

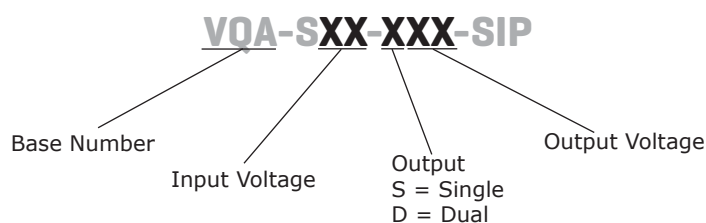
**SERIES: VQA | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- designed for IGBT driver modules
- small footprint
- 3,000 Vac isolation
- short circuit protection
- temperature range (-40~105°C)
- efficiency up to 80%



| MODEL           | input voltage |             | output voltage | output current | ripple and noise <sup>1</sup> | efficiency <sup>2</sup> |
|-----------------|---------------|-------------|----------------|----------------|-------------------------------|-------------------------|
|                 | typ (Vdc)     | range (Vdc) |                |                |                               |                         |
| VQA-S9-D15-SIP  | 12            | 9~15        | 15<br>-8       | 100<br>-80     | 200                           | 80                      |
| VQA-S12-D15-SIP | 12            | 11.6~12.4   | 15<br>-8.7     | 80<br>-40      | 200                           | 80                      |
| VQA-S15-S9-SIP  | 15            | 14.5~15.5   | 9              | 111            | 200                           | 80                      |
| VQA-S15-D9-SIP  | 15            | 14.5~15.5   | 9<br>-9        | 55<br>-55      | 200                           | 80                      |
| VQA-S15-D15-SIP | 15            | 14.5~15.5   | 15<br>-8.7     | 80<br>-40      | 200                           | 80                      |
| VQA-S15-D17-SIP | 15            | 14.5~15.5   | 17<br>-8.7     | 80<br>-40      | 200                           | 80                      |
| VQA-S24-D15-SIP | 24            | 23.3~24.7   | 15<br>-8.7     | 80<br>-40      | 200                           | 80                      |

Notes: 1. ripple and noise measured at 20 MHz bandwidth, full load  
2. at full load

**PART NUMBER KEY**


## INPUT

| parameter               | conditions/description | min  | typ | max   | units |
|-------------------------|------------------------|------|-----|-------|-------|
| input voltage           | VQA-S9-D15-SIP         | 9    | 12  | 15    | Vdc   |
|                         | VQA-S12-D15-SIP        | 11.6 | 12  | 12.4  | Vdc   |
|                         | VQA-S24-D15-SIP        | 23.3 | 24  | 24.7  | Vdc   |
|                         | all other models       | 14.5 | 15  | 15.5  | Vdc   |
| surge voltage           | VQA-S9-D15-SIP         | -0.7 |     | 15    | Vdc   |
|                         | VQA-S12-D15-SIP        | -0.7 |     | 13    | Vdc   |
|                         | VQA-S24-D15-SIP        | -0.7 |     | 26    | Vdc   |
|                         | all other models       | -0.7 |     | 16    | Vdc   |
| temperature coefficient | at full load           |      |     | ±0.03 | %/°C  |

## OUTPUT

| parameter           | conditions/description      | min | typ | max | units |
|---------------------|-----------------------------|-----|-----|-----|-------|
| line regulation     | for Vin change of ±1%       |     | 1.2 | 1.5 | %     |
| switching frequency | at full load, nominal input |     | 100 | 200 | KHz   |

## PROTECTIONS

| parameter                | conditions/description   | min | typ | max | units |
|--------------------------|--------------------------|-----|-----|-----|-------|
| short circuit protection | continuous, auto restart |     |     |     |       |

## SAFETY AND COMPLIANCE

| parameter             | conditions/description                                             | min       | typ | max | units |
|-----------------------|--------------------------------------------------------------------|-----------|-----|-----|-------|
| isolation voltage     | input to output for 1 minute at 1 mA max. leakage                  | 3,000     |     |     | Vac   |
| isolation resistance  | input to output at 500 Vdc                                         | 1,000     |     |     | MΩ    |
| isolation capacitance | input to output, 100 kHz/0.1 V                                     |           | 6.6 |     | pF    |
| conducted emissions   | CISPR22/EN55022, class B, external circuit required (see figure 1) |           |     |     |       |
| radiated emissions    | CISPR22/EN55022, class B, external circuit required (see figure 1) |           |     |     |       |
| ESD                   | IEC/EN61000-4-2, contact ±8kV, class B                             |           |     |     |       |
| MTBF                  | MIL-HDBK-217F @ 25°C                                               | 3,500,000 |     |     | hours |
| RoHS compliant        | yes                                                                |           |     |     |       |

## ENVIRONMENTAL

| parameter             | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature | see derating curve     | -40 |     | 105 | °C    |
| storage temperature   |                        | -55 |     | 125 | °C    |
| storage humidity      | non-condensing         |     |     | 95  | %     |

## SOLDERABILITY

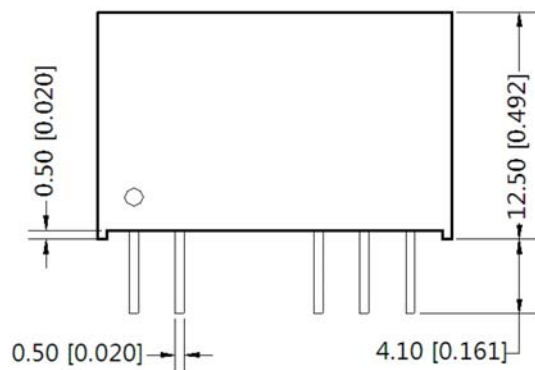
| parameter      | conditions/description         | min | typ | max | units |
|----------------|--------------------------------|-----|-----|-----|-------|
| hand soldering | 1.5mm from case for 10 seconds |     |     | 300 | °C    |

## MECHANICAL

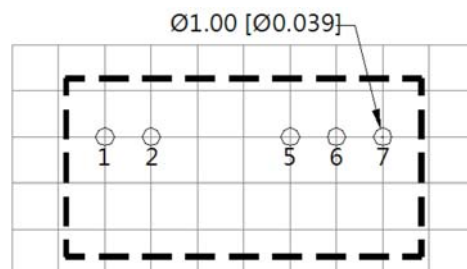
| parameter        | conditions/description                           | min | typ | max | units |
|------------------|--------------------------------------------------|-----|-----|-----|-------|
| dimensions       | 19.50 x 9.80 x 12.5 (0.768 x 0.386 x 0.492 inch) |     |     |     | mm    |
| material         | plastic (UL94V-0)                                |     |     |     |       |
| weight           |                                                  |     | 4.3 |     | g     |
| temperature rise | Ta=25°C                                          |     | 25  |     | °C    |

## MECHANICAL DRAWING

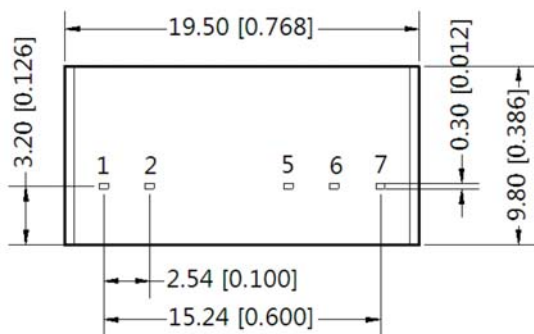
units: mm [inches]

tolerance:  $\pm 0.50$  [ $\pm 0.020$ ]pin section tolerance:  $\pm 0.10$  [ $\pm 0.004$ ]

Front View



Grid size: 2.54mm x 2.54mm

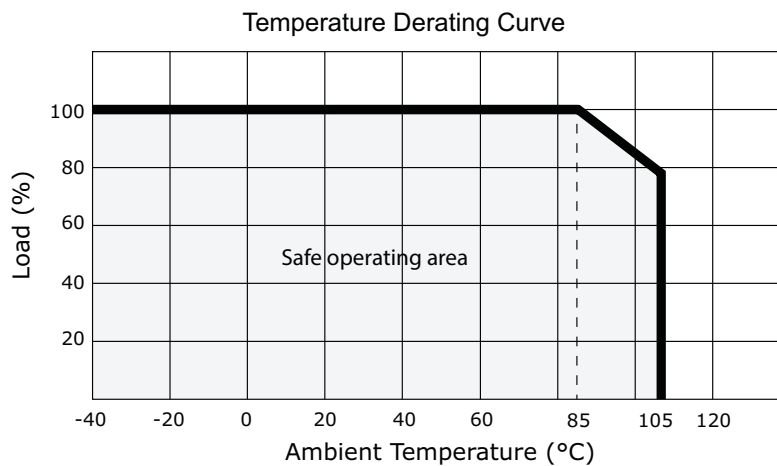
Top View  
PCB LAYOUT

Bottom View

| PIN CONNECTIONS |          |
|-----------------|----------|
| PIN             | FUNCTION |
| 1               | Vin      |
| 2               | GND      |
| 5*              | -Vo      |
| 6               | 0 V      |
| 7               | +Vo      |

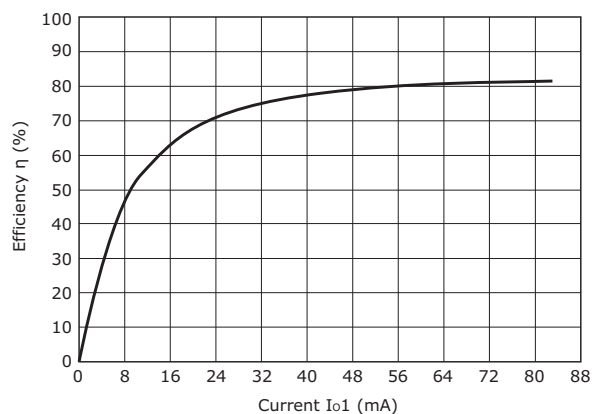
Note: \*VQA-S15-S9-SIP has no connection

## DERATING CURVES



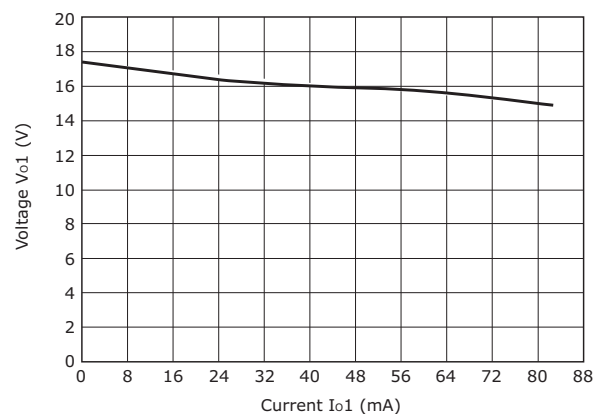
## PERFORMANCE CURVES

1. output current vs. efficiency

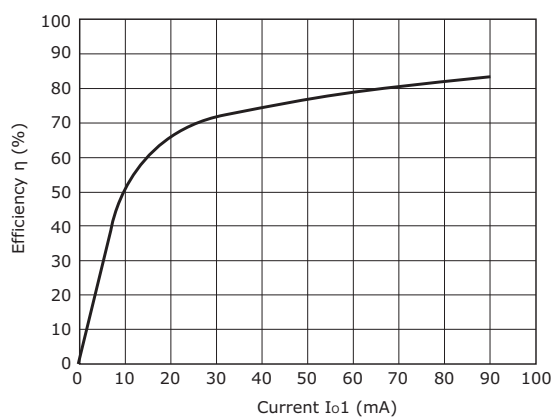


VQA-S12-D15-SIP, VQA-S15-D15-SIP, VQA-S24-D15-SIP

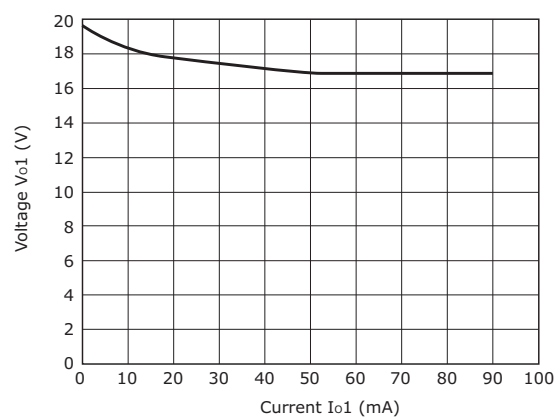
2. output current vs. output voltage



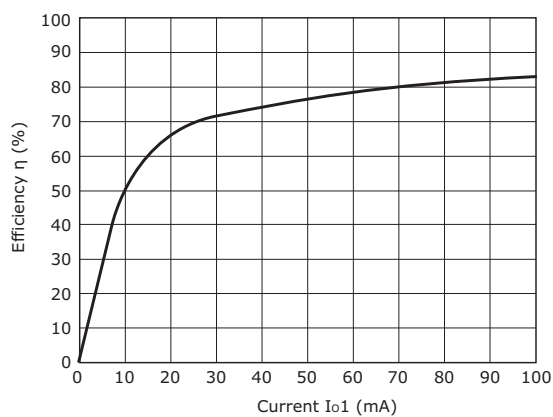
VQA-S12-D15-SIP, VQA-S15-D15-SIP, VQA-S24-D15-SIP



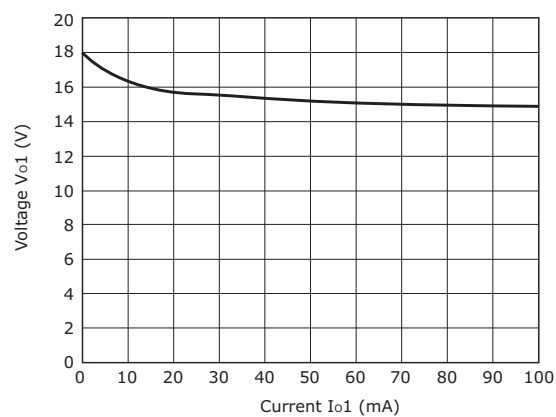
VQA-S15-D17-SIP



VQA-S15-D17-SIP



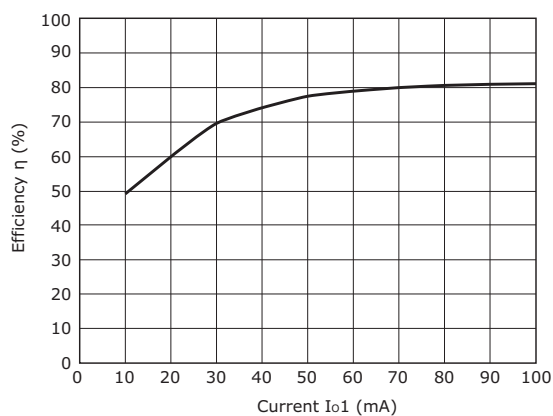
VQA-S9-D15-SIP



VQA-S9-D15-SIP

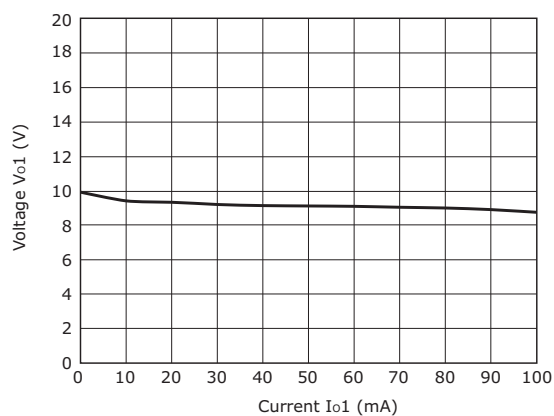
## PERFORMANCE CURVES (CONTINUED)

1. output current vs. efficiency

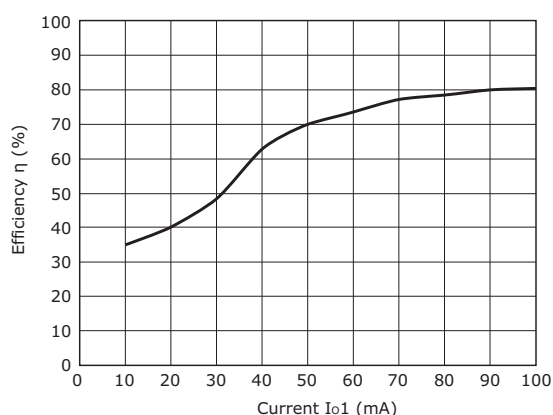


VQA-S15-S9-SIP

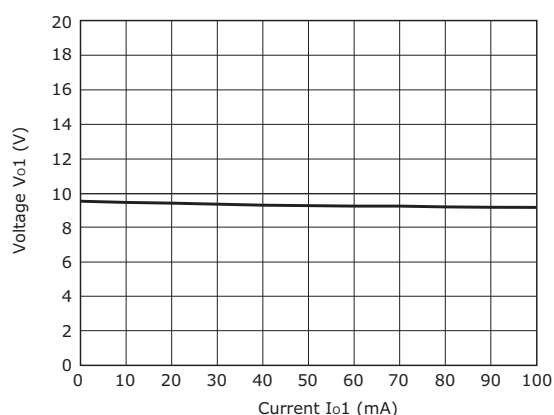
2. output current vs. output voltage



VQA-S15-S9-SIP



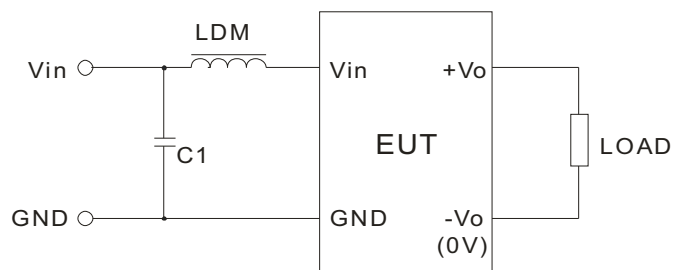
VQA-S15-D9-SIP



VQA-S15-D9-SIP

## EMC RECOMMENDED CIRCUIT

### Figure 1

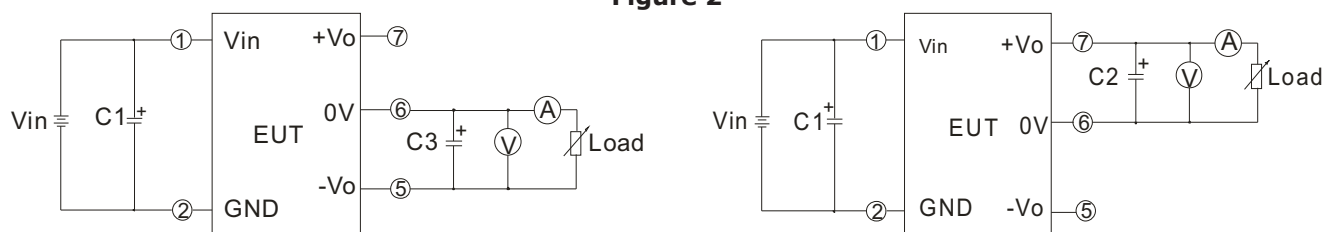


### Table 1

| Recommended external circuit components |           |      |
|-----------------------------------------|-----------|------|
| V <sub>in</sub><br>(Vdc)                | C1        | LDM  |
| 12                                      | 4.7μF/50V | 12μH |
| 15                                      | 4.7μF/50V | 12μH |
| 24                                      | 4.7μF/50V | 12μH |

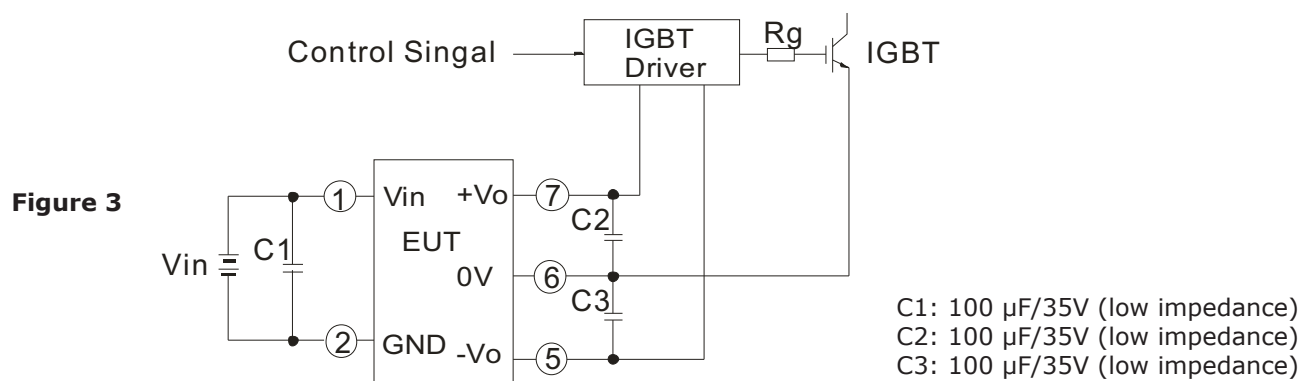
## TEST CONFIGURATION

## Figure 2



C1, C2, C3: 100  $\mu$ F/35V (low impedance)

## APPLICATION CIRCUIT



- Notes:
1. The wire between the converter and IGBT driver must as short as possible.
  2. External filter capacitors should be connected as close as possible to the converter and the IGBT driver.
  3. The output average power of the IGBT driver should be less than the output power of DC-DC module.
  4. Maximum capacitive load is tested at nominal input voltage and full load.

## REVISION HISTORY

| rev. | description                       | date       |
|------|-----------------------------------|------------|
| 1.0  | initial release                   | 08/16/2012 |
| 1.01 | updated features                  | 09/20/2012 |
| 1.02 | updated product photograph        | 11/13/2012 |
| 1.03 | various updates                   | 02/05/2013 |
| 1.04 | added switching frequency to spec | 07/01/2013 |
| 1.05 | added models, updated spec        | 09/23/2013 |

The revision history provided is for informational purposes only and is believed to be accurate.



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