

## 3-TERMINAL POSITIVE VOLTAGE REGULATOR

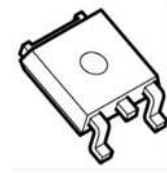
### ■ GENERAL DESCRIPTION

The NJM78M00S is a 0.5A output 3-Terminal Positive Voltage Regulator.

It has improvements in contrast with a conventional NJM78M00:

An output voltage accuracy, an operating temperature range and MLCC correspondence.

### ■ PACKAGE OUTLINE

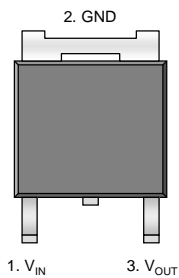


NJM78M00SDL1  
(TO-252-3)

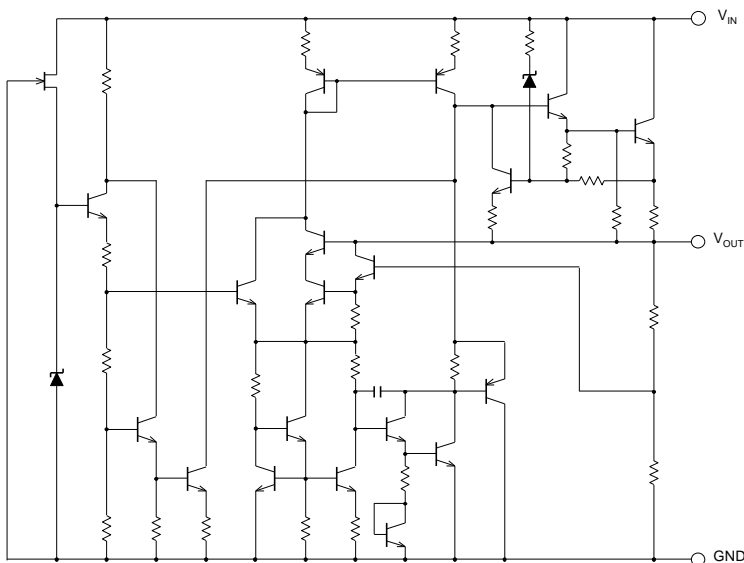
### ■ FEATURES

- Output Current                      0.5A max.
- Output Voltage Accuracy         $V_O \pm 3.0\%$
- High Ripple Rejection
- Correspond to Low ESR Capacitor (MLCC)
- Over Current Protection Circuit
- Thermal Shutdown Circuit
- Output Voltage Lineup            5V, 9V, 12V, 15V
- Package                                TO-252-3

### ■ PIN CONFIGURATION



### ■ EQUIVALENT CIRCUIT



# NJM78M00S

## ■ ABSOLUTE MAXIMUM RATINGS

(Unless otherwise noted,  $T_a = 25^\circ\text{C}$ )

PARAMETER	SYMBOL	MAXIMUM RATINGS	UNIT
Input Voltage	$V_{IN}$	35	V
Power Dissipation	$P_D$	1190 (*1) 3125 (*2)	mW
Junction Temperature Range	$T_j$	- 40 to + 150	$^\circ\text{C}$
Operating Temperature Range	$T_{opr}$	- 40 to + 125	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	- 50 to + 150	$^\circ\text{C}$

(\*1) Mounted on glass epoxy board. (76.2×114.3×1.6mm:EIA/JDEC standard size, 2Layers, copper area 100mm<sup>2</sup>)

(\*2) Mounted on glass epoxy board. (76.2×114.3×1.6mm:EIA/JDEC standard size, 4Layers)

(4Layers inner foil: 74.2 ×74.2mm applying a thermal via hole to a board based on JEDEC standard JESD51-5)

## ■ ELECTRICAL CHARACTERISTICS

( $C_{IN}=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_f=25^\circ\text{C}$ ) Measurement is to be conducted is pulse testing.

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>NJM78M05SDL1</b>						
Output Voltage	$V_O$	$V_{IN}=10\text{V}$ , $I_O=0.35\text{A}$	4.85	5.0	5.15	V
Line Regulation	$\Delta V_O-V_{IN}$	$V_{IN}=7\text{V}$ to 25V, $I_O=0.2\text{A}$	-	3	50	mV
Load Regulation	$\Delta V_O-I_O$	$V_{IN}=10\text{V}$ , $I_O=0.005\text{A}$ to 0.5A	-	5	50	mV
Quiescent Current	$I_Q$	$V_{IN}=10\text{V}$ , $I_O=0\text{mA}$	-	4	6.0	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=10\text{V}$ , $I_O=5\text{mA}$	-	-0.5	-	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=10\text{V}$ , $I_O=0.35\text{A}$ , $e_{in}=1V_{P-P}$ , $f=120\text{Hz}$	60	80	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=10\text{V}$ , BW=10Hz to 100kHz, $I_O=0.35\text{A}$	-	60	-	$\mu\text{Vrms}$
Dropout Voltage	$\Delta V_{IO}$	$I_O=0.5\text{A}$	-	1.8	-	V

### NJM78M09SDL1

Output Voltage	$V_O$	$V_{IN}=15\text{V}$ , $I_O=0.35\text{A}$	8.73	9.0	9.27	V
Line Regulation	$\Delta V_O-V_{IN}$	$V_{IN}=11.5\text{V}$ to 25V, $I_O=0.2\text{A}$	-	6	60	mV
Load Regulation	$\Delta V_O-I_O$	$V_{IN}=15\text{V}$ , $I_O=0.005\text{A}$ to 0.5A	-	8	90	mV
Quiescent Current	$I_Q$	$V_{IN}=15\text{V}$ , $I_O=0\text{mA}$	-	4.1	6.0	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=15\text{V}$ , $I_O=5\text{mA}$	-	-0.9	-	mV/ $^\circ\text{C}$
Ripple Rejection	RR	$V_{IN}=15\text{V}$ , $I_O=0.35\text{A}$ , $e_{in}=1V_{P-P}$ , $f=120\text{Hz}$	56	70	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=15\text{V}$ , BW=10Hz to 100kHz, $I_O=0.35\text{A}$	-	90	-	$\mu\text{Vrms}$
Dropout Voltage	$\Delta V_{IO}$	$I_O=0.5\text{A}$	-	1.8	-	V

## ■ ELECTRICAL CHARACTERISTICS

( $C_{IN}=0.33\mu\text{F}$ ,  $C_O=0.1\mu\text{F}$ ,  $T_f=25^\circ\text{C}$ ) Measurement is to be conducted is pulse testing.

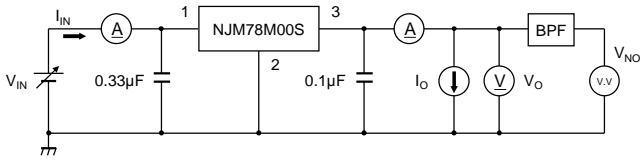
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
<b>NJM78M12SDL1</b>						
Output Voltage	$V_O$	$V_{IN}=19\text{V}$ , $I_O=0.35\text{A}$	11.64	12.0	12.36	V
Line Regulation	$\Delta V_O-V_{IN}$	$V_{IN}=14.5\text{V}$ to $30\text{V}$ , $I_O=0.2\text{A}$	-	8	60	mV
Load Regulation	$\Delta V_O-I_O$	$V_{IN}=19\text{V}$ , $I_O=0.005\text{A}$ to $0.5\text{A}$	-	8	120	mV
Quiescent Current	$I_Q$	$V_{IN}=19\text{V}$ , $I_O=0\text{mA}$	-	4.1	6.0	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=19\text{V}$ , $I_O=5\text{mA}$	-	-1.2	-	mV/°C
Ripple Rejection	RR	$V_{IN}=19\text{V}$ , $I_O=0.35\text{A}$ , $e_{in}=1\text{V}_{P.P.}$ , $f=120\text{Hz}$	55	70	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=19\text{V}$ , BW=10Hz to 100kHz, $I_O=0.35\text{A}$	-	100	-	$\mu\text{Vrms}$
Dropout Voltage	$\Delta V_{IO}$	$I_O=0.5\text{A}$	-	1.8	-	V

<b>NJM78M15SDL1</b>						
Output Voltage	$V_O$	$V_{IN}=23\text{V}$ , $I_O=0.35\text{A}$	14.55	15.0	15.45	V
Line Regulation	$\Delta V_O-V_{IN}$	$V_{IN}=17.5\text{V}$ to $30\text{V}$ , $I_O=0.2\text{A}$	-	10	60	mV
Load Regulation 1	$\Delta V_O-I_O$	$V_{IN}=23\text{V}$ , $I_O=0.005\text{A}$ to $0.5\text{A}$	-	10	150	mV
Quiescent Current	$I_Q$	$V_{IN}=23\text{V}$ , $I_O=0\text{mA}$	-	4.1	6.0	mA
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T$	$V_{IN}=23\text{V}$ , $I_O=5\text{mA}$	-	-1.5	-	mV/°C
Ripple Rejection	RR	$V_{IN}=23\text{V}$ , $I_O=0.35\text{A}$ , $e_{in}=1\text{V}_{P.P.}$ , $f=120\text{Hz}$	54	70	-	dB
Output Noise Voltage	$V_{NO}$	$V_{IN}=23\text{V}$ , BW=10Hz to 100kHz, $I_O=0.35\text{A}$	-	120	-	$\mu\text{Vrms}$
Dropout Voltage	$\Delta V_{IO}$	$I_O=0.5\text{A}$	-	1.8	-	V

# NJM78M00S

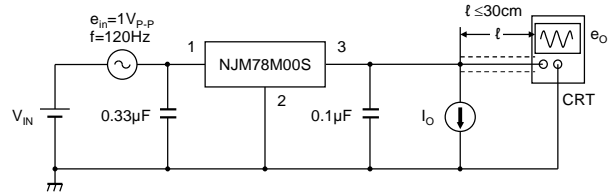
## ■ TEST CIRCUIT

1. Output Voltage, Line Regulation, Load Regulation, Quiescent Current, Average, Output Noise Voltage, Temperature Coefficient of Output Voltage, Peak Output/Short Circuit Current



- Measurement is to be conducted in pulse testing
- $I_Q = I_{IN} - I_O$

2. Ripple Rejection



$$RR = 20 \log_{10} \left( \frac{e_{in}}{e_o} \right)$$

### • Input Capacitor $C_{IN}$

Input Capacitor  $C_{IN}$  is required to prevent oscillation and reduce power supply ripple for applications when high power supply impedance or a long power supply line.

Therefore, use the recommended  $C_{IN}$  value (refer to conditions of ELECTRIC CHARACTERISTIC) or larger and should connect between GND and  $V_{IN}$  as shortest path as possible to avoid the problem.

### • Output Capacitor $C_O$

Output capacitor ( $C_O$ ) will be required for a phase compensation of the internal error amplifier.

The capacitance and the equivalent series resistance (ESR) influence to stable operation of the regulator.

Use of a smaller  $C_O$  may cause excess output noise or oscillation of the regulator due to lack of the phase compensation.

On the other hand, Use of a larger  $C_O$  reduces output noise and ripple output, and also improves output transient response when rapid load change.

Therefore, use the recommended  $C_O$  value (refer to conditions of ELECTRIC CHARACTERISTIC) or larger and should connect between GND and  $V_{OUT}$  as shortest path as possible for stable operation.

In addition, you should consider varied characteristics of capacitor (a frequency characteristic, a temperature characteristic, a DC bias characteristic and so on) and unevenness peculiar to a capacitor supplier enough.

When selecting  $C_O$ , recommend that have withstand voltage margin against output voltage and superior temperature characteristic though this product is designed stability works with wide range ESR of capacitor including low ESR products.

## ■ THERMAL RESISTANCE CHARACTERISTICS

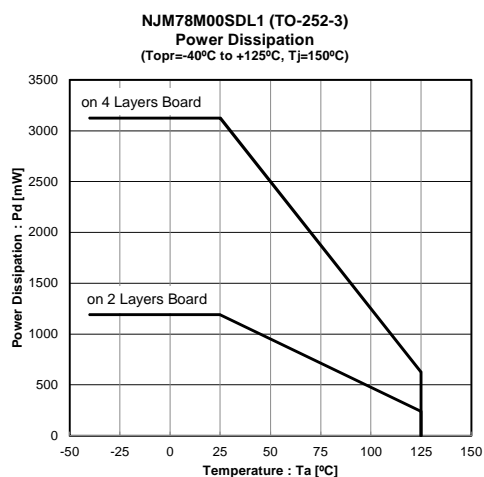
PARAMETER	SYMBOL	VALUE	UNIT
Junction-to-Ambient Thermal Resistance	$\theta_{ja}$	105 (*1)	°C/W
		40 (*2)	
Junction-to-Top of Package Characterization Parameter	$\psi_{jt}$	17 (*1)	°C/W
		12 (*2)	

(\*1) Mounted on glass epoxy board. (76.2×114.3×1.6mm:EIA/JDEC standard size, 2Layers, copper area 100mm<sup>2</sup>)

(\*2) Mounted on glass epoxy board. (76.2×114.3×1.6mm:EIA/JDEC standard size, 4Layers)

(4Layers inner foil: 74.2 ×74.2mm applying a thermal via hole to a board based on JEDEC standard JESD51-5)

## ■ AMBIENT TEMPERATURE vs. POWER DISSIPATION



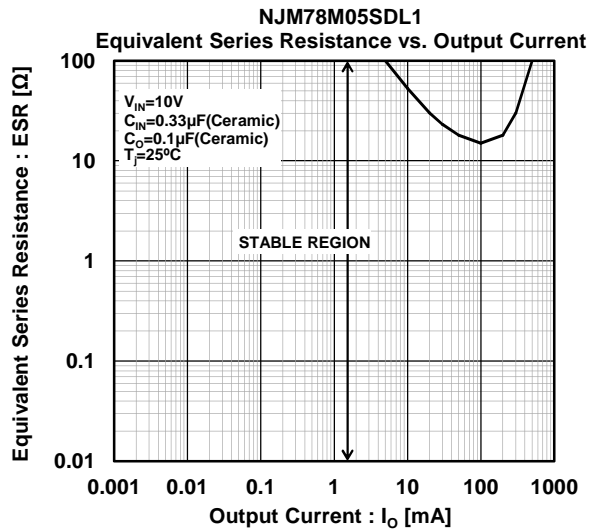
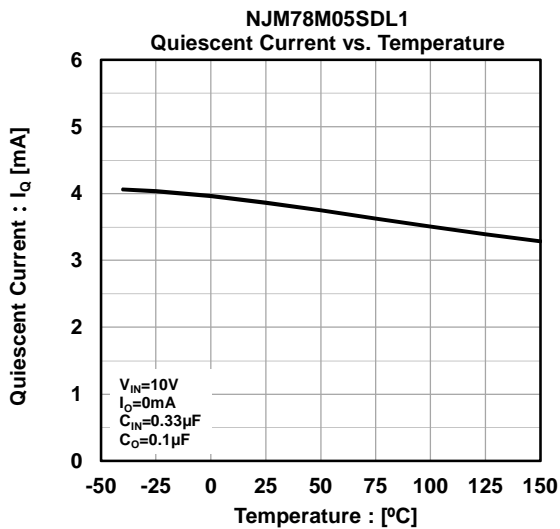
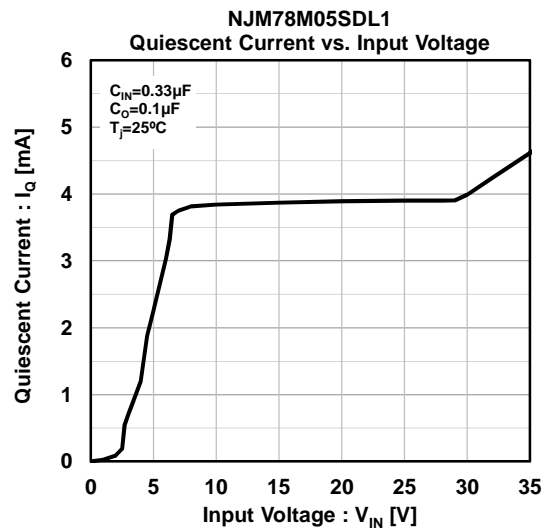
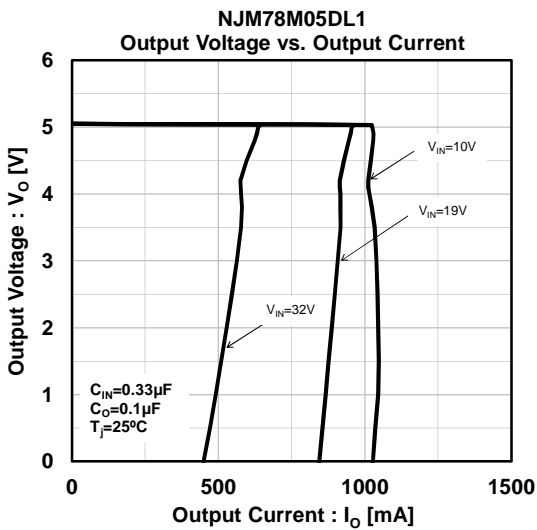
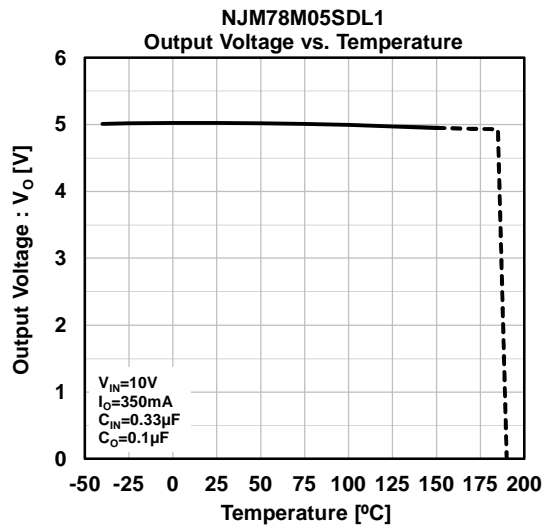
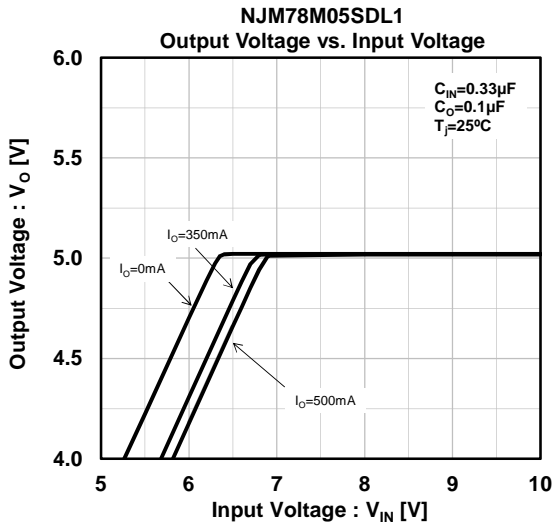
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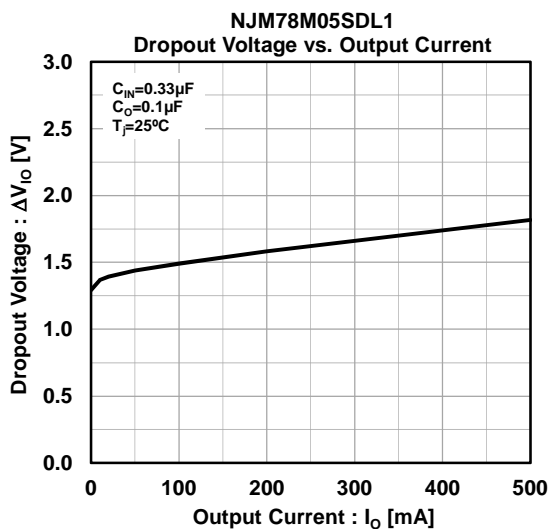
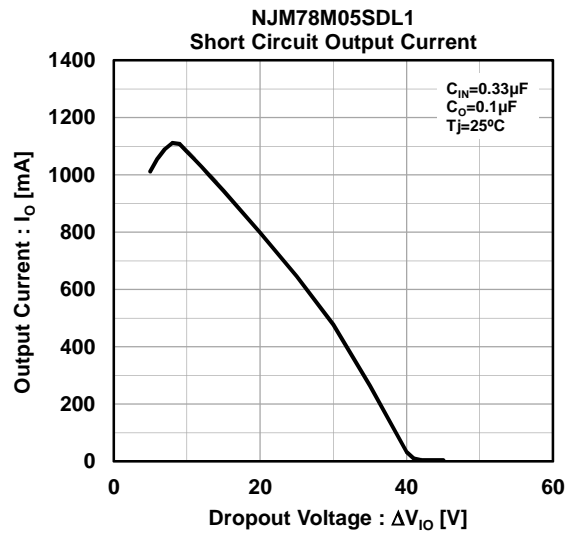
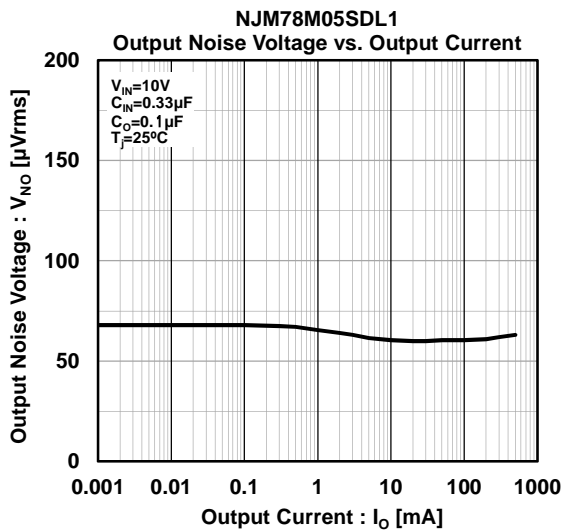
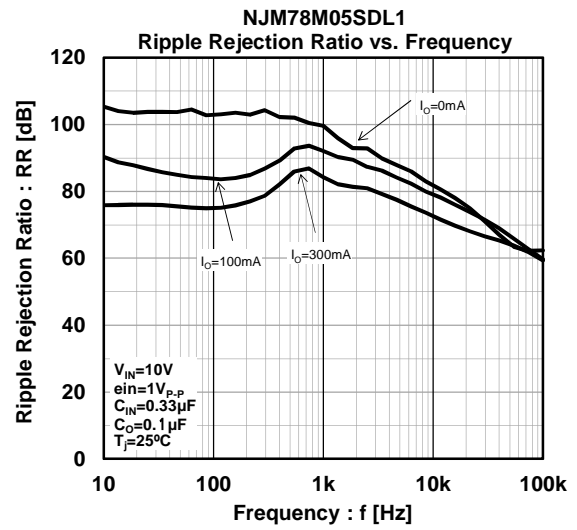
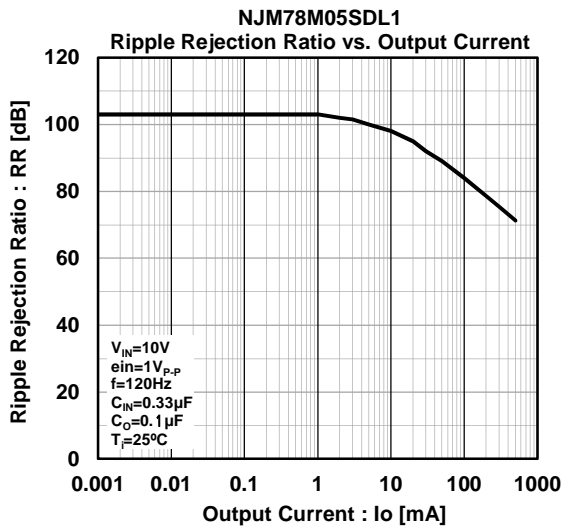
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# NJM78M00S

## ■ TYPICAL CHARACTERISTICS (5V)

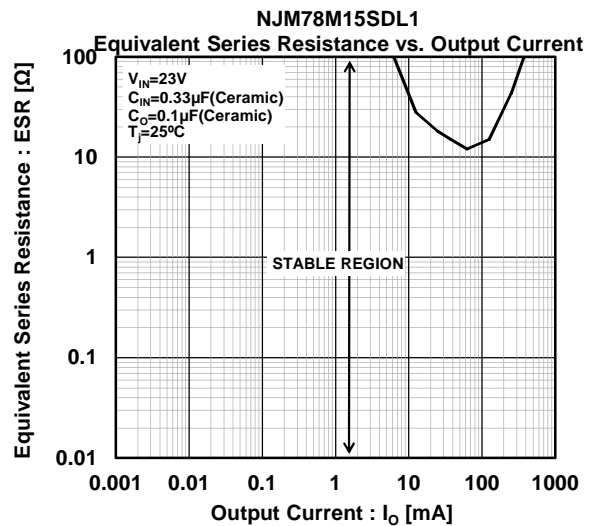
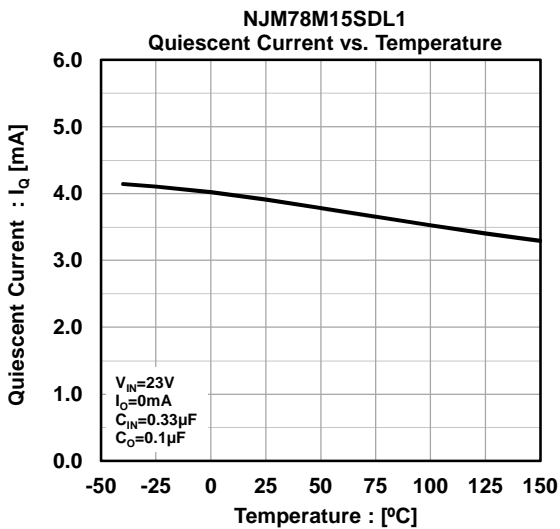
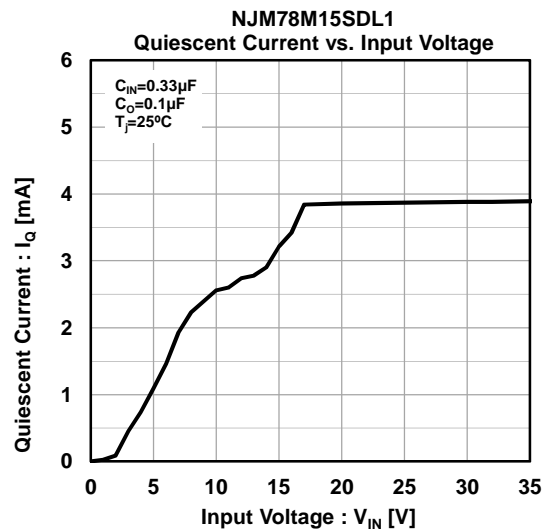
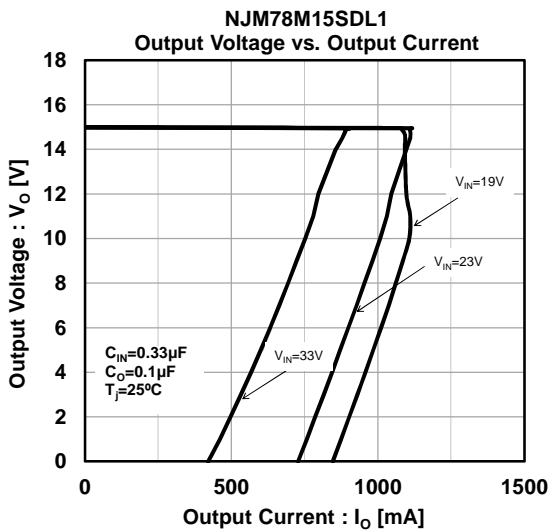
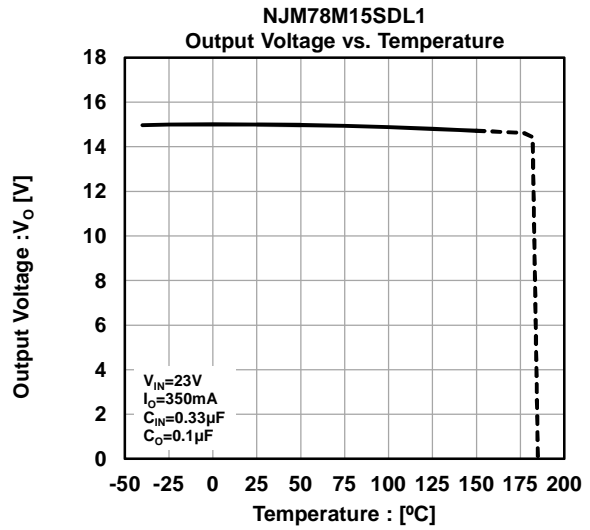
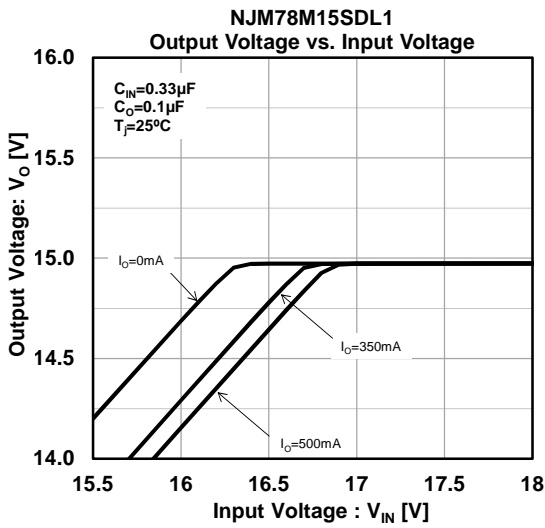


## ■ TYPICAL CHARACTERISTICS (5V)



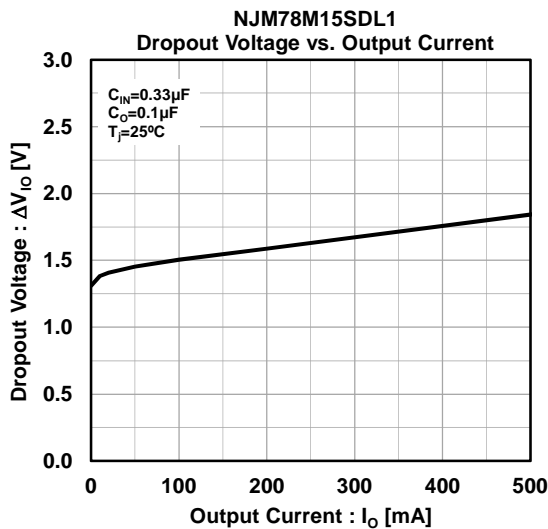
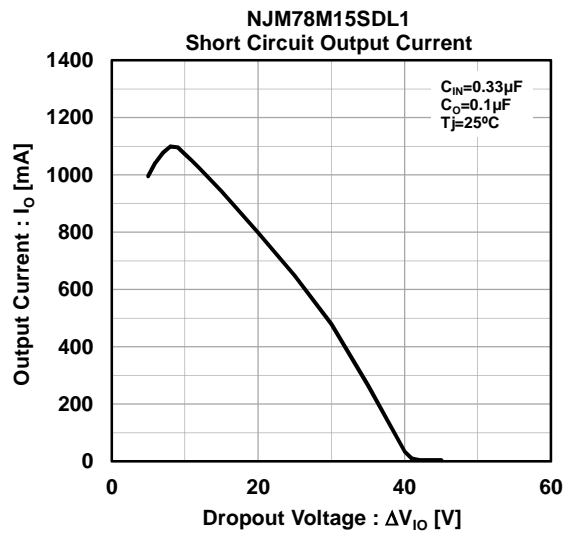
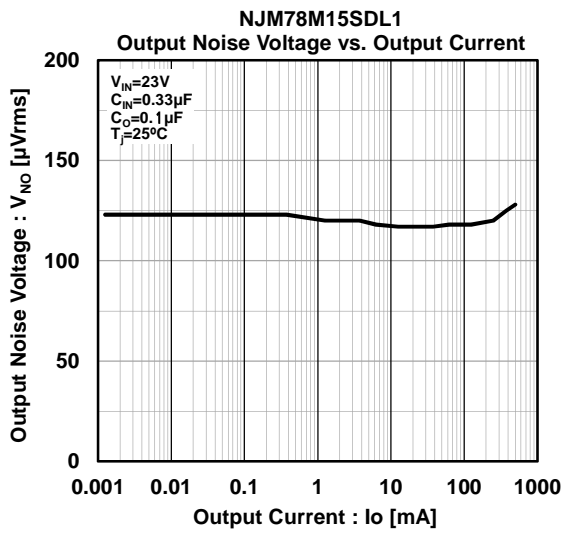
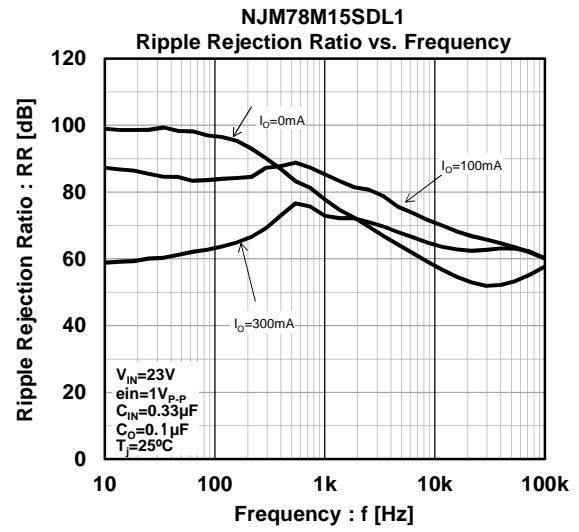
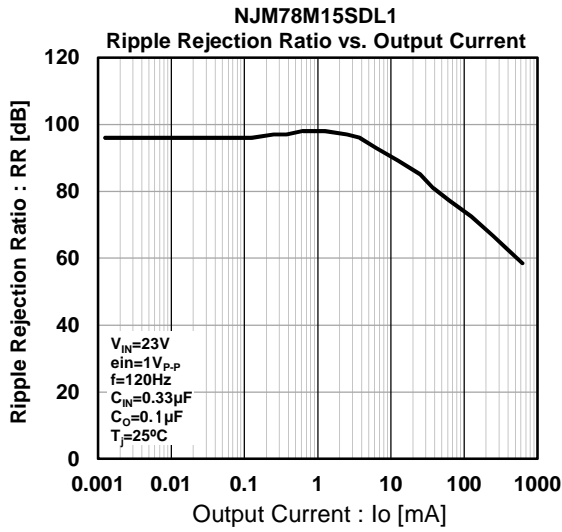
# NJM78M00S

## ■ TYPICAL CHARACTERISTICS (15V)





## ■ TYPICAL CHARACTERISTICS (15V)



# NJM78M00S

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## MEMO

**[CAUTION]**

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