



## 78DXX

## LINEAR INTEGRATED CIRCUIT

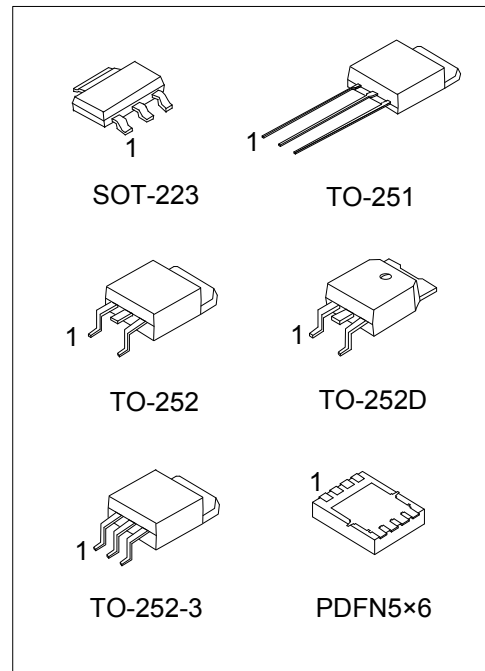
### 3-TERMINALS 0.5A POSITIVE VOLTAGE REGULATOR

#### 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, 10, 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	4	5	6	7	8		
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
78DXXL-TND-R	78DXXG-TND-R	TO-252D	I	G	O	-	-	-	-	-	-	Tape Reel
78DXXL-P5060-R	78DXXG-P5060-R	PDFN5x6	I	I	I	O	G	G	G	G	G	Tape Reel

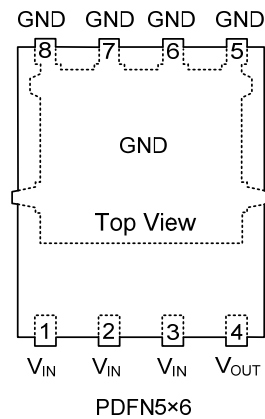
Note: 1. XX: Output Voltage, refer to Marking Information  
 2. Pin Code: I: Input G: GND O: Output

<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, TND: TO-252D, P5060: PDFN5x6          (3) G: Halogen Free and Lead Free, L: Lead Free          (4) XX: refer to Marking Information</p>
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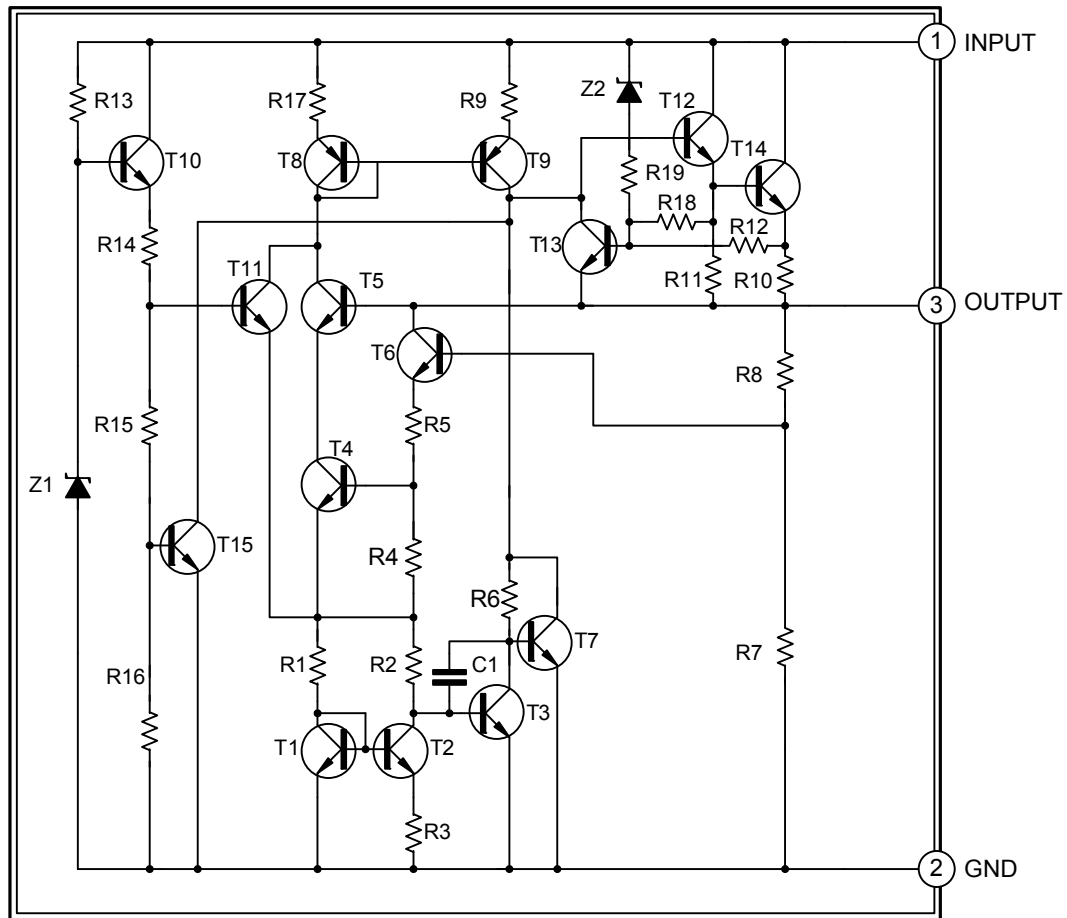
### MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-223	05: 5V 06: 6V 07: 7V 08: 8V 09: 9V 10: 10V 12: 12V 15: 15V 18: 18V 20: 20V 24: 24V	<p>L: Lead Free G: Halogen Free Voltage Code Date Code</p>
TO-251 TO-252 TO-252-3 TO-252D		<p>UTC 78DXX Voltage Code Lot Code L: Lead Free G: Halogen Free Date Code</p>
PDFN5x6		<p>UTC 78 DXX Lot Code L: Lead Free G: Halogen Free Date Code</p>

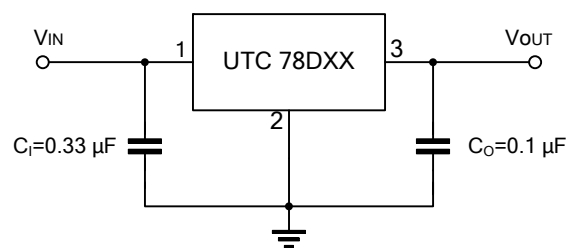
### PIN CONFIGURATION



■ 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	$V_{\text{OUT}}=5\sim 20\text{V}$	$V_{\text{IN}}$	35	V
	$V_{\text{OUT}}=24\text{V}$		40	V
Output Current		$I_{\text{OUT}}$	0.5	A
Power Dissipation ( $T_C=25^{\circ}\text{C}$ )	SOT-223	$P_D$	8.3	W
	TO-251/TO-252		10	W
	TO-252-3/TO-252D		8.0	W
	PDFN5×6			
Operating Junction Temperature		$T_J$	+150	$^{\circ}\text{C}$
Operating Temperature		$T_{\text{OPR}}$	-40 ~ +125	$^{\circ}\text{C}$
Storage Temperature		$T_{\text{STG}}$	-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	$\theta_{\text{JC}}$	15	$^{\circ}\text{C}/\text{W}$
	TO-251/TO-252		12.5	$^{\circ}\text{C}/\text{W}$
	TO-252-3/TO-252D		15.6	$^{\circ}\text{C}/\text{W}$
	PDFN5×6			

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{\text{OUT}}$	$I_{\text{OUT}}=5\text{mA}\sim 0.5\text{A}$	4.90	5.0	5.10	V
		$V_{\text{IN}}=7.5\sim 20\text{V}$ , $I_{\text{OUT}}=5\text{mA}\sim 0.5\text{A}$	4.85		5.15	V
Load Regulation	$\Delta V_{\text{OUT}}$	$I_{\text{OUT}}=5\text{mA}\sim 0.5\text{A}$			50	mV
		$I_{\text{OUT}}=5\text{mA}\sim 200\text{mA}$			25	mV
Line Regulation	$\Delta V_{\text{OUT}}$	$V_{\text{IN}}=7\text{V}\sim 25\text{V}$			50	mV
		$V_{\text{IN}}=7.5\sim 20\text{V}$ , $I_{\text{OUT}}=0.5\text{A}$			50	mV
Quiescent Current	$I_Q$	$I_{\text{OUT}}=0.5\text{A}$			8	mA
Quiescent Current Change	$\Delta I_Q$	$V_{\text{OUT}}=7.5\sim 20\text{V}$			1	mA
		$I_{\text{OUT}}=5\text{mA}\sim 0.5\text{A}$			0.5	mA
Output Noise Voltage	eN	$10\text{Hz}\leq f\leq 100\text{kHz}$		40		$\mu\text{V}$
Ripple Rejection	RR	$V_{\text{IN}}=8\sim 18\text{V}$ , $f=120\text{Hz}$	59	80		dB
Peak Output Current	$I_{\text{PEAK}}$			1.2		A
Short-Circuit Current	$I_{\text{SC}}$	$V_{\text{IN}}=V_{\text{OUT}}+19\text{V}$		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	$V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$	5.88	6.0	6.12	V
		$V_{IN}=8.5\sim 21V, I_{OUT}=5mA\sim 0.5A$	5.82		6.18	V
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$			60	mV
		$I_{OUT}=5mA\sim 200mA$			30	mV
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=8\sim 25V$			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	$\Delta I_Q$	$V_{IN}=8.5\sim 21V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		45		$\mu V$
Ripple Rejection	RR	$V_{IN}=9\sim 19V, f=120Hz$	56	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	$V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$	6.86	7.0	7.14	V
		$V_{IN}=9.5\sim 22V, I_{OUT}=5mA\sim 0.5A$	6.79		7.21	V
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$			70	mV
		$I_{OUT}=5mA\sim 200mA$			35	mV
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=10.5\sim 25V$			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	$\Delta I_Q$	$V_{IN}=10.5\sim 23V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		50		$\mu V$
Ripple Rejection	RR	$V_{IN}=10.5V\sim 20.5V, f=120Hz$	56	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	$V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$	7.84	8.0	8.16	V
		$V_{IN}=10.5\sim 23V, I_{OUT}=5mA\sim 0.5A$	7.76		8.24	V
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$			80	mV
		$I_{OUT}=5mA\sim 200mA$			40	mV
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=10.5\sim 25V$			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	$\Delta I_Q$	$V_{IN}=10.5\sim 23V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		58		$\mu V$
Ripple Rejection	RR	$V_{IN}=11.5\sim 21.5V, f=120Hz$	53	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	$V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$	8.82	9.0	9.18	V
		$V_{IN}=11.5\sim 24V, I_{OUT}=5mA\sim 0.5A$	8.73		9.27	V
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$			90	mV
		$I_{OUT}=5mA\sim 200mA$			45	mV
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=11.5\sim 25V$			90	mV
		$V_{IN}=11.5\sim 24V, I_{OUT}=0.5A$			90	mV
Quiescent Current	$I_Q$	$I_{OUT}=1.0A$			8	mA
Quiescent Current Change	$\Delta I_Q$	$V_{IN}=11.5\sim 24V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		58		$\mu V$
Ripple Rejection	RR	$V_{IN}=12.5\sim 22.5V, f=120Hz$	53	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 78D10 ( $V_{IN}=16V$ ,  $I_{OUT}=0.5A$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$	9.8	10	10.2	V
		$V_{IN}=12.5\sim 25V, I_{OUT}=5mA\sim 0.5A$	9.7		10.3	V
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$			100	mV
		$I_{OUT}=5mA\sim 200mA$			50	mV
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=12.5\sim 25V$			100	mV
		$V_{IN}=12.5\sim 25V, I_{OUT}=0.5A$			100	mV
Quiescent Current	$I_Q$	$I_{OUT}=0.5A$			8.0	mA
Quiescent Current Change	$\Delta I_Q$	$V_{IN}=12.6V\sim 25V$			1.0	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		58		$\mu V$
Ripple Rejection	RR	$V_{IN}=13\sim 23V, f=120Hz$	53	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	$V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$	11.76	12	12.24	V
		$V_{IN}=14.5\sim 27V, I_{OUT}=5mA\sim 0.5A$	11.64		12.36	V
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$			120	mV
		$I_{OUT}=5mA\sim 200mA$			60	mV
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=14.5\sim 30V$			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	$\Delta I_Q$	$V_{IN}=14.5\sim 30V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		75		$\mu V$
Ripple Rejection	RR	$V_{IN}=15\sim 25V, f=120Hz$	52	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 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	$V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$	14.70	15	15.30	V
		$V_{IN}=17.5\sim 30V$ , $I_{OUT}=5mA\sim 0.5A$	14.55		15.45	V
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$			150	mV
		$I_{OUT}=5mA\sim 200mA$			75	mV
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=18.5\sim 30V$			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	$\Delta I_Q$	$V_{IN}=17.5\sim 30V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		90		$\mu V$
Ripple Rejection	RR	$V_{IN}=18.5\sim 28.5V$ , $f=120Hz$	51	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

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$	17.64	18	18.36	V
		$V_{IN}=21\sim 33V$ , $I_{OUT}=5mA\sim 0.5A$	17.46		18.54	V
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$			180	mV
		$I_{OUT}=5mA\sim 200mA$			90	mV
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=21\sim 33V$			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	$\Delta I_Q$	$V_{IN}=21.5\sim 33V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		110		$\mu V$
Ripple Rejection	RR	$V_{IN}=22\sim 32V$ , $f=120Hz$	50	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	$V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$	19.6	20	20.4	V
		$V_{IN}=23\sim 35V$ , $I_{OUT}=5mA\sim 0.5A$	19.4		20.6	V
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$			200	mV
		$I_{OUT}=5mA\sim 200mA$			100	mV
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=23\sim 35V$			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	$\Delta I_Q$	$V_{IN}=23.5\sim 35V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		130		$\mu V$
Ripple Rejection	RR	$V_{IN}=24\sim 34V$ , $f=120Hz$	49	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

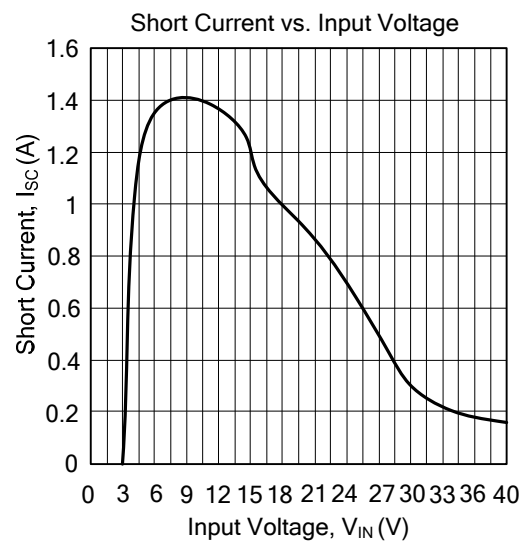
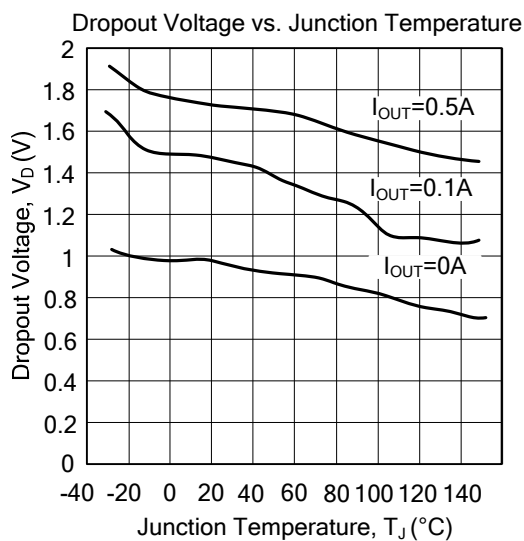
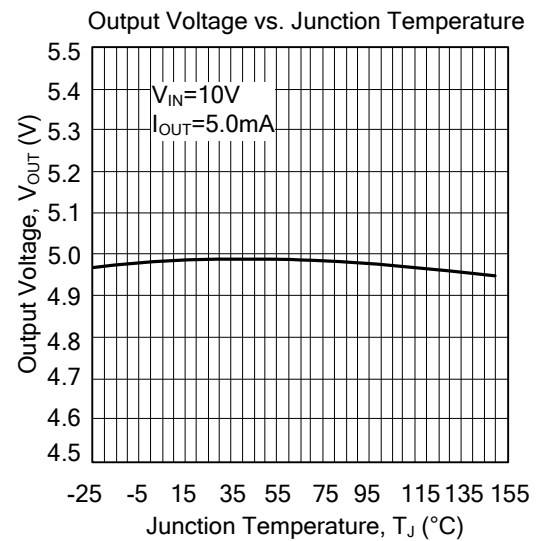
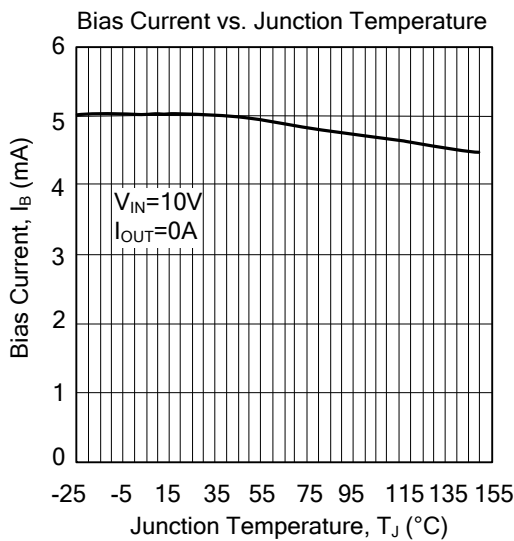
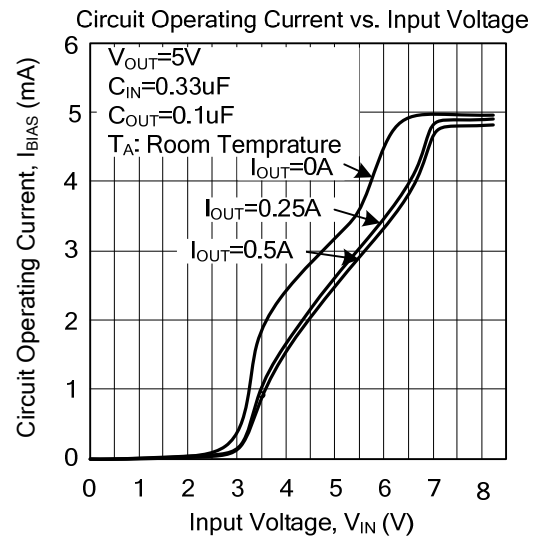
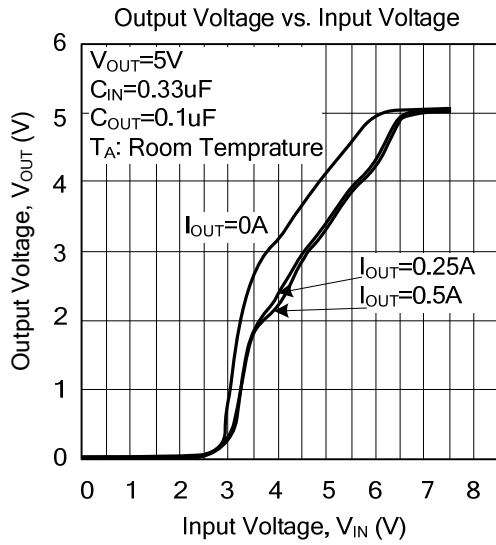
■ ELECTRICAL CHARACTERISTICS (Cont.)

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

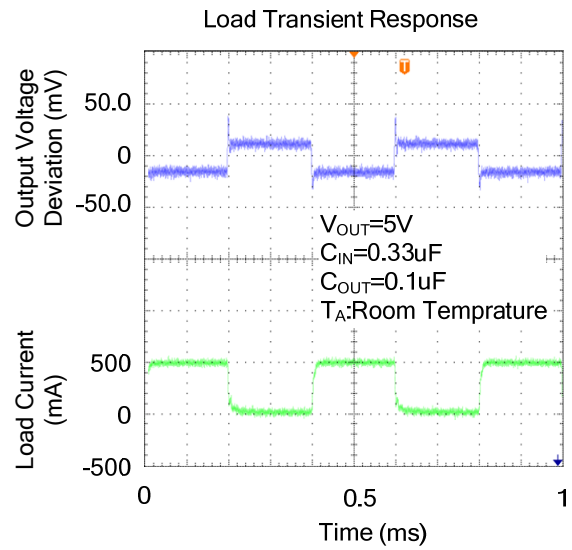
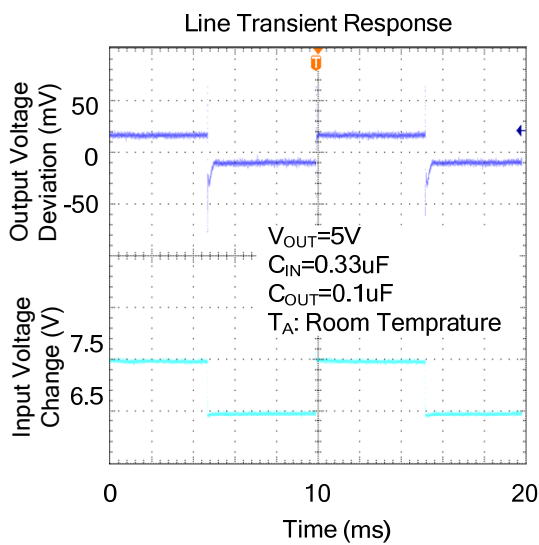
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$	23.52	24	24.48	V
		$V_{IN}=27\sim 38V$ , $I_{OUT}=5mA\sim 0.5A$	23.28		24.72	V
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA\sim 0.5A$			240	mV
		$I_{OUT}=5mA\sim 200mA$			120	mV
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=27\sim 38V$			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	$\Delta I_Q$	$V_{IN}=28\sim 38V$			1	mA
		$I_{OUT}=5mA\sim 0.5A$			0.5	mA
Output Noise Voltage	eN	$10Hz\leq f\leq 100kHz$		170		$\mu V$
Ripple Rejection	RR	$V_{IN}=28\sim 38V$ , $f=120Hz$	47	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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