

DECT Single-Chip Transceiver

Description

The U2801B is an RF IC for low-power DECT applications. The TQFP48-packaged IC is a complete transceiver including image rejection mixer, IF amplifier, FM demodulator, baseband filter, RSSI, TX preamplifier, power-ramping generator for power amplifiers, inte-

grated synthesizer, fully integrated VCO, TX filter and modulation compensation circuit for advanced closed-loop modulation concept. No mechanical tuning is necessary in production.

Features

- Supply-voltage range 3 V to 5 V (unregulated)
- Auxiliary-voltage regulator on-chip
- Low current consumption
- Few low cost external components
- No mechanical tuning required
- Non-blindslot and blindslot operation
- Unlimited multislot operation with advanced closed-loop modulation (13.824 MHz/ 27.648 MHz)
- TX preamplifier with 0 dBm output power at 1.9 GHz and ramp-signal generator for SiGe power amplifier

Block Diagram

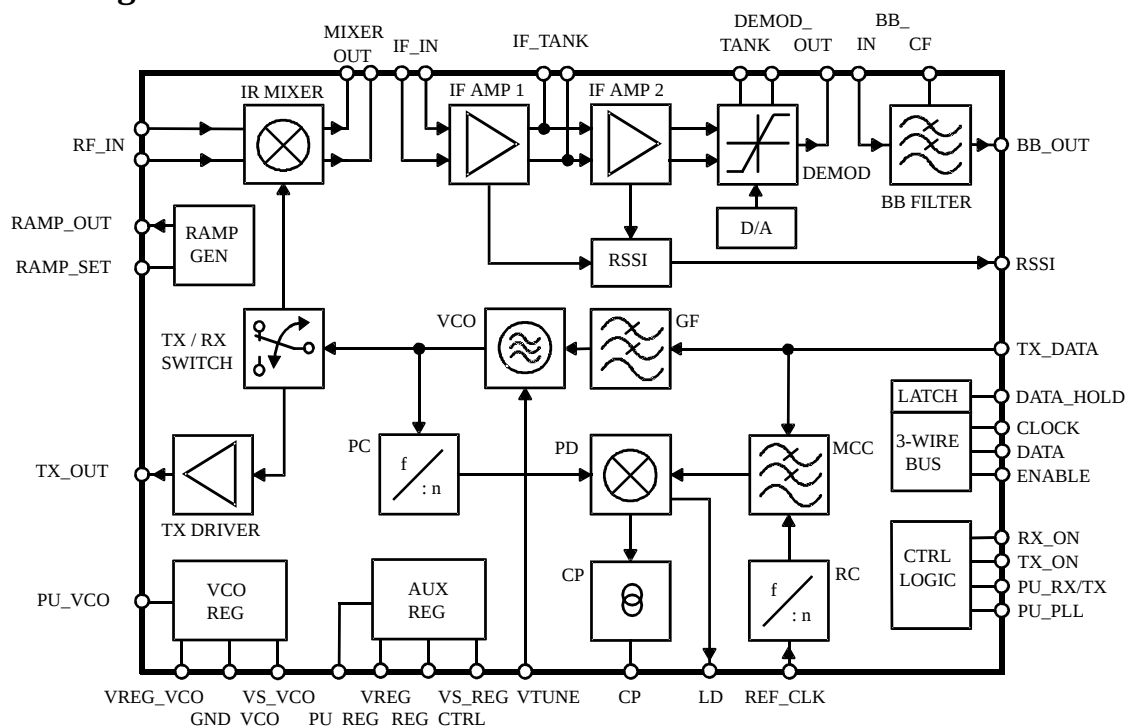
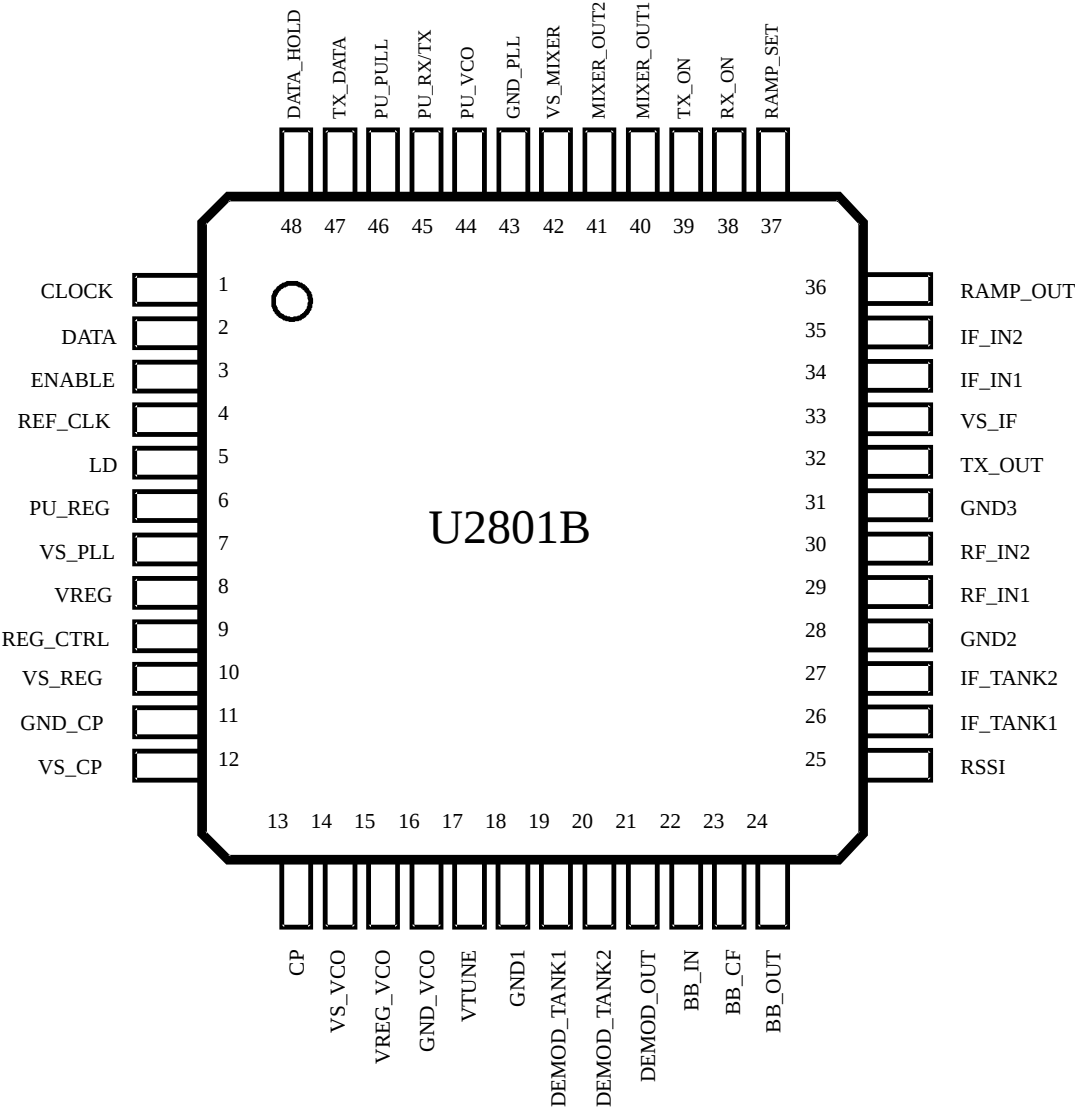


Figure 1. Block diagram

Ordering Information

Extended Type Number	Package	Remarks
U2801B-MFY	TQFP48	Tray
U2801B-MFYG3	TQFP48	Taped and reeled

Pin Description



14228

Figure 2. Pinning

Pin	Symbol	Function	Configuration
1	CLOCK	3-wire-bus: Clock input	The diagram shows a 3-wire-bus configuration for pins 1, 2, and 3. It includes a reference voltage (Ref) and a supply voltage (Vs). The bus lines are connected to the pins through 5k resistors. A diode is connected to the bus lines, and another diode is connected to the reference voltage. The supply voltage (Vs) is connected to the bus lines through a diode.
2	DATA	3-wire-bus: Data input	
3	ENABLE	3-wire-bus: Enable input	

Pin Description (continued)

Pin	Symbol	Function	Configuration
4	REF_CLK	Reference-frequency input	
5	LD	Lock-detect output	
6	PU_REG	Aux. voltage regulator power-up input	
7	VS_PLL	PLL supply voltage	

Pin Description (continued)

Pin	Symbol	Function	Configuration
8	VREG	Aux. voltage-regulator output	
9	REG_CTRL	Aux. voltage-regulator control output	
10	VS_REG	Aux. voltage-regulator supply voltage	
11	GND_CP	Charge-pump ground	
12	VS_CP	Charge-pump supply voltage	
13	CP	Charge-pump output	
14	VS_VCO	VCO voltage-regulator supply voltage	
15	VREG_VCO	VCO voltage-regulator control output	
16	GND_VCO	VCO ground	
17	VTUNE	VCO tuning voltage input	

Pin Description (continued)

Pin	Symbol	Function	Configuration
18	GND1	Ground	
19	DEMOD_TANK1	Demodulator tank circuit	
20	DEMOD_TANK2	Demodulator tank circuit	
21	DEMOD_OUT	Demodulator output	

Pin Description (continued)

Pin	Symbol	Function	Configuration
22	BB_IN	Baseband filter input	
23	BB_CF	Baseband filter corner-frequency control input	
24	BB_OUT	Baseband filter output	
25	RSSI	Received signal-strength indicator output	
26	IF_TANK1	IF tank circuit	
27	IF_TANK2	IF tank circuit	

Pin Description (continued)

Pin	Symbol	Function	Configuration
28	GND2	Ground	
29	RF_IN1	Differential RF input of image reject mixer	
30	RF_IN2	Differential RF input of image reject mixer	
31	GND3	Ground	

Pin Description (continued)

Pin	Symbol	Function	Configuration
32	TX_OUT	TX driver amplifier output for PA	
33	VS_IF	IF amplifier supply voltage	
34	IF_IN1	Differential IF input of IF amplifier	
35	IF_IN2	Differential IF input of IF amplifier	

Pin Description (continued)

Pin	Symbol	Function	Configuration
36	RAMP_OUT	Ramp-generator output for PA power ramping	
37	RAMP_SET	Slew-rate setting of ramping signal	
38	RX_ON	RX control input	
39	TX_ON	TX control input	
40	MIXER_OUT1	Differential mixer output for SAW filter	
41	MIXER_OUT2	Differential mixer output for SAW filter	

Pin Description (continued)

Pin	Symbol	Function	Configuration
42	VS_MIXER	Mixer supply voltage	
43	GND_PLL	PLL ground	
44	PU_VCO	VCO power-up input	
45	PU_RX/TX	RX/TX power-up input	
46	PU_PLL	PLL power-up input	

Pin Description (continued)

Pin	Symbol	Function	Configuration
47	TX_DATA	TX data input of Gaussian filter and modulation-compensation circuit	
48	DATA_HOLD	Data-hold input to keep the latch information in power-down mode	

Functional Description

Receiver

The RF-input signal at RF_IN is fed to an image rejection mixer IR_MIXER with its differential outputs MIXER_OUT1 and MIXER_OUT2 driving an IF SAW filter at 110.592 MHz or 112.320 MHz. IF amplifier IF_AMP1 and IF_AMP2 with external IF_TANK and integrated RSSI function feed the signal to the demodulator DEMOD and finally to an integrated baseband filter BB. For demodulator tuning in production an integrated 5-bit digital to analog converter D/A is used to control the on-chip varicap diode.

Transmitter

The transmit data at TX_DATA is filtered by an integrated Gaussian filter GF and fed to the fully integrated VCO operating at twice the output frequency. After modulation the signal is frequency divided by 2 and fed via a TX/RX SWITCH to the TX_DRIVER. This driver amplifier supplies 0 dBm output power at TX_OUT. A ramp signal generator RAMP_GEN, providing ramp-signals at RAMP_OUT for use with the U7004B or U7006B SiGe power amplifier, is also integrated. The slope of the ramp signal is controlled by a capacitor at RAMP_SET.

Synthesizer

The IR_MIXER, the TX_DRIVER and the programmable counter PC are driven from the fully integrated VCO (including on chip inductors and varactors). For preset of VCO frequency an integrated 3-bit digital-to-analog converter is used. The output signal is divided in frequency to supply the desired frequency to the TX_DRIVER, 0/90 degree phase shifter for the IR_MIXER and to be used by the PC for the phase detector PD. Operating with reference clock frequencies of 13.824 MHz and 27.648 MHz supplied to the reference counter RC the PD and charge pump CP are operating at 3.456 MHz resulting in low settling time and thus allowing blindslot and non-blindslot operation. Unlimited multislot operation is possible by use of the integrated advanced closed loop modulation concept based on the modulation compensation circuit MCC.

Power Supply

For minimum interference and maximum signal isolation an integrated bandgap-stabilized voltage regulator for use with an external low-cost PNP transistor is implemented. Additionally three independent internal voltage regulators provide multiple power down and current saving modi.

PLL Principle

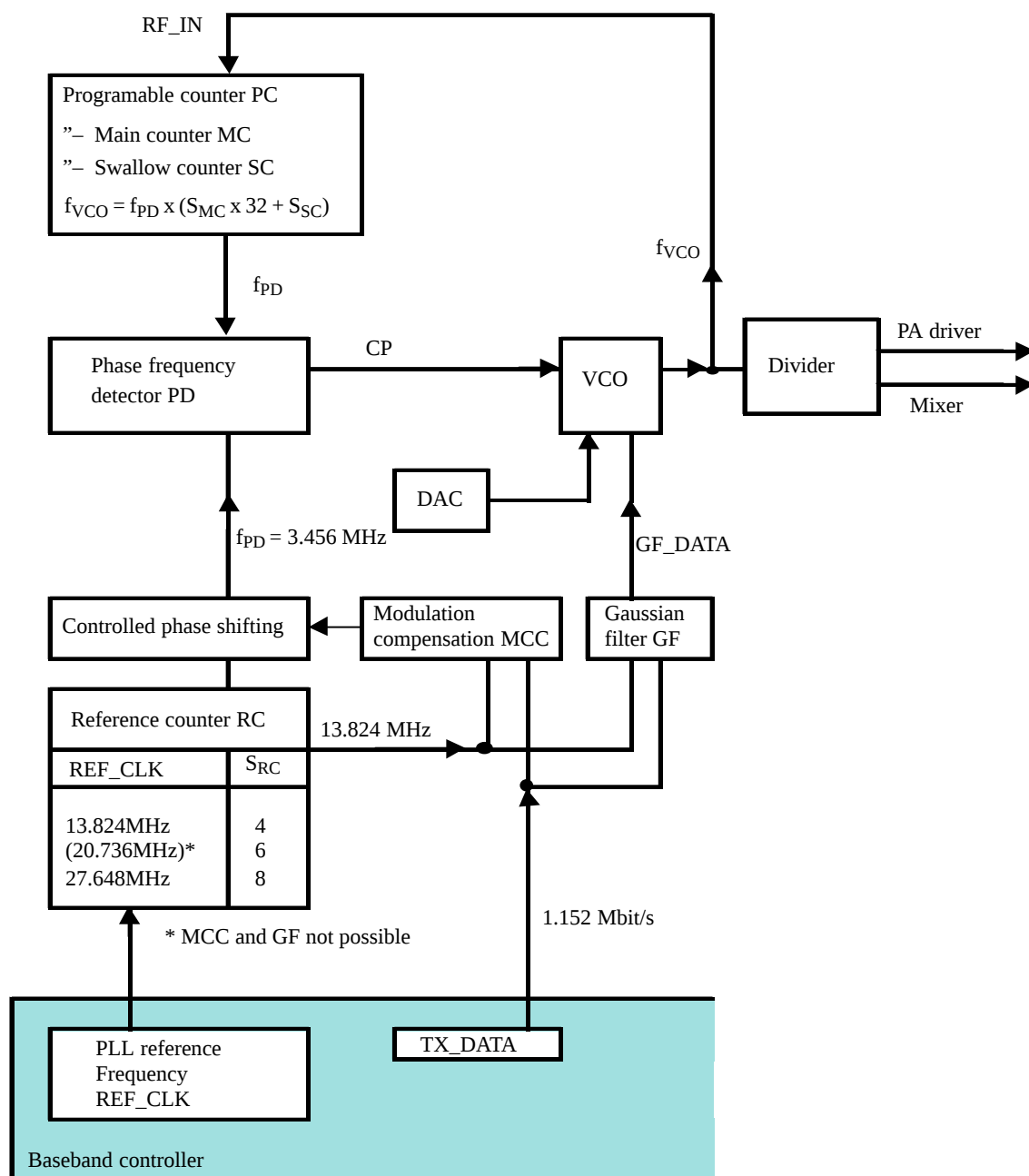


Figure 3.

The following table shows the LO frequencies for RX and TX for the DECT band plus additional channels for an optional DECT band extension. Intermediate frequencies of 110.592 and 112.32 MHz are supported.

Table 1. LO frequencies

Mode	f _{IF} /MHz	Channel	f _{ANT} /MHz	f _{VCO} /MHz	f _{VCO} /2/MHz	S _{MC}	S _{SC}
TX		C0	1897.344	3794.688	1897.344	34	10
		C1	1895.616	3791.232	1895.616	34	9
		C2	1893.888	3787.776	1893.888	34	8
		C3	1892.160	3784.320	1892.160	34	7
		C4	1890.432	3780.864	1890.432	34	6
		C5	1888.704	3777.408	1888.704	34	5
		C6	1886.976	3773.952	1886.976	34	4
		C7	1885.248	3770.496	1885.248	34	3
		C8	1883.520	3767.040	1883.520	34	2
		C9	1881.792	3763.584	1881.792	34	1
RX	110.592	C0	1897.344	3573.504	1786.752	32	10
		C1	1895.616	3570.048	1785.024	32	9
		C2	1893.888	3566.592	1783.296	32	8
		C3	1892.160	3563.136	1781.568	32	7
		C4	1890.432	3559.680	1779.840	32	6
		C5	1888.704	3556.224	1778.112	32	5
		C6	1886.976	3552.768	1776.384	32	4
		C7	1885.248	3549.312	1774.656	32	3
		C8	1883.520	3545.856	1772.928	32	2
		C9	1881.792	3542.400	1771.200	32	1
	112.32	C0	1897.344	3570.048	1785.024	32	9
		C1	1895.616	3566.592	1783.296	32	8
		C2	1893.888	3563.136	1781.568	32	7
		C3	1892.160	3559.680	1779.840	32	6
		C4	1890.432	3556.224	1778.112	32	5
		C5	1888.704	3552.768	1776.384	32	4
		C6	1886.976	3549.312	1774.656	32	3
		C7	1885.248	3545.856	1772.928	32	2
		C8	1883.520	3542.400	1771.200	32	1
		C9	1881.792	3538.944	1769.472	32	0

Table 2. Limits

Mode	f _{IF} /MHz		f _{ANT} /MHz	f _{VCO} /MHz	f _{VCO} /2/MHz	S _{MC}	S _{SC}
TX		f _{min}	1769.472	3538.944	1769.472	32	0
RX	110.592		1880.064	3538.944	1769.472	32	0
	112.320		1826.496	3538.944	1769.472	32	0
TX		f _{max}	1988.928	3977.856	1988.928	35	31
RX	110.592		2099.520	3977.856	1988.928	35	31
	112.320		2101.248	3977.856	1988.928	35	31

Formula

$f_{ANT\ Ci} - f_{ANT\ Ci-1} = 1.728 \text{ MHz}$

for TX: $f_{VCO} = 2 \times f_{ANT}$

for RX: $f_{VCO} = 2 \times (f_{ANT} - f_{IF})$

Control Signals

LD	output, which is active after PLL is locked and test-mode output (according to programmed test mode)
PU_REG	hardware power up → standby of regulator
PU_VCO	hardware power up → standby of voltage controlled oscillator
PU_RX/TX	hardware power up → standby of RX/ TX part
PU_PLL	hardware power up → standby of synthesizer

Table 3.

Logic	Standby	Standby Hold Register	TX Mode	RX Mode	RSSI Only
DATA_HOLD	0	1	X	X	X
PU_REG	0	0	1	1	1
PU_VCO	X	X	1	1	1
PU_RX/TX	X	X	1	1	1
PU_PLL	X	X	1	1	1
RX_ON	X	X	0	1	1
TX_ON	X	X	1	0	1
BB filter	OFF	OFF	OFF	ON	OFF
Demodulator	OFF	OFF	OFF	ON	OFF
IF amplifiers and RSSI	OFF	OFF	OFF	ON	ON
IR mixer	OFF	OFF	OFF	ON	ON
RX switch	OFF	OFF	ON	ON	ON
TX switch	OFF	OFF	ON	OFF	OFF
TX driver	OFF	OFF	ON	OFF	OFF
Ramp generator	OFF	OFF	ON	OFF	OFF
Programmable counter	OFF	OFF	ON	ON	ON
Voltage-controlled oscillator	OFF	OFF	ON	ON	ON
Gaussian filter	OFF	OFF	ON	OFF	OFF
Phase detector / charge pump	OFF	OFF	ON	ON	ON
Modulation compensation circuit	OFF	OFF	ON	OFF	OFF
Reference counter	OFF	OFF	ON	ON	ON
Current consumption / mA @ $V_S = 3.2\text{ V}$	<0.01	<0.1	54	85	80

Serial Programming Bus

Reference and programmable counters can be programmed by the 3-wire bus (CLOCK, DATA and ENABLE). Besides this information additional control bits as phase detector polarity and scaling of charge-pump currents as well as internal currents for Gaussian lowpass filter and modulation compensation circuit can be transferred.

After setting enable signal to low condition, on the rising edge of the clock signal, the data status is transferred bit by bit into the shift register, starting with the MSB-bit.

After enable returning to high condition the programmed information is loaded into the addressed latches, according to the addressbit condition (last bit). Additional leading bits are ignored and there is no check made how many pulses have arrived during enable-low condition. The bus then returns to a low current standby mode until the ENABLE signal changes to low again.

To keep the information in the registers of the PLL during standby DATA_HOLD must be set to high condition.

Bus Protocol Formats

MSB																							LSB
Data bits																							Address bit
D22	D21	D20	D19	D18	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	A0
RC		SC					MC		PS			GF	MCC	GFCS			VCODAC			CPCS			1
1	0	0	1	1	1	1	0	0	1	1	1	0	0	1	0	0	1	0	0	1	0	0	1

Standard bit setting:

Word 1

Word 2

E10	E9	E8	E7	E6	E5	E4	E3	E2	E1	E0	A0
DEMOMDAC					MCCS			TEST			0
0	0	0	0	0	0	0	0	0	0	0	0

PLL Settings

RC (Reference Divider)		
D22	D21	S _{RC}
0	0	—
0	1	4
1	0	6
1	1	8

MC (Main Divider)		
D15	D14	S _{MS}
0	0	32
0	1	33
1	0	34
1	1	35

SC (Swallow Counter)					
D20	D19	D18	D17	D16	S _{SC}
0	0	0	0	0	0
0	0	0	0	1	1
0	0	0	1	0	2
...					...
1	1	1	0	1	29
1	1	1	1	0	30
1	1	1	1	1	31

Phase Settings

Phase of GF-Output (Internal Connection)	
D13	GF-DATA
0	Source
1	Sink

Phase of MCC-Output (Internal Connection)	
D12	MCC-Data
0	Inverted
1	Normal

Phase of CP (Charge Pump)			
D11	f _R > f _p	f _R < f _p	f _R = f _p
0	I _{Sink}	I _{Source}	High imp.
1	I _{Source}	I _{Sink}	High imp.

Current Savings Power up/down Settings

D10	GF (Gaussian Filter)
0	OFF
1	ON

D9	MCC (Modulation Compensation Circuit)
0	OFF
1	ON

Current Gain Settings

GFCS (Gaussian Filtered Current Settings)			
D8	D7	D6	GFCS
0	0	0	60%
0	0	1	70%
0	1	0	80%
0	1	1	90%
1	0	0	100%
1	0	1	110%
1	1	0	120%
1	1	1	130%

Pretune DAC Voltage Settings

Pretune DAC Voltage (Internal Connection)			
D5	D4	D3	f _{VCO} /%
0	0	0	-12.0
0	0	1	...
0	1	0	...
0	1	1	...
1	0	0	...
1	0	1	...
1	1	0	...
1	1	1	12.0

CPCS (Charge-Pump Current Settings) (Internal Connection)			
D2	D1	D0	CPCS
0	0	0	60%
0	0	1	70%
0	1	0	80%
0	1	1	90%
1	0	0	100%
1	0	1	110%
1	1	0	120%
1	1	1	130%

Test Mode Settings

Test Output Pin (Lock Detect)					
D11	E2	E1	E0	Signal at lock detect output	CP mode
X	0	0	0	Lock detect	Active
0	0	0	1	RC out	Active
1	0	1	0	PC out	Active
X	0	1	1	RC out divided by 2048 (MCCTEST)	Active
X	1	0	0	CP tristate only	High imp.
0	1	0	1	RC out	High imp.
1	1	1	0	PC out	High imp.
X	1	1	1	RC out divided by 2 (GFTEST)	High imp.

MCCS (Modulation Compensation Current Settings) (Internal Connection)			
E5	E4	E3	MCCS
0	0	0	60%
0	0	1	70%
0	1	0	80%
0	1	1	90%
1	0	0	100%
1	0	1	110%
1	1	0	120%
1	1	1	130%

DEMODO DAC Voltage Settings (DEMODO DAC)

Demod DAC Voltage (Internal Connection)					
E10	E9	E8	E7	E6	f _{IFcenter} %
0	0	0	0	0	-6.0
0	0	0	0	1	...
0	0	0	1	0	...
					...
1	1	1	0	1	...
1	1	1	1	0	...
1	1	1	1	1	6.0

3-Wire Bus Protocol Timing Diagram

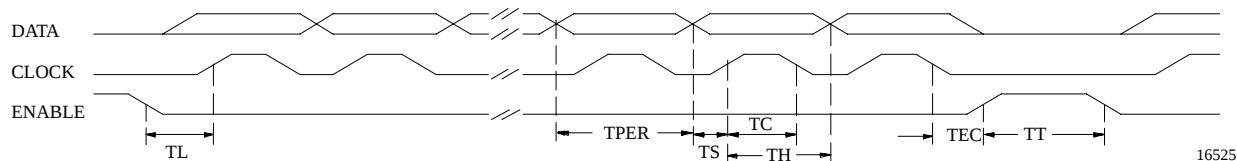


Figure 4.

Description	Symbol	Min. Value	Unit
Clock period	TPER	125	ns
Set time data to clock	TS	60	ns
Hold time data to clock	TH	60	ns
Clock pulse width	TC	125	ns
Set time enable to clock	TL	200	ns
Hold time enable to data	TEC	0	ns
Time between two protocols	TT	250	ns

Absolute Maximum Ratings

All voltages are referred to GND

Parameter	Symbol	Min.	Max.	Unit
Supply voltage regulator Pin 10	V_{S_REG}	3.2 *)	6.0	V
Supply voltage Pins 7, 12, 14, 33 and 42	V_S	3.0	6.0	V
Logic input voltage Pins 1, 2, 3, 38, 39, 44, 45, 46, 47 and 48	V_{IN}	-0.3	V_S	V
Junction temperature	T_{jmax}		150	°C
Storage temperature	T_{stg}	-40	150	°C

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R_{thJA}	t.b.d.	K/W

Operating Range

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply voltage regulator Pins 10	V_S	3.2 *)	3.2 *)	5.5	V
Supply voltage Pins 7, 12, 14, 33 and 42	V_S	3.0	3.0	5.5	V
Ambient temperature	T_{amb}	-25	+25	+85	°C

*) Optionally 3.0 V, if not using the voltage regulator

Electrical Characteristics

Test conditions (unless otherwise specified): $V_{S_REG} = 3.2\text{ V}$, $T_{amb} = 25^{\circ}\text{C}$

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Receiver						
IR mixer Pins 29, 30, 40 and 41						
Input impedance	Pins 29 and 30	Z_{in}		50		Ω
Input matching	Pins 29 and 30	$VSWR_{in}$		<2:1		
Image rejection ratio	Pins 40 and 41	IRR		20		dB
DSB noise figure	Pins 40 and 41	NFDSB= NFSSB		10		dB
Conversion gain	$R_{load} = 200\ \Omega$	G_{conv}		12		dB
Output interception point	Pins 40 and 41	OIP3		10		dBm
IF amplifier Pins 26, 27, 34 and 35						
Input impedance	Pins 34 and 35	Z_{in}	200		400	Ω
Lower cut-off frequency		f_{l3dB}		90		MHz
Upper cut-off frequency		f_{u3dB}		130		MHz
Power gain		G_p		85		dB
Bandwidth of external tank circuit	Pins 26 and 27	BW3dB		10		MHz
Noise figure		NF		9		dB
RSSI Pins 25, 34 and 35						
RSSI sensitivity	at IF_IN1, IF_IN2 Pins 34 and 35	P_{min}		20		dB μ V
RSSI compression	at IF_IN1, IF_IN2 Pins 34 and 35	P_{max}		100		dB μ V
RSSI dynamic range		DR		80		dB
RSSI resolution	Slope of the RSSI has to be steady	Acc		± 2		dB
RSSI rise time	$P_{in} = 30$ to 100 dB μ V, Pin 25	t_r		1		μ s
RSSI fall time	$P_{in} = 100$ to 30 dB μ V, Pin 25	t_f		1		μ s
Quiescent output current	@ $P_{in} < 20$ dB μ V at IF_IN1, IF_IN2 Pin 25	I_{out}		30		μ A
Maximum output current	@ $P_{in} = 100$ dB μ V at IF_IN1, IF_IN2 Pin 25	I_{out}		150		μ A
FM demodulator Pins 19, 20 and 21						
Co-channel rejection ratio	@ $P_{in} = -75$ dBm at IR-mixer input	CCRR		10		dB
Sensitivity	Quality factor of external tank circuit approx. 20, Pin 21	S		0.5		V/MHz
Amplitude of recovered signal	Nominal deviation of signal ± 288 kHz, Pin 21	A		288		mV _{ss}
Output voltage DC range	Pin 21	FM_{outDC}	0.4		$V_s - 0.4$	V
Output impedance	Pin 21	Z_{out}		13		k Ω
AM rejection ratio	Pin 21	AMRR		t.b.d.		dB
DAC for FM demodulator (internally connected) (5-bit programming see bus protocol E5 to E10)						
DAC range		T_{DAC}		± 6		%

Electrical Characteristics (continued)

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Transmitter/ PLL						
VCO						
Frequency range		f _{VCO}	3500		4000	MHz
Tuning gain	Pin 17	G _{tune}		150		MHz/V
Frequency control voltage range	Pin 17	V _{tune}	0.4		2.3	V
DAC for VCO pretune (internally connected) (3-bit bus programming se bus protocol D3 to D5)						
DAC tuning range		Δf _{VCO,DAC}		± 5		%
PLL Pin 4						
Scaling factor prescaler		S _{PSC}	32 / 33			
Scaling factor main counter		S _{MC}	32 / 33 / 34 / 35			
Scaling factor swallow counter		S _{SC}	0		31	
External reference input frequency	AC coupled sinewave Pin 4	f _{REF_CLK}		13.824 27.648		MHz MHz
External reference input voltage	AC coupled sinewave Pin 4	V _{REF_CLK}	50		250	mV _{RMS}
Scaling factor reference counter		S _{RC}	4 / 6 / 8			
Charge pump (active when RX, TX) Pin 13						
Output current	V _{I_CP_SW} = '0', V _{CP} = V _{VS_CP} / 2	I _{CP_1}		± 1		mA
Current scaling factor	I _{CP} = CPCS * I _{CP_TYP} (see bus protocol D0 ... D2)	CPCS	60		130	%
Leakage current		I _L		± 100		pA
Gaussian transmit filter (Gaussian shape B*T = 0.5) f_{REF_CLK} has to be chosen !						
Tx data filter clock	f _{REF_CLK} = 13.824 MHz, TX, 18 taps in filter, S _{RC} = 12	f _{TXFCLK}		13.824		MHz
	f _{REF_CLK} = 27.648 MHz, TX, 18 taps in filter, S _{RC} = 24	f _{TXFCLK}		13.824		MHz
Frequency deviation	Polarity (see bus protocol D13)	G _{FFM_TYP}		576		kHz
Frequency deviation scaling	G _{FFM} = G _{FFM_TYP} * G _{FCS} (see bus protocol D6 ... D8)	G _{FCS}	60		130	%
Modulation compensation circuit @ maximum DSV ≤ 64 (internally connected)						
Oversampling	f _{REF_CLK} = 13.824 MHz or = 27.648 MHz	OVS		9		
Integration counter		MAC	– 576		576	
Current scaling factor	(see bus protocol E3 ... E5)	MCCS	60		130	%

Electrical Characteristics (continued)

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
VCO switch and TX driver Pin 32						
Power gain	@ $P_{in} = -40$ dBm	G_p		30		dB
Output impedance	Pin 3 2	Z_{out}		100		Ω
Maximum output power	Pin 3 2	P_{max}		3		dBm
Gain compression	@ TX_RF_OUT Pin 3 2	P_{1dB}		1		dBm
Output interception point	Pin 3 2	OIP3		10		dBm
Ramp generator Pins 36 and 37						
Minimum output voltage	According to RAMP_SET input	V_{min}		0.2		V
Maximum output voltage	According to RAMP_SET input	V_{max}		1.95		V
Rise time	$C_{ramp} = 270$ pF at Pin 37	t_r		5		μs
Fall time	$C_{ramp} = 270$ pF at Pin 37	t_f		5		μs
Lock detect and test mode output Pin 5						
Lock detect output, test mode output	locked = '1' unlocked = '0' test modes (see bus protocol E0 ... E2)	LD				
Leakage current	$V_{OH} = 5.5$ V	I_L			5	μA
Saturation voltage	$I_{OL} = 0.5$ mA	V_{SL}			0.4	V
Auxiliary regulator Pins 8, 9 and 10						
Output voltage	Pin 8	V_{REG}	2.9	3.0	3.1	V
Supply voltage rejection	$V_{Pin10} = V_{DC} + 0.1 V_{pp}$ $f_{Pin10} = 0.1$ to 10 kHz $C_{Pin8} = 100$ nF	SVR		tbd		dB
Auxiliary regulator Pins 14, 15 and 16						
Output voltage	Pin 15	V_{REG_VCO}	2.6	2.7	2.8	V
3-wire bus						
Clock		f_{Clock}		1.152	6.912	MHz

Electrical Characteristics (continued)

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Logic input levels (CLOCK, DATA, ENABLE, RX_ON, TX_ON, PU_VCO, TX_DATA, DATA_HOLD) Pins 1, 2, 3, 38, 39, 44, 47 and 48						
High input level	= '1'	V _{IH}	1.5			V
Low input level	= '0'	V _{IL}			0.5	V
High input current	= '1'	I _{IH}	-5		5	μA
Low input current	= '0'	I _{IL}	-5		5	μA
Standby control Pins 6, 45 and 46						
Power up PU_REG = '1' PU_RX/TX = '1' PU_PLL = '1' High input level	Pin 6 Pin 45 Pin 46	V _{PU_REG} V _{PU_RX/TX} V _{PU_PLL}	2.0			V
Standby PU_REG = '0' PU_RX/TX = '0' PU_PLL = '0' Low input level	Pin 6 Pin 45 Pin 46	V _{PU_REG,OFF} V _{PU_RX/TX,OFF} V _{PU_PLL,OFF}			0.7	V
Power up PU_REG = '1' PU_RX/TX = '1'	V _{PU} = 3 V Pin 6 V _{PU} = 5.5 V Pin 45	I _{PU_REG} I _{PU_RX/TX}	20 60	30 80	40 100	μA μA
PU_PLL = '1' High input current	V _{PU} = 3 V Pin 46 V _{PU} = 5.5 V	I _{PU_PLL}	100 200	125 300	150 400	μA μA
Standby PU_xxxx = '0' Low input current	V _{PU} = 0 V Pin 6, V _{PU} = 0.5 V Pins 45, 46	I _{PU,OFF}			0.1 1	μA μA
Settling time V _S = 0 → active operation	Switched from V _S = 0 to V _S = 3V	t _{soa}		< 10		μs
Settling time standby → active operation	Switched from PU = '0' to PU = '1'	t _{ssa}		< 10		μs
Settling time active operation → standby	Switched from PU = '1' to standby	t _{sas}		< 2		μs
Power supply Pins 7, 10, 12, 14, 33 and 42						
Total supply current	RX	I _S		85		mA
	RSSI only	I _S		82		mA
	TX	I _S		54		mA
	TX (MCC, GF active)	I _S		58		mA
Standby current, mode 1 mode 2	PU_RX/TX = GND	I _S		1	10	μA
	PU = GND, DATA_HOLD = V _S	I _S		50	100	μA
Supply current CP	V _{VS_CP} = 3 V, PLL in lock condition Pin 13	I _{CP}		1		μA

Typical Application Circuit

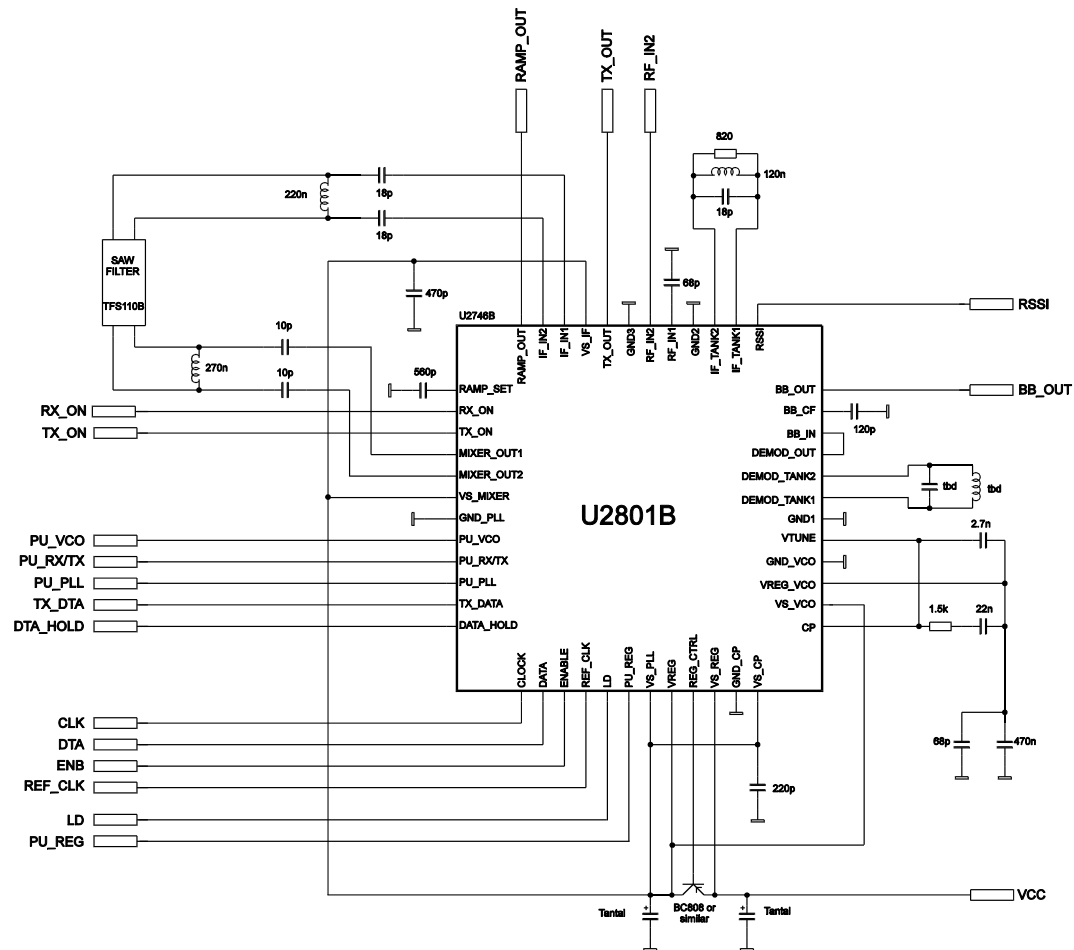


Figure 5. Typical application circuit

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.

We reserve the right to make changes to improve technical design and may do so without further notice.

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use TEMIC Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify TEMIC Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

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