DATA SHEET

TDA8008
Dual multiprotocol smart card coupler

Objective specification
File under Integrated Circuits, IC02

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Dual multiprotocol smart card coupler TDA8008

FEATURES

- 8xC51 core with 16 kbytes or EPROM (TDA8008), 256 bytes RAM, 512 bytes AUXRAM, Timer 0, 1, 2 and enhanced UART
- Specific ISO 7816 UART, accessible with MOVX instructions for automatic convention processing, variable baud rate through frequency or division ratio programming, error management at character level for T = 0 protocol, extra guard time register
- Dual V_{CC} generation (5 V ±5% or 3 V ±5%), maximum current of 60 mA with controlled rise and fall times
- Dual cards clock generation (up to 10 MHz) with two times synchronous frequency doubling
- Cards clock STOP HIGH or LOW or 1.25 MHz (from an integrated oscillator) for cards power reduction mode
- Automatic activation and deactivation sequences through an independent sequencer
- Supports the asynchronous protocols T = 0 and T = 1 in accordance with ISO 7816 and EMV
- Versatile 24-bit time-out counter for Answer To Reset (ATR) and waiting times processing
- 22 ETU counter for block guard time
- Supports synchronous cards
- Current limitations on cards contacts
- Special circuitry for killing spikes during power-on or off
- Supply supervisor for Power-on reset
- Step-up converter (supply voltage from 2.7 to 5.5 V at 16 MHz), doubler, tripler or follower according to V_{CC} and V_{DD}
- Speed up to 25 MHz at V_{DD} = 5 V
- Additional I/O pin allowing the use of the ISO 7816 UART for an external card interface (pin IOAUX)
- Additional interrupt pin allowing detection of level toggling on an external signal (pin INTAUX)
- Fast and efficient swapping between the 3 cards due to separate buffering of parameters for each card
- Chip select input allowing use of several devices in parallel and memory space paging
- Enhanced ESD protections on card contacts (6 kV min.)
- Software library for easy integration within the application
- Development tool with a TDA8007B and a regular emulator.

APPLICATIONS

- Multiple smart card readers for multiprotocol applications (EMV banking, digital pay TV, access control, etc.).

GENERAL DESCRIPTION

The TDA8008 is a complete, one-chip, low cost dual smart card coupler.

It can be used as the kernel of a multiple card reader. It can handle all ISO 7816, EMV and GSM11-11 requirements. The integrated ISO 7816 UART and the time-out counters allow easy use even at high baud rates with no real time constraints. Due to its chip select and external I/O and interrupt features, it simplifies the realization of any number of cards reader. It gives the cards and the set a very high level of security, due to its special hardware against ESD, short-circuiting, power failure and overheating. Its integrated step-up converter allows operation within a supply voltage range of 2.7 to 5.5 V at 16 MHz.

The OTP version of the TDA8008 allows fast and reliable software development and fast product introduction.

A software library has been developed, that can handle all actions required for T = 0, T = 1 and synchronous protocols.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
TDA8008HL	LQFP80	plastic low profile quad flat package; 80 leads; body 12 × 12 × 1.4 mm	SOT315-1

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DD}	supply voltage	$V_{DDD} = V_{DDA} = V_{DDP}$	2.7	–	5.5	V
$I_{DD(pd)}$	supply current in Power-down mode	V_{DD} = 3.3 V; cards inactive; 8xC51 controller in power-down mode; note 1	–	–	tbf	µA
$I_{DD(sm)}$	supply current in sleep mode	V_{DD} = 3.3 V; cards active at V_{CC} = 5V; clock stopped; 8xC51 controller in Idle mode; note 1	–	–	tbf	mA
$I_{DD(om)}$	supply current in operating mode	V_{DD} = 3.3 V; f_{XTAL1} = 20 MHz $V_{CC1} = V_{CC2}$ = 5 V; $I_{CC1} + I_{CC2}$ = 80 mA; note 1	–	–	tbf	mA
V_{CC}	card output supply voltage	including static loads (5 V card)	4.75	5.0	5.25	V
		with 40 nAs dynamic loads on 200 nF capacitor (5 V card)	4.6	5.0	5.4	V
		including static loads (3 V card)	2.80	3.0	3.20	V
		with 40 nAs dynamic loads on 200 nF capacitor (3 V card)	2.75	3.0	3.25	V
I_{CC}	card output supply current	operating	–	–	65	mA
		overload detection	–	80	–	mA
$I_{CC1} + I_{CC2}$	sum of both cards currents		–	–	80	mA
SR	slew rate on V_{CC} (rise and fall)	C_L = 300 nF (max.)	0.10	0.16	0.22	V/µs
t_{de}	deactivation cycle duration		–	–	100	µs
t_{act}	activation cycle duration		–	–	225	µs
f_{XTAL}	crystal frequency		3.5	–	25	MHz
f_{op}	operating frequency	external frequency applied to pin XTAL1	0	–	25	MHz
T_{amb}	ambient temperature		–25	–	+85	°C

Note

1. I_{DD} in all configurations includes the current at pins V_{DDD}, V_{DDA} and V_{DDP}.

BLOCK DIAGRAM

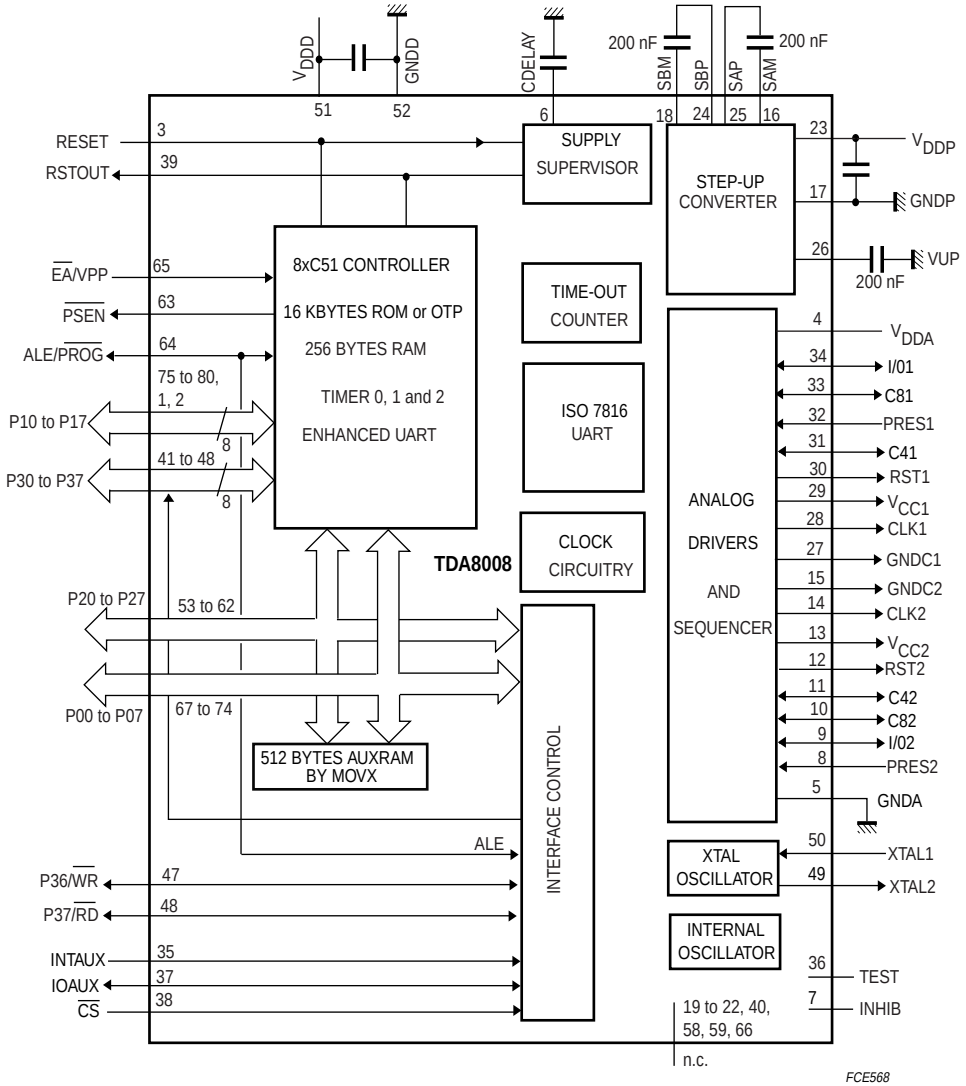


Fig.1 Block diagram.

PINNING

SYMBOL	PIN	DESCRIPTION
P16	1	8xC51 general purpose I/O port
P17	2	8xC51 general purpose I/O port
RESET	3	reset input: a HIGH on this pin for 2 machine cycles while the oscillator is running, resets the device. An internal diffused resistor connected to GNDD permits a Power-on reset using an external capacitor connected to V_{DDD}.
V_{DDA}	4	analog supply voltage
GNDA	5	analog ground
CDELAY	6	pin for an external delay capacitor
INHIB	7	test pin (must be left open-circuit in the application)
PRES2	8	card 2 presence contact input (active HIGH or LOW by mask option)
IO2	9	data line to/from card 2 (ISO C7 contact)
C82	10	auxiliary I/O for ISO C8 contact for card 2 (i.e. synchronous cards)
C42	11	auxiliary I/O for ISO C4 contact for card 2 (i.e. synchronous cards)
RST2	12	card 2 reset output (ISO C2 contact)
V_{CC2}	13	card 2 output supply voltage (ISO C1 contact)
CLK2	14	clock output of card 2 (ISO C3 contact)
GNDC2	15	ground for card 2
SAM	16	contact 2 for the step-up converter (connect a low ESR 220 nF capacitor between pins SAP and SAM)
GNDP	17	ground for the step-up converter
SBM	18	contact 4 for the step-up converter (connect a low ESR 220 nF capacitor between pins SBP and SBM)
n.c.	19	not connected
n.c.	20	not connected
n.c.	21	not connected
n.c.	22	not connected
V_{DDP}	23	supply voltage for the step-up converter
SBP	24	contact 3 for the step-up converter (connect a low ESR 220 nF capacitor between pins SBP and SBM)
SAP	25	contact 1 for the step-up converter (connect a low ESR 220 nF capacitor between pins SAP and SAM)
VUP	26	output of the step-up converter
GNDC1	27	ground for card 1
CLK1	28	clock output of card 1 (ISO C3 contact)
V_{CC1}	29	card 1 output supply voltage (ISO C1 contact)
RST1	30	card 1 reset output (ISO C2 contact)
C41	31	auxiliary I/O for ISO C4 contact for card 1 (i.e. synchronous cards)
PRES1	32	card 1 presence contact input (active HIGH or LOW by mask option)
C81	33	auxiliary I/O for ISO C8 contact for card 1 (i.e. synchronous cards)
IO1	34	data line to and from card 1 (ISO C7 contact)
INTAUX	35	auxiliary interrupt input

SYMBOL	PIN	DESCRIPTION
TEST	36	test pin (must be left open-circuit in the application)
IOAUX	37	input or output for an I/O line issued on an auxiliary smart card interface
$\overline{CS}$	38	chip select input (active LOW)
RSTOUT	39	open-drain output for resetting external chips
n.c.	40	not connected
P30/RXD	41	8xC51 general purpose I/O port/serial input port
P31/TXD	42	8xC51 general purpose I/O port/serial output port
P32/$\overline{INT0}$	43	8xC51 general purpose I/O port/external interrupt 0
P33/$\overline{INT1}$	44	8xC51 general purpose I/O port/external interrupt 1
P34/T0	45	8xC51 general purpose I/O port/Timer 0 external input
P35/T1	46	8xC51 general purpose I/O port/Timer 1 external input
P36/$\overline{WR}$	47	8xC51 general purpose I/O port/external data memory write strobe
P37/$\overline{RD}$	48	8xC51 general purpose I/O port/external data memory read strobe
XTAL2	49	connection pin for an external crystal (output from the inverting oscillator amplifier)
XTAL1	50	connection pin for an external crystal, or input for an external clock signal (input to the inverting oscillator amplifier and input to the internal clock generator circuits)
V_{DDD}	51	digital supply voltage
GNDD	52	digital ground
P20/A8	53	8xC51 general purpose I/O port/address 8
P21/A9	54	8xC51 general purpose I/O port/address 9
P22/A10	55	8xC51 general purpose I/O port/address 10
P23/A11	56	8xC51 general purpose I/O port/address 11
P24/A12	57	8xC51 general purpose I/O port/address 12
n.c.	58	not connected
n.c.	59	not connected
P25/A13	60	8xC51 general purpose I/O port/address 13
P26/A14	61	8xC51 general purpose I/O port/address 14
P27/A15	62	8xC51 general purpose I/O port/address 15
$\overline{PSEN}$	63	Program store enable output: this is the read strobe to the external program memory. When executing code from the external program memory, $\overline{PSEN}$ is activated twice each machine cycle, except that two $\overline{PSEN}$ activations are skipped during each access to external data memory. $\overline{PSEN}$ is not activated during fetches from internal program memory.
ALE/$\overline{PROG}$	64	Address latch enable/program pulse: this is the output pulse for latching the low byte of the address during an access to external memory. In normal operation, ALE pulses are emitted at a constant rate of $\frac{1}{6}$ of the oscillator frequency and can be used for external timing or clocking. It should be noted that one ALE pulse is skipped during each access to external data memory. This pin is also the program pulse input ($\overline{PROG}$) during EPROM programming. ALE can be disabled by setting bit SFR Auxiliary 0. With this bit set, ALE will be active only during a MOVX instruction.

SYMBOL	PIN	DESCRIPTION
$\overline{EA}$/VPP	65	External access enable/programming supply voltage: $\overline{EA}$ must be externally held LOW to enable the device to fetch code from external program memory locations starting with 0000H. If $\overline{EA}$ is held HIGH, the device executes from the internal program memory unless the program counter contains an address greater than 3FFFH (16 kbytes boundary). This pin also receives the 12.75 V programming supply voltage (VPP) during EPROM programming. If security bit 1 is programmed, $\overline{EA}$ will be internally latched on reset.
n.c.	66	not connected
P07/AD7	67	8xC51 general purpose I/O port/address/data 7
P06/AD6	68	8xC51 general purpose I/O port/address/data 6
P05/AD5	69	8xC51 general purpose I/O port/address/data 5
P04/AD4	70	8xC51 general purpose I/O port/address/data 4
P03/AD3	71	8xC51 general purpose I/O port/address/data 3
P02/AD2	72	8xC51 general purpose I/O port/address/data 2
P01/AD1	73	8xC51 general purpose I/O port/address/data 1
P00/AD0	74	8xC51 general purpose I/O port/address/data 0
P10/T2	75	8xC51 general purpose I/O port/timer, counter 2 external count input and clock output
P11/T2EX	76	8xC51 general purpose I/O port/timer, counter 2 reload, capture and direction control
P12	77	8xC51 general purpose I/O port
P13	78	8xC51 general purpose I/O port
P14	79	8xC51 general purpose I/O port
P15	80	8xC51 general purpose I/O port

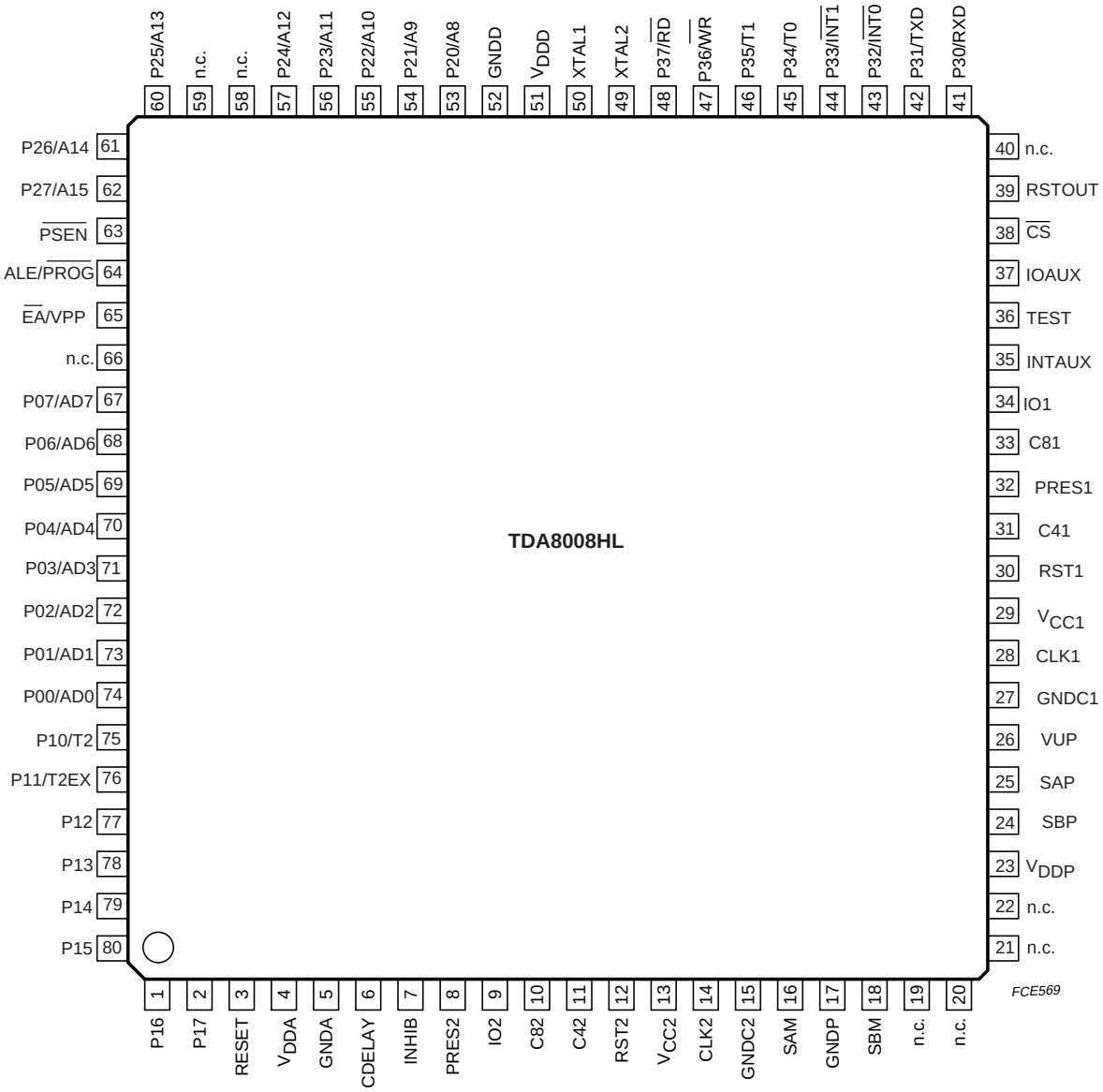
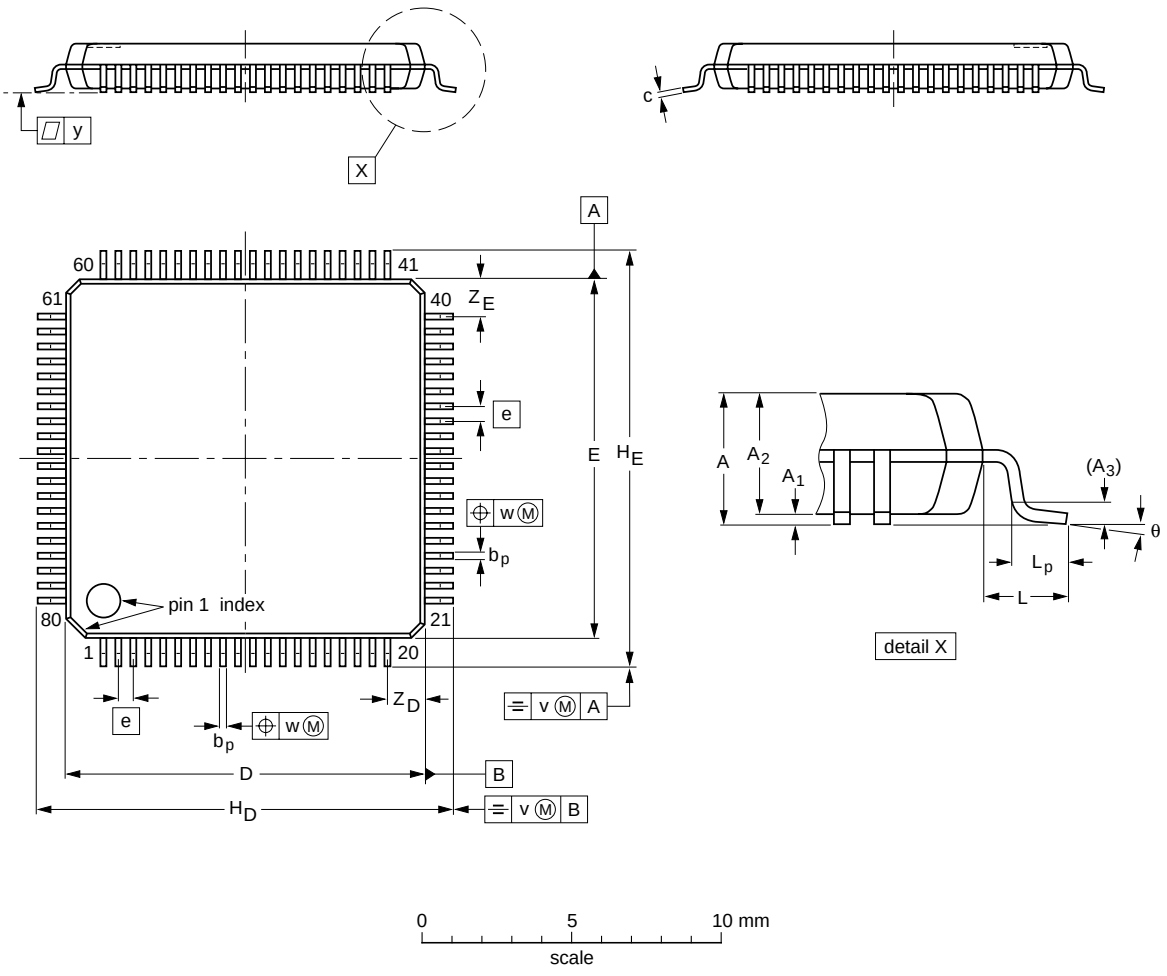


Fig.2 Pin configuration.

PACKAGE OUTLINE

LQFP80: plastic low profile quad flat package; 80 leads; body 12 x 12 x 1.4 mm **SOT315-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	H_D	H_E	L	L_p	v	w	y	$Z_D^{(1)}$	$Z_E^{(1)}$	θ
mm	1.6	0.16 0.04	1.5 1.3	0.25	0.27 0.13	0.18 0.12	12.1 11.9	12.1 11.9	0.5	14.15 13.85	14.15 13.85	1.0	0.75 0.30	0.2	0.15	0.1	1.45 1.05	1.45 1.05	7^o 0^o

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT315-1						~~95-12-19~~ 97-07-15

SOLDERING

Introduction to soldering surface mount packages

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 surface mount IC packages. 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.

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 surface mount IC packages for wave and reflow soldering methods

PACKAGE	SOLDERING METHOD	
	WAVE	REFLOW(1)
BGA, LFBGA, SQFP, TFBGA	not suitable	suitable
HBCC, HLQFP, HSQFP, HSOP, HTQFP, HTSSOP, SMS	not suitable(2)	suitable
PLCC(3), SO, SOJ	suitable	suitable
LQFP, QFP, TQFP	not recommended(3)(4)	suitable
SSOP, TSSOP, VSO	not recommended(5)	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. 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).
3. 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.
4. Wave soldering is only suitable for LQFP, TQFP and QFP 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.
5. 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.

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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