Very Low Output Negative Voltage Regulator

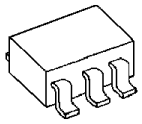
■ GENERAL DESCRIPTION

The NJM2829 is a negative voltage regulator that delivers up to 100mA output current with the output voltage of -0.8 to -1.3V with ON/OFF control.

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

It has soft-start and shunt SW function. 2.2μF Output capacitor and small package can make NJM2829 suitable for portable items

■ PACKAGE OUTLINE

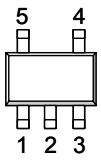


NJM2829F3

■ FEATURES

- High Precision Output V_O±1.5%
- High Ripple Rejection 80dB typ. (f=1kHz, V_O=-1.0V version)
- Output Capacitor with 2.2μF ceramic capacitor
- Output Current I_O(max)=100mA
- ON/OFF Control (Positive voltage control from 0V to +5V)
- Soft-start Function
- Shunt SW Function
- Built-in Thermal Overload Protection and Short Circuit Current Limit Protection
- Bipolar Technology
- Package Outline SC-88A

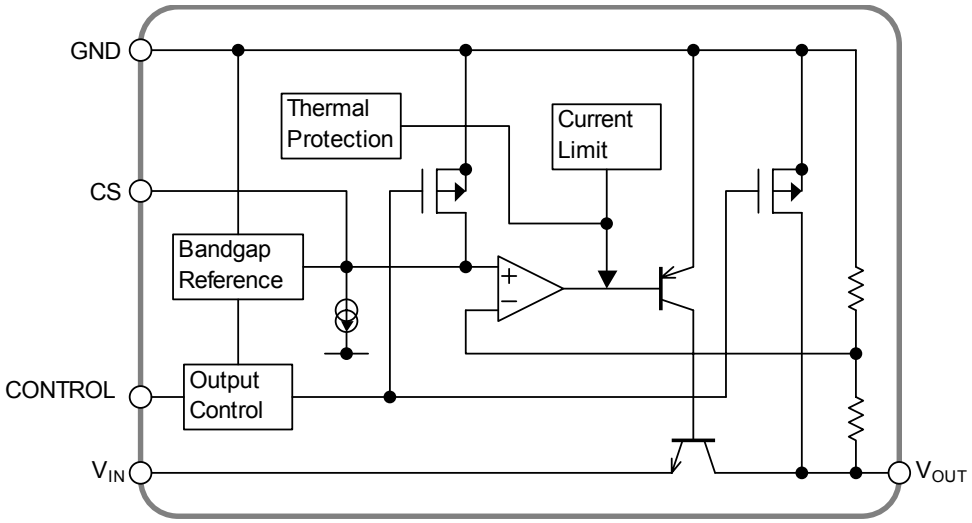
■ PIN CONNECTION



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

NJM2829F3

■ BLOCK DIAGRAM



■ OUTPUT VOLTAGE LANK LIST

Device Name	V_{out}
NJM2829F3 -008	-0.8V
NJM2829F3 -095	-0.95V
NJM2829F3 -010	-1.0V
NJM2829F3 -012	-1.2V
NJM2829F3 -013	-1.3V

Output Voltage Range: -0.8V to -1.3V

■ ABABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	-14	V
Control Voltage	V_{CONT}	+5	V
Output Sink Current at OFF-state	$I_{SINK(OFF)}$	10	mA
Power Dissipation	P_D	250(*1)	mW
Operating Temperature	Topr	- 40 ~ +85	°C
Storage Temperature	Tstg	- 40 ~ +125	°C

(*1): Mounted on glass epoxy board. (114.3×76.2×1.6mm : 2layer,FR-4)

■ OPERATING VOLTAGE

V_{IN}=-3.2 ~ -12V

■ ELECTRICAL CHARACTERISTICS

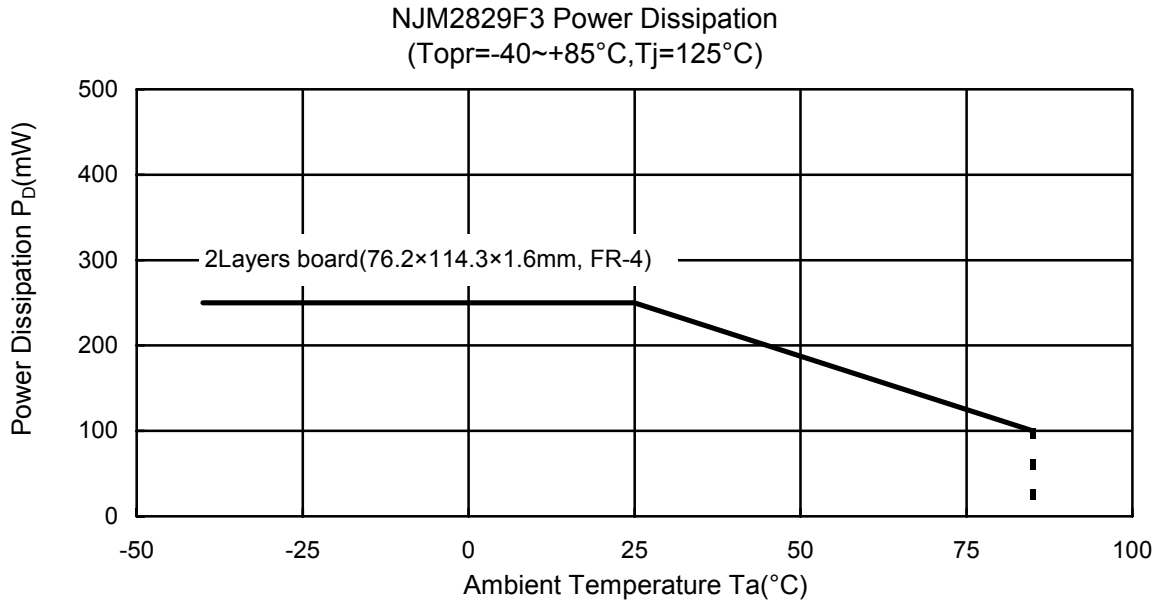
(V_{IN}=3.2V, V_{CONT}=3V, C_{IN}=0.1μF, Co=2.2μF(Vo > -0.9V :Co=4.7μF) , Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	Vo	Io=30mA	-1.5%	-	+1.5%	V
Quiescent Current	I_Q	Io=0mA, except Icont	-	140	220	μA
Quiescent Current at OFF-state	$I_{Q(OFF)}$	V_{CONT}=0V	-	-	100	nA
Output Current	Io	V_O×0.9	100	130	-	mA
Line Regulation	$\Delta Vo/\Delta V_{IN}$	V_{IN}=Vo-3.2V~ -12V, Io=30mA	-	-	0.10	%/V
Load Regulation	$\Delta Vo/\Delta Io$	Io=0~60mA	-	-	0.04	%/mA
Ripple Rejection	RR	V_{IN}=-4.0V,ein=200mVrms,f=1kHz, Io=10mA,Vo=-1.0V Version	-	80	-	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=--1.0V Version	-	40	-	μVrms
CS Terminal Charge Current	Ics	V_{CS}=0V	4	5.3	6.5	μA
Output Resistance at OFF-state	$R_{O(OFF)}$	V_{CONT}=0V	-	560	-	Ω
Control Current	I_{CONT}	V_{CONT}=1.6V	-	2	4	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}		-12	-	-	V

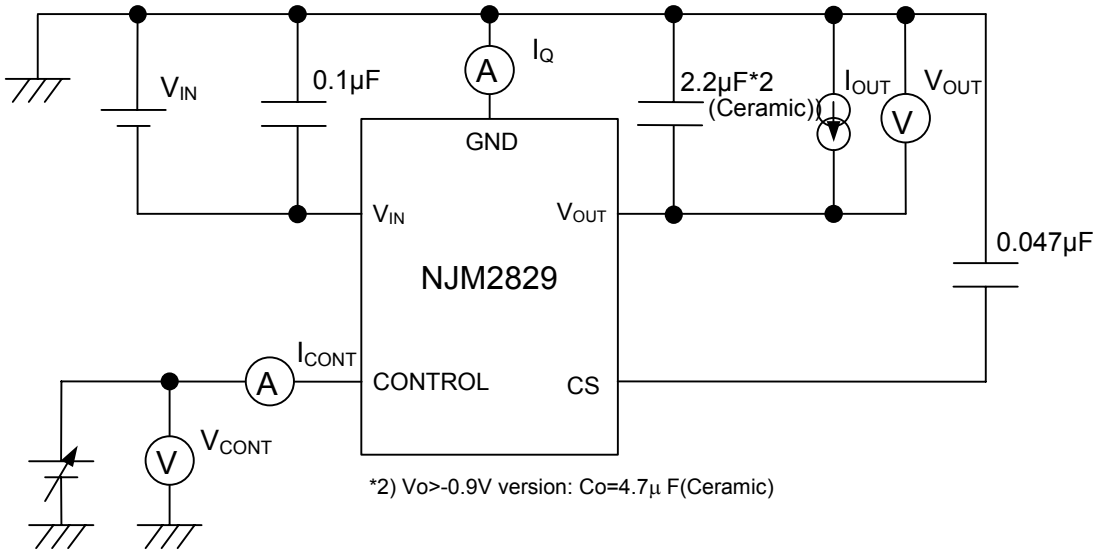
The above specification is a common specification for all output voltages.

Therefore, it may be different from the individual specification for a specific output voltage.

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



■ **TEST CIRCUIT**



■ TYPICAL APPLICATION

✻ON/OFF control

ON/OFF control can be achieved by applying positive control voltage to CONTROL terminal.

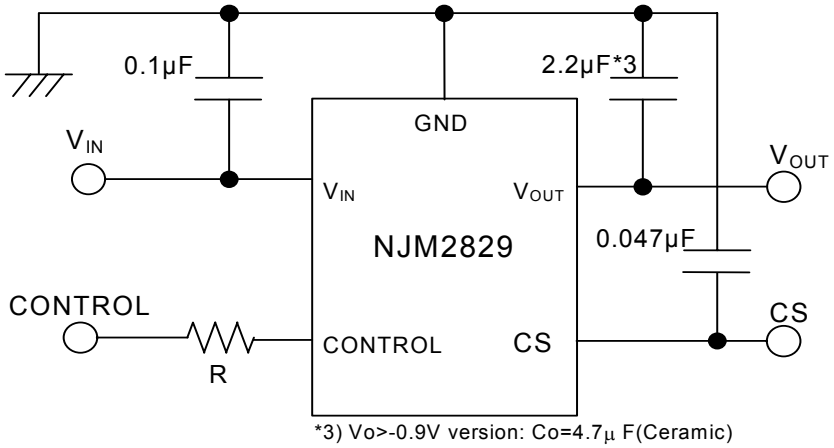
Apply positive Vcont ("H") to make chip to be ON (Enabled), and either Vcont is "L" or open (High Z) to make chip to be OFF (Disabled).

The relations between Vcont and the state is as follows:

Vcont +1.6V ≤ Vcont ≤ +5V ("H" level):	ON state
Vcont 0V ≤ Vcont ≤ +0.6V ("L" level):	OFF state
Vcont +0.6V < Vcont < +1.6V ("L" level):	Undefined

In case ON/OFF control is not used, keep applying positive Vcont to CONTROL terminal to make chip ON.

Note that negative Vcont does not make the chip enabled.



*3) Vo>-0.9V version: Co=4.7µ F(Ceramic)

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

The current flow into the control terminal while the IC is ON state (I_{CONT}) can be reduced when a pull up resistance "R" is inserted between V_{IN} and the control terminal.

The minimum control voltage for ON state ($V_{CONT\,(ON)}$) is increased due to the voltage drop caused by I_{CONT} and the resistance "R".

* Input Capacitance C_{IN}

Input Capacitance C_{IN} is required to prevent oscillation and reduce power supply ripple for applications with high power supply impedance or a long power supply line.

Use the C_{IN} value of 0.1µF greater to avoid the problem.

C_{IN} should connect between GND and V_{IN} as short as possible.

*Output Capacitance C_O

Output capacitor (Co) is required for a phase compensation of the internal error amplifier. The capacitance and the equivalent series resistance (ESR) influences stability of the regulator.

This product is designed to work with a low ESR capacitor for the Co; however, use of recommended capacitance or greater value is essential for stable operation.

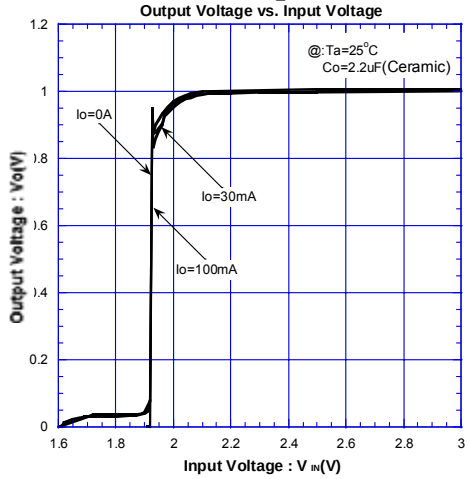
Use of a smaller Co may cause excess output noise or oscillation of the regulator due to lack of the phase compensation.

Therefore, use Co with the recommended capacitance or greater value and connect between Vo terminal and GND terminal with minimal wiring. The recommended capacitance depends on the output voltage. Low voltage regulator requires greater value of the Co. Thus, check the recommended capacitance for each output voltage.

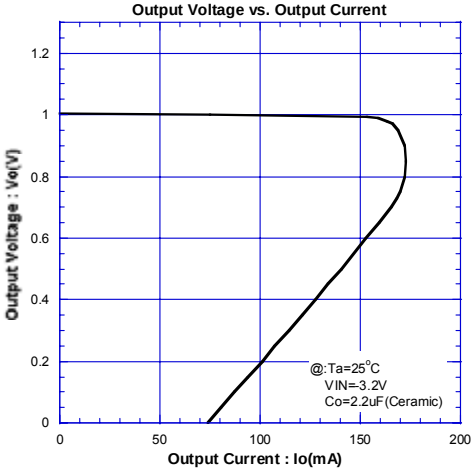
Use of a greater Co reduces output noise and ripple output, and also improves transient response of the output voltage against rapid load change.

■ TYPICAL CHARACTERISTICS

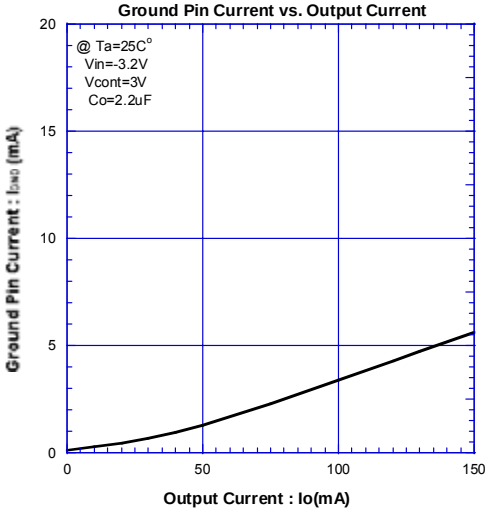
NJM2829_-1.0V
Output Voltage vs. Input Voltage



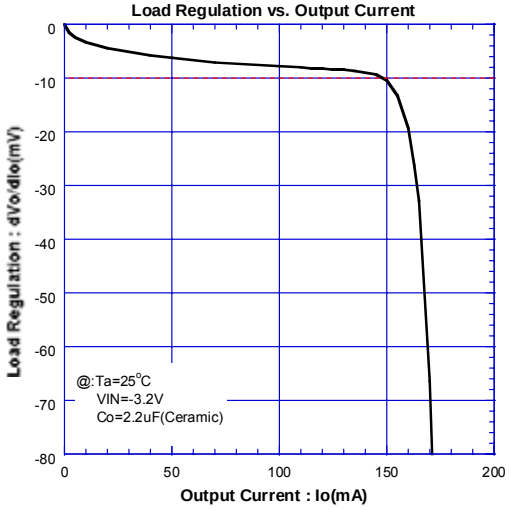
NJM2829_-1.0V
Output Voltage vs. Output Current



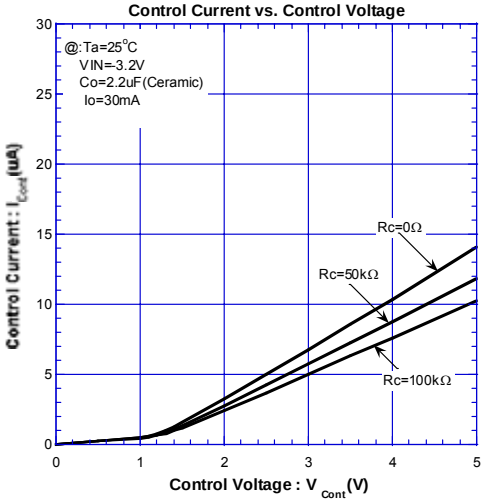
NJM2829_-1.0V
Ground Pin Current vs. Output Current



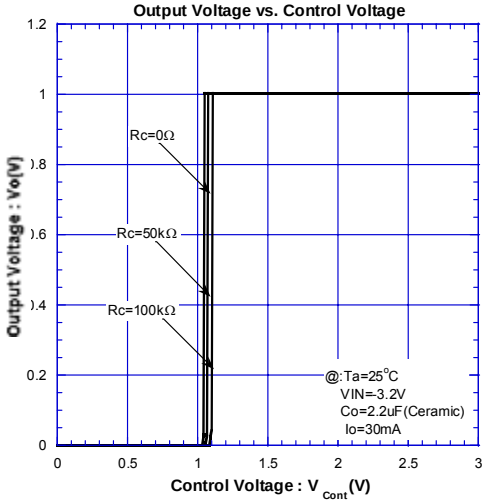
NJM2829_-1.0V
Load Regulation vs. Output Current



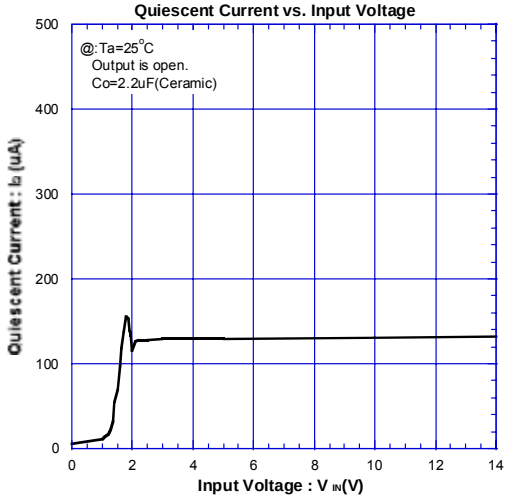
NJM2829_-1.0V
Control Current vs. Control Voltage



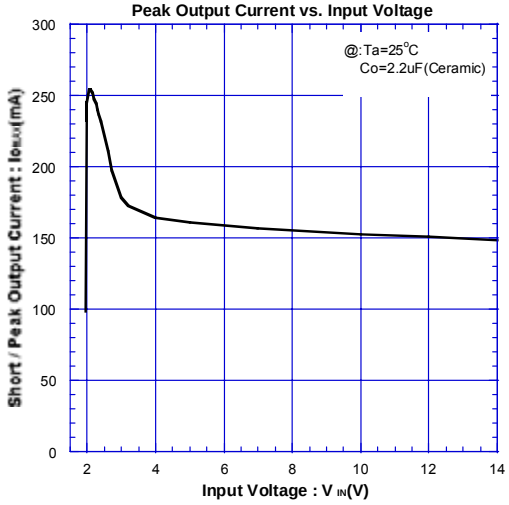
NJM2829_-1.0V
Output Voltage vs. Control Voltage



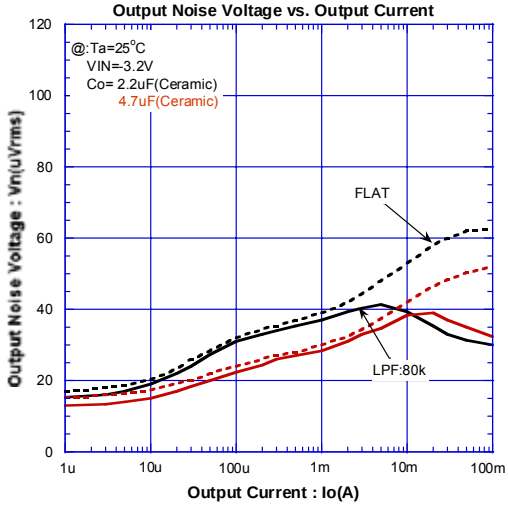
NJM2829_-1.0V
Quiescent Current vs. Input Voltage



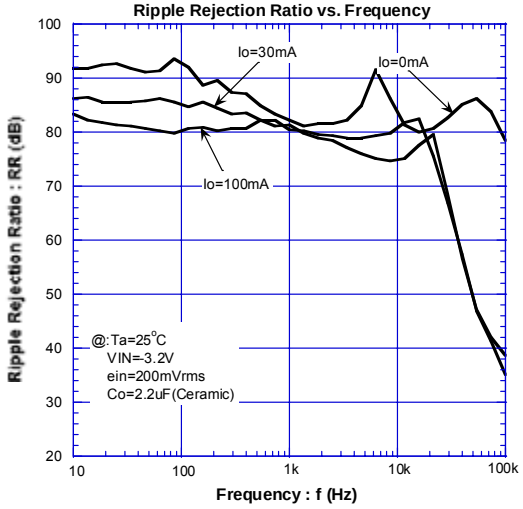
NJM2829_-1.0V
Peak Output Current vs. Input Voltage



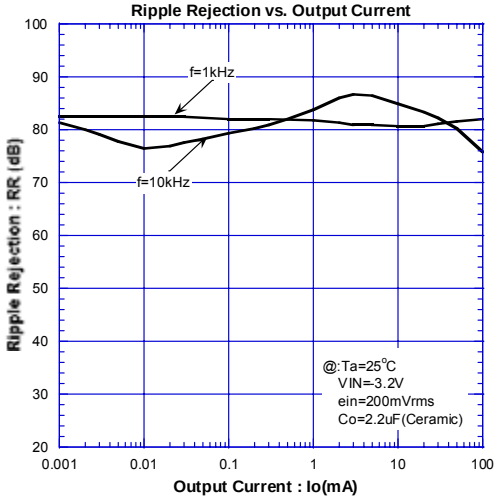
NJM2829_-1.0V
Output Noise Voltage vs. Output Current



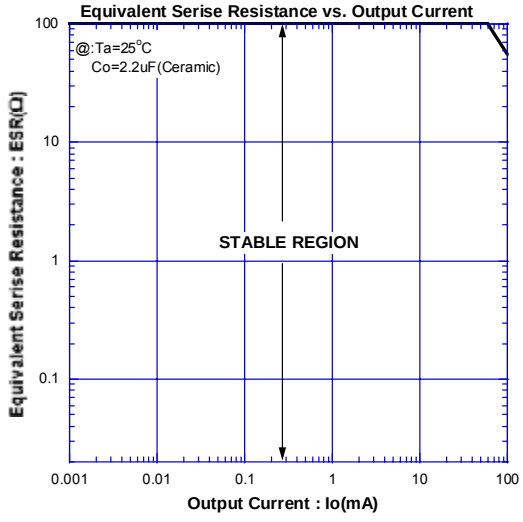
NJM2829_-1.0V
Ripple Rejection Ratio vs. Frequency



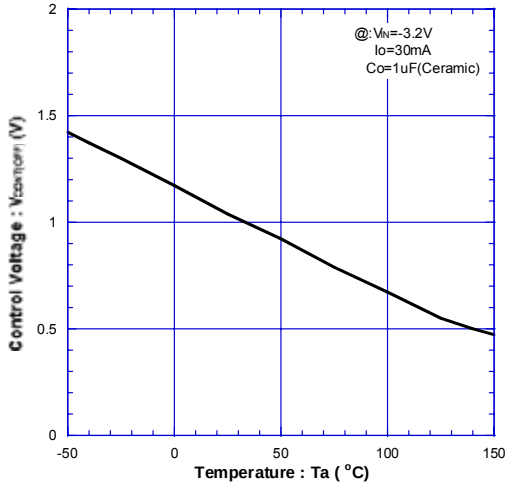
NJM2829_-1.0V
Ripple Rejection vs. Output Current



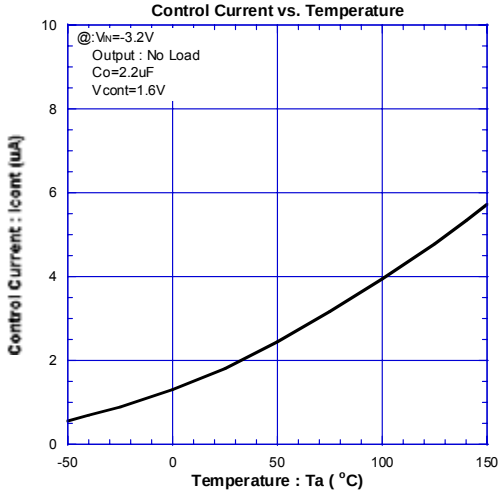
NJM2829_-1.0V
Equivalent Serise Resistance vs. Output Current



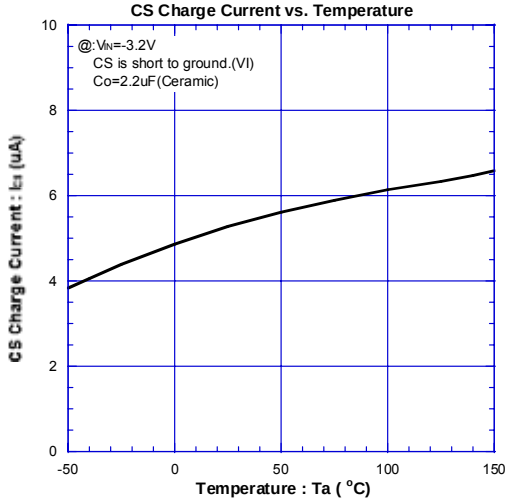
NJM2829_-1.0V
Control Voltage v.s. Temperature



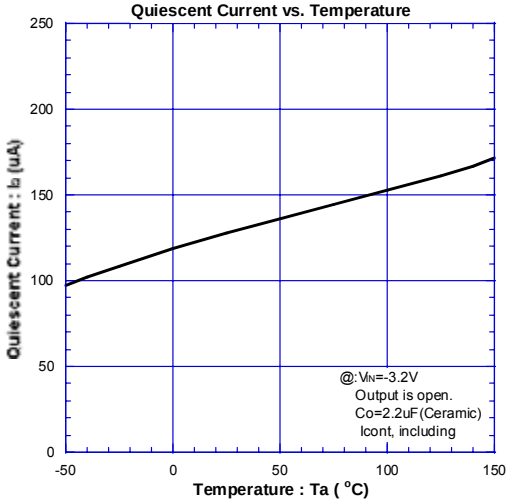
NJM2829_1.0V
Control Current vs. Temperature



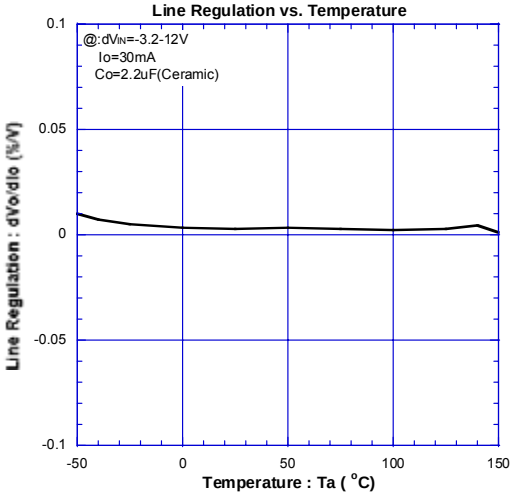
NJM2829_-1.0V
CS Charge Current vs. Temperature



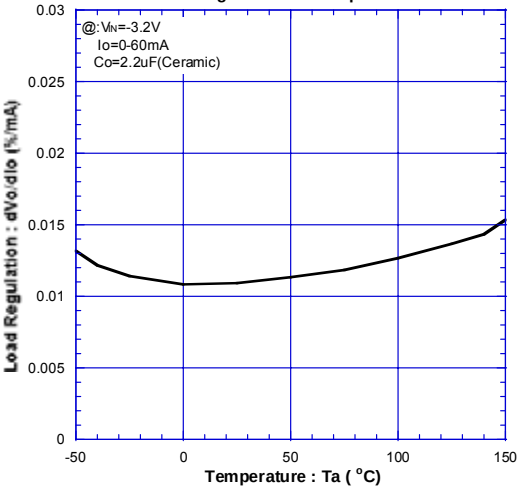
NJM2829_-1.0V
Quiescent Current vs. Temperature

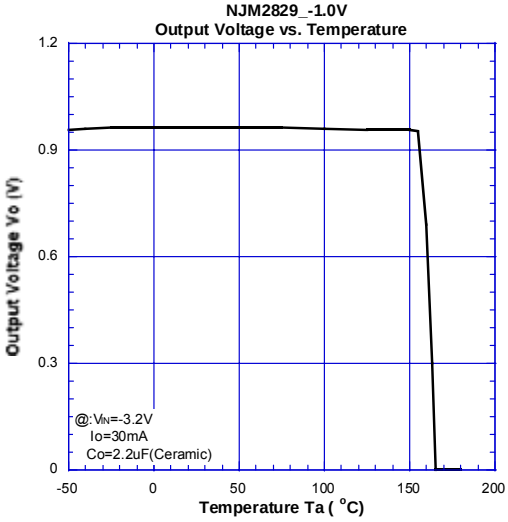


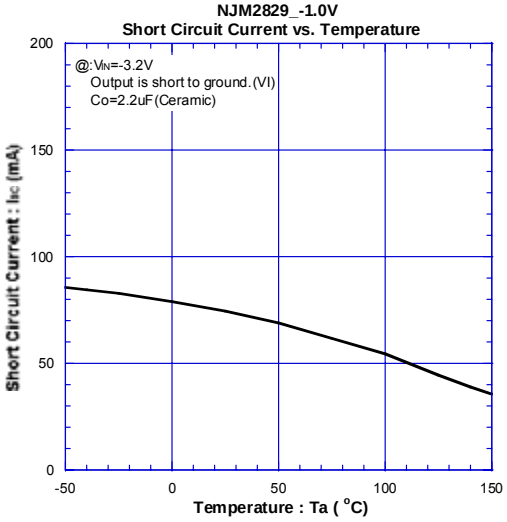
NJM2829_-1.0V
Line Regulation vs. Temperature

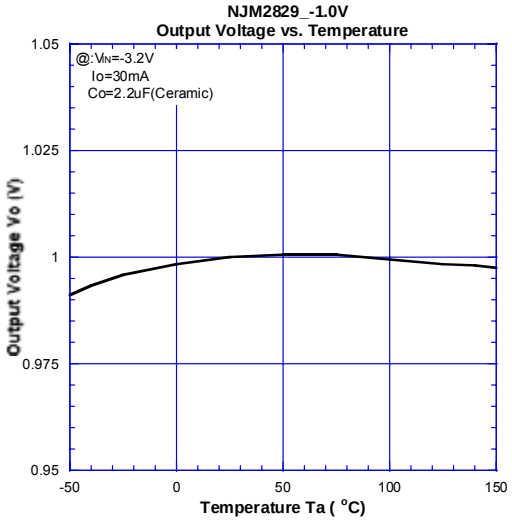


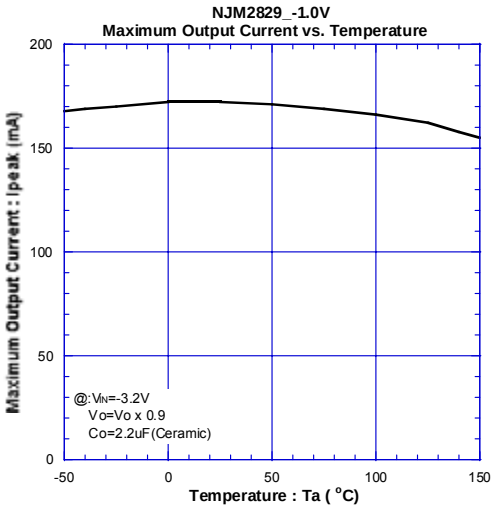
NJM2829_-1.0V
Load Regulation vs. Temperature



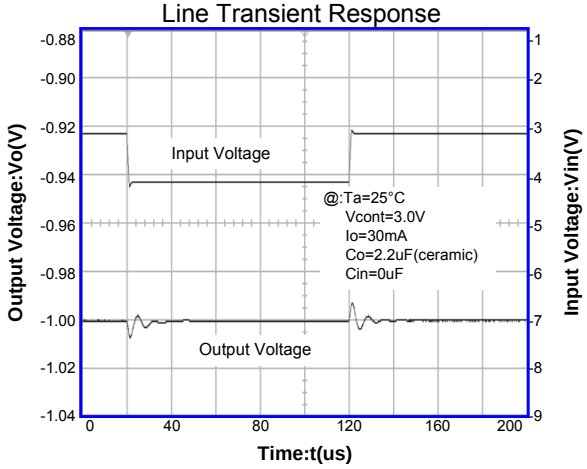

NJM2829_-1.0V
Output Voltage vs. Temperature
Output Voltage Vo (V)
Temperature Ta (°C)
@:VIN=-3.2V
Io=30mA
Co=2.2uF(Ceramic)


NJM2829_-1.0V
Short Circuit Current vs. Temperature
Short Circuit Current : ISC (mA)
Temperature : Ta (°C)
@:VIN=-3.2V
Output is short to ground.(VI)
Co=2.2uF(Ceramic)

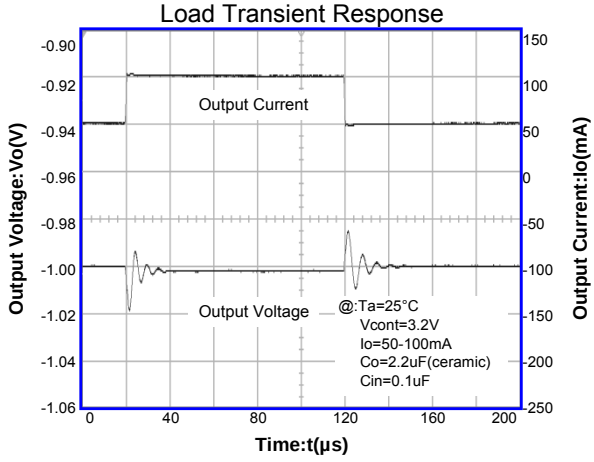

NJM2829_-1.0V
Output Voltage vs. Temperature
Output Voltage Vo (V)
Temperature Ta (°C)
@:VIN=-3.2V
Io=30mA
Co=2.2uF(Ceramic)


NJM2829_-1.0V
Maximum Output Current vs. Temperature
Maximum Output Current : Ipeak (mA)
Temperature : Ta (°C)
@:VIN=-3.2V
Vo=Vo x 0.9
Co=2.2uF(Ceramic)

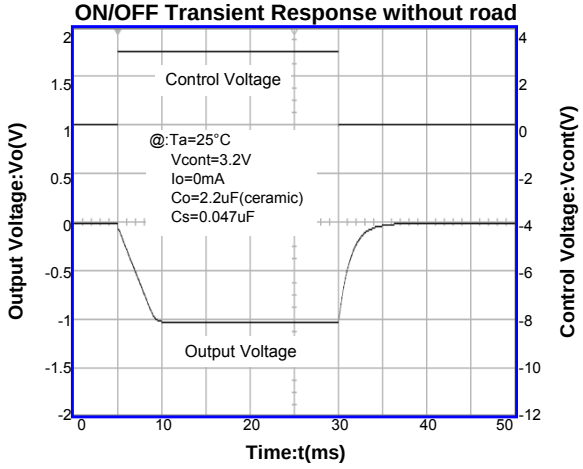
NJM2829_-1.0V
Line Transient Response



NJM2829_-1.0V
Load Transient Response



NJM2829_-1.0V
ON/OFF Transient Response without road



NJM2829_-1.0V
ON/OFF Transient Response