UGY1088

24 V Push-Pull line amplifier MMIC

Rev. 2 — 12 July 2013 Product data sheet

1. Product profile

1.1 General description

The UGY1088 MMIC is a device which covers all push-pull applications. Dependent on the application circuit, the gain can be set between 21 dB and 35 dB power gain with a flat power gain response and excellent input and output return loss over the 40 MHz to 1003 MHz frequency range.

It is especially suited for CATV amplifiers. The UGY1088 is a highly linear, monolithic GaAs RF amplifier that has been developed to replace standard CATV hybrid amplifiers. Offered in a HVQFN32 surface mount package, the MMIC consists of 3 stages of balanced amplifiers that are optimized for exceptionally low distortion and noise figure. The flat power gain response and excellent input and output return loss over the 40 MHz to 1003 MHz CATV downstream band is formed when one UGY1088 is cascaded between transmission line baluns. The gain level is set by the external feedback circuit in the final MMIC application.

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

1.2 Features and benefits

- 1 GHz specified performance
- Gain is typical 30 dB, by application, power gain can be set between 21 dB and 35 dB
- Very low distortion
- Excellent 75 Ω input and output match
- Stable with high VSWR load conditions
- Monolithic design for consistent performance part-to-part
- Low DC power consumption
- Highly integrated for low additional part count
- Surface mount package compatible with automatic assembly
- Compliant to Directive 2002/95/EC, regarding Restriction of Hazardous Substances (RoHS)

1.3 Applications

- Up to 1003 MHz CATV push-pull amplifier for line extender, distribution and trunk amplifiers and optical nodes in hybrid TV infrastructure networks.

1.4 Quick reference data

Table 1. Quick reference data

Bandwidth 40 MHz to 1003 MHz; for a 29 dB application circuit; V_B = 24 V (DC); $Z_S = Z_L$ = 75 Ω; T_{mb} = 35 °C; I_{CC} = 265 mA; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
G_p	power gain	f = 1003 MHz	[1]	28	29	30	dB
NF	noise figure	f = 50 MHz	[1]	-	3.7	4.1	dB
CTB	composite triple beat	V_o = 44 dBmV	[1][2]	-	−65	−62	dBc
CSO	composite second-order distortion	V_o = 44 dBmV	[1][2]	-	−70	−64	dBc
Xmod	cross modulation	V_o = 44 dBmV	[1][2]	-	−58	-	dBc
I_{CC}	supply current			230	265	300	mA

[1] Measured with baluns and transformers on the input and output of the device, see Figure 2.

[2] 79 NTSC channels [f = 55.25 MHz to 547.35 MHz]; flat output level.

2. Pinning information

2.1 Pinning

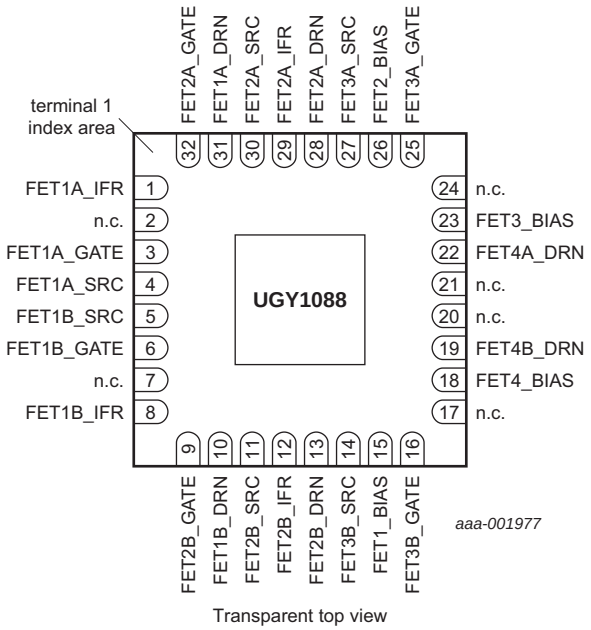


Fig 1. Pin configuration for HVQFN32

2.2 Pin description

Table 2. Pin description

Symbol	Pin	Description
FET1A_IFR	1	internal feedback resistor FET1a
n.c.	2	not connected
FET1A_GATE	3	gate FET1a
FET1A_SRC	4	source FET1a
FET1B_SRC	5	source FET1b
FET1B_GATE	6	gate FET1b
n.c.	7	not connected
FET1B_IFR	8	internal feedback resistor FET1b
FET2B_GATE	9	gate FET2b
FET1B_DRN	10	drain FET1b
FET2B_SRC	11	source FET2b
FET2B_IFR	12	internal feedback resistor FET2b
FET2B_DRN	13	drain FET2b
FET3B_SRC	14	source FET3b
FET1_BIAS	15	bias FET1
FET3B_GATE	16	gate FET3b
n.c.	17	not connected
FET4_BIAS	18	bias FET4
FET4B_DRN	19	drain FET4b
n.c.	20	not connected
n.c.	21	not connected
FET4A_DRN	22	drain FET4a
FET3_BIAS	23	bias FET3
n.c.	24	not connected
FET3A_GATE	25	gate FET3a
FET2_BIAS	26	bias FET2
FET3A_SRC	27	source FET3a
FET2A_DRN	28	drain FET2a
FET2A_IFR	29	internal feedback resistor FET2a
FET2A_SRC	30	source FET2a
FET1A_DRN	31	drain FET1a
FET2A_GATE	32	gate FET2a
-	die pad	ground

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
UGY1088	HVQFN32	plastic thermal enhanced very thin quad flat package; no leads; 32 terminals; body 5 × 5 × 0.85 mm.	SOT617-3

4. Marking

Table 4. Marking codes

Type number	Marking code
UGY1088	Y888C

5. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions	Min	Max	Unit
V_B	supply voltage		-	30	V
$V_{i(RF)}$	RF input voltage	single tone	-	75	dBmV
T_{stg}	storage temperature		−40	+150	°C
T_{case}	case temperature		−20	+125	°C
I_{CC}	supply current		-	300	mA
V_{ESD}	electrostatic discharge voltage	Human Body Model (HBM); According JEDEC standard 22-A114E	-	300	V
		Charged Device Model (CDM); According to JEDEC standard 22-C101B	-	400	V

6. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-c)}$	thermal resistance from junction to case		3.5	K/W

7. Characteristics

Table 7. Characteristics

Bandwidth 40 MHz to 1003 MHz; for a 29 dB application circuit; V_B = 24 V (DC); $Z_S = Z_L$ = 75 Ω; T_{mb} = 35 °C; I_{CC} = 265 mA; unless otherwise specified.

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
G_p	power gain	f = 1003 MHz	[1]	28	29	30	dB
SL_{sl}	slope straight line	f = 45 MHz to 1003 MHz	[1]	1.3	1.6	2.0	dB
FL	flatness of frequency response	f = 1003 MHz	[1]	-	0.8	1.0	dB
NF	noise figure	f = 50 MHz	[1]	-	3.7	4.1	dB
		f = 1003 MHz	[1]	-	4.5	5.0	dB
RL_{in}	input return loss	f = 45 MHz to 200 MHz	[1]	18	-	-	dB
		f = 200 MHz to 550 MHz	[1]	19	-	-	dB
		f = 550 MHz to 870 MHz	[1]	19	-	-	dB
		f = 870 MHz to 914 MHz	[1]	19	-	-	dB
		f = 914 MHz to 1003 MHz	[1]	15	-	-	dB
RL_{out}	output return loss	f = 45 MHz to 200 MHz	[1]	19	-	-	dB
		f = 200 MHz to 550 MHz	[1]	19	-	-	dB
		f = 550 MHz to 870 MHz	[1]	19	-	-	dB
		f = 870 MHz to 914 MHz	[1]	19	-	-	dB
		f = 914 MHz to 1003 MHz	[1]	18	-	-	dB
I_{CC}	supply current		[4]	230	265	300	mA
79 NTSC channels							
CTB	composite triple beat	V_o = 44 dBmV	[1][2]	-	–65	–62	dBc
CSO	composite second-order distortion	V_o = 44 dBmV	[1][2]	-	–70	–64	dBc
Xmod	cross modulation	V_o = 44 dBmV	[1][2]	-	–58	-	dB
79 NTSC channels + 75 digital channels							
CTB	composite triple beat	V_o = 44 dBmV	[1][3]	-	–62	-	dBc
CSO	composite second-order distortion	V_o = 44 dBmV	[1][3]	-	–64	-	dBc
Xmod	cross modulation	V_o = 44 dBmV	[1][3]	-	–58	-	dB
CCN	carrier-to-composite noise	V_o = 44 dBmV	[1][3]	-	63	-	dBc

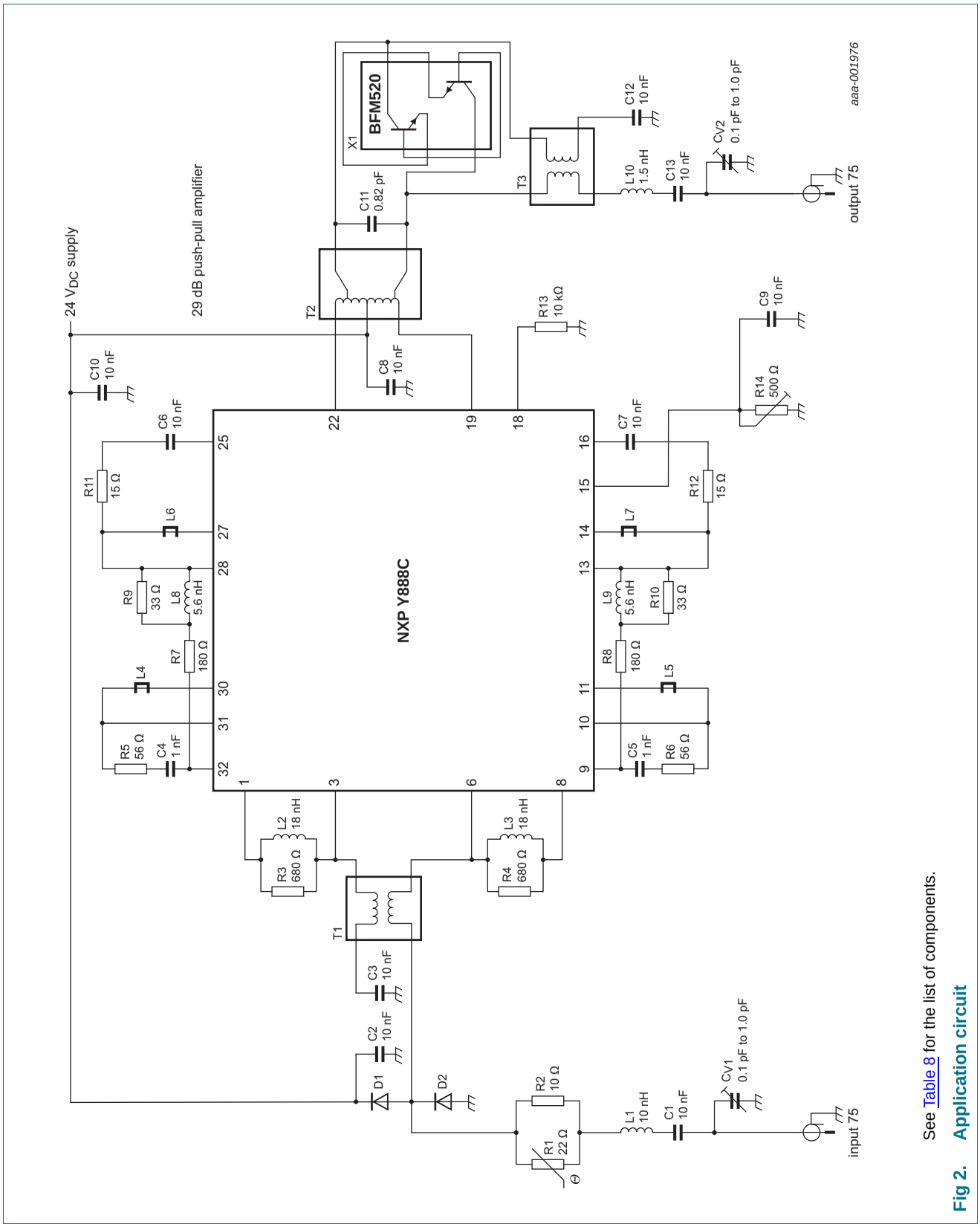
[1] Measured with baluns and transformers on the input and output of the device, see Figure 2.

[2] 79 NTSC channels [f = 55.25 MHz to 547.35 MHz]; flat output level.

[3] 79 NTSC channels [f = 55.25 MHz to 547.35 MHz] + 75 digital channels [f = 547.25 MHz to 1003 MHz] (–6 dB offset); flat output level.

[4] The supply current may be reduced by decreasing the value of R14 (see Figure 2). All specifications are measured on evaluation board rev 1.0 (see Figure 2).

8. Application information



See Table 8 for the list of components.

Fig 2. Application circuit

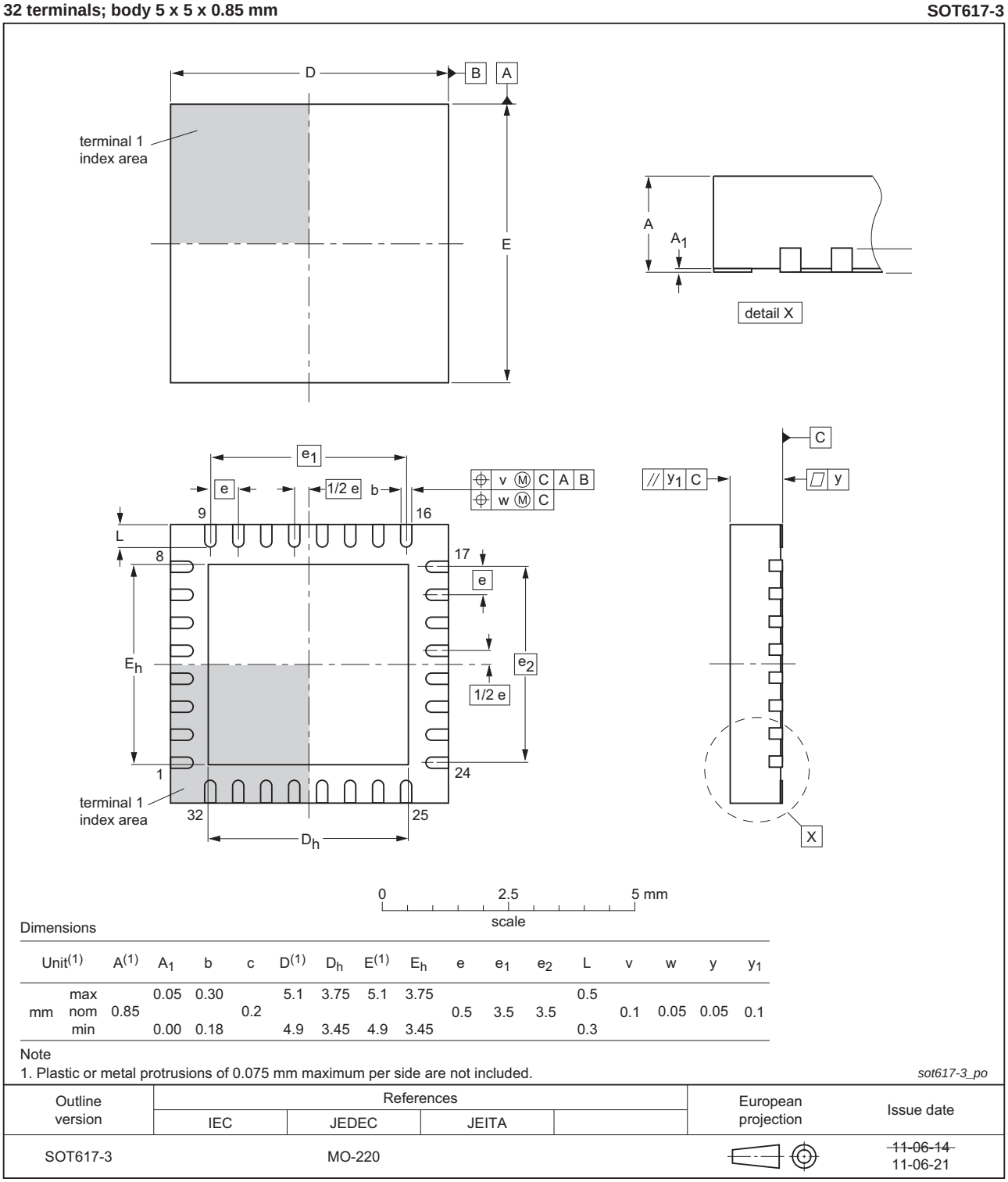
Table 8. List of components

See Figure 2 for component layout.

Component	Description	Value	Remarks
C1, C2, C3, C6, C7, C8, C9, C10, C12, C13	capacitor	10 nF	
C4, C5	capacitor	1 nF	
C11	capacitor	0.82 pF	
C_{V1}, C_{V2}	preset capacitor	0.1 pF to 1.0 pF	
D1, D2	high-speed switching diode	-	BAS516 (NXP)
L1	inductor	10 nH	
L2, L3	inductor	18 nH	
L4, L5, L6, L7	ferrite bead	-	BLM15HD182SN1D (Murata)
L8, L9	inductor	5.6 nH	
L10	inductor	1.5 nH	
R1	NTC thermistor	22 Ω	
R2	resistor	10 Ω	
R3, R4	resistor	680 Ω	
R5, R6	resistor	56 Ω	
R7, R8	resistor	180 Ω	
R9, R10	resistor	33 Ω	
R11, R12	resistor	15 Ω	
R13	resistor	10 kΩ	
R14	preset resistor	500 Ω	
T1, T3	balun transformer	-	617DB-1655 (TOKO) or balun of the same quality
T2	center transformer	-	617PS-A0369=P3 (TOKO) or Gemphil A0369
X1	dual NPN wideband transistor	-	BFM520 (NXP)

9. Package outline

HVQFN32: plastic thermal enhanced very thin quad flat package; no leads; 32 terminals; body 5 x 5 x 0.85 mm **SOT617-3**



Dimensions

Unit(1)		A(1)	A_1	b	c	D(1)	D_h	E(1)	E_h	e	e_1	e_2	L	v	w	y	y_1
mm	max	0.85	0.05	0.30	0.2	5.1	3.75	5.1	3.75	0.5	3.5	3.5	0.5	0.1	0.05	0.05	0.1
	nom																
	min		0.00	0.18		4.9	3.45	4.9	3.45				0.3				

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot617-3_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT617-3		MO-220				~~11-06-14~~ 11-06-21

Fig 3. Package outline SOT617-3

10. Abbreviations

Table 9. Abbreviations

Acronym	Description
CATV	Community Antenna TeleVision
GaAs	Gallium-Arsenide
MMIC	Monolithic Microwave Integrated Circuit
NPN	Negative-Positive-Negative
NTSC	National Television Standard Committee
NTC	Negative Temperature Coefficient
VSWR	Voltage Standing Wave Ratio

11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
UGY1088 v.2	20130712	Product data sheet	-	UGY1088 v.1
Modifications	• Table 1 on page 2: T_{case} has been changed to T_{mb} • Table 5 on page 4: The maximum value of T_{case} has been changed • Table 7 on page 5: T_{case} has been changed to T_{mb} • Figure 3 on page 8: Drawing has been updated • Section 12.3 on page 10: Disclaimer “Translations” has been added			
UGY1088 v.1	20120126	Product data sheet	-	-

12. Legal information

12.1 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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14. Contents

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