ML6206 Series Low ESR Cap. Compatible Positive Voltage Regulator

❖ *Application*

- *Battery Powered Equipment*
- *Palmtops*
- *Portable Cameras and Video Recorders*
- *Reference Voltage Sources*

❖ *Features*

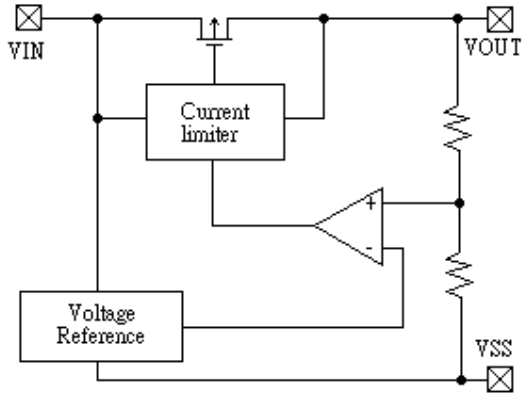
- CMOS Low Power Consumption :
  Typical 1.0uA at Vout=3.0V
- Output Voltage Range : 1.5V to 5.0V in 0.1V increments
- Highly Accurate:
  Output Voltage ± 3% for 1.5V to 1.9V
  Output Voltage ± 2% for 2.0V to 5.0V
- Maximum Output Current: 250mA
  (within the maximum power dissipation, Vout=5.0V)
- Small Input-Output Voltage Differential:
  0.16V at 100mA and 0.4V at 200mA
- Input stability: Typ. 0.2%/V
- Package Available:
  SOT-23 (150mW), SOT-89 (500mW) &
  TO-92 (300mW)
- Reverse Battery Protection
- Current Limit

❖ *General Description*

The ML6206 series are highly precise, low power consumption, high voltage, positive voltage output, three-pin regulator. It provides high output current even when the input/output voltage differential is small.

The ML6206 consists of a high-precision voltage reference, an error correction circuit, a current limited output driver and reverse battery protection.

❖ *Block Diagram*

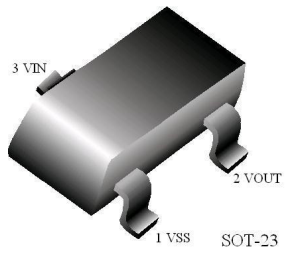


Absolute Maximum Ratings

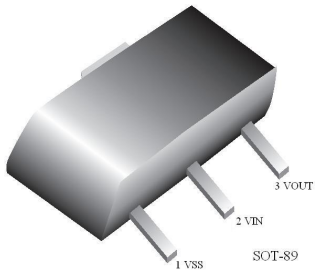
Parameter		Symbol	Ratings	Units
Input Voltage		V_{IN}	6.5	V
Output Current		I_{OUT}	500	mA
Output Voltage		V_{OUT}	V_{SS}-0.3 ~V_{IN}+0.3	V
Continuous Total Power Dissipation	SOT-23	P_d	150	mW
	SOT-89		500	
	TO-92		300	
Operating Ambient Temperature		T_{opr}	-40 ~ +70	°C
Storage Temperature		T_{stg}	-40 ~ +70	°C

❖ *Pin Configuration*

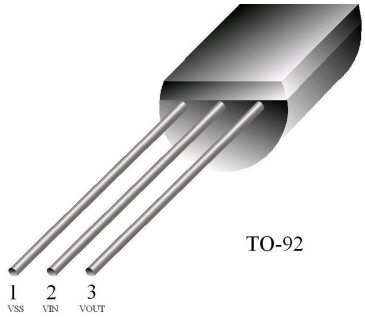
SOT-23



SOT-89



TO-92



Package Pin Number			Pin Name	Function
SOT23	SOT89	TO-92		
1	1	1	VSS	Ground
3	2	2	VIN	Power Input
2	3	3	VOUT	Output

❖ *Standard Circuit*

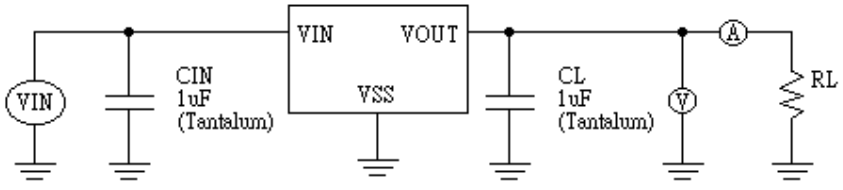
Note on Use

1. Oscillation may occur as a result of the impedance present between the power supply and the IC's input. Please use a capacitor (CIN) of at least 1uF, when the impedance is 10 ohm or more.
   With a large output current, Voltage output can be stabilised by increasing capacitor (CIN) size. If CIN is small and capacitor (CL) size is increased, oscillation may occur. In such cases, Voltage output can be stabilised by either increasing the size of CIN or decreasing the size of CL.

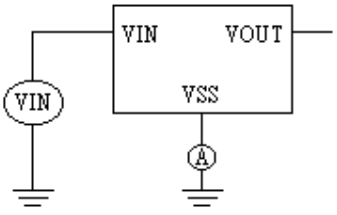
2. Please ensure that output current (IOUT) is less than Pd / (VIN-VOUT) and does not exceed the stipulated Continuous Total Power Dissipation value (Pd).

❖ *Test Circuit*

Test Circuit 1



Test Circuit 2



❖ *Electrical Characteristic*

ML6206P153 VOUT(T)=1.5V(Note 1)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Circuit
Output Voltage	VOUT(E) (Note 2)	IOUT=30mA VIN=2.5V	1.455	1.500	1.545	V	1
Maximum Output Current	IOUT max	VIN=2.5V, VOUT(E) ≥ 1.35V	200			mA	1
Load Stability	ΔVOUT	VIN=2.5V, 1mA ≤IOUT≤ 100mA		35		mV	1
Input –Output Voltage Differential (Note 3)	Vdif1	IOUT=100mA		250		mV	1
	Vdif2	IOUT=200mA		500		mV	1
Supply Current	ISS	VIN=2.5V		1.0		uA	2
Input Stability	$\frac{\Delta VOUT}{\Delta VIN * VOUT}$	IOUT=30mA VOUT(T)+1.0V≤VIN≤6V		0.01	0.30	%V	1
Input Voltage	VIN		1.2		6.5	V	-
Current Limiter	Ishort	VIN = VOUT+1.5V, VOUT=VSS		100		mA	1

ML6206P183 VOUT(T)=1.8V(Note 1)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Circuit
Output Voltage	VOUT(E) (Note 2)	IOUT=30mA VIN=2.8V	1.746	1.800	1.854	V	1
Maximum Output Current	IOUT max	VIN=2.8V, VOUT(E) ≥ 1.62V	200			mA	1
Load Stability	ΔVOUT	VIN=2.8V, 1mA ≤IOUT≤ 100mA		35		mV	1
Input –Output Voltage Differential (Note 3)	Vdif1	IOUT=100mA		250		mV	1
	Vdif2	IOUT=200mA		500		mV	1
Supply Current	ISS	VIN=2.8V		1.0		uA	2
Input Stability	$\frac{\Delta VOUT}{\Delta VIN * VOUT}$	IOUT=30mA VOUT(T)+1.0V≤VIN≤6V		0.01	0.30	%V	1
Input Voltage	VIN		1.2		6.5	V	-
Current Limiter	Ishort	VIN = VOUT+1.5V, VOUT=VSS		100		mA	1

ML6206P212 VOUT(T)=2.1V(Note 1)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Circuit
Output Voltage	VOUT(E) (Note 2)	IOUT=30mA VIN=3.1V	2.058	2.100	2.142	V	1
Maximum Output Current	IOUT max	VIN=3.1V, VOUT(E) ≥ 1.89V	240			mA	1
Load Stability	ΔVOUT	VIN=3.1V, 1mA ≤IOUT≤ 100mA		30		mV	1
Input –Output Voltage Differential (Note 3)	Vdif1	IOUT=100mA		180		mV	1
	Vdif2	IOUT=200mA		390		mV	1
Supply Current	ISS	VIN=3.1V		1.0		uA	2
Input Stability	$\frac{\Delta VOUT}{\Delta VIN * VOUT}$	IOUT=30mA VOUT(T)+1.0V≤VIN≤6V		0.01	0.30	%V	1
Input Voltage	VIN		1.2		6.5	V	-
Current Limiter	Ishort	VIN = VOUT+1.5V, VOUT=VSS		100		mA	1

ML6206P302 VOUT(T)=3.0V(Note 1)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Circuit
Output Voltage	VOUT(E) (Note 2)	IOUT=30mA VIN=4.0V	2.940	3.000	3.060	V	1
Maximum Output Current	IOUT max	VIN=4.0V, VOUT(E) ≥2.7V	270			mA	1
Load Stability	ΔVOUT	VIN=4.0V, 1mA≤IOUT≤100mA		25		mV	1
Input –Output Voltage Differential (Note 3)	Vdif1	IOUT=100mA		120		mV	1
	Vdif2	IOUT=200mA		260		mV	1
Supply Current	ISS	VIN=4.0V		1.0		uA	2
Input Stability	$\frac{\Delta VOUT}{\Delta VIN * VOUT}$	IOUT=30mA VOUT(T)+1.0V≤VIN≤6V		0.01	0.30	%V	1
Input Voltage	VIN		1.2		6.5	V	-
Current Limiter	Ishort	VIN = VOUT+1.5V, VOUT=VSS		100		mA	1

ML6206P332 VOUT(T)=3.3V(Note 1)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Circuit
Output Voltage	VOUT(E) (Note 2)	IOUT=30mA VIN=4.3V	2.234	3.300	3.366	V	1
Maximum Output Current	IOUT max	VIN=4.3V, VOUT(E) ≥2.97V	270			mA	1
Load Stability	ΔVOUT	VIN=4.3V, 1mA≤IOUT≤100mA		25		mV	1
Input –Output Voltage Differential (Note 3)	Vdif1	IOUT=100mA		120		mV	1
	Vdif2	IOUT=200mA		260		mV	1
Supply Current	ISS	VIN=4.3V		1.0		uA	2
Input Stability	$\frac{\Delta VOUT}{\Delta VIN * VOUT}$	IOUT=30mA VOUT(T)+1.0V≤VIN≤6V		0.01	0.30	%V	1
Input Voltage	VIN		1.2		6.5	V	-
Current Limiter	Ishort	VIN = VOUT+1.5V, VOUT=VSS		100		mA	1

ML6206P502 VOUT(T)=5.0V(Note 1)

Parameter	Symbol	Conditions	Min	Typ	Max	Units	Circuit
Output Voltage	VOUT(E) (Note 2)	IOUT=30mA VIN=6.0V	4.900	5.000	5.100	V	1
Maximum Output Current	IOUT max	VIN=6.0V, VOUT(E) ≥4.5V	270			mA	1
Load Stability	ΔVOUT	VIN=6.0V, 1mA≤IOUT≤100mA		25		mV	1
Input –Output Voltage Differential (Note 3)	Vdif1	IOUT=100mA		110		mV	1
	Vdif2	IOUT=200mA		260		mV	1
Supply Current	ISS	VIN=5.0V		1.0		uA	2
Input Stability	$\frac{\Delta VOUT}{\Delta VIN * VOUT}$	IOUT=30mA 5.0V≤VIN≤6.5V		0.01	0.30	%V	1
Input Voltage	VIN		1.2		6.5	V	-
Current Limiter	Ishort	VIN = VOUT+1.5V, VOUT=VSS		100		mA	1

Note : 1. VOUT(T) = Specified Output Voltage.

2. VOUT(E) = Effective Output Voltage (i.e. the output voltage when (VOUT(T)+1.0V) is provided at the VIN pin while maintaining a certain IOUT value).

3. Vdif = VIN1(Note 4) – VOUT(E)

4. VIN1 = The input voltage at the time 98% of VOUT (E) is output (input voltage has been gradually reduced).

❖ *Typical Performance Characteristics*

1) Output Voltage vs. Output Current

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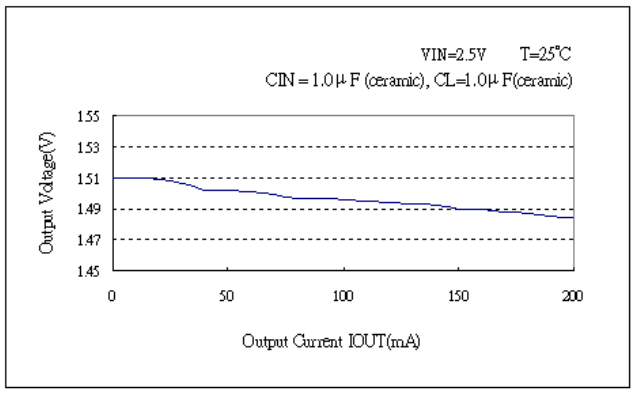

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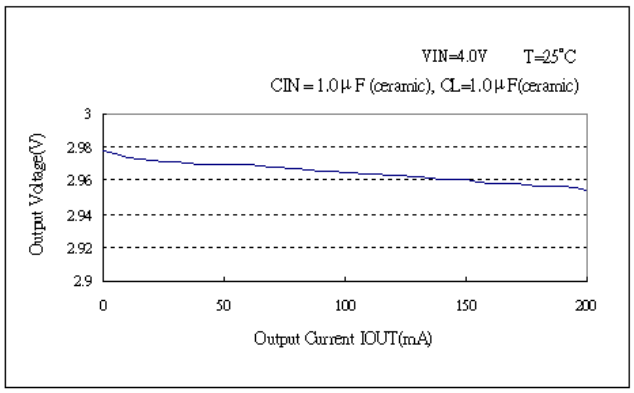

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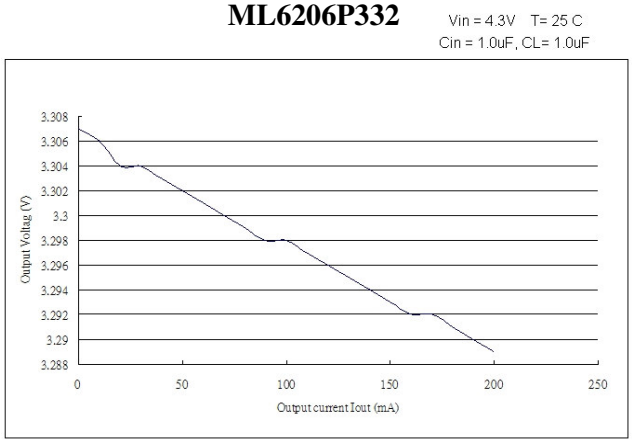

2) Current Limit

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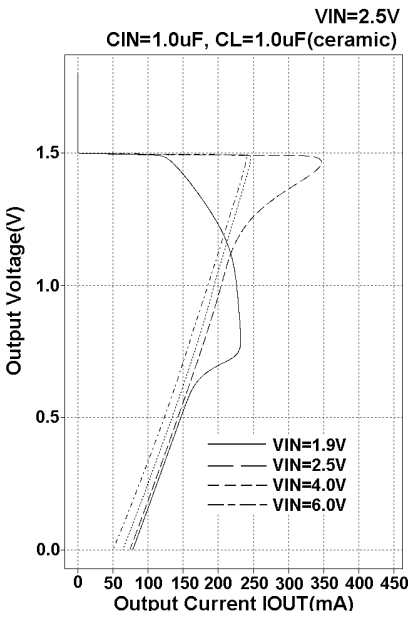

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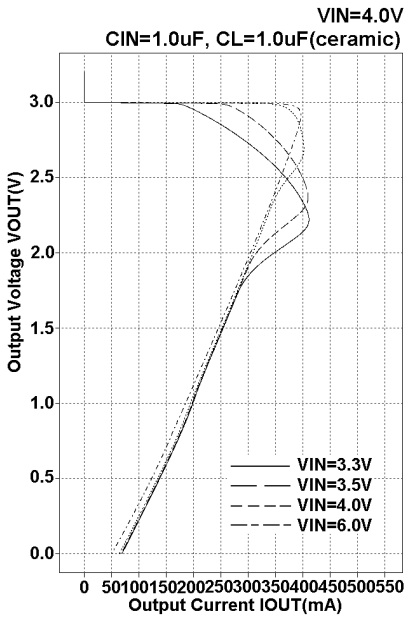

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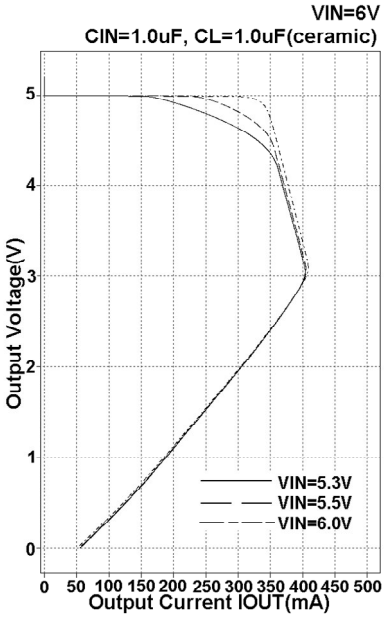

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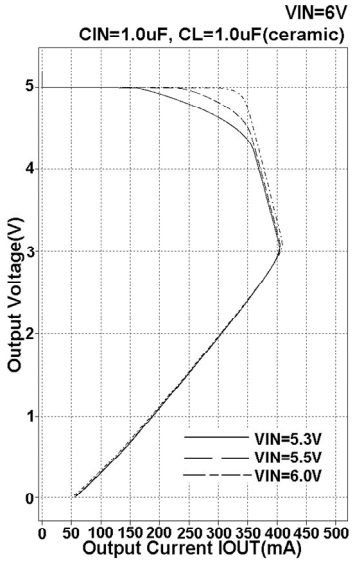

3) Output Voltage vs. Input Voltage

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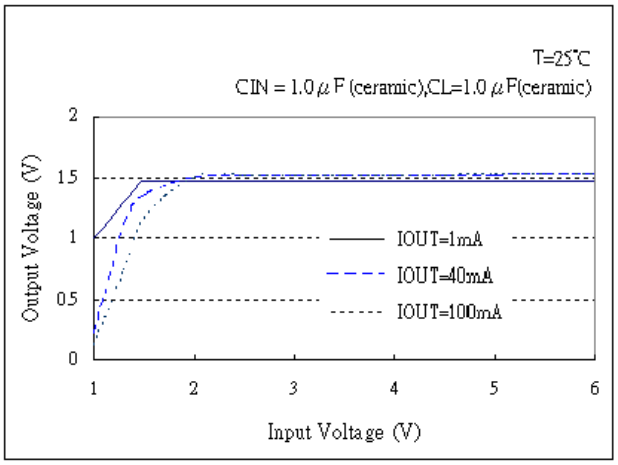

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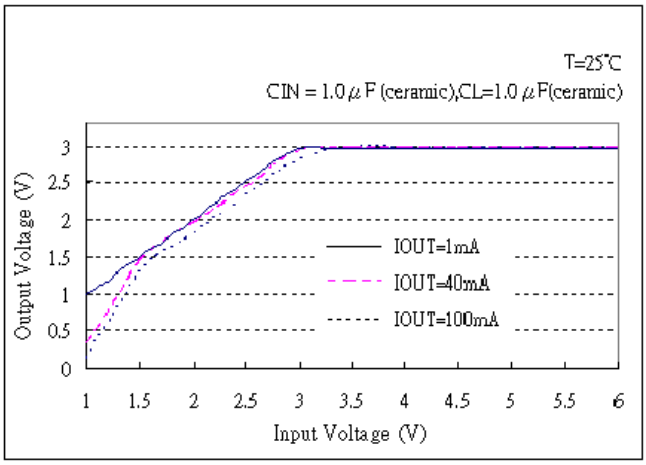

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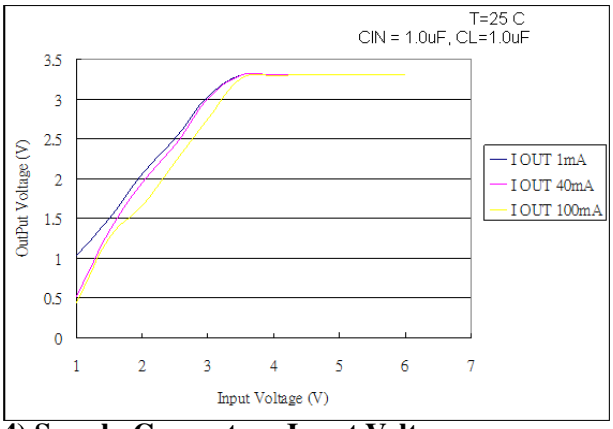

4) Supply Current vs. Input Voltage

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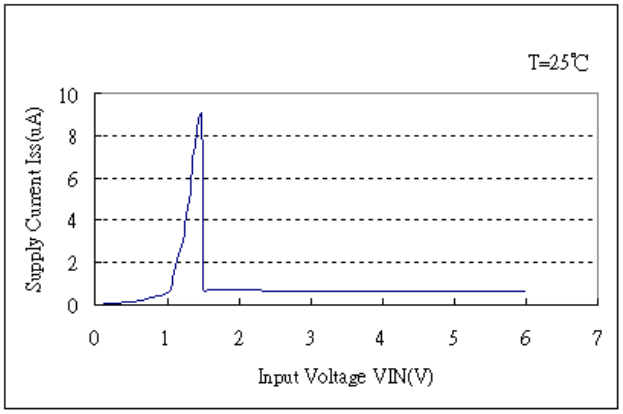

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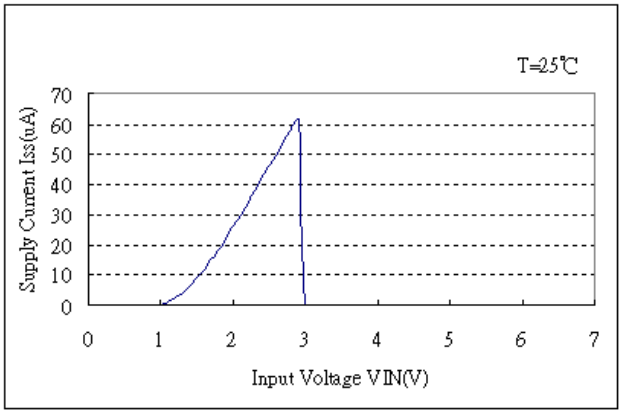

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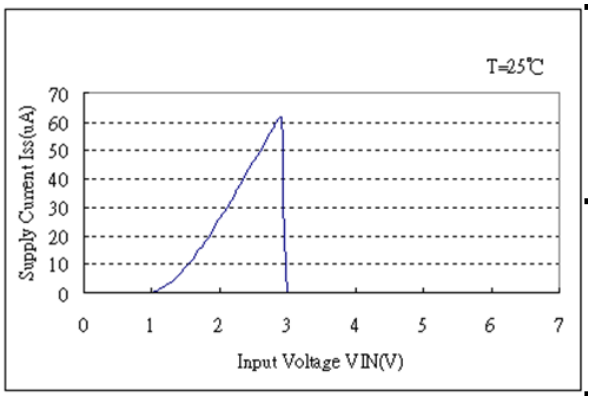

5) Output Voltage vs. Ambient Temperature

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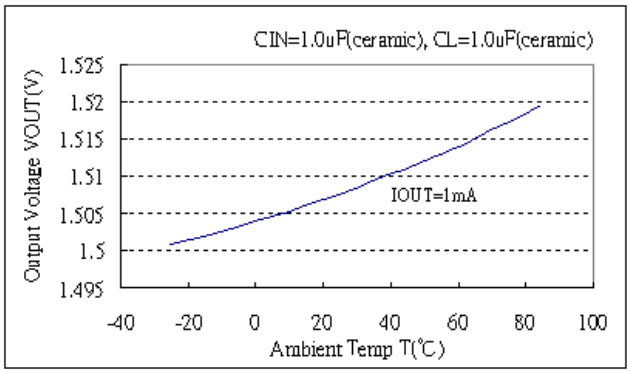

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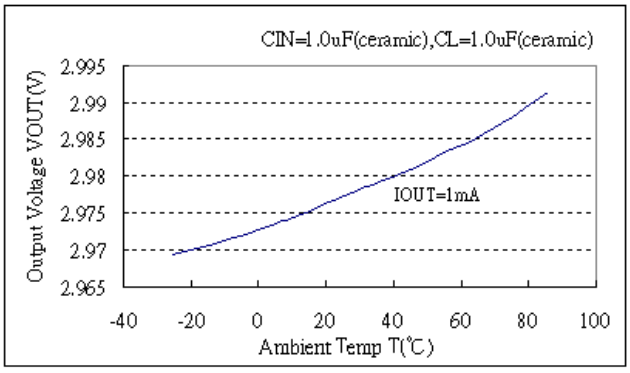

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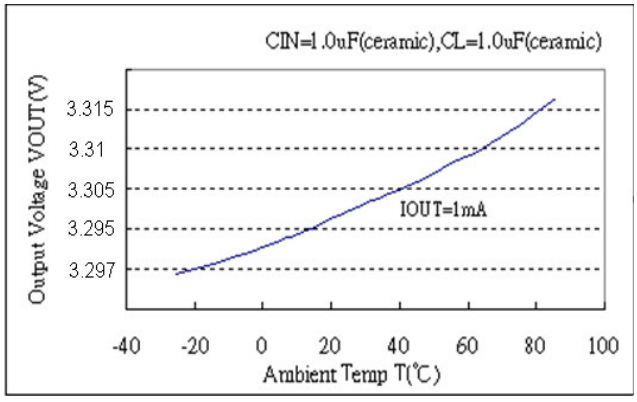

6) Supply Current vs. Ambient Temperature

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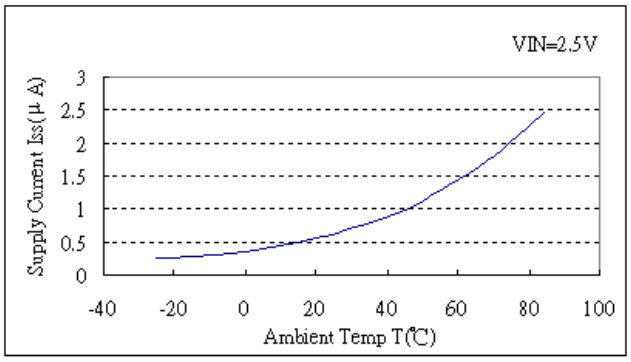

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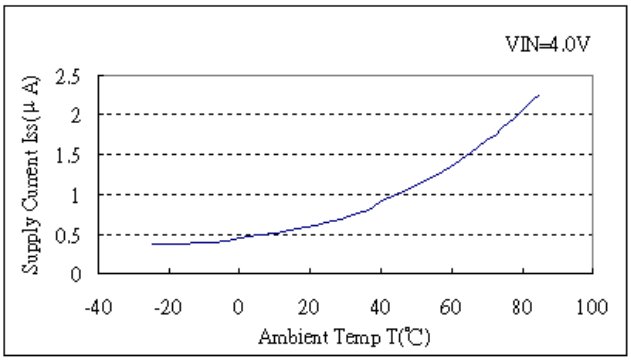

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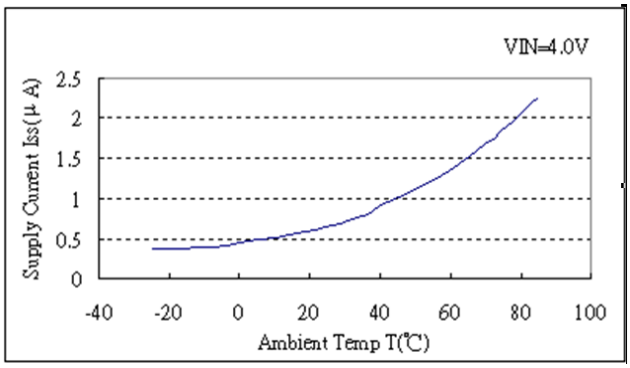

7) Input Transient Response 1

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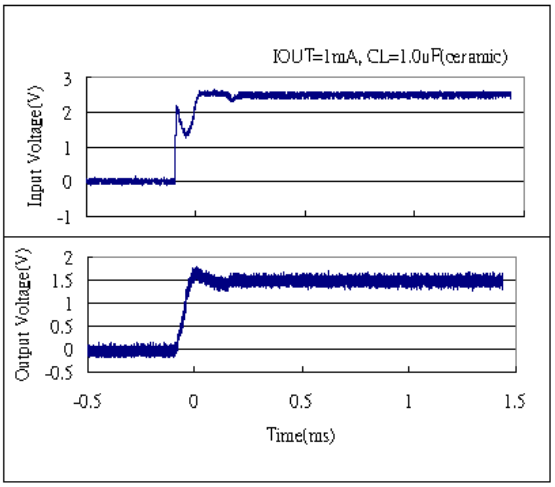

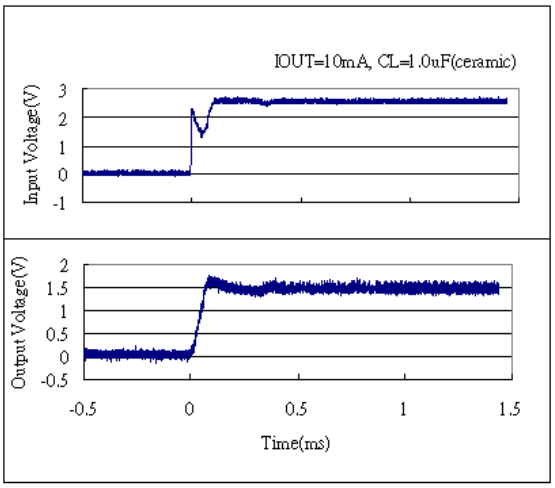

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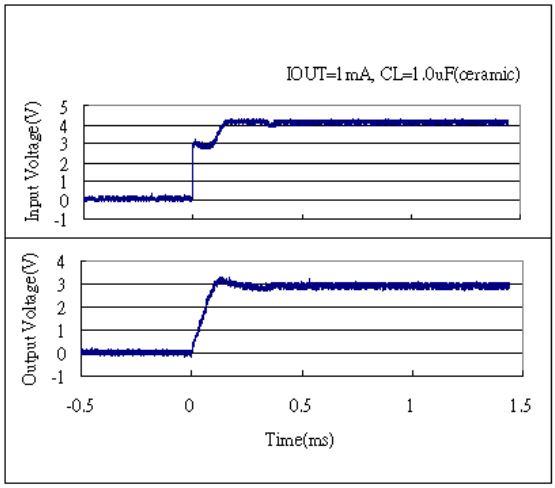

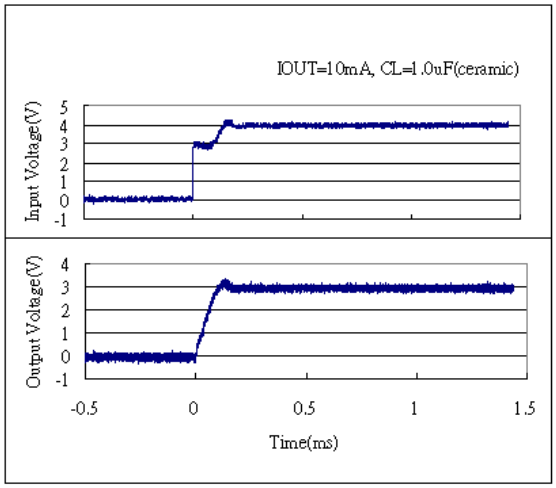

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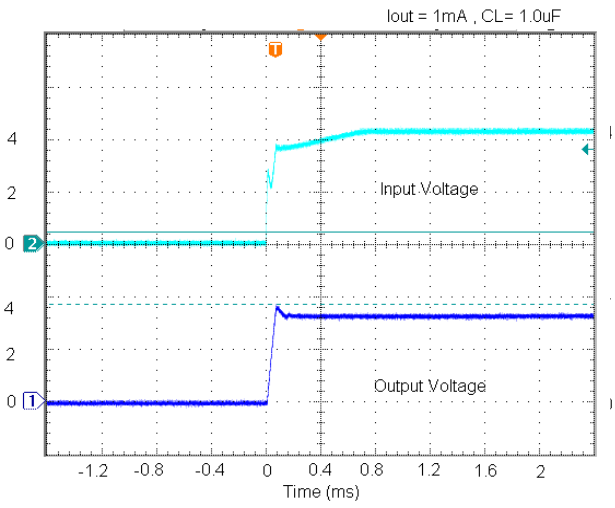

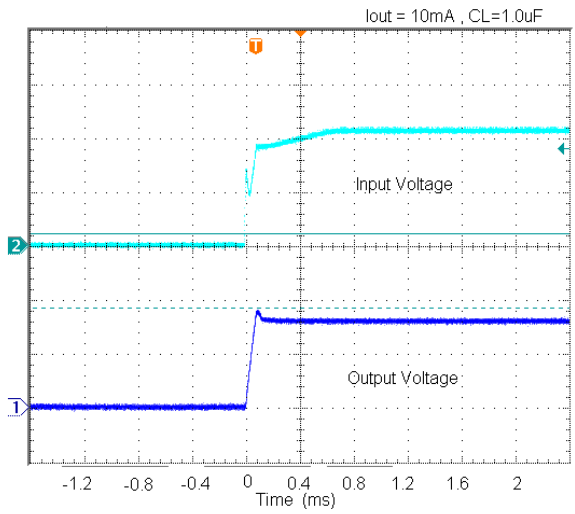

8) Input Transient Response 2

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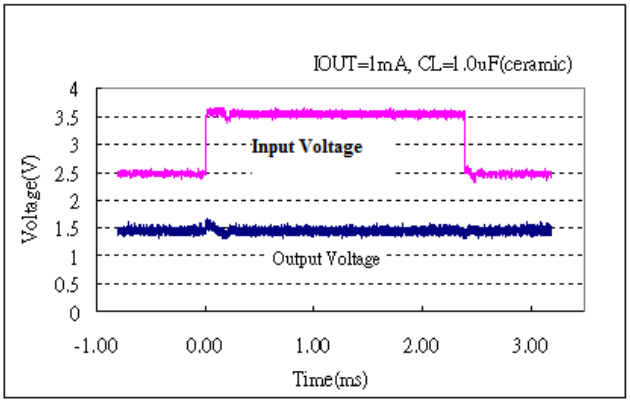

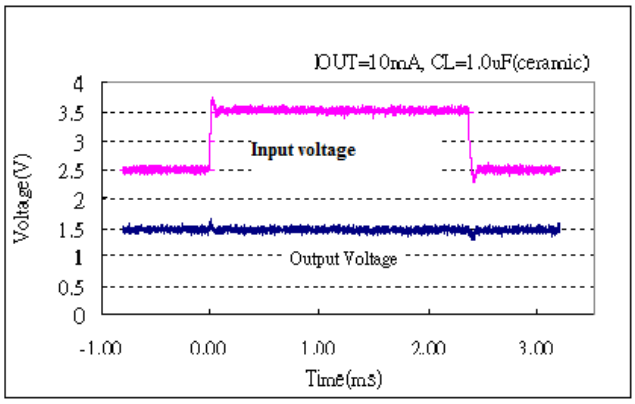

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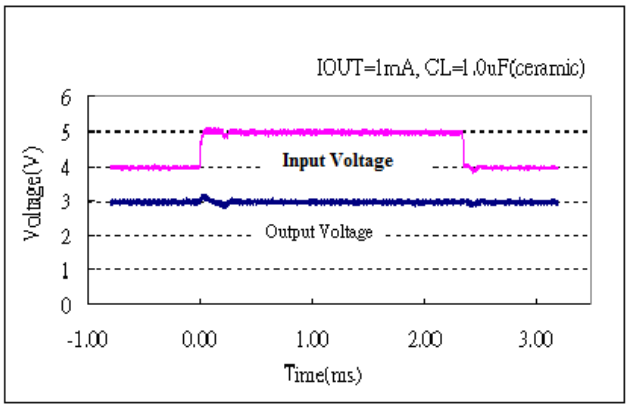

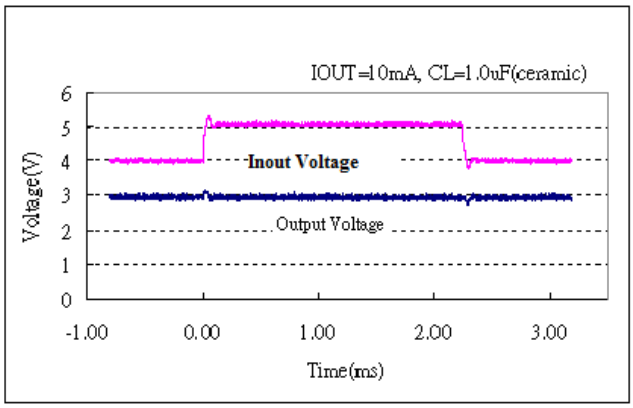

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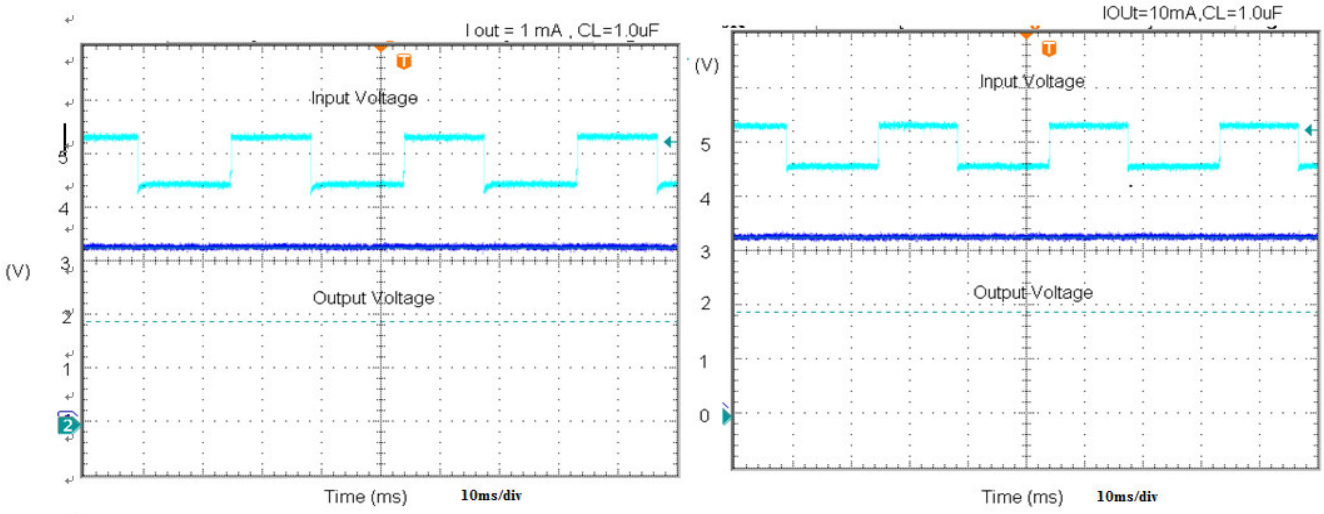

9) Load Transient Response

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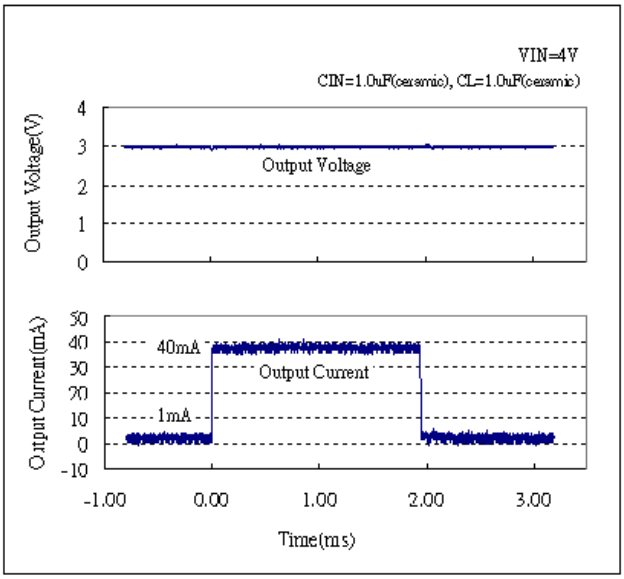
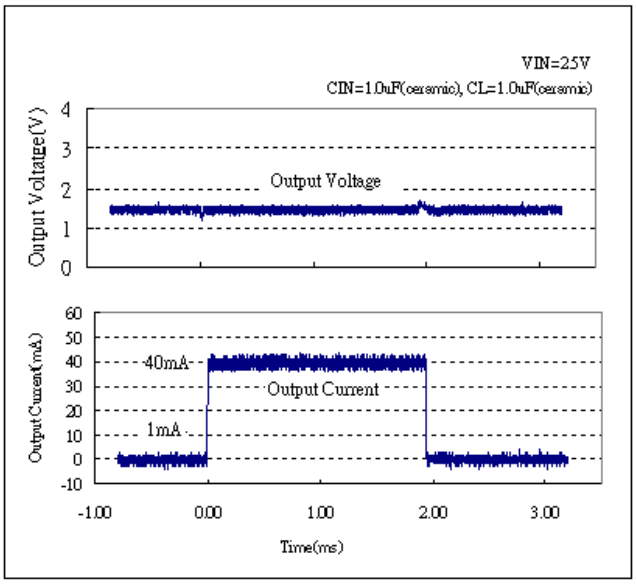
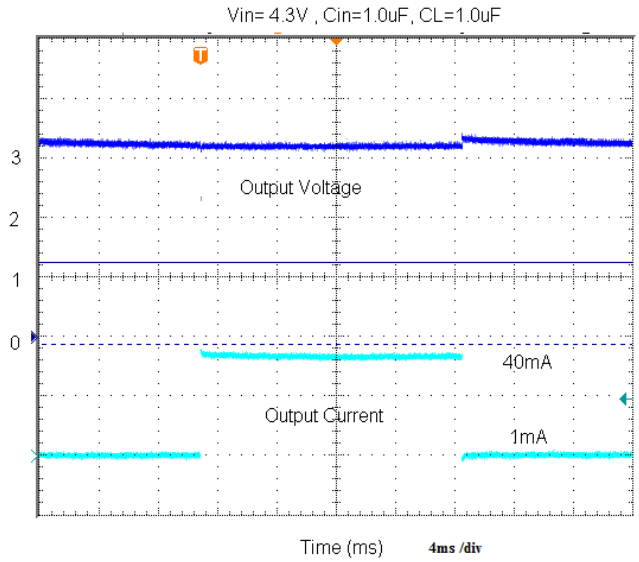


ML6206P302

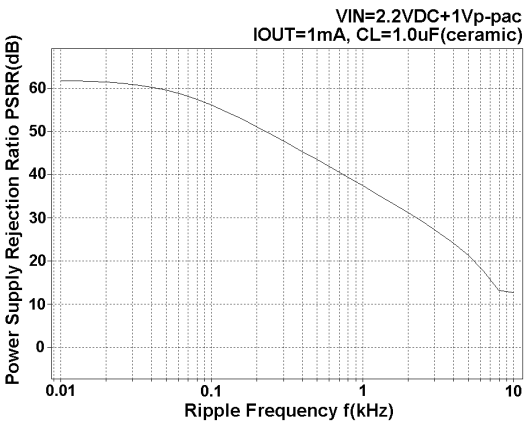


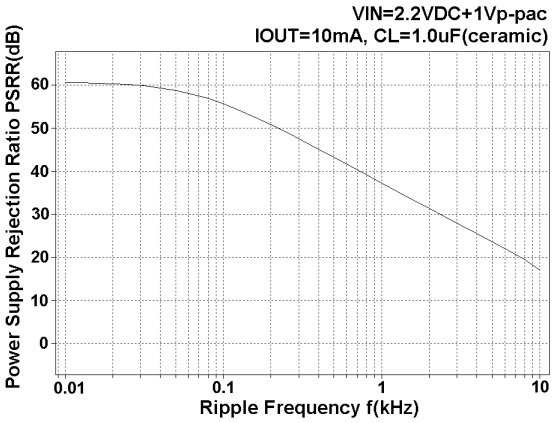
ML6206P332



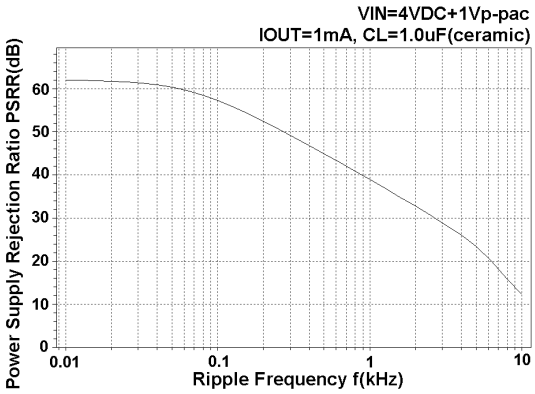
10) Power Supply Rejection Ratio

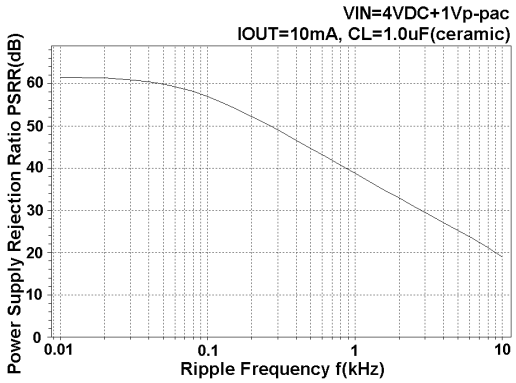
ML6206P153





ML6206P332





❖ *Ordering Information*

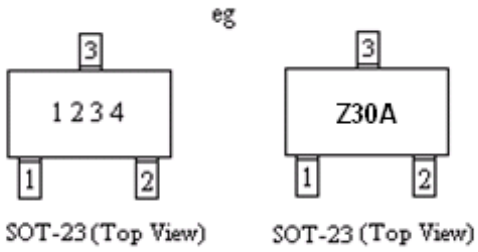
Designator	Description
①②	**Output Voltage** eg. 30=3.0V 50=5.0V
③	**Output Voltage Accuracy** 2 = ± 2.0% 3 = ± 3.0%
④	**Package Type** M = SOT-23 P = SOT-89 T = TO-92
⑤	**Device Orientation** R = Embossed Tape (Orientation of Device : Right) L = Embossed Tape (Orientation of Device : Left) B = Bag (TO-92) H = Paper Tape (TO-92)
⑥	G = ROHS Part

ML6206P①②③④⑤⑥

❖ *Marking*

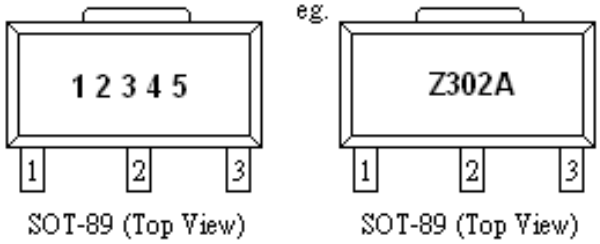
SOT-23 :

Designator	Description
1	**Type** Z = Positive Voltage Regulator
2,3	**Output Voltage** eg. 30 = 3.0V
4	**Internal Code**



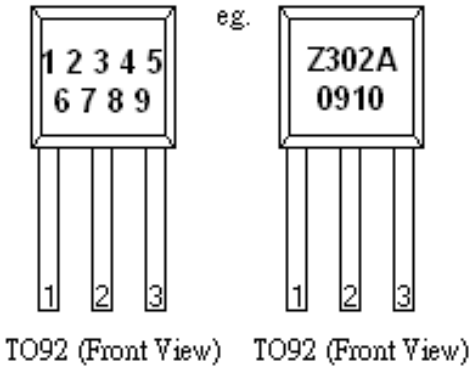
SOT-89 :

Designator	Description
1	**Type** Z = Positive Voltage Regulator
2,3	**Output Voltage** eg. 30 = 3.0V
4	**Output Voltage Accuracy** 2 = ± 2.0% 3 = ± 3.0%
5	**Internal Code**



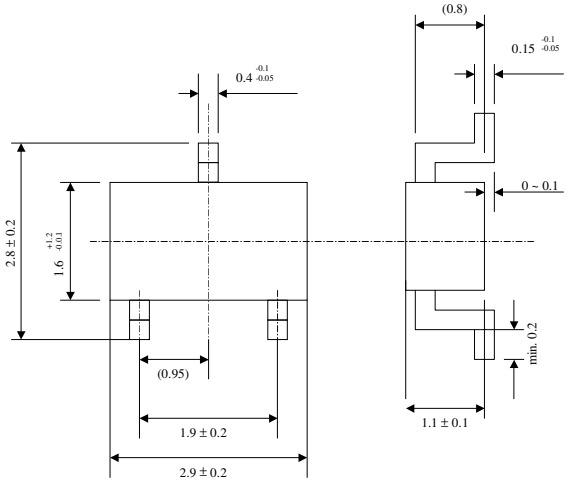
TO-92 :

Designator	Description
1	**Type** Z = Positive Voltage Regulator
2,3	**Output Voltage** eg. 30 = 3.0V
4	**Output Voltage Accuracy** 2 = ± 2.0% 3 = ± 3.0%
5	**Internal code**
6, 7	**Year Code** eg. 09 = Year 2009
8, 9	**Week Code** eg. 10 = Week 10



❖ *Packaging Information*

SOT-23 :



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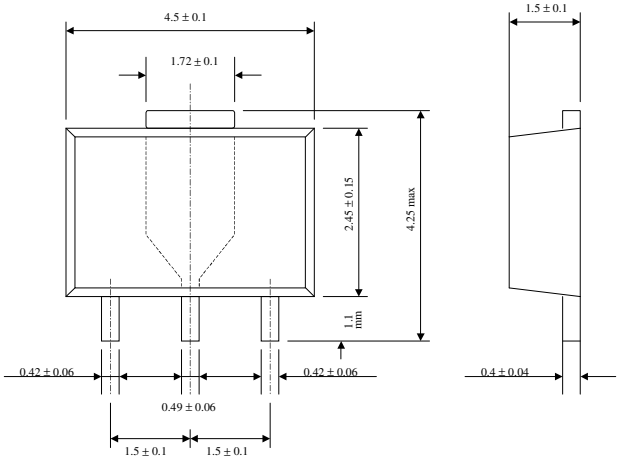
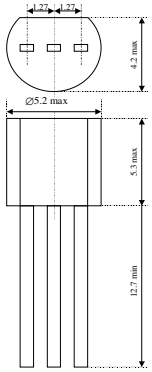


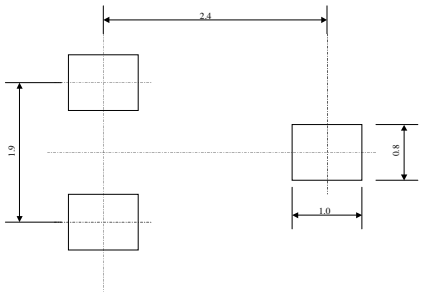
TO-92 :



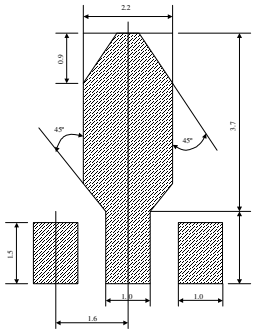
Units : mm

❖ *Recommended Pattern Layout*

SOT-23 :

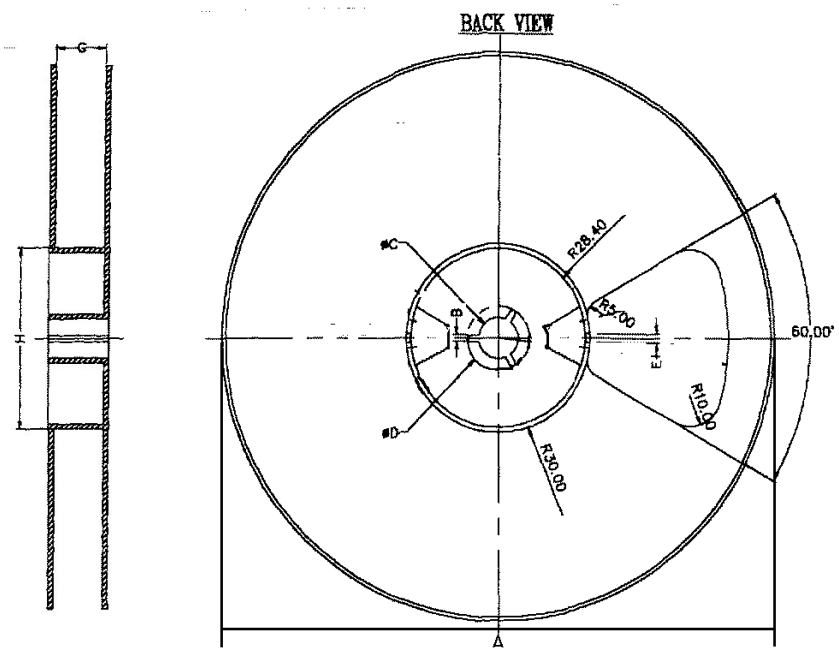


SOT-89



❖ *Tape and Reel Information*

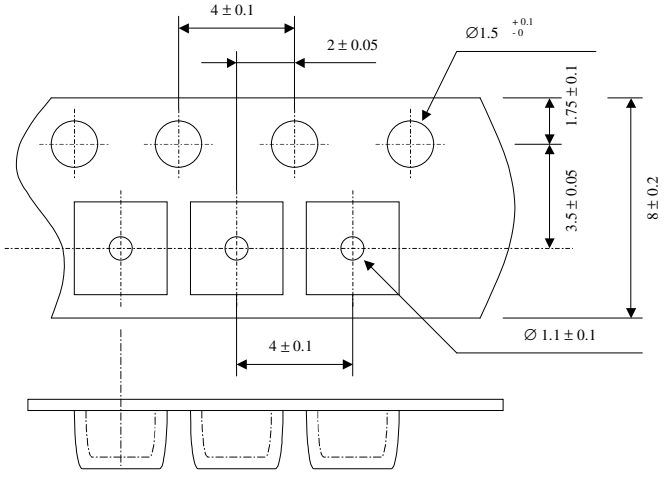
SOT-23 :

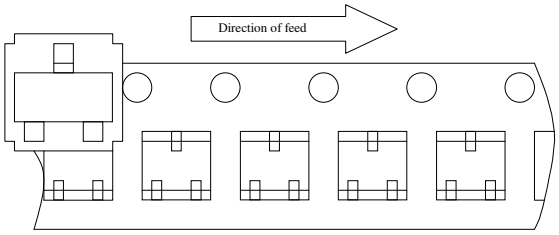


	SIZE (mm)
A	∅ 178 ± 0.8
B	2 ± 0.2
C	∅ 13 ± 0.2
D	∅ 21 ± 0.8
G	8 ± 0.5
H	∅ 60

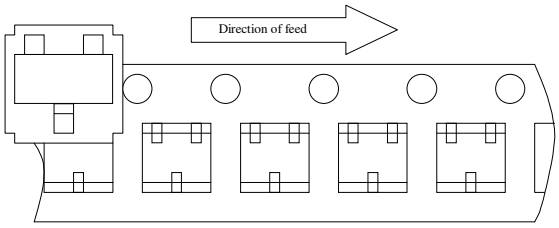
3,000 pcs / reel

SOT-23 Taping Specifications :



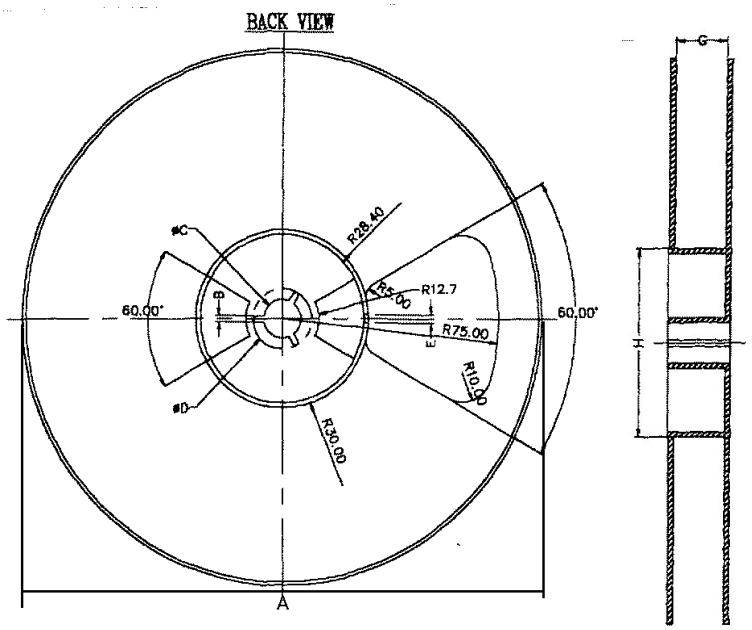


"R" type [Orientation of Device: Right]
Standard Type



"L" type [Orientation of Device: Left]
Reverse Type

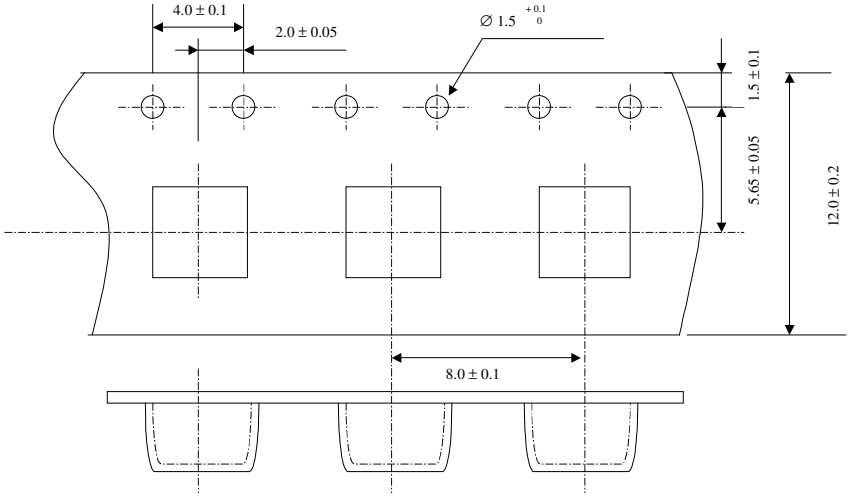
SOT-89 :

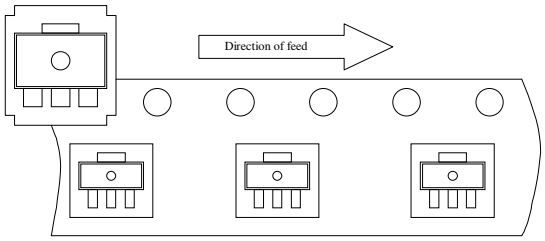


	SIZE (mm)
A	∅ 178 ± 0.8
B	2 ± 0.2
C	∅ 13 ± 0.2
D	∅ 21 ± 0.8
G	12 ± 0.5
H	∅ 60

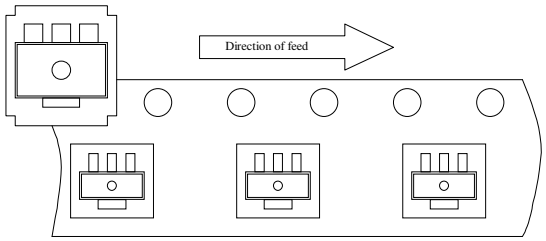
1,000 pcs / reel

SOT-89 Taping Specifications :



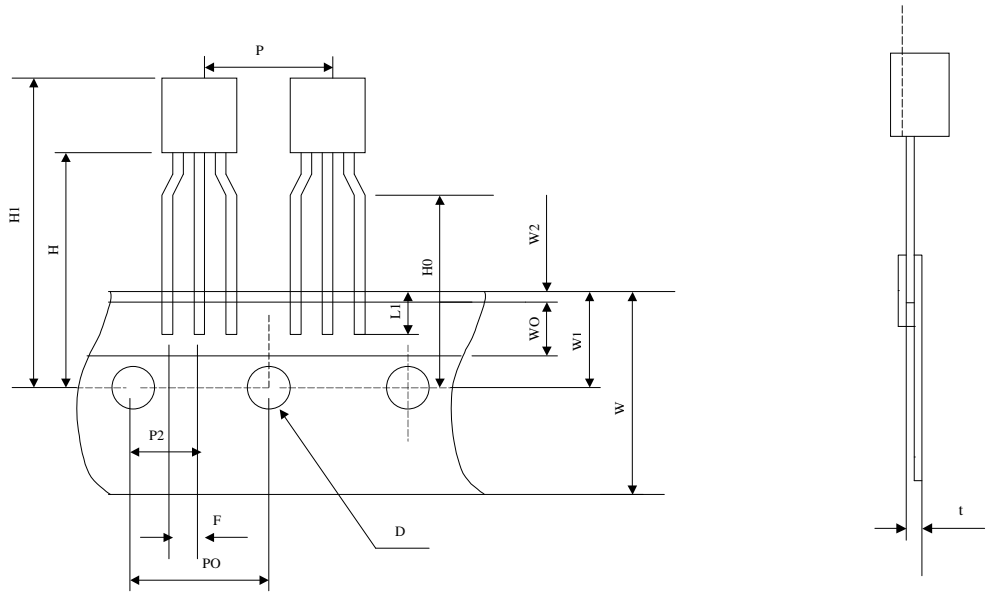


"R" type [Orientation of Device: Right]
Standard Type



"L" type [Orientation of Device: Left]
Reverse Type

TO-92 Taping Specifications :



	SIZE (mm)
P	12.7 ± 1.0
PO	12.7 ± 0.3
P2	6.35 ± 0.4
F	$2.5^{+0.45}_{-0.15}$
W	18.0 ± 1.0
WO	6.0 ± 0.3
W1	9.0 ± 0.5
W2	0.5 MAX
H	19.0 ± 0.5
H0	16.0 ± 0.5
H1	32.25 MAX
D	∅ 4.0 ± 0.2
t	0.6 ± 0.2
L1	3.5 MIN

2,000 pcs / box