2.5-GHz Double Balanced Mixer

Description

U2795B is a 2.5-GHz mixer for WLAN and RF telecommunications equipment, e.g., DECT and PCN, built with TELEFUNKEN's advanced bipolar technology. A double balanced approach was chosen to assure good isolation characteristics and a minimum of spurious products. The input and output are single ended, and their characteristics are programmable. No output transformer or balun is required.

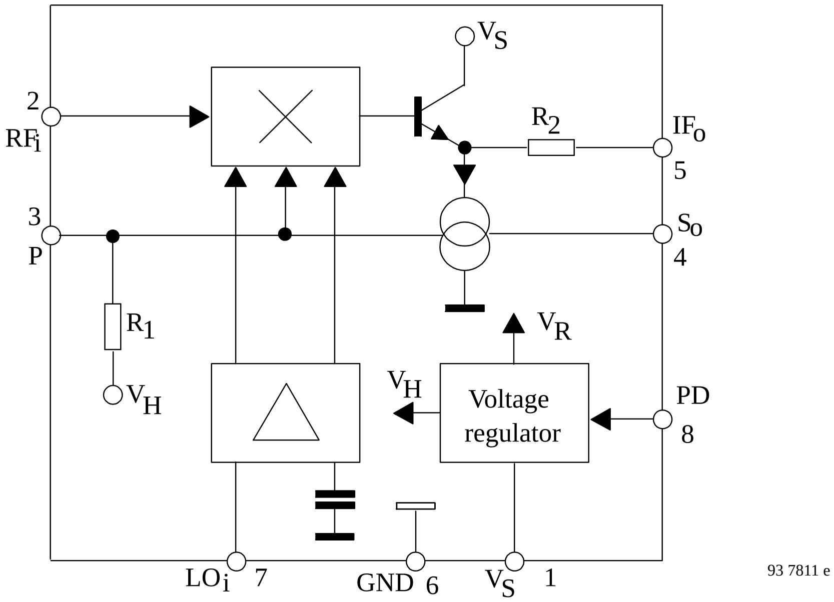
Features

- Supply voltage range: 2.7 to 5.5 V
- Single-ended output, no balun required
- Single-ended input for RF and LO
- Exellent isolation characteristics
- Power down mode
- IP3 and compression point programmable
- 2.5-GHz operating frequency
- SO-8 package

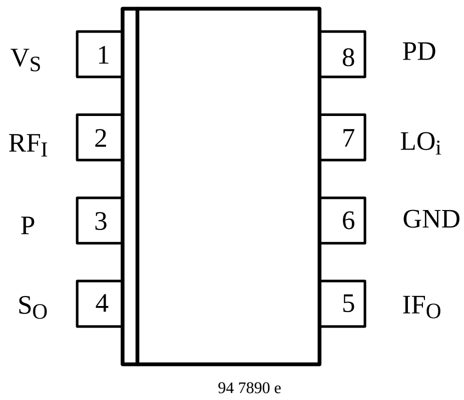
Benefits

- Reduced system costs due to few external component (no balun) requirements
- Standard independent product
- 3-V operation reduces the battery count and saves space

Block Diagram



Pin Description



Pin	Symbol	Function
1	V_S	Supply voltage
2	RF_i	RF input
3	P	Progamming port IP3, CP
4	S_O	Output symmetry
5	IF_O	IF output
6	GND	Ground
7	LO_i	LO input
8	PD	Power down

Functional Description

Supply Voltage

The IC is designed for a supply voltage of 2.7 to 5.5 V. As the IC is internally stabilized, the performance of the circuit is nearly independent of the supply voltage.

Input Impedance

Input impedance, Z_{RFi}, is about 700 Ω with an additional capacitive component. This condition provides the best noise figure in combination with a matching network.

3. Order Intercept Point (IP3)

Voltage divider, R_P / R_1, determinates both the input and output intercept point, IIP3 and OIP3. If R_P is infinity the IIP3 has the maximum of about –4 dBm.

The IP3/R_P characteristics are shown in figure 1 and 2.

Output Impedance and Intercept Point

Output impedance is shown in figure 9.

Both low output impedance and a high intercept point are with reference to a high value of R_P.

Current Consumption, I_S

Depending on the chosen input and output conditions of the IC, the current consumption, I_S, is between 4 mA and 10 mA. The current consumption in dependence of Rp is shown in figure 4.

Power Down

This feature provides an extension of battery life. If this function is not used, Pin 8 has to be connected to V_S (Pin 1).

Output Symmetry

The symmetry of the load current can be matched and so be optimized for a given load impedance.

Absolute Maximum Ratings

Parameters		Symbol	Value	Unit
Supply voltage	Pin 1	V_S	6	V
Input voltage	Pins 2, 3, 7 and 8	V_I	0 to V_S	V
Junction temperature		T_j	125	°C
Storage temperature range		T_{stg}	–40 to +125	°C

Thermal Resistance

Parameters		Symbol	Value	Unit
Junction ambient	SO 8	R_{thja}	175	K/W

Operating Range

Parameters		Symbol	Value	Unit
Supply voltage range	Pin 1	V_S	2.7 to 5.5	V
Ambient temperature range		T_{amb}	–40 to +85	°C

Electrical Characteristics

V_S = 3 V, f_{LOi} = 1 GHz, IF = 900 MHz, RF = 100 MHz, $R_P = \infty$, system impedance Zo = 50 Ω, T_{amb} = 25°C, R_T = 56 Ω reference point Pin 6, unless otherwise specified

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pin 1	V_S	2.7		5.5	V
Typical supply current range [1]	Pin 1	I_S	4		11	mA
Maximum supply current	Pin 1	I_S			13	mA
Conversion power gain	R_L = 50 Ω, $R_T = \infty$ R_L = 50 Ω, R_T = 56 Ω	PG_C PG_C		9 4		dB dB
Operating frequencies						
RF_i frequency	Pin 2	RF_i	10		2500	MHz
LO_i frequency	Pin 7	f_{LOi}	50		2500	MHz
IF_o frequency	Pin 5	f_{IFo}	50		2500	MHz
Isolation						
LO spurious at R_{Fi}	Pin 7 to 2 P_{iLO} = –10 to 0 dBm	IS_{LO-RF}		–30		dBm
RF_i to LO_i	Pin 2 to 7 P_{iRF} = –25 dBm	IS_{RF-LO}		35		dB
LO spurious at IF_o	Pin 7 to 5, P_{iLO} = –10 to 0 dBm	IS_{LO-IF}		–25		dBm
IF_o to LO_i	Pin 5 to 7	IS_{IF-LO}		30		dB
Output (IF)						
Output compression point	Pin 5	CP_o		–10		dBm
Input (RF)						
Input impedance	Pin 2	Z_{RFi}		700Ω‖0.8pF		Ω
Input compression point	Pin 2	CP_i		–14		dBm
Third order input intercept point	Pin 2	IIP3		–4		dBm
Input (LO)						
LO level	Pin 7	P_{iLO}		–6		dBm
Voltage standing wave ratio (VSWR)						
Input LO	Pin 7	$VSWR_{LOi}$		<2		
Output IF	Pin 4	$VSWR_{IFo}$		<2		
Noise performance						
Noise figure	P_{iLO} = 0 dBm, $R_T = \infty$	NF		10		dB
Power down mode						
Supply current	Pin 1 V_{PD} < 0.5 V Pin 1 V_{PD} = 0 V	I_{SPD}		 <5	30	µA
Power down voltage						
"Power ON"	Pin 8 V_S = 3.5 to 5.5 V V_S = 2.7 to 3.5 V	V_{PON}	V_S –0.5 V_S		V_S +0.5 V_S +0.5	V V
"Power DOWN"	Pin 8	V_{PDN}			1	V
Power down current	Pin 8 Power ON Power DOWN	I_{PON} I_{PDN}		0.15 < 5		mA µA
Settling time	Pin 8 to 5	t_{SPD}		<30		µs

Note 1: Depending on R_P

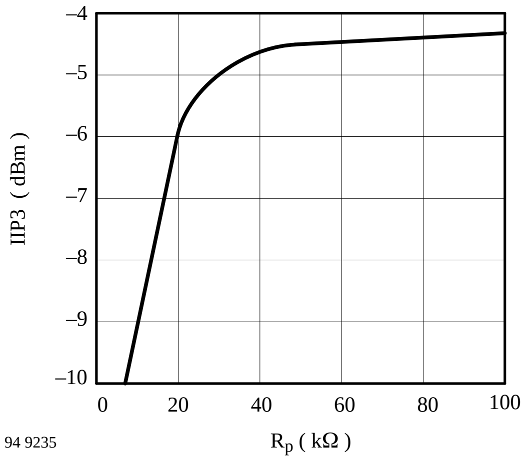


Figure 1. IIP3 versus resistor Rp, IF: 900 MHz

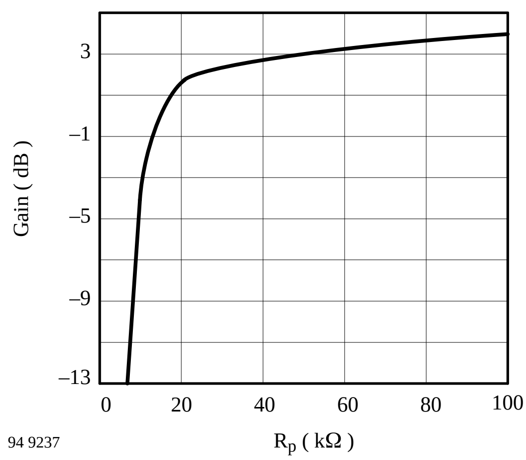


Figure 3. Gain versus resistor Rp, LO: 1030 MHz, level –10 dBm; RF: 130 MHz, –30 dBm, R_T = 56 Ω

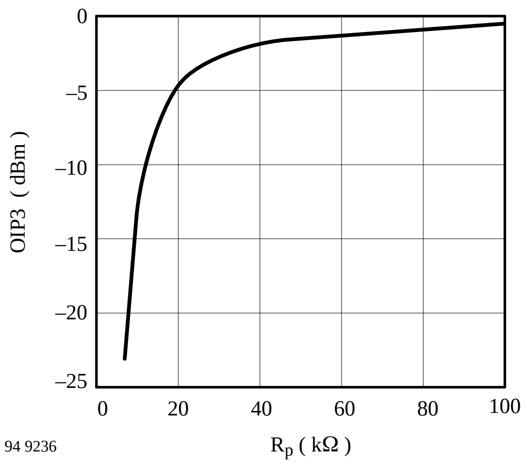


Figure 2. OIP3 versus resistor Rp, IF: 900 MHz

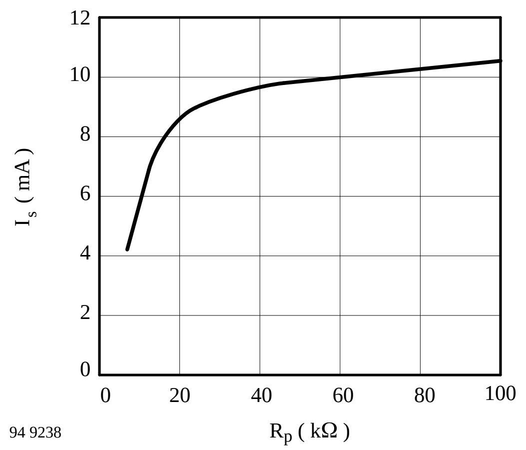


Figure 4. Supply current I_S versus resistor Rp

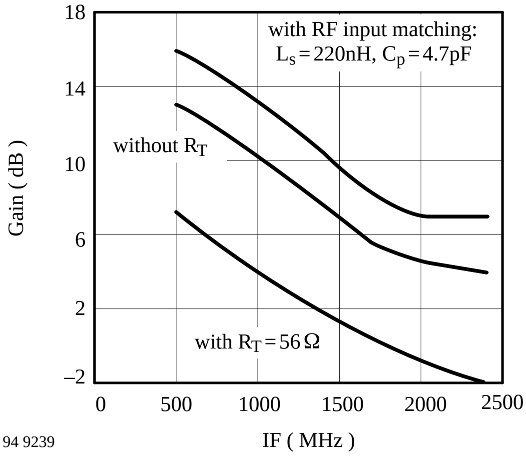


Figure 5. Gain versus IF output frequency, LO level: –6 dBm, RF: 130 MHz, –35 dBm; parameter: RF input termination

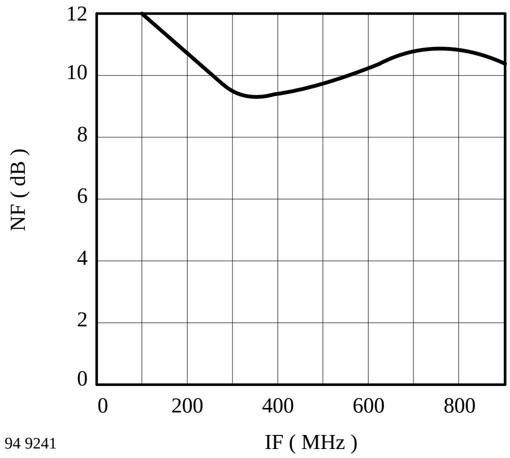


Figure 7. Double sideband noise figure versus IF output frequency; LO: 1000 MHz, level 0 dBm; no RF input matching, R_T left out

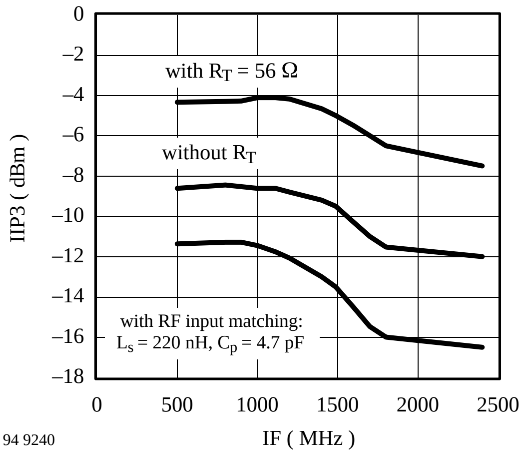


Figure 6. IIP3 versus IF output frequency, LO level: –6 dBm; RF: 130 MHz / 130.1 MHz, –35 dBm; parameter: RF input termination

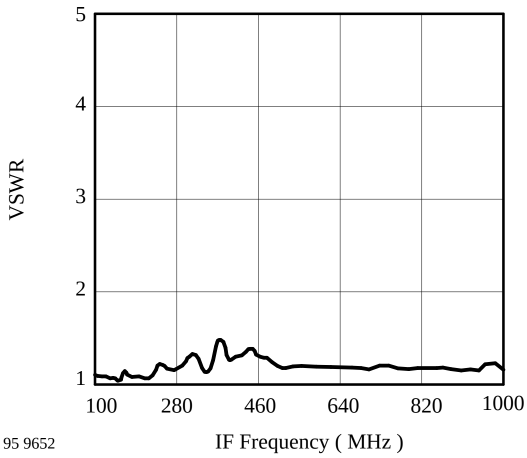


Figure 8. Typical VSWR frequency response of the IF output, $R_P = \infty$

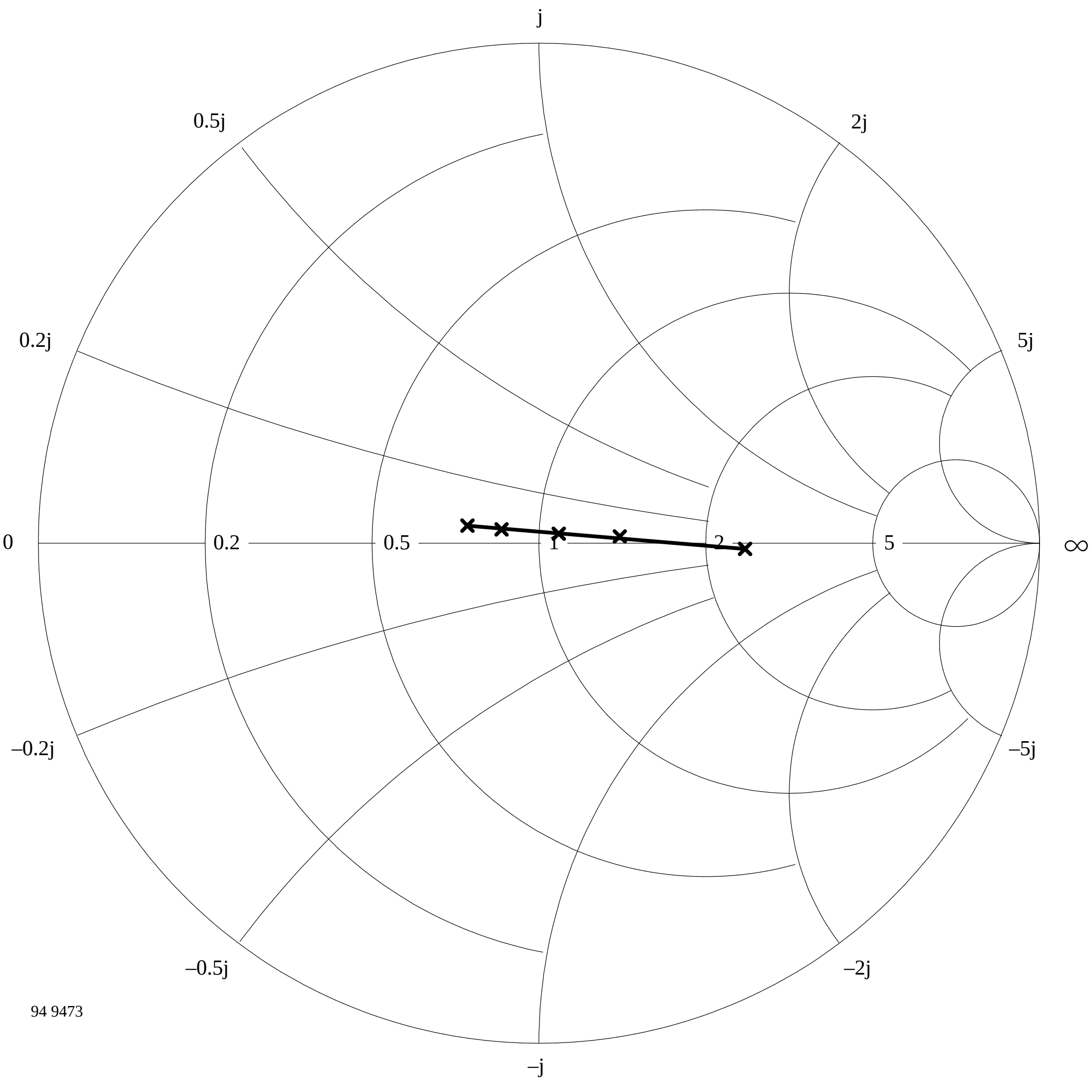


Figure 9. Typical Impedance of the output versus R_P at frequency f_{IFo} = 900 MHz
markers (from left to right): R_P = ∞ / 22 kΩ / 10 kΩ / 8.2 kΩ / 5.6 kΩ

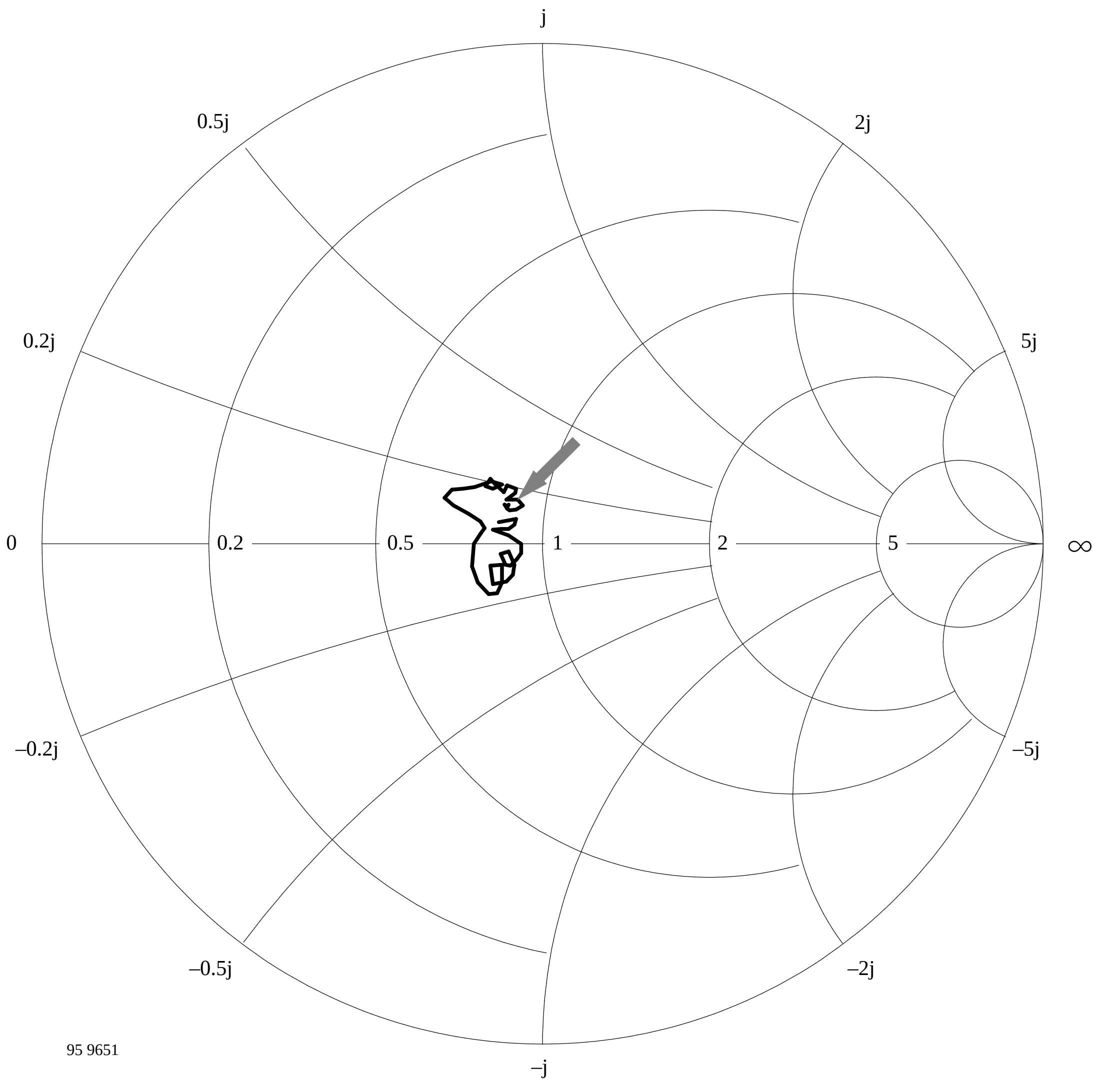


Figure 10. Typical S11 frequency response of the IF output, $R_P = \infty$,
IF frequency from 100 MHz to 1000 MHz, marker: 900 MHz

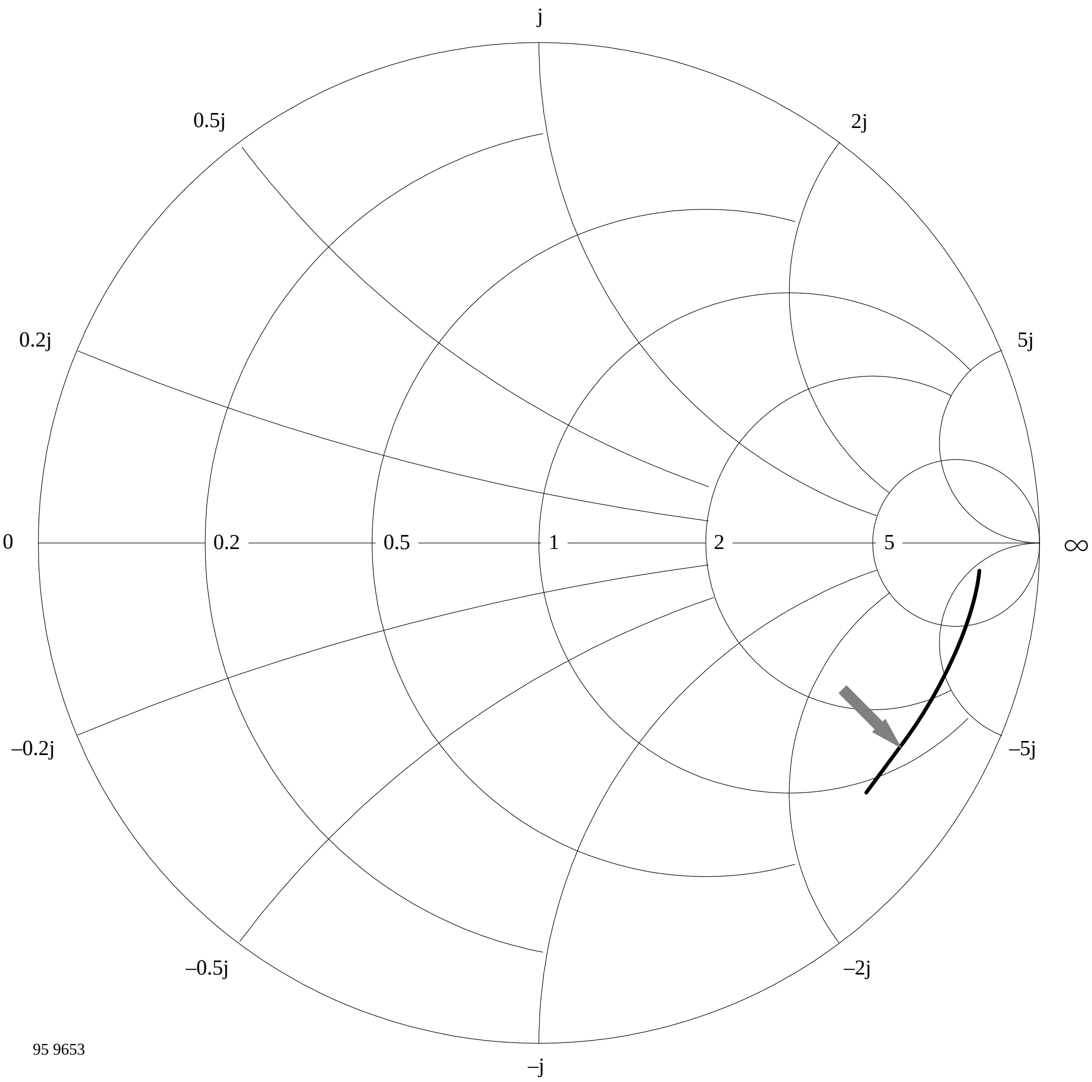


Figure 11. Typical S11 frequency response of the RF intput, $R_P = \infty$, $R_T = \infty$
RF frequency from 100 MHz to 1000 MHz, marker: 900 MHz

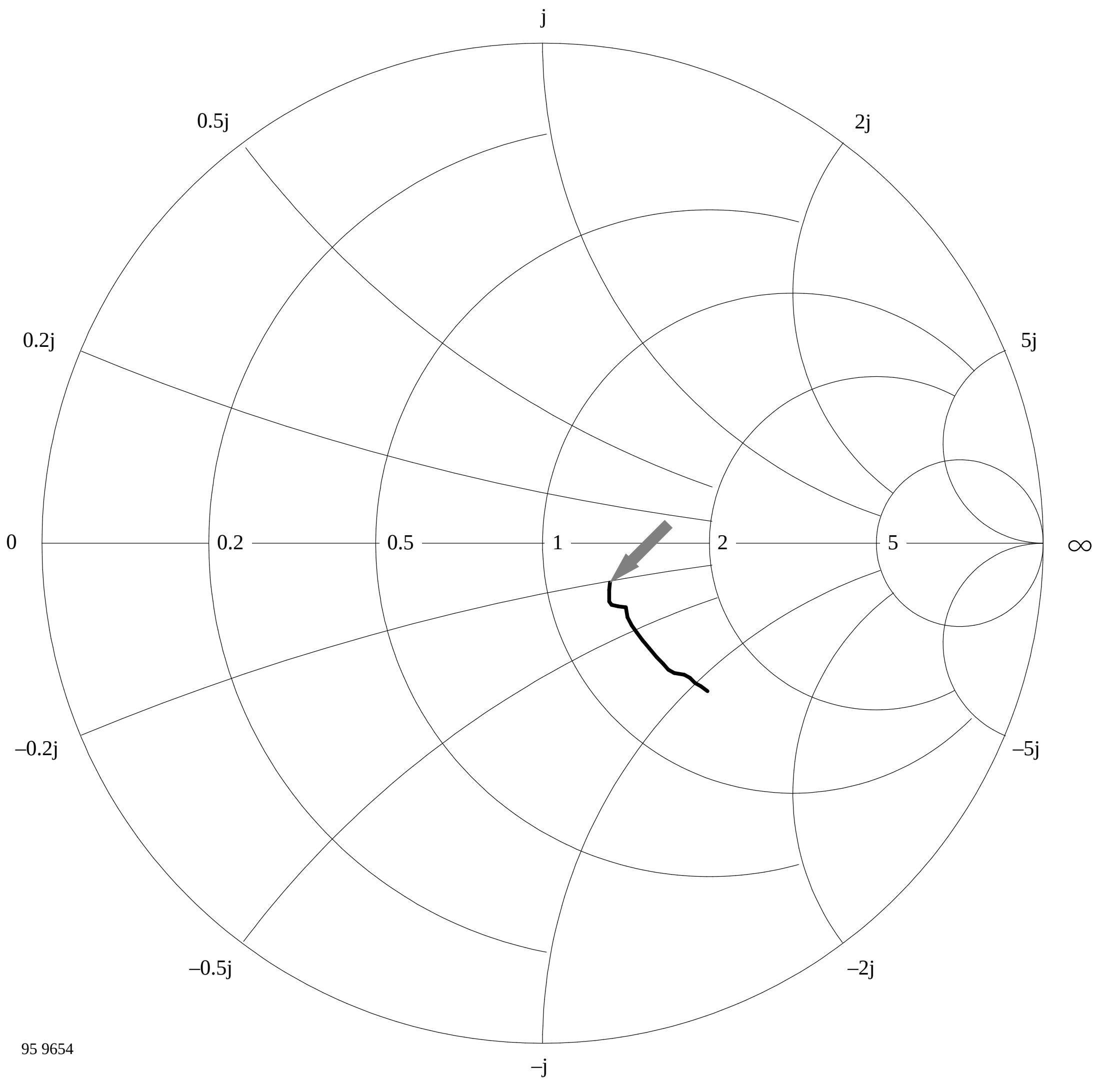
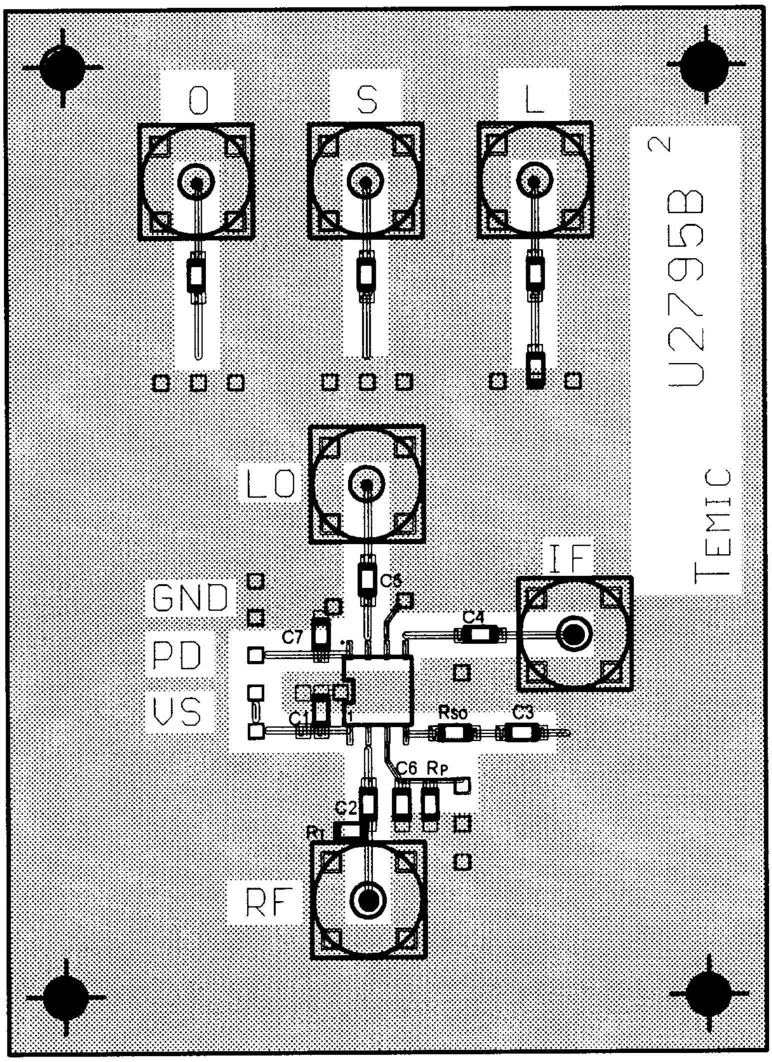


Figure 12. Typical S11 frequency response of the LO intput, $R_P = \infty$,
LO frequency from 100 MHz to 1000 MHz, marker: 900 MHz

Application Circuit (Evaluation Board)



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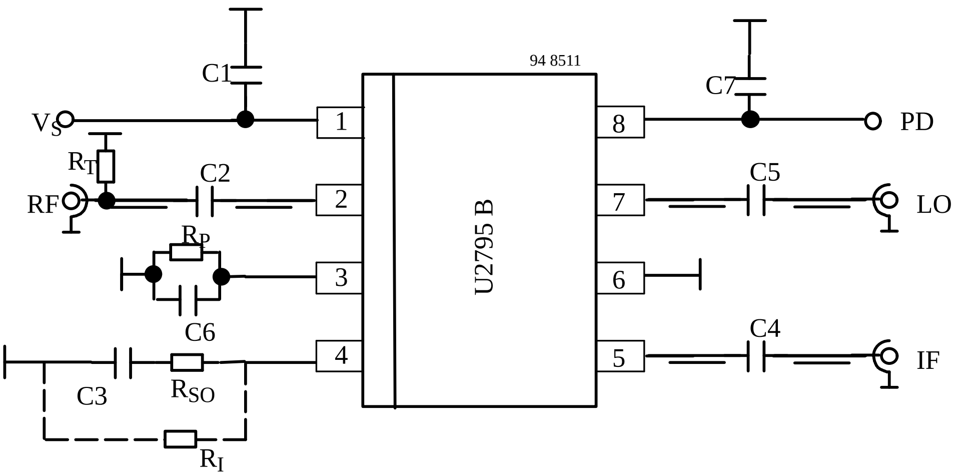
Application



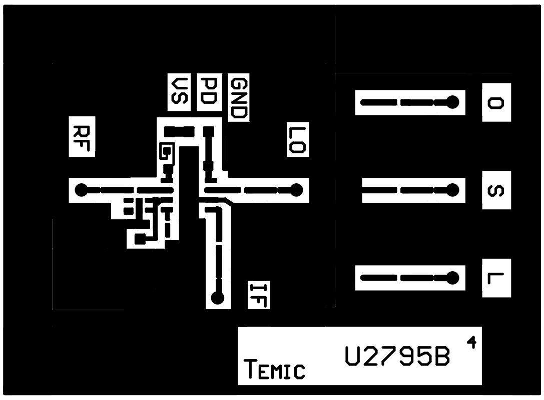
Part List	
C 1	10 nF
C2, C3, C4, C5, C6, C7	100 pF
*R_P	
———	50-Ω Microstrip
*R_{SO}	68 Ω
— — —	optional
R_T	56 Ω

With the part list values, the PD settling time is < 20 µs. Using other values, time requirements in burst-mode appli- cations have to be considered.

Values of R_{SO} and R_P depending on the input and output condition requirements. For R_{SO} 68 Ω is recommended.

With the optional R_I the intercept and compression point can be slightly increased; values between 500 Ω and 1 kΩ are suitable. Please note that such modification will also increase the supply current.

Application Board



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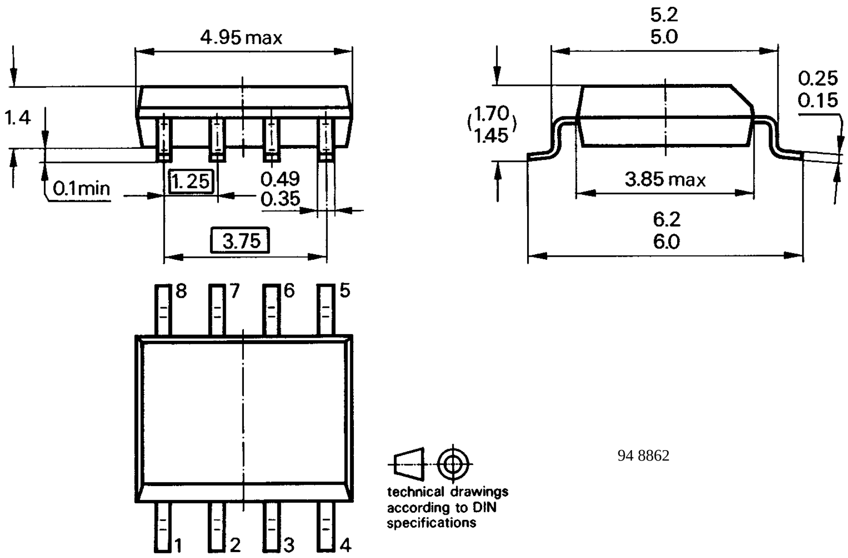
Ordering Information

Extended Type Number	Package
U2795B-FP	SO 8

Dimensions in mm

Package: SO 8



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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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