DELPHI SERIES

FEATURES

- Small size and low profile:
  0.67” x 0.5” x 0.48”
  (16.9mm x 12.7mm x 12.2mm)
- Surface mount
- No minimum load required
- Input: UVLO, Output OCP/SCP, OVP, OTP
- Parallel Units
- ISO 9000, TL 9000, ISO 14001 certified manufacturing facility

D12S36A, Non-Isolated, Power Block
Power Modules: 7.0~13.2Vin, 0.8V~1.8V/20Aout

The Delphi D12S36A, surface mounted, power block is the latest offering from a world leader in power systems technology and manufacturing — Delta Electronics, Inc. The D12S36A is the latest offering in the DXP30 family which was developed to address the ever-growing demands of increased current and power densities in networking applications while providing maximum flexibility for system configuration, its benefits can easily be applied to other applications transcending various market segments. The DXP family, containing all necessary power components and boasting of a USABLE (55˚C, 200LFM) current density of 60A/in^2 and a power density of up to 224W/in^3, is a building block for a new open Digital Power Architecture developed to work with either digital or analog controllers. Measured at 0.50”Wx0.67”Lx0.48”H and rated at 20A of output current, the D12S36A is designed to operate with an input voltage from 7V to 13.2V and provide an output voltage adjustable from 0.8V to 1.8V in digitally defined step resolution of 1.62mV. Multiple D12S36A can be used in parallel to serve applications where output currents are in excess of 20A with limitation imposed only by the control circuit, analog or digital. Designed for superior price/performance, the D12S36A can provide 1.8V and 20A full load in ambient temperature up to 55˚C with 200LFM airflow.

APPLICATIONS

- Telecom / DataCom
- Distributed power architectures
- Servers and workstations
- LAN / WAN applications
- Data processing applications

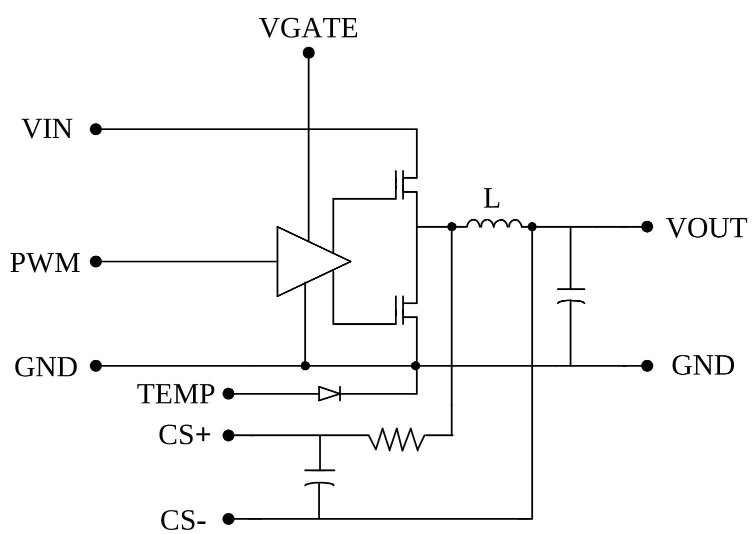
DATASHEET
DS_D12S36A_01232009

Delta Electronics, Inc.

TECHNICAL SPECIFICATIONS

T_A = 25°C, airflow rate = 300 LFM, V_{in} = 7~13.2Vdc, nominal Vout unless otherwise noted.

PARAMETER	NOTES and CONDITIONS	D12S36A			
		Min.	Typ.	Max.	Units
ABSOLUTE MAXIMUM RATINGS					
Input Voltage (Continuous)		0		14	Vdc
Operating Temperature	Refer to Figure 47 for the measuring point			105	°C
Storage Temperature		-40		125	°C
INPUT CHARACTERISTICS					
Operating Input Voltage		7.0		13.2	V
Maximum Input Current	Vin=11V, Vout=1.0V, Iout=20A		TBD		A
PWM	Pin 8	4.5	5.0	6	V
PWM logic low				0.8	V
PWM logic high		2			V
Gate Voltage	Pin 10 (reference to ground)	4.5	5.0	5.5	Vdc
OUTPUT CHARACTERISTICS					
Output Voltage Adjustable Range	Vin=9.6V	0.8	1.0	1.8	V
Total Output Voltage Regulation	Total Regulation over load, line and temperature	-1		+1	%V
Output Voltage Ripple and Noise	3x 560μF OSCON and 320μF ceramic capacitor, BW=20MHz		TBD		mVpp
Output Voltage Overshoot	@ turn on		0	0.5	%V
Output Current Range		0		20	A
Transient Response			TBD		mVpp
Inductor Value			375		nH
Inductor DCR			0.7		mΩ
Inductor Peak Current	Inductor temperature of 125°C			35	A
Temperature sense	25°C, 495μA bias current	1.345	1.35	1.355	V
EFFICIENCY					
	Vin=7V		TBD		%
	Vin=11V		TBD		%
	Vin=12V, Vo=1.0V, Io=20A		TBD		%
FEATURE CHARACTERISTICS					
perating Frequency			500		kHz
GENERAL SPECIFICATIONS					
MTBF	Io=Io,max, Ta=25℃		TBD		M hours
Weight			8		grams



Block diagram of D12S36 A

ELECTRICAL CHARACTERISTICS CURVES

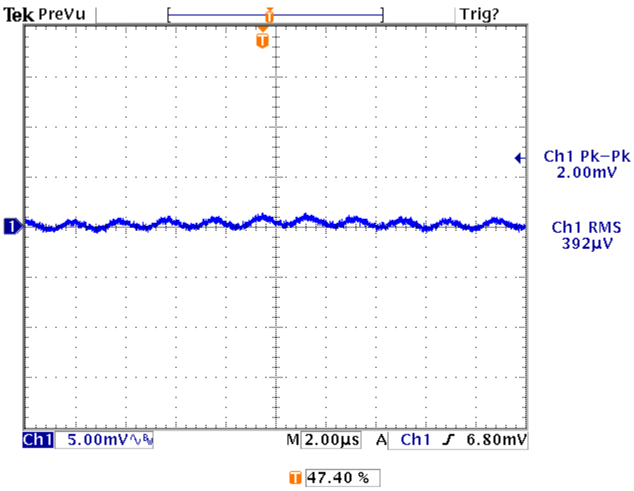


Figure 1:*Output Ripple & Noise, Vin=7V Vout=1V Iout=10A, Reading: 2.00mV*

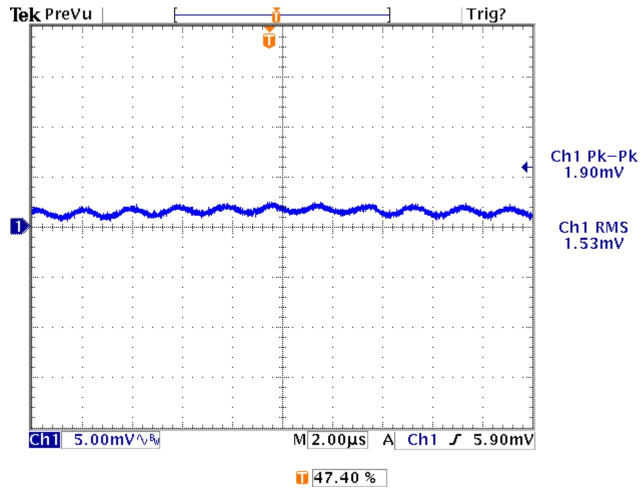


Figure 2:*Output Ripple & Noise, Vin=7V Vout=1V Iout=20A, Reading: 1.90mV*

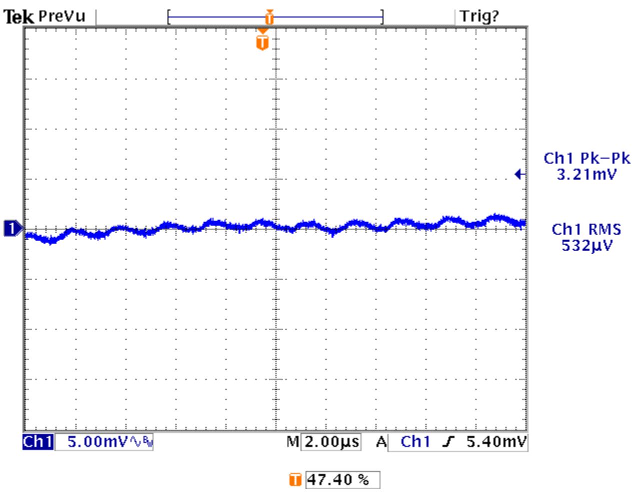


Figure 3:*Output Ripple & Noise, Vin=11V Vout=1V Iout=10A, Reading: 3.21mV*

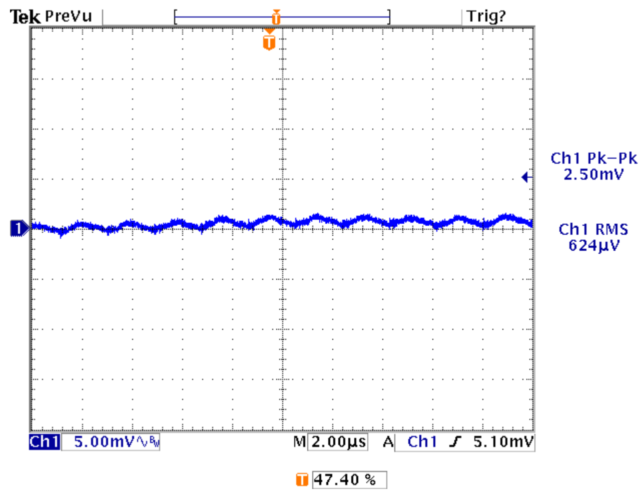


Figure 4:*Output Ripple & Noise, Vin=11V Vout=1V Iout=20A, Reading: 2.50mV*

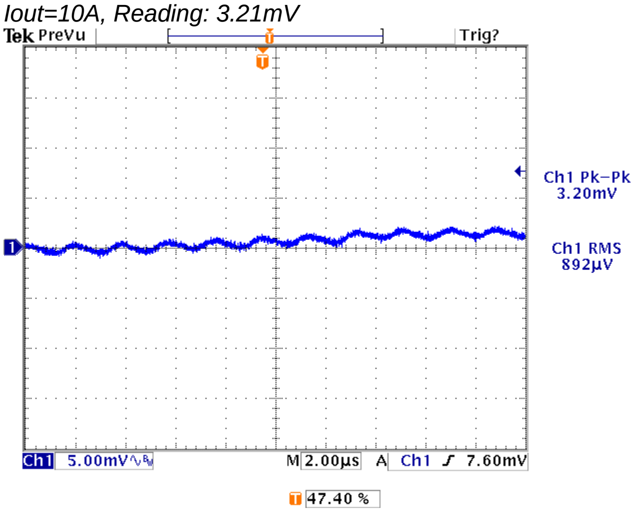


Figure 5:*Output Ripple & Noise, Vin=13.2V Vout=1V Iout=10A, Reading: 3.20mV*

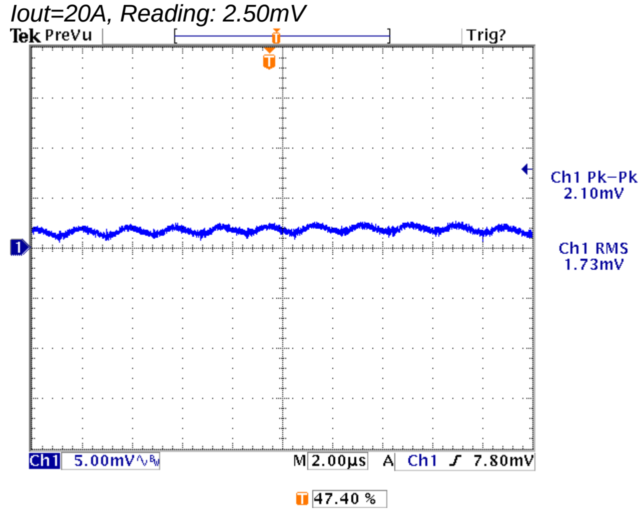


Figure 6:*Output Ripple & Noise, Vin=13.2V Vout=1V Iout=20A, Reading: 2.10mV*

ELECTRICAL CHARACTERISTICS CURVES

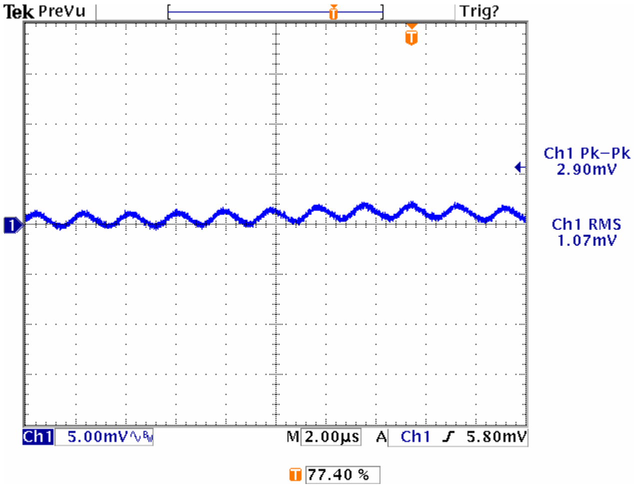


Figure 7:*Output Ripple & Noise, Vin=7V Vout=1.8V Iout=10A, Reading: 2.90mV*

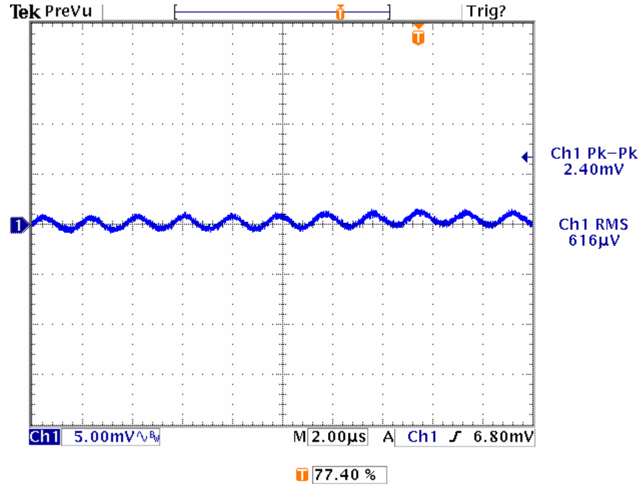


Figure 8:*Output Ripple & Noise, Vin=7V Vout=1.8V Iout=20A, Reading: 2.40mV*

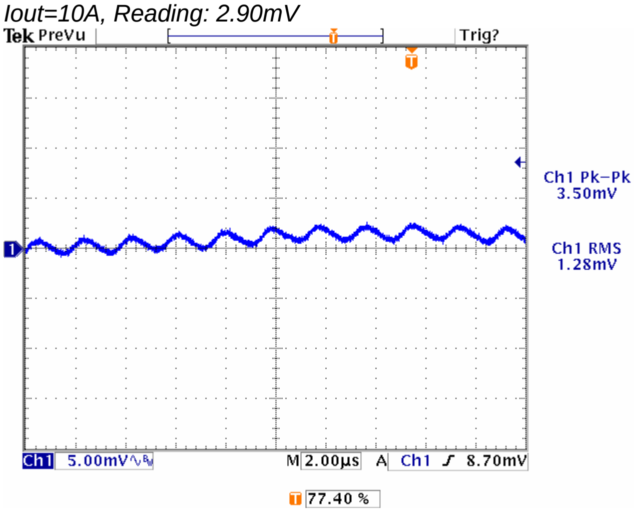


Figure 9:*Output Ripple & Noise, Vin=11V Vout=1.8V Iout=10A, Reading: 3.50mV*

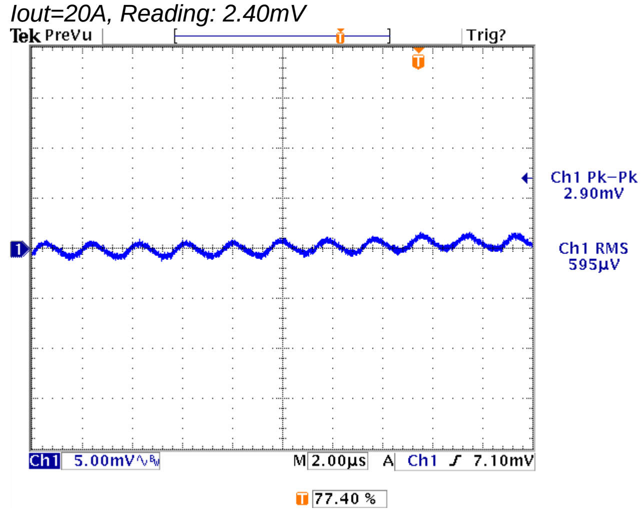


Figure 10:*Output Ripple & Noise, Vin=11V Vout=1.8V Iout=20A, Reading: 2.90mV*

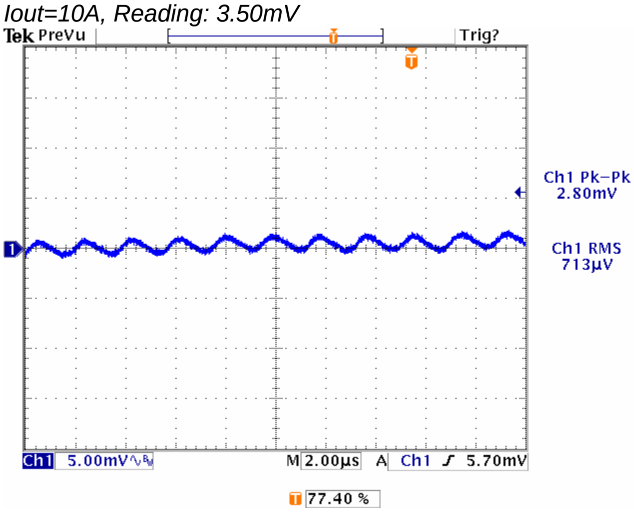


Figure 11:*Output Ripple & Noise, Vin=13.2V Vout=1.8V Iout=10A, Reading: 2.80mV*

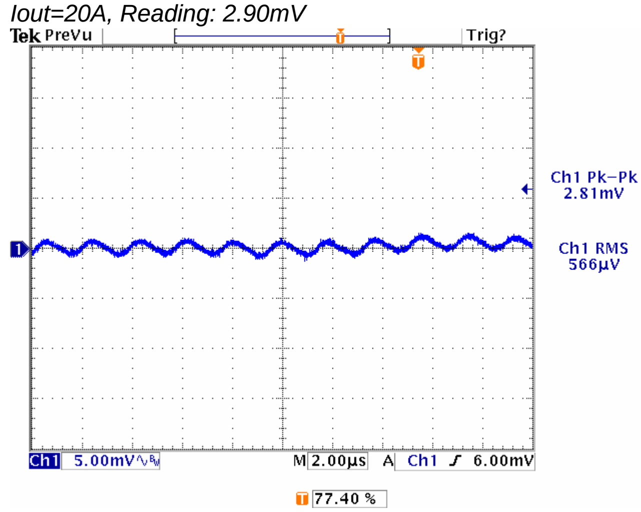


Figure 12:*Output Ripple & Noise, Vin=13.2V Vout=1.8V Iout=20A, Reading: 2.81mV*

ELECTRICAL CHARACTERISTICS CURVES

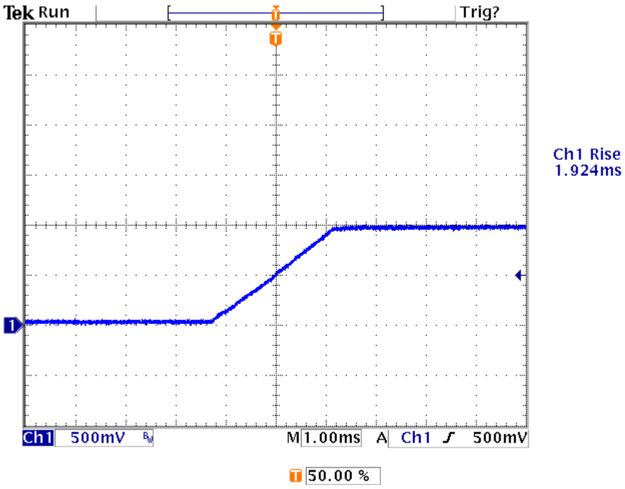


Figure 13:*Output Voltage Rise time, Vin=7V, Vout=1V, Iout=10A, Reading: 1.924mS*

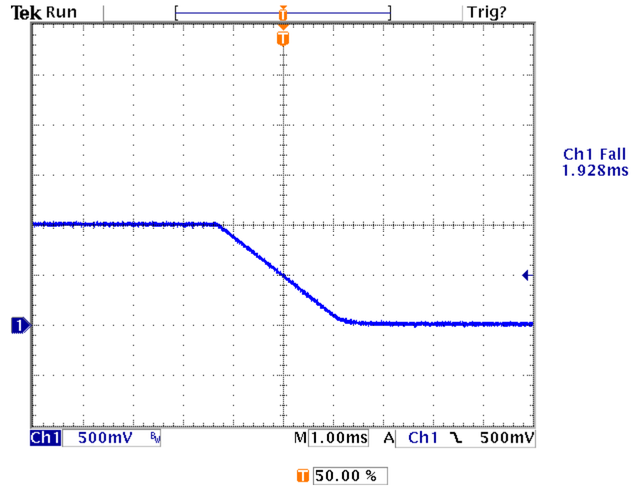


Figure 14:*Output Voltage Fall time, Vin=7V, Vout=1V, Iout=10A, Reading: 1.928mS*

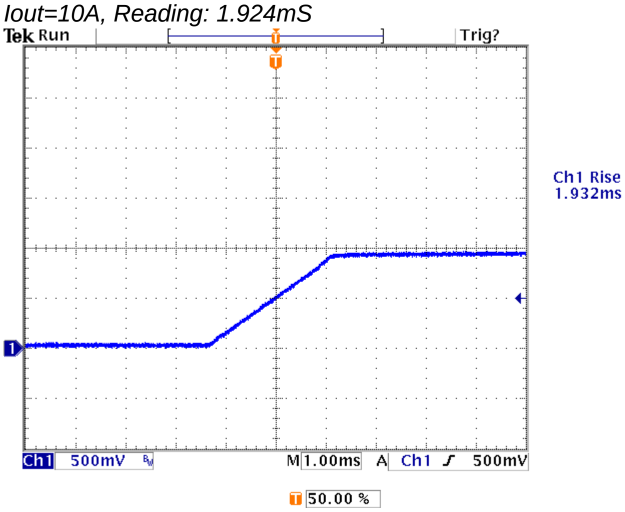


Figure 15:*Output Voltage Rise time, Vin=7V, Vout=1V, Iout=20A, Reading: 1.932mS*

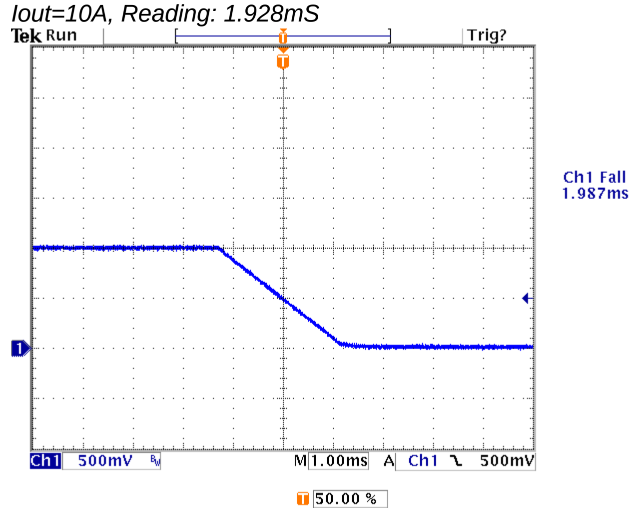


Figure 16:*Output Voltage Fall time, Vin=7V, Vout=1V, Iout=20A, Reading: 1.987mS*

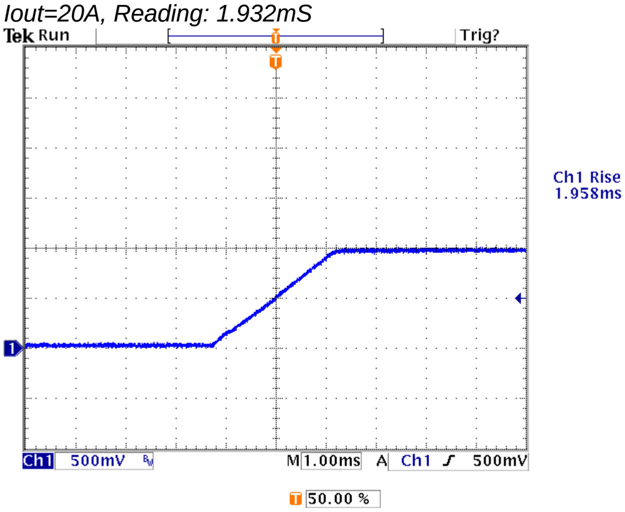


Figure 17:*Output Voltage Rise time, Vin=11V, Vout=1V, Iout=10A, Reading: 1.958mS*

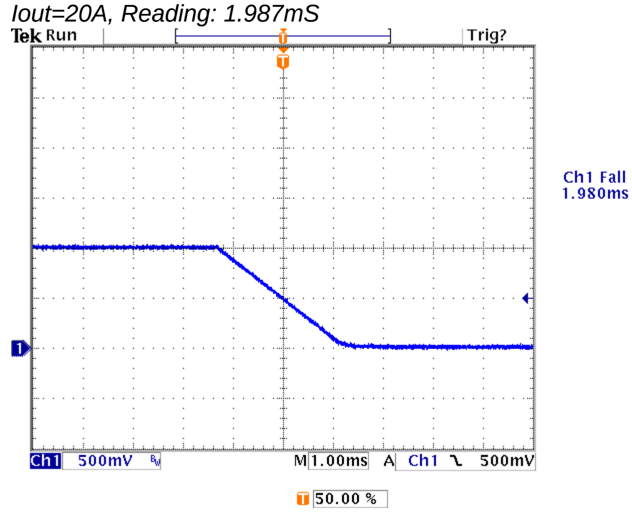


Figure 18:*Output Voltage Fall time, Vin=11V, Vout=1V, Iout=10A, Reading: 1.980mS*

ELECTRICAL CHARACTERISTICS CURVES

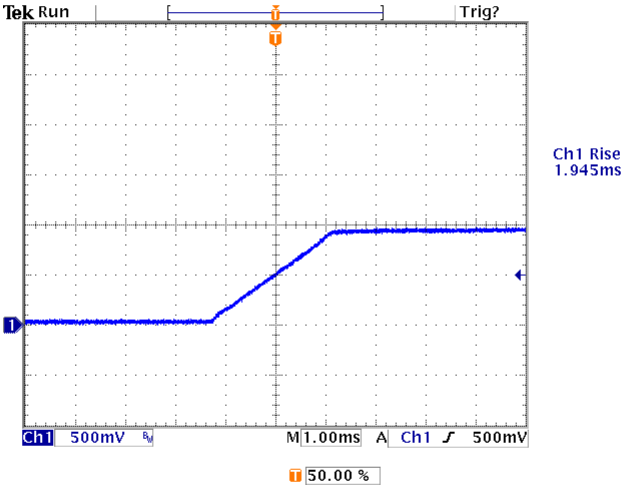


Figure 19:*Output Voltage Rise time, Vin=11V, Vout=1V, Iout=20A, Reading: 1.945mS*

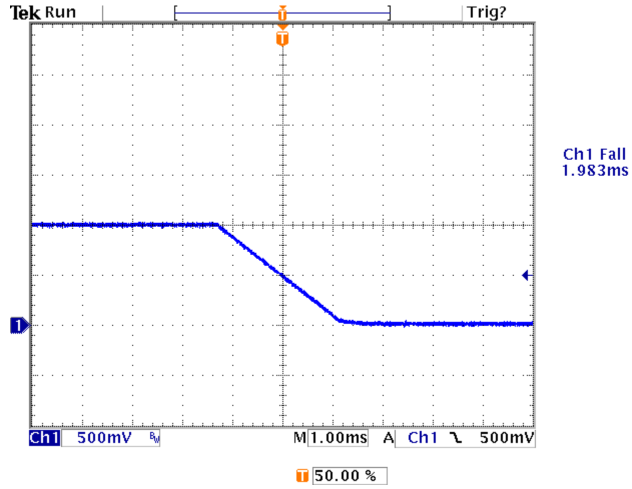


Figure 20:*Output Voltage Fall time, Vin=11V, Vout=1V, Iout=20A, Reading: 1.983mS*

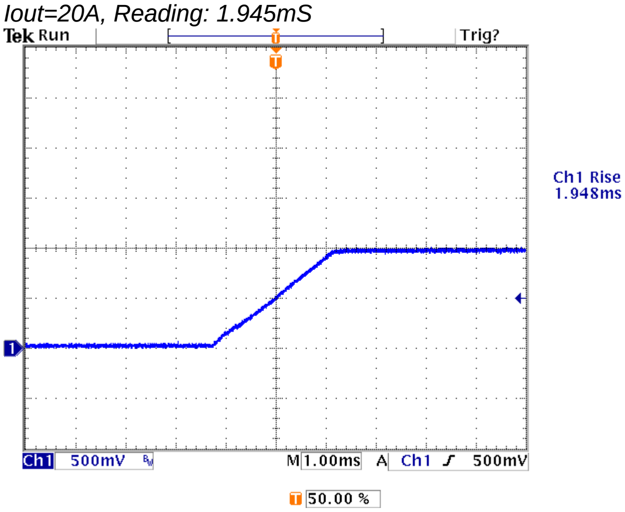


Figure 21:*Output Voltage Rise time, Vin=13.2V, Vout=1V, Iout=10A, Reading: 1.948mS*

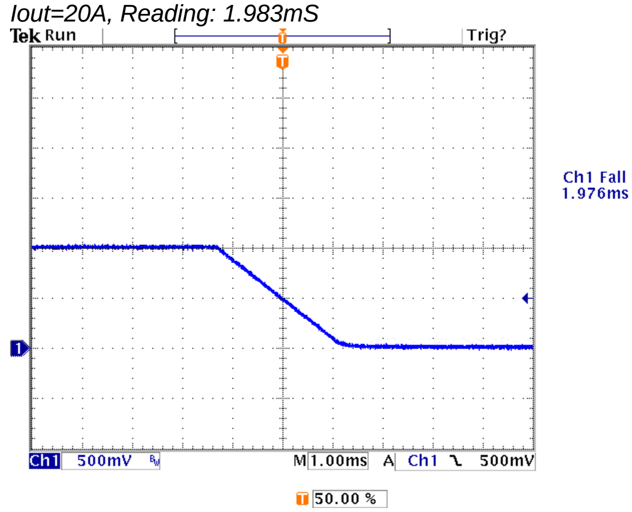


Figure 22:*Output Voltage Fall time, Vin=13.2V, Vout=1V, Iout=10A, Reading: 1.976mS*

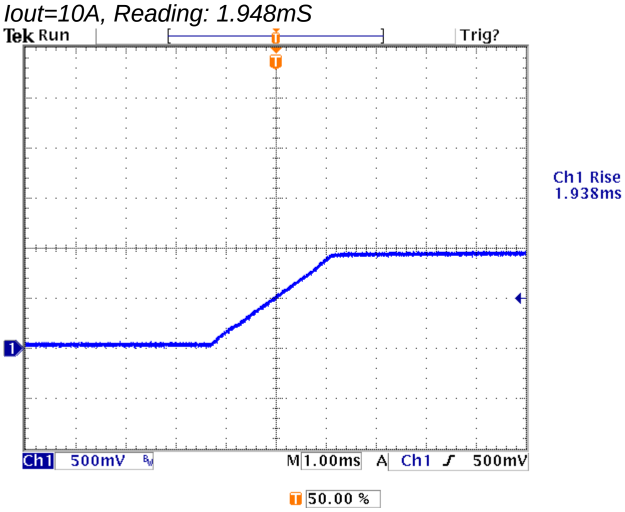


Figure 23:*Output Voltage Rise time, Vin=13.2V, Vout=1V, Iout=20A, Reading: 1.938mS*

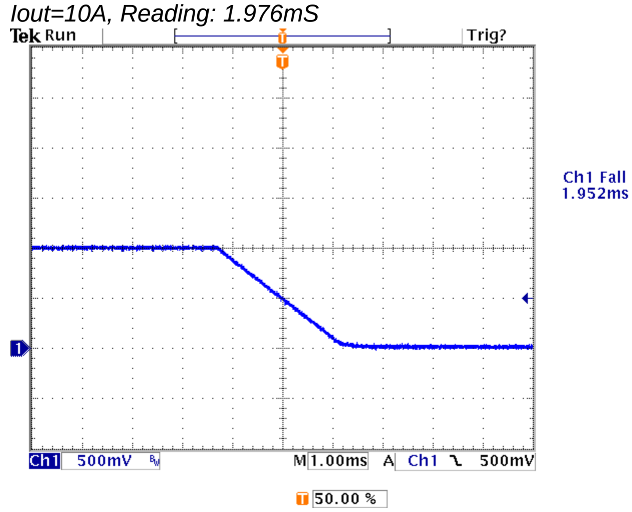


Figure 24:*Output Voltage Fall time, Vin=13.2V, Vout=1V, Iout=20A, Reading: 1.952mS*

ELECTRICAL CHARACTERISTICS CURVES

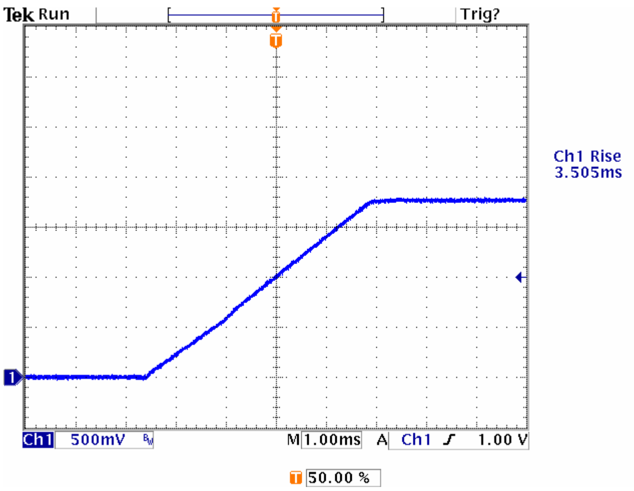


Figure 25:*Output Voltage Rise time, Vin=7V, Vout=1.8V, Iout=10A, Reading: 3.505mS*

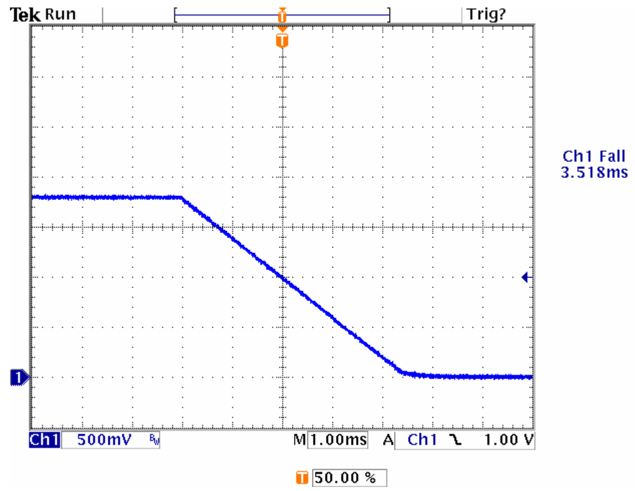


Figure 26:*Output Voltage Fall time, Vin=7V, Vout=1.8V, Iout=10A, Reading: 3.518mS*

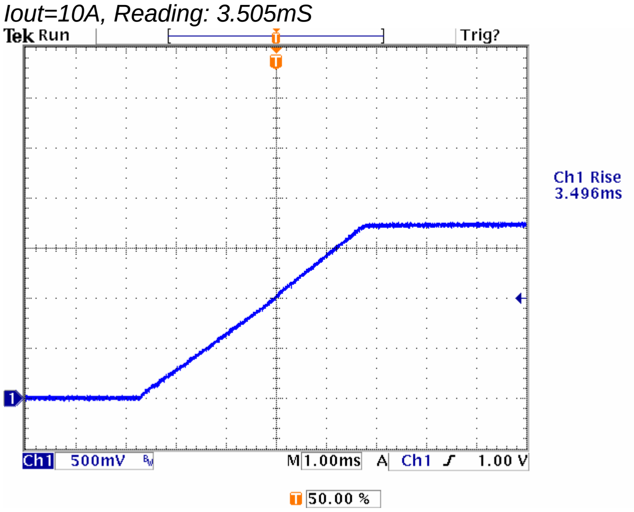


Figure 27:*Output Voltage Rise time, Vin=7V, Vout=1.8V, Iout=20A, Reading: 3.496mS*

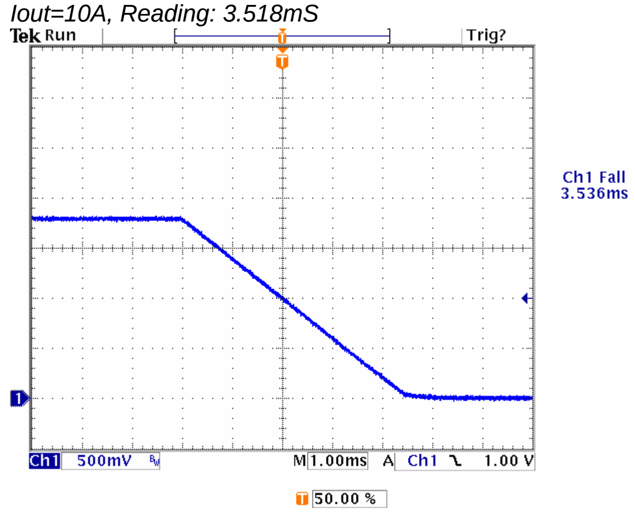


Figure 28:*Output Voltage Fall time, Vin=7V, Vout=1.8V, Iout=20A, Reading: 3.536mS*

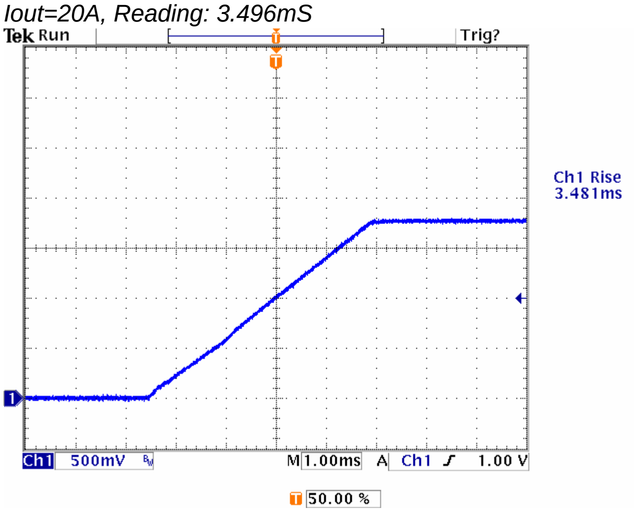


Figure 29:*Output Voltage Rise time, Vin=11V, Vout=1.8V, Iout=10A, Reading: 3.481mS*

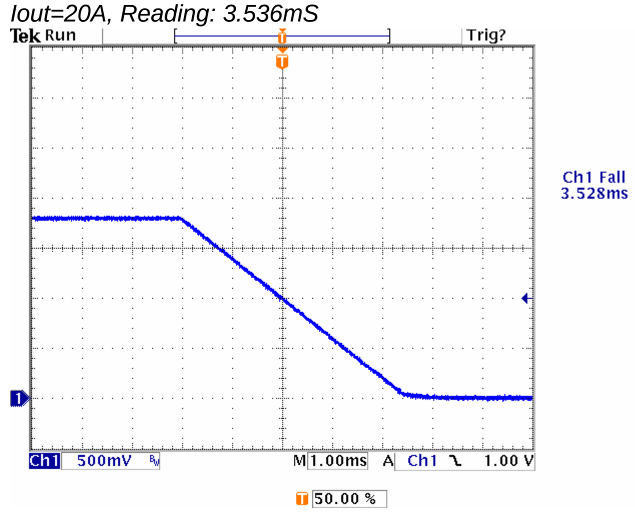


Figure 30:*Output Voltage Fall time, Vin=11V, Vout=1.8V, Iout=10A, Reading: 3.528mS*

ELECTRICAL CHARACTERISTICS CURVES

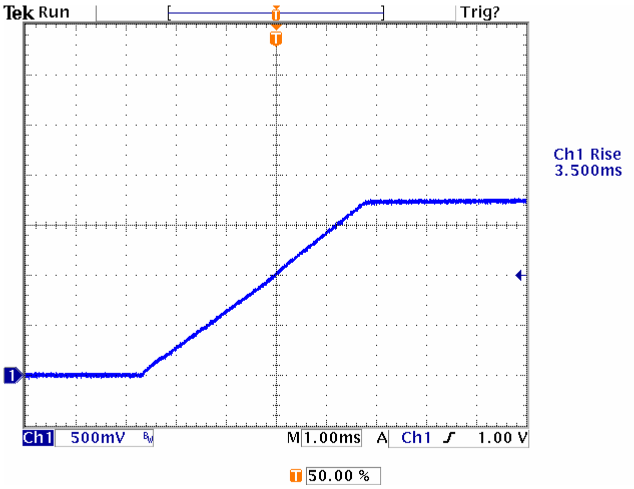


***Figure 31:**Output Voltage Rise time, Vin=11V, Vout=1.8V, Iout=20A, Reading: 3.500mS*

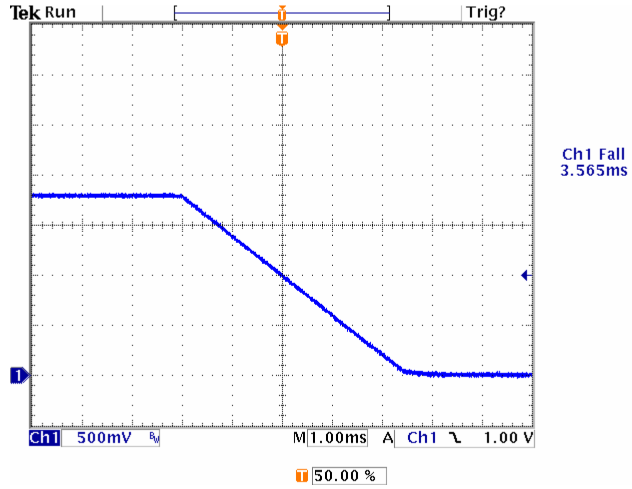


***Figure 32:**Output Voltage Fall time, Vin=11V, Vout=1.8V, Iout=20A, Reading: 3.565mS*

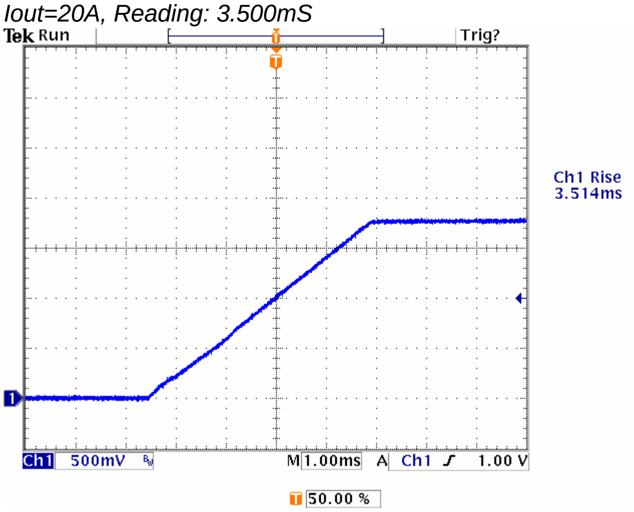


***Figure 33:**Output Voltage Rise time, Vin=13.2V, Vout=1.8V, Iout=10A, Reading: 3.514mS*

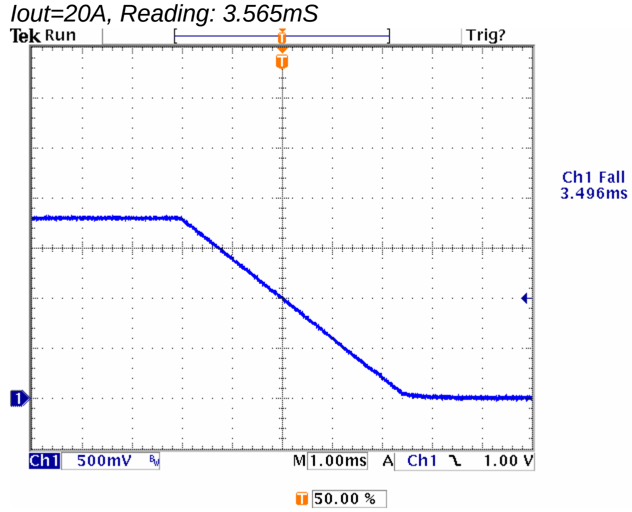


***Figure 34:**Output Voltage Fall time, Vin=13.2V, Vout=1.8V, Iout=10A, Reading: 3.496mS*

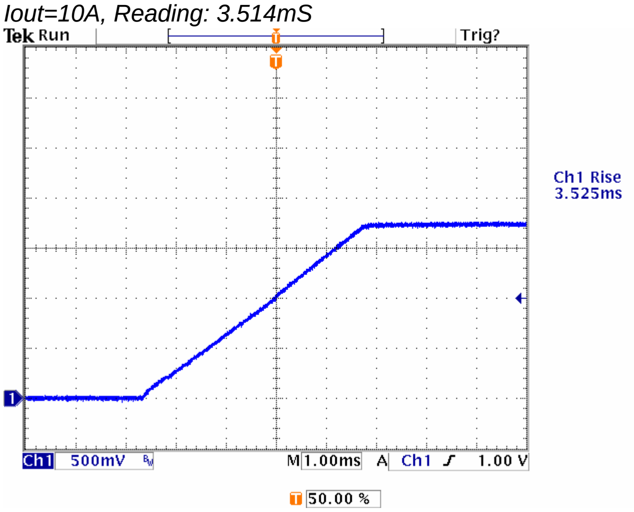


***Figure 35:**Output Voltage Rise time, Vin=13.2V, Vout=1.8V, Iout=20A, Reading: 3.525mS*

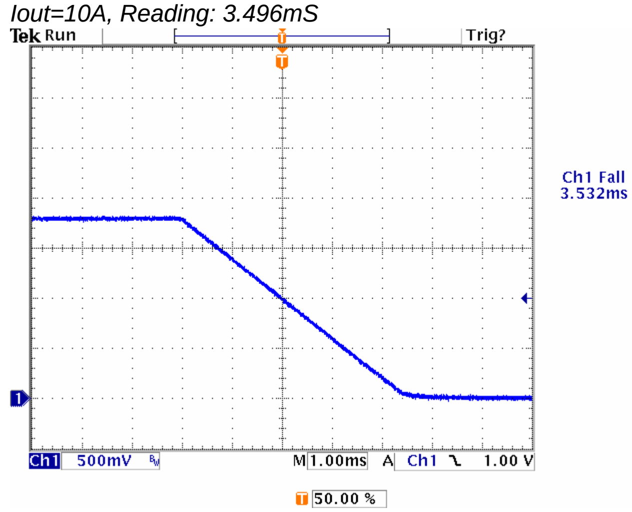


***Figure 36:**Output Voltage Fall time, Vin=13.2V, Vout=1.8V, Iout=20A, Reading: 3.532mS*

ELECTRICAL CHARACTERISTICS CURVES

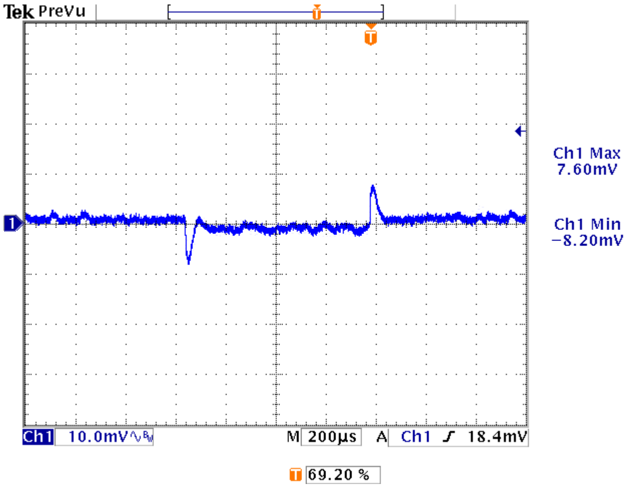


Figure 37:*Dynamic Response, Vo=1V, Vin=7V, Iout=15->20A, Reading: Max 7.40mV Min -8.20mV*

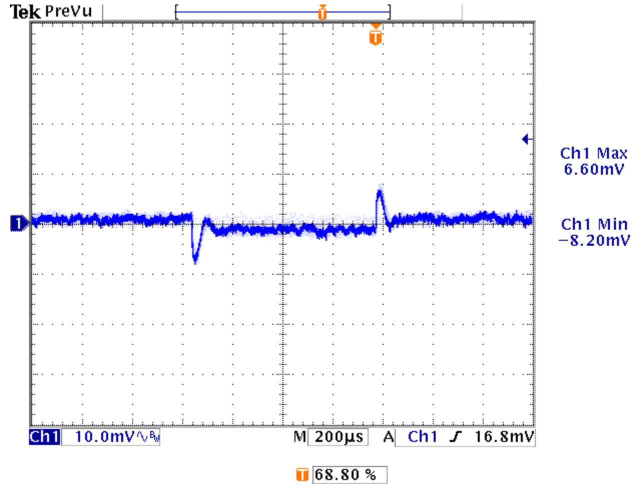


Figure 38:*Dynamic Response, Vo=1V, Vin=11V, Iout=15->20A, Reading: Max 6.40mV Min -8.20mV*

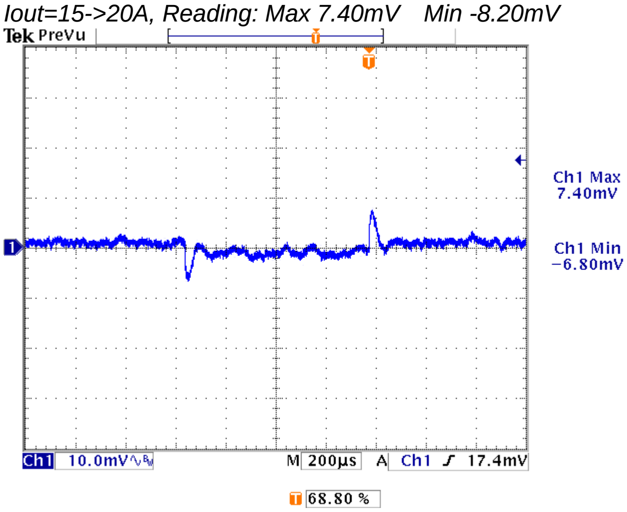


Figure 39:*Dynamic Response, Vo=1V, Vin=13.2V, Iout=15->20A, Reading: Max 7.40mV Min -6.80mV*

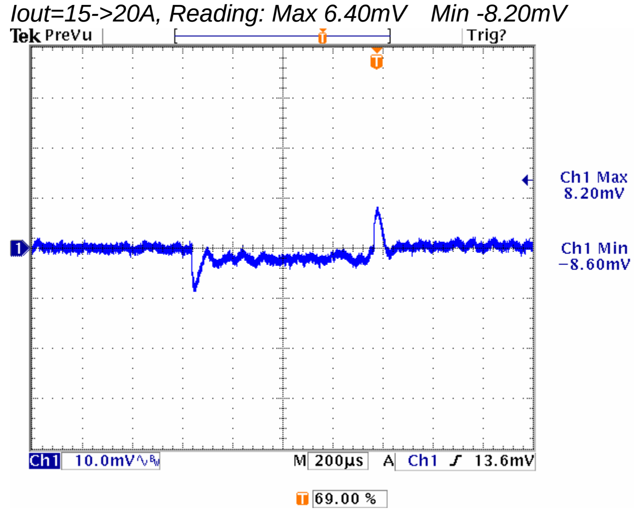


Figure 40:*Dynamic Response, Vo=1.8V, Vin=7V, Iout=15->20A, Reading: Max 8.20mV Min -8.60mV*

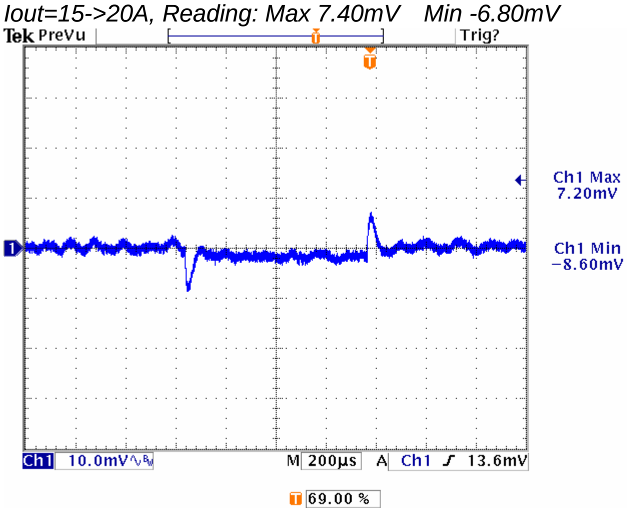


Figure 41:*Dynamic Response, Vo=1.8V, Vin=11V Iout=15->20A, Reading: Max 7.20mV Min -8.60mV*

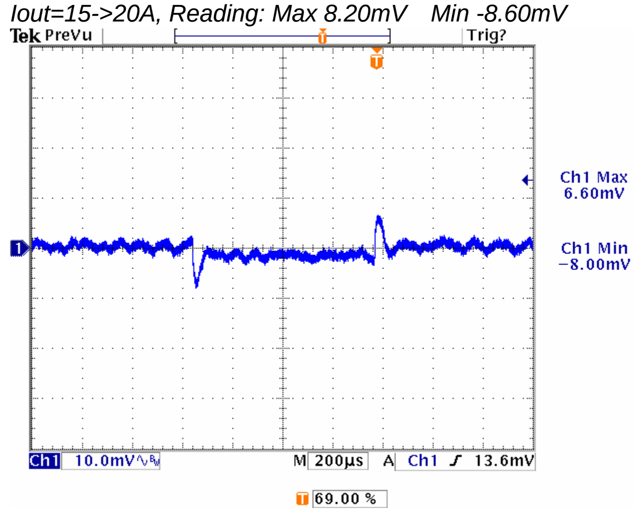


Figure 42:*Dynamic Response, Vo=1.8V, Vin=13.2V Iout=15->20A, Reading: Max 6.60mV Min -8.00mV*

TEST CONFIGURATIONS

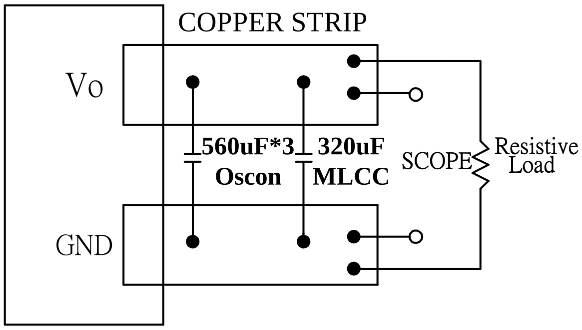


Figure 43: *Peak-peak output ripple & noise and startup transient measurement test setup*

Note: 12pcs 560μF OSCON and 2472μF MLCC capacitor in the module output. Scope measurement should be made by using a BNC connector.

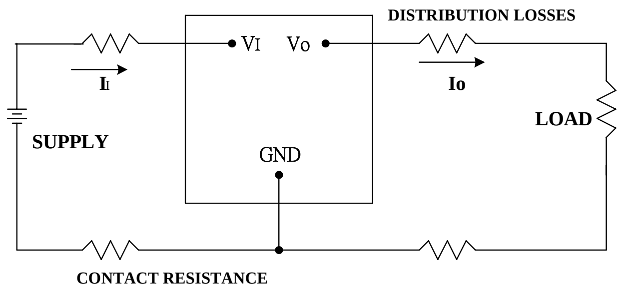


Figure 44: *Output voltage and efficiency measurement test setup*

Note: All measurements are taken at the module terminals. When the module is not soldered (via socket), place Kelvin connections at module terminals to avoid measurement errors due to contact resistance.

$$\eta = (\frac{Vo \times Io}{Vi \times Ii}) \times 100 \quad \%$$

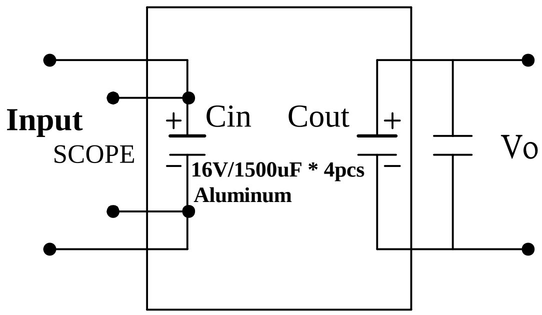


Figure 45: *Peak-peak Input ripple & noise measurement test setup*

Note: 4pcs 1,500μF Aluminum in the module input. Scope measurement should be made by using a BNC connector.

DESIGN CONSIDERATIONS

The power module should be connected to a low ac-impedance input source. Highly inductive source impedances can affect the stability of the module. An input capacitance must be placed close to the modules input pins to filter ripple current and ensure module stability in the presence of inductive traces that supply the input voltage to the module.

Safety Considerations

For safety-agency approval the power module must be installed in compliance with the spacing and separation requirements of the end-use safety agency standards.

For the converter output to be considered meeting the requirements of safety extra-low voltage (SELV), the input must meet SELV requirements. The power module has extra-low voltage (ELV) outputs when all inputs are ELV.

The input to these units is to be provided with a maximum 15A time-delay fuse in the ungrounded lead.

FEATURES DESCRIPTIONS

Over-Current Protection

To provide protection in an output over load fault condition, the unit is equipped with internal over-current protection. When the over-current protection is triggered, the unit will be shutdown and restart by input or OUTEN on/off. The units operate normally once the fault condition is removed.

Over-Temperature Protection

To provide additional over-temperature protection in a fault condition, the unit is equipped with a latching thermal shutdown circuit. The shutdown circuit engages when the temperature of monitored component exceeds approximately 135℃. The shutdown unit will restart by input or OUTEN on/off while the temperature lower than 125C.

THERMAL CONSIDERATIONS

Thermal management is an important part of the system design. To ensure proper, reliable operation, sufficient cooling of the power module is needed over the entire temperature range of the module. Convection cooling is usually the dominant mode of heat transfer.

Hence, the choice of equipment to characterize the thermal performance of the power module is a wind tunnel.

Thermal Testing Setup

Delta's DC/DC power modules are characterized in heated wind tunnels that simulate the thermal environments encountered in most electronics equipment.

The following figures show the wind tunnel characterization setup. The power module is mounted on Primarion test board and is horizontally positioned within the wind tunnel.

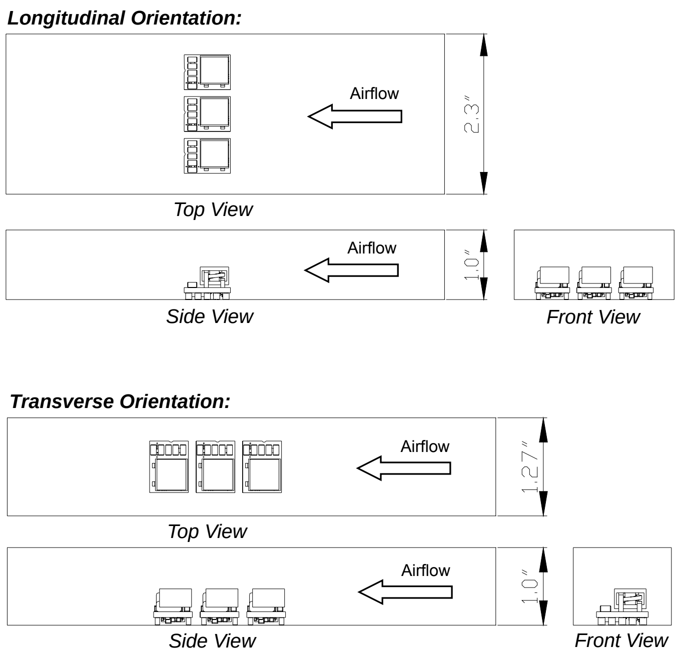


Figure 46: *Wind Tunnel Test Setup (Parallel Module)*

Thermal De-rating

The module's maximum hot spot temperature is 105°C. To enhance system reliability, the power module should always be operated below the maximum operating temperature. If the temperature exceeds the maximum module temperature, reliability of the unit may be affected.

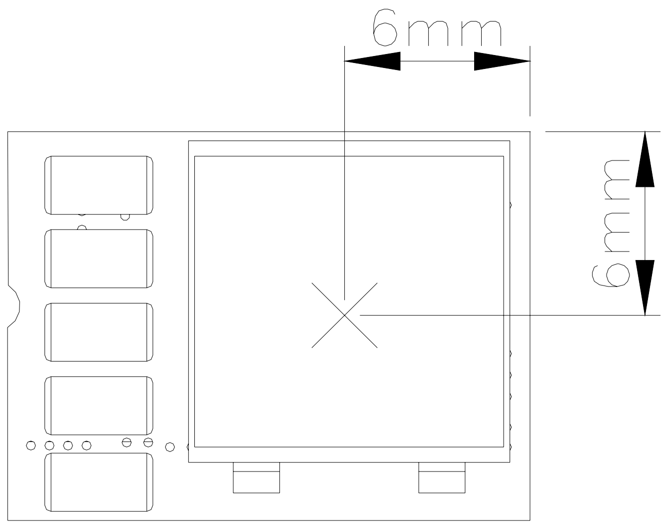


Figure 47: *Temperature measurement location*
The allowed maximum hot spot temperature is defined at 105℃

Parallel Module (Longitudinal Orientation)

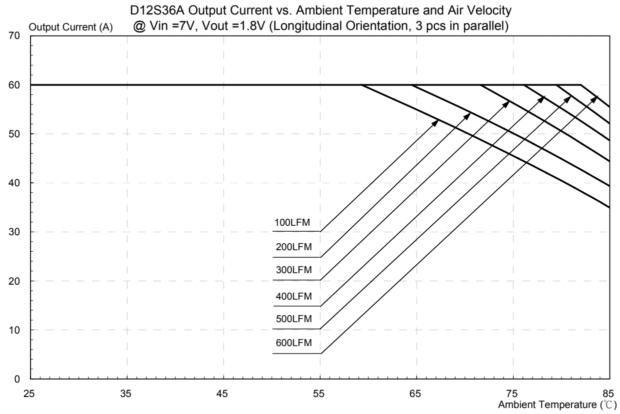


Figure 48: *Output current vs. ambient temperature and air velocity@ V_{in}=7V, V_{out}=1.8V (Longitudinal Orientation)*

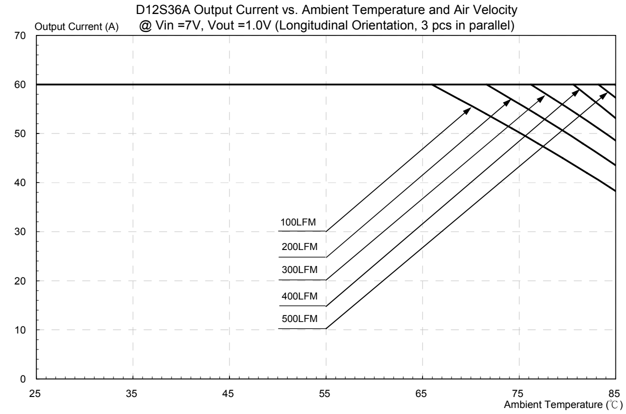


Figure 51: *Output current vs. ambient temperature and air velocity@ V_{in}=7V, V_{out}=1.0V (Longitudinal Orientation)*

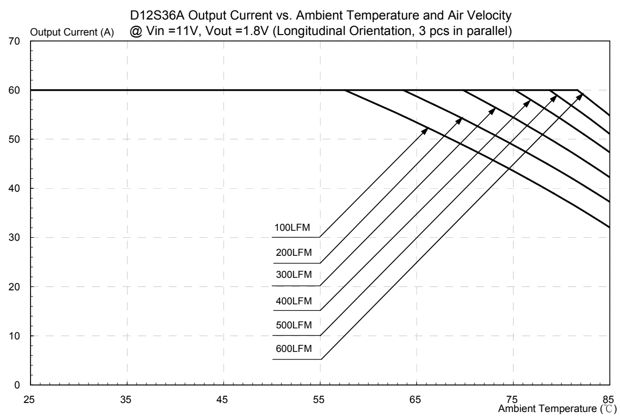


Figure 49: *Output current vs. ambient temperature and air velocity@ V_{in}=11V, V_{out}=1.8V (Longitudinal Orientation)*

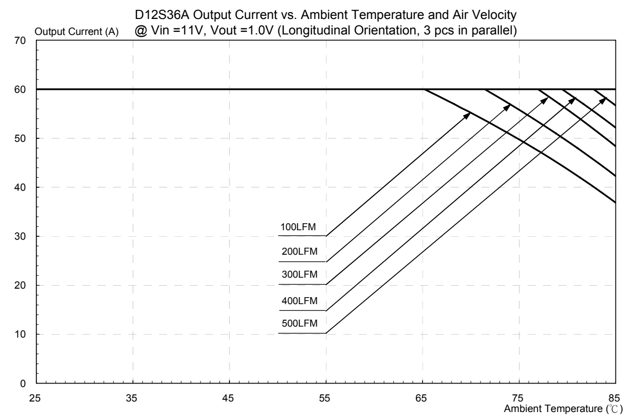


Figure 52: *Output current vs. ambient temperature and air velocity@ V_{in}=11V, V_{out}=1.0V (Longitudinal Orientation)*

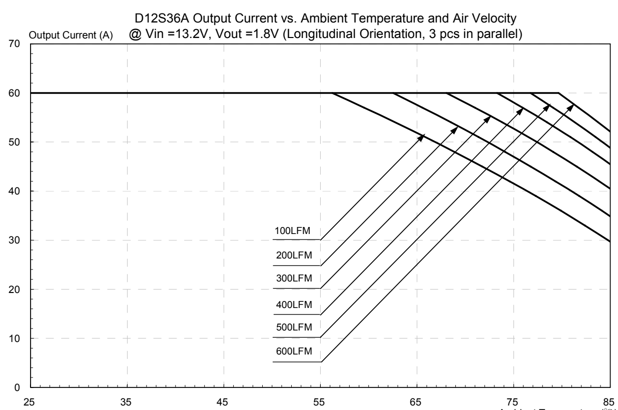


Figure 50: *Output current vs. ambient temperature and air velocity@ V_{in}=13.2V, V_{out}=1.8V (Longitudinal Orientation)*

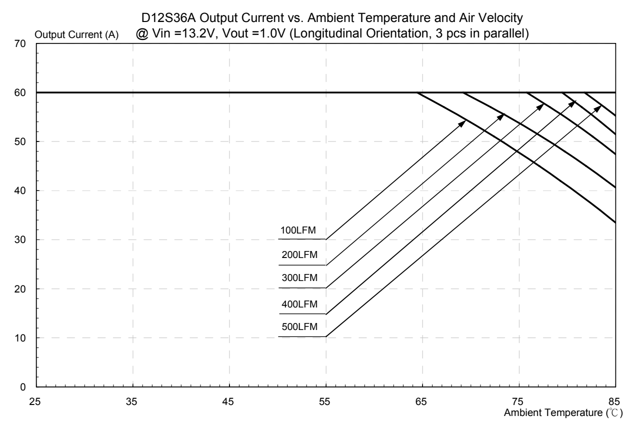


Figure 53: *Output current vs. ambient temperature and air velocity@ V_{in}=13.2V, V_{out}=1.0V (Longitudinal Orientation)*

Parallel Module (Transverse Orientation)

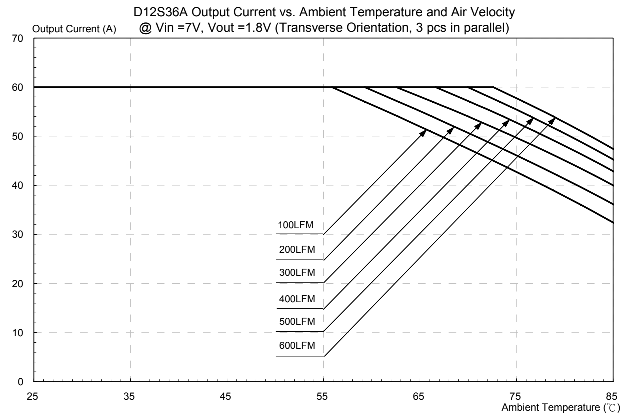


Figure 54: *Output current vs. ambient temperature and air velocity@ V_{in}=7V, V_{out}=1.8V (Transverse Orientation)*

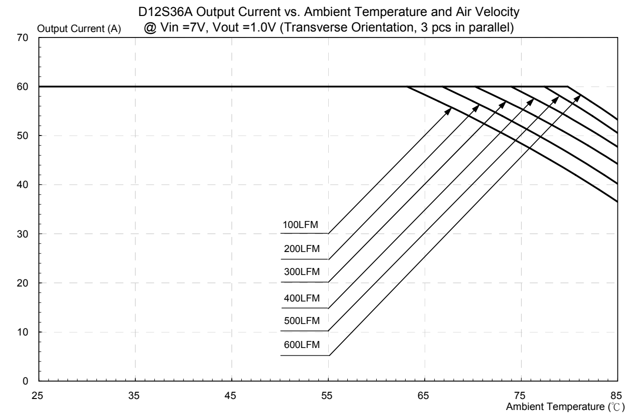


Figure 57: *Output current vs. ambient temperature and air velocity@ V_{in}=7V, V_{out}=1.0V (Transverse Orientation)*

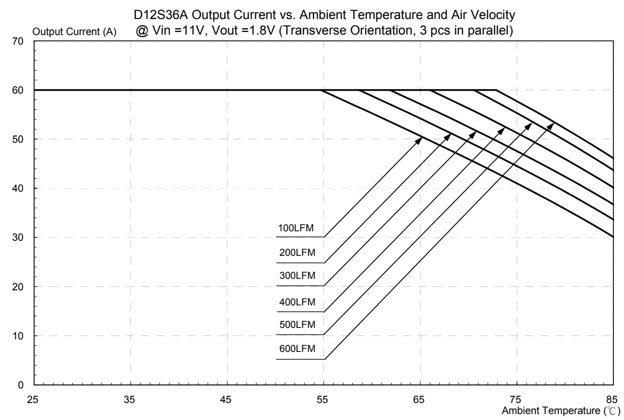


Figure 55: *Output current vs. ambient temperature and air velocity@ V_{in}=11V, V_{out}=1.8V (Transverse Orientation)*

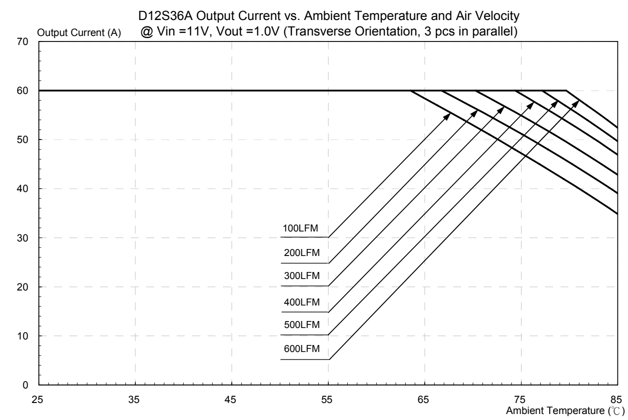


Figure 58: *Output current vs. ambient temperature and air velocity@ V_{in}=11V, V_{out}=1.0V (Transverse Orientation)*

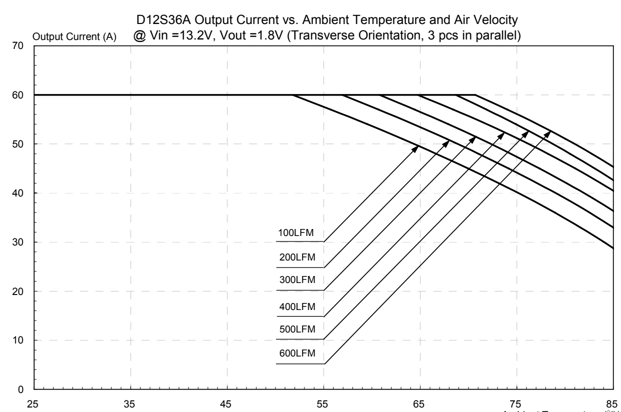


Figure 56: *Output current vs. ambient temperature and air velocity@ V_{in}=13.2V, V_{out}=1.8V (Transverse Orientation)*

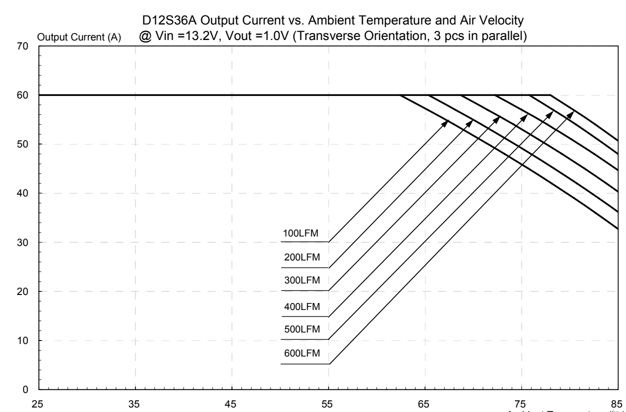
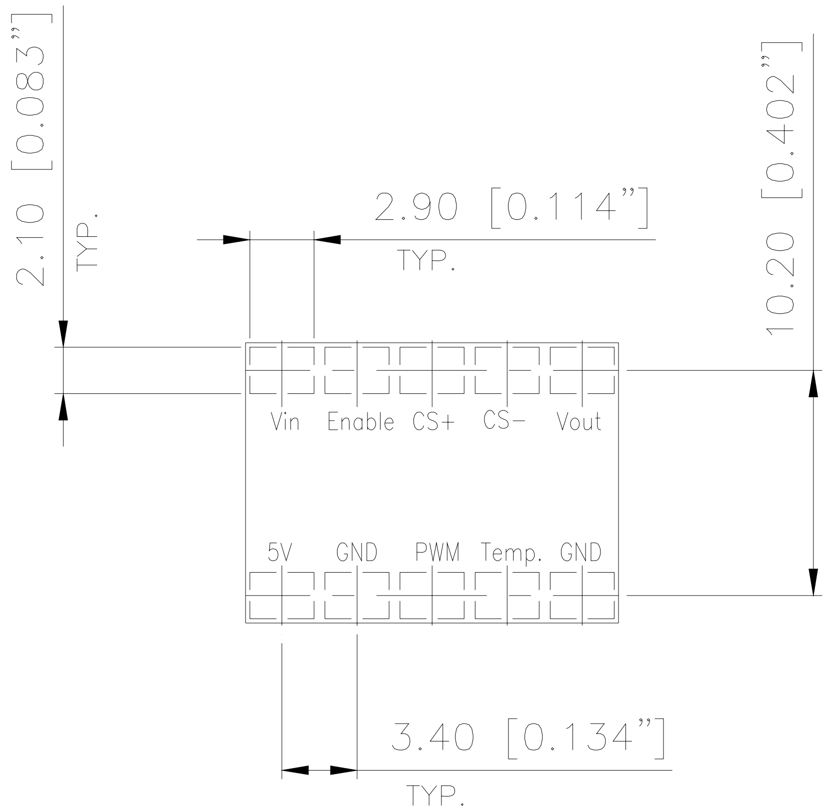
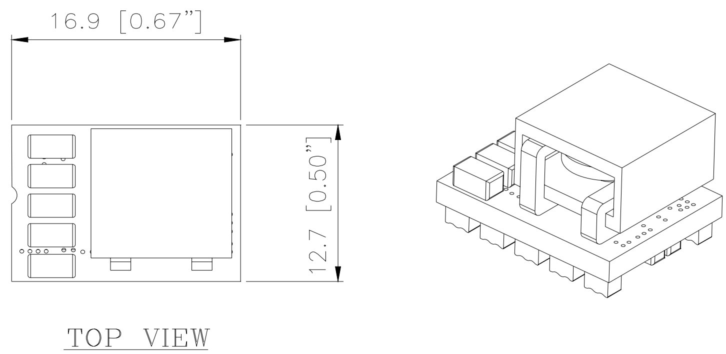


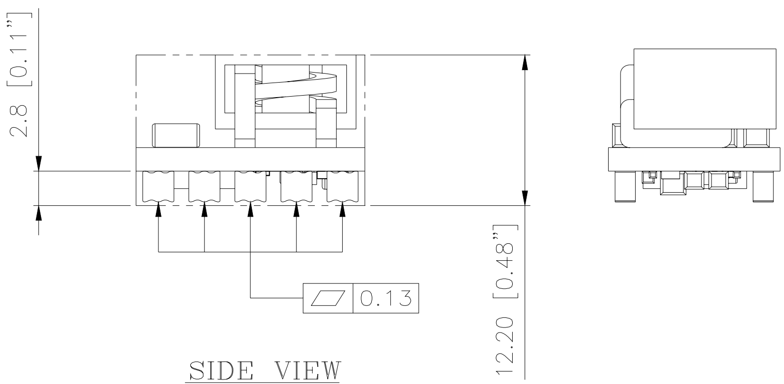
Figure 59: *Output current vs. ambient temperature and air velocity@ V_{in}=13.2V, V_{out}=1.0V (Transverse Orientation)*

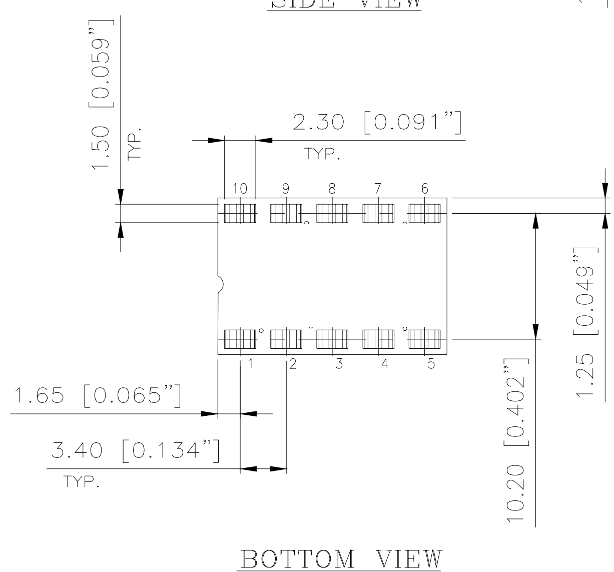
MECHANICAL CONSIDERATIONS



RECOMMENDED P.W.B PAD LAYOUT







PIN#	Function
1	Vin
2	ENABLE
3	Cs+
4	Cs–
5	Vout
6	GND
7	Temperature
8	PWM
9	GND
10	5V

ALL DIMENSIONS ARE IN MILLIMETERS (INCHES)

TOLERANCE: X.X mm ± 0.5mm (X.XX in. ± 0.02 in.)

X.XX mm ± 0.25 mm (X.XXX in. ± 0.010 in.)

PIN DESCRIPTIONS

Pin	Label	Type	Description
1	Vin	I	Power Input Voltage range from 7V to 13.2V
2	Enable	I	Control Power Module ON/OFF
3	Cs+	O	Choke Current Sense
4	Cs -	O	Choke Current Sense
5	Vout	O	Power Output
6	GND	PWG	Power Ground
7	Temperature	O	Temperature Sense
8	PWM	I	PWM signal
9	GND	PWG	Power Ground
10	Gate Voltage	I	Voltage range from 4.5V to 6V

PART NUMBERING SYSTEM

D	12	S	36	A
Type of Product	**Input Voltage**	**Number of Outputs**	**Output Current**	**Option Code**
D - DC/DC modules	12 - 7 ~13.2V	S - Single	36 - 36W (1.8V/20A) max	A - Standard

MODEL LIST

Model Name	Input Voltage	Output Voltage	Output Current	RoHS 5/6 compliant	Total Height	Efficiency 9.6Vin, 1.8Vout @ 100% load
D12S36A	7.0 ~ 13.2Vdc	0.8V ~ 1.8V	20A	Yes	0.48"	TBD

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WARRANTY

Delta offers a two (2) year limited warranty. Complete warranty information is listed on our web site or is available upon request from Delta.