

3-TERMINAL POSITIVE VOLTAGE REGULATOR

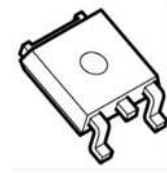
■ GENERAL DESCRIPTION

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

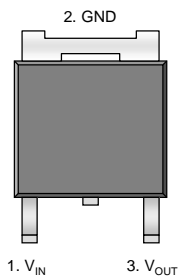


NJM78M00SDL1
(TO-252-3)

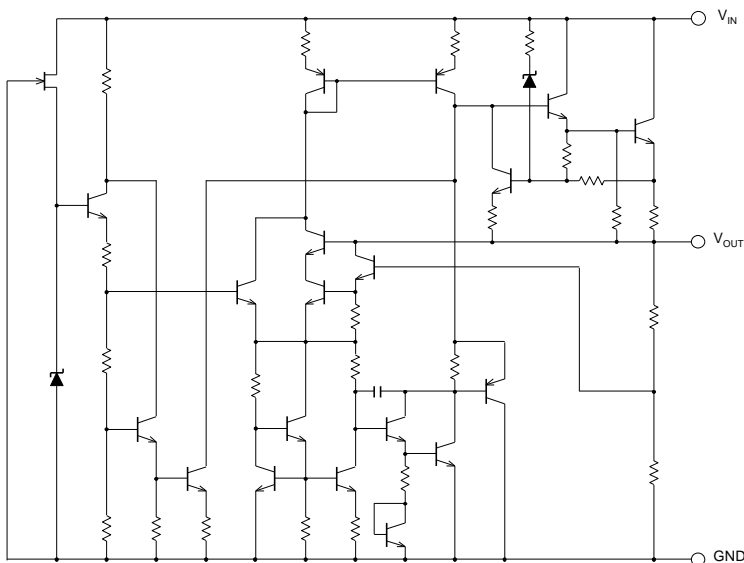
■ FEATURES

- 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 100mm²)

(*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
NJM78M05SDL1						
Output Voltage	V_O	$V_{IN}=10\text{V}$, $I_O=0.35\text{A}$	4.85	5.0	5.15	V
Line Regulation	ΔV_O-V_{IN}	$V_{IN}=7\text{V}$ to 25V, $I_O=0.2\text{A}$	-	3	50	mV
Load Regulation	ΔV_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	-	μVrms
Dropout Voltage	ΔV_{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	ΔV_O-V_{IN}	$V_{IN}=11.5\text{V}$ to 25V, $I_O=0.2\text{A}$	-	6	60	mV
Load Regulation	ΔV_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	-	μVrms
Dropout Voltage	ΔV_{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.

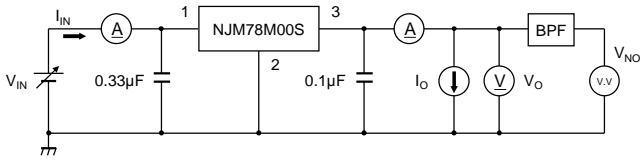
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
NJM78M12SDL1						
Output Voltage	V_O	$V_{IN}=19\text{V}$, $I_O=0.35\text{A}$	11.64	12.0	12.36	V
Line Regulation	$\Delta V_O/V_{IN}$	$V_{IN}=14.5\text{V}$ to 30V , $I_O=0.2\text{A}$	-	8	60	mV
Load Regulation	$\Delta V_O/I_O$	$V_{IN}=19\text{V}$, $I_O=0.005\text{A}$ to 0.5A	-	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	-	μV_{rms}
Dropout Voltage	ΔV_{IO}	$I_O=0.5\text{A}$	-	1.8	-	V

NJM78M15SDL1						
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 30V , $I_O=0.2\text{A}$	-	10	60	mV
Load Regulation 1	$\Delta V_O/I_O$	$V_{IN}=23\text{V}$, $I_O=0.005\text{A}$ to 0.5A	-	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	-	μV_{rms}
Dropout Voltage	ΔV_{IO}	$I_O=0.5\text{A}$	-	1.8	-	V

NJM78M00S

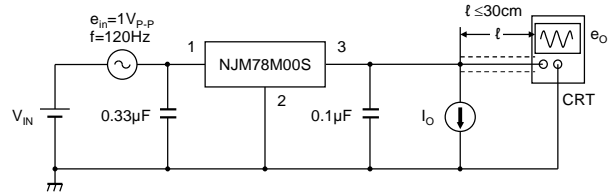
■ TEST CIRCUIT

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

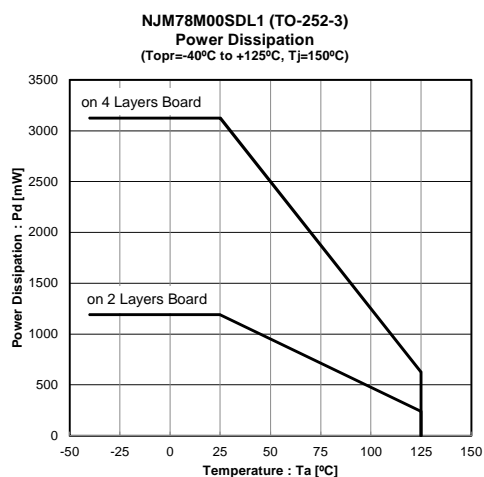
PARAMETER	SYMBOL	VALUE	UNIT
Junction-to-Ambient Thermal Resistance	θ_{ja}	105 (*1) 40 (*2)	°C/W
Junction-to-Top of Package Characterization Parameter	ψ_{jt}	17 (*1) 12 (*2)	°C/W

(*1) Mounted on glass epoxy board. (76.2×114.3×1.6mm:EIA/JDEC standard size, 2Layers, copper area 100mm²)

(*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



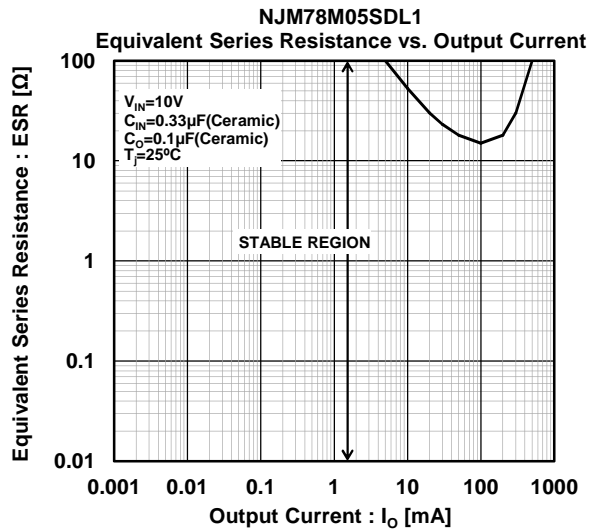
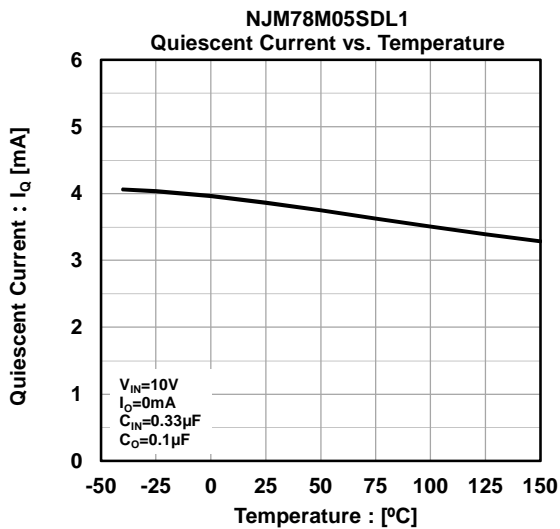
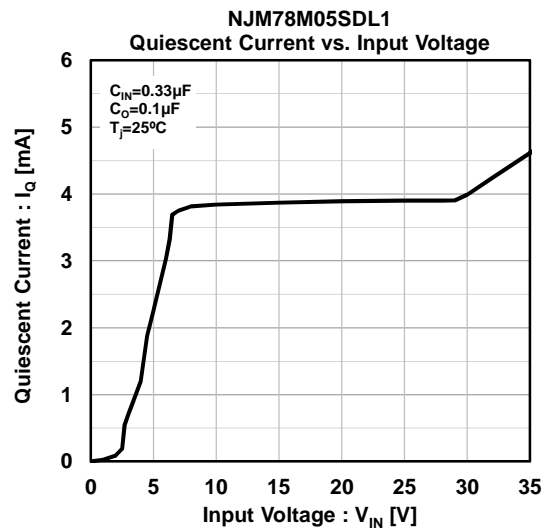
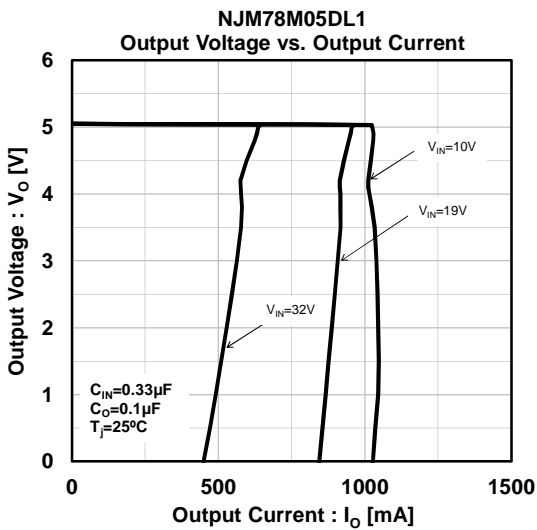
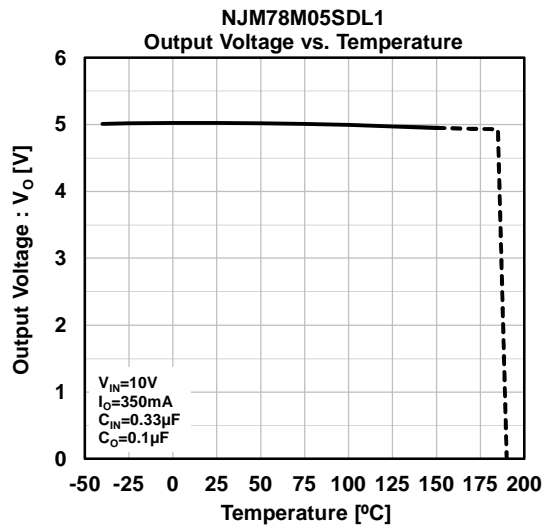
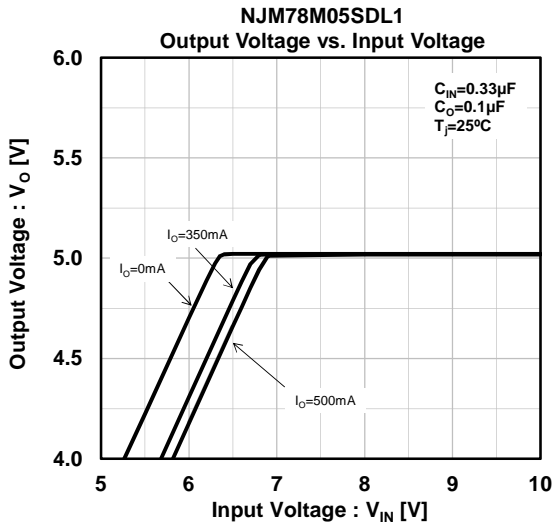
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(*2) Mounted on glass epoxy board. (76.2×114.3×1.6mm:EIA/JDEC standard size, 4Layers)

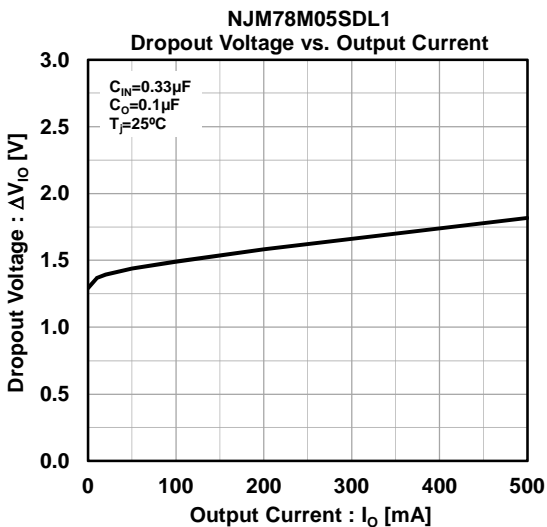
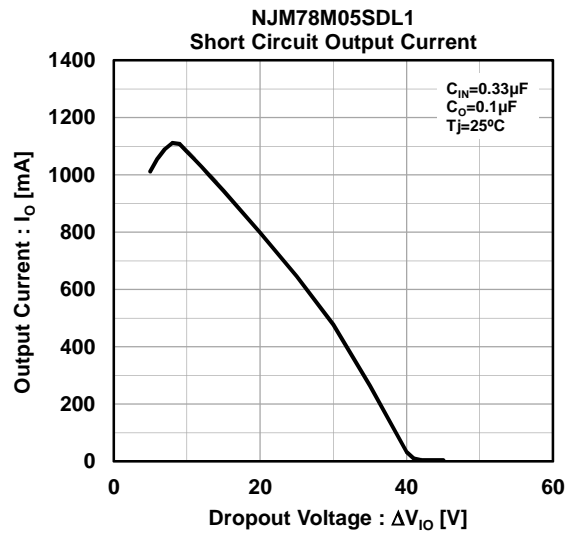
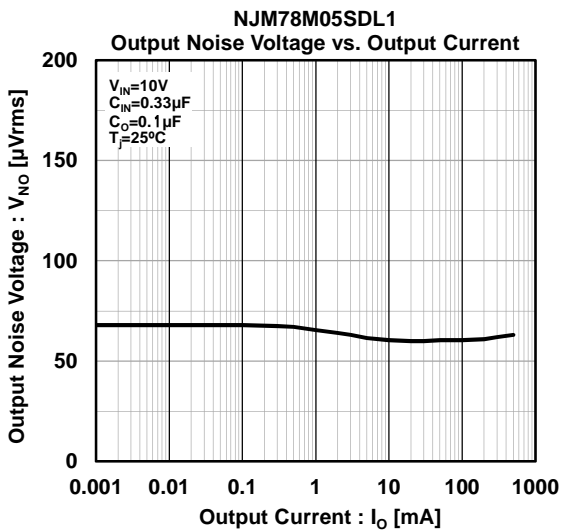
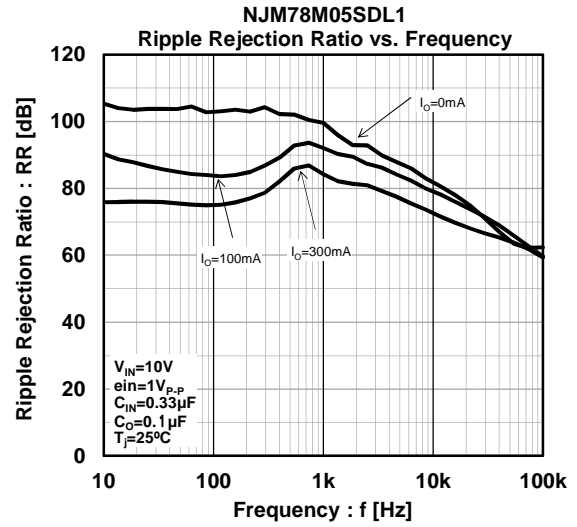
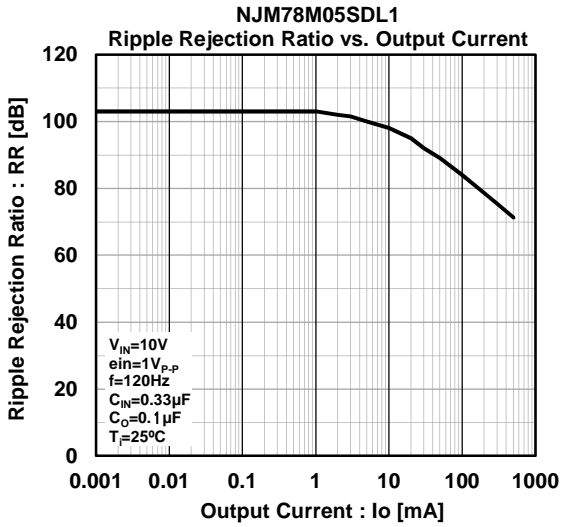
(4Layers inner foil: 74.2 ×74.2mm applying a thermal via hole to a board based on JEDEC standard JESD51-5)

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■ TYPICAL CHARACTERISTICS (5V)

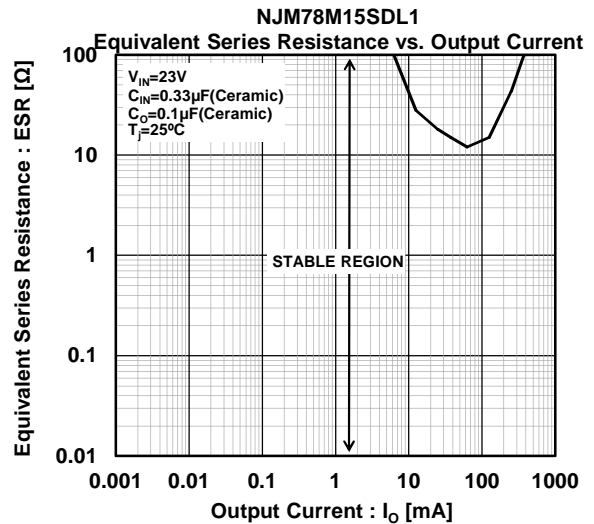
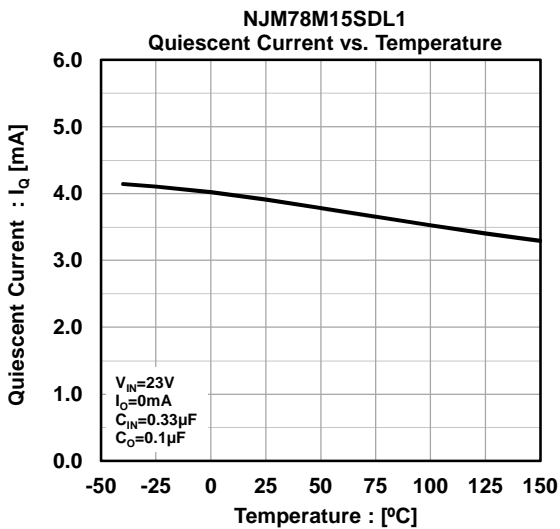
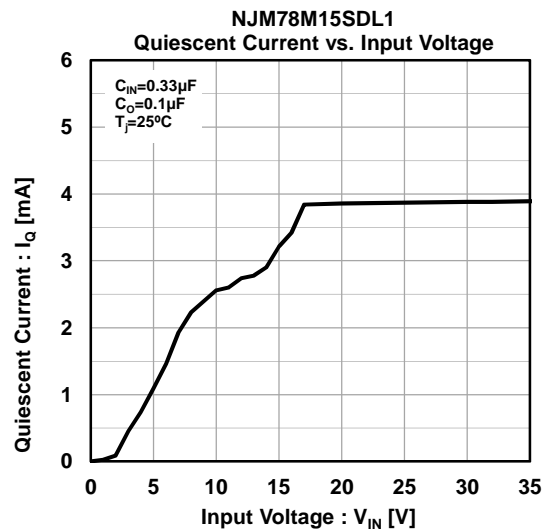
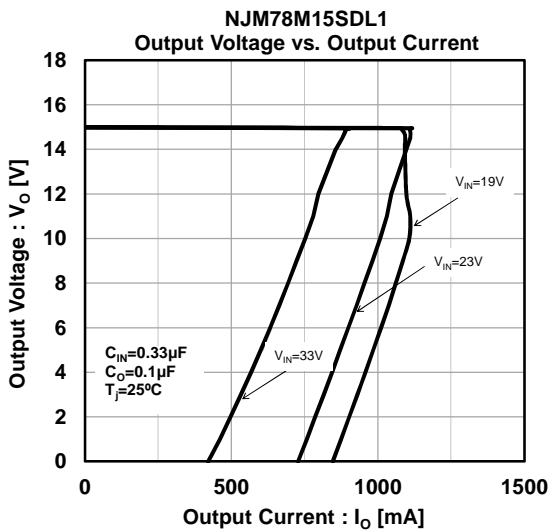
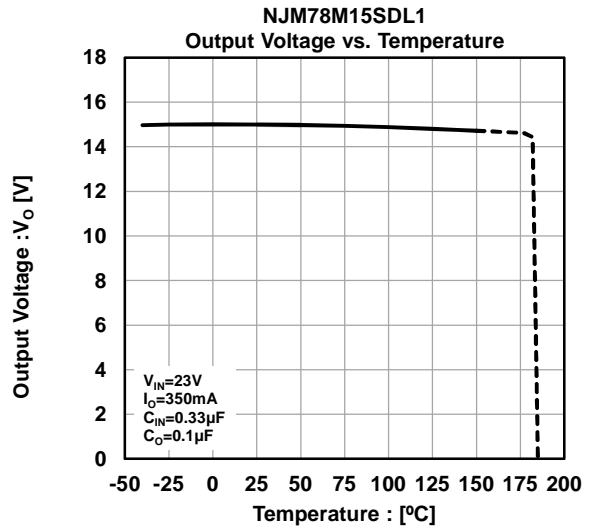
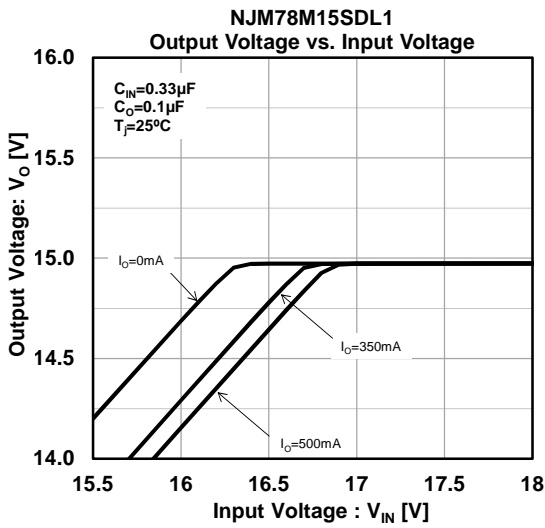


■ TYPICAL CHARACTERISTICS (5V)

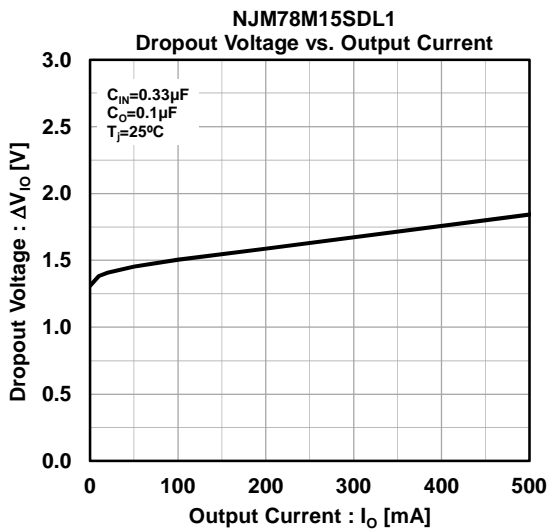
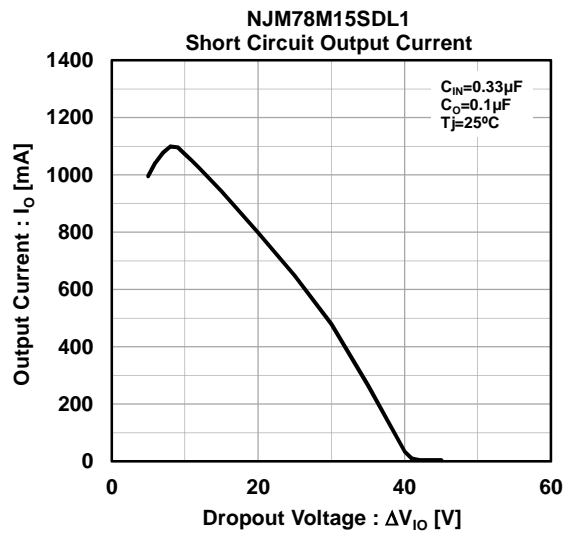
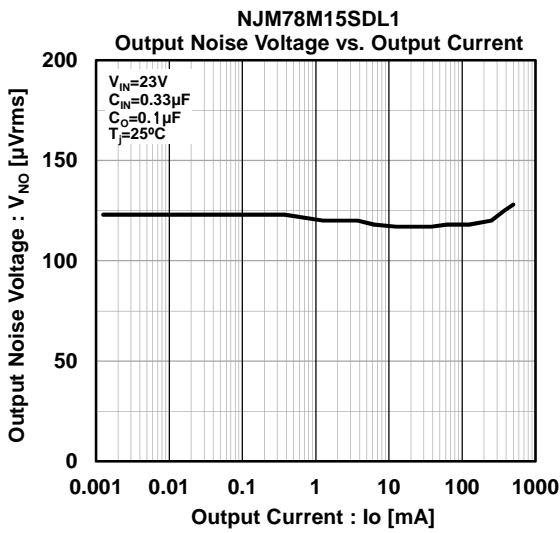
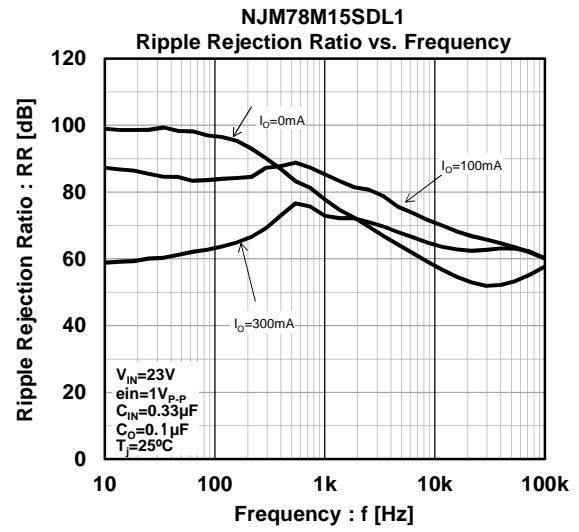
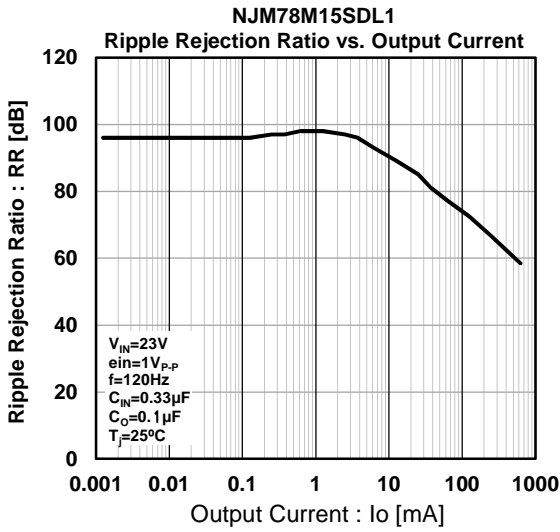


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■ TYPICAL CHARACTERISTICS (15V)



■ TYPICAL CHARACTERISTICS (15V)



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MEMO

[CAUTION]

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