



78DXX

LINEAR INTEGRATED CIRCUIT

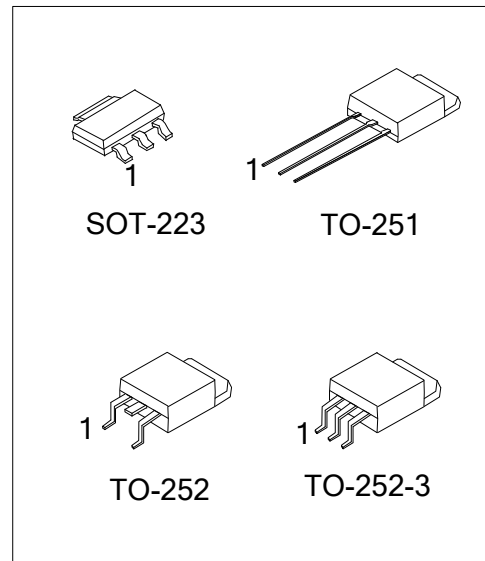
3-TERMINALS 0.5A POSITIVE VOLTAGE REGULATOR

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 5V, 6V, 7V, 8V, 9V, 12V, 15V, 18V, 20V 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	
-	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

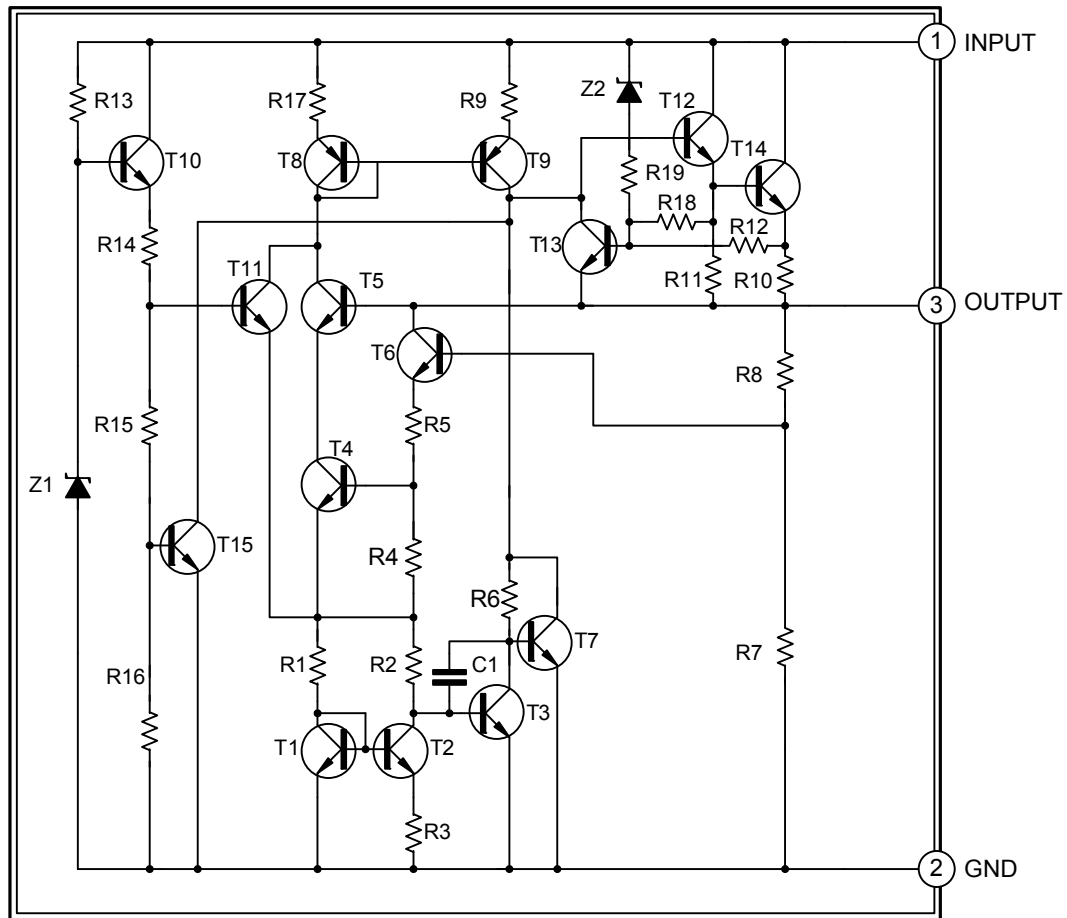
Note: 1. XX: Output Voltage, refer to Marking Information
 2. Pin Code: I: Input G: GND O: Output

<p>78DXXG-AA3-R</p>	<p>(1) R: Tape Reel, T: Tube (2) AA3: SOT-223, TM3: TO-251, TN3: TO-252, TNA: TO-252-3 (3) G: Halogen Free and Lead Free, L: Lead Free (4) XX: refer to Marking Information</p>
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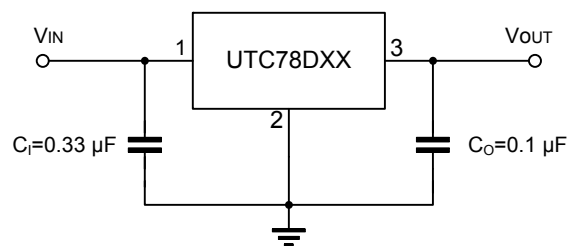
MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-223	05: 5V 06: 6V 07: 7V 08: 8V 09: 9V	<p>78DXXG</p> <p>Voltage Code</p> <p>Date Code</p> <p>1 2 3</p>
TO-251 TO-252 TO-252-3	12: 12V 15: 15V 18: 18V 20: 20V 24: 24V	<p>UTC</p> <p>78DXXG</p> <p>Voltage Code</p> <p>Lot Code</p> <p>L: Lead Free</p> <p>G: Halogen Free</p> <p>Date Code</p> <p>1 2 3</p>

■ 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 ($T_J=25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Input Voltage		V_{IN}	35	V
Output Current		I_{OUT}	0.5	A
Power Dissipation ($T_C=25^\circ\text{C}$)	SOT-223	P_D	8.5	W
	TO-251/TO-252		10	
	TO-252-3			
Operating Junction Temperature		T_J	-20~ +150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-65 ~ +150	$^\circ\text{C}$

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	RATINGS	UNIT
Junction to Case	SOT-223	θ_{JC}	15	$^\circ\text{C/W}$
	TO-251/TO-252		12.5	
	TO-252-3			

■ ELECTRICAL CHARACTERISTICS

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

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5\text{mA}\sim 0.5\text{A}$	4.8	5	5.2	V
		$V_{IN}=7.5\sim 20\text{V}$, $I_{OUT}=5\text{mA}\sim 0.5\text{A}$	4.75		5.25	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5\text{mA}\sim 0.5\text{A}$			50	mV
		$I_{OUT}=5\text{mA}\sim 200\text{mA}$			25	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=7\text{V}\sim 25\text{V}$			50	mV
		$V_{IN}=7.5\sim 20\text{V}$, $I_{OUT}=0.5\text{A}$			50	mV
Quiescent Current	I_Q	$I_{OUT}=0.5\text{A}$			8	mA
Quiescent Current Change	ΔI_Q	$V_{UT}=7.5\sim 20\text{V}$			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	$V_{IN}=8\sim 18\text{V}$, $f=120\text{Hz}$	62	80		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=V_{OUT}+19\text{V}$		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}	$I_{OUT}=5mA\sim 0.5A$	5.76	6	6.24	V
		$V_{IN}=8.5\sim 21V, I_{OUT}=5mA\sim 0.5A$	5.7		6.3	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim 0.5A$			60	mV
		$I_{OUT}=5mA\sim 200mA$			30	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=8\sim 25V$			60	mV
		$V_{IN}=8.5\sim 21V, I_{OUT}=0.5A$			60	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=8.5\sim 21V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			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	$V_{IN}=9\sim 19V, f=120Hz$	59	75		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=V_{OUT}+19V$		250		mA
Dropout Voltage	V_D			2		V

For 78D07 ($V_{IN}=13V$, $I_{OUT}=0.5A$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim 0.5A$	6.72	7	7.28	V
		$V_{IN}=9.5\sim 22V, I_{OUT}=5mA\sim 0.5A$	6.65		7.35	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim 0.5A$			70	mV
		$I_{OUT}=5mA\sim 200mA$			35	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=10.5\sim 25V$			70	mV
		$V_{IN}=10.5\sim 23V, I_{OUT}=0.5A$			70	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=10.5\sim 23V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		50		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		-0.8		$mV/^\circ C$
Ripple Rejection	RR	$V_{IN}=11.5\sim 21.5V, f=120Hz$	59	75		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=V_{OUT}+19V$		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}	$I_{OUT}=5mA\sim 0.5A$	7.68	8	8.32	V
		$V_{IN}=10.5\sim 23V, I_{OUT}=5mA\sim 0.5A$	7.6		8.4	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim 0.5A$			80	mV
		$I_{OUT}=5mA\sim 200mA$			40	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=10.5\sim 25V$			80	mV
		$V_{IN}=10.5\sim 23V, I_{OUT}=0.5A$			80	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=10.5\sim 23V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			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	$V_{IN}=11.5\sim 21.5V, f=120Hz$	56	72		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=V_{OUT}+19V$		250		mA
Dropout Voltage	V_D			2		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim 0.5A$	8.64	9	9.36	V
		$V_{IN}=11.5\sim 24V, I_{OUT}=5mA\sim 0.5A$	8.55		9.45	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim 0.5A$			90	mV
		$I_{OUT}=5mA\sim 200mA$			45	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=11.5\sim 25V$			90	mV
		$V_{IN}=11.5\sim 24V, I_{OUT}=0.5A$			90	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=11.5\sim 24V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			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	$V_{IN}=12.5\sim 22.5V, f=120Hz$	56	72		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=V_{OUT}+19V$		250		mA
Dropout Voltage	V_D			2		V

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim 0.5A$	11.52	12	12.48	V
		$V_{IN}=14.5\sim 27V, I_{OUT}=5mA\sim 0.5A$	11.4		12.6	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim 0.5A$			120	mV
		$I_{OUT}=5mA\sim 200mA$			60	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=14.5\sim 30V$			120	mV
		$V_{IN}=14.6\sim 27V, I_{OUT}=0.5A$			120	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=14.5\sim 30V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			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		$mV/^\circ C$
Ripple Rejection	RR	$V_{IN}=15\sim 25V, f=120Hz$	55	72		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=V_{OUT}+19V$		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}	$I_{OUT}=5mA\sim 0.5A$	14.4	15	15.6	V
		$V_{IN}=17.5\sim 30V, I_{OUT}=5mA\sim 0.5A$	14.25		15.75	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim 0.5A$			150	mV
		$I_{OUT}=5mA\sim 200mA$			75	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=18.5\sim 30V$			150	mV
		$V_{IN}=17.5\sim 30V, I_{OUT}=0.5A$			150	mV
Quiescent Current	I_Q	$I_{OUT}=0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=17.5\sim 30V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			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		$mV/^\circ C$
Ripple Rejection	RR	$V_{IN}=18.5\sim 28.5V, f=120Hz$	54	70		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=V_{OUT}+19V$		250		mA
Dropout Voltage	V_D			2		V

■ ELECTRICAL CHARACTERISTICS(Cont.)

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

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

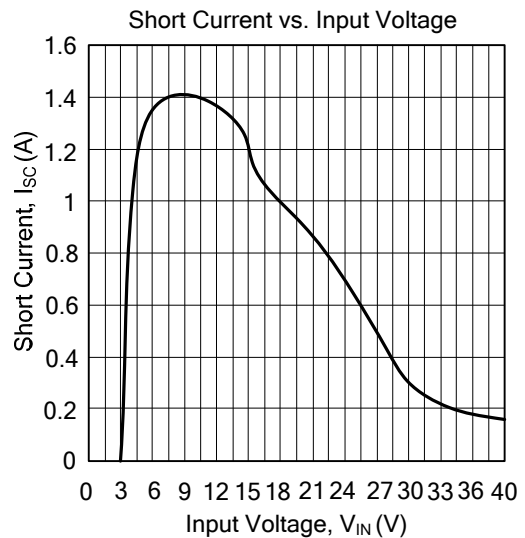
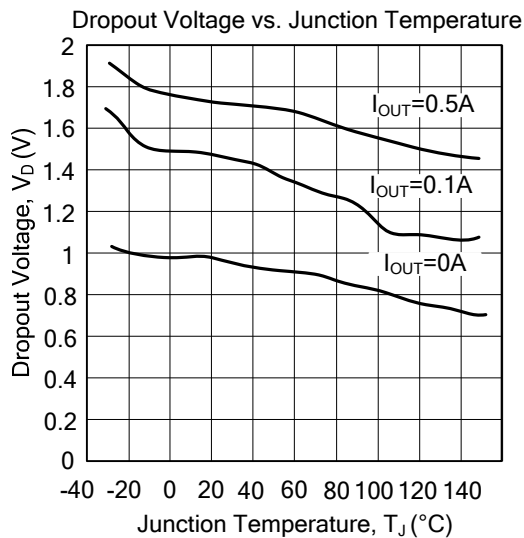
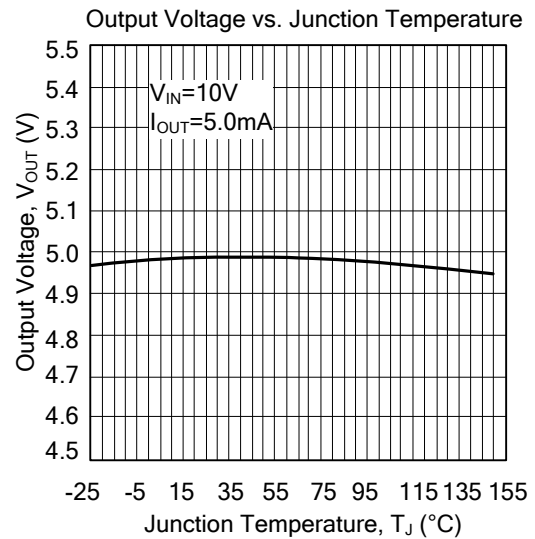
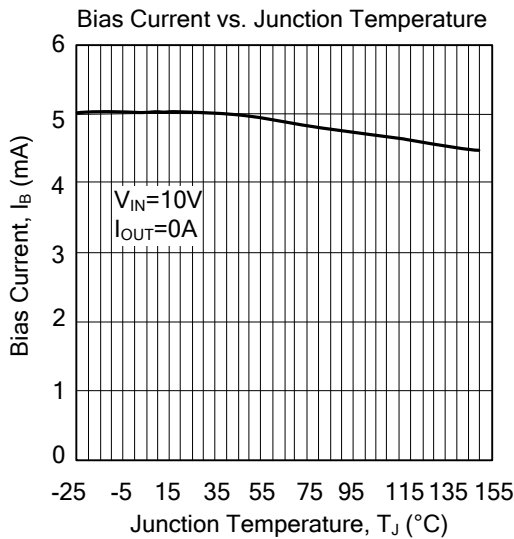
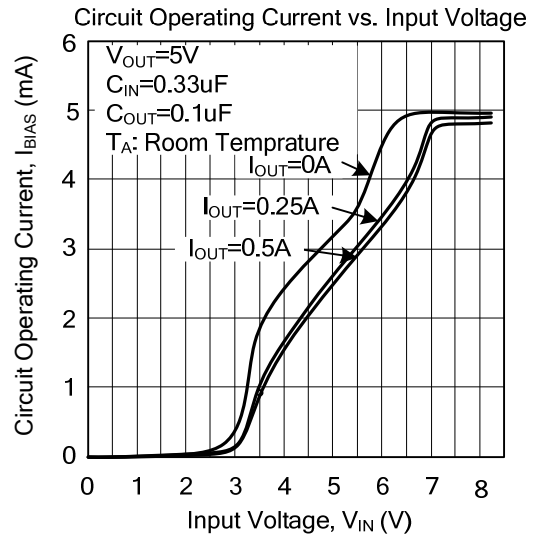
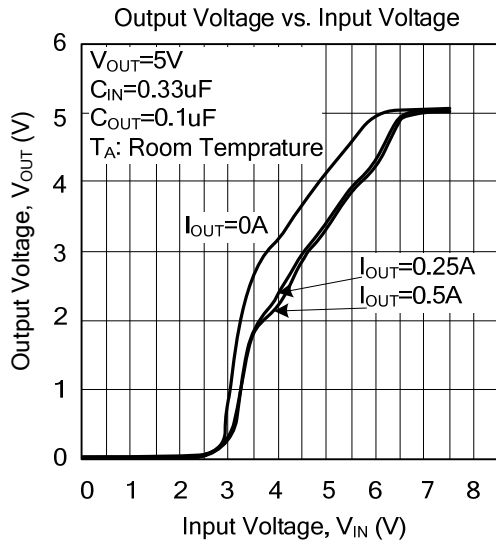
For 78D20 ($V_{IN}=29V$, $I_{OUT}=0.5A$)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	$I_{OUT}=5mA\sim 0.5A$	19.20	20.0	20.80	V
		$V_{IN}=23\sim 35V, I_{OUT}=5mA\sim 0.5A$	19.00		21.00	V
Load Regulation	ΔV_{OUT}	$I_{OUT}=5mA\sim 0.5A$			200	mV
		$I_{OUT}=5mA\sim 200mA$			100	mV
Line Regulation	ΔV_{OUT}	$V_{IN}=23\sim 35V$			200	mV
		$V_{IN}=23\sim 35V, I_{OUT}=0.5A$			200	mV
Quiescent Current	I_Q	$I_{OUT}\leq 0.5A$			8	mA
Quiescent Current Change	ΔI_Q	$V_{IN}=23.5\sim 35V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		130		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	$I_{OUT}=5mA$		-2.6		$mV/^\circ C$
Ripple Rejection	RR	$V_{IN}=24\sim 34V, f=120Hz$	52	68		dB
Peak Output Current	I_{PEAK}			1.2		A
Short-Circuit Current	I_{SC}	$V_{IN}=35V$		250		mA
Dropout Voltage	V_D			2.0		V

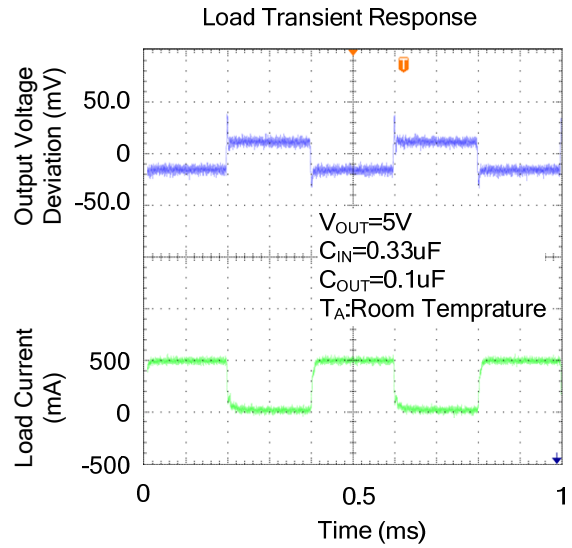
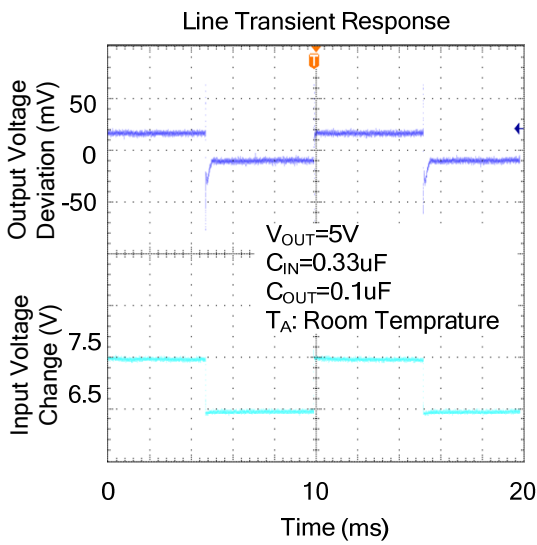
For 78D24 ($V_{IN}=33V$, $I_{OUT}=0.5A$)

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

■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



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