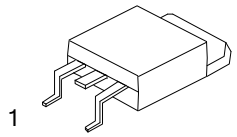
3-TERMINAL 1.5A POSITIVE VOLTAGE REGULATOR



TO-263

■ DESCRIPTION

The UTC **78TXXAA** family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications requiring supply current up to 1.5 A.

■ FEATURES

* Output current up to 1.5A
* Fixed output voltage of 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V and 24V available
* Thermal overload shutdown protection
* Short circuit current limiting
* Output transistor SOA protection

■ ORDERING INFORMATION

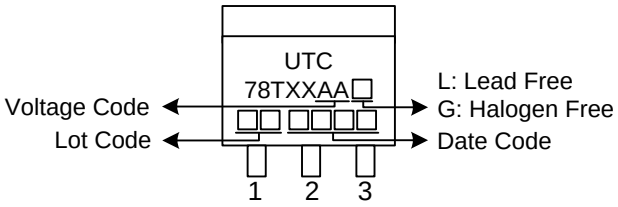
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
78TXXAAL-TQ2-T	78TXXAAG-TQ2-T	TO-263	I	G	O	Tube
78TXXAAL-TQ2-R	78TXXAAG-TQ2-R	TO-263	I	G	O	Tape Reel

Note: Pin Assignment: O: Output G: GND I: Input

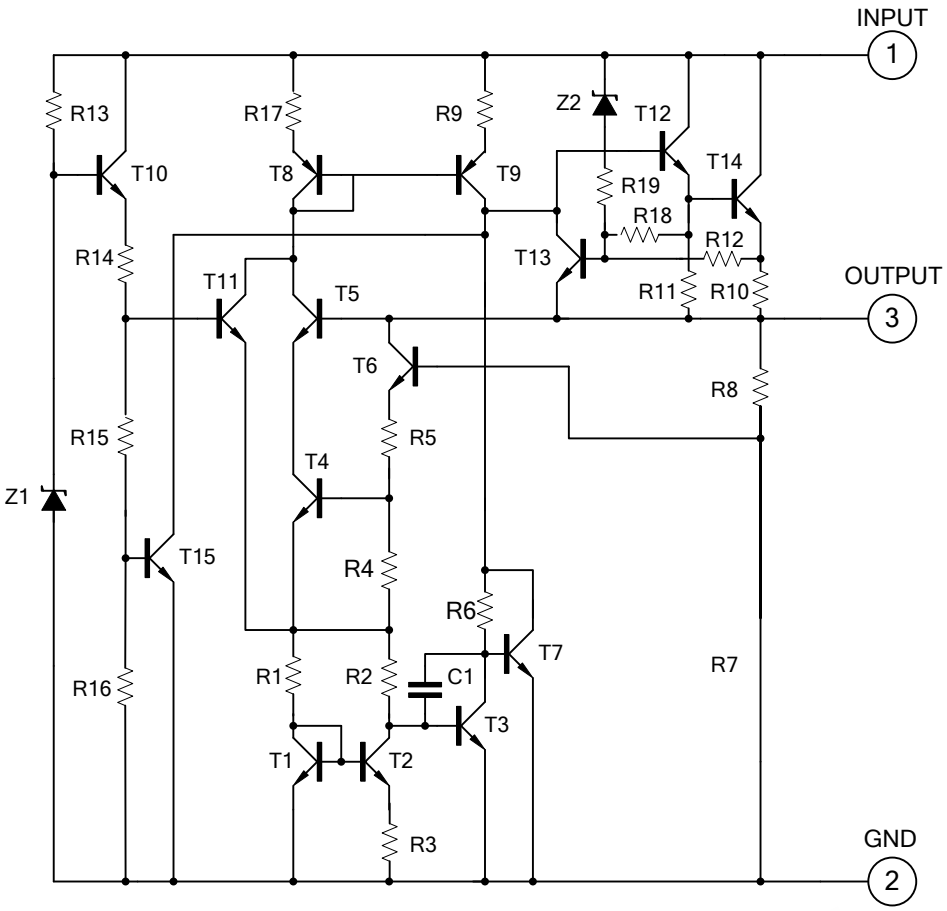
78TXXAAG-TQ2-T

(1)Packing Type	(1) T: Tube, R: Tape Reel
(2)Package Type	(2) TQ2: TO-263
(3)Green Package	(3) G: Halogen Free and Lead Free, L: Lead Free
(4)Output Voltage Code	(4) XX: refer to Marking Information

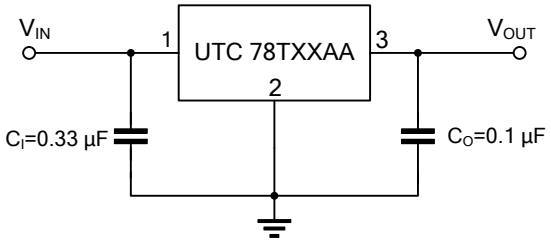
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
TO-263	05: 5.0 V 06: 6.0 V 07: 7.0 V 08: 8.0 V 09: 9.0 V 10: 1 0 V 12: 1 2 V 15: 1 5 V 18: 1 8 V 24: 2 4 V	

■ BLOCK DIAGRAM



■ APPLICATION CIRCUIT



Note 1: To specify an output voltage, substitute voltage value for "XX".
2: 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	RATING	UNIT
Input voltage	V_{OUT}=5~18V	V_{IN}	35	V
	V_{OUT}=24V		40	V
Output Current		I_{OUT}	1.5	A
Power Dissipation		P_D	Internally Limited	W
Operating Junction Temperature		T_{OPR}	-40 ~ +150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Ambient	θ_{JA}	65	°C/W
Junction to Case	θ_{JC}	5	°C/W

■ ELECTRICAL CHARACTERISTICS

(I_{OUT}=0.5A, T_J= 0°C~125°C, C_I =0.33μF, C_O=0.1μF, unless otherwise specified)(Note 1)

For UTC 78T05AA (V_{IN} =10V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	4.80	5.0	5.20	V
		V_{IN} =7.5V ~ 20V, I_{OUT}=5mA ~ 1.0A,P_D≤15W	4.75		5.25	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C,I_{OUT}=5mA ~ 1.5A			100	mV
		T_J =25°C,I_{OUT}=0.25A ~ 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =7V ~ 25V, T_J =25°C			50	mV
		V_{IN} =7.5V ~ 20V, T_J =25°C, I_{OUT}=1.0A			50	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =7.5V ~ 20V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		40		μV
Temperature Coefficient of Vo	ΔVo/ΔT	I_{OUT}=5mA		-0.6		mV/°C
Ripple Rejection	RR	V_{IN} =8V ~ 18V,f=120Hz, T_J =25°C	62	80		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A
Short-Circuit Current	I_{SC}	V_{IN} =35V, T_J =25°C		250		mA
Short-Circuit Current	I_{SC}	V_{IN} =35V, T_J =25°C		250		mA

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC 78T06AA (V_{IN} =11V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	5.76	6.0	6.24	V
		V_{IN} =8.5V ~ 21V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	5.70		6.30	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C,I_{OUT}=5mA ~ 1.5A			100	mV
		T_J =25°C,I_{OUT}=0.25A~ 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =8V ~ 25V, T_J =25°C			60	mV
		V_{IN} =8.5V ~ 21V, T_J =25°C,I_{OUT}=1.0A			60	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =8.5V ~ 21V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		45		μV
Temperature Coefficient of Vo	ΔVo/ΔT	I_{OUT}=5mA		-0.7		mV/°C
Ripple Rejection	RR	V_{IN} =9V ~ 19V,f=120Hz, T_J =25°C	59	75		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

For UTC 78T07AA (V_{IN} =13V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA - 1.0A	6.72	7.0	7.28	V
		V_{IN} =9.5V ~ 22V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	6.65		7.35	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C,I_{OUT}=5mA ~ 1.5A			100	mV
		T_J =25°C,I_{OUT}=0.25A ~ 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =9V ~ 25V, T_J =25°C			70	mV
		V_{IN} =9.5V ~ 22V, T_J =25°C,I_{OUT}=1.0A			70	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =9.5V ~ 22V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		50		μV
Temperature Coefficient of Vo	ΔVo/ΔT	I_{OUT}=5mA		-0.8		mV/°C
Ripple Rejection	RR	V_{IN} =10V ~ 20V,f=120Hz, T_J =25°C	59	75		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.7		A
Short-Circuit Current	I_{SC}	V_{IN} =35V, T_J =25°C		250		mA

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC 78T08AA (V_{IN} =14V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA~ 1.0A	7.68	8.0	8.32	V
		V_{IN} =10.5V ~ 23V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	7.60		8.40	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C,I_{OUT}=5mA ~ 1.5A			100	mV
		T_J =25°C,I_{OUT}=0.25A ~ 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =10.5V ~ 25V, T_J =25°C			80	mV
		V_{IN} =10.5V ~ 23V, T_J =25°C,I_{OUT}=1.0A			80	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =10.5V ~ 23V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Temperature Coefficient of Vo	ΔVo/ΔT	I_{OUT}=5mA		-0.9		mV/°C
Ripple Rejection	RR	V_{IN} =11.5V ~ 21.5V, f=120Hz, T_J =25°C	56	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A
Short-Circuit Current	I_{SC}	V_{IN} =35V, T_J =25°C		250		mA

For UTC 78T09AA (V_{IN} =15V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	8.64	9.0	9.36	V
		V_{IN} =11.5V ~ 24V, I_{OUT}=5mA ~ 1.0A,P_D≤15W	8.55		9.45	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C,I_{OUT}=5mA ~ 1.5A			100	mV
		T_J =25°C,I_{OUT}=0.25A ~ 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =11.5V ~ 25 V, T_J =25°C			90	mV
		V_{IN} =11.5V ~ 24V, T_J =25°C, I_{OUT}=1.0A			90	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =11.5V ~ 24V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Temperature Coefficient of Vo	ΔVo/ΔT	I_{OUT}=5mA		-1.1		mV/°C
Ripple Rejection	RR	V_{IN} =12.5V ~ 22.5V,f=120Hz, T_J =25°C	56	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A
Short-Circuit Current	I_{SC}	V_{IN} =35V, T_J =25°C		250		mA

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC 78T10AA (V_{IN} =16V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	9.60	10.0	10.40	V
		V_{IN} =12.5V ~ 25V, I_{OUT}=5mA ~ 1.0A,P_D≤15W	9.50		10.50	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C,I_{OUT}=5mA - 1.5A			100	mV
		T_J =25°C,I_{OUT}=0.25A - 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =13V ~ 25V, T_J =25°C			100	mV
		V_{IN} =13V ~ 25V, T_J =25°C,I_{OUT}=1.0A			100	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =12.6V ~ 25V			1.0	mA
		I_{OUT}=5mA - 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Temperature coefficient of Vo	ΔVo/ΔT	I_{OUT}=5mA		-1.1		mV/°C
Ripple Rejection	RR	V_{IN} =13V - 23V,f=120Hz, T_J =25°C	56	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A
Short-Circuit Current	I_{SC}	V_{IN} =35V, T_J =25°C		250		mA

For UTC 78T12AA (V_{IN} =19V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	11.52	12.0	12.48	V
		V_{IN} =14.5V ~ 27V, I_{OUT}=5mA ~ 1.0A,P_D≤15W	11.40		12.60	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C,I_{OUT}=5mA ~ 1.5A			100	mV
		T_J =25°C,I_{OUT}=0.25A ~ 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =14.5V ~ 30V, T_J =25°C			120	mV
		V_{IN} =14.6V ~ 27V, T_J =25°C, I_{OUT}=1.0A			120	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =14.5V ~ 30V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		75		μV
Temperature Coefficient of Vo	ΔVo/ΔT	I_{OUT}=5mA		-1.5		mV/°C
Ripple Rejection	RR	V_{IN} =15V - 25V,f=120Hz, T_J =25°C	55	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A
Short-Circuit Current	I_{SC}	V_{IN} =35V, T_J =25°C		250		mA

■ ELECTRICAL CHARACTERISTICS (Cont.)

For UTC 78T15AA (V_{IN} =23V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	14.40	15.0	15.60	V
		V_{IN} =17.5V ~ 30V, I_{OUT}=5mA ~ 1.0A,P_D≤15W	14.25		15.75	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C,I_{OUT}=5mA ~ 1.5A			100	mV
		T_J =25°C,I_{OUT}=0.25A ~ 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =18.5V ~ 30V, T_J =25°C			150	mV
		V_{IN} =17.7V ~ 30V, T_J =25°C, I_{OUT} =1.0A			150	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =17.5V ~ 30V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		90		μV
Temperature Coefficient of Vo	ΔVo/ΔT	I_{OUT}=5mA		-1.8		mV/°C
Ripple Rejection	RR	V_{IN} =18.5V ~ 28.5V,f=120Hz, T_J =25°C	54	70		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A
Short-Circuit Current	I_{SC}	V_{IN} =35V, T_J =25°C		250		mA

For UTC 78T18AA (V_{IN} =27V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	17.28	18.0	18.72	V
		V_{IN} =21V ~ 33V, I_{OUT}=5mA ~ 1.0A, P_D≤15W	17.10		18.90	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C,I_{OUT}=5mA ~ 1.5A			100	mV
		T_J =25°C,I_{OUT}=0.25A ~ 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =21V ~ 33V, T_J =25°C			180	mV
		V_{IN} =21V ~ 33V, T_J =25°C, I_{OUT} =1.0A			180	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =21.5V ~ 33V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		110		μV
Temperature Coefficient of Vo	ΔVo/ΔT	I_{OUT}=5mA		-2.2		mV/°C
Ripple Rejection	RR	V_{IN} =22V ~ 32V,f=120Hz, T_J =25°C	53	69		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A
Short-Circuit Current	I_{SC}	V_{IN} =35V, T_J =25°C		250		mA

■ ELECTRICAL CHARACTERISTICS (Cont.)

For UTC 78T24AA (V_{IN} =33V)

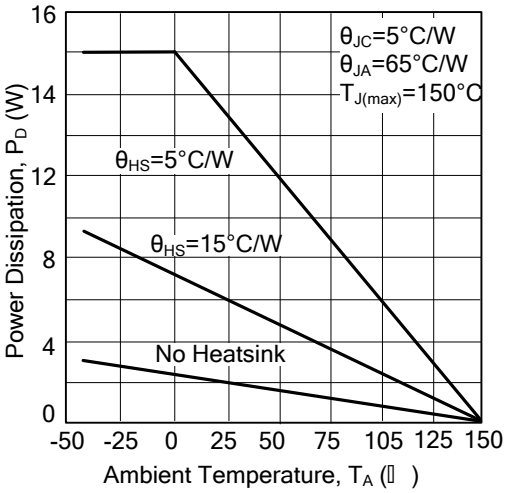
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	23.04	24.0	24.96	V
		V_{IN} =27V ~ 38V, I_{OUT}=5mA ~ 1.0A, ,P_D≤15W	22.80		25.20	V
Dropout Voltage	V_D	T_J =25°C		2.0		V
Load Regulation	ΔV_{OUT}	T_J =25°C,I_{OUT}=5mA ~ 1.5A			100	mV
		T_J =25°C,I_{OUT}=0.25A ~ 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =27V ~ 38V, T_J =25°C			240	mV
		V_{IN} =27V ~ 38V, T_J =25°C,I_{OUT}=1.0A			240	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =28V ~ 38V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		170		μV
Temperature Coefficient of Vo	ΔVo/ΔT	I_{OUT}=5mA		-2.8		mV/°C
Ripple Rejection	RR	V_{IN} =28V ~ 38V, f=120Hz, T_J =25°C	50	66		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A
Short-Circuit Current	I_{SC}	V_{IN} =35V, T_J =25°C		250		mA

Note 1: 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 above represents pulse test conditions with junction temperatures specified at the initiation of test.

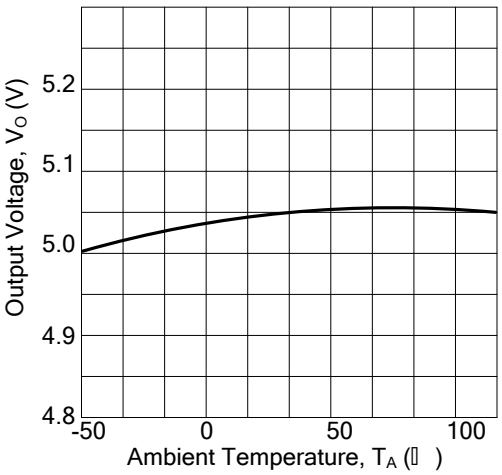
Note 2: Power dissipation<0.5W

■ TYPICAL CHARACTERISTICS

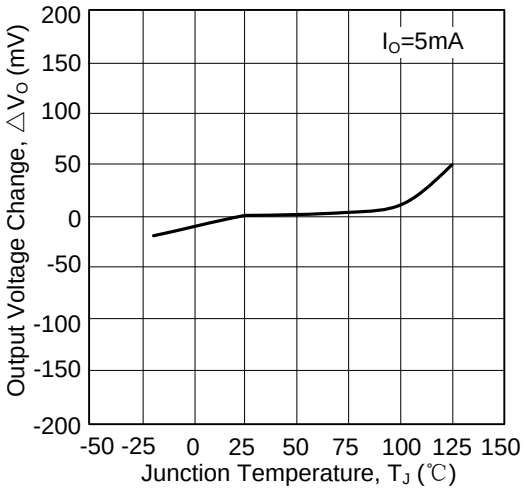
Ambient Temperature vs. Power Dissipation



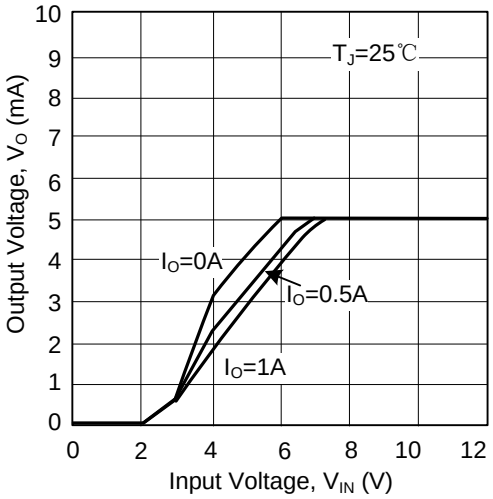
Output Voltage vs. Ambient Temperature



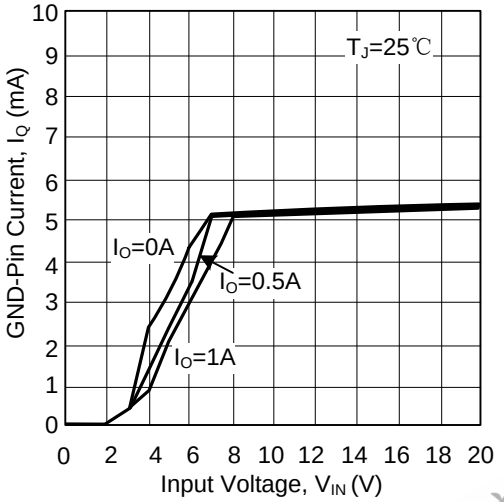
Output Voltage Change vs. Junction Temperature



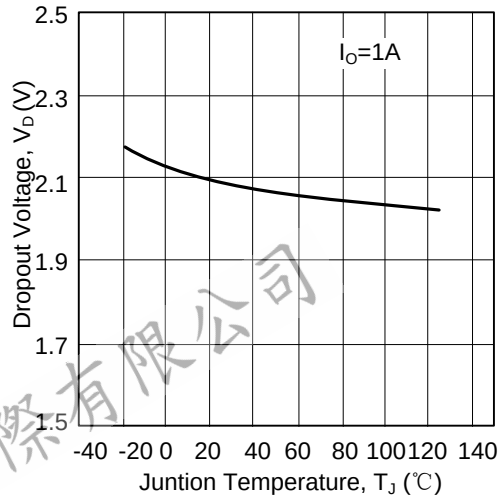
Output Voltage vs. Input Voltage



GND Current vs. Input Voltage

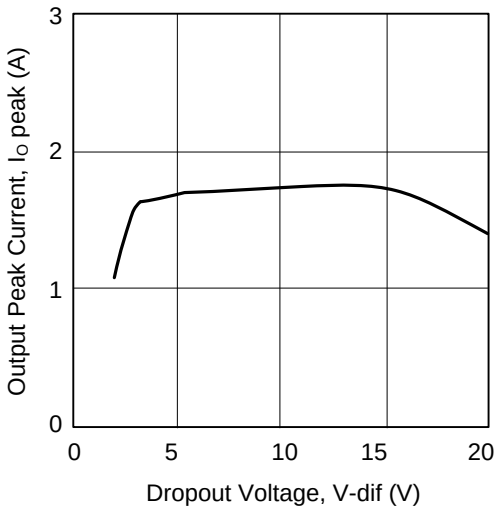


Dropout Voltage vs. Juntion Temperature

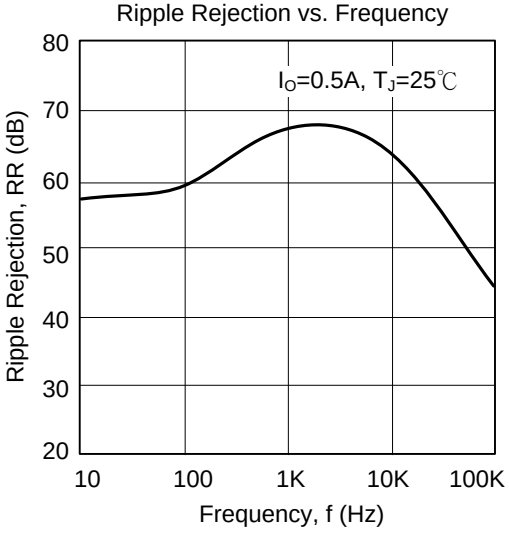


■ TYPICAL CHARACTERISTICS (Cont.)

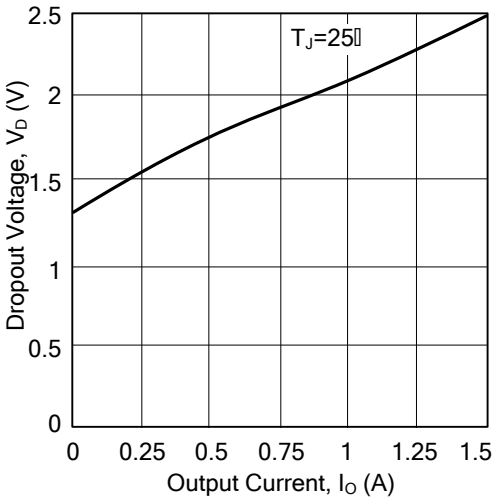
Output Peak Current vs. Dropout Voltage



Ripple Rejection vs. Frequency



Dropout Voltage vs. Output Current



Output Voltage vs. Output Current