

DATA SHEET

CGY2021G DCS/PCS 2 W power amplifier

Preliminary specification
Supersedes data of 1996 Oct 15
File under Integrated Circuits, IC17

1997 Apr 03

DCS/PCS 2 W power amplifier**CGY2021G****FEATURES**

- Power Amplifier (PA) overall efficiency 50% (DCS)
- 34 dB gain
- 0 dBm input power
- Gain control range >50 dB
- Integrated power sensor driver
- Low output noise floor of PA <-121 dBm/Hz in DCS/PCS RX band
- Wide operating temperature range -20 to +85 °C
- LQFP 48-pin package
- Compatible with power ramping controller PCA5077 and GaAs PA power modulator UBA1710.

GENERAL DESCRIPTION

The CGY2021G is a DCS/PCS class 1 GaAs Monolithic Microwave Integrated Circuit (MMIC) power amplifier specifically designed to operate at 4.8 V battery supply.

The chip also includes a power sensor driver so that no directional coupler is required in the power control loop.

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

APPLICATIONS

- Hand-held transceivers for DCS/PCS applications (DCS: 1710 to 1785 MHz and PCS: 1850 to 1910 MHz)
- 1800 MHz Time Division Multiple Access (TDMA) systems.

QUICK REFERENCE DATA

SYMBOL	PARAMETER ⁽¹⁾	MIN.	TYP.	MAX.	UNIT
V _{DD}	positive supply voltage	-	4.5	-	V
I _{DD}	positive peak supply current	-	1.4	-	A
P _{o(max)}	maximum output power	-	34	-	dBm
T _{amb}	operating ambient temperature	-20	-	+85	°C

Note

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

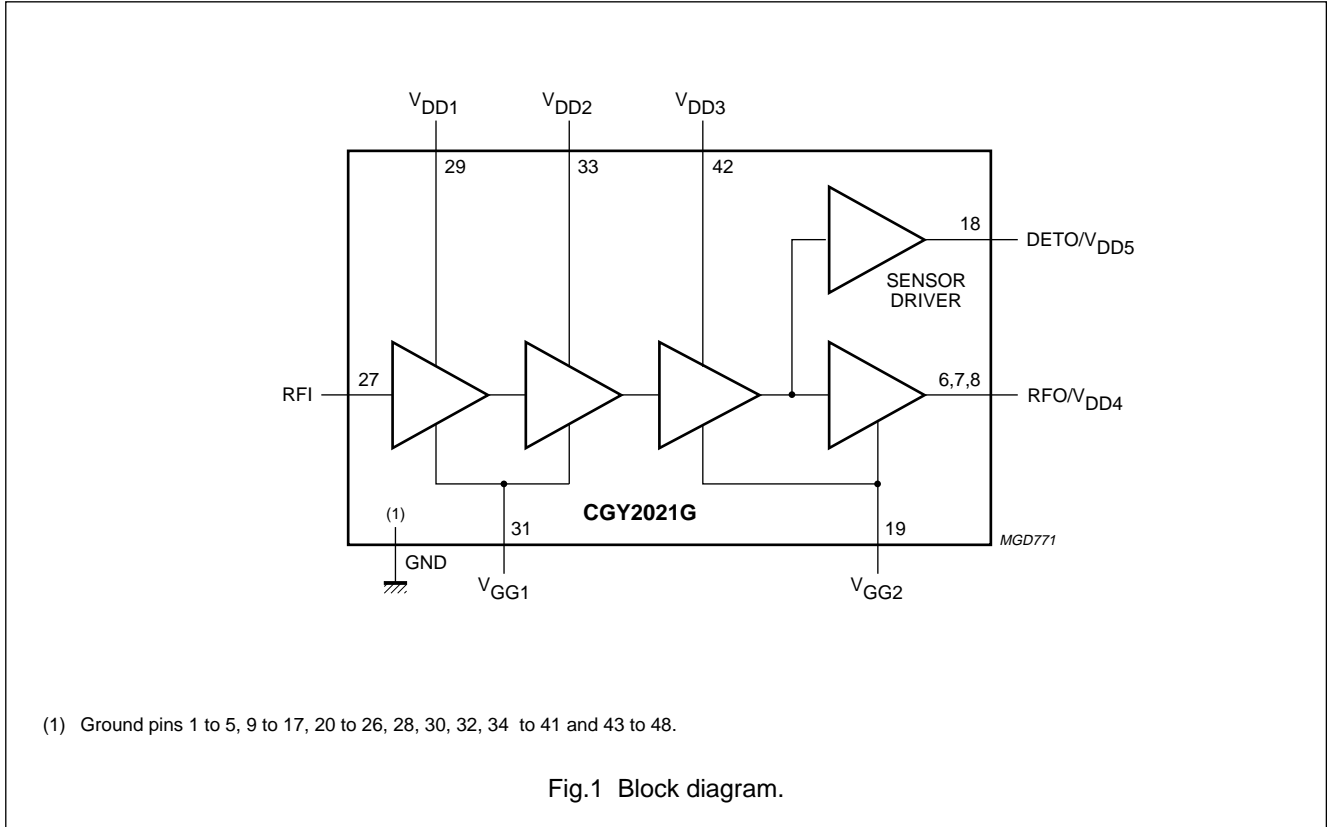
ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
CGY2021G	LQFP48	plastic low profile quad flat package; 48 leads; body 7 × 7 × 1.4 mm	SOT313-2

DCS/PCS 2 W power amplifier

CGY2021G

BLOCK DIAGRAM



PINNING

SYMBOL	PIN	DESCRIPTION
GND	1 to 5	ground
RFO/V _{DD4}	6 to 8	PA output and fourth stage supply voltage
GND	9 to 17	ground
DETO/V _{DD5}	18	power sensor output and supply voltage
V _{GG2}	19	third and fourth stage negative gate supply voltage
GND	20 to 26	ground
RFI	27	PA input
GND	28	ground
V _{DD1}	29	first stage supply voltage
GND	30	ground
V _{GG1}	31	first and second stage negative gate supply voltage
GND	32	ground
V _{DD2}	33	second stage supply voltage
GND	34 to 41	ground
V _{DD3}	42	third stage supply voltage
GND	43 to 48	ground

DCS/PCS 2 W power amplifier

CGY2021G

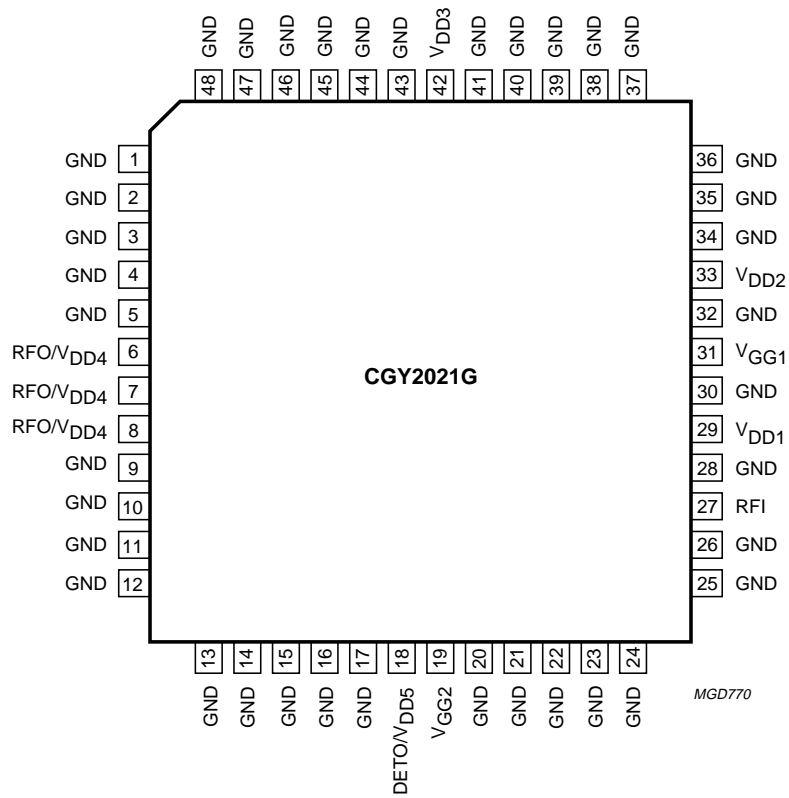


Fig.2 Pin configuration.

DCS/PCS 2 W power amplifier

CGY2021G

FUNCTIONAL DESCRIPTION**Operating conditions**

The CGY2021G is designed to meet the European Telecommunications Standards Institute (ETSI) DCS 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.

This amplifier is specifically designed for pulse operation allowing the use of a LQFP48 plastic package.

Power amplifier

The Power Amplifier (PA) 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 by 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 of the amplifier.

Power sensor driver

The power sensor driver is a buffer amplifier that delivers an output signal at the DETO pin which is proportional to the amplifier power. This signal can be detected by external diodes for power control purpose. As the sensor signal is taken from the input of the last stage of the PA, it is isolated from disturbances at the output by the reverse isolation of the PA output stage. An impedance mismatch at the PA output therefore does not significantly influence the signal delivered by the power sensor as this normally occurs when power sense is made using a directional coupler. Consequently, the cost and space of using a directional coupler are saved.

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	–	1.3	W

THERMAL CHARACTERISTICS

General operating conditions applied.

SYMBOL	PARAMETER	VALUE	UNIT
$R_{th j-c}$	thermal resistance from junction to case; note 1	45	K/W

Note

1. This thermal resistance is a typical value and is measured under DCS/PCS pulse conditions.

DCS/PCS 2 W power amplifier

CGY2021G

DC CHARACTERISTICS

$V_{DD} = 4.5 \text{ V}$; $T_{amb} = 25 \text{ }^\circ\text{C}$; peak current values during burst; general operating conditions applied; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Pins RFO/V_{DD4}, V_{DD3}, V_{DD2}, V_{DD1} and DETO/V_{DD5}						
V_{DD}	positive supply voltage		–	4.5	–	V
I_{DD}	positive peak supply current		–	1.4	–	A
Pins V_{GG1} and V_{GG2}						
V_{GG1}	negative supply voltage	note 1	–	–1.6	–	V
V_{GG2}	negative supply voltage	note 1	–	–1.6	–	V
$I_{GG1} + I_{GG2}$	negative peak supply current		–	–	2	mA

Note

1. The negative bias V_{GG} 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.

DCS/PCS 2 W power amplifier

CGY2021G

AC CHARACTERISTICS

$V_{DD} = 4.5\text{ V}$; $T_{amb} = 25\text{ °C}$; general operating conditions applied; unless otherwise specified.

Measured and guaranteed on CGY2021G evaluation board.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Power amplifier						
P_i	input power		-2	-	+2	dBm
S_{11}	input return loss	50 Ω source; note 1	-	-	-10	dB
f_{RF}	RF frequency range	DCS	1710	-	1785	MHz
		PCS	1850	-	1910	MHz
$P_{o(max)}$	maximum output power	$T_{amb} = 25\text{ °C}$; $V_{DD} = 4.5\text{ V}$	33	34	-	dBm
		$T_{amb} = -20\text{ to }+85\text{ °C}$; $V_{DD} = 4.2\text{ V}$	31	-	-	dBm
η	efficiency	DCS; at $P_{o(max)}$	40	50	-	%
		PCS; at $P_{o(max)}$	-	47	-	%
R_S	optimum series load resistance		-	6	-	Ω
C_S	optimum series load capacitance		-	11	-	pF
$P_{o(off)}$	isolation	PA OFF; $P_i = 0\text{ dBm}$	-	-50	-	dBm
N_{RX}	output noise in RX band		-	-	-121	dBm/Hz
H2	2nd harmonic level		-	-40	-	dBc
H3	3rd harmonic level		-	-35	-	dBc
Stab	stability	note 2	-	-	-50	dBc
Power sensor driver						
$P_{o(DET)}$	sensor driver output power	$R_L = 100\ \Omega$; relative to PA output power into 50 Ω load	-	-25	-	dBc

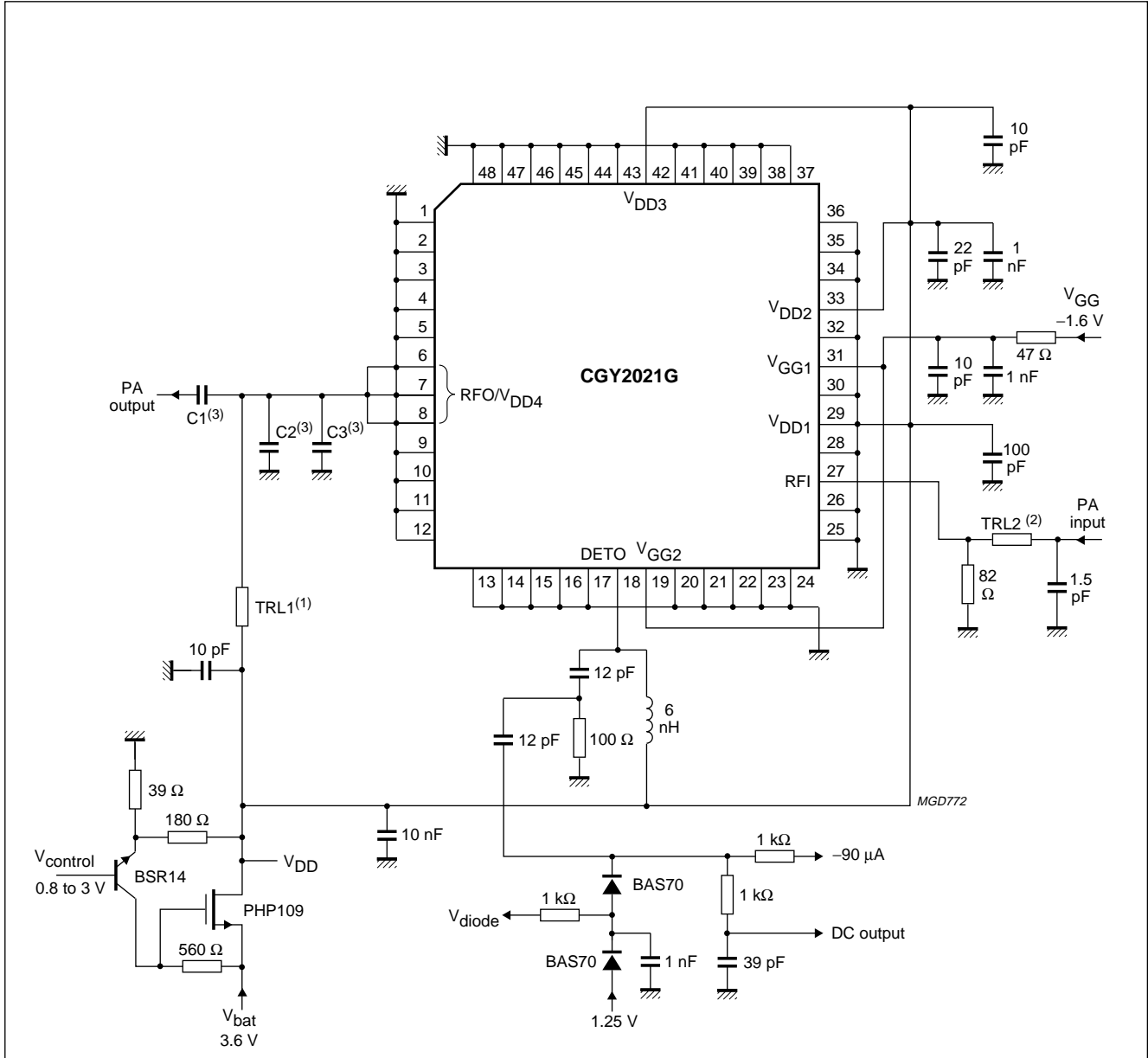
Notes

1. Including the 82 Ω resistor connected in parallel at the power amplifier input on the evaluation board.
2. The device is adjusted to provide nominal value of load power into a 50 Ω load. The device is switched off and a 6 : 1 load replaces the 50 Ω load. The device is switched on and the phase of the 6 : 1 load is varied 360 electrical degrees during a 60 seconds test period.

DCS/PCS 2 W power amplifier

CGY2021G

APPLICATION INFORMATION



All capacitors are type: SMD0603.
 Thickness: 0.8 mm; substrate: FR4; $\epsilon_r = 4.7$.
 (1) TRL1: width = 0.3 mm; length = 16 mm.
 (2) TRL2: width = 0.5 mm; length = 10 mm.
 (3) the component values are:

SYSTEM	C1 (pF)	C2 (pF)	C3 (pF)
DCS	2.2	1.8	2.2
PCS	1.5	1.8	1.2

Fig.3 Evaluation board schematic.

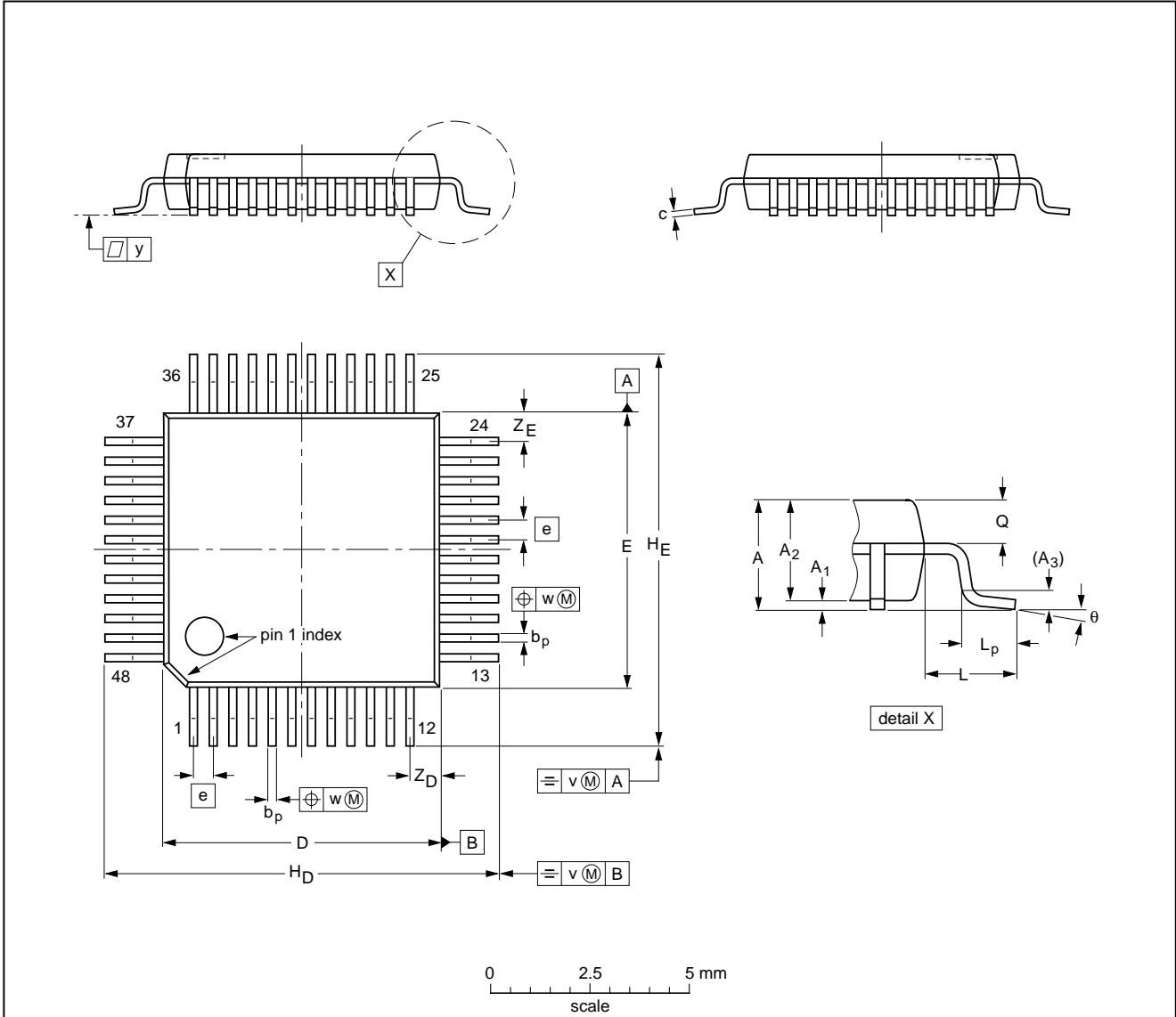
DCS/PCS 2 W power amplifier

CGY2021G

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 ₁	A ₂	A ₃	b _p	c	D ⁽¹⁾	E ⁽¹⁾	e	H _D	H _E	L	L _p	Q	v	w	y	Z _D ⁽¹⁾	Z _E ⁽¹⁾	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	0.69 0.59	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						93-06-15 94-12-19

DCS/PCS 2 W power amplifier

CGY2021G

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.

DCS/PCS 2 W power amplifier

CGY2021G

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.
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.
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

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.

Philips Semiconductors – a worldwide company

Argentina: see South America

Australia: 34 Waterloo Road, NORTH RYDE, NSW 2113,
Tel. +61 2 9805 4455, Fax. +61 2 9805 4466

Austria: Computerstr. 6, A-1101 WIEN, P.O. Box 213,
Tel. +43 1 60 101, Fax. +43 1 60 101 1210

Belarus: Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,
220050 MINSK, Tel. +375 172 200 733, Fax. +375 172 200 773

Belgium: see The Netherlands

Brazil: see South America

Bulgaria: Philips Bulgaria Ltd., Energoproject, 15th floor,
51 James Bourchier Blvd., 1407 SOFIA,
Tel. +359 2 689 211, Fax. +359 2 689 102

Canada: PHILIPS SEMICONDUCTORS/COMPONENTS,
Tel. +1 800 234 7381

China/Hong Kong: 501 Hong Kong Industrial Technology Centre,
72 Tat Chee Avenue, Kowloon Tong, HONG KONG,
Tel. +852 2319 7888, Fax. +852 2319 7700

Colombia: see South America

Czech Republic: see Austria

Denmark: Prags Boulevard 80, PB 1919, DK-2300 COPENHAGEN S,
Tel. +45 32 88 2636, Fax. +45 31 57 0044

Finland: Sinikalliontie 3, FIN-02630 ESPOO,
Tel. +358 9 615800, Fax. +358 9 61580920

France: 4 Rue du Port-aux-Vins, BP317, 92156 SURESNES Cedex,
Tel. +33 1 40 99 6161, Fax. +33 1 40 99 6427

Germany: Hammerbrookstraße 69, D-20097 HAMBURG,
Tel. +49 40 23 53 60, Fax. +49 40 23 536 300

Greece: No. 15, 25th March Street, GR 17778 TAVROS/ATHENS,
Tel. +30 1 4894 339/239, Fax. +30 1 4814 240

Hungary: see Austria

India: Philips INDIA Ltd, Shivsagar Estate, A Block, Dr. Annie Besant Rd.
Worli, MUMBAI 400 018, Tel. +91 22 4938 541, Fax. +91 22 4938 722

Indonesia: see Singapore

Ireland: Newstead, Clonskeagh, DUBLIN 14,
Tel. +353 1 7640 000, Fax. +353 1 7640 200

Israel: RAPAC Electronics, 7 Kehilat Saloniki St, PO Box 18053,
TEL AVIV 61180, Tel. +972 3 645 0444, Fax. +972 3 649 1007

Italy: PHILIPS SEMICONDUCTORS, Piazza IV Novembre 3,
20124 MILANO, Tel. +39 2 6752 2531, Fax. +39 2 6752 2557

Japan: Philips Bldg 13-37, Kohnan 2-chome, Minato-ku, TOKYO 108,
Tel. +81 3 3740 5130, Fax. +81 3 3740 5077

Korea: Philips House, 260-199 Itaewon-dong, Yongsan-ku, SEOUL,
Tel. +82 2 709 1412, Fax. +82 2 709 1415

Malaysia: No. 76 Jalan Universiti, 46200 PETALING JAYA, SELANGOR,
Tel. +60 3 750 5214, Fax. +60 3 757 4880

Mexico: 5900 Gateway East, Suite 200, EL PASO, TEXAS 79905,
Tel. +9-5 800 234 7381

Middle East: see Italy

Netherlands: Postbus 90050, 5600 PB EINDHOVEN, Bldg. VB,
Tel. +31 40 27 82785, Fax. +31 40 27 88399

New Zealand: 2 Wagener Place, C.P.O. Box 1041, AUCKLAND,
Tel. +64 9 849 4160, Fax. +64 9 849 7811

Norway: Box 1, Manglerud 0612, OSLO,
Tel. +47 22 74 8000, Fax. +47 22 74 8341

Philippines: Philips Semiconductors Philippines Inc.,
106 Valero St. Salcedo Village, P.O. Box 2108 MCC, MAKATI,
Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

Poland: Ul. Lukiska 10, PL 04-123 WARSZAWA,
Tel. +48 22 612 2831, Fax. +48 22 612 2327

Portugal: see Spain

Romania: see Italy

Russia: Philips Russia, Ul. Usatcheva 35A, 119048 MOSCOW,
Tel. +7 095 755 6918, Fax. +7 095 755 6919

Singapore: Lorong 1, Toa Payoh, SINGAPORE 1231,
Tel. +65 350 2538, Fax. +65 251 6500

Slovakia: see Austria

Slovenia: see Italy

South Africa: S.A. PHILIPS Pty Ltd., 195-215 Main Road Martindale,
2092 JOHANNESBURG, P.O. Box 7430 Johannesburg 2000,
Tel. +27 11 470 5911, Fax. +27 11 470 5494

South America: Rua do Rocio 220, 5th floor, Suite 51,
04552-903 São Paulo, SÃO PAULO - SP, Brazil,
Tel. +55 11 821 2333, Fax. +55 11 829 1849

Spain: Balmes 22, 08007 BARCELONA,
Tel. +34 3 301 6312, Fax. +34 3 301 4107

Sweden: Kottbygatan 7, Akalla, S-16485 STOCKHOLM,
Tel. +46 8 632 2000, Fax. +46 8 632 2745

Switzerland: Allmendstrasse 140, CH-8027 ZÜRICH,
Tel. +41 1 488 2686, Fax. +41 1 481 7730

Taiwan: Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1,
TAIPEI, Taiwan Tel. +886 2 2134 2865, Fax. +886 2 2134 2874

Thailand: PHILIPS ELECTRONICS (THAILAND) Ltd.,
209/2 Sanpavuth-Bangna Road Prakanong, BANGKOK 10260,
Tel. +66 2 745 4090, Fax. +66 2 398 0793

Turkey: Talatpasa Cad. No. 5, 80640 GÜLTEPE/ISTANBUL,
Tel. +90 212 279 2770, Fax. +90 212 282 6707

Ukraine: PHILIPS UKRAINE, 4 Patrice Lumumba str., Building B, Floor 7,
252042 KIEV, Tel. +380 44 264 2776, Fax. +380 44 268 0461

United Kingdom: Philips Semiconductors Ltd., 276 Bath Road, Hayes,
MIDDLESEX UB3 5BX, Tel. +44 181 730 5000, Fax. +44 181 754 8421

United States: 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,
Tel. +1 800 234 7381

Uruguay: see South America

Vietnam: see Singapore

Yugoslavia: PHILIPS, Trg N. Pasica 5/v, 11000 BEOGRAD,
Tel. +381 11 625 344, Fax. +381 11 635 777

For all other countries apply to: Philips Semiconductors, Marketing & Sales Communications,
Building BE-p, P.O. Box 218, 5600 MD EINDHOVEN, The Netherlands, Fax. +31 40 27 24825

Internet: <http://www.semiconductors.philips.com>

© Philips Electronics N.V. 1997

SCA54

All rights are reserved. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner.

The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

Printed in The Netherlands

437027/1200/02/pp12

Date of release: 1997 Apr 03

Document order number: 9397 750 02022

Let's make things better.

**Philips
Semiconductors**



PHILIPS