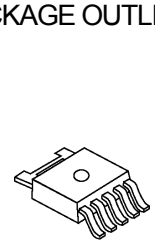
ADJUSTABLE LOW DROPOUT VOLTAGE REGULATOR

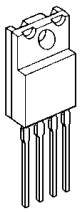
■ GENERAL DESCRIPTION

The NJM2387/89 are adjustable low dropout voltage regulators .
The output current is up to 1.0A and dropout voltage is 0.2V typ. at Io=0.5A. NJM2387 has ON/OFF control circuit and enable to reduce quiescent current.
The NJM2387/89 are suitable for power module, TV, Display, car stereo and low power applications.

■ PACKAGE OUTLINE



NJM2387DL3

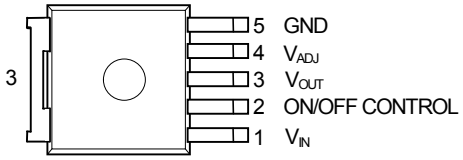


NJM2389F

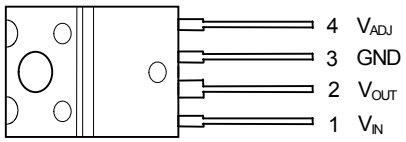
■ FEATURES

- 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 (Active High : Only NJM2387)
- Internal Short Circuit Current Limit
- Internal Overvoltage Protection
- Internal Thermal Overload Protection
- Bipolar Technology
- Package Outline TO-252-5(NJM2387), TO-220F-4(NJM2389)

■ PIN CONFIGURATION

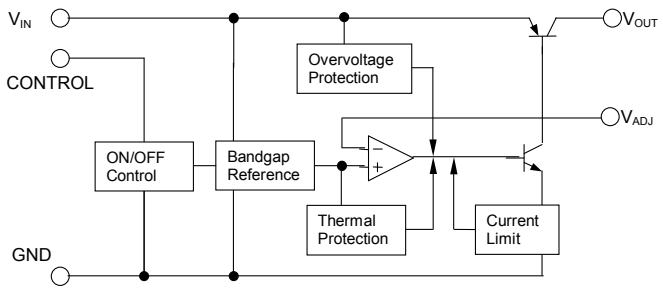


NJM2387DL3

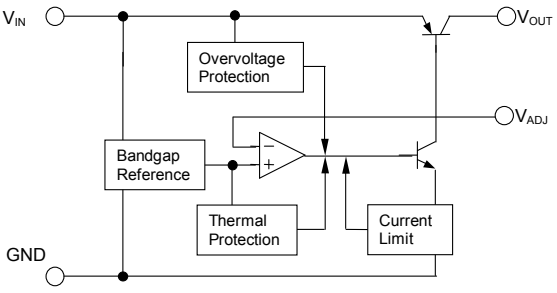


NJM2389F

■ BLOCK DIAGRAM



NJM2387DL3



NJM2389F

■ 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	NJM2387	1190(*2) / 3125(*3)	mW
		NJM2389	18(Tc<50°C)	W
Operating Junction Temperature Range	Tj	-40 ~ +150		°C
Operating Temperature Range	Topr	-40 ~ +85		°C
Storage Temperature Range	Tstg	-50 ~ +150		°C

(*1): This applies for NJM2387. 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/JDEC standard size, 2Layers, Cu area 100mm^2)

(*3): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC 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)

■ NJM2387

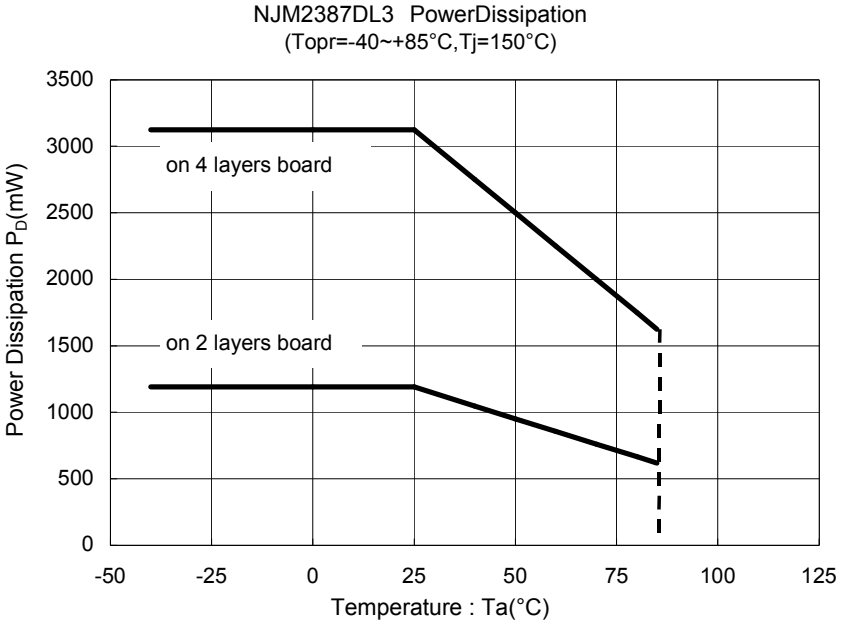
■ ELECTRICAL CHARACTERISTICS (V_{IN}=15V, V_O=10V, Io=0.5A, R1=1kΩ, C_{IN}=0.33μF, Co=22μF, Ta=25°C)

Measurement is to be conducted is pulse testing.

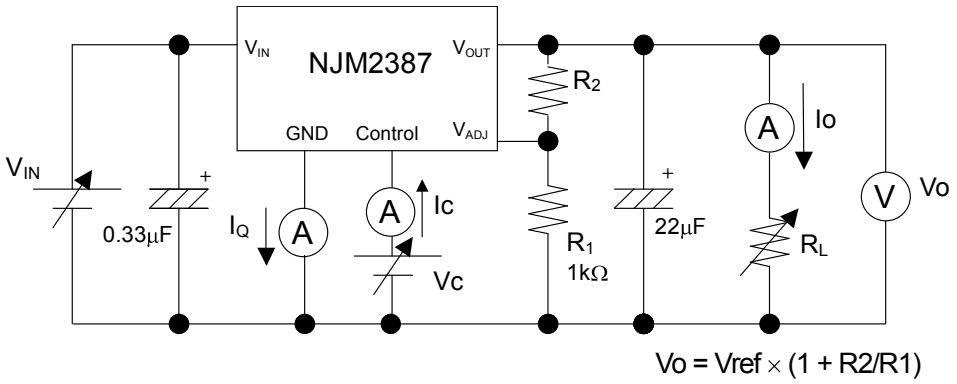
PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
Input Voltage	V_{IN}	-	3.8	-	35	V
Output Voltage	V_{OUT}	-	1.5	-	20	V
Reference Voltage	Vref	-	1.235	1.26	1.285	V
Line Regulation	$\Delta Vo/\Delta V_{IN}$	$V_{IN}=V_O+1V \sim V_O+17V$	-	0.04	0.16	%/V
Load Regulation	$\Delta Vo/\Delta Io$	$V_{IN}=V_O+2V$,Io=0A ~ 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	-	-	5	mA
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	-	-	20	μA
OFF Control Current	$I_{CONT(OFF)}$	V_C=0.4V	-	-	-20	μA

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

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

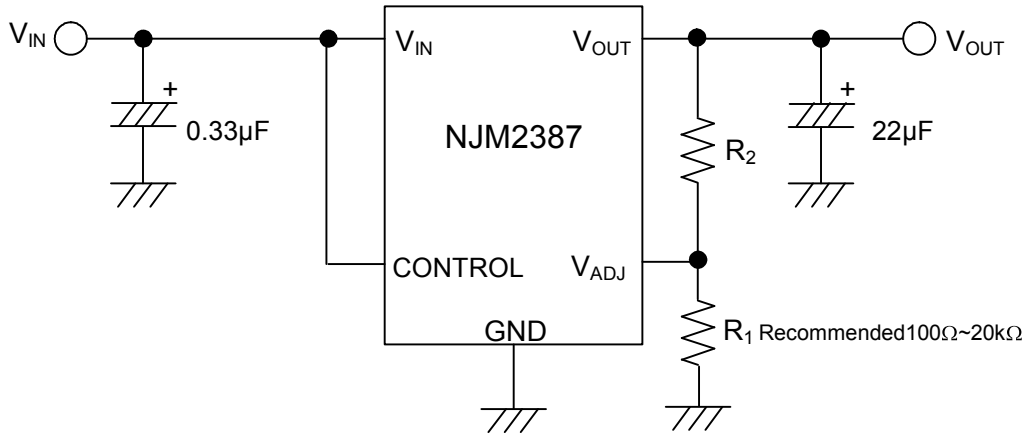


■ TEST CIRCUIT



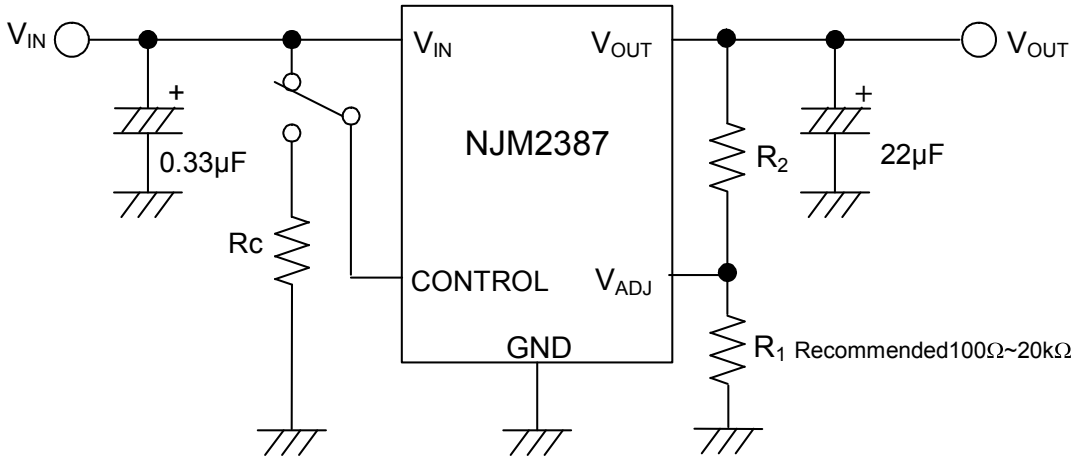
■ TYPICAL APPLICATION

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



Connect control pin to V_{IN} pin or open.

② In use of ON/OFF CONTROL:



State of control pin:

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

■ NJM2389

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

Measurement is to be conducted is pulse testing.

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
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Average Temperature Coefficient of Output Voltage	$\Delta Vo/\Delta T$	Tj=0 ~ +125°C	-	±0.02	-	%/°C
Quiescent Current	I_Q	Io=0A	-	-	5	mA
Dropout Voltage	ΔV_{I-O}	Io=0.5A	-	0.2	0.5	V
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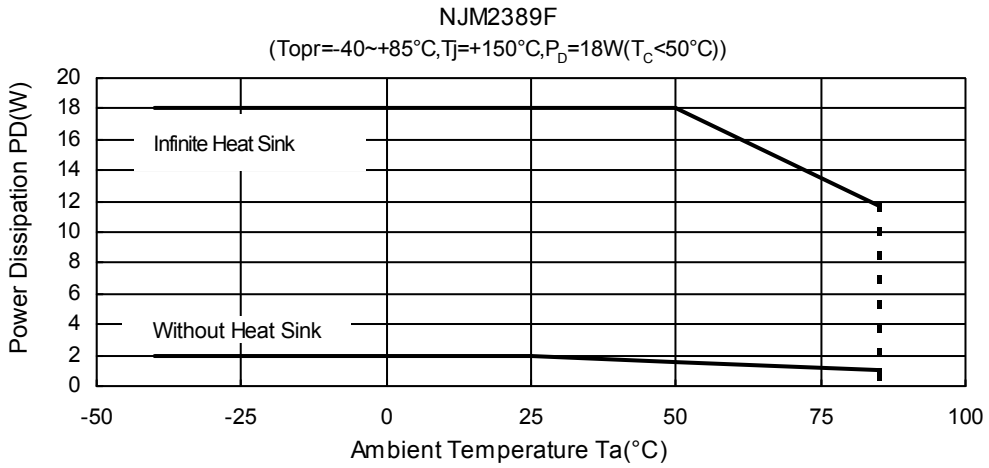
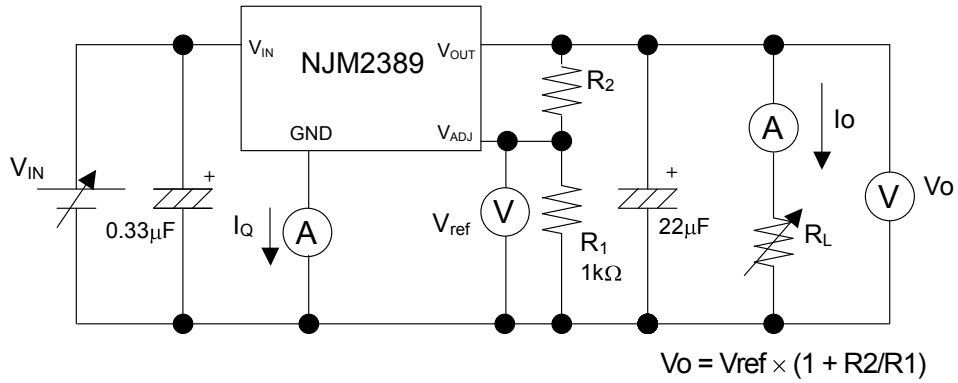
■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



■ TEST CIRCUIT



Vo = Vref × (1 + R2/R1)

*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.

*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.

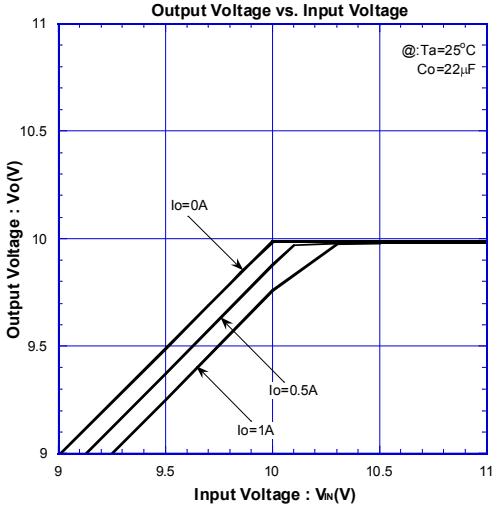
On the other hand, Use of a larger C_O reduces output noise and ripple output, and also improves output transient response when rapid load change.

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

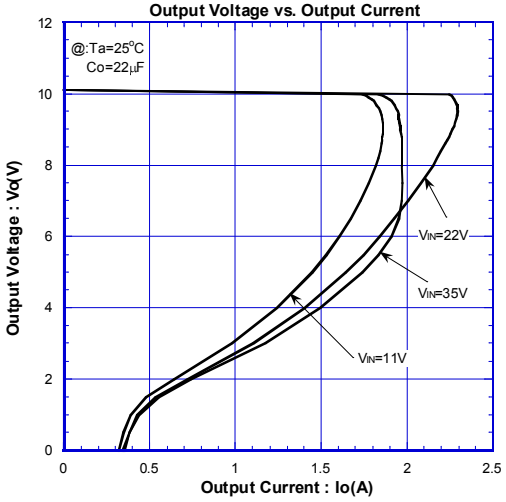
In addition, Please choose an appropriate capacitor in considering varied characteristics of capacitor (a frequency characteristic, a temperature characteristic, and so on) when selecting C_O.

■ TYPICAL CHARACTERISTICS

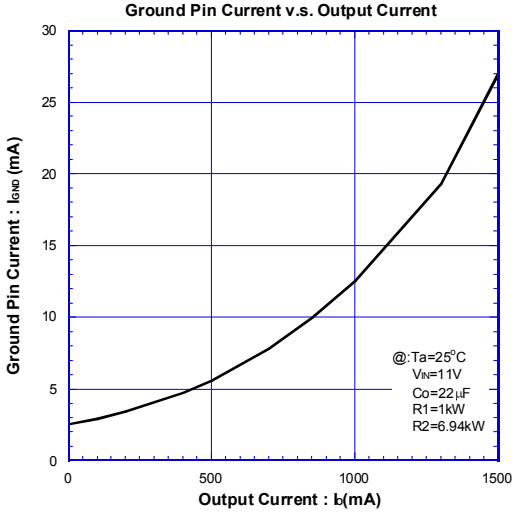
NJM2387/89_10V
Output Voltage vs. Input Voltage



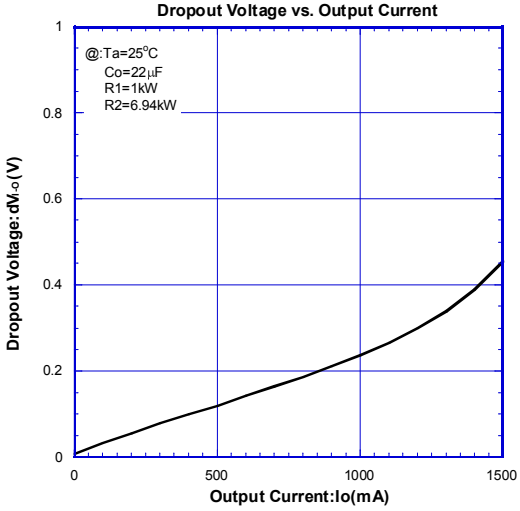
NJM2387/89_10V
Output Voltage vs. Output Current



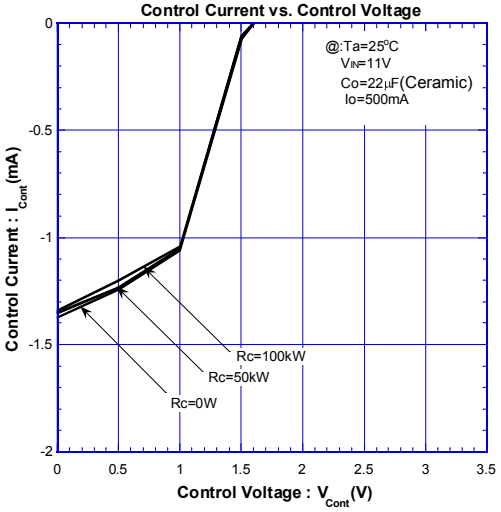
NJM2387/89_10V
Ground Pin Current v.s. Output Current



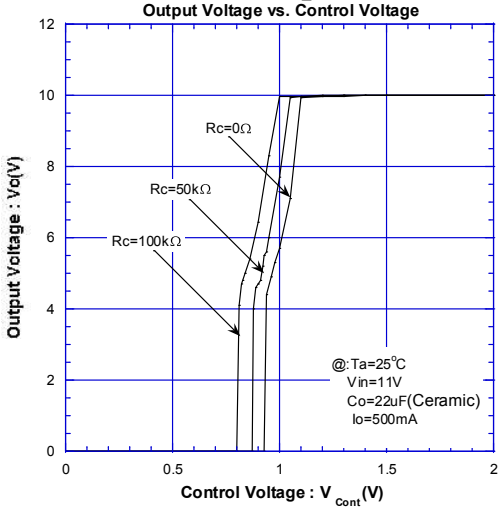
NJM2387/89_10V
Dropout Voltage vs. Output Current



NJM2387/89_10V
Control Current vs. Control Voltage

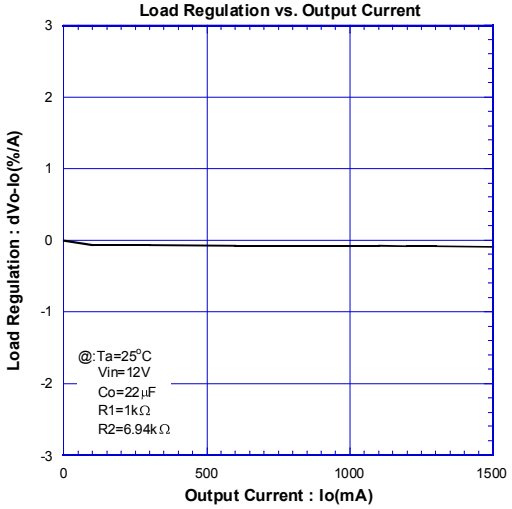


NJM2387_10V
Output Voltage vs. Control Voltage

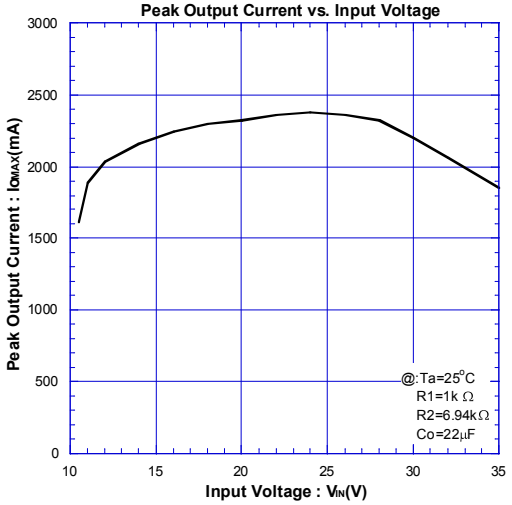


■ TYPICAL CHARACTERISTICS

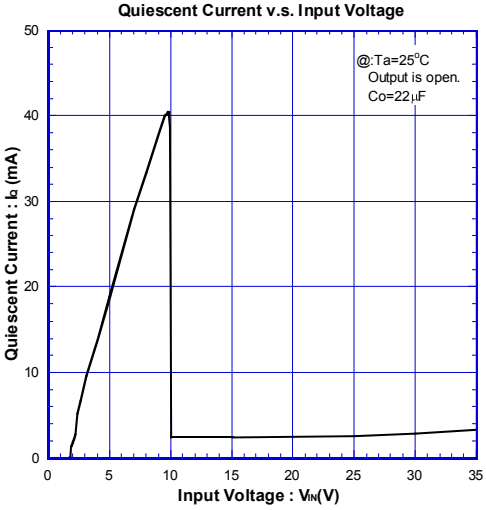
NJM2387/89_10V
Load Regulation vs. Output Current



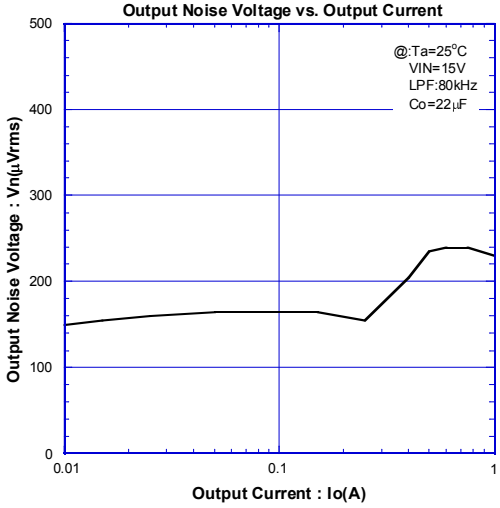
NJM2387/89_10V
Peak Output Current vs. Input Voltage



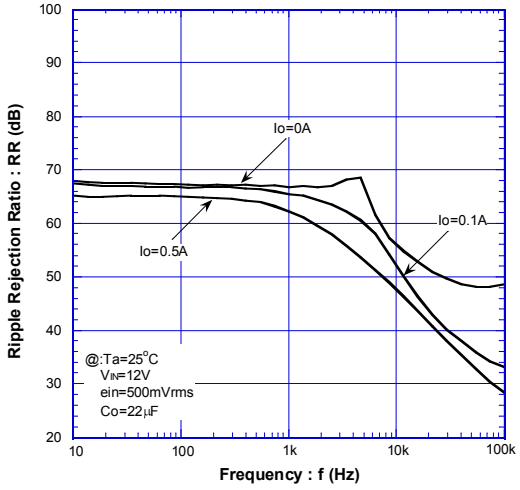
NJM2387/89_10V
Quiescent Current v.s. Input Voltage



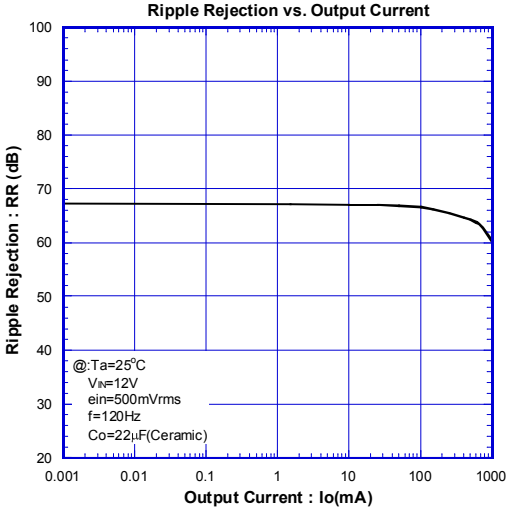
NJM2387/89_10V
Output Noise Voltage vs. Output Current



NJM2387/89_10V
Ripple Rejection Ratio v.s. Frequency

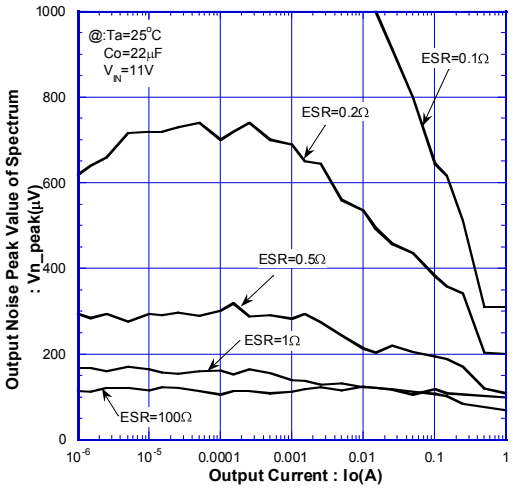


NJM2387/89_10V
Ripple Rejection vs. Output Current

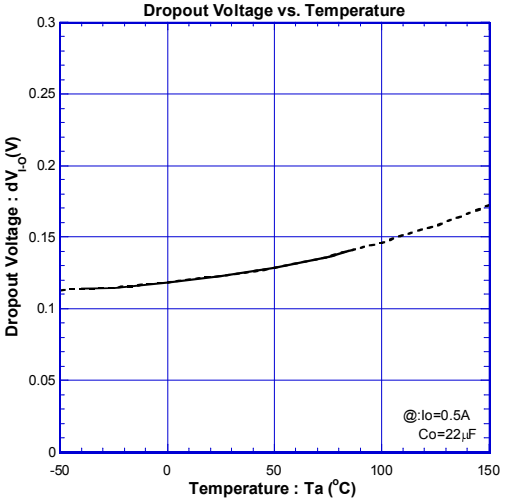


■ TYPICAL CHARACTERISTICS

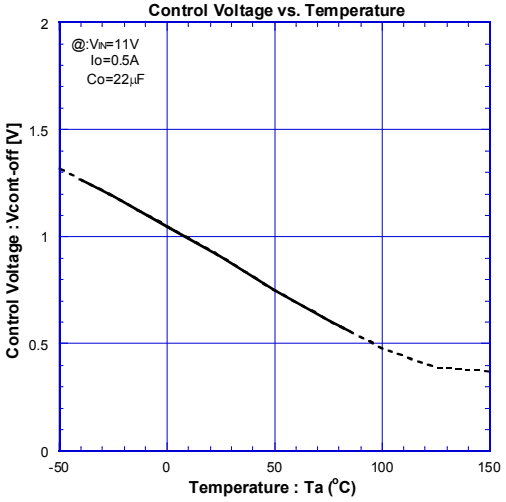
NJM2387/89_10V
Output Noise Peak Value of Spectrum vs Output Current



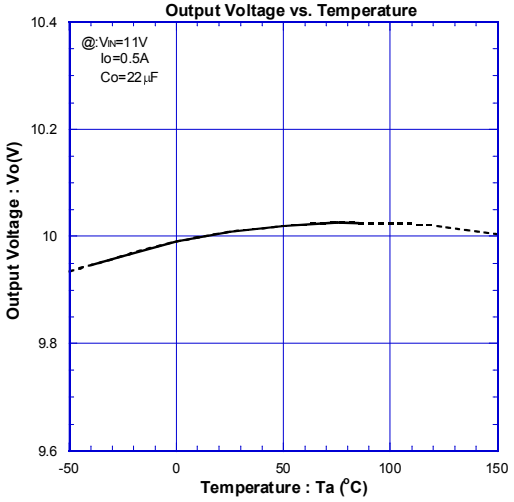
NJM2387/89_10V
Dropout Voltage vs. Temperature



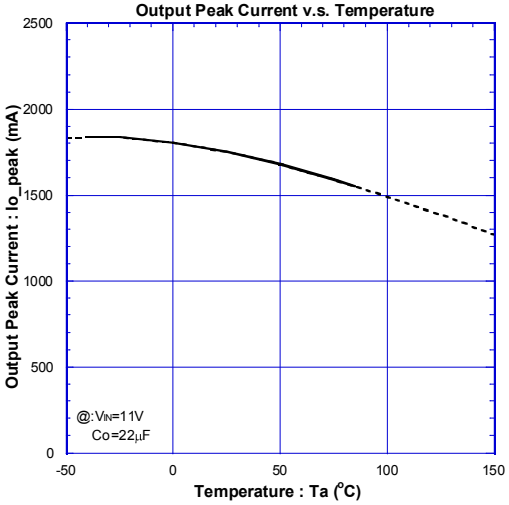
NJM2387/89_10V
Control Voltage vs. Temperature



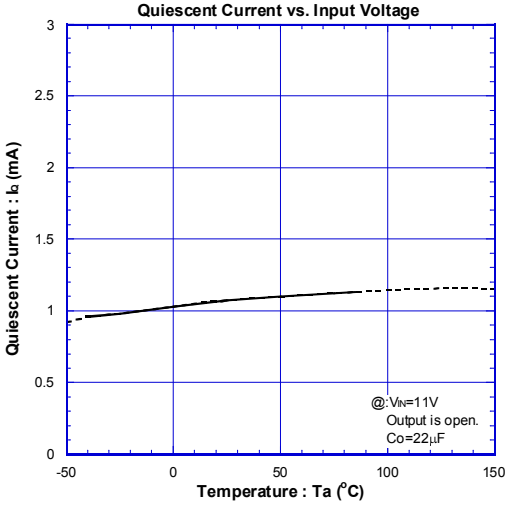
NJM2387/89_10V
Output Voltage vs. Temperature



NJM2387/89_10V
Output Peak Current v.s. Temperature

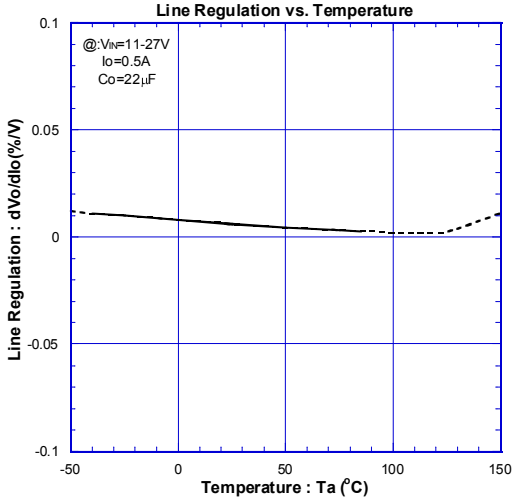


NJM2387/89_10V
Quiescent Current vs. Input Voltage

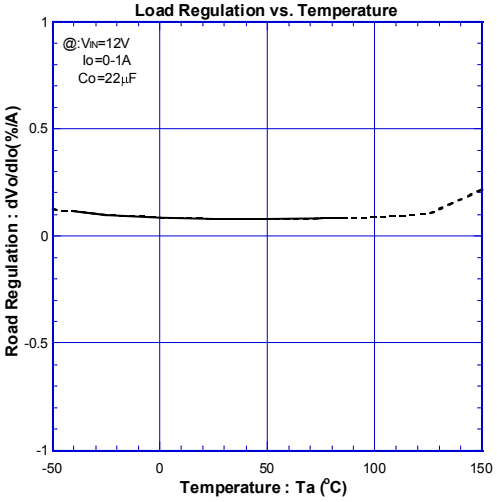


■ TYPICAL CHARACTERISTICS

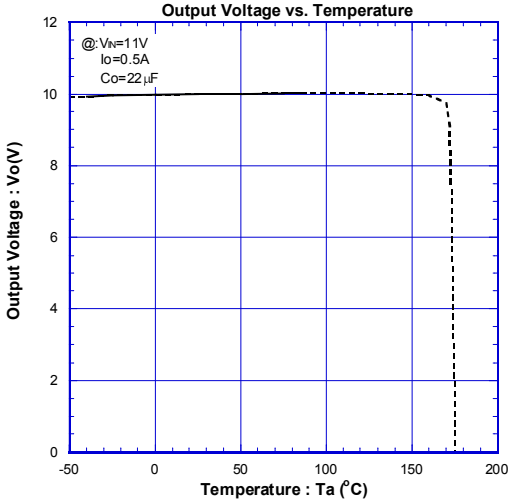
NJM2387/89_10V
Line Regulation vs. Temperature



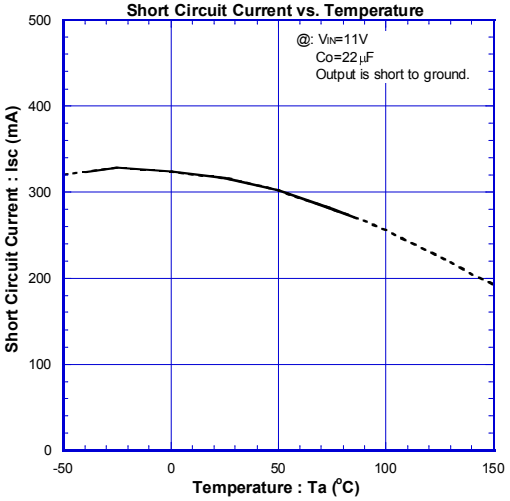
NJM2387/89_10V
Load Regulation vs. Temperature



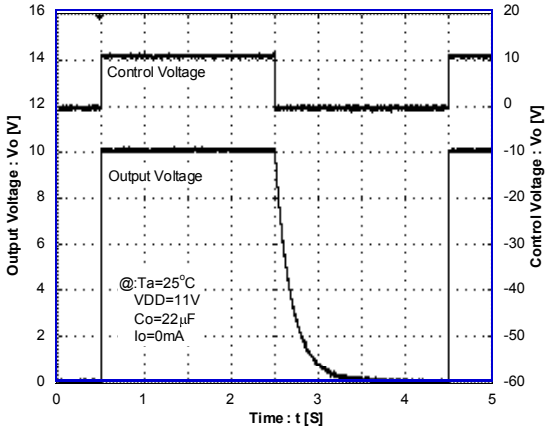
NJM2387/89_10V
Output Voltage vs. Temperature



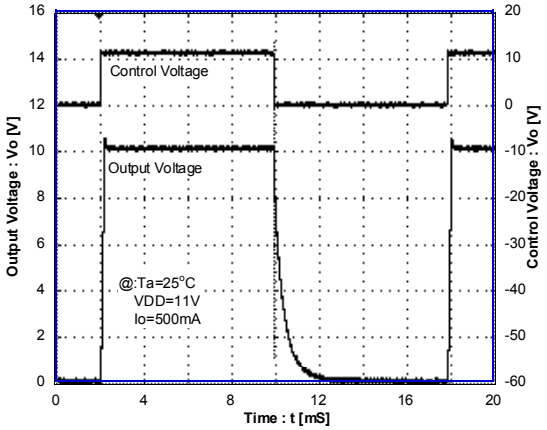
NJM2387/89_10V
Short Circuit Current vs. Temperature



NJM2387/89_10V
ON/OFF Transient Response without Load



NJM2387/89_10V
ON/OFF Transient Response



■ TYPICAL CHARACTERISTICS