

# High-Efficiency, Step-Up DC/DC Controller

## FEATURES

- 4V to 20V Input Voltage Operation.
- Adjustable Output Voltage.
- Low Quiescent Current at 100 $\mu$ A.
- Pulse-Skipping and Pulse-Frequency Modulation Maintain High Efficiency (max. 95%).
- 90KHz to 250KHz Oscillator Frequency.
- Power-Saving Shutdown Mode (8 $\mu$ A Typical).
- Push-Pull Driver Output.
- V<sub>REF</sub> Pin Available.
- Current Limit Function Available.

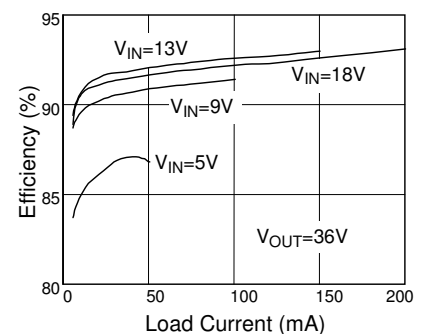
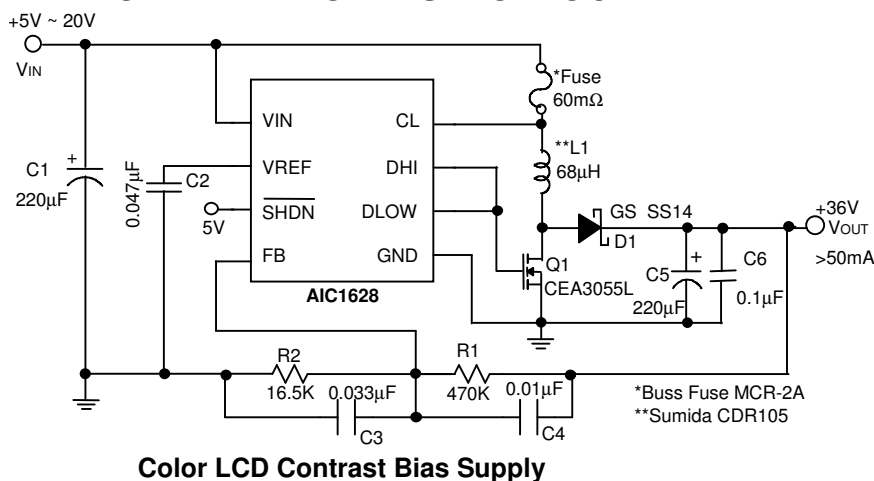
## APPLICATIONS

- Flash Memory Programming Power Supply.
- Positive LCD Contrast Bias for Notebook & Palmtop Computers.
- Step-Up DC/DC Converter Module.
- Telecom Power Supply.

## DESCRIPTION

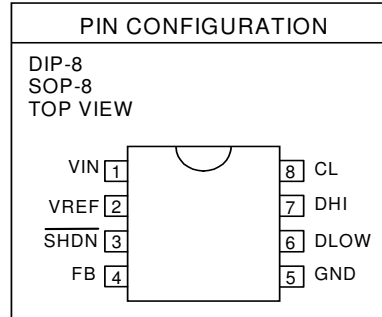
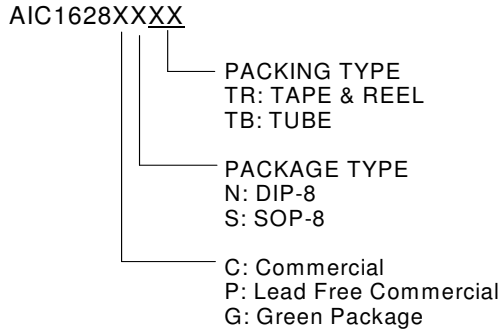
The AIC1628 is a high performance step-up DC/DC controller, designed to drive an external power switch to generate programmable positive voltages. In the particularly suitable LCD contrast bias and flash memory programming power supply applications, typical full-load efficiencies are 85% to 95%. 4V to 20V input operation range allows the AIC1628 to be powered directly by the battery pack in the most battery-operated applications for greater efficiency. Output voltage can be scaled to 40V or greater by two external resistors. A Pulse-Frequency Modulation scheme is employed to maintain high efficiency conversion under wide input voltage range. Quiescent current is about 100 $\mu$ A and can be reduced to 8 $\mu$ A in shutdown mode. Switching frequency being around 90KHz to 250KHz range, small size switching components are ideal for battery powered portable equipments, like notebook and palmtop computers.

## TYPICAL APPLICATION CIRCUIT



**Efficiency vs. Output Current**

**ORDERING INFORMATION**



EX: AIC1628CSTR  
 → in SOP-8 Package & Tape & Reel Packing Type  
 (CN is not available in TR packing type.)  
 AIC1628PSTR  
 → in SOP-8 Lead Free Package & Tape & Reel  
 Packing Type

**ABSOLUTE MAXIMUM RATINGS**

VIN Supply Voltage (VIN Pin) .....	20V
SHDN Pin Voltage .....	15V
Operating Temperature Range .....	-40°C ~ 85°C
Junction Temperature .....	125°C
Storage Temperature Range .....	-65°C~ 150°C
Lead Temperature (Soldering, 10 sec) .....	260°C

**Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.**

**TEST CIRCUIT**

Refer to Typical Application Circuit

**ELECTRICAL CHARACTERISTICS** ( $V_{IN}= 13V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.) (Note1)

PARAMETERS	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Input Voltage		4		20	V
Quiescent Current	$V_{FB} = 1.5V$		100	200	$\mu A$
Shutdown Mode Current	$V_{\overline{SHDN}} = 0V$		8	20	$\mu A$
$V_{REF}$ Voltage	$I_{SOURCE} = 250\mu A$	1.16	1.22	1.28	V
$V_{REF}$ Source Current		250			$\mu A$
DLOW "ON Resistance"			15		$\Omega$
DHI "ON Resistance"			10		$\Omega$
CL Threshold	$V_{IN} - V_{CL}$	50	70	90	mV
Shutdown Threshold		0.8	1.5	2.4	V
Shutdown Input Leakage Current	$V_{\overline{SHDN}} < 15V$			1	$\mu A$

**Note 1:** Specifications are production tested at  $T_A=25^{\circ}C$ . Specifications over the  $-40^{\circ}C$  to  $85^{\circ}C$  operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

**TYPICAL PERFORMANCE CHARACTERISTICS**

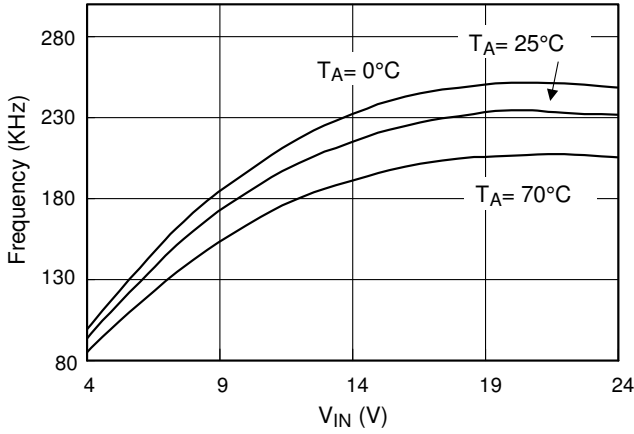


Fig. 1 Frequency vs. V<sub>IN</sub> Voltage

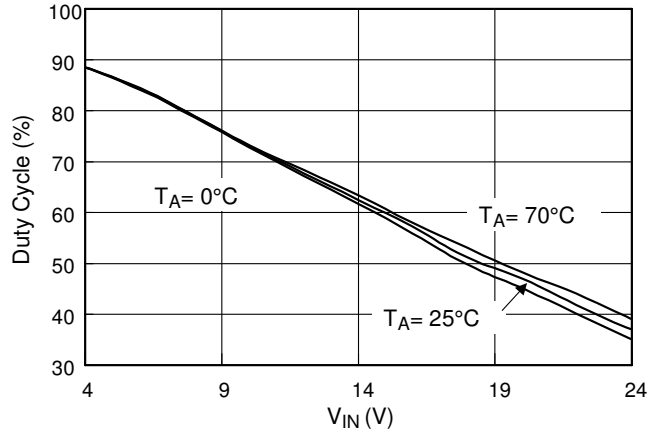


Fig. 2 Duty Cycle vs. V<sub>IN</sub> Voltage

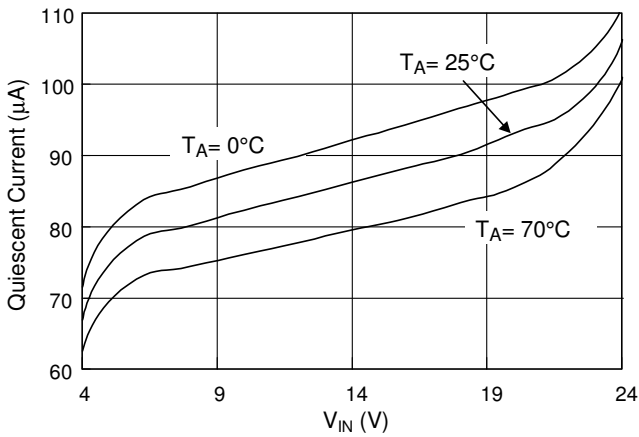


Fig. 3 Quiescent Current vs. V<sub>IN</sub> Voltage

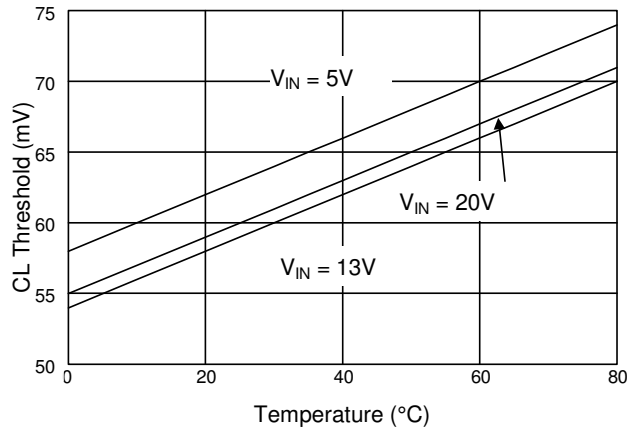


Fig. 4 Current Limit Threshold vs. Temperature

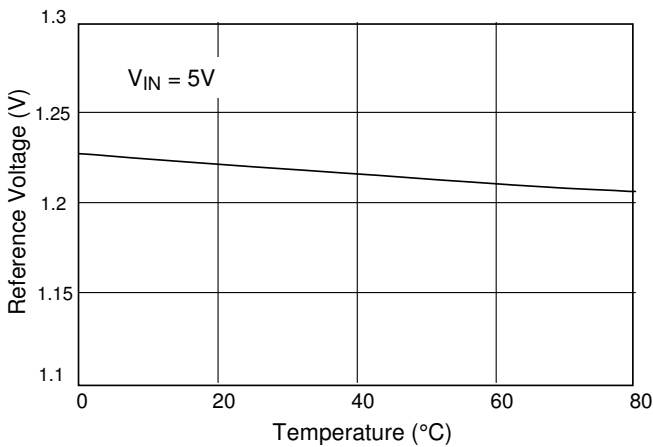
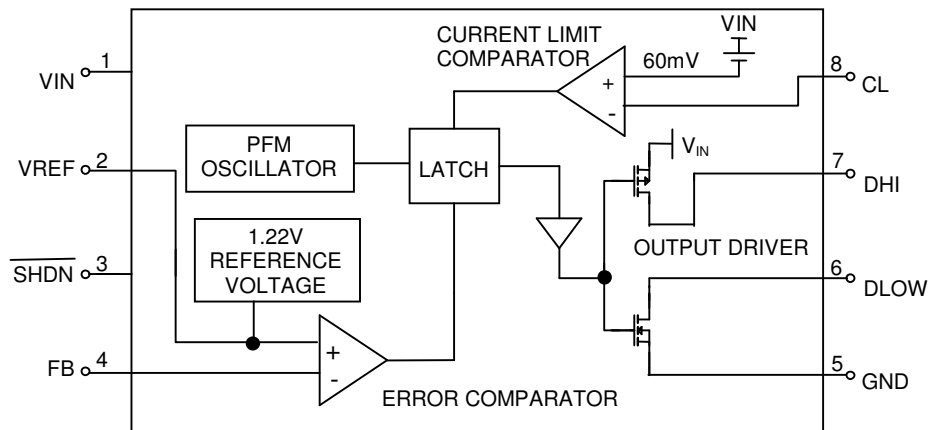


Fig. 5 Reference Voltage vs. Temperature

## ■ BLOCK DIAGRAM



## ■ PIN DESCRIPTIONS

PIN 1: VIN - Input supply voltage is from 4V to 20V.

PIN 2: VREF - Reference output is 1.22V. Bypass with a 0.047 $\mu$ F capacitor to GND. Sourcing capability is guaranteed to be greater than 250 $\mu$ A.

PIN 3:  $\overline{\text{SHDN}}$  - Logical input to shutdown the chip.  
 >1.5V = normal operation,  
 GND = Shutdown,  
 Cannot be floating or forced greater than 15V. In shutdown mode DLOW and DHI pins are at low level.

PIN 4: FB - Feedback signal input to sense VREF. Connecting a resistor R1 to  $V_{\text{OUT}}$  and a resistor R2 to GND yields the output voltage:

$$V_{\text{OUT}} = (R1+R2)/R2 \times V_{\text{REF}}$$

(Refer to typical application circuit)

PIN 5: GND - Power ground.

PIN 6: DLOW- Connected to gate of the external N-channel MOSFET or base of the NPN bipolar transistor.

PIN 7: DHI - Driver sourcing output. Connected to DLOW when using an external N-channel MOSFET. When using an external NPN bipolar transistor, connect a base resistor RB from this pin to DLOW. RB value depends on  $V_{\text{IN}}$ , inductor and NPN current gain.

PIN 8: CL - Current-limit input. Threshold voltage is 60mV from  $V_{\text{IN}}$ . This pin clamps the switch peak current to prevent over-current damage to the external switch, under abnormal conditions.

APPLICATION EXAMPLES

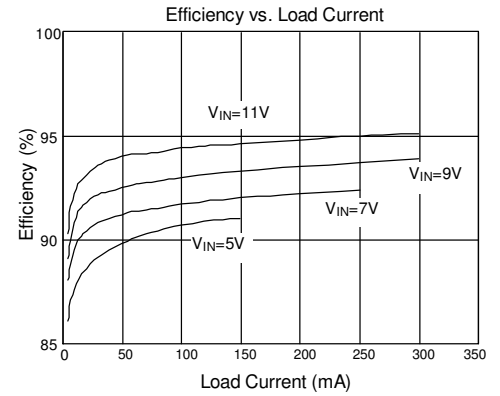
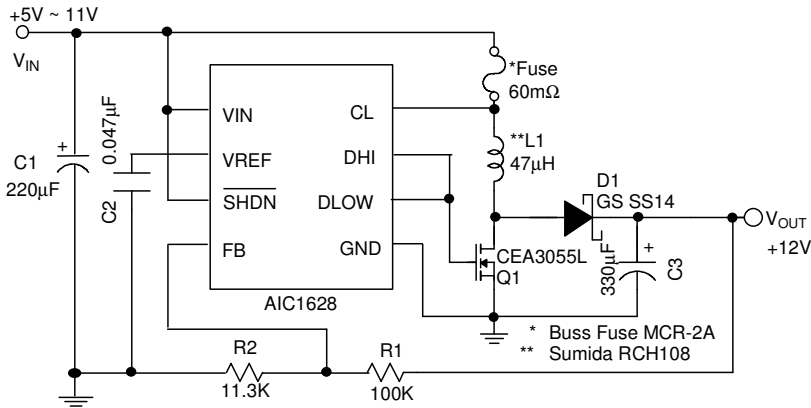


Fig. 6 Flash memory Programming Supply

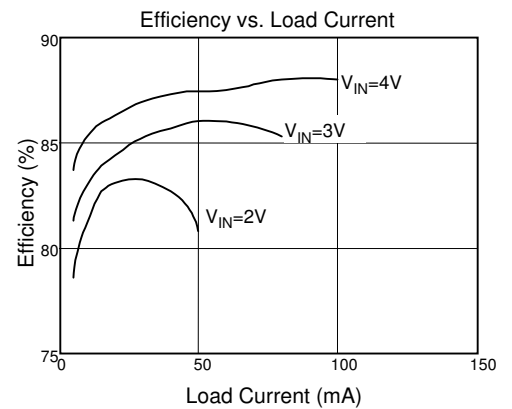
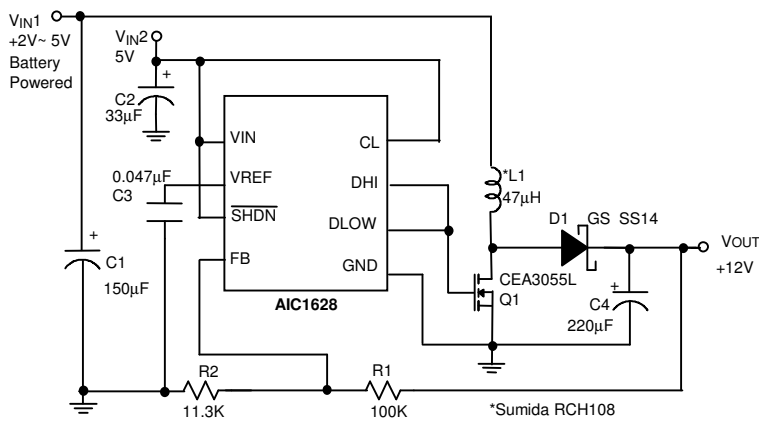


Fig. 7 2-Cells to +12V Flash Memory Programmer

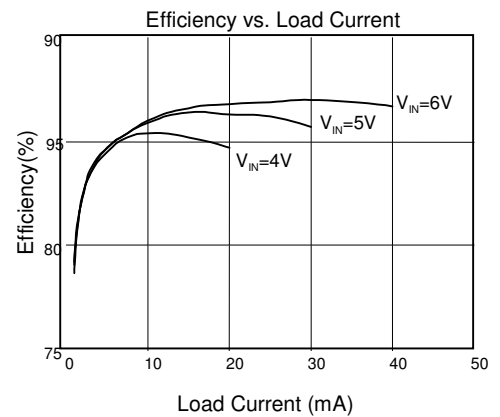
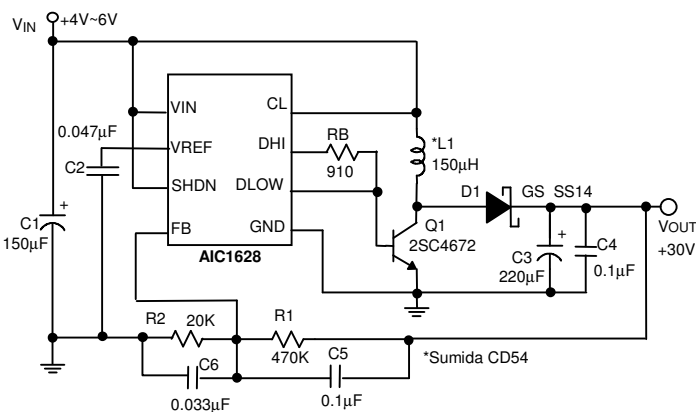


Fig. 8 4-Cells to +30V Power Supply

APPLICATION EXAMPLES (Continued)

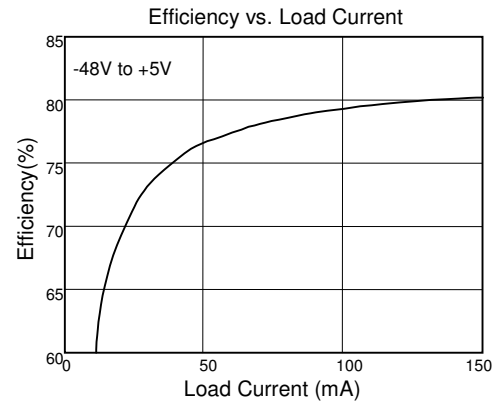
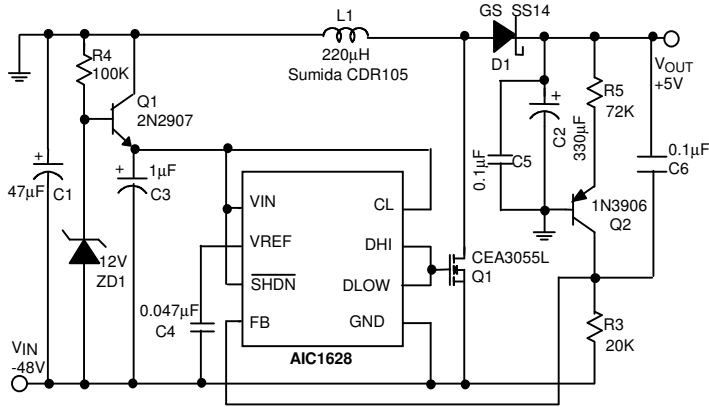


Fig. 9 Telecom +5V Supply

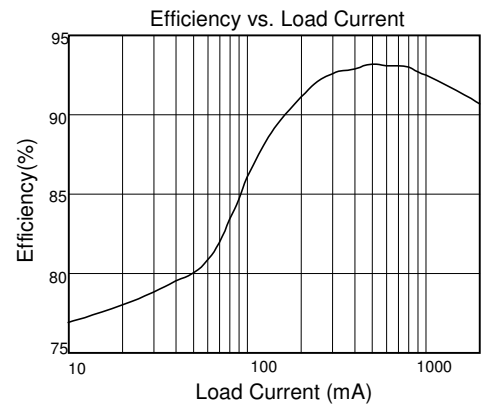
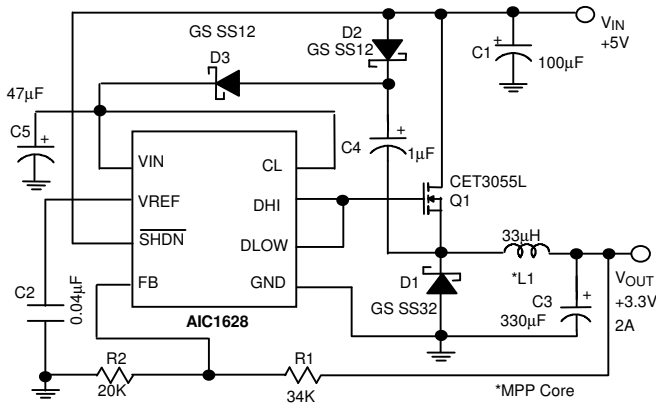
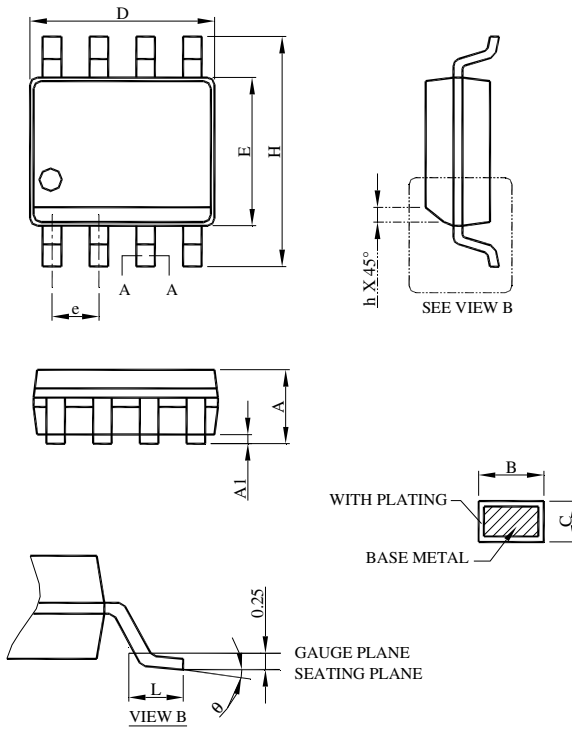


Fig. 10 5V to 3.3V Step-Down Converter

■ PHYSICAL DIMENSIONS (unit: mm)

● SOP-8



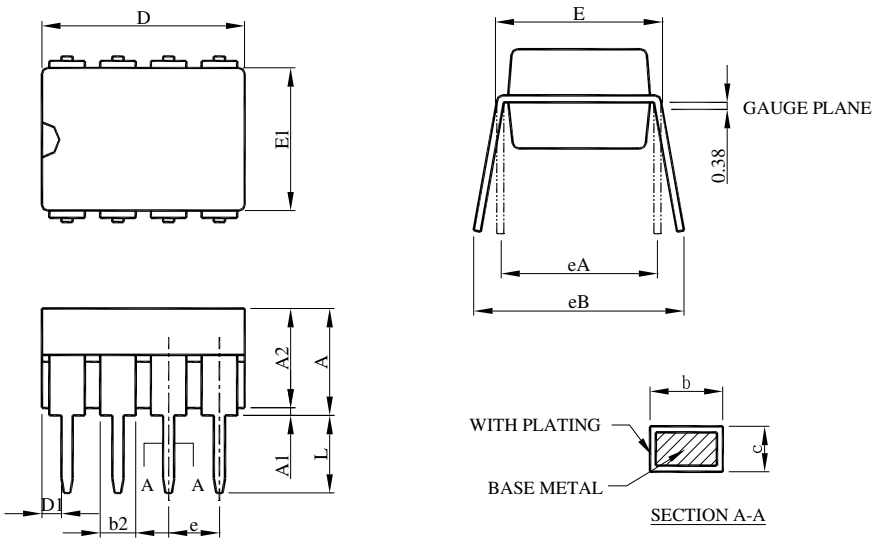
SYMBOL	SOP-8	
	MILLIMETERS	
	MIN.	MAX.
A	1.35	1.75
A1	0.10	0.25
B	0.33	0.51
C	0.19	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.27
$\theta$	0°	8°

Note:

- 1.Refer to JEDEC MS-012AA.
- 2.Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.
- 3.Dimension "E" does not include inter-lead flash or protrusions. Inter-lead flash or protrusion shall not exceed 10 mil per side.
- 4.Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.



● DIP-8



SYMBOL	DIP-8	
	MILLIMETERS	
	MIN.	MAX.
A		5.33
A1	0.38	
A2	2.92	4.95
b	0.36	0.56
b2	1.14	1.78
c	0.20	0.35
D	9.01	10.16
D1	0.13	
E	7.62	8.26
E1	6.10	7.11
e	2.54 BSC	
eA	7.62 BSC	
eB		10.92
L	2.92	3.81

Note:

- 1.Refer to JEDEC MS-001BA.
- 2.Dimension D, D1 and E1 do not include mold flash or protrusions. Mold flash or protrusion shall not exceed 10 mil.
- 3.Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

Note:

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