



**THE DATASHEET OF  
ALD1117SAL**





## QUAD/DUAL P-CHANNEL MATCHED PAIR MOSFET ARRAY

### GENERAL DESCRIPTION

The ALD1107/ALD1117 are monolithic quad/dual P-channel enhancement mode matched MOSFET transistor arrays intended for a broad range of precision analog applications. The ALD1107/ALD1117 offer high input impedance and negative current temperature coefficient. The transistor pairs are matched for minimum offset voltage and differential thermal response, and they are designed for precision analog switching and amplifying applications in +2V to +12V systems where low input bias current, low input capacitance and fast switching speed are desired. These MOSFET devices feature very large (almost infinite) current gain in a low frequency, or near DC, operating environment. The ALD1107/ALD1117 are building blocks for differential amplifier input stages, transmission gates, and multiplexer applications, current sources and many precision analog circuits.

### FEATURES

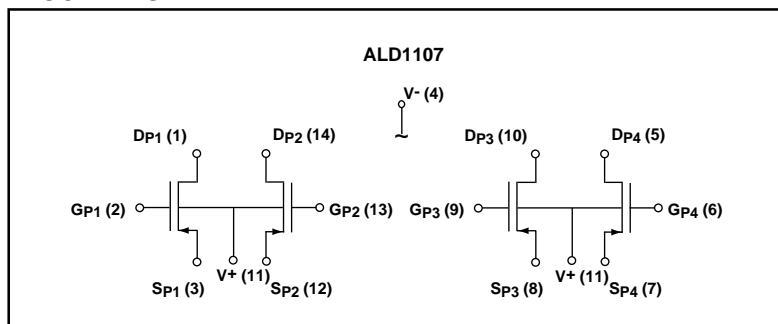
- Low threshold voltage of -0.7V
- Low input capacitance
- Low  $V_{os}$  2mV typical
- High input impedance -- 1014Ω typical
- Negative current ( $I_{DS}$ ) temperature coefficient
- Enhancement-mode (normally off)
- DC current gain 10<sup>9</sup>
- Low input and output leakage currents
- RoHS compliant

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

Operating Temperature Range*		
0°C to +70°C	0°C to +70°C	-55°C to +125°C
8-Pin SOIC Package	8-Pin Plastic Dip Package	8-Pin CERDIP Package
ALD1117SAL	ALD1117PAL	ALD1117DA
14-Pin SOIC Package	14-Pin Plastic Dip Package	14-Pin CERDIP Package
ALD1107SBL	ALD1107PBL	ALD1107DB

\* Contact factory for leaded (non-RoHS) or high temperature versions.

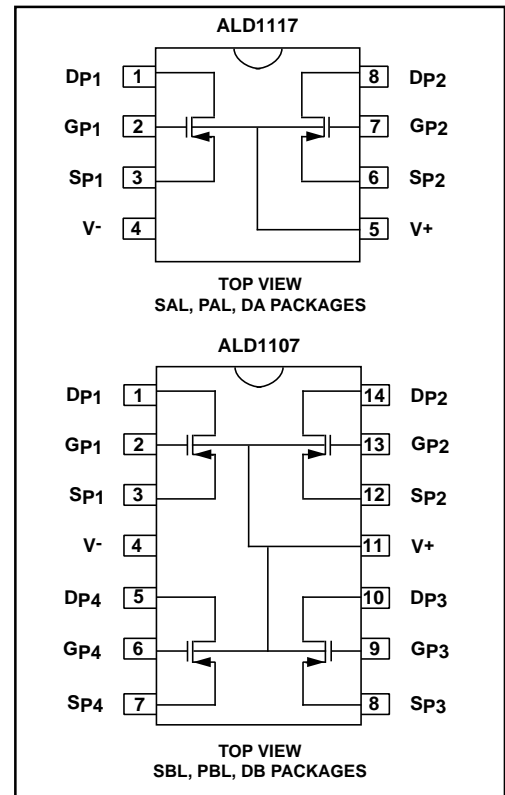
### BLOCK DIAGRAM



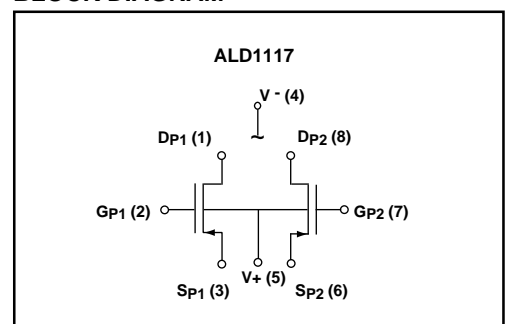
### APPLICATIONS

- Precision current mirrors
- Precision current sources
- Voltage choppers
- Differential amplifier input stage
- Voltage comparator
- Data converters
- Sample and Hold
- Analog signal processing

### PIN CONFIGURATION



### BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Drain-source voltage,  $V_{DS}$  \_\_\_\_\_ -10.6V  
 Gate-source voltage,  $V_{GS}$  \_\_\_\_\_ -10.6V  
 Power dissipation \_\_\_\_\_ 500mW  
 Operating temperature range SAL, PAL, SBL, PBL packages \_\_\_\_\_ 0°C to +70°C  
 DA, DB packages \_\_\_\_\_ -55°C to +125°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

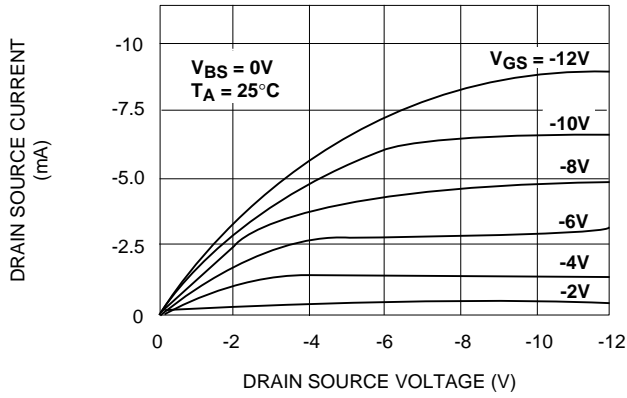
Parameter	Symbol	ALD1107			ALD1117			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max		
Gate Threshold Voltage	$V_T$	-0.4	-0.7	-1.0	-0.4	-0.7	-1.0	V	$I_{DS} = -1.0\mu\text{A}$ $V_{GS} = V_{DS}$
Offset Voltage $V_{GS1} - V_{GS2}$	$V_{OS}$		2	10		2	10	mV	$I_{DS} = -10\mu\text{A}$ $V_{GS} = V_{DS}$
Gate Threshold Temperature Drift <sup>2</sup>	$TC_{VT}$		-1.3			-1.3		mV/°C	
On Drain Current	$I_{DS(ON)}$	-1.3	-2		-1.3	-2		mA	$V_{GS} = V_{DS} = -5\text{V}$
Transconductance	$G_{IS}$	0.25	0.67		0.25	0.67		mmho	$V_{DS} = -5\text{V}$ $I_{DS} = -10\text{mA}$
Mismatch	$\Delta G_{fs}$		0.5			0.5		%	
Output Conductance	$G_{OS}$		40			40		$\mu\text{mho}$	$V_{DS} = -5\text{V}$ $I_{DS} = -10\text{mA}$
Drain Source On Resistance	$R_{DS(ON)}$		1200	1800		1200	1800	$\Omega$	$V_{DS} = -0.1\text{V}$ $V_{GS} = -5\text{V}$
Drain Source On Resistance Mismatch	$\Delta R_{DS(ON)}$		0.5			0.5		%	$V_{DS} = -0.1\text{V}$ $V_{GS} = -5\text{V}$
Drain Source Breakdown Voltage	$BV_{DSS}$	-12			-12			V	$I_{DS} = -1.0\mu\text{A}$ $V_{GS} = 0\text{V}$
Off Drain Current <sup>1</sup>	$I_{DS(OFF)}$		10	400 4		10	400 4	pA nA	$V_{DS} = -12\text{V}$ $V_{GS} = 0\text{V}$ $T_A = 125^\circ\text{C}$
Gate Leakage Current	$I_{GSS}$		0.1	10 1		0.1	10 1	pA nA	$V_{DS} = 0\text{V}$ $V_{GS} = -12\text{V}$ $T_A = 125^\circ\text{C}$
Input Capacitance <sup>2</sup>	$C_{ISS}$		1	3		1	3	pF	

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

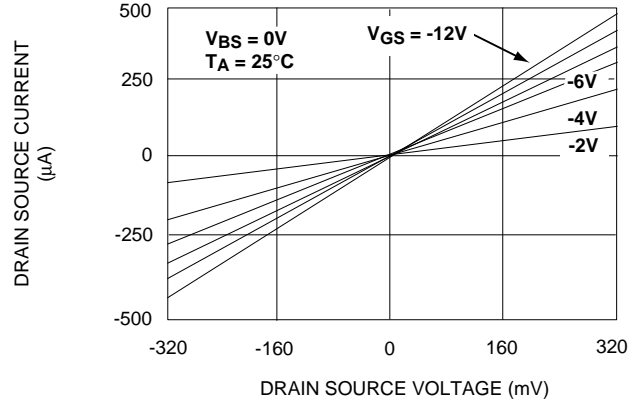
<sup>2</sup> Sample tested parameters

# TYPICAL PERFORMANCE CHARACTERISTICS

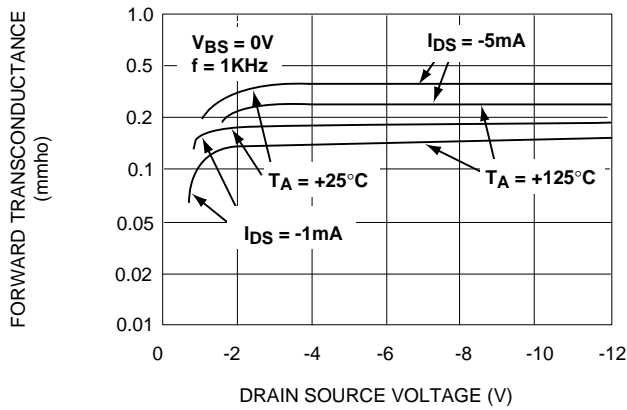
## OUTPUT CHARACTERISTICS



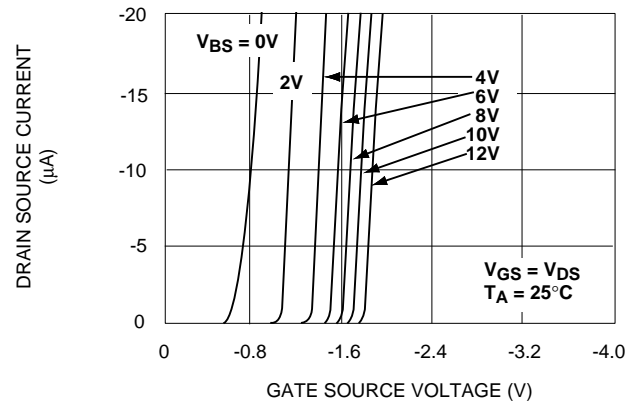
## LOW VOLTAGE OUTPUT CHARACTERISTICS



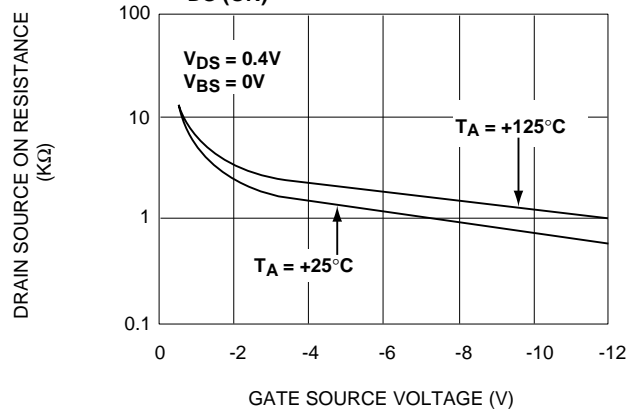
## FORWARD TRANSCONDUCTANCE vs. DRAIN SOURCE VOLTAGE



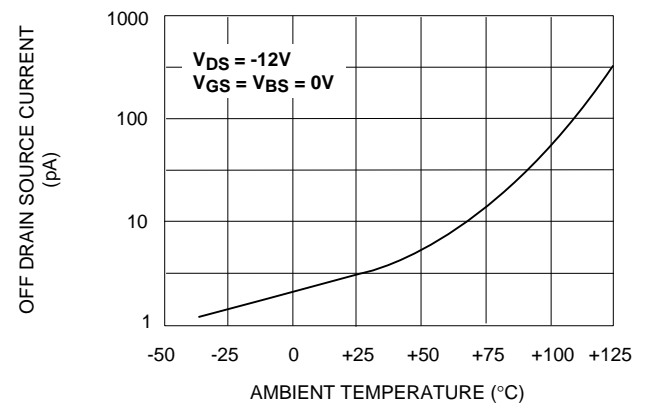
## TRANSFER CHARACTERISTIC WITH SUBSTRATE BIAS



## DRAIN SOURCE ON RESISTANCE $R_{DS(ON)}$ vs. GATE SOURCE VOLTAGE

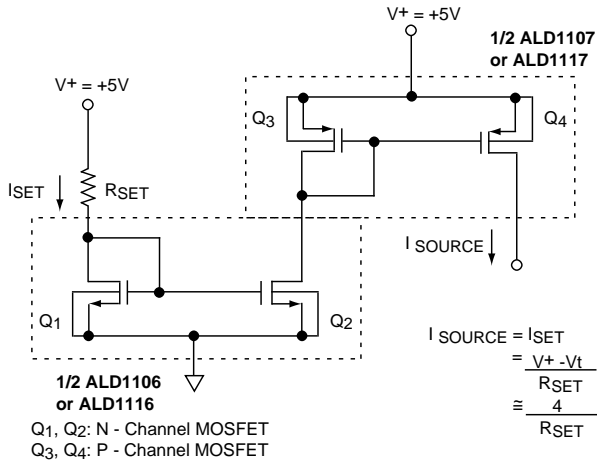


## OFF DRAIN CURRENT vs. AMBIENT TEMPERATURE

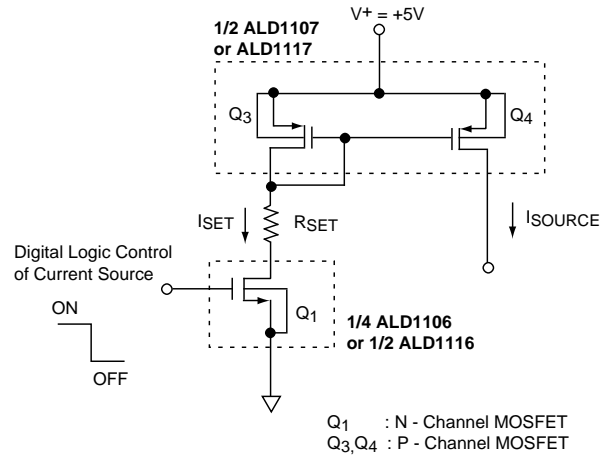


# TYPICAL APPLICATIONS

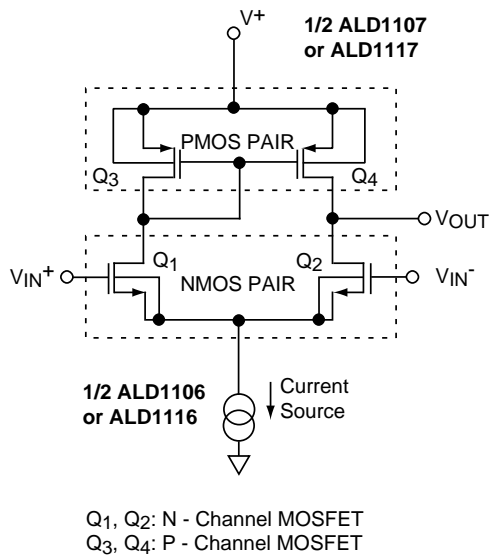
## CURRENT SOURCE MIRROR



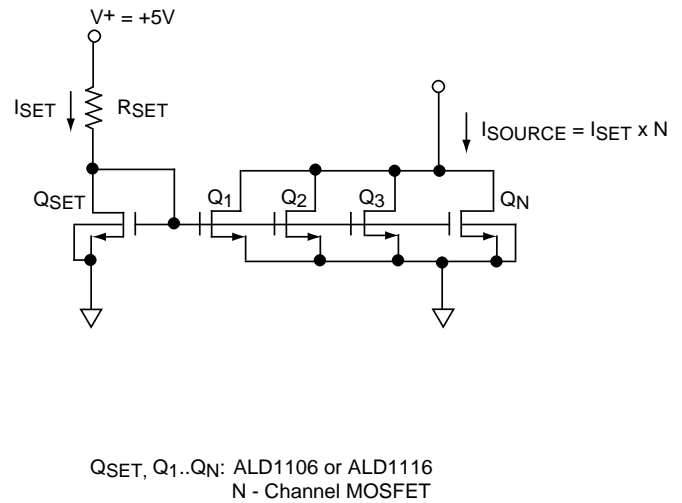
## CURRENT SOURCE WITH GATE CONTROL



## DIFFERENTIAL AMPLIFIER



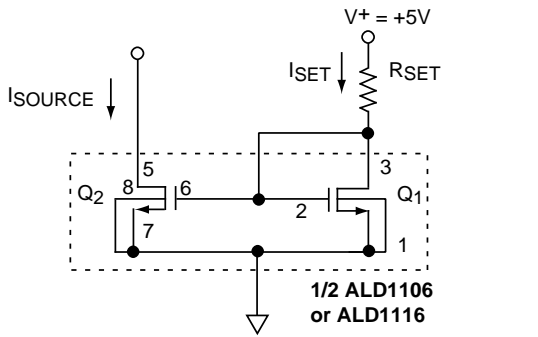
## CURRENT SOURCE MULTIPLICATION



## TYPICAL APPLICATIONS (cont.)

### BASIC CURRENT SOURCES

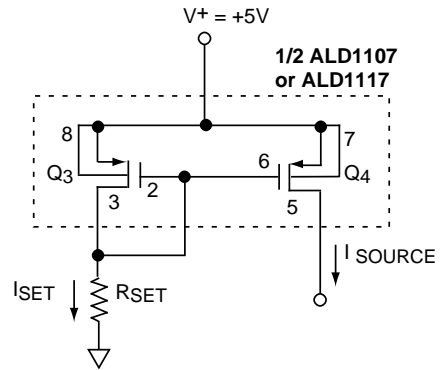
#### N- CHANNEL CURRENT SOURCE



$$I_{SOURCE} = I_{SET} = \frac{V^+ - V_t}{R_{SET}} \cong \frac{V^+ - 1.0}{R_{SET}} \cong \frac{4}{R_{SET}}$$

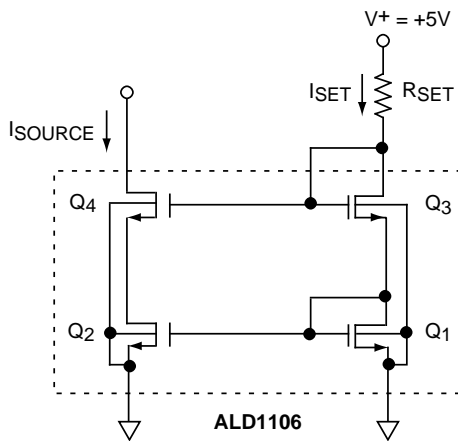
Q<sub>1</sub>, Q<sub>2</sub> : N - Channel MOSFET

#### P- CHANNEL CURRENT SOURCE

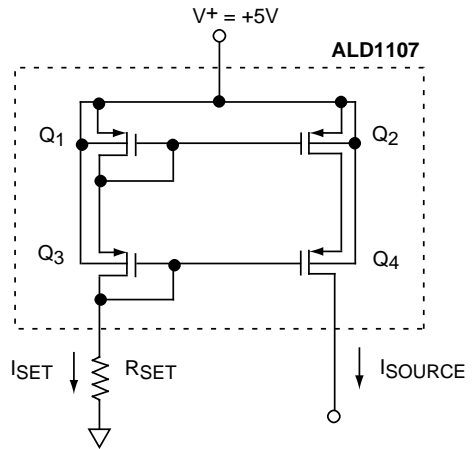


Q<sub>3</sub>, Q<sub>4</sub>: P - Channel MOSFET

### CASCODE CURRENT SOURCES



Q<sub>1</sub>, Q<sub>2</sub>, Q<sub>3</sub>, Q<sub>4</sub>: N - Channel MOSFET  
(ALD1101 or ALD1103)

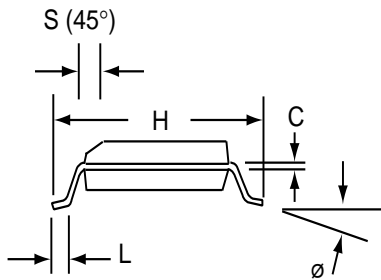
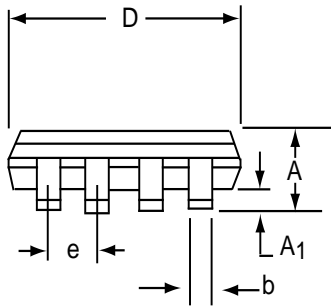
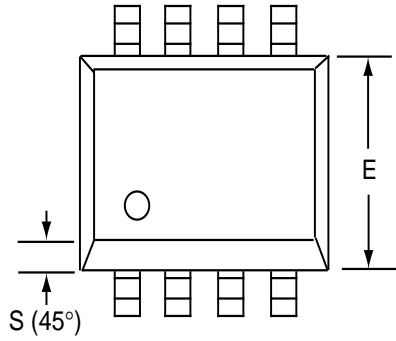


$$I_{SOURCE} = I_{SET} = \frac{V^+ - 2V_t}{R_{SET}} \cong \frac{3}{R_{SET}}$$

Q<sub>1</sub>, Q<sub>2</sub>, Q<sub>3</sub>, Q<sub>4</sub>: P - Channel MOSFET  
(ALD1102 or ALD1103)

# SOIC-8 PACKAGE DRAWING

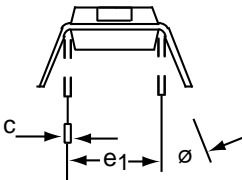
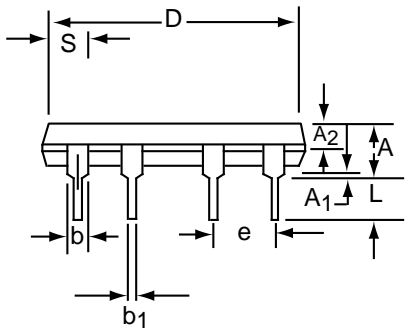
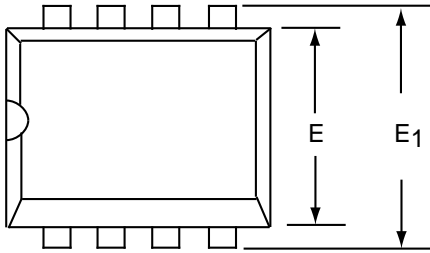
## 8 Pin Plastic SOIC Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A <sub>1</sub>	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
∅	0°	8°	0°	8°
S	0.25	0.50	0.010	0.020

# PDIP-8 PACKAGE DRAWING

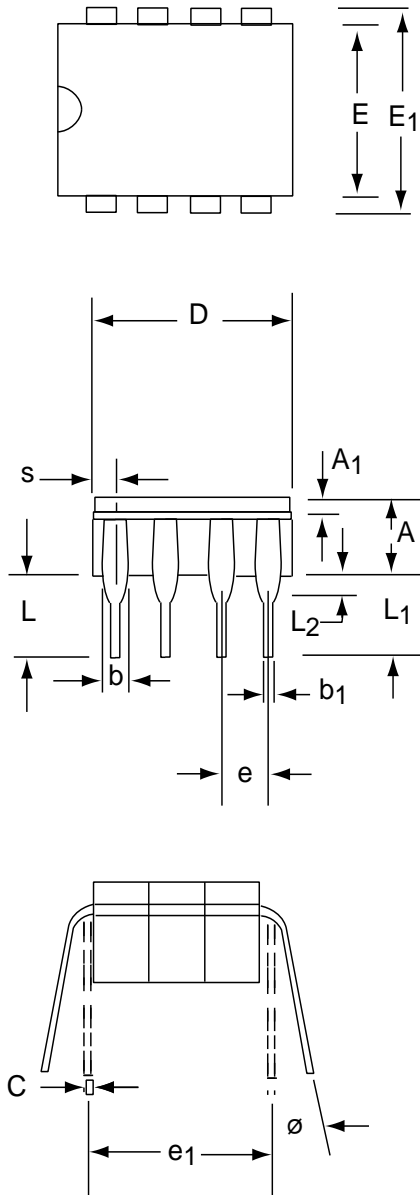
## 8 Pin Plastic DIP Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	3.81	5.08	0.105	0.200
A <sub>1</sub>	0.38	1.27	0.015	0.050
A <sub>2</sub>	1.27	2.03	0.050	0.080
b	0.89	1.65	0.035	0.065
b <sub>1</sub>	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 <sub>1</sub>	7.62	8.26	0.300	0.325
e	2.29	2.79	0.090	0.110
e <sub>1</sub>	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°

# CERDIP-8 PACKAGE DRAWING

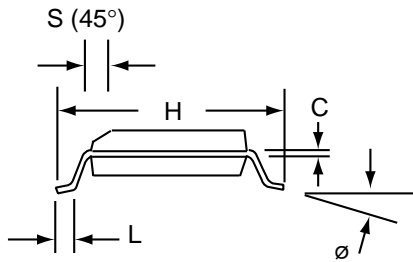
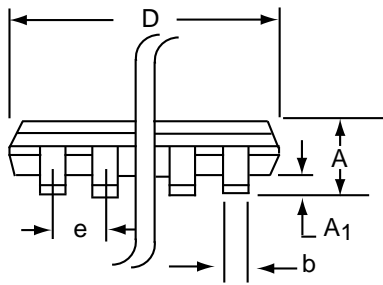
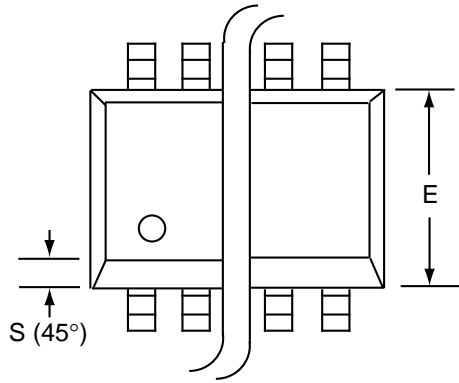
## 8 Pin CERDIP Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	3.55	5.08	0.140	0.200
A <sub>1</sub>	1.27	2.16	0.050	0.085
b	0.97	1.65	0.038	0.065
b <sub>1</sub>	0.36	0.58	0.014	0.023
C	0.20	0.38	0.008	0.015
D-8	--	10.29	--	0.405
E	5.59	7.87	0.220	0.310
E <sub>1</sub>	7.73	8.26	0.290	0.325
e	2.54 BSC		0.100 BSC	
e <sub>1</sub>	7.62 BSC		0.300 BSC	
L	3.81	5.08	0.150	0.200
L <sub>1</sub>	3.18	--	0.125	--
L <sub>2</sub>	0.38	1.78	0.015	0.070
S	--	2.49	--	0.098
∅	0°	15°	0°	15°

# SOIC-14 PACKAGE DRAWING

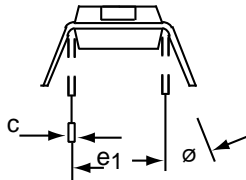
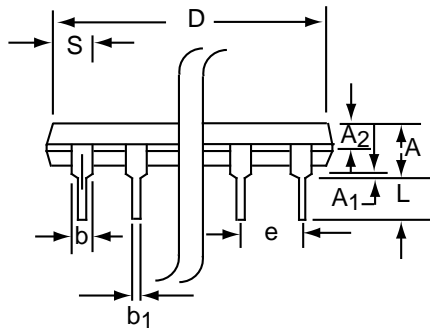
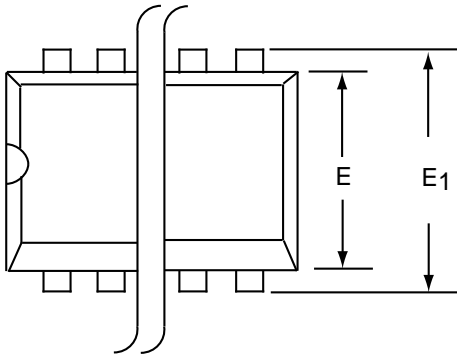
## 14 Pin Plastic SOIC Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A <sub>1</sub>	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-14	8.55	8.75	0.336	0.345
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-14 PACKAGE DRAWING

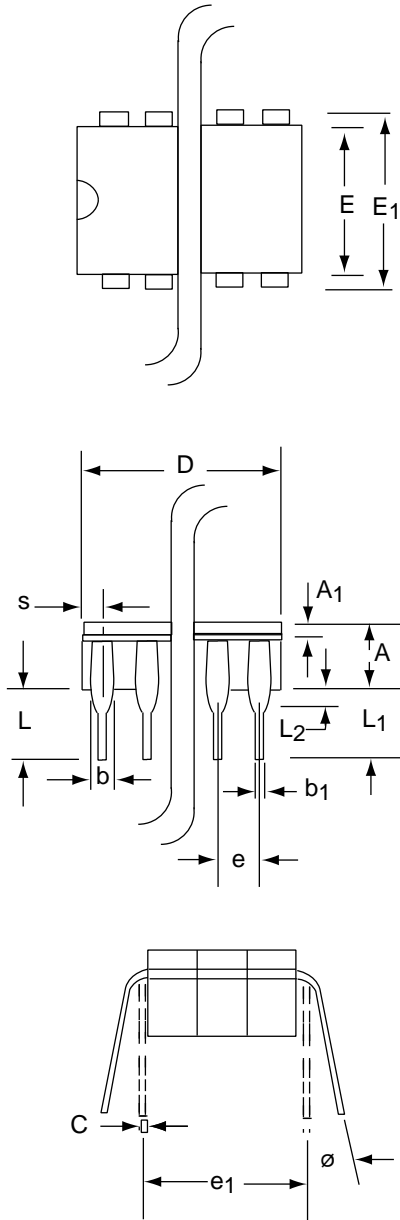
## 14 Pin Plastic DIP Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
A	3.81	5.08	0.105	0.200
A <sub>1</sub>	0.38	1.27	0.015	0.050
A <sub>2</sub>	1.27	2.03	0.050	0.080
b	0.89	1.65	0.035	0.065
b <sub>1</sub>	0.38	0.51	0.015	0.020
c	0.20	0.30	0.008	0.012
D-14	17.27	19.30	0.680	0.760
E	5.59	7.11	0.220	0.280
E <sub>1</sub>	7.62	8.26	0.300	0.325
e	2.29	2.79	0.090	0.110
e <sub>1</sub>	7.37	7.87	0.290	0.310
L	2.79	3.81	0.110	0.150
S-14	1.02	2.03	0.040	0.080
ø	0°	15°	0°	15°

# CERDIP-14 PACKAGE DRAWING

## 14 Pin CERDIP Package



Dim	Millimeters		Inches	
	Min	Max	Min	Max
<b>A</b>	3.55	5.08	0.140	0.200
<b>A<sub>1</sub></b>	1.27	2.16	0.050	0.085
<b>b</b>	0.97	1.65	0.038	0.065
<b>b<sub>1</sub></b>	0.36	0.58	0.014	0.023
<b>C</b>	0.20	0.38	0.008	0.015
<b>D-14</b>	--	19.94	--	0.785
<b>E</b>	5.59	7.87	0.220	0.310
<b>E<sub>1</sub></b>	7.73	8.26	0.290	0.325
<b>e</b>	2.54 BSC		0.100 BSC	
<b>e<sub>1</sub></b>	7.62 BSC		0.300 BSC	
<b>L</b>	3.81	5.08	0.150	0.200
<b>L<sub>1</sub></b>	3.18	--	0.125	--
<b>L<sub>2</sub></b>	0.38	1.78	0.015	0.070
<b>S</b>	--	2.49	--	0.098
<b>∅</b>	0°	15°	0°	15°

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