

**QUAD/DUAL N-CHANNEL DEPLETION MODE EPAD®  
MATCHED PAIR MOSFET ARRAY**

**$V_{GS(th)} = -0.4V$**

**GENERAL DESCRIPTION**

ALD114804/ALD114804A/ALD114904/ALD114904A are monolithic quad/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. They are excellent functional replacements for normally-closed relay applications, as they are normally on (conducting) without any power applied, but could be turned off or modulated when system power supply is turned on. These MOSFETS have the unique characteristics of, when the gate is grounded, operating in the resistance mode for low drain voltage levels and in the current source mode for higher voltage levels and providing a constant drain current.

ALD114804/ALD114804A/ALD114904/ALD114904A MOSFETS are designed for exceptional device electrical characteristics matching. As these devices are on the same monolithic chip, they also exhibit excellent temperature tracking characteristics. They are versatile as design components for a broad range of analog applications, such as basic building blocks for current sources, differential amplifier input stages, transmission gates, and multiplexer applications.

Besides matched pair electrical characteristics, each individual MOSFET also exhibits well controlled parameters, enabling the user to depend on tight design limits corresponding to well matched characteristics.

These depletion mode devices are built for minimum offset voltage and differential thermal response, and they are suitable for switching and amplifying applications in single supply (0.4V to +5V) or dual supply (+/- 0.4V to +/-5V) systems where low input bias current, low input capacitance and fast switching speed are desired. These devices exhibit well controlled turn-off and sub-threshold characteristics and therefore can be used in designs that depend on sub-threshold characteristics.

The ALD114804/ALD114804A/ALD114904/ALD114904A are suitable for use in precision applications which require very high current gain, beta, such as current mirrors and current sources. A sample calculation of the DC current gain at a drain current of 3mA and gate input leakage current of 30pA = 100,000,000. It is recommended that the user, for most applications, connect V+ pin to the most positive voltage potential (or left open unused) and V- and N/C pins to the most negative voltage potential in the system. All other pins must have voltages within these voltage limits.

**FEATURES**

- Depletion mode (normally ON)
- Precision Gate Threshold Voltages: -0.4V +/- 0.02V
- Nominal  $R_{DS(ON)}$  @  $V_{GS}=0.0V$  of 5.4K $\Omega$
- Matched MOSFET to MOSFET characteristics
- Tight lot to lot parametric control
- Low input capacitance
- $V_{GS(th)}$  match (VOS) — 20mV
- High input impedance — 10<sup>12</sup> $\Omega$  typical
- Positive, zero, and negative  $V_{GS(th)}$  temperature coefficient
- DC current gain >10<sup>8</sup>
- Low input and output leakage currents

**ORDERING INFORMATION**

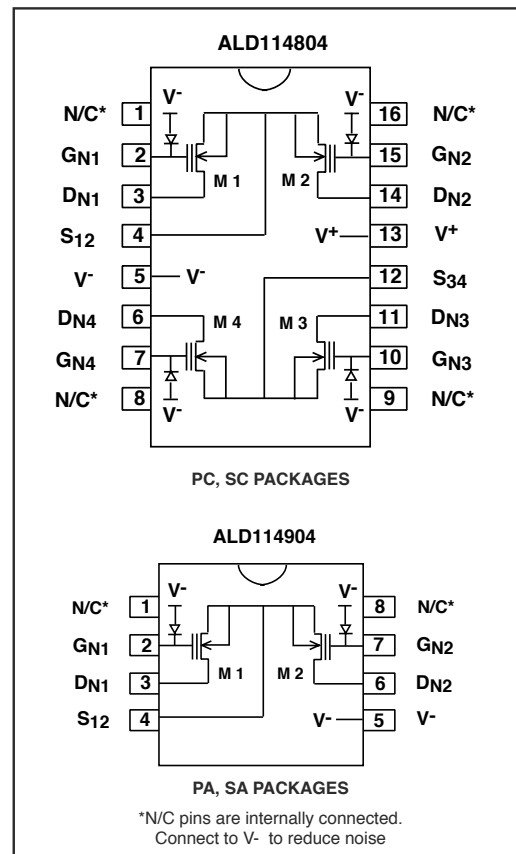
Operating Temperature Range*		Operating Temperature Range*	
0°C to +70°C		0°C to +70°C	
16-Pin Plastic Dip Package	16-Pin SOIC Package	8-Pin Plastic Dip Package	8-Pin SOIC Package
ALD114804APC	ALD114804ASC	ALD114904APA	ALD114904ASA
ALD114804 PC	ALD114804SC	ALD114904PA	ALD114904SA

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

**APPLICATIONS**

- Functional replacement of Form B (NC) relays
- Ultra low power (nanowatt) analog and digital circuits
- Ultra low operating voltage (<0.2V) analog and digital circuits
- Sub-threshold biased and operated circuits
- Zero power fail safe circuits in alarm systems
- Backup battery circuits
- Power failure and fail safe detector
- Source followers and high impedance buffers
- Precision current mirrors and current sources
- Capacitive probes and sensor interfaces
- Charge detectors and charge integrators
- Differential amplifier input stage
- High side switches
- Peak detectors and level shifters
- Sample and Hold
- Current multipliers
- Discrete analog switches and multiplexers
- Discrete voltage comparators

**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, PC, SC package	0°C to +70°C
Storage temperature range	-65°C to +150°C
Lead temperature, 10 seconds	+260°C

## OPERATING ELECTRICAL CHARACTERISTICS

$V_+ = +5V$  (or open)  $V_- = -5V$   $T_A = 25^\circ C$  unless otherwise specified

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

Parameter	Symbol	ALD114808A / ALD114908A			ALD110848 / ALD114908			Unit	Test Condition
		Min	Typ	Max	Min	Typ	Max		
Gate Threshold Voltage	$V_{GS(th)}$	-0.42	-0.40	-0.38	-0.44	-0.40	-0.36	V	$I_{DS} = 1\mu A$ $V_{DS} = 0.1V$
Offset Voltage $V_{GS1} - V_{GS2}$	VOS		2	5		7	20	mV	$I_{DS} = 1\mu A$
$V_{GS1} - V_{GS2}$ Tempco	$\Delta V_{OS}$		5			5		$\mu V / ^\circ C$	$V_{DS1} = V_{DS2}$
Gate Threshold Tempco	$\Delta V_{GS(th)}$		-1.7 0.0 +1.6			-1.7 0.0 +1.6		mV / $^\circ C$	$I_D = 1\mu A$ $I_D = 20\mu A, V_{DS} = 0.1V$ $I_D = 40\mu A$
On Drain Current	$I_{DS(ON)}$		12.0 3.0			12.0 3.0		mA	$V_{GS} = +9.1V$ $V_{GS} = +3.6V$ $V_{DS} = +5V$
Forward Transconductance	$G_{FS}$		1.4			1.4		mmho	$V_{GS} = +3.6V$ $V_{DS} = +8.6V$
Transconductance Mismatch	$\Delta G_{FS}$		1.8			1.8		%	
Output Conductance	$G_{OS}$		68			68		$\mu mho$	$V_{GS} = +3.6V$ $V_{DS} = +8.6V$
Drain Source On Resistance	$R_{DS(ON)}$		500			500		$\Omega$	$V_{DS} = 0.1V$ $V_{GS} = +3.6V$
Drain Source On Resistance	$R_{DS(ON)}$		5.4			5.4		K $\Omega$	$V_{DS} = 0.1V$ $V_{GS} = +0.0V$
Drain Source On Resistance Tolerance	$\Delta R_{DS(ON)}$		10			10		%	
Drain Source On Resistance Mismatch	$\Delta R_{DS(ON)}$		0.5			0.5		%	
Drain Source Breakdown Voltage	$BV_{DSX}$	10			10			V	$I_{DS} = 1.0\mu A$ $V_{GS} = -1.4V$
Drain Source Leakage Current <sup>1</sup>	$I_{DS(OFF)}$		10	100 4		10	100 4	pA nA	$V_{GS} = -1.4V, V_{DS} = +5V$ $T_A = 125^\circ C$
Gate Leakage Current <sup>1</sup>	$I_{GSS}$		3	30 1		3	30 1	pA nA	$V_{DS} = 0V, V_{GS} = +10V$ $T_A = 125^\circ C$
Input Capacitance	$C_{ISS}$		2.5			2.5		pF	
Transfer Reverse Capacitance	$C_{RSS}$		0.1			0.1		pF	
Turn-on Delay Time	$t_{on}$		10			10		ns	$V_+ = 5V, R_L = 5K\Omega$
Turn-off Delay Time	$t_{off}$		10			10		ns	$V_+ = 5V, R_L = 5K\Omega$
Crosstalk			60			60		dB	$f = 100KHz$

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