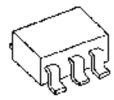
Negative Output Low Drop Out voltage regulator

■ GENERAL DESCRIPTION

The NJM2827 is a negative output low dropout regulator. Advanced bipolar technology achieves low noise, high precision voltage and high ripple rejection.

It has soft-start and shunt SW function. 1.0µF Output capacitor and small package can make NJM2827 suitable for portable items.

■ PACKAGE OUTLINE

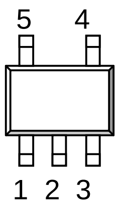


NJM2827F3

■ FEATURES

- Low Dropout Voltage :0.13V (typ.) @Io=60mA
- High Precision Output :±1.5%
- High Ripple Rejection :65dB(typ.) @f=1kHz, Vo=-7V Version
- Output capacitor with 1.0µF ceramic capacitor.
- Output Current :Io(max.)=100mA
- Soft-start Function
- Shunt SW Function
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limit
- Bipolar Technology
- Package Outline SC88A

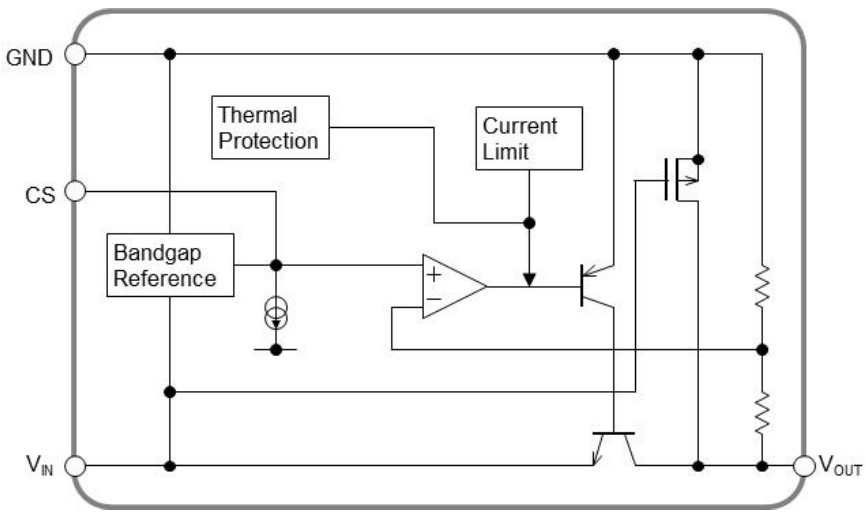
■ PIN CONFIGURATION



NJM2827F3-XX

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

■ BLOCK DIAGRAM



■ OUTPUT VOLTAGE RANK LIST

Device Name	V_{out}
NJM2827F3 -14	-1.4V
NJM2827F3 -15	-1.5V
NJM2827F3 -05	-5.0V
NJM2827F3 -06	-6.0V
NJM2827F3 -07	-7.0V
NJM2827F3 -75	-7.5V
NJM2827F3 -08	-8.0V
NJM2827F3 -10	-10.0V

Output voltage options available: -1.4 ~ -10.0V

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	-14	V
Power Dissipation	P_D	250(*1)	mW
Operating Temperature	Topr	–40 ~ +85	°C
Storage Temperature	Tstg	–40 ~ +125	°C

(*1): Mount on EIA/JEDEC STANDARD Test board (76.2*114.3*1.6mm, 2layers, FR-4)

■ Operating voltage

V_{IN}=-3.2 ~ -12V (In case of Vo>-3.0V version)

■ ELECTRICAL CHARACTERISTICS

(Vo<-2.2V Version: V_{IN}=Vo-1V, C_{IN}=0.1µF, Co=1.0µF, Ta=25°C)

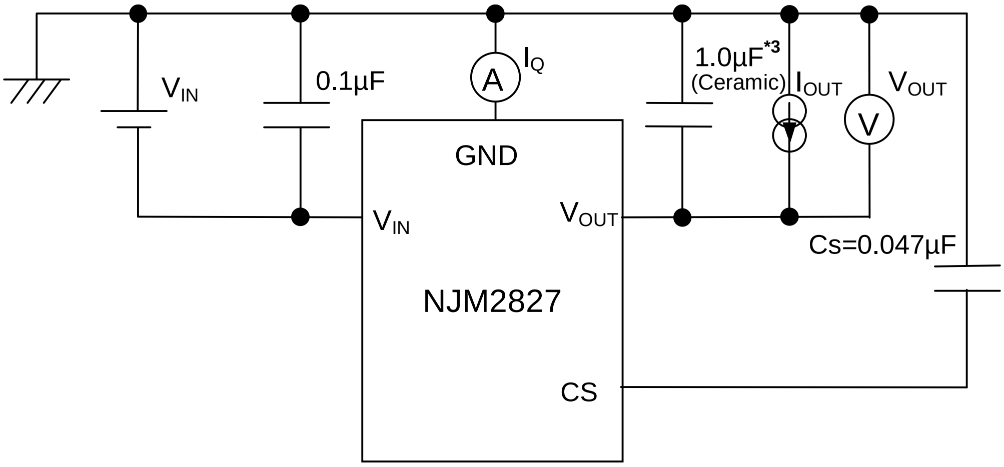
(Vo≥-2.2V Version: V_{IN}=-3.2V, C_{IN}=0.1µF, Co=2.2µF(Vo>-2.0V: Co=4.7µF), Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	Vo	Io=30mA	+1.5%	-	-1.5%	V
Quiescent Current	I_Q	Io=0mA	-	130	200	µA
Output Current	Io	V_O+0.3V	100	130	-	mA
Line Regulation	ΔVo/ΔV_{IN}	V_{IN}=Vo-1V ~ -12V(V_O < -2.2V) V_{IN}=-3.2V ~ -12V(V_O ≥ -2.2V) Io=30mA	-	-	0.10	%/V
Load Regulation	ΔVo/ΔIo	Io=0~60mA	-	-	0.03	%/mA
Dropout Voltage(*2)	$\Delta V_{I\ O}$	Io=60mA	-	0.13	0.23	V
Ripple Rejection	RR	V_{IN}=Vo-1V ~ -12V(V_O ≤ -3.0V) V_{IN}=-4.0V ~ -12V(V_O > -3.0V) ein=200mVrms, f=1kHz, Io=10mA, Vo=-7V Version	-	65	-	dB
Average Temperature Coefficient of Output Voltage	ΔVo/ΔTa	Ta=0 ~ 85°C, Io=10mA	-	±50	-	ppm/°C
Output Noise Voltage	V_{NO}	f=10Hz~80kHz, Io=10mA, Vo=-7V Version	-	100	-	µVrms
CS Terminal Charge Current	Ics	V_{CS}=0V	4	5	6	µA
Input Voltage	V_{IN}		-12	-	-	V

(*2): Excludes Vo>-3.0V version.

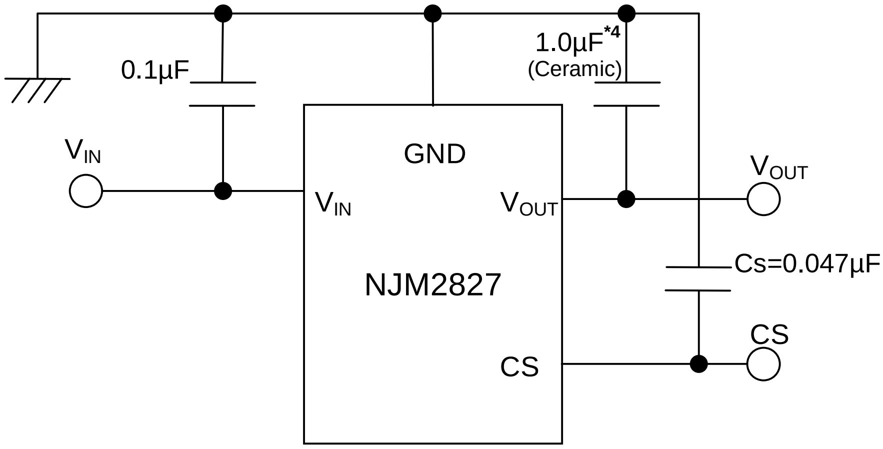
The above specification is a common specification for all output voltages.
Therefore, it may be different from the individual specification for a specific output voltage.

■ TEST CIRCUIT



*3 -2.2V≤Vo≤-2.0V version: Co=2.2µF(Ceramic)
Vo>-2.0V version: Co=4.7µ F(Ceramic)

■ TYPICAL APPLICATIONS



*4 -2.2V≤Vo≤-2.0V version: Co=2.2µF(Ceramic)
Vo>-2.0V version: Co=4.7µ F(Ceramic)

∗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.

∗Soft-start function

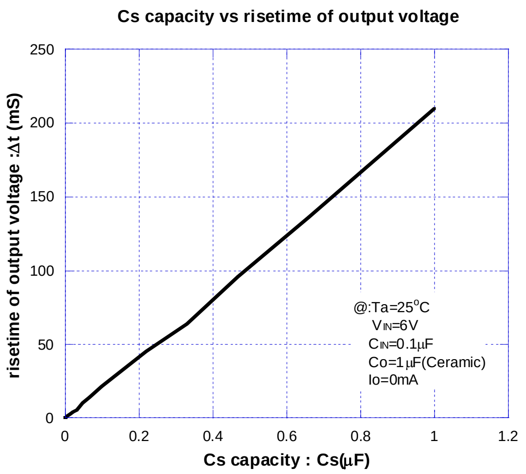
Capacitance Cs connect between CS pin and GND for the following.

- Control at risetime of output voltage.
- Reduces inrush current at output ON.

When the soft start function is not used, CS pin should be open.

1.Cs capacitance vs risetime of output voltage

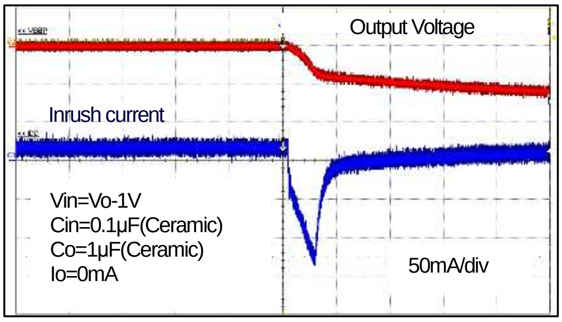
Calculation : risetime of output voltage $\Delta t \cong 213 \times Cs(\mu F)$



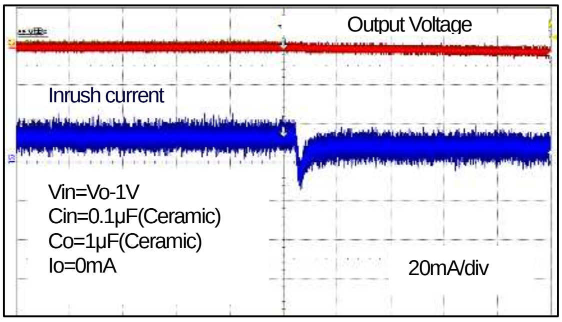
2.Inrush current at control ON

The peak value of the inrush current can be limited according to the capacitance of the Cs.

Inrush current wave :



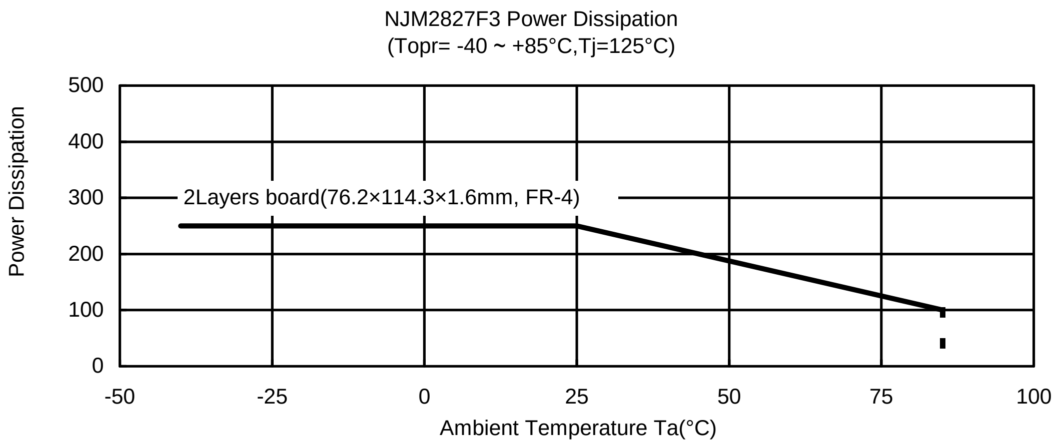
Inrush Peak Current=150mA(Cs=Open)



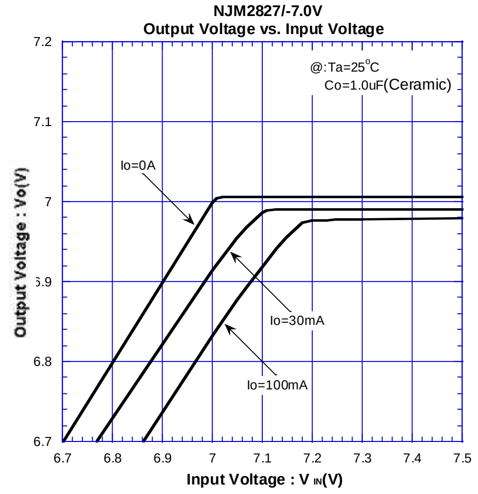
Inrush Peak Current=20mA(Cs=0.0047μF)

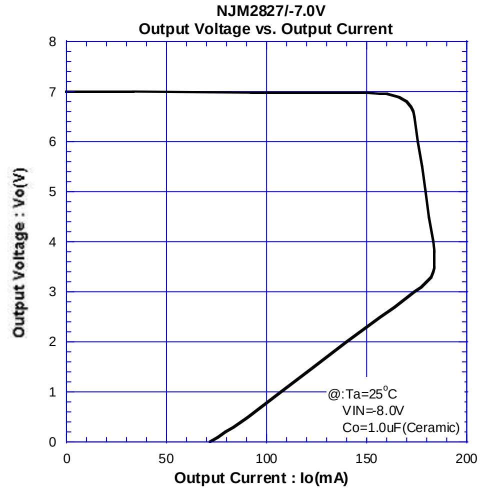
* This characteristic is one example. It is necessary to examine the characteristic with an actual circuit because there is an influence by the characteristic such as output voltage/output capacitor.

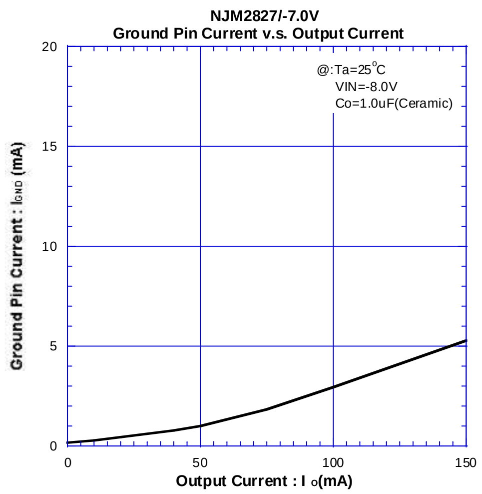
■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

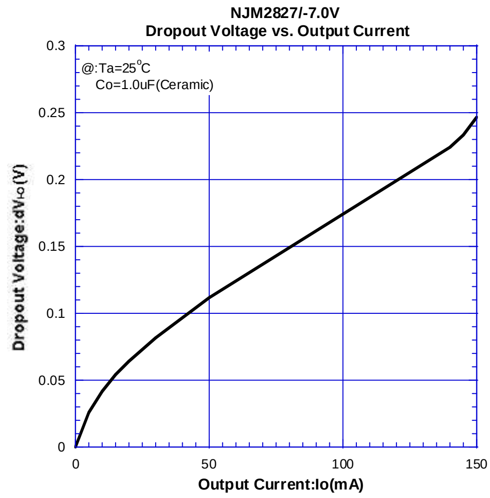


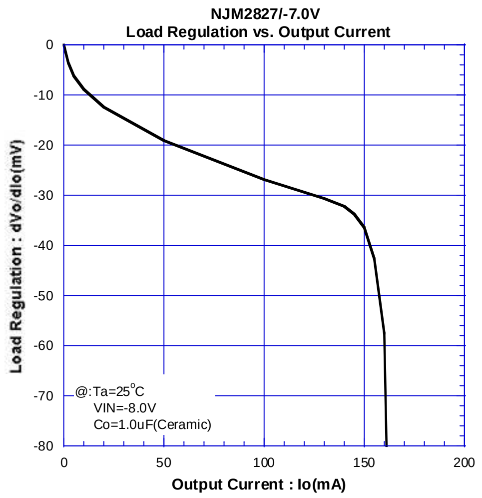
■TYPICAL CHRACTERISTICS

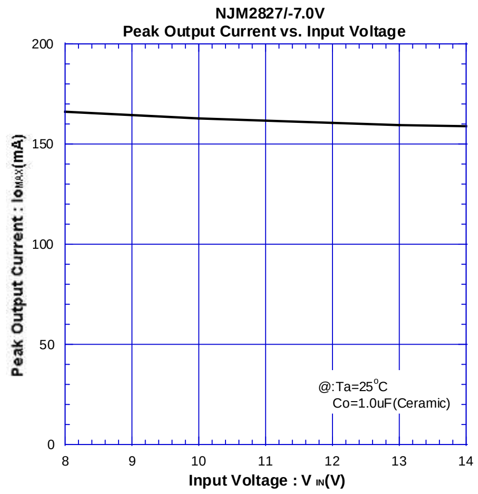


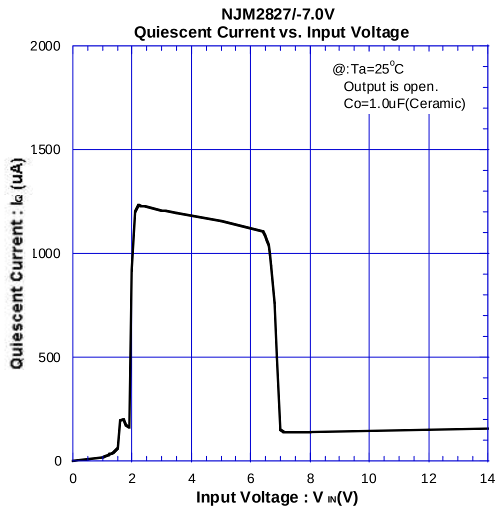


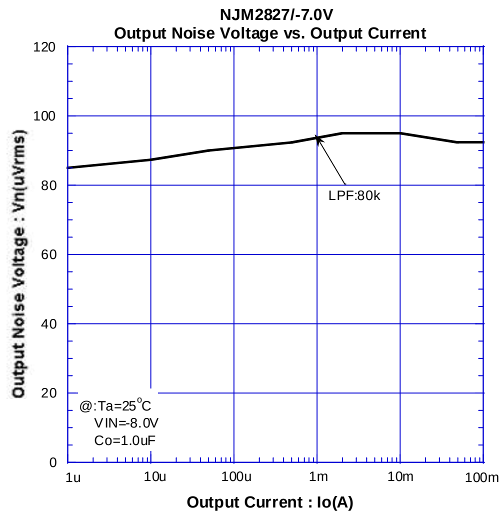


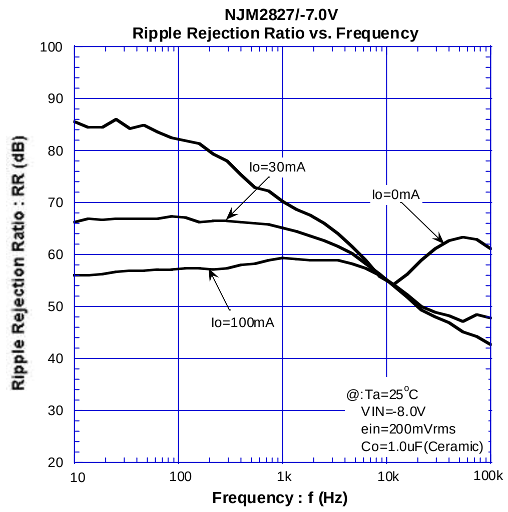


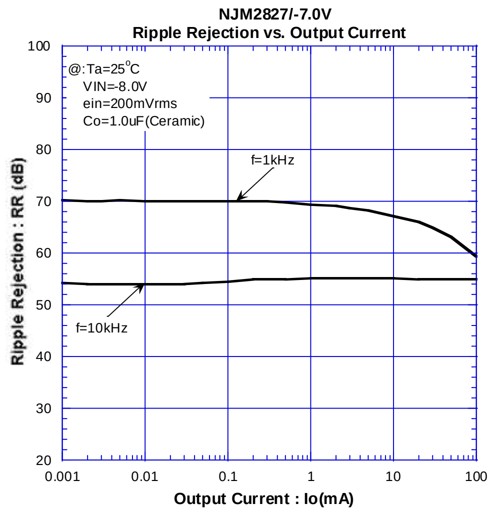


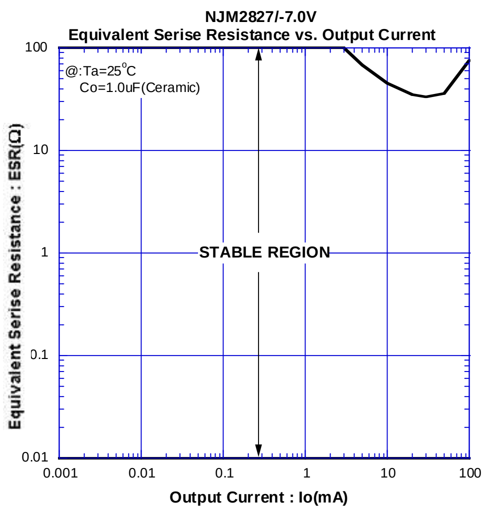


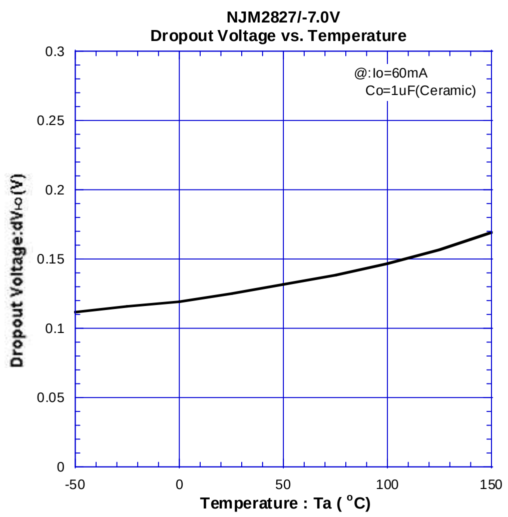

NJM2827/-7.0V
Quiescent Current vs. Input Voltage
@:Ta=25°C
Output is open.
Co=1.0uF(Ceramic)
Quiescent Current : IQ (uA)
Input Voltage : VIN(V)
2000
1500
1000
500
0
0
2
4
6
8
10
12
14

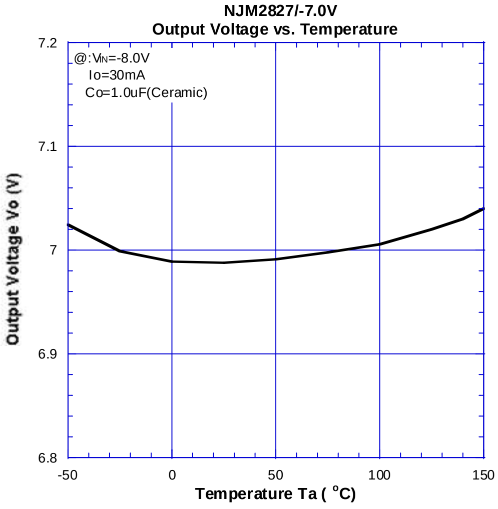

NJM2827/-7.0V
Output Noise Voltage vs. Output Current
LPF:80k
@:Ta=25°C
VIN=-8.0V
Co=1.0uF
Output Noise Voltage : Vn(uVrms)
Output Current : Io(A)
120
100
80
60
40
20
0
1u
10u
100u
1m
10m
100m

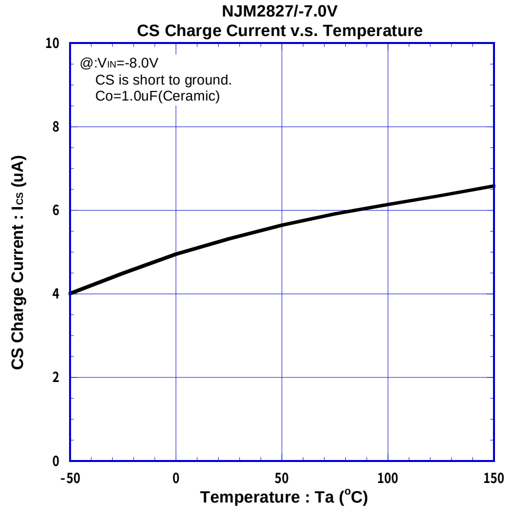

NJM2827/-7.0V
Ripple Rejection Ratio vs. Frequency
Io=30mA
Io=0mA
Io=100mA
@:Ta=25°C
VIN=-8.0V
ein=200mVrms
Co=1.0uF(Ceramic)
Ripple Rejection Ratio : RR (dB)
Frequency : f (Hz)
100
90
80
70
60
50
40
30
20
10
100
1k
10k
100k

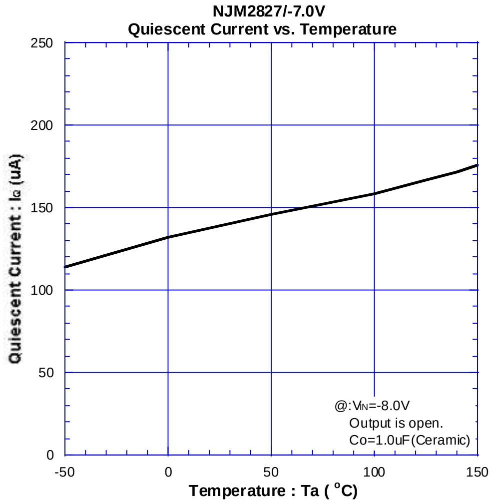

NJM2827/-7.0V
Ripple Rejection vs. Output Current
@:Ta=25°C
VIN=-8.0V
ein=200mVrms
Co=1.0uF(Ceramic)
f=1kHz
f=10kHz
Ripple Rejection : RR (dB)
Output Current : Io(mA)
100
90
80
70
60
50
40
30
20
0.001
0.01
0.1
1
10
100

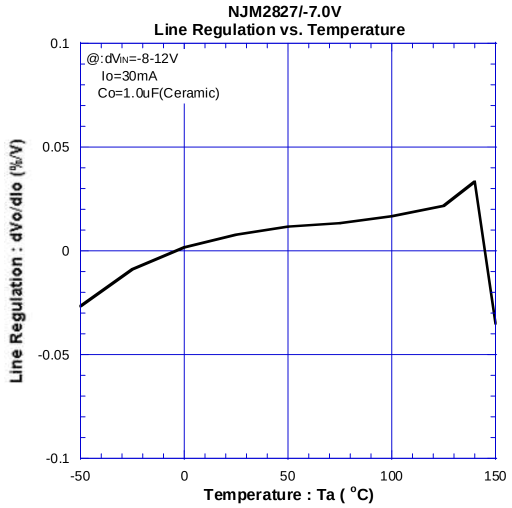

NJM2827/-7.0V
Equivalent Serise Resistance vs. Output Current
@:Ta=25°C
Co=1.0uF(Ceramic)
STABLE REGION
Equivalent Serise Resistance : ESR(Ω)
Output Current : Io(mA)
100
10
1
0.1
0.01
0.001
0.01
0.1
1
10
100

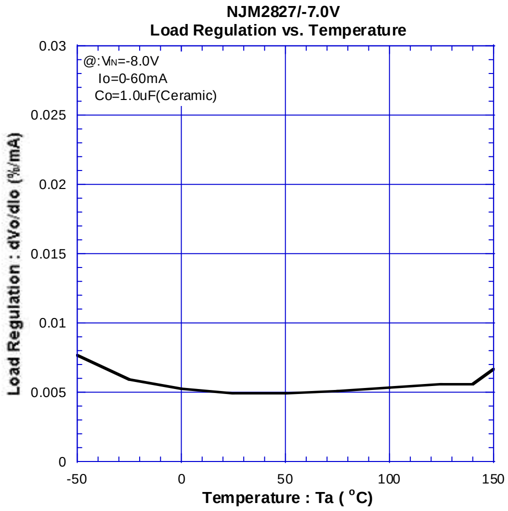

NJM2827/-7.0V
Dropout Voltage vs. Temperature
@:Io=60mA
Co=1uF(Ceramic)
Dropout Voltage:dVI-O(V)
Temperature : Ta (°C)
0.3
0.25
0.2
0.15
0.1
0.05
0
-50
0
50
100
150

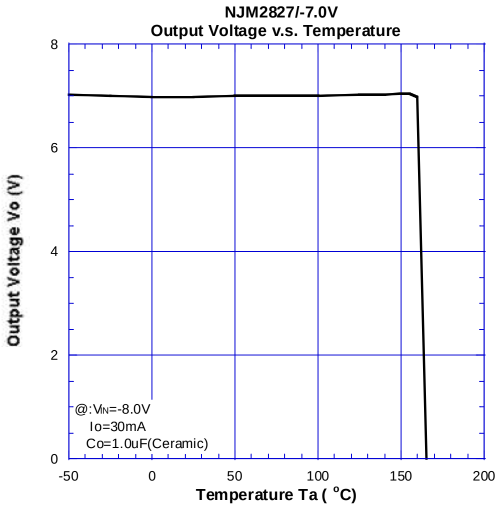

NJM2827/-7.0V
Output Voltage vs. Temperature
@:VIN=-8.0V
Io=30mA
Co=1.0uF(Ceramic)
Output Voltage Vo (V)
Temperature Ta (°C)

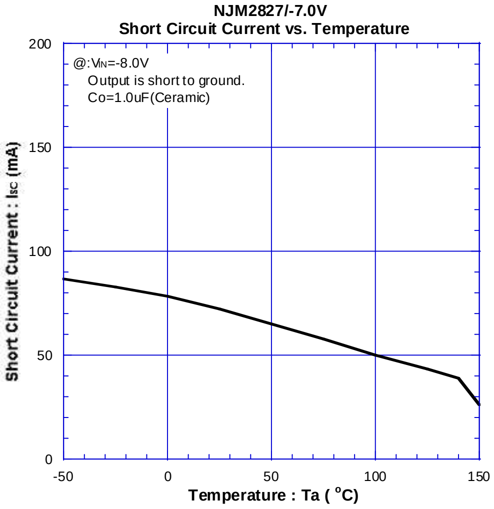

NJM2827/-7.0V
CS Charge Current v.s. Temperature
@:VIN=-8.0V
CS is short to ground.
Co=1.0uF(Ceramic)
CS Charge Current : Ics (uA)
Temperature : Ta (°C)

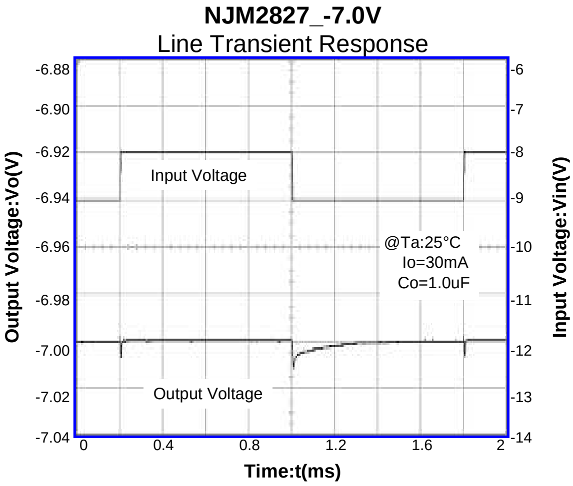

NJM2827/-7.0V
Quiescent Current vs. Temperature
@:VIN=-8.0V
Output is open.
Co=1.0uF(Ceramic)
Quiescent Current : IQ (uA)
Temperature : Ta (°C)

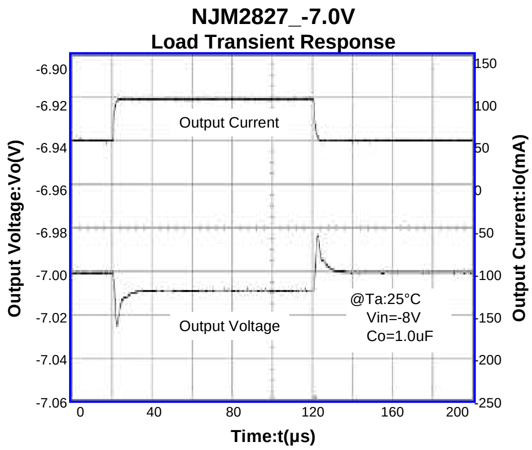

NJM2827/-7.0V
Line Regulation vs. Temperature
@:dVIN=-8-12V
Io=30mA
Co=1.0uF(Ceramic)
Line Regulation : dVo/dIo (%/V)
Temperature : Ta (°C)


NJM2827/-7.0V
Load Regulation vs. Temperature
@:VIN=-8.0V
Io=0-60mA
Co=1.0uF(Ceramic)
Load Regulation : dVo/dIo (%/mA)
Temperature : Ta (°C)


NJM2827/-7.0V
Output Voltage v.s. Temperature
@:VIN=-8.0V
Io=30mA
Co=1.0uF(Ceramic)
Output Voltage Vo (V)
Temperature Ta (°C)







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