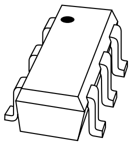

BGM1014

MMIC wideband amplifier

Rev. 01 — 11 March 2005 **Product data sheet**

1. Product profile

1.1 General description

Silicon Monolithic Microwave Integrated Circuit (MMIC) wideband amplifier with internal matching circuit in a 6-pin SOT363 SMD plastic package.

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling.

1.2 Features

- Internally matched to 50 Ω
- Good output match to 75 Ω
- 32 dB to 34 dB positive sloped gain for Low Noise Block (LNB) application
- 12.9 dBm saturated load power at 1 GHz
- 40 dB isolation

1.3 Applications

- LNB Intermediate Frequency (IF) amplifiers
- Cable systems
- General purpose

1.4 Quick reference data

Table 1: Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_S	DC supply voltage	RF input; AC coupled	-	5	6	V
I_S	DC supply current		17	21.0	25	mA
$\|s_{21}\|^2$	insertion power gain	f = 1 GHz	31.5	32.3	33.0	dB
NF	noise figure	f = 1 GHz	-	4.2	4.3	dB
$P_{L(sat)}$	saturated load power	f = 1 GHz	12.5	12.9	-	dBm

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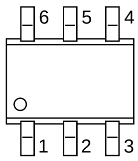
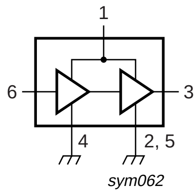
2. Pinning information

Table 2: Pinning

Pin	Description	Simplified outline	Symbol
1	V_S		
2, 5	GND2		
3	RF_OUT		
4	GND1		
6	RF_IN		

3. Ordering information

Table 3: Ordering information

Type number	Package		
	Name	Description	Version
BGM1014	SC-88	plastic surface mounted package; 6 leads	SOT363

4. Marking

Table 4: Marking

Type number	Marking code
BGM1014	C5-

5. Limiting values

Table 5: Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_S	DC supply voltage	RF input; AC coupled	-	6	V
I_S	supply current		-	30	mA
P_{tot}	total power dissipation	$T_{sp} \leq 90$ °C	-	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		-	150	°C
P_D	maximum drive power		-	–10	dBm

6. Recommended operating conditions

Table 6: Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_S	DC supply voltage		4.5	5.0	5.5	V
T_{amb}	ambient temperature		–40	+25	+85	°C

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7. Thermal characteristics

Table 7: Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point	P_{tot} = 200 mW; $T_{sp} \leq 90$ °C	300	K/W

8. Characteristics

Table 8: Characteristics

$V_S = 5$ V; $I_S = 21.1$ mA; $T_j = 25$ °C; measured on demo board; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_S	DC supply voltage	RF input; AC coupled	-	5	6	V
I_S	supply current		17	21.0	25	mA
$\|s_{21}\|^2$	insertion power gain	see Figure 4				
		f = 100 MHz	29.0	30.0	31.0	dB
		f = 1 GHz	31.5	32.3	33.0	dB
		f = 1.8 GHz	34.0	35.2	36.5	dB
		f = 2.2 GHz	33.0	34.1	35.5	dB
		f = 2.6 GHz	29.0	30.5	32.0	dB
		f = 3 GHz	25.0	26.4	28.0	dB
$\|s_{11}\|^2$	input return loss	f = 1 GHz	11	12.2	-	dB
		f = 2.2 GHz	7.5	8.8	-	dB
$\|s_{22}\|^2$	output return loss	Z_L = 50 Ω				
		f = 1 GHz	15	18.9	-	dB
		f = 2.2 GHz	12	16.7	-	dB
		Z_L = 75 Ω				
		f = 1 GHz	12	16.8	-	dB
		f = 2.2 GHz	12	17.7	-	dB
$\|s_{12}\|^2$	isolation	see Figure 3				
		f = 1 GHz	40	42	-	dB
		f = 2.2 GHz	35	37	-	dB
NF	noise figure	see Figure 7				
		f = 1 GHz	-	4.2	4.3	dB
		f = 2.2 GHz	-	4.1	4.3	dB
B	bandwidth	3 dB below flat gain at f = 1 GHz	-	2.5	-	GHz
K	stability factor	see Figure 8				
		f = 1 GHz	1.5	1.6	-	
		f = 2.2 GHz	0.9	1.0	-	
$P_{L(sat)}$	saturated load power	f = 1 GHz	12.5	12.9	-	dBm
		f = 2.2 GHz	8.8	9.3	-	dBm
$P_{L(1dB)}$	load power at 1 dB gain compression	f = 1 GHz	10.5	11.2	-	dBm
		f = 2.2 GHz	5.0	5.7	-	dBm

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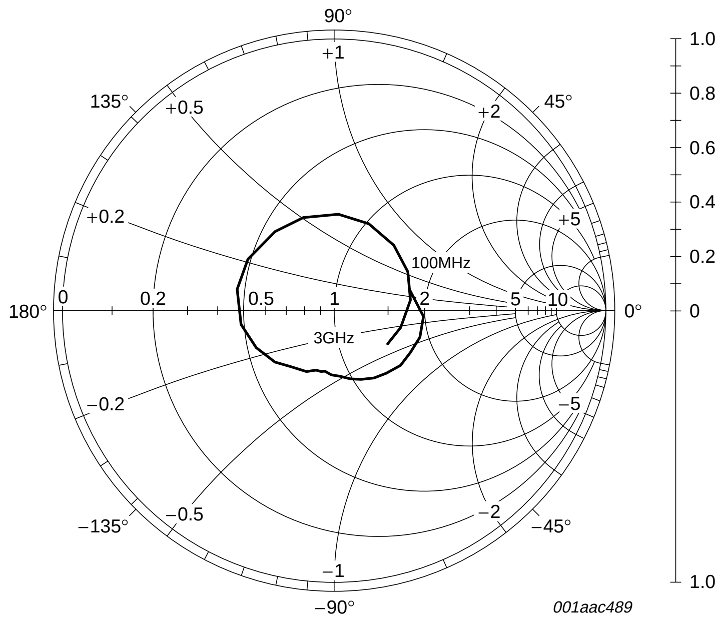
Table 8: Characteristics *...continued*

V_S = 5 V; I_S = 21.1 mA; T_j = 25 °C; measured on demo board; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$IP3_{in}$	input third order intercept point	f = 1 GHz	–13	–11.8	-	dBm
		f = 2.2 GHz	–21	–19	-	dBm
$IP3_{out}$	output third order intercept point	f = 1 GHz	19.5	20.5	-	dBm
		f = 2.2 GHz	14	15.1	-	dBm
IM2	second order intermodulation distortion	f_0 = 1 GHz; P_L = –10 dBm	36	37	-	dBc
		f_0 = 1 GHz; P_L = –5 dBm	33	34	-	dBc



I_S = 21.1 mA; V_S = 5 V; P_D = –35 dBm; Z_o = 50 Ω

Fig 1. Input reflection coefficient (s_{11}); typical values

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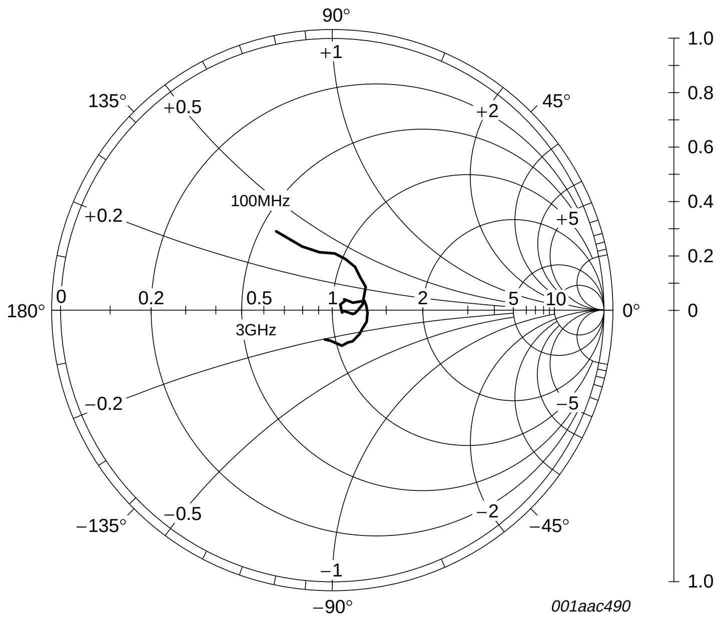
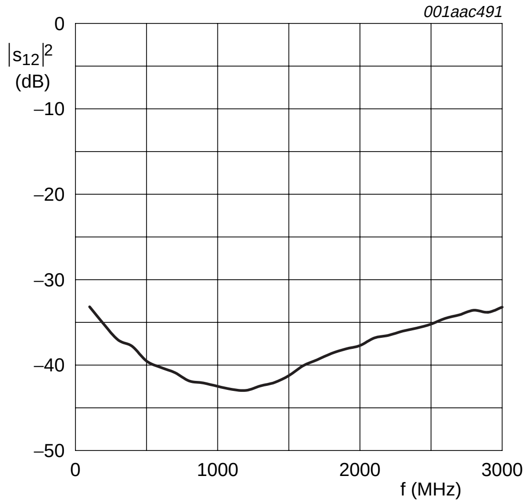


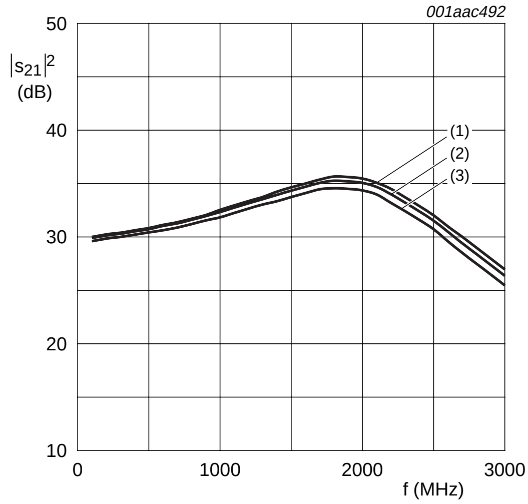
I_S = 21.1 mA; V_S = 5 V; P_D = −35 dBm; Z_o = 50 Ω

Fig 2. Output reflection coefficient (s_{22}); typical values



I_S = 21.1 mA; V_S = 5 V; P_D = −35 dBm; Z_o = 50 Ω

Fig 3. Isolation ($|s_{12}|^2$) as a function of frequency; typical values



P_D = −35 dBm; Z_o = 50 Ω

(1) I_S = 25.6 mA; V_S = 5.5 V

(2) I_S = 21.5 mA; V_S = 5 V

(3) I_S = 16.6 mA; V_S = 4.5 V

Fig 4. Insertion gain ($|s_{21}|^2$) as a function of frequency; typical values

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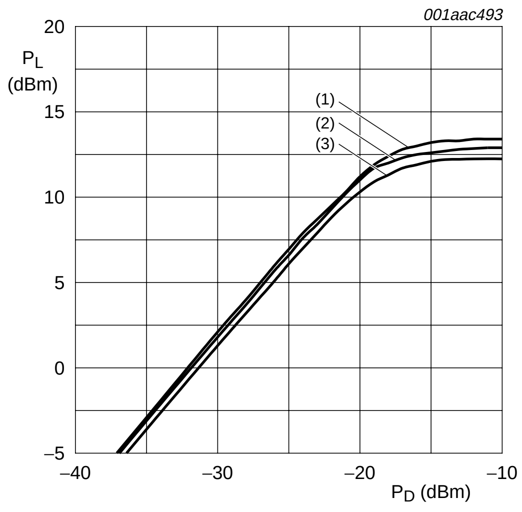


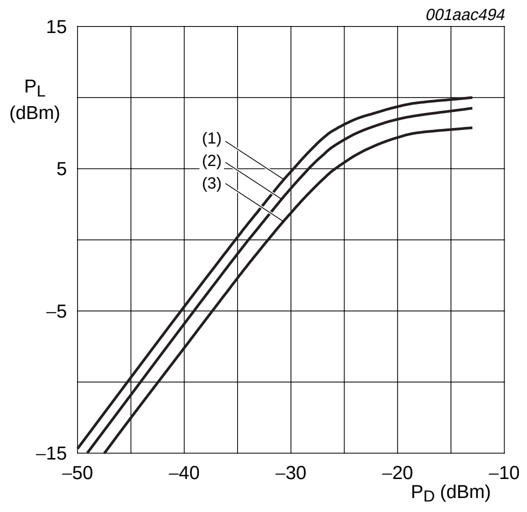
f = 1 GHz; Z_o = 50 Ω

(1) V_S = 5.5 V

(2) V_S = 5 V

(3) V_S = 4.5 V

Fig 5. Load power as a function of drive power at 1 GHz; typical values



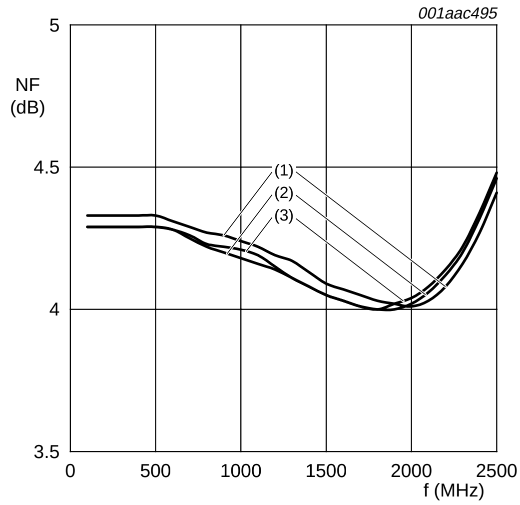
f = 2.2 GHz; Z_o = 50 Ω

(1) V_S = 5.5 V

(2) V_S = 5 V

(3) V_S = 4.5 V

Fig 6. Load power as a function of drive power at 2.2 GHz; typical values



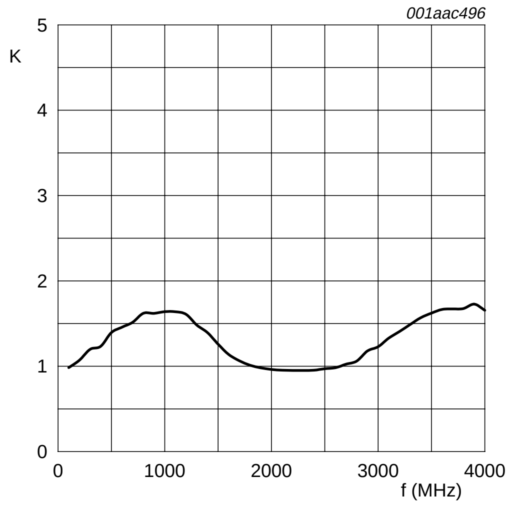
Z_o = 50 Ω

(1) V_S = 5.5 V

(2) V_S = 5 V

(3) V_S = 4.5 V

Fig 7. Noise figure as a function of frequency; typical values



I_S = 21.1 mA; V_S = 5 V; Z_o = 50 Ω

Fig 8. Stability factor as a function of frequency; typical values

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9. Application information

Figure 9 shows a typical application circuit for the BGM1014 MMIC. The device is internally matched to 50 Ω and therefore does not need any external matching. Good impedance matching is also achieved with a 75 Ω load. The value of the input and output DC blocking capacitors C1 and C2 should be not more than 100 pF for applications above 100 MHz. Their values can be used to fine-tune the input and output impedance.

For the RF choke, optimal results are obtained with a good quality chip inductor like the TDK MLG1608 (0603) or a wire-wound SMD. The value of the inductor can be used to fine-tune the output impedance.

The RF choke and supply decoupling components should be located as close as possible to the MMIC.

Ground paths must be as short as possible. The printed-circuit board (PCB) top ground plane must be as close as possible to the MMIC, and ideally directly beneath it. When using vias, use at least 3 vias for the top ground plane in order to limit ground path inductance. Supply decoupling with C3 should be from pin 1 to the same top ground plane.

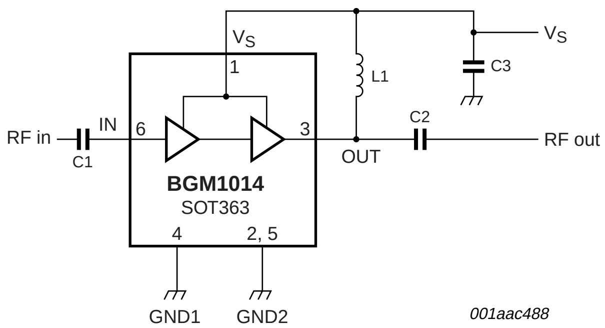

Fig 9. Typical application circuit

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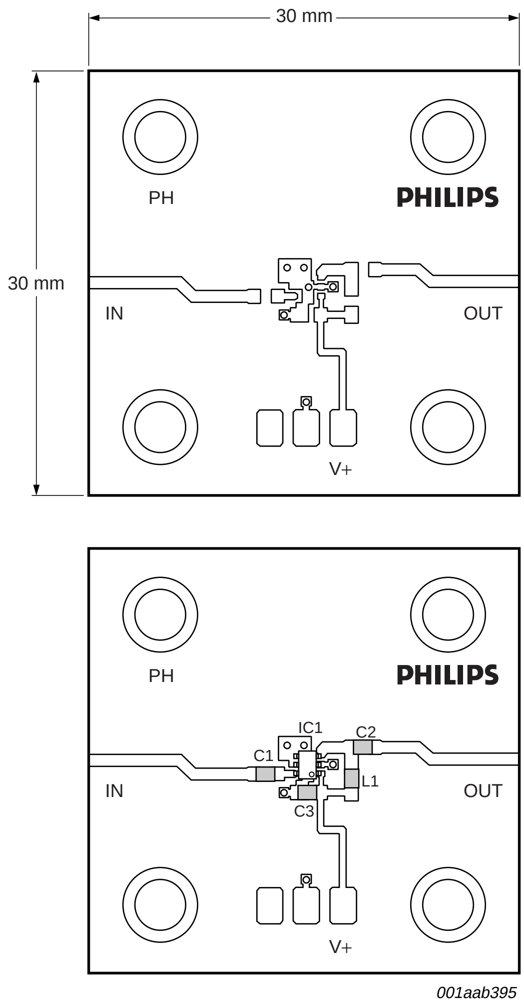
Figure 10 shows the PCB layout used for the typical application.



Material = FR4; thickness = 0.6 mm; ε_r = 4.6

Fig 10. Printed-circuit board layout and component view for typical application

Table 9: List of components used for the typical application

Component	Description	Value	Dimensions
C1, C2	multilayer ceramic chip capacitor	100 pF	0603
C3	multilayer ceramic chip capacitor	22 nF	0603
L1	SMD inductor	100 nH	0603

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Table 10: Scattering parameters

V_S = 5 V; I_S = 21.1 mA; P_D = –35 dBm; Z_o = 50 Ω; T_{amb} = 25 °C; measured on demo board.

f (MHz)	s_{11}		s_{21}		s_{12}		s_{22}		K-factor
	Magnitude (ratio)	Angle (deg)	Magnitude (ratio)	Angle (deg)	Magnitude (ratio)	Angle (deg)	Magnitude (ratio)	Angle (deg)	
100	0.287	16.1	31.28	9.1	0.02196	9.4	0.355	125.5	1.0
200	0.328	–3.9	32.14	–7.1	0.01734	–3.3	0.258	115.3	1.1
400	0.319	–28.8	33.57	–30.9	0.01287	–21.1	0.208	87.6	1.2
600	0.299	–50.3	35.61	–52.3	0.00969	–35.3	0.179	62.1	1.5
800	0.272	–68.6	38.05	–73.3	0.00808	–42.7	0.149	34.7	1.6
1000	0.243	–84.7	41.37	–95.5	0.00751	–44.8	0.113	10.3	1.6
1200	0.225	–98.9	45.48	–119.1	0.00711	–43.7	0.084	–8.1	1.6
1400	0.229	–106.9	49.78	–144.8	0.00792	–37.3	0.042	–4.5	1.4
1600	0.261	–127.8	54.37	–173.0	0.00991	–37.9	0.042	34.4	1.1
1800	0.317	–154.4	57.96	154.4	0.01171	–37.2	0.059	41.5	1.0
2000	0.364	167.7	56.65	120.1	0.01302	–45.7	0.123	15.9	1.0
2200	0.362	126.7	50.11	85.0	0.01493	–60.5	0.130	–4.6	1.0
2400	0.354	87.5	41.68	54.6	0.01647	–69.8	0.130	–32.5	1.0
2600	0.325	47.6	33.47	25.9	0.01878	–81.7	0.137	–57.1	1.0
2800	0.282	7.7	26.34	1.4	0.02094	–94.0	0.135	–74.9	1.1
3000	0.231	–32.0	20.81	–20.3	0.02184	–112.2	0.112	–104.3	1.2

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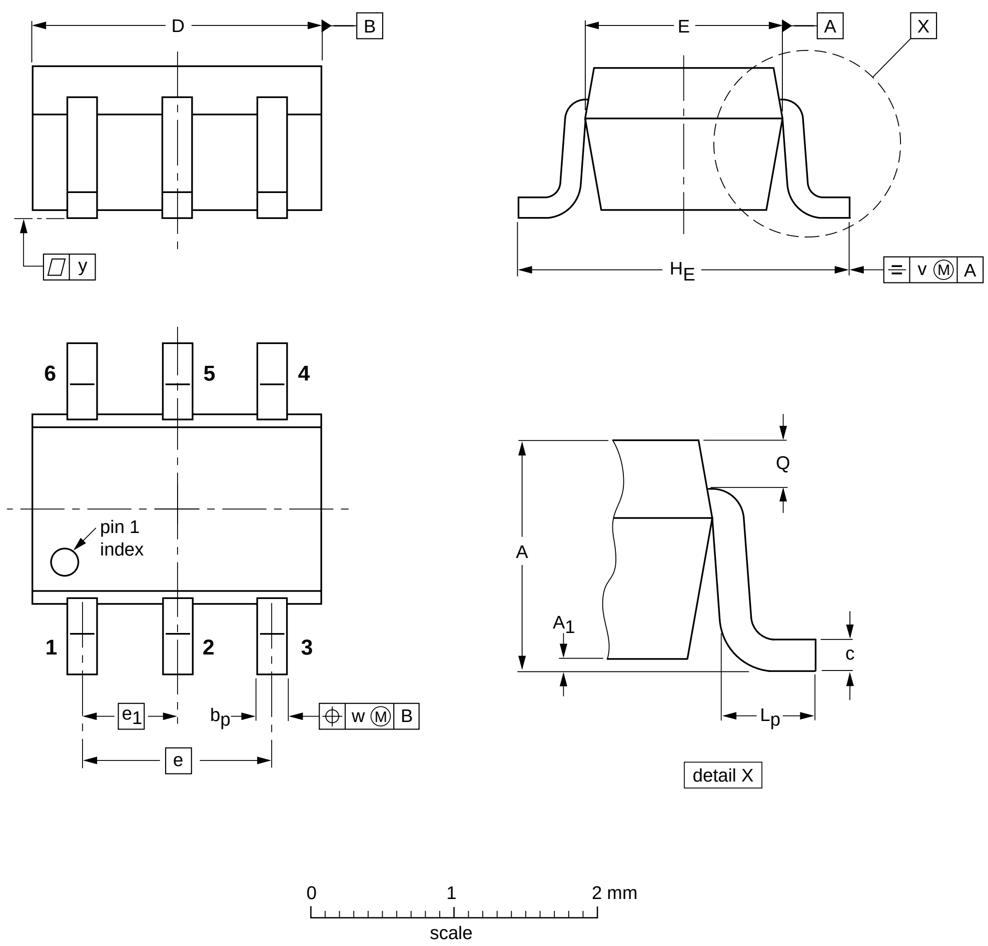
10. Package outline

Plastic surface mounted package; 6 leads **SOT363**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT363			SC-88			~~97-02-28~~ 04-11-08

Fig 11. Package outline SOT363 (SC-88)

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11. Revision history

Table 11: Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
BGM1014_1	20050311	product data sheet	-	9370 750 14499	-

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12. 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.
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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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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16. Contents

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