



## 78LXX

## LINEAR INTEGRATED CIRCUIT

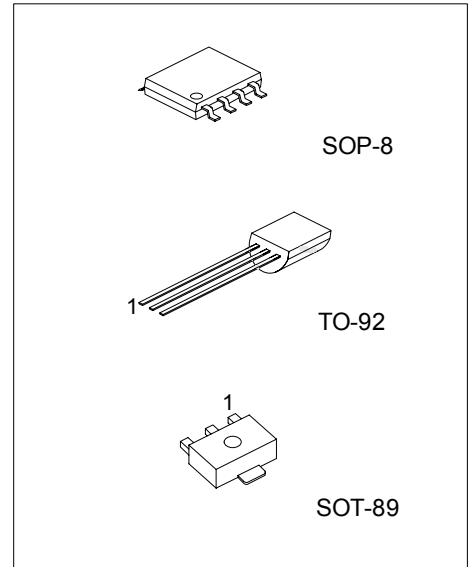
### 3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATOR

#### 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, 12V, 15V, 18V and 24V available
- \*Thermal overload shutdown protection
- \*Short circuit current limiting



\* Pb-free plating product number: 78LXXL

#### ORDERING INFORMATION

Order Number		Pin Assignment								Package	Packing
Normal	Lead Free Plating	1	2	3	4	5	6	7	8		
78Lxx-AB3-B-R	78LxxL-AB3-B-R	O	G	I	-	-	-	-	-	SOT-89	Tape Reel
78Lxx-S08-0-R	78LxxL-S08-0-R	O	G	G	N	N	G	G	I	SOP-8	Tape Reel
78Lxx-S08-0-T	78LxxL-S08-0-T	O	G	G	N	N	G	G	I	SOP-8	Tube
78Lxx-T92-B-B	78LxxL-T92-B-B	O	G	I	-	-	-	-	-	TO-92	Tape Box
78Lxx-T92-B-K	78LxxL-T92-B-K	O	G	I	-	-	-	-	-	TO-92	Bulk
78Lxx-T92-B-R	78LxxL-T92-B-R	O	G	I	-	-	-	-	-	TO-92	Tape Reel

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

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

<p>78LxxL-AB3-B-R</p>	<p>(1)Packing Type (2)Pin Assignment (3)Package Type (4)Lead Plating (5)Output Voltage Code</p>	<p>(1) B: Tape Box, K: Bulk, R: Tape Reel, T: Tube (2) refer to Pin Assignment (3) AB3: SOT-89, S08: SOP-8, T92: TO-92 (4) L: Lead Free Plating, Blank: Pb/Sn (5) xx: refer to Marking Information</p>
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## MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOP-8	05:5.0V 06:6.0V 08:8.0V 09:9.0V 12:12V 15:15V 18:18V 24:24V	
SOT-89		
TO-92		

### ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT	
Input voltage	$V_{IN}$	$V_{OUT}=5\sim 9V$	30	V
		$V_{OUT}=12\sim 24V$	35	
Output Current	$I_{OUT}$	100	mA	
Power Dissipation	$P_D$	SOP-8	300	mW
		TO-92	625	
		SOT-89	350	
Junction Temperature	$T_J$	+125	°C	
Operating Temperature	$T_{OPR}$	-20~+85	°C	
Storage Temperature	$T_{STG}$	-40~+150	°C	

Note 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. The device is guaranteed to meet performance specification within 0°C~+70°C operating temperature range and assured by design from -20°C~+85°C

### ■ ELECTRICAL CHARACTERISTICS

For UTC78L05 ( $V_{IN}=10V$ ,  $I_{OUT}=40mA$ ,  $0^\circ C < T_J < 125^\circ C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^\circ C$	4.80	5.0	5.20	V
		$7V \leq V_{IN} \leq 20V, I_{OUT}=1mA-40mA$	4.75		5.25	V
		$7V \leq V_{IN} \leq V_{MAX}, I_{OUT}=1mA-70mA$	4.75		5.25	V (note 2)
Load Regulation	$V_{OUT}$	$T_J=25^\circ C, I_{OUT}=1mA-100mA$		11	60	mV
		$T_J=25^\circ C, I_{OUT}=1mA-40mA$		5.0	30	mV
Line regulation	$V_{OUT}$	$7V \leq V_{IN} \leq 20V, T_J=25^\circ C$		8	150	mV
		$8V \leq V_{IN} \leq 20V, T_J=25^\circ C$		6	100	mV
Quiescent Current	$\Delta I_Q$	$V_{IN}=10V, I_{OUT}=0mA, T_J=25^\circ C$		2.0	5.5	mA
Quiescent Current Change	$\Delta I_Q$	$8V \leq V_{IN} \leq 20V$			1.5	mA
		$1mA \leq V_{IN} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		40		uV
Temperature coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-0.65		mV/°C
Ripple Rejection	RR	$8V \leq V_{IN} \leq 20V, f=120Hz, T_J=25^\circ C$	41	80		dB
Dropout Voltage	$V_D$	$T_J=25^\circ C$		1.7		V

For UTC78L06 ( $V_{IN}=12V$ ,  $I_{OUT}=40mA$ ,  $0^\circ C < T_J < 125^\circ C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^\circ C$	5.76	6.0	6.24	V
		$8.5V \leq V_{IN} \leq 20V, I_{OUT}=1mA-40mA$	5.70		6.30	V
		$8.5V \leq V_{IN} \leq V_{MAX}, I_{OUT}=1mA-70mA$	5.70		6.30	V (note 2)
Load Regulation	$V_{OUT}$	$T_J=25^\circ C, I_{OUT}=1mA-100mA$		12.8	80	mV
		$T_J=25^\circ C, I_{OUT}=1mA-70mA$		5.8	40	mV
Line regulation	$V_{OUT}$	$8.5V \leq V_{IN} \leq 20V, T_J=25^\circ C$		64	175	mV
		$9V \leq V_{IN} \leq 20V, T_J=25^\circ C$		54	125	mV
Quiescent Current	$\Delta I_Q$	$V_{IN}=12V, I_{OUT}=0mA, T_J=25^\circ C$		3.9	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$9V \leq V_{IN} \leq 20V$			1.5	mA
		$1mA \leq V_{IN} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		49		uV
Temperature coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		0.75		mV/°C
Ripple Rejection	RR	$10V \leq V_{IN} \leq 20V, f=120Hz, T_J=25^\circ C$	40	46		dB
Dropout Voltage	$V_D$	$T_J=25^\circ C$		1.7		V

### ■ ELECTRICAL CHARACTERISTICS (Cont.)

For UTC78L08 ( $V_{IN}=14V$ ,  $I_{OUT}=40mA$ ,  $0^{\circ}C < T_J < 125^{\circ}C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	7.68	8.0	8.32	V
		$10.5V \leq V_{IN} \leq 23V, I_{OUT}=1mA-40mA$	7.60		8.40	V
		$10.5V \leq V_{IN} \leq V_{MAX}, I_{OUT}=1mA-70mA$	7.60		8.40	V(note 2)
Load Regulation	$V_{OUT}$	$T_J=25^{\circ}C, I_{OUT}=1mA-100mA$		15	80	mV
		$T_J=25^{\circ}C, I_{OUT}=1mA-70mA$		8.0	40	mV
Line regulation	$V_{OUT}$	$10.5V \leq V_{IN} \leq 23V, T_J=25^{\circ}C$		10	175	mV
		$11V \leq V_{IN} \leq 23V, T_J=25^{\circ}C$		8	125	mV
Quiescent Current	$\Delta I_Q$	$V_{IN}=14V, I_{OUT}=0mA, T_J=25^{\circ}C$		2.0	5.5	mA
Quiescent Current Change	$\Delta I_Q$	$11V \leq V_{IN} \leq 23V$			1.5	mA
		$1mA \leq V_{IN} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		49		$\mu V$
Temperature coefficient of $V_o$	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		0.75		$mV/^{\circ}C$
Ripple Rejection	RR	$11V \leq V_{IN} \leq 23V, f=120Hz, T_J=25^{\circ}C$	39	70		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

For UTC78L09 ( $V_{IN}=15V$ ,  $I_{OUT}=40mA$ ,  $0^{\circ}C < T_J < 125^{\circ}C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	8.64	9.0	9.36	V
		$11.5V \leq V_{IN} \leq 24V, I_{OUT}=1mA-40mA$	8.55		9.45	V
		$11.5V \leq V_{IN} \leq V_{MAX}, I_{OUT}=1mA-70mA$	8.55		9.45	V(note 2)
Load Regulation	$V_{OUT}$	$T_J=25^{\circ}C, I_{OUT}=1mA-100mA$		20	90	mV
		$T_J=25^{\circ}C, I_{OUT}=1mA-40mA$		10	45	mV
Line regulation	$V_{OUT}$	$11.5V \leq V_{IN} \leq 24V, T_J=25^{\circ}C$		90	200	mV
		$13V \leq V_{IN} \leq 24V, T_J=25^{\circ}C$		100	150	mV
Quiescent Current	$\Delta I_Q$	$V_{IN}=15V, I_{OUT}=0mA, T_J=25^{\circ}C$		2.0	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$13V \leq V_{IN} \leq 24V$			1.5	mA
		$1mA \leq V_{IN} \leq 40mA$			0.1	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		49		$\mu V$
Temperature coefficient of $V_{OUT}$	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		0.75		$mV/^{\circ}C$
Ripple Rejection	RR	$12V \leq V_{IN} \leq 23V, f=120Hz, T_J=25^{\circ}C$	38	44		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

For UTC78L12 ( $V_{IN}=19V$ ,  $I_{OUT}=40mA$ ,  $0^{\circ}C < T_J < 125^{\circ}C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	11.52	12.0	12.48	V
		$14.5V \leq V_{IN} \leq 27V, I_{OUT}=1mA-40mA$	11.40		12.60	V
		$14.5V \leq V_{IN} \leq V_{MAX}, I_{OUT}=1mA-70mA$	11.40		12.60	V(note 2)
Load Regulation	$V_{OUT}$	$T_J=25^{\circ}C, I_{OUT}=1mA-100mA$		25	150	mV
		$T_J=25^{\circ}C, I_{OUT}=1mA-40mA$		12	75	mV
Line regulation	$V_{OUT}$	$14.5V \leq V_{IN} \leq 27V, T_J=25^{\circ}C$		25	300	mV
		$16V \leq V_{IN} \leq 27V, T_J=25^{\circ}C$		20	250	mV
Quiescent Current	$\Delta I_Q$	$V_{IN}=19V, I_{OUT}=0mA, T_J=25^{\circ}C$		2.0	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$16V \leq V_{IN} \leq 27V$			1.5	mA
		$1mA \leq V_{IN} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		80		$\mu V$
Temperature coefficient of $V_{OUT}$	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		-1.0		$mV/^{\circ}C$
Ripple Rejection	RR	$15V \leq V_{IN} \leq 25V, f=120Hz, T_J=25^{\circ}C$	37	65		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

### ■ ELECTRICAL CHARACTERISTICS (Cont.)

For UTC78L15 ( $V_{IN}=23V$ ,  $I_{OUT}=40mA$ ,  $0^{\circ}C < T_J < 125^{\circ}C$ ,  $C1=0.33\mu F$ ,  $C0=0.1\mu F$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	14.40	15.0	15.60	V
		$17.5V \leq V_{IN} \leq 30V, I_{OUT}=1mA-40mA$	14.25		15.75	V
		$17.5V \leq V_{IN} \leq V_{MAX}, I_{OUT}=1mA-70mA$	14.25		15.75	V(note 2)
Load Regulation	$V_{OUT}$	$T_J=25^{\circ}C, I_{OUT}=1mA-100mA$		20	150	mV
		$T_J=25^{\circ}C, I_{OUT}=1mA-70mA$		25	150	mV
Line regulation	$V_{OUT}$	$17.5V \leq V_{IN} \leq 30V, T_J=25^{\circ}C$		25	150	mV
		$20V \leq V_{IN} \leq 30V, T_J=25^{\circ}C$		15	75	mV
Quiescent Current	$\Delta I_Q$	$V_{IN}=23V, I_{OUT}=0mA, T_J=25^{\circ}C$		2.2	6.5	mA
Quiescent Current Change	$\Delta I_Q$	$20V \leq V_{IN} \leq 30V$			1.5	mA
		$1mA \leq V_{IN} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		90		$\mu V$
Temperature coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-1.3		mV/ $^{\circ}C$
Ripple Rejection	RR	$18.5V \leq V_{IN} \leq 28.5V, f=120Hz, T_J=25^{\circ}C$	34	63		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

For UTC78L18 ( $V_{IN}=27V$ ,  $I_{OUT}=40mA$ ,  $0^{\circ}C < T_J < 125^{\circ}C$ ,  $C1=0.33\mu F$ ,  $C0=0.1\mu F$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	17.28	18.0	18.72	V
		$21V \leq V_{IN} \leq 33V, I_{OUT}=1mA-40mA$	17.10		18.90	V
		$21V \leq V_{IN} \leq V_{MAX}, I_{OUT}=1mA-70mA$	17.10		18.90	V(note 2)
Load Regulation	$V_{OUT}$	$T_J=25^{\circ}C, I_{OUT}=1mA-100mA$		30	170	mV
		$T_J=25^{\circ}C, I_{OUT}=1mA-40mA$		15	85	mV
Line regulation	$V_{OUT}$	$21V \leq V_{IN} \leq 33V, T_J=25^{\circ}C$		145	300	mV
		$22V \leq V_{IN} \leq 33V, T_J=25^{\circ}C$		135	250	mV
Quiescent Current	$\Delta I_Q$	$V_{IN}=27V, I_{OUT}=0mA, T_J=25^{\circ}C$		2.0	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$21V \leq V_{IN} \leq 33V$			1.5	mA
		$1mA \leq V_{IN} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		150		$\mu V$
Temperature coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-1.8		mV/ $^{\circ}C$
Ripple Rejection	RR	$23V \leq V_{IN} \leq 33V, f=120Hz, T_J=25^{\circ}C$	34	48		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

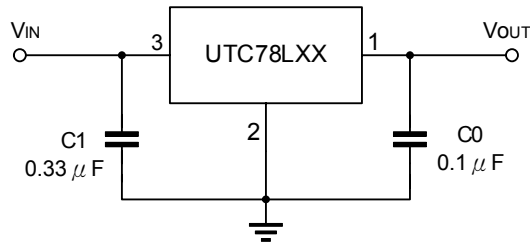
For UTC78L24 ( $V_{IN}=33V$ ,  $I_{OUT}=40mA$ ,  $0^{\circ}C < T_J < 125^{\circ}C$ ,  $C1=0.33\mu F$ ,  $C0=0.1\mu F$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	23.04	24.0	24.96	V
		$27V \leq V_{IN} \leq 38V, I_{OUT}=1mA-40mA$	22.8		25.2	V
		$27V \leq V_{IN} \leq V_{MAX}, I_{OUT}=1mA-70mA$	22.8		25.2	V(note 2)
Load Regulation	$\Delta V_{OUT}$	$T_J=25^{\circ}C, I_{OUT}=1mA-100mA$		40	200	mV
		$T_J=25^{\circ}C, I_{OUT}=1mA-40mA$		20	100	mV
Line regulation	$\Delta V_{OUT}$	$27V \leq V_{IN} \leq 38V, T_J=25^{\circ}C$		160	300	mV
		$28V \leq V_{IN} \leq 38V, T_J=25^{\circ}C$		150	250	mV
Quiescent Current	$\Delta I_Q$	$V_{IN}=33V, I_{OUT}=0mA, T_J=25^{\circ}C$		2.2	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$27V \leq V_{IN} \leq 38V$			1.5	mA
		$1mA \leq V_{IN} \leq 40mA$			0.1	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		200		$\mu V$
Temperature coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-2.0		mV/ $^{\circ}C$
Ripple Rejection	RR	$27V \leq V_{IN} \leq 38V, f=120Hz, T_J=25^{\circ}C$	34	45		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

Note 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

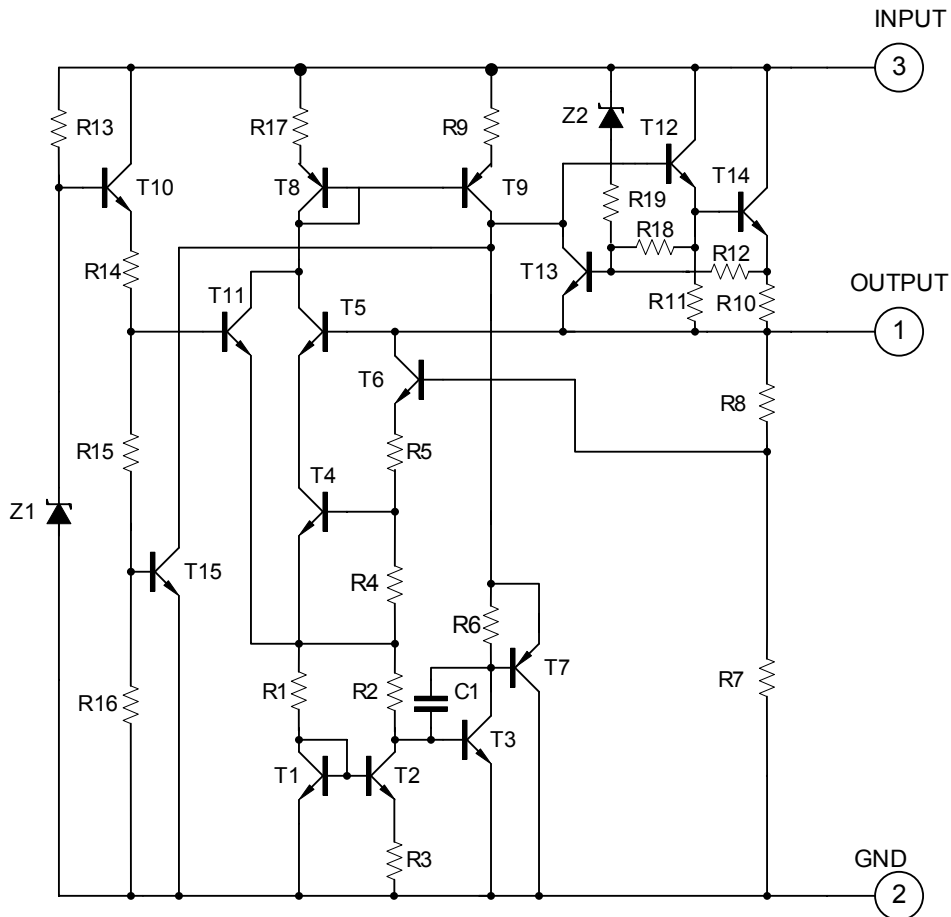
## ■ APPLICATION CIRCUIT



Note 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

Fig.1 Ambient temperature vs. Power dissipation

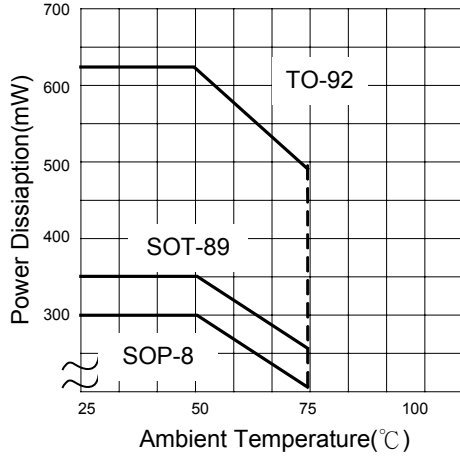


Fig.2 UTC78L05 Output Voltage vs. Ambient temperature

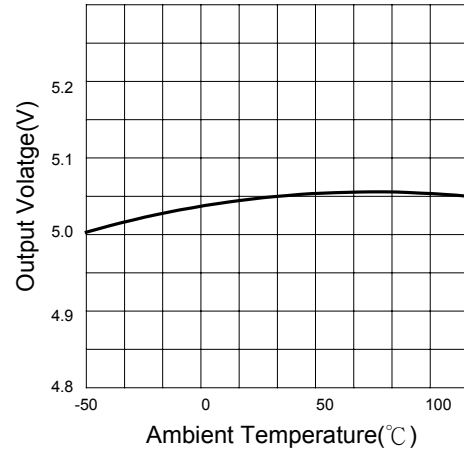


Fig.3 UTC78L12 Output Voltage vs. Ambient temperature

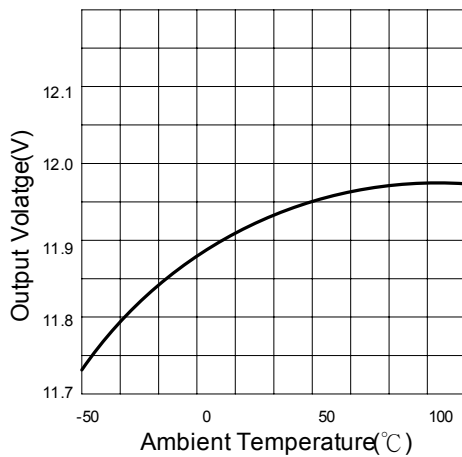


Fig.4 Output Characteristics (I<sub>p</sub>=0mA, T<sub>J</sub>=25°C)

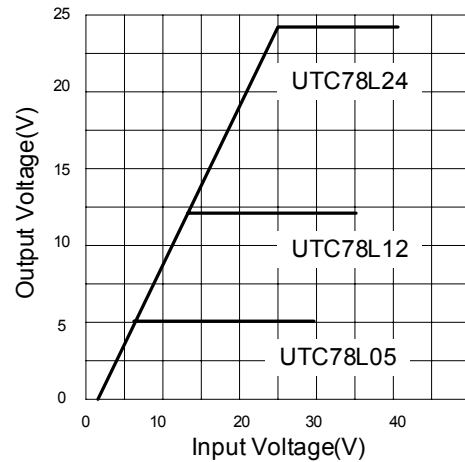


Fig.5 UTC78L05 Dropout Characteristics (T<sub>J</sub>=25°C)

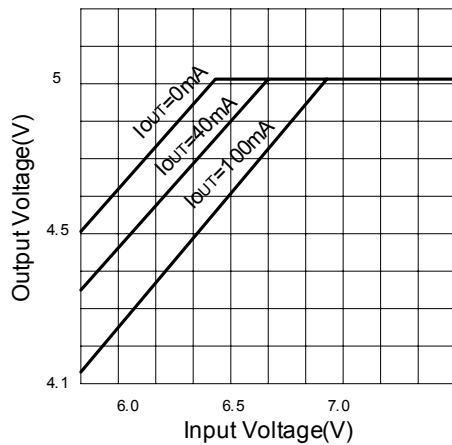
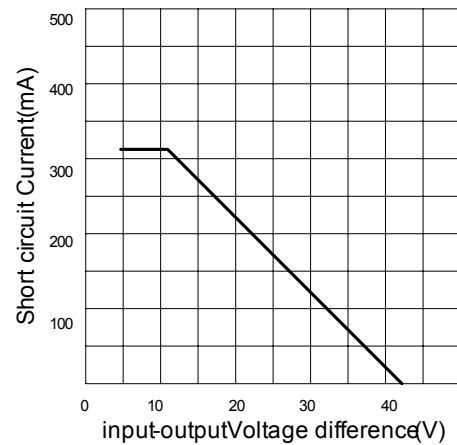


Fig.6 Short Circuit output current (T<sub>J</sub>=25°C)



## ■ TYPICAL CHARACTERISTICS(Cont.)

Fig.7 UTC78L12/24 quiescent current vs output current ( $T_J=25^\circ\text{C}$ )

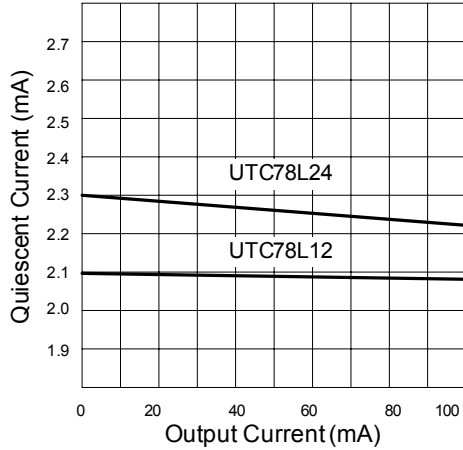


Fig.8 UTC78L05 Quiescent Current vs. Input Voltage ( $I_{OUT}=0\text{mA}, T_J=25^\circ\text{C}$ )

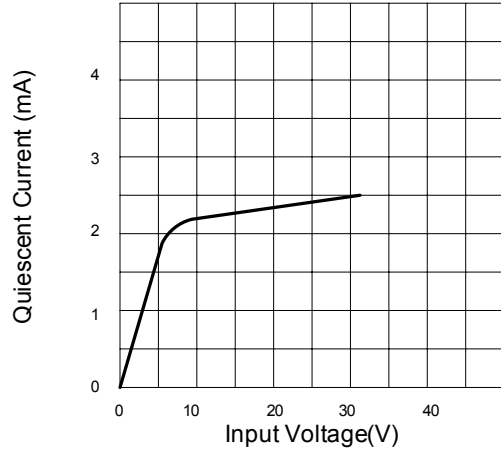


Fig.9 Peak Output Current vs Dropout Voltage Difference

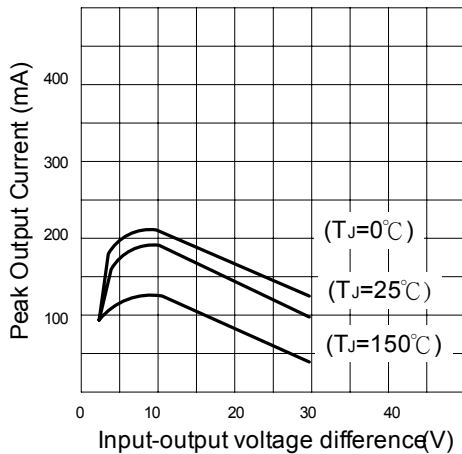
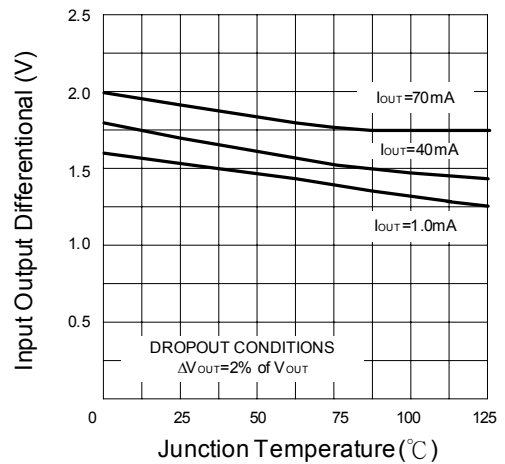


Fig.10 Dropout Voltage



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