CT2-RX/TX IC

Description

The IC for digital cordless telephone application is fabricated using TEMIC's most advanced UHF process. It covers the CT2 band (864 MHz to 868 MHz) as well as the CT2 Plus band (up to 952 MHz). The RX/TX circuit provides the down conversion to the data stream and the up conversion from the first IF. In conjunction with TEMIC's RF front end, Twin PLL, I/Q modulator and AMDs CT2 PhoX^{TM} controller AM 79C4xx a complete CT2 IC kit is available.

Electrostatic sensitive device.
Observe precautions for handling.

Features

- Low supply voltage 2.9 V typical (min. 2.7 V)
- Provides down conversion to the data stream, up conversion from the first IF
- Integrated UHF and VHF VCOs
- Low noise figure of RX path (NF ≤ 10 dB)
- RX and TX power down
- First IF filter used for transmit as well receive mode
- Temperature compensated logarithmic **R**eceiver **S**ignal **S**trength **I**ndicator (RSSI) with a 75 dB dynamic range
- Low power consumption in RX and TX mode (<20 mA typ.)
- SSO28 plastic package

Benefits

- Low power consumption results in extended talk time
- Few external components and very small package save space

Block Diagram (Simplified Schematic)

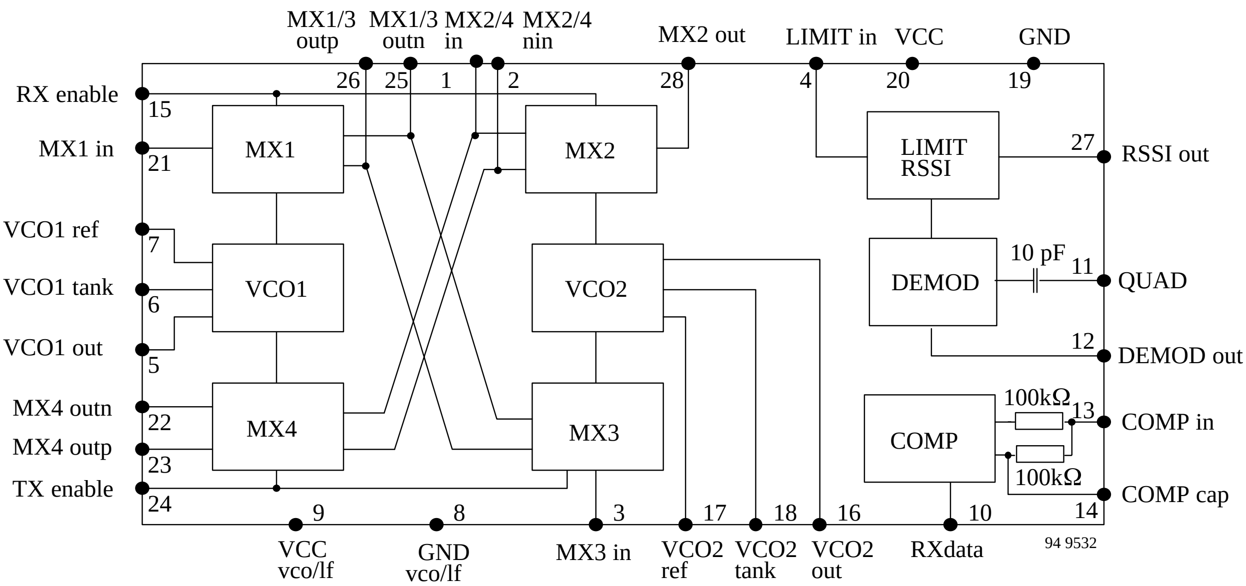


Figure 1.

Ordering Information

Extended Type Number	Package	Remarks
U2760B-AFS	SSO28	Rail, MOQ 600pcs.
U2760B-AFS G3	SSO28	Tape + reel, MOQ 4000 pcs.

Functional Description

MX1

Mixer 1 converts the RF signal to the first IF. It has a high impedance, unsymmetrical input and a symmetrical open collector output.

MX2

The second mixer provides the down conversion to the second IF. An external SAW filter is placed at its input to provide rejection of the image frequency and spurious signals that went through the RF filtering.

LIMITER / RSSI

This block contains a high gain (100 dB) amplifier, providing a limited signal at the second IF frequency for the demodulation, as well as a signal strength indicator providing an output voltage proportional to the input power.

Demod

The quadrature demodulator in the receiving path contains an internal 10 pF quadrature capacitor to couple the IF signal to the external Tank providing the 90 degree phase shift. An external bit slicer reshapes the bits, a sample and hold circuit maintains the average DC value at the demodulator when switching the signal between transmission and reception.

COMP

The comparator circuit with 100 kΩ input resistor and external input biasing has a 10 mV hysteresis. It is designed to square up the demodulated data signal.

MX3

The third mixer converts the 800 kHz signal coming from the modulator circuit to the IF frequency. It has a high impedance, unsymmetrical input and a symmetrical open collector output.

MX4

This mixer is designed for the up conversion of the RF frequency. It has a high impedance, unsymmetrical input and a symmetrical open collector output. The image rejection is obtained by external RF filtering.

The same first IF filter is used for the transmit path and the receive path. In the transmit path, this filter is supposed to eliminate the mixing products from MX3, in particular, the harmonics of the IF frequency.

VCO1

The UHF VCO covers the frequency band up to 700 MHz. For external VCO application this circuit can be used as a buffer stage.

VCO2

This VCO covers a frequency band up to 400 MHz.

Pin Description

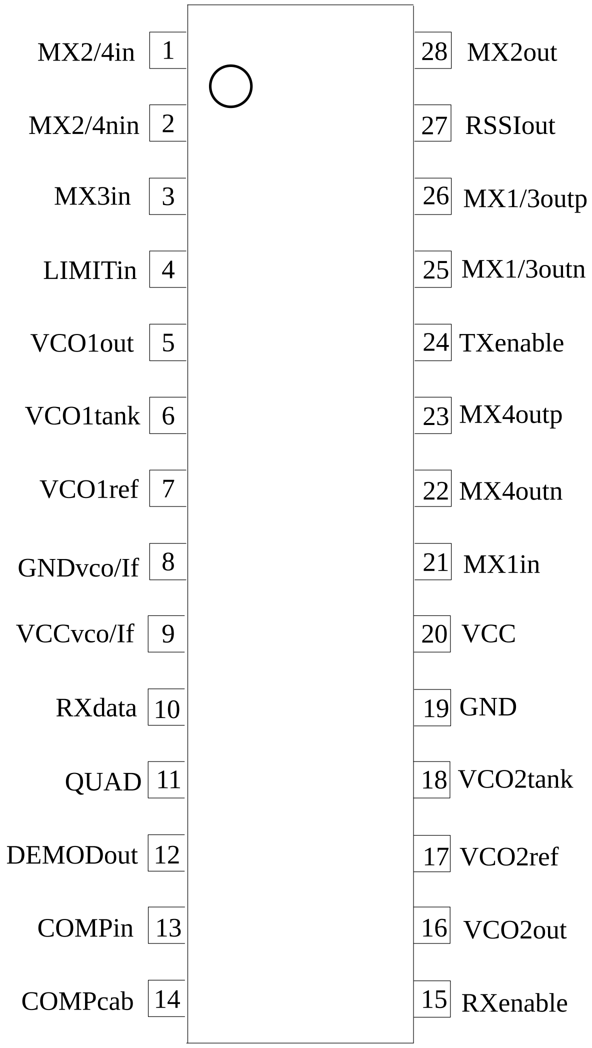
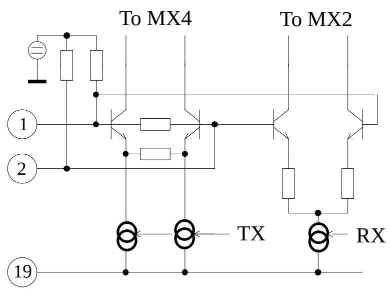
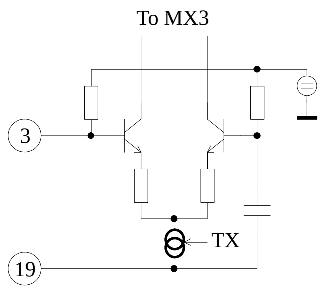
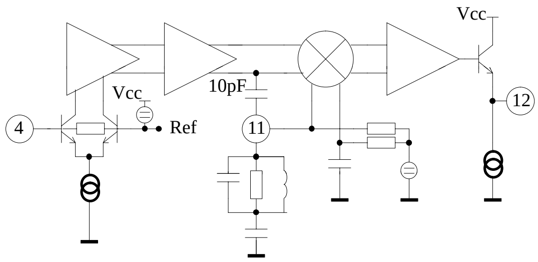
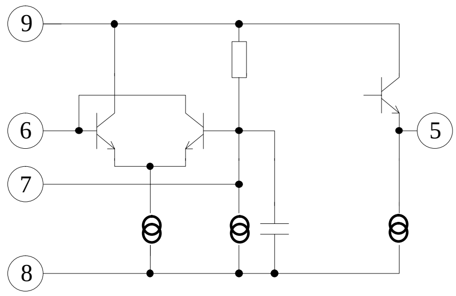
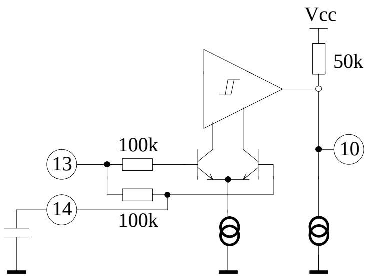
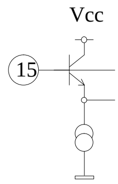
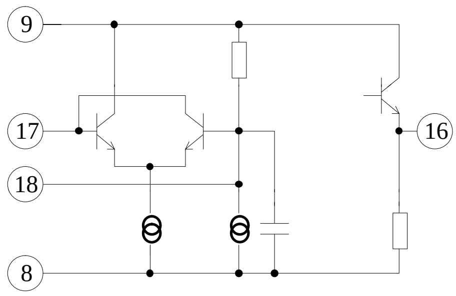
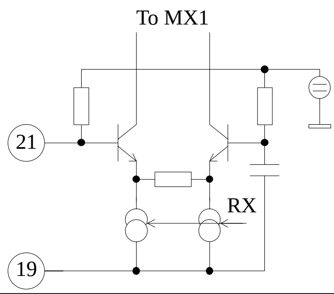
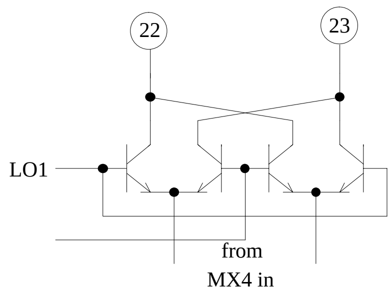


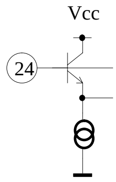
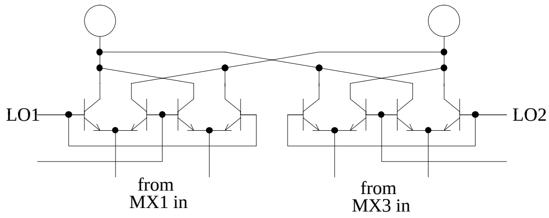
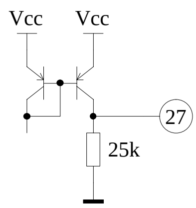
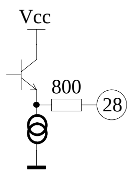
Figure 2. Pinning

Pin	Symbol	Function
1	MX2/4in	Mixer2/ Mixer4 input
2	MX2/4nin	Mixer2/ Mixer4 ref. input
3	MX3in	Mixer3 input
4	LIMITin	Limiter/RSSI input
5	VCO1out	VCO1 output (to PLL)
6	VCO1tank	VCO1 resonator
7	VCO1ref	VCO1 resonator, to be blocked
8	GNDvco/lf	Ground VCO, low frequency parts
9	VCCvco/lf	Power supply VCO/LF parts
10	RXdata	RX data output
11	QUAD	Quadrature filter
12	DEMODout	Demodulator output
13	COMPin	Comparator input
14	COMPcap	Comparator blocking capacitor
15	RXenable	RX enable
16	VCO2out	VCO2 output (to PLL)
17	VCO2ref	VCO2 resonator, to be blocked
18	VCO2tank	VCO2 resonator
19	GND	Ground
20	VCC	Power supply voltage
21	MX1in	Mixer1 input
22	MX4outn	Mixer 4 output n
23	MX4outp	Mixer 4 output p
24	TXenable	TX enable
25	MX1/3outn	Mixer1/ Mixer3 output n
26	MX1/3outp	Mixer1/ Mixer3 output p
27	RSSIout	Signal strength output
28	MX2out	Mixer2 output

Pin Functions

Pin	Symbol	Pin Voltage	Function	Equivalent Circuit
1	MX2/4in	1.5	Mixer2/ Mixer4 input	
2	MX2/4nin	1.5	Mixer2/ Mixer4 complementary input Pin 1 is the input of the mixers, Pin 2 can be used for differential input signal, or should be connected to GND via a bypass capacitor	
3	MX3in	1.7 (RX) 2.4 (TX)	Mixer3 input complementary input is internally connected to GND via a bypass capacitor	
4	LIMITin	2.1	Limiter/RSSI input	
11	QUAD	1.5	Quadrature filter	
12	DEMODout	1.2	Demodulator output	
5	VCO1out	1.1	VCO1 output (to PLL)	
6	VCO1tank	1.5	VCO1 resonator	
7	VCO1ref	1.5	VCO1 reference, to be blocked. This Pin is also internally connected to GND via a bypass capacitor	
8	GNDvco/lf	–	Ground VCO, low frequency parts	
9	VCCvco/lf	–	Power supply VCO/LF parts	

Pin	Symbol	Pin Voltage	Function	Equivalent Circuit
10	RXdata	0 to 2.9	RX data output	
13	COMPin	1.2	Comparator input	
14	COMPcap	1.2	Comparator blocking capacitor	
15	RXenable	–	RX enable	
16	VCO2out	1.1	VCO2 output (to PLL)	
17	VCO2ref	1.6	VCO2 resonator, to be blocked	
18	VCO2tank	1.6	VCO2 resonator	
19	GND	–	Ground (mixer parts)	
20	VCC	–	Power supply (mixer parts)	
21	MX1in	1.5	Mixer1 input complimentary input is internally connected to GND via a bypass capacitor	
22	MX4outn	–	Mixer 4 output n	
23	MX4outp	–	Mixer 4 output p	

Pin	Symbol	Pin Voltage	Function	Equivalent Circuit
24	TXenable	–	TX enable	
25	MX1/3outn	–	Mixer1/ Mixer3 output n	
26	MX1/3outp	–	Mixer1/ Mixer3 output p	
27	RSSIout	0.2 to 2.7	Signal strength output	
28	MX2out	1.0 (RX) 2.4 (TX)	Mixer2 output	

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Supply voltage	V_{CC}	0 to +5	V
Input voltages Pins 1, 2, 3, 4, 13, 14, 15, 21 and 24	V_{in}	0 to V_{CC}	V
Input voltages Pins 6, 7, 17 and 18	V_{in}	1.5	V
Junction temperature	T_j	125	°C
Storage temperature range	T_{stg}	–40 to +125	°C

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient SSO28	R_{thJA}	130	K/W

Operating Conditions

Parameters	Symbol	Value	Unit
Supply voltage	V_{CC}	2.7 to 3.6	V
Operating temperature	T_{amb}	–5 to +45	°C

Electrical Characteristics: Receiver Input Mixer (MX1)

Test conditions (unless otherwise specified): V_{CC} = 2.9 V, T_{amb} = 25°C, referred to application circuit, f_{RF} = 866.05 MHz, f_{IF1} = 240.05 MHz.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pin 20	V_{CC}	2.7	2.9	3.6	V
Supply current	@ V_{CC} = 2.9 V, Pin 20	Is		3		mA
Input impedance	Pin 21	Zin		3		kΩ
Input frequency	Pin 21	fin			1000	MHz
Output frequency	Pins 25 and 26	fout		240	300	MHz
Power gain	Pins 21, 25 and 26	Gp		8		dB
Noise figure	Pins 21, 25 and 26	NF		8	10	dB
Compression	Pins 21, 25 and 26	P_1dB	–18			dBm
Third order input intercept point	Pins 21, 25 and 26	IIP3	–8			dBm
LO to RF isolation	Pin 21	$Isol_{LO}$	20			dB
LO ± (IF/2) response	@ P_{in} = –84 dBm, Pin 21				–10	dB

Electrical Characteristics: Receiver IF Mixer (MX2)

Test conditions (unless otherwise specified): V_{CC} = 2.9 V, T_{amb} = 25°C, referred to application circuit, f_{IF1} = 240.05 MHz, f_{IF2} = 800 kHz.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pin 20	V_{CC}	2.7	2.9	3.6	V
Supply current	@ V_{CC} = 2.9 V, Pin 20	Is		3		mA
Input impedance	Pin 1	Zin	130	200	300	Ω
Input frequency	Pin 1	fin			300	MHz
Output frequency	Pin 28	fout		0.8	15	MHz
Power gain	Pins 1 and 28	Gp	10	11		dB
Noise figure	Pins 1 and 28	NF			20	dB
Compression	Pins 1 and 28	P_1dB	–20			dBm
Third order input intercept point	Pins 1 and 28	IIP3	–10			dBm
LO to RF isolation	Pin 1	$Isol_{LO}$	20			dB
LO ± (IF/2) response	@ P_{in} = –40 dBm, Pin 1				–35	dB

Electrical Characteristics: RSSI/Limiter Amplifier

Test conditions (unless otherwise specified): V_{CC} = 2.9 V, T_{amb} = 25°C, referred to application circuit, f_{LIMIT} = 800 kHz.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pin 9	V_{CC}	2.7	2.9	3.6	V
Supply current	@ Vcc = 2.9 V, Pin 9	Is		1.5		mA
Input impedance	Pin 4	Zin		1500		Ω
Voltage gain	Pin 4	Gv		100		dB
Frequency range	Pin 4	f_{LIMIT}	0.5	0.8	5	MHz
RSSI range	Pins 4 and 27		– 90		– 15	dBm
RSSI voltage at Pmin	Pins 4 and 27		0.2		0.4	V
RSSI voltage at Pmax	Pins 4 and 27		2.4		2.6	V
RSSI accuracy	Pins 4 and 27		– 2		2	dB
Output impedance	Pins 27	R_{RSSI}	19	24	29	kΩ
Rise time	C_{RSSI} = 1 nF, Pin 27				50	µs
Fall time	C_{RSSI} = 1 nF, Pin 27				50	µs

Electrical Characteristics: Demodulator

Test conditions (unless otherwise specified): V_{CC} = 2.9 V, T_{amb} = 25°C, referred to application circuit, f_{LIMIT} = 800 kHz.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pin 9	V_{CC}	2.7	2.9	3.6	V
Supply current	@ Vcc = 2.9 V, Pin 9	Is		0.2		mA
Output voltage	±18 kHz deviation, Pins 4 and 12	Vout		120		mV_{rms}

Electrical Characteristics: Comparator

Test conditions (unless otherwise specified): V_{CC} = 2.9 V, T_{amb} = 25°C, referred to application circuit

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pin 9	Vcc	2.7	2.9	3.6	V
Supply current	@ Vcc = 2.9 V, Pin 9	Is		0.15		mA
Input hysteresis	Pins 13 and 14			10		mV
Output HIGH voltage	RLoad to GND ≥ 500 kΩ, Pin 10		2.3			V
Output LOW voltage	RLoad to V_{CC} ≥ 50 kΩ, Pin 10				0.6	V

Electrical Characteristics Transmitter IF Mixer (MX3)

Test conditions (unless otherwise specified): V_{CC} = 2.9 V, T_{amb} = 25°C, referred to application circuit,
fin = 800 kHz, f_{IF} = 240.05 MHz.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pin 20	V_{CC}	2.7	2.9	3.6	V
Supply current	@ V_{CC} = 2.9 V, Pin 20	Is		1.3		mA
Input impedance	Pin 2	Zin		5		kΩ
Input frequency	Pin 3	fin		0.8	15	MHz
Output frequency	Pins 25 and 26	fout		250	300	MHz
Output power	v_{inpp} = 320 mV Pins 25 and 26	Pout		– 16		dBm
Noise figure	Pins 2, 25 and 26	NF			25	dB

Electrical Characteristics Transmitter Output Mixer (MX4)

Test conditions (unless otherwise specified): V_{CC} = 2.9 V, T_{amb} = 25°C, referred to application circuit,
f_{IF} = 240.05 MHz, f_{RF} = 866.05 MHz.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pin 20	Vcc	2.7	2.9	3.6	V
Supply current	@ V_{CC} = 2.9 V, Pin 20	Is		3.5	4	mA
Input impedance	Pin 1	Zin	130	200	300	Ω
Input frequency	Pin 1				300	MHz
Output frequency	Pins 22 and 23				900	MHz
Output power	P_{In} = –22 dBm, Pins 22 and 23	Pout	–16	– 14		dBm
Noise figure	Pins 1, 22 and 23	NF			12	dB
LO leakage	Pins 22 and 23	Lk_{LO}			–34	dBm
IF leakage	Pins 22 and 23	Lk_{IF}			–45	dBm
(2*IF) leakage	Pins 22 and 23	Lk_{2IF}			– 55	dBm
(3*IF) leakage	Pins 22 and 23	Lk_{3IF}			– 65	dBm
(n*IF) leakage, n > 3	Pins 22 and 23	Lk_{nIF}			– 60	dBm

Electrical Characteristics: UHF Voltage Controlled Oscillator (VCO1)

Test conditions (unless otherwise specified): V_{CC} = 2.9 V, T_{amb} = 25°C, referred to application circuit, f = 626 MHz

Parameters	Test Conditions / Pins	Symbol	Min	Typ	Max	Unit
Supply voltage range	Pin 9	V_{CC}	2.7	2.9	3.6	V
Supply current	@ Vcc = 2.9 V, Pin 9	Is		3		mA
Frequency bandwidth	Pins 5, 6 and 7	f_{BW}			700	MHz
Phase noise ±100 kHz	Pins 5, 6 and 7	P_N			– 86	dBc/Hz
Phase noise ±200 kHz	Pins 5, 6 and 7	P_N			– 104	dBc/Hz
Phase noise ±300 kHz	Pins 5, 6 and 7	P_N			– 109	dBc/Hz
Phase noise ±400 kHz	Pins 5, 6 and 7	P_N			– 125	dBc/Hz
Phase noise @ 50 MHz	Pins 5, 6 and 7	P_N			– 150	dBc/Hz
Output power	50 Ω termination, Pin 5	Pout	– 15			dBm

Electrical Characteristics: VHF Voltage Controlled Oscillator (VCO2)

Test conditions (unless otherwise specified): V_{CC} = 2.9 V, T_{amb} = 25°C, referred to application circuit, f = 239.25 MHz

Parameters	Test Conditions / Pins	Symbol	Min	Typ	Max	Unit
Supply voltage range	Pin 9	Vcc	2.7	2.9	3.6	V
Supply current	@ Vcc = 2.9 V, Pin 9	Is		2.5		mA
Frequency bandwidth	Pins 16, 17 and 18	f_{BW}			400	MHz
Phase noise 100 kHz	Pins 16, 17 and 18	P_N			– 86	dBc/Hz
Phase noise 200 kHz	Pins 16, 17 and 18	P_N			– 114	dBc/Hz
Phase noise 300 kHz	Pins 16, 17 and 18	P_N			– 119	dBc/Hz
Phase noise 400 kHz	Pins 16, 17 and 18	P_N			– 135	dBc/Hz
Phase noise @ 50 MHz	Pins 16, 17 and 18	P_N			– 150	dBc/Hz
Output power	50 Ω termination, Pin 16	Pout	– 15			dBm

Applications Information

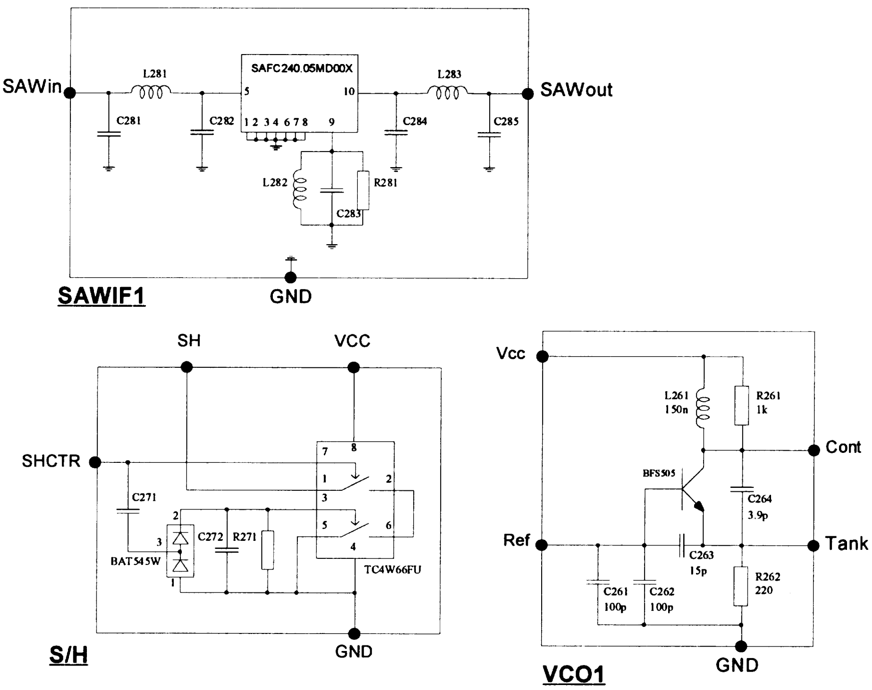


Figure 3.

Application Circuit

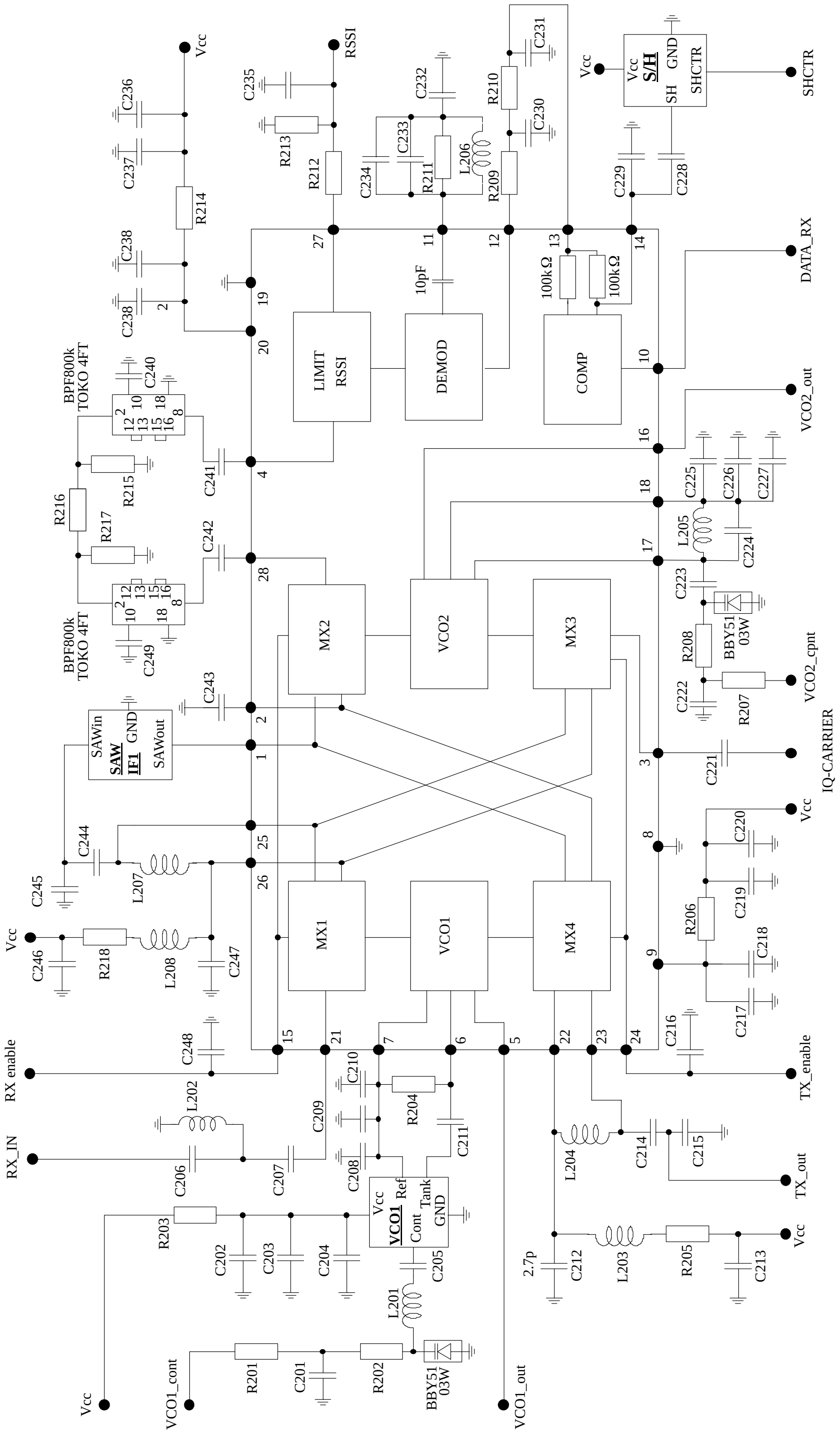
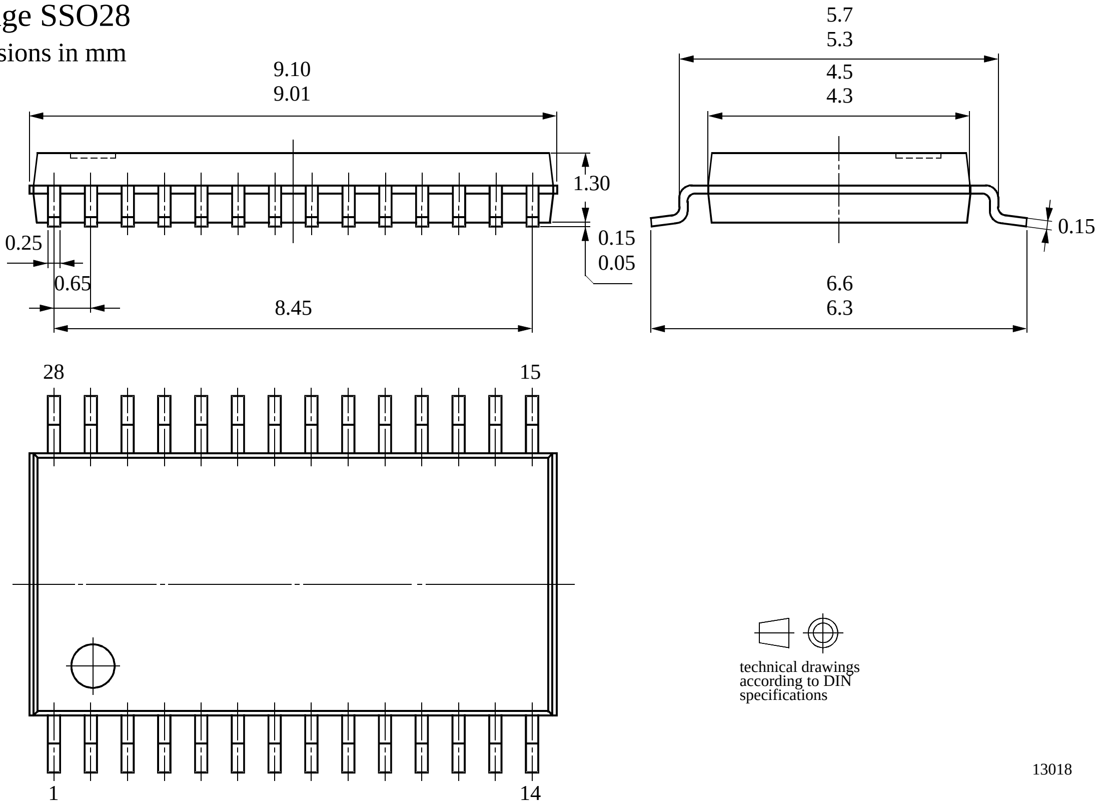


Figure 4.

Package Information

Package SSO28
Dimensions in mm



Ozone Depleting Substances Policy Statement

It is the policy of **TEMIC Semiconductor 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 Semiconductor GmbH 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 Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

TEMIC Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany
Telephone: 49 (0)7131 67 2594, Fax number: 49 (0)7131 67 2423