VOLTAGE REGULATOR CONTROLLER

FEATURES

- **Low Supply Current ..... 50μA Typ (TC4730A)**
- **Standby Quiescent Current ..... 0.2μA Typ (TC4730A)**
- **Low Dropout Voltage ..... 0.1V Typ (I_{OUT} = 100mA: with External Tr.)**
- **High Line Regulation ..... 0.1%/V Typ**
- **Broad Output Voltage Range ..... 2.0V to 6.0V in 0.1V steps**
- **High Accuracy Output Voltage ..... ±2.5%**
- **Small Package ..... SOT-23-5 (Mini-mold)**

APPLICATIONS

- **Regulator Control IC for a variety of external low V_{CE} (sat) transistors**

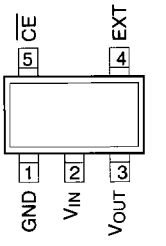
GENERAL DESCRIPTION

The TC47 Series are CMOS voltage regulator controller ICs for use with an external power transistor. They feature high output voltage accuracy (±2.5%) and low supply current. Each is composed of a voltage reference unit, an error amplifier and precision laser-trimmed resistors. These ICs are suitable for constructing regulators with extremely low dropout voltage and an output current in the range of several tens to several hundreds of mA. Furthermore, these ICs have a chip enable function, so that the supply current on standby can be minimized. The SOT-23-5 package ensures that the entire regulator will be minimally larger than the power transistor alone.

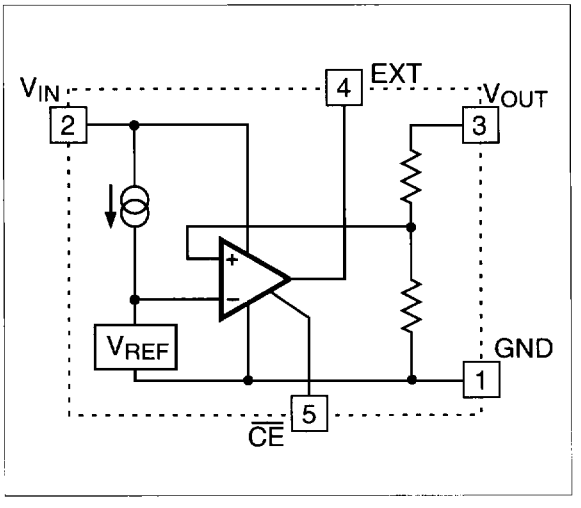
3

PIN CONFIGURATION

SOT-23-5



FUNCTIONAL BLOCK DIAGRAM



ORDERING INFORMATION

PART CODE TC47BR XX X X X XX XXX

Output Voltage:
Ex: 20 = 2.0V; 60 = 6.0V

Extra Feature Code: Fixed: 0

Tolerance:
3: ± 2.5%

Temperature: E: – 40°C to +85°C

Package Type and Pin Count:
CT: SOT-23-5

Taping Direction:
723: Left Taping
713: Right Taping

TC47 Series

ABSOLUTE MAXIMUM RATINGS

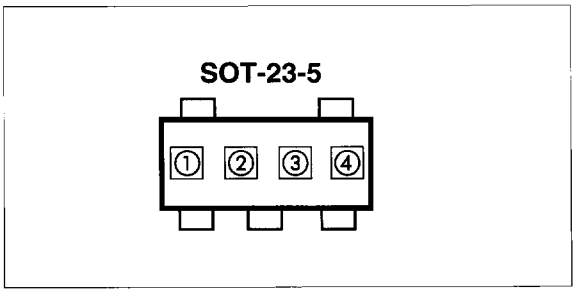
Parameter	Symbol	Limit	Unit
Input Voltage	V_{IN}	+12	V
Input Voltage ($\overline{CE}$ Pin)	V_{CE}	– 0.3 to (V_{IN} + 0.3)	V
EXT Output Voltage	V_{EXT}	+12	V
EXT Output Current	I_{EXT}	50	mA
Power Dissipation	P_D	150	mW
Operating Temperature Range	T_A	– 40 to +85	°C
Storage Temperature Range	T_{stg}	– 65 to +150	°C
Lead Temperature (Soldering)	T_{solder}	260°C, 10 sec	–

ELECTRICAL CHARACTERISTICS: (T_A = 25°C)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{OUT}	Output Voltage	I_{OUT} = 50mA	V_{OUT} x 0.975		V_{OUT} x 1.025	V
I_{OUT}	Output Current	$V_{IN} - V_{OUT}$ = 1.0V (Note 1)		1000		mA
$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	Load Regulation	$V_{IN} - V_{OUT}$ = 1.0V 1mA ≤ I_{OUT} ≤ 100mA	– 60		60	mV
V_{DIF}	Dropout Voltage	I_{OUT} = 100mA		100	200	mV
I_{SS}	Supply Current	$V_{IN} - V_{OUT}$ = 1.0V No Load		50	80	µA
$I_{STANDBY}$	Supply Current (Standby)	V_{IN} = 8.0V No Load	0.01	0.2	1.0	µA
$I_{EXTLEAK}$	EXT Leakage Current				0.5	µA
$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	Line Regulation	I_{OUT} = 50mA V_{OUT} + 0.5V ≤ V_{IN} ≤ 8.0V	0	0.1	0.3	%/V
V_{IN}	Input Voltage				8.0	V
V_{EXT}	EXT Output Voltage				8.0	V
$\frac{\Delta V_{OUT}}{\Delta T}$	Output Voltage Temperature Coefficient	I_{OUT} = 10mA – 40°C ≤ T_A ≤ 85°C		±100		ppm/°C
V_{CEH}	$\overline{CE}$ Input Voltage "H"		1.5			V
V_{CEL}	$\overline{CE}$ Input Voltage "L"				0.25	V
I_{CEH}	$\overline{CE}$ Input Current "H"			0	– 0.1	µA
I_{CEL}	$\overline{CE}$ Input Current "L"		5	3	0.1	µA

Note: 1. The output current depends upon the performance of the external PNP transistor. Use a low saturation type, with an h_{FE} of 100 or more.

MARKING



① represents first digit of voltage

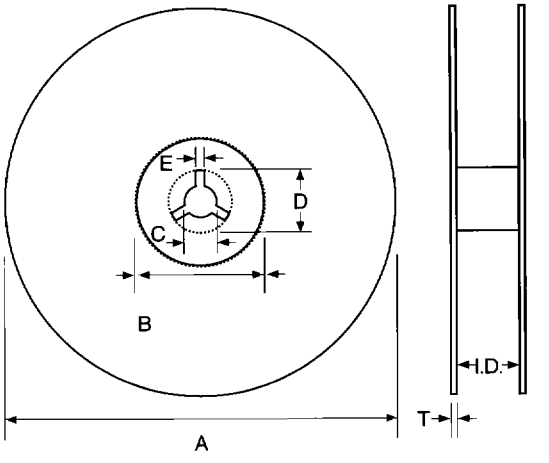
Mark①	Volt
J	2.②(V)
K	3.②(V)
L	4.②(V)
M	5.②(V)
N	6.②(V)

② represents first decimal place of voltage

Mark②	Volt	Mark②	Volt
0	①.0(V)	5	①.5(V)
1	①.1(V)	6	①.6(V)
2	①.2(V)	7	①.7(V)
3	①.3(V)	8	①.8(V)
4	①.4(V)	9	①.9(V)

③ and ④ represent assembly lot number

TAPING REEL



SOT-23-5: 3,000 pcs/Reel

	SOT-23-5	
A	178	±1.0
B	60	±2.0
C	13	±0.2
D	22	±0.5
E	2	±0.2
I.D.	8.5	±1.5
T	1.5	±0.3

(unit = mm)

Reel Materials: Plastic

3

OPERATION

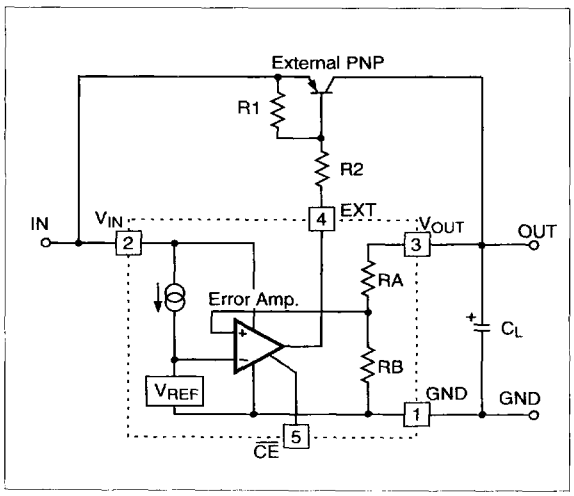


Figure 1

SELECTION GUIDE FOR EXTERNAL COMPONENTS

1. External PNP Transistor

The external PNP should have low V_{CE} (sat) and high h_{FE} at the desired I_{OUT}. If V_{IN} is not close to V_{OUT}, the package must be able to dissipate the heat.

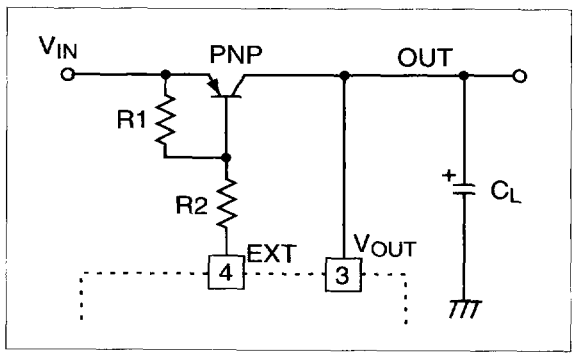


Figure 2. R1 approximately 10k.

2. Base Resistor R2

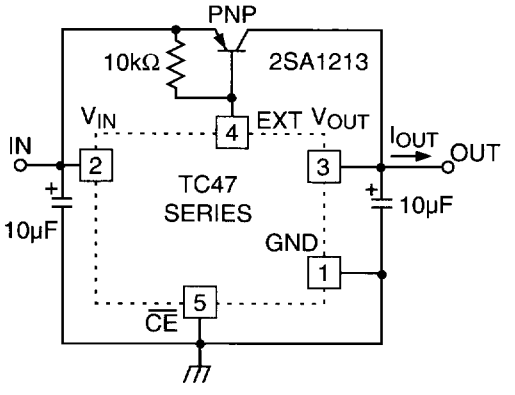
The EXT Pin of these ICs is protected by a current limit circuit. However, since this circuit protects the IC, use a resistor R2 to protect the external transistor, although this IC is operable without such a resistor. R2 is calculated with the input voltage, output voltage, output current, temperature, and the h_{FE} value (and their tolerances) taken into consideration. The following must also be satisfied:

$$\frac{V_{IN}\,[min] - 1.2(V)}{R2} - \frac{0.7(V)}{R1} > \frac{I_{OUT}\,[max]}{h_{FE}}$$

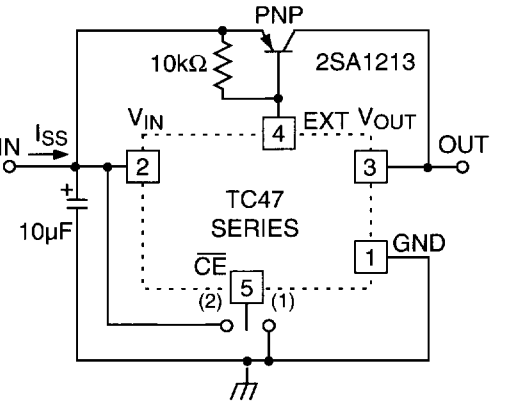
3. Phase Compensation

In these ICs, phase compensation is required for stable operation. For this purpose, be sure to use a capacitor C_L with a value of 10μF or more (preferably tantalum) and a resistor R1 of about 10kΩ between the base and the emitter.

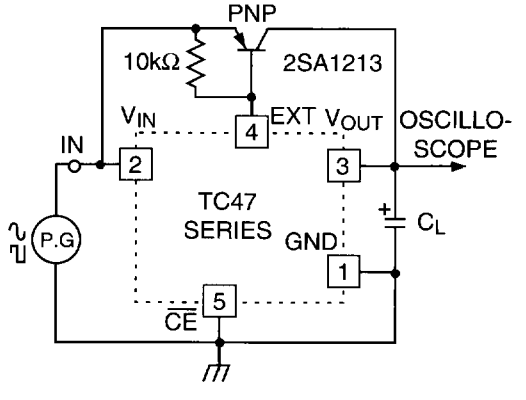
TEST CIRCUITS



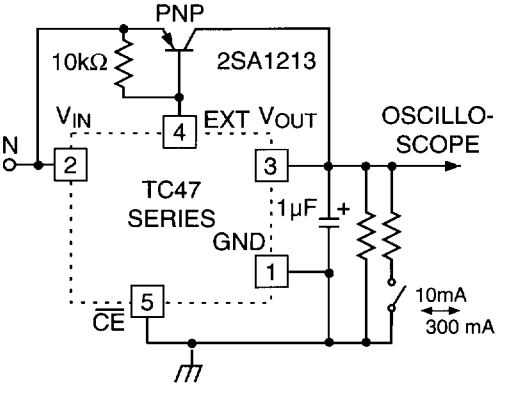
STATIC CHARACTERISTICS TEST (Except QUIESCENT CURRENT, STANDBY CURRENT)



QUIESCENT CURRENT (1), STANDBY CURRENT TEST



RIPPLE REJECTION, LINE TRANSIENT RESPONSE TEST

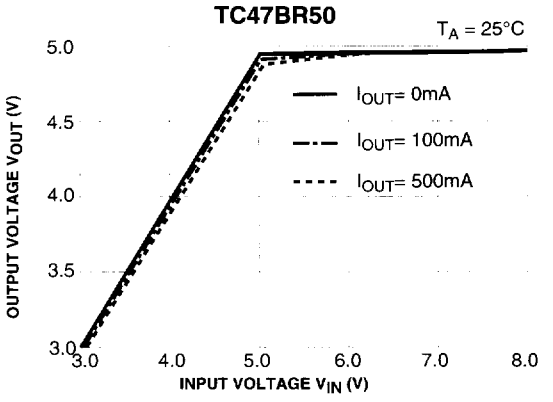


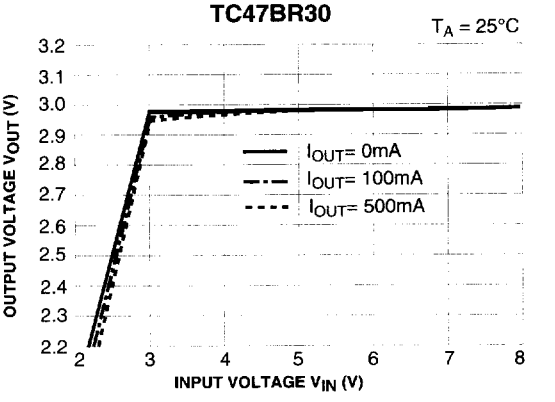
LOAD TRANSIENT RESPONSE TEST

TC47 Series

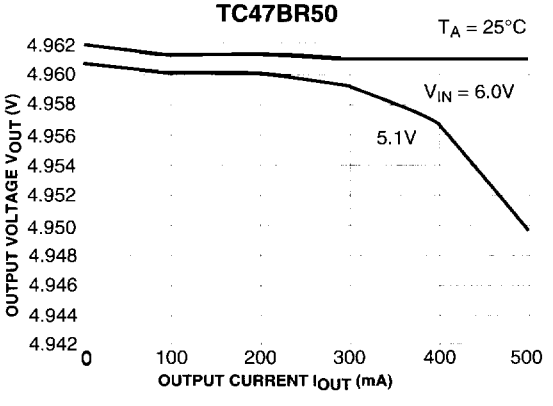
TYPICAL CHARACTERISTICS

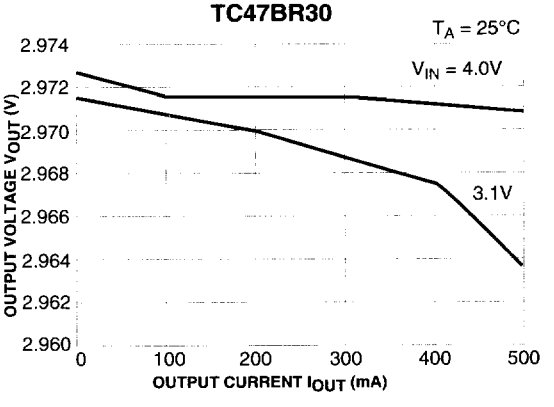
1) Output Voltage vs. Input Voltage



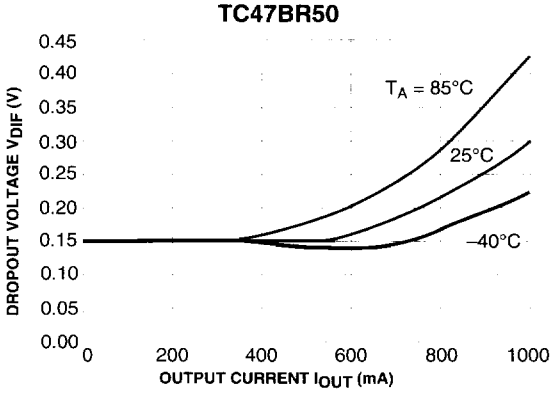


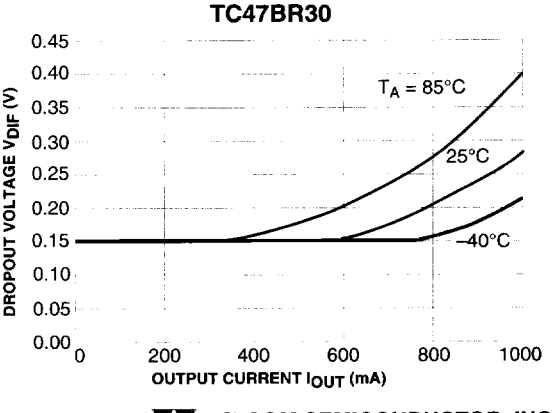
2) Output Voltage vs. Output Current





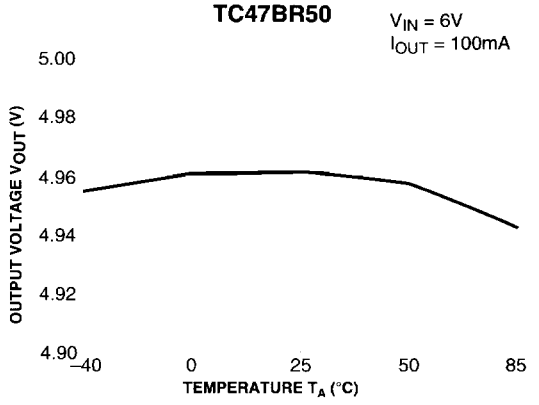
3) Dropout Voltage vs. Output Current

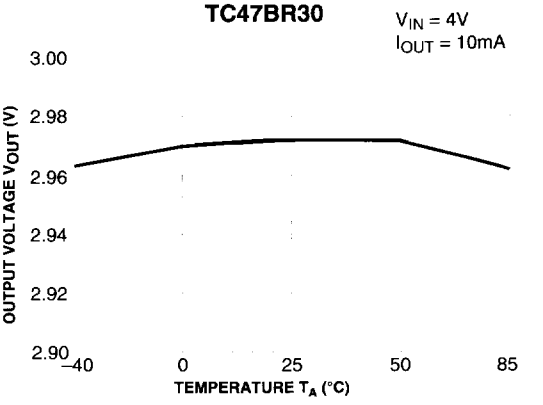




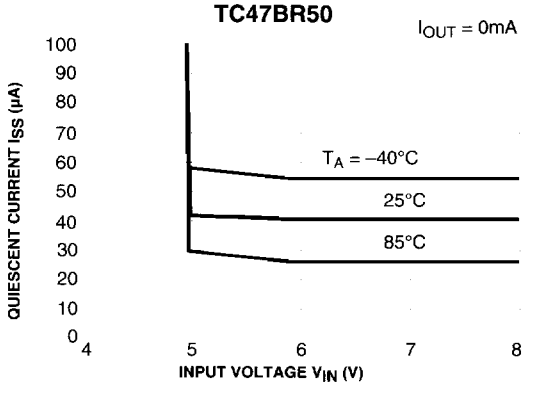
TYPICAL CHARACTERISTICS (CONT.)

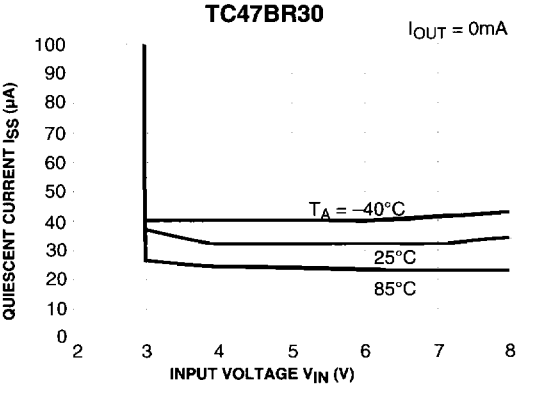
4) Output Voltage vs. Temperature



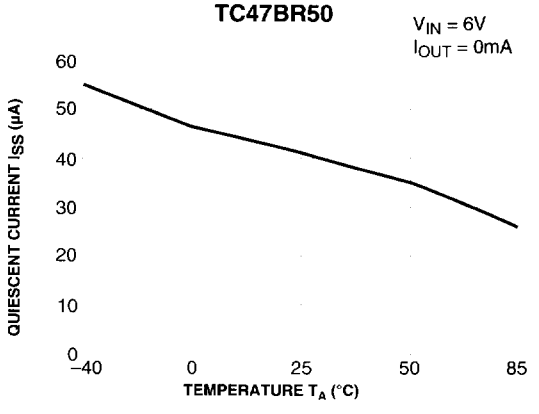


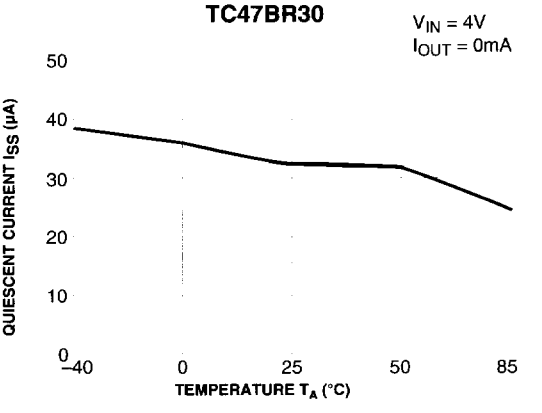
5) Quiescent Current vs. Input Voltage





6) Quiescent current vs. Temperature

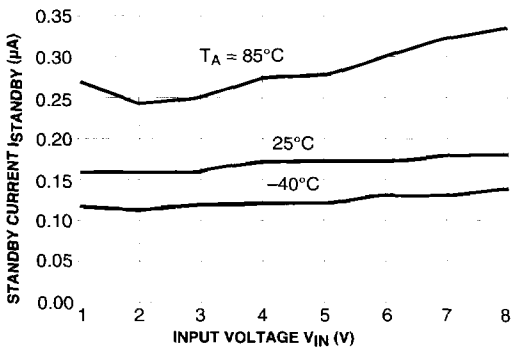




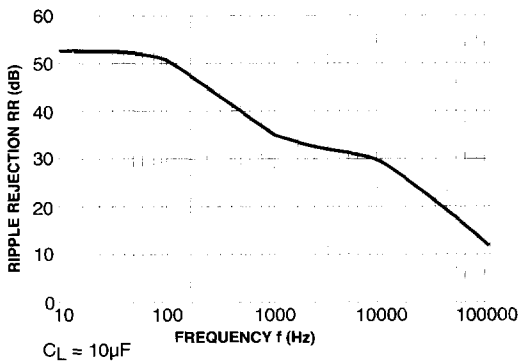
TC47 Series

TYPICAL CHARACTERISTICS (CONT.)

7) Standby Current vs. Input Voltage

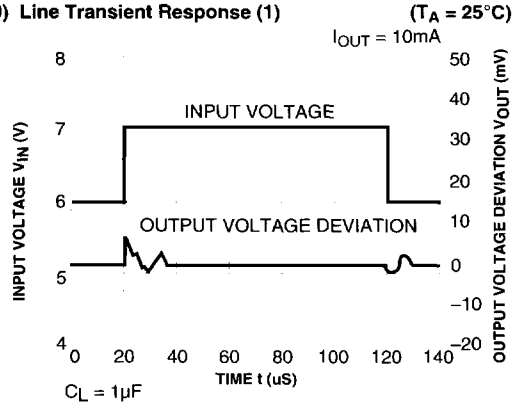


8) Ripple Rejection (T_A = 25°C)



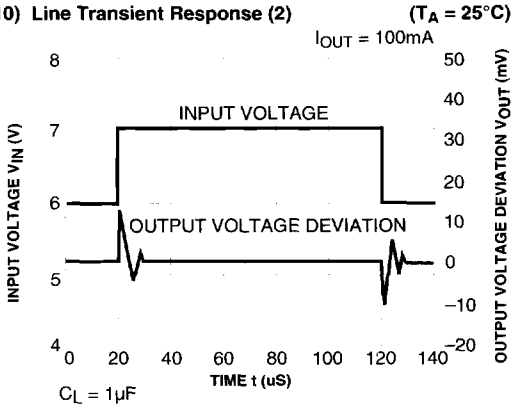
C_L = 10μF
I_{OUT} = 200mA
V_{IN} = 6Vdc + 0.5 (p-p)

9) Line Transient Response (1) (T_A = 25°C)



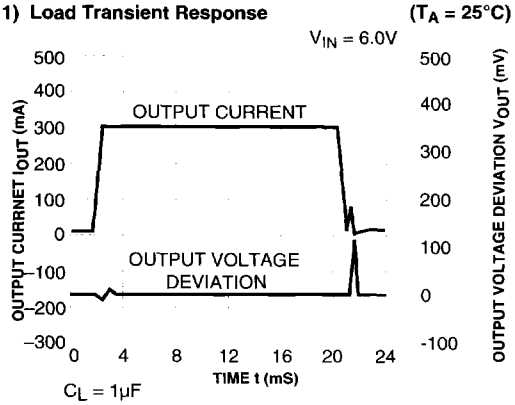
C_L = 1μF

10) Line Transient Response (2) (T_A = 25°C)



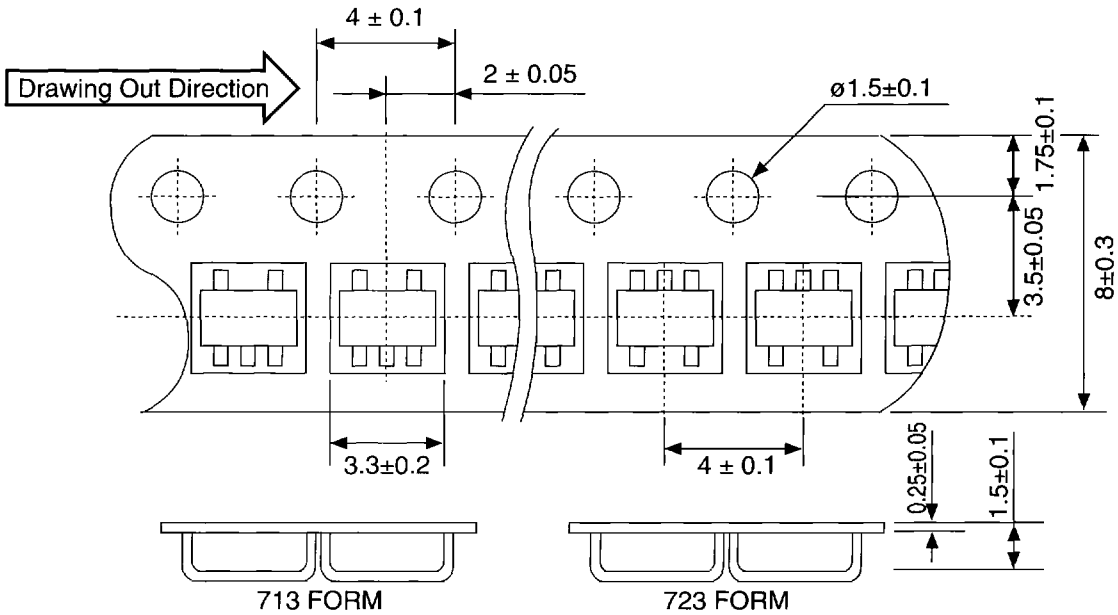
C_L = 1μF

11) Load Transient Response (T_A = 25°C)



C_L = 1μF

TAPING FORM



SOT-23-5