



## 78NXX

## LINEAR INTEGRATED CIRCUIT

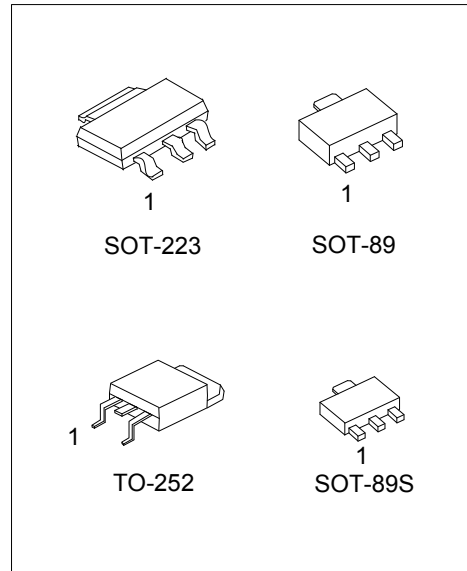
### 3-TERMINAL 300mA POSITIVE VOLTAGE REGULATOR

#### DESCRIPTION

The UTC **78NXX** family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications requiring supply current up to 300mA.

#### FEATURES

- \* Output Current up to 300mA
- \* Fixed Output Voltage of 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V, 24V
- \* Thermal Overload Shutdown Protection
- \* Short Circuit Current Limiting



#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
78NXXL-AA3-R	78NXXG-AA3-R	SOT-223	O	G	I	Tape Reel
78NXXL-AB3-R	78NXXG-AB3-R	SOT-89	O	G	I	Tape Reel
78NXXL-ABS-R	78NXXG-ABS-R	SOT-89S	O	G	I	Tape Reel
78NXXL-TN3-R	78NXXG-TN3-R	TO-252	I	G	O	Tape Reel

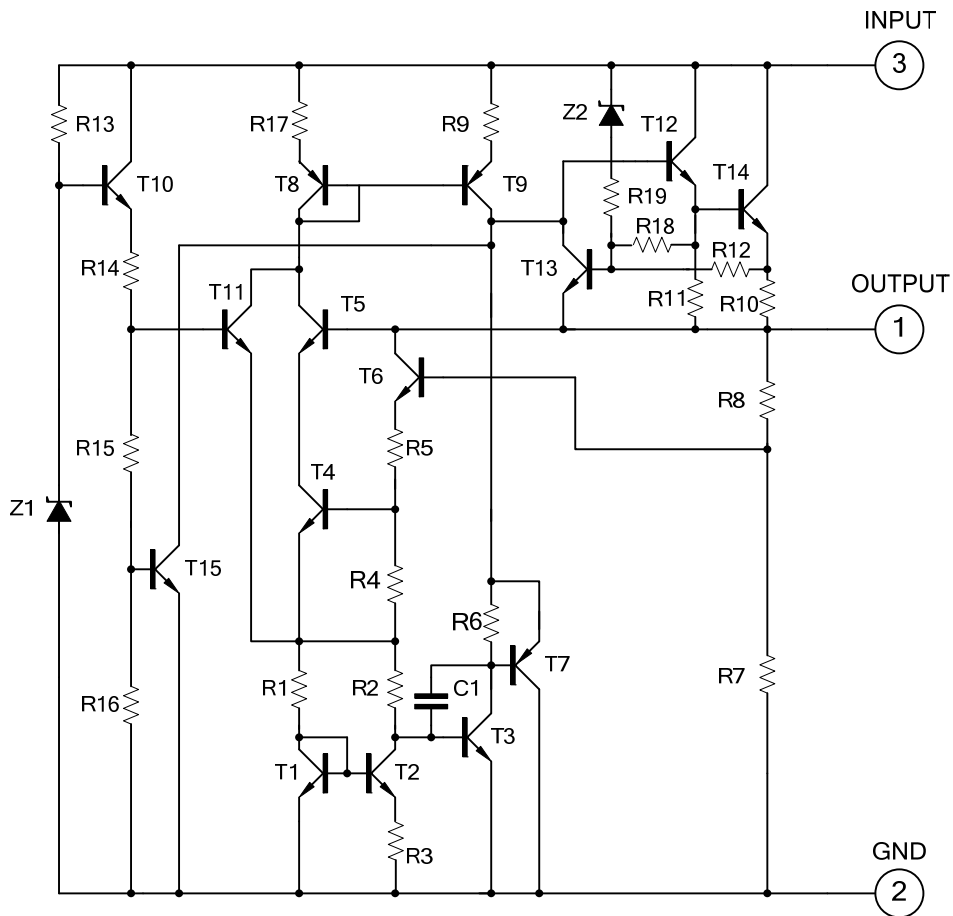
Notes: 1. XX: Output Voltage, refer to Marking Information  
 2. Pin Assignment: O: Output G: GND I: Input

<p>78NXXG-AA3-R</p> <p>(1) Packing Type        (2) Package Type        (3) Green Package        (4) Output Voltage Code</p>	<p>(1) R: Tape Reel        (2) AA3: SOT-223, AB3: SOT-89, ABS: SOT-89S        TN3: TO-252        (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-89 SOT-89S	05: 5.0V 06: 6.0V 08: 8.0V 09: 9.0V 10: 10V 12: 12V 15: 15V 18: 18V 24: 24V	<p>Date Code ← Voltage Code → L: Lead Free G: Halogen Free</p>
SOT-223		<p>Voltage Code ← L: Lead Free G: Halogen Free Date Code</p>
TO-252		<p>Voltage Code ← Lot Code → L: Lead Free G: Halogen Free Date Code</p>

### BLOCK CIRCUIT



■ ABSOLUTE MAXIMUM RATING (Operating temperature range applies, unless otherwise specified.)

PARAMETER		SYMBOL	RATINGS	UNIT
Input Voltage	$V_{OUT}=5\sim 9V$	$V_{IN}$	30	V
	$V_{OUT}=10\sim 18V$		35	V
Output Current		$I_{OUT}$	300	mA
Power Dissipation	SOT-89	$P_D$	550	mW
	SOT-89S			
	SOT-223		750	mW
	TO-252		1000	mW
Junction Temperature		$T_J$	+150	°C
Operating Temperature (Note 2)		$T_{OPR}$	-40 ~ +125	°C
Storage Temperature		$T_{STG}$	-55 ~ +150	°C

Notes: 1. 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.  
2. It is guarantee by design, not 100% be tested.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-89	$\theta_{JA}$	180	°C/W
	SOT-89S			
	SOT-223		133	°C/W
	TO-252		100	°C/W
Junction to Case	SOT-89	$\theta_{JC}$	50	°C/W
	SOT-89S			
	SOT-223		15	°C/W
	TO-252		12	°C/W

■ ELECTRICAL CHARACTERISTICS

(0°C <  $T_J$  < 125°C,  $C_1=0.33\mu F$ ,  $C_0=0.1\mu F$ , unless otherwise specified) (Note 1)

For 78N05 ( $V_{IN}=10V$ ,  $I_{OUT}=40mA$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^\circ C$	4.80	5.0	5.20	V
		$7V \leq V_{IN} \leq V_{MAX}$ $I_{OUT}=1mA \sim 300mA$ (Note 2)	4.75		5.25	V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^\circ C$ , $I_{OUT}=1mA \sim 300mA$		15	60	mV
		$T_J=25^\circ C$ , $I_{OUT}=1mA \sim 40mA$		8	30	mV
Line Regulation	$\Delta V_{OUT}$	$7V \leq V_{IN} \leq 20V$ , $T_J=25^\circ C$		8	150	mV
		$8V \leq V_{IN} \leq 20V$ , $T_J=25^\circ C$		6	100	mV
Quiescent Current	$I_Q$			2.0	5.5	mA
Quiescent Current Change	$\Delta I_Q$	$8V \leq V_{IN} \leq 20V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	$e_N$	$10Hz \leq f \leq 100kHz$		40		uV
Temperature Coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-0.65		mV/°C
Ripple Rejection	RR	$8V \leq V_{IN} \leq 20V$ , $f=120Hz$ , $T_J=25^\circ C$		60		dB
Dropout Voltage	$V_D$	$T_J=25^\circ C$		1.7		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

For 78N06 ( $V_{IN}=12V$ ,  $I_{OUT}=40mA$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^\circ C$	5.76	6.0	6.24	V
		$8.5V \leq V_{IN} \leq V_{MAX}$ , $I_{OUT}=1mA \sim 300mA$ (Note 2)	5.7		6.3	V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^\circ C$ , $I_{OUT}=1mA \sim 300mA$		16	80	mV
		$T_J=25^\circ C$ , $I_{OUT}=1mA \sim 40mA$		9	40	mV
Line Regulation	$\Delta V_{OUT}$	$8.5V \leq V_{IN} \leq 20V$ , $T_J=25^\circ C$		10	175	mV
		$9V \leq V_{IN} \leq 20V$ , $T_J=25^\circ C$		8	125	mV
Quiescent Current	$I_Q$			2.0	5.5	mA
Quiescent Current Change	$\Delta I_Q$	$9V \leq V_{IN} \leq 20V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	$e_N$	$10Hz \leq f \leq 100kHz$		49		$\mu V$
Temperature Coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-0.75		$mV/^\circ C$
Ripple Rejection	RR	$10V \leq V_{IN} \leq 20V$ , $f=120Hz$ , $T_J=25^\circ C$		56		dB
Dropout Voltage	$V_D$	$T_J=25^\circ C$		1.7		V

For 78N08 ( $V_{IN}=14V$ ,  $I_{OUT}=40mA$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^\circ C$	7.68	8.0	8.32	V
		$10.5V \leq V_{IN} \leq V_{MAX}$ , $I_{OUT}=1mA \sim 300mA$ (Note 2)	7.60		8.40	V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^\circ C$ , $I_{OUT}=1mA \sim 300mA$		18	80	mV
		$T_J=25^\circ C$ , $I_{OUT}=1mA \sim 40mA$		10	40	mV
Line Regulation	$\Delta V_{OUT}$	$10.5V \leq V_{IN} \leq 23V$ , $T_J=25^\circ C$		10	175	mV
		$11V \leq V_{IN} \leq 23V$ , $T_J=25^\circ C$		8	125	mV
Quiescent Current	$I_Q$			2.0	5.5	mA
Quiescent Current Change	$\Delta I_Q$	$11V \leq V_{IN} \leq 23V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	$e_N$	$10Hz \leq f \leq 100kHz$		49		$\mu V$
Temperature Coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-0.75		$mV/^\circ C$
Ripple Rejection	RR	$11V \leq V_{IN} \leq 23V$ , $f=120Hz$ , $T_J=25^\circ C$		52		dB
Dropout Voltage	$V_D$	$T_J=25^\circ C$		1.7		V

For 78N09 ( $V_{IN}=15V$ ,  $I_{OUT}=40mA$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^\circ C$	8.64	9.0	9.36	V
		$10.5V \leq V_{IN} \leq V_{MAX}$ , $I_{OUT}=1mA \sim 300mA$ (Note 2)	8.55		9.45	V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^\circ C$ , $I_{OUT}=1mA \sim 300mA$		20	90	mV
		$T_J=25^\circ C$ , $I_{OUT}=1mA \sim 40mA$		10		mV
Line Regulation	$\Delta V_{OUT}$	$11.5V \leq V_{IN} \leq 24V$ , $T_J=25^\circ C$		15	200	mV
		$13V \leq V_{IN} \leq 24V$ , $T_J=25^\circ C$		10	150	mV
Quiescent Current	$I_Q$			2.0	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$13V \leq V_{IN} \leq 24V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	$e_N$	$10Hz \leq f \leq 100kHz$		70		$\mu V$
Temperature Coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-0.75		$mV/^\circ C$
Ripple Rejection	RR	$12V \leq V_{IN} \leq 24V$ , $f=120Hz$ , $T_J=25^\circ C$		46		dB
Dropout Voltage	$V_D$	$T_J=25^\circ C$		1.7		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

**For 78N10 ( $V_{IN}=16V$ ,  $I_{OUT}=40mA$ )**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	9.6	10	10.4	V
		$12.5V \leq V_{IN} \leq V_{MAX}$ , $I_{OUT}=1mA \sim 300mA$ (Note 2)	9.5		10.5	V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^{\circ}C$ , $I_{OUT}=1mA \sim 300mA$		20	94	mV
		$T_J=25^{\circ}C$ , $I_{OUT}=1mA \sim 40mA$		10	47	mV
Line Regulation	$\Delta V_{OUT}$	$12.5V \leq V_{IN} \leq 25V$ , $T_J=25^{\circ}C$		25	200	mV
		$14V \leq V_{IN} \leq 25V$ , $T_J=25^{\circ}C$		20	170	mV
Quiescent Current	$I_Q$			2.0	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$12.5V \leq V_{IN} \leq 25V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	$e_N$	$10Hz \leq f \leq 100kHz$		74		$\mu V$
Temperature Coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-0.8		$mV/^{\circ}C$
Ripple Rejection	RR	$15V \leq V_{IN} \leq 25V$ , $f=120Hz$ , $T_J=25^{\circ}C$		45		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

**For 78N12 ( $V_{IN}=19V$ ,  $I_{OUT}=40mA$ )**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	11.52	12	12.48	V
		$14.5V \leq V_{IN} \leq V_{MAX}$ , $I_{OUT}=1mA \sim 300mA$ (Note 2)	11.40		12.60	V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^{\circ}C$ , $I_{OUT}=1mA \sim 300mA$		25	100	mV
		$T_J=25^{\circ}C$ , $I_{OUT}=1mA \sim 40mA$		12	50	mV
Line Regulation	$\Delta V_{OUT}$	$14.5V \leq V_{IN} \leq 27V$ , $T_J=25^{\circ}C$		25	300	mV
		$16V \leq V_{IN} \leq 27V$ , $T_J=25^{\circ}C$		20	250	mV
Quiescent Current	$I_Q$			2.0	6.5	mA
Quiescent Current Change	$\Delta I_Q$	$16V \leq V_{IN} \leq 27V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	$e_N$	$10Hz \leq f \leq 100kHz$		80		$\mu V$
Temperature Coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-1.0		$mV/^{\circ}C$
Ripple Rejection	RR	$15V \leq V_{IN} \leq 25V$ , $f=120Hz$ , $T_J=25^{\circ}C$		45		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

**For 78N15 ( $V_{IN}=23V$ ,  $I_{OUT}=40mA$ )**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	14.40	15	15.60	V
		$17.5V \leq V_{IN} \leq V_{MAX}$ , $I_{OUT}=1mA \sim 300mA$ (Note 2)	14.25		15.75	V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^{\circ}C$ , $I_{OUT}=1mA \sim 300mA$		25	150	mV
		$T_J=25^{\circ}C$ , $I_{OUT}=1mA \sim 40mA$		15	75	mV
Line Regulation	$\Delta V_{OUT}$	$17.5V \leq V_{IN} \leq 30V$ , $T_J=25^{\circ}C$		25	150	mV
		$20V \leq V_{IN} \leq 30V$ , $T_J=25^{\circ}C$		15	75	mV
Quiescent Current	$I_Q$			2.2	6.5	mA
Quiescent Current Change	$\Delta I_Q$	$20V \leq V_{IN} \leq 30V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	$e_N$	$10Hz \leq f \leq 100kHz$		90		$\mu V$
Temperature Coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		-1.3		$mV/^{\circ}C$
Ripple Rejection	RR	$18.5V \leq V_{IN} \leq 28.5V$ , $f=120Hz$ , $T_J=25^{\circ}C$		45		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

■ ELECTRICAL CHARACTERISTICS (Cont.)

**For 78N18 ( $V_{IN}=27V$ ,  $I_{OUT}=40mA$ )**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	17.28	18	18.72	V
		$21V \leq V_{IN} \leq V_{MAX}$ , $I_{OUT}=1mA \sim 300mA$ (Note 2)	17.10		18.90	V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^{\circ}C$ , $I_{OUT}=1mA \sim 300mA$		30	180	mV
		$T_J=25^{\circ}C$ , $I_{OUT}=1mA \sim 40mA$		20	90	mV
Line Regulation	$\Delta V_{OUT}$	$21V \leq V_{IN} \leq 33V$ , $T_J=25^{\circ}C$		45	300	mV
		$22V \leq V_{IN} \leq 33V$ , $T_J=25^{\circ}C$		35	250	mV
Quiescent Current	$I_Q$			2.2	6.5	mA
Quiescent Current Change	$\Delta I_Q$	$21V \leq V_{IN} \leq 33V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	$e_N$	$10Hz \leq f \leq 100kHz$		150		$\mu V$
Temperature Coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		1.8		$mV/^{\circ}C$
Ripple Rejection	RR	$23V \leq V_{IN} \leq 28.5V$ , $f=120Hz$ , $T_J=25^{\circ}C$		45		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

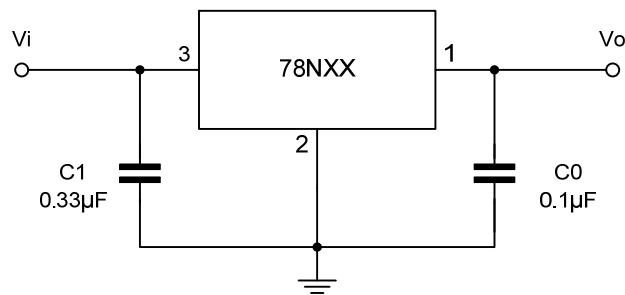
**For 78N24 ( $V_{IN}=33V$ ,  $I_{OUT}=40mA$ )**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_{OUT}$	$T_J=25^{\circ}C$	23.04	24.00	24.96	V
		$27V \leq V_{IN} \leq V_{MAX}$ , $I_{OUT}=1mA \sim 300mA$ (Note 2)	22.80		25.20	V
Load Regulation	$\Delta V_{OUT}$	$T_J=25^{\circ}C$ , $I_{OUT}=1mA \sim 300mA$		30	200	mV
		$T_J=25^{\circ}C$ , $I_{OUT}=1mA \sim 40mA$		20	100	mV
Line Regulation	$\Delta V_{OUT}$	$27V \leq V_{IN} \leq 35V$ , $T_J=25^{\circ}C$		160	300	mV
		$28V \leq V_{IN} \leq 35V$ , $T_J=25^{\circ}C$		150	250	mV
Quiescent Current	$I_Q$			3.0	7.5	mA
Quiescent Current Change	$\Delta I_Q$	$27V \leq V_{IN} \leq 35V$			1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$			0.1	mA
Output Noise Voltage	$e_N$	$10Hz \leq f \leq 100kHz$		200		$\mu V$
Temperature Coefficient of $V_{OUT}$	$\Delta V_O/\Delta T$	$I_{OUT}=5mA$		2.0		$mV/^{\circ}C$
Ripple Rejection	RR	$27V \leq V_{IN} \leq 35V$ , $f=120Hz$ , $T_J=25^{\circ}C$		45		dB
Dropout Voltage	$V_D$	$T_J=25^{\circ}C$		1.7		V

Notes: 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 represent pulse test conditions with junction temperatures specified at the initiation of test.

2. Power dissipation < 0.5W

## ■ TYPICAL APPLICATION CIRCUIT



- Notes: 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.

## TYPICAL CHARACTERISTICS

Fig.1 78N05 Dropout Characteristics  
( $T_J=25^\circ\text{C}$ )

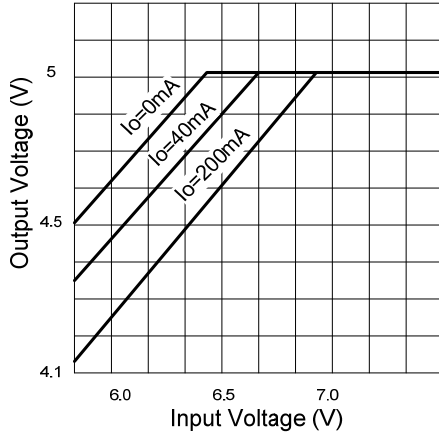


Fig.2 Short Circuit Output Current  
( $T_J=25^\circ\text{C}$ )

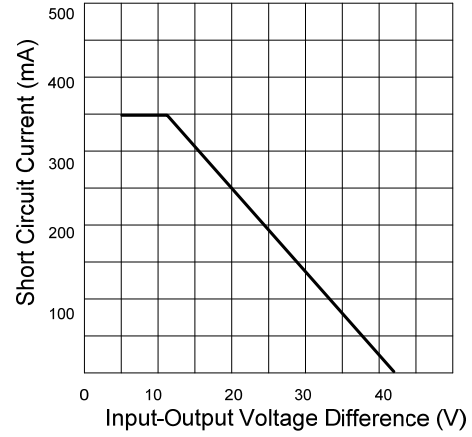


Fig.3 78N05 Quiescent Current vs. Input Voltage  
( $I_{OUT}=0\text{mA}, T_J=25^\circ\text{C}$ )

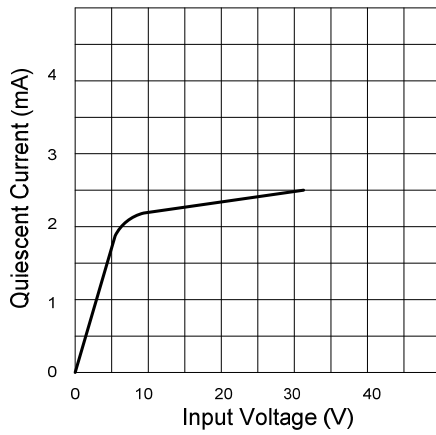


Fig.4 Peak Output Current vs Dropout Voltage Difference

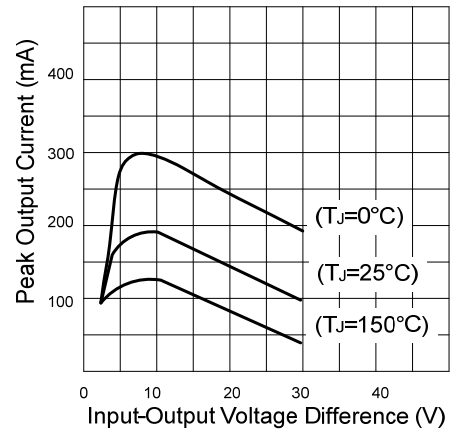
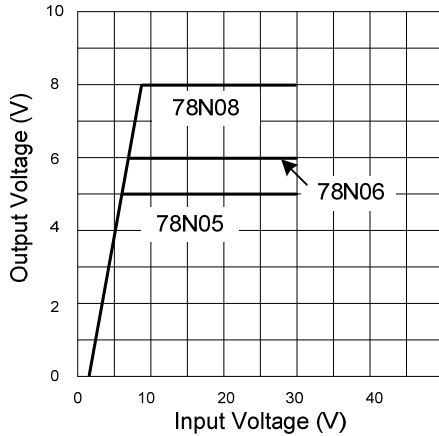


Fig.5 Output Characteristics  
( $I_{OUT}=0\text{mA}, T_J=25^\circ\text{C}$ )





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