



78TXXAA

LINEAR INTEGRATED CIRCUIT

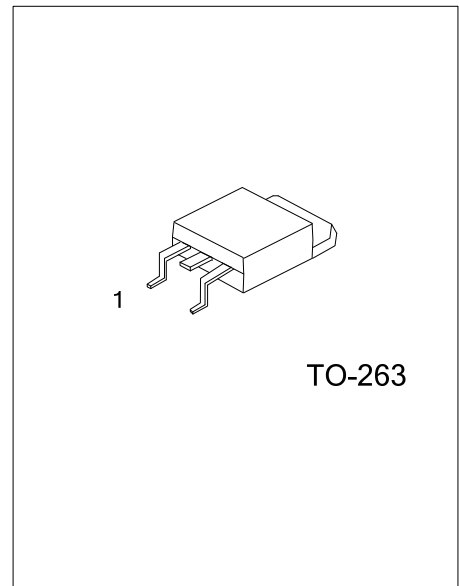
3-TERMINAL 1.5A POSITIVE VOLTAGE REGULATOR

DESCRIPTION

The UTC **78TXXAA** family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications requiring supply current up to 1.5 A.

FEATURES

- * Output current up to 1.5A
- * Fixed output voltage of 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V and 24V available
- * Thermal overload shutdown protection
- * Short circuit current limiting
- * Output transistor SOA protection



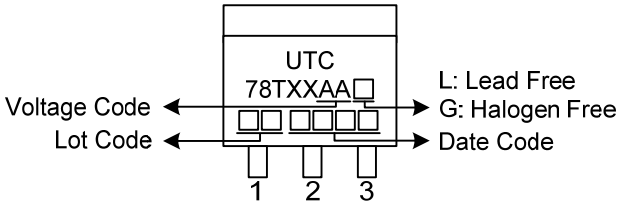
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
78TXXAAL-TQ2-T	78TXXAAG-TQ2-T	TO-263	I	G	O	Tube
78TXXAAL-TQ2-R	78TXXAAG-TQ2-R	TO-263	I	G	O	Tape Reel

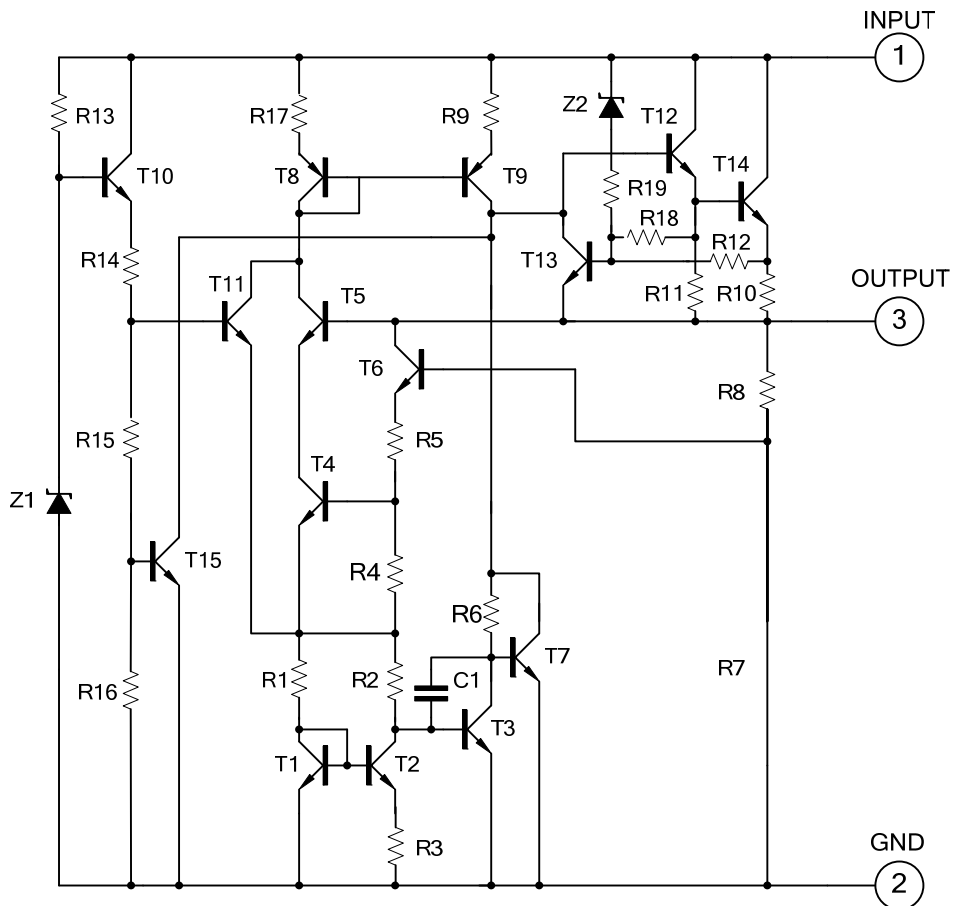
Note: Pin Assignment: O: Output G: GND I: Input

<p>78TXXAAL-TQ2-T</p> <p>(1) Packing Type (2) Package Type (3) Lead Free (4) Output Voltage Code</p>	<p>(1) T: Tube, R: Tape Reel (2) TQ2: TO-263 (3) L: Lead Free, G: Halogen Free (4) XX: refer to Marking Information</p>
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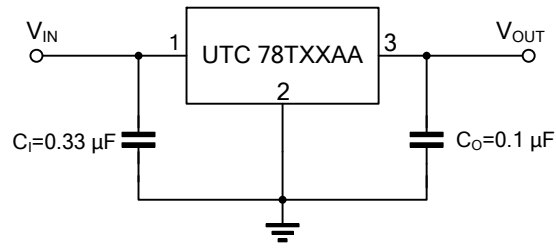
MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
TO-263	05: 5.0 V	
	06: 6.0 V	
	07: 7.0 V	
	08: 8.0 V	
	09: 9.0 V	
	10: 10 V	
	12: 12 V	
	15: 15 V	
	18: 18 V	
	24: 2.4 V	

BLOCK DIAGRAM



■ 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.

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

PARAMETER	SYMBOL	RATING	UNIT	
Input voltage	V_{IN}	$V_{OUT}=5\sim 18V$	35	V
		$V_{OUT}=24V$	40	V
Output Current	I_{OUT}	1.5	A	
Power Dissipation	P_D	Internally Limited	W	
Operating Junction Temperature	T_{OPR}	-20 ~ +150	°C	
Storage Temperature	T_{STG}	-55 ~ +150	°C	

Note: 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.

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Ambient	θ_{JA}	65	°C/W
Junction to Case	θ_{JC}	5	°C/W

■ ELECTRICAL CHARACTERISTICS

($I_{OUT}=0.5A$, $T_J=0^{\circ}C\sim 125^{\circ}C$, $C_I=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

For UTC 78T05AA ($V_{IN}=10V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=5mA \sim 1.0A$	4.80	5.0	5.20	V
		$V_{IN}=7.5V \sim 20V$, $I_{OUT}=5mA \sim 1.0A$, $P_D \leq 15W$	4.75		5.25	V
Dropout Voltage	V_D	$T_J=25^{\circ}C$		2.0		V
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=5mA \sim 1.5A$			100	mV
		$T_J=25^{\circ}C$, $I_{OUT}=0.25A \sim 0.75A$			50	mV
Line regulation	ΔV_{OUT}	$V_{IN}=7V \sim 25V$, $T_J=25^{\circ}C$			50	mV
		$V_{IN}=7.5V \sim 20V$, $T_J=25^{\circ}C$, $I_{OUT}=1.0A$			50	mV
Quiescent Current	I_Q	$T_J=25^{\circ}C$, $I_{OUT} \leq 1.0A$			8.0	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=7.5V \sim 20V$			1.0	mA
		$I_{OUT}=5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		40		μV
Temperature Coefficient of V_o	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		-0.6		mV/°C
Ripple Rejection	RR	$V_{IN}=8V \sim 18V$, $f=120Hz$, $T_J=25^{\circ}C$	62	80		dB
Peak Output Current	I_{PEAK}	$T_J=25^{\circ}C$		1.8		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$, $T_J=25^{\circ}C$		250		mA

For UTC 78T06AA ($V_{IN}=11V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=5mA \sim 1.0A$	5.76	6.0	6.24	V
		$V_{IN}=8.5V \sim 21V$, $I_{OUT}=5mA \sim 1.0A$, $P_D \leq 15W$	5.70		6.30	V
Dropout Voltage	V_D	$T_J=25^{\circ}C$		2.0		V
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C$, $I_{OUT}=5mA \sim 1.5A$			100	mV
		$T_J=25^{\circ}C$, $I_{OUT}=0.25A \sim 0.75A$			50	mV
Line regulation	ΔV_{OUT}	$V_{IN}=8V \sim 25V$, $T_J=25^{\circ}C$			60	mV
		$V_{IN}=8.5V \sim 21V$, $T_J=25^{\circ}C$, $I_{OUT}=1.0A$			60	mV
Quiescent Current	I_Q	$T_J=25^{\circ}C$, $I_{OUT} \leq 1.0A$			8.0	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=8.5V \sim 21V$			1.0	mA
		$I_{OUT}=5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		45		μV
Temperature Coefficient of V_o	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		-0.7		mV/°C
Ripple Rejection	RR	$V_{IN}=9V \sim 19V$, $f=120Hz$, $T_J=25^{\circ}C$	59	75		dB
Peak Output Current	I_{PEAK}	$T_J=25^{\circ}C$		1.8		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$, $T_J=25^{\circ}C$		250		mA

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC 78T07AA ($V_{IN}=13V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA - 1.0A$	6.72	7.0	7.28	V
		$V_{IN}=9.5V \sim 22V,$ $I_{OUT}=5mA \sim 1.0A, P_D \leq 15W$	6.65		7.35	V
Dropout Voltage	V_D	$T_J=25^{\circ}C$		2.0		V
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.5A$			100	mV
		$T_J=25^{\circ}C, I_{OUT}=0.25A \sim 0.75A$			50	mV
Line regulation	ΔV_{OUT}	$V_{IN}=9V \sim 25V, T_J=25^{\circ}C$			70	mV
		$V_{IN}=9.5V \sim 22V, T_J=25^{\circ}C, I_{OUT}=1.0A$			70	mV
Quiescent Current	I_Q	$T_J=25^{\circ}C, I_{OUT} \leq 1.0A$			8.0	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=9.5V \sim 22V$			1.0	mA
		$I_{OUT}=5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		50		μV
Temperature Coefficient of V_o	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		-0.8		$mV/^{\circ}C$
Ripple Rejection	RR	$V_{IN}=10V \sim 20V, f=120Hz, T_J=25^{\circ}C$	59	75		dB
Peak Output Current	I_{PEAK}	$T_J=25^{\circ}C$		1.7		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V, T_J=25^{\circ}C$		250		mA

For UTC 78T08AA ($V_{IN}=14V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.0A$	7.68	8.0	8.32	V
		$V_{IN}=10.5V \sim 23V,$ $I_{OUT}=5mA \sim 1.0A, P_D \leq 15W$	7.60		8.40	V
Dropout Voltage	V_D	$T_J=25^{\circ}C$		2.0		V
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.5A$			100	mV
		$T_J=25^{\circ}C, I_{OUT}=0.25A \sim 0.75A$			50	mV
Line regulation	ΔV_{OUT}	$V_{IN}=10.5V \sim 25V, T_J=25^{\circ}C$			80	mV
		$V_{IN}=10.5V \sim 23V, T_J=25^{\circ}C, I_{OUT}=1.0A$			80	mV
Quiescent Current	I_Q	$T_J=25^{\circ}C, I_{OUT} \leq 1.0A$			8.0	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=10.5V \sim 23V$			1.0	mA
		$I_{OUT}=5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		58		μV
Temperature Coefficient of V_o	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		-0.9		$mV/^{\circ}C$
Ripple Rejection	RR	$V_{IN}=11.5V \sim 21.5V,$ $f=120Hz, T_J=25^{\circ}C$	56	72		dB
Peak Output Current	I_{PEAK}	$T_J=25^{\circ}C$		1.8		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V, T_J=25^{\circ}C$		250		mA

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC 78T09AA ($V_{IN} = 15V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.0A$	8.64	9.0	9.36	V
		$V_{IN} = 11.5V \sim 24V,$ $I_{OUT} = 5mA \sim 1.0A, P_D \leq 15W$	8.55		9.45	V
Dropout Voltage	V_D	$T_J = 25^\circ C$		2.0		V
Load Regulation	ΔV_{OUT}	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.5A$			100	mV
		$T_J = 25^\circ C, I_{OUT} = 0.25A \sim 0.75A$			50	mV
Line regulation	ΔV_{OUT}	$V_{IN} = 11.5V \sim 25V, T_J = 25^\circ C$			90	mV
		$V_{IN} = 11.5V \sim 24V, T_J = 25^\circ C, I_{OUT} = 1.0A$			90	mV
Quiescent Current	I_Q	$T_J = 25^\circ C, I_{OUT} \leq 1.0A$			8.0	mA
Quiescent Current Change	ΔI_Q	$V_{IN} = 11.5V \sim 24V$			1.0	mA
		$I_{OUT} = 5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		58		μV
Temperature Coefficient of V_o	$\Delta V_o / \Delta T$	$I_{OUT} = 5mA$		-1.1		$mV/^\circ C$
Ripple Rejection	RR	$V_{IN} = 12.5V \sim 22.5V, f = 120Hz, T_J = 25^\circ C$	56	72		dB
Peak Output Current	I_{PEAK}	$T_J = 25^\circ C$		1.8		A
Short-Circuit Current	I_{SC}	$V_{IN} = 35V, T_J = 25^\circ C$		250		mA

For UTC 78T10AA ($V_{IN} = 16V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.0A$	9.60	10.0	10.40	V
		$V_{IN} = 12.5V \sim 25V,$ $I_{OUT} = 5mA \sim 1.0A, P_D \leq 15W$	9.50		10.50	V
Dropout Voltage	V_D	$T_J = 25^\circ C$		2.0		V
Load Regulation	ΔV_{OUT}	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.5A$			100	mV
		$T_J = 25^\circ C, I_{OUT} = 0.25A \sim 0.75A$			50	mV
Line regulation	ΔV_{OUT}	$V_{IN} = 13V \sim 25V, T_J = 25^\circ C$			100	mV
		$V_{IN} = 13V \sim 25V, T_J = 25^\circ C, I_{OUT} = 1.0A$			100	mV
Quiescent Current	I_Q	$T_J = 25^\circ C, I_{OUT} \leq 1.0A$			8.0	mA
Quiescent Current Change	ΔI_Q	$V_{IN} = 12.6V \sim 25V$			1.0	mA
		$I_{OUT} = 5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		58		μV
Temperature coefficient of V_o	$\Delta V_o / \Delta T$	$I_{OUT} = 5mA$		-1.1		$mV/^\circ C$
Ripple Rejection	RR	$V_{IN} = 13V \sim 23V, f = 120Hz, T_J = 25^\circ C$	56	72		dB
Peak Output Current	I_{PEAK}	$T_J = 25^\circ C$		1.8		A
Short-Circuit Current	I_{SC}	$V_{IN} = 35V, T_J = 25^\circ C$		250		mA

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC 78T12AA ($V_{IN}=19V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.0A$	11.52	12.0	12.48	V
		$V_{IN}=14.5V \sim 27V, I_{OUT}=5mA \sim 1.0A, P_D \leq 15W$	11.40		12.60	V
Dropout Voltage	V_D	$T_J=25^{\circ}C$		2.0		V
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.5A$			100	mV
		$T_J=25^{\circ}C, I_{OUT}=0.25A \sim 0.75A$			50	mV
Line regulation	ΔV_{OUT}	$V_{IN}=14.5V \sim 30V, T_J=25^{\circ}C$			120	mV
		$V_{IN}=14.6V \sim 27V, T_J=25^{\circ}C, I_{OUT}=1.0A$			120	mV
Quiescent Current	I_Q	$T_J=25^{\circ}C, I_{OUT} \leq 1.0A$			8.0	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=14.5V \sim 30V$			1.0	mA
		$I_{OUT}=5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		75		μV
Temperature Coefficient of V_o	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		-1.5		$mV/^{\circ}C$
Ripple Rejection	RR	$V_{IN}=15V - 25V, f=120Hz, T_J=25^{\circ}C$	55	72		dB
Peak Output Current	I_{PEAK}	$T_J=25^{\circ}C$		1.8		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V, T_J=25^{\circ}C$		250		mA

For UTC 78T15AA ($V_{IN}=23V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.0A$	14.40	15.0	15.60	V
		$V_{IN}=17.5V \sim 30V, I_{OUT}=5mA \sim 1.0A, P_D \leq 15W$	14.25		15.75	V
Dropout Voltage	V_D	$T_J=25^{\circ}C$		2.0		V
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.5A$			100	mV
		$T_J=25^{\circ}C, I_{OUT}=0.25A \sim 0.75A$			50	mV
Line regulation	ΔV_{OUT}	$V_{IN}=18.5V \sim 30V, T_J=25^{\circ}C$			150	mV
		$V_{IN}=17.7V \sim 30V, T_J=25^{\circ}C, I_{OUT}=1.0A$			150	mV
Quiescent Current	I_Q	$T_J=25^{\circ}C, I_{OUT} \leq 1.0A$			8.0	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=17.5V \sim 30V$			1.0	mA
		$I_{OUT}=5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		90		μV
Temperature Coefficient of V_o	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		-1.8		$mV/^{\circ}C$
Ripple Rejection	RR	$V_{IN}=18.5V \sim 28.5V, f=120Hz, T_J=25^{\circ}C$	54	70		dB
Peak Output Current	I_{PEAK}	$T_J=25^{\circ}C$		1.8		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V, T_J=25^{\circ}C$		250		mA

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC 78T18AA ($V_{IN}=27V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.0A$	17.28	18.0	18.72	V
		$V_{IN}=21V \sim 33V, I_{OUT}=5mA \sim 1.0A, P_D \leq 15W$	17.10		18.90	V
Dropout Voltage	V_D	$T_J=25^{\circ}C$		2.0		V
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.5A$			100	mV
		$T_J=25^{\circ}C, I_{OUT}=0.25A \sim 0.75A$			50	mV
Line regulation	ΔV_{OUT}	$V_{IN}=21V \sim 33V, T_J=25^{\circ}C$			180	mV
		$V_{IN}=21V \sim 33V, T_J=25^{\circ}C, I_{OUT}=1.0A$			180	mV
Quiescent Current	I_Q	$T_J=25^{\circ}C, I_{OUT} \leq 1.0A$			8.0	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=21.5V \sim 33V$			1.0	mA
		$I_{OUT}=5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		110		μV
Temperature Coefficient of V_o	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		-2.2		$mV/^{\circ}C$
Ripple Rejection	RR	$V_{IN}=22V \sim 32V, f=120Hz, T_J=25^{\circ}C$	53	69		dB
Peak Output Current	I_{PEAK}	$T_J=25^{\circ}C$		1.8		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V, T_J=25^{\circ}C$		250		mA

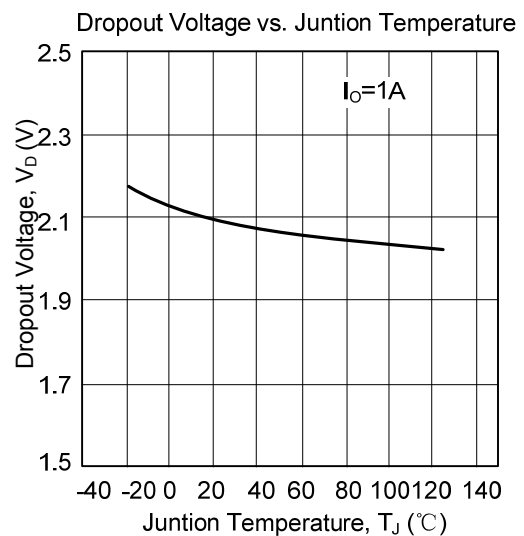
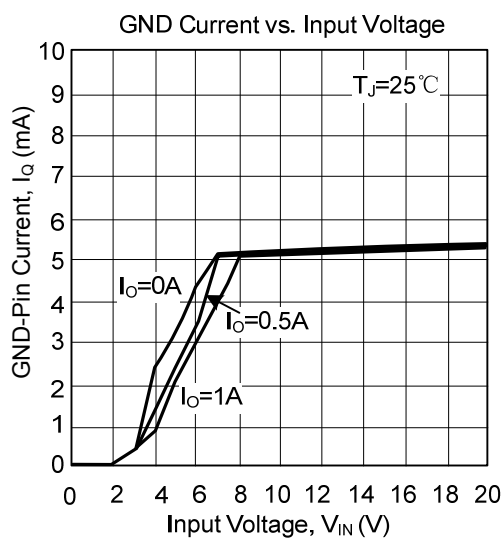
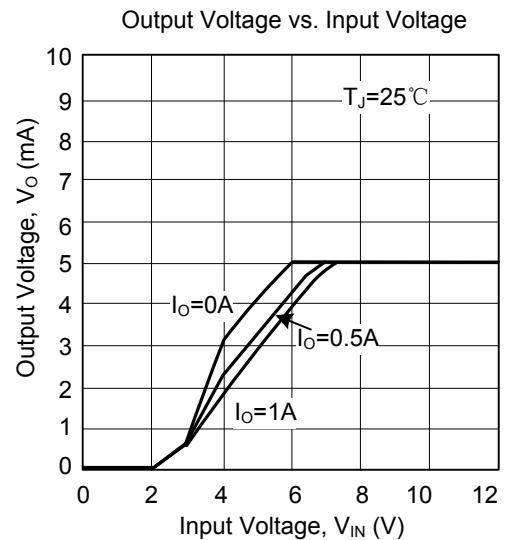
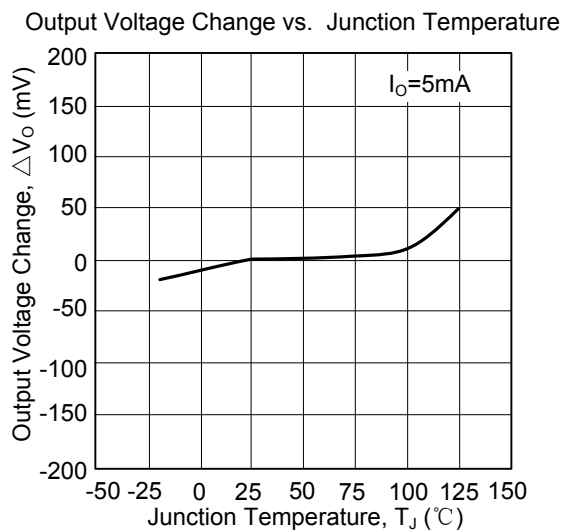
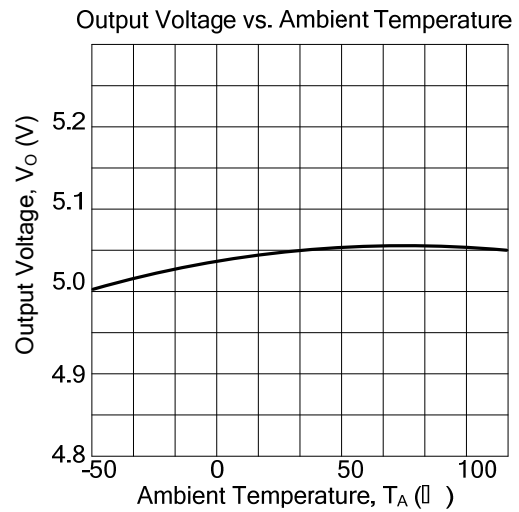
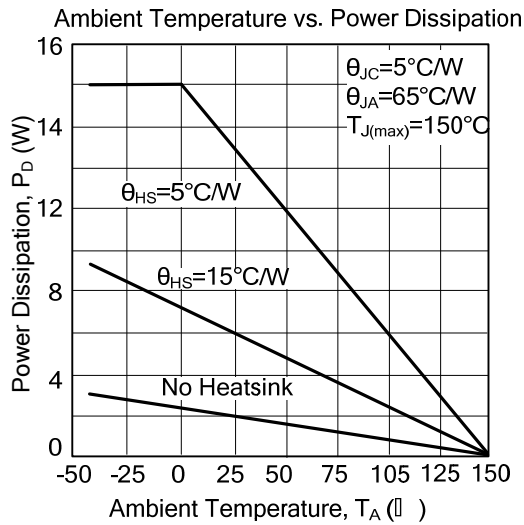
For UTC 78T24AA ($V_{IN}=33V$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.0A$	23.04	24.0	24.96	V
		$V_{IN}=27V \sim 38V, I_{OUT}=5mA \sim 1.0A, P_D \leq 15W$	22.80		25.20	V
Dropout Voltage	V_D	$T_J=25^{\circ}C$		2.0		V
Load Regulation	ΔV_{OUT}	$T_J=25^{\circ}C, I_{OUT}=5mA \sim 1.5A$			100	mV
		$T_J=25^{\circ}C, I_{OUT}=0.25A \sim 0.75A$			50	mV
Line regulation	ΔV_{OUT}	$V_{IN}=27V \sim 38V, T_J=25^{\circ}C$			240	mV
		$V_{IN}=27V \sim 38V, T_J=25^{\circ}C, I_{OUT}=1.0A$			240	mV
Quiescent Current	I_Q	$T_J=25^{\circ}C, I_{OUT} \leq 1.0A$			8.0	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=28V \sim 38V$			1.0	mA
		$I_{OUT}=5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		170		μV
Temperature Coefficient of V_o	$\Delta V_o/\Delta T$	$I_{OUT}=5mA$		-2.8		$mV/^{\circ}C$
Ripple Rejection	RR	$V_{IN}=28V \sim 38V, f=120Hz, T_J=25^{\circ}C$	50	66		dB
Peak Output Current	I_{PEAK}	$T_J=25^{\circ}C$		1.8		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V, T_J=25^{\circ}C$		250		mA

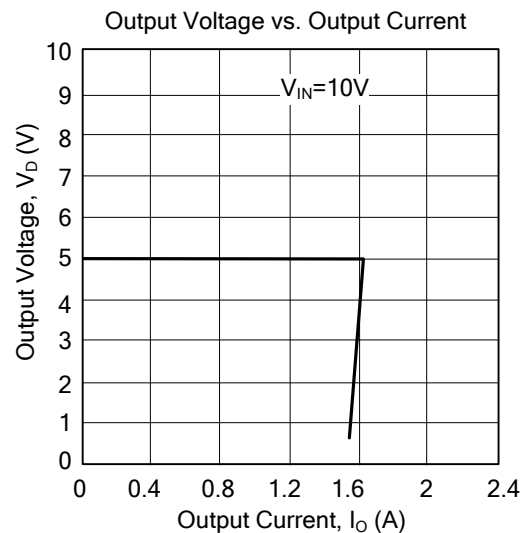
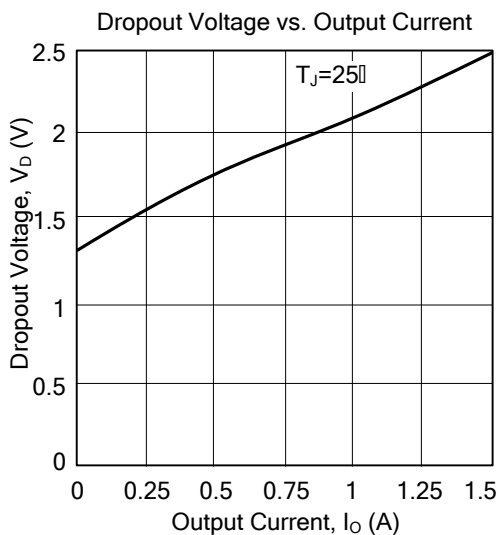
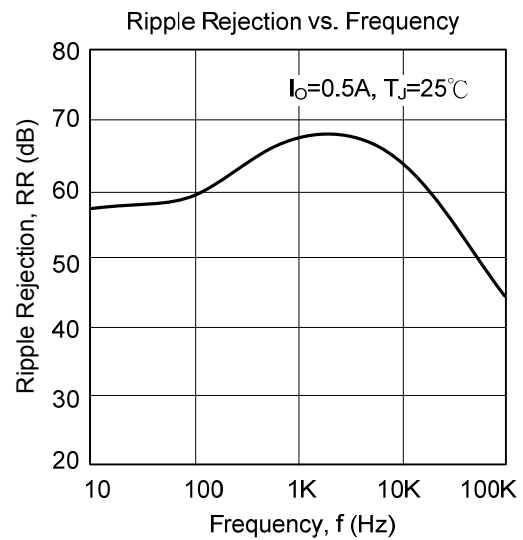
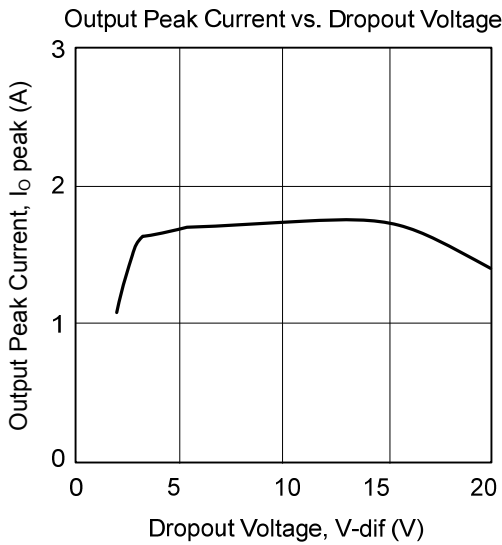
Note 1: The Maximum steady state usable output current are dependent on input voltage, heat sinking, lead length of the package and copper pattern of PCB. The data above represents pulse test conditions with junction temperatures specified at the initiation of test.

Note 2: Power dissipation < 0.5W

TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS(Cont.)



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