

### 3-TERMINAL 0.3A POSITIVE VOLTAGE REGULATORS

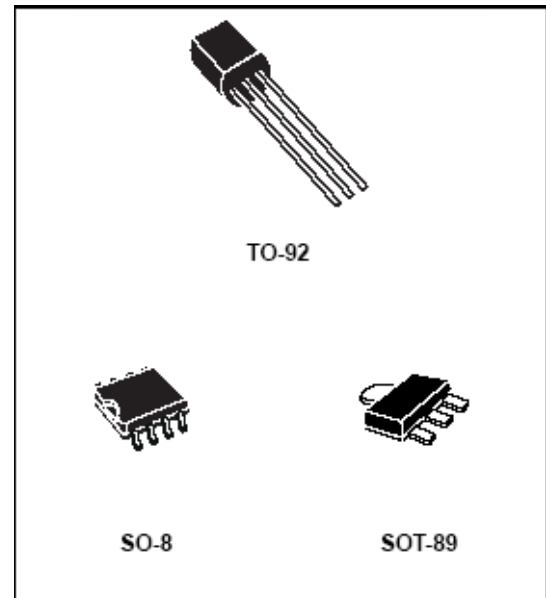
This series of fixed-voltage monolithic integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. In addition, they can be used with power-pass elements to make high current voltage regulators. Each of these regulators can deliver up to 100mA output current.

The internal limiting and thermal shutdown features of these regulators make them essentially immune to overload.

When used as a replacement for a zener diode-resistor combination, an effective improvement in output impedance can be obtained together with lower-bias current.

#### Features

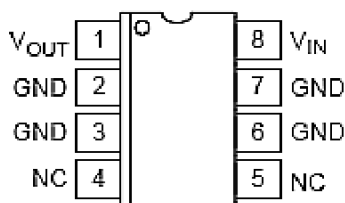
- Output current Up to 250mA
- No External Components
- Internal Thermal Overload Protection
- Internal Short-Circuit Limiting
- Output Voltage of 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V and 24V



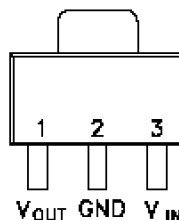
#### ORDERING INFORMATION

Device	Operating Temperature Range	Package	Packing
HT78HXXBTZ	$T_A = -40^\circ \text{ to } 125^\circ \text{ C}$	TO-92	Bulk
HT78HXXBRTZ		TO-92	Taping
HT78HXXBRZ		SO-8	Tape & Reel
HT78HXXBRDZ		SOT-89	Tape & Reel

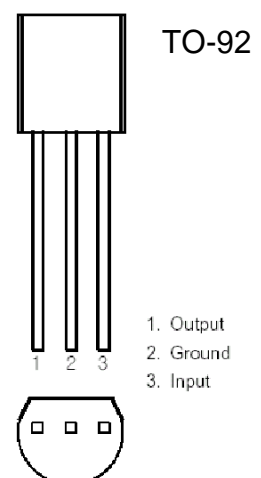
#### Pin Configuration



SO-8



SOT-89



TO-92

1. Output
2. Ground
3. Input

## Absolute Maximum Ratings

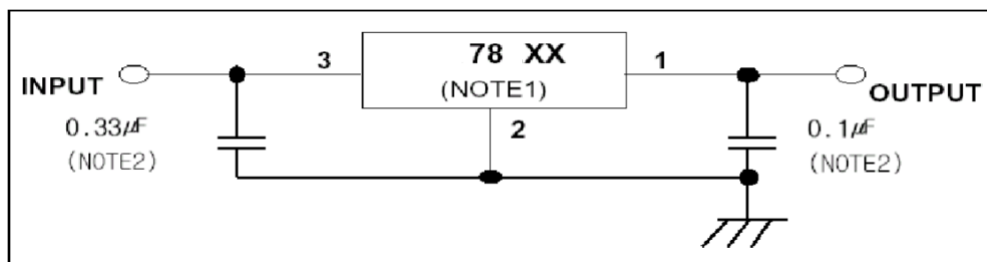
Characteristic		Symbol	Value	Unit
Input voltage	HT78H05 ~ HT78H10	VI	30	V
	HT78H12 ~ HT78H18		35	
	HT78H24		40	
Power Dissipation	TO-92	Pd	625	mW
	SOT-89		500	
	SOP-8		625	
Operating junction temperature		Topr	-40 ~ +150	°C
Storage temperature		Tstg	-65 ~ +150	
Soldering temperature and time		Tsol	260/10sec	

\* Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

## RECOMMENDED OPERATING CONDITIONS

78Hxx		Min.	Max.	Unit
Input voltage, VI	HT78H05	7	20	V
	HT78H06	8	20	
	HT78H08	10.5	23	
	HT78H09	11.5	24	
	HT78H10	12.5	25	
	HT78H12	14.5	27	
	HT78H15	17.5	30	
	HT78H18	20.5	33	
	HT78H24	26.5	39	
Output current, Io			250	mA
Operating virtual junction temperature, Tj		-40	125	°C

## TYPICAL APPLICATION



### Notes

1. To specify an output voltage, substitute voltage for "XX"
2. Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

## HT78H05 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature,  $V_I=10V$ ,  $I_O=40mA$  (unless otherwise noted))

Characteristic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	$V_{out}$	25°C		4.8	5	5.2	V
		$1mA \leq I_O \leq 40mA$ $7V \leq V_I \leq V_{max}$	-40 ~ 125°C	4.75	5	5.25	
		$1mA \leq I_O \leq 70mA$		4.75	5	5.25	
Line regulation	Reg line	$7 \leq V_I \leq 20V$	25°C		32	150	mV
		$8 \leq V_I \leq 20V$			26	100	
Load regulation	Reg load	$1mA \leq I_O \leq 100mA$	25°C		15	60	mV
		$1mA \leq I_O \leq 40mA$			8	30	
Bias current	$I_B$		25°C		3.8	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	$9 \leq V_I \leq 20V$	-40 ~ 125°C			1.5	mA
		$1mA \leq I_O \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		42		$\mu V$
Ripple rejection	RR	$8 \leq V_I \leq 20V$ $f=120Hz$	25°C	41	49		dB
Dropout voltage	$V_D$		25°C		1.7		V

### Notes

- \*. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.  
Thermal effects must be taken into account separately.  
All characteristics are measured with a  $0.33\mu F$  capacitor across the input and a  $0.1\mu F$  capacitor across the output.
- \*\*. This specification applies only for DC power dissipation permitted by absolute maximum ratings.

## HT78H06 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature,  $V_I=12V$ ,  $I_O=40mA$  (unless otherwise noted))

Characteristic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	$V_{out}$		25°C	5.75	6	6.25	V
		1 mA ≤ $I_O$ ≤ 40 mA 8V ≤ $V_I$ ≤ 20V	-40 ~ 125°C	5.7	6	6.3	
		1 mA ≤ $I_O$ ≤ 70 mA		5.7	6	6.3	
Line regulation	Reg line	8 ≤ $V_I$ ≤ 20V	25°C		35	175	mV
		9 ≤ $V_I$ ≤ 20V			29	125	
Load regulation	Reg load	1 mA ≤ $I_O$ ≤ 100 mA	25°C		16	80	mV
		1 mA ≤ $I_O$ ≤ 40 mA			9	40	
Bias current	$I_B$		25°C		3.9	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	9 ≤ $V_I$ ≤ 20V	-40 ~ 125°C			1.5	mA
		1 mA ≤ $I_O$ ≤ 40 mA				0.1	
Output noise voltage	$V_N$	10 Hz ≤ $f$ ≤ 100 kHz	25°C		46		μV
Ripple rejection	RR	9 ≤ $V_I$ ≤ 19V $f=120$ Hz	25°C	40	48		dB
Dropout voltage	$V_D$		25°C		1.7		V

### Notes

- \*. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.  
Thermal effects must be taken into account separately.  
All characteristics are measured with a 0.33 μF capacitor across the input and a 0.1 μF capacitor across the output.
- \*\*. This specification applies only for DC power dissipation permitted by absolute maximum ratings.

## HT78H08 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature,  $V_I=14V$ ,  $I_O=40mA$  (unless otherwise noted))

Characteristic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	$V_{out}$		25°C	7.7	8	8.3	V
		1 mA ≤ $I_O$ ≤ 40 mA 10.5V ≤ $V_I$ ≤ 23V	-40 ~ 125°C	7.6	8	8.4	
		1 mA ≤ $I_O$ ≤ 70 mA		7.6	8	8.4	
Line regulation	Reg line	10.5 ≤ $V_I$ ≤ 23V	25°C		42	175	mV
		11 ≤ $V_I$ ≤ 23V			36	125	
Load regulation	Reg load	1 mA ≤ $I_O$ ≤ 100 mA	25°C		18	80	mV
		1 mA ≤ $I_O$ ≤ 40 mA			10	40	
Bias current	$I_B$		25°C		4	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	11 ≤ $V_I$ ≤ 23V	-40 ~ 125°C			1.5	mA
		1 mA ≤ $I_O$ ≤ 40 mA				0.1	
Output noise voltage	$V_N$	10 Hz ≤ $f$ ≤ 100 kHz	25°C		54		μV
Ripple rejection	RR	13 ≤ $V_I$ ≤ 23V $f=120$ Hz	25°C	37	46		dB
Dropout voltage	$V_D$		25°C		1.7		V

### Notes

\*. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

Thermal effects must be taken into account separately.

All characteristics are measured with a 0.33 μF capacitor across the input and a 0.1 μF capacitor across the output.

\*\*. This specification applies only for DC power dissipation permitted by absolute maximum ratings.

## HT78H09 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature,  $V_I=14V$ ,  $I_O=40mA$  (unless otherwise noted))

Characteistic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	$V_{out}$		25°C	806	9	9.4	V
		1 mA ≤ $I_O$ ≤ 40 mA 12V ≤ $V_I$ ≤ 24V	-40 ~ 125°C	8.55	9	9.45	
		1 mA ≤ $I_O$ ≤ 70 mA		8.55	9	9.45	
Line regulation	Reg line	12 ≤ $V_I$ ≤ 24V	25°C		45	175	mV
		13 ≤ $V_I$ ≤ 24V			40	125	
Load regulation	Reg load	1 mA ≤ $I_O$ ≤ 100 mA	25°C		19	90	mV
		1 mA ≤ $I_O$ ≤ 40 mA			11	40	
Bias current	$I_B$		25°C		4.1	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	13 ≤ $V_I$ ≤ 24V	-40 ~ 125°C			1.5	mA
		1 mA ≤ $I_O$ ≤ 40 mA				0.1	
Output noise voltage	$V_N$	10 Hz ≤ $f$ ≤ 100 kHz	25°C		58		μV
Ripple rejection	RR	13 ≤ $V_I$ ≤ 23V $f=120$ Hz	25°C	38	45		dB
Dropout voltage	$V_D$		25°C		1.7		V

### Notes

\*. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

Thermal effects must be taken into account separately.

All characteristics are measured with a 0.33 μF capacitor across the input and a 0.1 μF capacitor across the output.

\*\* . This specification applies only for DC power dissipation permitted by absolute maximum ratings.

## HT78H10 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature,  $V_I=16V$ ,  $I_O=40mA$  (unless otherwise noted))

Characteristic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	$V_{out}$		25°C	9.6	10	10.4	V
		$1mA \leq I_O \leq 40mA$ $13V \leq V_I \leq 25V$	-40 ~ 125°C	9.5	10	10.5	
		$1mA \leq I_O \leq 70mA$		9.5	10	10.5	
Line regulation	Reg line	$13 \leq V_I \leq 25V$	25°C		51	175	mV
		$14 \leq V_I \leq 25V$			42	125	
Load regulation	Reg load	$1mA \leq I_O \leq 100mA$	25°C		20	90	mV
		$1mA \leq I_O \leq 40mA$			11	40	
Bias current	$I_B$		25°C		4.2	6	mA
			125°C			5.5	
Bias current change	$\Delta I_B$	$14 \leq V_I \leq 25V$	-40 ~ 125°C			1.5	mA
		$1mA \leq I_O \leq 40mA$				0.1	
Output noise voltage	$V_N$	10 Hz $\leq f \leq$ 100 kHz	25°C		62		$\mu V$
Ripple rejection	RR	$15 \leq V_I \leq 25V$ $f=120Hz$	25°C	37	44		dB
Dropout voltage	$V_D$		25°C		1.7		V

### Notes

\*. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

Thermal effects must be taken into account separately.

All characteristics are measured with a 0.33  $\mu F$  capacitor across the input and a 0.1  $\mu F$  capacitor across the output.

\*\* . This specification applies only for DC power dissipation permitted by absolute maximum ratings.

## HT78H12 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature,  $V_I=17V$ ,  $I_O=40mA$  (unless otherwise noted))

Characteristic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	$V_{out}$		25°C	11.5	12	12.5	V
		$1mA \leq I_O \leq 40mA$ $14V \leq V_I \leq 27V$	-40 ~ 125°C	11.4	12	12.6	
		$1mA \leq I_O \leq 70mA$		11.4	12	12.6	
Line regulation	Reg line	$14.5 \leq V_I \leq 27V$	25°C		55	250	mV
		$16 \leq V_I \leq 27V$			49	200	
Load regulation	Reg load	$1mA \leq I_O \leq 100mA$	25°C		22	100	mV
		$1mA \leq I_O \leq 40mA$			13	50	
Bias current	$I_B$		25°C		4.3	6.5	mA
			125°C			6	
Bias current change	$\Delta I_B$	$16 \leq V_I \leq 27V$	-40 ~ 125°C			1.5	mA
		$1mA \leq I_O \leq 40mA$				0.1	
Output noise voltage	$V_N$	10 Hz ≤ f ≤ 100 kHz	25°C		70		μV
Ripple rejection	RR	$15 \leq V_I \leq 25V$ f=120 Hz	25°C	37	42		dB
Dropout voltage	$V_D$		25°C		1.7		V

### Notes

\*. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

Thermal effects must be taken into account separately.

All characteristics are measured with a 0.33 μF capacitor across the input and a 0.1 μF capacitor across the output.

\*\*. This specification applies only for DC power dissipation permitted by absolute maximum ratings.



## HT78H15 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature,  $V_I=19V$ ,  $I_O=40mA$  (unless otherwise noted))

Characteristic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	$V_{out}$		25°C	14.4	15	15.6	V
		$1mA \leq I_O \leq 40mA$ $17.5V \leq V_I \leq 30V$	-40 ~ 125°C	14.25	15	15.75	
		$1mA \leq I_O \leq 70mA$		14.25	15	15.75	
Line regulation	Reg line	$17.5V \leq V_I \leq 30V$	25°C		65	300	mV
		$19V \leq V_I \leq 30V$			58	250	
Load regulation	Reg load	$1mA \leq I_O \leq 100mA$	25°C		25	150	mV
		$1mA \leq I_O \leq 40mA$			15	75	
Bias current	$I_B$		25°C		4.2	6.5	mA
			125°C			6	
Bias current change	$\Delta I_B$	$19V \leq V_I \leq 30V$	-40 ~ 125°C			1.5	mA
		$1mA \leq I_O \leq 40mA$				0.1	
Output noise voltage	$V_N$	$10Hz \leq f \leq 100kHz$	25°C		82		$\mu V$
Ripple rejection	RR	$18.5V \leq V_I \leq 28.5V$ $f=120Hz$	25°C	37	44		dB
Dropout voltage	$V_D$		25°C		1.7		V

### Notes

\*. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

Thermal effects must be taken into account separately.

All characteristics are measured with a  $0.33\mu F$  capacitor across the input and a  $0.1\mu F$  capacitor across the output.

\*\* This specification applies only for DC power dissipation permitted by absolute maximum ratings.

## HT78H18 ELECTRICAL CHARACTERISTICS

(At specified virtual junction temperature,  $V_I=23V$ ,  $I_O=40mA$  (unless otherwise noted))

Characteristic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	$V_{out}$		25°C	17.3	18	18.7	V
		1 mA ≤ $I_O$ ≤ 40 mA 20.5V ≤ $V_I$ ≤ 33V	-40 ~ 125°C	17.1	18	18.9	
		1 mA ≤ $I_O$ ≤ 70 mA		17.1	18	18.9	
Line regulation	Reg line	20.5 ≤ $V_I$ ≤ 33V	25°C		70	360	mV
		22 ≤ $V_I$ ≤ 33V			64	300	
Load regulation	Reg load	1 mA ≤ $I_O$ ≤ 100 mA	25°C		27	180	mV
		1 mA ≤ $I_O$ ≤ 40 mA			19	90	
Bias current	$I_B$		25°C		4.7	6.5	mA
			125°C			6	
Bias current change	$\Delta I_B$	22 ≤ $V_I$ ≤ 33V	-40 ~ 125°C			1.5	mA
		1 mA ≤ $I_O$ ≤ 40 mA				0.1	
Output noise voltage	$V_N$	10 Hz ≤ $f$ ≤ 100 kHz	25°C		82		μV
Ripple rejection	RR	21.5 ≤ $V_I$ ≤ 31.5V $f=120$ Hz	25°C	32	36		dB
Dropout voltage	$V_D$		25°C		1.7		V

### Notes

\*. Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible.

Thermal effects must be taken into account separately.

All characteristics are measured with a 0.33 μF capacitor across the input and a 0.1 μF capacitor across the output.

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## HT78H24 ELECTRICAL CHARACTERISTICS

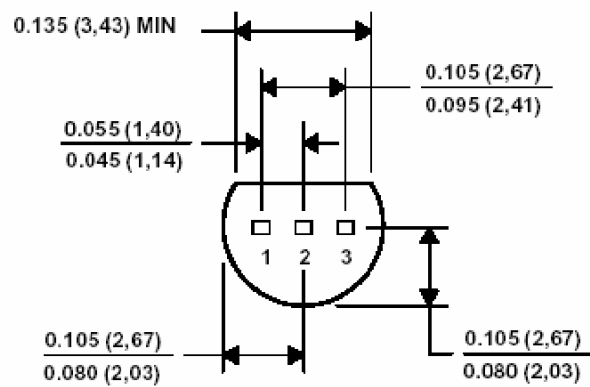
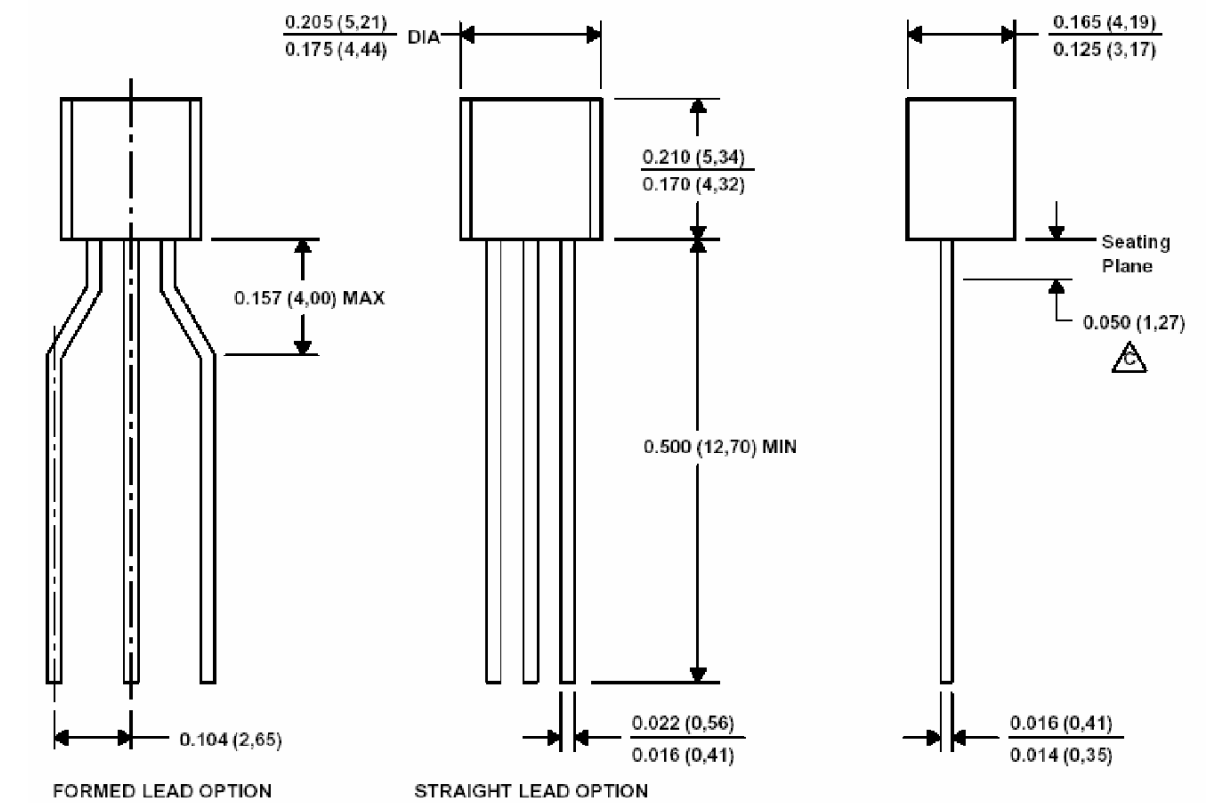
(At specified virtual junction temperature,  $V_I=26V$ ,  $I_O=40mA$  (unless otherwise noted))

Characteristic	Symbol	Test condition *		Min	Typ.	Max.	Unit
Output voltage **	$V_{OUT}$		25°C	23	24	25	V
		$1mA \leq I_O \leq 40mA$ $26.5V \leq V_I \leq 39V$	-40 ~ 125°C	22.8	24	25.2	
		$1mA \leq I_O \leq 70mA$		22.8	24	25.2	
Line regulation	Reg line	$26.5 \leq V_I \leq 39V$	25°C		95	480	mV
		$29 \leq V_I \leq 39V$			78	400	
Load regulation	Reg load	$1mA \leq I_O \leq 100mA$	25°C		41	240	mV
		$1mA \leq I_O \leq 40mA$			28	120	
Bias current	$I_B$		25°C		4.8	6.5	mA
			125°C			6	
Bias current change	$\Delta I_B$	$28 \leq V_I \leq 39V$	-40 ~ 125°C			1.5	mA
		$1mA \leq I_O \leq 40mA$				0.1	
Output noise voltage	$V_N$	10 Hz $\leq f \leq$ 100 kHz	25°C		82		$\mu V$
Ripple rejection	RR	$27.5 \leq V_I \leq 37.5V$ $f=120Hz$	25°C	30	33		dB
Dropout voltage	$V_D$		25°C		1.7		V

### Notes

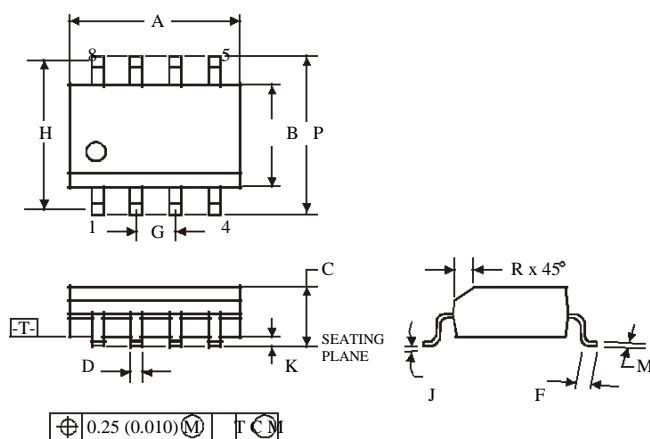
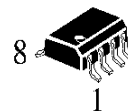
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Thermal effects must be taken into account separately.  
All characteristics are measured with a 0.33  $\mu F$  capacitor across the input and a 0.1  $\mu F$  capacitor across the output.
- \*\*. This specification applies only for DC power dissipation permitted by absolute maximum ratings.

• **TO-92**



• SO-8

**D SUFFIX SOIC**  
(MS - 012AA)



Symbol	Dimension, mm	
	MIN	MAX
A	4.8	5
B	3.8	4
C	1.35	1.75
D	0.33	0.51
F	0.4	1.27
G	1.27	
H	5.72	
J	0°	8°
K	0.1	0.25
M	0.19	0.25
P	5.8	6.2
R	0.25	0.5

**NOTES:**

1. Dimensions A and B do not include mold flash or protrusion.
2. Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B - 0.25 mm (0.010) per side.