

AM / FM-PLL

Description

The U4286BM is an integrated circuit in BICMOS technology for frequency synthesizer. It performs all the functions of a PLL radio tuning system and is controlled by I²C bus. The device is designed for all frequency syn-

thesizer applications of radio receivers, as well as RDS (Radio Data System) applications.

Features

- Reference oscillator up to 15 MHz
- Two programmable 16 bit dividers adjustable from 2 to 65535
- Fine tuning steps: AM \geq 1 kHz
FM \geq 2 kHz
- Two programmable switching outputs (open drain up to 20 V)
- Few external component requirements due to integrated loop-transistor for AM/FM
- High signal/noise ratio

Block Diagram

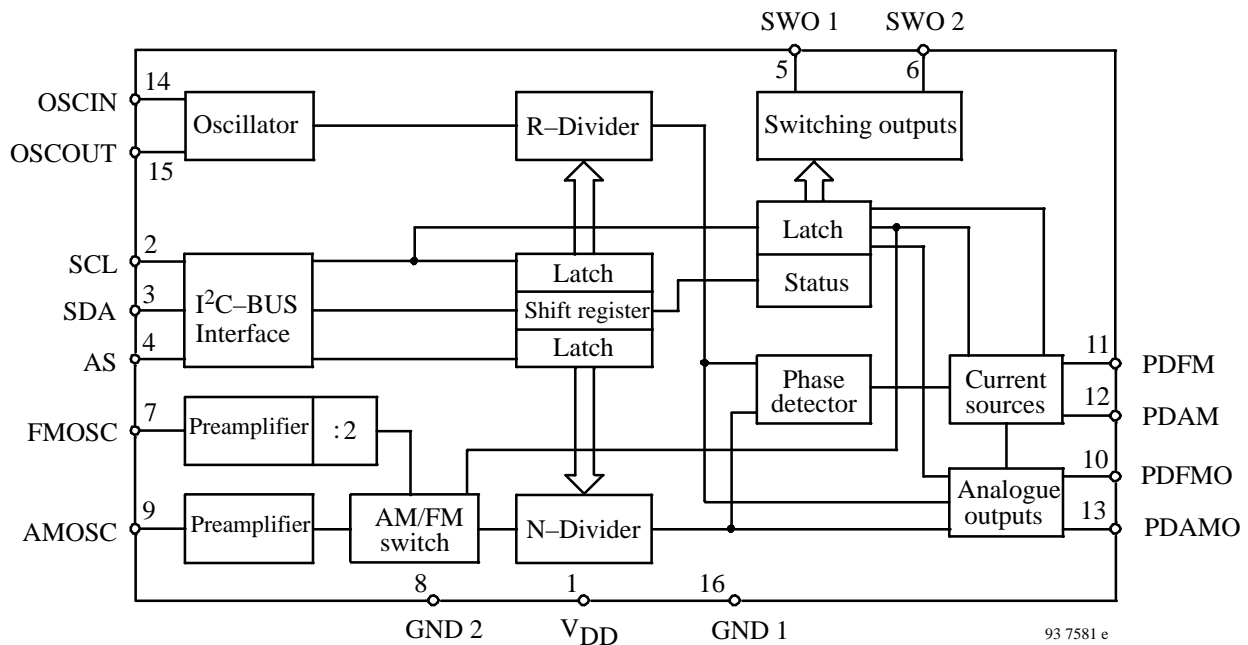
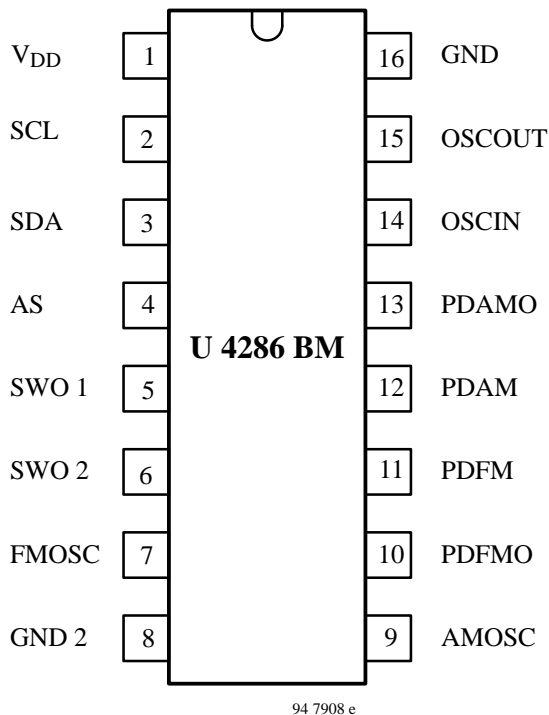


Figure 1.

Pin Description



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Pin	Symbol	Function
1	V _{DD}	Supply voltage
2	SCL	I ² C bus clock
3	SDA	I ² C bus data
4	AS	Address selection
5	SWO 1	Switching output 1
6	SWO 2	Switching output 2
7	FMOSC	FM oscillator input
8	GND 2	Ground 2 (analogue)
9	AMOSC	AM oscillator input
10	PDFMO	FM analogue output
11	PDFM	FM current output
12	PDAM	AM current output
13	PDAMO	AM analogue output
14	OSCIN	Oscillator input
15	OSCOUT	Oscillator output
16	GND 1	Ground 1 (digital)

Functional Description

The U4286BM is controlled via the 2-wire I²C bus. For programming there are one module address byte, two sub-address bytes and five data bytes.

The module address contains a programmable address bit A 1 which with address select input AS (pin 4) makes it possible to operate two U4286BM-B in one system. If bit A 1 is identical with the status of the address select input AS, the chip is selected.

The subaddress determines which one of the data bytes is transmitted first. If subaddress of R - divider is transmitted, the sequence of the next data bytes is DB 0 (Status), DB 1 and DB 2.

If subaddress of N - divider is transmitted, the sequence of the next data bytes is DB 3 and DB 4. The bit organisation of the module address, subaddress and 5 data bytes are shown in figure 2.

Each transmission on the I²C bus begins with the "START"- condition and has to be ended by the "STOP"-condition (see figure 3).

The integrated Circuit U4286BM has two separate inputs for AM and FM oscillator. Pre-amplified AM signal is directed to the 16 bit N-divider via AM/FM switch, whereas (pre-amplified) FM signal is first divided by a fixed prescaler (:2). AM/FM switch is controlled by software. Tuning steps can be selected by 16 bit R-divider. Further there is a digital memory phase detector. There are two separate current sources for AM and FM amplifier (charge pump) as given in electrical characteristics. It allows independent adjustment of gain, whereby providing high current for high speed tuning and low current for stable tuning.

Bit Organisation

	MSB							LSB
Module address	1	1	0	0	1	0	0/1	0
	A7	A6	A5	A4	A3	A2	A1	A0

Subaddress (R-divider)	X	X	X	X	0	1	X	X
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Subaddress (N-divider)	X	X	X	X	1	1	X	X
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	MSB							LSB
Data byte 0 (Status)	X	SWO1	SWO2	X	AM/ FM	PD ANA	PD POL	PD CUR
	D7	D6	D5	D4	D3	D2	D1	D0

Data byte 1	2^{15}	R-divider						2^8
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Data byte 2	2^7	R-divider						2^0
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Data byte 3	2^{15}	N-divider						2^8
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Data byte 4	2^7	N-divider						2^0
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	LOW	HIGH
AM/FM	FM-operation	AM-operation
PD – ANA	PD analogue	TEST
PD – POL	Negative polarity	Positive polarity
PD – CUR	Output current 2	Output current 1

Figure 2.

Transmission protocol

	MSB	LSB									
S	Address A7	A0	A	Subaddress R-divider	A	Data 0	A	Data 1	A	Data 2	A P

	MSB	LSB								
S	Address A7	A0	A	Subaddress N-divider	A	Data 3	A	Data 4 A	A	P

S = Start P = Stop A = Acknowledge

Figure 3.

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Supply voltage Pin 1	V_{DD}	-0 to +6	V
Input voltage Pin 2, 3, 4, 7, 9, 14, 15	V_I	-0.3 to $V_{DD} + 0.3$	V
Output current Pin 3, 5, 6	I_O	-1 to +5	mA
Output drain voltage Pin 5, 6	V_{OD}	20	V
Output voltage Pin 10, 13	V_{AO}	15	V
Output current Pin 10, 13	I_{AO}	-1 to +20	mA
Ambient temperature range	T_{amb}	-25 to +85	°C
Storage temperature range	T_{stg}	-40 to +125	°C
Junction temperature	T_j	125	°C
Electrostatic handling (MIL Standard 883C)	$\pm V_{ESD}$	2000	V

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R_{thJA}	160	K/W

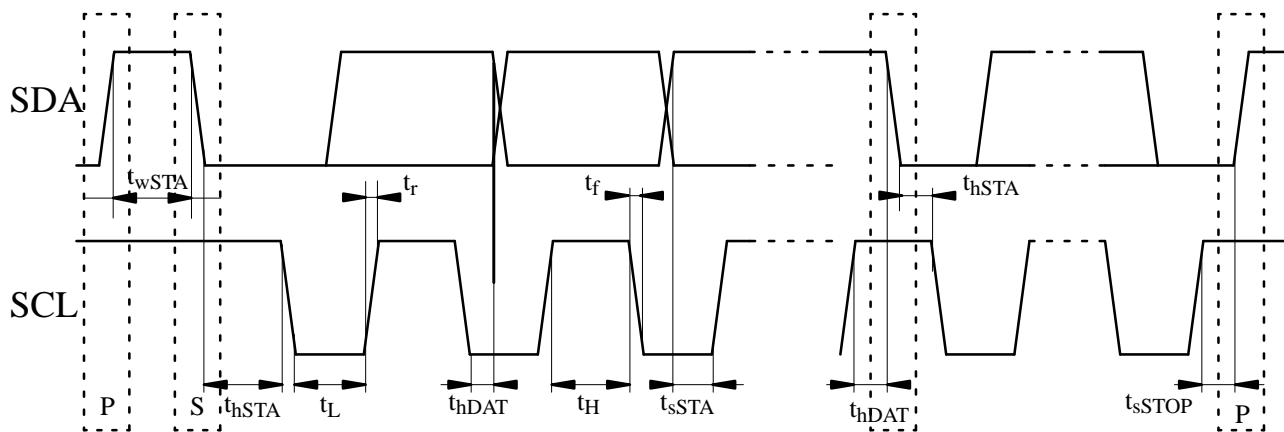
Electrical Characteristics

$V_{DD} = 5\text{ V}$, $T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage	Pin 1	V_{DD}	4.5	5.0	5.5	V
Quiescent supply current	Pin 1	I_{DD}		6.0	11.6	mA
FM Input Sensitivity, $R_G = 50\ \Omega$ FMOSC						
$f_i = 70$ to 120 MHz	Pin 7	V_{SFM}	25			mV
$f_i = 120$ to 130 MHz	Pin 7	V_{SFM}	50			mV
AM Input Sensitivity, $R_G = 50\ \Omega$ AMOSC						
$f_i = 0.5$ to 35 MHz	Pin 9	V_{SAM}	25			mV
Oscillator Input Sensitivity, $R_G = 50\ \Omega$ OSCIN						
$f_i = 0.1$ to 15 MHz	Pin 14	V_{SOSC}	100			mV
Switching Output SWO 1, SWO 2 (Open Drain)						
Output voltage LOW	Pin 5, 6 $I_L = 1\text{ mA}$	V_{SWOL}		200	400	mV
Output voltage LOW	Pin 5, 6 $I_L = 0.1\text{ mA}$	V_{SWOL}		20	100	mV
Output leakage current HIGH	Pin 5, 6 $V_5, V_6 = 20\text{ V}$	I_{OHL}			100	nA
Phase Detector PDFM						
Output current 1	Pin 11	$\pm I_{PDFM}$	400	500	600	μA
Output current 2	Pin 11	$\pm I_{PDFM}$	100	125	150	μA
Phase Detector PDAM						
Output current 1	Pin 12	$\pm I_{PDAM}$	75	100	125	μA
Output current 2	Pin 12	$\pm I_{PDAM}$	20	25	30	μA
Analogue Output PDFMO, PDAMO						
Saturation voltage	$I = 15\text{ mA}$ Pin 10, 13	V_{sat}		270	400	mV
Leakage current	Pin 10, 13	I_{LEAK}			1	μA
I²C Bus SCL, SDA, AS						
Input voltage HIGH LOW	Pin 2, 3, 4	V_{iBUS}	3.0 0		V_{DD} 1.5	V V
Output voltage Acknowledge LOW	$I_{SDA} = 3\text{ mA}$ Pin 3	V_O			0.4	V
Clock frequency	Pin 2	f_{SCL}			100	kHz
Rise time SDA, SCL	Pin 2, 3	t_r			1	μs
Fall time SDA, SCL	Pin 2, 3	t_f			300	ns
Period of SCL HIGH LOW	Pin 2	t_H t_L	4.0 4.7			μs μs

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Setup Time						
Start condition		t_{sSTA}	4.7			μs
Data		t_{sDAT}	250			ns
Stop condition		t_{sSTOP}	4.7			μs
Time the bus must be free before a new transmission can be started		t_{wSTA}	4.7			μs
Hold time						
Start condition		t_{hSTA}	4.0			μs
DATA		t_{hDAT}	0			μs

Bus timing



P = Stop, S = Start

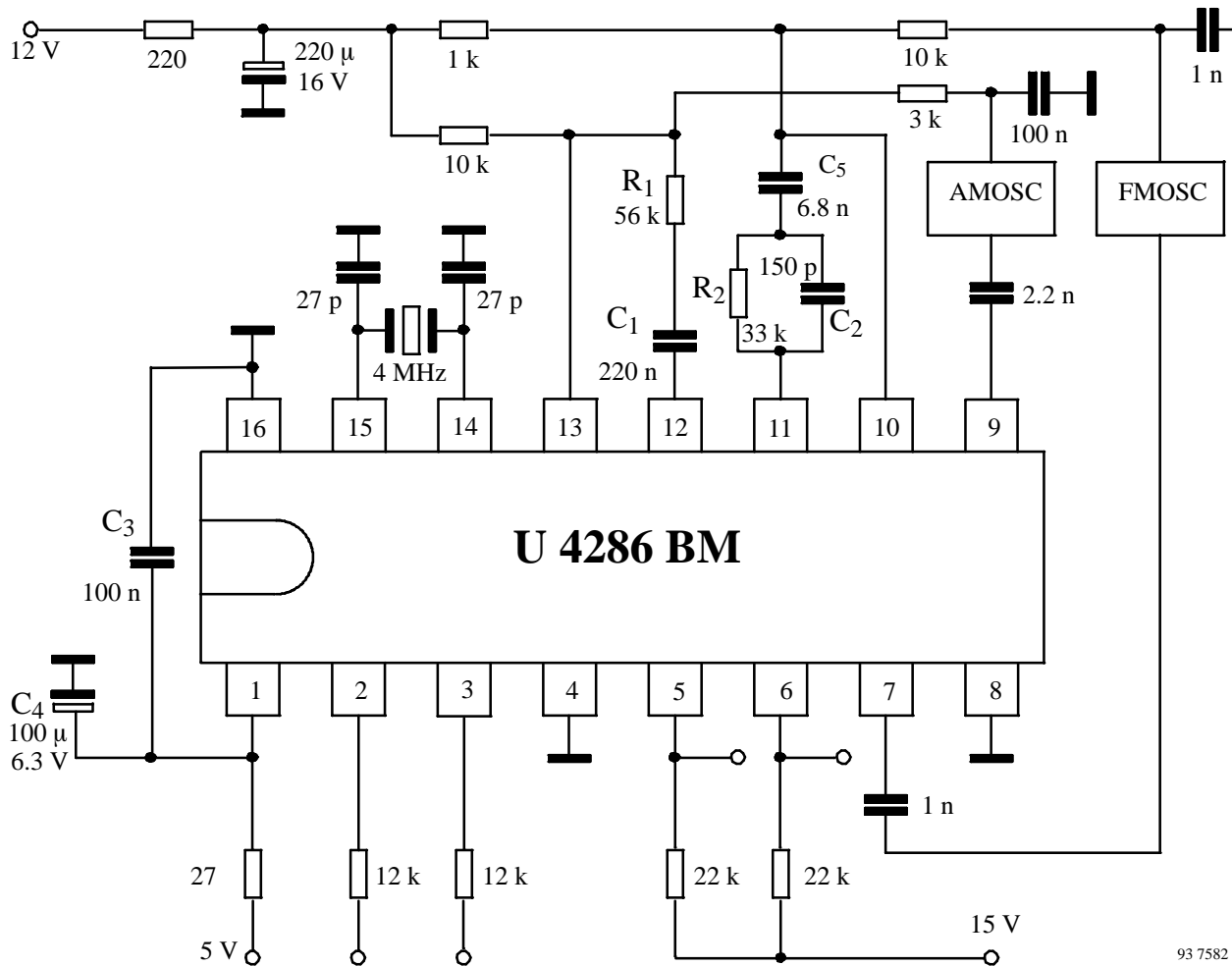
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Figure 4.

The following hints are recommended:

- $C_3 = 100 \text{ nF}$ should be very close to pin 1 (V_{DD}) and pin 16 (GND 1)
- 4 MHz quartz must be very close to pin 14 and pin 15
- Components of the charge pump (C_1/R_1 for AM and C_2/R_2 for FM) should be very close to pin 12 with respect to pin 11.
- GND 2 (pin 8 – analogue ground) and GND 1 (pin 16 – digital ground) must be connected according to Figure 6

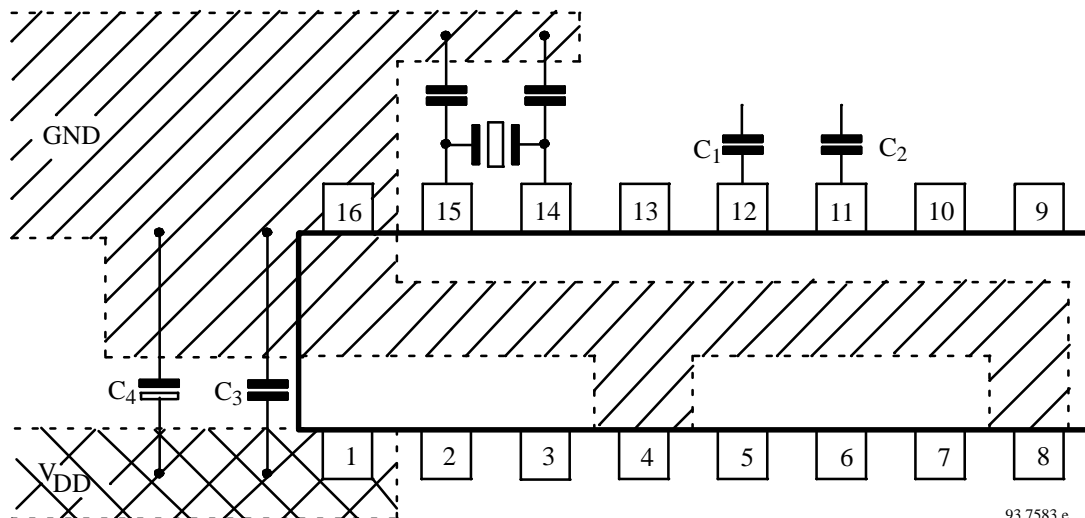
Application circuit



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Figure 5.

PCB-Layout



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Figure 6.

U4286BM

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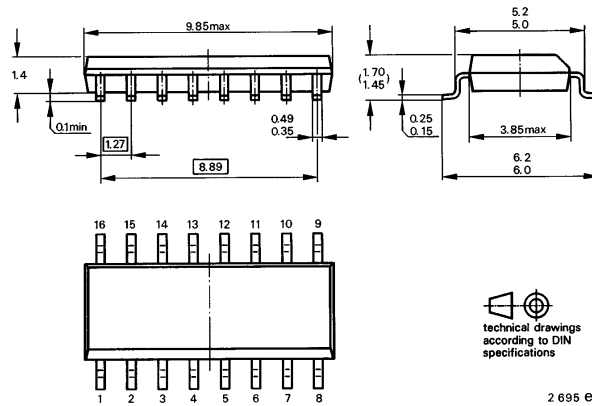
TELEFUNKEN Semiconductors

Ordering and Package Information

Extended Type Number	Package	Remarks
U4286BM-BFP	SO 16 plastic	
U4286BM-BFPG3	SO 16 plastic	Taping according to IEC-286-3

Dimensions in mm

Package: SO 16



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.

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