# DATA SHEET

# 2N3553
## Silicon planar epitaxial overlay transistor

Product specification
Supersedes data of October 1981
File under Discrete Semiconductors, SC08a

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Philips Semiconductors

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# Silicon planar epitaxial overlay transistor

# 2N3553

## APPLICATIONS

- The 2N3553 is intended for use in VHF and UHF transmitting applications.

## DESCRIPTION

The device is a silicon NPN overlay transistor in a TO-39 metal package with the collector connected to the case.

## PINNING - TO-39/3

| PIN | DESCRIPTION |
|---|---|
| 1 | emitter |
| 2 | base |
| 3 | collector |

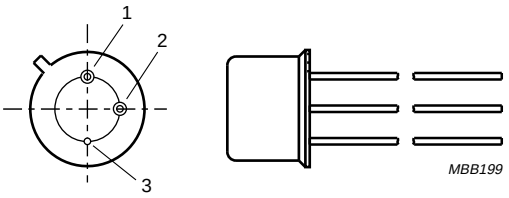



Fig.1 Simplified outline.

## QUICK REFERENCE DATA

| SYMBOL | PARAMETER | CONDITIONS | MAX. | UNIT |
|---|---|---|---|---|
| $V_{CEX}$ | collector-emitter voltage | $I_C \leq 200$ mA; $V_{BE} = -1.5$ V | 65 | V |
| $V_{CEO}$ | collector-emitter voltage | open base; $I_C \leq 200$ mA | 40 | V |
| $I_{CM}$ | peak collector current | | 1.0 | A |
| $P_{tot}$ | total power dissipation | up to $T_{mb} = 25$ °C | 7.0 | W |
| $T_j$ | junction temperature | | 200 | °C |
| $f_T$ | transition frequency | $I_C = 125$ mA; $V_{CE} = 28$ V | 500 | – |

## RF performance

| f (MHz) | $V_{CE}$ (V) | $P_o$ (W) | $G_p$ (dB) | η (%) |
|---|---|---|---|---|
| 175 | 28 | 2.5 | >10 | >50 |

**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.

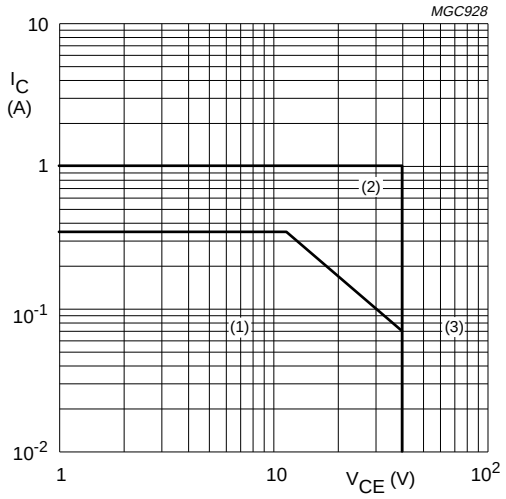
## LIMITING VALUES

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 |
| $V_{CEX}$ | collector-emitter voltage | $I_C \leq 200$ mA; $V_{BE} = -1.5$ V | – | 65 | V |
| $V_{CEO}$ | collector-emitter voltage | open base; $I_C \leq 200$ mA | – | 40 | V |
| $V_{EBO}$ | emitter-base voltage | open collector | – | 4 | V |
| $I_C$ | collector current (DC) | | – | 0.35 | A |
| $I_{CM}$ | peak collector current | | – | 1 | A |
| $P_{tot}$ | total power dissipation | up to $T_{mb} = 25$ °C | – | 7 | W |
| $T_{stg}$ | storage temperature | | –65 | +200 | °C |
| $T_j$ | junction temperature | | – | 200 | °C |

## THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | VALUE | UNIT |
|---|---|---|---|
| $R_{th\ j\text{-}mb}$ | thermal resistance from junction to mounting base | 25 | K/W |




(1) All frequencies, including DC.
(2) f ≥ 1 MHz.
(3) Allowed during switching off, provided the transistor is cut-off with $V_{BB} \leq -1.5$ V; $R_{BE} \geq 33\ \Omega$; $I_C \leq 200$ mA and the transient energy ≤ 0.5 mW.

Fig.2 DC SOAR.

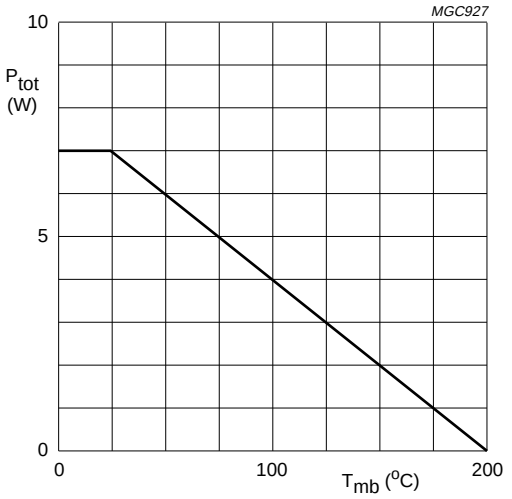



Fig.3 Power derating curve.

## CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| $V_{(BR)CBO}$ | collector-base breakdown voltage | open emitter; $I_C$ = 0.25 mA | 65 | – | – | V |
| $V_{(BR)CEO}$ | collector-emitter breakdown voltage | open base; $I_C$ up to 200 mA; note 1 | 40 | – | – | V |
| $V_{(BR)CEX}$ | collector-emitter breakdown voltage | $I_C$ up to 200 mA; $V_{BE}$ = –1.5 V; $R_B$ = 33 Ω; note 1 | 65 | – | – | V |
| $V_{(BR)EBO}$ | emitter-base breakdown voltage | open collector; $I_E$ = 0.25 mA | 4 | – | – | V |
| $V_{BE}$ | base-emitter voltage | $I_C$ = 250 mA; $V_{CE}$ = 5 V | – | – | 1.5 | V |
| $V_{CEsat}$ | collector-emitter saturation voltage | $I_C$ = 250 mA; $I_B$ = 50 mA | – | – | 1.0 | V |
| $I_{CEO}$ | collector leakage current | open base; $V_{CE}$ = 30 V | – | – | 0.1 | mA |
| $h_{FE}$ | DC current gain | $V_{CE}$ = 5 V; $I_C$ = 125 mA | 15 | – | 200 | |
| | | $V_{CE}$ = 5 V; $I_C$ = 250 mA | 10 | – | 100 | |
| $f_T$ | transition frequency | $I_C$ = 125 mA; $V_{CE}$ = 28 V | – | 500 | – | MHz |
| $Rho_{ie}$) | real part of input impedance | $I_C$ = 125 mA; $V_{CE}$ = 28 V; f = 200 MHz | – | – | 20 | Ω |
| $C_c$ | collector capacitance | $V_{CB}$ = 28 V; $I_E = i_e$ = 0; f = 1 MHz | – | – | 10 | pF |

**Note**

1. Pulsed through an inductor of 25 mH; δ = 0.5; f = 50 Hz.

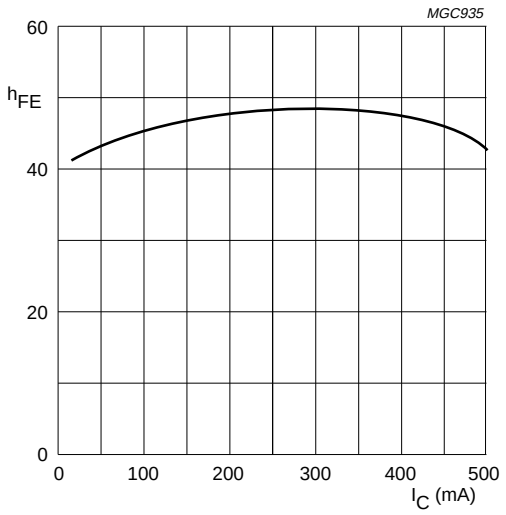



Fig.4 DC current gain as a function of collector current; typical values.

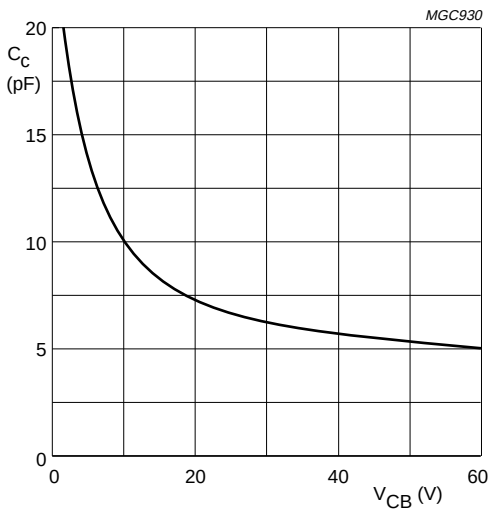



Fig.5 Collector capacitance as a function of collector-base voltage; typical values.

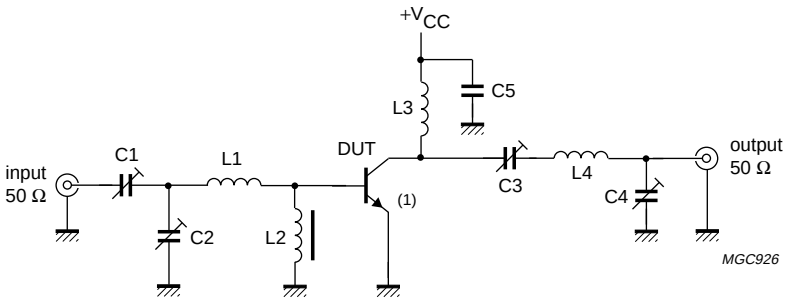
## APPLICATION INFORMATION

RF performance at $T_{mb}$ = 25 °C.

| f (MHz) | $V_{CE}$ (V) | $P_o$ (W) | $G_p$ (dB) | η (%) |
|---|---|---|---|---|
| 175 | 28 | 2.5 | >10 | >50 |

### Ruggedness

The transistor is capable of withstanding a load mismatch corresponding to VSWR = 3 : 1 varied through all phases, under the conditions: $V_{CE}$ = 28 V; f = 175 MHz; $T_{mb}$ = 25 °C; $P_o$ = 2.5 W.

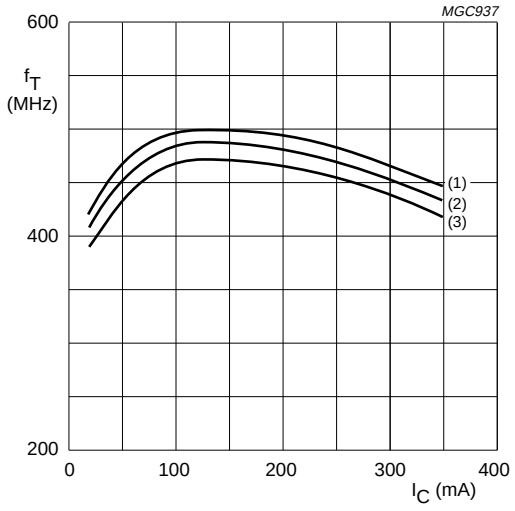



(1) The length of the external emitter wire is 1.6 mm.

Fig.6 Test circuit at 175 MHz.

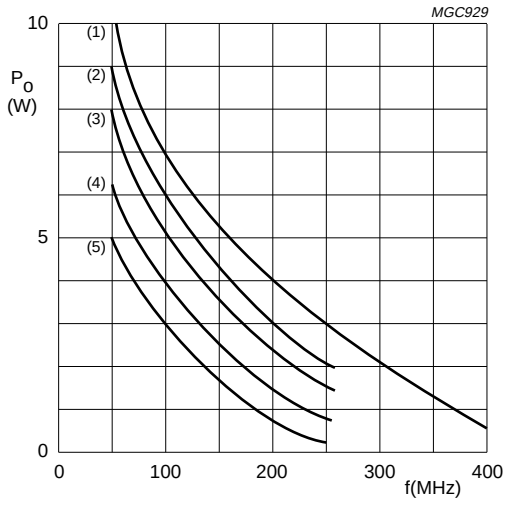
**List of components** (see Fig.6)

| COMPONENT | DESCRIPTION | VALUE | DIMENSIONS | CATALOGUE No. |
|---|---|---|---|---|
| C1, C2, C3, C4 | air trimmer capacitor | 4 to 29 pF | | |
| C5 | polyester capacitor | 10 nF | | |
| L1 | 1 turn 1.0 mm copper wire | | int. diameter 10 mm; leads 2 × 10 mm | |
| L2 | Ferroxcube choke coil | Z = 550 Ω ±20%; f = 175 MHz | | 4312 020 36640 |
| L3 | 15 turns enamelled 0.7 mm copper wire | | int. diameter 4 mm; closely wound | |
| L4 | 3 turns enamelled 1.5 mm copper wire | | int. diameter 12 mm; leads 2 × 20 mm; closely wound | |




$T_j$ = 25 °C.
(1) $V_{CE}$ = 28 V.
(2) $V_{CE}$ = 14 V.
(3) $V_{CE}$ = 7 V.

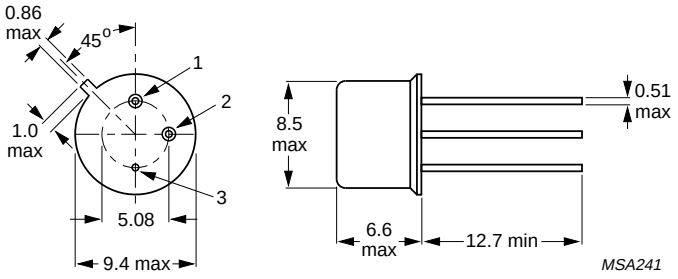
Fig.7 Transition frequency as a function of collector current; typical values.




$V_{CE}$ = 28 V; $T_{mb}$ = 25 °C.
(1) $P_i$ = 0.5 W.
(2) $P_i$ = 0.375 W.
(3) $P_i$ = 0.25 W.
(4) $P_i$ = 0.1 W.
(5) $P_i$ = 0.05 W.

Fig.8 Output power as a function of frequency; typical values.

**PACKAGE OUTLINE**




Dimensions in mm.

Fig.9 TO-39.

## 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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