LOW DROPOUT VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

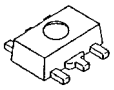
The NJM2884/A is a low dropout voltage regulator with ON/OFF control.

Advanced Bipolar technology achieves low noise, high ripple rejection and low quiescent current.

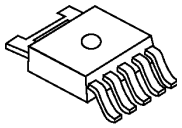
It delivers up to 5V/500mA output power with the maximum input voltage of 10V.

The NJM2884/A is suitable for audio/video and PC related applications.

■ PACKAGE OUTLINE



NJM2884U1



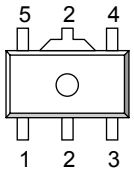
NJM2884ADL3

NJM2884AKH1(2.0×2.0×0.397mm)

■ FEATURES

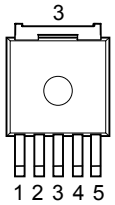
- High Ripple Rejection 75dB typ. (f=1kHz, Vo=3V Version)
- Low Output Noise Voltage Vno=45μVrms typ.
- Output capacitor with 2.2μF ceramic capacitor (Vo≥2.7V)
- Output Current Io(max.)=500mA
- High Precision Output Vo±1.0%
- Low Dropout Voltage 0.18V typ. (Io=100mA)
- ON/OFF Control
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limit
- Bipolar Technology
- Package Outline SOT-89-5(NJM2884U1) / TO-252-5(NJM2884ADL3) / ESON6-H1(NJM2884AKH1)

■ PIN CONFIGURATION



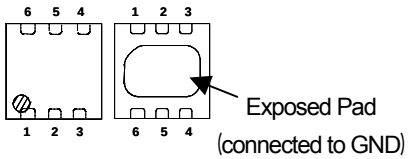
1. CONTROL
2. GND
3. N.C.
4. V_{OUT}
5. V_{IN}

NJM2884U1



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

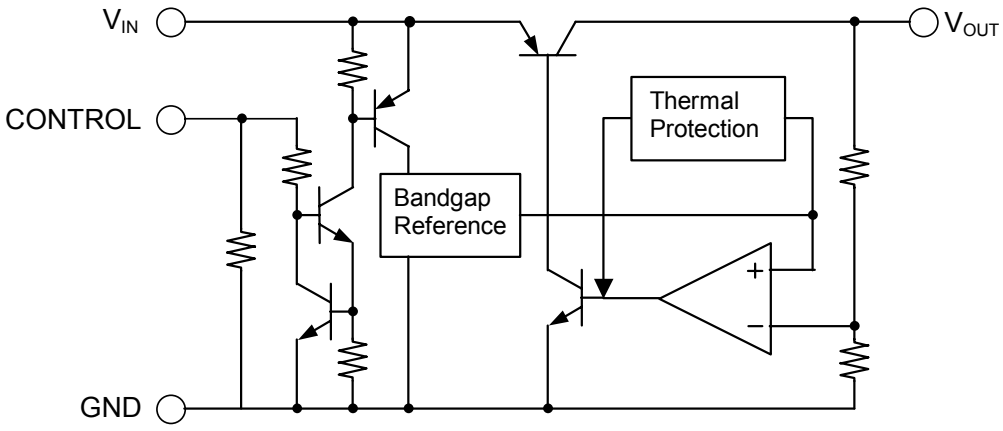
NJM2884ADL3



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

NJM2884AKH1

■ EQUIVALENT CIRCUIT



■ OUTPUT VOLTAGE RANK LIST

The WHITE column shows applicable Voltage Rank(s) (*: Under development)

Device Name	V_{out}	Device Name	V_{out}
NJM2884U1-15	1.5V	NJM2884U1-34	3.4V
NJM2884U1-16	1.6V	NJM2884U1-35	3.5V
NJM2884U1-17	1.7V	NJM2884U1-36	3.6V
NJM2884U1-18	1.8V	NJM2884U1-37	3.7V
NJM2884U1-19	1.9V	NJM2884U1-38	3.8V
NJM2884U1-02	2.0V	NJM2884U1-39	3.9V
NJM2884U1-21	2.1V	NJM2884U1-04	4.0V
NJM2884U1-22	2.2V	NJM2884U1-41	4.1V
NJM2884U1-23	2.3V	NJM2884U1-42	4.2V
NJM2884U1-24	2.4V	NJM2884U1-43	4.3V
NJM2884U1-25	2.5V	NJM2884U1-44	4.4V
NJM2884U1-255	2.55V	NJM2884U1-45	4.5V
NJM2884U1-26	2.6V	NJM2884U1-46	4.6V
NJM2884U1-27	2.7V	NJM2884U1-47	4.7V
NJM2884U1-28	2.8V	NJM2884U1-48	4.8V
NJM2884U1-29	2.9V	NJM2884U1-49	4.9V
NJM2884U1-03	3.0V	NJM2884U1-05	5.0V
NJM2884U1-31	3.1V		
NJM2884U1-32	3.2V		
NJM2884U1-33	3.3V		

Device Name	V_{out}	Device Name	V_{out}
NJM2884ADL3-15	1.5V	NJM2884ADL3-35	3.5V
NJM2884ADL3-16	1.6V	NJM2884ADL3-36	3.6V
NJM2884ADL3-17	1.7V	NJM2884ADL3-37	3.7V
NJM2884ADL3-18	1.8V	NJM2884ADL3-38	3.8V
NJM2884ADL3-19	1.9V	NJM2884ADL3-39	3.9V
NJM2884ADL3-02	2.0V	NJM2884ADL3-40	4.0V
NJM2884ADL3-21	2.1V	NJM2884ADL3-41	4.1V
NJM2884ADL3-22	2.2V	NJM2884ADL3-42	4.2V
NJM2884ADL3-23	2.3V	NJM2884ADL3-43	4.3V
NJM2884ADL3-24	2.4V	NJM2884ADL3-44	4.4V
NJM2884ADL3-25	2.5V	NJM2884ADL3-45	4.5V
NJM2884ADL3-26	2.6V	NJM2884ADL3-46	4.6V
NJM2884ADL3-27	2.7V	NJM2884ADL3-47	4.7V
NJM2884ADL3-28	2.8V	NJM2884ADL3-48	4.8V
NJM2884ADL3-29	2.9V	NJM2884ADL3-49	4.9V
NJM2884ADL3-03	3.0V	NJM2884ADL3-05	5.0V
NJM2884ADL3-31	3.1V		
NJM2884ADL3-32	3.2V		
NJM2884ADL3-33	3.3V		
NJM2884ADL3-34	3.4V		

Device Name	V_{out}	Device Name	V_{out}
NJM2884AKH1-15	1.5V	NJM288AKH1-35	3.5V
NJM2884AKH1-16	1.6V	NJM288AKH1-36	3.6V
NJM2884AKH1-17	1.7V	NJM288AKH1-37	3.7V
NJM2884AKH1-18	1.8V	NJM288AKH1-38	3.8V
NJM2884AKH1-19	1.9V	NJM288AKH1-39	3.9V
NJM2884AKH1-02	2.0V	NJM288AKH1-04	4.0V
NJM2884AKH1-21	2.1V	NJM288AKH1-41	4.1V
NJM2884AKH1-22	2.2V	NJM288AKH1-42	4.2V
NJM2884AKH1-23	2.3V	NJM288AKH1-43	4.3V
NJM2884AKH1-24	2.4V	NJM288AKH1-44	4.4V
NJM2884AKH1-25	2.5V	NJM288AKH1-45	4.5V
NJM2884AKH1-26	2.6V	NJM288AKH1-46	4.6V
NJM2884AKH1-27	2.7V	NJM288AKH1-47	4.7V
NJM2884AKH1-28	2.8V	NJM288AKH1-48	4.8V
NJM2884AKH1-29	2.9V	NJM288AKH1-49	4.9V
NJM2884AKH1-03	3.0V	NJM288AKH1-05	5.0V
NJM2884AKH1-31	3.1V		
NJM2884AKH1-32	3.2V		
NJM2884AKH1-33	3.3V		
NJM2884AKH1-34	3.4V		

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	RATINGS		UNIT
Input Voltage	V_{IN}	+10		V
Control Voltage	V_{CONT}	+10		V
Power Dissipation	P_D(*1)	SOT-89-5	625(*1)	mW
		TO-252-5	1190(*1)	
		ESON6-H1	445(*2) 1135(*3)	
Operating Temperature	Topr	- 40 ~ +85		°C
Storage Temperature	Tstg	- 40 ~ +150		°C

(*1): Mounted on glass epoxy board based on EIA/JEDEC STANDARD.
(114.3×76.2×1.6mm: 2Layers, copper area 100mm^2)
(*2): Mounted on glass epoxy board based on EIA/JEDEC STANDARD.
(101.5×114.5×1.6mm: 2Layers with Exposed Pad FR-4, copper area 100mm^2)
(*3): Mounted on glass epoxy board based on EIA/JEDEC STANDARD.
(101.5 × 114.5 × 1.6mm: 4Layers FR-4,
Internal foil area size: 99.5 × 99.5mm, Applying a thermal via hole to a board based on JEDEC standard JESD51-5)

■ ELECTRICAL CHARACTERISTICS

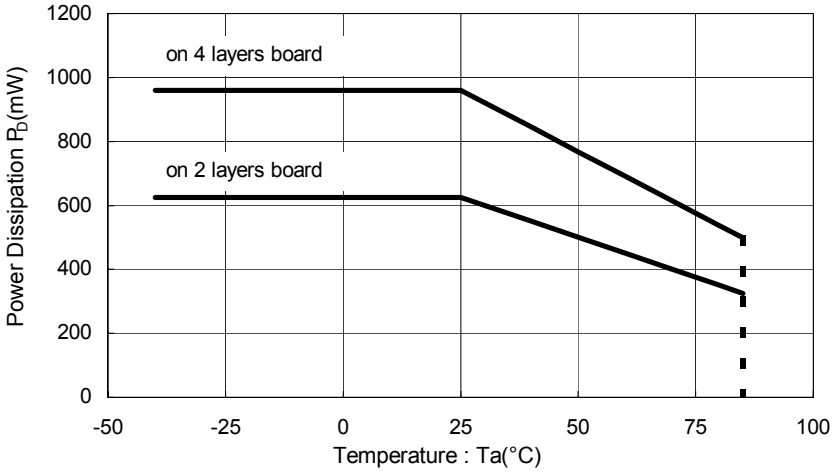
(V_{IN}=Vo+1V, C_{IN}=0.33µF, Co=2.2µF: Vo≥2.7V (Co=4.7µF : 1.7V<Vo≤2.6V, Co=10µF : Vo≤1.7V), Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Voltage	Vo	Io=30mA	-1.0%	–	+1.0%	V
Quiescent Current	I_Q	Io=0mA	–	200	300	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≤3V Version), V_{IN}=Vo+1V ~ 9V (Vo>3V Version), Io=30mA	–	–	0.10	%/V
Load Regulation	$\Delta Vo/\Delta Io$	Io=0 ~ 500mA	–	–	0.009	%/mA
Dropout Voltage (*2)	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}		–	–	9	V

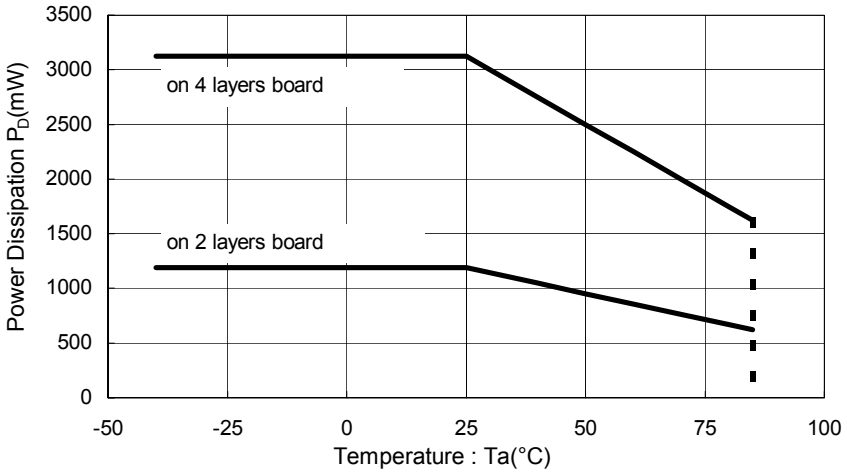
(*2): The output voltage excludes under 2.1V.
The above specification is a common specification for all output voltages.
Therefore, it may be different from the individual specification for a specific output voltage.

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

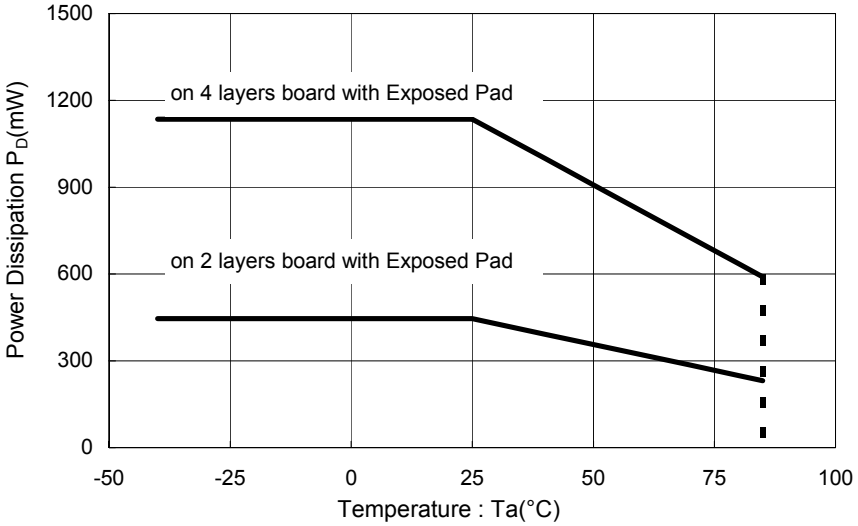
NJM2884U1 PowerDissipation
(Topr=-40~+85°C,Tj=150°C)



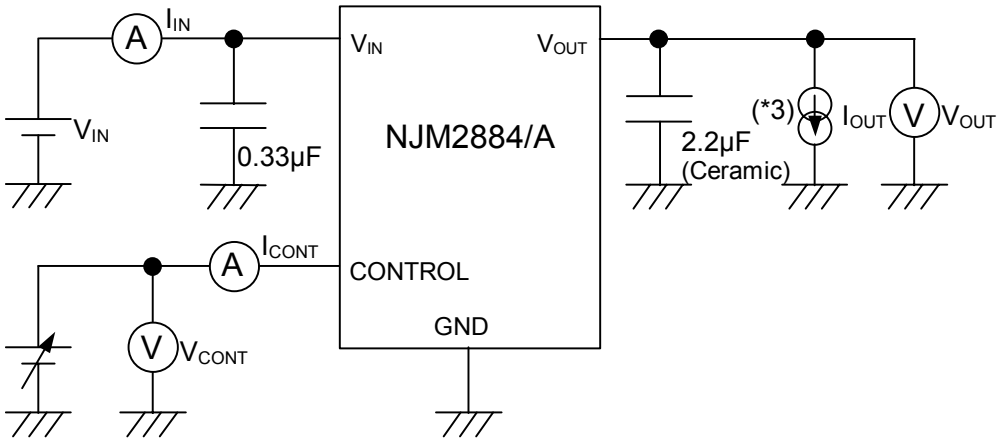
NJM2884ADL3 PowerDissipation
(Topr=-40~+85°C,Tj=150°C)



NJM2884AKH1 PowerDissipation
(Topr=-40~+85°C,Tj=150°C)



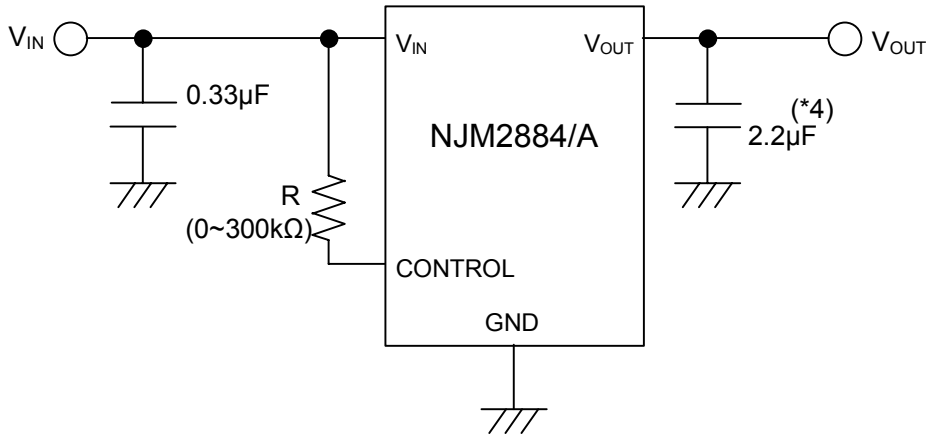
■ TEST CIRCUIT



(*3) 1.7<Vo≤2.6V version: Co=4.7μF (Ceramic)
Vo≤1.7V version: Co=10μF (Ceramic)

■ TYPICAL APPLICATION

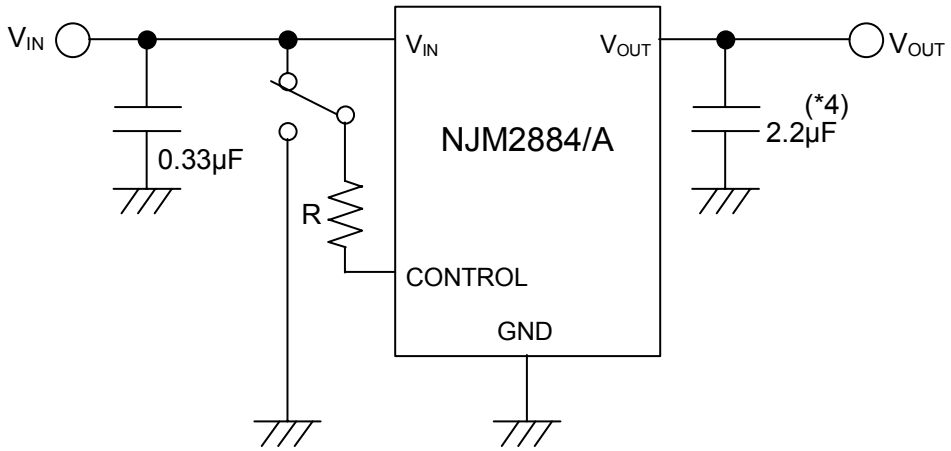
① In the case where ON/OFF Control is not required:



(*4) 1.7<Vo≤2.6V version: Co=4.7μF
Vo≤1.7V version: Co=10μF

Connect control terminal to V_{IN} terminal
The quiescent current can be reduced by using a resistance “R”. Instead, it increases the minimum operating voltage. For further information, please refer to Figure “Output Voltage vs. Control Voltage”.

② In use of ON/OFF CONTROL:



(*4) 1.7<Vo≤2.6V version: Co=4.7μF
Vo≤1.7V version: Co=10μF

State of control terminal:
- "H"→ output is enabled.
- "L" or "open" → output is disabled.

∗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 0.33μF greater to avoid the problem.

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

∗Output Capacitance Co

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

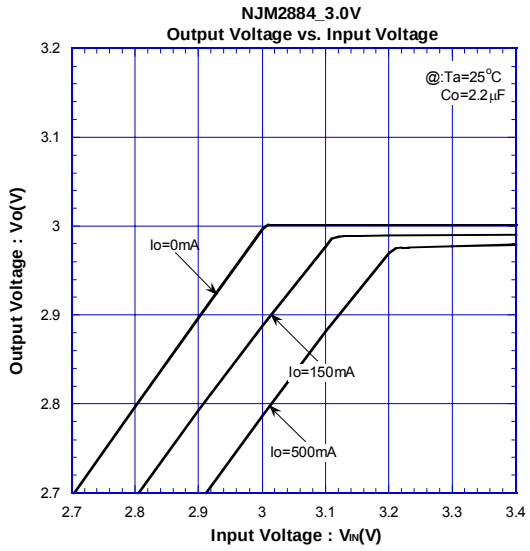
If use a smaller Co, it may cause excess output noise or oscillation of the regulator due to lack of the phase compensation. Therefore, use Co with the recommended capacitance or greater value and connect between Vo terminal and GND terminal with minimal wiring.

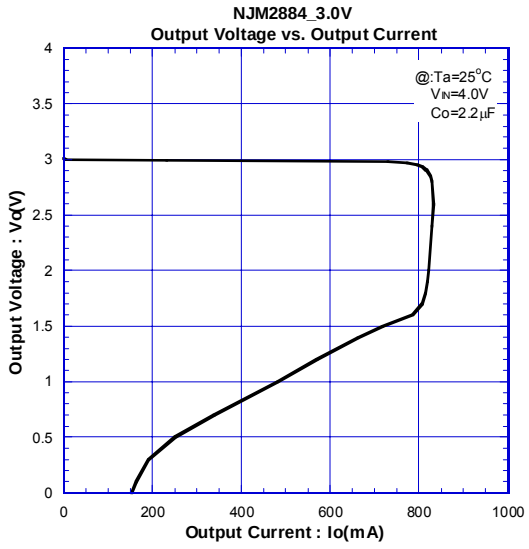
The recommended capacitance depends on the output voltage. Low voltage regulator requires greater value of the Co. Thus, check the recommended capacitance for each output voltage.

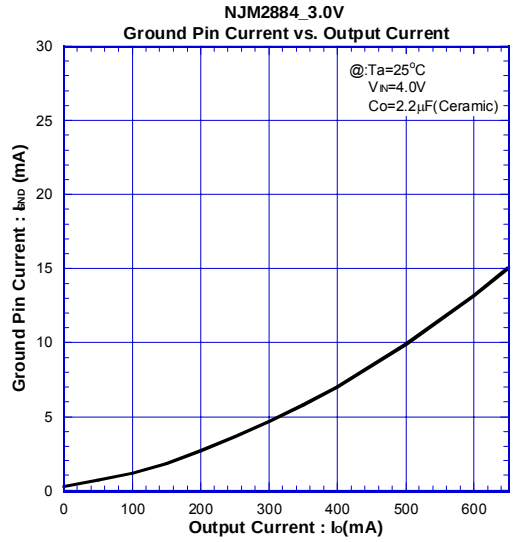
Use of a greater Co reduces output noise and ripple output, and also improves transient response of the output voltage against rapid load change.

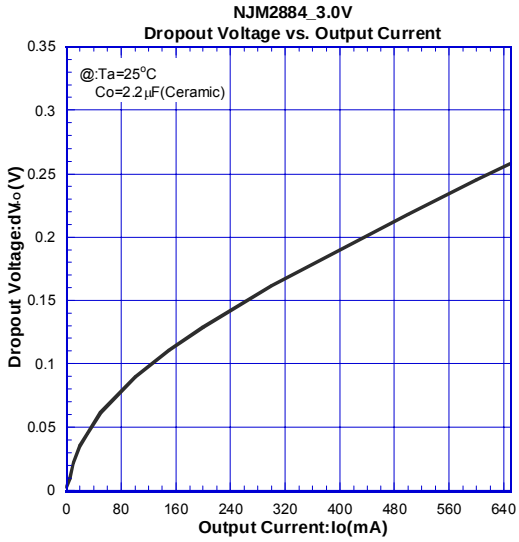
This product is designed to work with any capacitor including a low ESR capacitor for the Co; however, refer "Equivalent Series Resistance vs. Output Current" and choose suitable capacitor.

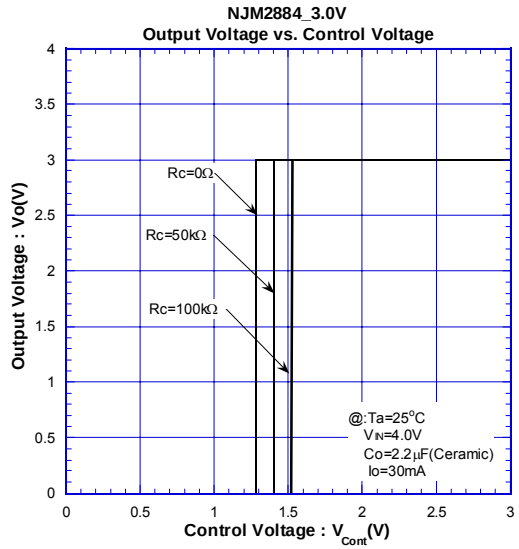
■ TYPICAL CHARACTERISTICS



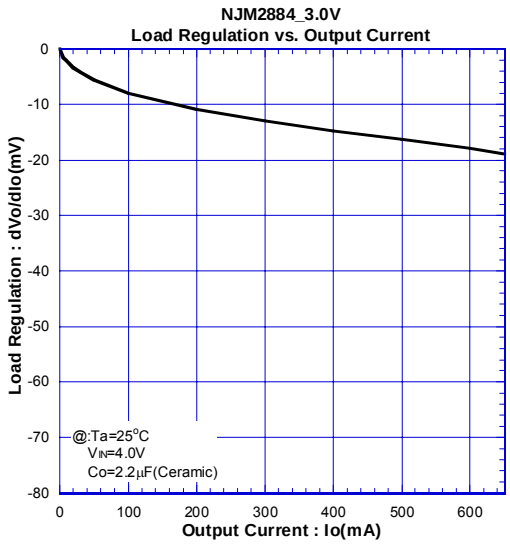


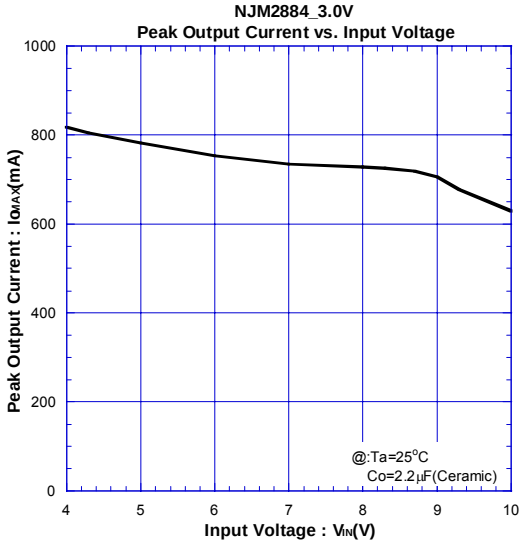


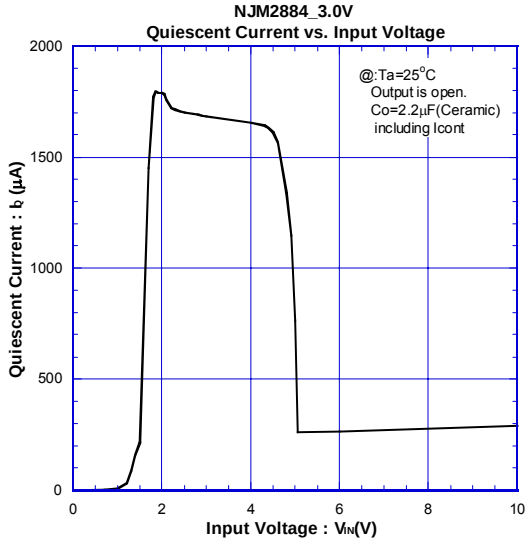


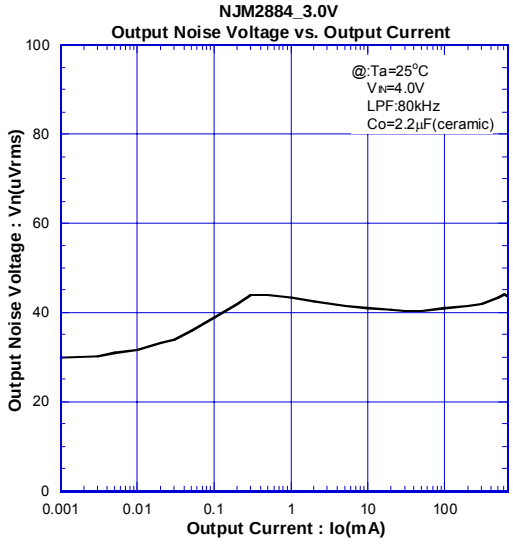


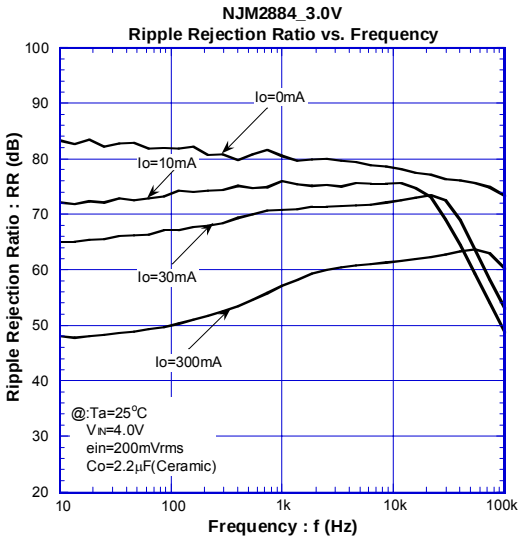
■ TYPICAL CHARACTERISTICS

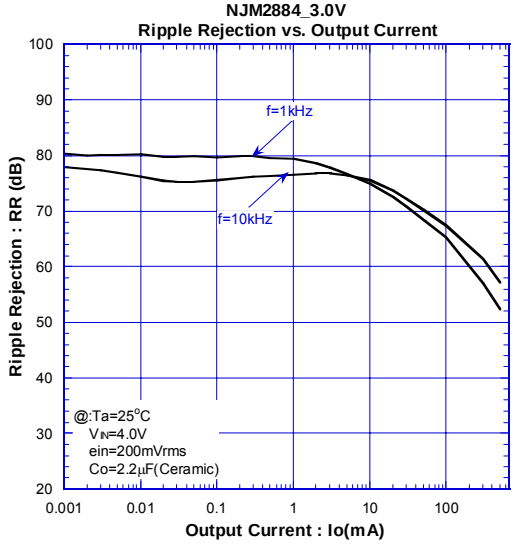






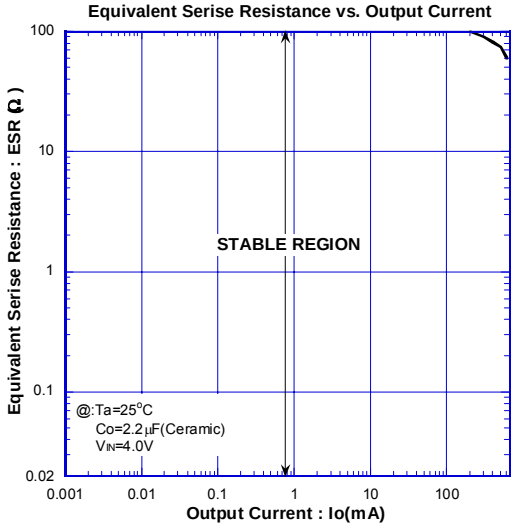




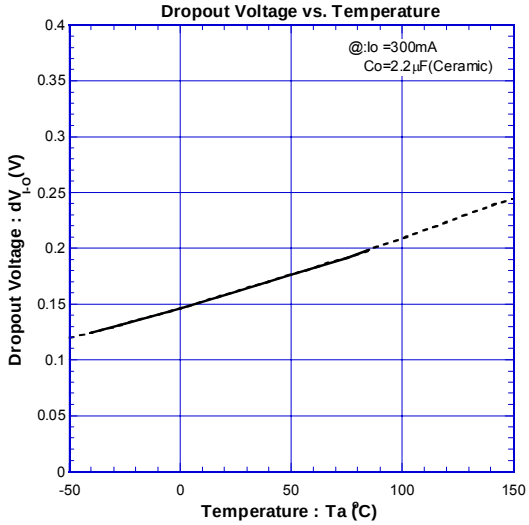


■ TYPICAL CHARACTERISTICS

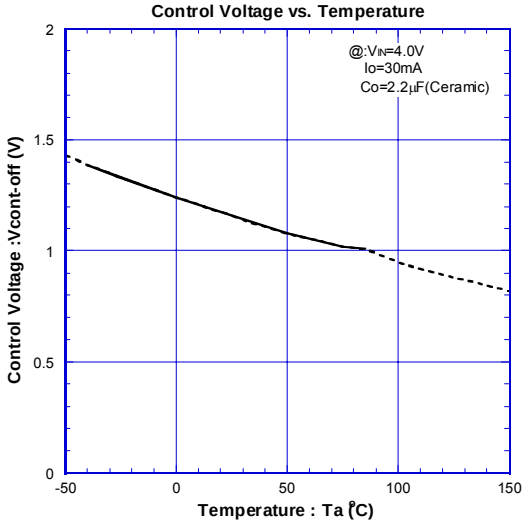
NJM2884_3.0V
Equivalent Serise Resistance vs. Output Current



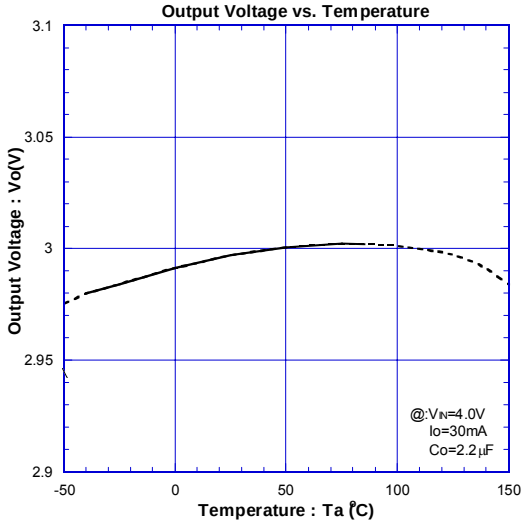
NJM2884_3.0V
Dropout Voltage vs. Temperature



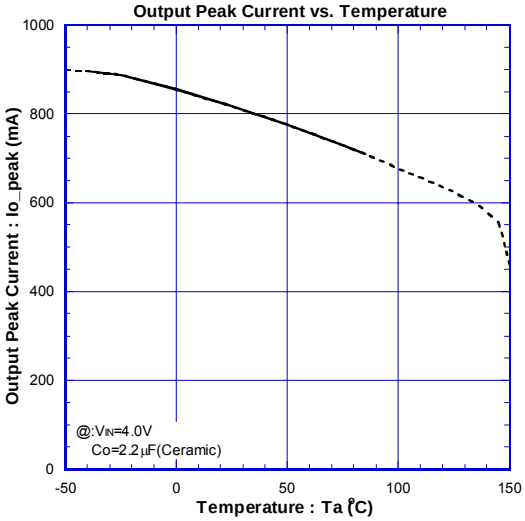
NJM2884_3.0V
Control Voltage vs. Temperature



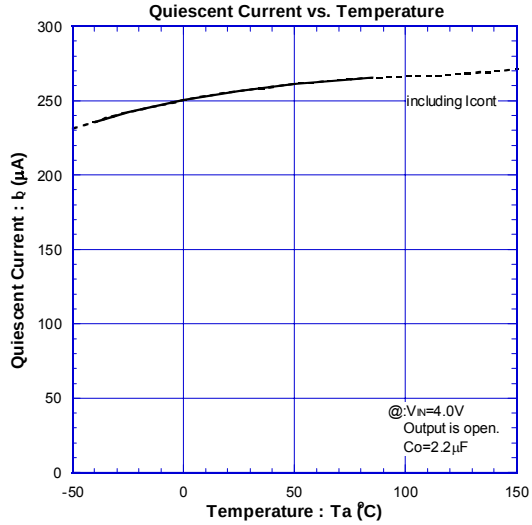
NJM2884_3.0V
Output Voltage vs. Temperature



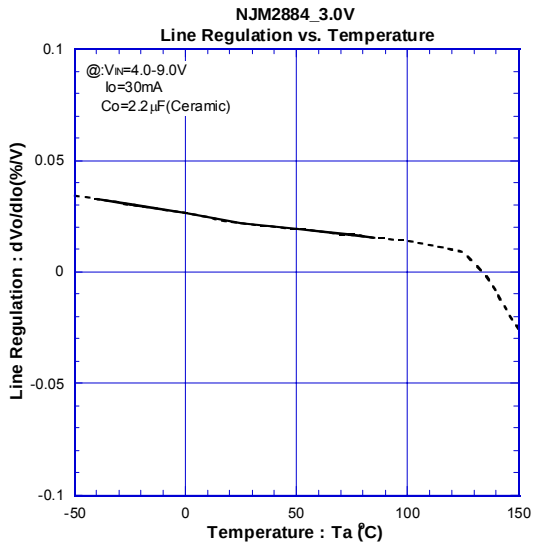
NJM2884_3.0V
Output Peak Current vs. Temperature

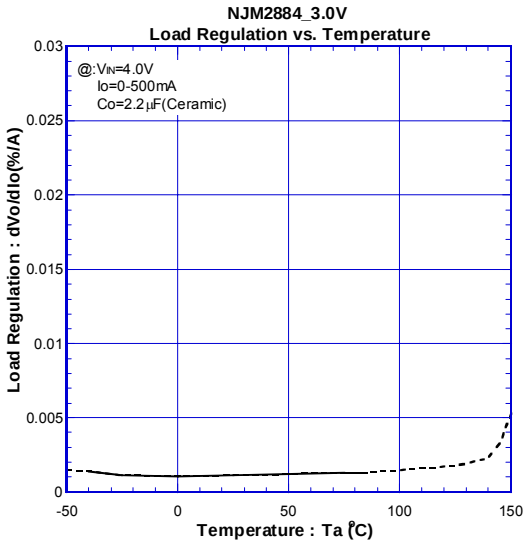


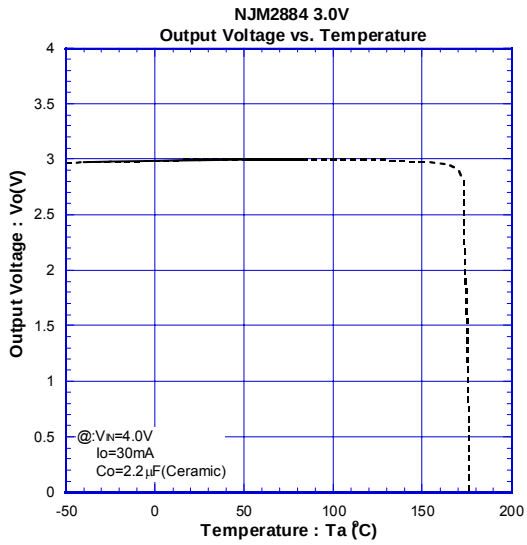
NJM2884_3.0V
Quiescent Current vs. Temperature

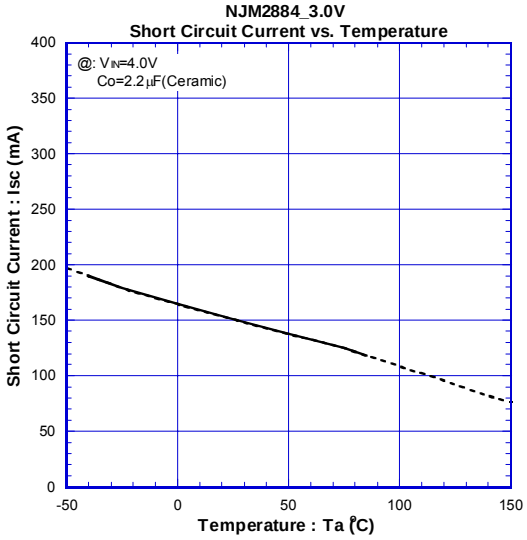


■ TYPICAL CHARACTERISTICS



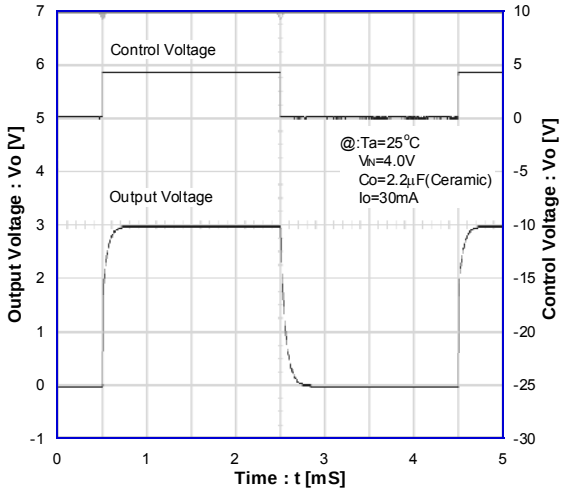






■ TYPICAL CHARACTERISTICS

NJM2884_3.0V
ON/OFF Transient Response



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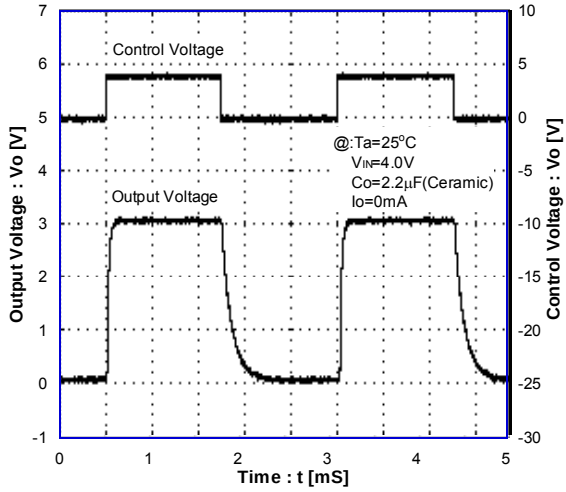
ON/OFF Transient Response Without Load



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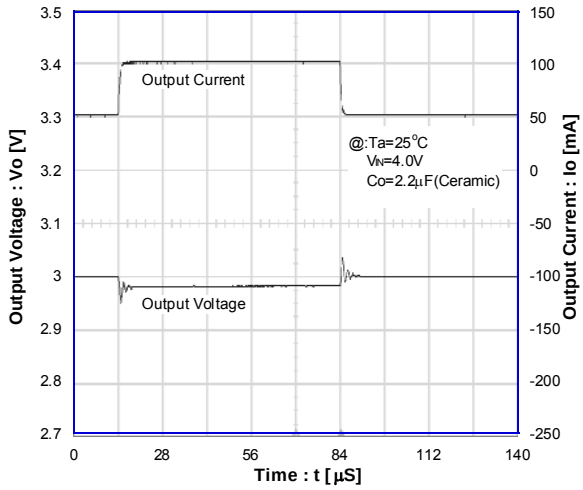
Load Transient Response



NJM2884_3.0V
Line Transient Response