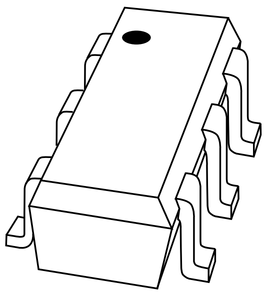
DATA SHEET



BGA2712
MMIC wideband amplifier

Product specification
Supersedes data of 2002 Jan 31

2002 Sep 10

MMIC wideband amplifier — BGA2712

FEATURES

- Internally matched to 50 Ω
- Wide frequency range (3.2 GHz at 3 dB bandwidth)
- Flat 21 dB gain (DC to 2.6 GHz at 1 dB flatness)
- 5 dBm saturated output power at 1 GHz
- Good linearity (11 dBm $IP3_{(out)}$ at 1 GHz)
- Unconditionally stable (K > 1.5).

APPLICATIONS

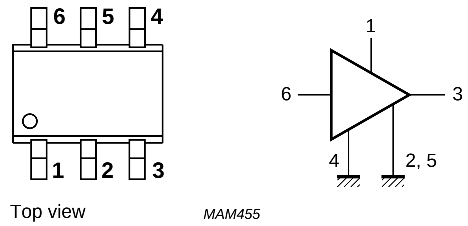
- LNB IF amplifiers
- Cable systems
- ISM
- General purpose.

DESCRIPTION

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

PINNING

PIN	DESCRIPTION
1	V_S
2, 5	GND2
3	RF out
4	GND1
6	RF in



Marking code: E2-.

Fig.1 Simplified outline (SOT363) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_S	DC supply voltage		5	6	V
I_S	DC supply current		12.3	–	mA
$\|s_{21}\|^2$	insertion power gain	f = 1 GHz	21.3	–	dB
NF	noise figure	f = 1 GHz	3.9	–	dB
$P_{L(sat)}$	saturated load power	f = 1 GHz	4.8	–	dBm

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		–	35	mA
P_{tot}	total power dissipation	$T_s \leq 90$ °C	–	200	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	operating junction temperature		–	150	°C
P_D	maximum drive power		–	10	dBm

CAUTION
This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling. For further information, refer to Philips specs.: SNW-EQ-608, SNW-FQ-302A and SNW-FQ-302B.

THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j\text{-}s}$	thermal resistance from junction to solder point	P_{tot} = 200 mW; $T_s \leq 90$ °C	300	K/W

CHARACTERISTICS

V_S = 5 V; I_S = 12.3 mA; T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_S	supply current		9	12.3	15	mA
$\|s_{21}\|^2$	insertion power gain	f = 100 MHz	20	20.8	22	dB
		f = 1 GHz	20	21.3	22	dB
		f = 1.8 GHz	20	22	23	dB
		f = 2.2 GHz	20	22	23	dB
		f = 2.6 GHz	19	21.2	22	dB
		f = 3 GHz	16	19.3	21	dB
$R_{L\ IN}$	return losses input	f = 1 GHz	12	14	–	dB
		f = 2.2 GHz	8	10	–	dB
$R_{L\ OUT}$	return losses output	f = 1 GHz	17	20	–	dB
		f = 2.2 GHz	15	18	–	dB
$\|s_{12}\|^2$	isolation	f = 1.6 GHz	31	33	–	dB
		f = 2.2 GHz	36	39	–	dB
NF	noise figure	f = 1 GHz	–	3.9	4.3	dB
		f = 2.2 GHz	–	4.3	4.7	dB
BW	bandwidth	at $\|s_{21}\|^2$ –3 dB below flat gain at 1 GHz	2.8	3.2	–	GHz
K	stability factor	f = 1 GHz	1.5	2	–	–
		f = 2.2 GHz	2.5	3	–	–
$P_{L(sat)}$	saturated load power	f = 1 GHz	3	4.8	–	dBm
		f = 2.2 GHz	0	1.3	–	dBm
$P_{L\ 1\ dB}$	load power	at 1 dB gain compression; f = 1 GHz	–2	0.2	–	dBm
		at 1 dB gain compression; f = 2.2 GHz	–4	–2	–	dBm
$IP3_{(in)}$	input intercept point	f = 1 GHz	–12	–10	–	dBm
		f = 2.2 GHz	–14	–16	–	dBm
$IP3_{(out)}$	output intercept point	f = 1 GHz	9	11	–	dBm
		f = 2.2 GHz	4	6	–	dBm

APPLICATION INFORMATION

Figure 2 shows a typical application circuit for the BGA2712 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 closely as possible to the MMIC.

Separate paths must be used for the ground planes of the ground pins GND1 and GND2, and these paths must be as short as possible. When using vias, use multiple vias per pin in order to limit ground path inductance.

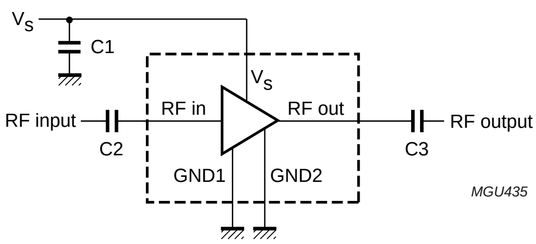


Fig.2 Typical application circuit.

Figure 3 shows two cascaded MMICs. This configuration doubles overall gain while preserving broadband characteristics. Supply decoupling and grounding conditions for each MMIC are the same as those for the circuit of Fig.2.

The excellent wideband characteristics of the MMIC make it an ideal building block in IF amplifier applications such as LBNs (see Fig.4).

As a buffer amplifier between an LNA and a mixer in a receiver circuit, the MMIC offers an easy matching, low noise solution (see Fig.5).

In Fig.6 the MMIC is used as a driver to the power amplifier as part of a transmitter circuit. Good linear performance and matched input and output offer quick design solutions in such applications.

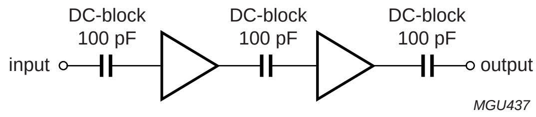


Fig.3 Easy cascading application circuit.

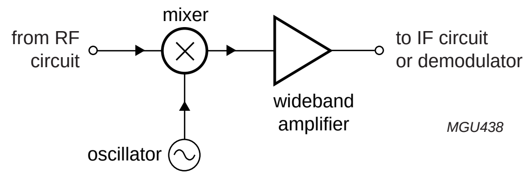


Fig.4 Application as IF amplifier.

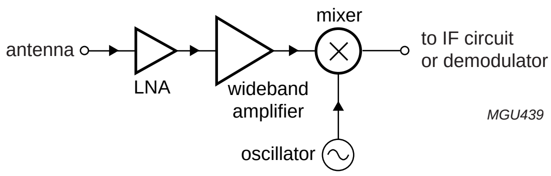


Fig.5 Application as RF amplifier.

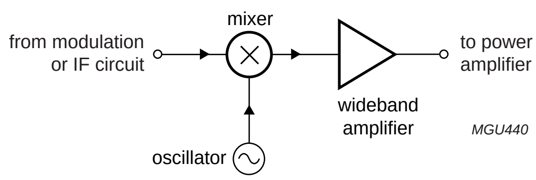
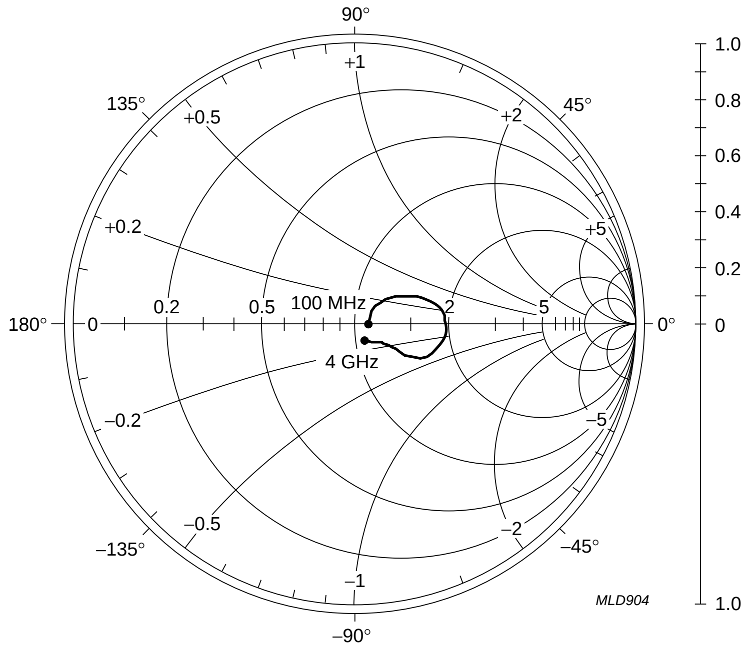
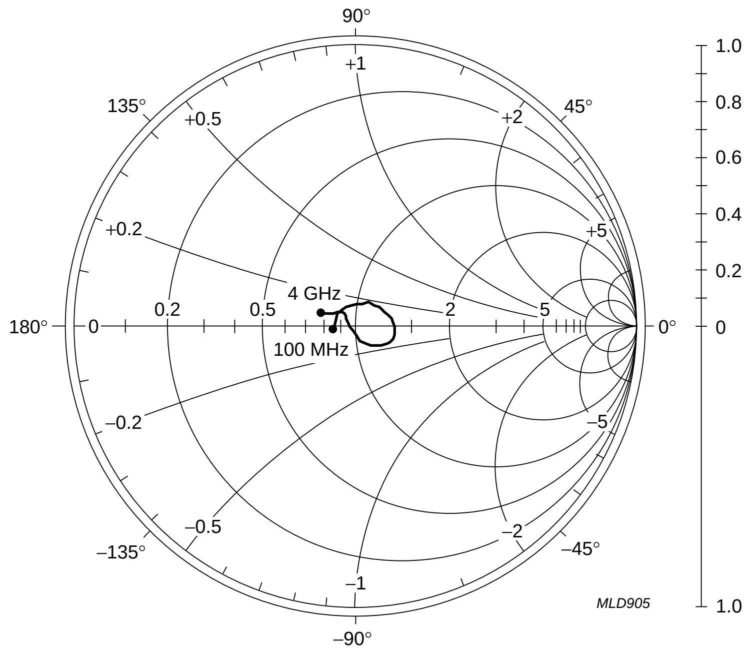


Fig.6 Application as driver amplifier.



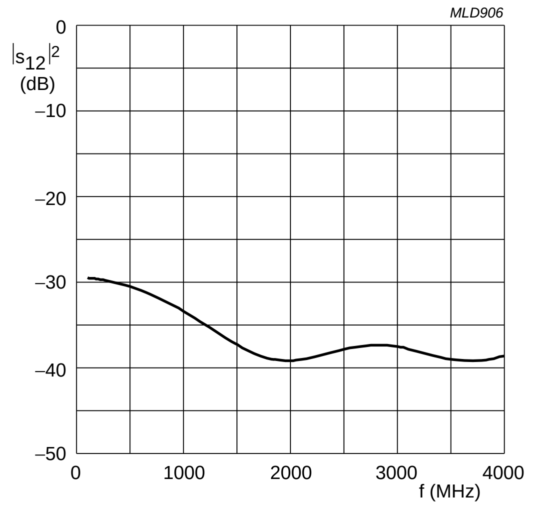
I_S = 12.3 mA; V_S = 5 V; P_D = −30 dBm; Z_O = 50 Ω.

Fig.7 Input reflection coefficient (s_{11}); typical values.



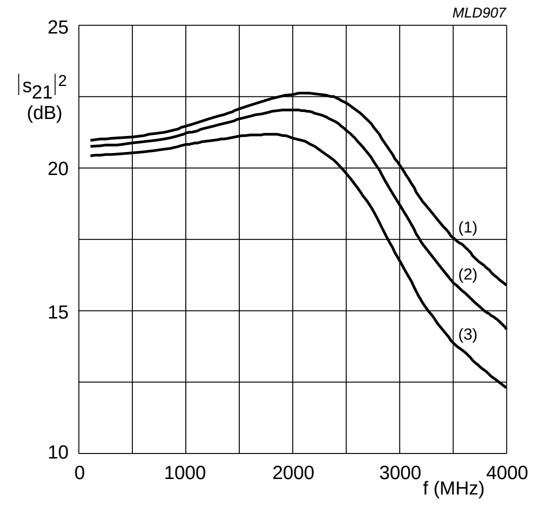
I_S = 12.3 mA; V_S = 5 V; P_D = −30 dBm; Z_O = 50 Ω.

Fig.8 Output reflection coefficient (s_{22}); typical values.



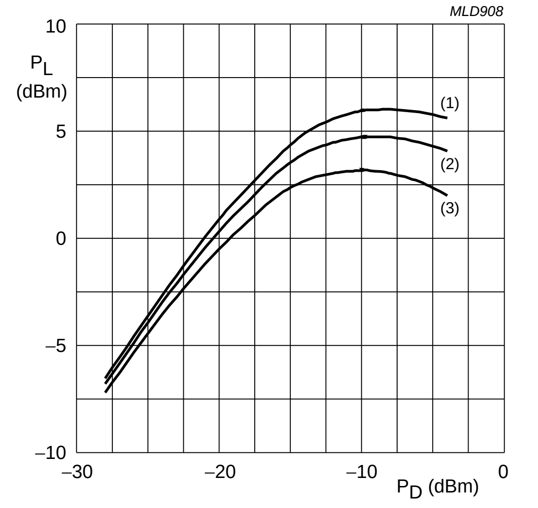
I_S = 12.3 mA; V_S = 5 V; P_D = −30 dBm; Z_O = 50 Ω.

Fig.9 Isolation ($|s_{12}|^2$) as a function of frequency; typical values.



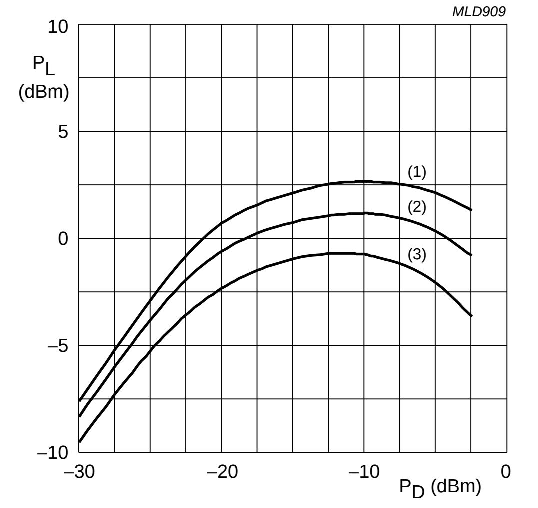
P_D = −30 dBm; Z_O = 50 Ω.
(1) I_S = 15.1 mA; V_S = 5.5 V.
(2) I_S = 12.3 mA; V_S = 5 V.
(3) I_S = 10.1 mA; V_S = 4.5 V.

Fig.10 Insertion gain ($|s_{21}|^2$) as a function of frequency; typical values.



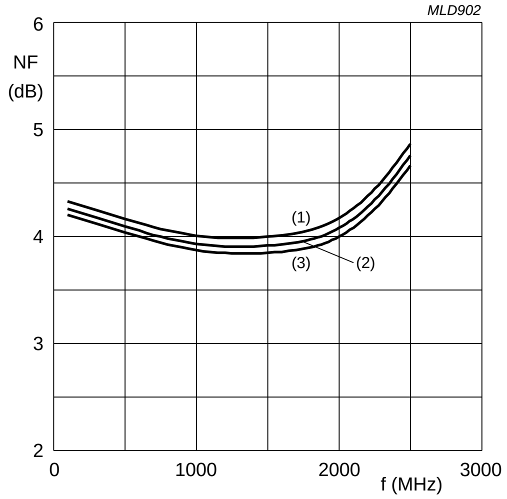
f = 1 GHz; Z_O = 50 Ω.
(1) V_S = 5.5 V.
(2) V_S = 5 V.
(3) V_S = 4.5 V.

Fig.11 Load power as a function of drive power at 1 GHz; typical values.



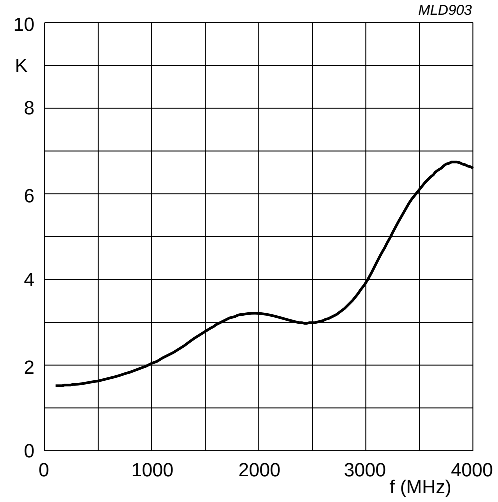
f = 2.2 GHz; Z_O = 50 Ω.
(1) V_S = 5.5 V.
(2) V_S = 5 V.
(3) V_S = 4.5 V.

Fig.12 Load power as a function of drive power at 2.2 GHz; typical values.



Z_O = 50 Ω.
(1) I_S = 15.1 mA; V_S = 5.5 V.
(2) I_S = 12.3 mA; V_S = 5 V.
(3) I_S = 10.1 mA; V_S = 4.5 V.

Fig.13 Noise figure as a function of frequency; typical values.



I_S = 12.3 mA; V_S = 5 V; Z_O = 50 Ω.

Fig.14 Stability factor as a function of frequency; typical values.

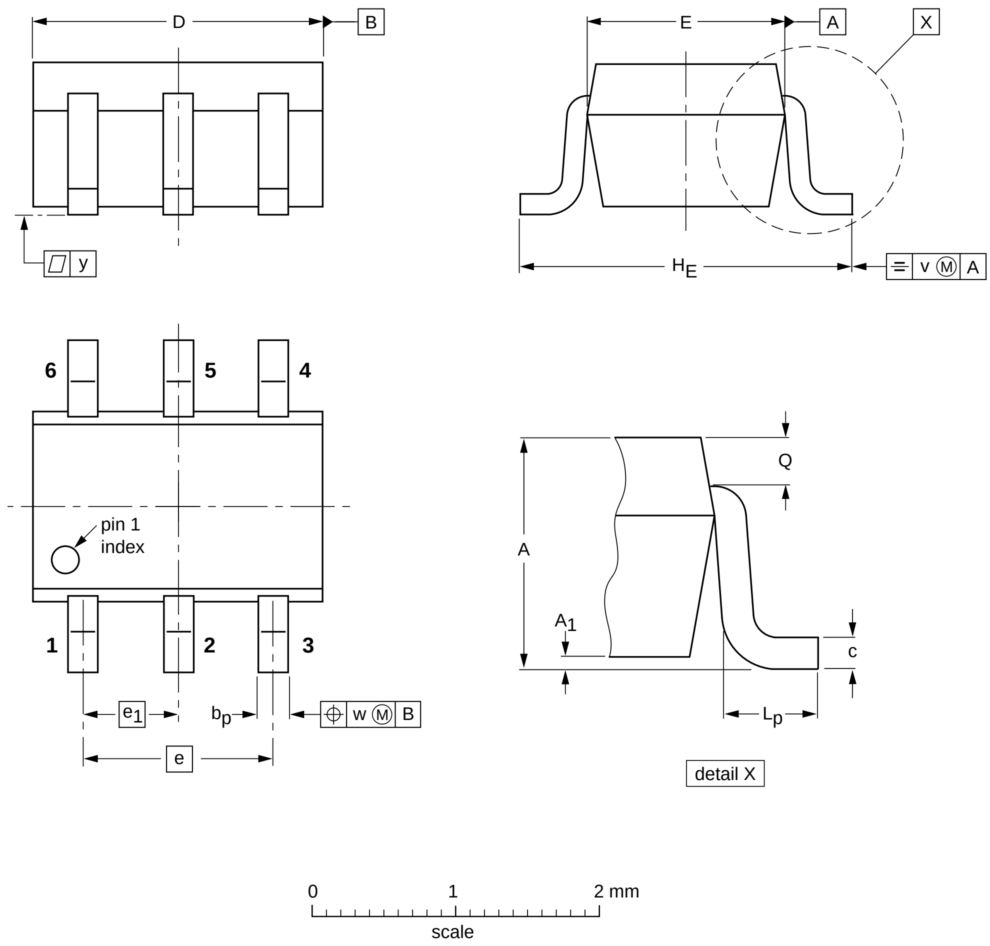
Scattering parameters

V_S = 5 V; I_S = 12.3 mA; P_D = –30 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	0.04752	–13.48	10.9826	–1.753	0.03355	–2.342	0.07706	–170.0	1.5
200	0.05643	22.73	11.0172	–6.898	0.03308	–7.340	0.07237	164.8	1.5
400	0.09546	39.62	11.0842	–15.64	0.03111	–15.47	0.07314	130.7	1.6
600	0.13547	37.16	11.1812	–24.08	0.02829	–21.84	0.07471	101.8	1.7
800	0.17466	32.62	11.3239	–32.64	0.02501	–26.57	0.08218	72.30	1.9
1000	0.20739	27.40	11.5760	–41.38	0.02145	–30.44	0.10113	47.04	2.0
1200	0.24036	23.23	11.8439	–50.97	0.01788	–31.20	0.11792	25.82	2.3
1400	0.26469	18.36	12.1222	–61.14	0.01489	–28.60	0.13314	10.96	2.6
1600	0.29368	13.54	12.3892	–72.07	0.01262	–22.41	0.14376	–1.624	3.0
1800	0.31261	8.127	12.5808	–83.89	0.01132	–12.86	0.14606	–13.51	3.2
2000	0.31986	1.984	12.6359	–96.79	0.01102	–2.369	0.13749	–24.90	3.2
2200	0.32544	–4.878	12.4802	–110.7	0.01151	5.585	0.11928	–37.21	3.1
2400	0.31554	–13.05	12.2649	–125.2	0.01238	9.990	0.08992	–51.50	3.0
2600	0.29374	–21.53	11.5087	–139.8	0.01322	11.44	0.05626	–68.53	3.1
2800	0.26599	–28.39	10.4126	–152.8	0.01362	10.70	0.02424	–110.2	3.3
3000	0.21222	–31.80	9.17830	–163.8	0.01335	9.622	0.02731	159.1	4.0
3200	0.17076	–31.52	8.12024	–171.0	0.01239	10.22	0.04752	135.0	4.9
3400	0.14479	–32.14	7.38827	–176.5	0.01150	15.36	0.06279	132.1	5.8
3600	0.11730	–35.25	6.96284	177.3	0.01108	19.97	0.07643	142.1	6.4
3800	0.08946	–46.06	6.62125	171.3	0.01107	27.62	0.09760	153.5	6.7
4000	0.06606	–64.65	6.32249	165.6	0.01178	34.46	0.12925	160.6	6.6

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

DATA SHEET STATUS

DOCUMENT STATUS(1)	PRODUCT STATUS(2)	DEFINITION
Objective data sheet	Development	This document contains data from the objective specification for product development.
Preliminary data sheet	Qualification	This document contains data from the preliminary specification.
Product data sheet	Production	This document contains the product specification.

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Contact information

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