LOW DROPOUT VOLTAGE REGULATOR

■ GENERAL DESCRIPTION

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

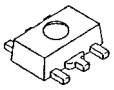
Advanced Bipolar technology achieves low noise, high ripple rejection and low quiescent current.

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

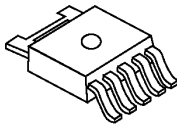
The NJM2884/A is suitable for audio/video and PC related applications.

The "U2" suffix product achieves high P_D compared with "U1" although the same package outline (SOT-89-5) .

■ PACKAGE OUTLINE



NJM2884U1/U2



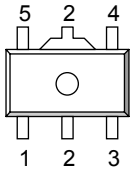
NJM2884ADL3

NJM2884AKH1(2.0×2.0×0.397mm)

■ FEATURES

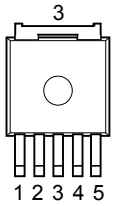
- High Ripple Rejection 75dB typ. (f=1kHz, Vo=3V Version)
- Low Output Noise Voltage Vno=45μVrms typ.
- Output capacitor with 2.2μF ceramic capacitor (Vo≥2.7V)
- Output Current Io(max.)=500mA
- High Precision Output Vo±1.0%
- Low Dropout Voltage 0.18V typ. (Io=300mA)
- ON/OFF Control Function
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limit
- Bipolar Technology
- Package Outline SOT-89-5(NJM2884U1/U2)/ TO-252-5(NJM2884ADL3)/ ESON6-H1(NJM2884AKH1)

■ PIN CONFIGURATION



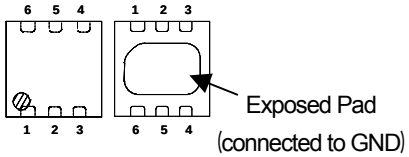
1. CONTROL
2. GND
3. N.C.
4. V_{OUT}
5. V_{IN}

NJM2884U1/U2



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

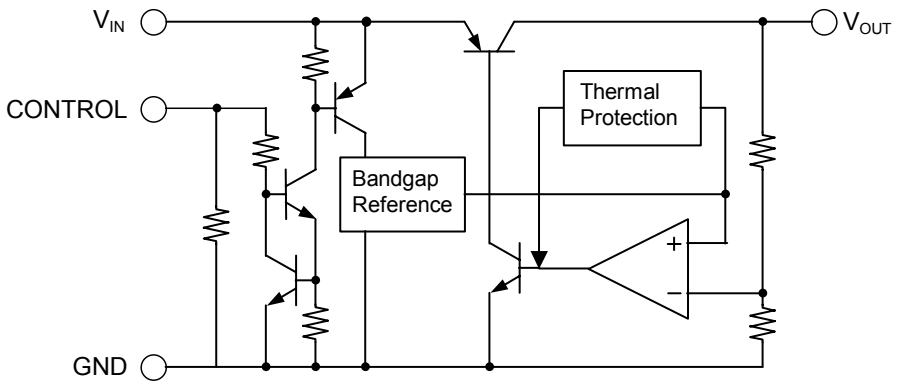
NJM2884ADL3



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)

Device Name	V_{out}	Device Name	V_{out}
NJM2884U1/U2-15	1.5V	NJM2884U1-34	3.4V
NJM2884U1-16	1.6V	NJM2884U1-35	3.5V
NJM2884U1-17	1.7V	NJM2884U1-36	3.6V
NJM2884U1/U2-18	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/U2-255	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/U2-05	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	NJM2884AU1-15	1.5V
NJM2884ADL3-32	3.2V		
NJM2884ADL3-33	3.3V		
NJM2884ADL3-34	3.4V		

Device Name	V_{out}	Device Name	V_{out}
NJM2884AKH1-15	1.5V	NJM2884AKH1-35	3.5V
NJM2884AKH1-16	1.6V	NJM2884AKH1-36	3.6V
NJM2884AKH1-17	1.7V	NJM2884AKH1-37	3.7V
NJM2884AKH1-18	1.8V	NJM2884AKH1-38	3.8V
NJM2884AKH1-19	1.9V	NJM2884AKH1-39	3.9V
NJM2884AKH1-02	2.0V	NJM2884AKH1-04	4.0V
NJM2884AKH1-21	2.1V	NJM2884AKH1-41	4.1V
NJM2884AKH1-22	2.2V	NJM2884AKH1-42	4.2V
NJM2884AKH1-23	2.3V	NJM2884AKH1-43	4.3V
NJM2884AKH1-24	2.4V	NJM2884AKH1-44	4.4V
NJM2884AKH1-25	2.5V	NJM2884AKH1-45	4.5V
NJM2884AKH1-26	2.6V	NJM2884AKH1-46	4.6V
NJM2884AKH1-27	2.7V	NJM2884AKH1-47	4.7V
NJM2884AKH1-28	2.8V	NJM2884AKH1-48	4.8V
NJM2884AKH1-29	2.9V	NJM2884AKH1-49	4.9V
NJM2884AKH1-03	3.0V	NJM2884AKH1-05	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	SOT-89-5 (U1)	625(*1)	mW
			960(*2)	
		SOT-89-5 (U2)	625(*1)	
			2400(*2)	
		TO-252-5	1190(*1)	
			3125(*2)	
		ESON6-H1	445(*3)	
			1135(*4)	
Operating Temperature	Topr	- 40 ~ +85		°C
Storage Temperature	Tstg	- 40 ~ +150		°C

(*1): Mounted on glass epoxy board. (76.2 x114.3 x 1.6mm:based on EIA/JDEC standard size, 2Layers, Cu area 100mm^2)

(*2): Mounted on glass epoxy board. (76.2 x 114.3 x 1.6mm:based on EIA/JDEC standard, 4Layers)
(4Layers: Applying 74.2×74.2mm inner Cu area and a thermal via hall to a board based on JEDEC standard JESD51-5)

(*3): Mounted on glass epoxy board (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 2Layers FR-4, with Exposed Pad)

(*4): Mounted on glass epoxy board (101.5×114.5×1.6mm: based on EIA/JEDEC standard, 4Layers FR-4, with 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)

■ INPUT VOLTAGE RANGE

V_{IN}=+2.3V~9V (In case of Vo<2.1V)

■ 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 (*5)	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

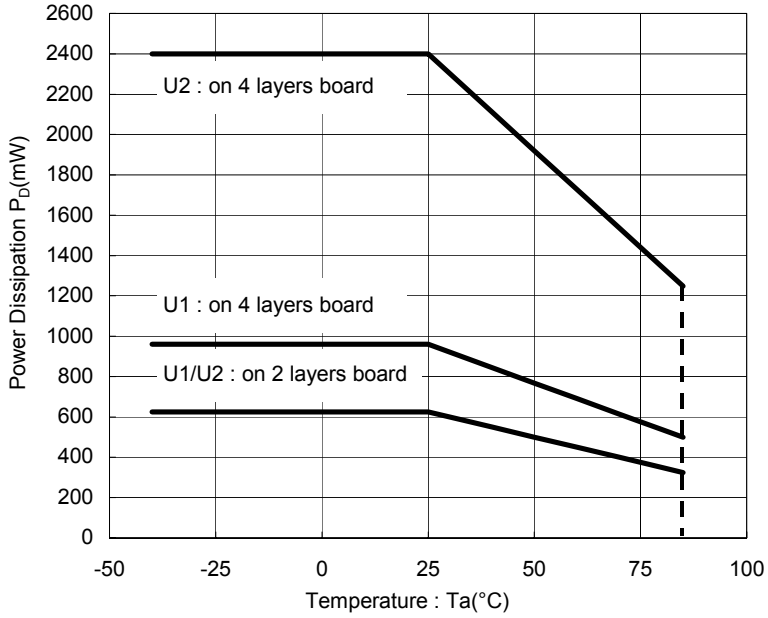
(*5): The output voltage excludes under 2.1V.

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

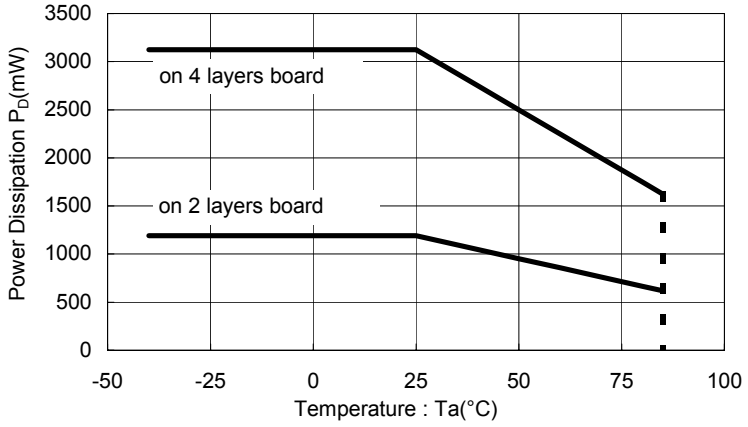
Therefore, it may be different from the individual specification for a specific output voltage.

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

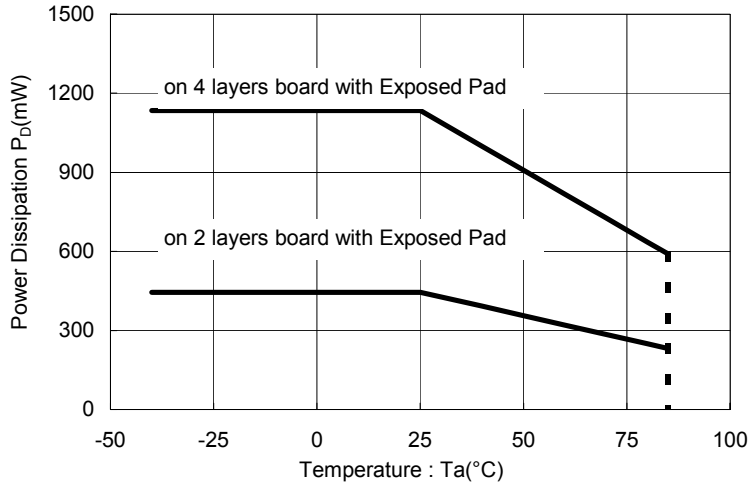
NJM2884U1/U2 Power Dissipation
(Topr=-40~+85°C,Tj=150°C)



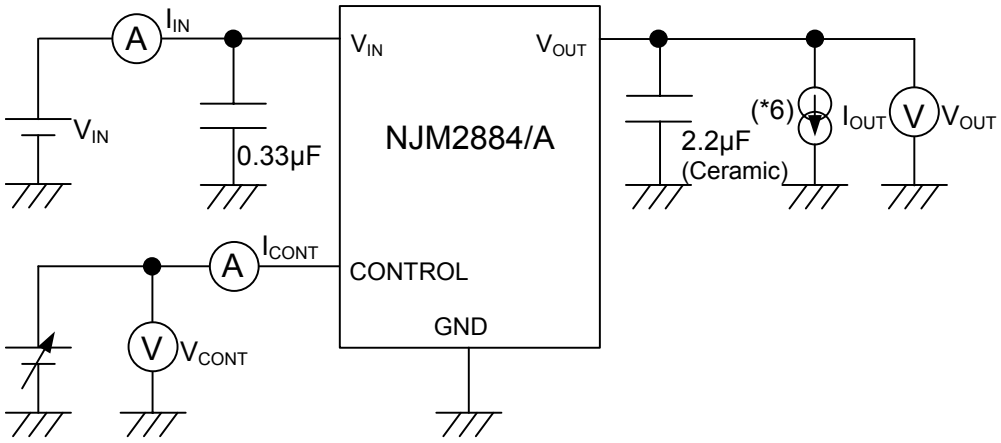
NJM2884ADL3 PowerDissipation
(Topr=-40~+85°C,Tj=150°C)



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



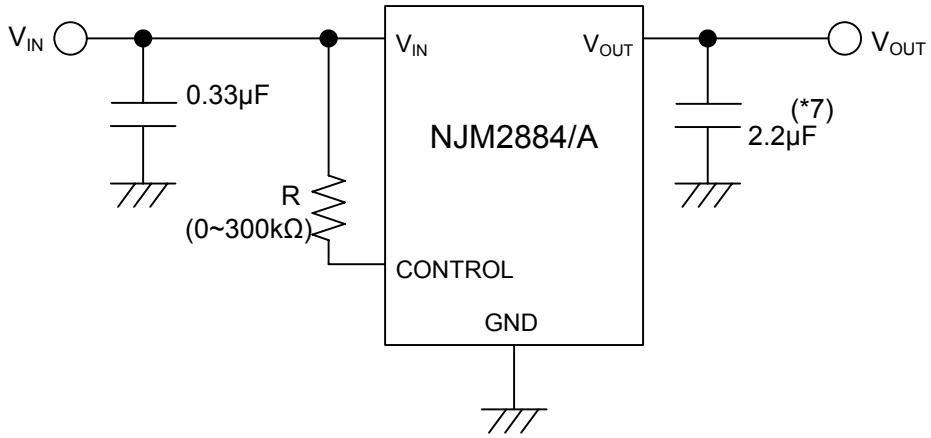
■ TEST CIRCUIT



(*6) 1.7<Vo≤2.6V version: Co=4.7μF (Ceramic)
Vo≤1.7V version: Co=10μF (Ceramic)

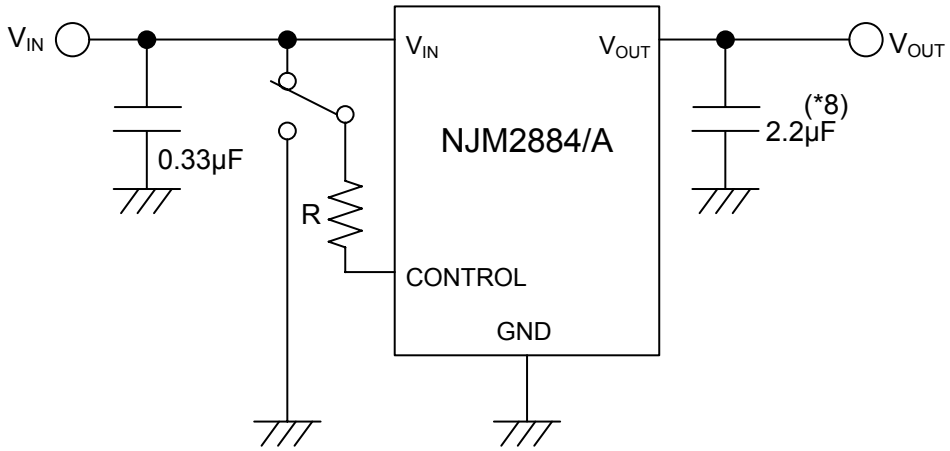
■ TYPICAL APPLICATION

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



(*7) 1.7<Vo≤2.6V version: Co=4.7μF
Vo≤1.7V version: Co=10μF

② In use of ON/OFF CONTROL:



(*8) 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.

If this resistor is inserted, it can reduce the control current when the control voltage is high.

The applied voltage to control terminal 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.

*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

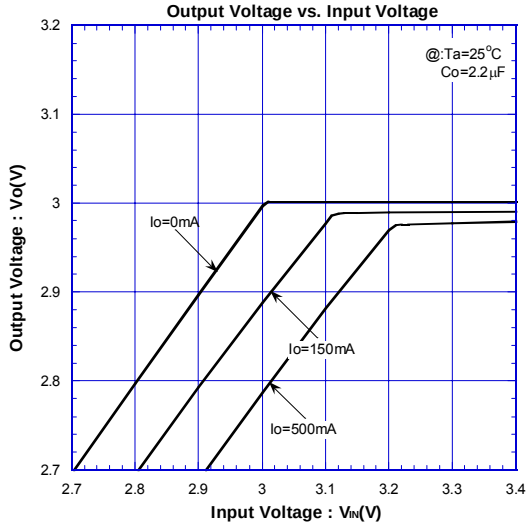
The recommended capacitance depends on the output voltage rank. Especially, low voltage regulator requires larger C_O value.

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.

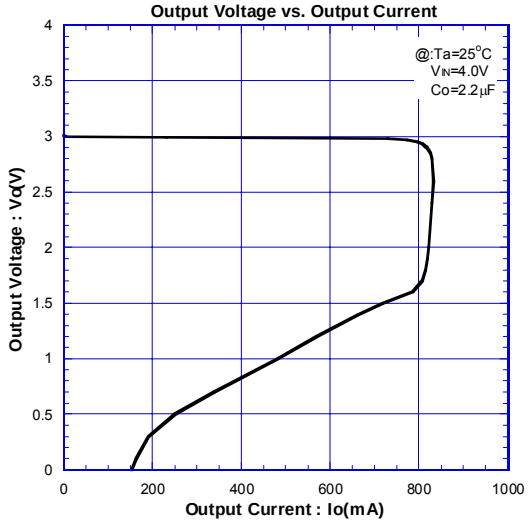
When selecting C_O, recommend that have withstand voltage margin against output voltage and superior temperature characteristic.

■ TYPICAL CHARACTERISTICS

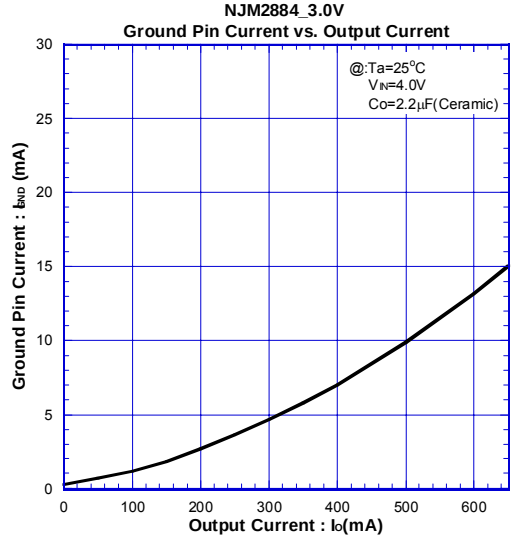
NJM2884_3.0V
Output Voltage vs. Input Voltage



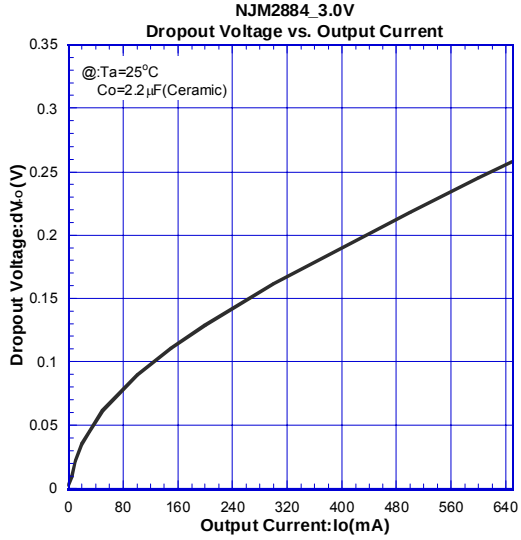
NJM2884_3.0V
Output Voltage vs. Output Current



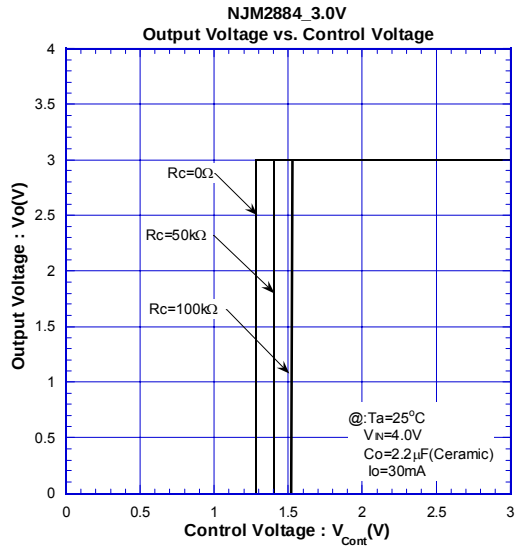
NJM2884_3.0V
Ground Pin Current vs. Output Current



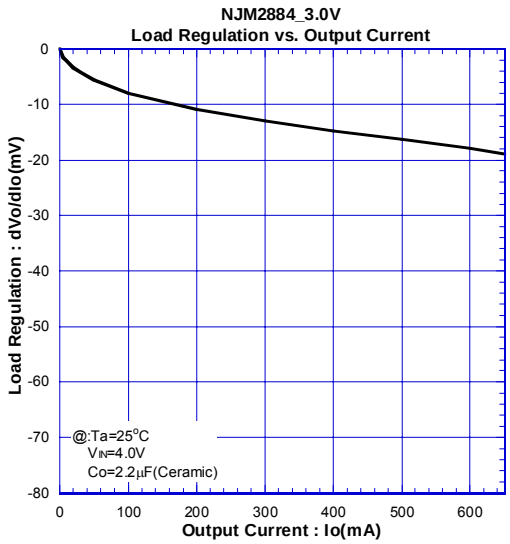
NJM2884_3.0V
Dropout Voltage vs. Output Current

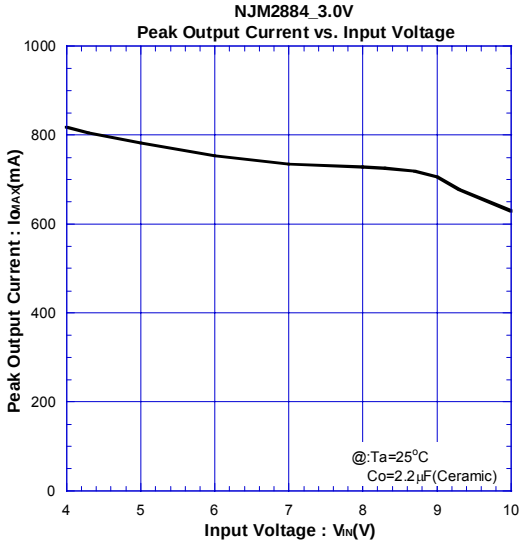


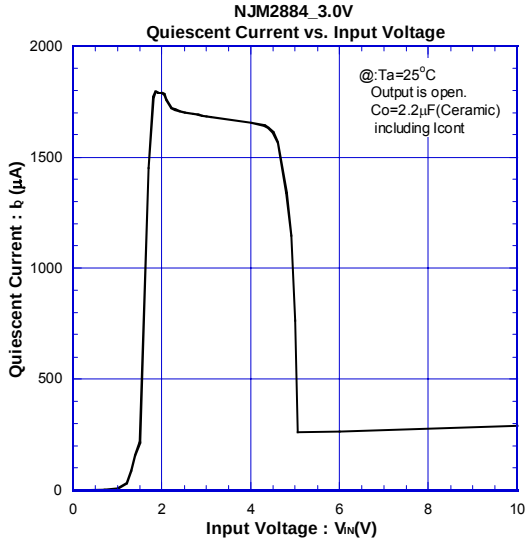
NJM2884_3.0V
Output Voltage vs. Control Voltage

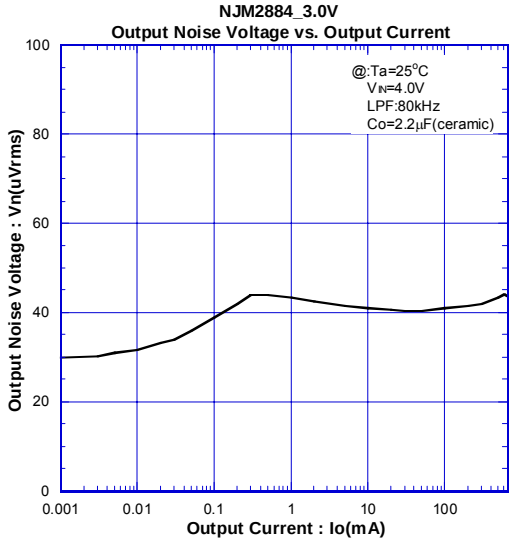


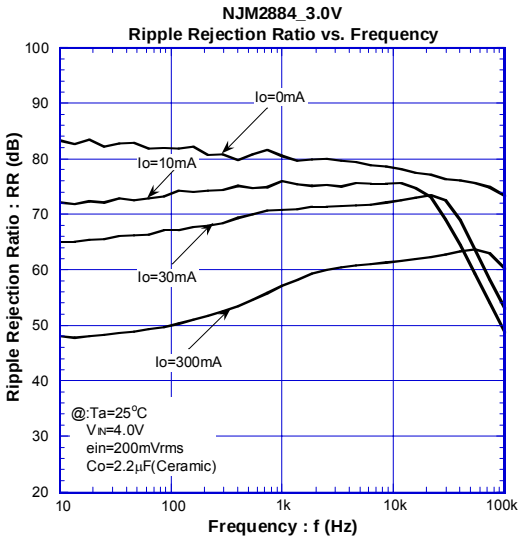
■ TYPICAL CHARACTERISTICS

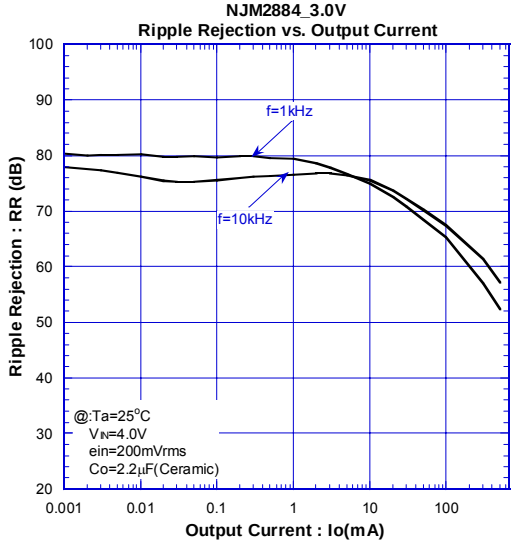






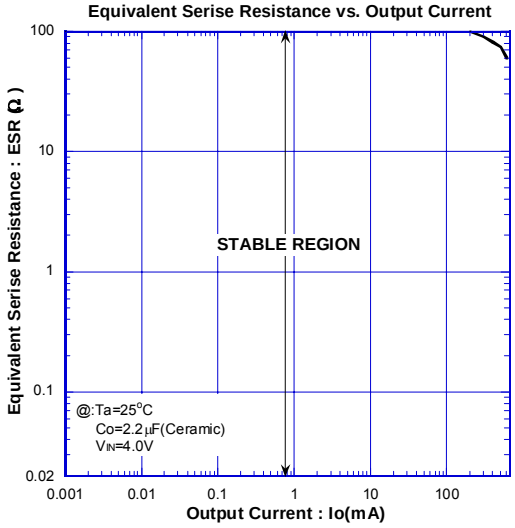




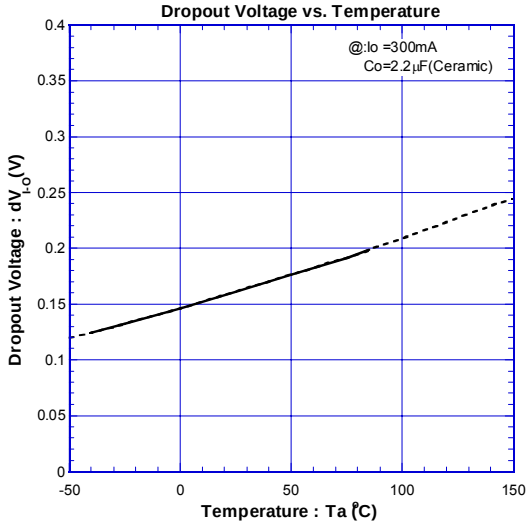


■ TYPICAL CHARACTERISTICS

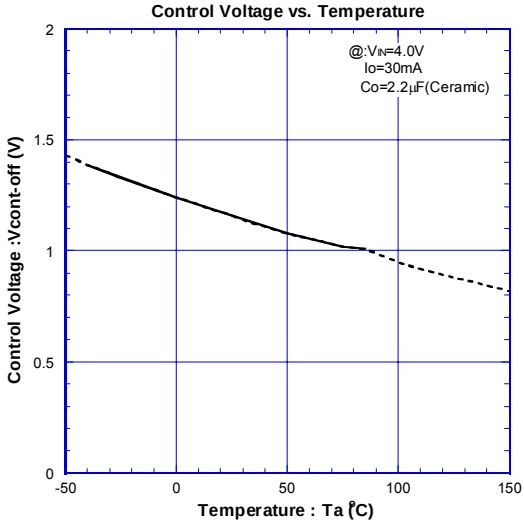
NJM2884_3.0V
Equivalent Serise Resistance vs. Output Current



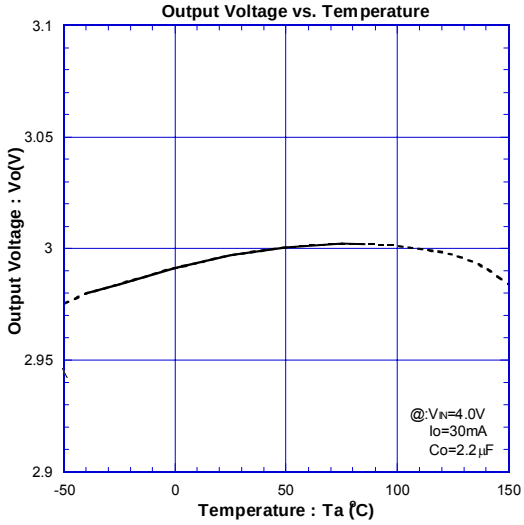
NJM2884_3.0V
Dropout Voltage vs. Temperature



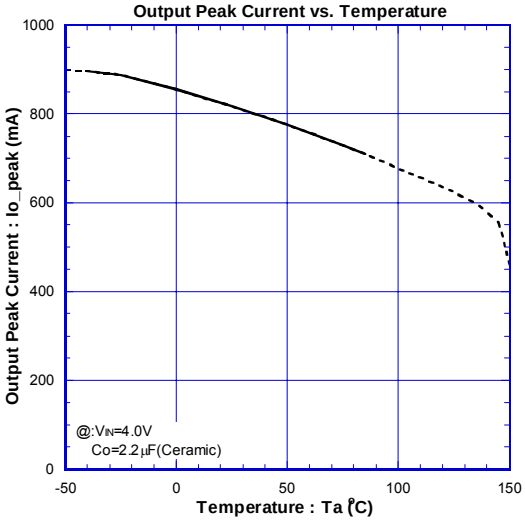
NJM2884_3.0V
Control Voltage vs. Temperature



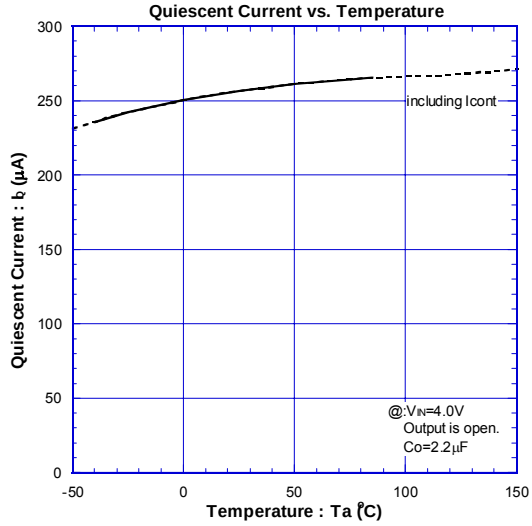
NJM2884_3.0V
Output Voltage vs. Temperature



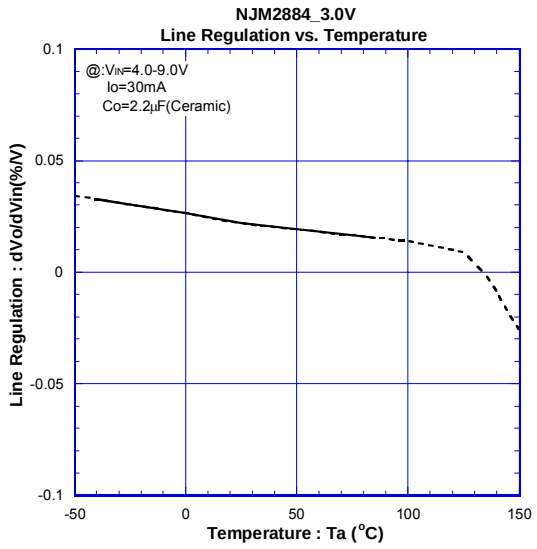
NJM2884_3.0V
Output Peak Current vs. Temperature

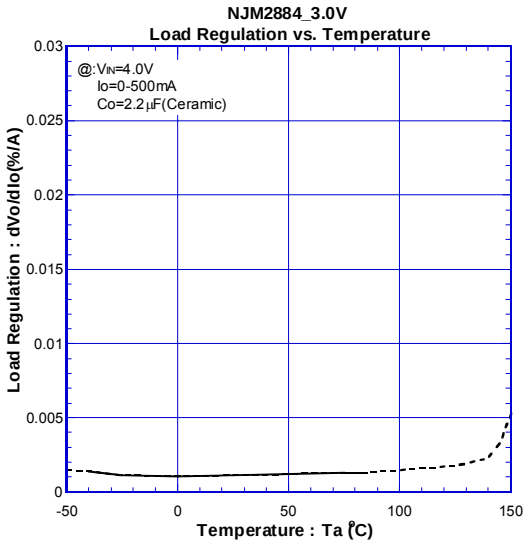


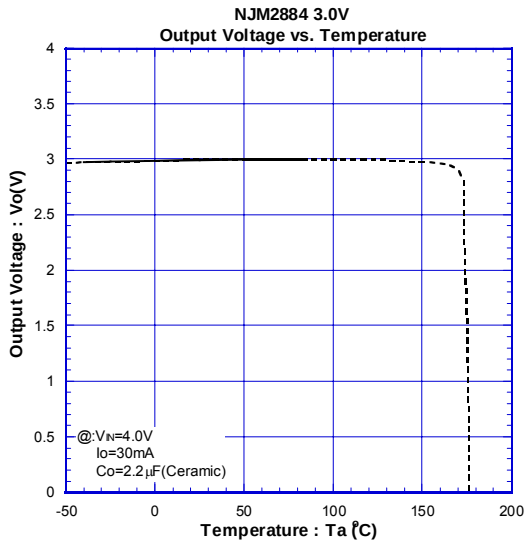
NJM2884_3.0V
Quiescent Current vs. Temperature

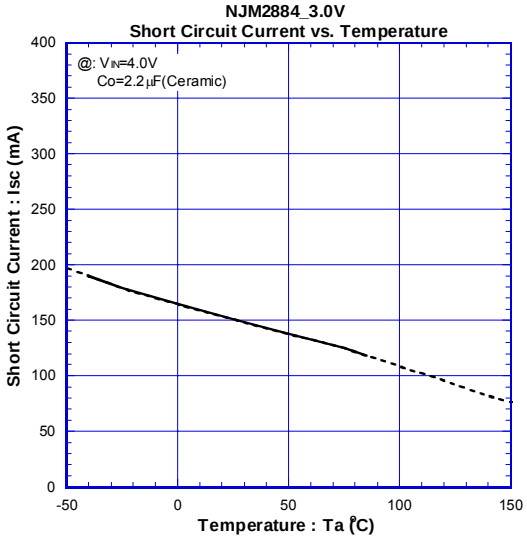


■ TYPICAL CHARACTERISTICS



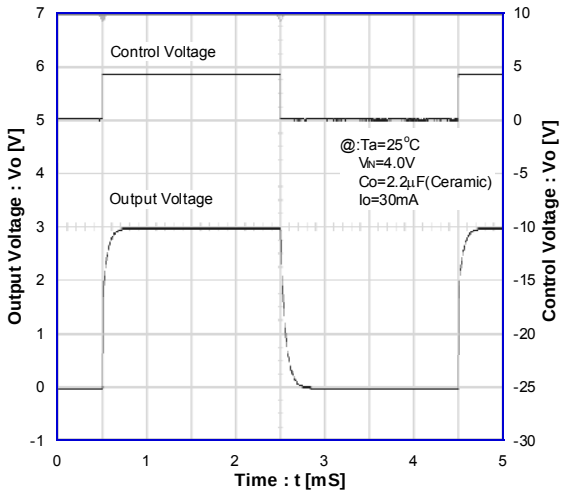




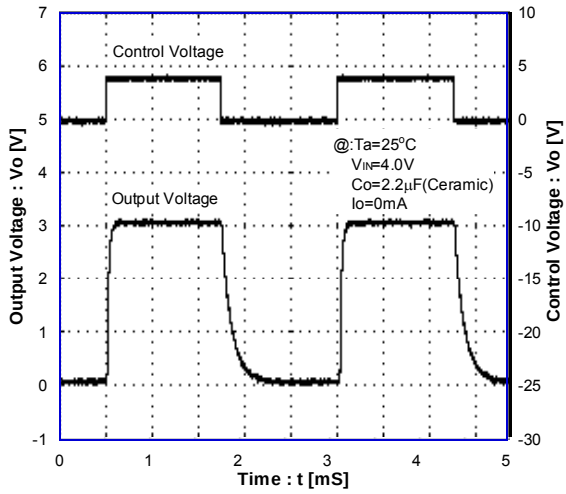


■ TYPICAL CHARACTERISTICS

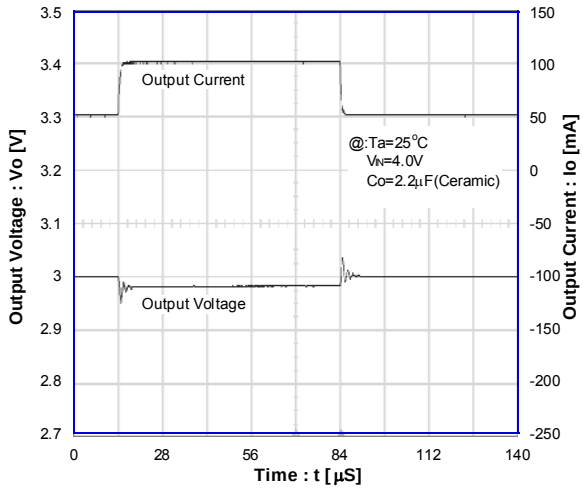
NJM2884_3.0V
ON/OFF Transient Response



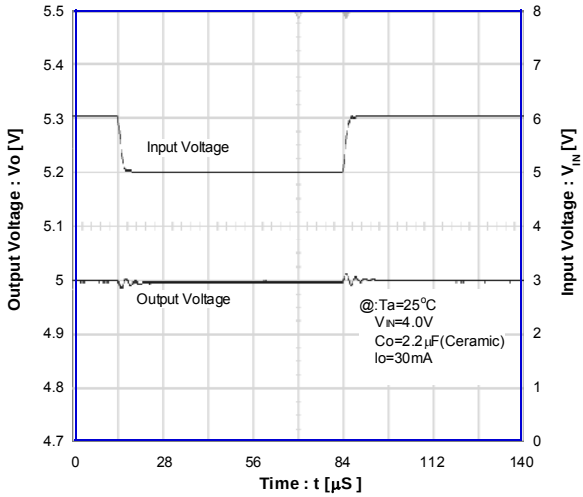
NJM2884_3.0V
ON/OFF Transient Response Without Load



NJM2884_3.0V
Load Transient Response



NJM2884_3.0V
Line Transient Response



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