

**SERIES: V78-500-SMT | DESCRIPTION: NON-ISOLATED SWITCHING REGULATOR**
**FEATURES**

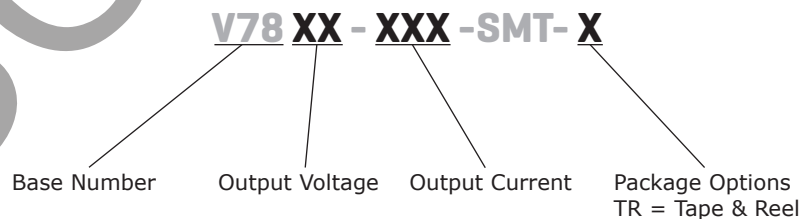
- 500 mA current output
- high efficiency up to 96%
- no heat sink required
- SMT package
- remote on/off control
- low ripple and noise
- short circuit protection, thermal shutdown
- wide temperature ( $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$ )

**MODEL**

|                              | input voltage |                | output voltage<br>(Vdc) | output current<br>(mA) | output power<br>max<br>(W) | ripple and noise <sup>1</sup><br>max<br>(mVp-p) | efficiency     |                |
|------------------------------|---------------|----------------|-------------------------|------------------------|----------------------------|-------------------------------------------------|----------------|----------------|
|                              | typ<br>(Vdc)  | range<br>(Vdc) |                         |                        |                            |                                                 | Vin min<br>(%) | Vin max<br>(%) |
| V7803-500-SMT*               | 12            | 4.5 ~ 28       | 3.3                     | 500                    | 1.65                       | 25                                              | 90             | 75             |
| V7805-500-SMT                | 12            | 6 ~ 28         | 5                       | 500                    | 2.5                        | 25                                              | 94             | 81             |
| V7812-500-SMT <sup>2</sup>   | 24            | 14 ~ 28        | 12                      | 500                    | 6                          | 25                                              | 95             | 90             |
| V7815-500-SMT <sup>2,*</sup> | 24            | 17 ~ 28        | 15                      | 500                    | 7.5                        | 25                                              | 96             | 92             |

Notes:

1. ripple & noise are measured at 20 MHz BW with 1  $\mu\text{F}$  ceramic cap and 10  $\mu\text{F}$  electrolytic capacitors on the output
2. must operate with a minimum of 5% loading
3. \* Discontinued model
4. Tape and reel option discontinued.

**PART NUMBER KEY**

## INPUT

| parameter                                | conditions/description                                         | min | typ  | max | units   |
|------------------------------------------|----------------------------------------------------------------|-----|------|-----|---------|
| input voltage                            | 3.3 Vdc output                                                 | 4.5 | 12   | 28  | Vdc     |
|                                          | 5 Vdc output                                                   | 6   | 12   | 28  | Vdc     |
|                                          | 12 Vdc output                                                  | 14  | 24   | 28  | Vdc     |
|                                          | 15Vdc output                                                   | 17  | 24   | 28  | Vdc     |
| remote on/off shutdown threshold voltage |                                                                | 1.1 | 1.25 | 1.4 | Vdc     |
| on/off control current                   | on: open or $1.5 < V_c \leq 6V$<br>off: GND or $0V < V_c < 1V$ |     | 2    |     | $\mu A$ |
| shutdown input current                   |                                                                |     | 15   | 30  | $\mu A$ |

## OUTPUT

| parameter                  | conditions/description                           | min | typ       | max        | units          |
|----------------------------|--------------------------------------------------|-----|-----------|------------|----------------|
| max capacitive load        |                                                  |     |           | 1000       | $\mu F$        |
| line regulation            | measured from low line to high line at 100% load |     | $\pm 0.2$ | $\pm 0.5$  | %              |
| load regulation            | measured from 10% to full load at nominal input  |     | $\pm 0.3$ | $\pm 0.75$ | %              |
| voltage accuracy           | measured from low line to high line at 100% load |     | $\pm 2$   | $\pm 3$    | %              |
| adjustability <sup>1</sup> | see application notes                            |     |           |            |                |
| temperature coefficient    |                                                  |     |           | $\pm 0.02$ | %/ $^{\circ}C$ |

Notes: 1. output voltage adjustment must meet  $V_{in} - V_o > 2V$  requirement

## PROTECTIONS

| parameter                | conditions/description                 | min | typ | max | units       |
|--------------------------|----------------------------------------|-----|-----|-----|-------------|
| short circuit protection | hiccup, continuous, automatic recovery |     |     |     |             |
| thermal shutdown         | internal IC junction                   |     | 160 |     | $^{\circ}C$ |
| current limit            |                                        |     | 1.8 |     | A           |

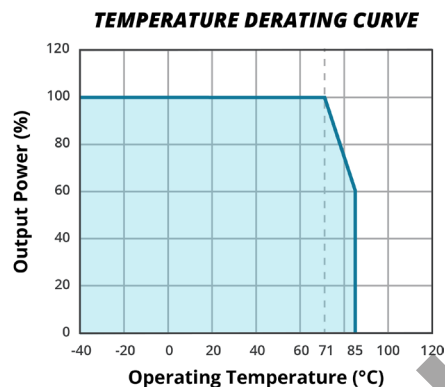
## SAFETY AND COMPLIANCE

| parameter | conditions/description               | min       | typ | max | units |
|-----------|--------------------------------------|-----------|-----|-----|-------|
| RoHS      | 2011/65/EU                           |           |     |     |       |
| MTBF      | as per MIL-HDBK-217F, 25 $^{\circ}C$ | 2,000,000 |     |     | hours |

## ENVIRONMENTAL

| parameter                  | conditions/description                                                                    | min | typ | max | units       |
|----------------------------|-------------------------------------------------------------------------------------------|-----|-----|-----|-------------|
| case operating temperature |                                                                                           |     |     | 100 | $^{\circ}C$ |
| operating temperature      | see derating curve                                                                        | -40 |     | 85  | $^{\circ}C$ |
| storage temperature        |                                                                                           | -55 |     | 125 | $^{\circ}C$ |
| storage humidity           |                                                                                           |     |     | 95  | %           |
| hand soldering             | for 10 seconds                                                                            |     |     | 300 | $^{\circ}C$ |
| reflow soldering           | at maximum duration time $\leq 60s$ at 217 $^{\circ}C$<br>refer to IPC/JEDEC J-STD-020D.1 |     |     | 240 | $^{\circ}C$ |

## DERATING CURVES



## MECHANICAL

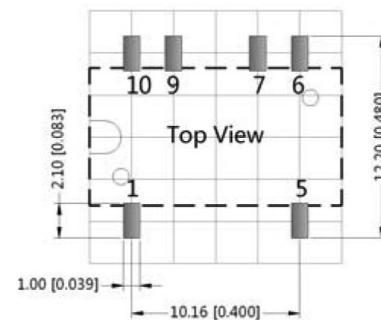
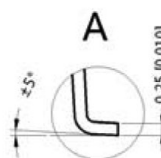
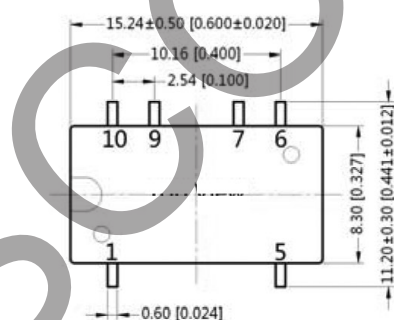
| parameter     | conditions/description                           | min | typ | max | units |
|---------------|--------------------------------------------------|-----|-----|-----|-------|
| dimensions    | 15.24 x 8.30 x 7.25 (0.600 x 0.327 x 0.285 inch) |     |     |     | mm    |
| case material | plastic (UL94-V0)                                |     |     |     |       |
| weight        |                                                  |     | 2.3 |     | g     |

## MECHANICAL DRAWING

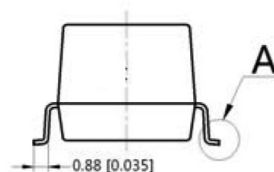
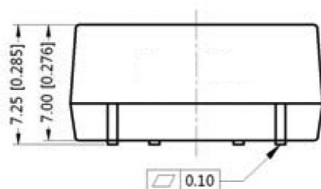
units: mm [in]

pin tolerance:  $\pm 0.10$  mm [ $\pm 0.004$  in]general tolerance:  $\pm 0.25$  mm [ $\pm 0.010$  in]

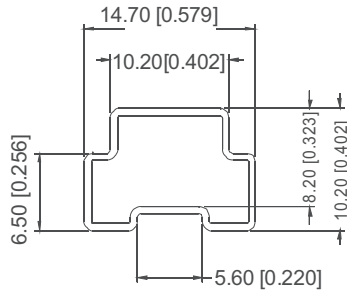
| PIN CONNECTIONS |        |
|-----------------|--------|
| 1               | Vin    |
| 5               | Vout   |
| 6               | Vadj   |
| 7               | GND    |
| 9               | GND    |
| 10              | On/Off |



Note: Grid 2.54\*2.54mm



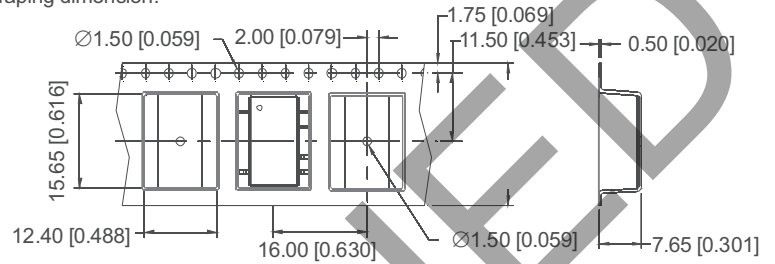
## PACKAGING DIMENSIONS



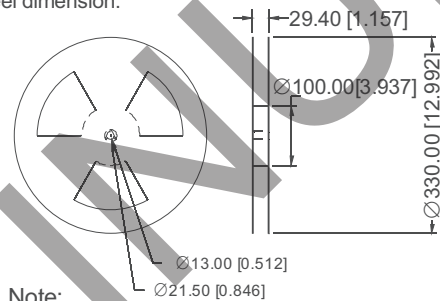
Note:  
Unit :mm[inch]  
General tolerances:  $\pm 0.50\text{mm}[\pm 0.020\text{inch}]$

L=530mm[20.866inch] Tube Quantity: 33pcs  
L=220mm[8.661inch] Tube Quantity: 13pcs

Taping dimension:

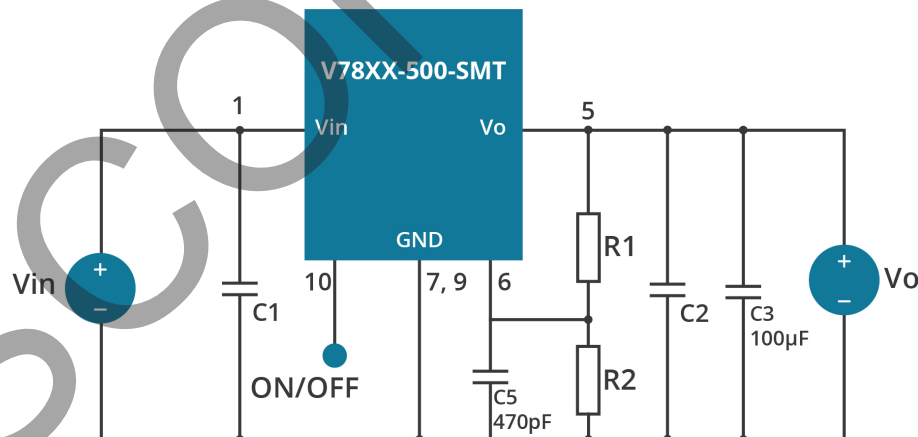


Taping reel dimension:



Note:  
Unit :mm[inch]  
General tolerances:  $\pm 0.50\text{mm}[\pm 0.020\text{inch}]$   
Devices per reel quantity: 500pcs

## TYPICAL APPLICATION CIRCUIT



1. C1, C2: Use ceramic capacitors (see table below); C3: For best performance, use a 100  $\mu\text{F}$  or more capacitor.
2. C1, C2, & C3 are required and should be placed close to the pins of the converter, with shortest possible leads.
3. R1 is used when trimming down. R2 is used when trimming up.
4. No parallel connection or plug and play.

| Part Number   | C1<br>(ceramic capacitor)   | C2<br>(ceramic capacitor)   |
|---------------|-----------------------------|-----------------------------|
| V7803-500-SMT | 10 $\mu\text{F}/50\text{V}$ | 22 $\mu\text{F}/16\text{V}$ |
| V7805-500-SMT | 10 $\mu\text{F}/50\text{V}$ | 22 $\mu\text{F}/16\text{V}$ |
| V7812-500-SMT | 10 $\mu\text{F}/50\text{V}$ | 10 $\mu\text{F}/25\text{V}$ |
| V7815-500-SMT | 10 $\mu\text{F}/50\text{V}$ | 10 $\mu\text{F}/25\text{V}$ |

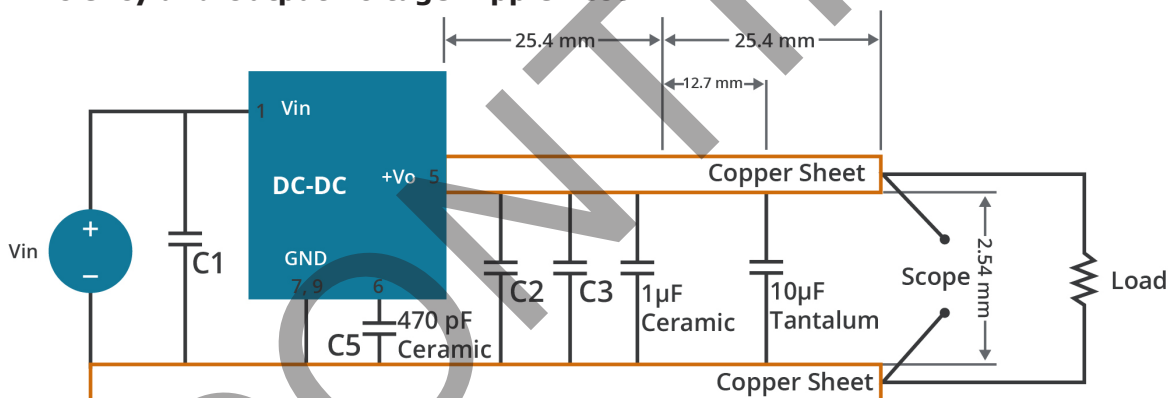
## OUTPUT TRIMMING

| Part Name     | Vo nom | Trim Down                                  | Trim Up                                    |
|---------------|--------|--------------------------------------------|--------------------------------------------|
|               |        | R1(KΩ)                                     | R2(KΩ)                                     |
| V7803-500-SMT | 3.3V   | $= \frac{61 \cdot V_o - 75.10}{3.3 - V_o}$ | $= \frac{75.10 - 10 \cdot V_o}{V_o - 3.3}$ |
| V7805-500-SMT | 5.0V   | $= \frac{61 \cdot V_o - 91.52}{5.0 - V_o}$ | $= \frac{91.52 - 10 \cdot V_o}{V_o - 5.0}$ |
| V7812-500-SMT | 12V    | $= \frac{71 \cdot V_o - 287.02}{12 - V_o}$ | $= \frac{287.02 - 20 \cdot V_o}{V_o - 12}$ |
| V7815-500-SMT | 15V    | $= \frac{66 \cdot V_o - 269.37}{15 - V_o}$ | $= \frac{269.37 - 15 \cdot V_o}{V_o - 15}$ |

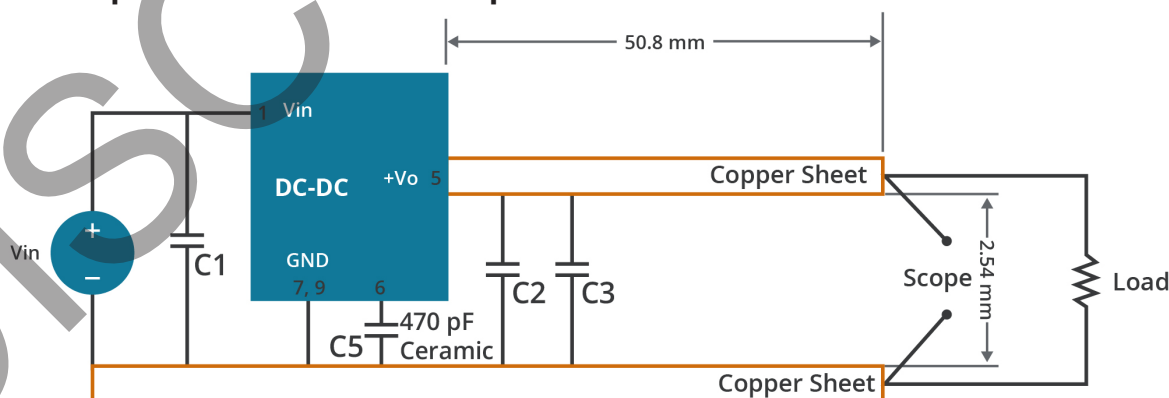
To trim the output of the device input the desired output voltage (Vo) into the proper equation. R1 trims the output voltage down and R2 trims the voltage up. If not using the trim feature R1 and R2 are left open. Make sure that the desired output voltage is within the trim range.

## TEST CIRCUIT

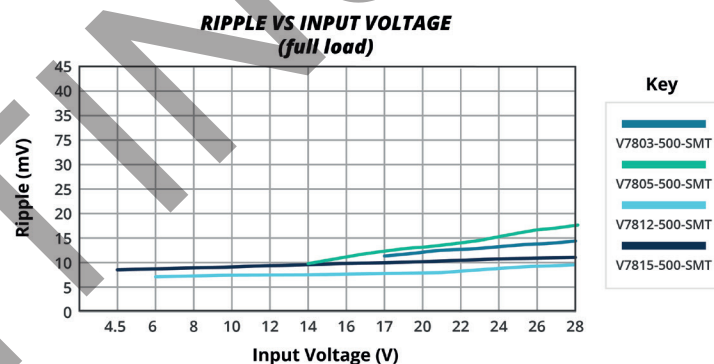
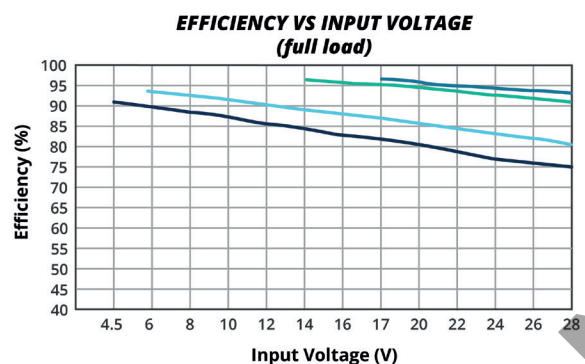
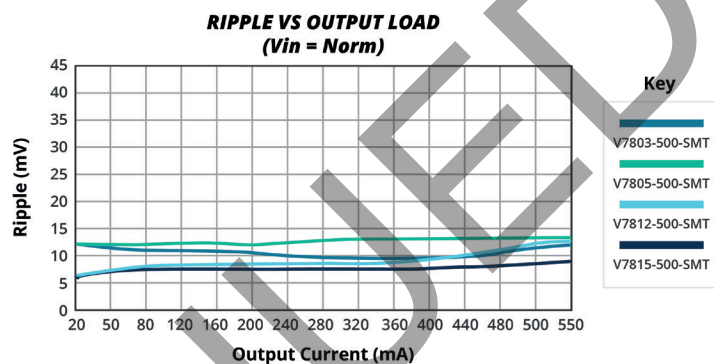
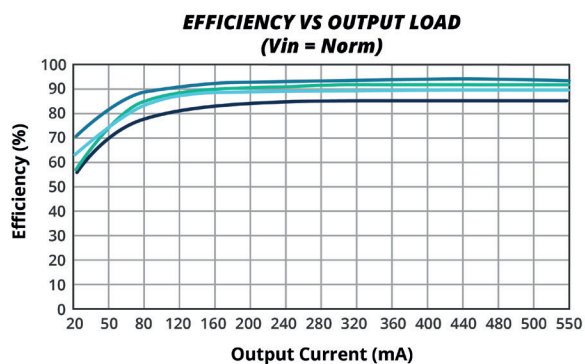
### Efficiency and Output Voltage Ripple Test



### Start-up and Load Transient Response Test



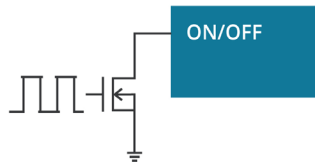
## EFFICIENCY AND RIPPLE



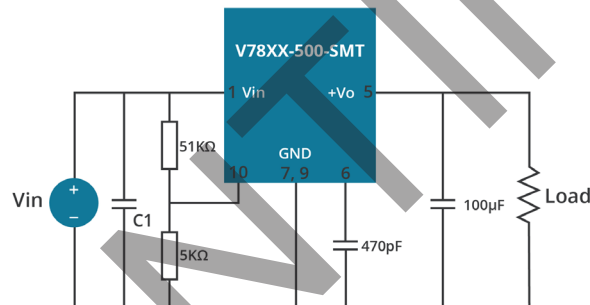
## SHUTDOWN CONTROL

The ON/OFF pin provides several features for adjusting and sequencing the power supply, a user has the flexibility of using the ON/OFF pin as:

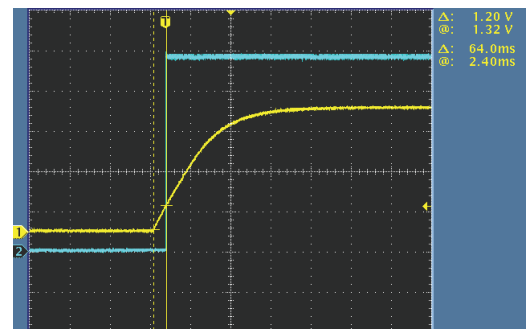
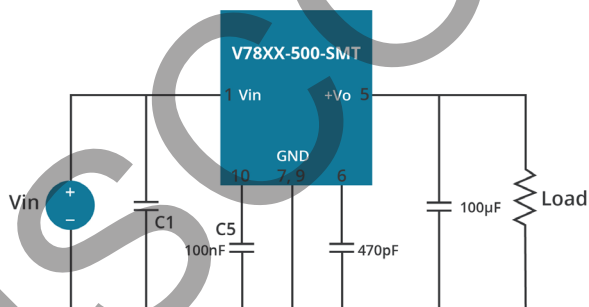
- 1) A digital on/off control by pulling down the ON/OFF pin with an open-drain transistor.



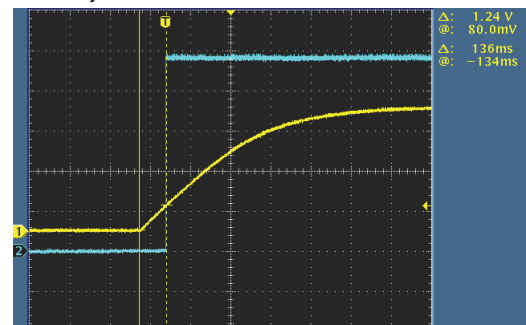
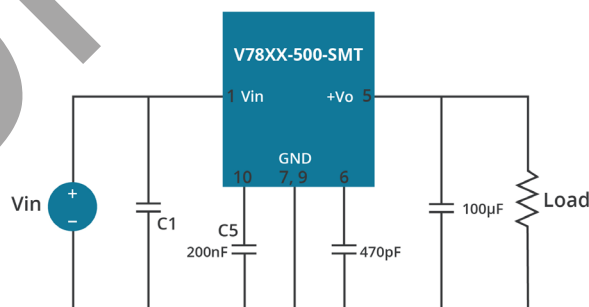
- 2) Line UVLO. If desired to achieve a UVLO voltage, a resistor divider from  $V_{in}$  to ON/OFF to GND can be used to disable the converter until a higher input voltage is achieved. For example, it is not useful for a converter with 12V output to start up with a 12V input, as the output cannot reach regulation. To enable the converter when the input voltage reaches 14V, a 51k $\Omega$ /5k $\Omega$  voltage divider from  $V_{in}$  to GND can be connected to the ON/OFF pin. Both the precision 1.25V threshold and 150mV hysteresis are multiplied by the resistor ratio, providing a proportional 12% hysteresis for any startup threshold. So, the turn off threshold would be between 12.3V to 15.7V.



- 3) Power supply sequencing. By connecting a small capacitor from ON/OFF to GND, the 2 $\mu$ A current source and 1.25V threshold can provide a stable and predictable delay between startup of multiple power supplies. For example, a startup delay of roughly 64mS is provided using 100nF, and roughly 136mS by using 200nF.



CH1: Von/off  
CH2: Vo  
Delay time: 64mS



CH1: Von/off  
CH2: Vo  
Delay time: 136mS

## REVISION HISTORY

| rev. | description                                                             | date       |
|------|-------------------------------------------------------------------------|------------|
| 1.0  | initial release                                                         | 01/04/2008 |
| 1.01 | new template applied                                                    | 04/28/2009 |
| 1.02 | V-Infinity branding removed                                             | 09/06/2012 |
| 1.03 | added TR package option                                                 | 10/31/2012 |
| 1.04 | added minimum loading requirement note                                  | 01/30/2013 |
| 1.05 | updated spec                                                            | 03/08/2013 |
| 1.06 | housing width changed, updated datasheet                                | 01/26/2016 |
| 1.07 | discontinued V7815-500-SMT model                                        | 06/24/2019 |
| 1.08 | reflow soldering updated                                                | 09/14/2020 |
| 1.09 | derating curve, efficiency curves and circuit figures updated           | 08/17/2021 |
| 1.10 | standard packaging discontinued, PN key updated                         | 05/30/2022 |
| 1.11 | discontinued model V7803-500-SMT, V7803-500-SMT-TR,<br>V7815-500-SMT-TR | 10/05/2023 |

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



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