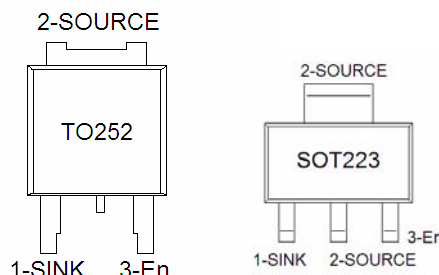


## 5-10-15-20mA Temperature Compensated Unipolar Current Regulator

- Limits and regulates current to 20mA.
- Rejects 50Hz / 60Hz ripple.
- Fast 2 $\mu$ Sec settling time.
- Simple enable pin operation ( $V_{En} > 4.0V$ )
- <15% Overshoot.
- No external components.
- 250V Maximum Operating Voltage.
- Can be paralleled for higher current.



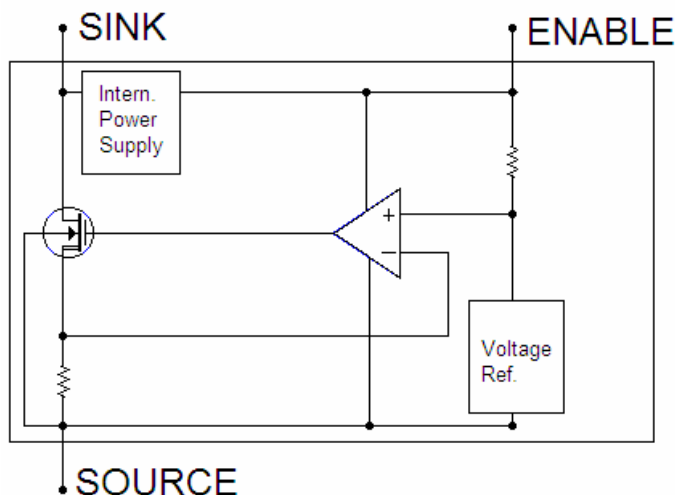
### Description:

The CL2A is SimpleChips' 20 mA temperature-compensated unipolar current regulator. It is designed to be used with voltages from 6V to 250V DC and the temperature coefficient is optimized from -40C to 125C. SimpleChips' 5-10-15-20mA unipolar current regulator can source or sink constant current. For high voltage applications a heat sink can be connected to the Ground pin (Source) (pin 2), or the device can be mounted on a larger copper plate used as a heat sink. These devices can be paralleled for larger current drives or connected back-to-back for AC current limiting function.

These current regulators can be used for applications with AC or DC such as:

- serial LED drivers for industrial lamp indicators, signage, accent lighting, and automotive lighting.
- Power limiter in transformer input stage (mounted back to back).
- constant current source or sink.
- current reference or level translator.
- laser diode driver for VCSELs used in Optical Networking.

### Functional Block Diagram:





**PRELIMINARY**

**CL2A**

5-10-15-20mA Temperature Compensated  
Unipolar Current Regulator

**Terminal Functions:**

| Terminal SC_CL1A Name | pin no. | Type     | Description                                                                          |
|-----------------------|---------|----------|--------------------------------------------------------------------------------------|
| Sink                  | 1       | HV Input | Sinks load current                                                                   |
| Source                | 2       | HV input | Usually Grounded. All voltages referenced to source. Sources load current            |
| Enable                | 3       | LV input | Usually 5V referenced to source. Enable current limiting function when Venable >4.0V |

**Absolute Maximum Ratings:**

Maximum Operating Voltage (see Note 1) ..... 0 to 250 Volts DC  
Reverse current in Enable pin ..... -100uA  
Enable Voltage ..... 0 to 10V  
Operating free air temperature range ..... -40 degree C to 85 degree C  
Storage temperature ..... -40 degree C to 85 degree C  
Circuit temperature ..... -40 degree C to 135 degree C  
ESD tolerance, human body model ..... 500 Volts

Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended period may affect device reliability.

NOTE 1: All voltages are with respect to Source for 10Sec.

**Recommended Operating Conditions:**

|                                       | Min. | Max. | Unit     |
|---------------------------------------|------|------|----------|
| Operating Voltage (V Sink – V Source) | 0    | 200  | Volt DC  |
| Enable Voltage (V Enable – V Source)  | 0    | 10   | Volt DC  |
| Operating free air temperature        | -40  | 85   | degree C |
| Operating chip temperature            | -40  | 135  | degree C |

**Thermal Characteristics** (see note 2)

Temp. = 25 degree C unless otherwise specified

| Parameter                                         | Unit   | Min. | Typ. | Max. |
|---------------------------------------------------|--------|------|------|------|
| SOT223 thermal resistance minimum copper layout   | C/Watt |      | 160  |      |
| SOT223 thermal resistance (0.600inch X 0.500inch) | C/Watt |      | 88   |      |
| SOT223 thermal resistance (1.000inch X 1.000inch) | C/Watt |      | 67   |      |
| TO252 thermal resistance minimum copper layout    | C/Watt |      | 110  |      |
| TO252 thermal resistance (0.600inch X 0.500inch)  | C/Watt |      | 75   |      |
| TO252 thermal resistance (1.000inch X 1.000inch)  | C/Watt |      | 50   |      |

Note 2: See page 8 for copper layout

5-10-15-20mA Temperature Compensated  
Unipolar Current Regulator

### Operating Characteristics

V Sink – V Source = 20V, V Enable=5V, Temp. = 25 degree C unless otherwise specified

#### 20mA nominal

| Parameter                                      | Unit    | Min. | Typ. | Max. |
|------------------------------------------------|---------|------|------|------|
| Regulated Current (ILim) at 25C                | mA      | 17.1 | 20.0 | 22.9 |
| Regulated Current (ILim) at -40C               | mA      |      | 19.5 |      |
| Regulated Current (ILim) at +85C               | mA      |      | 18.9 |      |
| Operating Voltage for 90% Regulated Current    | V       | 2.0  | 3.0  | 4.0  |
| Absolute Temp. Coefficient (20V)               | μA / C  | -    | 24   | -    |
| Voltage Coefficient 10V to 200V (pulse 10mSec) | mA/100V | n/a  | 0.40 | 0.60 |
| Enable Voltage for 90% Regulated Current       | V       | 2.0  | 3.1  | 4.0  |
| Enable Current (V Enable = 5V, 25C)            | μA      | n/a  | 18   | 30   |
| Enable Current (V Enable = 8V, 85C)            | μA      |      | 65   |      |
| Stabilisation time to 10% of final value       | μSec    |      | 2.0  |      |
| Transient response to 10% to 90%               | nSec    |      | 300  |      |

#### 15mA nominal

| Parameter                                      | Unit    | Min. | Typ. | Max. |
|------------------------------------------------|---------|------|------|------|
| Regulated Current (ILim) at 25C                | mA      | 12.8 | 15.0 | 17.2 |
| Regulated Current (ILim) at -40C               | mA      |      | 14.6 |      |
| Regulated Current (ILim) at +85C               | mA      |      | 14.2 |      |
| Operating Voltage for 90% Regulated Current    | V       | 2.0  | 3.0  | 4.0  |
| Absolute Temp. Coefficient (20V)               | μA / C  | -    | 18   | -    |
| Voltage Coefficient 10V to 200V (pulse 10mSec) | mA/100V | n/a  | 0.30 | 0.50 |
| Enable Voltage for 90% Regulated Current       | V       | 2.0  | 3.1  | 4.0  |
| Enable Current (V Enable = 5V, 25C)            | μA      | n/a  | 18   | 30   |
| Enable Current (V Enable = 8V, 85C)            | μA      |      | 65   |      |
| Stabilisation time to 10% of final value       | μSec    |      | 2.0  |      |
| Transient response to 10% to 90%               | nSec    |      | 300  |      |

#### 10mA nominal

| Parameter                                      | Unit    | Min. | Typ. | Max. |
|------------------------------------------------|---------|------|------|------|
| Regulated Current (ILim) at 25C                | mA      | 8.5  | 10.0 | 11.5 |
| Regulated Current (ILim) at -40C               | mA      |      | 9.7  |      |
| Regulated Current (ILim) at +85C               | mA      |      | 9.4  |      |
| Operating Voltage for 90% Regulated Current    | V       | 2.0  | 3.0  | 4.0  |
| Absolute Temp. Coefficient (20V)               | μA / C  | -    | 12   | -    |
| Voltage Coefficient 10V to 200V (pulse 10mSec) | mA/100V | n/a  | 0.20 | 0.40 |
| Enable Voltage for 90% Regulated Current       | V       | 2.0  | 3.1  | 4.0  |
| Enable Current (V Enable = 5V, 25C)            | μA      | n/a  | 18   | 30   |
| Enable Current (V Enable = 8V, 85C)            | μA      |      | 65   |      |
| Stabilisation time to 10% of final value       | μSec    |      | 2.0  |      |
| Transient response to 10% to 90%               | nSec    |      | 300  |      |



*PRELIMINARY*

CL2A

5-10-15-20mA Temperature Compensated  
Unipolar Current Regulator

**5mA nominal**

| Parameter                                      | Unit    | Min. | Typ. | Max. |
|------------------------------------------------|---------|------|------|------|
| Regulated Current (ILim) at 25C                | mA      | 4.2  | 5.0  | 5.8  |
| Regulated Current (ILim) at -40C               | mA      |      | 4.8  |      |
| Regulated Current (ILim) at +85C               | mA      |      | 4.7  |      |
| Operating Voltage for 90% Regulated Current    | V       | 2.0  | 3.0  | 4.0  |
| Absolute Temp. Coefficient (20V)               | μA / C  | -    | 6    | -    |
| Voltage Coefficient 10V to 200V (pulse 10mSec) | mA/100V | n/a  | 0.40 | 0.60 |
| Enable Voltage for 90% Regulated Current       | V       | 2.0  | 3.1  | 4.0  |
| Enable Current (V Enable = 5V, 25C)            | μA      | n/a  | 18   | 30   |
| Enable Current (V Enable = 8V, 85C)            | μA      |      | 65   |      |
| Stabilisation time to 10% of final value       | μSec    |      | 2.0  |      |
| Transient response to 10% to 90%               | nSec    |      | 300  |      |

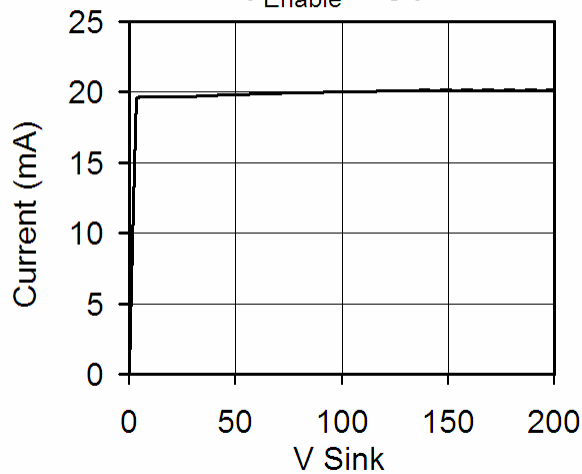
Note 1: see next pages for more details

## 5-10-15-20mA Temperature Compensated Unipolar Current Regulator

Data shown for 20mA version.

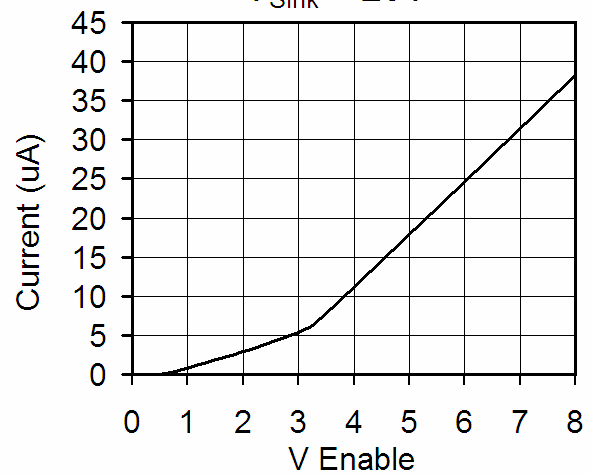
Sink Current versus Sink Voltage

$V_{\text{Enable}} = 5V$



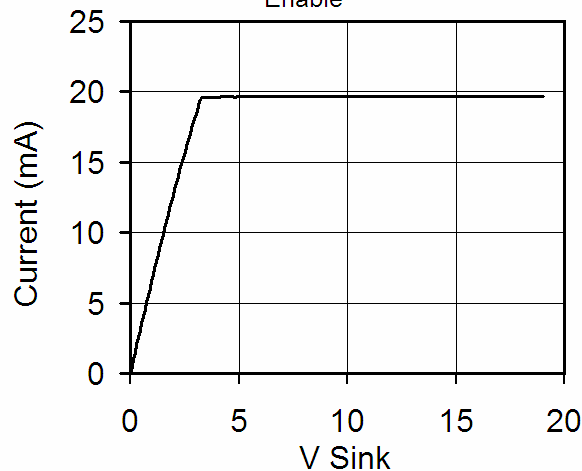
Enable Current vs. Enable Voltage

$V_{\text{Sink}} = 20V$



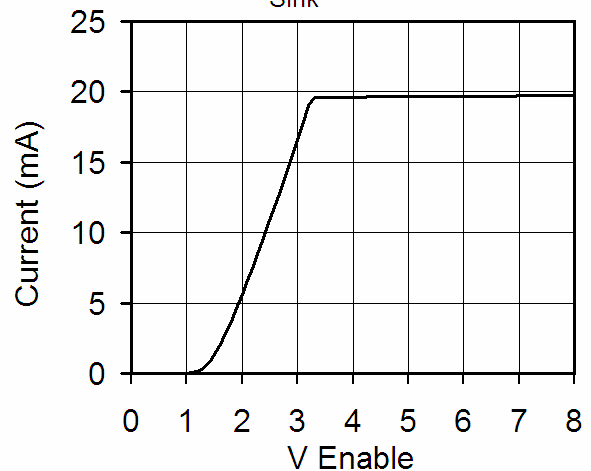
Sink Current versus Sink Voltage

$V_{\text{Enable}} = 5V$



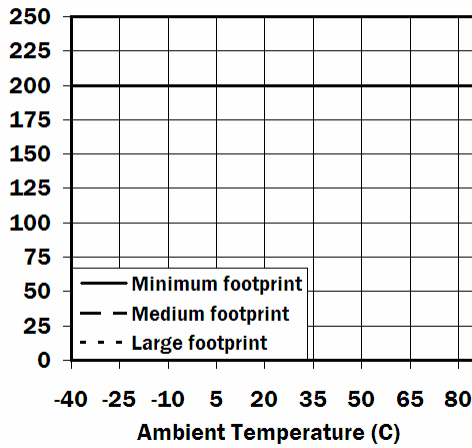
Sink Current versus Enable Voltage

$V_{\text{Sink}} = 20V$

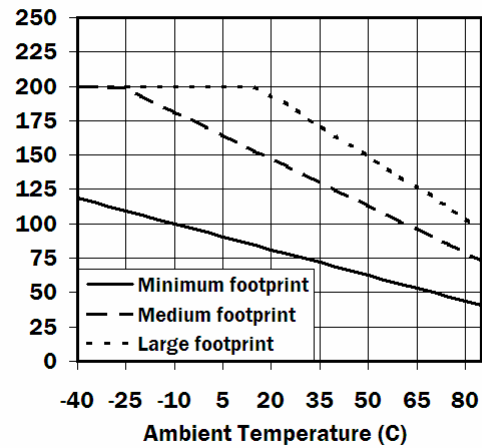


## 5-10-15-20mA Temperature Compensated Unipolar Current Regulator

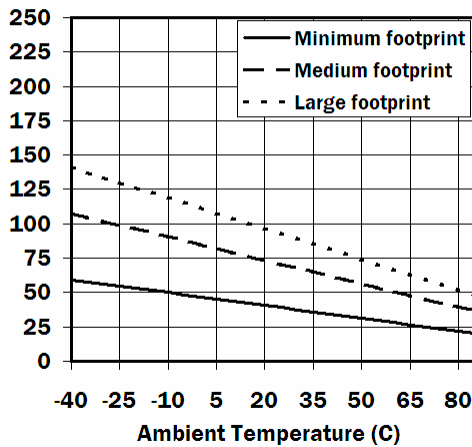
Maximum Voltage vs ambient temperature  
SOT223 - 10% duty cycle



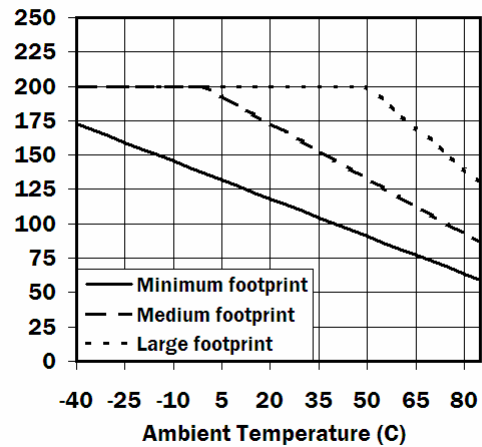
Maximum Voltage vs ambient temperature  
SOT223 - 50% duty cycle



Maximum Voltage vs ambient temperature  
SOT223 - 100% duty cycle

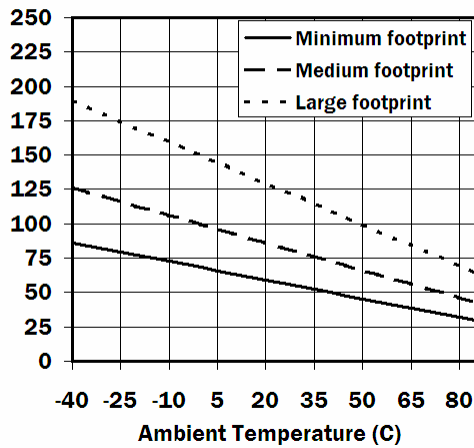


Maximum Voltage vs ambient temperature  
T0252 - 50% duty cycle

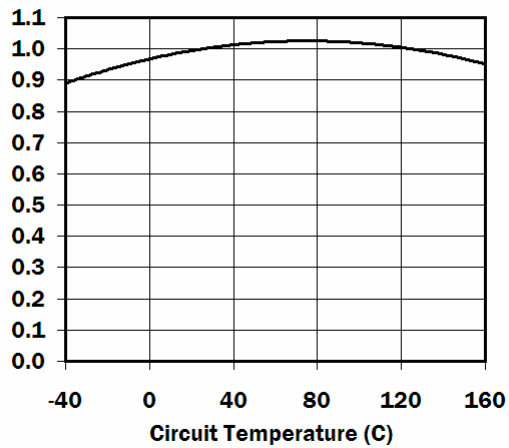


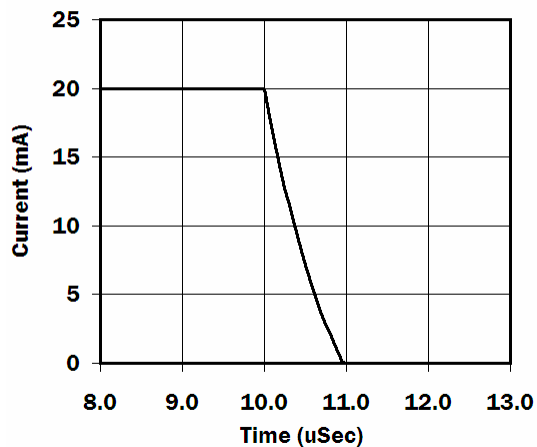
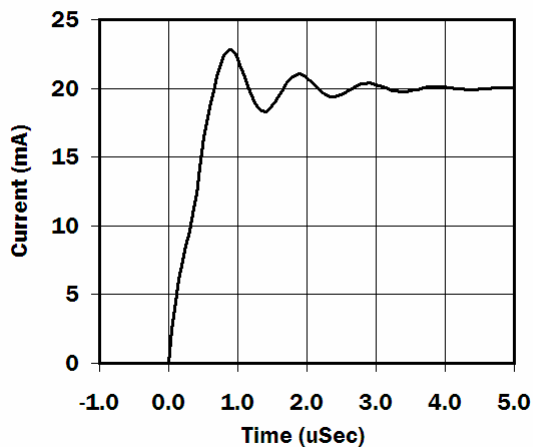
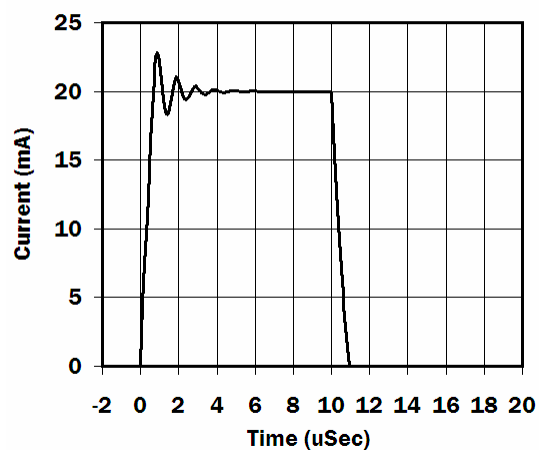
### 5-10-15-20mA Temperature Compensated Unipolar Current Regulator

Maximum Voltage vs ambient temperature  
T0252 - 100% duty cycle



Relative Current Output  
I(25°C)=1.0

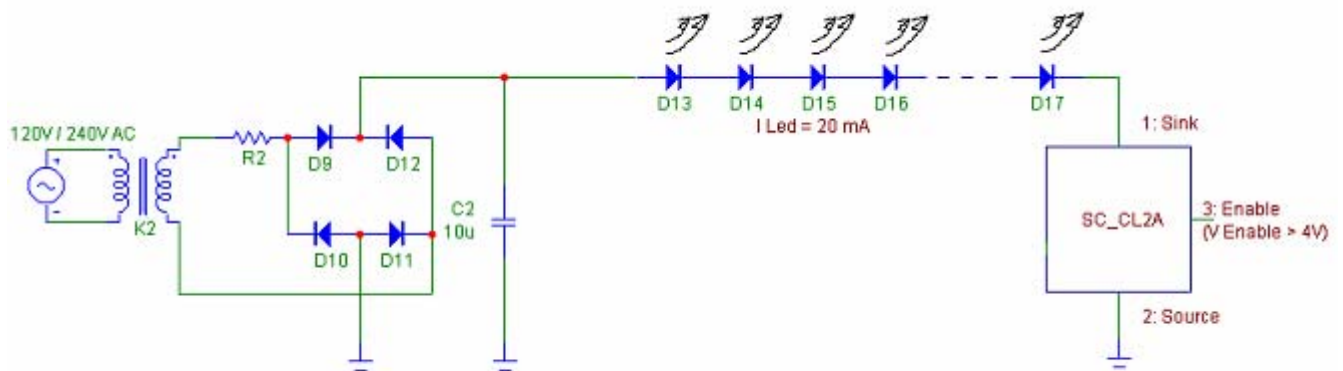


5-10-15-20mA Temperature Compensated  
Unipolar Current RegulatorTransient Response  
Turn-off CharacteristicsTransient Response  
Turn-on CharacteristicsTransient Response  
10uSec Pulse Characteristics



5-10-15-20mA Temperature Compensated  
Unipolar Current Regulator

Typical applications Sink and Source:

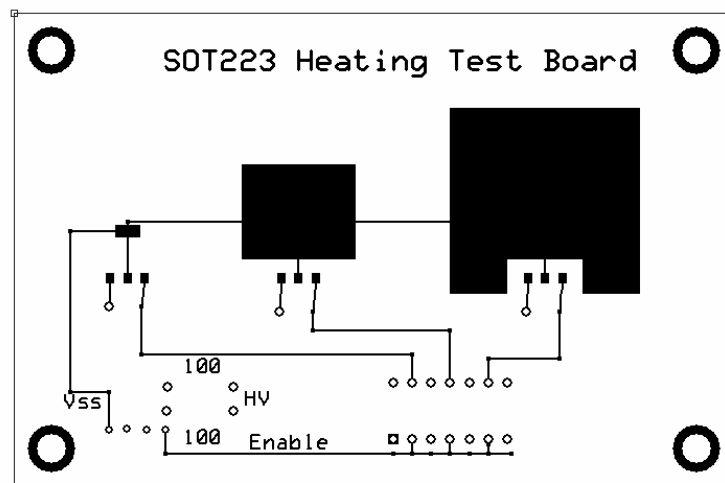
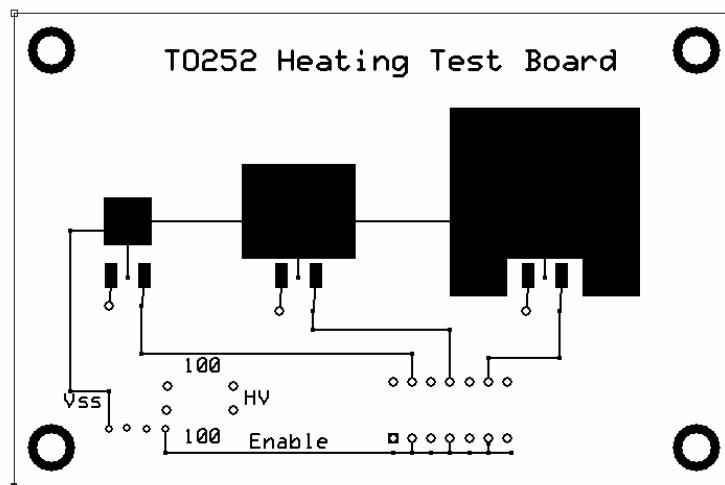


5-10-15-20mA Temperature Compensated  
Unipolar Current Regulator

**Packaging availability:**

- SOT223
- TO252 (DPAK)
- Bare Die

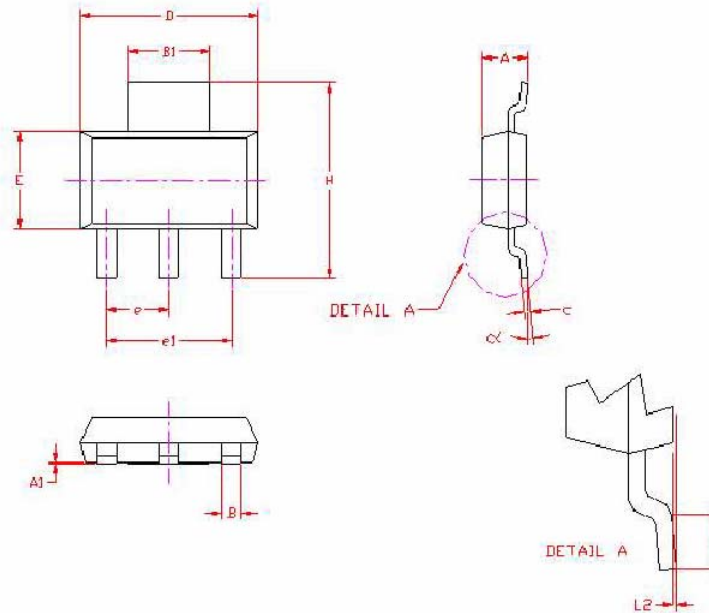
**Thermal properties test boards (Drawing to scale):**



5-10-15-20mA Temperature Compensated  
Unipolar Current Regulator

**Package Description:**

SOT223

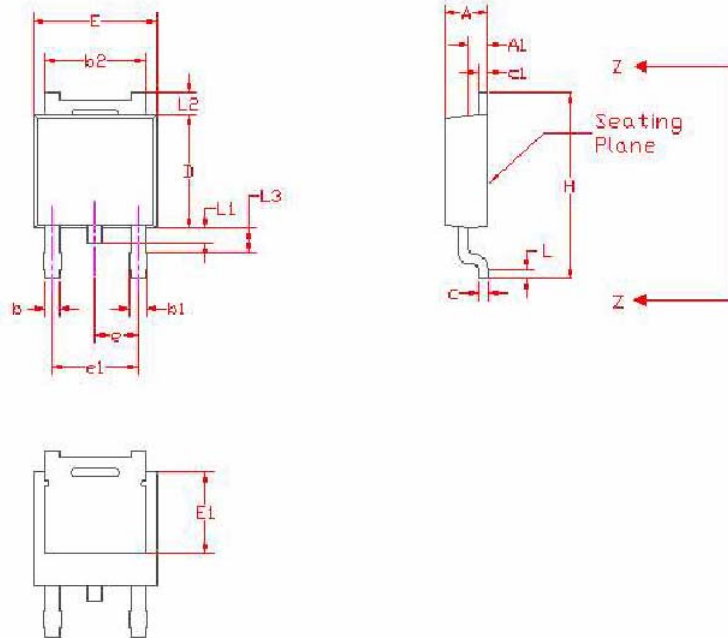


| SYMBOL | MILIMETER |         | INCHES    |         |
|--------|-----------|---------|-----------|---------|
|        | MINIMUM   | MAXIMUM | MINIMUM   | MAXIMUM |
| A      | 1.55      | 1.80    | .061      | .071    |
| A1     | 0.02      | 0.10    | .0008     | .004    |
| B      | 0.60      | 0.80    | .024      | .031    |
| B1     | 2.90      | 3.10    | .114      | .122    |
| c      | 0.24      | 0.32    | .009      | .013    |
| D      | 6.30      | 6.70    | .248      | .264    |
| E      | 3.30      | 3.70    | .130      | .146    |
| e      | 2.30 BSC  |         | .090 BSC  |         |
| e1     | 4.60 BSC  |         | .181 BSC  |         |
| H      | 6.70      | 7.30    | .264      | .287    |
| L      | 0.91 MIN  |         | .036 MIN  |         |
| L2     | 0.06 BSC  |         | .0024 BSC |         |
| α      | 0°        | 10°     | 0°        | 10°     |

### 5-10-15-20mA Temperature Compensated Unipolar Current Regulator

#### Package Description:

#### TO252 (DPAK-3L)



| SYMBOL | MILIMETER  |         |  | INCHES     |         |
|--------|------------|---------|--|------------|---------|
|        | MINIMUM    | MAXIMUM |  | MINIMUM    | MAXIMUM |
| A      | 2.19       | 2.38    |  | .086       | .094    |
| A1     | 0.89       | 1.14    |  | .035       | .045    |
| b      | 0.64       | 0.88    |  | .025       | .035    |
| b1     | 0.76       | 1.14    |  | .030       | .045    |
| b2     | 5.21       | 5.46    |  | .205       | .215    |
| c      | 0.46       | 0.58    |  | .018       | .023    |
| c1     | 0.46       | 0.58    |  | .018       | .023    |
| D      | 5.97       | 6.22    |  | .235       | .244    |
| E      | 6.35       | 6.73    |  | .250       | .265    |
| E1     | MIN 4.32   |         |  | MIN .170   |         |
| e      | 2.28 (BSC) |         |  | .090 (BSC) |         |
| e1     | 4.57 (BSC) |         |  | .180 (BSC) |         |
| H      | 9.40       | 10.42   |  | .370       | .410    |
| L      | 0.51       | -       |  | .020       | -       |
| L1     | 0.64       | 1.02    |  | .025       | .040    |
| L2     | 0.88       | 1.27    |  | .035       | .050    |
| L3     | 1.15       | 1.52    |  | .045       | .060    |