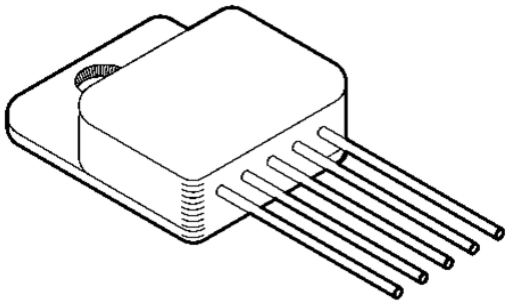
RAD HARD POSITIVE 0.7A, LDO, SINGLE RESISTOR, ADJ VOLTAGE REGULATOR

FEATURES

- Ultra Low Dropout for Reduced Power Consumption
- External Shutdown Function
- Latching Overload Protection
- Available in 1.5V,1.8V,1.9V,2.5V,2.8V,3.3V and 5.0V Output Voltages
- Alternate Output Voltages Available
- Output Current Limit
- Available in Straight Lead Form Option
- TID Hardened to 300 Krads
- Neutron Tested to $1.0x10^{12}$ n/cm²
- Comparable to MSK5820RH, OMR9601 IRUH33PXXXB/IRUH50PXXXB



DESCRIPTION

The JTR5820 is a rad hard fixed linear regulator with a maximum output current of 5.0 amps. With a 2.5 amp load, the typical dropout is only 0.22 volts. For power supply sequencing, an external shutdown function is ideal. Internal latching overload protection is also included in this device. The JTR5820 is developed for space/satellite applications and is radiation resistant. The device is housed in a space-saving 5 pin SIP that is hermetically sealed and electrically separated from the internal circuitry, allowing for direct heat sinking.

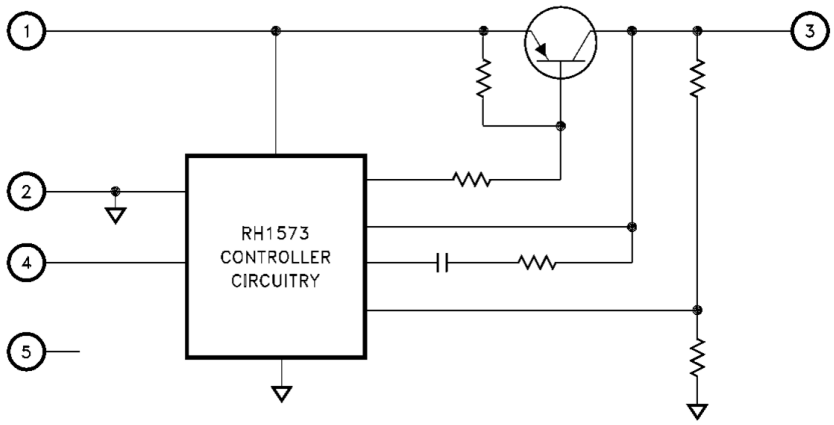
Table 1. Pin description.

PIN	NAME
1	VIN
2	GND
3	VOUT
4	SHUTDOWN
5	NC
CASE=ISOLATED	

TYPICAL APPLICATIONS

- Satellite System Power Supplies
- Switching Power Supply Post Regulators
- Constant Voltage/Current Regulators
- Microprocessor Power Supplies

EQUIVALENT SCHEMATIC



ELECTRICAL SPECIFICATIONS

Table 2. Electrical specifications

Parameter	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS
V_{IN}	V_{IN}		2.9	-	6.5	V
Output Voltage Tolerance	S_T	I_{OUT}=1A; V_{IN}=V_{OUT}+1V	-	-	±2.5	%
Ripple Rejection	PSRR	F=120Hz, I. OUT=50mA	65	-	-	dB
On Resistance	$R_{DS(ON)}$	I_{OUT}=2.5A, V_{EN}=5.0 V, V_{OUT}=3.3 V	-	105	180	mΩ
Dropout Voltage	V_{DROP}	I_{OUT} = 2.5A	-	0.26	0.45	V
Soft Start Time	T_{SS}		-	0.35	-	ms
SHDN Pin Logic High Threshold Voltage	V_{ENH}	Disable	1.0	-	-	V
	V_{ENL}	Enable	-	-	1.6	
SHDN Pin Pull-Up Current	I_{EN}	SHDN=5V	-	90	180	uA
		SHDN=GND	-	11	86	
Thermal Shutdown Threshold	T_{SD}		-	135	-	°C
Quiescent Current	I_Q	No Load	-	14	20	mA
		Full Load	-	16	54	

APPLICATION NOTES

PIN FUNCTIONS

VIN- All internal circuitry, including bias, start-up, temperature limit, and overcurrent latch, get power from this pin. The input voltage ranges from 2.9 to 6.5 volts.

GND - This pin, which is internally linked to ground, should be connected externally to the circuit ground by the user.

SHUTDOWN - The SHUTDOWN pin performs two tasks. It can be used to reset a present latch state or deactivate the output voltage. The user must supply a voltage greater than 1.6V to the SHUTDOWN pin to trigger the shutdown/reset functionality. The input voltage can be larger than the voltage supplied to the SHUTDOWN pin. When the SHUTDOWN pin is pushed below the threshold voltage, the output voltage will switch on. If the SHUTDOWN pin isn't being utilized, it should be grounded. It should be noted that a present latch situation can only be reset by cycling power off and on with the shutdown pin connected to ground.

VOUT - The device's output pin is located here.

OVERCURRENT LATCH

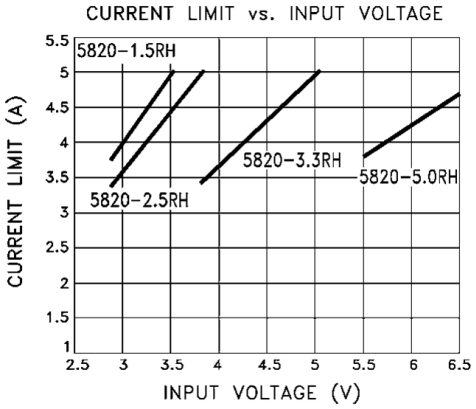
Through the use of a timed latch off circuit, the JTR5820 series provides overcurrent protection. An overcurrent condition triggers the internal latch timeout. At 25°C, the timeout is roughly 5.5mS to allow for start-up surge currents. The regulator will latch off until the latch is reset if the overcurrent condition persists at the conclusion of the timeout cycle. Pull the shutdown pin high or cycle VIN off and on to reset the latch. With no timeout wait, a thermal limit situation will activate the latch.

INPUT POWER SUPPLY BYPASSING

Two 47F tantalum capacitors should be connected between VIN and ground to optimize transient responsiveness and decrease power supply transients. For high frequency bypassing, a 0.1F ceramic capacitor should also be utilized. See an example of an application circuit.

OUTPUT CAPACITOR SELECTION

To ensure regulation and stability, low ESR output capacitors are necessary. For most applications, four CWR29FB227 tantalum capacitors (AVX PN TAZH227K010L) in parallel with ceramic decoupling capacitors (0.1F common) offer sufficient gain and phase margin. The CWR29FB227 capacitor has a maximum ESR of 180m at 100kHz, which is suitable for many applications. JT discovered through complete WCCA that screening for a maximum ESR of 57m guarantees EOL stability standards are satisfied for many of the most demanding applications. The TAZH227K010L from AVX has a typical ESR of 49m. It is suggested that the final design be subjected to analysis to ensure that the stability criteria are satisfied.



CURRENT LIMIT AND SOA

The input and output voltages have a direct impact on the JTR5820 current limit function. The relationship between VIN and ICL for various output voltages is shown in Figure 1. When utilizing input voltages that result in current limit circumstances greater than 4.5 Amps, it is critical that the user reference the SOA curve. To avoid device damage when utilizing input voltages that result in a current limit of more than 4.5 Amps, the user must keep the output current inside the SOA curve. The 5 Amp limit is related to the internal wirebonds' current carrying capacity.

REPLACING THE OMR9601/IRUH33P253AIM

When replacing the IR OMR9601 or IRUH33P253B with the JTR5820-2.5, the user should be aware that the JTR5820-2.5 does not include inbuilt tantalum capacitors on the input and output.

REPLACING THE OMR9601/IRUH33P253AIM

During startup, the JTR5820 drains more current to raise the output voltage. For more information, see the "Saturated Drive Current vs. Input Voltage" graph in this data sheet's typical performance curves and the "Understanding Startup Surge Current With MS Kennedy's RH1573 Based Rad Hard LDO Regulators" application note in the MS Kennedy Web site's application notes section.

THERMAL LIMITING

The thermal shutdown temperature of the JTR5820 control circuitry is around 150°C. This thermal shutdown can be utilized as a safety feature, however the junction temperature of the pass transistor must be kept below 150°C for continuous operation. To keep these conditions, you'll need to choose the right heat sink. The latch function of the JTR5820 is activated when the heat limit is exceeded. To reset the latch, toggle the shutdown pin high and low or cycle the power. For additional details, see the shutdown pin and overcurrent latch descriptions.

HEAT SINK SELECTION

The following formula for convective heat flow can be used to choose a heat sink for the JTR5820.

Governing Equation:

$$TJ = PD \times (R\theta JC + R\theta CS + R\theta SA) + TA$$

Where
TJ = Junction Temperature
PD = Total Power Dissipation
RθJC = Junction to Case Thermal Resistance
RθCS = Case to Heat Sink Thermal Resistance
RθSA = Heat Sink to Ambient Thermal Resistance
TA = Ambient Temperature

$$\text{Power Dissipation} = (VIN - VOUT) \times IOUT$$

The next step is for the user to choose a maximum junction temperature. The absolute maximum temperature for a junction is 150°C. To solve for the necessary heat sink to ambient thermal resistance (RSA), rearrange the equation.

Example:

For VIN=+3.3V and VOUT=+2.5V, an JTR5820-2.5 is used. IOUT is a 3A DC level that runs continuously. The temperature outside is +25°C. The highest junction temperature desired is +125°C.

RθJC=4.0°C/W and RθCS=0.15°C/W for most thermalgreases

$$\text{Power Dissipation} = (3.3V - 2.5V) \times (3A) = 2.4 \text{ Watts}$$

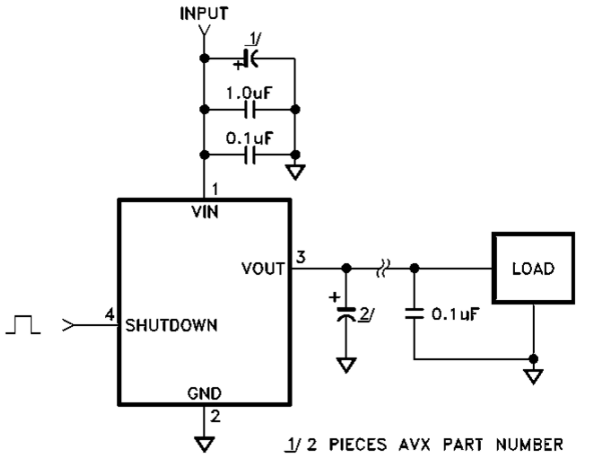
Solve for RθSA:

$$R\theta SA = \left[\frac{125°C - 25°C}{2.4W}\right] - 2.9°C/W - 0.15°C/W$$

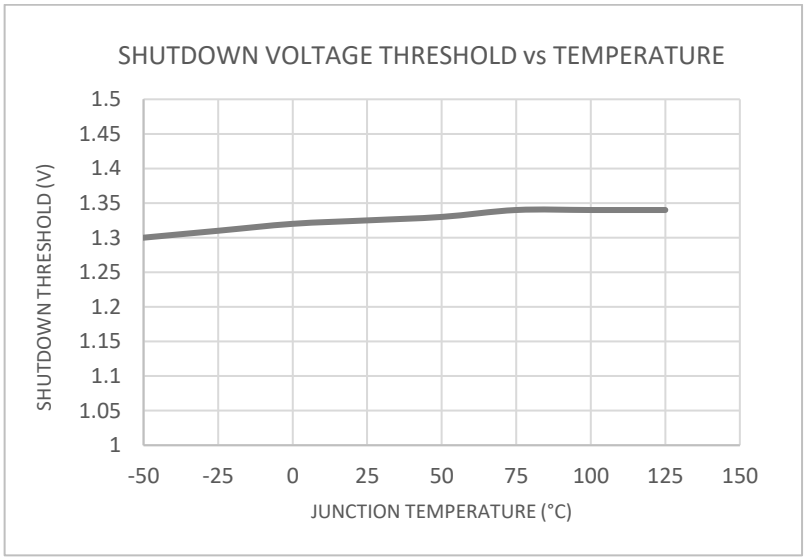
$$= 38.6°C/W$$

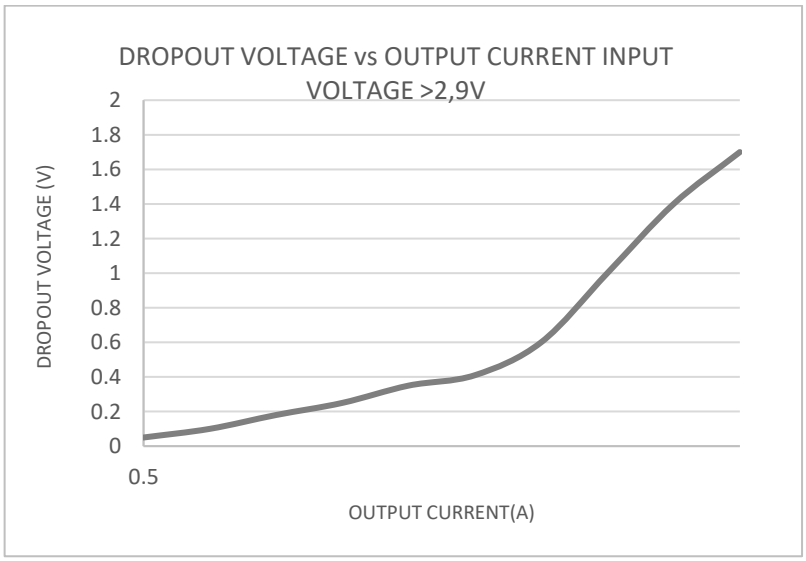
To maintain a junction temperature of no more than 125°C, a heat sink with a thermal resistance of no more than 38.6°C/W must be employed.

ADDITIONAL STABILITY

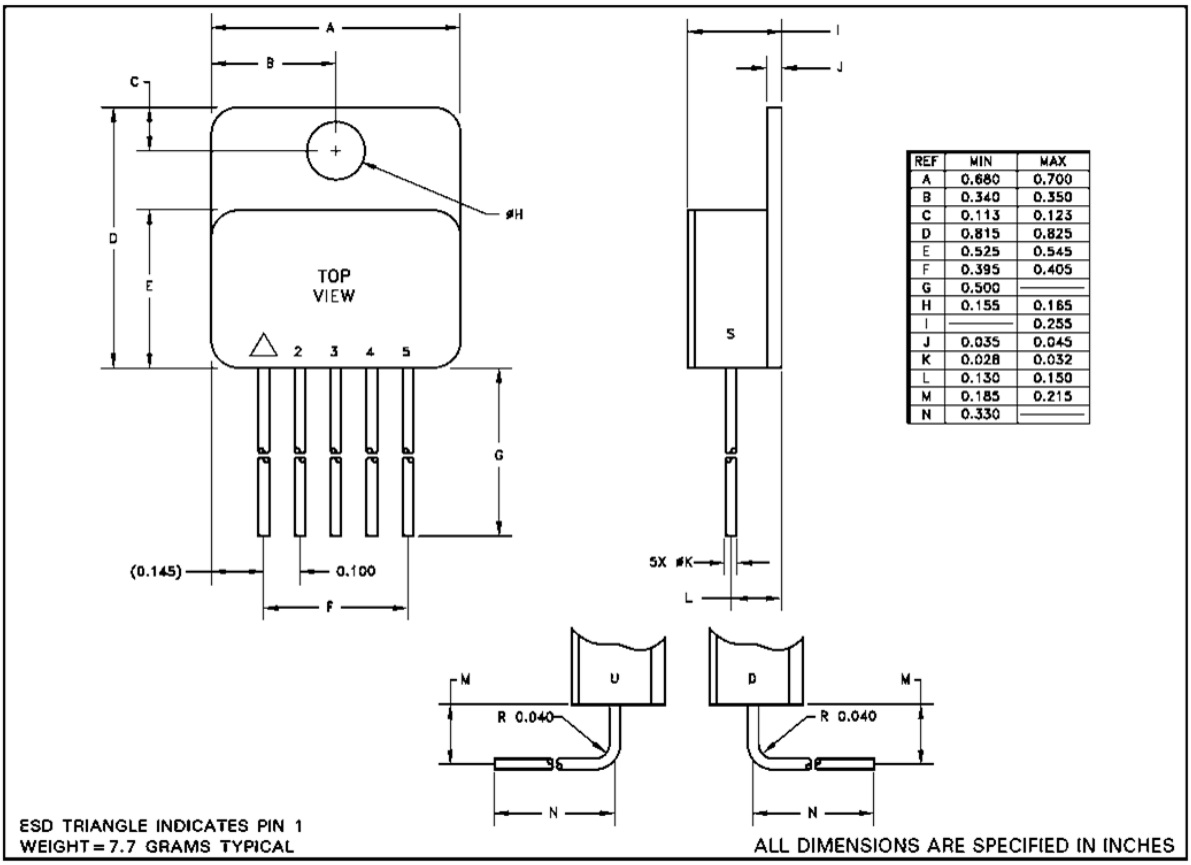


TYPICAL PERFORMANCE CURVES





MECHANICAL SPECIFICATION



REF	MIN	MAX
A	0.680	0.700
B	0.340	0.350
C	0.113	0.123
D	0.815	0.825
E	0.525	0.545
F	0.395	0.405
G	0.500	———
H	0.155	0.165
I	———	0.255
J	0.035	0.045
K	0.028	0.032
L	0.130	0.150
M	0.185	0.215
N	0.330	———

ORDERING INFORMATION