

# MSA/MGA Single and Dual DC-DC Converters

## 28 VOLT INPUT – 5 WATT

### FEATURES

**Small size, 1.16 in<sup>2</sup> (7.46 cm<sup>2</sup>) - MSA**

**Surface mount package - MGA**

- –55° to +125°C operation
- 16 to 40 VDC input
- 50 V for 50 ms transient protection
- Fully isolated
- Fixed high frequency switching
- Inhibit function
- Indefinite short circuit protection
- Up to 76% efficiency



MODELS	
VDC OUTPUT	
SINGLE	DUAL
5	±5
5.2 (MSA only)	±12
12	±15
15	

### DESCRIPTION

The Interpoint™ MSA Series™ and MGA Series™ of dc-dc converters provide up to 5 watts of output power over the full military temperature range with up to 76% efficiency. Thick-film hybrid techniques provide military/aerospace reliability levels and optimum miniaturization.

The converters are offered with standard screening, “ES” screening, or fully compliant to “883” MIL-PRF-38534 Class H screening. Standard microcircuit drawings (SMD) are available. See “Table 12: Element Evaluation” on page 14 and “Table 13: Environmental Screening” on page 15 for screening options and descriptions.

### CONVERTER DESIGN

The converters are switching regulators that use a flyback converter design with a constant switching frequency of 550 kHz typical. They are regulated, isolated units using a pulse width modulated topology and are built as high reliability thick-film hybrids. Isolation between input and output circuits is provided with a transformer in the forward power path and an optical link in the feedback control loop. Excellent input line transient response and audio rejection is achieved by an advanced feed-forward compensation technique. Negative output regulation is maintained by tightly coupled magnetics. Up to 4 watts, 80% of the total output power, is available from either output, provided that the opposite output is simultaneously carrying 20% of the total power in order to maintain the specified regulation on the negative output. A predictable current limit is accomplished by

direct monitoring of the output load current, which results in a constant current output. Internal input and output filters eliminate the need for external capacitors for stable operation. Output filter examples in “Figure 3: Low Noise Output Filter MSA and MGA Single Output Models” on page 3 and “Figure 4: Low Noise Output Filter MSA and MGA Dual Output Models” on page 3 provide suggested solutions for systems where very low output ripple is required.

### WIDE VOLTAGE RANGE

The MSA converters are designed to provide full power operation over a full 16 to 40 VDC voltage range. Operation below 16 volts, including MIL-STD-704E emergency power conditions is possible with derated power. Low-line drop out graphs, “Figure 17” on page 10 and “Figure 23” on page 11, graphs provide more information.

### IMPROVED DYNAMIC RESPONSE

The feed-forward compensation system provides excellent dynamic response and noise rejection. Audio rejection is typically 50 dB. The minimum to maximum step line transient response is typically less than 1%.

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### INHIBIT FUNCTION

The inhibit feature can be used to disable internal switching and inhibit the unit's output. Inhibiting in this manner results in low standby current and no generation of switching noise.

The converter is inhibited when the inhibit pin is pulled below 0.8 V and enabled when its inhibit pin is left floating. An external inhibit interface should be capable of pulling the converter's inhibit pin below 0.8 V while sinking the maximum inhibit current and also allowing the inhibit pin to float high to enable the converter. A voltage should not be applied to the inhibit pin. The open circuit output voltage associated with the inhibit pin is 9 to 11 V. In the inhibit mode, a maximum of 4 mA must be sunk from the inhibit pin. See "Figure 2: Inhibit Interface MSA and MGA" on page 3.

### UNDERVOLTAGE LOCKOUT AND TRANSIENT PROTECTION

Undervoltage lockout helps keep system current levels low during initialization or re-start operations. They can withstand short term transients of up to 50 volts without damage. A low voltage lockout feature keeps the converter shutdown below approximately 13 VDC to ensure smooth initialization.

### MIL-STD-461

Use our FMSA-461 (down-leaded) or our FMGA-461 (surface mount) EMI filter to pass the CE03 requirements of MIL-STD-461C.

### PACKAGING

#### MSA - Down-leaded package

The MSA Series converters are packaged in hermetically sealed, projection-welded metal cases which provide EMI/RFI shielding. The small size, 1.075 x 1.075 x 0.270 inches (27.31 x 27.31 x 6.86 mm), saves space and weight in critical applications. See "Figure 26: MSA Case Dimensions" on page 12.

#### MGA - Surface mount package

The surface mount MGA dc-dc converters can be mounted with pick-and-place equipment or manually. See "Figure 28: MGA Gull-Wing Solder Pad Layout" on page 13 for more information.

Internal components are soldered with SN96 (melting temperature 221°C) to prevent damage during reflow. Maximum reflow temperature for surface mounting the MGA converter is 220°C for a maximum of 30 seconds. SN60, 62, or 63 are the recommended types of solder. Hand soldering should not exceed 300°C for 10 seconds per pin.

The hermetically sealed metal cases are available in two different lead configurations. See "Figure 27: MGA Case Dimensions" on page 13 and "Figure 28: MGA Gull-Wing Solder Pad Layout" on page 13.

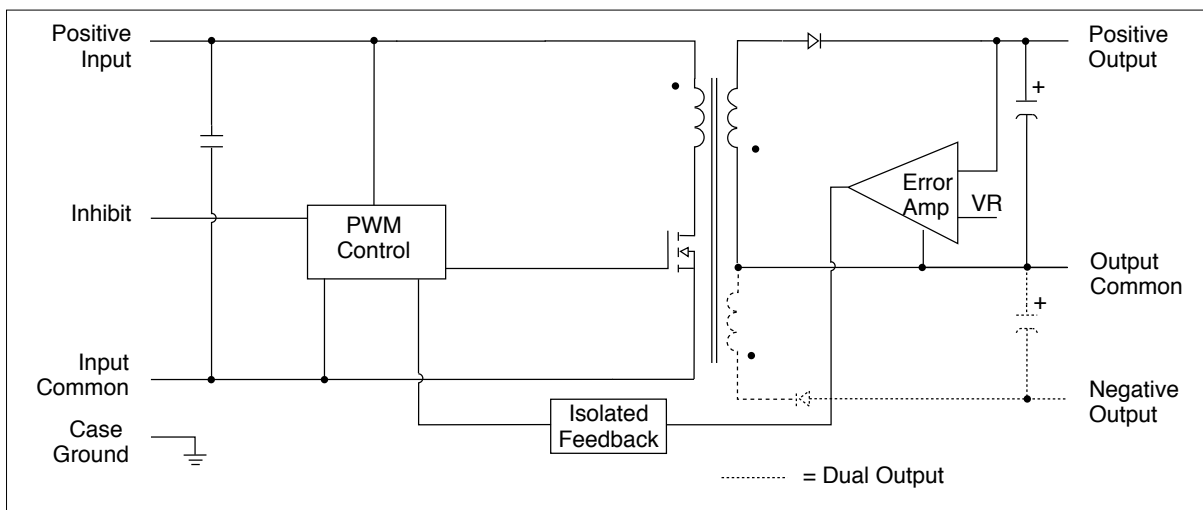


FIGURE 1: BLOCK DIAGRAM MSA AND MGA



# MSA/MGA Single and Dual DC-DC Converters

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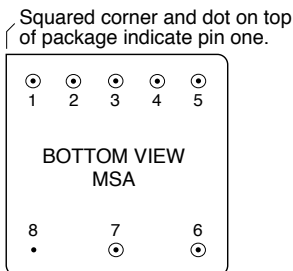
PIN OUT MSA MODELS		
Pin	Single Output	Dual Output
1	Positive Output	Positive Output
2	Output Common	Output Common
3	No Connection	Negative Output
4	No Connection	No Connection
5	Inhibit	Inhibit
6	Positive Input	Positive Input
7	Input Common	Input Common
8	Case Ground	Case Ground

TABLE 1: MSA PIN OUT

PIN OUT MGA MODELS		
Pin	Single Output	Dual Output
1	Inhibit	Inhibit
2, 3	Positive Input	Positive Input
4	No Connection	No Connection
5, 6	Input Common	Input Common
7, 8	Case Ground	Case Ground
9, 10	No Connection	No Connection
11, 12	Positive Output	Positive Output
13	Positive Output	Output Common
14	Output Common	Output Common
15, 16	Output Common	Negative Output
17, 18	No Connection	No Connection
19, 20	Case Ground	Case Ground

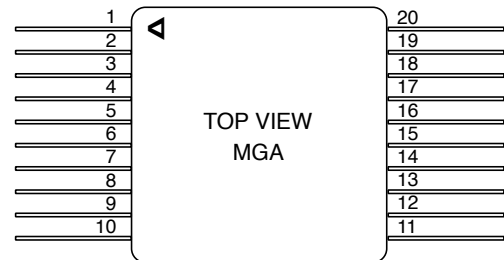
To meet specified performance for the MGA, all pins must be connected except "No Connection" pins and Inhibit pin.

TABLE 3: MGA PIN OUT



See "Figure 26: MSA Case Dimensions" on page 12.

FIGURE 5: MSA PIN OUT BOTTOM VIEW



Triangle in upper left corner of cover indicates pin one.

See "Figure 27: MGA Case Dimensions" on page 13.

FIGURE 6: MGA PIN OUT TOP VIEW

MSA PINS NOT IN USE	
Inhibit	Leave unconnected
"No Connection" pin	Leave unconnected

TABLE 2: MSA PINS NOT IN USE

MGA PINS NOT IN USE	
Inhibit	Leave unconnected
"No Connection" pins	Connect to case ground for best EMI performance.

TABLE 4: MGA PINS NOT IN USE

# MSA/MGA Single and Dual DC-DC Converters

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SMD NUMBERS	
STANDARD MICROCIRCUIT DRAWING (SMD)	MSA SIMILAR PART
5962-9309201HXC	MSA2805S/883
5962-0251301HXC	MSA285R2S/883
5962-9309301HXC	MSA2812S/883
5962-9309401HXC	MSA2815S/883
5962-0052201HXC	MSA2805D/883
5962-9308901HXC	MSA2812D/883
5962-9309001HXC	MSA2815D/883

For exact specifications for an SMD product, refer to the SMD drawing. SMDs can be downloaded from: <http://www.landandmaritime.dla.mil/programs/smcr>

TABLE 5: MSA SMD NUMBERS

SMD NUMBERS	
STANDARD MICROCIRCUIT DRAWING (SMD)	MGA SIMILAR PART
5962-9309201HZC	MGA2805SZ/883
5962-9309301HZC	MGA2812SZ/883
5962-9309401HZC	MGA2815SZ/883
5962-0052201HZC	MGA2805DZ/883
5962-9308901HZC	MGA2812DZ/883
5962-9309001HZC	MGA2815DZ/883

For exact specifications for an SMD product, refer to the SMD drawing. SMD numbers are shown for the surface mount gull-wing case. For the straight-lead case, replace the Z (HZC) in the SMD with a Y (HYC). SMDs can be downloaded from: <http://www.landandmaritime.dla.mil/programs/smcr>

TABLE 6: MGA SMD NUMBERS

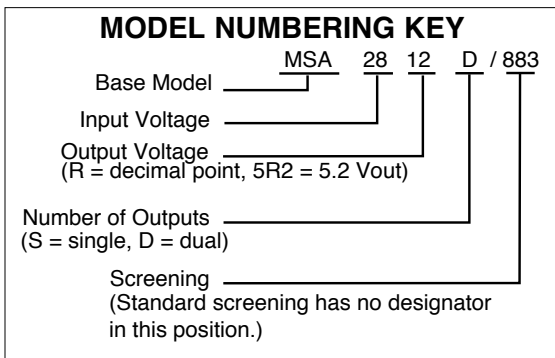


FIGURE 7: MSA MODEL NUMBERING KEY

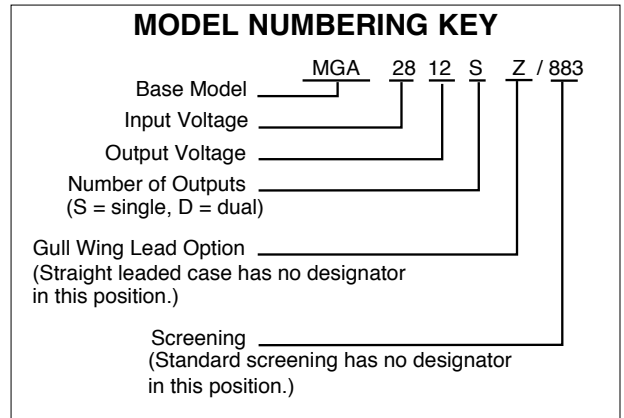


FIGURE 8: MGA MODEL NUMBERING KEY

MODEL NUMBER OPTIONS					
TO DETERMINE THE MODEL NUMBER ENTER ONE OPTION FROM EACH CATEGORY IN THE FORM BELOW.					
CATEGORY	Base Model and Input Voltage	Output Voltage <sup>1</sup>	Number of Outputs <sup>2</sup>	Case Options <sup>3</sup>	Screening <sup>4</sup>
OPTIONS	MSA	05, 5R2, 12, 15	S	MSA – down-leaded: leave blank	(standard, leave blank)
	MGA	05, 12, 15	D	MGA – straight leads: leave blank MGA – gull wings: Z	ES 883
FILL IN FOR MODEL #	___ M A ___	_____	_____		/ _____

Notes:

- 5R2 is a 5.2 output model.
- Number of Outputs: S is a single output and D is a dual output
- Case Options: For the MSA down-leaded case leave the case option blank. For the MGA straight-lead case, leave the case option blank. For the MGA, surface mount gull-wing case, insert the letter "Z" in the case option position.
- Screening: For standard screening leave the screening option blank. For other screening options, insert the desired screening level. For more information see "Table 11: Element Evaluation" on page 12 and "Table 12: Environmental Screening" on page 13.

TABLE 7: MSA AND MGA MODEL NUMBER OPTIONS

# MSA/MGA Single and Dual DC-DC Converters

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TABLE 8: OPERATING CONDITIONS, ALL MODELS : 25°C T<sub>C</sub>, 28 VDC V<sub>IN</sub>, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

PARAMETER	CONDITIONS	ALL MODELS			UNITS
		MIN	TYP	MAX	
LEAD SOLDERING TEMPERATURE	10 SECONDS MAX. PER LEAD	—	—	300	°C
MGA, SURFACE MOUNT SOLDER REFLOW <sup>2</sup>	SN 60, 62 OR 63 RECOMMENDED	220°C for max. of 30 seconds			
STORAGE TEMPERATURE <sup>1</sup>		-65	—	+150	°C
CASE OPERATING TEMPERATURE	FULL POWER	-55	—	+125	°C
	ABSOLUTE <sup>1</sup>	-55	—	+135	
DERATING OUTPUT POWER/CURRENT <sup>1</sup>	LINEARLY	From 100% at 125°C to 0% at 135°C			
ISOLATION, INPUT TO OUTPUT, ANY PIN TO CASE EXCEPT CASE PIN	@ 500 VDC AT 25°C	100	—	—	Megohms
INPUT TO OUTPUT CAPACITANCE <sup>1</sup>		—	50	—	pF
UNDERVOLTAGE LOCKOUT <sup>1</sup>		—	13	—	V
CURRENT LIMIT <sup>1,3</sup>	% OF FULL LOAD	—	115%	—	%
AUDIO REJECTION <sup>1</sup>		—	50	—	dB
CONVERSION FREQUENCY	FREE RUN -55° TO +125°C	400	—	600	kHz
INHIBIT ACTIVE LOW (OUTPUT DISABLED) Do not apply a voltage to the inhibit pin. <sup>4</sup>	INHIBIT PIN PULLED LOW	—	—	0.8	VDC
	INHIBIT PIN SOURCE CURRENT <sup>1</sup>	—	—	4	mA
	REFERENCED TO	INPUT COMMON			
INHIBIT ACTIVE HIGH (OUTPUT ENABLED) Do not apply a voltage to the inhibit pin. <sup>4</sup>	INHIBIT PIN CONDITION	OPEN COLLECTOR OR UNCONNECTED			
	OPEN PIN VOLTAGE <sup>1</sup>	9	—	11	V

Notes:

1. Guaranteed by qualification test and/or analysis. Not an in-line test.
2. See "Figure 28: MGA Gull-Wing Solder Pad Layout" on page 13 for more information
3. Dual outputs: The over-current limit will trigger when the sum of the currents from both outputs reaches 115% (typical value) of the maximum rated "total" current of both outputs.
4. An external inhibit interface should be used to pull the inhibit low or leave it floating. The inhibit pin can be left unconnected if not used.

# MSA/MGA Single and Dual DC-DC Converters

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TABLE 9: ELECTRICAL CHARACTERISTICS: -55°C TO +125°C T<sub>C</sub>, 28 VDC V<sub>IN</sub>, 100% LOAD, FREE RUN, UNLESS OTHERWISE SPECIFIED.

MSA/MGA SINGLE OUTPUT MODELS		MSA2805S MGA2805S			MSA285R2S (no MGA285R2S)			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE		4.80	5.00	5.20	4.99	5.20	5.40	VDC
OUTPUT CURRENT	V <sub>IN</sub> = 16 to 40 VDC	0	—	1000	0	—	962	mA
OUTPUT POWER	V <sub>IN</sub> = 16 to 40 VDC	0	—	5	0	—	5	W
OUTPUT RIPPLE 10 KHZ - 2 MHZ	T <sub>C</sub> = 25°C	—	125	350	—	110	335	mV p-p
	T <sub>C</sub> = -55°C TO +125°C	—	—	525	—	—	525	
LINE REGULATION	V <sub>IN</sub> = 16 TO 40 VDC	—	10	50	—	10	50	mV
LOAD REGULATION	NO LOAD TO FULL	—	10	50	—	10	50	mV
INPUT VOLTAGE NO LOAD TO FULL	CONTINUOUS	16	28	40	16	28	40	VDC
	TRANSIENT 50 ms <sup>1</sup>	—	—	50	—	—	50	
INPUT CURRENT	NO LOAD	—	27	40	—	28	40	mA
	INHIBITED	—	3	5	—	3	4	
INPUT RIPPLE CURRENT <sup>2</sup>	10 kHz - 10 MHz	—	30	200	—	30	150	mA p-p
EFFICIENCY	T <sub>C</sub> = 25°C	66	71	—	66	71	—	%
	T <sub>C</sub> = -55°C TO +125°C	64	—	—	64	—	—	
LOAD FAULT <sup>3, 4</sup>	POWER DISSIPATION	—	—	2.0	—	—	2.2	W
SHORT CIRCUIT	RECOVERY <sup>1</sup>	—	—	75	—	—	75	ms
STEP LOAD RESPONSE <sup>4, 5</sup> 50% - 100% - 50%	TRANSIENT	—	—	±750	—	—	±750	mV pk
	RECOVERY	—	—	1500	—	—	1500	μs
STEP LINE RESPONSE <sup>1, 4, 5</sup> 16 - 40 - 16 VDC	TRANSIENT	—	—	±500	—	—	±500	mV pk
	RECOVERY	—	—	900	—	—	900	μs
START-UP 0 - 28 V <sub>IN</sub> , FULL LOAD	DELAY	—	—	75	—	—	75 <sup>1</sup>	ms
	OVERSHOOT <sup>1</sup>	—	—	200	—	—	500	mV pk
CAPACITIVE LOAD <sup>1</sup> T <sub>C</sub> = 25°C	NO EFFECT ON DC PERFORMANCE	—	—	300	—	—	300	μF

### Notes

1. Guaranteed by qualification test and/or analysis. Not an in-line test.
2. An external 2 μH inductor, added in series to the input, is necessary to maintain specifications.
3. Indefinite short circuit protection not guaranteed above 125°C (case).

4. Recovery time is measured from application of the transient to point at which V<sub>out</sub> is within 1% of V<sub>out</sub> at final value.
5. Transition time >10 μs.

# MSA/MGA Single and Dual DC-DC Converters

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TABLE 10: ELECTRICAL CHARACTERISTICS: -55°C TO +125°C T<sub>C</sub>, 28 VDC V<sub>IN</sub>, 100% LOAD, FREE RUN, UNLESS OTHERWISE SPECIFIED.

MSA/MGA SINGLE OUTPUT MODELS		MSA2812S MGA2812S			MSA2815S MGA2815S			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
PARAMETER	CONDITIONS							
OUTPUT VOLTAGE		11.52	12.00	12.48	14.40	15.00	15.60	VDC
OUTPUT CURRENT	V <sub>IN</sub> = 16 to 40 VDC	0	—	417	0	—	333	mA
OUTPUT POWER	V <sub>IN</sub> = 16 to 40 VDC	0	—	5	0	—	5	W
OUTPUT RIPPLE 10 KHZ - 2 MHZ	T <sub>C</sub> = 25°C	—	50	200	—	50	170	mV p-p
	T <sub>C</sub> = -55°C TO +125°C	—	—	300	—	—	250	
LINE REGULATION	V <sub>IN</sub> = 16 TO 40 VDC	—	10	50	—	10	50	mV
LOAD REGULATION	NO LOAD TO FULL	—	10	50	—	10	50	mV
INPUT VOLTAGE NO LOAD TO FULL	CONTINUOUS	16	28	40	16	28	40	VDC
	TRANSIENT 50 ms <sup>1</sup>	—	—	50	—	—	50	V
INPUT CURRENT	NO LOAD	—	29	42	—	31	44	mA
	INHIBITED	—	3	5	—	3	5	
INPUT RIPPLE CURRENT <sup>2</sup>	10 kHz - 10 MHz	—	30	150	—	30	150	mA p-p
EFFICIENCY	T <sub>C</sub> = 25°C	70	76	—	71	76	—	%
	T <sub>C</sub> = -55°C TO +125°C	68	—	—	69	—	—	
LOAD FAULT <sup>3, 4</sup>	POWER DISSIPATION	—	—	2.1	—	—	2.0	W
SHORT CIRCUIT	RECOVERY <sup>1</sup>	—	—	30	—	—	30	ms
STEP LOAD RESPONSE <sup>4, 5</sup> 50% - 100% - 50%	TRANSIENT	—	—	±1100	—	—	±1500	mV pk
	RECOVERY	—	—	3000	—	—	3500	μs
STEP LINE RESPONSE <sup>1, 4, 5</sup> 16 - 40 - 16 VDC	TRANSIENT	—	—	±800	—	—	±500	mV pk
	RECOVERY	—	—	1300	—	—	1300	μs
START-UP 0 - 28 V <sub>IN</sub> , FULL LOAD	DELAY	—	—	30	—	—	30	ms
	OVERSHOOT <sup>1</sup>	—	—	500	—	—	500	mV pk
CAPACITIVE LOAD <sup>1</sup> T <sub>C</sub> = 25°C	NO EFFECT ON DC PERFORMANCE	—	—	500	—	—	500	μF

### Notes

1. Guaranteed by qualification test and/or analysis. Not an in-line test.
2. An external 2 μH inductor, added in series to the input, is necessary to maintain specifications.
3. Indefinite short circuit protection not guaranteed above 125°C (case).
4. Recovery time is measured from application of the transient to point at which V<sub>out</sub> is within 1% of V<sub>out</sub> at final value.
5. Transition time >10 μs.



# MSA/MGA Single and Dual DC-DC Converters

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TABLE 11: ELECTRICAL CHARACTERISTICS: -55°C TO +125°C T<sub>C</sub>, 28 VDC V<sub>IN</sub>, 100% LOAD, FREE RUN, UNLESS OTHERWISE SPECIFIED.

MSA/MGA DUAL OUTPUT MODELS		MSA2805D MGA2805D			MSA2812D MGA2812D			MSA2815D MGA2815D			UNITS
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
OUTPUT VOLTAGE	+V <sub>OUT</sub>	4.80	5.00	5.20	11.52	12.00	12.48	14.40	15.00	15.60	VDC
	-V <sub>OUT</sub>	4.75	5.00	5.25	11.09	12.00	12.96	14.70	15.00	16.20	
OUTPUT CURRENT <sup>2</sup> V <sub>IN</sub> = 16 to 40 VDC	EITHER OUTPUT	—	±500	800	—	±208	333	—	±167	267	mA
	TOTAL OUTPUT	—	—	1000	—	—	416	—	—	334	
OUTPUT POWER <sup>2</sup> V <sub>IN</sub> = 16 to 40 VDC	EITHER OUTPUT	—	±2.50	4	—	±2.50	4	—	±2.50	4	W
	TOTAL OUTPUT	—	—	5	—	—	5	—	—	5	
OUTPUT RIPPLE 10 KHZ - 2 MHZ ± V <sub>OUT</sub>	T <sub>C</sub> = 25°C	—	—	150	—	40	140	—	60	150	mV p-p
	T <sub>C</sub> = -55°C TO +125°C	—	—	300	—	—	250	—	—	250	
LINE REGULATION V <sub>IN</sub> = 16 TO 40 V	+V <sub>OUT</sub>	—	10	25	—	10	50	—	10	50	mV
	-V <sub>OUT</sub>	—	40	75	—	40	180	—	40	180	
LOAD REGULATION NO LOAD TO FULL	+V <sub>OUT</sub>	—	10	50	—	10	50	—	10	50	mV
	-V <sub>OUT</sub>	—	50	200	—	50	200	—	50	200	
CROSS REGULATION <sup>1, 3</sup> EFFECT ON -V <sub>OUT</sub>	Figure 24 (10-90%)	—	10	20	—	8	15	—	7	15	%
	Figure 25 (50-10%)	—	5	8	—	3.7	6	—	3	6	
INPUT VOLTAGE NO LOAD TO FULL	CONTINUOUS	16	28	40	16	28	40	16	28	40	VDC
	TRANSIENT 50 ms <sup>1</sup>	—	—	50	—	—	50	—	—	50	V
INPUT CURRENT	NO LOAD	—	30	35	—	33	58	—	38	60	mA
	INHIBITED	—	3	5	—	3	5	—	3	5	
INPUT RIPPLE CURRENT <sup>4</sup>	10 kHz - 10 MHz	—	30	160	—	30	150	—	30	150	mA p-p
EFFICIENCY	T <sub>C</sub> = 25°C	68	72	—	69	75	—	70	75	—	%
	T <sub>C</sub> = -55°C TO +125°C	65	—	—	67	—	—	68	—	—	
LOAD FAULT <sup>5, 6</sup>	POWER DISSIPATION	—	—	2.0	—	—	1.9	—	—	1.8	W
SHORT CIRCUIT	RECOVERY <sup>1</sup>	—	—	50	—	—	30	—	—	50	ms
STEP LOAD RESPONSE <sup>6, 7</sup> 50% - 100% - 50%	TRANSIENT	—	—	±500	—	—	±1400	—	—	±1400	mV pk
	RECOVERY	—	—	1000	—	—	4500	—	—	4500	μs
STEP LINE RESPONSE <sup>1, 6, 7</sup> 16 - 40 - 16 VDC	TRANSIENT	—	—	±750	—	—	±500	—	—	±1500	mV pk
	RECOVERY	—	—	1.2	—	—	2.0	—	—	1.2	ms
START-UP 0 TO 28 V <sub>IN</sub> , FULL LOAD	DELAY	—	—	25	—	—	30	—	—	25	ms
	OVERSHOOT <sup>1</sup>	—	—	750	—	—	500	—	—	500	mV pk
CAPACITIVE LOAD <sup>1</sup> T <sub>C</sub> = 25°C	NO EFFECT ON DC PERFORMANCE	—	—	10	—	—	100	—	—	10	μF

### Notes

- Guaranteed by qualification test and/or analysis. Not an in-line test.
- Up to 4 watts (80% of full power) is available from either output providing the opposite output is carrying 20% of total power.
- Shows regulation effect on the minus output during defined cross loading conditions. See "Figure 24" and "Figure 25" on page 11.
- An external 2 μH inductor, added in series to the input, is necessary to maintain specifications.
- Indefinite short circuit protection not guaranteed above 125°C (case).
- Recovery time is measured from application of the transient to point at which V<sub>out</sub> is within 1% of V<sub>out</sub> at final value.
- Transition time >10 μs.

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TYPICAL PERFORMANCE PLOTS:

25°C T<sub>C</sub>, 28 V<sub>IN</sub>, 100% LOAD, FREE RUN, UNLESS OTHERWISE SPECIFIED.

These are examples for reference only and are not guaranteed specifications.

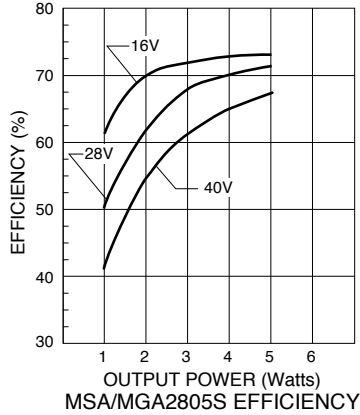


FIGURE 9

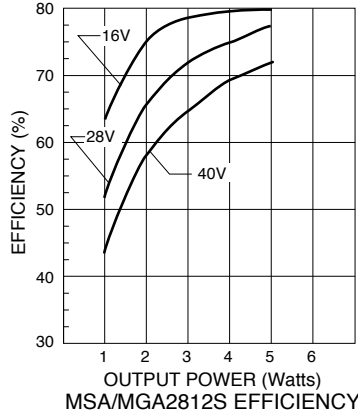


FIGURE 10

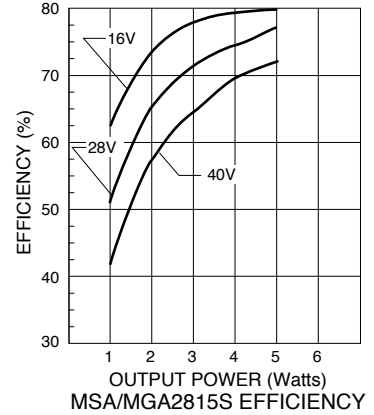


FIGURE 11

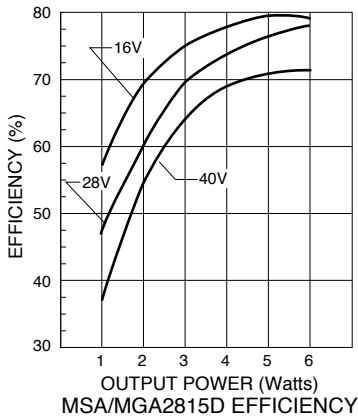


FIGURE 12

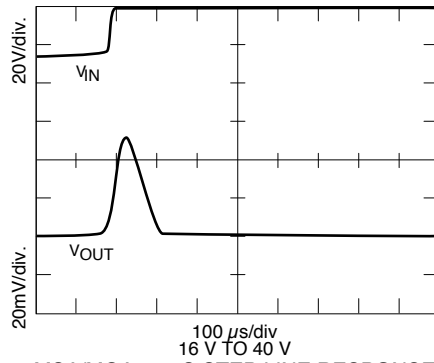


FIGURE 13

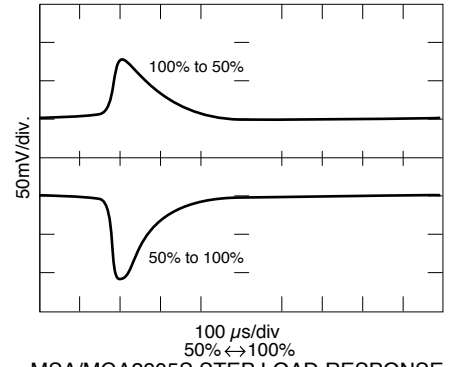


FIGURE 14

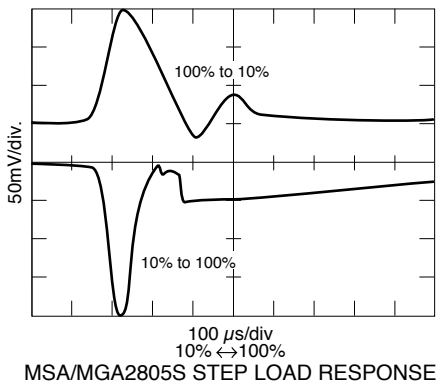


FIGURE 15

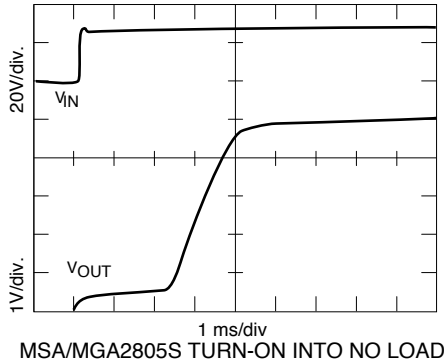


FIGURE 16

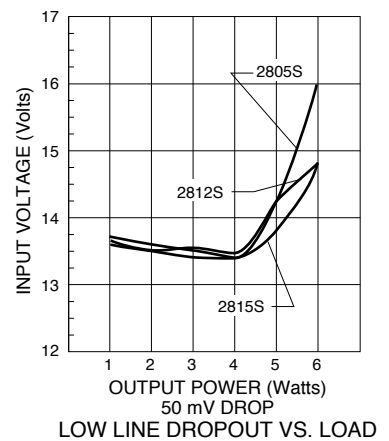


FIGURE 17

# MSA/MGA Single and Dual DC-DC Converters

## 28 VOLT INPUT – 5 WATT

TYPICAL PERFORMANCE PLOTS:

28 V<sub>IN</sub>, 25°C T<sub>C</sub>, 100% LOAD, FREE RUN, UNLESS OTHERWISE SPECIFIED.

These are examples for reference only and are not guaranteed specifications.

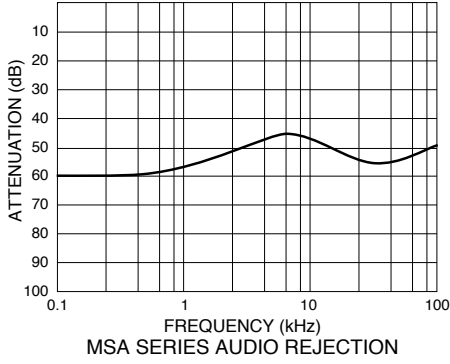


FIGURE 18

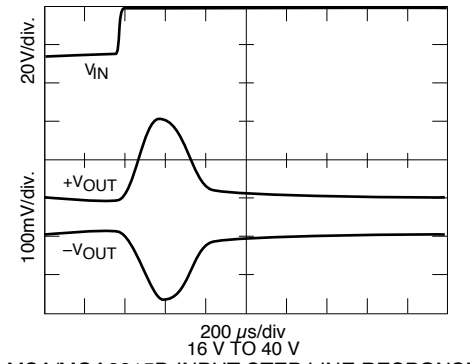


FIGURE 19

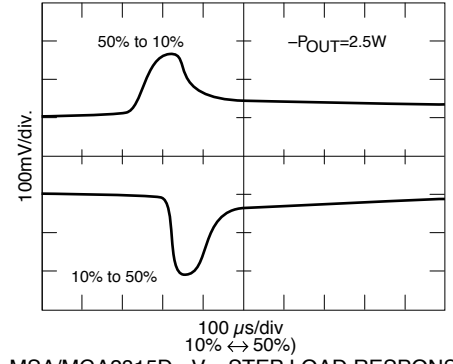


FIGURE 20

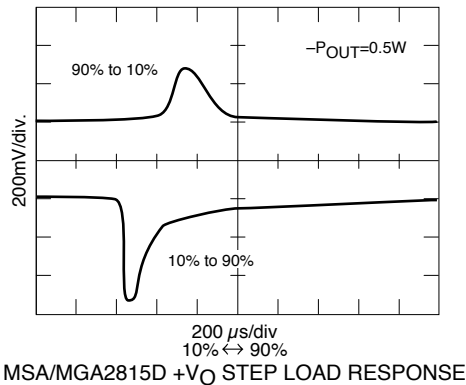


FIGURE 21

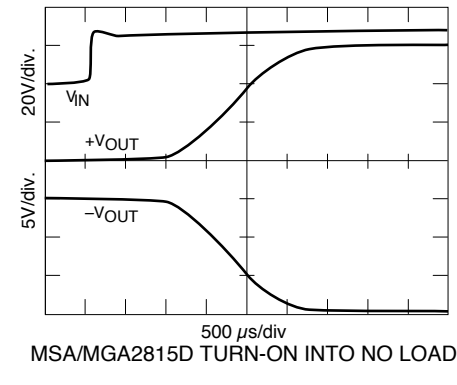
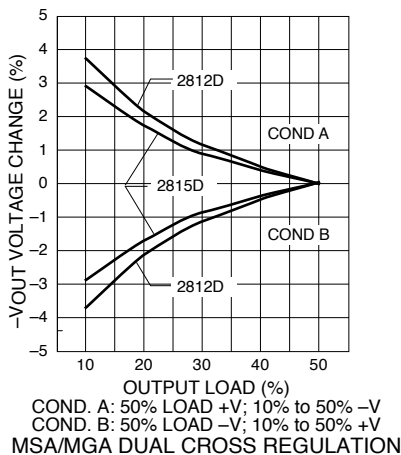
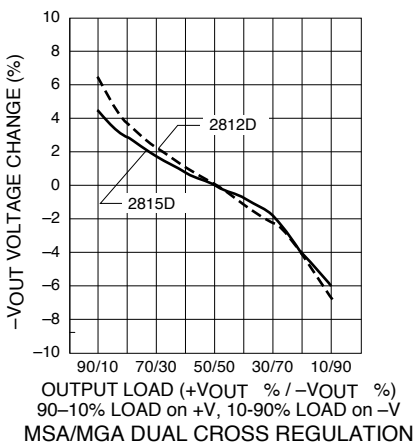
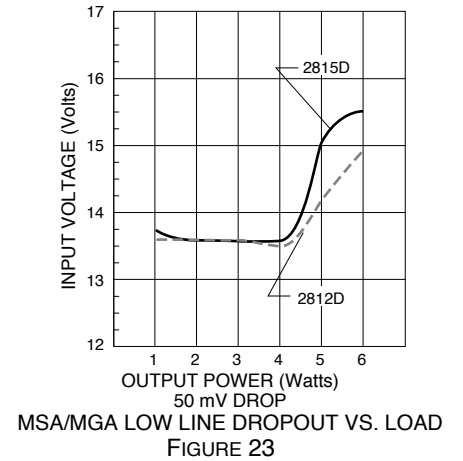


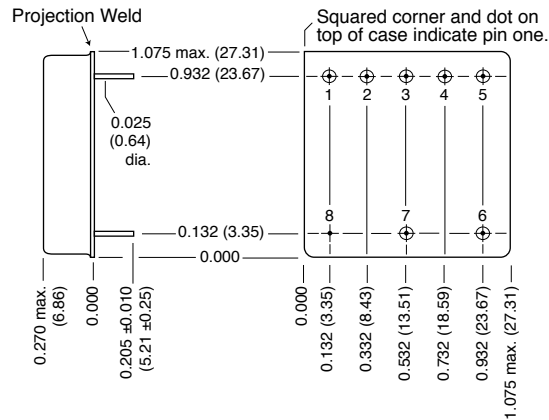
FIGURE 22



# MSA/MGA Single and Dual DC-DC Converters

## 28 VOLT INPUT – 5 WATT

### BOTTOM VIEW CASE C1



**Weight:** 15 grams maximum

#### Case dimensions in inches (mm)

Tolerance  $\pm 0.005$  (0.13) for three decimal places  
 $\pm 0.01$  (0.3) for two decimal places  
 unless otherwise specified

#### CAUTION

Heat from reflow or wave soldering may damage the device.  
 Solder pins individually with heat application  
 not exceeding 300°C for 10 seconds per pin.

#### Materials

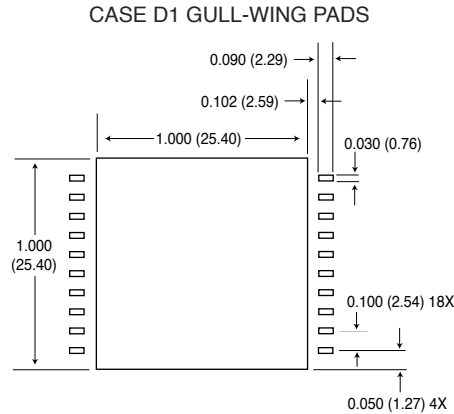
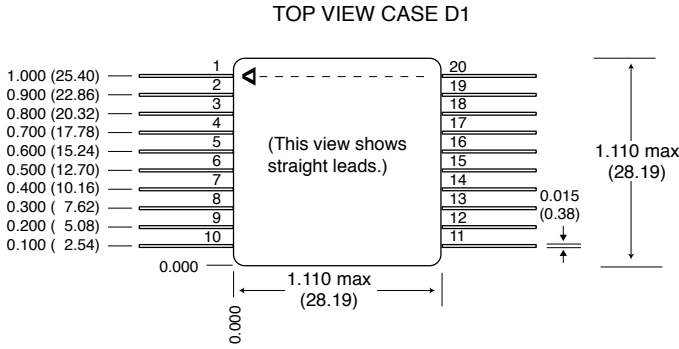
Header Cold Rolled Steel/Nickel/Gold  
 Cover Cold Rolled Steel/Nickel  
 Pins #52 alloy, gold, compression glass seal  
 Gold plating of 50 - 150 microinches included in pin diameter  
 Seal hole: 0.070 ±0.003 (1.78 ±0.08)

Case C1 MSA, Rev B, 2013.04.15  
 Please refer to the numerical dimensions for accuracy.

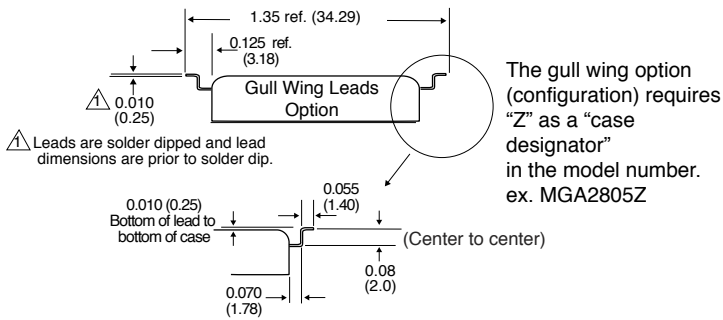
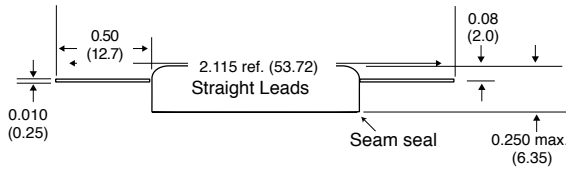
FIGURE 26: MSA CASE DIMENSIONS

# MSA/MGA Single and Dual DC-DC Converters

## 28 VOLT INPUT – 5 WATT



The triangle (ESD) marking on the cover indicates pin one. Cover marking is oriented with pin one at the upper right corner. The straight lead configuration does not require a "case designator" in the model number. ex. MGA2805S



Dimensions in inches (mm)  
Tolerance  $\pm 0.005$  (0.13) for three decimal places  $\pm 0.01$  (0.3) for two decimal places, unless otherwise specified. Please refer to the numerical dimensions for accuracy.

**CAUTION:**  
Internal components are soldered with SN96 (melting temperature 221°C) to prevent damage during reflow. Maximum reflow temperature for surface mounting the MGA converter is 220°C for a maximum of 30 seconds. SN60, 62, or 63 are the recommended types of solder. Hand soldering should not exceed 300°C for 10 seconds per pin.

**SOLDER MASK NOTES**

1. Pad dimensions are for the solder mask. Leads common to each other can be connected to each other as desired.
2. Ground (case) pins should be connected to the center pad for improved grounding.
3. Connect "no connection" pins to case ground to reduce EMI.
4. Center pad should not have a solder mask. Solder, copper, or Au/Ni plate are preferred over solder mask for adhesive attach.
5. Pre-tin base of converter prior to soldering.
6. If less rotation of case is desired, reduce the width of the large case pad by 0.020 inches (0.51 mm). Pad length can be extended 0.010 inches (0.25 mm) towards the case body and an as-desired dimension away from the case body.
7. Do not exceed 220°C as measured on the body of the converter (top or bottom).
8. Attach the body of the case to the board with a thermally conductive adhesive or SN60, 62, or 63 solder. The adhesive can be electrically conductive as well. It can be applied as an underfill post solder or dispensed and cured prior or during solder.
9. In the presence of vibration, to ensure reliable mechanical attachment, the body of the case should be attached with adhesive or solder as noted above (note 8). The leads alone do not provide sufficient mechanical attachment.

Case D1 MGA Solder Pads, Rev F, 2013.05.31

**Weight:** 15 grams max.

**Dimensions in inches (mm)**

Tolerance  $\pm 0.005$  (0.13) for three decimal places,  $\pm 0.01$  (0.3) for two decimal places, unless otherwise specified. Please refer to the numerical dimensions for accuracy.

**CAUTION**

Maximum reflow temperature is 220°C for a maximum of 30 seconds. SN60, SN62, or SN63 are the recommended types of solder. See MGA gull-wing solder pads layout. Hand soldering should not exceed 300°C for 10 seconds per pin.

**Materials**

- Header Kovar/Nickel/Gold
- Cover Kovar/Nickel
- Pins Kovar/Nickel/Gold matched glass seal
- Gold plating of 50 - 225 microinches is included in pin diameter
- Seal hole: 0.040  $\pm$  0.002 (1.02  $\pm$  0.05)

Case D1, Rev D, 2013.04.22

FIGURE 27: MGA CASE DIMENSIONS

FIGURE 28: MGA GULL-WING SOLDER PAD LAYOUT

SURFACE MOUNT CASE AND LEAD OPTIONS

## MSA/MGA Single and Dual DC-DC Converters

28 VOLT INPUT – 5 WATT

### STANDARD AND /ES (NON-QML) AND /883 (CLASS H, QML) MIL-PRF-38534 ELEMENT EVALUATION

COMPONENT-LEVEL TEST PERFORMED	NON-QML <sup>1</sup>	QML	
	STANDARD AND /ES	CLASS H /883	
	M/S <sup>2</sup>	M/S <sup>2</sup>	P <sup>3</sup>
Element Electrical	■	■	■
Visual		■	■
Internal Visual		■	
Final Electrical		■	■
Wire Bond Evaluation		■	■

Notes:

- Standard and /ES non-QML products may not meet all of the requirements of MIL-PRF-38534.
- M/S = Active components (Microcircuit and Semiconductor Die)
- P = Passive components, Class H element evaluation. Not applicable to Standard and /ES element evaluation.

TABLE 12: ELEMENT EVALUATION

# MSA/MGA Single and Dual DC-DC Converters

## 28 VOLT INPUT – 5 WATT

### STANDARD AND /ES (NON-QML) AND /883 (CLASS H, QML) MIL-PRF-38534 ENVIRONMENTAL SCREENING

TEST PERFORMED	NON-QML <sup>1</sup>		QML
	STANDARD	/ES	CLASS H /883
<b>Pre-cap Inspection, Method 2017, 2032</b>	■	■	■
<b>Temperature Cycle (10 times)</b>			
Method 1010, Cond. C, -65°C to +150°C, ambient			■
Method 1010, Cond. B, -55°C to +125°C, ambient		■	
<b>Constant Acceleration</b>			
Method 2001, 3000 g			■
Method 2001, 500 g		■	
<b>Burn-in Method 1015, +125°C case, typical <sup>2</sup></b>			
96 hours		■	
160 hours			■
<b>Final Electrical Test, MIL-PRF-38534, Group A,</b>			
Subgroups 1 through 6, -55°C, +25°C, +125°C case			■
Subgroups 1 and 4, +25°C case	■	■	■
<b>Hermeticity Test</b>			
Gross Leak, Method 1014, Cond. C		■	■
Fine Leak, Method 1014, Cond. A		■	■
Gross Leak, Dip	■		
<b>Final visual inspection, Method 2009</b>	■	■	■

Test methods are referenced to MIL-STD-883 as determined by MIL-PRF-38534.

Notes:

1. Standard and /ES, non-QML products, may not meet all of the requirements of MIL-PRF-38534.
2. Burn-in temperature designed to bring the case temperature to +125°C minimum. Burn-in is a powered test.

TABLE 13: ENVIRONMENTAL SCREENING