

- Up to 5 watts output power
- 0.27 inch height
- -55°C to +125°C full power operation
- 16 to 40 Vdc input
- 5, 12, 15, ± 12 , ± 15 Vdc outputs
- Input to output to case isolation
- Input voltage surge protected to MIL-STD-704A
- No external capacitors required
- Up to 50 dB audio rejection
- SMD models available

GENERAL INFORMATION

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 1.065 by 1.065 inches — with a height of only .027 inch. Power density for the MSA Series parts is 16 watts per cubic inch — an increase of 60% over Interpoint's 3.5 watt MSR Series parts.

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 in both unscreened, screened and fully compliant SMD versions (see Screening Options table for conditions). Unscreened parts undergo gross leak hermeticity testing and full electrical tests. Custom versions, screened per customer specification control drawings, are also available.

CONVERTER DESIGN

The MSA converters are switching regulators that use a fly-back 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 loop 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-704D emergency power conditions is possible with derated power. Please refer to the low line dropout graphs (Figures 4 and 6) 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 min. to max. 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 ($\leq 0.8V$) 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 Vdc. In the inhibit mode, a maximum of 4 mA must be sunk from the inhibit pin.

Undervoltage lockout helps keep system current levels low during initialization or re-start operations. These converters comply with MIL-STD-704 A-D relating to application of over-voltage on the input line. They can withstand short term transients of up to 80 volts without damage.

ELECTRICAL CHARACTERISTICS: $T_c = 25^\circ\text{C}$, $V_{IN} = 28\text{ Vdc}$ unless otherwise specified.

OPERATING TEMPERATURE RANGE:

Full Power: -55°C to $+125^\circ\text{C}$ (case)
 Absolute: -55°C to $+135^\circ\text{C}$ (case)
 STORAGE TEMPERATURE RANGE: -65°C to $+135^\circ\text{C}$ (case)
 OUTPUT VOLTAGE TEMPERATURE COEFFICIENT:
 0.010%/°C (typical)
 TEMPERATURE RISE (STILL AIR): 22°C/W dissipated (typ)
 ISOLATION: 100 megohm minimum at 500 Vdc
 AUDIO REJECTION: 50 dB (typical)
 WEIGHT: 15 grams (max)

CONVERSION FREQUENCY:

450 kHz min., 550 typ., 600 max.

OUTPUT INHIBIT PIN:

TTL logic high = output enabled

TTL logic low = output disabled

Open circuit voltage = 9 to 11 Vdc

Logic low current = 4.0 mA (max.)

Logic low voltage level = 0.8V (max.)

MEAN TIME BETWEEN FAILURES: 668,000 hrs. (AIT, 85°C)

SINGLE OUTPUT MODELS

PARAMETER	CONDITION	MSA2805S			MSA285R2S			MSA2812S			MSA2815S			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
INPUT VOLTAGE	$T_c = -55^\circ\text{C}$ to $+125^\circ\text{C}$ NO LOAD TO FULL NORMAL TRANSIENT ¹	16 0	28 —	40 80	16 0	28 —	40 80	16 0	28 —	40 80	16 0	28 —	40 80	Vdc
INPUT CURRENT	$T_c = -55^\circ\text{C}$ to $+125^\circ\text{C}$ NO LOAD FULL LOAD INHIBITED	—	27 250 3	40 — 4	—	28 250 3	40 — 4	—	29 235 3	42 — 4	—	31 235 3	44 — 4	mA
OUTPUT VOLTAGE	FULL LOAD	4.95	5.00	5.05	5.15	5.20	5.25	11.88	12.00	12.12	14.85	15.00	15.15	Vdc
OUTPUT CURRENT ²	$V_o = 16$ to 40 Vdc $T_c = -55^\circ\text{C}$ to $+125^\circ\text{C}$	0	—	1000	0	—	962	0	—	417	0	—	333	mA
OUTPUT POWER ²	$V_o = 16$ to 40 Vdc $T_c = -55^\circ\text{C}$ TO $+125^\circ\text{C}$	—	—	5	—	—	5	—	—	5	—	—	5	W
EFFICIENCY	FULL LOAD	66	71	—	66	71	—	70	76	—	71	76	—	%
LINE REGULATION	$T_c = -55^\circ\text{C}$ to $+125^\circ\text{C}$ FULL LOAD V_o MIN TO MAX	—	10	50 ³	—	10	50	—	10	50	—	10	50	mV
LOAD REGULATION	NO LOAD TO FULL, $T_c = -55^\circ\text{C}$ TO $+125^\circ\text{C}$	—	10	50	—	10	50	—	10	50	—	10	50	mV
OUTPUT RIPPLE VOLTAGE	FULL LOAD, 10 kHz–2 MHz	—	125	350	—	110	335	—	50	200	—	50	170	mVp-p
INPUT RIPPLE CURRENT	FULL LOAD, 10 kHz–10 MHz $T_c = 25^\circ\text{C}$ $T_c = -55^\circ\text{C}$ TO $+125^\circ\text{C}$	—	25 30	100 150	—	25 30	100 150	—	25 30	100 150	—	25 30	100 150	mAp-p
LOAD FAULT POWER DISSIPATION ⁴	SHORT CIRCUIT	—	1.5	2.0	—	1.5	2.0	—	1.2	1.9	—	1.2	1.8	W
LOAD FAULT RECOVERY ⁵	SHORT CIRCUIT TO FULL LOAD	—	12.5	25	—	1.5	25	—	1	10	—	1	10	mS
STEP LOAD RESPONSE, TRANSIENT	50% TO 100%; 100% TO 50% 10% TO 100% 100% TO 10%	—	100 220 150	250 550 375	—	100 220 150	250 550 375	—	150 350 300	375 875 750	—	200 300 300	500 750 750	mVpk
STEP LOAD RESPONSE, RECOVERY ⁶	50% TO 100%; 100% TO 50% 10% TO 100% 100% TO 10%	—	100 100 200	250 250 500	—	100 100 200	250 250 500	—	200 1000 1000	500 2500 2500	—	200 400 400	500 1000 1000	μS
STEP LINE RESPONSE, TRANSIENT ⁶	16 to 40 Vdc 40 to 16 Vdc	—	50 50	150 150	—	50 50	150 150	—	80 100	200 250	—	50 50	125 125	mVpk
STEP LINE RESPONSE, RECOVERY ⁶	16 to 40 Vdc 40 to 16 Vdc	—	100 200	250 500	—	100 200	250 500	—	250 250	625 625	—	250 250	625 625	μS
INPUT/OUTPUT CAPACITANCE		—	50	—	—	50	—	—	40	—	—	60	—	pF
STARTUP DELAY OVERSHOOT	FULL LOAD FULL LOAD	—	10 0	25 50	—	10 0	25 50	—	3 0	10 120	—	3 0	10 150	mS mVpk

Notes:

- 80V limit rated for up to 50 mS.
- Derate output power/current linearly from 100% at $+125^\circ\text{C}$ to 0 at $+135^\circ\text{C}$.
- 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).

- Indefinite short circuit protection not guaranteed above 125°C (case).
- Recovery time is measured from application of the transient to point at which V_{OUT} is within 1% of V_{OUT} at final value.
- Transition time $>10\mu\text{S}$.

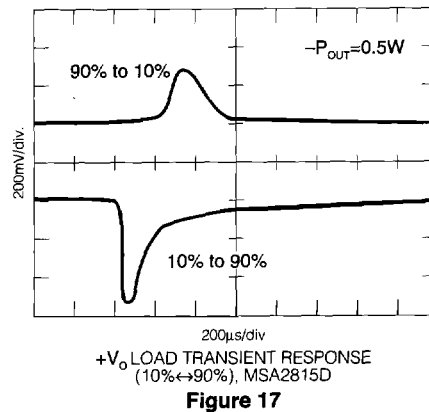
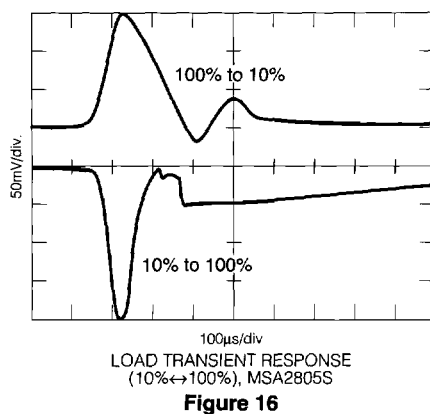
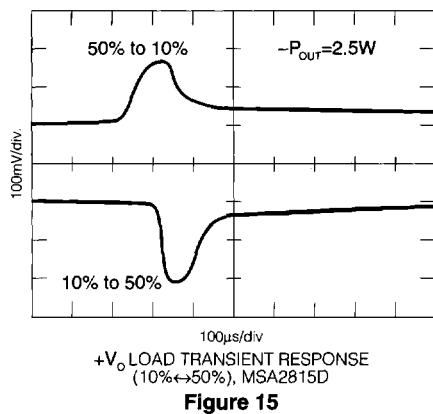
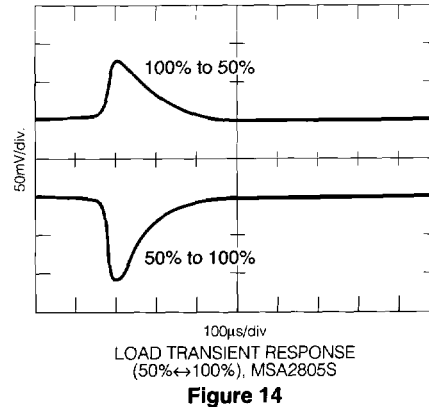
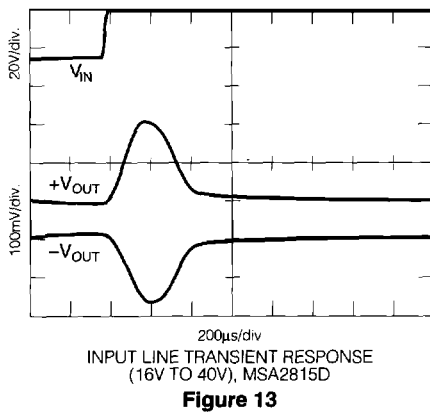
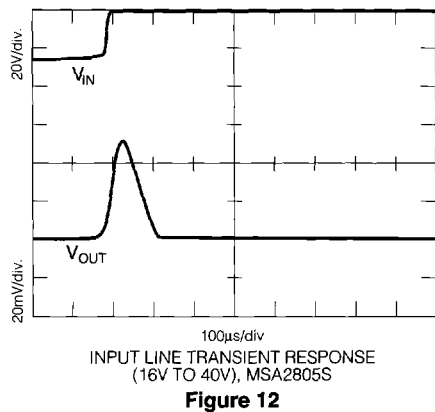
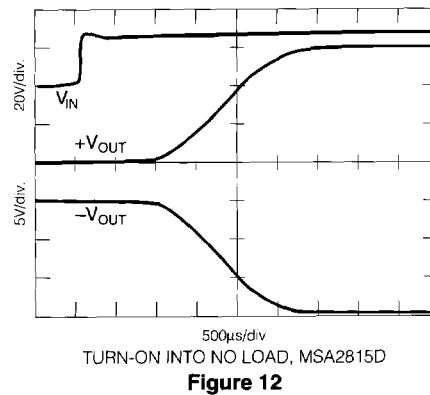
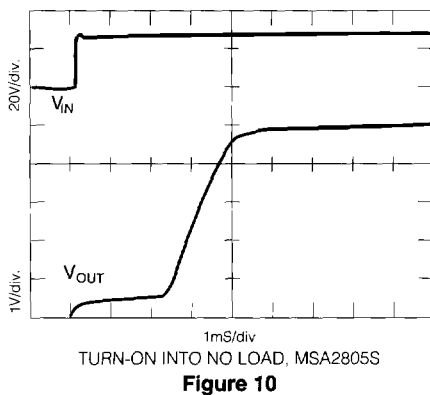
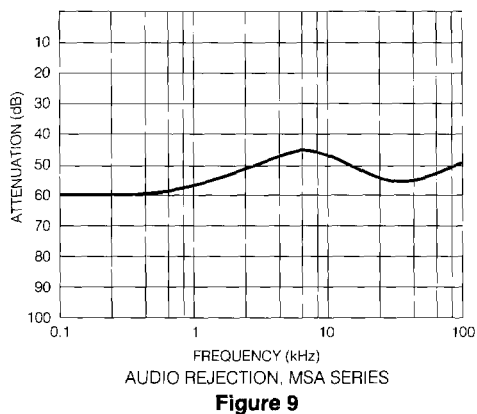
DUAL OUTPUT MODELS

PARAMETER	CONDITION	MSA2812D			MSA2815D			UNITS	
		MIN	TYP	MAX	MIN	TYP	MAX		
INPUT VOLTAGE	T _c = -55°C to +125°C NO LOAD TO FULL NORMAL TRANSIENT ¹	16 0	28 —	40 80	16 0	28 —	40 80	Vdc	
INPUT CURRENT	T _c = -55°C to +125°C NO LOAD FULL LOAD INHIBITED	— — —	33 235 3	58 — 4	— — —	38 235 3	60 — 4	mA	
OUTPUT VOLTAGE	FULL LOAD	+V _{out} -V _{out}	11.88 -11.76	12.00 -12.00	12.12 -12.24	14.85 -14.70	15.00 -15.00	15.15 -15.30	Vdc
OUTPUT CURRENT ^{2,3}	V _{in} = 16 to 40 Vdc T _c = -55°C to +125°C	0	±208	333	0	±167	267	mA	
OUTPUT POWER ^{2,3}	V _{in} = 16 to 40 Vdc T _c = -55°C to +125°C	0	—	5	0	—	5	W	
EFFICIENCY	FULL LOAD	69	75	—	70	75	—	%	
LINE REGULATION ³	T _c = -55°C to +125°C, FULL LOAD V _{in} MIN to MAX	+V _{out} -V _{out}	— —	10 40	50 180	— —	10 40	50 180	mV
LOAD REGULATION	NO LOAD TO FULL, T _c = -55°C to +125°C	+V _{out} -V _{out}	— —	10 50	50 200	— —	10 50	50 200	mV
OUTPUT RIPPLE VOLTAGE	FULL LOAD, 10 kHz-2 MHz	—	40	140	—	60	150	mVp-p	
INPUT RIPPLE CURRENT	FULL LOAD, 10 kHz-10 MHz T _c = 25°C T _c = -55°C to +125°C	— —	25 30	100 150	— —	25 30	100 150	mA _{p-p}	
LOAD FAULT POWER DISSIPATION ⁵	SHORT CIRCUIT	—	1.3	1.7	—	1.3	1.6	W	
LOAD FAULT RECOVERY ⁵	SHORT CIRCUIT TO FULL LOAD	—	1	10	—	1	10	mS	
STEP LOAD RESPONSE, TRANSIENT	+P _o = 10-50%, -P _o = 50% +P _o = 50-10%, -P _o = 50% +P _o = 10-90%, -P _o = 10% +P _o = 90-10%, -P _o = 10%	— — — —	200 200 350 300	500 500 875 750	— — — —	220 180 400 300	550 450 1000 750	mVpk	
STEP LOAD RESPONSE, RECOVERY ⁵	+P _o = 10-50%, -P _o = 50% +P _o = 50-10%, -P _o = 50% +P _o = 10-90%, -P _o = 10% +P _o = 90-10%, -P _o = 10%	— — — —	200 200 200 200	500 500 500 500	— — — —	200 200 500 500	500 500 1250 1250	μS	
STEP LINE RESPONSE, TRANSIENT ⁷	16 to 40 Vdc 40 to 16 Vdc	— —	50 50	125 125	— —	150 100	375 250	mVpk	
STEP LINE RESPONSE, RECOVERY ⁸	16 to 40 Vdc 40 to 16 Vdc	— —	150 400	375 1000	— —	250 800	625 2000	μS	
INPUT/OUTPUT CAPACITANCE		—	50	—	—	50	—	pF	
CROSS REGULATION ⁴	+P _o = 20-80%, -P _o = 80-20% -P _o = 20-80%; +P _o = 80-20% +P _o = 50-10%, -P _o = 50% -P _o = 50-10%, +P _o = 50%	— —	8 3.7	15 6	— —	7 3	15 6	%	
STARTUP DELAY OVERSHOOT	FULL LOAD FULL LOAD	— —	3 0	10 120	— —	3 0	10 150	mS mVpk	

Notes:

- 80V limit rated for up to 50 mS.
- Derate output power/ current linearly from 100% at +125°C to 0 at +135°C.
- Up to 4 watts (80% 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 the defined cross loading conditions. See figure 7 & 8.
- Indefinite short circuit protection not guaranteed above 125°C (case).
- Recovery time is measured from application of the transient to point at which V_{out} is within 1% of V_{out} at final value.
- Transition time > 10μS.

TYPICAL PERFORMANCE CURVES



TYPICAL PERFORMANCE CURVES

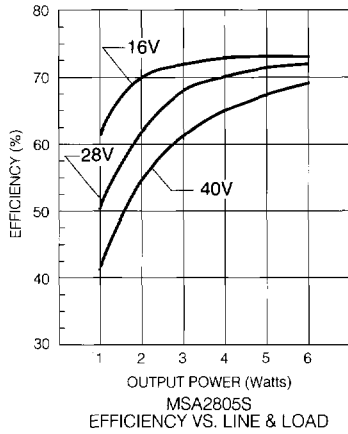


Figure 1

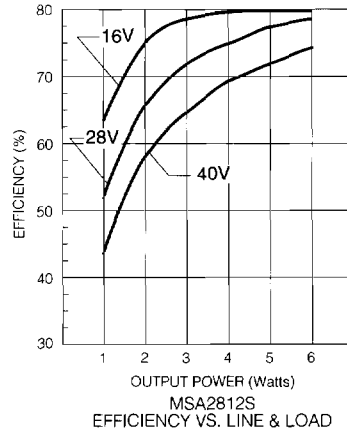


Figure 2

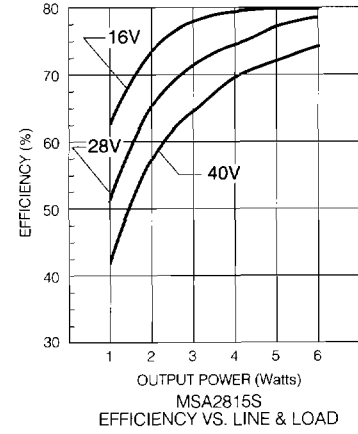


Figure 3

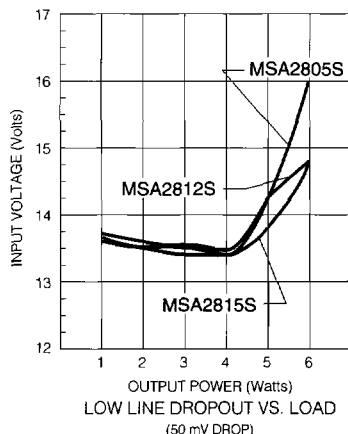


Figure 4

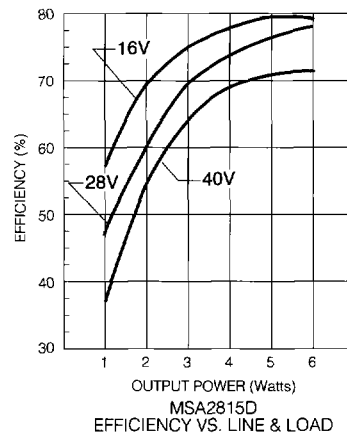


Figure 5

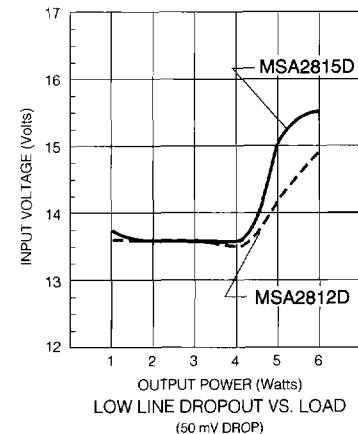


Figure 6

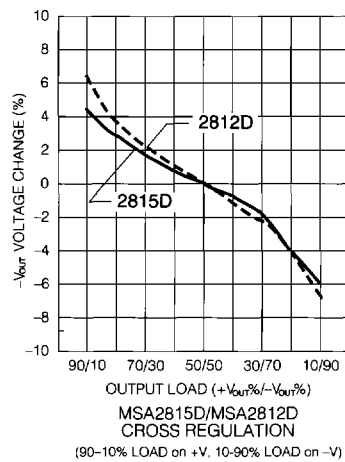


Figure 7

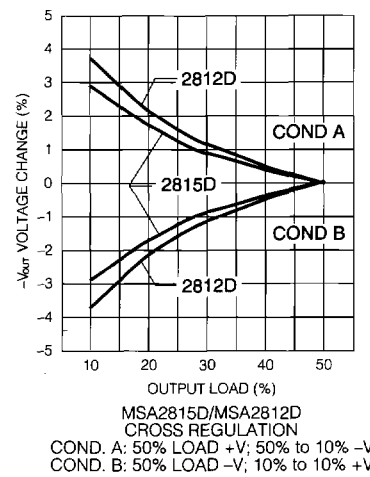


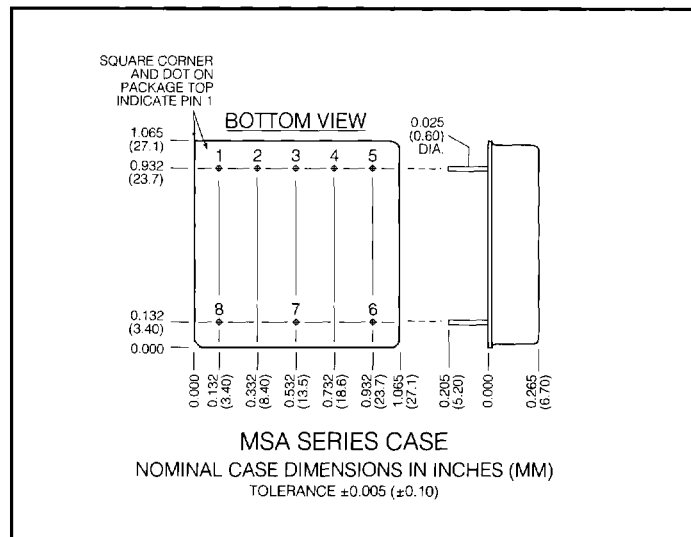
Figure 8

SCREENING OPTIONS*

	/ES	/SX /883		/ES	/SX /883
PRE-CAP INSPECTION Method 2017, 2032	•	•	FINAL VISUAL INSPECTION Method 2009	•	•
TEMPERATURE CYCLE (10 times) Method 1010, Cond. C. (-65°C to +150°C) Method 1010, -55 to +125°C	•	•	FINAL ELECTRICAL TEST MIL-H 38534, Group A 25°C case	•	•
CONSTANT ACCELERATION Method 2001, Cond. A (5000 g) Method 2001, 500 g	•	•	HERMETICITY TESTING Fine Leak, Method 1014, Cond. A Gross Leak, Method 1014, Cond., C	•	•
BURN-IN Method 1015, 160 hours at 125°C (min) 96 hours at 125°C case (typ.)	•	•	*All methods and conditions referenced to MIL-STD-883.		

To order model options, enter screening designation as suffix to the part number. For example, MSA 2805S/883. On unscreened parts, the screening code block is marked "01"; on /ES screened parts, it is marked "02". For /SX or /883 parts, "SX" or "883" appears in the screening code block. /SX parts receive the same screening levels as /883 parts but may not be built exclusively with MIL-H-38534 qualified processes and element evaluated components.

METAL HERMETIC PACKAGE:



DESIGNATION	MSA2805S MSA285R2S MSA2812S MSA2815S MSA2812D MSA2815D
	PIN NO.
Positive output	1
Output common	2
Negative output*	3
Inhibit	5
Positive input	6
Input common	7
Case ground	8
OTHER PINS — NO CONNECTION	

*Dual models only

CASE: Cold rolled steel with gold finish.

COVER: Cold rolled steel with nickel finish.

CAUTION: Heat from reflow or wave soldering may damage this part. Solder pins individually with heat application NOT exceeding 300°C for 10 seconds per pin.

STANDARD MILITARY DRAWING (SMD) MODELS AVAILABLE

STANDARD MILITARY DRAWING	MSA SIMILAR PART
5962-9309201HXC	MSA2805S/883
5962-9309301HXC	MSA2812S/883
5962-9309401HXC	MSA2815S/883
5962-9308901HXC	MSA2812D/883
5962-9309001HXC	MSA2815D/883