

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)
- UL 60950-1 approval
- efficiency up to 80%

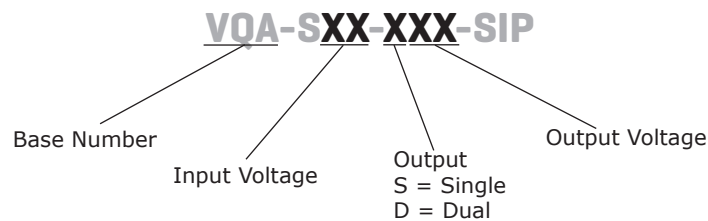


MODEL

| MODEL | input voltage | | output voltage (Vdc) | output current max (mA) | ripple and noise ² max (mVp-p) | efficiency ³ typ (%) |
|------------------------------|---------------|----------------|-------------------------|-------------------------------|---|---------------------------------------|
| | typ (Vdc) | range (Vdc) | | | | |
| VQA-S9-D15-SIP ¹ | 12 | 9~15 | 15 -8 | 100 -80 | 200 | 80 |
| VQA-S12-D15-SIP ¹ | 12 | 11.6~12.4 | 15 -8.7 | 80 -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 -9 | 55 -55 | 200 | 80 |
| VQA-S15-D15-SIP ¹ | 15 | 14.5~15.5 | 15 -8.7 | 80 -40 | 200 | 80 |
| VQA-S15-D17-SIP ¹ | 15 | 14.5~15.5 | 17 -8.7 | 80 -40 | 200 | 80 |
| VQA-S24-D15-SIP ¹ | 24 | 23.3~24.7 | 15 -8.7 | 80 -40 | 200 | 80 |

Notes: 1. UL approved
 2. Ripple and noise are measured at 20 MHz BW by "parallel cable" method with 1 μF ceramic and 10 μF electrolytic capacitors on the output.
 3. 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 |
|---------------------|-----------------------------|-----|-----|-----|-------|
| capacitive load | | | | 200 | μF |
| 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 ¹ | | | | 1 | s |

Notes: 1. The supply voltage must be discontinued at the end of the short circuit duration

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 |
| safety approvals ² | UL 60950-1 | | | | |
| 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 | as per MIL-HDBK-217F @ 25°C | 3,500,000 | | | hours |
| RoHS | 2011/65/EU | | | | |

Notes: 2. See specific models listed on page 1

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

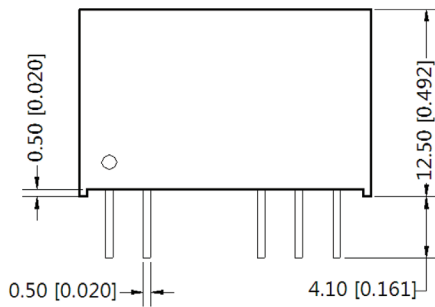
| parameter | conditions/description | min | typ | max | units |
|------------------|--|-----|-----|-----|-------|
| dimensions | 19.50 x 9.80 x 12.5 (0.768 x 0.386 x 0.492 inch) | | | | mm |
| material | plastic (UL94V-0) | | | | |
| weight | | | 4.3 | | g |
| temperature rise | Ta=25°C | | 25 | | °C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

MECHANICAL DRAWING

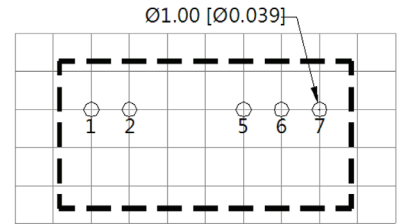
units: mm [inches]
 tolerance: ±0.50 [±0.020]
 pin section tolerance: ±0.10 [±0.004]

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

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

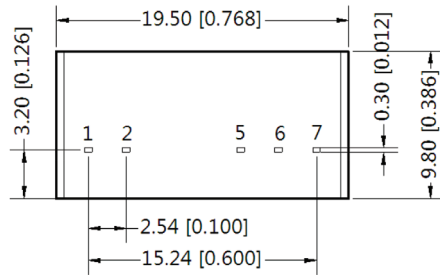


Front View



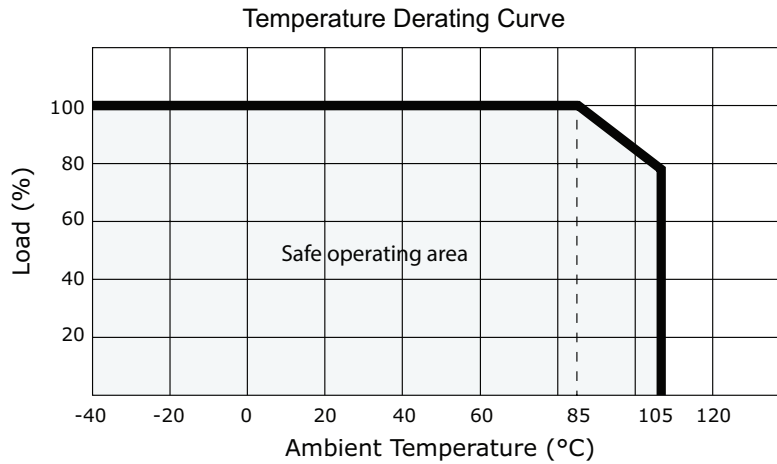
Grid size: 2.54mm x 2.54mm

Top View
PCB LAYOUT



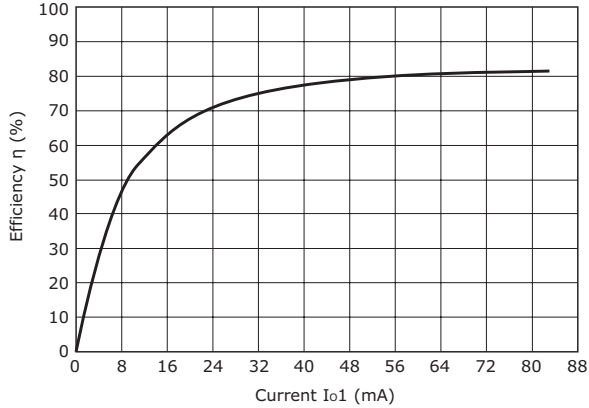
Bottom View

DERATING CURVES



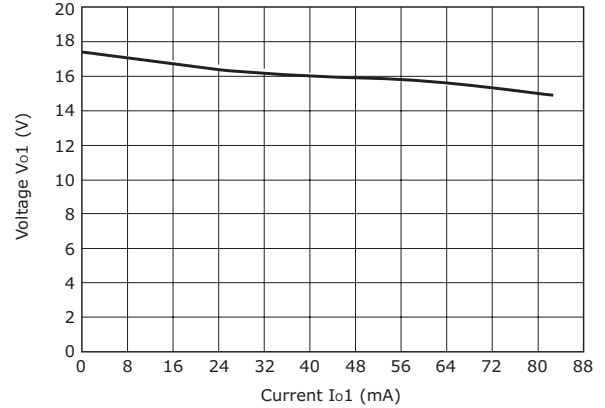
PERFORMANCE CURVES

1. output current vs. efficiency

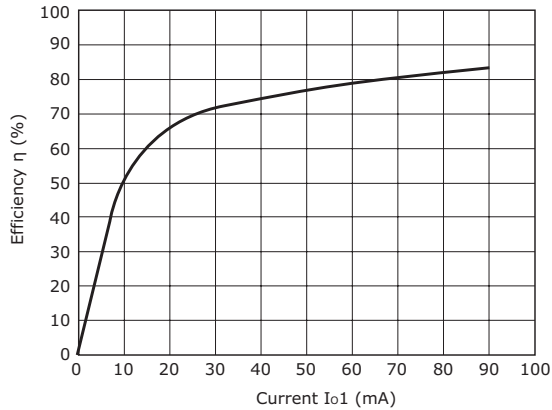


VQA-S12-D15-SIP, VQA-S15-D15-SIP, VQA-S24-D15-SIP

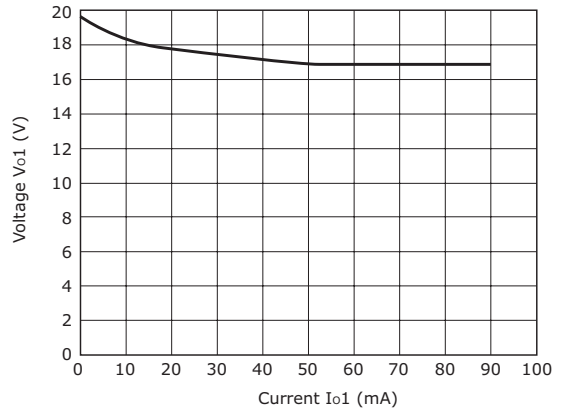
2. output current vs. output voltage



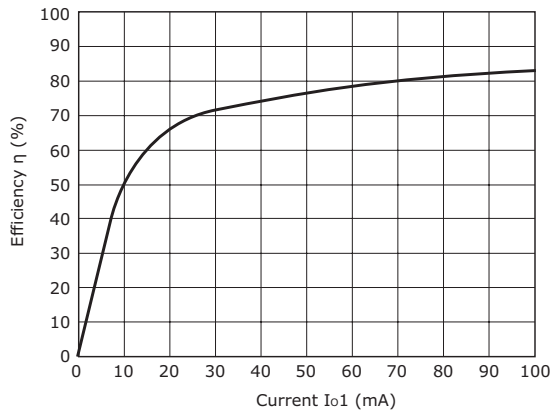
VQA-S12-D15-SIP, VQA-S15-D15-SIP, VQA-S24-D15-SIP



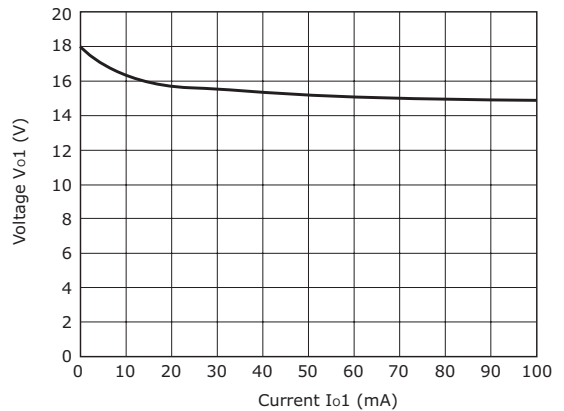
VQA-S15-D17-SIP



VQA-S15-D17-SIP



VQA-S9-D15-SIP



VQA-S9-D15-SIP

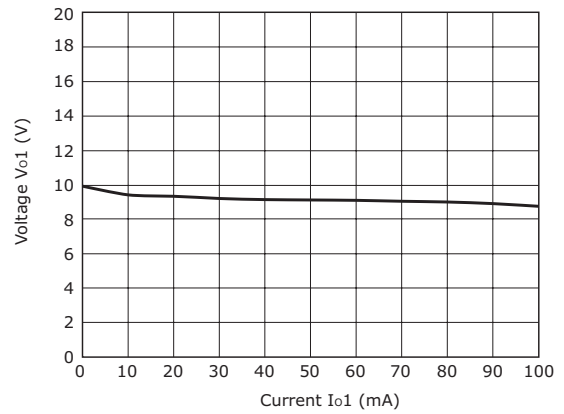
PERFORMANCE CURVES (CONTINUED)

1. output current vs. efficiency

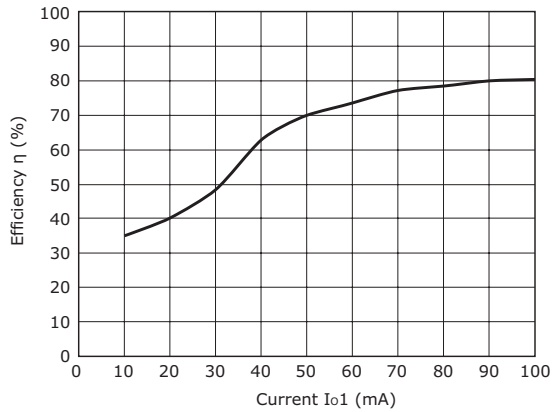


VQA-S15-S9-SIP

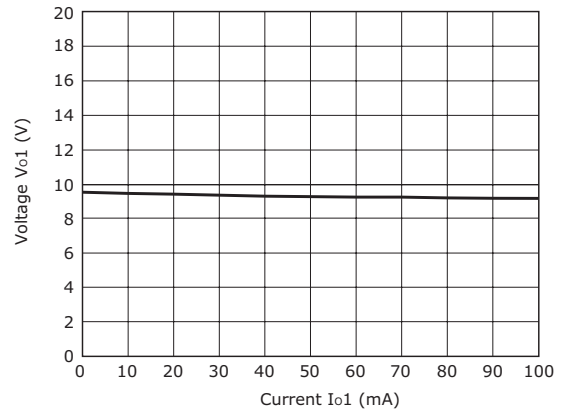
2. output current vs. output voltage



VQA-S15-S9-SIP



VQA-S15-D9-SIP



VQA-S15-D9-SIP

EMC RECOMMENDED CIRCUIT



Figure 1

Table 1

| Recommended external circuit components | | |
|---|-----------------|------------|
| V_{in} (Vdc) | C1 | LDM |
| 12 | 4.7 μ F/50V | 12 μ H |
| 15 | 4.7 μ F/50V | 12 μ H |
| 24 | 4.7 μ F/50V | 12 μ H |

TEST CONFIGURATION

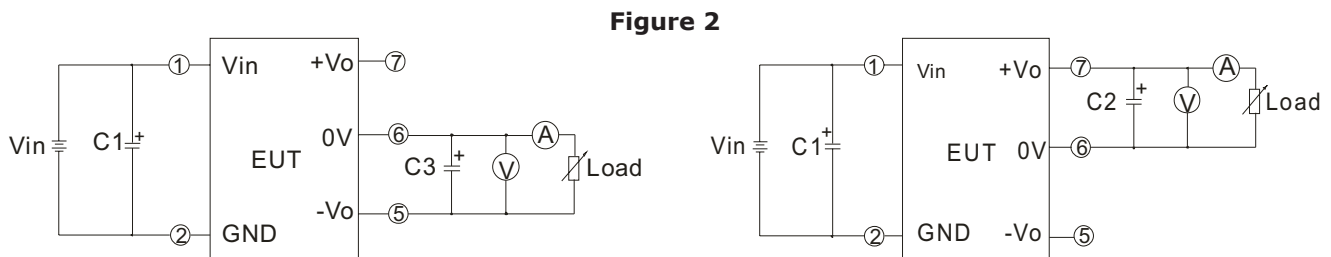
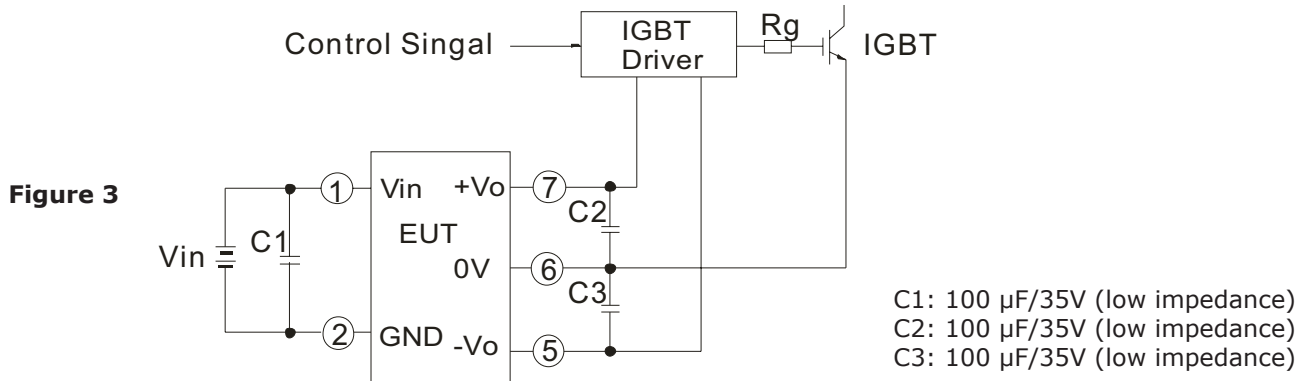


Figure 2

C1, C2, C3: 100 μ 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.

Note: 1. All specifications are measured at $T_a=25^\circ\text{C}$, humidity <75%, nominal input voltage and rated output load unless otherwise specified.

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 |
| 1.06 | added UL to some models | 02/12/2015 |

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



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