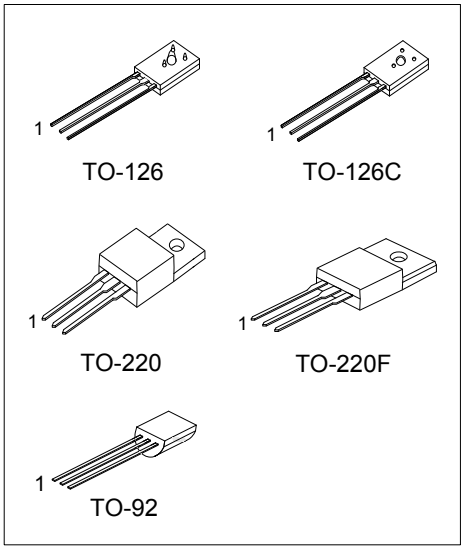
78MXX

LINEAR INTEGRATED CIRCUIT

3-TERMINAL 0.5A POSITIVE VOLTAGE REGULATOR



■ DESCRIPTION

The UTC **78MXX** family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications that required supply current up to 0.5A.

■ FEATURES

* Output Current up to 0.5A
* Fixed Output Voltage of 5V, 6V, 7V, 8V, 9V, 12V, 15V, 18V and 20V Available
* Thermal Overload Shutdown Protection
* Short Circuit Current Limiting
* Output Transistor SOA Protection

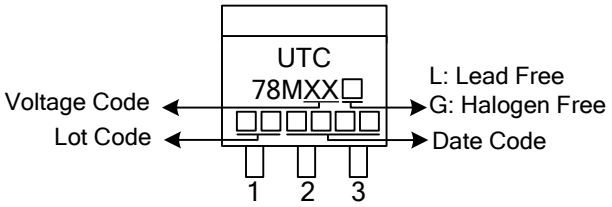
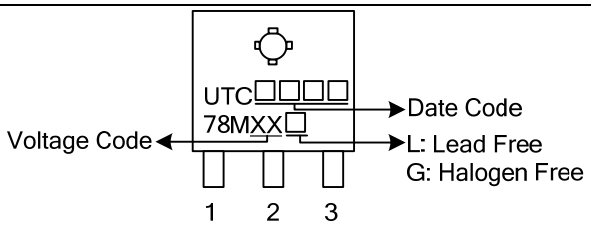
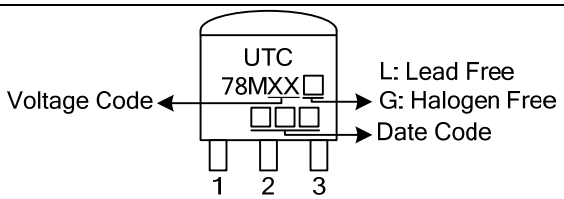
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
78MXXL-TA3-T	78MXXG-TA3-T	TO-220	I	G	O	Tube
78MXXL-TF3-T	78MXXG-TF3-T	TO-220F	I	G	O	Tube
78MXXL-T60-K	78MXXG-T60-K	TO-126	I	G	O	Bulk
78MXXL-T6C-K	78MXXG-T6C-K	TO-126C	I	G	O	Bulk
78MXXL-T92-B	78MXXG-T92-B	TO-92	O	G	I	Tape Box
78MXXL-T92-K	78MXXG-T92-K	TO-92	O	G	I	Bulk

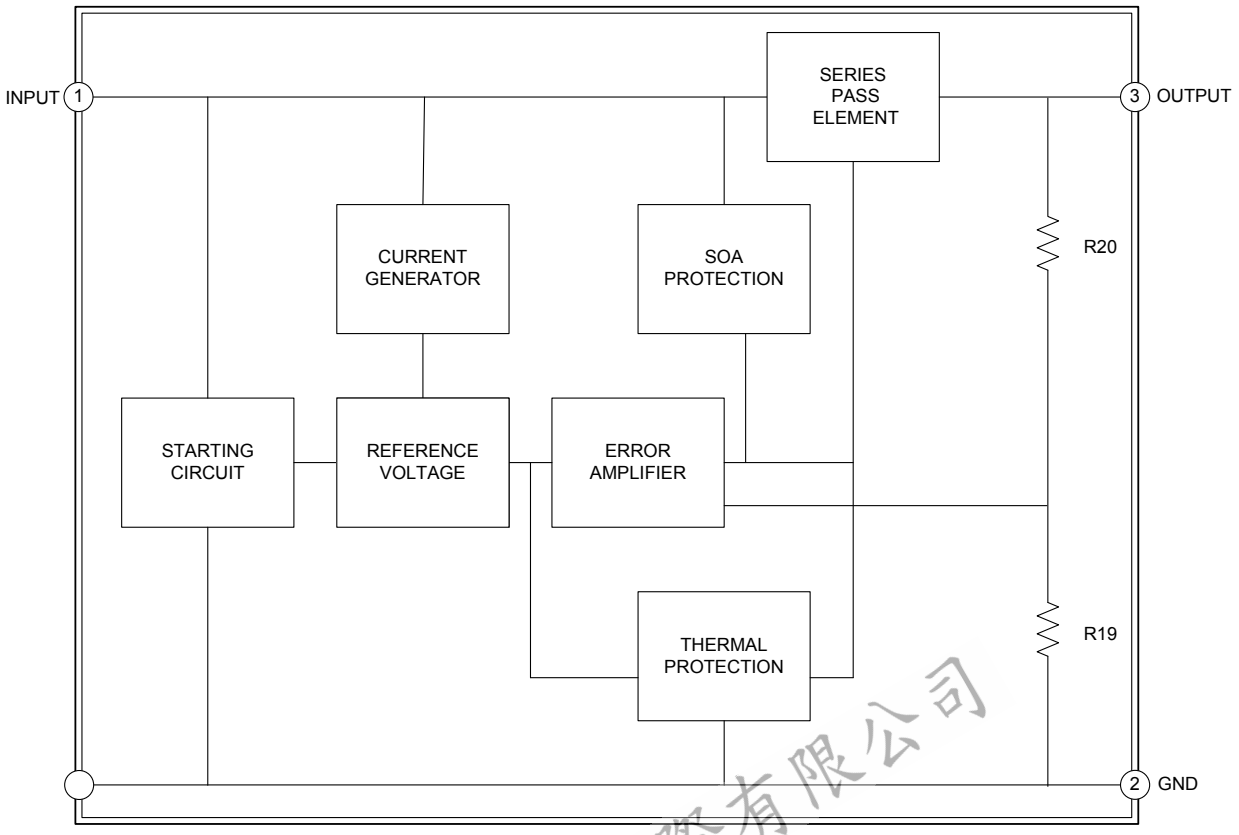
78MXXL-TA3-T
(1)Packing Type
(2)Package Type
(3)Green Package
(4)Output Voltage

(1) T: Tube, B: Tape Box, K: Bulk
(2) TA3: TO-220, TF3: TO-220F, T60: TO-126
T6C: TO-126C, T92: TO-92
(3) L: Lead Free, G: Halogen Free and Lead Free
(4) xx: refer to Marking Information

■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
TO-220 TO-220F	05: 5V 06: 6V 07: 7V 08: 8V 09: 9V 12: 12V 15: 15V 18: 18V 20: 20V	
TO-126 TO-126C		
TO-92		

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

(Operating temperature range applies unless otherwise specified)

PARAMETER	SYMBOL	RATING	UNIT
Input Voltage	V_{IN}	35	V
Output Current	I_{OUT}	0.5	A
Power Dissipation	P_D	Internally Limited	W
Operating Junction Temperature	T_{OPR}	-40 ~ +85	°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.

■ ELECTRICAL CHARACTERISTICS

FOR UTC78M05

(Refer to the test circuits, T_J=25°C, I_{OUT}=350mA, V_{IN}=10V, unless otherwise specified, C_I=0.33μF, C_O=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J=25°C	4.80	5.0	5.20	V
		I_{OUT}=5mA ~ 350mA, V_{IN}=7~ 20V	4.75		5.25	V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA~0.5A			100	mV
		T_J =25°C, I_{OUT}=5mA~200mA			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =7 ~ 25V, T_J =25°C, I_{OUT}=200mA			100	mV
		V_{IN} =8 ~ 25V, T_J =25°C, I_{OUT}=200mA			50	mV
Quiescent Current	I_Q	T_J =25°C		4.0	6.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =8 ~ 25V, I_{OUT}=200mA			0.8	mA
		I_{OUT}=5mA~350mA			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100KHz		40		μV
Ripple Rejection	RR	V_{IN} =8 ~ 18V, f=120Hz, I_{OUT}=300mA	62			dB
Peak Output Current	I_{PEAK}	T_J =25°C		700		mA
Short-Circuit Current	I_{SC}	V_{IN}=V_{OUT}+19V, T_J =25°C		300		mA
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=500mA		2.0		V

FOR UTC78M06

(Refer to the test circuits, T_J=25°C, I_{OUT}=350mA,V_{IN}=11V, unless otherwise specified, C_I=0.33μF, C_O=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5~350mA	5.76	6.0	6.24	V
		V_{IN} =8 ~ 21V, I_{OUT}=5mA~350mA	5.70		6.30	V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA~0.5A			120	mV
		T_J =25°C, I_{OUT}=5mA~200mA			60	mV
Line regulation	ΔV_{OUT}	V_{IN}=8V ~ 25V, T_J =25°C, I_{OUT}=200mA			100	mV
		V_{IN}=9V ~ 25V, T_J =25°C, I_{OUT}=200mA			50	mV
Quiescent Current	I_Q	T_J =25°C		4.0	6	mA
Quiescent Current Change	ΔI_Q	I_{OUT}=5mA ~ 350mA			0.8	mA
		V_{IN}=9V~ 25V, I_{OUT}=200mA			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		45		μV
Ripple Rejection	RR	V_{IN}=9V ~ 19V, f=120Hz, T_J =25°C I_{OUT}=300mA	59			dB
Peak Output Current	I_{PEAK}	T_J =25°C		700		mA
Short-Circuit Current	I_{SC}	V_{IN}=V_{OUT}+19V, T_J =25°C		300		mA
Dropout Voltage	V_D	T_J =25°C		2.0		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

FOR UTC78M07

(Refer to the test circuits, T_J=25°C, I_{OUT}=350mA, V_{IN}=13V, unless otherwise specified, C_I=0.33μF, C_O=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C	6.72	7.0	7.28	V
		V_{IN} =9.5V ~ 22V, I_{OUT}=5mA~350mA	6.65		7.35	V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA~0.5A			140	mV
		T_J =25°C, I_{OUT}=5mA~200mA			70	mV
Line regulation	ΔV_{OUT}	V_{IN} =9.5V ~ 22V, T_J =25°C, I_{OUT}=200mA			100	mV
		V_{IN} =9.5V ~ 22V, T_J =25°C, I_{OUT}=200mA			50	mV
Quiescent Current	I_Q	T_J =25°C		4.0	6	mA
Quiescent Current Change	ΔI_Q	V_{IN} =10.5V ~ 22V, I_{OUT}=200mA			0.8	mA
		I_{OUT}=5mA~ 350mA			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100KHz		49		μV
Ripple Rejection	RR	V_{IN} =11.5V ~ 21.5V, f=120Hz, I_{OUT}=300mA	57			dB
Peak Output Current	I_{PEAK}	T_J =25°C		700		mA
Short-Circuit Current	I_{SC}	V_{IN}=V_{OUT}+19V, T_J =25°C		300		mA
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=500mA		2.0		V

FOR UTC78M08

(Refer to the test circuits, T_J=25°C, I_{OUT}=350mA, V_{IN}=14V, unless otherwise specified, C_I=0.33μF, C_O=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C	7.68	8.0	8.32	V
		V_{IN} =10.5V ~ 23V, I_{OUT}=5mA~350mA	7.60		8.40	V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA~0.5A			160	mV
		T_J =25°C, I_{OUT}=5mA~200mA			80	mV
Line regulation	ΔV_{OUT}	V_{IN} =10.5V ~ 25V, T_J =25°C, I_{OUT}=200mA			100	mV
		V_{IN} =11V ~ 25V, T_J =25°C, I_{OUT}=200mA			50	mV
Quiescent Current	I_Q	T_J =25°C		4.0	6	mA
Quiescent Current Change	ΔI_Q	V_{IN} =10.5V ~ 25V, I_{OUT}=200mA			0.8	mA
		I_{OUT}=5mA~ 350mA			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100KHz		52		μV
Ripple Rejection	RR	V_{IN} =11.5V ~ 21.5V, f=120Hz, I_{OUT}=300mA	56			dB
Peak Output Current	I_{PEAK}	T_J =25°C		700		mA
Short-Circuit Current	I_{SC}	V_{IN}=V_{OUT}+19V, T_J =25°C		300		mA
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=500mA		2.0		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

FOR UTC78M09

(Refer to the test circuits, T_J=25°C, I_{OUT}=350mA, V_{IN}=17V, unless otherwise specified, C_I=0.33μF, C_O=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C	8.64	9	9.36	V
		V_{IN} =12.5V ~ 25V, I_{OUT}=5mA~350mA	8.55		9.45	V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA~0.5A			200	mV
		T_J =25°C, I_{OUT}=5mA~200mA			100	mV
Line regulation	ΔV_{OUT}	V_{IN} =12.5V~ 25 V, T_J =25°C, I_{OUT}=200mA			100	mV
		V_{IN}=13V~ 25V, T_J =25°C, I_{OUT}=200mA			50	mV
Quiescent Current	I_Q	T_J =25°C		4.1	6	mA
Quiescent Current Change	ΔI_Q	V_{IN} =12.5V ~ 25V, I_{OUT}=200mA			0.8	mA
		I_{OUT}=5mA~350mA			0.5	mA
Output Noise Voltage	eN	10Hz<=f<=100kHz		65		μV
Ripple Rejection	RR	V_{IN} =13V~ 23V, f=120Hz, I_{OUT}=300mA	55			dB
Peak Output Current	I_{PEAK}	T_J =25°C		700		mA
Short-Circuit Current	I_{SC}	V_{IN}=V_{OUT}+19V, T_J =25°C		300		mA
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=500mA		2.0		V

FOR UTC78M12

(Refer to the test circuits, T_J=25°C, I_{OUT}=350mA, V_{IN}=19V, unless otherwise specified, C_I=0.33μF, C_O=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C	11.52	12.0	12.48	V
		V_{IN} =14.5V to 27V, I_{OUT}=5mA~350mA	11.40		12.60	V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA~0.5A			240	mV
		T_J =25°C, I_{OUT}=5mA~2A			120	mV
Line regulation	ΔV_{OUT}	V_{IN} =14.5V to 30V, T_J =25°C, I_{OUT}=200mA			100	mV
		V_{IN} =16V to 30V, T_J =25°C, I_{OUT}=200mA			50	mV
Quiescent Current	I_Q	T_J =25°C		4.1	6.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =14.5V to 30V, I_{OUT}=200mA			0.8	mA
		I_{OUT}=5mA~350mA			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		75		μV
Ripple Rejection	RR	V_{IN} =15V to 25V,f=120Hz, I_{OUT}=300mA	55			dB
Peak Output Current	I_{PEAK}	T_J =25°C		700		mA
Short-Circuit Current	I_{SC}	V_{IN}=V_{OUT}+19V, T_J =25°C		300		mA
Dropout Voltage	V_D	T_J =25°C,I_{OUT}=500mA		2.0		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

FOR UTC78M15

(Refer to the test circuits, T_J=25°C, I_{OUT}=350mA,V_{IN}=23V, unless otherwise specified, C_I=0.33μF, C_O=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C	14.40	15.0	15.60	V
		V_{IN} =17.5V ~ 30V, I_{OUT}=5mA~350mA	14.25		15.75	V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA~0.5A			300	mV
		T_J =25°C, I_{OUT}=5mA~200mA			150	mV
Line regulation	ΔV_{OUT}	V_{IN} =17.5V ~ 30V, T_J =25°C, I_{OUT} =200mA			100	mV
		V_{IN} =20V ~ 30V, T_J =25°C,I_{OUT} =200mA			50	mV
Quiescent Current	I_Q	T_J=25°C		4.1	6.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =17.5V ~ 30V, I_{OUT}=200mA			0.8	mA
		I_{OUT}=5mA~350mA			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100KHz		90		μV
Ripple Rejection	RR	V_{IN} =18.5V ~ 28.5V, f=120Hz, I_{OUT}=300mA	54			dB
Peak Output Current	I_{PEAK}	T_J =25°C		700		mA
Short-Circuit Current	I_{SC}	V_{IN}=V_{OUT}+19V, T_J =25°C		300		mA
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=500mA		2.0		V

FOR 78M18

(Refer to the test circuits, T_J=25°C, I_{OUT}=350mA,V_{IN}=26V,unless otherwise specified, C_I=0.33μF, C_O=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C	17.28	18.0	18.72	V
		V_{IN} =20.5V ~ 33V I_{OUT}=5mA~350mA	17.10		18.90	V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA~0.5A			360	mV
		T_J =25°C, I_{OUT}=5mA~200mA			180	mV
Line regulation	ΔV_{OUT}	V_{IN}=21V ~ 33V T_J =25°C, I_{OUT} =200mA			100	mV
		V_{IN} =24V ~ 33V, T_J =25°C, I_{OUT} =200mA			50	mV
Quiescent Current	I_Q	T_J =25°C		4.2	6	mA
Quiescent Current Change	ΔI_Q	V_{IN} =21V ~ 33V, I_{OUT} =200mA			0.8	mA
		I_{OUT}=5mA~350mA			0.5	mA
Output Noise Voltage	eN	10HzM≤f≤100KHz		100		μV
Ripple Rejection	RR	V_{IN}=22V ~ 32V, f=120Hz I_{OUT} =300mA	53			dB
Peak Output Current	I_{PEAK}	T_J =25°C		700		mA
Short-Circuit Current	I_{SC}	V_{IN}=35V, T_J =25°C		300		mA
Dropout Voltage	V_D	T_J =25°C		2.0		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

FOR 78M20

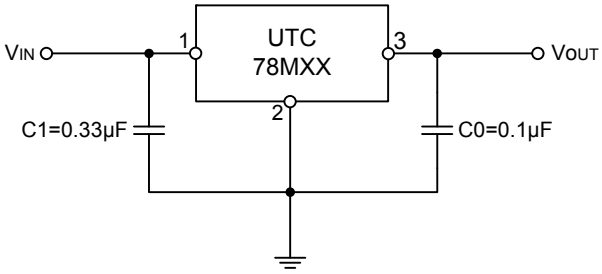
(Refer to the test circuits, T_J=25°C, I_{OUT}=350mA,V_{IN}=29V,unless otherwise specified, C_I=0.33μF, C_O=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C	19.20	20.0	20.80	V
		V_{IN} =23V ~ 35V I_{OUT}=5mA~350mA	19		21	V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA~0.5A			400	mV
		T_J =25°C, I_{OUT}=5mA~200mA			200	mV
Line regulation	ΔV_{OUT}	V_{IN}=23V ~ 35V T_J =25°C, I_{OUT} =200mA			100	mV
		V_{IN} =24V ~ 35V, T_J =25°C, I_{OUT} =200mA			50	mV
Quiescent Current	I_Q	T_J =25°C		4	6	mA
Quiescent Current Change	ΔI_Q	V_{IN} =23.5V ~ 35V, I_{OUT} =200mA			0.8	mA
		I_{OUT}=5mA~350mA			0.5	mA
Output Noise Voltage	eN	10HzM≤f≤100KHz		105		μV
Ripple Rejection	RR	V_{IN}=24V ~ 34V, f=120Hz I_{OUT} =300mA	52			dB
Peak Output Current	I_{PEAK}	T_J =25°C		700		mA
Short-Circuit Current	I_{SC}	V_{IN}=35V, T_J =25°C		300		mA
Dropout Voltage	V_D	T_J =25°C		2.0		V

Notes: 1. The Maximum steady state usable output current is 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.

2. Power dissipation<0.5W

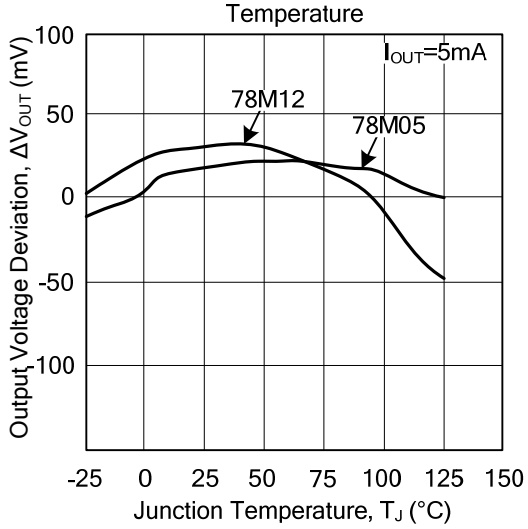
■ APPLICATION CIRCUIT



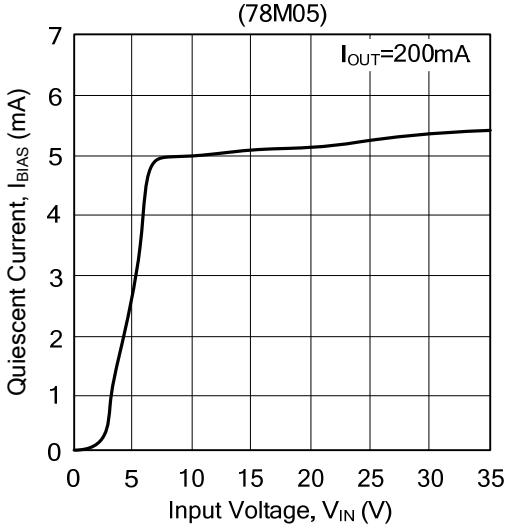
Notes: 1. To specify an output voltage, substitute voltage value for "MXX".
2. Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

■ TYPICAL CHARACTERISTICS

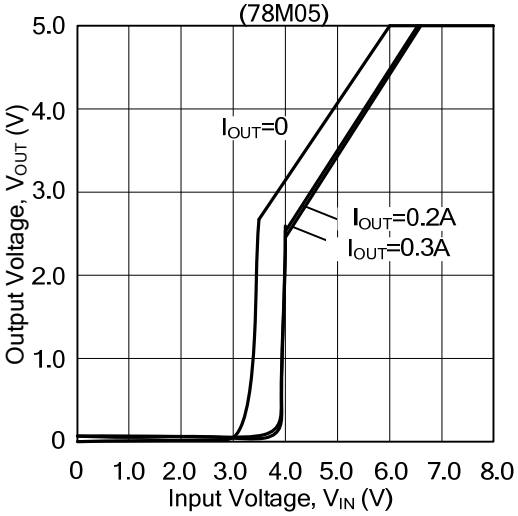
Output Voltage Deviation vs Junction Temperature



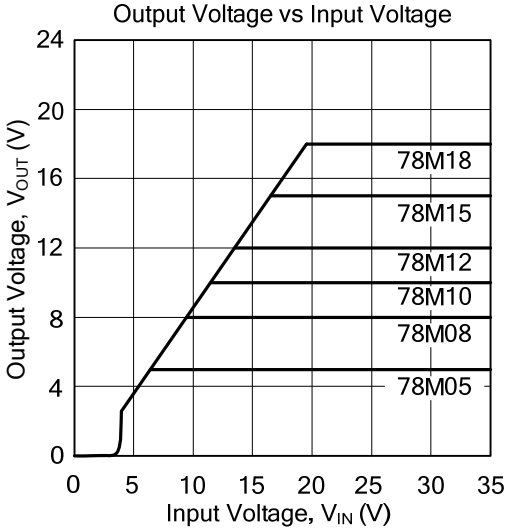
Quiescent Current vs Input Voltage (78M05)



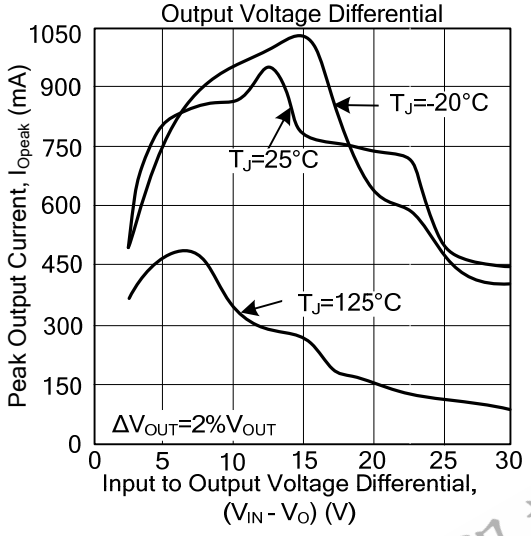
Output Voltage vs Input Voltage (78M05)



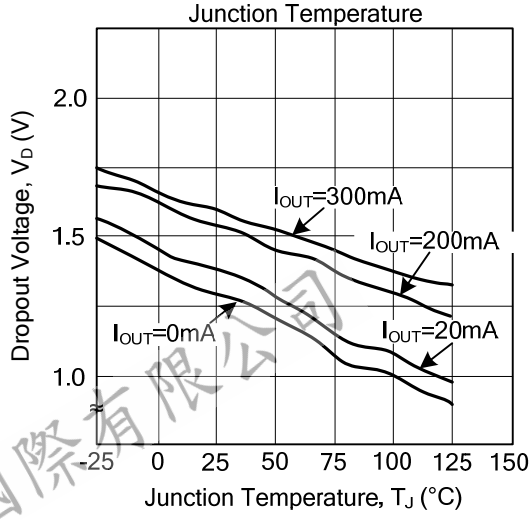
Output Voltage vs Input Voltage



Peak Output Current vs Input to Output Voltage Differential



Dropout Voltage vs Junction Temperature



■ TYPICAL CHARACTERISTICS(Cont.)