



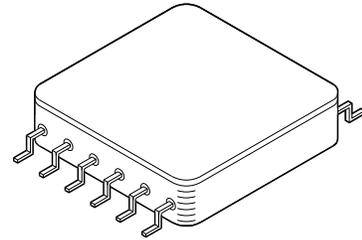
M.S.KENNEDY CORP.

# ULTRA-HIGH TEMPERATURE REGULATOR

# 5502 SERIES

**FEATURES:**

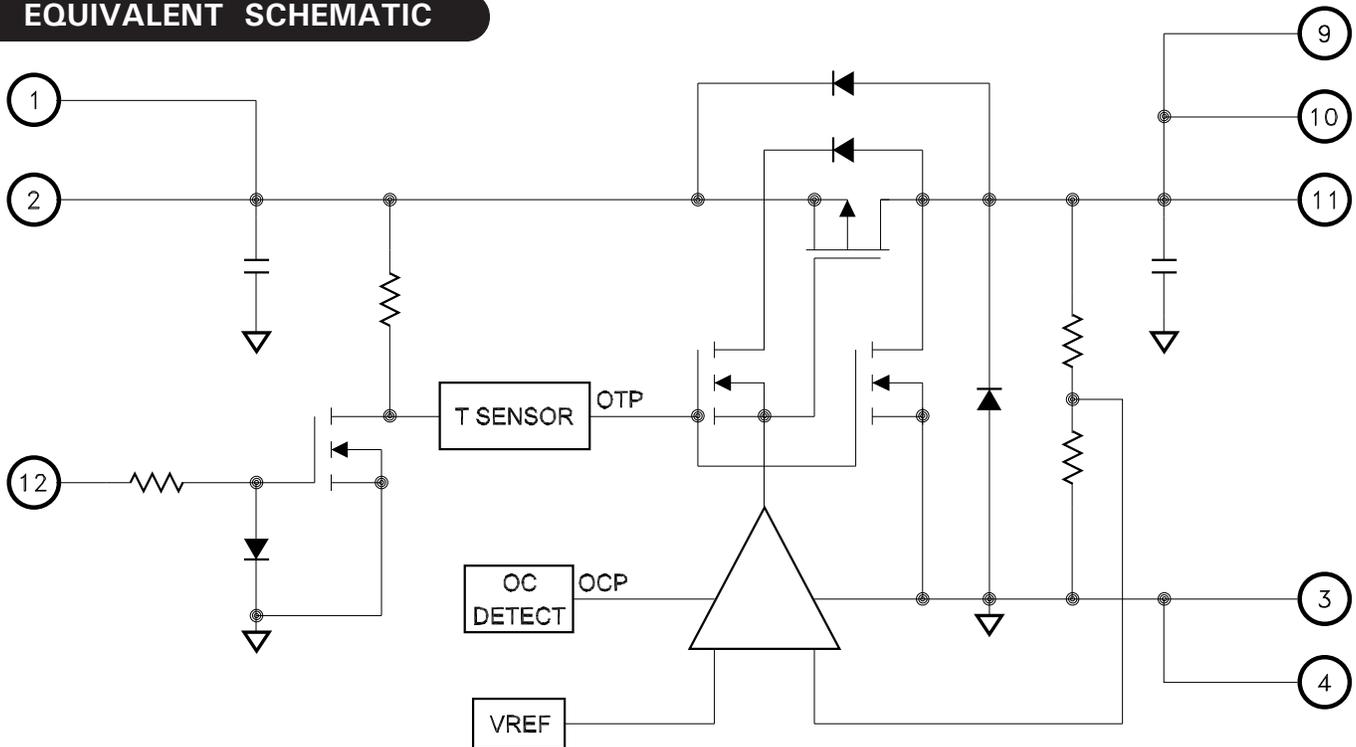
- Operational from -55°C to + 232°C
- Input Voltage from Vout + Dropout to 30V
- Available in 12V and 15V Output Voltages
- Alternate Output Voltages Available
- Output Current up to 100mA @ 232°C
- External Enable (Active Low)
- Stable Over Wide Range of Load Capacitance
- Surface Mount Package with Lead Forming
- Contact MSK for Qualification Status



**DESCRIPTION:**

The MSK5502-12 and MSK5502-15 are high temperature linear voltage regulators capable of delivering 100mA of output current at 232°C. Typical dropout is 1.7V with a 100mA load at 232°C. This device also has self-protection features. Thermal protection will activate when junction temperature exceeds 275°C. Internal current limit protection will limit the maximum current delivered to 200mA typical. The MSK5502-12 and MSK5502-15 are specifically design for automotive, aeronautics and aerospace, and down-hole applications. The device is packaged in a hermetically sealed 12 pin flat pack that is lead formed for surface mount applications.

**EQUIVALENT SCHEMATIC**



**TYPICAL APPLICATIONS**

- Reliability-Critical, Automotive, Aeronautics & Aerospace, Down-Hole
- Precision Regulators/References, A/D and D/A Converters, Current Sources

**PIN-OUT INFORMATION**

1 VIN	12 ENABLE
2 VIN	11 VOUT
3 GND	10 VOUT
4 GND	9 VOUT
5 NC	8 NC
6 NC	7 NC

CASE = ISOLATED

## ABSOLUTE MAXIMUM RATINGS <sup>⑤</sup>

V<sub>IN</sub> with Respect to GND. . . . . -0.5 to 35V  
 ENABLE with Respect to GND. . . . . -0.5 to V<sub>IN</sub>  
 Storage Temperature Range. . . . . -65°C to +250°C  
 Case Operating Temperature Range. . . . . -55°C to +232°C

## ELECTRICAL SPECIFICATIONS

Parameter	Test Conditions	Group A Subgroup	MSK5502H SERIES			MSK5502 SERIES			Units
			Min.	Typ.	Max.	Min.	Typ.	Max.	
<b>OUTPUT CHARACTERISTIC</b>									
Dropout Voltage	I <sub>OUT</sub> = 100mA	1,2,3	-	TBD	1.7	-	TBD	1.7	V
Output Voltage Tolerance	V <sub>IN</sub> = V <sub>OUT</sub> + 1.7V	1	-0.2	TBD	+0.2	-0.2	TBD	+0.2	%
	I <sub>OUT</sub> = 10mA	2,3	TBD	TBD	TBD	-	-	-	%
Line Regulation	V <sub>OUT</sub> + 1.7V < V <sub>IN</sub> < 30V I <sub>OUT</sub> = 0mA	1	-1	TBD	+1	-1	TBD	+1	%
		2	-1	TBD	+1	-	-	-	%
		3	-1	TBD	+1	-	-	-	%
Output Voltage Load Regulation	V <sub>IN</sub> = V <sub>OUT</sub> + 1.7V 0mA < I <sub>OUT</sub> < 100mA	1	-0.25	TBD	+0.25	-0.25	TBD	+0.25	%
		2	TBD	TBD	TBD	-	-	-	%
		3	TBD	TBD	TBD	-	-	-	%
<b>SUPPLY CURRENT</b>									
Supply Current	V <sub>IN</sub> = V <sub>OUT</sub> + 1.7V I <sub>OUT</sub> = 0mA	1	-	TBD	2	-	TBD	2	mA
		2	-	TBD	TBD	-	-	-	mA
		3	-	TBD	TBD	-	-	-	mA
	V <sub>IN</sub> = 30V I <sub>OUT</sub> = 0mA	1	-	TBD	2.25	-	TBD	2.25	mA
		2	-	TBD	TBD	-	-	-	mA
		3	-	TBD	TBD	-	-	-	mA
Standby Current	V <sub>IN</sub> = V <sub>OUT</sub> + 1.7V, $\overline{\text{ENABLE}}$ = 5V	1,2,3	-	20	30	-	20	30	uA
	V <sub>IN</sub> = 30V, $\overline{\text{ENABLE}}$ = 5V	1,2,3	-	40	50	-	40	50	uA
<b>ENABLE</b>									
$\overline{\text{ENABLE}}$ Input Current	V $\overline{\text{ENABLE}}$ = 5V	1,2,3	-	TBD	10	-	TBD	10	uA
$\overline{\text{ENABLE}}$ Voltage	V $\overline{\text{ENABLE}}$ Going Down	1,2,3	-	TBD	1.2	-	TBD	1.2	V
Shutdown Voltage	V $\overline{\text{ENABLE}}$ Going Up	1,2,3	2.0	TBD	-	2.0	TBD	-	V
<b>PROTECTION FEATURES</b>									
Short-Circuit Current	V <sub>IN</sub> = V <sub>OUT</sub> + 1.7V <sup>①</sup>	1	100	200	260	100	200	260	mA
Over Temperature Protection		-	-	275	-	-	275	-	°C

### NOTES:

- ① Guaranteed by design but not tested. Typical parameters are representative of actual device performance but are for reference only.
- ② Military grade devices ("H" suffix) shall be 100% tested to subgroups 1,2 and 3.
- ③ Subgroup 1 T<sub>c</sub> = +25°C  
 2 T<sub>c</sub> = +232°C  
 3 T<sub>c</sub> = -55°C
- ④ Industrial grade devices shall be 100% tested at 25°C only.
- ⑤ Continuous operation at or above absolute maximum ratings may adversely effect the device performance and/or life cycle.

## APPLICATION NOTES

### ***PIN FUNCTIONS***

**VIN** - These pins provide the input power connection to the MSK5502. All VIN pins must be connected for proper operation.

**GND** - These pins provide the VIN and VOUT ground reference. All GND pins must be connected for proper operation.

**VOUT** - These are the output pins for the device. All VOUT pins must be connected for proper operation.

**ENABLE** - When tied low, the MSK5502 is enabled and operates normally. When tied high, the MSK5502 is disabled and VOUT is connected to ground.

### ***INPUT AND OUTPUT BYPASSING***

The MSK5502 has an internal ceramic output capacitor, which in most cases, is sufficient to stabilize the internal control loop. Additional capacitance between 1 and 10 $\mu$ F can be added. The output capacitor requires an ESR from 0.01 to 1 $\Omega$ . Higher capacitor values improve load transient response. Proper input bypassing is required in order to filter out noise and provide low AC impedance source. The MSK5502 has an internal ceramic input capacitor connected between VIN and GND. In most applications the internal capacitor is sufficient for proper operation. Additional input capacitance up to 1 $\mu$ F can be added to maximize transient response and minimize power supply transients.

### ***THERMAL LIMITING***

The MSK5502 has an internal thermal shutdown feature. The typical junction temperature threshold is 275 $^{\circ}$ C with 10 $^{\circ}$ C of hysteresis. When in thermal shutdown, the pass transistor is disabled and VOUT is internally connected to ground.

### ***OVERCURRENT PROTECTION***

The MSK5502 has an internal current limiter feature. The typical current limit threshold is 200mA. In the case of short, the MSK5502 may switch between current limit and thermal shutdown mode.

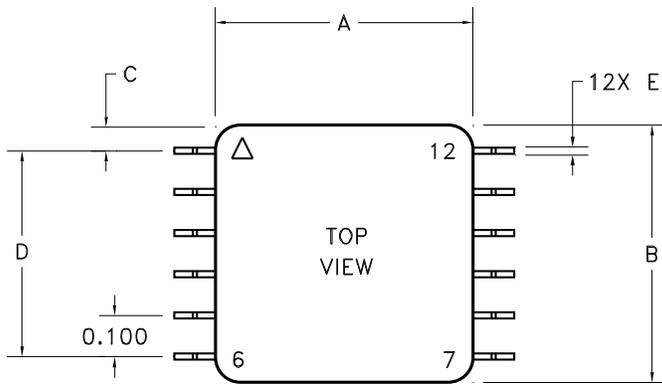
### ***ENABLE FUNCTION***

When the enable pin is tied low the MSK5502 is enabled and operates normally. When the enable pin is tied high the MSK5502 is disabled and VOUT is internally connected to ground. The disable feature acts the same as the thermal shutdown feature.

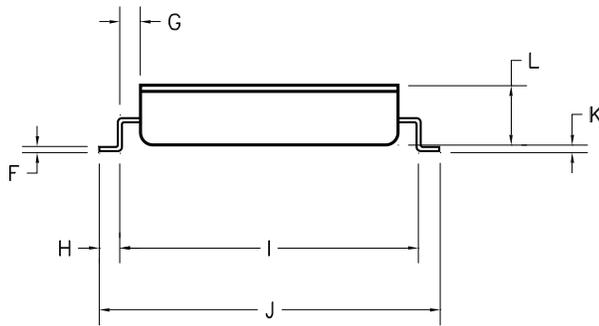
# TYPICAL PERFORMANCE CURVES

TBD

# MECHANICAL SPECIFICATIONS



REF	MIN	MAX
A	0.620	0.630
B	0.620	0.630
C	0.0575	0.0675
D	0.495	0.505
E	0.012	0.018
F	0.007	0.013
G	0.045	0.055
H	0.045	0.055
I	0.720	0.730
J	0.820	0.830
K	0.015	0.019
K	0.012	0.018
L	—	0.160



**NOTE: K IS MEASURED FROM BOTTOM OF LEAD TO BOTTOM OF THE PACKAGE.**

ESD TRIANGLE INDICATES PIN 1  
WEIGHT = TBD GRAMS TYPICAL

ALL DIMENSIONS ARE SPECIFIED IN INCHES

## ORDERING INFORMATION

PART NUMBER	SCREENING LEVEL	OUTPUT VOLTAGE
MSK5502-12	INDUSTRIAL	12V
MSK5502-12H	MIL-PRF-38534 CLASS H	
MSK5502-15	INDUSTRIAL	15V
MSK5502-15H	MIL-PRF-38534 CLASS H	

## REVISION HISTORY

REV	STATUS	DATE	DESCRIPTION
-	Preliminary	05/14	Initial Release

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Contact MSK for MIL-PRF-38534 qualification status.