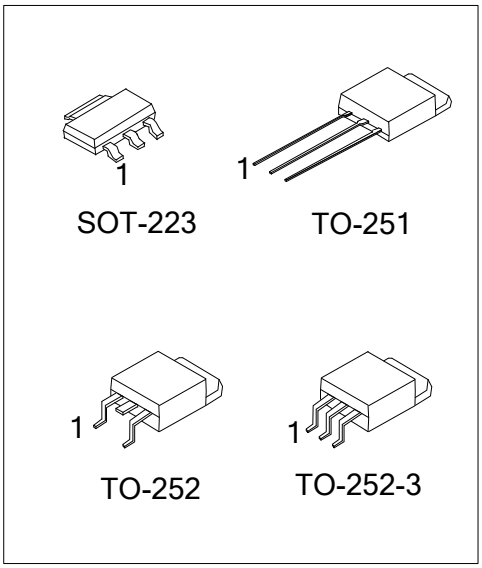
3-TERMINALS 0.5A POSITIVE VOLTAGE REGULATOR



■ 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.

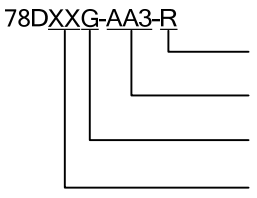
■ FEATURE

* 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

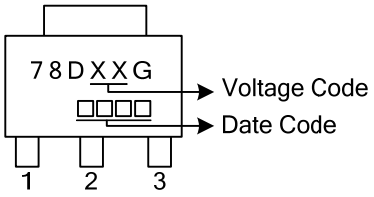
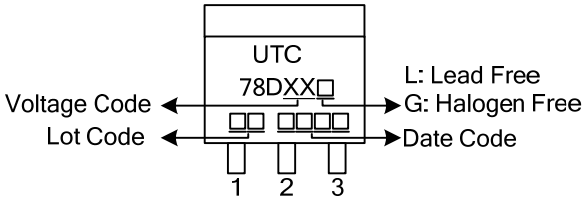
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
-	78DXXG-AA3-R	SOT-223	I	G	O	Tape Reel
78DXXL-TM3-T	78DXXG-TM3-T	TO-251	I	G	O	Tube
78DXXL-TN3-R	78DXXG-TN3-R	TO-252	I	G	O	Tape Reel
78DXXL-TNA-R	78DXXG-TNA-R	TO-252-3	I	G	O	Tape Reel

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

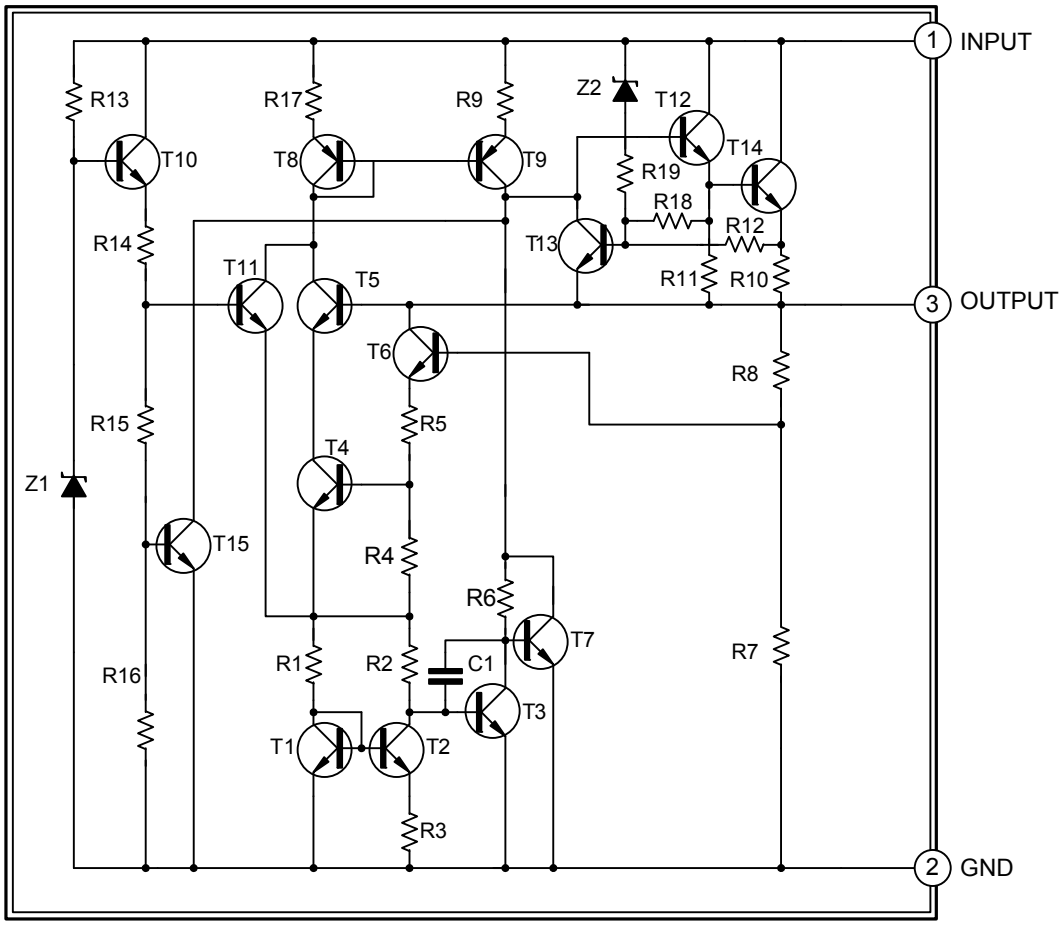


(1) R: Tape Reel, T: Tube
(2) AA3: SOT-223, TM3: TO-251, TN3: TO-252, TNA: TO-252-3
(3) G: Halogen Free and Lead Free, L: Lead Free
(4) XX: refer to Marking Information

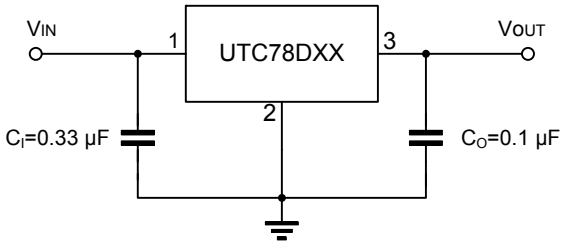
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-223	05: 5V 06: 6V 07: 7V 08: 8V 09: 9V 12: 12V 15: 15V 18: 18V 20: 20V 24: 24V	
TO-251 TO-252 TO-252-3		

■ 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 (T_J=25°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°C)	SOT-223	P_D	8.5	W
	TO-251/TO-252 TO-252-3		10	
Operating Junction Temperature		T_J	-20~ +150	°C
Storage Temperature		T_{STG}	-65 ~ +150	°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	°C/W
	TO-251/TO-252 TO-252-3		12.5	

■ ELECTRICAL CHARACTERISTICS

(T_J=25°C, C_I=0.33μF, C_O=0.1μF, P_D≤7W, unless otherwise specified)

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	I_{OUT}=5mA~0.5A	4.8	5	5.2	V
		V_{IN} =7.5~20V,I_{OUT}=5mA~0.5A	4.75		5.25	V
Load Regulation	ΔV_{OUT}	I_{OUT}=5mA~0.5A			50	mV
		I_{OUT}=5mA~200 mA			25	mV
Line Regulation	ΔV_{OUT}	V_{IN} =7V~25V			50	mV
		V_{IN} =7.5~20V, I_{OUT}=0.5A			50	mV
Quiescent Current	I_Q	I_{OUT}=0.5A			8	mA
Quiescent Current Change	ΔI_Q	V_{UT} =7.5~20V			1	mA
		I_{OUT}=5mA~0.5A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		40		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	I_{OUT}=5mA		-0.6		mV/°C
Ripple Rejection	RR	V_{IN} =8~18V,f=120Hz	62	80		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 78D06 (V_{IN}=11V, I_{OUT}=0.5A)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	I_{OUT}=5mA~0.5A	5.76	6	6.24	V
		V_{IN}=8.5~21V,I_{OUT}=5mA~0.5A	5.7		6.3	V
Load Regulation	ΔV_{OUT}	I_{OUT}=5mA~0.5A			60	mV
		I_{OUT}=5mA~200mA			30	mV
Line Regulation	ΔV_{OUT}	V_{IN}=8~25V			60	mV
		V_{IN}=8.5~21V, I_{OUT}=0.5A			60	mV
Quiescent Current	I_Q	I_{OUT}=0.5A			8	mA
Quiescent Current Change	ΔI_Q	V_{IN} =8.5~21V			1	mA
		I_{OUT}=5mA~0.5A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		45		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	I_{OUT}=5mA		-0.7		mV/°C
Ripple Rejection	RR	V_{IN} =9~19V,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~0.5A	6.72	7	7.28	V
		V_{IN}=9.5~22V,I_{OUT}=5mA~0.5A	6.65		7.35	V
Load Regulation	ΔV_{OUT}	I_{OUT}=5mA~0.5A			70	mV
		I_{OUT}=5mA~200mA			35	mV
Line Regulation	ΔV_{OUT}	V_{IN}=10.5~25V			70	mV
		V_{IN}=10.5~23V, I_{OUT}=0.5A			70	mV
Quiescent Current	I_Q	I_{OUT}=0.5A			8	mA
Quiescent Current Change	ΔI_Q	V_{IN} =10.5~23V			1	mA
		I_{OUT}=5mA~0.5A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		50		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	I_{OUT}=5mA		-0.8		mV/°C
Ripple Rejection	RR	V_{IN} =11.5~21.5V,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~0.5A	7.68	8	8.32	V
		V_{IN}=10.5~23V, I_{OUT}=5mA~0.5A	7.6		8.4	V
Load Regulation	ΔV_{OUT}	I_{OUT}=5mA~0.5A			80	mV
		I_{OUT}=5mA~200mA			40	mV
Line Regulation	ΔV_{OUT}	V_{IN} =10.5~25V			80	mV
		V_{IN} =10.5~23V, I_{OUT}=0.5A			80	mV
Quiescent Current	I_Q	I_{OUT}=0.5A			8	mA
Quiescent Current Change	ΔI_Q	V_{IN} =10.5~23V			1	mA
		I_{OUT}=5mA~0.5A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	I_{OUT}=5mA		-0.9		mV/°C
Ripple Rejection	RR	V_{IN} =11.5~21.5V, 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~0.5A	8.64	9	9.36	V
		V_{IN} =11.5~24V,I_{OUT}=5mA~0.5A	8.55		9.45	V
Load Regulation	ΔV_{OUT}	I_{OUT}=5mA~0.5A			90	mV
		I_{OUT}=5mA~200mA			45	mV
Line Regulation	ΔV_{OUT}	V_{IN} =11.5~25V			90	mV
		V_{IN} =11.5~24V, I_{OUT}=0.5A			90	mV
Quiescent Current	I_Q	I_{OUT}=0.5A			8	mA
Quiescent Current Change	ΔI_Q	V_{IN}=11.5~24V			1	mA
		I_{OUT}=5mA~0.5A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤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}=12.5~22.5V,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~0.5A	11.52	12	12.48	V
		V_{IN} =14.5~27V,I_{OUT}=5mA~0.5A	11.4		12.6	V
Load Regulation	ΔV_{OUT}	I_{OUT}=5mA~0.5A			120	mV
		I_{OUT}=5mA~200mA			60	mV
Line Regulation	ΔV_{OUT}	V_{IN}=14.5~30V			120	mV
		V_{IN}=14.6~27V, I_{OUT}=0.5A			120	mV
Quiescent Current	I_Q	I_{OUT}=0.5A			8	mA
Quiescent Current Change	ΔI_Q	V_{IN} =14.5~30V			1	mA
		I_{OUT}=5mA~0.5A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤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} =15~25V, 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 =0.33μF, C_O=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	I_{OUT}=5mA~0.5A	14.4	15	15.6	V
		V_{IN} =17.5~30V, I_{OUT}=5mA~0.5A	14.25		15.75	V
Load Regulation	ΔV_{OUT}	I_{OUT}=5mA~0.5A			150	mV
		I_{OUT}=5mA~200mA			75	mV
Line Regulation	ΔV_{OUT}	V_{IN}=18.5~30V			150	mV
		V_{IN}=17.5~30V, I_{OUT}=0.5A			150	mV
Quiescent Current	I_Q	I_{OUT}=0.5A			8	mA
Quiescent Current Change	ΔI_Q	V_{IN}=17.5~30V			1	mA
		I_{OUT}=5mA~0.5A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤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}=18.5~28.5V, 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~0.5A	17.28	18	18.72	V
		V_{IN}=21~33V,I_{OUT}=5mA~0.5A	17.1		18.9	V
Load Regulation	ΔV_{OUT}	I_{OUT}=5mA~0.5A			180	mV
		I_{OUT}=5mA~200mA			90	mV
Line Regulation	ΔV_{OUT}	V_{IN}=21~33V			180	mV
		V_{IN}=21~33V, I_{OUT} =0.5A			180	mV
Quiescent Current	I_Q	I_{OUT}=0.5A			8	mA
Quiescent Current Change	ΔI_Q	V_{IN}=21.5~33V			1	mA
		I_{OUT}=5mA~0.5A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤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} =22~32V,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)

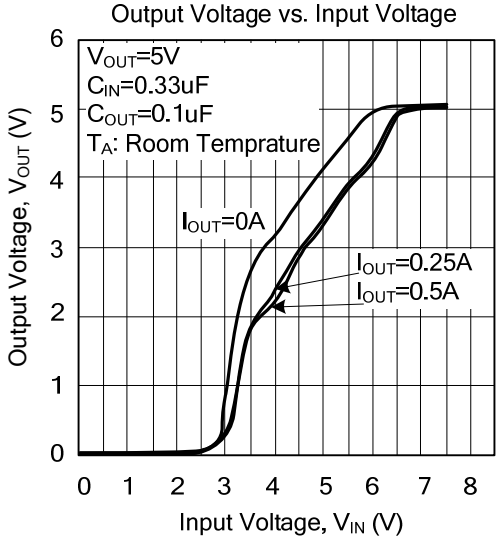
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	I_{OUT}=5mA~0.5A	19.20	20.0	20.80	V
		V_{IN} =23~35V, I_{OUT}=5mA~0.5A	19.00		21.00	V
Load Regulation	ΔV_{OUT}	I_{OUT}=5mA~0.5A			200	mV
		I_{OUT}=5mA~200mA			100	mV
Line Regulation	ΔV_{OUT}	V_{IN}=23~35V			200	mV
		V_{IN}=23~35V, I_{OUT}=0.5A			200	mV
Quiescent Current	I_Q	I_{OUT}≤0.5A			8	mA
Quiescent Current Change	ΔI_Q	V_{IN}=23.5~35V			1	mA
		I_{OUT}=5mA~0.5A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		130		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	I_{OUT}=5mA		-2.6		mV/°C
Ripple Rejection	RR	V_{IN} =24~34V,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)

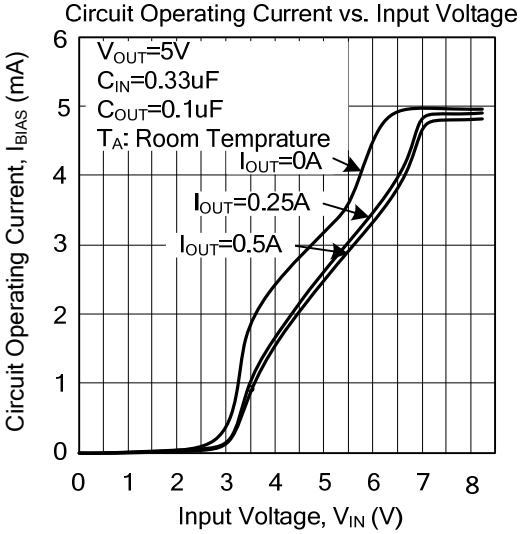
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	I_{OUT}=5mA~0.5A	23.04	24	24.96	V
		V_{IN}=27~38V, I_{OUT}=5mA~0.5A	22.8		25.2	V
Load Regulation	ΔV_{OUT}	I_{OUT}=5mA~0.5A			240	mV
		I_{OUT}=5mA~200mA			120	mV
Line Regulation	ΔV_{OUT}	V_{IN}=27~38V			240	mV
		V_{IN}=27~38V, I_{OUT}=0.5A			240	mV
Quiescent Current	I_Q	I_{OUT}=0.5A			8	mA
Quiescent Current Change	ΔI_Q	V_{IN}=28~38V			1	mA
		I_{OUT}=5mA~0.5A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		170		μV
Temperature coefficient of V_{OUT}	$\Delta V_{OUT}/\Delta T$	I_{OUT}=5mA		-2.8		mV/°C
Ripple Rejection	RR	V_{IN} =28~38V, 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

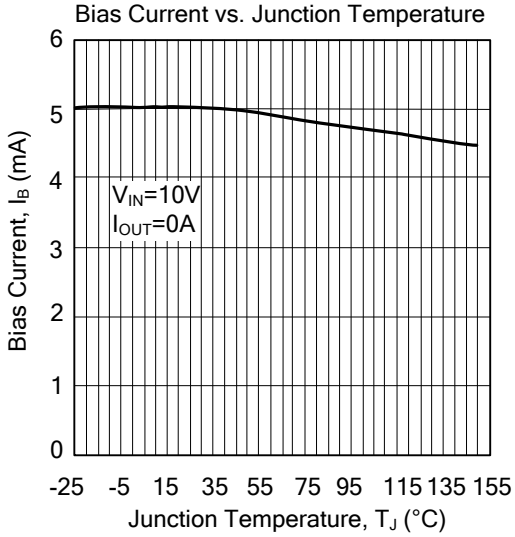
Output Voltage vs. Input Voltage



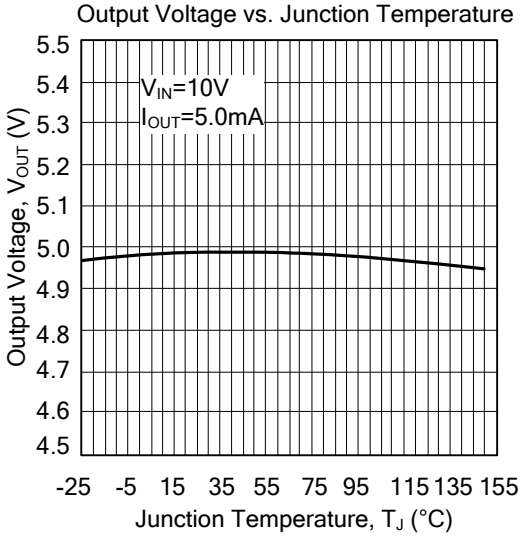
Circuit Operating Current vs. Input Voltage



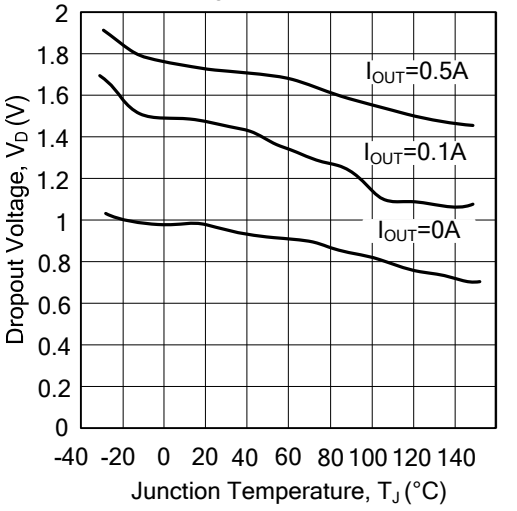
Bias Current vs. Junction Temperature



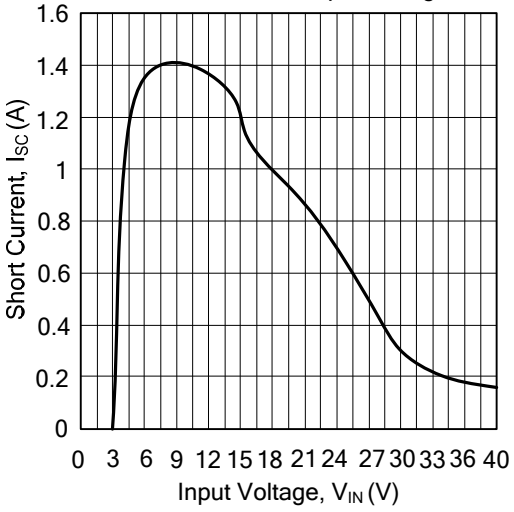
Output Voltage vs. Junction Temperature



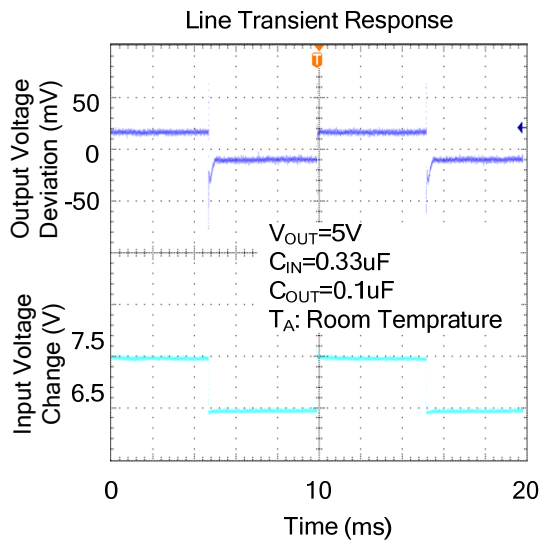
Dropout Voltage vs. Junction Temperature

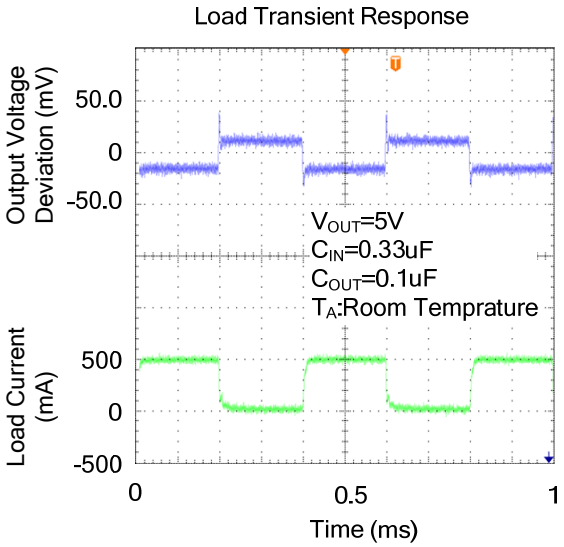


Short Current vs. Input Voltage



■ TYPICAL CHARACTERISTICS (Cont.)





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