

## LOW DROP OUT VOLTAGE REGULATOR

### ■ GENERAL DESCRIPTION

The NJM2930 3-terminal positive voltage regulator features an ability to source 150mA of output current (100mA: L-Type) with an input-output differential of 0.6V or less. Efficient use of low input voltages obtained, for example, from an automotive battery during cold crank conditions, allows 5V circuitry to be properly powered with supply voltages as low as 5.6V.

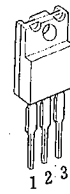
Familiar regulator features such as current limit and thermal overload protection are also provided.

### ■ FEATURES

- Operating Voltage
  - Input-Output differential less 0.6V
  - Output Current in Excess of 150mA
  - 40V Load Dump Protection
  - Internal Short Circuit Current Limit
  - Internal Thermal Overload Protection
  - Package Outline
  - Bipolar Technology
- TO-220F, TO-92

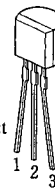
### ■ PACKAGE OUTLINE

(TO-220F)



NJM2930F

(TO-92)

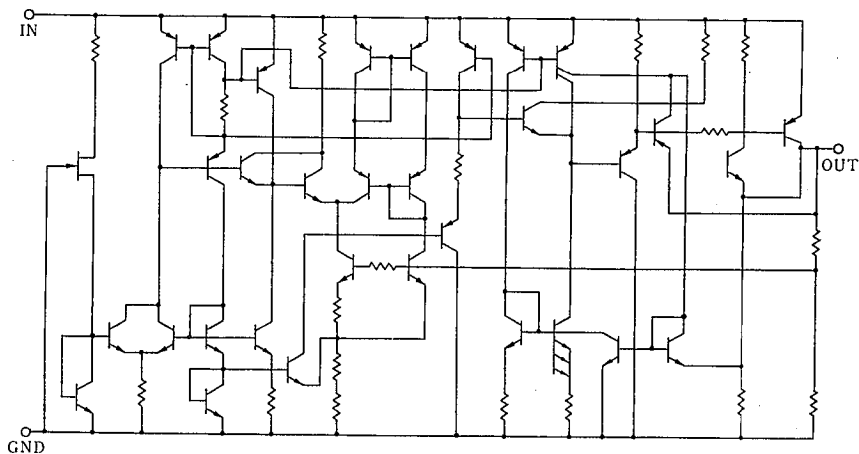


NJM2930L

1. Input
2. GND
3. Output

1. Output
2. GND
3. Input

### ■ EQUIVALENT CIRCUIT



6

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Operating Input Voltage Range	V <sub>IN</sub>	26	V
Input Overvoltage Protection	V <sub>PR</sub>	40	V
Input Reverse Voltage	V <sub>INR1</sub> (100ms)	-12	V
Input Reverse Voltage	V <sub>INR2</sub> (DC)	-6	V
Maximum Output Current	I <sub>OM</sub>	(TO-92) 100	mA
		(TO-220F) 150	mA
Power Dissipation	P <sub>D</sub>	(TO-92) 500	mW
		(TO-220F) 7.5(Note)	W
Operating Temperature Range	T <sub>opr</sub>	-30~75	°C
Storage Temperature Range	T <sub>stg</sub>	-40~125	°C

(note) Case Temperature : T<sub>case</sub> ≤ 75°C, Thermal Resistance: θ<sub>je</sub> = 5°C/W TYP.

## ■ ELECTRICAL CHARACTERISTICS

(All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques.)

**NJM2930F05** (V<sub>IN</sub>=14V, C<sub>2</sub>=10μF, T<sub>J</sub>=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V <sub>O</sub>	6V ≤ V <sub>IN</sub> ≤ 26V, 5mA ≤ I <sub>O</sub> ≤ 100mA	4.5	5	5.5	V
Line Regulation	ΔV <sub>O</sub> -V <sub>I</sub>	9V ≤ V <sub>IN</sub> ≤ 16V, I <sub>O</sub> = 5mA	—	7	25	mV
		6V ≤ V <sub>IN</sub> ≤ 26V, I <sub>O</sub> = 5mA	—	30	80	mV
Load Regulation	ΔV <sub>O</sub> -I <sub>O</sub>	5mA ≤ I <sub>O</sub> ≤ 150mA	—	14	50	mV
Quiescent Current	I <sub>Q1</sub>	I <sub>O</sub> = 10mA	—	4	7	mA
		I <sub>O</sub> = 150mA	—	30	40	mA
Dropout Voltage	ΔV <sub>I</sub> -O	I <sub>O</sub> = 150mA	—	0.3	0.6	V
Output Noise Voltage	V <sub>NO</sub>	10Hz~100kHz, I <sub>O</sub> = 150mA	—	100	—	μV
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 150mA	—	60	—	dB

**NJM2930L 05** (V<sub>IN</sub>=14V, C<sub>2</sub>=10μF, T<sub>J</sub>=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V <sub>O</sub>	6V ≤ V <sub>IN</sub> ≤ 26V, 5mA ≤ I <sub>O</sub> ≤ 100mA	4.5	5	5.5	V
Line Regulation	ΔV <sub>O</sub> -V <sub>I</sub>	9V ≤ V <sub>IN</sub> ≤ 16V, I <sub>O</sub> = 5mA	—	7	25	mV
		6V ≤ V <sub>IN</sub> ≤ 26V, I <sub>O</sub> = 5mA	—	30	80	mV
Load Regulation	ΔV <sub>O</sub> -I <sub>O</sub>	5mA ≤ I <sub>O</sub> ≤ 100mA	—	14	50	mV
Quiescent Current	I <sub>Q1</sub>	I <sub>O</sub> = 10mA	—	4	7	mA
		I <sub>O</sub> = 100mA	—	25	40	mA
Dropout Voltage	ΔV <sub>I</sub> -O	I <sub>O</sub> = 100mA	—	0.25	0.6	V
Output Noise Voltage	V <sub>NO</sub>	10Hz~100kHz, I <sub>O</sub> = 40mA, V <sub>IN</sub> = 10V	—	100	—	μV
Ripple Rejection	RR	f = 120Hz, I <sub>O</sub> = 40mA, V <sub>IN</sub>	—	60	—	dB

**NJM2930F08** ( $V_{IN}=14V$ ,  $C_2=10\mu F$ ,  $T_j=25^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	$V_O$	$9.4V \leq V_{IN} \leq 26V$ , $5mA \leq I_O \leq 150mA$	7.2	8	8.8	V
Line Regulation	$\Delta V_O - V_I$	$9.4V \leq V_{IN} \leq 16V$ , $I_O = 5mA$	—	12	50	mV
	$\Delta V_O - V_I$	$9.4V \leq V_{IN} \leq 26V$ , $I_O = 5mA$	—	50	100	mV
Load Regulation	$\Delta V_O - I_O$	$5mA \leq I_O \leq 150mA$	—	25	50	mV
Quiescent Current	$I_{Q1}$	$I_O = 10mA$	—	4	7	mA
	$I_{Q2}$	$I_O = 150mA$	—	30	40	mA
Dropout Voltage	$\Delta V_{1-o}$	$I_O = 150mA$	—	0.3	0.6	V
Output Noise Voltage	$V_{NO}$	10Hz~100kHz, $I_O = 150mA$	—	140	—	$\mu V$
Ripple Rejection	RR	$f=120Hz$ , $I_O = 150mA$	—	57	—	dB

**NJM2930L 08** ( $V_{IN}=14V$ ,  $C_2=10\mu F$ ,  $T_j=25^\circ C$ )

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	$V_O$	$9.4V \leq V_{IN} \leq 26V$ , $5mA \leq I_O \leq 100mA$	7.2	8	8.8	V
Line Regulation	$\Delta V_O - V_I$	$9.4V \leq V_{IN} \leq 16V$ , $I_O = 5mA$	—	12	50	mV
	$\Delta V_O - V_I$	$9.4V \leq V_{IN} \leq 26V$ , $I_O = 5mA$	—	50	100	mV
Load Regulation	$\Delta V_O - I_O$	$5mA \leq I_O \leq 100mA$	—	25	50	mV
Quiescent Current	$I_{Q1}$	$I_O = 10mA$	—	4	7	mA
	$I_{Q2}$	$I_O = 100mA$	—	25	40	mA
Dropout Voltage	$\Delta V_{1-o}$	$I_O = 100mA$	—	0.25	0.6	V
Output Noise Voltage	$V_{NO}$	10Hz~100kHz, $I_O = 40mA$	—	140	—	$\mu V$
Ripple Rejection	RR	$f=120Hz$ , $I_O = 40mA$	—	57	—	dB

**NJM2930F85** ( $V_{IN}=14V$ ,  $C_2=10\mu F$ ,  $T_j=25^\circ C$ )

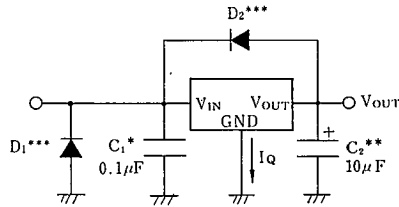
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	$V_O$	$9.95V \leq V_{IN} \leq 26V$ , $5mA \leq I_O \leq 150mA$	7.65	8.5	9.35	V
Line Regulation	$\Delta V_O - V_I$	$9.95V \leq V_{IN} \leq 16V$ , $I_O = 5mA$	—	12	50	mV
	$\Delta V_O - V_I$	$9.95V \leq V_{IN} \leq 26V$ , $I_O = 5mA$	—	50	100	mV
Load Regulation	$\Delta V_O - I_O$	$5mA \leq I_O \leq 150mA$	—	25	50	mV
Quiescent Current	$I_{Q1}$	$I_O = 10mA$	—	4	7	mA
	$I_{Q2}$	$I_O = 150mA$	—	30	40	mA
Dropout Voltage	$\Delta V_{1-o}$	$I_O = 150mA$	—	0.3	0.6	V
Output Noise Voltage	$V_{NO}$	10Hz~100kHz, $I_O = 150mA$	—	150	—	$\mu V$
Ripple Rejection	RR	$f=120Hz$ , $I_O = 150mA$	—	56	—	dB

**NJM2930L 85** ( $V_{IN}=14V$ ,  $C_2=10\mu F$ ,  $T_j=25^\circ C$ )

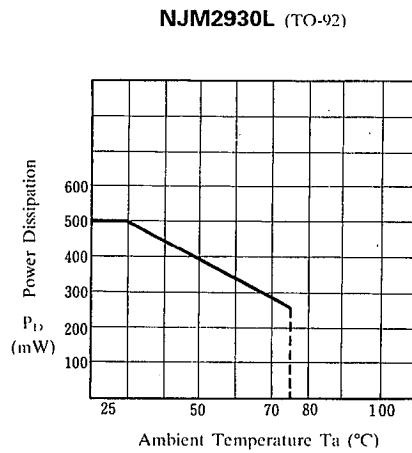
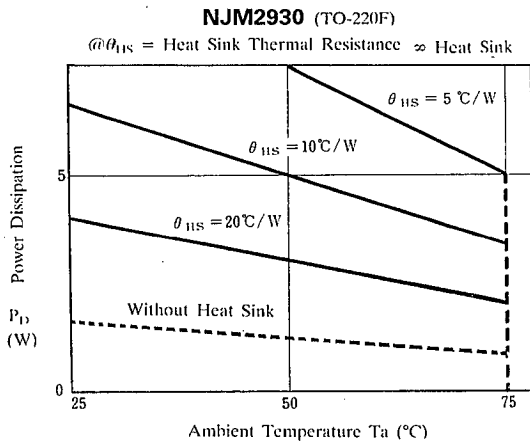
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	$V_O$	$9.95V \leq V_{IN} \leq 26V$ , $5mA \leq I_O \leq 100mA$	7.65	8.5	9.35	V
Line Regulation	$\Delta V_O - V_I$	$9.95V \leq V_{IN} \leq 16V$ , $I_O = 5mA$	—	12	50	mV
	$\Delta V_O - V_I$	$9.4V \leq V_{IN} \leq 26V$ , $I_O = 5mA$	—	50	100	mV
Load Regulation	$\Delta V_O - I_O$	$5mA \leq I_O \leq 100mA$	—	25	50	mV
Quiescent Current	$I_{Q1}$	$I_O = 10mA$	—	4	7	mA
	$I_{Q2}$	$I_O = 100mA$	—	25	40	mA
Dropout Voltage	$\Delta V_{1-o}$	$I_O = 100mA$	—	0.25	0.6	V
Output Noise Voltage	$V_{NO}$	10Hz~100kHz, $I_O = 40mA$	—	150	—	$\mu V$
Ripple Rejection	RR	$f=120Hz$ , $I_O = 40mA$	—	56	—	dB

## ■ STANDARD APPLICATION EXAMPLES

- \* This NJM2930 is required when the mounting position is separated from the power filter.
- \*\* Use an aluminum electrolytic capacitor or a tantalum capacitor as  $C_2$ . The temperature guarantee range of capacitors should be down to  $-30^{\circ}\text{C}$ . A capacity value of  $10\mu\text{F}$  is a minimum requirement for improving the stability and transient response. Mount it at a position as close to the leads as possible.
- \*\*\* When application on automobile car operation, the minus pulse might be input on IC. In this case, however, the pulse might trigger to latch up. If it were that, this kind of latching up might be continued, the IC would burn up into defective in many cases. It is advisable to apply D1, D2 as described in the drawing, in order to prevent from making any troubles. It is important to make devices D1, D2 against  $V_{\text{IN}}$  to be able to stand for brake down voltage, current volume, and then less volume for Vf.

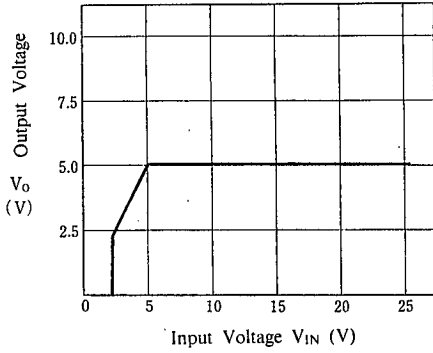


## ■ POWER DISSIPATION VS. AMBIENT TEMPERATURE

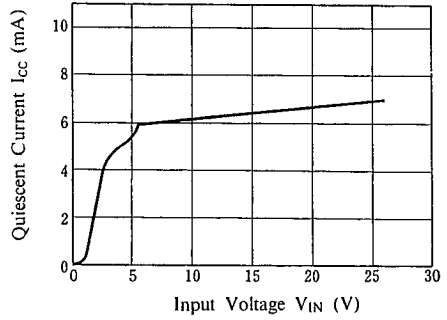


## TYPICAL CHARACTERISTICS

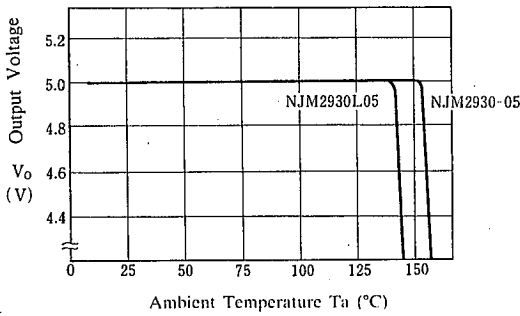
**NJM2930F05/L05 Output Voltage**  
( $T_j=25^\circ\text{C}$ ,  $I_o=0\text{mA}$ )



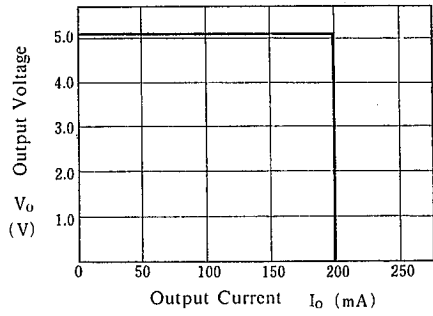
**NJM2930F05/L05  $I_{CC}-V_{IN}$**   
( $T_j=25^\circ\text{C}$ ,  $I_o=0\text{mA}$ )



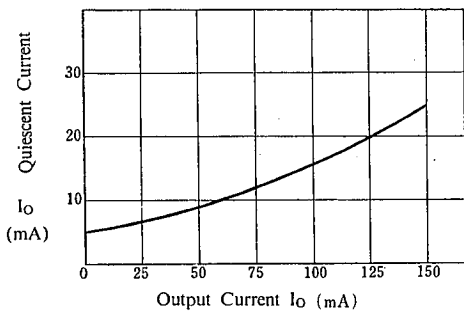
**NJM2939F05/L05 Thermal Shutdown**  
( $V_{IN}=14\text{V}$ ,  $I_o=50\text{mA}$ )



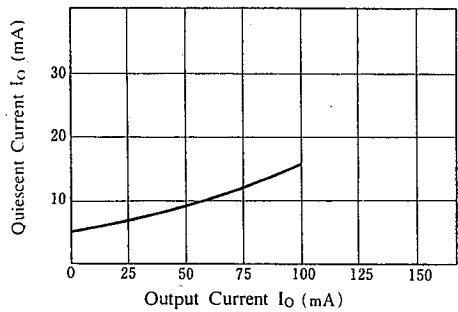
**NJM2930F05/L05 Load Characteristics**  
( $V_{IN}=14\text{V}$ ,  $T_j=25^\circ\text{C}$ )



**NJM2930L05 Output Current vs. Quiescent Current**  
( $V_{IN}=14\text{V}$ ,  $T_j=25^\circ\text{C}$ )



**NJM2930F05 Output Current vs. Quiescent Current**  
( $V_{IN}=14\text{V}$ ,  $T_j=25^\circ\text{C}$ )

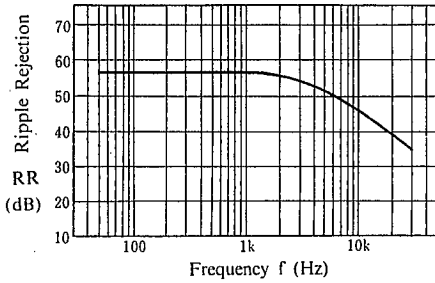


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## ■ TYPICAL CHARACTERISTICS

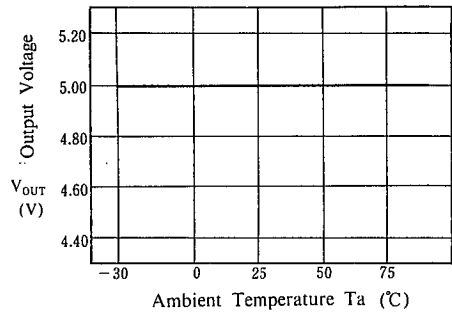
**NJM2930F05/L05 Ripple Rejection vs. Frequency**

( $T_a=25^\circ\text{C}$ ,  $V_{IN}=14\text{V}$ ,  $I_o=40\text{mA}$ ,  $e_{in}=2\text{V}_{P-P}$ )



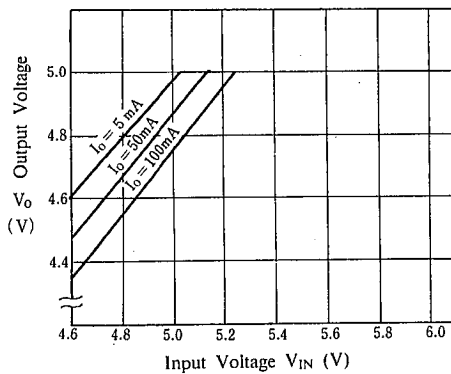
**NJM2930F05/L05 Output Voltage**

( $V_{IN}=14\text{V}$ ,  $I_o=1\text{mA}$ )



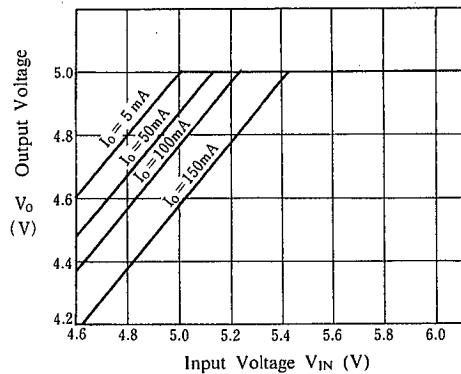
**NJM2930L05 Dropout Voltage**

( $T_j=25^\circ\text{C}$ )



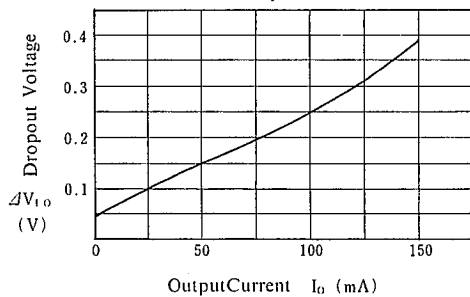
**NJM2930F05 Dropout Voltage**

( $T_j=25^\circ\text{C}$ )



**NJM2930F05 Dropout Voltage vs. Output Current**

( $T_j=25^\circ\text{C}$ )



## MEMO

[CAUTION]

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