

HIGH CURRENT, LOW DROPOUT VOLTAGE REGULATORS

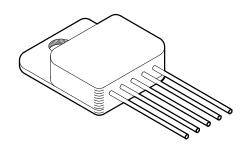
5116 SERIES

4707 Dey Road Liverpool, N.Y. 13088

(315) 701-6751

FEATURES:

- · Electrically Isolated Top Tab or Z Tab SIP
- 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% Maximum Guaranteed Accuracy
- Output Current to 1.5 Amps
- · Contact MSK for MIL-PRF-38534 Qualification Status

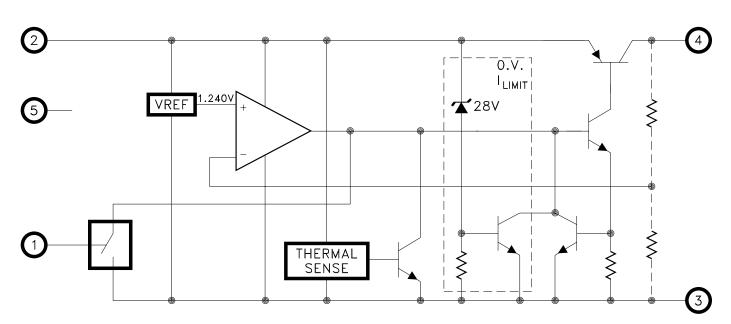


DESCRIPTION:

The MSK 5116 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% maximum output voltage tolerance. The series also offers a TTL/CMOS compatible on/off enable function. The MSK 5116 series is packaged in a space efficient 5 pin power SIP available in two styles with three lead bend options.

EQUIVALENT SCHEMATIC

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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 Enable
- 2 Vin
- 3 Ground
- 4 Vout
- 5 NC

Rev. A 1/06

ABSOLUTE MAXIMUM RATINGS

V_{INP}	Input Voltage (100mS 1%D.C.)-20V to +60V	Тsт	Storage Temperature Range	-65°C to +150°C
V_{IN}	Input Voltage	T_LD	Lead Temperature	300°C
V_{EN}	Enable Voltage0.3V to 26V		(10 Seconds Soldering)	
lоит	Output Current	ΤJ	Operating Temperature	
			MSK 5116 Series	40°C to +85°C
			MSK 5116H/F Sprips	-55°C to +125°C

ELECTRICAL SPECIFICATIONS

Parameter	Test Conditions ①③		Group A	MSK 5116H/E SERIES		MSK 5116 SERIES				
raiailletei			Subgroup	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Output Voltage Tolerance	IOUT = 10mA; VIN = VOUT + 1V		1	-	±0.5	±1.0	-	±0.5	± 1.0	%
Output Voltage Folerance			2,3	-	±1.0	±2.0	-	-	-	%
Dropout Voltage ②	ΔV out = -1%; lout=10	00m A	1	-	80	200	-	80	225	mV
Diopout Voltage (2)	ΔV out = -1%; lout = 1.5A		1	-	350	600	-	350	625	mV
Load Regulation (8)	VIN = VOUT + 5V	•	1	-	±0.2	±1.0	-	±0.2	±1.2	%
Load Hegulation (b)	10mA ≤ Iout ≤ 1.2	25A	2,3	-	±0.3	± 2.0	-	±0.3	-	%
Line Regulation	(Vout +1V) ≤ Vin ≤	26V	1	-	±0.05	±0.5	-	±0.05	±0.6	%
Line negulation	Ioυτ = 10mA		2,3	-	±0.5	±1.0	-	±0.5	-	%
Output Current Limit ②	Vout = 0V; Vin = Vou	Vout = 0V; Vin = Vout + 1V		-	2.1	3.5	-	2.1	3.5	Α
Ground Current ②	VIN = VOUT + 1V; IOUT =	=0.75A	-	-	18	30	-	18	30	mA
diodna Carrent (2)	VIN = VOUT + 1V; IOUT = 1.5A		-	-	32	-	-	32	-	mA
Output Noise ②	$C_L = 10 \mu F; 10 Hz \le f \le 100 KHz$		-	-	400	-	-	400	-	μV
Enable Input Voltage (2)		HIGH/ON	1	2.4	1.2	-	2.4	1.2	-	V
Litable iliput voltage (2)		LOW/OFF	1	-	1.2	0.8	-	1.2	0.8	V
Enable Input Current (2)		HIGH/ON	1	-	100	600	-	20	600	μΑ
Lilable input Current (2)		LOW/OFF	1	-	-	2	-	-	2	μΑ
Shutdown Output Current②	Shutdown Output Current ② $Venable \le 0.8V$		-	-	10	500	-	10	500	μΑ
Thermal Resistance ②	Junction to Case @	125°C	-	-	3.1	3.6	-	3.1	3.7	°C/W
Thermal Shutdown ②	TJ		-	-	130	-	-	130	-	°C

NOTES:

- ① Output decoupled to ground using $33\mu\text{F}$ 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 and "E" suffix devices shall be tested to subgroup 1 unless otherwise specified.
- (b) Military grade devices ('B' suffix) shall be 100% tested to subgroups 1,2,3.
- 6 Subgroup 1 $Tc = +25 \,^{\circ}C$ $T_J = +125 \,{}^{\circ}C$ Subgroup 2
 - Subgroup 3 $T_A = -55 \,^{\circ} C$
- 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.
- (9) Continuous operation at or above absolute maximum ratings may adversely effect the device performance and/or life cyle.

APPLICATION NOTES

REGULATOR PROTECTION:

The MSK 5116 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 5116 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 10μ F is recommended for optimum performance. This capacitor need not be an expensive low ESR type: aluminum electrolytics are adequate. In fact, extremely low ESR capacitors may contribute to instability. Tantalum capacitors are recommended for systems where fast load transient response is important. 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 5116 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 10μ A of quiescent current. If the enable function is not used, simply connect the enable pin to the input.

DEVICE/CASE CONNECTION:

The MSK 5116 series are highly thermally conductive devices and the thermal path from the package heat sink to the internal junctions is very short. Since the case is electrically isolated from the internal circuitry, the package can be directly connected to a heat sink.

HEAT SINK SELECTION:

To select a heat sink for the MSK 5116, the following formula for convective heat flow may be used.

Governing Equation:

$$T_i = Pd x (R_{\theta}ic + R_{\theta}cs + R_{\theta}sa) + Ta$$

WHERE:

Ti = Junction Temperature

Pd = Total Power Dissipation

 $R\theta jc = Junction to Case Thermal Resistance$

 $R\theta cs = Case to Heat Sink Thermal Resistance$

Resa = Heat Sink to Ambient Thermal Resistance

Ta = Ambient Temperature

First, the power dissipation must be calculated as follows:

Power Dissipation =
$$(Vin - Vout) \times Iout$$

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 (Resa).

EXAMPLE:

An MSK 5116-3.3 is configured for Vin = +5V and Vout = +3.3V. lout is a continuous 1A DC level. The ambient temperature is $+25^{\circ}$ C. The maximum desired junction temperature is 125° C.

Rejc =
$$3.6$$
°C/W and Recs = 0.15 °C/W for most thermal greases
Power Dissipation = $(5V - 3.3V) \times (1A)$
= 1.7 Watts

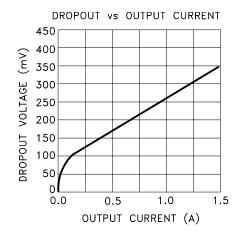
Solve for Resa:
Resa =
$$\left[\frac{125 \text{ °C} - 25 \text{ °C}}{1.7\text{W}}\right] - 3.6 \text{ °C/W} - 0.15 \text{ °C/W}$$

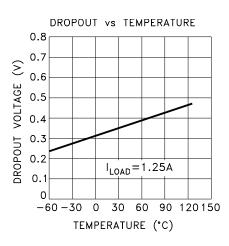
= 55.07 °C/W

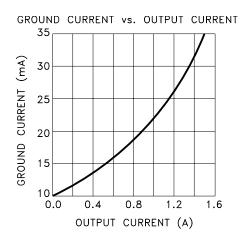
In this example, a heat sink with a thermal resistance of no more than $55\,^{\circ}\text{C/W}$ must be used to maintain a junction temperature of no more than $125\,^{\circ}\text{C}$.

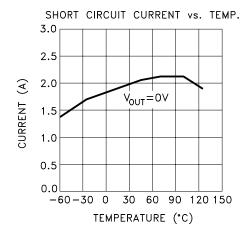
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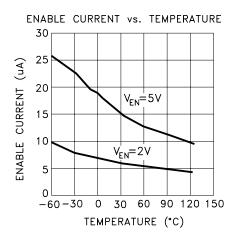
TYPICAL PERFORMANCE CURVES

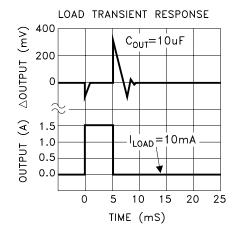


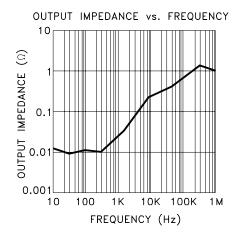


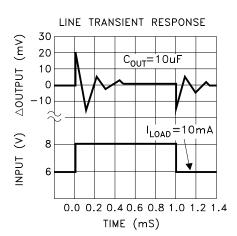




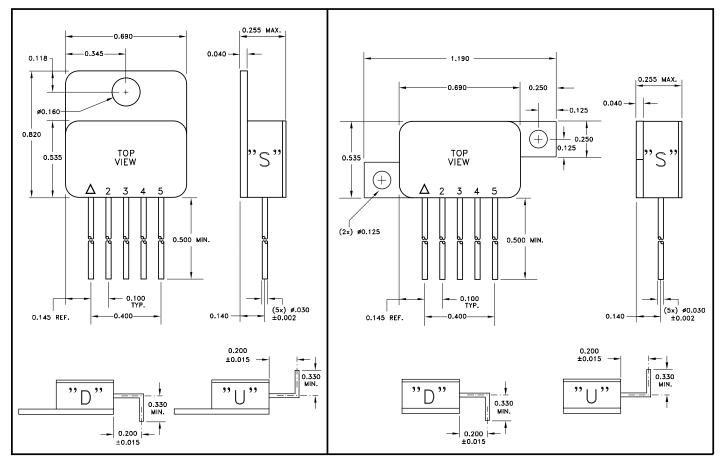






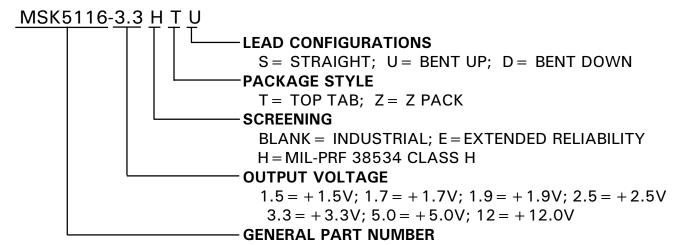


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NOTE: ALL DIMENSIONS ARE ± 0.010 INCHES UNLESS OTHERWISE LABELED. ESD Triangle indicates Pin 1.

ORDERING INFORMATION



The above example is a +3.3V, Military regulator using the top tab package with leads bent up.

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Please visit our website for the most recent revision of this datasheet.

Contact MSK for MIL-PRF-38534 qualification status.