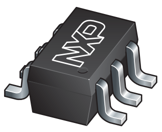


BGA2717

MMIC wideband amplifier

Rev. 3 — 8 September 2011

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 and benefits

- Internally matched to 50 Ω
- Wide frequency range (3.2 GHz at 3 dB bandwidth)
- Flat 24 dB gain (±1 dB up to 2.8 GHz)
- –2.5 dBm output power at 1 dB compression point
- Good linearity for low current ($IP3_{out}$ = 10 dBm)
- Low second harmonic; –38 dBc at P_D = –40 dBm
- Low noise figure; 2.3 dB at 1 GHz
- Unconditionally stable (K ≥ 2).

1.3 Applications

- LNB IF amplifiers
- Cable systems
- ISM
- General purpose.

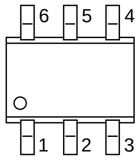
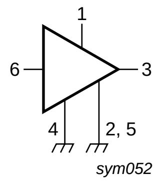
1.4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_S	DC supply voltage		-	5	6	V
I_S	supply current		-	8	-	mA
$\lvert s_{21}\rvert^2$	insertion power gain	f = 1 GHz	-	24	-	dB
NF	noise figure	f = 1 GHz	-	2.3	-	dB
$P_{L(sat)}$	saturated load power	f = 1 GHz	-	1	-	dBm

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
BGA2717	-	plastic surface mounted package; 6 leads	SOT363

4. Marking

Table 4. Marking

Type number	Marking code
BGA2717	1B-

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		-	15	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. Thermal characteristics

Table 6. Thermal characteristics

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

7. Characteristics

Table 7. Characteristics

V_S = 5 V; I_S = 8 mA; T_j = 25 °C; measured on demo board; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_S	supply current		6	8	10	mA
$\lvert s_{21}\rvert^2$	insertion power gain	f = 100 MHz	18	18.6	20	dB
		f = 1 GHz	23	23.9	25	dB
		f = 1.8 GHz	24	25	27	dB
		f = 2.2 GHz	24	25.1	27	dB
		f = 2.6 GHz	22	24	26	dB
		f = 3 GHz	20	22.1	24	dB
$\lvert s_{11}\rvert^2$	input return losses	f = 1 GHz	15	19	-	dB
		f = 2.2 GHz	8	9.4	-	dB
$\lvert s_{22}\rvert^2$	output return losses	f = 1 GHz	8	10	-	dB
		f = 2.2 GHz	5	6.8	-	dB
$\lvert s_{12}\rvert^2$	isolation	f = 1.6 GHz	54	55	-	dB
		f = 2.2 GHz	38	39	-	dB
NF	noise figure	f = 1 GHz	-	2.3	2.5	dB
		f = 2.2 GHz	-	2.9	3.1	dB
B	bandwidth	at $\lvert s21\rvert^2$ –3 dB below flat gain at 1 GHz	3	3.2	-	GHz
K	stability factor	f = 1 GHz	-	13	-	
		f = 2.2 GHz	-	1.7	-	
$P_{L(sat)}$	saturated load power	f = 1 GHz	0	1.4	-	dBm
		f = 2.2 GHz	–1	+0.1	-	dBm
$P_{L(1dB)}$	load power	at 1 dB gain compression; f = 1 GHz	–4	–2.6	-	dBm
		at 1 dB gain compression; f = 2.2 GHz	–5	–3.1	-	dBm
IM2	second order intermodulation product	at P_D = –40 dBm; f_0 = 1 GHz	36	38	-	dBc
$IP3_{in}$	input, third order intercept point	f = 1 GHz	–15	–13.9	-	dBm
		f = 2.2 GHz	–20	–18.8	-	dBm
$IP3_{out}$	output, third order intercept point	f = 1 GHz	9	10	-	dBm
		f = 2.2 GHz	4	6.3	-	dBm

8. Application information

Figure 1 shows a typical application circuit for the BGA2717 MMIC. The device is internally matched to 50 Ω, and therefore does not need any external matching. The value of the input and output DC blocking capacitors C2 and C3 should not be more than 100 pF for applications above 100 MHz. However, when the device is operated below 100 MHz, the capacitor value should be increased.

The 22 nF supply decoupling capacitor C1 should be located as close as possible to the MMIC.

The printed-circuit board (PCB) top ground plane, connected to pins 2, 4 and 5 must be as close as possible to the MMIC, and ideally directly beneath it. When using via holes, use multiple via holes, located as close as possible to the MMIC.

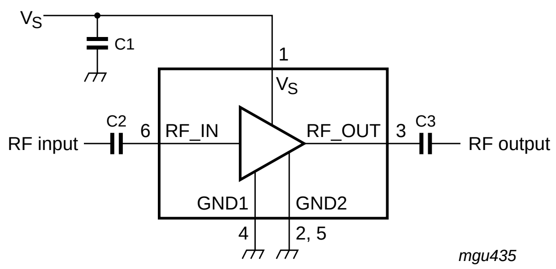
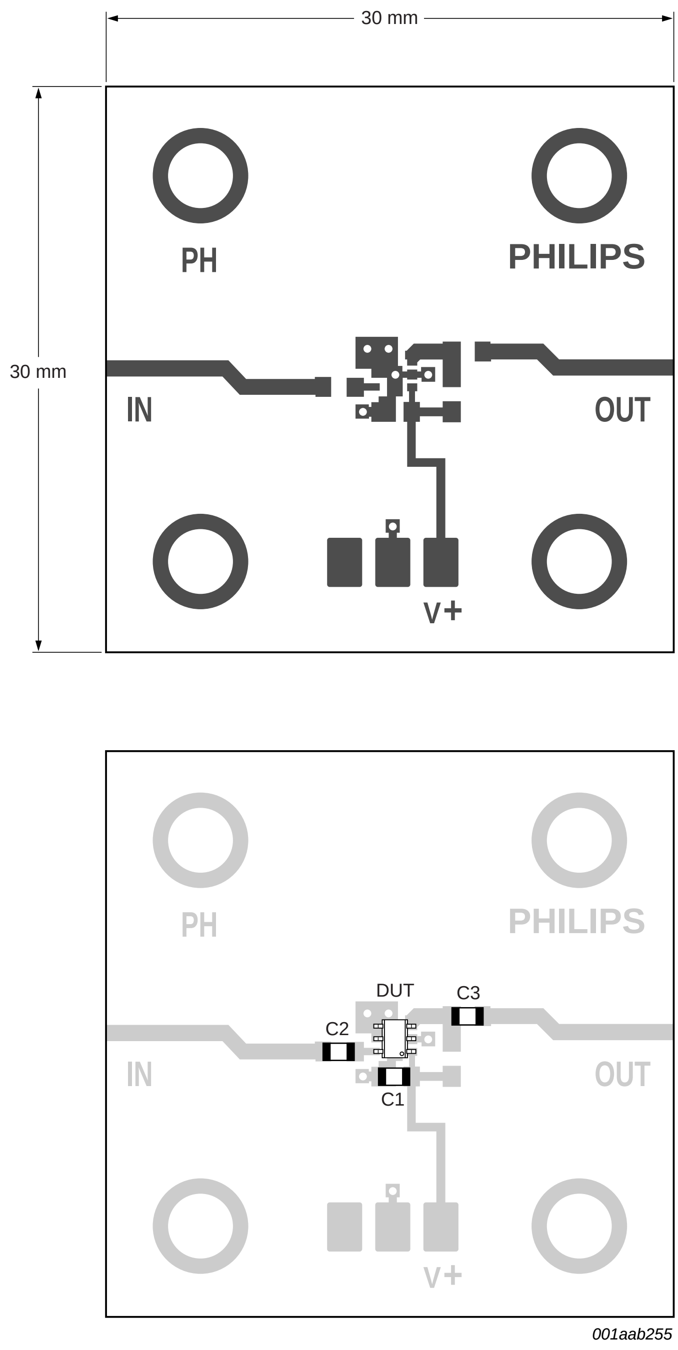


Fig 1. Typical application circuit.

Figure 2 shows the PCB layout, used for the standard demonstration board.



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

Fig 2. PCB layout and demonstration board showing components.

8.1 Grounding and output impedance

If the grounding is not optimal, the gain becomes less flat and the 50 Ω output matching becomes worse. If a better output matching to 50 Ω is required, a 12 Ω resistor (R1) can be placed in series with C3 (see Figure 3). This will significantly improve the output impedance, at the cost of 1 dB gain and 1 dB output power.

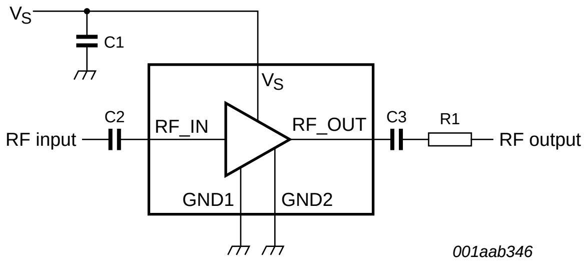


Fig 3. Application circuit for better output impedance into 50 Ω.

8.2 Application examples

The MMIC is very suitable as IF amplifier in e.g. LNBs. The excellent wideband characteristics make it an ideal building block (see Figure 4). As second amplifier after an LNA, the MMIC offers an easy matching, low noise solution (see Figure 5).

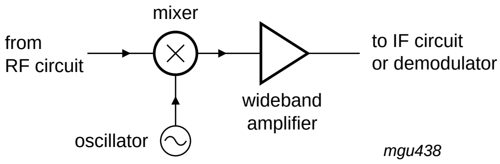


Fig 4. Application as IF amplifier.

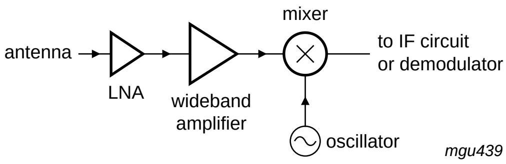
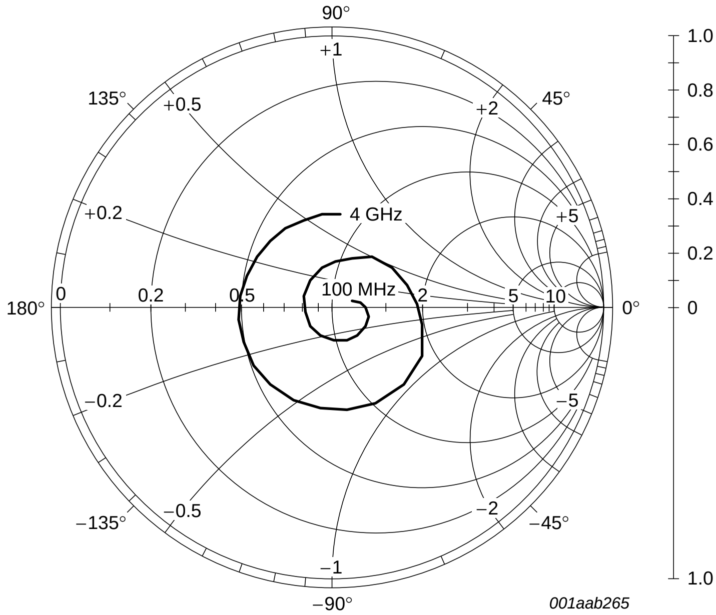
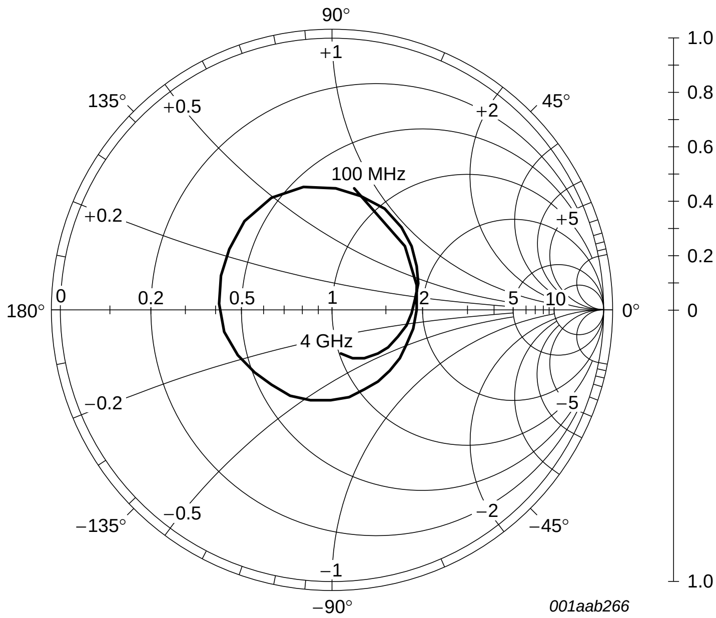


Fig 5. Application as RF amplifier.



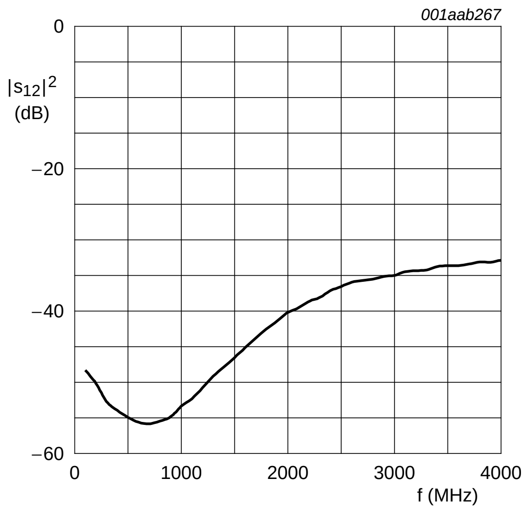
I_S = 8 mA; V_S = 5 V; P_D = −35 dBm; Z_o = 50 Ω.

Fig 6. Input reflection coefficient (s_{11}); typical values.



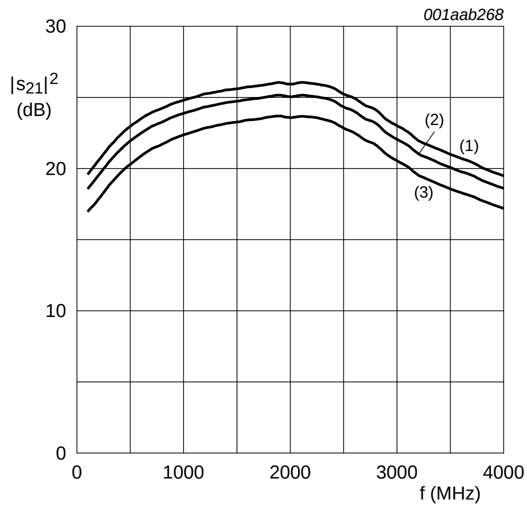
I_S = 8 mA; V_S = 5 V; P_D = −35 dBm; Z_o = 50 Ω.

Fig 7. Output reflection coefficient (s_{22}); typical values.



I_S = 8 mA; V_S = 5 V; P_D = −35 dBm; Z_o = 50 Ω.

Fig 8. Isolation ($|s_{12}|^2$) as a function of frequency; typical values.



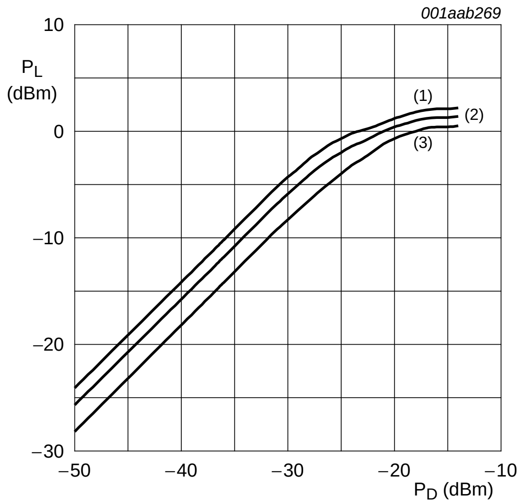
P_D = −35 dBm; Z_o = 50 Ω.

(1) I_S = 8.9 mA; V_S = 5.5 V.

(2) I_S = 8 mA; V_S = 5 V.

(3) I_S = 7.2 mA; V_S = 4.5 V.

Fig 9. Insertion gain ($|s_{21}|^2$) as a function of frequency; typical values.



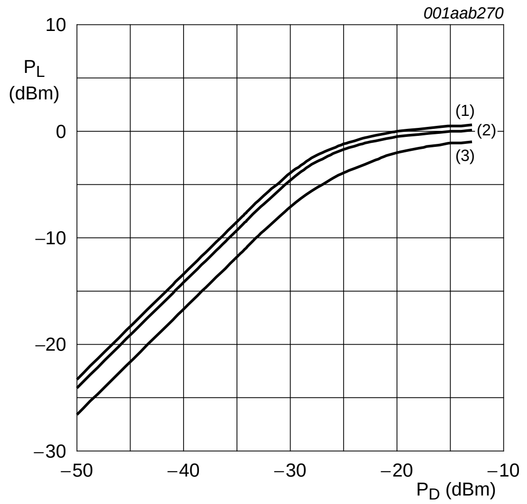
f = 1 GHz; Z_o = 50 Ω.

(1) V_S = 5.5 V.

(2) V_S = 5 V.

(3) V_S = 4.5 V.

Fig 10. Load power as a function of drive power at 1 GHz; typical values.



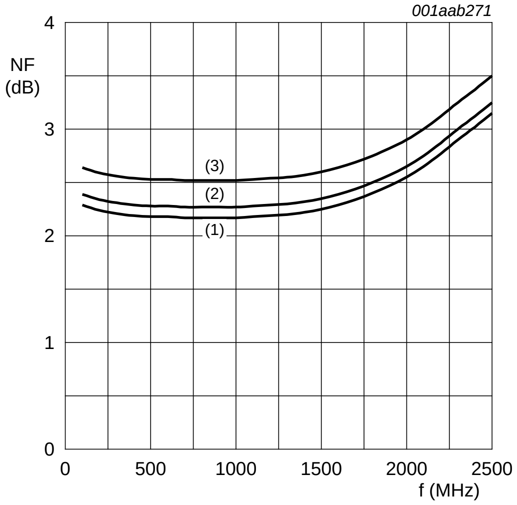
f = 2.2 GHz; Z_o = 50 Ω.

(1) V_S = 5.5 V.

(2) V_S = 5 V.

(3) V_S = 4.5 V.

Fig 11. Load power as a function of drive power at 2.2 GHz; typical values.



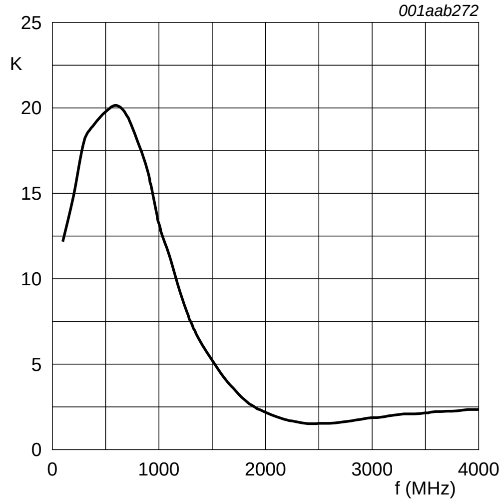
$Z_o = 50\ \Omega$.

(1) $I_S = 8.9$ mA; $V_S = 5.5$ V.

(2) $I_S = 8$ mA; $V_S = 5$ V.

(3) $I_S = 7.2$ mA; $V_S = 4.5$ V.

Fig 12. Noise figure as a function of frequency; typical values.



$I_S = 8$ mA; $V_S = 5$ V; $Z_o = 50\ \Omega$.

Fig 13. Stability factor as a function of frequency; typical values.

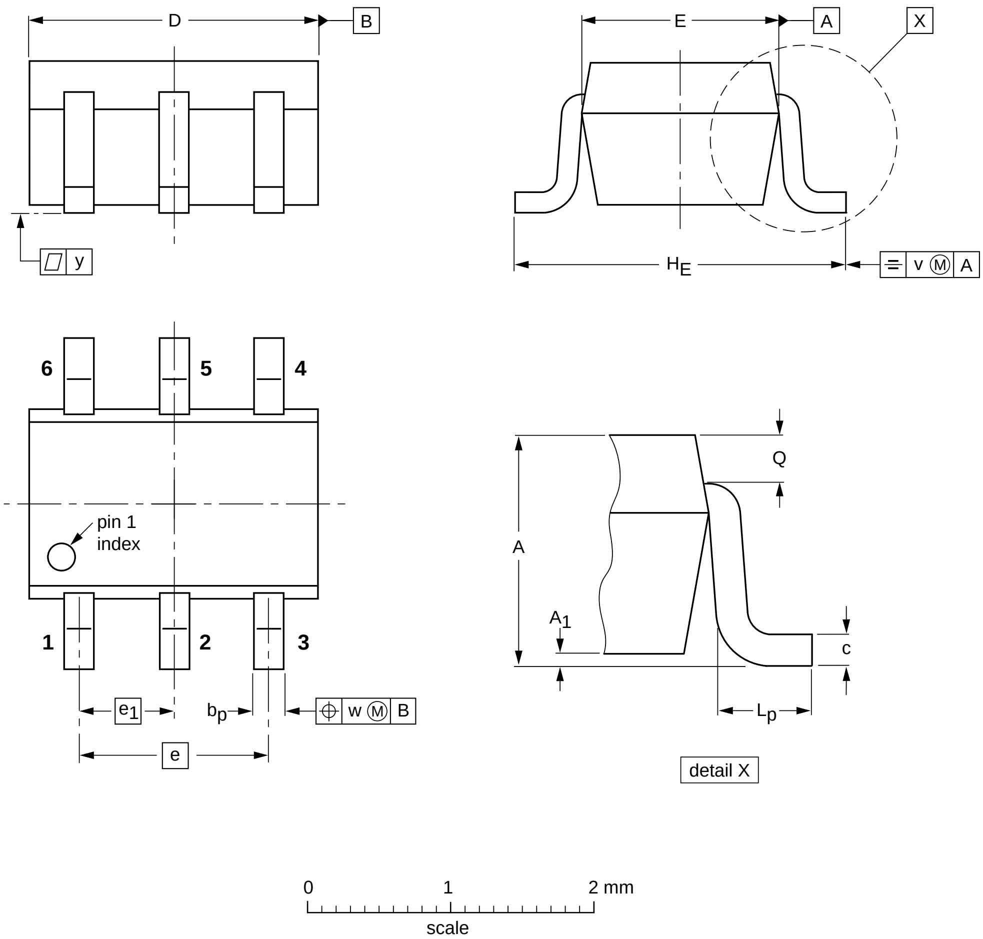
Table 8. Scattering parameters

V_S = 5 V; I_S = 8 mA; P_D = –35 dBm; Z_o = 50 Ω; T_{amb} = 25 °C.

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	0.074378	13.78537	8.465495	22.90763	0.003859	–66.39435	0.450496	79.88713	12.2
200	0.076338	13.70153	9.420359	7.358555	0.003112	–122.2687	0.354179	40.70919	14.9
400	0.123748	–1.402521	11.56481	–14.92222	0.002011	–40.5142	0.312568	–0.3804	19.1
600	0.145511	–31.32646	13.31271	–37.77988	0.001659	–156.393	0.3038	–25.36808	20.2
800	0.134956	–67.10955	14.56872	–61.08808	0.00169	–164.4454	0.30873	–46.7704	18.1
1000	0.114063	–111.2495	15.61733	–84.67015	0.002146	–174.8593	0.319208	–68.71787	13.2
1200	0.101959	–168.8557	16.45625	–107.9167	0.002901	139.8136	0.335623	–91.58398	9.2
1400	0.125656	129.9717	17.05668	–131.63	0.004053	123.527	0.353582	–116.5485	6.2
1600	0.16736	85.791	17.49643	–155.2301	0.005545	107.0763	0.366893	–140.7537	4.3
1800	0.234721	51.43065	17.90167	–179.6656	0.007498	105.9423	0.404064	–167.9683	2.9
2000	0.285944	16.46701	17.86635	155.5993	0.009779	90.10168	0.42512	163.3173	2.2
2200	0.339673	–11.74152	17.96498	130.5601	0.011736	75.19814	0.459194	135.039	1.7
2400	0.393746	–47.58817	17.32414	103.3297	0.013927	53.10814	0.459988	103.1106	1.5
2600	0.384353	–81.55786	15.87927	77.84766	0.015937	21.70136	0.428158	75.83004	1.5
2800	0.376183	–112.353	14.44081	52.77053	0.016795	4.656224	0.393701	50.16202	1.7
3000	0.358586	–142.5801	12.67831	30.51455	0.01786	–19.19006	0.3497	26.66791	1.9
3200	0.345562	–171.7261	11.27597	10.04765	0.019217	–32.22469	0.30875	6.504047	2.0
3400	0.33312	160.2254	10.43483	–9.842264	0.020551	–49.16136	0.279672	–12.63121	2.1
3600	0.331268	133.8644	9.743293	–30.36495	0.020908	–59.65434	0.248479	–33.64811	2.2
3800	0.337502	108.48	9.072149	–50.7401	0.022136	–78.78085	0.21362	–56.42401	2.3
4000	0.344645	84.75183	8.513716	–71.86536	0.022792	–94.87525	0.168643	–80.24833	2.4

9. 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			~~04-11-08~~ 06-03-16

Fig 14. Package outline; SOT363 (SC-88).

10. Revision history

Table 9. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGA2717 v.3	20110908	Product data sheet	-	BGA2717 v.2
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Package outline drawings have been updated to the latest version.			
BGA2717 v.2 (9397 750 13293)	20040924	Product data sheet	-	BGA2717_N v.1
BGA2717_N v.1 (9397 750 12828)	20040202	Preliminary data sheet	-	-

11. Legal information

11.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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13. Contents

Date of release: 8 September 2011
Document identifier: BGA2717