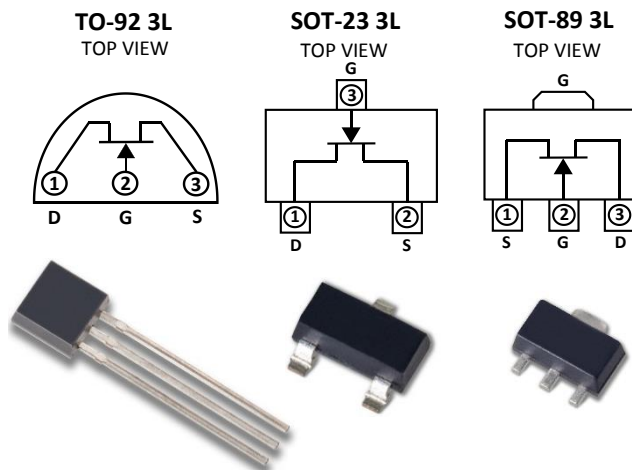


## Ultra-Low Noise at Both High & Low Frequencies With a Narrow Range of IDSS

<b>Absolute Maximum Ratings</b>	
@ 25 °C (unless otherwise stated)	
<b>Maximum Temperatures</b>	
Storage Temperature	-55 to +150°C
Junction Operating Temperature	-55 to +135°C
<b>Maximum Power Dissipation</b>	
Continuous Power Dissipation @ +25°C	400mW
<b>Maximum Currents</b>	
Gate Forward Current	$I_{G(F)} = 10\text{mA}$
<b>Maximum Voltages</b>	
Gate to Source	$V_{GSS} = 40\text{V}$
Gate to Drain	$V_{GDS} = 40\text{V}$



### Features

- ULTRA LOW NOISE ( $f=1\text{kHz}$ ):  $e_n = 0.9\text{nV}/\sqrt{\text{Hz}}$
- High Breakdown Voltage:  $BV_{GSS} = 40\text{V min}$
- High Gain:  $G_{fs} = 22\text{mS (typ)}$
- High Input Impedance:  $20\text{G}\Omega \text{ typ}$
- Low Capacitance:  $22\text{pF max}$
- Improved Second Source Replacement for 2SK170
- For Equivalent Monolithic-Dual, See the LSK389 Series

### Benefits

- Direct Pin-For-Pin Replacement of Toshiba's 2SK170
- Optimized to Provide Low Noise at Both High and Low Frequencies With a Narrow Range of IDSS and Low Capacitance
- Low Noise to Capacitance Ratio and Narrow Range of Low Value IDSS Provide Solutions for Low Noise Applications Which Cannot Tolerate High Values of Capacitance or Wide Ranges of IDSS

### Applications

- Audio Amplifiers and Preamps
- Discrete Low-Noise Operational Amplifiers
- Guitar Pickups
- Effects Pedals
- Microphones
- Audio Mixer Consoles
- Acoustic Sensors
- Sonobuoys
- Hydrophones

### Applications Cont'd

- Chemical and Radiation Detectors
- Instrumentation Amplifiers
- Accelerometers
- CT Scanners Input Stages
- Oscilloscope Input Stages
- Electrometers and Vibrations Detectors

### Description

The LSK170 is specifically designed for low noise, high input impedance applications within the audio, instrumentation, medical and sensors markets. The narrow ranges of  $I_{DSS}$  grades with the LSK170 promote ease of design, particularly in low voltage applications. The LSK170 is ideal for portable battery operated applications, and features high  $BV_{DSS}$  for maximum linear headroom in high transient program content amplifiers. The series has a uniquely linear  $V_{GS}$  transfer function for a stability that is highly desirable, particularly for audio front-end preamplifiers.

The device is available in a surface mount SOT-23 package, through-hole TO-92 package and SOT-89 package. The surface mount version of the LSK170 Series creates new opportunities for engineers seeking to design lower noise circuits in compact embeddable applications where shielding and space are critical. The LSK170 series is a pin for pin replacement of the Toshiba 2SK170 and improved functional replacement for the Interfet IF1320, IF1330, IF1331, and IF4500. Contact the factory for tighter noise and other specification selections.

# LSK170 A/B/C/D

High Input Impedance, Ultra-Low Noise, Single N-Channel JFET

## Electrical Characteristics @ 25°C (unless otherwise stated)

SYMBOL	CHARACTERISTIC	MIN	TYP	MAX	UNITS	CONDITIONS	
$BV_{GSS}$	Gate to Source Breakdown Voltage	-40.0			V	$V_{DS} = 0V, I_D = -100\mu A$	
$V_{GS(OFF)}$	Gate to Source Pinch-off Voltage	-0.2		-2.0	V	$V_{DS} = 10V, I_D = 1nA$	
$V_{GS}$	Gate to Source Operating Voltage		0.5		V	$V_{DS} = 10V, I_D = 1mA$	
$I_{DSS}^2$	Drain to Source Saturation Current	LSK170A	2.6		6.5	mA	$V_{DS} = 10V, V_{GS} = 0$
		LSK170B	6.0		12.0		
		LSK170C	10.0		20.0		
		LSK170D	18.0		30.0		
$I_G$	Gate Operating Current			-0.5	nA	$V_{DG} = 10V, I_D = 1mA$	
$I_{GSS}$	Gate to Source Leakage Current			-1.0	nA	$V_{GS} = -10V, V_{DS} = 0V$	
$G_{fs}$	Full Conduction Transconductance	14.0	22.0		mS	$V_{DS} = 10V, V_{GS} = 0, f = 1kHz$	
$G_{fs}$	Typical Conduction Transconductance	6.0	10.0		mS	$V_{DS} = 15V, I_D = 1mA$	
$e_n$	Noise Voltage		0.9	1.9	nV/ $\sqrt{Hz}$	$V_{DS} = 10V, I_D = 2mA, f = 1kHz, NBW = 1Hz$	
$e_n$	Noise Voltage		1.4	4.0	nV/ $\sqrt{Hz}$	$V_{DS} = 10V, I_D = 2mA, f = 10Hz, NBW = 1Hz$	
$C_{ISS}$	Common Source Input Capacitance		20.0		pF	$V_{DS} = 15V, I_D = 100\mu A, f = 1MHz,$	
$C_{RSS}$	Common Source Reverse Transfer Cap.		5.0		pF	$V_{DS} = 15V, I_D = 100\mu A, f = 1MHz,$	

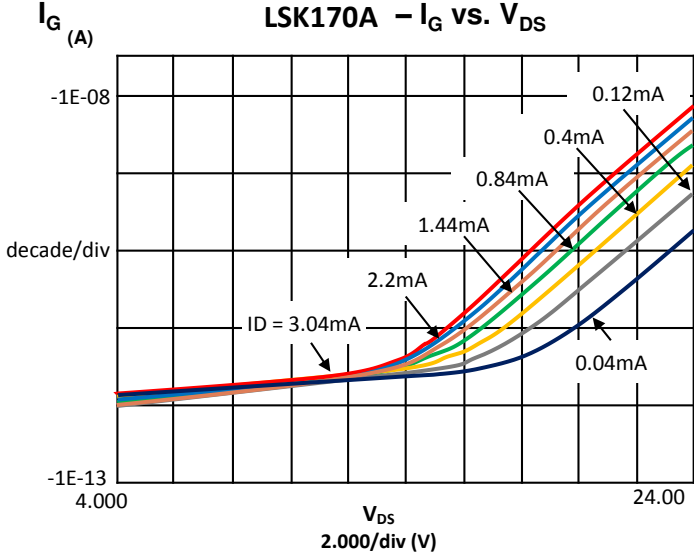
# LSK170 A/B/C/D

High Input Impedance, Ultra-Low Noise, Single N-Channel JFET

## Typical Characteristics

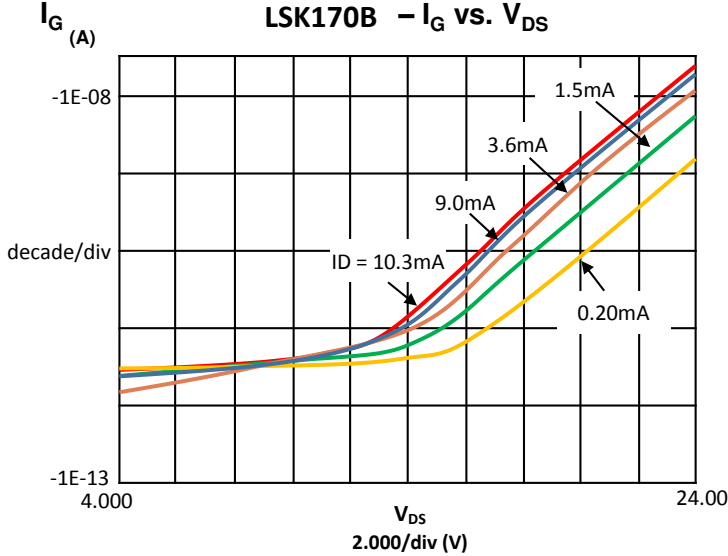
### Operating Current

LSK170A -  $I_G$  vs.  $V_{DS}$



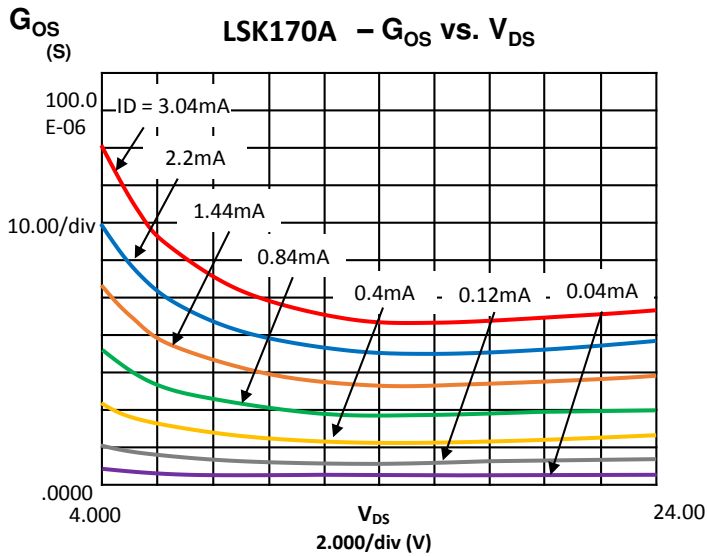
### Operating Current

LSK170B -  $I_G$  vs.  $V_{DS}$



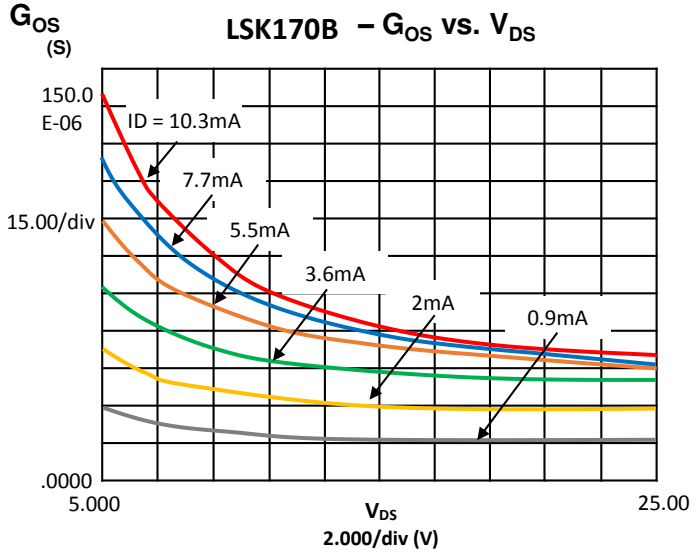
### Output Conductance

LSK170A -  $G_{OS}$  vs.  $V_{DS}$



### Output Conductance

LSK170B -  $G_{OS}$  vs.  $V_{DS}$



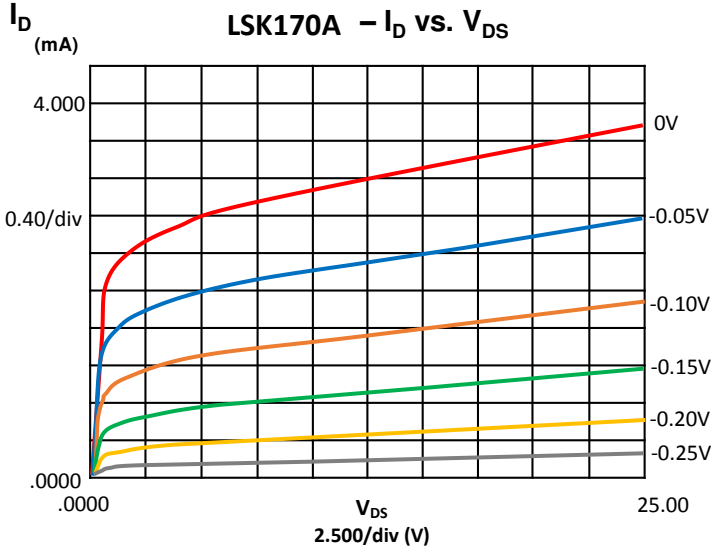
# LSK170 A/B/C/D

High Input Impedance, Ultra-Low Noise, Single N-Channel JFET

## Typical Characteristics

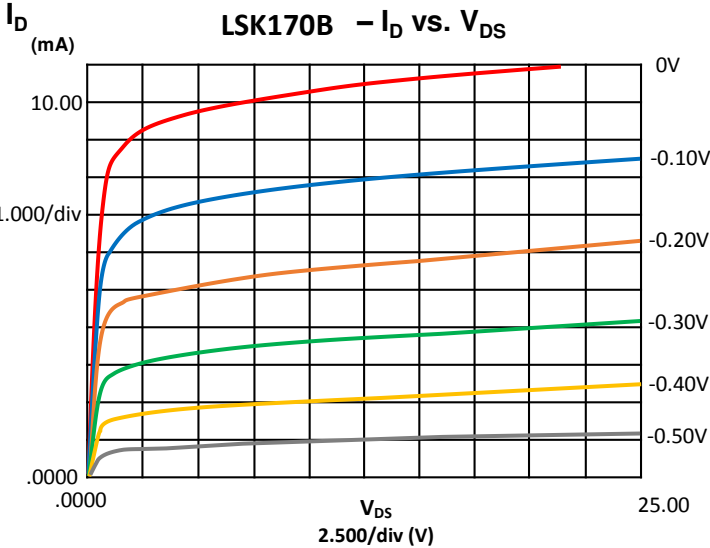
### Output Characteristics

LSK170A -  $I_D$  vs.  $V_{DS}$



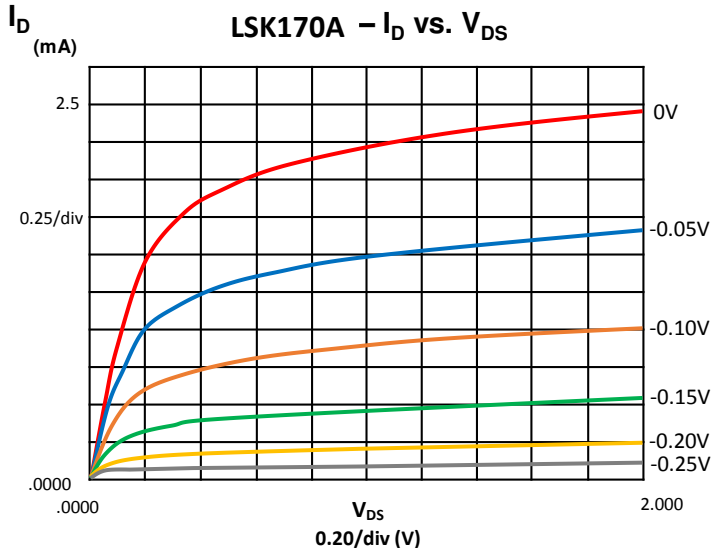
### Output Characteristics

LSK170B -  $I_D$  vs.  $V_{DS}$



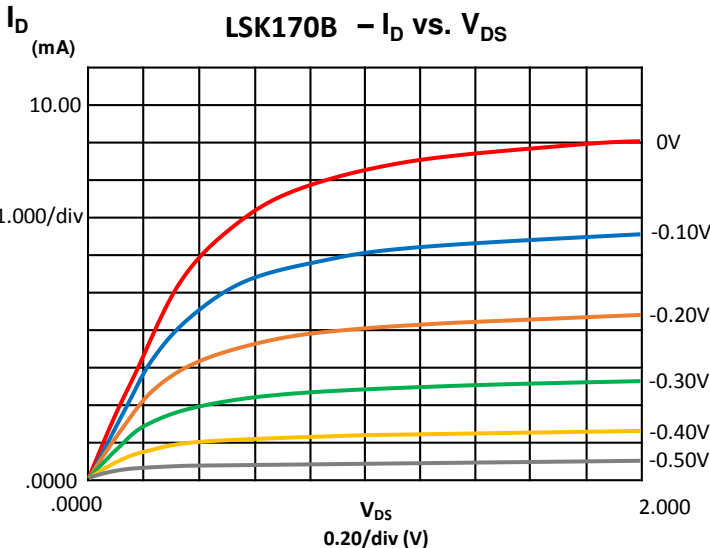
### Operating Characteristics

LSK170A -  $I_D$  vs.  $V_{DS}$



### Operating Characteristics

LSK170B -  $I_D$  vs.  $V_{DS}$

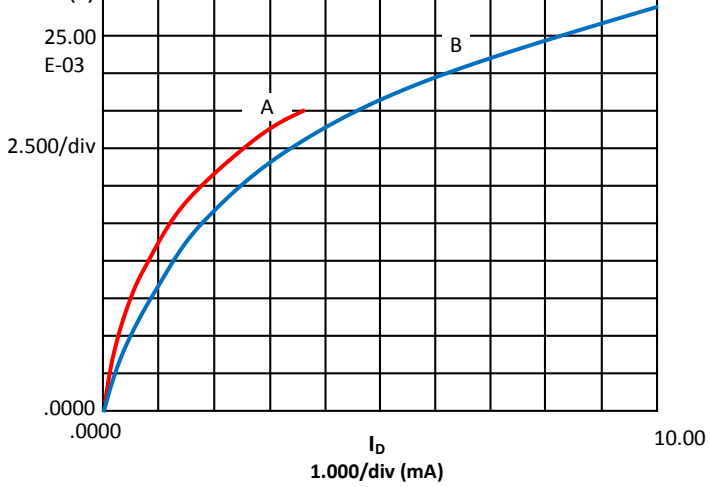


# LSK170 A/B/C/D

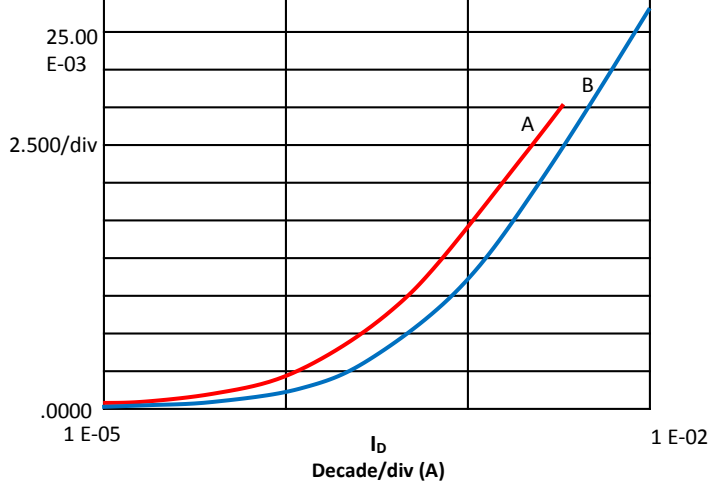
High Input Impedance, Ultra-Low Noise, Single N-Channel JFET

## Typical Characteristics

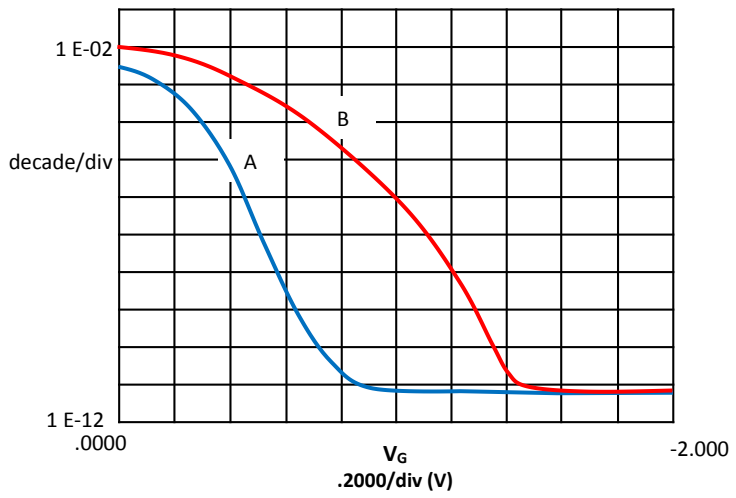
**Common Source Forward Transconductance vs. Drain Current**  
LSK170A & B -  $G_{FS}$  vs.  $I_D$



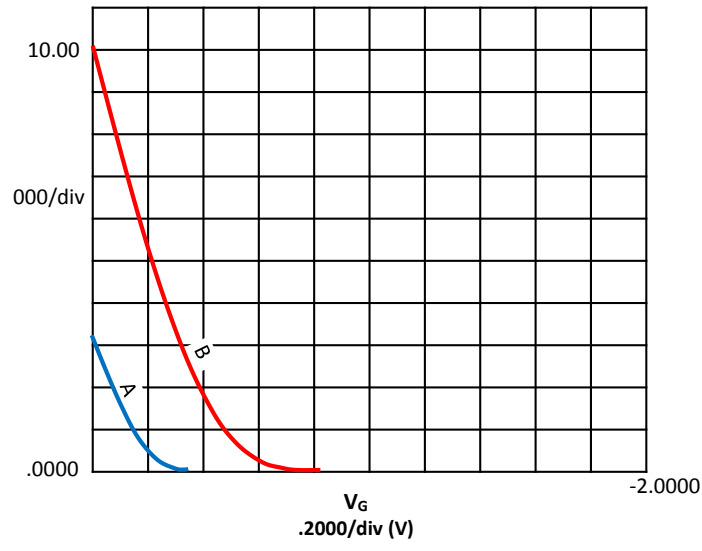
**Common Source Transconductance vs. Drain Current**  
LSK170A & B -  $G_{FS}$  vs.  $I_D$



**LSK170A & B -  $I_D$  vs.  $V_{GS}$**

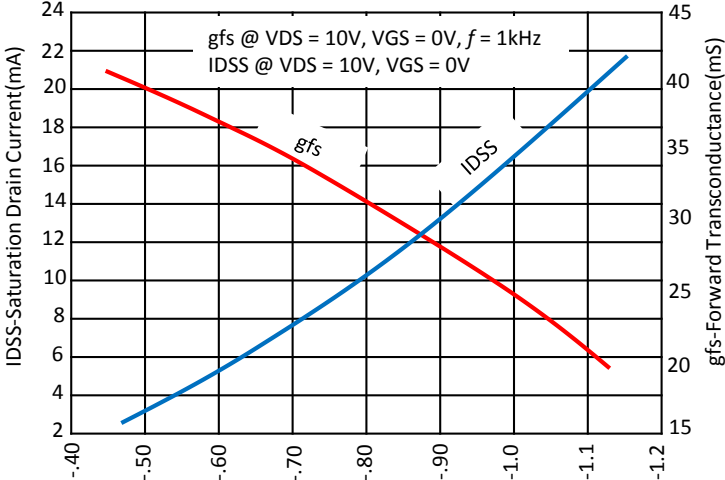


**LSK170A & B -  $I_D$  vs.  $V_{GS}$**

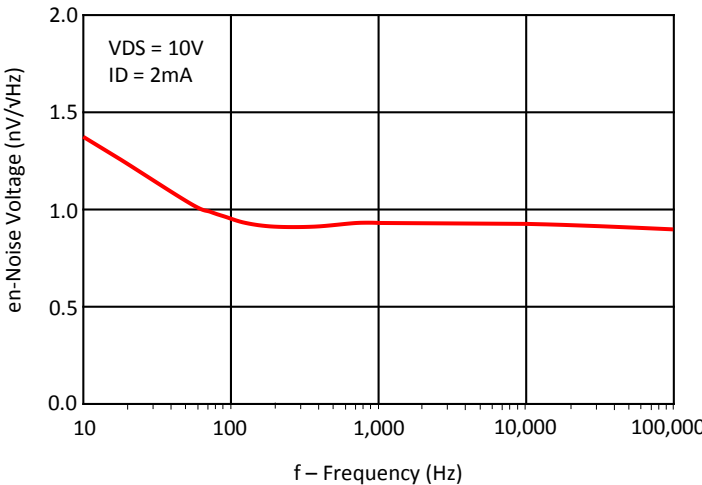


## Typical Characteristics

### Drain Current Transconductance vs. Gate-Source Cutoff Voltage



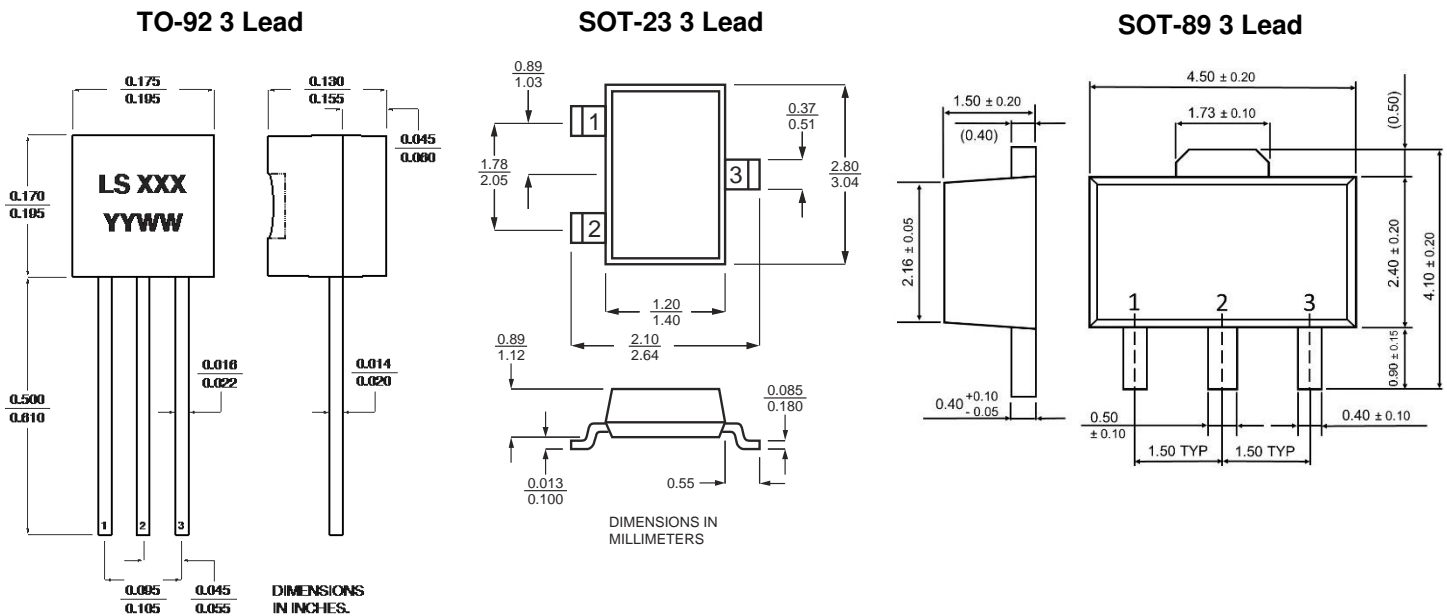
### Equivalent Input Noise Voltage vs. Frequency



### Ordering Information

STANDARD PART CALL-OUT	CUSTOM PART CALL-OUT CUSTOM PARTS INCLUDE SEL + 4 DIGIT NUMERIC CODE)
LSK170A TO-92 3L RoHS	LSK170A TO-92 3L RoHS SELXXXX
LSK170B TO-92 3L RoHS	LSK170B TO-92 3L RoHS SELXXXX
LSK170C TO-92 3L RoHS	LSK170C TO-92 3L RoHS SELXXXX
LSK170D TO-92 3L RoHS	LSK170D TO-92 3L RoHS SELXXXX
LSK170A SOT-23 3L RoHS	LSK170A SOT-23 3L RoHS SELXXXX
LSK170B SOT-23 3L RoHS	LSK170B SOT-23 3L RoHS SELXXXX
LSK170C SOT-23 3L RoHS	LSK170C SOT-23 3L RoHS SELXXXX
LSK170D SOT-23 3L RoHS	LSK170D SOT-23 3L RoHS SELXXXX
LSK170A SOT-89 3L RoHS	LSK170A SOT-89 3L RoHS SELXXXX
LSK170B SOT-89 3L RoHS	LSK170B SOT-89 3L RoHS SELXXXX
LSK170C SOT-89 3L RoHS	LSK170C SOT-89 3L RoHS SELXXXX
LSK170D SOT-89 3L RoHS	LSK170D SOT-89 3L RoHS SELXXXX

### Package Dimensions



### Notes

1. Absolute maximum ratings are limiting values above which serviceability may be impaired.
2. Pulse Test: PW ≤ 300μs, Duty Cycle ≤ 3%
3. All characteristics MIN/TYP/MAX numbers are absolute values. Negative values indicate electrical polarity only.
4. When ordering include the full Linear Systems part number and package type. Linear Systems creates custom parts on a case by case basis. To learn whether Linear Systems can meet your requirements, please send your drawing along with a detailed description of the device specifications to [sales@linearsystems.com](mailto:sales@linearsystems.com). One of our qualified representatives will contact you.
5. All standard parts are RoHS compliant. Contact the factory for availability of non-RoHS parts.
6. Information furnished by Linear Integrated Systems is believed to be accurate and reliable. However, no responsibility is assumed for its use; nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Linear Integrated Systems.
7. Voltage specifications are not tested 100%, but guaranteed by lot sampling. Contact the factory if 100% test is required.