UHF ASK Transmitter

Description

The U2745B is a PLL transmitter IC which has been specially developed for the demands of RF low-cost data transmission systems at data rates up to 20 kBaud.

The transmitting frequency range is 310 MHz to 440 MHz. It can be used in ASK systems. The main applications of the U2745B are in the areas of outside temperature metering, socket control, garage door opener, consumption metering, light/ fan or aircondition control, jalousies, wireless keyboard and various other consumer market applications.

Electrostatic sensitive device.
Observe precautions for handling.

Features

- Supply voltage 2.2 V to 4.0 V
  in the temperature range –40°C to 85°C
- One-chip solution with minimum external circuitry
- Lower cost than the usual discrete solutions using SAW and transistors
- Very small SSO16 package, pitch 0.635, 150 mil
- “Single-Ended Open-Collector” output (same antennas can be used as in discrete solutions, simpler adaptation of magnetic loop antennas)
- XTO output for clocking the µC, thereby together with M44C090 or M44C890 the optimum system cost-effectiveness
- Very high transmitting frequency accuracy compared to SAW solutions. This enables receivers at lower bandwidth than is possible with SAW resonators.
- ESD protection according to MIL-STD.883 (4KV HBM) except Pins XTO1/ 2, ANT and LF

System Block Diagram

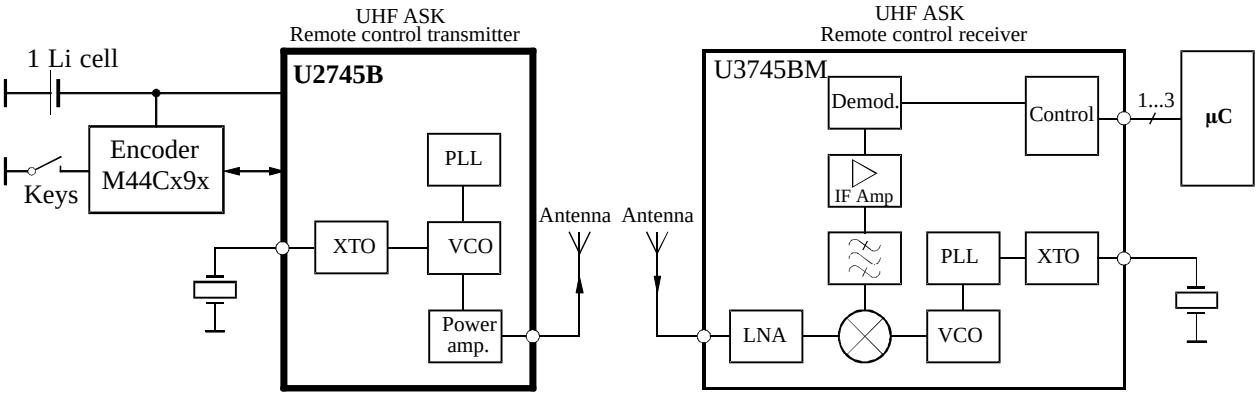


Figure 1. System block diagram

Order Information

Extended Type Number	Package	Remarks
U2745B-MFB	SSO16	Tube
U2745B-MFBG3	SSO16	Taped and reeled

Pin Description

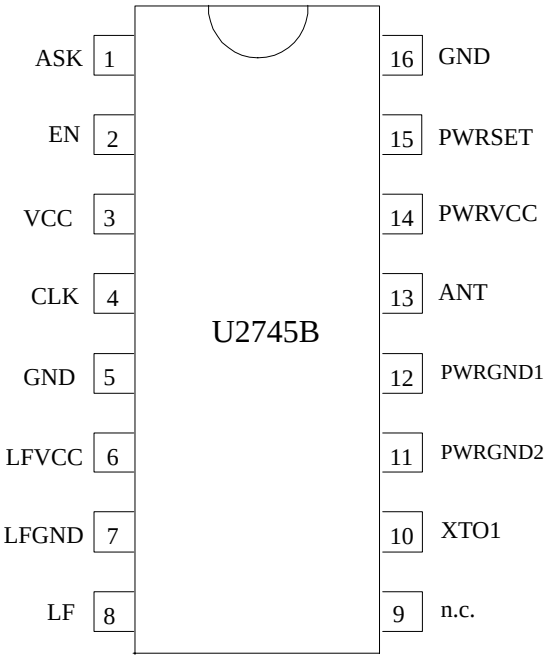


Figure 2. Pinning SSO16

Pin	Symbol	Function
1	ASK	Modulation input ASK
2	EN	Enable input
3	VCC	Supply voltage
4	CLK	Clock output
5	GND	Ground
6	LFVCC	Supply voltage VCO
7	LFGND	VCO ground
8	LF	Circuit PLL loop
9	n.c.	Not connected
10	XTO1	Connection for crystal
11	PWRGND2	Power GND2
12	PWRGND1	Power GND1
13	ANT	RF output
14	PWRVCC	Supply voltage power amplifier
15	PWRSET	Applied to VCC
16	GND	Ground

Block Diagram

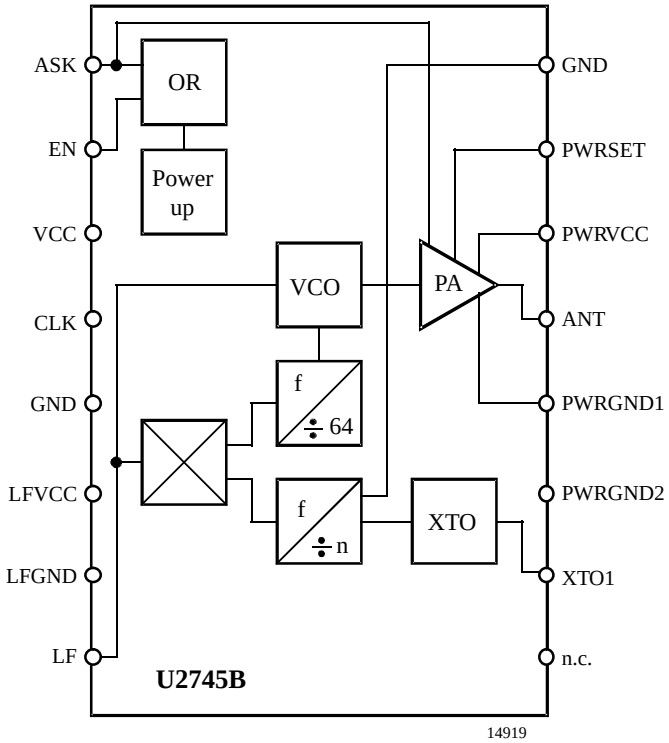


Figure 3. Block diagram

General Description

The fully integrated VCO and the “single-ended open-collector” output allow particularly simple, low-cost RF miniature transmitters to be assembled. The single-ended output enables a considerably simplified adaptation of both a magnetic loop antenna of any form or a λ/4 antenna. This is because the load impedance must not be balanced as would be the case with a differential output.

The XTO’s frequency can be selected at 13.56 MHz or USA 9.844 MHz. At these frequencies, crystals have a very fast start-up time < 1.5 ms, whereby a wait time of 5 to 10 ms is required until the transmitter IC is locked. This means that the processor does not need to poll a lock detect output.

Functional Description

ASK Transmission

The U2745B is activated by EN = V_S. V_{ASK} must remain 0 V for 5 ms, then the output power can be modulated by means of Pin ASK. V_{EN} remains = V_S during transmission of the message. The ASK input activates the power amplifier and the PLL.

Take-Over of the Clock Pulse in the µC

The clock of the crystal oscillator can be used for clocking the µC. The M44C090 and M44C890 have the special feature of starting with an integrated RC oscillator to switch on the U2745B with V_{EN} = V_S. 5 ms later, the 3.39-MHz clock frequency is present, so that the message can be sent with crystal accuracy.

Application Circuit

The following component values are recommendations for a typical application. C4, C5, C6 are block capacitors. The values of these capacitors depend on the board layout. C4 = 1 nF, C5 = 1 nF, C6 = 22 nF are typically used here. For C5, the impedance between f = 100 MHz and f = 1 GHz should be as low as possible.

CLoop1, CLoop2 are selected so that the antenna oscillates in resonance and the adaptation to the appropriate impedance transformation is possible.

LFeed is an inductor for the antenna’s DC current supply. A typical value is LFeed = 220 nH. LFeed can be either printed on the PC_Board or be a discrete component.

Further information regarding the application is provided in the description of the “RKE Design Kit”.

Output Power Measurement

The following output network (see figure 4) can be used for output power evaluation, the exact values of L10, C10 are dependent on the layout.

L10, C10 is the transformation network to adopt the output impedance of the IC to 50 Ω. The following table shows the values for an output power of 2 mW and an R_{PWRSET} = 1.2 kΩ.

f/ MHz	C10/ pF	L10/ nH	Z_{Load_opt}/ Ω
315	2.7	56	260 + j330
433.92	1.8	33	185 + j268

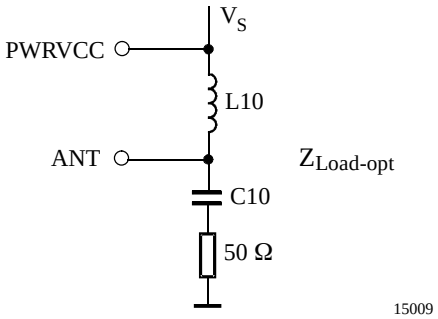


Figure 4. Measurement output network

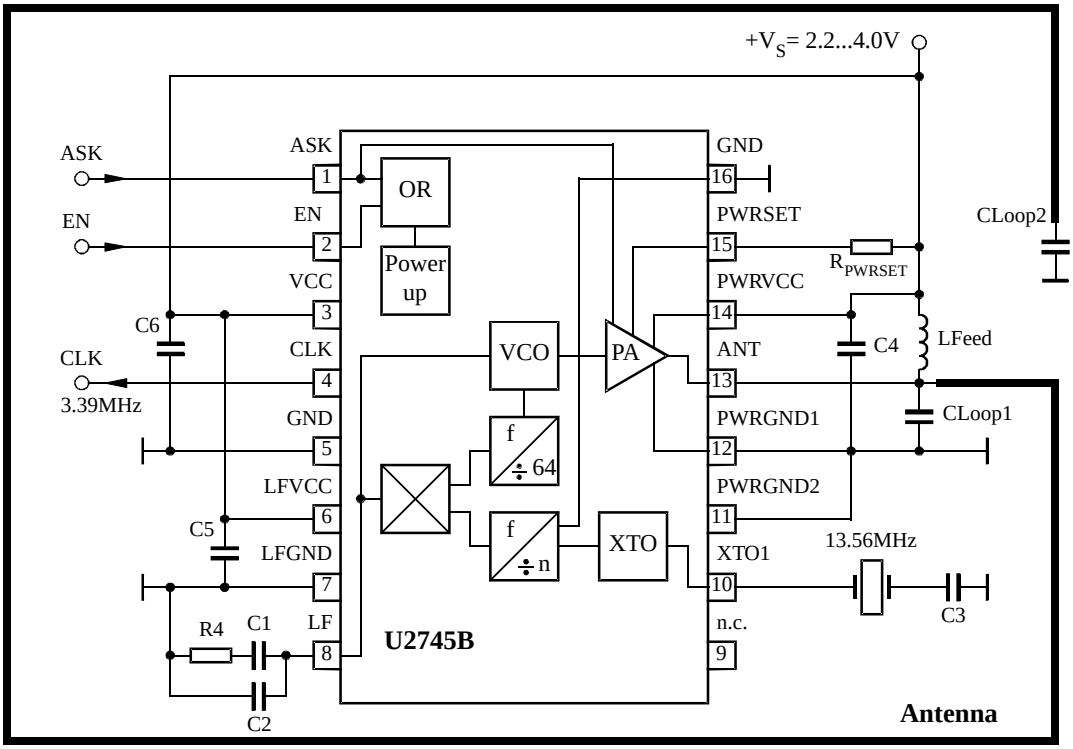


Figure 5. Application circuit

Absolute Maximum Ratings

Parameters	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	V_S			6	V
Power dissipation	P_{tot}			250	mW
Junction temperature	T_j			150	°C
Storage temperature	T_{stg}	–55		125	°C
Ambient temperature	T_{amb}	–40		85	°C

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R_{thJA}	180	K/W

Electrical Characteristics

All parameters are refered to GND (Pin 5), V_S = 3 V, T_{amb} = 25°C, unless otherwise specified
The possible operating ranges refer to different circuit conditions: V_S = 2.2 V to 4.0 V @ T_{amb} = –40°C to +85°C

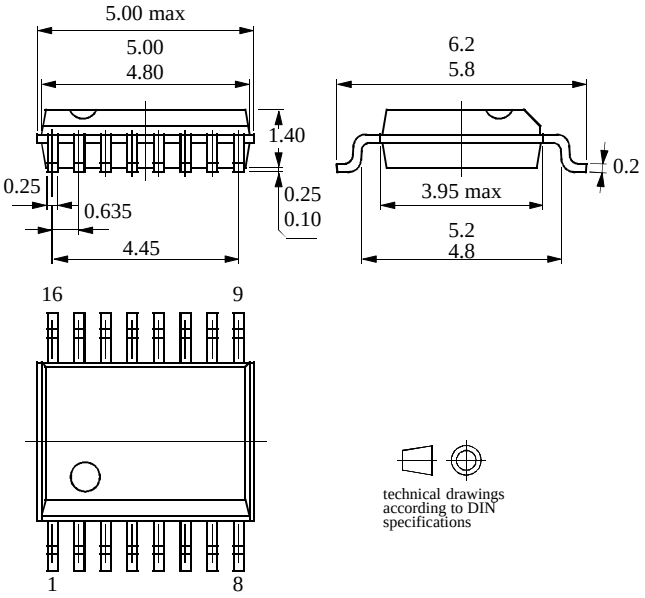
Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply current (power down)	V_{ASK}, $V_{EN} \leq$ 0.3 V, V_S < 3.6 V	IS_{off}		2	10	µA
Supply current (power up, output OFF)	V_{ASK} = GND, $V_{EN} = V_S$, V_s = 3 V	IS_{on}		4.7	6.2	mA
Supply current (power up, output ON)	$V_{ASK} = V_S$, V_S = 3 V R_{PWRSET} = 1.2 kΩ	$IS_{transmit}$		10	12.5	mA
Output power	V_S = 3 V, T_{amb} = 25°C, f = 433.92 MHz R_{PWRSET} = 1.2 kΩ	P_{Ref}	1	3	5	dBm
Output power variation for f = 315 MHz compared to f = 433.92 MHz	f = 315 MHz $P_{out} = P_{Ref} + \Delta P_{Ref}$	ΔP_{Ref}		1.5		dB
Maximum peak output antenna voltage	@P_{out} = 2.0 mW, The load impedance must be selected to meet the V_{out} maximum requirement. The supply current is not dependent on the load impedance tolerance.	V_{outmax}		V_S – 0.7 V		$V_{(peak)}$
Spurious emission	$f_o \pm n \times f_{PC}$ (f_{PC} = 6.78 MHz) Load capacitance at CLK ≤ 3 pF f = 230 MHz to 470 MHz f < 230 MHz, f > 470 MHz	 Em Em		 –40 –58		 dBC dBC
Oscillator frequency XTO	Crystal frequency = 13.56 MHz	f_{XTO}	13.56 – 50 ppm	13.56	13.56 +50 ppm	MHz
Loop bandwidth	For best LO noise Loop filter components: C2 = 3.9 nF, C1 = 15 nF, R4 = 220 Ω	B_{Loop}		100		kHz
Phase noise VCO	@ 1 MHz @ 36 MHz	PN_{VCO} PN_{VCO}		–90 –122		dBC/Hz
Frequency range of the VCO		f_{VCO}	310		440	MHz
Clock output (CMOS µC compatible)		Clk_{out}		f_{out}/128		MHz
Load capacitance at CLK		C_{CLK}			10	pF
Series resonance R of the crystal	f_{XTO} = 13.56 MHz f_{XTO} = 9.84 MHz	Rs Rs			80 100	Ω Ω
ASK modulation frequency rate	Duty cycle of the modulation signal = 50%	f_{modASK}	0		20	kHz
CLK output – Output current Low – Output current Low – Output current High – Output current High	 $V_{CLK} = 0.2 \times V_S$ $V_{CLK} = 0.3 \times V_S$ $V_{CLK} = 0.8 \times V_S$ $V_{CLK} = 0.7 \times V_S$	 I_{ol} I_{ol} I_{oh} I_{oh}	 150 200 –150 –200		 100	 µA µA µA µA

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
ASK input – Low level input voltage – High level input voltage – Input current High		 V_{ASKl} V_{ASKh} I_{ASKh}	 1.7 	 	 0.3 140	 V V µA
Enable ASK – Low level input voltage – High level input voltage – Input current High		V_{EN} V_{FSKl} V_{FSKh} I_{FSKh}	 1.7 	 	 0.3 140	 V V µA

Package Information

Package SSO16

Dimensions in mm



Ozone Depleting Substances Policy Statement

It is the policy of **Atmel Germany 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.

Atmel Germany 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.

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

Data sheets can also be retrieved from the Internet: http://www.atmel–wm.com

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