

## N-channel field-effect transistor

2N4416; 2N4416A

## FEATURES

- Low noise
- Interchangeability of drain and source connections
- High gain.

## DESCRIPTION

N-channel symmetrical silicon junction FETs in a TO-72 envelope, with shield connected to the case. These devices are intended for use in VHF/UHF amplifiers, oscillators and mixers.

## PINNING - TO-72.

PIN	DESCRIPTION
1	source
2	drain
3	gate
4	shield

## CAUTION

The device is supplied in an antistatic package. The gate-source input must be protected against static charge during transport and handling.

## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DS}$	drain-source voltage				
	2N4416		-	30	V
	2N4416A		-	35	V
$I_{DSS}$	drain current	$V_{DS} = 15\text{ V}; V_{GS} = 0$	5	15	mA
$P_{tot}$	total power dissipation	up to $T_{amb} = 25\text{ }^{\circ}\text{C}$	-	250	mW
$V_{GS(off)}$	gate-source cut-off voltage	$V_{DS} = 15\text{ V}; I_D = 1\text{ nA}$			
	2N4416		-	-6	V
	2N4416A		-2.5	-6	V
$ Y_{fs} $	common-source transfer admittance	$V_{DS} = 15\text{ V}; V_{GS} = 0; f = 1\text{ kHz}$	4.5	7.5	mS



**Marking codes:**  
2N4416.  
2N4416A.

Fig. 1 Simplified outline and symbol.

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## LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{DS}$	drain-source voltage				
	2N4416		-	30	V
	2N4416A		-	35	V
$V_{GSO}$	gate-source voltage				
	2N4416		-	-30	V
	2N4416A		-	-35	V
$V_{GDO}$	gate-drain voltage				
	2N4416		-	-30	V
	2N4416A		-	-35	V
$I_G$	DC forward gate current		-	10	mA
$P_{tot}$	total power dissipation	up to $T_{amb} = 25\text{ }^\circ\text{C}$ ; note 1	-	250	mW
$T_{stg}$	storage temperature		-65	+175	$^\circ\text{C}$
$T_J$	junction temperature		-	175	$^\circ\text{C}$

## THERMAL RESISTANCE

SYMBOL	PARAMETER	THERMAL RESISTANCE
$R_{th(j-a)}$	from junction to ambient; note 1	590 K/W

## Note

1. Mounted on a printed-circuit board, maximum lead length 4 mm, mounting pad for the drain lead 10 mm<sup>2</sup>.

## STATIC CHARACTERISTICS

 $T_J = 25\text{ }^\circ\text{C}$  unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{(BR)GSS}$	gate-source breakdown voltage	$V_{DS} = 0$ ; $I_G = -1\text{ }\mu\text{A}$			
	2N4416		-30	-	V
	2N4416A		-35	-	V
$I_{GSS}$	reverse gate leakage current	$V_{DS} = 0$ ; $V_{GS} = -15\text{ V}$	-	-0.1	nA
$I_{DSS}$	drain current	$V_{DS} = 15\text{ V}$ ; $V_{GS} = 0$	5	15	mA
$V_{GSS}$	gate-source forward voltage	$V_{DS} = 0$ ; $I_G = 1\text{ mA}$	-	1	V
$V_{GS(off)}$	gate-source cut-off voltage	$V_{DS} = 15\text{ V}$ ; $I_D = 1\text{ nA}$			
	2N4416		-	-6	V
	2N4416A		-2.5	-6	V
$ Y_{is} $	common source transfer admittance	$V_{DS} = 15\text{ V}$ ; $V_{GS} = 0$	4.5	7.5	mS
$ Y_{os} $	common source output admittance	$V_{DS} = 15\text{ V}$ ; $V_{GS} = 0$			
	2N4416		-	50	$\mu\text{S}$
	2N4416A		-	50	$\mu\text{S}$

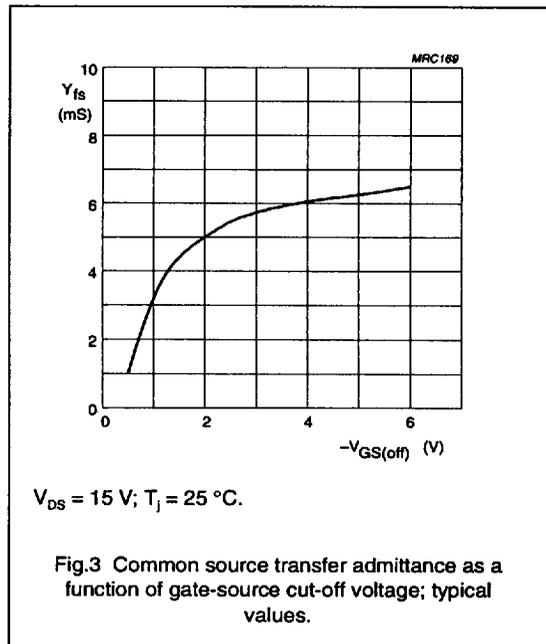
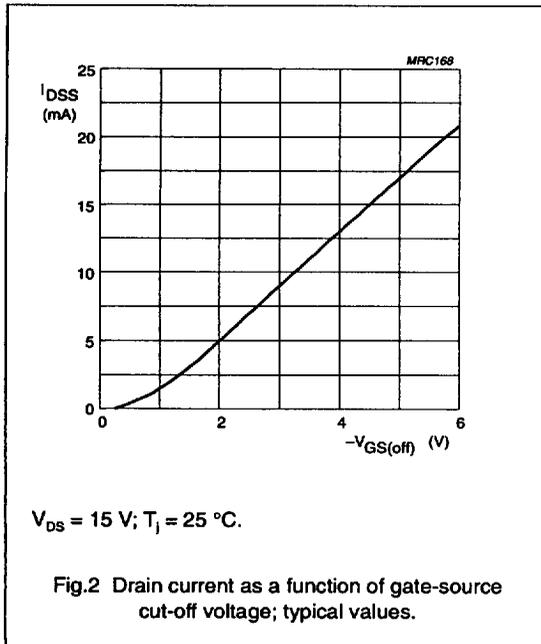
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## DYNAMIC CHARACTERISTICS

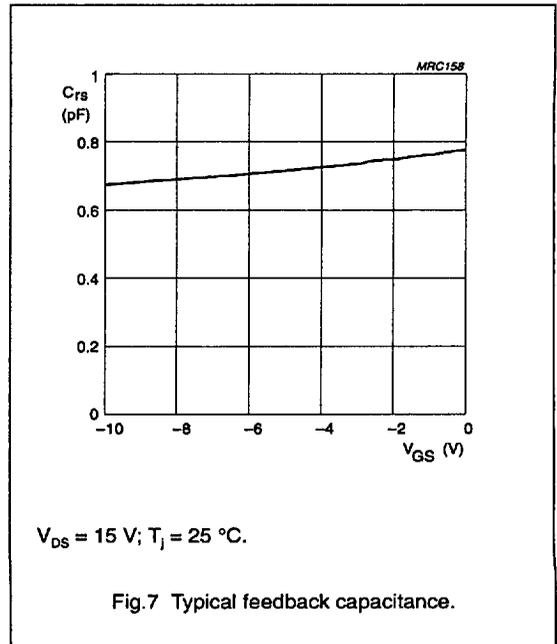
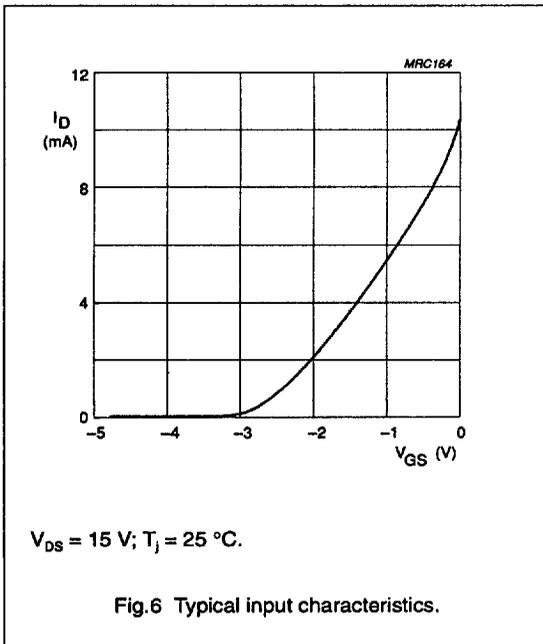
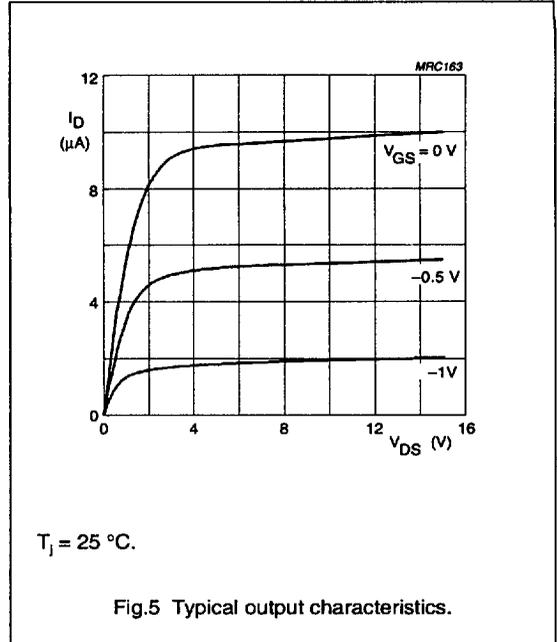
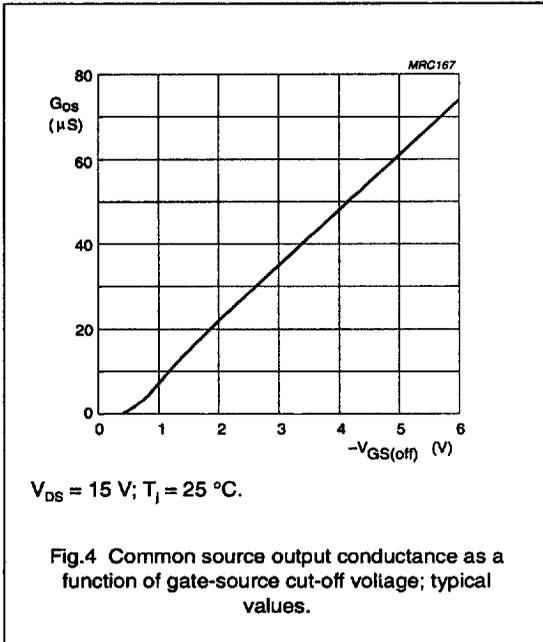
 $T_j = 25\text{ }^\circ\text{C}$ ;  $V_{DS} = 15\text{ V}$ ;  $V_{GS} = 0$ .

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$C_{is}$	input capacitance	$f = 1\text{ MHz}$	-	-	4	pF
$C_{os}$	output capacitance	$f = 1\text{ MHz}$	-	-	2	pF
$C_{fs}$	feedback capacitance	$f = 1\text{ MHz}$	-	-	0.8	pF
$g_{is}$	common source input conductance	$f = 100\text{ MHz}$	-	-	100	$\mu\text{S}$
		$f = 400\text{ MHz}$	-	-	1	mS
$g_{fs}$	common source transfer conductance	$f = 100\text{ MHz}$	-	5.2	-	mS
		$f = 400\text{ MHz}$	4	5	-	mS
$g_{rs}$	common source feedback conductance	$f = 100\text{ MHz}$	-	-8	-	$\mu\text{S}$
		$f = 400\text{ MHz}$	-	-100	-	$\mu\text{S}$
$g_{os}$	common source output conductance	$f = 100\text{ MHz}$	-	-	75	$\mu\text{S}$
		$f = 400\text{ MHz}$	-	-	100	$\mu\text{S}$
$V_n$	equivalent input noise voltage	$f = 100\text{ Hz}$	-	5	-	nV/√HZ



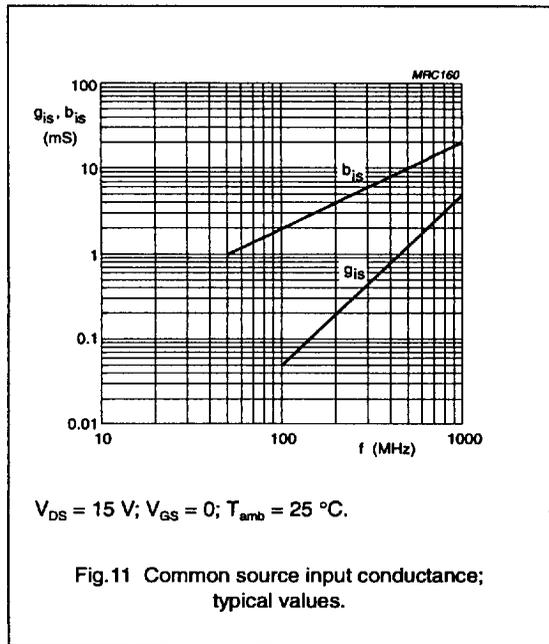
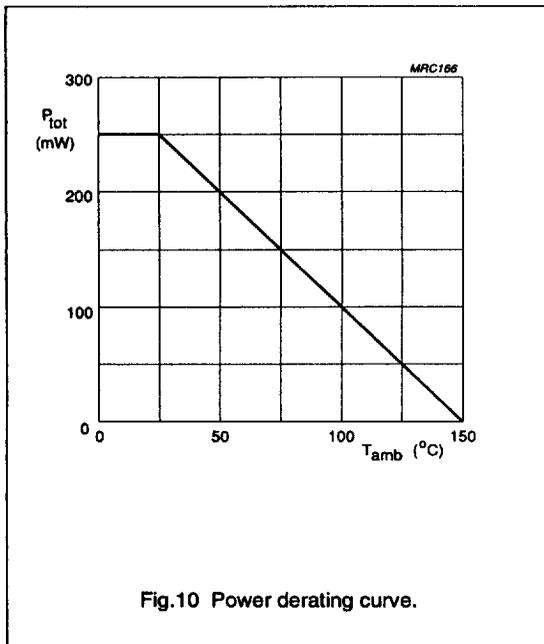
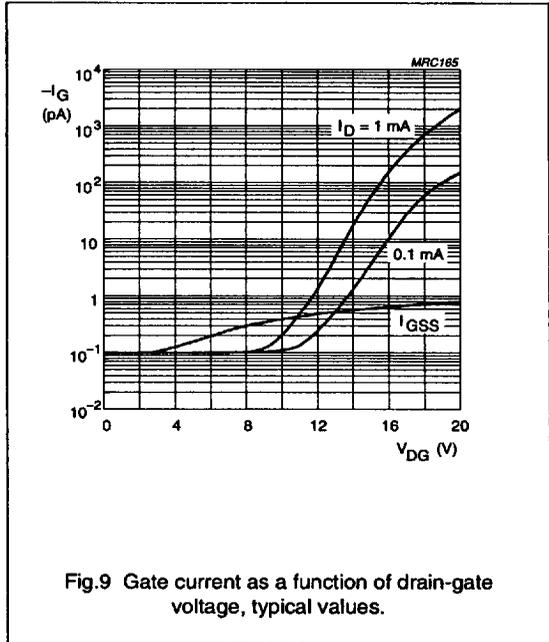
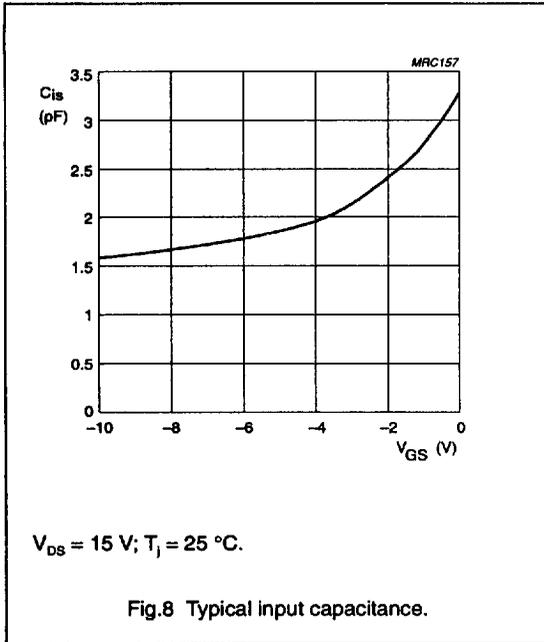
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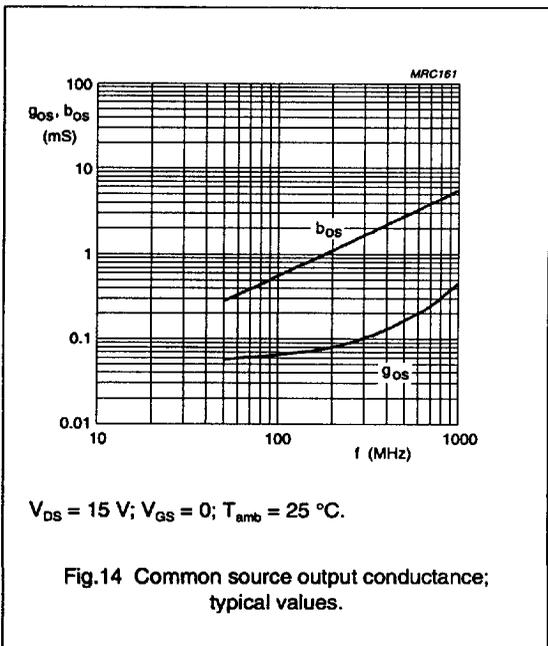
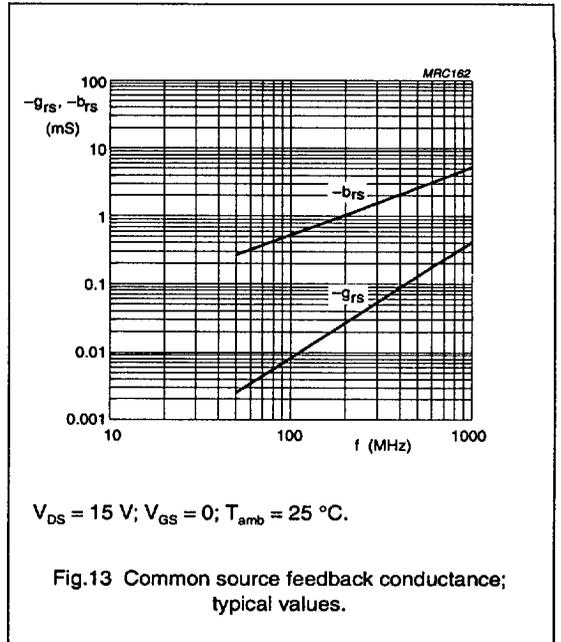
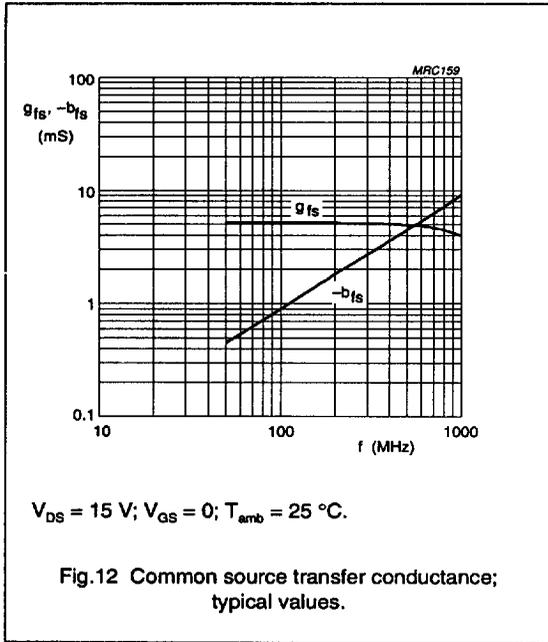
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**SPICE parameters for 2N4416**  
 September 1992; version 1.0.

1	VTO = -3.553	V
2	BETA = 792.6	$\mu\text{A}/\text{V}^2$
3	LAMBDA = 18.46	m/V
4	RD = 7.671	$\Omega$
5	RS = 7.671	$\Omega$
6	IS = 333.4	aA
7	CGSO = 2.920	pF
8	CGDO = 2.261	pF
9	PB = 1.090	V
10 (note 1)	FC = 500.0	m

**Note**

1. Parameter not extracted; default value.