DATA SHEET

SA58780
Sense current amplifier with selectable gain

Product data

2001 Oct 03

File under Integrated Circuits, Standard Analog

Philips
Semiconductors

PHILIPS

Sense current amplifier with selectable gain SA58780

GENERAL DESCRIPTION

The SA58780 is a single amplifier that allows current sensing independent of the supply voltage. The input offset voltage is typically ±500 μV with typical offset drift of ±6 μV/°C. The SA58780 supply current is typically 150 μA and it operates from 3.0 V to 24 V single supply. The input common mode range is selectable for high and low ranges. The amplifler gain is user selected for a “High” of 100 V/V or a “Low” of 50 V/V.

The SA58780 is ideal for battery charger applications in notebook computers and PDAs.

FEATURES

- Supply voltage range: 3 V to 24 V
- Low supply current: 150 μA (typical)
- Low input offset voltage: ±500 μV (typical)
- Low input offset drift: ±6 μV/°C (typical)
- Power supply rejection ratio (1 kHz): 80 dB (typical)
- Common mode rejection ratio (1 kHz): 100 dB (typical)
- Common mode input range selection:
  1.8 V to 24 V (I_{SEL} HIGH);
  –0.3 V to V_{CC} – 2.4 V (I_{SEL} LOW)
- Amplifier gain selection:
  G_{SEL} HIGH: G_V = 100 V/V;
  G_{SEL} LOW: G_V = 50 V/V

APPLICATIONS

- Notebook computers
- Personal digital assistants (PDA)

SIMPLIFIED DEVICE DIAGRAM

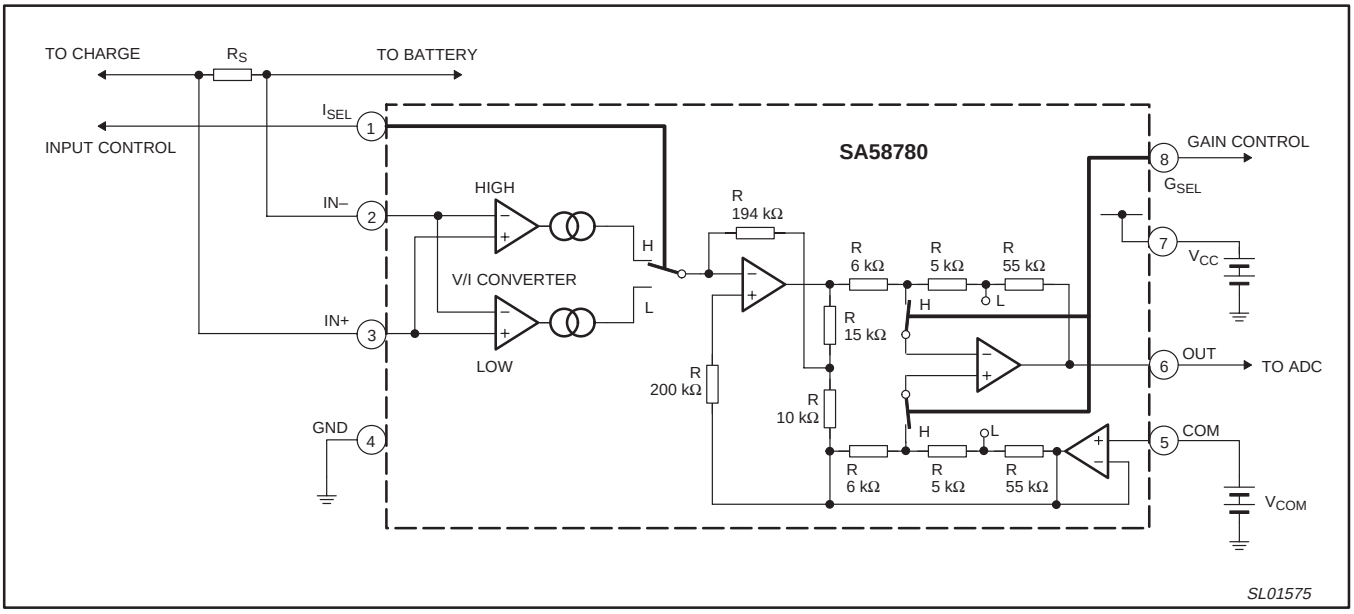


Figure 1. Simplified device diagram.

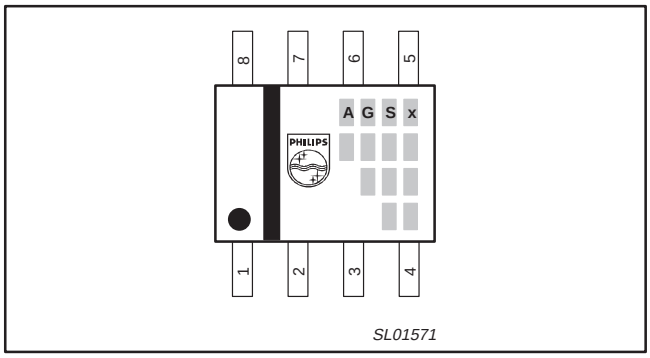
ORDERING INFORMATION

TYPE NUMBER	PACKAGE		TEMPERATURE RANGE
	NAME	DESCRIPTION	
SA58780D	SO8	plastic small outline package; 8 leads; body width 3.9 mm	–20 to +85 °C

Part number marking

Each device is marked with three or four lines of alphanumeric codes. The first three letters of the top line designate the product. The fourth letter, represented by 'x', is a date tracking code. The remaining lines are for manufacturing codes.

Part number	Marking
SA58780D	A G S x



PIN CONFIGURATION

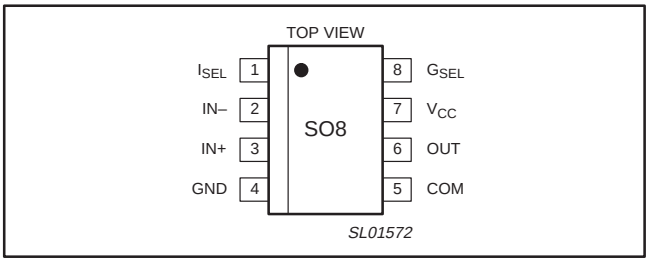
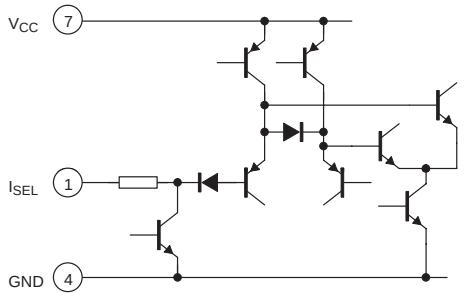
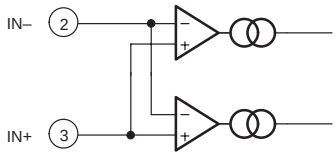
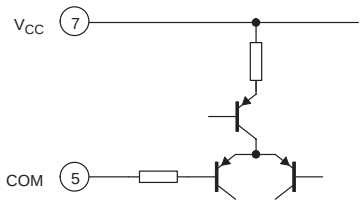
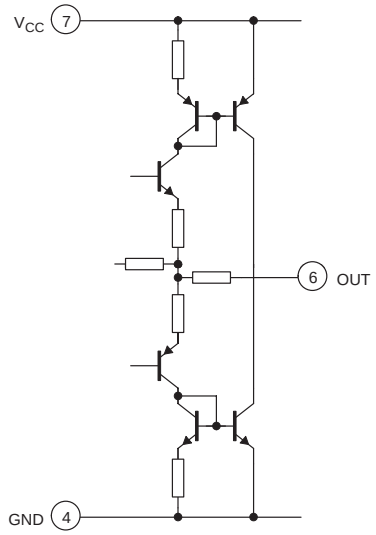
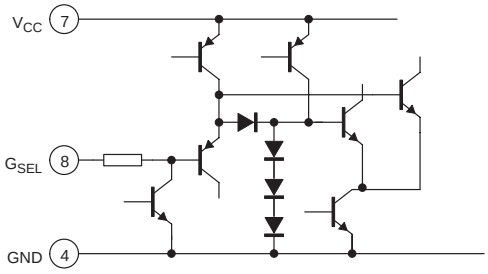


Figure 2. Pin configuration.

PIN DESCRIPTION AND EQUIVALENT CIRCUITS

PIN	SYMBOL	DESCRIPTION	INTERNAL EQUIVALENT CIRCUIT
1	I_{SEL}	Input common mode range selection HIGH: 1.8 V to 24 V LOW: –0.3 V to V_{CC} – 2.4 V	
4	GND	Ground	
2	IN–	Inverting input	
3	IN+	Non-inverting input	

PIN	SYMBOL	DESCRIPTION	INTERNAL EQUIVALENT CIRCUIT
5	COM	Reference voltage input	
6	OUT	Output	
7	V_{CC}	Positive supply	
8	G_{SEL}	Gain selection HIGH: 100 V/V LOW: 50 V/V	

MAXIMUM RATINGS

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{CC}	Single supply voltage	–0.3	+25	V
V_{IN}	Input voltage	–0.3	+25	V
T_{stg}	Storage temperature	–40	+125	°C
T_{amb}	Operating ambient temperature	–20	+85	°C
P_D	Power dissipation	–	300	mW

ELECTRICAL CHARACTERISTICS

V_{CC} = 5.0 V; V_{ICM} = 15 V; V_{COM} = 25 V; V_{ISEL} = 5 V; V_{GSEL} = 5 V; R_L = 10 kΩ; T_{amb} = 25 °C, unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{CC}	Supply voltage operating range		3.0	–	24	V
I_{CC}	Supply current		–	150	200	µA
$G_{v(high)}$	Voltage gain HIGH	G_{SEL} = 5 V	97	100	103	mV/mV
$G_{v(low)}$	Voltage gain LOW	G_{SEL} = 0 V	48.5	50	51.5	mV/mV
V_{IO1}	Input offset voltage 1	ΔV_{IN} = 0 V; V_{ISEL} = 5 V (HIGH)	–0.5	–	0.5	mV
V_{IO2}	Input offset voltage 2	ΔV_{IN} = 0 V; V_{ISEL} = 0 V (LOW)	–0.5	–	0.5	mV
ΔV_{IO1}	Input offset voltage 1 temperature coefficient	V_{ISEL} = 5 V	–4	–	4	µV/°C
ΔV_{IO2}	Input offset voltage 1 temperature coefficient	V_{ISEL} = 0 V	–6	–	6	µV/°C
$V_{I(CM)1}$	Common mode input voltage range 1	V_{ISEL} = 5 V (HIGH)	1.8	–	24	V
$V_{I(CM)2}$	Common mode input voltage range 1	V_{ISEL} = 0 V (LOW)	–0.3	–	V_{CC} – 2.4	V
$V_{I(dif)}$	Differential input voltage		–200	–	200	mV
$I_{i(bias)1}$	Input bias current 1	ΔV_{IN} = 0 V; V_{ISEL} = 5 V (HIGH)	0.8	1.2	1.6	µA
$I_{i(bias)2}$	Input bias current 2	ΔV_{IN} = 0 V; V_{ISEL} = 0 V (LOW)	–0.8	–1.2	–1.6	µA
$\Delta V_{IO}/\Delta T$	Input offset voltage temperature drift	T_{amb} = –20 to +75 °C	–	±1	±3	µV/°C
Z_i	Input impedance		100	–	–	kΩ
V_{COM}	COM voltage range	R_L = open	1.2	–	V_{CC} – 1.2	V
I_{ISEL}	I_{SEL} current	V_{ISEL} = 5 V	–	1.0	–	µA
V_{ISEL1}	I_{SEL} voltage range 1 (HIGH)		1.7	–	24	V
V_{ISEL2}	I_{SEL} voltage range 2 (LOW)		0	–	0.5	V
I_{GSEL}	G_{SEL} sink current	V_{GSEL} = 5 V	–	1.0	–	µA
V_{GSEL1}	G_{SEL} voltage range 1	(100 V/V)	1.7	–	24	V
V_{GSEL2}	G_{SEL} voltage range 2	(50 V/V)	0	–	0.5	V
V_{OUT}	Output voltage range	R_L = open	0.3	–	V_{CC} – 0.3	V
$I_{O(source)}$	Output source current	V_{OUT} = V_{CC} – 0.3 V	0.5	1.0	–	mA
$I_{O(sink)}$	Output sink current	V_{OUT} = 0.3 V	–0.5	–1.0	–	mA
f_{C1}	Cutoff frequency 1	V_{GSEL} = 5 V ($G_{v(high)}$ = 100 V/V); V_{OUT} = –3 dB	–	100	–	kHz
f_{C2}	Cutoff frequency 2	V_{GSEL} = 0 V ($G_{v(low)}$ = 50 V/V); V_{OUT} = –3 dB	–	140	–	kHz
PSRR1	Power supply rejection ratio 1	f = 1 kHz; V_{ISEL} = 5 V	70	80	–	dB
PSRR2	Power supply rejection ratio 2	f = 1 kHz; V_{ISEL} = 0 V	70	80	–	dB
CMRR1	Common mode rejection ratio 1	f = 1 kHz; V_{ISEL} = 5 V	70	80	–	dB
CMRR2	Common mode rejection ratio 2	f = 1 kHz; V_{ISEL} = 0 V	70	80	–	dB

APPLICATION INFORMATION

Battery current sensing circuit

The circuit shown in Figure 3 will sense when the load is drawing current from the battery, and the output of Pin 6 to an analog-to-digital converter can be used to provide a digital readout.

Pin 8, the Gain Select, is tied to ground. This gives a fixed G_V of 50 V/V. For a fixed G_V of 100 V/V, tie Pin 8 to V_{CC}. For selectable gain, Pin 8 may be connected to a user-controlled selector switch or the output of another device that will change state as the current rises and falls.

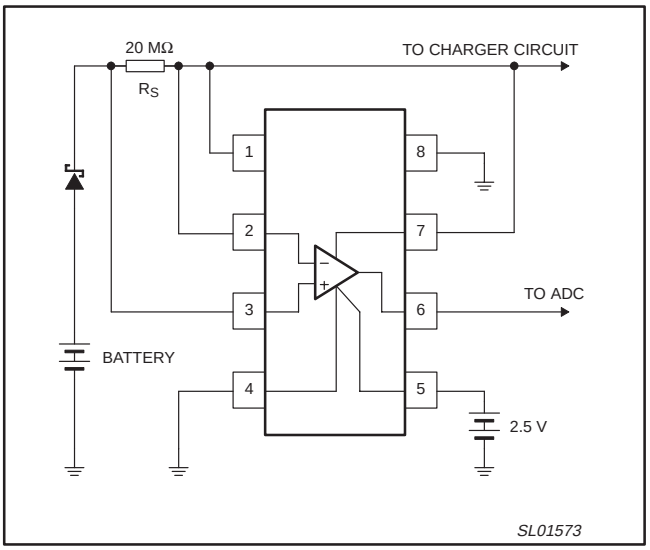


Figure 3. Battery current sensing circuit.

Charger current sensing

The only difference between the battery and charge current sense circuits is the diode position.

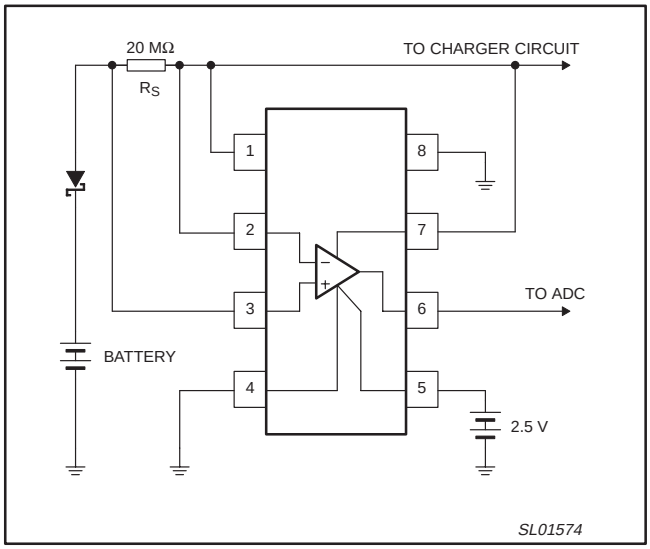


Figure 4. Charger current sensing circuit.

PACKING METHOD

The SA58780 is packed in reels, as shown in Figure 5.

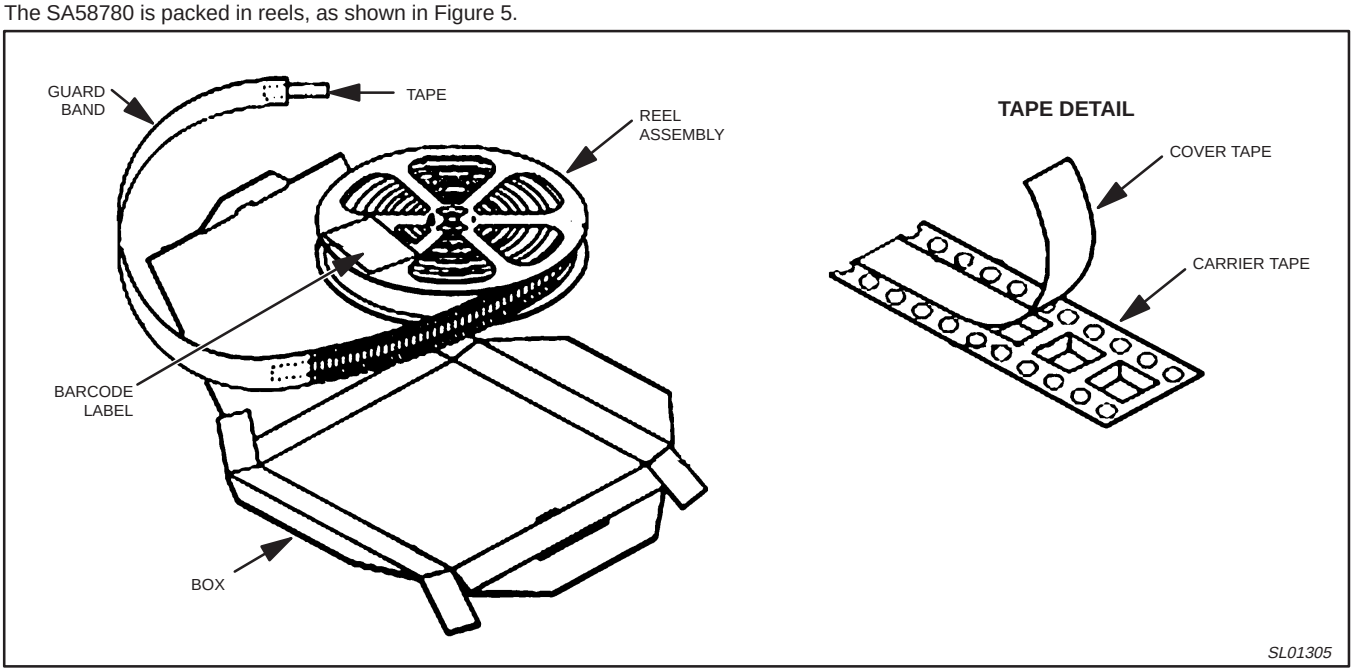
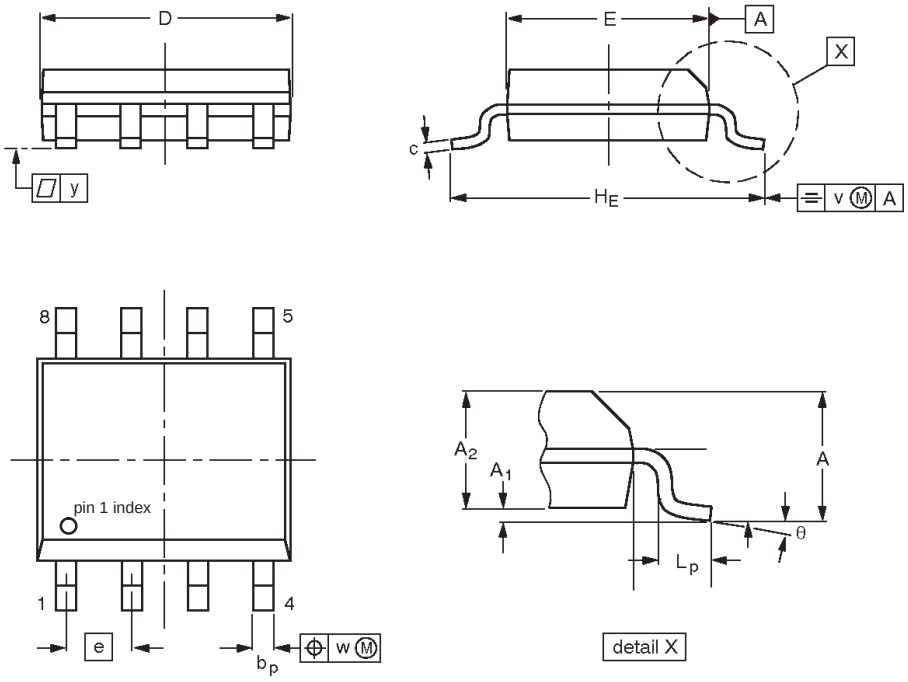
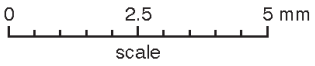


Figure 5. Tape and reel packing method

SO8: plastic small outline package; 8 leads; body width 3.9 mm





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

UNIT	A max.	A_1	A_2	B_2	b_p	c	$D^{(1)}$	$E^{(2)}$	e	H_E		L_p				y		θ
mm	1.73	0.25 0.10	1.45 1.25	4.95 4.80	0.51 0.33	0.25 0.19	4.95 4.80	4.0 3.8	1.27	6.2 5.8		1.27 0.38				0.076		8^o 0^o
inches	0.068	0.010 0.004	0.057 0.049	0.189 0.195	0.013 0.020	0.0100 0.0075	0.20 0.19	0.16 0.15	0.050	0.244 0.228		0.050 0.015				0.003		

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			
	IEC	JEDEC	EIAJ	
SO8	076E03	MS-012		

Data sheet status

Data sheet status [1]	Product status [2]	Definitions
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.
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.
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. Changes will be communicated according to the Customer Product/Process Change Notification (CPCN) procedure SNW-SQ-650A.

[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.

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, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. 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: 10-01

Document order number: 9397 750 08982

Let's make things better.

Philips Semiconductors

PHILIPS