SN761685 TV TUNER IC

FEATURES

- **Mixer/Oscillator for TV Tuner**
- **Three-Band Local Oscillator and Mixer**
- **Local Oscillator Output**
- **5-V Power Supply**
- **24-Pin TSSOP Package**

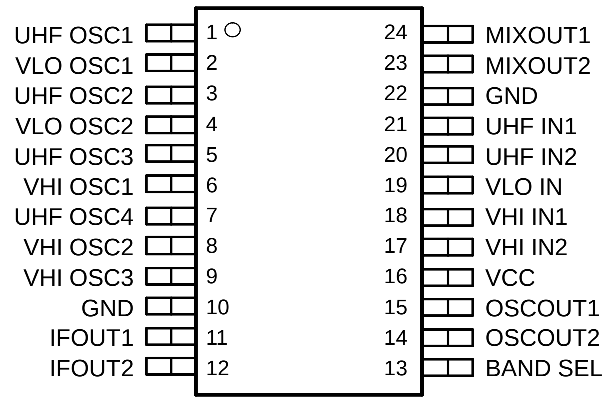
APPLICATIONS

- **TV**
- **VCR**

DESCRIPTION

The SN761685 is a monolithic IC designed for TV tuning systems. The circuit consists of a three-band local oscillator and mixer, and is available in a small outline package.

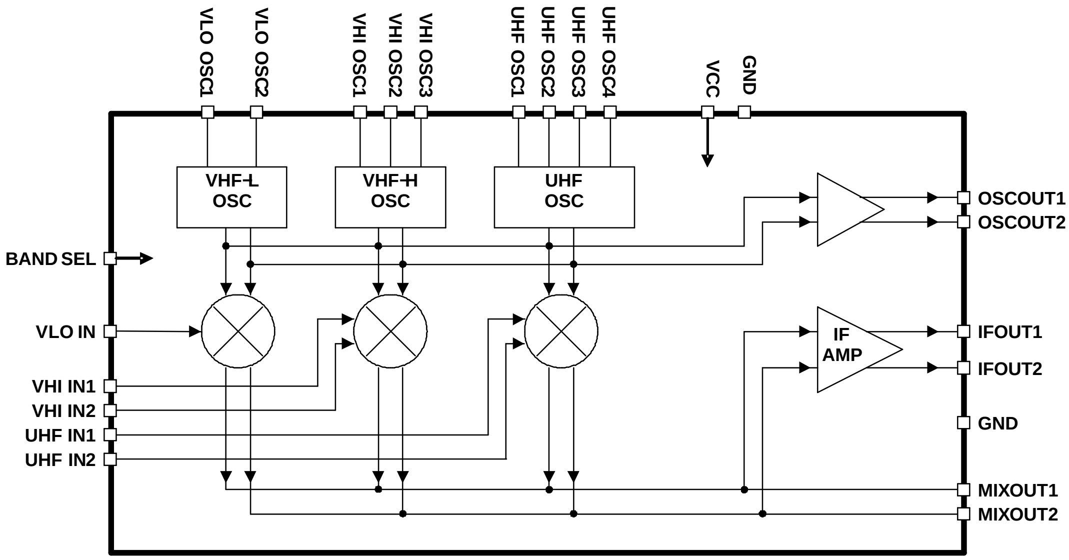
PW PACKAGE
(TOP VIEW)



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.

UHF IN1 and UHF IN2 (pins 20 and 21) withstand 1 kV, and all other pins withstand 2 kV, according to the human body model (1.5 kΩ, 100 pF).

Functional Block Diagram



Pin Assignments

Pin Description

TERMINAL NAME	TERMINAL NO.	DESCRIPTION	SCHEMATIC
BAND SEL	13	Band selection input	Figure 1
GND	10, 22	Ground	
IF OUT1	11	IF amplifier output 1	Figure 2
IF OUT2	12	IF amplifier output 2	Figure 2
MIXOUT1	24	Mixer output 1	Figure 3
MIXOUT2	23	Mixer output 2	Figure 3
OSCOUT1	15	Local oscillator output 1	Figure 4
OSCOUT2	14	Local oscillator output 2	Figure 4
UHF IN1	21	UHF mixer input 1	Figure 5
UHF IN2	20	UHF mixer input 2	Figure 5
UHF OSC 1	1	UHF oscillator 1	Figure 6
UHF OSC 2	3	UHF oscillator 2	Figure 6
UHF OSC 3	5	UHF oscillator 3	Figure 6
UHF OSC 4	7	UHF oscillator 4	Figure 6
VCC	16	VCC 5 V	
VHI IN1	18	VHF HIGH mixer input 1	Figure 7
VHI IN2	17	VHF HIGH mixer input 2	Figure 7
VHI OSC 1	6	VHF HIGH oscillator 1	Figure 8
VHI OSC 2	8	VHF HIGH oscillator 2	Figure 8
VHI OSC 3	9	VHF HIGH oscillator 3	Figure 8
VLO IN	19	VHF LOW mixer input	Figure 9

Pin Assignments (continued)

Pin Description (continued)

TERMINAL NAME	NO.	DESCRIPTION	SCHEMATIC
VLO OSC 1	2	VHF LOW oscillator 1	Figure 10
VLO OSC 2	4	VHF LOW oscillator 2	Figure 10

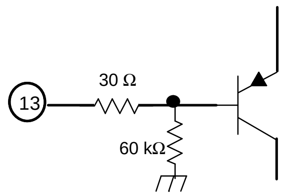


Figure 1.

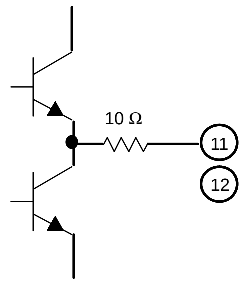


Figure 2.

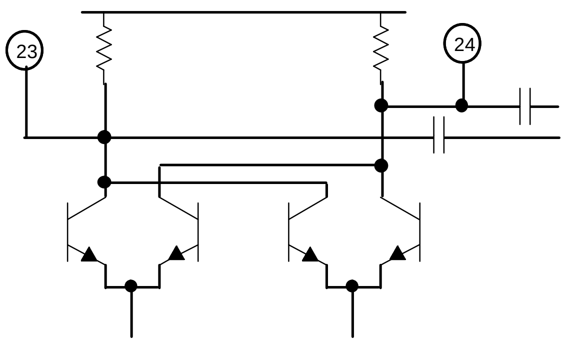


Figure 3.

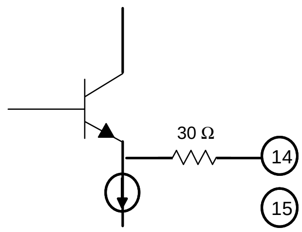


Figure 4.

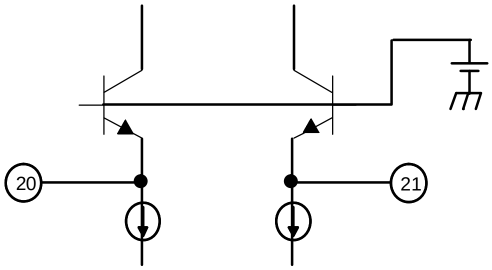


Figure 5.

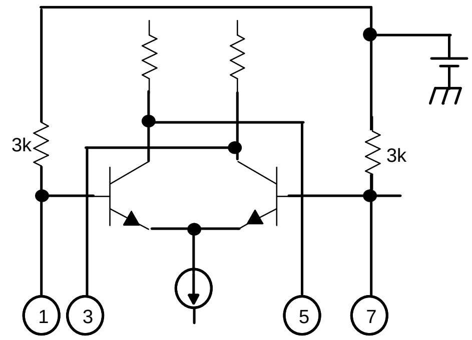


Figure 6.

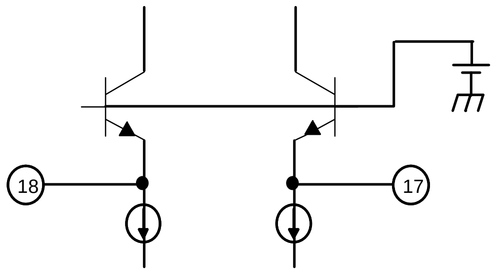


Figure 7.

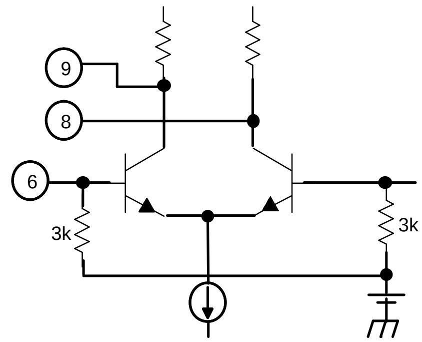


Figure 8.

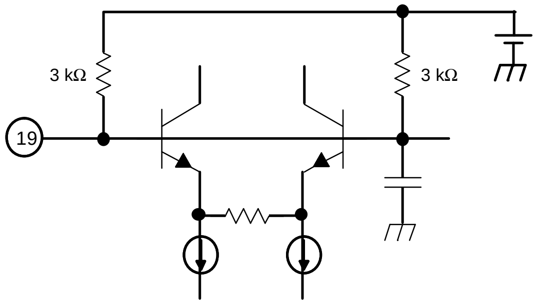


Figure 9.

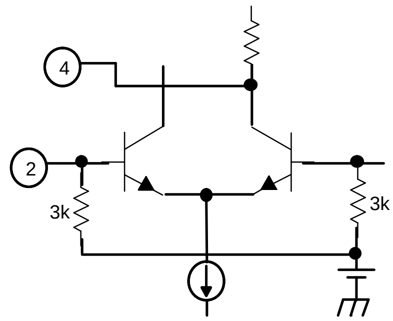


Figure 10.

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) (1)

Supply voltage, V_{CC} (2)	VCC (Pin 16)	–0.4 V to 6.5 V
Input voltage (2)	V_{IN} (Pins 1–9, 11–15, 17–21, 23, 24)	–0.4 V to 6.5 V
Continuous total dissipation, P_D (3)	$T_A \leq 25°C$	1092 mW
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 8.73 mW/°C for $T_A \geq 25°C$.

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
Operating free-air temperature, T_A		–20		85	°C

ELECTRICAL CHARACTERISTICS, DC Parameters

V_{CC} = 5 V, T_A = 25°C, unless otherwise noted

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{CC}	Supply current	VHF-LOW band, no signal		43		mA
V_{SEL1}	Voltage on band selection (BAND SEL)	VHF-LOW band	0		0.18 V_{CC}	V
V_{SEL2}		VHF-HIGH band	0.26 V_{CC}		0.47 V_{CC}	
V_{SEL3}		UHF band	0.55 V_{CC}		V_{CC}	
I_{SEL}	Input current (BAND SEL)	V_{SEL} = 5 V			130	µA

ELECTRICAL CHARACTERISTICS, AC Parameters

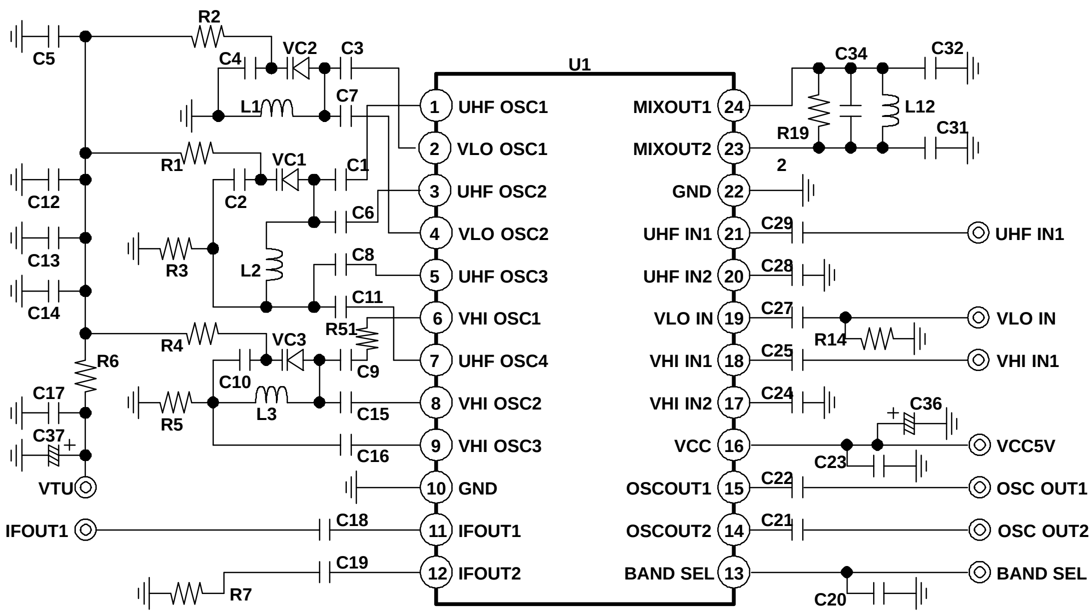
V_{CC} = 5 V, T_A = 25°C, measured in reference measurement circuit of 50-Ω system, IF filter characteristics: f_{PEAK} = 36 MHz, unless otherwise noted

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
G_{c1}	Conversion gain, VHF-LOW (1)	f_{IN} = 50 MHz	22	25	28	dB
G_{c3}		f_{IN} = 170 MHz	22	25	28	
G_{c4}	Conversion gain, VHF-HIGH (2)	f_{IN} = 170 MHz	21	24	27	dB
G_{c6}		f_{IN} = 450 MHz	21	24	27	
G_{c7}	Conversion gain, VHF-UHF (2)	f_{IN} = 450 MHz	21	24	27	dB
G_{c9}		f_{IN} = 860 MHz	21	24	27	
NF_1	Noise figure, VHF-LOW (see Figure 14)	f_{IN} = 50 MHz		9.5		dB
NF_3		f_{IN} = 170 MHz		9.5		
NF_4	Noise figure, VHF-HIGH (see Figure 15)	f_{IN} = 170 MHz		12		dB
NF_6		f_{IN} = 450 MHz		12		
NF_7	Noise figure, UHF (see Figure 15)	f_{IN} = 450 MHz		11		dB
NF_9		f_{IN} = 860 MHz		11		
CM_1	1% cross-modulation, VHF-LOW (3)	f_{IN} = 50 MHz		88		dBμV
CM_3		f_{IN} = 170 MHz		90		
CM_4	1% cross-modulation, VHF-HIGH (4)	f_{IN} = 170 MHz		84		dBμV
CM_6		f_{IN} = 450 MHz		84		
CM_7	1% cross-modulation, UHF (4)	f_{IN} = 450 MHz		85		dBμV
CM_9		f_{IN} = 860 MHz		85		
V_{IFO1}	IF output voltage, VHF-LOW (5)	f_{IN} = 50 MHz		117		dBμV
V_{IFO3}		f_{IN} = 170 MHz		117		
V_{IFO4}	IF output voltage, VHF-HIGH (6)	f_{IN} = 170 MHz		117		dBμV
V_{IFO6}		f_{IN} = 450 MHz		117		
V_{IFO7}	IF output voltage, UHF (6)	f_{IN} = 450 MHz		117		dBμV
V_{IFO9}		f_{IN} = 860 MHz		117		
Δf_{SWO1}	SW ON drift, VHF-LOW (7)	f_{OSC} = 86 MHz			±300	kHz
Δf_{SWO3}		f_{OSC} = 206 MHz			±400	
Δf_{SWO4}	SW ON drift, VHF-HIGH (7)	f_{OSC} = 206 MHz			±300	kHz
Δf_{SWO6}		f_{OSC} = 486 MHz			±400	
Δf_{SWO7}	SW ON drift, UHF (7)	f_{OSC} = 486 MHz			±400	kHz
Δf_{SWO9}		f_{OSC} = 896 MHz			±500	
Δf_{VSO1}	Frequency sift on V_{CC}, VHF-LOW (NOTE13)	f_{OSC} = 86 MHz			±150	kHz
Δf_{VSO3}		f_{OSC} = 206 MHz			±250	
Δf_{VSO4}	Frequency sift on V_{CC}, VHF-HIGH (8)	f_{OSC} = 206 MHz			±150	kHz
Δf_{VSO6}		f_{OSC} = 486 MHz			±250	
Δf_{VSO7}	Frequency sift on V_{CC}, UHF(8)	f_{OSC} = 486 MHz			±150	kHz
Δf_{VSO9}		f_{OSC} = 896 MHz			±250	

(1) IF = 36 MHz, V_{IN} = 70 dBμV (see Figure 12).
(2) IF = 36 MHz, V_{IN} = 70 dBμV (see Figure 13).
(3) DES: V_{IN} = 80 dBμV, UNDES: f_{des} ±6 MHz, AM 1 kHz, 30%, DES/CM = S/I = 46 dB (see Figure 16).
(4) DES: V_{IN} = 80 dBμV, UNDES: f_{des} ±6 MHz AM 1 kHz 30%, DES/CM = S/I = 46 dB (see Figure 17).
(5) IF = 36 MHz, V_{IN} = 107 dBμV (see Figure 18).
(6) IF = 36 MHz, V_{IN} = 107 dBμV, (see Figure 19).
(7) Delta frequency from 3 s to 3 min after switch on
(8) Delta frequency when V_{CC} = 5 V changes ±10%

APPLICATION INFORMATION

Reference Measurement Circuit



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, such as an infringement of intellectual property rights or other rights, including patents, of third parties.

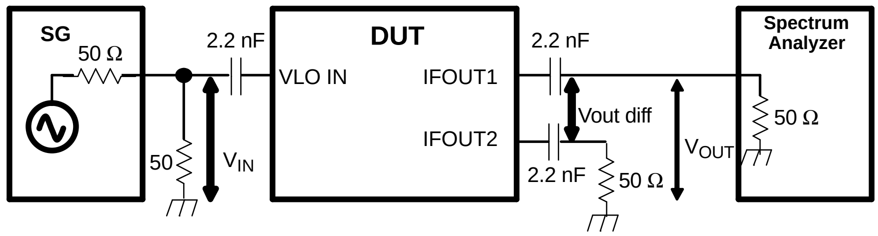
Figure 11. Reference Measurement Circuit

APPLICATION INFORMATION (continued)

Component Values for Measurement Circuit

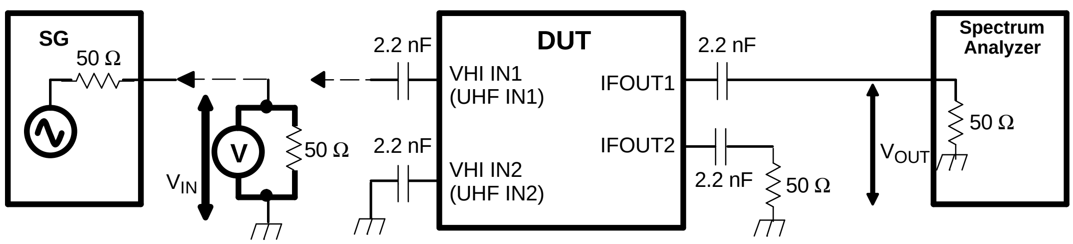
PART NAME	VALUE	PART NAME	VALUE
C1 (UHF OSC)	2 pF	C28 (UHF IN2)	2.2 nF
C2 (UHF OSC)	15 pF	C29 (UHF IN1)	2.2 nF
C3 (VLO OSC)	1.5 pF	C31 (MIXOUT)	Open
C4 (VLO OSC)	120 pF	C32 (MIXOUT)	Open
C5 (VTU)	Open	C34 (MIXOUT)	15 pF
C6 (UHF OSC)	1.5 pF	C36 (VCC)	47 μF
C7 (VLO OSC)	2 pF	C37 (VTU)	47 μF/50 V
C8 (UHF OSC)	1.5 pF	L1 (VHI OSC)	ϕ3 mm, 8T, wire 0,32 mm
C9 (VHI OSC)	3 pF	L2 (UHF OSC)	ϕ1.8 mm, 2T, wire 0,4 mm
C10 (VHI OSC)	91 pF	L3 (VHI OSC)	ϕ2 mm, 4T, wire 0,4 mm
C11 (UHF OSC)	2 pF	L12 (MIXOUT)	ϕ3 mm, 25T, wire 0,29 mm
C12 (VTU)	2.2 nF	R1(UHF OSC)	22 kΩ
C13 (VTU)	2.2 nF	R2 (VLO OSC)	33 kΩ
C14 (VTU)	2.2 nF	R3 (UHF OSC)	22 kΩ
C15 (VHI OSC)	3 pF	R4 (VHI OSC)	33 kΩ
C16 (VHI OSC)	Open	R5 (VHI OSC)	0 Ω
C17 (VTU)	1 μF/50 V	R6 (VTU)	22 kΩ
C18 (IF OUT1)	2.2 nF	R7 (IFOUT2)	50 Ω
C19 (IF OUT2)	2.2 nF	R14 (VLO IN)	Open or 50 Ω
C20 (BAND SEL)	0.1 μF	R19 (MIXOUT)	Open
C21 (OSC OUT2)	2.2 nF	R51 (VHI OSC)	0 Ω
C22 (OSC OUT1)	2.2 nF	U1	SN761685
C23 (VCC)	0.1 μF	VC1 (UHF OSC)	1T363A
C24 (VHI IN2)	2.2 nF	VC2 (VLO OSC)	1T363A
C25 (VHI IN1)	2.2 nF	VC3 (VHI OSC)	1T363A
C27 (VLO IN)	2.2 nF		

Test Circuits



GC = 20log(Vout diff / V_{IN}) = 20log(V_{OUT} / V_{IN}) + 6

Figure 12. VHF-L Conversion Gain-Measurement Circuit



GC = 20log(Vout / V_{IN})
Input: No Matching

Figure 13. VHF-H, UHF-Conversion Gain-Measurement Circuit

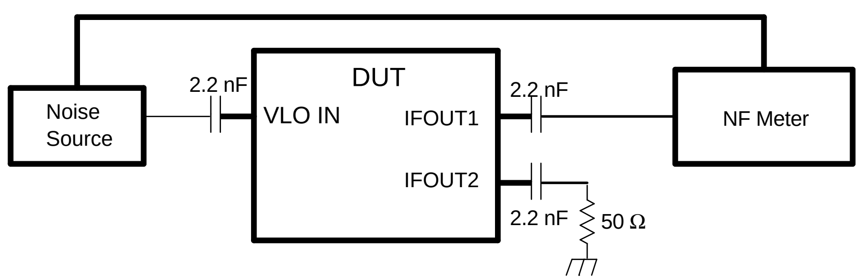


Figure 14. VHF-L Noise-Figure Measurement Circuit

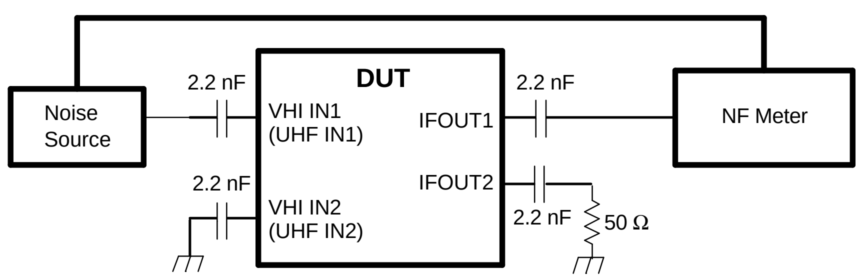


Figure 15. VHF-H, UHF Noise-Figure Measurement Circuit

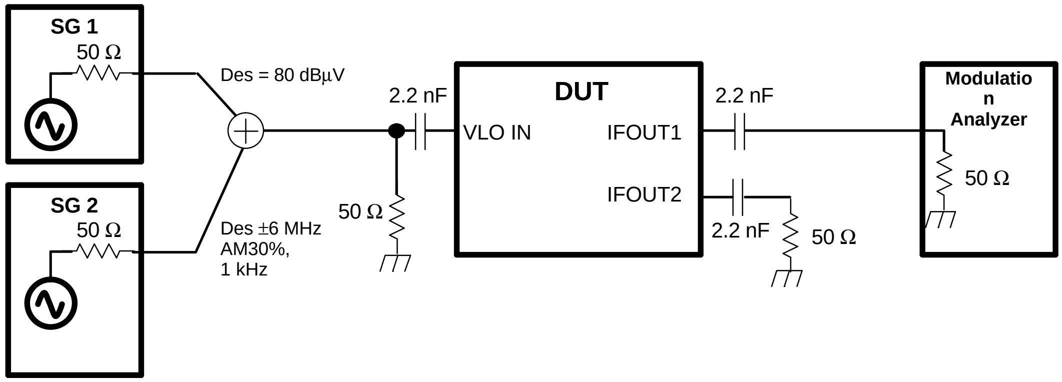


Figure 16. VHF-L 1% Cross-Modulation Distortion Measurement Circuit

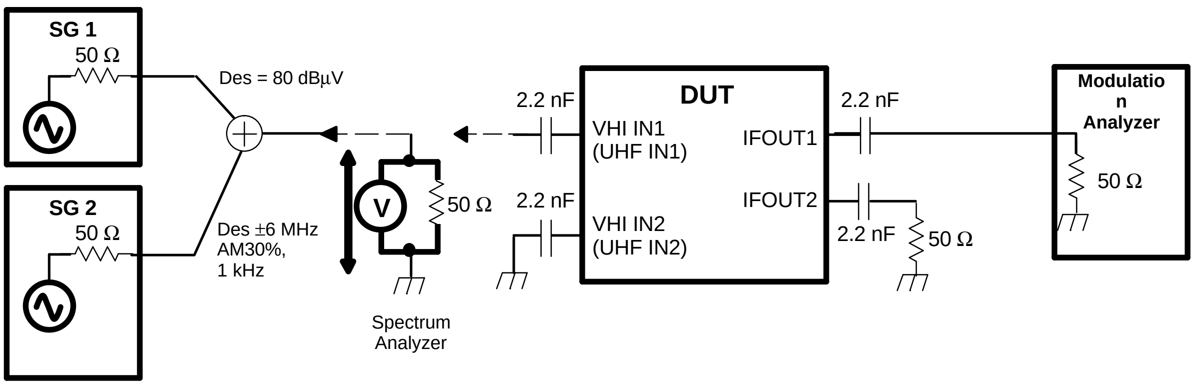


Figure 17. VHF-L 1% Cross-Modulation Distortion Measurement Circuit

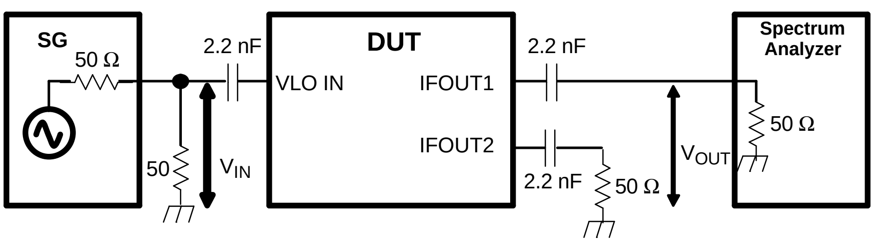


Figure 18. VHF-L Output Voltage Measurement Circuit

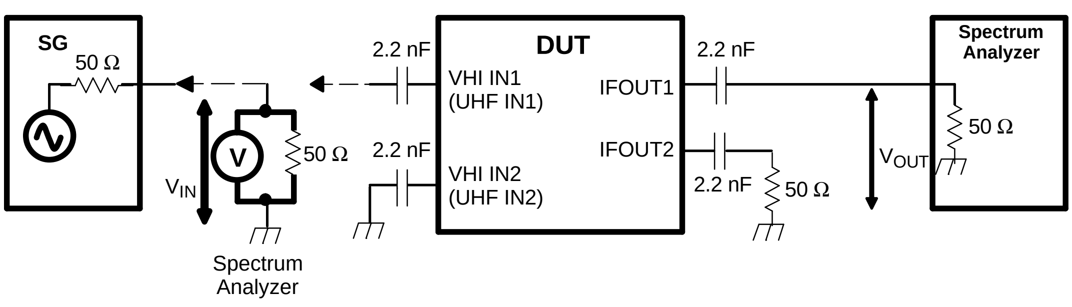


Figure 19. VHF-H, UHF Output Voltage Measurement Circuit

TYPICAL CHARACTERISTICS

S-Parameter

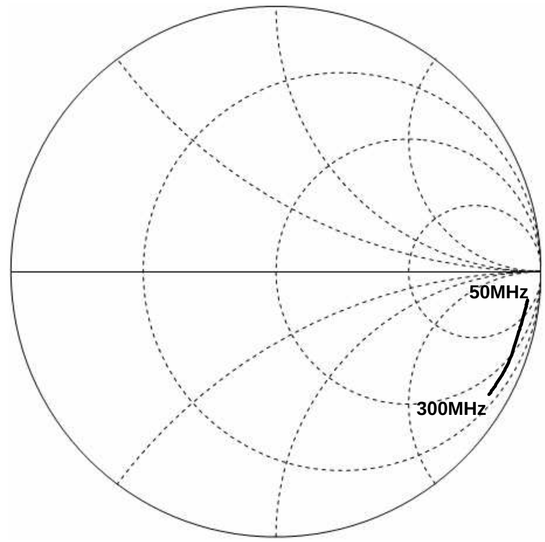


Figure 20. VLO IN

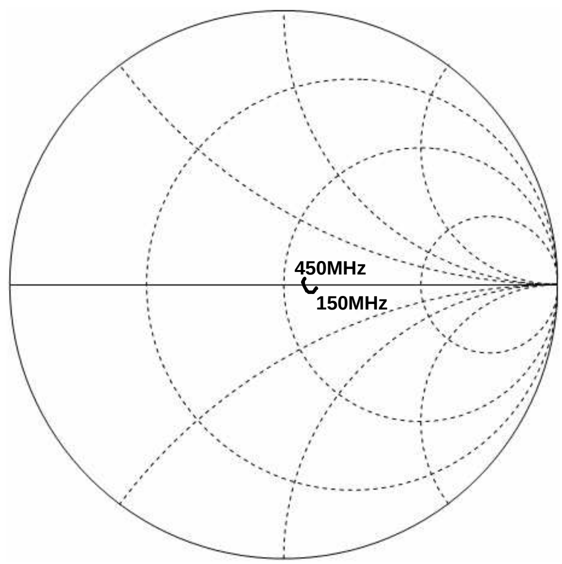


Figure 21. VH IN1,2

TYPICAL CHARACTERISTICS (continued)

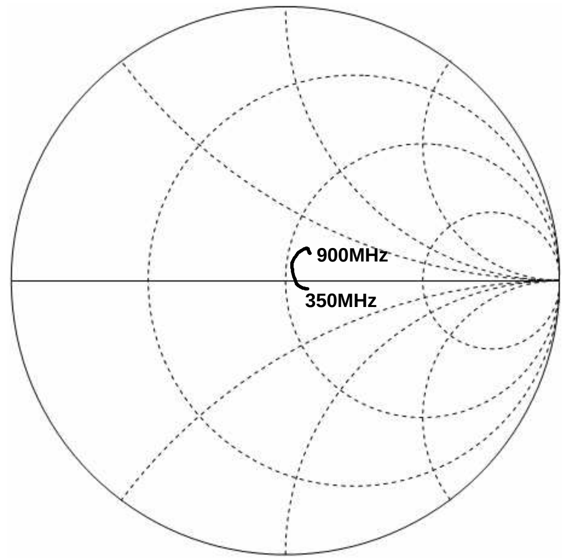


Figure 22. UHF IN1,2

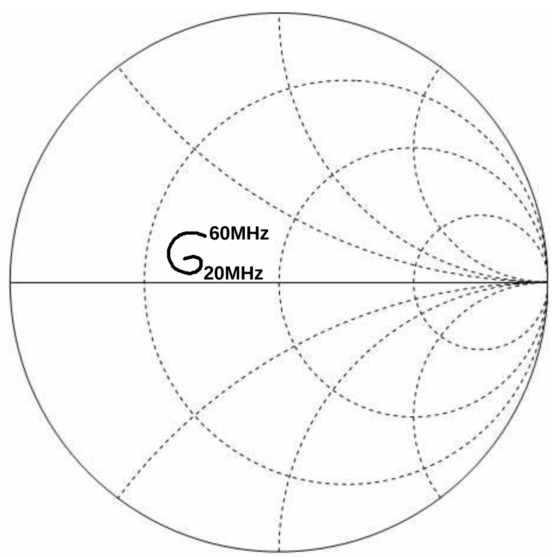
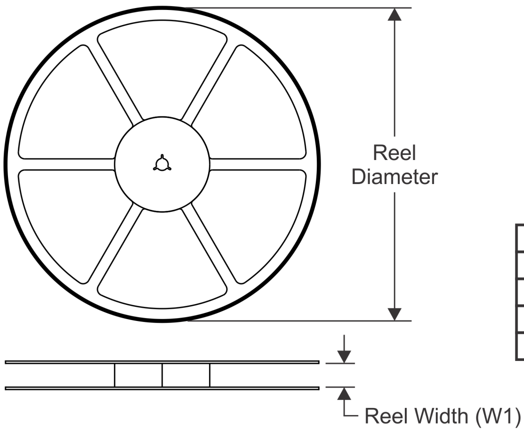


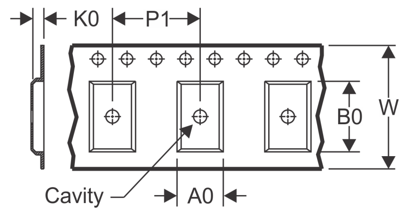
Figure 23. IFOUT1,2

TAPE AND REEL INFORMATION

REEL DIMENSIONS

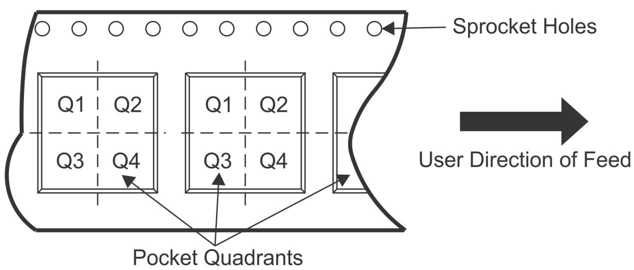


TAPE DIMENSIONS



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

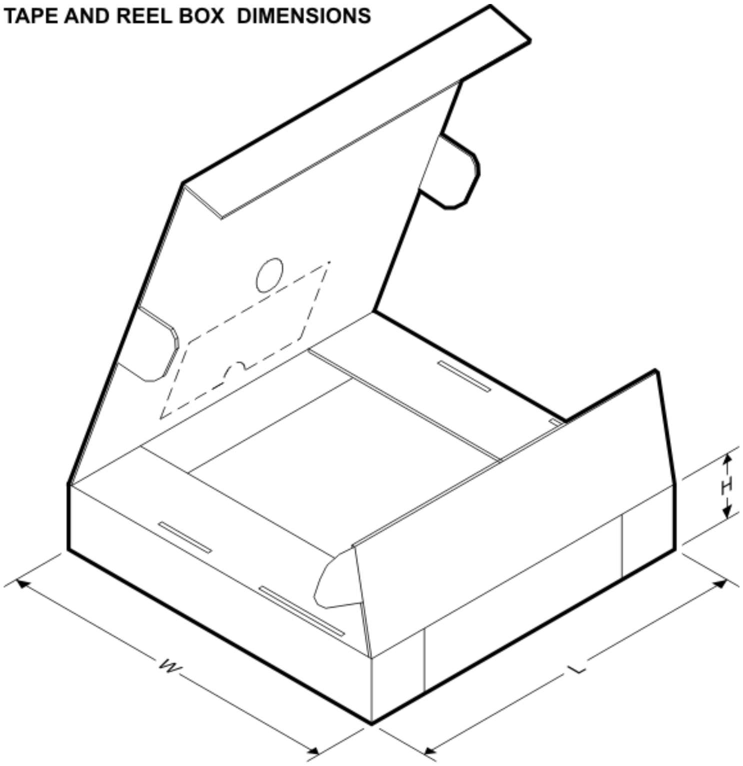
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN761685PWR	TSSOP	PW	24	0	330.0	16.4	6.95	8.3	1.6	8.0	16.0	Q1

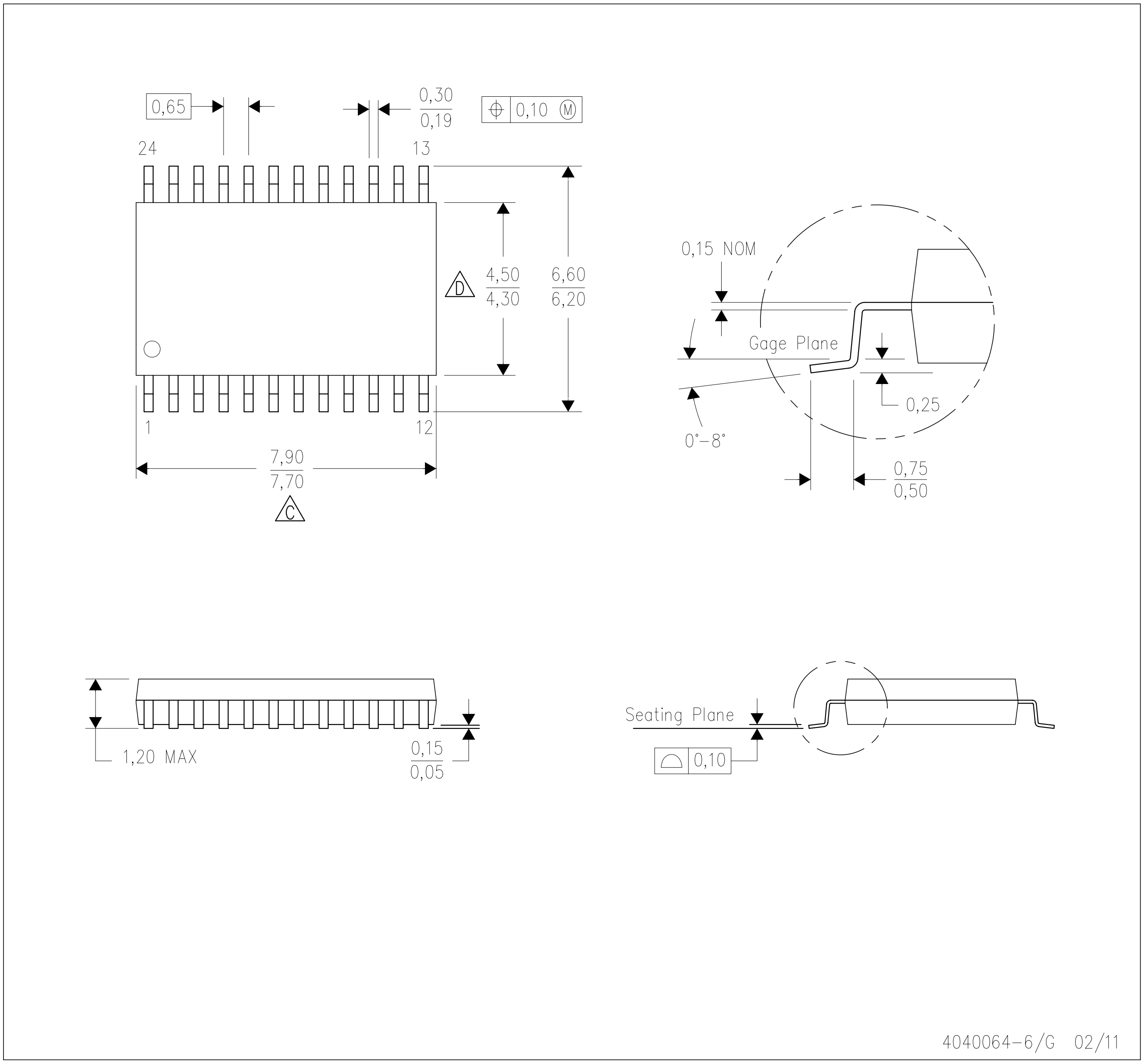
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN761685PWR	TSSOP	PW	24	0	367.0	367.0	38.0

PW (R-PDSO-G24) 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 length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
- E. Falls within JEDEC MO–153

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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.

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