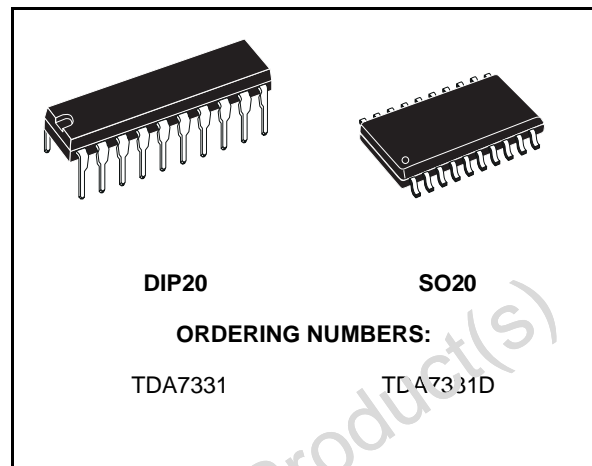




## SINGLE CHIP RDS DEMODULATOR + FILTER

- VERY HIGH RDS DEMODULATION QUALITY WITH IMPROVED DIGITAL SIGNAL PROCESSING
- HIGH PERFORMANCE, 57KHz BANDPASS FILTER (8th ORDER)
- PURELY DIGITAL RDS DEMODULATION WITHOUT EXTERNAL COMPONENTS
- ARI INDICATION AND RDS SIGNAL QUALITY OUTPUTS
- 4.332MHz CRYSTAL OSCILLATOR (8.664 and 17.328MHz SELECTABLE OPTIONS)
- LOW NOISE CMOS TECHNOLOGY
- LOW RADIATION



### DESCRIPTION

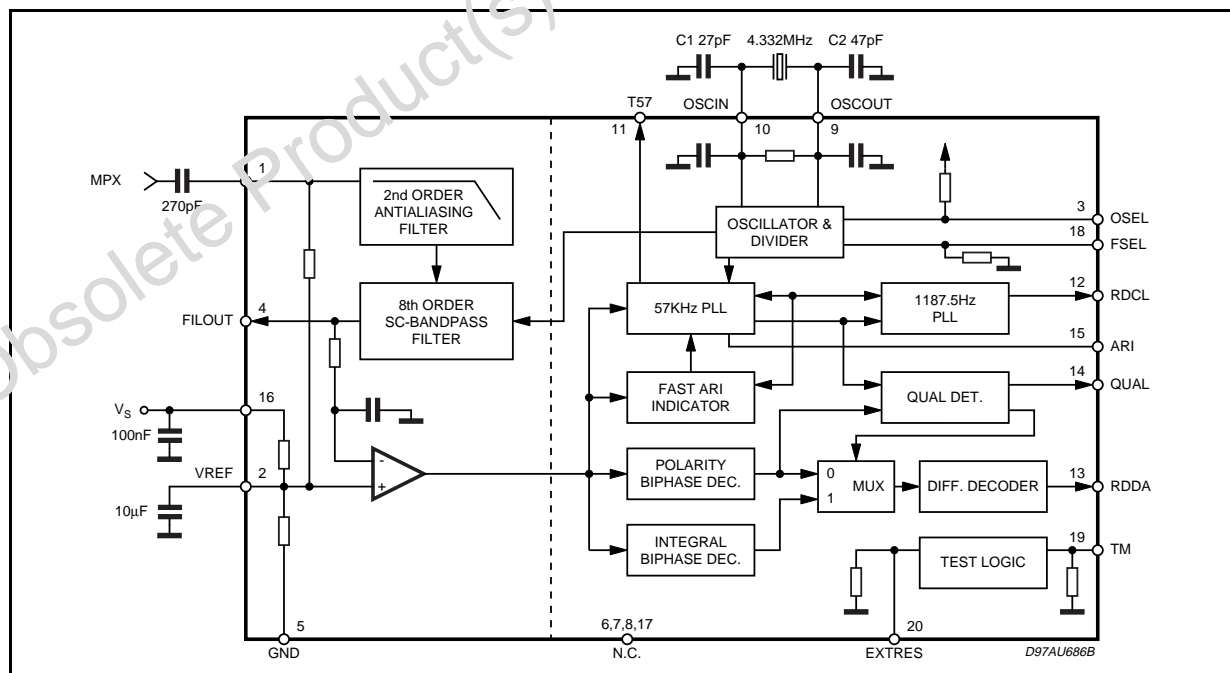
The TDA7331, an improved version of TDA7330B, recovers the additional inaudible RDS information which is transmitted by FM radio broadcasting stations and operates in accordance with the EBU (European Broadcasting Union) specifications.

The device is made up of two sections: a cas-

caded antialiasing + switched capacitors band-pass filter for precise RDS band selection and a demodulating section that performs the extraction of RDS data stream (RDDA) and clock (RDCL), to be further processed by a suitable RDS decoder.

Outputs for RDS signal quality and ARI indication are also present.

### BLOCK DIAGRAM and TEST CIRCUIT



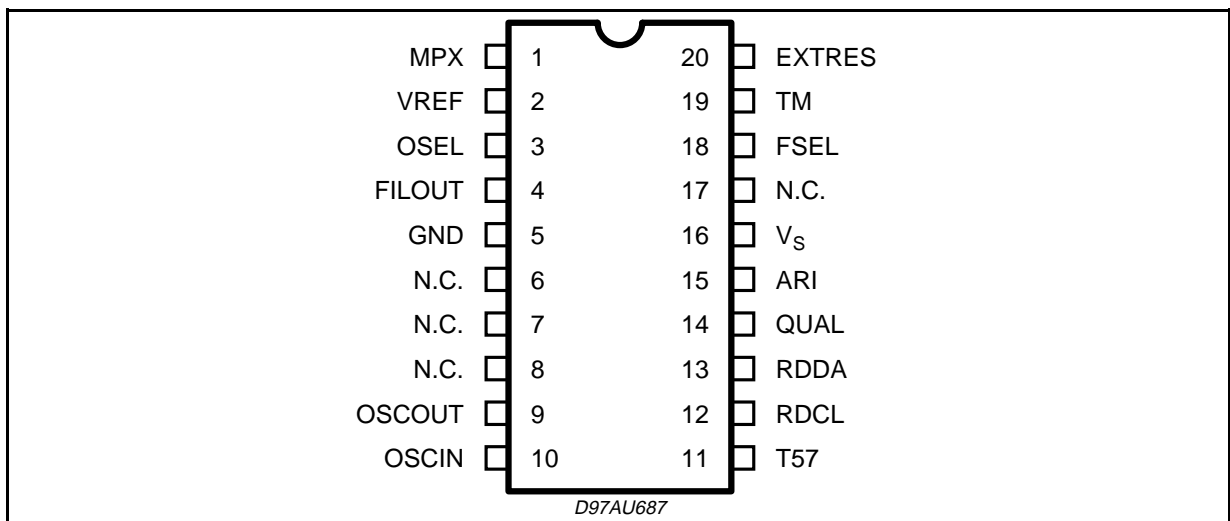
**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>S</sub>	Supply Voltage	7	V
T <sub>op</sub>	Operating Temperature Range	-40 to 85	°C
T <sub>stg</sub>	Storage Temperature	-55 to 150	°C

**PIN FUNCTION**

N° pin	Name	Functional description
1	MPX	RDS input signal
2	VREF	Reference voltage
3	OSEL	Oscillator selector pin: - open, or closed to V <sub>S</sub> = quartz oscillator - closed to GND = external driven
4	FILOUT	Filter output
5	GND	Ground
6	nc	Not connected
7	nc	Not connected
8	nc	Not connected
9	OSCOUT	Oscillator output
10	OSCIN	Oscillator input
11	T57	Testing output pin: 57kHz clock output
12	RDCL	RDS clock output 1187.5Hz
13	RDDA	RDS data output
14	QUAL	Output for signal quality indication (High = good)
15	ARI	Output for ARI indication: - high when RDS+ARI are present - high when only ARI is present - low when only RDS is present - undefined when nos signal is present
16	V <sub>S</sub>	Supply voltage
17	nc	Not connected
18	FSEL	Frequency selector pin: - 100K to V <sub>S</sub> = 17.328MHz - open = 4.332MHz - closed to V <sub>S</sub> = 8.664MHz
19	TM	Test mode pin: - open = normal operation - closed to V <sub>S</sub> = testmode
20	EXTRES	Reset pin: - open = run mode - closed to V <sub>S</sub> = reset condition

**PIN CONNECTION**



## THERMAL DATA

Symbol	Description	DIP20	SO20	Unit
$R_{th\ j-amb}$	Thermal Resistance Junction-Ambient Max	100	200	°C/W

ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25^{\circ}\text{C}$ ,  $V_S = 5\text{V}$ , unless otherwise specified).

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$V_S$	Supply voltage		4.5	5	5.5	V
$I_S$	Supply current			7.5	11.0	mA

## FILTER

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$f_C$	Center frequency		56.5	57	57.5	kHz
BW	3dB Bandwidth		2.5	3	3.5	kHz
G	Gain	$f = 57\text{kHz}$	18	20	22	dB
A	Attenuation	$\Delta f \pm 4\text{kHz}$	18	22		dB
		$f = 38\text{kHz}$	50	60		dB
		$f = 67\text{kHz}$	35	45		dB
$R_I$	Input impedance of MPX		80	120	150	$K\Omega$
$R_L$	Load impedance on FILOUT		1			$M\Omega$
S/N	Signal to noise ratio	$V_{IN} = 3\text{mV}_{RMS}$	30	40		dB
$V_{IN}$	MPX input signal	$f = 19\text{kHz}$ ; $T_3 \leq 40\text{dB}(1)$ $f = 57\text{kHz}$ (RDS+ ARI)			1000 50	$\text{mV}_{RMS}$ $\text{mV}_{RMS}$
$V_{REF}$	Reference			$V_S/2$		V

## DEMODULATOR

Input pins (EXTRES, FSEL, TM) all with internal pull down resistor  
 Input pin (OSEL) with internal pull up resistor

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$I_{PD}$	Input Current	$V_{IN} = 5\text{V}$ (pull-down input)	15		30	$\mu\text{A}$
$I_{PU}$	Input Current	$V_{IN} = 0\text{V}$ (pull-up input)	-25		-10	$\mu\text{A}$
$V_{IH}$	Input voltage high		$0.7 \cdot V_S$	$0.8 \cdot V_S$		V
$V_{IL}$	Input voltage low			$0.2 \cdot V_S$	$0.3 \cdot V_S$	V

## Output pins (RDCL, RDDA, ARI, QUAL, T57)

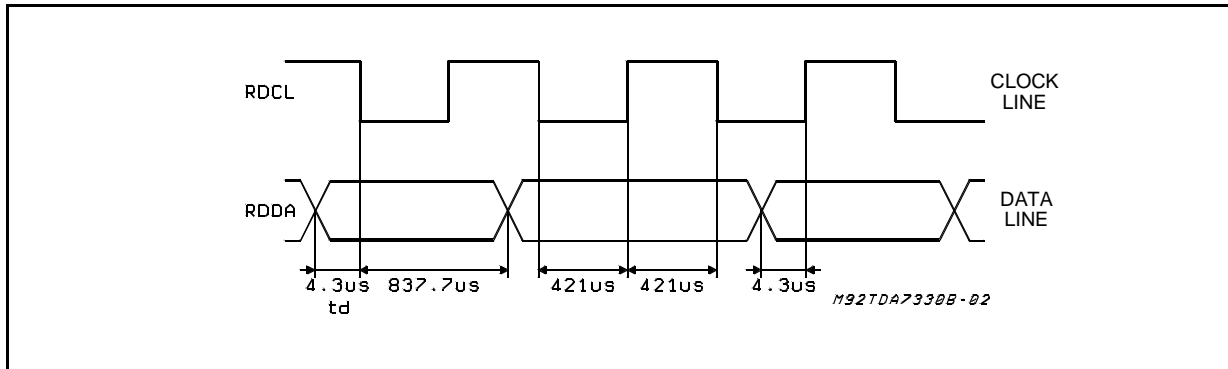
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$V_{OH}$	Output voltage high	$I_L = 0.5\text{mA}$	4	4.6		V
$V_{OL}$	Output voltage low	$I_L = 0.5\text{mA}$		0.4	1	V

## OSCILLATOR

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
VCLL	Input level OSCIN pin	OSEL = open circuit			1	V
VCLH	Input level OSCIN pin	OSEL = open circuit	4			V
	Amplitude OSCOUT	OSEL = open circuit		4.5		V
$V_{PP}$	Amplitude OSCIN (for external drive)	OSEL = GND, $f = 4.332\text{MHz}$		100		mVpp
		OSEL = GND, $f = 8.664\text{MHz}$		120		mVpp
		OSEL = GND, $f = 17.328\text{MHz}$		150		mVpp

(1) The 3rd harmonic (57kHz) must be less than -40dB with respect to the input signal plus gain.

Figure 1. RDS timing diagram



**OUTPUT TIMING**

The RDS (1187.5Hz) output clock on RDCL line is synchronized to the incoming data.

According to the internal PLL lock condition data change can result on the falling or on the rising clock edge. (see Fig. 1)

Whichever clock edge is used by the decoder (rising or falling edge) the data will remain valid for 416.7 µsec after the clock transition.

**OSCILLATOR CONTROLS (FSEL, OSEL)**

Three different crystal frequencies can be used. The adaption of the internal clock divider to the external crystal is achieved via the input pin FSEL. See the followings table for reference:

Crystal	FSEL (pin configuration)
4.332MHz	connected to GND or open
8.664MHz	connected to Vs
17.328MHz	external resistor of 100K to Vs

A special mode is introduced to reduce EMI. With pin OSEL connected to GND the internal oscillator is switched off and an external sinusoidal frequency could be applied on OSCIN. The peak to peak voltage of this signal can be reduced down to 60mV.

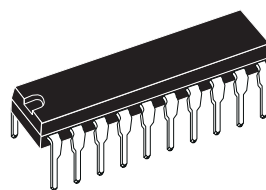
In this mode the frequency selection via FSEL is still active.

Suggested values of C1 and C2 are shown in the following table:

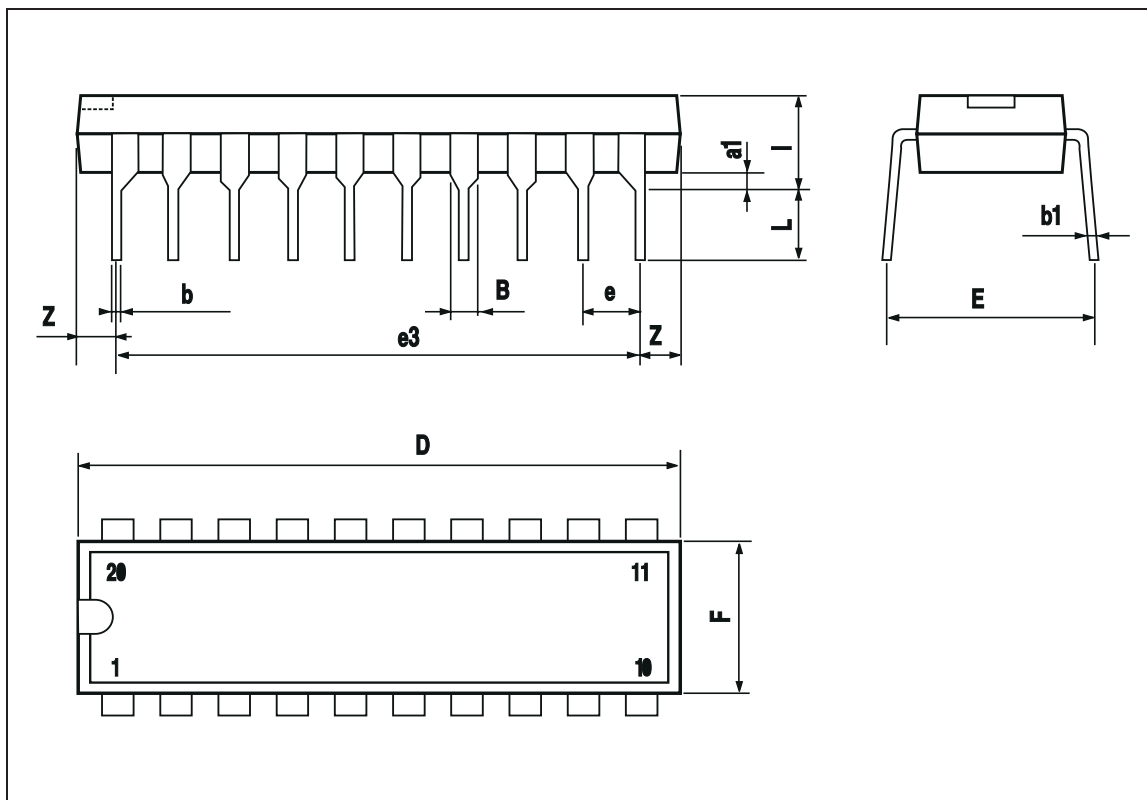
Crystal	C1	C2
4.332MHz	27pF	47pF
8.664MHz	27pF	-
17.328MHz	27pF	-

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.254			0.010		
B	1.39		1.65	0.055		0.065
b		0.45			0.018	
b1		0.25			0.010	
D			25.4			1.000
E		8.5			0.335	
e		2.54			0.100	
e3		22.86			0.900	
F			7.1			0.280
l			3.93			0.155
L		3.3			0.130	
Z			1.34			0.053

**OUTLINE AND MECHANICAL DATA**

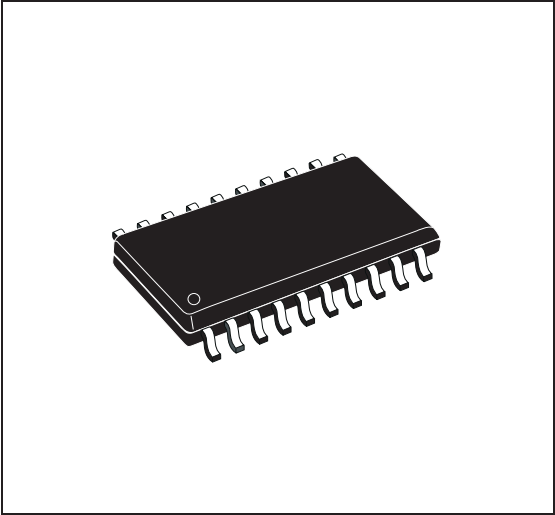


**DIP20**

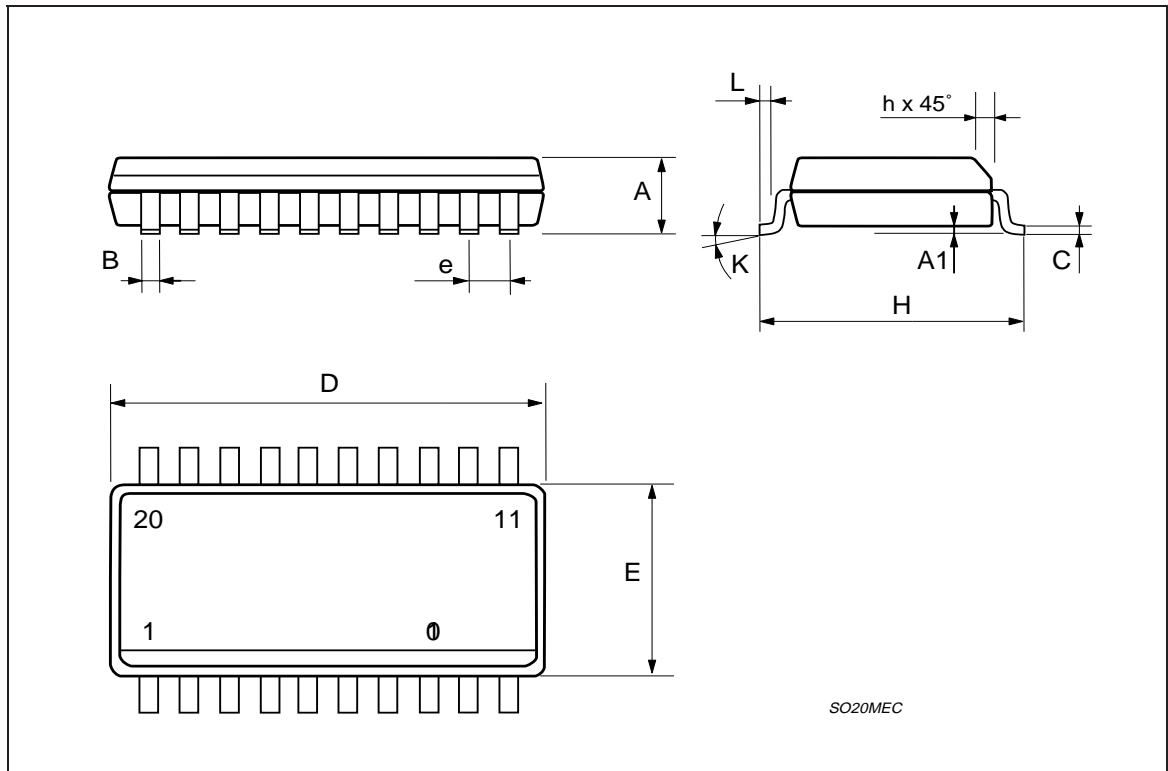


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.35		2.65	0.093		0.104
A1	0.1		0.3	0.004		0.012
B	0.33		0.51	0.013		0.020
C	0.23		0.32	0.009		0.013
D	12.6		13	0.496		0.512
E	7.4		7.6	0.291		0.299
e		1.27			0.050	
H	10		10.65	0.394		0.419
h	0.25		0.75	0.010		0.030
L	0.4		1.27	0.016		0.050
K	0° (min.)8° (max.)					

**OUTLINE AND MECHANICAL DATA**



**SO20**



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