# DATA SHEET

# PN4391 to 4393
## N-channel silicon field-effect transistors

Product specification
File under Discrete Semiconductors, SC07

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Philips
Semiconductors

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# N-channel silicon field-effect transistors PN4391 to 4393

## DESCRIPTION

Symmetrical silicon n-channel junction FETs in plastic TO-92 envelopes. They are intended for applications such as analog switches, choppers, commutators etc.

## PINNING

1 = gate
2 = source
3 = drain

Note: Drain and source are interchangeable.

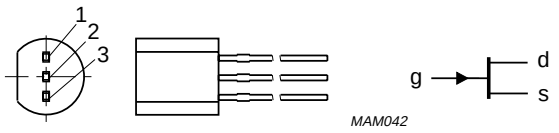



Fig.1 Simplified outline and symbol, TO-92.

## QUICK REFERENCE DATA

| | | | | | | |
|---|---|---|---|---|---|---|
| Drain-source voltage | $\pm V_{DS}$ | max. | | 40 | | V |
| Total power dissipation | | | | | | |
| up to $T_{amb}$ = 25 °C | $P_{tot}$ | max. | | 360 | | mW |
| | | | **PN4391** | **PN4392** | **PN4393** | |
| Drain current | | | | | | |
| $V_{DS}$ = 20 V; $V_{GS}$ = 0 | $I_{DSS}$ | min. | 50 | 25 | 5 | mA |
| Gate-source cut-off voltage | | | | | | |
| $V_{DS}$ = 20 V; $I_D$ = 1 nA | $-V_{GS\ off}$ | min. | 4 | 2 | 0.5 | V |
| | | max. | 10 | 5 | 3 | V |
| Drain-source on-resistance | | | | | | |
| $I_D$ = 1 mA; $V_{GS}$ = 0 | $R_{DS\ on}$ | max. | 30 | 60 | 100 | Ω |

## RATINGS

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

| | | | | |
|---|---|---|---|---|
| Drain-source voltage | $\pm V_{DS}$ | max. | 40 | V |
| Gate-source voltage | $-V_{GSO}$ | max. | 40 | V |
| Gate-drain voltage | $-V_{GDO}$ | max. | 40 | V |
| Forward gate current (DC) | $I_G$ | max. | 50 | mA |
| Total power dissipation | | | | |
| up to $T_{amb}$ = 25 °C | $P_{tot}$ | max. | 360 | mW |
| Storage temperature range | $T_{stg}$ | | −65 to+150 | °C |
| Junction temperature | $T_j$ | max. | 150 | °C |

## THERMAL RESISTANCE

| | | | | |
|---|---|---|---|---|
| From junction to ambient in free air | $R_{th\ j\text{-}a}$ | = | 350 | K/W |

## STATIC CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified

| | | | PN4391 | PN4392 | PN4393 | |
|---|---|---|---|---|---|---|
| Reverse gate current | | | | | | |
| $-V_{GS}$ = 20 V; $V_{DS}$ = 0 | $-I_{GSS}$ | max. | 1.0 | 1.0 | 1.0 | nA |
| $-V_{GS}$ = 20 V; $V_{DS}$ = 0 | | | | | | |
| $T_{amb}$ = 100 °C | $-I_{GSS}$ | max. | 200 | 200 | 200 | nA |
| Drain cut-off current | | | | | | |
| $-V_{GS}$ = 12 V; $V_{DS}$ = 20 V | $I_{DSX}$ | max. | 1.0 | | | nA |
| $-V_{GS}$ = 7 V; $V_{DS}$ = 20 V | $I_{DSX}$ | max. | | 1.0 | | nA |
| $-V_{GS}$ = 5 V; $V_{DS}$ = 20 V | $I_{DSX}$ | max. | | | 1.0 | nA |
| $-V_{GS}$ = 12 V; $V_{DS}$ = 20 V; $T_{amb}$ = 100 °C | $I_{DSX}$ | max. | 200 | | | nA |
| $-V_{GS}$ = 7 V; $V_{DS}$ = 20 V; $T_{amb}$ = 100 °C | $I_{DSX}$ | max. | | 200 | | nA |
| $-V_{GS}$ = 5 V; $V_{DS}$ = 20 V; $T_{amb}$ = 100 °C | $I_{DSX}$ | max. | | | 200 | nA |
| Drain saturation current | | | | | | |
| $V_{DS}$ = 20 V; $V_{GS}$ = 0 | $I_{DSS}$ | min. | 50 | 25 | 5 | mA |
| | | max. | 150 | 100 | 60 | mA |
| Gate-source breakdown voltage | | | | | | |
| $-I_G$ = 1 μA; $V_{DS}$ = 0 | $-V_{(BR)GSS}$ | min. | 40 | 40 | 40 | V |
| Gate-source cut-off voltage | | | | | | |
| $V_{DS}$ = 20 V; $I_D$ = 1 nA | $-V_{GS\ off}$ | min. | 4.0 | 2.0 | 0.5 | V |
| | | max. | 10 | 5.0 | 3.0 | V |
| Drain-source on-resistance | | | | | | |
| $I_D$ = 1 mA; $V_{GS}$ = 0 | $R_{DS\ on}$ | max. | 30 | 60 | 100 | Ω |
| Drain-source on-voltage | | | | | | |
| $V_{GS}$ = 0; $I_D$ = 12 mA | $V_{DS\ on}$ | max. | 0.4 | | | V |
| $V_{GS}$ = 0; $I_D$ = 6 mA | $V_{DS\ on}$ | max. | | 0.4 | | V |
| $V_{GS}$ = 0; $I_D$ = 3 mA | $V_{DS\ on}$ | max. | | | 0.4 | V |

## DYNAMIC CHARACTERISTICS

$T_j$ = 25 °C unless otherwise specified

| | | | PN4391 | PN4392 | PN4393 | |
|---|---|---|---|---|---|---|
| Drain-source on-resistance | | | | | | |
| $V_{DS}$ = 0 V; $V_{GS}$ = 0; f = 1 kHz; $T_a$ = 25 °C | $R_{DS\ on}$ | max. | 30 | 60 | 100 | Ω |
| Input capacitance | | | | | | |
| $V_{DS}$ = 20 V; $V_{GS}$ = 0; f = 1 MHz; $T_a$ = 25 °C | $C_{iss}$ | max. | 16 | 16 | 16 | pF |
| Feedback capacitance | | | | | | |
| $V_{DS}$ = 0; $-V_{GS}$ = 12 V \| f = 1 MHz | $C_{rss}$ | max. | 5 | | | pF |
| $V_{DS}$ = 0; $-V_{GS}$ = 7 V \| f = 1 MHz | $C_{rss}$ | max. | | 5 | | pF |
| $V_{DS}$ = 0; $-V_{GS}$ = 5 V \| f = 1 MHz | $C_{rss}$ | max. | | | 5 | pF |
| Switching times | | | | | | |
| test conditions | | | | | | |
| $V_{DD}$ = 10 V; $V_{GS}$ = 0 to $V_{GS\ off}$ | $I_D$ | = | 12 | 6.0 | 3.0 | mA |
| | $-V_{GS\ off}$ | = | 12 | 7.0 | 5.0 | V |
| | $R_L$ | = | 750 | 1550 | 3150 | Ω |
| Rise time | $t_r$ | max. | 5 | 5 | 5 | ns |
| Turn-on time | $t_{on}$ | max. | 15 | 15 | 15 | ns |
| Fall time | $t_f$ | max. | 15 | 20 | 30 | ns |
| Turn-off time | $t_{off}$ | max. | 20 | 35 | 50 | ns |

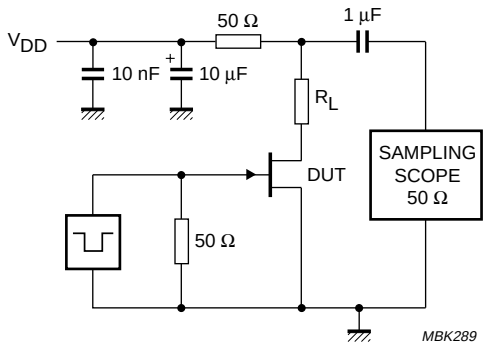



Fig.2 Switching times test circuit.

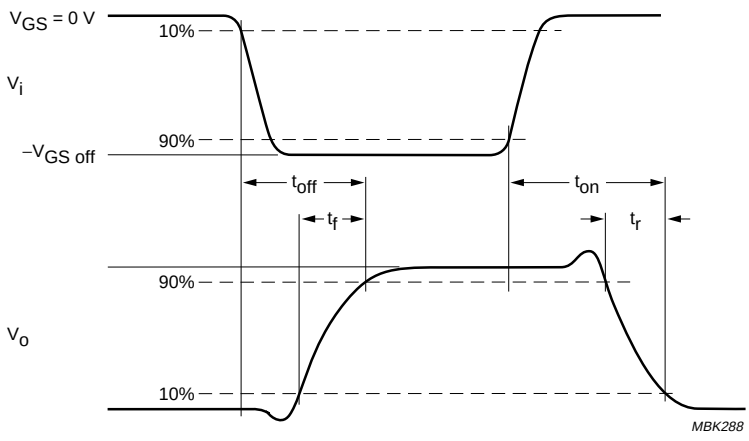
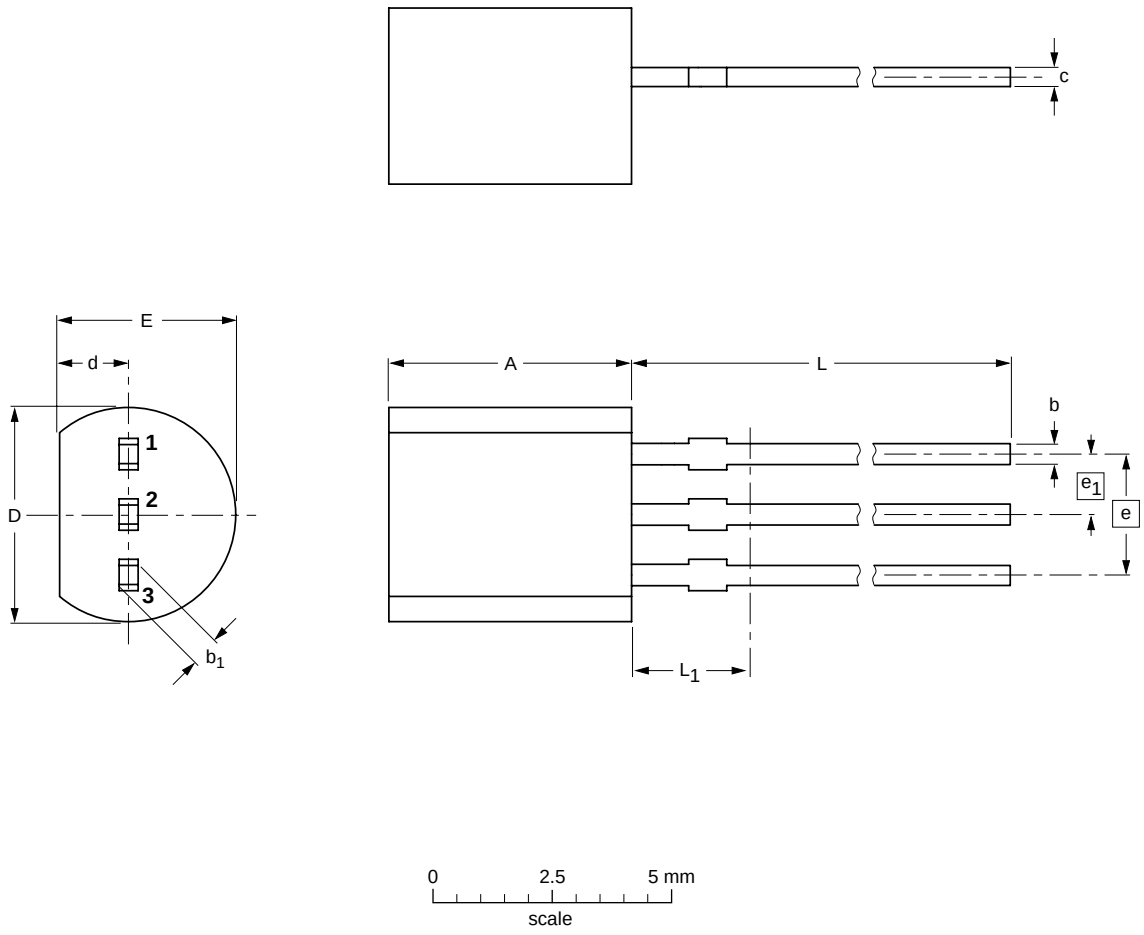



Fig.3 Input and output waveforms.

## PACKAGE OUTLINE

**Plastic single-ended leaded (through hole) package; 3 leads** **SOT54**




**DIMENSIONS (mm are the original dimensions)**

| UNIT | A | b | $b_1$ | c | D | d | E | e | $e_1$ | L | $L_1$(1) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | 5.2<br>5.0 | 0.48<br>0.40 | 0.66<br>0.56 | 0.45<br>0.40 | 4.8<br>4.4 | 1.7<br>1.4 | 4.2<br>3.6 | 2.54 | 1.27 | 14.5<br>12.7 | 2.5 |

**Note**

1. Terminal dimensions within this zone are uncontrolled to allow for flow of plastic and terminal irregularities.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | EIAJ | | | |
| SOT54 | | TO-92 | SC-43 | | | 97-02-28 |

## 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. |
| Short-form specification | The data in this specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook. |
| **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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