

### Monolithic N-Channel JFET Duals

#### Product Summary

Part Number	$V_{GS(off)}$ (V)	$V_{(BR)GSS}$ Min (V)	$g_{fs}$ Min (mS)	$I_G$ Max (pA)	$ V_{GS1} - V_{GS2} $ Max (mV)
2N5196	-0.7 to -4	-50	1	-15	5
2N5197	-0.7 to -4	-50	1	-15	5
2N5198	-0.7 to -4	-50	1	-15	10
2N5199	-0.7 to -4	-50	1	-15	15

#### Features

- Monolithic Design
- High Slew Rate
- Low Offset/Drift Voltage
- Low Gate Leakage: 5 pA
- Low Noise
- High CMRR: 100 dB

#### Benefits

- Tight Differential Match vs. Current
- Improved Op Amp Speed, Settling Time Accuracy
- Minimum Input Error/Trimming Requirement
- Insignificant Signal Loss/Error Voltage
- High System Sensitivity
- Minimum Error with Large Input Signal

#### Applications

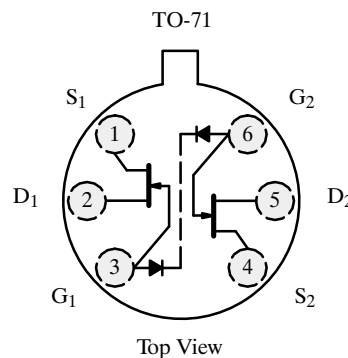
- Wideband Differential Amps
- High-Speed, Temp-Compensated, Single-Ended Input Amps
- High Speed Comparators
- Impedance Converters

#### Description

The 2N5196/5197/5198/5199 JFET duals are designed for high-performance differential amplification for a wide range of precision test instrumentation applications. This series features tightly matched specs, low gate leakage for accuracy, and wide dynamic range with  $I_G$  guaranteed at  $V_{DG} = 20$  V.

The hermetically-sealed TO-71 package is available with full military processing (see Military Information and the 2N5545/5546/5547JANTX/JANTXV data sheet).

For similar products see the low-noise U/SST401 series, the high-gain 2N5911/5912, and the low-leakage U421/423 data sheets.



#### Absolute Maximum Ratings

Gate-Drain, Gate-Source Voltage	-50 V
Gate Current	50 mA
Lead Temperature ( $1/16$ " from case for 10 sec.)	300 °C
Storage Temperature	-65 to 200 °C
Operating Junction Temperature	-55 to 150 °C

Power Dissipation :	Per Side <sup>a</sup>	250 mW
	Total <sup>b</sup>	500 mW

- Notes
- Derate 2 mW/°C above 85 °C
  - Derate 4 mW/°C above 85 °C

### Specifications<sup>a</sup> for 2N5196 and 2N5197

Parameter	Symbol	Test Conditions	Typ <sup>b</sup>	Limits				Unit
				2N5196		2N5197		
				Min	Max	Min	Max	
<b>Static</b>								
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = -1 \mu A, V_{DS} = 0 V$	-57	-50		-50		V
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 20 V, I_D = 1 nA$	-2	-0.7	-4	-0.7	-4	
Saturation Drain Current <sup>c</sup>	$I_{DSS}$	$V_{DS} = 20 V, V_{GS} = 0 V$	3	0.7	7	0.7	7	mA
Gate Reverse Current	$I_{GSS}$	$V_{GS} = -30 V, V_{DS} = 0 V$	-10		-25		-25	pA
		$T_A = 150^\circ C$	-20		-50		-50	nA
Gate Operating Current	$I_G$	$V_{DG} = 20 V, I_D = 200 \mu A$	-5		-15		-15	pA
		$T_A = 125^\circ C$	-0.8		-15		-15	nA
Gate-Source Voltage	$V_{GS}$	$V_{DG} = 20 V, I_D = 200 \mu A$	-1.5	-0.2	-3.8	-0.2	-3.8	V
<b>Dynamic</b>								
Common-Source Forward Transconductance	$g_{fs}$	$V_{DS} = 20 V, V_{GS} = 0 V$ $f = 1 kHz$	2.5	1	4	1	4	mS
Common-Source Output Conductance	$g_{os}$		2		50		50	$\mu S$
Common-Source Forward Transconductance	$g_{fs}$	$V_{DS} = 20 V, I_D = 200 \mu A$ $f = 1 kHz$	0.8	0.7	1.6	0.7	1.6	mS
Common-Source Output Conductance	$g_{os}$		1		4		4	$\mu S$
Common-Source Input Capacitance	$C_{iss}$	$V_{DS} = 20 V, V_{GS} = 0 V$ $f = 1 MHz$	3		6		6	pF
Common-Source Reverse Transfer Capacitance	$C_{rss}$		1		2		2	
Equivalent Input Noise Voltage	$\bar{e}_n$	$V_{DS} = 20 V, V_{GS} = 0 V, f = 1 kHz$	9		20		20	$\frac{nV}{\sqrt{Hz}}$
Noise Figure	NF	$V_{DS} = 20 V, V_{GS} = 0 V$ $f = 100 Hz, R_G = 10 M\Omega$			0.5		0.5	dB
<b>Matching</b>								
Differential Gate-Source Voltage	$ V_{GS1} - V_{GS2} $	$V_{DG} = 20 V, I_D = 200 \mu A$			5		5	mV
Gate-Source Voltage Differential Change with Temperature	$\frac{\Delta  V_{GS1} - V_{GS2} }{\Delta T}$	$V_{DG} = 20 V, I_D = 200 \mu A$ $T_A = -55 to 125^\circ C$			5		10	$\mu V/^\circ C$
Saturation Drain Current Ratio	$\frac{I_{DSS1}}{I_{DSS2}}$	$V_{DS} = 20 V, V_{GS} = 0 V$	0.98	0.95	1	0.95	1	
Transconductance Ratio	$\frac{g_{fs1}}{g_{fs2}}$	$V_{DS} = 20 V, I_D = 200 \mu A$ $f = 1 kHz$	0.99	0.97	1	0.97	1	
Differential Output Conductance	$ g_{os1} - g_{os2} $		0.1		1		1	$\mu S$
Differential Gate Current	$ I_{G1} - I_{G2} $	$V_{DG} = 20 V, I_D = 200 \mu A$ $T_A = 125^\circ C$	0.1		5		5	nA
Common Mode Rejection Ratio <sup>d</sup>	CMRR	$V_{DG} = 10 to 20 V, I_D = 200 \mu A$	100					dB

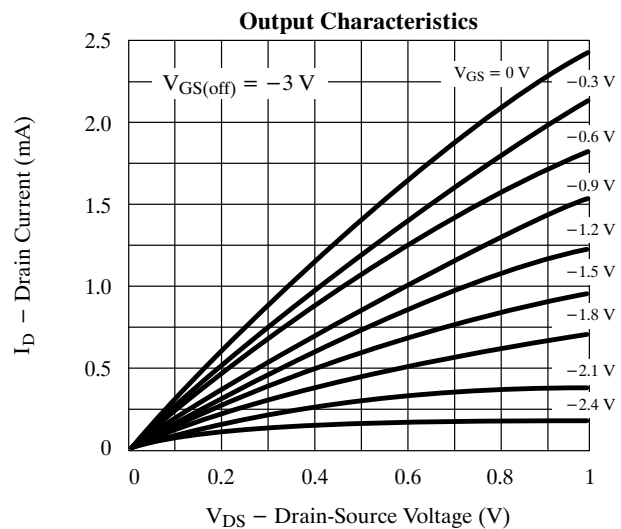
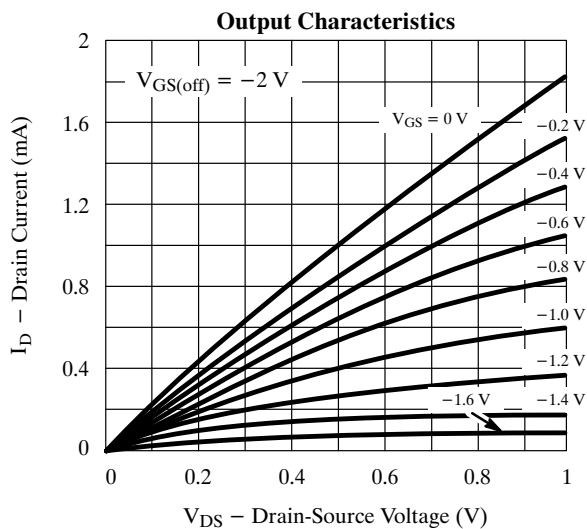
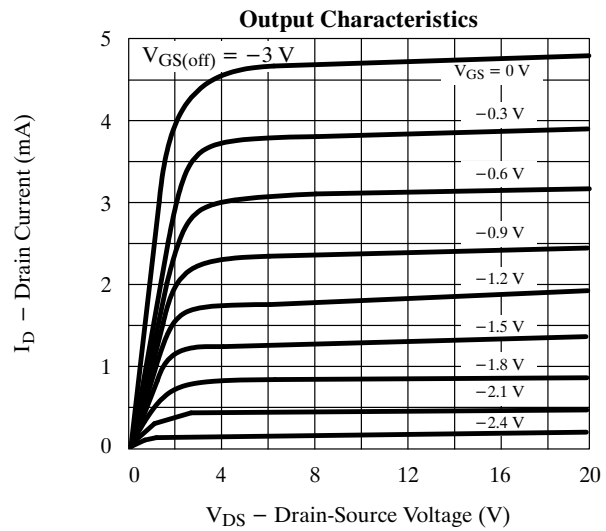
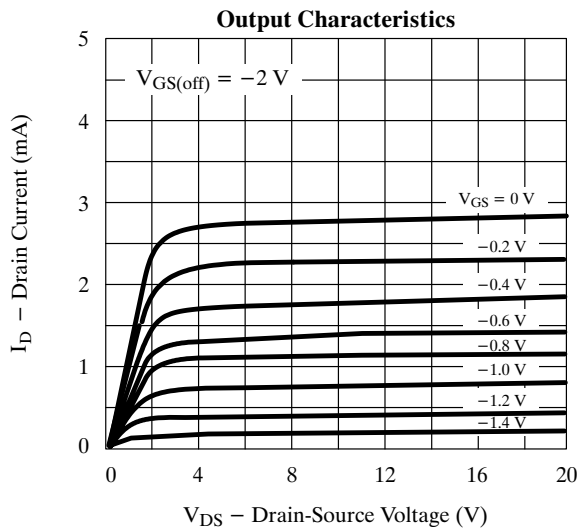
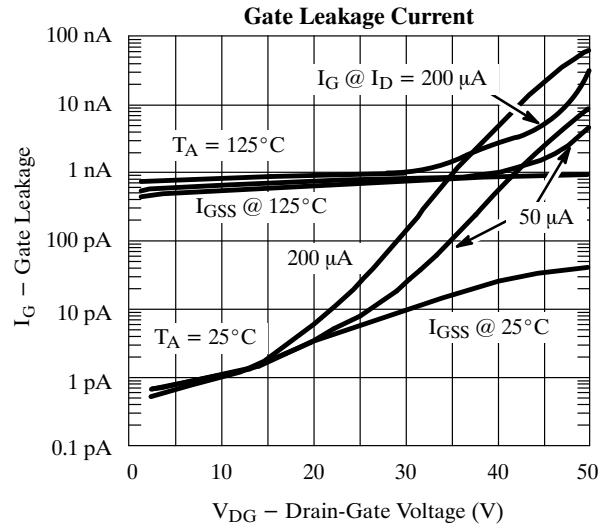
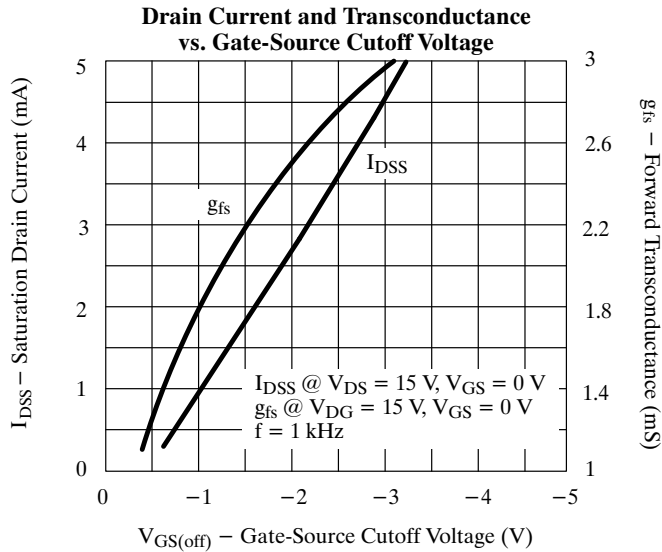
### Specifications<sup>a</sup> for 2N5198 and 2N5199

Parameter	Symbol	Test Conditions	Typ <sup>b</sup>	Limits				Unit
				2N5198		2N5199		
				Min	Max	Min	Max	
<b>Static</b>								
Gate-Source Breakdown Voltage	$V_{(BR)GSS}$	$I_G = -1 \mu A, V_{DS} = 0 V$	-57	-50		-50		V
Gate-Source Cutoff Voltage	$V_{GS(off)}$	$V_{DS} = 20 V, I_D = 1 nA$	-2	-0.7	-4	-0.7	-4	
Saturation Drain Current <sup>c</sup>	$I_{DSS}$	$V_{DS} = 20 V, V_{GS} = 0 V$	3	0.7	7	0.7	7	mA
Gate Reverse Current	$I_{GSS}$	$V_{GS} = -30 V, V_{DS} = 0 V$	-10		-25		-25	pA
		$T_A = 150^\circ C$	-20		-50		-50	nA
Gate Operating Current	$I_G$	$V_{DG} = 20 V, I_D = 200 \mu A$	-5		-15		-15	pA
		$T_A = 125^\circ C$	-0.8		-15		-15	nA
Gate-Source Voltage	$V_{GS}$	$V_{DG} = 20 V, I_D = 200 \mu A$	-1.5	-0.2	-3.8	-0.2	-3.8	V
<b>Dynamic</b>								
Common-Source Forward Transconductance	$g_{fs}$	$V_{DS} = 20 V, V_{GS} = 0 V, f = 1 kHz$	2.5	1	4	1	4	mS
Common-Source Output Conductance	$g_{os}$		2		5.0		5.0	$\mu S$
Common-Source Forward Transconductance	$g_{fs}$	$V_{DS} = 20 V, I_D = 200 \mu A, f = 1 kHz$	0.8	0.7	1.6	0.7	1.6	mS
Common-Source Output Conductance	$g_{os}$		1		4		4	$\mu S$
Common-Source Input Capacitance	$C_{iss}$	$V_{DS} = 20 V, V_{GS} = 0 V, f = 1 MHz$	3		6		6	pF
Common-Source Reverse Transfer Capacitance	$C_{rss}$		1		2		2	
Equivalent Input Noise Voltage	$\bar{e}_n$	$V_{DS} = 20 V, V_{GS} = 0 V, f = 1 kHz$	9		20		20	$\frac{nV}{\sqrt{Hz}}$
Noise Figure	NF	$V_{DS} = 20 V, V_{GS} = 0 V$ $f = 100 Hz, R_G = 10 M\Omega$			0.5		0.5	dB
<b>Matching</b>								
Differential Gate-Source Voltage	$ V_{GS1} - V_{GS2} $	$V_{DG} = 20 V, I_D = 200 \mu A$			10		15	mV
Gate-Source Voltage Differential Change with Temperature	$\frac{\Delta  V_{GS1} - V_{GS2} }{\Delta T}$	$V_{DG} = 20 V, I_D = 200 \mu A$ $T_A = -55 \text{ to } 125^\circ C$			20		40	$\mu V/^\circ C$
Saturation Drain Current Ratio	$\frac{I_{DSS1}}{I_{DSS2}}$	$V_{DS} = 20 V, V_{GS} = 0 V$	0.97	0.95	1	0.95	1	
Transconductance Ratio	$\frac{g_{fs1}}{g_{fs2}}$	$V_{DS} = 20 V, I_D = 200 \mu A, f = 1 kHz$	0.97	0.95	1	0.95	1	
Differential Output Conductance	$ g_{os1} - g_{os2} $		0.2		1		1	$\mu S$
Differential Gate Current	$ I_{G1} - I_{G2} $	$V_{DG} = 20 V, I_D = 200 \mu A$ $T_A = 125^\circ C$	0.1		5		5	nA
Common Mode Rejection Ratio <sup>d</sup>	CMRR	$V_{DG} = 10 \text{ to } 20 V, I_D = 200 \mu A$	97					dB

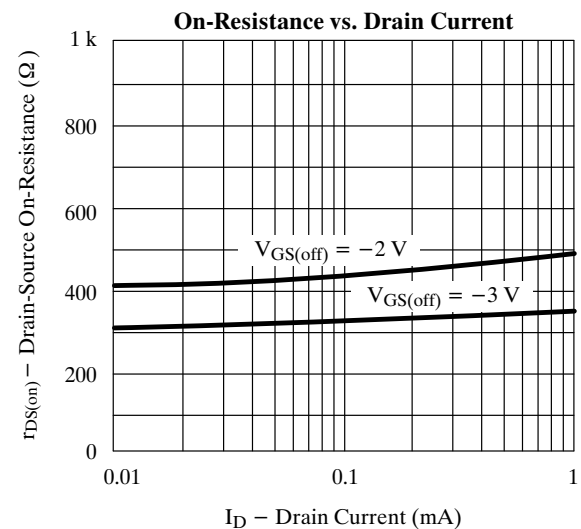
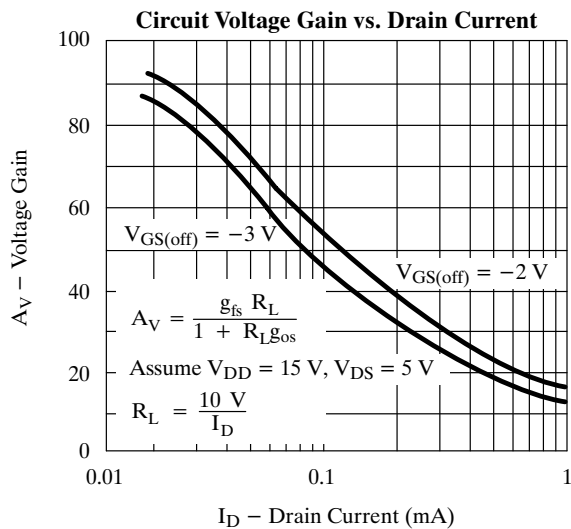
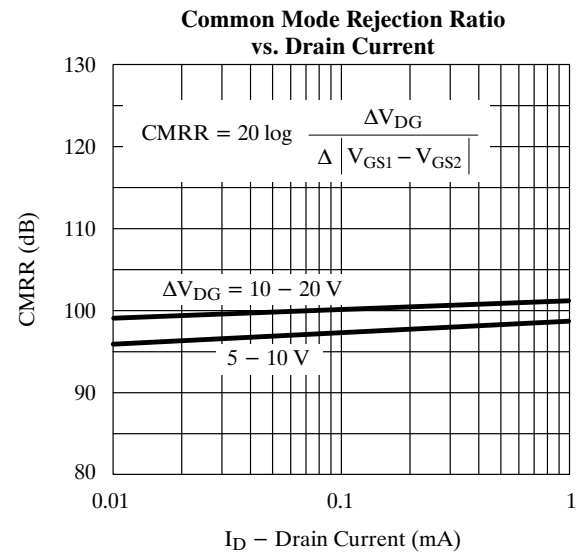
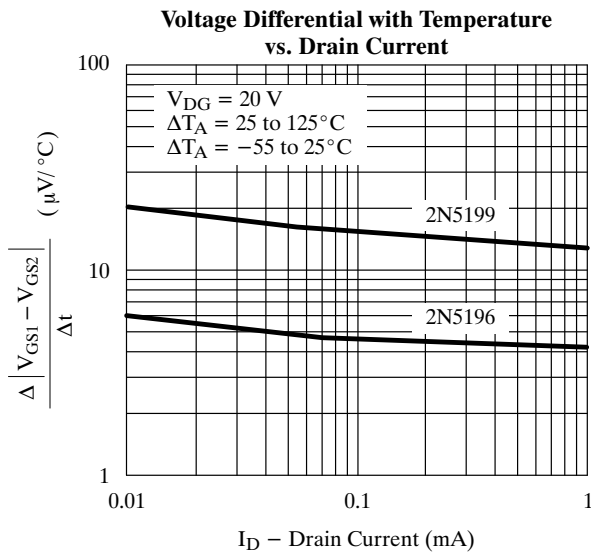
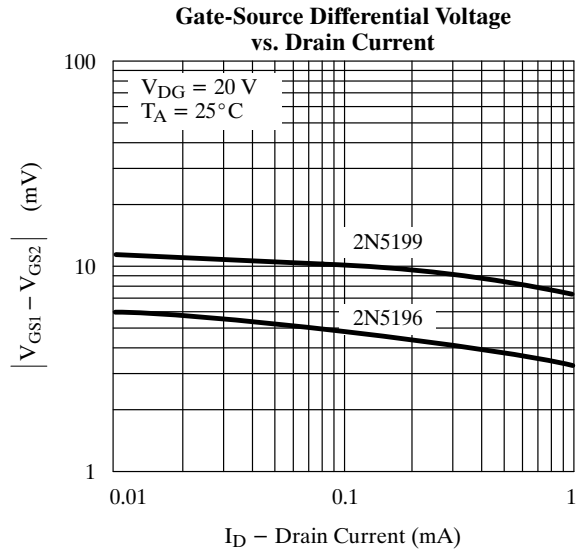
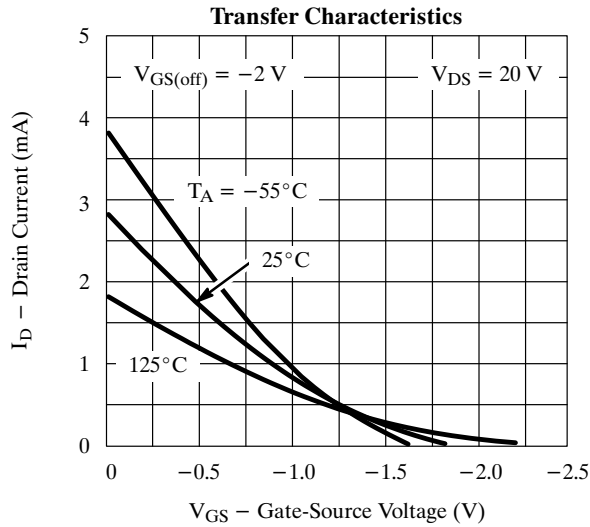
Notes

- $T_A = 25^\circ C$  unless otherwise noted.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- Pulse test:  $PW \leq 300 \mu s$  duty cycle  $\leq 3\%$ .
- This parameter not registered with JEDEC.

### Typical Characteristics

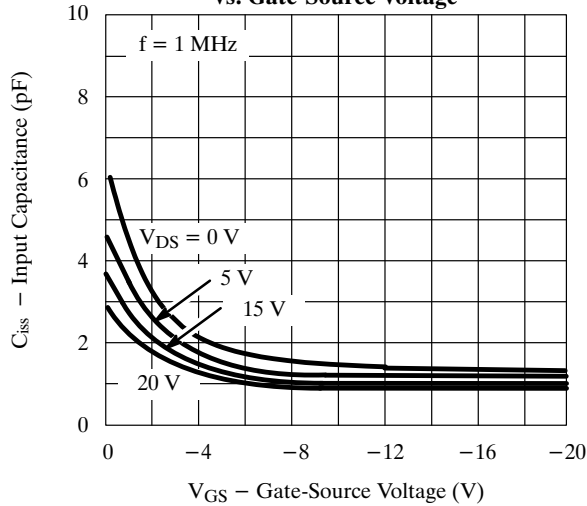


## Typical Characteristics (Cont'd)

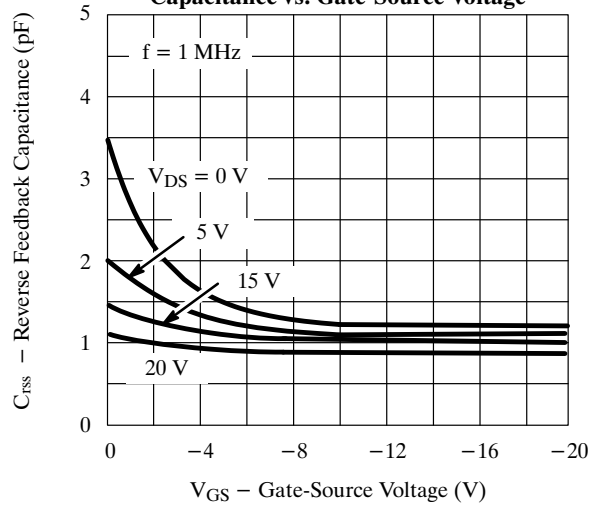


### Typical Characteristics (Cont'd)

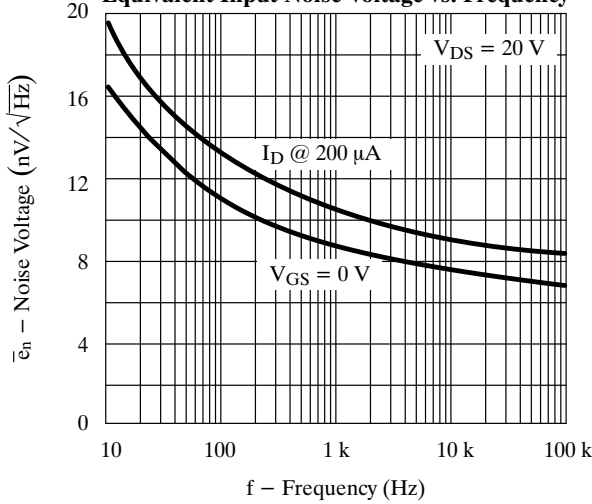
**Common-Source Input Capacitance vs. Gate-Source Voltage**



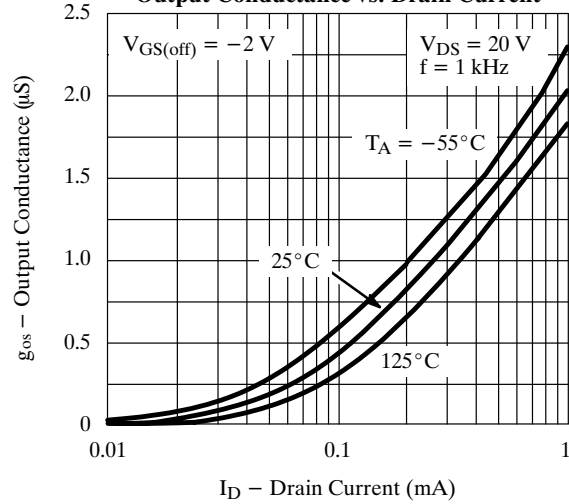
**Common-Source Reverse Feedback Capacitance vs. Gate-Source Voltage**



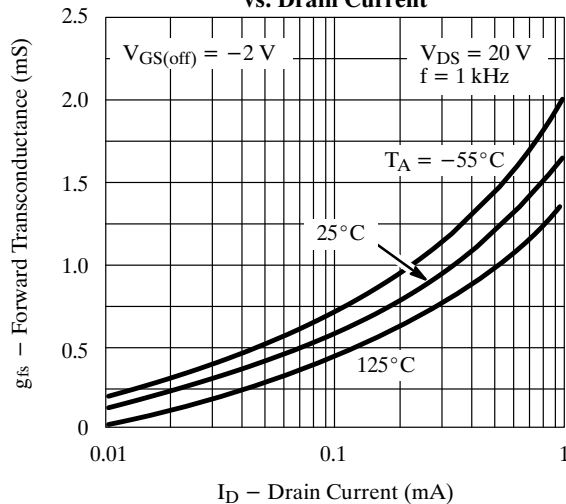
**Equivalent Input Noise Voltage vs. Frequency**



**Output Conductance vs. Drain Current**



**Common-Source Forward Transconductance vs. Drain Current**



**On-Resistance and Output Conductance vs. Gate-Source Cutoff Voltage**

