INTEGRATED CIRCUITS

DATA SHEET

TDA7073A; TDA7073AT
Dual BTL power driver

Product specification
Supersedes data of 1994 July

1999 Aug 30

FEATURES

- No external components
- Very high slew rate
- Single power supply
- Short-circuit proof
- High output current (0.6 A)
- Wide supply voltage range
- Low output offset voltage
- Suited for handling PWM signals up to 176 kHz
- ESD protected on all pins.

GENERAL DESCRIPTION

The TDA7073A/AT are dual power driver circuits in a BTL configuration, intended for use as a power driver for servo systems with a single supply. They are specially designed for compact disc players and are capable of driving focus, tracking, sled functions and spindle motors.

Missing Current Limiter (MCL)

A MCL protection circuit is built-in. The MCL circuit is activated when the difference in current between the output terminal of each amplifier exceeds 100 mA (typical 300 mA). This level of 100 mA allows for headphone applications (single-ended).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	positive supply voltage range		3.0	5.0	18	V
G_v	voltage gain		32.5	33.5	34.5	dB
I_P	total quiescent current	V_P = 5 V; $R_L = \infty$	–	8	16	mA
SR	slew rate		–	12	–	V/μs
I_O	output current		–	–	0.6	A
I_{bias}	input bias current		–	100	300	nA
f_{co}	cut-off frequency	–3 dB	–	1.5	–	MHz

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA7073A	DIP16	plastic dual in-line package; 16 leads (300 mil); long body	SOT38-1
TDA7073AT	SO16	plastic small outline package; 16 leads; body width 7.5 mm	SOT162-1

BLOCK DIAGRAM

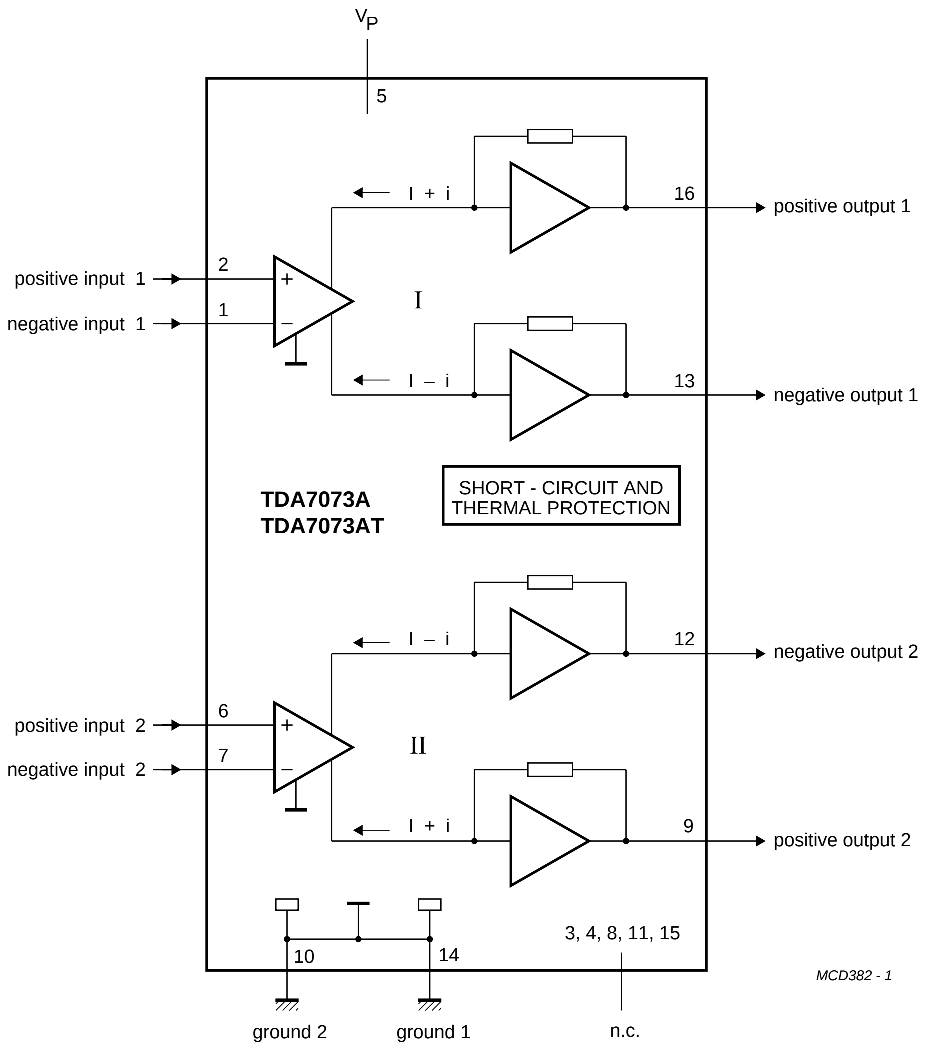


Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
IN1–	1	negative input 1
IN1+	2	positive input 1
n.c.	3	not connected
n.c.	4	not connected
V_P	5	positive supply voltage
IN2+	6	positive input 2
IN2–	7	negative input 2
n.c.	8	not connected
OUT2+	9	positive output 2
GND2	10	ground 2
n.c.	11	not connected
OUT2–	12	negative output 2
OUT1–	13	negative output 1
GND1	14	ground 1
n.c.	15	not connected
OUT1+	16	positive output 1

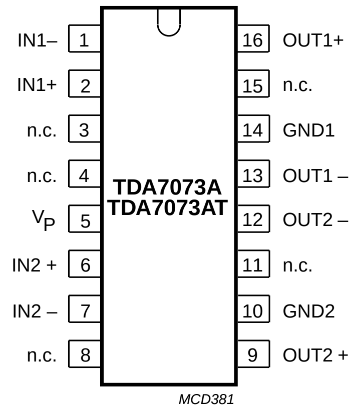


Fig.2 Pin configuration.

FUNCTIONAL DESCRIPTION

The TDA7073A/AT are dual power driver circuits in a BTL configuration, intended for use as a power driver for servo systems with a single supply. They are particular designed for compact disc players and are capable of driving focus, tracking, sled functions and spindle motors.

Because of the BTL configuration, the devices can supply a bi-directional DC current in the load, with only a single supply voltage. The voltage gain is fixed by internal feedback at 33.5 dB and the devices operate in a wide supply voltage range (3 to 18 V). The devices can supply a maximum output current of 0.6 A. The outputs can be short-circuited over the load, to the supply and to ground at all input conditions. The differential inputs can handle common mode input voltages from ground level up to (V_P – 2.2 V with a maximum of 10 V). The devices have a very high slew rate. Due to the large bandwidth, they can handle PWM signals up to 176 kHz.

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_P	positive supply voltage range		–	18	V
I_{ORM}	repetitive peak output current		–	1	A
I_{OSM}	non repetitive peak output current		–	1.5	A
P_{tot}	total power dissipation				
	TDA7073A	T_{amb} < 25 °C	–	2.5	W
	TDA7073AT	T_{amb} < 25 °C	–	1.32	W
T_{stg}	storage temperature range		–55	+150	°C
T_{vj}	virtual junction temperature		–	150	°C
T_{sc}	short-circuit time	see note 1	–	1	hr

Note

1. The outputs can be short-circuited over the load, to the supply and to ground at all input conditions.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ (j\text{-}a)}$	from junction to ambient			
	TDA7073A	in free air; note 1	50	K/W
	TDA7073AT	in free air; note 2	95	K/W

Notes

1. TDA7073A: V_P = 5 V; R_L = 8 Ω; The typical voltage swing = 5.8 V and V_{loss} is 2.1 V therefore I_O = 0.36 A and $P_{tot} = 2 \times 0.76$ W = 1.52 W; $T_{amb\ (max)} = 150 - 1.52 \times 50 = 74$ °C.
2. TDA7073AT: V_P = 5 V; R_L = 16 Ω; typical voltage swing = 5.8 V and V_{loss} is 2.1 V therefore I_O = 0.18 A and $P_{tot} = 2 \times 0.38$ W = 0.76 W; $T_{amb\ (max)} = 150 - 0.76 \times 95 = 77$ °C.

CHARACTERISTICS

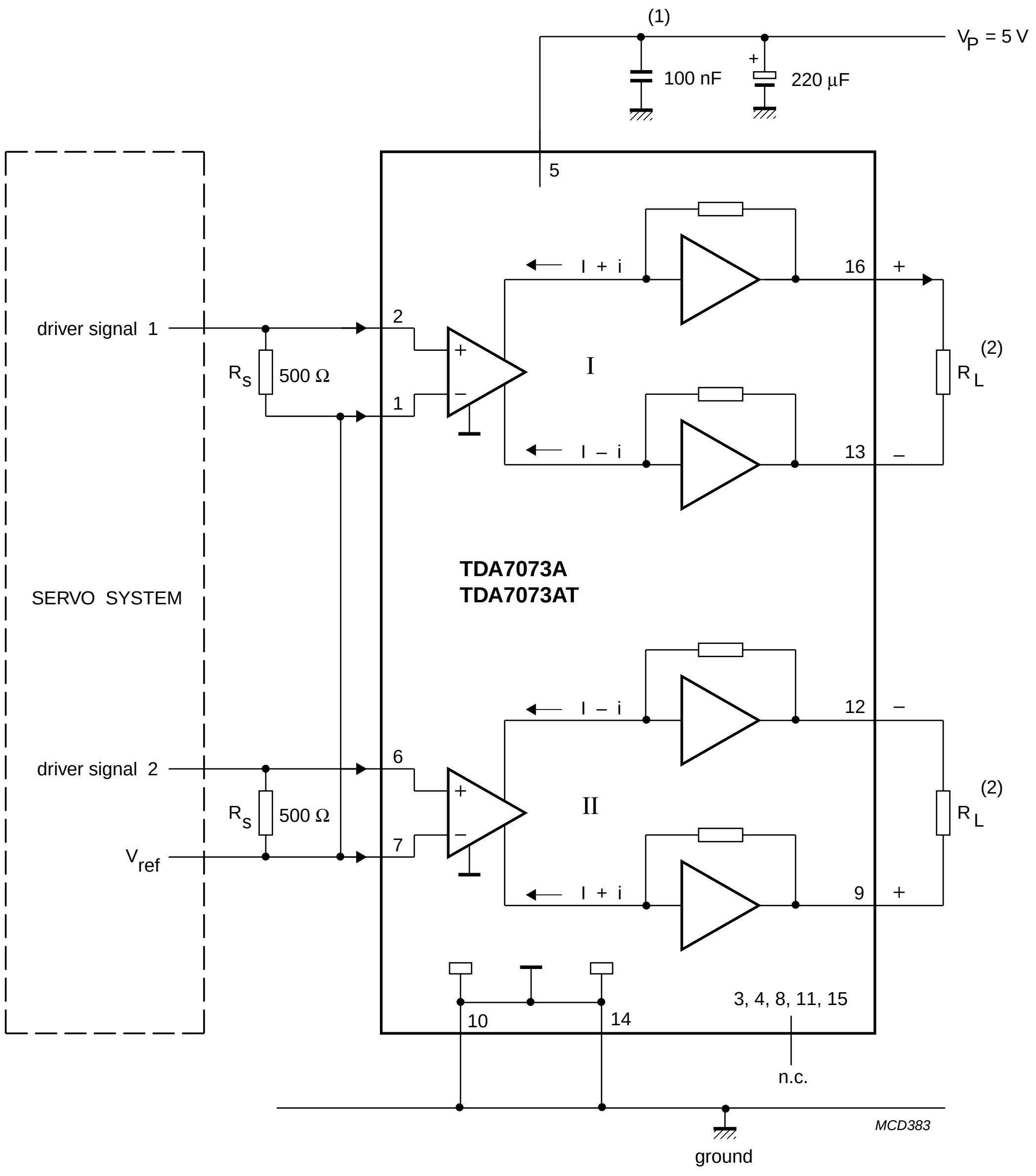
V_P = 5 V; f = 1 kHz; T_{amb} = 25 °C; unless otherwise specified (see Fig.3). TDA7073A: R_L = 8 Ω; TDA7073AT: R_L = 16 Ω.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_P	positive supply voltage range		3.0	5.0	18	V
I_{ORM}	repetitive peak output current		–	–	0.6	A
I_P	total quiescent current	V_P = 5 V; R_L = ∞; note 1	–	8	16	mA
ΔV_{OUT}	output voltage swing	note 2	5.2	5.8	–	V
THD	total harmonic distortion					
	TDA7073A	V_{OUT} = 1 V (RMS)	–	0.3	–	%
	TDA7073AT	V_{OUT} = 1 V (RMS)	–	0.1	–	%
G_v	voltage gain		32.5	33.5	34.5	dB
$V_{no(rms)}$	noise output voltage (RMS value)	note 3	–	75	150	μV
B	bandwidth		–	–	1.5	MHz
SVRR	supply voltage ripple rejection	note 4	38	55	–	dB
$\lvert\Delta V_{16\text{-}13,12\text{-}9}\rvert$	DC output offset voltage	R_S = 500 Ω	–	–	100	mV
$V_{I(CM)}$	DC common mode voltage range	note 5	0	–	2.8	V
CMRR	DC common mode rejection ratio	note 6	–	100	–	dB
Z_I	input impedance		–	100	–	kΩ
I_{bias}	input bias current		–	100	300	nA
α	channel separation		40	50	–	dB
$\lvert\Delta GV\rvert$	channel unbalance		–	–	1	dB
SR	slew rate		–	12	–	V/μs

Notes

1. With a load connected to the outputs the quiescent current will increase, the maximum value of this increase being equal to the DC output offset voltage divided by R_L.
2. The output voltage swing is typically limited to 2 × (V_P – 2.1 V) (see Fig.4).
3. The noise output voltage (RMS value), unweighted (20 Hz to 20 kHz) is measured with R_S = 500 Ω.
4. The ripple rejection is measured with R_S = 0 Ω and f = 100 Hz to 10 kHz. The ripple voltage of 200 mV (RMS value) is applied to the positive supply rail.
5. The DC common mode voltage range is limited to (V_P – 2.2 V with a maximum of 10 V).
6. The common mode rejection ratio is measured at V_{ref} = 1.4 V, $V_{I(CM)}$ = 200 mV and f = 1 kHz.

APPLICATION INFORMATION



(1) This capacitor can be omitted if the 220 µF electrolytic capacitor is connected close to pin 5.

(2) R_L can be: focus, tracking, sled function or spindle motor.

Fig.3 Test and application diagram.

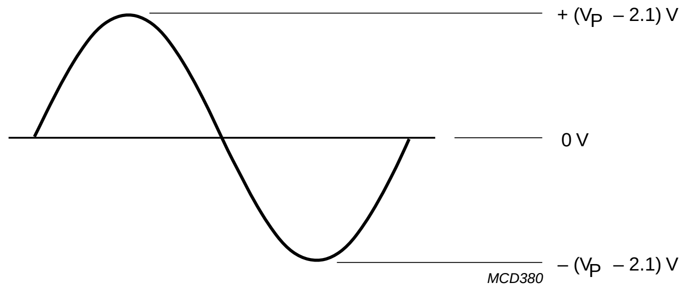
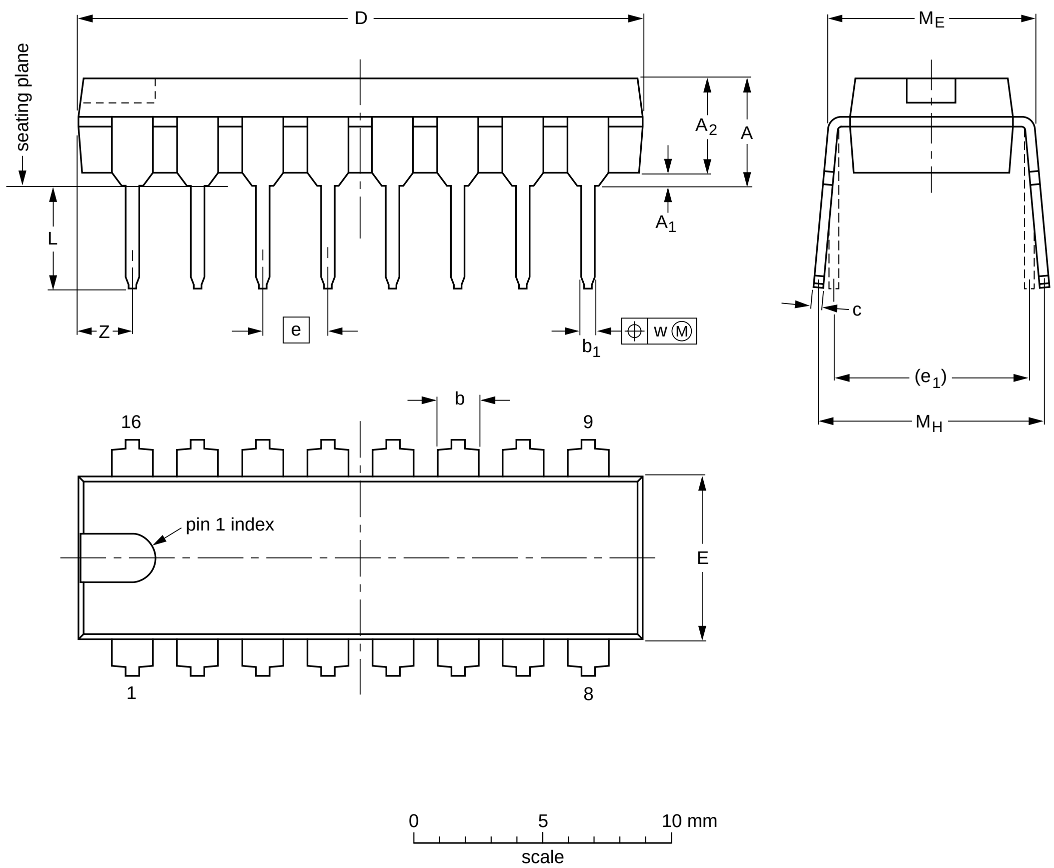


Fig.4 Typical output voltage swing over R_L.

PACKAGE OUTLINES

DIP16: plastic dual in-line package; 16 leads (300 mil); long body **SOT38-1**



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

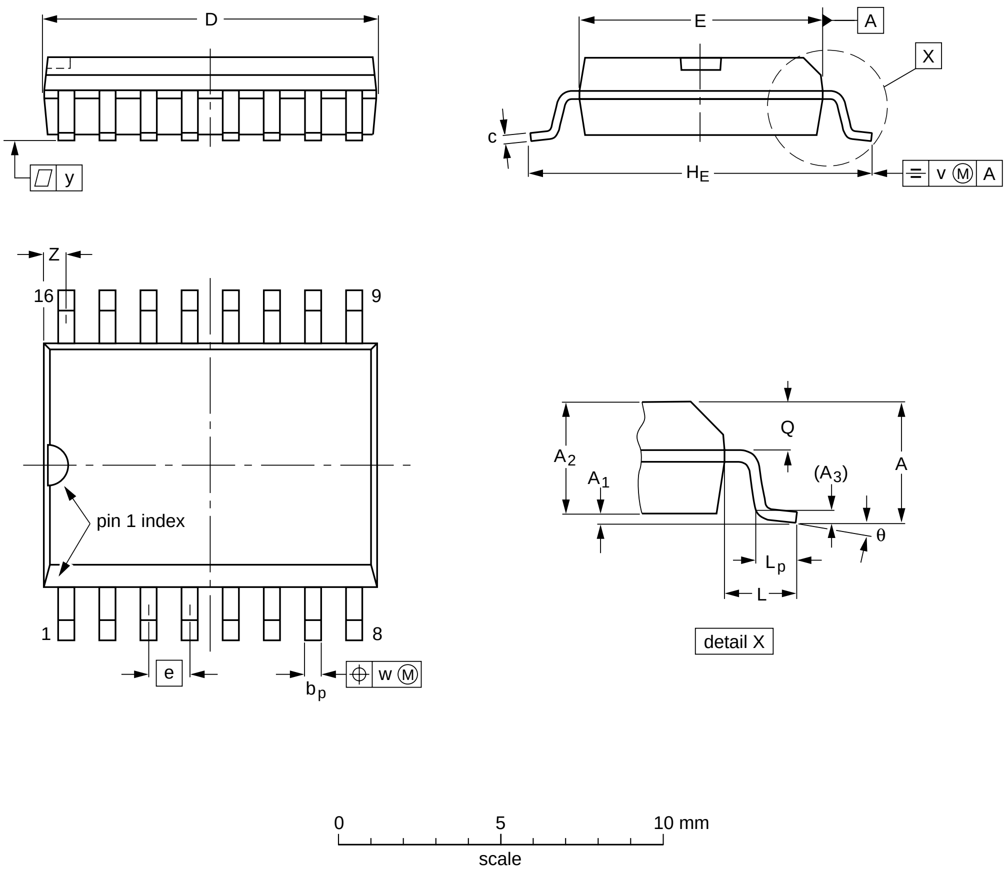
UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D [(1)]	E [(1)]	e	e_1	L	M_E	M_H	w	Z [(1)] max.
mm	4.7	0.51	3.7	1.40 1.14	0.53 0.38	0.32 0.23	21.8 21.4	6.48 6.20	2.54	7.62	3.9 3.4	8.25 7.80	9.5 8.3	0.254	2.2
inches	0.19	0.02	0.15	0.055 0.045	0.021 0.015	0.013 0.009	0.86 0.84	0.26 0.24	0.1	0.3	0.15 0.13	0.32 0.31	0.37 0.33	0.01	0.087

Note

1. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT38-1	050G09	MO-001	SC-503-16			~~99-12-27~~ 03-02-13

SO16: plastic small outline package; 16 leads; body width 7.5 mm **SOT162-1**



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	0.3 0.1	2.45 2.25	0.25	0.49 0.36	0.32 0.23	10.5 10.1	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	0.1	0.012 0.004	0.096 0.089	0.01	0.019 0.014	0.013 0.009	0.41 0.40	0.30 0.29	0.05	0.419 0.394	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 (0.006 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT162-1	075E03	MS-013				~~99-12-27~~ 03-02-19

SOLDERING

Introduction

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"Data Handbook IC26; Integrated Circuit Packages"* (document order number 9398 652 90011).

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

Through-hole mount packages

SOLDERING BY DIPPING OR BY SOLDER WAVE

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joints for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg(max)}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

MANUAL SOLDERING

Apply the soldering iron (24 V or less) to the lead(s) of the package, either below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

Surface mount packages

REFLOW SOLDERING

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 methods exist for reflowing; for example, infrared/convection heating in a conveyor type oven. Throughput times (preheating, soldering and cooling) vary between 100 and 200 seconds depending on heating method.

Typical reflow peak temperatures range from 215 to 250 °C. The top-surface temperature of the packages should preferable be kept below 230 °C.

WAVE SOLDERING

Conventional single wave soldering is not recommended for surface mount devices (SMDs) or printed-circuit boards with a high component density, as solder bridging and non-wetting can present major problems.

To overcome these problems the double-wave soldering method was specifically developed.

If wave soldering is used the following conditions must be observed for optimal results:

- Use a double-wave soldering method comprising a turbulent wave with high upward pressure followed by a smooth laminar wave.
- For packages with leads on two sides and a pitch (e):
  - larger than or equal to 1.27 mm, the footprint longitudinal axis is **preferred** to be parallel to the transport direction of the printed-circuit board;
  - smaller than 1.27 mm, the footprint longitudinal axis **must** be parallel to the transport direction of the printed-circuit board.

  The footprint must incorporate solder thieves at the downstream end.
- For packages with leads on four sides, the footprint must be placed at a 45° angle to the transport direction of the printed-circuit board. The footprint must incorporate solder thieves downstream and at the side corners.

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.

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.

MANUAL SOLDERING

Fix the component by first soldering two diagonally-opposite end leads. Use a low voltage (24 V or less) soldering iron 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.

Suitability of IC packages for wave, reflow and dipping soldering methods

MOUNTING	PACKAGE	SOLDERING METHOD		
		WAVE	**REFLOW**(1)	**DIPPING**
Through-hole mount	DBS, DIP, HDIP, SDIP, SIL	suitable(2)	–	suitable
Surface mount	BGA, LFBGA, SQFP, TFBGA	not suitable	suitable	–
	HLQFP, HSQFP, HSOP, HTQFP, HTSSOP, SMS	not suitable(3)	suitable	–
	PLCC(4), SO, SOJ	suitable	suitable	–
	LQFP, QFP, TQFP	not recommended(4)(5)	suitable	–
	SSOP, TSSOP, VSO	not recommended(6)	suitable	–

Notes

1. All surface mount (SMD) packages are moisture sensitive. Depending upon the moisture content, the maximum temperature (with respect to time) and body size of the package, there is a risk that internal or external package cracks may occur due to vaporization of the moisture in them (the so called popcorn effect). For details, refer to the Drypack information in the *“Data Handbook IC26; Integrated Circuit Packages; Section: Packing Methods”*.
2. For SDIP packages, the longitudinal axis must be parallel to the transport direction of the printed-circuit board.
3. These packages are not suitable for wave soldering as a solder joint between the printed-circuit board and heatsink (at bottom version) can not be achieved, and as solder may stick to the heatsink (on top version).
4. If wave soldering is considered, then the package must be placed at a 45° angle to the solder wave direction. The package footprint must incorporate solder thieves downstream and at the side corners.
5. Wave soldering is only suitable for LQFP, QFP and TQFP packages with a pitch (e) equal to or larger than 0.8 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.65 mm.
6. Wave soldering is only suitable for SSOP and TSSOP packages with a pitch (e) equal to or larger than 0.65 mm; it is definitely not suitable for packages with a pitch (e) equal to or smaller than 0.5 mm.

DATA SHEET STATUS

DOCUMENT STATUS(1)	PRODUCT STATUS(2)	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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