



78LXX

LINEAR INTEGRATED CIRCUIT

3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATOR

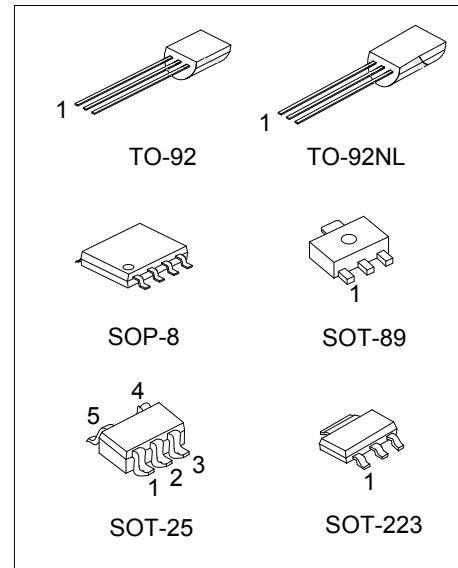
■ DESCRIPTION

The UTC **78LXX** family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications that required supply current up to 100mA.

■ FEATURES

- * Output current up to 100mA
- * Fixed output voltage of 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V and 24V available
- * Thermal overload shutdown protection
- * Short circuit current limiting

■ ORDERING INFORMATION



Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
78LXXL-AA3-R	78LXXG-AA3-R	SOT-223	O	G	I	-	-	-	-	-	Tape Reel
78LXXL-AB3-R	78LXXG-AB3-R	SOT-89	O	G	I	-	-	-	-	-	Tape Reel
78LXXL-AB3-C-R	78LXXG-AB3-C-R	SOT-89	G	I	O	-	-	-	-	-	Tape Reel
78LXXL-AF5-R	78LXXG-AF5-R	SOT-25	G	I	O	N	N	-	-	-	Tape Reel
78LXXL-S08-R	78LXXG-S08-R	SOP-8	O	G	G	N	N	G	G	I	Tape Reel
78LXXL-T92-B	78LXXG-T92-B	TO-92	O	G	I	-	-	-	-	-	Tape Box
78LXXL-T92-K	78LXXG-T92-K	TO-92	O	G	I	-	-	-	-	-	Bulk
78LXXL-T9N-B	78LXXG-T9N-B	TO-92NL	O	G	I	-	-	-	-	-	Tape Box
78LXXL-T9N-K	78LXXG-T9N-K	TO-92NL	O	G	I	-	-	-	-	-	Bulk

Note: 1. XX: Output Voltage, refer to Marking Information.

2. Pin Assignment: O: Output G: GND I: Input N: No Connection

<p>78LXXG-AB3-C-R</p>	<p>(1) B: Tape Box, K: Bulk, R: Tape Reel (2) refer to Pin Assignment (3) AA3: SOT-223, AB3: SOT-89, AF5: SOT-25, S08: SOP-8, T92: TO-92, T9N: TO-92NL (4) G: Halogen Free and Lead Free, L: Lead Free (5) XX: refer to Marking Information</p>
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MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-223	05: 5.0V 06: 6.0V 08: 8.0V 09: 9.0V 10: 10V 12: 12V 15: 15V 18: 18V 24: 24V	<p>Voltage Code ← 78L □□□ □□□ □□□ → L: Lead Free G: Halogen Free Date Code</p> <p>1 2 3</p>
SOT-89		<p>Date Code ← □□□□□ → Pin Code Voltage Code ← 78LXX□ □□□ □□□ → L: Lead Free G: Halogen Free</p> <p>1 2 3</p>
SOT-25		<p>Voltage Code ← 8LXX□ □□□ □□□ → L: Lead Free G: Halogen Free</p> <p>1 2 3</p>
SOP-8		<p>Date Code ← UTC □□□□□ → L: Lead Free Voltage Code ← 78LXX□ □□□ □□□ → G: Halogen Free Lot Code</p>
TO-92		<p>Voltage Code ← UTC 78LXX□ □□□ □□□ → L: Lead Free G: Halogen Free Date Code</p> <p>1 2 3</p>
TO-92NL		<p>Voltage Code ← UTC 78LXX□ □□□ □□□ → L: Lead Free G: Halogen Free Date Code</p> <p>3 2 1</p>

■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNIT
Input Voltage	$V_{OUT}=5\sim 9V$	V_{IN}	30	V
	$V_{OUT}=10\sim 18V$		35	V
	$V_{OUT}=24V$		40	V
Output Current		I_{OUT}	100	mA
Power Dissipation	SOT-223	P_D	750	mW
	SOT-89		500	mW
	SOT-25		240	mW
	SOP-8		660	mW
	TO-92/TO-92NL		625	mW
Junction Temperature		T_J	+150	°C
Operating Temperature (Note 2)		T_{OPR}	-40 ~ +125	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. It is guarantee by design, not 100% be tested.

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	SOT-223	θ_{JA}	133	°C/W
	SOT-89		200	°C/W
	SOT-25		416	°C/W
	SOP-8		150	°C/W
	TO-92/TO-92NL		160	°C/W
Junction to Case	SOT-223	θ_{JC}	15	°C/W
	SOT-89		50	°C/W
	SOT-25		130	°C/W
	SOP-8		45	°C/W
	TO-92/TO-92NL		83	°C/W

■ ELECTRICAL CHARACTERISTICS

For UTC78L05 ($V_{IN}=10V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 150^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	4.90	5.0	5.10	V
		$7V \leq V_{IN} \leq 20V$, $I_{OUT}=1mA-40mA$	4.85		5.15	V
		$7V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$	4.85		5.15	V (note 2)
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=1mA-100mA$		15	60	mV
		$T_J=25^{\circ}C$, $I_{OUT}=1mA-40mA$		8	30	mV
Line regulation	ΔV_{OUT}	$7V \leq V_{IN} \leq 20V$, $T_J=25^{\circ}C$		8	150	mV
		$8V \leq V_{IN} \leq 20V$, $T_J=25^{\circ}C$		6	100	mV
Quiescent Current	I_Q	$V_{IN}=10V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$		2.0	5.5	mA
Quiescent Current Change	ΔI_Q	$8V \leq V_{IN} \leq 20V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		40		μV
Temperature coefficient of V_{OUT}	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		1.0		$mV/^{\circ}C$
Ripple Rejection	RR	$8V \leq V_{IN} \leq 20V$, $f=120Hz$, $T_J=25^{\circ}C$		60		dB
Dropout Voltage	V_D	$T_J=25^{\circ}C$		1.7		V

For UTC78L06 ($V_{IN}=12V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 150^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	5.88	6.0	6.12	V
		$8.5V \leq V_{IN} \leq 20V$, $I_{OUT}=1mA-40mA$	5.82		6.18	V
		$8.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$				V (note 2)
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=1mA-100mA$		16	80	mV
		$T_J=25^{\circ}C$, $I_{OUT}=1mA-40mA$		9	40	mV
Line regulation	ΔV_{OUT}	$8.5V \leq V_{IN} \leq 20V$, $T_J=25^{\circ}C$		10	175	mV
		$9V \leq V_{IN} \leq 20V$, $T_J=25^{\circ}C$		8	125	mV
Quiescent Current	I_Q	$V_{IN}=12V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$		2.0	5.5	mA
Quiescent Current Change	ΔI_Q	$9V \leq V_{IN} \leq 20V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		49		μV
Temperature coefficient of V_{OUT}	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		1.3		$mV/^{\circ}C$
Ripple Rejection	RR	$10V \leq V_{IN} \leq 20V$, $f=120Hz$, $T_J=25^{\circ}C$		56		dB
Dropout Voltage	V_D	$T_J=25^{\circ}C$		1.7		V

For UTC78L08 ($V_{IN}=14V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 150^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	7.84	8.0	8.16	V
		$10.5V \leq V_{IN} \leq 23V$, $I_{OUT}=1mA-40mA$	7.76		8.24	V
		$10.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$	7.76		8.24	V (note 2)
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=1mA-100mA$		18	80	mV
		$T_J=25^{\circ}C$, $I_{OUT}=1mA-40mA$		10	40	mV
Line regulation	ΔV_{OUT}	$10.5V \leq V_{IN} \leq 23V$, $T_J=25^{\circ}C$		12	175	mV
		$11V \leq V_{IN} \leq 23V$, $T_J=25^{\circ}C$		10	125	mV
Quiescent Current	I_Q	$V_{IN}=14V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$		2.0	5.5	mA
Quiescent Current Change	ΔI_Q	$11V \leq V_{IN} \leq 23V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		49		μV
Temperature coefficient of V_o	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		1.5		$mV/^{\circ}C$
Ripple Rejection	RR	$11V \leq V_{IN} \leq 23V$, $f=120Hz$, $T_J=25^{\circ}C$		52		dB
Dropout Voltage	V_D	$T_J=25^{\circ}C$		1.7		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

For UTC78L09 ($V_{IN}=15V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 150^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	8.82	9.0	9.18	V
		$11.5V \leq V_{IN} \leq 24V$, $I_{OUT}=1mA-40mA$	8.73		9.27	V
		$11.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$	8.73		9.27	V(note 2)
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=1mA-100mA$		20	90	mV
		$T_J=25^{\circ}C$, $I_{OUT}=1mA-40mA$		10	40	mV
Line regulation	ΔV_{OUT}	$11.5V \leq V_{IN} \leq 24V$, $T_J=25^{\circ}C$		15	200	mV
		$13V \leq V_{IN} \leq 24V$, $T_J=25^{\circ}C$		10	150	mV
Quiescent Current	I_Q	$V_{IN}=15V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$		2.0	6.0	mA
Quiescent Current Change	ΔI_Q	$13V \leq V_{IN} \leq 24V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		70		μV
Temperature coefficient of V_{OUT}	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		1.6		$mV/^{\circ}C$
Ripple Rejection	RR	$12V \leq V_{IN} \leq 24V$, $f=120Hz$, $T_J=25^{\circ}C$		46		dB
Dropout Voltage	V_D	$T_J=25^{\circ}C$		1.7		V

For UTC78L10 ($V_{IN}=16V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 150^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	9.8	10	10.2	V
		$12.5V \leq V_{IN} \leq 25V$, $I_{OUT}=1mA-40mA$	9.7		10.3	V
		$12.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$	9.7		10.3	V(note 2)
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=1mA-100mA$		20	90	mV
		$T_J=25^{\circ}C$, $I_{OUT}=1mA-40mA$		10	45	mV
Line regulation	ΔV_{OUT}	$12.5V \leq V_{IN} \leq 25V$, $T_J=25^{\circ}C$		25	200	mV
		$14V \leq V_{IN} \leq 25V$, $T_J=25^{\circ}C$		20	170	mV
Quiescent Current	I_Q	$V_{IN}=17V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$		2.0	6.0	mA
Quiescent Current Change	ΔI_Q	$12.5V \leq V_{IN} \leq 25V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		74		μV
Temperature coefficient of V_{OUT}	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		1.7		$mV/^{\circ}C$
Ripple Rejection	RR	$15V \leq V_{IN} \leq 25V$, $f=120Hz$, $T_J=25^{\circ}C$		45		dB
Dropout Voltage	V_D	$T_J=25^{\circ}C$		1.7		V

For UTC78L12 ($V_{IN}=19V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 150^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	11.76	12	12.24	V
		$14.5V \leq V_{IN} \leq 27V$, $I_{OUT}=1mA-40mA$	11.64		12.36	V
		$14.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$	11.64		12.36	V(note 2)
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=1mA-100mA$		25	100	mV
		$T_J=25^{\circ}C$, $I_{OUT}=1mA-40mA$		12	50	mV
Line regulation	ΔV_{OUT}	$14.5V \leq V_{IN} \leq 27V$, $T_J=25^{\circ}C$		25	300	mV
		$16V \leq V_{IN} \leq 27V$, $T_J=25^{\circ}C$		20	250	mV
Quiescent Current	I_Q	$V_{IN}=19V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$		2.0	6.5	mA
Quiescent Current Change	ΔI_Q	$16V \leq V_{IN} \leq 27V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		80		μV
Temperature coefficient of V_{OUT}	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		1.8		$mV/^{\circ}C$
Ripple Rejection	RR	$15V \leq V_{IN} \leq 25V$, $f=120Hz$, $T_J=25^{\circ}C$		45		dB
Dropout Voltage	V_D	$T_J=25^{\circ}C$		1.7		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

For UTC78L15 ($V_{IN}=23V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 150^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	14.70	15	15.30	V
		$17.5V \leq V_{IN} \leq 30V$, $I_{OUT}=1mA-40mA$	14.55		15.45	V
		$17.5V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$	14.55		15.45	V(note 2)
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=1mA-100mA$		25	150	mV
		$T_J=25^{\circ}C$, $I_{OUT}=1mA-40mA$		15	75	mV
Line Regulation	ΔV_{OUT}	$17.5V \leq V_{IN} \leq 30V$, $T_J=25^{\circ}C$		25	150	mV
		$20V \leq V_{IN} \leq 30V$, $T_J=25^{\circ}C$		15	75	mV
Quiescent Current	I_Q	$V_{IN}=23V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$		2.2	6.5	mA
Quiescent Current Change	ΔI_Q	$20V \leq V_{IN} \leq 30V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		90		μV
Temperature Coefficient of V_{OUT}	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		2.0		mV/ $^{\circ}C$
Ripple Rejection	RR	$18.5V \leq V_{IN} \leq 28.5V$, $f=120Hz$, $T_J=25^{\circ}C$		45		dB
Dropout Voltage	V_D	$T_J=25^{\circ}C$		1.7		V

For UTC78L18 ($V_{IN}=27V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 150^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	17.64	18	18.36	V
		$21V \leq V_{IN} \leq 33V$, $I_{OUT}=1mA-40mA$	17.46		18.54	V
		$21V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$	17.46		18.54	V(note 2)
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=1mA-100mA$		30	180	mV
		$T_J=25^{\circ}C$, $I_{OUT}=1mA-40mA$		20	90	mV
Line Regulation	ΔV_{OUT}	$21V \leq V_{IN} \leq 33V$, $T_J=25^{\circ}C$		45	300	mV
		$22V \leq V_{IN} \leq 33V$, $T_J=25^{\circ}C$		35	250	mV
Quiescent Current	I_Q	$V_{IN}=27V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$		2.2	6.5	mA
Quiescent Current Change	ΔI_Q	$21V \leq V_{IN} \leq 33V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		150		μV
Temperature Coefficient of V_{OUT}	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		2.2		mV/ $^{\circ}C$
Ripple Rejection	RR	$23V \leq V_{IN} \leq 33V$, $f=120Hz$, $T_J=25^{\circ}C$		45		dB
Dropout Voltage	V_D	$T_J=25^{\circ}C$		1.7		V

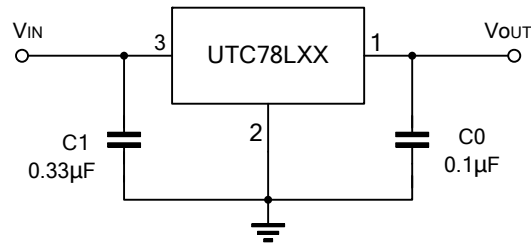
For UTC78L24 ($V_{IN}=33V$, $I_{OUT}=40mA$, $0^{\circ}C < T_J < 150^{\circ}C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$	23.52	24	24.48	V
		$27V \leq V_{IN} \leq 38V$, $I_{OUT}=1mA-40mA$	23.28		24.72	V
		$27V \leq V_{IN} \leq V_{MAX}$, $I_{OUT}=1mA-70mA$	23.28		24.72	V(note 2)
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=1mA-100mA$		41	240	mV
		$T_J=25^{\circ}C$, $I_{OUT}=1mA-40mA$		28	120	mV
Line Regulation	ΔV_{OUT}	$27V \leq V_{IN} \leq 38V$, $T_J=25^{\circ}C$		160	300	mV
		$28V \leq V_{IN} \leq 38V$, $T_J=25^{\circ}C$		150	250	mV
Quiescent Current	I_Q	$V_{IN}=33V$, $I_{OUT}=0mA$, $T_J=25^{\circ}C$		2.2	6.0	mA
Quiescent Current Change	ΔI_Q	$27V \leq V_{IN} \leq 38V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		200		μV
Temperature Coefficient of V_{OUT}	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-2.0		mV/ $^{\circ}C$
Ripple Rejection	RR	$27V \leq V_{IN} \leq 38V$, $f=120Hz$, $T_J=25^{\circ}C$		45		dB
Dropout Voltage	V_D	$T_J=25^{\circ}C$		1.7		V

Notes: 1. The Maximum steady state usable output current is dependent on input voltage, heat sinking, lead length of the package and copper pattern of PCB.

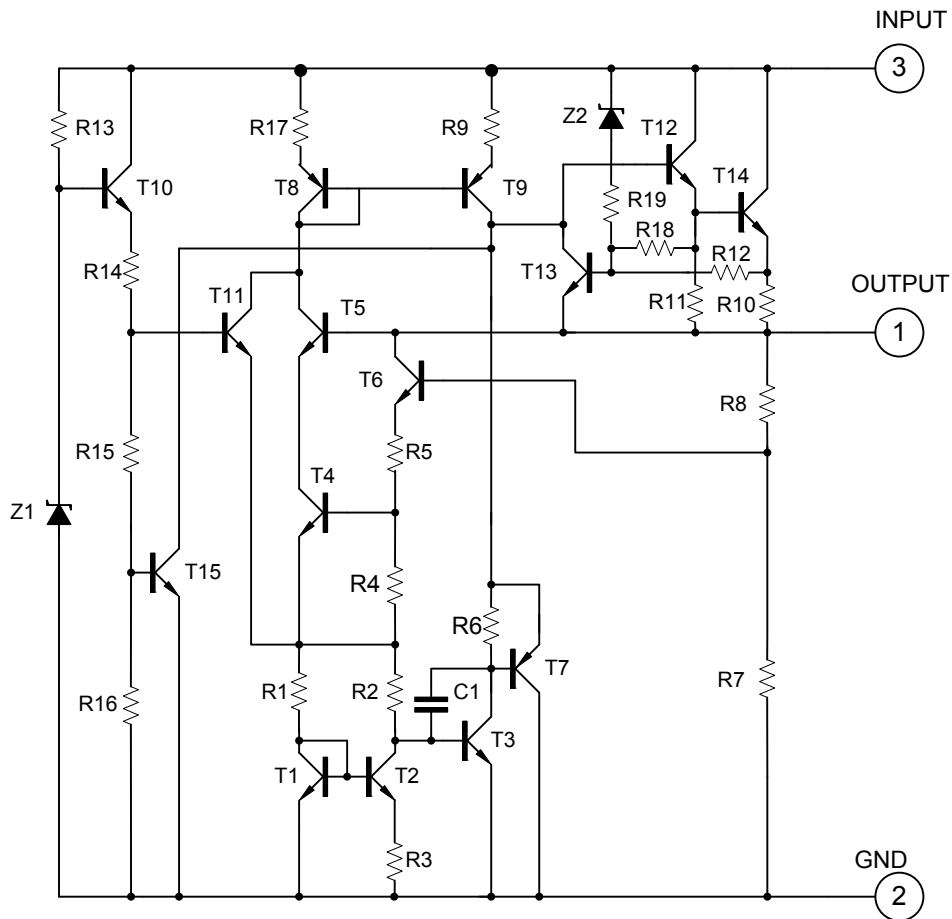
2. Power dissipation < 0.5W.

■ APPLICATION CIRCUIT

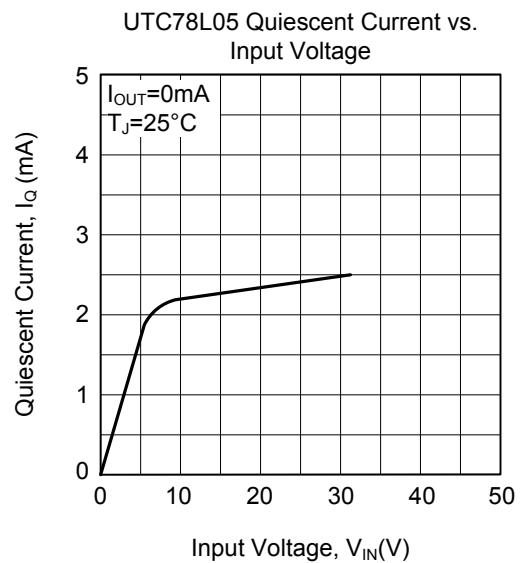
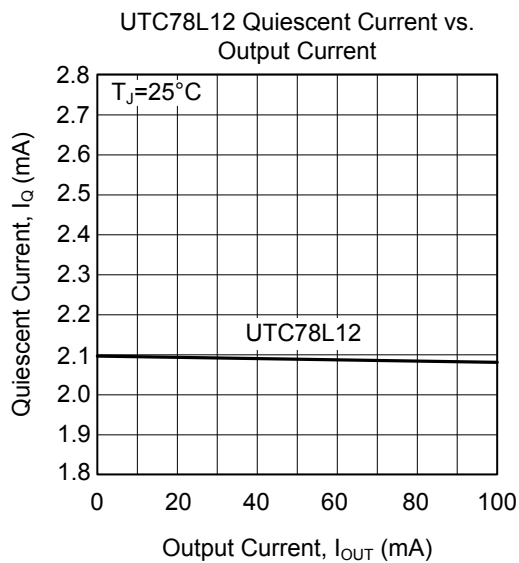
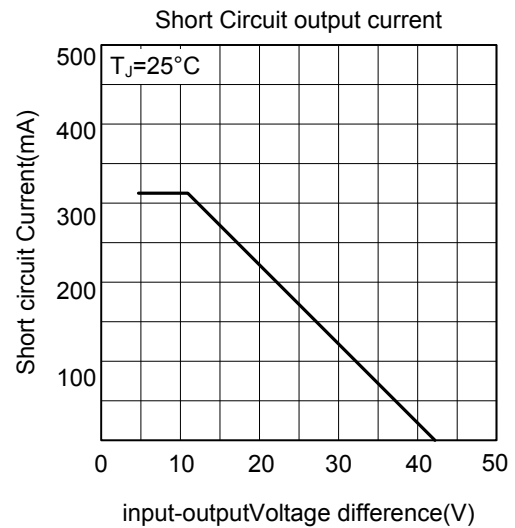
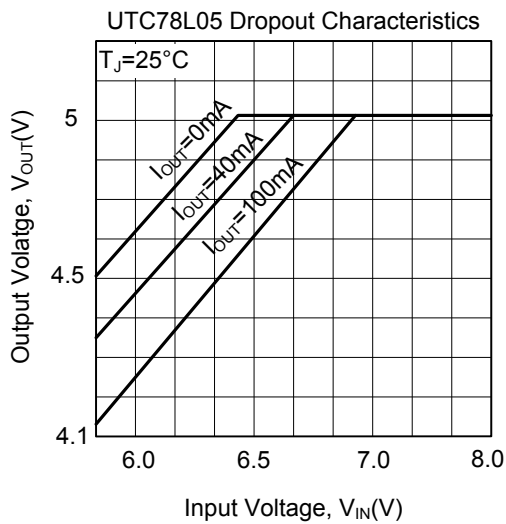
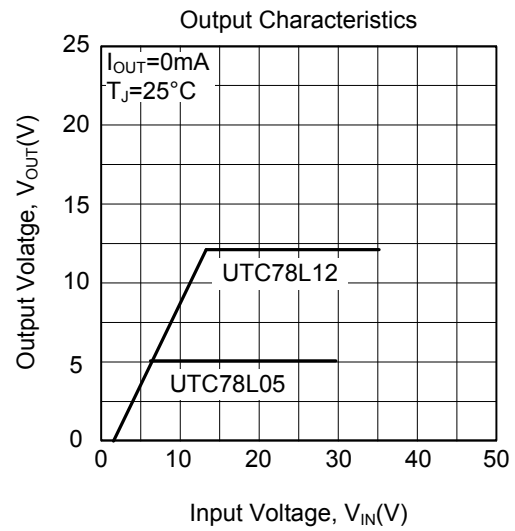
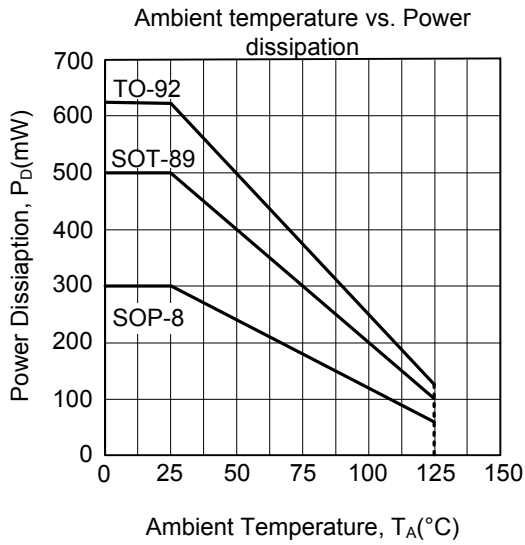


- Notes:
1. To specify an output voltage, substitute voltage value for "XX".
 2. Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

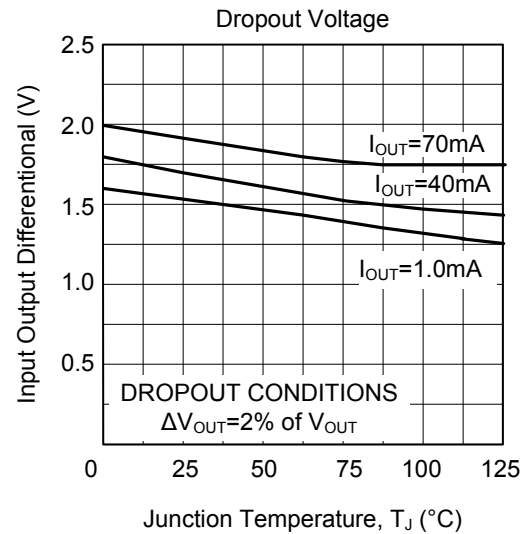
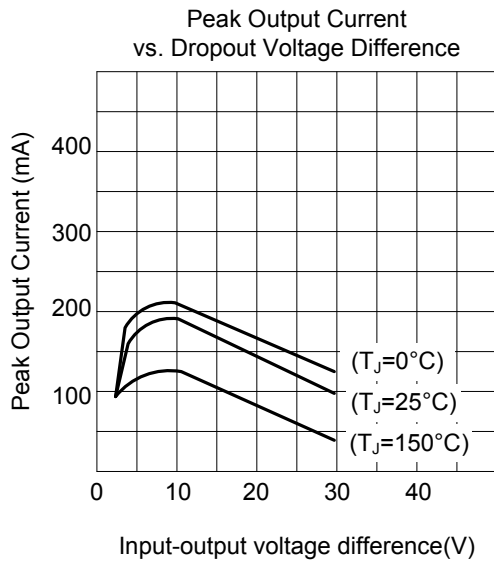
■ TEST CIRCUIT



TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



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