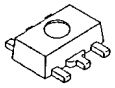
Very Low Output Low Dropout Regulator

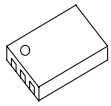
■ GENERAL DESCRIPTION

The NJM2842 is a very low output voltage, low drop out regulators.
It delivers up to 1A output current with the output voltage of 0.8 to 1.8V.
The use of an external bias voltage can improve the transient response and the ripple rejection characteristics while maintaining minimum input to output voltage.

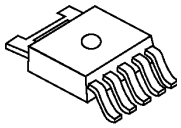
■ PACKAGE OUTLINE



NJM2842U2



NJM2842KH1

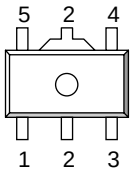


NJM2842DL3

■ FEATURES

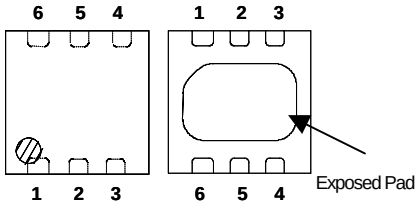
- Output Voltage Range 0.8V to 1.8V
- High Ripple Rejection 91 dB typ.(V_O=1.2V)
- Output Noise Voltage V_{NO}=44 μVrms
- Output Current I_O(max)=1.0A
- High Precision Output V_O±1.0%
- Dual Supply Voltage Type V_{IN}, V_{BIAS} (sequence free)
- High Stability for Load 0.002%/mA (max)
- Output Capacitor with 4.7μF ceramic capacitor (V_O>1.0V)
- Low Dropout Voltage 0.2V typ. @I_O=600mA
- ON/OFF Control
- Built-in Thermal Overload Protection and Short Circuit Current Limit Protection
- Bipolar Technology
- Package Outline SOT-89-5, ESON6-H1, TO252-5

■ PIN CONNECTION



1. CONTROL
2. GND
3. V_{OUT}
4. V_{IN}
5. V_{BIAS}

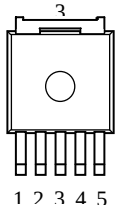
NJM2842U2



1. V_{OUT}
2. V_{BIAS}
3. N.C.
4. CONTROL
5. GND
6. V_{IN}

(Connected to GND)

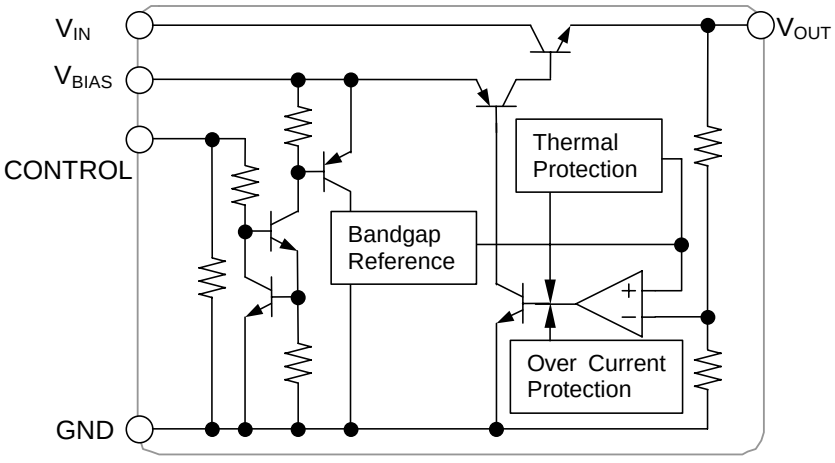
NJM2842KH1



1. CONTROL
2. V_{OUT}
3. GND
4. V_{IN}
5. V_{BIAS}

NJM2842DL3

■ BLOCK DIAGRAM



■ OUTPUT VOLTAGE RANK

Device Name SOT-89-5	V_{out}	Device Name ESON6-H1	V_{out}	Device Name TO252-5	V_{out}
NJM2842U2-008	0.8V	NJM2842KH1-008	0.8V	NJM2842DL3-012	1.2V
NJM2842U2-010	1.0V	NJM2842KH1-010	1.0V		
NJM2842U2-012	1.2V	NJM2842KH1-012	1.2V		
NJM2842U2-015	1.5V	NJM2842KH1-015	1.5V		
NJM2842U2-018	1.8V	NJM2842KH1-018	1.8V		

Available Fixed Output Voltage Setting Range: 0.8V to 1.8V

■ ABABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYNBOL	RATINGS		UNIT
Input Voltage	V_{IN}	+7		V
Bias Voltage	V_{BIAS}	+7		V
Control Voltage	V_{CONT}	+7		V
Power Dissipation	P_D	SOT-89-5	625 (*1) 2400 (*2)	mW
		TO252-5	1190(*1)	
			3125(*2)	
		ESON6-H1	440 (*3)	
			1200 (*4)	
Operating Temperature	Topr	-40~+85		°C
Storage Temperature	Tstg	-50~+150		°C

(*1): Mounted on glass epoxy board. (76.2x 114.3x1.6mm:EIA/JDEC standard size, 2Layers, copper area 100mm^2)
(*2): Mounted on glass epoxy board. (76.2x 114.3x1.6mm:EIA/JDEC standard size, 4Layers)
(4Layers inner foil : 74.2 x 74.2mm Applying a thermal via hall to a board based on JEDEC standard JESD51-5)
(*3): Mounted on glass epoxy board based on EIA/JEDEC. (101.5x 114.57x1.6mm, 2Layers, Use the Exposed Pad)
(*4): Mounted on glass epoxy board based on EIA/JEDEC. (101.5x 114.57x1.6mm, 4Layers, Use the Exposed Pad)
(4 Layers, Internal foil area: 99.5×99.5mm, Based on JEDEC Standard JESD51-5, used a Thermal Via Hole)

■ BIAS VOLTAGE INPUT RANGE

V_{BIAS}= +2.5V to +5.5V (V_O<1.5V)
V_{BIAS}= +V_O+1V to +5.5V (V_O≥1.5V)

■ ELECTRICAL CHARACTERISTICS

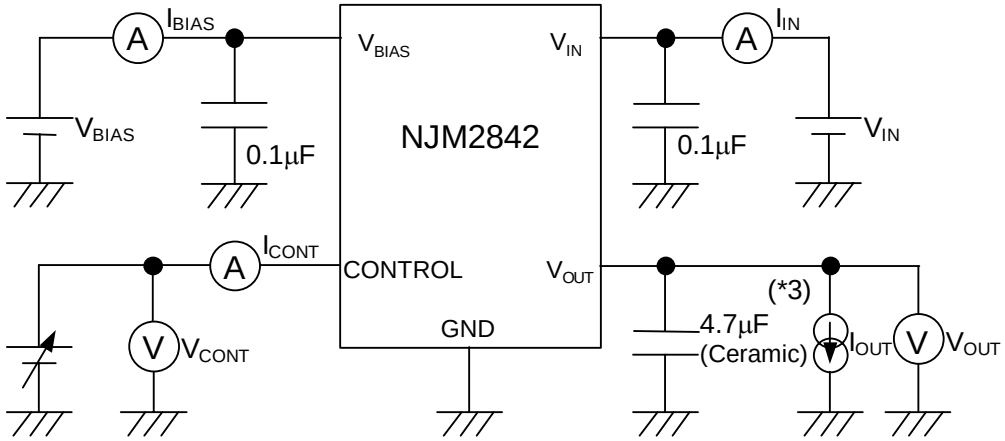
(V_{BIAS}=2.5V(Vo≥1.5V: V_{BIAS}=V_O+1V), V_{IN}=Vo+1V, C_{BIAS}=0.1μF, C_{IN}=4.7μF, C_O=4.7μF, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	I_O=30mA	-1.0%	-	+1.0%	V
Unloaded Bias Current	I_{BIAS}	I_O=0mA, except I_{CONT}	-	300	500	μA
Unloaded Input Current	I_{IN}	I_O=0mA, except I_{CONT}	-	-	20	μA
Bias Current at Control OFF	$I_{BIAS(OFF)}$	V_{CONT}=0V	-	-	100	nA
Input Current at Control OFF	$I_{IN(OFF)}$	V_{CONT}=0V	-	-	100	nA
Output Current	I_O	V_O × 0.9V	1000	1700	-	mA
Line Regulation 1 (V_{BIAS})	$\Delta V_O/\Delta V_{BIAS}$	V_{BIAS}=2.5V to V_O+5.5V(V_O<1.5V) V_{BIAS}=V_O+1V to V_O+5.5V(V_O≥1.5V) I_O=30mA	-	-	0.10	%/V
Line Regulation 2 (V_{IN})	$\Delta V_O/\Delta V_{IN}$	V_{IN}=V_O+1V to V_O+5.5V, I_O=30mA	-	-	0.10	%/V
Load Regulation	$\Delta V_O/\Delta I_O$	I_O=30 to 500mA	-	-	0.002	%/mA
Dropout Voltage	ΔV_{I-O}	I_O=600mA	-	0.10	0.18	V
Ripple Rejection Ratio 1 (V_{BIAS})	RR1(V_{BIAS})	V_{BIAS}=3.5V, ebias=200mVrms, f=1kHz, I_O=10mA	Refer to Table 1			dB
Ripple Rejection Ratio 2 (V_{IN})	RR2(V_{IN})	ebias=200mVrms, f=1kHz, I_O=10mA	Refer to Table 1			dB
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta Ta$	Ta=0 to +85°C, I_O=10mA	-	±50	-	ppm/°C
Output Noise Voltage	V_{NO}	f=10Hz to 80kHz, I_O=10mA	Refer to Table 1			μVrms
Control Current	I_{CONT}	V_{CONT}=1.6V	-	3	12	μA
Control Voltage for ON-state	$I_{CONT(ON)}$		1.6	-	-	V
Control Voltage for OFF-state	$V_{CONT(ON)}$		-	-	0.6	V
Bias Voltage	V_{BIAS}		-	-	5.5	V
Input Voltage	V_{IN}		-	-	5.5	V

• Table1

Voltage Rank	RR1(V_{BIAS})				RR2(V_{IN})				V_{NO}			
	MIN.	TYP.	MAX.	UNIT	MIN.	TYP.	MAX.	UNIT	MIN.	TYP.	MAX.	UNIT
0.8V	-	77	-		-	93	-		-	34	-	
1.0V	-	75	-		-	92	-		-	38	-	
1.2V	-	73	-		-	91	-	dB	-	44	-	μVrms
1.5V	-	71	-		-	90	-		-	47	-	
1.8V	-	70	-		-	89	-		-	51	-	

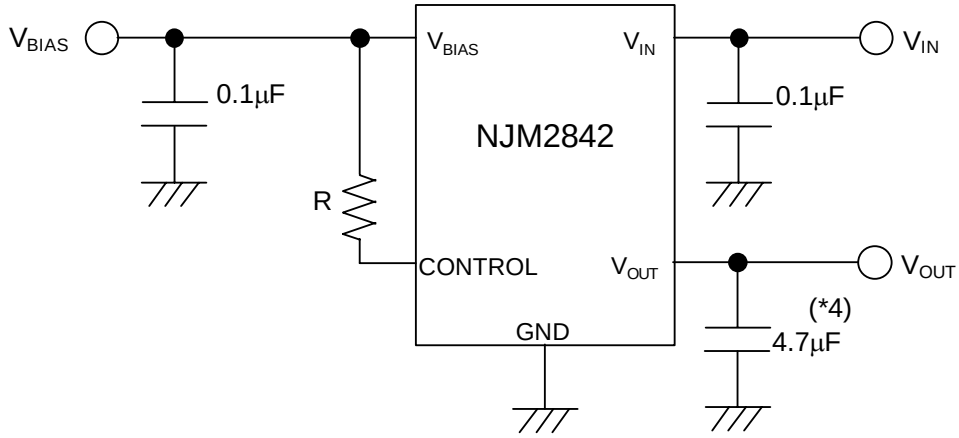
■ TEST CIRCUIT



(*3) Vo≤1.0V version: Co=4.7μF (Ceramic)

■ TYPICAL APPLICATION

a) In case of where ON/OFF control is not required:

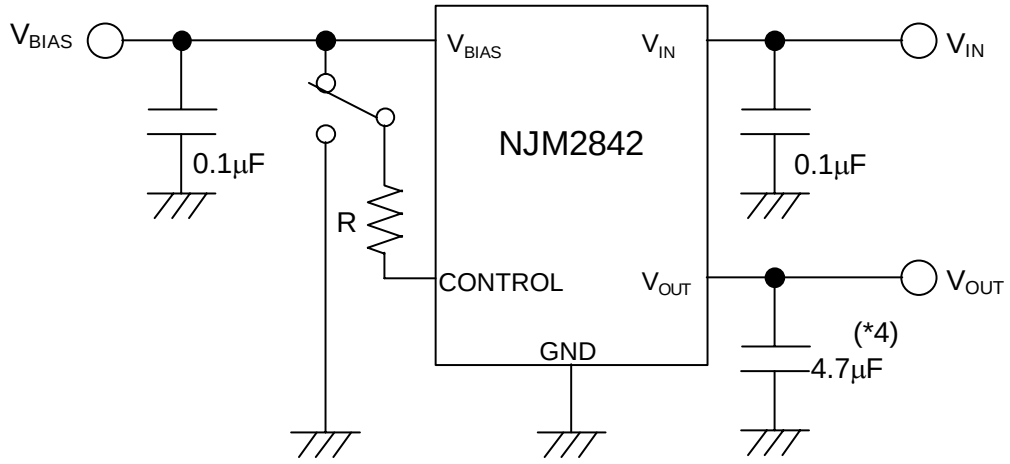


(*4) Vo≤1.0V version: Co=4.7μF

You shall connect control terminal to V_{BIAS} terminal.

Though the I_{CONT} decreases by inserting "R" to between Control terminal and V_{BIAS} terminal, the minimum operating voltage is increased due to the resister "R".

b) In use of ON/OFF control:



(*4) Vo≤1.0V version: Co=2.2μF

State of control terminal:

"H" → output is enabled.

"L" or "open" → output is disabled.

*Regarding a Bias Capacitance (C_{BIAS}) and an Input Capacitance (C_{IN})

C_{BIAS} and C_{IN} have the effect that prevents the oscillation at the time of the following condition.

When Source impedance is high.

When V_{IN} and/or GND line is long.

Therefore, you shall connect the C_{BIAS} and C_{IN} that recommendation value or larger (C_{BIAS} ≥0.1μF, C_{IN}≥0.1μF) so that lines that V_{BIAS}-GND and V_{IN}-GND become as short as possible.

*Output Capacitance Co

Output capacitor (Co) 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.

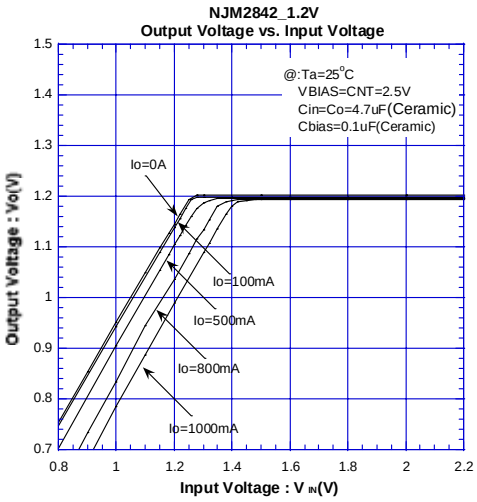
This product is designed to work with a low ESR capacitor (Co). However use of recommended capacitance or larger value is effective for stable operation.

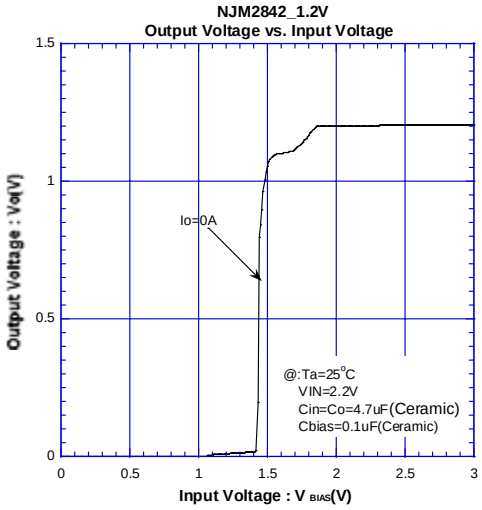
Use of a smaller Co may cause excess output noise or oscillation of the regulator due to lack of the phase compensation.

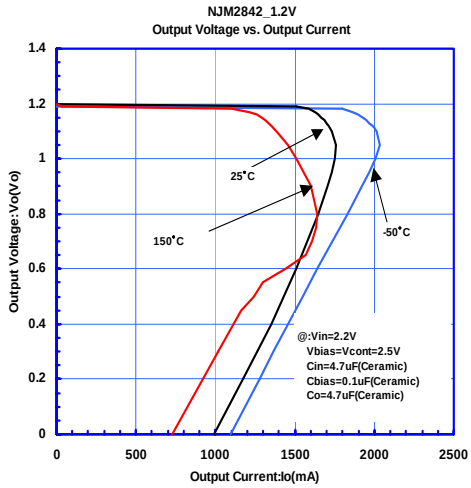
Therefore use Co with the recommended capacitance or larger value and connect between Vo terminal and GND terminal with shortest path. The recommended capacitance depends on the output voltage rank. Low voltage regulator requires larger value Co. Thus, check the recommended capacitance for each output voltage rank.

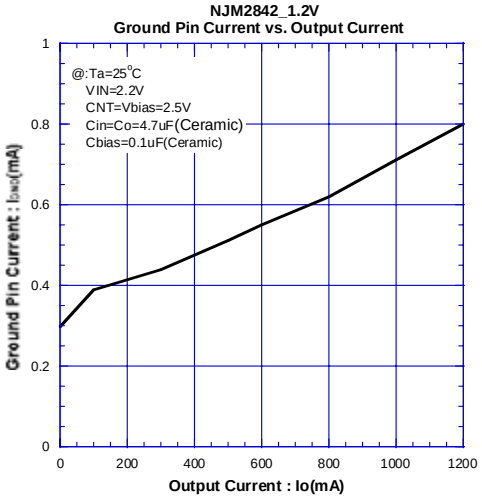
Use of a larger Co reduces output noise and ripple output, and also improves output transient response a gainst rapid load change.

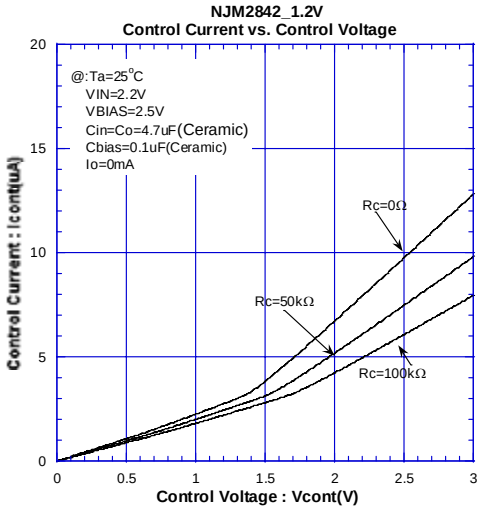
■ TYPICAL CHARACTERICTICS

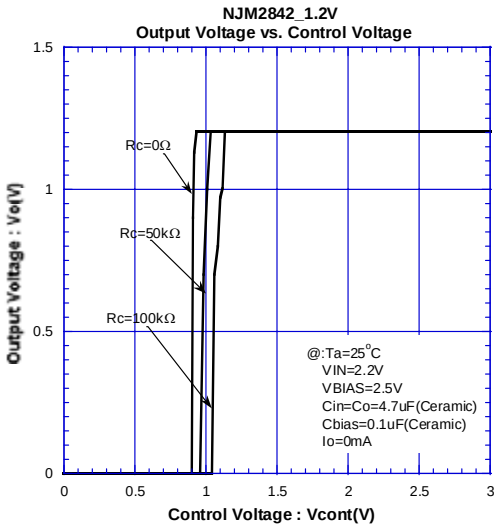




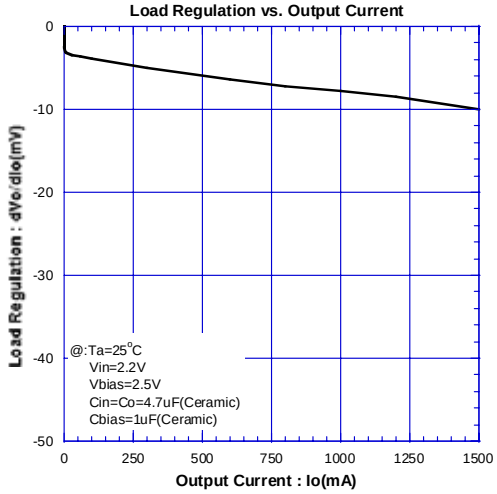




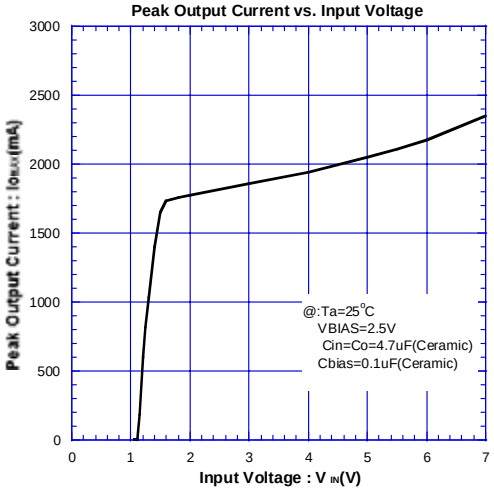




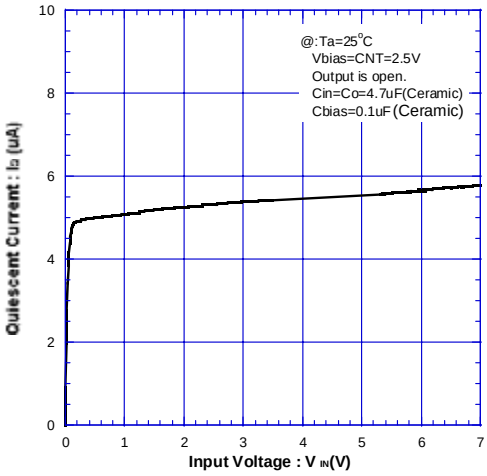
NJM2842_1.2V
Load Regulation vs. Output Current



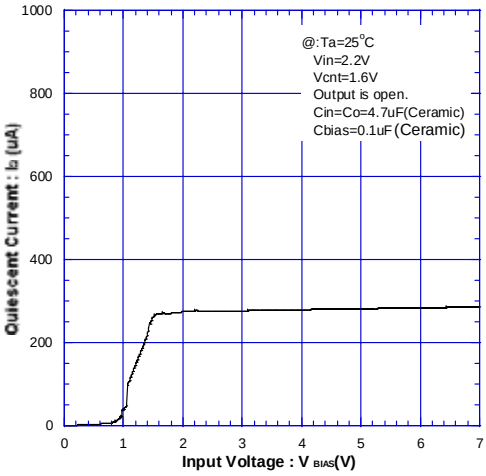
NJM2842_1.2V
Peak Output Current vs. Input Voltage



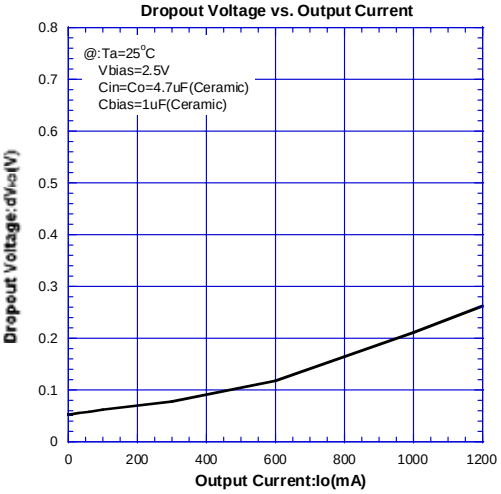
NJM2842_1.2V
Quiescent Current v.s. Input Voltage



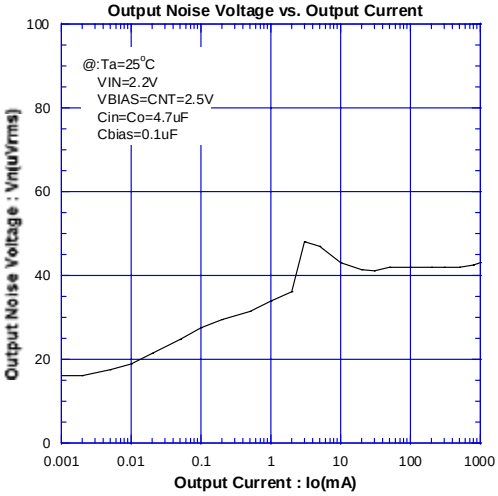
NJM2842_1.2V
Quiescent Current v.s. Input Voltage



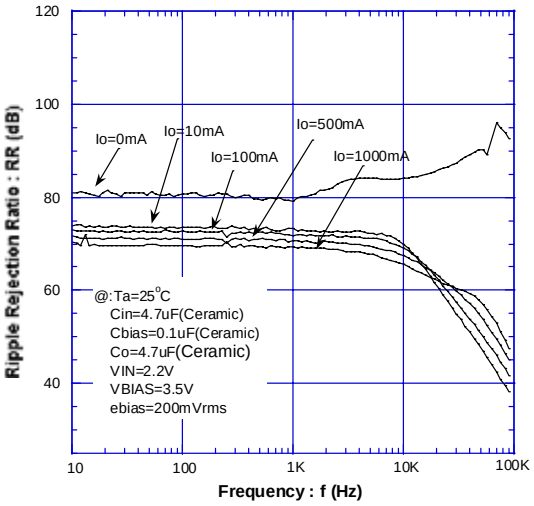
NJM2842_1.2V
Dropout Voltage vs. Output Current



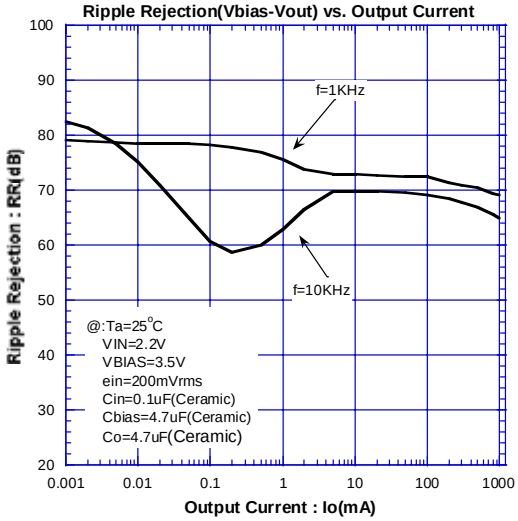
NJM2842_1.2V
Output Noise Voltage vs. Output Current



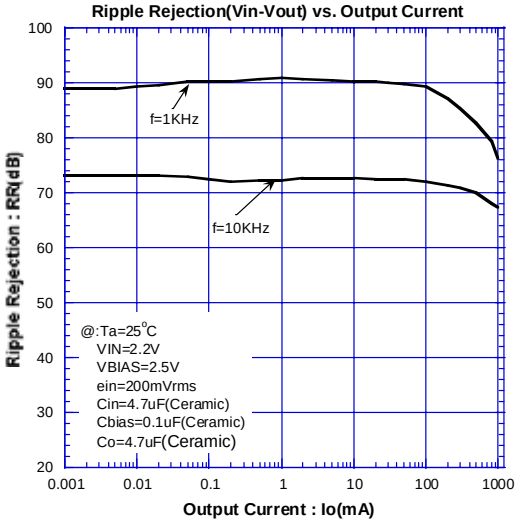
NJM2842_1.2V
Ripple Rejection Ratio v.s. Frequency



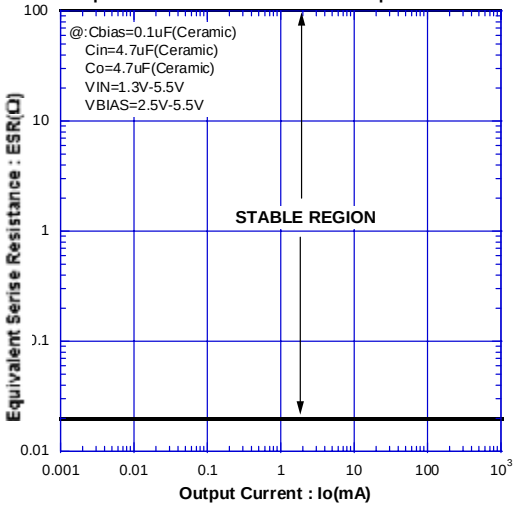
NJM2842_1.2V
Ripple Rejection(Vbias-Vout) vs. Output Current



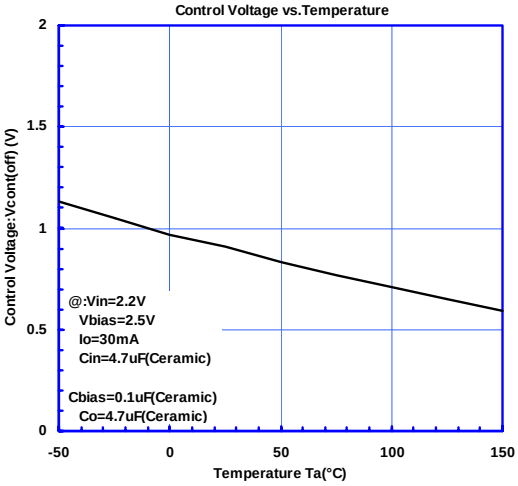
NJM2842_1.2V
Ripple Rejection(Vin-Vout) vs. Output Current



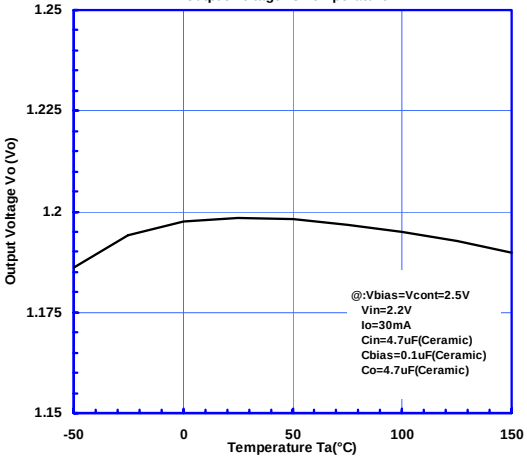
NJM2842_1.2V
Equivalent Serise Resistance vs. Output Current

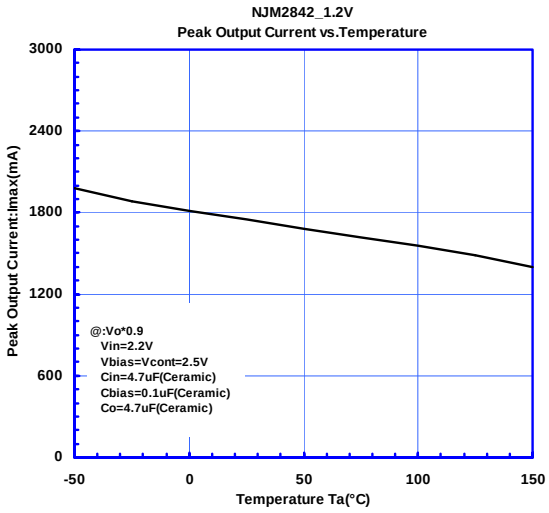


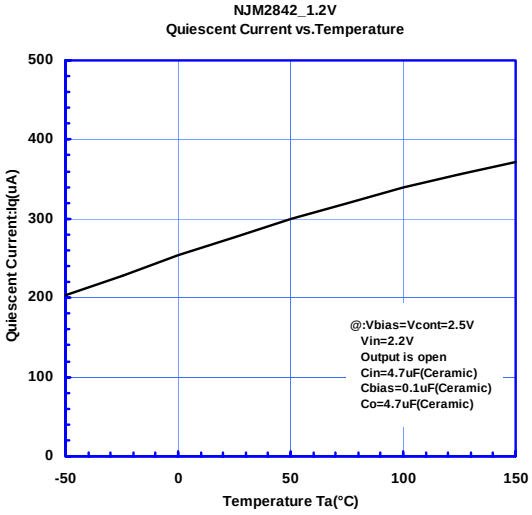
NJM2842_1.2V
Control Voltage vs.Temperature

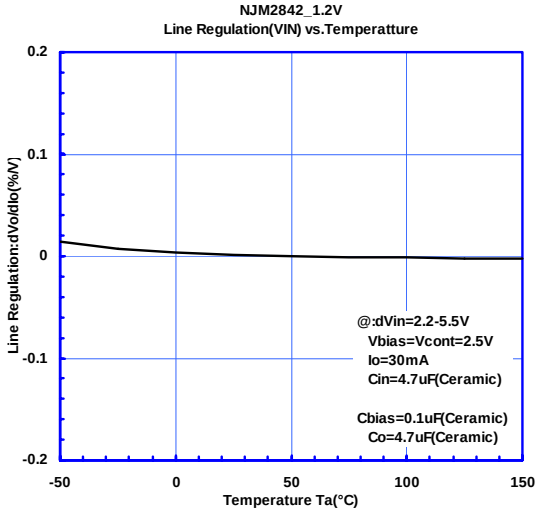


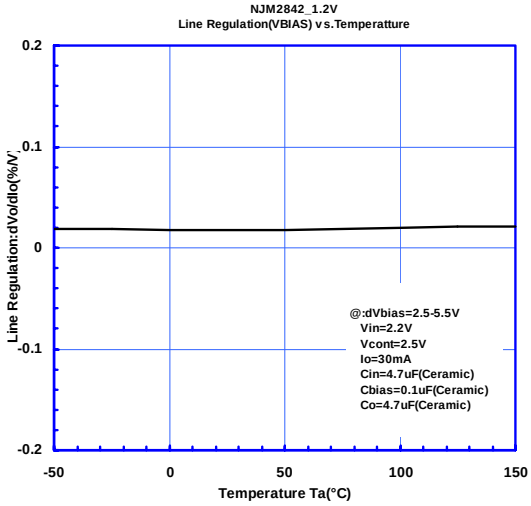
NJM2842_1.2V
Output Voltage vs.Temperature

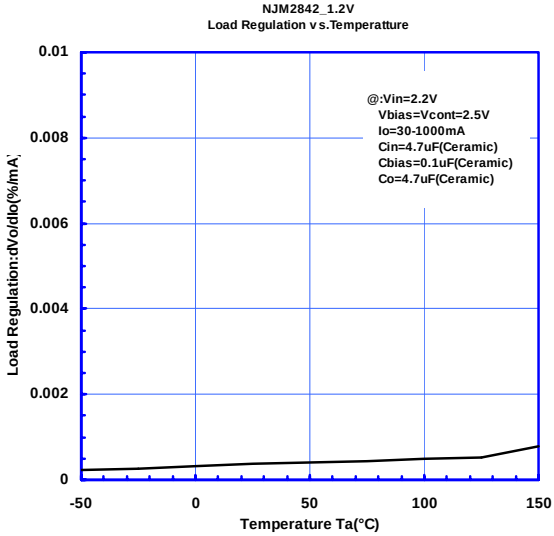


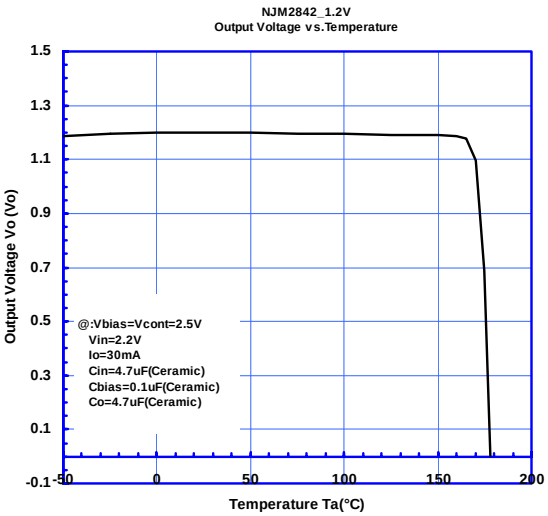

NJM2842_1.2V
Peak Output Current vs.Temperature
Peak Output Current:Imax(mA)
3000
2400
1800
1200
600
0
-50
0
50
100
150
Temperature Ta(°C)
@:Vo*0.9
Vin=2.2V
Vbias=Vcont=2.5V
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

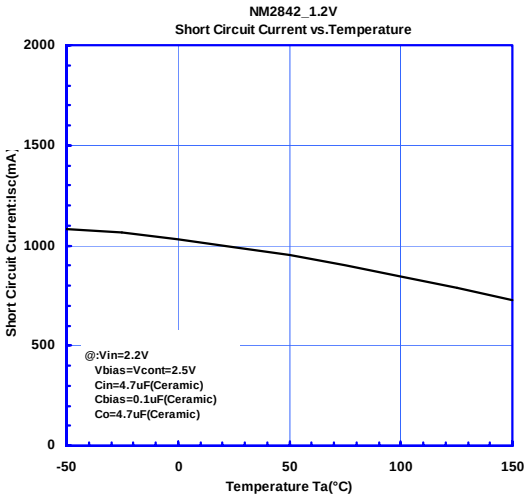

NJM2842_1.2V
Quiescent Current vs.Temperature
Quiescent Current:Iq(uA)
500
400
300
200
100
0
-50
0
50
100
150
Temperature Ta(°C)
@:Vbias=Vcont=2.5V
Vin=2.2V
Output is open
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

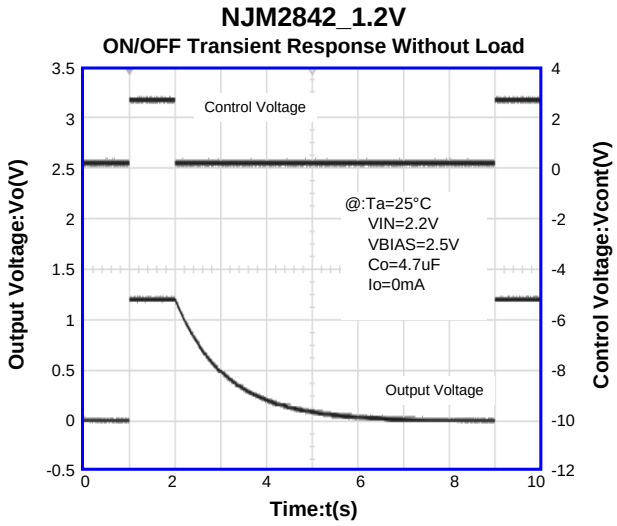

NJM2842_1.2V
Line Regulation(VIN) vs.Temperatture
Line Regulation:dVo/dIo(%/V)
0.2
0.1
0
-0.1
-0.2
-50
0
50
100
150
Temperature Ta(°C)
@:dVin=2.2-5.5V
Vbias=Vcont=2.5V
Io=30mA
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

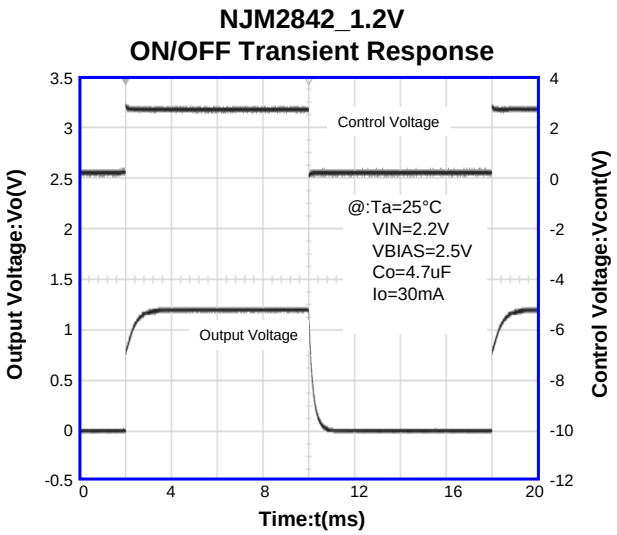

NJM2842_1.2V
Line Regulation(VBIAS) vs.Temperatture
Line Regulation:dVo/dIo(%/V)
0.2
0.1
0
-0.1
-0.2
-50
0
50
100
150
Temperature Ta(°C)
@:dVbias=2.5-5.5V
Vin=2.2V
Vcont=2.5V
Io=30mA
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

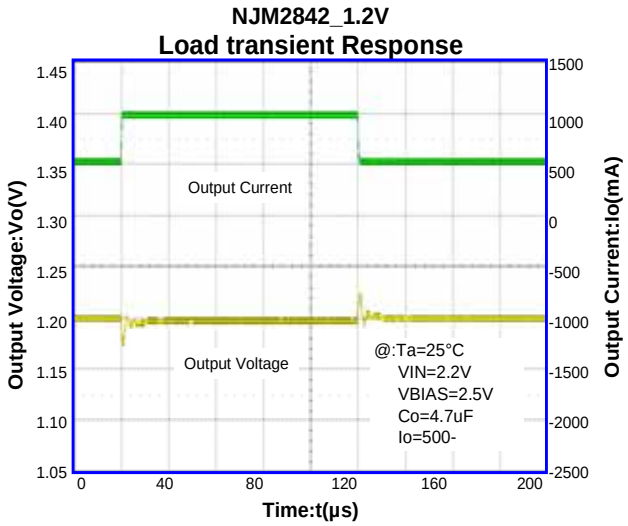

NJM2842_1.2V
Load Regulation vs.Temperatture
Load Regulation:dVo/dIo(%/mA)
0.01
0.008
0.006
0.004
0.002
0
-50
0
50
100
150
Temperature Ta(°C)
@:Vin=2.2V
Vbias=Vcont=2.5V
Io=30-1000mA
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

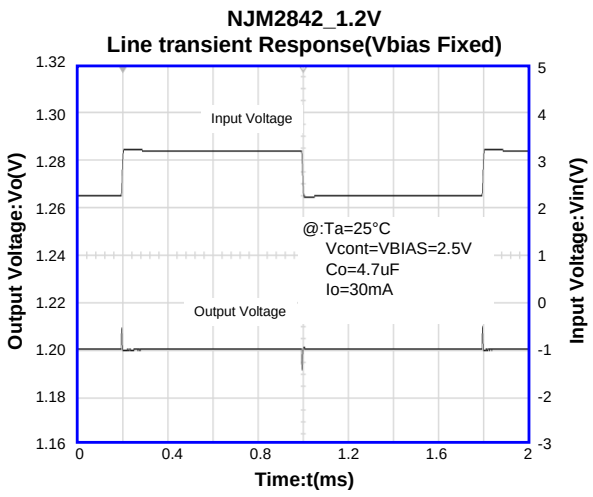

NJM2842_1.2V
Output Voltage vs.Temperature
Output Voltage Vo (Vo)
1.5
1.3
1.1
0.9
0.7
0.5
0.3
0.1
-0.1
-50
0
50
100
150
200
Temperature Ta(°C)
@:Vbias=Vcont=2.5V
Vin=2.2V
Io=30mA
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

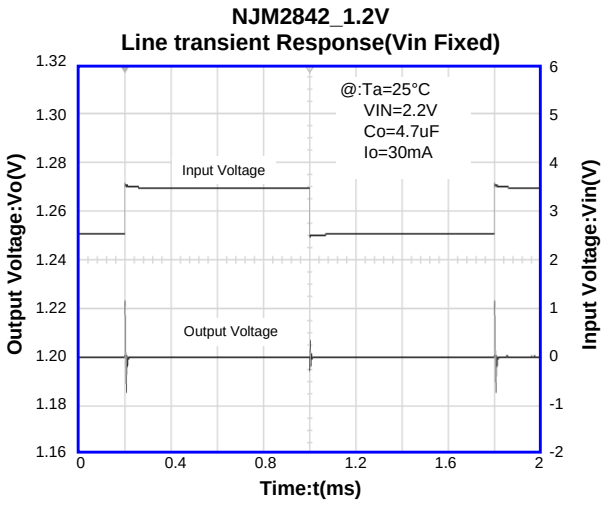

NM2842_1.2V
Short Circuit Current vs.Temperature
Short Circuit Current:Isc(mA)
Temperature Ta(°C)
@:Vin=2.2V
Vbias=Vcont=2.5V
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)


NJM2842_1.2V
ON/OFF Transient Response Without Load
Output Voltage:Vo(V)
Control Voltage:Vcont(V)
Time:t(s)
Control Voltage
Output Voltage
@:Ta=25°C
VIN=2.2V
VBIAS=2.5V
Co=4.7uF
Io=0mA


NJM2842_1.2V
ON/OFF Transient Response
Output Voltage:Vo(V)
Control Voltage:Vcont(V)
Time:t(ms)
Control Voltage
Output Voltage
@:Ta=25°C
VIN=2.2V
VBIAS=2.5V
Co=4.7uF
Io=30mA


NJM2842_1.2V
Load transient Response
Output Voltage:Vo(V)
Output Current:Io(mA)
Time:t(µs)
Output Current
Output Voltage
@:Ta=25°C
VIN=2.2V
VBIAS=2.5V
Co=4.7uF
Io=500-


NJM2842_1.2V
Line transient Response(Vbias Fixed)
Output Voltage:Vo(V)
Input Voltage:Vin(V)
Time:t(ms)
Input Voltage
Output Voltage
@:Ta=25°C
Vcont=VBIAS=2.5V
Co=4.7uF
Io=30mA


NJM2842_1.2V
Line transient Response(Vin Fixed)
Output Voltage:Vo(V)
Input Voltage:Vin(V)
Time:t(ms)
Input Voltage
Output Voltage
@:Ta=25°C
VIN=2.2V
Co=4.7uF
Io=30mA

[CAUTION]
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