UPC835

Low Power, High Stability, Low Offset Voltage J-FET Input Dual Operational Amplifier

DESCRIPTION

The UPC835 is the higher version of UPC832 and 4062, the J-FET input operational amplifiers, in stability and accuracy. The UPC835 is a J-FET input dual operational amplifier which realizes both low power consumption and high stability, by adopting a high speed PNP transistor of f_T = 300 MHz on its output stage.

In addition, despite its J-FET input, the UPC835 realizes low offset voltage characteristics that eclipses conventional general operational amplifiers, by using a resistance trimming system, the proven method for our high accuracy operational amplifier and high accuracy reference voltage.

The UPC835 is ideal for use in measurement instruments and control instruments, which especially requires the stability during capacitive load connections.

FEATURES

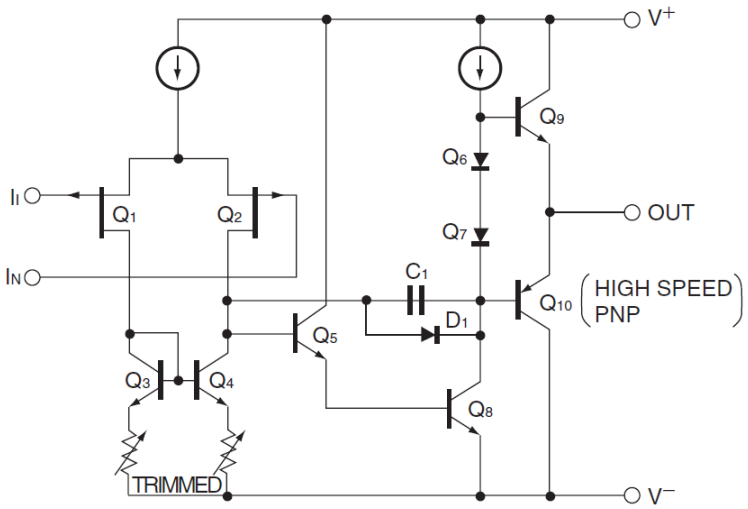
- Input Offset Voltage ±3 mV MAX.
- Slew Rate 5.5 V/μs (TYP.)
- Unity Gain Frequency 2.8 MHz (TYP.)
- Low Power I_{CC} ≤ 2.2 mA MAX.
  (Reduces circuit currents while maintaining relatively high slew rate and bandwidth)
- High stability is secured to capacitive loads
  (Capacitive Load at 4000 pF, AV = +1)
- Built-In Phase Compensation Circuit
- Small package
  The whole size of the package is downsized by 30 to 40% compared with a standard SOP contour, by using a TSSOP (3 x 3 mm^2 body) package

ORDERING INFORMATION

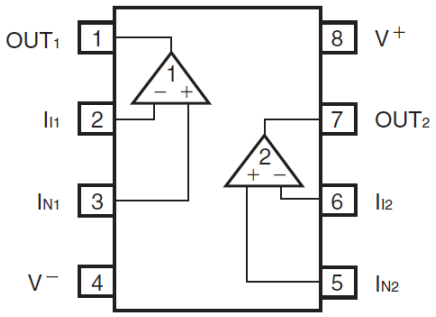
Order Name	Package	Packing Type
UPC835MN-KAA-E1-AT Note	8-pin plastic TSSOP (3 x 3)	・12mm wide embossed taping ・Pin 1 at draw-out side ・4000 p/reel
UPC835MN-KAA-E2-AT Note	8-pin plastic TSSOP (3 x 3)	・12mm wide embossed taping ・Pin 1 at reel side ・4000 p/reel

Note Pb-free (This product does not contain Pb in the external electrode and other parts.)

EQUIVALENT CIRCUIT (1/2 Circuit)



PIN CONFIGURATION (Top View)



ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise specified)

Parameter	Symbol	UPC835	Unit
Supply Voltage Note1	$V^+ - V^-$	-0.3 ~ +36	V
Differential Input Voltage	V_{ID}	±30	V
Input Voltage Note 2	V_I	V^- -0.3 ~ V^+ +0.3	V
Output Applied Voltage Note3	V_O	V^- -0.3 ~ V^+ +0.3	V
Total Power Dissipation Note4	P_T	350	mW
Output Short Circuit Duration Note5		Indefinite	s
Operating Ambient Temperature	T_A	-40 ~ +85	°C
Storage Temperature	T_{stg}	-55 ~ +125	°C

【Notes】 **1.** Note that reverse connections of the power supply may damage the ICs.

2. The input terminal must be applied within the input voltage range to avoid deteriorating or damaging the device characteristic. Do not exceed the ratings including during transition state such as ON/OFF, etc. The Op-Amp input voltage must operates within the electrical characteristics range of input common-mode voltage.

3. The output terminal must be applied within the output voltage range to avoid deteriorating or damaging the device characteristic. Do not exceed the ratings including during transition state such as ON/OFF, etc. The Op-Amp output voltage must operates within the electrical characteristics range of maximum output voltage.

4. This is the value when $T_A \leq 59°C$ during loading a glass epoxy substrate (size: 100 mm x 100 mm,thickness: 1 mm, filling wiring of 15% of the substrate only on the one side of copper foil). When TA > 59°C,conduct a derating in −5.4 mW/°C. The heat resistance between a junction and ambient air under the same condition is $R_{th(J-A)}$ = 187°C /W.

5. Pay careful attention to the total power dissipation not to exceed the absolute maximum ratings, Note 4.

Caution Product quality may suffer if the absolute maximum rating is exceeded even momentarily for any parameter. That is, the absolute maximum ratings are rated values at which the product is on the verge of suffering physical damage, and therefore the product must be used under conditions that ensure that the absolute maximum ratings are not exceeded.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Power Supply Voltage	$V^{\pm}$	±5		±16	V
Output Current	I_O			±6	mA
Load Capacitance (When A_V = +1)	C_L			4000 Note6	pF

【Note】 **6.** This is the value when the feedback resistor (R_f) = 0 Ω. The higher the R_f value, the more likely it is to oscillate due to the influence of the input capacitance. So connect a capacitor of about 100 pF in parallel with R_f.

ELECTRICAL CHARACTERISTICS (T_A = 25 °C, $V^{\pm}$ = ±15 V, unless otherwise specified)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit	Test Condition
Input Offset Voltage	V_{IO}		±1.5	±3	mV	R_S ≤ 50 Ω
Input Offset Current	I_{IO}		±25	±100	pA	
Input Bias Current Note7	I_B		50	200	pA	
Large Signal Voltage Gain	A_V	25000	200000			R_L ≥ 2 kΩ, V_O = ±10 V
Circuit Current Note8	I_{CC}		1.4	2.2	mA	I_O = 0 A
Common Mode Rejection Ratio	CMR	70	80		dB	
Supply Voltage Rejection Ratio	SVR	70	85		dB	
Output Voltage Swing	V_{om}	±12	+14.0 -13.3		V	R_L ≥ 10 kΩ
Output Voltage Swing	V_{om}	±10	+13.5 -12.8		V	R_L ≥ 2 kΩ
Common Model Input Voltage Range	V_{ICM}	+11.7 -11.0	+15 -12		V	
Slew Rate	SR		5.5		V/μs	A_V = 1
Unity Gain Frequency	f_{unity}		2.8		MHz	
Input Equivalent Noise Voltage Density	e_n		25		nV/√Hz	R_S = 100 Ω, f = 1 kHz
Channel Separation			120		dB	
Average V_{IO} Temperature Drift	$\Delta V_{IO}/\Delta T$		±7		μV/°C	T_A = -20 ~ +70 °C

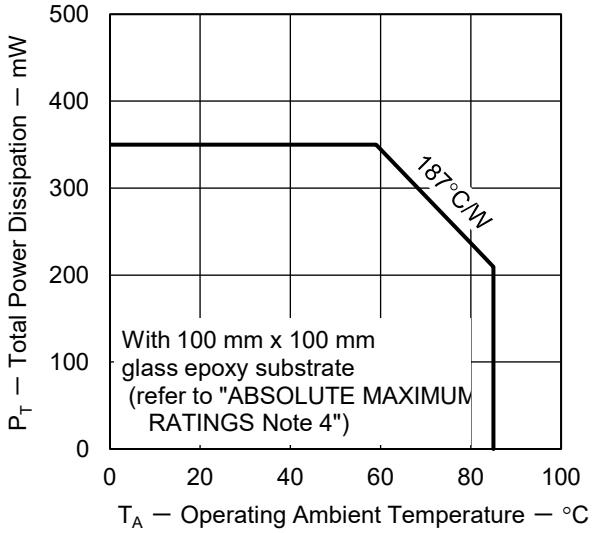
【**Note**】**7.** Input bias currents flow into IC, because each currents are base current to Pch J-FET on input stage.When T_J = 25°C or more, this figure exponentially grows along with a rise of temperature.

8. This current flows irrespective of the existence of use.

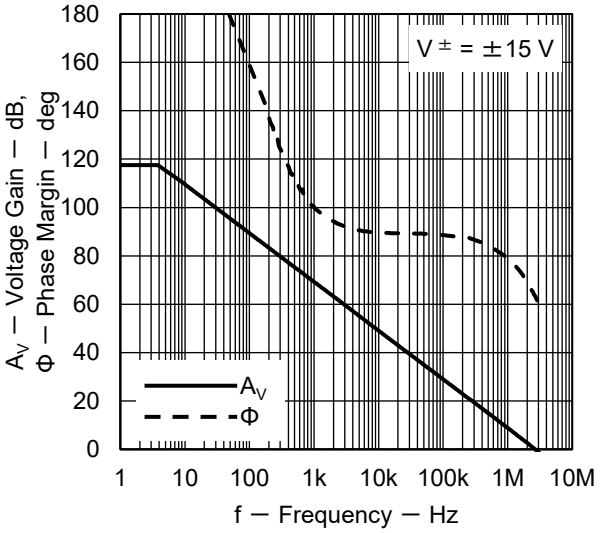
Caution Special attention is required for insulation between pins on a board, since the UPC835 has a high-input impedance characteristic..

TYPICAL PERFORMANCE CHARACTERISTICS (T_A = 25°C, unless otherwise specified)
(Reference value)

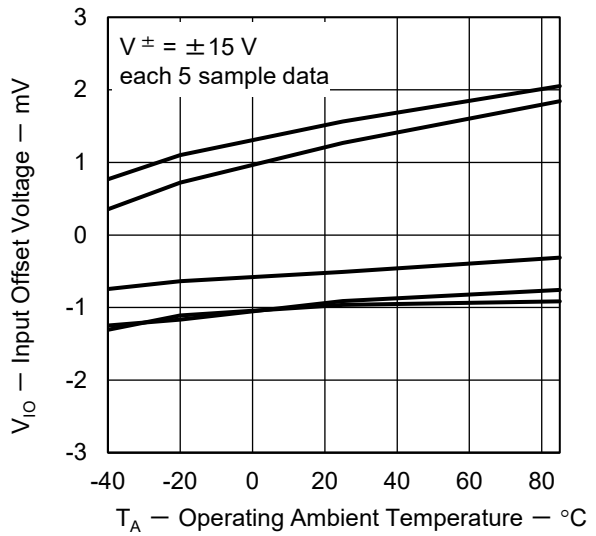
P_T vs.T_A (ABSOLUTE MAXIMUM RATING)



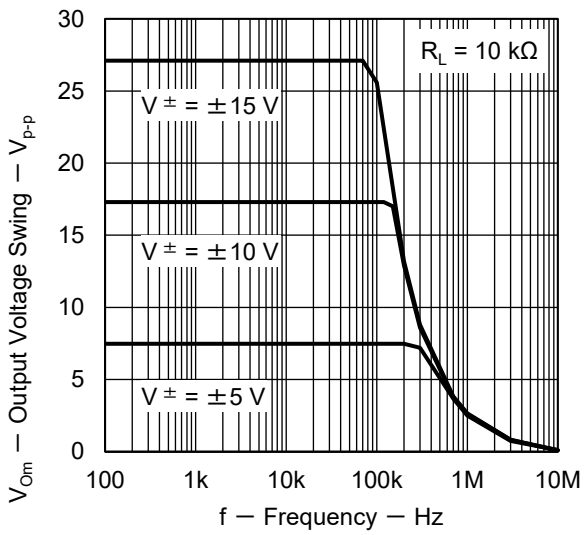
A_V, Φ vs. f



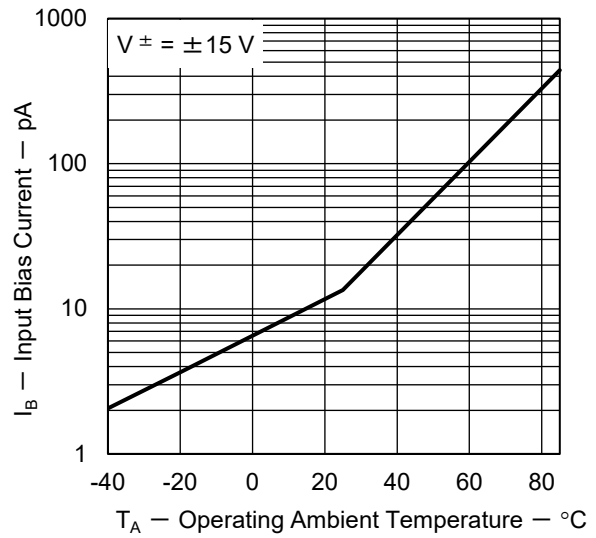
V_{IO} vs T_A



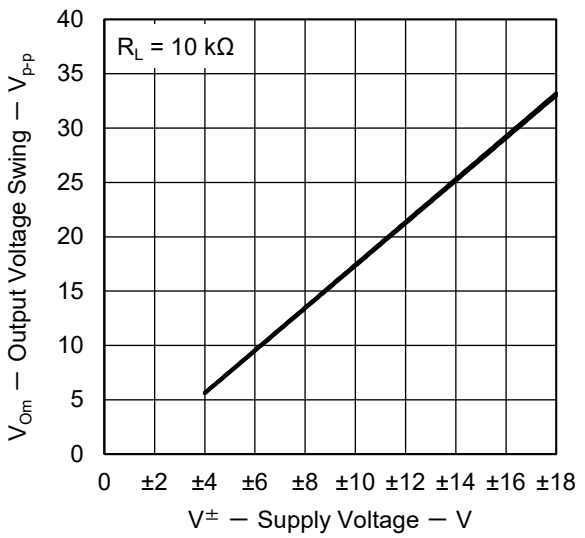
V_{Om} vs f



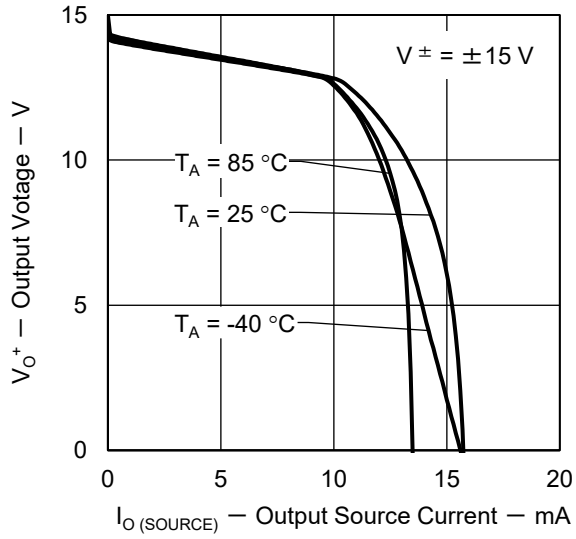
I_B vs T_A



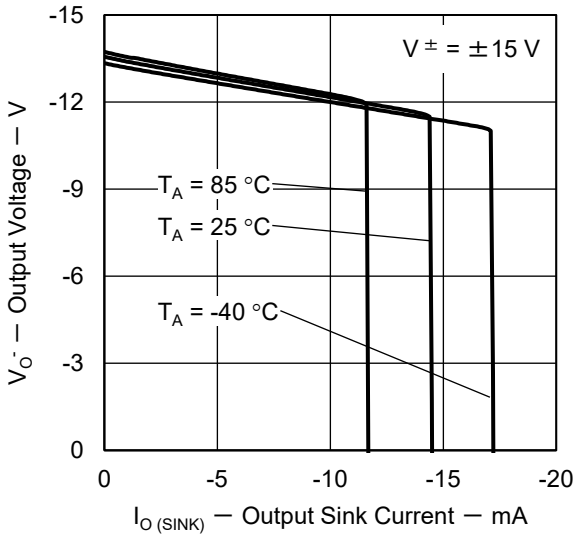
V_{Om} vs $V^{\pm}$



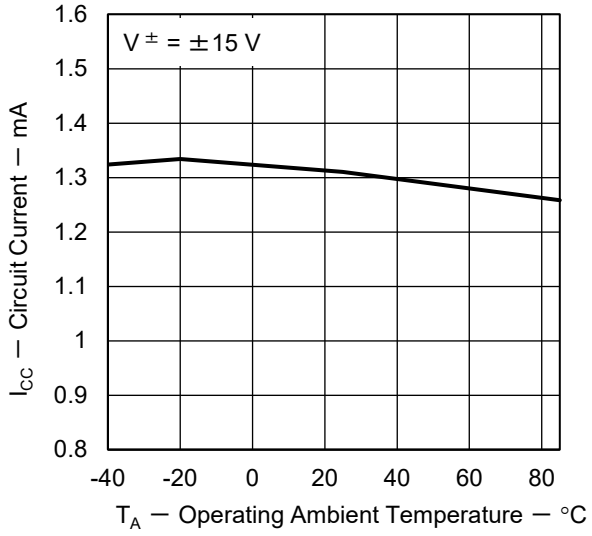
V_O^+ vs $I_{O\ (SOURCE)}$



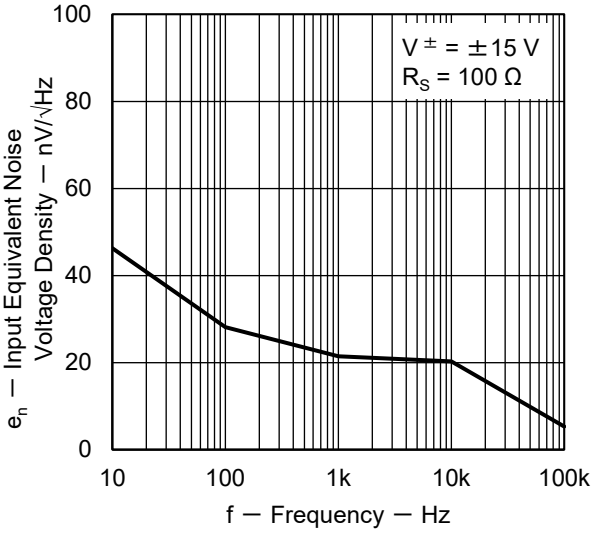
V_O^- vs $I_{O\ (SINK)}$



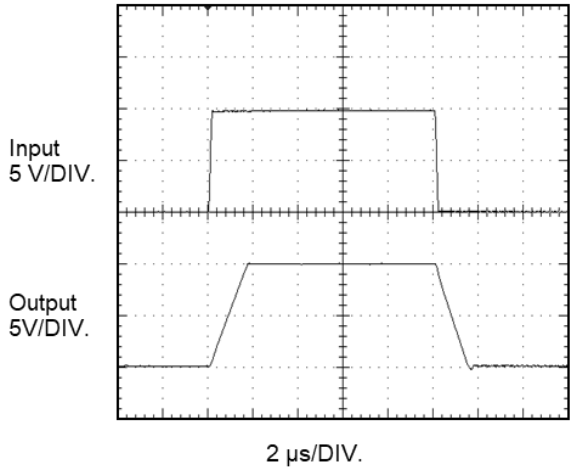
I_{CC} vs T_A



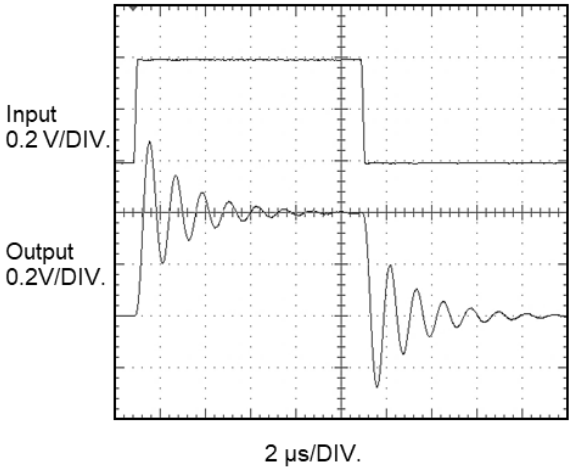
e_n vs f



PULSE RESPONSE I
($V^{\pm}$ = ± 15 V, A_V = +1 , R_L = 2 kΩ, C_L = 100 pF)



PULSE RESPONSE II
($V^{\pm}$ = ± 15 V, A_V = +1 , R_L = 2 kΩ, C_L = 4000 pF)

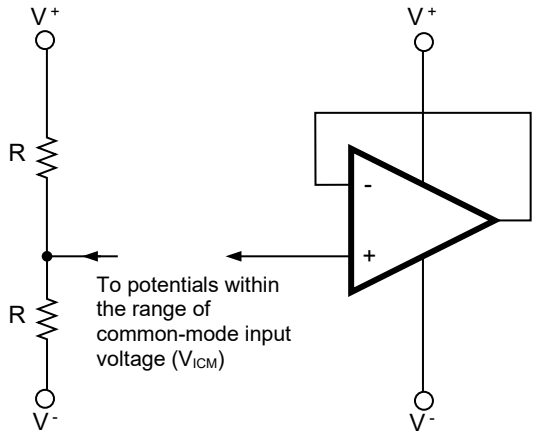


PRECAUTIONS FOR USE

- **Managing unused circuits**

  If there is an unused circuit, the following connection is recommended.

  Example of unused circuit process



Remark Note in this example, an intermediate voltage of V^+ and V^- is applied.

- **Power Supply (Dual Power Supply / Single Power Supply)**

  Operational amplifiers operate when a given voltage is applied to between V^+ and V^-. Therefore, they can operate with a single power supply (V^- = GND). However, since input/output around the GND is impossible with the single power supply, it is required to pay attention to the common-mode input voltage range and the maximum output voltage when using them.

- **Ratings of input/output pin voltage**

  When the voltage of input/output pin exceeds the absolute maximum rating, it may cause degradation of characteristics or damages, by a conduction of a parasitic diode within an IC. In addition, when the input pin may be lower than V^-, or the output pin may exceed the supply voltage, it is recommended to make a clump circuit by a diode whose forward voltage is low (e.g.: Schottky diode) for protection.

- **Range of common-mode input voltage**

  When the supply voltage does not meet the condition of electrical characteristics, the range of common-mode input voltage is as follows.

  V_{ICM} (TYP.) : V^- +3 ~ V^+ [V] (T_A = 25 °C).

  During designing, consider variations in characteristics and temperature characteristics for use with allowance.

- **Maximum output voltage**

  The range of the TYP. value of the maximum output voltage when the supply voltage does not meet the condition of electrical characteristics is as follows:

  $V_{om}{}^+$ (TYP.) : V^+ -1 [V] (T_A = 25 °C, R_L ≥ 10 kΩ), $V_{om}{}^-$ (TYP.) : V^- +1.7 [V] (T_A = 25°C, R_L ≥ 10 kΩ)

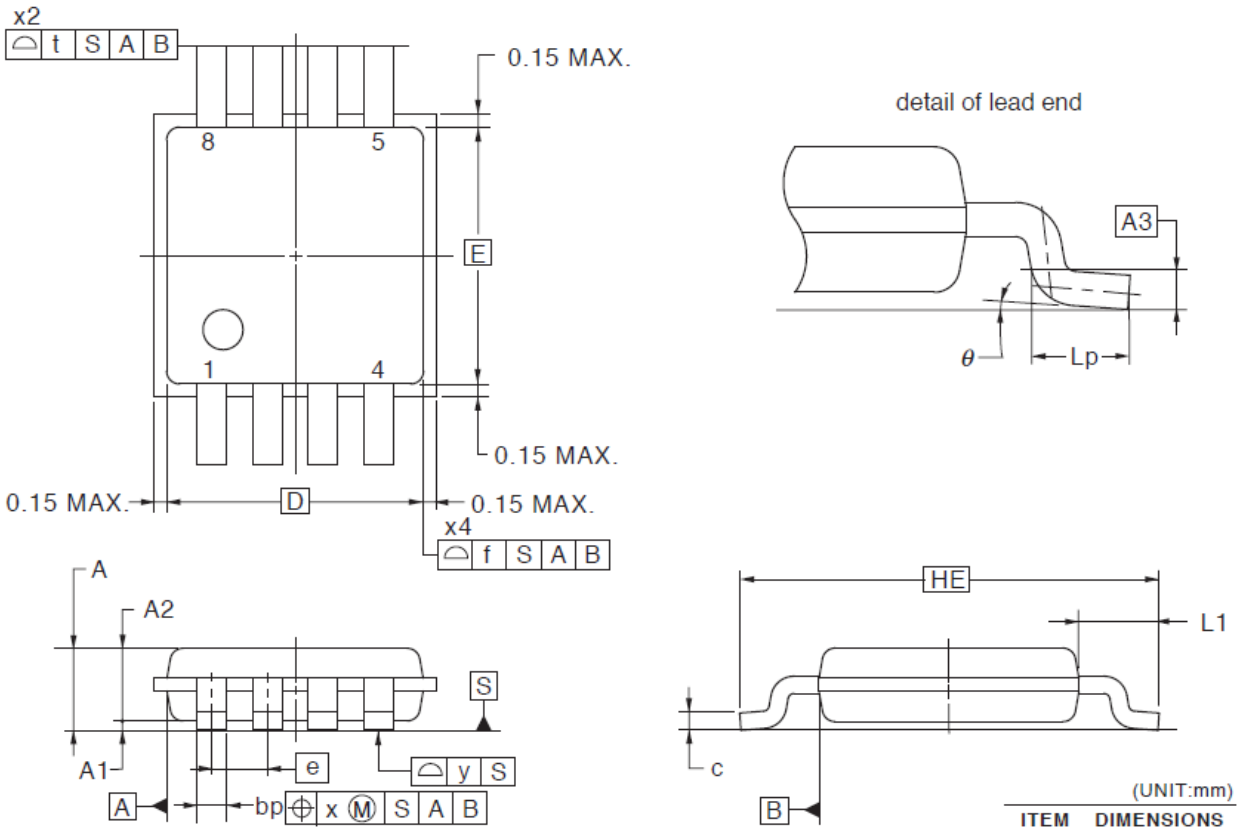
  During designing, consider variations in characteristics and temperature characteristics for use with allowance. In addition, note that the output voltage range ($V_{om}{}^+ - V_{om}{}^-$) becomes narrow when the output current increases.

- **Handling of ICs**

  When stress is added to ICs due to warpage or bending of a board, the characteristic fluctuates due to piezoelectric effect. Therefore, pay attention to warpage or bending of a board.

PACKAGE DRAWINGS

8-PIN PLASTIC TSSOP (3x3)



(UNIT:mm)

ITEM	DIMENSIONS
D	3.00
E	3.00
f	0.20
HE	4.90
t	0.20
e	0.65
bp	0.25 to 0.38
A1	0.10±0.05
A	1.10 MAX.
A2	0.85±0.10
A3	0.25
L1	0.95
c	0.13 to 0.23
Lp	0.55±0.15
x	0.10
y	0.10
θ	$3^{\circ}{}^{+5^{\circ}}_{-3^{\circ}}$

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