

# XC62K Series

## Negative Voltage Regulators



- ◆ CMOS Low Power Consumption
- ◆ Small Input-Output Voltage Differential
  - : 0.12V @ 50mA,
  - 0.38V @ 100mA
- ◆ Maximum Output Current : 100mA ( $V_{OUT} = -5.0V$ )
- ◆ Highly Accurate :  $\pm 2\%$  ( $\pm 1\%$ )
- ◆ Output Voltage Range : -2.1V ~ -6.0V
- ◆ Supply Current : 3.0 $\mu$ A ( $V_{OUT} = -5.0V$ )
- ◆ SOT-23/SOT-89/TO-92 Package

### General Description

The XC62K series are highly precise, low power consumption, negative voltage regulators, manufactured using CMOS and laser trimming technologies. The series achieves high output currents with small input-output voltage differentials, and consists of a high precision voltage reference, an error correction circuit, and an output driver with current limitation.

SOT-23 (150mW), SOT-89 (500mW) and TO-92 (300mW) packages are available.

### Applications

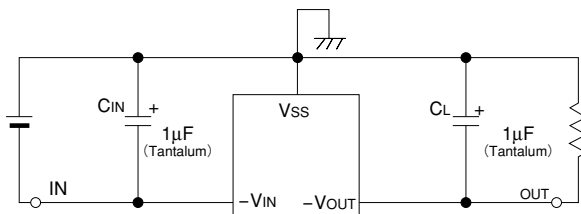
- Battery Powered Equipment
- Portable & Cellular Phones
- Various Portable Equipment
- Power Supply for GaAs Applications

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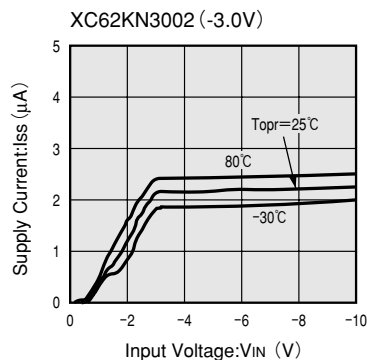
### Features

- Ultra Small Input-Output Voltage Differential** : 50mA output possible with a 0.12V differential ( $V_{OUT} = -5.0V$ ).
- Maximum Output Current** : 100mA (within max. power dissipation,  $V_{OUT} = -5.0V$ )
- Output Voltage Range** : -2.1V ~ -6.0V in 0.1V increments.  
-5.0, -4.0, -3.0V, -2.5V standard.  
(All other voltages are semi-custom)
- Highly Accurate** : Output voltage  $\pm 2\%$   
( $\pm 1\%$  for semi-custom products)
- Low Power Consumption** : Typ. 3.0 $\mu$ A @  $V_{OUT} = -5.0V$
- Output Voltage Temperature Characteristics** : Typ.  $\pm 100$ ppm/ $^{\circ}C$
- Input Stability** : Typ. 0.1%/V
- Ultra Small Packages** : SOT-23 (150mW) mini-mold,  
SOT-89 (500mW) mini-power mold  
TO-92 (300mW)

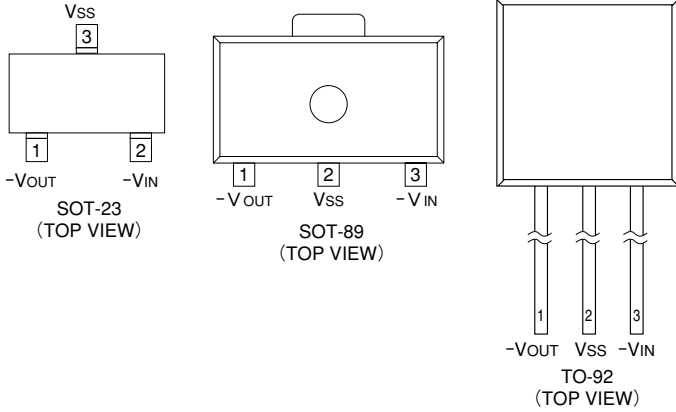
### Typical Application Circuit



### Typical Performance Characteristic



## Pin Configuration



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## Pin Assignment

PIN NUMBER			PIN NAME	FUNCTION
SOT-23	SOT-89	TO-92		
2	3	3	-VIN	Power Supply Input
3	2	2	VSS	Ground
1	1	1	-VOUT	Output

## Product Classification

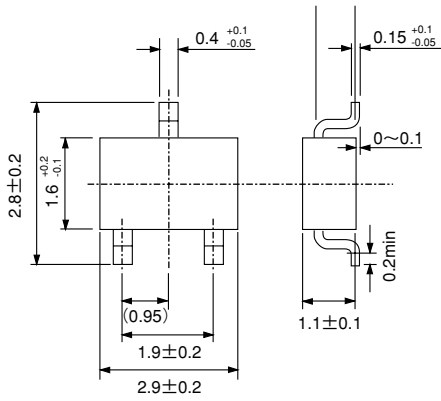
### Ordering Information

X C 6 2 K X X X X X X X  
 ↑ ↑ ↑ ↑ ↑ ↑  
 a b c d e f

DESIGNATOR	DESCRIPTION	DESIGNATOR	DESCRIPTION
a	<u>Polarity of Output Voltage</u> N=Negative	e	<u>Package Type</u> M=SOT-23 P=SOT-89 T=TO-92 (Standard)
b	<u>Output Voltage</u> 30=3.0V 50=5.0V		
c	<u>Temperature Characteristics</u> 0=±100ppm/°C(typical)	f	<u>Device Orientation</u> R=Embossed Tape (Standard Feed) L=Embossed Tape (Reverse Feed) H=Paper Tape (TO-92) B=Bag (TO-92)
d	<u>Accuracy</u> 1=±1.0%(Semi-custom products) 2=±2.0%		

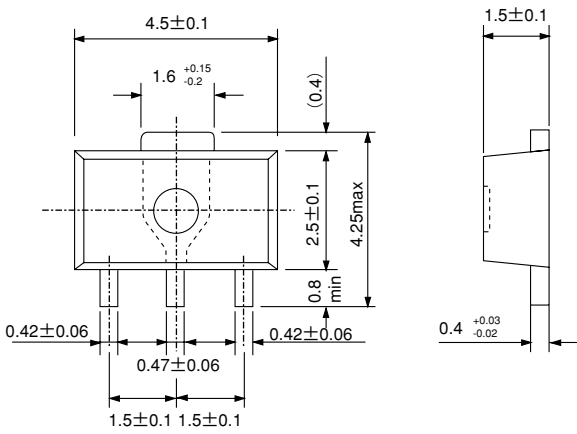
## ■ Packaging Information

### ● SOT-23



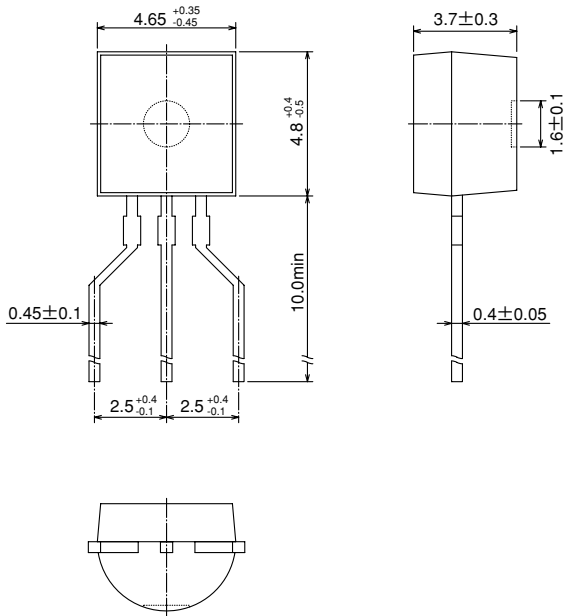
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### ● SOT-89



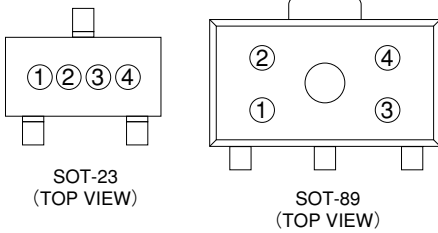
●TO-92

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## ■Marking

●SOT-23, SOT-89



① Integral Number of Output Voltage

DESIGNATOR	VOLTAGE(V)	DESIGNATOR	VOLTAGE(V)
2	2.②	5	5.②
3	3.②	6	6.②
4	4.②		

② Decimal number of Output Voltage

DESIGNATOR	VOLTAGE(V)	DESIGNATOR	VOLTAGE(V)
A	①.0	F	①.5
B	①.1	H	①.6
C	①.2	K	①.7
D	①.3	L	①.8
E	①.4	M	①.9

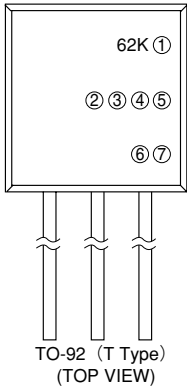
③ Polarity of Output Voltage

DESIGNATOR	POLARITY
5	Negative

④ Assembly Lot Number

Based on internal standards.

●TO-92



① Represents the Polarity of Output Voltage

DESIGNATOR	OUTPUT CONFIGURATION
N	—

④ Represents the temperature Characteristics

DESIGNATOR	TEMPERATURE CHARACTERISTICS
0	TPY±100ppm

⑤ Represents the Detect Voltage Accuracy

DESIGNATOR	DETECT VOLTAGE ACCURACY
1	within ±1% (semi-custom)
2	within ±2%

⑥ Represents a least significant digit of the produced year

DESIGNATOR	PRODUCED YEAR
0	2000
1	2001

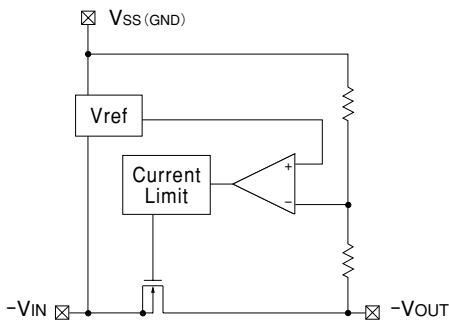
⑦ Denotes the production lot number  
0 to 9, A to Z repeated(G.I.J.O.Q.W excepted)

②③ Represents the Detect Voltage

DESIGNATOR		VOLTAGE (V)
②	③	
3	3	3.3
5	0	5.0

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■Block Diagram



■Absolute Maximum Ratings

Ta=25°C

PARAMETER	SYMBOL	RATINGS	UNITS
Input Voltage	V <sub>IN</sub>	-12	V
Output Current	I <sub>OUT</sub>	200	mA
Output Voltage	V <sub>OUT</sub>	-V <sub>DD</sub> -0.3 ~ V <sub>IN</sub> +0.3	V
Continuous Total Power Dissipation	SOT-23	150	mW
	SOT-89	500	
	TO-92	300	
Operating Ambient Temperature	T <sub>opr</sub>	-30 ~ +80	°C
Storage Temperature	T <sub>stg</sub>	-40 ~ +125	°C

Note: Please ensure that I<sub>OUT</sub> is less than Pd ÷ (V<sub>OUT</sub> - V<sub>IN</sub>)

## Electrical Characteristics

XC62KN5002

$V_{OUT}(T) = -5.0V$

$T_a = 25^\circ C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	$V_{OUT}(E)$	$I_{OUT} = 20mA$ $V_{IN} = -6.0V$	$\times 0.98$ -4.90	$V_{OUT}(T)$ -5.0	$\times 1.02$ -5.10	V
Maximum Output Current	$I_{OUT \max}$	$V_{IN} = -6.0V, V_{OUT}(E) \geq -4.5V$	100			mA
Load Stability	$\Delta V_{OUT}$	$V_{IN} = -6.0V$ $1mA \leq I_{OUT} \leq 50mA$		40	80	mV
Input/Output Voltage Differential	$V_{dif}$	$I_{OUT} = 50mA$ $I_{OUT} = 100mA$		120 380	300 600	mV
Supply Current	$I_{SS}$	$V_{IN} = -6.0V$		3.0	7.0	$\mu A$
Input Stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	$I_{OUT} = 20mA$ $-6.0V \leq V_{IN} \leq -10.0V$		0.1	0.3	%/V
Input Voltage	$V_{IN}$				-10.0	V
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$	$I_{OUT} = 20mA$ $-30^\circ C \leq T_{opr} \leq 80^\circ C$		$\pm 100$		ppm/ $^\circ C$

XC62KN4002

$V_{OUT}(T) = -4.0V$

$T_a = 25^\circ C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	$V_{OUT}(E)$	$I_{OUT} = 20mA$ $V_{IN} = -5.0V$	$\times 0.98$ -3.92	$V_{OUT}(T)$ -4.0	$\times 1.02$ -4.08	V
Maximum Output Current	$I_{OUT \max}$	$V_{IN} = -5.0V, V_{OUT}(E) \geq -3.6V$	80			mA
Load Stability	$\Delta V_{OUT}$	$V_{IN} = -5.0V$ $1mA \leq I_{OUT} \leq 45mA$		40	80	mV
Input/Output Voltage Differential	$V_{dif}$	$I_{OUT} = 45mA$ $I_{OUT} = 90mA$		120 380	300 600	mV
Supply Current	$I_{SS}$	$V_{IN} = -5.0V$		3.0	6.5	$\mu A$
Input Stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	$I_{OUT} = 20mA$ $-5.0V \leq V_{IN} \leq -10.0V$		0.1	0.3	%/V
Input Voltage	$V_{IN}$				-10.0	V
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$	$I_{OUT} = 20mA$ $-30^\circ C \leq T_{opr} \leq 80^\circ C$		$\pm 100$		ppm/ $^\circ C$

- Note:
1.  $V_{OUT}(T)$  = Specified output voltage
  2.  $V_{OUT}(E)$  = Effective output voltage (i.e. the output voltage when " $V_{OUT}(T) - 1.0V$ " is provided at the  $V_{IN}$  pin while maintaining a certain  $I_{OUT}$  value).
  3.  $V_{dif} = \{V_{IN1} - V_{OUT1}\}$
  4.  $V_{OUT1}$  = A voltage equal to 98% of the Output Voltage whenever an amply stabilised  $I_{OUT}$  ( $V_{OUT}(T) - 1.0V$ ) is input.
  5.  $V_{IN1}$  = The Input Voltage when a voltage equal to 98% of  $V_{OUT}(E)$  appears. (Input Voltage is gradually decreased.)
  6.  $I_{OUT \max}$  = Please ensure that output current is within the values given for power dissipation.

XC62KN3002

$V_{OUT}(T) = -3.0V$

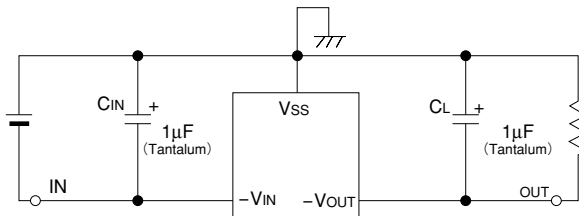
$T_a = 25^\circ C$

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	$V_{OUT}(E)$	$I_{OUT} = 20mA$ $V_{IN} = -4.0V$	$\times 0.98$ $-2.94$	$V_{OUT}(T)$ $-3.0$	$\times 1.02$ $-3.06$	V
Maximum Output Current	$I_{OUT\ max.}$	$V_{IN} = -4.0V, V_{OUT}(E) \geq -2.7V$	60			mA
Load Stability	$\Delta V_{OUT}$	$V_{IN} = -4.0V$ $1mA \leq I_{OUT} \leq 40mA$		40	80	mV
Input/Output Voltage Differential	$V_{dif}$	$I_{OUT} = 40mA$ $I_{OUT} = 80mA$		120 380	300 600	mV
Supply Current	$I_{SS}$	$V_{IN} = -4.0V$		2.5	6.0	$\mu A$
Input Stability	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \cdot V_{OUT}}$	$I_{OUT} = 20mA$ $-4.0V \leq V_{IN} \leq -10.0V$		0.1	0.3	%/V
Input Voltage	$V_{IN}$				-10.0	V
Output Voltage Temperature Characteristics	$\frac{\Delta V_{OUT}}{\Delta T_{opr} \cdot V_{OUT}}$	$I_{OUT} = 20mA$ $-30^\circ C \leq T_{opr} \leq 80^\circ C$		$\pm 100$		ppm/ $^\circ C$

- Note:
1.  $V_{OUT}(T)$  = Specified output voltage
  2.  $V_{OUT}(E)$  = Effective output voltage (i.e. the output voltage when " $V_{OUT}(T) - 1.0V$ " is provided at the  $V_{IN}$  pin while maintaining a certain  $I_{OUT}$  value).
  3.  $V_{dif} = \{V_{IN1} - V_{OUT1}\}$
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  5.  $V_{IN1}$  = The Input Voltage when a voltage equal to 98% of  $V_{OUT}(E)$  appears. (Input Voltage is gradually decreased.)
  6.  $I_{OUT\ max}$  = Please ensure that output current is within the values given for power dissipation.

## ■ Typical Application Circuit

### ● Standard Circuit



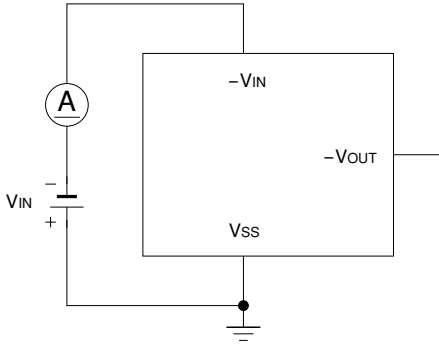
## ■ Directions for use

### ● Notes on Use

Please ensure that values for  $C_{IN}$  and  $C_L$  are more than  $1\mu F$  (Tantalum).

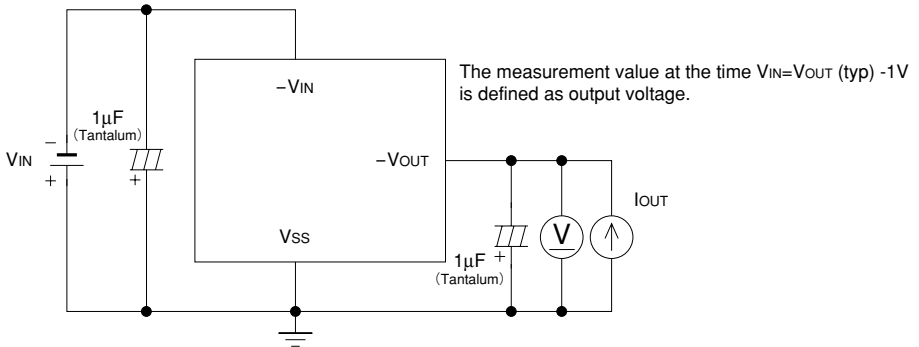
## Test Circuits

### 1. Supply Current

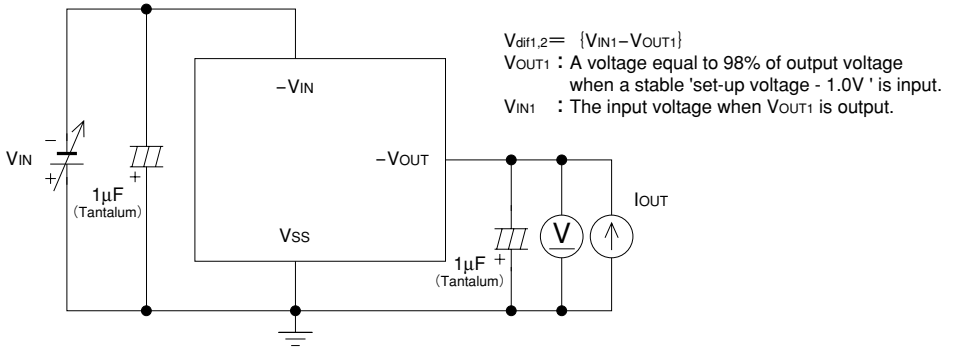


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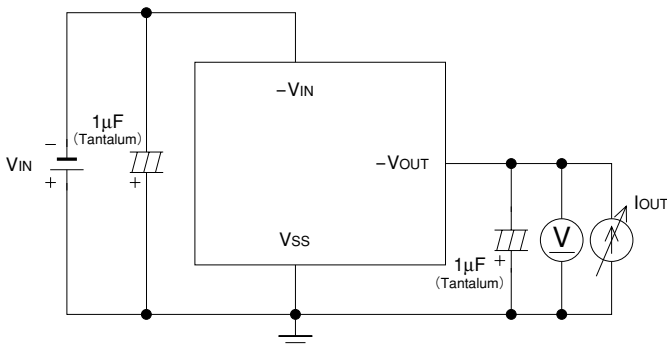
### 2. Output Voltage



### 3. Input stability, Input/Output voltage differential



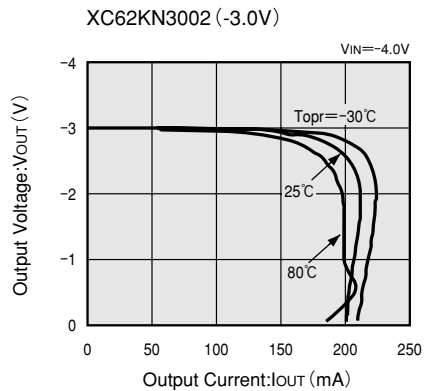
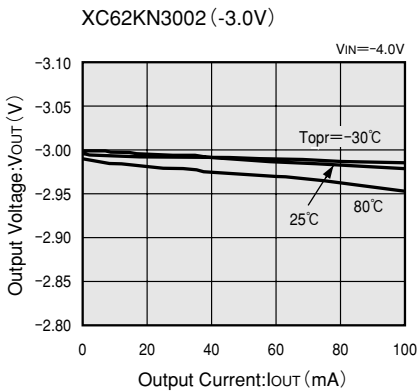
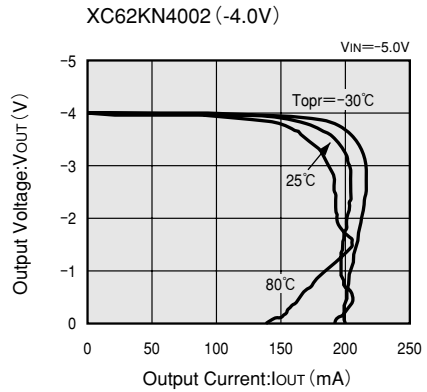
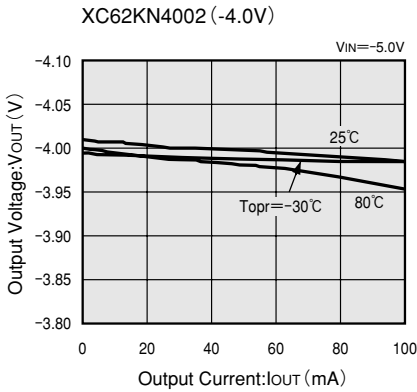
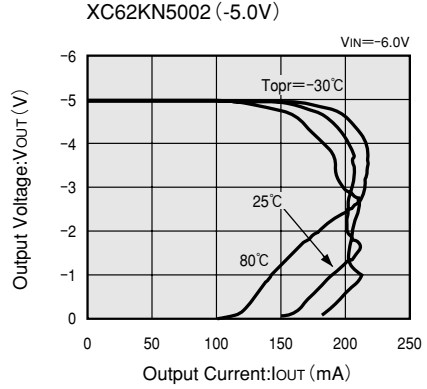
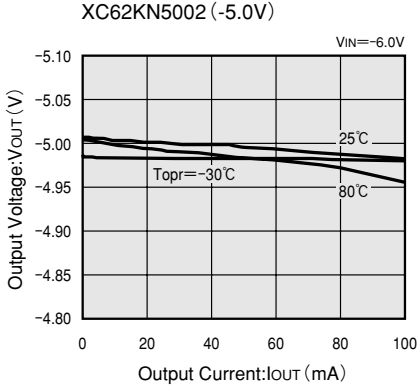
### 4. Load stability, Maximum output current





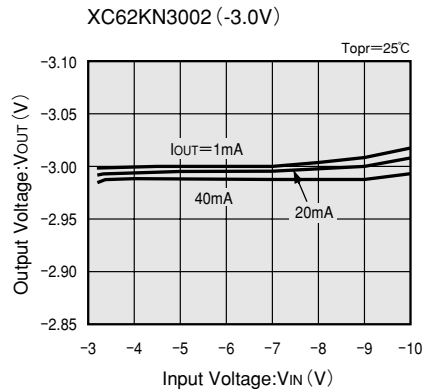
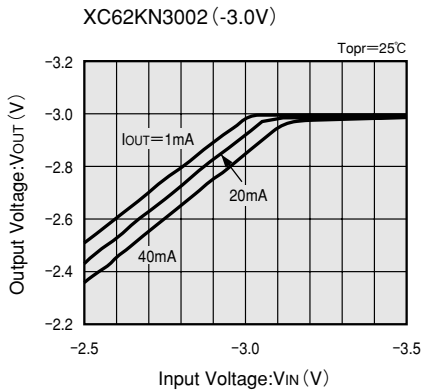
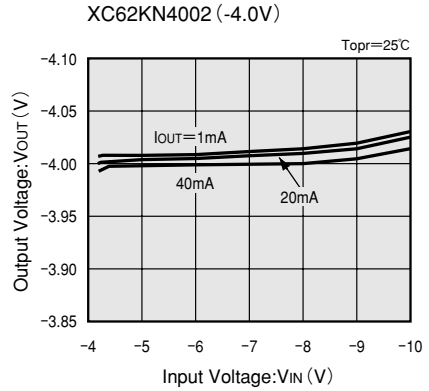
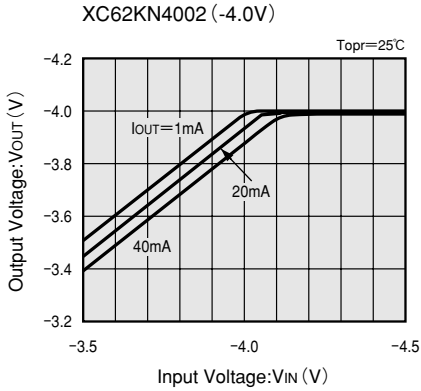
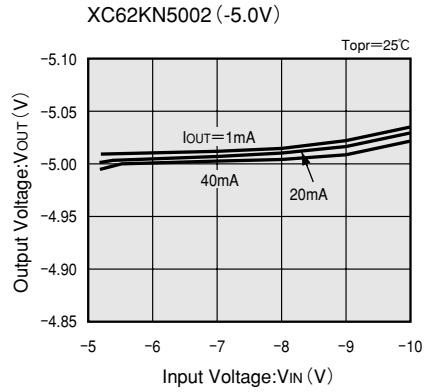
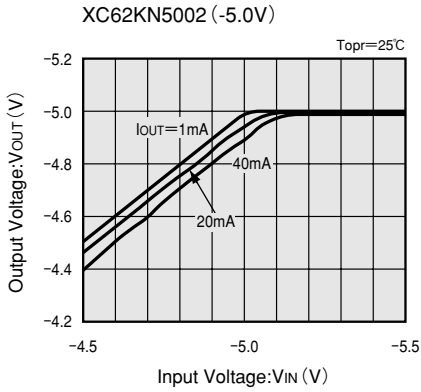
## Typical Performance Characteristics

### (1) OUTPUT VOLTAGE vs. OUTPUT CURRENT

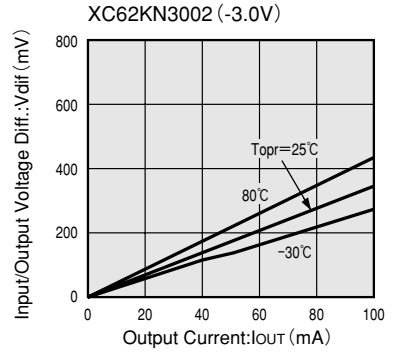
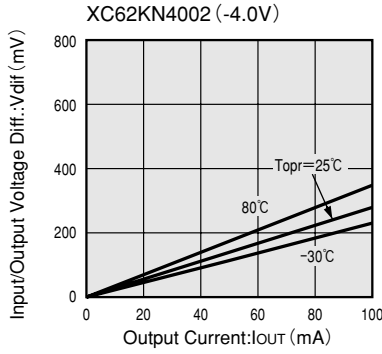
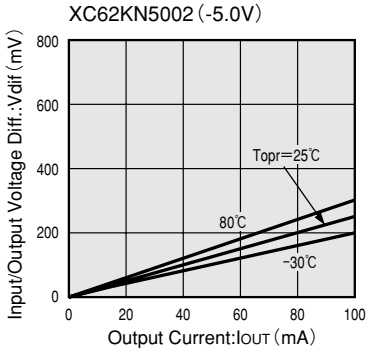


## (2) OUTPUT VOLTAGE vs. INPUT VOLTAGE

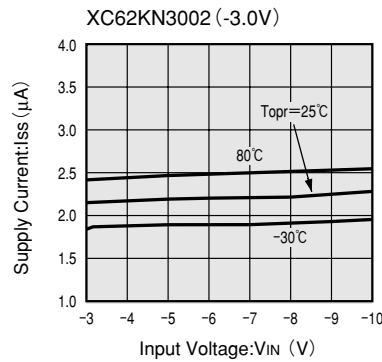
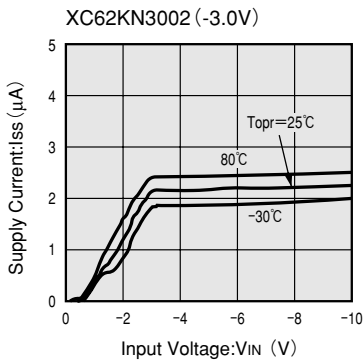
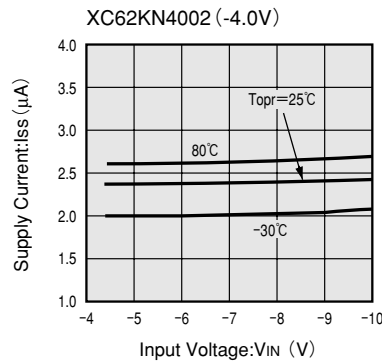
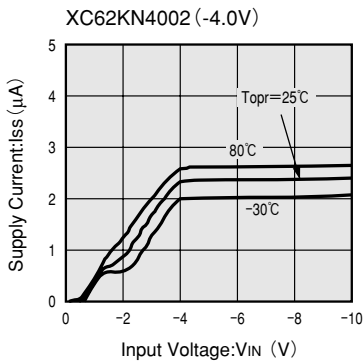
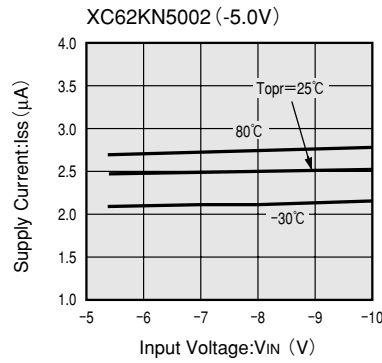
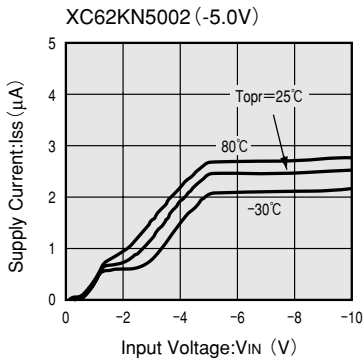
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**(3) INPUT/OUTPUT VOLTAGE DIFFERENTIAL vs. OUTPUT CURRENT**

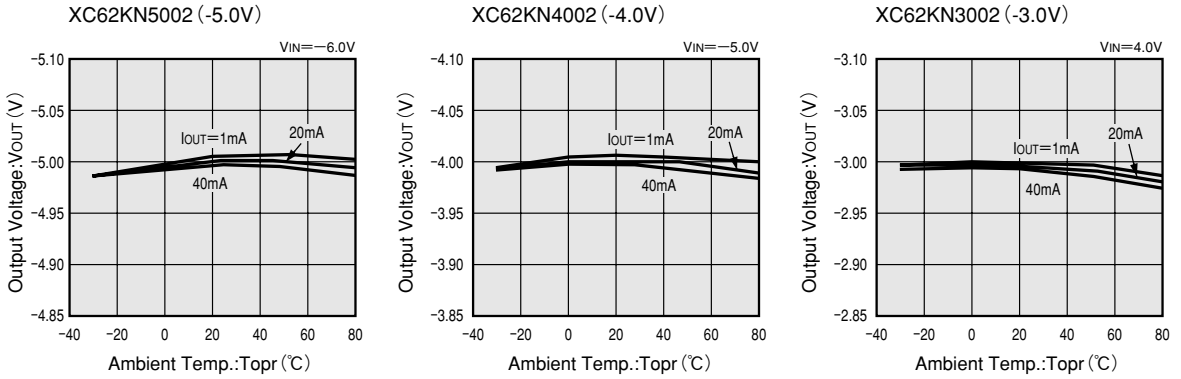


**(4) SUPPLY CURRENT vs. INPUT VOLTAGE**

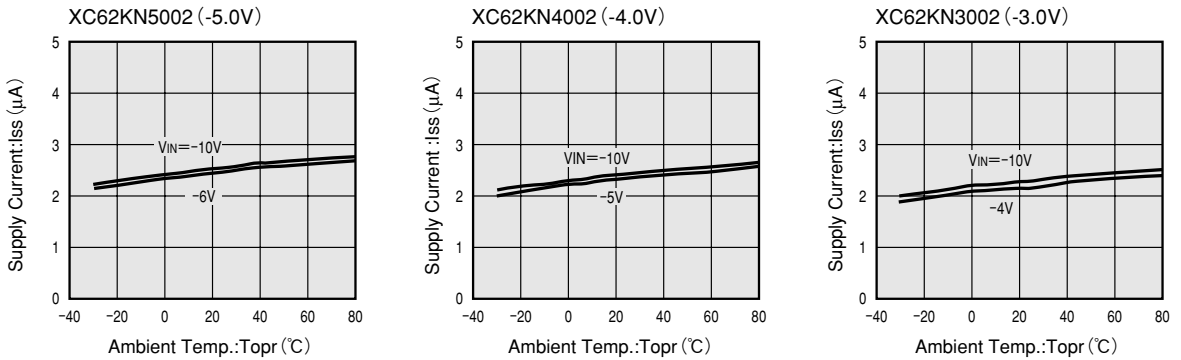


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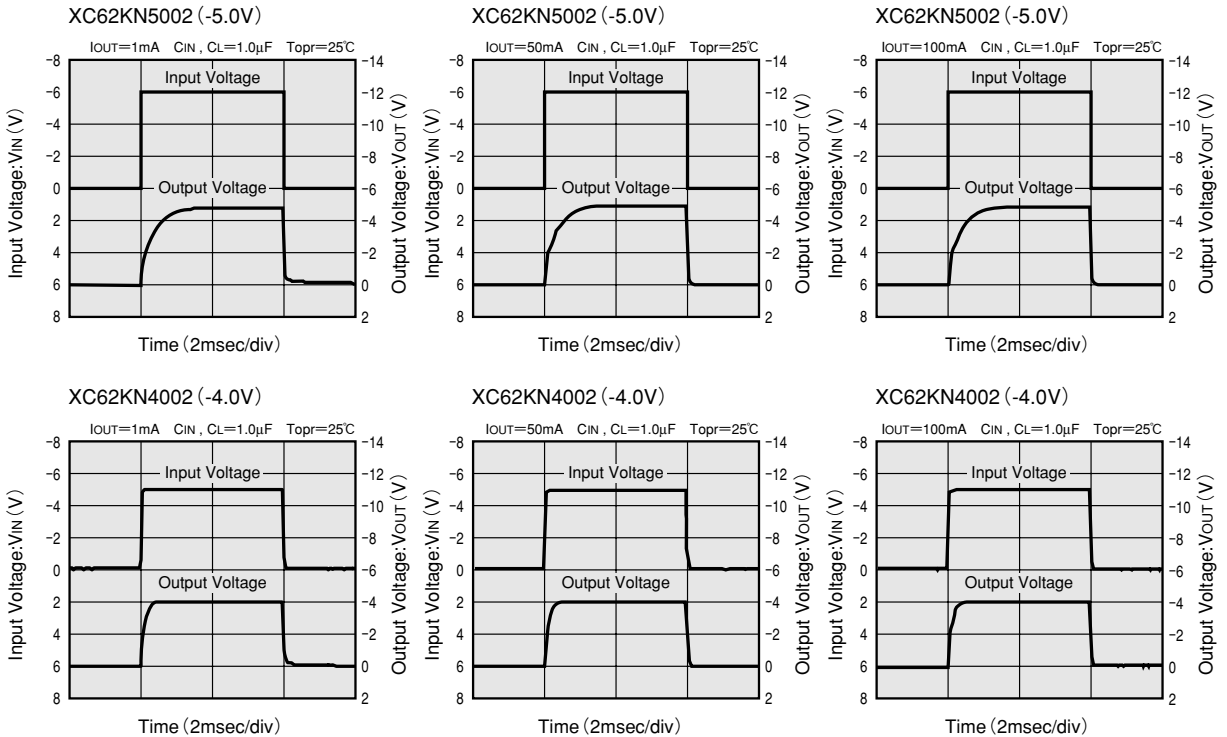
## (5) OUTPUT VOLTAGE vs. AMBIENT TEMPERATURE



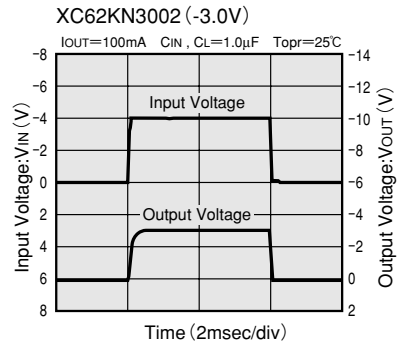
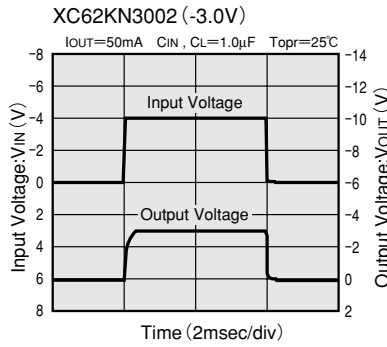
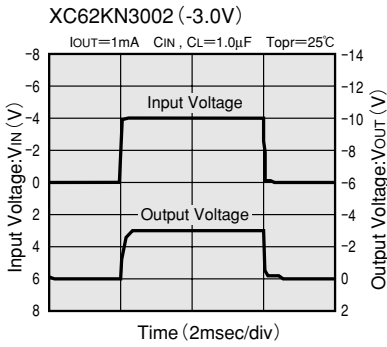
## (6) SUPPLY CURRENT vs. AMBIENT TEMPERATURE



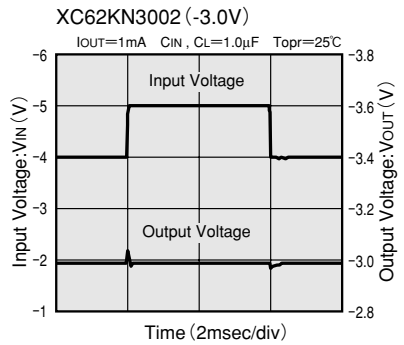
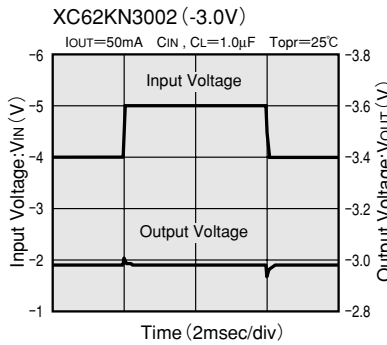
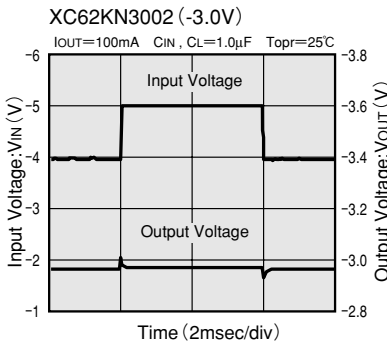
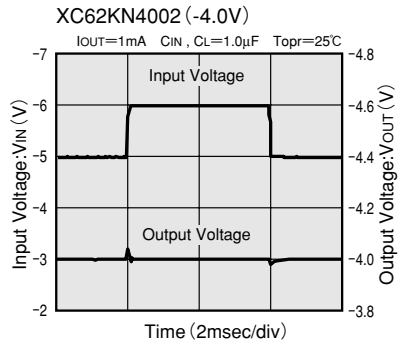
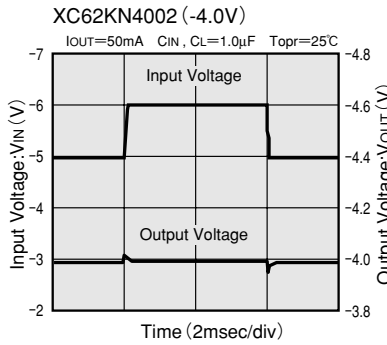
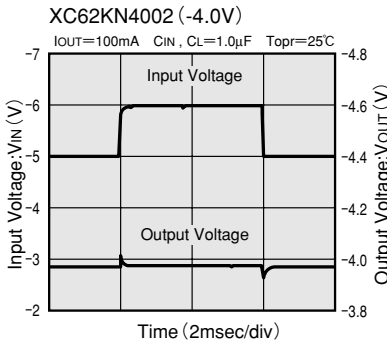
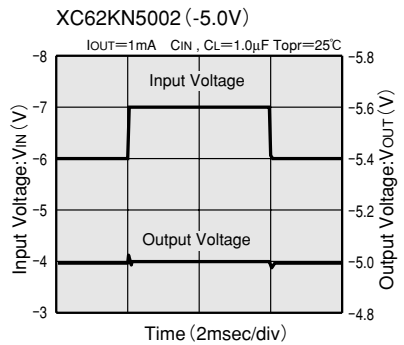
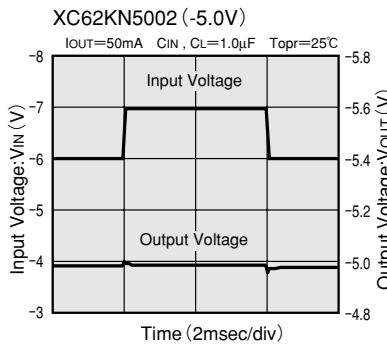
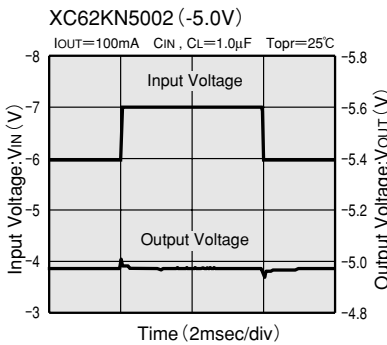
## (7) INPUT TRANSIENT RESPONSE 1



**(7) INPUT TRANSIENT RESPONSE 1**

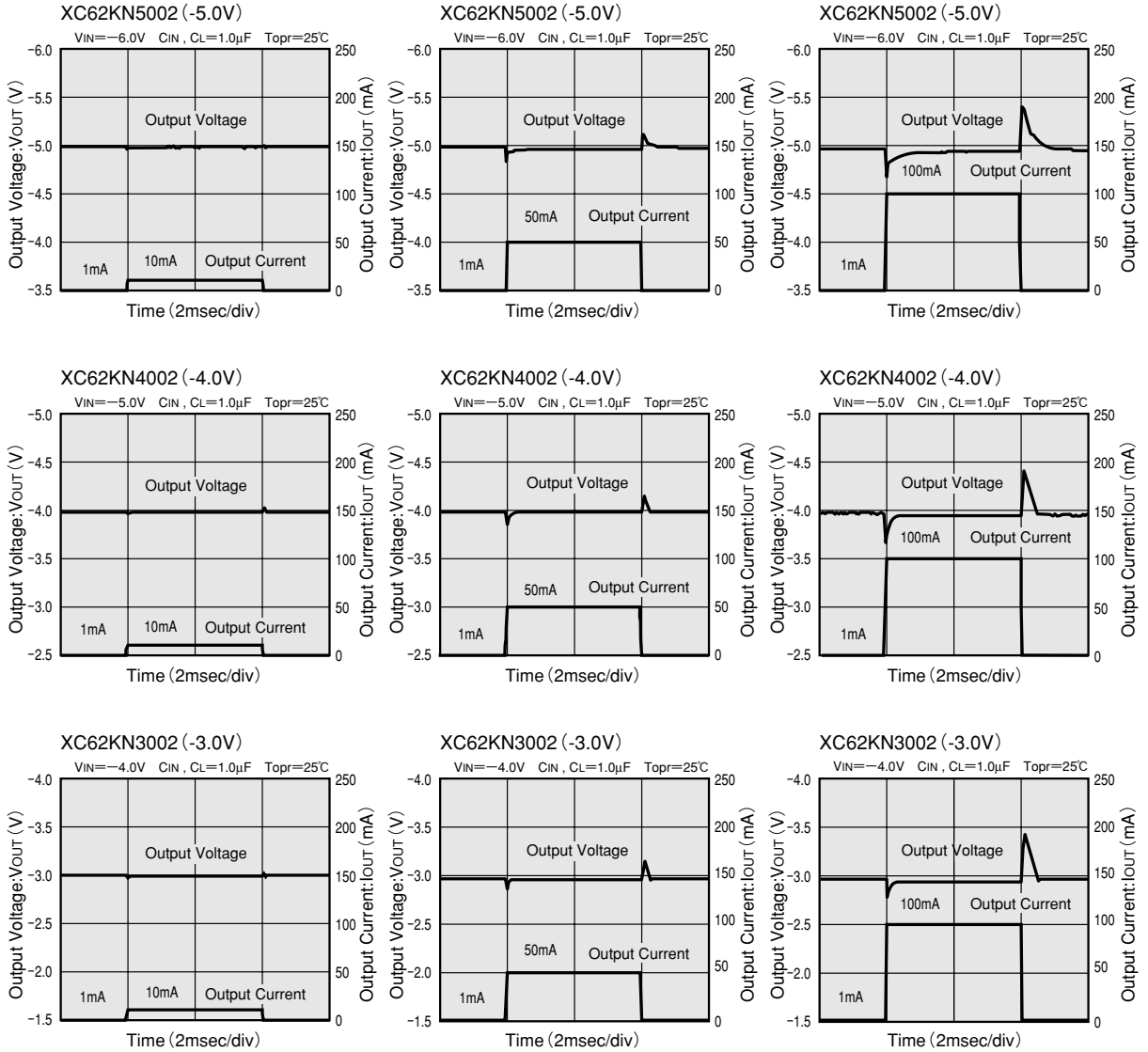


**(8) INPUT TRANSIENT RESPONSE 2**



**3**

## (9) LOAD TRANSIENT RESPONSE



## (10) RIPPLE REJECTION RATE

