

# Precision voltage regulator

# $\mu$ A723/723C

## DESCRIPTION

The  $\mu$ A723/ $\mu$ A723C is a monolithic precision voltage regulator capable of operation in positive or negative supplies as a series, shunt, switching, or floating regulator. The 723 contains a temperature-compensated reference amplifier, error amplifier, series pass transistor, and current limiter, with access to remote shutdown.

## FEATURES

- Positive or negative supply operation
- Series, shunt, switching, or floating operation
- 0.01% line and load regulation
- Output voltage adjustable from 2V to 37V
- Output current to 150mA without external pass transistor
- $\mu$ A723 MIL-STD-883A, B, C available

## PIN CONFIGURATION

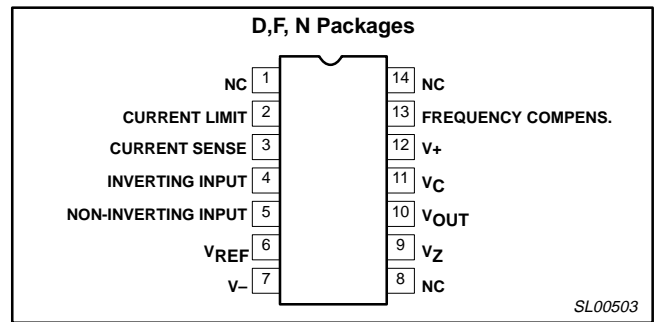


Figure 1. Pin Configuration

## ORDERING INFORMATION

DESCRIPTION	TEMPERATURE RANGE	ORDER CODE	DWG #
14-Pin Ceramic Dual In-Line Package (CERDIP)	-55°C to 125°C	$\mu$ A723F	0581B
14-Pin Plastic Dual In-Line Package (DIP)	0 to 70°C	$\mu$ A723CN	SOT27-1
14-Pin Plastic Small Outline (SO) Package	0 to 70°C	$\mu$ A723CD	SOT108-1

## EQUIVALENT CIRCUIT

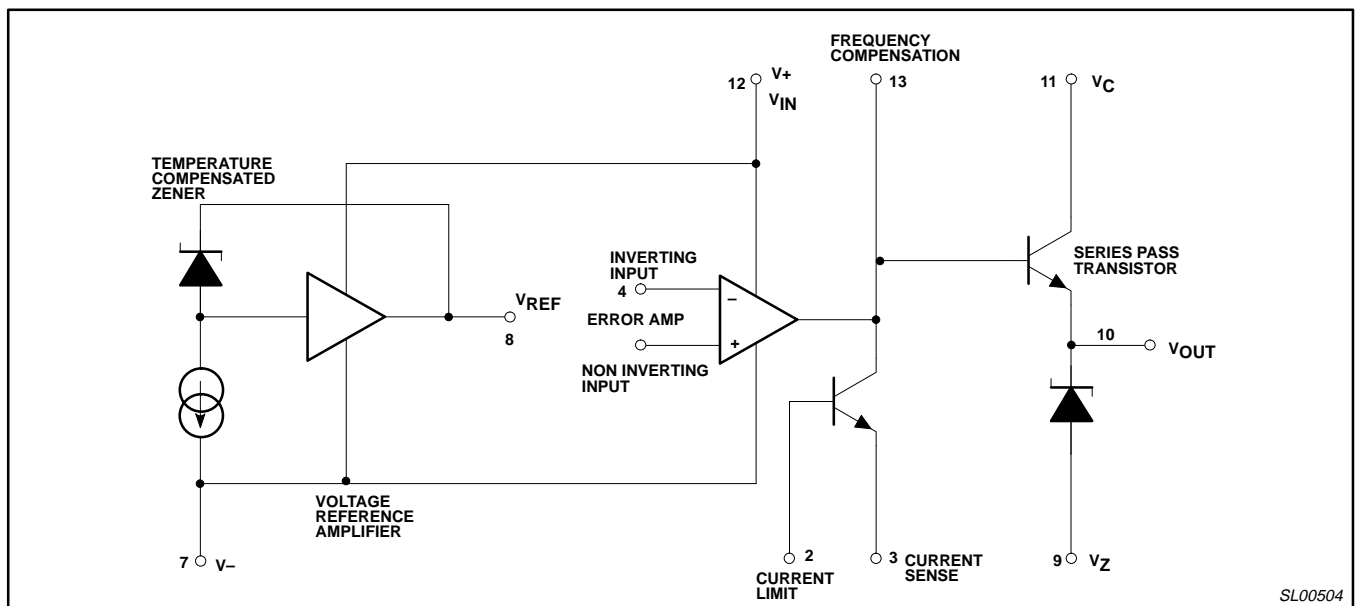


Figure 2. Equivalent Circuit

## Precision voltage regulator

 $\mu$ A723/723C

## ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNIT
	Pulse voltage from V+ to V- (50ms)	50	V
	Continuous voltage from V+ to V-	40	V
	Input-output voltage differential	40	V
V <sub>DIFF</sub>	Error amplifier maximum input differential voltage	±5	V
V <sub>CM</sub>	Error amplifier non-inverting input (Pin 5) to -V (Pin 7)	8	V
I <sub>OUT</sub>	Maximum output current	150	mA
	Current from V <sub>REF</sub>	15	mA
	Current from V <sub>Z</sub>	25	mA
P <sub>MAX</sub>	Maximum power dissipation T <sub>A</sub> =25°C (still-air) <sup>1</sup>		
	F package	1190	mW
	N package	1420	mW
	D package	1040	mW
T <sub>A</sub>	Operating ambient temperature range		
	$\mu$ A723	-55 to +125	°C
	$\mu$ A723C	0 to 70	°C
T <sub>STG</sub>	Storage temperature range	-65 to +150	°C
T <sub>SOLD</sub>	Lead soldering temperature (10sec max)	300	°C

## NOTES:

1. The following derating factors should be applied above 25°C

F package at 9.5mW/°C

N package at 11.4mW/°C

D package at 8.3mW/°C

## Precision voltage regulator

 $\mu$ A723/723C**DC ELECTRICAL CHARACTERISTICS** $T_A=25^\circ\text{C}$ , unless otherwise specified.<sup>1</sup>

SYMBOL	PARAMETER	TEST CONDITIONS	$\mu$ A723			$\mu$ A723C			UNITS
			Min	Typ	Max	Min	Typ	Max	
$V_{R\text{ LINE}}$	Line regulation <sup>2</sup>	$V_{\text{IN}}=12\text{V}$ to $V_{\text{IN}}=15\text{V}$ $V_{\text{IN}}=12\text{V}$ to $V_{\text{IN}}=40\text{V}$		0.01 0.02	0.1 0.2		0.01 0.1	0.1 0.5	$\%V_{\text{OUT}}$
$V_{R\text{ LOAD}}$	Load regulation <sup>2</sup>	$I_L=1\text{mA}$ to $I_L=50\text{mA}$		0.03	0.15		0.03	0.2	$\%V_{\text{OUT}}$
$\Delta V_{\text{IN}}/\Delta V_{\text{O}}$	Ripple Rejection	$f=50\text{Hz}$ to $10\text{kHz}$ , $C_{\text{REF}}=0$		74			74		dB
		$f=50\text{Hz}$ to $10\text{kHz}$ , $C_{\text{REF}}=5\mu\text{F}$		86			86		
$I_{\text{OS}}$	Short-circuit current	$R_{\text{SC}}=10\Omega$ , $V_{\text{OUT}}=0$		65			65		mA
$V_{\text{REF}}$	Reference voltage	$I_{\text{REF}}=0.1\text{mA}$	6.95	7.15	7.35	6.80	7.15	7.50	V
$V_{\text{REF (LOAD)}}$	Reference voltage change with load	$I_{\text{REF}}=0.1\text{mA}$ to $5\text{mA}$			20			20	mV
$V_{\text{NOISE}}$	Output noise voltage	$\text{BW}=100\text{Hz}$ to $10\text{kHz}$ , $C_{\text{REF}}=0$		20			20		$\mu\text{V}_{\text{RMS}}$
		$\text{BW}=100\text{Hz}$ to $10\text{kHz}$ , $C_{\text{REF}}=5\mu\text{F}$		2.5			2.5		
S	Long-term stability	$T_j=T_{j\text{max}}$ , $T_A=25^\circ\text{C}$ for end point measurement		0.1			0.1		$\%1000\text{ hrs.}$
$I_{\text{SCD}}$	Standby current drain	$I_L=0$ , $V_{\text{IN}}=30\text{V}$		2.3	3.5		2.3	4.0	mA
$V_{\text{IN}}$	Input voltage range		9.5		40	9.5		40	V
$V_{\text{OUT}}$	Output voltage range		2.0		37	2.0		37	V
$V_{\text{DIFF}}$	Input-output voltage differential		3.0		38	3.0		38	V
<b>The following specifications apply over the operating temperature ranges.</b>									
$V_{R\text{ LINE}}$	Line regulation	$V_{\text{IN}}=12\text{V}$ to $V_{\text{IN}}=15\text{V}$			0.3			0.3	$\%V_{\text{OUT}}$
$V_{R\text{ LOAD}}$	Load regulation	$I_L=1\text{mA}$ to $I_L=50\text{mA}$			0.6			0.6	$\%V_{\text{OUT}}$
TC	Average temperature coefficient of output voltage			0.002	0.015		0.003	0.015	$\%/^\circ\text{C}$

**NOTES:**

- $V_{\text{IN}}=V_+=V_C=12\text{V}$ ,  $V_-=0\text{V}$ ,  $V_{\text{OUT}}=5\text{V}$ ,  $I_L=1\text{mA}$ ,  $R_{\text{SC}}=0$ ,  $C_1=100\text{pF}$ ,  $C_{\text{REF}}=0$  and divider impedance as seen by error amplifier  $\leq 10\text{k}\Omega$ .
- The load and line regulation specifications are for constant junction temperature. Temperature drift effects must be taken into account separately when the unit is operating under conditions of high dissipation.

# Precision voltage regulator

# $\mu$ A723/723C

## TYPICAL PERFORMANCE CHARACTERISTICS

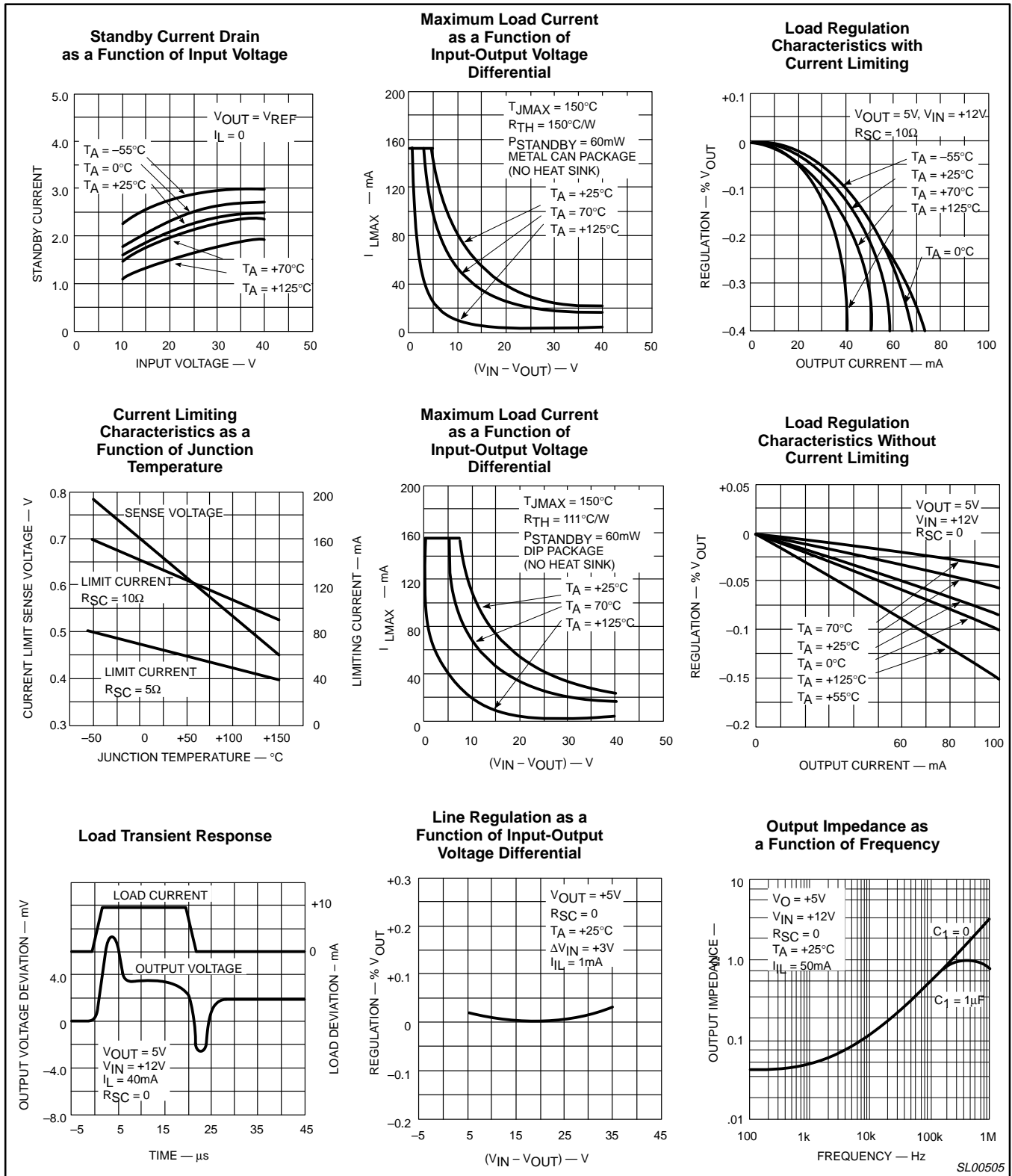


Figure 3. Typical Performance Characteristics

# Precision voltage regulator

# μA723/723C

## TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

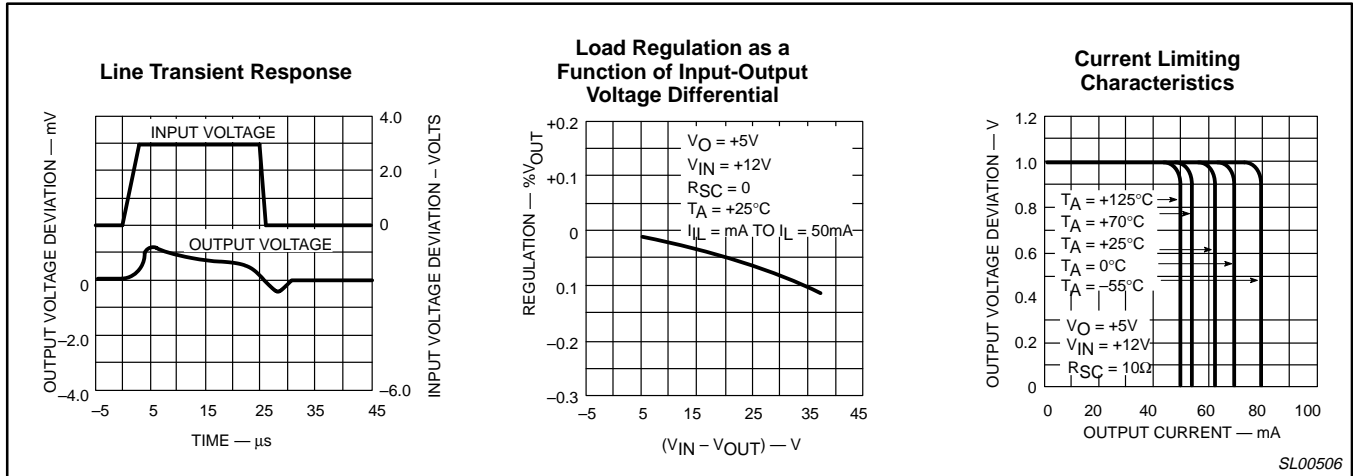


Figure 4. Typical Performance Characteristics (cont.)

## TYPICAL APPLICATIONS

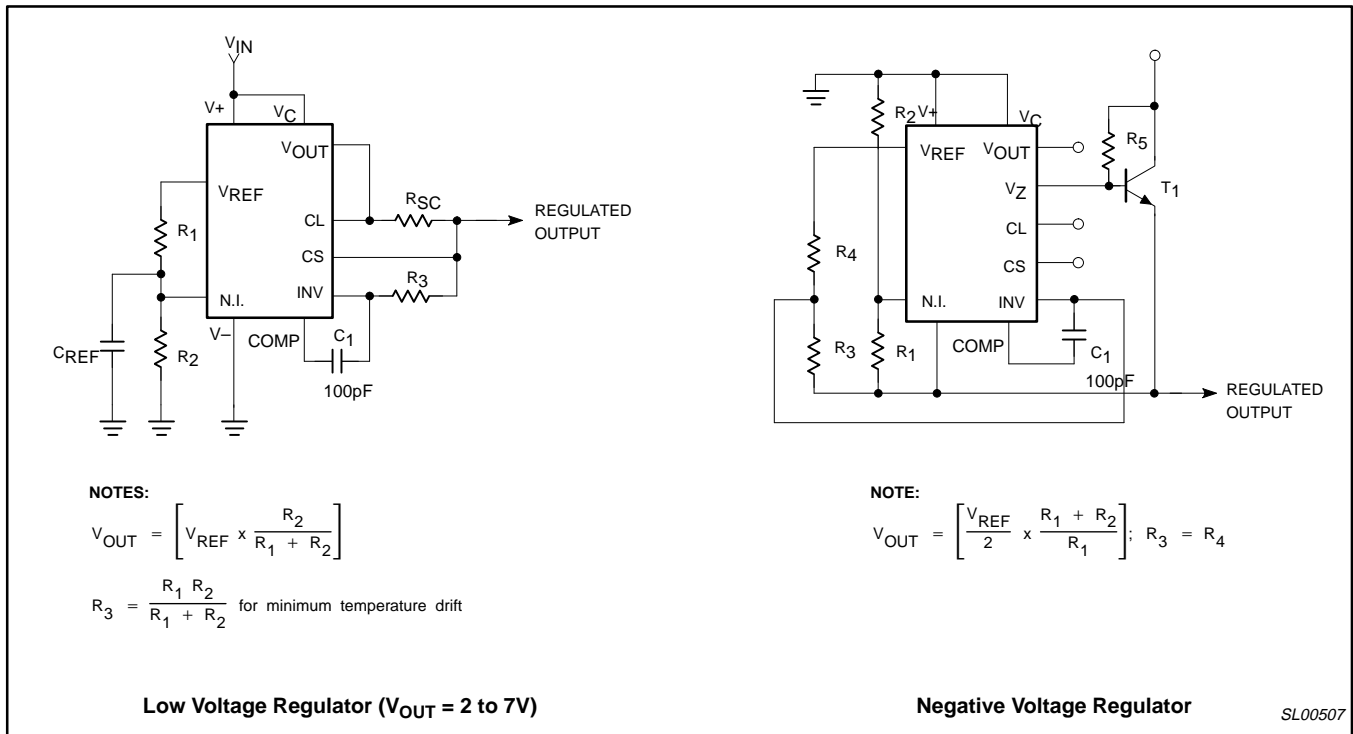
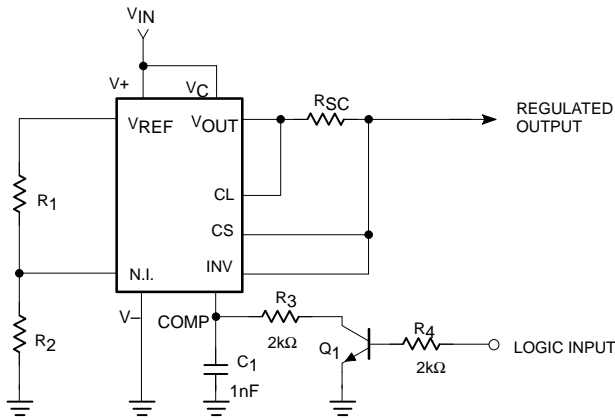


Figure 5. Typical Applications

# Precision voltage regulator

# μA723/723C

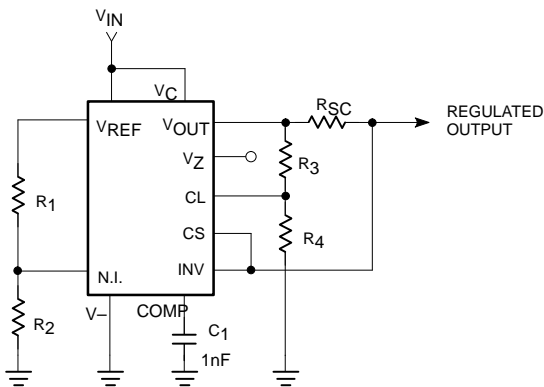
## TYPICAL APPLICATIONS (Continued)



NOTE:

$$V_{OUT} = \left[ V_{REF} \times \frac{R_2}{R_1 + R_2} \right]$$

### Remote Shutdown Regulator With Current Limiting ( $V_{OUT} = 2$ to $7V$ )



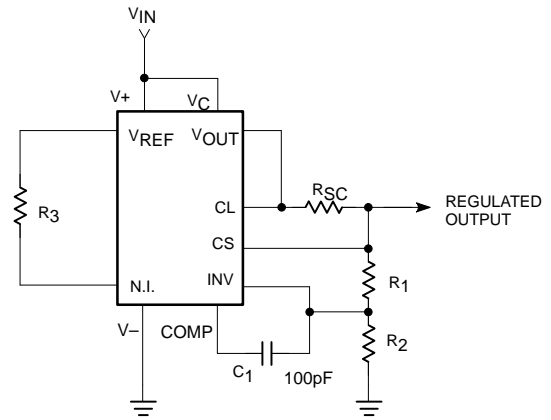
NOTES:

$$I_{KNEE} = \left[ \frac{V_{OUT} R_3}{R_{SC} R_4} + \frac{V_{SENSE} (R_3 + R_4)}{R_{SC} R_4} \right]$$

$$V_{OUT} = \left[ V_{REF} \times \frac{R_1 + R_2}{R_4} \right]$$

$$I_{SHORT\ CKT} = \left[ \frac{V_{SENSE}}{R_{SC}} \times \frac{R_3 + R_4}{R_4} \right]$$

### Foldback Current Limiting Regulator ( $V_{OUT} = 2$ to $7V$ )



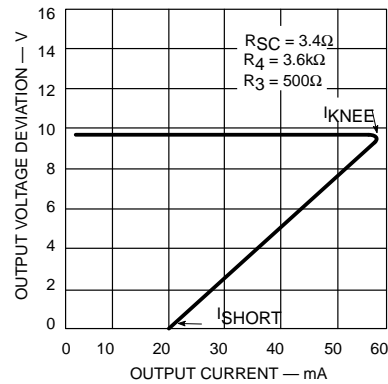
NOTE:

$$V_{OUT} = \left[ V_{REF} \times \frac{R_2}{R_1 + R_2} \right]; R_3 = R_4$$

$$R_3 = \frac{R_1 R_2}{R_1 + R_2} \text{ for minimum temperature drift}$$

R3 may be eliminated for minimum component count

### High Voltage Regulator ( $V_{OUT} = 7$ to $37V$ )



NOTES:

$$\frac{R_4}{R_3} = \frac{V_{OUT} I_{SC}}{V_{SENSE} (I_{KNEE} - I_{SHORT\ CKT})} - 1$$

$$R_{SC} = \frac{V_{SENSE}}{I_{SC}} \left[ 1 + \frac{R_3}{R_4} \right]$$

SL00508

Figure 6. Typical Applications (cont.)