SIEMENS

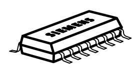
FM-IF with Counter Output, Field Strength Indicator, Noise Detector and MUTE Setting

TDA 4320X

1 Overview

1.1 Features

- 7-stage limiter amplifier
- Coincidence demodulator
- Counter output with request input
- Field strength output
- Multipath identification circuit
- Adjustable muting depth (with full muting ≥ 80 dB)
- This device is ESD protected



P-DSO-16-1

Type	Ordering Code	Package
TDA 4320X	Q67000-A-5000	P-DSO-16-1

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1.2 Pin Configuration
(top view)

P-DSO-16-1

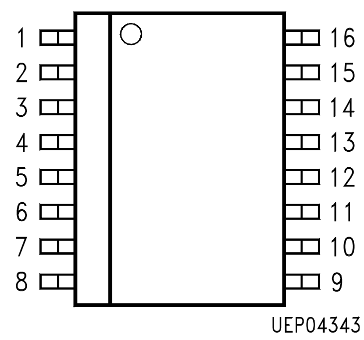

Figure 1

1.3 Pin Definitions and Functions

Pin No.	Symbol	Function
1	GND	**Ground** Decoupling capacitors for bias, V_S and V_{REF} Pins are to be connected directly to Pin 1
2	Multipath identification input	**Multipath identification input** High impedance input (R_i ~ 10 kΩ). This input receives the filtered field strength output (high pass or band pass).
3	Rectifier time constant	**Rectifier time constant** Determines the attack and release time of the identification circuit.
4	Multipath identification output	**Multipath identification output** Open npn-collector output, which is low during (V4/V1 ≤0.7 V) multipath interference.
5	MUTE input	**MUTE input** For DC voltage (usually derived from field strength output voltage) which attenuates the AF output voltage by the setting muting depth (Pin 7). Max. attenuation when $V_5 = 0$ V, no attenuation when $V_5 \geq 0.5$ V.
6	AF output	**AF output** Demodulated FM-IF.

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1.3 Pin Definitions and Functions (cont'd)

Pin No.	Symbol	Function
7	MUTE depth	**MUTE depth** Adjustment by connecting a dc voltage to ground the requested muting depth can be set. Maximal attenuation of AF output voltage with V_7 = 2.4 V (typ. 38 dB), minimal attenuation with V_7 = 4.8 V (typ. 0 dB). Full muting with $V_7 \leq 1$ V ($\geq$ 80 dB).
8	Demodulator tank circuit	**Demodulator tank circuit** Driven via two on-chip capacitors (approx.15 pF ± 25 %). The tank circuit voltage should be typ. 400 mVpp.
9	Demodulator circuit	**Demodulator circuit**
10	Reference voltage	**Reference voltage** Should be RF decoupled to Pin 1.
11	IF counter output	**IF counter output** Provides the IF carrier frequency (low impedance output $R_{out} \approx 1.5$ kΩ).
12	V_S	**Supply voltage** RF decoupled to Pin 1
13	Field strength output	**Field strength output** Supplies a DC voltage proportional to the IF input level with very low delay time.
14	Field strength adjust	**Field strength adjust** Adjustment of slope and starting point of field strength output voltage
15	IF input bias	**IF input bias** To be RF decoupled to Pin 1
16	IF input	**IF input** FM-IF input

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1.4 Functional Block Diagram

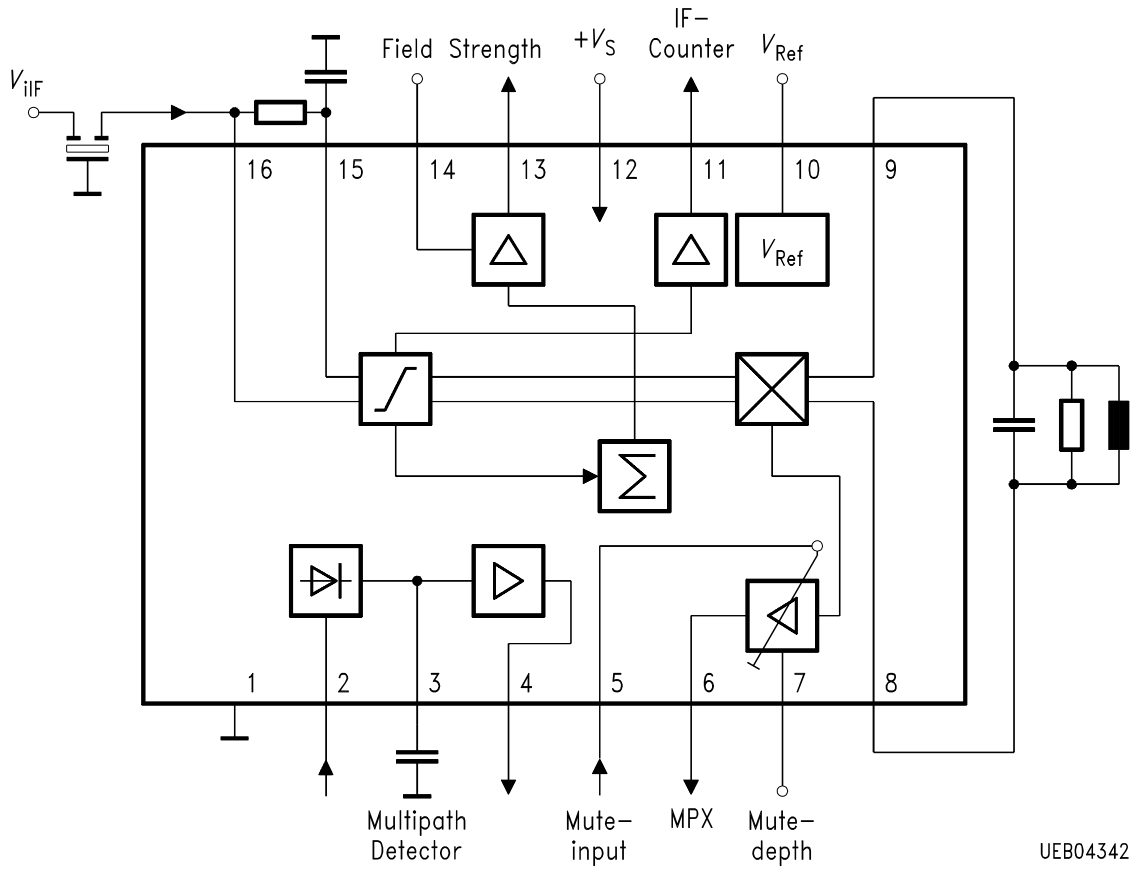

Figure 2

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2 Functional Description

The FM-IF demodulator TDA 4320X has been developed especially for car radio applications. The on-chip multipath identification circuit activates an interference suppression circuit in case of multipath interferences.

3 Circuit Description

The IC includes a 7-stage capacitive coupled limiter amplifier with coincidence demodulator and AF output. The AF output signal can be continuously attenuated to decrease the noise. In case of multipath interferences, the TDA 4320X includes an identification circuitry. There is a field strength output (with min. 76 dB dynamic range, typ. ± 1 dB nonlinearity and typ. ± 3 dB temperature drift), an IF counter output and an adjustable muting (with full muting ≥ 80 dB).

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4 Electrical Characteristics

4.1 Absolute Maximum Ratings

T_A = – 40 °C to + 85 °C

Parameter	Symbol	Limit Values		Unit	Remarks
		min.	max.		
Supply voltage	V_S	0	13.2	V	
Junction temperature	T_j		150	°C	
Storage temperature	T_S		125	°C	
Thermal resistance (system-air)	R_{thSA}		105	K/W	
ESD voltage, HBM (1.5 kΩ, 100 pF)	V_{ESD}	– 4	4	kV	

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

4.2 Operating Range

T_A = – 40 °C to + 85 °C

Parameter	Symbol	Limit Values		Unit	Remarks
		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.

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4.3 AC/DC Characteristics

V_S = 10 V; f_{iIF} = 10.7 MHz; Δf = 75 kHz; f_{mod} = 1 kHz;
V_{iIFrms} = 10 mV; T_A = – 40 °C to + 85 °C

Parameter	Symbol	Limit Values			Unit	Test Condition	Test Circuit
		min.	typ.	max.			
Current consumption	I_{12}		30		mA	V_5 = 4.8 V; V_7 = 4 V	1
Stabilized voltage	V_{10}	4.5	4.8	5.1	V	V_5 = 4.8 V; V_7 = 4 V	1
Field strength output	V_{13}					V_5 = 4.8 V; V_7 = 4 V	
– Dynamic range			80		dB		D1
– Nonlinearity			± 1		dB		D2
– Temperature drift				± 3	dB		D3
– Load capacitance				50	pF		
– Load resistance		1			kΩ		
	V_{13}	5.0	5.5	6.0	V	V_{iIFrms} = 200 mV	1
	V_{13}	2.2	2.7	3.2	V	V_{iIFrms} = 1 mV	1
	V_{13}	0		1.2	V	V_{iIFrms} = 0 mV	1
Input voltage for limiter threshold	V_{16}		30		µVrms	V_{qAF} = – 3 dB	1
AF output voltage	V_{qAF}	480		840	mVrms	V_5 = 4.8 V; V_7 = 4 V	1
Total harmonic distortion	THD_{qAF}			1.2	%	V_5 = 4.8 V; V_7 = 4 V	1
AM suppression	a_{AM}	60			dB	m = 80 %	1
		76			dB	m = 30 %	1
Signal-to-noise ratio	$a_{S/N}$	76			dB	V_5 = 4.8 V; V_7 = 4 V	1
Counter output voltage	V_{11}	50			mVrms	C_L = 5 pF; R_{i11} = 1.5 kΩ	1
Noise detector sensitivity	V_2		3.2		mVrms	f_2 = 20 kHz	1
	V_2		4.3		mVrms	f_2 = 300 kHz	1
Charge current Pin 3	I_3		2.5		mA	f_2 = 20 kHz; $V_2 \geq$ 6 mVrms	1
			2.5		mA	f_2 = 300 kHz; $V_2 \geq$ 7 mVrms	1
Discharge current Pin 3	I_3		20		µA	V_{2AC} = 0 V	1

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4.3 AC/DC Characteristics (cont'd)

V_S = 10 V; f_{iIF} = 10.7 MHz; Δf = 75 kHz; f_{mod} = 1 kHz;
V_{iIFrms} = 10 mV; T_A = – 40 °C to + 85 °C

Parameter	Symbol	Limit Values			Unit	Test Condition	Test Circuit
		min.	typ.	max.			
AF MUTE	a_{AF}		0		dB	V_5 = 4.8 V; V_7 = 4.8 V	D4
		– 2		2	dB	V_5 = 0 V; V_7 = 4.8 V	D4
		30	38	46	dB	V_5 = 0 V; V_7 = 2.4 V	D4
		80			dB	V_5 = 4.8 V; $V_7 \leq$ 1.0 V	D4
		80			dB	V_5 = 0 V; $V_7 \leq$ 1.0 V	D4
Voltage for MUTE OFF	V_5	0.7			V		1
Voltage for MUTE ON	V_5	0			V		1

V_S = 10 V; f_{iIF} = 10.7 MHz; Δf = 75 kHz; f_{mod} = 1 kHz;
V_{iIFrms} = 10 mV; T_A = 25 °C

Parameter	Symbol	Limit Values			Unit	Test Condition	Test Circuit
		min.	typ.	max.			
Current consumption	I_{12}		30		mA	V_5 = 4.8 V; V_7 = 4 V	1
Stabilized voltage	V_{10}	4.6	4.8	5.0	V	V_5 = 4.8 V; V_7 = 4 V	1
Field strength output	V_{13}					V_5 = 4.8 V; V_7 = 4 V	
Dynamic range		74	80		dB		D1
Nonlinearity			± 1		dB		D2
Temperature drift				± 3	dB		D3
Load capacitance				50	pF		
Load resistance		1			kΩ		
	V_{13}	5.1	5.5	5.9	V	V_{iIFrms} = 200 mV	1
	V_{13}	2.3	2.7	3.1	V	V_{iIFrms} = 1 mV	1
	V_{13}	0		1.1	V	V_{iIFrms} = 0 mV	1
Input voltage for limiter threshold	V_{16}		30	39	µVrms	V_{qAF} = – 3 dB	1
AF output voltage	V_{qAF}	550	650	750	mVrms	V_5 = 4.8 V; V_7 = 4 V	1
Total harmonic distortion	THD_{qAF}			1.2	%	V_5 = 4.8 V; V_7 = 4 V	1
AM suppression	a_{AM}	60			dB	m = 80 %	1
		76	82		dB	m = 30 %	1

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4.3 AC/DC Characteristics (cont'd)

V_S = 10 V; f_{iIF} = 10.7 MHz; Δf = 75 kHz; f_{mod} = 1 kHz;
V_{iIFrms} = 10 mV; T_A = 25 °C

Parameter	Symbol	Limit Values			Unit	Test Condition	Test Circuit
		min.	typ.	max.			
Signal-to-noise ratio	$a_{S/N}$	76	84		dB	V_5 = 4.8 V; V_7 = 4 V	1
Counter output voltage	V_{11}	50	80		mVrms	C_L = 5 pF; R_{i11} = 1.5 kΩ	1
Noise detector sensitivity	V_2	2	3.2	6	mVrms	f_2 = 20 kHz	1
	V_2	2.7	4.3	7	mVrms	f_2 = 300 kHz	1
Charge current Pin 3	I_3	1.6	2.5	4	mA	f_2 = 20 kHz; $V_2 \geq$ 6 mVrms	1
		1.6	2.5	4	mA	f_2 = 300 kHz; $V_2 \geq$ 7 mVrms	1
Discharge current Pin 3	I_3	10	20	40	µA	V_{2AC} = 0 V	1
AF MUTE	a_{AF}		0		dB	V_5 = 4.8 V; V_7 = 4.8 V	D4
		– 2		2	dB	V_5 = 0 V; V_7 = 4.8 V	D4
		32	38	44	dB	V_5 = 0 V; V_7 = 2.4 V	D4
		80			dB	V_5 = 4.8 V; $V_7 \leq$ 1.0 V	D4
		80			dB	V_5 = 0 V; $V_7 \leq$ 1.0 V	D4
Voltage for MUTE OFF	V_5	0.5			V		1
Voltage for MUTE ON	V_5	0		0.1	V		1

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Test Circuit 1

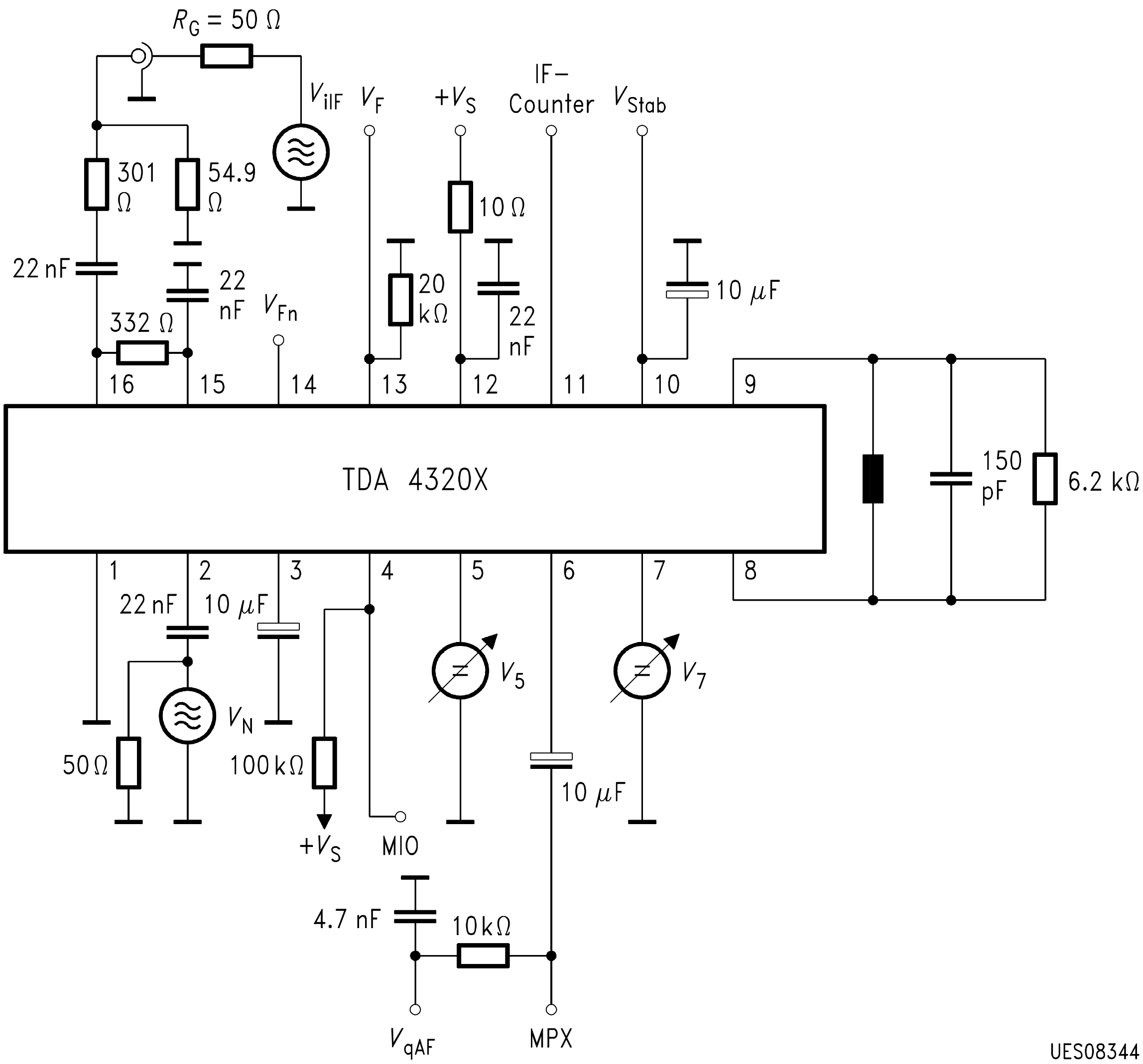

Figure 3

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Application Circuit

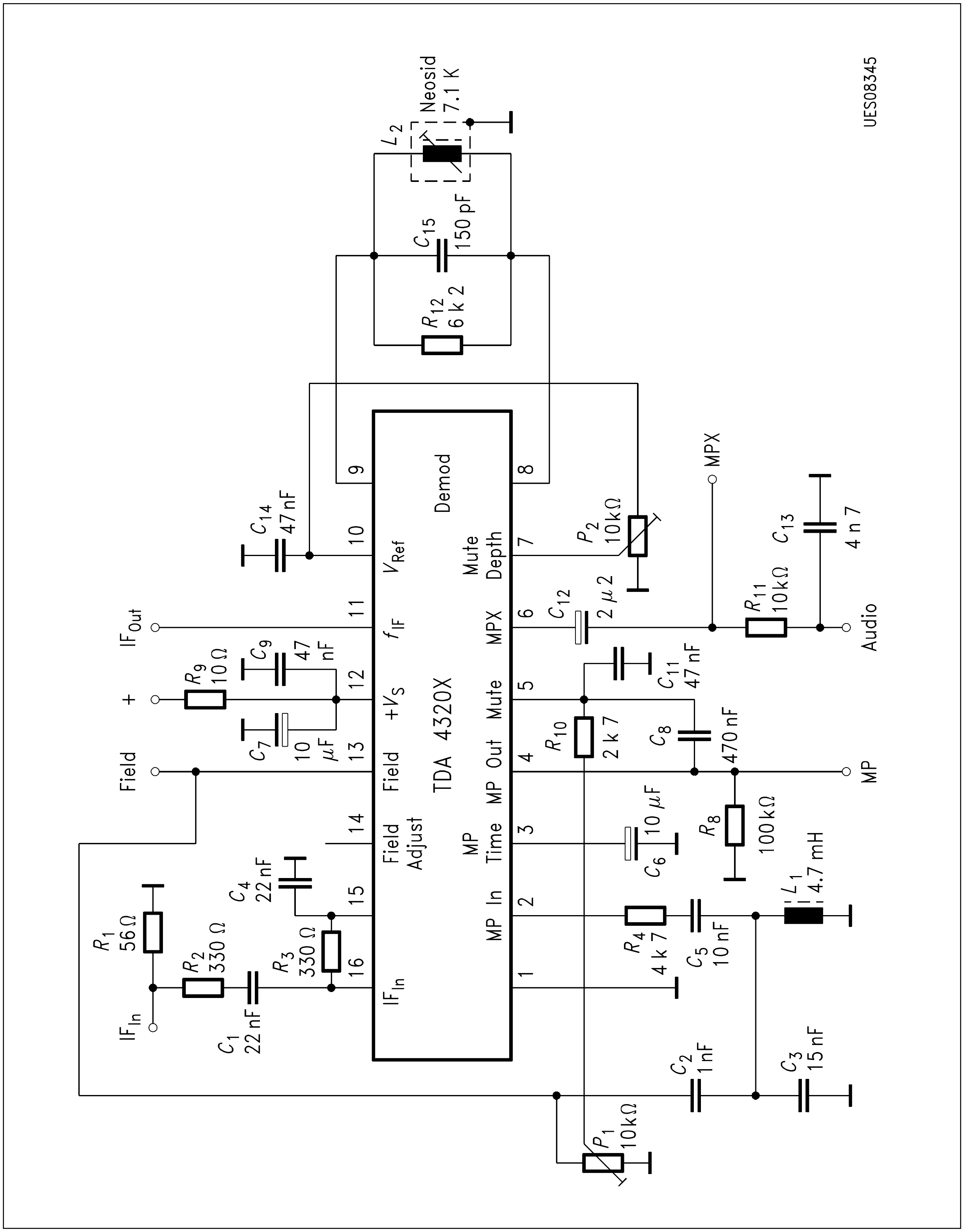

Figure 4

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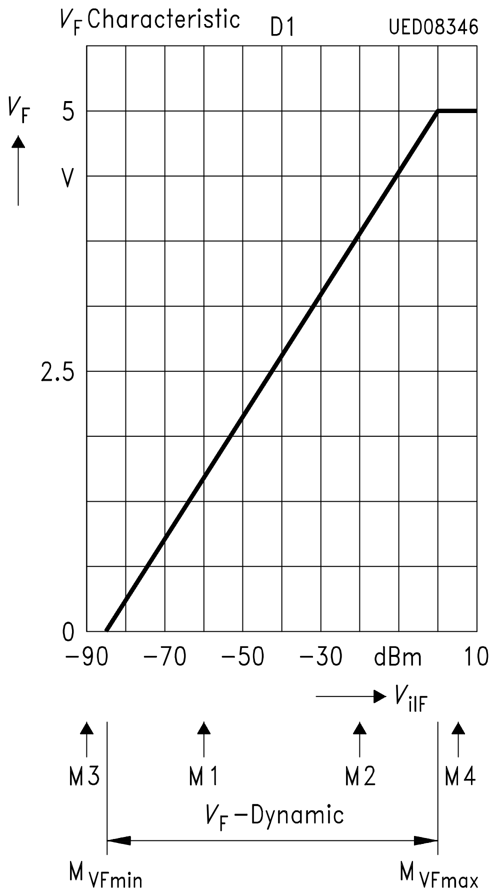
Diagrams

Diagram D1



V_F Dynamics

The dynamic range of V_F voltage is determined by the test points M1 through M4 as follows:

M1: test point (at V_{iIF} = – 60 dBm) supplies $V_{F(M1)}$

M2: test point (at V_{iIF} = – 20 dBm) supplies $V_{F(M2)}$

M3: test point (at V_{iIF} = – 90 dBm) supplies $V_{F(M3)}$

M4: test point (at V_{iIF} = + 5 dBm) supplies $V_{F(M4)}$

Hence follows:

$M_{VF\ max}$:= – 20 dBm + $(V_{F(M4)} - V_{F(M2)})/(V_{F(M2)} - V_{F(M1)}) \times$ 40 dB

$M_{VF\ min}$:= – 60 dBµV – $(V_{F(M1)} - V_{F(M3)})/(V_{F(M2)} - V_{F(M1)}) \times$ 40 dB

$V_{F\ Dynamics} = M_{VF\ max} - M_{VF\ min}$

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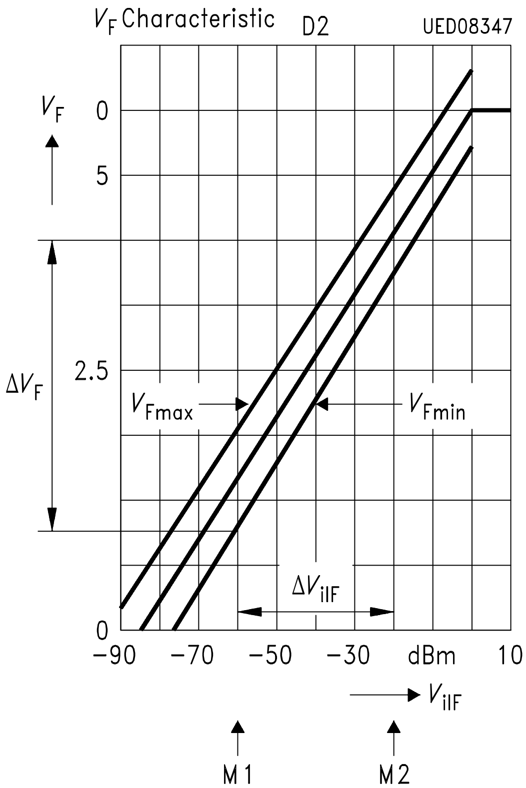
Diagram D2



Test points to determine V_F linearity:

V_F is determined at 25 °C

Slope: $m = (V_F(M2) - V_F(M1))/40$ dB.

The tolerance range of the V_F-linearity is determined by two parallel lines:

$V_{F\ max} = V_F(M1) + m(M + 60\ dB + 1\ dB)$

$V_{F\ min} = V_F(M1) + m(M + 60\ dB - 1\ dB)$

The V_F values within the V_F dynamic range ($M_{VF\ min} \leq M \leq M_{VF\ max}$) must be inside the predetermined tolerance range:

$$V_{F\ min} \leq V_F(M) \leq V_{F\ max}$$

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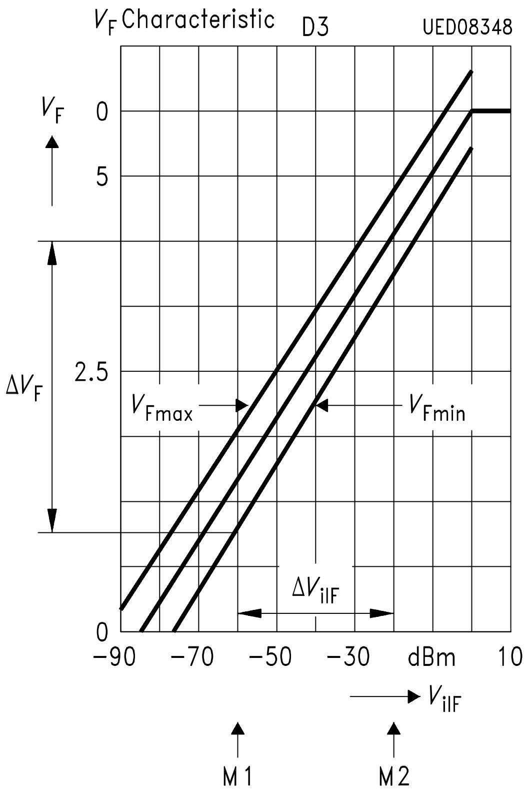
Diagram D3



Test points to determine V_F temperature drift:

V_F-temperature drift: it is determined within – 40 to + 85 °C.

Slope: $m = (V_{F(M2)} - V_{F(M1)})/40$ dB (at 25 °C).

The tolerance range of the V_F-temperature is determined by two parallel lines:

$V_{F\ max} = V_{F(M1)} + m(M + 60\ dB + 3\ dB)$

$V_{F\ min} = V_{F(M1)} + m(M + 60\ dB - 3\ dB)$

The V_F values for temperatures between – 40 to + 85 °C within the V_F dynamic range ($M_{VF\ min} \leq V_F \leq M_{VF\ max}$) must be inside the predetermined tolerance field:

$$V_{F\ min} \leq V_{F(M)} \leq V_{F\ max}$$

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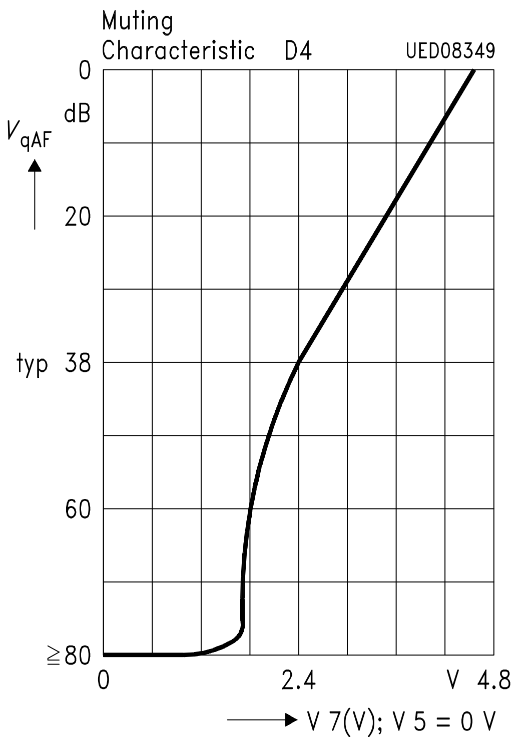
Diagram D4
Mute Characteristics



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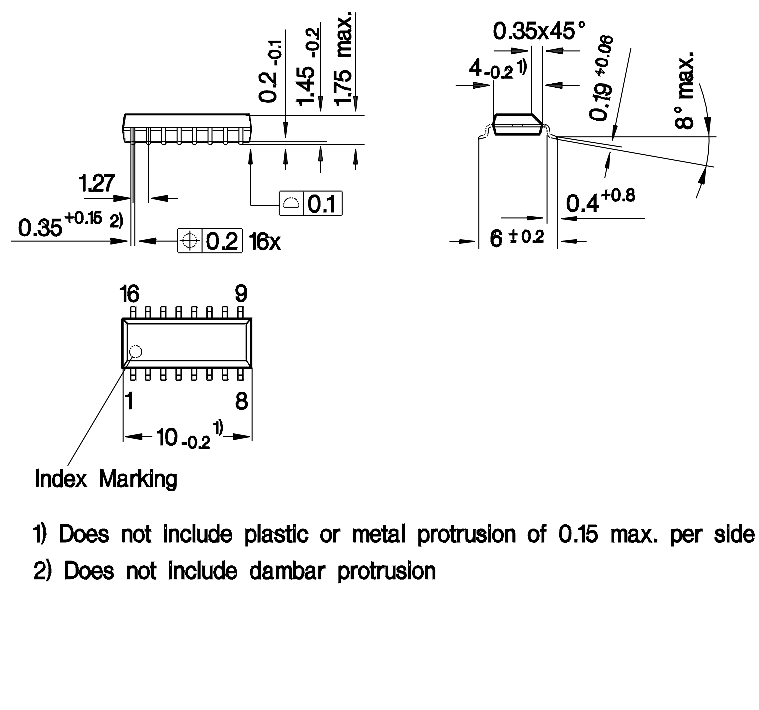
5 Package Outlines

P-DSO-16-1
(Plastic Dual Small Outline Package)



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

SMD = Surface Mounted Device

Dimensions in mm

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