DATA SHEET

BLV93
UHF power transistor

Product specification

March 1993

Philips
Semiconductors

PHILIPS

UHF power transistor BLV93

DESCRIPTION

N-P-N silicon planar epitaxial transistor primarily intended for use in mobile radio transmitters in the 900 MHz communications band.

FEATURES

- multi-base structure and emitter-ballasting resistors for an optimum temperature profile
- internal input matching to achieve an optimum wideband capability and high power gain
- gold metallization ensures excellent reliability.

The transistor has a 6-lead flange envelope with a ceramic cap (SOT-171). All leads are isolated from the flange.

QUICK REFERENCE DATA

R.F. performance at T_h = 25 °C in a common-emitter class-B test circuit

MODE OF OPERATION	V_{CE} V	f MHz	P_L W	G_p dB	η_C %
narrow band; c.w.	12,5	900	8	> 6,5	> 50
	9,6	900	6	typ. 6,0	typ. 59

PINNING - SOT171A

PIN	SYMBOL	DESCRIPTION
1	e	emitter
2	e	emitter
3	b	base
4	c	collector
5	e	emitter
6	e	emitter

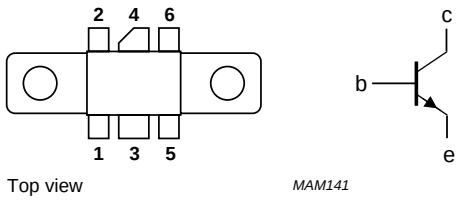


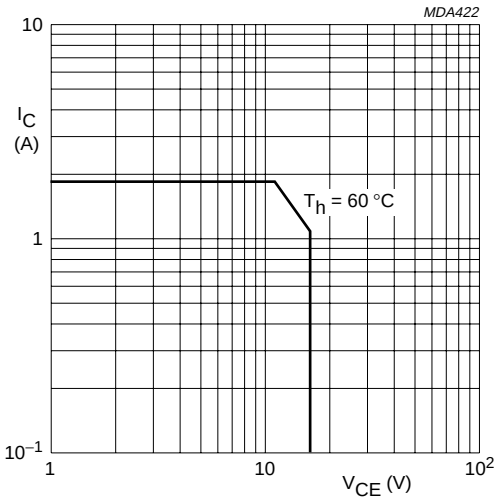
Fig.1 Simplified outline and symbol.

WARNING
Product and environmental safety - toxic materials
This product contains beryllium oxide. The product is entirely safe provided that the BeO disc is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with the general or domestic waste.

RATINGS

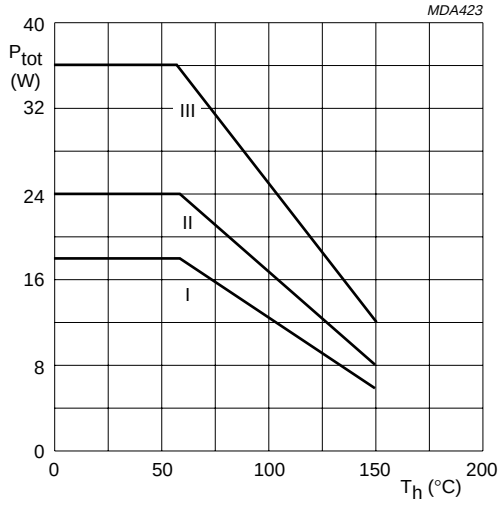
Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)				
peak value	V_{CBOM}	max.	36	V
Collector-emitter voltage (open base)	V_{CEO}	max.	16	V
Emitter-base voltage (open collector)	V_{EBO}	max.	3	V
Collector current				
d.c. or average	I_C; $I_{C\,AV}$	max.	1,6	A
(peak value); f > 1 MHz	I_{CM}	max.	4,8	A
Total power dissipation				
at T_{mb} = 67 °C	$P_{tot(dc)}$	max.	18	W
at T_{mb} = 67 °C; f > 1 MHz	$P_{tot(rf)}$	max.	24	W
Storage temperature	T_{stg}		−65 to +150	°C
Operating junction temperature	T_j	max.	200	°C



$R_{th\ mb\text{-}h}$ = 0,4 K/W

Fig.2 D.C. SOAR.



I Continuous operation
II Continuous operation (f > 1 MHz)
III Short-time operation during mismatch; (f > 1 MHz)

Fig.3 Power/temperature derating curves.

THERMAL RESISTANCE

Dissipation = 12 W; T_{mb} = 112 °C

From junction to mounting base				
(d.c. dissipation)	$R_{th\ j\text{-}mb(dc)}$	max.	7,0	K/W
(r.f. dissipation)	$R_{th\ j\text{-}mb(rf)}$	max.	5,2	K/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	max.	0,4	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector-base breakdown voltage				
open emitter; I_C = 20 mA	$V_{(BR)CBO}$	>	36	V
Collector-emitter breakdown voltage				
open base; I_C = 40 mA	$V_{(BR)CEO}$	>	16	V
Emitter-base breakdown voltage				
open collector; I_E = 2 mA	$V_{(BR)EBO}$	>	3	V
Collector cut-off current				
V_{BE} = 0; V_{CE} = 16 V	I_{CES}	<	10	mA
Second breakdown energy				
L = 25 mH; f = 50 Hz; R_{BE} = 10 Ω	E_{SBR}	>	2	mJ
D.C. current gain				
I_C = 1,2 A; V_{CE} = 10 V	h_{FE}	>	25	
Transition frequency at f = 500 MHz(1)				
$-I_E$ = 1,2 A; V_{CE} = 12,5 V	f_T	typ.	4	GHz
Collector capacitance at f = 1 MHz				
$I_E = i_e$ = 0; V_{CB} = 12,5 V	C_c	typ.	15	pF
Feed-back capacitance at f = 1 MHz				
I_C = 0; V_{CE} = 12,5 V	C_{re}	typ.	9	pF
Collector-flange capacitance	C_{cf}	typ.	2	pF

Note

1. Measured under pulse conditions: t_p = 50 μs; δ < 1%.

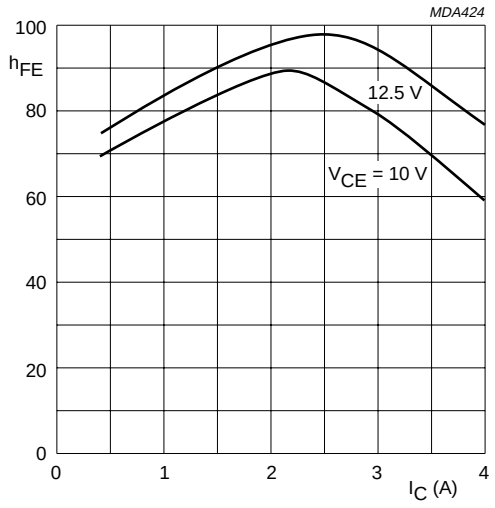


Fig.4 T_j = 25 °C; typical values.

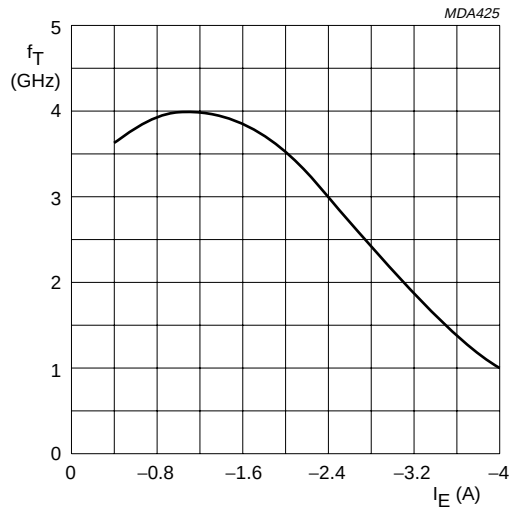


Fig.5 V_{CB} = 12,5 V; f = 500 MHz; T_j = 25 °C; typical values.

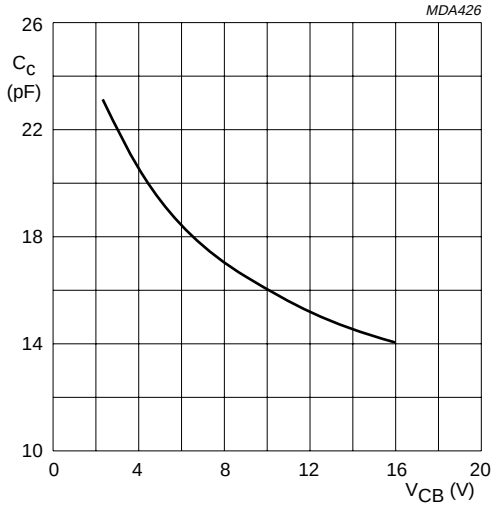


Fig.6 $I_E = i_e = 0$; f = 1 MHz; typical values.

APPLICATION INFORMATION

R.F. performance in c.w. operation (common-emitter circuit; class-B): f = 900 MHz; T_h = 25 °C.

MODE OF OPERATION	V_{CE} V	P_L W	P_S W	G_p dB	I_C A	η_C %
narrow band; c.w.	12,5	8	< 1,8	> 6,5	< 1,28	> 50
			typ. 1,5	typ. 7,3	typ. 1,1	typ. 58
	9,6	6	typ. 1,5	typ. 6,0	typ. 1,05	typ. 59

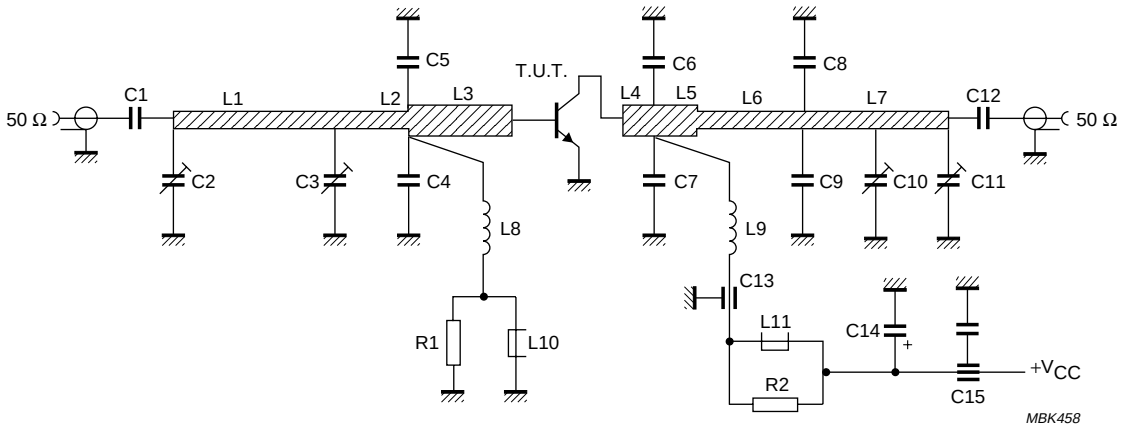


Fig.7 Class-B test circuit at f = 900 MHz.

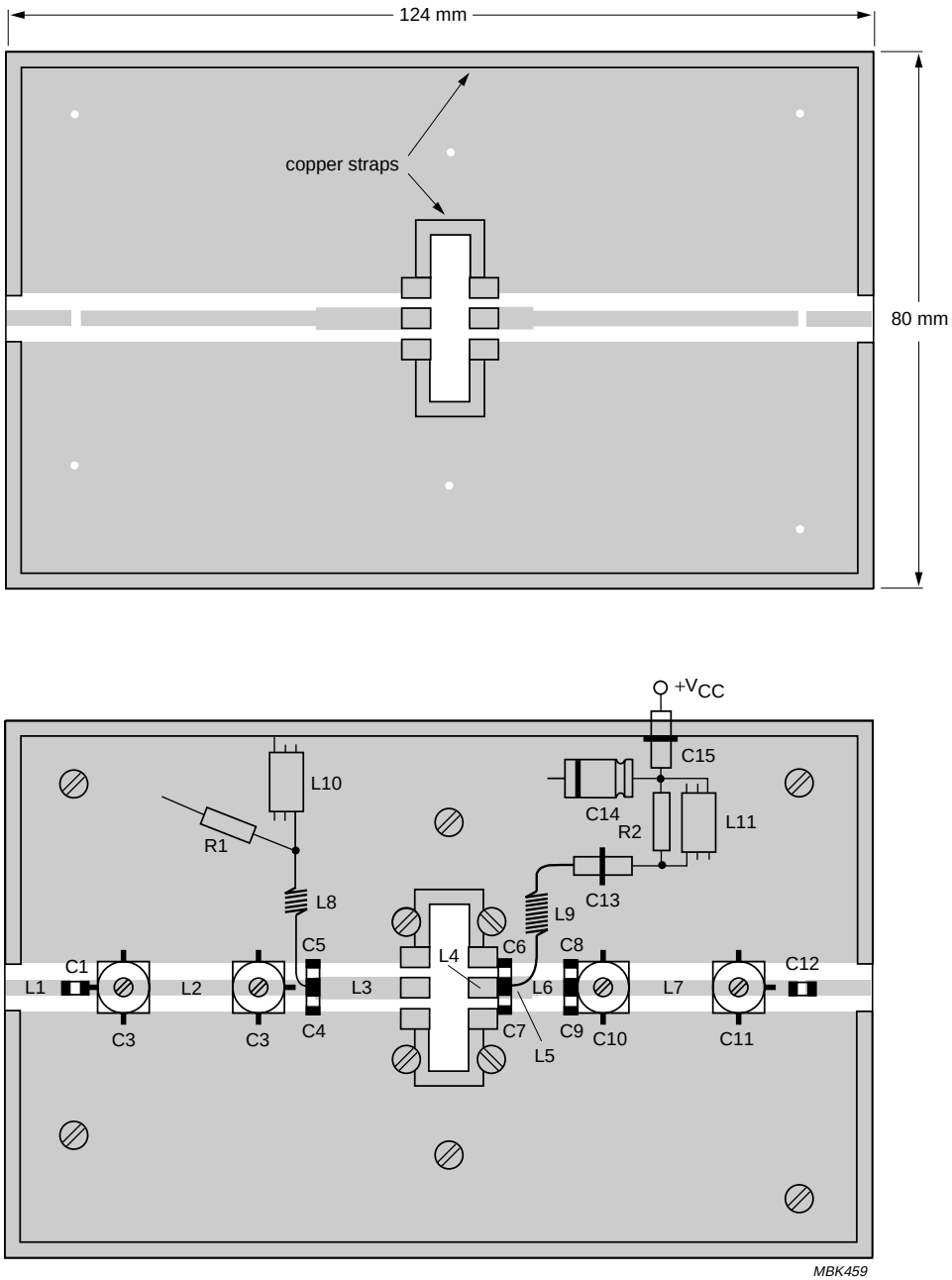
List of components:

C1 = C12 = 33 pF multilayer ceramic chip capacitor
C2 = C3 = C10 = C11 = 1,4 to 5,5 pF film dielectric trimmer (cat. no. 2222 809 09001)
C4 = C5 = 4,7 pF multilayer ceramic chip capacitor(1)
C6 = C7 = 5,6 pF multilayer ceramic chip capacitor(1)
C8 = C9 = 3,3 pF multilayer ceramic chip capacitor(1)
C13 = 10 pF ceramic feed-through capacitor
C14 = 6,8 μF (63 V) electrolytic capacitor
C15 = 330 pF ceramic feed-through capacitor
L1 = L7 = 50 Ω stripline (29,0 × 2,4 mm)
L2 = 50 Ω stripline (6,0 mm × 2,4 mm)
L3 = 42,7 Ω stripline (13,1 mm × 3,0 mm)
L4 = 42,7 Ω stripline (4,4 mm × 3,0 mm)
L5 = 42,7 Ω stripline (4,6 mm × 3,0 mm)
L6 = 50 Ω stripline (11,0 × 2,4 mm)
L8 = 60 nH; 4 turns closely wound enamelled Cu-wire (0,4 mm); int. dia. 3 mm; leads 2 × 5 mm
L9 = 45 nH; 4 turns enamelled Cu-wire (1,0 mm); length 6 mm; int. dia 4 mm; leads 2 × 5 mm
L10 = L11 = Ferroxcube wideband h.f. choke, grade 3B (cat. no. 4312 020 36642)
R1 = R2 = 10 Ω ± 10%; 0,25 W, metal film resistor

L1 to L7 are striplines on a double Cu-clad printed circuit board with P.T.F.E. fibre-glass dielectric (ε_r = 2,2); thickness $\frac{1}{32}$ inch.

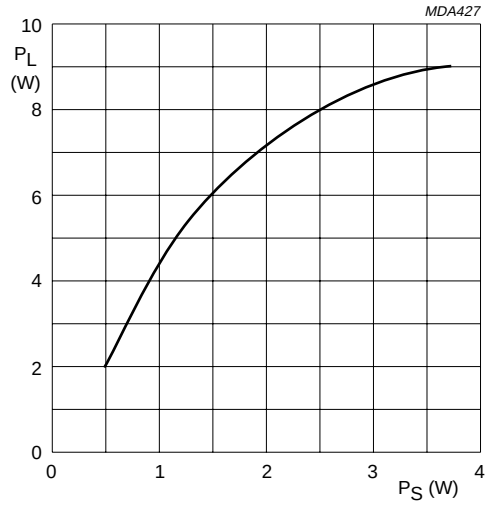
Note

1. American Technical Ceramics capacitor type 100A or capacitor of same quality.



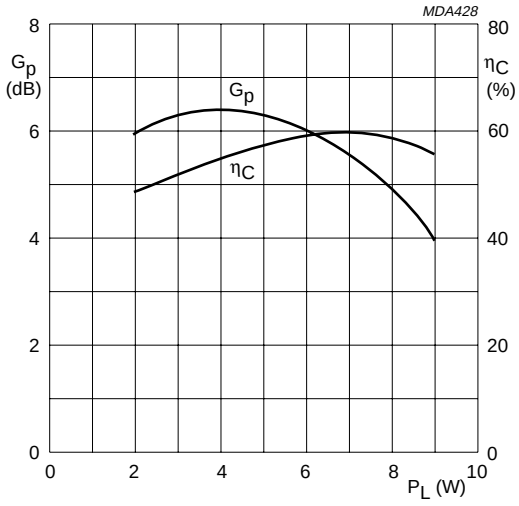
The circuit and the components are on one side of the P.T.F.E. fibre-glass board; the other side is unetched copper serving as ground plane. Earth connections are made by fixing screws and copper straps around the board and under the emitters to provide a direct contact between the copper on the component side and the ground plane.

Fig.8 Printed circuit board and component lay-out for 900 MHz class-B test circuit.



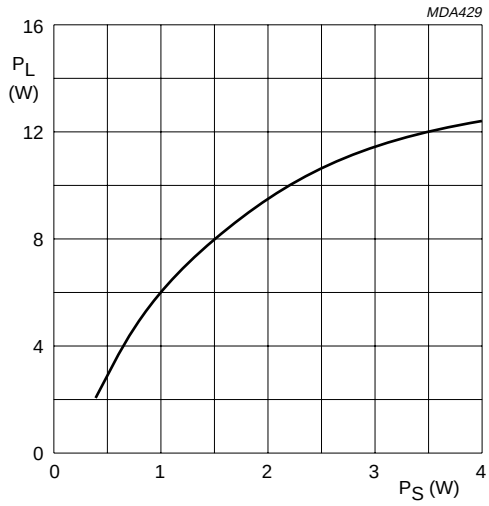
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C;
class-B operation; typical values.

Fig.9 Load power vs. source power.



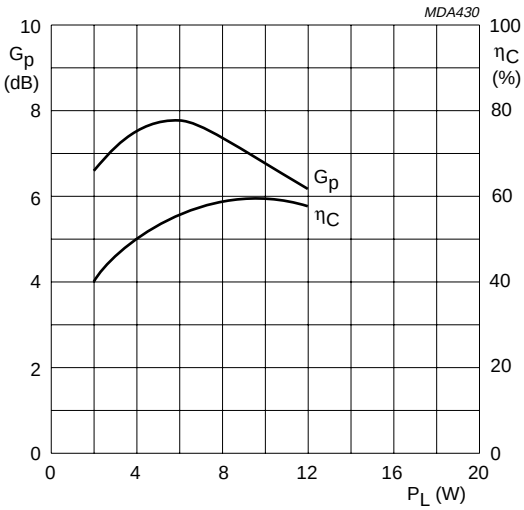
V_{CE} = 9,6 V; f = 900 MHz; T_h = 25 °C;
class-B operation; typical values.

Fig.10 Power gain and efficiency vs. load power.



V_{CE} = 12,5 V; f = 900 MHz; T_h = 25 °C;
class-B operation; typical values.

Fig.11 Load power vs. source power.

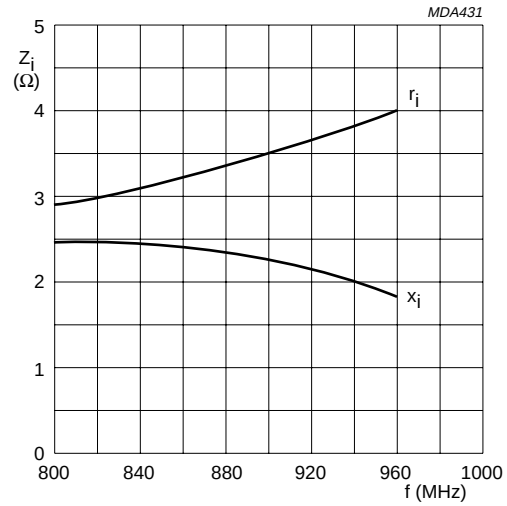


V_{CE} = 12,5 V; f = 900 MHz; T_h = 25 °C;
class-B operation; typical values.

Fig.12 Power gain and efficiency vs. load power.

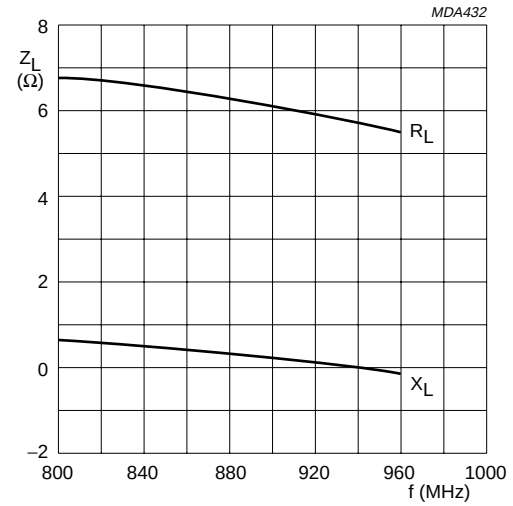
RUGGEDNESS

The device is capable of withstanding a full load mismatch (VSWR = 50; all phases) at rated load power up to a supply voltage of 15,5 V and at T_h = 25 °C.



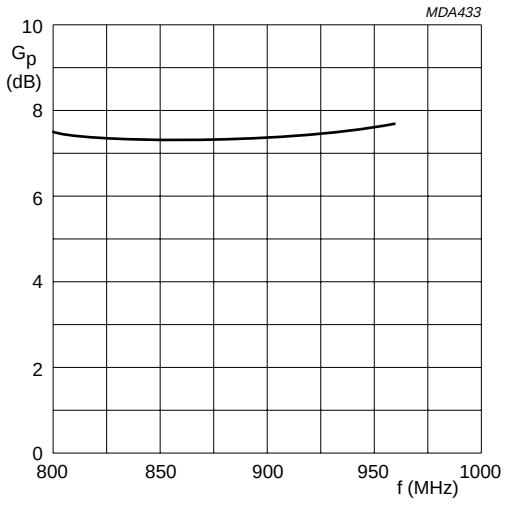
V_{CE} = 12,5 V; P_L = 8 W; f = 800-960 MHz;
T_h = 25 °C; class-B operation; typical values.

Fig.13 Input impedance (series components).



V_{CE} = 12,5 V; P_L = 8 W; f = 800-960 MHz;
T_h = 25 °C; class-B operation; typical values.

Fig.14 Load impedance (series components).

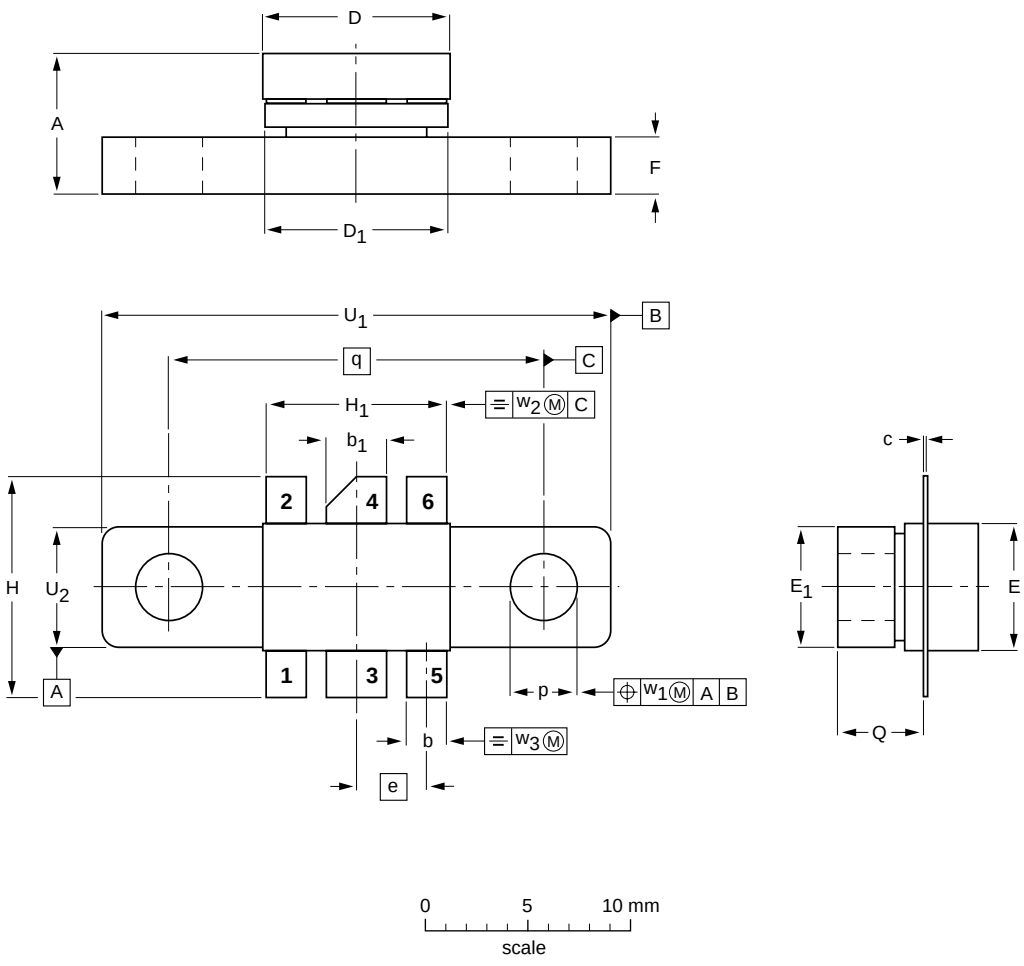


V_{CE} = 12,5 V; P_L = 8 W; f = 800-960 MHz;
T_h = 25 °C; class-B operation; typical values.

Fig.15 Power gain vs. frequency.

PACKAGE OUTLINE

Flanged ceramic package; 2 mounting holes; 6 leads **SOT171A**



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	b	b_1	c	D	D_1	E	E_1	e	F	H	H_1	p	Q	q	U_1	U_2	w_1	w_2	w_3
mm	6.81 6.07	2.15 1.85	3.20 2.89	0.16 0.07	9.25 9.04	9.30 8.99	5.95 5.74	6.00 5.70	3.58	3.05 2.54	11.31 10.54	9.27 9.01	3.43 3.17	4.32 4.11	18.42	24.90 24.63	6.00 5.70	0.51	1.02	0.26
inches	0.268 0.239	0.085 0.073	0.126 0.114	0.006 0.003	0.364 0.356	0.366 0.354	0.234 0.226	0.236 0.224	0.140	0.120 0.100	0.445 0.415	0.365 0.355	0.135 0.125	0.170 0.162	0.725	0.980 0.970	0.236 0.224	0.02	0.04	0.01

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT171A						97-06-28

DEFINITIONS

Data Sheet Status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

LIFE SUPPORT APPLICATIONS

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