DATA SHEET

TDA1575T
FM front end circuit for CENELEC EN 55020 applications

Preliminary specification
Supersedes data of October 1990
File under Integrated Circuits, IC01

April 1993

Philips
Semiconductors

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FM front end circuit for CENELEC EN 55020 applications

TDA1575T

FEATURES

- Bipolar integrated FM front end circuit, designed for use in car radios and home receivers
- Fulfils CENELEC EN 55020 requirements
- Radio frequency range of 76 to 90 MHz (Japan) or 87.5 to 108 MHz (Europe, USA)
- Low noise oscillator, buffered oscillator output
- Double balanced mixer
- Internal buffered mixer driving
- Linear IF amplifier, suitable for ceramic IF filters
- Regulated reference voltage.

QUICK REFERENCE DATA

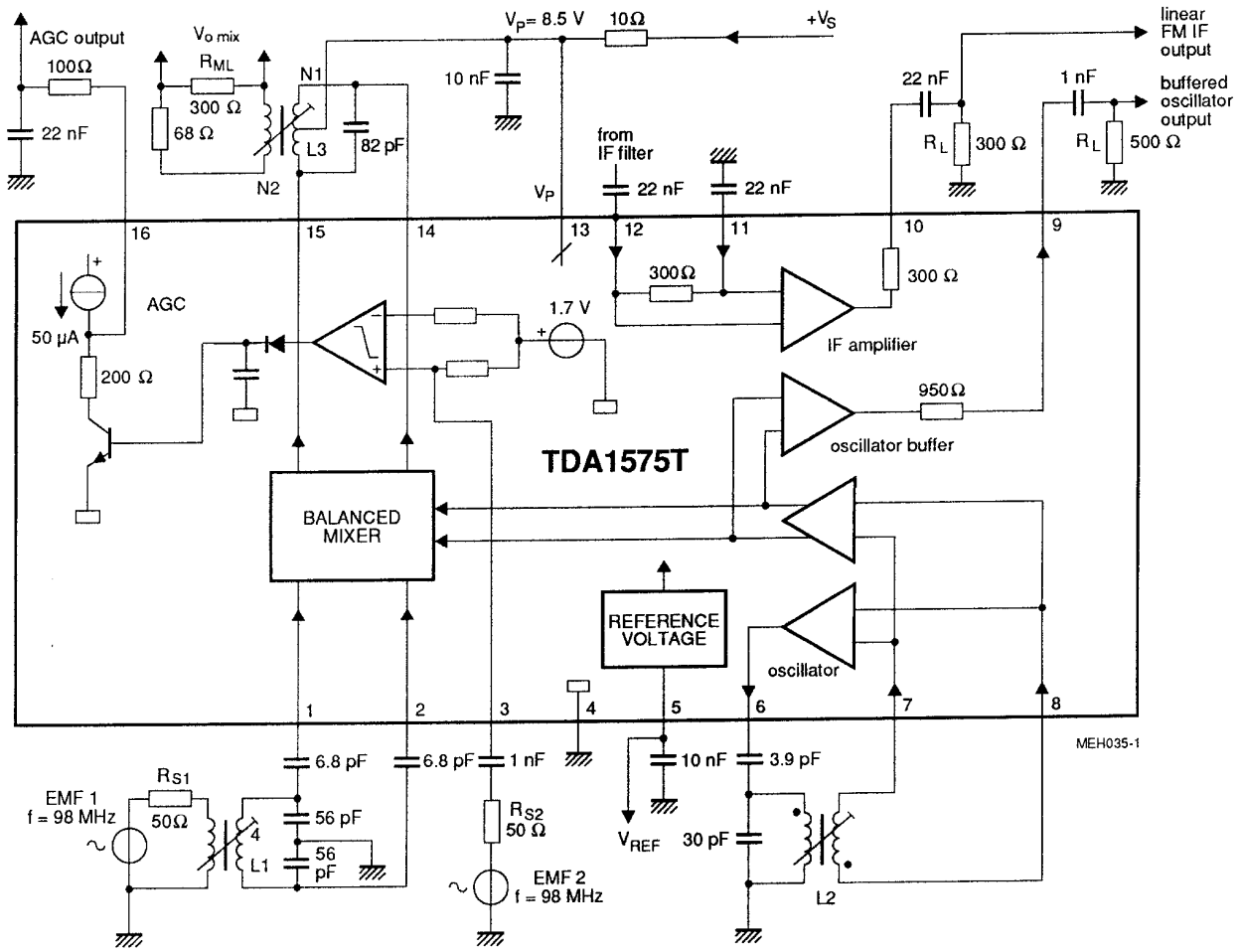
SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage	7	8.5	10	V
I_P	supply current, without mixer	–	23	–	mA
V_{REF}	reference voltage output	–	4.2	–	V
Z_I	mixer input impedance	–	14	–	Ω
NF	noise figure of mixer	–	9	–	dB
EMF1	3rd order intermodulation	–	115	–	dBμV
V_{OSC}	oscillator buffer output signal (RMS value)	75	–	–	mV
THD	total harmonic distortion	–	–15	–	dBC
G_v	IF gain	–	30	–	dB
NF	IF noise figure	–	6.5	–	dB
Z_I	IF input impedance	–	300	–	Ω
Z_O	IF output impedance	–	300	–	Ω
EMF2	AGC wideband threshold (RMS value)	–	17	–	mV

ORDERING INFORMATION

EXTENDED TYPE NUMBER	PACKAGE			
	PINS	PIN POSITION	MATERIAL	CODE
TDA1575T	16	mini-pack	plastic	SOT109A(1)

Note

1. SOT109-1; 1996 August 29.



Coils TOKO
L1: MC-108 514 HNE-150023S14; L = 78 nH, N = 4 turns
L2: MC-111 E516 HNS-200057; L = 80 nH
L3: A119 ACS-17114 FTT

Fig.1 Block diagram and test circuit.

PINNING

SYMBOL	PIN	DESCRIPTION
MIXI1	1	RF input 1 to mixer
MIXI2	2	RF input 2 to mixer
AGCI	3	HF input to automatic gain control
GND	4	ground (0 V)
V_{REF}	5	reference voltage output
OSCO	6	oscillator output
OSCI1	7	oscillator input 1
OSCI2	8	oscillator input 2
LO	9	buffered oscillator output
IFO	10	linear FM IF output
IFI1	11	FM IF input 1
IFI2	12	FM IF input 2
V_P	13	supply voltage (+8.5 V)
MIXO1	14	mixer output 1
MIXO2	15	mixer output 2
AGCO	16	automatic gain control output

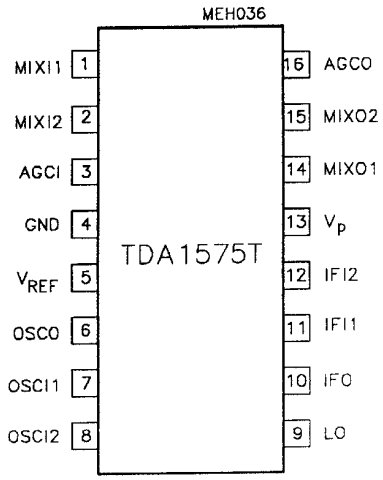


Fig.2 Pin configuration.

LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134).

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_P	supply voltage (pin 13)	0	12	V
$V_{14, 15}$	voltage at mixer output	0	V_P	V
P_{tot}	total power dissipation	0	380	mW
T_{stg}	storage temperature range	–55	+150	°C
T_{amb}	operating ambient temperature range	–40	+85	°C
V_{ESD}	electrostatic handling (see note 1)			
	all pins except 3 and 10	–	±2000	V
	pin 3	–	+2000	V
		–	–1000	V
	pin 10	–	+1500	V
		–	–2000	V

Note to the limiting values

1. Equivalent to discharging a 100 pF capacitor through a 1.5 kΩ series resistor.

CHARACTERISTICS

V_P = 8.5 V and T_{amb} = +25°C, measurements taken in Fig.1 with f_0 = 98 MHz (EMF1) unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage (pin 13)		7	8.5	10	V
I_P	supply current	without mixer	16	23	30	mA
V_{REF}	reference voltage (pin 5)	$I_5 \leq 3$ mA	3.9	4.2	4.4	V
Mixer						
I_{14+15}	mixer supply current (pins 14 and 15)		–	4	–	mA
$V_{1,2}$	DC voltage input (pins 1 and 2)		–	1	–	V
$Z_{1,2}$	input impedance		–	14	–	Ω
$V_{14,15}$	DC output voltage (pins 14 and 15)		4	–	10	V
$C_{14,15}$	output capacitance		–	13	–	pF
G_P	conversion power gain	note 1	–	14	–	dB
$EMF1_{IP3}$	3rd order intercept point		–	115	–	dBμV
NF	noise figure		–	9	–	dB
	total noise figure	including transforming network	–	11	–	dB
Oscillator						
$V_{7,8}$	DC input voltage (pins 7 and 8)		–	1.3	–	V
V_6	DC output voltage (pin 6)		–	2.0	–	V
Δf	residual FM at pin 6	f = 300 to 15000 Hz; de-emphasis 50 μs	–	2.2	–	Hz
Oscillator buffered output (pin 9)						
V_O	output signal (RMS value)	R_L= 500 Ω; C_L= 2 pF	75	–	–	mV
V_9	DC output voltage		–	6	–	V
R_9	DC output resistor		–	950	–	Ω
THD	total harmonic distortion		–	–15	–	dBC
f_S	spurious frequencies	EMF1 = 2 V; R_S = 50 Ω; f_{OSC} = 108.7 MHz	–	–37	–	dBC
Automatic gain control (AGC)						
R_3	input resistance (pin 3)		–	4	–	kΩ
C_3	input capacitance		–	3	–	pF
V_{16}	AGC output swing (DC)	Figs 3 and 4	0.5	–	V_P – 0.3	V
I_{16}	output current at I_3 = 0	V_{16} = ½V_P	–25	–50	–150	μA
	output current at U_3 = 2 V	V_{16} = 7 to 10 V	2	–	5	mA
EMF2	threshold (RMS value)	I_{16} = 0; V_{16} = ½V_P; Figs 4 and 5	–	17	–	mV

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Linear IF amplifier		IF = 10.7 MHz				
$V_{11,12}$	DC input voltage (pins 11 and 12)		–	1.25	–	V
$Z_{12\text{-}11}$	input impedance		240	300	360	Ω
$C_{12\text{-}11}$	input capacitance		–	13	–	pF
V_{10}	DC output voltage (pin 10)		–	4.4	–	V
Z_{10}	output impedance		240	300	360	Ω
C_{10}	output capacitance		–	3	–	pF
V_O	output signal (RMS value)	–1 dB compression	–	–	650	mV
G_v	IF voltage gain (20 log (V_{10-4} / V_{12-11}))		27	30	–	dB
ΔG_v	IF voltage gain deviation	T_{amb}= –40 to +85 °C	–	0	–	dB
NF	noise figure	R_S = 300 Ω	–	6.5	–	dB

Note

1. G_P = 10 log ($4V_{o\ mix} \times 10.7$ MHz) / (EMF2 × 98 MHz)^2 × (R_{S1} / R_{ML}).

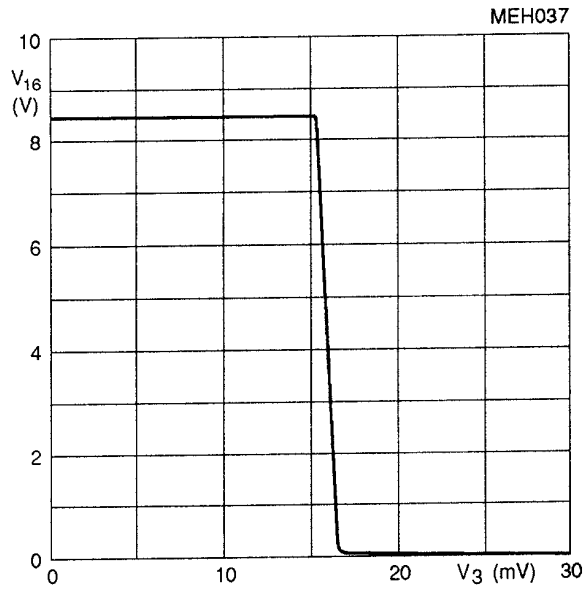


Fig.3 AGC output voltage V_{16} as a function of V_{i3} RMS at I_{16} = 0, measured in test circuit Fig.1.

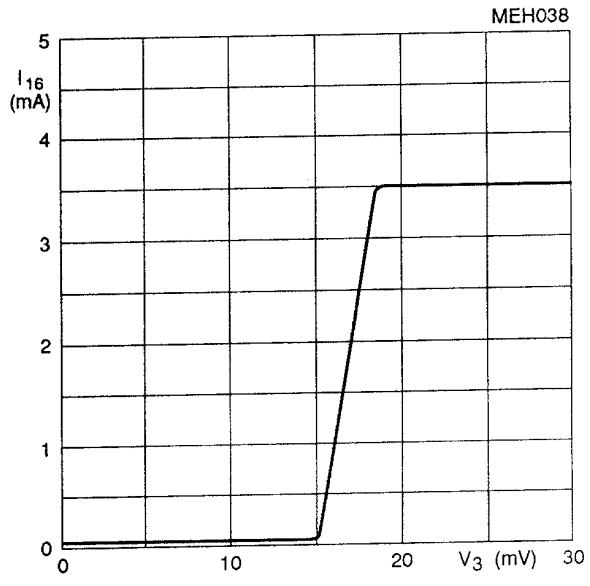


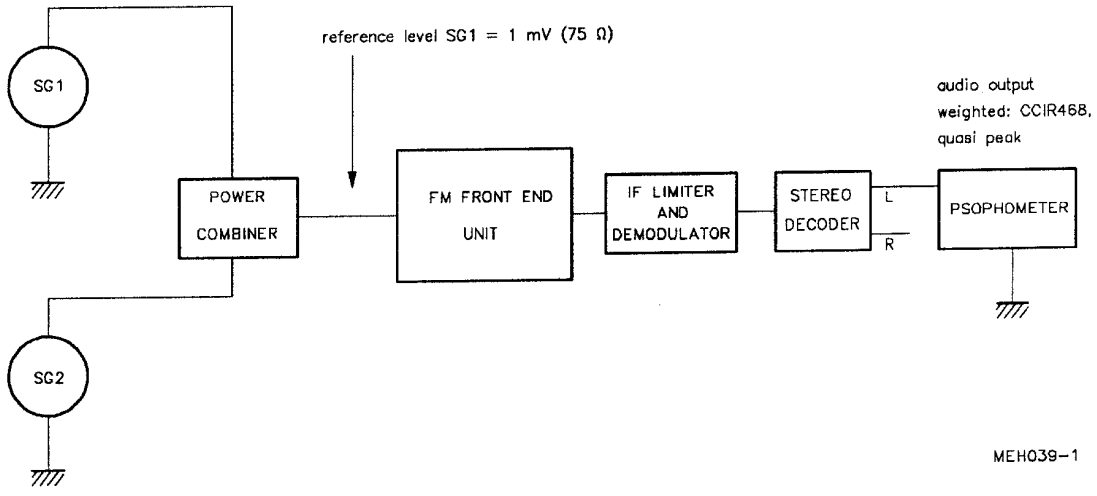
Fig.4 AGC output current I_{16} as a function of V_{i3} RMS at V_{16} = 8.5 V, measured in test circuit Fig.1.

APPLICATION INFORMATION

Operating characteristics

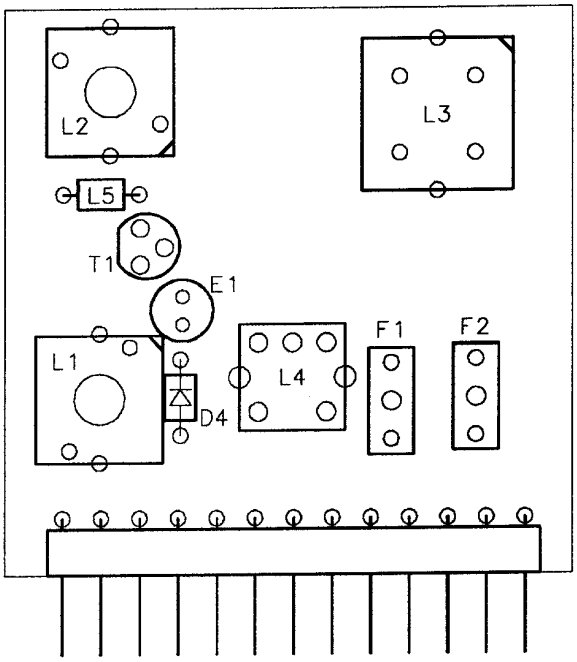
Measured in application circuit Fig.7, according to *"CENELEC EN 55020, Chapter 4.1 (passive interference suppression)"*. Measurements are shown in Figs. 8 and 9.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_S	supply voltage		7	8.5	10	V
I_S	total supply current		–	37	–	mA
f_{RF}	tuning range of RF input		87.5	–	108	MHz
V_{tune}	tuning voltage of RF input		1	–	7	V
G	gain (20 log $V_{O\ IF}$ / V_{ant})		–	43	–	dB
$V_{i\ ant}$	input sensitivity	S/N = 26 dB; R_{ant} = 150 Ω	–	2	–	μV
IR	image rejection	f = 98 MHz	–	64	–	dB
RSS	repeat spot suppression	f = 98 MHz; $V_{i\ ant}$ = 10 μV	–	89	–	dB
DBS	double beat suppression	f1 = 93 MHz; f2 = 98 MHz				
	DBS1	f_{tune} = 88 MHz	–	81	–	dB
	DBS2	f_{tune} = 103 MHz	–	80	–	dB
	DBS3	f_{tune} = 90.15 MHz	–	85	–	dB
CBS	continuous beat suppression	f1 = 90 MHz; f2 = 100.7 MHz f_{tune} = 95 MHz	–	90	–	dB

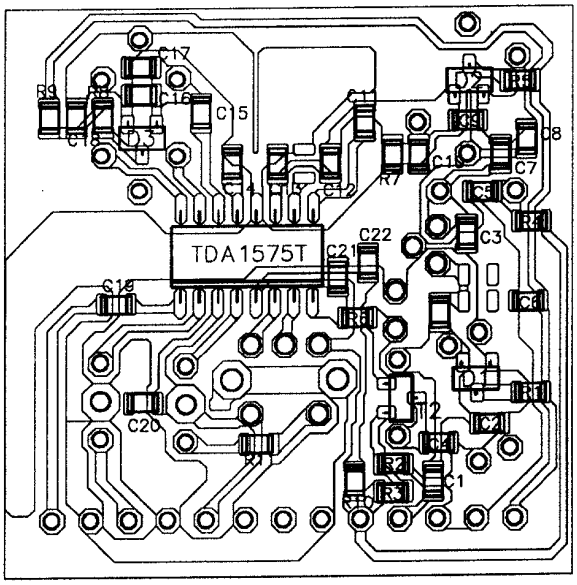


SG1: Wanted carrier; modulated with f = 1 kHz, Δf = ±40 kHz (for audio reference)
SG2: Unwanted carrier; modulated with f = 1 kHz, FM: Δf = ±40 kHz (in band) or AM: m = 80% (out of band)
increase level of SG2 until S/N = 26 dB w.r.t. wanted modulation (for car radio, home radio S/N = 40 dB)

Fig.5 Set-up for CENELEC EN 55020 passive interference measurements.



Component Side



MEH040

SMD and Track Side

Fig.6 PCB layout of FM front end unit.

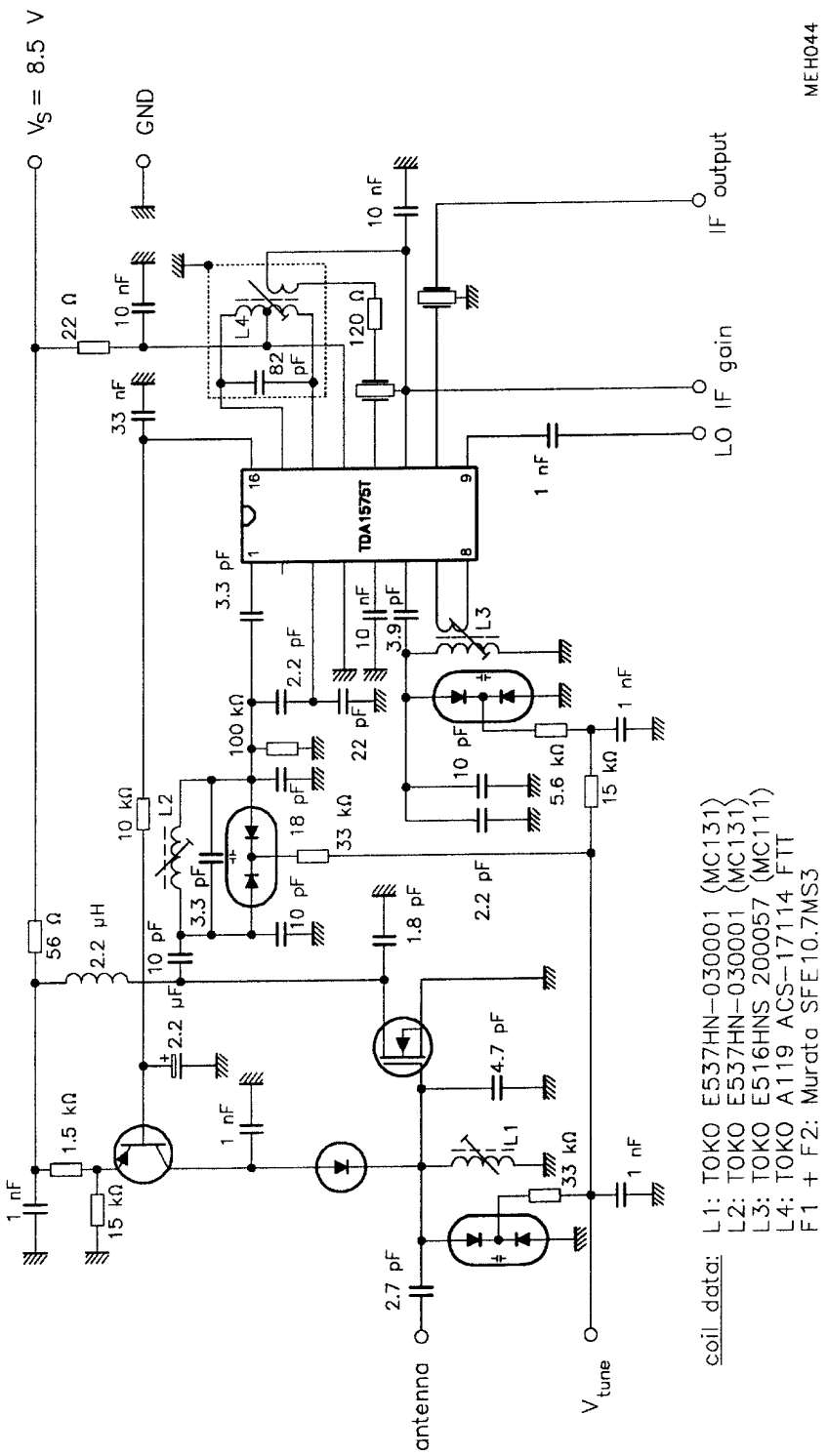


Fig.7 Application circuit of FM front end with TDA1575T and FET-preamplifier.

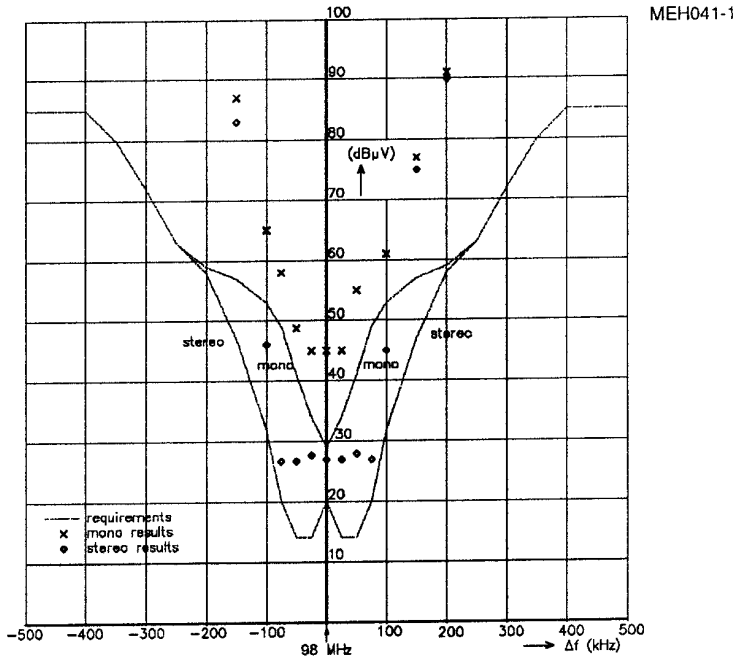


Fig.8 Interference level as a function of detuning for S/N = 26 dB; IN-BAND passive interference (CENELEC EN 55020).

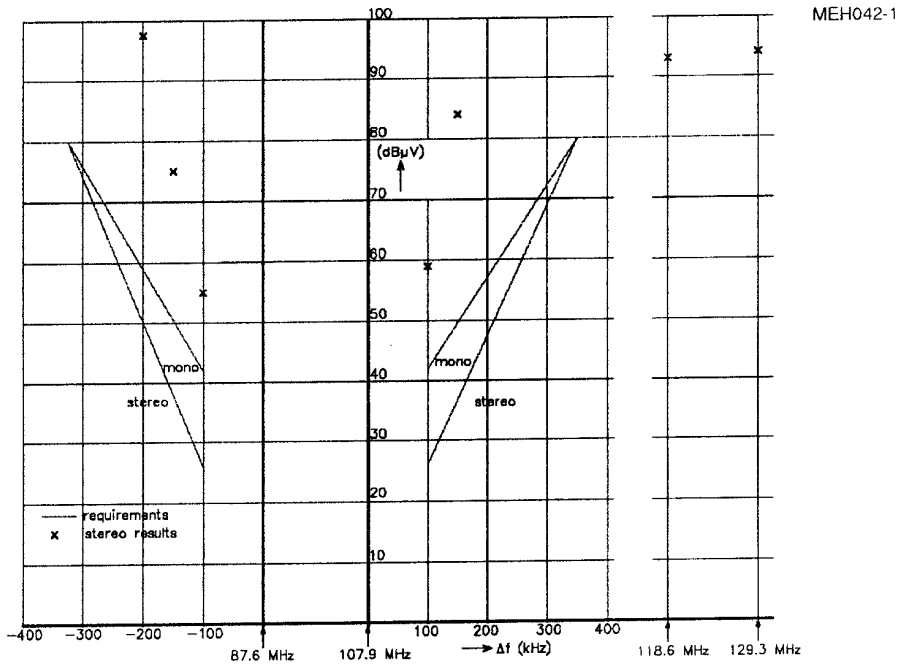


Fig.9 Interference level as a function of detuning for S/N = 26 dB; OUT-OF-BAND passive interference (CENELEC EN 55020).

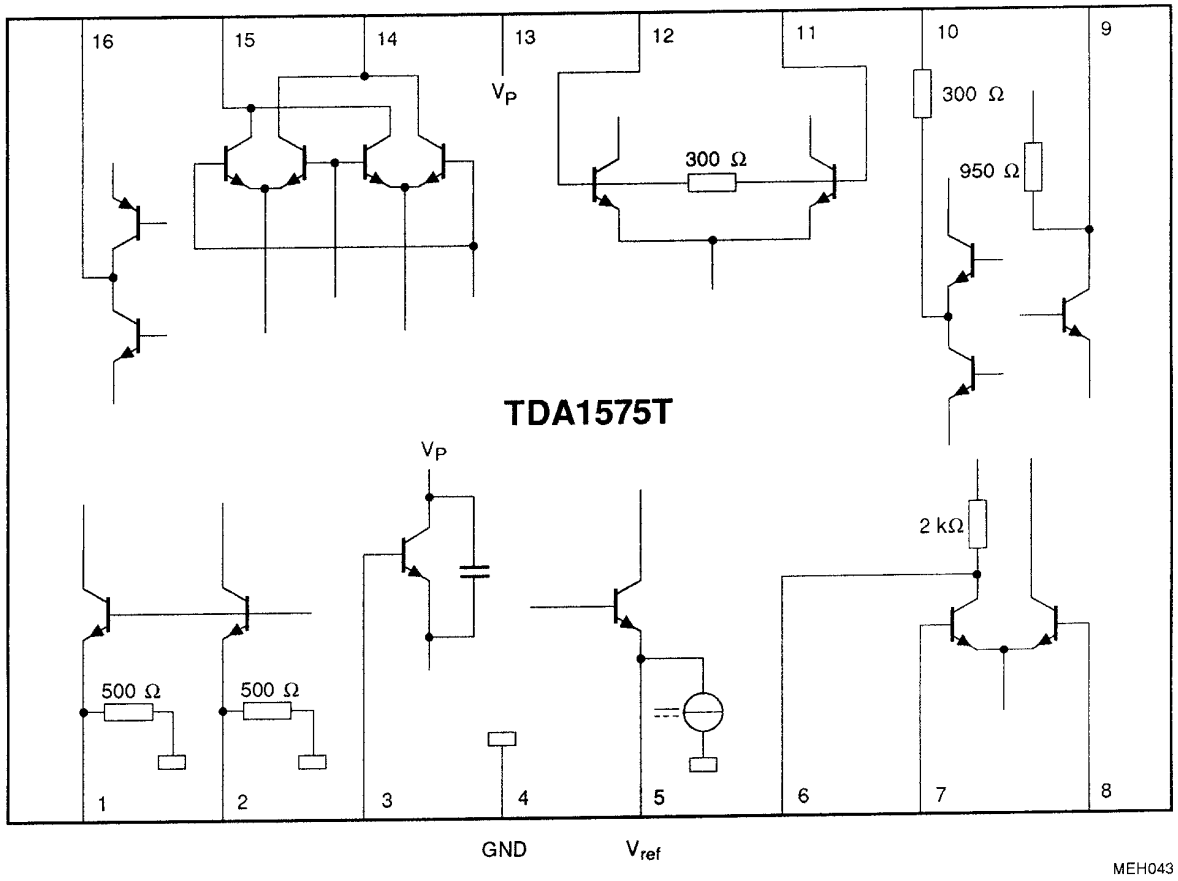
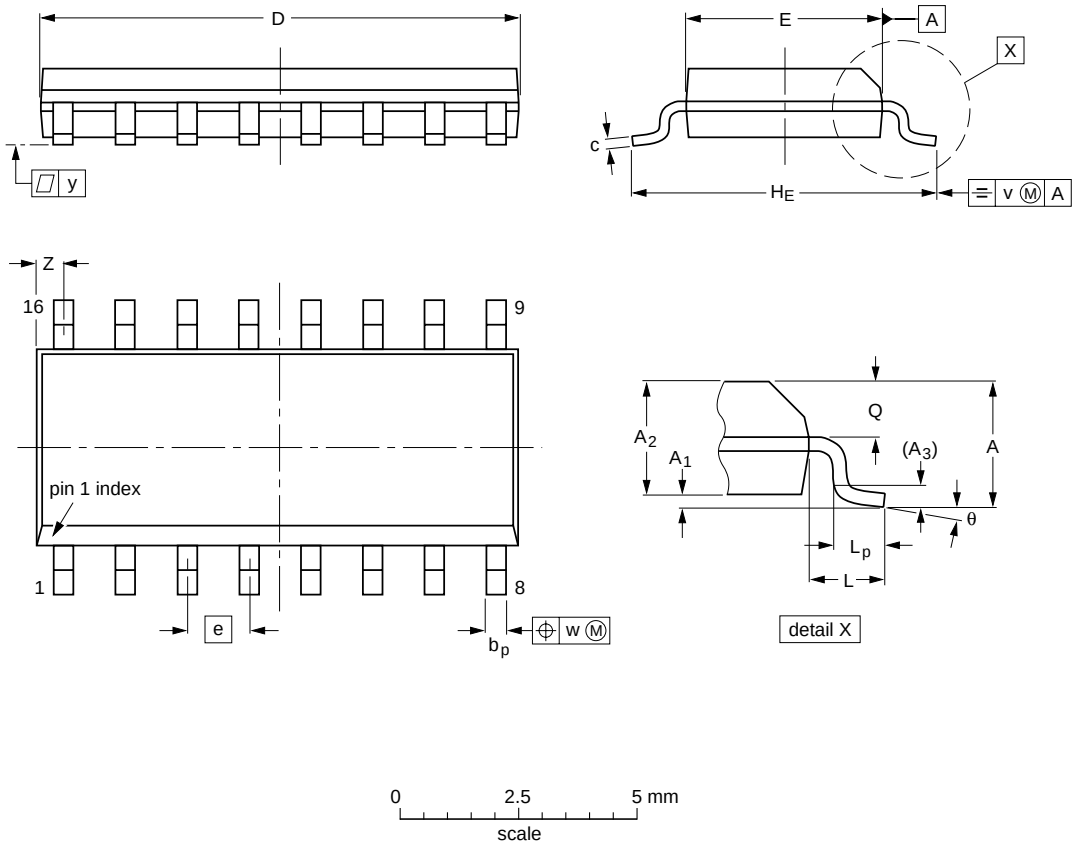


Fig.10 Internal circuits.

PACKAGE OUTLINE

SO16: plastic small outline package; 16 leads; body width 3.9 mm **SOT109-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	10.0 9.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.39 0.38	0.16 0.15	0.050	0.244 0.228	0.041	0.039 0.016	0.028 0.020	0.01	0.01	0.004	0.028 0.012	

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT109-1	076E07S	MS-012AC				~~95-01-23~~ 97-05-22

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

Reflow soldering

Reflow soldering techniques are suitable for all SO packages.

Reflow soldering requires solder paste (a suspension of fine solder particles, flux and binding agent) to be applied to the printed-circuit board by screen printing, stencilling or pressure-syringe dispensing before package placement.

Several techniques exist for reflowing; for example, thermal conduction by heated belt. Dwell times vary between 50 and 300 seconds depending on heating method. Typical reflow temperatures range from 215 to 250 °C.

Preheating is necessary to dry the paste and evaporate the binding agent. Preheating duration: 45 minutes at 45 °C.

Wave soldering

Wave soldering techniques can be used for all SO packages if the following conditions are observed:

- A double-wave (a turbulent wave with high upward pressure followed by a smooth laminar wave) soldering technique should be used.
- The longitudinal axis of the package footprint must be parallel to the solder flow.
- The package footprint must incorporate solder thieves at the downstream end.

During placement and before soldering, the package must be fixed with a droplet of adhesive. The adhesive can be applied by screen printing, pin transfer or syringe dispensing. The package can be soldered after the adhesive is cured.

Maximum permissible solder temperature is 260 °C, and maximum duration of package immersion in solder is 10 seconds, if cooled to less than 150 °C within 6 seconds. Typical dwell time is 4 seconds at 250 °C.

A mildly-activated flux will eliminate the need for removal of corrosive residues in most applications.

Repairing soldered joints

Fix the component by first soldering two diagonally-opposite end leads. Use only a low voltage soldering iron (less than 24 V) applied to the flat part of the lead. Contact time must be limited to 10 seconds at up to 300 °C. When using a dedicated tool, all other leads can be soldered in one operation within 2 to 5 seconds between 270 and 320 °C.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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Printed in The Netherlands 547027/00/03/pp16 Date of release: April 1993 Document order number: 9397 750 02439

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