DATA SHEET

TDA5332T

Double mixer/oscillator for TV and VCR tuners

Preliminary specification

File under Integrated Circuits, IC02

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Philips
Semiconductors

PHILIPS

Double mixer/oscillator for TV and VCR tuners

TDA5332T

GENERAL DESCRIPTION

The TDA5332T is an integrated circuit that performs the mixer/oscillator functions in TV and VCR tuners. This device gives the designer the capability to design an economical and physically small tuner which will be capable of meeting the most stringent requirements e.g. FTZ or FCC. The tuner development time can be drastically reduced by using this device.

Features

- Balanced mixer with a common emitter input for band A
- Amplitude-controlled oscillator for band A
- Balanced mixer with common base input for band B
- Balanced oscillator for band B
- SAW filter preamplifier with an output impedance of 75 Ω in application
- Bandgap voltage stabilizer for oscillator stability
- Electronic bandswitch

QUICK REFERENCE DATA

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage		V_P	–	12	–	V
Band A frequency range	depending on application	f_A	45	–	470	MHz
Band B frequency range	depending on application	f_B	160	–	860	MHz
Band A noise factor	50 MHz	NF_A	–	7.5	–	dB
Band B noise factor	860 MHz	NF_B	–	9	–	dB
Band A input voltage	1% cross-modulation	V_{18-20}	–	100	–	dBμV
Band B input power	1% cross-modulation note 5	P_I	–	–21	–	dBm
Band A voltage gain		G_{VA}	–	25	–	dB
Band B voltage gain		G_{VB}	–	36	–	dB

PACKAGE OUTLINE

20-lead mini-pack, plastic (SO20L; SOT163A); SOT163-1; 1996 November 29.

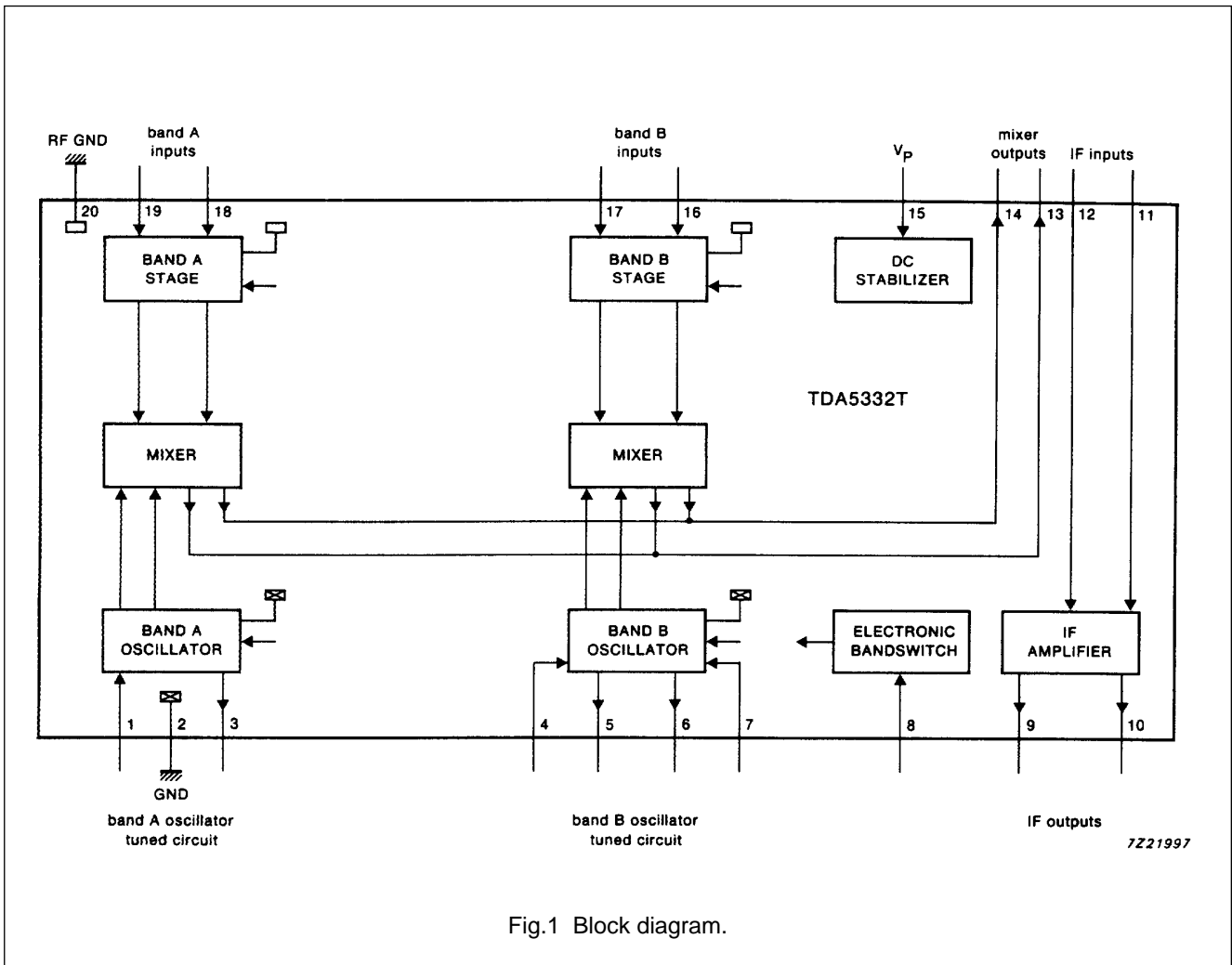## Double mixer/oscillator for TV and VCR tuners

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Fig.1 Block diagram.

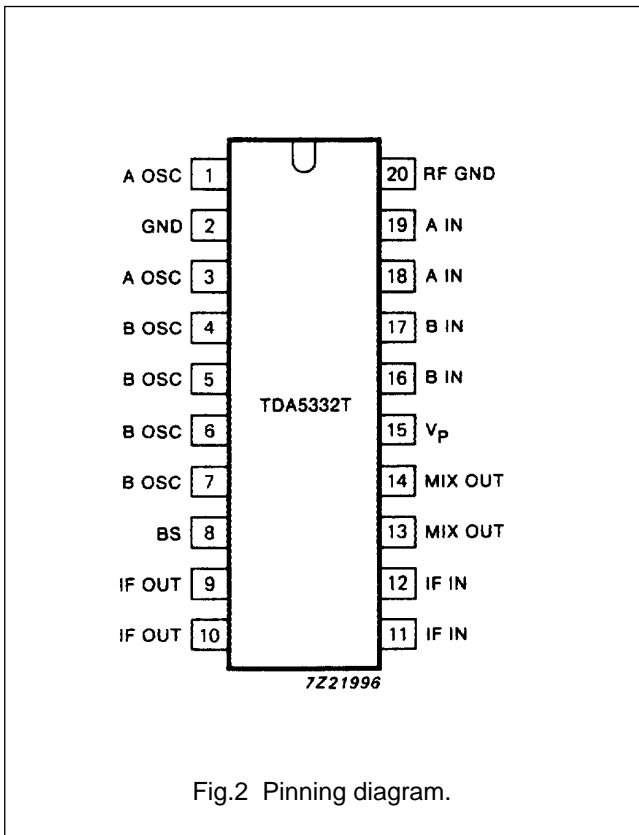## Double mixer/oscillator for TV and VCR tuners

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Fig.2 Pinning diagram.

PINNING

1	A OSC	band A oscillator input
2	GND	ground (0 V)
3	A OSC	band A oscillator output
4	B OSC	band B oscillator input
5	B OSC	band B oscillator output
6	B OSC	band B oscillator output
7	B OSC	band B oscillator input
8	BS	electronic bandswitch
9	IF OUT	IF amplifier output
10	IF OUT	IF amplifier output
11	IF IN	IF amplifier input
12	IF IN	IF amplifier input
13	MIX OUT	mixer output
14	MIX OUT	mixer output
15	V_P	positive supply voltage
16	B IN	band B input
17	B IN	band B input
18	A IN	band A input
19	A IN	band A input
20	RF GND	ground for RF inputs

RATINGS

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

PARAMETER	CONDITIONS	SYMBOL	MIN.	MAX.	UNIT
Supply voltage		V_P	−0.3	14	V
Switching voltage		V_8	0	14	V
Output current of each pin to ground		I_O	–	−10	mA
Maximum short-circuit time (all pins)		t_{SC}	–	10	s
Storage temperature range		T_{stg}	−55	+ 150	°C
Operating ambient temperature range		T_{amb}	−25	+ 80	°C
Junction temperature		T_j	–	+ 150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	typ.	100	K/W

HANDLING

Pins 8, 9 and 10 withstand the ESD test in accordance with MIL-STD-883C category B (2000 V).

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CHARACTERISTICS

V_P = 12 V; T_{amb} = 25 °C; all voltages are referenced to ground (pins 2 and 20); measured in Fig.3; unless otherwise specified.

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.		MAX.	UNIT
Supply voltage		V_{15}	10	–		13.2	V
Supply current		I_{15}	–	42		55	mA
Switching voltage;							
band A		V_{SA}	0	–		1.1	V
band B		V_{SB}	3	–		5	V
Switching current							
band A		I_{SA}	–	–		10	μA
band B		I_{SB}	–	–		50	μA
IF Amplifier	differentially measured at 36 MHz			mod.	phase		
Input reflection coefficient	note 4	S_{11}	–	–0.5	–2	–	dB/°
Reverse transmission coefficient		S_{12}	–	–41	–7	–	dB/°
Forward transmission coefficient		S_{21}	–	12	160	–	dB/°
Output reflection coefficient		S_{22}	–	–9	10	–	dB/°
Input admittance in application		Y_I	–	–	1.4	–	mS
					0.9	–	pF
Output admittance in application		Z_O	–	–	55	–	Ω
					230	–	nH
Band A mixer (including IF amplifier)	measured using circuit shown in Fig.3						
Frequency range		f_A	45	–		470	MHz
Noise factor	50 MHz	NF	–	7.5		9	dB
	225 MHz	NF	–	9		11	dB
	300 MHz	NF	–	10		12	dB
	470 MHz	NF	–	11		13	dB
Optimum source conductance	50 MHz	G_{18-20}	–	0.5		–	mS
	225 MHz	G_{18-20}	–	1.1		–	mS
	300 MHz	G_{18-20}	–	1.2		–	mS
	470 MHz	G_{18-20}	–	1.9		–	mS

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PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Input capacitance	50 – 470 MHz	C_{18-20}	–	2.5	–	pF
Input voltage	1% cross-modulation; in channel;	V_{18-20}	97	100	–	dBμV
Input voltage	10 kHz pulling; in channel; f < 300 MHz	V_{18-20}	100	108	–	dBμV
Voltage gain	20 log (V_{9-10}/V_{18})	G_V	22.5	25.0	27.5	dB
Band A mixer						
Conversion transadmittance mixer	$I_{13}/V_{18} = -I_{14}/V_{18}$	C_t	–	3.5	–	mS
Mixer output admittance	pins 13 and 14		–	0.1	–	mS
Mixer output capacitance		C_{13-14}	–	2	–	pF
Band A oscillator						
Frequency range		f_A	80	–	520	MHz
Frequency shift	ΔV_P = 10% note 6; f = 330 MHz	Δf	–	–	200	kHz
Frequency drift	ΔT = 25 °C note 7; f = 330 MHz	Δf	–	–	400	kHz
Frequency drift	5 s to 15 min after switching on; f = 330 MHz	Δf	–	–	200	kHz
Band B mixer (including IF)	measured using circuit shown in Fig.3; measurements using hybrid; note 1					
Frequency range		f_B	160	–	860	MHz
Noise factor not corrected for image	pins 16 and 17					
	160 MHz	NF_B	–	9	11	dB
	860 MHz	NF_B	–	9	11	dB
Available input power	note 5; 1% cross-modulation; in channel; pins 16 and 17;					
	160 MHz	P_{IB}	–25	–21	–	dBm
	860 MHz	P_{IB}	–25	–21	–	dBm
10 kHz pulling	note 5; pins 16 and 17; in channel					
	860 MHz		–	–20	–	dBm

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PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
N + 5 – 1 MHz						
pulling	notes 2 and 5; 820 MHz		−42	−35	–	dBm
Voltage gain	note 3; 160 MHz	G_{VB}	33	36	39	dB
	860 MHz	G_{VB}	33	36	39	dB
Band B oscillator						
Frequency range		f_B	200	–	900	MHz
Frequency shift	note 6; $\Delta V_P = 10\%$	Δf	–	–	400	kHz
Frequency drift	note 7; $\Delta T = 25\ °C$	Δf	–	–	800	kHz
Frequency drift	5 s to 15 min after switching on	Δf	–	–	400	kHz

Notes to the characteristics

1. The values have been corrected for hybrid and cable losses. The symmetrical output impedance of the circuit is 100 Ω.

2. The input level of a N + 5 – 1 MHz signal (just visible).

3. The gain is defined as the transducer gain (measured in Fig.3) plus the voltage transformation ratio of L6 to L7 (6:1, 16 dB).

4. All S parameters are referred to a 50 Ω system.

5. The input power is defined as the power delivered by the generator on a 50 Ω load.

6. The frequency shift is defined for a variation of power supply from;

    a) $V_P = 12\ V$ to $V_P = 10.8\ V$

    b) $V_P = 12\ V$ to $V_P = 13.2\ V$.

    In both cases the frequency shift is below the specified value.

7. The frequency drift is defined for a variation of ambient temperature from;

    a) $T_{amb} = 25\ °C$ to $T_{amb} = 0\ °C$

    b) $T_{amb} = 25\ °C$ to $T_{amb} = 50\ °C$

    In both cases the frequency shift is below the specified value.

APPLICATION INFORMATION

Fig.3 Application diagram.

Proposal of VHF/UHF tuner

band A = VHF I + VHF III (45 to 300 MHz)
band B = UHF (470 to 900 MHz)
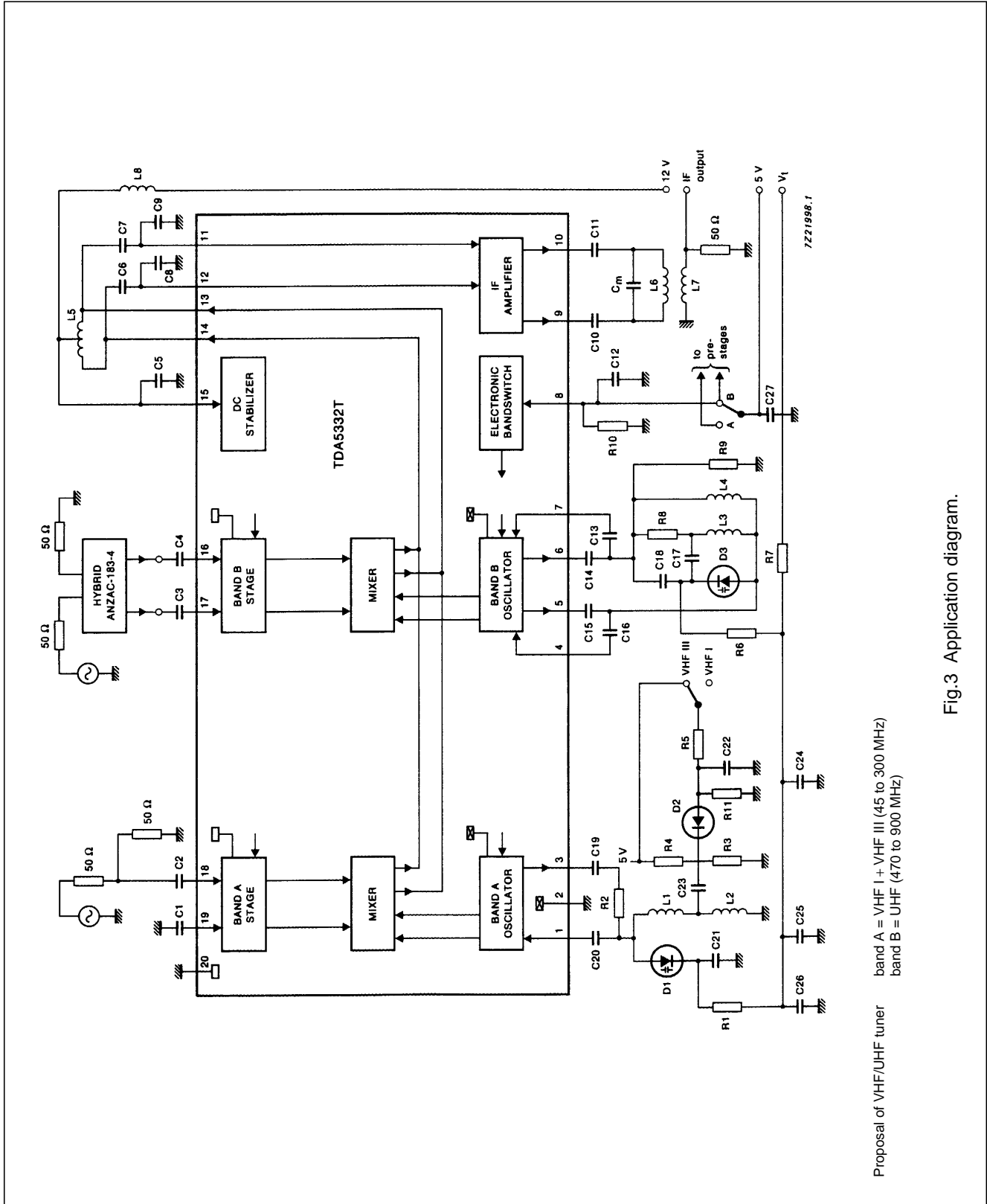
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Component values of the application diagram

resistors

R1 = 47 kΩ	R2 = 18 Ω	R3 = 1.2 kΩ	R4 = 4.7 kΩ
R5 = 100 Ω	R6 = 22 kΩ	R7 = 1 kΩ	R8 = 2.2 kΩ
R9 = 22 kΩ	R10 = 15 kΩ	R11 = 47 kΩ	

capacitors

C1 = 1 nF	C2 = 1 nF	C3 = 1 nF	C4 = 1 nF
C5 = 1 nF	C6 = 1 nF	C7 = 1 nF	C8 = 15 pF (N750)
C9 = 15 pF (N750)	C10 = 1 nF	C11 = 1 nF	C12 = 1 nF
C13 = 0.68 pF (SMD)	C14 = 1 pF (SMD)	C15 = 1 pF (SMD)	
C16 = 0.68 pF (SMD)	C17 = 100 pF (SMD)	C18 = 5.6 pF (SMD)	C19 = 1 pF (NPO)
C20 = 1 pF (NPO)	C21 = 82 pF (N750)	C22 = 1 nF	C23 = 1 nF
C24 = 1 nF	C25 = 1 nF	C26 = 1 μF (40V)	C27 = 1 nF
Cm = 18 pF (N750)			

diodes and IC

D1 = BB911	D2 = BA482	D3 = BB405B	IC = TDA5332T

coils

L1 = 2.5 t (φ3)	L2 = 8.5 t (φ3)	L3 = 1.5 t (φ3)
L4 = 1.5 t (φ3)	L5 = 2 × 5 t (note 1)	L8 = 5 μH (choke coil)

transformer

L6 = 12t (note 1)	L7 = 2 t

wire size for L1 to L4 = 0.4 and for L5 to L7 = 0.1 mm.

Note

1.   Coil type: TOKO 7 kN; material: 113 kN, screw core (03-0093), pot core (04-0026).
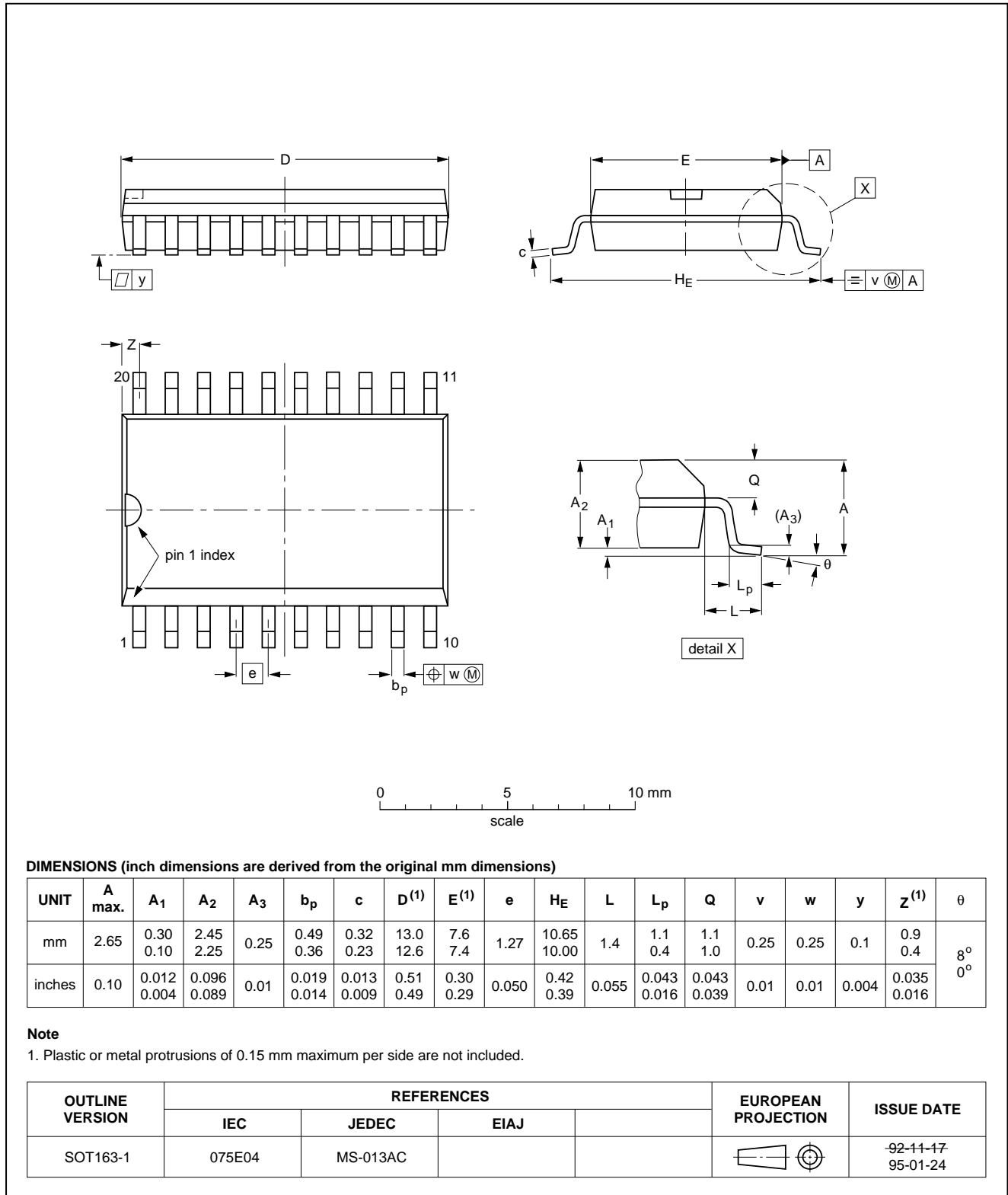
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PACKAGE OUTLINE

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1

0   5   10 mm

scale

DIMENSIONS (inch dimensions are derived from the original mm 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	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8° 0°
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.050	0.42 0.39	0.055	0.043 0.016	0.043 0.039	0.01	0.01	0.004	0.035 0.016	

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			
SOT163-1	075E04	MS-013AC				92-11-17 95-01-24

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.	

LIFE SUPPORT APPLICATIONS

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