200 W GX SINGLE SERIES DC/DC CONVERTERS

Features

- Precisely regulated voltage
- Small size 2.4” x 2.28” x 0.55”
- Master/slave frequency synchronization
- Built in load sharing
- Excellent thermal performance with metal baseplate
- Volt-seconds clamp and fast over voltage protection
- Pulse-by-pulse current limiting, dead short shut down
- Over-temperature protection
- Auto-softstart
- Low noise
- Constant frequency during normal operation
- Remote sense
- Remote ON/OFF
- Output trim with very low temperature drift
- Water washable, wide humidity applications
- Good shock and vibration damping
- RoHS Compliant

Description

The GX Single Series of DC/DC converters provide precisely regulated dc outputs. The output voltage is fully isolated from the input, allowing the output to be positive or negative polarity and with various ground connections. The GX Single Series meets the most rigorous performance standards for data communications and process control applications.

The GX Single Series has added features that allow for master/slave frequency synchronization and load sharing without the need for external circuitry. The GX Single Series also includes remote sensing, output trim, and remote ON/OFF. Unthreaded through-holes are provided to allow easy mounting or the addition of a heat sink for extended temperature use.

Selection Chart

Model	Input Range VDC		Iin ADC	Vout VDC	Iout ADC
	Min	Max	TYP		
28S15.13GX	16	40	8.6	15	13.33
28S24.8GX	16	40	8.4	24	8.33

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Unless otherwise stated, these specifications apply for baseplate temperature T_B=23±2ºC, nominal input voltage, and rated full load. (1)

Input Parameters				
Model		**28S15.13GX**	**28S24.8GX**	**Units**
Voltage Range	MIN TYP MAX	16 28 40		V
Input Overvoltage (100 ms)	MAX	50		V
Input Ripple Rejection (30-1500Hz)	TYP	40		dB
Undervoltage Lockout		Yes		
Input Reverse Voltage Protection		Yes		
Input Current (14) No Load 100% Load	 TYP TYP	 50 8.6	 50 8.4	 mA A
Inrush Current	MAX	0.5		A^2s
Reflected Ripple, 12µH Source Impedance (3)	TYP	50		mA P-P
Efficiency	TYP	83	85	%
Switching Frequency	TYP	255		kHz
Recommended Fuse		(2)		A

* Absolute Maximum Ratings. Caution: Stresses in excess of the Absolute Maximum Ratings can cause permanent damage to the device (see Note 1.)

Output Parameters				
Model		**28S15.13GX**	**28S24.8GX**	**Units**
Output Voltage		15	24	V
Output Voltage Setpoint Accuracy	MAX	±2		%
Turn On Overshoot Min-Max Load	TYP	0		%
Temperature Drift	TYP MAX	0.003 0.005		%/ºC
Noise (8)	TYP	150	240	mV P-P
Load Current	MIN MAX	0.00 13.33	0.00 8.33	A
Load Transient Overshoot (7)	TYP	2.5		%
Load Transient Recovery Time (6)	TYP	100		µs
Load Regulation (5) Min-Max Load	TYP MAX	0.2 0.5		%
Line Regulation (4) Vin = Min-Max	TYP MAX	0.01 0.1		%
Overvoltage Protection (OVP) Threshhold OVP Type - Non-latching Open Loop Overvoltage Clamp	 MIN MAX	 115 135		%
Output Current Limit Vout = 90% of Vout-nom	TYP	120		%
Output Short Circuit Current Vout = 0.25V	TYP	150		%

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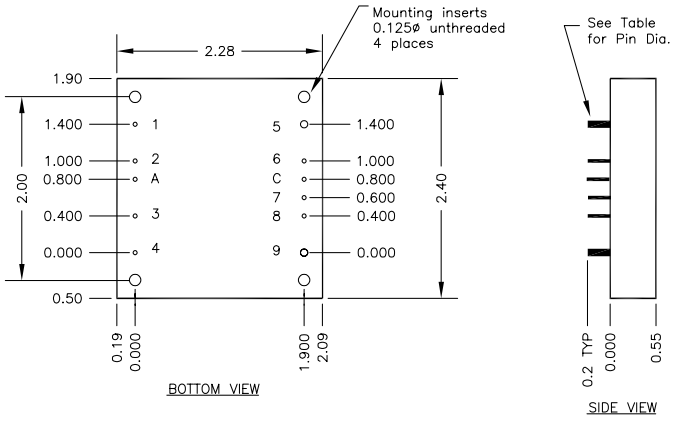
General Specifications			
All Models			**Units**
ON/OFF Function			
HIGH Logic Level or Leave ON/OFF Pin Open	MIN	3.0	VDC
External Leakage Current Allowed for Logic High (9)	MAX	10	µA
Input Diode Protection Voltage	MAX	50	VDC
LOW Logic Level or Tie ON/OFF Pin to -INPUT	MAX	1.0	VDC
Sinking Current for Logic Low	MAX	500	µA
Open Circuit Voltage at ON/OFF Pin (10)	TYP	2.3	VDC
Output Resistance	TYP	3	k Ω
Idle Current (Module is OFF)	TYP	40	mADC
Turn-on Time to 1% error	TYP	20	ms
Positive Logic	HIGH - Module ON LOW - Module OFF		
Output Voltage Remote Sensing			
Maximum Voltage Drops on Leads	MAX	0.5	%
Line Regulation under remote sensing	TYP MAX	0.02 0.1	%
Load Regulation under remote sensing	TYP MAX	0.05 0.2	%
Output Voltage Trim			
Trim Range	MIN MAX	-40 +10	% of Vout
Input Resistance	TYP	16.2	kΩ
Open Circuit Voltage	TYP	2.5	V
Isolation			
Input to Output Isolation 10µA Leakage	MAX	1544	VDC
Input to Output Resistance	MIN	10	MΩ
Input to Output Capacitance	TYP	1800	pF
Load Sharing			
Current Share Bus (16)	TYP	0.75	VDC
Frequency Synchronization			
Clock synchronization frequency setpoint (15)	MIN MAX	-1 +1	kHz
Clock synchronization amplitude (15)	MIN MAX	3 5	Vp-p

General Specifications			
All Models			**Units**
Environmental			
Calculated MTBF, Bellcore Method 1, Case 1	>1,000,000		h
Baseplate Operating Temperature Range	MIN MAX	-40 100	ºC
Storage Temperature	MIN MAX	-40 120	ºC
Thermal Impedance (11)	TYP	7	ºC/W
Thermal Shutdown Baseplate Temperature (Auto Restart)	MIN TYP	100 110	ºC
General			
Unit Weight	TYP	4.6/114	oz/g
Case Dimension		2.4” x 2.28” x 0.55”	
Agency Approvals			
Designed to meet UL60950			



TOLERANCE: ALL DIMENSIONS ARE TYPICAL IN INCHES UNLESS OTHERWISE NOTED:	
X.XX	±0.020
X.XXX	±0.005

Pin	Name	Pin Dia.
1	-INPUT	0.04”
2	CASE	0.04”
3	ON/OFF	0.04”
4	+INPUT	0.04”
5	-OUTPUT	0.08”
6	-SENSE	0.04”
7	TRIM	0.04”
8	+ SENSE	0.04”
9	+ OUTPUT	0.08”
A	Clock Sync	0.04”
C	Load Share	0.04”

Notes:

(1) Refer to the CALEX Application Notes for the definition of terms, measurement circuits, and other information.

(2) Refer to the CALEX Application Notes for information of fusing. For inrush current, refer to the specifications above.

(3) Connect a 100µF capacitor between the two "Input" pins. Then connect a current sensor in series with 12µH inductor between the capacitor and the source. The reflected ripple current is measured over a 5Hz to 20MHz bandwidth (the current sensor is located between the converter input pin and the inductor).

(4) Line regulation is defined as the output voltage changes when changing input (line) voltage from minimum to maximum.

(5) Load Regulation is defined as the output voltage change when changing load current from 10% of maximum load to 90% of maximum load.

(6) Load Transient Recovery Time is defined as the time for the output to settle from a 25% to 75% step load change to a 1% error band (rise time of step = 2µs).

(7) Load Transient Overshoot is defined as the peak overshoot during a transient as defined in the Note 6 above.

(8) Noise is measured per the CALEX Application Notes. Output noise is measured with a 10µF tantalum capacitor in parallel with a 0.1µF ceramic capacitor connected across the output pins. Measurement bandwidth is 20MHz.

(9) When an external ON/OFF switch is used, such as an open collector switch, logic high requires the switch to be high-impedance. Switch leakage currents greater than 10µA may be sufficient to trigger the ON/OFF to the logic-low state.

(10) Most switches would be suitable for the logic ON/OFF control. In case there is a problem make the following estimations and then leave some margin.
When open collector is used for logic high, "Open Circuit Voltage at ON/OFF Pin", "Output Resistance" and "External Leakage Current Allowed for Logic High" are used to estimate the high impedance requirement of open collector.
When switch is used for logic low, "Open Circuit Voltage at ON/OFF Pin", "Output Resistance" and "LOW Logic Level" are used to estimate the low impedance requirement of the switch.

(11) Thermal impedance is tested with the converter mounted vertically and facing another printed circuit board 1/2 inch away. If the converter is mounted horizontally with no obstructions, thermal impedance is approximately 7°C/W.

(12) Water Washability - Calex DC/DC converters are designed to withstand most solder/wash processes. Careful attention should be used when assessing the applicability in your specific manufacturing process. Converters are not hermetically sealed.

(13) Source impedance of these units needs to be kept to a minimum. The GX series operates between 16-40Vdc and requires a maximum source impedance of 0.44 ohms. It is recommended to have 5.0 µF of capacitance (low ESR) for every 1.0µH of inductance between the power source and the DC/DC converter. Inductance includes all sources and should take into account input power lines.

(14) Power sources which drive the converter must be capable of sourcing the required amount of current for the converter to operate correctly. If there are any conditions that may keep the source from supplying the required amount of current, the user must incorporate shutdown circuitry and/or power shedding. The source voltage should be measured at the input pins of the DC/DC converter. The primary referenced ON/OFF pin can be used to assist in implementing this function.

(15) Frequency synchronization is obtained by tying pin A of all converters together. Driving the Sync pin with an external clock is not recommended. Synchronization may result in a slight reduction in an individual converter's efficiency. Failure of this pin will not compromise the performance of a free running unit.

(16) Load sharing is accomplished by tying the load share pins of each module directly to each other. This creates a load share bus with a typical voltage as listed. However, it will vary with varying loads. No external components are needed.
It is well-known that accurate load sharing prevents good load regulation as well as trim functionality. In order to overcome these design constraints Calex has chosen an implementation that allows the user to choose which features are needed in a particular application. This is achieved by characterizing the application in one of two modes of operation.
Load sharing- When using the converter in a load sharing application the sense pins must be connected directly to the output pins. This connection MUST be as short as possible - preferably directly underneath the unit. The reason for this is related to the concept of load sharing, where each converter adjusts its voltage slightly to equalize the current distribution. In short, load sharing requires load regulation to be sacrificed. The sense pins of each unit in a load share configuration should NOT be connected to the sense pins of the other units in the configuration. Load and supply wires should be kept as short as possible and always at the same length between modules.
Stand-alone - When the converter is used as a stand-alone power source the sense pins can be connect to the point-of-load to compensate for any line voltage drops. In addition, the trim function of the converter can be utilized to adjust the output voltage to the desired level. Overall load regulation is within the specified limit.

(17) The converter will continue normal operation even when the DC input voltage is superimposed with an AC signal of magnitude up to 10% of the Input Voltage as RMS Ripple Noise, as long as the peak voltages or frequencies do not exceed the specified parameters.
Due to the peak-to-peak amplitude of an AC signal, the specified minimum RMS ripple noise of the input voltage is only guaranteed a minimum attenuation of 40dB within the voltage range: 18VDC to 36VDC.

(18) RoHS Compliance means conformity to EU Directive 2002/95/EC of 27 January 2003, on the restriction of the use of certain hazardous substances in electrical and electronic equipment, lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls, and polybrominated diphenyl ethers are not present in quantities exceeding the following maximum concentrations in any homogeneous material, except for applicable exemptions.
0.1% (by weight of homogeneous material) lead, mercury, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ethers, or 0.01% (by weight of homogeneous material) cadmium. The RoHS marking is as follows.