



# LM78XXA

## LINEAR INTEGRATED CIRCUIT

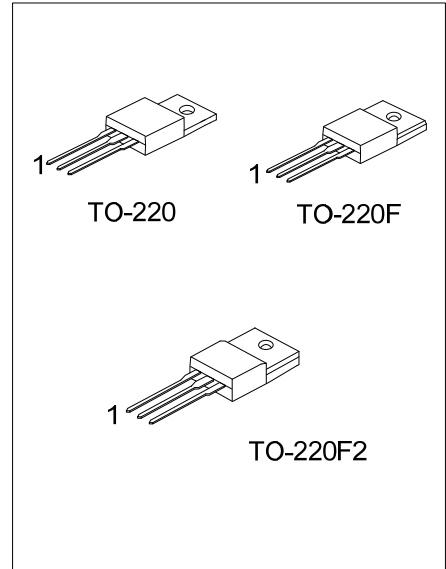
### 3-TERMINAL 1.5A POSITIVE VOLTAGE REGULATOR

■ DESCRIPTION

The UTC **LM78XXA** 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
- \* Output transistor SOA protection



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
LM78XXAL-TA3-T	LM78XXAG-TA3-T	TO-220	I	G	O	Tube
LM78XXAL-TF2-T	LM78XXAG-TF2-T	TO-220F2	I	G	O	Tube
LM78XXAL-TF3-T	LM78XXAG-TF3-T	TO-220F	I	G	O	Tube

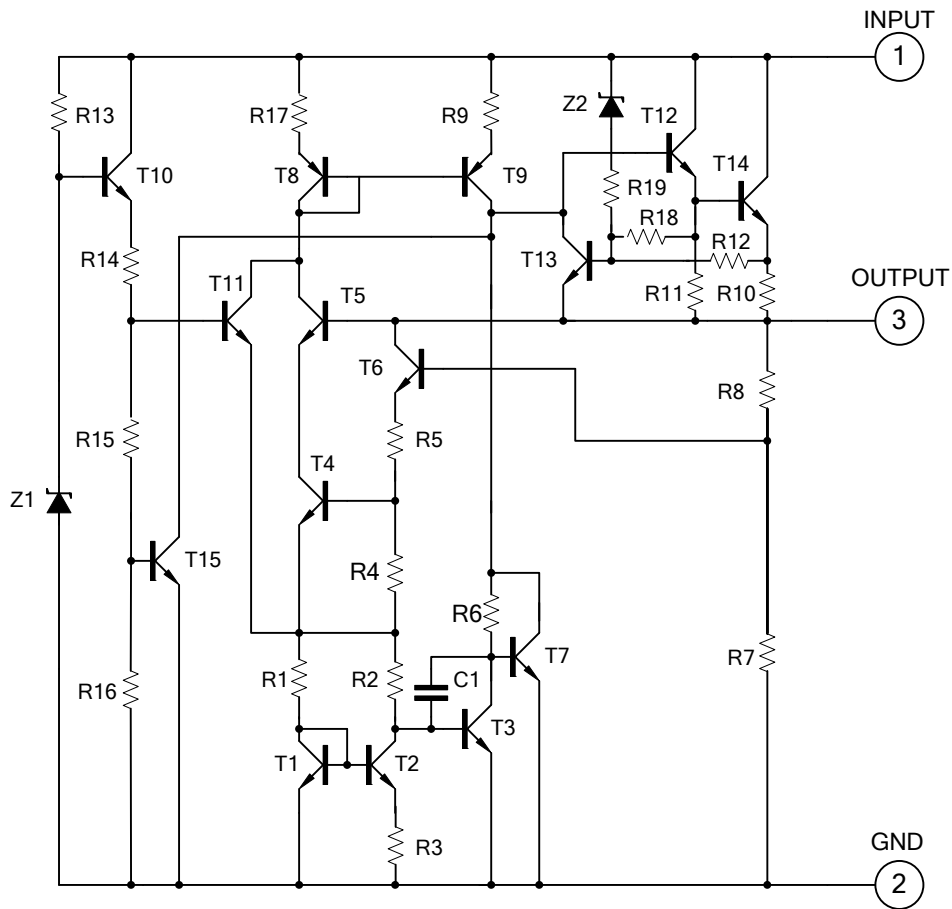
Notes: 1. xx: output voltage, refer to Marking Information  
 2. Pin Code: I: Input G: GND O: Output

<p>LM78XXAG-TA3-T</p>	<p>(1) Packing Type          (2) Package Type          (3) Green Package          (4) Output Voltage Code</p>	<p>(1) T: Tube          (2) TA3: TO-220, TF2: TO-220F2, TF3: TO-220F          (3) G: Halogen Free and Lead Free, L: Lead Free          (4) XX: refer to Marking Information</p>
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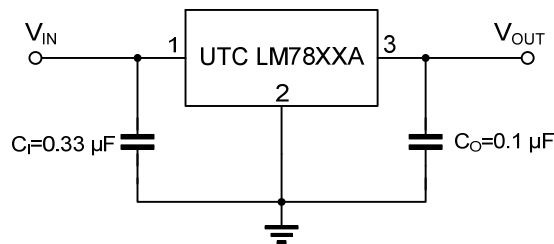
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
TO-220 TO-220F TO-220F2	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: 24 V	<p>Voltage Code ←      → Date Code          Lot Code ←      →</p> <p>1    2    3</p> <p>L: Lead Free G: Halogen Free</p>

## ■ TEST CIRCUIT



## ■ 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	$V_{OUT}=5\sim 18V$	$V_{IN}$	35	V
	$V_{OUT}=24V$		40	V
Output Current		$I_{OUT}$	1.5	A
Power Dissipation		$P_D$	Internally Limited	W
Junction Temperature		$T_J$	+150	°C
Operating Junction Temperature		$T_{OPR}$	-40 ~ +125	°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		$\theta_{JA}$	65	°C/W
Junction to Case	TO-220	$\theta_{JC}$	5	°C/W
	TO-220F/TO-220F2		8	°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 LM7805A ( $V_{IN}=10V$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^\circ C$ , $I_{OUT}=5mA \sim 1.0A$	4.90	5.0	5.10	V
		$V_{IN}=7.5V \sim 20V$ , $I_{OUT}=5mA \sim 1.0A$	4.85		5.15	V
Dropout Voltage	$V_D$	$T_J=25^\circ C$ , $I_{OUT}=1.5A$		2.5		V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^\circ C$ , $I_{OUT}=5mA \sim 1.5A$			100	mV
		$T_J=25^\circ C$ , $I_{OUT}=0.25A \sim 0.75A$			50	mV
Line regulation	$\Delta V_{OUT}$	$V_{IN}=7V \sim 25V$ , $T_J=25^\circ C$			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	$\Delta I_Q$	$V_{IN}=7.5V \sim 20V$			1.0	mA
		$I_{OUT}=5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		40		$\mu V$
Ripple Rejection	RR	$V_{IN}=8V \sim 18V$ , $f=120Hz$ , $T_J=25^\circ C$	59	80		dB
Peak Output Current	$I_{PEAK}$	$T_J=25^\circ C$		1.8		A

For UTC LM7806A ( $V_{IN}=11V$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^\circ C$ , $I_{OUT}=5mA \sim 1.0A$	5.88	6.0	6.12	V
		$V_{IN}=8.5V \sim 21V$ , $I_{OUT}=5mA \sim 1.0A$	5.82		6.18	V
Dropout Voltage	$V_D$	$T_J=25^\circ C$ , $I_{OUT}=1.5A$		2.5		V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^\circ C$ , $I_{OUT}=5mA \sim 1.5A$			120	mV
		$T_J=25^\circ C$ , $I_{OUT}=0.25A \sim 0.75A$			60	mV
Line regulation	$\Delta V_{OUT}$	$V_{IN}=8V \sim 25V$ , $T_J=25^\circ C$			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	$\Delta I_Q$	$V_{IN}=8.5V \sim 21V$			1.0	mA
		$I_{OUT}=5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		45		$\mu V$
Ripple Rejection	RR	$V_{IN}=9V \sim 19V$ , $f=120Hz$ , $T_J=25^\circ C$	56	75		dB
Peak Output Current	$I_{PEAK}$	$T_J=25^\circ C$		1.8		A

### ■ ELECTRICAL CHARACTERISTICS (Cont.)

For UTC LM7807A ( $V_{IN}=13V$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J = 25^\circ C, I_{OUT} = 5mA - 1.0A$	6.86	7.0	7.14	V
		$V_{IN} = 9.5V \sim 22V, I_{OUT} = 5mA \sim 1.0A$	6.79		7.21	V
Dropout Voltage	$V_D$	$T_J = 25^\circ C, I_{OUT} = 1.5A$		2.5		V
Load Regulation	$\Delta V_{OUT}$	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.5A$			140	mV
		$T_J = 25^\circ C, I_{OUT} = 0.25A \sim 0.75A$			70	mV
Line regulation	$\Delta V_{OUT}$	$V_{IN} = 9V \sim 25V, T_J = 25^\circ C$			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	$\Delta I_Q$	$V_{IN} = 9.5V \sim 22V$			1.0	mA
		$I_{OUT} = 5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		50		$\mu V$
Ripple Rejection	RR	$V_{IN} = 10V \sim 20V, f = 120Hz, T_J = 25^\circ C$	56	75		dB
Peak Output Current	$I_{PEAK}$	$T_J = 25^\circ C$		1.7		A

For UTC LM7808A ( $V_{IN}=14V$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.0A$	7.84	8.0	8.16	V
		$V_{IN} = 10.5V \sim 23V, I_{OUT} = 5mA \sim 1.0A$	7.76		8.24	V
Dropout Voltage	$V_D$	$T_J = 25^\circ C, I_{OUT} = 1.5A$		2.5		V
Load Regulation	$\Delta V_{OUT}$	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.5A$			160	mV
		$T_J = 25^\circ C, I_{OUT} = 0.25A \sim 0.75A$			80	mV
Line regulation	$\Delta V_{OUT}$	$V_{IN} = 10.5V \sim 25V, T_J = 25^\circ C$			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	$\Delta I_Q$	$V_{IN} = 10.5V \sim 23V$			1.0	mA
		$I_{OUT} = 5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		58		$\mu V$
Ripple Rejection	RR	$V_{IN} = 11.5V \sim 21.5V, f = 120Hz, T_J = 25^\circ C$	53	72		dB
Peak Output Current	$I_{PEAK}$	$T_J = 25^\circ C$		1.8		A

For UTC LM7809A ( $V_{IN}=15V$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.0A$	8.82	9.0	9.18	V
		$V_{IN} = 11.5V \sim 24V, I_{OUT} = 5mA \sim 1.0A$	8.73		9.27	V
Dropout Voltage	$V_D$	$T_J = 25^\circ C, I_{OUT} = 1.5A$		2.5		V
Load Regulation	$\Delta V_{OUT}$	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.5A$			180	mV
		$T_J = 25^\circ C, I_{OUT} = 0.25A \sim 0.75A$			90	mV
Line regulation	$\Delta V_{OUT}$	$V_{IN} = 11.5V \sim 25V, T_J = 25^\circ C$			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	$\Delta I_Q$	$V_{IN} = 11.5V \sim 24V$			1.0	mA
		$I_{OUT} = 5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		58		$\mu V$
Ripple Rejection	RR	$V_{IN} = 12.5V \sim 22.5V, f = 120Hz, T_J = 25^\circ C$	53	72		dB
Peak Output Current	$I_{PEAK}$	$T_J = 25^\circ C$		1.8		A

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC LM7810A (V<sub>IN</sub>=16V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V <sub>OUT</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> =5mA ~ 1.0A	9.8	10.0	10.2	V
		V <sub>IN</sub> =12.5V ~ 25V, I <sub>OUT</sub> =5mA ~ 1.0A	9.7		10.3	V
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> =1.5A		2.5		V
Load Regulation	ΔV <sub>OUT</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> =5mA - 1.5A			200	mV
		T <sub>J</sub> =25°C, I <sub>OUT</sub> =0.25A - 0.75A			100	mV
Line regulation	ΔV <sub>OUT</sub>	V <sub>IN</sub> =13V ~ 25V, T <sub>J</sub> =25°C			100	mV
		V <sub>IN</sub> =13V ~ 25V, T <sub>J</sub> =25°C, I <sub>OUT</sub> =1.0A			100	mV
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> ≤1.0A			8.0	mA
Quiescent Current Change	ΔI <sub>Q</sub>	V <sub>IN</sub> =12.6V ~ 25V			1.0	mA
		I <sub>OUT</sub> =5mA - 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Ripple Rejection	RR	V <sub>IN</sub> =13V - 23V, f=120Hz, T <sub>J</sub> =25°C	53	72		dB
Peak Output Current	I <sub>PEAK</sub>	T <sub>J</sub> =25°C		1.8		A

For UTC LM7812A (V<sub>IN</sub>=19V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V <sub>OUT</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> =5mA ~ 1.0A	11.76	12.0	12.24	V
		V <sub>IN</sub> =14.5V ~ 27V, I <sub>OUT</sub> =5mA ~ 1.0A	11.64		12.36	V
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> =1.5A		2.5		V
Load Regulation	ΔV <sub>OUT</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> =5mA ~ 1.5A			240	mV
		T <sub>J</sub> =25°C, I <sub>OUT</sub> =0.25A ~ 0.75A			120	mV
Line regulation	ΔV <sub>OUT</sub>	V <sub>IN</sub> =14.5V ~ 30V, T <sub>J</sub> =25°C			120	mV
		V <sub>IN</sub> =14.6V ~ 27V, T <sub>J</sub> =25°C, I <sub>OUT</sub> =1.0A			120	mV
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> ≤1.0A			8.0	mA
Quiescent Current Change	ΔI <sub>Q</sub>	V <sub>IN</sub> =14.5V ~ 30V			1.0	mA
		I <sub>OUT</sub> =5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		75		μV
Ripple Rejection	RR	V <sub>IN</sub> =15V - 25V, f=120Hz, T <sub>J</sub> =25°C	52	72		dB
Peak Output Current	I <sub>PEAK</sub>	T <sub>J</sub> =25°C		1.8		A

For UTC LM7815A (V<sub>IN</sub>=23V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V <sub>OUT</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> =5mA ~ 1.0A	14.70	15.0	15.30	V
		V <sub>IN</sub> =17.5V ~ 30V, I <sub>OUT</sub> =5mA ~ 1.0A	14.55		15.45	V
Dropout Voltage	V <sub>D</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> =1.5A		2.5		V
Load Regulation	ΔV <sub>OUT</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> =5mA ~ 1.5A			300	mV
		T <sub>J</sub> =25°C, I <sub>OUT</sub> =0.25A ~ 0.75A			150	mV
Line regulation	ΔV <sub>OUT</sub>	V <sub>IN</sub> =18.5V ~ 30V, T <sub>J</sub> =25°C			150	mV
		V <sub>IN</sub> =17.7V ~ 30V, T <sub>J</sub> =25°C, I <sub>OUT</sub> =1.0A			150	mV
Quiescent Current	I <sub>Q</sub>	T <sub>J</sub> =25°C, I <sub>OUT</sub> ≤1.0A			8.0	mA
Quiescent Current Change	ΔI <sub>Q</sub>	V <sub>IN</sub> =17.5V ~ 30V			1.0	mA
		I <sub>OUT</sub> =5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		90		μV
Ripple Rejection	RR	V <sub>IN</sub> =18.5V ~ 28.5V, f=120Hz, T <sub>J</sub> =25°C	51	70		dB
Peak Output Current	I <sub>PEAK</sub>	T <sub>J</sub> =25°C		1.8		A

### ■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC LM7818A ( $V_{IN}=27V$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.0A$	17.64	18.0	18.36	V
		$V_{IN} = 21V \sim 33V, I_{OUT} = 5mA \sim 1.0A$	17.46		18.54	V
Dropout Voltage	$V_D$	$T_J = 25^\circ C, I_{OUT} = 1.5A$		2.5		V
Load Regulation	$\Delta V_{OUT}$	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.5A$			360	mV
		$T_J = 25^\circ C, I_{OUT} = 0.25A \sim 0.75A$			180	mV
Line regulation	$\Delta V_{OUT}$	$V_{IN} = 21V \sim 33V, T_J = 25^\circ C$			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	$\Delta I_Q$	$V_{IN} = 21.5V \sim 33V$			1.0	mA
		$I_{OUT} = 5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		110		$\mu V$
Ripple Rejection	RR	$V_{IN} = 22V \sim 32V, f = 120Hz, T_J = 25^\circ C$	50	69		dB
Peak Output Current	$I_{PEAK}$	$T_J = 25^\circ C$		1.8		A

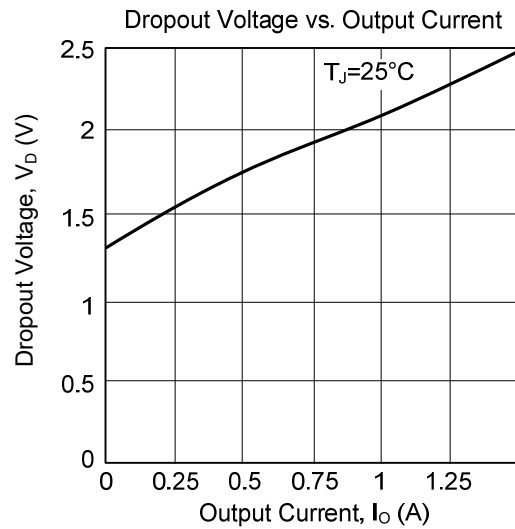
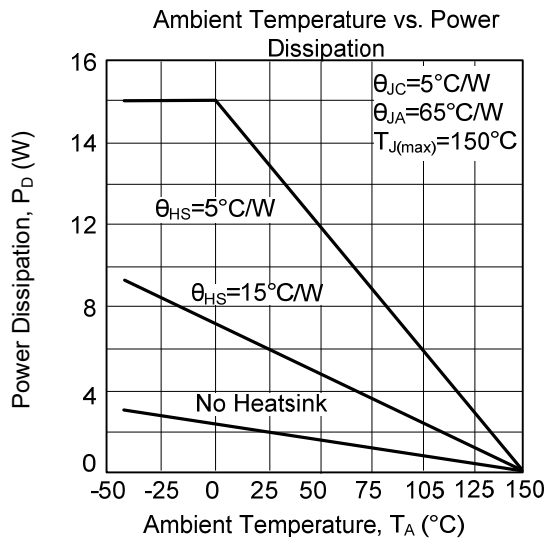
For UTC LM7824A ( $V_{IN}=33V$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.0A$	23.52	24.0	24.48	V
		$V_{IN} = 27V \sim 38V, I_{OUT} = 5mA \sim 1.0A$	23.28		24.72	V
Dropout Voltage	$V_D$	$T_J = 25^\circ C, I_{OUT} = 1.5A$		2.5		V
Load Regulation	$\Delta V_{OUT}$	$T_J = 25^\circ C, I_{OUT} = 5mA \sim 1.5A$			480	mV
		$T_J = 25^\circ C, I_{OUT} = 0.25A \sim 0.75A$			240	mV
Line regulation	$\Delta V_{OUT}$	$V_{IN} = 27V \sim 38V, T_J = 25^\circ C$			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	$\Delta I_Q$	$V_{IN} = 28V \sim 38V$			1.0	mA
		$I_{OUT} = 5mA \sim 1.0A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		170		$\mu V$
Ripple Rejection	RR	$V_{IN} = 28V \sim 38V, f = 120Hz, T_J = 25^\circ C$	47	66		dB
Peak Output Current	$I_{PEAK}$	$T_J = 25^\circ C$		1.8		A

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.

2. Power dissipation < 0.5W.

## ■ TYPICAL CHARACTERISTICS



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