FEATURES

- Low Output Noise: 2mV Ripple.
- Work with Small Capacitors (as Low as 0.22µF).
- Fixed -2V or Adjustable Output.
- 2.5V to 6.5V Input Voltage Range.
- Switching Frequency: 104KHz in Normal Operation.
- 1µA Maximum in Shutdown Mode.

APPLICATIONS

- Cellular Phones.
- GaAsFET Power Amplifier Modules.
- Personal Communicators and PDAs.
- Wireless Data Loggers.
- LCD Bias Contrast Control.
- Regulated Negative Power Supplies.

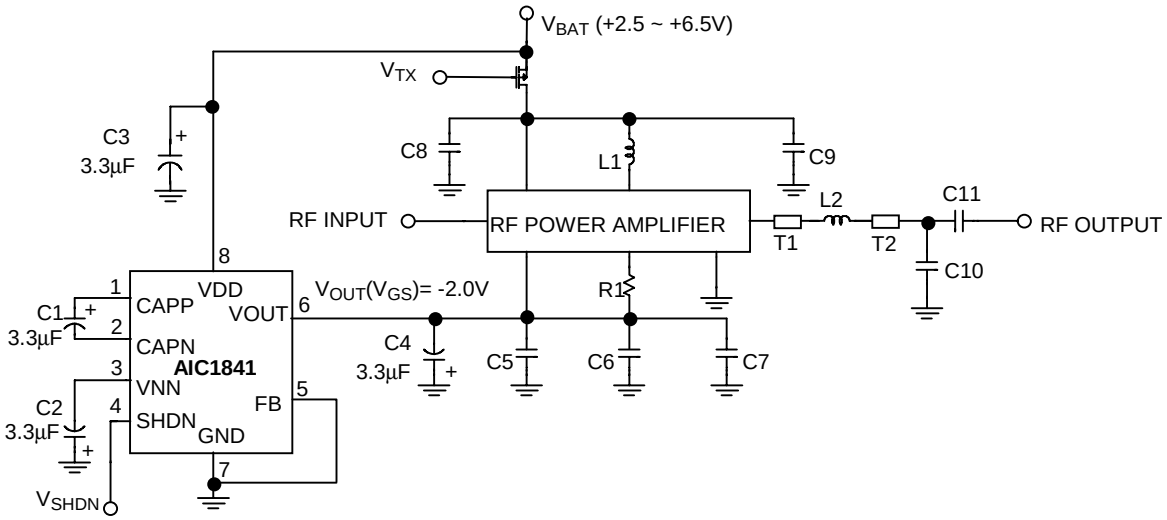
DESCRIPTION

The AIC1840/1841 is a switched-capacitor voltage inverter that generates a regulated fixed -2.0V or externally adjustable output. An internal linear post-regulator reduces the output voltage ripple to less than 2mV, making the AIC1840/1841 excellent for use as bias voltage generator for transmitter GaAsFETs in portable RF and cellular telephone applications. The operation voltage is as low as 2.5V.

The AIC1840/1841 offers a -2V preset output as well as a -1.3V to -3.0V adjustable output. Input voltage range for AIC1840/1841 is 2.5V to 6.5V. Output current is 5mA at V_{OUT}= -2V and with V_{IN}≥2.5V. Quiescent current is 510µA at V_{IN}=3.6V and reduces to less than 1µA in shutdown mode (3µA max. for the AIC1841).

The AIC1840 has an active-low shutdown input, while the AIC1841 has an active-high shutdown input.

TYPICAL APPLICATION CIRCUIT



Bias Generator for GaAsFET Power Amplifier

ORDERING INFORMATION

AIC1840 XX
AIC1841 XX

PACKAGE TYPE
N: PLASTIC DIP
S: SMALL OUTLINE

TEMPERATURE RANGE
C: 0°C~+70°C

ORDER NUMBER	PIN CONFIGURATION
AIC1840CN AIC1841CN (PLASTIC DIP)	TOP VIEW CAPP 1, CAPN 2, VNN 3, SHDN 4 (AIC1840) / *SHDN (AIC1841) 8 VDD, 7 GND, 6 VOUT, 5 FB
AIC1840CS AIC1841CS (PLASTIC SO)	

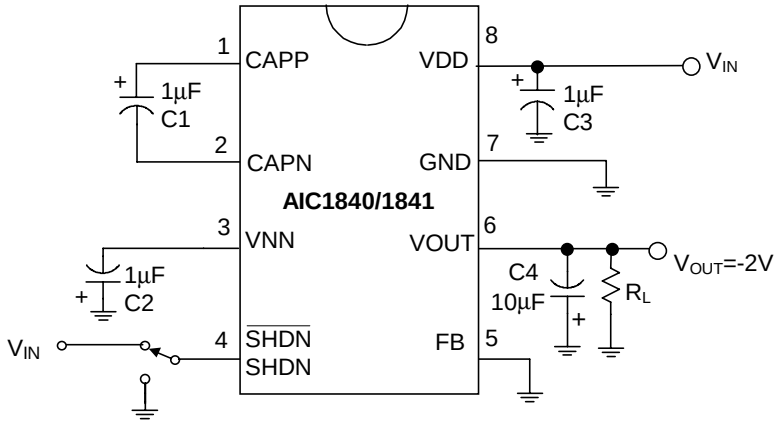
■ ABSOLUTE MAXIMUM RATINGS

Supply Voltage 7V

Operating Temperature Range ..... -25°C~80°C

Storage Temperature Range ..... -65°C~150°C

■ TEST CIRCUIT

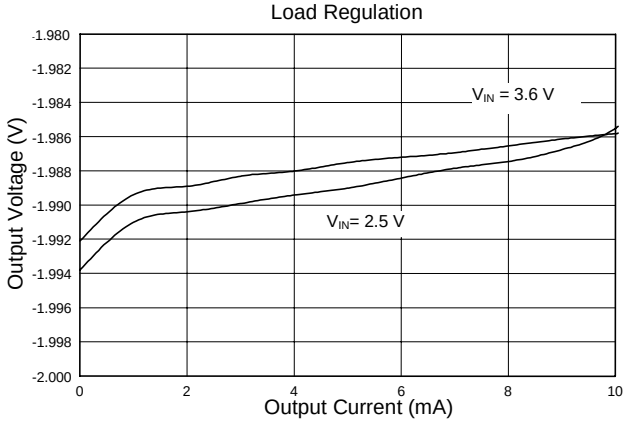


■ ELECTRICAL CHARACTERISTICS (V_{IN}=3.6V, Ta=25°C, unless otherwise specified.)

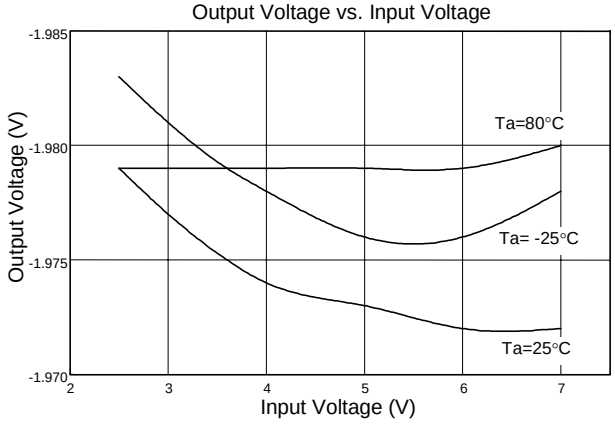
PARAMETER	TEST CONDITIONS		SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply Voltage Range			V_{DD}	2.5		6.5	V
Output Voltage	V_{IN}≥2.5V, I_{OUT}=0~5mA		V_{OUT}	-2.1	-2.0	-1.9	V
Output Voltage Adjustment Range	V_{IN}=6.5V		V_{OUT}		-1.3 ~ -3.0		V
Set Voltage	No Load		V_{FBSET}	-1.25	-1.15	-1.05	V
Supply Current	No Load, V_{IN}=3.6V		I_Q		510	800	µA
Shutdown Mode Current	AIC1840	$\overline{SHDN}$=0, V_{IN}=5V	I_{SHDN}			1	µA
	AIC1841	SHDN=2V, V_{IN}=5V			1	3	
Output Load Regulation	V_{IN}=3.6V, R_L=∞ or 400Ω				2	8	mV/mA
Output Ripple	C_4=10µF				2		mVp-p
Oscillator Frequency	V_{IN}=3.6V		F_{OSC}	79	104	129	KHz
Shutdown Pin High Voltage	V_{IN}=3.6V		V_{IH}	2.0			V
Shutdown Pin Low Voltage	V_{IN}=3.6V		V_{IL}			0.5	V

TYPICAL PERFORMANCE CHARACTERISTICS

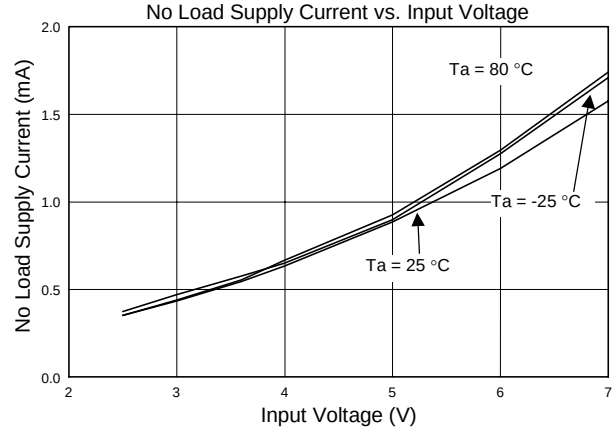
Load Regulation



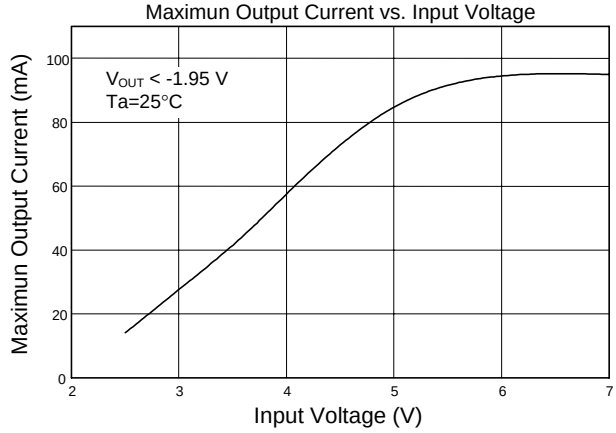
Output Voltage vs. Input Voltage



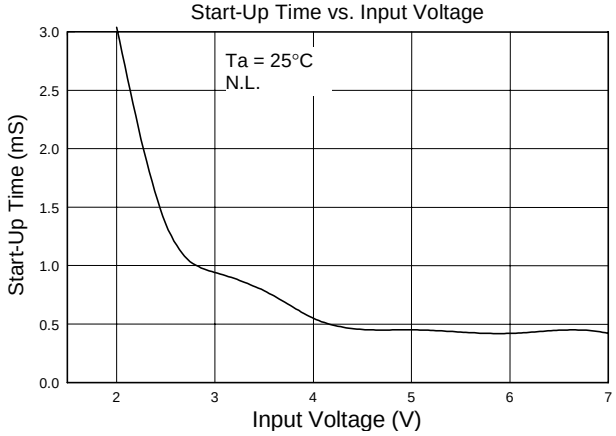
No Load Supply Current vs. Input Voltage



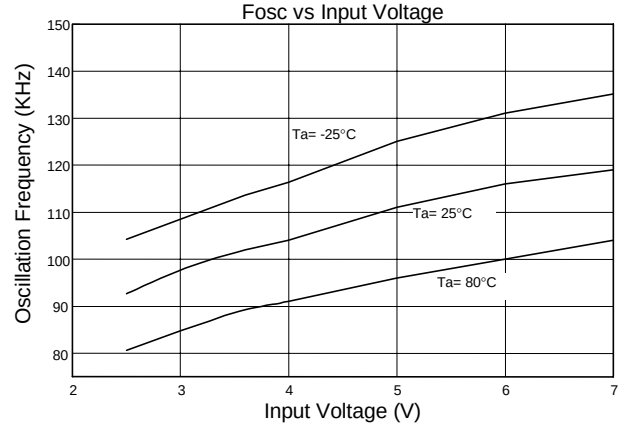
Maximun Output Current vs. Input Voltage



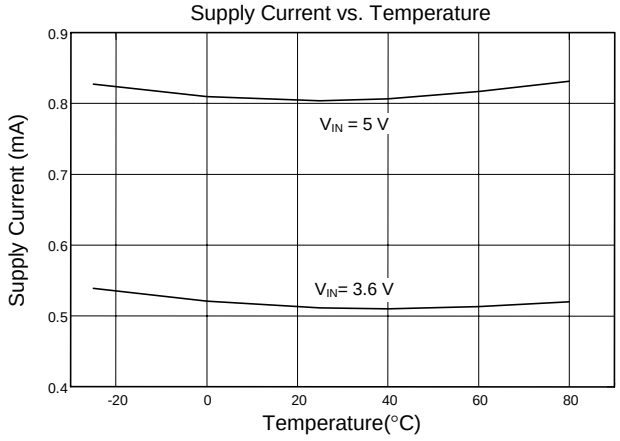
Start-Up Time vs. Input Voltage

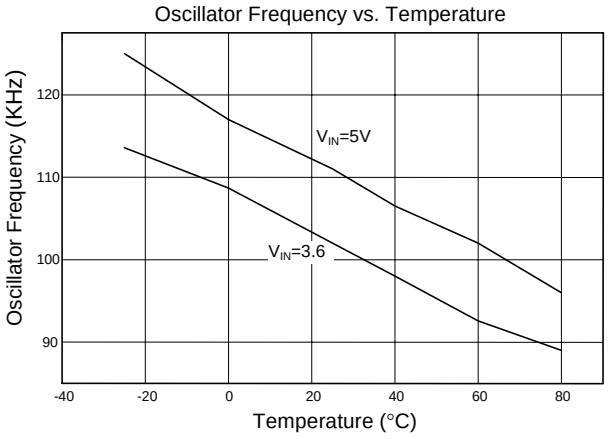


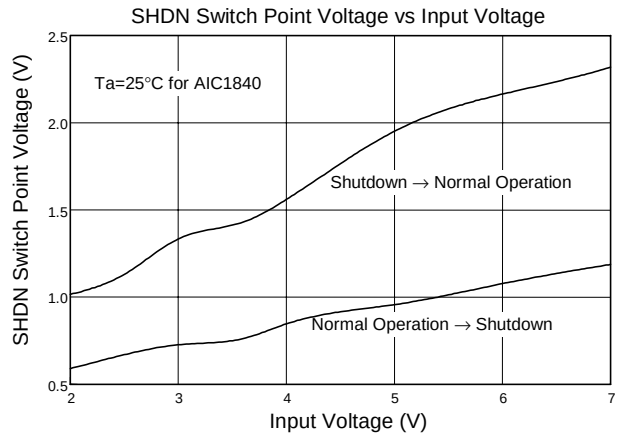
Fosc vs Input Voltage

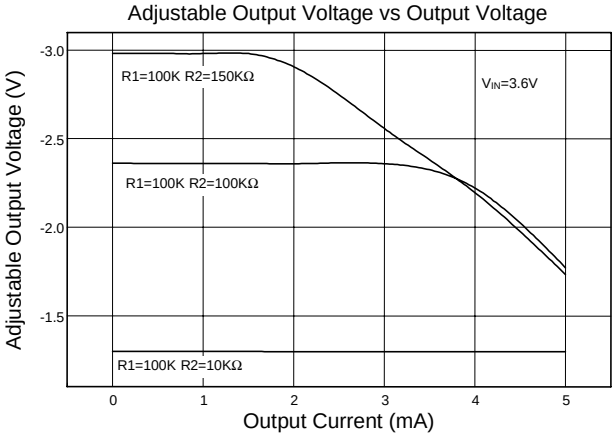


TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

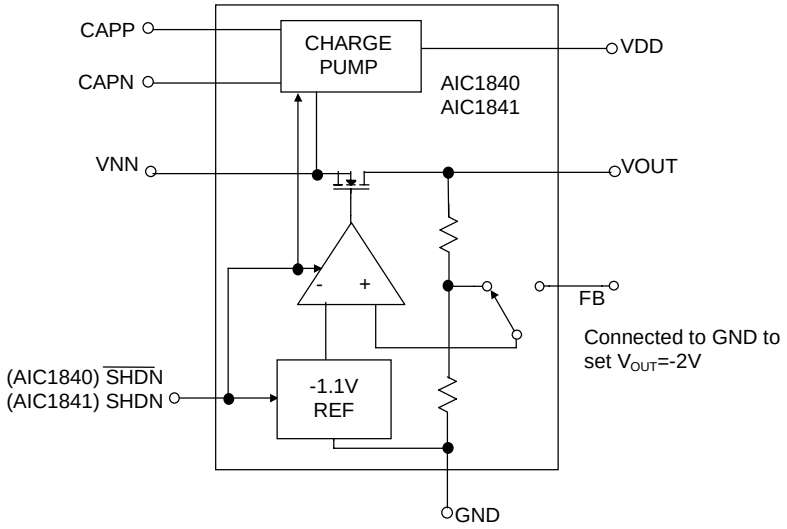








BLOCK DIAGRAM



PIN DESCRIPTIONS

PIN 1: CAPP - Positive terminal for C1.

PIN 2: CAPN - Negative terminal for C1.

PIN 3: VNN - Unregulated negative output voltage.

PIN 4: $\overline{SHDN}$ - Active-low TTL logic level shutdown input. (AIC1840)

SHDN - Active-high TTL logic level shutdown input. (AIC1841)

PIN 5: FB - When FB is grounded, the output is preset to -2.0V. To select other output voltage, connect FB to external resistor divider.

PIN 6: VOUT - Negative regulated output voltage.

PIN 7: GND - Ground.

PIN 8: VDD - Input supply.

APPLICATION INFORMATION

SETTING THE OUTPUT VOLTAGE

The AIC1840/AIC1841 can select either a fixed or an adjustable output voltage. Connect FB directly to GND to select the fixed -2.0V output (Fig.1), and connect FB to the midpoint of a resistor voltage divider from V_{OUT} to GND (Fig. 2) to select an adjustable output voltage. V_{IN} must be 0.5V above the absolute value of V_{OUT} to allow proper regulation. The output voltage is calculated from the formula below. Choose R2 to be between 10KΩ to 150KΩ. The adjustment range is from –1.3V to -3.0V.

$$V_{OUT} = (-1.15) \times (1 + \frac{R_2}{R_1})$$

CAPACITORS

Use capacitors with low effective series resistance (ESR) to maintain a low dropout voltage ($V_{IN} - |V_{OUT}|$). The overall dropout voltage is a function of the charge pump's output resistance and the voltage drop across the linear regulator (N-channel pass transistor). At the 104KHz switching frequency, the charge-pump output resistance is a function of C1 and C2's ESR. Therefor, minimizing the ESR of the charge-pump capacitors minimizes the dropout voltage.

LAYOUT AND GROUNDING

Good layout is important, primarily for good noise performance.

1. Mount all components as close together as possible.
2. Keep traces short to minimize parasitic inductance and capacitance. This includes connections to FB.
3. Use a ground plane.

NOISE AND RIPPLE MEASUREMENT

Accurately measuring the output noise and ripple is a challenge. Brief differences in ground potential between the AIC1840/1841 circuit and the oscilloscope (which result from the charge pump's switching action) cause ground currents in the probe's wires, inducing sharp voltage spikes. For best results, measure directly across the output capacitor (C4). Do not use the ground lead of the oscilloscope probe; instead, remove the probe's tip cover and touch the ground ring on the probe directly to C4's ground terminal. You can also use a Tektronix chassis-mount test jack (part no. 131-0258) to connect your scope probe directly. This direct connection gives the most accurate noise and ripple measurement.

APPLICATION EXAMPLES

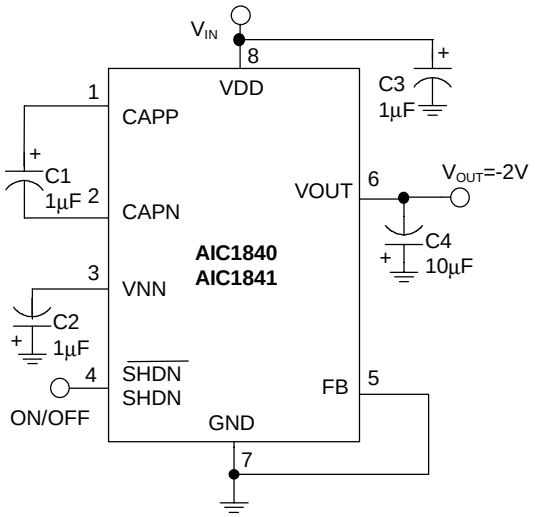


Fig. 1 Fixed Output Configuration

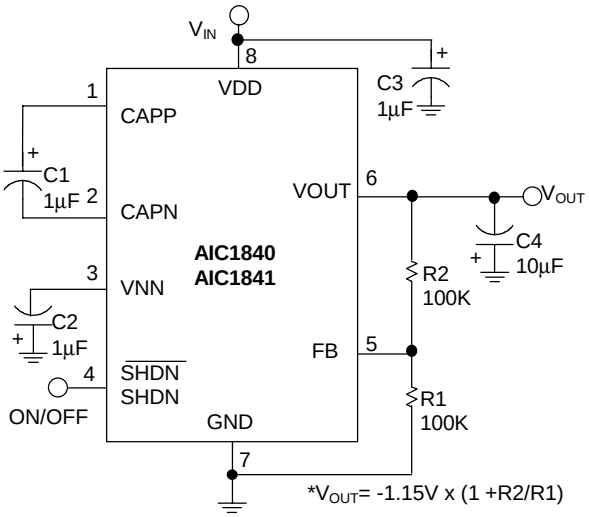


Fig. 2 Adjustable Output Configuration

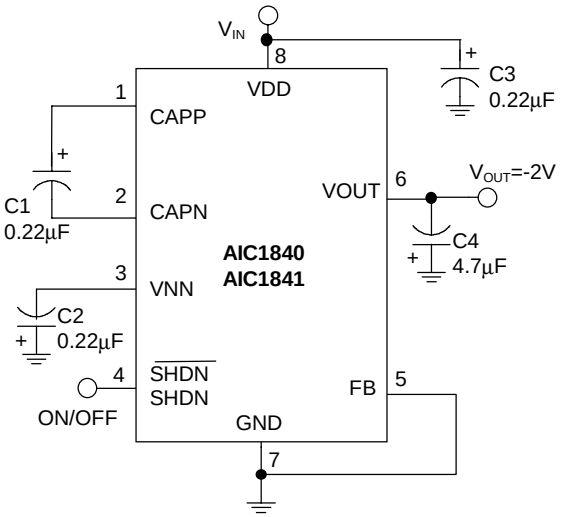
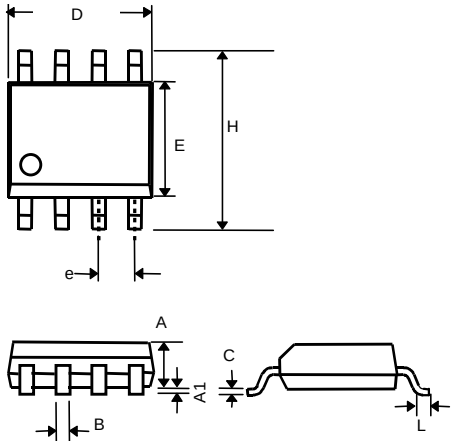


Fig. 3 Smaller Capacitor Application Circuit

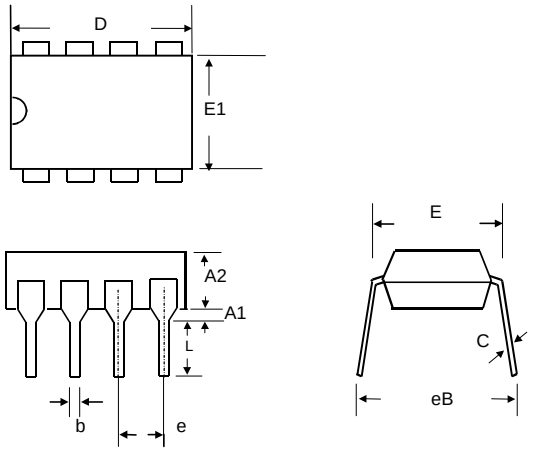
PHYSICAL DIMENSIONS

- **8 LEAD PLASTIC SO (unit: mm)**



SYMBOL	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(TYP)	
H	5.80	6.20
L	0.40	1.27

- **8 LEAD PLASTIC DIP (unit: mm)**



SYMBOL	MIN	MAX
A1	0.381	—
A2	2.92	4.96
b	0.35	0.56
C	0.20	0.36
D	9.01	10.16
E	7.62	8.26
E1	6.09	7.12
e	2.54 (TYP)	
eB	—	10.92
L	2.92	3.81