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

- **Limits and regulates current to 20mA.**
- **Rejects 50Hz / 60Hz ripple.**
- **Fast 2μSec 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.**

2-SOURCE

TO252

1-SINK   3-En

2-SOURCE

SOT223

1-SINK   2-SOURCE   3-En
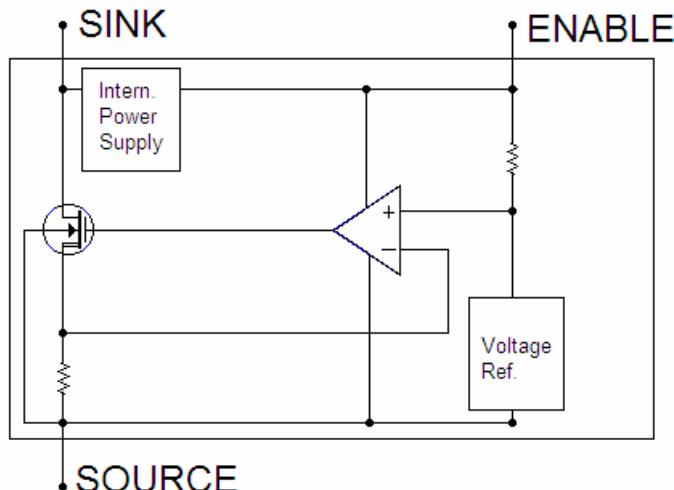
Description:

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:

SimpleChips Technologies Inc.   www.simplechips.com

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

Parameter	Unit	20mA nominal 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	

Parameter	Unit	15mA nominal 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	

Parameter	Unit	10mA nominal 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	

5-10-15-20mA Temperature Compensated
Unipolar Current Regulator
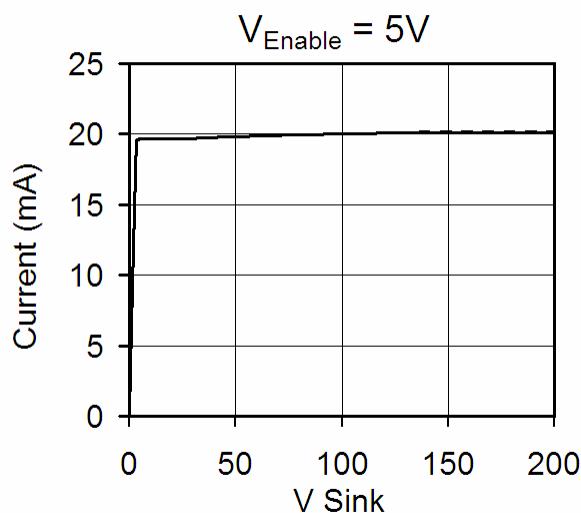
Parameter	Unit	Min.	Typ.	Max.
		5mA nominal		
Regulated Current (ILim) at 25C	mA	4.2	5.0	5.8
Regulated Current (ILim) at -40C	mA		4.8	
Regulated Current (ILim) at +85C	mA		4.7	
Operating Voltage for 90% Regulated Current	V	2.0	3.0	4.0
Absolute Temp. Coefficient (20V)	μA / C	-	6	-
Voltage Coefficient 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
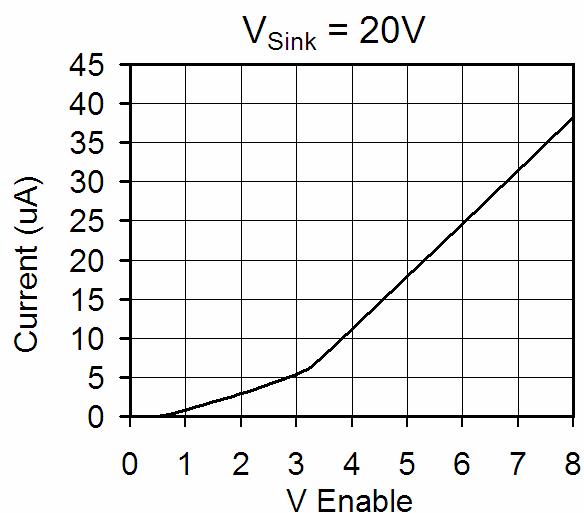
5-10-15-20mA Temperature Compensated
Unipolar Current Regulator

Data shown for 20mA version.
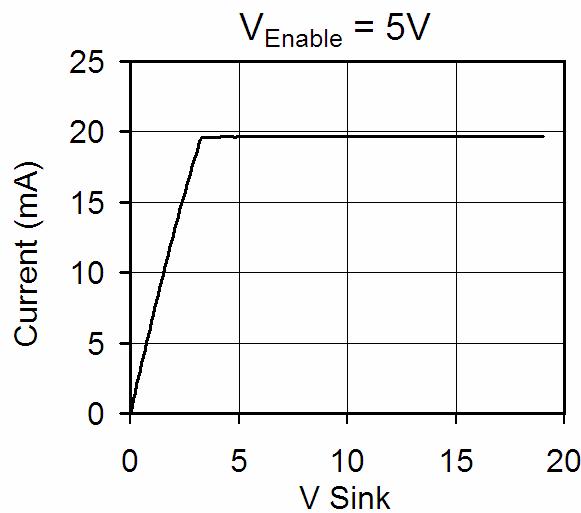
Sink Current versus Sink Voltage
V_{Enable} = 5V
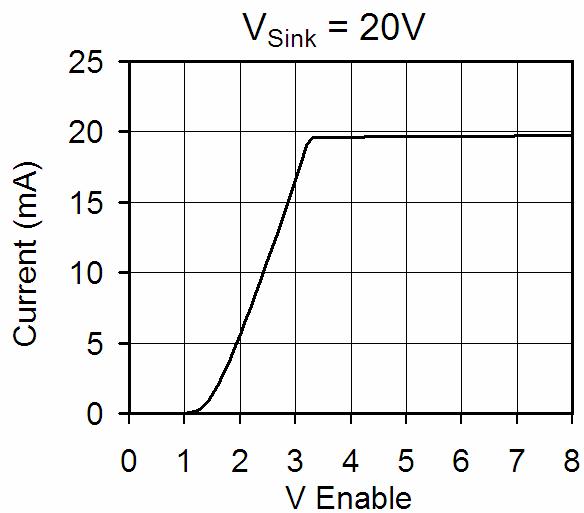
Enable Current vs. Enable Voltage
V_{Sink} = 20V

Sink Current versus Sink Voltage
V_{Enable} = 5V
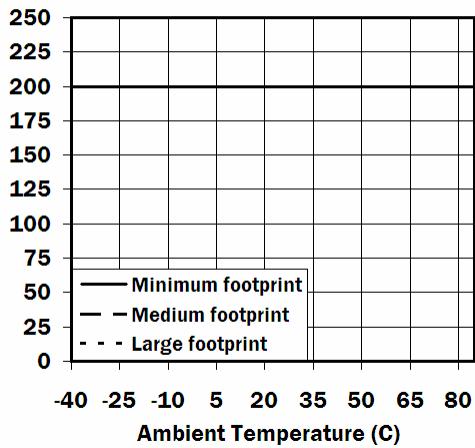
### Sink Current versus Enable Voltage
V_{Sink} = 20V
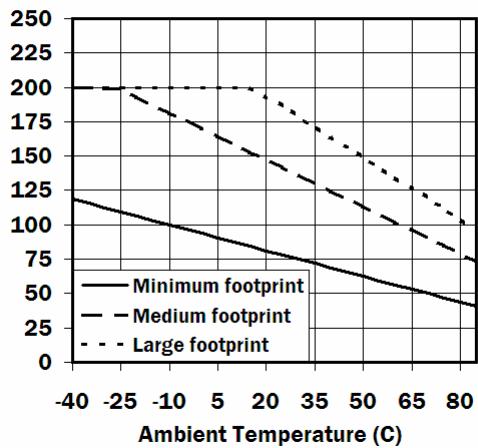
5-10-15-20mA Temperature Compensated
Unipolar Current Regulator
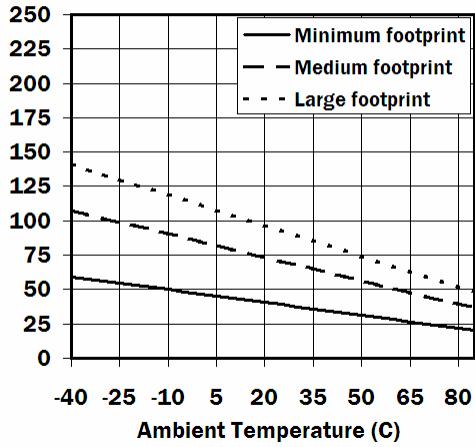
**Maximum Voltage vs ambient temperature**
SOT223 - 10% duty cycle
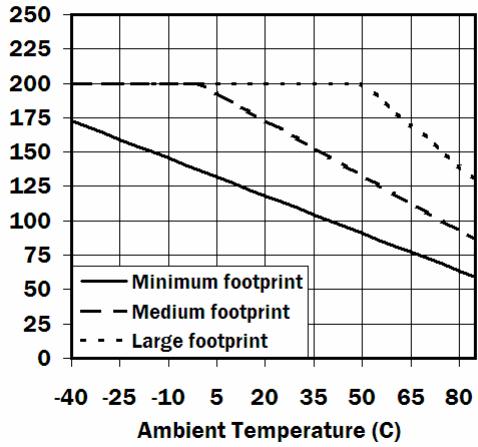
Maximum Voltage vs ambient temperature
SOT223 - 50% duty cycle

Maximum Voltage vs ambient temperature
SOT223 - 100% duty cycle
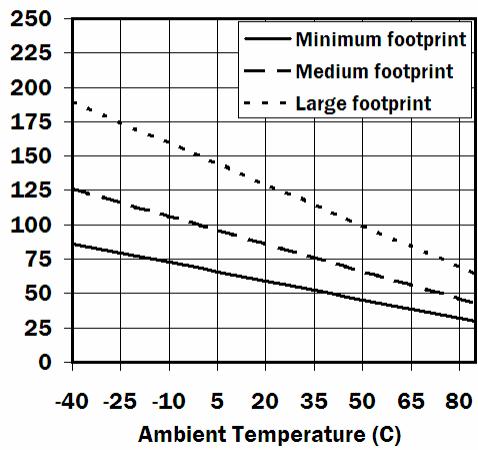
**Maximum Voltage vs ambient temperature**
TO252 - 50% duty cycle
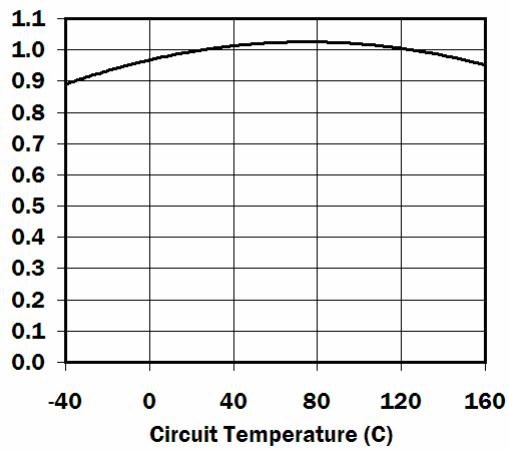
5-10-15-20mA Temperature Compensated
Unipolar Current Regulator
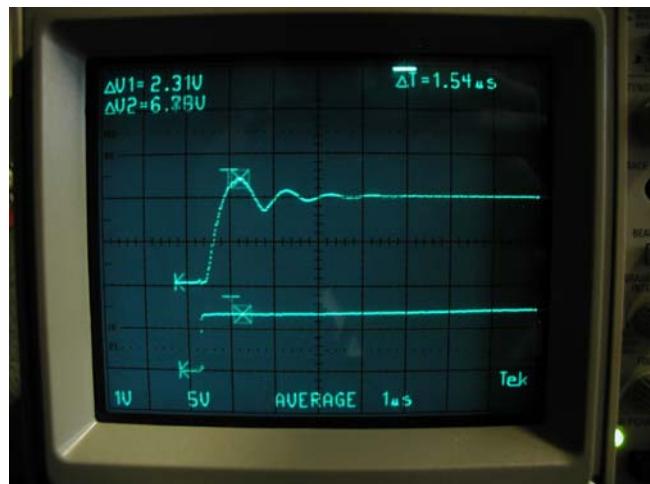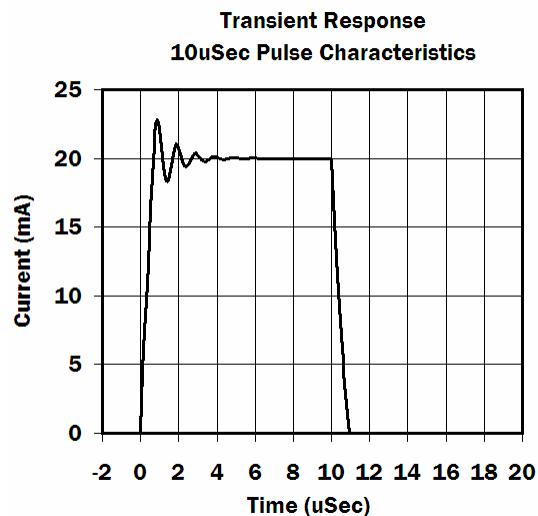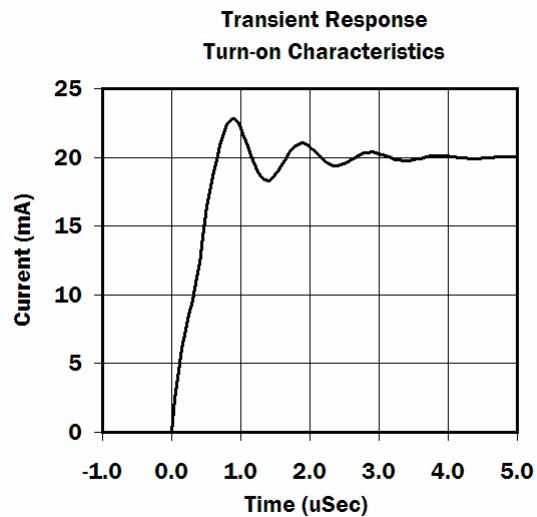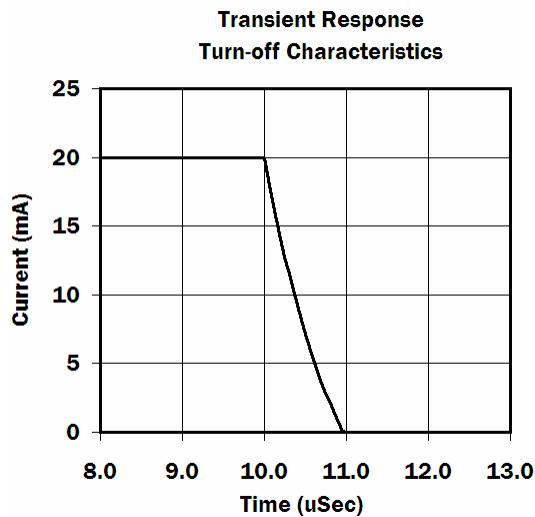
Maximum Voltage vs ambient temperature
**TO252 - 100% duty cycle**
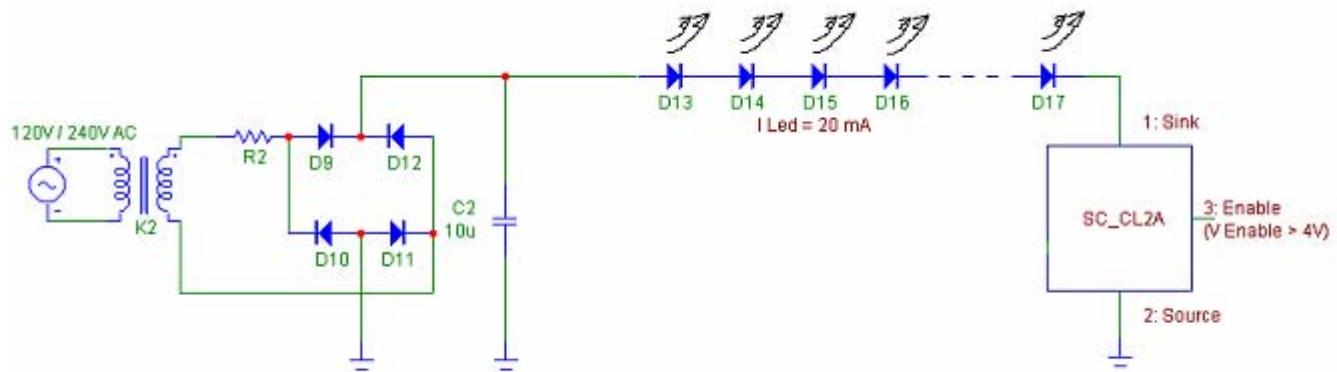
- Minimum footprint
- Medium footprint
- Large footprint

Ambient Temperature (C)

Relative Current Ouput
**I(25C)=1.0**

Circuit Temperature (C)

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

**Transient Response
Turn-off Characteristics**


**Transient Response
Turn-on Characteristics**

**Transient Response
10uSec Pulse Characteristics**

5-10-15-20mA Temperature Compensated
Unipolar Current Regulator
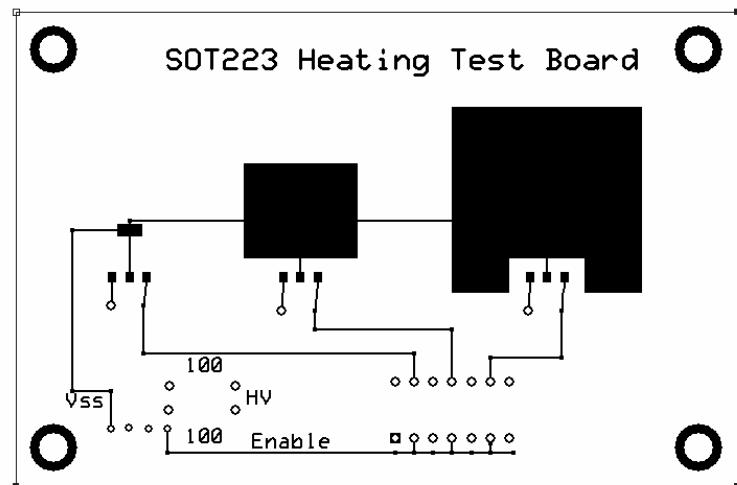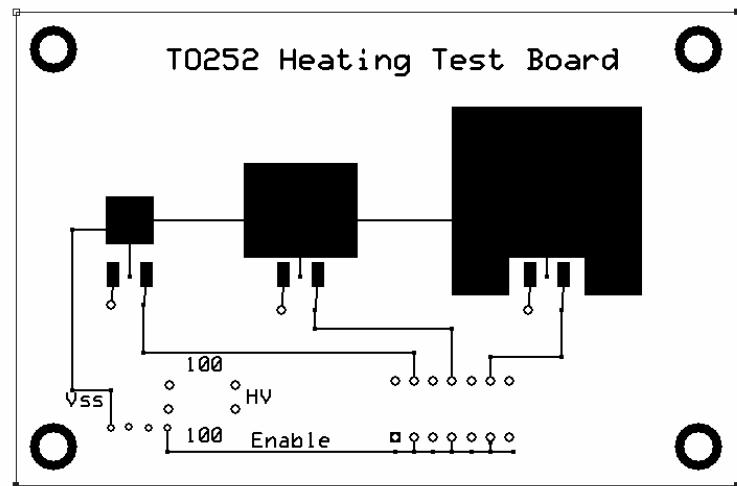
Typical applications Sink and Source:

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

Packaging availability:
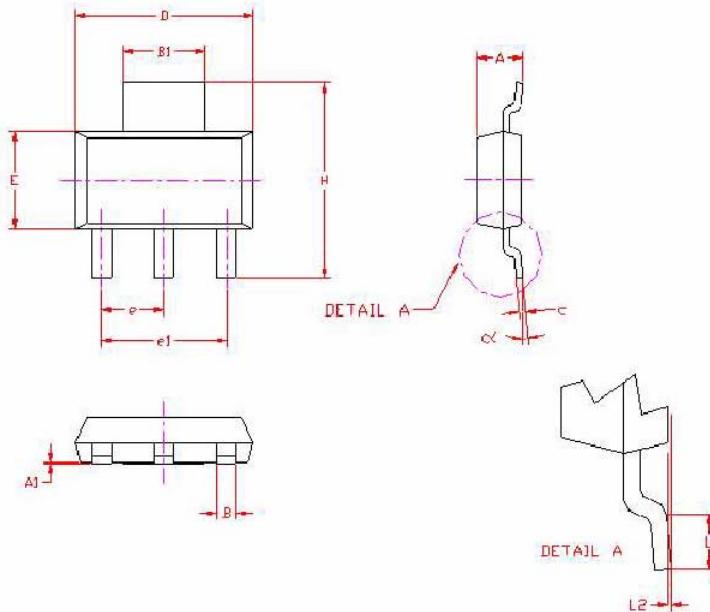
- SOT223
- TO252 (DPAK)
- Bare Die

Thermal properties test boards (Drawing to scale):

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

Package Description:

SOT223
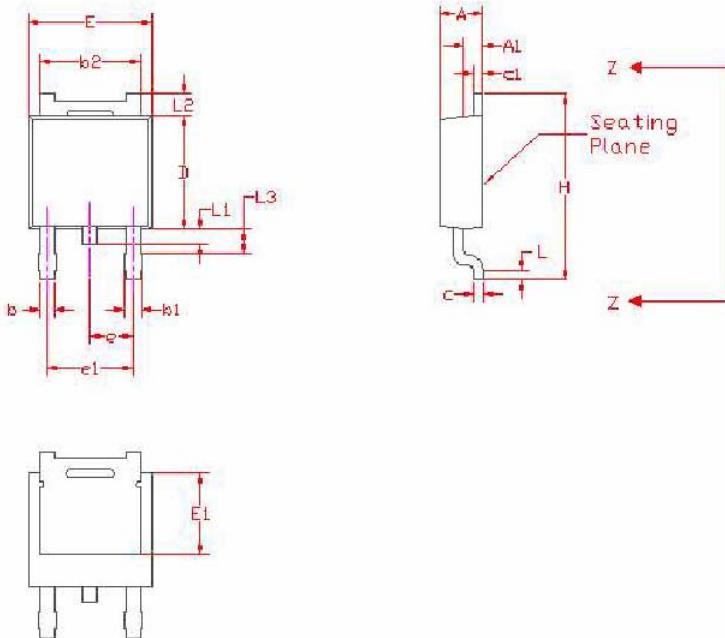
S Y M B O L	MILIMETER		INCHES	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
A	1.55	1.80	.061	.071
A1	0.02	0.10	.0008	.004
B	0.60	0.80	.024	.031
B1	2.90	3.10	.114	.122
c	0.24	0.32	.009	.013
D	6.30	6.70	.248	.264
E	3.30	3.70	.130	.146
e	2.30 BSC		.090 BSC	
e1	4.60 BSC		.181 BSC	
H	6.70	7.30	.264	.287
L	0.91 MIN		.036 MIN	
L2	0.06 BSC		.0024 BSC	
$\propto$	0°	10°	0°	10°

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

Package Description:

TO252 (DPAK-3L)

S Y M B O L	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