Performance Curves NP
See Page 4-37

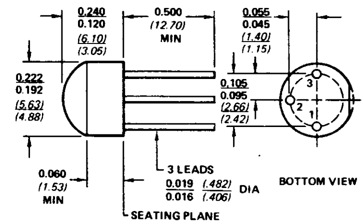
E201 E202 E203

N-CHANNEL SILICON JUNCTION FIELD-EFFECT TRANSISTORS

FOR GENERAL-PURPOSE AMPLIFIER APPLICATIONS

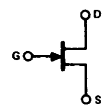
This series of epoxy-encapsulated FETs is characterized for low and medium frequency small-signal amplifier applications which require moderately low input current and low equivalent input noise voltage.

- Typical input current I_G = 35 pA
- Typical $\bar{e}_n$ = 10 nV/ $\sqrt{Hz}$ at 1 kHz



ALL DIMENSIONS IN INCHES
(ALL DIMENSIONS IN MILLIMETERS)

TO-106



PIN	OUT
1	S
2	D
3	G

ABSOLUTE MAXIMUM RATINGS (25°C)

Gate-Drain or Gate-Source Voltage (Note 1) .... -40 V
Gate Current .... 50 mA
Total Device Dissipation
(25°C Free-Air Temperature)................ 350 mW
Power Derating (to +125°C)................. 3.5 mW/°C
Storage Temperature Range.............. -55 to +125°C
Operating Temperature Range............ -55 to +125°C
Lead Temperature
(1/16" from case for 10 seconds).............. 300°C

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

		Characteristic		E201 Min	E201 Typ	E201 Max	E202 Min	E202 Typ	E202 Max	E203 Min	E203 Typ	E203 Max	Unit	Test Conditions	
1	STATIC	I_{GSS}	Gate Reverse Current (Note 2)			-100			-100			-100	pA	V_{DS} = 0, V_{GS} = -20 V	
2		$V_{GS(off)}$	Gate-Source Cutoff Voltage	-0.3		-1.5	-0.8		-4.0	-2.0		-10.0	V	V_{DS} = 20 V, I_D = 10 nA	
3		BV_{GSS}	Gate-Source Breakdown Voltage	-40			-40			-40			V	V_{DS} = 0, I_G = -1 μA	
4		I_{DSS}	Saturation Drain Current (Note 3)	0.2		1.0	0.9		4.5	4.0		20	mA	V_{DS} = 20 V, V_{GS} = 0	
5		I_G	Gate Current		-35			-35			-35		pA	V_{DG} = 20 V, I_D = $I_{DSS(min)}$	
6	DYNAMIC	g_{fs}	Common-Source Forward Transconductance (Note 3)	500			1,000			1,500			μmho	V_{DS} = 20 V, V_{GS} = 0	f = 1 kHz
7		g_{os}	Common-Source Output Conductance		1			3.5			10		μmho	V_{DS} = 20 V, V_{GS} = 0	f = 1 kHz
8		C_{iss}	Common-Source Input Capacitance		5			5			5		pF	V_{DS} = 20 V, V_{GS} = 0	f = 1 MHz
9		C_{rss}	Common-Source Reverse Transfer Capacitance		2			2			2		pF	V_{DS} = 20 V, V_{GS} = 0	f = 1 MHz
10		$\bar{e}_n$	Equivalent Short-Circuit Input Noise Voltage		10			10			10		$\frac{nV}{\sqrt{Hz}}$	V_{DS} = 10 V, V_{GS} = 0	f = 1 kHz

NOTES: NP

1. Geometry is symmetrical. Units may be operated with source and drain leads interchanged.
2. Approximately doubles for every 10°C increase in T_A.
3. Pulse test duration = 2 ms.

Performance Curves NZF
See Page 4-49

N-CHANNEL SILICON JUNCTION FIELD-EFFECT TRANSISTORS

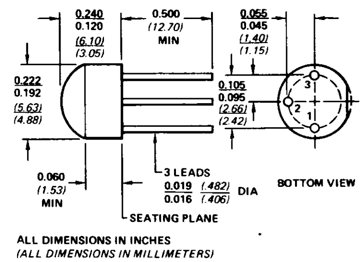
FOR GENERAL-PURPOSE AMPLIFIER APPLICATIONS

This series of epoxy-encapsulated FETs is characterized for low and medium frequency small-signal amplifier applications which require high transconductance and low input capacitance.

- **Typical transconductance g_{fs} = 10,000 μmho (E211 and E212)**
- **Typical input capacitance C_{iss} = 5 pF**

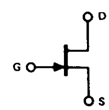
ABSOLUTE MAXIMUM RATINGS (25°C)

Gate-Drain or Gate-Source Voltage .... -25 V
Gate Current .... 10 mA
Total Device Dissipation
(25°C Free-Air Temperature) .... 350 mW
Power Derating (to +125°C) .... 3.5 mW/°C
Storage Temperature Range .... -55 to +125°C
Operating Temperature Range .... -55 to +125°C
Lead Temperature
(1/16" from case for 10 seconds) .... 300°C



ALL DIMENSIONS IN INCHES
(ALL DIMENSIONS IN MILLIMETERS)

TO-106



PIN	OUT
1	S
2	D
3	G

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

		Characteristic		E210 Min	E210 Typ	E210 Max	E211 Min	E211 Typ	E211 Max	E212 Min	E212 Typ	E212 Max	Unit	Test Conditions	
1	S	I_{GSS}	Gate Reverse Current (Note 1)			-100			-100			-100	pA	V_{DS} = 0, V_{GS} = -15 V	
2	T	$V_{GS(off)}$	Gate-Source Cutoff Voltage	-1		-3	-2.5		-4.5	-4		-6	V	V_{DS} = 15 V, I_D = 1 nA	
3	A T	BV_{GSS}	Gate-Source Breakdown Voltage	-25			-25			-25			V	V_{DS} = 0, I_G = -1 μA	
4	I	I_{DSS}	Saturation Drain Current (Note 2)	2		15	7		20	15		40	mA	V_{DS} = 15 V, V_{GS} = 0	
5	C	I_G	Gate Current		-10			-10			-10		pA	V_{DG} = 10 V, I_D = 1 mA	
6		g_{fs}	Common-Source Forward Transconductance (Note 2)	4,000		12,000	7,000		12,000	7,000		12,000	μmho	V_{DS} = 15 V, V_{GS} = 0	f = 1 kHz
7	D Y	g_{os}	Common-Source Output Conductance			150			200			200	μmho	V_{DS} = 15 V, V_{GS} = 0	f = 1 kHz
8	N A	C_{iss}	Common-Source Input Capacitance		5.0			5.0			5.0		pF	V_{DS} = 15 V, V_{GS} = 0	f = 1 MHz
9	M I C	C_{rss}	Common-Source Reverse Transfer Capacitance		1.5			1.5			1.5		pF	V_{DS} = 15 V, V_{GS} = 0	f = 1 MHz
10		$\bar{e}_n$	Equivalent Short-Circuit Input Noise Voltage		10			10			10		$\frac{nV}{\sqrt{Hz}}$	V_{DS} = 15 V, V_{GS} = 0	f = 1 kHz

NOTES:
1. Approximately doubles for every 10°C increase in T_A.
2. Pulse test duration = 2 ms.

NZF

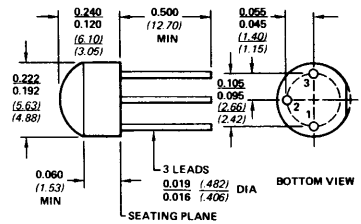
Performance Curves NS
See Page 4-43

N-CHANNEL SILICON JUNCTION FIELD-EFFECT TRANSISTORS

FOR GENERAL PURPOSE LOW-NOISE AMPLIFIERS

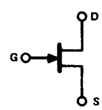
This series of epoxy-encapsulated FETs is characterized for low-frequency, small-signal amplifier applications which require low input noise and moderate transconductance.

- $\bar{e}_n$ = 15 nV/ $\sqrt{Hz}$ Typical @ f = 10 Hz
- Transconductance to 4000 μmhos (E232)



ALL DIMENSIONS IN INCHES
(ALL DIMENSIONS IN MILLIMETERS)

TO-106



PIN	OUT
1	S
2	D
3	G

ABSOLUTE MAXIMUM RATINGS (25°C)

Gate-Drain or Gate-Source Voltage (Note 1) .... -40 V
Gate Current .... 50 mA
Total Device Dissipation ......
(25°C Free-Air Temperature)............... 350 mW
Power Derating (to +125°C)................ 3.5 mW/°C
Storage Temperature Range.............. -55 to +125°C
Operating Temperature Range............ -55 to +125°C
Lead Temperature
(1/16" from case for 10 seconds)............. 300°C

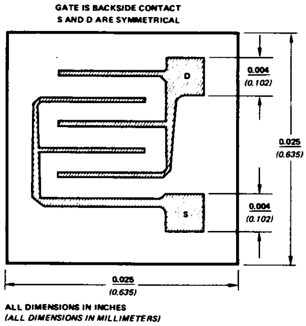
ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

		Characteristic		E230			E231			E232			Unit	Test Conditions	
				Min	Typ	Max	Min	Typ	Max	Min	Typ	Max			
1	STATIC	I_{GSS}	Gate Reverse Current (Note 2)			-250			-250			-250	pA	V_{DS} = 0, V_{GS} = -30 V	
2		$V_{GS(off)}$	Gate-Source Cutoff Voltage	-1		-3	-2		-5	-4		-6	V	V_{DS} = 20 V, I_D = 1 μA	
3		BV_{GSS}	Gate-Source Breakdown Voltage	-40			-40			-40				V_{DS} = 0, I_G = -1 μA	
4		I_{DSS}	Saturation Drain Current	0.7		3	2		6	5		10	mA	V_{DS} = 20 V, V_{GS} = 0	
5		I_G	Gate Current		-10			-10			-10		pA	V_{DG} = 10 V, I_D = 0.5 mA	
6	DYNAMIC	g_{fs}	Common-Source Forward Transconductance	1,000		2,500	1,500		3,000	2,500		4,000	μmho	V_{DS} = 20 V, V_{GS} = 0	f = 1 kHz
7		g_{os}	Common-Source Output Conductance			2			4			6			
8		C_{iss}	Common-Source Input Capacitance		15			15			15		pF		f = 1 MHz
9		C_{rss}	Common-Source Reverse Transfer Capacitance		2			2			2				
10		$\bar{e}_n$	Equivalent Short Circuit Input Noise Voltage		15	30		15	30		15	30	$\frac{nV}{\sqrt{Hz}}$	V_{DS} = 10 V, V_{GS} = 0	f = 10 Hz
11					5			5			5				f = 1 kHz

NOTES:

NS

1. Geometry is symmetrical. Unit may be operated with source and drain leads interchanged.
2. Approximately doubles for every 10°C increase in T_A.



N-CHANNEL DEPLETION MODE SILICON JUNCTION FIELD-EFFECT TRANSISTOR

APPLICATIONS

- Geometry Design Combines Low-Noise Current and Low Noise Voltage for:
  - Ultra Low Noise, High Audio Amplifiers
  - High CMRR Differential Amplifiers and Comparators

PRINCIPAL DEVICES

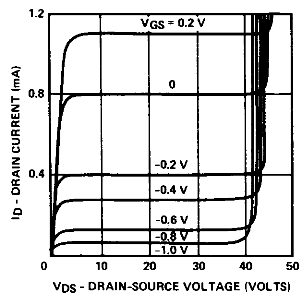
2N4867-69, 2N4867A-69A, 2N5515-24, E230-32, P236-38

PACKAGE TYPES:

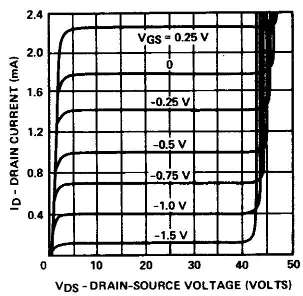
TO-72, TO-106, SI-71

PERFORMANCE CURVES (25°C unless otherwise noted)

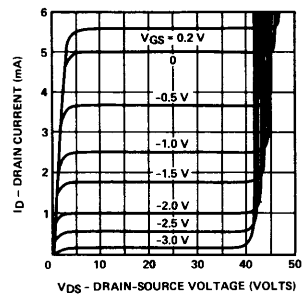
Output Characteristics



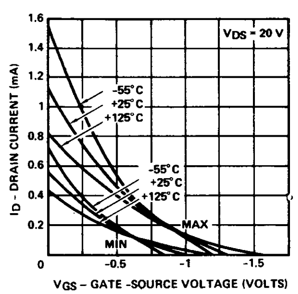
Output Characteristics



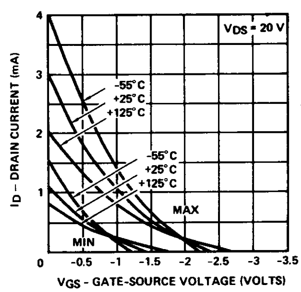
Output Characteristics



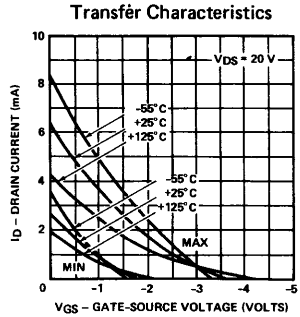
Transfer Characteristics



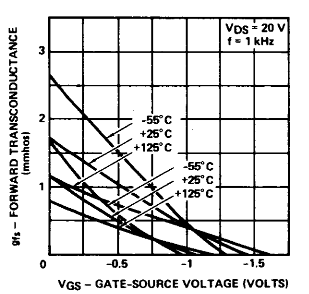
Transfer Characteristics



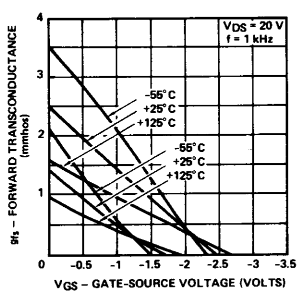
Transfer Characteristics



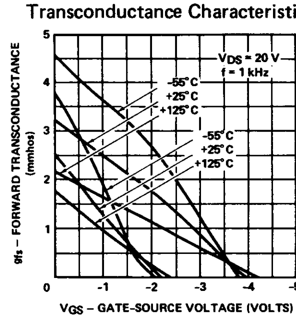
Transconductance Characteristics



Transconductance Characteristics

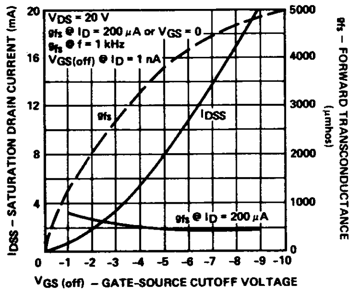


Transconductance Characteristics

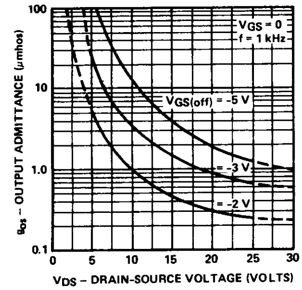


PERFORMANCE CURVES (Cont'd) (25°C unless otherwise noted)

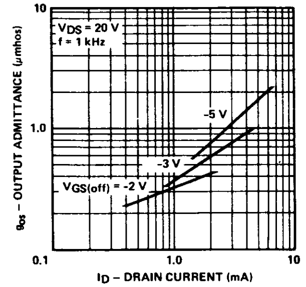
Saturation Drain Current and Forward Transconductance vs. Gate-Source Cutoff Voltage



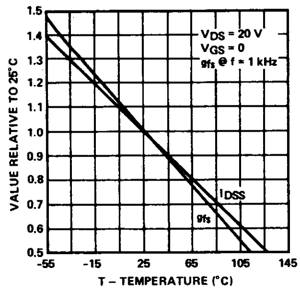
Common-Source Output Admittance vs Drain-Source Voltage



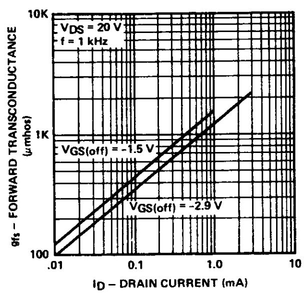
Common Source Output Admittance vs Drain Current



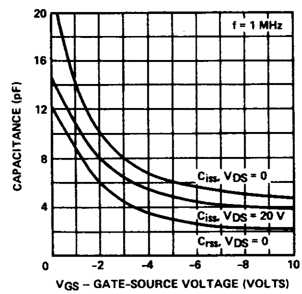
Drain Current & Transconductance vs Ambient Temperature



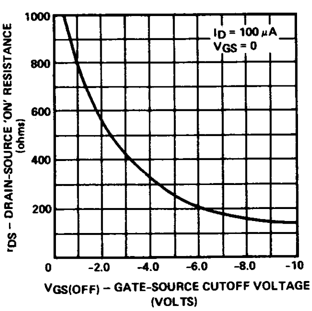
Common-Source Forward Transconductance vs Drain Current



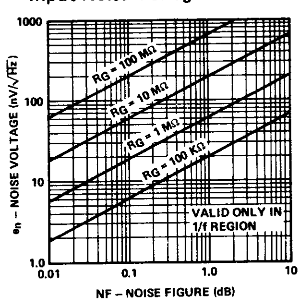
Common-Source Capacitance vs Gate-Source Voltage



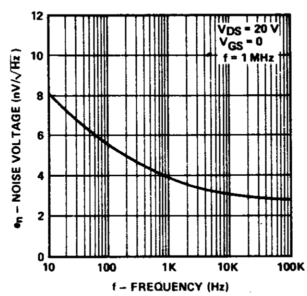
Static Drain-Source 'ON' Resistance vs Gate-Source Cutoff Voltage



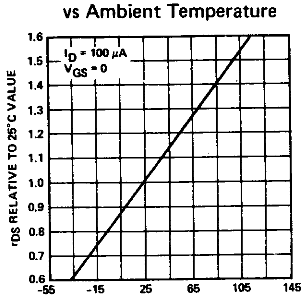
Approximate Noise Figure vs Input Noise Voltage Correlation



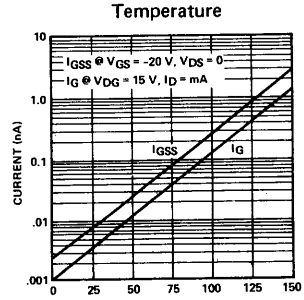
Equivalent Input Noise Voltage vs Frequency



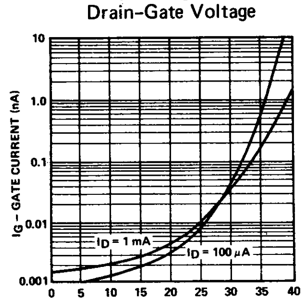
Drain-Source 'ON' Resistance vs Ambient Temperature



Gate Current vs Ambient Temperature



Gate Operating Current vs Drain-Gate Voltage



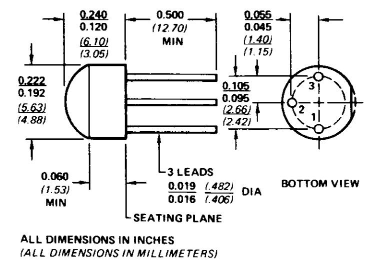
Performance Curves PS
See Page 4-61

P-CHANNEL SILICON JUNCTION FIELD-EFFECT TRANSISTORS

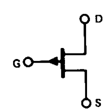
FOR GENERAL-PURPOSE AMPLIFIER APPLICATIONS

This series of epoxy-encapsulated FETs is characterized for low and medium frequency small-signal amplifier applications which require high transconductance and low equivalent input noise voltage.

- **Typical transconductance g_{fs} = 14,000 μmho (E271)**
- **Typical $\bar{e}_n$ = 10 nV/ $\sqrt{Hz}$ at 1 kHz**



TO-106



PIN	OUT
1	S
2	G
3	D

ABSOLUTE MAXIMUM RATINGS (25°C)

Gate-Drain or Gate-Source Voltage (Note 1) .... 30 V
Gate Current .... -50 mA
Total Device Dissipation
(25°C Free-Air Temperature) .... 350 mW
Power Derating (to +125°C)................ 3.5 mW/°C
Storage Temperature Range.............. -55 to +125°C
Operating Temperature Range .... -55 to +125°C
Lead Temperature
(1/16" from case for 10 seconds).............. 300°C

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

			Characteristic	E270 Min	E270 Typ	E270 Max	E271 Min	E271 Typ	E271 Max	Unit	Test Conditions	
1	S	I_{GSS}	Gate Reverse Current (Note 2)			200			200	pA	V_{DS} = 0, V_{GS} = 20 V	
2	T	$V_{GS(off)}$	Gate-Source Cutoff Voltage	0.5		2.0	1.5		4.5	V	V_{DS} = -15 V, I_D = -1 nA	
3	A T	BV_{GSS}	Gate-Source Breakdown Voltage	30			30			V	V_{DS} = 0, I_G = 1 μA	
4	I	I_{DSS}	Saturation Drain Current (Note 3)	-2		-15	-6		-50	mA	V_{DS} = -15 V, V_{GS} = 0	
5	C	I_G	Gate Current		15			60		pA	V_{DG} = -15 V, I_D = $I_{DSS(min)}$	
6		g_{fs}	Common-Source Forward Transconductance (Note 3)	6,000		15,000	8,000		18,000	μmho	V_{DS} = -15 V, V_{GS} = 0	f = 1 kHz
7	D Y	g_{os}	Common-Source Output Conductance			200			500	μmho	V_{DS} = -15 V, V_{GS} = 0	f = 1 kHz
8	N A	C_{iss}	Common-Source Input Capacitance		20			20		pF	V_{DS} = -15 V, V_{GS} = 0	f = 1 MHz
9	M I	C_{rss}	Common-Source Reverse Transfer Capacitance		5			5		pF	V_{DS} = -15 V, V_{GS} = 0	f = 1 MHz
10	C	e_n	Equivalent Short-Circuit Input Noise Voltage		10			10		$\frac{nV}{\sqrt{Hz}}$	V_{DS} = -10 V, I_D = $I_{DSS(min)}$	f = 1 kHz

PS

NOTES:
1. Geometry is symmetrical. Units may be operated with source and drain leads interchanged.
2. Approximately doubles for every 10°C increase in T_A.
3. Pulse test duration = 2 ms.