TEMIC
Semiconductors

U2750B-A

Tuner IC for DAB

Description

The U2750B-A is a monolithically integrated tuner circuit fabricated in TEMIC's advanced UHF5S technology. Designed for applications in DAB receivers it performs two selectable mixers, one VCO, a SAW–filter driver, an LO output buffer, a tri-state band switch and an AGC-voltage generation block.

Features

- 8.5 V supply voltage
- RF frequency range 70 to 260 MHz
- Two identical mixers, selectable by bandswitch input
- Balanced mixer input, balanced mixer output (open collector)
- Four pin voltage controlled oscillator
- Balanced LO output for PLL
- SAW filter driver with low impedance output
- Power measurement and generation of AGC voltage by charge pump output
- Three charge pump currents selectable (zero, low, high)
- Voltage regulator for stable operating characteristics

Block Diagram

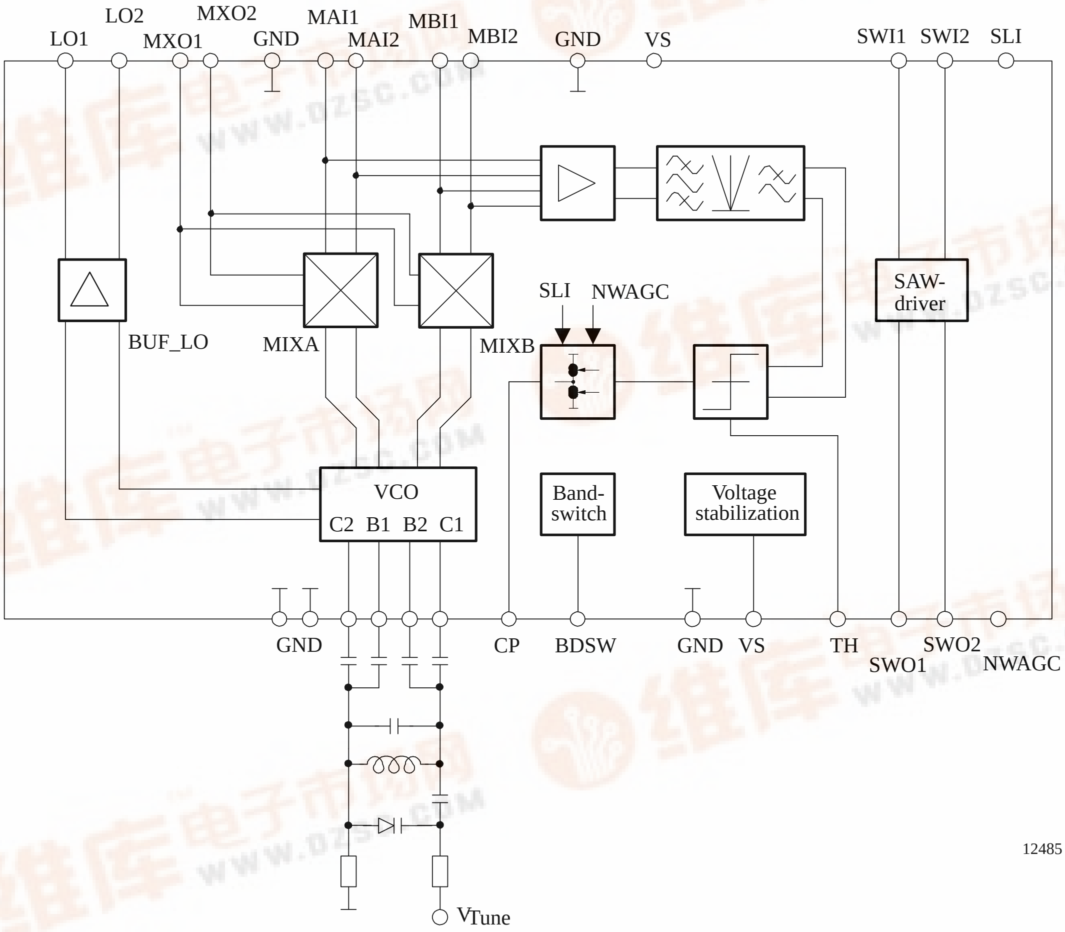


Figure 1.

Preliminary Information

Pin Description

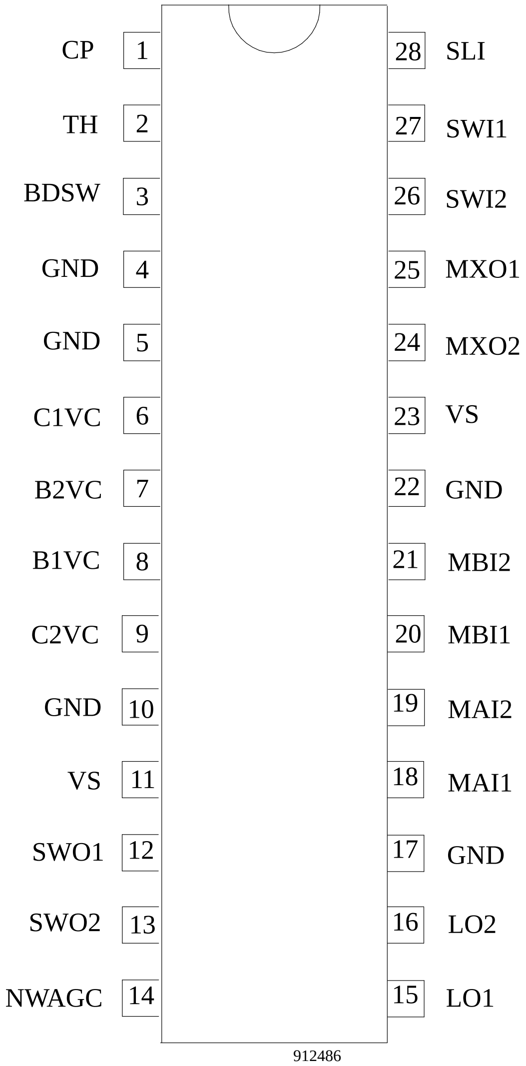


Figure 2.

Pin	Symbol	Function
1	CP	Charge pump output of comparator
2	TH	Threshold input of comparator
3	BDSW	Band switch input
4, 5, 10, 21, 26	GND	Ground
6	C1VC	Collector Pin 1 of VCO
7	B2VC	Base Pin 2 of VCO
8	B1VC	Base Pin 1 of VCO
9	C2VC	Collector Pin 2 of VCO
11, 20	VS	Supply voltage
12	SWO1	Differential output of SAW-driver
13	SWO2	Differential output of SAW-driver
14	NWAGC	AGC mode selection
15	SLI	AGC mode selection
16	SWI1	Differential input of SAW-driver
17	SWI2	Differential input of SAW-driver
18	MXO1	Differential mixer output
19	MXO2	Differential mixer output
22	MBI2	Differential input of mixer B
23	MBI1	Differential input of mixer B
24	MAI2	Differential input of mixer A
25	MAI1	Differential input of mixer A
27	LO2	Differential output of LO for PLL
28	LO1	Differential output of LO for PLL

Functional Description

The U2750B-A represents a tuner IC for applications in DAB receivers. It is intended to be used for receiption of band II or band III DAB signals and consists of two mixers, one VCO, a SAW–filter driver, an LO output buffer, a tri-state band switch and an AGC-voltage generation circuitry as shown in figure 1.

Mixers and VCO

In order to support two different channels two identical mixers are integrated. The RF signal is fed to these mixers via the differential input ports MAI1, MAI2 and MBI1, MBI2. The band switch input BDSW allows to select one of these mixers or to switch off both.

An internal four pin (pins: B1VC, C1VC, B2VC, C2VC) oscillator − an equivalent circuit is shown in figure 5 − provides the LO signal to both mixers. Via an LO-buffer the oscillators signal can be accessed at the balanced output pins LO1, LO2 in order to be fed to a frequency synthesizer circuit (U2753B or U2733B). The result of the mixing process of both mixers appears at the differential open collector output MXO1, MXO2. In the application shown in figure 3 these mixer output pins are loaded by a resonant load.

SAW-Filter Driver

The filters' mixer output signal is applied to the differential input pins SWI1, SWI2 of a SAW-filter driver which amplifies the result of the mixing process and feeds it via its differential output pins SWO1, SWO2 to an external SAW-filter.

AGC-Voltage Generation Block

The incoming RF signal which appears at the input pins MAI1, MAI2 or MBI1, MBI2 − depending on the selection made by the BDSW pin − is amplified, weakly band pass filtered (transition range: 50 to 300 MHz), rectified and finally low pass filtered.

The voltage derived in this 'power measurement process' is compared with a voltage threshold which is defined by an external resistor connected to pin TH according to figure 3. Depending on the result of this comparison a charge pump feeds a positive or negative current to pin CP in order to charge or discharge an external capacitor. The voltage of this external capacitor can be used to control the gain of an external (pre-) amplifier stage. By means of the pins NWAGC and SLI the current of the charge pump can be selected according to the following table:

NWAGC	SLI	Charge Pump Current / A
'Low'	X	off
'High'	'Low'	40 A (slow mode)
'High'	'High'	250 A (fast mode)

An overview of the functionality of this block can be taken from figure 4.

Absolute Maximum Ratings

Parameters		Symbol	Min.	Typ.	Max.	Unit
Supply voltage	Pins 11 and 20	V_S	–0.3		9.5	V
Junction temperature		T_j			+125	°C
Storage temperature		T_{stg}	–40		+125	°C
Ext. applied voltage at charge pump output	Pin 1	VCP	0.4		6.9	V
Band switch input voltage	Pin 3	VBDSW	–0.3		6	V
NWAGC input voltage	Pin 14	VNWAGC	–0.3		6	V
SLI input voltage	Pin 15	VSLI	–0.3		6	V
differential input voltage of SAW–driver	Pins 16 and 17	VSWI			300	mV_{RMS}
mixer output supply voltage	Pin 19	VMXO	6.5		9.5	V
differential input voltage mixer A,B	Pins 22, 23, 24 and 25	VMXI			50	mV_{RMS}

Operating Range

Parameters		Symbol	Min.	Typ.	Max.	Unit
Supply voltage	Pins 11 and 20	V_S	8.0	8.5	9.35	V
Ambient temperature		T_{amb}	–40		85	°C

Thermal Resistance

Parameters		Symbol	Min.	Typ.	Max.	Unit
Junction ambient	SSO28	R_{thJA}		130		K/W

Electrical Characteristics

Test conditions (unless otherwise specified): V_S = 8.5 V, T_{amb} = +25°C, test circuit see figure 3

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Overall characteristics						
Supply voltage	VS	V_S	8.0	8.5	9.35	V
Supply current	VS	I_S	21.6	27	32.4	mA
Voltage gain	Pins MXA, MXB → IF-Port 1)	GV,tot	30	32	34	dB
Noise figure double side band	Pins MXA, MXB → IF-Port 1)	NF,DSB		8		dB
Maximum input level	3rd order intermodulation distance 30 dBc Pins MXA,MXB 1)	Pin, max	–25	–22		dBm
Mixer A, B						
Mixer output current	Pins 18 and 19	IOMX	2.6	3.3	4.0	mA
Input frequency range	Pins 22, 23, 24 and 25	f_{in}, IMX	70		260	MHz
Input impedance	Pins 22, 23, 24 and 25	Zin, max		80		Ω
VCO						
Phase noise	Pin LO port Δf = 10 kHz	L(f) f_{LO}	 110	–92	 300	dBc/Hz MHz

Preliminary Information

Electrical Characteristics (continued)

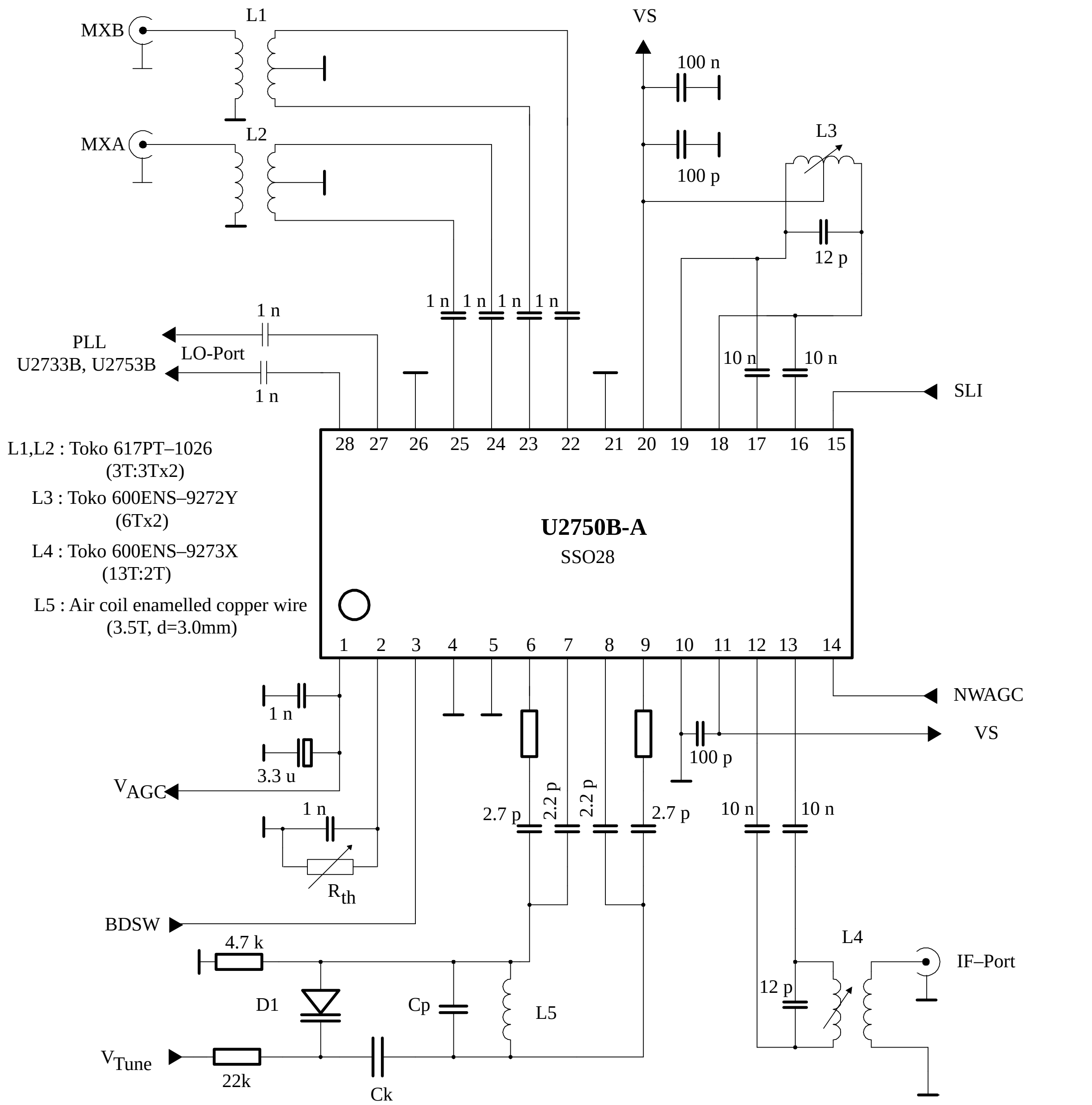
Test conditions (unless otherwise specified): V_S = 8.5 V, T_{amb} = +25°C, test circuit see figure 3

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
LO buffer						
LO output power	200 Ω load, differential	pLO	26	34		mV_{eff}
LO output impedance	Differential Pins 27 and 28	ZoutLO		200		Ω
SAW driver						
Input impedance	Differential Pins 16 and 17	ZISAW		580		Ω
Output impedance	Differential Pins 12 and 13	ZOSAW		24		Ω
Voltage gain	Pins 16, 17 – 12, 13 2)	GV,SAW		18		dB
AGC unit						
Internal voltage for threshold adjustment	Without external resistor Pin 2	VTH		1.94		V
Maximum positive charge pump current, fast mode	V_{NWAGC} =‘H’, V_{SLI} = ‘H’, P_{RF} = –30 dBm, R_{th} = 12 kΩ, Pin 1	$ICP_{pos,fm}$	200	250	300	µA
Maximum negative charge pump current, fast mode	V_{NWAGC} = ‘H’, V_{SLI} = ‘H’, P_{RF} = –25 dBm, R_{th} = 12 kΩ, Πιν 1	$ICP_{neg,fm}$	–300	–250	–200	µA
Maximum positive charge pump current, slow mode	V_{NWAGC} = ‘H’, V_{SLI} = ‘L’, P_{RF} = –30 dBm, Rth = 12 kΩ, Pin 1	$ICP_{pos,sm}$	32	40	48	µA
Maximum negative charge pump current, slow mode	V_{NWAGC} = ‘H’, V_{SLI} = ‘L’, P_{RF} = –25 dBm, Rth = 12 kΩ, Pin 1	$ICP_{neg,sm}$	–48	–40	–32	µA
High impedance mode charge pump current	V_{NWAGC} = ‘L’ Pin 1	ICP_{hi}	–50	0	50	nA
Minimum gain control voltage		$VAGC_{min}$		0.5		V
Maximum gain control voltage		$VAGC_{max}$		6.9		V
Control voltage at NWAGC	NWAGC = ‘H’ Pin 14	$VNWAGC_{H}$	3.0			V
Control voltage at NWAGC	NWAGC = ‘L’ Pin 14	$VNWAGC_{L}$			1.5	V
Control voltage at SLI	SLI = ‘H’	$VSLI_H$	3.0			V
Control voltage at SLI	SLI = ‘L’	$VSLI_L$			1.5	V
Bandswitch						
Bandswitch	MXA active	$VBDSW_A$		0	1.0	V
	MXB active	$VBDSW_B$	4.0	5.0		V
	MXA,MXB inactive	$VBDSW_{off}$	2.0		3.0	V

1) Measurement corrected by loss of transformers.
2) Ratio of the output voltage at the primary coil of L4 (Pins 12 and 13) to the input voltage (MXA, MXB).

Application Circuit

(f_{IF} = 38.912 MHz)



fLO	D1	Cp	Ck	L5
208 to 285 MHz	BB 515	4.7 p	22 p	3.5 T, d = 3.0 mm
108 to 285 MHz	BB 619	–	100 p	4.5 T, d = 3.0 mm

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Figure 3.

Equivalent Circuit of AGC-Voltage Generation Block

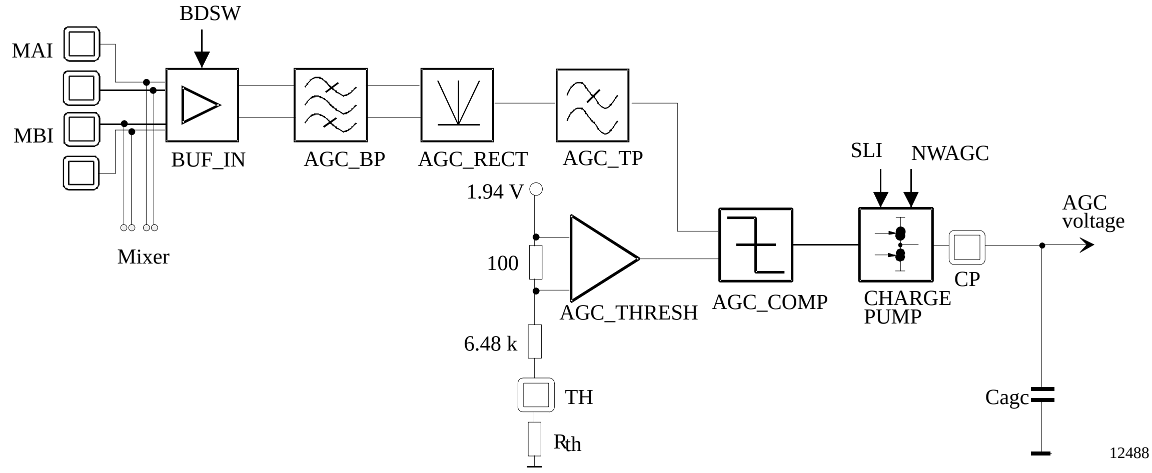


Figure 4.

Equivalent Circuit of VCO

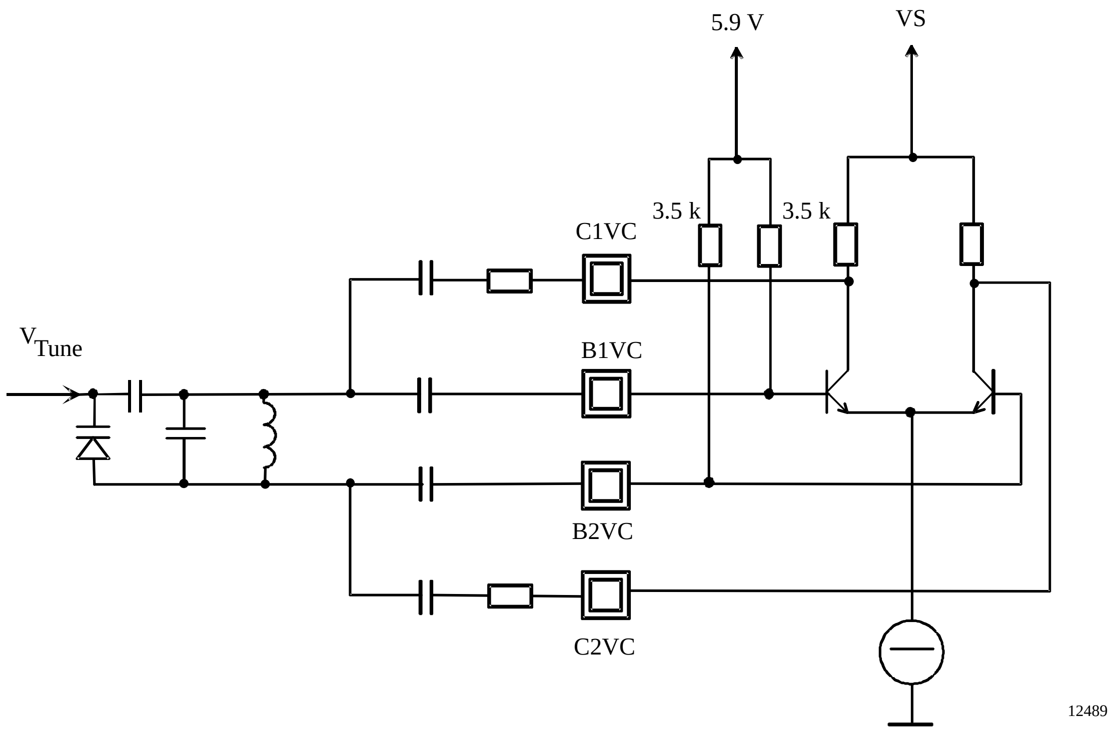


Figure 5.

Preliminary Information

Typical Operation Characteristics

Operating conditions: V_S = 8.5 V, T_{amb} = 27°C. Test conditions see figure 3.

Overall Gain

f_{RF} = 240 MHz applied to MXA-Port;
pIF measured at IF-Port

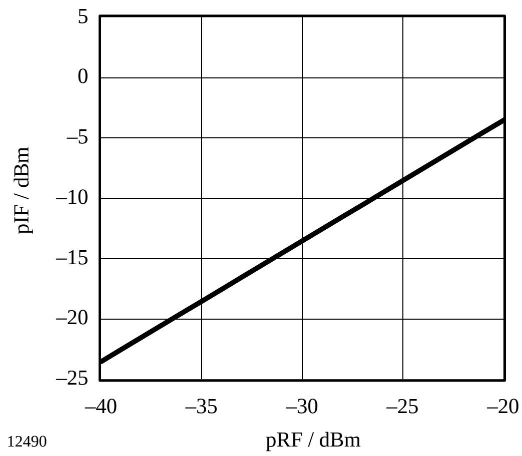


Figure 6.

3rd Order 2-Tone Intermodulation Ratio

fRF1 = 240 MHz and fRF2 = 241 MHz applied to MXA-Port; DIM3 measured at IF-Port

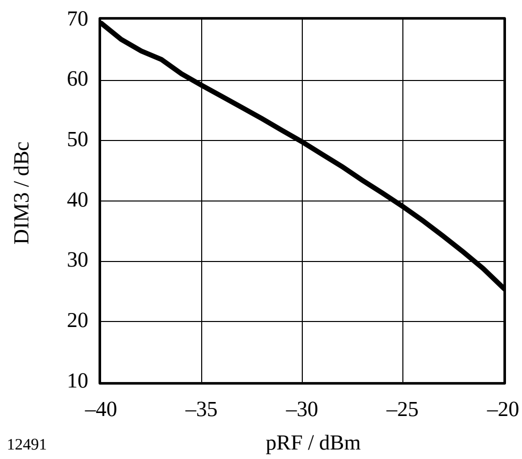


Figure 7.

RF Power Adjustment by Rth

fRF = 240 MHz

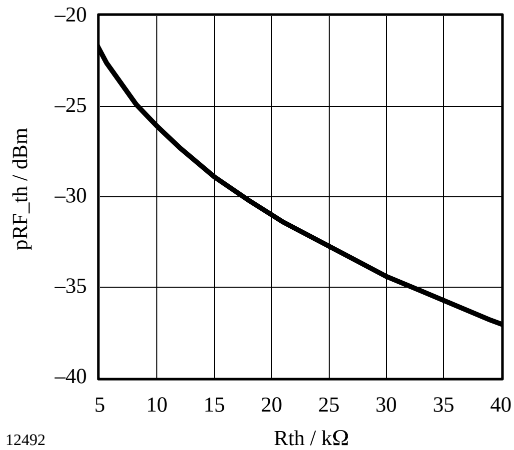


Figure 8.

Output Impedance SAW-Filter Driver

Pins 12 and 13, differential

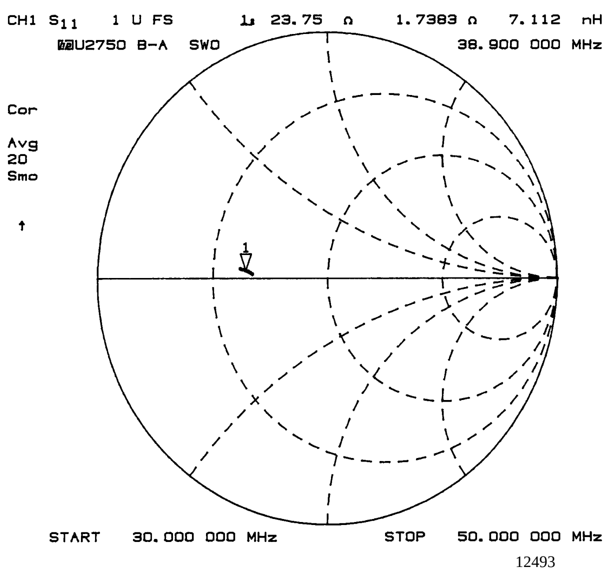
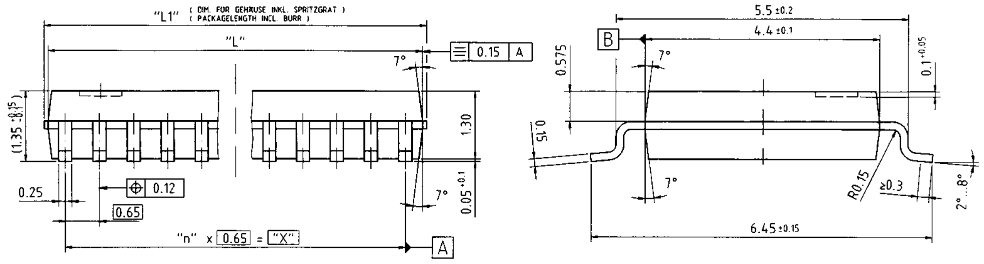
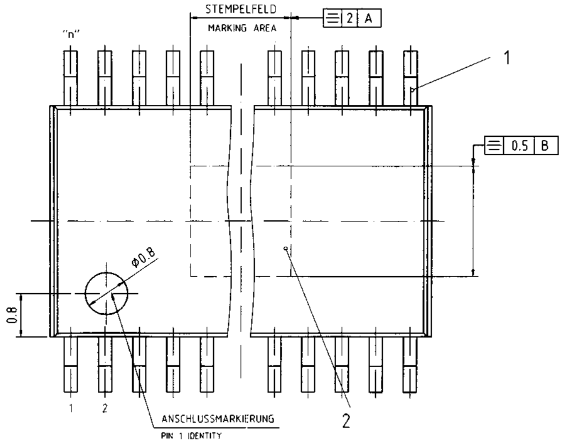


Figure 9.

fPackage Information

Package: SSO28
Dimensions in mm





GEHÄUSE PACKAGE	DIMENSION "L1"	DIMENSION "L"	DIMENSION "X"	MOLDINGSTREIFEN-ZEICHN. MOLDEDSTRIP-DRWG.
SSO20	6.75 -0.25	6.6±0.1	5.85	9.920-6264.3-3
SSO24	8.05 -0.25	7.9±0.1	7.15	9.920-6265.3-3
SSO28	9.35 -0.25	9.2±0.1	8.45	9.920-6266.3-3

ANSCHLÜSSE MATTVERZINNT 10-15µm
LEADS TIN PLATED

95 9943

Preliminary Information

Ozone Depleting Substances Policy Statement

It is the policy of **TEMIC TELEFUNKEN microelectronic GmbH** to

1. Meet all present and future national and international statutory requirements.

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

TEMIC TELEFUNKEN microelectronic GmbH semiconductor division has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA

3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

TEMIC can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

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