# DATA SHEET

# MX0912B100Y; MZ0912B100Y
## NPN microwave power transistors

Product specification
Supersedes data of June 1992

1997 Feb 20

Philips
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# NPN microwave power transistors MX0912B100Y; MZ0912B100Y

## FEATURES

- Interdigitated structure provides high emitter efficiency
- Diffused emitter ballasting resistors providing excellent current sharing and withstanding a high VSWR
- Gold metallization realizes very stable characteristics and excellent lifetime
- Multicell geometry improves power sharing and low thermal resistance
- Input and output matching cell allows an easier design of circuits.

## APPLICATIONS

- Common base class-C broadband pulse power amplifiers operating at 960 to 1215 MHz for TACAN application.

## DESCRIPTION

NPN silicon planar epitaxial microwave power transistors.

The MX0912B100Y has a SOT439A metal ceramic flange package and improved output prematching cells. It is recommended for new designs.

The MZ0912B100Y has a SOT443A metal ceramic flange package with the base connected to the flange. It is mounted in common base configuration and specified in class C.

## PINNING

| PIN | DESCRIPTION |
|---|---|
| 1 | collector |
| 2 | emitter |
| 3 | base connected to flange |

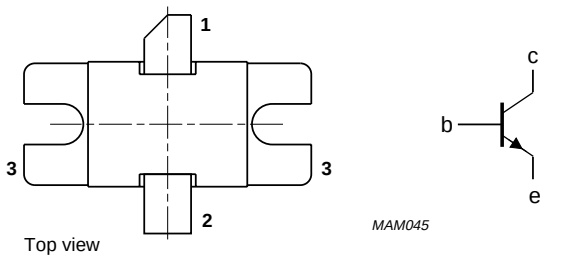



Fig.1 Simplified outline and symbol (SOT439A).

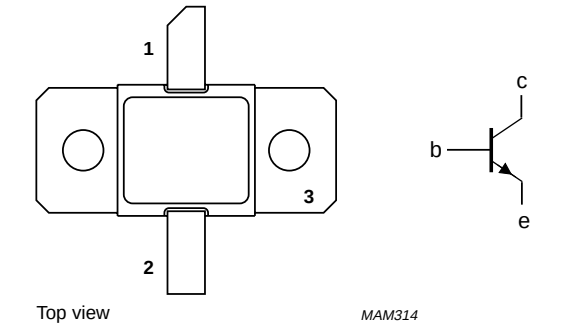



Fig.2 Simplified outline and symbol (SOT443A).

## QUICK REFERENCE DATA

Microwave performance at $T_{mb} \leq 25$ °C in a common base class-C broadband amplifier.

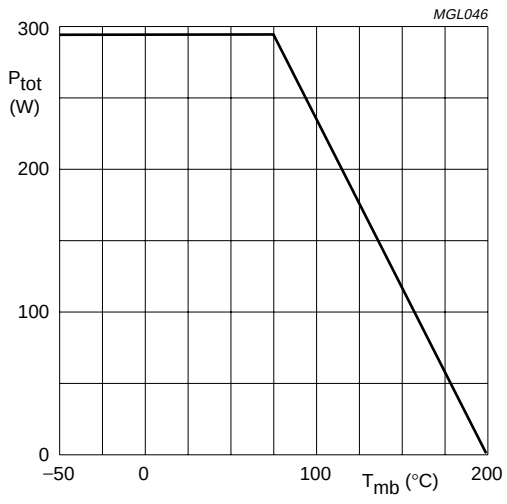
| MODE OF OPERATION | f (GHz) | $V_{CC}$ (V) | $P_L$ (W) | $G_P$ (dB) | $\eta_C$ (%) | $Z_i$; $Z_L$ (Ω) |
|---|---|---|---|---|---|---|
| Class-C; $t_p$ = 10 μs; δ = 10 % | 0.960 to 1.215 | 50 | >100 | >7 | >42 | see Figs 8 and 9 |

| WARNING |
|---|
| Product and environmental safety - toxic materials |
| This product contains beryllium oxide. The product is entirely safe provided that the BeO slab 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. |

**LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 134).

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|---|---|---|---|---|---|
| $V_{CBO}$ | collector-base voltage | open emitter | – | 65 | V |
| $V_{CES}$ | collector-emitter voltage | $R_{BE}$ = 0 Ω | – | 60 | V |
| $V_{CEO}$ | collector-emitter voltage | open base | – | 20 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | 3 | V |
| $I_C$ | collector current (DC) | $t_p \leq 10$ µs; $\delta \leq 10$ % | – | 6 | A |
| $P_{tot}$ | total power dissipation (peak power) | $t_p \leq 10$ µs; $\delta \leq 10$ %; $T_{mb}$ = 75 °C | – | 290 | W |
| $T_{stg}$ | storage temperature | | –65 | +200 | °C |
| $T_j$ | operating junction temperature | | – | 200 | °C |
| $T_{sld}$ | soldering temperature | up to 0.2 mm from ceramic; t ≤ 10 s | – | 235 | °C |




$t_p$ = 10 µs; $\delta$ = 10 %; $P_{tot\ max}$ = 290 W.

Fig.3 Maximum power dissipation derating as a function of mounting-base temperature.

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | MAX. | UNIT |
|---|---|---|---|---|
| $R_{th\ j\text{-}mb}$ | thermal resistance from junction to mounting-base | $T_j$ = 125 °C | 3.2 | K/W |
| $R_{th\ mb\text{-}h}$ | thermal resistance from mounting-base to heatsink | $T_j$ = 125 °C; note 1 | 0.2 | K/W |
| $Z_{th\ j\text{–}h}$ | thermal impedance from junction to heatsink | $t_p$ = 10 μs; δ = 10 %; $T_j$ = 125 °C; notes 1 and 2 | 0.43 | K/W |

**Notes**

1. See "*Mounting recommendations in the General part of handbook SC19a"*.
2. Equivalent thermal impedance under pulsed microwave operating conditions.

## CHARACTERISTICS

$T_{mb}$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MAX. | UNIT |
|---|---|---|---|---|
| $I_{CBO}$ | collector cut-off current | $V_{CB}$ = 65 V; $I_E$ = 0 | 40 | mA |
| | | $V_{CB}$ = 50 V; $I_E$ = 0 | 4 | mA |
| $I_{CES}$ | collector cut-off current | $V_{CB}$ = 60 V; $R_{BE}$ = 0 | 40 | mA |
| $I_{EBO}$ | emitter cut-off current | $V_{EB}$ = 1.5 V; $I_C$ = 0 | 400 | μA |

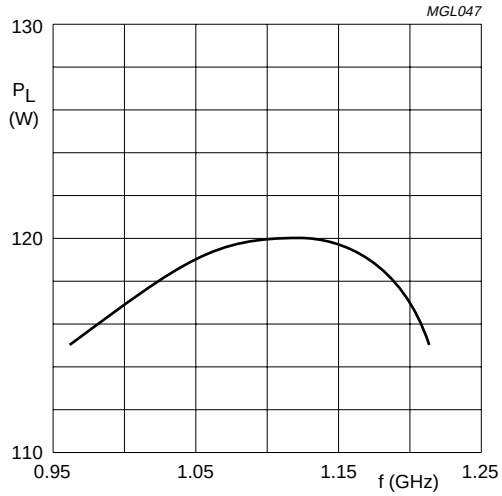
## APPLICATION INFORMATION

Microwave performance up to $T_{mb}$ = 25 °C measured in the test jig as shown in Fig.7 and working in class C broadband in pulse mode; note 1.

| MODE OF OPERATION | f (GHz) | $V_{CC}$ (V)(2) | $P_L$ (W) | $G_p$ (dB) | $\eta_C$ (%) | $Z_i/Z_L$ (Ω) |
|---|---|---|---|---|---|---|
| Class C; $t_p$ = 10 μs; δ = 10% | 0.960 to 1.215 | 50 | ≥100 typ. 115 | ≥7 typ. 7.6 | ≥42 typ. 44 | see Figs 8 and 9 |
| $t_p$ = 300 μs; δ = 10%; see Fig.6 | 1.03 to 1.09 | 50 | typ. 125 | typ. 8 | typ. 50 | |

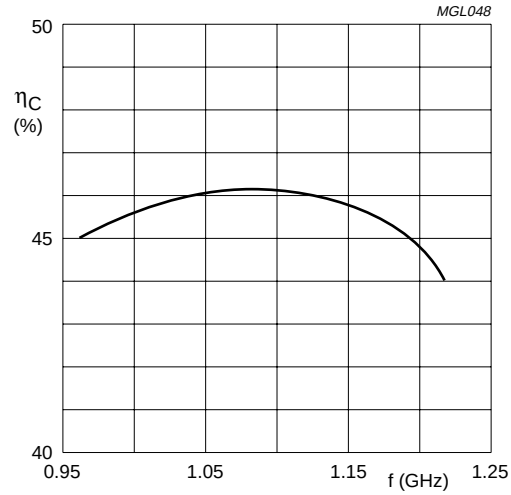
**Notes**

1. Operating conditions and performance for other pulse formats can be made available on request.
2. $V_{CC}$ during pulse.




$V_{CC}$ = 50 V; $t_p$ = 10 μs; δ = 10%.

Fig.4 Load power as a function of frequency. (In broadband test circuit as shown in Fig.7)




$V_{CC}$ = 50 V; $t_p$ = 10 μs; δ = 10%.

Fig.5 Collector efficiency as a function of frequency. (In broadband test circuit as shown in Fig.7)

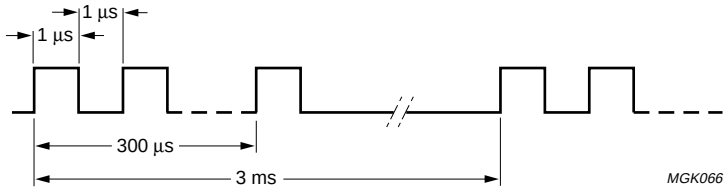
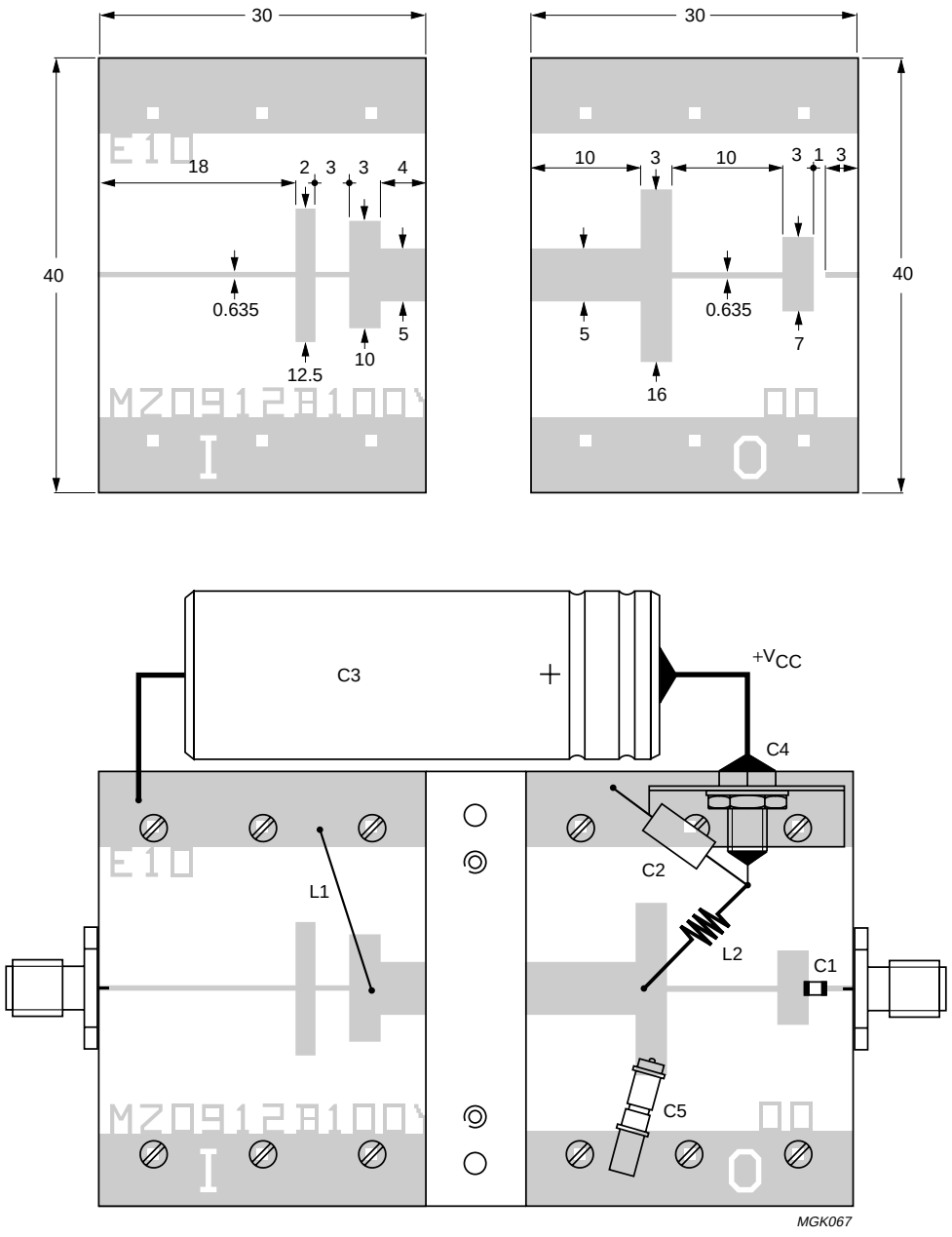



Fig.6 Pulse definition.

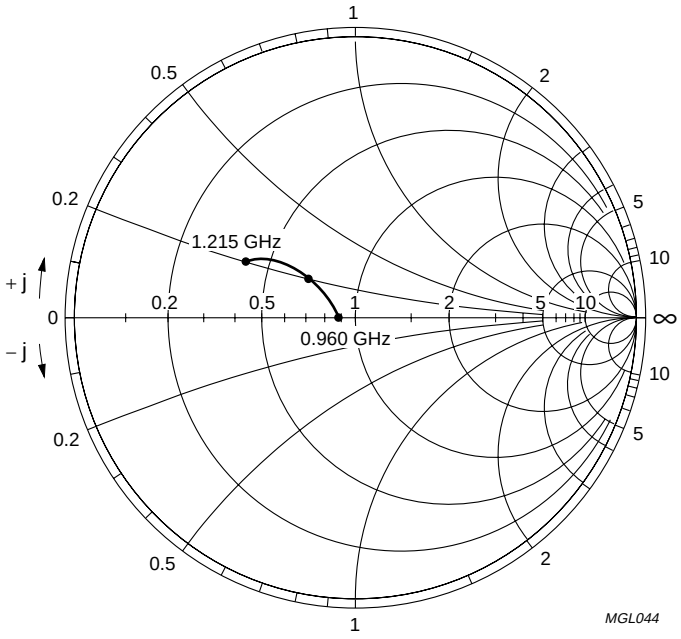
**List of components**

| COMPONENT | DESCRIPTION | VALUE | DIMENSIONS | CATALOGUE NO. |
|---|---|---|---|---|
| L1 | 0.65 mm diameter copper wire | – | total length = 12 mm; height of loop = 12 mm | – |
| L2 | 4 turns 0.65 mm diameter copper wire | – | int. dia. 3 mm; L = 5 mm | – |
| C1 | capacitor | 100 pF | – | ATC, ref. 100A101KP50X |
| C2 | tantalum capacitor | 10 µF; 50 V | – | – |
| C3 | electrolytic capacitor | 470 µF; 63 V | – | – |
| C4 | feedthrough bypass capacitor | – | – | Erie, ref. 1250-003 |
| C5, C6 | variable gigatrim capacitor | 0.6 to 4.5 pF | – | Tekelec, ref. 727.1 |



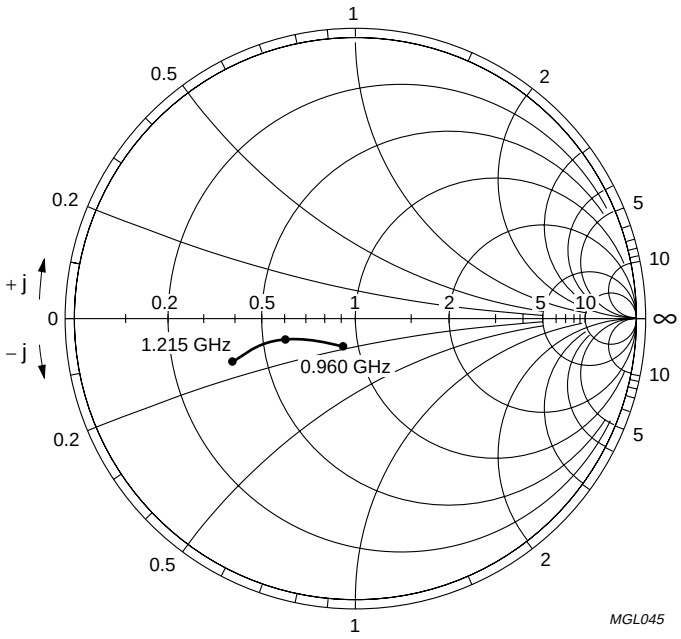

Dimensions in mm.
Substrate: Epsilam 10.
Thickness: 0.635 mm.
Permittivity: $\varepsilon_r = 10$.

Fig.7 Broadband test circuit.




$V_{CC}$ = 50 V; $Z_o$ = 10 Ω; $P_L$ = 100 W.

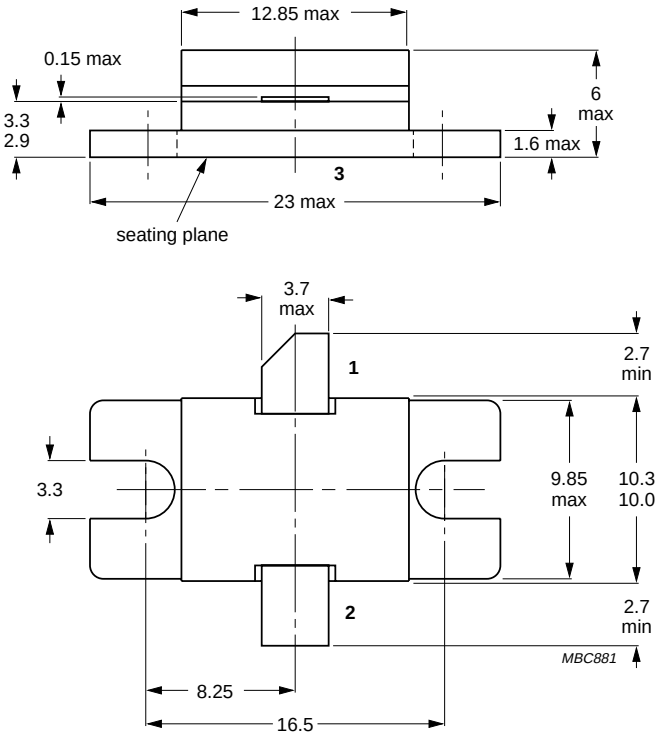
Fig.8 Input impedance as a function of frequency associated with optimum load impedance.




$V_{CC}$ = 50 V; $Z_o$ = 10 Ω.; $P_L$ = 100 W.

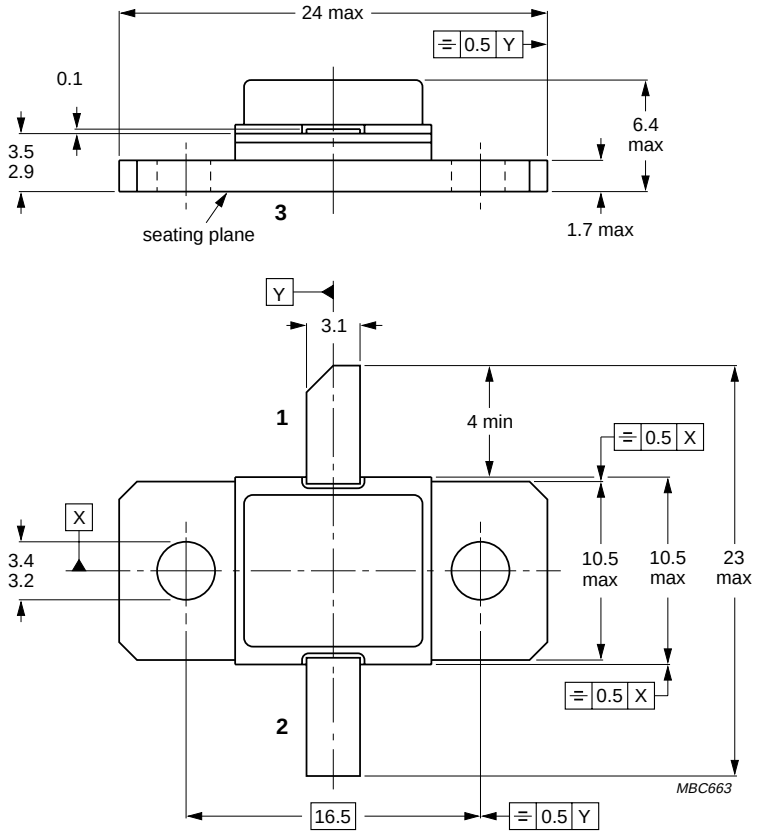
Fig.9 Optimum load impedance as a function of frequency associated with input impedance.

**PACKAGE OUTLINES**




Dimensions in mm.
Torque on nut: max 0.4 Nm.
Recommended screw: M3
Recommended pitch for mounting screw: 19 mm.

Fig.10 SOT439A.




Dimensions in mm.
Torque on nut: max 0.5 Nm.
Recommended screw: M3

Fig.11 SOT443A.

## 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. | |

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