



**DUAL N-CHANNEL ENHANCEMENT MODE EPAD®  
MATCHED PAIR MOSFET ARRAY**

**V<sub>GS(th)</sub> = +3.3V**

**GENERAL DESCRIPTION**

ALD111933 are monolithic dual N-Channel MOSFETs matched at the factory using ALD's proven EPAD® CMOS technology. These devices are intended for low voltage, small signal applications.

ALD111933 MOSFETs are designed and built with exceptional device electrical characteristics matching. Since these devices are on the same monolithic chip, they also exhibit excellent tempco tracking characteristics. Each device is versatile as a circuit element and is a useful design component for a broad range of analog applications. They are basic building blocks for current sources, differential amplifier input stages, transmission gates, and multiplexer applications. For most applications, connect V- and N/C pins to the most negative voltage potential in the system. All other pins must have voltages within these voltage limits.

The ALD111933 devices are built for minimum offset voltage and differential thermal response, and they are designed for switching and amplifying applications in +3.0V to +10V systems where low input bias current, low input capacitance and fast switching speed are desired. Since these are MOSFET devices, they feature very large (almost infinite) current gain in a low frequency, or near DC, operating environment.

The ALD111933 are suitable for use in precision applications which require very high current gain, beta, such as current mirrors and current sources. The high input impedance and the high DC current gain of the Field Effect Transistors result in extremely low current loss through the control gate. The DC current gain is limited by the gate input leakage current, which is specified at 30pA at room temperature. For example, DC beta of the device at a drain current of 3mA and input leakage current of 30pA at 25°C is  $= 3\text{mA}/30\text{pA} = 100,000,000$ .

**FEATURES**

- Enhancement-mode (normally off)
- Standard Gate Threshold Voltages: +3.3V
- Matched MOSFET to MOSFET characteristics
- Tight lot to lot parametric control
- Parallel connection of MOSFETs to increase drain currents
- Low input capacitance
- V<sub>GS(th)</sub> match to 20mV
- High input impedance — 10<sup>12</sup>Ω typical
- Positive, zero, and negative V<sub>GS(th)</sub> temperature coefficient
- DC current gain >10<sup>8</sup>
- Low input and output leakage currents

**ORDERING INFORMATION** ("L" suffix for lead free version)

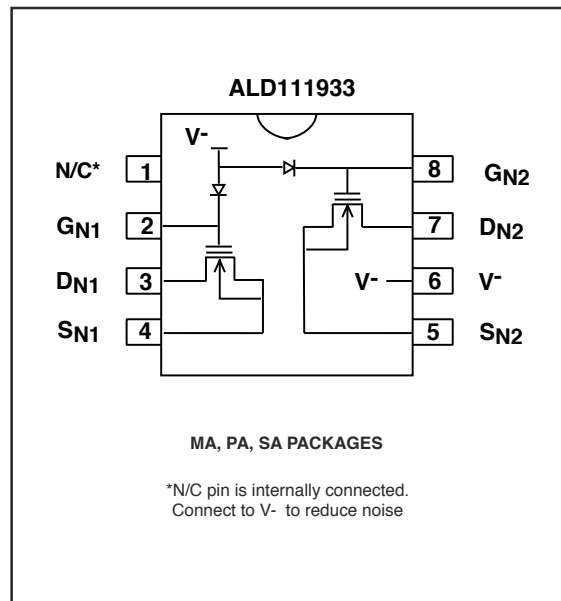
Operating Temperature Range*		
0°C to +70°C		
8-Pin Plastic Dip Package	8-Pin MSOP Package	8-Pin SOIC Package
ALD111933PAL	ALD111933MAL	ALD111933SAL

\* Contact factory for industrial or military temp. ranges or user-specified threshold voltage values.

**APPLICATIONS**

- Precision current mirrors
- Precision current sources
- Voltage choppers
- Differential amplifier input stages
- Discrete voltage comparators
- Voltage bias circuits
- Sample and Hold circuits
- Analog inverters
- Level shifters
- Source followers and buffers
- Current multipliers
- Discrete analog multiplexers/matrices
- Discrete analog switches
- Low current voltage clamps
- Voltage detectors
- Capacitive probes
- Sensor interfaces
- Peak detectors
- Level shifters
- Multiple preset voltage hysteresis circuits (with other V<sub>GS(th)</sub> EPAD MOSFETS)
- Energy harvesting circuits
- Zero standby power voltage monitors

**PIN CONFIGURATION**



## ABSOLUTE MAXIMUM RATINGS

Drain-Source voltage, $V_{DS}$	10.6V
Gate-Source voltage, $V_{GS}$	10.6V
Power dissipation	500 mW
Operating temperature range PA, SA, MA package	0°C to +70°C
Storage temperature range	-65°C to +150°C
Lead temperature, 10 seconds	+260°C

## OPERATING ELECTRICAL CHARACTERISTICS

**V- = GND  $T_A = 25^\circ\text{C}$  unless otherwise specified**

**CAUTION:** ESD Sensitive Device. Use static control procedures in ESD controlled environment.

Parameter	Symbol	ALD111933			Unit	Test Conditions
		Min	Typ	Max		
Gate Threshold Voltage	$V_{GS(th)}$	3.25	3.3	3.35	V	$I_{DS} = 1\mu\text{A}$ $V_{DS} = 0.1\text{V}$
Offset Voltage $V_{GS(th)1} - V_{GS(th)2}$	$V_{OS}$		2	20	mV	$I_{DS} = 1\mu\text{A}$
Offset Voltage Tempco	$TC \Delta V_{OS}$		5		$\mu\text{V}/^\circ\text{C}$	$V_{DS1} = V_{DS2}$
Gate Threshold Voltage Tempco	$TC \Delta V_{GS(th)}$		-1.7 0.0 +1.6		$\text{mV}/^\circ\text{C}$	$I_D = 1\mu\text{A}$ $I_D = 20\mu\text{A}$ , $V_{DS} = 0.1\text{V}$ $I_D = 40\mu\text{A}$
On Drain Current	$I_{DS(ON)}$		6.9 3.0		mA	$V_{GS} = +10.0\text{V}$ $V_{GS} = +7.3\text{V}$ $V_{DS} = +5\text{V}$
Forward Transconductance	$G_{FS}$		1.4		mmho	$V_{GS} = +7.3\text{V}$ $V_{DS} = +10.4\text{V}$
Transconductance Mismatch	$\Delta G_{FS}$		1.8		%	
Output Conductance	$G_{OS}$		68		$\mu\text{mho}$	$V_{GS} = +7.3\text{V}$ $V_{DS} = +10.4\text{V}$
Drain Source On Resistance	$R_{DS(ON)}$		500		$\Omega$	$V_{DS} = 0.1\text{V}$ $V_{GS} = +5.9\text{V}$
Drain Source On Resistance Mismatch	$\Delta R_{DS(ON)}$		0.5		%	$V_{DS} = 0.1\text{V}$ $V_{GS} = +7.3\text{V}$
Drain Source Breakdown Voltage	$BV_{DSX}$	10			V	$I_{DS} = 1.0\mu\text{A}$ $V_{GS} = +2.3\text{V}$
Drain Source Leakage Current <sup>1</sup>	$I_{DS(OFF)}$		10	100 4	pA nA	$V_{GS} = +2.3\text{V}$ $V_{DS} = 10\text{V}$ , $T_A = 125^\circ\text{C}$
Gate Leakage Current <sup>1</sup>	$I_{GSS}$		3	30 1	pA nA	$V_{DS} = 0\text{V}$ $V_{GS} = 10\text{V}$ $T_A = 125^\circ\text{C}$
Input Capacitance	$C_{ISS}$		2.5		pF	
Transfer Reverse Capacitance	$C_{RSS}$		0.1		pF	
Turn-on Delay Time	$t_{on}$		10		ns	$V^+ = 5\text{V}$ $R_L = 5\text{K}\Omega$
Turn-off Delay Time	$t_{off}$		10		ns	$V^+ = 5\text{V}$ $R_L = 5\text{K}\Omega$
Crosstalk			60		dB	$f = 100\text{KHz}$

Notes: <sup>1</sup> Consists of junction leakage currents