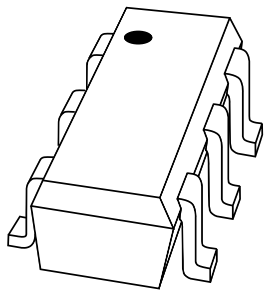
DATA SHEET



BGM1012
MMIC wideband amplifier

Product specification
Supersedes data of 2002 May 16

2002 Sep 06

FEATURES

- Internally matched to 50 Ω
- Very wide frequency range (4 GHz at 3 dB bandwidth)
- Very flat 20 dB gain (DC to 2.9 GHz at 1 dB flatness)
- 10 dBm saturated output power at 1 GHz
- High linearity (18 dBm $IP3_{(out)}$ at 1 GHz)
- Low current (14.6 mA)
- Unconditionally stable.

APPLICATIONS

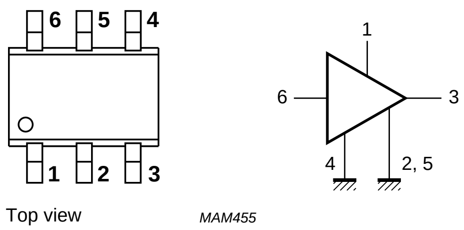
- LNB IF amplifiers
- Cable systems
- ISM
- General purpose.

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: C2-.

Fig.1 Simplified outline (SOT363) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
V_S	DC supply voltage		3	4	V
I_S	DC supply current		14.6	–	mA
$\|s_{21}\|^2$	insertion power gain	f = 1 GHz	20.1	–	dB
NF	noise figure	f = 1 GHz	4.8	–	dB
$P_{L(sat)}$	saturated load power	f = 1 GHz	9.7	–	dBm

CAUTION
This product is supplied in anti-static packing to prevent damage caused by electrostatic discharge during transport and handling.

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	–	4	V
I_S	supply current		–	50	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

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 = 3 V; I_S = 14.6 mA; T_j = 25 °C; unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
I_S	supply current		11	14.6	19	mA
$\|s_{21}\|^2$	insertion power gain	f = 100 MHz	19	19.5	20	dB
		f = 1 GHz	19	20.1	21	dB
		f = 1.8 GHz	19	20.4	21	dB
		f = 2.2 GHz	19	20.4	22	dB
		f = 2.6 GHz	18	19.9	21	dB
		f = 3 GHz	16	18.7	20	dB
$R_{L\ IN}$	return losses input	f = 1 GHz	9	11	–	dB
		f = 2.2 GHz	13	15	–	dB
$R_{L\ OUT}$	return losses output	f = 1 GHz	11	14	–	dB
		f = 2.2 GHz	10	13	–	dB
$\|s_{12}\|^2$	isolation	f = 1 GHz	30	33	–	dB
		f = 2.2 GHz	35	38	–	dB
NF	noise figure	f = 1 GHz	–	4.8	5.1	dB
		f = 2.2 GHz	–	4.9	5.3	dB
BW	bandwidth	at $\|s_{21}\|^2$ –3 dB below flat gain at 1 GHz	3.1	3.6	–	GHz
K	stability factor	f = 1 GHz	1.5	2.1	–	–
		f = 2.2 GHz	3	3.4	–	–
$P_{L(sat)}$	saturated load power	f = 1 GHz	8	9.7	–	dBm
		f = 2.2 GHz	3.5	5.6	–	dBm
$P_{L\ 1\ dB}$	load power	at 1 dB gain compression; f = 1 GHz	4	6.0	–	dBm
		at 1 dB gain compression; f = 2.2 GHz	1.5	3.4	–	dBm
$IP3_{(in)}$	input intercept point	f = 1 GHz	–4	–2	–	dBm
		f = 2.2 GHz	–9	–7	–	dBm
$IP3_{(out)}$	output intercept point	f = 1 GHz	16	18	–	dBm
		f = 2.2 GHz	11	13	–	dBm

APPLICATION INFORMATION

Figure 2 shows a typical application circuit for the BGM1012 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 nominal value of the RF choke L1 is 100 nH. At frequencies below 100 MHz this value should be increased to 220 nH. At frequencies above 1 GHz a much lower value (e.g. 10 nH) can be used 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.

Both the RF choke L1 and 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.

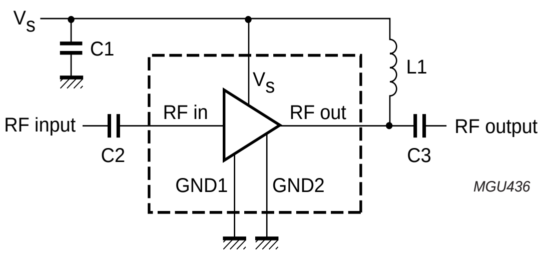


Fig.2 Typical application circuit.

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.

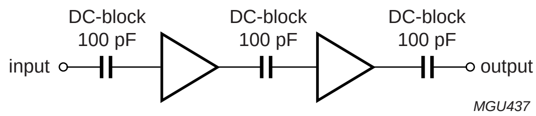


Fig.3 Easy cascading application circuit.

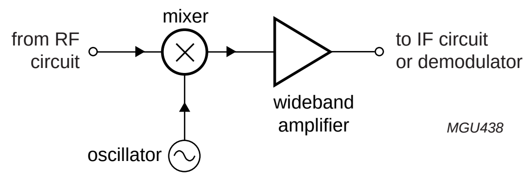


Fig.4 Application as IF amplifier.

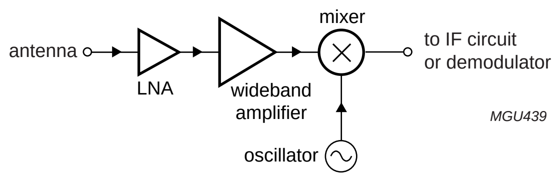


Fig.5 Application as RF amplifier.

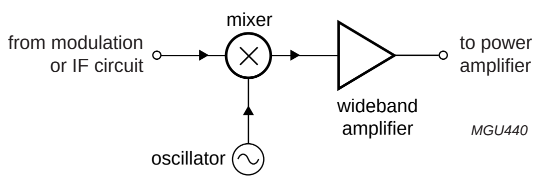
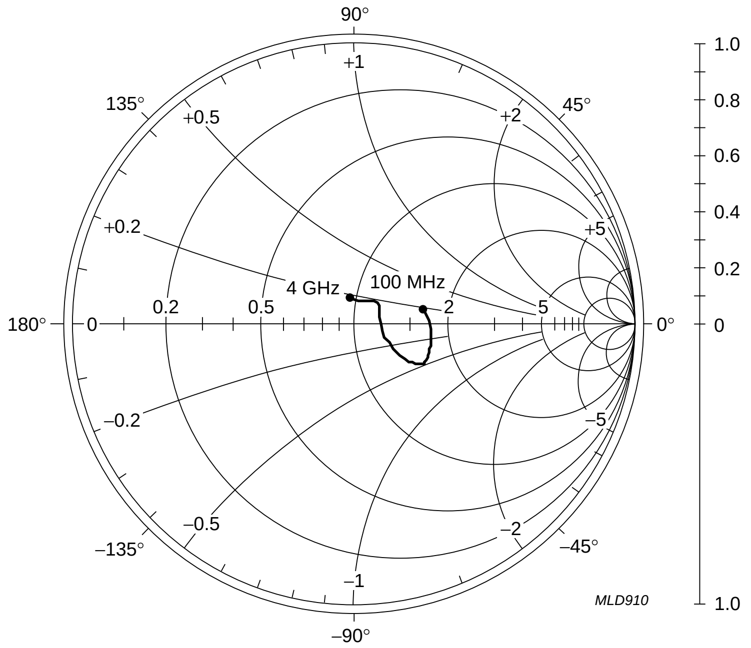
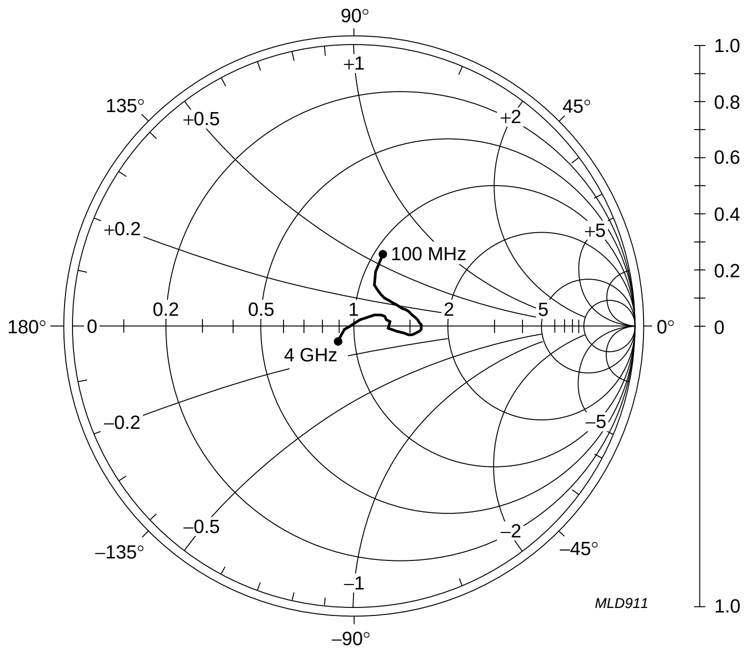


Fig.6 Application as driver amplifier.



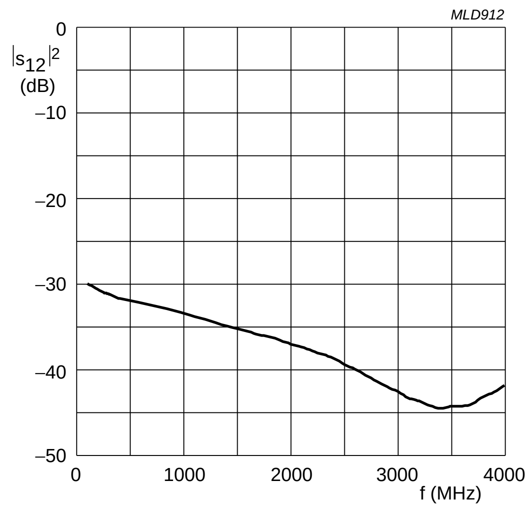
I_S = 14.6 mA; V_S = 3 V; P_D = −30 dBm; Z_O = 50 Ω.

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



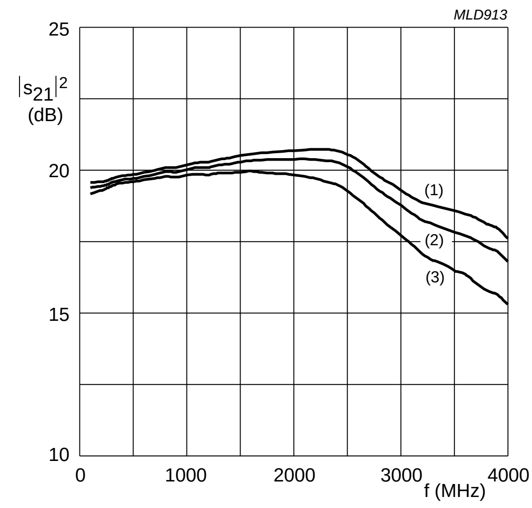
I_S = 14.6 mA; V_S = 3 V; P_D = −30 dBm; Z_O = 50 Ω.

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



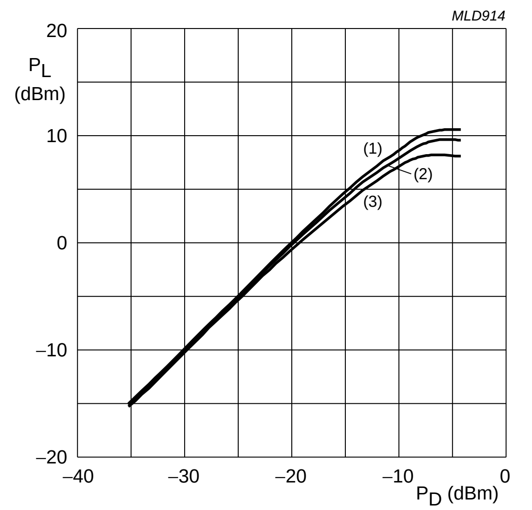
I_S = 14.6 mA; V_S = 3 V; P_D = −30 dBm; Z_O = 50 Ω.

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



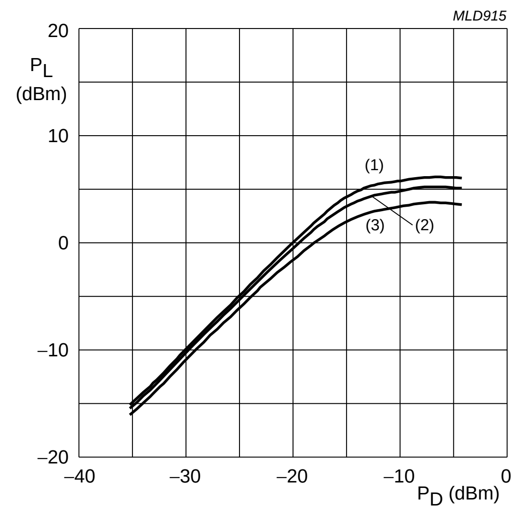
P_D = −30 dBm; Z_O = 50 Ω.
(1) I_S = 18.7 mA; V_S = 3.3 V.
(2) I_S = 14.6 mA; V_S = 3 V.
(3) I_S = 10.6 mA; V_S = 2.7 V.

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



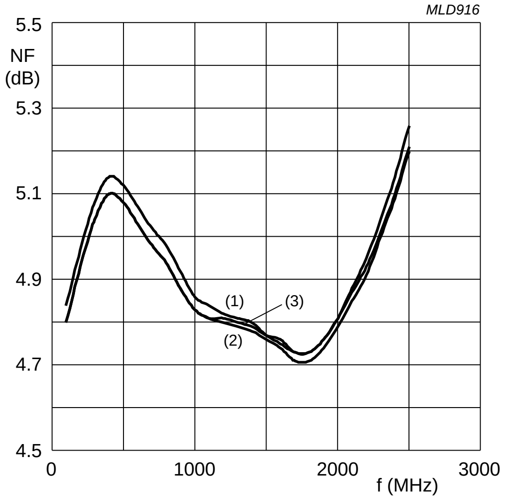
f = 1 GHz; Z_O = 50 Ω.
(1) V_S = 3.3 V.
(2) V_S = 3 V.
(3) V_S = 2.7 V.

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 = 3.3 V.
(2) V_S = 3 V.
(3) V_S = 2.7 V.

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



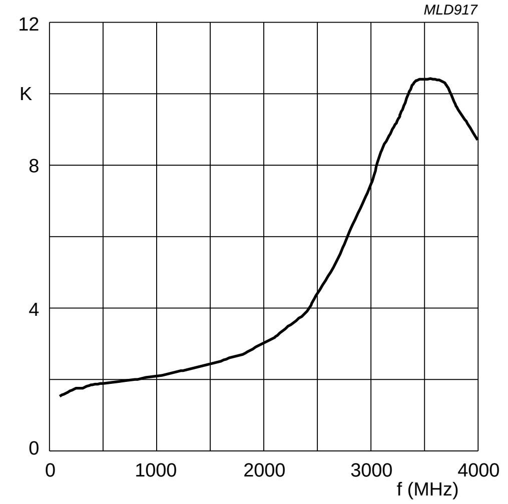
$Z_O = 50\ \Omega$.

(1) $I_S = 10.6$ mA; $V_S = 2.7$ V.

(2) $I_S = 14.6$ mA; $V_S = 3$ V.

(3) $I_S = 18.7$ mA; $V_S = 3.3$ V.

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



$I_S = 14.6$ mA; $V_S = 3$ V; $P_D = -30$ dBm; $Z_O = 50\ \Omega$.

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

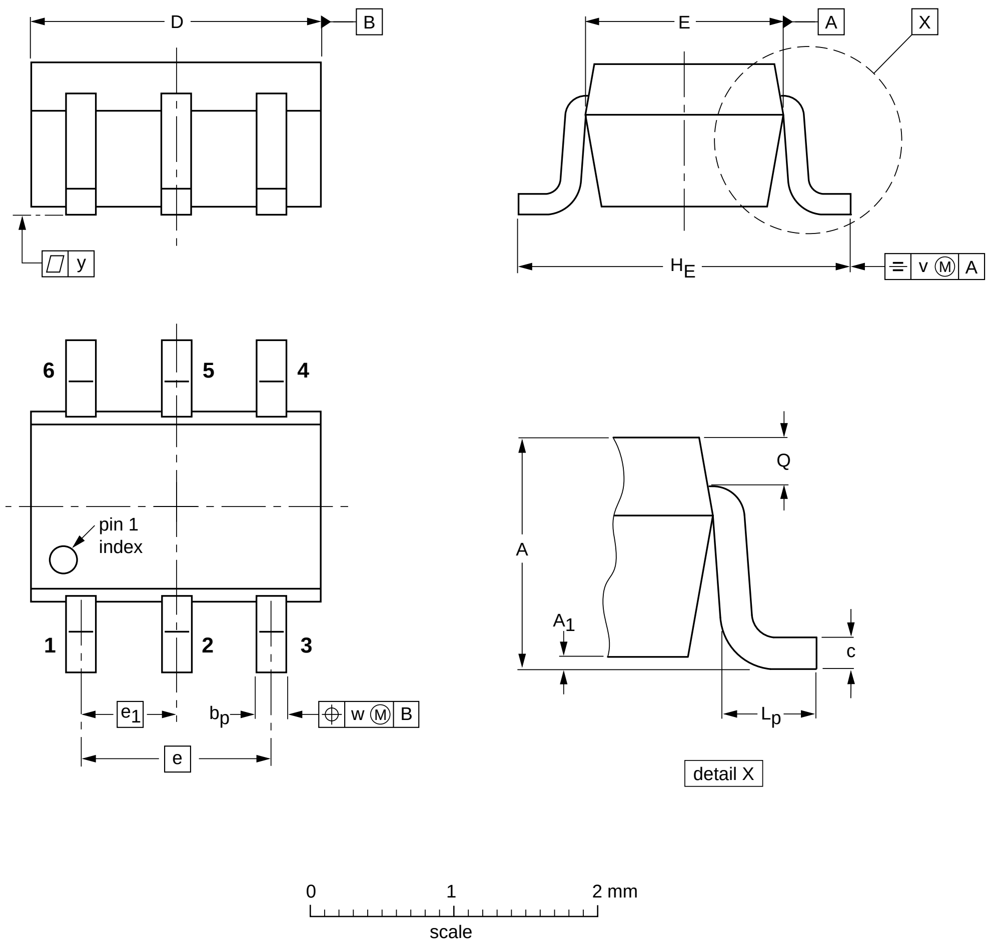
Scattering parameters

V_S = 3 V; I_S = 14.6 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	0.25122	14.607	9.33681	12.018	0.032124	16.445	0.26458	64.156	1.6
200	0.27070	2.759	9.42458	5.676	0.028303	6.37	0.20645	64.153	1.8
400	0.27979	–7.969	9.63627	–8.447	0.026297	–4.545	0.1543	52.558	1.9
600	0.28323	–14.78	9.76543	–19.02	0.024833	–10.24	0.15203	39.347	1.9
800	0.28557	–20.13	9.93782	–27.93	0.023234	–14.62	0.16867	27.926	2.0
1000	0.28673	–24.14	10.03633	–36.88	0.021523	–17.42	0.19196	19.293	2.1
1200	0.28517	–27.57	10.11638	–46.47	0.019830	–19.83	0.21421	12.703	2.2
1400	0.27902	–29.93	10.26450	–56.05	0.018230	–21.14	0.23292	7.154	2.4
1600	0.26682	–31.81	10.40572	–65.76	0.016902	–21.62	0.24605	2.582	2.5
1800	0.24746	–33.12	10.44088	–76.97	0.015759	–22.32	0.25113	–1.26	2.7
2000	0.21894	–33.8	10.46224	–88.33	0.014310	–22.64	0.24367	–4.817	3.0
2200	0.18164	–32.67	10.45202	–100.3	0.013012	–23.13	0.22184	–7.573	3.4
2400	0.14000	–26.75	10.34342	–112.6	0.011826	–23.27	0.18787	–8.489	3.9
2600	0.10418	–10.16	9.87989	–122.9	0.010171	–23.23	0.13049	–4.601	4.9
2800	0.09469	15.051	9.20393	–129.5	0.008664	–16.9	0.1294	9.578	6.2
3000	0.10595	33.415	8.68177	–135.4	0.007541	–9.957	0.1127	18.402	7.5
3200	0.11609	42.888	8.18809	–142.2	0.006655	–0.835	0.092234	23.406	9.0
3400	0.10827	50.017	7.93039	–151.5	0.006042	12.444	0.059268	26.453	10.3
3600	0.09866	60.967	7.77538	–162.2	0.006205	29.297	0.015829	38.211	10.3
3800	0.08693	80.355	7.33775	–172.6	0.007039	40.351	0.028159	–152.8	9.6
4000	0.10090	102.07	6.90878	177.1	0.008241	46.053	0.075298	–133.1	8.7

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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