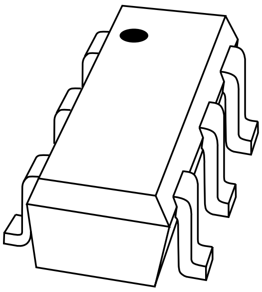
DATA SHEET



BGM1011
MMIC wideband amplifier

Preliminary specification 2002 Jan 14

Philips Semiconductors

PHILIPS

FEATURES

- Internally matched to 50 Ω
- Very high gain (up to 37 dB at 2 Ghz)
- Sloped gain curve for optimal performance with output into lossy cable
- 14 dBm saturated output power at 1 GHz
- High linearity (23 dBm $IP3_{(out)}$ at 1 GHz)
- 40 dB isolation

APPLICATIONS

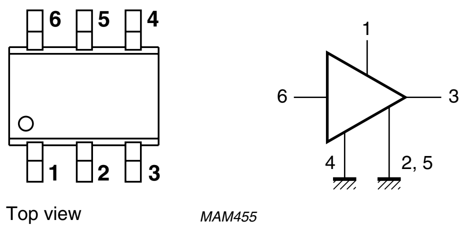
- LNB IF amplifiers
- Cable systems
- General purpose.

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: C1-.

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		25.5	–	mA
$\|s_{21}\|^2$	insertion power gain	f = 1 GHz	30	–	dB
NF	noise figure	f = 1 GHz	4.7	–	dB
$P_{L(sat)}$	saturated load power	f = 1 GHz	13.8	–	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		–	0	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 RESISTANCE

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 = 25.5 mA; T_j = 25 °C unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_S	supply current		20	25.5	32	mA
$\|s_{21}\|^2$	insertion power gain	f = 100 MHz	–	25	–	dB
		f = 1 GHz	–	30	–	dB
		f = 1.8 GHz	–	35	–	dB
		f = 2.2 GHz	–	37	–	dB
		f = 2.6 GHz	–	32	–	dB
		f = 3 GHz	–	28	–	dB
$R_{L\ IN}$	return losses input	f = 1 GHz	–	11	–	dB
		f = 2.2 GHz	–	8	–	dB
$R_{L\ OUT}$	return losses output	f = 1 GHz	–	18	–	dB
		f = 2.2 GHz	–	12	–	dB
NF	noise figure	f = 1 GHz	–	4.7	–	dB
		f = 2.2 GHz	–	4.6	–	dB
BW	bandwidth	at $\|s_{21}\|^2$ –3 dB below flat gain at 1 GHz	–	2.9	–	GHz
K	stability factor	f = 1 GHz	–	1.8	–	–
		f = 2.2 GHz	–	0.9	–	–
$P_{L(sat)}$	saturated load power	f = 1 GHz	–	13.8	–	dBm
		f = 2.2 GHz	–	10.8	–	dBm
$P_{L\ 1\ dB}$	load power	at 1 dB gain compression; f = 1 GHz	–	12.2	–	dBm
		at 1 dB gain compression; f = 2.2 GHz	–	7.7	–	dBm
$IP3_{(in)}$	input intercept point	f = 1 GHz	–	–7	–	dBm
		f = 2.2 GHz	–	–20	–	dBm
$IP3_{(out)}$	output intercept point	f = 1 GHz	–	23	–	dBm
		f = 2.2 GHz	–	16	–	dBm

APPLICATION INFORMATION

Figure 2 shows a typical application circuit for the BGM1011 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 C1, 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. However, when the device is operated below 100 MHz, the capacitor value should be increased.

The nominal value of the RF choke, L1 is 100 nH. At frequencies below 100 MHz this value should be increased to 200 nH. At frequencies between 1 and 3 GHz a much lower value must be used (e.g. 18 nH) to improve return losses. For optimal results, a good quality chip inductor such as the TDK MLG 1608 (0603), or a wire-wound SMD type should be chosen.

Capacitor, C4 and resistor, R1 are added for optimal supply decoupling.

Both the RF choke, L1 and the 22 nF supply decoupling capacitor, C3 should be located as closely as possible to the MMIC.

Separate paths must be used for the ground planes of the ground pins GND1, 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.

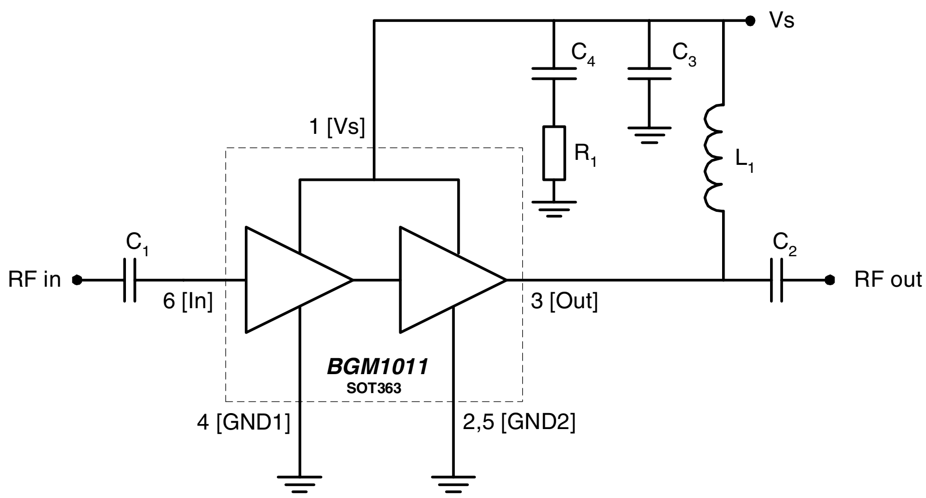


Fig.2 Typical application circuit

List of components used for the typical application; an amplifier for LNB IF output.

COMPONENT	DESCRIPTION	VALUE	DIMENSIONS.
C1, C2	multilayer ceramic chip capacitor	100 pF	0603
C3	multilayer ceramic chip capacitor	22 nF	0603
C4	multilayer ceramic chip capacitor	5.6 pF	0603
R1	SMD resistor	10 Ω	0603
L1	SMD inductor	10 to 200 nH	0603

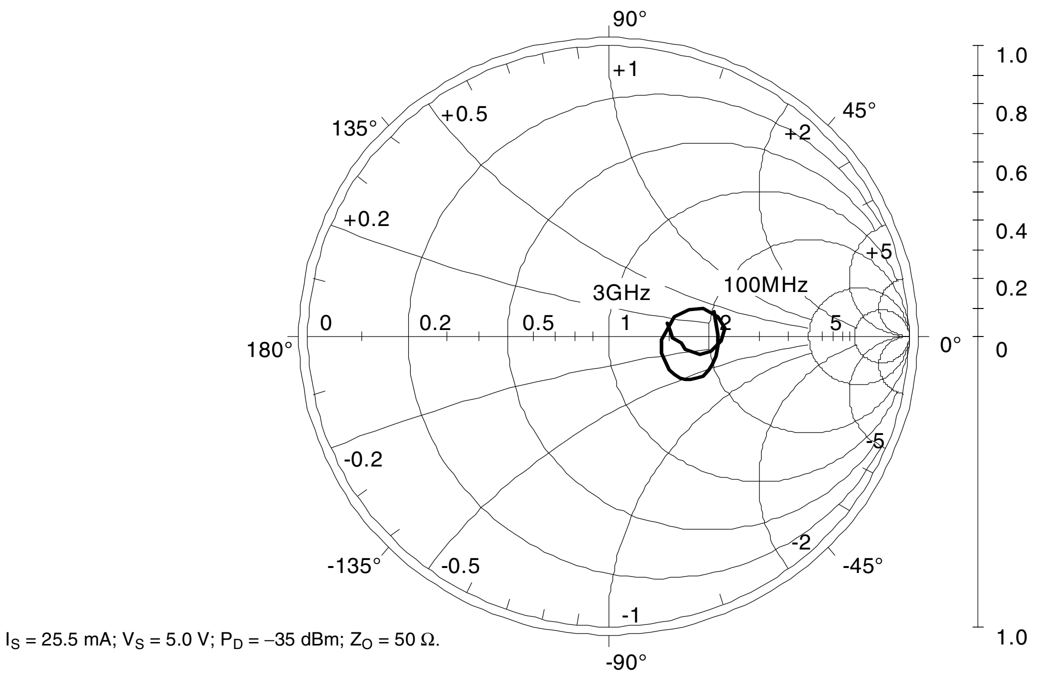


Fig.3 Input reflection coefficient (s_{11}); typical values.

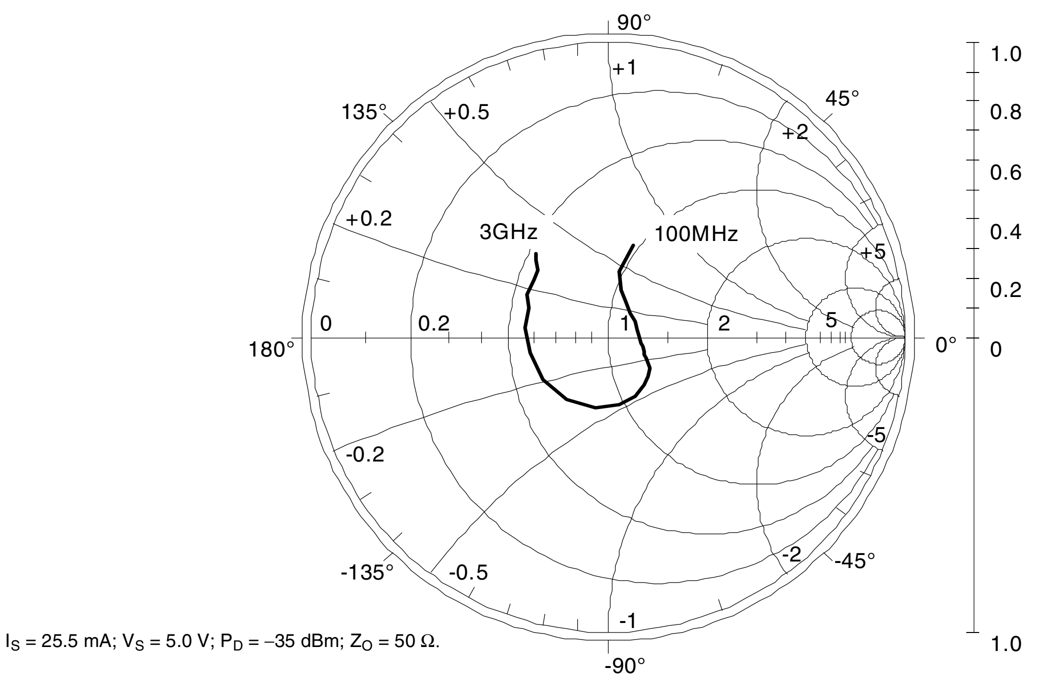
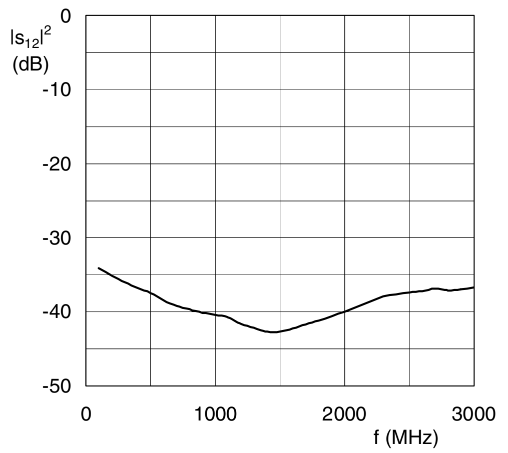
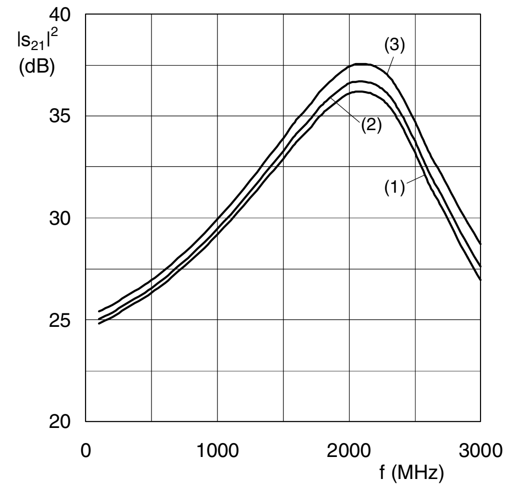


Fig.4 Output reflection coefficient (s_{22}); typical values.



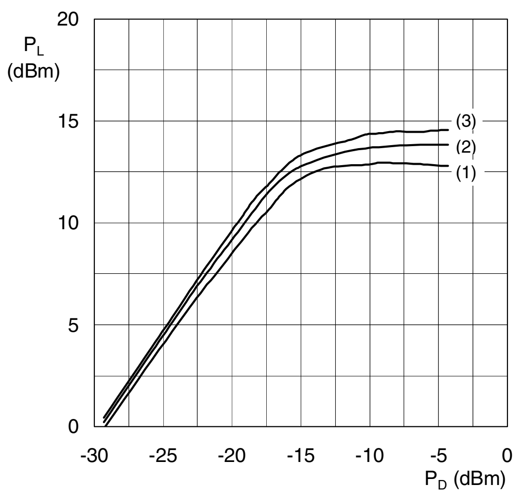
I_S = 25.5 mA; V_S = 5.0 V; P_D = −35 dBm; Z_O = 50 Ω.

Fig.5 Isolation ($|s_{12}|^2$) as a function of frequency; typical values.



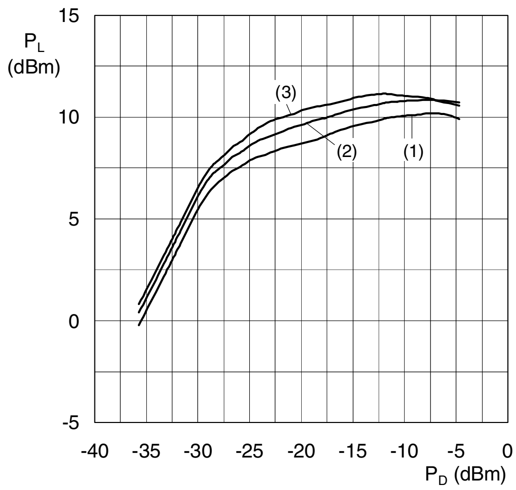
P_D = −35 dBm; Z_O = 50 Ω.
(1) I_S = 19.5 mA; V_S= 4.5 V
(2) I_S = 25.5 mA; V_S= 5.0 V
(3) I_S = 29.8 mA; V_S= 5.5 V

Fig.6 Insertion gain ($|s_{21}|^2$) as a function of frequency; typical values.



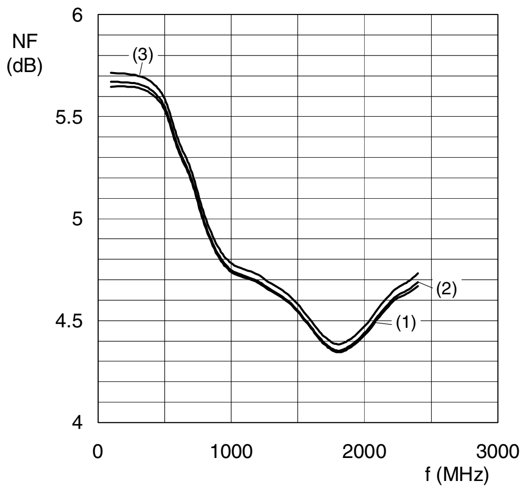
f = 1 GHz; Z_O = 50 Ω.
(1) V_S= 4.5 V
(2) V_S= 5.0 V
(3) V_S= 5.5 V

Fig.7 Load power as a function of drive power at 1 GHz; typical values.



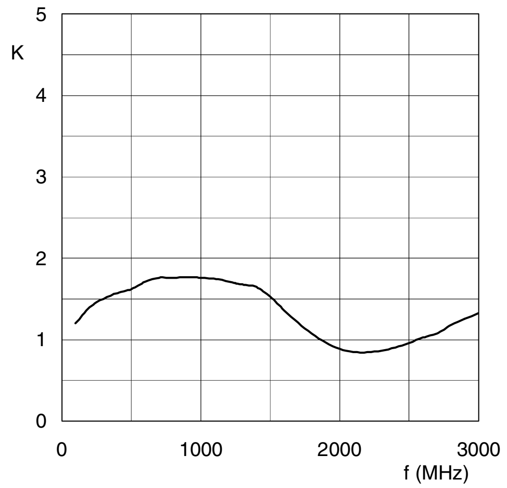
f = 2.2 GHz; Z_O = 50 Ω.
(1) V_S= 4.5 V
(2) V_S= 5.0 V
(3) V_S= 5.5 V

Fig.8 Load power as a function of drive power at 2.2 GHz; typical values.



Z_O = 50 Ω.
(1) I_S = 19.5 mA; V_S= 4.5 V
(2) I_S = 25.5 mA; V_S= 5.0 V
(3) I_S = 29.8 mA; V_S= 5.5 V

Fig.9 Noise figure as a function of frequency; typical values.



I_S = 25.5 mA; V_S = 5.0 V; Z_O = 50 Ω.

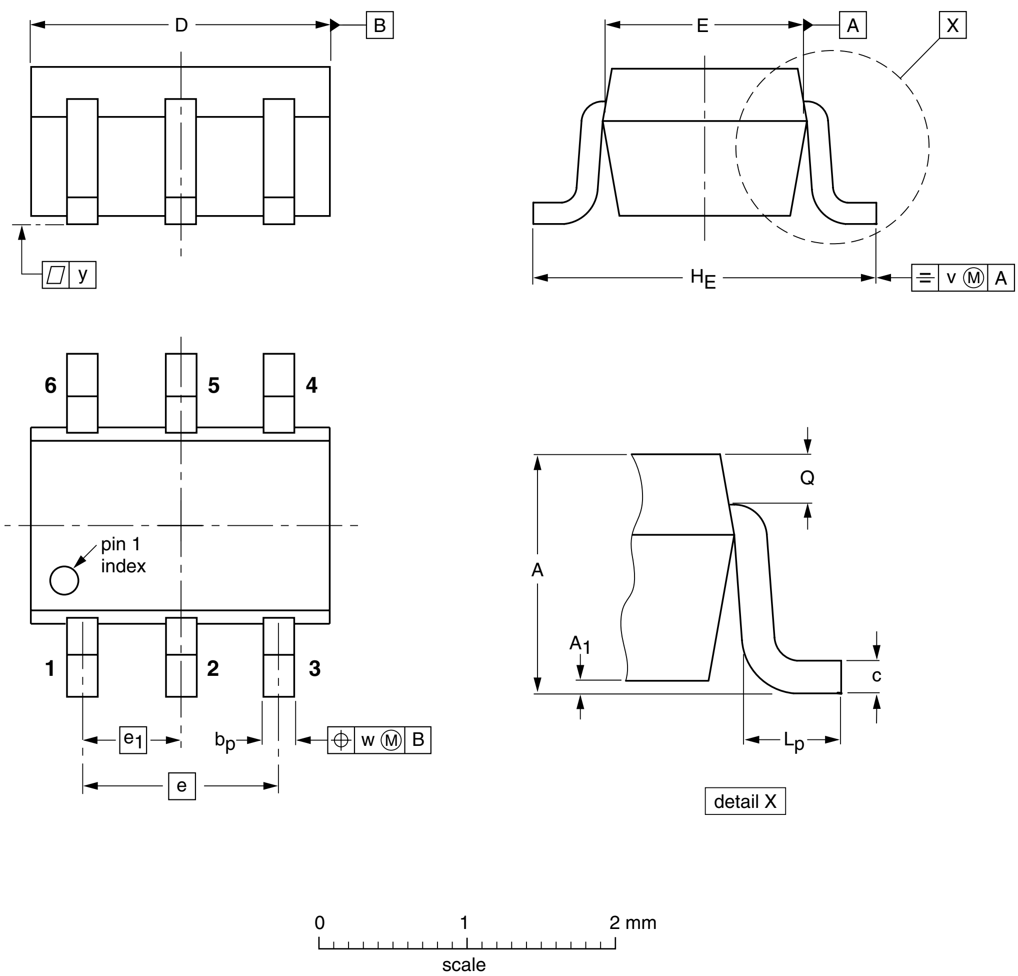
Fig.10 Stability factor as a function of frequency; typical values.

Scattering parameters: V_S = 5.0 V; I_S = 25.5 mA; P_D = −35 dBm; Z_O = 50 Ω; T_{amb} = 25 °C

f (MHz)	s_{11} MAGNITUDE (ratio)	s_{11} ANGLE(deg)	s_{21} MAGNITUDE (ratio)	s_{21} ANGLE (deg)	s_{12} MAGNITUDE (ratio)	s_{12} ANGLE (deg)	s_{22} MAGNITUDE (ratio)	s_{22} ANGLE (deg)	K-FACTOR
100	0.36264	13.342	17.83811	24.366	0.01974	16.631	0.32582	75.129	1.2
200	0.36374	0.954	18.52172	12.011	0.017526	3.391	0.22343	80.749	1.4
400	0.36404	−11.09	20.26048	4.008	0.014492	−9.722	0.13121	63.715	1.6
600	0.35160	−19.36	4.7	−1.373	0.011953	−9.388	0.10301	30.828	1.7
800	0.32818	−26.32	13.8	−7.408	0.010391	−5.884	0.10619	1.087	1.8
1000	0.29729	−29.66	29.73953	−14.9	0.009534	−0.816	0.12032	−15.72	1.7
1200	0.25490	−31.1	35.11364	−24.67	0.008254	9.695	0.13665	−25.66	1.7
1400	0.20591	−24.6	42.13907	−36.83	0.007313	23.979	0.15786	−33.18	1.6
1600	0.18024	−4.547	50.8261	−52.69	0.007684	33.26	0.18642	−44.12	1.4
1800	0.23153	16.758	60.12684	−73.19	0.008713	44.601	0.21778	−65.13	1.1
2000	0.32983	16.643	67.60676	−100.2	0.010019	42.512	0.24156	−100.6	0.9
2200	0.39031	4.096	67.08784	−131.3	0.011761	49.659	0.26347	−146.8	0.9
2400	0.34466	−8.496	56.50393	−160.5	0.013121	46.727	0.28137	173.89	0.9
2600	0.25915	−10.05	41.27266	178.27	0.013803	52.913	0.30823	151.71	1.0
2800	0.21573	−1.301	31.24721	164.33	0.013946	50.499	0.33170	136.52	1.2
3000	0.20270	12.698	23.98115	154.16	0.014548	55.48	0.37422	130.13	1.3

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	EIAJ			
SOT363			SC-88			97-02-28

DATA SHEET STATUS

DATA SHEET STATUS(1)	PRODUCT STATUS(2)	DEFINITIONS
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