DATA SHEET

TDA5632; TDA5633
9 V VHF and UHF mixers/oscillators for TV and VCR cable tuners

Product specification
Supersedes data of March 1995
File under Integrated Circuits, IC02

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Philips Semiconductors

PHILIPS

9 V VHF and UHF mixers/oscillators for TV and VCR cable tuners

TDA5632; TDA5633

FEATURES

- Balanced mixer with a common emitter input for band A
- 2-pin oscillator for band A
- Balanced mixer with a common base input for band C
- 4-pin oscillator for band C
- Local oscillator buffer output for external prescaler
- SAW filter preamplifier with a low output impedance to drive a 75 Ω load
- Band gap voltage stabilizer for oscillator stability
- Electronic band switch
- External IF filter connected between the mixer output and the IF amplifier input.

APPLICATIONS

- Cable tuners for TV and VTR; switched concept for VHF
- Recommended RF bands for Europe:
  48.25 to 105.25 MHz, 112.25 to 294.25 MHz and 471.25 to 855.25 MHz
- Recommended RF bands for the USA:
  55.25 to 133.25 MHz, 139.25 to 361.25 MHz and 367.25 to 801.25 MHz.

DESCRIPTION

The TDA5632 and TDA5633 are monolithic integrated circuits that perform VHF and UHF mixer/oscillator functions in TV and VCR cable tuners. With correct oscillator application and by using a switchable inductor to split the VHF band into two sub-bands, the full VHF/UHF TV bands can be covered. These low-power mixers/oscillators require a power supply of 9 V and are available in a very small package.

The devices provide the designer with the capability to design an economical and physically small cable tuner.

The tuner development time can be drastically reduced by using this device.

Frequency bands are determined by the external tank circuit. They can be adapted to various standards.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	supply voltage		–	9.0	–	V
I_P	supply current		–	40	–	mA
f_{RF}	frequency range (picture carrier)	RF input; band A; note 1	57.5	–	357.5	MHz
		RF input; band C; note 1	469.5	–	887.5	MHz
G_v	voltage gain	band A (75 Ω load)	–	19	–	dB
		band C (75 Ω load)	–	30	–	dB
NF	noise figure	band A (75 Ω load)	–	10	–	dB
		band C (75 Ω load)	–	9.5	–	dB
V_o	output voltage to obtain 1% cross modulation in channel	band A (75 Ω load)	–	110	–	dBμV
		band C (75 Ω load)	–	110	–	dBμV

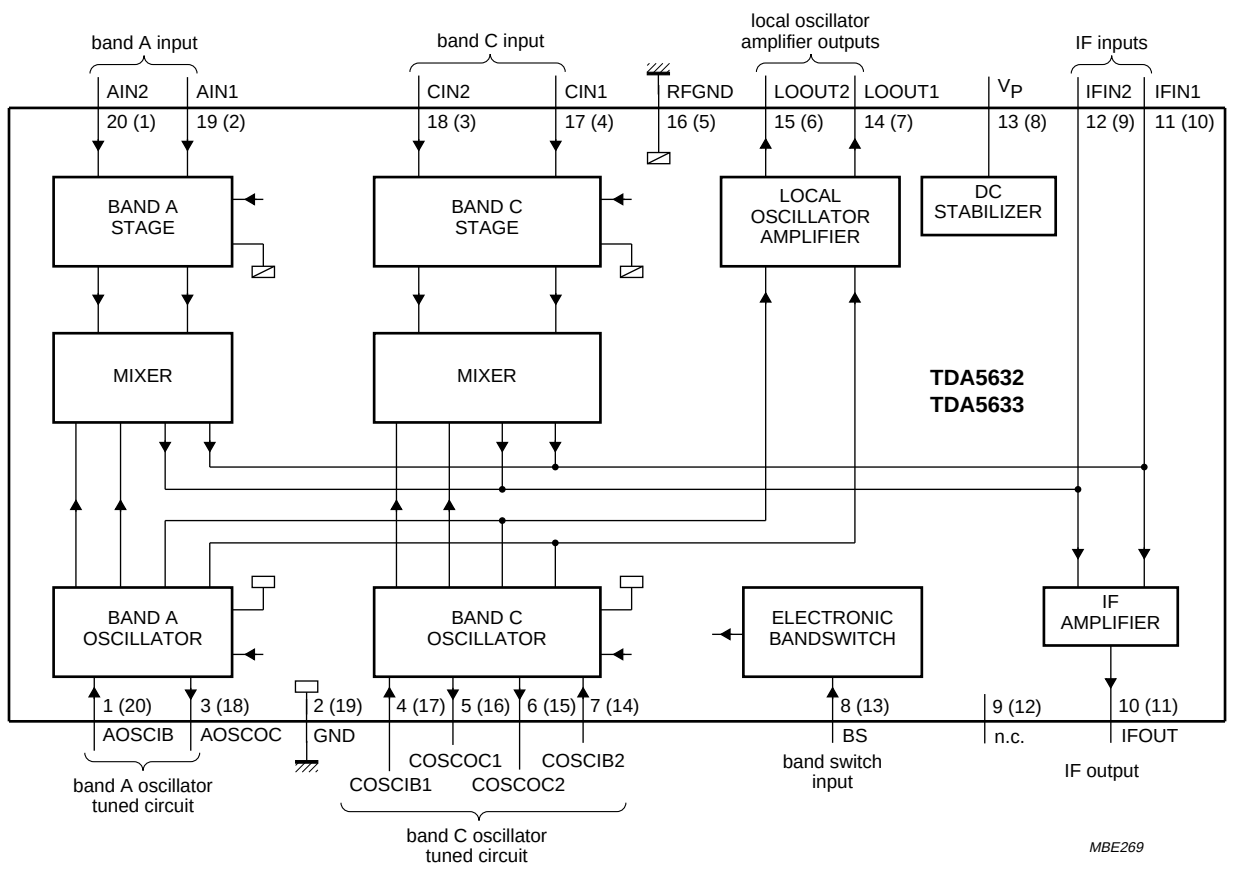
Note

1. The limits are related to the tank circuits used in Fig.10 and the intermediate frequency. Frequency bands may be adjusted by the choice of external components. Another UHF frequency range is available by modifying the tank circuit. The modification enables the following frequency range:
   a) RF frequencies from 361.25 to 801.25 MHz (picture carrier).
   b) Oscillator frequencies from 407 to 847 MHz. For this UHF range, L4 = 3 turns (diameter = 3.5 mm).

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA5632T	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
TDA5632M	SSOP20	plastic shrink small outline package; 20 leads; body width 4.4 mm	SOT266-1
TDA5633T	SO20	plastic small outline package; 20 leads; body width 7.5 mm	SOT163-1
TDA5633M	SSOP20	plastic shrink small outline package; 20 leads; body width 4.4 mm	SOT266-1

BLOCK DIAGRAM



The pin numbers in parenthesis represent the TDA5633.

Fig.1 Block diagram.

PINNING

SYMBOL	PIN		DESCRIPTION
	TDA5632	TDA5633	
AOSCIB	1	20	band A oscillator input base
GND	2	19	ground (0 V)
AOSCOC	3	18	band A oscillator output collector
COSCIB1	4	17	band C oscillator input base 1
COSCOC1	5	16	band C oscillator output collector 1
COSCOC2	6	15	band C oscillator output collector 2
COSCIB2	7	14	band C oscillator input base 2
BS	8	13	band switch input
n.c.	9	12	not connected
IFOUT	10	11	IF amplifier output
IFIN1	11	10	IF amplifier input 1
IFIN2	12	9	IF amplifier input 2
V_P	13	8	supply voltage
LOOUT1	14	7	local oscillator amplifier output 1
LOOUT2	15	6	local oscillator amplifier output 2
RFGND	16	5	ground for RF inputs
CIN1	17	4	band C input 1
CIN2	18	3	band C input 2
AIN1	19	2	band A input 1
AIN2	20	1	band A input 2

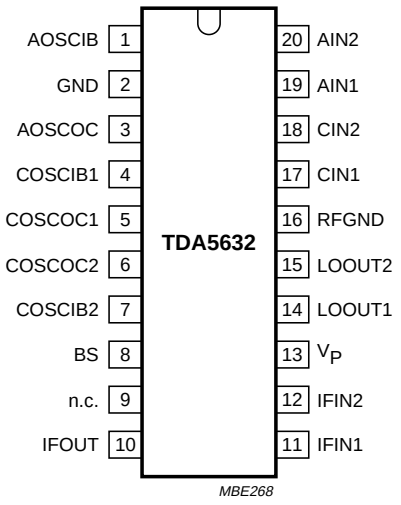


Fig.2 Pin configuration (TDA5632).

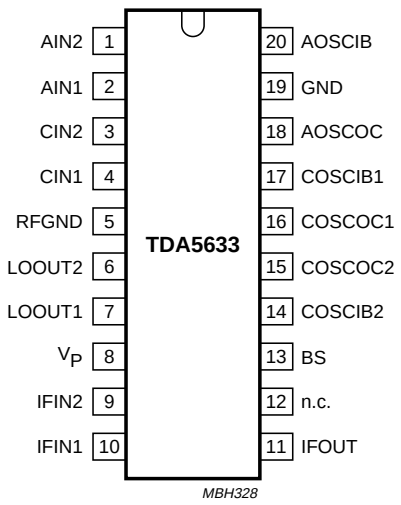


Fig.3 Pin configuration (TDA5633).

LIMITING VALUES

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

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_P	supply voltage	–0.3	+10.5	V
V_{SW}	switching voltage	0	10.5	V
I_O	output current of each pin referenced to ground	–	–10	mA
t_{sc}	maximum short-circuit time (all pins)	–	10	s
T_{stg}	IC storage temperature	–55	+150	°C
T_{amb}	operating ambient temperature	–20	+85	°C
T_j	junction temperature	–	+150	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient in free air		
	SOT163-1	80	K/W
	SOT266-1	120	K/W

HANDLING

Human body model: the IC withstands 2000 V in accordance with the *“UZW-B0/FQ-A302”*; specification equivalent to the “*MIL-STD-883C, category B*”; R = 1.5 kΩ; C = 100 pF.

Machine model: the IC withstands 200 V in accordance with the *“UZW-B0/FQ-B302” (date of issue: Nov 6th, 1990)*; R = 0 Ω; C = 200 pF.

IF AMPLIFIER CHARACTERISTICS

V_P = 9 V; T_{amb} = 25 °C; measured at 43.5 MHz; measured in circuit of Fig.10; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
S_{22}	output reflection coefficient	f_{IF} = 43.5 MHz; see Fig.9	–	–13.1	–	dB
		f_{IF} = 43.5 MHz; see Fig.9	–	2.9	–	deg
		f_{IF} = 58.75 MHz; see Fig.9	–	–13.1	–	dB
		f_{IF} = 58.75 MHz; see Fig.9	–	2.2	–	deg
Z_O	output impedance	f_{IF} = 43.5 MHz; see Fig.9	–	78.4	–	Ω
		f_{IF} = 43.5 MHz; see Fig.9	–	1.8	–	Ω
		f_{IF} = 58.75 MHz; see Fig.9	–	78.4	–	Ω
		f_{IF} = 58.75 MHz; see Fig.9	–	–1.4	–	Ω

CHARACTERISTICS

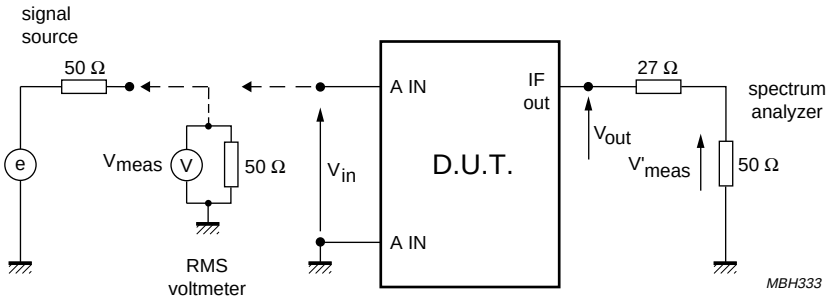
V_P = 9 V; T_{amb} = 25 °C; measured in circuit of Fig.10; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Supply						
V_P	supply voltage		8.1	9.0	9.9	V
I_P	supply current		–	40	48	mA
V_{SW}	switching voltage	band A	0	–	2.0	V
		band C	3.0	–	5.0	V
I_{SW}	switching current	band A	–	–	2	µA
		band C	–	–	10	µA
Band A mixer including IF amplifier						
f_{RF}	frequency range	note 1	57.5	–	357.5	MHz
G_v	voltage gain	f_{RF} = 57.5 MHz; R_L = 75 Ω; see Fig.4	16.5	19	21.5	dB
		f_{RF} = 357.5 MHz; R_L = 75 Ω; see Fig.4	16.5	19	21.5	dB
NF	noise figure	f_{RF} = 50 MHz; R_L = 75 Ω; see Fig.5	–	7.5	9.5	dB
		f_{RF} = 150 MHz; R_L = 75 Ω; see Fig.5	–	8.5	10.5	dB
		f_{RF} = 300 MHz; R_L = 75 Ω	–	10	12.5	dB
V_o	output voltage causing 1% cross modulation in channel	f_{RF} = 57.5 MHz; R_L = 75 Ω; see Fig.6	107	110	–	dBµV
		f_{RF} = 357.5 MHz; R_L = 75 Ω; see Fig.6	107	110	–	dBµV
V_i	input voltage causing 10 kHz pulling in channel	f_{RF} = 357.5 MHz; R_L = 75 Ω; see note 2	–	91	–	dBµV
g_{os}	optimum source conductance for noise figure	f_{RF} = 50 MHz; R_L = 75 Ω	–	0.5	–	mS
		f_{RF} = 150 MHz; R_L = 75 Ω	–	1.1	–	mS
		f_{RF} = 300 MHz; R_L = 75 Ω	–	1.9	–	mS
g_i	input conductance	f_{RF} = 57.5 MHz	–	0.27	–	mS
		f_{RF} = 357.5 MHz	–	0.68	–	mS
C_i	input capacitance	f_{RF} = 57.5 to 357.5 MHz; R_L = 75 Ω	–	2	–	pF
Band A oscillator						
f_{osc}	frequency range	note 3	101	–	401	MHz
f_{shift}	frequency shift	ΔV_P = 10%; note 4	–	–	200	kHz
f_{drift}	frequency drift	ΔT = 25 °C with no compensation; NP0 capacitors; note 5	–	–	1200	kHz
		5 s to 15 min after switch on; note 6	–	–	400	kHz

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Band C mixer including IF amplifier						
f_{RF}	frequency range	note 1	469.5	–	887.5	MHz
G_v	voltage gain	f_{RF} = 469.50 MHz; R_L = 75 Ω; see Fig.7	27	30	33	dB
		f_{RF} = 887.5 MHz; R_L = 75 Ω; see Fig.7	27	30	33	dB
NF	noise figure (not corrected for image)	f_{RF} = 469.50 MHz; R_L = 75 Ω	–	7.5	9.5	dB
		f_{RF} = 887.5 MHz; R_L = 75 Ω	–	9.5	11.5	dB
V_o	output voltage causing 1% cross modulation in channel	f_{RF} = 887.5 MHz; R_L = 75 Ω; see Fig.8	107	110	–	dBμV
Z_i	input impedance (R_s + L_s)	R_s; f_{RF} = 469.50 MHz	–	30	–	Ω
		L_s; f_{RF} = 887.5 MHz	–	12	–	nH
V_i	input voltage causing 10 kHz pulling in channel	R_L = 75 Ω; note 2	–	82	–	dBμV
Band C oscillator						
f_{osc}	frequency range	note 3	513	–	931	MHz
f_{shift}	frequency shift	ΔV_P = 10%; note 4	–	–	500	kHz
f_{drift}	frequency drift	ΔT = 25 °C with compensation; note 5	–	–	900	kHz
		5 s to 15 min after switching on; note 6	–	–	400	kHz
LO output						
V_O	output voltage	R_L = 50 Ω	83	91	100	dBμV
SRF	spurious signal on LO output with respect to LO output signal	R_L = 50 Ω; note 7	–	–14	–10	dB
SHD	LO signal harmonics with respect to LO signal	R_L = 50 Ω	–	–11	–10	dB

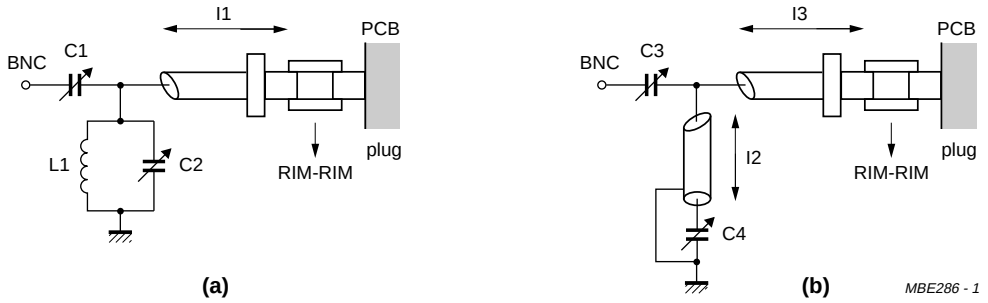
Notes

1. The RF frequency range is defined by the oscillator frequency range and the intermediate frequency.
2. The input level causing 10 kHz detuning at the LO output; $f_{osc} = f_{RF}$ + 43.5 MHz.
3. Limits are related to the tank circuit used in Fig.10. Frequency bands may be adjusted by the choice of external components. Another UHF frequency range is available by modifying the tank circuit. The modification enables the following frequency range:
   a) RF frequencies from 363.5 to 803.5 MHz.
   b) Oscillator frequencies from 407 to 847 MHz. For this UHF range, L4 = 3 turns (diameter = 3.5 mm).
4. The frequency shift is defined as the change in oscillator frequency when the supply voltage varies from V_P = 9 to 8.1 V or V_P = 9 to 9.9 V.
5. The frequency drift is defined as the change in oscillator frequency when the ambient temperature varies from T_{amb} = 25 to 0 °C or T_{amb} = 25 to 50 °C.
6. Switch on drift is defined as the change in oscillator frequency between 5 s and 15 min after switch on.
7. SRF: spurious signal on LO output with respect to LO signal:
   a) RF voltage level = 1 V at f_{RF} = 57.5 to 225 MHz.
   b) RF level = 2.5 dBm at f_{RF} = 225 to 357.5 MHz.
   c) RF level = –10 dBm at f_{RF} = 469.5 to 887.5 MHz.



$Z_i >> 50\ \Omega$ => $V_{in} = 2V_{meas}$ (V_{in} = 80 dBµV); $V_{out} = V'_{meas} \times \frac{50 + 27}{50}$; voltage gain for band A = 20 log $\frac{V_{out}}{V_{in}}$.

Fig.4 Band A gain measurement.



(a) For f_{RF} = 50 MHz:

mixer A frequency response measured = 57 MHz, loss = 0 dB

image suppression = 16 dB.

C1 = 9 pF.

C2 = 15 pF.

L1 = 7 turns (5.5 mm, wire diameter = 0.5 mm).

l1 = rigid cable (RIM): 5 cm long
(rigid cable (RIM); 33 dB/100 m; 50 Ω, 96 pF/m).

(b) For f_{RF} = 150 MHz:

mixer A frequency response measured = 150.3 MHz, loss = 1.3 dB

image suppression = 13 dB.

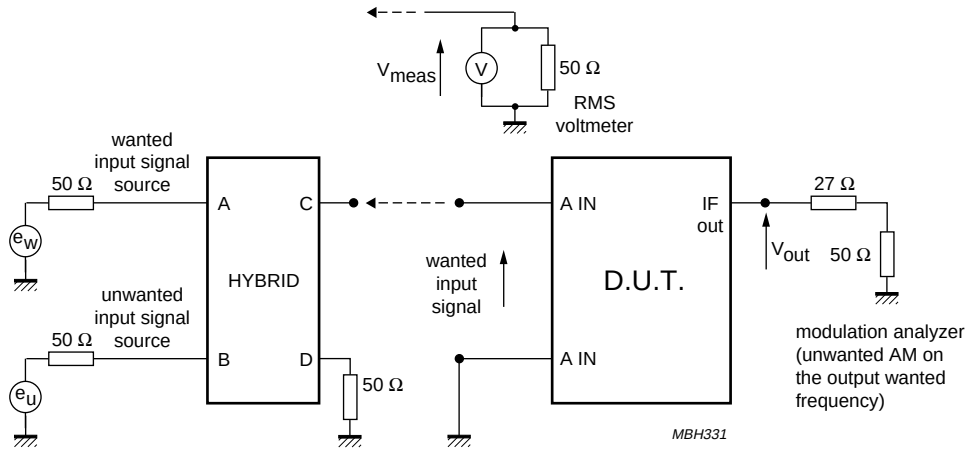
C3 = 5 pF.

C4 = 25 pF.

l2 = rigid cable (RIM): 30 cm long.

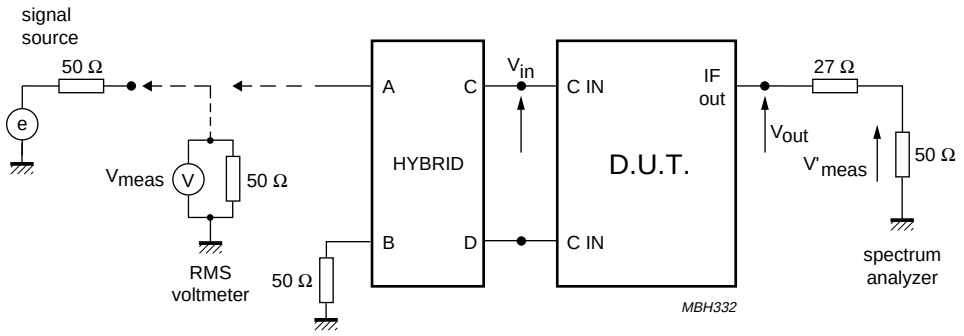
l3 = rigid cable (RIM): 5 cm long
(rigid cable (RIM); 33 dB/100 m; 50 Ω; 96 pF/m).

Fig.5 Input circuit for minimum noise figure.



Wanted input signal = 80 dBμV; Z_i >> 50 Ω = > wanted input signal = $2V_{meas}$; unwanted input signal modulated with 30% AM;
$V_{oA(IF)}$ = unwanted output signal V_{out} when the output wanted signal is modulated with 0.3% AM.
Measurement at 57.5 MHz: f_{wanted} = 55.25 MHz (80 dBμV), $f_{unwanted}$ = 59.75 MHz 30% modulated with 100 kHz, f_{osc} = 101 MHz.
Measurement at 357.5 MHz: f_{wanted} = 355.25 MHz (80 dBμV), $f_{unwanted}$ = 359.75 MHz 30% modulated with 100 kHz, f_{osc} = 401 MHz.

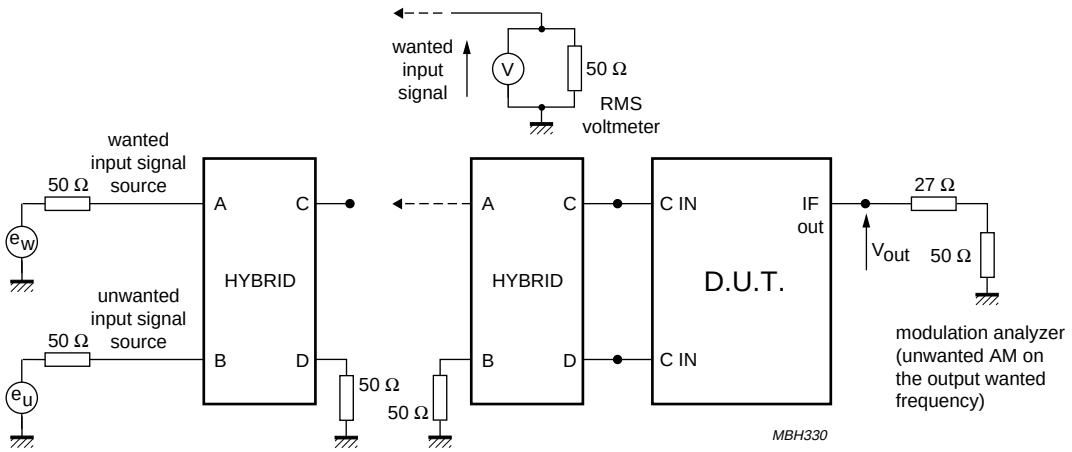
Fig.6 Band A 1% cross modulation.



$V_{in} = V_{meas}$ – loss of the hybrid; (V_{in} = 70 dBμV); loss of the hybrid = 1 dB;

$V_{out} = V'_{meas} \times \frac{50 + 27}{50}$; voltage gain for band C = 20 log $\frac{V_{out}}{V_{in}}$.

Fig.7 Band C gain measurement.



Wanted input signal = 70 dBμV; unwanted input signal modulated with 30% AM; $V_{oA(IF)}$ = unwanted output signal V_{out} when the wanted output signal is modulated with 0.3% AM.

Measurement at 887.5 MHz: f_{wanted} = 885.25 MHz (80 dBμV), $f_{unwanted}$ = 889.75 MHz 30% modulated with 100 kHz, f_{osc} = 931 MHz.

Fig.8 Band C 1% cross modulation.

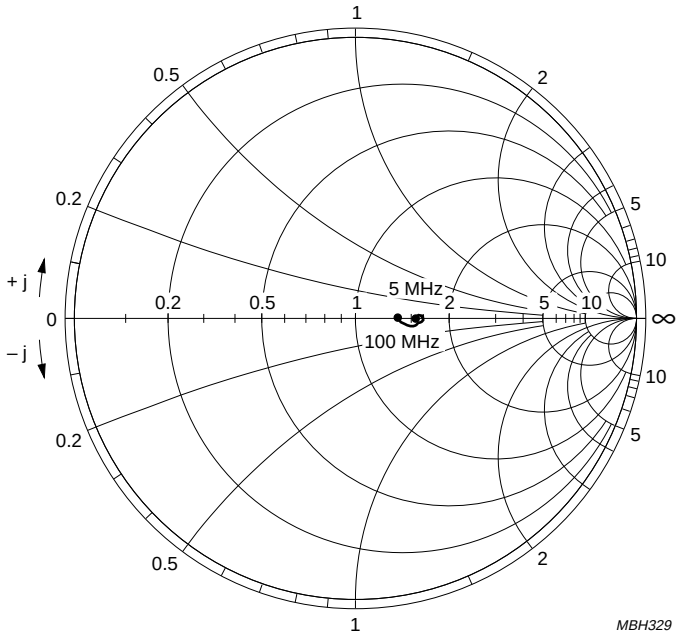
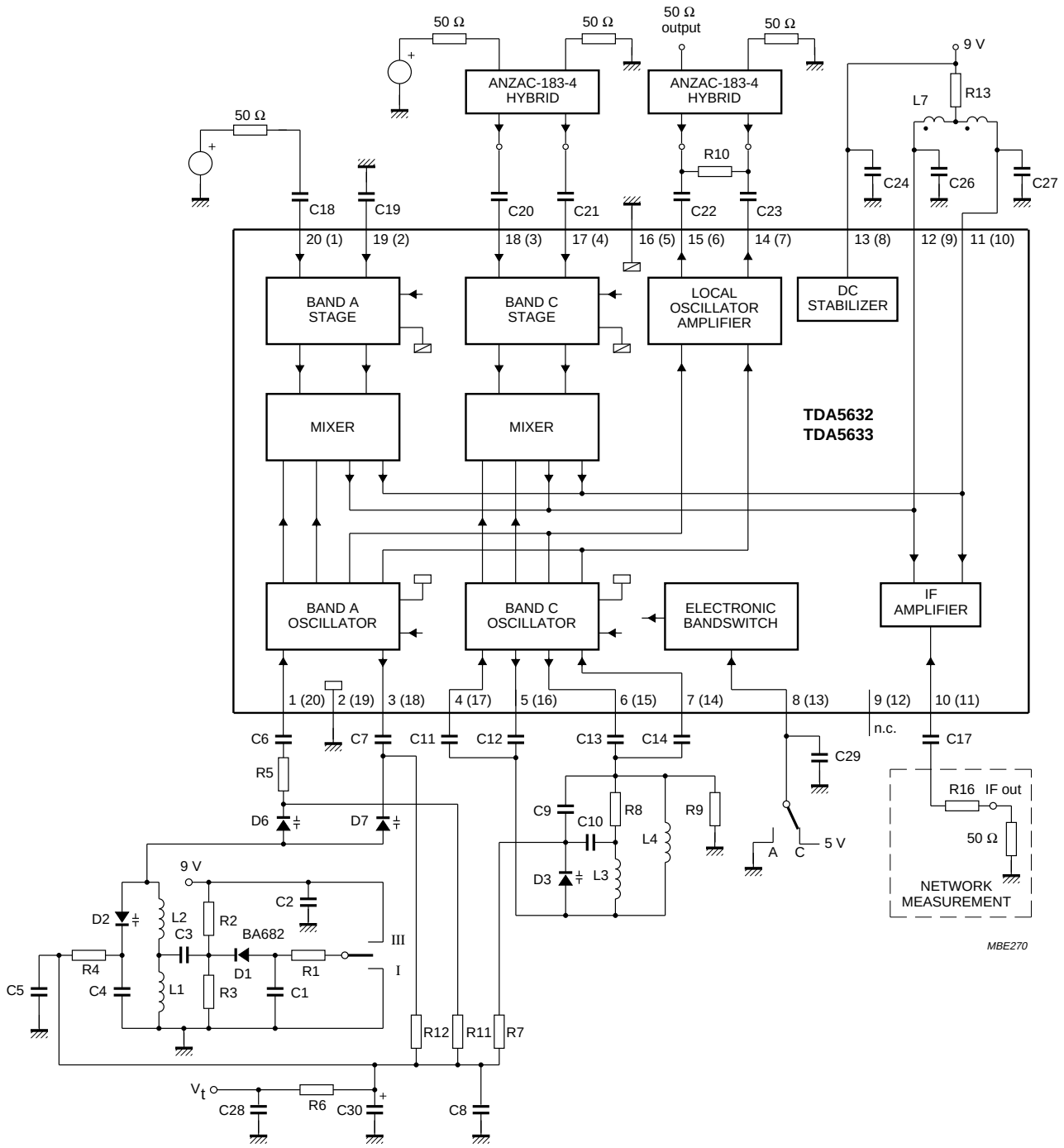


Fig.9 Output impedance (S22) of the IF amplifier (Z chart; Z_o = 50 Ω).

APPLICATION INFORMATION



The pin numbers in parenthesis represent the TDA5633.

Fig.10 Measurement circuit.

Application diagram component values

Table 1 Capacitors (all SMD and NP0 except C9, C11 to C14 and C30)

NUMBER	VALUE
C1	1 nF
C2	1 nF
C3	1 nF
C4	56 pF
C5	2.2 nF
C6	2 pF
C7	4 pF
C8	2.2 nF
C9	6 pF (N470)
C10	100 pF
C11	1 pF (N750)
C12	1 pF (N750)
C13	1 pF (N750)
C14	1 pF (N750)
C17	1 nF
C18	1 nF
C19	1 nF
C20	1 nF
C21	1 nF
C22	1 nF
C23	1 nF
C24	1 nF
C26	15 pF
C27	15 pF
C28	2.2 nF
C29	1 nF
C30	1 μF (40 V electrolytic capacitor)

Table 2 Resistors (all SMD)

NUMBER	VALUE
R1	10 Ω
R2	12 kΩ
R3	2.7 kΩ
R4	47 kΩ
R5	56 Ω
R6	47 kΩ
R7	22 kΩ
R8	2.2 kΩ
R9	22 kΩ
R10	100 Ω
R11	47 kΩ
R12	47 kΩ
R13	150 Ω
R16	27 Ω

Table 3 Diodes and coils

NUMBER	VALUE
Diodes	
D1	BA682
D2	BB133
D3	BB134
D6	BB131
D7	BB131
Coils(1)	
L1	6 t (4 mm)
L2	3 t (3.5 mm)
L3	2 t (2.5 mm)
L4	3 t (2.5 mm)

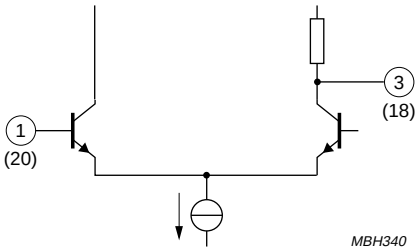
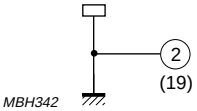
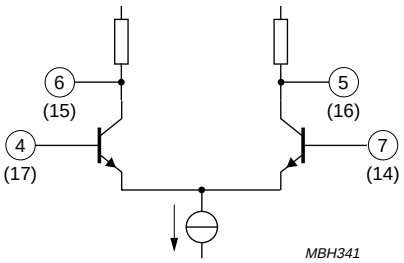
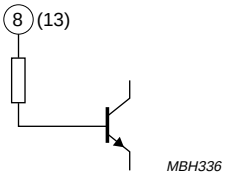
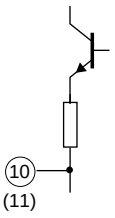
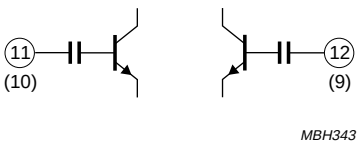
Note

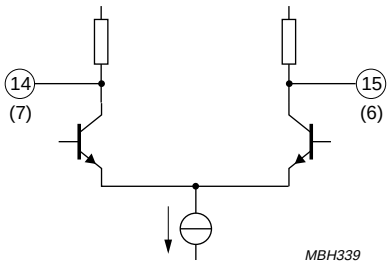
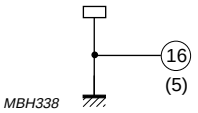
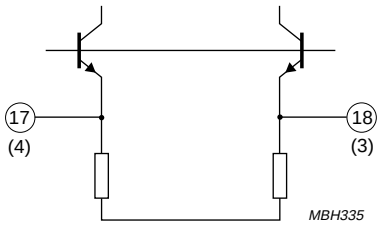
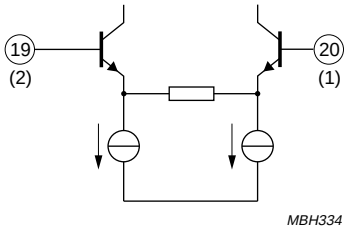
1. Wire size for L1 to L4 is 0.4 mm.

Transformer (L7 = 2 × 5 t)

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

INTERNAL PIN CONFIGURATION

SYMBOL	PIN		DESCRIPTION	AVERAGE DC VOLTAGE (V)[1]	
	TDA5632	TDA5633		BAND A	BAND C
AOSCIB	1	20		2.20	NR[2]
AOSCOC	3	18		3.90	NR[2]
GND	2	19		0	0
COSCIB1	4	17		NR[2]	2.35
COSCOC1	5	16		NR[2]	4.30
COSCOC2	6	15		NR[2]	4.30
COSCIB2	7	14		NR[2]	2.35
BS	8	13		0.0	5.0
n. c.	9	12		NR[2]	NR[2]
IFOUT	10	11		3.85	3.85
IFIN1	11	10		8.36	8.36
IFIN2	12	9		8.36	8.36

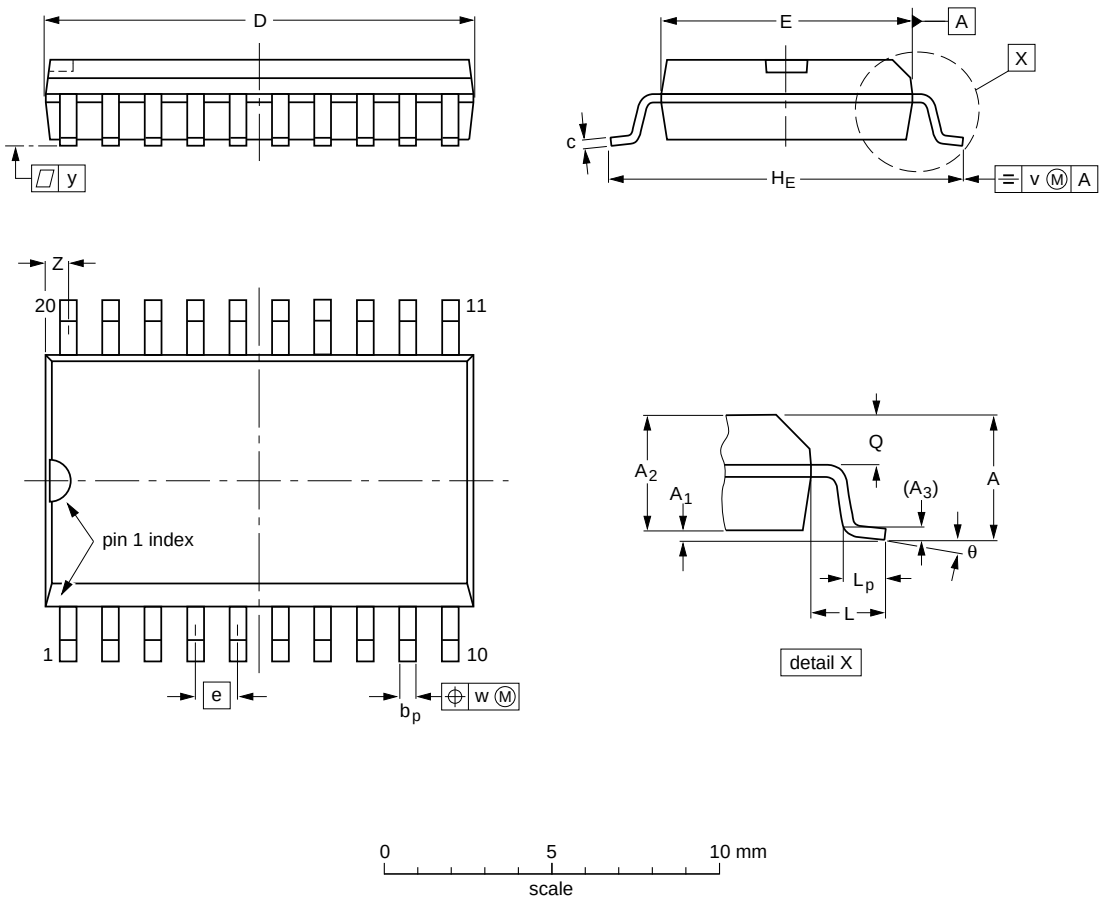
SYMBOL	PIN		DESCRIPTION	AVERAGE DC VOLTAGE (V)(1)	
	TDA5632	TDA5633		BAND A	BAND C
V_P	13	8	supply voltage	9.0	9.0
LOOUT1	14	7		7.35	7.35
LOOUT2	15	6		7.35	7.35
RFGND	16	5		0.0	0.0
CIN1	17	4		NR(2)	2.20
CIN2	18	3		NR(2)	2.20
AIN1	19	2		2.25	NR(2)
AIN2	20	1		2.25	NR(2)

Notes

1. Average DC voltage measured in Fig.10.
2. NR = not relevant.

PACKAGE OUTLINES

SO20: plastic small outline package; 20 leads; body width 7.5 mm **SOT163-1**



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

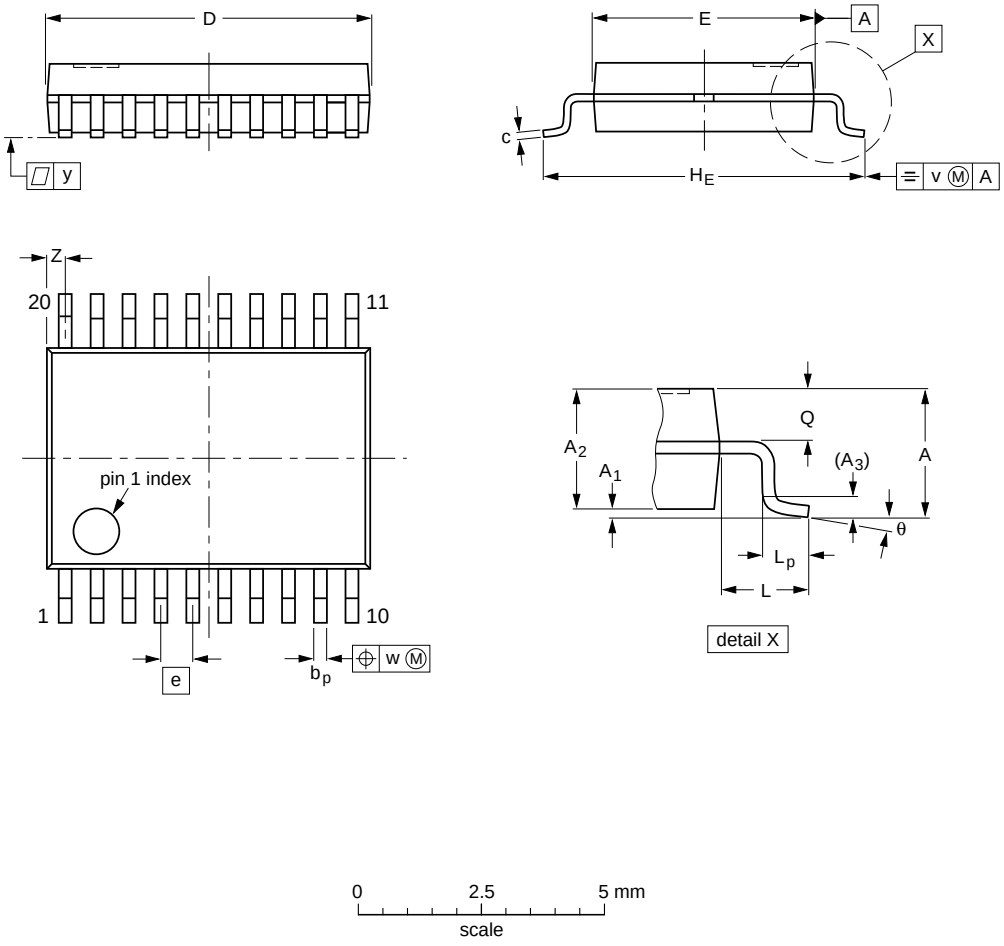
UNIT	A max.	A_1	A_2	A_3	b_p	c	D (1)	E (1)	e	H_E	L	L_p	Q	v	w	y	Z (1)	θ
mm	2.65	0.30 0.10	2.45 2.25	0.25	0.49 0.36	0.32 0.23	13.0 12.6	7.6 7.4	1.27	10.65 10.00	1.4	1.1 0.4	1.1 1.0	0.25	0.25	0.1	0.9 0.4	8^o 0^o
inches	0.10	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.51 0.49	0.30 0.29	0.050	0.42 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

SSOP20: plastic shrink small outline package; 20 leads; body width 4.4 mm **SOT266-1**



DIMENSIONS (mm are the original 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	1.5	0.15 0	1.4 1.2	0.25	0.32 0.20	0.20 0.13	6.6 6.4	4.5 4.3	0.65	6.6 6.2	1.0	0.75 0.45	0.65 0.45	0.2	0.13	0.1	0.48 0.18	10^o 0^o

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				
SOT266-1							~~90-04-05~~ 95-02-25

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 and SSOP 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

SO

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.

SSOP

Wave soldering is **not** recommended for SSOP packages. This is because of the likelihood of solder bridging due to closely-spaced leads and the possibility of incomplete solder penetration in multi-lead devices.

If wave soldering cannot be avoided, the following conditions must be 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 and must incorporate solder thieves at the downstream end.**

Even with these conditions, only consider wave soldering SSOP packages that have a body width of 4.4 mm, that is SSOP16 (SOT369-1) or SSOP20 (SOT266-1).

METHOD (SO AND SSOP)

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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