DC/DC CONVERTERS
28 VOLT INPUT

MCH SERIES
1.5 WATT

FEATURES

- **-55°C to +125°C operation**
- **12 to 50 VDC input**
- Fully isolated
- Magnetic feedback
- Fixed frequency 370 kHz typ.
- Topology – Current Mode Flyback
- 80 V for up to 120 ms transient protection (70 V for 15 V single and dual models)
- Inhibit function
- Short circuit protection
- Undervoltage lockout

MODELS	
VDC OUTPUT	
SINGLES	DUALS
3.3	±5
5	±12
5.2	±15
12	
15	

Size (max.): 0.975 x 0.800 x 0.270 inches (24.77 x 20.32 x 6.86 mm)
See Section B8, case A2, for dimensions.
Weight: 12 grams max.
Screening: Standard, ES, or 883 (Class H). See Section C2 for screening options, see Section A5 for ordering information.

DESCRIPTION

With a miniature footprint of just 0.8 square inches, the MCH Series™ of DC/DC converters delivers 1.5 watts of output power while saving significant board real estate. The wide input voltage range of 12 to 50 VDC accepts the varying voltages of military, aerospace, or space bus power and tightly regulates output voltages to protect downstream components. Transient protection of 80 volts for up to 120 milliseconds exceeds the requirements of MIL-STD-704A for the 3.3, 5, 5.2, and 12 volt single models and the 12 volt dual model. The 15 volt single and dual converters will withstand transients of up to 70 volts for up to 120 milliseconds.

CONVERTER DESIGN

MCH Series DC/DC converters incorporate a continuous flyback topology with a constant switching frequency of approximately 370 kHz. Current-mode pulse width modulation (PWM) provides output voltage regulation. Output error voltage is magnetically fed back to the input side of the PWM to regulate output voltage. Regulation is also affected by the load; refer to the Electrical Characteristics tables on the following pages.

Dual models regulate the negative output with magnetic coupling to the positive output. Up to 80% of the load may be on one output providing that the other output carries a minimum of 20% of the total load. The dual models can be used at double the output voltage by connecting the load between positive and negative outputs, leaving the common unconnected. (ex: MCH2805D can be used as a 10 VDC output.)

INHIBIT FUNCTION

When an open collector TTL logic low is applied to the inhibit terminal, pin 7, the converter shuts down and lowers the output voltage to near zero and input current to as low 2.3 mA. Leaving the terminal open or applying an open collector TTL logic high will enable the converter.

PROTECTION FEATURES

Undervoltage lockout prevents the MCH Series converters from operating below approximately 8 VDC input voltage to keep system current levels smooth, especially during initialization or re-start operations. All models include a soft-start function to prevent large current draw and minimize overshoot. The converters also provide short circuit protection by restricting the current.

MIL-STD-461

Use Interpoint's FMSA-461 EMI filter to pass the CE03 requirements of MIL-STD-461C.

CONVENIENT PACKAGING

The MCH Series converters are packaged in hermetically sealed, projection-welded metal cases which provide EMI/RFI shielding.

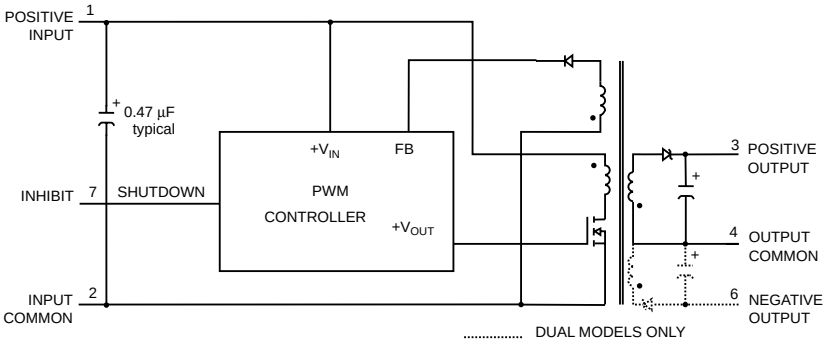

FIGURE 1: BLOCK DIAGRAM

MCH SERIES
1.5 WATT

DC/DC CONVERTERS

ABSOLUTE MAXIMUM RATINGS

Input Voltage
- 12 to 50 VDC

Output Power
- 1.5 W

Capacitive Load
- Single output models 200 µF
- Dual output models 100 µF

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

Storage Temperature Range (Case)
- –65°C to +150°C

INHIBIT

Inhibit – TTL Open Collector
- Logic low (output disabled) 0.8 V max
  Inhibit pin current 1 mA max
- Referenced to input common
- Logic high (output enabled) open collector

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range
- 12 to 50 VDC continuous
- 80 V for 120 msec transient
  (70 V for 15 V single and dual models)

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
- 100 to 170 pF typical

Undervoltage Lockout
- 8 V input typical

Current Limit
- 125% of full load typical

Isolation
- 100 megohm minimum at 500 V

Audio Rejection 40 dB, typical

Conversion Frequency (kHz)
- 25°C, 300 min, 370 typ, 450 max
- –55°C to +125°C
  270 min, 370 typ, 470 max

Inhibit Pin Voltage (unit enabled)
- 7 to 12 V

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

SINGLE OUTPUT MODELS		MCH283R3S			MCH2805S			MCH285R2S			MCH2812S			MCH2815S			
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
OUTPUT VOLTAGE[1]	Tc = 25°C				4.95	5	5.05				11.88	12	12.12	14.85	15	15.15	VDC
	Tc = –55°C TO +125°C				4.80	5	5.20				11.52	12	12.48	14.40	15	15.60	
OUTPUT CURRENT	V_{IN} = 12 to 50 VDC				0	—	300				0	—	125	0	—	100	mA
OUTPUT POWER	V_{IN} = 12 TO 50 VDC				0	—	1.5				0	—	1.5	0	—	1.5	W
OUTPUT RIPPLE	10 kHz - 2 MHz				—	45	150				—	50	200	—	35	150	mV p-p
VOLTAGE	Tc = –55°C TO +125°C				—	65	300				—	70	300	—	50	250	
LINE REGULATION	V_{IN} = 12 TO 50 VDC				—	35	100				—	60	200	—	70	300	mV
	Tc = –55°C TO +125°C				—	40	120				—	70	250	—	80	350	
LOAD REGULATION	10% TO FULL LOAD				—	350	700				—	600	1300	—	700	1500	mV
	Tc = –55°C TO +125°C				—	380	800				—	640	1400	—	760	1600	
	50% TO FULL				—	100	200				—	145	300	—	165	350	
	Tc = –55°C TO +125°C				—	115	300				—	160	400	—	185	450	
INPUT VOLTAGE	CONTINUOUS				12	28	50				12	28	50	12	28	50	VDC
NO LOAD TO FULL	TRANSIENT 120 ms				0	—	80				0	—	80	0	—	70	V
INPUT CURRENT	NO LOAD				—	5.5	10				—	6	10	—	6.0	11	mA
	Tc = –55°C TO +125°C				—	6.0	11				—	6.5	12	—	6.5	12	
	FULL LOAD				—	70	74				—	68	72	—	68	72	
	Tc = –55°C TO +125°C	AVAILABLE			—	73	78	AVAILABLE			—	70	74	—	70	74	
	INHIBITED	SOON, ASK			—	2.3	3.2	SOON, ASK			—	2.3	3.2	—	2.3	3.2	
	Tc = –55°C TO +125°C	YOUR			—	2.4	3.5	YOUR			—	2.4	3.5	—	2.4	3.5	
INPUT RIPPLE	10k Hz - 10 MHz	INTERPOINT			—	100	200	INTERPOINT			—	100	200	—	100	200	mA p-p
CURRENT[2]	Tc = –55°C TO +125°C	REP FOR			—	130	250	REP FOR			—	150	250	—	150	250	
EFFICIENCY	Tc = 25°C				72	77	—				74	79	—	74	79	—	%
	Tc = –55°C TO +125°C	INFORMATION			69	75	—	INFORMATION			72	77	—	72	77	—	
LOAD FAULT[3, 4]	POWER DISSIPATION				—	1.3	2.0				—	2.0	3.2	—	2.3	3.7	W
	Tc = –55°C TO +125°C				—	1.4	2.3				—	2.2	3.5	—	2.5	4.0	
	RECOVERY				—	3.0	12				—	3.5	15	—	4.0	18	ms
	Tc = –55°C TO +125°C				—	3.5	15				—	3.5	20	—	4.0	20	
STEP LOAD	50 %–100%– 50% LOAD																
RESPONSE[5]	TRANSIENT				–400	185	400				–700	350	700	–700	350	700	mV pk
	Tc = –55°C TO +125°C				–500	185	500				–800	380	800	–800	380	800	
	RECOVERY				—	125	500				—	130	500	—	140	600	µs
	Tc = –55°C TO +125°C				—	125	600				—	130	600	—	180	750	
STEP LINE	12 TO 50 TO 12 V_{IN}																
RESPONSE[5]	TRANSIENT				–400	170	400				–900	400	900	–750	400	750	mV pk
	Tc = –55°C TO +125°C				–500	180	500				–1000	400	1000	–850	450	850	
	RECOVERY				—	0.75	3.0				—	0.6	2.5	—	0.47	2.0	ms
	Tc = –55°C TO +125°C				—	0.75	4.0				—	0.6	3.0	—	0.5	2.5	
START-UP	DELAY				—	7	20				—	7	20	—	7	20	ms
0 TO 28 VDC	Tc = –55°C TO +125°C				—	10	40				—	10	40	—	10	40	
	OVERSHOOT				—	0	100				—	0	250	—	0	300	mV pk
	Tc = –55°C TO +125°C				—	0	150				—	0	350	—	0	450	

See notes 1, 2, 3, 4, 5, and 6 on the following page.

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

DUAL OUTPUT MODELS		MCH2805D			MCH2812D			MCH2815D			
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
OUTPUT VOLTAGE[1]	Tc = 25°C	±4.95	±5	±5.05	±11.88	±12	±12.12	±14.85	±15	±15.15	VDC
	Tc = –55°C TO +125°C	±4.80	±5	±5.20	±11.52	±12	±12.48	±14.40	±15	±15.60	
OUTPUT CURRENT[6]	V_{IN} = 12 TO 50 VDC	0	±150	240	0	±62.5	100	0	±50	80	mA
OUTPUT POWER	V_{IN} = 12 TO 50 VDC	0	—	1.5	0	—	1.5	0	—	1.5	W
OUTPUT RIPPLE VOLTAGE $+V_{OUT}$	10 kHz - 2 MHz	—	35	150	—	35	150	—	30	150	mV p-p
	Tc = –55°C TO +125°C	—	50	250	—	40	250	—	35	250	
$–V_{OUT}$	10 kHz - 2 MHz	—	35	150	—	35	150	—	30	150	
	Tc = –55°C TO +125°C	—	50	250	—	40	250	—	35	250	
LINE REGULATION[7]	V_{IN} = 12 TO 50 VDC	—	10	50	—	100	300	—	165	500	mV
	Tc = –55°C TO +125°C	—	20	100	—	110	400	—	180	650	
LOAD REGULATION[8] $±V_{OUT}$	10% TO FULL	—	300	600	—	550	1100	—	600	1300	mV
	–55°C TO +125°C	—	350	700	—	570	1200	—	630	1400	
	50% TO FULL	—	80	200	—	115	250	—	125	300	
	–55°C TO +125°C	—	100	300	—	130	350	—	135	400	
INPUT VOLTAGE	CONTINUOUS	12	28	50	12	28	50	12	28	50	VDC
NO LOAD TO FULL	TRANSIENT 120 ms	0	—	80	0	—	80	0	—	70	V
INPUT CURRENT	NO LOAD	—	5.0	10	—	7.5	13	—	7.5	13	mA
	Tc = –55°C TO +125°C	—	6.0	12	—	8.0	14	—	8.0	14	
	FULL LOAD	—	69	73	—	70	73	—	71	74	
	Tc = –55°C TO +125°C	—	72	77	—	71	77	—	72	78	
	INHIBITED	—	2.3	3.2	—	2.3	3.2	—	2.3	3.2	
	Tc = –55°C TO +125°C	—	2.4	3.5	—	2.4	3.5	—	2.4	3.5	
INPUT RIPPLE[2] CURRENT	10 kHz - 10 MHz	—	100	200	—	115	200	—	90	200	mA p-p
	Tc = –55°C TO +125°C	—	130	250	—	150	250	—	120	250	
EFFICIENCY	Tc = 25°C	73	77	—	73	77	—	72	76	—	%
	Tc = –55°C TO +125°C	70	75	—	70	75	—	69	74	—	
LOAD FAULT[3,4]	POWER DISSIPATION	—	1.4	2.2	—	2.5	3.8	—	2.7	4.1	W
	Tc = –55°C TO +125°C	—	1.6	2.5	—	2.7	4.2	—	3.0	4.5	
	RECOVERY	—	3.7	15	—	3.2	15	—	4.0	15	ms
	Tc = –55°C TO +125°C	—	3.8	20	—	3.2	20	—	4.0	20	
STEP LOAD RESPONSE[5] ± V_{OUT}	50 %–100%– 50% LOAD										
	TRANSIENT	–300	130	300	–600	250	600	–600	250	600	mV pk
	Tc = –55°C TO +125°C	–400	140	400	–700	260	700	–700	270	700	
	RECOVERY	—	100	400	—	165	700	—	50	200	µs
	–55°C TO +125°C	—	100	500	—	165	800	—	50	300	
STEP LINE RESPONSE[5] ± V_{OUT}	12 TO 50 TO 12 V_{IN}										
	TRANSIENT	–250	125	250	–500	240	500	–500	220	500	mV pk
	Tc = –55°C TO +125°C	–300	130	300	–600	250	600	–600	230	600	
	RECOVERY	—	0.6	2.5	—	0.9	3.0	—	0.6	3.0	ms
	Tc = –55°C TO +125°C	—	0.6	3.0	—	0.9	4.0	—	0.7	4.0	
START–UP 0 TO 28 VDC, ± V_{OUT}	DELAY	—	8	25	—	8	25	—	8	25	ms
	Tc = –55°C TO +125°C	—	10	45	—	10	45	—	10	45	
	OVERSHOOT	—	0	100	—	0	250	—	0	750	mV pk
	Tc = –55°C TO +125°C	—	0	150	—	0	350	—	0	900	

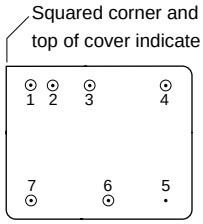
Notes:

1. Specified at 50% load.
2. Lin = 2 µH.
3. Maximum duration of short circuit:: 25°C-– 90 seconds, 125°C – 30 seconds.
4. Load fault is a short circuit (<50 mohms). Recovery is into resistive full load.
5. Transition ≥ 10 µs. Recovery = time to settle to within 1% of Vout final value.
6. Max. spec indicates 80% of the converter's total power, available from either output.
7. Specification applies to both + and – Vout.
8. Although no minimum load is required, at no load the output voltage may increase up to 15%.

DC/DC CONVERTERS

PIN OUT

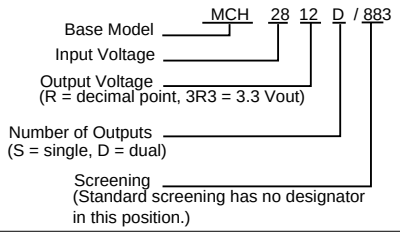
Pin	Single Output	Dual Output
1	Positive Input	Positive Input
2	Input Common	Input Common
3	Positive Output	Positive Output
4	Output Common	Output Common
5	Case Ground	Case Ground
6	No connection	Negative Output
7	Inhibit	Inhibit



Refer to Section B8, case A2, for dimensions.

FIGURE 2: PIN OUT

MODEL NUMBERING KEY



SMD NUMBERS

STANDARD MICROCIRCUIT DRAWING (SMD)	MCH SERIES SIMILAR PART
IN PROCESS	MCH283R3S/883
5962-9569601HXC	MCH2805S/883
IN PROCESS	MCH285R2S/883
5962-9569701HXC	MCH2812S/883
5962-9569801HXC	MCH2815S/883
5962-9570201HXC	MCH2805D/883
5962-9570301HXC	MCH2812D/883
5962-9570401HXC	MCH2815D/883

For exact specifications for an SMD product, refer to the SMD drawing. Call your Interpoint representative for status on the MCH Series SMD releases which are “in process”. See Section A3, SMDs, for more information.

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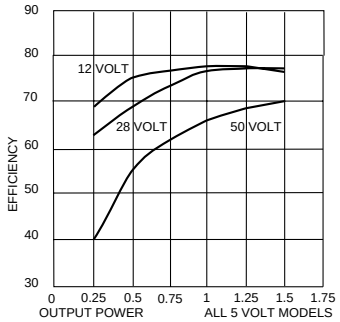
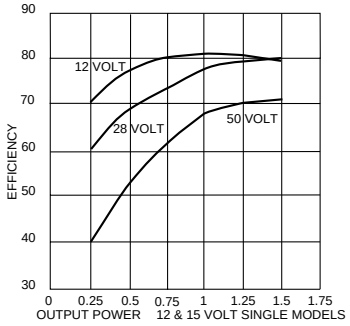
TYPICAL PERFORMANCE CURVES: Tc = 25°C, full load, Vin = 28 VDC, unless otherwise specified.



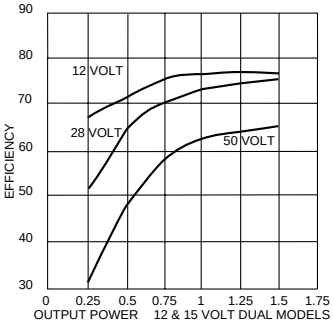
EFFICIENCY vs LOAD

FIGURE 3



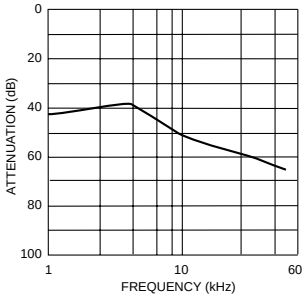
EFFICIENCY vs LOAD

FIGURE 4



EFFICIENCY vs LOAD

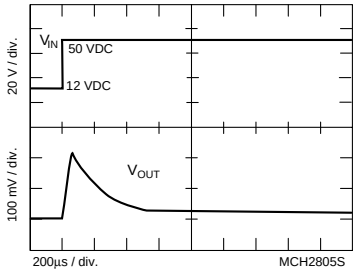
FIGURE 5



MCH2815S - Representative of all models

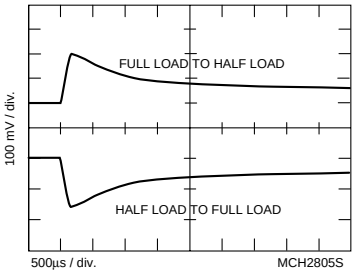
AUDIO REJECTION

FIGURE 6



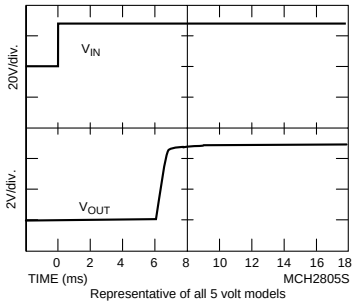
LINE TRANSIENT RESPONSE

FIGURE 7



LOAD TRANSIENT RESPONSE

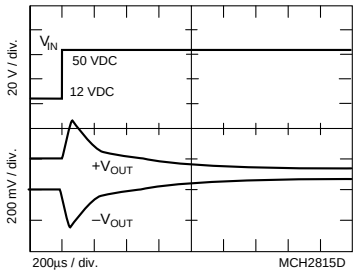
FIGURE 8



Representative of all 5 volt models

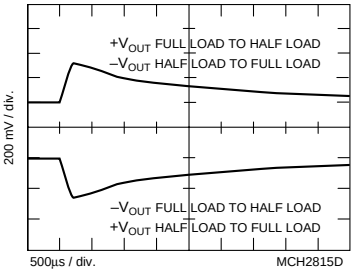
TURN-ON INTO FULL LOAD

FIGURE 9



LINE TRANSIENT RESPONSE

FIGURE 10

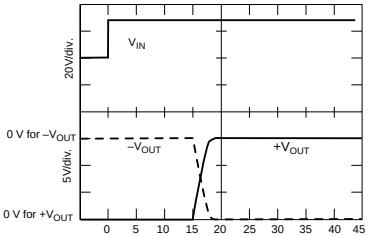


LOAD TRANSIENT RESPONSE

FIGURE 11

DC/DC CONVERTERS

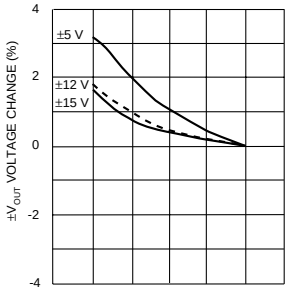
TYPICAL PERFORMANCE CURVES: Tc = 25°C, full load, Vin = 28 VDC, unless otherwise specified.



Also representative of MCH2812S & D and MCH2815S

TURN-ON INTO FULL LOAD

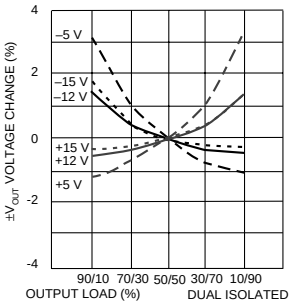
FIGURE 12



50% LOAD +V; 50% TO 10% LOAD –V
AND
50% LOAD –V; 50% TO 10% LOAD +V

CROSS REGULATION

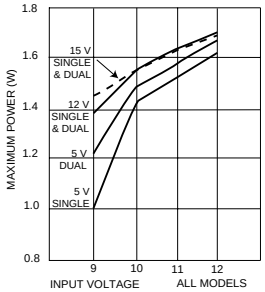
FIGURE 13



90% TO 10% LOAD ON +V
10% TO 90% LOAD ON –V

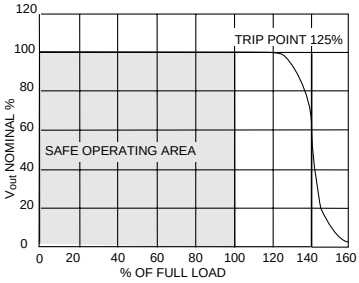
CROSS REGULATION

FIGURE 14



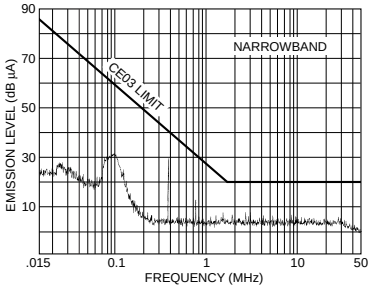
LOW LINE DROPOUT

FIGURE 15



OUTPUT VOLTAGE vs. OUTPUT LOAD

FIGURE 16



MCH FILTERED WITH FMSA

FIGURE 17

22422-001-DTS Rev A DQ# 1015

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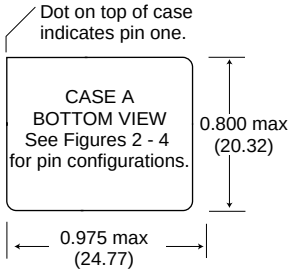
CASES



Materials

Header	Kovar/Nickel/Gold (Case A3, Kovar/Nickel)
Cover	Kovar/Nickel
Pins	Kovar/Nickel/Gold, matched 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 1: CASE A MAXIMUM DIMENSIONS

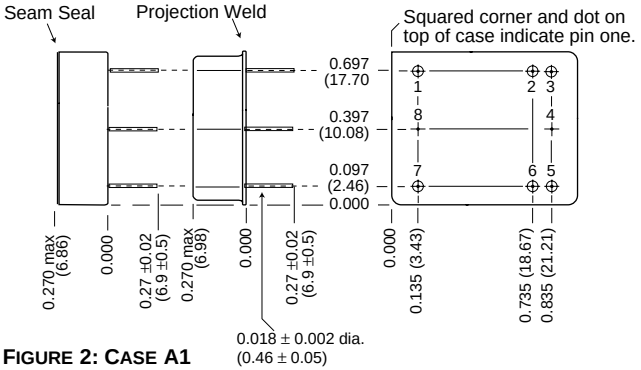


FIGURE 2: CASE A1

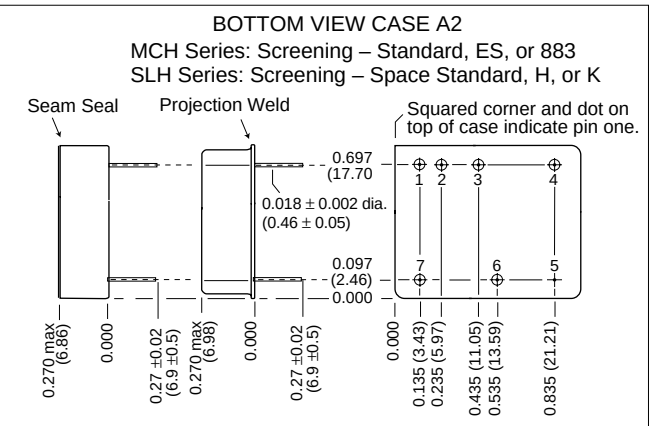


FIGURE 3: CASE A2

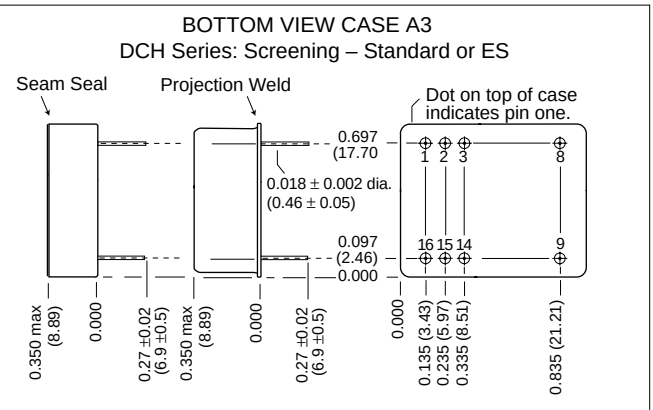


FIGURE 4: CASE A3

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.

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125°C PRODUCTS

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 (1×10^{-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.

Applies to the following products

MOR Series	MHD Series	MGH Series	FMGA EMI Filter
MFLHP Series	MHV Series	MCH Series	FMSA EMI Filter
MFL Series	MHF+ Series	FM-704A EMI Filter	HUM Modules**
MHP Series	MHF Series**	FMD**/FME EMI Filter	LCM Modules**
MTR Series	MGA Series	FMC EMI Filter	LIM Modules
MQO Series**	MSA Series	FMH EMI Filter	

**MFLHP Series, MQO Series, MHF Series, FMD EMI Filters, Hum Modules, and LCM Modules do not offer ‘883” screening.