Features

- **Reference Oscillator up to 15 MHz**
- **Two Programmable 16-bit Dividers Adjustable from 2 to 65535**
- **Fine Tuning Steps**
  - **AM ≥ 1 kHz**
  - **FM ≥ 2 kHz**
- **Four Programmable Switching Outputs (Open Drain up to 15 V)**
- **Integrated Loop-push-pull Stage for AM/FM**
- **High Signal/Noise Ratio**

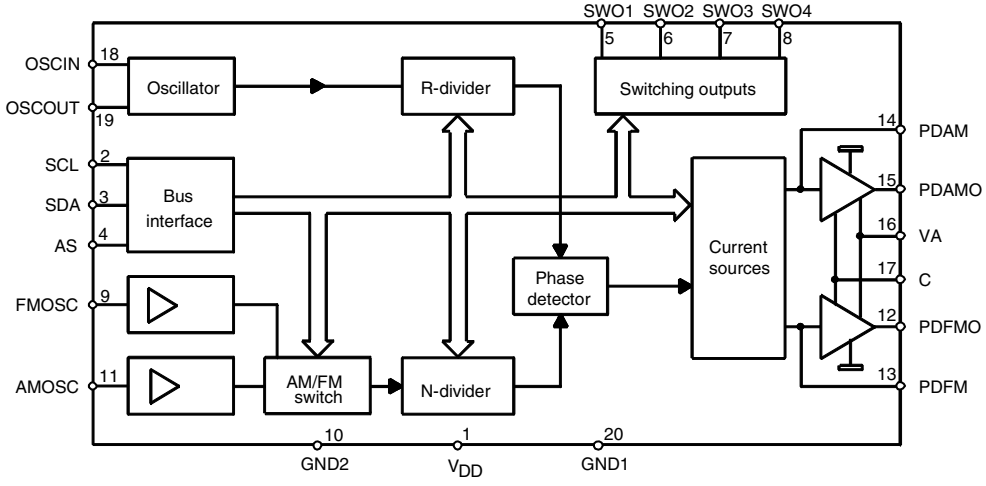
AM/FM PLL with 4 Switches

U4285BM

Description

The U4285BM is an integrated circuit in BICMOS technology for frequency synthesizers. It performs all the functions of a PLL radio tuning system and is controlled by a 2-wire bus. The device is designed for all frequency synthesizer applications in radio receivers, as well as for RDS (Radio Data System) applications.

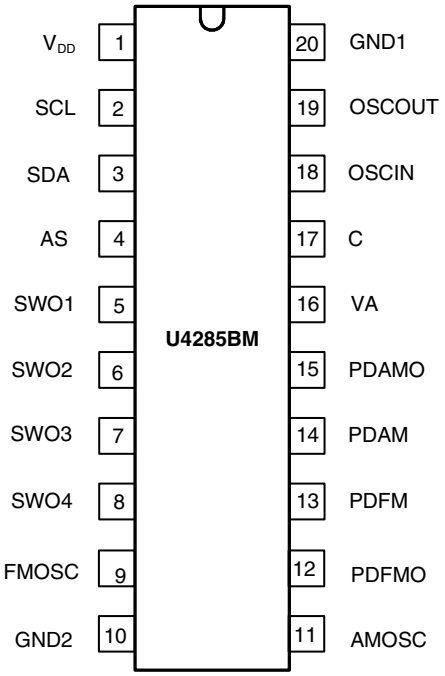
Figure 1. Block Diagram



Rev. 4750A–AUDR–11/03

Pin Configuration

Figure 2. Pinning SSO20



Pin Description

Pin	Symbol	Function
1	V_{DD}	Supply voltage
2	SCL	Bus clock
3	SDA	Bus data
4	AS	Address selection
5	SWO1	Switching output 1
6	SWO2	Switching output 2
7	SWO3	Switching output 3
8	SWO4	Switching output 4
9	FMOSC	FM oscillator input
10	GND2	Ground 2 (analog)
11	AMOSC	AM oscillator input
12	PDFMO	FM analog output
13	PDFM	FM current output
14	PDAM	AM current output
15	PDAMO	AM analog output
16	VA	Analog supply voltage
17	C	Capacitor
18	OSCIN	Oscillator input
19	OSCOUT	Oscillator output
20	GND1	Ground 1 (digital)

Functional Description

The U4285BM is controlled via the 2-wire bus. One module address byte, two subaddress bytes and five data bytes enable programming.

The module address contains a programmable address bit A 1, which (along with address select input AS, pin 4), enables the operation of two U4285BM devices 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 of the data bytes is transmitted first. If the subaddress of the R-divider is transmitted, the sequence of the next data bytes is DB 0 (status), DB 1 and DB 2. If the subaddress of the N-divider is transmitted, the sequence of the next data bytes is DB 3 and DB 4. The bit organization of the module address, subaddress and 5 data bytes is shown in table “Bit Organization” on page 7.

Each transmission on the bus begins with the "START" condition and has to be ended by the "STOP" condition (see Table “Transmission Protocol” on page 7).

The integrated circuit U4285BM has two separate inputs for the AM and FM oscillators. Pre-amplified AM and FM signals are fed to the 16 bit N-divider via the AM/FM switch. The AM/FM switch is software controlled. Tuning steps can be selected by the 16 bit R-divider.

Furthermore, the device provides a digital memory phase detector and two separate current sources for AM and FM amplifiers (charge pump) as given in the Table “Electrical Characteristics” on page 4. The separate current sources (charge pumps) allow independent gain adjustment, providing high current for high-speed tuning and low current for stable tuning.

Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Parameters	Pins	Symbol	Value	Unit
Supply voltage	1	V_{DD}	-0.3 to +6	V
Input voltage	2, 3, 4, 9, 11, 18, 19	V_I	-0.3 to V_{DD} + 0.3	V
Output current	3, 5, 6, 7, 8	I_O	-1 to +5	mA
Output drain voltage	5, 6, 7, 8	V_{OD}	15	V
Analog supply voltage with 220 Ω serial resistance 2 minutes[1]	16	V_A V_A	6 to 15 24	V V
Output current	12, 15	I_{AO}	-1 to +20	mA
Ambient temperature range		T_{amb}	-30 to +85	°C
Storage temperature range		T_{stg}	-40 to +125	°C
Junction temperature		T_j	125	°C
Electrostatic handling (modified MIL STD 883 D method 3015.7: all supply pins connected together)		$\pm V_{ESD}$	1000	V

Note: 1. Corresponding to the application circuit (Figure 8 on page 8)

Thermal Resistance

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

Electrical Characteristics

V_{DD} = 5 V, V_A = 10 V, T_{amb} = 25° C, unless otherwise specified

Parameters	Test Conditions	Pins	Symbol	Min.	Typ.	Max.	Unit
Supply voltage		1	V_{DD}	4.5	5.0	5.5	V
Quiescent supply current	AM mode/FM mode	1	I_{DD}		4.0	7.0	mA
FM input sensitivity, R_G = 50 Ω, FMOSC	f_i = 70 to 120 MHz	9	V_{SFM}	40			mV_{rms}
	f_i = 160 MHz	9	V_{SFM}	150			mV_{rms}
AM input sensitivity, R_G = 50 Ω, AMOSC	f_i = 0.6 to 35 MHz	11	V_{SAM}	40			mV_{rms}
Oscillator input sensitivity, R_G = 50 Ω, OSCIN	f_i = 0.1 to 15 MHz	18	V_{SOSC}	100			mV_{rms}
Switching Output SWO1, SWO2, SWO3, SWO4 (Open Drain)							
Output voltage LOW	I_L = 1 mA	5, 6, 7, 8	V_{SWOL}		100	400	mA
Output leakage current HIGH	V5, V6, V7, V8 = 10 V	5, 6, 7, 8	I_{OHL}			100	nA
Phase Detector PDFM							
Output current 1		13	$\pm I_{PDFM}$	1600	2000	2400	µA
Output current 2		13	$\pm I_{PDFM}$	400	500	600	µA
Leakage current		13	$\pm I_{PDFML}$			20	nA
Phase Detector PDAM							
Output current 1		14	$\pm I_{PDAM}$	160	200	240	µA
Output current 2		14	$\pm I_{PDAM}$	40	50	60	µA
Leakage current		14	$\pm I_{PDAML}$			20	µA
Analog Output PDFMO, PDAMO							
Saturation voltage LOW	I = 15 mA	12, 15	V_{satL}		200	400	mW
Saturation voltage HIGH	I = 15 mA	12, 15	V_{satH}	9.5	9.95		V
Bus SCL, SDA, AS							
Input voltage HIGH		2, 3, 4	V_{iBUS}	3.0		V_{DD}	V
Input voltage LOW		2, 3, 4	V_{iBUS}	0		1.5	V
Output voltage acknowledge LOW	I_{SDA} = 3 mA	3	V_O			0.4	V
Clock frequency		2	f_{SCL}			100	kHz
Rise time SDA, SCL		2, 3	t_r			1	µs
Fall time SDA, SCL		2, 3	t_f			300	ns
Period of SCL HIGH	HIGH	2	t_H	4.0			µs
Period of SCL LOW	LOW	2	t_L	4.7			µs

Electrical Characteristics (Continued)

V_{DD} = 5 V, V_A = 10 V, T_{amb} = 25° C, unless otherwise specified

Parameters	Test Conditions	Pins	Symbol	Min.	Typ.	Max.	Unit
Set-up Time							
Start condition			t_{sSTA}	4.7			µs
Data			t_{sDAT}	250			µs
Stop condition			t_{sSTOP}	4.7			µs
Time space(1)			t_{wSTA}	4.7			µs
Hold Time							
Start condition			t_{hSTA}	4.0			µs
DATA			t_{hDAT}	0			µs

Note: 1. This is a period of time where the bus must be free from data transmission before a new transmission can be started.

Figure 3. FM Input Sensitivity, T = 85° C

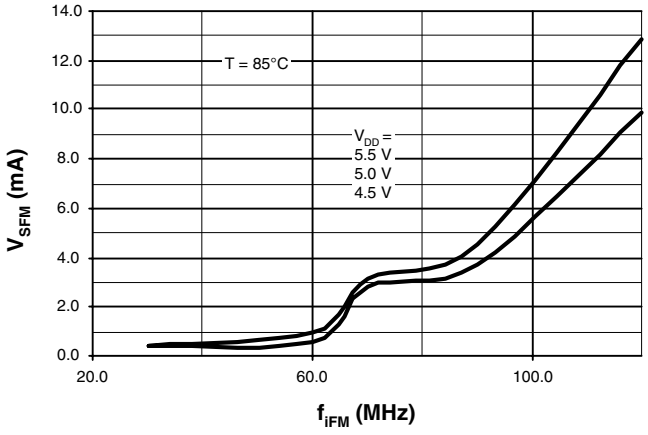


Figure 4. FM Input Sensitivity, T = -30° C

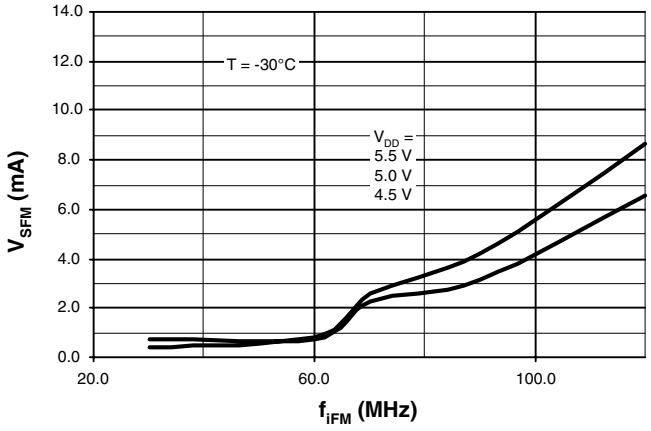


Figure 5. AM Input Sensitivity, T = 85° C

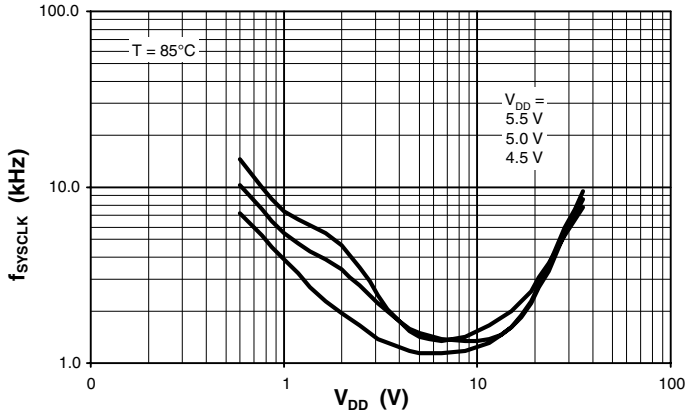


Figure 6. AM Input Sensitivity, T = -30° C

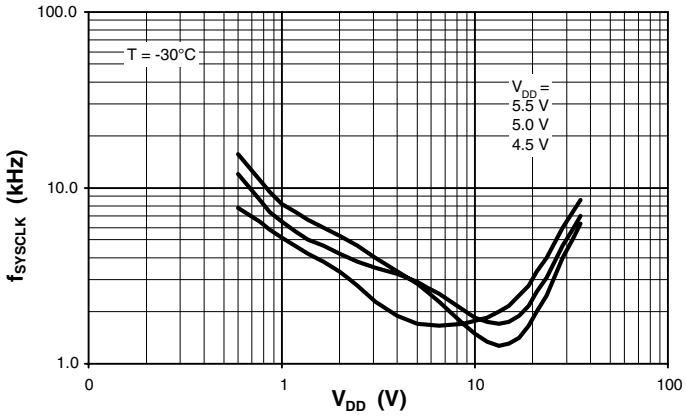
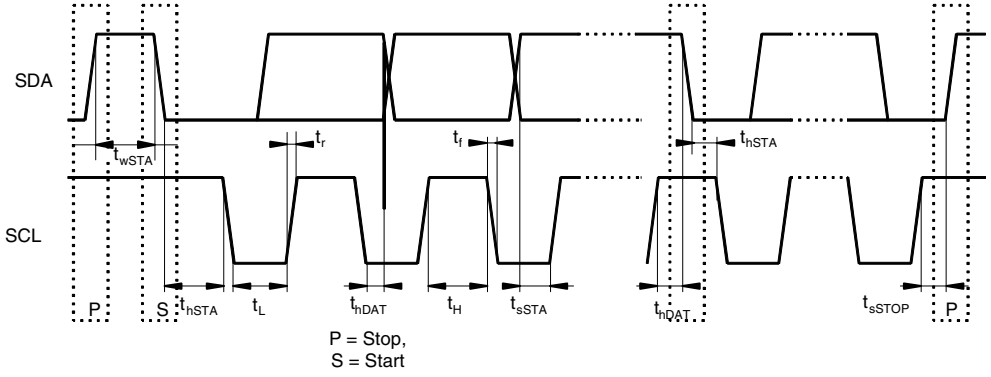


Figure 7. Bus Timing



Bit Organization

	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	0	0	1	X	X
Subaddress (N-divider)	X	X	X	X	1	1	X	X
Data byte 0 (Status)	SWO1	SWO2	SWO3	SWO4	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}
Data byte 2	2^{7}	R-divider						2^{0}
Data byte 3	2^{15}	N-divider						2^{8}
Data byte 4	2^{7}	N-divider						2^{0}

Table 1. Function Mode

Bit Description	Mode	LOW	HIGH
D3	AM/FM	FM operation	AM operation
D2	PD - ANA	PD analog	TEST
D1	PD - POL	Negative polarity	Positive polarity
D0	PD - CUR	Output current 2	Output current 1

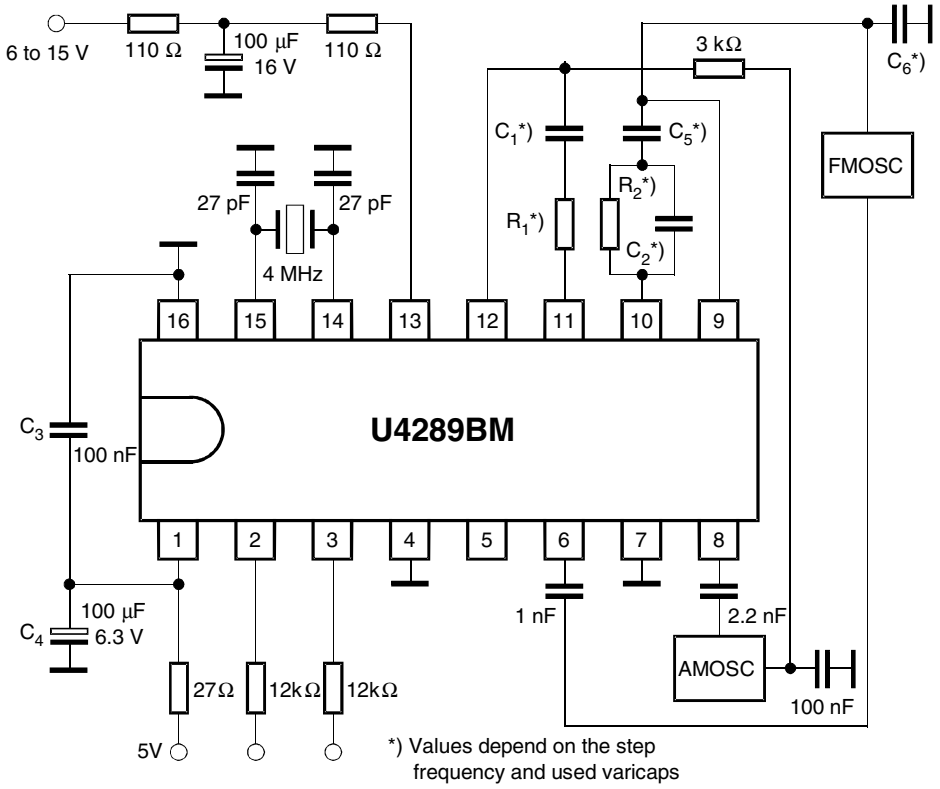
Transmission Protocol

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

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

Note: S = Start, P = Stop, A = Acknowledge

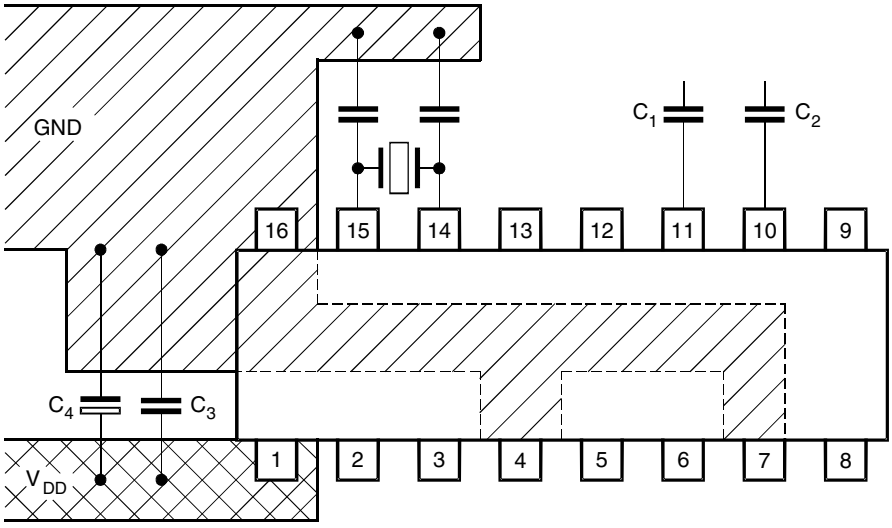
Figure 8. Application Circuit



Recommendations for Applications

- C_3 = 100 nF should be very close to pin 1 (V_{DD}) and pin 20 (GND 1)
- GND 2 (pin 10 - analog ground) and GND 1 (pin - digital ground) must be connected according to Figure 8
- 4 MHz crystal must be very close to pin 18 and pin 19
- Components of the charge pump (C_1/R_1 for AM and C_2/R_2 for FM) should be very close to pin 14 with respect to pin 13

Figure 9. PCB Layout

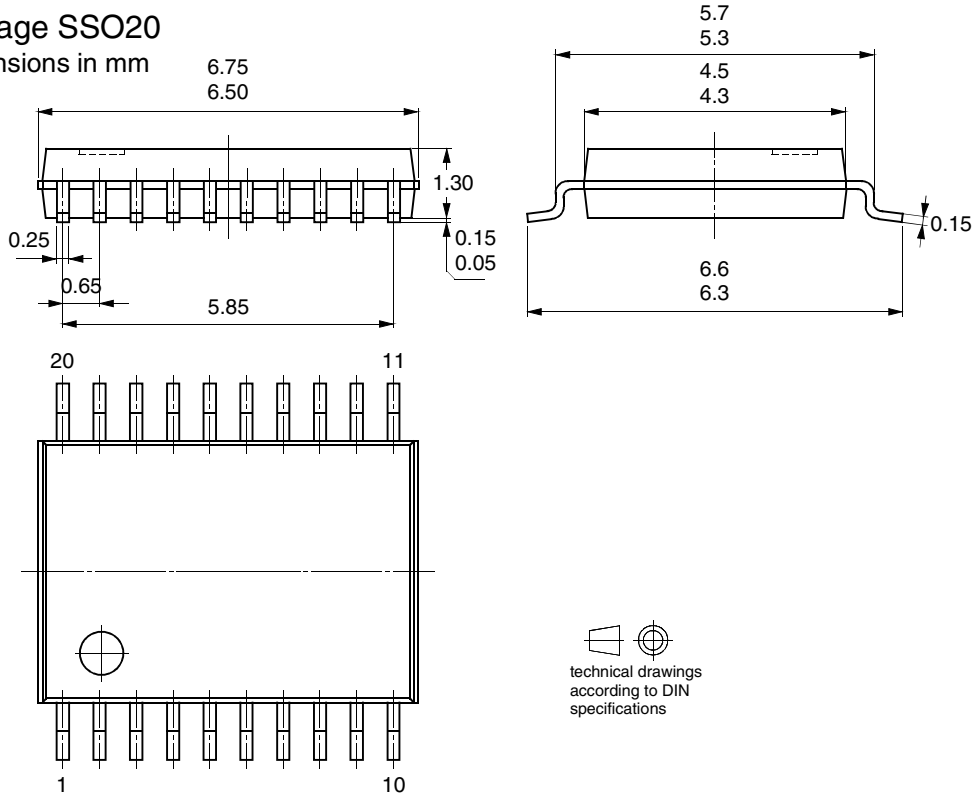


Ordering Information

Extended Type Number	Package	Remarks
U4285BM-MFS	SSO20 plastic	–
U4285BM-MFSG3	SSO20 plastic	Taping according to IEC-286-3

Package Information

Package SSO20
Dimensions in mm



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