



78DXX

LINEAR INTEGRATED CIRCUIT

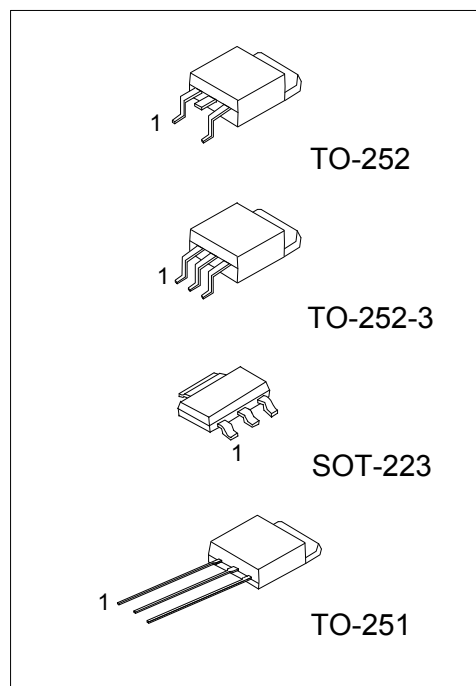
3-TERMINALS 0.5A POSITIVE VOLTAGE REGULATOR

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 4.7V, 5V, 6V, 8V, 9V, 12V, 15V, 18V and 24V Available
- * Thermal Overload Shutdown Protection
- * Short Circuit Current Limiting
- * Output Transistor SOA Protection



ORDERING INFORMATION

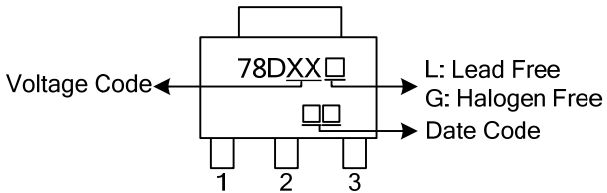
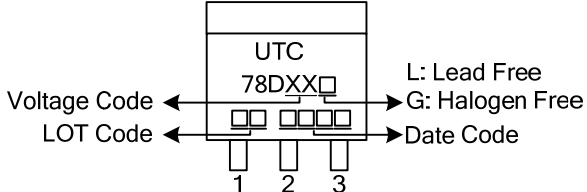
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
78DxxL-AA3-R	78DxxG-AA3-R	SOT-223	I	G	O	Tape Reel
78DxxL-TM3-T	78DxxG-TM3-T	TO-251	I	G	O	Tube
78DxxL-TN3-R	78DxxG-TN3-R	TO-252	I	G	O	Tape Reel
78DxxL-TNA-R	78DxxG-TNA-R	TO-252-3	I	G	O	Tape Reel

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

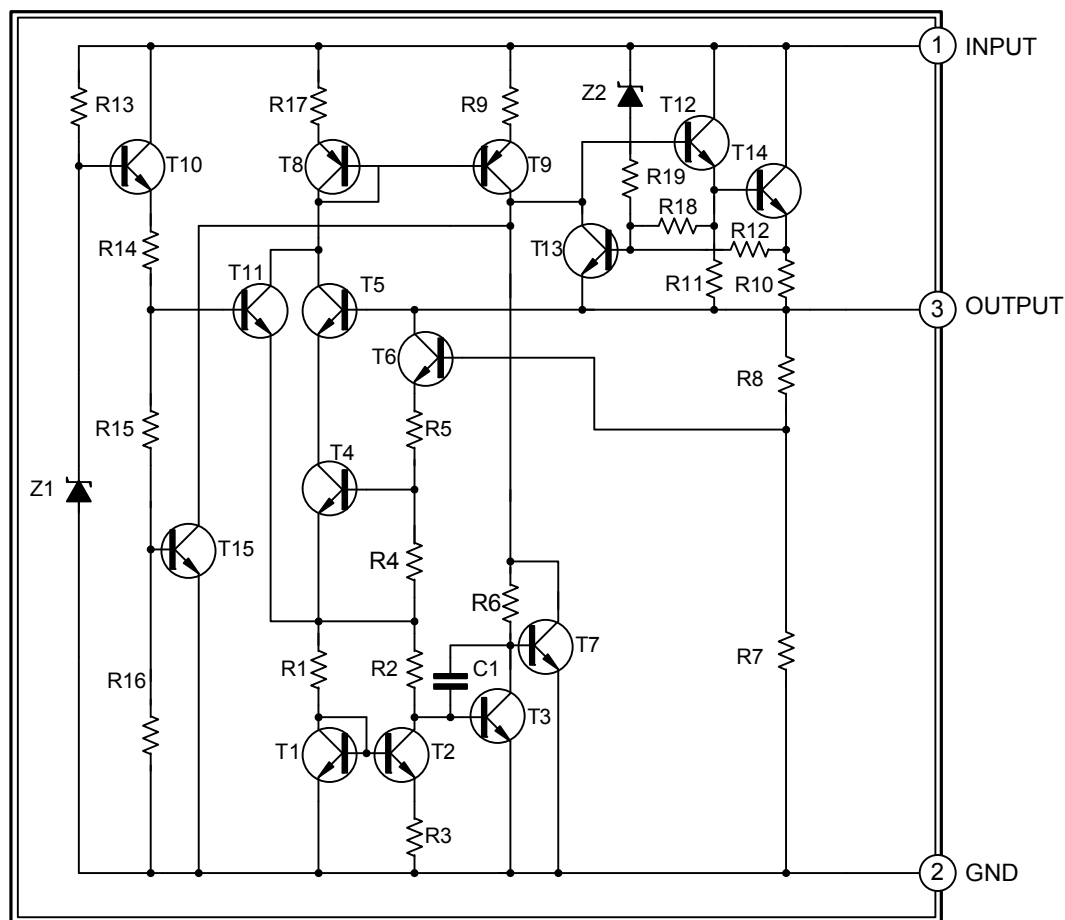
2. Pin Code: I: Input G: GND O: Output

	(1) Packing Type	(1) R: Tape Reel, T: Tube
	(2) Package Type	(2) AA3: SOT-223, TM3: TO-251, TN3: TO-252, TNA: TO-252-3
	(3) Lead Plating	(3) G: Halogen Free, L: Lead Free
	(4) Output Voltage Code	(4) xx: refer to Marking Information

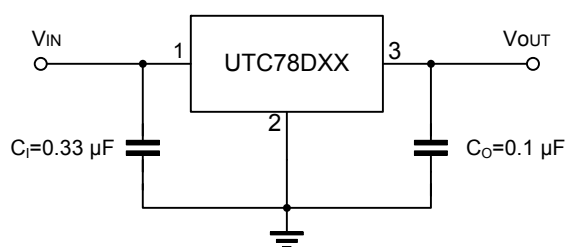
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-223	47: 4.7V 05: 5V 06: 6V 08: 8V 09: 9V	 Voltage Code ← 78DXX□ → L: Lead Free G: Halogen Free Date Code 1 2 3
TO-251 TO-252 TO-252-3	12: 12V 15: 15V 18: 18V 24: 24V	 UTC Voltage Code ← 78DXX□ → L: Lead Free G: Halogen Free Date Code LOT Code ← □□ □□ □□ → 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	$V_{OUT}=4.7\sim 18V$	V_{IN}	35	V
	$V_{OUT}=20\sim 24V$		40	V
Output Current		I_{OUT}	0.5	A
Power Dissipation ($T_C=25^\circ C$)	SOT-223	P_D	8.5	W
	TO-251		10	
	TO-252		10	
Operating Junction Temperature		T_J	-20~ +150	$^\circ C$
Storage Temperature		T_{STG}	-65 ~ +150	$^\circ C$

Notes: 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.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Case	SOT-223	θ_{JC}	15	$^\circ C/W$
	TO-251		12.5	
	TO-252		12.5	

■ ELECTRICAL CHARACTERISTICS

($T_J=25^\circ C$, $C_I=0.33\mu F$, $C_O=0.1\mu F$, $P_D\leq 7W$, unless otherwise specified)

For 78D47 ($V_{IN}=9.7V$, $I_{OUT}=0.5A$,)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim 0.5A$	4.512	4.7	4.888	V
		$V_{IN}=7.2\sim 19.7V$, $I_{OUT}=5mA\sim 0.5A$	4.465		4.935	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim 0.5A$			47	mV
		$I_{OUT}=5mA\sim 200mA$			24	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=7.2\sim 19.7V$			47	mV
		$V_{IN}=7.2\sim 19.7V$, $I_{OUT}=0.5A$			47	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=7.2\sim 19.7V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			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	$V_{IN}=7.7\sim 17.7V$, $f=120Hz$	62	80		dB
Peak Output Current	I_{PEAK}			1.8		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$		250		mA
Dropout Voltage	V_D			2		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

For 78D05 ($V_{IN}=10V$, $I_{OUT}=0.5A$)

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}	$I_{OUT}=5mA\sim0.5A$			100	mV
		$I_{OUT}=5mA\sim200\text{ mA}$			50	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=7V\sim25V$			100	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

■ ELECTRICAL CHARACTERISTICS(Cont.)

For 78D06 ($V_{IN}=11V$, $I_{OUT}=0.5A$)

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 ($V_{IN}=14V$, $I_{OUT}=0.5A$)

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

For 78D09 ($V_{IN}=15V$, $I_{OUT}=0.5A$)

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/ $^{\circ}C$
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

■ ELECTRICAL CHARACTERISTICS(Cont.)

For 78D12 ($V_{IN}=19V$, $I_{OUT}=0.5A$)

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 ($V_{IN}=23V$, $I_{OUT}=0.5A$, $C_I=0.33\mu F$, $C_O=0.1\mu F$)

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

For 78D18 ($V_{IN}=27V$, $I_{OUT}=0.5A$)

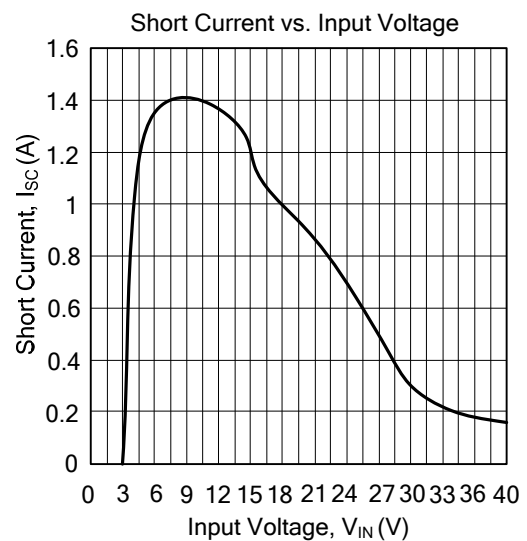
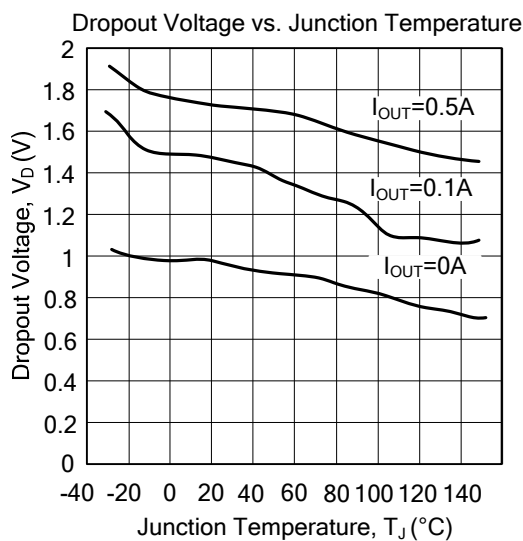
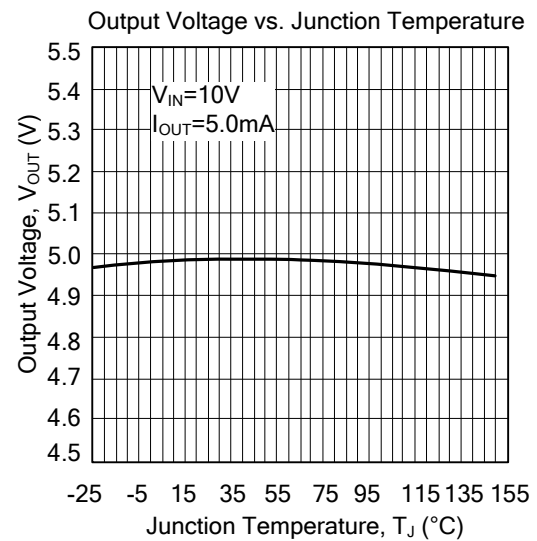
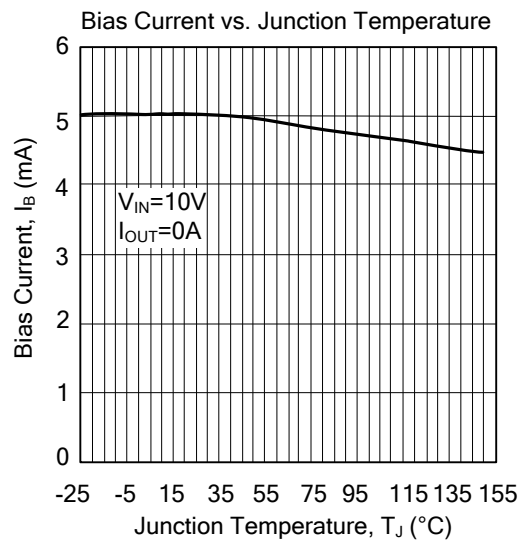
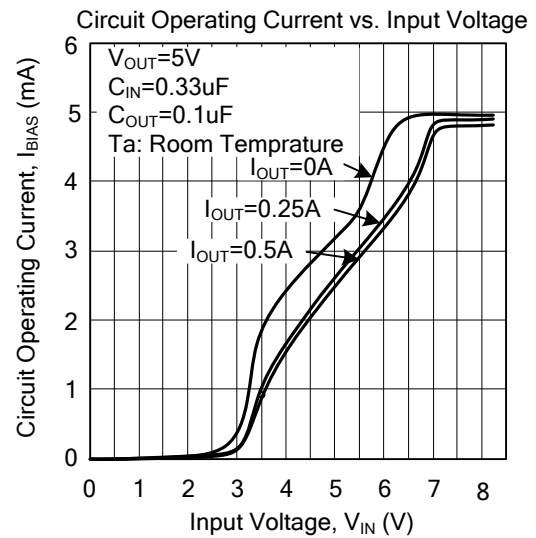
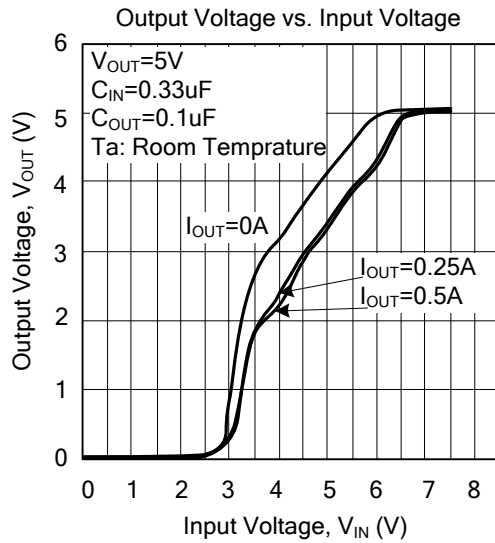
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim0.5A$	17.28	18	18.72	V
		$V_{IN}=21\sim33V, I_{OUT}=5mA\sim0.5A$	17.1		18.9	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim0.5A$			180	mV
		$I_{OUT}=5mA\sim200mA$			90	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=21\sim33V$			180	mV
		$V_{IN}=21\sim33V, I_{OUT}=0.5A$			180	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=21.5\sim33V$			1	mA
		$I_{OUT}=5mA\sim0.5A$			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/°C
Ripple Rejection	RR	$V_{IN}=22\sim32V, f=120Hz$	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

■ ELECTRICAL CHARACTERISTICS(Cont.)

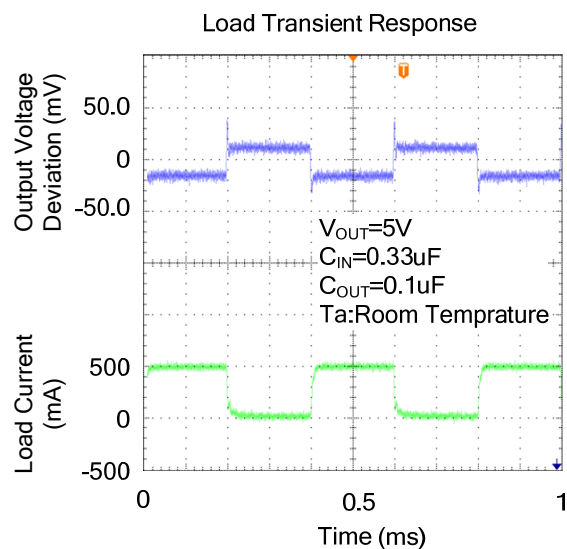
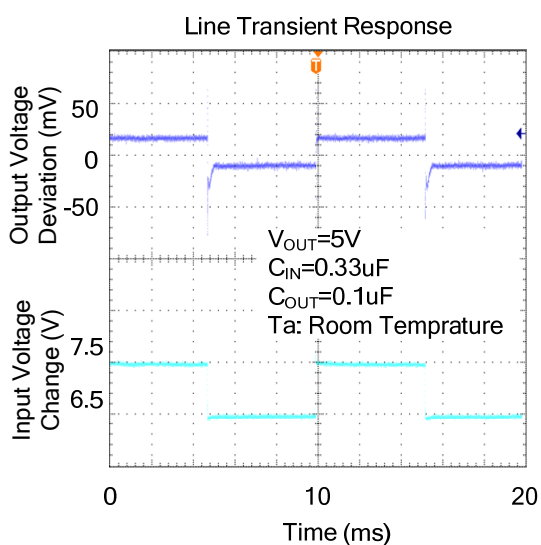
For 78D24 ($V_{IN}=33V$, $I_{OUT}=0.5A$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim0.5A$	23.04	24	24.96	V
		$V_{IN}=27\sim38V$, $I_{OUT}=5mA\sim0.5A$	22.8		25.2	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim0.5A$			240	mV
		$I_{OUT}=5mA\sim200mA$			120	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=27\sim38V$			240	mV
		$V_{IN}=27\sim38V$, $I_{OUT}=0.5A$			240	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=28\sim38V$			1	mA
		$I_{OUT}=5mA\sim0.5A$			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	$V_{IN}=28\sim38V$, $f=120Hz$	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

■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



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