

## 1 A Voltage Regulator (Operating Voltage up to 16 V) for Automotive Applications

NO.EC-183-131101

### OUTLINE

The R1190x series are a low supply current voltage regulator with high output voltage accuracy. The maximum operating voltage is 16V and the output current is 1A. Each of these ICs consists of a voltage reference unit, an error amplifier, a resistor-net for voltage setting, as a short current protection, a peak current protection, a thermal shutdown, an inrush current limit and a chip enable circuit. The wide input voltage range (Max. 16V). Additionally, the output voltage is fixed internally, in the range from 2.0V to 12.0V by the 0.1V steps. The supply current of R1190x series is excellent (Typ. 150 $\mu$ A) moreover R1190x series has the standby mode (Typ. 0.1 $\mu$ A) by the chip enable function.

Since the package for these ICs are TO-252-5-P2 and HSOP-6J with high power dissipation, high density mounting of the ICs on boards is possible.

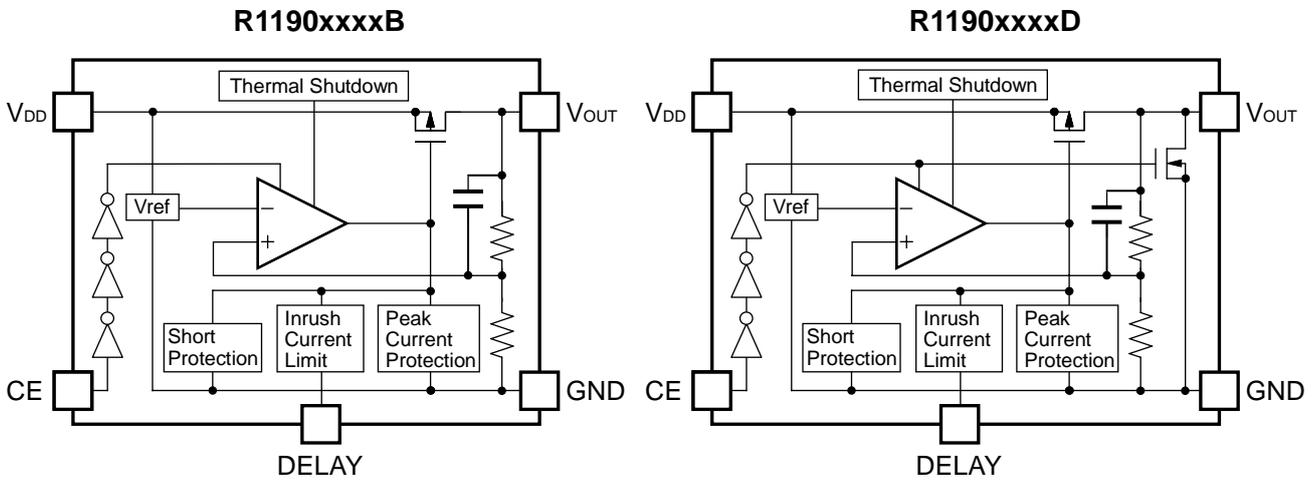
### FEATURES

- Input Voltage Range (Maximum Rating) .....3.5V to 16V (18 V)
- Supply Current..... Typ. 150 $\mu$ A
- Standby Current..... Typ. 0.1 $\mu$ A
- Output Voltage Range .....2.0V to 12.0V (0.1V steps)
- Output Voltage Accuracy .....  $\pm$ 1.5%
- Temperature-Drift Coefficient of Output Voltage... Typ.  $\pm$ 100ppm/ $^{\circ}$ C
- Dropout Voltage..... Typ. 1.1V ( $I_{OUT}$ =1A,  $V_{OUT}$ =5V)
- Output Current..... Min. 1A ( $3.3V \leq V_{OUT} \leq 12.0V$ )
- Line Regulation..... Typ. 0.02%/V
- Ripple Rejection ..... Typ. 60 dB
- Packages..... HSOP-6J, TO-252-5-P2
- Built-in Fold Back Protection Circuit..... Typ.300mA (Current at short mode)
- Built-in Thermal Shutdown Circuit
- Built-in Inrush Current Limit Circuit..... The Delay Pin for setting Inrush Current Limit Time

### APPLICATIONS

- Power source for accessories such as car audios, car navigation systems, and ETC systems

## BLOCK DIAGRAMS



## SELECTION GUIDE

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

Product Name	Package	Quantity per Reel	Pb Free	Halogen Free
R1190Sxxx*-E2-#E	HSOP-6J	1,000 pcs	Yes	Yes
R1190Jxxx*-T1-#E	TO-252-5-P2	3,000 pcs	Yes	Yes

xxx : The output voltage can be designated in the range of 2.0V(020) to 12.0V(120) in 0.1V steps.

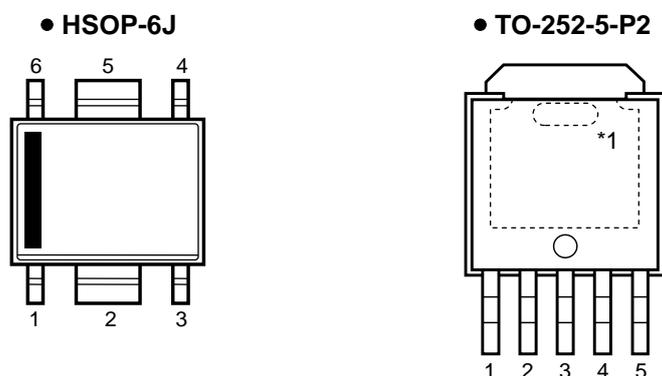
\* : The auto discharge function at off state are options as follows.  
 (B) without auto discharge function at off state  
 (D) with auto discharge function at off state

#: Specify Automotive Class Code

	Operating Temperature Range	Guaranteed Specs Temperature Range	Screening
A	-40°C ~ 85°C	25°C	High Temperature

Auto-discharge function quickly lowers the output voltage to 0V by releasing the electrical charge accumulated in the external capacitor when the chip enable signal is switched from the active mode to the standby mode.

## PIN DESCRIPTIONS



### • HSOP-6J

Pin No.	Symbol	Description
1	$V_{OUT}$	Output Pin
2	GND	Ground Pin
3	CE	Chip Enable Pin ("H" Active)
4	DELAY	Delay Pin (for setting Inrush Current Limit Time)
5	GND	Ground Pin
6	$V_{DD}$	Input Pin

### • TO-252-5-P2

Pin No.	Symbol	Description
1	DELAY	Delay Pin (for setting Inrush Current Limit Time)
2	$V_{DD}$	Input Pin
3	GND	Ground Pin
4	$V_{OUT}$	Output Pin
5	CE	Chip Enable Pin ("H" Active)

\*1 The tab on the bottom of the package enhances thermal performance and is electrically connected to GND (substrate level). It is recommended that the tab be connected to the ground plane on the board, or otherwise be left open.

## ABSOLUTE MAXIMUM RATINGS

Symbol	Item		Rating	Unit	
$V_{IN}$	Input Voltage		-0.3 to 18	V	
$V_{CE}$	Input Voltage (CE Pin)		-0.3 to $V_{IN}+0.3 \leq 18$	V	
$V_{OUT}$	Output Voltage		-0.3 to $V_{IN}+0.3 \leq 18$	V	
$P_D$	Power Dissipation	HSOP-6J*	Standard Land Pattern	1700	mW
			Ultra High Wattage Land Pattern	2700	
		TO-252-5-P2*	Standard Land Pattern	1900	
			Ultra High Wattage Land Pattern	3800	
$T_j$	Junction Temperature		-40 to 125	°C	
$T_{stg}$	Storage Temperature Range		-55 to 125	°C	

\*) Refer to *PACKAGE INFORMATION* for detailed information.

### 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 RATINGS

Symbol	Item	Rating	Unit
$V_{IN}$	Input Voltage	3.5 to 16	V
$T_a$	Operating Temperature Range	-40 to 85	°C

### RECOMMENDED OPERATING RATINGS

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

## ELECTRICAL CHARACTERISTICS

$V_{IN}=CE=Set V_{OUT} + 2.0V$ ,  $C_{IN}=4.7\mu F$ ,  $C_{OUT}=4.7\mu F$ ,  $I_{OUT}=1mA$ , unless otherwise noted.

The specifications surrounded by   are guaranteed by Design Engineering at  $-40^{\circ}C \leq Ta \leq 85^{\circ}C$ .

### R1190xxxxB/D

( $Ta=25^{\circ}C$ )

Symbol	Item	Conditions	MIN.	TYP.	MAX.	Unit
$V_{OUT}$	Output Voltage	$I_{OUT}=1mA$	$Ta=25^{\circ}C$	x 0.985	x 1.015	V
			$-40^{\circ}C \leq Ta \leq 85^{\circ}C$	<span style="border: 1px solid black; padding: 0 2px;">x 0.973</span>	<span style="border: 1px solid black; padding: 0 2px;">x 1.027</span>	
$I_{LIM}$	Output Current Limit	$V_{IN}=V_{OUT}+2.3V$	$2.0 \leq V_{OUT}<2.5$	<span style="border: 1px solid black; padding: 0 2px;">600</span>		mA
			$2.5 \leq V_{OUT}<3.3$	<span style="border: 1px solid black; padding: 0 2px;">700</span>		
			$3.3 \leq V_{OUT} \leq 12.0$	<span style="border: 1px solid black; padding: 0 2px;">1000</span>		
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	Please see the following table *(1)				
$V_{DIF}$	Dropout Voltage	Please see the following table *(2)				
$I_{SS}$	Supply Current	$I_{OUT}=0mA$		150	<span style="border: 1px solid black; padding: 0 2px;">220</span>	$\mu A$
$I_{standby}$	Supply Current (CE Off State)	$V_{IN}=16V$ $V_{CE}=0V$		0.1	1.0	$\mu A$
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	$V_{OUT}+0.5V(\text{Min. } 3.5V) \leq V_{IN} \leq 16V$ $I_{OUT}=1mA$		0.02	<span style="border: 1px solid black; padding: 0 2px;">0.10</span>	%/V
$I_{SC}$	Short Current Limit	$V_{OUT}=0V$		300		mA
$V_{CEH}$	CE Input Voltage "H"		<span style="border: 1px solid black; padding: 0 2px;">1.6</span>		$V_{IN}$	V
$V_{CEL}$	CE Input Voltage "L"		0.0		<span style="border: 1px solid black; padding: 0 2px;">0.6</span>	V
$T_{TSD}$	Thermal Shutdown Temperature	Junction Temperature		150		$^{\circ}C$
$T_{TSR}$	Thermal Shutdown Released Temperature	Junction Temperature		130		$^{\circ}C$
$R_{LOW}$	Nch On Resistance for Auto Discharge (D Version Only)	$V_{IN}=5.0V$ $V_{CE}=0V$ $V_{OUT}=0.3V$		100		$\Omega$

All of units are tested and specified under pulse load conditions such that  $T_j \approx Ta = 25^{\circ}C$  except for Thermal Shutdown, Load Regulation at  $0.1mA \leq V_{OUT} \leq 600mA (2.0 \leq V_{OUT} < 2.5V)$  and at  $0.1mA \leq V_{OUT} \leq 700mA (2.5 \leq V_{OUT} < 3.3V)$  and at  $0.1mA \leq V_{OUT} \leq 1000mA (3.3 \leq V_{OUT} \leq 12.0V)$ , Dropout Voltage at  $I_{OUT}=600mA (2.0 \leq V_{OUT} < 2.5V)$  and at  $I_{OUT}=700mA (2.5 \leq V_{OUT} < 3.3V)$  and at  $I_{OUT}=1000mA (3.3 \leq V_{OUT} \leq 12.0V)$

# R1190x

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$V_{IN}=CE=Set V_{OUT} + 2.0V$ ,  $C_{IN}=4.7\mu F$ ,  $C_{OUT}=4.7\mu F$ ,  $I_{OUT}=1mA$ , unless otherwise noted.

The specifications surrounded by   are guaranteed by Design Engineering at  $-40^{\circ}C \leq Ta \leq 85^{\circ}C$ .

## \* (1) Load Regulation

( $Ta=25^{\circ}C$ )

Output Voltage $V_{OUT}$ (V)	Load Regulation $\Delta V_{OUT}/\Delta I_{OUT}$ (mV)			
	Condition	Typ.	Max.	
$2.0 \leq V_{OUT} < 2.5$	$V_{IN}=V_{OUT}+2.3V$	$1mA \leq I_{OUT} \leq 200mA$	20	<span style="border: 1px solid black; padding: 0 2px;">60</span>
		$1mA \leq I_{OUT} \leq 600mA$	80	<span style="border: 1px solid black; padding: 0 2px;">180</span>
$2.5 \leq V_{OUT} < 3.3$	$V_{IN}=V_{OUT}+2.3V$	$1mA \leq I_{OUT} \leq 200mA$	20	<span style="border: 1px solid black; padding: 0 2px;">60</span>
		$1mA \leq I_{OUT} \leq 700mA$	90	<span style="border: 1px solid black; padding: 0 2px;">200</span>
$3.3 \leq V_{OUT} < 5.0$	$V_{IN}=V_{OUT}+2.3V$	$1mA \leq I_{OUT} \leq 200mA$	20	<span style="border: 1px solid black; padding: 0 2px;">60</span>
		$1mA \leq I_{OUT} \leq 1000mA$	120	<span style="border: 1px solid black; padding: 0 2px;">230</span>
$5.0 \leq V_{OUT} \leq 12.0$	$V_{IN}=V_{OUT}+2.3V$	$1mA \leq I_{OUT} \leq 200mA$	40	<span style="border: 1px solid black; padding: 0 2px;">100</span>
		$1mA \leq I_{OUT} \leq 1000mA$	130	<span style="border: 1px solid black; padding: 0 2px;">250</span>

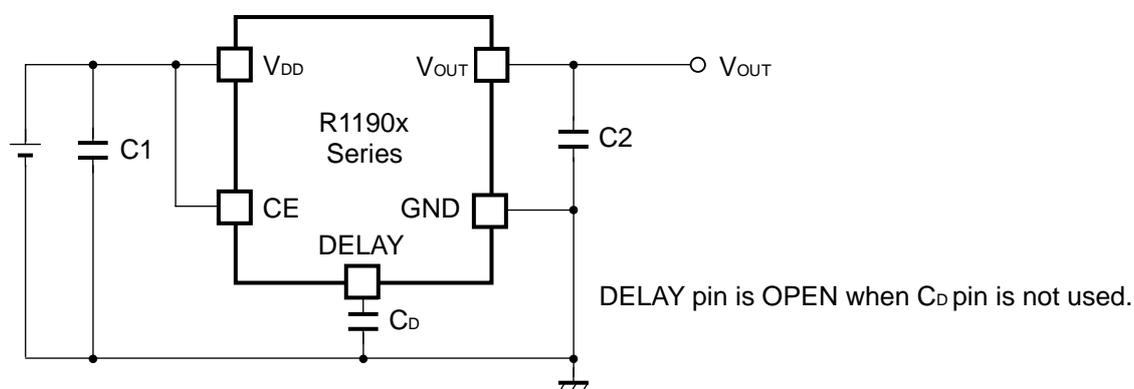
## \* (2) Dropout Voltage

( $Ta=25^{\circ}C$ )

Output Voltage $V_{OUT}$ (V)	Dropout Voltage $V_{DIF}$ (V)			Output Voltage $V_{OUT}$ (V)	Dropout Voltage $V_{DIF}$ (V)			
	Condition	Typ.	Max.		Condition	Typ.	Max.	
2.0	$I_{OUT}=200mA$		<span style="border: 1px solid black; padding: 0 2px;">1.5</span>	$2.0 \leq V_{OUT} < 2.5$	$I_{OUT}=600mA$	1.6	<span style="border: 1px solid black; padding: 0 2px;">2.2</span>	
2.1			<span style="border: 1px solid black; padding: 0 2px;">1.4</span>					
2.2			<span style="border: 1px solid black; padding: 0 2px;">1.3</span>					
2.3			<span style="border: 1px solid black; padding: 0 2px;">1.2</span>					
2.4			<span style="border: 1px solid black; padding: 0 2px;">1.1</span>					
2.5			<span style="border: 1px solid black; padding: 0 2px;">1.0</span>					
2.6			<span style="border: 1px solid black; padding: 0 2px;">0.9</span>	$2.5 \leq V_{OUT} < 3.3$	$I_{OUT}=700mA$	1.5	<span style="border: 1px solid black; padding: 0 2px;">2.15</span>	
2.7			<span style="border: 1px solid black; padding: 0 2px;">0.8</span>					
$2.8 \leq V_{OUT} < 3.1$			<span style="border: 1px solid black; padding: 0 2px;">0.7</span>					
$3.1 \leq V_{OUT} < 3.3$			0.4					<span style="border: 1px solid black; padding: 0 2px;">0.7</span>
$3.3 \leq V_{OUT} < 4.0$	0.3	<span style="border: 1px solid black; padding: 0 2px;">0.53</span>						
$4.0 \leq V_{OUT} < 5.0$	0.25	<span style="border: 1px solid black; padding: 0 2px;">0.42</span>	$3.3 \leq V_{OUT} \leq 12.0$	$I_{OUT}=1000mA$	1.6	<span style="border: 1px solid black; padding: 0 2px;">2.3</span>		
$5.0 \leq V_{OUT} < 9.0$	0.19	<span style="border: 1px solid black; padding: 0 2px;">0.31</span>						
$9.0 \leq V_{OUT} \leq 12.0$	0.1	<span style="border: 1px solid black; padding: 0 2px;">0.18</span>					1.4	<span style="border: 1px solid black; padding: 0 2px;">2.1</span>
							1.1	<span style="border: 1px solid black; padding: 0 2px;">1.85</span>
			0.8	<span style="border: 1px solid black; padding: 0 2px;">1.30</span>				

All of units are tested and specified under pulse load conditions such that  $T_j \approx Ta = 25^{\circ}C$  except for Thermal Shutdown, Load Regulation at  $0.1mA \leq V_{OUT} \leq 600mA$  ( $2.0 \leq V_{OUT} < 2.5V$ ) and at  $0.1mA \leq V_{OUT} \leq 700mA$  ( $2.5 \leq V_{OUT} < 3.3V$ ) and at  $0.1mA \leq V_{OUT} \leq 1000mA$  ( $3.3 \leq V_{OUT} \leq 12.0V$ ), Dropout Voltage at  $I_{OUT}=600mA$  ( $2.0 \leq V_{OUT} < 2.5V$ ) and at  $I_{OUT}=700mA$  ( $2.5 \leq V_{OUT} < 3.3V$ ) and at  $I_{OUT}=1000mA$  ( $3.3 \leq V_{OUT} \leq 12.0V$ )

## TYPICAL APPLICATION



(External Components)

C1, C2: Ceramic Capacitor 4.7 $\mu$ F Nippon Chemi-con Corporation KTD500B475M43A0T00

## 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  $C_{OUT}$  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 with a capacitance value as much as 4.7 $\mu$ F or more between  $V_{DD}$  and GND pin, and as close as possible to the pins.

Set external components, especially the output capacitor, as close as possible to the ICs, and make wiring as short as possible. (Refer to the TYPICAL APPLICATION diagram above.)

### Thermal Shutdown

There is the built-in thermal-shutdown function in R1190x 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. If the temperature increasing keeps the IC repeats ON and OFF operating. The output becomes the pulse condition.

### Chip Enable Circuit

For the output voltage stability, please do not use the intermediate electric potential (the voltage value between  $V_{CEH}$  and  $V_{CEL}$ ) that causes the supply current increasing and the unstable of output voltage.

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**Inrush-Current Limit Function**

R1190x Series has the function to limit the inrush-current, it limited approximately 0.3A when the voltage regulator is turn ON. It is also possible to set time of the rush-current limitation by connecting capacitor with DELAY pin. The rush-current time ( $t_D$ ) and the value of capacitor ( $C_D$ (F)) is calculatable by the following formula;

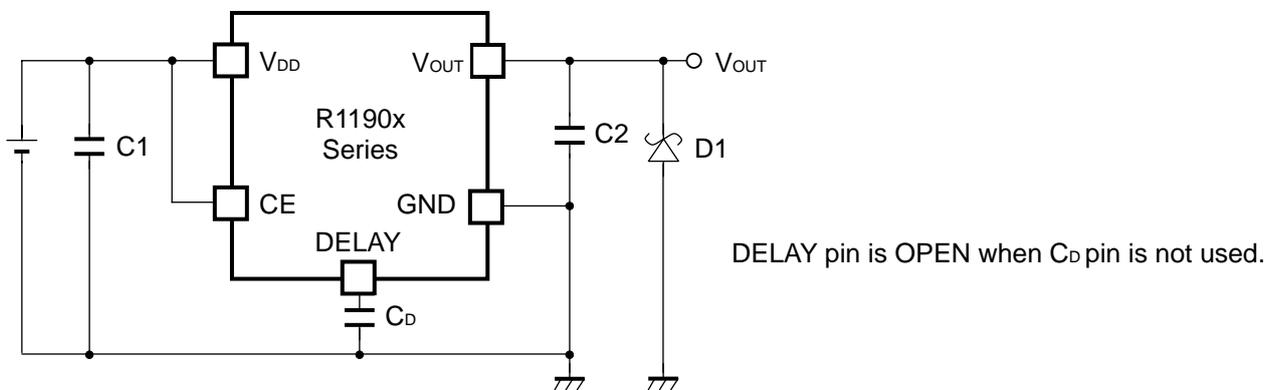
$$t_D = (0.000198 + (3.79 \times 10^7 \times C_D)) \times V_{IN}$$

The inrush-current is limited even if the capacitor is not connected with the DELAY pin. In this case, the time is calculated as  $C_D=0$  by the formula above.

Though, if the value of time is insufficient for controlling the inrush-current, please connect the capacitor with DELAY pin. The DELAY pin is used as OPEN when the capacitor is not used. Please use the DELAY pin as OPEN when the capacitor is not used.

**Auto-Discharge Function**

R1190xxxxD series has the auto-discharge function. When "L" signal is put into the Chip-enable pin (CE), the switch between  $V_{OUT}$  and GND is turned ON and the charge at capacitor is discharge rapidly by the auto-discharge function.

**TYPICAL APPLICATION FOR IC CHIP BREAKDOWN PREVENTION**

(External Components)

C1, C2: Ceramic Capacitor 4.7 $\mu$ F    Nippon Chemi-con Corporation    KTD500B475M43A0T00

When a sudden surge of electrical current travels along the  $V_{OUT}$  pin and GND due to a short-circuit, electrical resonance of a circuit involving an output capacitor ( $C_2$ ) and a short circuit inductor generates a negative voltage and may damage the device or the load devices. To prevent damage to the device or the load devices, it is recommended that a schottky diode ( $D_1$ ) be connected between the  $V_{OUT}$  pin and GND.

## PACKAGE INFORMATION

### POWER DISSIPATION (HSOP-6J)

Power Dissipation ( $P_D$ ) depends on conditions of mounting on board. This specification is based on the measurement at the condition below:

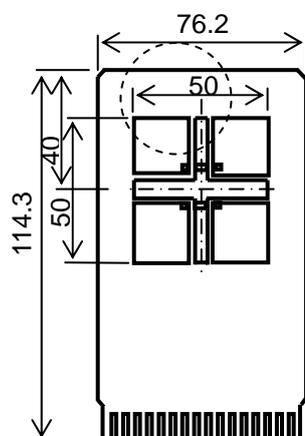
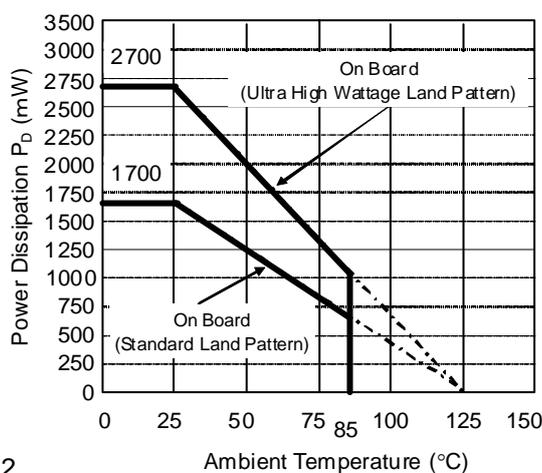
#### Measurement Conditions

	Ultra High Wattage Land Pattern	Standard Land Pattern
Environment	Mounting on Board (Wind velocity=0m/s)	Mounting on Board (Wind velocity=0m/s)
Board Material	Glass cloth epoxy plastic (4 Layers)	Glass cloth epoxy plastic (2 Layers)
Board Dimensions	76.2mm × 114.3mm × 0.8mm	50mm × 50mm × 1.6mm
Copper Ratio	96%	50%
Through-hole	φ0.3mm × 28pcs	φ0.5mm × 24pcs

#### Measurement Result

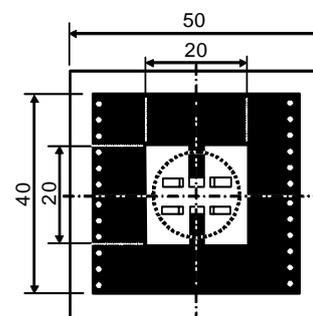
( $T_a=25^{\circ}\text{C}$ ,  $T_{j\text{max}}=125^{\circ}\text{C}$ )

	Ultra High Wattage Land Pattern	Standard Land Pattern	Free Air
Power Dissipation	2700mW	1700mW	540mW
Thermal Resistance	37°C/W	59°C/W	185°C/W



○ Ultra High Wattage Land Pattern  
IC mount area(Unit: mm)

#### Power Dissipation



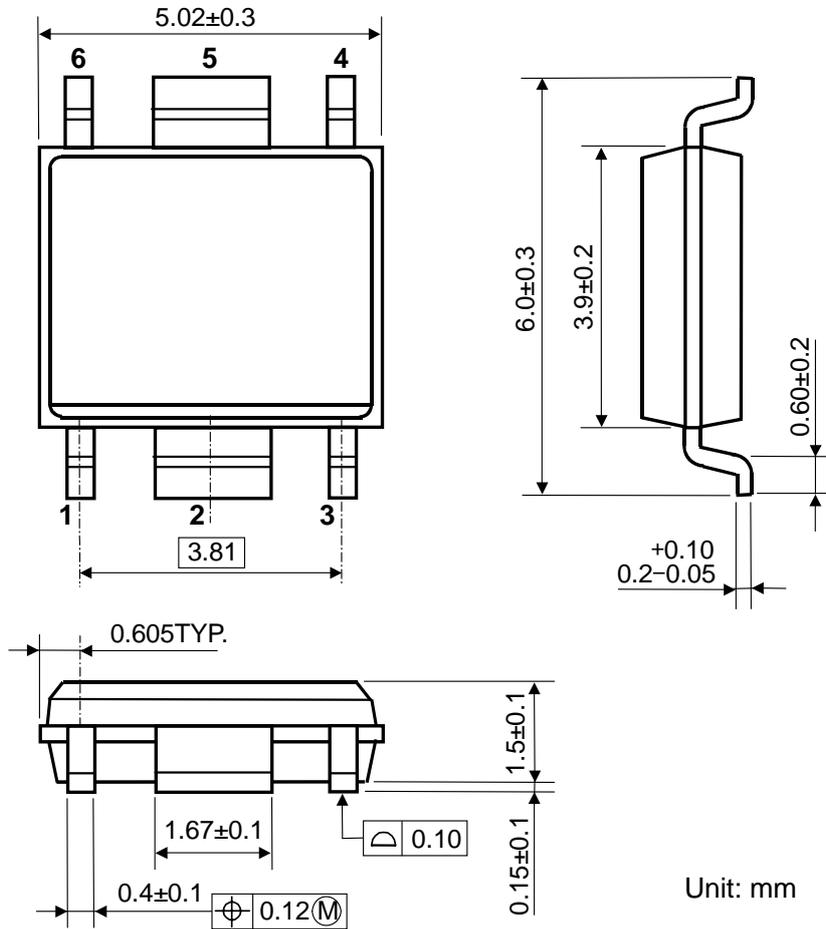
Standard

○ Measurement Board Pattern  
IC Mount Area (Unit : mm)

**R1190x**

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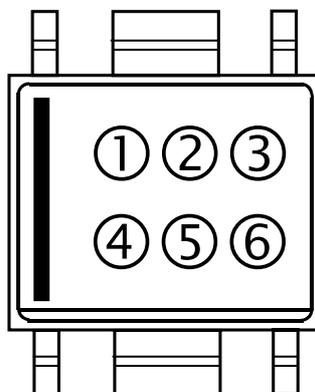
**PACKAGE DIMENSIONS (HSOP-6J)**



**MARK SPECIFICATION (HSOP-6J)**

①②③④: Product Code ... **Refer to MARK SPECIFICATION TABLE (HSOP-6J)**

⑤⑥: Lot Number ... Alphanumeric Serial Number



## MARK SPECIFICATION TABLE (HSOP-6J)

## R1190SxxxB

Product Name	① ② ③ ④	V <sub>SET</sub>	Product Name	① ② ③ ④	V <sub>SET</sub>	Product Name	① ② ③ ④	V <sub>SET</sub>
R1190S020B	L 0 2 0	2.0 V	R1190S060B	L 0 6 0	6.0 V	R1190S100B	L 1 0 0	10.0 V
R1190S021B	L 0 2 1	2.1 V	R1190S061B	L 0 6 1	6.1 V	R1190S101B	L 1 0 1	10.1 V
R1190S022B	L 0 2 2	2.2 V	R1190S062B	L 0 6 2	6.2 V	R1190S102B	L 1 0 2	10.2 V
R1190S023B	L 0 2 3	2.3 V	R1190S063B	L 0 6 3	6.3 V	R1190S103B	L 1 0 3	10.3 V
R1190S024B	L 0 2 4	2.4 V	R1190S064B	L 0 6 4	6.4 V	R1190S104B	L 1 0 4	10.4 V
R1190S025B	L 0 2 5	2.5 V	R1190S065B	L 0 6 5	6.5 V	R1190S105B	L 1 0 5	10.5 V
R1190S026B	L 0 2 6	2.6 V	R1190S066B	L 0 6 6	6.6 V	R1190S106B	L 1 0 6	10.6 V
R1190S027B	L 0 2 7	2.7 V	R1190S067B	L 0 6 7	6.7 V	R1190S107B	L 1 0 7	10.7 V
R1190S028B	L 0 2 8	2.8 V	R1190S068B	L 0 6 8	6.8 V	R1190S108B	L 1 0 8	10.8 V
R1190S029B	L 0 2 9	2.9 V	R1190S069B	L 0 6 9	6.9 V	R1190S109B	L 1 0 9	10.9 V
R1190S030B	L 0 3 0	3.0 V	R1190S070B	L 0 7 0	7.0 V	R1190S110B	L 1 1 0	11.0 V
R1190S031B	L 0 3 1	3.1 V	R1190S071B	L 0 7 1	7.1 V	R1190S111B	L 1 1 1	11.1 V
R1190S032B	L 0 3 2	3.2 V	R1190S072B	L 0 7 2	7.2 V	R1190S112B	L 1 1 2	11.2 V
R1190S033B	L 0 3 3	3.3 V	R1190S073B	L 0 7 3	7.3 V	R1190S113B	L 1 1 3	11.3 V
R1190S034B	L 0 3 4	3.4 V	R1190S074B	L 0 7 4	7.4 V	R1190S114B	L 1 1 4	11.4 V
R1190S035B	L 0 3 5	3.5 V	R1190S075B	L 0 7 5	7.5 V	R1190S115B	L 1 1 5	11.5 V
R1190S036B	L 0 3 6	3.6 V	R1190S076B	L 0 7 6	7.6 V	R1190S116B	L 1 1 6	11.6 V
R1190S037B	L 0 3 7	3.7 V	R1190S077B	L 0 7 7	7.7 V	R1190S117B	L 1 1 7	11.7 V
R1190S038B	L 0 3 8	3.8 V	R1190S078B	L 0 7 8	7.8 V	R1190S118B	L 1 1 8	11.8 V
R1190S039B	L 0 3 9	3.9 V	R1190S079B	L 0 7 9	7.9 V	R1190S119B	L 1 1 9	11.9 V
R1190S040B	L 0 4 0	4.0 V	R1190S080B	L 0 8 0	8.0 V	R1190S120B	L 1 2 0	12.0 V
R1190S041B	L 0 4 1	4.1 V	R1190S081B	L 0 8 1	8.1 V			
R1190S042B	L 0 4 2	4.2 V	R1190S082B	L 0 8 2	8.2 V			
R1190S043B	L 0 4 3	4.3 V	R1190S083B	L 0 8 3	8.3 V			
R1190S044B	L 0 4 4	4.4 V	R1190S084B	L 0 8 4	8.4 V			
R1190S045B	L 0 4 5	4.5 V	R1190S085B	L 0 8 5	8.5 V			
R1190S046B	L 0 4 6	4.6 V	R1190S086B	L 0 8 6	8.6 V			
R1190S047B	L 0 4 7	4.7 V	R1190S087B	L 0 8 7	8.7 V			
R1190S048B	L 0 4 8	4.8 V	R1190S088B	L 0 8 8	8.8 V			
R1190S049B	L 0 4 9	4.9 V	R1190S089B	L 0 8 9	8.9 V			
R1190S050B	L 0 5 0	5.0 V	R1190S090B	L 0 9 0	9.0 V			
R1190S051B	L 0 5 1	5.1 V	R1190S091B	L 0 9 1	9.1 V			
R1190S052B	L 0 5 2	5.2 V	R1190S092B	L 0 9 2	9.2 V			
R1190S053B	L 0 5 3	5.3 V	R1190S093B	L 0 9 3	9.3 V			
R1190S054B	L 0 5 4	5.4 V	R1190S094B	L 0 9 4	9.4 V			
R1190S055B	L 0 5 5	5.5 V	R1190S095B	L 0 9 5	9.5 V			
R1190S056B	L 0 5 6	5.6 V	R1190S096B	L 0 9 6	9.6 V			
R1190S057B	L 0 5 7	5.7 V	R1190S097B	L 0 9 7	9.7 V			
R1190S058B	L 0 5 8	5.8 V	R1190S098B	L 0 9 8	9.8 V			
R1190S059B	L 0 5 9	5.9 V	R1190S099B	L 0 9 9	9.9 V			

**R1190x**

NO.EC-183-131101

**R1190SxxxD**

Product Name	① ② ③ ④	V <sub>SET</sub>	Product Name	① ② ③ ④	V <sub>SET</sub>	Product Name	① ② ③ ④	V <sub>SET</sub>
R1190S020D	M 0 2 0	2.0 V	R1190S060D	M 0 6 0	6.0 V	R1190S100D	M 1 0 0	10.0 V
R1190S021D	M 0 2 1	2.1 V	R1190S061D	M 0 6 1	6.1 V	R1190S101D	M 1 0 1	10.1 V
R1190S022D	M 0 2 2	2.2 V	R1190S062D	M 0 6 2	6.2 V	R1190S102D	M 1 0 2	10.2 V
R1190S023D	M 0 2 3	2.3 V	R1190S063D	M 0 6 3	6.3 V	R1190S103D	M 1 0 3	10.3 V
R1190S024D	M 0 2 4	2.4 V	R1190S064D	M 0 6 4	6.4 V	R1190S104D	M 1 0 4	10.4 V
R1190S025D	M 0 2 5	2.5 V	R1190S065D	M 0 6 5	6.5 V	R1190S105D	M 1 0 5	10.5 V
R1190S026D	M 0 2 6	2.6 V	R1190S066D	M 0 6 6	6.6 V	R1190S106D	M 1 0 6	10.6 V
R1190S027D	M 0 2 7	2.7 V	R1190S067D	M 0 6 7	6.7 V	R1190S107D	M 1 0 7	10.7 V
R1190S028D	M 0 2 8	2.8 V	R1190S068D	M 0 6 8	6.8 V	R1190S108D	M 1 0 8	10.8 V
R1190S029D	M 0 2 9	2.9 V	R1190S069D	M 0 6 9	6.9 V	R1190S109D	M 1 0 9	10.9 V
R1190S030D	M 0 3 0	3.0 V	R1190S070D	M 0 7 0	7.0 V	R1190S110D	M 1 1 0	11.0 V
R1190S031D	M 0 3 1	3.1 V	R1190S071D	M 0 7 1	7.1 V	R1190S111D	M 1 1 1	11.1 V
R1190S032D	M 0 3 2	3.2 V	R1190S072D	M 0 7 2	7.2 V	R1190S112D	M 1 1 2	11.2 V
R1190S033D	M 0 3 3	3.3 V	R1190S073D	M 0 7 3	7.3 V	R1190S113D	M 1 1 3	11.3 V
R1190S034D	M 0 3 4	3.4 V	R1190S074D	M 0 7 4	7.4 V	R1190S114D	M 1 1 4	11.4 V
R1190S035D	M 0 3 5	3.5 V	R1190S075D	M 0 7 5	7.5 V	R1190S115D	M 1 1 5	11.5 V
R1190S036D	M 0 3 6	3.6 V	R1190S076D	M 0 7 6	7.6 V	R1190S116D	M 1 1 6	11.6 V
R1190S037D	M 0 3 7	3.7 V	R1190S077D	M 0 7 7	7.7 V	R1190S117D	M 1 1 7	11.7 V
R1190S038D	M 0 3 8	3.8 V	R1190S078D	M 0 7 8	7.8 V	R1190S118D	M 1 1 8	11.8 V
R1190S039D	M 0 3 9	3.9 V	R1190S079D	M 0 7 9	7.9 V	R1190S119D	M 1 1 9	11.9 V
R1190S040D	M 0 4 0	4.0 V	R1190S080D	M 0 8 0	8.0 V	R1190S120D	M 1 2 0	12.0 V
R1190S041D	M 0 4 1	4.1 V	R1190S081D	M 0 8 1	8.1 V			
R1190S042D	M 0 4 2	4.2 V	R1190S082D	M 0 8 2	8.2 V			
R1190S043D	M 0 4 3	4.3 V	R1190S083D	M 0 8 3	8.3 V			
R1190S044D	M 0 4 4	4.4 V	R1190S084D	M 0 8 4	8.4 V			
R1190S045D	M 0 4 5	4.5 V	R1190S085D	M 0 8 5	8.5 V			
R1190S046D	M 0 4 6	4.6 V	R1190S086D	M 0 8 6	8.6 V			
R1190S047D	M 0 4 7	4.7 V	R1190S087D	M 0 8 7	8.7 V			
R1190S048D	M 0 4 8	4.8 V	R1190S088D	M 0 8 8	8.8 V			
R1190S049D	M 0 4 9	4.9 V	R1190S089D	M 0 8 9	8.9 V			
R1190S050D	M 0 5 0	5.0 V	R1190S090D	M 0 9 0	9.0 V			
R1190S051D	M 0 5 1	5.1 V	R1190S091D	M 0 9 1	9.1 V			
R1190S052D	M 0 5 2	5.2 V	R1190S092D	M 0 9 2	9.2 V			
R1190S053D	M 0 5 3	5.3 V	R1190S093D	M 0 9 3	9.3 V			
R1190S054D	M 0 5 4	5.4 V	R1190S094D	M 0 9 4	9.4 V			
R1190S055D	M 0 5 5	5.5 V	R1190S095D	M 0 9 5	9.5 V			
R1190S056D	M 0 5 6	5.6 V	R1190S096D	M 0 9 6	9.6 V			
R1190S057D	M 0 5 7	5.7 V	R1190S097D	M 0 9 7	9.7 V			
R1190S058D	M 0 5 8	5.8 V	R1190S098D	M 0 9 8	9.8 V			
R1190S059D	M 0 5 9	5.9 V	R1190S099D	M 0 9 9	9.9 V			

**POWER DISSIPATION (TO-252-5-P2)**

Power Dissipation ( $P_D$ ) depends on conditions of mounting on board.  
 This specification is based on the measurement at the condition below:

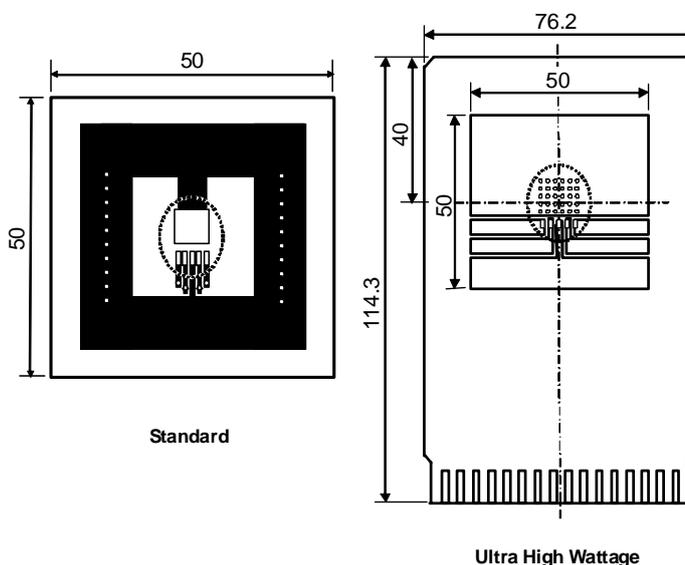
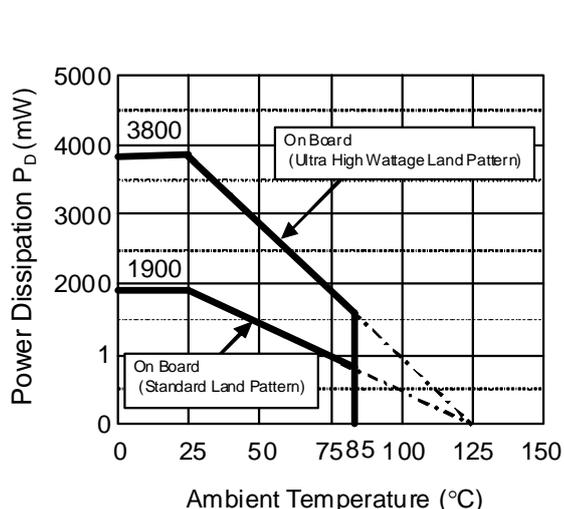
\* Measurement conditions

	Standard Land Pattern	Ultra High Wattage Land Pattern
Environment	Mounting on board (Wind velocity 0m/s)	
Board Material	Glass cloth epoxy plastic (Double layers)	Glass cloth epoxy plastic (Four-layers)
Board Dimensions	50mm x 50mm x 1.6mm	76.2mm x 114.3mm x 0.8mm
Copper Ratio	Top side: Approx. 50%, Back side: Approx. 50%	Top, Back side: Approx. 96%, 2nd, 3rd: 100%
Through - hole	$\phi$ 0.5mm x 24pcs	$\phi$ 0.4mm x 30pcs

\* Measurement Results

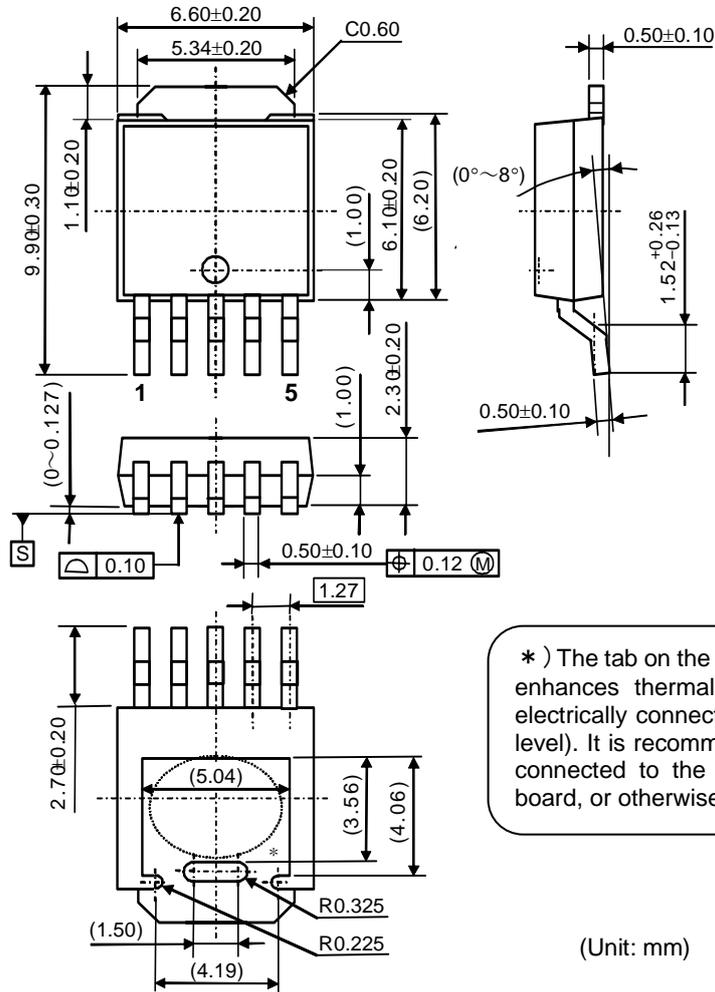
( $T_a=25^\circ\text{C}$ ,  $T_{jmax}=125^\circ\text{C}$ )

	Standard Land Pattern	Ultra High Wattage Land Pattern
Power Dissipation	1900mW	3800mW
Thermal Resistance	$\theta_{ja}=(125-25^\circ\text{C})/1.9\text{W}= 53^\circ\text{C/W}$	$\theta_{ja}=(125-25^\circ\text{C})/3.8\text{W} = 26^\circ\text{C/W}$
	$\theta_{jc}= 17^\circ\text{C/W}$	$\theta_{jc}= 7^\circ\text{C/W}$



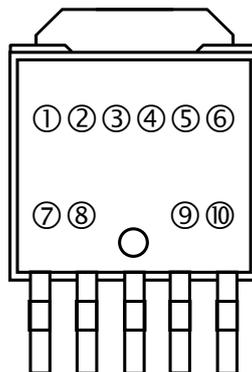
**Measurement Board Pattern**  
 ○ IC Mount Area (Unit : mm)

PACKAGE DIMENSIONS (TO-252-5-P2)



MARK SPECIFICATION (TO-252-5-P2)

①②③④⑤⑥⑦⑧: Product Code ... Refer to **MARK SPECIFICATION TABLE (TO-252-5-P2)**  
 ⑨⑩: Lot Number ... Alphanumeric Serial Number



## MARK SPECIFICATION TABLE (TO-252-5-P2)

## R1190JxxxB

Product Name	①②③④⑤⑥⑦⑧	V <sub>SET</sub>	Product Name	①②③④⑤⑥⑦⑧	V <sub>SET</sub>	Product Name	①②③④⑤⑥⑦⑧	V <sub>SET</sub>
R1190J020B	B 1 J 0 2 0 B	2.0 V	R1190J060B	B 1 J 0 6 0 B	6.0 V	R1190J100B	B 1 J 1 0 0 B	10.0 V
R1190J021B	B 1 J 0 2 1 B	2.1 V	R1190J061B	B 1 J 0 6 1 B	6.1 V	R1190J101B	B 1 J 1 0 1 B	10.1 V
R1190J022B	B 1 J 0 2 2 B	2.2 V	R1190J062B	B 1 J 0 6 2 B	6.2 V	R1190J102B	B 1 J 1 0 2 B	10.2 V
R1190J023B	B 1 J 0 2 3 B	2.3 V	R1190J063B	B 1 J 0 6 3 B	6.3 V	R1190J103B	B 1 J 1 0 3 B	10.3 V
R1190J024B	B 1 J 0 2 4 B	2.4 V	R1190J064B	B 1 J 0 6 4 B	6.4 V	R1190J104B	B 1 J 1 0 4 B	10.4 V
R1190J025B	B 1 J 0 2 5 B	2.5 V	R1190J065B	B 1 J 0 6 5 B	6.5 V	R1190J105B	B 1 J 1 0 5 B	10.5 V
R1190J026B	B 1 J 0 2 6 B	2.6 V	R1190J066B	B 1 J 0 6 6 B	6.6 V	R1190J106B	B 1 J 1 0 6 B	10.6 V
R1190J027B	B 1 J 0 2 7 B	2.7 V	R1190J067B	B 1 J 0 6 7 B	6.7 V	R1190J107B	B 1 J 1 0 7 B	10.7 V
R1190J028B	B 1 J 0 2 8 B	2.8 V	R1190J068B	B 1 J 0 6 8 B	6.8 V	R1190J108B	B 1 J 1 0 8 B	10.8 V
R1190J029B	B 1 J 0 2 9 B	2.9 V	R1190J069B	B 1 J 0 6 9 B	6.9 V	R1190J109B	B 1 J 1 0 9 B	10.9 V
R1190J030B	B 1 J 0 3 0 B	3.0 V	R1190J070B	B 1 J 0 7 0 B	7.0 V	R1190J110B	B 1 J 1 1 0 B	11.0 V
R1190J031B	B 1 J 0 3 1 B	3.1 V	R1190J071B	B 1 J 0 7 1 B	7.1 V	R1190J111B	B 1 J 1 1 1 B	11.1 V
R1190J032B	B 1 J 0 3 2 B	3.2 V	R1190J072B	B 1 J 0 7 2 B	7.2 V	R1190J112B	B 1 J 1 1 2 B	11.2 V
R1190J033B	B 1 J 0 3 3 B	3.3 V	R1190J073B	B 1 J 0 7 3 B	7.3 V	R1190J113B	B 1 J 1 1 3 B	11.3 V
R1190J034B	B 1 J 0 3 4 B	3.4 V	R1190J074B	B 1 J 0 7 4 B	7.4 V	R1190J114B	B 1 J 1 1 4 B	11.4 V
R1190J035B	B 1 J 0 3 5 B	3.5 V	R1190J075B	B 1 J 0 7 5 B	7.5 V	R1190J115B	B 1 J 1 1 5 B	11.5 V
R1190J036B	B 1 J 0 3 6 B	3.6 V	R1190J076B	B 1 J 0 7 6 B	7.6 V	R1190J116B	B 1 J 1 1 6 B	11.6 V
R1190J037B	B 1 J 0 3 7 B	3.7 V	R1190J077B	B 1 J 0 7 7 B	7.7 V	R1190J117B	B 1 J 1 1 7 B	11.7 V
R1190J038B	B 1 J 0 3 8 B	3.8 V	R1190J078B	B 1 J 0 7 8 B	7.8 V	R1190J118B	B 1 J 1 1 8 B	11.8 V
R1190J039B	B 1 J 0 3 9 B	3.9 V	R1190J079B	B 1 J 0 7 9 B	7.9 V	R1190J119B	B 1 J 1 1 9 B	11.9 V
R1190J040B	B 1 J 0 4 0 B	4.0 V	R1190J080B	B 1 J 0 8 0 B	8.0 V	R1190J120B	B 1 J 1 2 0 B	12.0 V
R1190J041B	B 1 J 0 4 1 B	4.1 V	R1190J081B	B 1 J 0 8 1 B	8.1 V			
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R1190J045B	B 1 J 0 4 5 B	4.5 V	R1190J085B	B 1 J 0 8 5 B	8.5 V			
R1190J046B	B 1 J 0 4 6 B	4.6 V	R1190J086B	B 1 J 0 8 6 B	8.6 V			
R1190J047B	B 1 J 0 4 7 B	4.7 V	R1190J087B	B 1 J 0 8 7 B	8.7 V			
R1190J048B	B 1 J 0 4 8 B	4.8 V	R1190J088B	B 1 J 0 8 8 B	8.8 V			
R1190J049B	B 1 J 0 4 9 B	4.9 V	R1190J089B	B 1 J 0 8 9 B	8.9 V			
R1190J050B	B 1 J 0 5 0 B	5.0 V	R1190J090B	B 1 J 0 9 0 B	9.0 V			
R1190J051B	B 1 J 0 5 1 B	5.1 V	R1190J091B	B 1 J 0 9 1 B	9.1 V			
R1190J052B	B 1 J 0 5 2 B	5.2 V	R1190J092B	B 1 J 0 9 2 B	9.2 V			
R1190J053B	B 1 J 0 5 3 B	5.3 V	R1190J093B	B 1 J 0 9 3 B	9.3 V			
R1190J054B	B 1 J 0 5 4 B	5.4 V	R1190J094B	B 1 J 0 9 4 B	9.4 V			
R1190J055B	B 1 J 0 5 5 B	5.5 V	R1190J095B	B 1 J 0 9 5 B	9.5 V			
R1190J056B	B 1 J 0 5 6 B	5.6 V	R1190J096B	B 1 J 0 9 6 B	9.6 V			
R1190J057B	B 1 J 0 5 7 B	5.7 V	R1190J097B	B 1 J 0 9 7 B	9.7 V			
R1190J058B	B 1 J 0 5 8 B	5.8 V	R1190J098B	B 1 J 0 9 8 B	9.8 V			
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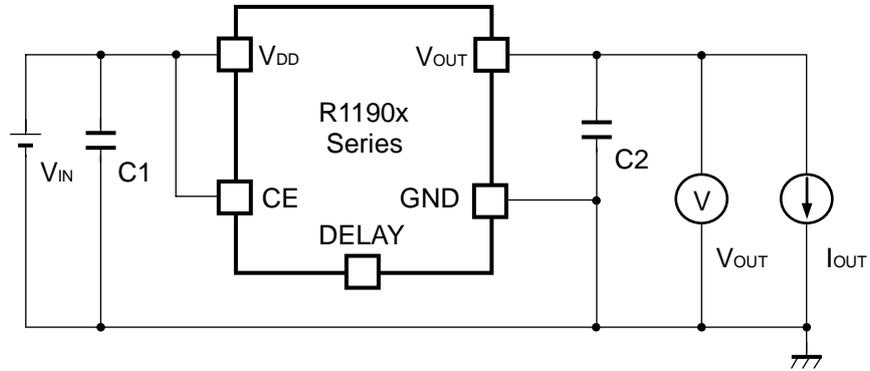
**R1190x**

NO.EC-183-131101

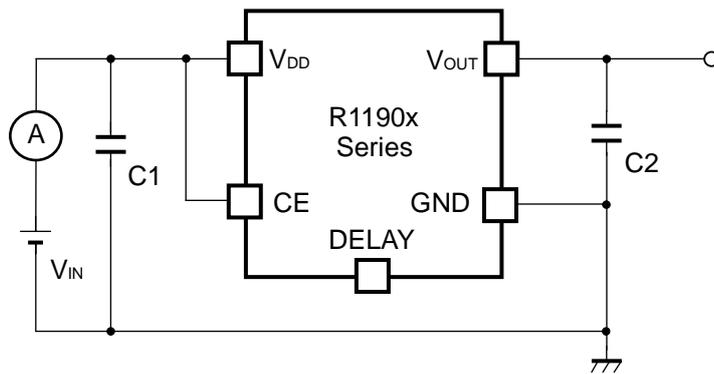
**R1190JxxxD**

Product Name	①②③④⑤⑥⑦⑧	V <sub>SET</sub>	Product Name	①②③④⑤⑥⑦⑧	V <sub>SET</sub>	Product Name	①②③④⑤⑥⑦⑧	V <sub>SET</sub>
R1190J020D	B 1 J 0 2 0 D	2.0 V	R1190J060D	B 1 J 0 6 0 D	6.0 V	R1190J100D	B 1 J 1 0 0 D	10.0 V
R1190J021D	B 1 J 0 2 1 D	2.1 V	R1190J061D	B 1 J 0 6 1 D	6.1 V	R1190J101D	B 1 J 1 0 1 D	10.1 V
R1190J022D	B 1 J 0 2 2 D	2.2 V	R1190J062D	B 1 J 0 6 2 D	6.2 V	R1190J102D	B 1 J 1 0 2 D	10.2 V
R1190J023D	B 1 J 0 2 3 D	2.3 V	R1190J063D	B 1 J 0 6 3 D	6.3 V	R1190J103D	B 1 J 1 0 3 D	10.3 V
R1190J024D	B 1 J 0 2 4 D	2.4 V	R1190J064D	B 1 J 0 6 4 D	6.4 V	R1190J104D	B 1 J 1 0 4 D	10.4 V
R1190J025D	B 1 J 0 2 5 D	2.5 V	R1190J065D	B 1 J 0 6 5 D	6.5 V	R1190J105D	B 1 J 1 0 5 D	10.5 V
R1190J026D	B 1 J 0 2 6 D	2.6 V	R1190J066D	B 1 J 0 6 6 D	6.6 V	R1190J106D	B 1 J 1 0 6 D	10.6 V
R1190J027D	B 1 J 0 2 7 D	2.7 V	R1190J067D	B 1 J 0 6 7 D	6.7 V	R1190J107D	B 1 J 1 0 7 D	10.7 V
R1190J028D	B 1 J 0 2 8 D	2.8 V	R1190J068D	B 1 J 0 6 8 D	6.8 V	R1190J108D	B 1 J 1 0 8 D	10.8 V
R1190J029D	B 1 J 0 2 9 D	2.9 V	R1190J069D	B 1 J 0 6 9 D	6.9 V	R1190J109D	B 1 J 1 0 9 D	10.9 V
R1190J030D	B 1 J 0 3 0 D	3.0 V	R1190J070D	B 1 J 0 7 0 D	7.0 V	R1190J110D	B 1 J 1 1 0 D	11.0 V
R1190J031D	B 1 J 0 3 1 D	3.1 V	R1190J071D	B 1 J 0 7 1 D	7.1 V	R1190J111D	B 1 J 1 1 1 D	11.1 V
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R1190J033D	B 1 J 0 3 3 D	3.3 V	R1190J073D	B 1 J 0 7 3 D	7.3 V	R1190J113D	B 1 J 1 1 3 D	11.3 V
R1190J034D	B 1 J 0 3 4 D	3.4 V	R1190J074D	B 1 J 0 7 4 D	7.4 V	R1190J114D	B 1 J 1 1 4 D	11.4 V
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R1190J036D	B 1 J 0 3 6 D	3.6 V	R1190J076D	B 1 J 0 7 6 D	7.6 V	R1190J116D	B 1 J 1 1 6 D	11.6 V
R1190J037D	B 1 J 0 3 7 D	3.7 V	R1190J077D	B 1 J 0 7 7 D	7.7 V	R1190J117D	B 1 J 1 1 7 D	11.7 V
R1190J038D	B 1 J 0 3 8 D	3.8 V	R1190J078D	B 1 J 0 7 8 D	7.8 V	R1190J118D	B 1 J 1 1 8 D	11.8 V
R1190J039D	B 1 J 0 3 9 D	3.9 V	R1190J079D	B 1 J 0 7 9 D	7.9 V	R1190J119D	B 1 J 1 1 9 D	11.9 V
R1190J040D	B 1 J 0 4 0 D	4.0 V	R1190J080D	B 1 J 0 8 0 D	8.0 V	R1190J120D	B 1 J 1 2 0 D	12.0 V
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R1190J048D	B 1 J 0 4 8 D	4.8 V	R1190J088D	B 1 J 0 8 8 D	8.8 V			
R1190J049D	B 1 J 0 4 9 D	4.9 V	R1190J089D	B 1 J 0 8 9 D	8.9 V			
R1190J050D	B 1 J 0 5 0 D	5.0 V	R1190J090D	B 1 J 0 9 0 D	9.0 V			
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R1190J052D	B 1 J 0 5 2 D	5.2 V	R1190J092D	B 1 J 0 9 2 D	9.2 V			
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R1190J054D	B 1 J 0 5 4 D	5.4 V	R1190J094D	B 1 J 0 9 4 D	9.4 V			
R1190J055D	B 1 J 0 5 5 D	5.5 V	R1190J095D	B 1 J 0 9 5 D	9.5 V			
R1190J056D	B 1 J 0 5 6 D	5.6 V	R1190J096D	B 1 J 0 9 6 D	9.6 V			
R1190J057D	B 1 J 0 5 7 D	5.7 V	R1190J097D	B 1 J 0 9 7 D	9.7 V			
R1190J058D	B 1 J 0 5 8 D	5.8 V	R1190J098D	B 1 J 0 9 8 D	9.8 V			
R1190J059D	B 1 J 0 5 9 D	5.9 V	R1190J099D	B 1 J 0 9 9 D	9.9 V			

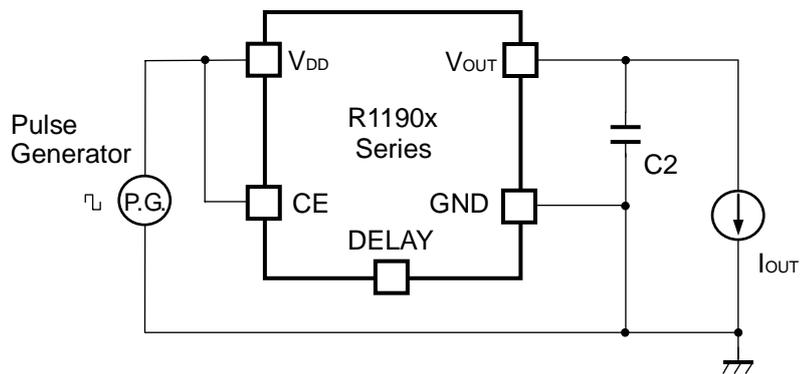
TEST CIRCUITS



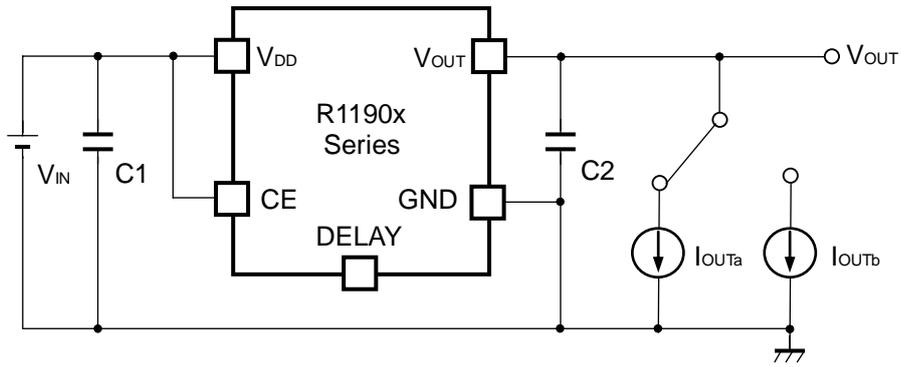
Basic Test Circuit



Test Circuit for Supply Current



Test Circuit for Ripple Rejection



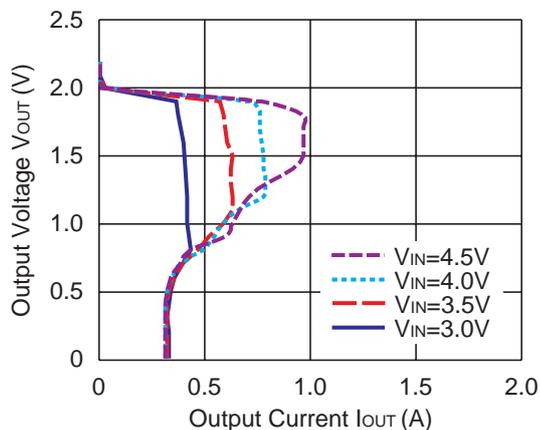
**Test Circuit for Load Transient Response**

## TYPICAL CHARACTERISTIC

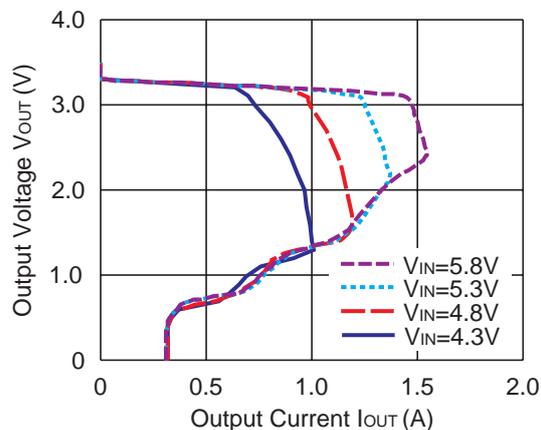
Note: Typical Characteristics are intended to be used as reference data; they are not guaranteed.

### 1) Output Voltage vs. Output Current (C1=C2=4.7 $\mu$ F, Ta=25°C)

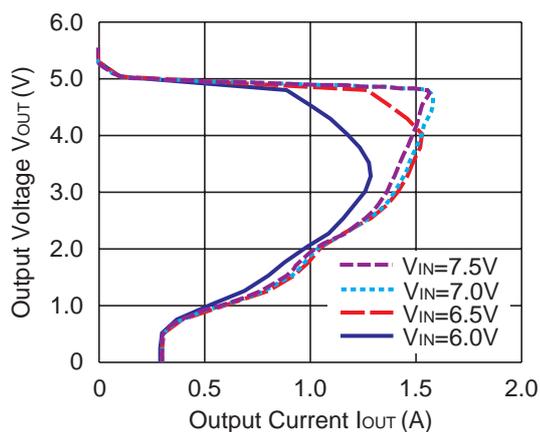
R1190x020x



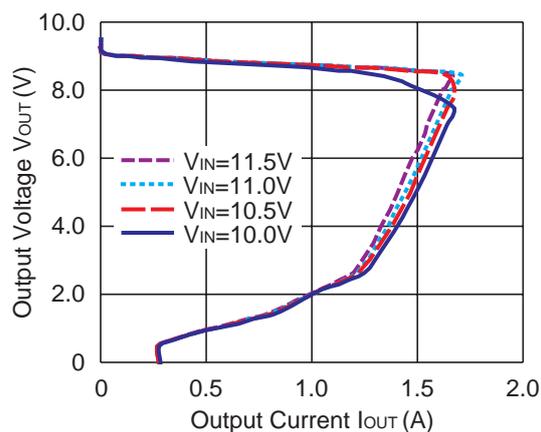
R1190x033x



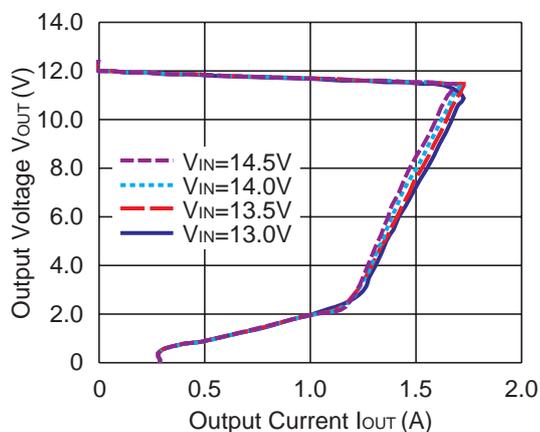
R1190x050x



R1190x090x



R1190x120x

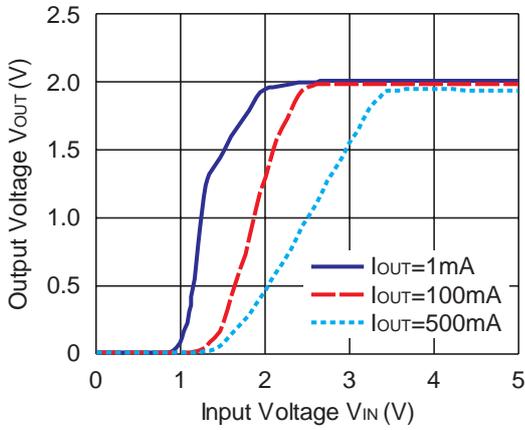


# R1190x

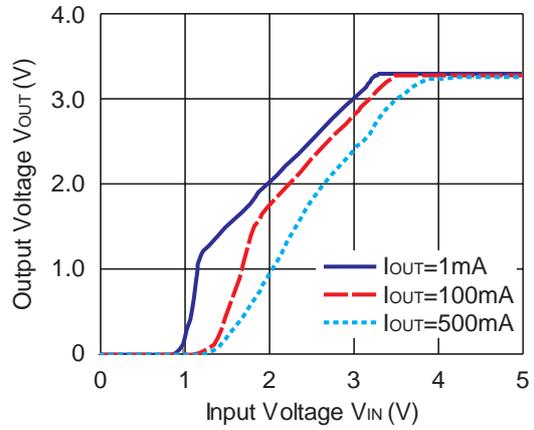
NO.EC-183-131101

## 2) Output Voltage vs. Input Voltage ( $C1=C2=4.7\mu\text{F}$ , $T_a=25^\circ\text{C}$ )

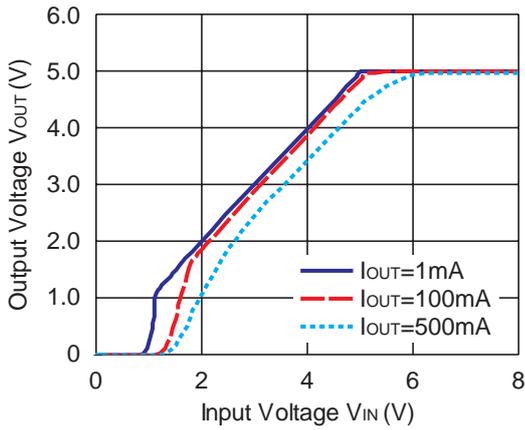
### R1190x020x



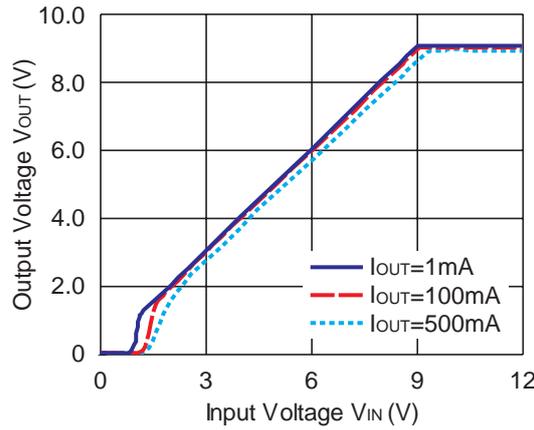
### R1190x033x



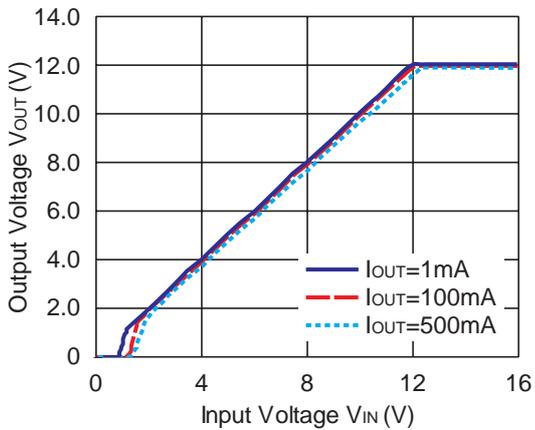
### R1190x050x



### R1190x090x

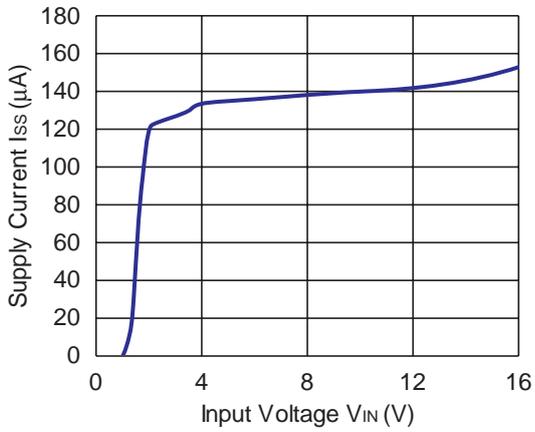


### R1190x120x

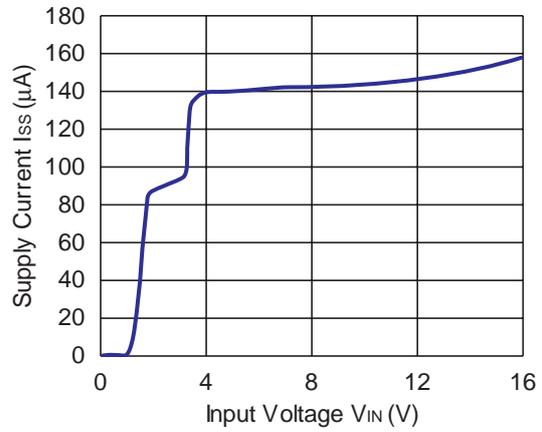


3) Supply Current vs. Input Voltage (C1=C2=4.7μF, Ta=25°C)

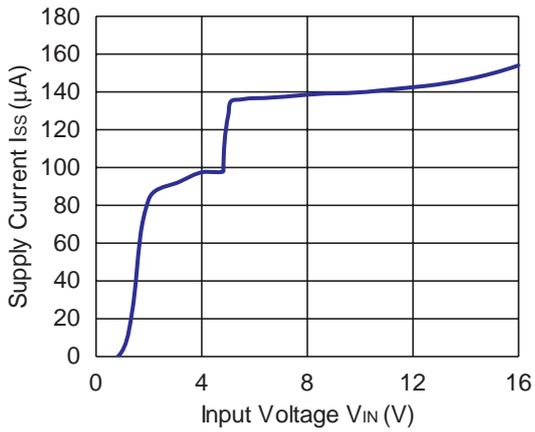
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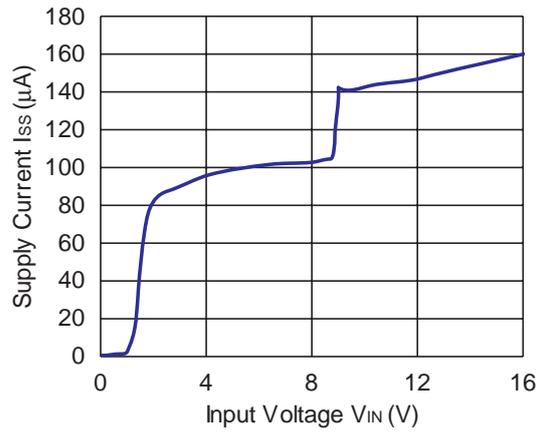
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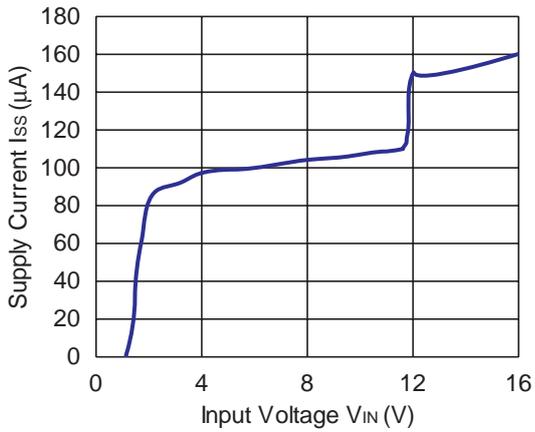
R1190x050x



R1190x090x



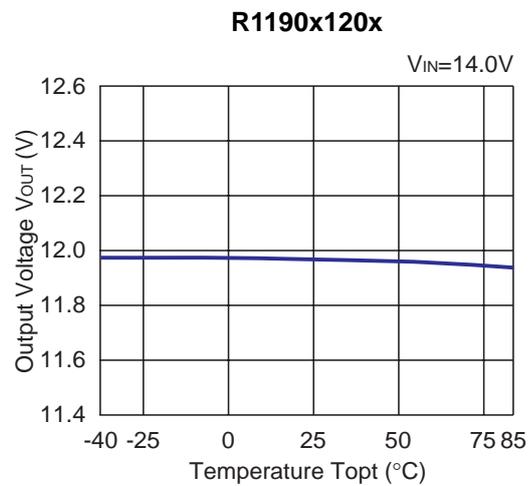
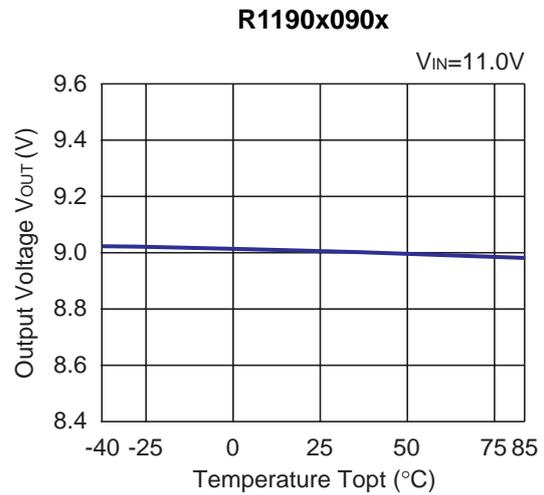
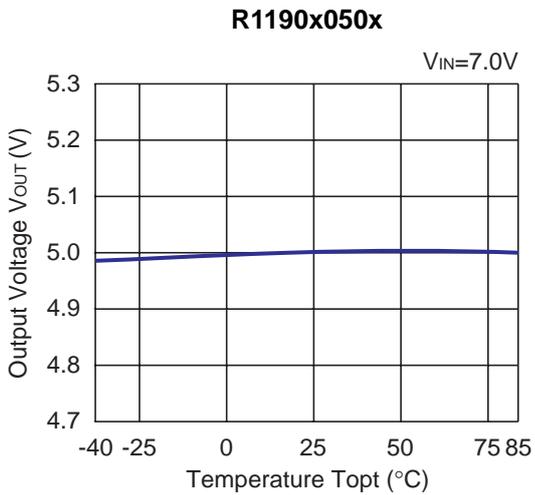
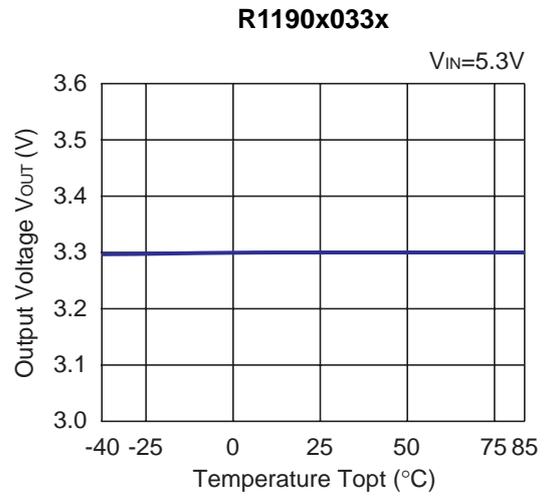
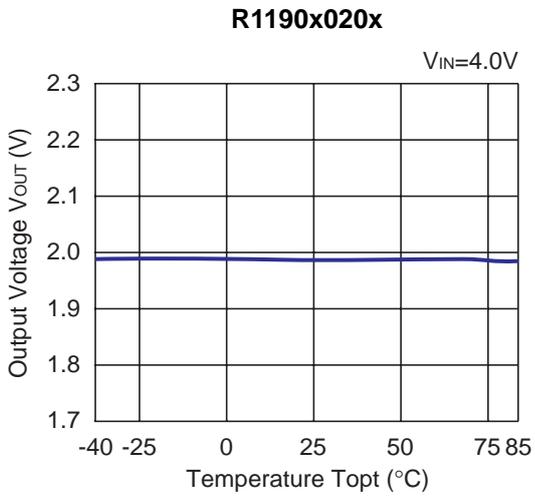
R1190x120x



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**R1190x**

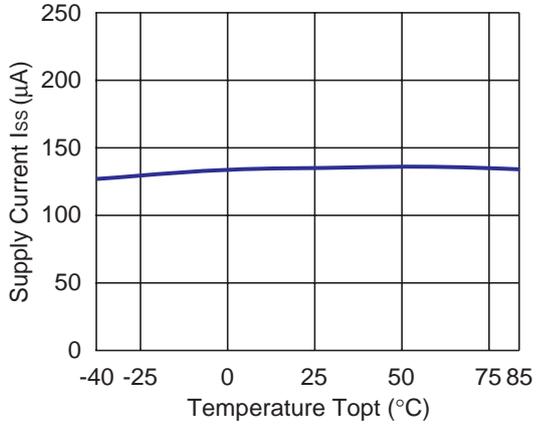
NO.EC-183-131101

**4) Output Voltage vs. Temperature ( $C1=C2=4.7\mu\text{F}$ ,  $I_{\text{OUT}}=1\text{mA}$ )**

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

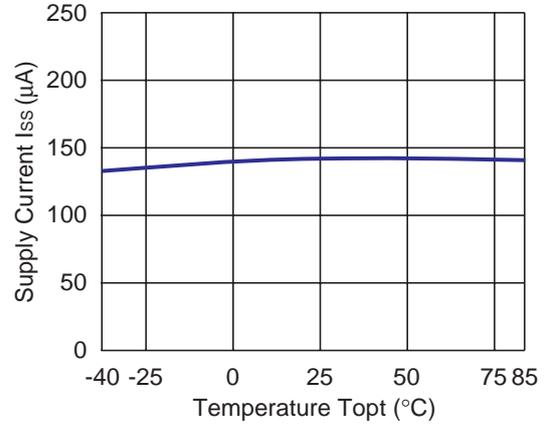
R1190x020x

V<sub>IN</sub>=4.0V



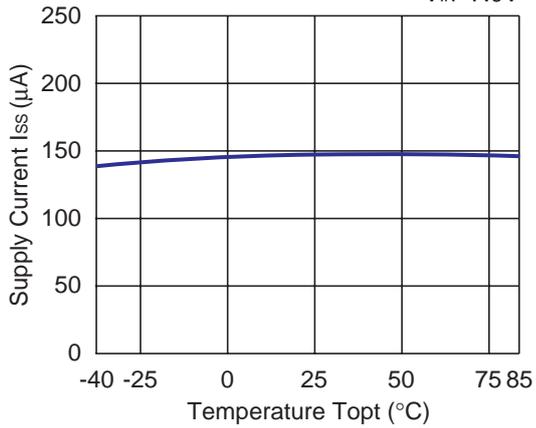
R1190x033x

V<sub>IN</sub>=5.3V



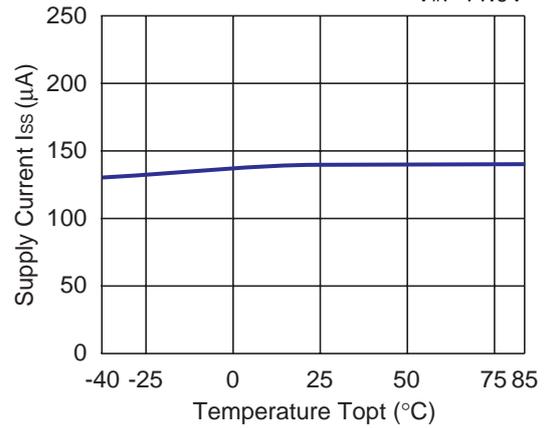
R1190x050x

V<sub>IN</sub>=7.0V



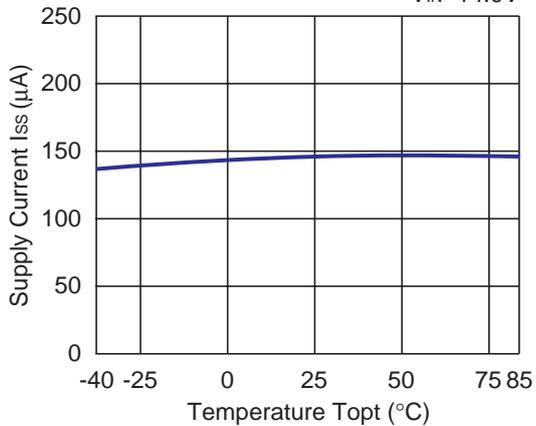
R1190x090x

V<sub>IN</sub>=11.0V



R1190x120x

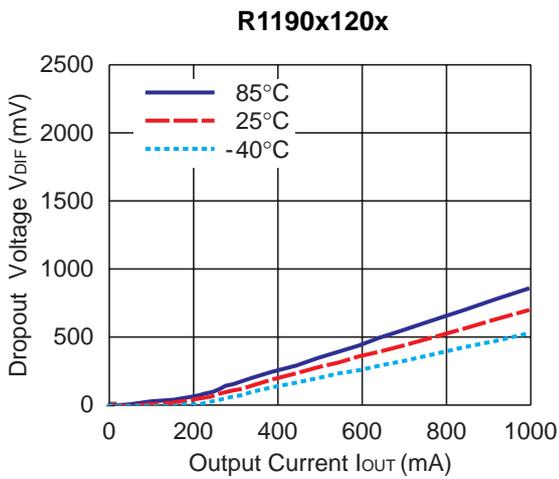
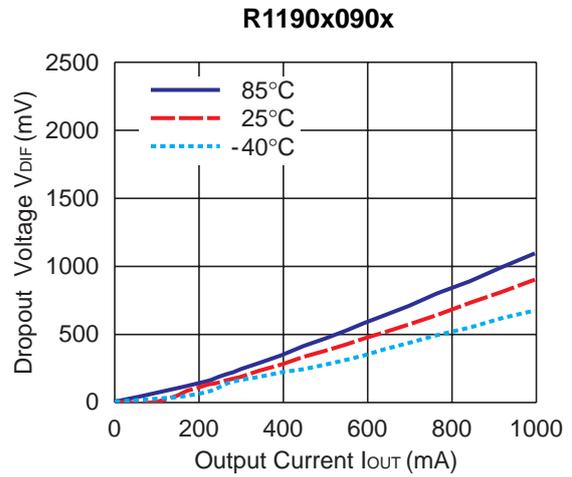
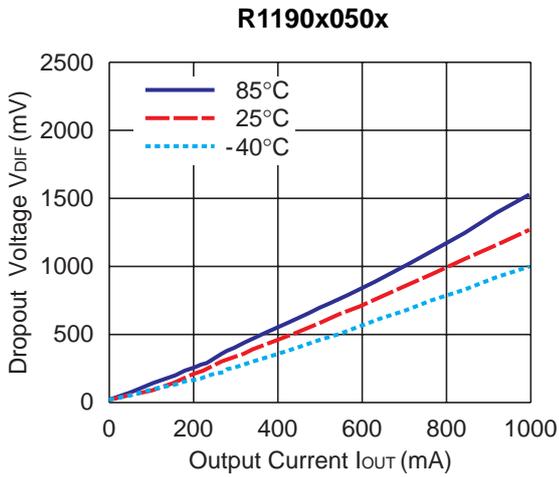
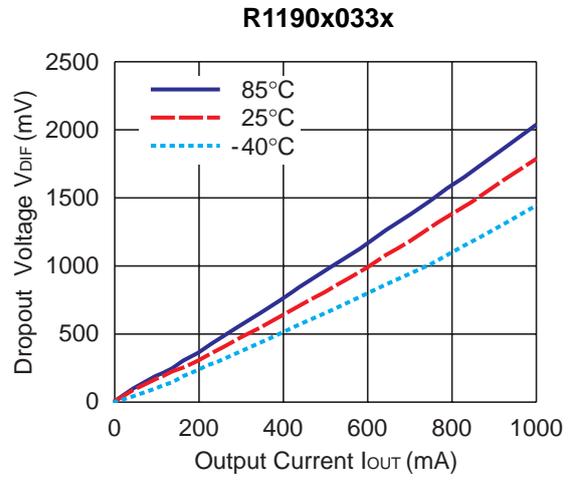
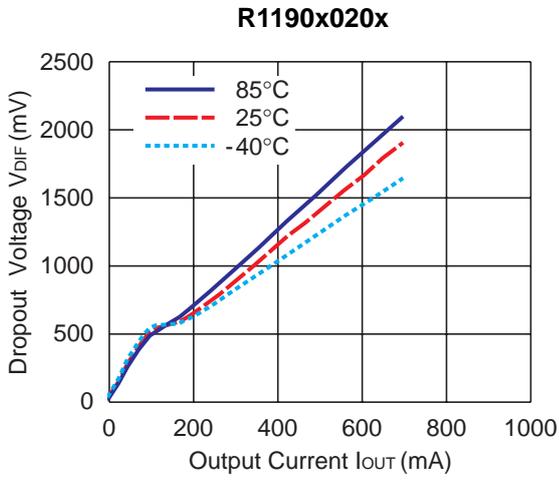
V<sub>IN</sub>=14.0V



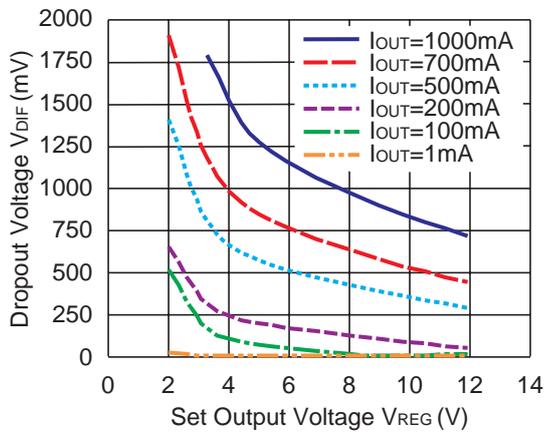
# R1190x

NO.EC-183-131101

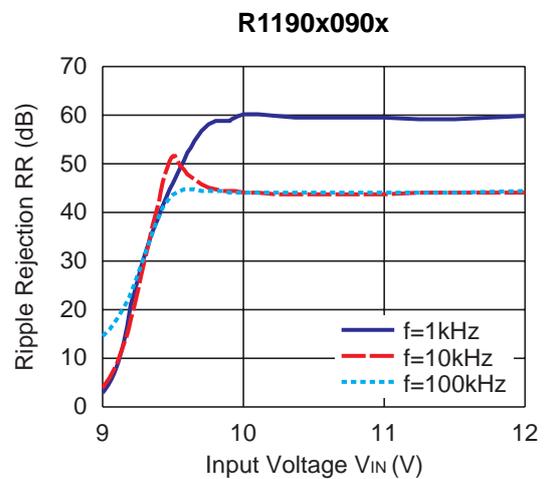
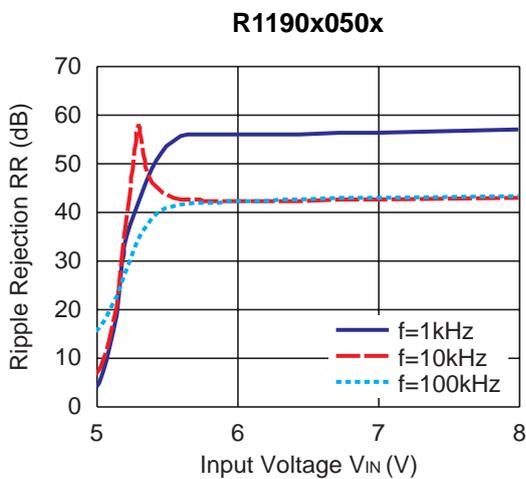
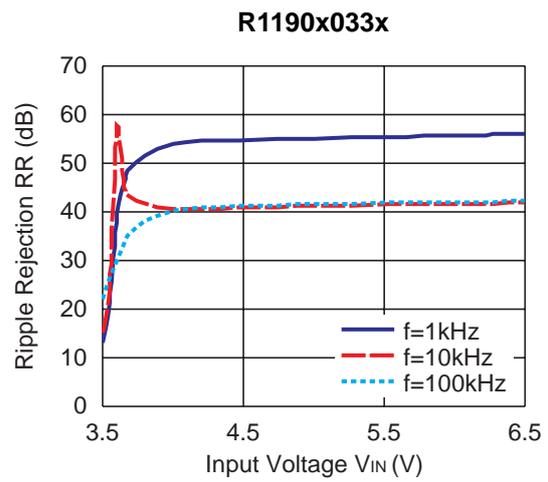
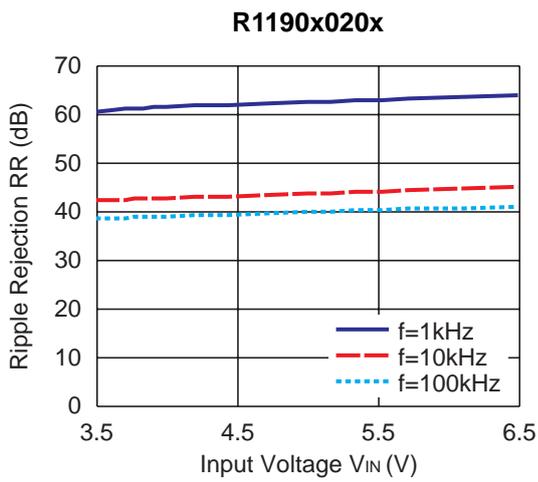
## 6) Dropout Voltage vs. Output Current (C1=C2=4.7μF)



7) Dropout Voltage vs. Set Output Voltage (C1=C2=4.7μF, Ta=25°C)

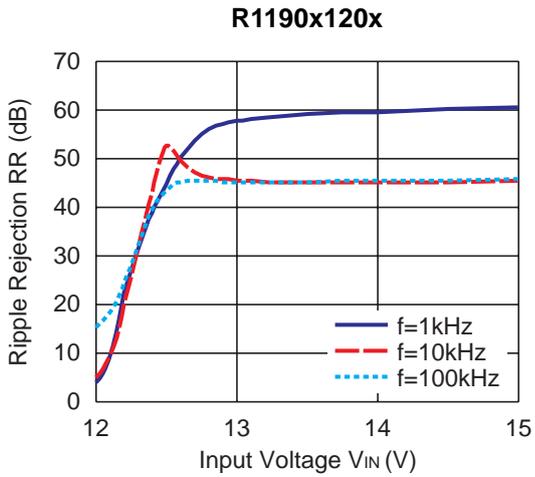


8) Ripple Rejection vs. Input Voltage (C1=none, C2=4.7μF,  $I_{OUT}=100mA$ , Ripple=0.2Vp-p, Ta=25°C)

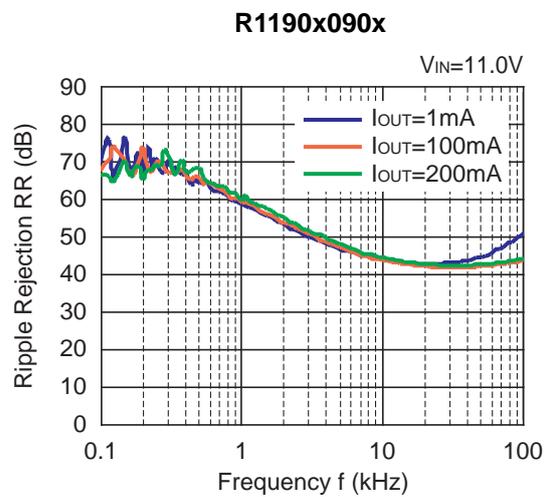
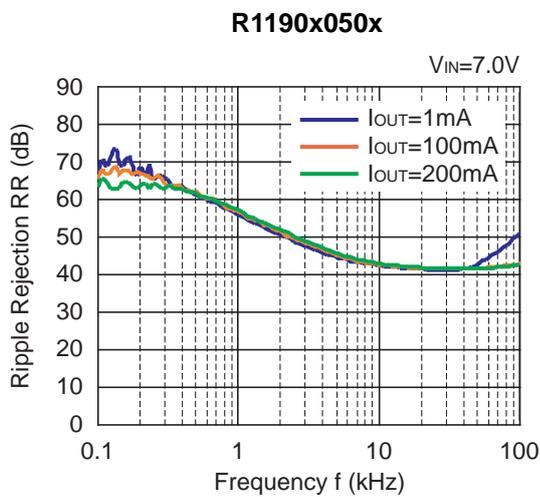
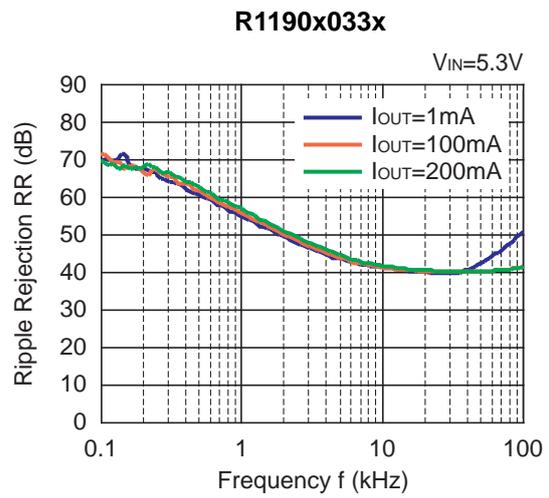
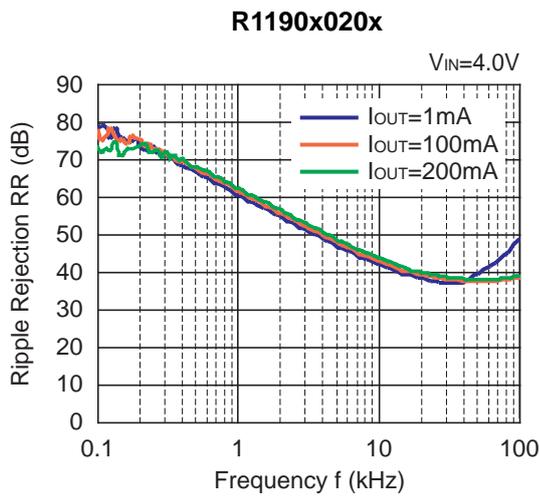


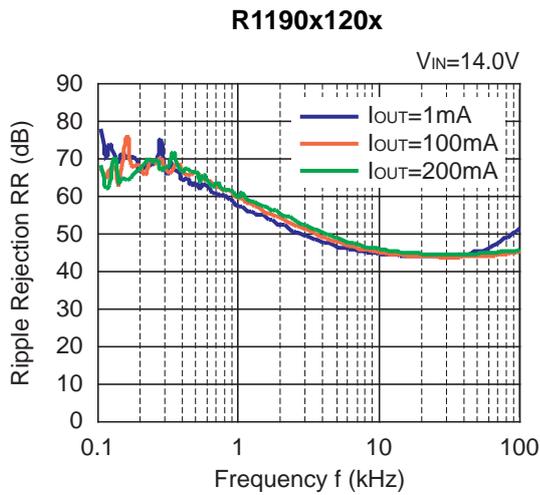
# R1190x

NO.EC-183-131101

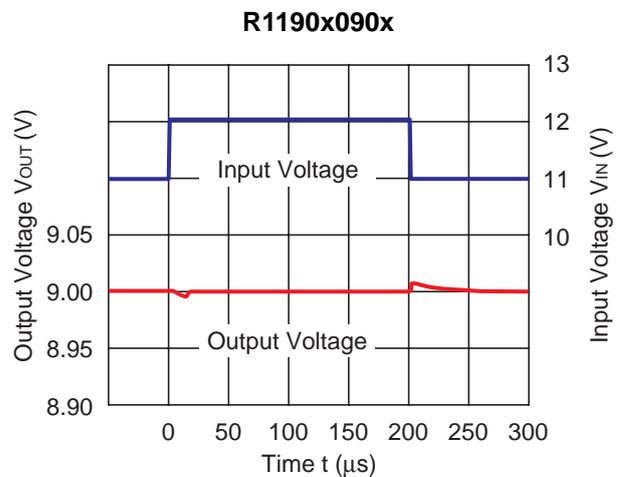
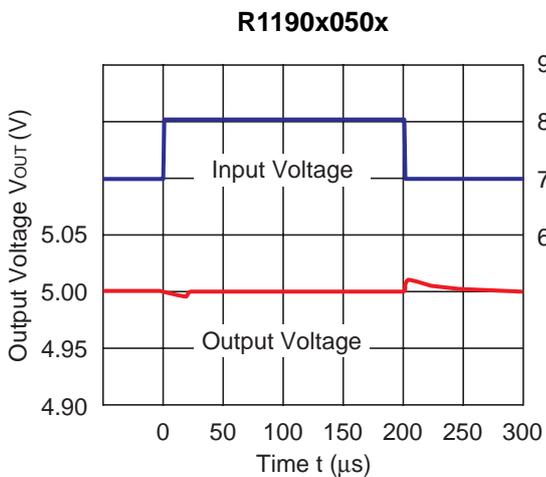
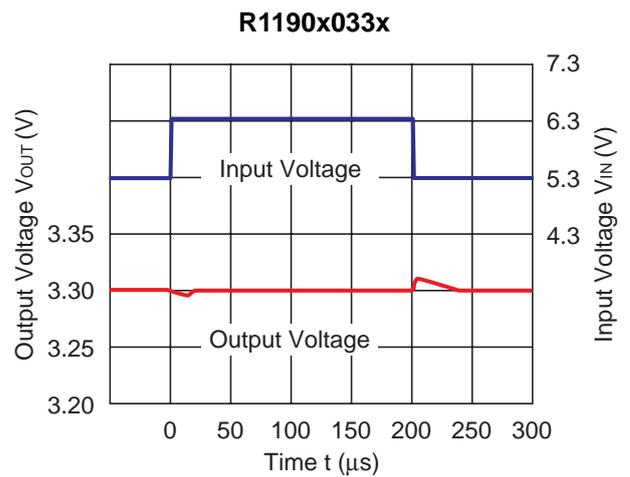
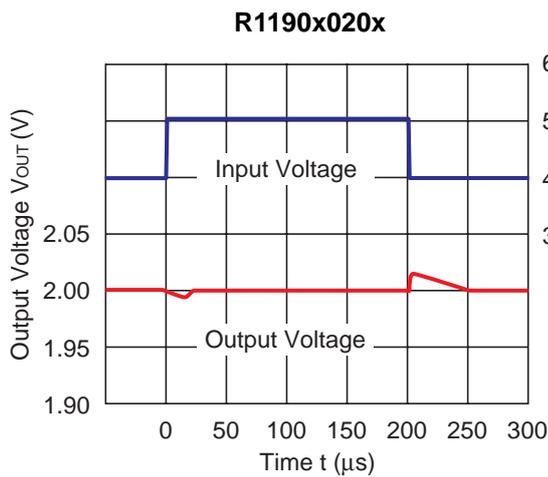


## 9) Ripple Rejection vs. Frequency ( $C1=\text{none}$ , $C2=4.7\mu\text{F}$ , Ripple=0.2Vp-p, $T_a=25^\circ\text{C}$ )





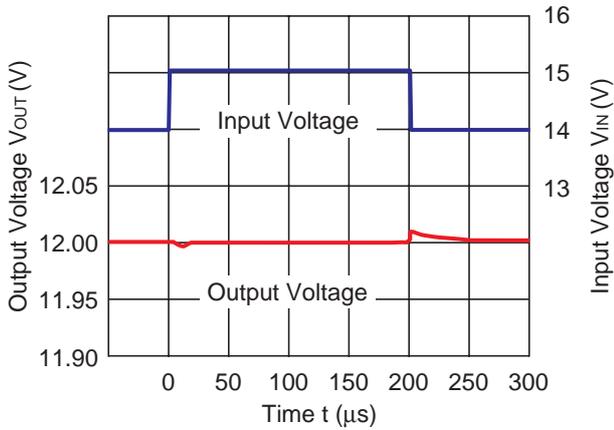
**10) Input Transient Response ( $C1=none$ ,  $C2=4.7\mu F$ ,  $I_{OUT}=1mA$ ,  $t_r=t_f=0.5\mu s$ )**



# R1190x

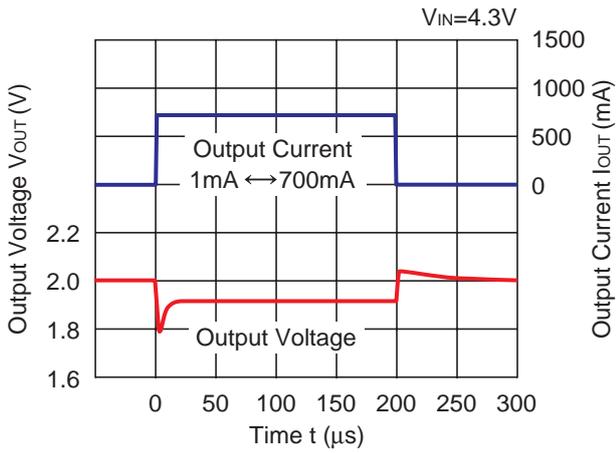
NO.EC-183-131101

### R1190x120x

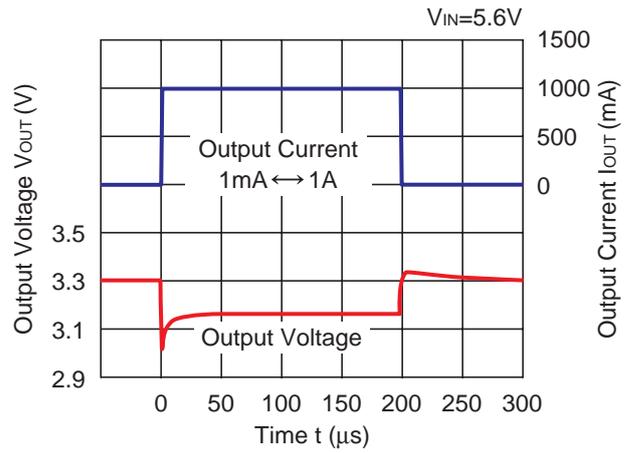


## 11) Load Transient Response ( $C1=C2=4.7\mu F$ , $t_r=t_f=0.5\mu s$ )

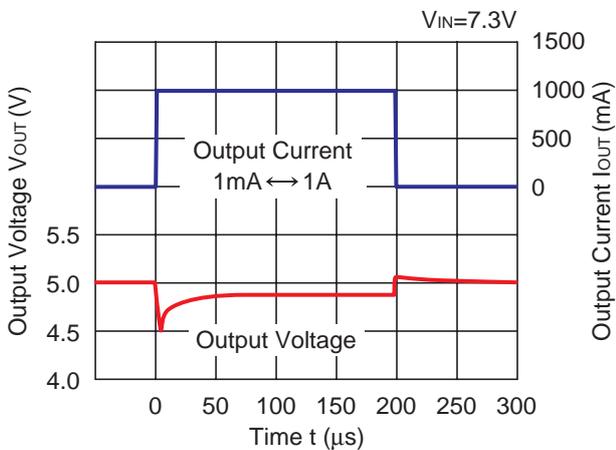
### R1190x020x



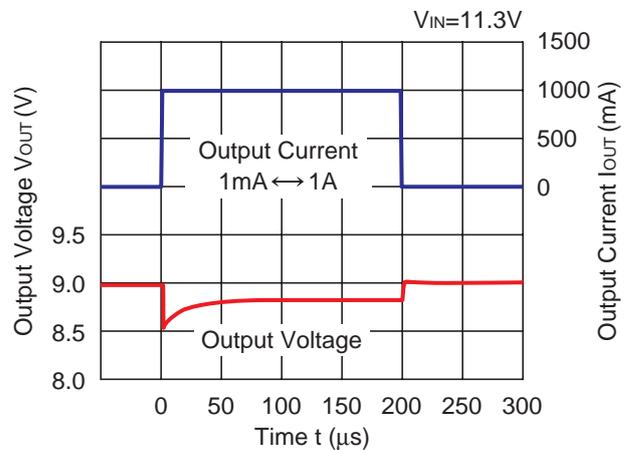
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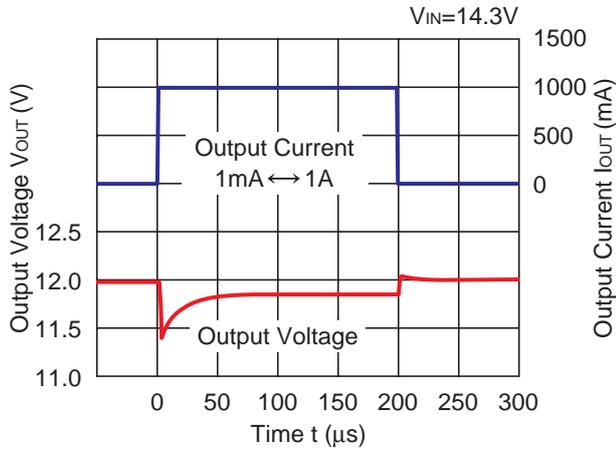
### R1190x050x



### R1190x090x

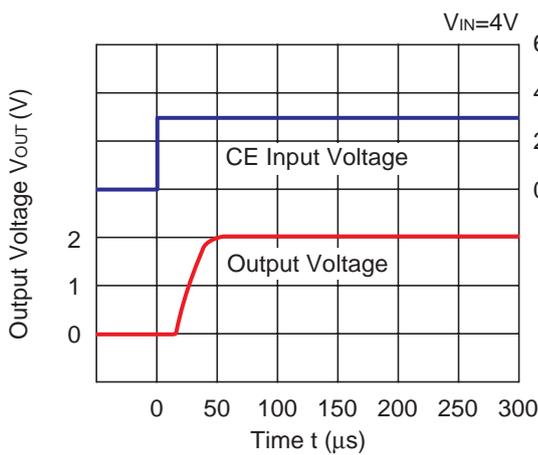


R1190x120x

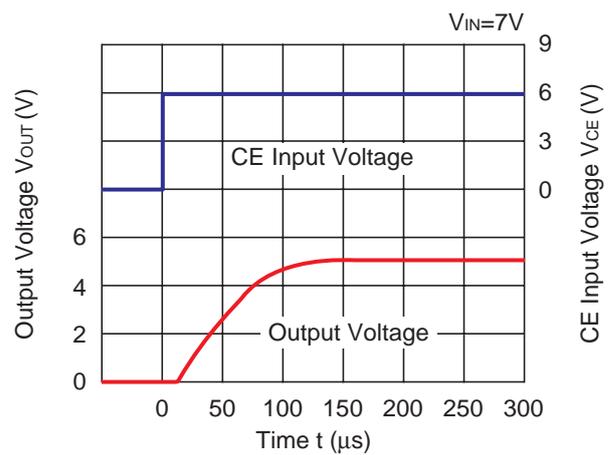


12) Turn On Speed with CE Pin ( $I_{out}=1mA$ ,  $C1=C2=4.7\mu F$ ,  $t_r=t_f=0.5\mu s$ )

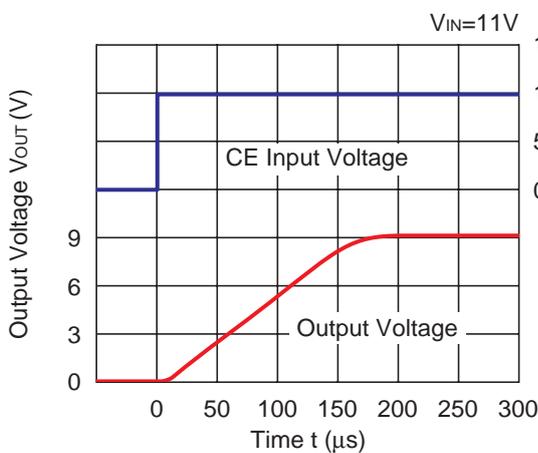
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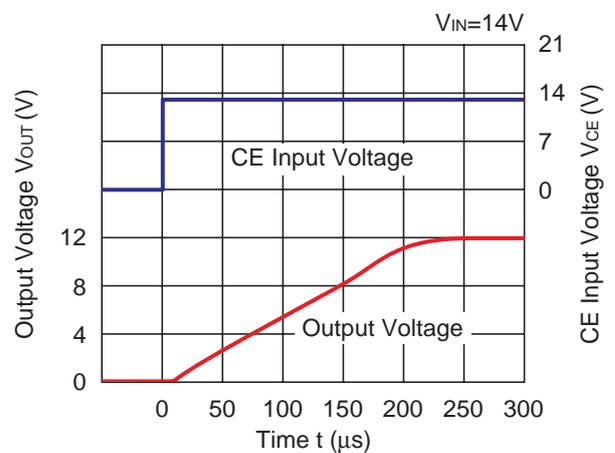
R1190x050x



R1190x090x



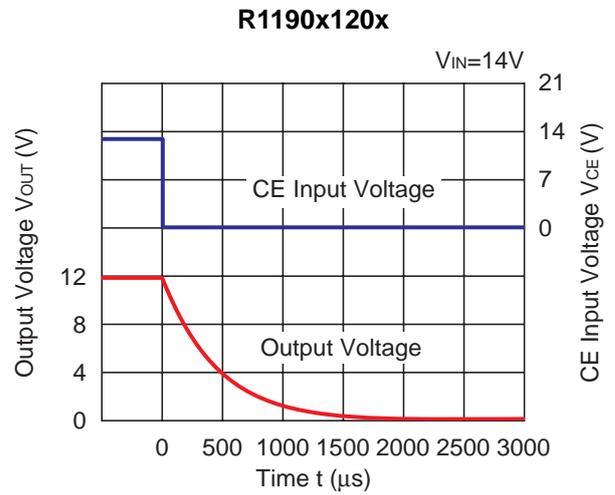
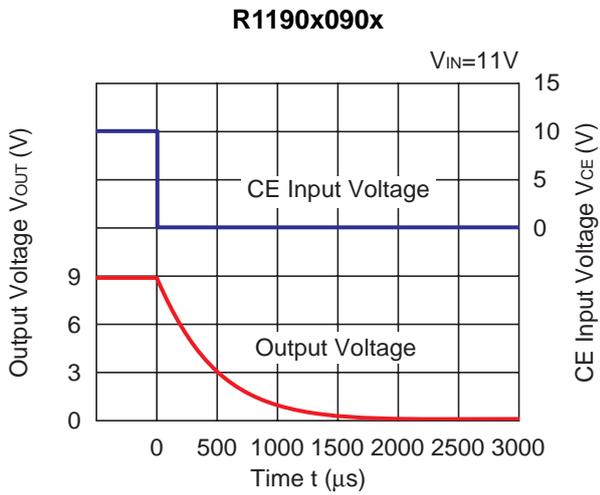
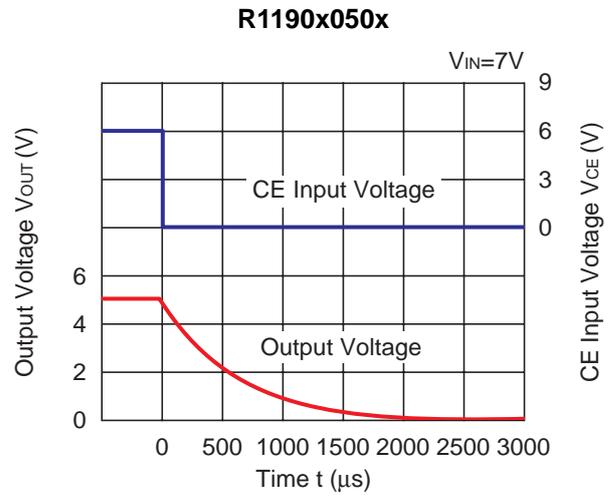
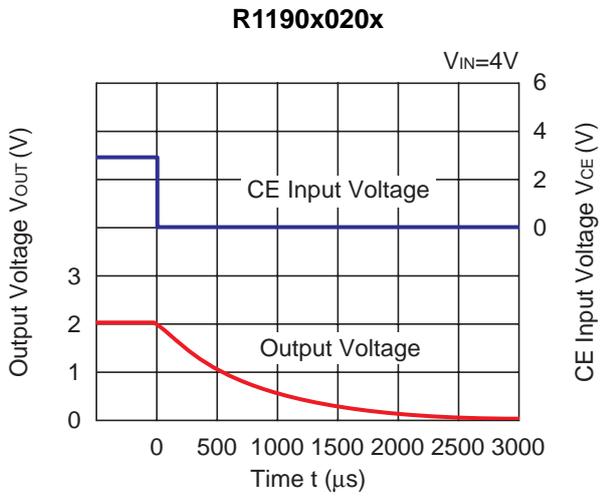
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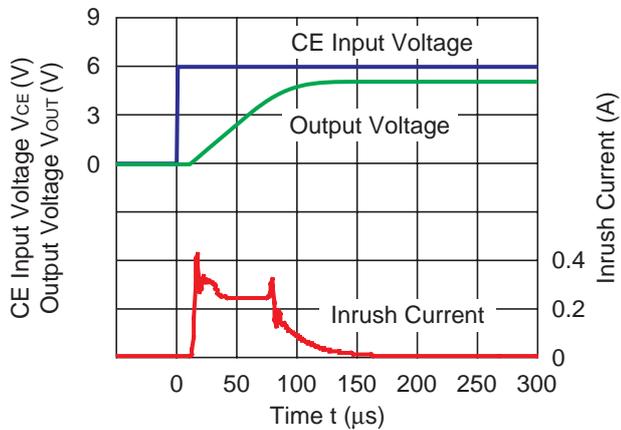
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NO.EC-183-131101

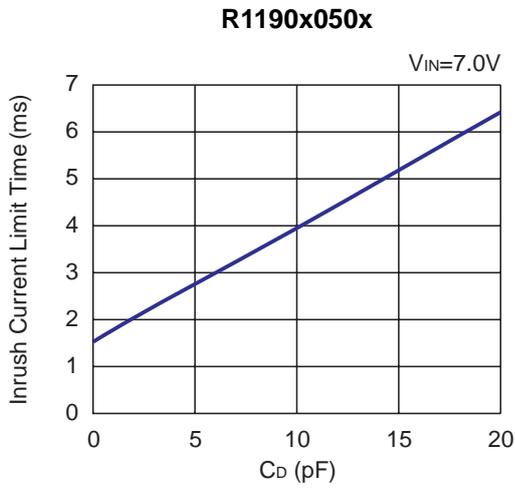
## 13) Turn Off Speed with CE Pin (D Version) ( $I_{OUT}=1mA$ , $C_1=C_2=4.7\mu F$ , $t_r=t_f=0.5\mu s$ )



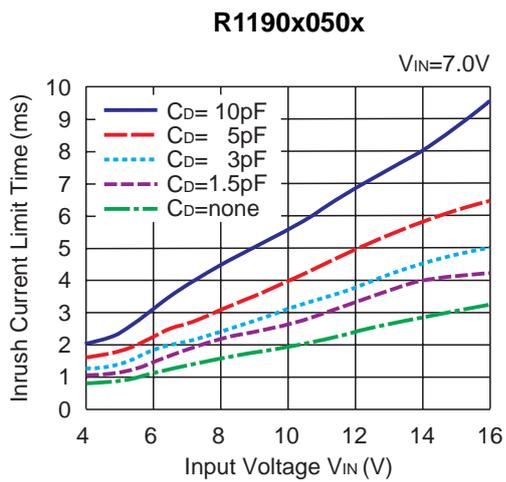
## 14) Inrush Current at Turn On ( $V_{IN}=7.0V$ , $C_1=C_2=4.7\mu F$ , $C_D=none$ , $t_r=t_f=0.5\mu s$ )



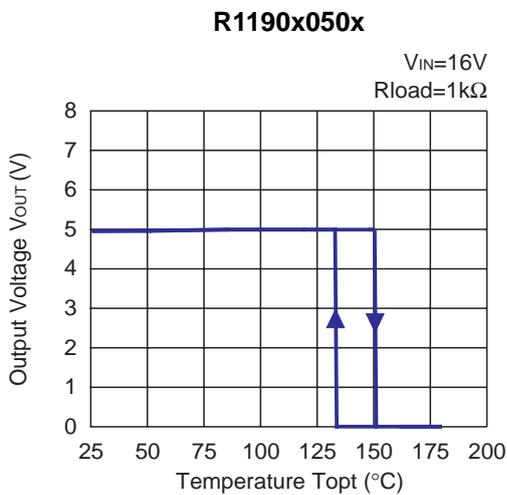
15) Inrush Current Limit vs.  $C_D$  Capacitance ( $C_1=C_2=4.7\mu F$ )



16) Inrush Current Limit Delay Time vs. Input Voltage ( $C_1=C_2=4.7\mu F$ )



17) Thermal Shutdown vs. Temperature ( $C_1=C_2=4.7\mu F$ )



## R1190x

NO.EC-183-131101

### ESR vs. Output Current

When using these ICs, consider the following points:

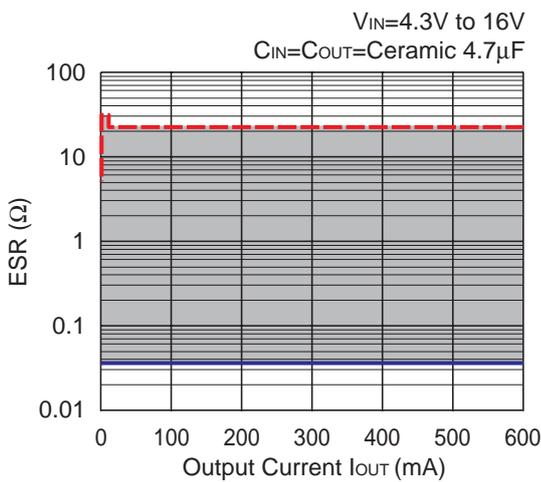
The relations between  $I_{OUT}$  (Output Current) and ESR of an output capacitor are shown below.

The conditions when the white noise level is under  $40\mu V_{rms}$  (Avg.) are marked as the hatched area in the graph.

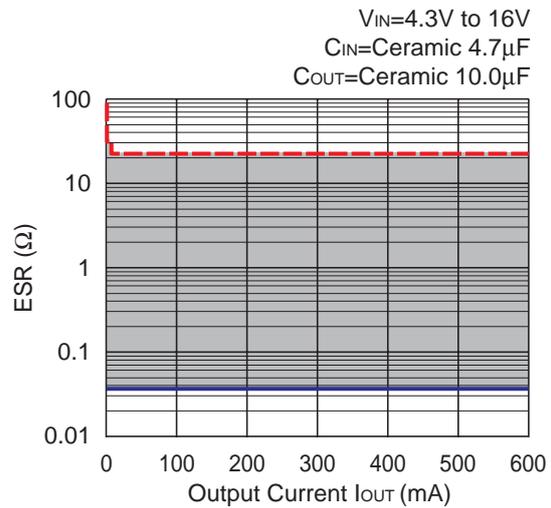
#### Measurement conditions

- Frequency Band : 10Hz to 1MHz
- Temperature :  $-40^{\circ}C$  to  $85^{\circ}C$
- Hatched Area : Noise level is under  $40\mu V_{rms}$  (Avg.)
- $C_{IN}$  :  $4.7\mu F$  (KTD500B475M43A0T00)
- $C_{OUT}$  :  $4.7\mu F$  (KTD500B475M43A0T00)  
:  $10.0\mu F$  (FK22Y5V1H106Z)

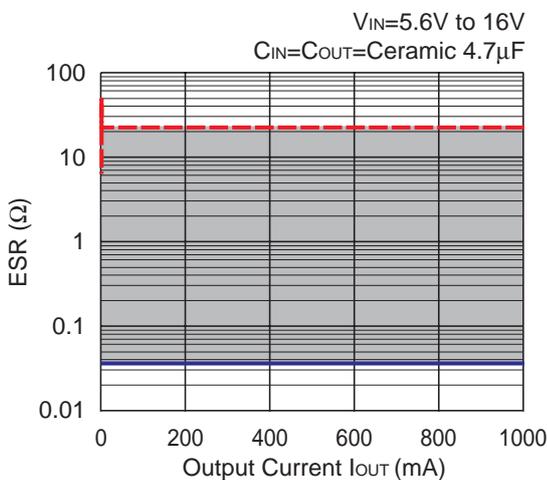
**R1190x020x**



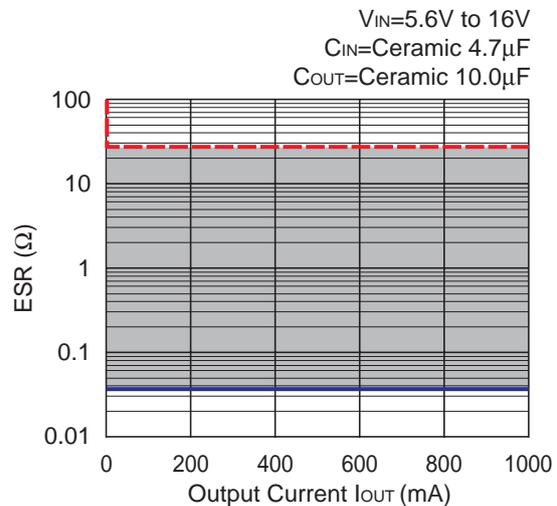
**R1190x020x**



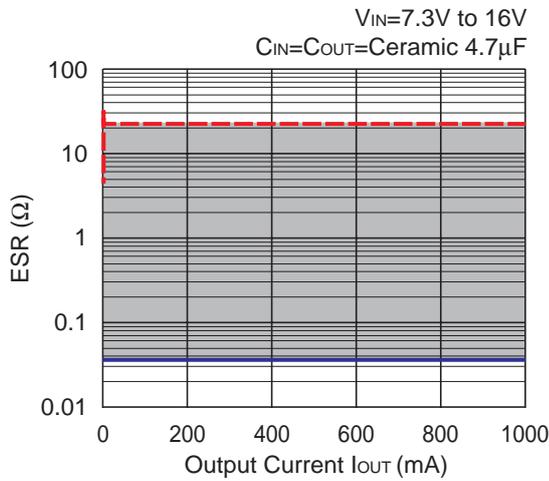
**R1190x033x**



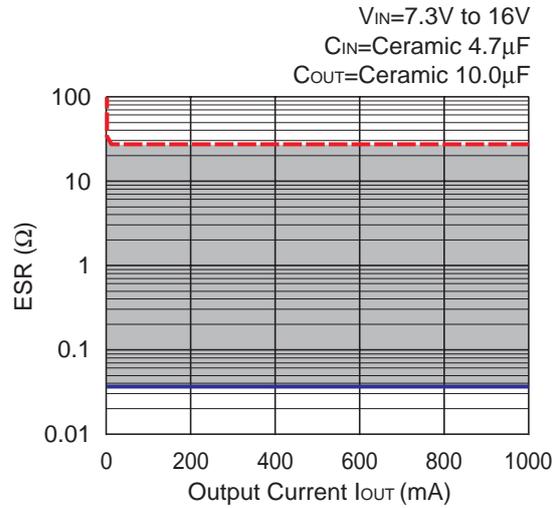
**R1190x033x**



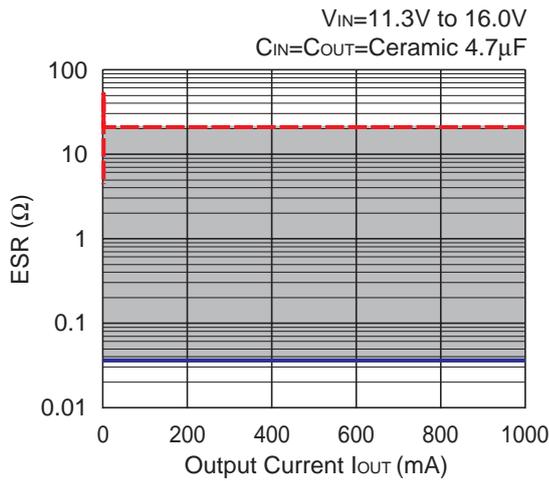
R1190x050x



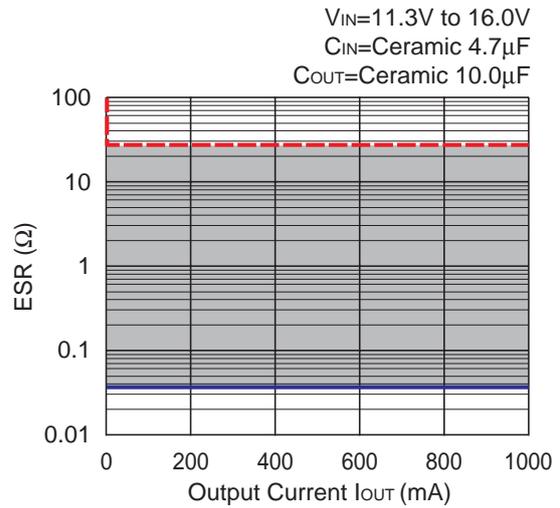
R1190x050x



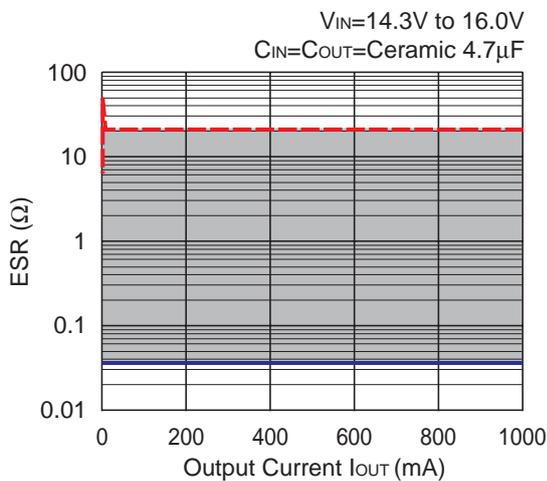
R1190x090x



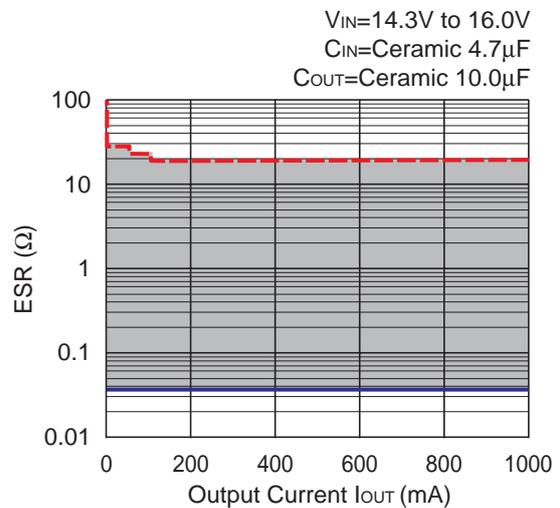
R1190x090x



R1190x120x



R1190x120x





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