300mA LDO REGULATOR with the Reverse Current Protection

NO.EA-229-230529

OUTLINE

R1191x Series are a low supply current voltage regulator with high output voltage accuracy. The maximum operating voltage is 16V. These ICs can switch to the fast mode and the low power mode by the low power / fast mode changer pin (ECO pin) without changing the output voltage value.

Each of these ICs consists of a voltage reference unit, an error amplifier, a resistor-net for voltage setting, a short current limit circuit, a thermal shutdown circuit and a chip enable circuit.

Moreover, the R1191x Series has the reverse current protection function, which protects the reverse current flow into V_{DD} pin when the output pin voltage becomes higher than the V_{DD} pin voltage. Thus it is suitable for the back-up circuit.

Since the packages for these ICs are SOT-89-5, SOT-23-5 and DFN1616-6, therefore high density mounting of the ICs on boards is possible.

FEATURES

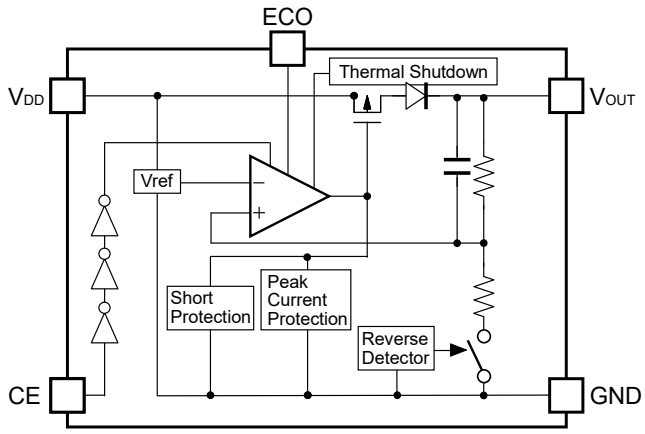
- Supply Current ..... Typ. 50μA (Fast Mode),
  Typ. 6.0μA (Low Power Mode)
- Standby Mode ..... Typ. 0.3μA
- Reverse Current ..... Max. 0.1μA
- Output Current ..... Min. 300mA
- Input Voltage Range ..... 3.5V to 16.0V
- Output Voltage Range ..... 2.0V to 15.0V (0.1V steps)
  (For other voltages, please refer to MARK INFORMATIONS.)
- Output Voltage Accuracy ..... ±1.5% (Fast Mode)
  ±2.5% (Low Power Mode)
- Temperature-Drift Coefficient of Output Voltage .. Typ. ±80ppm/°C
- Dropout Voltage ..... Typ. 0.55V (Fast Mode, I_{OUT}=300mA ,V_{OUT}=5.0V)
  Typ. 0.70V (Low Power Mode, I_{OUT}=300mA,V_{OUT}=5.0V)
- Ripple Rejection ..... Typ. 60dB (f=1kHz,V_{OUT}=5.0V, Fast Mode)
- Line Regulation ..... Typ. 0.02%/V (Fast Mode)
- Packages DFN1616-6, SOT-23-5, SOT-89-5
- Built-in fold-back protection circuit ..... Typ. 50mA (Current at short mode)
- Built-in Thermal Shutdown Circuit ..... Shutdown Temperature at 150°C
- Ceramic capacitors are recommended to be used with this IC ··· C_{IN}=2.2μF or more, C_{OUT}=4.7μF or more

APPLICATIONS

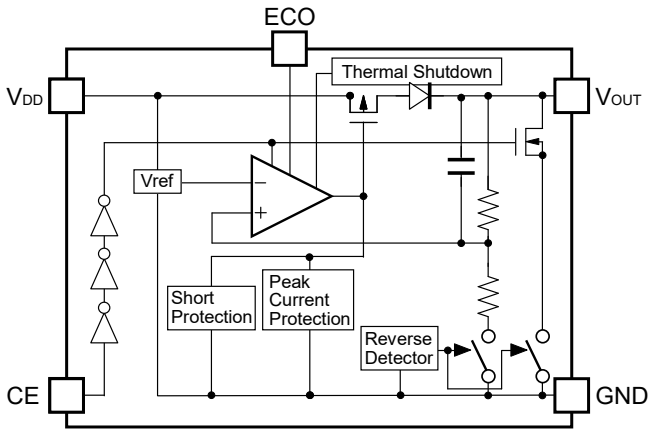
- Power source for digital home appliances
- Power source for audio visual equipment

BLOCK DIAGRAM

R1191xxxxB



R1191xxxxD



SELECTION GUIDE

The output voltage, auto-discharge function, and package, for the ICs can be selected at the user's request.

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1191Lxxx∗-TR	DFN1616-6	5,000 pcs	Yes	Yes
R1191Nxxx∗-TR-FE	SOT-23-5	3,000 pcs	Yes	Yes
R1191Hxxx∗-T1-FE	SOT-89-5	1,000 pcs	Yes	Yes

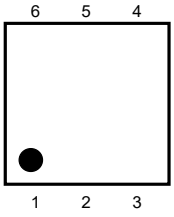
xxx : The output voltage can be designated in the range from 2.0V(020) to 15.0V(150) in 0.1V steps.
(For other voltages, please refer to MARK INFORMATIONS.)

∗ : The auto discharge function at off state are options as follows.
(B) without auto discharge function at off state.
(D) with auto discharge function at off state.

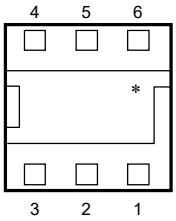
PIN CONFIGURATIONS

● **DFN1616-6*1**

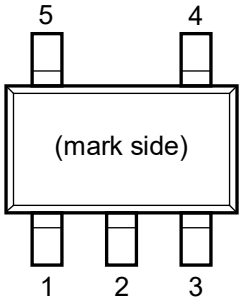
Top View



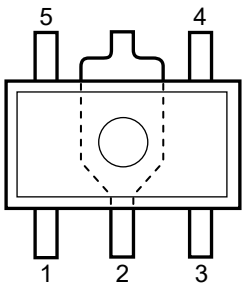
Bottom View



● **SOT-23-5**



● **SOT-89-5**



PIN DISCRIPTIONS

● **DFN1616-6*1**

Pin No	Symbol	Pin Description
1	ECO	Low Power / Fast Mode Changer Pin ("H": Fast Mode)
2	NC	No Connection
3	V_{DD}	Input Pin
4	V_{OUT}	Output pin
5	GND	Ground Pin
6	CE	Chip Enable Pin ("H" Active)

∗1) Tab is GND level. (They are connected to the reverse side of this IC.)
The tab is better to be connected to the GND, but leaving it open is also acceptable.

● **SOT-23-5**

Pin No	Symbol	Pin Description
1	ECO	Low Power / Fast Mode Changer Pin ("H": Fast Mode)
2	GND	Ground Pin
3	CE	Chip Enable Pin ("H" Active)
4	V_{OUT}	Output pin
5	V_{DD}	Input Pin

● **SOT-89-5**

Pin No	Symbol	Pin Description
1	V_{OUT}	Output pin
2	GND	Ground Pin
3	CE	Chip Enable Pin ("H" Active)
4	ECO	Low Power / Fast Mode Changer Pin ("H": Fast Mode)
5	V_{DD}	Input Pin

ABSOLUTE MAXIMUM RATINGS

Symbol	Item	Rating	Unit
V_{IN}	Input Voltage	−0.3 to 18.0	V
V_{CE}	Input Voltage (CE Pin)	−0.3 to 18.0	V
V_{ECO}	Input Voltage (ECO Pin)	−0.3 to V_{IN} + 0.3 ≤ 18.0	V
V_{OUT}	Output Voltage	−0.3 to 18.0	V
I_{OUT}	Output Current	400	mA
P_D	Power Dissipation	Refer to the Power Dissipation in the supplementary item	
Ta	Operating Temperature Range	−40 to +85	°C
Tstg	Storage Temperature Range	−55 to +125	°C

ABSOLUTE MAXIMUM RATINGS

Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause the permanent damages and may degrade the life time and safety for both device and system using the device in the field.
The functional operation at or over these absolute maximum ratings is not assured.

RECOMMENDED OPERATING CONDITIONS (ELECTRICAL CHARACTERISTICS)

All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions.

ELECTRICAL CHARACTERISTICS

V_{IN}=V_{CE}=Set V_{OUT}+3.0V (Max.16V), C_{IN}=2.2µF, C_{OUT}=4.7µF I_{OUT}=1mA, unless otherwise noted.
The values in [ ] are applicable under the condition of −40°C ≤ Topt ≤ 85°C.

R1191xxxxB/D

Topt=25°C

Symbol	Item		Conditions		Min.	Typ.	Max.	Unit
V_{OUT}	Output Voltage	Fast Mode	V_{ECO}=V_{IN}	Topt=25°C	×0.985		×1.015	V
				−40°C ≤ Topt ≤ 85°C	[×0.970]		[×1.030]	
		Low Power Mode	V_{ECO}=0V	Topt=25°C	×0.975		×1.025	
				−40°C ≤ Topt ≤ 85°C	[×0.960]		[×1.040]	
ΔV_{OUT}	Output Voltage Deviation between Fast Mode and Low Power Mode				[−1.5]	0	[1.5]	%
I_{OUT}	Output Current				[300]			mA
ΔV_{OUT}/ ΔI_{OUT}	Load Regulation	Fast Mode	V_{ECO}=V_{IN}, 1mA ≤ I_{OUT} ≤ 300mA			50	[120]	mV
		Low Power Mode	V_{ECO}=GND, 1mA ≤ I_{OUT} ≤ 300mA			60	[130]	
V_{DIF}	Dropout Voltage		Refer to the following table					
I_{SS1}	Supply Current (Fast Mode)		V_{ECO}=V_{IN}, I_{OUT}=0mA			50	[100]	µA
I_{SS2}	Supply Current (Low Power Mode)		V_{ECO}=GND, I_{OUT}=0mA			6	[15]	µA
$I_{standby}$	Supply Current (Standby)		V_{IN}=16V, V_{CE}=0V (If V_{OUT} < 3.0V, V_{IN}=14V)			0.3	1.0	µA
ΔV_{OUT}/ ΔV_{IN}	Line Regulation		Set V_{OUT}+0.5V ≤ V_{IN} ≤ 16V (If Set V_{OUT} < 3.0V, 3.5V ≤ V_{IN} ≤ 14V)			0.02	[0.10]	%/V
RR	Ripple Rejection		f=1kHz, I_{OUT}=30mA Ripple 0.2V_{p-p}, V_{IN}=V_{ECO}= Set V_{OUT}+1V	2.0V≤V_{OUT}<5.0V		70		dB
				5.0V≤V_{OUT}<12V		60		
				12V ≤ V_{OUT}		60		
V_{IN}	Input Voltage		2.0V ≤ V_{OUT} < 3.0V		[3.5]		[14.0]	V
			3.0V ≤ V_{OUT}				[16.0]	
ΔV_{OUT}/ $\Delta Topt$	Output Voltage Temperature Coefficient		−40°C ≤ Topt ≤ 85°C			±80		ppm /°C
I_{SC}	Short Current Limit		V_{OUT}=0V			50		mA
V_{CEH}	CE, ECO Input Voltage "H"				[1.6]		V_{IN}	V
V_{CEL}	CE, ECO Input Voltage "L"				0		[0.6]	V
T_{TSD}	Thermal Shutdown Temperature		Junction Temperature			150		°C
T_{TSR}	Thermal Shutdown Released Temperature		Junction Temperature			130		°C
R_{LOW}	Low Output Nch Tr. ON Resistance (of D Version)		V_{IN}=5V, V_{CE}=0V, V_{OUT}=0.3V			150		Ω
I_{REV}	Reverse Current		V_{OUT}> 0.6V, 0V ≤ V_{IN} ≤ 16V			0	[0.1]	µA

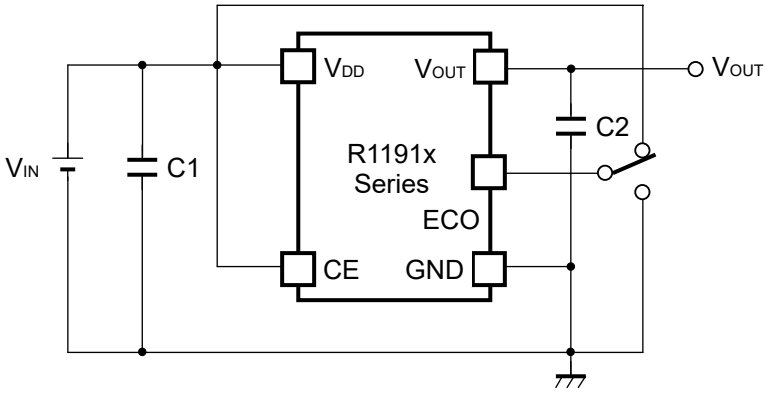
∗) The values in [ ] have been tested and guaranteed by Design Engineering.
All test categories were tested on the products under the pulse load condition (Tj≈Topt =25°C) except the following test categories: ripple rejection, output voltage temperature coefficient, and thermal shutdown.

ELECTRICAL CHARACTERISTICS by OUTPUT VOLTAGE

Topt=25°C

Output Voltage V_{OUT} (V)	Dropout Voltage V_{DIF} (V)				
	Condition	ECO="H"		ECO="L"	
		Typ.	Max.	Typ.	Max.
2.0 ≤ V_{OUT} < 2.5	I_{OUT}=300mA	1.20	1.80	2.5	3.0
2.5 ≤ V_{OUT} < 3.3		1.00	1.50	2.0	2.5
3.3 ≤ V_{OUT} < 5.0		0.75	1.00	1.5	1.8
5.0 ≤ V_{OUT} < 12.0		0.55	0.75	0.7	1.0
12.0 ≤ V_{OUT}		0.40	0.60	0.4	0.6

TYPICAL APPLICATION



(External Components)

Ex. C1: Ceramic Capacitor 2.2μF Murata GRM32RB11E225KC01B
C2: Ceramic Capacitor 4.7μF Murata GCM31CR71E475KA40

TECHNICAL NOTES

When using these ICs, consider the following points:

- **Phase Compensation**

In these ICs, phase compensation is made for securing stable operation even if the load current is varied. For this purpose, use a capacitor C2 with good frequency characteristics and ESR (Equivalent Series Resistance).

(Note: If additional ceramic capacitors are connected with parallel to the output pin with an output capacitor for phase compensation, the operation might be unstable. Because of this, test these ICs with as same external components as ones to be used on the PCB.)

- **PCB Layout**

Make V_{DD} and GND lines sufficient. If their impedance is high, noise pickup or unstable operation may result. Connect a capacitor C1 with a capacitance value as much as 2.2μF or more between V_{DD} and GND pin, and as close as possible to the pins.

Set external components, especially the capacitor C2, as close as possible to the ICs, and make wiring as short as possible.

- **Thermal Shutdown Function**

There is the built-in thermal-shutdown function in R1191x series. It discontinues operation of the IC when the junction temperature becomes over 150°C (Typ.) and IC re-operates when the junction temperature under 130°C (Typ.). If the temperature increasing keeps the IC repeats ON and OFF operating. The output becomes the pulse condition.

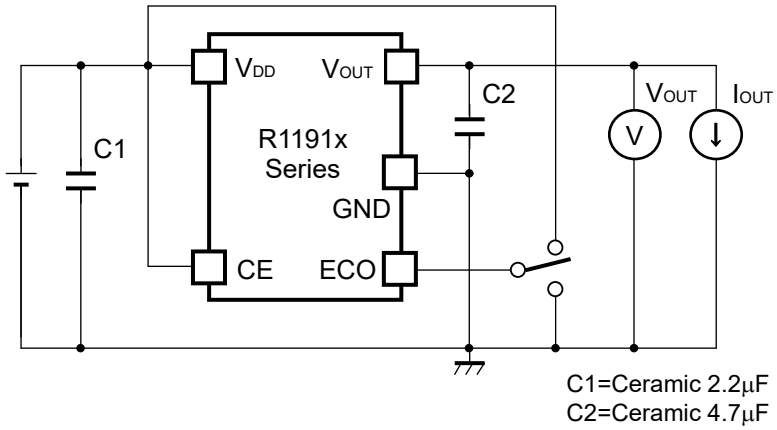
- **Chip Enable (CE) Circuit and High-speed/ Low Supply Current Switching (ECO) Circuit**

To maintain the stability of the output voltage, please do not use the intermediate electric potentials (the voltage values between V_{CEH} and V_{CEL}) for the CE pin and the ECO pin. The use of the intermediate electric potentials increases the supply current and causes the unstable output voltage.

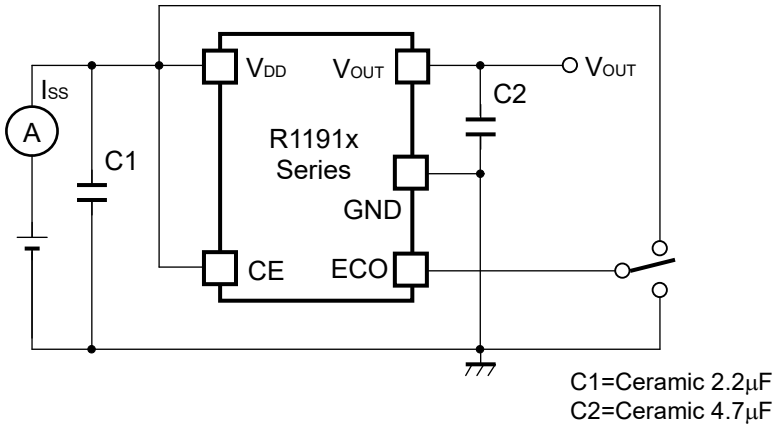
- **Auto-discharge Function**

R1191xxxxD has adopted Auto-discharge function, which decreases the output voltage quickly to 0V by turning on the transistor between V_{OUT} pin and GND pin when switching “Active” to “Standby” and releases the electrical charges accumulated in the external capacitor.

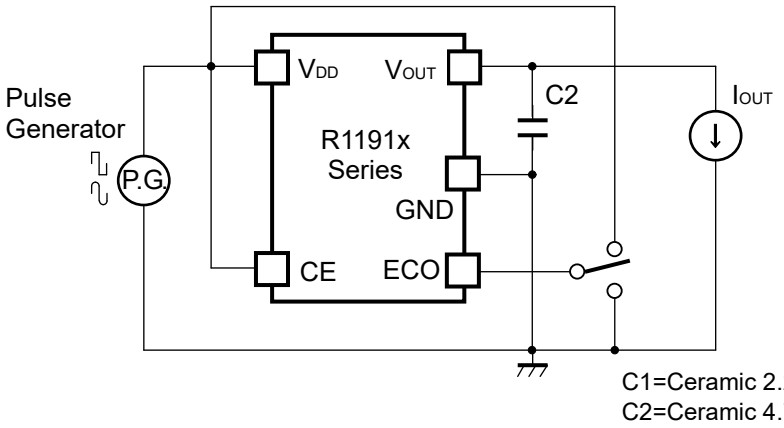
TEST CIRCUITS



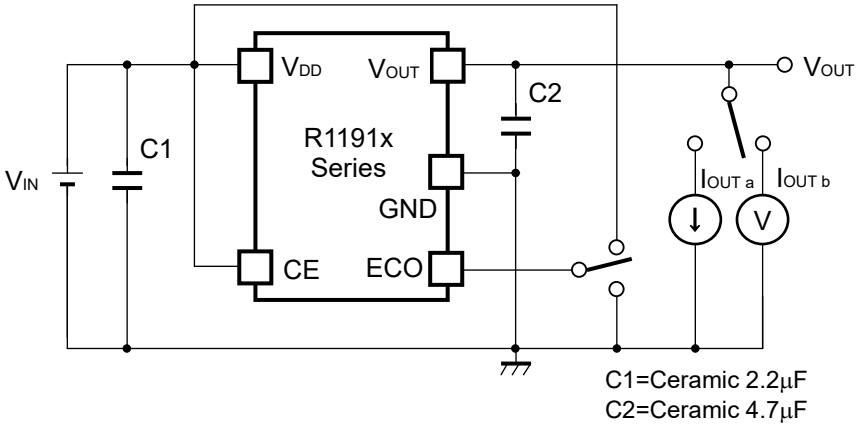
Basic Test Circuit



Test Circuit for Supply Current



Test Circuit for Ripple Rejection

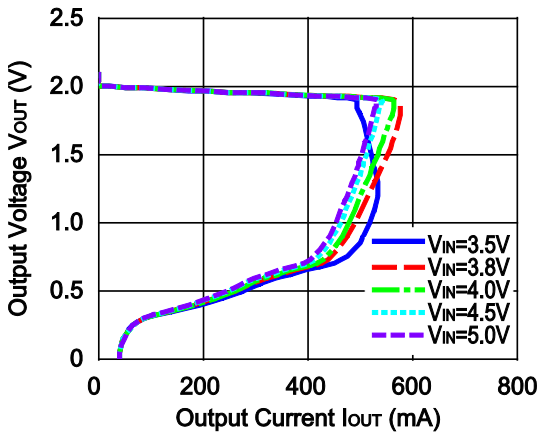


Test Circuit for Load Transient Response

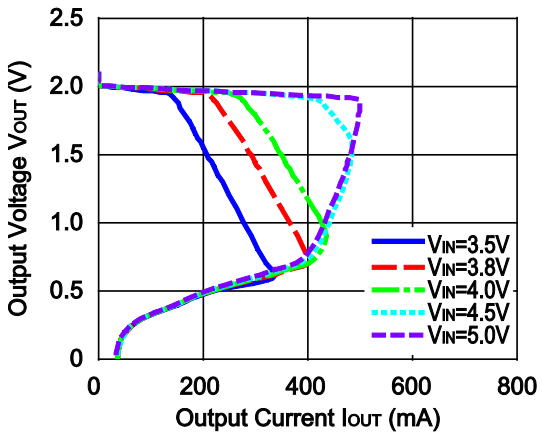
TYPICAL CHARACTERISTICS

1) Output Voltage vs. Output Current (C1=2.2µF, C2=4.7µF, Topt=25°C)

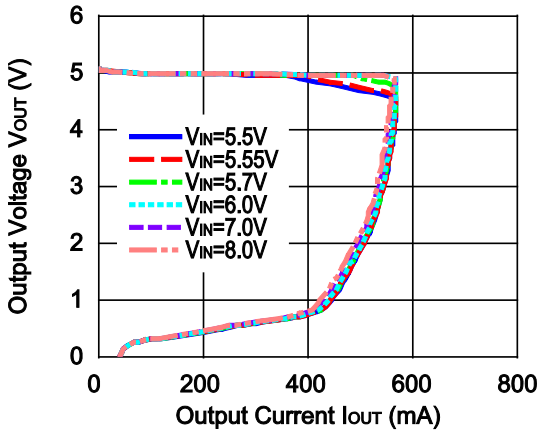
R1191x020x ECO=H



R1191x020x ECO=L



R1191x050x ECO=H



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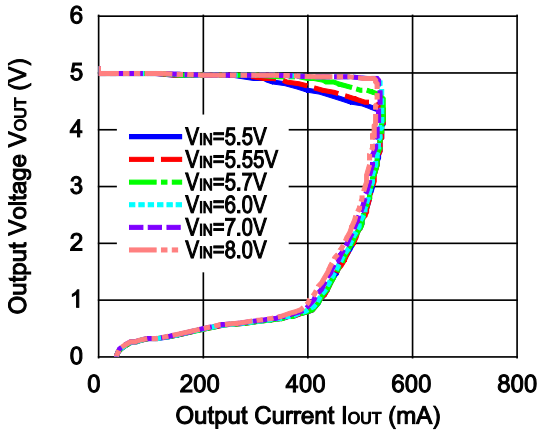

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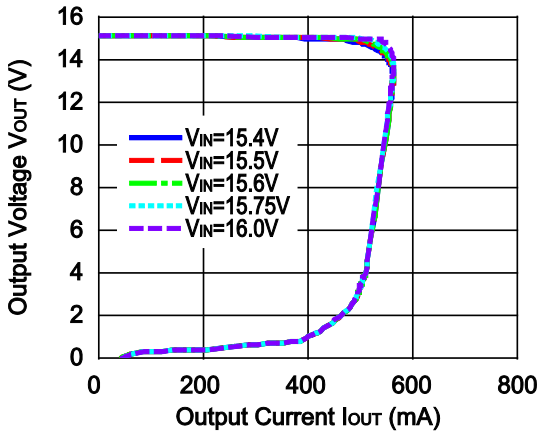

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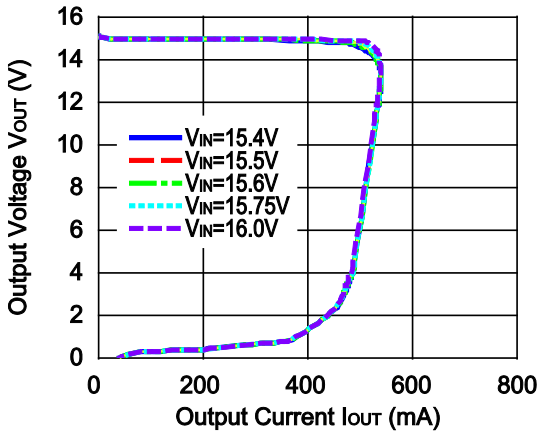
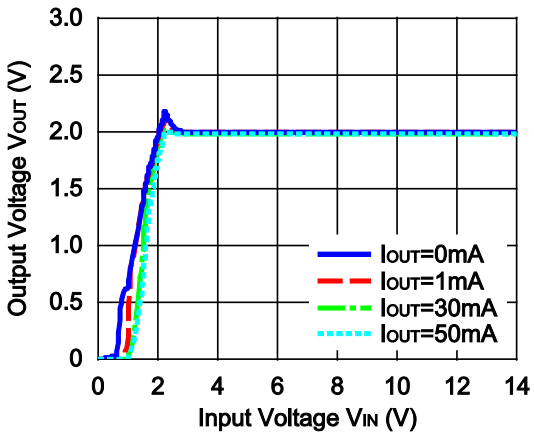
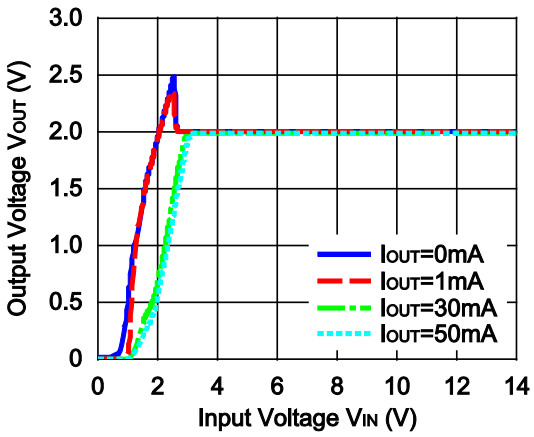


2) Output Voltage vs. Input Voltage (C1=2.2μF, C2=4.7μF, Topt=25°C)

R1191x020x ECO=H



R1191x020x ECO=L



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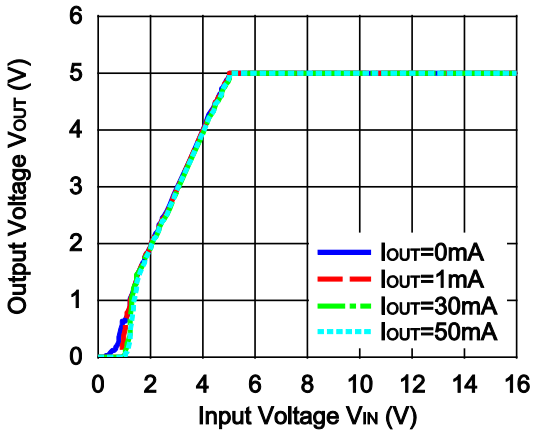

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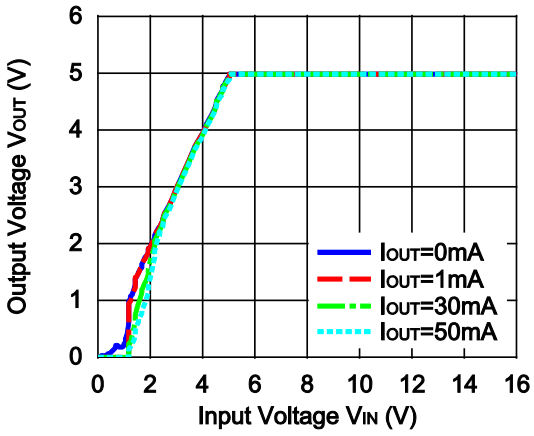

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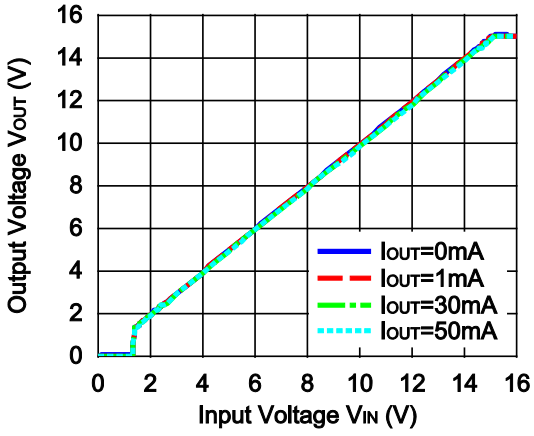

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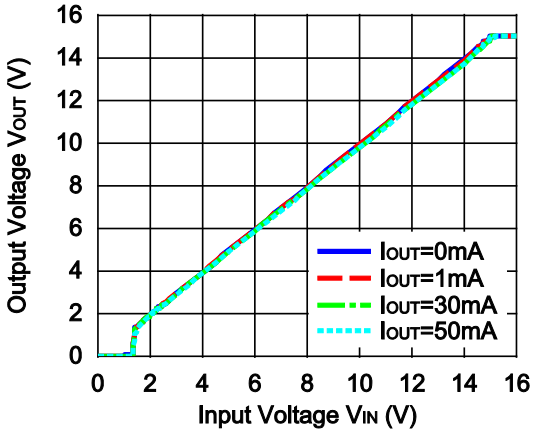
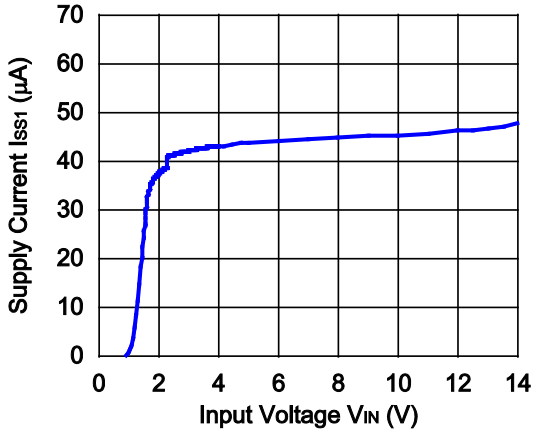
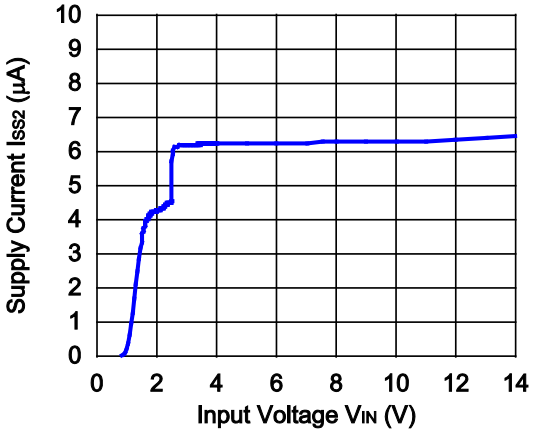


3) Supply Current vs. Input Voltage (C1=2.2μF, C2=4.7μF, Topt=25°C)

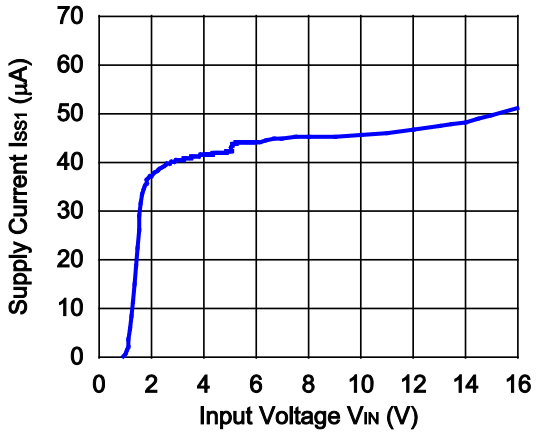
R1191x020x ECO=H



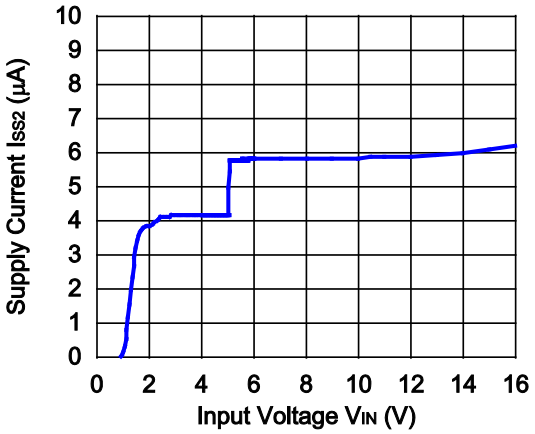
R1191x020x ECO=L



R1191x050x ECO=H



R1191x050x ECO=L



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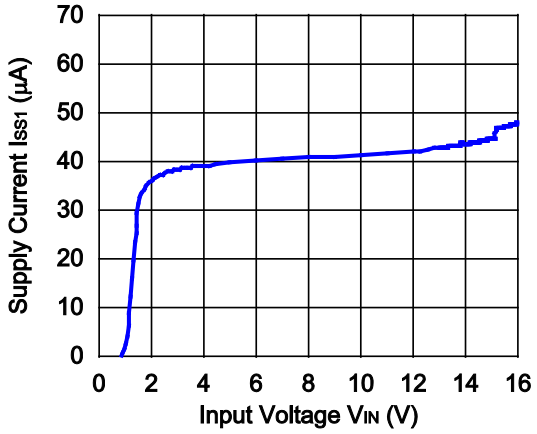
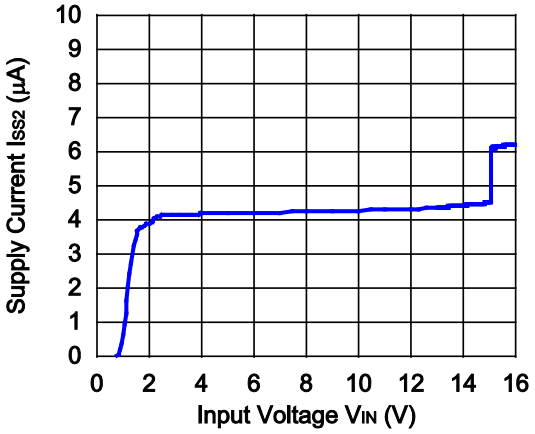
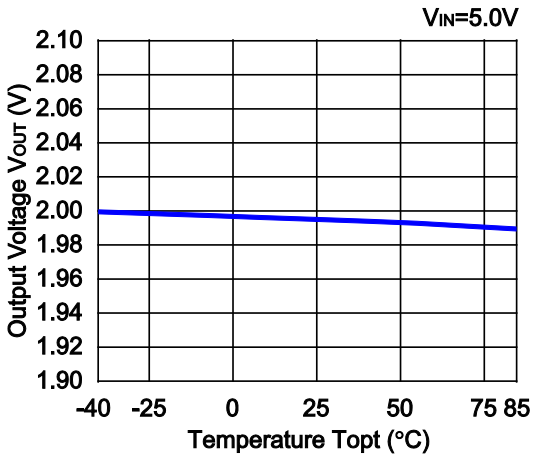


R1191x150x ECO=L

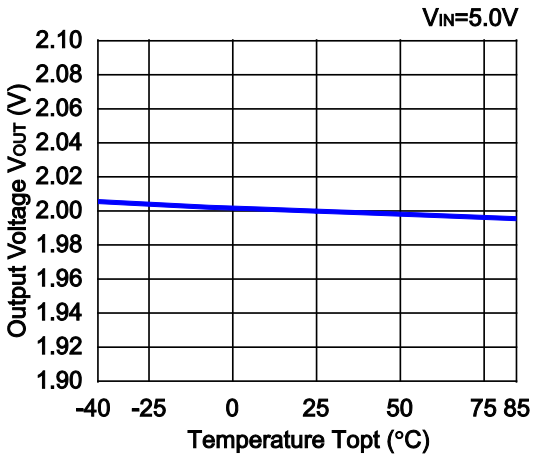


4) Output Voltage vs. Temperature (C1=2.2μF, C2=4.7μF, I_{OUT}=1mA)

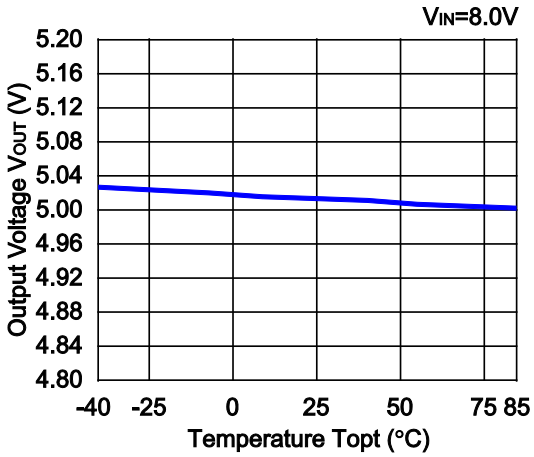
R1191x020x ECO=H



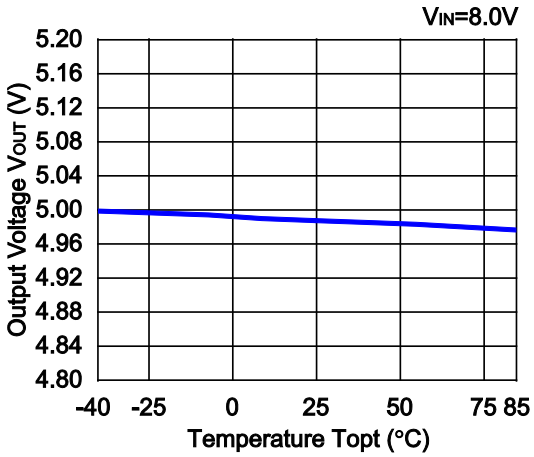
R1191x020x ECO=L



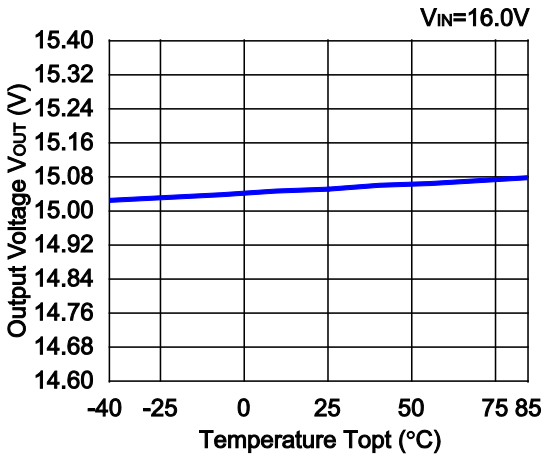
R1191x050x ECO=H



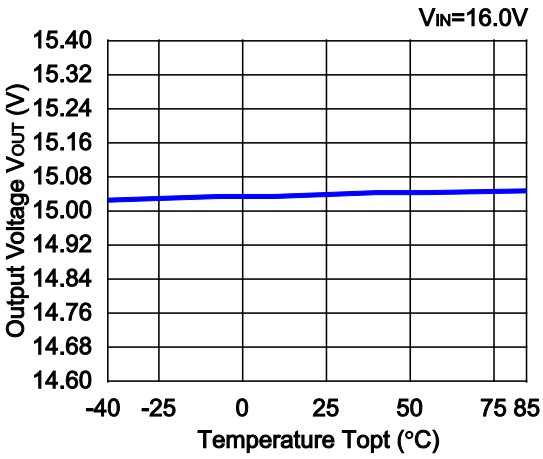
R1191x050x ECO=L



R1191x150x ECO=H

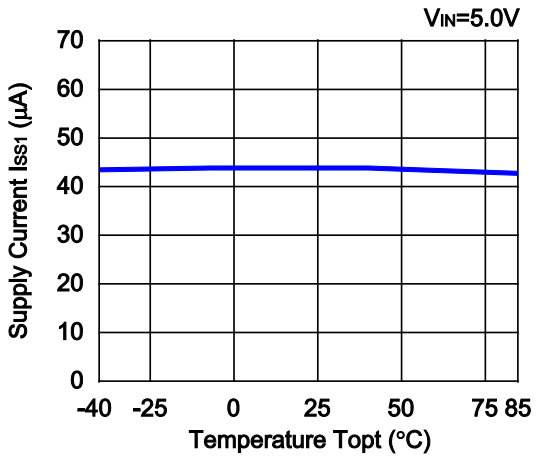


R1191x150x ECO=L

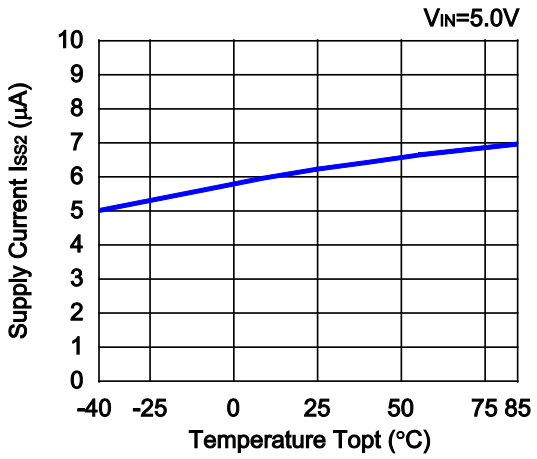


5) Supply Current vs. Temperature (C1=2.2μF, C2=4.7μF)

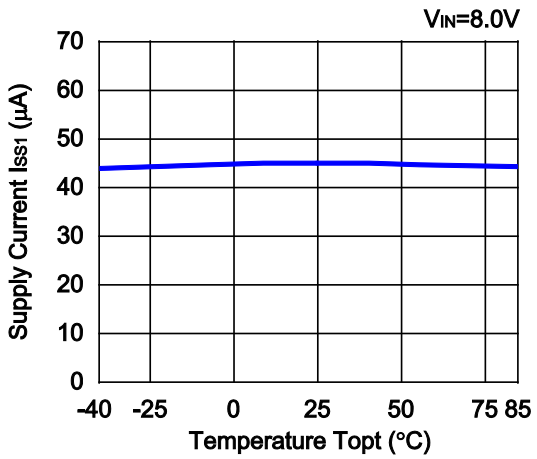
R1191x020x ECO=H



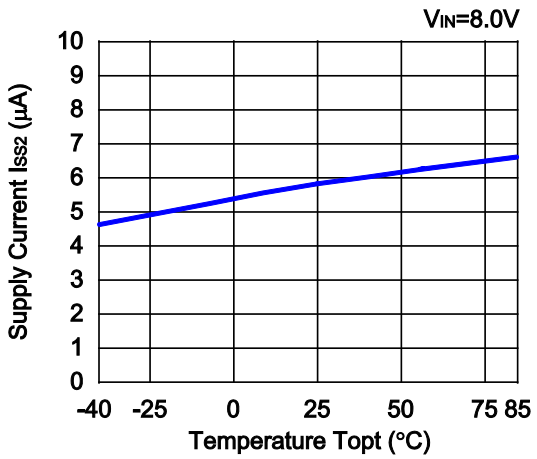
R1191x020x ECO=L



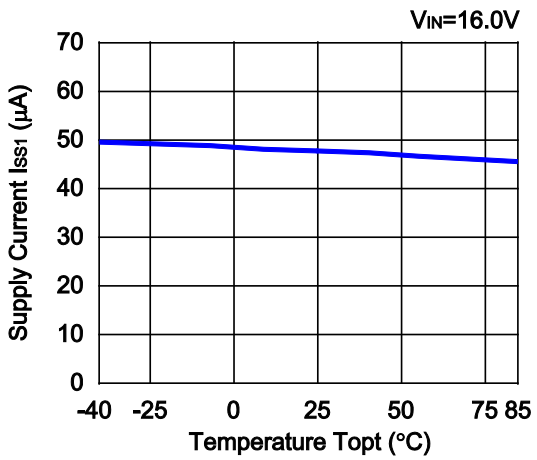
R1191x050x ECO=H



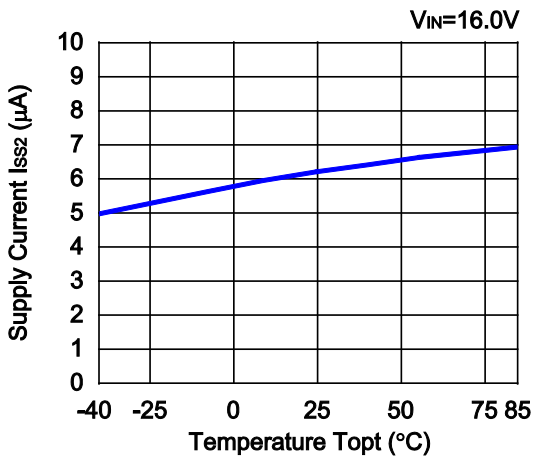
R1191x050x ECO=L



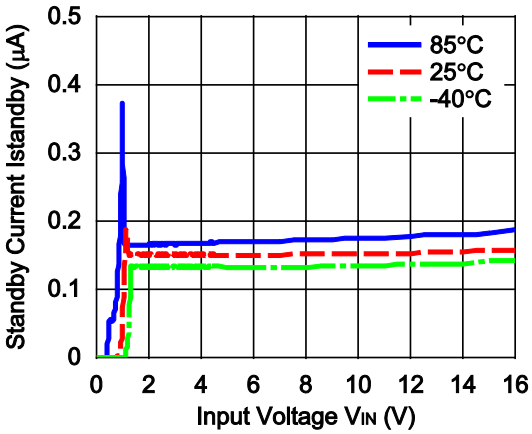
R1191x150x ECO=H



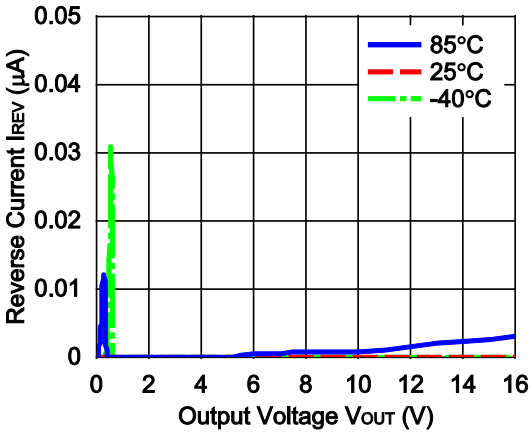
R1191x150x ECO=L



6) Standby Current vs. Input Voltage (C1=2.2µF, C2=4.7µF)

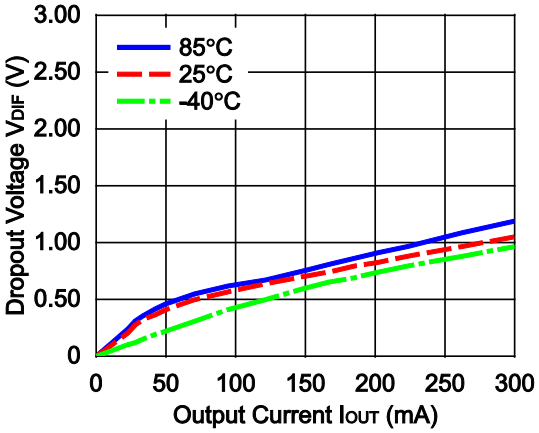


7) Reverse Current vs. Output Voltage (C1=2.2µF, C2=4.7µF, V_{IN}=0V)

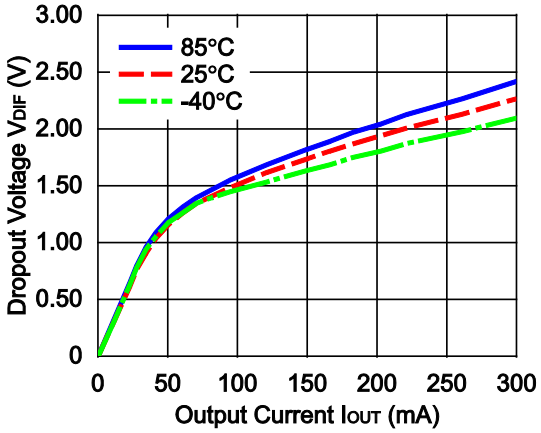


8) Dropout Voltage vs. Output Current (C1=2.2µF, C2=4.7µF)

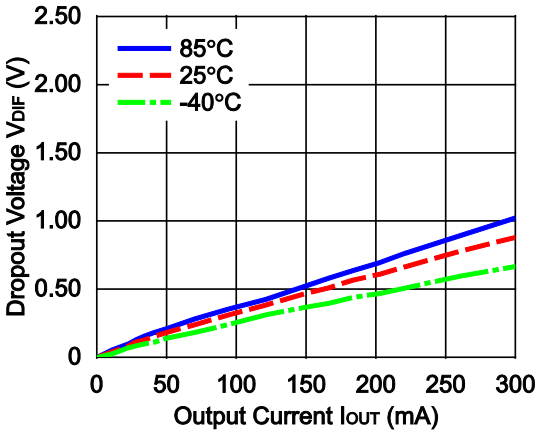
R1191x020x ECO=H



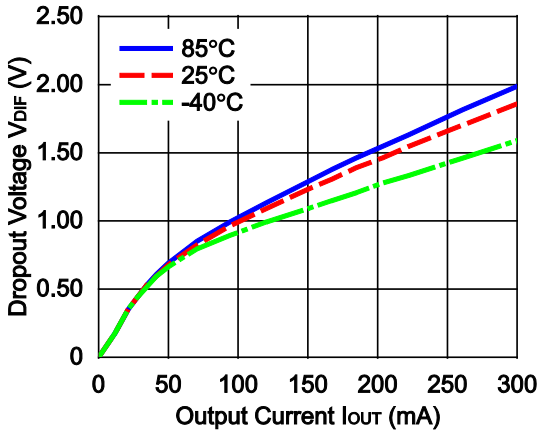
R1191x020x ECO=L



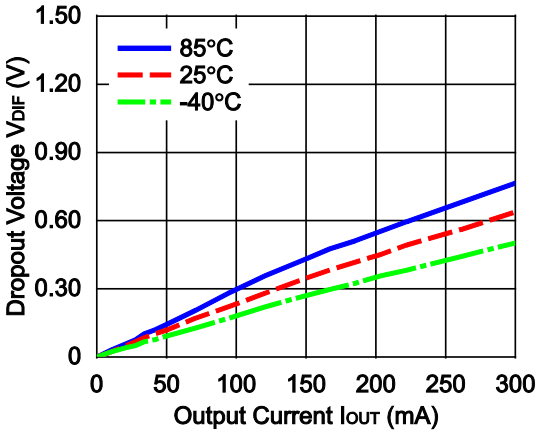
R1191x025x ECO=H



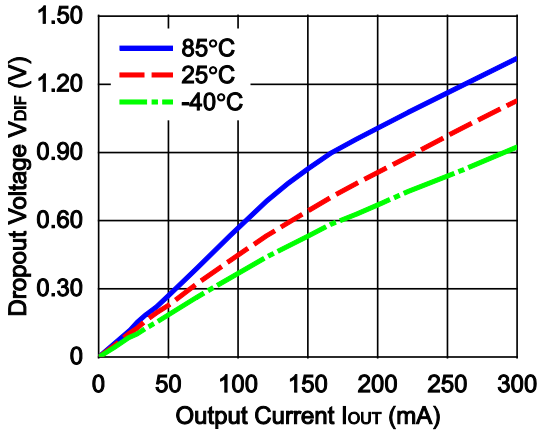
R1191x025x ECO=L



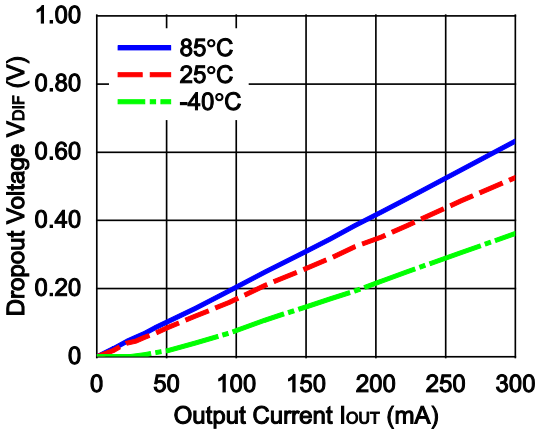
R1191x033x ECO=H



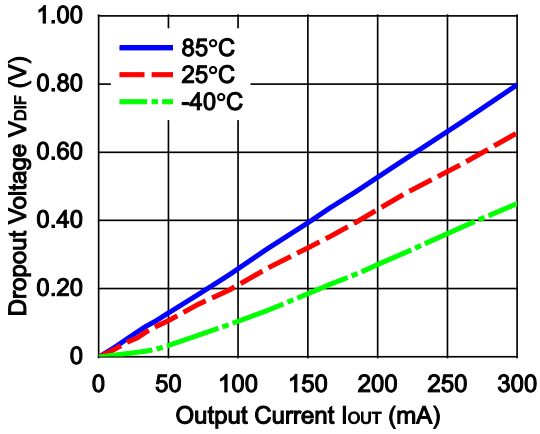
R1191x033x ECO=L



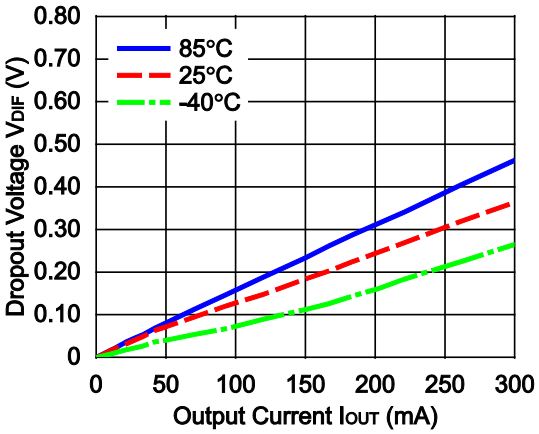
R1191x050x ECO=H



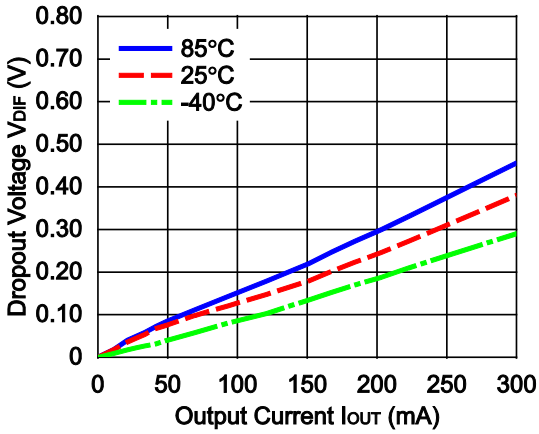
R1191x050x ECO=L



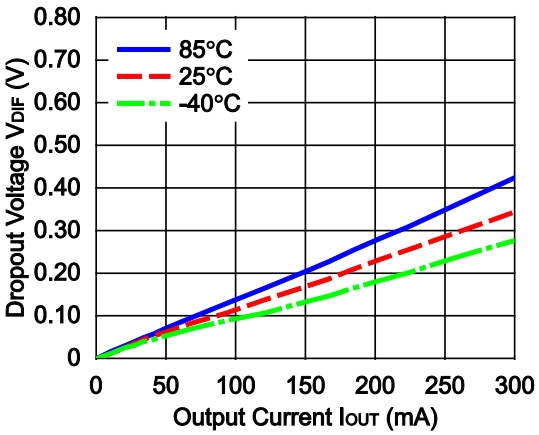
R1191x120x ECO=H



R1191x120x ECO=L



R1191x150x ECO=H



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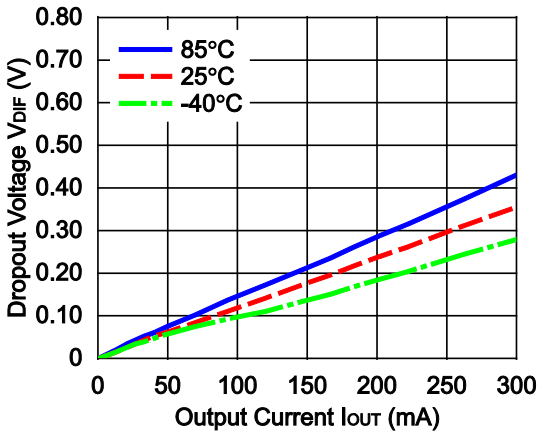
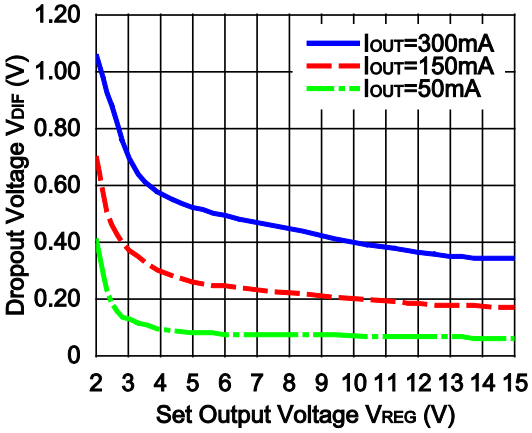
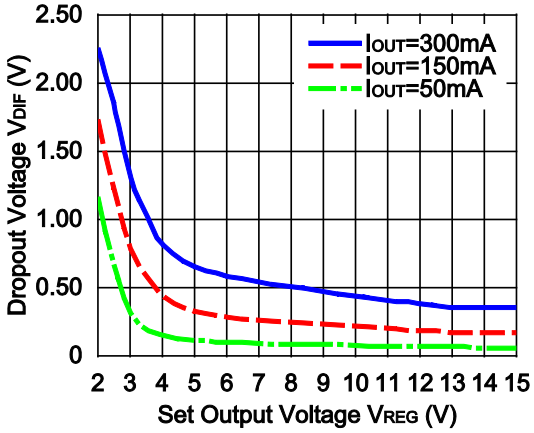


9) Dropout Voltage vs Set Output Voltage (C1=2.2µF, C2=4.7µF,Topt=25°C)

R1191x ECO=H

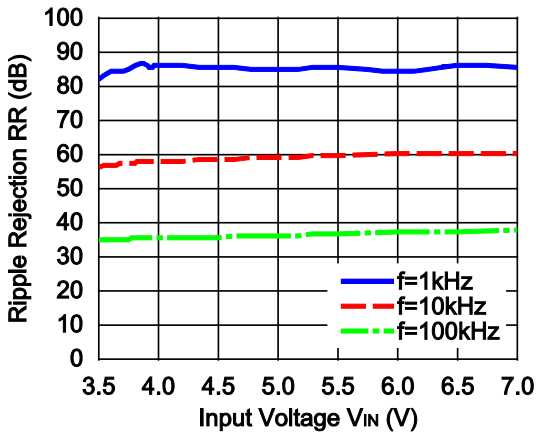


R1191x ECO=L

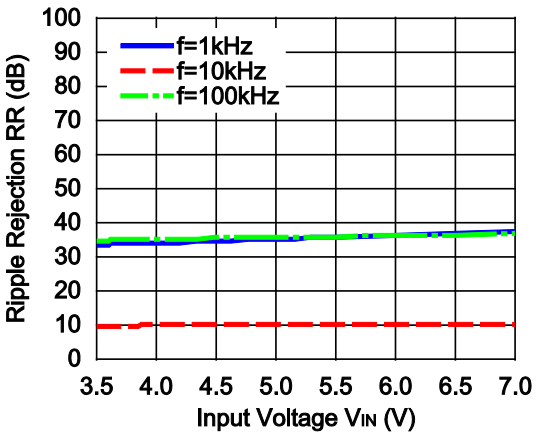


10) Ripple Rejection vs. Input Voltage (C1=none, C2=4.7µF, I_{OUT}=30mA, Ripple=0.5Vp-p, Topt=25°C)

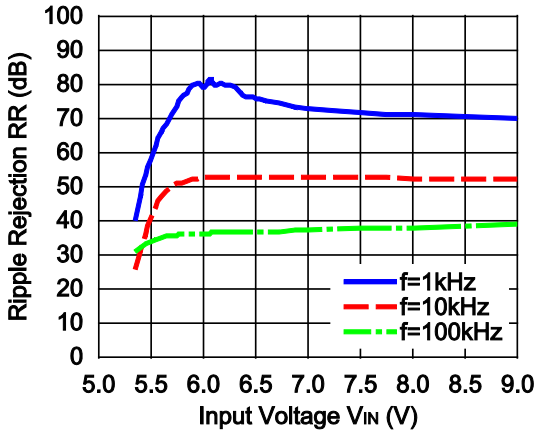
R1191x020x ECO=H



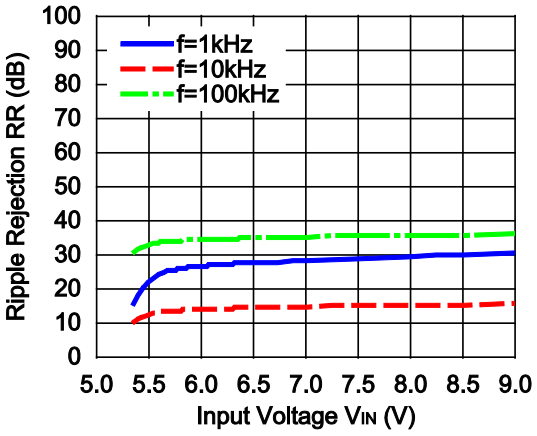
R1191x020x ECO=L



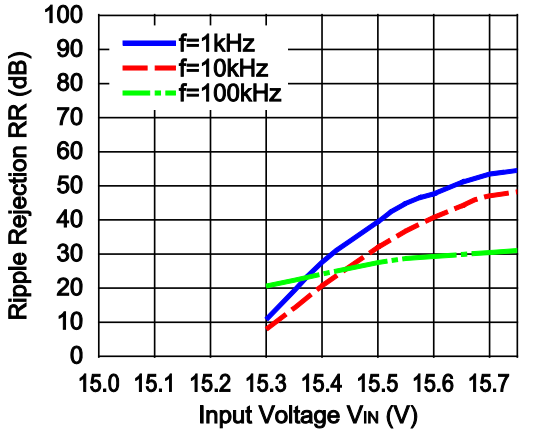
R1191x050x ECO=H



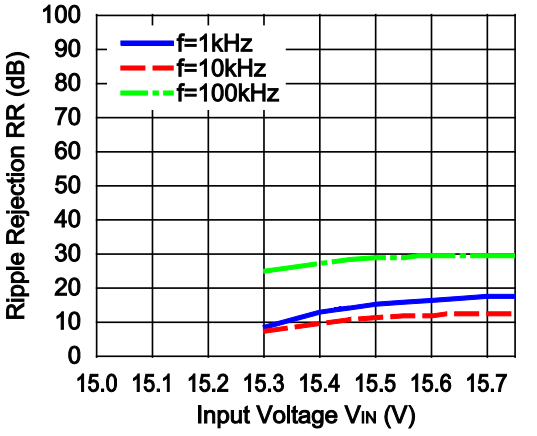
R1191x050x ECO=L



R1191x150x ECO=H

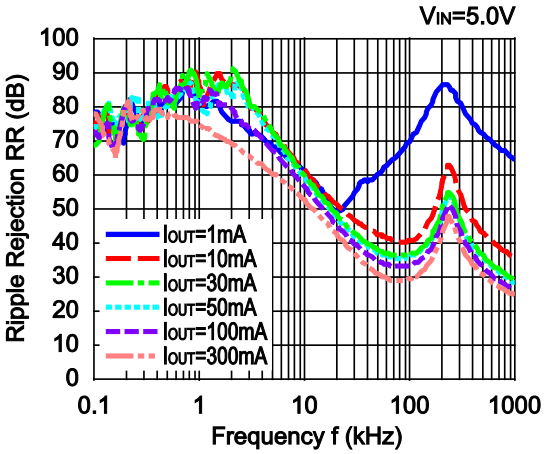


R1191x150x ECO=L

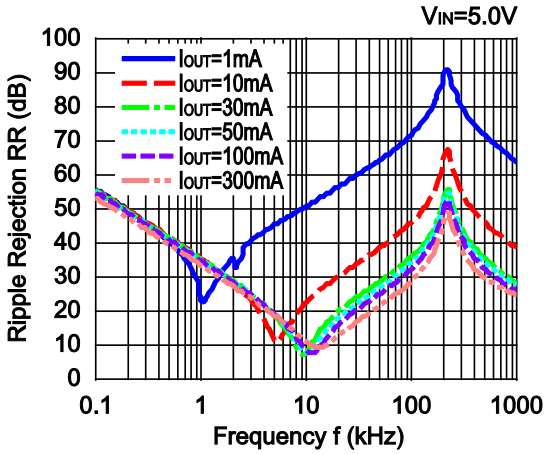


11) Ripple Rejection vs. Frequency (C1= none, C2=4.7μF, Ripple=0.5Vp-p, Topt=25°C)

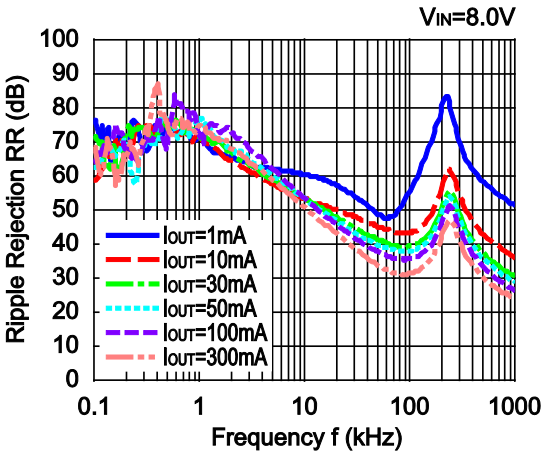
R1191x020x ECO=H



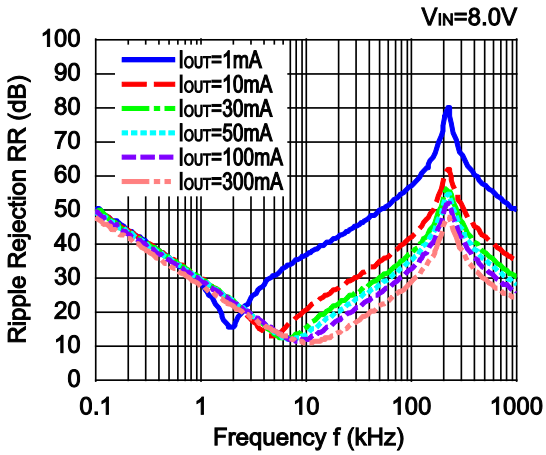
R1191x020x ECO=L



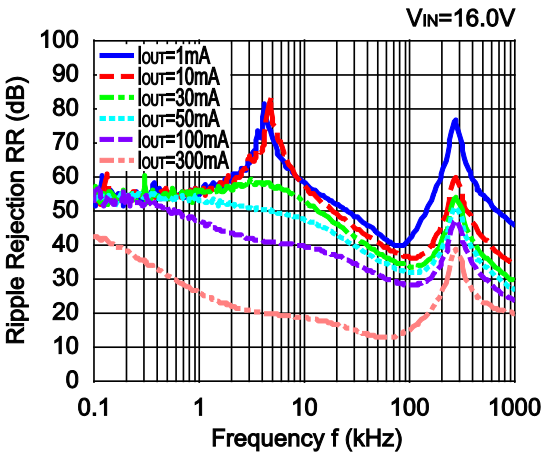
R1191x050x ECO=H



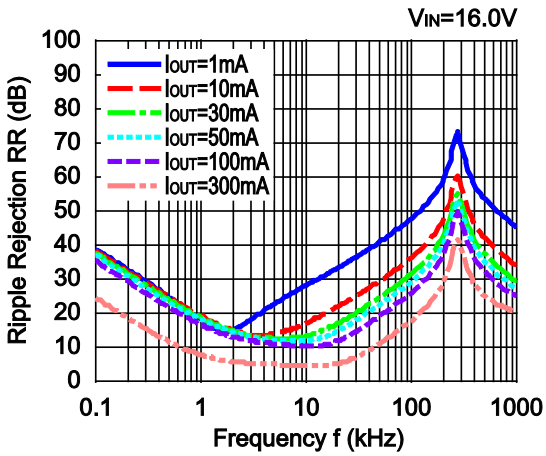
R1191x050x ECO=L



R1191x150x ECO=H

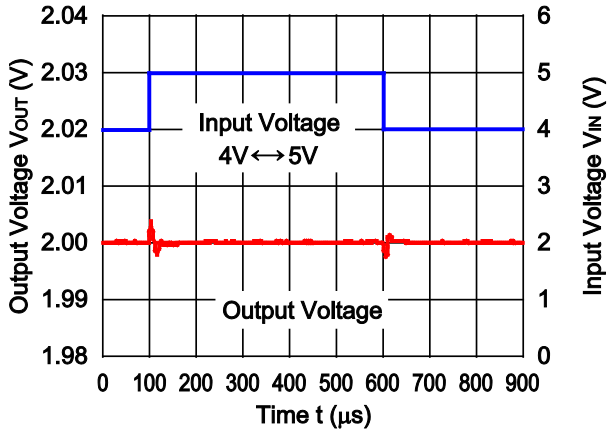


R1191x150x ECO=L

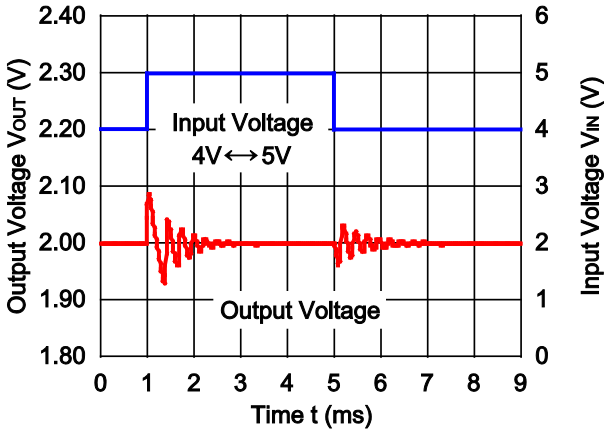


12) Input Transient Response (C1=none, C2=4.7μF, I_{OUT}=1mA, tr=tf=1μs, Topt=25°C)

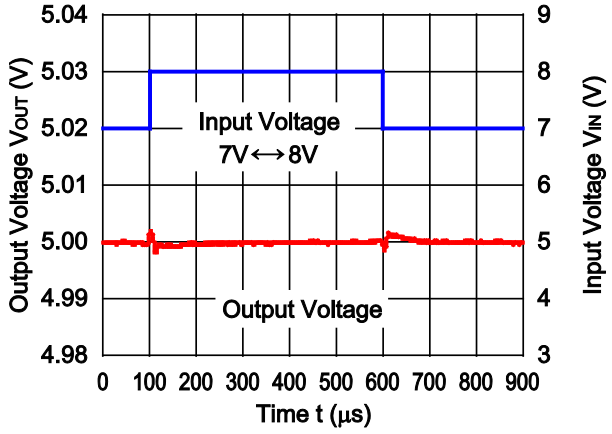
R1191x020x ECO=H



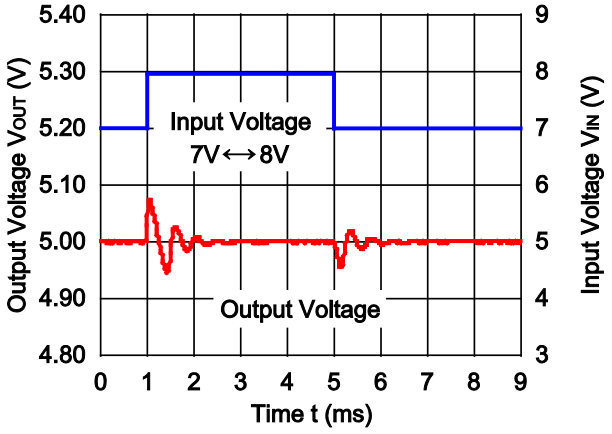
R1191x020x ECO=L



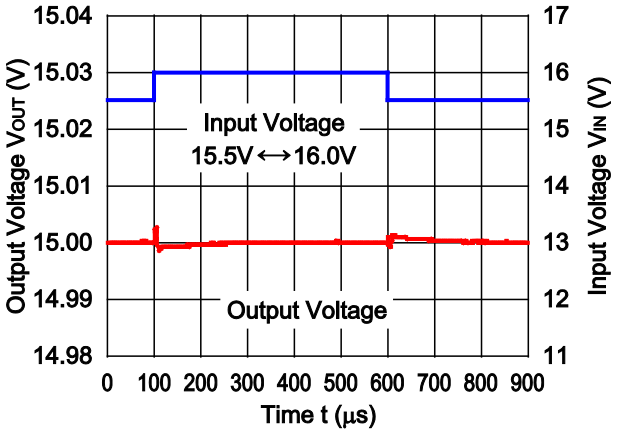
R1191x050x ECO=H



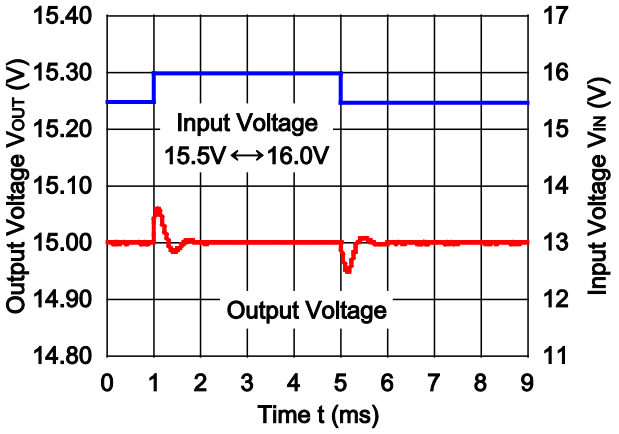
R1191x050x ECO=H



R1191x150x ECO=H

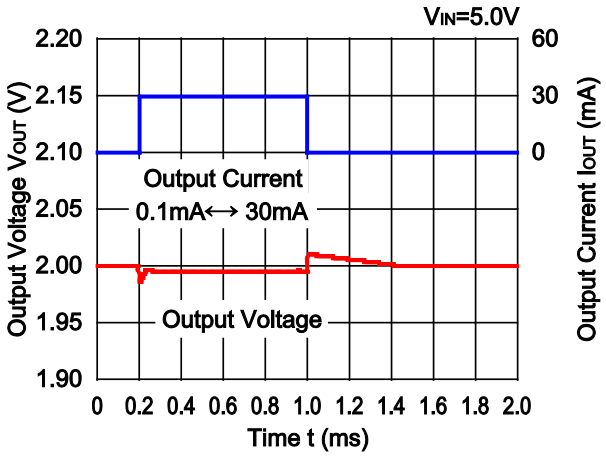


R1191x150x ECO=L

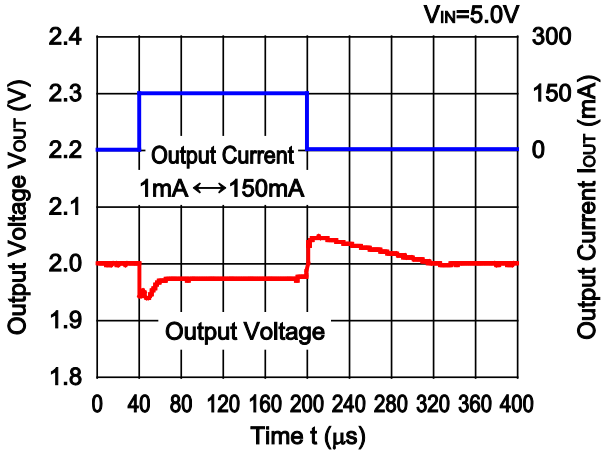


13) Load Transient Response (C1=2.2μF, C2=4.7μF, tr=tf=0.1μs, Topt=25°C)

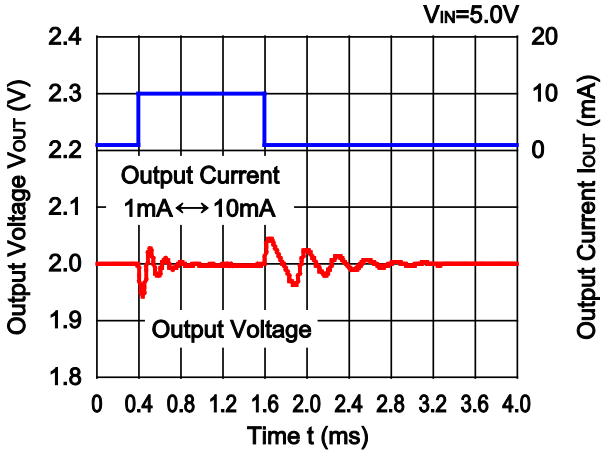
R1191x020x ECO=H



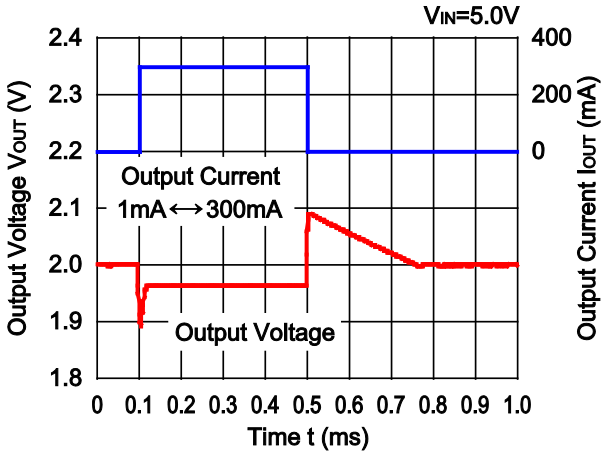
R1191x020x ECO=H



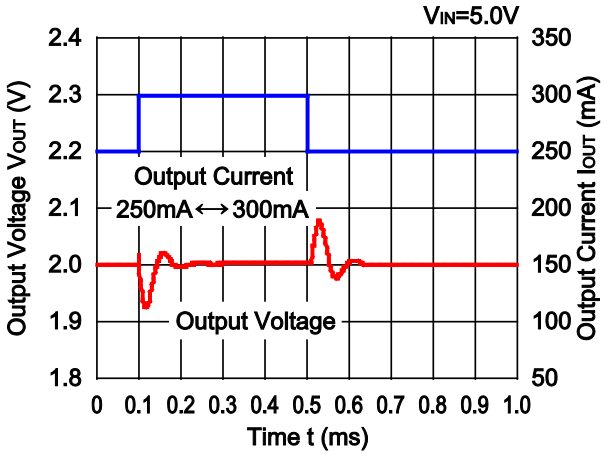
R1191x020x ECO=L



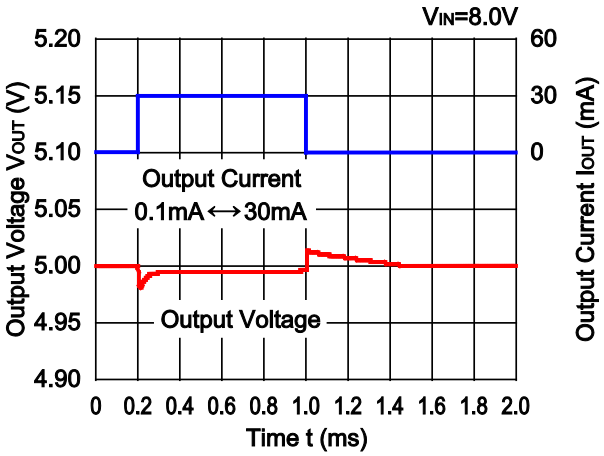
R1191x020x ECO=H



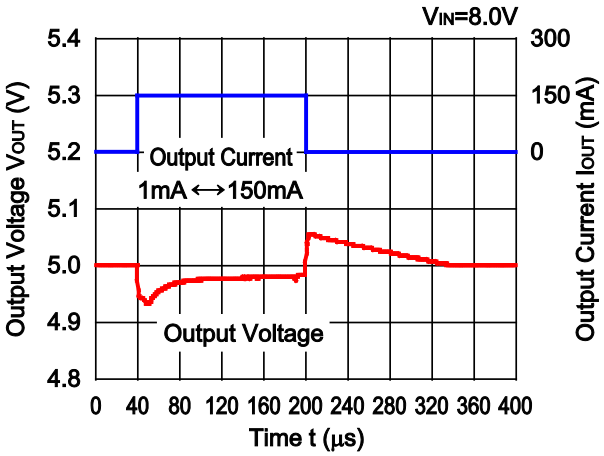
R1191x020x ECO=L



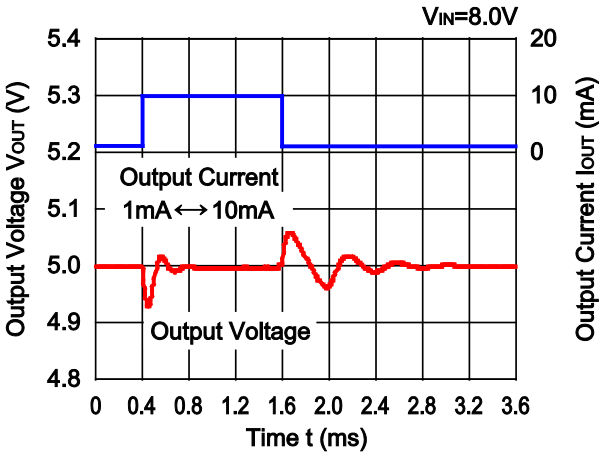
R1191x050x ECO=H



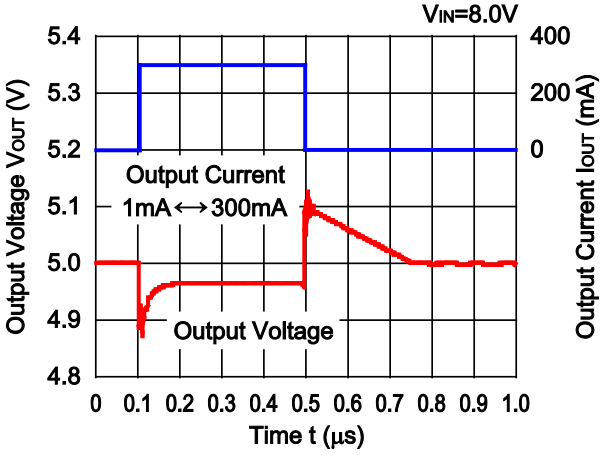
R1191x050x ECO=H



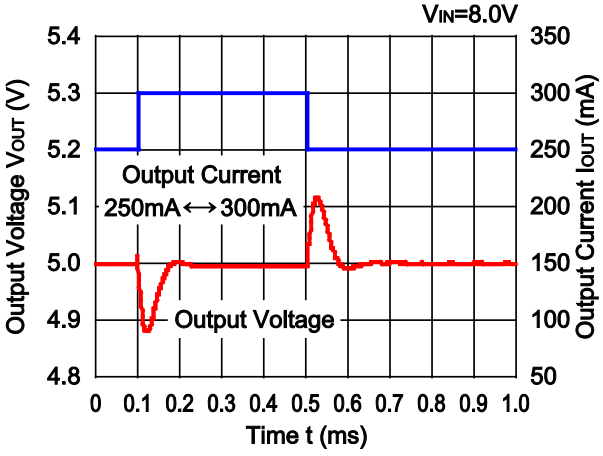
R1191x050x ECO=L



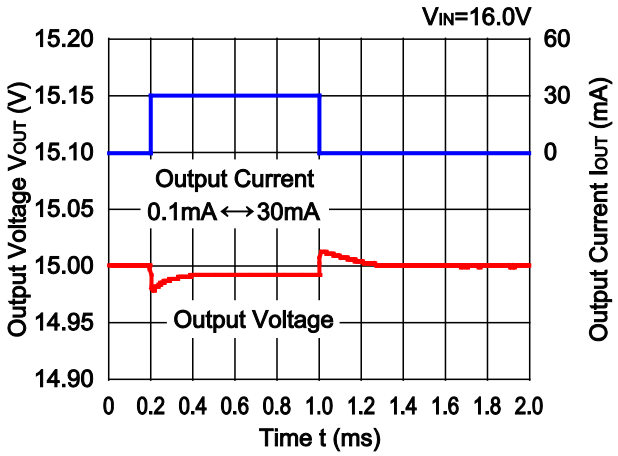
R1191x050x ECO=H



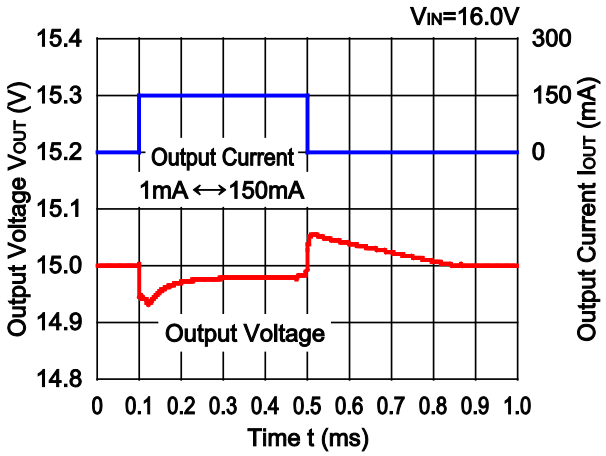
R1191x050x ECO=L



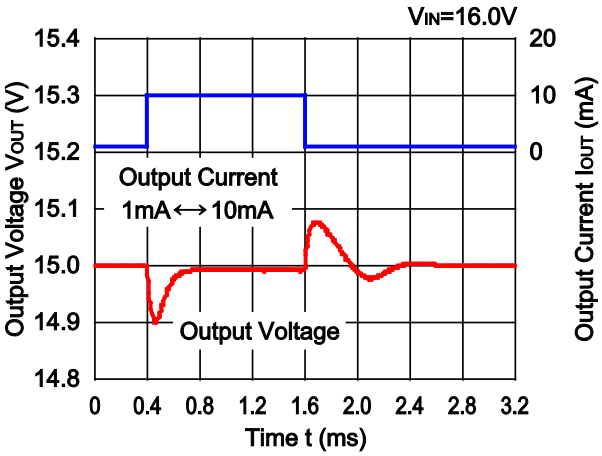
R1191x150x ECO=H



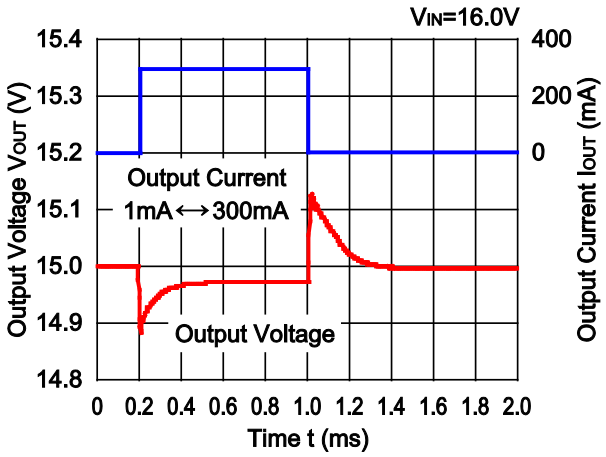
R1191x150x ECO=H



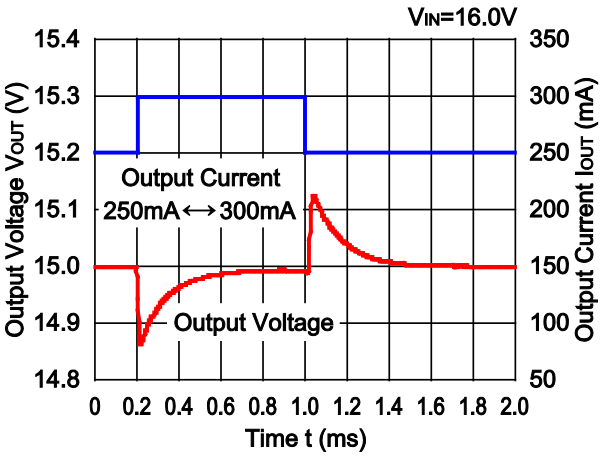
R1191x150x ECO=L



R1191x150x ECO=H

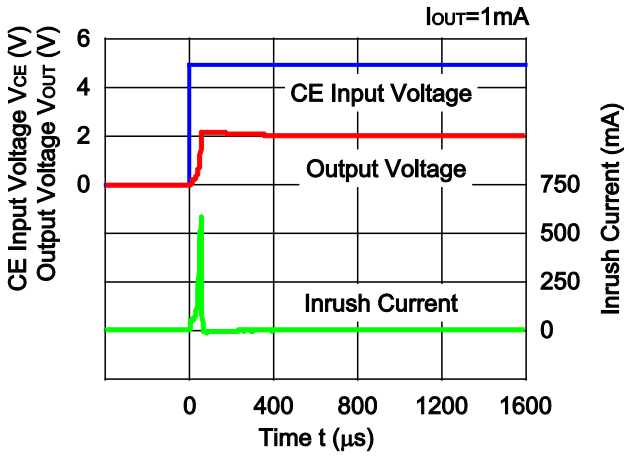


R1191x150x ECO=L

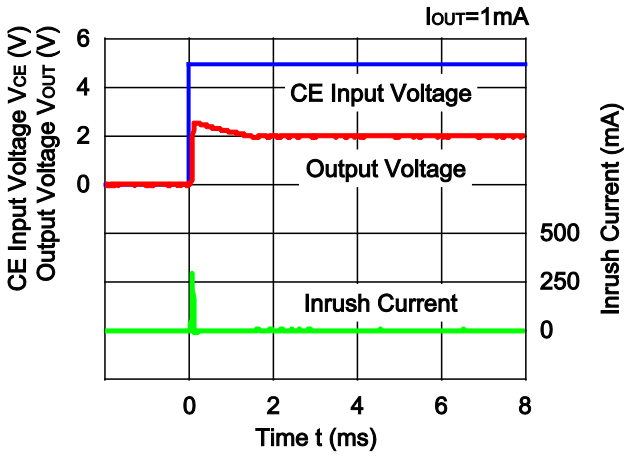


14) Inrush Current at Turn on(C1=2.2μF, C2=4.7μF, tr=0.1μs, Topt=25°C)

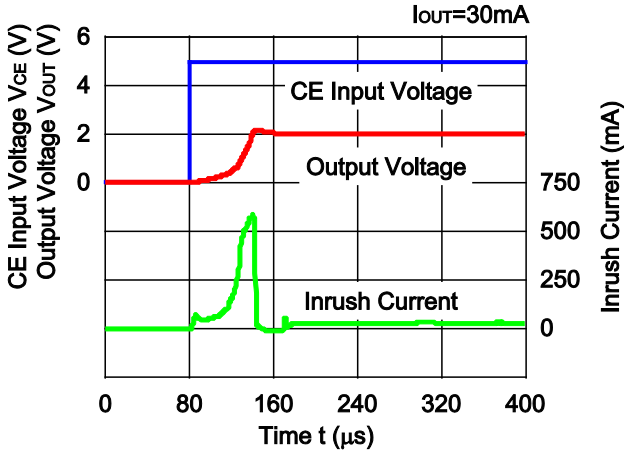
R1191x020x ECO=H



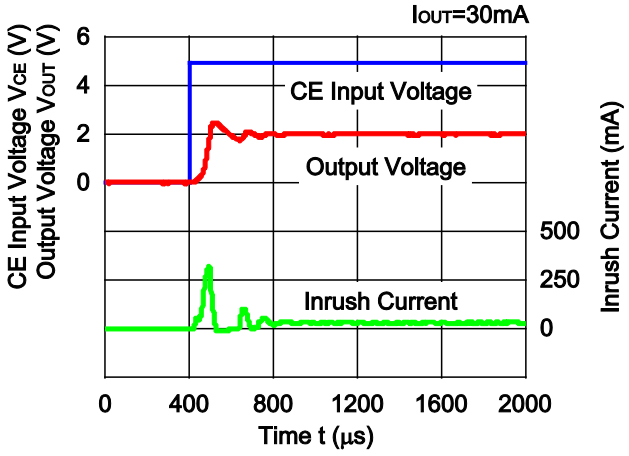
R1191x020x ECO=L



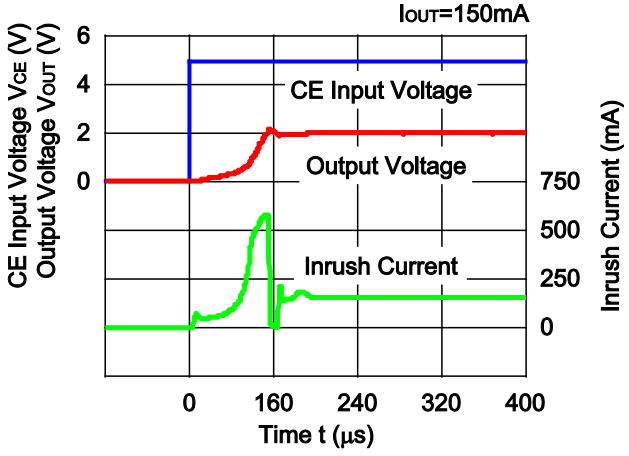
R1191x020x ECO=H



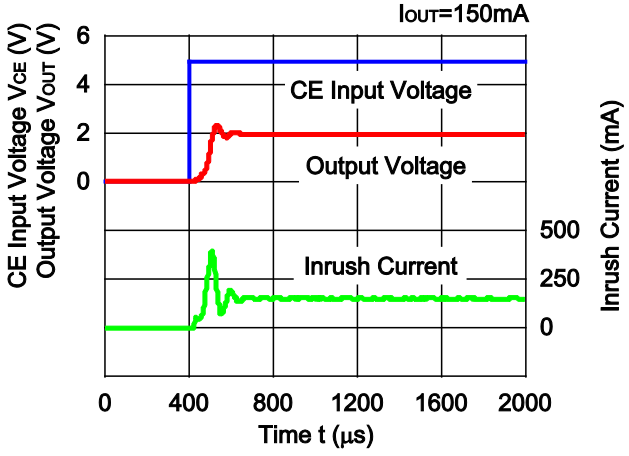
R1191x020x ECO=L



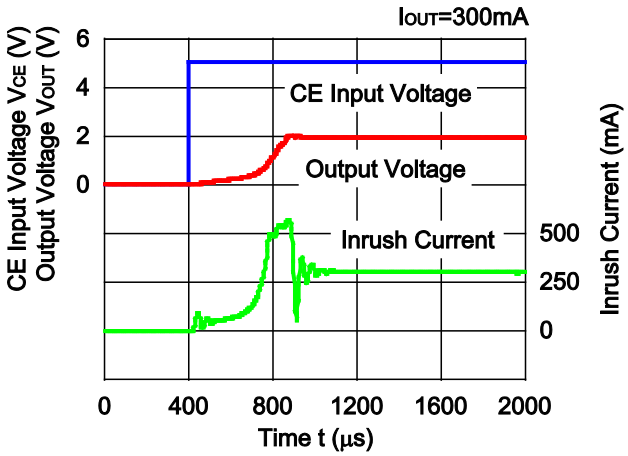
R1191x020x ECO=H



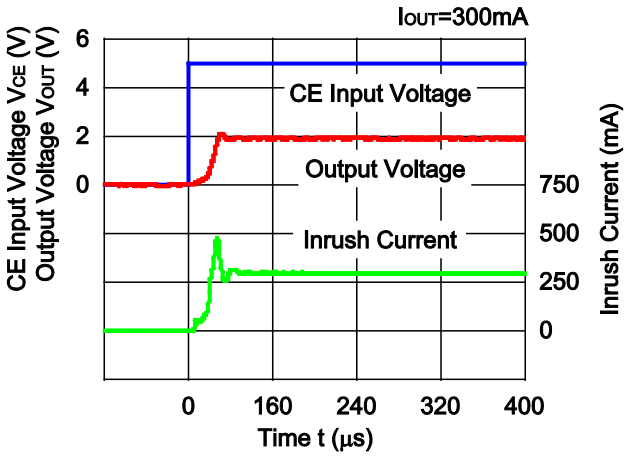
R1191x020x ECO=L



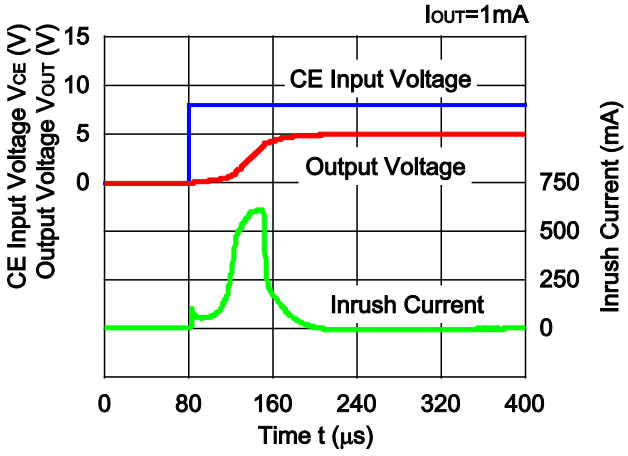
R1191x020x ECO=H



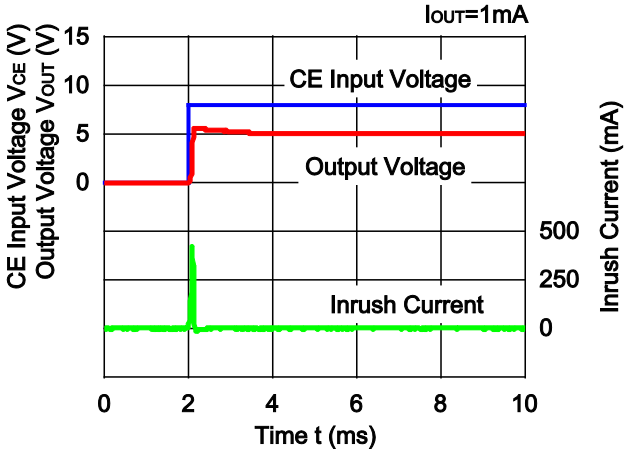
R1191x020x ECO=L



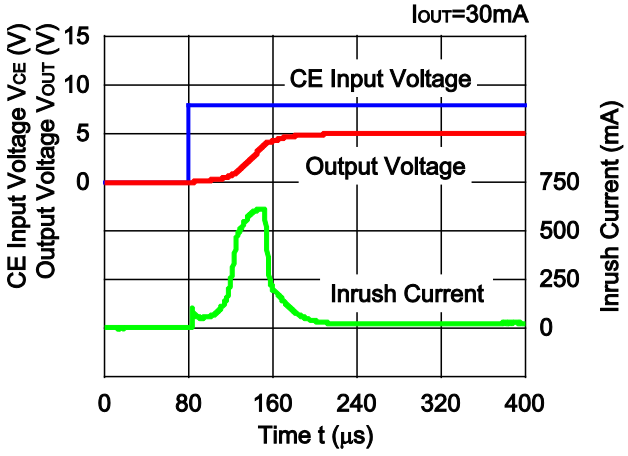
R1191x050x ECO=H



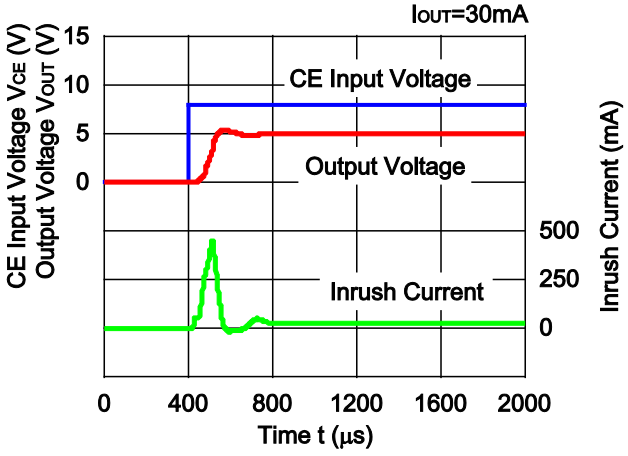
R1191x050x ECO=L



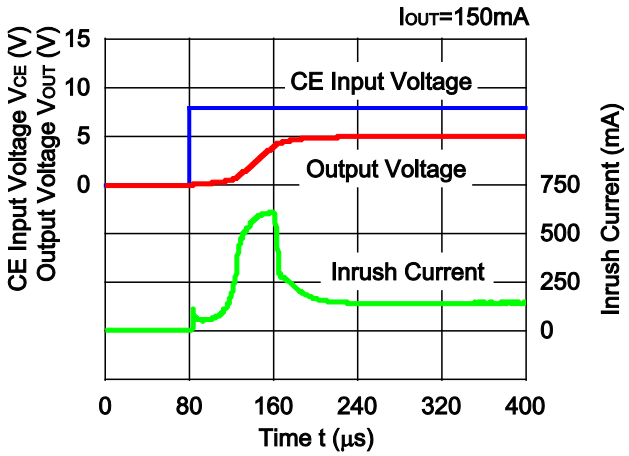
R1191x050x ECO=H



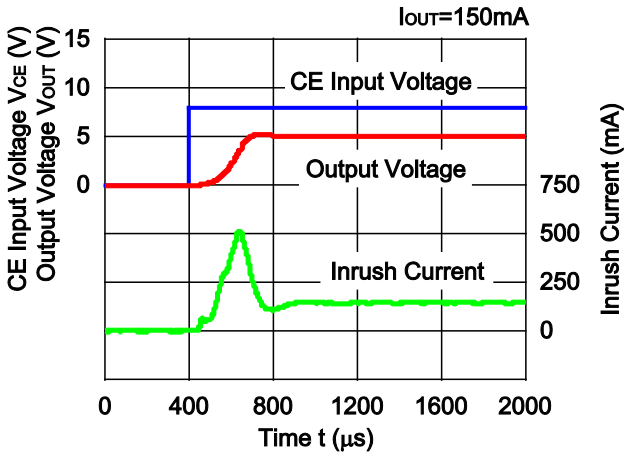
R1191x050x ECO=L



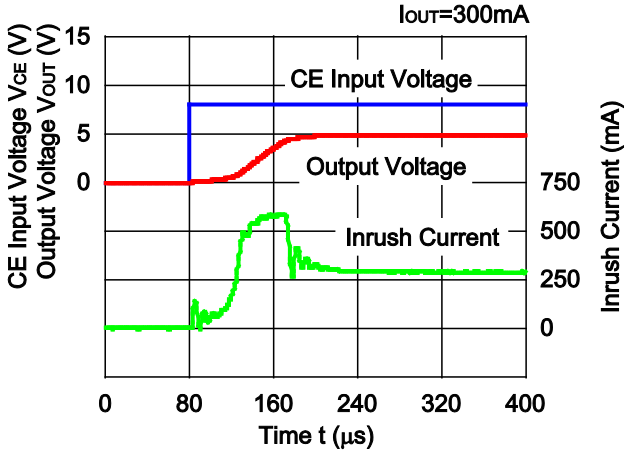
R1191x050x ECO=H



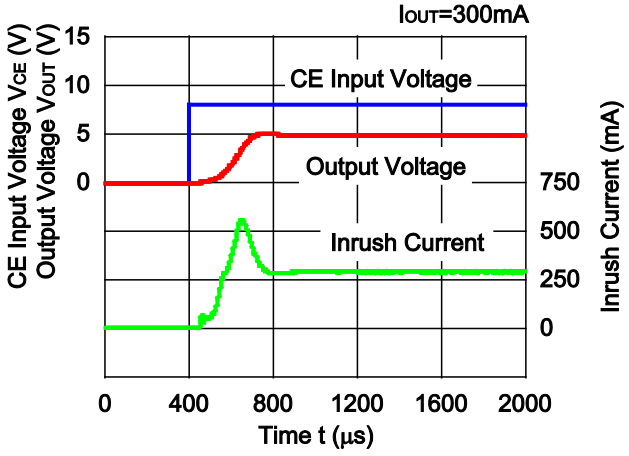
R1191x050x ECO=L



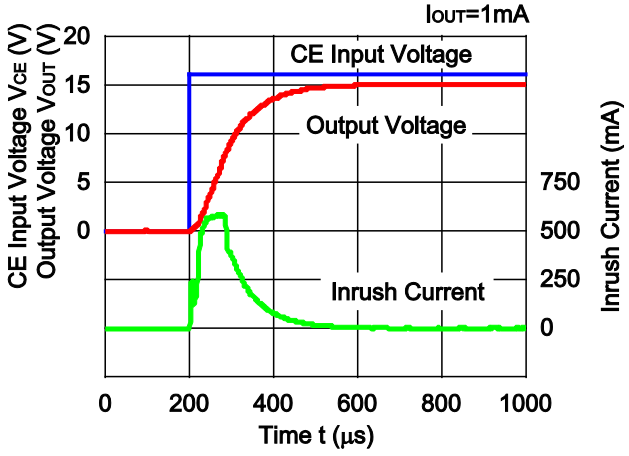
R1191x050x ECO=H



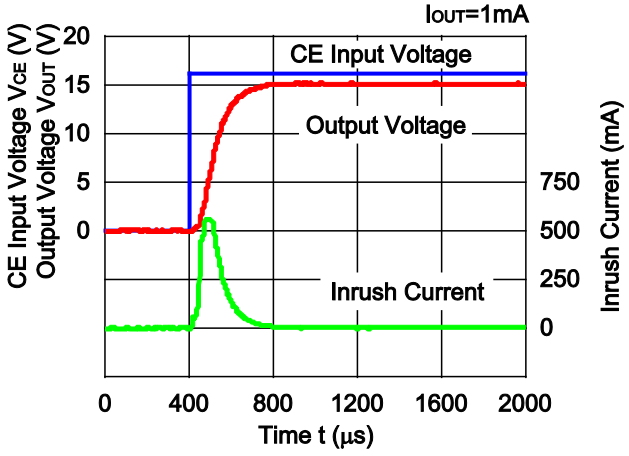
R1191x050x ECO=L



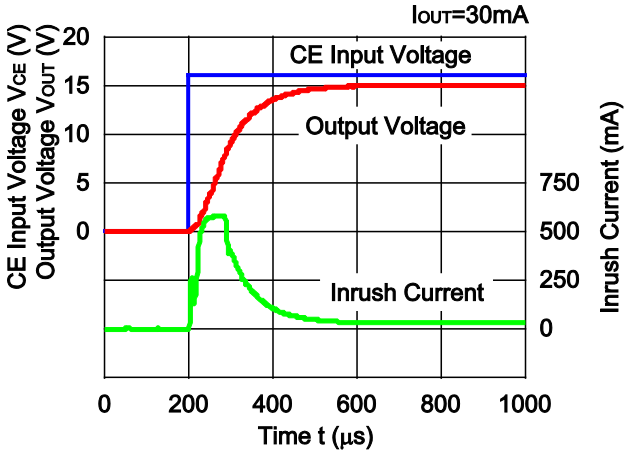
R1191x150x ECO=H



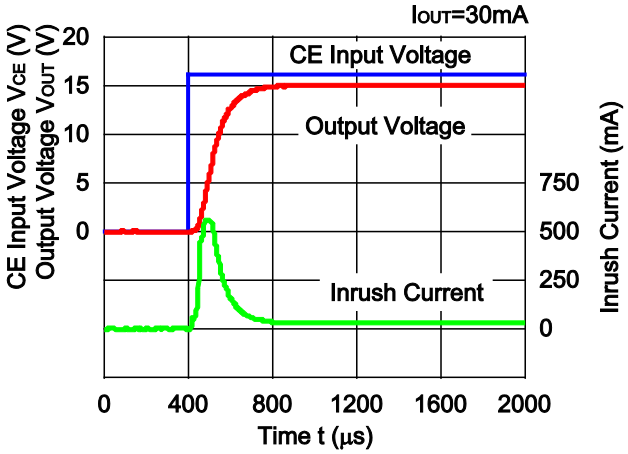
R1191x150x ECO=L



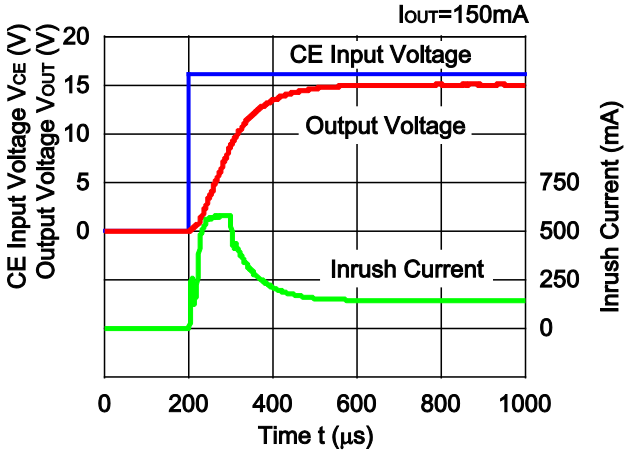
R1191x150x ECO=H



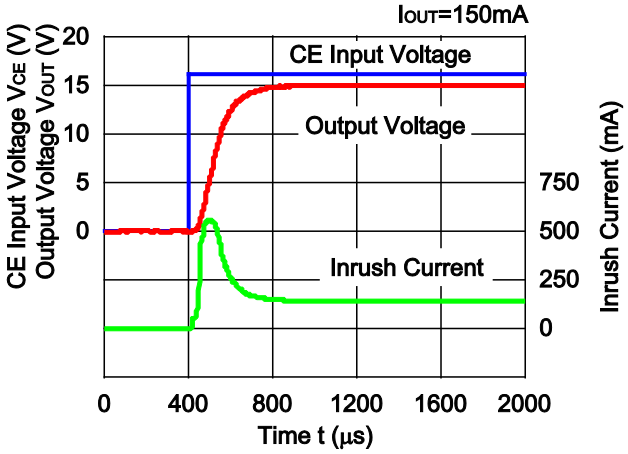
R1191x150x ECO=L



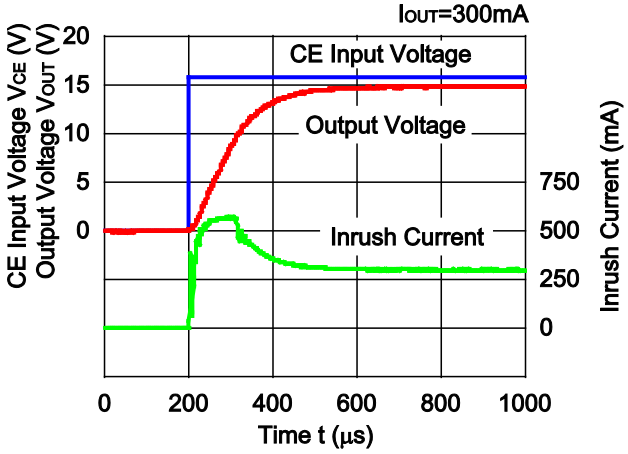
R1191x150x ECO=H



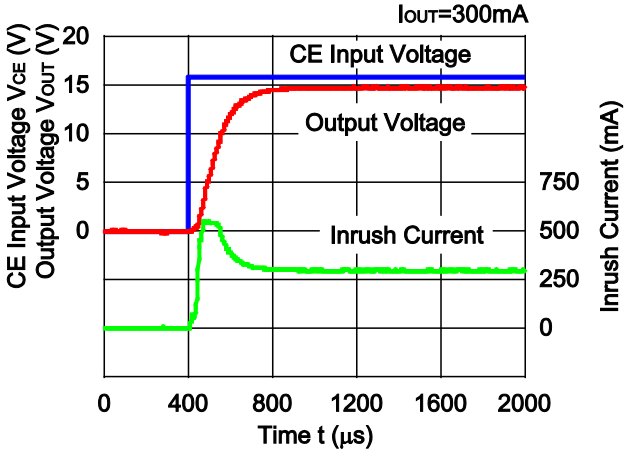
R1191x150x ECO=L



R1191x150x ECO=H

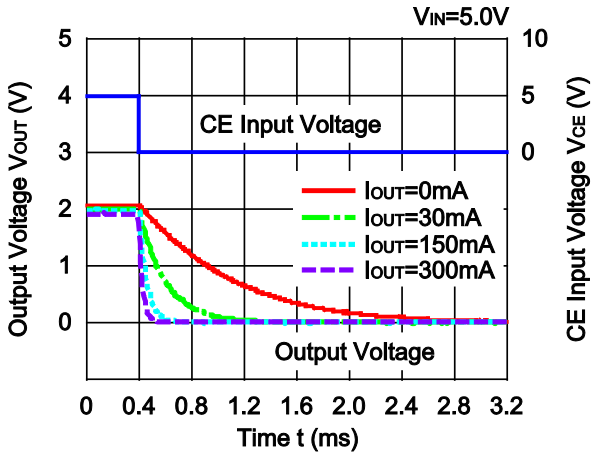


R1191x150x ECO=L

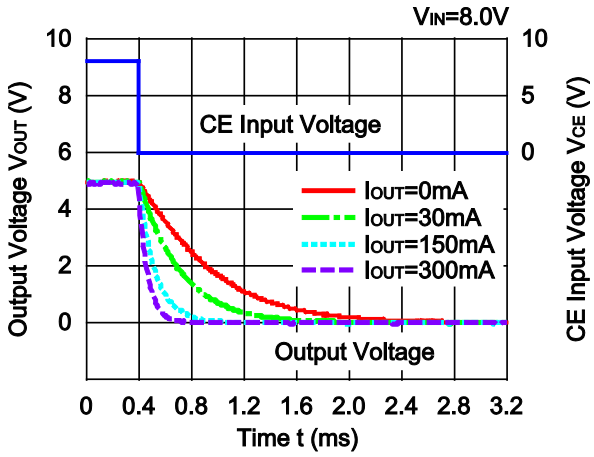


15) Turn Off Speed with CE pin (D Version) (C1=2.2μF, C2=4.7μF, tf=0.1μs, Topt=25°C)

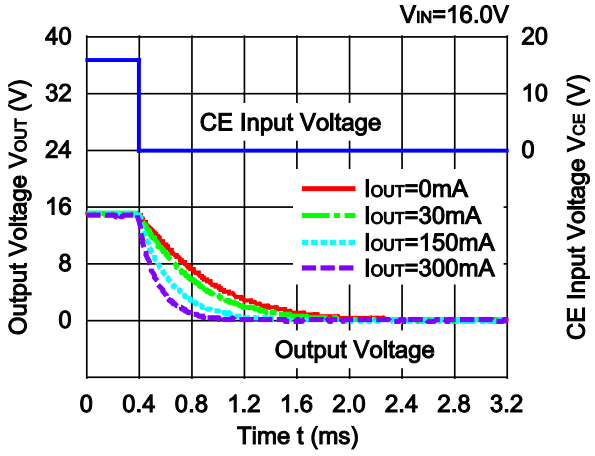
R1191x020D



R1191x050D

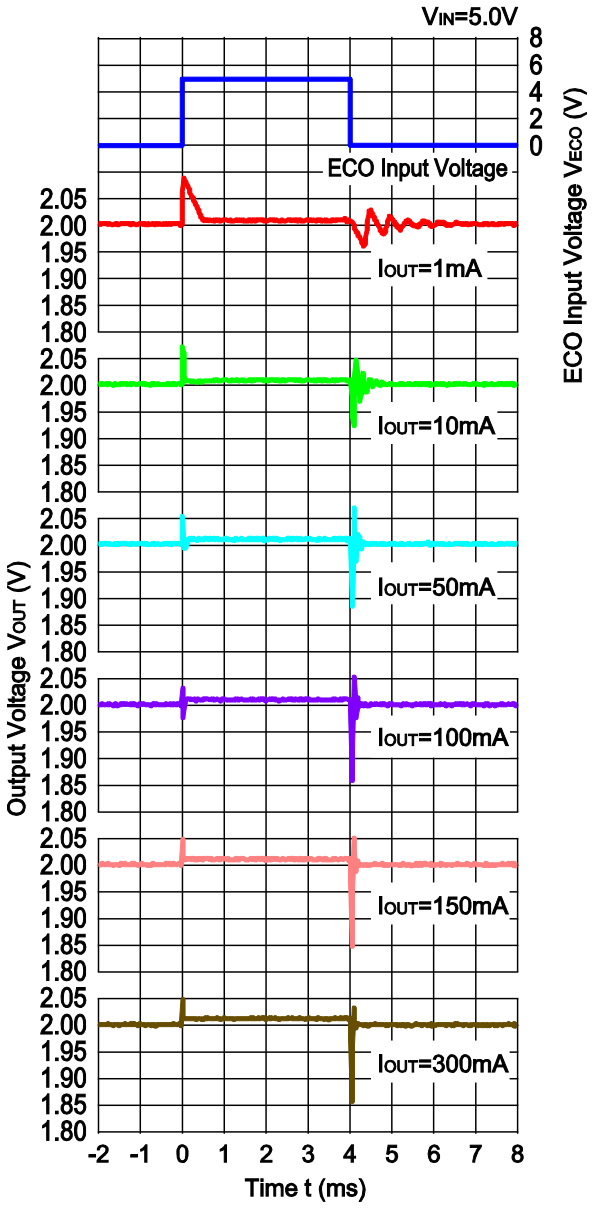


R1191x150D

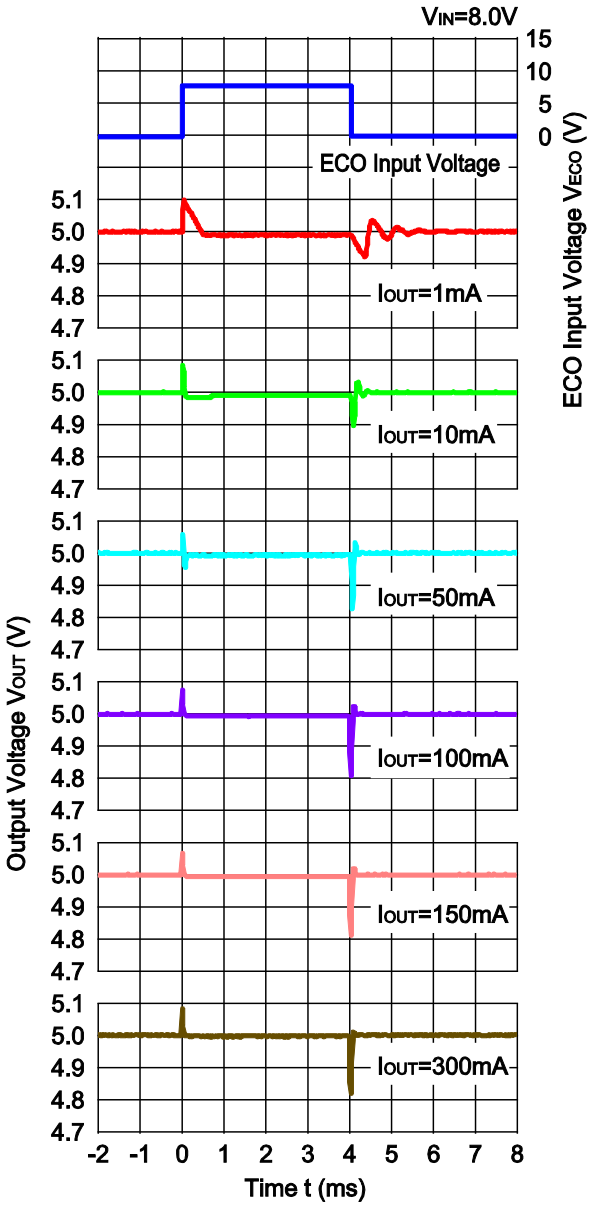


16) Output Voltage at Mode alternative point (C1=2.2µF, C2=4.7µF, tr=tf=0.1µs, Topt=25°C)

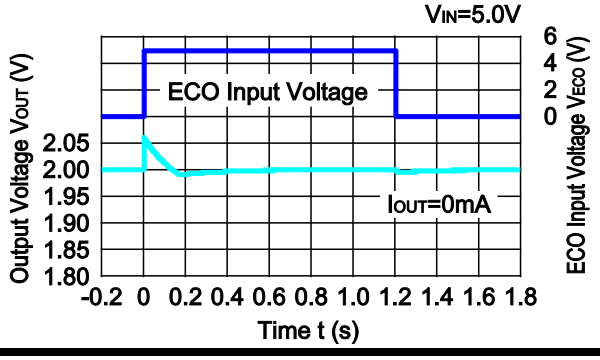
R1191x020x



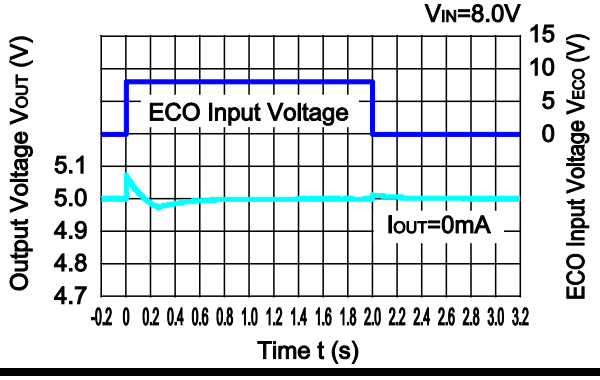
R1191x050x



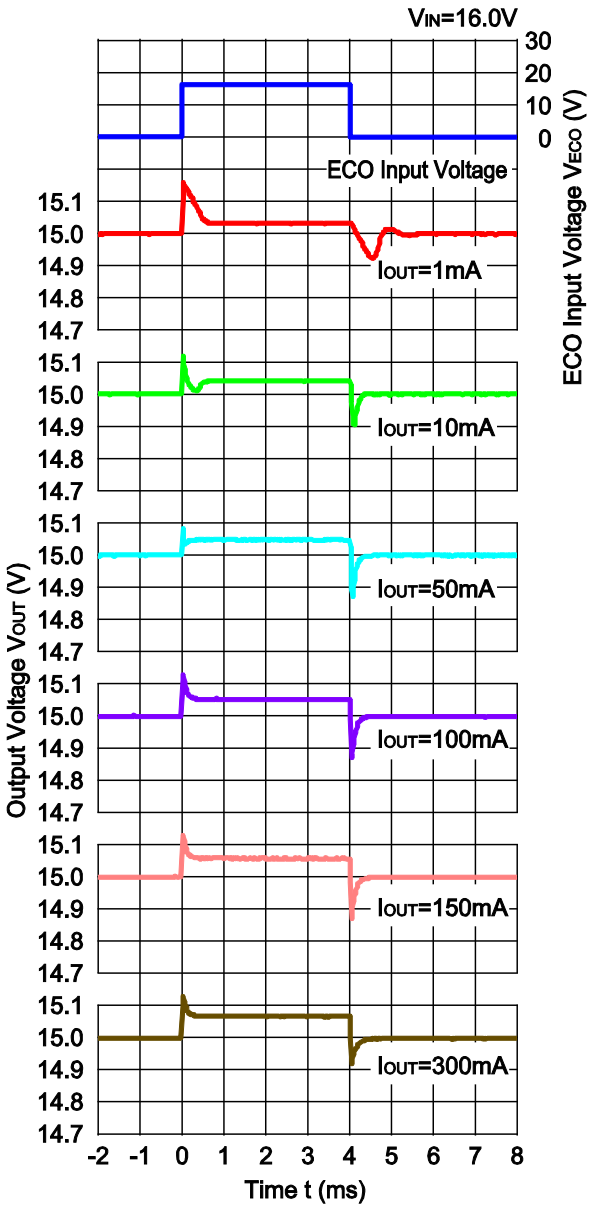
R1191x020x



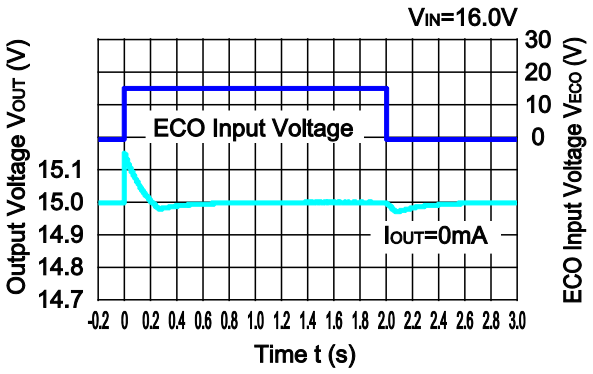
R1191x050x



R1191x150x

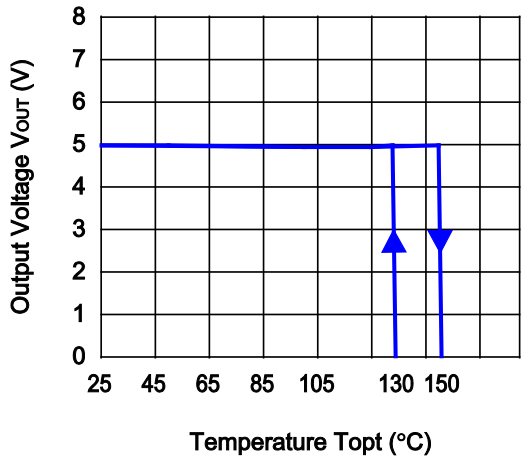


R1191x150x

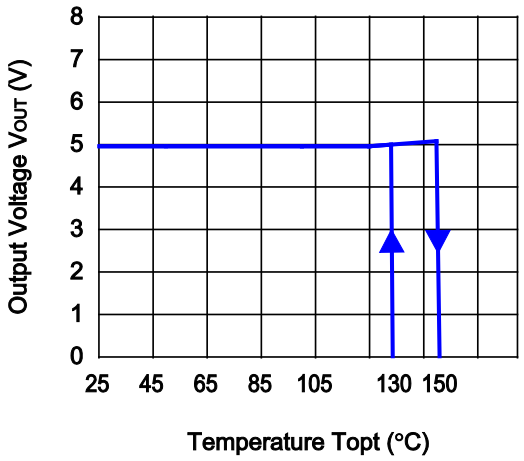


17) Thermal Shutdown Circuit ($C1=2.2\mu F$, $C2=4.7\mu F$, $V_{IN}=16V$, $R_{LOAD}=1k\Omega$)

R1191x050x ECO=H



R1191x050x ECO=L



ESR vs. Output Current

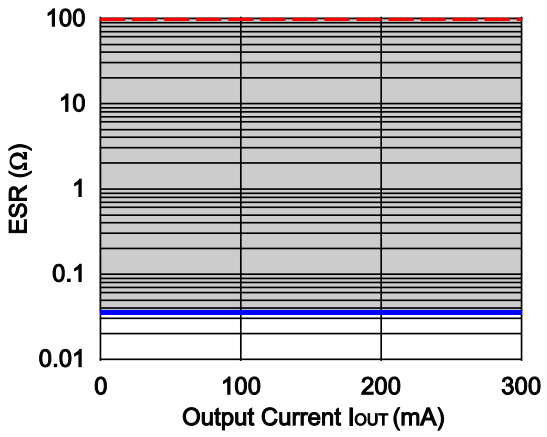
When using these ICs, consider the following points:

The relations between I_{OUT} (Output Current) and ESR of an output capacitor are shown below.
The conditions when the white noise level is under 40μV (Avg.) are marked as the hatched area in the graph.

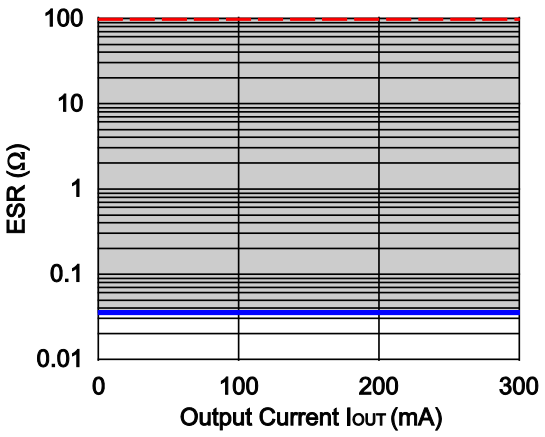
Measurement conditions

Frequency Band : 10Hz to 1MHz
Temperature : −40°C to 85°C
Hached Area : Noise level is under 40μVms(Avg.)
C_{IN} : 2.2μF Murata (GRM32RB11E225KC01B)
C_{OUT} : 4.7μF Murata (GCM31CR71E475KA40)

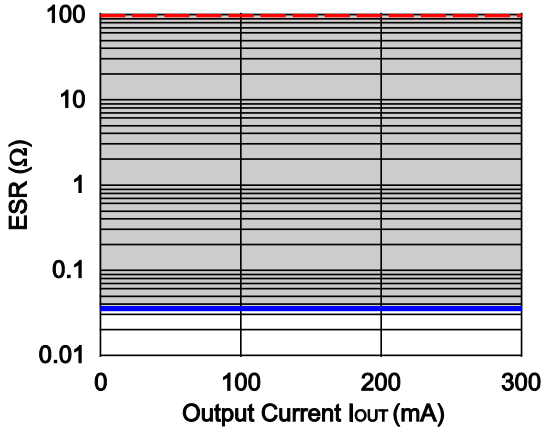
R1191x020x ECO=H, ECO=L



R1191x050x ECO=H, ECO=L



R1191x150x ECO=H, ECO=L



PD-DFN1616-6-(85125)-JE-B

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

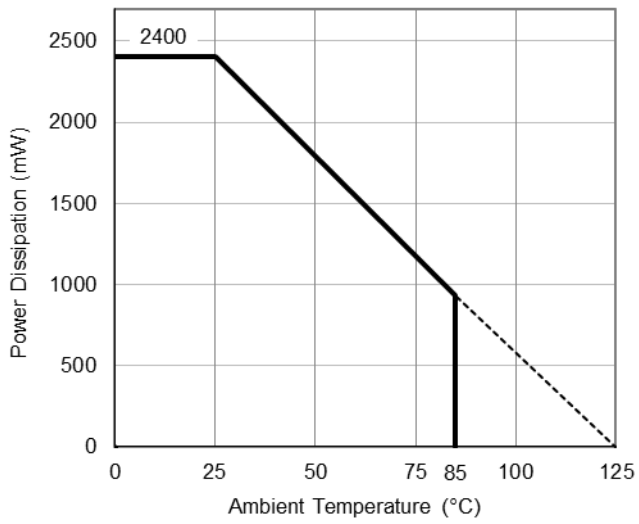
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.2 mm × 25 pcs

Measurement Result (Ta = 25°C, Tjmax = 125°C)

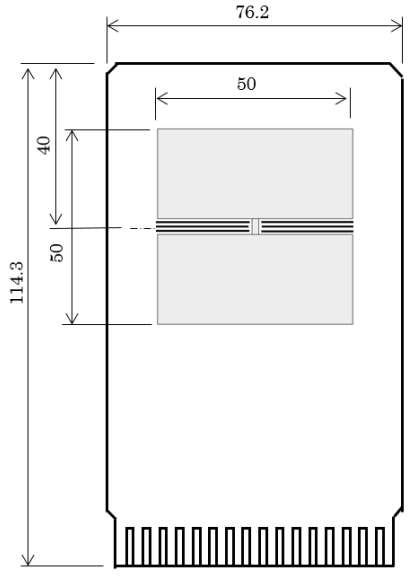
Item	Measurement Result
Power Dissipation	2400 mW
Thermal Resistance (θja)	θja = 41°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 11°C/W

θja: Junction-to-Ambient Thermal Resistance

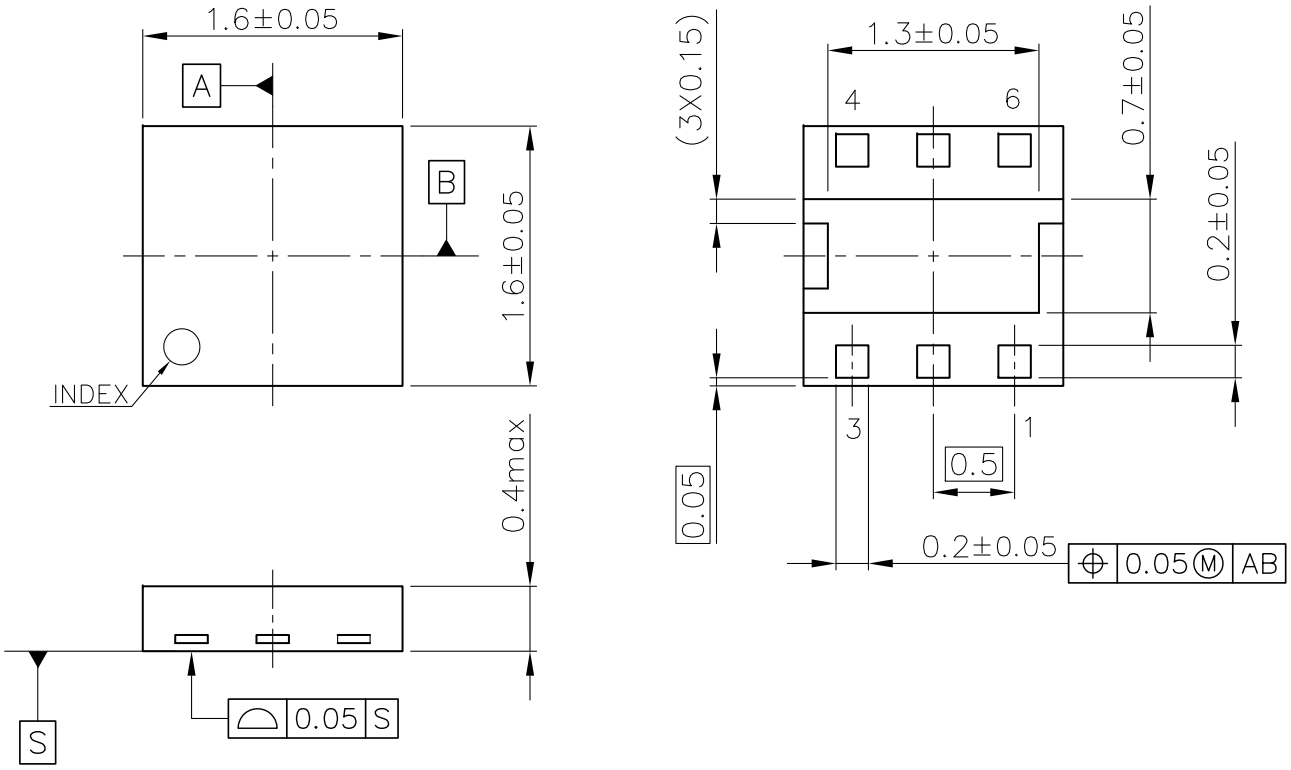
ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern



DFN1616-6 Package Dimensions (Unit: mm)

∗ The tab on the bottom of the package shown by blue circle is a substrate potential (GND/V_{DD}). It is recommended that this tab be connected to the ground plane/VDD pin on the board but it is possible to leave the tab floating.

PD-SOT-23-5-(85125)-JE-B

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

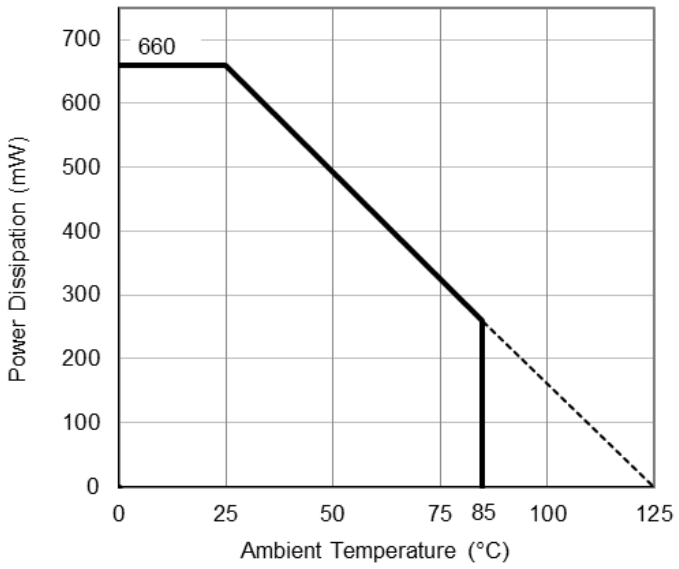
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 7 pcs

Measurement Result (Ta = 25°C, Tjmax = 125°C)

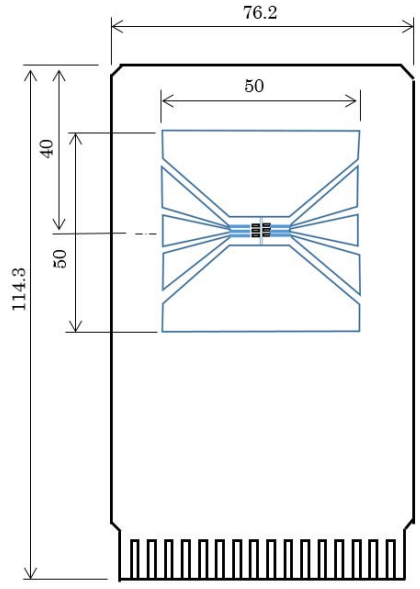
Item	Measurement Result
Power Dissipation	660 mW
Thermal Resistance (θja)	θja = 150°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 51°C/W

θja: Junction-to-Ambient Thermal Resistance

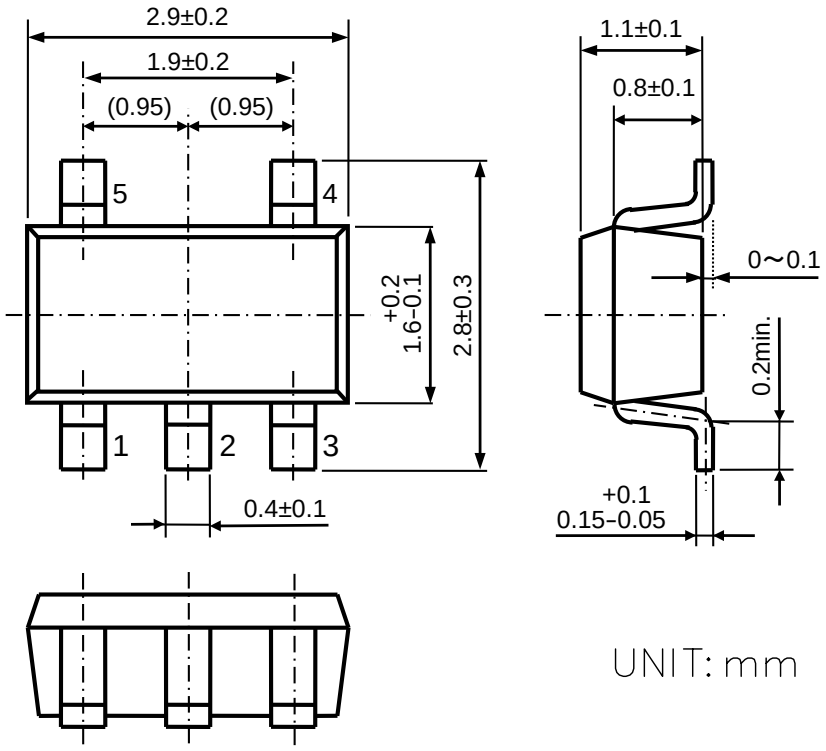
ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

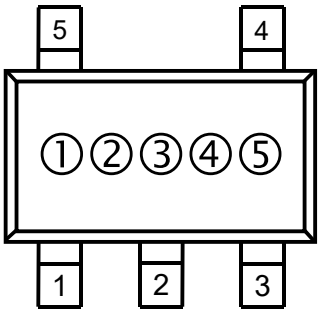


SOT-23-5 Package Dimensions

MK-R1191N-JE-C

①②③: Product Code ⋯ Refer to *Part Marking List*

④⑤: Lot Number ⋯ Alphanumeric Serial Number



SOT-23-5 Part Markings

NOTICE
There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or our distributor before attempting to use AOI.

MK-R1191N-JE-C

R1191NxxxB Part Marking List

Product Name	① ② ③	SET V_{OUT}
R1191N020B	4 2 0	2.0 V
R1191N021B	4 2 1	2.1 V
R1191N022B	4 2 2	2.2 V
R1191N023B	4 2 3	2.3 V
R1191N024B	4 2 4	2.4 V
R1191N025B	4 2 5	2.5 V
R1191N026B	4 2 6	2.6 V
R1191N027B	4 2 7	2.7 V
R1191N028B	4 2 8	2.8 V
R1191N029B	4 2 9	2.9 V
R1191N030B	4 3 0	3.0 V
R1191N031B	4 3 1	3.1 V
R1191N032B	4 3 2	3.2 V
R1191N033B	4 3 3	3.3 V
R1191N034B	4 3 4	3.4 V
R1191N035B	4 3 5	3.5 V
R1191N036B	4 3 6	3.6 V
R1191N037B	4 3 7	3.7 V
R1191N038B	4 3 8	3.8 V
R1191N039B	4 3 9	3.9 V
R1191N040B	4 4 0	4.0 V
R1191N041B	4 4 1	4.1 V
R1191N042B	4 4 2	4.2 V
R1191N043B	4 4 3	4.3 V
R1191N044B	4 4 4	4.4 V
R1191N045B	4 4 5	4.5 V
R1191N046B	4 4 6	4.6 V
R1191N047B	4 4 7	4.7 V
R1191N048B	4 4 8	4.8 V
R1191N049B	4 4 9	4.9 V
R1191N050B	4 5 0	5.0 V
R1191N051B	4 5 1	5.1 V
R1191N052B	4 5 2	5.2 V
R1191N053B	4 5 3	5.3 V
R1191N054B	4 5 4	5.4 V
R1191N055B	4 5 5	5.5 V
R1191N056B	4 5 6	5.6 V
R1191N057B	4 5 7	5.7 V
R1191N058B	4 5 8	5.8 V
R1191N059B	4 5 9	5.9 V
R1191N060B	4 6 0	6.0 V
R1191N061B	4 6 1	6.1 V
R1191N062B	4 6 2	6.2 V
R1191N063B	4 6 3	6.3 V
R1191N064B	4 6 4	6.4 V
R1191N065B	4 6 5	6.5 V
R1191N066B	4 6 6	6.6 V
R1191N067B	4 6 7	6.7 V
R1191N068B	4 6 8	6.8 V
R1191N069B	4 6 9	6.9 V

Product Name	① ② ③	SET V_{OUT}
R1191N070B	4 7 0	7.0 V
R1191N071B	4 7 1	7.1 V
R1191N072B	4 7 2	7.2 V
R1191N073B	4 7 3	7.3 V
R1191N074B	4 7 4	7.4 V
R1191N075B	4 7 5	7.5 V
R1191N076B	4 7 6	7.6 V
R1191N077B	4 7 7	7.7 V
R1191N078B	4 7 8	7.8 V
R1191N079B	4 7 9	7.9 V
R1191N080B	4 8 0	8.0 V
R1191N081B	4 8 1	8.1 V
R1191N082B	4 8 2	8.2 V
R1191N083B	4 8 3	8.3 V
R1191N084B	4 8 4	8.4 V
R1191N085B	4 8 5	8.5 V
R1191N086B	4 8 6	8.6 V
R1191N087B	4 8 7	8.7 V
R1191N088B	4 8 8	8.8 V
R1191N089B	4 8 9	8.9 V
R1191N090B	4 9 0	9.0 V
R1191N091B	4 9 1	9.1 V
R1191N092B	4 9 2	9.2 V
R1191N093B	4 9 3	9.3 V
R1191N094B	4 9 4	9.4 V
R1191N095B	4 9 5	9.5 V
R1191N096B	4 9 6	9.6 V
R1191N097B	4 9 7	9.7 V
R1191N098B	4 9 8	9.8 V
R1191N099B	4 9 9	9.9 V
R1191N100B	5 0 0	10.0 V
R1191N101B	5 0 1	10.1 V
R1191N102B	5 0 2	10.2 V
R1191N103B	5 0 3	10.3 V
R1191N104B	5 0 4	10.4 V
R1191N105B	5 0 5	10.5 V
R1191N106B	5 0 6	10.6 V
R1191N107B	5 0 7	10.7 V
R1191N108B	5 0 8	10.8 V
R1191N109B	5 0 9	10.9 V
R1191N110B	5 1 0	11.0 V
R1191N111B	5 1 1	11.1 V
R1191N112B	5 1 2	11.2 V
R1191N113B	5 1 3	11.3 V
R1191N114B	5 1 4	11.4 V
R1191N115B	5 1 5	11.5 V
R1191N116B	5 1 6	11.6 V
R1191N117B	5 1 7	11.7 V
R1191N118B	5 1 8	11.8 V
R1191N119B	5 1 9	11.9 V

Product Name	① ② ③	SET V_{OUT}
R1191N120B	5 2 0	12.0 V
R1191N121B	5 2 1	12.1 V
R1191N122B	5 2 2	12.2 V
R1191N123B	5 2 3	12.3 V
R1191N124B	5 2 4	12.4 V
R1191N125B	5 2 5	12.5 V
R1191N126B	5 2 6	12.6 V
R1191N127B	5 2 7	12.7 V
R1191N128B	5 2 8	12.8 V
R1191N129B	5 2 9	12.9 V
R1191N130B	5 3 0	13.0 V
R1191N131B	5 3 1	13.1 V
R1191N132B	5 3 2	13.2 V
R1191N133B	5 3 3	13.3 V
R1191N134B	5 3 4	13.4 V
R1191N135B	5 3 5	13.5 V
R1191N136B	5 3 6	13.6 V
R1191N137B	5 3 7	13.7 V
R1191N138B	5 3 8	13.8 V
R1191N139B	5 3 9	13.9 V
R1191N140B	5 4 0	14.0 V
R1191N141B	5 4 1	14.1 V
R1191N142B	5 4 2	14.2 V
R1191N143B	5 4 3	14.3 V
R1191N144B	5 4 4	14.4 V
R1191N145B	5 4 5	14.5 V
R1191N146B	5 4 6	14.6 V
R1191N147B	5 4 7	14.7 V
R1191N148B	5 4 8	14.8 V
R1191N149B	5 4 9	14.9 V
R1191N150B	5 5 0	15.0 V

MK-R1191N-JE-C

R1191NxxxD Part Marking List

Product Name	① ② ③	SET V_{OUT}
R1191N020D	6 2 0	2.0 V
R1191N021D	6 2 1	2.1 V
R1191N022D	6 2 2	2.2 V
R1191N023D	6 2 3	2.3 V
R1191N024D	6 2 4	2.4 V
R1191N025D	6 2 5	2.5 V
R1191N026D	6 2 6	2.6 V
R1191N027D	6 2 7	2.7 V
R1191N028D	6 2 8	2.8 V
R1191N029D	6 2 9	2.9 V
R1191N030D	6 3 0	3.0 V
R1191N031D	6 3 1	3.1 V
R1191N032D	6 3 2	3.2 V
R1191N033D	6 3 3	3.3 V
R1191N034D	6 3 4	3.4 V
R1191N035D	6 3 5	3.5 V
R1191N036D	6 3 6	3.6 V
R1191N037D	6 3 7	3.7 V
R1191N038D	6 3 8	3.8 V
R1191N039D	6 3 9	3.9 V
R1191N040D	6 4 0	4.0 V
R1191N041D	6 4 1	4.1 V
R1191N042D	6 4 2	4.2 V
R1191N043D	6 4 3	4.3 V
R1191N044D	6 4 4	4.4 V
R1191N045D	6 4 5	4.5 V
R1191N046D	6 4 6	4.6 V
R1191N047D	6 4 7	4.7 V
R1191N048D	6 4 8	4.8 V
R1191N049D	6 4 9	4.9 V
R1191N050D	6 5 0	5.0 V
R1191N051D	6 5 1	5.1 V
R1191N052D	6 5 2	5.2 V
R1191N053D	6 5 3	5.3 V
R1191N054D	6 5 4	5.4 V
R1191N055D	6 5 5	5.5 V
R1191N056D	6 5 6	5.6 V
R1191N057D	6 5 7	5.7 V
R1191N058D	6 5 8	5.8 V
R1191N059D	6 5 9	5.9 V
R1191N060D	6 6 0	6.0 V
R1191N061D	6 6 1	6.1 V
R1191N062D	6 6 2	6.2 V
R1191N063D	6 6 3	6.3 V
R1191N064D	6 6 4	6.4 V
R1191N065D	6 6 5	6.5 V
R1191N066D	6 6 6	6.6 V
R1191N067D	6 6 7	6.7 V
R1191N068D	6 6 8	6.8 V
R1191N069D	6 6 9	6.9 V

Product Name	① ② ③	SET V_{OUT}
R1191N070D	6 7 0	7.0 V
R1191N071D	6 7 1	7.1 V
R1191N072D	6 7 2	7.2 V
R1191N073D	6 7 3	7.3 V
R1191N074D	6 7 4	7.4 V
R1191N075D	6 7 5	7.5 V
R1191N076D	6 7 6	7.6 V
R1191N077D	6 7 7	7.7 V
R1191N078D	6 7 8	7.8 V
R1191N079D	6 7 9	7.9 V
R1191N080D	6 8 0	8.0 V
R1191N081D	6 8 1	8.1 V
R1191N082D	6 8 2	8.2 V
R1191N083D	6 8 3	8.3 V
R1191N084D	6 8 4	8.4 V
R1191N085D	6 8 5	8.5 V
R1191N086D	6 8 6	8.6 V
R1191N087D	6 8 7	8.7 V
R1191N088D	6 8 8	8.8 V
R1191N089D	6 8 9	8.9 V
R1191N090D	6 9 0	9.0 V
R1191N091D	6 9 1	9.1 V
R1191N092D	6 9 2	9.2 V
R1191N093D	6 9 3	9.3 V
R1191N094D	6 9 4	9.4 V
R1191N095D	6 9 5	9.5 V
R1191N096D	6 9 6	9.6 V
R1191N097D	6 9 7	9.7 V
R1191N098D	6 9 8	9.8 V
R1191N099D	6 9 9	9.9 V
R1191N100D	7 0 0	10.0 V
R1191N101D	7 0 1	10.1 V
R1191N102D	7 0 2	10.2 V
R1191N103D	7 0 3	10.3 V
R1191N104D	7 0 4	10.4 V
R1191N105D	7 0 5	10.5 V
R1191N106D	7 0 6	10.6 V
R1191N107D	7 0 7	10.7 V
R1191N108D	7 0 8	10.8 V
R1191N109D	7 0 9	10.9 V
R1191N110D	7 1 0	11.0 V
R1191N111D	7 1 1	11.1 V
R1191N112D	7 1 2	11.2 V
R1191N113D	7 1 3	11.3 V
R1191N114D	7 1 4	11.4 V
R1191N115D	7 1 5	11.5 V
R1191N116D	7 1 6	11.6 V
R1191N117D	7 1 7	11.7 V
R1191N118D	7 1 8	11.8 V
R1191N119D	7 1 9	11.9 V

Product Name	① ② ③	SET V_{OUT}
R1191N120D	7 2 0	12.0 V
R1191N121D	7 2 1	12.1 V
R1191N122D	7 2 2	12.2 V
R1191N123D	7 2 3	12.3 V
R1191N124D	7 2 4	12.4 V
R1191N125D	7 2 5	12.5 V
R1191N126D	7 2 6	12.6 V
R1191N127D	7 2 7	12.7 V
R1191N128D	7 2 8	12.8 V
R1191N129D	7 2 9	12.9 V
R1191N130D	7 3 0	13.0 V
R1191N131D	7 3 1	13.1 V
R1191N132D	7 3 2	13.2 V
R1191N133D	7 3 3	13.3 V
R1191N134D	7 3 4	13.4 V
R1191N135D	7 3 5	13.5 V
R1191N136D	7 3 6	13.6 V
R1191N137D	7 3 7	13.7 V
R1191N138D	7 3 8	13.8 V
R1191N139D	7 3 9	13.9 V
R1191N140D	7 4 0	14.0 V
R1191N141D	7 4 1	14.1 V
R1191N142D	7 4 2	14.2 V
R1191N143D	7 4 3	14.3 V
R1191N144D	7 4 4	14.4 V
R1191N145D	7 4 5	14.5 V
R1191N146D	7 4 6	14.6 V
R1191N147D	7 4 7	14.7 V
R1191N148D	7 4 8	14.8 V
R1191N149D	7 4 9	14.9 V
R1191N150D	7 5 0	15.0 V

PD-SOT-89-5-(85125)-JE-A

The power dissipation of the package is dependent on PCB material, layout, and environmental conditions. The following measurement conditions are based on JEDEC STD. 51-7.

Measurement Conditions

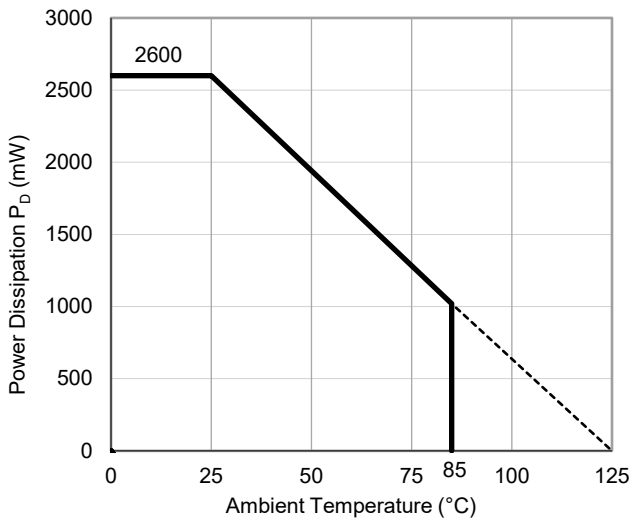
Item	Measurement Conditions
Environment	Mounting on Board (Wind Velocity = 0 m/s)
Board Material	Glass Cloth Epoxy Plastic (Four-Layer Board)
Board Dimensions	76.2 mm × 114.3 mm × 0.8 mm
Copper Ratio	Outer Layer (First Layer): Less than 95% of 50 mm Square Inner Layers (Second and Third Layers): Approx. 100% of 50 mm Square Outer Layer (Fourth Layer): Approx. 100% of 50 mm Square
Through-holes	ϕ 0.3 mm × 13 pcs

Measurement Result (Ta = 25°C, Tjmax = 125°C)

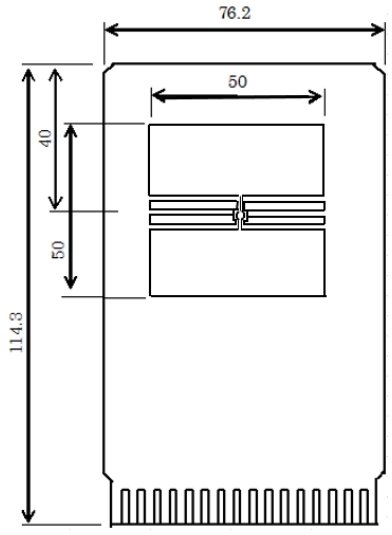
Item	Measurement Result
Power Dissipation	2600 mW
Thermal Resistance (θja)	θja = 38°C/W
Thermal Characterization Parameter (ψjt)	ψjt = 13°C/W

θja: Junction-to-Ambient Thermal Resistance

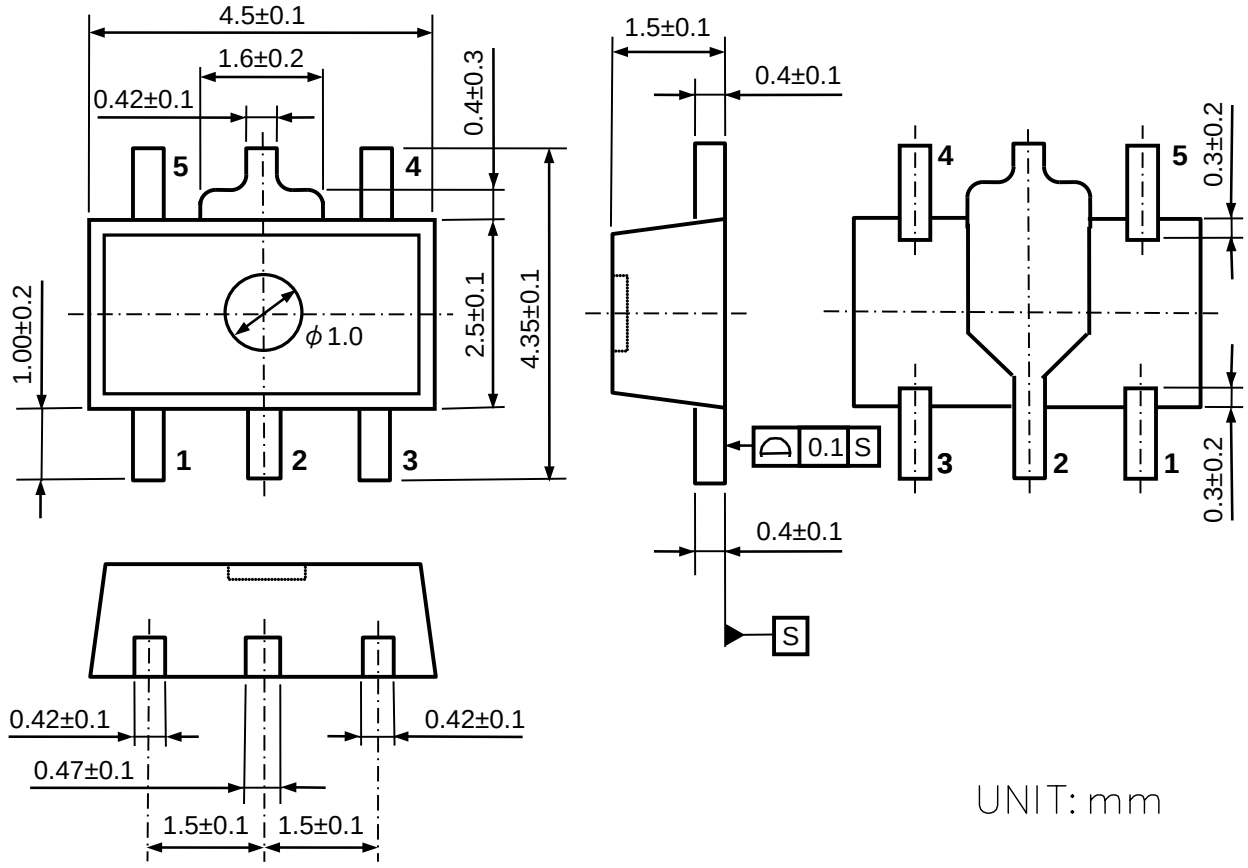
ψjt: Junction-to-Top Thermal Characterization Parameter



Power Dissipation vs. Ambient Temperature



Measurement Board Pattern

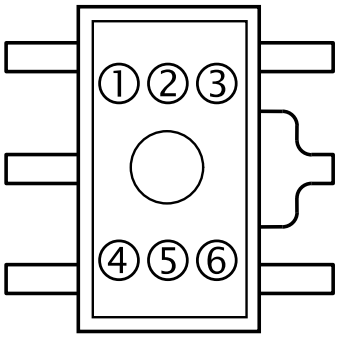


SOT-89-5 Package Dimensions

MK-R1191H-JE-B

①②③④: Product Code ⋯ Refer to *Part Marking List*

⑤⑥: Lot Number ⋯ Alphanumeric Serial Number



SOT-89-5 Part Markings

NOTICE
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MK-R1191H-JE-B

R1191HxxxB Part Marking List

Product Name	①②③④	Set V_{OUT}
R1191H020B	S 0 2 0	2.0 V
R1191H021B	S 0 2 1	2.1 V
R1191H022B	S 0 2 2	2.2 V
R1191H023B	S 0 2 3	2.3 V
R1191H024B	S 0 2 4	2.4 V
R1191H025B	S 0 2 5	2.5 V
R1191H026B	S 0 2 6	2.6 V
R1191H027B	S 0 2 7	2.7 V
R1191H028B	S 0 2 8	2.8 V
R1191H029B	S 0 2 9	2.9 V
R1191H030B	S 0 3 0	3.0 V
R1191H031B	S 0 3 1	3.1 V
R1191H032B	S 0 3 2	3.2 V
R1191H033B	S 0 3 3	3.3 V
R1191H034B	S 0 3 4	3.4 V
R1191H035B	S 0 3 5	3.5 V
R1191H036B	S 0 3 6	3.6 V
R1191H037B	S 0 3 7	3.7 V
R1191H038B	S 0 3 8	3.8 V
R1191H039B	S 0 3 9	3.9 V
R1191H040B	S 0 4 0	4.0 V
R1191H041B	S 0 4 1	4.1 V
R1191H042B	S 0 4 2	4.2 V
R1191H043B	S 0 4 3	4.3 V
R1191H044B	S 0 4 4	4.4 V
R1191H045B	S 0 4 5	4.5 V
R1191H046B	S 0 4 6	4.6 V
R1191H047B	S 0 4 7	4.7 V
R1191H048B	S 0 4 8	4.8 V
R1191H049B	S 0 4 9	4.9 V
R1191H050B	S 0 5 0	5.0 V
R1191H051B	S 0 5 1	5.1 V
R1191H052B	S 0 5 2	5.2 V
R1191H053B	S 0 5 3	5.3 V
R1191H054B	S 0 5 4	5.4 V
R1191H055B	S 0 5 5	5.5 V
R1191H056B	S 0 5 6	5.6 V
R1191H057B	S 0 5 7	5.7 V
R1191H058B	S 0 5 8	5.8 V
R1191H059B	S 0 5 9	5.9 V
R1191H060B	S 0 6 0	6.0 V
R1191H061B	S 0 6 1	6.1 V
R1191H062B	S 0 6 2	6.2 V
R1191H063B	S 0 6 3	6.3 V
R1191H064B	S 0 6 4	6.4 V
R1191H065B	S 0 6 5	6.5 V
R1191H066B	S 0 6 6	6.6 V
R1191H067B	S 0 6 7	6.7 V
R1191H068B	S 0 6 8	6.8 V
R1191H069B	S 0 6 9	6.9 V

Product Name	①②③④	Set V_{OUT}
R1191H070B	S 0 7 0	7.0 V
R1191H071B	S 0 7 1	7.1 V
R1191H072B	S 0 7 2	7.2 V
R1191H073B	S 0 7 3	7.3 V
R1191H074B	S 0 7 4	7.4 V
R1191H075B	S 0 7 5	7.5 V
R1191H076B	S 0 7 6	7.6 V
R1191H077B	S 0 7 7	7.7 V
R1191H078B	S 0 7 8	7.8 V
R1191H079B	S 0 7 9	7.9 V
R1191H080B	S 0 8 0	8.0 V
R1191H081B	S 0 8 1	8.1 V
R1191H082B	S 0 8 2	8.2 V
R1191H083B	S 0 8 3	8.3 V
R1191H084B	S 0 8 4	8.4 V
R1191H085B	S 0 8 5	8.5 V
R1191H086B	S 0 8 6	8.6 V
R1191H087B	S 0 8 7	8.7 V
R1191H088B	S 0 8 8	8.8 V
R1191H089B	S 0 8 9	8.9 V
R1191H090B	S 0 9 0	9.0 V
R1191H091B	S 0 9 1	9.1 V
R1191H092B	S 0 9 2	9.2 V
R1191H093B	S 0 9 3	9.3 V
R1191H094B	S 0 9 4	9.4 V
R1191H095B	S 0 9 5	9.5 V
R1191H096B	S 0 9 6	9.6 V
R1191H097B	S 0 9 7	9.7 V
R1191H098B	S 0 9 8	9.8 V
R1191H099B	S 0 9 9	9.9 V
R1191H100B	S 1 0 0	10.0 V
R1191H101B	S 1 0 1	10.1 V
R1191H102B	S 1 0 2	10.2 V
R1191H103B	S 1 0 3	10.3 V
R1191H104B	S 1 0 4	10.4 V
R1191H105B	S 1 0 5	10.5 V
R1191H106B	S 1 0 6	10.6 V
R1191H107B	S 1 0 7	10.7 V
R1191H108B	S 1 0 8	10.8 V
R1191H109B	S 1 0 9	10.9 V
R1191H110B	S 1 1 0	11.0 V
R1191H111B	S 1 1 1	11.1 V
R1191H112B	S 1 1 2	11.2 V
R1191H113B	S 1 1 3	11.3 V
R1191H114B	S 1 1 4	11.4 V
R1191H115B	S 1 1 5	11.5 V
R1191H116B	S 1 1 6	11.6 V
R1191H117B	S 1 1 7	11.7 V
R1191H118B	S 1 1 8	11.8 V
R1191H119B	S 1 1 9	11.9 V

Product Name	①②③④	Set V_{OUT}
R1191H120B	S 1 2 0	12.0 V
R1191H121B	S 1 2 1	12.1 V
R1191H122B	S 1 2 2	12.2 V
R1191H123B	S 1 2 3	12.3 V
R1191H124B	S 1 2 4	12.4 V
R1191H125B	S 1 2 5	12.5 V
R1191H126B	S 1 2 6	12.6 V
R1191H127B	S 1 2 7	12.7 V
R1191H128B	S 1 2 8	12.8 V
R1191H129B	S 1 2 9	12.9 V
R1191H130B	S 1 3 0	13.0 V
R1191H131B	S 1 3 1	13.1 V
R1191H132B	S 1 3 2	13.2 V
R1191H133B	S 1 3 3	13.3 V
R1191H134B	S 1 3 4	13.4 V
R1191H135B	S 1 3 5	13.5 V
R1191H136B	S 1 3 6	13.6 V
R1191H137B	S 1 3 7	13.7 V
R1191H138B	S 1 3 8	13.8 V
R1191H139B	S 1 3 9	13.9 V
R1191H140B	S 1 4 0	14.0 V
R1191H141B	S 1 4 1	14.1 V
R1191H142B	S 1 4 2	14.2 V
R1191H143B	S 1 4 3	14.3 V
R1191H144B	S 1 4 4	14.4 V
R1191H145B	S 1 4 5	14.5 V
R1191H146B	S 1 4 6	14.6 V
R1191H147B	S 1 4 7	14.7 V
R1191H148B	S 1 4 8	14.8 V
R1191H149B	S 1 4 9	14.9 V
R1191H150B	S 1 5 0	15.0 V

MK-R1191H-JE-B

R1191HxxxD Part Marking List

Product Name	①②③④	Set V_{OUT}
R1191H020D	T 0 2 0	2.0 V
R1191H021D	T 0 2 1	2.1 V
R1191H022D	T 0 2 2	2.2 V
R1191H023D	T 0 2 3	2.3 V
R1191H024D	T 0 2 4	2.4 V
R1191H025D	T 0 2 5	2.5 V
R1191H026D	T 0 2 6	2.6 V
R1191H027D	T 0 2 7	2.7 V
R1191H028D	T 0 2 8	2.8 V
R1191H029D	T 0 2 9	2.9 V
R1191H030D	T 0 3 0	3.0 V
R1191H031D	T 0 3 1	3.1 V
R1191H032D	T 0 3 2	3.2 V
R1191H033D	T 0 3 3	3.3 V
R1191H034D	T 0 3 4	3.4 V
R1191H035D	T 0 3 5	3.5 V
R1191H036D	T 0 3 6	3.6 V
R1191H037D	T 0 3 7	3.7 V
R1191H038D	T 0 3 8	3.8 V
R1191H039D	T 0 3 9	3.9 V
R1191H040D	T 0 4 0	4.0 V
R1191H041D	T 0 4 1	4.1 V
R1191H042D	T 0 4 2	4.2 V
R1191H043D	T 0 4 3	4.3 V
R1191H044D	T 0 4 4	4.4 V
R1191H045D	T 0 4 5	4.5 V
R1191H046D	T 0 4 6	4.6 V
R1191H047D	T 0 4 7	4.7 V
R1191H048D	T 0 4 8	4.8 V
R1191H049D	T 0 4 9	4.9 V
R1191H050D	T 0 5 0	5.0 V
R1191H051D	T 0 5 1	5.1 V
R1191H052D	T 0 5 2	5.2 V
R1191H053D	T 0 5 3	5.3 V
R1191H054D	T 0 5 4	5.4 V
R1191H055D	T 0 5 5	5.5 V
R1191H056D	T 0 5 6	5.6 V
R1191H057D	T 0 5 7	5.7 V
R1191H058D	T 0 5 8	5.8 V
R1191H059D	T 0 5 9	5.9 V
R1191H060D	T 0 6 0	6.0 V
R1191H061D	T 0 6 1	6.1 V
R1191H062D	T 0 6 2	6.2 V
R1191H063D	T 0 6 3	6.3 V
R1191H064D	T 0 6 4	6.4 V
R1191H065D	T 0 6 5	6.5 V
R1191H066D	T 0 6 6	6.6 V
R1191H067D	T 0 6 7	6.7 V
R1191H068D	T 0 6 8	6.8 V
R1191H069D	T 0 6 9	6.9 V

Product Name	①②③④	Set V_{OUT}
R1191H070D	T 0 7 0	7.0 V
R1191H071D	T 0 7 1	7.1 V
R1191H072D	T 0 7 2	7.2 V
R1191H073D	T 0 7 3	7.3 V
R1191H074D	T 0 7 4	7.4 V
R1191H075D	T 0 7 5	7.5 V
R1191H076D	T 0 7 6	7.6 V
R1191H077D	T 0 7 7	7.7 V
R1191H078D	T 0 7 8	7.8 V
R1191H079D	T 0 7 9	7.9 V
R1191H080D	T 0 8 0	8.0 V
R1191H081D	T 0 8 1	8.1 V
R1191H082D	T 0 8 2	8.2 V
R1191H083D	T 0 8 3	8.3 V
R1191H084D	T 0 8 4	8.4 V
R1191H085D	T 0 8 5	8.5 V
R1191H086D	T 0 8 6	8.6 V
R1191H087D	T 0 8 7	8.7 V
R1191H088D	T 0 8 8	8.8 V
R1191H089D	T 0 8 9	8.9 V
R1191H090D	T 0 9 0	9.0 V
R1191H091D	T 0 9 1	9.1 V
R1191H092D	T 0 9 2	9.2 V
R1191H093D	T 0 9 3	9.3 V
R1191H094D	T 0 9 4	9.4 V
R1191H095D	T 0 9 5	9.5 V
R1191H096D	T 0 9 6	9.6 V
R1191H097D	T 0 9 7	9.7 V
R1191H098D	T 0 9 8	9.8 V
R1191H099D	T 0 9 9	9.9 V
R1191H100D	T 1 0 0	10.0 V
R1191H101D	T 1 0 1	10.1 V
R1191H102D	T 1 0 2	10.2 V
R1191H103D	T 1 0 3	10.3 V
R1191H104D	T 1 0 4	10.4 V
R1191H105D	T 1 0 5	10.5 V
R1191H106D	T 1 0 6	10.6 V
R1191H107D	T 1 0 7	10.7 V
R1191H108D	T 1 0 8	10.8 V
R1191H109D	T 1 0 9	10.9 V
R1191H110D	T 1 1 0	11.0 V
R1191H111D	T 1 1 1	11.1 V
R1191H112D	T 1 1 2	11.2 V
R1191H113D	T 1 1 3	11.3 V
R1191H114D	T 1 1 4	11.4 V
R1191H115D	T 1 1 5	11.5 V
R1191H116D	T 1 1 6	11.6 V
R1191H117D	T 1 1 7	11.7 V
R1191H118D	T 1 1 8	11.8 V
R1191H119D	T 1 1 9	11.9 V

Product Name	①②③④	Set V_{OUT}
R1191H120D	T 1 2 0	12.0 V
R1191H121D	T 1 2 1	12.1 V
R1191H122D	T 1 2 2	12.2 V
R1191H123D	T 1 2 3	12.3 V
R1191H124D	T 1 2 4	12.4 V
R1191H125D	T 1 2 5	12.5 V
R1191H126D	T 1 2 6	12.6 V
R1191H127D	T 1 2 7	12.7 V
R1191H128D	T 1 2 8	12.8 V
R1191H129D	T 1 2 9	12.9 V
R1191H130D	T 1 3 0	13.0 V
R1191H131D	T 1 3 1	13.1 V
R1191H132D	T 1 3 2	13.2 V
R1191H133D	T 1 3 3	13.3 V
R1191H134D	T 1 3 4	13.4 V
R1191H135D	T 1 3 5	13.5 V
R1191H136D	T 1 3 6	13.6 V
R1191H137D	T 1 3 7	13.7 V
R1191H138D	T 1 3 8	13.8 V
R1191H139D	T 1 3 9	13.9 V
R1191H140D	T 1 4 0	14.0 V
R1191H141D	T 1 4 1	14.1 V
R1191H142D	T 1 4 2	14.2 V
R1191H143D	T 1 4 3	14.3 V
R1191H144D	T 1 4 4	14.4 V
R1191H145D	T 1 4 5	14.5 V
R1191H146D	T 1 4 6	14.6 V
R1191H147D	T 1 4 7	14.7 V
R1191H148D	T 1 4 8	14.8 V
R1191H149D	T 1 4 9	14.9 V
R1191H150D	T 1 5 0	15.0 V

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