

Tuner IC for DAB



Description

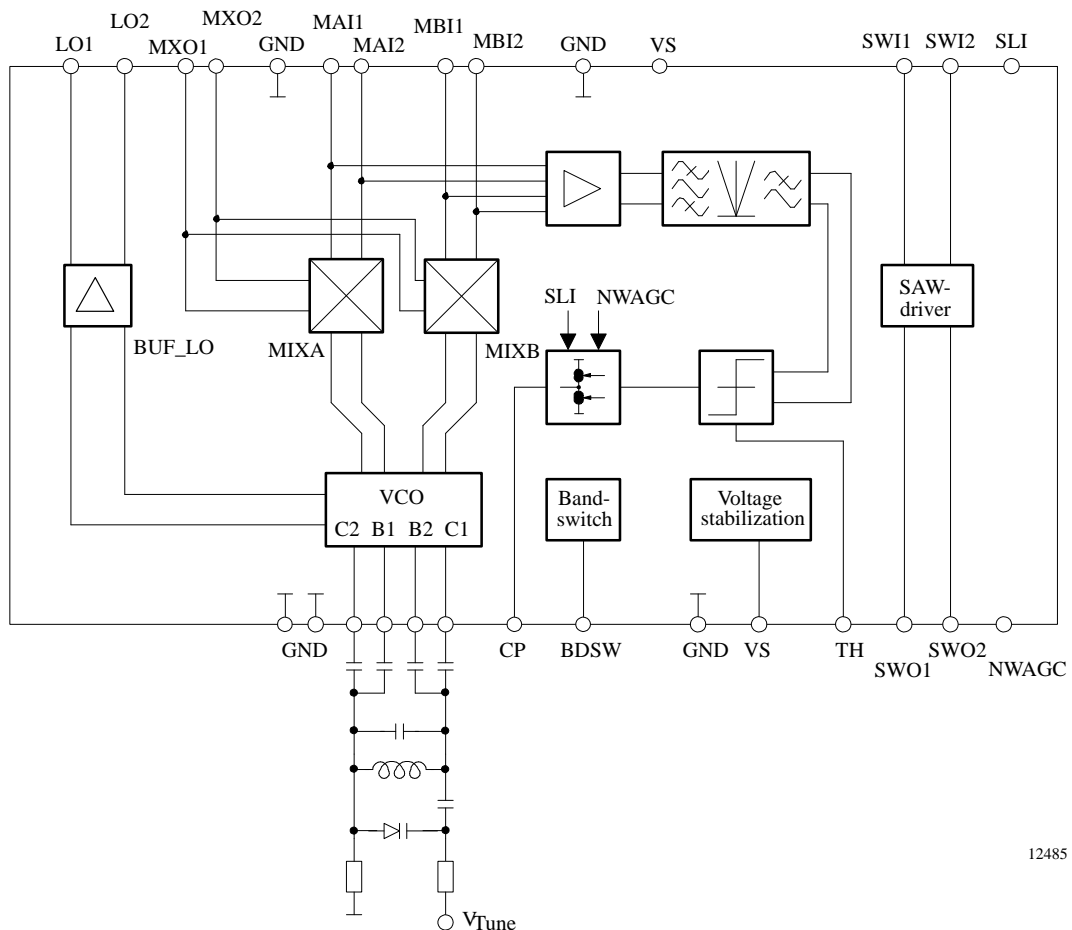
The U2750B-A is a monolithically integrated tuner circuit fabricated in TEMIC's advanced UHF5S technology. Designed for applications in DAB receivers

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

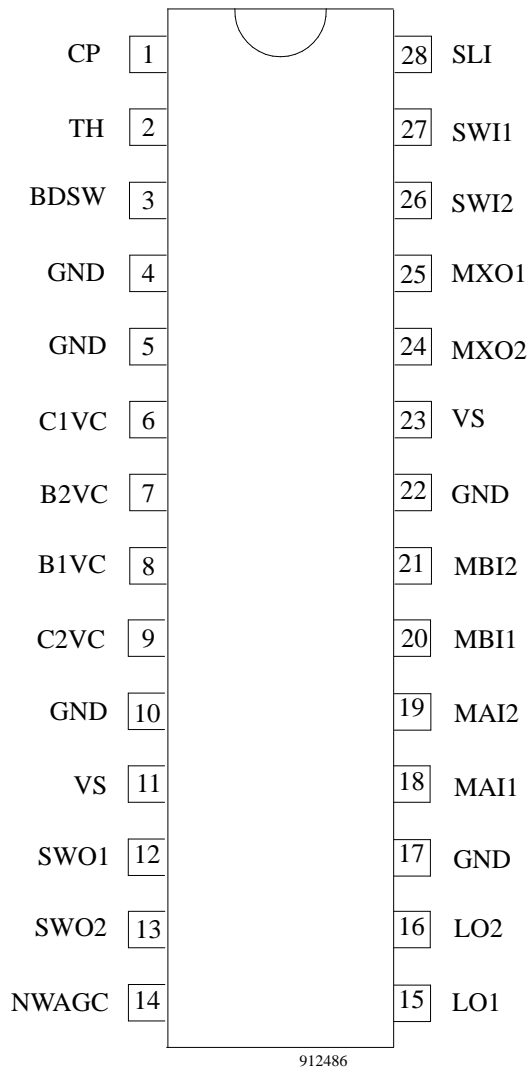
Block Diagram



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Figure 1.

Pin Description



912486

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 reception 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	$Z_{in, max}$		80		Ω
VCO						
Phase noise	Pin LO port $\Delta f = 10$ kHz	$L(f)$ f_{LO}	110	-92	300	dBc/Hz MHz

Electrical Characteristics (continued)

Test conditions (unless otherwise specified): $V_S = 8.5\text{ V}$, $T_{\text{amb}} = +25^\circ\text{C}$, 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	$V_{\text{NWAGC}} = \text{'H'}$, $V_{\text{SLI}} = \text{'H'}$, $P_{\text{RF}} = -30\text{ dBm}$, $R_{\text{th}} = 12\text{ k}\Omega$, Pin 1	ICP _{pos,fm}	200	250	300	μA
Maximum negative charge pump current, fast mode	$V_{\text{NWAGC}} = \text{'H'}$, $V_{\text{SLI}} = \text{'H'}$, $P_{\text{RF}} = -25\text{ dBm}$, $R_{\text{th}} = 12\text{ k}\Omega$, $\Pi_{\text{tv}} 1$	ICP _{neg,fm}	-300	-250	-200	μA
Maximum positive charge pump current, slow mode	$V_{\text{NWAGC}} = \text{'H'}$, $V_{\text{SLI}} = \text{'L'}$, $P_{\text{RF}} = -30\text{ dBm}$, $R_{\text{th}} = 12\text{ k}\Omega$, Pin 1	ICP _{pos,sm}	32	40	48	μA
Maximum negative charge pump current, slow mode	$V_{\text{NWAGC}} = \text{'H'}$, $V_{\text{SLI}} = \text{'L'}$, $P_{\text{RF}} = -25\text{ dBm}$, $R_{\text{th}} = 12\text{ k}\Omega$, Pin 1	ICP _{neg,sm}	-48	-40	-32	μA
High impedance mode charge pump current	$V_{\text{NWAGC}} = \text{'L'}$ 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

($f_{IF} = 38.912 \text{ MHz}$)

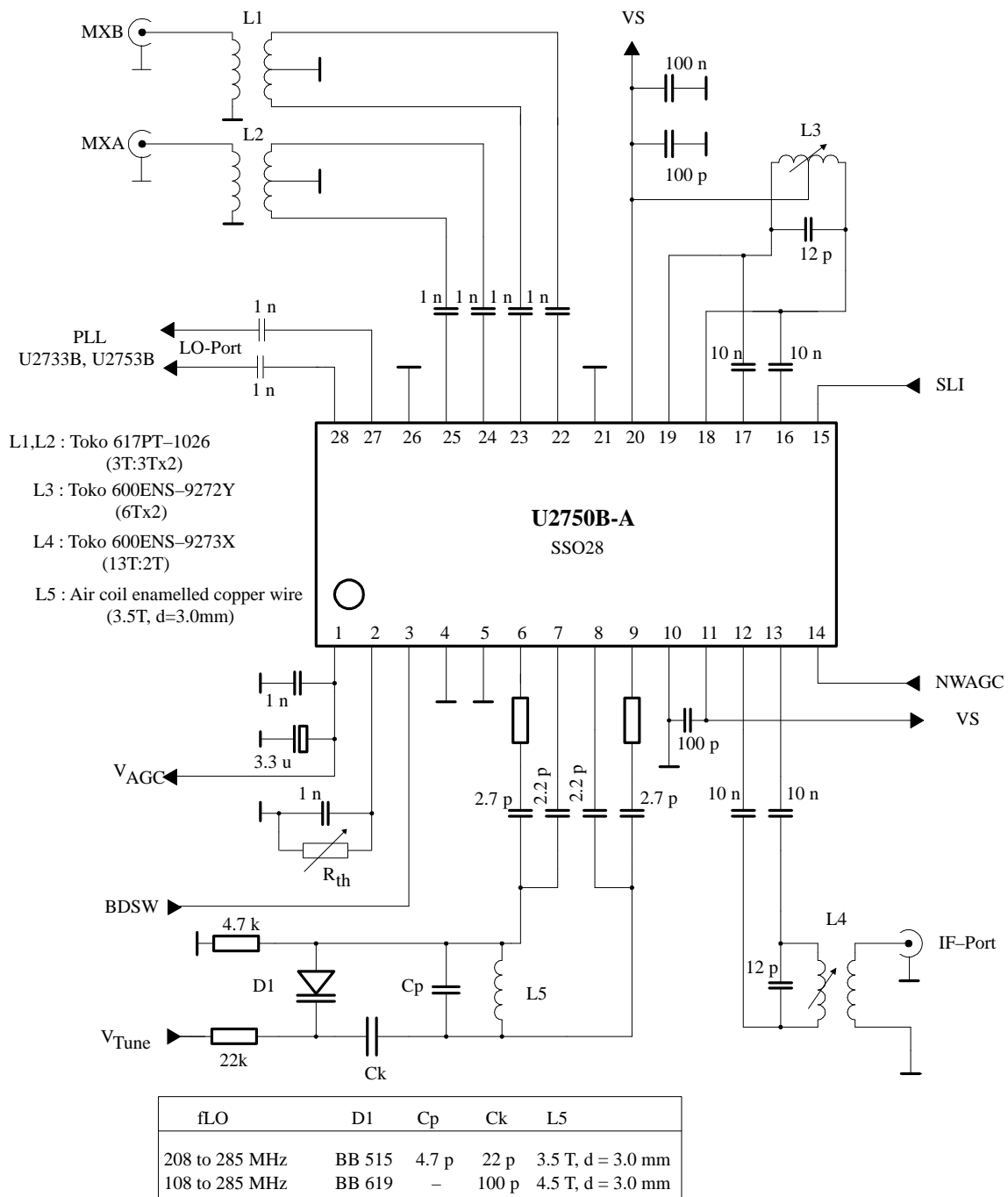


Figure 3.

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Equivalent Circuit of AGC-Voltage Generation Block

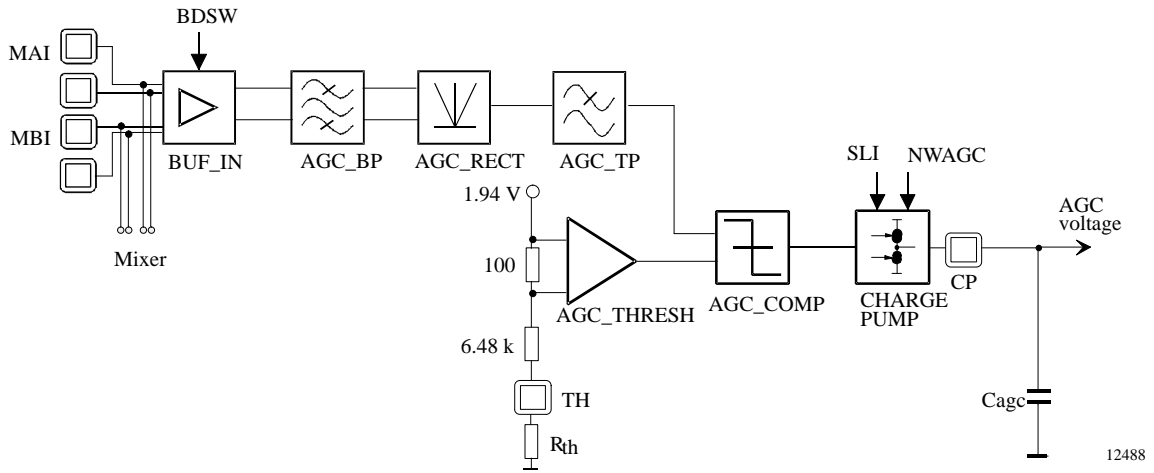


Figure 4.

Equivalent Circuit of VCO

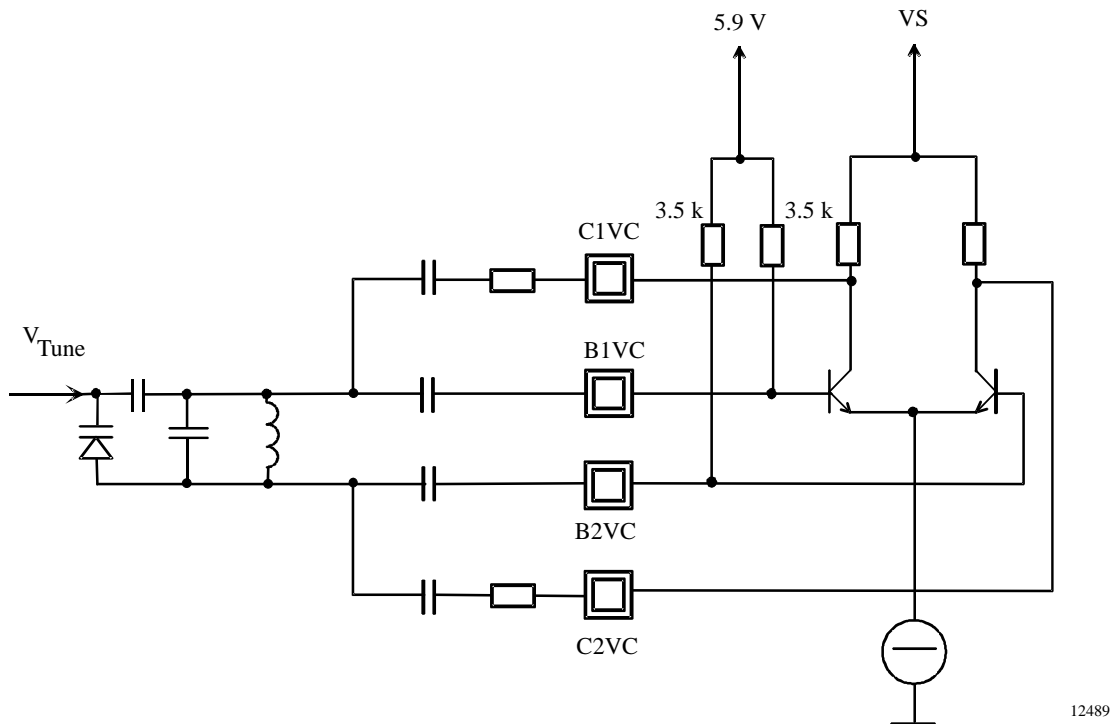


Figure 5.

Typical Operation Characteristics

Operating conditions: $V_S = 8.5\text{ V}$, $T_{amb} = 27^\circ\text{C}$. Test conditions see figure 3.

Overall Gain

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

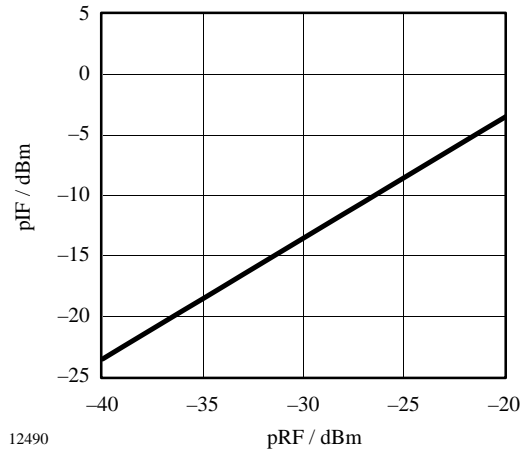


Figure 6.

3rd Order 2-Tone Intermodulation Ratio

$f_{RF1} = 240\text{ MHz}$ and $f_{RF2} = 241\text{ MHz}$ applied to MXA-Port;
DIM3 measured at IF-Port

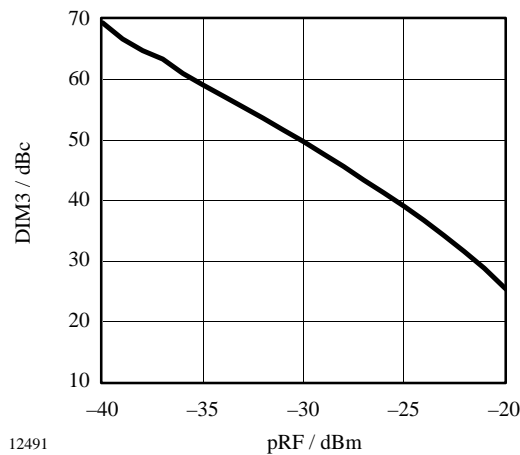


Figure 7.

RF Power Adjustment by Rth

$f_{RF} = 240\text{ MHz}$

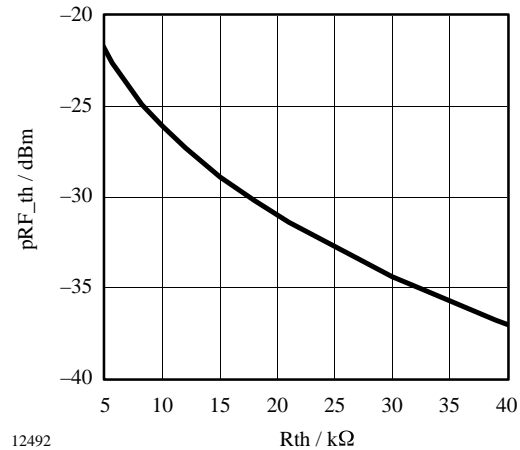


Figure 8.

Output Impedance SAW-Filter Driver

Pins 12 and 13, differential

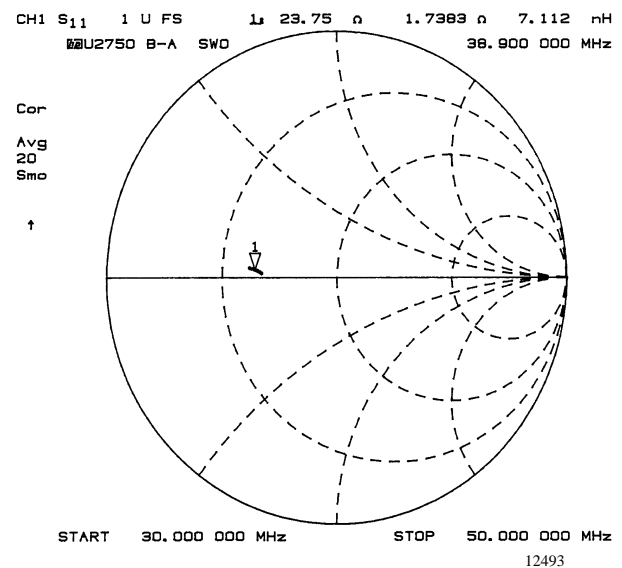
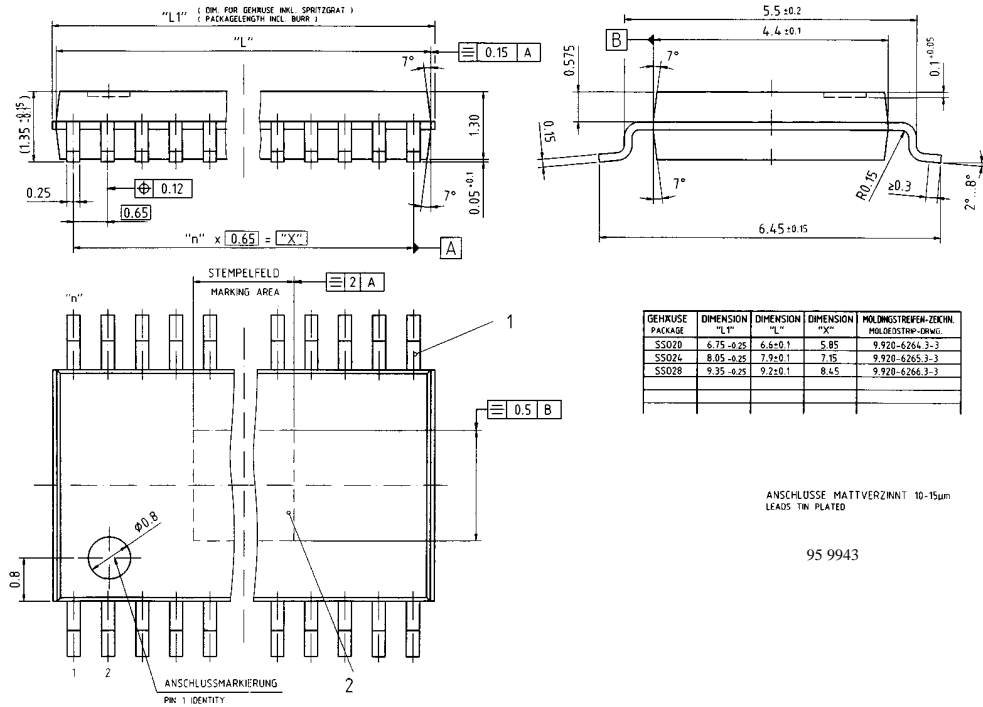


Figure 9.

fPackage Information

Package: SSO28
Dimensions in mm



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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.

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