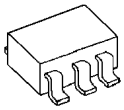
Adjustable Low Dropout Regulator w/Reverse Current Protection

■ GENERAL DESCRIPTION

The NJM11100 is a 240mA output low dropout adjustable type voltage regulator. The available setting voltage range is very wide from 1.3V to 17V. This product has Reverse Current Protection without external SBD. Advanced Bipolar technology achieves low noise, high ripple rejection and high supply voltage. It is suitable for various applications such as car AVN, any consumer products and so on.

■ PACKAGE OUTLINE



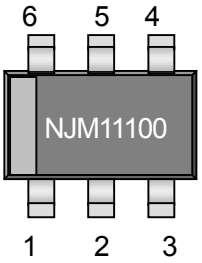
NJM11100F1

NJM11100KH1

■ FEATURES

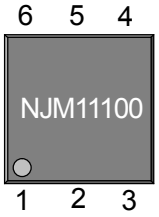
- Output Voltage Setting Range 1.3V to 17V
- Reference Voltage Accuracy 1.25V ±1.0%
- Output Current 240mA (min.) 320mA (typ.)
- Correspond to Low ESR capacitor (MLCC) 1.0μF: (Vo≥1.4V)
- Low Dropout Voltage 0.2V (typ.) @Io=200mA
- Input Voltage Range 2.1V to 18V
- ON/OFF Control
- Reverse Current Protection Circuit
- Thermal Shutdown Circuit
- Over Current Protection Circuit (OCP)
- Bipolar Technology
- Direct Replacement to TK11100 (180 degree rotated)
- Package Outline SOT-23-6-1, DFN6-H1(ESON6-H1)

■ PIN CONFIGURATION



1. CONTROL
2. GND
3. Noise Bypass
4. V_{OUT}
5. V_{ADJ}
6. V_{IN}

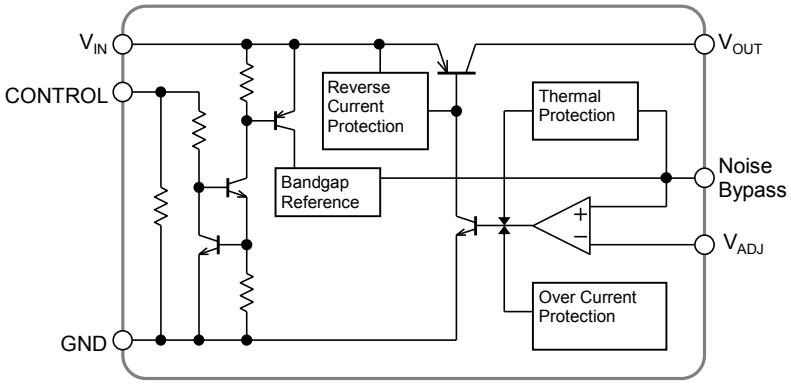
Should be noted the device direction when replacing from TK11100.



1. V_{IN}
2. V_{ADJ}
3. V_{OUT}
4. Noise Bypass
5. GND
6. CONTROL

Exposed Pad(Rear PAD) should be connect to GND

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

PARAMETER	SYMBOL	MAXIMUM RATING		UNIT
Input Voltage	V_{IN}	–0.3 to +20		V
Output Voltage	V_{OUT}	–0.3 to +19		V
Control Pin Voltage	V_{CONT}	–0.3 to +20		V
Output Adjust Pin Voltage	V_{ADJ}	–0.3 to +4		V
Noise Bypass Pin Voltage (*5)	V_{NB}	–0.3 to +4		V
Power Dissipation	P_D	SOT-23-6	510(*1) 710(*2)	mW
		DFN6-H1 (ESON6-H1)	450(*3) 1200(*4)	
Operating Temperature Range	Topr	–40 to +85		°C
Storage Temperature Range	Tstg	–40 to +150		°C

(*1): Mounted on glass epoxy board. (76.2×114.3×1.6mm: based on EIA/JDEC standard, 2Layers)

(*2): Mounted on glass epoxy board. (76.2×114.3×1.6mm: based on EIA/JDEC standard, 4Layers),internal Cu area: 74.2×74.2mm

(*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)

(*5): When input voltage is less than +4V, the absolute maximum control voltage is equal to the input voltage.

■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Input Voltage Range	V_{IN}		2.1	-	18	V
Output Voltage Range	V_{OUT}		1.3	-	17	V

■ ELECTRICAL CHARACTERISTICS

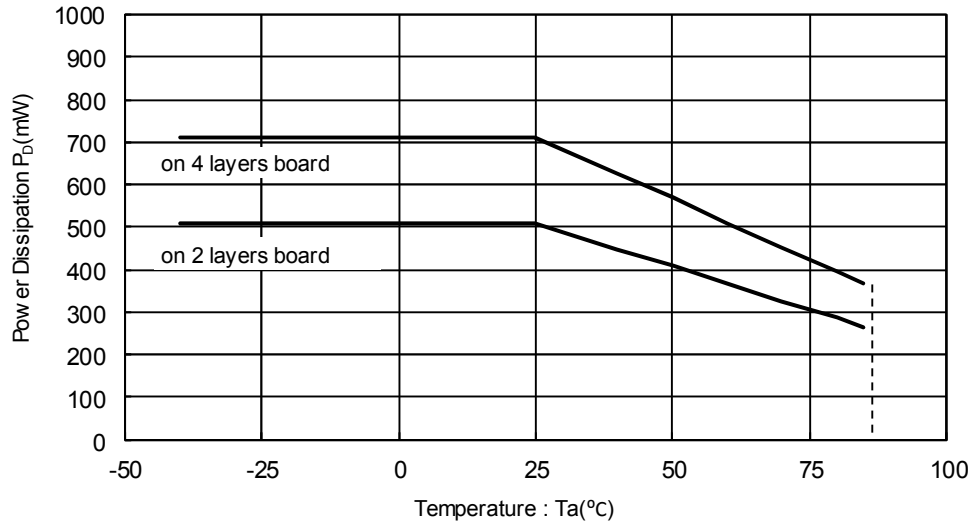
(Unless other noted, V_{IN}=4V, R1=51kΩ, R2=68kΩ, C_{IN}=0.1μF, C_O=1.0μF(V_O<1.4V: 2.2μF), Cp=0.01μF, Cfb=100pF, Ta=25°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Reference Voltage	Vref	I_O=30mA	–1.0%	1.25	+1.0%	V
Quiescent Current	I_Q	I_O=0mA, except Icont	-	200	260	μA
Quiescent Current at OFF-state	$I_{Q(OFF)}$	V_{CONT}=0V	-	-	100	nA
Ground Current	I_{GND}	I_O=50mA	-	0.75	1.5	mA
Output Current	I_O	V_O–0.3V	240	320	—	mA
Line Regulation	$\Delta V_O/\Delta V_{IN}$	V_{IN}= V_O+1V to V_O+6V, I_O=30mA	-	-	0.10	%/V
Load Regulation	$\Delta V_O/\Delta I_O$	I_O=0 to 200mA	-	-	0.01	%/mA
Dropout Voltage(*6)	ΔV_{I-O}	I_O=200mA	-	0.2	0.35	V
Control Voltage at ON-state	$V_{CONT(ON)}$		1.6	-	-	V
Control Voltage at OFF-state	$V_{CONT(OFF)}$		-	-	0.6	V
Control Current	I_{CONT}	V_{CONT}=1.6V	-	3	12	μA
Ripple Rejection	RR	ein=200mVrms,f=1kHz, I_O=10mA, V_O=3V setting	-	75	-	dB
Average Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta Ta$	Ta=0°C to +85°C, I_O=30mA	-	±35	-	ppm/°C
Output Noise Voltage	V_{NO}	f=10Hz to 80kHz, I_O=10mA, V_O=3V setting	-	30	-	μVrms

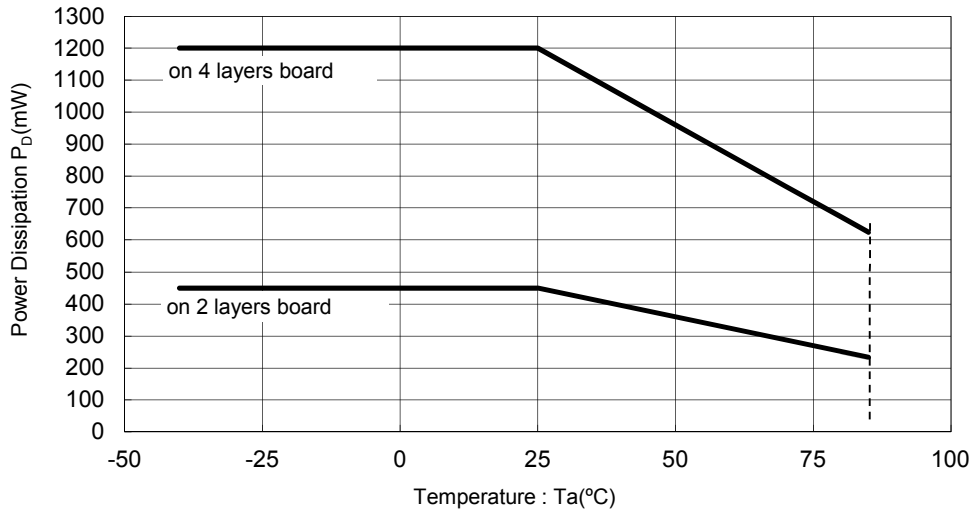
(*6):Except setting Output Voltage less than 2.1V.

■ POWER DISSIPATION vs. AMBIENT TEMPERATURE

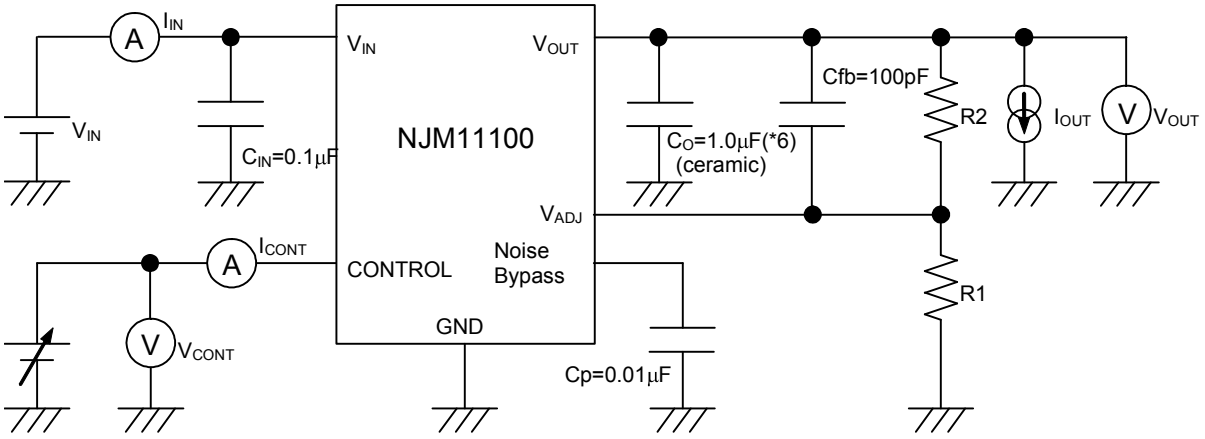
SOT-23-6-1 Power Dissipation
(Topr=-40 to +85°C,Tj=150°C)



DFN6-H1(ESON6-H1) Power Dissipation
(Topr=-40 to +85°C,Tj=150°C)



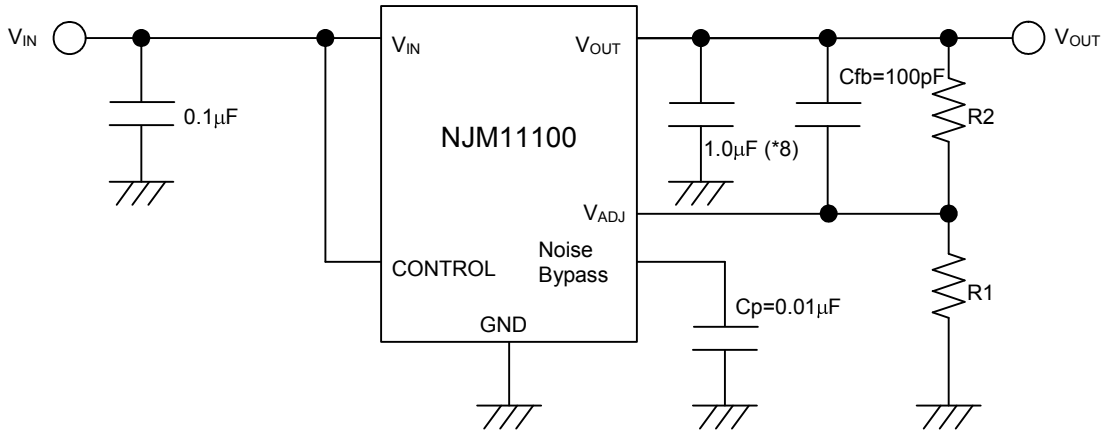
■ TEST CIRCUIT



(*7): V_O<1.4V: 2.2μF

■ TYPICAL APPLICATION

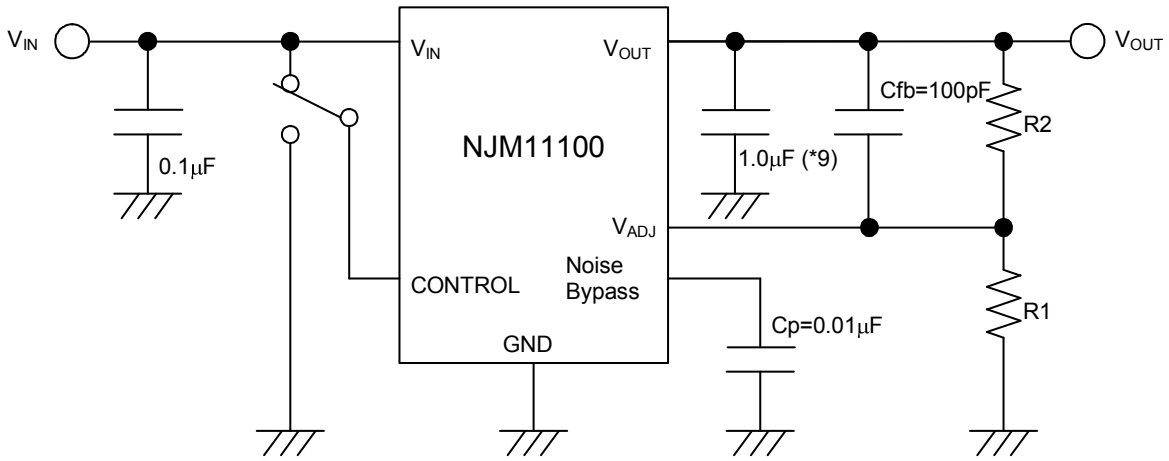
1. In the case where ON/OFF Control is not required:



Connect CONTROLl pin to V_{IN} pin

(*8): V_O<1.4V: 2.2μF

2. In use of ON/OFF CONTROL:



State of CONTROL pin:

- "H" → output is enabled.
- "L" or "open" → output is disabled.

(*9): V_O<1.4V: 2.2μF

[Output voltage setting formula]

$$V_{OUT} = Vref \times \frac{R1 + R2}{R1}$$

$$Vref_{(typ)} = 1.25V$$

$$1.3V \le V_{OUT(typ)} \le 17.0V$$

R1 value should be selected between 1kΩ and 120kΩ.

* 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 (MLCC)

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 though this product is designed stability works with wide range ESR of capacitor including low ESR products.

* Noise bypass Capacitor Cp

Noise bypass capacitor Cp reduces noise generated by band-gap reference circuit. Noise level and ripple rejection will be improved when larger Cp is used. Use of smaller Cp value may cause oscillation.

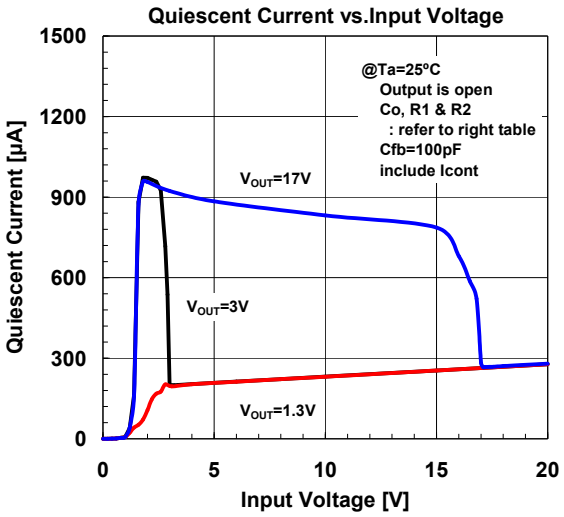
Use the Cp recommended value larger (refer to conditions of ELECTRIC CHARACTERISTIC) to avoid the problem.

* Reverse Current Protection

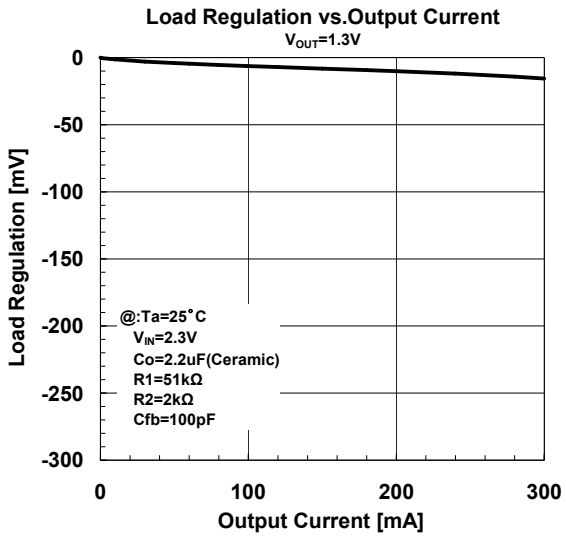
NJM11100 is built in Reverse Current Protection circuit.

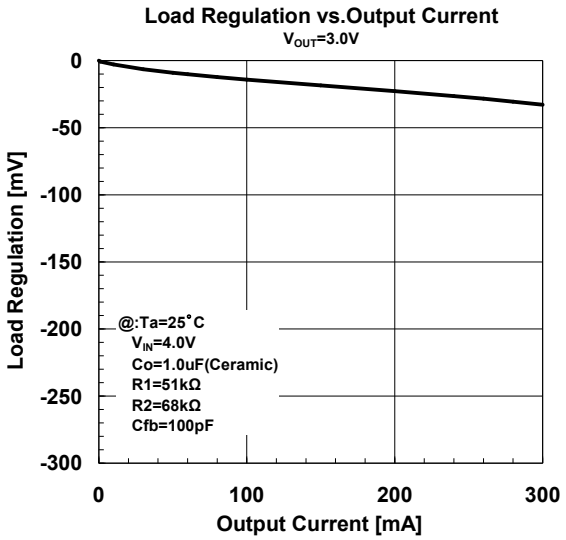
So external Schottky barrier diode(SBD) is not required that this circuit prevents the large reverse current due to the output voltage being higher than the input voltage.

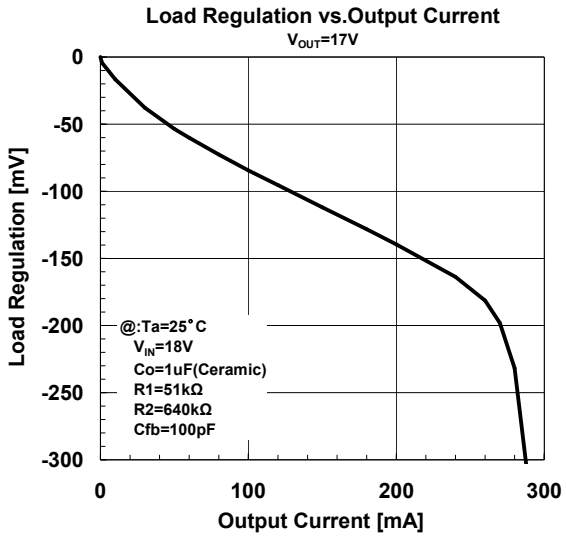
■CHARACTERISTICS

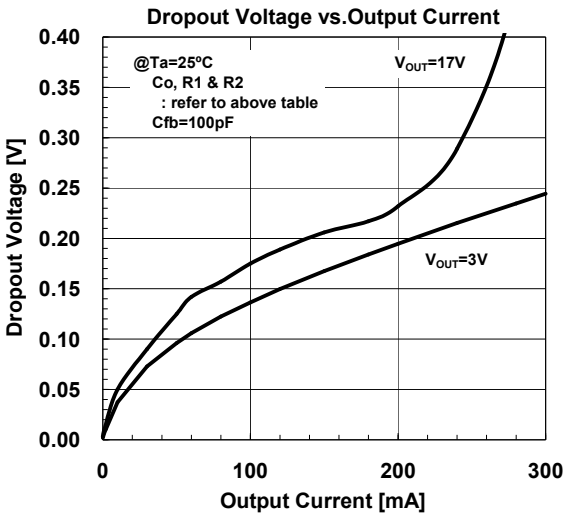


V_{OUT}=1.3V: C_O=2.2μF, R1=51kΩ, R2=2kΩ
3.0V: C_O=1.0μF, R1=51kΩ, R2=68kΩ
17V: C_O=1.0μF, R1=51kΩ, R2=640kΩ









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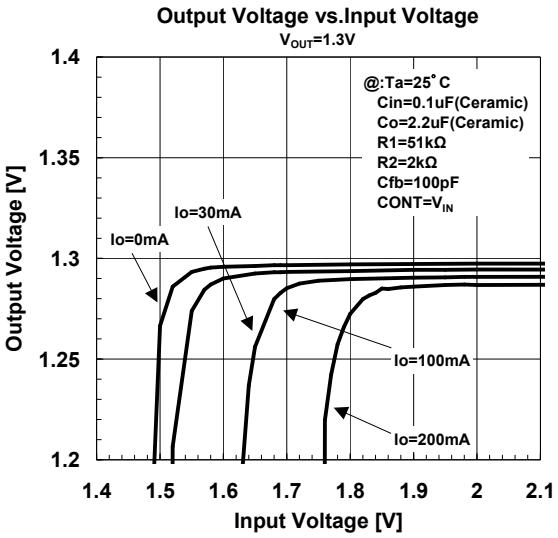

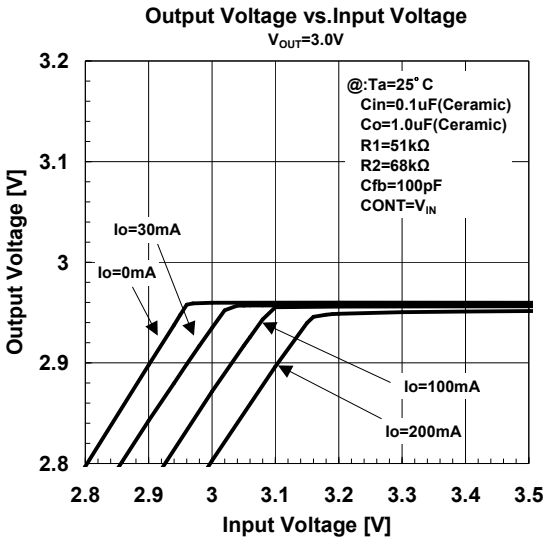

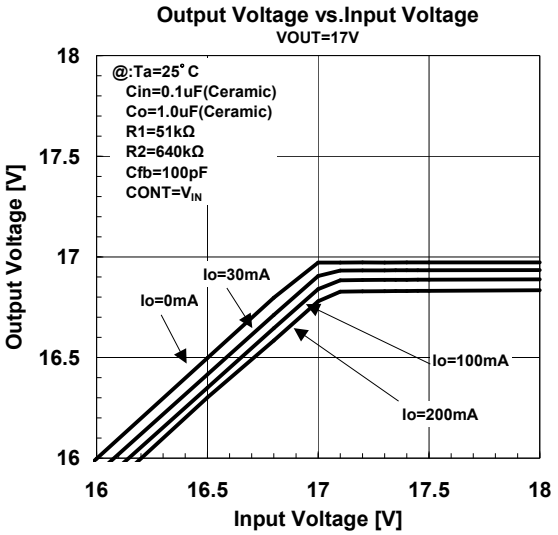

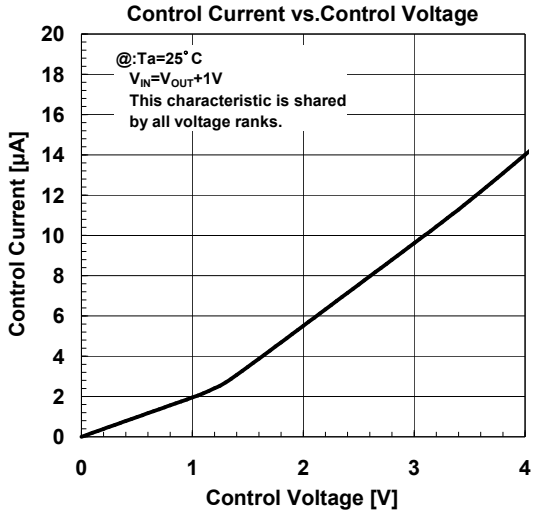

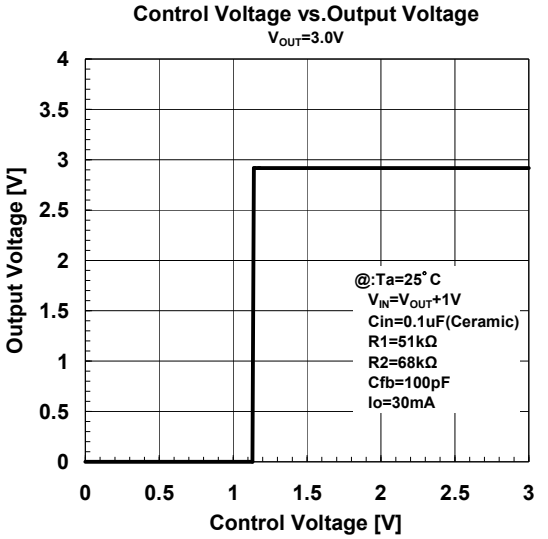

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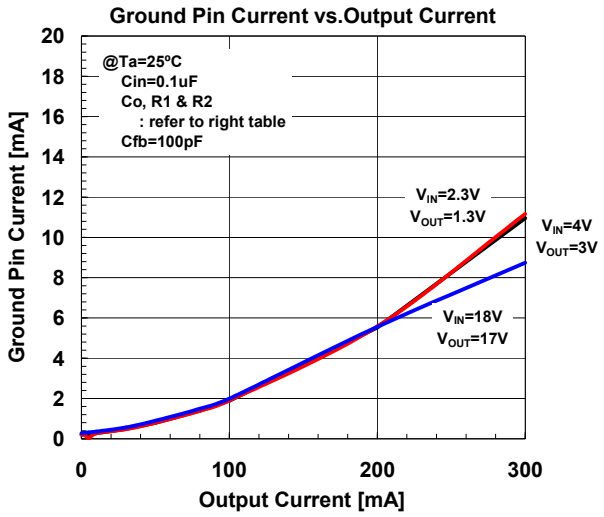

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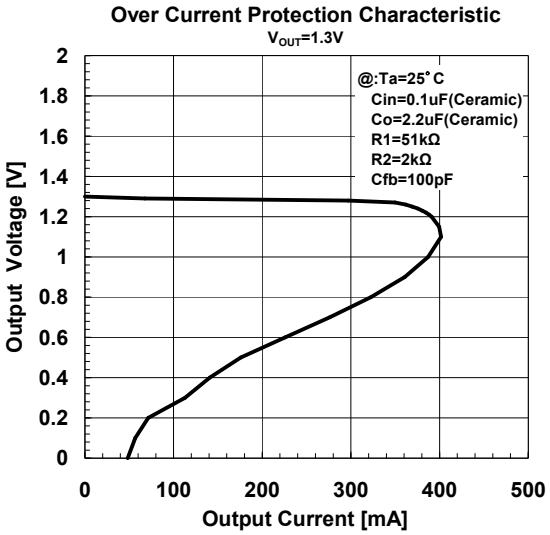

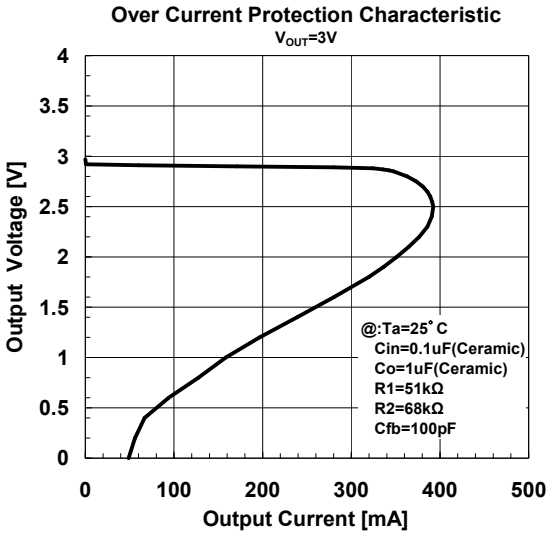

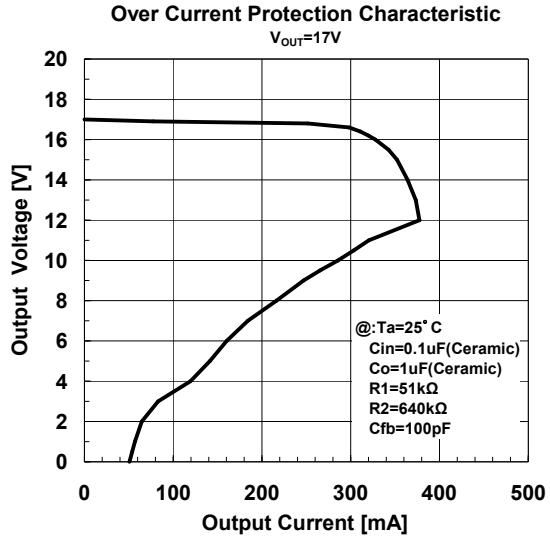

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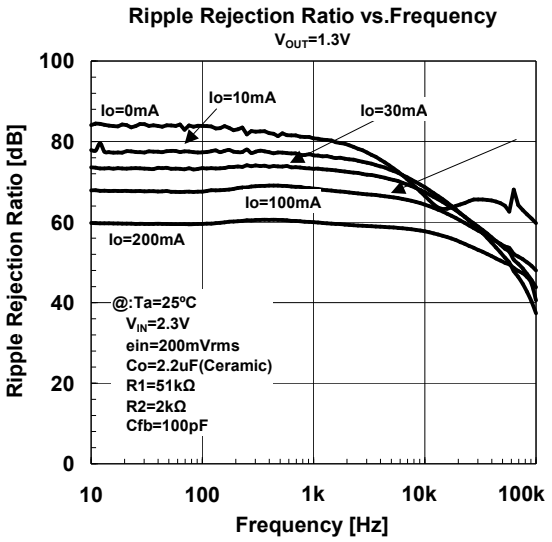

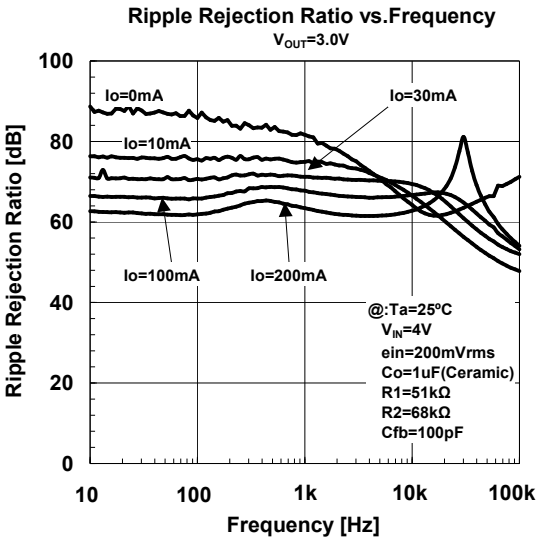

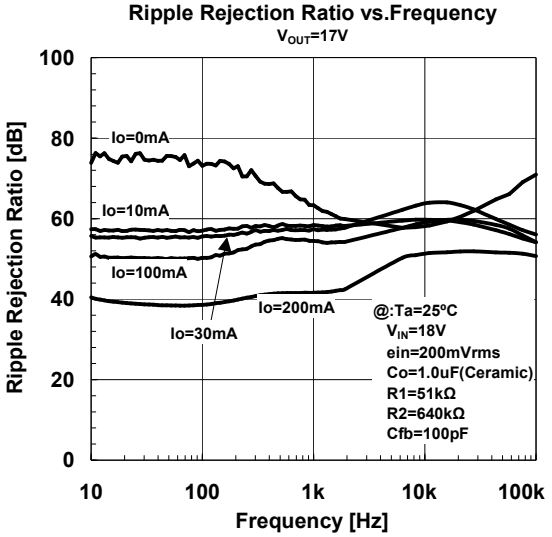

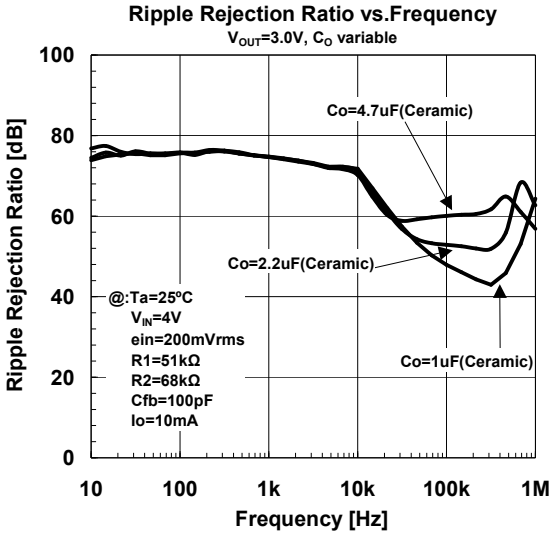

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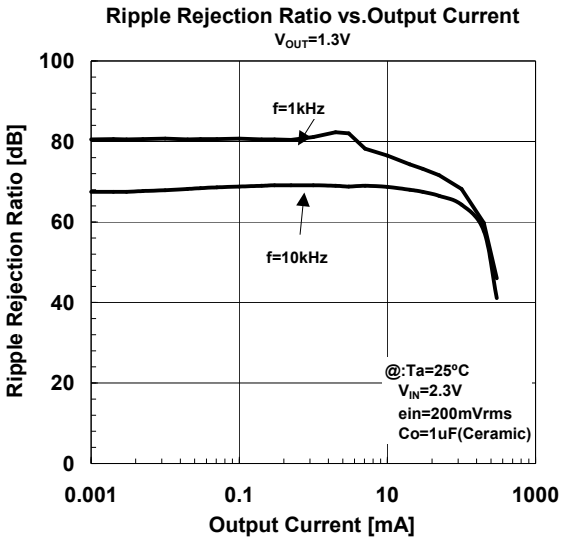

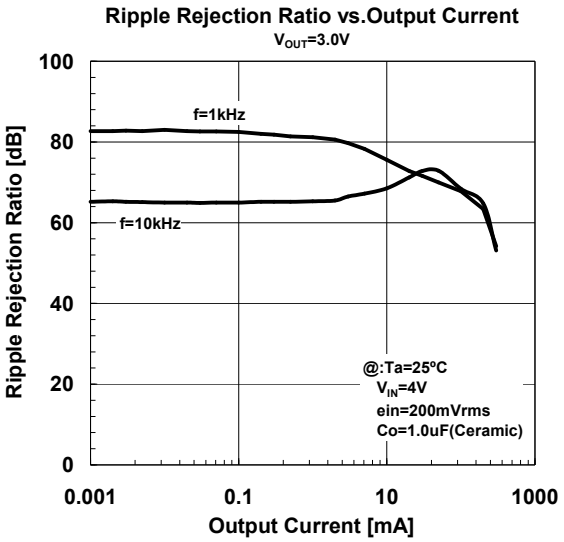

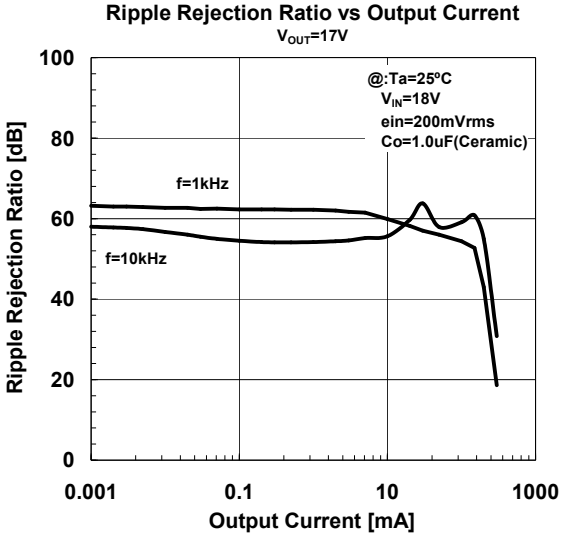

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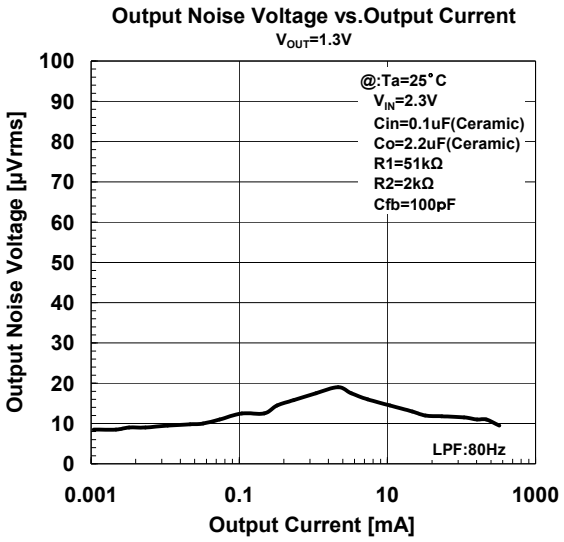

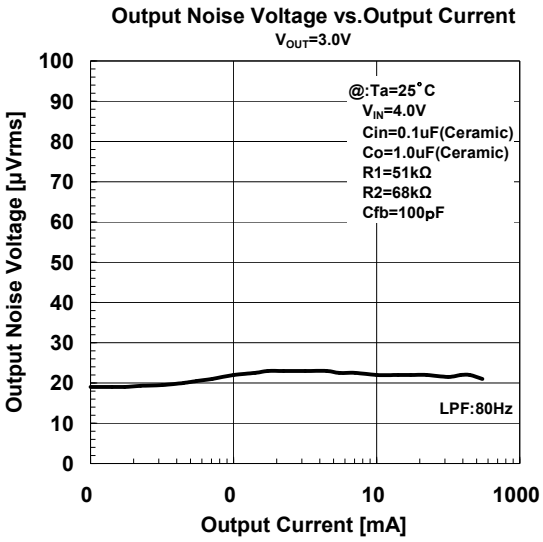

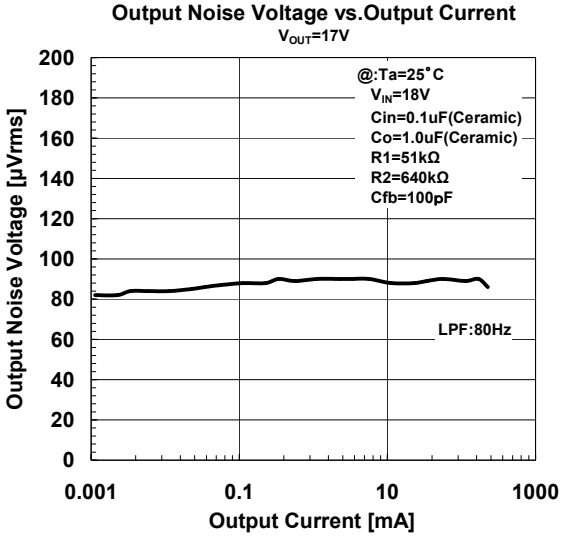

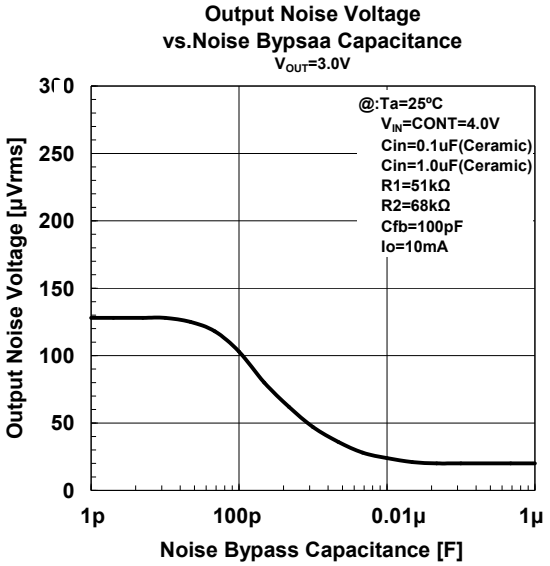

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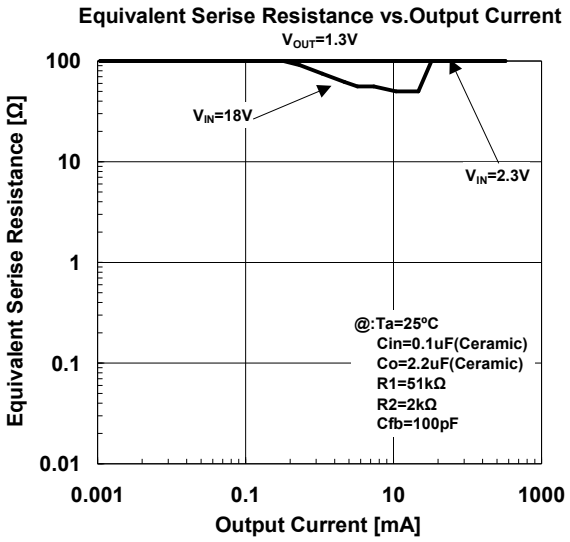

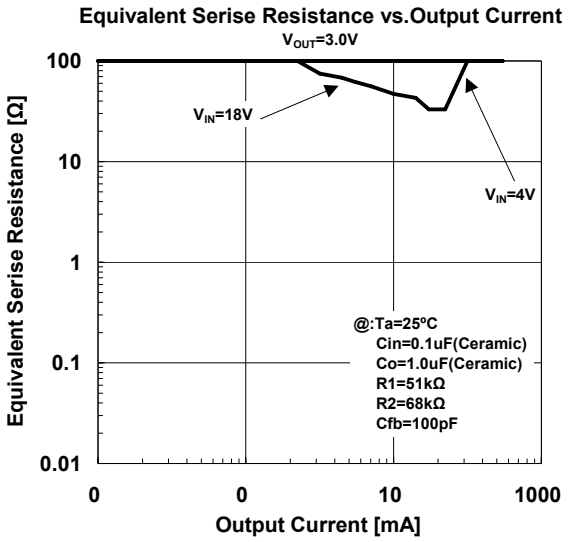

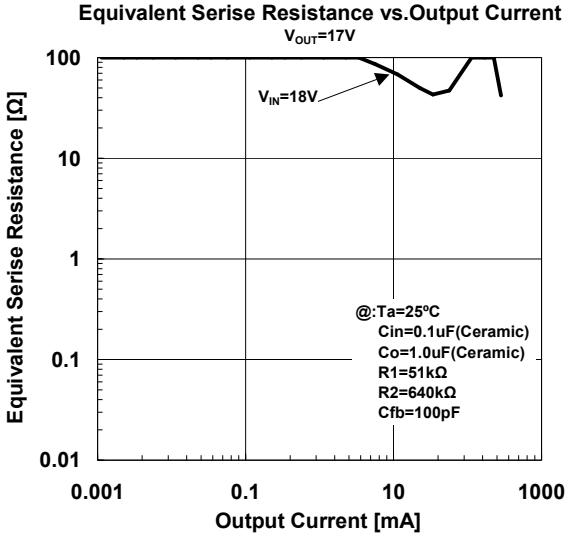

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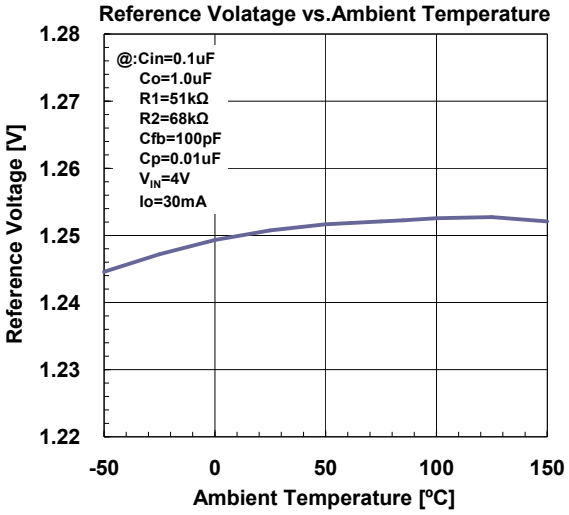
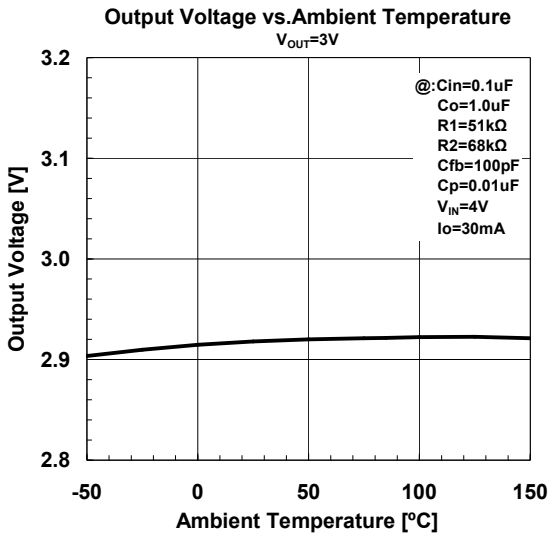
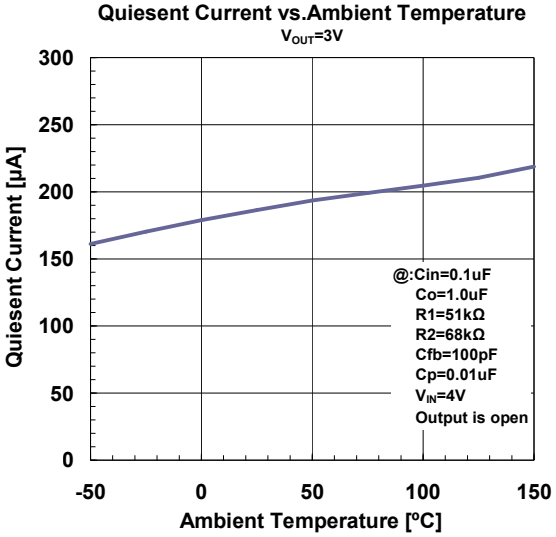
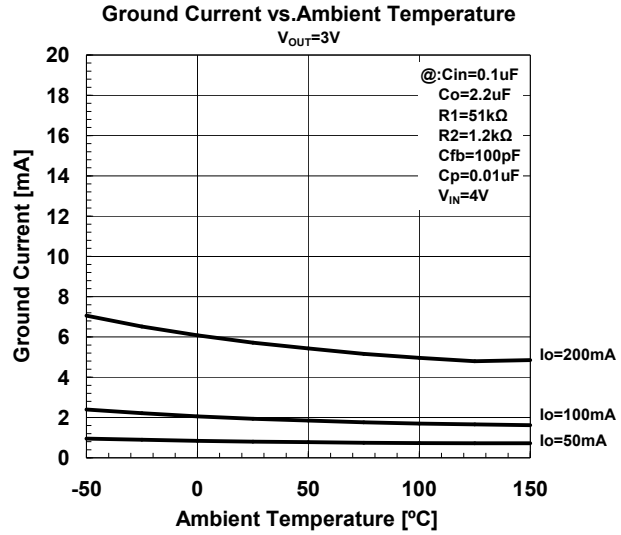
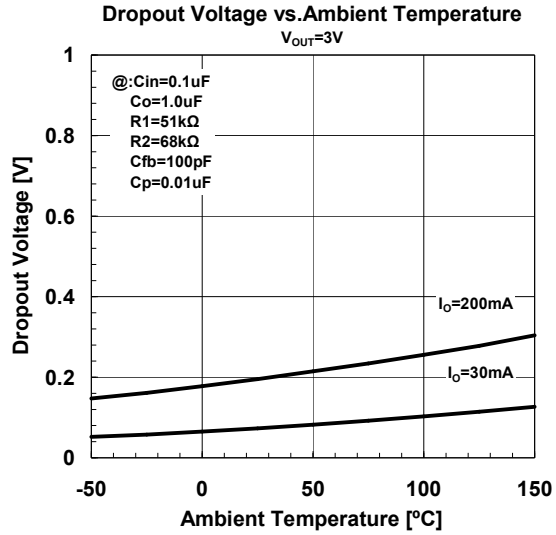




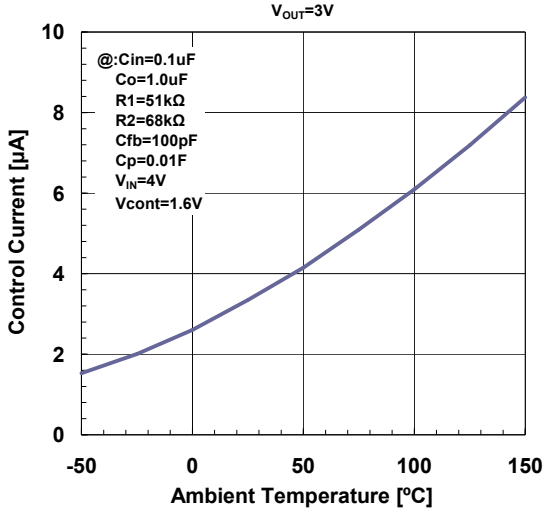




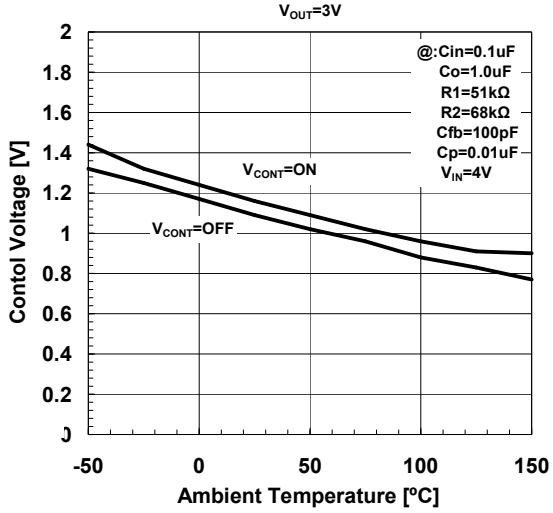


■ CHARACTERISTICS

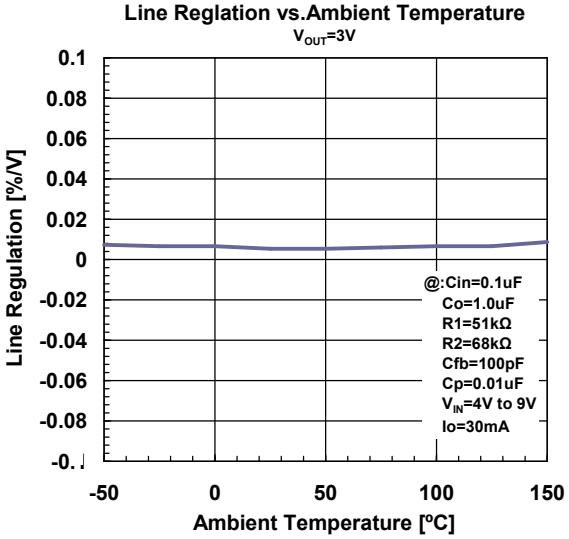
Control Current vs.Ambient Temperature



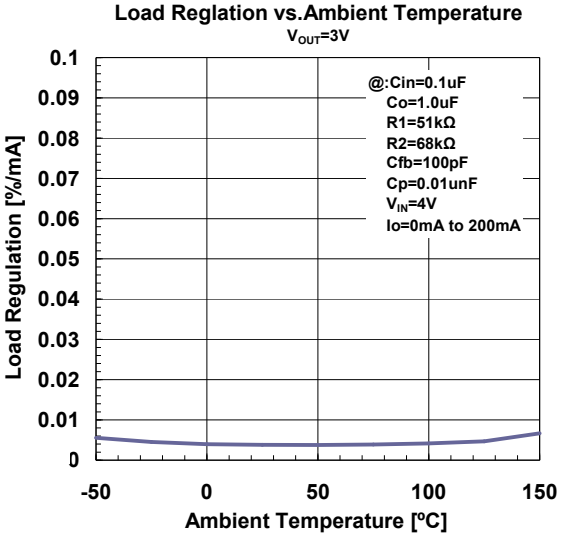
Control Voltage vs. Temperature



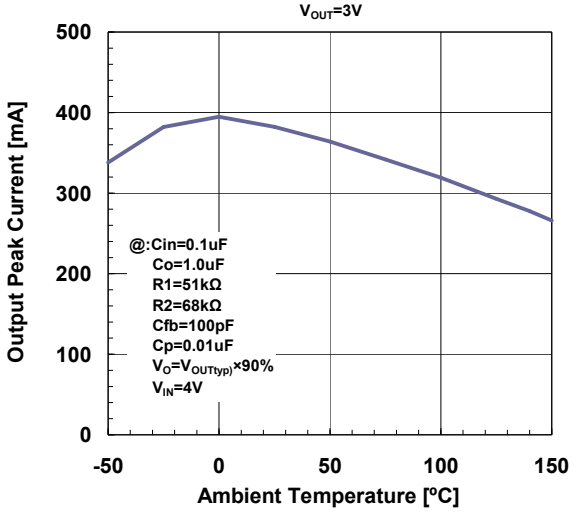
Line Reglation vs.Ambient Temperature



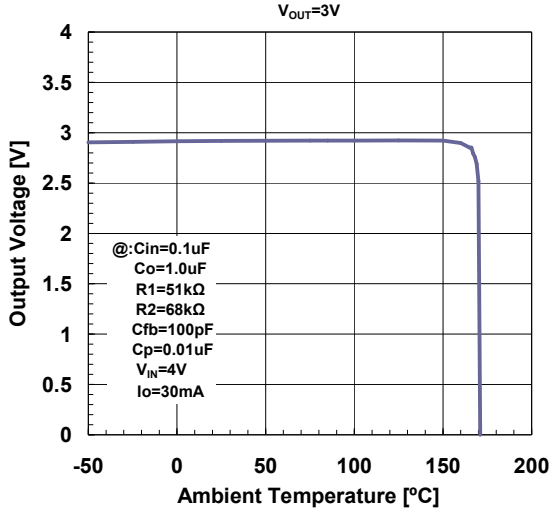
Load Reglation vs.Ambient Temperature



Output Peak Current vs.Ambient Temperature

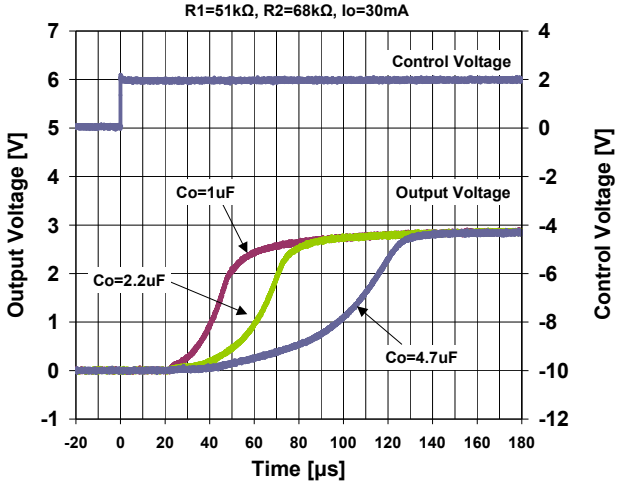


Thermal Shutdown Characteristic

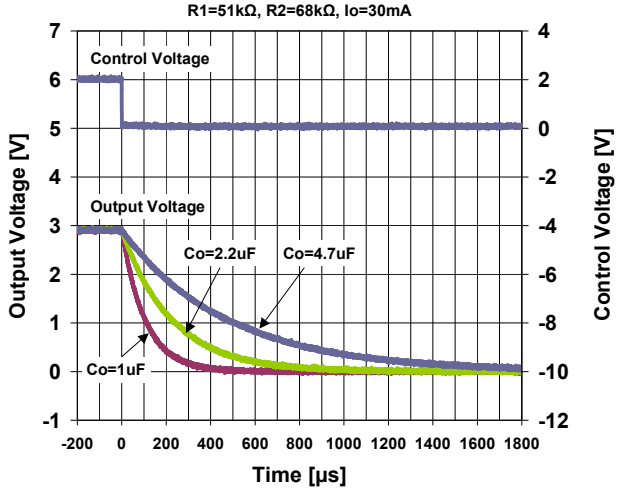


■ CHARACTERISTCS

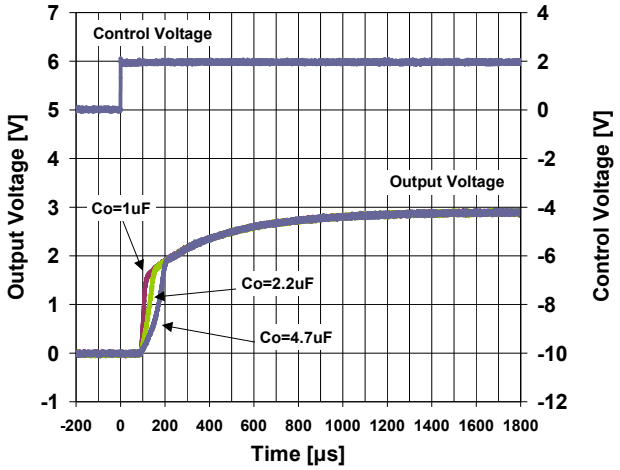
ON/OFF Transient Response (tr)
V_{OUT}=3V, V_{IN}=4V, Cp=0.001uF, Cfb=100pF,
R1=51kΩ, R2=68kΩ, Io=30mA



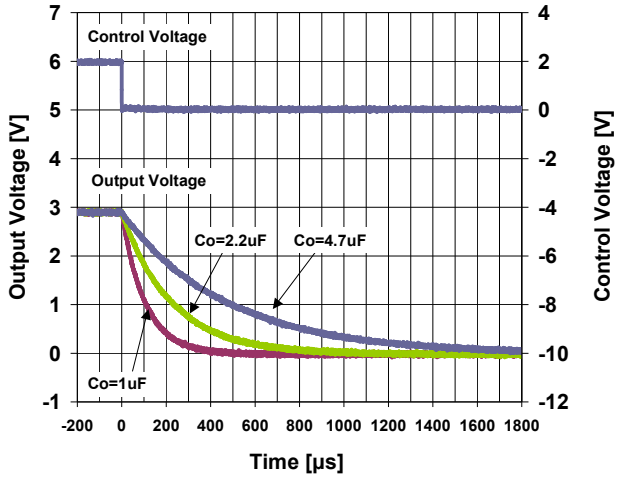
ON/OFF Transient Response (tf)
V_{OUT}=3V, V_{IN}=4V, Cp=0.001uF, Cfb=100pF,
R1=51kΩ, R2=68kΩ, Io=30mA



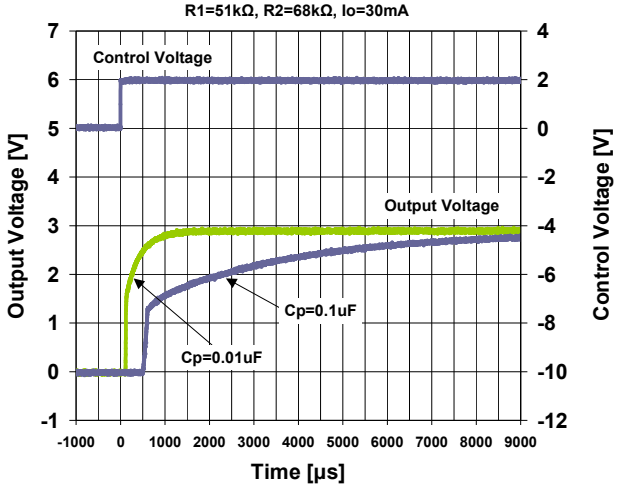
ON/OFF Transient (tr)
V_{OUT}=3V, V_{IN}=4V, Cp=0.01uF, Cfb=100pF,
R1=51kΩ, R2=68kΩ, Io=30mA



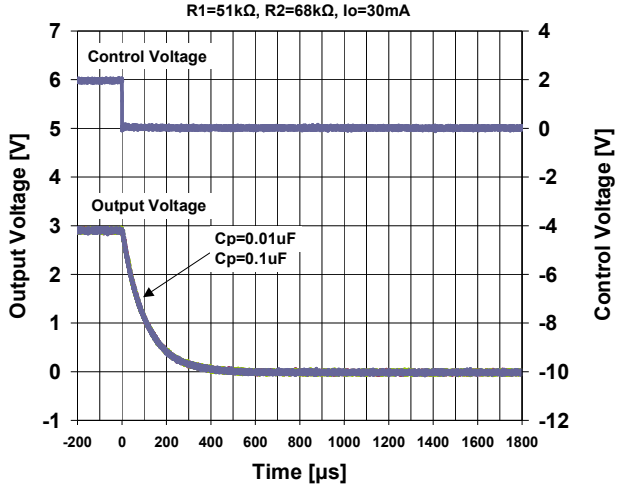
ON/OFF Transient Response (tf)
V_{OUT}=3V, V_{IN}=4V, Cp=0.01uF, Cfb=100pF,
R1=51kΩ, R2=68kΩ, Io=30mA



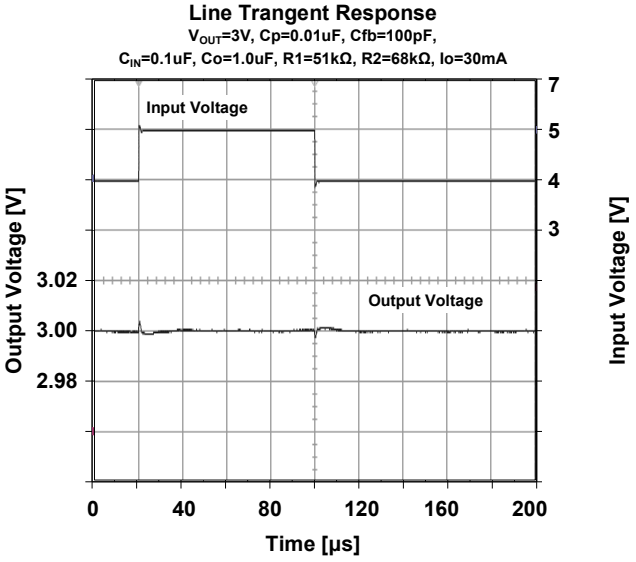
ON/OFF Transient Response (tr)
V_{OUT}=3V, V_{IN}=4V, Co=1uF, Cfb=100pF,
R1=51kΩ, R2=68kΩ, Io=30mA

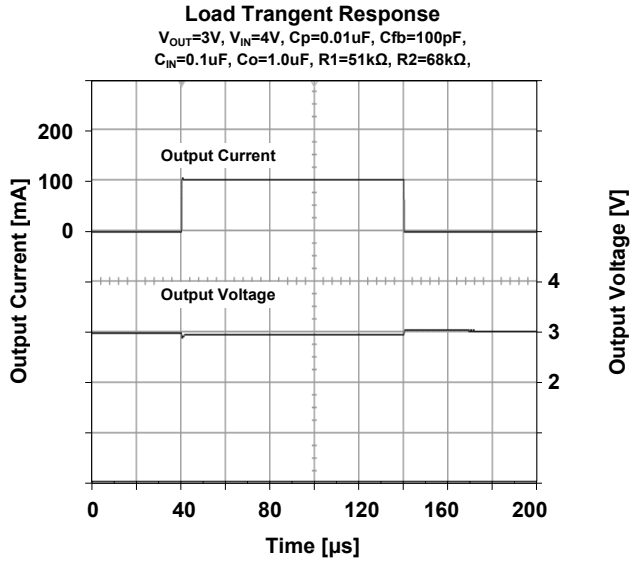


ON/OFF Transient Response (tr)
V_{OUT}=3V, V_{IN}=4V, Co=1uF, Cfb=100pF,
R1=51kΩ, R2=68kΩ, Io=30mA



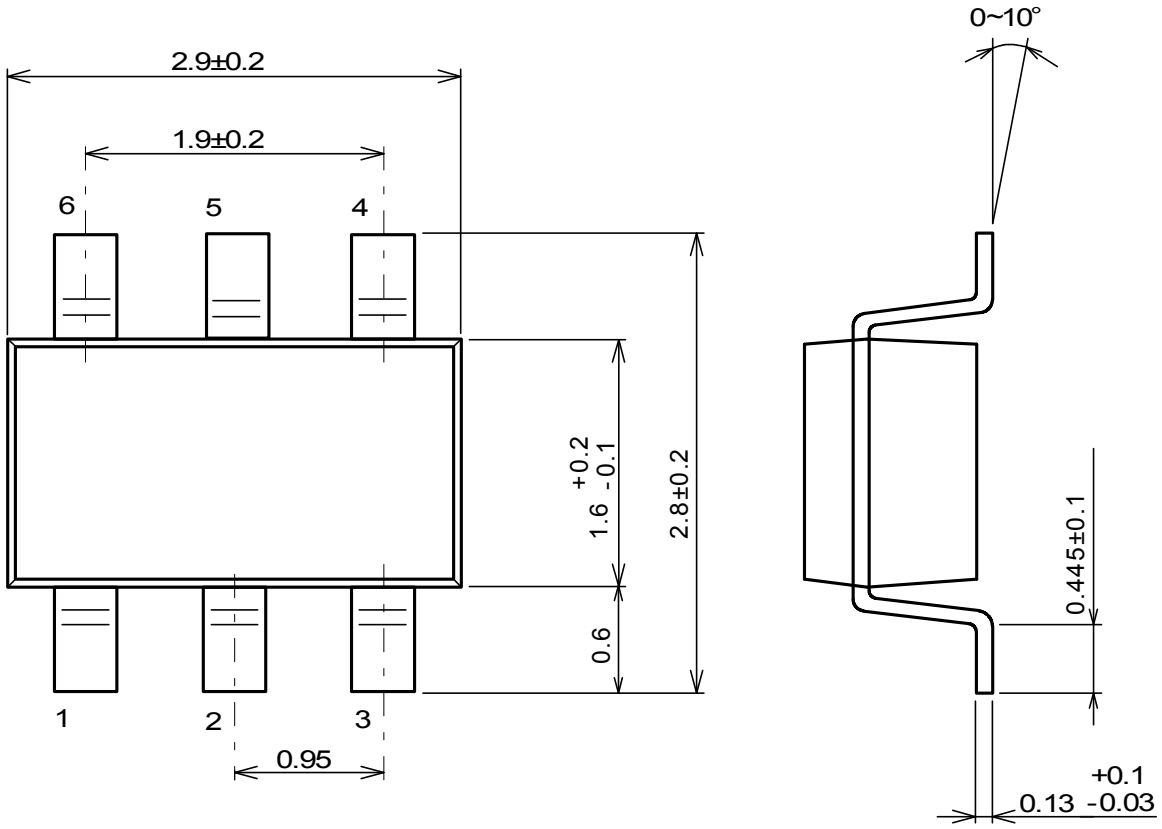
■ CHARACTERISTICS

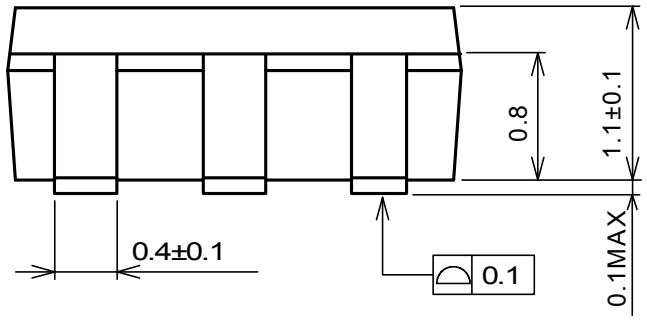




■ PACKAGE OUT LINE

SOT-23-6-1



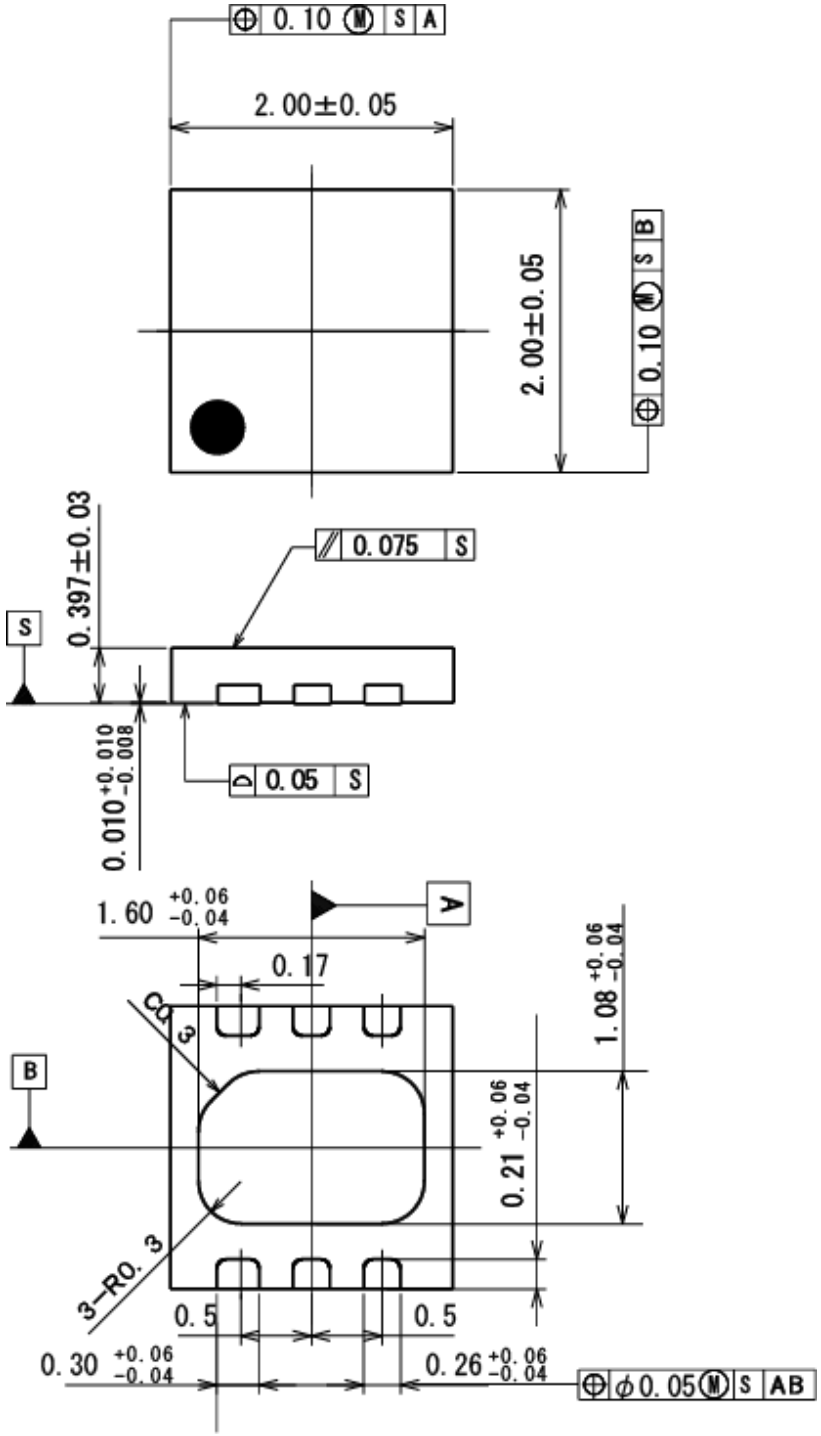


UNIT : mm

NOTES

All linear dimensions are in millimeters.

DFN6-H1 (ESON6-H1)



UNIT : mm

NOTES

All linear dimensions are in millimeters.

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