

## SINGLE CHIP RDS DEMODULATOR + FILTER

ADVANCE DATA

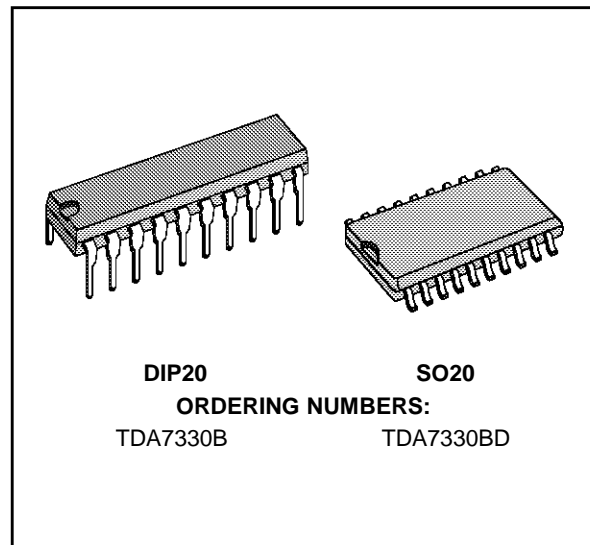
- HIGH PERFORMANCE, 57KHz BANDPASS FILTER (8th ORDER)
- FILTER ADJUSTMENT FREE AND WITHOUT EXTERNAL COMPONENTS
- PURELY DIGITAL RDS DEMODULATION WITHOUT EXTERNAL COMPONENTS
- ARI (SK INDICATION) AND RDS SIGNAL QUALITY OUTPUT
- 4.332MHz CRYSTAL OSCILLATOR (8.664MHz OPTIONAL)
- LOW NOISE MIXED BIPOLAR/CMOS TECHNOLOGY

### DESCRIPTION

The TDA7330B is a RDS demodulator. It recovers the additional inaudible RDS information which is transmitted by FM radio broadcasting stations.

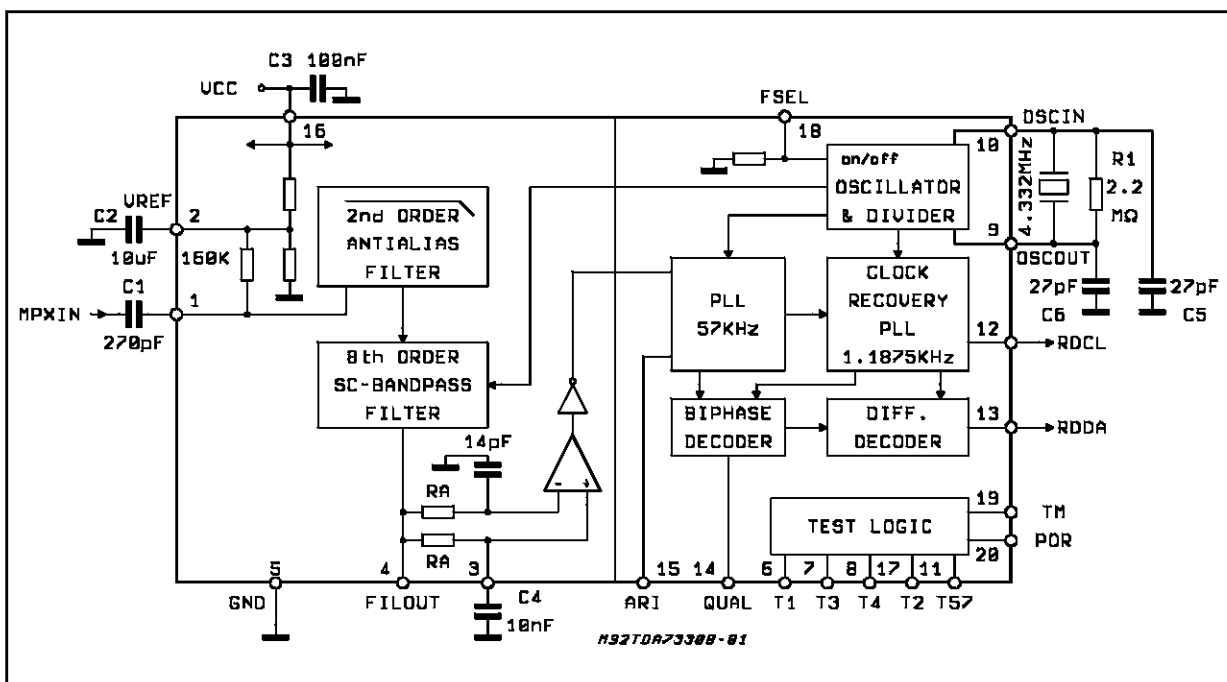
The output data signal (RDDA) and clock signal (RDCL) can be further processed by a suitable RDS decoder (microprocessor).

The device operates in accordance with the EBU (European Broadcasting Union) specifications. The IC includes a 2nd order antialiasing input filter,



ter, a 57KHz switched capacitor band pass filter, a smoothing filter and cross detector, a bit rate clock recovery circuit, a 57KHz PLL, BI-PHASE PSK decoder, differential decoding circuit, ARI indication and RDS signal quality output.

### BLOCK DIAGRAM



# TDA7330B

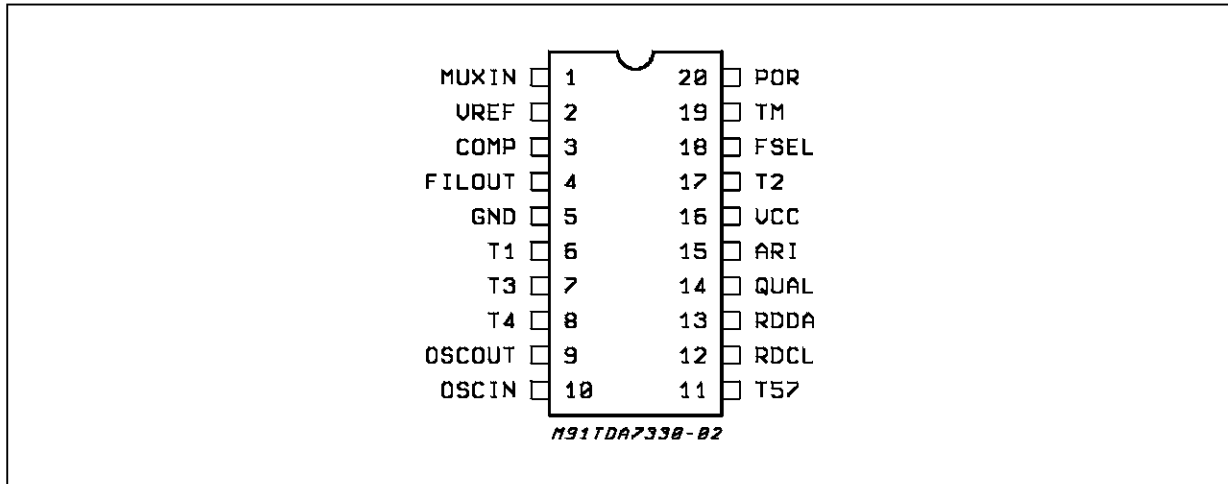
## ABSOLUTE MAXIMUM RATINGS

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

## THERMAL DATA

Symbol	Description	DIP20	SO20	Unit
R <sub>th j-case</sub>	Thermal Resistance Junction-case	Typ. 100	200	°C/W

## PIN CONNECTION (Top view)



## PIN FUNCTION

Nr.	Name	Description
1	MUXIN	RDS input signal.
2	V <sub>ref</sub>	Reference voltage
3	COMP	Not inverting comparator input (smoothing filter)
4	FIL OUT	Filter Output
5	GND	Ground
6	T1	Testing output pin (not to be used)
7	T3	Testing output pin (not to be used)
8	T4	Testing output pin (not to be used)
9	OSC OUT	Oscillator output
10	OSC IN	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 signals are present) (High when only ARI is present) (Low when only RDS is present) (undefined when no signal is present)
16	V <sub>CC</sub>	Supply Voltage
17	T2	Testing output pin (not to be used)
18	FSEL	Frequency selector pin: open = 4.332MHz, closed to V <sub>CC</sub> = 8.664MHz
19	TM	Test mode pin (open = normal RUN) (closed to V <sub>CC</sub> = Test mode)
20	POR	Reset Input for testing (active high)

**ELECTRICAL CHARACTERISTICS** ( $V_{CC} = 5V$ ,  $T_{amb} = 25^{\circ}C$ ;  $R_g = 600\Omega$ ;  $f_{osc} = 4.332MHz$ ;  $V_{IN} = 20mV_{rms}$  unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
--------	-----------	----------------	------	------	------	------

## SUPPLY

$V_{CC}$	Supply Voltage		4.5	5	5.5	V
$I_S$	Supply Current			9		mA
$R_{POR}$	POR Pull Down Resistor	pin 20		40		$K\Omega$
$POR_{ON}$	POR Threshold			2.5		V

## FILTER(measured an pin 4 FILOUT)

$F_C$	Center Frequency		56.5	57	57.5	KHz
BW	3dB Bandwidth		2.5	3	3.5	KHz
G	Gain	$f = 57KHz$	18	20	22	dB
A	Attenuation	$\Delta f = \pm 4KHz$ $f = 38KHz; V_i = 500mV_{rms}$ $f = 67KHz; V_i = 250mV_{rms}$	18 50 35	22 80 50		dB dB dB
$\Delta Ph$	Phase non linearity	A (see note1) B (see note1) C (see note1)		0.5 1 2	5 7.5 10	DEG DEG DEG
$R_i$	Input Impedance		100	160	200	$K\Omega$
S/N	Signal to Noise Ratio	$V_i = 3mV_{rms}$	30	40		dB
$V_i$	Maximum Input Signal Capability	$f = 19KHz; T_3 \leq -40dB$ (see note2) $f = 57KHz$ (RDS + ARI)			1 50	$V_{rms}$ $mV_{rms}$
$R_L$	Load Impedance	Pin 4	100			$K\Omega$

## CROSS DETECTOR

$R_A$	Resistance pin 3-4		15	21	28	$K\Omega$
-------	--------------------	--	----	----	----	-----------

## OSCILLATOR

$F_{OSC}$	Oscillator Frequency	$F_{SEL} = \text{Open} (*)$ $F_{SEL} = \text{Closed to } V_{CC} (**)$		4.332 8.664		MHz MHz
$V_{CLL}$	Clock Input level LOW (pin 10)				1	V
$V_{CLH}$	Clock Input Level HIGH (pin 10)		4			V
	Output Amplitude (pin 9)			4.5		$V_{PP}$

(\*)  $F_{SEL}$  pin has an internal  $40K\Omega$  pull down resistor A 4.332MHz QUARTZ must be used (\*\*) A 8.664MHz QUARTZ must be used.

## DEMODULATOR

$\Delta f_O$	Max Oscillator Deviation	$F_{SEL} = \text{Open}$		+ 1.2		KHz
$S_{RDS}$	RDS Detection Sensitivity		1			$mV_{rms}$
$S_{ARI}$	ARI Detection Sensitivity		3			$mV_{rms}$
$T_{lock}$	RDS Lockup Time			100		ms
$V_{OH}$	Output HIGH Voltage	$I_L = 0.5mA$ ; pins 12, 13, 14, 15	4			V
$V_{OL}$	Output LOW Voltage	$I_L = 0.5mA$ ; pins 12, 13, 14, 15			1	V
$f_{RDS}$	Data Rate for RDS	RDCL pin		1187.5		Hz
$t_D$	RDDA Transition versus RDCL	(see figure 2)		4.3		$\mu sec$

## Note(1):

The phase non linearity is defined as:  $\Delta Ph = | -2\phi_2 + \phi_1 + \phi_3 |$   
where  $\phi_x$  is the input-output phase difference at the frequency  $f_x$  ( $x = 1,2,3$ )

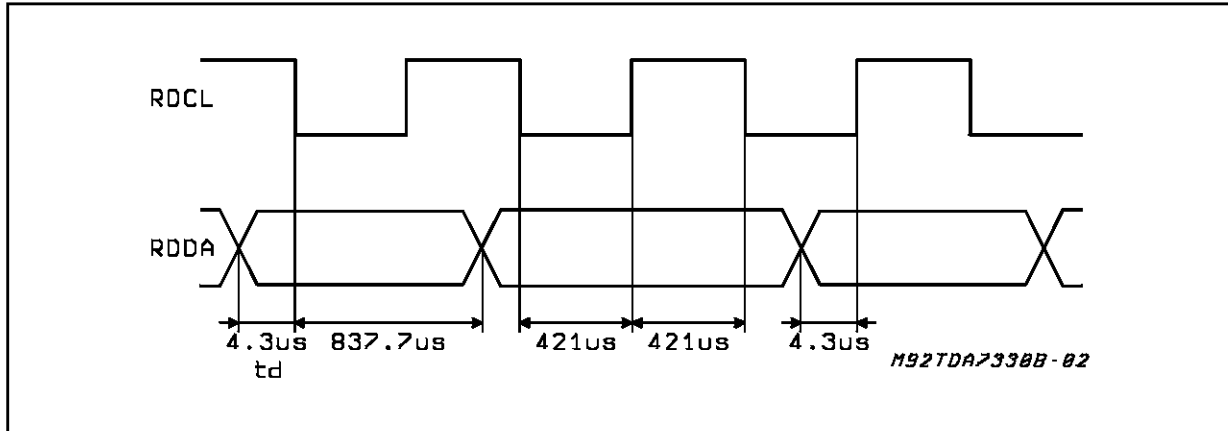
# TDA7330B

## ELECTRICAL CHARACTERISTICS (continued)

Measure	f1 (KHz)	f2 (KHz)	f3 (KHz)	ΔPh max
A	56.5	57	57.5	<5°
B	56	57	58	<7.5°
C	55.5	57	58.5	<10°

Note(2): The 3th harmonic (57KHz) must be less than -40dB in respect to the input signal 19KHz plus gain.

Figure 2: RDS timing diagram

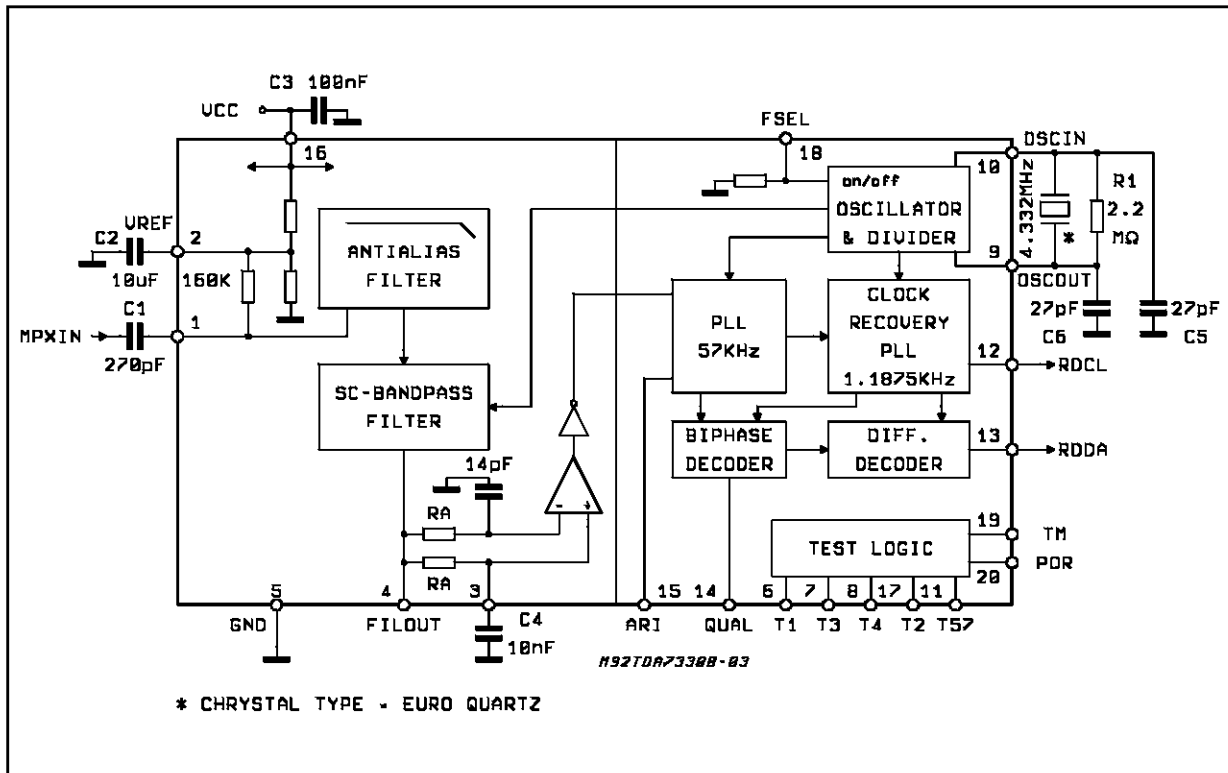


### OUTPUT TIMING

The generated 1187.5Hz output clock (RDCL line) is synchronized to the incoming data. According to the internal PLL lock condition this

data change can results on the falling or on the rising clock edge. 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.

Figure 3: Test Circuit



**APPLICATION SUGGESTION**

- A good DC decoupling between  $V_{CC}$  and GROUND is necessary: a 100nF ceramic capacitor, with low resistance and low inductance at high frequency, directly connected on pin 16 ( $V_{CC}$ ) and 5 (GND) is recommended.
- A small series inductance (100 $\mu$ H) or resistor (27 $\Omega$ ) may be used for supply line filtering.
- The Layout path pin2 - C2 - pin5 must be as short as possible.
- If the supply line, after the power on has a soft and disturbed (spikes) slope, a capacitor of 100nF, between POR and  $V_{CC}$ , is recommended.
- The various testing pins have no sense for the customer.

**Figure 4:** P.C. board and component layout of fig. 3 (1:1 scale)

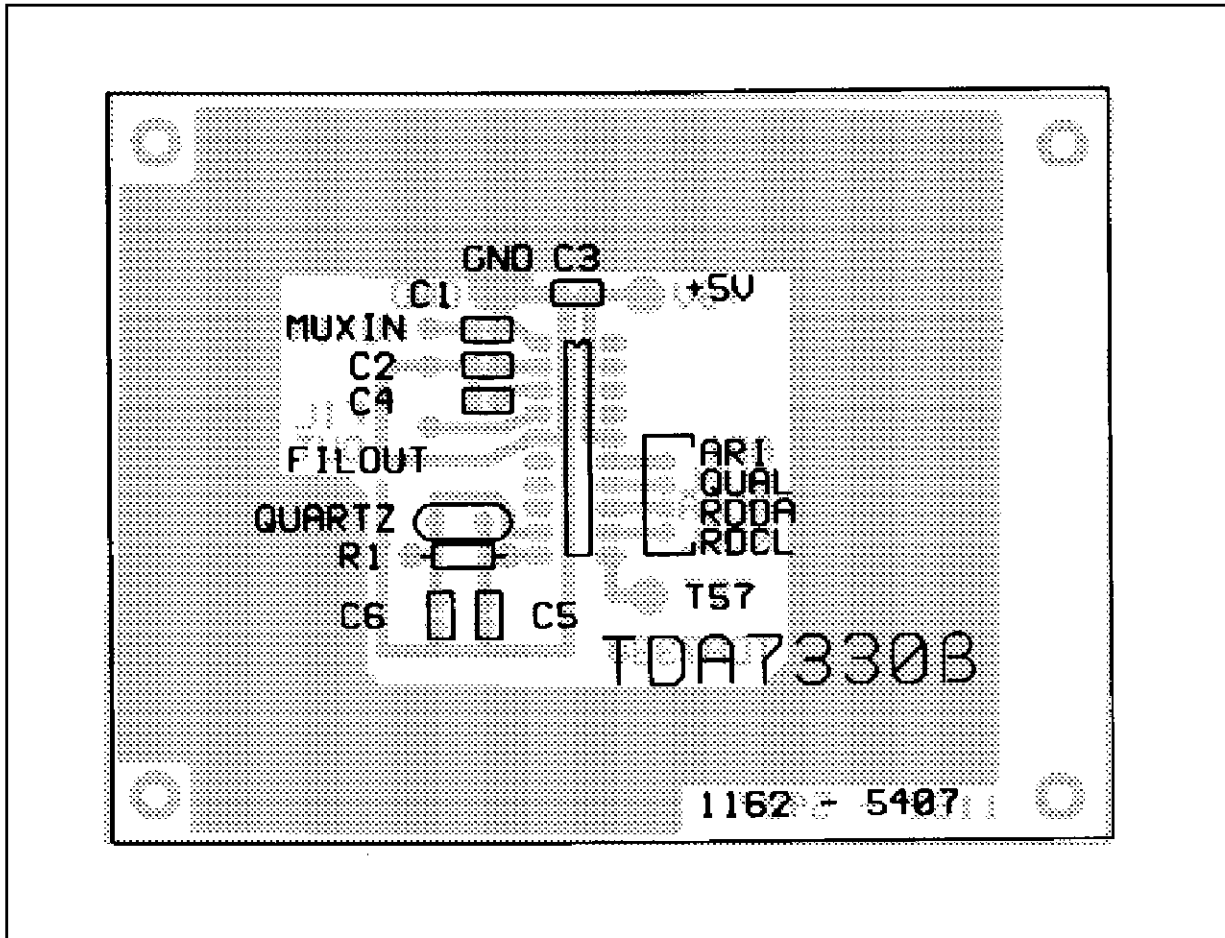


Figure 5: Gain vs. Frequency

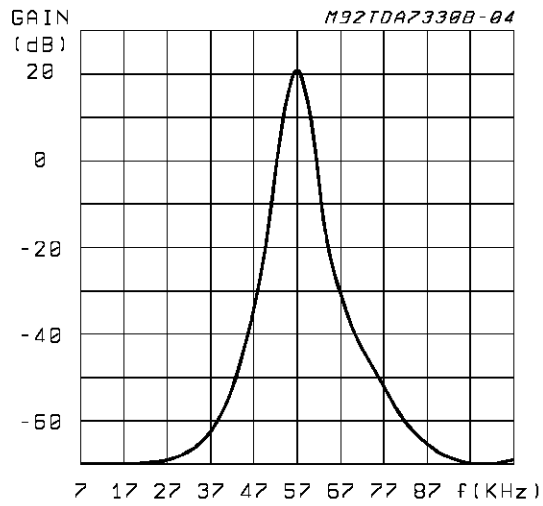
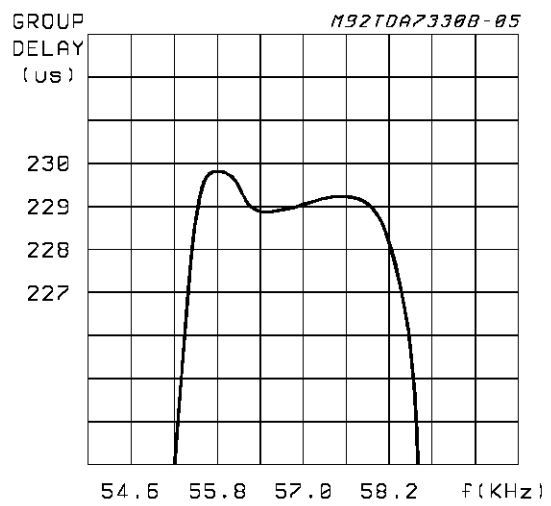
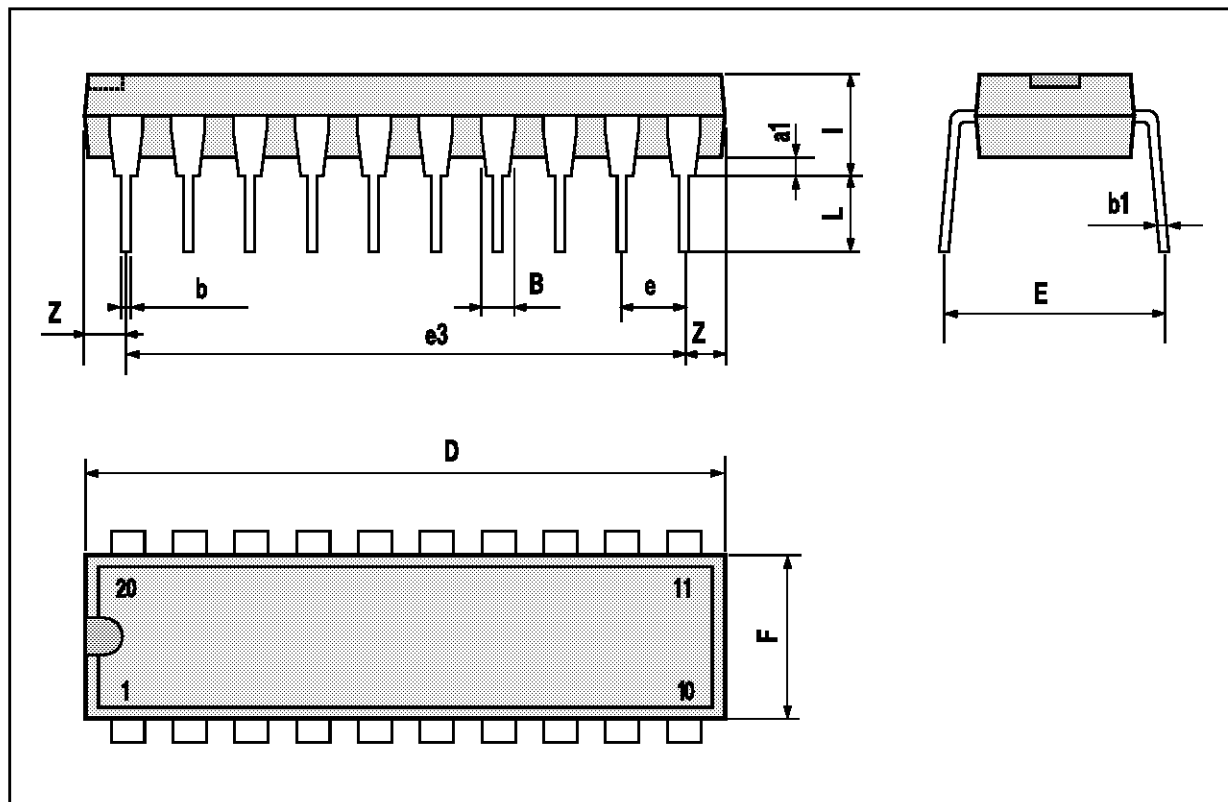


Figure 6: Group Delay vs. Frequency



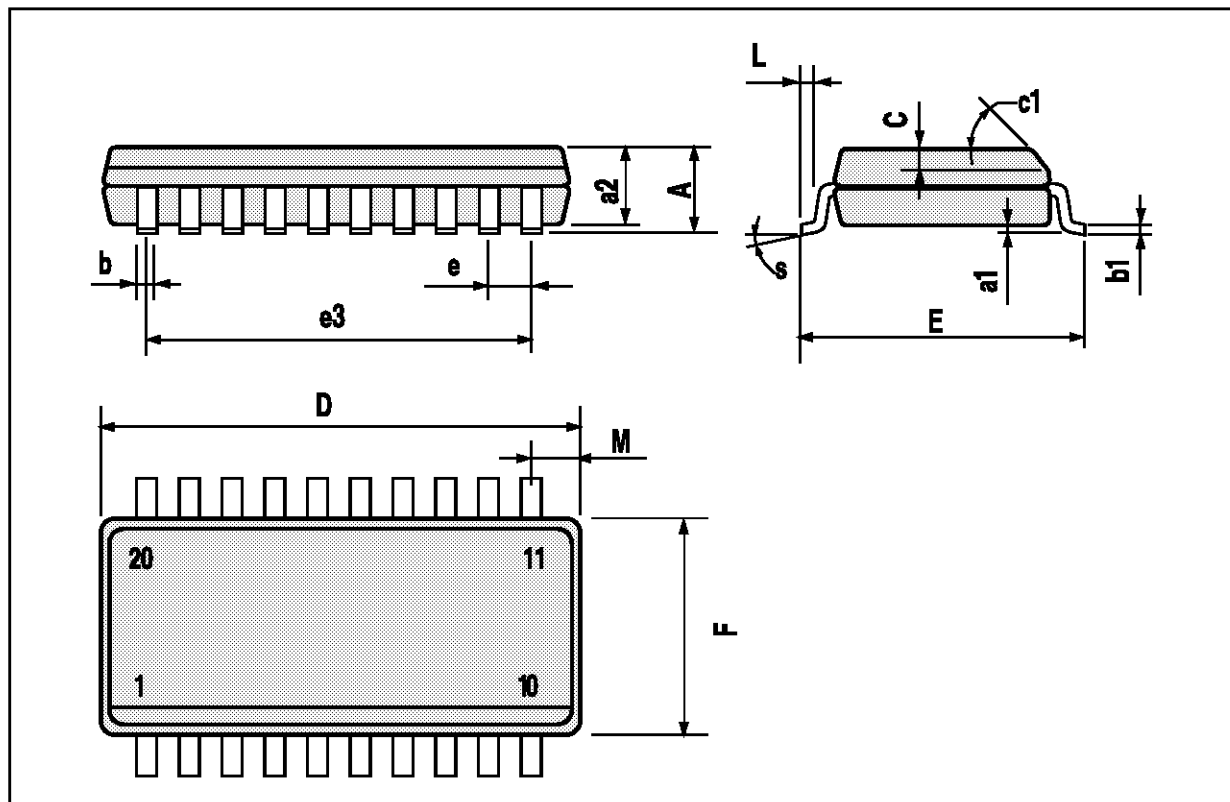
## DIP20 PACKAGE MECHANICAL DATA

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
I			3.93			0.155
L		3.3			0.130	
Z			1.34			0.053



SO20 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.3	0.004		0.012
a2			2.45			0.096
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.013
C		0.5			0.020	
c1	45 (typ.)					
D	12.6		13.0	0.496		0.512
E	10		10.65	0.394		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.4		7.6	0.291		0.299
L	0.5		1.27	0.020		0.050
M			0.75			0.030
S	8 (max.)					



Information furnished is believed to be accurate and reliable. However, SGS-THOMSON Microelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of SGS-THOMSON Microelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. SGS-THOMSON Microelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of SGS-THOMSON Microelectronics.

© 1994 SGS-THOMSON Microelectronics - All Rights Reserved

SGS-THOMSON Microelectronics GROUP OF COMPANIES

Australia - Brazil - France - Germany - Hong Kong - Italy - Japan - Korea - Malaysia - Malta - Morocco - The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A.