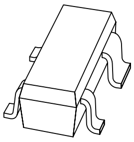

BFG325/XR

NPN 14 GHz wideband transistor

Rev. 01 — 2 February 2005 **Product data sheet**

1. Product profile

1.1 General description

NPN silicon planar epitaxial transistor in a 4-pin dual-emitter SOT143R plastic package.

1.2 Features

- High power gain
- Low noise figure
- High transition frequency
- Gold metallization ensures excellent reliability

1.3 Applications

- Intended for Radio Frequency (RF) front end applications in the GHz range, such as:
  - analog and digital cellular telephones
  - cordless telephones (Cordless Telephone (CT), Personal Communication Network (PCN), Digital Enhanced Cordless Telecommunications (DECT), etc.)
  - radar detectors
  - pagers
  - Satellite Antenna TeleVision (SATV) tuners
  - repeater amplifiers in fiber-optic systems

1.4 Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CBO}	collector-base voltage	open emitter	-	-	15	V
V_{CEO}	collector-emitter voltage	open base	-	-	6	V
I_C	collector current (DC)		-	-	35	mA
P_{tot}	total power dissipation	$T_{sp} \leq 90$ °C [1]	-	-	210	mW
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 3 V; T_j = 25 °C	60	100	200	
C_{CBS}	collector-base capacitance	V_{CB} = 5 V; f = 1 MHz; emitter grounded	-	0.26	0.4	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 3 V; f = 1 GHz; T_{amb} = 25 °C	-	14	-	GHz
G_{max}	maximum power gain [2]	I_C = 15 mA; V_{CE} = 3 V; f = 1.8 GHz; T_{amb} = 25 °C	-	18.3	-	dB

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Table 1: Quick reference data *...continued*

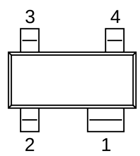
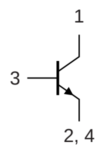
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$\lvert s_{21} \rvert^2$	insertion power gain	I_C = 15 mA; V_{CE} = 3 V; f = 1.8 GHz; T_{amb} = 25 °C; $Z_S = Z_L$ = 50 Ω	-	14	-	dB
NF	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 3 mA; V_{CE} = 3 V; f = 2 GHz	-	1.1	-	dB

[1] T_{sp} is the temperature at the soldering point of the collector pin.

[2] G_{max} is the maximum power gain, if K > 1. If K < 1 then G_{max} = MSG, see Figure 4.

2. Pinning information

Table 2: Pinning

Pin	Description	Simplified outline	Symbol
1	collector		 sym086
2	emitter		
3	base		
4	emitter		

3. Ordering information

Table 3: Ordering information

Type number	Package		
	Name	Description	Version
BFG325/XR	SC-61AA	plastic surface mounted package; reverse pinning; 4 leads	SOT143R

4. Marking

Table 4: Marking codes

Type number	Marking code [1]
BFG325/XR	S2*

[1] * = p: made in Hong Kong.

5. Limiting values

Table 5: Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CBO}	collector-base voltage	open emitter	-	15	V
V_{CEO}	collector-emitter voltage	open base	-	6	V
V_{EBO}	emitter-base voltage	open collector	-	2	V

Table 5: Limiting values *…continued*

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
I_C	collector current (DC)			-	35	mA
P_{tot}	total power dissipation	$T_{sp} \leq 90$ °C	[1]	-	210	mW
T_{stg}	storage temperature			–65	+175	°C
T_j	junction temperature			-	175	°C

[1] T_{sp} is the temperature at the soldering point of the collector pin.

6. Thermal characteristics

Table 6: Thermal characteristics

Symbol	Parameter	Conditions		Typ	Unit
$R_{th(j\text{-}sp)}$	thermal resistance from junction to solder point	$T_{sp} \leq 90$ °C	[1]	405	K/W

[1] T_{sp} is the temperature at the soldering point of the collector pin.

7. Characteristics

Table 7: Characteristics

T_j = 25 °C; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CBO}	collector-base cut-off current	I_E = 0 A; V_{CB} = 5 V	-	-	15	nA
h_{FE}	DC current gain	I_C = 15 mA; V_{CE} = 3 V	60	100	200	
C_{CBS}	collector-base capacitance	V_{CB} = 5 V; f = 1 MHz; emitter grounded	-	0.26	0.4	pF
C_{CES}	collector-emitter capacitance	V_{CE} = 5 V; f = 1 MHz; base grounded	-	0.27	-	pF
C_{EBS}	emitter-base capacitance	V_{EB} = 0.5 V; f = 1 MHz; collector grounded	-	0.53	-	pF
f_T	transition frequency	I_C = 15 mA; V_{CE} = 3 V; f = 1 GHz; T_{amb} = 25 °C	-	14	-	GHz
G_{max}	maximum power gain [1]	I_C = 15 mA; V_{CE} = 3 V; f = 1.8 GHz; T_{amb} = 25 °C	-	18.3	-	dB
$\|s_{21}\|^2$	insertion power gain	I_C = 15 mA; V_{CE} = 3 V; T_{amb} = 25 °C; $Z_S = Z_L$ = 50 Ω				
		f = 1.8 GHz	-	14	-	dB
		f = 3 GHz	-	10	-	dB
NF	noise figure	$\Gamma_s = \Gamma_{opt}$; I_C = 3 mA; V_{CE} = 3 V; f = 2 GHz	-	1.1	-	dB
$P_{L(1dB)}$	output power at 1 dB gain compression	I_C = 15 mA; V_{CE} = 3 V; f = 1.8 GHz; T_{amb} = 25 °C; $Z_S = Z_L$ = 50 Ω	-	8.7	-	dBm
IP3	third order intercept point	I_C = 15 mA; V_{CE} = 3 V; f = 1.8 GHz; T_{amb} = 25 °C; $Z_S = Z_L$ = 50 Ω	-	19.4	-	dBm

[1] G_{max} is the maximum power gain, if K > 1. If K < 1 then G_{max} = MSG, see Figure 4.

K is the Rollet stability factor: $K = \dfrac{1 + |Ds|^2 - |s_{11}|^2 - |s_{22}|^2}{2 \times |s_{21}| \times |s_{12}|}$ where $Ds = s_{11} \times s_{22} - s_{12} \times s_{21}$.

MSG = maximum stable gain.

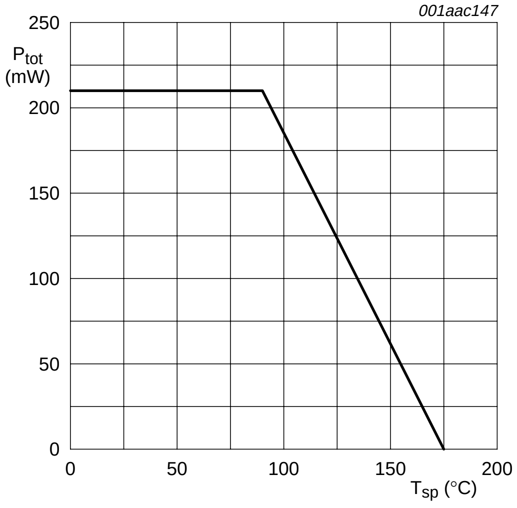


Fig 1. Power derating curve

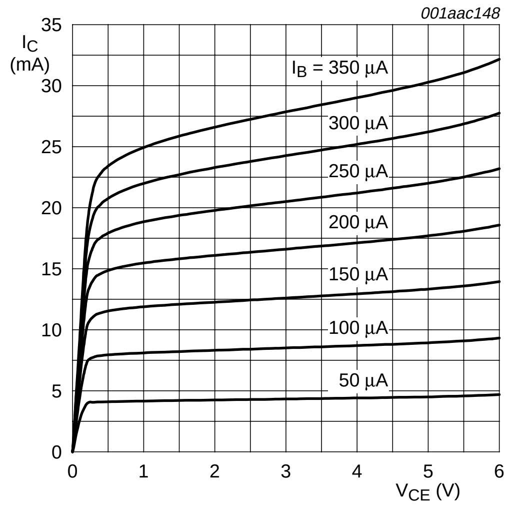
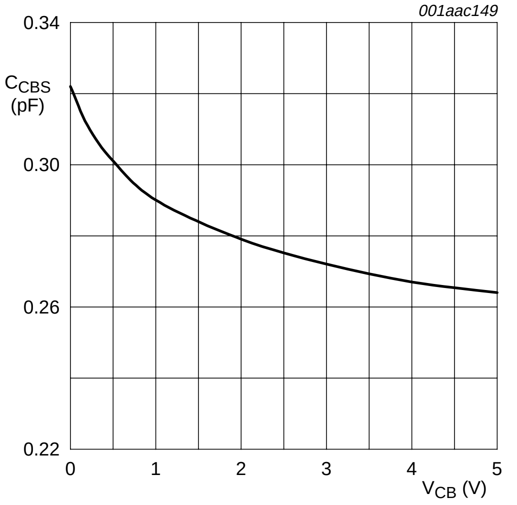
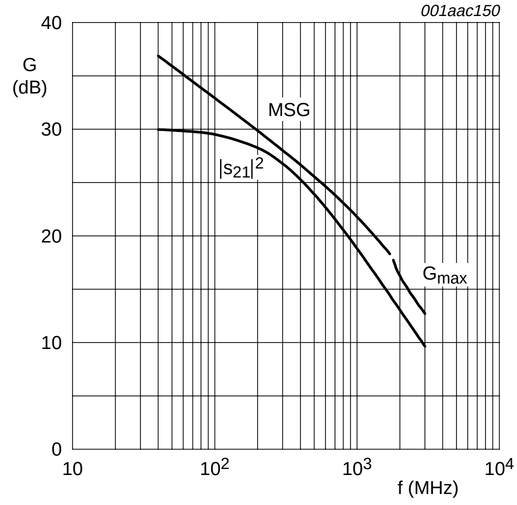


Fig 2. Collector current as a function of collector-emitter voltage; typical values



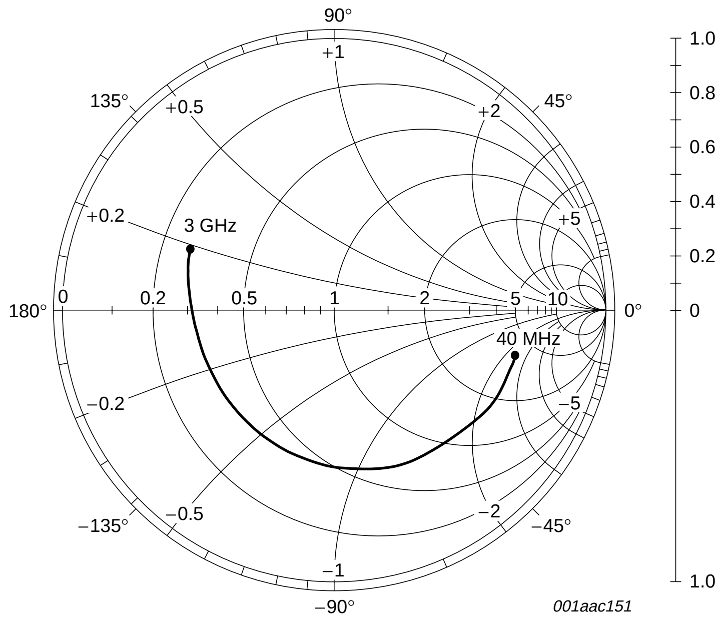
I_C = 0 mA; f = 1 MHz.

Fig 3. Collector-base capacitance as a function of collector-base voltage; typical values



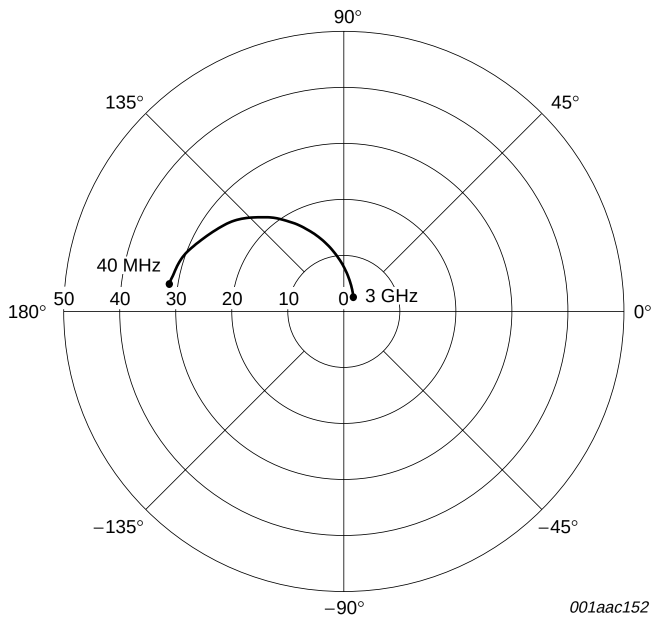
I_C = 15 mA; V_{CE} = 3 V.

Fig 4. Gain as a function of frequency; typical values



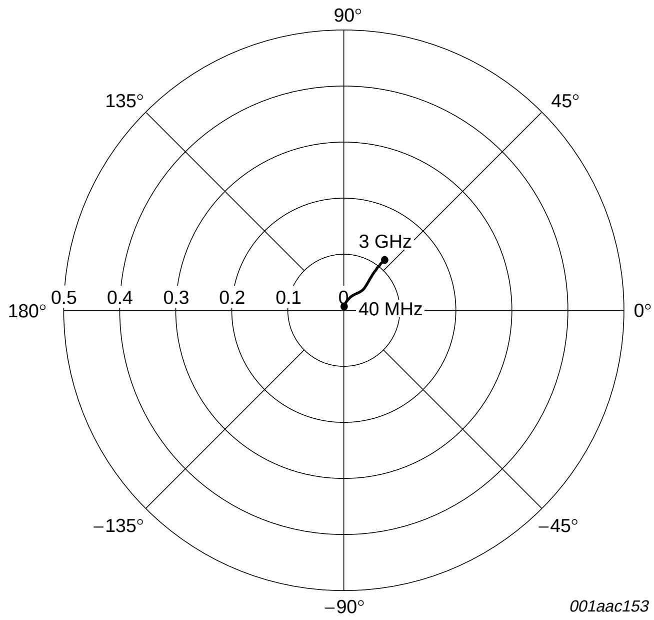
V_{CE} = 3 V; I_C = 15 mA; Z_o = 50 Ω.

Fig 5. Common emitter input reflection coefficient (s_{11}); typical values



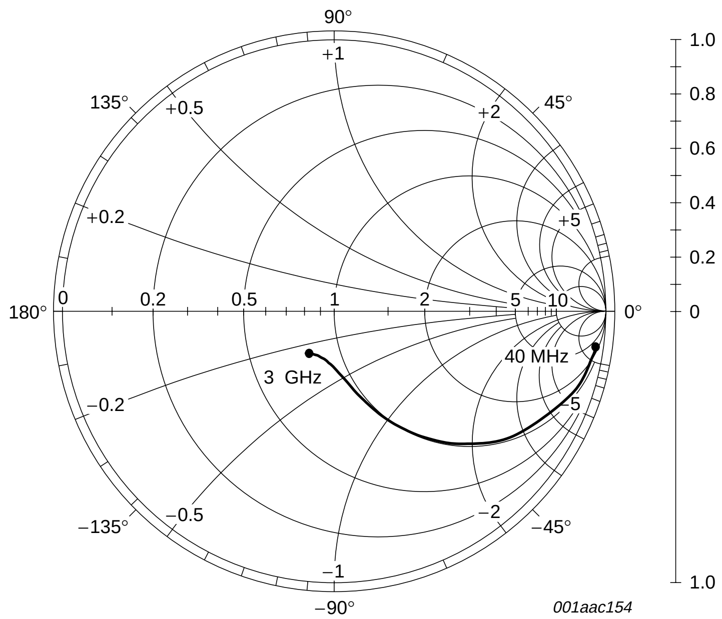
V_{CE} = 3 V; I_C = 15 mA.

Fig 6. Common emitter forward transmission coefficient (s_{21}); typical values



V_{CE} = 3 V; I_C = 15 mA.

Fig 7. Common emitter reverse transmission coefficient (s_{12}); typical values



V_{CE} = 3 V; I_C = 15 mA; Z_o = 50 Ω.

Fig 8. Common emitter output reflection coefficient (s_{22}); typical values

8. Application information

Table 8: SPICE parameters of the BFG325 DIE

Sequence	Parameter	Value	Unit
1	IS	26.6	aA
2	BF	200	-
3	NF	1	-
4	VAF	40	V
5	IKF	105	mA
6	ISE	2.3	fA
7	NE	2.114	-
8	BR	10	-
9	NR	1	-
10	VAR	2.5	V
11	IKR	10	A
12	ISC	0	aA
13	NC	1.5	-
14	RB	3.6	Ω
15	RE	1.5	Ω
16	RC	2.6	Ω
17	CJE	185.6	fF
18	VJE	890	mV
19	MJE	0.294	-
20	CJC	77.06	fF
21	VJC	601	mV
22	MJC	0.159	-
23	XCJC	1	-
24	FC	0.7	-
25	TF	8.1	ps
26	XTF	10	-
27	VTF	1000	V
28	ITF	150	mA
29	PTF	0	deg
30	TR	0	ns
31	KF	0	-
32	AF	1	-
33	TNOM	25	°C
34	EG	1.014	eV
35	XTB	0	-
36	XTI	8	-
37	Q1.AREA	2.5	-

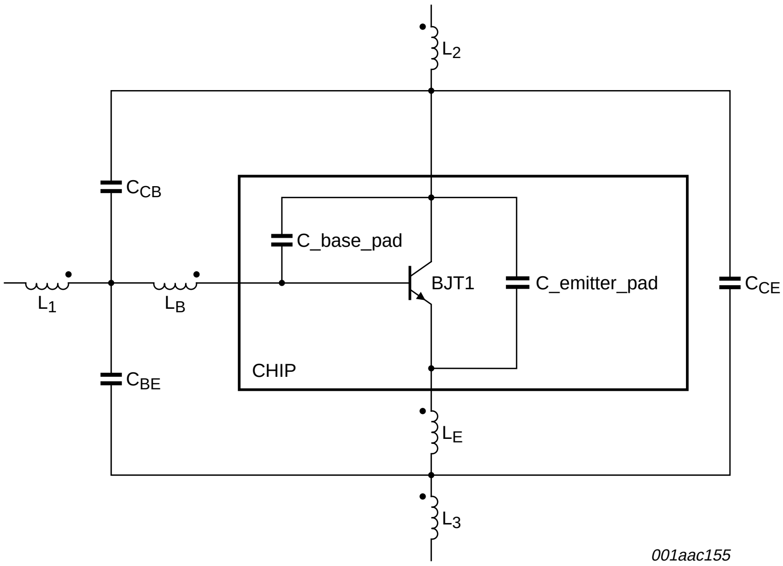


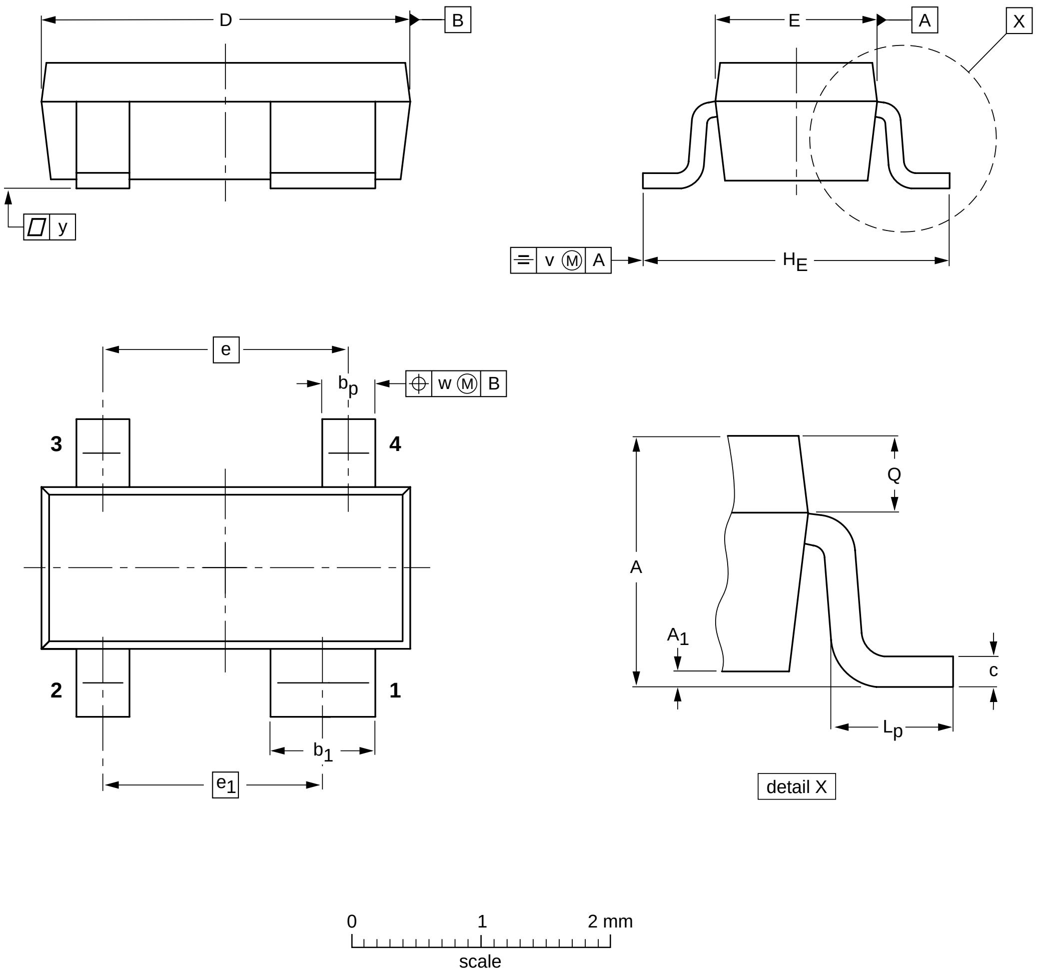
Fig 9. Package equivalent circuit of SOT143R

Table 9: List of components; see Figure 9

Designation	Value	Unit
C_{CB}	17	fF
C_{BE}	84	fF
C_{CE}	191	fF
C_base_pad	67	fF
C_emitter_pad	142	fF
L_B	0.95	nH
L_E	0.40	nH
L_1	0.12	nH
L_2	0.21	nH
L_3	0.06	nH

9. Package outline

Plastic surface mounted package; reverse pinning; 4 leads **SOT143R**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	b_1	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.1	0.48 0.38	0.88 0.78	0.15 0.09	3.0 2.8	1.4 1.2	1.9	1.7	2.5 2.1	0.55 0.25	0.45 0.25	0.2	0.1	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT143R			SC-61AA			~~99-09-13~~ 04-11-16

Fig 10. Package outline SOT143R (SC-61AA)

10. Revision history

Table 10: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
BFG325_XR_1	20050202	Product data sheet	-	9397 750 14247	-

11. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
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.
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[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.

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15. Contents

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