International
IOR Rectifier

PD-94475D

Ultra Low Dropout Linear Regulator

OMR9601SC +3.3Vin to +2.5Vout at 3.0A

Product Summary

Part Number	Dropout	I_O	V_{in}	V_{out}
OMR9601SC	0.4V	3.0A	3.3V	2.5V



MO-078AA

The OMR9601SC is a space qualified, ultra low dropout linear regulator designed specifically for space applications. This product has been characterized to a total ionizing dose of 1.0 Mrad (Si) per MIL-STD-883, Method 1019, Condition D at both high and low dose rates under biased and unbiased conditions to account for ELDRS effects in bipolar devices. The ultra low dropout voltage of 0.4V @ 3A makes the part particularly useful for applications requiring low noise and higher efficiency.

Features:

- Total dose to 1.0 Mrad (Si) and low dose capabilitiy to 500 krad (Si) allows use in space applications
- Single Event latchup Immune
  LET= 84 MeV/(mg/cm^2)
  Fluency = 1x10^9 ions/cm^2
- Low noise, higher efficiency
- Ultra low dropout voltage of 0.4V@ 3A out significantly reduces power consumption
- Remote shutdown permits power sequencing to be easily implemented
- Hermetic MO-078AA (TO-258AA) pack ensures higher reliability
- K-level screened
- This part is also available in 8-Lead Flat Pack Package as OMR9601SF

Absolute Maximum Ratings

Parameter	Symbol	Value	Units
Output Current	I_O	3.5	A
Input Voltage	V_{in}	7	V
Power Dissipation T_C = 25°C	P_{TOT}	19	W
Thermal Resistance, Junction to Case	R_{THJC}	6.5	°C/W
Operating Temperature Range	T_J	-55 to +125	°C
Storage Temperature Range	T_S	-65 to +150	
Lead Temperature	T_L	300	

Electrical Characteristics @Ta = 25°C (Unless Otherwise Specified)
Pre-Radiation

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Output Voltage	V_{in} = 3.3V, I_O = 1.5A	V_{out}	2.475	2.5	2.525	V
	V_{in} = 3.135V, I_O = 50mA		2.375	-	2.625	
	V_{in} = 3.135V, I_O = 3.0A		2.375	-	2.625	
	V_{in} = 3.465V, I_O = 50mA		2.375	-	2.625	
	V_{in} = 3.465V, I_O = 3.0A		2.375	-	2.625	
Input Voltage Range - Operating	I_O = 3.0A	V_{in}	2.9	-	6.5	
Dropout Voltage	I_O = 3.0A, V_{out} = 2.5V	V_{drop}	--	-	0.4	
Current Limit	V_{in} = 3.3V, Overcurrent Latch Up	I_{latch}	3.0	-	-	A
Ripple Rejection	F = 120Hz, I_{out} = 50mA		65	-	-	dB
Shutdown Source Current	V_{shdn} = 5.0V	I_{shdn}	-	200	-	µA
Shutdown Pin Threshold①	V_{in} = 3.3V	V_{shdn}	1.0	-	1.6	V
Output Voltage at Shutdown	V_{in} = 3.3V, I_O = 50mA, Vshdn = +5.0V	$V_{out\ (shdn)}$	-0.1	-	+0.1	

Electrical Characteristics @Ta = -55°C to 125°C (Unless Otherwise Specified)
Pre-Radiation

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Output Voltage	V_{in} = 3.3V, I_O = 1.5A	V_{out}	2.375	2.5	2.625	V
	V_{in} = 3.135V, I_O = 50mA		2.375	-	2.625	
	V_{in} = 3.135V, I_O = 3.0A		2.375	-	2.625	
	V_{in} = 3.465V, I_O = 50mA		2.375	-	2.625	
	V_{in} = 3.465V, I_O = 3.0A		2.375	-	2.625	
Input Voltage Range - Operating	I_O = 3.0A	V_{in}	2.9	-	6.5	
Dropout Voltage	I_O = 3.0A, V_{out} = 2.5V	V_{drop}	-	-	0.4	
Current Limit	V_{in} = 3.3V, Overcurrent Latch Up	I_{latch}	3.0	-	-	A
Ripple Rejection	F = 120Hz, I_{out} = 50mA		65	-	-	dB
Shutdown Source Current	V_{shdn} = 5.0V	I_{shdn}	-	200	-	µA
Shutdown Pin Threshold①	V_{in} = 3.3V	V_{shdn}	1.0	-	1.6	V
Output Voltage at Shutdown	V_{in} = 3.3V, I_O = 50mA, Vshdn = +5.0V	$V_{out\ (shdn)}$	-0.1	-	+0.1	

Refer page 3 for Notes for Electrical Characteristic Tables

Electrical Characteristics @Ta = 25°C (Unless Otherwise Specified)

Post-Radiation

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Output Voltage	V_{in} = 3.3V, I_O = 1.5A	V_{out}	2.375	-	2.625	V
	V_{in} = 3.135V, I_O = 50mA		2.375	-	2.625	
	V_{in} = 3.135V, I_O = 3.0A		2.375	-	2.625	
	V_{in} = 3.465V, I_O = 50mA		2.375	-	2.625	
	V_{in} = 3.465V, I_O = 3.0A		2.375	-	2.625	
Current Limit	V_{in} = 3.3V	I_{max}	3.0	-	-	A
Ripple Rejection	F = 120Hz, I_{out} = 50mA		40	-	-	dB
Output Voltage at Shutdown	V_{in} = 3.3V, I_O = 50mA, Vshdn = +5.0V	$V_{out (shdn)}$	-0.1	-	+0.1	V

Notes for Electrical Characteristic Tables

① $V_{Shutdown}$ ramp from 0.8V to 4.8V, output monitored for a 100mV drop below the nominal specification for V_{out}

Pre-Radiation Characteristics

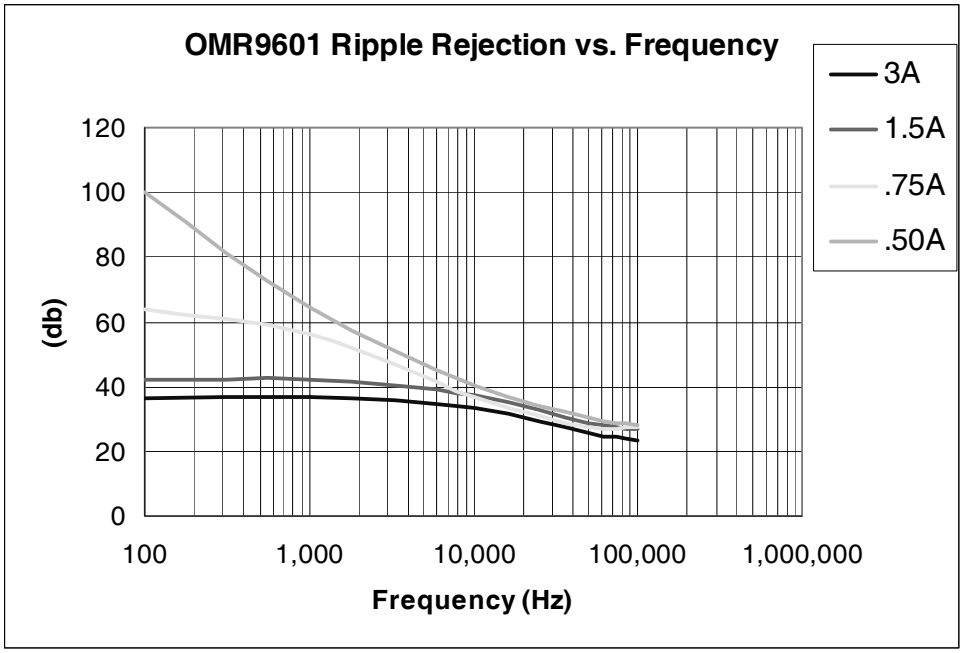


Fig 1. Ripple Rejection Vs Frequency

Post-Radiation Characteristics
Total Ionizing Dose (TID)

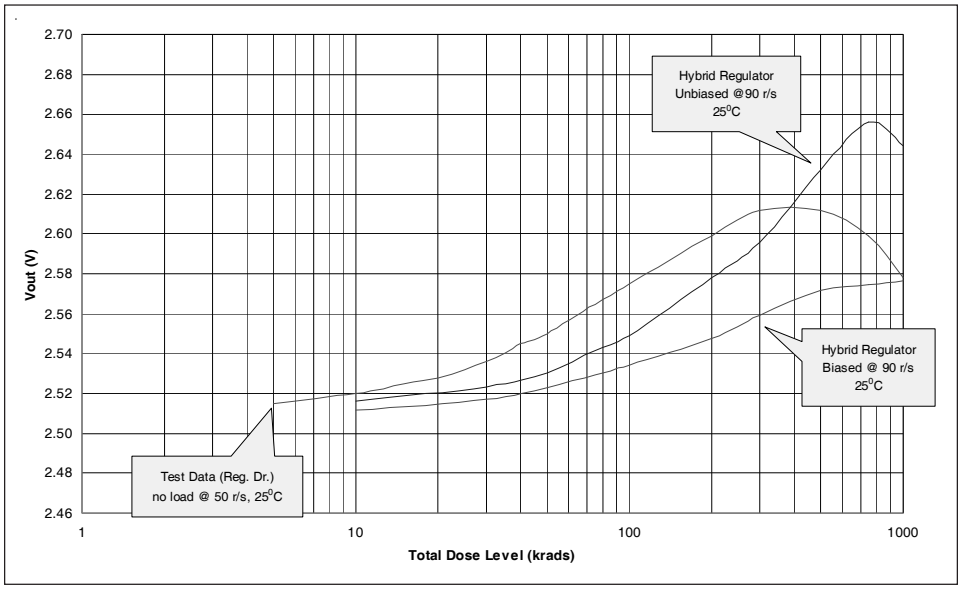


Fig 2. Voltage Output Vs Total Ionizing Dose

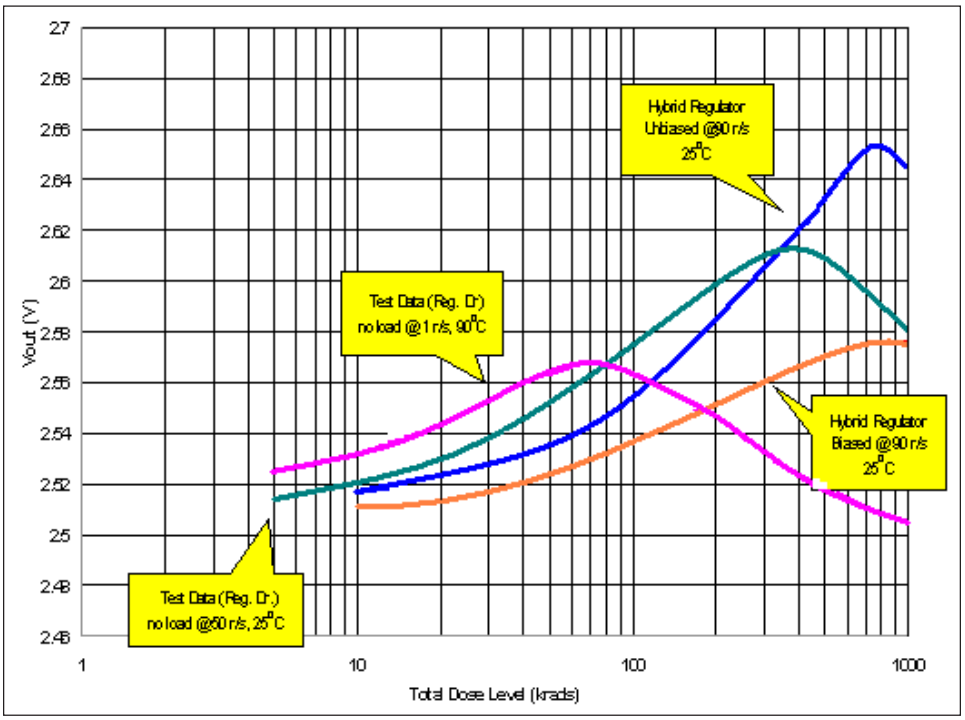


Fig 3. Voltage Output Vs Total Ionizing Dose

Post-Radiation Characteristics

Enhanced Low Dose Rate Sensitivity (Dose Rate = 0.1 Rad/s)

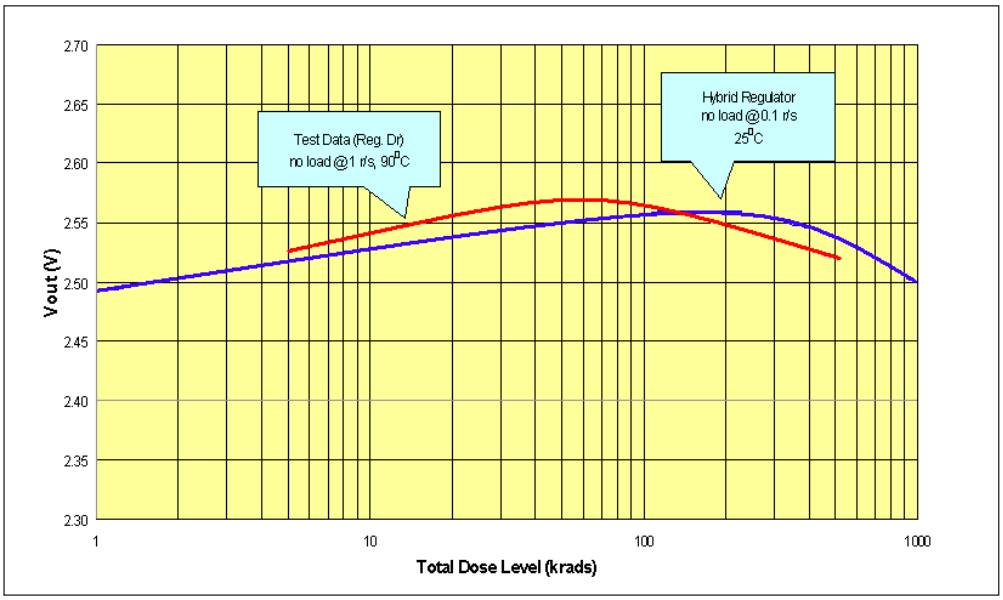


Fig 4. Voltage Output Vs Total Ionizing Dose

Single Event Latch-up

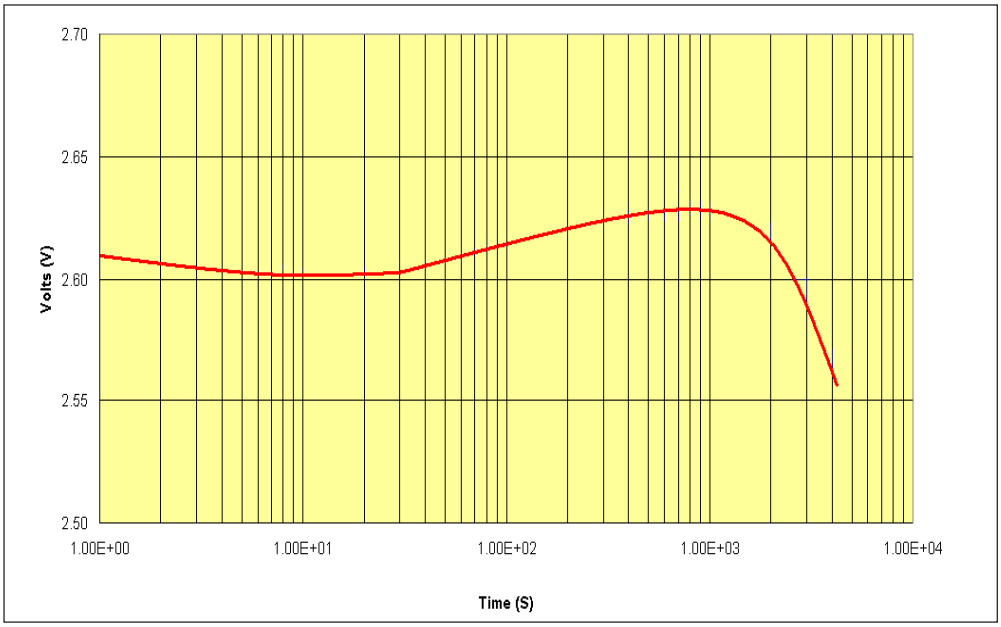


Fig 5. Voltage Output Vs Time

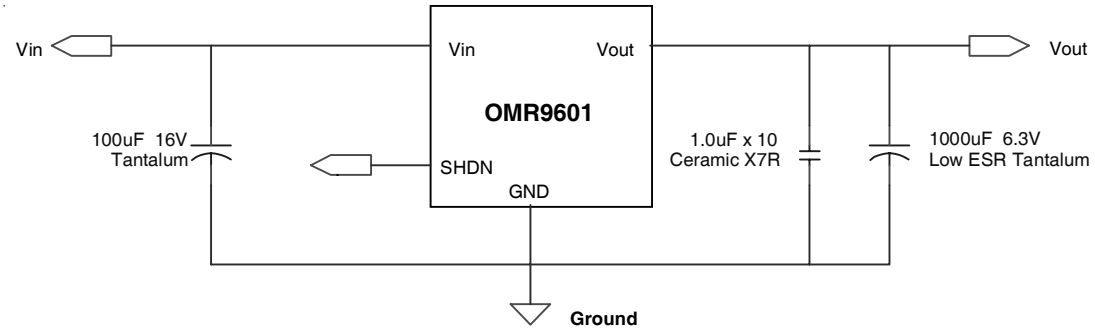


Fig 6. Typical Application Circuit

Input Capacitance

Recommended input capacitance for a generic application is a 100μF, 16V tantalum capacitor. However, the input capacitance is not critical to the stability of the regulator and is therefore application dependent. In designs with a clean bus voltage that is situated close to the input of the regulator, only a small ceramic capacitor will be needed to decouple high frequency noise. On the other hand, in designs with a noisy bus, a larger capacitor will be needed. Care should be taken to ensure that the input to the regulator is sufficiently free of noise and disturbances.

Output Capacitance

Like most ultra low dropout voltage regulators, OMR9601 requires the use of an output capacitor as part of the device frequency compensation. The device requires a minimum of 220μF tantalum to ensure stability.

Many different types of capacitor are available and have widely varying characteristics. These capacitors differ in capacitor tolerance, equivalent series resistance (ESR), equivalent series inductance and capacitance temperature coefficient. The OMR9601 frequency compensation optimizes frequency response with low ESR capacitors. In general, use capacitors with an ESR of less than 50 mΩ for heavy load applications.

High quality bypass capacitors must also be used to limit the high frequency noise generated by the load. Multiple small ceramic capacitors are typically required to limit parasitic inductance (ESL) and ESR in the capacitors to acceptable levels.

The upper limit of the capacitance is governed by the delayed over-current latch function of the regulator. The regulator has a protection circuit that will latch the device off in the event of a short circuit. However, since it is known that the regulator will draw a large in-rush current upon startup, the latch-off is delayed by about 10ms to allow the output capacitors to charge to a steady state without shutting down. During this period, the regulator will have an output current at its maximum of around 5A typical. Therefore, the maximum output capacitance can be as high as 20,000uF without causing device to latch-off during start-up.

Figure 6 shows a typical application circuit. The output load capacitor consists of one tantalum capacitor (or more in parallel) of 1,000μF with ESR no high than 50 mΩ, and 10 x 1.0μF X7R ceramic caps. This will give approximately 59 degrees phase and 24dB gain margin.

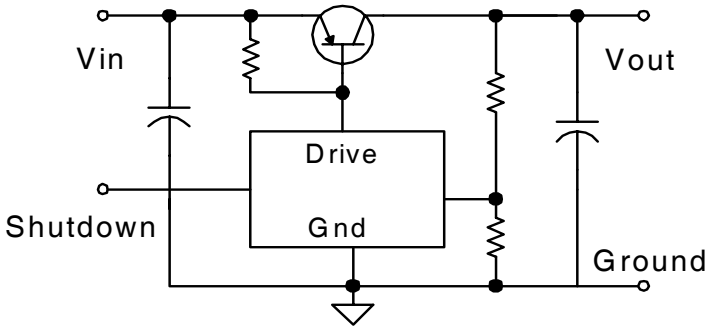


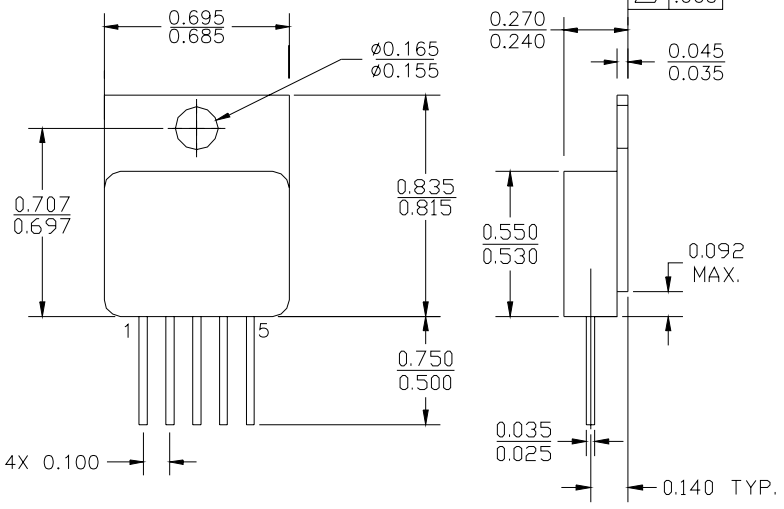
Fig 7. Simplified Schematic Circuit

MIL-PRF-38534 Screening Requirements

TEST/INSPECTION	SCREENING LEVEL	MIL-STD-883
	CLASS K (Space Level)	METHOD
Pre Seal Burn-In	Optional	1030
Nondestructive Bond Pull	100%	2023
Internal Visual	100%	2017
Temperature Cycle	100%	1010
Constant Acceleration	100%	2001
Mechanical Shock	100%	2002
PIND	100%	2020
Pre Burn-In-Electrical	100%	
Burn-In	100%	1015
Final Electrical	100%	
Seal	100%	1014
Radiographic	100%	2012
External Visual	100%	2009

Note:
International Rectifier does not currently have a DSCC certified Radiation Hardness Assurance Program

Case Outline and Dimensions - MO-078AA



Pin Assignment

Pin #	Pin Description
1	V_{in}
2	GND
3	V_{out}
4	SHUTDOWN
5	N/C

Notes:
1) All dimensions are in inches
2) The tolerance for X.XXX = 0.005

Part Numbering Nomenclature

OM R 9601 S C P

Process Identification
R = Radiation Tolerant

Device Number

Isolated / Non-Isolated
S = Isolated

Screening
P = 100 % Final Electrical
K = Class K per MIL-PRF-38534

Package Code
C = MO-078AA (TO-258AA)

International
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