

# LDO10C SERIES

## Single Output

10 A current rating

Input voltage range 3.0-13.8 V

Adjustable output voltage: 0.59-5.1 V

- Optional 3-pin model factory set
- Optional 5-pin model factory set with power good option

Excellent transient reponse

Power enable (5-pin model)

Minimum airflow

Small package

Termination voltage capacity

RoHS Compliant

The LDO10C is a new high density, open frame, non-isolated converter for space sensitive applications. This model has a wide input range of 3-13.8 V and offers a 0.59-5.1 V adjustable output with 10 A capability. Typical efficiency for this model is 91% (12 V<sub>in</sub>, 2.5 V<sub>out</sub>, 10 A load). The 5-pin version of this voltage device offers the additional features of enable, and with a default wide adjustable out voltage range or option of power good.

[ 2 YEAR WARRANTY ]



Stresses in excess of the maximum ratings can cause permanent damage to the device. Operation of the device is not implied at these or any other conditions in excess of those given in the specification. Exposure to absolute maximum ratings can adversely affect device reli-

#### Absolute Maximum Ratings

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input voltage - continuous	$V_{in}$ (cont)	3.0		13.8	Vdc	$V_{in}(+) - V_{in}(-)$
Enable	$V_{En}$ (max)			3.3 5.0	V V	When $V_{in} < 5$ V When $V_{in} > 5$ V
Pgood Voltage	$V_{Pgood}$ (max)			3.3 5.0	V V	When $V_{in} < 5$ V When $V_{in} > 5$ V
Operating temperature	$T_{Op}$	0		70	°C	Measured at thermal reference points, See Note 1. See Derating curves
Storage temperature	$T_{Storage}$	-40		125	°C	
Output current	$I_{out}$ (max)			10	A	

All specifications are typical at nominal input  $V_{in} = 5$  V and 12 V, full load under any resistive load combination at 25 °C, unless otherwise stated.

#### Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input voltage - operating	$V_{in}$	3.0		13.8	Vdc	
Input current - no load	$I_{in}$		80		mA	$V_{in}$ (min) - $V_{in}$ (max), enabled
Input current - quiescent	$I_{in(off)}$		10		mA	Converter disabled
Input voltage variation	$dv/dt$		1.0		V/ms	Product was tested at 1.2 V/ms. Much higher $dv/dt$ is possible (>10 V/ms)

#### Turn On/Off

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input voltage - turn on	$V_{in}$ (on)		2.8		Vdc	See App Note 186 to adjust this point
Input voltage - turn off	$V_{in}$ (off)		2.5		Vdc	
Turn on delay - enabled, then power applied	$T_{delay}$ (power)		2	3	ms	With the Remote ON/OFF signal asserted, this is the time from when the input voltage reaches the minimum specified operating voltage until $V_{out}$ is in regulation
Turn on delay - power applied, then Remote ON/OFF asserted	$T_{delay}$ (Remote ON/OFF)		2	3	ms	$V_{in} = V_{in(on)}$ , then Remote ON/OFF asserted. This is the time taken until $V_{out}$ is in regulation
Rise time	$T_{rise}$		1.3	2	ms	from 10% to 90%; full resistive load, 0 $\mu$ F capacitance

## Signal Electrical Interface

Characteristic - Signal Name	Symbol	Min	Typ	Max	Units	Notes and Conditions
Remote ON/OFF						See Application Note 186
Control pin open circuit voltage 3.3 V 5 V 12 V	$V_{ih}$		0.61 0.92 2.2		Vdc	$I_{ih} = 0 \mu A$ ; open circuit voltage See Notes 2 and 3
High level input current	$I_{ih}$		1		$\mu A$	Current flowing into control pin when pin is pulled high (max. at $V_{ih} = 5 V$ )
High level input voltage	$V_{ih}$	.502			Vdc	Converter guaranteed on when control pin is greater than $V_{ih}$ (min)
Low level input voltage	$V_{il}$			0.202	Vdc	Converter guaranteed off when control pin is less than $V_{il}$ (max)
Low level input current 3.3 V 5 V 12 V	$I_{il}$ (max)		110 166 398		$\mu A$	$V_{il} = 0 V_{dc}$

## Reliability and Service Life

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Mean time between failure	MTBF				Hours	MIL-HDBK-217F $V_{in} = V_{in}$ (nom); $I_{out} = I_{out}$ (max); ambient 25 °C; ground benign environment
Mean time between failure	MTBF	8,220,210			Hours	Telcordia SR-332 Issue 2, ground benign, ambient 40 °C, $V_{in} = V_{in}$ (nom)- $I_{out} = I_{out}$ (max)

## Other Specifications

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Switching frequency	$F_{sw}$		620		kHz	Fixed frequency
Weight			1.899/0.067		g/oz.	

## Environmental Specifications

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Thermal performance		0		70	°C	(See Note 1 and individual derating curves)
Type	Parameter	Reference		Test Level	Notes and Conditions	
Air temperature operating	10 °C to 70 °C					Max. rate of change is 30 degrees per hour while operating and 20 degrees per hour while non-operating
Air temperature non-operating	-40 °C to 120 °C					
Relative humidity - operating	80%					With non-condensing Excluding rain during parts shipment
Relative humidity - non-operating	100%					
Vibration - operating						Sinusoidal vibration, 0.5 G (0 to peak) acceleration.
Vibration - non-operating						Sinusoidal vibration, 1.0 G (0 to peak)
Shock	Accerlation					40 G, square wave at 200 in/s (508 cm/s); on all six sides
Non-operating square wave						
Non-operating half sine						
Operating half sine						Half sine pulse for 70 in/s (178 cm/s) for 2 ms; on all sides except top
						Half sine pulse for 40 in/s (102 cm/s) for 2 ms; on all sides except top

## Safety Agency Approvals

Characteristic	
UL/cUL	UL/cUL60950
TÜV Product Service	IEC 60950

## Material Ratings

Characteristic Signal Name	Notes and Conditions
Flammability rating	UL94V-0
Material type	FR4 PCB

## Model Numbers

Model Number	Input Voltage	Output Voltage	Output Current (Max.)	Efficiency at Full Load	Max. Load Regulation
LDO10C-005W05-SJ	3.0-13.8 V	0.59-5.1 V	10 A	92%	±0.5%
LDO10C-005W05-HJ	3.0-13.8 V	0.59-5.1 V	10 A	92%	±0.5%
LDO10C-005W05-VJ	3.0-13.8 V	0.59-5.1 V	10 A	92%	±0.5%

## RoHS Compliance Ordering Information



The 'J' at the end of the part number indicates that the part is Pb-free (RoHS 6/6 compliant). TSE RoHS 5/6 (non PB-free) compliant versions may be available on special request, please contact your local sales representative for details.

**3.3 V, 5 V, 12 V Model**  
**0.9 V Setpoint**
**Input Characteristics**

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating						
(Source) (3.3 V)	$I_{in}$		3.47		Adc	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (max)$
(Sink) (3.3 V)	$I_{in}$		-2.00		Adc	
(Source) (5 V)	$I_{in}$		2.24		Adc	
(Sink) (5 V)	$I_{in}$		-1.35		Adc	
(Source) (12 V)	$I_{in}$		0.98		Adc	
(Sink) (12 V)	$I_{in}$		-0.55		Adc	
Input capacitance - internal filter	$C_{input}$		22		$\mu F$	
Input capacitance - external filter	$C_{bypass}$		1		$\mu F$	Recommended customer added capacitance

**3.3 V, 5 V, 12 V Model**  
**0.9 V Setpoint**
**Electrical Characteristics**  
**- O/P**

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Nominal set-point voltage	$V_o (nom)$	0.891	0.9	0.909	Vdc	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (nom)$
Line regulation				$\pm 0.2$	%	$I_{out} = I_{out} (nom)$ ; $V_{in} (min)$ to $V_{in} (max)$
Load regulation				$\pm 0.5$	%	$V_{in} = V_{in} (nom)$ ; $I_{out} (min)$ to $I_{out} (max)$
Output current - continuous	$I_{out}$	0		10.0	Adc	Minus indicates sink mode
Output current - short circuit	$I_{sc}$		20.6		Apk	Continuous, unit auto recovers
Output voltage - noise						See Application Note 186 for more information
(3.3 V) 0.9 V	$V_{p-p}$			15	mV pk-pk	Measurement band width 20 MHz See Application Note 186 for details
(5.0 V) 0.9 V	$V_{p-p}$			15	mV pk-pk	
(12 V) 0.9 V	$V_{p-p}$			25	mV pk-pk	

**3.3 V, 5 V, 12 V Model**  
**0.9 V Setpoint**
**Electrical Characteristics**  
**- O/P**

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Load transient response - peak deviation	$V_{dynamic}$		100	100	mV	Peak deviation for 50% to 100% step load, $di/dt = 10 A/\mu s$
Load transient response - recovery	$T_{recovery}$			20	$\mu s$	Settling time to within 1% of output set-point voltage for 50% to 75% step load
External load capacitance (3.3 V)	$C_{ext}$		0	8400	$\mu F$	See Application Note 186 for output capacitance vs. stability

3.3 V, 5 V, 12 V Model  
0.9 V Setpoint

Protection and Control  
Features

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Overcurrent limit inception	$I_{OC}$		17		Adc	$V_o = 90\%$ of $V_o$ (nom)

3.3 V, 5 V, 12 V Model  
0.9 V Setpoint

Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency 3.3 V (source mode) 3.3 V (sink mode)	$\eta$	76	78 74		%	$I_{out} = 100\%$ (max) $V_{in} - V_{in}$ (nom)
Efficiency 5.0 V (source mode) 5.0 V (sink mode)	$\eta$	78	80 75		%	
Efficiency 12 V (source mode) 12 V (sink mode)	$\eta$	74	76 72		%	
Efficiency 3.3 V (source mode) 3.3 V (sink mode)	$\eta$	84	86 82		%	$I_{out} = 50\%$ (max) $V_{in} - V_{in}$ (nom)
Efficiency 5.0 V (source mode) 5.0 V (sink mode)	$\eta$	84	86 82		%	
Efficiency 12 V (source mode) 12 V (sink mode)	$\eta$	78	80 73		%	

### 3.3 V, 5 V, 12 V Model 2.5 V Setpoint

#### Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating (Source) (3.3 V)	$I_{in}$		8.27		A <sub>dc</sub>	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (max)$ ; $V_o = V_o (nom)$
(Sink) (3.3 V)	$I_{in}$		-6.62		A <sub>dc</sub>	
(Source) (5 V)	$I_{in}$		5.48		A <sub>dc</sub>	
(Sink) (5 V)	$I_{in}$		-4.39		A <sub>dc</sub>	
(Source) (12 V)	$I_{in}$		2.34		A <sub>dc</sub>	
(Sink) (12 V)	$I_{in}$		-1.84		A <sub>dc</sub>	
Input capacitance - internal filter	$C_{input}$		22		μF	Internal to converter
Input capacitance - external filter	$C_{bypass}$		1		μF	Recommended customer added capacitance

### 3.3 V, 5 V, 12 V Model 2.5 V Setpoint

#### Electrical Characteristics - O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Nominal set-point voltage	$V_o (nom)$	2.475	2.500	2.525	V <sub>dc</sub>	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (nom)$
Line regulation				±0.2	%	$I_{out} = I_{out} (nom)$ ; $V_{in} (min)$ to $V_{in} (max)$
Load regulation				±0.5	%	$V_{in} = V_{in} (nom)$ ; $I_{out} (min)$ to $I_{out} (max)$
Output current - continuous	$I_{out}$	0		10.0	A <sub>dc</sub>	
Output current - short circuit	$I_{sc}$		20.6		A <sub>pk</sub>	Continuous, unit auto recovers from short
Output voltage - noise $V_{rms}$ (3.3 V) 2.5 V	$V_{p-p}$			15	mV pk-pk	Measurement band width 20 MHz See Application Note 186 for details
(5.0 V) 2.5 V	$V_{p-p}$			20	mV pk-pk	
(12 V) 2.5 V	$V_{p-p}$			30	mV pk-pk	

### 3.3 V, 5 V, 12 V Model 2.5 V Setpoint

#### Electrical Characteristics - O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Load transient response - peak deviation	$V_{dynamic}$		140		mV	Peak deviation for 50% to 100% step load, $di/dt = 10 A/\mu s$
Load transient response - recover	$T_{recovery}$		20		μs	Settling time to within 1% of output set point voltage for 50% to 75% step load
External load capacitance	$C_{ext}$		0	2300	μF	See Application Notes 186 for output capacitance values vs. stability

3.3 V, 5 V, 12 V Model  
2.5 V Setpoint

Protection and Control  
Features

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Overcurrent limit inception	$I_{OC}$		16		Adc	$V_o = 90\%$ of $V_o$ (nom)

3.3 V, 5 V, 12 V Model  
2.5 V Setpoint

Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency 3.3 V (source mode) 3.3 V (sink mode)	□	84	91 89		%	$I_{out} = 100\%$ (max) $V_{in} - V_{in}$ (nom)
Efficiency 5.0 V (source mode) 5.0 V (sink mode)	□	89	91 88		%	
Efficiency 12 V (source mode) 12 V (sink mode)	□	87	89 93		%	
Efficiency 3.3 V (source mode) 3.3 V (sink mode)	□	93	95 92		%	$I_{out} = 50\%$ (max) $V_{in} - V_{in}$ (nom)
Efficiency 5.0 V (source mode) 5.0 V (sink mode)	□	92	94 91		%	
Efficiency 12 V (source mode) 12 V (sink mode)	□	88	90 84		%	



12 V Model  
5 V Setpoint

Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating			4.48			$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (max)$ ; $V_o = V_o (nom)$
Input capacitance - internal filter	$C_{input}$		22		$\mu F$	Internal to converter
Input capacitance - external filter	$C_{bypass}$		1		$\mu F$	Recommended customer added capacitance

12 V Model  
5 V Setpoint

Electrical Characteristics  
- O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Nominal set-point voltage	$V_o (nom)$	4.95	5.00	5.05	Vdc	$V_{in} = V_{in} (nom)$ ; $I_{out} = I_{out} (nom)$
Line regulation				$\pm 0.2$	%	$I_{out} = I_{out} (nom)$ ; $V_{in} (min)$ to $V_{in} (max)$
Load regulation				$\pm 0.5$	%	$V_{in} = V_{in} (nom)$ ; $I_{out} (min)$ to $I_{out} (max)$
Output current - continuous	$I_{out}$	0		10.0	Adc	
Output current - short circuit	$I_{sc}$		20.6		Apk	Continuous, unit auto recovers from short
Output voltage - noise $V_{rms}$	$V_{p-p}$		45		mV pk-pk	Measurement band width 20 MHz See Application Note 186 for details

12 V Model  
5 V Setpoint

Electrical Characteristics  
- O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Load transient response - peak deviation	$V_{dynamic}$		100		mV	Peak deviation for 50% to 100% step load, $di/dt = 10 A/s$
Load transient response - recover	$T_{recovery}$		10		$\mu s$	Settling time to within 1% of output set point voltage for 50% to 75% step load
External load capacitance	$C_{ext}$		0	1100	$\mu F$	See Application Notes 186 for output capacitance values vs. stability

12 V Model  
5 V Setpoint

Protection and Control  
Features

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Overcurrent limit inception	$I_{oc}$		14.5		Adc	$V_o = 90\%$ of $V_o$ (nom)

12 V Model  
5 V Setpoint

Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency (source)	$\eta$	91	93		%	$\eta_{opt} = 100\%$ $I_{out}$ (max), $V_{in} = V_{in}$ (nom)
Efficiency (source)	$\eta$	92	94		%	$I_{out} = 50\%$ $I_{out}$ (max), $V_{in} = V_{in}$ (nom)

0.9 V Setpoint

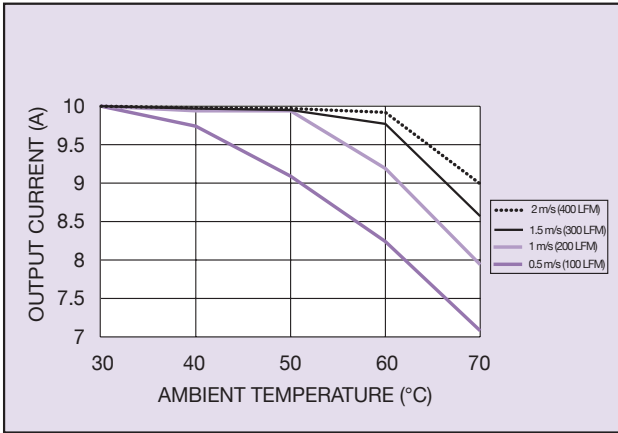


Figure 1: Thermal Derating Curve 3.3 Vin

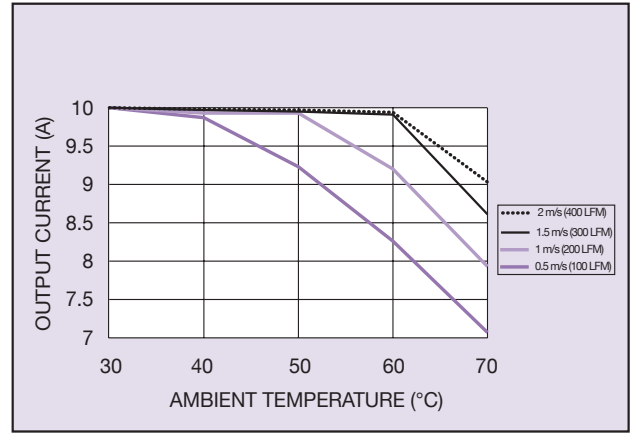


Figure 2: Thermal Derating Curve 5 Vin

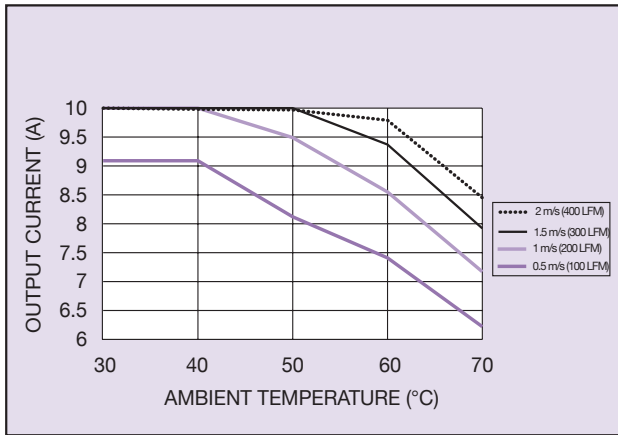


Figure 3: Thermal Derating Curve 12 Vin

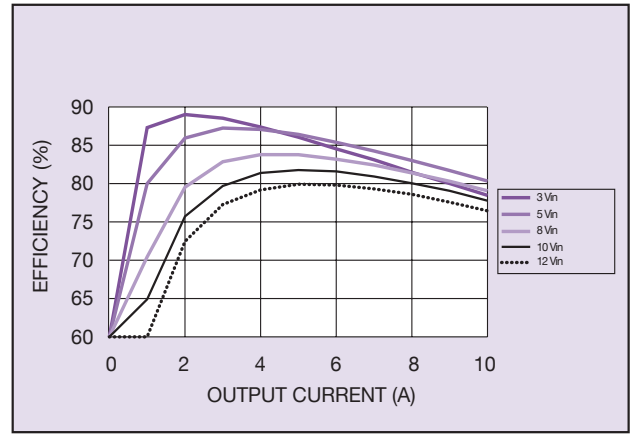


Figure 4: Efficiency vs. Load

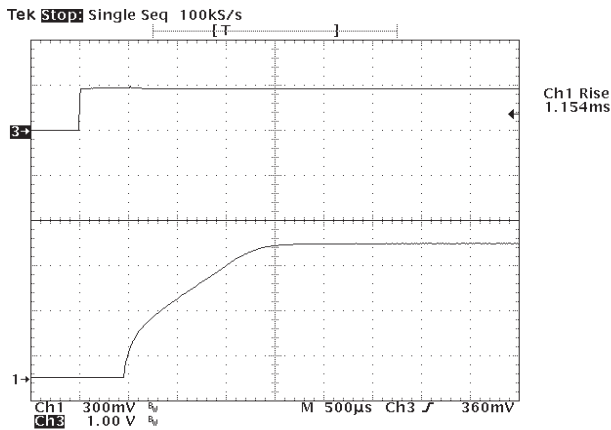


Figure 5: Remote On/Off  
(Channel 1: Output Voltage, Channel 3: Enable)

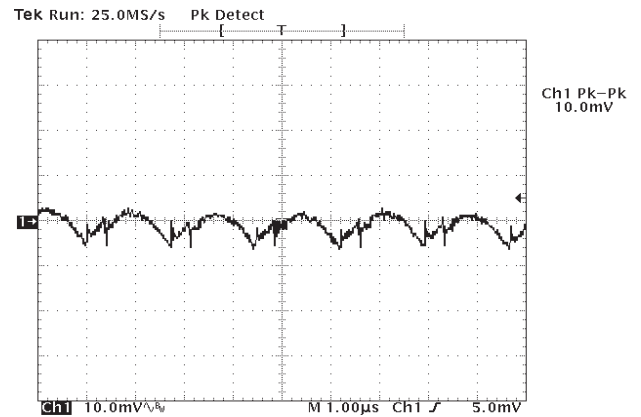
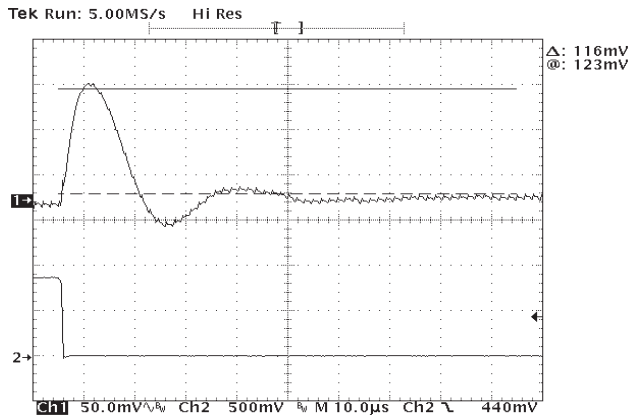
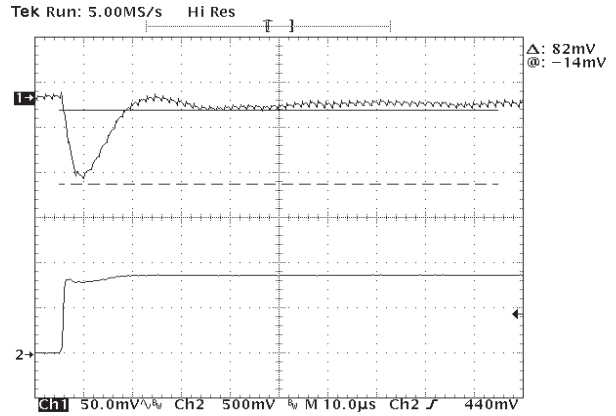


Figure 6: Typical Output Ripple

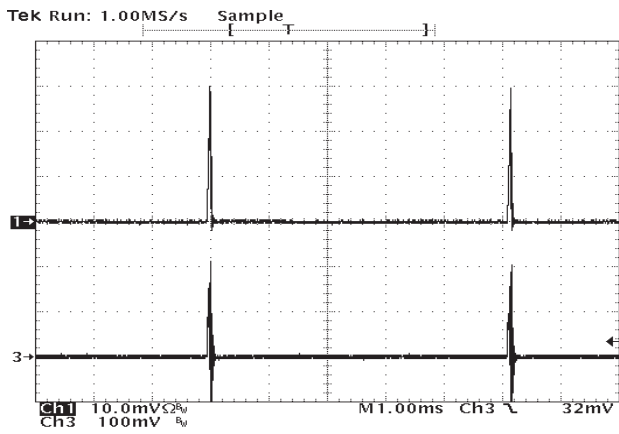
0.9 V Setpoint



**Figure 7: Transient Response 100% - 70%**  
(Channel 4: Current Step at 1.7 A/div,  
Channel 1: Output Voltage Deviation)



**Figure 8: Transient Response 70% - 100%**  
(Channel 4: Current Step at 1.7 A/div,  
Channel 1: Output Voltage Deviation)



**Figure 9: Short Circuit Characteristic**  
(Channel 2: Output Current at 10 A/div,  
Channel 1: Output Voltage)

2.5 V Setpoint

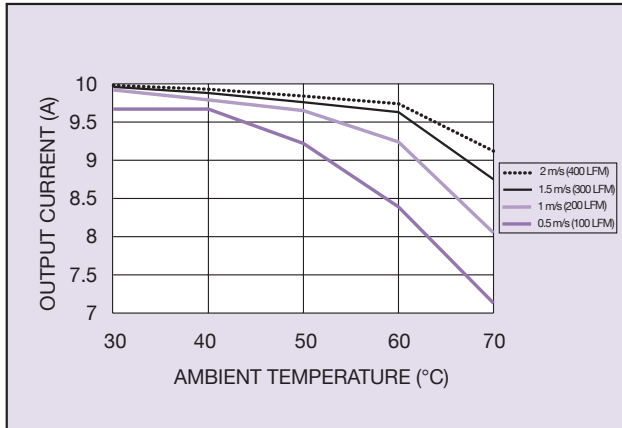


Figure 10: Thermal Derating Curve 3.3 Vin

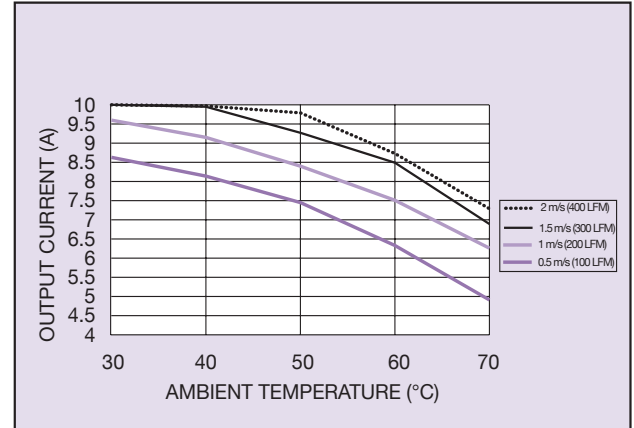


Figure 11: Thermal Derating Curve 5 Vin

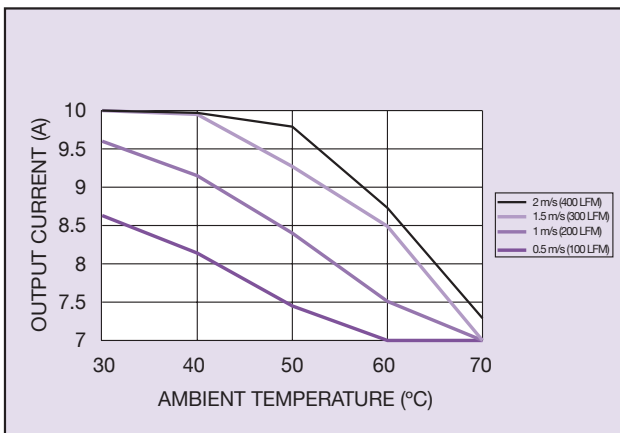


Figure 12: Thermal Derating Curve 12 Vin

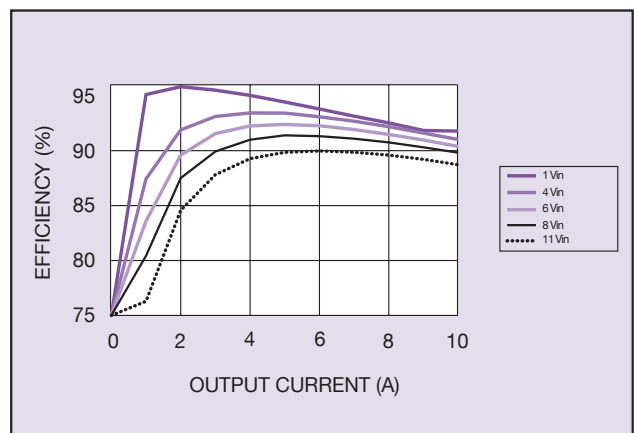


Figure 13: Efficiency vs. Load

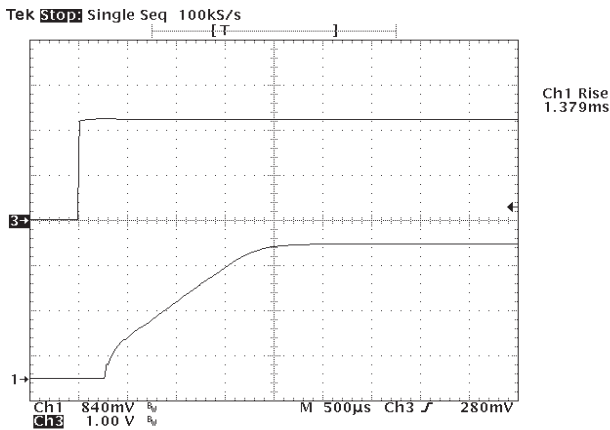


Figure 14: Remote On/Off  
(Channel 1: Output Voltage, Channel 3: Enable)

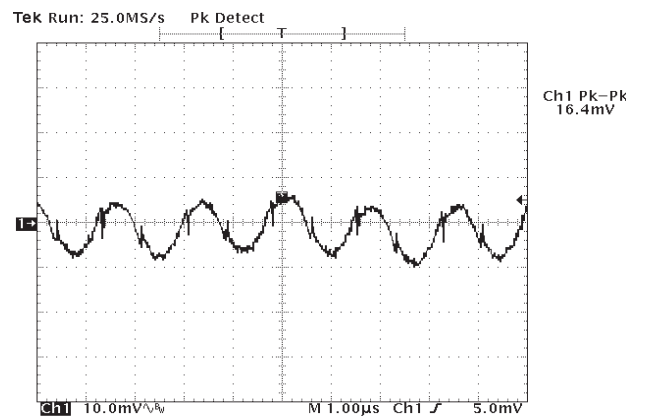
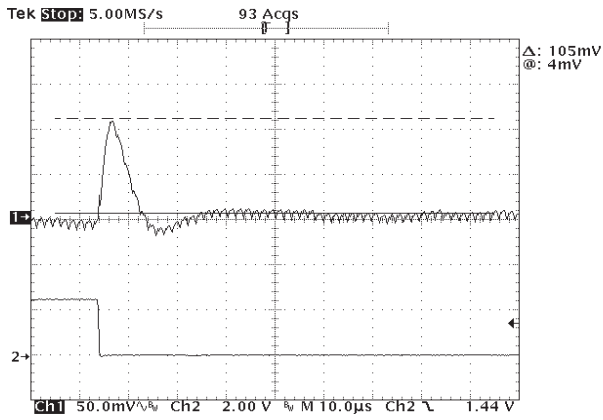
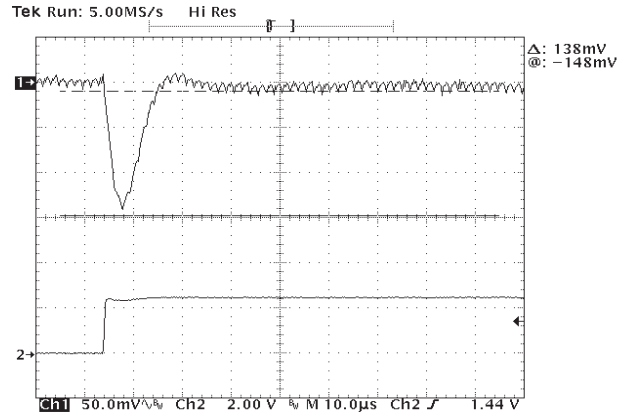


Figure 15: Typical Output Ripple

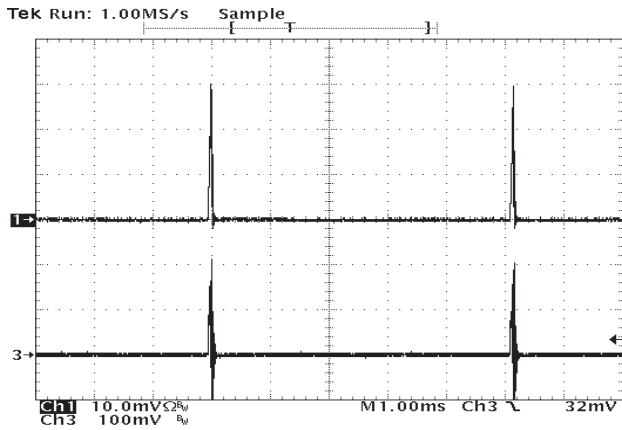
2.5 V Setpoint



**Figure 16: Transient Response 100%- 50%**  
 (Channel 1: Output Voltage Deviation,  
 Channel 2: Output Current)



**Figure 17: Transient Response 50% - 100%**  
 (Channel 1: Output Voltage Deviation,  
 Channel 2: Output Current)



**Figure 18: Short Circuit Characteristic**  
 (Channel 1: Output Current at 10 A/div,  
 Channel 3: Output Voltage)

5 V Setpoint

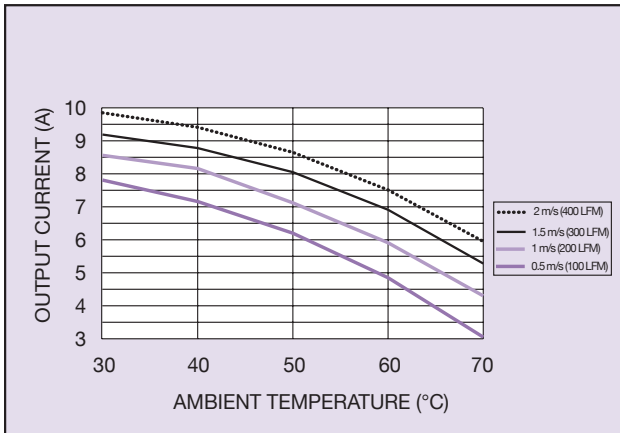


Figure 19: Thermal Derating Curve 12 Vin

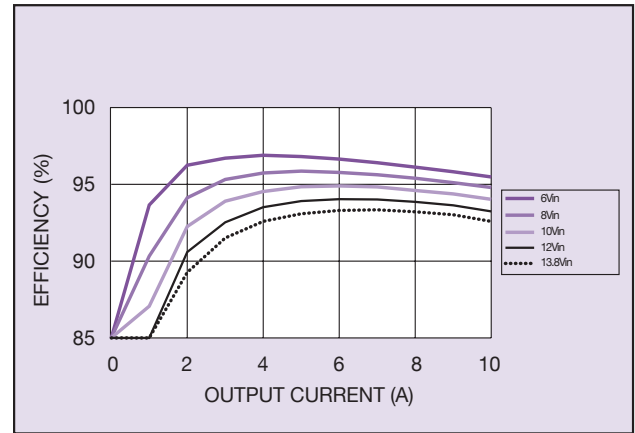


Figure 20: Efficiency vs. Load

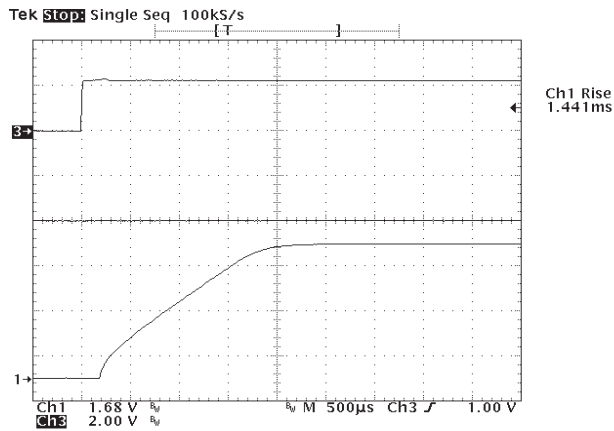


Figure 21: Remote On/Off  
(Channel 1: Output Voltage, Channel 3: Enable)

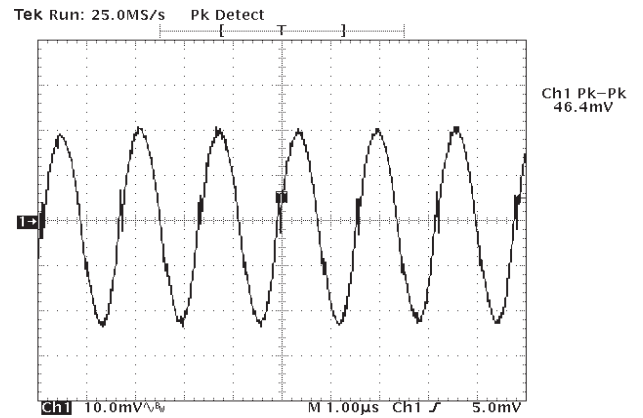
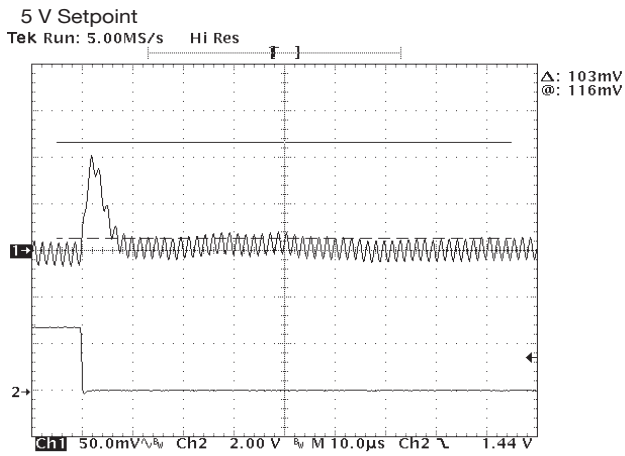
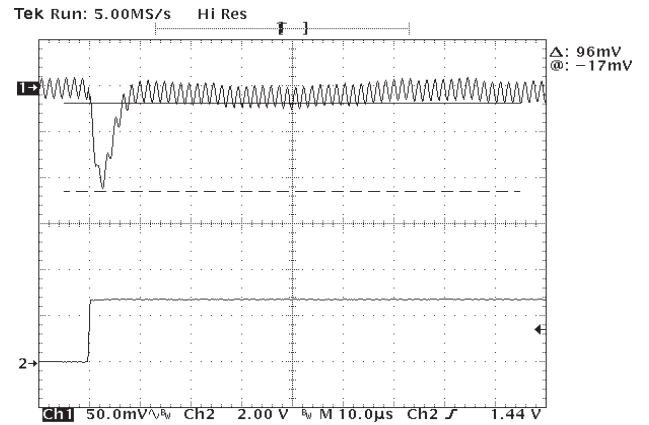


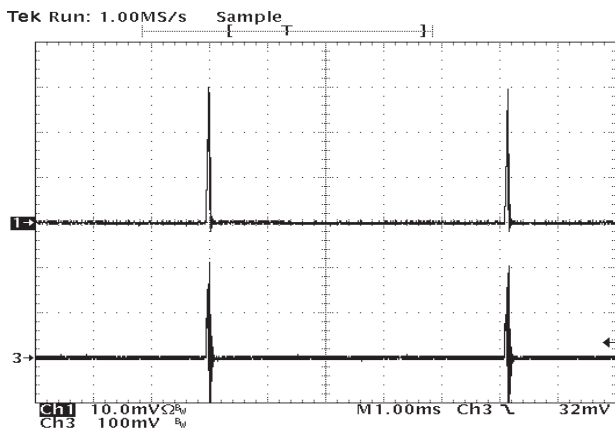
Figure 22: Typical Output Ripple



**Figure 23: Transient Response 100% - 70%**  
(Channel 2: Current Step at 2.5 A/div,  
Channel 1: Output Voltage Deviation)



**Figure 24: Transient Response 70% - 100%**  
(Channel 2: Current Step at 2.5 A/div,  
Channel 1: Output Voltage Deviation)

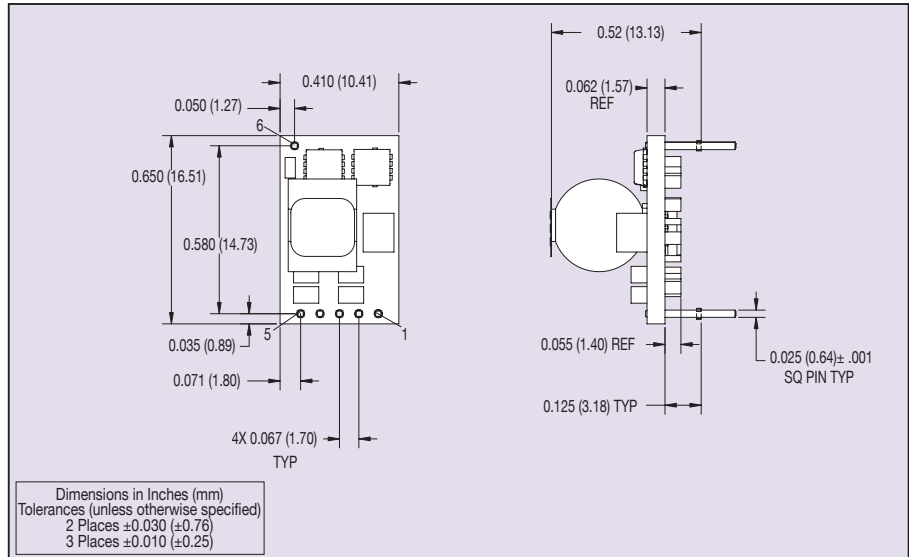


**Figure 25: Short Circuit Characteristic**  
(Channel 1: Output Current at 10 A/div,  
Channel 3: Output Voltage)

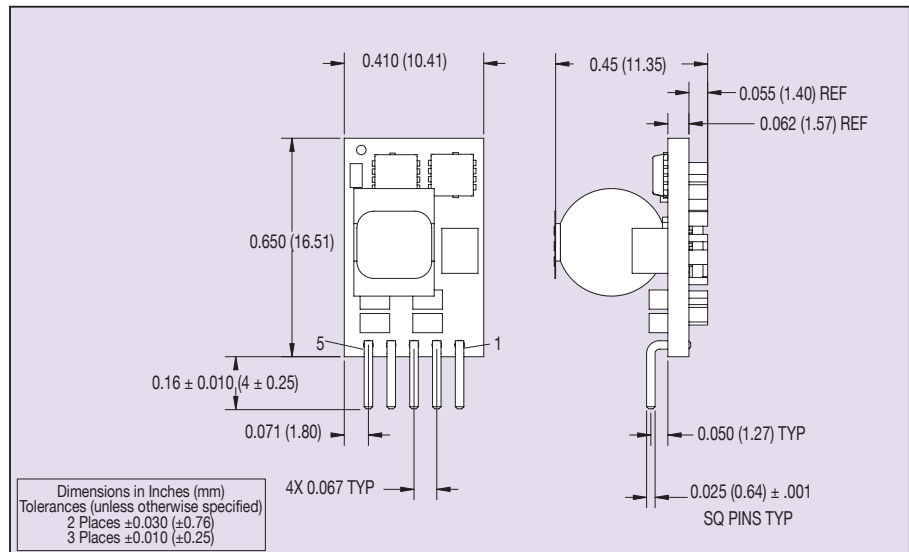


**Pin Connections**

Pin No.	Function
1	Enable
2	Vin
3	Common / RTN
4	Vout
5	PG / Trim
6	Mech Pin (Horz/SMT only)



**Figure 26: Mechanical Drawing - Horizontal**



**Figure 27: Mechanical Drawing - Vertical**

**Pin Connections**

Pin No.	Function
1	Enable
2	Vin
3	Common / RTN
4	Vout
5	PG / Trim
6	Mech Pin (Horz/SMT only)

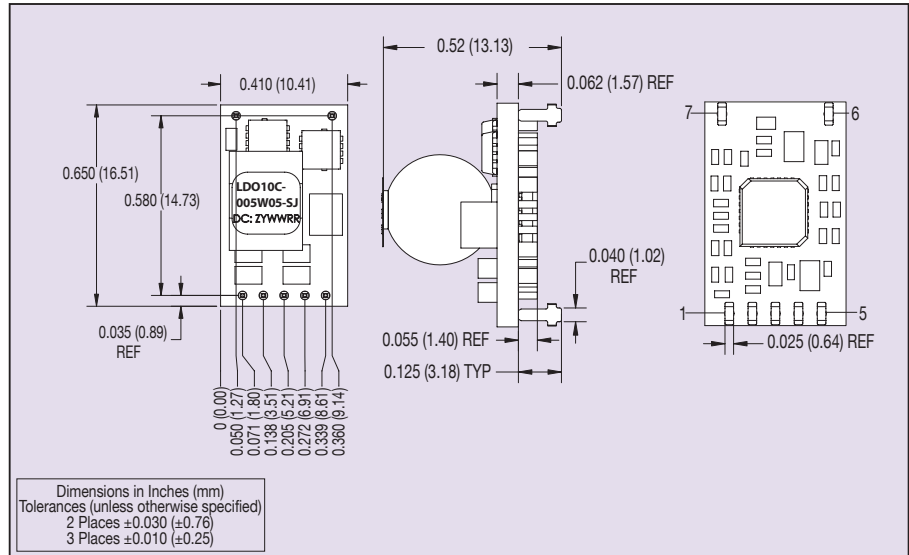


Figure 28: Mechanical Drawing - Surface Mount

**Note 1**

Thermal reference point is defined as the highest temperature measured at any one of the specified thermal reference points. See Application Note 186.

**Note 2**

The control pin is referenced to Ground.

**Note 3**

The LDO10C is supplied as standard with positive logic. Control input pulled low: Unit Disabled  
Control input left open: Unit Enabled

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