High Voltage Io=500mA Low Dropout Regulator

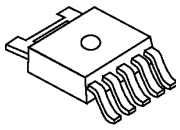
■ GENERAL DESCRIPTION

The NJW4185 is a high voltage and low current consumption low dropout regulator.

NJW4185 is mounted to TO-252-5 package and corresponded to Low ESR capacitor (MLCC).

The wide input range makes NJW4185 suitable for a Car accessory, Industrial supplies, battery equipment and various applications.

■ PACKAGE OUTLINE

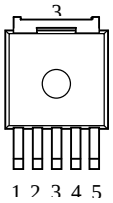


NJW4185DL3

■ FEATURES

- Wide Operating Voltage Range 4.0V ~ 40V
- Low Current Consumption 55μA(typ.)
- Correspond to Low ESR capacitor (MLCC)
- Output Current I_O(min.)=500mA
- Output Voltage Range 2.0V to 15.0V
- High Precision Output V_O ±1.0%
- ON/OFF Function
- Internal Thermal Overload Protection
- Internal Over Current Protection
- Package Outline TO-252-5

■ PIN CONFIGURATION

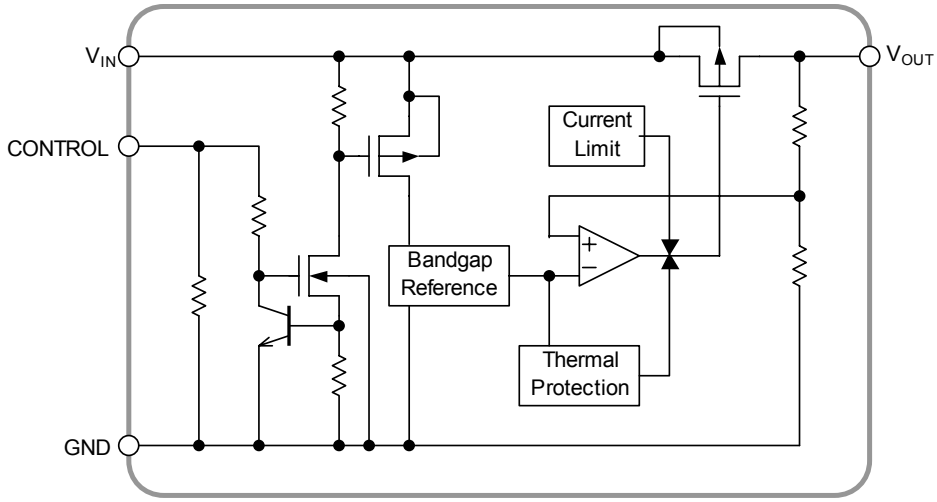


NJW4185DL3

PIN FUNCTION

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

■ BLOCK DIAGRAM



■ OUTPUT VOLTAGE RANK LIST

Device Name	V_{OUT}
NJW4185DL3-33	3.3V
NJW4185DL3-05	5.0V
NJW4185DL3-08	8.0V
NJW4185DL3-15	15.0V

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYNBOL	RATINGS	UNIT
Input Voltage	V_{IN}	-0.3 to +45	V
Control Voltage	V_{CONT}	-0.3 to +45	V
Output Voltage	V_{OUT}	-0.3 to $V_{IN} \leq$ +17	V
Power Dissipation	P_D	1190 (*1) 3125 (*2)	mW
Junction Temperature	T_J	-40 to +150	°C
Operating Temperature	Topr	-40 to +85	°C
Storage Temperature	Tstg	-40 to +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 x 74.2mm inner Cu area and thermal via hole to a board based on JEDEC standard JESD51-5)

■ INPUT VOLTAGE RANGE

V_{IN}=4.0V〜40V

■ ELECTRICAL CHARACTERISTICS

Unless otherwise noted, $V_O \geq 3.0V$: $V_{IN}=V_O+1V$, $C_{IN}=1.0\mu F$, $C_O=2.2\mu F$, Ta=25°C
$V_O<3.0V$: $V_{IN}=4.0V$, $C_{IN}=1.0\mu F$,Co=4.7µF, Ta=25°C

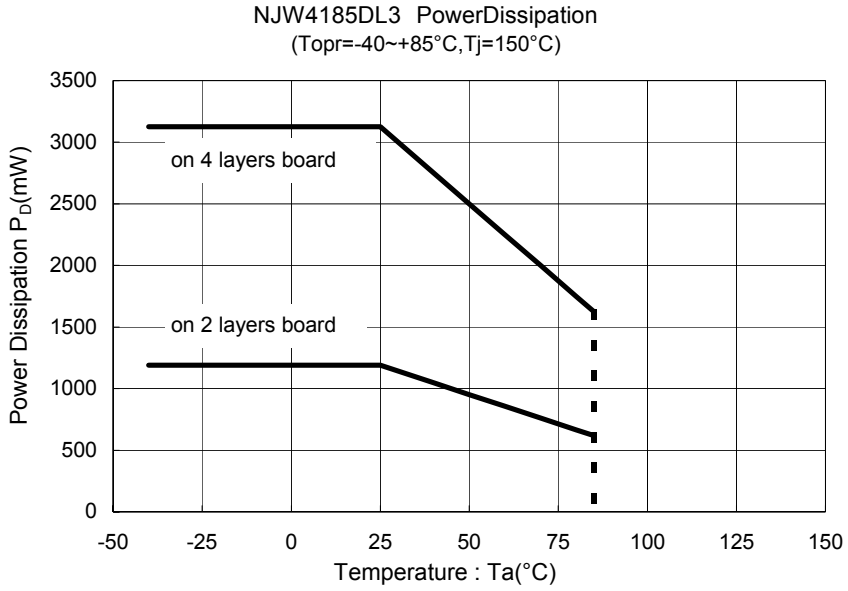
PARAMETER	SYMBOL	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Voltage	V_O	I_O =30mA		-1.0%	-	+1.0%	V
Quiescent Current	I_Q	I_O =0mA, except I_{CONT}		-	55	90	µA
Quiescent Current at Control OFF	$I_{Q(OFF)}$	V_{CONT}=0V		-	-	1	µA
Output Current	I_O	$V_O \times 0.9$		500	-	-	mA
Line Regulation	$\Delta V_O/\Delta V_{IN}$	V_{IN} = V_O+1V to 40V, I_O=30mA ($V_O \geq 3V$) V_{IN} = 4V to 40V, I_O=30mA ($V_O<3V$)		-	-	0.03	%/V
Load Regulation	$\Delta V_O/\Delta I_O$	I_O=0mA to 500mA		-	-	0.006	%/mA
Ripple Rejection	RR	V_{IN} = V_O+1V ,ein=200mVrms, f=1kHz, I_O =10mA	V_O=3.3V	-	62	-	dB
			V_O=5.0V	-	60	-	
			V_O=8.0V	-	55	-	
			V_O=15V	-	50	-	
Dropout Voltage(*3)	ΔV_{IO}	I_O=300mA		-	0.27	0.42	V
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta Ta$	Ta=0 to 85°C, I_O =30mA		-	±50	-	ppm/°C
Control Current	I_{CONT}	V_{CONT}=1.6V		-	1	3	µA
Control Voltage for ON-state	$V_{CONT(ON)}$			1.6	-	-	V
Control Voltage for OFF-state	$V_{CONT(OFF)}$			-	-	0.6	V

(*3):The output voltage excludes under 3.8V

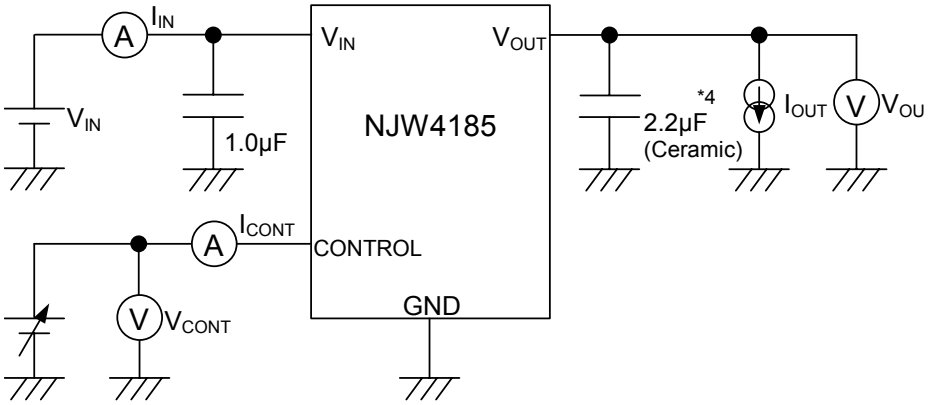
The above specification is a common specification for all output voltages.

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

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE



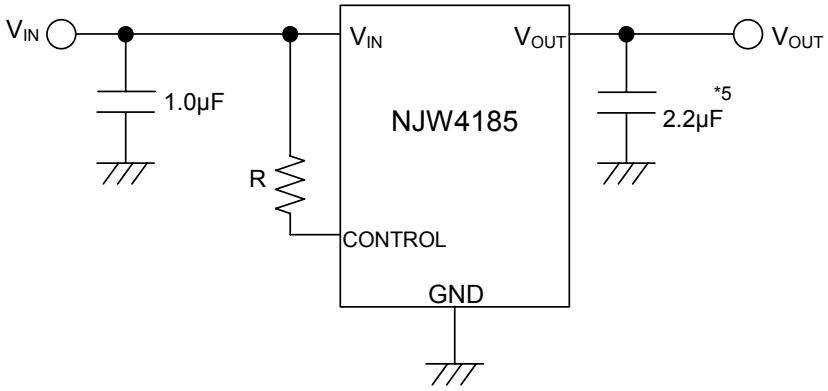
■ TEST CIRCUIT



*4 : Vo<3.0V version : Co=4.7μF (Ceramic)

■ TYPICAL APPLICATION

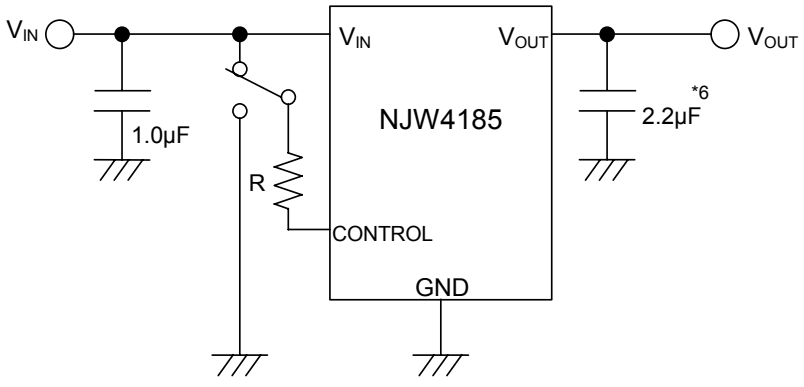
①In the case where ON/OFF Control is not required



*5 : Vo<3.0V version : Co=4.7μF

Connect control pin to V_{IN} pin

②In use of ON/OFF CONTROL



*6 : Vo<3.0V version : Co=4.7μF

State of control pin:

- "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 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 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.

*The notes of the evaluation when output pin is shorted to GND

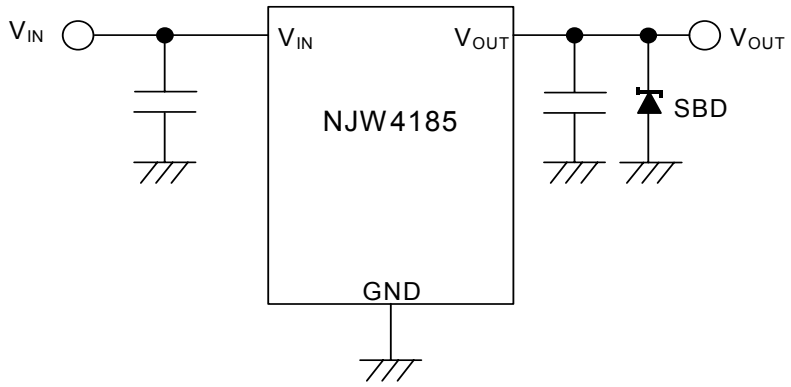
When evaluated short circuit test, the IC may break down because of regenerated energy by the parasitic inductance included in wiring pattern.

It phenomenon appears conspicuously when output voltage is high(Vo=8.0V or more)or connected to inductive load.

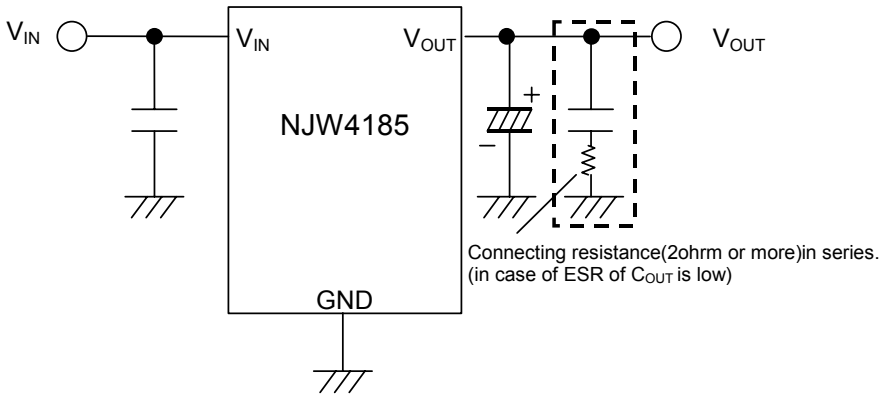
In case of short circuit in actual application, not likely to destruction of IC because of some of Resistance exist between load.

If happened above phenomenon by the short circuit test with the actual application, recommend connecting schottky barrier diode(SBD) between Vo pin and the GND or using output condensers that have ESR more than 2ohrm like a tantalum or aluminum electrolytic capacitor.(see below figure)

(a)In case of insert Schottky barrier diode between output pin - GND

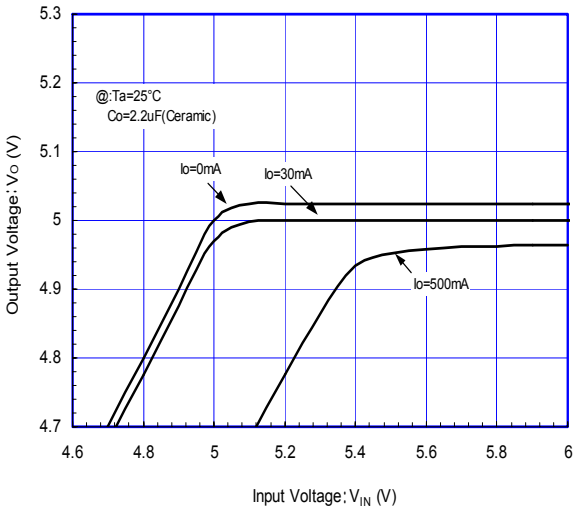


(b) In case of using the electrolysis condenser or insert series resistance

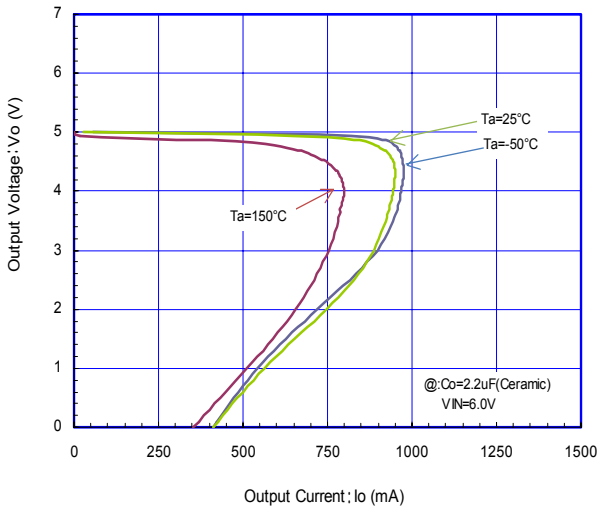


■ TYPICAL CHARACTERISTICS

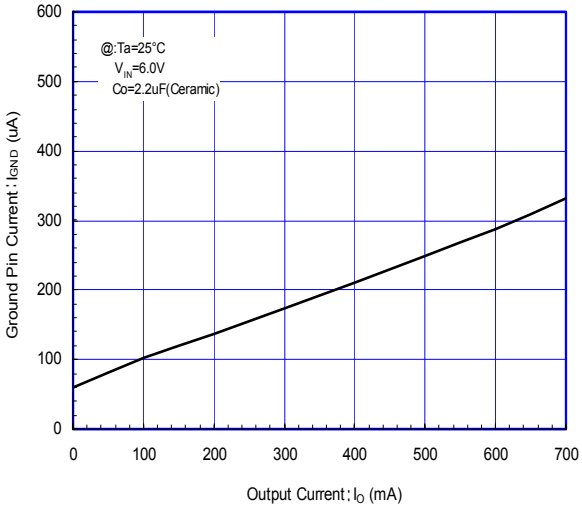
NJW4185_5.0V
Output Voltage vs. Input Voltage



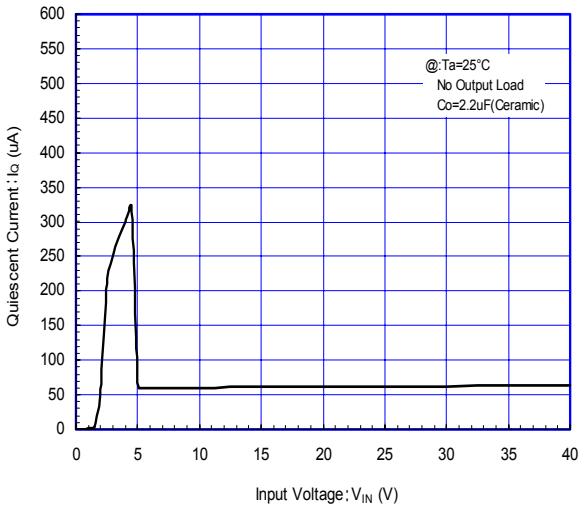
NJW4185_5.0V
Output Volatge vs. Output Current



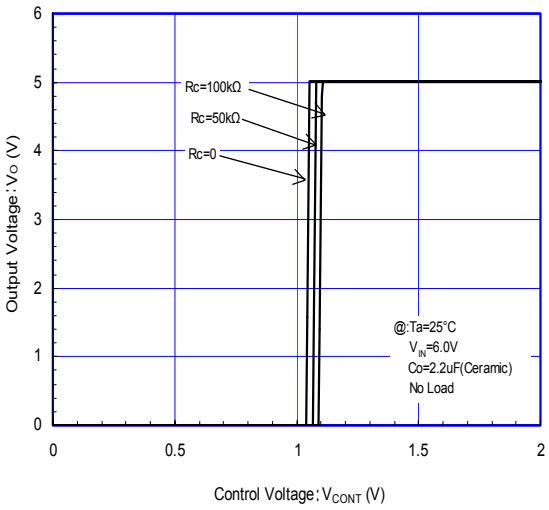
NJW4185_5.0V
Ground Pin Current vs. Output Current



NJW4185_5.0V
Quiescent Current vs. Input Voltage



NJW4185_5.0V
Output Voltage vs. Control Voltage



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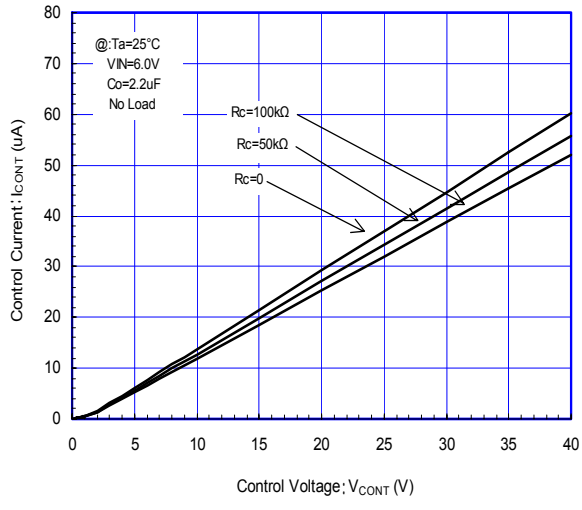
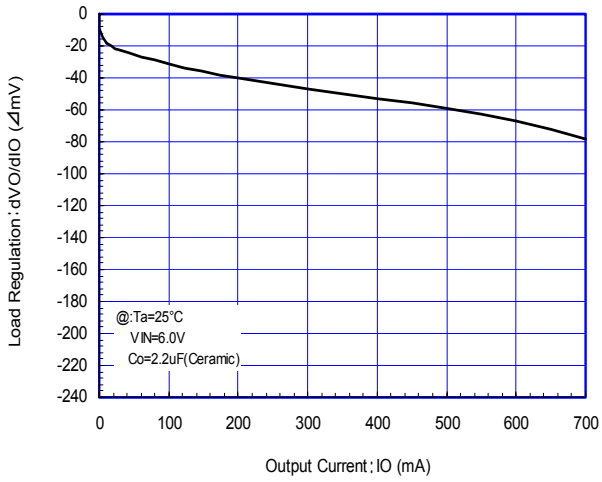
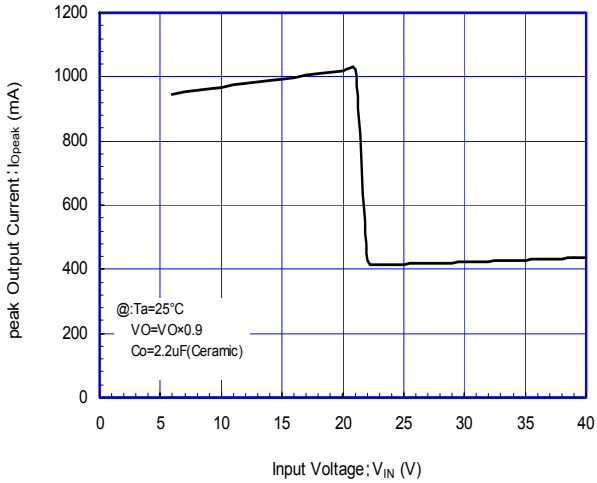
Control Current vs. Control Voltage



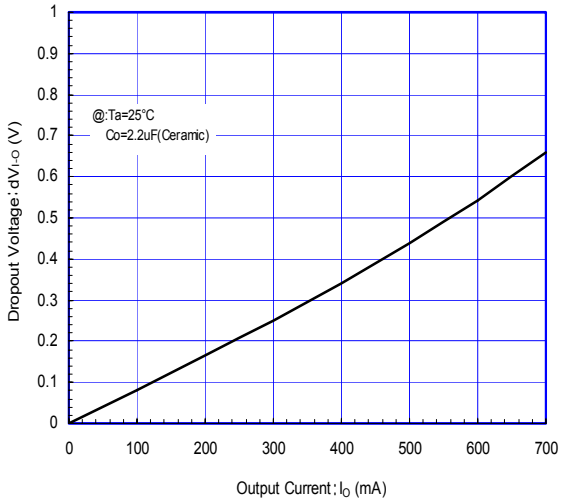
NJW4185_5.0V
Load Regulaton vs. Output Current



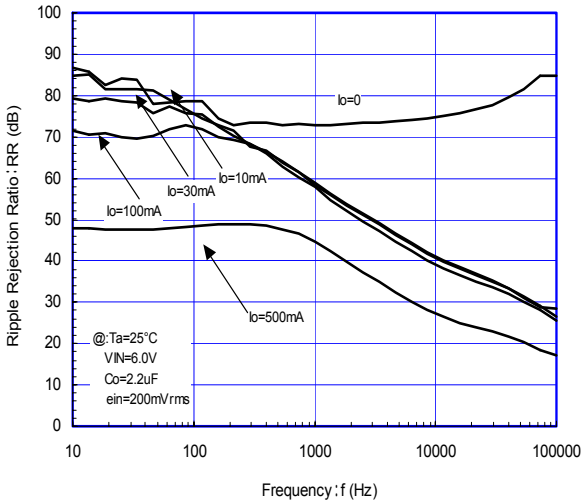
NJW4185_5.0V
Peak Output Current vs. Input Voltage



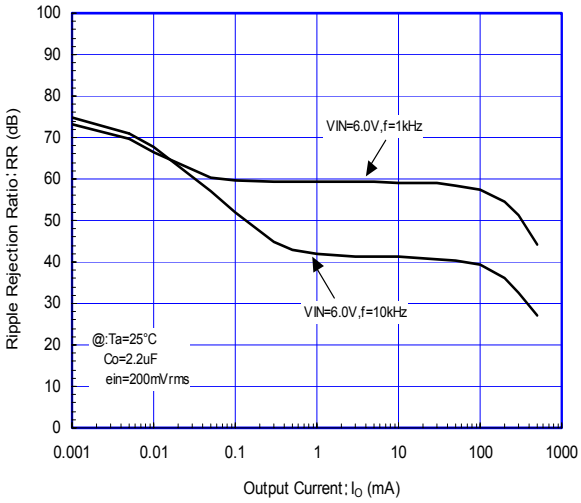
NJW4185_5.0V
Dropout Voltage vs. Output Current



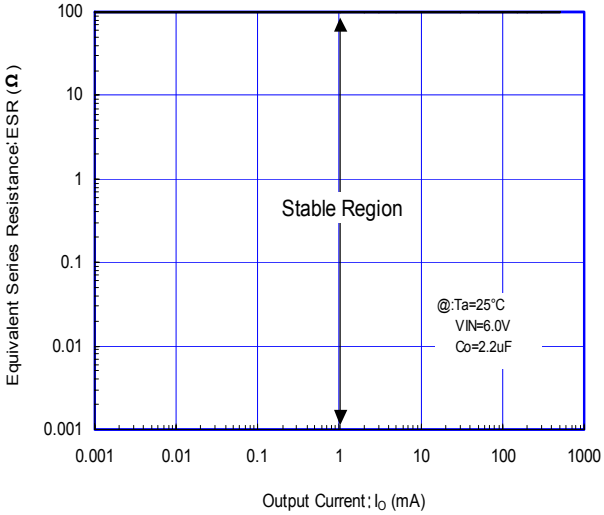
NJW4185_5.0V
Ripple Rejection Ratio vs. Frequency



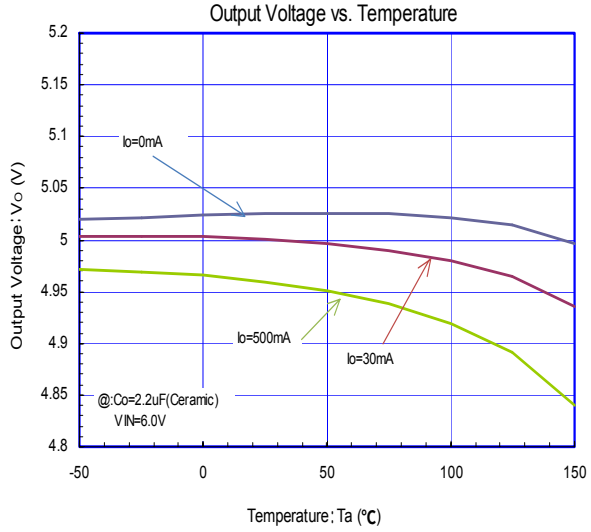
NJW4185_5.0V
Ripple Rejection Ratio vs. Output Current



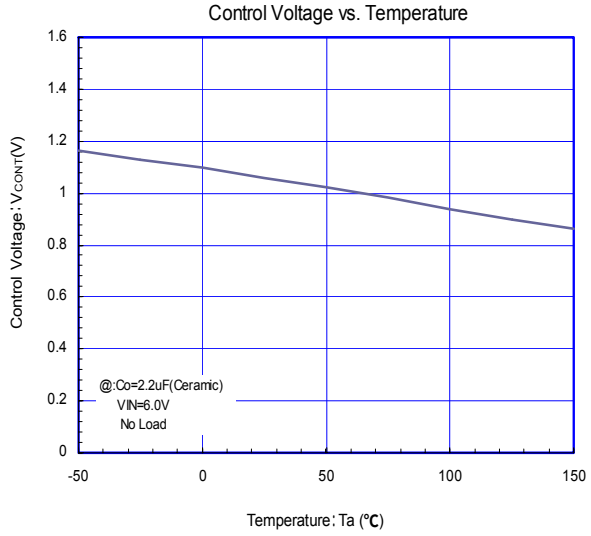
NJW4185_5.0V
Equivalent Series Resistance vs. Output Current



NJW4185_5.0V
Output Voltage vs. Temperature



NJW4185_5.0V
Control Voltage vs. Temperature



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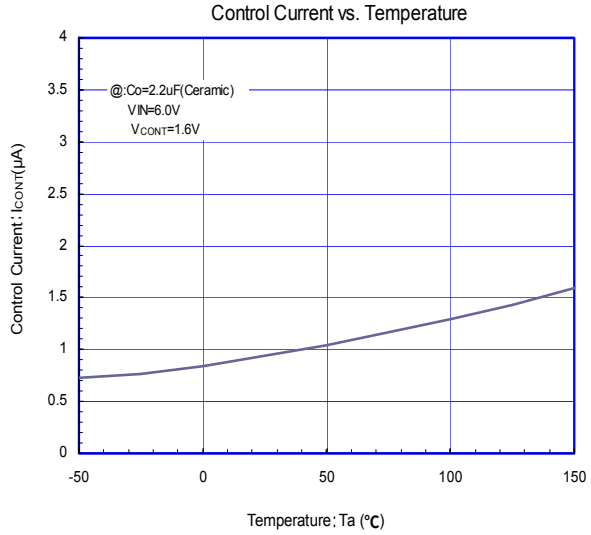
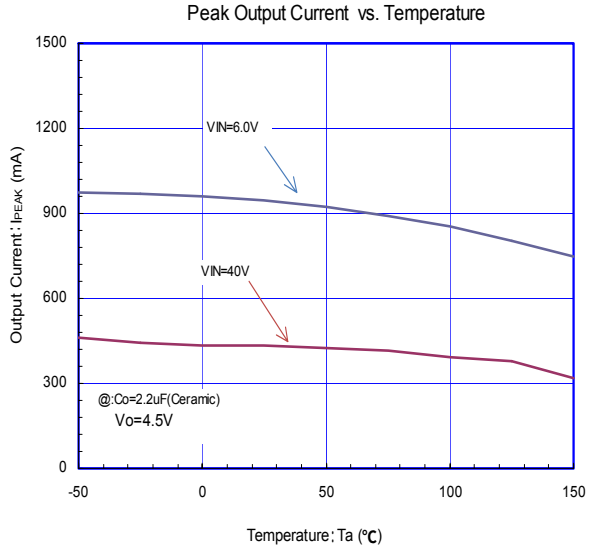
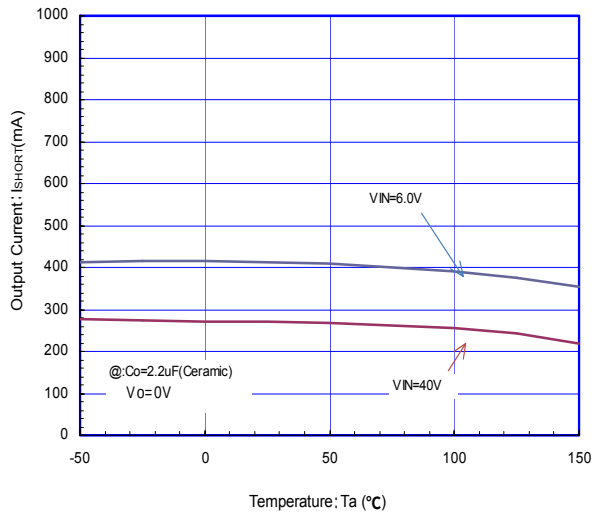
Control Current vs. Temperature



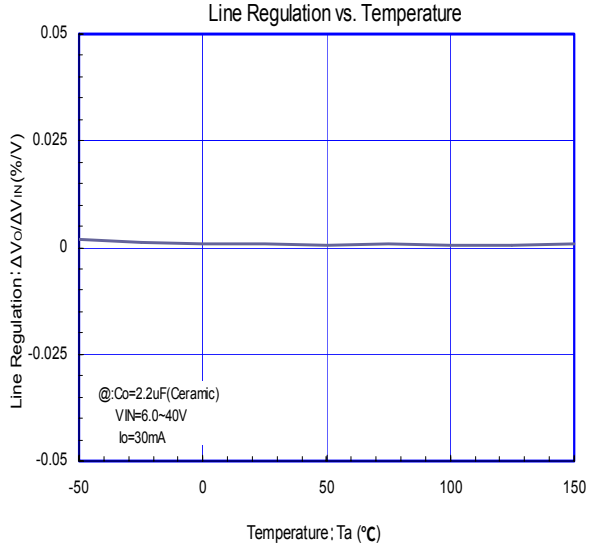
NJW4185_5.0V
Peak Output Current vs. Temperature



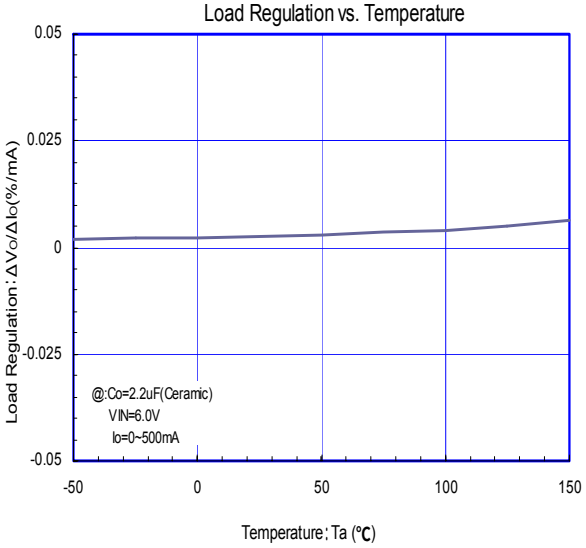
NJW4185_5.0V
Short Cuircuit Current vs. Temperature



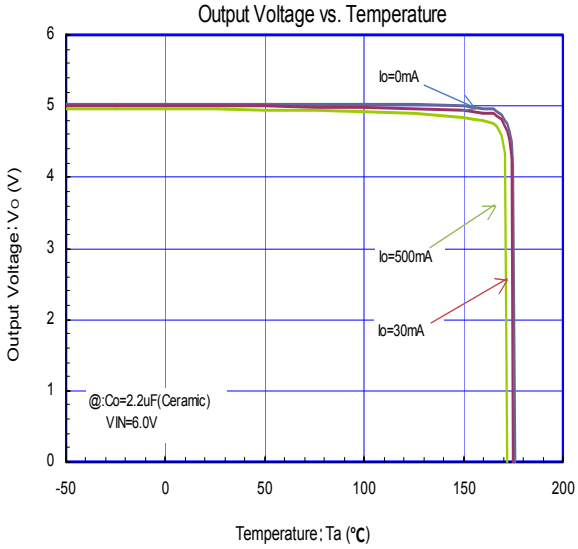
NJW4185_5.0V
Line Regulation vs. Temperature



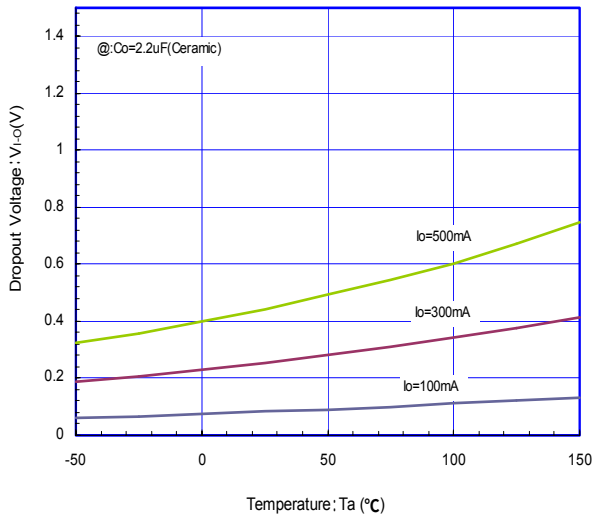
NJW4185_5.0V
Load Regulation vs. Temperature



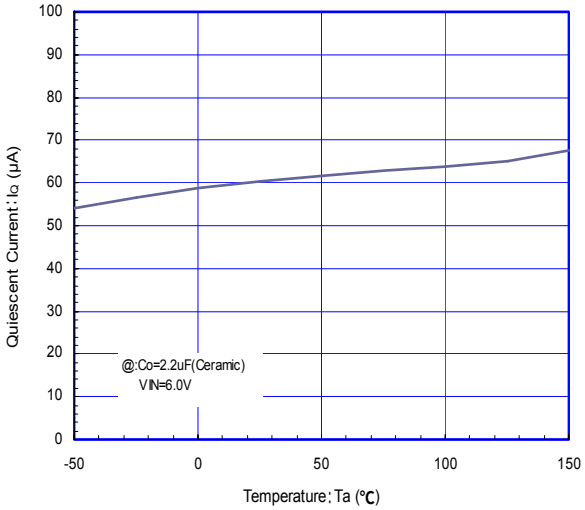
NJW4185_5.0V
Output Voltage vs. Temperature



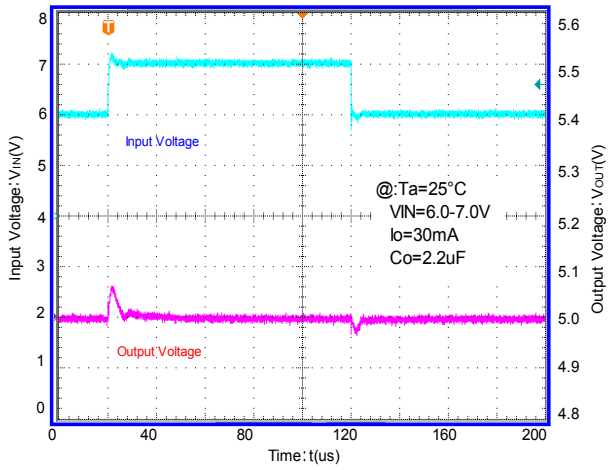
NJW4185_5.0V
Dropout Voltage vs. Temperature



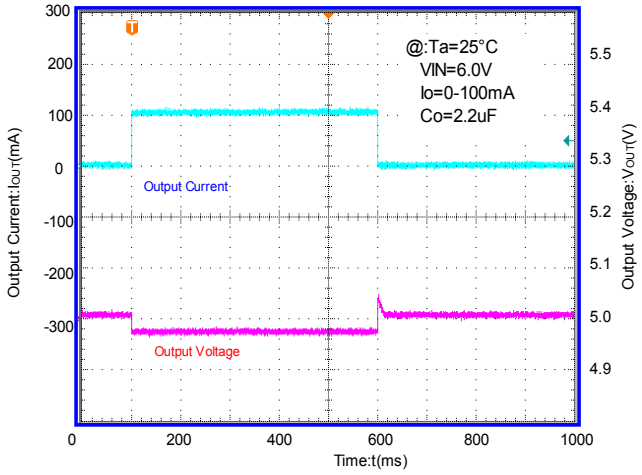
NJW4185_5.0V
Quiescent Current vs. Temperature



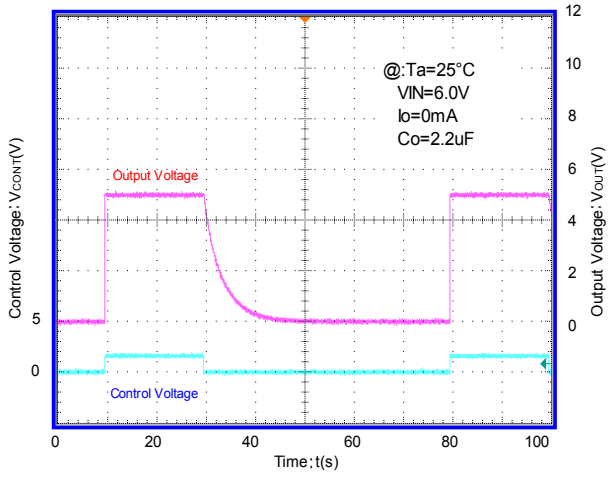
NJW4185_5.0V
Input Transient Response



NJW4185_5.0V
Load Transient Response



NJW4185_5.0V
ON/OFF Transient Response without Load



NJW4185_5.0V
ON/OFF Transient Response