

# DATA SHEET

## **CGY2013G** GSM 4 W power amplifier

Preliminary specification  
Supersedes data of 1996 Jul 12  
File under Integrated Circuits, IC17

1998 Jan 23

**GSM 4 W power amplifier****CGY2013G****FEATURES**

- Power Amplifier (PA) overall efficiency 52%
- 35.5 dB gain
- 0 dBm input power
- Gain control range >55 dB
- Low output noise floor of PA < -130 dBm/Hz in GSM RX band
- Wide operating temperature range -20 to +85 °C
- LQFP 48 pin package
- Compatible with power ramping controller PCF5077
- Compatible with GSM RF transceiver SA1620.

**GENERAL DESCRIPTION**

The CGY2013G is a GSM class 4 GaAs Monolithic Microwave Integrated Circuit (MMIC) power amplifier specifically designed to operate at 3.6 V battery supply.

The PA requires only a 30 dB harmonic low-pass filter to comply with the GSM transmit spurious specification. It can be switched off and its power controlled by monitoring the actual drain voltage applied to the amplifier stages.

**APPLICATIONS**

- 880 to 915 MHz hand-held transceivers for E-GSM applications
- 900 MHz Time Division Multiple Access (TDMA) systems.

**QUICK REFERENCE DATA**

SYMBOL	PARAMETER <sup>(1)</sup>	MIN.	TYP.	MAX.	UNIT
V <sub>DD</sub>	positive supply voltage	-	3.6	-	V
I <sub>DD</sub>	positive peak supply current	-	2.4	-	A
P <sub>o(max)</sub>	maximum output power	-	35.5	-	dBm
T <sub>amb</sub>	operating ambient temperature	-20	-	+85	°C

**Note**

1. For conditions, see Chapters "AC characteristics" and "DC characteristics".

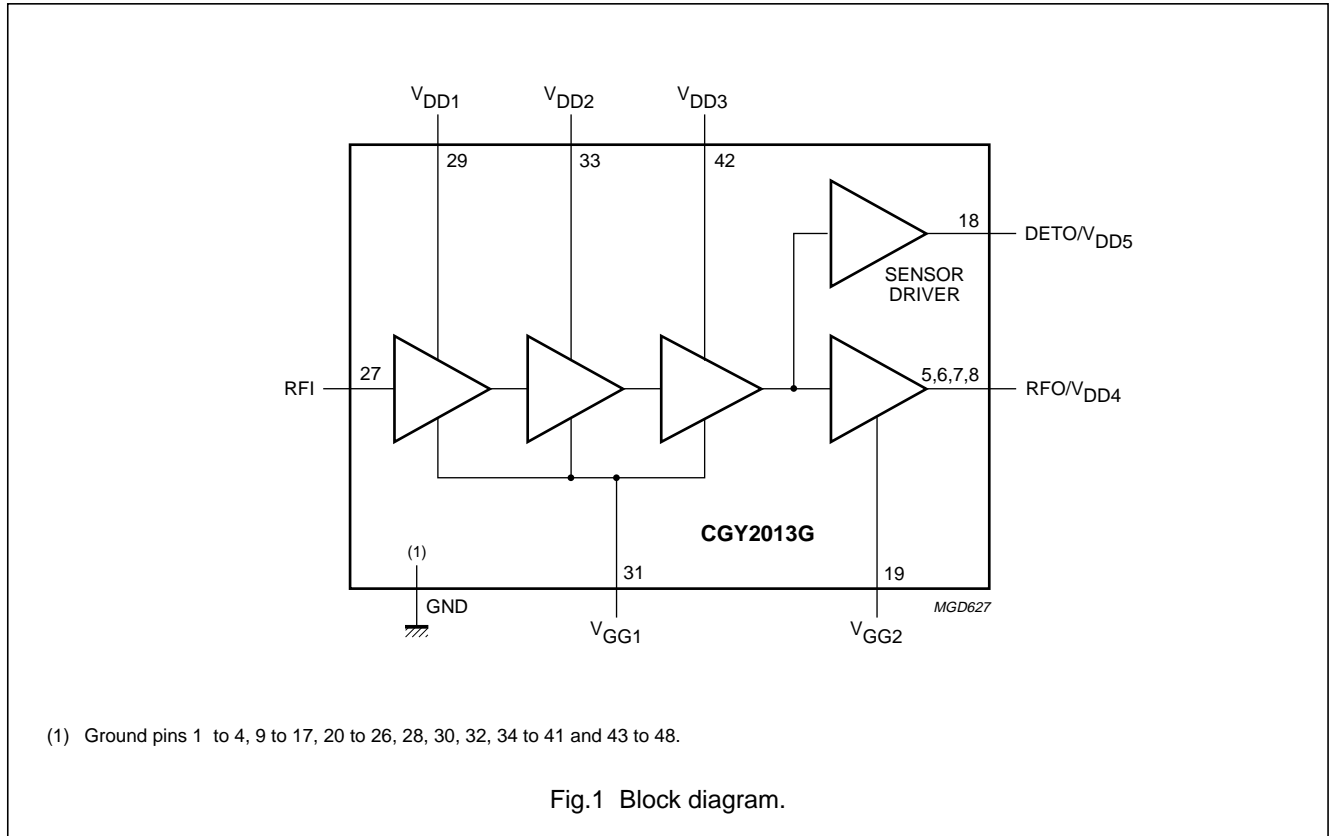
**ORDERING INFORMATION**

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
CGY2013G	LQFP48	plastic low profile quad flat package; 48 leads; body 7 × 7 × 1.4 mm	SOT313-2

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BLOCK DIAGRAM



PINNING

SYMBOL	PIN	DESCRIPTION
GND	1 to 4	ground
RFO/V <sub>DD4</sub>	5 to 8	power amplifier output and fourth stage supply voltage
GND	9 to 17	ground
DETO/V <sub>DD5</sub>	18	power sensor output and supply voltage
V <sub>GG2</sub>	19	fourth stage negative gate supply voltage
GND	20 to 26	ground
RFI	27	power amplifier input
GND	28	ground
V <sub>DD1</sub>	29	first stage supply voltage
GND	30	ground
V <sub>GG1</sub>	31	first three stages negative gate supply voltage
GND	32	ground
V <sub>DD2</sub>	33	second stage supply voltage
GND	34 to 41	ground
V <sub>DD3</sub>	42	third stage supply voltage
GND	43 to 48	ground

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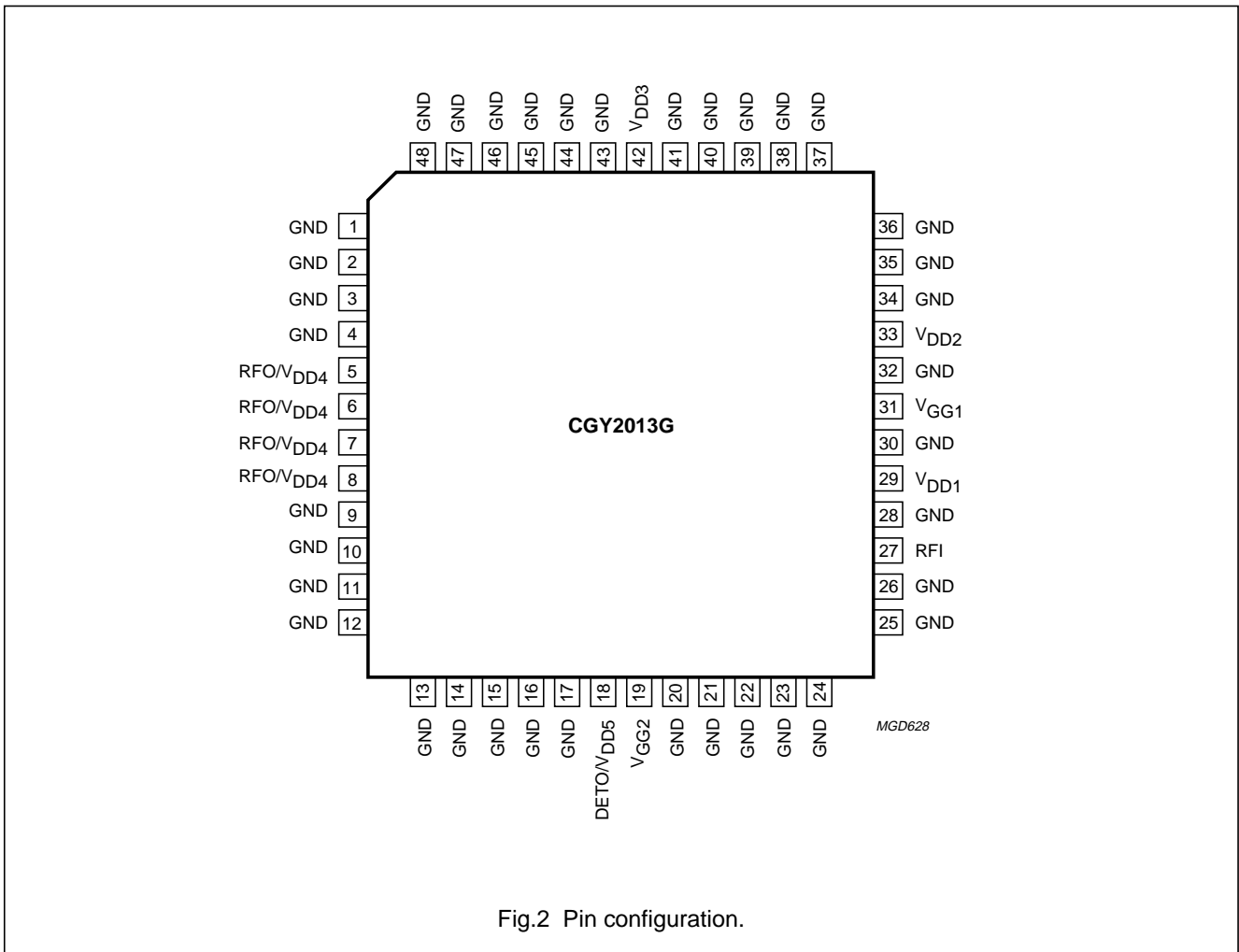


Fig.2 Pin configuration.

**FUNCTIONAL DESCRIPTION**

**Operating conditions**

The CGY2013G is designed to meet the European Telecommunications Standards Institute (ETSI) GSM documents, the "ETS 300 577 specification", which are defined as follows:

- $t_{on} = 542.8 \mu s$
- $T = 4.3 ms$
- Duty cycle = 1/8.

The device is specifically designed for pulse operation allowing the use of a LQFP48 plastic package.

**Power amplifier**

The power amplifier consists of four cascaded gain stages with an open-drain configuration. Each drain has to be loaded externally by an adequate reactive circuit which also has to be a DC path to the supply.

The amplifier bias is set using a negative voltage applied at pins  $V_{GG1}$  and  $V_{GG2}$ . This negative voltage must be present before the supply voltage is applied to the drains to avoid current overstress for the amplifier.

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**LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 134); general operating conditions applied.

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
$V_{DD}$	positive supply voltage	–	7	V
$V_{GG}$	negative supply voltage	–	–10	V
$T_{j(max)}$	maximum operating junction temperature	–	150	°C
$T_{stg}$	IC storage temperature	–	150	°C
$P_{tot}$	total power dissipation	–	1.5	W

**THERMAL CHARACTERISTICS**

General operating conditions applied.

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th\ j-c}$	thermal resistance from junction to case; note 1	25	K/W

**Note**

1. This thermal resistance is measured under GSM pulse conditions.

**DC CHARACTERISTICS**

$V_{DD} = 3.6\text{ V}$ ;  $T_{amb} = 25\text{ °C}$ ; general operating conditions applied; peak current values during burst; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Pins RFO/<math>V_{DD4}</math>, <math>V_{DD3}</math>, <math>V_{DD2}</math>, <math>V_{DD1}</math> and DETO/<math>V_{DD5}</math></b>						
$V_{DD}$	positive supply voltage		0	3.6	5.5	V
$I_{DD}$	positive peak supply current		–	2.4	3.0	A
<b>Pins <math>V_{GG1}</math> and <math>V_{GG2}</math></b>						
$V_{GG1}$	negative supply voltage	note 1	–	–1.8	–	V
$V_{GG2}$	negative supply voltage	note 1	–	–1.8	–	V
$I_{GG1} + I_{GG2}$	negative peak supply current		–	2.5	5	mA

**Note**

1. The negative bias  $V_{GG1}$  and  $V_{GG2}$  must be applied 10  $\mu\text{s}$  before the power amplifier is switched on, and must remain applied until the power amplifier has been switched off.

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**AC CHARACTERISTICS**

$V_{DD} = 3.6 \text{ V}$ ;  $T_{amb} = 25 \text{ }^\circ\text{C}$ ;  $V_{GG1} = V_{GG2} = -1.8 \text{ V}$ ; measured on Philips demoboard.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Power amplifier</b>						
$P_i$	input power		-2	-	+2	dBm
$f_{RF}$	RF frequency range		880	-	915	MHz
$P_{o(max)}$	maximum output power	$T_{amb} = 25 \text{ }^\circ\text{C}$ ; $V_{DD} = 3.6 \text{ V}$	33.5	35.5	-	dBm
		$T_{amb} = -20 \text{ to } +85 \text{ }^\circ\text{C}$ ; $V_{DD} = 3 \text{ V}$	32	-	-	dBm
$\eta$	efficiency	$V_{DD} = 3.6 \text{ V}$	42	52	-	%
$P_{o(min)}$	minimum output power	$V_{DD} < 0.1 \text{ V}$	-	-20	-15	dBm
$N_{RX}$	output noise in RX band	$f_{RF} = 925 \text{ to } 935 \text{ MHz}$ at $P_{o(max)}$	-	-	-117	dBm/Hz
		$f_{RF} = 935 \text{ to } 960 \text{ MHz}$ at $P_{o(max)}$	-	-	-125	dBm/Hz
H2	2nd harmonic level		-	-	-35	dBc
H3	3rd harmonic level		-	-	-35	dBc
Stab	stability	note 1	-	-	-70	dBc

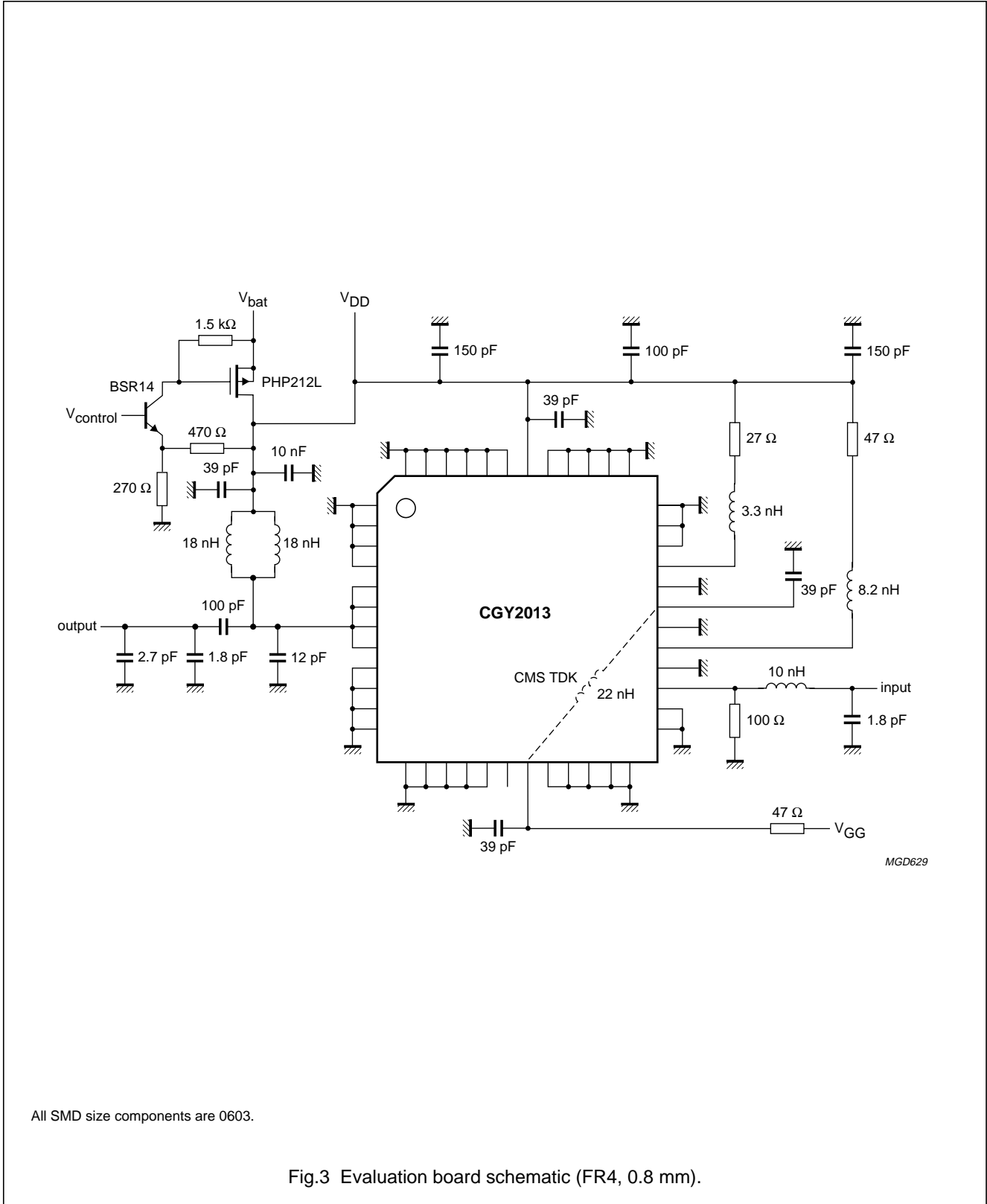
**Note**

- The device is adjusted to provide nominal value of load power into a  $50 \text{ } \Omega$  load. The device is switched off and a 6 : 1 load replaces the  $50 \text{ } \Omega$  load. The device is switched on and the phase of the 6 : 1 load is varied 360 electrical degrees during a 60 second period.

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APPLICATION INFORMATION



All SMD size components are 0603.

Fig.3 Evaluation board schematic (FR4, 0.8 mm).

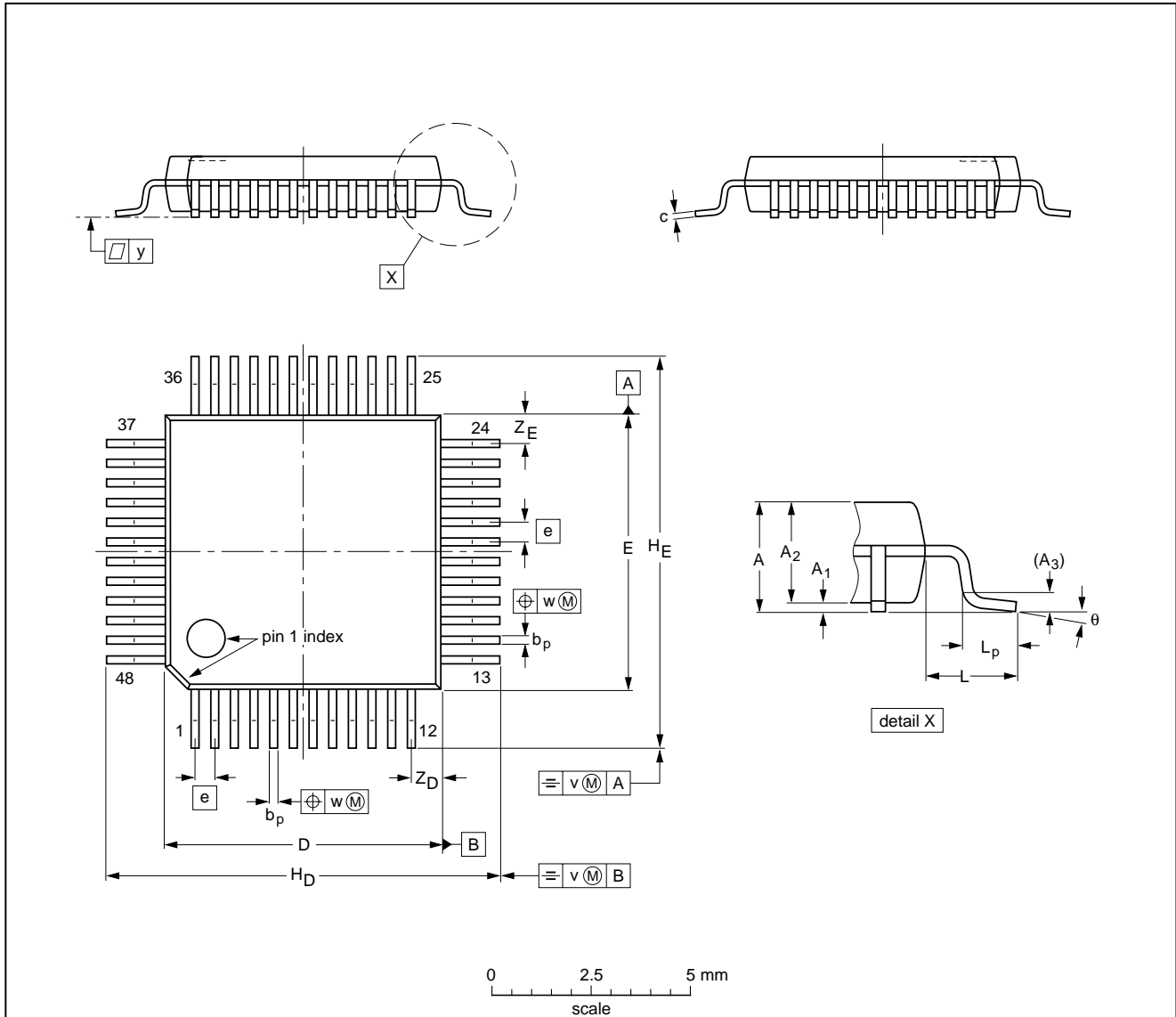
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PACKAGE OUTLINE

LQFP48: plastic low profile quad flat package; 48 leads; body 7 x 7 x 1.4 mm

SOT313-2



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	H <sub>D</sub>	H <sub>E</sub>	L	L <sub>p</sub>	v	w	y	Z <sub>D</sub> <sup>(1)</sup>	Z <sub>E</sub> <sup>(1)</sup>	θ
mm	1.60	0.20 0.05	1.45 1.35	0.25	0.27 0.17	0.18 0.12	7.1 6.9	7.1 6.9	0.5	9.15 8.85	9.15 8.85	1.0	0.75 0.45	0.2	0.12	0.1	0.95 0.55	0.95 0.55	7° 0°

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			
SOT313-2						94-12-19 97-08-01



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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 LQFP 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 is **not** recommended for LQFP 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 footprint must be at an angle of 45° to the board direction and must incorporate solder thieves downstream and at the side corners.**

**Even with these conditions, do not consider wave soldering LQFP packages LQFP48 (SOT313-2), LQFP64 (SOT314-2) or LQFP80 (SOT315-1).**

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**

<b>Data sheet status</b>	
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.
<b>Limiting values</b>	
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.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	

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