LOW DROPOUT VOLTAGE REGULATOR

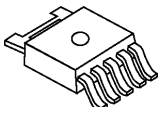
■ GENERAL DESCRIPTION

The NJM2836 is a 500mA output low dropout voltage regulator.

Advanced Bipolar technology achieves low noise, high ripple rejection and high supply voltage.

2.1V to 15.5V output voltage range, 2.2μF small decoupling capacitor, built-in noise bypass capacitor make the NJM2836 suitable for various applications.

■ PACKAGE OUTLINE

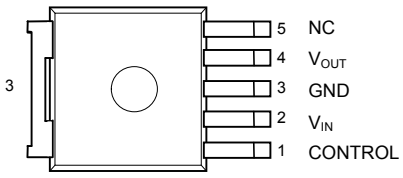


NJM2836DL3

■ FEATURES

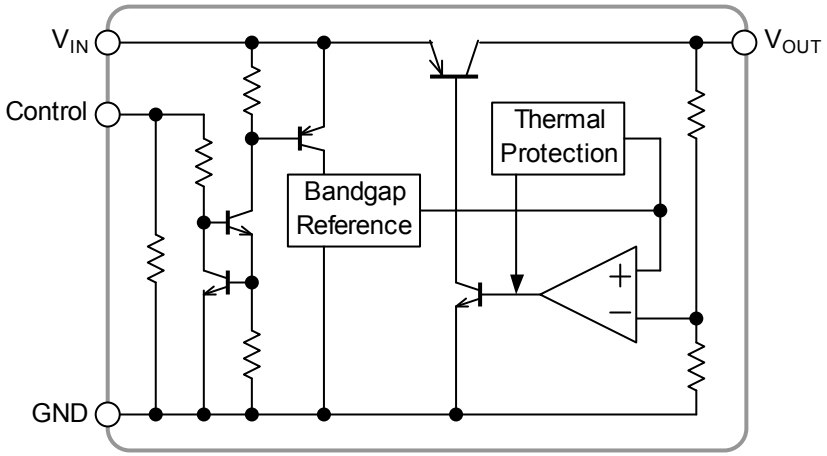
- Output voltage options available 2.1 ~ 15.5V
- High Ripple Rejection 75dB typ. (f=1kHz,Vo=3V Version)
- Low Output Noise Voltage Vno=45μVrms typ.
- Output Current Io(max.)=500mA
- High Precision Output Voltage Vo±1.0%
- Output capacitor with 2.2μF ceramic capacitor (Vo≥5.1V)
- Low Dropout Voltage 0.18V typ. (Io=300mA)
- ON/OFF Control
- Internal Thermal Overload Protection
- Internal Over Current Protection
- Bipolar Technology
- Package Outline TO-252-5

■ PIN CONFIGURATION



NJM2836DL3

■ BLOCK DIAGRAM



■ OUTPUT VOLTAGE RANK LIST

The WHITE column shows applicable Voltage Rank(s)

Device Name	Vout	Device Name	Vout	Device Name	Vout
NJM2836DL3-21	2.1V	NJM2836DL3-36	3.6V	NJM2836DL3-08	8.0V
NJM2836DL3-22	2.2V	NJM2836DL3-37	3.7V	NJM2836DL3-85	8.5V
NJM2836DL3-23	2.3V	NJM2836DL3-38	3.8V	NJM2836DL3-09	9.0V
NJM2836DL3-24	2.4V	NJM2836DL3-39	3.9V	NJM2836DL3-10	10.0V
NJM2836DL3-25	2.5V	NJM2836DL3-04	4.0V	NJM2836DL3-12	12.0V
NJM2836DL3-26	2.6V	NJM2836DL3-41	4.1V	NJM2836DL3-125	12.5V
NJM2836DL3-27	2.7V	NJM2836DL3-42	4.2V	NJM2836DL3-13	13.0V
NJM2836DL3-28	2.8V	NJM2836DL3-43	4.3V	NJM2836DL3-15	15.0V
NJM2836DL3-29	2.9V	NJM2836DL3-44	4.4V		
NJM2836DL3-03	3.0V	NJM2836DL3-45	4.5V		
NJM2836DL3-31	3.1V	NJM2836DL3-46	4.6V		
NJM2836DL3-32	3.2V	NJM2836DL3-47	4.7V		
NJM2836DL3-33	3.3V	NJM2836DL3-48	4.8V		
NJM2836DL3-34	3.4V	NJM2836DL3-49	4.9V		
NJM2836DL3-35	3.5V	NJM2836DL3-05	5.0V		

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	+20	V
Control Voltage	V_{CONT}	+20	V
Power Dissipation	P_D	1190(*1) 3125(*2)	mW
Operating Temperature	Topr	-40 ~ +85	°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)

(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

($V_{IN=}$ Vo+1V, C_{IN}=0.33μF, Co=2.2μF (2.9V<Vo≤5V:Co=4.7μF,Vo≤2.9V:Co=10μF),Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION		MIN	TYP	MAX	UNIT
Output Voltage	Vo	Io=30mA		-1.0%	-	+1.0%	V
Quiescent Current	I_Q	Io=0mA	Vo≤5V Version	-	200	300	μA
			5V<Vo≤10V Version	-	215	315	μA
			10V<Vo≤15V Version	-	230	330	μA
Quiescent Current at Control OFF	$I_{Q(OFF)}$	V_{CONT}=0V		–	–	100	nA
Output Current	Io	Vo-0.3V		500	650	-	mA
Line Regulation	$\Delta Vo/\Delta V_{IN}$	V_{IN}=Vo+1V ~ Vo+6V(Vo≤12V), V_{IN}=Vo+1V ~ 18V(Vo>12V), Io=30mA		-	-	0.10	%/V
Load Regulation	$\Delta Vo/\Delta Io$	Io=0 ~ 500mA		-	-	0.007	%/mA
Dropout Voltage(*3)	ΔV_{I-O}	Io=300mA		-	0.18	0.28	V
Ripple Rejection	RR	ein=200mVrms,f=1kHz,Io=10mA Vo=3V Version		-	75	-	dB
Average Temperature Coefficient of Output Voltage	$\Delta Vo/\Delta Ta$	Ta=0 ~ 85°C, Io=10mA		-	± 50	-	ppm/°C
Output Noise Voltage	V_{NO}	f=10Hz ~ 80kHz, Io=10mA, Vo=3V Version		-	45	-	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
Input Voltage	V_{IN}			-	-	18	V

(*3): The above specification is a common specification for all output voltages.
Therefore, it may be different from the individual specification for a specific output voltage.

■ THERMAL CHARACTERISTICS

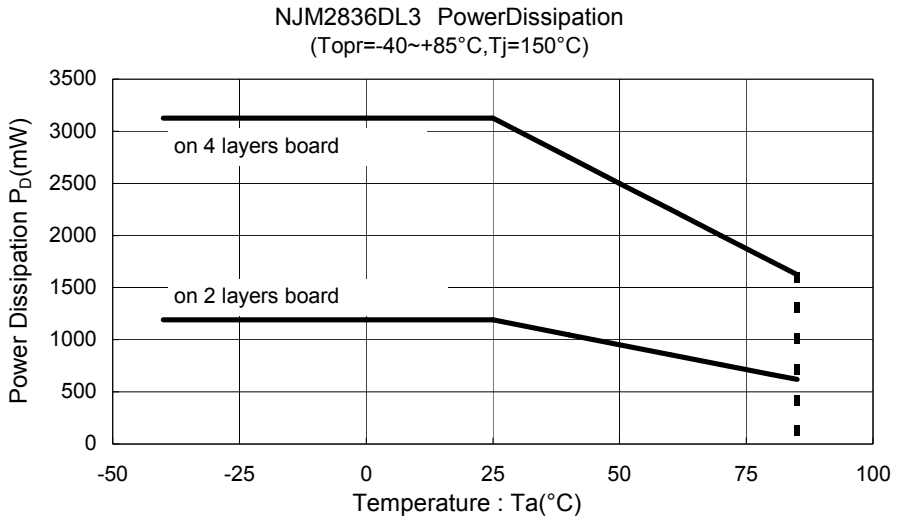
PARAMETER	SYMBOL	VALUE	UNIT
Junction-to-ambient thermal resistance	θja	105 (*3) 40 (*4)	°C/W
Junction-to-Top of package characterization parameter	ψjt	17 (*3) 12 (*4)	°C/W

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

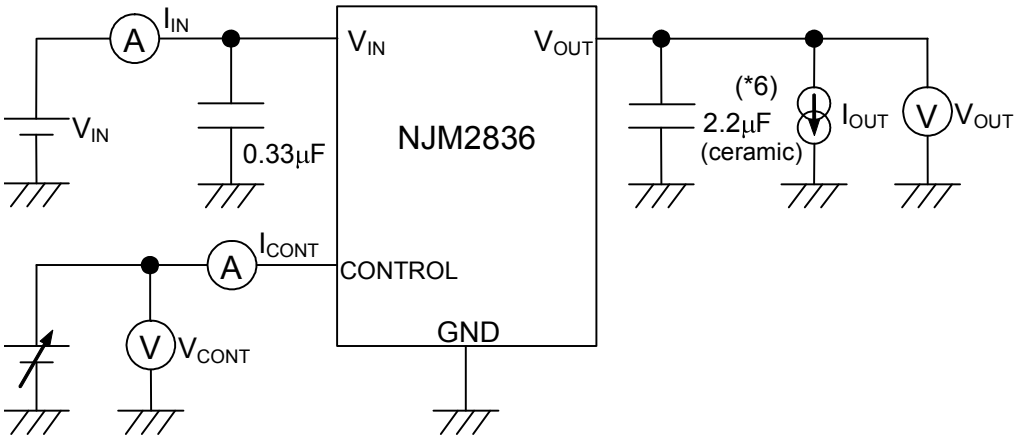
(*5): Mounted on glass epoxy board. (76.2 × 114.3 × 1.6mm:based on EIA/JDEC standard, 4Layers)

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

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



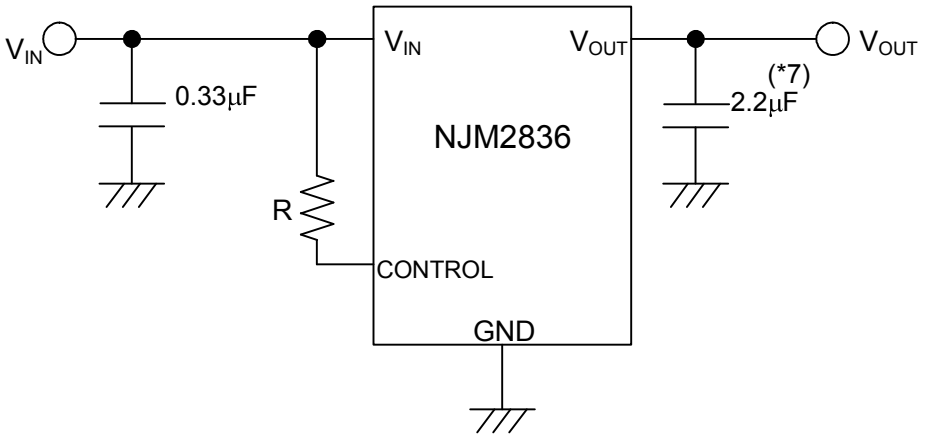
■TEST CIRCUIT



(*6)2.9V<Vo≤5V version : Co=4.7μF(ceramic)
Vo≤2.9V version : Co=10μF(ceramic)

■ TYPICAL APPLICATIONS

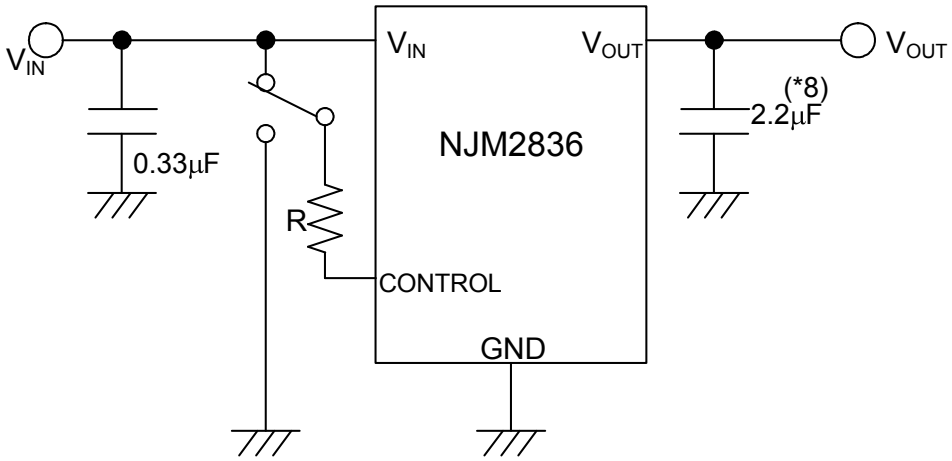
① In the case where ON/OFF Control is not required



(*7): 2.9V<Vo≤5V version : Co=4.7μF
Vo≤2.9V version : Co=10μF

Connect control pin to V_{IN} pin

② In use of ON/OFF CONTROL



(*8) :2.9V<Vo≤5V version : Co=4.7μF
Vo≤2.9V version : Co=10μF

State of control pin:

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

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

If this resistor is inserted, the control current could be reduced 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 resistor "R" 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

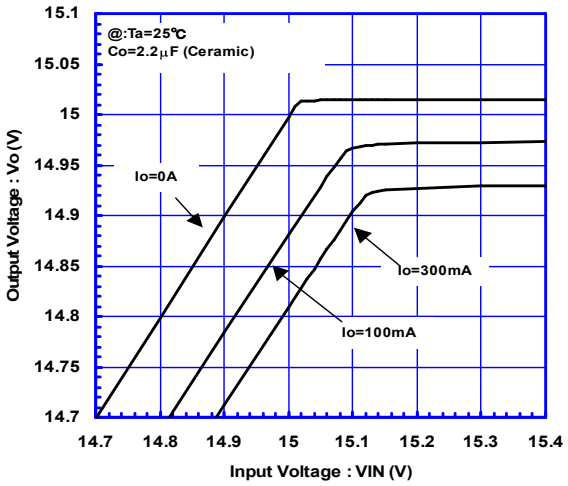
The recommended capacitance depends on the output voltage rank. Especially, low voltage regulator requires larger C_O value.

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.

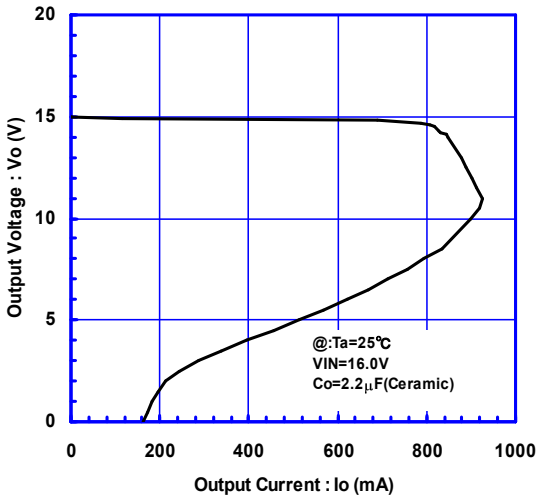
When selecting C_O, recommend that have withstand voltage margin against output voltage and superior temperature characteristic though this product is designed stability works with wide range ESR of capacitor including low ESR products.

■ TYPICAL CHARACTERISTICS

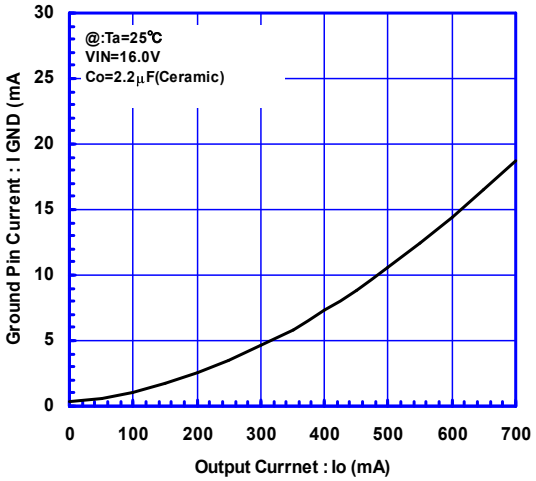
NJM2836_15V
Output Voltage vs Input Voltage



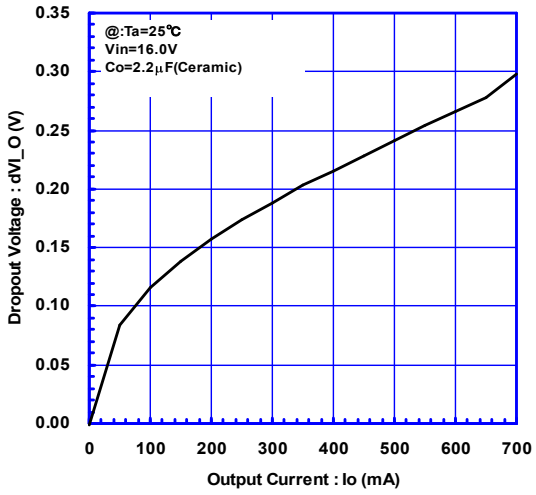
NJM2836_15V
Over Current Protection vs Output Current



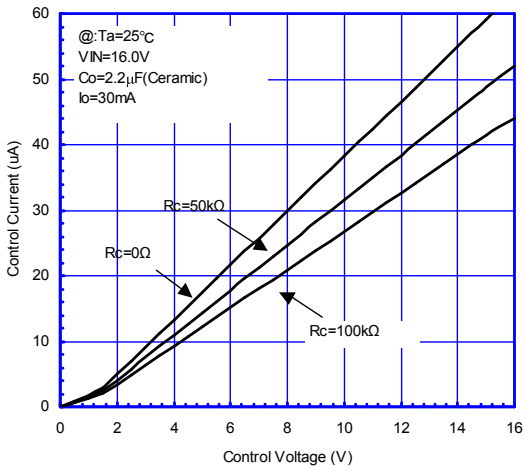
NJM2836_15V
Ground Current vs Output Current



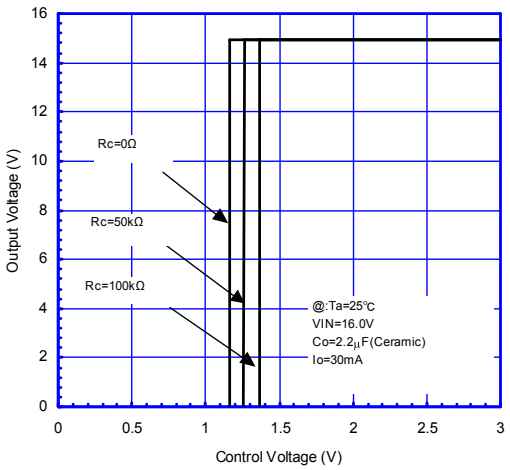
NJM2836_15V
Dropout Voltage VS Output Current



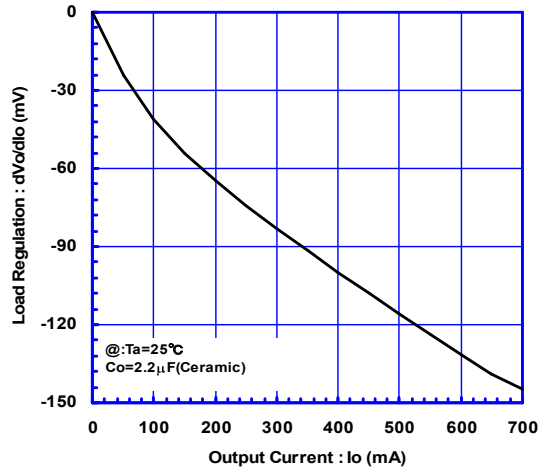
NJM2836_15V
Control Voltage vs Control Current



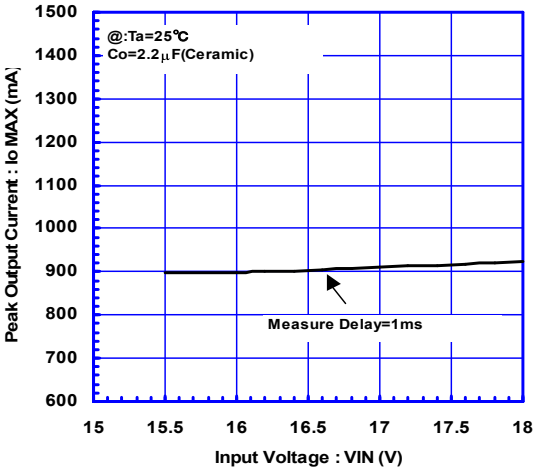
NJM2836_15V
Control Voltage vs Output Voltage



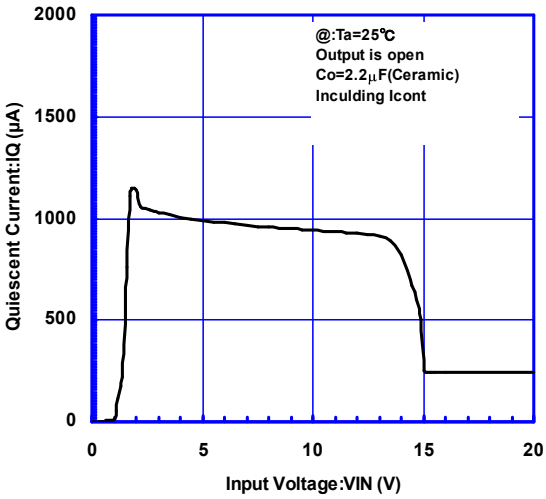
NJM2836_15V
Dropout Voltage VS Output Current



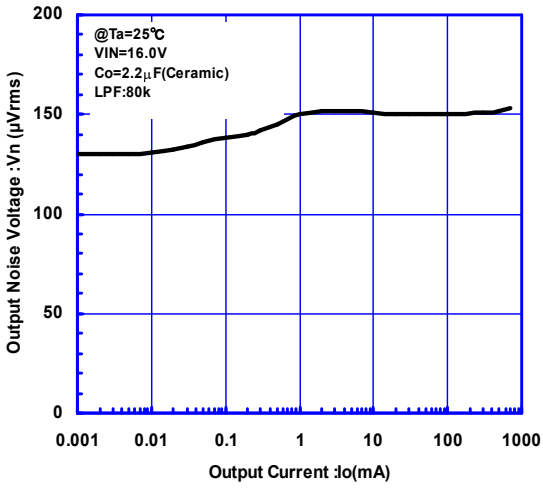
NJM2836_15V
Output Current vs Input Voltage



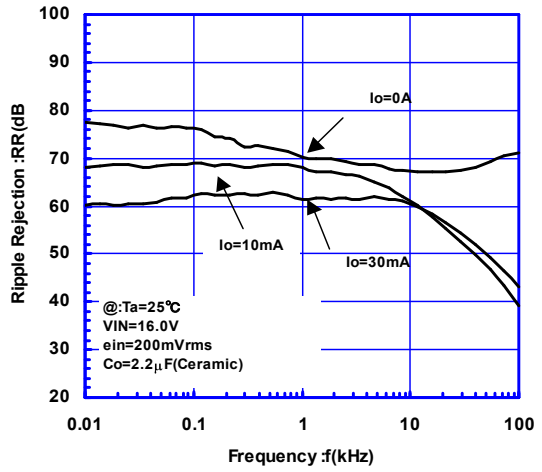
NJM2836_15V
Quiescent Current vs Input Voltage



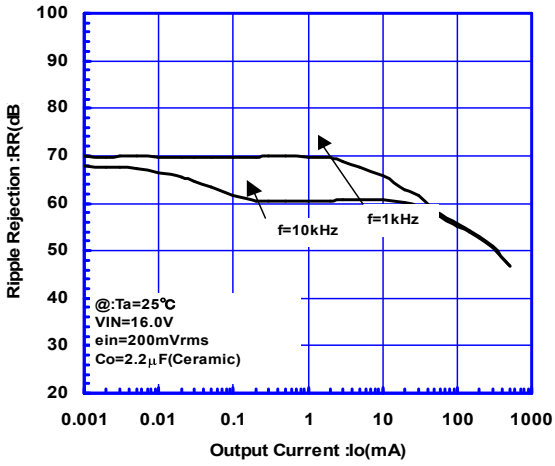
NJM2836_15V
Output Noise Voltage vs Output Current

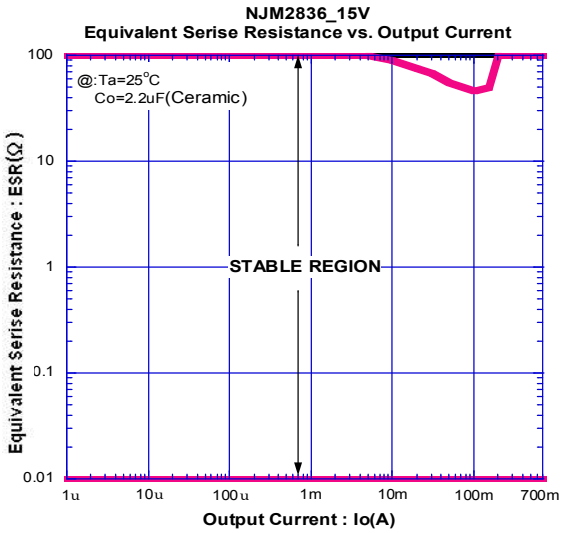


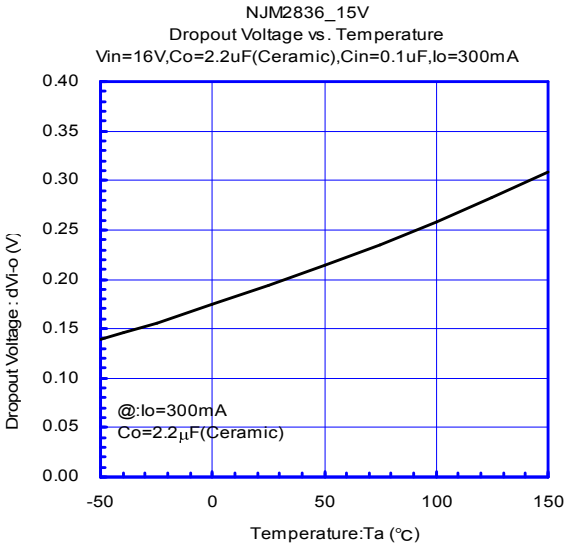
NJM2836_15V
Ripple Rejection

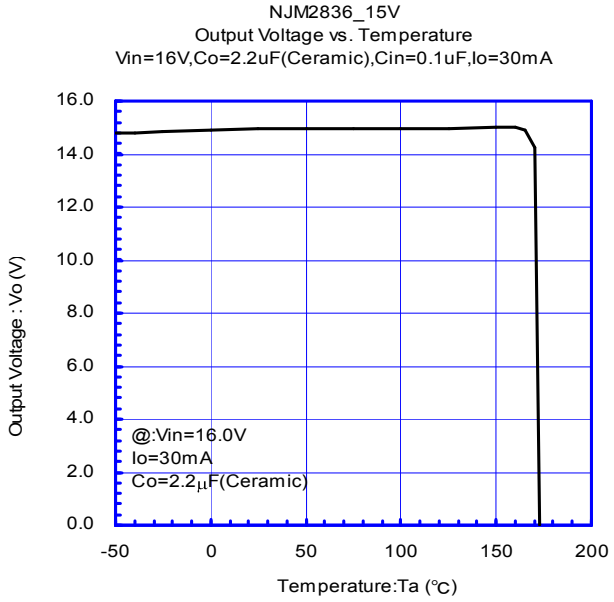


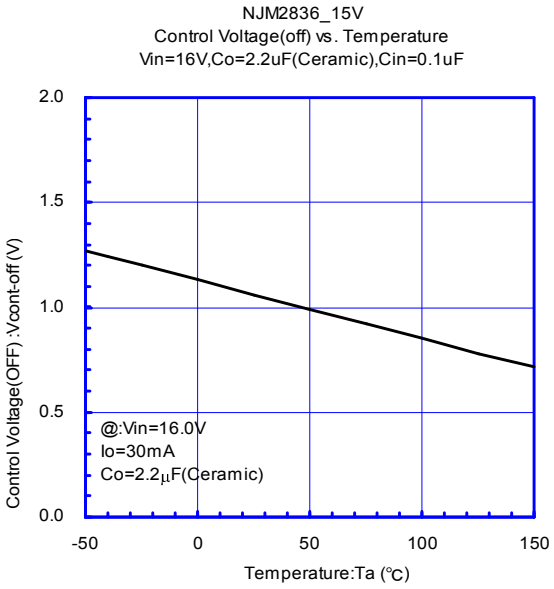
NJM2836_15V
Output Current vs Ripple Rejection

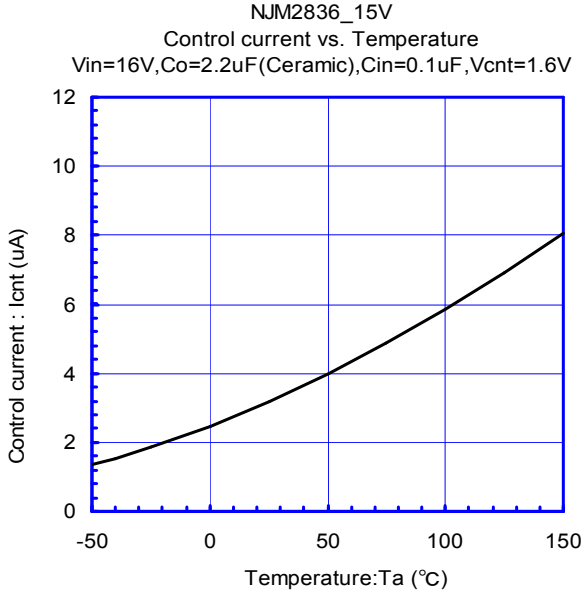


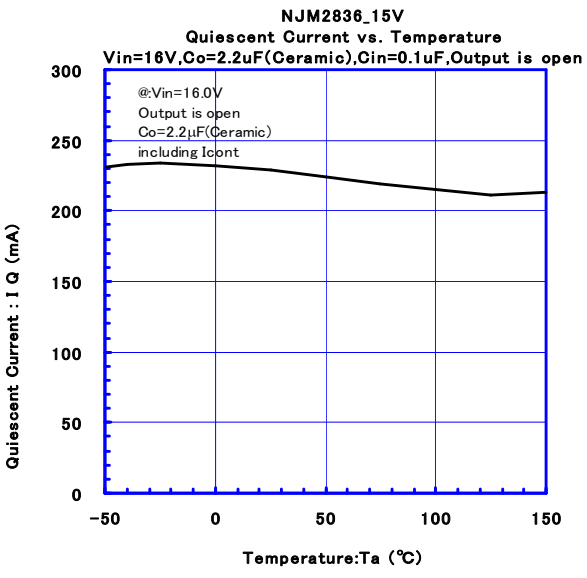

NJM2836_15V
Equivalent Serise Resistance vs. Output Current
@:Ta=25°C
Co=2.2uF(Ceramic)
STABLE REGION
Equivalent Serise Resistance : ESR(Ω)
Output Current : Io(A)
100
10
1
0.1
0.01
1u
10u
100u
1m
10m
100m
700m


NJM2836_15V
Dropout Voltage vs. Temperature
Vin=16V,Co=2.2uF(Ceramic),Cin=0.1uF,Io=300mA
@:Io=300mA
Co=2.2μF(Ceramic)
Dropout Voltage : dVi-o (V)
Temperature:Ta (°C)
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-50
0
50
100
150

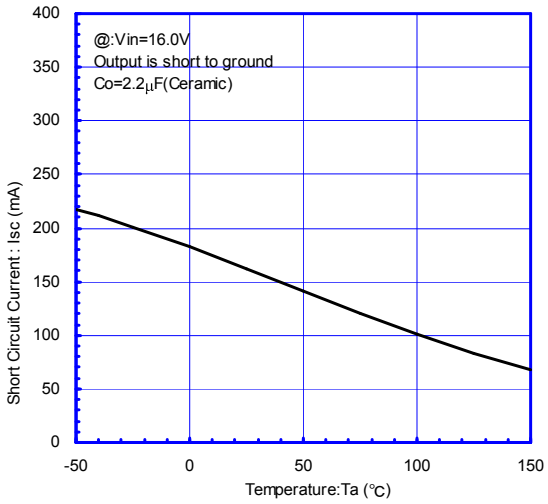

NJM2836_15V
Output Voltage vs. Temperature
Vin=16V,Co=2.2uF(Ceramic),Cin=0.1uF,Io=30mA
@:Vin=16.0V
Io=30mA
Co=2.2μF(Ceramic)
Output Voltage : Vo (V)
Temperature:Ta (°C)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-50
0
50
100
150
200


NJM2836_15V
Control Voltage(off) vs. Temperature
Vin=16V,Co=2.2uF(Ceramic),Cin=0.1uF
@:Vin=16.0V
Io=30mA
Co=2.2μF(Ceramic)
Control Voltage(OFF) :Vcont-off (V)
Temperature:Ta (°C)
2.0
1.5
1.0
0.5
0.0
-50
0
50
100
150

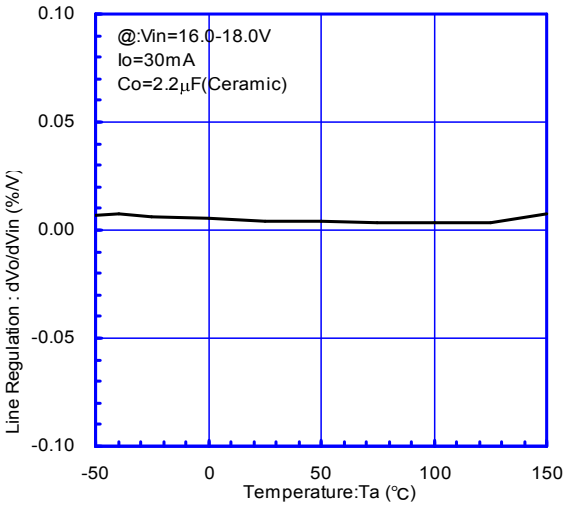

NJM2836_15V
Control current vs. Temperature
Vin=16V,Co=2.2uF(Ceramic),Cin=0.1uF,Vcnt=1.6V
Control current : Icnt (uA)
Temperature:Ta (°C)
12
10
8
6
4
2
0
-50
0
50
100
150


NJM2836_15V
Quiescent Current vs. Temperature
Vin=16V,Co=2.2uF(Ceramic),Cin=0.1uF,Output is open
@:Vin=16.0V
Output is open
Co=2.2μF(Ceramic)
including Icont
Quiescent Current : I Q (mA)
Temperature:Ta (°C)
300
250
200
150
100
50
0
-50
0
50
100
150

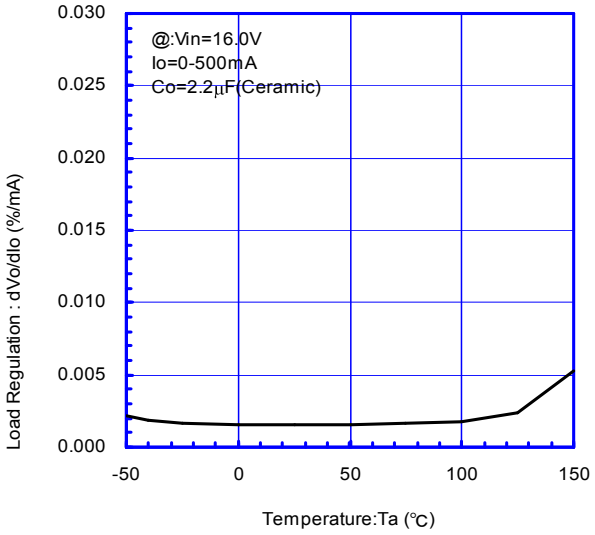
NJM2836_15V
Short Circuit Current vs. Temperature
Vin=16V,Co=2.2uF(Ceramic),Cin=0.1uF
Output is shorted to Ground



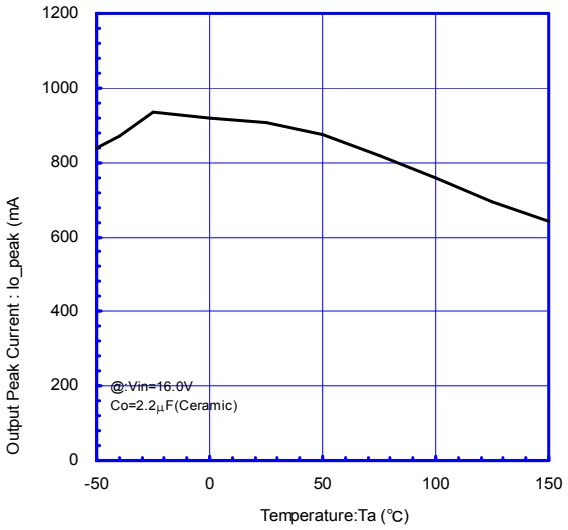
NJM2836_15V
Line Regulation vs. Temperature
Vin=16V,Co=2.2uF(Ceramic),Cin=0.1uF



NJM2836_15V
Load Regulation vs. Temperature
Vin=16V,Co=2.2uF(Ceramic),Cin=0.1uF,Io=0-500mA

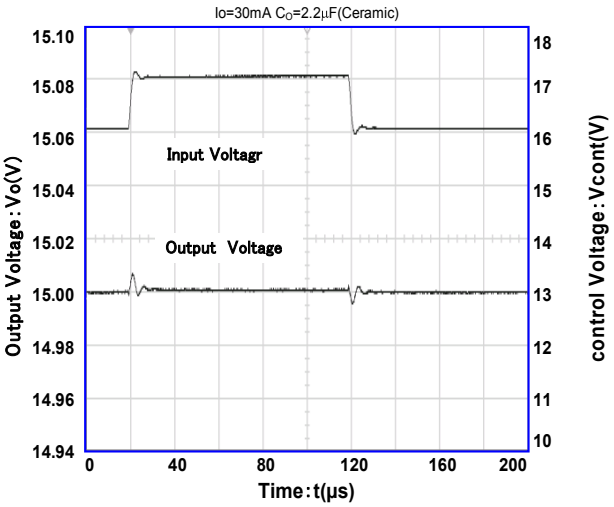


NJM2836_15V
Output Peak Current vs. Temperature
Vin=16V,Co=2.2uF(Ceramic),Cin=0.1uF,Vo=14.9V



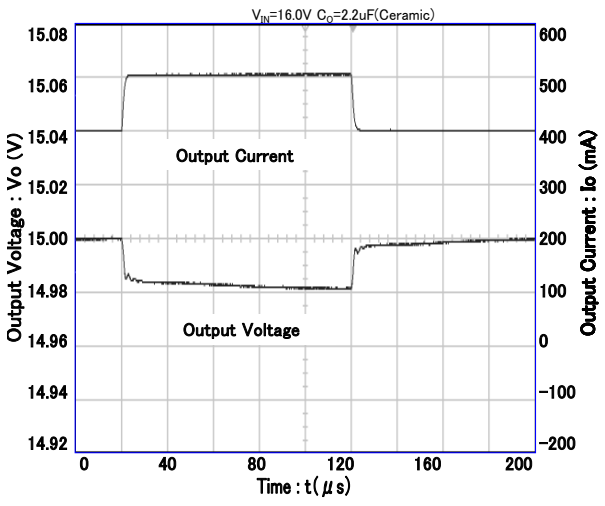
NJM2836_15V

Line Transient Respons



NJM2836_15V

Load Transient Respons



[CAUTION]
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