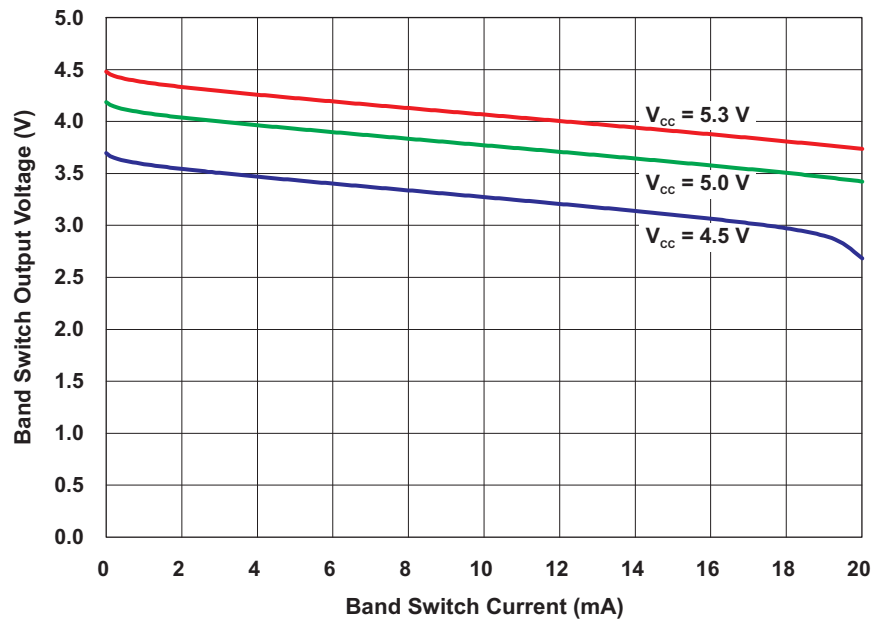


Figure 33. Band Switch Driver Output Voltage

S-Parameter

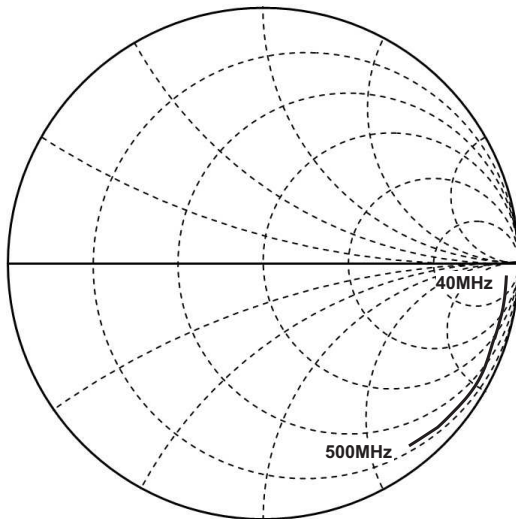


Figure 34. VLO, VHI RFIN

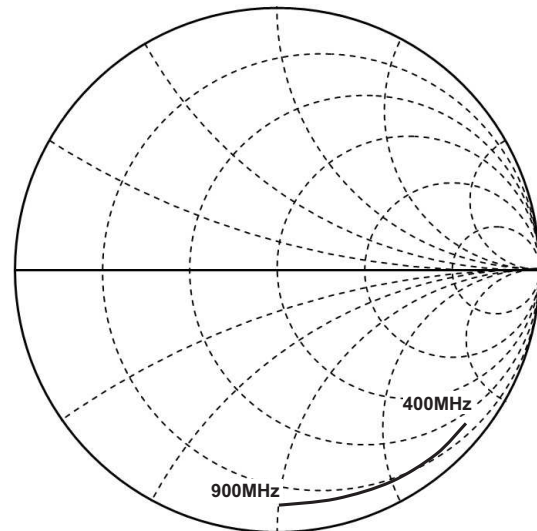


Figure 35. UHF RFIN

TYPICAL CHARACTERISTICS (continued)

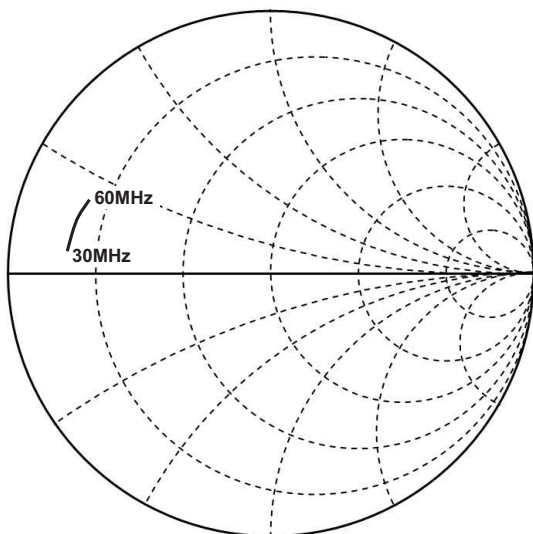


Figure 36. DIFOUT

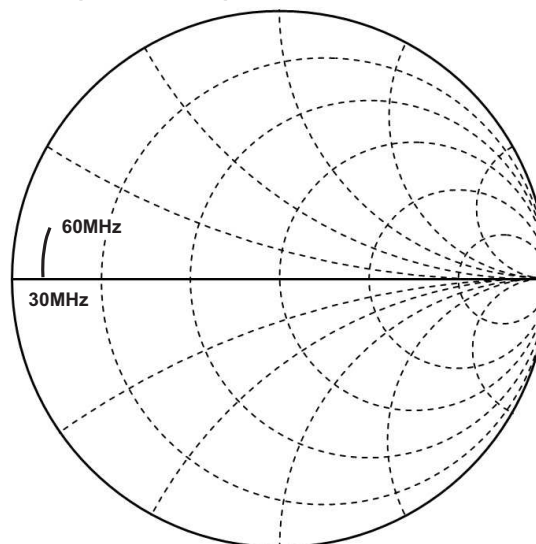


Figure 37. AIFOUT

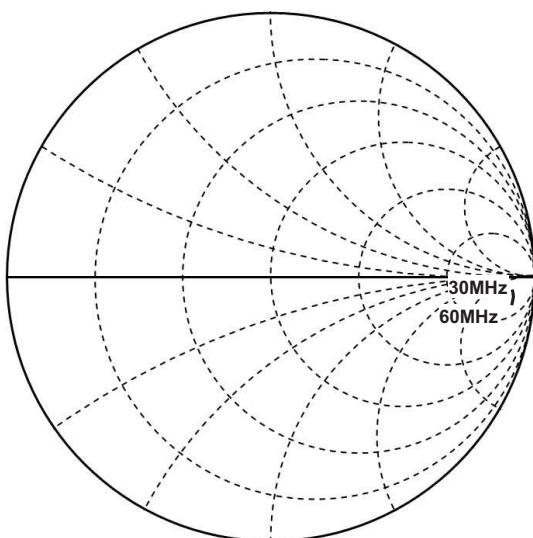


Figure 38. IF GCA IN

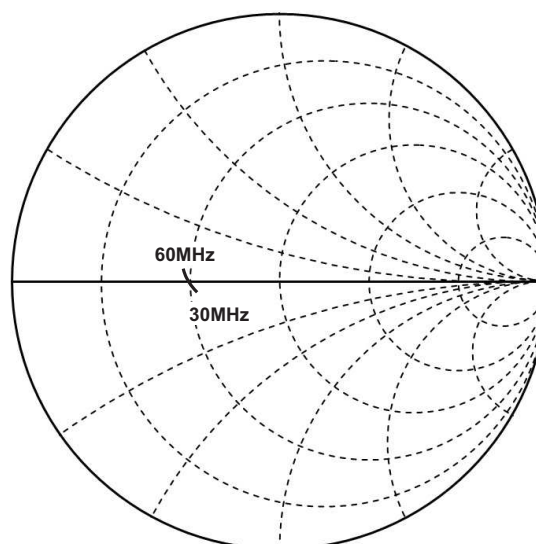


Figure 39. IF GCAOUT

TYPICAL CHARACTERISTICS (continued)

IF GCA Gain vs Control Voltage

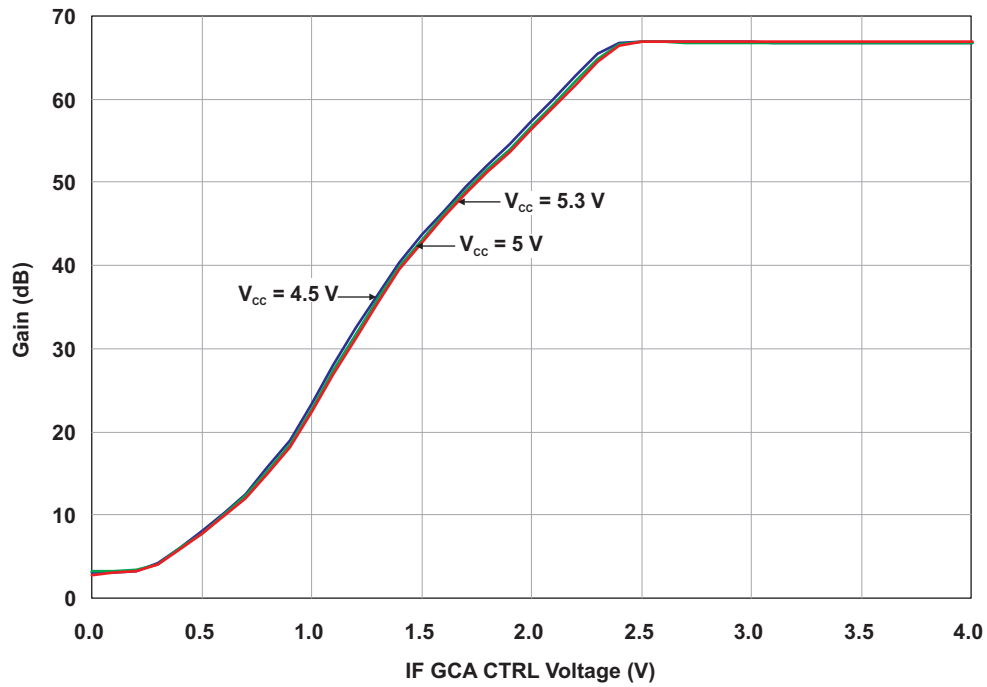


Figure 40. IF GCA Gain vs Control Voltage

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN761645DBTR	OBSOLETE	TSSOP	DBT	38		TBD	Call TI	Call TI	-20 to 85	B1645	

(1) 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.

(2) 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)

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

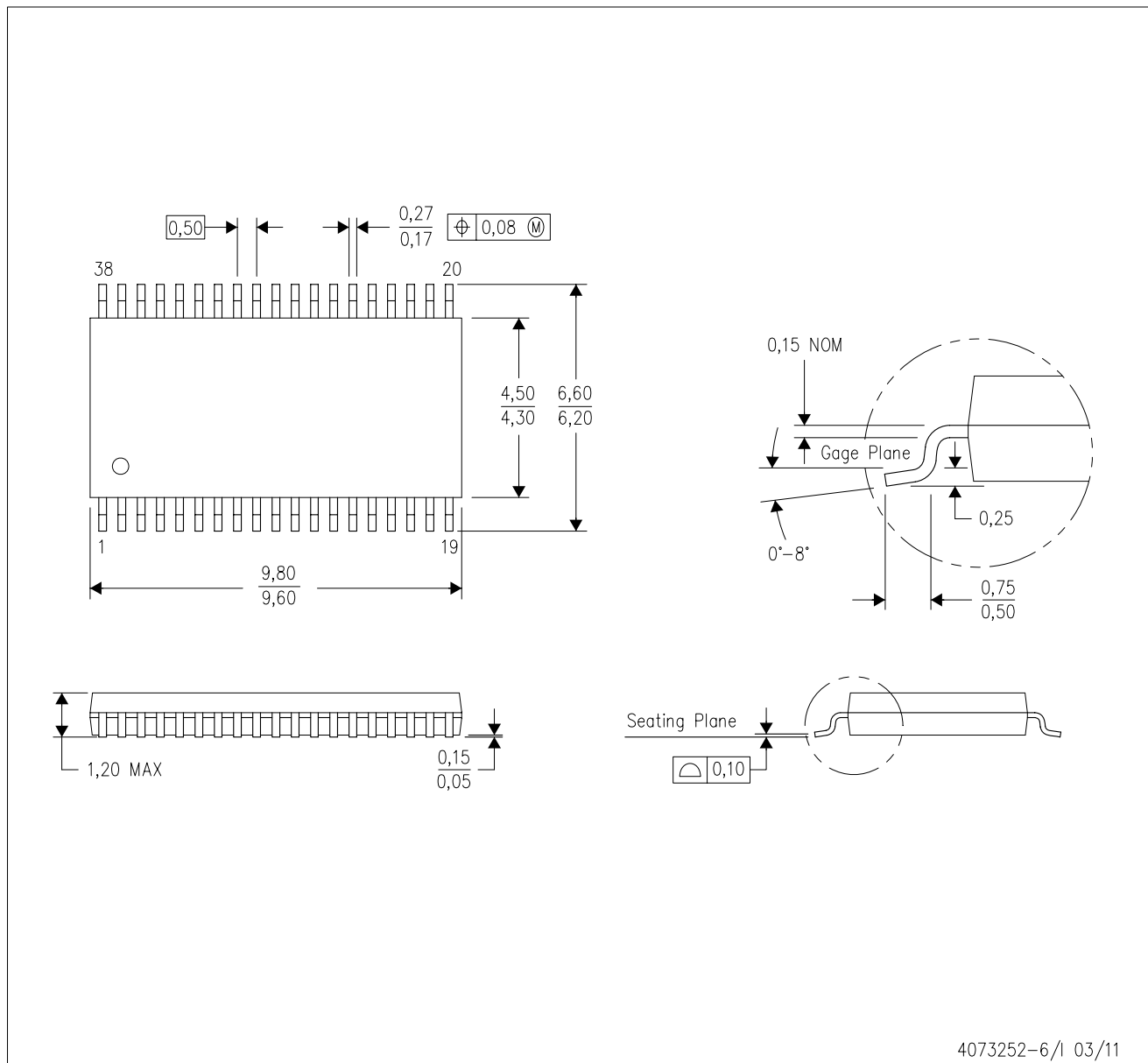
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. 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.

MECHANICAL DATA

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 JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. 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 as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

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 Applications 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

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View SN761645DBTR on WIN SOURCE](#)

 [Texas Instruments](#) Information

Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management