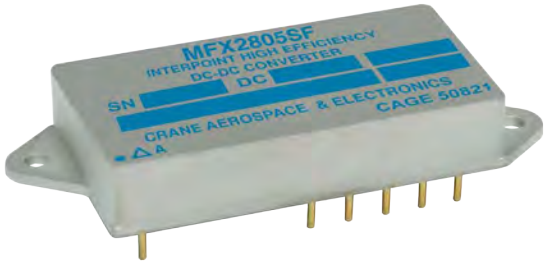
MFX Single Output DC-DC Converters

16 TO 50 VOLTS INPUT - 50 WATT

FEATURES

- **90% typical efficiency**
- **Wide input range, 16 to 50 volts**
- **Transient protection up to 80 volts per MIL-STD-704A**
- **Fully isolated, magnetic feedback**
- **-55°C to +125°C operation**
- **Undervoltage lockout**
- **Inhibit function**



MODELS OUTPUT VOLTAGE (V)
SINGLE
3.3
5

DESCRIPTION

The Interpoint® MFX Series™ of high efficiency dc-dc converters offers a wide input voltage range of 16 to 50 volts and up to 50 watts of output power. The units are capable of withstanding short term transients up to 80 volts per MIL-STD-704A. The package is a hermetically sealed, welded metal case. Flanged and non-flanged models are available.

CONVERTER DESIGN

The MFX converters are switching regulators that use an active-clamp, single-ended forward converter and synchronous rectification design with a constant switching frequency of 500 kHz, typical. Isolation between input and output circuits is provided with transformers in the forward path and in the feedback control loop.

HIGHER POWER DENSITY

The MFX Series offers a new standard of performance for small size and high power density. At just 0.426 inches high and a total footprint of 2.34 in^2, this low profile package offers a total power density of approximately 50 watts per cubic inch.

LOW NOISE

The MFX converters current mode control system provides excellent dynamic response and noise rejection. Output voltage response for a 50% to 100% step load transient is as low as 5% with a 350 μs, or less, recovery time.

INHIBIT FUNCTION

MFX converters provide an inhibit terminal that can be used to disable internal switching, resulting in no output and very low quiescent input current. The converter is inhibited when an active low (≤0.8 V – output disabled) is applied to the inhibit pin. The unit is enabled when the pin, which is internally connected to a pull-up current source, is left unconnected or is connected to an open-collector. The open circuit voltage associated with the inhibit pin is 14 to 18 volts. The inhibit pin may sink up to 4 mA maximum when driven to an active low condition. See Table 6 on page 6 for more information.

SHORT CIRCUIT PROTECTION

MFX Series converters provide short circuit protection by restricting the output current to approximately 125% of the full load output current.

UNDERVOLTAGE LOCKOUT

Undervoltage lockout with hysteresis prevents the units from operating below approximately 15 volts input voltage to keep system current levels smooth, especially during initialization or re-start operations.

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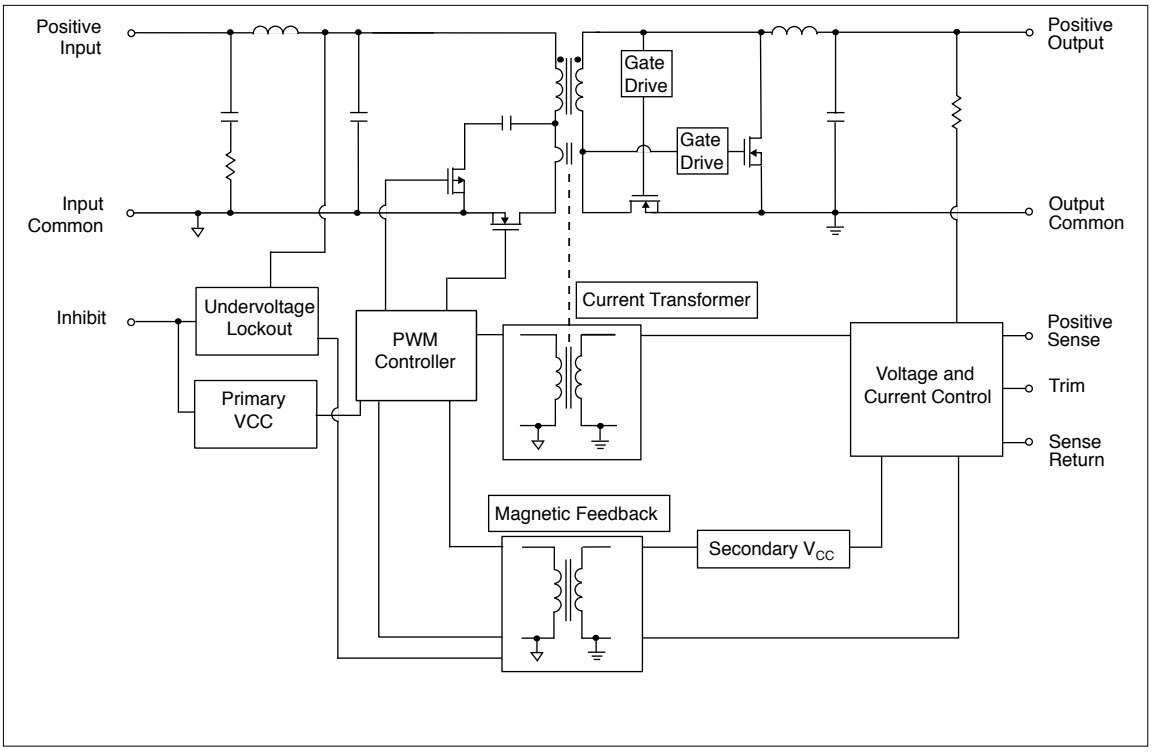

FIGURE 1: MFX SINGLE BLOCK DIAGRAM

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REMOTE SENSE

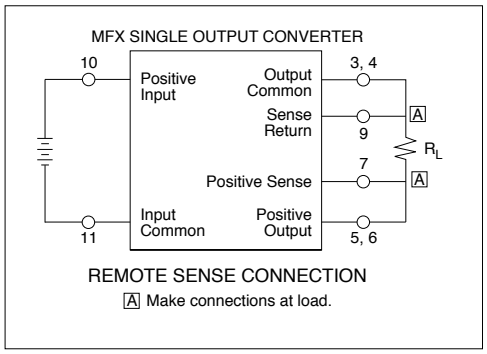

FIGURE 2: REMOTE SENSE CONNECTION [1]

CAUTION: The converter will be permanently damaged if the positive sense (pin 7) is shorted to ground. Damage may also result if the output common or positive output is disconnected from the load when the remote sense leads are connected to the load.

TRIM

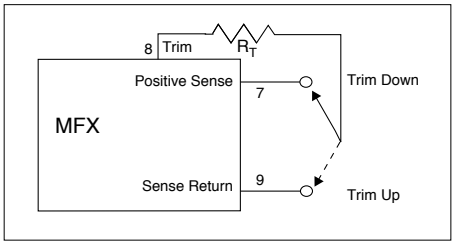

FIGURE 3: TRIM CONNECTION

TABLE 1: TRIM FORMULAS

25° C, V_O = desired output voltage [1], R_T = trim resistor (kΩ)

Function	Nominal V_{OUT}	Trim Range	Formula [2]
Trim Down [3]	3.3	3.3 to 3.0	$R_T = 31.1 \frac{2.982 - V_O}{V_O - 3.311}$
Trim Up [4]		3.3 to 3.9	$R_T = 23.2 \frac{3.996 - V_O}{V_O - 3.311}$
Trim Down [3]	5	5.0 to 4.5	$R_T = 90.2 \frac{4.409 - V_O}{V_O - 5.015}$
Trim Up [4]		5.0 to 5.5	$R_T = 72 \frac{5.522 - V_O}{V_O - 5.015}$

1. The output voltage may vary by ±5% of the calculated value.
2. If the calculated value is negative, the desired output voltage is outside the allowed trim range.
3. When trimming down do not exceed the maximum current.
4. When trimming up do not exceed the maximum power.

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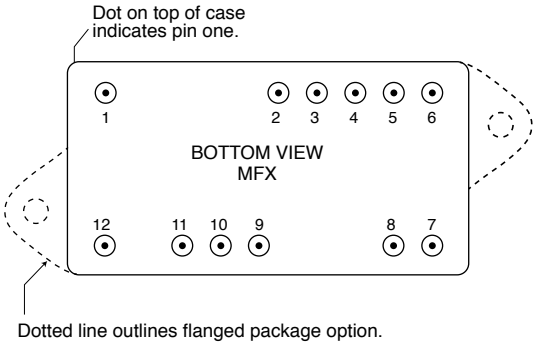
PIN OUT	
Pin	**Single Output**
1	No connection
2	Case Ground
3	Output Common
4	Output Common
5	Positive Output
6	Positive Output
7	Positive Sense
8	Trim
9	Sense Return
10	Positive Input
11	Input Common
12	Inhibit

TABLE 2: PIN OUT

PINS NOT IN USE	
Inhibit	Leave unconnected
Positive Sense	Connect to Positive Output
Trim	Leave unconnected
Sense Return	Connect to Output Common

TABLE 3: PINS NOT IN USE



See Figure 6 on page 8 and
Figure 7 on page 9 for dimensions.

FIGURE 4: MFX SINGLE PIN OUT

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MODEL NUMBERING KEY

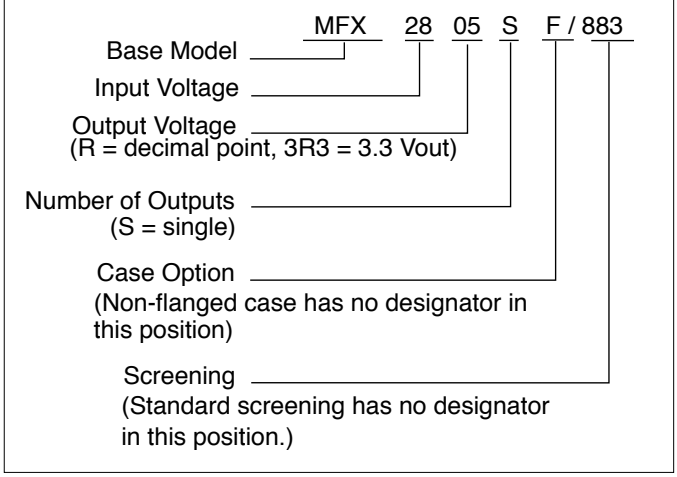

FIGURE 5: MODEL NUMBERING KEY

SMD NUMBERS	
STANDARD MICROCIRCUIT DRAWING (SMD)	**MFX SIMILAR PART**
5962-1520401HXC IN PROCESS	MFX283R3S/883
5962-1520402HXC IN PROCESS	MFX2805S/883
To indicate the flanged case option change the "X" to "Z" In the SMD number. The SMD number shown is for Class H screening, non-flanged. 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 4: SMD NUMBER CROSS REFERENCE

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 [1]	Number of Outputs [2]	Case Options [3]	Screening [4]
OPTIONS	MFX28	3R3, 05	S	(non-flanged, leave blank) F (flanged)	(standard, leave blank) ES 883
FILL IN FOR MODEL #	MFX28	_____	_____	_____	/ _____

Notes
1. Output Voltage: An R indicates a decimal point. 3R3 is 3.3 volts out.
2. Number of Outputs: S is a single output.
3. Case Options: For the standard case, Figure 6 on page 8, leave the case option blank. For the flanged case option, Figure 7 on page 9, insert the letter F in the Case Option position
4. Screening: For standard screening leave the screening option blank. For other screening options, insert the desired screening level. For more information see Table 8 on page 10 and Table 9 on page 11.

TABLE 5: MODEL NUMBER OPTIONS

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TABLE 6: OPERATING CONDITIONS, ALL MODELS, 25°C CASE, 28 VIN, 100% LOAD, UNLESS OTHERWISE SPECIFIED.

MFX SERIES		ALL MODELS			
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
LEAD SOLDERING TEMPERATURE [1]	10 SECONDS MAX.	—	—	300	°C
STORAGE TEMPERATURE [1]		-65	—	+150	°C
CASE OPERATING	FULL POWER	-55	—	+125	°C
TEMPERATURE	ABSOLUTE [1]	-55	—	+135	
DERATING OUTPUT POWER/CURRENT [1]	LINEARLY	From 100% at 125°C to 0% at 135°C			
ESD RATING [1]	MIL-STD-883 METHOD 3015	250 - 499			V
MIL-PRF-38534, 3.9.5.8.2	CLASS 1A				
ISOLATION: INPUT TO OUTPUT OR ANY PIN TO CASE EXCEPT CASE PIN	500 VDC AT 25°C	100	—	—	Megohms
UNDERVOLTAGE LOCKOUT	RISING V_{IN} (TURN ON)	13.3	15.3	15.9	V
-55°C TO +125°C	FALLING V_{IN} (TURN OFF)	13.3	14.3	15.6	
CURRENT LIMIT	% OF FULL LOAD	—	125	—	%
CONVERSION FREQUENCY	FREE RUN -55° TO +125°C	455	500	545	kHz
INHIBIT ACTIVE LOW (OUTPUT DISABLED)	INHIBIT PIN PULLED LOW [2]	—	—	0.8	V
Do not apply a voltage to the inhibit pin [3]	INHIBIT PIN SOURCE CURRENT [1]	—	—	4	mA
	REFERENCED TO	INPUT COMMON			
INHIBIT ACTIVE HIGH (OUTPUT ENABLED)	INHIBIT PIN CONDITION	EXTERNAL OPEN COLLECTOR OR LEAVE UNCONNECTED			
Do not apply a voltage to the inhibit pin [3]					
	OPEN CIRCUIT PIN VOLTAGE [1]	14	16	18	V

For mean time between failures (MTBF) contact Applications Engineering
powerapps@crane-eg.com +1 425-882-3100 option 7

Notes:
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Tested with inhibit pin pulled to ground through a diode.
3. 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.

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TABLE 7: ELECTRICAL CHARACTERISTICS -55°C TO +125°C CASE, 28 VIN, 100% LOAD, FREE RUN, UNLESS OTHERWISE SPECIFIED.

SINGLE OUTPUT MODELS		MFX283R3S			MFX2805S			
PARAMETER	CONDITIONS	MIN	TYP	MAX	MIN	TYP	MAX	UNITS
OUTPUT VOLTAGE	T_C = 25°C	3.26	3.30	3.34	4.95	5.00	5.05	
	T_C = -55°C TO +125°C	3.20	3.30	3.40	4.85	5.00	5.15	V
OUTPUT CURRENT	V_{IN} = 16 TO 50 V	—	—	15.15	—	—	10	A
OUTPUT POWER	V_{IN} = 16 TO 50 V	—	—	50	—	—	50	W
OUTPUT RIPPLE	T_C = 25°C	—	50	100	—	50	100	mV p-p
20 Hz - 10 MHz	T_C = -55°C TO +125°C	—	50	100	—	50	100	
LINE REGULATION	V_{IN} = 16 TO 50	—	1	15	—	1	15	mV
LOAD REGULATION	NO LOAD TO FULL	—	2	30	—	2	30	mV
INPUT VOLTAGE	CONTINUOUS	16	28	50	16	28	50	V
NO LOAD TO FULL	TRANSIENT [1, 2]	—	—	80	—	—	80	V
INPUT CURRENT	NO LOAD	—	60	140	—	75	140	mA
	INHIBITED	—	3	6	—	3	6	
INPUT RIPPLE CURRENT	20 Hz - 10 MHz	—	50	150	—	50	150	mA p-p
EFFICIENCY	T_C = 25°C	85	89	—	87	91	—	%
	TC = -55°C TO +125°C	84	88	—	85	89	—	
LOAD FAULT [3]	POWER DISSIPATION	—	9	16	—	6	16	W
SHORT CIRCUIT	RECOVERY [1]	—	13	20	—	13	20	ms
STEP LOAD RESPONSE [3]	TRANSIENT	—	120	300	—	70	250	mV pk
50% - 100% - 50%	RECOVERY	—	150	300	—	190	350	us
STEP LINE RESPONSE [1, 3]	TRANSIENT	—	50	265	—	80	300	mV pk
16 - 50 -16 V	RECOVERY	—	130	350	—	180	350	µs
START-UP [3, 4]	DELAY	—	17	25	—	17	25	ms
FULL LOAD	OVERSHOOT [1]	—	0	30	—	0	50	mV pk
CAPACITIVE LOAD T_C = 25°C	NO EFFECT ON DC PERFORMANCE	—	—	3000	—	—	3000	uF

Notes
1. Guaranteed by characterization test and/or analysis. Not a production test.
2. Up to 80 volt transient per MIL-STD-704 A.
3. Recovery and startup times are measured from application of the transient or change in condition to the point at which V_{OUT} is within 1% of final value.
4. Tested on release from inhibit.

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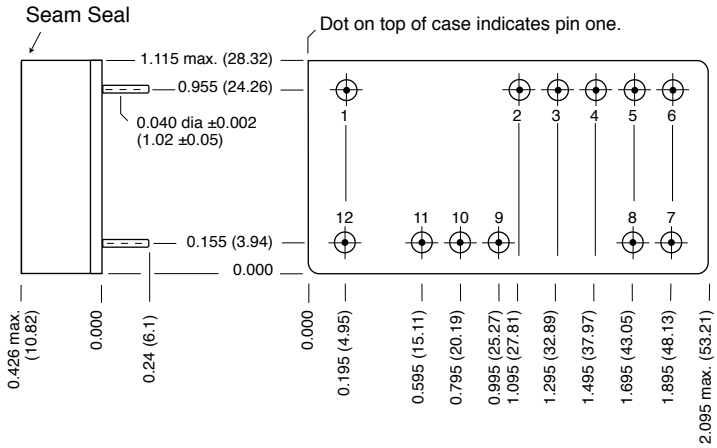
BOTTOM VIEW MFX



Weight: 52 grams maximum

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.

Materials

Header	Cold Rolled Steel/Nickel
Cover	Kovar/Nickel
Pins	#52 alloy/Gold glass compression seal Gold plating of 50 - 150 microinches included in pin diameter Seal hole 0.092 ±0.002 (3.05 ± 0.05)

Case H7 MFX S, Rev A 2015.04.21
Please refer to the numerical dimensions for accuracy.

FIGURE 6: MFX

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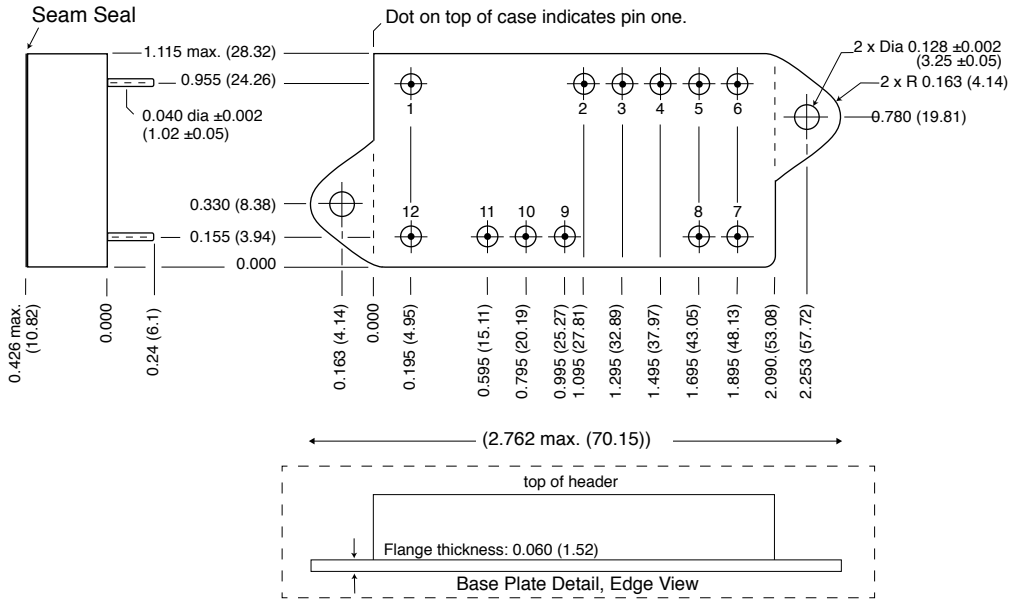
BOTTOM VIEW MFX FLANGED

Flanged cases: Designator "F" required in Case Option position of model number



Weight: 52 grams maximum

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.

Materials

Header	Cold Rolled Steel/Nickel
Cover	Kovar/Nickel
Pins	#52 alloy/Gold glass compression seal
	Gold plating of 50 - 150 microinches included in pin diameter
	Seal hole 0.092 ±0.002 (3.05 ± 0.05)

Case J7 MFX S, Rev A 2015.04.21
Please refer to the numerical dimensions for accuracy.

FIGURE 7: MFX FLANGED

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ELEMENT EVALUATION [1] HIGH RELIABILITY /883 (CLASS H)

	QML	
	CLASS H /883	
COMPONENT-LEVEL TEST PERFORMED	M/S [2]	P [3]
Element Electrical	■	■
Visual	■	■
Internal Visual	■	
Final Electrical	■	■
Wire Bond Evaluation	■	■

Notes
1. Element evaluation does not apply to standard and /ES product.
2. M/S = Active components (microcircuit and semiconductor die).
3. P = Passive components, Class H element evaluation. Not applicable to standard and /ES element evaluation.

TABLE 8: ELEMENT EVALUATION

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ENVIRONMENTAL SCREENING HIGH RELIABILITY STANDARD, /ES AND /883 (CLASS H)

TEST PERFORMED	NON-QML [1]		QML [2]
	STANDARD	/ES	CLASS H /883
Pre-cap Inspection, Method 2017, 2032	■	■	■
Temperature Cycle (10 times)			
Method 1010, Cond. C, -65°C to +150°C, ambient			■
Method 1010, Cond. B, -55°C to +125°C, ambient		■	
Constant Acceleration			
Method 2001, 3000 g			■
Method 2001, 500 g		■	
PIND, Test Method 2020, Cond. A			■ [3]
Burn-in Method 1015, +125°C case, typical [4]			
96 hours		■	
160 hours			■
Final Electrical Test, MIL-PRF-38534, Group A,			
Subgroups 1 through 6, -55°C, +25°C, +125°C case			■
Subgroups 1 and 4, +25°C case	■	■	
Hermeticity Test			
Gross Leak, Cond. C_1, fluorocarbon		■	■
Fine Leak, Cond. A_2, helium		■	■
Gross Leak, Dip	■		
Final visual inspection, Method 2009	■	■	■

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

Notes
1. Standard and ES are non-QML products and may not meet all of the requirements of MIL-PRF-38534.
2. All processes are QML qualified and performed by certified operators.
3. Not required by DLA but performed to assure product quality.
4. Burn-in temperature designed to bring the case temperature to +125°C minimum. Burn-in is a powered test.

TABLE 9: ENVIRONMENTAL SCREENING