DATA SHEET

TZA1022
Preamplifier and laser supply for CD/CDRW read-only optical systems (TRIGINTA)

Product specification

File under Integrated Circuits, <Handbook>

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Philips
Semiconductors

PHILIPS

Preamplifier and laser supply for CD/CDRW read-only optical systems

TZA1022

FEATURES.

- Five amplifiers and low-pass filters with virtually no offset.
- Data amplifier with high bandwidth suitable for data rates of at least 32x.
- Gain switch for CD and CDRW discs.
- Laser supply without external components stabilizing the laser output power with separate power supply connection to increase efficiency.
- Protection circuit to prevent laser damage due to supply voltage dip.
- Radial error signal for fast track counting.
- On/off switch to control laser and reduce power consumption in idle mode.
- Wide temperature range.

GENERAL DESCRIPTION.

The TRIGINTA is a dedicated circuit with preamplifiers and an Automatic Power Control (APC) for CD/CDROM player mechanisms using the single Foucault focusing system. It consists of 5 amplifiers and low-pass filters to process the detector signals for the servo functions. The gain of the amplifiers can be selected to allow playback of CD(R) as well as CDRW discs. The APC is able to drive N-substrate lasers equipped with N-substrate monitor diode as well as with P-substrate monitor diode, while the polarity of the monitor diode is detected automatically. The RF amplifier can handle signals up to thirty times nominal data speed. The FTC (Fast track count) amplifier generates a radial error signal to allow fast track detection during access.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
T_{amb}	operating ambient temperature		0		70	°C
Supply						
V_{DD}	supply voltage		4.5	5.0	5.5	V
LF diode amplifiers						
$|MIA|$	channel matching	amb			3	%
$BW_{(LF)}$	-3 dB bandwidth		50	68		kHz
RF amplifier						
$BW_{(RF)}$	-3 dB bandwidth			55		MHz
$t_{d(RF)}$	flatness delay RF	f = 0....32 MHz		0.2		ns
Laser supply						
V_{DDL}	laser supply voltage		2.5		5.5	V
I_{lo}	output current				-100	mA
V_{MI}	monitor input voltage	P-type monitor		V_{DD}-0.18		V
		N-type monitor		0.18		V

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	**DESCRIPTION**	**VERSION**
TZA1022	SSOP24	plastic shrink small outline package; 24 leads; body width 5.3 mm	SOT340-1

BLOCK DIAGRAM
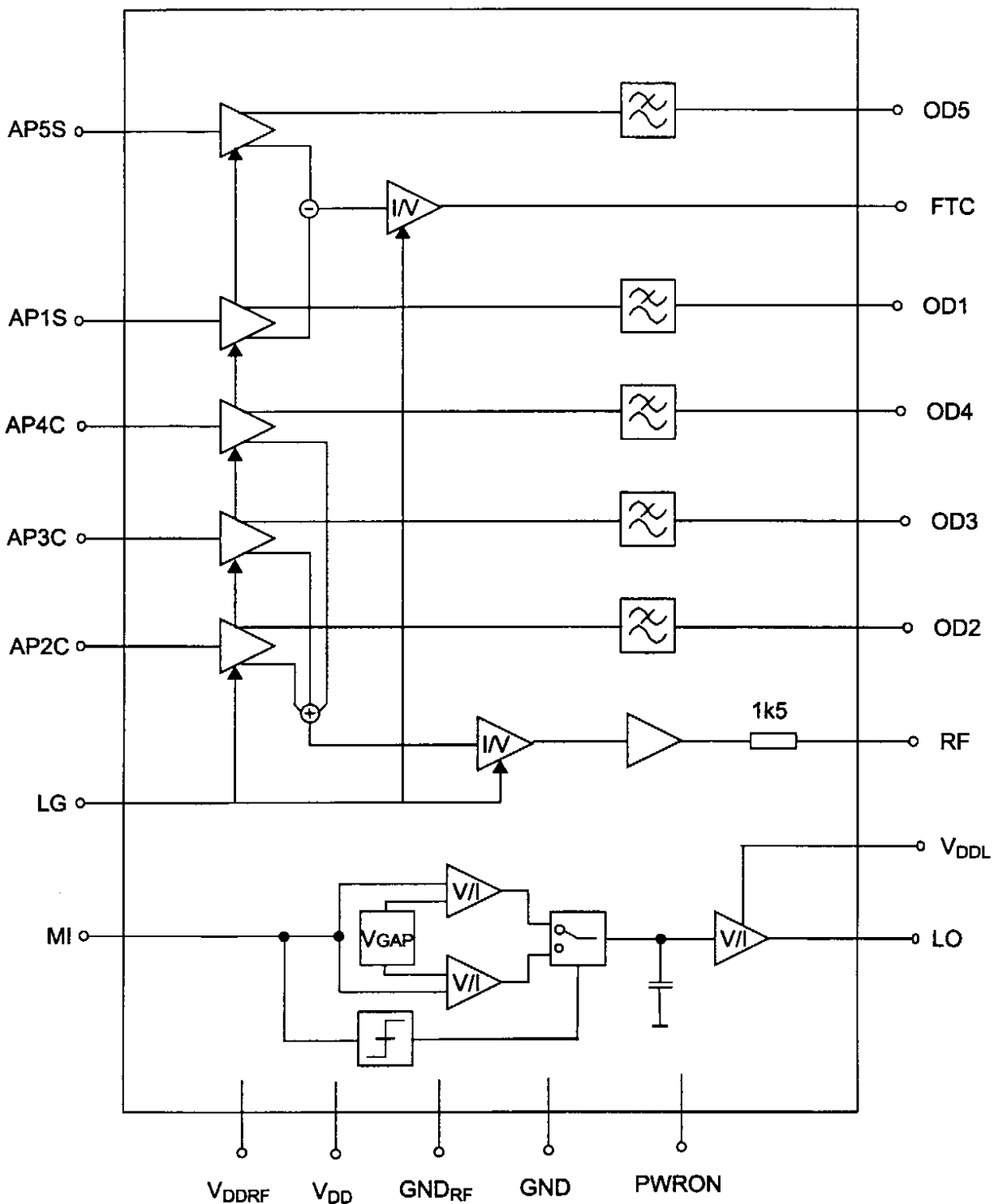

Fig.1 Block diagram

Preamplifier and laser supply for CD/CDRW read-only optical systems

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PINNING

SYMBOL	PIN	DESCRIPTION
OD2	1	output photo diode amplifier 2
OD3	2	output photo diode amplifier 3
OD4	3	output photo diode amplifier 4
OD5	4	output photo diode amplifier 5
OD1	5	output photo diode amplifier 1
PWRON	6	power on switch
RF	7	output data signal
V_{DDRF}	8	RF amplifier supply voltage
V_{DD}	9	supply voltage
GND	10	ground
GND_{RF}	11	ground RF amplifier
V_{DDL}	12	laser supply voltage
LO	13	current output for the laser diode
MI	14	Monitor input
n.c.	15	not connected
n.c.	16	not connected
AP1S	17	Input photo diode amplifier (satellite)
AP2C	18	Input photo diode amplifier (central)
n.c.	19	not connected
FTC	20	output fast track counting
LG	21	CD/CDRW gain switch
AP3C	22	Input photo diode amplifier (central)
AP5S	23	Input photo diode amplifier (satellite)
AP4C	24	Input photo diode amplifier (central)

Preamplifier and laser supply for
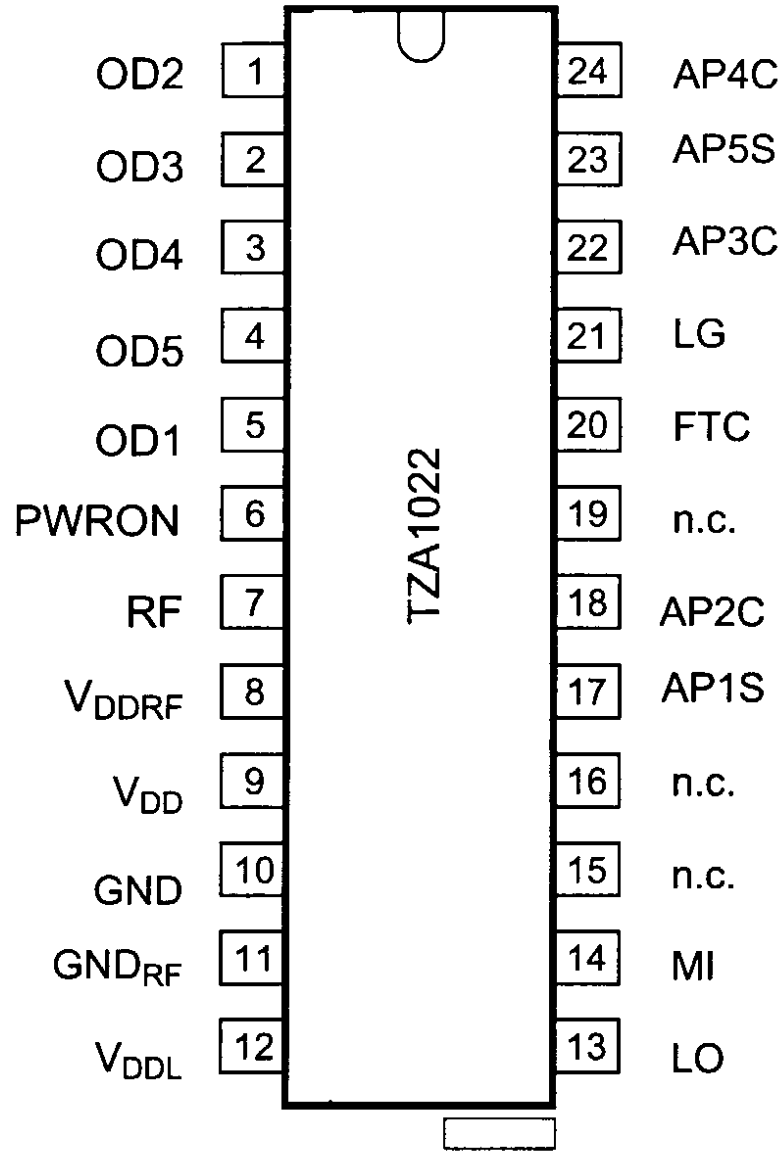CD/CDRW read-only optical systems

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Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

Automatic Power Control (APC)

The function of the APC is to control the current applied to the laser diode in order to achieve a constant light output power which is continuously measured by means of the monitor diode.

The circuits consists of three parts:
1. Input stage.
2. Integrator stage.
3. Output stage.

The current from the monitor diode is applied to a potentiometer to generate a voltage. This voltage is compared with the built in reference source. The resulting error signal is fed to the internal capacitor for integration, which is compared to a reference voltage determined by the integrated bandgap reference source to be independent of temperature. This capacitor determines two characteristics of the APC:
1. The slope of the laser current during switch on of the laser..
2. The closed loop bandwidth of the APC.

The voltage across the integrator capacitor is applied to the output stage which consists of a transconductance amplifier. The output current is available at pin LO.

A protection circuit prevents damage of the laser during a dip of the power supply voltage. It measures the voltage level at pin LO and prevent charging of the integrator capacitor during low supply voltage conditions. The APC can be switched on by means of pin PWRON

The photo diode signal processor

The photo diode signal processor consists of five current amplifiers with selectable gain and low-pass filters. The bandwidth of the low-pass filters is 68 kHz. The outputs of the amplifiers connected to pins AP2C, AP3C and AP4C are connected to the wide band RF amplifier. The transimpedance of the RF amplifier is controlled by pin LG. The output of the transimpedance amplifier is connected to pin RF via a resistor in order to achieve a current output. Signals from the amplifiers 1 and 5 are subtracted and applied to a transimpedance amplifier in order to generate the radial error signal.

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{dd}	Supply voltage			5.5	V
P_{max}	maximum power dissipation	note 1		500	mW
T_{amb}	Operating ambient temperature		0	70	°C
Ves	Electrostatic handling	Human body model		1500	V
		Machine model		150	V

Notes

1. Based on standard measurement for determining thermal resistance of the package, according to MIL-STD 883C.

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CHARACTERISTICS

$V_{DD} = V_{DDRF} = 5.0V$; $V_{DDL} = 2.5V$; $T_{amb} = 25$ °C; PWRON = H; LG = H; $I_{LO} = -50$ mA; unless otherwise specified.

title

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_{DD}	supply voltage	$V_{DD} = V_{DDRF}$	4.5	5.0	5.5	V
I_{DD}	LF supply current			16	19	mA
I_{DDRF}	RF supply current			3.5	4.5	mA
I_{DDL}	laser diode supply current			note 1		
I_q	quiescent supply current	PWRON = L		9.5	13	mA
LF diode amplifiers, m = 1..5, n = 1..5						
A_{apm}	Current amplification	$V_{odm} = 0V$				
		LG = 1	1.5	1.7	1.9	
		LG = 0	4.2	4.8	5.4	
I_{ap}	Input current range	on track, central channels	0.3		8	μA
		LG = 1				
		on track, satellite channels	0.15		4	μA
		LG = 0				
$V_{ap.c}$	Input voltage	$I_{apm} = 2$ μA central channel		1.0		V
$V_{ap.s}$	Input voltage	$I_{apm} = 2$ μA satellite channel		1.8		V
V_{odm}	Output voltage range		-0.2		$V_{DD} - 1.5$	V
$|I_{odm}|$	Output offset current	$I_{apm} = 0$			100	nA
$|dI_{odm}|$	Offset difference	$I_{apm} = 0$, note 2			15	nA
Z_{odm}	Output impedance	$V_{odm} = 0$, $I_{apm} = 2$ μA	500			kΩ
BW_{odm}	Bandwidth	$I_{apm} = 2$ μA, LG = 1	50	68		kHz
		$I_{apm} = 0.3$ μA, LG = 0	50	68		kHz
$|MIA|$	Mismatch amplification	$I_{apm} = 2$ μA, LG = 1			3	%
		$I_{apm} = 0.3$ μA, LG = 0				
		$V_{odm} = V_{odn}$				
		note 3				
RF amplifier, m = 2,3,4 note 4						
$V_{O(RF)}$	DC output voltage	$I_{apm} = 0$		$V_{DD} - 0.85$		V
$T_{I(RF)}$	Transimpedance	LG = 1	165	205	245	kΩ
		LG = 0	540	670	800	kΩ
		note 5				
$V_{S(RF)}$	Output voltage swing	$V_{DD} = 4.5V$	2			V
$R_{(RF)}$	Output impedance	f = 1 MHz		1.5		kΩ

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$BW_{(RF)}$	Bandwidth RF	$I_{apm} = 2\ \mu A$, LG = 1		55		MHz
		$I_{apm} = 0.4\ \mu A$, LG = 0		7.5		MHz
$t_{d(RF)}$	Flatness delay RF	$I_{apm} = 2\ \mu A$, f = 100k...40MHz, LG = 1		0.2		ns
		$I_{apm} = 0.4\ \mu A$, f = 100k...5 MHz, LG = 0		2		ns
$V_{n(RF)}$	Total output noise	$I_{apm} = 2\ \mu A$, LG = 1, $C_{apm} \leq 4.7$ pF to ground, f = 10 kHz - 100MHz		5		mV_{eff}
		$I_{apm} = 0.4\ \mu A$, LG = 0, $C_{apm} \leq 4.7$ pF to ground, f = 10 kHz -20 MHz		5		mV_{eff}
FTC amplifier, m = 1,5						
$V_{O(FTC)}$	DC output voltage	$I_{apm} = 0$		2		V
$T_{I(FTC)}$	Transimpedance	LG = 1	480	600	720	$k\Omega$
		LG = 0	1700	2200	2500	$K\Omega$
$V_{R(FTC)}$	Output voltage range			4		V_{pp}
$BW_{(FTC)}$	Bandwidth		250	400		kHz
$R_{O(FTC)}$	Output impedance			125		Ω
Control inputs						
V_{IL}	Low level input voltage		-0.2		1.5	V
V_{IH}	High level input voltage		2.1		$V_{DD}+0.2$	V
I_{IL}	Input current	$V_{in} = 0V$	-125		-50	μA
R_P	R pull-up			65		$k\Omega$
APC						
V_{DDL}	Voltage range laser supply		2.5		5.5	V
I_{LO}	Output current				-100	mA
V_{LO}	Output voltage range		-0.2		$V_{DDL}-0.7$	V
dI_{LO}/dt	Slewrate output current			-40		mA/ms
V_{MI}	Monitor input voltage	Closed loop, P-substrate monitor		$V_{DD}-0.18$		V
		Closed loop, N-substrate monitor		0.18		V
I_{MI}	Monitor input current range	V_{MI} = VDD- 0.18	-200		200	nA
		V_{MI} = 0.18	-200		200	nA
$BW_{(LS)}$	Bandwidth	Closed loop		1		kHz

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SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
RSR	Reference supply rejection	note 6			5	%
PSRR	Power supply rejection ratio	note 7			10	%
i_{LO}	Output noise current	I_{LO} = -50 mA, f = 100...300 kHz		2.5		nA/√Hz

Table of transfer functions

$I_{odm} = I_{apm} * A_{apm} * TFF_{(LPF)}$

@ m = 1..5

$TFF_{(LPF)}$ = transfer function low-pass filter

$V_{(RF)} = V_{O(RF)} - (I_{ap2c} + I_{ap3c} + I_{ap4c}) * T_{I(RF)}$ (see note 3)

$V_{(FTC)} = V_{O(FTC)} + (I_{ap1s} - I_{ap5s}) * T_{I(FTC)}$

Notes

1. Supply current through V_{DDL} is approximately I_{laser} x 1.03.

2. Over full temperature.range

3. $|MIA| = \dfrac{MAX (|A_{average} - A_{m}|)}{A_{average}}$
   m = 1..3 central, m=1..2 satellite. Including offset currents.

4. Total capacitance at the input range: < 5.8 pF

5. T_{IRF} is specified before 1k5 output resistor.

6. RSR = (dV_{MI}/V_{MI})/(dV_{DD}/V_{DD}), f < 5 kHz

7. PSRR = (dI_{LO}/I_{LO})/(dV_{DDL}/V_{DDL}), f > 200 Hz

APPLICATION CIRCUIT
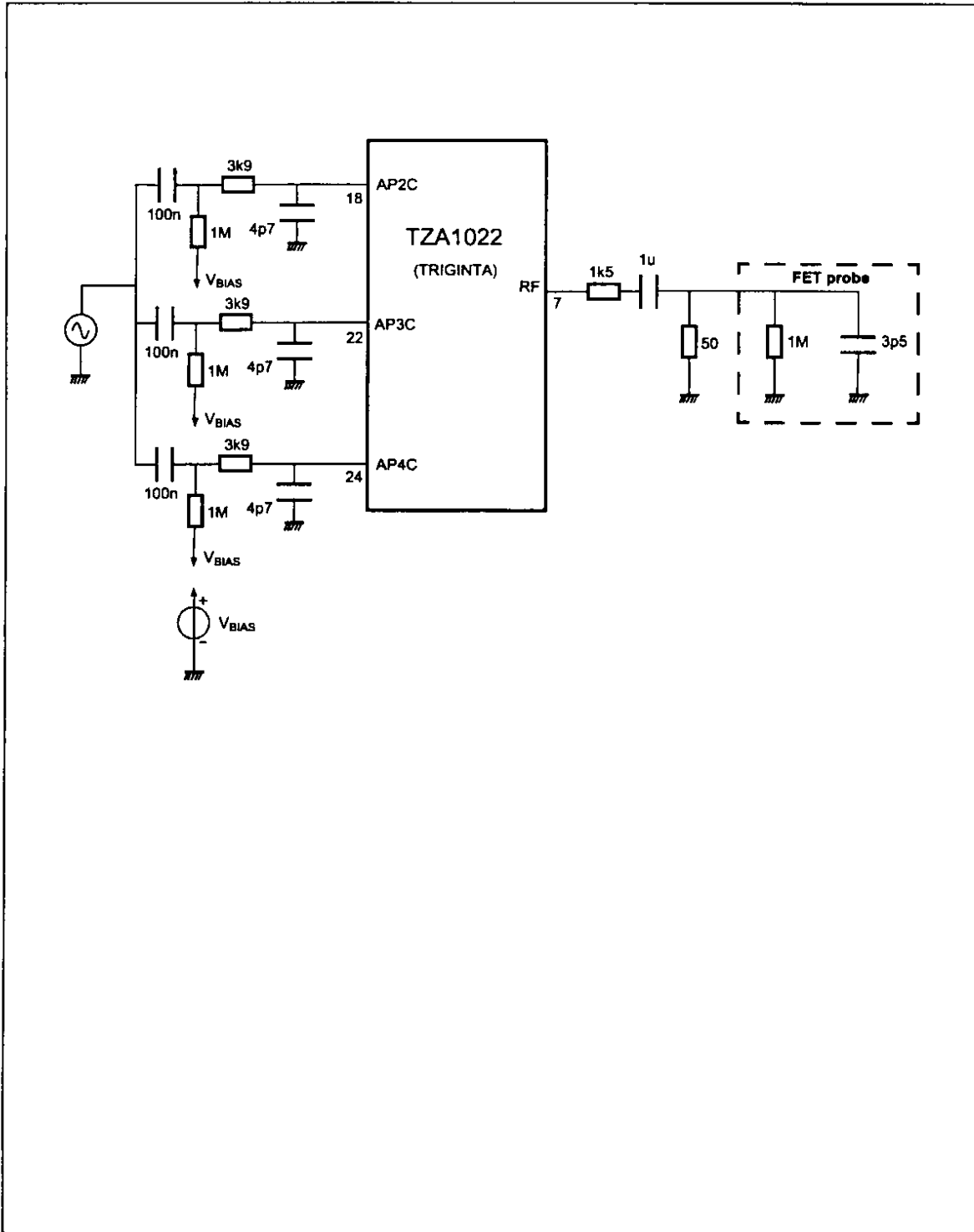
TZA1022/SAA7359/SAA7334
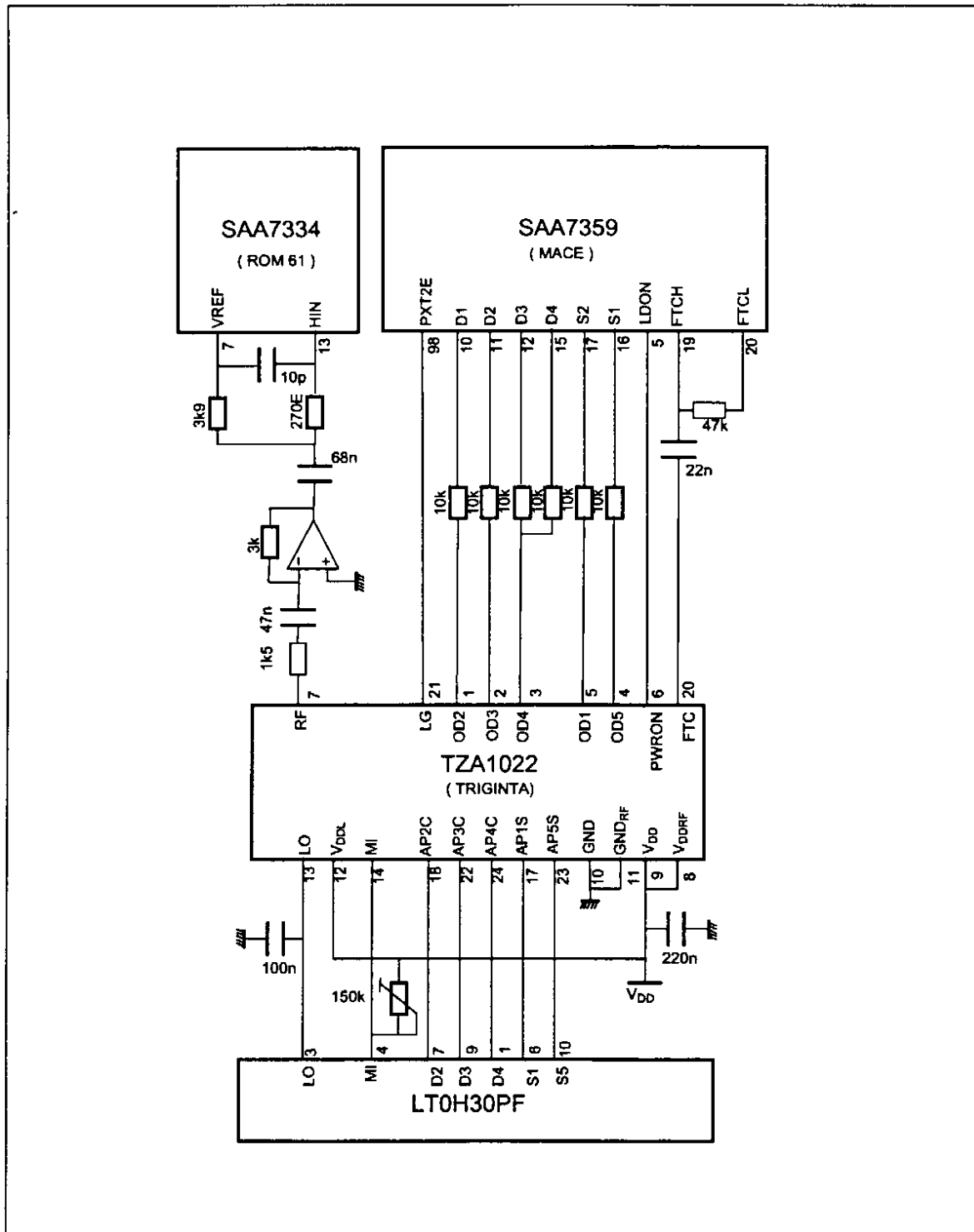
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TESTDIAGRAM
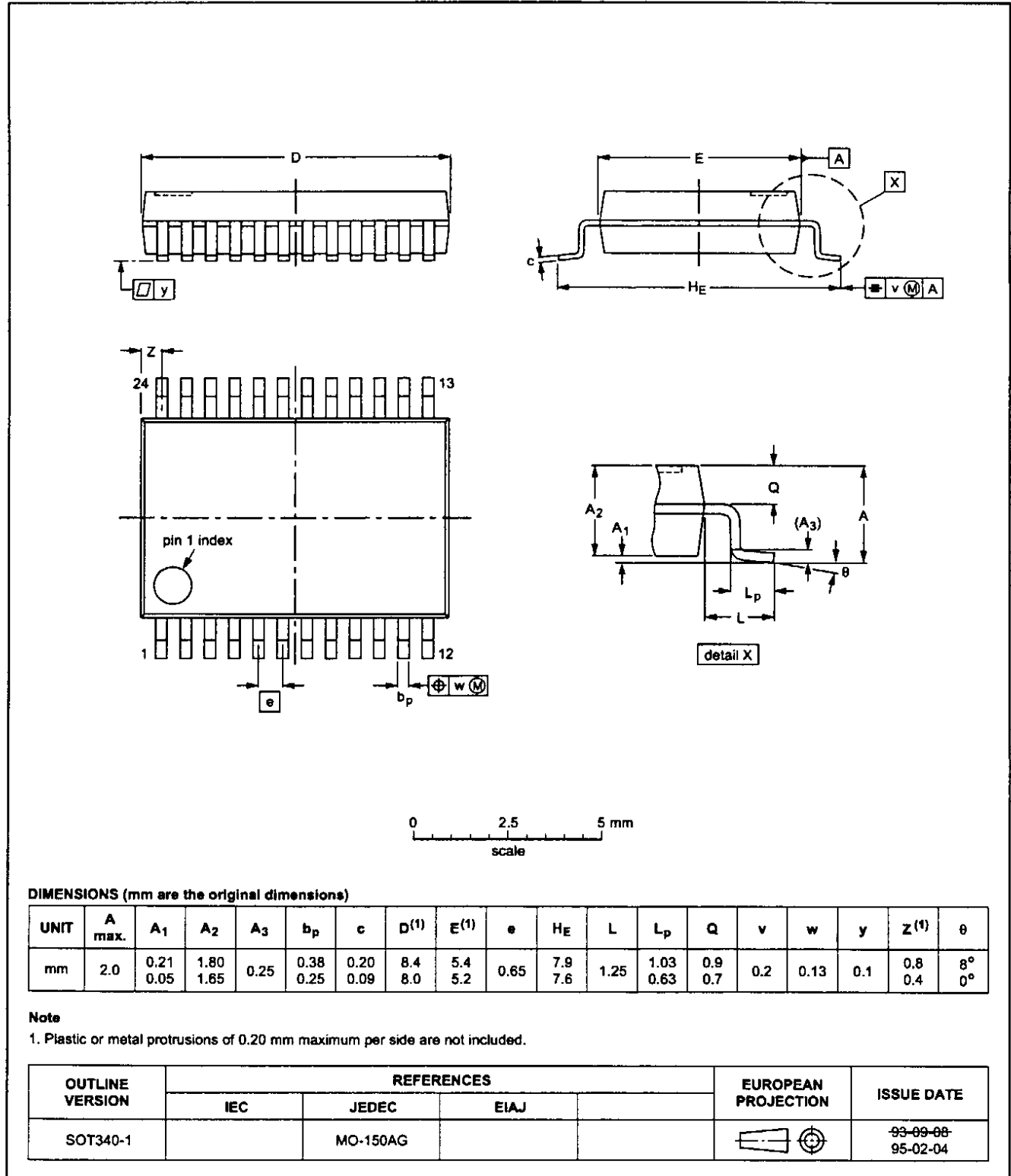
BANDWIDTH MEASUREMENT IN RF-PATH

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PACKAGE OUTLINE

SSOP24: plastic shrink small outline package; 24 leads; body width 5.3 mm   SOT340-1

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A₁	A₂	A₃	bₚ	c	D⁽¹⁾	E⁽¹⁾	e	H_E	L	Lₚ	Q	v	w	y	Z⁽¹⁾	θ
mm	2.0	0.21 0.05	1.80 1.65	0.25	0.38 0.25	0.20 0.09	8.4 8.0	5.4 5.2	0.65	7.9 7.6	1.25	1.03 0.63	0.9 0.7	0.2	0.13	0.1	0.8 0.4	8° 0°

Note

1. Plastic or metal protrusions of 0.20 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT340-1		MO-150AG				~~93-09-08~~ 95-02-04

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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.

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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.
Short-form specification	The data in this specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.
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.	

LIFE SUPPORT APPLICATIONS

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