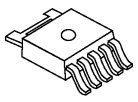
ADJUSTABLE LOW DROPOUT VOLTAGE REGULATOR

WITH ON/OFF CONTROL

■ GENERAL DESCRIPTION

The NJM2387A is an adjustable low dropout voltage regulator.
The output current is up to 1.0A and dropout voltage is 0.2V typ. at Io=0.5A.
OFF control quiescent current is drastically reduced compare with the current NJM2387 through changing ON/OFF control circuit.
The NJM2387A is suitable for power module, TV, Display, car stereo and low power applications.

■ PACKAGE OUTLINE

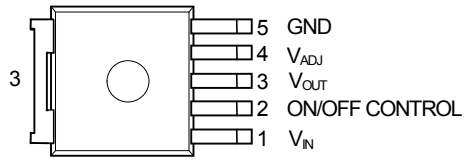


NJM2387ADL3

■ FEATURES

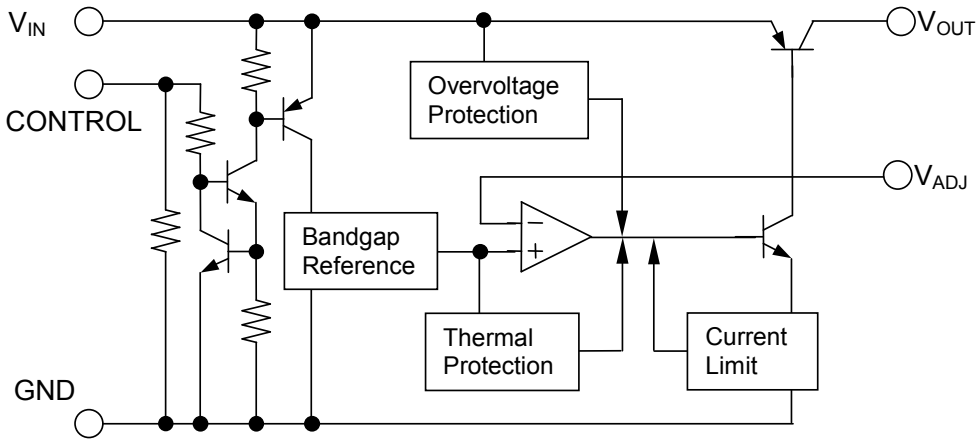
- Low Dropout Voltage ΔV_{I-O}=0.2V typ. at Io=0.5A
- Output Current Io(max.)=1.0A
- Reference Voltage Vref=1.26V ± 2%
- ON/OFF Control
- OFF Control Quiescent Current 1μA max.
- Internal Short Circuit Current Limit
- Internal Overvoltage Protection
- Internal Thermal Overload Protection
- Bipolar Technology
- Package Outline TO-252-5

■ PIN CONFIGURATION



NJM2387ADL3

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	+35	V
Control Voltage	V_{CONT}	+35(*1)	V
Adjust Terminal Voltage	V_{ADJ}	+6	V
Power Dissipation	P_D	1190(*2)	mW
		3125(*3)	
Operating Junction Temperature Range	Tj	-40 ~ +150	°C
Operating Temperature Range	Topr	-40 ~ +85	°C
Storage Temperature Range	Tstg	-50 ~ +150	°C

(*1): When input voltage is less than +35V, the absolute maximum control voltage is equal to the input voltage.

(*2): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JEDEC standard size, 2Layers, Cu area 100mm^2)

(*3): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JEDEC standard, 4Layers)

(For 4Layers: Applying 74.2 × 74.2mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

■ ELECTRICAL CHARACTERISTICS (V_{IN}=15V, V_O=10V, Io=0.5A, R1=1kΩ, C_{IN}=0.33μF, Co=22μF, Tj=25°C)

Measurement is conducted by pulse testing.

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Input Voltage	V_{IN}		3.8	-	30	V
Output Voltage	$V_{O(ADJ)}$		1.5	-	20	V
Reference Voltage	Vref		1.235	1.26	1.285	V
Line Regulation	$\Delta Vo/\Delta V_{IN}$	$V_{IN}=V_O+1V \sim V_O+17V$	-	0.04	0.16	%/V
Load Regulation	$\Delta Vo/\Delta Io$	$V_{IN}=V_O+2V$,Io=0A ~ 1.0A	-	0.2	1.4	%/A
Average Temperature Coefficient of Output Voltage	$\Delta Vo/\Delta T$	Tj=0 ~ +125°C	-	± 0.02	-	%/°C
Quiescent Current	I_Q	Io=0A, V_{CONT}=2.7V Except I_{CONT}	-	-	5	mA
OFF Control Quiescent Current	$I_{Q(OFF)}$	V_{CONT}=0V	-	-	1	μA
Dropout Voltage	ΔV_{I-O}	Io=0.5A	-	0.2	0.5	V
Ripple Rejection	RR	Vin=Vo+2V, ein=0.5Vrms ein=0.5Vrms, f=120Hz	52	65	-	dB
ON Control Voltage	$V_{CONT(ON)}$		2.0(*4)	-	-	V
OFF Control Voltage	$V_{CONT(OFF)}$		-	-	0.4	V
ON Control Current	$I_{CONT(ON)}$	V_C=2.7V	10	30	50	μA
OFF Control Current	$I_{CONT(OFF)}$	V_C=0.4V	1	3	5	μA

(*4): When ON/OFF CONTROL pin is open, Output Voltage is OFF.

■ THERMAL CHARACTERISTICS

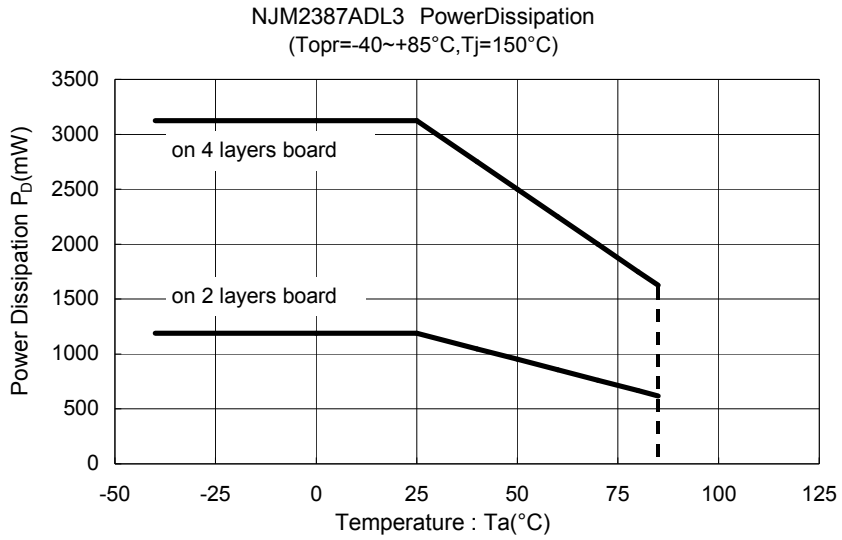
PARAMETER	SYMBOL	VALUE	UNIT
Junction-to-Ambient thermal resistance	θja	105 (*5) 40 (*6)	°C/W
Junction-to-Top of package characterization parameter	ψjt	17 (*5) 12 (*6)	°C/W

(*5): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JEDEC standard size, 2Layers, Cu area 100mm^2)

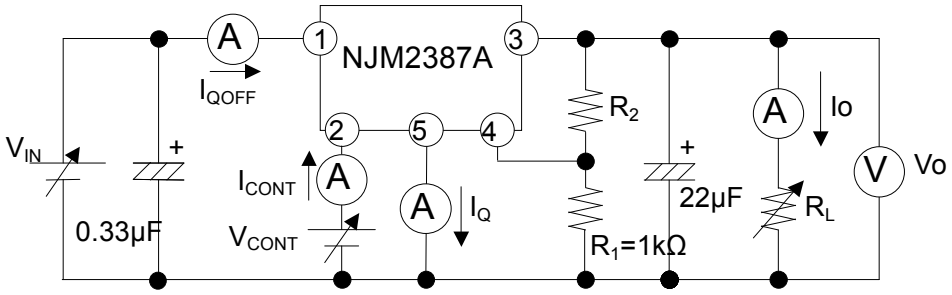
(*6): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JEDEC standard, 4Layers)

(For 4Layers: Applying 74.2 × 74.2mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



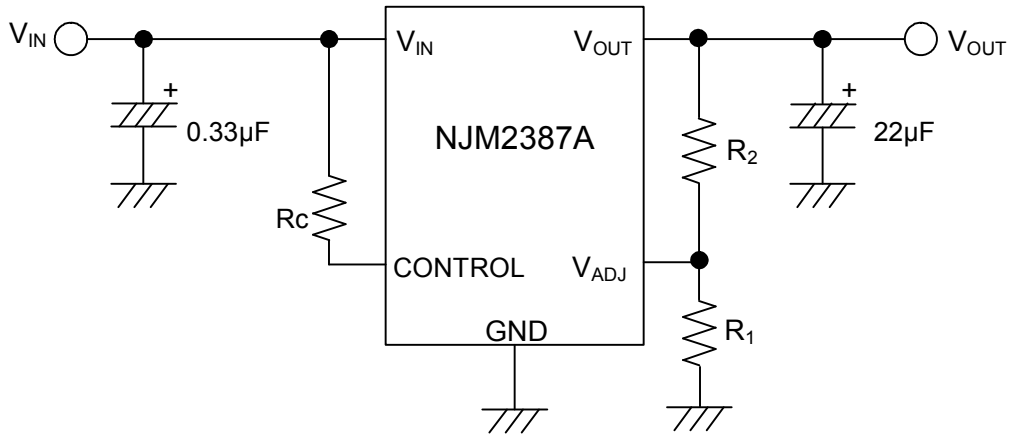
■ TEST CIRCUIT



Vo = Vref × (1 + R2/R1)

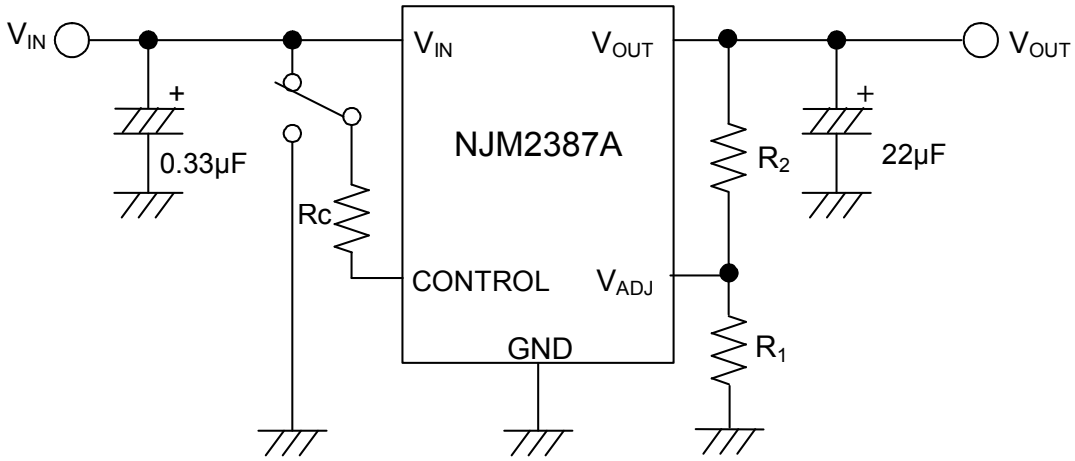
■ TYPICAL APPLICATION

① In the case where ON/OFF Control is not required:



Connect control pin to V_{IN} pin.

② In use of ON/OFF CONTROL:



State of control pin:

- "H" → output is enabled.
- "L" or "open" → output is disabled.

*Feed back Resistance R1

The output voltage may rise against the set point by the leak current from the V_{OUT} pin at high temperature when this resistance is set too big.

Conversely, the current flowing to R1 grows big when R1 is set too small, and make the consumption current increase.

From the above, recommend 100Ω to 20kΩ as a set range of R1.

*In the case of using a resistance "Rc" between V_{IN} and control.

If this resistor is inserted, it can reduce the control current when the control voltage is high.

The applied voltage to control pin should set to consider voltage drop through the resistor “Rc” and the minimum control voltage for ON-state.

The $V_{CONT\ (ON)}$ and I_{CONT} have temperature dependence as shown in the "Control Current vs. Temperature" and " Control Voltage vs. Temperature" characteristics. Therefore, the resistance "Rc" should be selected to consider the temperature characteristics.

*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.

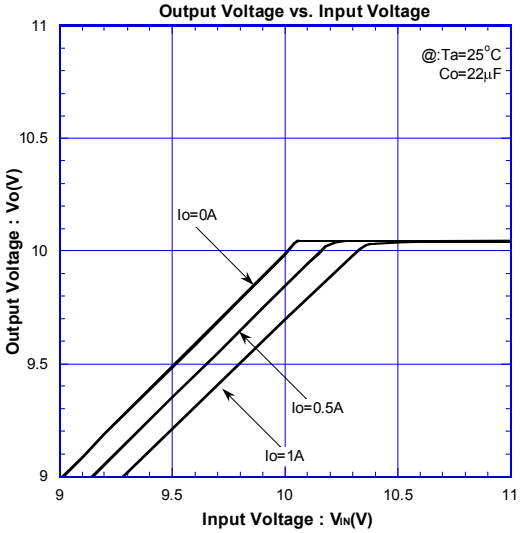
On the other hand, Use of a larger C_O reduces output noise and ripple output, and also improves output transient response when rapid load change.

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

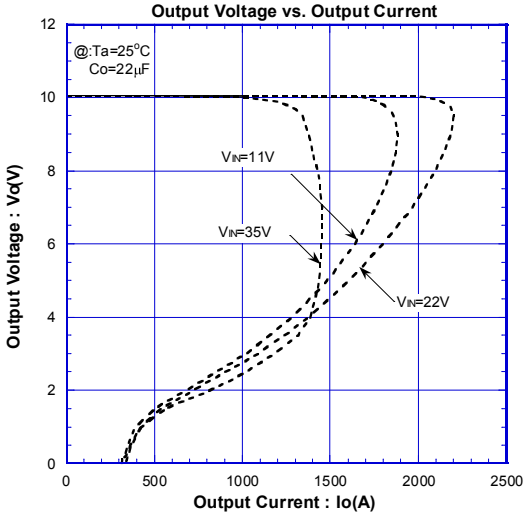
In addition, Please choose an appropriate capacitor in considering varied characteristics of capacitor (a frequency characteristic, a temperature characteristic, and so on) when selecting C_O.

■ TYIPICAL CHARACTERISTICS

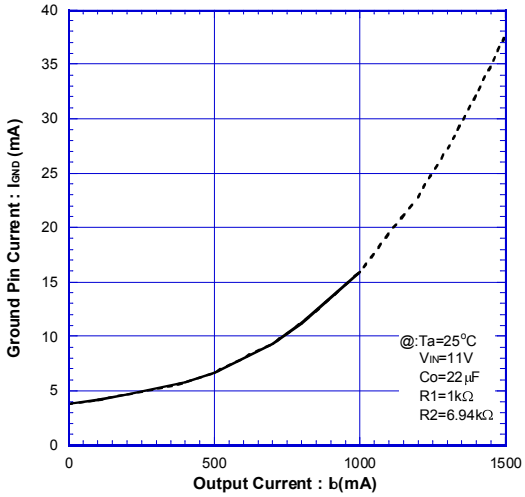
NJM2387A_10V
Output Voltage vs. Input Voltage



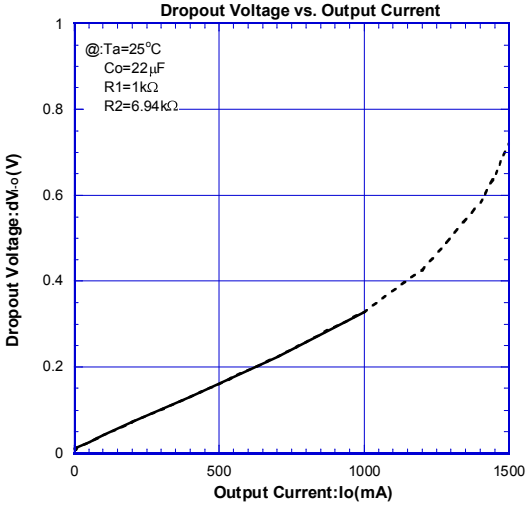
NJM2387A_10V
Output Voltage vs. Output Current



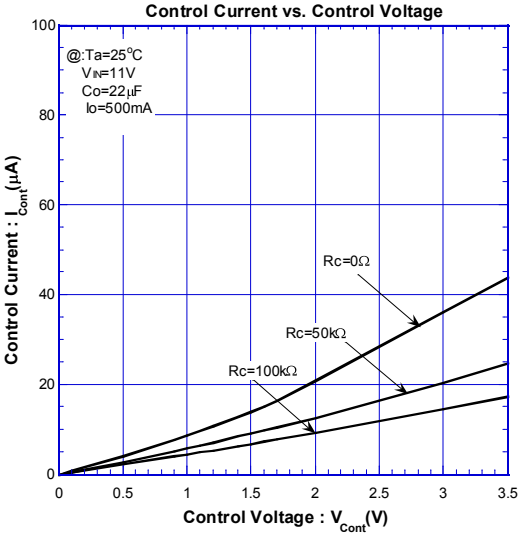
NJM2387A_10V
Ground Pin Current v.s. Output Current



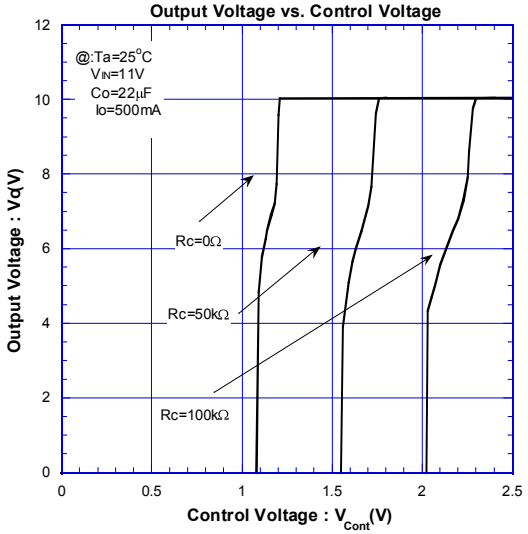
NJM2387A_10V
Dropout Voltage vs. Output Current



NJM2387A_10V
Control Current vs. Control Voltage

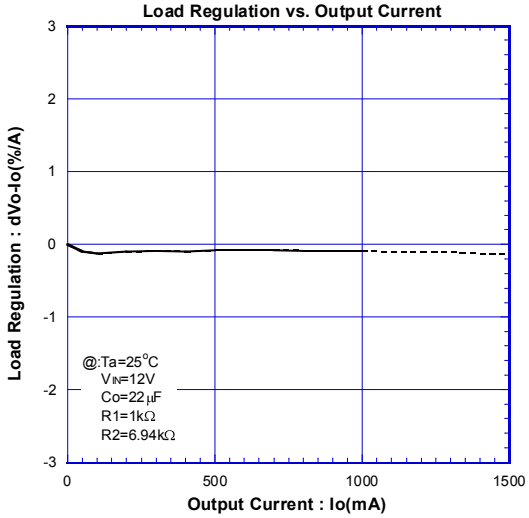


NJM2387A_10V
Output Voltage vs. Control Voltage

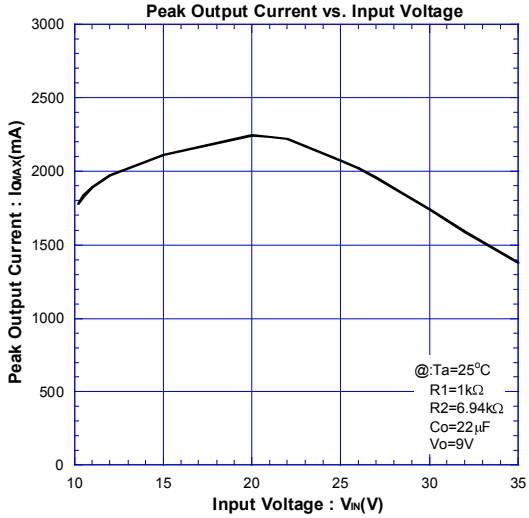


■ TYIPICAL CHARACTERISTICS

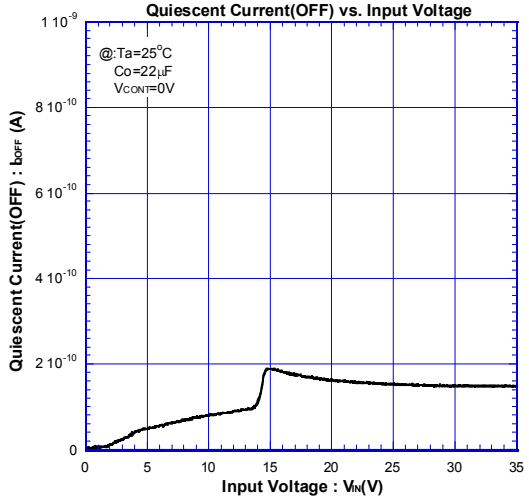
NJM2387A_10V
Load Regulation vs. Output Current



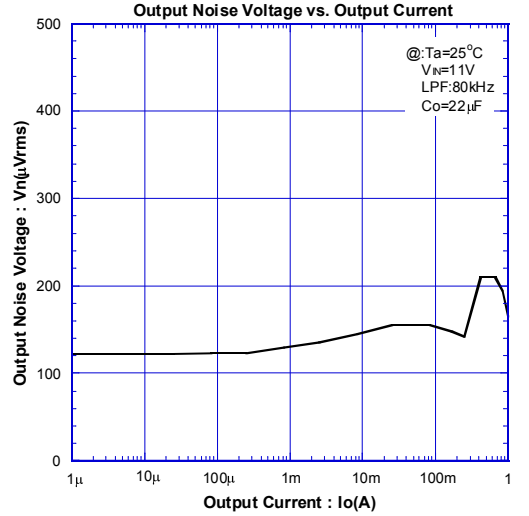
NJM2387A_10V
Peak Output Current vs. Input Voltage



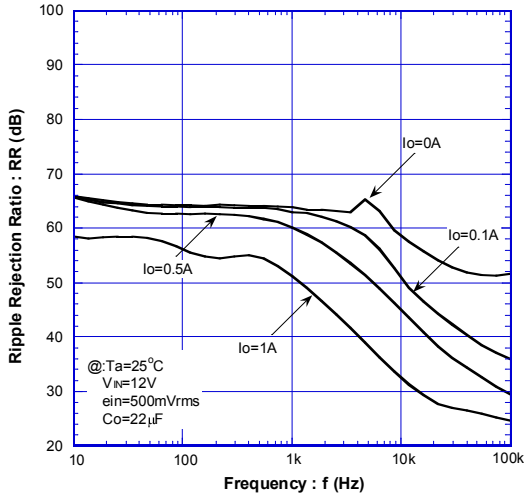
NJM2387A_10V
Quiescent Current(OFF) vs. Input Voltage



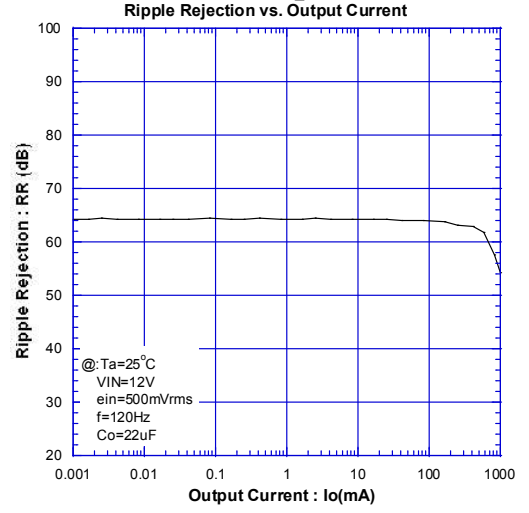
NJM2387A_10V
Output Noise Voltage vs. Output Current



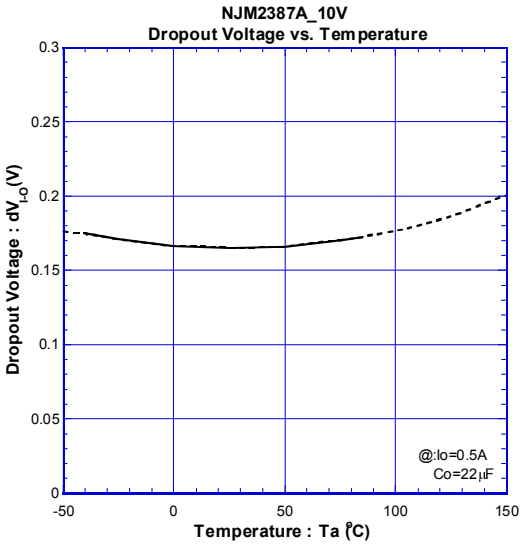
NJM2387A_10V
Ripple Rejection Ratio v.s. Frequency

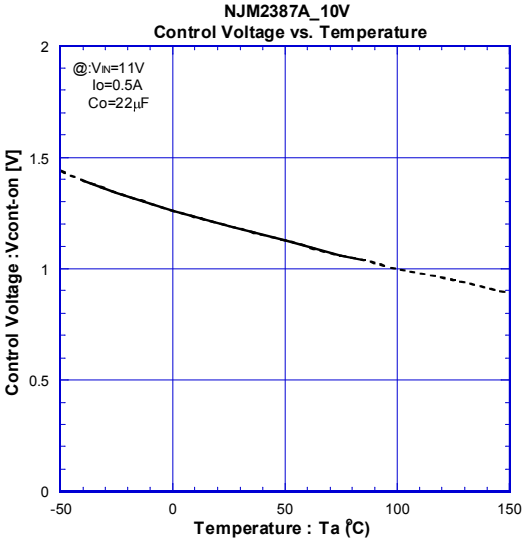


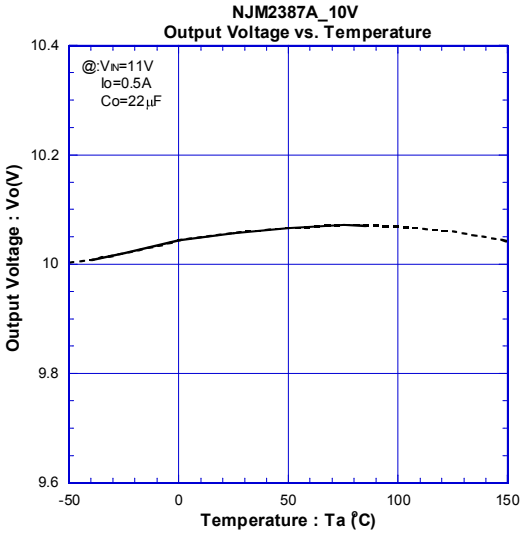
NJM2387A_10V
Ripple Rejection vs. Output Current

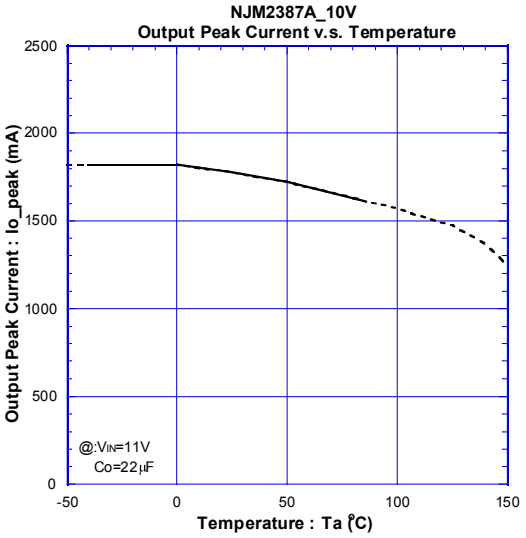


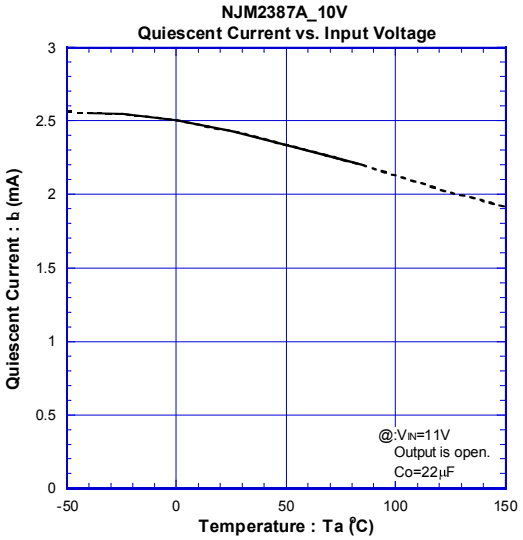
■ TYIPICAL CHARACTERISTICS











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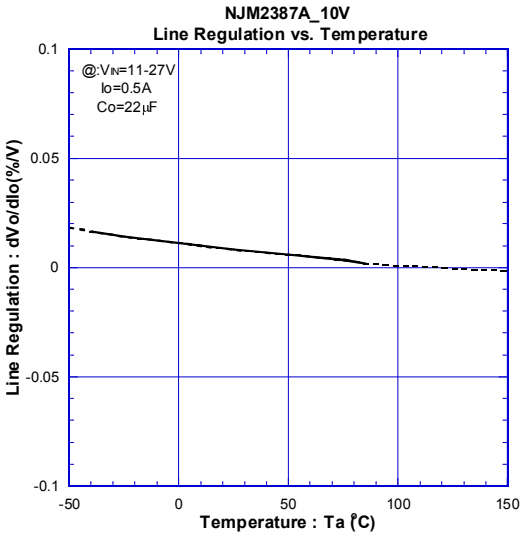
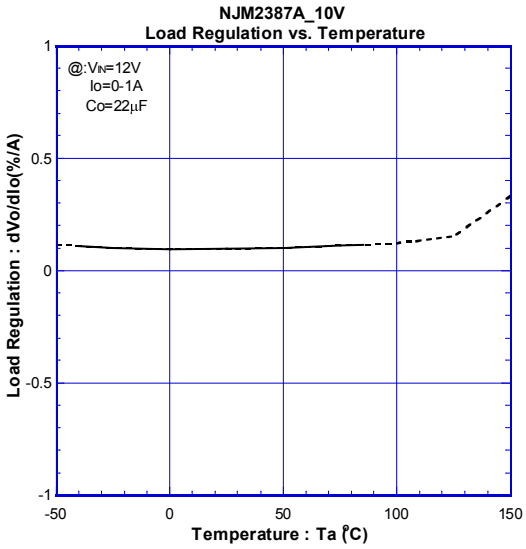
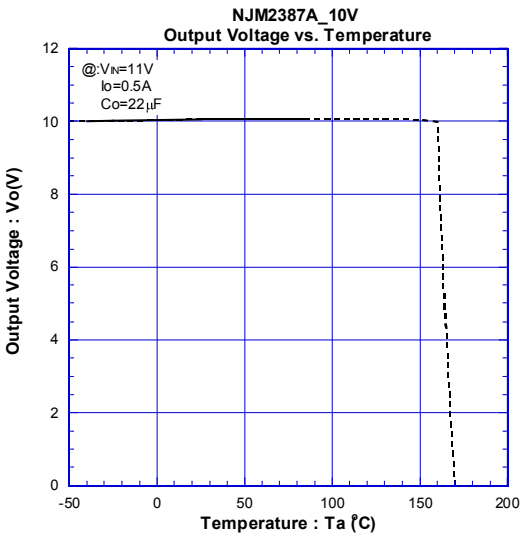
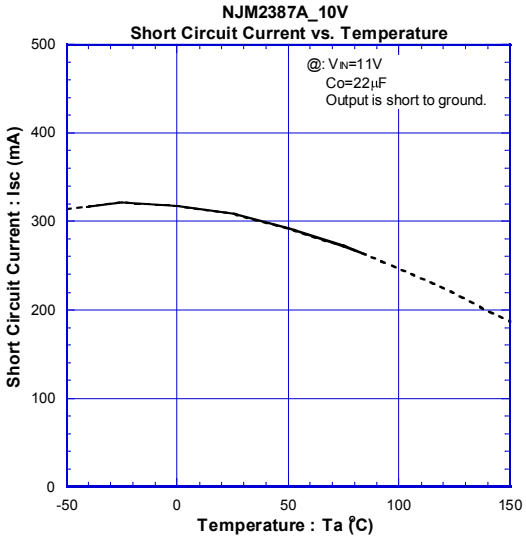


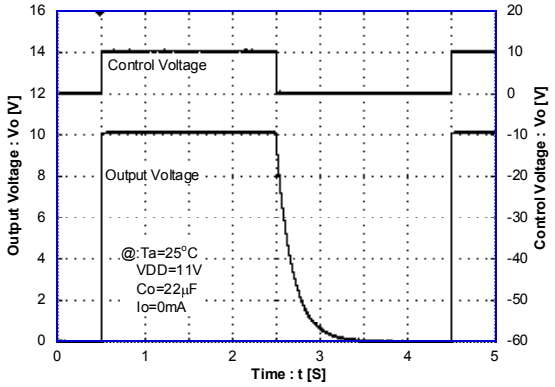




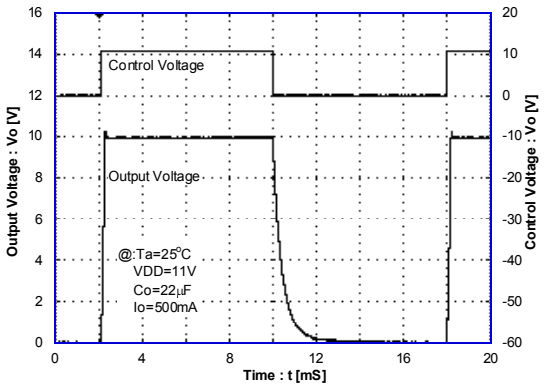


■ TYIPICAL CHARACTERISTICS

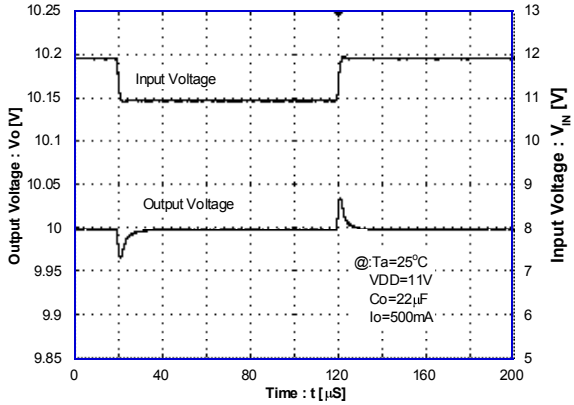
NJM2387A_10.0V
ON/OFF Transient Response without Load



NJM2387A_10.0V
ON/OFF Transient Response



NJM2387A_10.0V
Input Transient Response



NJM2387A_10.0V
Load Transient Response