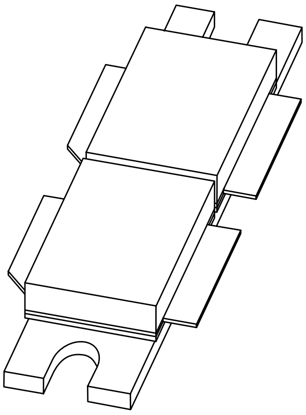
DISCRETE SEMICONDUCTORS

DATA SHEET



BLV2048
UHF push-pull power transistor

Preliminary specification

1999 Apr 23

Philips Semiconductors

PHILIPS

FEATURES

- Emitter ballasting resistors for optimum temperature profile
- Gold metallization ensures excellent reliability
- Internal input and output matching for an easy design of wideband circuits.
- AlN substrate package for environmental safety
- Linear amplification with low distortion
- Low spectral regrowth in multichannel power amplifiers according to IS-95.

APPLICATIONS

- Common emitter class-AB operation in base stations for PCN (Personal Communication Network): 1805 - 1880 MHz and PCS (Personal Communication Services): 1910 - 1990 MHz.

DESCRIPTION

NPN silicon planar push-pull power transistor in a 4-lead AlN SOT494A flange package with two ceramic caps. The emitters are connected to the flange.

PINNING - SOT494A

PIN	SYMBOL	DESCRIPTION
1	c	collector 1
2	c	collector 2
3	b	base 1
4	b	base 2
5	e	emitter, connected to flange

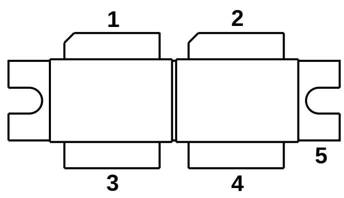


Fig.1 Simplified outline.

QUICK REFERENCE DATA

RF performance at T_h = 25 °C in a common emitter test circuit.

MODE OF OPERATION	f (MHz)	V_{CE} (V)	P_L (W)	G_p (dB)	η_C (%)	d_{im} (dBc)
CW, class-AB	2000	26	120	≥8	≥40	–
2-tone, class-AB	f_1 = 2000.0; f_2 = 2000.1	26	120 (PEP)	≥8.5	≥33	≤–28

LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134)

Per section unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	65	V
V_{CEO}	collector-emitter voltage	open base	–	27	V
V_{EBO}	emitter-base voltage	open collector	–	3	V
I_C	collector current (DC)		–	20	A
$I_{C(AV)}$	average collector current		–	10	A
P_{tot}	total power dissipation	T_{mb} = 25 °C	–	415	W
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	200	°C

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}h}$	thermal resistance from junction to heatsink	P_L = 120 W(PEP); T_h = 40°C; note 1: total device; both sections equally loaded	≤0.6	K/W
$R_{th\ mb\text{-}h}$	thermal resistance from mounting base to heatsink		0.2	K/W

Note

1. Thermal resistance is determined under nominal 2-tone RF operating conditions.

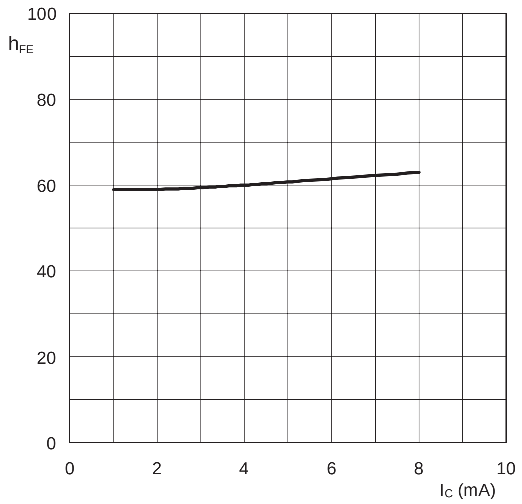
CHARACTERISTICS

T_j = 25 °C; per section; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(BR)CBO}$	collector-base breakdown voltage	open emitter; I_C = 40 mA	65	–	–	V
$V_{(BR)CEO}$	collector-emitter breakdown voltage	open base; I_C = 120 mA	27	–	–	V
$V_{(BR)EBO}$	emitter-base breakdown voltage	open collector; I_E = 40 mA	3	–	–	V
I_{CES}	collector leakage current	V_{CE} = 26 V; V_{BE} = 0	–	–	8	mA
h_{FE}	DC current gain	V_{CE} = 10 V; I_C = 4 A	45	–	100	
C_c	collector capacitance	V_{CB} = 26 V; I_E = i_e = 0; f = 1 MHz; note 1	–	72	–	pF
C_{re}	feedback capacitance	V_{CE} = 26 V; I_C = 0; f = 1 MHz	–	41	–	pF

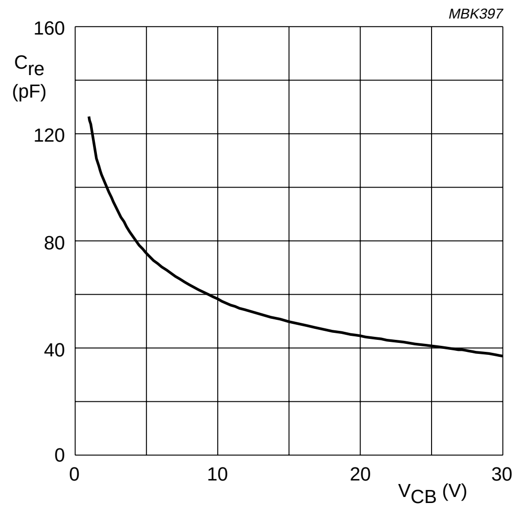
Note

1. Capacitance of die only.



V_{CE} = 10 V.

Fig.2 DC current gain as a function of collector current (per section); typical values.



f = 1 MHz.

Fig.3 Feedback capacitance as a function of collector-base voltage (per section); typical values.

APPLICATION INFORMATION

RF performance at T_h = 25 °C in a common emitter test circuit; bias circuit: R_i = 0.2 Ω.

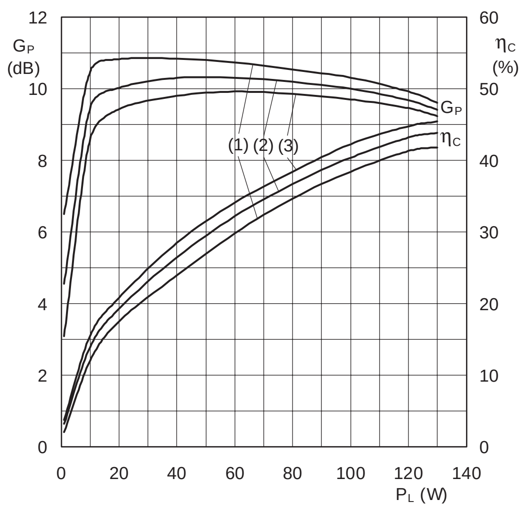
MODE OF OPERATION	f (MHz)	V_{CE} (V)	I_{CQ} (mA)	P_L (W)	G_p (dB)	η_C (%)	d_{im} (dBc)	ACP (dBc)
CW, class-AB	2000	26	2x300	120	≥8	≥40	–	–
2-tone, class-AB	f_1 = 2000.0; f_2 = 2000.1	26	2x300	120 (PEP)	≥8.5	≥33	≤–28	–
CDMA, class-AB	2000	26	2x500	25	typ. 9	typ. 22	–	≤–46 (note 1)

Notes

1. CDMA testsignal with peak to average ratio of 11.9 dB.
   ACP is measured at +/- 885 kHz offset from the centre of the channel (2000 MHz) using a spectrum analyzer with a resolution set to 30 kHz

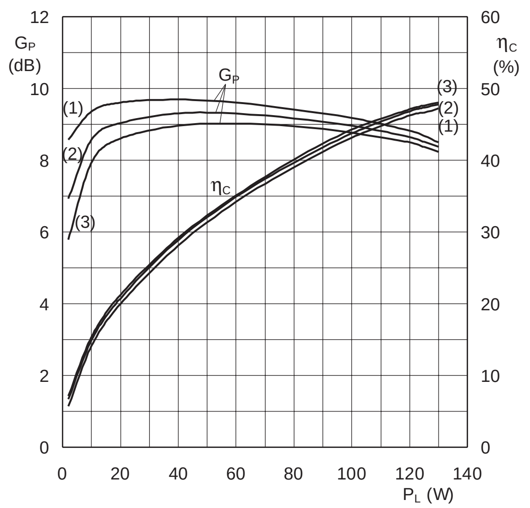
Ruggedness in class-AB operation

The BLV2048 is capable of withstanding a load mismatch corresponding to VSWR = 3 : 1 through all phases under the following conditions: f_1 = 2000.0 MHz; f_2 = 2000.1 MHz; V_{CE} = 26 V; I_{CQ} = 2 x 300 mA; P_L = 120 W (PEP); T_{mb} = 25 °C.



(1) I_{CQ} = 2x300 mA
(2) I_{CQ} = 2x100 mA
(3) I_{CQ} = 2x50 mA
V_{CE} = 26 V; R1 = R2 = 0; f = 2000 MHz

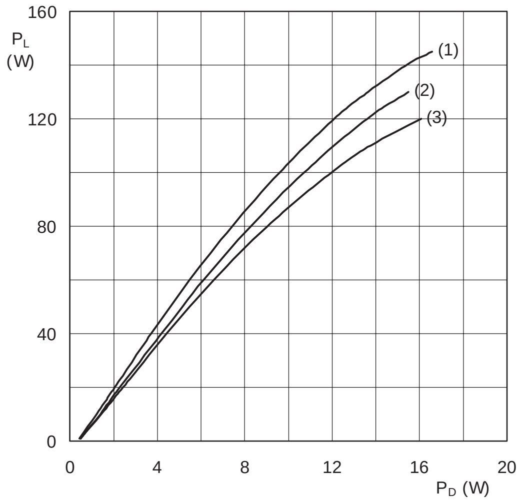
Fig.4 Power gain and collector efficiency as a function of load power; typical values.



(1) I_{CQ} = 2x300 mA
(2) I_{CQ} = 2x100 mA
(3) I_{CQ} = 2x50 mA
V_{CE} = 26 V; R1 = R2 = 2.4 Ω; f = 2000 MHz

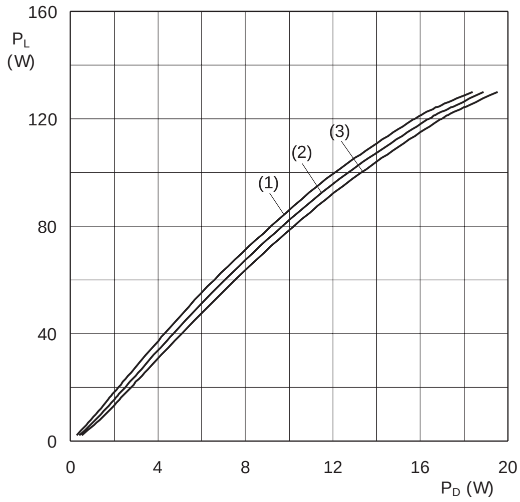
Fig.5 Power gain and collector efficiency as a function of load power; typical values.

UHF push-pull power transistor BLV2048



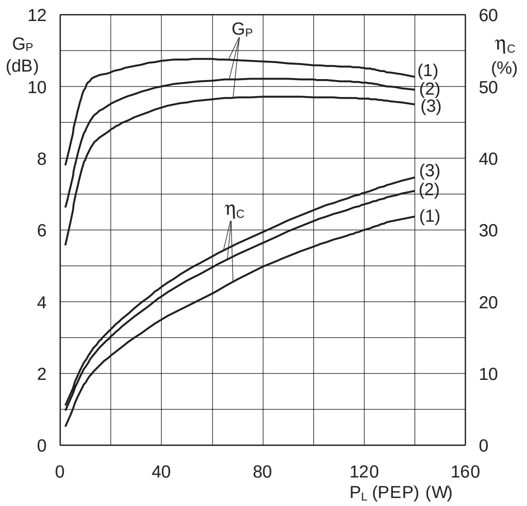
(1) V_{CE} = 28 V
(2) V_{CE} = 26 V
(3) V_{CE} = 24 V
I_{CQ} = 2x50 mA; R1 = R2 = 0; f = 2000 MHz

Fig.6 Load power as a function of drive power; typical values.



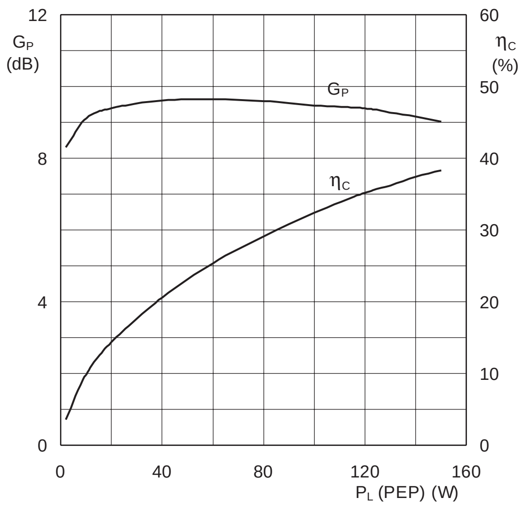
(1) I_{CQ} = 2x300 mA
(2) I_{CQ} = 2x100 mA
(3) I_{CQ} = 2x50 mA
V_{CE} = 26 V; R1 = R2 = 2.4 Ω; f = 2000 MHz

Fig.7 Load power as a function of drive power; typical values.



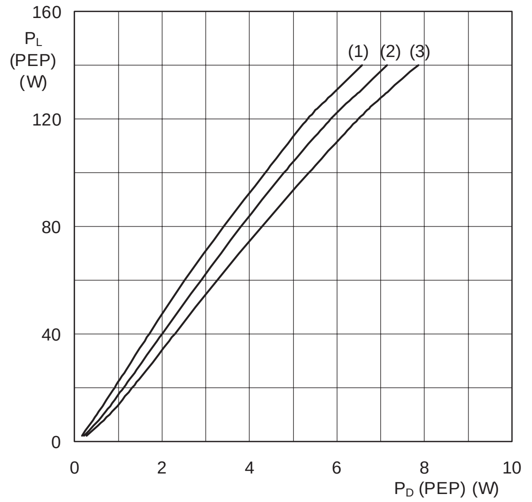
(1) I_{CQ} = 2x300 mA
(2) I_{CQ} = 2x100 mA
(3) I_{CQ} = 2x50 mA
V_{CE} = 26 V; R1 = R2 = 0; f_1 = 2000 MHz; f_2 = 2000.1 MHz

Fig.8 Power gain and collector efficiency as a functions of peak envelope load power; typical values.



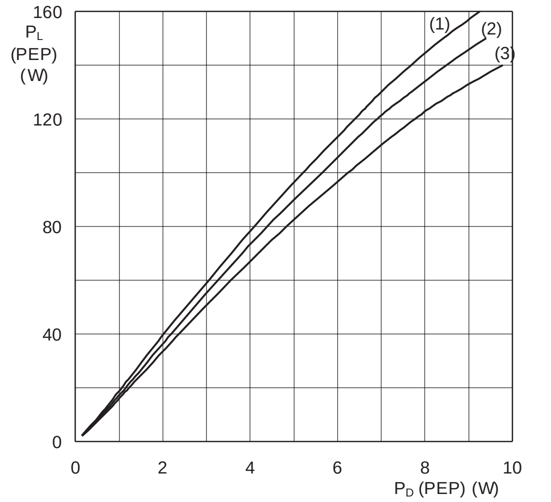
I_{CQ} = 2x300 mA; V_{CE} = 26 V; R1 = R2 = 2.4 Ω;
f_1 = 2000 MHz; f_2 = 2000.1 MHz

Fig.9 Power gain and collector efficiency as a function of peak envelope load power; typical values.



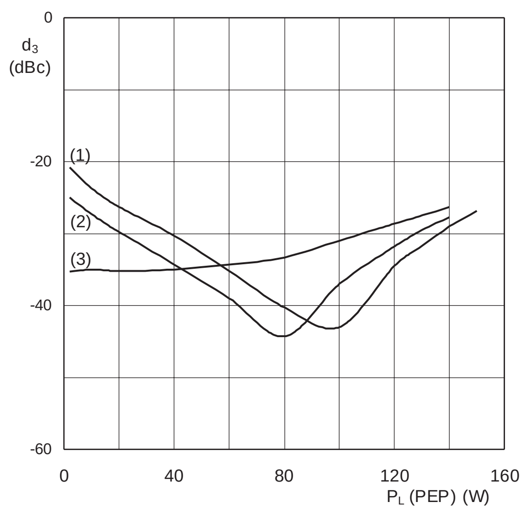
(1) I_{CQ} = 2x300 mA
(2) I_{CQ} = 2x100 mA
(3) I_{CQ} = 2x50 mA
V_{CE} = 26 V; R1 = R2 = 0; f_1 = 2000 MHz; f_2 = 2000.1 MHz

Fig.10 Peak envelope load power as a function of peak envelope drive power; typical values.



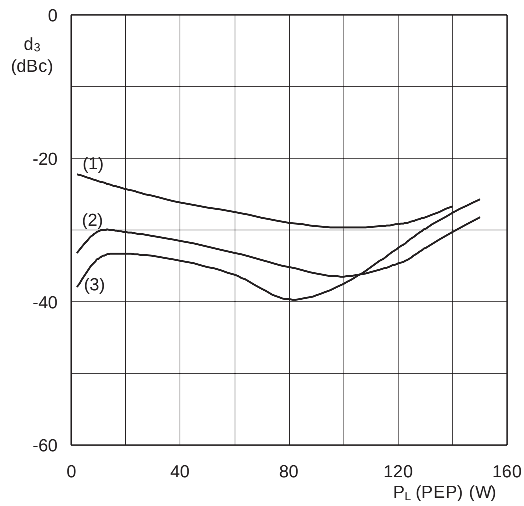
(1) V_{CE} = 28 V
(2) V_{CE} = 26 V
(3) V_{CE} = 24 V
I_{CQ} = 2x300 mA; R1 = R2 = 2.4 Ω; f_1 = 2000 MHz; f_2 = 2000.1 MHz

Fig.11 Peak envelope load power as a function of peak envelope drive power; typical values.



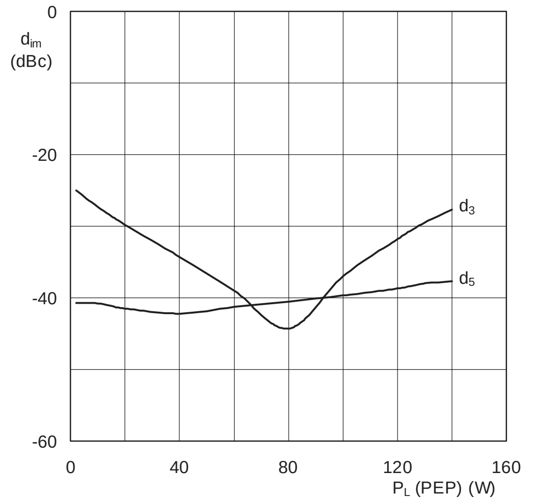
(1) I_{CQ} = 2x50 mA
(2) I_{CQ} = 2x100 mA
(3) I_{CQ} = 2x300 mA
V_{CE} = 26 V; R1 = R2 = 0; f_1 = 2000 MHz; f_2 = 2000.1 MHz

Fig.12 Intermodulation distortion as a function of peak envelope load power; typical values.



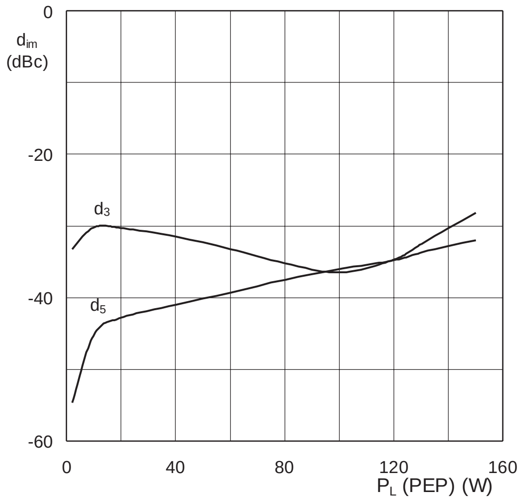
(1) I_{CQ} = 2x100 mA
(2) I_{CQ} = 2x300 mA
(3) I_{CQ} = 2x500 mA
V_{CE} = 26 V; R1 = R2 = 2.4 Ω; f_1 = 2000 MHz; f_2 = 2000.1 MHz

Fig.13 Intermodulation products as a function of peak envelope load power; typical values.



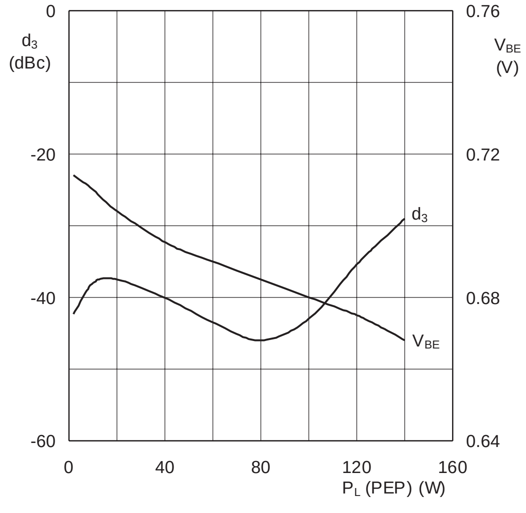
I_{CQ} = 2x100 mA; V_{CE} = 26 V; R1 = R2 = 0;
f_1 = 2000 MHz; f_2 = 2000.1 MHz

Fig.14 Intermodulation products as a function of peak envelope load power; typical values.



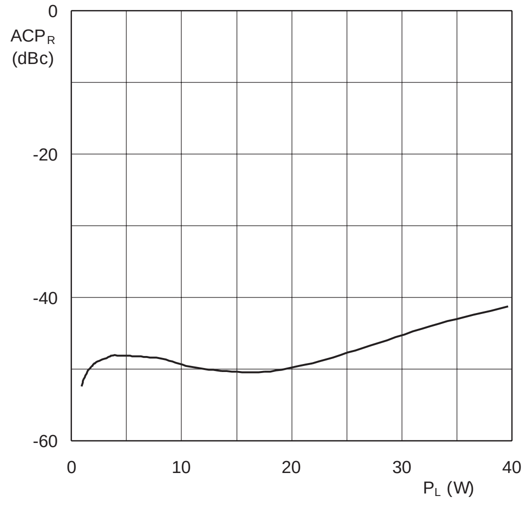
I_{CQ} = 2x300 mA; V_{CE} = 26 V; R1 = R2 = 2.4 Ω;
f_1 = 2000 MHz; f_2 = 2000.1 MHz

Fig.15 Intermodulation products as a function of peak envelope load power; typical values.



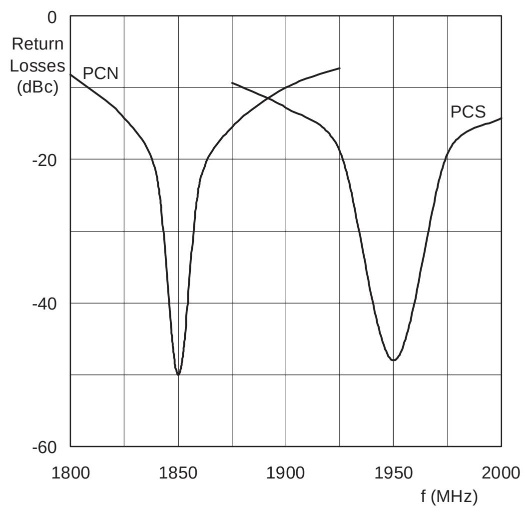
I_{CQ} = 2x300 mA; V_{CE} = 26 V; R1 = R2 = 0;
f_1 = 2000 MHz; f_2 = 2000.1 MHz

Fig.16 Minimal intermodulation and corresponding V_{BE} as a function of peak envelope load power; typical values.



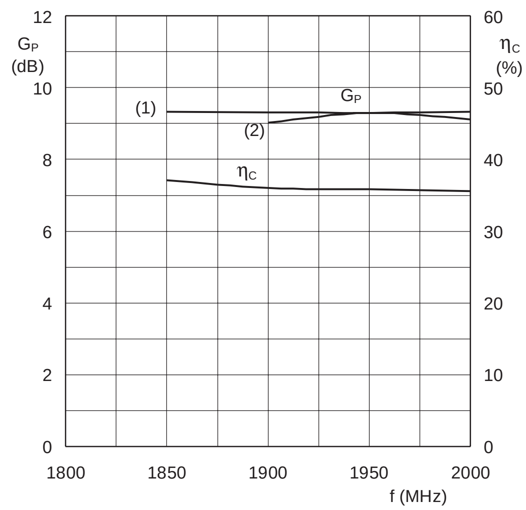
I_{CQ} = 2x500mA; V_{CE} = 26 V; R1 = R2 = 2.4 Ω;
Measured at 885 kHz offset with 30 kHz bandwidth
CDMA testsignal with 11.9 dB peak to average ratio

Fig.17 Adjacent channel power as a function of the load power; typical values.



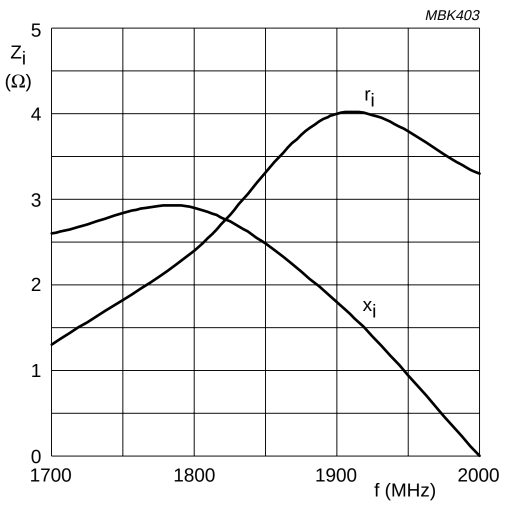
V_{CE} = 26 V; I_{CQ} = 2x300 mA; P_L = 120 W; R1 = R2 = 0;
Optimized for respectively the PCN-band and PCS-band

Fig.18 Input return losses as a function of frequency; typical values.



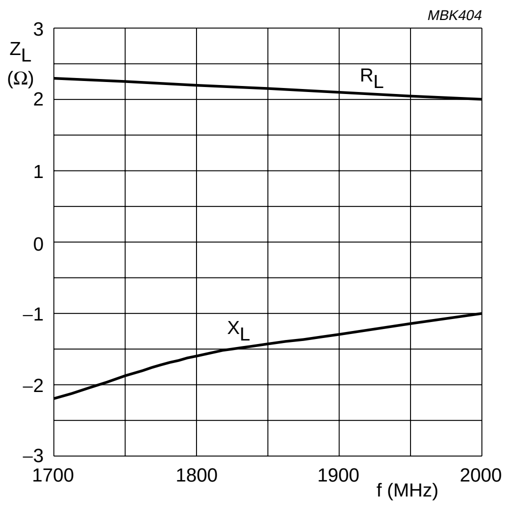
(1) Input tuned for minimal return losses
(2) Input tuned at 1.95 GHz
V_{CE} = 26 V; I_{CQ} = 2x300 mA; P_L = 120 W (PEP)

Fig.19 Power gain and collector efficiency as a functions of frequency; typical values.



V_{CE} = 26 V; I_{CQ} = 2x300 mA; P_L = 120 W (total device);
T_{mb} = 25 °C.

Fig.20 Input impedance per section as a function of frequency (series components); typical values.



V_{CE} = 26 V; I_{CQ} = 2x300 mA; P_L = 120 W (total device);
T_{mb} = 25 °C.

Fig.21 Load impedance per section as a function of frequency (series components); typical values.

UHF push-pull power transistor BLV2048

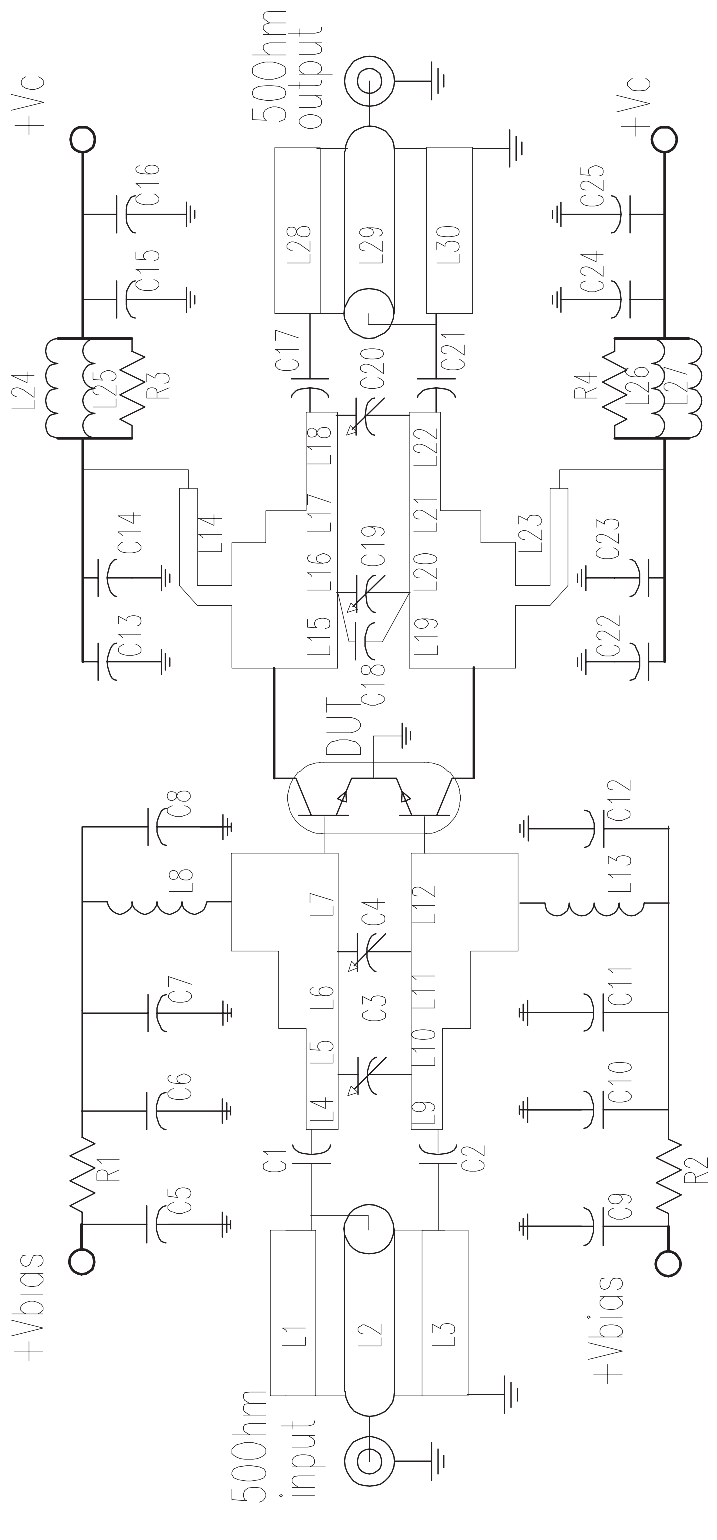


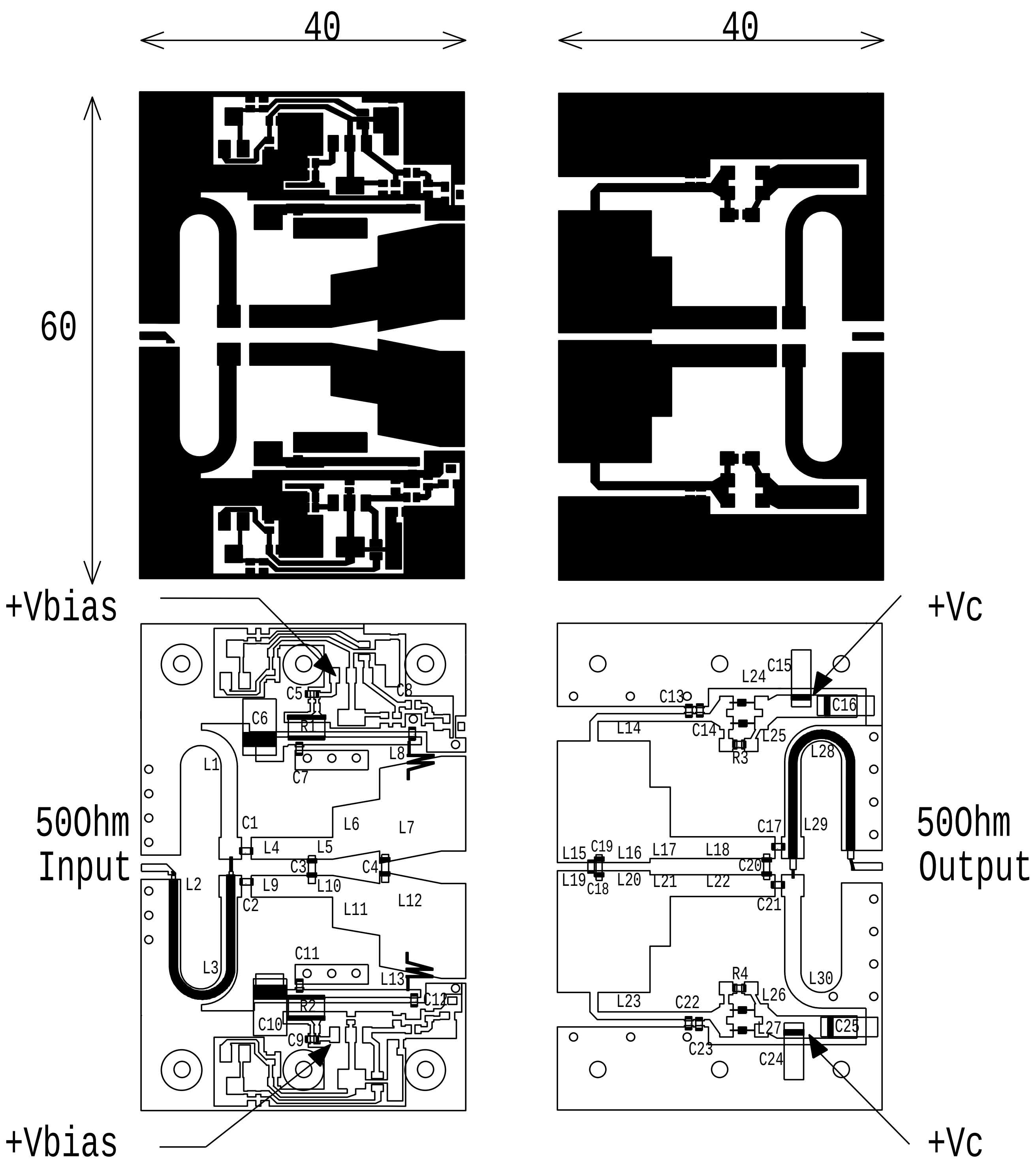
Fig.22 Class-AB test circuit for 2000 MHz.

List of components

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS	CATALOGUE NO.
C1, C2, C13, C17, C21, C22	multilayer ceramic chip capacitor; note 1	10 pF		
C3, C4, C19, C20	Tekelec variable capacitor; type 37271	0.6 to 4.5 pF		
C5, C9, C14, C23	multilayer ceramic chip capacitor; note 1	10 nF		
C6, C10, C16, C25	tantalum SMD capacitor	10 μF, 35 V		
C7, C11	multilayer ceramic chip capacitor, note 2	100 pF		
C8, C12	multilayer ceramic chip capacitor, note 2	18 pF		
C18	multilayer ceramic chip capacitor; note 1	1.2 pF		
C15, C24	tantalum SMD capacitor	4.7 μF, 50 V		
L1, L3, L28, L30	stripline; note 3	30 Ω	length 16 mm; width 2 mm	
L2, L29	semi-rigid cable	50 Ω	length 32 mm; width 2.2 mm	
L4 L5, L9, L10	stripline; note 3	25 Ω	length 5 mm; width 2.68 mm	
L6, L11	stripline; note 3	12.5 Ω	length 5.8 mm; width 6.4 mm	
L7, L12	stripline; note 3	7.3 Ω	length 10.6 mm; width 11.7 mm	
L8, L13	2 turns enamelled 1 mm copper wire	12 nH	int.dia. 3 mm; length 4 mm	
L14, L23	stripline; note 3	43.7 Ω	length 12.5 mm; width 1 mm	
L15, L19	stripline; note 3	5.9 Ω	length 6.5 mm; width 15 mm	
L16, L20	stripline; note 3	5.9 Ω	length 5 mm; width 15 mm	
L17, L21	stripline; note 3	9.5 Ω	length 2.5 mm; width 8.8 mm	
L18, L22	stripline; note 3	25 Ω	length 16 mm; width 2.68 mm	
L24, L25, L26, L27	grade 4B1 ferroxcube chip-bead			4322 020 34420
R1, R2	SMD resistor	2.4 Ω	type PRC201	
R3, R4	SMD resistor	10 Ω	type 0603	

Notes

1. American Technical Ceramics type 100B or capacitor of same quality.
2. American Technical Ceramics type 100A or capacitor of same quality.
3. The striplines are on a double copper-clad printed-circuit board with Teflon dielectric (ε_r = 6.15); thickness 0.64 mm.



The components are situated on one side of the copper-clad Teflon board, the other side is unetched and serves as a ground plane.
Earth connections from the component side to the ground plane are made by through metallization.

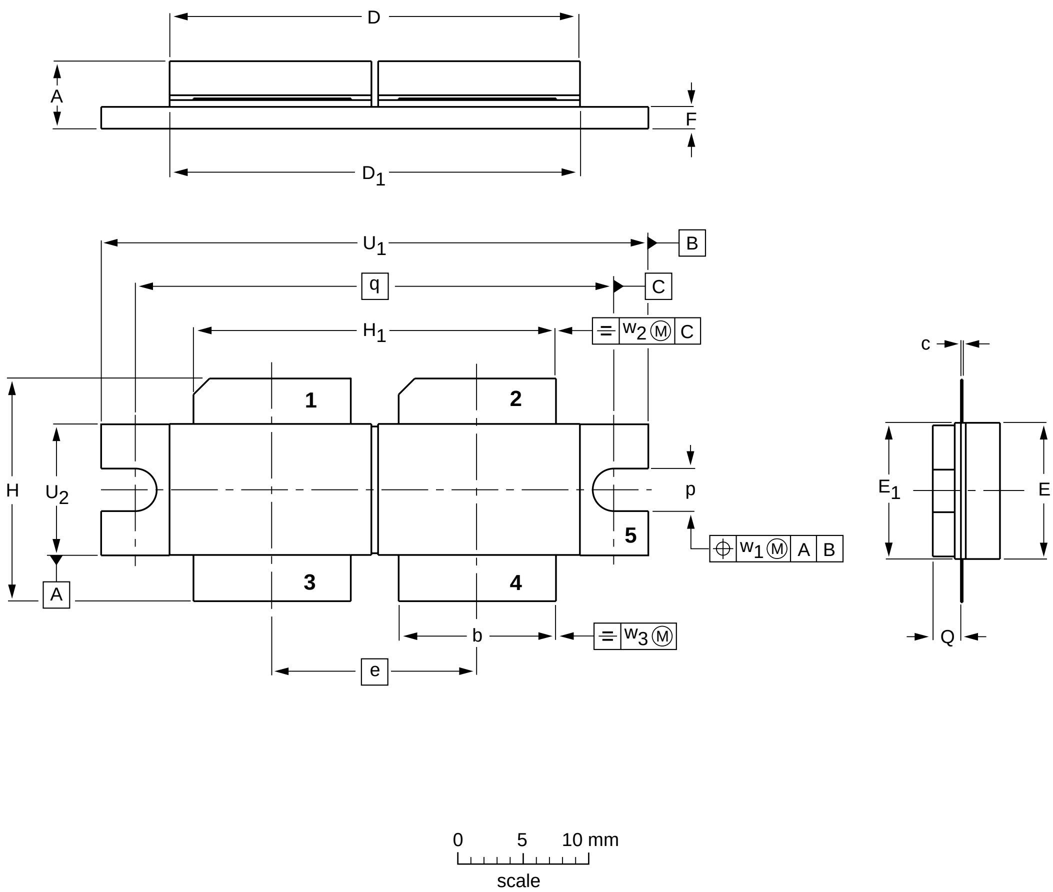
Fig.23 Component layout for 2000 MHz class-AB test circuit.

PACKAGE OUTLINE

Flanged double-ended ceramic (AIN) package; 2 mounting holes; 4 leads **SOT494A**

Package under development

Philips Semiconductors reserves the right to make changes without notice.



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

UNIT	A	b	c	D	D_1	E	E_1	e	F	H	H_1	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	5.26 4.60	11.81 11.56	0.15 0.10	33.96 28.02	31.37 30.61	10.26 10.06	10.29 10.03	15.75	1.66 1.60	16.74 16.48	27.81 27.05	3.30 3.05	2.21 2.06	36.07	41.28 41.02	10.29 10.03	0.25	0.51	0.25
inches	0.207 0.181	0.465 0.455	0.006 0.004	1.337 1.103	1.235 1.205	0.404 0.396	0.405 0.395	0.62	0.065 0.063	0.659 0.649	1.095 1.065	0.130 0.120	0.087 0.081	1.42	1.625 1.615	0.405 0.395	0.01	0.02	0.01

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT494A						99-03-30

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.
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.

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