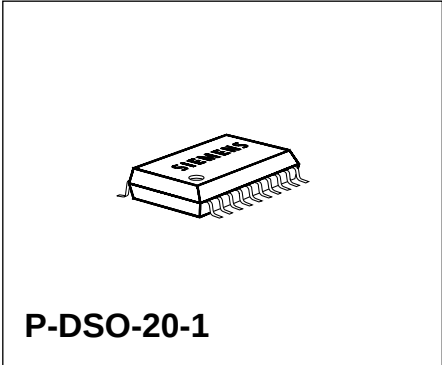


1 Overview

1.1 Features

- Internal reference voltage source
- Adjustment free oscillator with ceramic resonator 456 kHz
- Pilot dependent mono/stereo switching with hysteresis
- Stereo indicator output
- Analogue control of mono/stereo change over (stereo noise control, SNC)
- Pilot canceller (19 kHz)
- Adjacent channel noise suppression (114 kHz)
- MUTE facility
- Analogue control of deemphasis (high cut control, HCC).
- Stereo inputs for additional signal source at output amplifiers
- Interference noise detector with integrated high-pass filter
- (IF level signal or MPX input)
- MPX input low-pass filter
- Noise blanking at MPX demodulator outputs
- Input and output level adjustable (resistor values)



Type	Ordering Code	Package
TDA 4340X	Q67000-A5058	P-DSO-20-1

1.2 Application

The TDA 4340X is an integrated circuit providing the stereo decoder function and noise blanking for FM car radio applications.

1.3 Pin Configuration (top view)

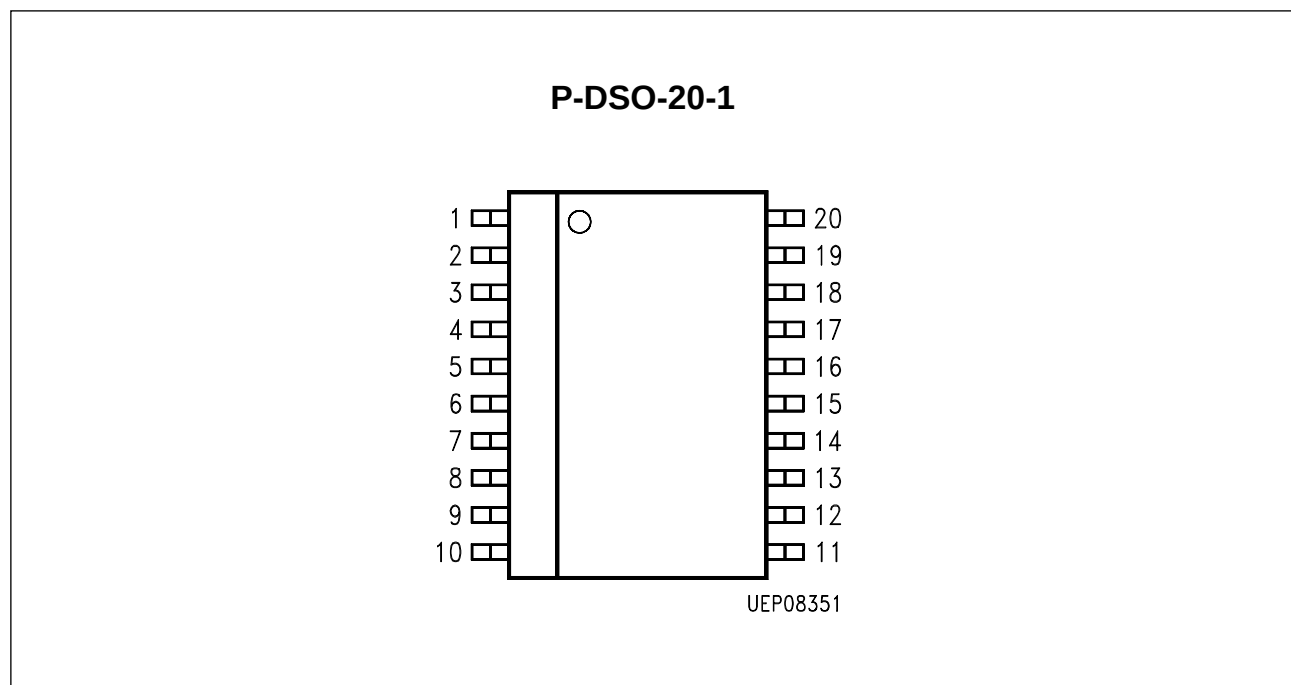


Figure 1

1.4 Pin Definitions and Functions

Pin No.	Function
1	Phase detector output, PLL loop filter
2	Oscillator pin (456 kHz)
3	Ground
4	Reference current pin, external reference resistor
5	Positive supply voltage
6	Interference detector input, noise detector input
7	Timing capacitor for monoflop (gate time) Low voltage applied turns off oscillator, phase detector, pilot detector, SNC and changes the time constant for HCC, noise gate monoflop
8	Hold capacitor for noise detector average level Low voltage applied mutes the stereo decoder output, noise level capacitor
9	Auxiliary input left, output amplifier left
10	Audio signal output left
11	Audio signal output right
12	Auxiliary input right, output amplifier right
13	HCC timing/hold capacitor, deemphasis right
14	HCC timing/hold capacitor, deemphasis left
15	Input for HCC voltage
16	Input for SNC voltage
17	Input for reference level control voltage (HCC and SNC)
18	Pilot indicator output, open collector, active low
19	Pilot detector output Low voltage applied switches the stereodecoder to mono state
20	Input for MPX signal

1.5 Functional Block Diagram

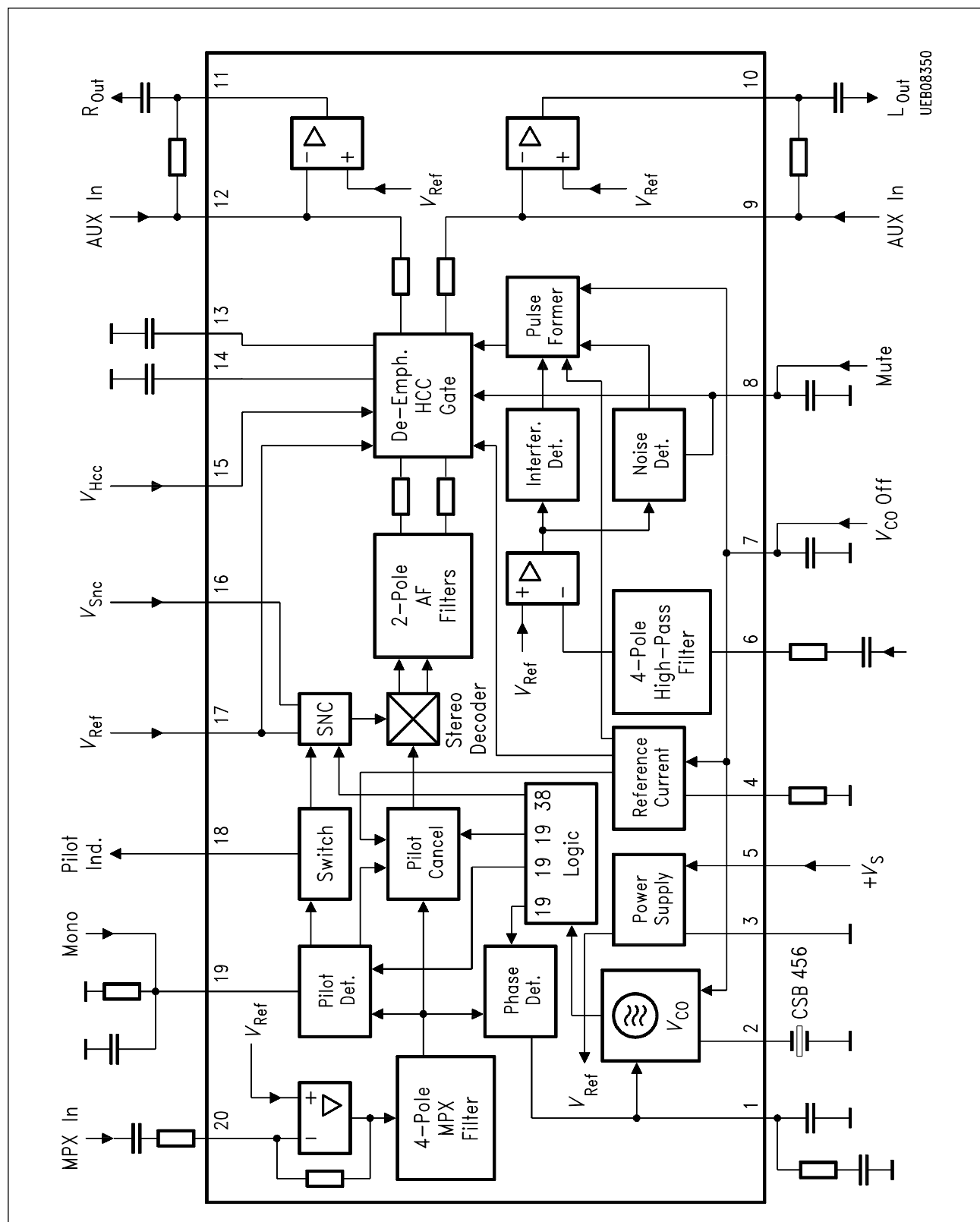


Figure 2
Block Diagram

2 Circuit Description

Power Supply, Reference Current

A temperature stable, low noise reference voltage generator is used for better ripple rejection and for the generation of a reference current. This current is used as a time base for the deemphasis, the gate time of the pulse former, and the pilot cancellation, avoiding temperature and tolerance effects.

MPX Input, MPX Filter

Adjusting the value of the input resistor, the MPX input can be adapted to the output level of the FM demodulator. A 4-pole low-pass filter determines the bandwidth of the MPX signal.

Voltage Controlled Oscillator, Phase Detector

The 456 kHz oscillator and the frequency dividers are used as walsh function generators (suppression of 3rd order harmonics) for:

- 38 kHz for the stereo decoder
- 19 kHz inphase for phase detector and pilot cancellation
- 19 kHz quadrature for the phase detector.

The phase detector locks the on-chip 19 kHz signal to the pilot tone in the MPX signal at 90° phase.

Pilot Detector, Pilot Indicator, Pilot Cancellation

The voltage at the pilot detector output is proportional to the pilot tone input level. If that level is high enough, the pilot indicator output is activated and the pilot Cancellation turned on: a 19 kHz signal proportional to the voltage at the pilot detector output is added to the MPX signal with inverse polarity, cancelling the 19 kHz pilot tone.

Interference Detector, Noise Detector, Pulse Former

The signal from the interference input (MPX or field strength signal) passes a 4-pole high-pass to the noise blanking circuitry. The average noise level is stored on an external capacitor. The interference detector compares the actual noise level with that stored on the capacitor and triggers the pulse former if there is a significant difference. The pulse former generates a gate pulse for the HCC block. During that pulse time the outputs of the deemphasis circuit are switched to hold mode.

3 Electrical Characteristics

3.1 Absolute Maximum Ratings

$T_A = -40\text{ °C to }85\text{ °C}$

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
PLL loopfilter	V_1	0	5	V	
Oscillator	I_2	- 1	0.1	mA	
Reference current	I_4	- 1	0	mA	
Supply voltage	V_5	0	13.2	V	
Noise detector input	V_6	0	5	V	
Noise gate monoflop	V_7	0	V_5	V	
Noise level capacitor	V_8	0	$V_5 - 1.5$	V	
Output amplifier left	V_9	0	6	V	
AF output left	I_{10}	- 1	0.3	mA	
AF output right	I_{11}	- 1	0.3	mA	
Output amplifier right	V_{12}	0	6	V	
Deemphasis right	V_{13}	0	5	V	
Deemphasis left	V_{14}	0	5	V	
HCC voltage	V_{15}	0	13.2	V	
SNC voltage	V_{16}	0	13.2	V	
Reference level voltage	V_{17}	0	13.2	V	
Pilot indicator output	I_{18}	0	2	mA	
Pilot detector output	V_{19}	0	$V_5 - 1.5$	V	
MPX input	V_{20}	0	6	V	
Junction temperature	T_j	- 40	150	°C	
Storage temperature	T_s	- 40	125	°C	
Thermal resistance	R_{thSA}		95	K/W	
ESD voltage, HBM	V_{ESD}	- 4	4	kV	100 pF, 1500 Ω

Note: Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to the integrated circuit.

3.2 Operating Range

Parameter	Symbol	Limit Values		Unit
		min.	max.	
Supply voltage	V_S	7.5	13.2	V
Ambient temperature	T_A	– 40	85	°C

Note: In the operating range the functions given in the circuit description are fulfilled.

3.3 AC/DC Characteristics

$V_S = 10\text{ V}$, $T_A = 25\text{ °C}$

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Supply current	I_S		15	20	mA	Osc. ON
Supply current	I_S		10	15	mA	Osc. OFF, $V_7 = 1\text{ V}$
Total harmonic distortion	THD		0.1	0.3	%	$f = 1\text{ kHz}$
Signal to noise ratio	S/N	74	80		dB	20 Hz ... 16 kHz, Stereo
Channel separation		32	40		dB	$f = 1\text{ kHz}$
MPX input level			1.7		Vpp	
Overdrive margin of input		4	8		dB	$THD = 1\%$
AF output voltage			660		mVrms	$f = 1\text{ kHz}$, Stereo
Overdrive margin of output		6	9		dB	$THD = 1\%$
AF output DC voltage		2.6	3	3.4	V	
Difference of output voltage levels				1	dB	
Muting depth		80	100		dB	$f = 1\text{ kHz}$
DC offset at MUTE		– 50	0	50	mV	
DC offset stereo ON/OFF		– 30	0	30	mV	

3.3 AC/DC Characteristics (cont'd)

$V_S = 10 \text{ V}$, $T_A = 25 \text{ °C}$

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		

Carrier and Harmonic Suppression

Pilotsignal subcarrier	a_{19}	44	50		dB	$f = 19 \text{ kHz}$
	a_{38}	44	50		dB	$f = 38 \text{ kHz}$
	$a_{57}^{1)}$	50	60		dB	$f = 57 \text{ kHz}$
	$a_{76}^{1)}$	50	60		dB	$f = 76 \text{ kHz}$

Intermodulation

$f_{\text{mod}} = 10 \text{ kHz}$	$a_2^{1)}$	60	65		dB	$f_S = 2 \times 10 \text{ kHz} \dots 19 \text{ kHz}$ 91 % Mono, 9 % pilot, $f_S = 1 \text{ kHz}$
$f_{\text{mod}} = 13 \text{ kHz}$	$a_3^{1)}$	60	75		dB	$f_S = 3 \times 13 \text{ kHz} \dots 38 \text{ kHz}$ 91 % Mono, 9 % pilot, $f_S = 1 \text{ kHz}$

Traffic Radio

$f = 57 \text{ kHz}$	$a_{57}^{1)}$	70			dB	$f_S = 1 \text{ kHz} \pm 23 \text{ Hz}$ 91 % Mono, 9 % pilot, $f_m = 1 \text{ kHz}$, 5 % Traffic Radio Carrier ($f = 57 \text{ kHz}$, $f_m = 23 \text{ Hz AM}$, $m = 60 \%$)
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SCA (subsidiary communications authorization)

$f = 67 \text{ kHz}$	$a_{67}^{1)}$	70			dB	$f_S = 9 \text{ kHz}$ 81 % Mono, 9 % pilot, $f_m = 1 \text{ kHz}$, 10 % SCA carrier
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ACI (adjacent channel interference)

$f = 119 \text{ kHz}$	$a_{114}^{1)}$		80		dB	
$f = 190 \text{ kHz}$	$a_{190}^{1)}$		70		dB	
Ripple rejection	¹⁾	60	70		dB	$V_S = 10 \text{ V}$, 100 mVrms , $f = 1 \text{ kHz}$

¹⁾ No subject of production testing.

3.3 AC/DC Characteristics (cont'd)

$V_S = 10\text{ V}$, $T_A = 25\text{ °C}$

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		

Mono/Stereo Control

Pilot threshold voltage: – for Stereo ON – for Stereo OFF – hysteresis	$V_{\text{PIL on}}$ $V_{\text{PIL off}}$	5 1.5	20 14 3	30	mVrms mVrms dB	$V_{\text{PIL on}}/V_{\text{PIL off}}$
Stereo indicator output: – Pilot OFF – Pilot ON	$V_{18\text{ off}}$ $I_{18\text{ on}}$			0.5 10	V μA	$I_{18} = 1\text{ mA}$ $V_{18} = 13.2\text{ V}$

External Control Voltages (active low)

Threshold voltage for external mono control (pin 19)	$V_{19\text{ thr}}$	1	1.2		V	
Threshold voltage for MUTE (pin 8)	$V_{8\text{ thr}}$	1	1.5		V	
Threshold voltage for VCO OFF (pin 7)	$V_{7\text{ thr}}$	1	1.5		V	

Deemphasis

Reference voltage	V_{17}	0.5		4.5	V	Reference level 100 Hz
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Control Range

Minimum	τ_{min}	45	50	55	μs	$V_{17} = 3\text{ V}$, $V_{15} = 6\text{ V}$, $C_{\text{deemph}} = 6.8\text{ nF}$
Maximum	τ_{max}	135	150	165	μs	$V_{17} = 3\text{ V}$, $V_{15} = 0\text{ V}$ $C_{\text{deemph}} = 6.8\text{ nF}$
$\tau_{\text{deemph}} = \tau_{\text{nom}}$	V_{15}		V_{17}			$V_{17} = 3\text{ V}$, $C_{\text{deemph}} = 6.8\text{ nF}$
$\tau_{\text{deemph}} = 1.5 \times \tau_{\text{nom}}$	V_{15}	$V_{17} - 220$	$V_{17} - 170$	$V_{17} - 120$	mV	$V_{17} = 3\text{ V}$, $C_{\text{deemph}} = 6.8\text{ nF}$
$\tau_{\text{deemph}} = 2.7 \times \tau_{\text{nom}}$	V_{15}	$V_{17} - 400$	$V_{17} - 300$	$V_{17} - 200$	mV	$V_{17} = 3\text{ V}$, $C_{\text{deemph}} = 6.8\text{ nF}$

3.3 AC/DC Characteristics (cont'd)

$V_S = 10\text{ V}$, $T_A = 25\text{ °C}$

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		

Control Range (osc. OFF)

Minimum	$\tau_{AM\ min}$	13	15	17	μs	$V_{17} = 3\text{ V}$, $V_{15} = 6\text{ V}$, $V_7 = 1\text{ V}$ $C_{deemph} = 6.8\text{ nF}$
Maximum	$\tau_{AM\ max}$	35	40	45	μs	$V_{17} = 3\text{ V}$, $V_{15} = 0\text{ V}$, $V_7 = 1\text{ V}$ $C_{deemph} = 6.8\text{ nF}$

Stereo/Mono Blend Control

Channel separation	V_{16}	$V_{17} - 140$	$V_{17} - 115$	$V_{17} - 90$	mV	15 dB sep.
Channel separation	V_{16}	$V_{17} - 190$	$V_{17} - 170$	$V_{17} - 150$	mV	6 dB sep.
Reference voltage	V_{17}	0.5		4.5	V	

Oscillator

Max. osc. frequency	$f_{osc\ max}$	0.7	1.0	2.0	%	$100\% \times (f_{max}/456\text{ kHz} - 1)$
Min. osc. frequency	$f_{osc\ min}$	- 2.0	- 1.0	- 0.7	%	$100\% \times (f_{min}/456\text{ kHz} - 1)$
VCO gain	$\Delta f/\Delta V_1$	- 13	- 10	- 7	kHz/V	
Oscillator voltage	$V_{2\ DC}$	3	4	5	V	
Oscillator swing	$V_{2\ AC}$	800	1100	1400	mVpp	

PLL

PD gain	$\Delta i/\Delta \Phi^{(1)}$	5	7.0	9	$\mu\text{A/rad}$	$V_{pilot} = 54\text{ mVrms}$
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Noise Detector

Input resistance	R_6	75	100	135	k Ω	
Input high-pass filter	$f_{in, 6}$	80	100	120	kHz	- 3 dB
Trigger threshold	$V_{6\ min}$		10		mVrms	$V_8 = V_8$ ($V_{6\ mean} = 0$), $f_6 = 200\text{ kHz}$
Trigger threshold	$V_{6\ dyn}$		160		mVrms	$V_8 = V_8$ ($V_{6\ mean} = 50\text{ mVrms}$), $f_6 = 200\text{ kHz}$
Maximum noise mean value	$V_{6maxmean}$		80		mVrms	$f_6 = 200\text{ kHz}$

3.3 AC/DC Characteristics (cont'd)

$V_S = 10\text{ V}$, $T_A = 25\text{ °C}$

Parameter	Symbol	Limit Values			Unit	Test Condition
		min.	typ.	max.		
Suppression pulse duration			40		μs	
Input offset current	$I_{13}, I_{14}^{1)}$	– 50	0	50	nA	
Pulse threshold	$V_{6\text{ burst}}^{1)}$		130	200	mVpp	100 kHz single burst repetition rate 100 Hz both polarities $C_{in, 6} = 1\text{ nF}$

¹⁾ No subject of production testing.

Note: The listed characteristics are ensured over the operating range of the integrated circuit. Typical characteristics specify mean values expected over the production spread. If not otherwise specified, typical characteristics apply at $T_A = 25\text{ °C}$ and the given supply voltage.

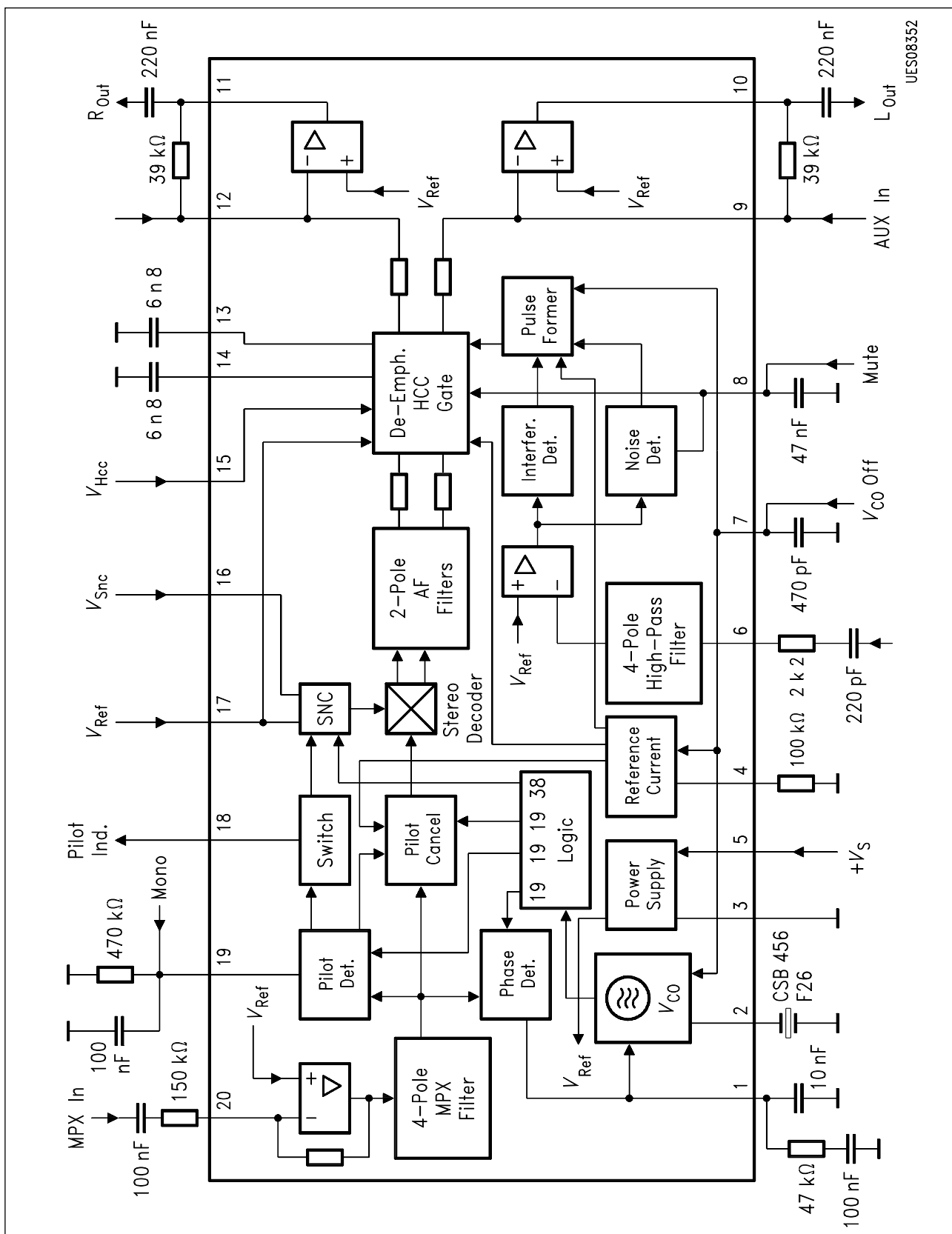


Figure 3 Test Circuit

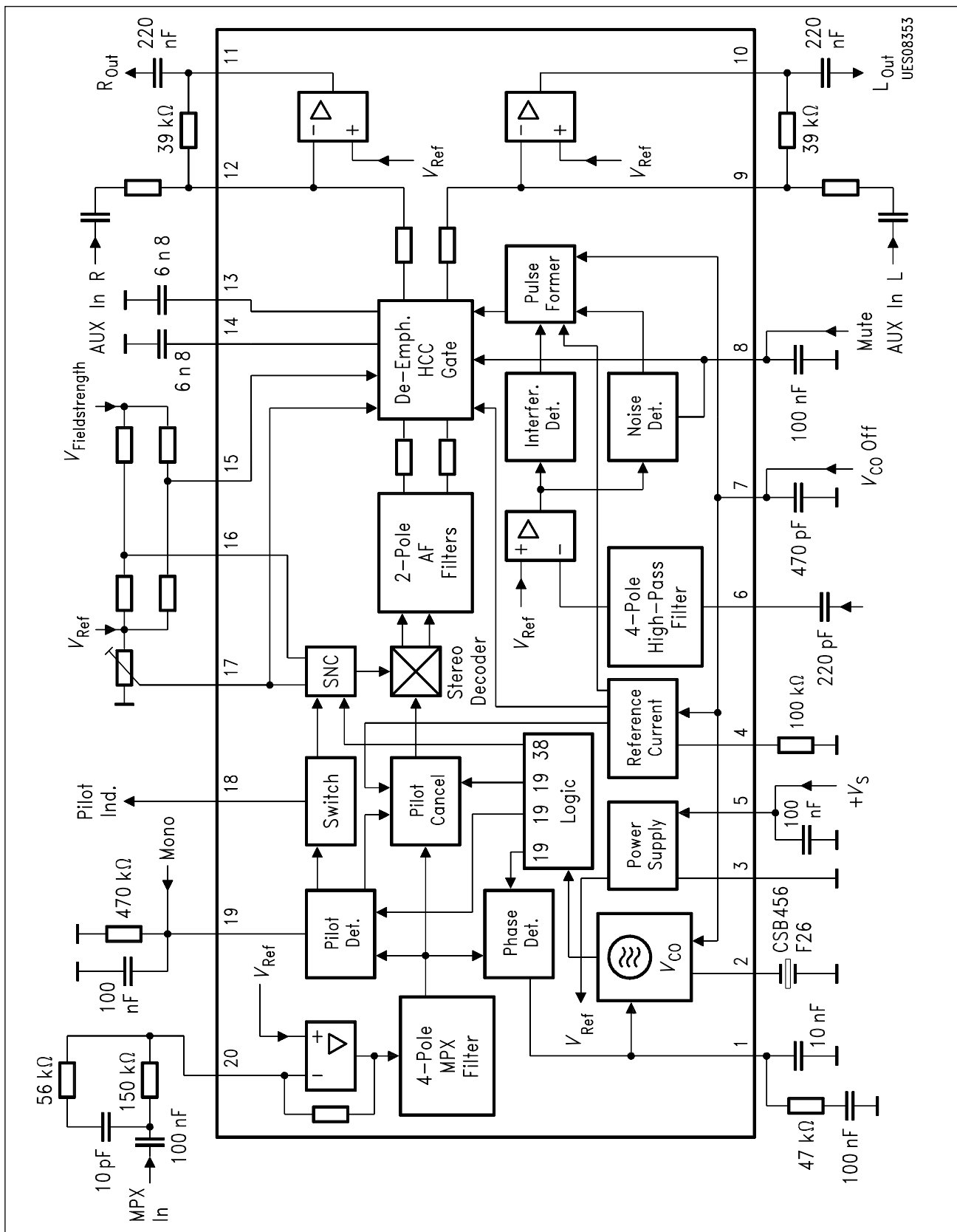


Figure 4
Application Circuit

Diagrams

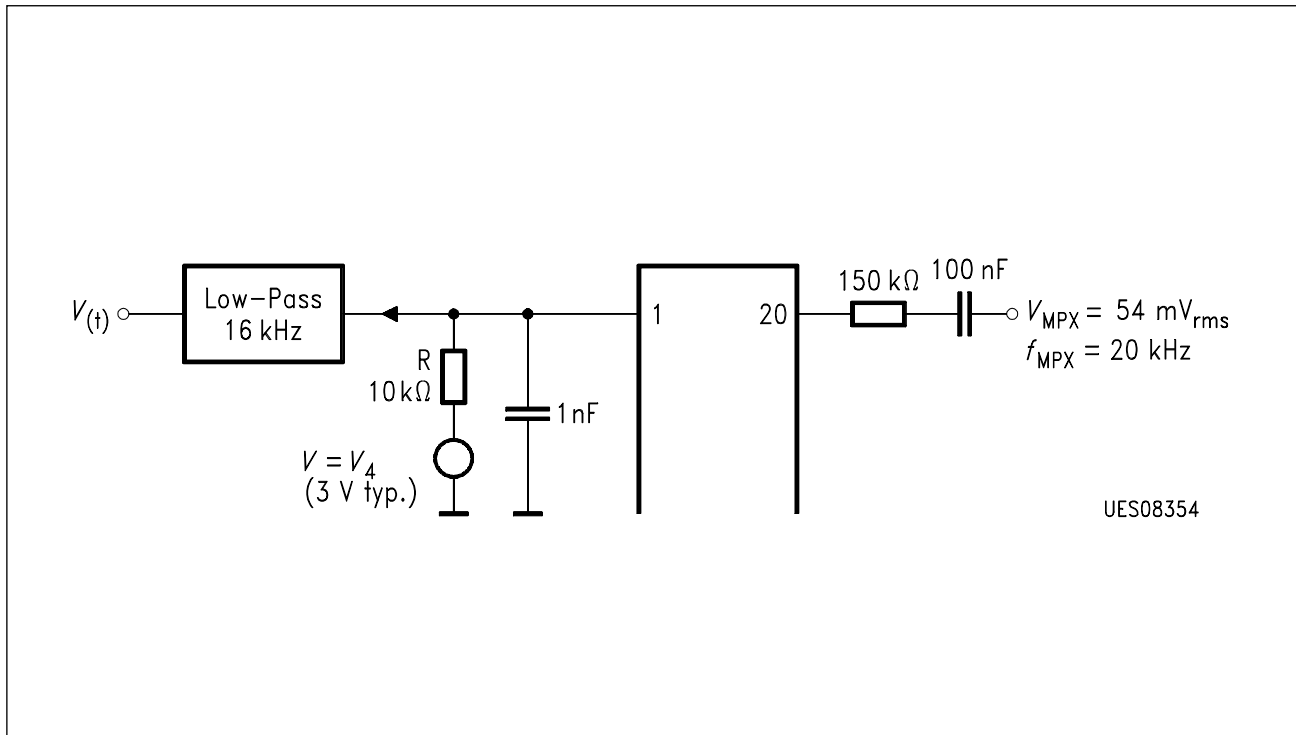


Figure 5
Definition of Phase Detector Gain

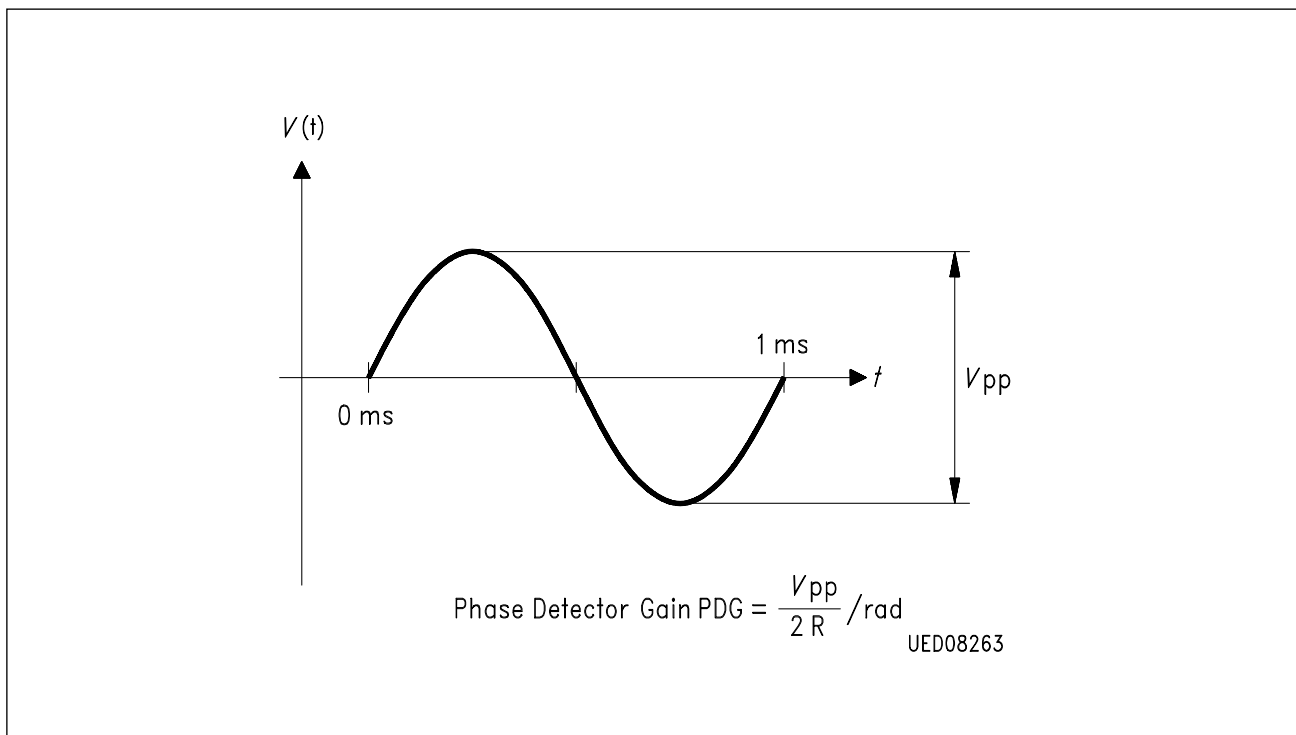
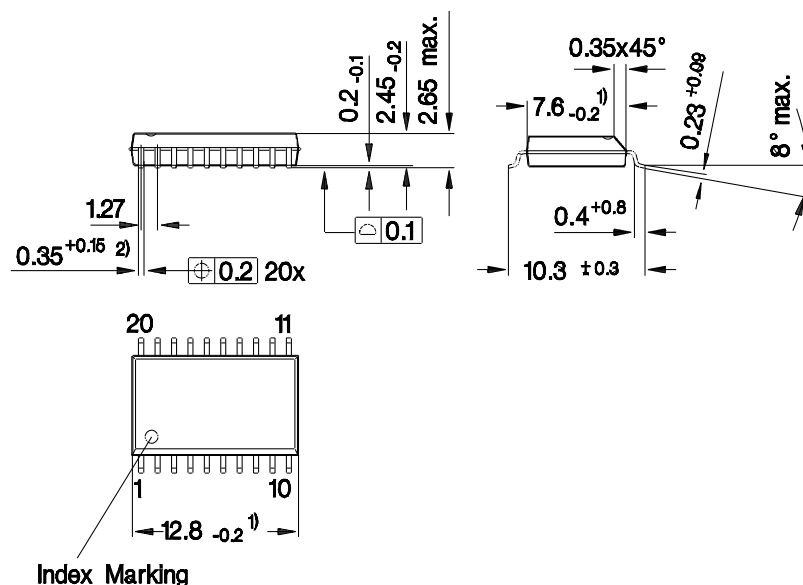


Figure 6
Phase Detector Gain

4 Package Outlines

P-DSO-20-1

(Plastic Dual Small Outline Package)



- 1) Does not include plastic or metal protrusion of 0.15 max. per side
- 2) Does not include dambar protrusion

GPS05094

Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device

Dimensions in mm