MIL-PRF-38534 CERTIFIED

M.S.KENNEDY CORP.

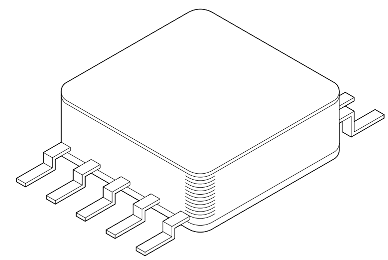
HIGH CURRENT, LOW DROPOUT VOLTAGE REGULATORS

5102 SERIES

4707 Dey Road Liverpool, N.Y. 13088 (315) 701-6751

FEATURES:

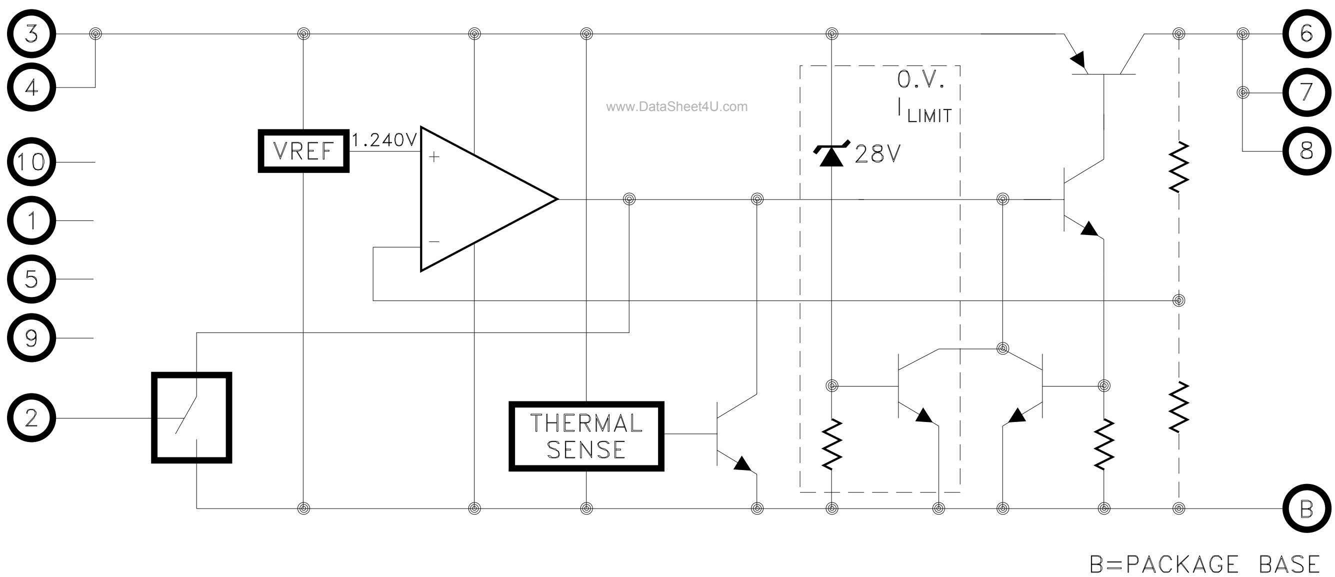
- Extremely Compact 10 Pin Flatpack With Metal Base
- Extremely Low Dropout Voltage: 350mV @ 1.5 Amps
- Available in +1.5V, +1.7V, +1.9V, +2.5V, +3.3V, +5.0V and +12.0V
- TTL Level Enable Pin: Zero Current Shutdown Mode
- Reverse Battery and Load Dump Protection
- Low Ground Current: 32mA Typical at Full Load
- 1% Guaranteed Accuracy
- Output Current to 1.5 Amps



DESCRIPTION:

The MSK 5102 series voltage regulators are available in +1.5V, +1.7V, +1.9V, +2.5V, +3.3V, +5.0V and +12.0V 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% output voltage tolerance. The series also offers a TTL/ CMOS compatible on/off enable function. The MSK 5102 series is packaged in a space efficient 10 pin ceramic flatpack with a built in metal base.

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	NC
2	Enable
3	Vin A
4	Vin B
5	NC
6	Vout A
7	Vout B
8	Vout C
9	NC
10	NC

BASE
The base of the package is electrically connected to ground.

ABSOLUTE MAXIMUM RATINGS ⑨

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	
	MSK5102 Series	-40°C to +85°C
	MSK5102H/E Series	-55°C to +125°C

ELECTRICAL SPECIFICATIONS

Parameter	Test Conditions ① ③	Group A Subgroup	MSK 5102H/E SERIES Min.	MSK 5102H/E SERIES Typ.	MSK 5102H/E SERIES Max.	MSK 5102 SERIES Min.	MSK 5102 SERIES Typ.	MSK 5102 SERIES Max.	Units
Output Voltage Tolerance	I_{OUT} = 10mA; V_{IN} = V_{OUT} + 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	V_{IN} = V_{OUT} + 1V	1	-	±0.2	±1.0	-	±0.2	±1.2	%
	10mA ≤ I_{OUT} ≤ 1.25A	2,3	-	±0.3	±2.0	-	±0.3	-	%
Line Regulation	(V_{OUT} + 1V) ≤ V_{IN} ≤ 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	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	-	-	18	30	-	18	30	mA
	V_{IN} = V_{OUT} + 1V; I_{OUT} = 1.5A	-	-	32	-	-	32	-	mA
Output Noise ②	C_L = 10μF; 10Hz ≤ f ≤ 100KHz	-	-	400	-	-	400	-	μV
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	μA
	LOW/OFF	1	-	-	2	-	-	2	μA
Shutdown Output Current ②	V_{ENABLE} ≤ 0.8V	-	-	10	500	-	10	500	μA
Thermal Resistance ②	Junction to Case @ 125°C	-	-	5.6	6	-	5.6	7	°C/W
Thermal Shutdown	T_J	-	-	135	-	-	135	-	°C

NOTES:

① Output decoupled to ground using 10μF minimum capacitor 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 and class E devices shall be tested to subgroups 1 and 4 unless otherwise specified.
⑤ Military grade devices ('H' 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 Please consult factory if alternate output voltages are desired.
⑧ Due to current limit, maximum output current may not be available at all values of V_{IN}-V_{OUT} and temperatures. See typical performance curves for clarification.
⑨ Continuous operation at or above absolute maximum ratings may adversely effect the device performance and/or life cycle.

APPLICATION NOTES

REGULATOR PROTECTION:

The MSK 5102 series 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 5102 series voltage regulators 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 10μF 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.

ENABLE PIN:

The MSK 5102 series of voltage regulators are 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 10μA of quiescent current. If the enable function is not used, simply connect the enable pin to the input.

DEVICE SOLDERING/CASE CONNECTION:

The MSK 5102 series are highly thermally conductive devices and the thermal path from the package base to the internal junctions is very short. Standard surface mount techniques should be used when soldering the device into a circuit board. The external heat sink/pad needs to be connected to ground because the base of the MSK 5102 is also electrically connected to ground. The user is urged to keep this in mind when designing the printed circuit board for the MSK 5102. There should be no printed circuit traces making contact with the base of the device except for ground. The ground plane can be used to pull heat away from the device.

HEAT SINK SELECTION:

To select a heat sink for the MSK 5102, 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:

- Tj = Junction Temperature
- Pd = 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
- Ta = 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 5102-3.3 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.

$R_{\theta jc}$ = 6°C/W and $R_{\theta cs}$ = 0.5°C/W typically.

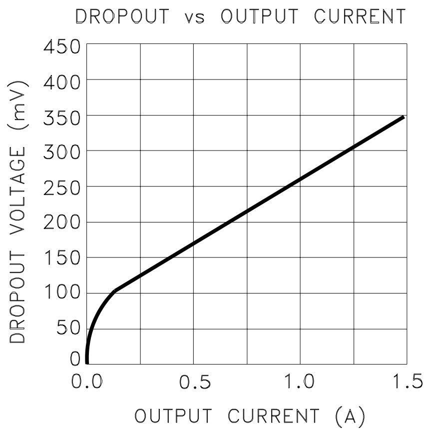
$$\text{Power Dissipation} = (5V - 3.3V) \times (1A) = 1.7\text{ Watts}$$

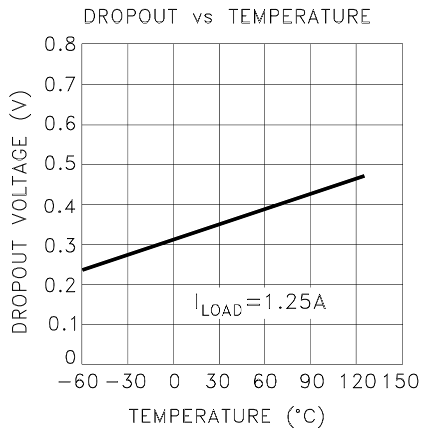
Solve for $R_{\theta sa}$:

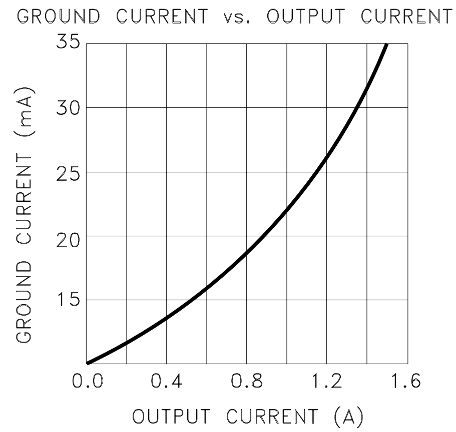
$$R_{\theta sa} = \left[\frac{125°C - 25°C}{1.7W}\right] - 6°C/W - 0.5°C/W = 52.3°C/W$$

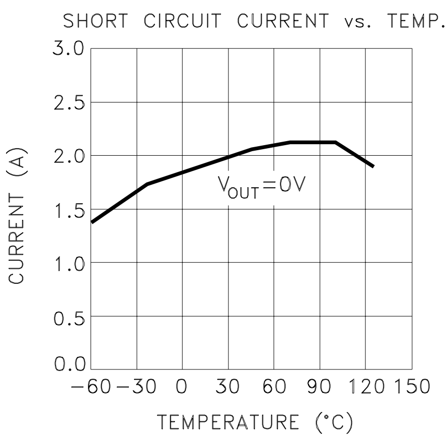
In this example, a heat sink with a thermal resistance of no more than 52°C/W must be used to maintain a junction temperature of no more than 125°C.

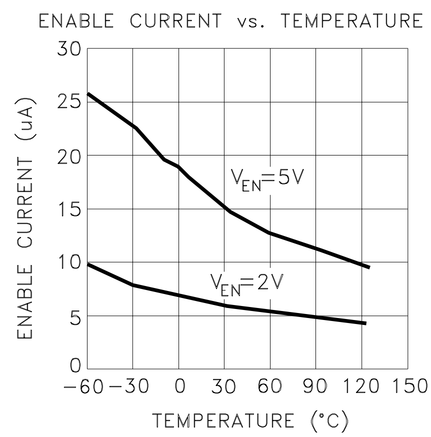
TYPICAL PERFORMANCE CURVES

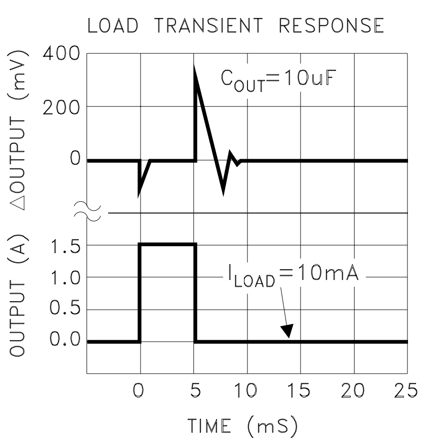


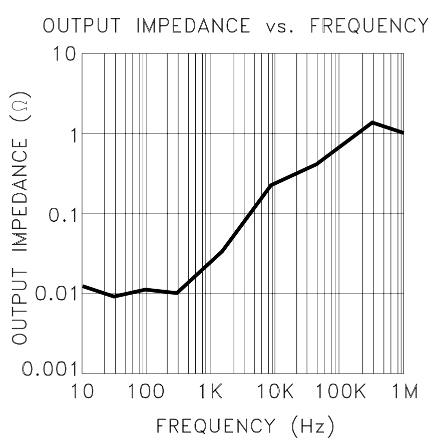


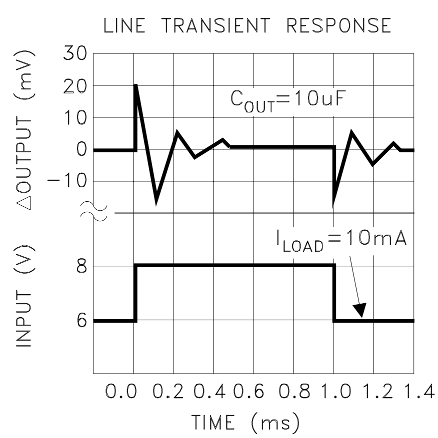




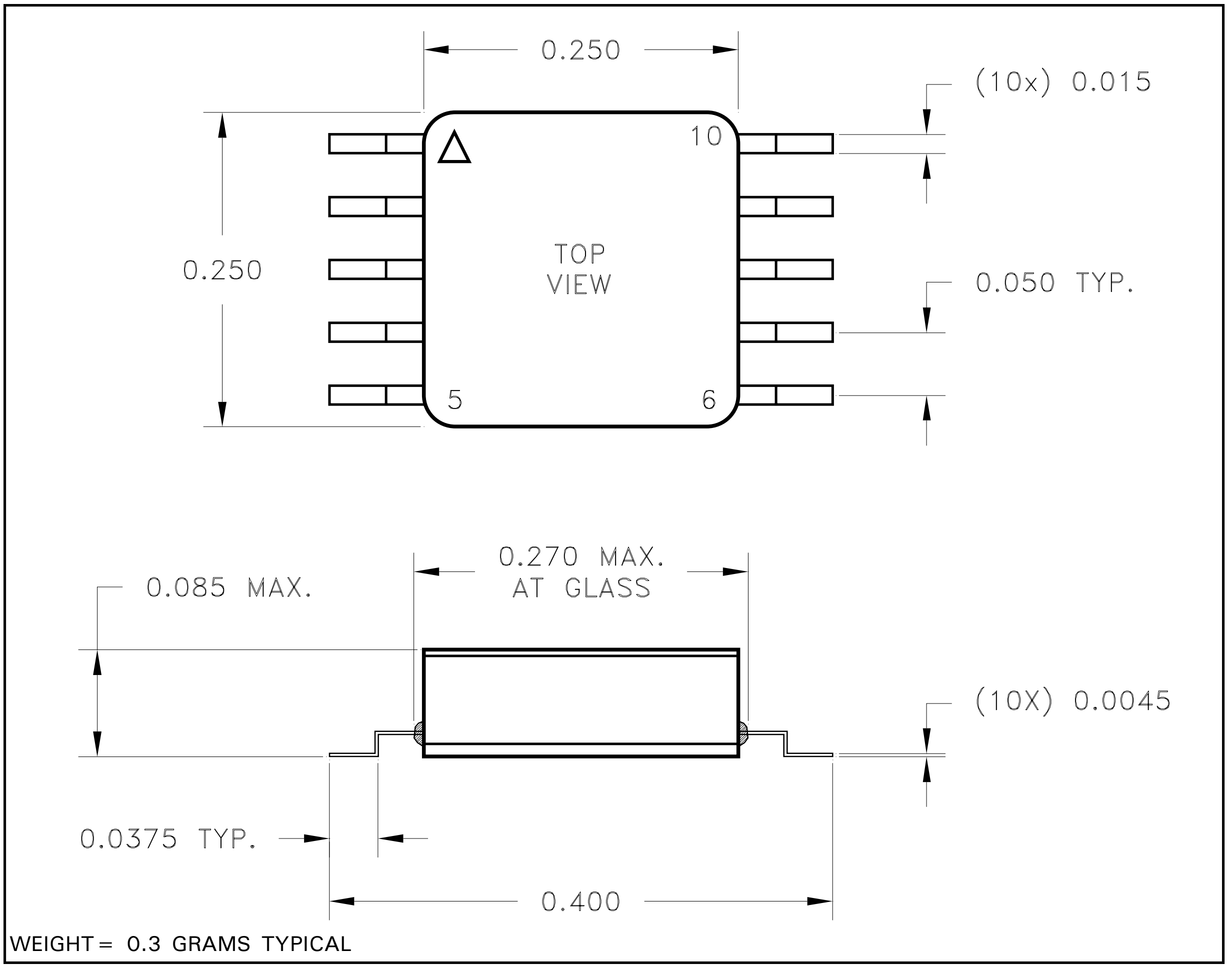








MECHANICAL SPECIFICATIONS



NOTE: ALL DIMENSIONS ARE ±0.010 INCHES UNLESS OTHERWISE LABELED.
ESD Triangle indicates Pin 1.

ORDERING INFORMATION

MSK5102-3.3 H

SCREENING
BLANK = INDUSTRIAL, E = EXTENDED RELIABILITY;
H = MIL-PRF-38534 CLASS H

OUTPUT VOLTAGE
1.5 = +1.5V; 1.7 = +1.7V; 1.9 = +1.9V; 2.5 = +2.5V
3.3 = +3.3V; 5.0 = +5.0V; 12 = +12.0V

GENERAL PART NUMBER

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

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