

300mA CMOS LDO

FEATURES

- Extremely Low Supply Current (50µA, Typ.)
- Very Low Dropout Voltage
- Guaranteed 300mA Output
- High Output Voltage Accuracy
- Standard or Custom Output Voltages
- Over-Current and Over-Temperature Protection

APPLICATIONS

- Battery-Operated Systems
- Portable Computers
- Medical Instruments
- Instrumentation
- Cellular / GSM / PHS Phones
- Linear Post-Regulator for SMPS
- Pagers

GENERAL DESCRIPTION

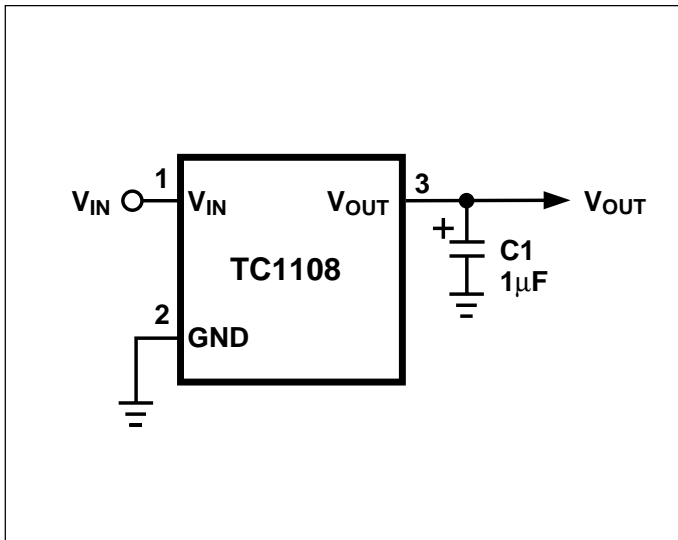
The TC1108 is a fixed output, high accuracy (typically $\pm 0.5\%$) CMOS low dropout regulator. Total supply current is typically 50µA at full load (20 to 60 times lower than in bipolar regulators!).

TC1108 key features include ultra low noise, very low dropout voltage (typically 240mV at full load), and fast response to step changes in load. The TC1108 incorporates both over-temperature and over-current protection. The TC1108 is stable with an output capacitor of only 1µF and has a maximum output current of 300mA. It is available in a SOT-223 package.

ORDERING INFORMATION

Part Number	Package	Junction Temp. Range
TC1108-xxVDB	3-Pin SOT-223	-40°C to +125°C
TC1015EV	Evaluation Kit for CMOS LDO Family	

TYPICAL APPLICATION



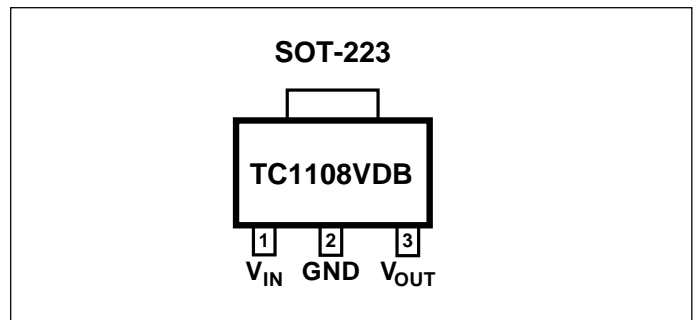
Available Output Voltages:

2.5, 2.8, 3.0, 3.3, 5.0

xx indicates output voltages

Other output voltages are available. Please contact Microchip Technology for details.

PIN CONFIGURATION



TC1108

ABSOLUTE MAXIMUM RATINGS*

Input Voltage	6.5V
Output Voltage	(V _{SS} – 0.3) to (V _{IN} + 0.3)
Power Dissipation	Internally Limited (Note 7)
Operating Temperature	– 40°C < T _J < 125°C
Storage Temperature	– 65°C to +150°C
Maximum Voltage on Any Pin	V _{IN} + 0.3V to – 0.3V
Lead Temperature (Soldering, 10 Sec.)	+260°C

*Absolute Maximum Ratings indicate device operation limits beyond damage may occur. Device operation beyond the limits listed in Electrical Characteristics is not recommended.

ELECTRICAL CHARACTERISTICS: V_{IN} = V_{OUT} + 1V, I_L = 100µA, C_L = 3.3µF, T_A = 25°C, unless otherwise specified.
BOLDFACE type specifications apply for junction temperatures of – 40°C to +125°C.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V _{IN}	Input Operating Voltage		—	—	6.0	V
I _{OUTMAX}	Maximum Output Current		300	—	—	mA
V _{OUT}	Output Voltage	Note 1	— V_R – 2.5%	V _R ± 0.5% —	— V_R + 2.5%	V
ΔV _{OUT} /ΔT	V _{OUT} Temperature Coefficient	Note 2	—	40	—	ppm/°C
ΔV _{OUT} /ΔV _{IN}	Line Regulation	(V _R + 1V) ≤ V _{IN} ≤ 6V	—	0.05	0.35	%
ΔV _{OUT} /V _{OUT}	Load Regulation	I _L = 0.1mA to I _{OUTMAX} (Note 3)	—	1.1	2.0	%
V _{IN} – V _{OUT}	Dropout Voltage	I _L = 0.1mA I _L = 100mA I _L = 300mA (Note 4)	— — —	20 80 270	30 160 480	mV
I _{DD}	Supply Current		—	50	90	µA
PSRR	Power Supply Rejection Ratio	F _{RE} ≤ 1kHz	—	60	—	dB
I _{OUTSC}	Output Short Circuit Current	V _{OUT} = 0V	—	550	650	mA
ΔV _{OUT} /ΔP _D	Thermal Regulation	Note 5	—	0.04	—	V/W
eN	Output Noise	F = 10kHz, C _{OUT} = 1µF, R _{LOAD} = 50Ω	—	260	—	nV/√Hz

- NOTES:**
- V_R is the regulator output voltage setting.
 - T_C V_{OUT} = $\frac{(V_{OUTMAX} - V_{OUTMIN}) \times 10^6}{V_{OUT} \times \Delta T}$
 - Regulation is measured at a constant junction temperature using low duty cycle pulse testing. Load regulation is tested over a load range from 0.1mA to the maximum specified output current. Changes in output voltage due to heating effects are covered by the thermal regulation specification.
 - Dropout voltage is defined as the input to output differential at which the output voltage drops 2% below its nominal value measured at a 1V differential.
 - Thermal Regulation is defined as the change in output voltage at a time T after a change in power dissipation is applied, excluding load or line regulation effects. Specifications are for a current pulse equal to I_{LMAX} at V_{IN} = 6V for T = 10msec.
 - The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature, and the thermal resistance from junction-to-air (i.e. T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation causes the device to initiate thermal shutdown. Please see *Thermal Considerations* section of this data sheet for more details.

DETAILED DESCRIPTION

The TC1108 is a precision, fixed output LDO. Unlike bipolar regulators, the TC1108 supply current does not increase with load current. In addition, V_{OUT} remains stable and within regulation at very low load currents (an important consideration in RTC and CMOS RAM battery backup applications). Figure 1 shows a typical application circuit.

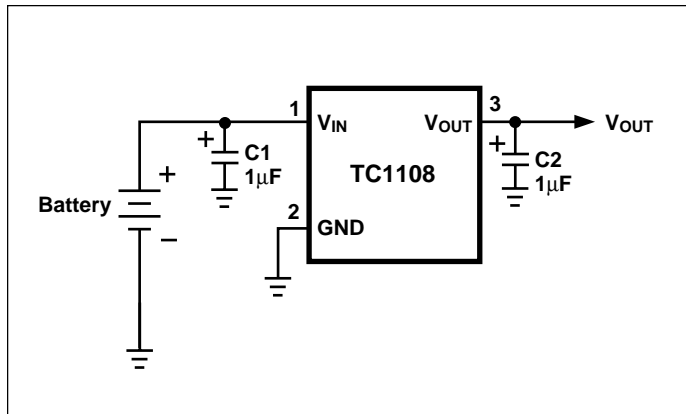


Figure 1: Typical Application Circuit

Output Capacitor

A 1µF (min) capacitor from V_{OUT} to ground is required. The output capacitor should have an effective series resistance of 5Ω or less. A 1µF capacitor should be connected from V_{IN} to GND if there is more than 10 inches of wire between the regulator and the AC filter capacitor, or if a battery is used as the power source. Aluminum electrolytic or tantalum capacitor types can be used. (Since many aluminum electrolytic capacitors freeze at approximately -30°C, solid tantalums are recommended for applications operating below -25°C.) When operating from sources other than batteries, supply-noise rejection and transient response can be improved by increasing the value of the input and output capacitors and employing passive filtering techniques.

Thermal Considerations

Thermal Shutdown

Integrated thermal protection circuitry shuts the regulator off when die temperature exceeds 150°C. The regulator remains off until the die temperature drops to approximately 140°C.

Power Dissipation

The amount of power the regulator dissipates is primarily a function of input and output voltage, and output current. The following equation is used to calculate worst case *actual* power dissipation:

$$P_D \approx (V_{INMAX} - V_{OUTMIN})I_{LOADMAX}$$

Where: P_D = worst case actual power dissipation
 V_{INMAX} = maximum voltage on V_{IN}
 V_{OUTMIN} = minimum regulator output voltage
 $I_{LOADMAX}$ = maximum output (load) current

Equation 1.

The maximum *allowable* power dissipation (Equation 2) is a function of the maximum ambient temperature (T_{AMAX}), the maximum allowable die temperature (T_{JMAX}) and the thermal resistance from junction-to-air (θ_{JA}).

$$P_{DMAX} = \frac{(T_{JMAX} - T_{AMAX})}{\theta_{JA}}$$

Where all terms are previously defined.

Equation 2.

Table 1 shows various values of θ_{JA} for the TC1108 mounted on a 1/16 inch, 2-layer PCB with 1 oz. copper foil.

Table 1. Thermal Resistance Guidelines for TC1108

Copper Area (Topside)*	Copper Area (Backside)	Board Area	Thermal Resistance (θ_{JA})
2500 sq mm	2500 sq mm	2500 sq mm	45°C/W
1000 sq mm	2500 sq mm	2500 sq mm	45°C/W
225 sq mm	2500 sq mm	2500 sq mm	53°C/W
100 sq mm	2500 sq mm	2500 sq mm	59°C/W
1000 sq mm	1000 sq mm	1000 sq mm	52°C/W
1000 sq mm	0 sq mm	1000 sq mm	55°C/W

NOTES: *Tab of device attached to topside copper

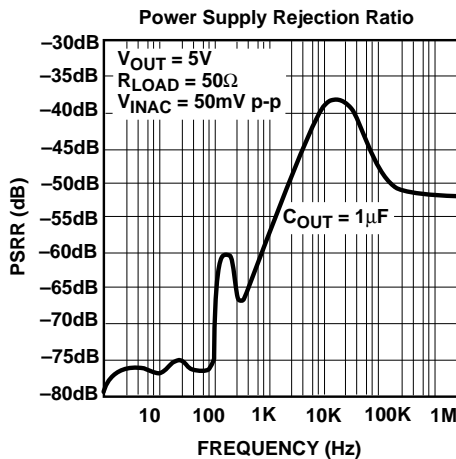
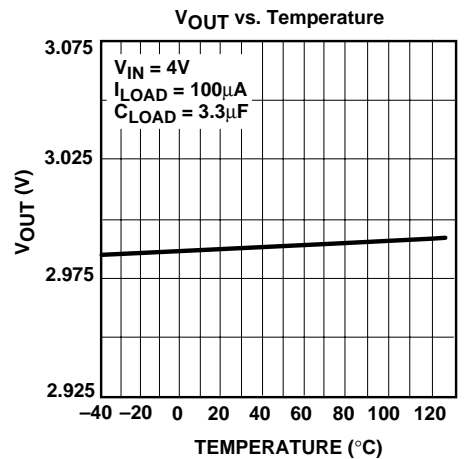
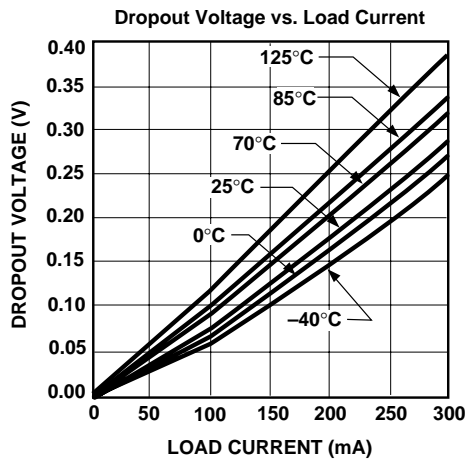
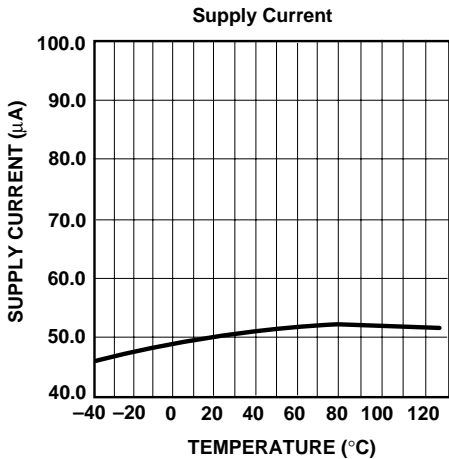
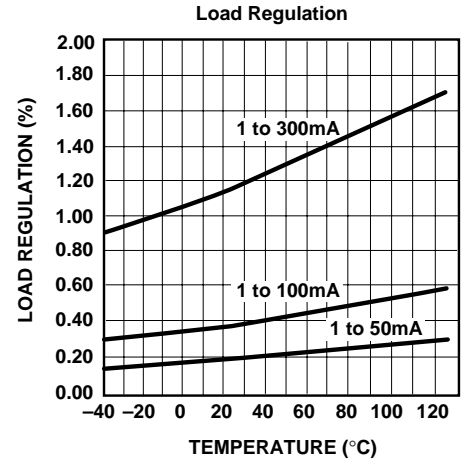
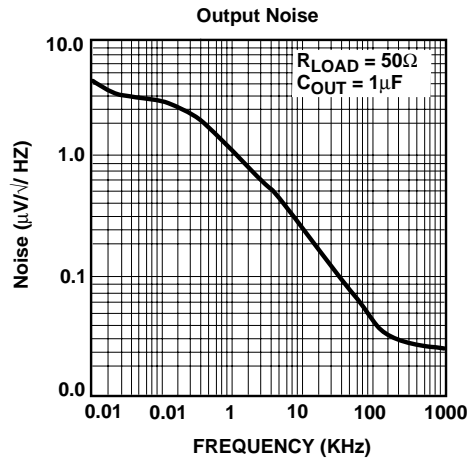
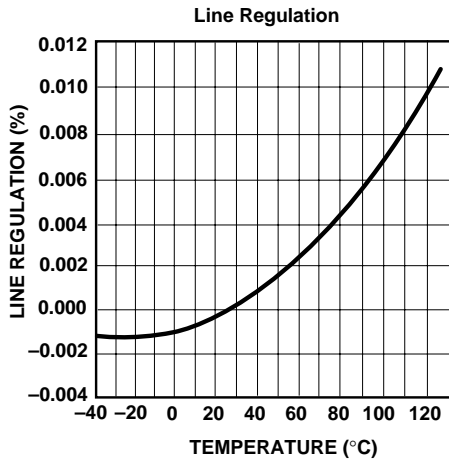
Equation 1 can be used in conjunction with Equation 2 to ensure regulator thermal operation is within limits. For example:

GIVEN: $V_{INMAX} = 3.3V + 10\%$
 $V_{OUTMIN} = 2.7V - 0.5\%$
 $I_{LOADMAX} = 275mA$
 $T_{JMAX} = 125°C$
 $T_{AMAX} = 95°C$
 $\theta_{JA} = 59°C/W$

FIND: 1. Actual power dissipation
 2. Maximum allowable dissipation

TC1108

TYPICAL CHARACTERISTICS



Actual power dissipation:

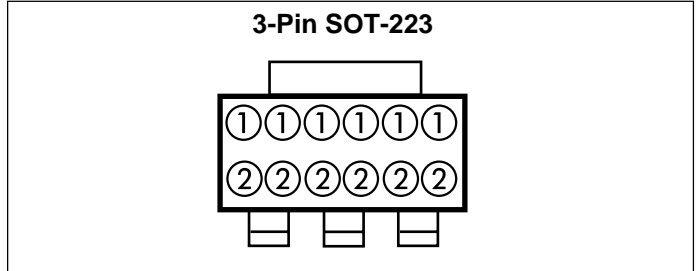
$$\begin{aligned}
 P_D &\approx (V_{INMAX} - V_{OUTMIN}) I_{LOADMAX} \\
 &= [(3.3 \times 1.1) - (2.7 \times .995)] 275 \times 10^{-3} \\
 &= \underline{260mW}
 \end{aligned}$$

Maximum allowable power dissipation:

$$\begin{aligned}
 P_{DMAX} &= \frac{(T_{JMAX} - T_{AMAX})}{\theta_{JA}} \\
 &= \frac{(125 - 95)}{59} \\
 &= \underline{508mW}
 \end{aligned}$$

In this example, the TC1108 dissipates a maximum of only 260mW; far below the allowable limit of 508mW. In a similar manner, Equation 1 and Equation 2 can be used to calculate maximum current and/or input voltage limits. For example, the maximum allowable V_{IN} is found by substituting the maximum allowable power dissipation of 508mW into Equation 1, from which $V_{INMAX} = 4.6V$.

MARKINGS

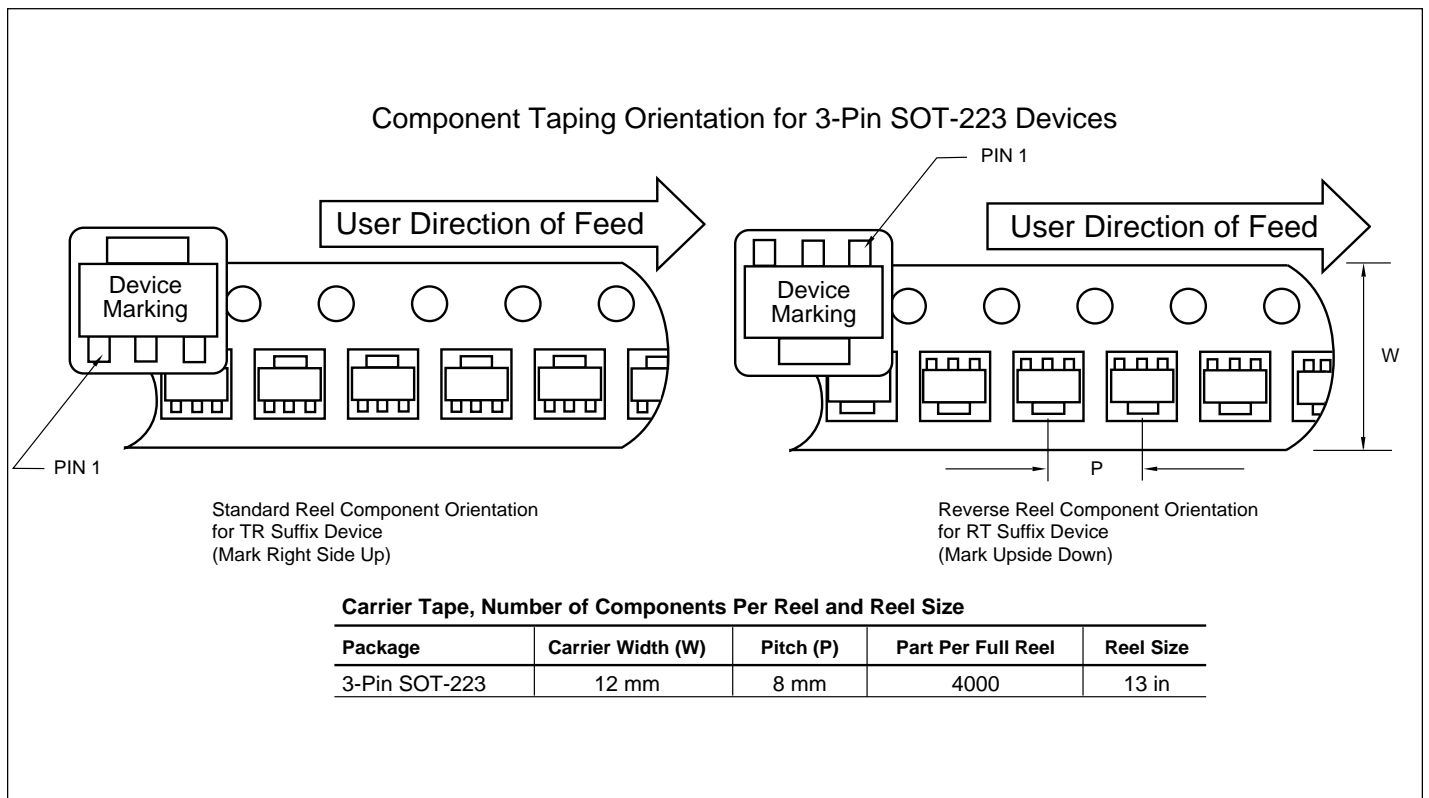


① part number code

② represents temperature + date code + lot Identity + subcontractor identity

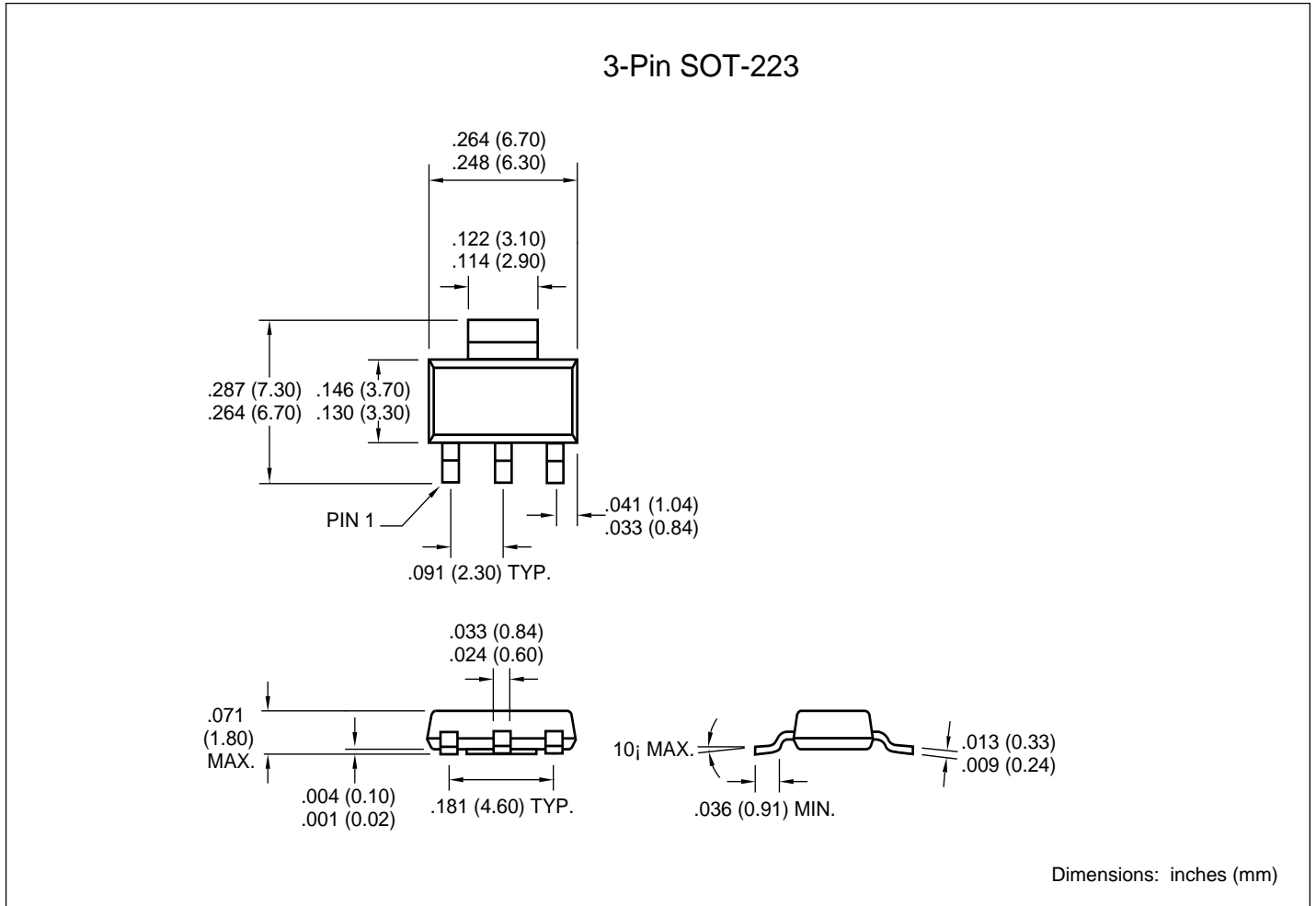
TC1108 (V)	Code
TC1108-2.5VDB	110825
TC1108-2.8VDB	110828
TC1108-3.0VDB	110830
TC1108-3.3VDB	110833
TC1108-5.0VDB	110850

TAPING FORM



TC1108

PACKAGE DIMENSIONS





WORLDWIDE SALES AND SERVICE

AMERICAS

Corporate Office

2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200 Fax: 480-792-7277
Technical Support: 480-792-7627
Web Address: <http://www.microchip.com>

Rocky Mountain

2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7966 Fax: 480-792-7456

Atlanta

500 Sugar Mill Road, Suite 200B
Atlanta, GA 30350
Tel: 770-640-0034 Fax: 770-640-0307

Austin

Analog Product Sales
8303 MoPac Expressway North
Suite A-201
Austin, TX 78759
Tel: 512-345-2030 Fax: 512-345-6085

Boston

2 Lan Drive, Suite 120
Westford, MA 01886
Tel: 978-692-3848 Fax: 978-692-3821

Boston

Analog Product Sales
Unit A-8-1 Millbrook Tarry Condominium
97 Lowell Road
Concord, MA 01742
Tel: 978-371-6400 Fax: 978-371-0050

Chicago

333 Pierce Road, Suite 180
Itasca, IL 60143
Tel: 630-285-0071 Fax: 630-285-0075

Dallas

4570 Westgrove Drive, Suite 160
Addison, TX 75001
Tel: 972-818-7423 Fax: 972-818-2924

Dayton

Two Prestige Place, Suite 130
Miamisburg, OH 45342
Tel: 937-291-1654 Fax: 937-291-9175

Detroit

Tri-Atria Office Building
32255 Northwestern Highway, Suite 190
Farmington Hills, MI 48334
Tel: 248-538-2250 Fax: 248-538-2260

Los Angeles

18201 Von Karman, Suite 1090
Irvine, CA 92612
Tel: 949-263-1888 Fax: 949-263-1338

Mountain View

Analog Product Sales
1300 Terra Bella Avenue
Mountain View, CA 94043-1836
Tel: 650-968-9241 Fax: 650-967-1590

New York

150 Motor Parkway, Suite 202
Hauppauge, NY 11788
Tel: 631-273-5305 Fax: 631-273-5335

San Jose

Microchip Technology Inc.
2107 North First Street, Suite 590
San Jose, CA 95131
Tel: 408-436-7950 Fax: 408-436-7955

Toronto

6285 Northam Drive, Suite 108
Mississauga, Ontario L4V 1X5, Canada
Tel: 905-673-0699 Fax: 905-673-6509

ASIA/PACIFIC

China - Beijing

Microchip Technology Beijing Office
Unit 915
New China Hong Kong Manhattan Bldg.
No. 6 Chaoyangmen Beidajie
Beijing, 100027, No. China
Tel: 86-10-85282100 Fax: 86-10-85282104

China - Shanghai

Microchip Technology Shanghai Office
Room 701, Bldg. B
Far East International Plaza
No. 317 Xian Xia Road
Shanghai, 200051
Tel: 86-21-6275-5700 Fax: 86-21-6275-5060

Hong Kong

Microchip Asia Pacific
RM 2101, Tower 2, Metroplaza
223 Hing Fong Road
Kwai Fong, N.T., Hong Kong
Tel: 852-2401-1200 Fax: 852-2401-3431

India

Microchip Technology Inc.
India Liaison Office
Divyasree Chambers
1 Floor, Wing A (A3/A4)
No. 11, O'Shaughnessey Road
Bangalore, 560 025, India
Tel: 91-80-2290061 Fax: 91-80-2290062

Japan

Microchip Technology Intl. Inc.
Benex S-1 6F
3-18-20, Shinyokohama
Kohoku-Ku, Yokohama-shi
Kanagawa, 222-0033, Japan
Tel: 81-45-471-6166 Fax: 81-45-471-6122

Korea

Microchip Technology Korea
168-1, Youngbo Bldg. 3 Floor
Samsung-Dong, Kangnam-Ku
Seoul, Korea
Tel: 82-2-554-7200 Fax: 82-2-558-5934

ASIA/PACIFIC (continued)

Singapore

Microchip Technology Singapore Pte Ltd.
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-334-8870 Fax: 65-334-8850

Taiwan

Microchip Technology Taiwan
11F-3, No. 207
Tung Hua North Road
Taipei, 105, Taiwan
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

EUROPE

Australia

Microchip Technology Australia Pty Ltd
Suite 22, 41 Rawson Street
Epping 2121, NSW
Australia
Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

Denmark

Microchip Technology Denmark ApS
Regus Business Centre
Lautrup høj 1-3
Ballerup DK-2750 Denmark
Tel: 45 4420 9895 Fax: 45 4420 9910

France

Arizona Microchip Technology SARL
Parc d'Activite du Moulin de Massy
43 Rue du Saule Trapu
Batiment A - 1er Etage
91300 Massy, France
Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79

Germany

Arizona Microchip Technology GmbH
Gustav-Heinemann Ring 125
D-81739 Munich, Germany
Tel: 49-89-627-144 0 Fax: 49-89-627-144-44

Germany


Analog Product Sales
Lochamer Strasse 13
D-82152 Martinsried, Germany
Tel: 49-89-895650-0 Fax: 49-89-895650-22

Italy

Arizona Microchip Technology SRL
Centro Direzionale Colleoni
Palazzo Taurus 1 V. Le Colleoni 1
20041 Agrate Brianza
Milan, Italy
Tel: 39-039-65791-1 Fax: 39-039-6899883

United Kingdom

Arizona Microchip Technology Ltd.
505 Eskdale Road
Winnersh Triangle
Wokingham
Berkshire, England RG41 5TU
Tel: 44 118 921 5869 Fax: 44-118 921-5820

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