

MegaTarzan™ MQ7280SIP03, MQ7280SIP05
Non-isolated 3~5.5VDC input, 0.75~3.6V output, 30A DC-DC Converter



FEATURES

- Wide operating voltage:
 - MQ7280SIP03: 3.0V ~4.0V
 - MQ7280SIP05: 4.5~5.5V
- Output Current up to 30A
- Output voltage ripple: 20mVPP
- High Efficiency 93%
- Overcurrent /shortcircuit protection
- Over-temperature protection
- Remote on/off control – negative or positive
- High reliability: designed to meet 5 million hour MTBF
- Output voltage remote sense compensation
- Minimal space on PCB:
 - 50.8 mm x 12.7 mm x 10.4 mm or
 - 2.0 in x 0.5 in x 0.41 in
- No derating to +60°C, natural convection
- UL/IEC/EN60950 compliant
- RoHS Compliant available

APPLICATIONS

- Workstations, servers
- Desktop computers
- DSP applications
- Distributed power architectures
- Telecommunications equipment
- Data communications equipment
- Wireless communications equipment

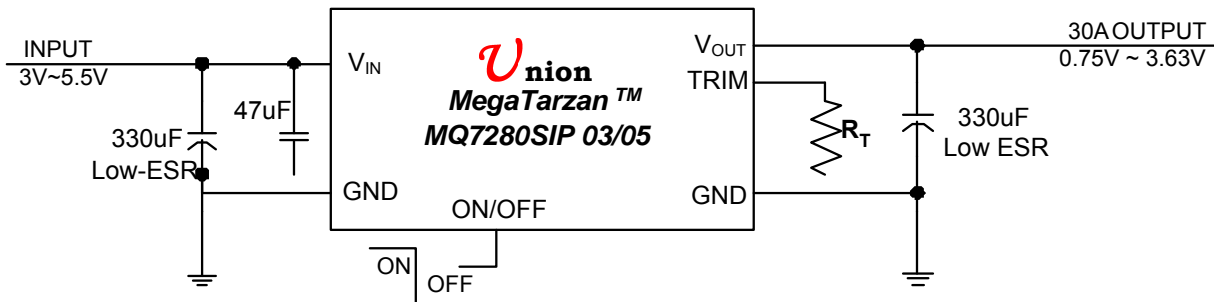
OPTIONS

- Positive or negative logic

Description

The **MegaTarzan™** MQ7280SIP03/05 Series Power Modules are non-isolated dc-dc converters that operate over a wide input voltage range of 3Vdc to 5.5Vdc and provide a precisely (2%) regulated dc output with industry standard pin configuration. Such a module is suitable to application with 3V/5V power supply bus. The modules have a maximum output current rating of 30A at a typical full-load efficiency over 93%. Default features include remote on/off with positive logic and output voltage adjustment, over-current protection, over-temperature protection. Option features include positive or negative logic mode.

***** **Typical Application Circuit** *****

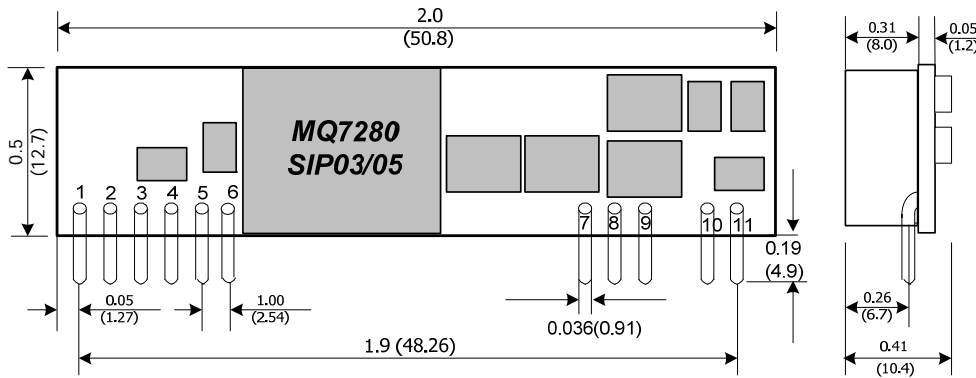


Performance Specificaons (at TA=+25°C)

Model	Input V _{IN} Range (V)	Output				Efficiency (%)
		I _{OUT} (A)	Trim Range (V)	Regulation		
				Line (%)	Load (%)	
MQ7280SIP03	3~3.6	30	0.75V~2.5V	1	1	93
MQ7280SIP05	4.5~5.5	30	0.75V~3.63V	1	1	93

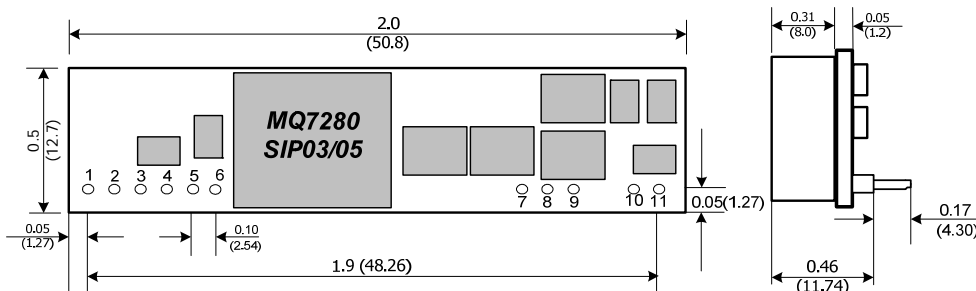
Mechanical Specifications

Dimensions are in inches (millimeters)



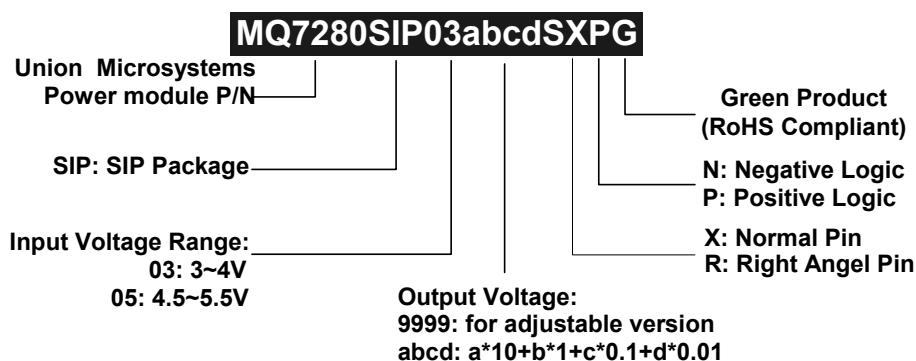
PIN	Description
1,2,4	VOUT
3	Sense
5	GND
6	GND
7	GND
8	VIN
9	VIN
10	TRIM
11	ON/OFF

Dimensions are in inches(mm) with -R option



PIN	Description
1,2,4	VOUT
3	Sense
5	GND
6	GND
7	GND
8	VIN
9	VIN
10	TRIM
11	ON/OFF

Ordering Information



For examples:

MQ7280SIP039999SXPG means MQ7280 in SIP package, input voltage 3~3.6V, output voltage 0.75V~2.5V, positive logic mode and RoHS compliant.

MQ7280SIP059999SXNG means MQ7280 in SIP package, input voltage 4.5~5.5, output voltage 0.75V~3.6V, negative logic mode and RoHS compliant.

Absolute Maximum Ratings

Note: These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability. Proper operation under conditions other than those listed in the Performance Specifications Table is not implied.

Parameter	Symbol	Min	Max	Unit
Input Voltage	V_{IN}	-0.3	6	V
Storage Temperature	T_{STG}	-40	125	°C

MQ7280SIP05 Electrical Specifications: ($T_A=+25^\circ\text{C}$, input voltage 5V, unless otherwise noted)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Input Voltage Range		V_{IN}	4.5		5.5	V
Output Current		I_o	0		30	A
Output Voltage Set point	100% load	ΔV_o	-2		+2	%
Output Trim Range	See Performance Specifications					
Line Regulation						
Load Regulation						
Output Ripple and Noise Voltage	$I_o=30A, 0\sim 20\text{MHz}$ (Detail Please see Ripple Figures, Page TBD)					

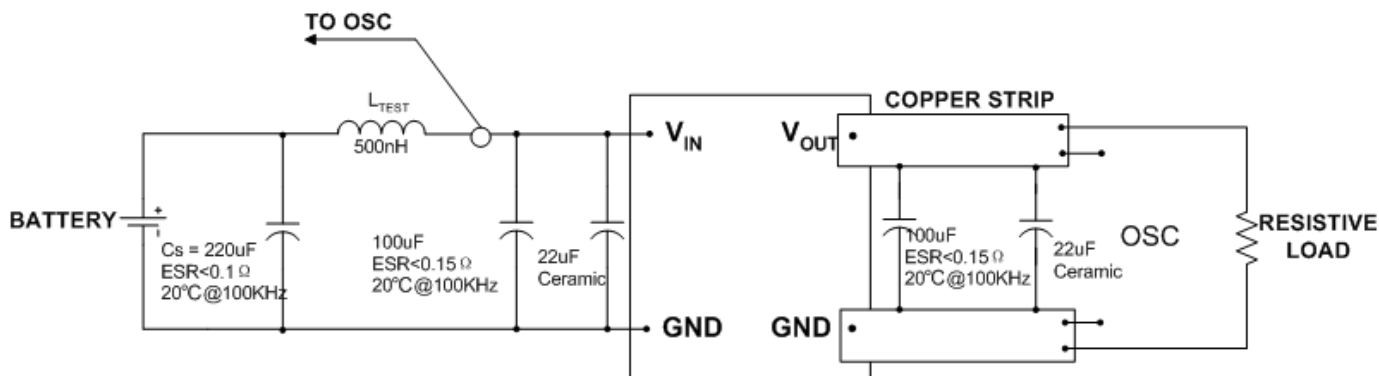
MQ7280SIP03 Electrical Specifications: ($T_A=+25^\circ\text{C}$)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Input Voltage Range	SIP03, SMT03	V_{IN}	3.0		4	V
	SIP05, SMT05		4.5		5.5	
Output Current		I_o	0		30	A
Output Voltage Set point	100% load	ΔV_o	-2		+2	%
Output Trim Range	See Performance Specifications					
Line Regulation						
Load Regulation						
Output Ripple and Noise Voltage	$I_o=30A, 0\sim 20\text{MHz}$ (Detail Please see Ripple Figures, Page TBD)					

General Specifications

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Maximum Capacitive Load	30A resistive load +Sanyo POSCAP			5000		μF
Overcurrent Protection			36		50	A
Output short-circuit current (average)	All				3	A
Under Voltage Lockout Trip Level	Rising and falling V_{IN} , 3% hysteresis		1.95	2.05	2.15	V
Logic High		V_{IH}			$V_{in}+0.7$	V
Logic Low		V_{IL}	-0.7		0.3	V
Start-up Time	30A resistive load, no external output capacitors			2		mS
Switching Frequency		F_o		300		kHz
Operating Temperature	Natural convection, no forced air flow (with derating of $0.5\text{W}/^\circ\text{C}$ when $T_A \geq +55^\circ\text{C}$)		-40		85	°C
Vibration	3 Axes, 5 Min Each	10~55Hz, 0.35mm, 5g				
	3 Axes, 6 Times Each	Peak Deviation 300g, Settling Time 6mS				
MTBF		5,000,000				Hour

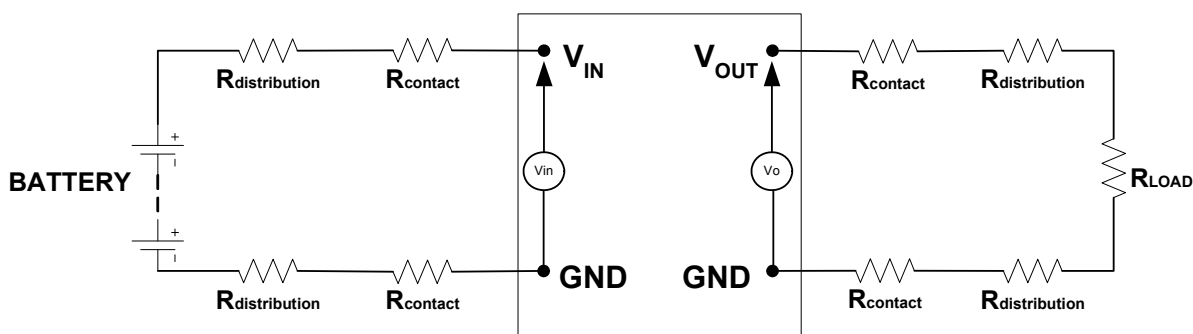
Test Configurations



Test setup for input noise, output noise and ripple

Note:

Output noise is measured with 0.1µ F ceramic capacitor connected at the output. OSC measurement should be made using a BNC socket. Position the load between 50mm and 75mm (2in. and 3in) from the tested module.



Test setup for efficiency

Note:

All voltage measurements must be taken at the module's terminals, as shown above. If sockets are needed, Kelvin connections are required at the module terminals to avoid measurement errors due to socket contact resistance.

Technical Notes

Input Voltage Range

The MQ7280SIP Series can be used in a wide variety of applications, esp. most of 3.3V or 5V power supply bus system. So, when system voltage transferred from 5V to 3.3V or vice versa, no redesign needed which simplifies design, speeds the time to market and adds flexibility to system.

Return Current Paths

The MQ7280SIP Series is non-isolated DC/DC converters. Their three Common pins (pins 5,6 and 7) are connected to each other internally. To the extent possible with the intent of minimizing ground loops, input return current should be directed through pin 7 (also referred to as---Input or Input Return), and output return current should be directed through pin 5 and 6 (also referred to as---Output or Output Return).

I/O Filtering

All the specifications of the MQ7280SIP Series are tested and specified with specific output capacitors. Certain input capacitors are necessary to improve the power modules' operating conditions and to reduce the ac impedance. For example, under some conditions, the power modules can't normally start up when fully loaded due to the high ac-impedance input source. External input

capacitors serve primarily as energy-storage devices. They should be added close to the input pins of the MQ7280SIP and selected for bulk capacitance (at appropriate frequencies), low ESR, and high rms-ripple-current ratings. All external capacitors should have appropriate voltage ratings. To reduce the amount of ripple current fed back to the input supply (input reflected-ripple current), an external L-C filter can be added with the inductance as close to the power module as possible.

MQ7280SIP's output ripple and transient response can be improved with the increasing output capacitance. When using output capacitors, take care that the total output capacitance does not exceed MQ7280SIP's Maximum Capacitive Load to avoid the module's protection condition in the start-up.

When an external L-C filter is added to reduce ripple on load, for best results, the filter components should be mounted close to the load circuit rather than the power module.

When testing the relationship between external capacitors and output voltage noise, the oscilloscope's probe should be applied to the module's end directly with scope probe ground less than 10mm in length.

Input Fusing

The MQ7280SIP Series is not internally fused. Certain applications and/or safety agencies may require the installation of fuses at the inputs of power conversion components. The selection of the fuses should conform to the following:

1. The fuse value should be fast-blow 30A fuses.
2. Both input traces must be capable of carrying a current of 1.5 times the value of the fuse without opening.

Safety Considerations

MQ7280SIP's are non-isolated DC/DC converters. In general, all DC-DC's must be installed in compliance with relevant safety-agency specifications (usually UL/IEC/EN60950). In particular, for a non-isolated converter's output voltage to meet SELV (safety extra low voltage) requirements, its input must be SELV compliant. If the output needs to be ELV (extra low voltage), the input must be ELV.

Remote Sense

MQ7280SIP Power Modules offer an output sense function on pin 3. The sense function enables point-of-use regulation for overcoming moderate IR drops in conductors and/or cabling. The sense line carries very little current and consequently requires a minimal cross-sectional-area conductor. As such, it is not a low-impedance point and must be treated with care in layout and cabling. Sense lines should be run adjacent to signals (preferably ground).

Use of trim and sense functions can cause the output voltage to increase, thereby increasing output power beyond the MQ7280SIP's specified rating. Therefore:

$$V_{OUT} \text{ (at pins)} \times I_{OUT} \leq P \text{ (rated output power)}$$

Note: If devices have the +Sense pin (pin3) installed and the sense function is not used for remote regulation, +Sense (pin3) must be tied to +Output (pin4) at the DC/DC converter pins.

ON/OFF Control

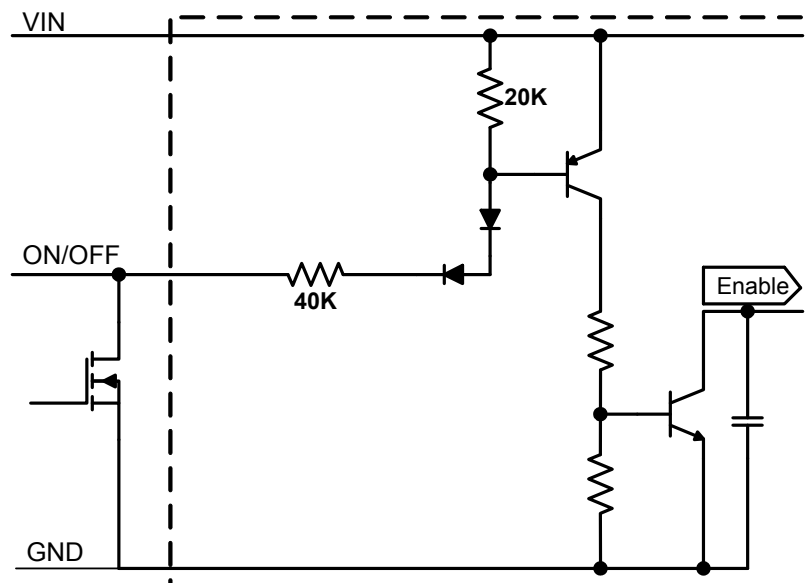


Fig1c, Remote ON/OFF Implementation with Open Collector/Drain transistor for positive logic control

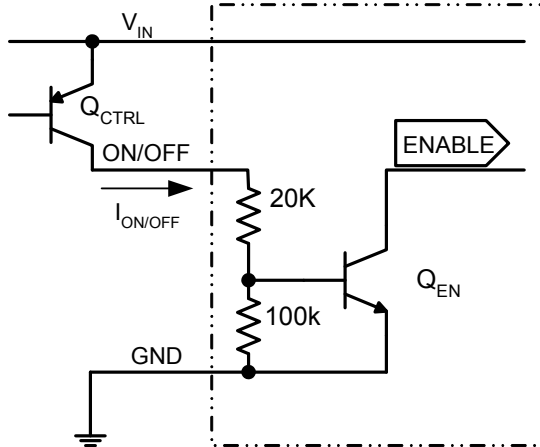


Fig1b. Remote ON/OFF Implementation with pull-up pnp transistor for negative logic control

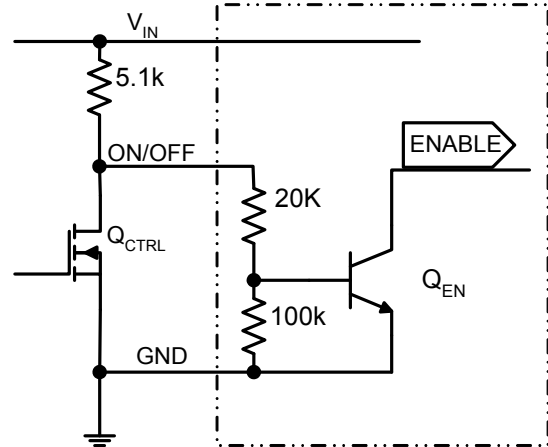


Fig1c. Remote ON/OFF Implementation with Open Collector/Drain transistor for negative logic control

The MQ7280SIP power modules feature an On/Off pin for remote On/Off operation with optional negative or positive logic. If not using the remote On/Off pin, leave the pin open (module will be On). The On/Off pin signal ($V_{on/off}$) is referenced to ground. To switch module on and off using remote On/Off, refer to Figure 1a~1c.

Output Over voltage Protection

MQ7280SIP Series products do not incorporate output over voltage protection. If the operating circuit requires protection against abnormal output voltage, voltage-limiting circuitry must be provided external to the power module.

Output Overcurrent Protection (OCP)

MQ7280SIP incorporates over current and short circuit protection. If the load current exceeds the overcurrent protection setpoint, the MQ7280SIP's internal over current-protection circuitry immediately turns off the module, which then goes into Hiccup mode. The unit operates normally once the output current is brought back into its specified range. The typical average output current during hiccup is 2~3A.

Caution: Be careful never to operate MQ7280SIP in a "heavy overload" condition that is between the rated output current and the over current protection setpoint. This can cause permanent damage to the components.

Overtemperature Protection (OTP)

To ensure MQ7280SIP's reliability and avoid damaging its internal components, MQ7280SIP incorporates over temperature protection circuit. When the temperature of the T_{REF} is above 120°C, the over temperature protection circuit will be enabled and the module will stop working. when the temperature of the temperature-testing component is below about 80°C, the over temperature protection circuit will release and the module will automatically recover from shutdown. To avoid permanently damaging components, the surface temperature of MQ7280SIP's power components, esp. of the MOSFET (T_{REF}) should be ensured below 120°C.

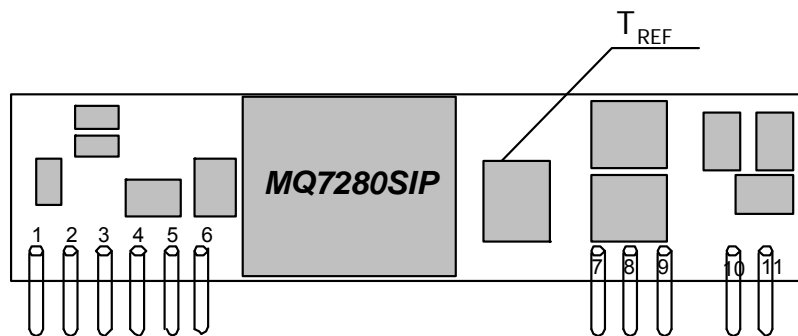


Fig2, Temperature Reference Point

Note: The over temperature protection may be issued when MQ7280SIP operates in a “heavy overload” condition for a long time. Thus, the airflow should be improved.

Output Voltage Programming

MQ7280SIP's output voltage can only be programmed to increase output voltage. It can be implemented by applying a single resistor between TRIM and GND pins of the module (see Figure 3a). See Performance Specifications for allowable trim ranges in detail. Also we offer customized products.

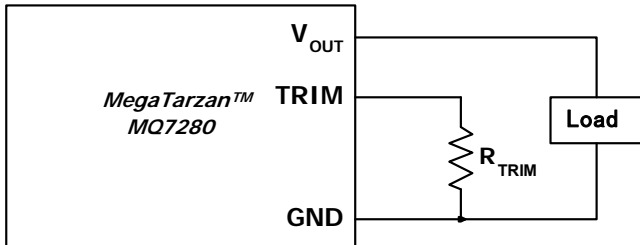


Figure 3a, Trim the output voltage by a single resistor

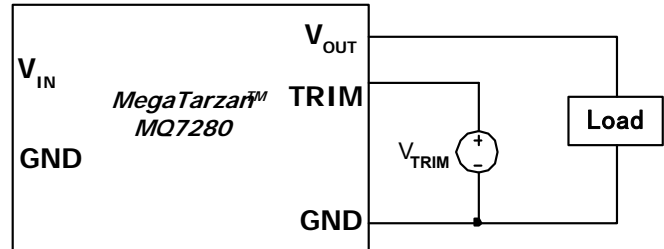


Figure 3b, Trim the output voltage by a voltage source

Trim Equations:

$$R_{TRIM} = \frac{21.07}{(V_o - 0.7525)} - 5.11$$

Resistor values are in kΩ, V_o (desired output voltage).

Table 1 provides **Rtrim** values required for some common output voltages.

Table 1

VO, (V)	Rtrim (KΩ)
0.7525	Open
1.2	41.973
1.5	23.077
1.8	15.004
2.5	6.947
3.3	3.160

Table 2

VO, set (V)	Vtrim (V)
0.7525	Open
1.2	0.6240
1.5	0.5731
1.8	0.5221
2.5	0.4033
3.3	0.2670

Output voltage also can be programmed by applying one external voltage source between TRIM and GND Pins of the module (see Figure 3b).

Following equations can be used to calculate the Vtrim for desired output voltage:

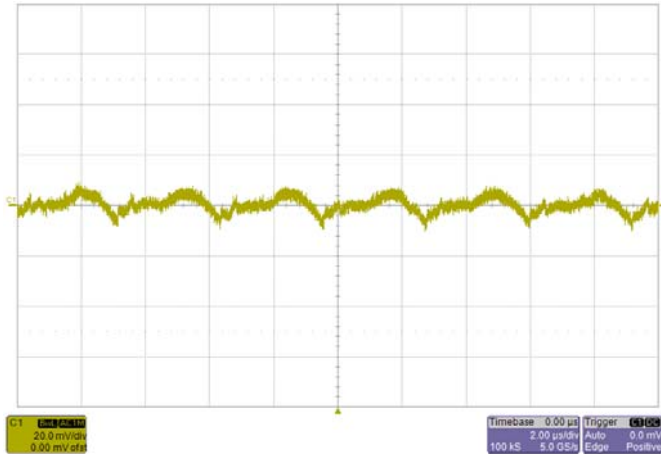
$$V_{TRIM} = 0.7 - 0.1698 * (V_o - 0.7525)$$

The unit of Vtrim is Volt. Table 2 provides Vtrim values required for some common output voltages.

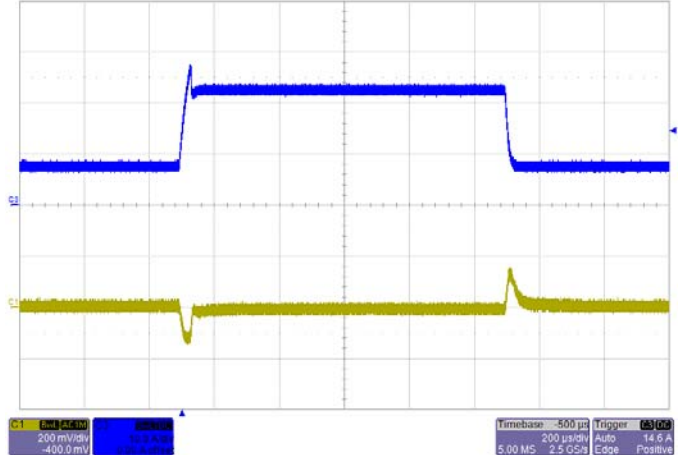
Typical Characteristics – output adjusted to 0.75V

General conditions:

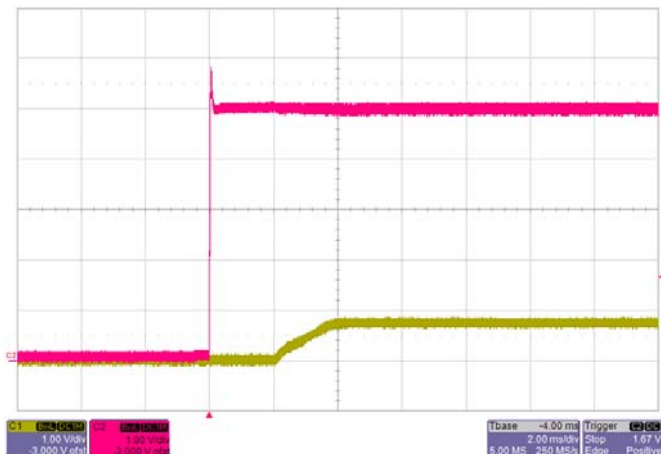
Input filter 47µF Ceramic + 300µF TAN (100mΩ ESR), Output filter 47µF Ceramic + 300µF TAN (100mΩ ESR)



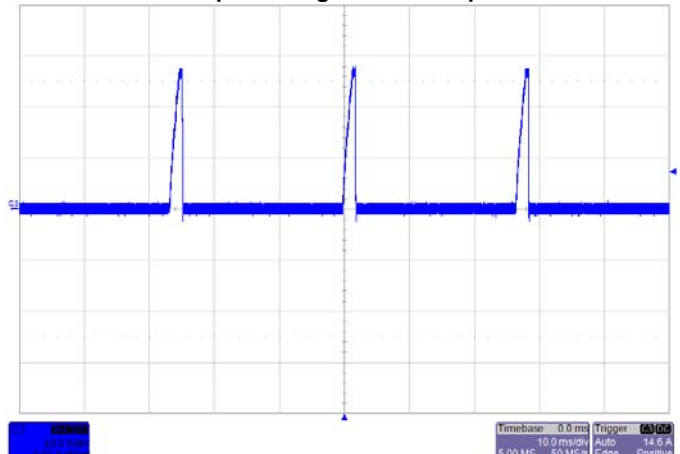
Noise Vin=5V, I_o=30A, 5~20MHz Bandwidth



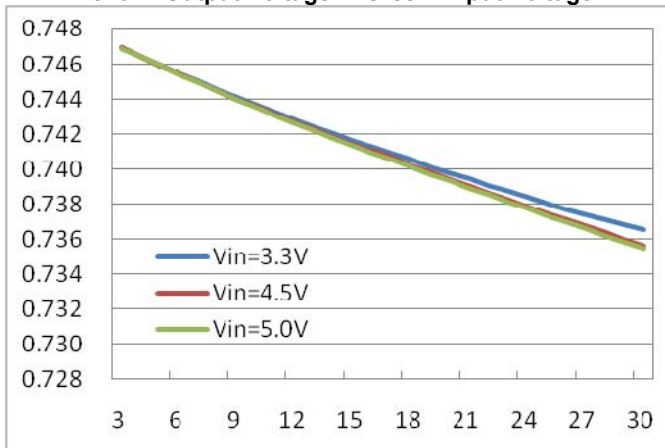
Transient Response Vin=5V, Step from 15A~30A~15A
Yellow: Output Voltage Red: Output Current



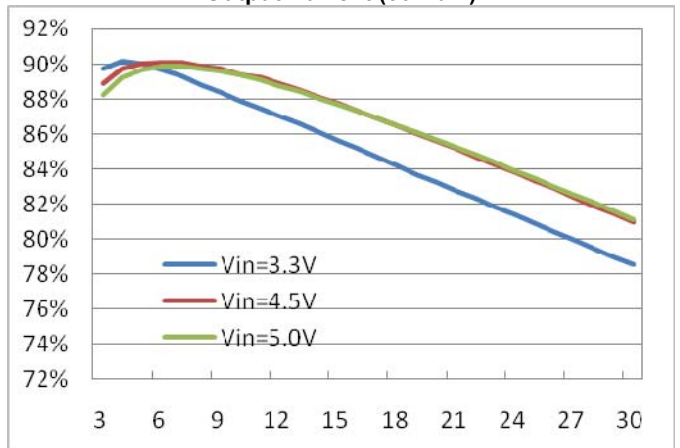
Start-up Vin=5V, I_o=30A
Yellow: Output Voltage Green: Input Voltage



Short-Circuit Output Vin=5V
Output Current (30A/div)



Regulation
Output voltage vs. Load Current

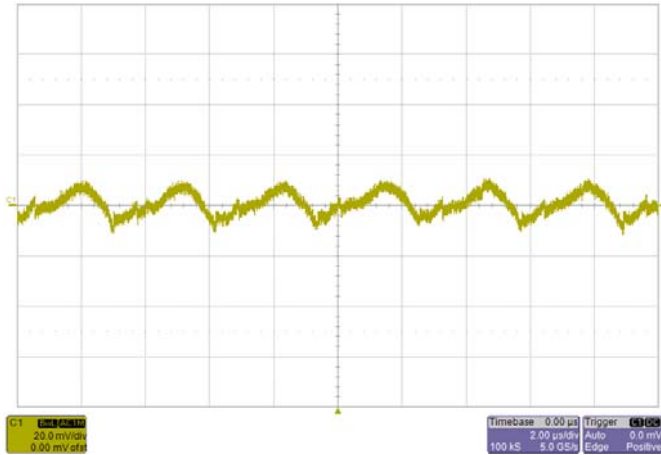


Efficiency

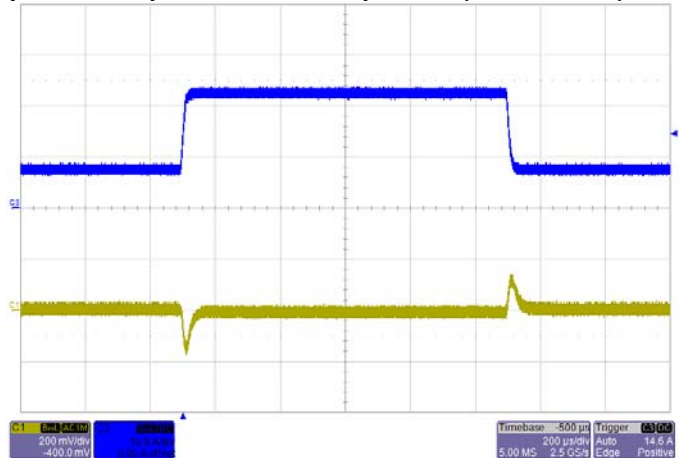
Typical Characteristics – output adjusted to 1V

General conditions:

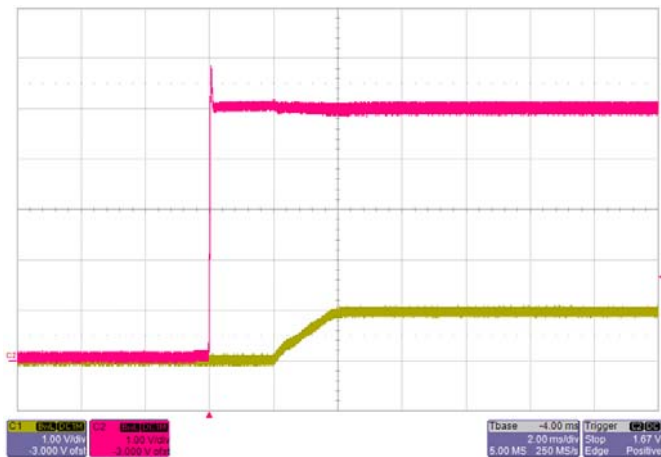
Input filter 47µF Ceramic + 300µF TAN (100mΩ ESR), Output filter 47µF Ceramic + 300µF TAN (100mΩ ESR)



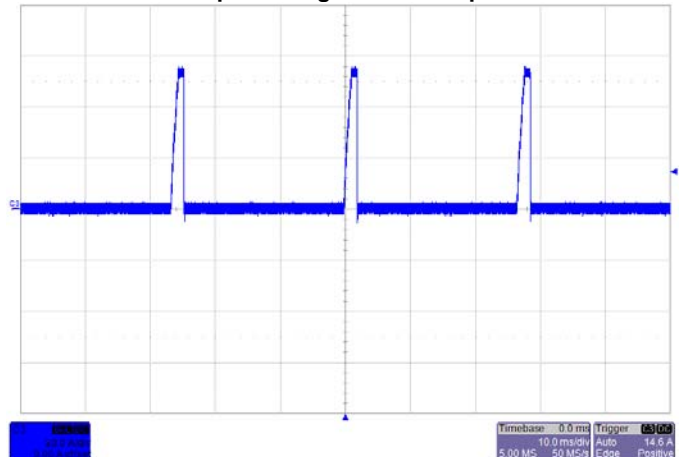
Noise Vin=5V, I_o=30A, 5~20MHz Bandwidth



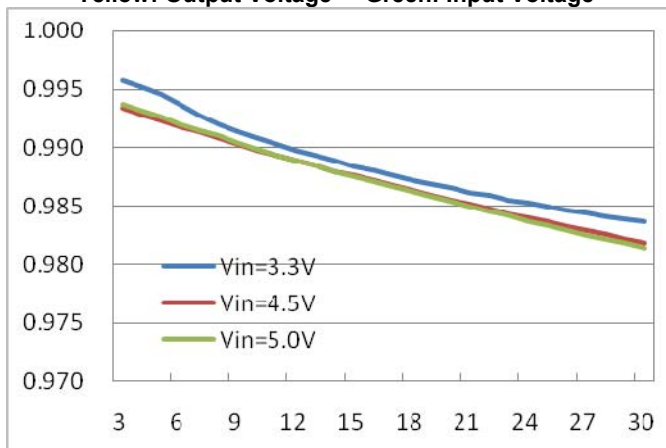
Transient Response Vin=5V, Step from 15A~30A~15A
Yellow: Output Voltage Red: Output Current



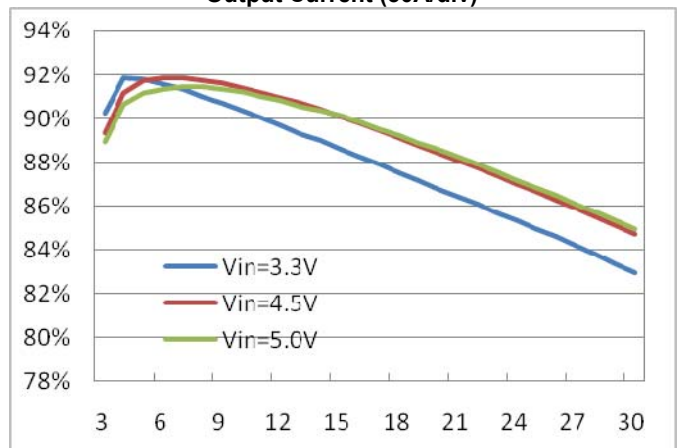
Start-up Vin=5V, I_o=30A
Yellow: Output Voltage Green: Input Voltage



Short-Circuit Output Vin=5V
Output Current (30A/div)



Regulation
Output voltage vs. Load Current

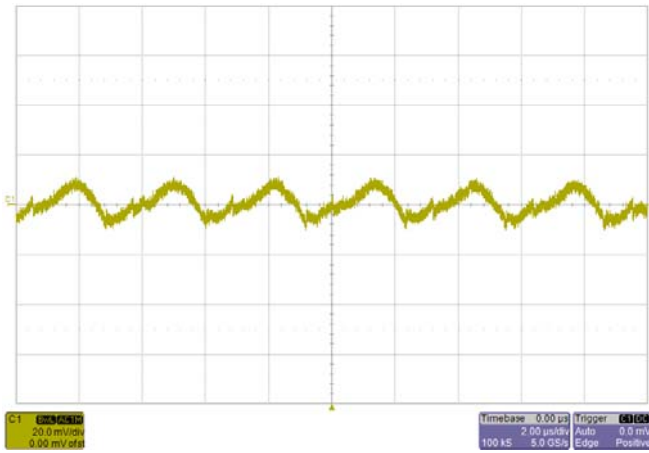


Efficiency

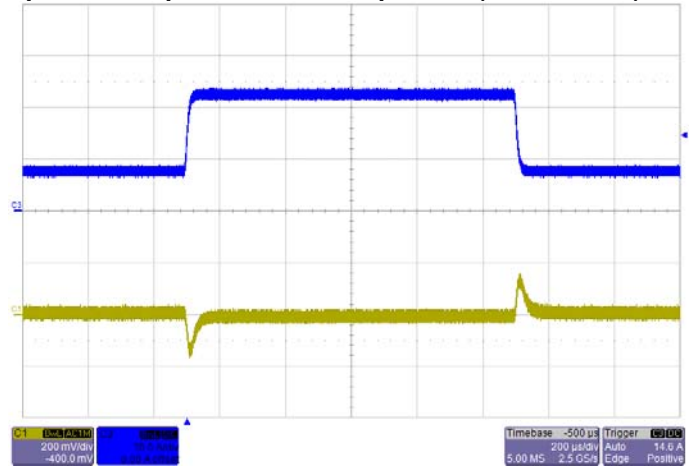
Typical Characteristics – output adjusted to 1.2V

General conditions:

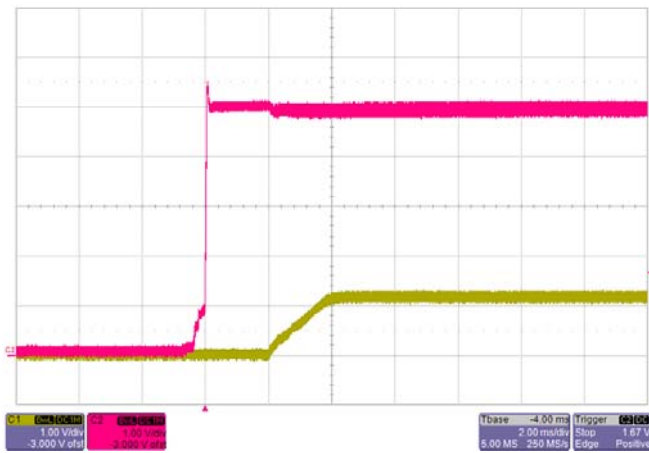
Input filter 22µF Ceramic + 200µF TAN (100mΩ ESR), Output filter 22µF Ceramic + 150µF TAN (100mΩ ESR)



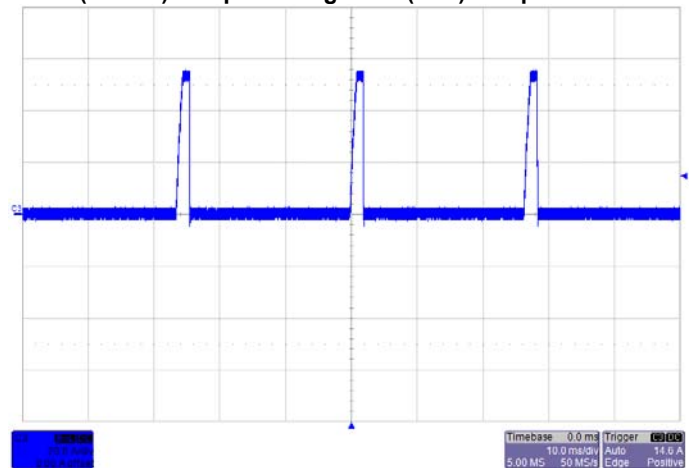
Noise Vin=5V, Io=30A, 5~20MHz Bandwidth



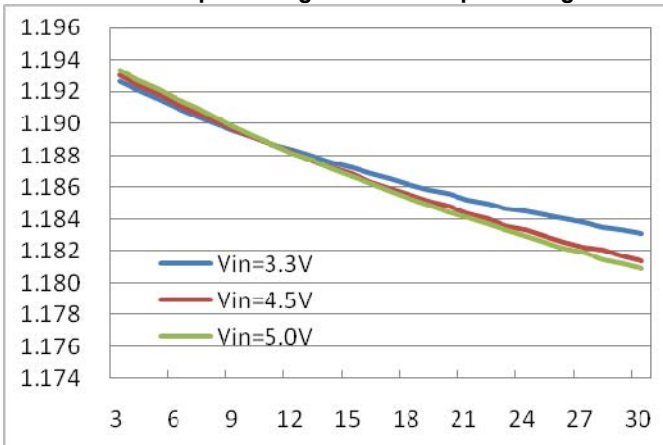
Transient Response Vin=5V, Step from 15A~30A~15A
C1(Yellow): Output Voltage C2(Red): Output Current



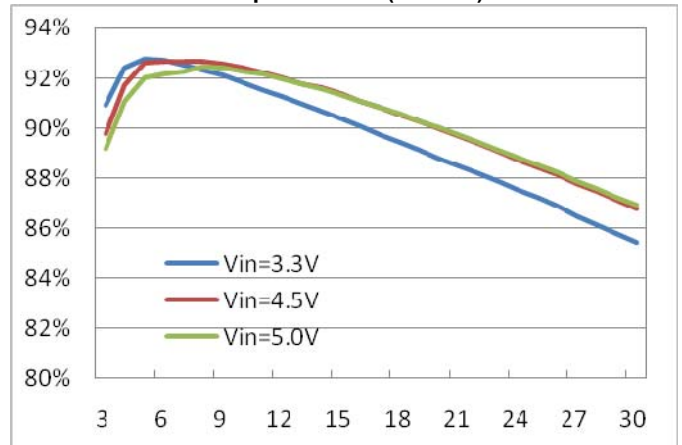
Start-up Vin=5V, Io=30A
Yellow: Output Voltage Green: Input Voltage



Short-Circuit Output Vin=5V
Output Current (30A/div)



Regulation
Output voltage vs. Load Current

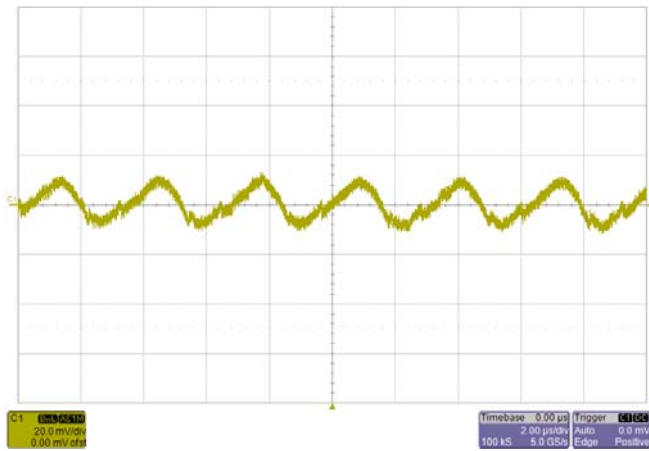


Efficiency

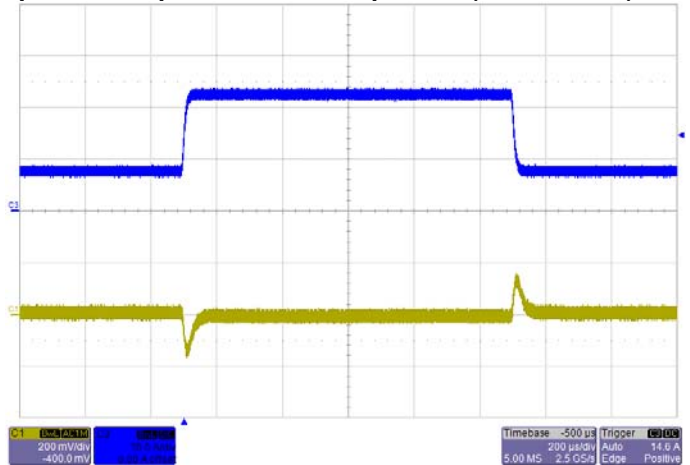
Typical Characteristics – output adjusted to 1.5V

General conditions:

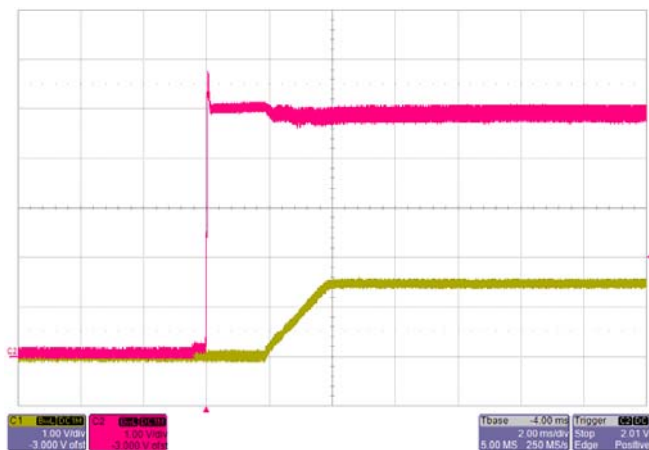
Input filter 47µF Ceramic + 300µF TAN (100mΩ ESR), Output filter 47µF Ceramic + 300µF TAN (100mΩ ESR)



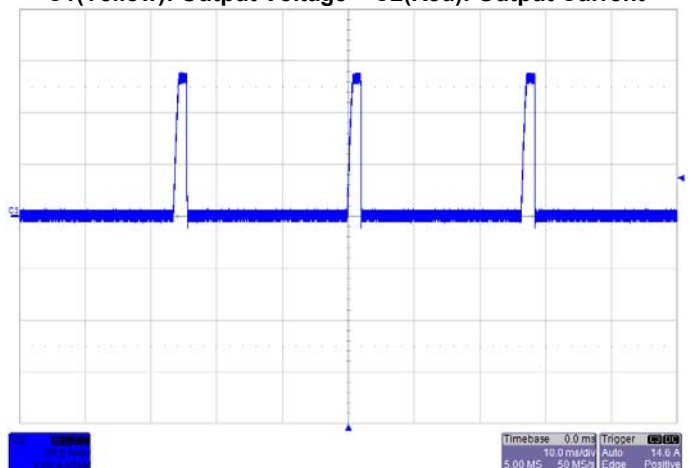
Noise Vin=5V, Io=30A, 5~20MHz Bandwidth



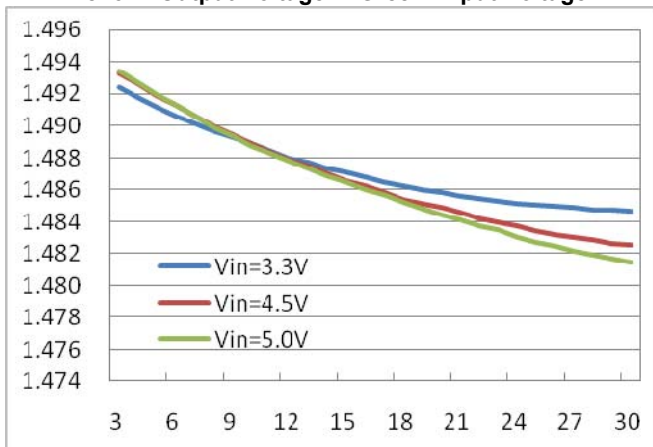
Transient Response Vin=5V, Step from 15A~30A~15A
C1(Yellow): Output Voltage C2(Red): Output Current



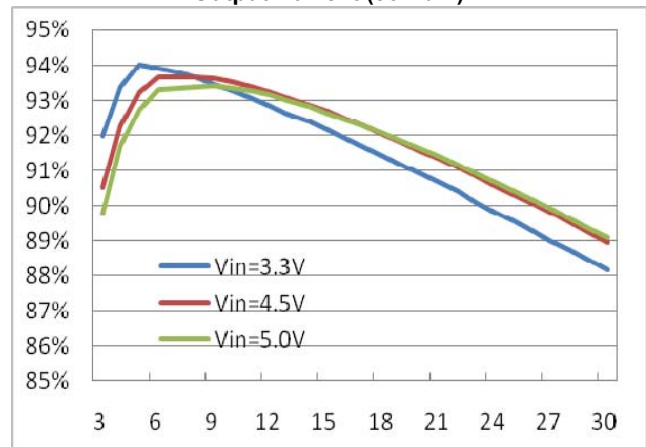
Start-up Vin=5V, Io=30A
Yellow: Output Voltage Green: Input Voltage



Short-Circuit Output Vin=5V
Output Current (30A/div)



Regulation
Output voltage vs. Load Current

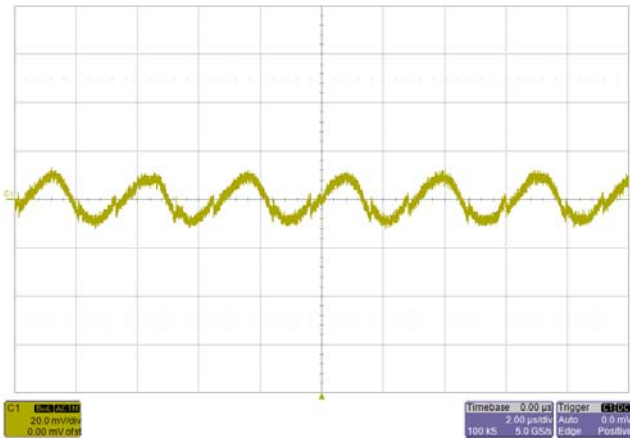


Efficiency

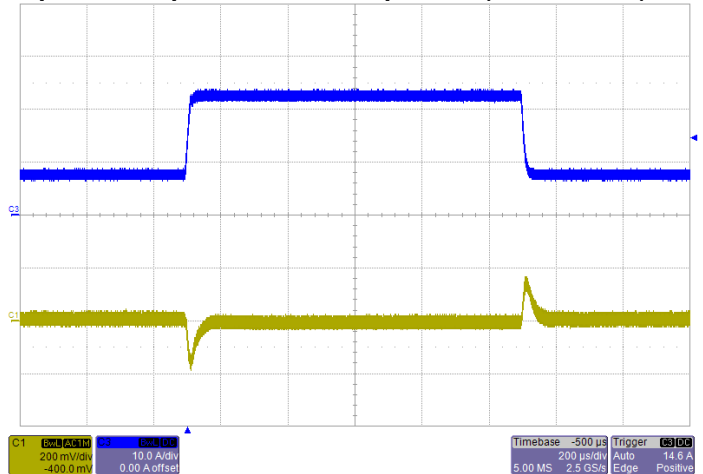
Typical Characteristics – output adjusted to 1.8V

General conditions:

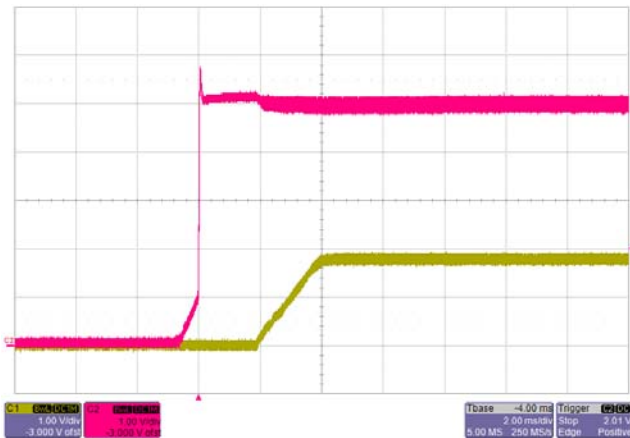
Input filter 47µF Ceramic + 300µF TAN (100mΩ ESR), Output filter 47µF Ceramic + 300µF TAN (100mΩ ESR)



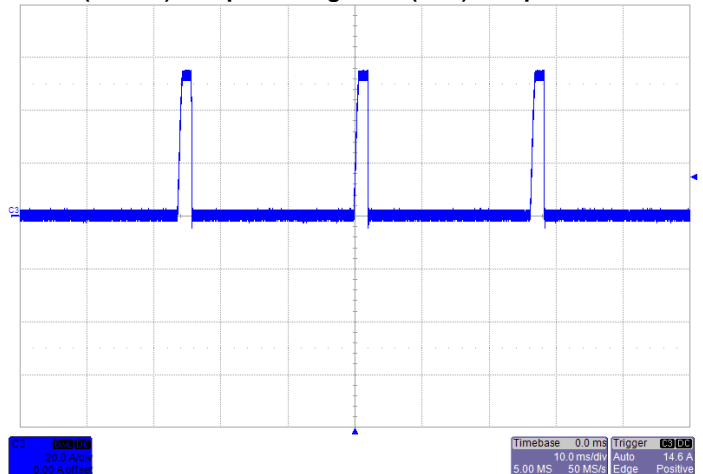
Noise Vin=5V, Io=30A, 5~20MHz Bandwidth



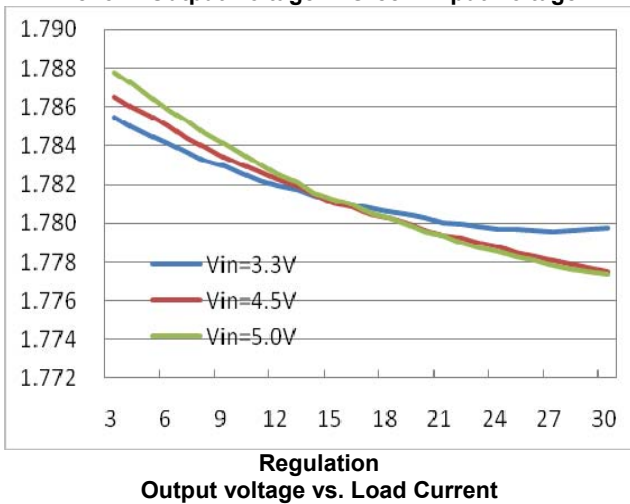
Transient Response Vin=5V, Step from 15A~30A~15A
C1(Yellow): Output Voltage C2(Red): Output Current



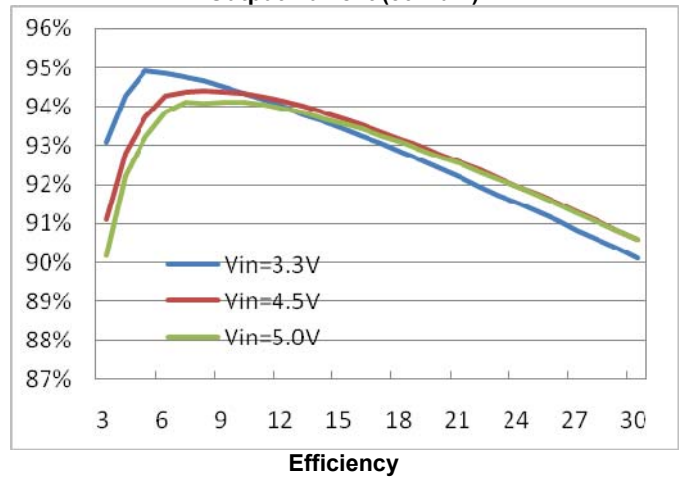
Start-up Vin=5V, Io=30A
Yellow: Output Voltage Green: Input Voltage



Short-Circuit Output Vin=5V
Output Current (30A/div)



Regulation
Output voltage vs. Load Current

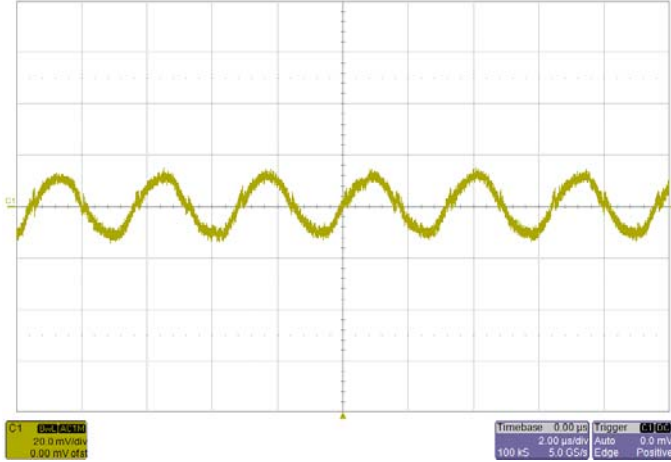


Efficiency

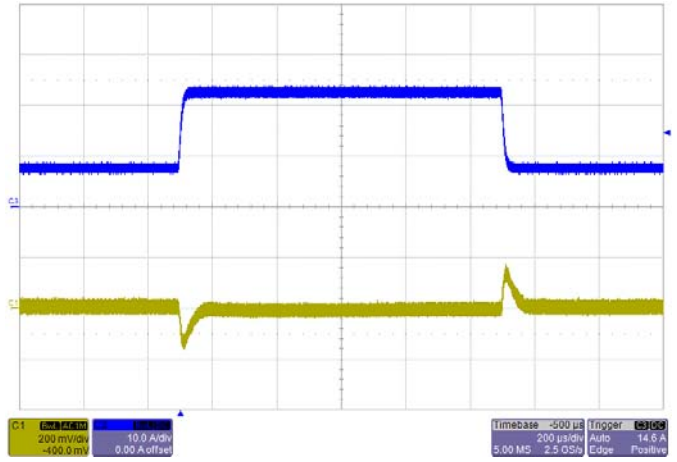
Typical Characteristics – output adjusted to 2.5V

General conditions:

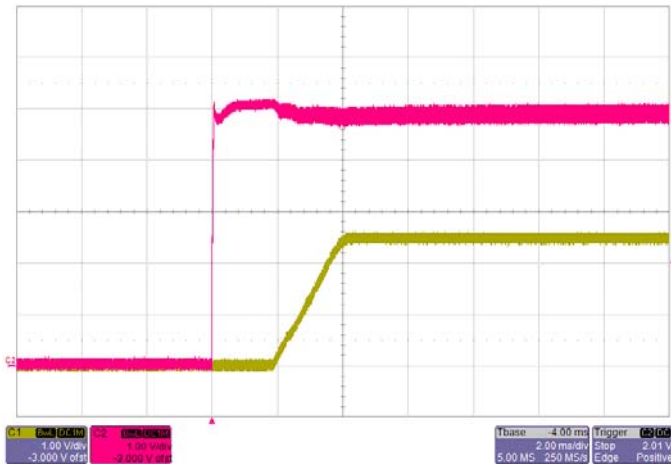
Input filter 47µF Ceramic + 300µF TAN (100mΩ ESR), Output filter 47µF Ceramic + 300µF TAN (100mΩ ESR)



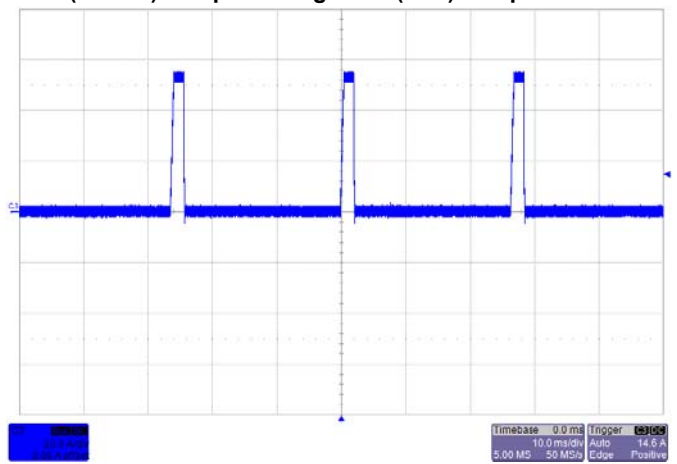
Noise Vin=5V, Io=30A, 5~20MHz Bandwidth



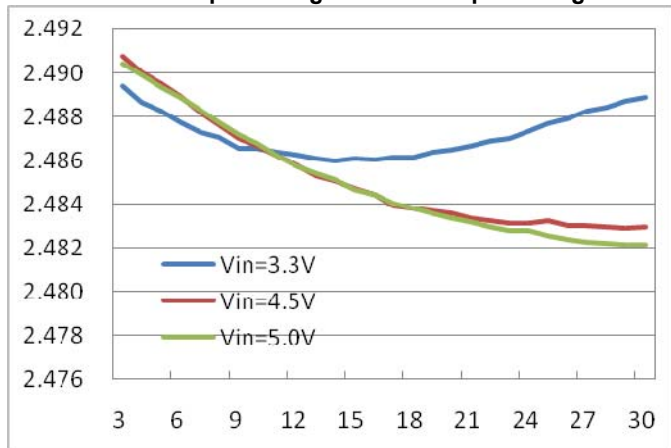
Transient Response Vin=5V, Step from 15A~30A~15A
C1(Yellow): Output Voltage C2(Red): Output Current



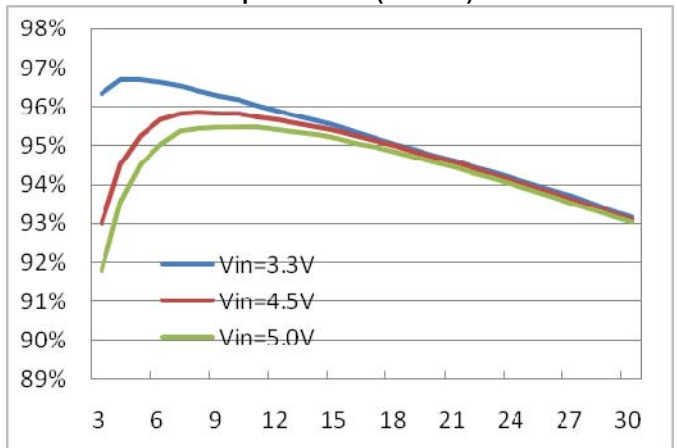
Start-up Vin=5V, Io=30A
Yellow: Output Voltage Green: Input Voltage



Short-Circuit Output Vin=5V
Output Current (30A/div)



Regulation
Output voltage vs. Load Current

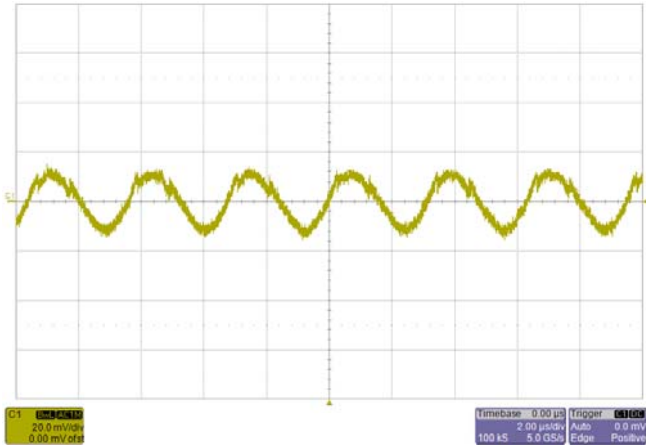


Efficiency

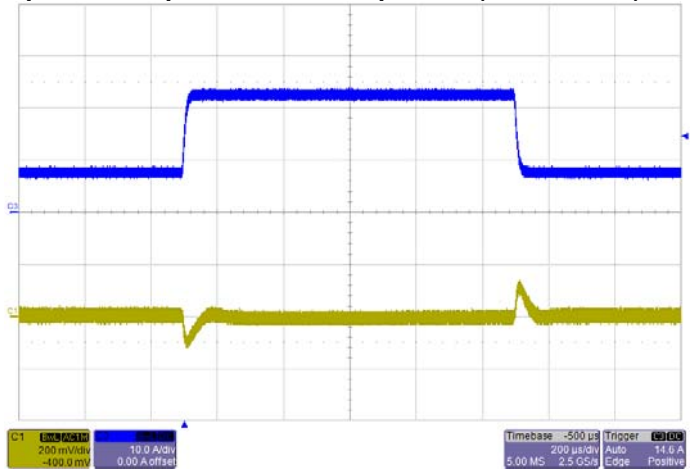
Typical Characteristics – output adjusted to 3.3V

General conditions:

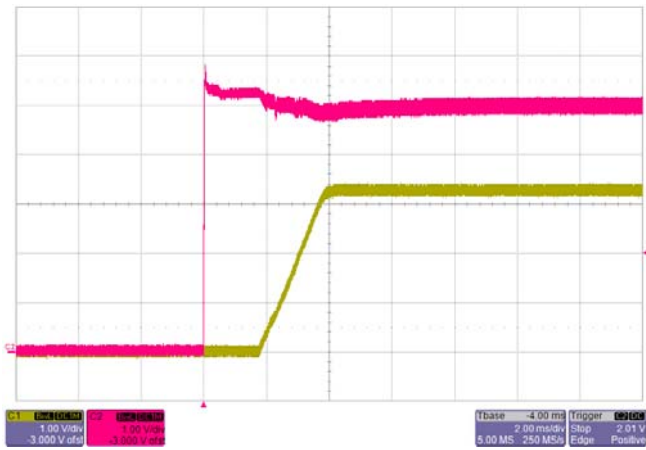
Input filter 47µF Ceramic + 300µF TAN (100mΩ ESR), Output filter 47µF Ceramic + 300µF TAN (100mΩ ESR)



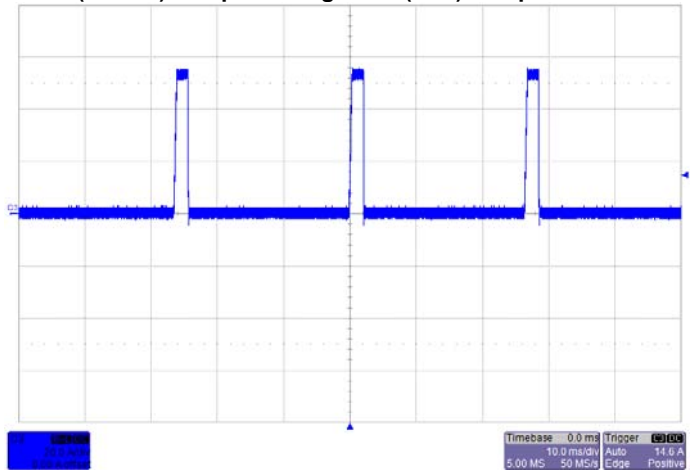
Noise Vin=5V, Io=30A, 5~20MHz Bandwidth



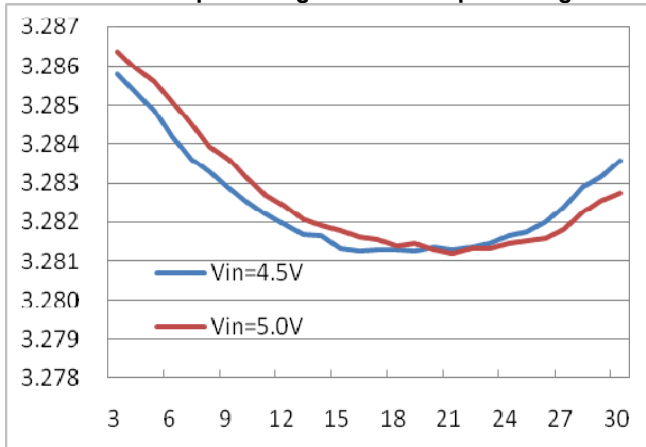
Transient Response Vin=5V, Step from 15A~30A~15A
C1(Yellow): Output Voltage C2(Red): Output Current



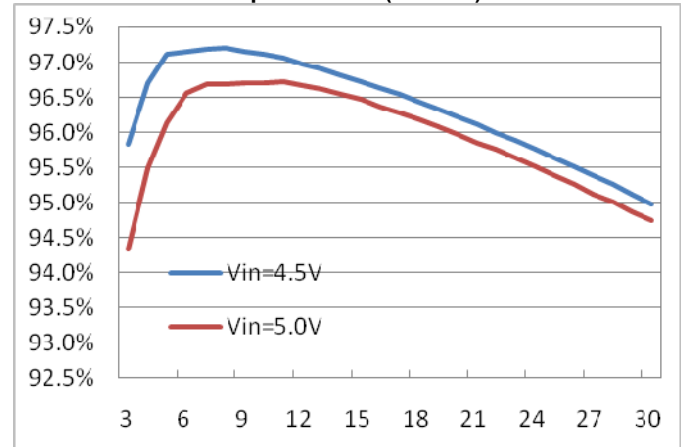
Start-up Vin=5V, Io=30A
Yellow: Output Voltage Green: Input Voltage



Short-Circuit Output Vin=5V
Output Current (30A/div)



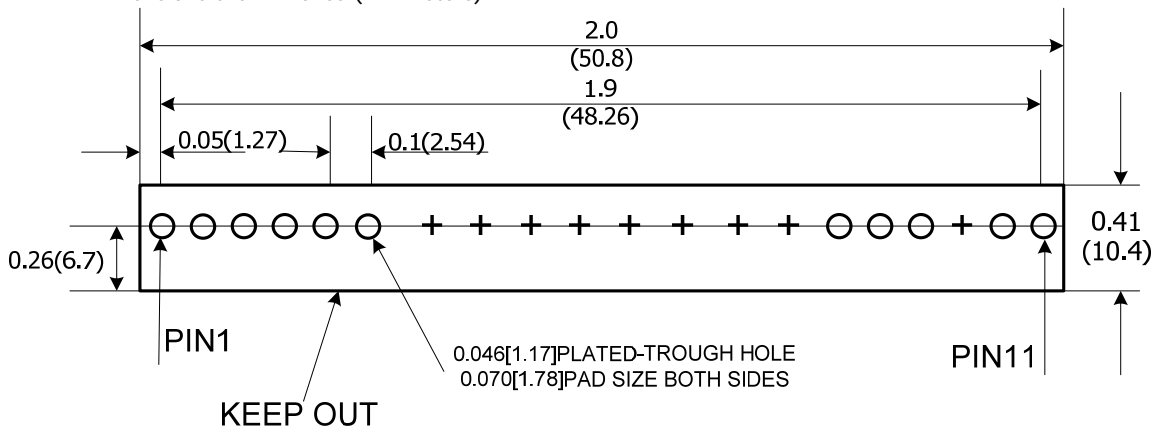
Regulation
Output voltage vs. Load Current



Efficiency

Recommended Hole Pattern

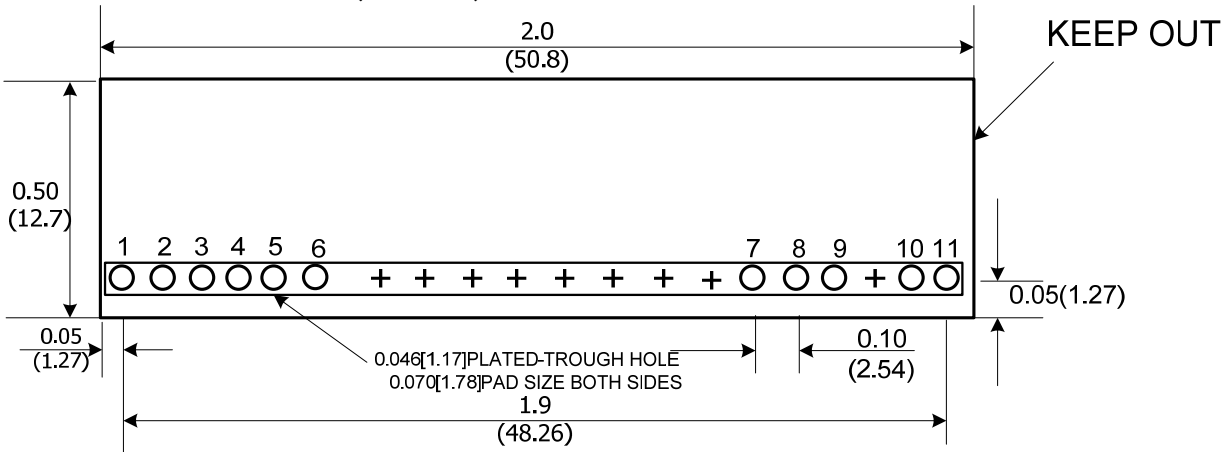
Dimensions are in inches (millimeters)



Component-side footprint

Recommended Hole Pattern for "R" suffix

Dimensions are in inches (millimeters)



Component-side footprint

