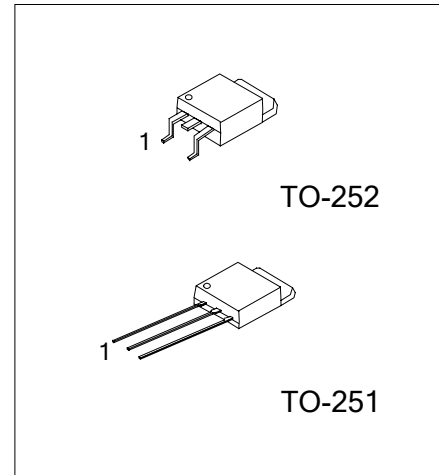


**78DXX****LINEAR INTEGRATED CIRCUIT****3-TERMINALS 0.5A POSITIVE
VOLTAGE REGULATOR****■ DESCRIPTION**

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



*Pb-free plating product number: 78DXXL

■ PIN CONFIGURATION

PIN NO.	PIN NAME
1	Input
2	GND
3	Output

■ ORDERING INFORMATION

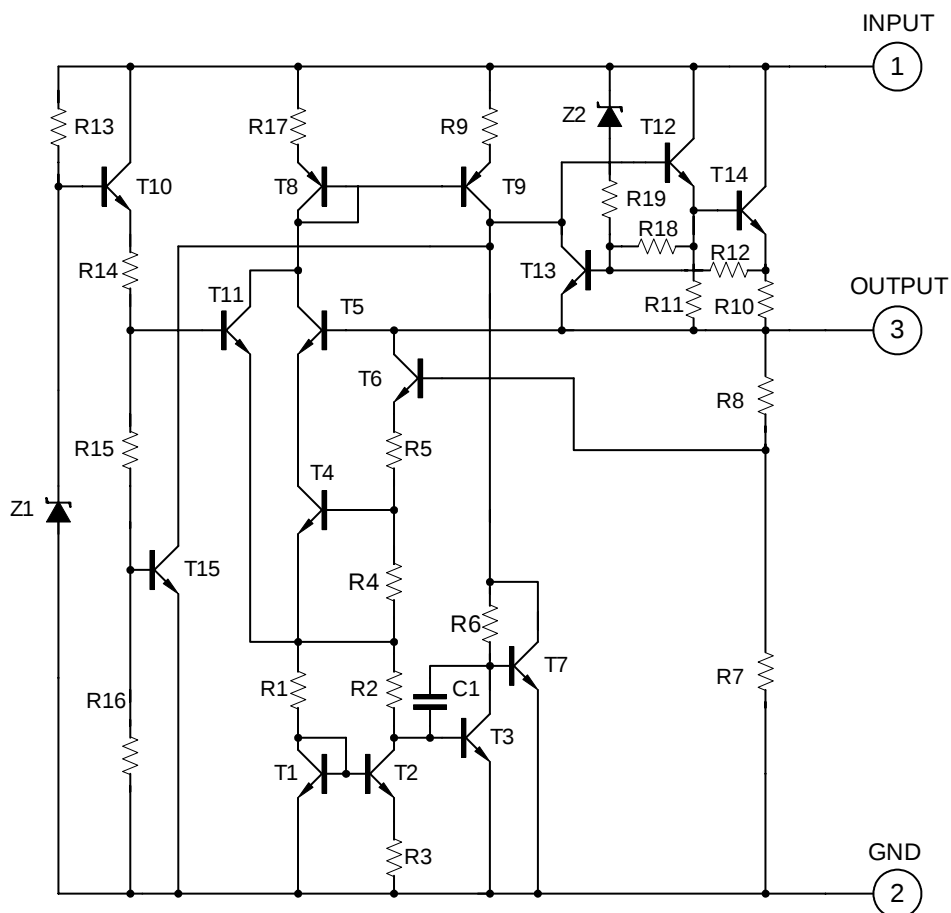
Order Number		Package	Packing
Normal	Lead free		
78Dxx-TM3-T	78DxxL-TM3-T	TO-251	Tube
78Dxx-TN3-R	78DxxL-TN3-R	TO-252	Tape Reel
78Dxx-TN3-T	78DxxL-TN3-T	TO-252	Tube

Note: xx: Output Voltage, refer to below table.

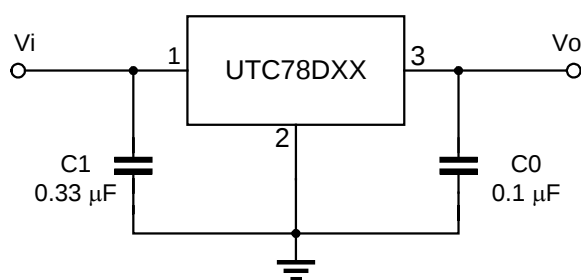
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
TO-251 TO-252	33 : 3.3V 47 : 4.7V 05 : 5V 06 : 6V 08 : 8V 09 : 9V 12 : 12V 15 : 15V 18 : 18V 24 : 24V	UTC 78DXXL VOLTAGE CODE DATE CODE Space: Pb/Sn L: Pb-free 1 2 3

■ BLOCK DIAGRAM



■ TYPICAL APPLICATION CIRCUIT



Note: 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	RATINGS	UNIT
Input Voltage	V_{IN}	35	V
		40	V
Output Current	I_{OUT}	0.5	A
Power Dissipation	P_D	Internally Limited	W
Operating Temperature Range	T_{OPR}	-20 ~ +85	°C
Operating Junction Temperature	T_J	0~+125	°C
Storage Temperature Range	T_{STG}	-40 ~ +150	°C

Note:1. Absolute maximum ratings are stress ratings only and functional device operation is not implied. The device could be damaged beyond Absolute maximum ratings.

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

3. 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 are showed as electrical characteristics table represents pulse test conditions with junction temperatures specified at the initiation of test.

■ **ELECTRICAL CHARACTERISTICS** ($T_J=25^\circ\text{C}$, $P_D \leq 7\text{W}$, unless otherwise specified)

For 78D33 ($V_{IN}=8.5\text{V}$, $I_{OUT}=0.5\text{A}$, $C_1=0.33\mu\text{F}$, $C_0=0.1\mu\text{F}$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5\text{mA} \sim 0.5\text{A}$	3.168	3.3	3.432	V
		$V_{IN}=5.8 \sim 18.3\text{V}$, $I_{OUT}=5\text{mA} \sim 0.5\text{A}$	3.135		3.465	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5\text{mA} \sim 0.5\text{A}$			33	mV
		$I_{OUT}=5\text{mA} \sim 200\text{mA}$			17	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=5.8 \sim 18.3\text{V}$			33	mV
		$V_{IN}=5.8 \sim 18.3\text{V}$, $I_{OUT}=0.5\text{A}$			33	mV
Quiescent Current	I_Q	$I_{OUT}=0.5\text{A}$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=5.8 \sim 18.3\text{V}$			1	mA
		$I_{OUT}=5\text{mA} \sim 0.5\text{A}$			0.5	mA
Output Noise Voltage	eN	$10\text{Hz} \leq f \leq 100\text{kHz}$		55		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5\text{mA}$		-0.4		$\text{mV}/^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=6.3 \sim 16.3\text{V}$, $f=120\text{Hz}$		57		dB
Peak Output Current	I_{PEAK}			1.8		A
Short-Circuit Current	I_{SC}	$V_{IN}=35\text{V}$		250		mA
Dropout Voltage	V_D			2		V

For 78D47 ($V_{IN}=9.7\text{V}$, $I_{OUT}=0.5\text{A}$, $C_1=0.33\mu\text{F}$, $C_0=0.1\mu\text{F}$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5\text{mA} \sim 0.5\text{A}$	4.512	4.7	4.888	V
		$V_{IN}=7.2 \sim 19.7\text{V}$, $I_{OUT}=5\text{mA} \sim 0.5\text{A}$	4.465		4.935	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5\text{mA} \sim 0.5\text{A}$			47	mV
		$I_{OUT}=5\text{mA} \sim 200\text{mA}$			24	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=7.2 \sim 19.7\text{V}$			47	mV
		$V_{IN}=7.2 \sim 19.7\text{V}$, $I_{OUT}=0.5\text{A}$			47	mV
Quiescent Current	I_Q	$I_{OUT}=0.5\text{A}$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=7.2 \sim 19.7\text{V}$			1	mA
		$I_{OUT}=5\text{mA} \sim 0.5\text{A}$			0.5	mA
Output Noise Voltage	eN	$10\text{Hz} \leq f \leq 100\text{kHz}$		40		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5\text{mA}$		-0.6		$\text{mV}/^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=7.7 \sim 17.7\text{V}$, $f=120\text{Hz}$	62	80		dB
Peak Output Current	I_{PEAK}			1.8		A
Short-Circuit Current	I_{SC}	$V_{IN}=35\text{V}$		250		mA
Dropout Voltage	V_D			2		V

■ ELECTRICAL CHARACTERISTICS(Cont.)

For 78D05 ($V_{IN}=10V$, $I_{OUT}=0.5A$, $C1=0.33\mu F$, $C0=0.1\mu F$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim0.5A$	4.8	5	5.2	V
		$V_{IN}=7.5\sim20V, I_{OUT}=5mA\sim0.5A$	4.75		5.25	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim0.5A$			50	mV
		$I_{OUT}=5mA\sim200mA$			25	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=7V\sim25V$			50	mV
		$V_{IN}=7.5\sim20V, I_{OUT}=0.5A$			50	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{UT}=7.5\sim20V$			1	mA
		$I_{OUT}=5mA\sim0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		40		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		-0.6		$mV/^\circ C$
Ripple Rejection	RR	$V_{IN}=8\sim18V, f=120Hz$	62	80		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$		250		mA
Dropout Voltage	V_D			2		V

For 78D06 ($V_{IN}=11V$, $I_{OUT}=0.5A$, $C1=0.33\mu F$, $C0=0.1\mu F$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim0.5A$	5.76	6	6.24	V
		$V_{IN}=8.5\sim21V, I_{OUT}=5mA\sim0.5A$	5.7		6.3	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim0.5A$			60	mV
		$I_{OUT}=5mA\sim200mA$			30	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=8\sim25V$			60	mV
		$V_{IN}=8.5\sim21V, I_{OUT}=0.5A$			60	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=8.5\sim21V$			1	mA
		$I_{OUT}=5mA\sim0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		45		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		-0.7		$mV/^\circ C$
Ripple Rejection	RR	$V_{IN}=9\sim19V, f=120Hz$	59	75		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$		250		mA
Dropout Voltage	V_D			2		V

For 78D08 ($V_{IN}=14V$, $I_{OUT}=0.5A$, $C1=0.33\mu F$, $C0=0.1\mu F$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim0.5A$	7.68	8	8.32	V
		$V_{IN}=10.5\sim23V, I_{OUT}=5mA\sim0.5A$	7.6		8.4	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim0.5A$			80	mV
		$I_{OUT}=5mA\sim200mA$			40	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=10.5\sim25V$			80	mV
		$V_{IN}=10.5\sim23V, I_{OUT}=0.5A$			80	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=10.5\sim23V$			1	mA
		$I_{OUT}=5mA\sim0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		58		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		-0.9		$mV/^\circ C$
Ripple Rejection	RR	$V_{IN}=11.5\sim21.5V, f=120Hz$	56	72		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$		250		mA
Dropout Voltage	V_D			2		V

■ ELECTRICAL CHARACTERISTICS(Cont.)

For 78D09 ($V_{IN}=15V$, $I_{OUT}=0.5A$, $C1=0.33\mu F$, $C0=0.1\mu F$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim0.5A$	8.64	9	9.36	V
		$V_{IN}=11.5\sim24V, I_{OUT}=5mA\sim0.5A$	8.55		9.45	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim0.5A$			90	mV
		$I_{OUT}=5mA\sim200mA$			45	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=11.5\sim25V$			90	mV
		$V_{IN}=11.5\sim24V, I_{OUT}=0.5A$			90	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=11.5\sim24V$			1	mA
		$I_{OUT}=5mA\sim0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		58		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		-1.1		mV/°C
Ripple Rejection	RR	$V_{IN}=12.5\sim22.5V, f=120Hz$	56	72		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$		250		mA
Dropout Voltage	V_D			2		V

For 78D12 ($V_{IN}=19V$, $I_{OUT}=0.5A$, $C1=0.33\mu F$, $C0=0.1\mu F$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim0.5A$	11.52	12	12.48	V
		$V_{IN}=14.5\sim27V, I_{OUT}=5mA\sim0.5A$	11.4		12.6	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim0.5A$			120	mV
		$I_{OUT}=5mA\sim200mA$			60	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=14.5\sim30V$			120	mV
		$V_{IN}=14.6\sim27V, I_{OUT}=0.5A$			120	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=14.5\sim30V$			1	mA
		$I_{OUT}=5mA\sim0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		75		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		-1.5		mV/°C
Ripple Rejection	RR	$V_{IN}=15\sim25V, f=120Hz$	55	72		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$		250		mA
Dropout Voltage	V_D			2		V

For 78D15 ($V_{IN}=23V$, $I_{OUT}=0.5A$, $C1=0.33\mu F$, $C0=0.1\mu F$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim0.5A$	14.4	15	15.6	V
		$V_{IN}=17.5\sim30V, I_{OUT}=5mA\sim0.5A$	14.25		15.75	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim0.5A$			150	mV
		$I_{OUT}=5mA\sim200mA$			75	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=18.5\sim30V$			150	mV
		$V_{IN}=17.5\sim30V, I_{OUT}=0.5A$			150	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=17.5\sim30V$			1	mA
		$I_{OUT}=5mA\sim0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		90		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		-1.8		mV/°C
Ripple Rejection	RR	$V_{IN}=18.5\sim28.5V, f=120Hz$	54	70		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$		250		mA
Dropout Voltage	V_D			2		V

■ ELECTRICAL CHARACTERISTICS(Cont.)

For 78D18 ($V_{IN}=27V$, $I_{OUT}=0.5A$, $C1=0.33\mu F$, $C0=0.1\mu F$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim 0.5A$	17.28	18	18.72	V
		$V_{IN}=21\sim 33V, I_{OUT}=5mA\sim 0.5A$	17.1		18.9	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim 0.5A$			180	mV
		$I_{OUT}=5mA\sim 200mA$			90	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=21\sim 33V$			180	mV
		$V_{IN}=21\sim 33V, I_{OUT}=0.5A$			180	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=21.5\sim 33V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		110		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		-2.2		mV/ $^{\circ}C$
Ripple Rejection	RR	$V_{IN}=22\sim 32V, f=120Hz$	53	69		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$		250		mA
Dropout Voltage	V_D			2		V

For 78D24 ($V_{IN}=33V$, $I_{OUT}=0.5A$, $C1=0.33\mu F$, $C0=0.1\mu F$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim 0.5A$	23.04	24	24.96	V
		$V_{IN}=27\sim 38V, I_{OUT}=5mA\sim 0.5A$	22.8		25.2	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim 0.5A$			240	mV
		$I_{OUT}=5mA\sim 200mA$			120	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=27\sim 38V$			240	mV
		$V_{IN}=27\sim 38V, I_{OUT}=0.5A$			240	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=28\sim 38V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz \leq f \leq 100kHz$		170		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		-2.8		mV/ $^{\circ}C$
Ripple Rejection	RR	$V_{IN}=28\sim 38V, f=120Hz$	50	66		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$		250		mA
Dropout Voltage	V_D			2		V

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