Very Low Output Low Dropout Regulator

■ GENERAL DESCRIPTION

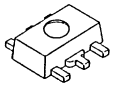
The NJM2842 is a very low output voltage, low drop out regulators.

It delivers up to 1A output current with the output voltage from 0.8V to 1.8V.

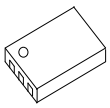
The use of an external bias voltage can improve the transient response and the ripple rejection characteristics while maintaining minimum input to output voltage.

The NJM2842 suitable for constant-voltage source such as CPU, DSP and ASIC.

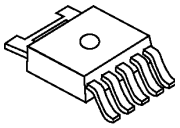
■ PACKAGE OUTLINE



NJM2842U2



NJM2842KH1

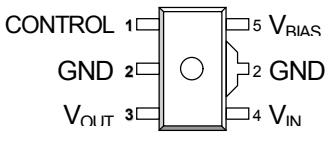


NJM2842DL3

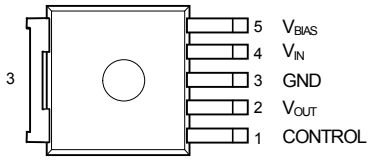
■ FEATURES

- 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 typ.@V_O=1.2V
- Output Current I_O(min)=1.0A
- High Precision Output V_O±1.0%
- Dual input Voltage Type V_{IN}, V_{BIAS} (sequence free)
- High Stability for Load 0.002%/mA (max)
- Output Capacitor with 4.7μF ceramic capacitor
- Low Dropout Voltage 0.1V typ. @I_O=600mA
- ON/OFF Control
- Built-in Thermal Overload Protection and Current Limit Protection
- Bipolar Technology
- Package Outline SOT-89-5,DFN6-H1(ESON6-H1), TO-252-5

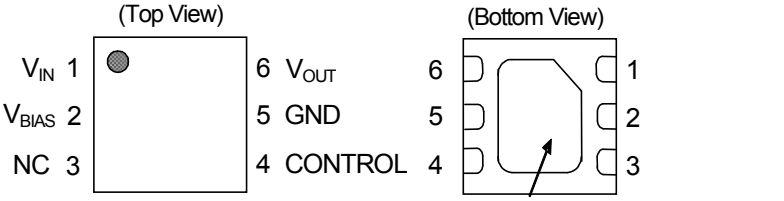
■ PIN COFIGURATION



NJM2842U2



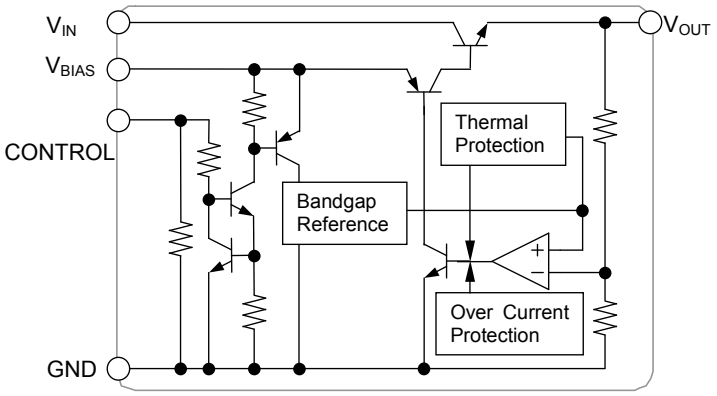
NJM2842DL3



Exposed PAD on backside connected to GND.

NJM2842KH1

■ BLOCK DIAGRAM



■ OUTPUT VOLTAGE RANK LIST

Device Name SOT-89-5	V_O	Device Name DFN6-H1 (ESON6-H1)	V_O	Device Name TO-252-5	V_O
NJM2842U2-008	0.8V	NJM2842KH1-008	0.8V	NJM2842DL3-011	1.1V
NJM2842U2-010	1.0V	NJM2842KH1-010	1.0V	NJM2842DL3-012	1.2V
NJM2842U2-011	1.1V	NJM2842KH1-012	1.2V		
NJM2842U2-012	1.2V	NJM2842KH1-015	1.5V		
NJM2842U2-0145	1.45V	NJM2842KH1-018	1.8V		
NJM2842U2-015	1.5V				
NJM2842U2-018	1.8V				

■ ABSOLUTE 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
		TO-252-5	1190(*1)	
			3125(*2)	
		DFN6-H1 (ESON6-H1)	440 (*3)	
			1200 (*4)	
Operating Temperature	Topr	-40 ~ +125		°C
Storage Temperature	Tstg	-40 ~ +150		°C

(*1): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC standard size, 2Layers, Cu area 100mm^2)
(*2): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC standard, 4Layers)
(4Layers: Applying 74.2×74.2mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)
(*3): Mounted on glass epoxy board based on EIA/JEDEC. (101.5x 114.5x1.6mm, 2Layers, Use the Exposed Pad)
(*4): Mounted on glass epoxy board based on EIA/JEDEC. (101.5x 114.5x1.6mm, 4Layers, Use the Exposed Pad)
(4Layers: Applying 99.5×99.5mm inner Cu area and a thermal via hole to a board based on JEDEC standard JESD51-5)

■ 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)

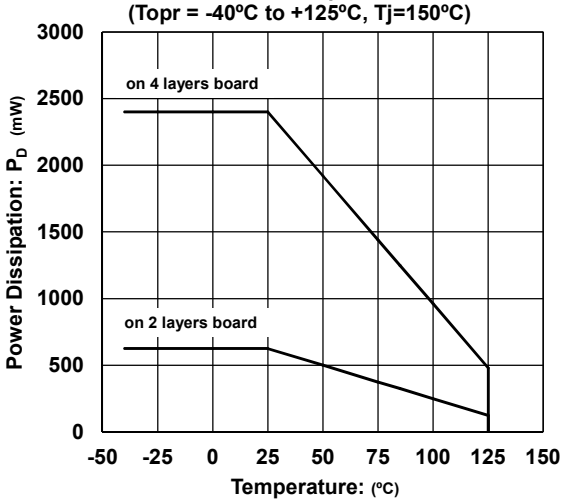
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	I_O=30mA	-1.0%	-	+1.0%	V
Unloaded Bias Current	I_{BIAS}	I_O=0mA, except I_{CONT}	-	300	500	μA
Unloaded Input Current	I_{IN}	I_O=0mA, except I_{CONT}	-	-	20	μA
Bias Current at Control OFF	$I_{BIAS(OFF)}$	V_{CONT}=0V	-	-	100	nA
Input Current at Control OFF	$I_{IN(OFF)}$	V_{CONT}=0V	-	-	100	nA
Output Current	I_O	$V_O \times 0.9$	1000	-	-	mA
Line Regulation 1 (V_{BIAS})	$\Delta V_O/\Delta V_{BIAS}$	V_{BIAS}=2.5V to +5.5V(V_O<1.5V) V_{BIAS}=V_O+1V to +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 +5.5V, I_O=30mA	-	-	0.10	%/V
Load Regulation	$\Delta V_O/\Delta I_O$	I_O=30mA to 1000mA	-	-	0.002	%/mA
Dropout Voltage	ΔV_{I-O}	I_O=600mA	-	0.10	0.18	V
Ripple Rejection Ratio 1 (V_{BIAS})	RR(V_{BIAS})	V_{BIAS}=3.5V(V_O<1.5V) V_{BIAS}=3.8V(V_O≥1.5V) ebias=200mVrms, f=1kHz, I_O=10mA	Refer to Table 1			dB
Ripple Rejection Ratio 2 (V_{IN})	RR(V_{IN})	ein=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	$V_{CONT(ON)}$		1.6	-	-	V
Control Voltage for OFF-state	$V_{CONT(OFF)}$		-	-	0.6	V
Bias Voltage	V_{BIAS}		-	-	5.5	V
Input Voltage	V_{IN}		-	-	5.5	V

Table1

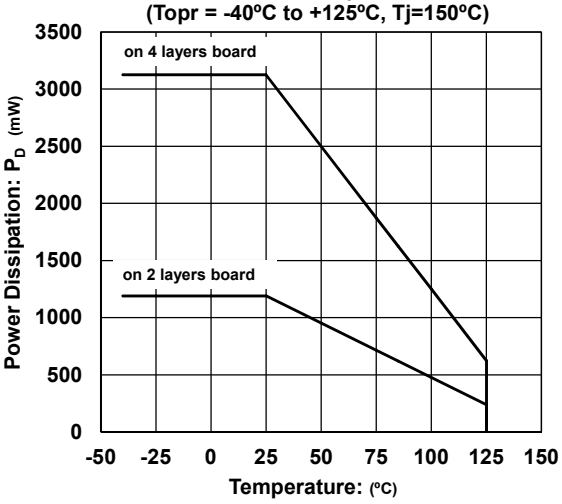
Voltage Rank	Ripple Rejection Ratio 1(V_{BIAS})				Ripple Rejection Ratio 2 (V_{IN})				Output Noise Voltage			
	MIN.	TYP.	MAX.	UNIT	MIN.	TYP.	MAX.	UNIT	MIN.	TYP.	MAX.	UNIT
0.8V	-	77	-	dB	-	93	-	dB	-	34	-	μVrms
1.0V	-	75	-		-	92	-		-	38	-	
1.1V	-	74	-		-	91	-		-	41	-	
1.2V	-	73	-		-	91	-		-	44	-	
1.45V	-	71	-		-	90	-		-	47	-	
1.5V	-	71	-		-	90	-		-	47	-	
1.8V	-	70	-		-	89	-		-	51	-	

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

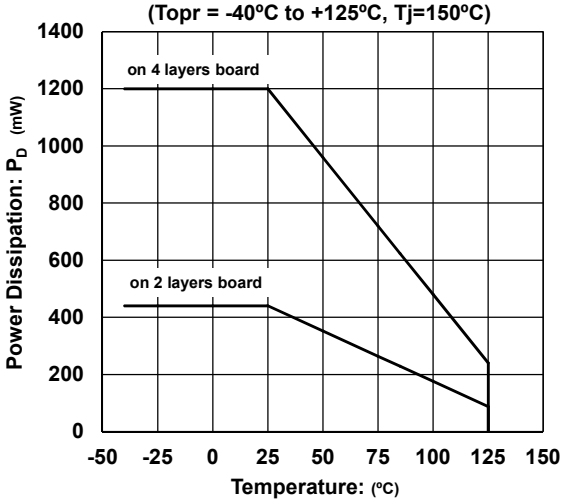
NJM2842U2 (SOT-89-5)
Power Dissipation
(Topr = -40ºC to +125ºC, Tj=150ºC)



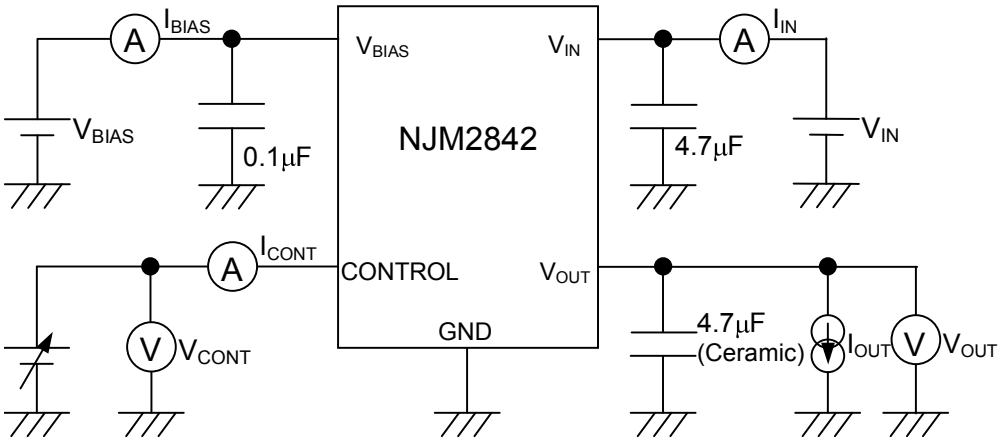
NJM2842DL3 (TO-252-5)
Power Dissipation
(Topr = -40ºC to +125ºC, Tj=150ºC)



NJM2842KH1 (DFN6-H1)
Power Dissipation
(Topr = -40ºC to +125ºC, Tj=150ºC)

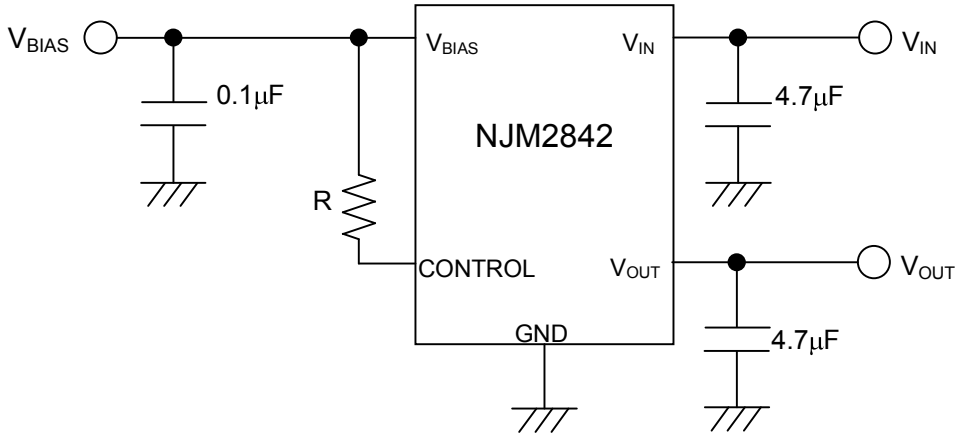


■ TEST CIRCUIT

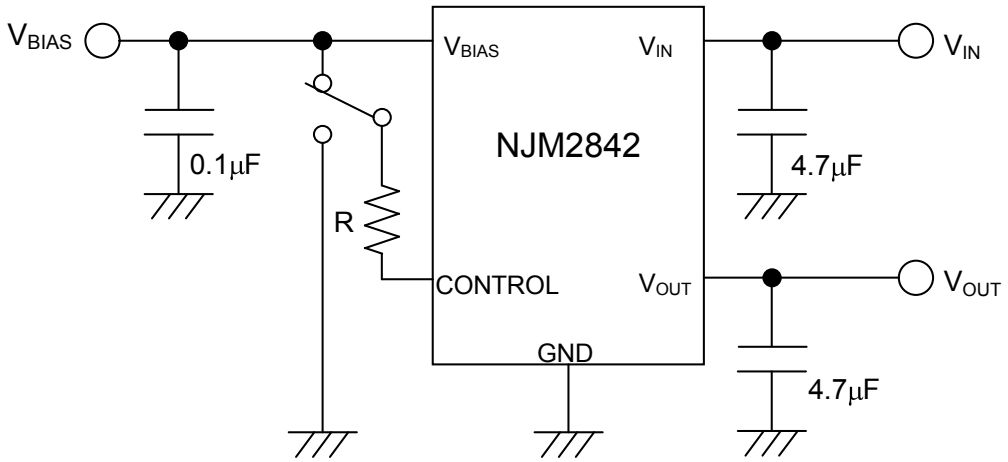


■ TYPICAL APPLICATION

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



b) In use of ON/OFF control:



State of control pin:

"H" → output is enabled.

"L" or "open" → output is disabled.

*In the case of using a resistance "R" between V_{BIAS} 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 “R” 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 "R" should be selected to consider the temperature characteristics.

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

C_{BIAS} and C_{IN} are 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_{BIAS} and C_{IN} value (refer to conditions of ELECTRIC CHARACTERISTIC) or larger and should connect between V_{BIAS}-GND and V_{IN}-GND 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.

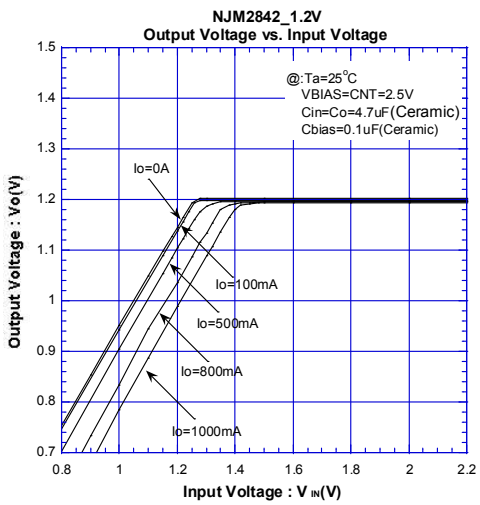
On the other hand, Use of a larger C_O reduces output noise and ripple output, and also improves output transient response when rapid load change.

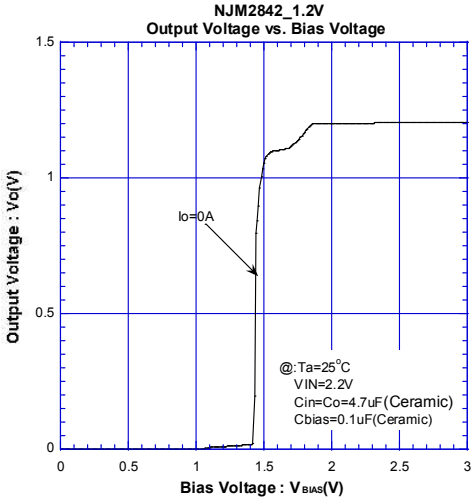
Therefore, use the recommended C_O value (refer to conditions of ELECTRIC CHARACTERISTIC) or larger and should connect between GND and V_{OUT} as shortest path as possible for stable operation

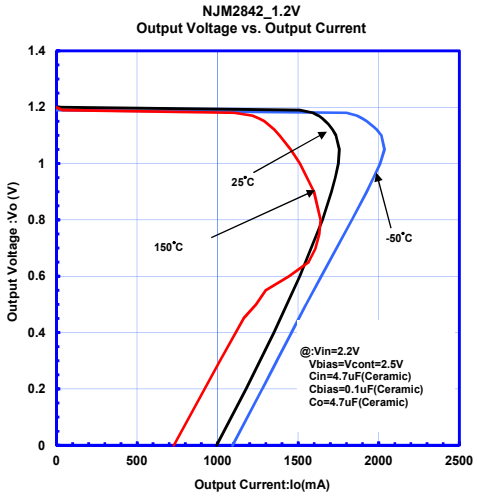
In addition, you should consider varied characteristics of capacitor (a frequency characteristic, a temperature characteristic, a DC bias characteristic and so on) and unevenness peculiar to a capacitor supplier enough.

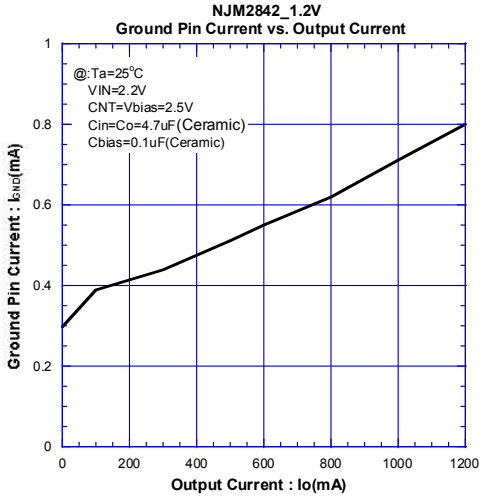
When selecting C_O, recommend that have withstand voltage margin against output voltage and superior temperature characteristic.

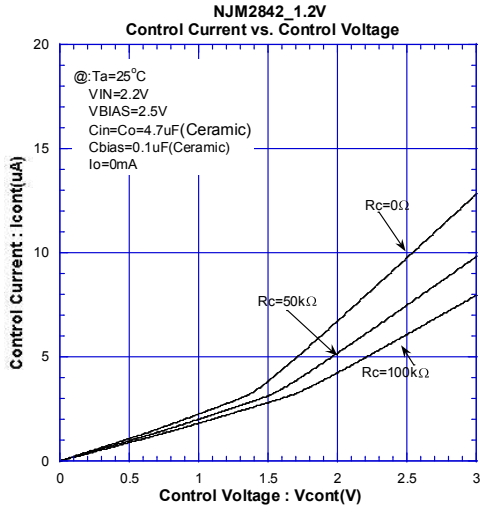
■ TYPICAL CHARACTERICTICS

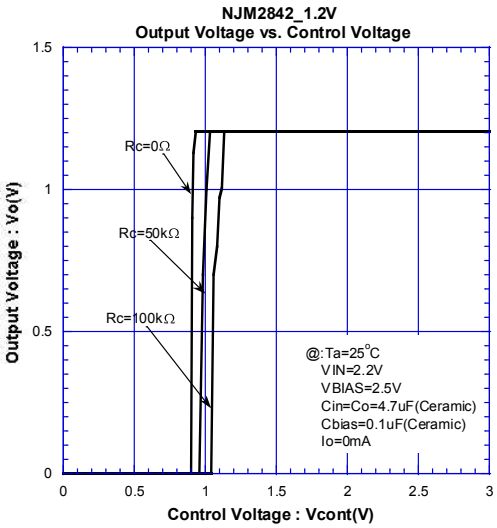


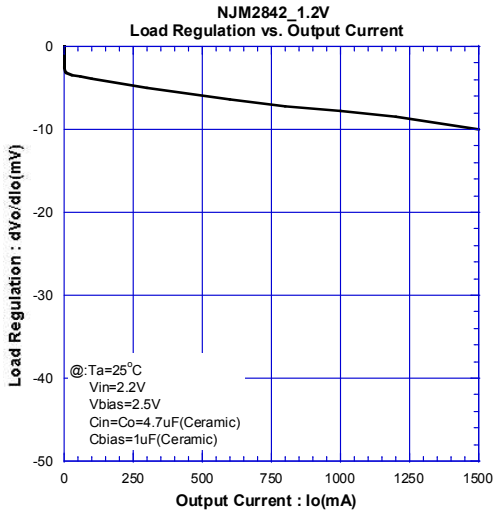


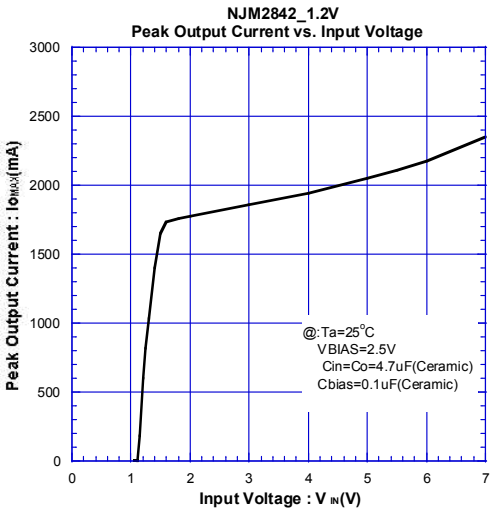


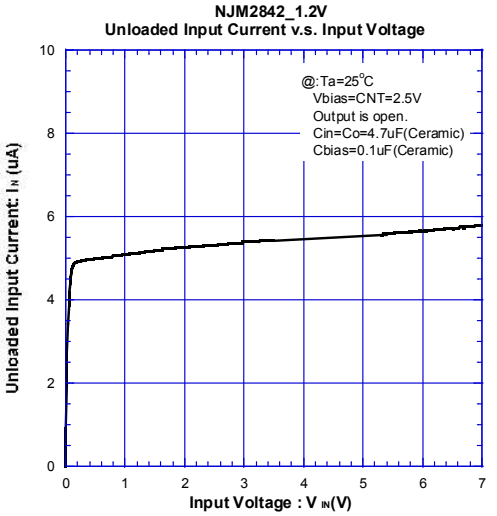


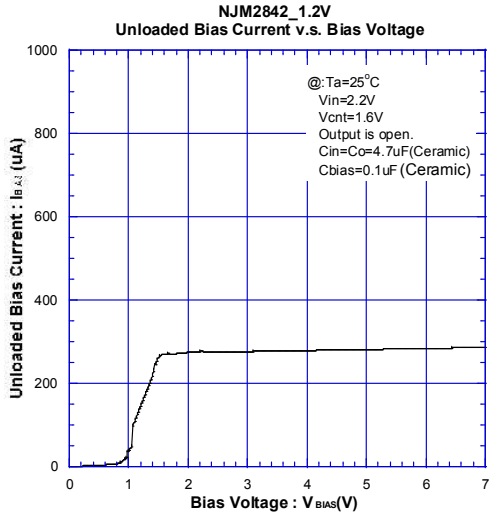


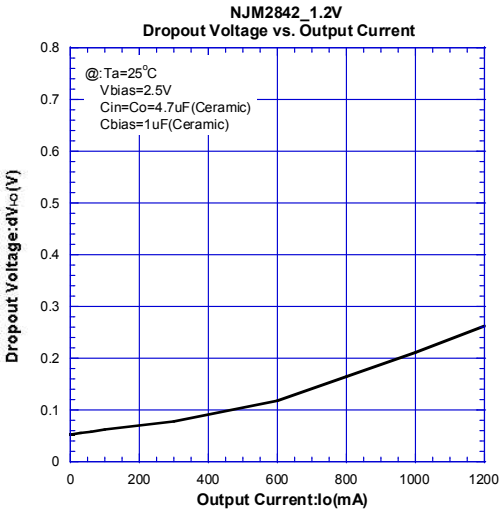


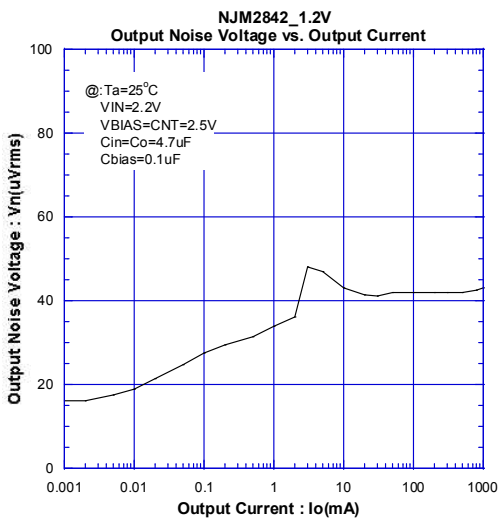

NJM2842_1.2V
Load Regulation vs. Output Current
Load Regulation : dVo/dIo(mV)
Output Current : Io(mA)
@:Ta=25°C
Vin=2.2V
Vbias=2.5V
Cin=Co=4.7uF(Ceramic)
Cbias=1uF(Ceramic)


NJM2842_1.2V
Peak Output Current vs. Input Voltage
Peak Output Current : IOMAX(mA)
Input Voltage : VIN(V)
@:Ta=25°C
VBIAS=2.5V
Cin=Co=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)

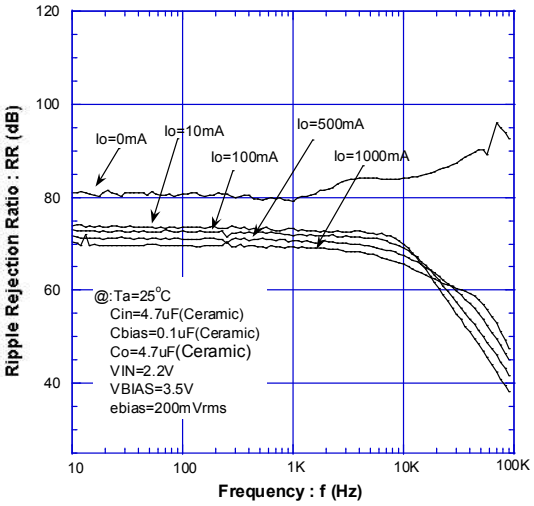

NJM2842_1.2V
Unloaded Input Current v.s. Input Voltage
Unloaded Input Current: IIN (uA)
Input Voltage : VIN(V)
@:Ta=25°C
Vbias=CNT=2.5V
Output is open.
Cin=Co=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)


NJM2842_1.2V
Unloaded Bias Current v.s. Bias Voltage
Unloaded Bias Current : IBIAS (uA)
Bias Voltage : VBIAS(V)
@:Ta=25°C
Vin=2.2V
Vcnt=1.6V
Output is open.
Cin=Co=4.7uF(Ceramic)
Cbias=0.1uF (Ceramic)

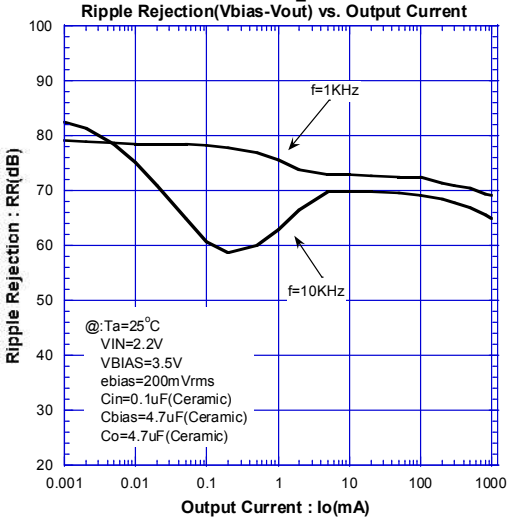

NJM2842_1.2V
Dropout Voltage vs. Output Current
Dropout Voltage:dVIO(V)
Output Current:Io(mA)
@:Ta=25°C
Vbias=2.5V
Cin=Co=4.7uF(Ceramic)
Cbias=1uF(Ceramic)


NJM2842_1.2V
Output Noise Voltage vs. Output Current
Output Noise Voltage : Vn(uVrms)
Output Current : Io(mA)
@:Ta=25°C
VIN=2.2V
VBIAS=CNT=2.5V
Cin=Co=4.7uF
Cbias=0.1uF

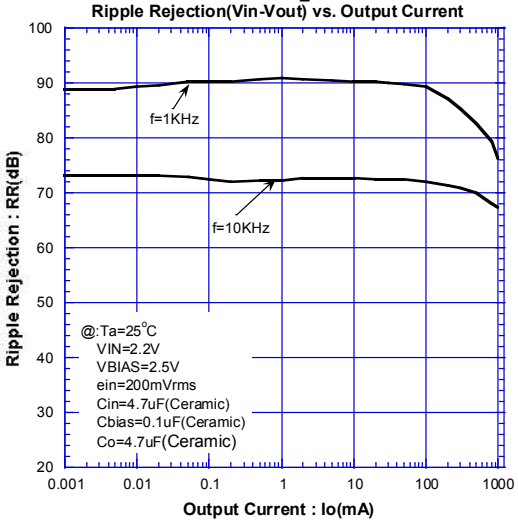
NJM2842_1.2V
Ripple Rejection Ratio v.s. Frequency



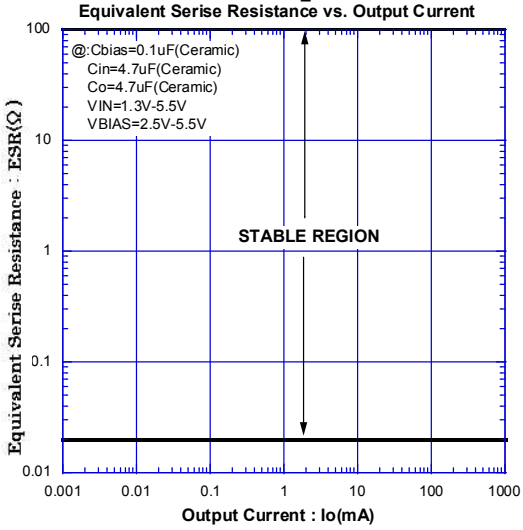
NJM2842_1.2V
Ripple Rejection(Vbias-Vout) vs. Output Current



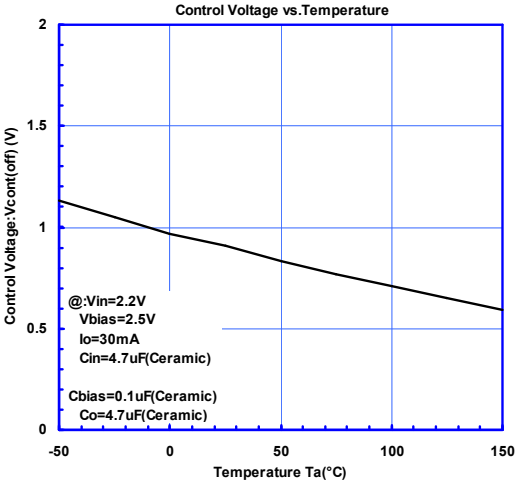
NJM2842_1.2V
Ripple Rejection(Vin-Vout) vs. Output Current



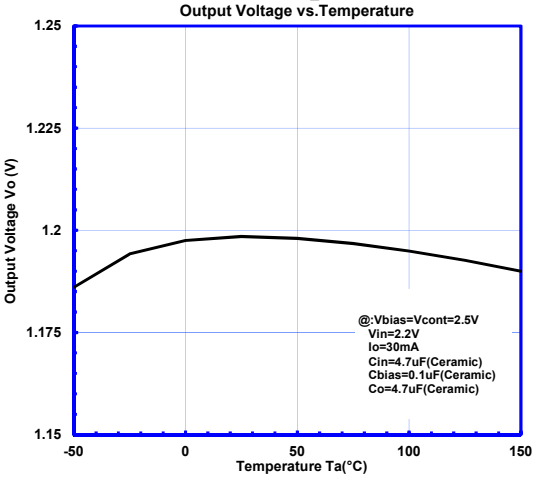
NJM2842_1.2V
Equivalent Serise Resistance vs. Output Current

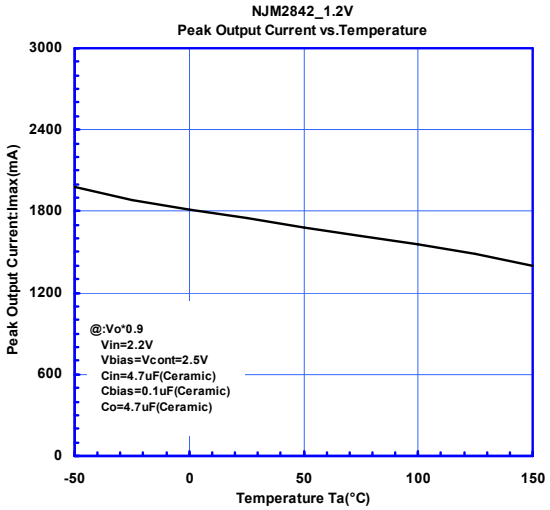


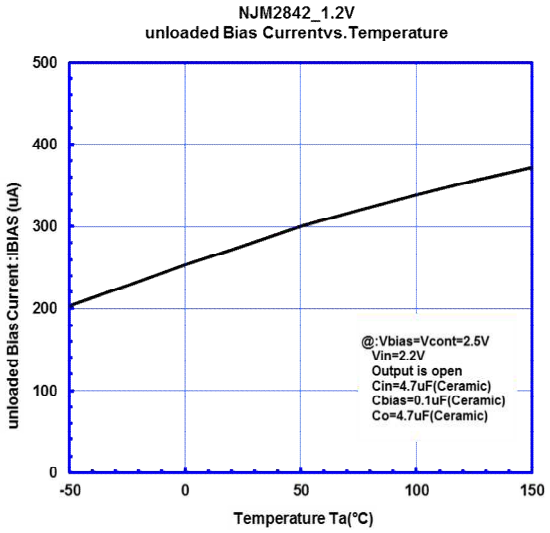
NJM2842_1.2V
Control Voltage vs.Temperature

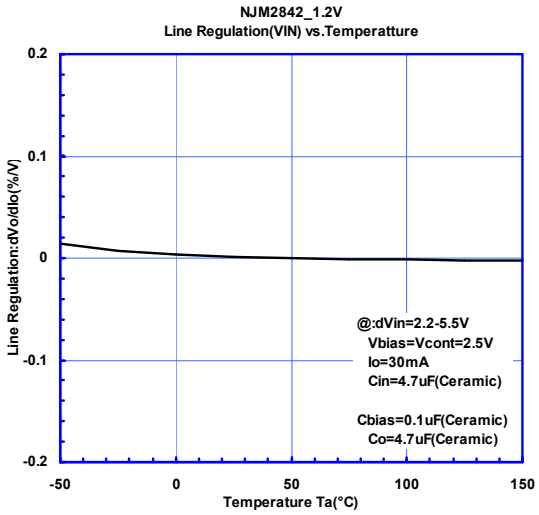


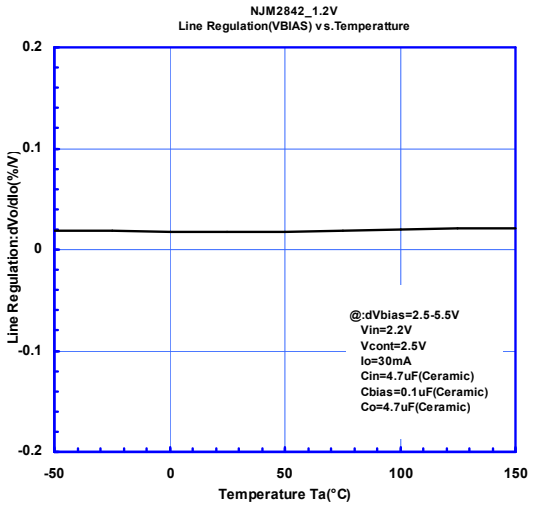
NJM2842_1.2V
Output Voltage vs.Temperature

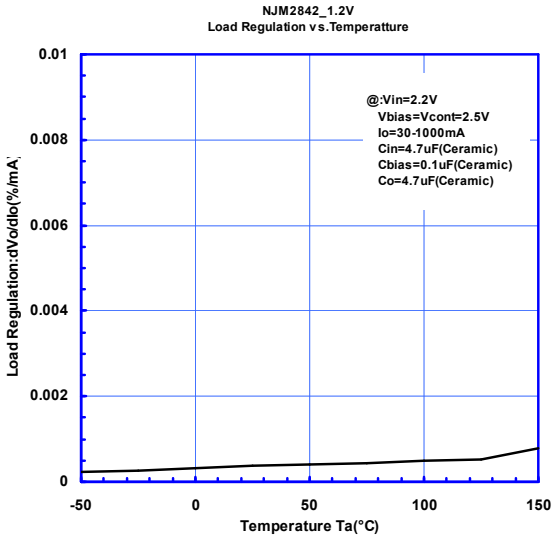


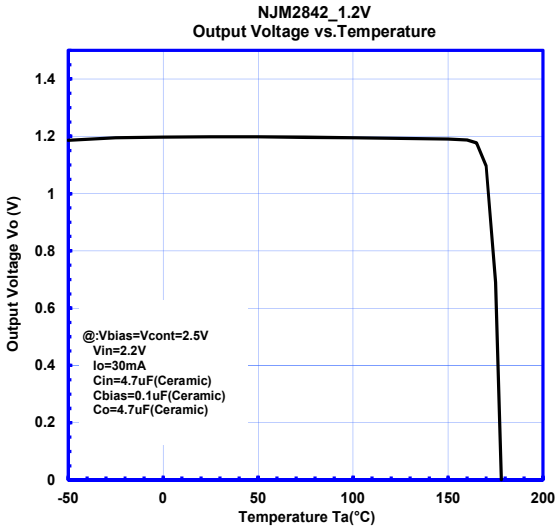

NJM2842_1.2V
Peak Output Current vs.Temperature
Peak Output Current:Imax(mA)
3000
2400
1800
1200
600
0
-50
0
50
100
150
Temperature Ta(°C)
@:Vo*0.9
Vin=2.2V
Vbias=Vcont=2.5V
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

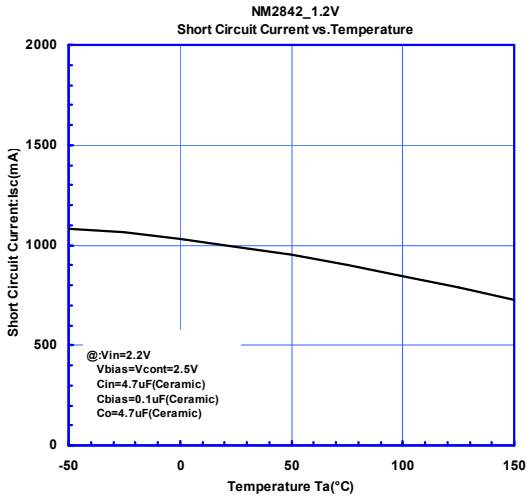

NJM2842_1.2V
unloaded Bias Currentvs.Temperature
unloaded Bias Current :IBIAS (uA)
500
400
300
200
100
0
-50
0
50
100
150
Temperature Ta(°C)
@:Vbias=Vcont=2.5V
Vin=2.2V
Output is open
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

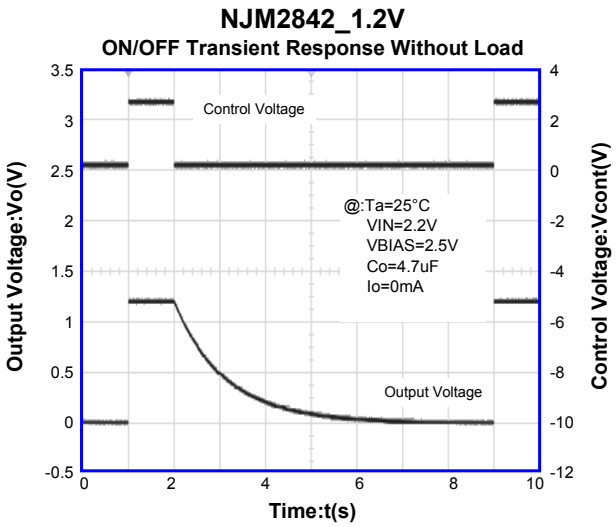

NJM2842_1.2V
Line Regulation(VIN) vs.Temperatture
Line Regulation:dVo/dIo(%/V)
0.2
0.1
0
-0.1
-0.2
-50
0
50
100
150
Temperature Ta(°C)
@:dVin=2.2-5.5V
Vbias=Vcont=2.5V
Io=30mA
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

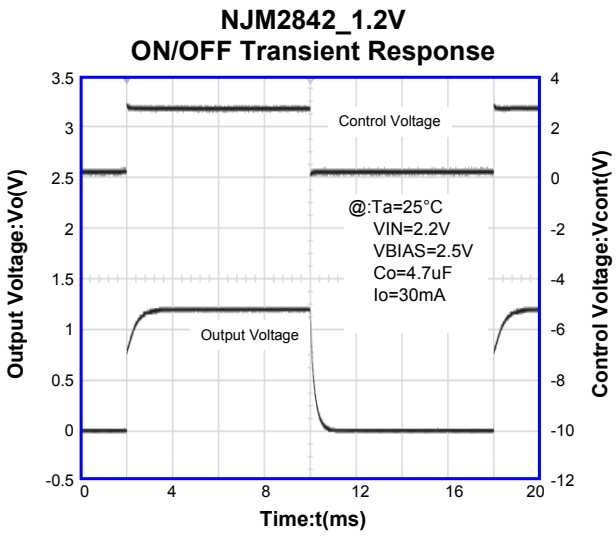

NJM2842_1.2V
Line Regulation(VBIAS) vs.Temperatture
Line Regulation:dVo/dIo(%/V)
0.2
0.1
0
-0.1
-0.2
-50
0
50
100
150
Temperature Ta(°C)
@:dVbias=2.5-5.5V
Vin=2.2V
Vcont=2.5V
Io=30mA
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

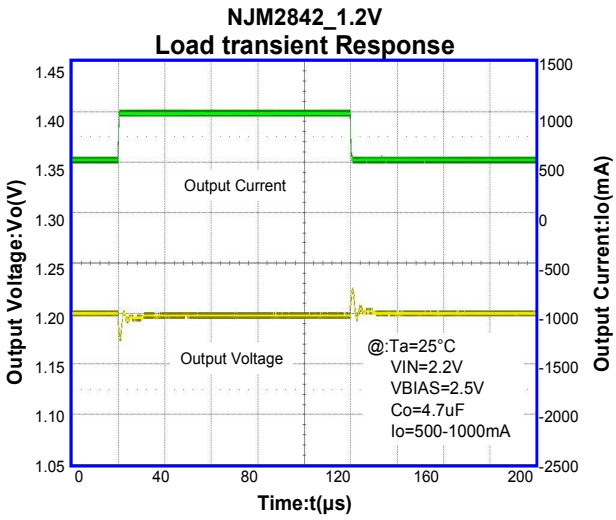

NJM2842_1.2V
Load Regulation vs.Temperatture
Load Regulation:dVo/dIo(%/mA)
0.01
0.008
0.006
0.004
0.002
0
-50
0
50
100
150
Temperature Ta(°C)
@:Vin=2.2V
Vbias=Vcont=2.5V
Io=30-1000mA
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

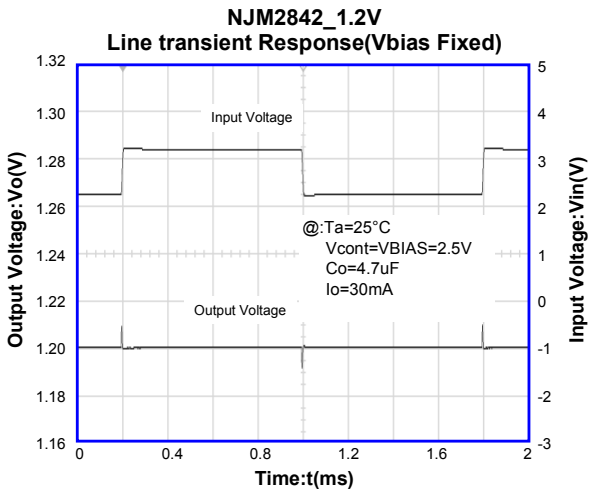

NJM2842_1.2V
Output Voltage vs.Temperature
Output Voltage Vo (V)
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-50
0
50
100
150
200
Temperature Ta(°C)
@:Vbias=Vcont=2.5V
Vin=2.2V
Io=30mA
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)

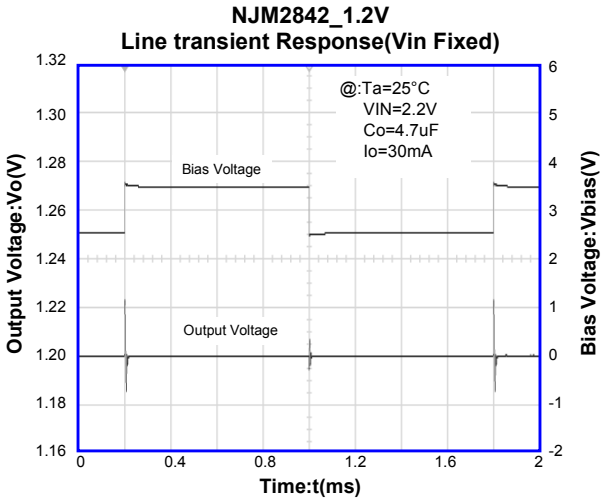

NM2842_1.2V
Short Circuit Current vs.Temperature
Short Circuit Current:Isc(mA)
Temperature Ta(°C)
@:Vin=2.2V
Vbias=Vcont=2.5V
Cin=4.7uF(Ceramic)
Cbias=0.1uF(Ceramic)
Co=4.7uF(Ceramic)


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


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


NJM2842_1.2V
Load transient Response
Output Current
Output Voltage
@:Ta=25°C
VIN=2.2V
VBIAS=2.5V
Co=4.7uF
Io=500-1000mA
Output Voltage:Vo(V)
Output Current:Io(mA)
Time:t(µs)


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


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

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