MIL-PRF-38534 CERTIFIED FACILITY

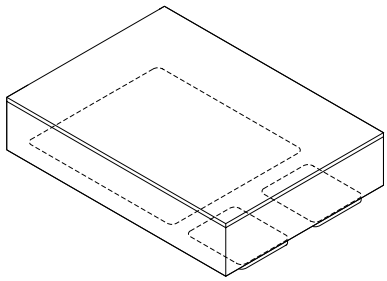
HIGH CURRENT, LOW DROPOUT SURFACE MOUNT VOLTAGE REGULATORS

5215 SERIES

TTM Technologies
Time-To-Market Interconnect Solutions

FEATURES:

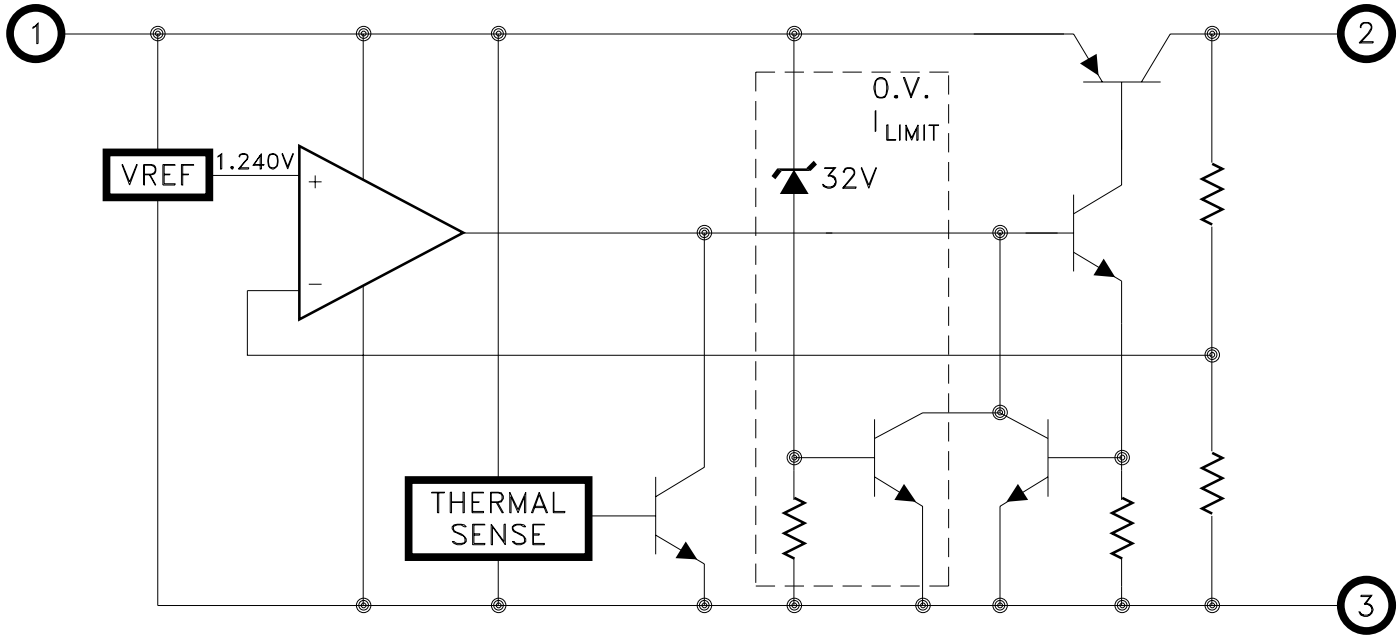
- Hermetic Surface Mount Package
- Extremely Low Dropout Voltage: 350mV @ 1.5 Amps
- Available in 1.5V, 1.7V, 1.8V, 1.9V, 2.5V, 3.3V, 5.0V and 12.0V
- On Board Thermal Shut Down
- Reverse Battery and Load Dump Protection
- Low Ground Current: 32mA Typical at Full Load
- 1% Maximum Guaranteed Accuracy
- Output Current to 1.5 Amps
- Alternate Output Voltages Available



DESCRIPTION:

The MSK5215 series voltage regulators are available in +1.5V, +1.7V, +1.8V, +1.9V, +2.5V, +3.3V, +5.0V, and +12.0V output configurations. All boast ultra low dropout specifications due to the utilization of a super PNP output pass transistor with monolithic technology. Dropout voltages of 350mV at 1.5 amps are typical in this configuration, which drives efficiency up and power dissipation down. Accuracy is guaranteed with a 1% maximum output voltage tolerance. The MSK5215 series is packaged in a space efficient 3 pin power surface mount ceramic package.

EQUIVALENT SCHEMATIC



TYPICAL APPLICATIONS

- High Efficiency, High Current Linear Regulators
- Constant Voltage/Current Regulators
- System Power Supplies
- Switching Power Supply Post Regulators
- Battery Powered Equipment

PIN-OUT INFORMATION

1 VIN
2 VOUT
3 GROUND

LID = ISOLATED

ABSOLUTE MAXIMUM RATINGS

V_{INP} Input Voltage (100mS 1% D.C.) .....-20V to +60V
VIN Input Voltage.....26V
V_{EN} Enable Voltage ..... -0.3V to 26V
I_{OUT} Output Current.....3.5A

T_{ST} Storage Temperature Range .....-65°C to +150°C
T_{LD} Lead Temperature
(10 Seconds Soldering).....300°C
T_C Case Operating Temperature Range
MSK5215 Series.....-40°C to +85°C
MSK5215B Series .....-55°C to +125°C
ESD Rating ..... Class 1B

ELECTRICAL SPECIFICATIONS

Parameter	Test Conditions (1) (3)	Group A Subgroup	MSK5215H SERIES Min.	MSK5215H SERIES Typ.	MSK5215H SERIES Max.	MSK5215 SERIES Min.	MSK5215 SERIES Typ.	MSK5215 SERIES Max.	Units
Output Voltage Tolerance	I_{OUT} = 10mA; VIN = VOUT +1V	1	-	±0.5	±1.0	-	±0.5	±1.0	%
		2, 3	-	±1.0	±2.0	-	-	-	%
Dropout Voltage (2)	ΔV_{OUT} = -1%; I_{OUT} = 100mA	1	-	80	200	-	80	225	mV
	ΔV_{OUT} = -1%; I_{OUT} = 1.5A	1	-	350	600	-	350	625	mV
Load Regulation (8)	10mA ≤ I_{OUT} ≤ 1.25A	1	-	±0.2	±1.0	-	±0.2	±1.2	%
		2, 3	-	±0.3	±2.0	-	±0.3	-	%
Line Regulation	(VOUT +1V) ≤ VIN ≤ 26V	1	-	±0.05	±0.5	-	±0.05	±0.6	%
	I_{OUT} = 10mA	2, 3	-	±0.5	±1.0	-	±0.5	-	%
Output Current Limit (2)	VOUT = 0V; VIN = VOUT +1V	-	-	2.1	3.5	-	2.1	3.5	A
Ground Current (2)	VIN = VOUT +1V; I_{OUT} = 0.75A	-	-	18	30	-	18	30	mA
	VIN = VOUT +1V; I_{OUT} = 1.5A	-	-	32	-	-	32	-	mA
Output Noise (2)	C_L = 10µF; 10Hz ≤ f ≤ 100KHz	-	-	400	-	-	400	-	µV
Thermal Resistance (2)	Junction to Case @ 125°C	-	-	3.5	4.0	-	3.5	4.5	°C/W
Thermal Shutdown (2)	T_J	-	-	130	-	-	130	-	°C

PART NUMBER (7)	OUTPUT VOLTAGE
MSK5215-1.5	+1.5V
MSK5215-1.7	+1.7V
MSK5215-1.8	+1.8V
MSK5215-1.9	+1.9V
MSK5215-2.5	+2.5V
MSK5215-3.3	+3.3V
MSK5215-5.0	+5.0V
MSK5215-12	+12.0V

NOTES:

(1) Output decoupled to ground using 33µF minimum capacitance unless otherwise specified.

(2) This parameter is guaranteed by design but need not be tested. Typical parameters are representative of actual device performance but are for reference only.

(3) All output parameters are tested using a low duty cycle pulse to maintain $T_J = T_C$.

(4) Industrial grade devices shall be tested to subgroup 1 unless otherwise specified.

(5) Military grade devices ("H" suffix) shall be 100% tested to subgroups 1, 2 and 3.

(6) Subgroup 1 T_C = +25°C
Subgroup 2 T_J = +125°C
Subgroup 3 T_A = -55°C

(7) Please consult the factory if alternate output voltages are required.

(8) Due to current limit, maximum output current may not be available at all values of VIN - VOUT and temperatures. See typical performance curves for clarification.

APPLICATION NOTES

REGULATOR PROTECTION

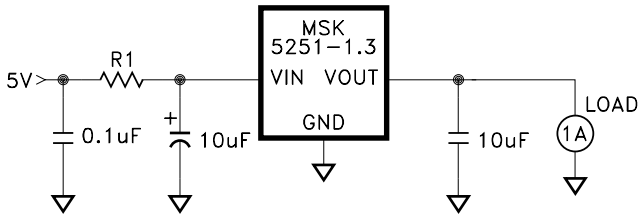
The MSK5251 series are high performance linear regulators for high current, low voltage applications requiring fast transient response. The devices are fully protected from damage due to fault conditions, offering constant current limiting and thermal shutdown. The thermal shutdown junction temperature is typically 140°C and is 100% tested to verify thermal shutdown occurs above 135°C.

INPUT SUPPLY VOLTAGE

The input voltage must be maintained at a minimum of 3.0 volts for proper operation for devices with output voltage below 1.0 volt. With an output voltage of 1.0 volt or higher, the input voltage must be a minimum of 2.1 volts above the output.

MINIMIZING POWER DISSIPATION

To maximize the performance and reduce power dissipation of the MSK5251 series devices, Vin should be maintained as close to dropout as possible. See Input Supply Voltage requirements. A series resistor can be used to lower Vin close to the dropout specification, lowering the input to output voltage differential. In turn, this will decrease the power that the device is required to dissipate. Knowing peak current requirements and worst case voltages, a resistor can be selected that will drop a portion of the excess voltage and help to distribute the heating. The circuit below illustrates this method.



The maximum resistor value can be calculated from the following:

INPUT CAPACITOR:

If the device is to be located more than 4 inches from the bulk supply capacitance, a minimum 1uF capacitor should be placed as close to the input pin as possible for proper bypassing. A smaller value capacitor such as 0.01uF should be placed in parallel with the larger value capacitor. Larger input capacitor values will help to improve ripple rejection.

HEAT SINK SELECTION

To select a heat sink for the MSK5215, the following formula for convective heat flow may be used.

Governing Equation:

$T_J = P_D \times (R\theta_{JC} + R\theta_{CS} + R\theta_{SA}) + T_A$

Where:

T_J = Junction Temperature

P_D = Total Power Dissipation
$R\theta_{JC}$ = Junction to Case Thermal Resistance
$R\theta_{CS}$ = Case to Heat Sink Thermal Resistance
$R\theta_{SA}$ = Heat Sink to Ambient Thermal Resistance
T_A = Ambient Temperature

First, the power dissipation must be calculated as follows:

$$\text{Power Dissipation} = (V_{IN} - V_{OUT}) \times I_{OUT}$$

Next, the user must select a maximum junction temperature. The absolute maximum allowable junction temperature is 125°C. The equation may now be rearranged to solve for the required heat sink to ambient thermal resistance ($R\theta_{SA}$).

Example:

An MSK5215-3.3 is configured for VIN = +5V and VOUT = +3.3V. Iout is a continuous 1A DC level. The ambient temperature is +25°C. The maximum desired junction temperature is 125°C.

$R\theta_{JC}$ = 3.5°C/W and $R\theta_{CS}$ = 0.5°C/W for most thermal greases

$$\text{Power Dissipation} = (5V - 3.3V) \times (1A)$$
$$= 1.7 \text{ Watts}$$

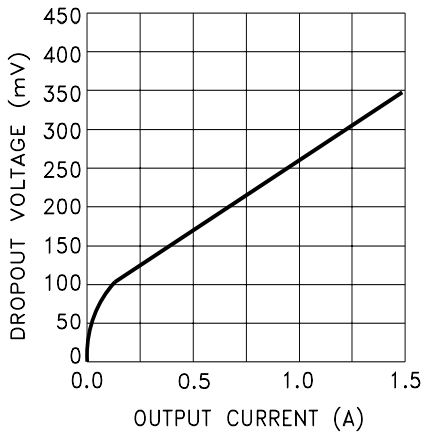
Solve for $R\theta_{SA}$:

$$R\theta_{SA} = \left[\frac{125°C - 25°C}{1.7W}\right] - 3.5°C/W - 0.5°C/W$$
$$= 54.82°C/W$$

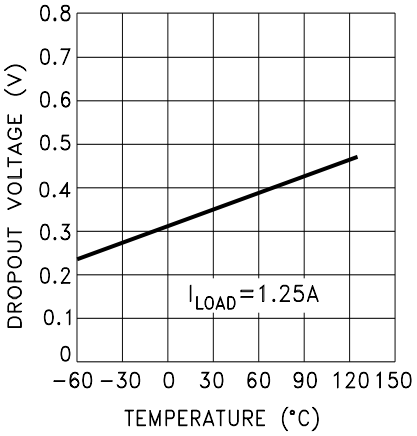
In this example, a heat sink with a thermal resistance of no more than 54°C/W must be used to maintain a junction temperature of no more than 125°C.

TYPICAL PERFORMANCE CURVES

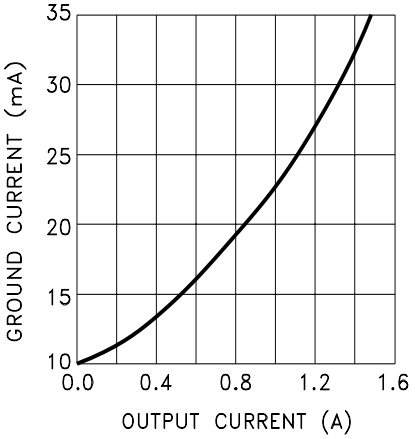
DROPOUT vs OUTPUT CURRENT



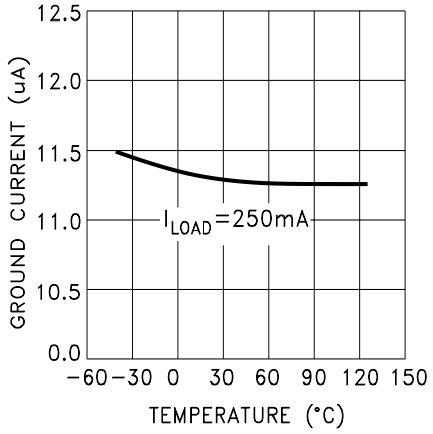
DROPOUT vs TEMPERATURE



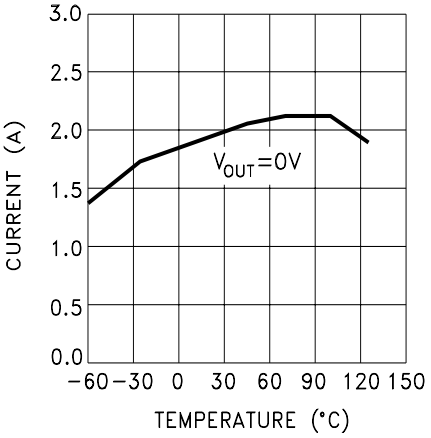
GROUND CURRENT vs. OUTPUT CURRENT



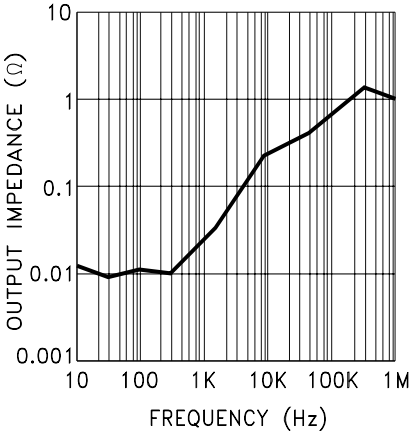
GROUND CURRENT vs. TEMPERATURE



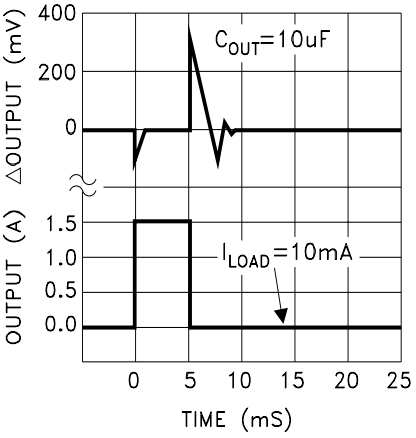
SHORT CIRCUIT CURRENT vs. TEMP.



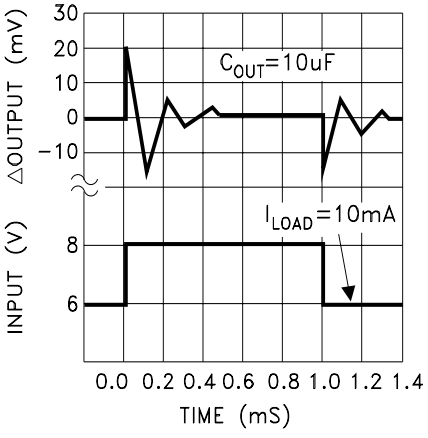
OUTPUT IMPEDANCE vs. FREQUENCY



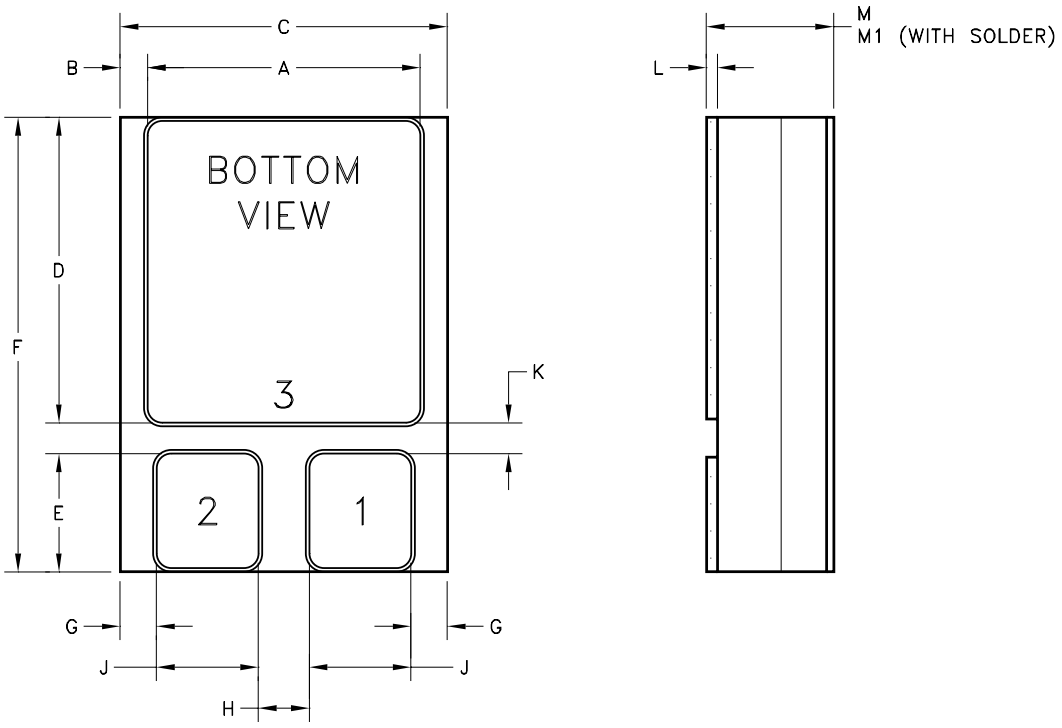
LOAD TRANSIENT RESPONSE



LINE TRANSIENT RESPONSE



MECHANICAL SPECIFICATIONS



REF	MIN	MAX
A	0.365	0.385
B	0.032	0.042
C	0.440	0.460
D	0.405	0.425
E	0.152	0.162
F	0.615	0.635
G	0.045	0.055
H	0.035	———
J	0.130	0.150
K	0.030	———
L	0.012	0.018
M	———	0.130
W/SOLDER M1	———	0.135

WEIGHT = 2.3 GRAMS TYPICAL

ALL DIMENSIONS ARE SPECIFIED IN INCHES

ORDERING INFORMATION

MSK5215-3.3 H

- H — SCREENING
  - BLANK = INDUSTRIAL; H = MIL-PRF-38534 CLASS H
- 3.3 — OUTPUT VOLTAGE
  - 1.5 = +1.5V; 1.7 = +1.7V; 1.8 = +1.8V; 1.9 = +1.9V
  - 2.5 = +2.5V; 3.3 = +3.3V; 5.0 = +5.0V; 12 = +12.0V
- MSK5215 — GENERAL PART NUMBER

The above example is a +3.3V, Military regulator.

REVISION HISTORY

REV	STATUS	DATE	DESCRIPTION
H	Released	07/15	Add ESD rating to absolute maximum ratings and update format
J	Released	04/23	Remove MIL-PRF-38535 and update company name and website