

# UTC 78DXX LINEAR INTEGRATED CIRCUIT

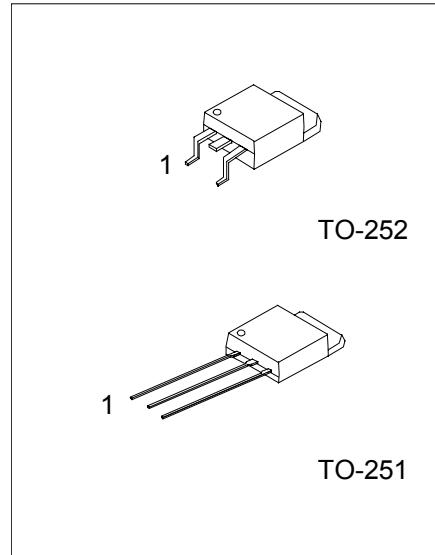
## 3-TERMINAL 0.5A POSITIVE VOLTAGE REGULATOR

### DESCRIPTION

The UTC 78DXX family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications that required supply current up to 0.5 A.

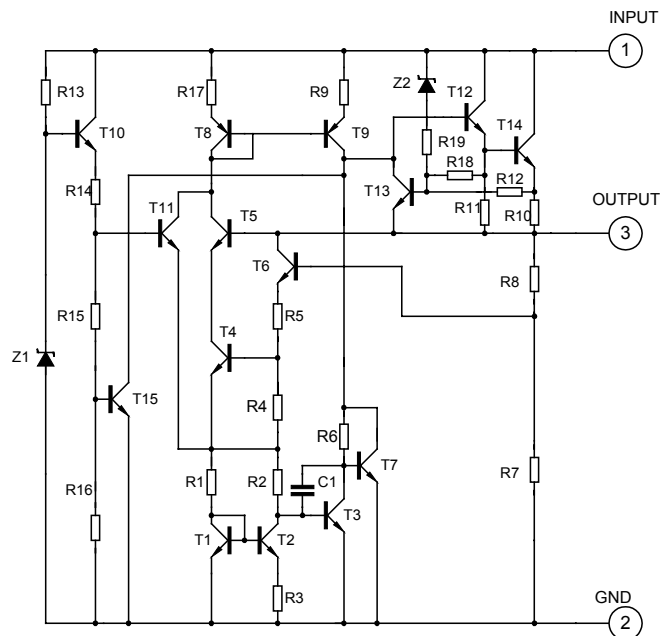
### FEATURE

- \*Output current up to 0.5 A
- \*Fixed output voltage of 3.3V, 4.7V, 5V, 6V, 8V, 9V, 12V, 15V, 18V and 24V available
- \*Thermal overload shutdown protection
- \*Short circuit current limiting
- \*Output transistor SOA protection



1: Input 2: GND 3: Output

### EQUIVALENT CIRCUIT



# UTC 78DXX LINEAR INTEGRATED CIRCUIT

## ABSOLUTE MAXIMUM RATINGS

( Operating temperature range applies unless otherwise specified )

PARAMETER	SYMBOL	VALUE	UNIT
Input voltage(for Vo=5~18V) (for Vo=20~24V)	Vi	35	V
		40	V
Output Current	Io	0.5	A
Power Dissipation	PD	Internally Limited	W
Operating Junction Temperature Range	TJ	+150	°C
Storage Temperature Range	TSTG	-65 to+150	°C

## THERMAL DATA

PARAMETER	SYMBOL	VALUE	UNIT
Thermal Resistance Junction-ambient	Rθja	92	°C/W

## UTC 78D33 ELECTRICAL CHARACTERISTICS

( Vi=8.5V, Io=0.5A, Tj= 0°C - 12°C, C1=0.33uF, Co=0.1uF, unless otherwise specified )(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C, Io=5mA -0.5A	3.168	3.30	3.432	V
		Vi =5.8V to 18.3V Io=5mA- 0.5A PD<7W	3.135		3.465	V
Load Regulation	ΔVo	Tj=25°C,Io=5mA - 0.5A			33	mV
		Tj=25°C,Io=5mA - 200mA			17	mV
Line regulation	ΔVo	Vi =5.8V to 18.3V,Tj=25°C			33	mV
		Vi=5.8V to 18.3V,Tj=25°C,Io=0.5A			33	mV
Quiescent Current	Iq	Tj=25°C, Io=0.5A			8.0	mA
Quiescent Current Change	ΔIq	Vi =5.8V to 18.3V			1.0	mA
		Io=5mA - 0.5A			0.5	mA
Output Noise Voltage	VN	10Hz<=f<=100kHz		55		μV
Temperature coefficient of Vo	ΔVo/ΔT	Io=5mA		-0.4		mV/°C
Ripple Rejection	RR	Vi=6.3V-16.3V,f=120Hz,Tj=25°C		57		dB
Peak Output Current	IPK	Tj=25°C		1.8		A
Short-Circuit Current	Isc	Vi=35V, Tj=25°C		250		mA
Dropout Voltage	Vd	Tj=25°C		2.0		V

## UTC 78D47 ELECTRICAL CHARACTERISTICS

( Vi=9.7V, Io=0.5A, Tj= 0°C - 12°C, C1=0.33uF, Co=0.1uF, unless otherwise specified )(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C, Io=5mA - 0.5A	4.512	4.70	4.888	V
		Vi =7.2V to 19.7V Io=5mA- 0.5A, PD<7W	4.465		4.935	V
Load Regulation	ΔVo	Tj=25°C,Io=5mA - 0.5A			47	mV
		Tj=25°C,Io=5mA -200mA			24	mV
Line regulation	ΔVo	Vi =7.2V to 19.7V,Tj=25°C			47	mV
		Vi=7.2V to 19.7V,Tj=25°C,Io=0.5A			47	mV
Quiescent Current	Iq	Tj=25°C, Io=0.5A			8.0	mA
Quiescent Current Change	ΔIq	Vi =7.2V to 19.7V			1.0	mA
		Io=5mA - 0.5A			0.5	mA

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PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Noise Voltage	V <sub>N</sub>	10Hz<=f<=100kHz		40		μV
Temperature coefficient of V <sub>o</sub>	ΔV <sub>o</sub> /ΔT	I <sub>o</sub> =5mA		-0.6		mV/°C
Ripple Rejection	RR	V <sub>i</sub> =7.7V 17.7V, f=120Hz, T <sub>j</sub> =25°C	62	80		dB
Peak Output Current	I <sub>PK</sub>	T <sub>j</sub> =25°C		1.8		A
Short-Circuit Current	I <sub>SC</sub>	V <sub>i</sub> =35V, T <sub>j</sub> =25°C		250		mA
Dropout Voltage	V <sub>d</sub>	T <sub>j</sub> =25°C		2.0		V

## UTC78D05 ELECTRICAL CHARACTERISTICS

(V<sub>i</sub>=10V, I<sub>o</sub>=0.5A, T<sub>j</sub>= 0°C - 125°C, C<sub>1</sub>=0.33μF, C<sub>o</sub>=0.1μF, unless otherwise specified )(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V <sub>o</sub>	T <sub>j</sub> =25°C, I <sub>o</sub> =5mA - 0.5A	4.80	5.0	5.20	V
		V <sub>i</sub> =7.5V to 20V, I <sub>o</sub> =5mA - 0.5A, PD<7W	4.75		5.25	V
Load Regulation	ΔV <sub>o</sub>	T <sub>j</sub> =25°C, I <sub>o</sub> =5mA - 0.5A			50	mV
		T <sub>j</sub> =25°C, I <sub>o</sub> =5mA - 200 mA			25	mV
Line regulation	ΔV <sub>o</sub>	V <sub>i</sub> =7V to 25V, T <sub>j</sub> =25°C			50	mV
		V <sub>i</sub> =7.5V to 20V, T <sub>j</sub> =25°C, I <sub>o</sub> =0.5A			50	mV
Quiescent Current	I <sub>q</sub>	T <sub>j</sub> =25°C, I <sub>o</sub> =0.5A			8.0	mA
Quiescent Current Change	ΔI <sub>q</sub>	V <sub>i</sub> =7.5V to 20V			1.0	mA
		I <sub>o</sub> =5mA - 0.5A			0.5	mA
Output Noise Voltage	V <sub>N</sub>	10Hz<=f<=100kHz		40		μV
Temperature coefficient of V <sub>o</sub>	ΔV <sub>o</sub> /ΔT	I <sub>o</sub> =5mA		-0.6		mV/°C
Ripple Rejection	RR	V <sub>i</sub> =8V - 18V, f=120Hz, T <sub>j</sub> =25°C	62	80		dB
Peak Output Current	I <sub>PK</sub>	T <sub>j</sub> =25°C		1.2		A
Short-Circuit Current	I <sub>SC</sub>	V <sub>i</sub> =35V, T <sub>j</sub> =25°C		250		mA
Dropout Voltage	V <sub>d</sub>	T <sub>j</sub> =25°C		2.0		V

## UTC78D06 ELECTRICAL CHARACTERISTICS

(V<sub>i</sub>=11V, I<sub>o</sub>=0.5A, T<sub>j</sub>= 0°C - 125°C, C<sub>1</sub>=0.33μF, C<sub>o</sub>=0.1μF, unless otherwise specified )(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V <sub>o</sub>	T <sub>j</sub> =25°C, I <sub>o</sub> =5mA - 0.5A	5.76	6.0	6.24	V
		V <sub>i</sub> =8.5V to 21V, I <sub>o</sub> =5mA - 0.5A, PD<7W	5.70		6.30	V
Load Regulation	ΔV <sub>o</sub>	T <sub>j</sub> =25°C, I <sub>o</sub> =5mA - 0.5A			60	mV
		T <sub>j</sub> =25°C, I <sub>o</sub> =5mA - 200mA			30	mV
Line regulation	ΔV <sub>o</sub>	V <sub>i</sub> =8V to 25V, T <sub>j</sub> =25°C			60	mV
		V <sub>i</sub> =8.5V to 21V, T <sub>j</sub> =25°C, I <sub>o</sub> =0.5A			60	mV
Quiescent Current	I <sub>q</sub>	T <sub>j</sub> =25°C, I <sub>o</sub> =0.5A			8.0	mA
Quiescent Current Change	ΔI <sub>q</sub>	V <sub>i</sub> =8.5V to 21V			1.0	mA
		I <sub>o</sub> =5mA - 0.5A			0.5	mA
Output Noise Voltage	V <sub>N</sub>	10Hz<=f<=100kHz		45		μV
Temperature coefficient of V <sub>o</sub>	ΔV <sub>o</sub> /ΔT	I <sub>o</sub> =5mA		-0.7		mV/°C
Ripple Rejection	RR	V <sub>i</sub> =9V - 19V, f=120Hz, T <sub>j</sub> =25°C	59	75		dB
Peak Output Current	I <sub>PK</sub>	T <sub>j</sub> =25°C		1.2		A
Short-Circuit Current	I <sub>SC</sub>	V <sub>i</sub> =35V, T <sub>j</sub> =25°C		250		mA
Dropout Voltage	V <sub>d</sub>	T <sub>j</sub> =25°C		2.0		V

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## UTC78D08 ELECTRICAL CHARACTERISTICS

( $V_I=14V$ ,  $I_o=0.5A$ ,  $T_j=0^\circ C - 125^\circ C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^\circ C$ , $I_o=5mA - 0.5A$	7.68	8.0	8.32	V
		$V_I = 10.5V$ to $23V$ , $I_o=5mA - 0.5A$ , $PD<7W$	7.60		8.40	V
Load Regulation	$\Delta V_o$	$T_j=25^\circ C$ , $I_o=5mA - 0.5A$			80	mV
		$T_j=25^\circ C$ , $I_o=5mA - 200mA$			40	mV
Line regulation	$\Delta V_o$	$V_I = 10.5V$ to $25V$ , $T_j=25^\circ C$			80	mV
		$V_I = 10.5V$ to $23V$ , $T_j=25^\circ C$ $I_o=0.5A$			80	mV
Quiescent Current	$I_q$	$T_j=25^\circ C$ , $I_o=0.5A$			8.0	mA
Quiescent Current Change	$\Delta I_q$	$V_I = 10.5V$ to $23V$			1.0	mA
		$I_o=5mA - 0.5A$			0.5	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		58		$\mu V$
Temperature coefficient of $V_o$	$\Delta V_o/\Delta T$	$I_o=5mA$		-0.9		$mV/^\circ C$
Ripple Rejection	RR	$V_I = 11.5V$ to $21.5V$ , $f=120Hz$ , $T_j=25^\circ C$	56	72		dB
Peak Output Current	$I_{PK}$	$T_j=25^\circ C$		1.2		A
Short-Circuit Current	$I_{SC}$	$V_I=35V$ , $T_j=25^\circ C$		250		mA
Dropout Voltage	$V_d$	$T_j=25^\circ C$		2.0		V

## UTC78D09 ELECTRICAL CHARACTERISTICS

( $V_I=15V$ ,  $I_o=0.5A$ ,  $T_j=0^\circ C - 125^\circ C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^\circ C$ , $I_o=5mA - 0.5A$	8.64	9.0	9.36	V
		$V_I = 11.5V$ to $24V$ , $I_o=5mA - 0.5A$ , $PD<7W$	8.55		9.45	V
Load Regulation	$\Delta V_o$	$T_j=25^\circ C$ , $I_o=5mA - 0.5A$			90	mV
		$T_j=25^\circ C$ , $I_o=5mA - 200mA$			45	mV
Line regulation	$\Delta V_o$	$V_I = 11.5V$ to $25V$ , $T_j=25^\circ C$			90	mV
		$V_I = 11.5V$ to $24V$ , $T_j=25^\circ C$ $I_o=0.5A$			90	mV
Quiescent Current	$I_q$	$T_j=25^\circ C$ , $I_o=0.5A$			8.0	mA
Quiescent Current Change	$\Delta I_q$	$V_I = 11.5V$ to $24V$			1.0	mA
		$I_o=5mA - 0.5A$			0.5	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		58		$\mu V$
Temperature coefficient of $V_o$	$\Delta V_o/\Delta T$	$I_o=5mA$		-1.1		$mV/^\circ C$
Ripple Rejection	RR	$V_I = 12.5V$ to $22.5V$ , $f=120Hz$ , $T_j=25^\circ C$	56	72		dB
Peak Output Current	$I_{PK}$	$T_j=25^\circ C$		1.2		A
Short-Circuit Current	$I_{SC}$	$V_I=35V$ , $T_j=25^\circ C$		250		mA
Dropout Voltage	$V_d$	$T_j=25^\circ C$		2.0		V

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## UTC78D12 ELECTRICAL CHARACTERISTICS

( $V_I=19V$ ,  $I_o=0.5A$ ,  $T_j=0^\circ C - 125^\circ C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^\circ C$ , $I_o=5mA - 0.5A$	11.52	12.0	12.48	V
		$V_I = 14.5V$ to $27V$ , $I_o=5mA - 0.5A$ , $PD<7W$	11.40		12.60	V
Load Regulation	$\Delta V_o$	$T_j=25^\circ C$ , $I_o=5mA - 0.5A$			120	mV
		$T_j=25^\circ C$ , $I_o=5mA - 200mA$			60	mV
Line regulation	$\Delta V_o$	$V_I = 14.5V$ to $30V$ , $T_j=25^\circ C$			120	mV
		$V_I = 14.6V$ to $27V$ , $T_j=25^\circ C$ , $I_o=0.5A$			120	mV
Quiescent Current	$I_q$	$T_j=25^\circ C$ , $I_o=0.5A$			8.0	mA
Quiescent Current Change	$\Delta I_q$	$V_I = 14.5V$ to $30V$			1.0	mA
		$I_o=5mA - 0.5A$			0.5	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		75		$\mu V$
Temperature coefficient of $V_o$	$\Delta V_o/\Delta T$	$I_o=5mA$		-1.5		$mV/^\circ C$
Ripple Rejection	RR	$V_I = 15V - 25V$ , $f=120Hz$ , $T_j=25^\circ C$	55	72		dB
Peak Output Current	$I_{PK}$	$T_j=25^\circ C$		1.2		A
Short-Circuit Current	$I_{SC}$	$V_I=35V$ , $T_j=25^\circ C$		250		mA
Dropout Voltage	$V_d$	$T_j=25^\circ C$		2.0		V

## UTC78D15 ELECTRICAL CHARACTERISTICS

( $V_I=23V$ ,  $I_o=0.5A$ ,  $T_j=0^\circ C - 125^\circ C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^\circ C$ , $I_o=5mA - 0.5A$	14.40	15.0	15.60	V
		$V_I = 17.5V$ to $30V$ , $I_o=5mA - 0.5A$ , $PD<7W$	14.25		15.75	V
Load Regulation	$\Delta V_o$	$T_j=25^\circ C$ , $I_o=5mA - 0.5A$			150	mV
		$T_j=25^\circ C$ , $I_o=5mA - 200mA$			75	mV
Line regulation	$\Delta V_o$	$V_I = 18.5V$ to $30V$ , $T_j=25^\circ C$			150	mV
		$V_I = 17.5V$ to $30V$ , $T_j=25^\circ C$ , $I_o = 0.5A$			150	mV
Quiescent Current	$I_q$	$T_j=25^\circ C$ , $I_o=0.5A$			8.0	mA
Quiescent Current Change	$\Delta I_q$	$V_I = 17.5V$ to $30V$			1.0	mA
		$I_o=5mA - 0.5A$			0.5	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		90		$\mu V$
Temperature coefficient of $V_o$	$\Delta V_o/\Delta T$	$I_o=5mA$		-1.8		$mV/^\circ C$
Ripple Rejection	RR	$V_I = 18.5V$ to $28.5V$ $f=120Hz$ , $T_j=25^\circ C$	54	70		dB
Peak Output Current	$I_{PK}$	$T_j=25^\circ C$		1.2		A
Short-Circuit Current	$I_{SC}$	$V_I=35V$ , $T_j=25^\circ C$		250		mA
Dropout Voltage	$V_d$	$T_j=25^\circ C$		2.0		V

# UTC78DXX LINEAR INTEGRATED CIRCUIT

## UTC78D18 ELECTRICAL CHARACTERISTICS

( $V_I=27V$ ,  $I_o=0.5A$ ,  $T_j=0^{\circ}C - 125^{\circ}C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^{\circ}C$ , $I_o=5mA - 0.5A$	17.28	18.0	18.72	V
		$V_I = 21V$ to $33V$ , $I_o=5mA - 0.5A, PD<7W$	17.10		18.90	V
Load Regulation	$\Delta V_o$	$T_j=25^{\circ}C, I_o=5mA - 0.5A$			180	mV
		$T_j=25^{\circ}C, I_o=5mA - 200mA$			90	mV
Line regulation	$\Delta V_o$	$V_I = 21V$ to $33V, T_j=25^{\circ}C$			180	mV
		$V_I = 21V$ to $33V$ , $T_j=25^{\circ}C$ , $I_o = 0.5A$			180	mV
Quiescent Current	$I_q$	$T_j=25^{\circ}C$ , $I_o=0.5A$			8.0	mA
Quiescent Current Change	$\Delta I_q$	$V_I = 21.5V$ to $33V$			1.0	mA
		$I_o=5mA - 0.5A$			0.5	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		110		$\mu V$
Temperature coefficient of $V_o$	$\Delta V_o/\Delta T$	$I_o=5mA$		-2.2		$mV/^{\circ}C$
Ripple Rejection	RR	$V_I = 22V - 32V, f=120Hz, T_j=25^{\circ}C$	53	69		dB
Peak Output Current	$I_{PK}$	$T_j=25^{\circ}C$		1.2		A
Short-Circuit Current	$I_{SC}$	$V_I=35V$ , $T_j=25^{\circ}C$		250		mA
Dropout Voltage	$V_d$	$T_j=25^{\circ}C$		2.0		V

## UTC78D24 ELECTRICAL CHARACTERISTICS

( $V_I=33V$ ,  $I_o=0.5A$ ,  $T_j=0^{\circ}C - 125^{\circ}C$ ,  $C_1=0.33\mu F$ ,  $C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

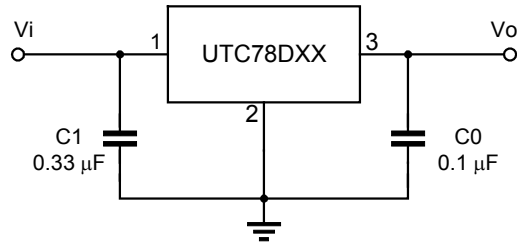
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^{\circ}C$ , $I_o=5mA - 0.5A$	23.04	24.0	24.96	V
		$V_I = 27V$ to $38V$ , $I_o=5mA - 0.5A, PD<7W$	22.80		25.20	V
Load Regulation	$\Delta V_o$	$T_j=25^{\circ}C, I_o=5mA - 0.5A$			240	mV
		$T_j=25^{\circ}C, I_o=5mA - 200mA$			120	mV
Line regulation	$\Delta V_o$	$V_I = 27V$ to $38V, T_j=25^{\circ}C$			240	mV
		$V_I = 27V$ to $38V, T_j=25^{\circ}C, I_o=0.5A$			240	mV
Quiescent Current	$I_q$	$T_j=25^{\circ}C$ , $I_o=0.5A$			8.0	mA
Quiescent Current Change	$\Delta I_q$	$V_I = 28V$ to $38V$			1.0	mA
		$I_o=5mA - 0.5A$			0.5	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		170		$\mu V$
Temperature coefficient of $V_o$	$\Delta V_o/\Delta T$	$I_o=5mA$		-2.8		$mV/^{\circ}C$
Ripple Rejection	RR	$V_I = 28V - 38V, f=120Hz, T_j=25^{\circ}C$	50	66		dB
Peak Output Current	$I_{PK}$	$T_j=25^{\circ}C$		1.2		A
Short-Circuit Current	$I_{SC}$	$V_I=35V$ , $T_j=25^{\circ}C$		250		mA
Dropout Voltage	$V_d$	$T_j=25^{\circ}C$		2.0		V

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

# UTC78DXX LINEAR INTEGRATED CIRCUIT

## TYPICAL APPLICATION CIRCUIT



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

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