DATA SHEET

SA58605
Dual operational amplifier and 2.5 V shunt regulator

Product data
Supersedes data of 2002 Mar 25

2003 Nov 12

Philips
Semiconductors

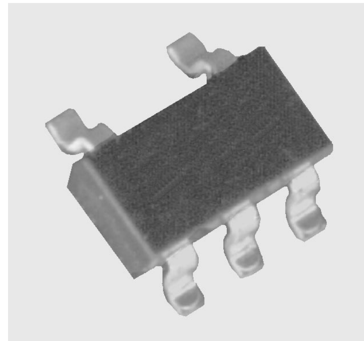
PHILIPS

Dual operational amplifier and 2.5 V shunt regulator SA58605

DESCRIPTION

The SA58605 incorporates two op amps and 2.5 V shunt regulator in an unique circuit configuration. The output of the device is inverted when the inverting inputs of either or both op amps exceed the internally set reference voltages at their non-inverting inputs. Amp "A" is referenced to 2.5 V while Amp "B" is referenced to 154 mV. The SA58605 incorporates a "NOR logic" configuration with these specific gate levels.

SA58605 supports voltage control and sensor applications such as AC adapter, switch mode power supply and battery chargers. It is available in a 5-lead small outline surface mount package (SOP003).



FEATURES

- Low input bias current: 30 nA typ.
- Low operating supply current: 1.2 mA typ.
- Reference voltages at non-inverting inputs:
  - Amp "A" at 2.5 V typ.
  - Amp "B" at 154 mV

APPLICATIONS

- AC adapter and battery charger
- Switched Mode Power Supply (SMPS)
- Control voltage/sensor

SIMPLIFIED DEVICE DIAGRAM

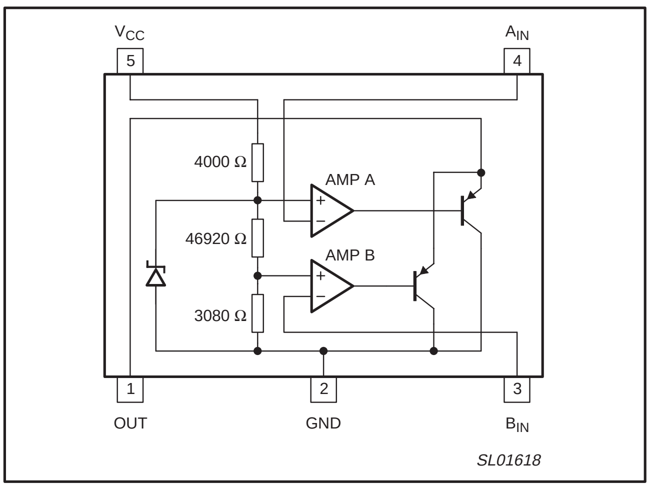


Figure 1. Simplified system diagram.

ORDERING INFORMATION

TYPE NUMBER	PACKAGE			TEMPERATURE RANGE
	NAME	DESCRIPTION	VERSION	
SA58605D	SOT23-5, SOT25, SO5	Plastic small outline package; 5 leads; body width 1.6 mm	SOP003	–40 to +85 °C

Part number marking

The package is marked with a four letter code. The first three letters designate the product. The fourth letter, represented by ‘x’, is a date tracking code.

Part Number	Marking
SA58605D	AJAx

PIN CONFIGURATION

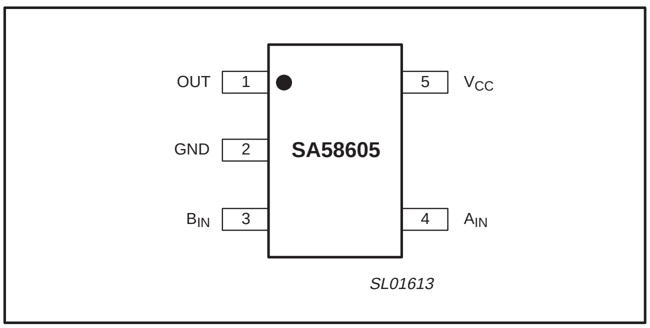


Figure 2. Pin configuration.

PIN DESCRIPTION

PIN	SYMBOL	DESCRIPTION
1	OUT	Output.
2	GND	Ground.
3	B_{IN}	Amp B inverting input. Non-inverting input internally set at 154 mV reference voltage.
4	A_{IN}	Amp A inverting input. Non-inverting input internally set at 2.5 V reference voltage.
5	V_{CC}	Positive supply.

INTERNAL EQUIVALENT CIRCUIT

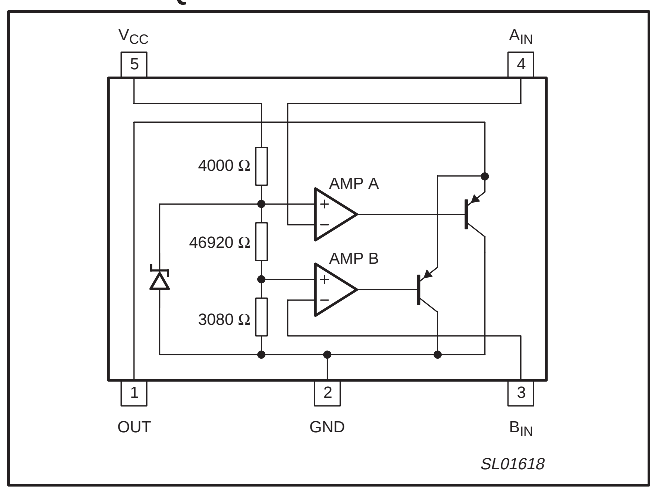


Figure 3. Internal equivalent circuit.

MAXIMUM RATINGS

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	Supply voltage	–0.3	+20	V
T_{amb}	Ambient operating temperature	–40	+85	°C
T_{stg}	Storage temperature	–40	+125	°C
P	Power dissipation	–	250	mW

ELECTRICAL CHARACTERISTICS

T_{amb} = 25 °C, V_{CC} = 5 V (see Figure 6 "Test circuit", and Table 1 "Parameter test circuit 1 and power supply settings"), unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_{CC}	Supply current	A_{IN} = 0 V; B_{IN} = 0 V; $R_L = \infty$	–	1.2	1.7	mA
A amplifier						
$V_{o(A)}$	Output inverting voltage (A)	B_{IN} = 0 V; R_L = 4.3 kΩ	2.45	2.50	2.55	V
$I_{i(bias)(A)}$	Input bias current (A)	B_{IN} = 0 V; R_L = 4.3 kΩ	–	30	150	nA
PSSR (A)	PSSR (A)	B_{IN} = 0 V; R_L = 4.3 kΩ	62	–	–	dB
$I_{o(sink)(A)}$	Output sink current (A)	A_{IN} = 2.7 V; B_{IN} = 0 V; V_{OUT} = 1.5 V	5	–	–	mA
B amplifier						
$V_{o(B)}$	Output inverting voltage (B)	A_{IN} = 0 V; R_L = 4.3 kΩ	151	154	157	mV
$I_{i(bias)(B)}$	Input bias current (B)	A_{IN} = 0 V; R_L = 4.3 kΩ	–	30	150	nA
PSSR (B)	PSSR (B)	A_{IN} = 0 V; R_L = 4.3 kΩ	65	–	–	dB
$I_{o(sink)(B)}$	Output sink current (B)	A_{IN} = 0 V; B_{IN} = 0.17 V; V_{OUT} = 1.5 V	5	–	–	mA

TYPICAL PERFORMANCE CURVES

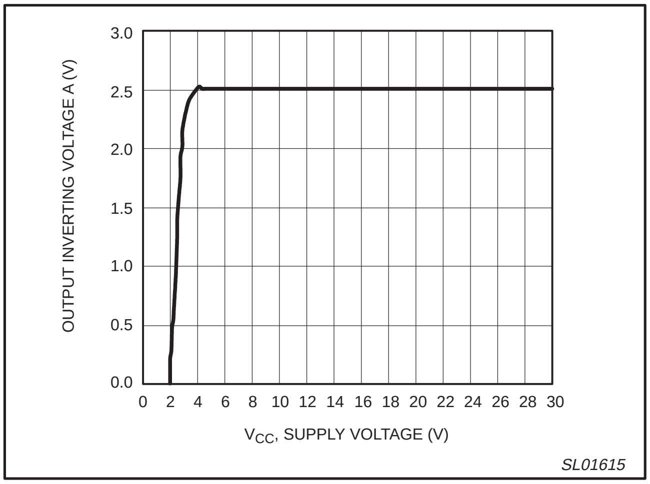


Figure 4. Output inverting voltage (A) versus V_{CC}.

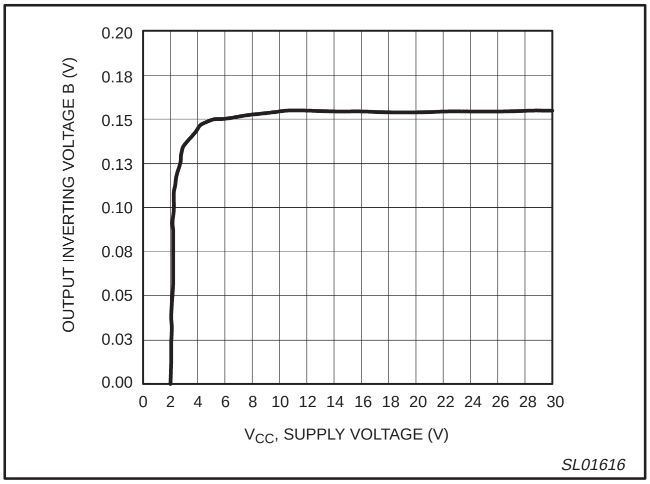


Figure 5. Output inverting voltage (B) versus V_{CC}.

TEST CIRCUITS

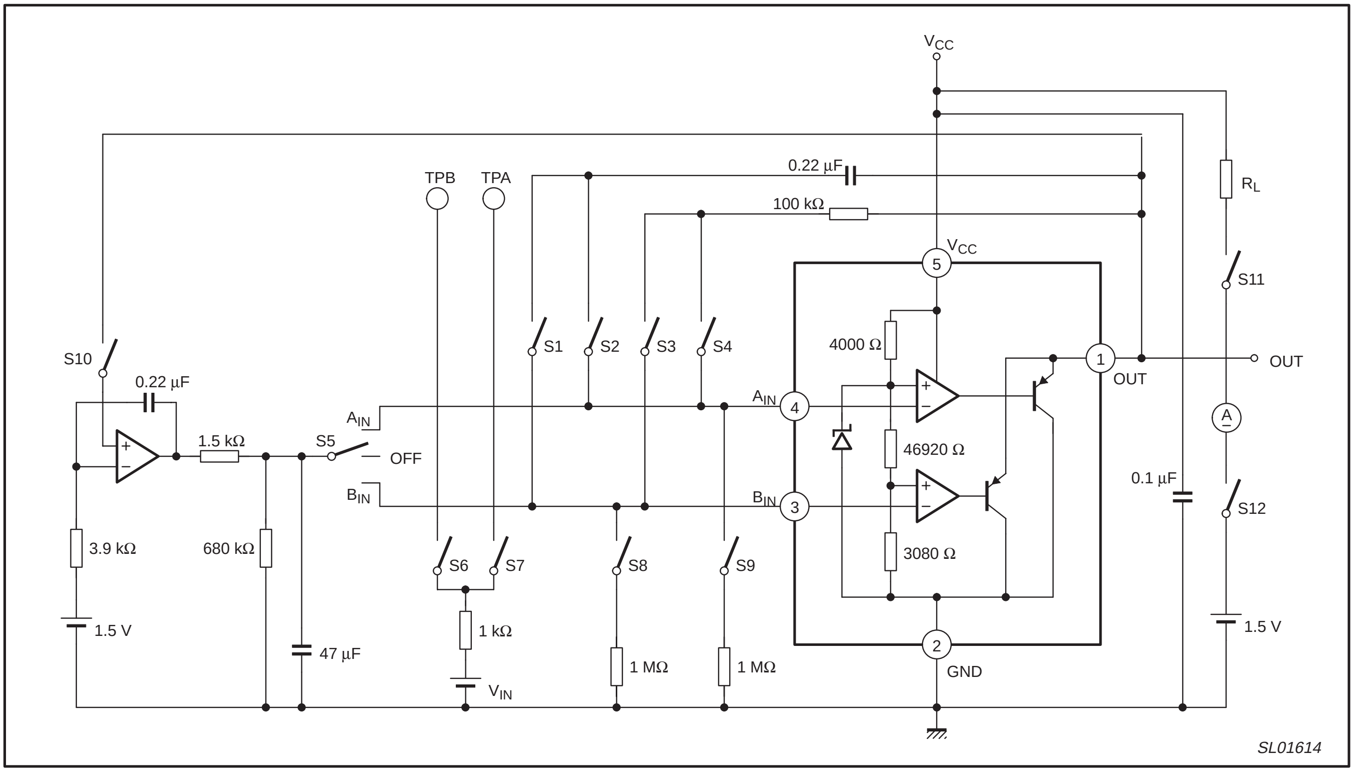


Figure 6. Test circuit.

Table 1. Parameter test circuit 1 switch and power supply settings

SYMBOL	PARAMETER	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	R_L (Ω)	V_{IN} (V)	Comments
I_{CC}	Power supply current	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	4.3 k		
$V_{o(A)}$	Output inverting voltage (A)	OFF	ON	OFF	OFF	A_{IN}	OFF	OFF	ON	OFF	ON	ON	OFF	4.3 k		measure TPA voltage
$I_{i(bias)(A)}$	Input bias current (A)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	4.3 k		measure TPA voltage
$I_{o(sink)(A)}$	Output sink current (A)	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	ON		2.7	measure output sink current
PSSR (A)	PSSR (A)	OFF	ON	OFF	ON	OFF	OFF	ON	ON	OFF	OFF	ON	OFF	4.3 k	$V_{o(A)}$	Note 1
$V_{o(B)}$	Output inverting voltage (B)	ON	OFF	OFF	OFF	B_{IN}	OFF	OFF	OFF	ON	ON	ON	OFF	4.3 k		measure TPB voltage
$I_{i(bias)(B)}$	Input bias current (B)	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	OFF	4.3 k		measure TPB voltage
$I_{o(sink)(B)}$	Output sink current (B)	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON	OFF	OFF	ON		0.17	measure output sink current
PSSR (B)	PSSR (B)	ON	OFF	ON	OFF	OFF	ON	OFF	OFF	ON	OFF	ON	OFF	4.3 k	$V_{o(B)}$ – 20 mV	Note 2

NOTES:
1. V_{OUT1} is defined by the voltage when V_{CC} = 4 V. V_{OUT2} is defined by the voltage when V_{CC} = 25 V. PSSR (A) is shown in Equation (1).
2. V_{OUT1} is defined by the voltage when V_{CC} = 4 V. V_{OUT2} is defined by the voltage when V_{CC} = 25 V. PSSR (B) is shown in Equation (1).

$$\mathrm{PSSR} = 40 + 20\log\left|\frac{(25\text{ V} - 4\text{ V})}{(V_{OUT1} - V_{OUT2})}\right| \qquad \textbf{Equation (1)}$$

APPLICATION INFORMATION

The SA58605 may be used for various voltage control applications in which the input threshold voltage exceed 2.5 V for Amp "A" and 154 mV for Amp "B". When either or both input threshold voltage is exceeded the output is pulled LOW. The output is connected to V_{CC} with a pull-up resistance.

Figure 7 shows the schematic for a Universal Converter/Charger circuit in which the SA58605 Amp "A" is used to monitor the B+ level of the converter/charger. Amp "B" input is pulled to ground through a 390 Ω resistor and will remain there. The input to the Amp "A" is maintained at 0.5 × B+ with the voltage divider of the two 1.5 kΩ resistors. As B+ drops below 5 V, the input to Amp "A" of the SA58605 follows and drops below 2.5 V. This causes the output (pin 1) to go HIGH and the LED is turned off. Q1 base drive is reduced and Q2 is increased. Thus, the PW modulation is increased, and B+ is able to satisfy the load requirements of the battery and circuitry. As B+ is increased above 5 V, it causes the input to Amp "A" to increase above 2.5 V. Then, the output goes LOW and the LED is activated which turns on the detection diode. This increases the drive on Q1 and pulls down the base of Q2 reducing it base drive. With Q2 conducting less, the PW modulation is decreased and B+ is reduced. Under quasi-steady state, B+ is maintained at 5 V.

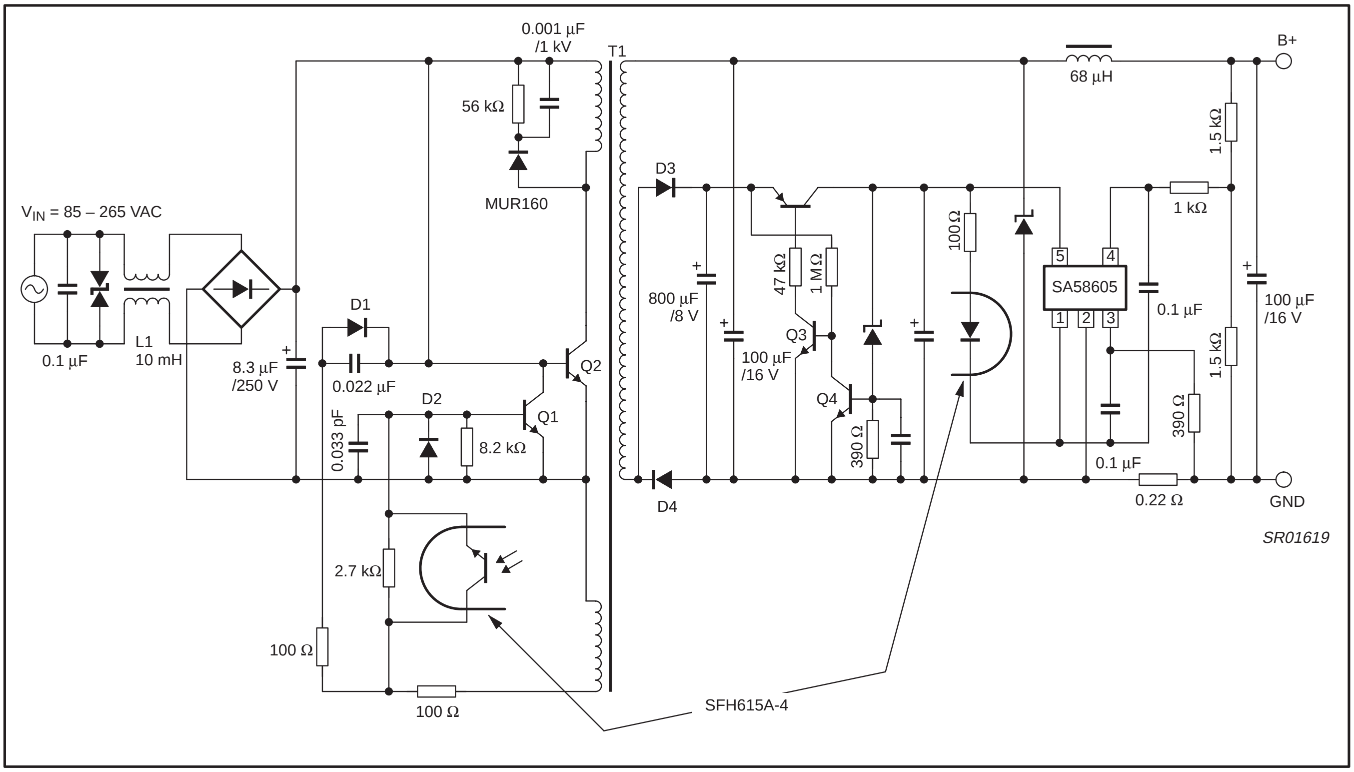


Figure 7. Universal converter/charger application.

Components used in Figure 7

D1–D4: 1N5822

Q1–Q4: 2N3904

T1: Cooper Electronic Technologies
Part#: CTX22-25348
Primary: 47 YTurns of #29 AWG, Pin 4 = Start, Pin 5 = Finish
Secondary: 5 Turns of 0.40 mm, Pins 1 and 2 = Start, Pins 7 and 8 = Finish
Gap: Designed for total primary inductance of 1.24 mH
Core: TSF-7070
Bobbin: Pins 3 and 6 removed, EE19

PACKING METHOD

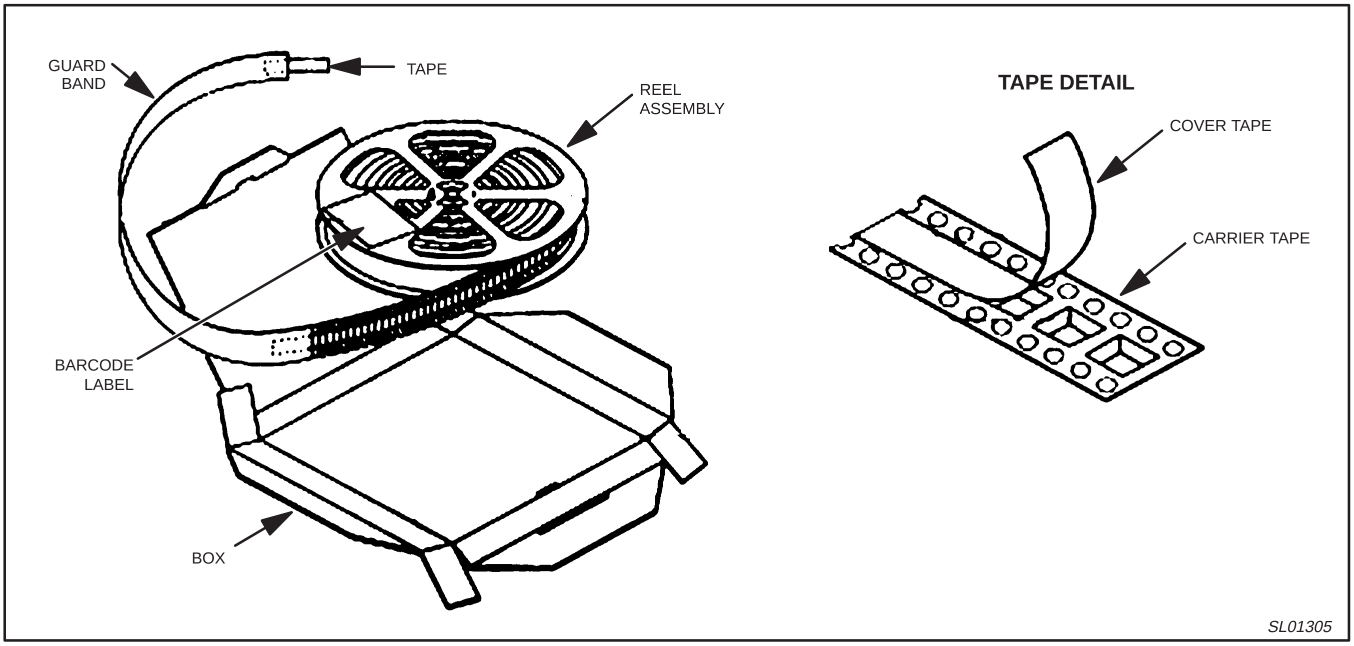
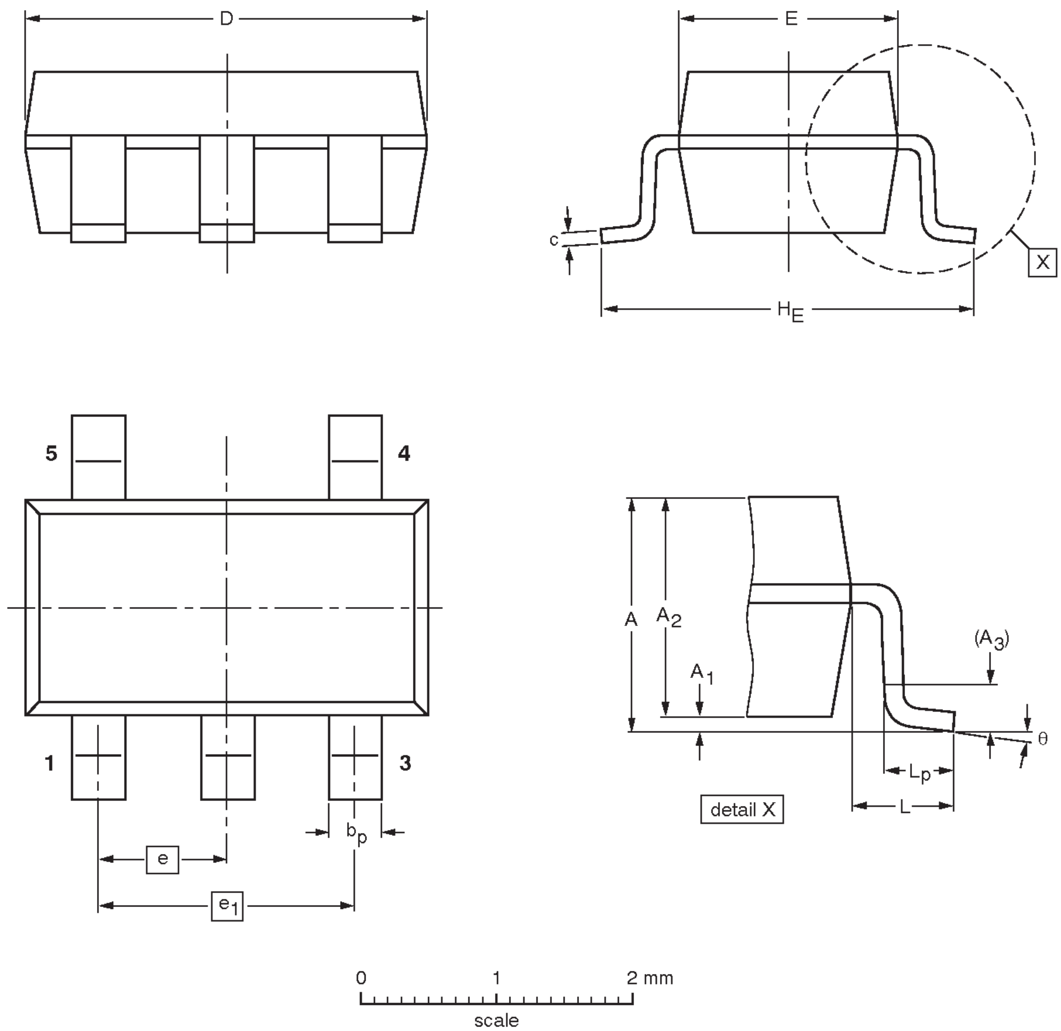


Figure 8. Tape and reel packing method.

Plastic small outline package; 5 leads; body width 1.6 mm **SOP003**

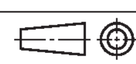


DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(2)}$	e	e_1	H_E	L	L_p	θ
mm	1.35	0.15 0.05	1.2 1.0	0.25	0.50 0.25	0.22 0.08	3.0 2.7	1.7 1.5	0.95	1.9	3.0 2.6	0.6	0.55 0.35	8° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOP003		MO-178				~~03-06-25~~ 03-10-07

Dual operational amplifier and 2.5 V shunt regulator | SA58605

REVISION HISTORY

Rev	Date	Description
_2	20031112	**Product data (9397 750 12324). ECN 853-2334 30334 of 09 September 2003.** **Supersedes data of 2002 Mar 25 (9397 750 09865).** Modifications: • Change package outline version to SOP003 in Ordering information table and Package outline sections.
_1	20020325	**Product data (9397 750 09865). ECN 853-2334 27919 of 25 March 2002.**

Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definitions
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

[1] Please consult the most recently issued data sheet before initiating or completing a design.

[2] The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL http://www.semiconductors.philips.com.

[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

Definitions

Short-form specification — The data in a short-form 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 definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). 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 — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Disclaimers

Life support — 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 Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

Right to make changes — Philips Semiconductors reserves the right to make changes in the products—including circuits, standard cells, and/or software—described or contained herein in order to improve design and/or performance. When the product is in full production (status 'Production'), relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN). Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

Contact information

For additional information please visit
http://www.semiconductors.philips.com. Fax: **+31 40 27 24825**

For sales offices addresses send e-mail to:
sales.addresses@www.semiconductors.philips.com.

Date of release: 11-03

Document order number: 9397 750 12324