Data Sheet
March 26, 2008

LINEAGE POWER

EQW006 Series, Eighth-Brick Power Modules: DC-DC Converter
36 –75Vdc Input; 12Vdc Output; 6A Output Current

RoHS Compliant

Applications

- Distributed power architectures
- Wireless networks
- Access and optical network Equipment
- Enterprise Networks
- Latest generation IC's (DSP, FPGA, ASIC) and Microprocessor powered applications

Options

- Remote On/Off logic (positive or negative)
- Surface Mount (-S Suffix)
- Short Pins

Features

- Compliant to RoHS EU Directive 2002/95/EC (-Z versions)
- Compliant to ROHS EU Directive 2002/95/EC with lead solder exemption (non-Z versions)
- Delivers up to 6A output current
- High efficiency: 91.5% at 12V full load (V_{IN} = 48Vdc)
- Industry-Standard Eighth-brick foot print:
  57.9 mm x 22.8 mm x 8.52 mm
  (2.28 in x 0.90 in x 0.335 in)
- Low output ripple and noise
- Surface mount or through hole
- Cost efficient open frame design
- Remote On/Off positive logic (primary referenced)
- Remote Sense
- Adjustable output voltage
- Constant switching frequency (330 kHz)
- Output over voltage and over current protection
- Over temperature protection
- Input undervoltage lockout
- Wide operating temperature range (-40°C to 85°C)
- *UL** 60950 Recognized, *CSA*† C22.2 No. 60950-00 Certified, and *VDE*‡ 0805 (IEC60950, 3rd edition) Licensed
- CE mark meets 73/23/EEC and 93/68/EEC directives§
- ISO** 9001 and ISO14001 certified manufacturing facilities
- Meets the voltage and current requirements for ETSI 300-132-2 and complies with and licensed for Basic insulation rating per IEC60950 3rd edition

Description

The EQW series, Eighth-brick power modules are isolated dc-dc converters that can deliver up to 6A of output current and provide a precisely regulated output voltage of 12Vdc over a wide range of input voltages (Vi = 36 - 75Vdc). The modules achieve full load efficiency of 91.5% at 12Vdc output voltage. The open frame modules construction, available in both surface-mount and through-hole packaging, enable designers to develop cost- and space-efficient solutions. Standard features include remote On/Off, remote sense, output voltage adjustment, over voltage, over current and over temperature protection.

* *UL* is a registered trademark of Underwriters Laboratories, Inc.
† *CSA* is a registered trademark of Canadian Standards Association.
‡ *VDE* is a trademark of Verband Deutscher Elektrotechniker e.V.
** ISO is a registered trademark of the International Organization of Standards

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only, functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect the device reliability.

Parameter	Device	Symbol	Min	Max	Unit
Input Voltage					
Continuous	All	V_{IN}	-0.3	80	Vdc
Transient (100 ms)	All	$V_{IN,trans}$	-0.3	100	Vdc
Operating Ambient Temperature (see Thermal Considerations section)	All	T_A	-40	85	°C
Storage Temperature	All	T_{stg}	-55	125	°C
I/O Isolation voltage (100% factory Hi-Pot tested)	All	—	—	1500	Vdc

Electrical Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and temperature conditions.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Operating Input Voltage	All	V_{IN}	36	48	75	Vdc
Maximum Input Current (V_{IN}= $V_{IN, min}$ to $V_{IN, max}$, I_O=$I_{O, max}$)	All	$I_{IN,max}$			2.5	Adc
Input No Load Current (V_{IN} = $V_{IN, nom}$, I_O = 0, module enabled)	All	$I_{IN,No\ load}$		75		mA
Input Stand-by Current (V_{IN} = $V_{IN, nom}$, module disabled)	All	$I_{IN,stand-by}$		3		mA
Inrush Transient	All	I^2t			1	A^2s
Input Reflected Ripple Current, peak-to-peak (5Hz to 20MHz, 1μH source impedance; $V_{IN, min}$ to $V_{IN, max,}$ I_O= I_{Omax} ; See Test configuration section)	All			13		mAp-p
Input Ripple Rejection (120Hz)	All			50		dB
EMC,EN5022		See EMC Considerations section				

CAUTION: This power module is not internally fused. An input line fuse must always be used.

This power module can be used in a wide variety of applications, ranging from simple standalone operation to an integrated part of sophisticated power architectures. To preserve maximum flexibility, internal fusing is not included, however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a time-delay fuse with a maximum rating of 6 A (see Safety Considerations section). Based on the information provided in this data sheet on inrush energy and maximum dc input current, the same type of fuse with a lower rating can be used. Refer to the fuse manufacturer's data sheet for further information.

Electrical Specifications (continued)

Parameter	Device	Symbol	Min	Typ	Max	Unit
Output Voltage Set-point (V_{IN}=$_{IN, min}$, I_O=$I_{O, max}$, T_A=25°C)	All	$V_{O, set}$	11.8	12.0	12.2	Vdc
Output Voltage (Over all operating input voltage, resistive load, and temperature conditions until end of life)	All	V_O	11.6	—	12.4	Vdc
Adjustment Range Selected by external resistor	All	V_O	10.8	—	13.2	Vdc
Output Regulation						
Line (V_{IN}=$V_{IN, min}$ to $V_{IN, max}$)	All		—	—	0.1	% $V_{O, set}$
Load (I_O=$I_{O, min}$ to $I_{O, max}$)	All		—	—	0.1	% $V_{O, set}$
Temperature (T_{ref}=$T_{A, min}$ to $T_{A, max}$)	All		—	0.2	—	% $V_{O, set}$
Output Ripple and Noise on nominal output measured with 10µF Tantalum, 1µF ceramic (V_{IN}=$V_{IN, nom}$,I_O= $I_{O, max}$, T_A=$T_{A, min}$ to $T_{A, max}$)						
RMS (5Hz to 20MHz bandwidth)	All		—	15	25	mV_{rms}
Peak-to-Peak (5Hz to 20MHz bandwidth)	All		—	40	75	mV_{pk-pk}
External Capacitance	All	$C_{O, max}$	0	—	1000	μF
Output Current	All	I_o	0	—	6	Adc
Output Current Limit Inception (Hiccup Mode) (V_O= 90% of $V_{O, set}$)	All	$I_{O, lim}$	—	7.0	—	Adc
Output Short-Circuit Current (V_O≤250mV) (Hiccup Mode)	All	$I_{O, s/c}$	—	0.5	—	Adc
Efficiency V_{IN}= $V_{IN, nom}$, T_A=25°C I_O=$I_{O, max}$, V_O= $V_{O,set}$	All	η		91.5		%
Switching Frequency	All	f_{sw}		300		kHz
Dynamic Load Response (dIo/dt=0.1A/µs; V_{IN} = $V_{IN, nom}$; T_A=25°C) Load Change from Io= 50% to 75% of Io,max; 220µF Tantalum or Electrolytic external capacitance						
Peak Deviation	All	V_{pk}	—	200	—	mV
Settling Time (Vo<10% peak deviation)	All	t_s	—	250	—	µs
(ΔIo/Δt=0.1A/µs; V_{in}=V_{in},set; T_A=25°C) Load Change from Io= 50% to 25% of Io,max; 220µF Tantalum or Electrolytic external capacitance						
Peak Deviation	All	V_{pk}	—	200	—	mV
Settling Time (Vo<10% peak deviation)	All	t_s	—	250	—	µs

Isolation Specifications

Parameter	Device	Symbol	Min	Typ	Max	Unit
Isolation Capacitance	All	C_{iso}	—	1000	—	pF
Isolation Resistance	All	R_{iso}	10	—	—	MΩ
I/O Isolation Voltage	All	All	—	—	1500	Vdc

General Specifications

Parameter	Device	Min	Typ	Max	Unit
Calculated MTBF ($V_{IN}=V_{IN,\ nom}$, $I_O=0.8I_{O,max}$, $T_A=40°C$) Telcordia SR332 Issue 1: Method 1, Case 3			1,795,700		Hours
Weight	All	—	15.2 (0.6)	—	g (oz.)

Feature Specifications

Unless otherwise indicated, specifications apply over all operating input voltage, resistive load, and temperature conditions. See Feature Descriptions for additional information.

Parameter	Device	Symbol	Min	Typ	Max	Unit
Remote On/Off Signal Interface						
(V_{IN}=$V_{IN, min}$ to $V_{IN, max}$; open collector or equivalent,						
Signal referenced to V_{IN-} terminal)						
Negative Logic: device code suffix "1"						
Logic Low = module On, Logic High = module Off						
Positive Logic: No device code suffix required						
Logic Low = module Off, Logic High = module On						
Logic Low - Remote On/Off Current	All	$I_{on/off}$	—	0.15	1.0	mA
Logic Low - On/Off Voltage	All	$V_{on/off}$	-0.7	—	1.2	V
Logic High Voltage – (Typ = Open Collector)	All	$V_{on/off}$	—		15	V
Logic High maximum allowable leakage current	All	$I_{on/off}$	—	—	10	μA
Turn-On Delay and Rise Times						
(I_O=$I_{O, max}$, V_{IN}=$V_{IN, nom,}$ T_A = 25 °C)						
Case 1: On/Off input is set to Logic Low (Module ON) and then input power is applied (delay from instant at which V_{IN} = $V_{IN, min}$ until Vo=10% of Vo,set)	All	Tdelay	—	20	—	msec
Case 2: Input power is applied for at least 1 second and then the On/Off input is set from OFF to ON (T_{delay} = from instant at which V_{IN}=$V_{IN, min}$ until V_O = 10% of $V_{O, set}$).	All	Tdelay	—	12	—	msec
Output voltage Rise time (time for Vo to rise from 10% of $V_{o,set}$ to 90% of $V_{o, set}$)	All	Trise	—	5	—	msec
Output voltage overshoot – Startup				—	5	% $V_{O, set}$
I_O= 80% of $I_{O, max}$; V_{IN}=$V_{IN, min}$ to $V_{IN, max}$, T_A = 25 °C						
Remote Sense Range	All	V_{SENSE}			0.5	Vdc
Over temperature Protection	All	T_{ref}	—	120	—	°C
Output Overvoltage Protection	All	$V_{O, limit}$	13.8	—	15	V
Input Undervoltage Lockout						
Turn-on Threshold	All	V_{UVLO}	—	32	36	V
Turn-off Threshold			25	27	—	V

Characteristic Curves

The following figures provide typical characteristics for the EQW006A0B1 (12V, 6A) at 25°C. The figures are identical for either positive or negative remote On/Off logic.

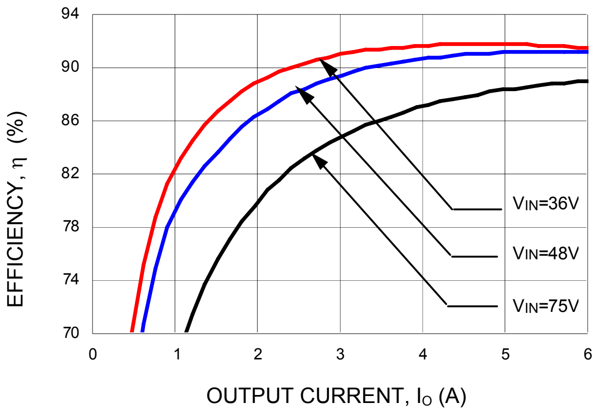


Figure 1. Converter Efficiency versus Output Current.

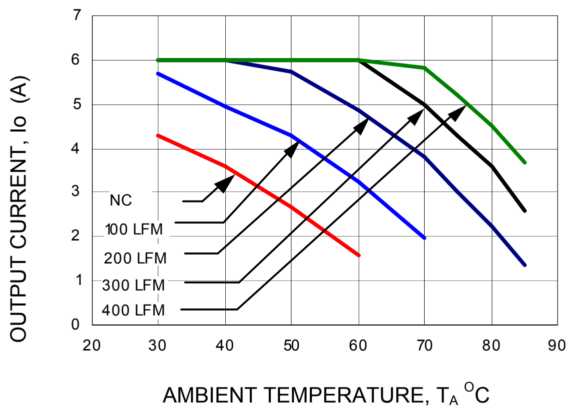


Figure 4. Derating Output Current versus Local Ambient Temperature and Airflow.

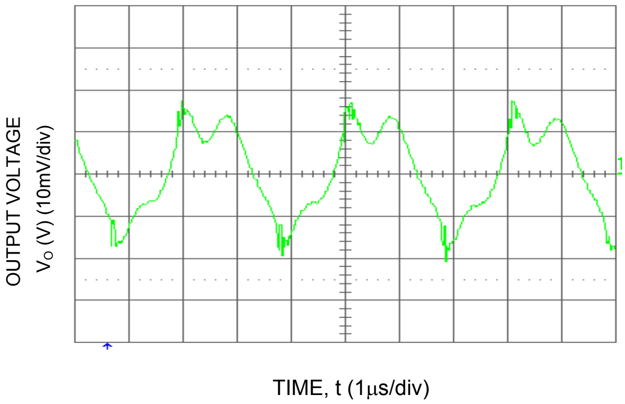


Figure 2. Typical output ripple and noise (V_{IN} = $V_{IN,NOM}$, I_o = $I_{o,max}$).

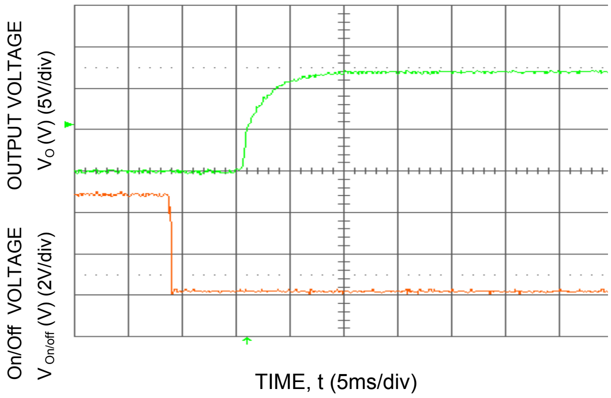


Figure 5. Typical Start-up Using Remote On/Off, negative logic version shown (V_{IN} = $V_{IN,NOM}$, I_o = $I_{o,max}$).

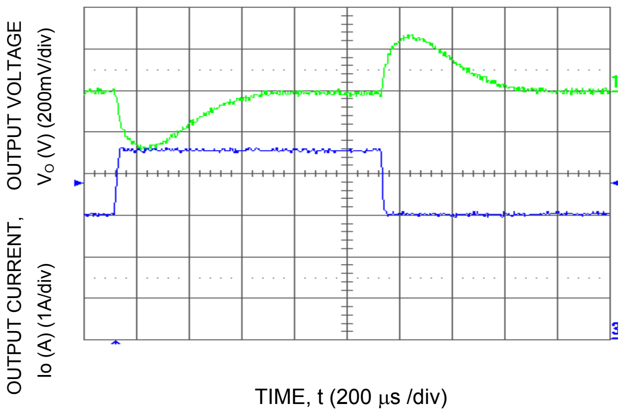


Figure 3. Transient Response to Dynamic Load Change from 50% to 75% to 50% of full load.

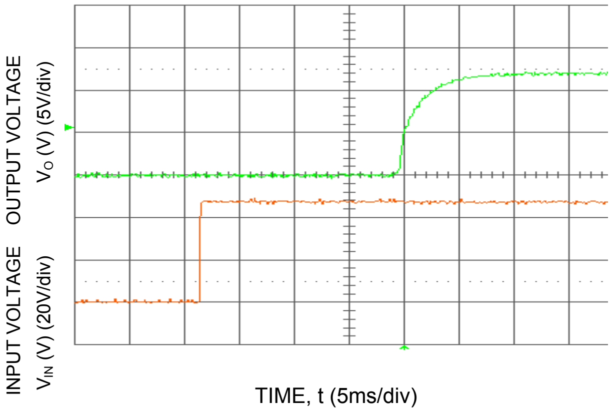


Figure 6. Typical Start-up Using Input Voltage (V_{IN} = $V_{IN,NOM}$, I_o = $I_{o,max}$).

Test Configurations

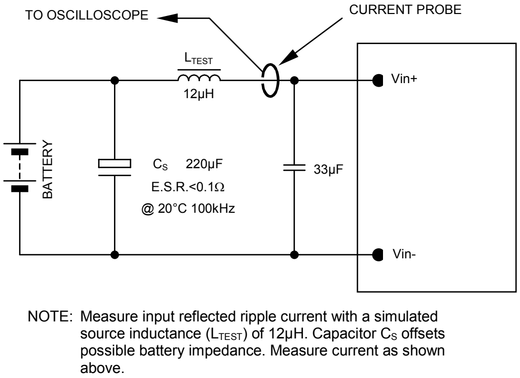


Figure 7. Input Reflected Ripple Current Test Setup.

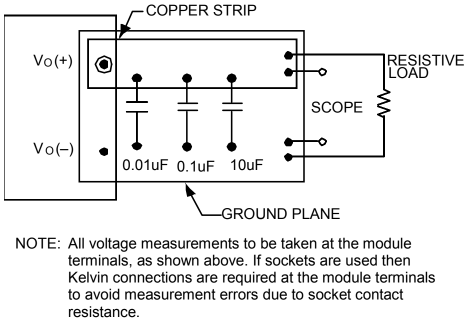


Figure 8. Output Ripple and Noise Test Setup.

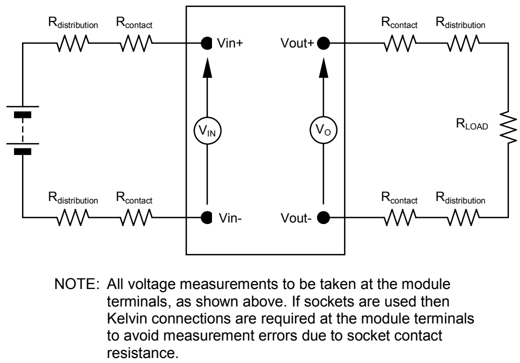


Figure 9. Output Voltage and Efficiency Test Setup.

$$\text{Efficiency} \quad \eta = \frac{V_O \cdot I_O}{V_{IN} \cdot I_{IN}} \times 100 \ \%$$

Design Considerations

Input Filtering

The power module should be connected to a low ac-impedance source. Highly inductive source impedance can affect the stability of the power module. For the test configuration in Figure 7 a 33μF electrolytic capacitor (ESR<0.7Ω at 100kHz), mounted close to the power module helps ensure the stability of the unit. Consult the factory for further application guidelines.

Safety Considerations

For safety-agency approval of the system in which the power module is used, the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standard, i.e., UL60950, CSA C22.2 No. 60950-00 and VDE 0805:2001-12 (IEC60950, 3rd Ed).

These converters have been evaluated to the spacing requirements for Basic Insulation, per the above safety standards; and 1500 Vdc is applied from Vi to Vo to 100% of outgoing production.

For all input voltages, other than DC MAINS, where the input voltage is less than 60V dc, if the input meets all of the requirements for SELV, then:

- The output may be considered SELV. Output voltages will remain within SELV limits even with internally-generated non-SELV voltages. Single component failure and fault tests were performed in the power converters.
- One pole of the input and one pole of the output are to be grounded, or both circuits are to be kept floating, to maintain the output voltage to ground voltage within ELV or SELV limits.

For all input sources, other than DC MAINS, where the input voltage is between 60 and 75V dc (Classified as TNV-2 in Europe), the following must be adhered to, if the converter's output is to be evaluated for SELV:

- The input source is to be provided with reinforced insulation from any hazardous voltage, including the AC mains.
- One Vi pin and one Vo pin are to be reliably earthed, or both the input and output pins are to be kept floating.
- Another SELV reliability test is conducted on the whole system, as required by the safety agencies, on the combination of supply source and the subject module to verify that under a single fault, hazardous voltages do not appear at the module's output.

The power module has ELV (extra-low voltage) outputs when all inputs are ELV.

All flammable materials used in the manufacturing of these modules are rated 94V-0, and UL60950 A.2 for reduced thickness. The input to these units is to be provided with a maximum 6A time- delay in the unearthed lead.

Feature Description

Remote On/Off

Two remote on/off options are available. Positive logic turns the module on during a logic high voltage on the ON/OFF pin, and off during a logic low. Negative logic remote On/Off, device code suffix "1", turns the module off during a logic high and on during a logic low.

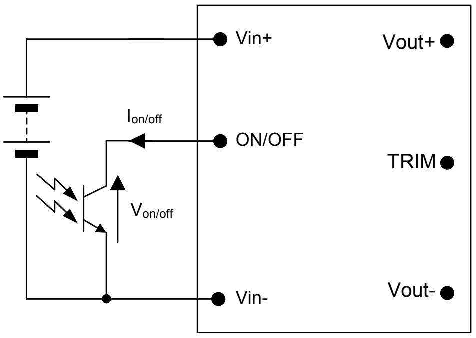


Figure 10. Remote On/Off Implementation.

To turn the power module on and off, the user must supply a switch (open collector or equivalent) to control the voltage ($V_{on/off}$) between the ON/OFF terminal and the V_{IN}(-) terminal (see Figure 10). Logic low is 0V ≤ $V_{on/off}$ ≤ 1.2V. The maximum $I_{on/off}$ during a logic low is 1mA, the switch should be maintain a logic low level whilst sinking this current.

During a logic high, the typical maximum $V_{on/off}$ generated by the module is 15V, and the maximum allowable leakage current at $V_{on/off}$ = 5V is 1μA.

If not using the remote on/off feature:

For positive logic, leave the ON/OFF pin open.

For negative logic, short the ON/OFF pin to V_{IN}(-).

Remote Sense

Remote sense minimizes the effects of distribution losses by regulating the voltage at the remote-sense connections (See Figure 11). The voltage between the remote-sense pins and the output terminals must not exceed the output voltage sense range given in the Feature Specifications table:

[VO(+) – VO(–)] – [SENSE(+) – SENSE(–)] ≤ 0.5 V

Although the output voltage can be increased by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both. The maximum increase is the larger of either the remote sense or the trim.

The amount of power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. When using remote sense and trim, the output voltage of the module can be increased, which at the same output current would increase the power output of the module. Care should be taken to ensure that the maximum output power of the module remains at or below the maximum rated power (Maximum rated power = Vo,set x Io,max).

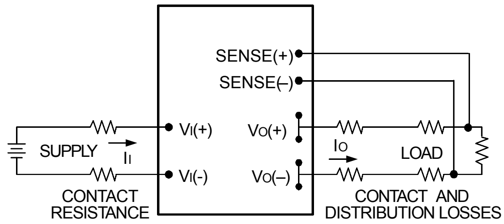


Figure 11. Circuit Configuration for remote sense .

Input Undervoltage Lockout

At input voltages below the input undervoltage lockout limit, the module operation is disabled. The module will only begin to operate once the input voltage is raised above the undervoltage lockout turn-on threshold, $V_{UV/ON}$.

Once operating, the module will continue to operate until the input voltage is taken below the undervoltage turn-off threshold, $V_{UV/OFF}$.

Overtemperature Protection

To provide protection under certain fault conditions, the unit is equipped with a thermal shutdown circuit. The unit will shutdown if the thermal reference point Tref (Figure 14), exceeds 110°C (typical), but the thermal shutdown is not intended as a guarantee that the unit will survive temperatures beyond its rating. The module will automatically restarts after it cools down.

Output Overvoltage Protection

The output overvoltage protection consists of circuitry that internally clamps the output voltage. If a more accurate output overvoltage protection scheme is required then this should be implemented externally via use of the remote on/off pin.

Feature Descriptions (continued)

Output Voltage Programming

Trimming allows the output voltage set point to be increased or decreased, this is accomplished by connecting an external resistor between the TRIM pin and either the $V_O(+)$ pin or the $V_O(-)$ pin (COM pin) .

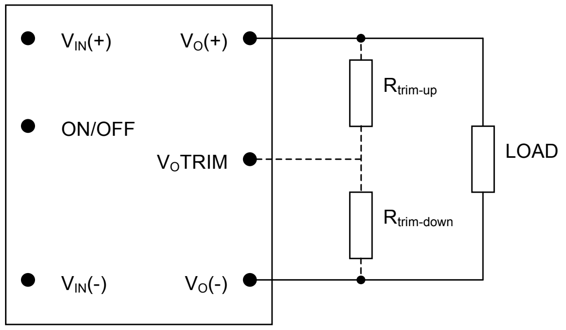


Figure 12. Circuit Configuration to Trim Output Voltage.

Connecting an external resistor ($R_{trim-down}$) between the TRIM pin and the Vo(-) (or Sense(-)) pin decreases the output voltage set point. To maintain set point accuracy, the trim resistor tolerance should be ±0.1%.

The following equation determines the required external resistor value to obtain a percentage output voltage change of Δ%

For output voltage: 12Vdc

$$Rtrim-down=\left[\frac{510}{\Delta\%}-10.2\right]K\Omega$$

Where

$$\Delta\%=\left(\frac{Vo,set-Vdesired}{Vo,set}\right)\times 100$$

For example, to trim-down the output voltage of 12V module (EQW006A0B1) by 8% to 11.04V, Rtrim-down is calculated as follows:

$$\Delta\%=8$$

$$Rtrim-down=\left[\frac{510}{8}-10.2\right]K\Omega$$

$$Rtrim-down=53.55K\Omega$$

Connecting an external resistor ($R_{trim-up}$) between the TRIM pin and the $V_O(+)$ (or Sense (+)) pin increases the output voltage set point. The following equations determine the required external resistor value to obtain a percentage output voltage change of Δ%:

For output voltage: 12Vdc

$$Rtrim-up=\left[\frac{5.1\times Vo,set\times(100+\Delta\%)}{1.225\times\Delta\%}-\frac{510}{\Delta\%}-10.2\right]K\Omega$$

Where

$$\Delta\%=\left(\frac{Vdesired-Vo,set}{Vo,set}\right)\times 100$$

For example, to trim-up the output voltage of 12V module by 6% to 12.72V, Rtrim-up is calculated is as follows:

$$\Delta\%=6$$

$$Rtrim-up=\left[\frac{5.1\times 12\times(100+6)}{1.225\times 6}-\frac{510}{6}-10.2\right]K\Omega$$

$$Rtrim-up=787K\Omega$$

The voltage between the Vo(+) and Vo(–) terminals must not exceed the minimum output overvoltage protection value shown in the Feature Specifications table. This limit includes any increase in voltage due to remote-sense compensation and output voltage set-point adjustment trim.

Although the output voltage can be increased by both the remote sense and by the trim, the maximum increase for the output voltage is not the sum of both. The maximum increase is the larger of either the remote sense or the trim. The amount of power delivered by the module is defined as the voltage at the output terminals multiplied by the output current. When using remote sense and trim, the output voltage of the module can be increased, which at the same output current would increase the power output of the module. Care should be taken to ensure that the maximum output power of the module remains at or below the maximum rated power (Maximum rated power = Vo,set x Io,max).

Overcurrent Protection

To provide protection in a fault (output overload) condition, the unit is equipped with internal current-limiting circuitry and can endure current limiting continuously. At the point of current-limit inception, the unit enters hiccup mode. The unit operates normally once the output current is brought back into its specified range. The average output current during hiccup is 10% $I_{O,\ max}$.

Thermal Considerations

The power modules operate in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation.

Considerations include ambient temperature, airflow, module power dissipation, and the need for increased reliability. A reduction in the operating temperature of the module will result in an increase in reliability. The thermal data presented here is based on physical measurements taken in a wind tunnel as shown in the Figure 13.

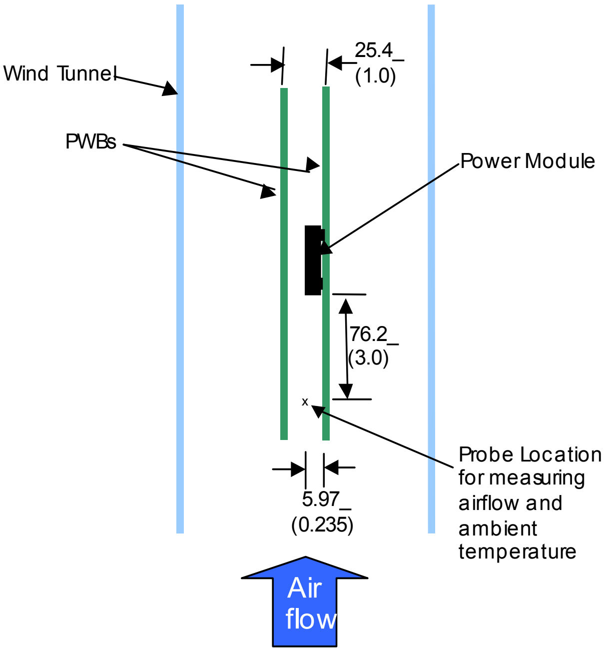


Figure 13. Thermal Test Set-up.

The thermal reference point, T_{ref} used in the specifications is shown in Figure 14. For reliable operation this temperature should not exceed 120°C.

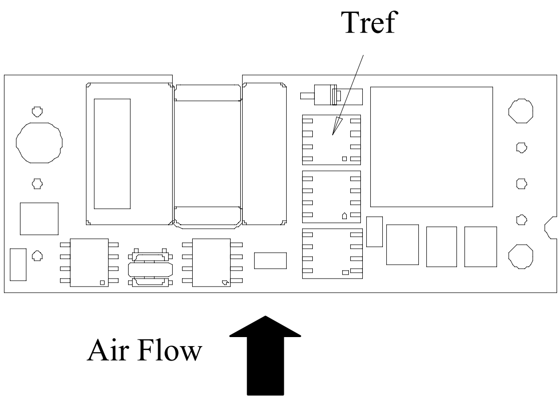


Figure 14. T_{ref} Temperature Measurement Locations.

Please refer to the Application Note "Thermal Characterization Process For Open-Frame Board-Mounted Power Modules" for a detailed discussion of thermal aspects including maximum device temperatures.

Heat Transfer via Convection

Increased airflow over the module enhances the heat transfer via convection. Derating figures showing the maximum output current that can be delivered by each module versus local ambient temperature (T_A) for natural convection and up to 2m/s (400 ft./min) are shown in the respective Characteristics Curves section.

Layout Considerations

Copper paths must not be routed beneath the power module mounting inserts. Recommended SMT layout shown in the mechanical section are for reference only. SMT layout depends on the end PCB configuration and the location of the load. For additional layout guide-lines, refer to FLTR100V10 data sheet or contact your local Lineage Power field application engineer.

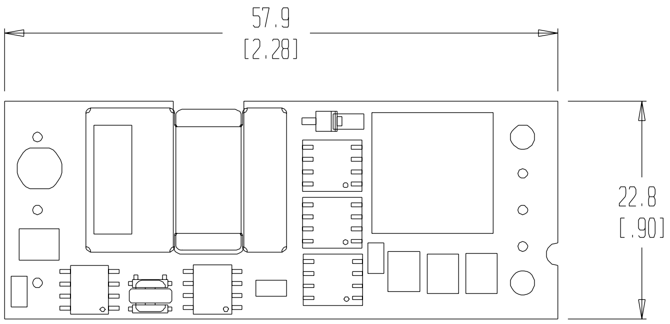
Mechanical Outline for Surface Mount Module

Dimensions are in millimeters and [inches].

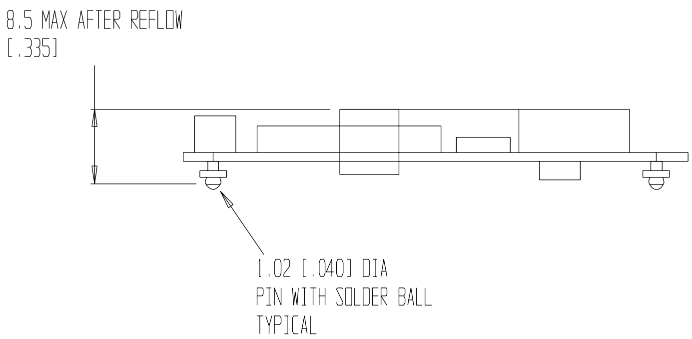
Tolerances: x.x mm ± 0.5 mm [x.xx in. ± 0.02 in.] (unless otherwise indicated)

x.xx mm ± 0.25 mm [x.xxx in ± 0.010 in.]

Top View

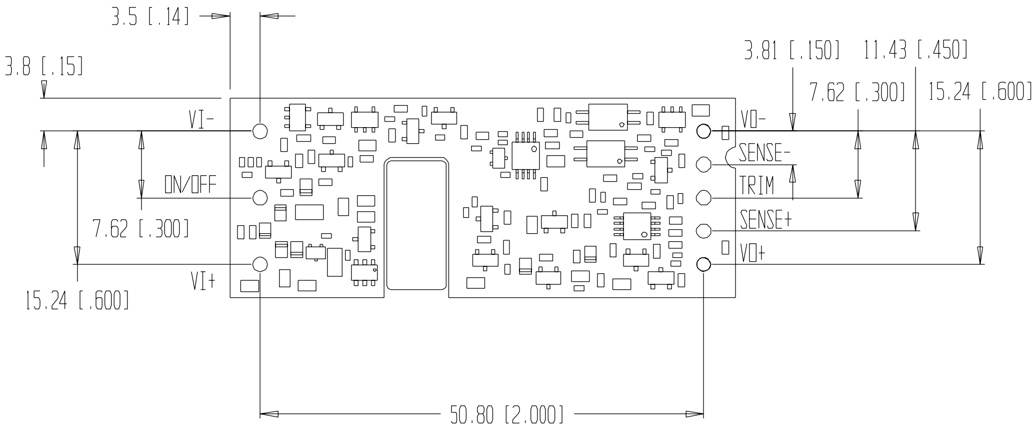


Side View



Bottom View

Pin	Function
1	V_I(+)
2	On/Off
3	V_I(-)
4	V_O(-)
5	Sense(-)
6	Trim
7	Sense(+)
8	V_O(+)



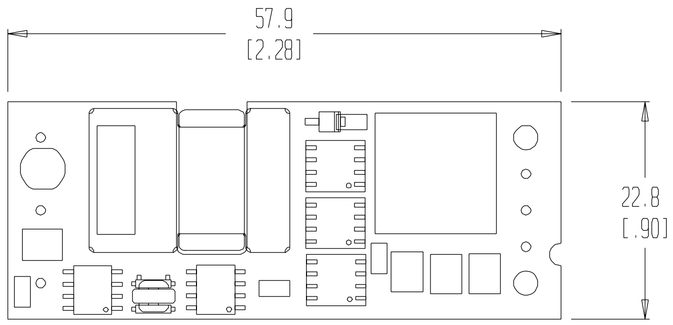
Mechanical Outline for Through-Hole Module

Dimensions are in millimeters and [inches].

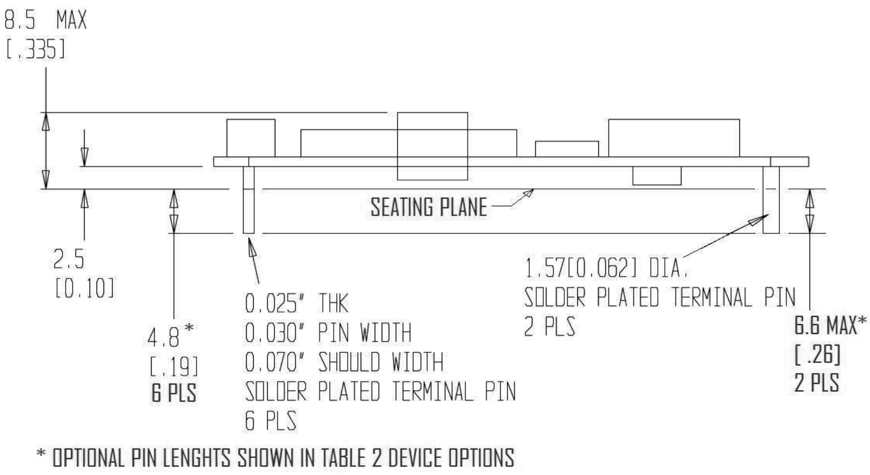
Tolerances: x.x mm ± 0.5 mm [x.xx in. ± 0.02 in.] (unless otherwise indicated)

x.xx mm ± 0.25 mm [x.xxx in ± 0.010 in.]

Top View

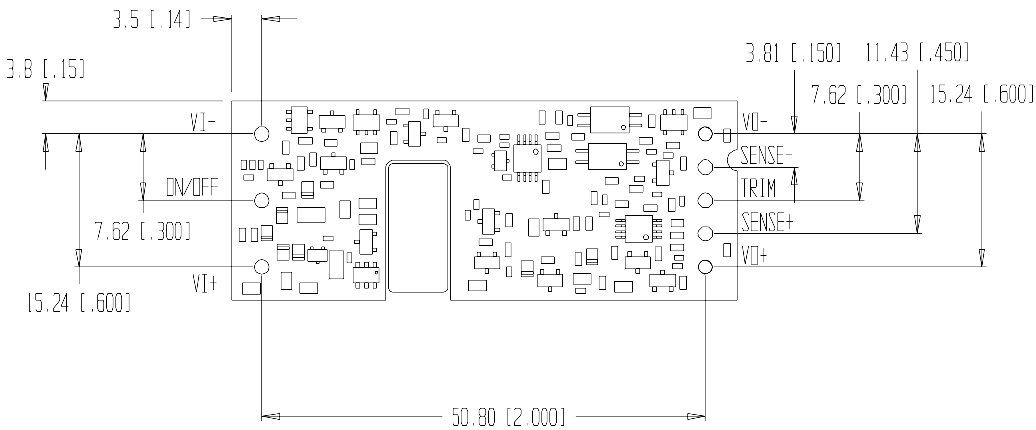


Side View



Bottom View

Pin	Function
1	VI(+)
2	On/Off
3	VI(-)
4	Vo(-)
5	Sense(-)
6	Trim
7	Sense(+)
8	Vo(+)

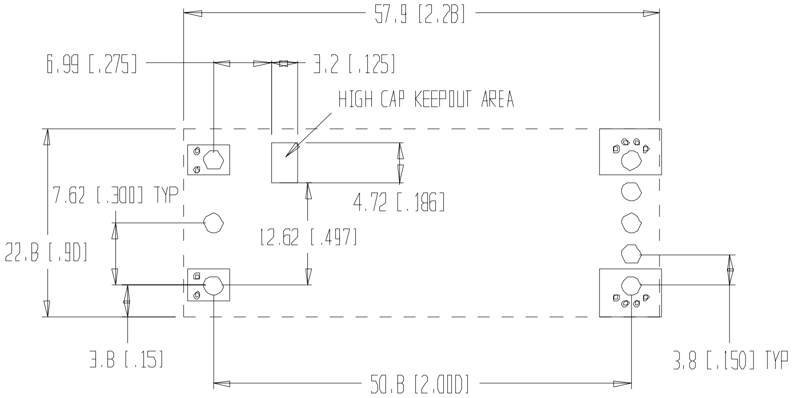


Recommended Pad Layout

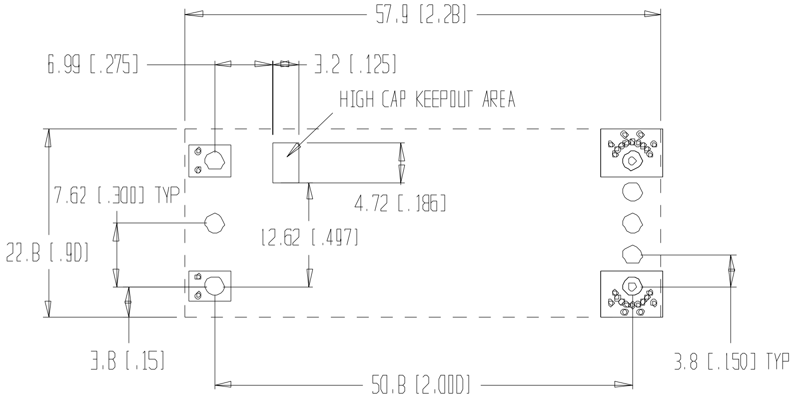
Dimensions are in millimeters and [inches].

Tolerances: x.x mm ± 0.5 mm [x.xx in. ± 0.02 in.] (unless otherwise indicated)

x.xx mm ± 0.25 mm [x.xxx in ± 0.010 in.]



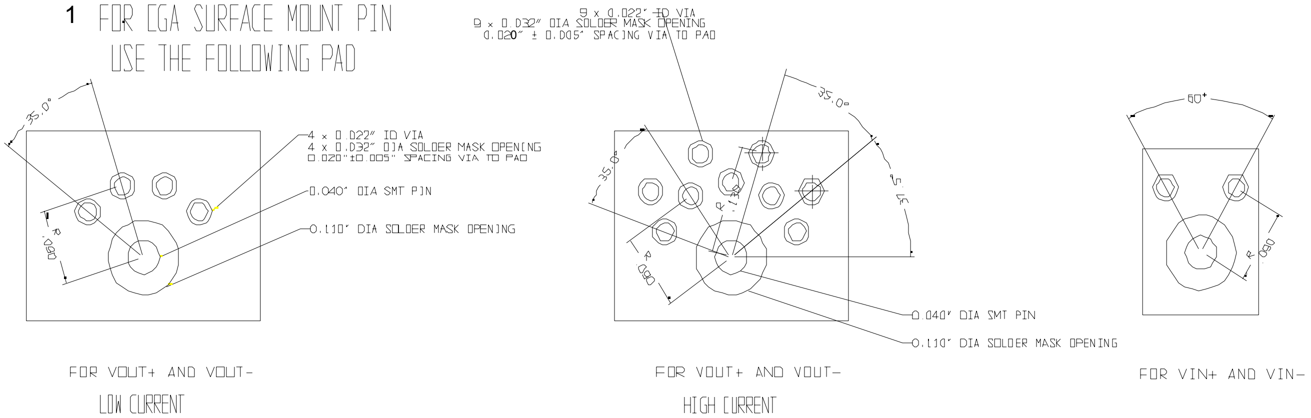
Low Current



High Current

NOTES:

1 FOR CGA SURFACE MOUNT PIN USE THE FOLLOWING PAD



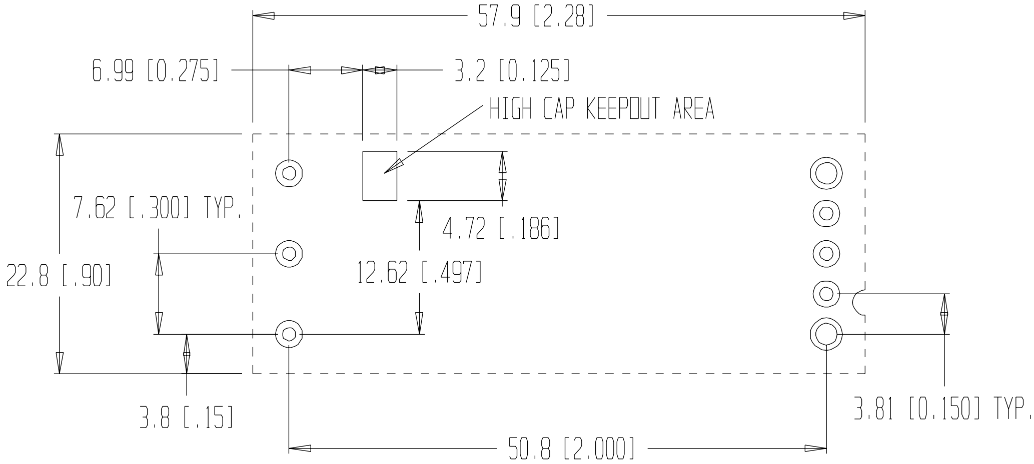
Recommended Pad Layout

Dimensions are in millimeters and [inches].

Tolerances: x.x mm ± 0.5 mm [x.xx in. ± 0.02 in.] (unless otherwise indicated)

x.xx mm ± 0.25 mm [x.xxx in ± 0.010 in.]

Component side view



NOTES:

1. FOR 0.030" x 0.024" PIN
   USE 0.050"DIA PLATED THROUGH HOLE
2. FOR 0.060"DIA PIN
   USE 0.076"DIA PLATED THROUGH HOLE

Packaging Details

The surface mount versions of the EQW surface mount modules (suffix –S) are supplied as standard in the plastic tray shown in Figure 15. The tray has external dimensions of 135.1mm (W) x 321.8mm (L) x 12.42mm (H) or 5.319in (W) x 12.669in (L) x 0..489in (H).

Tray Specification

Material	Antistatic coated PVC
Max surface resistivity	$10^{12}\Omega$/sq
Color	Clear
Capacity	12 power modules
Min order quantity	48 pcs (1box of 4 full trays)

Each tray contains a total of 12 power modules. The trays are self-stacking and each shipping box will contain 4 full trays plus one empty hold down tray giving a total number of 48 power modules.

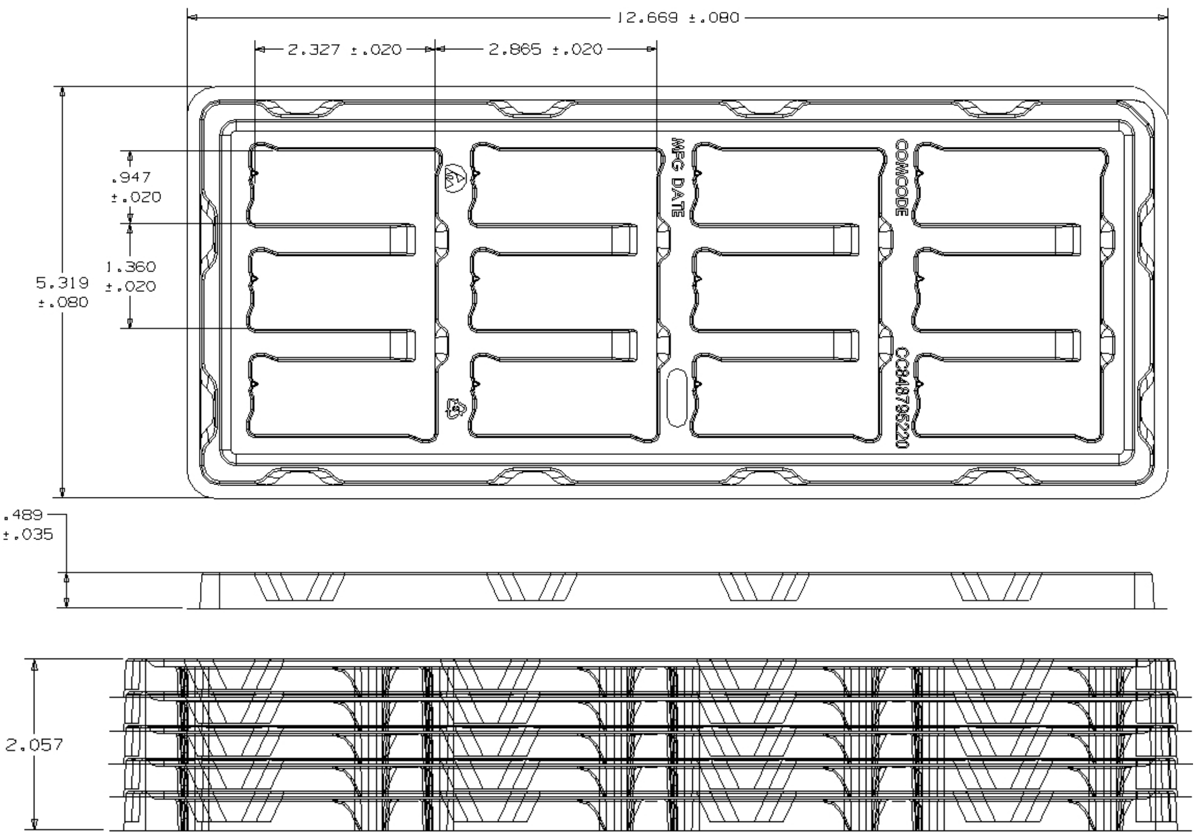


Figure 15. Surface Mount Packaging Tray.

Surface Mount Information

Pick and Place

The SMT versions of the EQW series of DC-to-DC power converters use an open-frame construction and are designed for surface mount assembly within a fully automated manufacturing process.

The EQW-S series modules are fitted with a label designed to provide a large flat surface for pick and placing. The label is located covering the center of gravity of the power module. The label meets all the requirements for surface-mount processing, as well as meeting UL safety agency standards. The label will withstand reflow temperatures up to 300°C. The label also carries product information such as product code, date and location of manufacture.

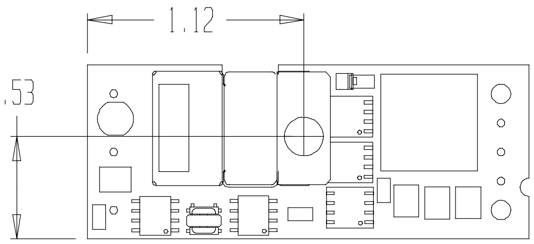


Figure 16. Pick and Place Location.

Z Plane Height

The 'Z' plane height of the pick and place label is 9.15 mm (0.360 in) nominal with an RSS tolerance of +/- 0.25 mm.

Nozzle Recommendations

The module weight has been kept to a minimum by using open frame construction. Even so, they have a relatively large mass when compared with conventional smt components. Variables such as nozzle size, tip style, vacuum pressure and placement speed should be considered to optimize this process.

The minimum recommended nozzle diameter for reliable operation is 6mm. The maximum nozzle outer diameter, which will safely fit within the allowable component spacing, is 9 mm. Oblong or oval nozzles up to 11 x 9 mm may also be used within the space available.

For further information please contact your local Lineage Power Technical Sales Representative.

Tin Lead Soldering

The following instructions must be observed when SMT soldering these units. Failure to observe these instructions may result in the failure of or cause damage to the modules, and can adversely affect long-term reliability.

The surface mountable modules in the EQW family use our newest SMT technology called "Column Pin" (CP) connectors. Figure 17 shows the new CP connector before and after reflow soldering onto the end-board assembly.

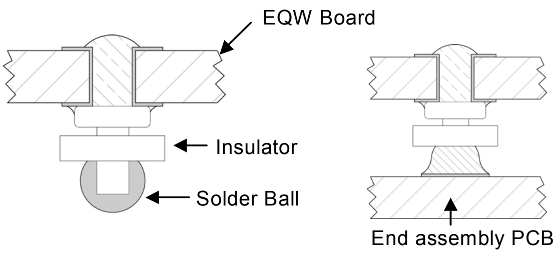


Figure 17. Column Pin Connector Before and After Reflow Soldering.

The CP is constructed from a solid copper pin with an integral solder ball attached, which is composed of tin/lead (Sn/Pb-63/37) solder. The CP connector design is able to compensate for large amounts of co-planarity and still ensure a reliable SMT solder joint.

Typically, the eutectic solder melts at 183°C, wets the land, and subsequently wicks the device connection. Sufficient time must be allowed to fuse the plating on the connection to ensure a reliable solder joint. There are several types of SMT reflow technologies currently used in the industry. These surface mount power modules can be reliably soldered using natural forced convection, IR (radiant infrared), or a combination of convection/IR. For reliable soldering the solder reflow profile should be established by accurately measuring the modules CP connector temperatures.

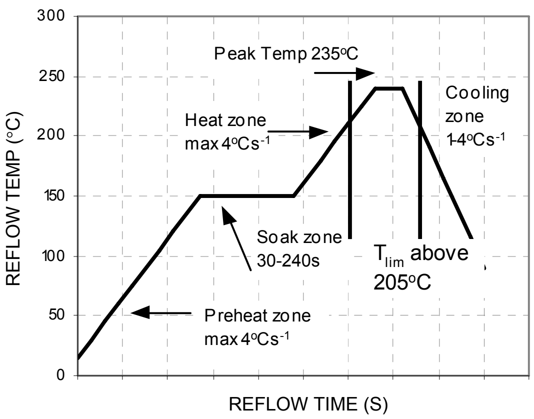


Figure 18. Reflow Profile for Tin/Lead (Sn/Pb) process.

Surface Mount Information (continued)

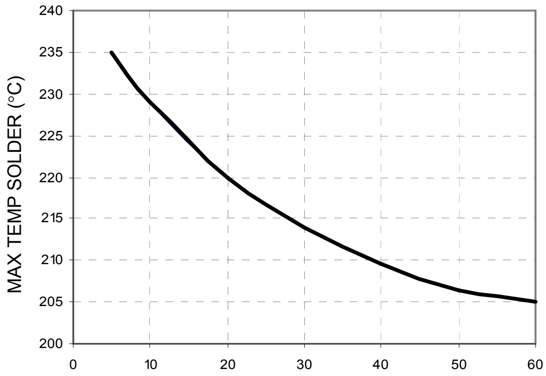


Figure 19. Time Limit Curve Above 205°C for Tin/Lead (Sn/Pb) process.

Lead Free Soldering

The –Z version of the EQW006 modules are lead-free (Pb-free) and RoHS compliant and are both forward and backward compatible in a Pb-free and a SnPb soldering process. Failure to observe the instructions below may result in the failure of or cause damage to the modules and can adversely affect long-term reliability.

Pb-free Reflow Profile

Power Systems will comply with J-STD-020 Rev. C (Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices) for both Pb-free solder profiles and MSL classification procedures. This standard provides a recommended forced-air-convection reflow profile based on the volume and thickness of the package (table 4-2). The suggested Pb-free solder paste is Sn/Ag/Cu (SAC). The recommended linear reflow profile using Sn/Ag/Cu solder is shown in Fig. 20.

MSL Rating

The EQW006 modules have a MSL rating of 2.

Storage and Handling

The recommended storage environment and handling procedures for moisture-sensitive surface mount packages is detailed in J-STD-033 Rev. A (Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices). Moisture barrier bags (MBB) with desiccant are required for MSL ratings of 2 or greater. These sealed packages should not be broken until time of use. Once the original package is broken, the floor life of the product at conditions of ≤ 30°C and 60% relative humidity varies according to the MSL rating (see J-STD-033A). The shelf life for dry packed SMT packages will be a minimum of 12 months from the bag seal date, when stored at the following conditions: < 40° C, < 90% relative humidity.

Post Solder Cleaning and Drying Considerations

Post solder cleaning is usually the final circuit-board assembly process prior to electrical board testing. The result of inadequate cleaning and drying can affect both the reliability of a power module and the testability of the finished circuit-board assembly. For guidance on appropriate soldering, cleaning and drying procedures, refer to Lineage Power *Board Mounted Power Modules: Soldering and Cleaning* Application Note (AN04-001).

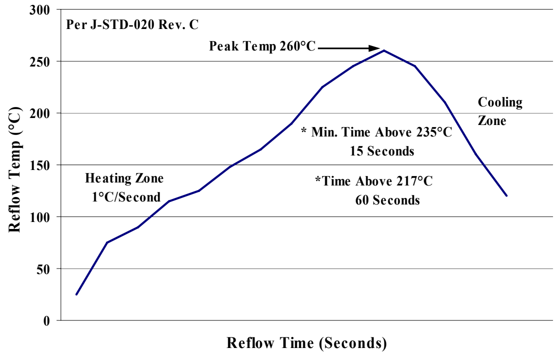


Figure 20. Recommended linear reflow profile using Sn/Ag/Cu solder.

Through-Hole Lead-Free Soldering Information

The RoHS-compliant through-hole products use the SAC (Sn/Ag/Cu) Pb-free solder and RoHS-compliant components. They are designed to be processed through single or dual wave soldering machines. The pins have an RoHS-compliant finish that is compatible with both Pb and Pb-free wave soldering processes. A maximum preheat rate of 3°C/s is suggested. The wave preheat process should be such that the temperature of the power module board is kept below 210°C. For Pb solder, the recommended pot temperature is 260°C, while the Pb-free solder pot is 270°C max. Not all RoHS-compliant through-hole products can be processed with paste-through-hole Pb or Pb-free reflow process. If additional information is needed, please consult with your Lineage Power representative for more details.

Ordering Information

Please contact your Lineage Power Sales Representative for pricing, availability and optional features.

Table 1. Device Codes

Input Voltage	Output Voltage	Output Current	On/Off Logic	Connector Type	Product codes	Comcodes
48V (36-75Vdc)	12.0 V	6 A	Positive	Through Hole	EQW006A0B	108994026
48V (36-75Vdc)	12.0 V	6 A	Negative	Through Hole	EQW006A0B1	108986415
48V (36-75Vdc)	12.0 V	6 A	Positive	Through Hole	EQW006A0B6	108993465
48V (36-75Vdc)	12.0 V	6 A	Negative	Surface Mount	EQW006A0B1-S	108995024
48V (36-75Vdc)	12.0 V	6 A	Negative	Through Hole	EQW006A0B1Z	CC109107034
48V (36-75Vdc)	12.0 V	6 A	Negative	Through Hole	EQW006A0B61Z	CC109121266
48V (36-75Vdc)	12.0 V	6 A	Negative	Surface Mount	EQW006A0B1-SZ	108995635

-Z Indicates RoHS Compliant modules

Table 2. Device Options

Option*	Suffix*
Negative remote on/off logic (On/Off pin fitted)	1
Pin Length: 3.68 mm ± 0.25mm , (0.145 in. ± 0.010 in.)	6
Short Pins: 2.79 mm ± 0.25 mm (0.110 in ±0.010 in)	8
Surface mount connections	-S

*Note: Legacy device codes may contain a –B option suffix to indicate 100% factory Hi-Pot tested to the isolation voltage specified in the Absolute Maximum Ratings table. The 100% Hi-Pot test is now applied to all device codes, with or without the –B option suffix. Existing comcodes for devices with the –B suffix are still valid; however, no new comcodes for devices containing the –B suffix will be created.

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Document No: DS03-119 ver. 1.08
PDF name: eqw006_series_ds.pdf