FEATURES

- **–55° to +125°C operation**
- **16 to 40 VDC input**
- Fully isolated
- Optocoupler feedback
- Fixed frequency, 550 kHz typical (400 kHz typ. 60 V output model)
- Topology – Flyback
- 50 V for up to 50 ms transient protection
- Inhibit function
- Indefinite short circuit protection
- Up to 76% efficiency, 16 W/in^3

DC/DC CONVERTERS 28 VOLT INPUT

MSA SERIES 5 WATT

MODELS VDC OUTPUT	
SINGLE	DUAL
5	±5
5.2	±12
12	±15
15	
60	

Size (max.): 1.075 x 1.075 x 0.270 inches (27.31 x 27.31 x 6.86 mm)
Weight: 15 grams maximum.
Screening: Standard, ES, or 883 (Class H).

DESCRIPTION

The MSA Series™ of high frequency DC/DC converters offers a new standard of performance for low power, military/aerospace grade DC/DC converters. MSA parts provide up to 5 watts 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 hermetically sealed case is only 1.075 by 1.075 inches — with a height of only 0.270 inches. Power density for the MSA Series parts is 16 watts per cubic inch.

The MSA Series' small size, low height, and hermetically sealed metal enclosures make them ideal for use in military, aerospace and other high reliability applications. Units are available with standard, screening, "ES", and fully compliant SMD "883" screening. See page 8 for screening options and descriptions.

CONVERTER DESIGN

The MSA converters are switching regulators that use a flyback converter design with a constant switching frequency of 550 kHz. They are regulated, isolated units using a pulse width modulated topology and 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. Each output must carry a minimum of 20% of the total output power in order to maintain specified regulation on the negative output. Predictable current limit is accomplished by direct monitoring of the output load current, which results in a constant current output above the overload point. Internal input and output filters eliminate the need for external capacitors.

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. Please refer to the low line dropout graphs (Figures 17 and 18) for details. A low voltage lockout feature keeps the converter shutdown below approximately 13 VDC to ensure smooth initialization.

IMPROVED DYNAMIC RESPONSE

The MSA 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%.

INHIBIT FUNCTION

MSA converters provide a TTL open collector-compatible inhibit feature that 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 TTL compatible low (≤0.8 V) is applied to the inhibit pin. The unit is enabled when the pin, which is internally connected to a pull-up resistor, is left unconnected or is connected to an open collector gate. 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.

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.

DC/DC CONVERTERS

ABSOLUTE MAXIMUM RATINGS

Input Voltage
- 16 to 40 V

Output Power
- 5 watts

Lead Soldering Temperature (10 sec per lead)
- 300°C

Storage Temperature Range (Case)
- –65°C to +135°C

INHIBIT

Inhibit TTL Open Collector
- Logic low (output disabled)
  Logic low voltage ≤0.8 V max
  Inhibit pin current 4 mA max
- Referenced to input common
- Logic high (output enabled)
  Open collector

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range
- 16 to 40 VDC continuous
- 50 V for up to 50 msec transient

Case Operating Temperature (Tc)
- –55°C to +125°C full power
- –55°C to +135°C absolute

Derating Output Power/Current (Tc)
- Linearly from 100% at 125°C to 0% at 135°C

TYPICAL CHARACTERISTICS

Output Voltage Temperature Coefficient
- 100 ppm/°C typical

Input to Output Capacitance
- 50 pF typical

Isolation
- 100 megohm minimum at 500 V

Audio Rejection
- 50 dB typical

Conversion Frequency
- 550 kHz typical (400 kHz 60 V model)
  450 kHz min, 600 kHz max
  350 kHz min, 450 kHz max 60 V model

Inhibit Pin Voltage (unit enabled)
- 9 to 11 V

Electrical Characteristics: 25°C Tc, 28 VDC Vin, 100% load, unless otherwise specified.

SINGLE OUTPUT MODELS		MSA2805S			MSA285R2S			MSA2812S			MSA2815S			MSA2860S[1]			
PARAMETER	**CONDITIONS**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**MIN**	**TYP**	**MAX**	**UNITS**
OUTPUT VOLTAGE	Tc = –55°C TO +125°C	4.95	5.00	5.05	5.15	5.20	5.25	11.88	12.00	12.12	14.85	15.00	15.15	59.1	60.00	60.9	VDC
OUTPUT CURRENT Tc = –55°C TO +125°C	V_{IN} = 16 TO 40 VDC	0	—	1000	0	—	962	0	—	417	0	—	333	0	—	20	mA
OUTPUT POWER	V_{IN} = 16 TO 40 VDC Tc = –55°C TO +125°C	—	—	5	—	—	5	—	—	5	—	—	5	—	—	1.2	W
OUTPUT RIPPLE VOLTAGE	10 kHz - 2 MHz	—	125	350	—	110	335	—	50	200	—	50	170	—	—	300	mV p-p
LINE REGULATION	V_{IN} = 16 TO 40 VDC Tc = –55°C TO +125°C	—	10	50[2]	—	10	50	—	10	50	—	10	50	—	—	300	mV
LOAD REGULATION	NO LOAD TO FULL Tc = –55°C TO +125°C	—	10	50	—	10	50	—	10	50	—	10	50	—	—	300	mV
INPUT VOLTAGE NO LOAD TO FULL	Tc = –55°C TO +125°C CONTINUOUS	16	28	40	16	28	40	16	28	40	16	28	40	16	28	40	VDC
	TRANSIENT 50 ms	0	—	50	0	—	50	0	—	50	0	—	50	0	—	50	V
INPUT CURRENT Tc = –55°C TO +125°C	NO LOAD	—	27	40	—	28	40	—	29	42	—	31	44	—	—	30	mA
	FULL LOAD	—	250	—	—	250	—	—	235	—	—	235	—	—	72	—	
	INHIBITED	—	3	5	—	3	5	—	3	5	—	3	5	—	3	5	
INPUT RIPPLE CURRENT	10 kHz - 10 MHz	—	25	100	—	25	100	—	25	100	—	25	100	—	—	90	mA p-p
	Tc = –55°C TO +125°C	—	30	150	—	30	150	—	30	150	—	30	150	—	—	—	
EFFICIENCY		66	71	—	66	71	—	70	76	—	71	76	—	70	75	—	%
LOAD FAULT[3, 4]	POWER DISSIPATION	—	1.5	2.0	—	1.5	2.0	—	1.2	1.9	—	1.2	1.8	—	—	—	W
SHORT CIRCUIT	RECOVERY	—	12.5	25	—	1.5	25	—	1	10	—	1	10	—	—	—	ms
STEP LOAD RESPONSE[4, 5]	50% - 100% - 50% TRANSIENT	—	100	250	—	100	250	—	150	375	—	200	500	—	—	—	mV pk
	RECOVERY	—	100	250	—	100	250	—	200	500	—	200	500	—	—	—	µs
STEP LINE RESPONSE[4, 5]	TRANSIENT 16 TO 40 V_{IN}	—	50	150	—	50	150	—	80	200	—	50	125	—	—	—	mV pk
	40 TO 16 V_{IN}	—	50	150	—	50	150	—	100	250	—	50	125	—	—	—	
	RECOVERY 16 TO 40 V_{IN}	—	100	250	—	100	250	—	250	625	—	250	625	—	—	—	µs
	40 TO 16 V_{IN}	—	200	500	—	200	500	—	250	625	—	250	625	—	—	—	
START-UP	DELAY	—	10	25	—	10	25	—	3	10	—	3	10	—	—	—	ms
	OVERSHOOT	—	0	50	—	0	50	—	0	120	—	0	150	—	—	—	mV pk

Notes

1. MSA2860S specifications are at 25°Tc only, contact your Interpoint representative for more information on over temperature specs.

2. Line regulation for /ES and non /ES 2805S models at 16 to 17 V_{IN} and 110 °C to 125°C (case) is 5% (max).

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_{OUT} is within 1% of V_{OUT} at final value.

5. Transition time >10µs.

Electrical Characteristics: 25°C Tc, 28 VDC Vin, 100% load, unless otherwise specified.

DUAL OUTPUT MODELS		MSA 2805D			MSA2812D			MSA2815D			
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
OUTPUT VOLTAGE	$+V_{OUT}$	4.95	5.00	5.05	11.88	12.00	12.12	14.85	15.00	15.15	VDC
	$-V_{OUT}$	4.9	5.0	5.1	11.76	12.00	12.24	14.70	15.00	15.30	
OUTPUT CURRENT[1]	V_{IN} = 16 to 40 VDC, Tc = –55°C to +125°C	—	±500	800	—	±208	333	—	±167	267	mA
OUTPUT POWER[1]	V_{IN} = 16 to 40 VDC, Tc = –55°C to +125°C	—	—	5	—	—	5	—	—	5	W
OUTPUT RIPPLE VOLT.	10 kHz - 2 MHz	—	—	150	—	40	140	—	60	150	mV p-p
LINE REGULATION Vin = 16 to 40 VDC	Tc = –55°C to +125°C, $+V_{OUT}$	—	10	25	—	10	50	—	10	50	mV
	Tc = –55°C to +125°C, $-V_{OUT}$	—	40	75	—	40	180	—	40	180	
LOAD REGULATION NO LOAD TO FULL	Tc = –55°C to +125°C, $+V_{OUT}$	—	10	50	—	10	50	—	10	50	mV
	Tc = –55°C to +125°C, $-V_{OUT}$	—	50	200	—	50	200	—	50	200	
CROSS REGULATION[2]	$+P_O$ = 20 - 80 %, $-P_O$ = 80 - 20% $-P_O$ = 20 - 80 %, $+P_O$ = 80 - 20%	—	10	20	—	8	15	—	7	15	%
	$+P_O$ = 50 - 10 %, $-P_O$ = 50% $-P_O$ = 50 - 10 %, $+P_O$ = 50%	—	5	8	—	3.7	6	—	3	6	
INPUT VOLTAGE Tc = –55°C to +125°	NO LOAD TO FULL, CONTINUOUS	16	28	40	16	28	40	16	28	40	VDC
	TRANSIENT 50 msec	—	—	50	—	—	50	—	—	50	V
INPUT CURRENT Tc = –55°C to +125°C	NO LOAD	—	30	35	—	33	58	—	38	60	mA
	FULL LOAD	—	248	—	—	235	—	—	235	—	
	INHIBITED	—	3	5	—	3	5	—	3	5	
INPUT RIPPLE CURRENT	10 kHz TO 10 MHz	—	25	80	—	25	100	—	25	100	mA p-p
	Tc = –55°C to +125°C	—	30	160	—	30	150	—	30	150	
EFFICIENCY		68	72	—	69	75	—	70	75	—	%
LOAD FAULT[3, 4]	POWER DISSIPATION SHORT CIRCUIT	—	1.3	1.8	—	1.3	1.7	—	1.3	1.6	W
	RECOVERY	—	—	50	—	1	10	—	1	10	ms
STEP LOAD RESPONSE[4, 5]	50% - 100% - 50% BALANCED TRANSIENT	—	—	±150	—	±300	±750	—	±300	±750	mV
	RECOVERY	—	—	100	—	200	500	—	500	1250	µs
STEP LINE RESP.[4, 5]	TRANSIENT, 16 TO 40 VDC	—	—	±750	—	±50	±125	—	±150	±375	mV pk
	TRANSIENT, 40 TO 16 VDC	—	—	±500	—	±50	±125	—	±100	±250	
	RECOVERY, 16 TO 40 VDC	—	—	1200	—	150	375	—	250	625	µs
	RECOVERY, 40 TO 16 VDC	—	—	1200	—	400	1000	—	800	2000	
START-UP	DELAY	—	—	25	—	3	10	—	3	10	ms
	OVERSHOOT	—	—	500	—	0	120	—	0	150	mV pk

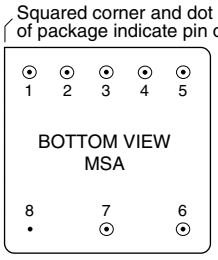
Notes

1. Up to 4 watts (80% of full power) is available from either output providing the opposite output is carrying 20% of total power.
2. Shows regulation effect on the minus output during the defined cross loading conditions. See Figures 15 and 16.
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_{OUT} is within 1% of V_{OUT} at final value.
5. Transition time >10µs.

DC/DC CONVERTERS

PIN OUT

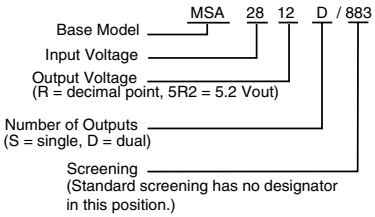
Pin	Single Output	Dual Output
1	Positive Output	Positive Output
2	Output Common	Output Common
3	No connection	Negative Output
4	No connection	No connection
5	Inhibit	Inhibit
6	Positive Input	Positive Input
7	Input Common	Input Common
8	Case Ground	Case Ground



See page 7 for dimensions.

FIGURE 1: PIN OUT BOTTOM VIEW

MODEL NUMBERING KEY



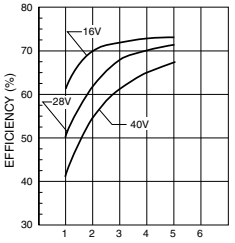
SMD NUMBERS

STANDARD MICROCIRCUIT DRAWING (SMD)	MSA SERIES SIMILAR PART
5962-9309201HXC	MSA2805S/883
IN PROCESS	MSA285R2S/883
5962-9309301HXC	MSA2812S/883
5962-9309401HXC	MSA2815S/883
5962-0052201HXC	MSA2860S/883
5962-9308901HXC	MSA2812D/883
5962-9309001HXC	MSA2815D/883

For exact specifications for an SMD product, refer to the SMD drawing. Call your Interpoint representative for status on MSA SMD releases. “883” suffix indicates SMD similar part. SMDs can be downloaded from:
http://www.dscc.dla.mil/programs/smcr

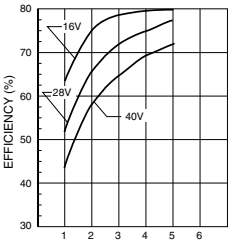
CRANE® interpoint
A CRANE CO. COMPANY

Typical Performance Curves: 25°C Tc, 28 VDC Vin, 100% load, unless otherwise specified.



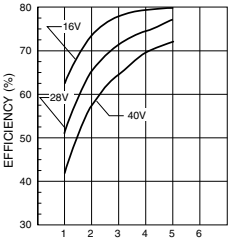
MSA2805S EFFICIENCY

FIGURE 2



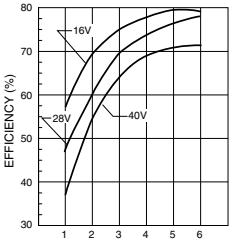
MSA2812S EFFICIENCY

FIGURE 3



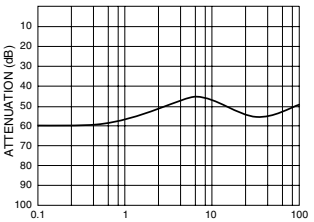
MSA2815S EFFICIENCY

FIGURE 4



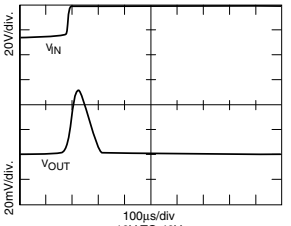
MSA2815D EFFICIENCY

FIGURE 5



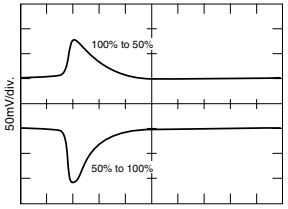
MSA SERIES AUDIO REJECTION

FIGURE 6



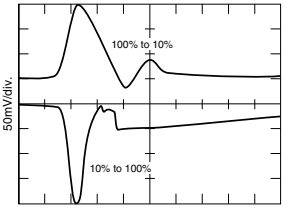
MSA2805S STEP LINE RESPONSE

FIGURE 7



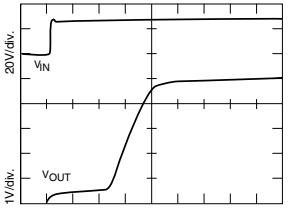
MSA2805S STEP LOAD RESPONSE

FIGURE 8



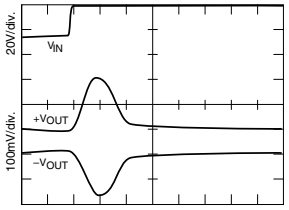
MSA2805S STEP LOAD RESPONSE

FIGURE 9



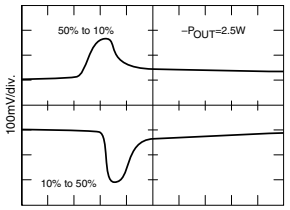
MSA2805S TURN-ON INTO NO LOAD

FIGURE 10



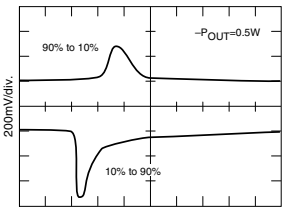
MSA2815D INPUT STEP LINE RESPONSE

FIGURE 11



MSA2815D +V_O STEP LOAD RESPONSE

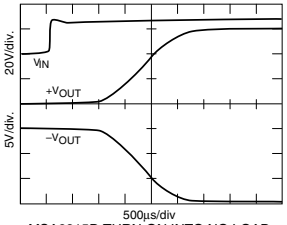
FIGURE 12



MSA2815D +V_O STEP LOAD RESPONSE

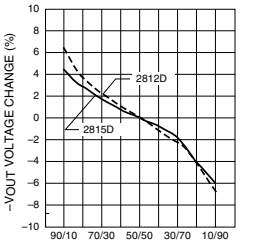
FIGURE 13

Typical Performance Curves: 25°C Tc, 28 VDC Vin, 100% load, unless otherwise specified.



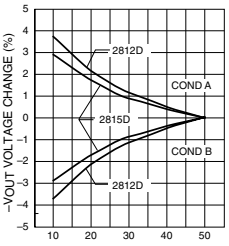
MSA2815D TURN-ON INTO NO LOAD

FIGURE 14



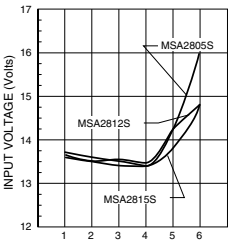
OUTPUT LOAD (+VOUT % / –VOUT %)
90–10% LOAD on +V, 10-90% LOAD on –V
MSA DUAL CROSS REGULATION

FIGURE 15



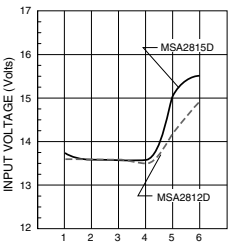
OUTPUT LOAD (%)
COND. A: 50% LOAD +V; 10% to 50% –V
COND. B: 50% LOAD –V; 10% to 50% +V
MSA DUAL CROSS REGULATION

FIGURE 16



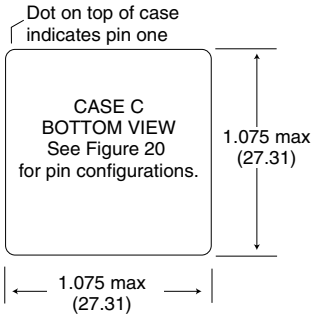
OUTPUT POWER (Watts)
50 mV DROP
LOW LINE DROPOUT VS. LOAD

FIGURE 17



OUTPUT POWER (Watts)
50 mV DROP
LOW LINE DROPOUT VS. LOAD

FIGURE 18



Materials
Header Cold Rolled Steel/Nickel/Gold
Cover Cold Rolled Steel/Nickel
Pins Copper/Nickel/Gold
compression glass seal

Case dimensions in inches (mm)
Tolerance
±0.005 (0.13) for three decimal places
±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.

FIGURE 19: CASE C MAXIMUM DIMENSIONS

BOTTOM VIEW CASE C1
MSA Series: Screening – Standard, ES, or 883

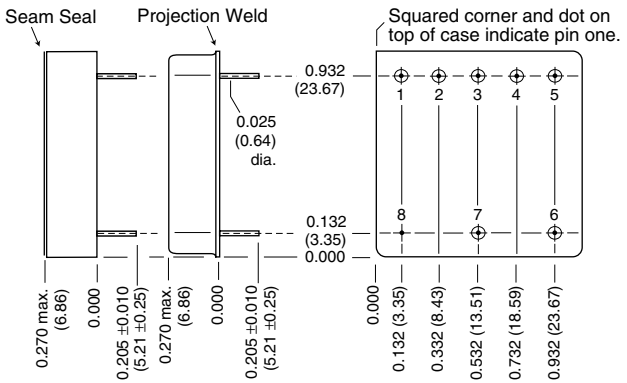


FIGURE 20: CASE C1

Note: Although every effort has been made to render the case drawings at actual size, variations in the printing process may cause some distortion. Please refer to the numerical dimensions for accuracy.

DC/DC CONVERTERS

ENVIRONMENTAL SCREENING

TEST (125°C Products)	STANDARD	/ES	/883 (Class H)*
PRE-CAP INSPECTION			
Method 2017, 2032	yes	yes	yes
TEMPERATURE CYCLE (10 times)			
Method 1010, Cond. C, -65°C to 150°C	no	no	yes
Method 1010, Cond. B, -55°C to 125°C	no	yes	no
CONSTANT ACCELERATION			
Method 2001, 3000 g	no	no	yes
Method 2001, 500 g	no	yes	no
BURN-IN			
Method 1015, 160 hours at 125°C	no	no	yes
96 hours at 125°C case (typical)	no	yes	no
FINAL ELECTRICAL TEST MIL-PRF-38534, Group A			
Subgroups 1 through 6: -55°C, +25°C, +125°C	no	no	yes
Subgroups 1 and 4: +25°C case	yes	yes	no
HERMETICITY TESTING			
Fine Leak, Method 1014, Cond. A	no	yes	yes
Gross Leak, Method 1014, Cond. C	no	yes	yes
Gross Leak, Dip (1 x 10^{-3})	yes	no	no
FINAL VISUAL INSPECTION			
Method 2009	yes	yes	yes

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

*883 products are built with element evaluated components and are 100% tested and guaranteed over the full military temperature range of –55°C to +125°C.

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