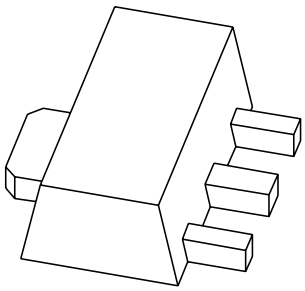
# DATA SHEET



# BFQ540
## NPN wideband transistor

Product specification
Supersedes data of 1998 Aug 27

2000 May 23

Philips
Semiconductors

PHILIPS

# NPN wideband transistor BFQ540

## FEATURES

- High gain
- High output voltage
- Low noise
- Gold metallization ensures excellent reliability
- Low thermal resistance.

## APPLICATIONS

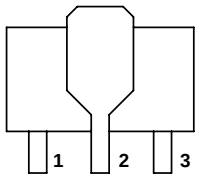
- VHF, UHF and CATV amplifiers.

## DESCRIPTION

NPN wideband transistor in a SOT89 plastic package.

## PINNING

| PIN | DESCRIPTION |
|---|---|
| 1 | emitter |
| 2 | collector |
| 3 | base |




Bottom view MBK514

**Marking code:** N4.

Fig.1 SOT89.

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | – | – | 20 | V |
| $V_{CES}$ | collector-emitter voltage | $R_{BE}$ = 0 | – | – | 15 | V |
| $V_{EBO}$ | collector-base voltage | open collector | – | – | 2 | V |
| $I_C$ | collector current (DC) | | – | – | 120 | mA |
| $P_{tot}$ | total power dissipation | $T_s \leq 60$ °C; note 1 | – | – | 1.2 | W |
| $h_{FE}$ | DC current gain | $I_C$ = 40 mA; $V_{CE}$ = 8 V; $T_j$ = 25 °C | 100 | 120 | 250 | |
| $f_T$ | transition frequency | $I_C$ = 40 mA; $V_{CE}$ = 8 V; f = 1 GHz; $T_{amb}$ = 25 °C | – | 9 | – | GHz |
| $\lvert s_{21}\rvert^2$ | insertion power gain | $I_C$ = 40 mA; $V_{CE}$ = 8 V; f = 900 MHz; $T_{amb}$ = 25 °C | 12 | 13 | – | dB |
| F | noise figure | $I_C$ = 40 mA; $V_{CE}$ = 8 V; f = 900 MHz; $\Gamma_S = \Gamma_{opt}$ | – | 1.9 | 2.4 | dB |

**Note**

1. $T_s$ is the temperature at the soldering point of the collector pin.

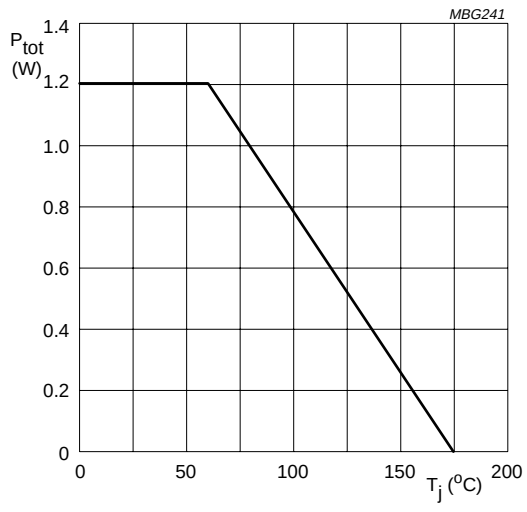
## LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | – | 20 | V |
| $V_{CES}$ | collector-emitter voltage | $R_{BE}$ = 0 | – | 15 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | 2 | V |
| $I_C$ | collector current (DC) | | – | 120 | mA |
| $P_{tot}$ | total power dissipation | $T_s \leq 60$ °C | – | 1.2 | W |
| $T_{stg}$ | storage temperature | | –65 | +150 | °C |
| $T_j$ | operating junction temperature | | – | 175 | °C |

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}s}$ | thermal resistance from junction to soldering point | $T_s \leq 60$ °C; $P_{tot}$ = 1.2 W | 95 | K/W |




$V_{CE} \leq 9$ V.

Fig.2 Power derating curve.

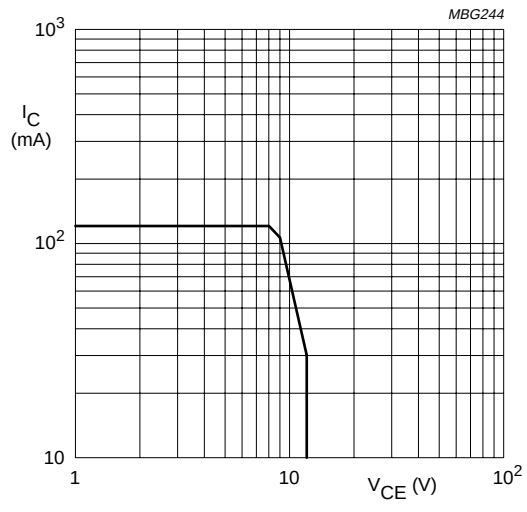



Fig.3 SOAR.

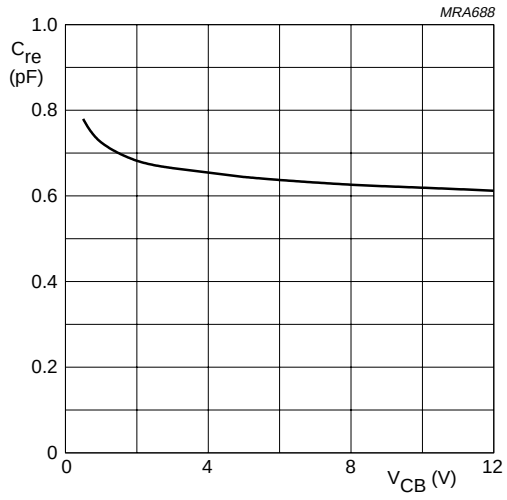
## CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | open emitter; $I_C$ = 10 μA; $I_E$ = 0 | 20 | – | – | V |
| $V_{(BR)CES}$ | collector-emitter breakdown voltage | $R_{BE}$ = 0; $I_C$ = 40 μA | 15 | – | – | V |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | $I_E$ = 100 μA; $I_C$ = 0 | 2 | – | – | V |
| $I_{CBO}$ | collector-base leakage current | $V_{CB}$ = 8 V; $I_E$ = 0 | – | – | 50 | nA |
| $I_{EBO}$ | emitter-base leakage current | $V_{CB}$ = 1 V; $I_C$ = 0 | – | – | 200 | nA |
| $h_{FE}$ | DC current gain | $I_C$ = 40 mA; $V_{CE}$ = 8 V | 100 | 120 | 250 | |
| $f_T$ | transition frequency | $I_C$ = 40 mA; $V_{CE}$ = 8 V; $f_m$ = 1 GHz | – | 9 | – | GHz |
| $C_e$ | emitter capacitance | $I_C = i_e$ = 0; $V_{EB}$ = 0.5 V; f = 1 MHz | – | 2 | – | pF |
| $C_{re}$ | feedback capacitance | $I_C$ = 0; $V_{CE}$ = 8 V; f = 1 MHz | – | 0.9 | – | pF |
| $\lvert s_{21}\rvert^2$ | insertion power gain | $I_C$ = 40 mA; $V_{CE}$ = 8 V; f = 900 MHz; $T_{amb}$ = 25 °C | 12 | 13 | – | dB |
| $V_o$ | output voltage | note 1 | – | 500 | – | mV |
| | | note 2 | – | 350 | – | mV |
| $d_2$ | second order intermodulation distortion | note 3 | – | – | –53 | dB |
| F | noise figure | $I_C$ = 40 mA; $V_{CE}$ = 8 V; f = 900 MHz; $\Gamma_S = \Gamma_{opt}$ | – | 1.9 | 2.4 | dB |

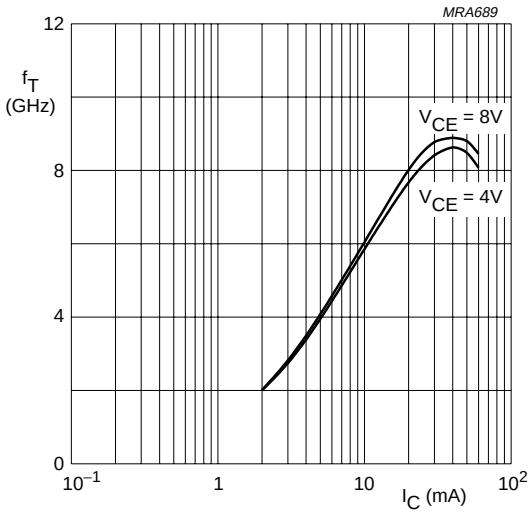
**Notes**

1. $d_{im}$ = –60 dB (DIN45004B); $V_{CE}$ = 8 V; $I_C$ = 40 mA; $R_L$ = 50 Ω; $V_p = V_o$; $V_q = V_o$ –6 dB; $V_r = V_o$ –6 dB; $f_p$ = 795.25 MHz; $f_q$ = 803.25 MHz; $f_r$ = 805.5 MHz; measured at $f_p + f_q - f_r$ = 793.25 MHz.
2. $d_{im}$ = –60 dB (DIN 45004B); $I_C$ = 40 mA; $V_{CE}$ = 8 V; $R_L$ = 50 Ω; $V_p = V_q = V_o$; $f_p$ = 806 MHz; $f_q$ = 810 MHz; measured at $2f_p - f_q$ = 802 MHz.
3. $I_C$ = 40 mA; $V_{CE}$ = 8 V; $R_L$ = 50 Ω; $V_p = V_q$ = 225 mV; $f_p$ = 250 MHz; $f_q$ = 560 MHz; measured at $f_p + f_q$ = 810 MHz.



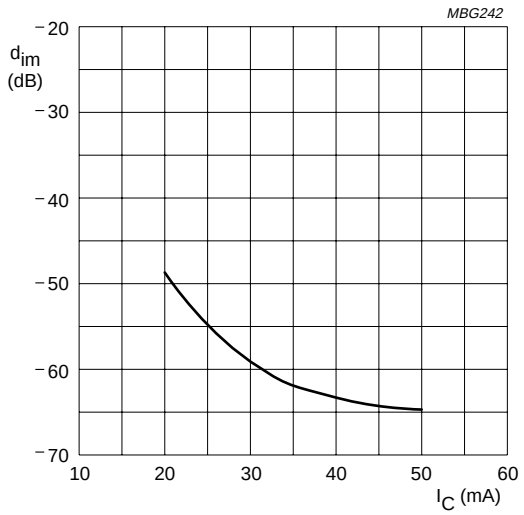

$I_C$ = 0; f = 1 MHz.

Fig.4 Feedback capacitance as a function of collector-base voltage; typical values.



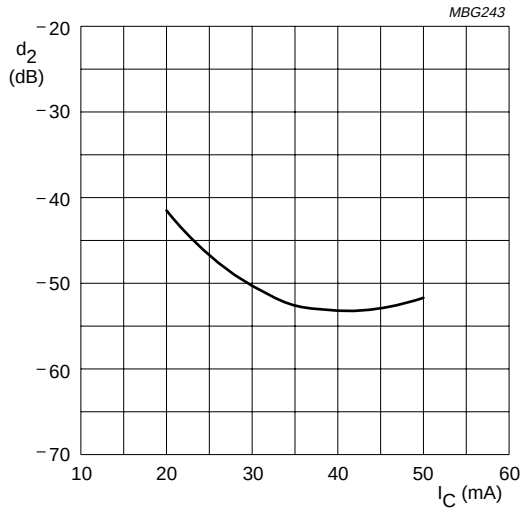

f = 1 GHz; $T_{amb}$ = 25 °C.

Fig.5 Transition frequency as a function of collector current; typical values.




$V_{CE}$ = 8 V; $V_o$ = 475 mV; $R_L$ = 50 Ω.
$f_p + f_q - f_r$ = 793.25 MHz; $T_{amb}$ = 25 °C.

Fig.6 Intermodulation distortion as a function of collector current; typical values.

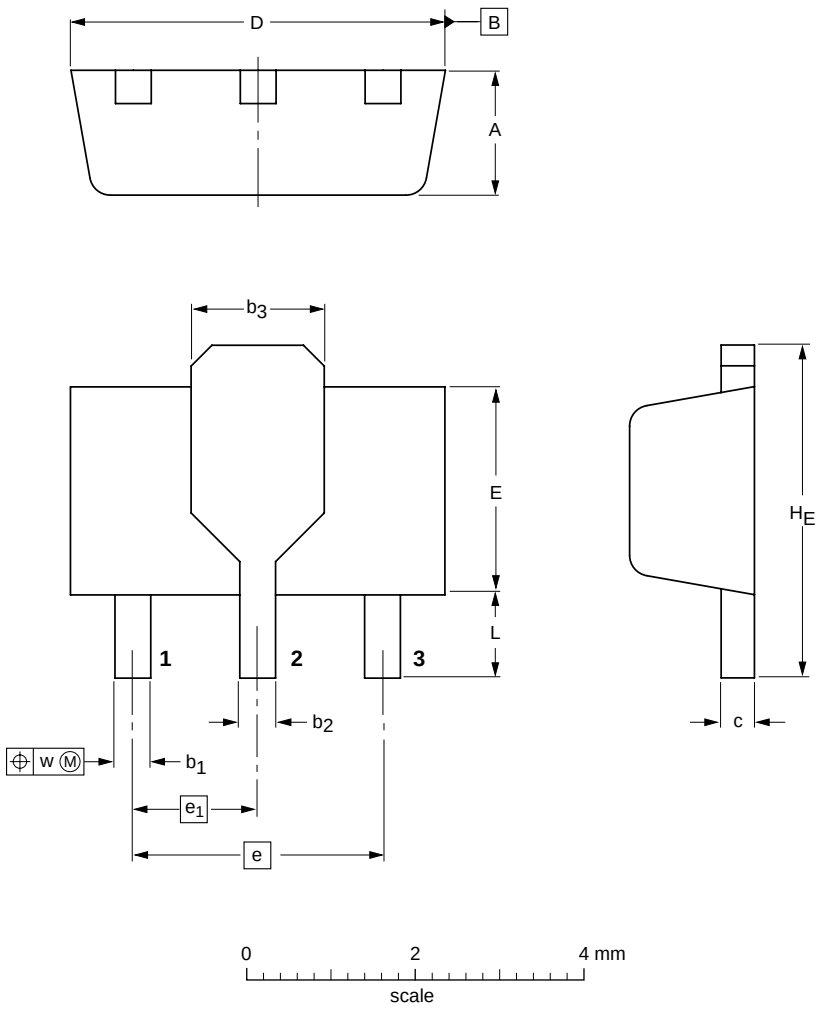



$V_{CE}$ = 8 V; $V_o$ = 225 mV; $R_L$ = 50 Ω; $f_p + f_q$ = 810 MHz;
$T_{amb}$ = 25 °C.

Fig.7 Second order intermodulation distortion as a function of collector current; typical values.

## PACKAGE OUTLINE

**Plastic surface mounted package; collector pad for good heat transfer; 3 leads** **SOT89**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | $b_1$ | $b_2$ | $b_3$ | c | D | E | e | $e_1$ | $H_E$ | L min. | w |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 1.6<br>1.4 | 0.48<br>0.35 | 0.53<br>0.40 | 1.8<br>1.4 | 0.44<br>0.37 | 4.6<br>4.4 | 2.6<br>2.4 | 3.0 | 1.5 | 4.25<br>3.75 | 0.8 | 0.13 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT89 | | TO-243 | SC-62 | | | ~~97-02-28~~<br>99-09-13 |

**DATA SHEET STATUS**

| DATA SHEET STATUS | PRODUCT STATUS | DEFINITIONS [1] |
|---|---|---|
| Objective specification | Development | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice. |
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| Product specification | Production | This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |

**Note**

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**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.

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# *Philips Semiconductors – a worldwide company*


**Argentina:** see South America

**Australia:** 3 Figtree Drive, HOMEBUSH, NSW 2140,
Tel. +61 2 9704 8141, Fax. +61 2 9704 8139

**Austria:** Computerstr. 6, A-1101 WIEN, P.O. Box 213,
Tel. +43 1 60 101 1248, Fax. +43 1 60 101 1210

**Belarus:** Hotel Minsk Business Center, Bld. 3, r. 1211, Volodarski Str. 6,
220050 MINSK, Tel. +375 172 20 0733, Fax. +375 172 20 0773

**Belgium:** see The Netherlands

**Brazil:** see South America

**Bulgaria:** Philips Bulgaria Ltd., Energoproject, 15th floor,
51 James Bourchier Blvd., 1407 SOFIA,
Tel. +359 2 68 9211, Fax. +359 2 68 9102

**Canada:** PHILIPS SEMICONDUCTORS/COMPONENTS,
Tel. +1 800 234 7381, Fax. +1 800 943 0087

**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:** Sydhavnsgade 23, 1780 COPENHAGEN V,
Tel. +45 33 29 3333, Fax. +45 33 29 3905

**Finland:** Sinikalliontie 3, FIN-02630 ESPOO,
Tel. +358 9 615 800, Fax. +358 9 6158 0920

**France:** 51 Rue Carnot, BP317, 92156 SURESNES Cedex,
Tel. +33 1 4099 6161, Fax. +33 1 4099 6427

**Germany:** Hammerbrookstraße 69, D-20097 HAMBURG,
Tel. +49 40 2353 60, Fax. +49 40 2353 6300

**Hungary:** see Austria

**India:** Philips INDIA Ltd, Band Box Building, 2nd floor,
254-D, Dr. Annie Besant Road, Worli, MUMBAI 400 025,
Tel. +91 22 493 8541, Fax. +91 22 493 0966

**Indonesia:** PT Philips Development Corporation, Semiconductors Division,
Gedung Philips, Jl. Buncit Raya Kav.99-100, JAKARTA 12510,
Tel. +62 21 794 0040 ext. 2501, Fax. +62 21 794 0080

**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, Via Casati, 23 - 20052 MONZA (MI),
Tel. +39 039 203 6838, Fax +39 039 203 6800

**Japan:** Philips Bldg 13-37, Kohnan 2-chome, Minato-ku,
TOKYO 108-8507, Tel. +81 3 3740 5130, Fax. +81 3 3740 5057

**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, Fax +9-5 800 943 0087

**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

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Metro MANILA, Tel. +63 2 816 6380, Fax. +63 2 817 3474

**Poland**: Al.Jerozolimskie 195 B, 02-222 WARSAW,
Tel. +48 22 5710 000, Fax. +48 22 5710 001

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2092 JOHANNESBURG, P.O. Box 58088 Newville 2114,
Tel. +27 11 471 5401, Fax. +27 11 471 5398

**South America:** Al. Vicente Pinzon, 173, 6th floor,
04547-130 SÃO PAULO, SP, Brazil,
Tel. +55 11 821 2333, Fax. +55 11 821 2382

**Spain:** Balmes 22, 08007 BARCELONA,
Tel. +34 93 301 6312, Fax. +34 93 301 4107

**Sweden:** Kottbygatan 7, Akalla, S-16485 STOCKHOLM,
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**Switzerland:** Allmendstrasse 140, CH-8027 ZÜRICH,
Tel. +41 1 488 2741 Fax. +41 1 488 3263

**Taiwan:** Philips Semiconductors, 6F, No. 96, Chien Kuo N. Rd., Sec. 1,
TAIPEI, Taiwan Tel. +886 2 2134 2886, 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:** Yukari Dudullu, Org. San. Blg., 2.Cad. Nr. 28 81260 Umraniye,
ISTANBUL, Tel. +90 216 522 1500, Fax. +90 216 522 1813

**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. +44 208 730 5000, Fax. +44 208 754 8421

**United States:** 811 East Arques Avenue, SUNNYVALE, CA 94088-3409,
Tel. +1 800 234 7381, Fax. +1 800 943 0087

**Uruguay:** see South America

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