



M.S.KENNEDY CORP.

HIGH CURRENT, LOW DROPOUT VOLTAGE REGULATOR

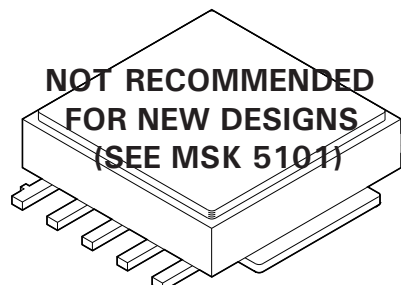
5100

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(315) 701-6751

FEATURES:

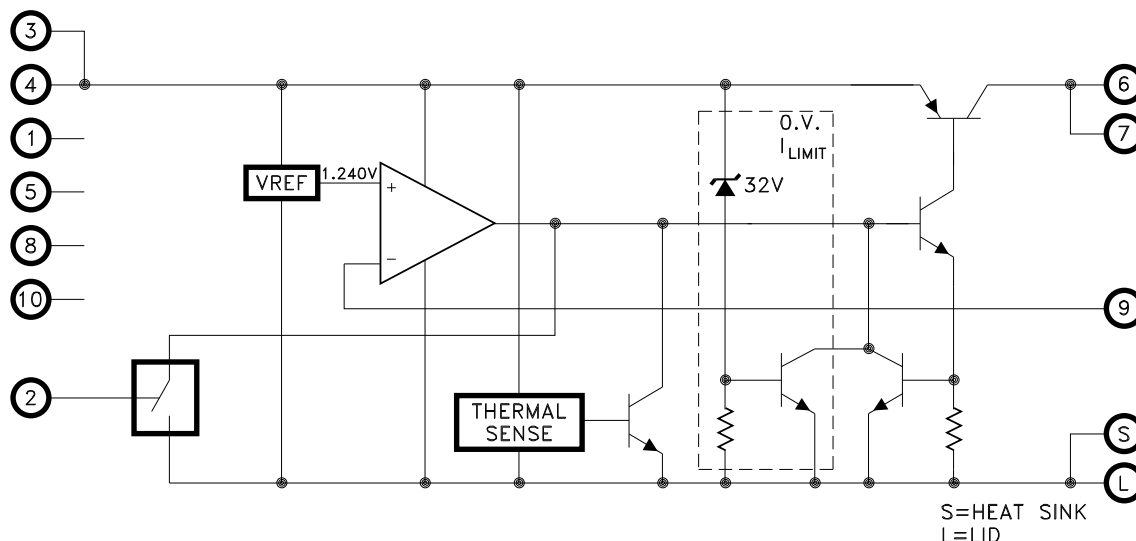
- Extremely Compact 10 Pin SOIC With Heat Sink Tab
- Extremely Low Dropout Voltage: 350mV @ 1.5 Amps
- Available in Adjustable Version only
- TTL Level Enable Pin: Zero Current Shutdown Mode
- Reverse Battery and Load Dump Protection
- Low Ground Current: 22mA Typical at Full Load
- 1% Guaranteed Accuracy
- Output Current to 1.5 Amps
- Contact MSK for MIL-PRF-38534 Qualification Status



DESCRIPTION:

The MSK 5100 voltage regulator is available in the adjustable output configuration only. The ultra low dropout specification is 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. The device also offers a TTL/CMOS compatible on/off enable function. The MSK 5100 is packaged in a space efficient 10 pin power SOIC with a built in copper-moly sink tab.

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

MSK5100-00

- | | |
|----|--------|
| 1 | NC |
| 2 | ENABLE |
| 3 | VIN A |
| 4 | VIN B |
| 5 | NC |
| 6 | VOUT A |
| 7 | VOUT B |
| 8 | NC |
| 9 | ADJ |
| 10 | NC |

HEAT SINK

The heat sink of the package and the lid are electrically connected to ground.

ABSOLUTE MAXIMUM RATINGS

⑦

V_{INP} Input Voltage (100mS 1%D.C.) -20V to +60V
V_{IN} 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_J Operating Temperature
MSK5100. -40°C to +85°C
MSK5100B. -55°C to +125°C

ELECTRICAL SPECIFICATIONS

Parameter	Test Conditions ① ③	Group A	MSK 5100B			MSK 5100			Units
		Subgroup	Min.	Typ.	Max.	Min.	Typ.	Max.	
Dropout Voltage ②	$\Delta V_{OUT} = -1\%$; I _{OUT} = 100mA	1	-	80	200	-	80	225	mV
	$\Delta V_{OUT} = -1\%$; I _{OUT} = 1.5A	1	-	350	600	-	350	625	mV
Load Regulation	V _{IN} = V _{OUT} + 5V 10mA < I _{OUT} < 1.5A	1	-	±0.2	±1.0	-	±0.2	±1.2	%
		2,3	-	±0.3	±2.0	-	±0.3	-	%
Line Regulation	(V _{OUT} + 1V) < V _{IN} < 26V I _{OUT} = 10mA	1	-	±0.05	±0.5	-	±0.05	±0.6	%
		2,3	-	±0.5	±1.0	-	±0.5	-	%
Output Current Limit ②	V _{OUT} = 0V; V _{IN} = V _{OUT} + 1V	-	-	2.1	3.5	-	2.1	3.5	A
Ground Current ②	V _{IN} = V _{OUT} + 1V; I _{OUT} = 0.75A	-	-	8	20	-	8	20	mA
	V _{IN} = V _{OUT} + 1V; I _{OUT} = 1.5A	-	-	22	-	-	22	-	mA
Output Noise ②	C _L = 10uF; 10Hz < f < 100KHz	-	-	400	-	-	400	-	uV
Enable Input Voltage ②	HIGH/ON	1	2.4	-	-	2.4	-	-	V
	LOW/OFF	1	-	-	0.8	-	-	0.8	V
Enable Input Current ②	HIGH/ON	1	-	100	600	-	100	600	uA
	LOW/OFF	1	-	-	2	-	-	2	uA
Shutdown Output Current ②	V _{ENABLE} < 0.8V	-	-	10	500	-	10	500	uA
Reference Voltage	Normal Operation	1	1.22	1.24	1.26	1.22	1.24	1.26	V
Reference Voltage Temp Drift ②	Normal Operation	-	-	20	-	-	20	-	ppm/°C
Adjust Pin Bias Current ②	Full Temp; V _{IN} = V _{OUT} + 1V	-	-	40	120	-	40	150	nA
Thermal Resistance ②	Junction to Case	-	-	1.8	2	-	1.8	2	°C/W
Thermal Shutdown	T _J	-	-	130	-	-	130	-	°C

NOTES:

- ① Output decoupled to ground using 33uF minimum capacitor unless otherwise specified.
- ② Guaranteed by design but not 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 subgroups 1 and 4 unless otherwise specified.
- ⑤ Military grade devices ('B' suffix) shall be 100% tested to subgroups 1,2,3 and 4..
- ⑥ Subgroup 1,4 T_C = +25°C
Subgroup 2 T_J = +125°C
Subgroup 3 T_A = -55°C
- ⑦ Continuous operation at or above absolute maximum ratings may adversely effect the device performance and/or life cycle.

APPLICATION NOTES

REGULATOR PROTECTION:

The MSK 5100 is fully protected against reversed input polarity, overcurrent faults, overtemperature conditions (Pd) and transient voltage spikes of up to 60V. If the regulator is used in dual supply systems where the load is returned to a negative supply, the output voltage must be diode clamped to ground.

OUTPUT CAPACITOR:

The output voltage ripple of the MSK 5100 voltage regulator can be minimized by placing a filter capacitor from the output to ground. The optimum value for this capacitor may vary from one application to the next, but a minimum of 33 μ F is recommended for optimum performance. Transient load response can also be improved by placing a capacitor directly across the load.

LOAD CONNECTIONS:

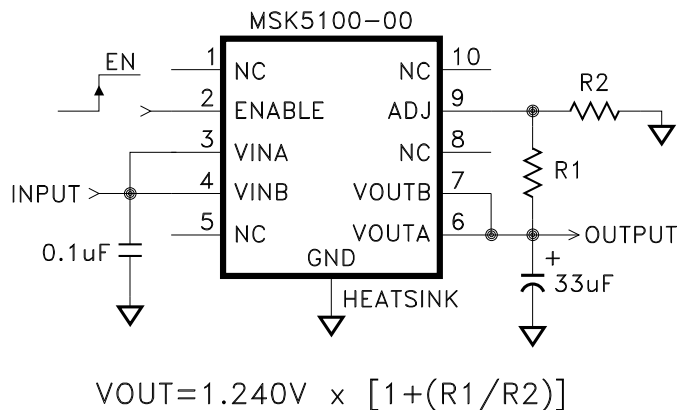
In voltage regulator applications where very large load currents are present, the load connection is very important. The path connecting the output of the regulator to the load must be extremely low impedance to avoid affecting the load regulation specifications. Any impedance in this path will form a voltage divider with the load. The MSK 5100 requires a minimum of 10mA of load current to stay in regulation.

ENABLE PIN:

The MSK 5100 voltage regulator is equipped with a TTL compatible ENABLE pin. A TTL high level on this pin activates the internal bias circuit and powers up the device. A TTL low level on this pin places the controller in shutdown mode and the device draws approximately 10 μ A of quiescent current. If the enable function is not used, simply connect the enable pin to the input.

MSK5100-00 OUTPUT ADJUSTMENT:

The diagram below illustrates proper adjustment technique for the output voltage. The series resistance of R1 + R2 should be selected to pass the minimum regulator output current requirement of 10mA.



HEAT SINK SELECTION:

To select a heat sink for the MSK 5100, 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 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 MSK 5100 is configured for $V_{IN} = +5V$ and $V_{OUT} = +3.3V$. I_{out} is a continuous 1A DC level. The ambient temperature is +25°C. The maximum desired junction temperature is 125°C.

$R_{\theta jc} = 2^\circ\text{C/W}$ and $R_{\theta cs} = 0.5^\circ\text{C/W}$ typically.

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

Solve for $R_{\theta sa}$:

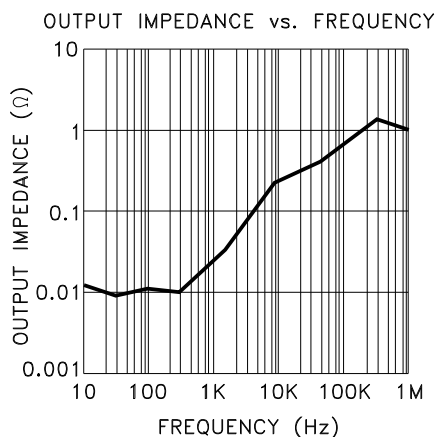
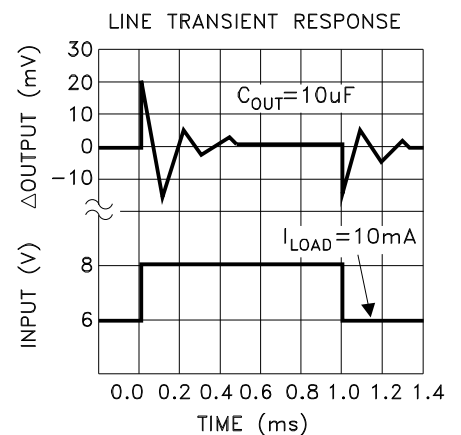
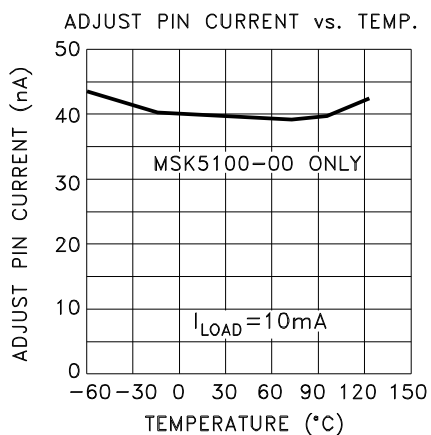
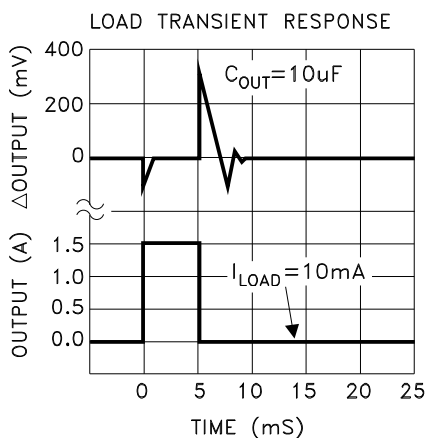
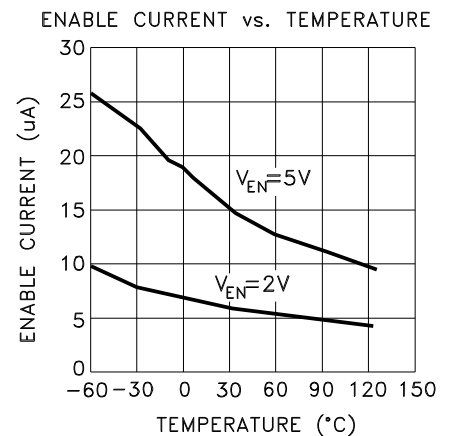
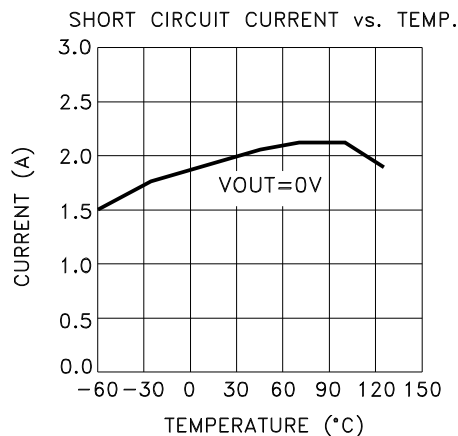
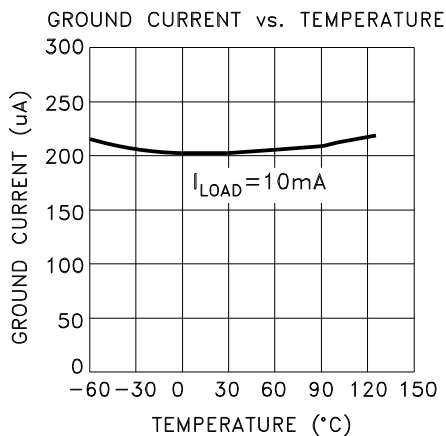
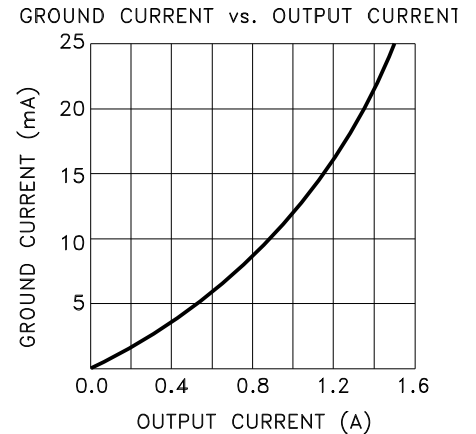
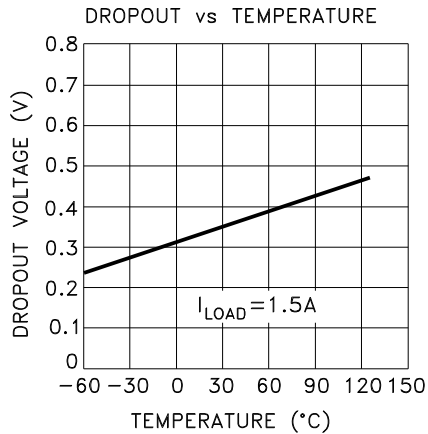
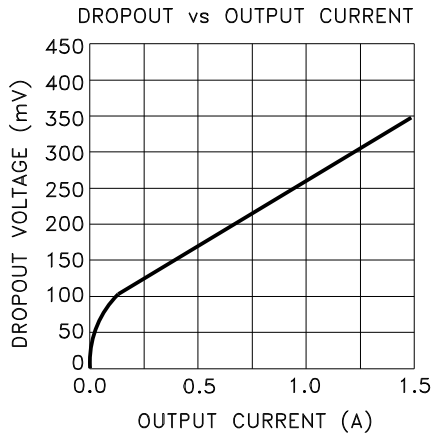
$$\begin{aligned} R_{\theta sa} &= \left[\frac{125^\circ\text{C} - 25^\circ\text{C}}{1.7W} \right] - 2^\circ\text{C/W} - 0.5^\circ\text{C/W} \\ &= 56.32^\circ\text{C/W} \end{aligned}$$

In this example, a heat sink with a thermal resistance of no more than 56°C/W must be used to maintain a junction temperature of no more than 125°C.

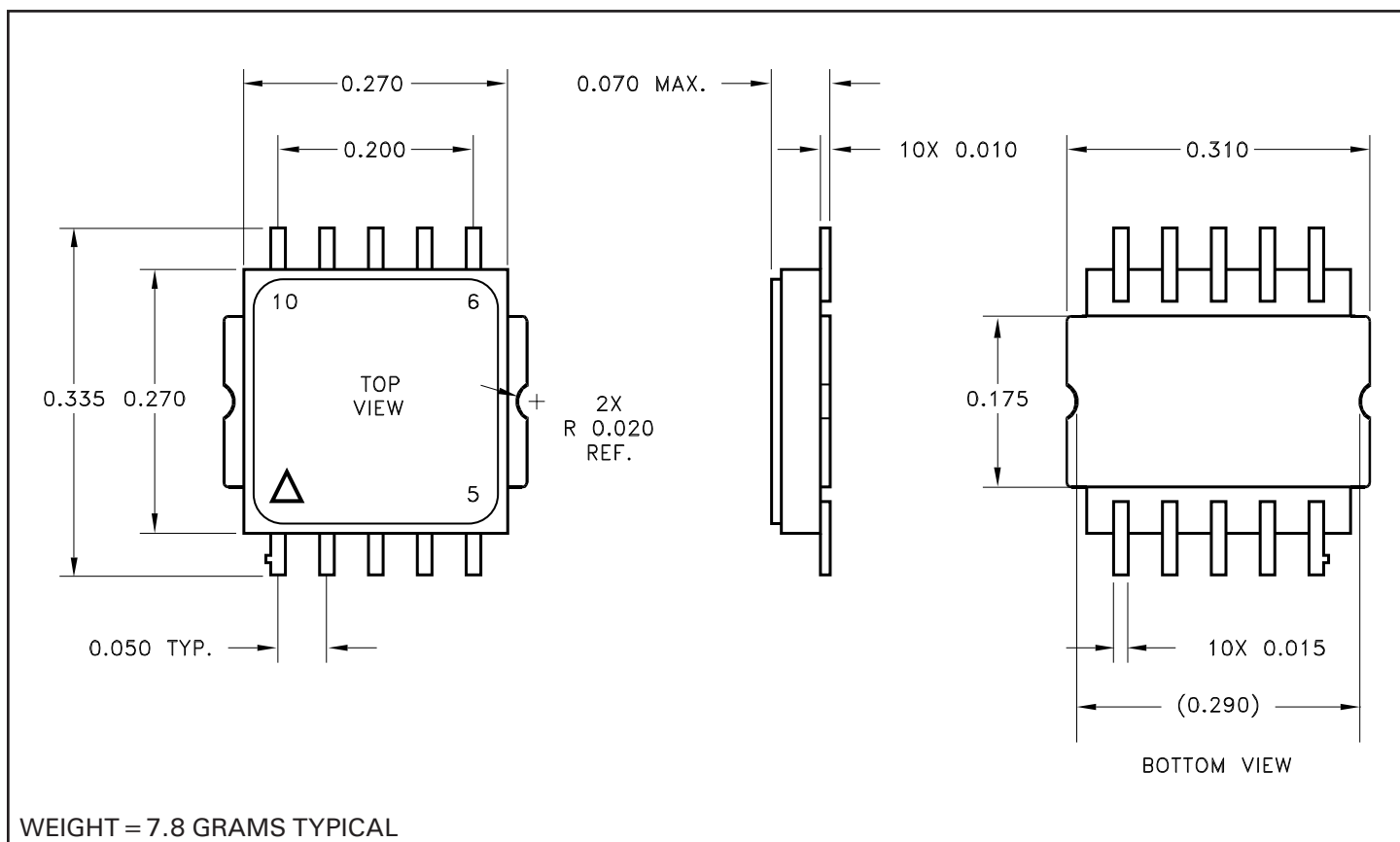
DEVICE SOLDERING/CASE CONNECTION:

The MSK 5100 is a highly thermally conductive device and the thermal path from the package heat sink to the internal junctions is very short. Standard surface mount techniques should be used when soldering the device into a circuit board. A hole can be cut in the printed circuit board to allow the heat sink of the package to be thermally bonded to an external heat sink for very high power applications. The external heat sink needs to be connected to ground because the heat sink and lid of the MSK 5100 are also electrically connected to ground. The user is urged to keep this in mind when designing the printed circuit board for the MSK 5100. There should be no printed circuit traces making contact with the case or lid of the device except for ground. The ground plane can be used to pull heat away from the device.

TYPICAL PERFORMANCE CURVES



MECHANICAL SPECIFICATIONS



ESD Triangle indicates Pin 1.

NOTE: ALL DIMENSIONS ARE ± 0.010 INCHES UNLESS OTHERWISE LABELED.

ORDERING INFORMATION

MSK5100-00 B

SCREENING

BLANK = INDUSTRIAL

B = MIL-PRF-38534 CLASS H

OUTPUT VOLTAGE

00 = Adjustable

GENERAL PART NUMBER

REVISION HISTORY

REV	STATUS	DATE	DESCRIPTION
G	Released	01/14	Initial Release

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Contact MSK for MIL-PRF-38534 qualification status.