

# EMERALD TECH

## Technical Specification

EMQ28050M20P, EMQ28050M20N

28V Input 5V/20A Output



## High Efficiency Military DC/DC Converter

Up to 120 Watts

Size (Max.): 3.00 x 1.50 x 0.40 in (76.5 x 38.2 x 10.0 mm)  
Weight: 100 grams maximum

### Description

The EMQ family of high current, high efficiency DC/DC converters offer current levels that exceed other military quarter-bricks and are comparable to existing half-bricks. They are targeted specifically at the aerospace, aircraft, portable weaponry industry and distributed power markets. With a wide input voltage range of 18-36VDC, 36-75VDC, 88-132VDC they are available with output voltage of 3.3, 5, 12 and 15 Volts. All models feature an input filter, input undervoltage lockout, output overvoltage protection, overtemperature protection, output current limiting and short circuit protection. The fully enclosed, encapsulated construction with aluminum heat spreader design achieves efficient heat transfer with no hot spots. The use of patent-pending hybrid planar transformer technology and other patent-pending design concepts facilitate maximum power delivery with the highest efficiency up to 90% - 92%. The converters combine creative design concepts with high derating engineering practices to offer very high reliability, high performance and low cost solution to systems designers requiring maximum power in compact spaces.

### Applications

- Aerospace, Aircraft
- Complex power system
- Portable weaponry
- Distributed Power Architecture

### Features

- Delivers up to 20A in quarter brick size
- Fully Isolated
- Fixed frequency, 400 KHz typical
- Magnetic coupling, no optocouplers
- High efficiency patented topology
- Can operate without airflow or heat sink
- No minimum load required
- 5V output model.
- Wide input operating range 18-36V
- -55°C to +125°C ambient operation
- Remote sense to compensate line drop
- Synchronization function
- Current sharing – Parallelable up to 800 watts.
- Output adjustable of +/-10% nominal range
- 500V, 10MΩ input-to-output isolation
- Full enclosed, encapsulated construction with heat spreader for low temperature rise
- Output overcurrent and overvoltage protection
- Indefinite short circuit protection
- Over Temperature protection
- Input Under voltage protection
- MTBF of 1,000,000 hours @ 50°C ( Bellcore )

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**EMERALTECH**  
Product Brief

## CONVERTER SELECTION

Typical @  $T_a = +25^\circ\text{C}$  under nominal line voltage and 75% load conditions, unless noted.

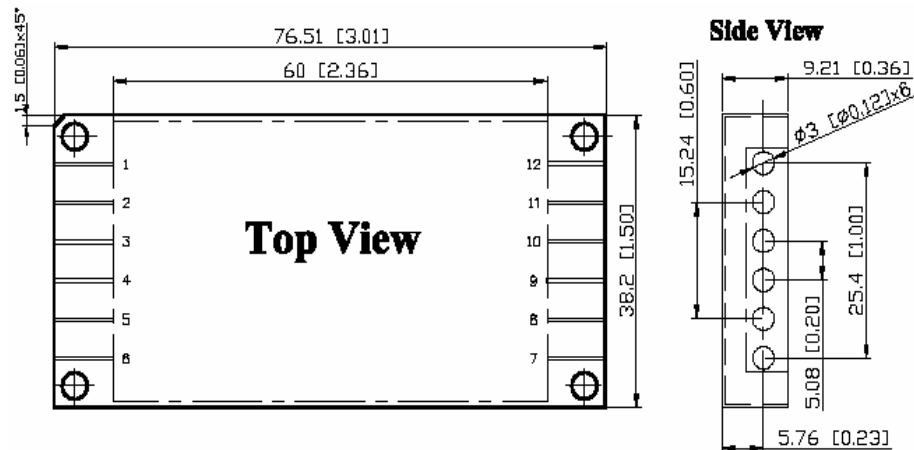
| Model               | Input         |       |             |           | Output             |                   | Efficiency<br>75% Load<br>(%) |
|---------------------|---------------|-------|-------------|-----------|--------------------|-------------------|-------------------------------|
|                     | Voltage (VDC) |       | Current (A) |           | Voltage<br>(Volts) | Current<br>(Amps) |                               |
|                     | Nominal       | Range | No load     | Full load |                    |                   |                               |
| <b>EMQ28050M20P</b> | 28            | 18-36 | 0.1         | 4.1       | 5                  | 20                | 91                            |

For negative logic feature add designator N as suffix to model number, i.e., EMQ28050M20N

Consult factory for other output voltage configurations.

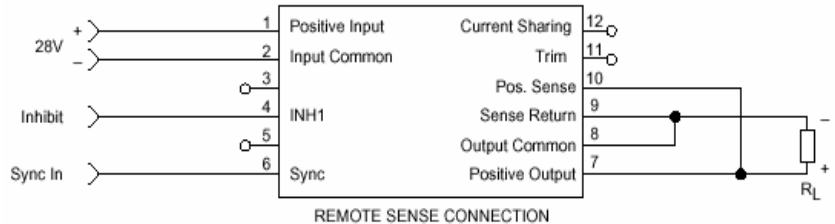
## Outline Information and Summary Specifications

| Pin Connection |                            |
|----------------|----------------------------|
| Pin#           | Function                   |
| 1              | Positive Input ( Vin + )   |
| 2              | Input Common ( Vin - )     |
| 3              |                            |
| 4              | Inhibit ( INHB )           |
| 5              |                            |
| 6              | Sync In/Out ( SYNC )       |
| 7              | Positive Output ( Vout + ) |
| 8              | Output Common ( Vout - )   |
| 9              | Sense Return ( S - )       |
| 10             | Positive Sense ( S + )     |
| 11             | Trim ( TRIM )              |
| 12             | Current Sharing ( LSHR )   |



### Notes:

- 1). All dimensions are in inches [mm]
- 2). All pins are dia. 0.040 [1.02]
- 3). Pin material: Brass
- 4). Pin finish: Gold plated
- 5). Heat spreader (baseplate) material: Aluminum
- 6). Weight: 100 gram Max.



### Thermal Derating

Vin = 28V

Full load (20A) from  $-55^\circ\text{C}$  to  $125^\circ\text{C}$  base plate temperature,  
Linearly derate to zero from  $125^\circ\text{C}$  to  $135^\circ\text{C}$ .

The information and specifications contained in this specification are believed to be accurate and reliable at the time of publication. Specifications are subject to change without notice.

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Product Brief

## Electrical Specification

Typical test data at Ta=25°C, Vin=28V unless otherwise noted.

| PARAMETER                                | NOTES                            | MIN   | TYP  | MAX       | UNIT      |
|--|----------------------------------|-------|------|-----------|-----------|
| <b>Absolute maximum rating</b>           |                                  |       |      |           |           |
| Input voltage                            |                                  | 0     |      | 40        | V         |
| Operating case temperature               |                                  | -55   |      | 125       | °C        |
| Storage temperature                      |                                  | -65   |      | 150       | °C        |
| Humidity                                 |                                  |       |      | 95        | %         |
| <b>Input characteristics</b>             |                                  |       |      |           |           |
| Operating input voltage range            |                                  | 18    | 28   | 36        | V         |
| Turn on voltage threshold                |                                  | 16    | 16.8 | 17.5      | V         |
| Turn off voltage threshold               |                                  | 15.5  | 16.3 | 17        | V         |
| Transient withstand                      | Transient duration: 100ms        |       |      | 50        | V         |
| Maximum input current                    | 100% load, 18Vin                 |       | 6.2  | 6.5       | A         |
| Off converter input current              | 28Vin                            |       | 3.5  | 5         | mA        |
| <b>Output characteristics</b>            |                                  |       |      |           |           |
| Output voltage set point                 |                                  | 4.950 | 5.00 | 5.050     | V         |
| Output voltage line regulation           | 18~36 Vin                        |       | ±0.5 | ±1.0      | %         |
| Output voltage load regulation           | 10%-100%Load                     |       | ±0.5 | ±1.0      | %         |
| Output voltage trim range                | Percentage of normal output      | -15   |      | +10       | %         |
| Output voltage ripple and noise          | 20MHz bandwidth, 75% Load, 28Vin |       | 75   | 100       | mV(pk-pk) |
| Output over power protection             |                                  | 110   | 120  | 130       | %         |
| Over-voltage protection                  |                                  | 5.6   | 5.8  | 6.1       | V         |
| Output current range                     |                                  | 0     |      | 20        | A         |
| Over-temperature protection              |                                  |       | 135  | 140       | °C        |
| Temperature coefficient                  |                                  |       |      | ±0.05     | %/°C      |
| Capacitive Load                          |                                  | 0     |      | 15,000    | μF        |
| <b>Output dynamic characteristics</b>    |                                  |       |      |           |           |
| Startup time                             | 5% to 95% of the output voltage  |       | 20   | 30        | ms        |
| Transient recovery time                  |                                  |       | 400  | 500       | μs        |
| Transient Peak                           | 50% - 75% - 50% load (2.0A/us)   |       | 280  | 350       | mv pk     |
| <b>Efficiency (see efficiency curve)</b> |                                  |       |      |           |           |
| 75% load efficiency                      | 28 Vin                           |       | 91   |           | %         |
| <b>Isolation characteristics</b>         |                                  |       |      |           |           |
| Isolation voltage (primary to secondary) | 1minute                          |       | 500  |           | VDC       |
| Isolation voltage (primary to case)      | 1minute                          |       | 250  |           | VDC       |
| Isolation voltage (secondary to case)    | 1minute                          |       | 250  |           | VDC       |
| Isolation resistance                     | 500VDC, Primary to secondary     | 10    |      |           | MΩ        |
| Isolation capacitance                    | Primary to secondary             |       |      | 1000      | pF        |
| <b>Feature Characteristics</b>           |                                  |       |      |           |           |
| Switching frequency                      |                                  | 360   | 400  | 440       | KHz       |
| ON/OFF control (Positive logic)          |                                  |       |      |           |           |
| Converter On (Open = on)                 |                                  | 2.5   |      | 7         | V         |
| Converter Off                            | EMQ28050M20P                     | -1.0  |      | 1.2       | V         |
| ON/OFF control (Negative logic)          |                                  |       |      |           |           |
| Converter On (Open = on)                 |                                  | -1.0  |      | 1.2       | V         |
| Converter Off                            | EMQ28050M20N                     | 2.5   |      | 7         | V         |
| Calculated MTBF                          | Bellcore @ 50°C                  |       |      | 1,000,000 | Hrs       |
| Weight                                   |                                  |       |      | 100       | gram      |

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## Basic operation and functions

The **EMQ family** uses a number of proprietary technologies to achieve high efficiency, high output current operations. The whole unit switches at the fixed frequency with a predictable EMI performance. The transformer secondary output is processed with synchronous rectifier to achieve high efficiency power conversion at high output current.

The product offers most complete control and protection functions with the pin outs as described below:

### Input Power ( pin1, pin2 )

Input power terminals. Vin+ (pin1) must be connected to Positive input voltage; Vin- (pin2) must be connected to Negative input voltage.

### Output Power ( pin7, pin8 )

Output power terminals. Vout+ (pin7) is the positive output voltage terminal; Vout- is the negative output voltage terminal.

### Inhibit ( pin 4 )

This pin is a TTL compatible inhibit terminal (INHB) to disable the power converter, resulting in a very low quiescent input current. Options of positive or negative logic are available with the signal levels as specified in the electric parameter table. In both cases open terminal allows the unit to continue its operation.

### Current Sharing ( pin 12)

Multiple EMQ converts can be used in parallel to drive a common load (see Figure 2). In this mode of operation EMQ converters offer a single bus share control configuration by just connecting the LSHR terminal of the paralleled converters together, as shown in Fig.2.

When paralleled, 95% of the total combined power ratings of the EMQ converters are available at the load. Overload and short circuit performance are not adversely affected during parallel operation.

### Remote Sense ( pin 9, pin 10 )

Remote sense allows the user to maintain accurate output voltage at the remote load terminals regardless of the line drop.

To achieve this the Sense- (pin9) and Sense+ (pin10) should be connected at the load terminals or at the point where the regulation is needed as shown on Fig. 1.

If remote Sense is not required, the Sense- pin must be connected to the Vout- pin (pin8), and the Sense+ pin must be connected to the Vout(+) pin(pin 7) to ensure that the unit will regulate at the specified output voltage. If these connections are not made, the unit's output voltage will not be maintained at the specified value.

The unit output over voltage protection senses the terminal voltage across Vout(+) and Vout(-), and not across the sense lines, so the resistance between the output pins of the unit and the load should be minimized to prevent unwanted triggering of OVP.

Also when using the remote sense function, the output power must be taken care of, as not to exceed the maximum power capability of the unit.

### Output Voltage Trim (pin 11)

Permits the user to adjust the output voltage up or down to satisfy specific custom voltage requirement. The adjustment range is from + 10% to -15%.

Output voltage can be adjusted up or down by connecting a trim resistor between Trim and Vout+ or Vout- terminal respectively as shown in Fig.3.

Leave Trim pin ( Pin 11) open for normal output voltage.

When trimming up, care must be taken not to exceed the unit OVP threshold.