

DUAL N-CHANNEL MATCHED MOSFET PAIR

GENERAL DESCRIPTION

The ALD1101 is a monolithic dual N-channel matched transistor pair intended for a broad range of analog applications. These enhancement-mode transistors are manufactured with Advanced Linear Devices' enhanced ACMOS silicon gate CMOS process.

The ALD1101 offers high input impedance and negative current temperature coefficient. The transistor pair is matched for minimum offset voltage and differential thermal response, and it is designed for switching and amplifying applications in +2V 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. When used with an ALD1102, a dual CMOS analog switch can be constructed. In addition, the ALD1101 is intended as a building block for differential amplifier input stages, transmission gates, and multiplexer applications.

The ALD1101 is 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 50pA at room temperature. For example, DC beta of the device at a drain current of 5mA at 25°C is $= 5\text{mA}/50\text{pA} = 100,000,000$.

FEATURES

- Low threshold voltage of 0.7V
- Low input capacitance
- Low Vos grades -- 2mV, 5mV, 10mV
- High input impedance -- $10^{12}\Omega$ typical
- Negative current (I_{DS}) temperature coefficient
- Enhancement-mode (normally off)
- DC current gain 10^9
- RoHS compliant

ORDERING INFORMATION ("L" suffix denotes lead-free (RoHS))

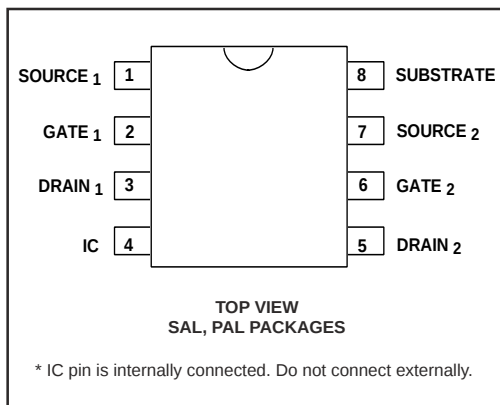
Operating Temperature Range*	
0°C to +70°C	0°C to +70°C
8-Pin SOIC Package	8-Pin Plastic Dip Package
ALD1101ASAL	ALD1101APAL
ALD1101BSAL	ALD1101BPAL
ALD1101SAL	ALD1101PAL

* Contact factory for high temperature versions.

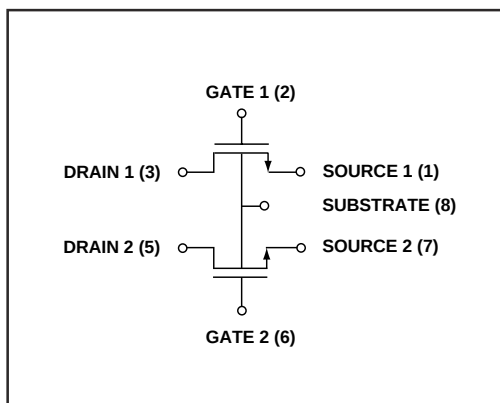
APPLICATIONS

- Precision current mirrors
- Precision current sources
- Analog switches
- Choppers
- Differential amplifier input stage
- Voltage comparator
- Data converters
- Sample and Hold
- Analog inverter

PIN CONFIGURATION



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Drain-source voltage, V_{DS} _____ 10V
 Gate-source voltage, V_{GS} _____ 10V
 Power dissipation _____ 500mW
 Operating temperature range SAL, PAL packages _____ 0°C to +70°C
 Storage temperature range _____ -65°C to +150°C
 Lead temperature, 10 seconds _____ +260°C

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

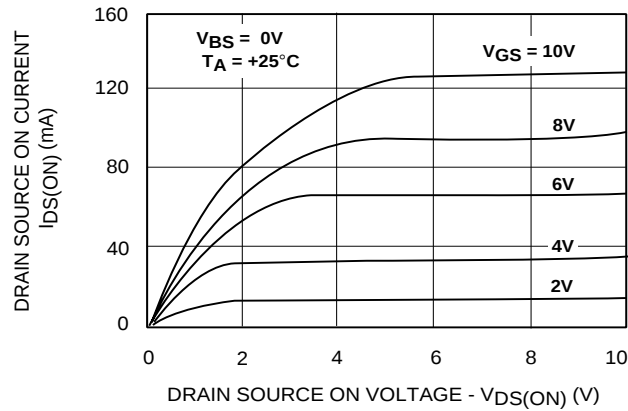
OPERATING ELECTRICAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$ unless otherwise specified

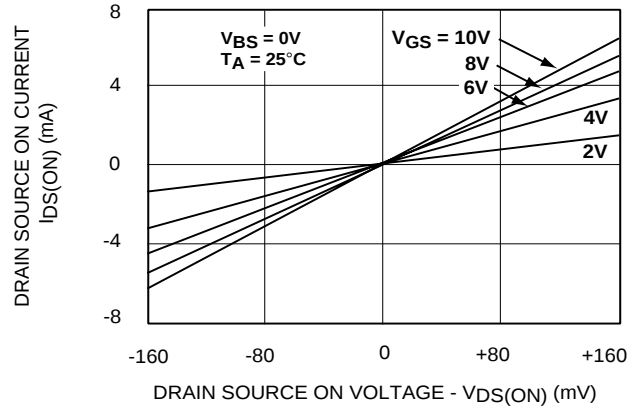
Parameter	Symbol	ALD1101A			ALD1101B			ALD1101			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Gate Threshold Voltage	V_T	0.4	0.7	1.0	0.4	0.7	1.0	0.4	0.7	1.0	V	$I_{DS} = 10\mu\text{A}$ $V_{GS} = V_{DS}$
Offset Voltage $V_{GS1} - V_{GS2}$	V_{OS}			2			5			10	mV	$I_{DS} = 100\mu\text{A}$ $V_{GS} = V_{DS}$
Gate Threshold Temperature Drift	TC_{VT}		-1.2			-1.2			-1.2		mV/°C	
On Drain Current	$I_{DS(ON)}$	25	40		25	40		25	40		mA	$V_{GS} = V_{DS} = 5\text{V}$
Transconductance	G_{fs}	5	10		5	10		5	10		mmho	$V_{DS} = 5\text{V}$ $I_{DS} = 10\text{mA}$
Mismatch	ΔG_{fs}		0.5			0.5			0.5		%	
Output Conductance	G_{OS}		200			200			200		μmho	$V_{DS} = 5\text{V}$ $I_{DS} = 10\text{mA}$
Drain Source ON Resistance	$R_{DS(ON)}$		50	75		50	75		50	75	Ω	$V_{DS} = 0.1\text{V}$ $V_{GS} = 5\text{V}$
Drain Source ON Resistance Mismatch	$\Delta R_{DS(ON)}$		0.5			0.5			0.5		%	$V_{DS} = 0.1\text{V}$ $V_{GS} = 5\text{V}$
Drain Source Breakdown Voltage	BV_{DSS}	10			10			10			V	$I_{DS} = 10\mu\text{A}$ $V_{GS} = 0\text{V}$
Off Drain Current	$I_{DS(OFF)}$		0.1	4 4		0.1	4 4		0.1	4 4	nA μA	$V_{DS} = 10\text{V}$ $V_{GS} = 0\text{V}$ $T_A = 125^\circ\text{C}$
Gate Leakage Current	I_{GSS}		1	100 10		1	100 10		1	100 10	pA nA	$V_{DS} = 0\text{V}$ $V_{GS} = 10\text{V}$ $T_A = 125^\circ\text{C}$
Input Capacitance	C_{ISS}		6	10		6	10		6	10	pF	

TYPICAL PERFORMANCE CHARACTERISTICS

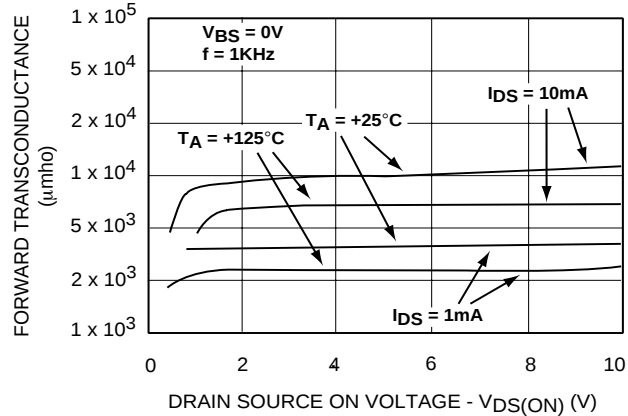
OUTPUT CHARACTERISTICS



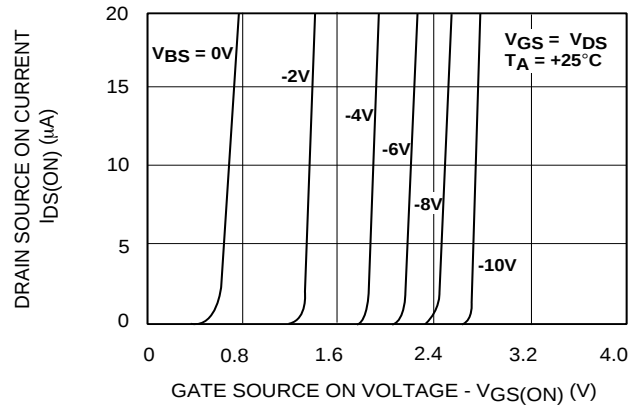
LOW VOLTAGE OUTPUT CHARACTERISTICS



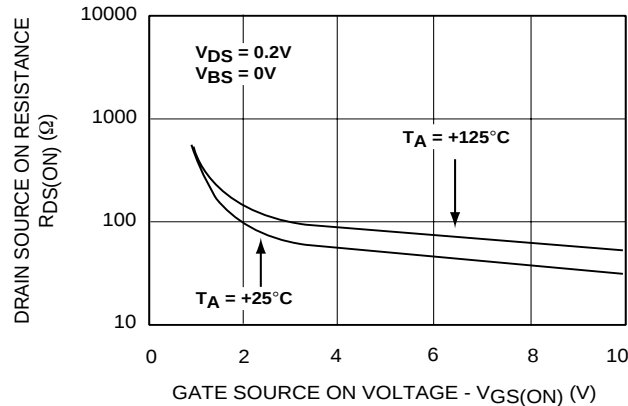
FORWARD TRANSCONDUCTANCE vs. DRAIN-SOURCE VOLTAGE



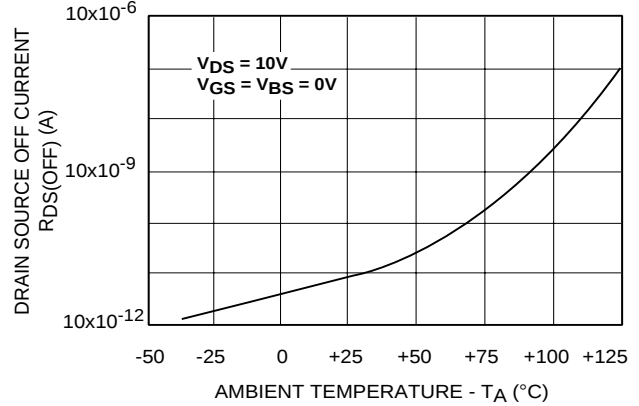
TRANSFER CHARACTERISTIC WITH SUBSTRATE BIAS



DRAIN SOURCE ON RESISTANCE vs. GATE-SOURCE VOLTAGE

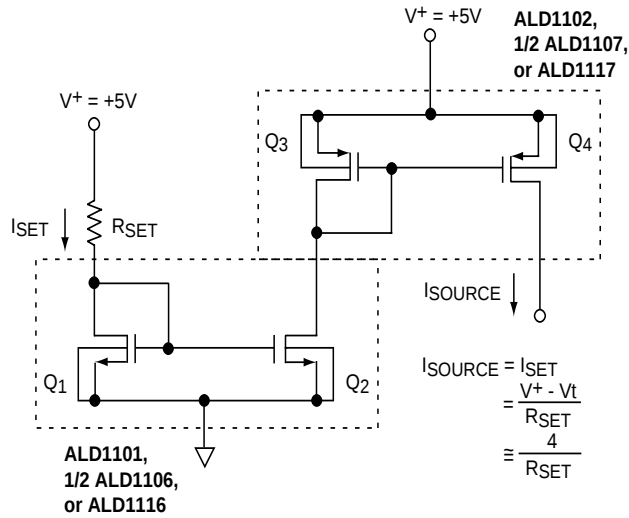


DRAIN SOURCE OFF CURRENT vs. AMBIENT TEMPERATURE



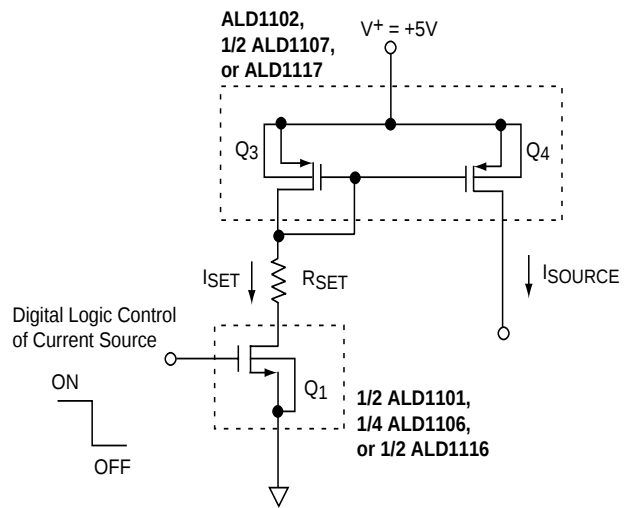
TYPICAL APPLICATIONS

CURRENT SOURCE MIRROR



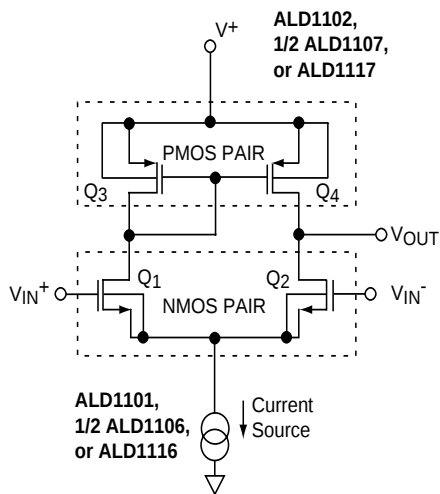
Q₁, Q₂: N-Channel MOSFET
Q₃, Q₄: P-Channel MOSFET

CURRENT SOURCE WITH GATE CONTROL



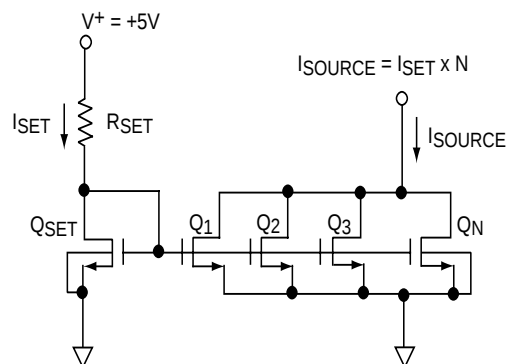
Q₁ : N-Channel MOSFET
Q₃, Q₄: P-Channel MOSFET

DIFFERENTIAL AMPLIFIER



Q₁, Q₂: N-Channel MOSFET
Q₃, Q₄: P-Channel MOSFET

CURRENT SOURCE MULTIPLICATION

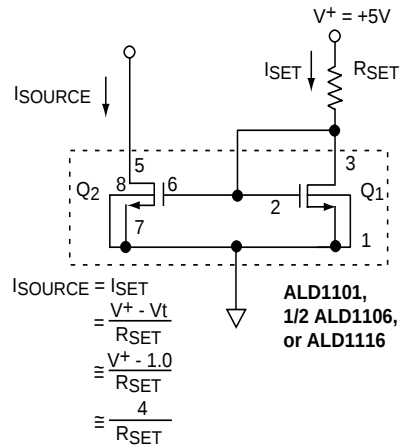


Q_{SET}, Q₁..Q_N: ALD1101, ALD1106, or ALD1116
N-Channel MOSFET

TYPICAL APPLICATIONS (cont.)

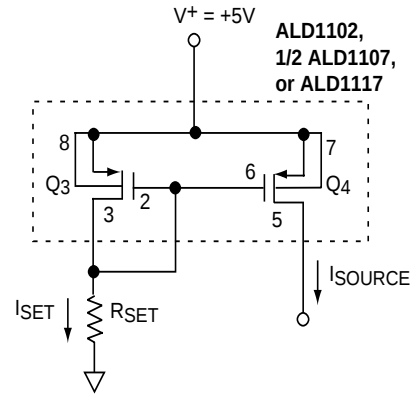
BASIC CURRENT SOURCES

N-CHANNEL CURRENT SOURCE



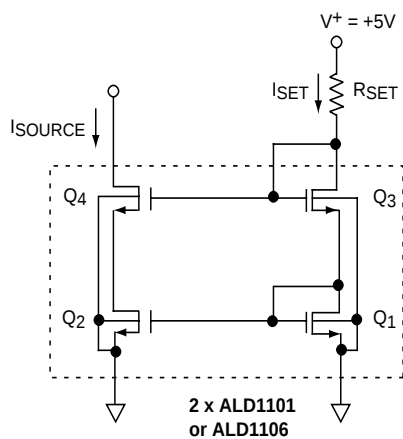
Q1, Q2: N-Channel MOSFET

P-CHANNEL CURRENT SOURCE

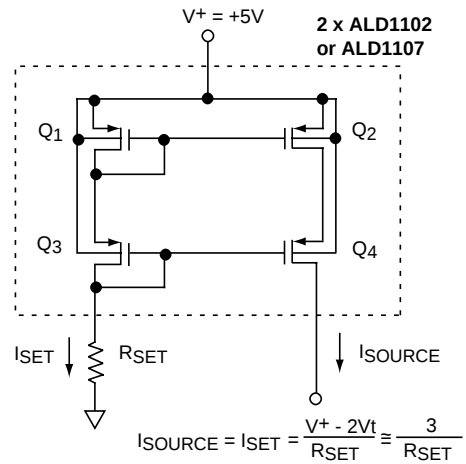


Q3, Q4: P-Channel MOSFET

CASCODE CURRENT SOURCES



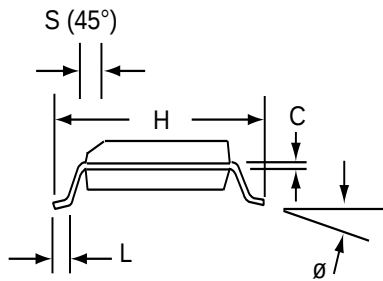
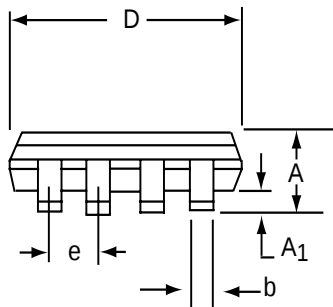
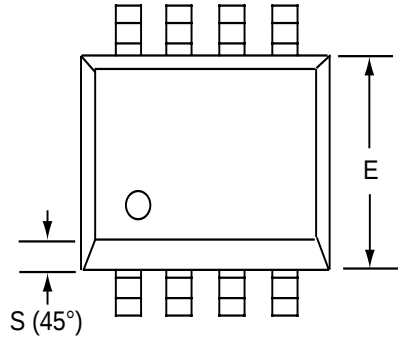
Q1, Q2, Q3, Q4: N-Channel MOSFET
(ALD1101 or ALD1103)



Q1, Q2, Q3, Q4: P-Channel MOSFET
(ALD1102 or ALD1103)

SOIC-8 PACKAGE DRAWING

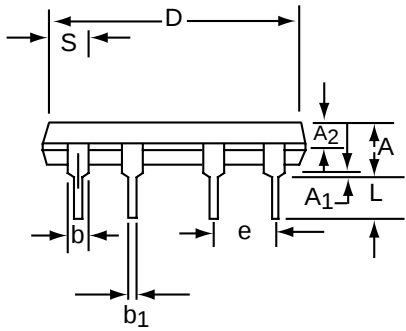
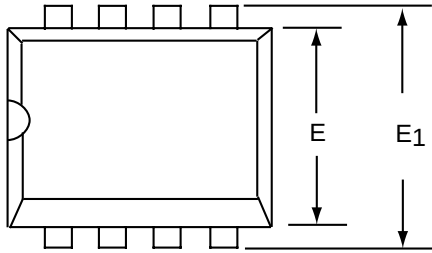
8 Pin Plastic SOIC Package



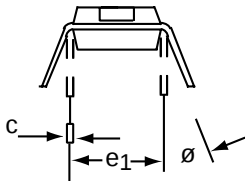
Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A ₁	0.10	0.25	0.004	0.010
b	0.35	0.45	0.014	0.018
C	0.18	0.25	0.007	0.010
D-8	4.69	5.00	0.185	0.196
E	3.50	4.05	0.140	0.160
e	1.27 BSC		0.050 BSC	
H	5.70	6.30	0.224	0.248
L	0.60	0.937	0.024	0.037
Ø	0°	8°	0°	8°
S	0.25	0.50	0.010	0.020

PDIP-8 PACKAGE DRAWING

8 Pin Plastic DIP Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	3.81	5.08	0.105	0.200
A ₁	0.38	1.27	0.015	0.050
A ₂	1.27	2.03	0.050	0.080
b	0.89	1.65	0.035	0.065
b ₁	0.38	0.51	0.015	0.020
c	0.20	0.30	0.008	0.012
D-8	9.40	11.68	0.370	0.460
E	5.59	7.11	0.220	0.280
E ₁	7.62	8.26	0.300	0.325
e	2.29	2.79	0.090	0.110
e ₁	7.37	7.87	0.290	0.310
L	2.79	3.81	0.110	0.150
S-8	1.02	2.03	0.040	0.080
Ø	0°	15°	0°	15°



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