

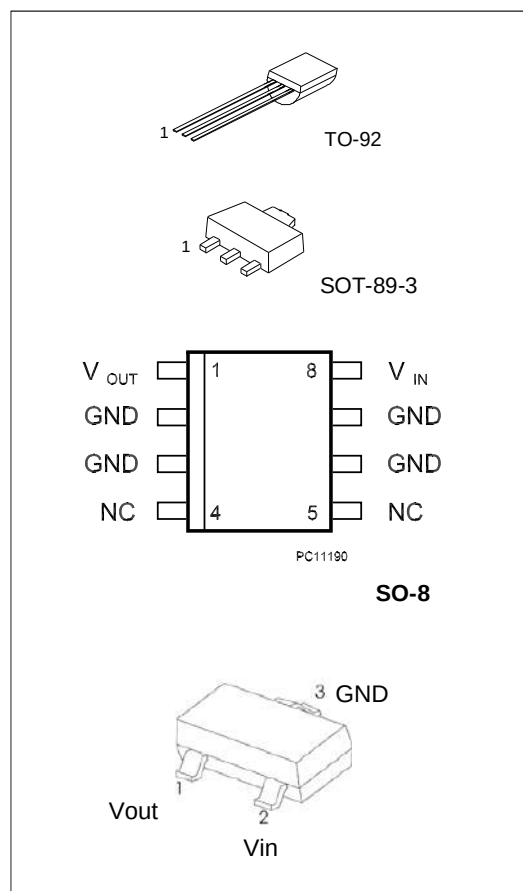
3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATORS

DESCRIPTION

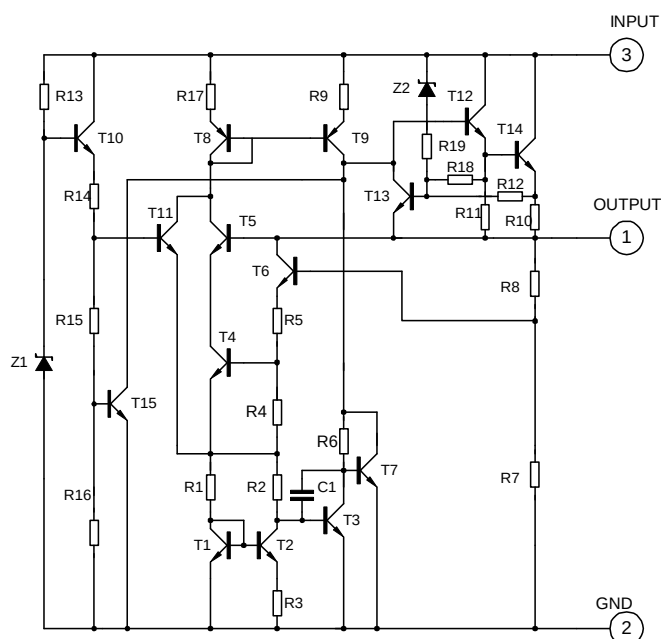
The 78LXX series of fixed voltage monolithic integrated circuit voltage regulators are suitable for applications that required supply up to 100mA.

FEATURE

- *Maximum output current of 100mA
- *Output voltage of 5V,6V,8V,9V,10V,12V,15V and 24V
- *Thermal overload protection
- *Short circuit current limiting



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (Operating temperature range applies unless otherwise specified))

CHARACTERISTICS	SYMBOL	VALUE	UNITS
Input voltage(for $V_o=5,8V$)	V_i	30	V
(for $V_o=12,15V$)	V_i	35	V
High power dissipation	P_d	TO-92	700
		SOT-23	300
		SOT-89	400
		SOP-8	400
Operating Junction Temperature Range	T_{opr}	-20~+120	°C
Storage Temperature Range	T_{stg}	-55~+150	°C

78L05 ELECTRICAL CHARACTERISTICS

($V_i=10V, I_o=40mA, 0<T_j<125^{\circ}C, C_1=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)(Note 1)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Output Voltage	V_o	$T_j=25^{\circ}C$	4.8	5.0	5.2	V
		$7.5V \leq V_i \leq 20V, I_o=1mA \sim 40mA$	4.75		5.25	V
		$7.5V \leq V_i \leq V_{MAX}, I_o=1mA \sim 70mA$	4.75		5.25	V (note 2)
Output Voltage(note 3)	V_o	$T_j=25^{\circ}C$	4.9	5.0	5.1	V
		$7.5V \leq V_i \leq 20V, I_o=1mA \sim 40mA$	4.85		5.15	V
		$7.5V \leq V_i \leq V_{MAX}, I_o=1mA \sim 70mA$	4.85		5.15	V (note 2)
Load Regulation	ΔV_o	$T_j=25^{\circ}C, I_o=1mA \sim 100mA$		11	60	mV
		$T_j=25^{\circ}C, I_o=1mA \sim 40mA$		5.0	30	mV
Line regulation	ΔV_o	$7V \leq V_i \leq 20V, T_j=25^{\circ}C$		8	150	mV
		$8V \leq V_i \leq 20V, T_j=25^{\circ}C$		6	100	mV
Quiescent Current	I_q			2.0	5.5	mA
Quiescent Current Change	ΔI_q	$8V \leq V_i \leq 20V$			1.5	mA
	ΔI_q	$1mA \leq V_i \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		40		μV
Temperature coefficient of V_o	$\Delta V_o / \Delta T$	$I_o=5mA$		0.65		mV/°C
Ripple Rejection	RR	$8V \leq V_i \leq 20V, f=120Hz, T_j=25^{\circ}C$	40	49		dB
Dropout Voltage	V_d	$T_j=25^{\circ}C$		1.7		V

78L06 ELECTRICAL CHARACTERISTICS

($V_I=12V$, $I_O=40mA$, $0<T_J<125^{\circ}C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^{\circ}C$	5.75	6.0	6.25	V
		$8.5V \leq V_I \leq 20V$, $I_O=1mA \sim 40mA$	5.7		6.3	V
		$8.5V \leq V_I \leq V_{MAX}$, $I_O=1mA \sim 70mA$	5.7		6.3	V (note 2)
Output Voltage(note 3)	V_O	$T_J=25^{\circ}C$	5.88	6.0	6.12	V
		$8.5V \leq V_I \leq 20V$, $I_O=1mA \sim 40mA$	5.82		6.18	V
		$8.5V \leq V_I \leq V_{MAX}$, $I_O=1mA \sim 70mA$	5.82		6.18	V (note 2)
Load Regulation	ΔV_O	$T_J=25^{\circ}C$, $I_O=1mA \sim 100mA$		12.8	80	mV
		$T_J=25^{\circ}C$, $I_O=1mA \sim 70mA$		5.8	40	mV
Line regulation	ΔV_O	$8.5V \leq V_I \leq 20V$, $T_J=25^{\circ}C$		64	175	mV
		$9V \leq V_I \leq 20V$, $T_J=25^{\circ}C$		54	125	mV
Quiescent Current	I_Q			2.0	5.5	mA
Quiescent Current Change	ΔI_Q	$9V \leq V_I \leq 20V$			1.5	mA
	ΔI_Q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		49		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O=5mA$		0.75		mV/ $^{\circ}C$
Ripple Rejection	RR	$10V \leq V_I \leq 20V$, $f=120Hz$, $T_J=25^{\circ}C$	38	46		dB
Dropout Voltage	V_d	$T_J=25^{\circ}C$		1.7		V

78L08 ELECTRICAL CHARACTERISTICS

($V_I=14V$, $I_O=40mA$, $0<T_J<125^{\circ}C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^{\circ}C$	7.7	8.0	8.3	V
		$10.5V \leq V_I \leq 23V$, $I_O=1mA \sim 40mA$	7.6		8.4	V
		$10.5V \leq V_I \leq V_{MAX}$, $I_O=1mA \sim 70mA$	7.6		8.4	V (note 2)
Output Voltage(note 3)	V_O	$T_J=25^{\circ}C$	7.84	8.0	8.16	V
		$10.5V \leq V_I \leq 23V$, $I_O=1mA \sim 40mA$	7.76		8.24	V
		$10.5V \leq V_I \leq V_{MAX}$, $I_O=1mA \sim 70mA$	7.76		8.24	V (note 2)
Load Regulation	ΔV_O	$T_J=25^{\circ}C$, $I_O=1mA \sim 100mA$		15	80	mV
Line regulation	ΔV_O	$T_J=25^{\circ}C$, $I_O=1mA \sim 70mA$		8.0	40	mV
		$10.5V \leq V_I \leq 23V$, $T_J=25^{\circ}C$		10	175	mV
		$11V \leq V_I \leq 23V$, $T_J=25^{\circ}C$		8	125	mV
Quiescent Current	I_q			2.0	5.5	mA
Quiescent Current Change	ΔI_q	$11V \leq V_I \leq 23V$			1.5	mA
	ΔI_q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		49		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O=5mA$		0.75		mV/ $^{\circ}C$
Ripple Rejection	RR	$11V \leq V_I \leq 23V$, $f=120Hz$, $T_J=25^{\circ}C$	36	45		dB
Dropout Voltage	V_d	$T_J=25^{\circ}C$		1.7		V

78L09 ELECTRICAL CHARACTERISTICS

($V_I=15V$, $I_O=40mA$, $0<T_J<125^{\circ}C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^{\circ}C$	8.64	9.0	9.36	V
		$11.5V \leq V_I \leq 24V$, $I_O=1mA \sim 40mA$	8.55		9.45	V
		$11.5V \leq V_I \leq V_{MAX}$, $I_O=1mA \sim 70mA$	8.55		9.45	V (note 2)
Output Voltage(note 3)	V_O	$T_J=25^{\circ}C$	8.82	9.0	9.18	V
		$11.5V \leq V_I \leq 24V$, $I_O=1mA \sim 40mA$	8.73		9.27	V
		$11.5V \leq V_I \leq V_{MAX}$, $I_O=1mA \sim 70mA$	8.73		9.27	V (note 2)
Load Regulation	ΔV_O	$T_J=25^{\circ}C$, $I_O=1mA \sim 100mA$		20	90	mV
		$T_J=25^{\circ}C$, $I_O=1mA \sim 40mA$		10	45	mV
Line regulation	ΔV_O	$11.5V \leq V_I \leq 24V$, $T_J=25^{\circ}C$		90	200	mV
		$13V \leq V_I \leq 24V$, $T_J=25^{\circ}C$		100	150	mV
Quiescent Current	I_q			2.0	5.5	mA
Quiescent Current Change	ΔI_q	$13V \leq V_I \leq 24V$			1.5	mA
	ΔI_q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		49		μV
Temperature coefficient of V_O	$\Delta V_O/\Delta T$	$I_O=5mA$		0.75		mV/ $^{\circ}C$
Ripple Rejection	RR	$12V \leq V_I \leq 23V$, $f=120Hz$, $T_J=25^{\circ}C$	36	44		dB
Dropout Voltage	V_d	$T_J=25^{\circ}C$		1.7		V

78L12 ELECTRICAL CHARACTERISTICS

($V_I=19V$, $I_O=40mA$, $0<T_J<125^{\circ}C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^{\circ}C$	11.5	12	12.6	V
		$14.5V \leq V_I \leq 27V$, $I_O=1mA \sim 40mA$	11.4		12.6	V
		$14.5V \leq V_I \leq V_{MAX}$, $I_O=1mA \sim 70mA$	11.4		12.6	V (note 2)
Output Voltage(note 3)	V_O	$T_J=25^{\circ}C$	11.76	12.0	12.24	V
		$14.5V \leq V_I \leq 27V$, $I_O=1mA \sim 40mA$	11.64		12.36	V
		$14.5V \leq V_I \leq V_{MAX}$, $I_O=1mA \sim 70mA$	11.64		12.36	V (note 2)
Load Regulation	ΔV_O	$T_J=25^{\circ}C$, $I_O=1mA \sim 100mA$		25	150	mV
		$T_J=25^{\circ}C$, $I_O=1mA \sim 40mA$		12	75	mV
Line regulation	ΔV_O	$14.5V \leq V_I \leq 27V$, $T_J=25^{\circ}C$		25	300	mV
		$16V \leq V_I \leq 27V$, $T_J=25^{\circ}C$		20	250	mV
Quiescent Current	I_q			2.0	5.5	mA
Quiescent Current Change	ΔI_q	$16V \leq V_I \leq 27V$			1.5	mA
	ΔI_q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		80		μV
Temperature coefficient of V_O	$\Delta V_O/\Delta T$	$I_O=5mA$		1.0		mV/ $^{\circ}C$
Ripple Rejection	RR	$15V \leq V_I \leq 25V$, $f=120Hz$, $T_J=25^{\circ}C$	36	42		dB
Dropout Voltage	V_d	$T_J=25^{\circ}C$		1.7		V

78L15 ELECTRICAL CHARACTERISTICS

($V_I=23V$, $I_O=40mA$, $0<T_J<125^{\circ}C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^{\circ}C$	14.4	15	15.6	V
		$17.5V \leq V_I \leq 30V, I_O=1mA \sim 40mA$	14.25		15.75	V
		$17.5V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$	14.25		15.75	V (note 2)
Output Voltage(note 3)	V_O	$T_J=25^{\circ}C$	14.7	15.0	15.3	V
		$17.5V \leq V_I \leq 30V, I_O=1mA \sim 40mA$	14.55		15.45	V
		$17.5V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$	14.55		15.45	V (note 2)
Load Regulation	ΔV_O	$T_J=25^{\circ}C, I_O=1mA \sim 100mA$		20	150	mV
Line regulation	ΔV_O	$T_J=25^{\circ}C, I_O=1mA \sim 70mA$		25	150	mV
		$17.5V \leq V_I \leq 30V, T_J=25^{\circ}C$		25	150	mV
		$20V \leq V_I \leq 30V, T_J=25^{\circ}C$		15	75	mV
Quiescent Current	I_q			2.2	6.0	mA
Quiescent Current Change	ΔI_q	$20V \leq V_I \leq 30V$			1.5	mA
	ΔI_q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		90		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O=5mA$		1.3		mV/ $^{\circ}C$
Ripple Rejection	RR	$18.5V \leq V_I \leq 28.5V, f=120Hz, T_J=25^{\circ}C$	33	39		dB
Dropout Voltage	V_d	$T_J=25^{\circ}C$		1.7		V

78L18 ELECTRICAL CHARACTERISTICS

($V_I=27V$, $I_O=40mA$, $0<T_J<125^{\circ}C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

Characteristic	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^{\circ}C$	17.3	18	18.7	V
		$21V \leq V_I \leq 33V, I_O=1mA \sim 40mA$	17.1		18.9	V
		$21V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$	17.1		18.9	V (note 2)
Output Voltage(note 3)	V_O	$T_J=25^{\circ}C$	17.64	18.0	18.36	V
		$21V \leq V_I \leq 33V, I_O=1mA \sim 40mA$	17.46		18.54	V
		$21V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$	17.46		18.54	V (note 2)
Load Regulation	ΔV_O	$T_J=25^{\circ}C, I_O=1mA \sim 100mA$		30	170	mV
		$T_J=25^{\circ}C, I_O=1mA \sim 40mA$		15	85	mV
Line regulation	ΔV_O	$21V \leq V_I \leq 33V, T_J=25^{\circ}C$		145	300	mV
		$22V \leq V_I \leq 33V, T_J=25^{\circ}C$		135	250	mV
Quiescent Current	I_Q			2.2	6.0	mA
Quiescent Current Change	ΔI_Q	$21V \leq V_I \leq 33V$			1.5	mA
	ΔI_Q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		150		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O=5mA$		1.8		mV/ $^{\circ}C$
Ripple Rejection	RR	$23V \leq V_I \leq 33V, f=120Hz, T_J=25^{\circ}C$	32	38		dB
Dropout Voltage	V_D	$T_J=250^{\circ}C$		1.7		V

78L24 ELECTRICAL CHARACTERISTICS

($V_I=33V, I_O=40mA, 0<T_J<125^{\circ}C, C_1=0.33\mu F, C_o=0.1\mu F$, unless otherwise specified)(Note 1)

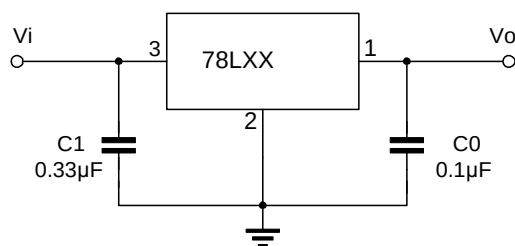
Characteristic	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^{\circ}C$	23	24	25	V
		$27V \leq V_I \leq 38V, I_O=1mA \sim 40mA$	22.8		25.2	V
		$27V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$	22.8		25.2	V (note 2)
Output Voltage(note 3)	V_O	$T_J=25^{\circ}C$	23.5	24	24.5	V
		$27V \leq V_I \leq 38V, I_O=1mA \sim 40mA$	23.25		24.75	V
		$27V \leq V_I \leq V_{MAX}, I_O=1mA \sim 70mA$	23.25		24.75	V (note 2)
Load Regulation	ΔV_O	$T_J=25^{\circ}C, I_O=1mA \sim 100mA$		40	200	mV
		$T_J=25^{\circ}C, I_O=1mA \sim 40mA$		20	100	mV
Line regulation	ΔV_O	$27V \leq V_I \leq 38V, T_J=25^{\circ}C$		160	300	mV
		$28V \leq V_I \leq 38V, T_J=25^{\circ}C$		150	250	mV
Quiescent Current	I_q			2.2	6.0	mA
Quiescent Current Change	ΔI_q	$27V \leq V_I \leq 38V$			1.5	mA
	ΔI_q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		200		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O=5mA$		2.0		mV/ $^{\circ}C$
Ripple Rejection	RR	$27V \leq V_I \leq 38V, f=120Hz, T_J=25^{\circ}C$	30	37		dB
Dropout Voltage	V_d	$T_J=25^{\circ}C$		1.7		V

Note 1: The Maximum steady state usable output current and input voltage are very dependent on the heating sinking and/or lead temperature length of the package. The data above represent pulse test conditions with junction temperatures as indicated at the initiation of test.

Note 2: Power dissipation $< 0.75W$.

Note 3: Output voltage of 78LXXA.

TYPICAL APPLICATION



Note 1: To specify an output voltage, substitute voltage value for "XX".

Note 2: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

Fig.1 78L05/12 Output Voltage vs Ambient Temperature

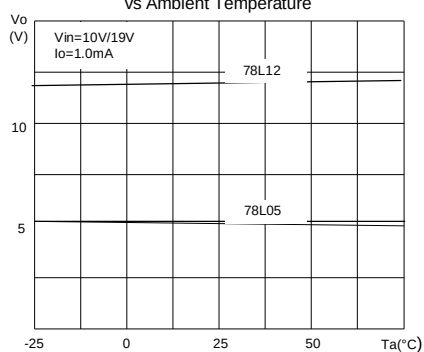


Fig.2 78L05/12 Quiescent Current vs Output Current

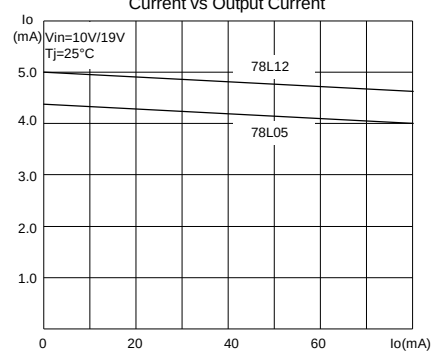


Fig.3 78L05 Quiescent Current vs Input

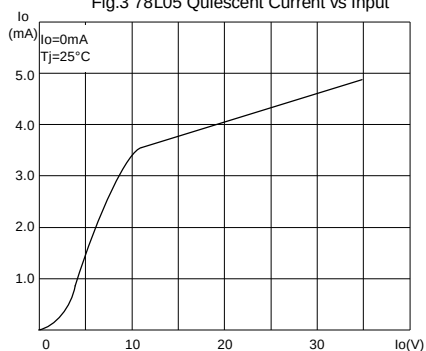


Fig.4 78L05/12/24 Thermal Shutdown

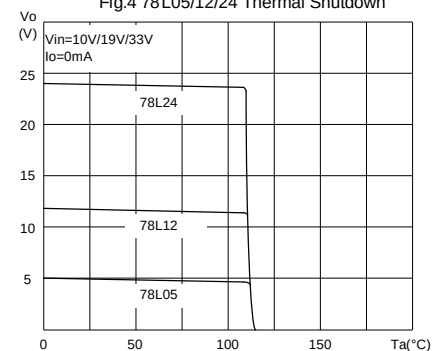


Fig.5 78L05/12/24 Output Characteristics

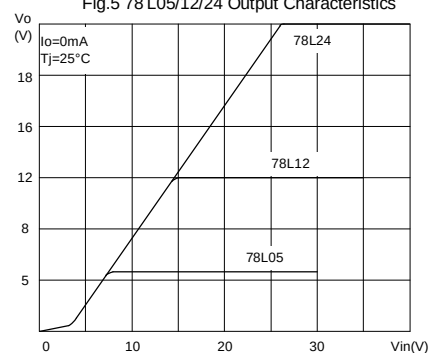
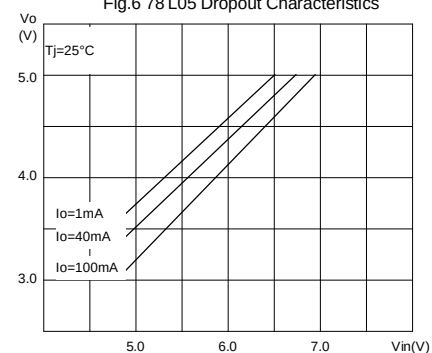
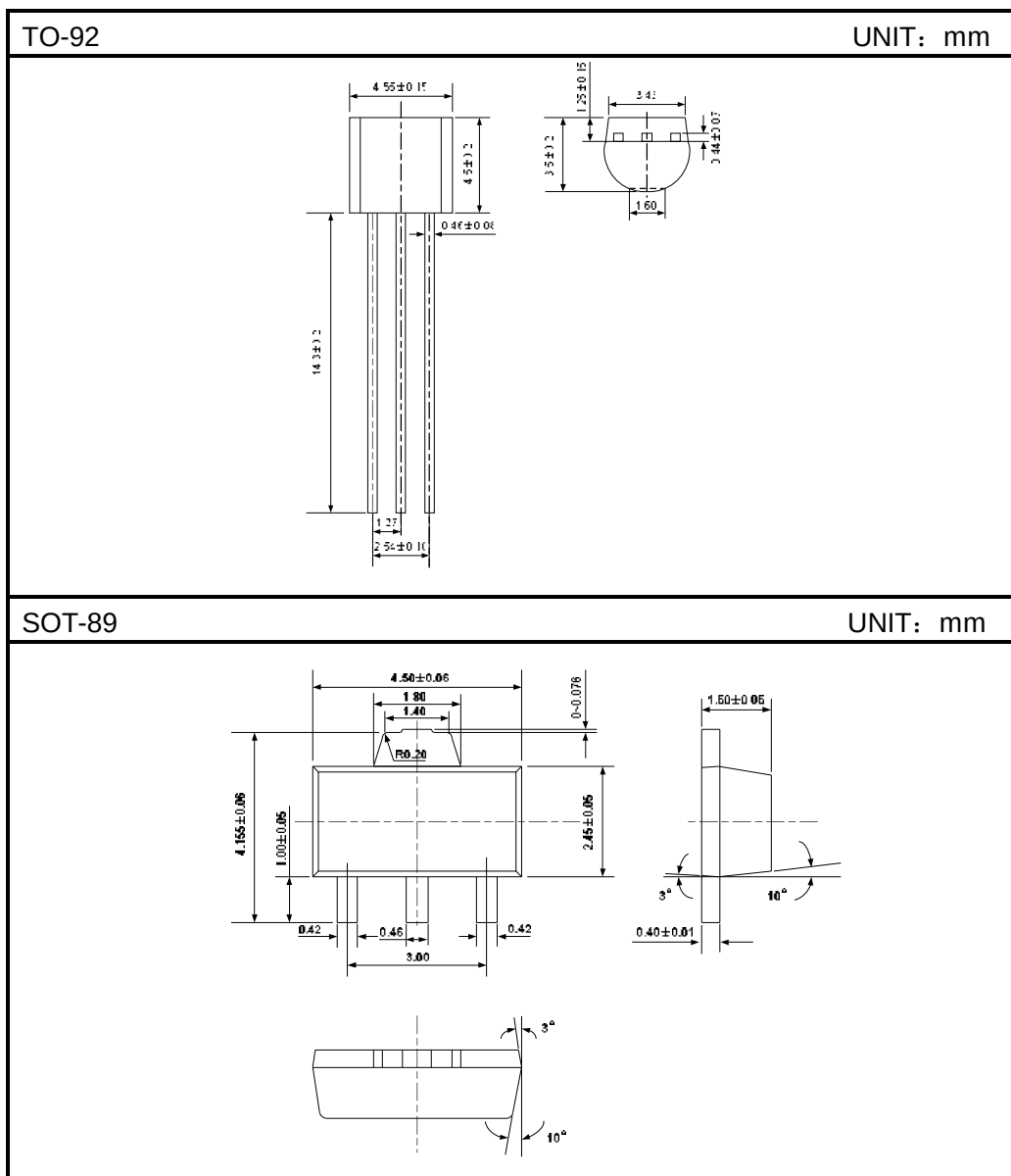


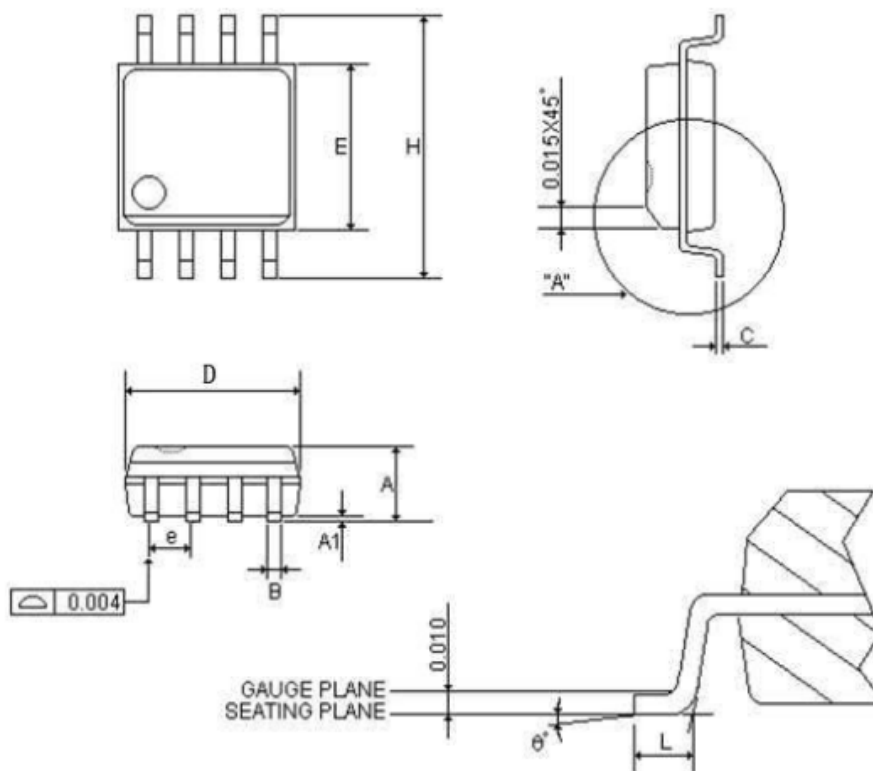
Fig.6 78L05 Dropout Characteristics



PACKAGE OUTLINE

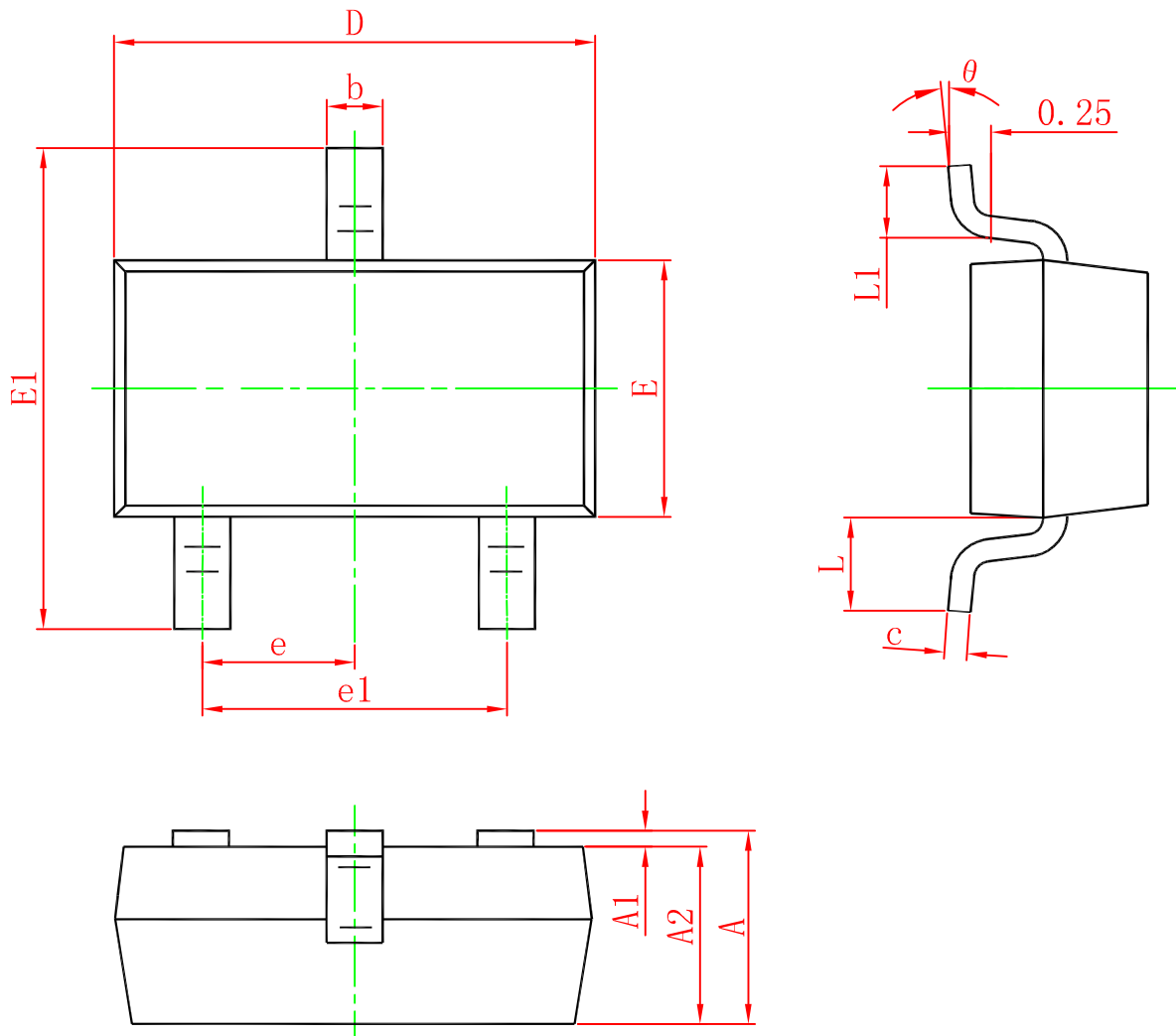


SOP 8



SYMBOLS	MIN	NOR	MAX	MIN	NOR	MAX
	(inch)			(mm)		
A	0.058	0.064	0.068	1.4732	1.6256	1.7272
A1	0.004	-	0.010	0.1016	-	0.254
B	0.013	0.016	0.020	0.3302	0.4064	0.508
C	0.0075	0.008	0.0098	0.1905	0.2032	0.2490
D	0.186	0.191	0.196	5.9944	6.1214	6.1976
E	0.150	0.154	0.157	3.81	3.9116	3.9878
e	-	0.050	-	-	1.27	-
H	0.228	0.236	0.244	5.7912	5.9944	6.1976
L	0.015	0.025	0.050	0.381	0.635	1.27
0°	0°	-	8°	0°	-	8°

SOT-23



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP.		0.037 TYP.	
e1	1.800	2.000	0.071	0.079
L	0.550 REF.		0.022 REF.	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°