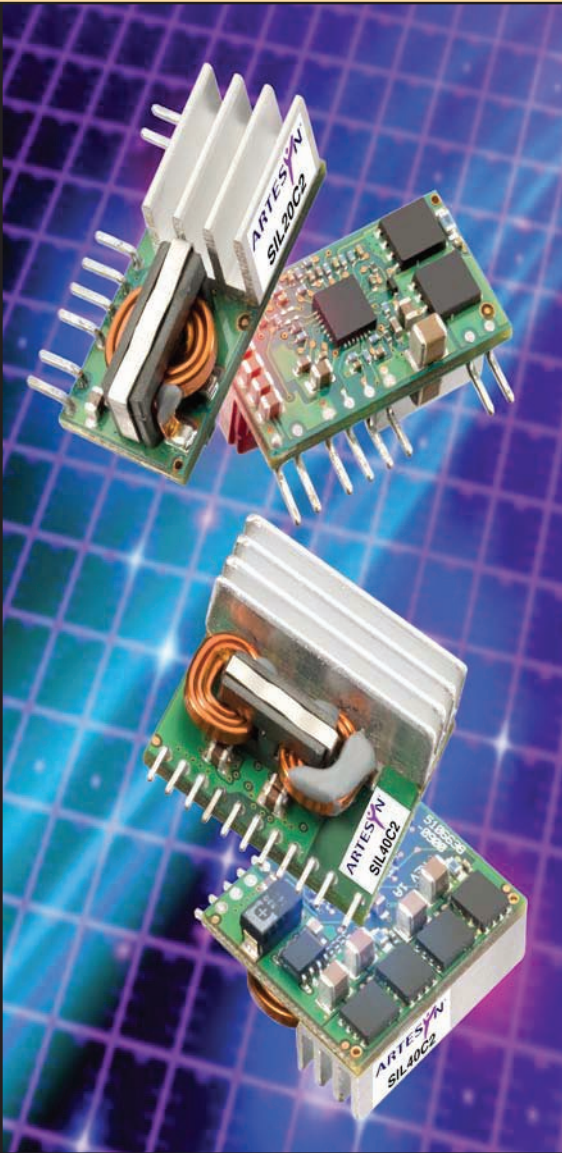


SIL20C2 Series

Single Output



Adjustable output voltage (0.59-5.1 V, 20 A max.)

Power good output signal (open collector)

Input undervoltage lockout

Current sink capability for termination applications

Operating ambient temperature up to 70 °C with suitable derating and forced

Remote ON/OFF

No minimum load requirements

Non-latching over-current protection

Compact footprint, vertical, horizontal, and horizontal SMT options

Wide input voltage 4.5-13.8 V

RoHS compliant

The SIL20C2 is a new high density open frame non-isolated converter series for space-sensitive applications. Each model has a wide input range (4.5-13.8 V) and offer a wide 0.59-5.1 V output voltage range with a 20 A load. An external resistor adjusts the output voltage from its pre-set value of 0.59 V to any value up to the maximum allowed value for that model. Typical efficiencies are 90% when operated at 5 V input, 2.5 V output at full load. The SIL20C2 series offers remote ON/OFF and over-current protection as standard. With full international safety approval including EN60950 and UL/cUL60950, the SIL20C2 reduces compliance costs and time to market.

[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 reliability.

Absolute Maximum Ratings

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input voltage - continuous	$V_{in (cont)}$	0		13.8	Vdc	$V_{in(+)} - V_{in(-)}$
Operating temperature	T_{op}	0		70	°C	Measured at thermal reference points, see Note 1. See derating curves
Enable Voltage	$V_{En (max)}$			V_{in} 5.0	V V	When $V_{in} < 5 V$ When $V_{in} > 5 V$
Pgood Voltage	$V_{Pgood (max)}$			V_{in} 5.0	V V	When $V_{in} < 5 V$ When $V_{in} > 5 V$
Storage temperature	$T_{storage}$	-40		125	°C	
Output current	$I_{out (max)}$			20	A	

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

Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input voltage - operating	V_{in}	4.5		13.8	Vdc	
Input current - no load	I_{in}		100		mA	$V_{in (min)} - V_{in (max)}$, enabled
Input current - quiescent	$I_{in(off)}$		10	20	mA	Converter disabled
Input voltage variation	dv/dt		1.2		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	$V_{in (on)}$		4.3		Vdc	See App Note 188 to adjust this point
Input voltage - turn off	$V_{in (off)}$		4.0		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
Output to power good delay (power good)			0.2		ms	Output voltage in full regulation power good asserted high
Rise time	T_{rise}		1.5	2.5	ms	From 10% to 90%; full resistive load, 0 μF capacitance

Signal Electrical Interface

Characteristic - Signal Name	Symbol	Min	Typ	Max	Units	Notes and Conditions
Remote ON/OFF						See Application Note 188
Control pin open circuit voltage 5 V 12 V	V_{ih}		0.61 1.47		Vdc	$I_{ih} = 0 \mu\text{A}$; open circuit voltage
High level input current	I_{ih}	0		1.0	μA	Current flowing into control pin when pin is pulled high (max. at $V_{ih} = 13.8 \text{ V}$)
High level input voltage	V_{ih}	0.5			Vdc	Converter guaranteed on when control pin is greater than V_{ih} (min)
Low level input voltage	V_{il}			0.200	Vdc	Converter guaranteed off when control pin is less than V_{il} (max)
Low level input current 5 V 12 V	I_{il} (max)		0.16 0.40		mA	$V_{il} = 0.0 \text{ V}$

Reliability and Service Life

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Mean time between failure	MTBF	TBD			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		6,721,853		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}		750		kHz	Fixed frequency
Weight			8.50/0.30		g/oz.	

Safety Agency Approvals

Characteristic	
UL/cUL	TBD
TÜV Product Service	TBD

Material Ratings

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

Environmental Specifications

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Thermal performance		0		70	0	°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/sec (508 cm/sec); on all six sides
Non-operating square wave						
Non-operating half sine						Half sine pulse for 70 in/sec (178 cm/sec) for 2 ms; on all sides except top
Operating half sine						Half sine pulse for 40 in/sec (102 cm/sec) for 2 ms; on all sides except top

Model Numbers

Model Number	Input Voltage	Output Voltage	Output Current (Max.)	Efficiency at Full Load	Max. Load Regulation
SIL20C2-00SADJ-VJ	4.5-13.8 V	0.59-5.1 V	20 A	93%	±0.5%
SIL20C2-00SADJ-HJ	4.5-13.8 V	0.59-5.1 V	20 A	93%	±0.5%
SMT20C2-00SADJJ	4.5-13.8 V	0.59-5.1 V	20 A	93%	±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.

5 V and 12 V Model
0.9 V Setpoint

Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating (Source) (5 V)	I_{in}		4.47		A _{dc}	$V_{in} = V_{in} (nom); I_{out} = I_{out} (max)$
(Sink) (5 V)	I_{in}		-2.73		A _{dc}	
(Source) (12 V)	I_{in}		1.94		A _{dc}	
(Sink) (12 V)	I_{in}		-1.08		A _{dc}	
Input capacitance - internal filter	C_{input}		44		μF	
Input capacitance - external filter	C_{bypass}		1		μF	Recommended customer added capacitance

5 V and 12 V Model
0.9 V SetpointElectrical 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	V _{dc}	$V_{in} = V_{in} (nom); I_{out} = I_{out} (nom)$
Line regulation				±0.2	%	$I_{out} = I_{out} (nom); V_{in} (min) \text{ to } V_{in} (max)$
Load regulation				±0.5	%	$V_{in} = V_{in} (nom); I_{out} (min) \text{ to } I_{out} (max)$
Output current - continuous	I_{out}	0		±20	A _{dc}	Minus indicates sink mode
Output current - short circuit	I_{sc}		31		A _{pk}	Continuous, unit auto recovers
Output voltage - noise (5.0 V) 0.9 V (12 V) 0.9 V	V_{p-p} V_{p-p}		15 20		mV pk-pk mV pk-pk	See Application Note 188 for more information Measurement band width 20 MHz See Application Note 188 for details

5 V and 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		mV	Peak deviation for 50% to 75% step load, $di/dt = 10 \text{ A}/\mu\text{s}$
Load transient response - recovery	$T_{recovery}$		20		μsec	Settling time to within 1% of output set-point voltage for 50% to 75% step load
External load capacitance	C_{ext}		0	11000	μF	See Application Note 188 for output capacitance vs. stability

5 V and 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}		26.5		Adc	V _o = 90% of V _o (nom)

5 V and 12 V Model
0.9 V Setpoint

Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency 5.0 V (source mode) 5.0 V (sink mode)		76.4	78.4 76.3		%	I _{out} = 100% I _{out} (max), V _{in} = V _{in} (nom)
Efficiency 12 V (source mode) 12 V (sink mode)		73.3	75.3 71.3		%	
Efficiency 5.0 V (source mode) 5.0 V (sink mode)		83.3	85.3 84.6		%	I _{out} = 50% I _{out} (max), V _{in} = V _{in} (nom)
Efficiency 12 V (source mode) 12 V (sink mode)		76.9	78.9 76.0		%	

5 V and 12 V Model
2.5 V Setpoint

Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating (Source) (5 V) (Sink) (5 V) (Source) (12 V) (Sink) (12 V)	I_{in} I_{in} I_{in} I_{in}		11.2 -8.9 4.71 -3.74		Adc Adc Adc Adc	$V_{in} = V_{in} (nom)$; $I_{out} = I_{out} (max)$; $V_o = V_o (nom)$
Input capacitance - internal filter	C_{input}		44		μF	Internal to converter
Input capacitance - external filter	C_{bypass}		1		μF	Recommended customer added capacitance

5 V and 12 V Model
2.5 V SetpointElectrical 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	Vdc	$V_{in} = V_{in} (nom)$; $I_{out} = I_{out} (nom)$
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		± 20	Adc	
Output current - short circuit	I_{sc}		31		Apk	Continuous, unit auto recovers from short
Output voltage - noise (5 V) 2.5 V (12 V) 2.5 V	V_{p-p} V_{p-p}			20 30	Vrms mV pk-pk mV pk-pk	Measurement band width 20 MHz See Application Note 188 for details

5 V and 12 V Model
2.5 V SetpointElectrical 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 75% step load, $di/dt = 10 A/s$
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	5000	μA	See Application Notes 188 for output capacitance values vs. stability

5 V and 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}		26.5		Adc	V _o = 90% of V _o (nom)

5 V and 12 V Model
2.5 V Setpoint

Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency 5.0 V (source mode) 5.0 V (sink mode)		87.5	89.5 89.4		%	I _{out} = 100% I _{out} (max), V _{in} = V _{in} (nom)
Efficiency 12 V (source mode) 12 V (sink mode)		86.4	88.4 88.1		%	
Efficiency 5.0 V (source mode) 5.0 V (sink mode)		87.2	93.3 93.6		%	I _{out} = 50% I _{out} (max), V _{in} = V _{in} (nom)
Efficiency 12 V (source mode) 12 V (sink mode)		88.8	90.4 90.8		%	

12 V Model
5 V Setpoint

Input Characteristics

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Input current - operating			8.91		A _{dc}	$V_{in} = V_{in(nom)}$; $I_{out} = I_{out(max)}$; $V_o = V_o(nom)$ Internal to converter
Input capacitance - internal filter	C_{input}		44		μF	
Input capacitance - external filter	C_{bypass}		1		μF	Recommended customer added capacitance

12 V Model
5 V SetpointElectrical 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	V _{dc}	$V_{in} = V_{in(nom)}$; $I_{out} = I_{out(nom)}$
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		20	A _{dc}	
Output current - short circuit	I_{sc}		31		A _{pk}	Continuous, unit auto recovers from short
Output voltage - noise V _{rms}	V_{p-p}		30	40	mV pk-pk	Measurement band width 20 MHz See Application Note 188 for details

12 V Model
5 V SetpointElectrical Characteristics
- O/P

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Load transient response - peak deviation	$V_{dynamic}$		90		mV	Peak deviation for 50% to 75% step load, $di/dt = 10 A/sec$
Load transient response - recover	$T_{recovery}$		40		μs	Settling time to within 1% of output set point voltage for 50% to 75% step load
External load capacitance	C_{ext}		0	2500	μA	See Application Notes 188 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}		26.5		Adc	

12 V Model
5 V Setpoint

Efficiency

Characteristic	Symbol	Min	Typ	Max	Units	Notes and Conditions
Efficiency		90.9	92.9		%	I _{out} = 100% I _{out} (max), V _{in} = V _{in} (nom)
Efficiency		92.3	94.3		%	I _{out} = 50% I _{out} (max), V _{in} = V _{in} (nom)

0.9 V Setpoint

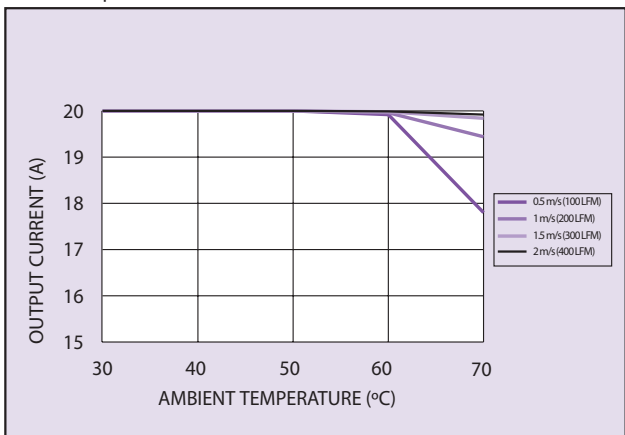


Figure 1: Thermal Derating Curve 5 Vin

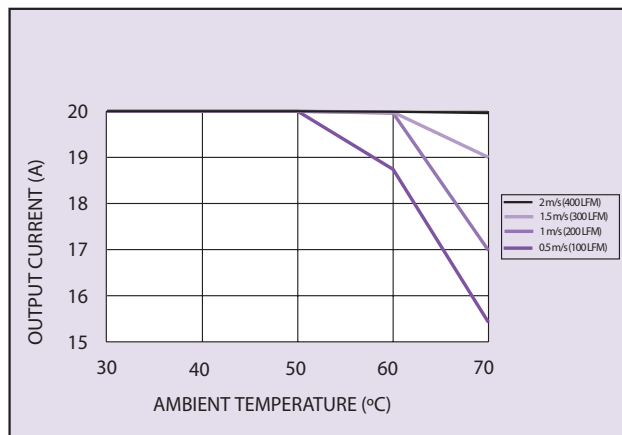


Figure 2: Thermal Derating Curve 12 Vin

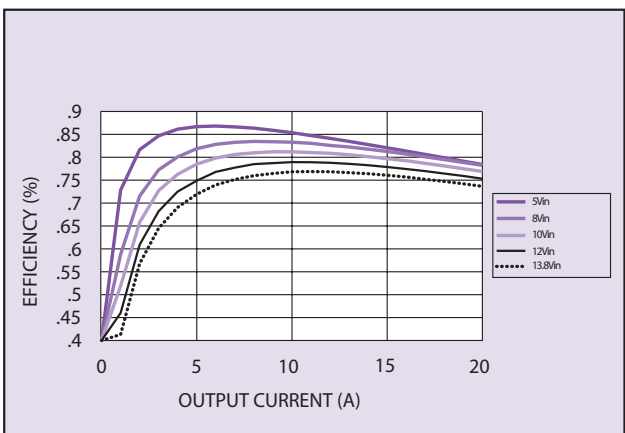


Figure 3: Efficiency

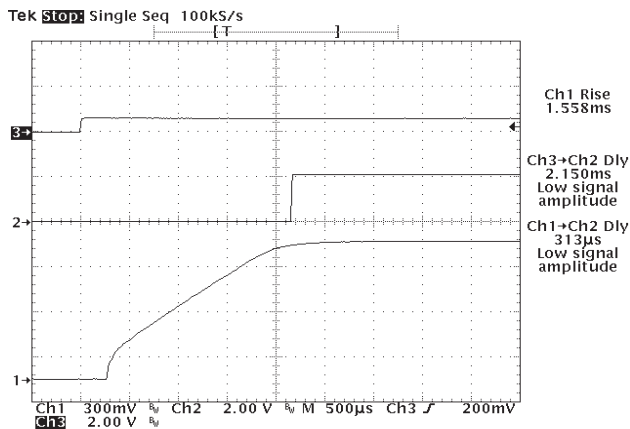


Figure 4: Control On/Off
(Channel 1: Output Voltage, Channel 3: Enable)

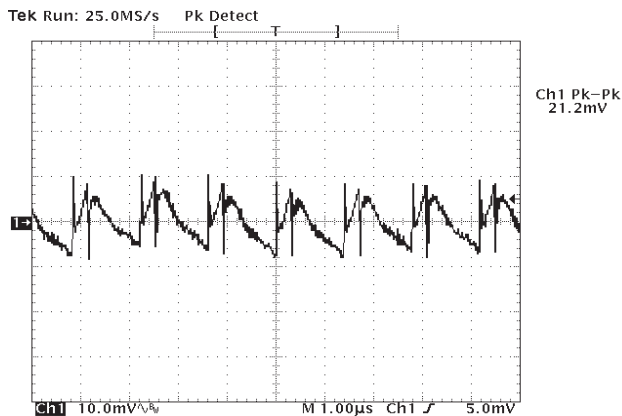


Figure 5: Typical Ripple Output

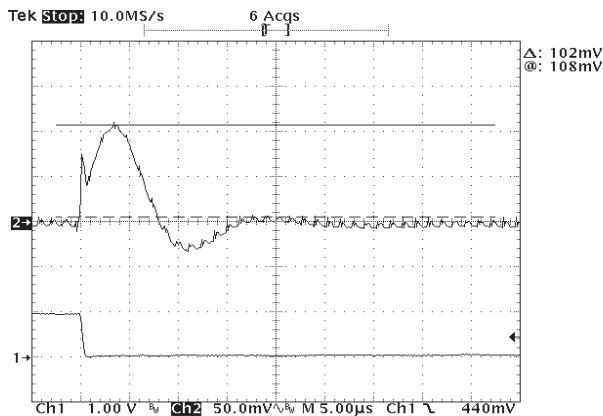


Figure 6: Transient Response 100% - 75%
(Channel 1: Current Step at 5 A/div,
Channel 2: Output Voltage Deviation)

0.9 V Setpoint

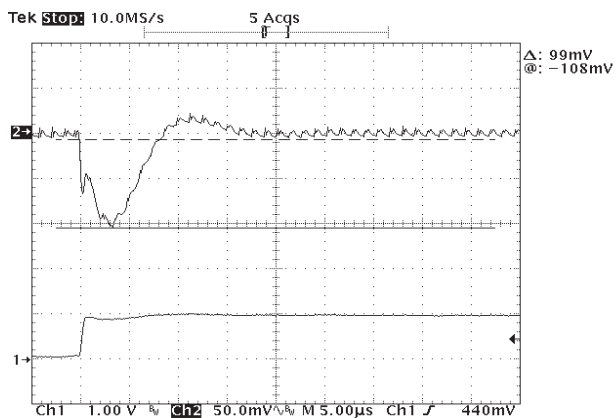


Figure 7: Transient Response 75% - 100%
(Channel 1: Current Step at 5 A/div,
Channel 2: Output Voltage Deviation)

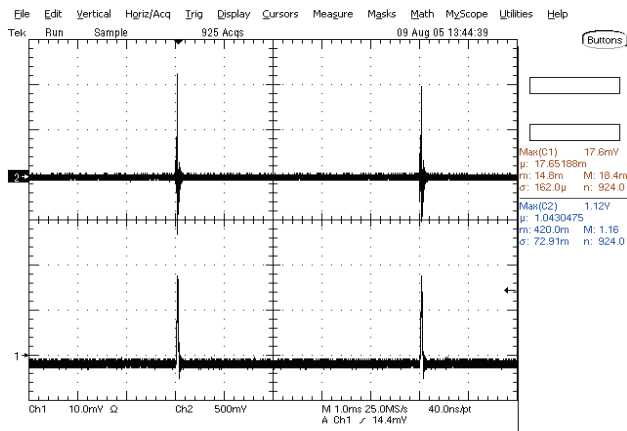


Figure 8: Short Circuit Characteristic
(Channel 1: Output Current at 20 A/div,
Channel 2: Output Voltage)

2.5 V Setpoint

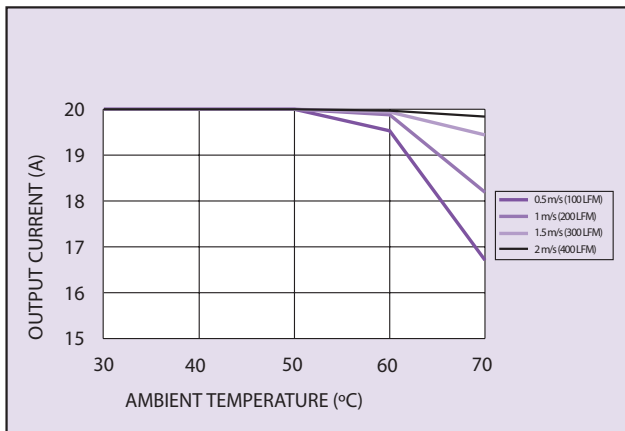


Figure 9: Thermal Derating Curve 5 Vin

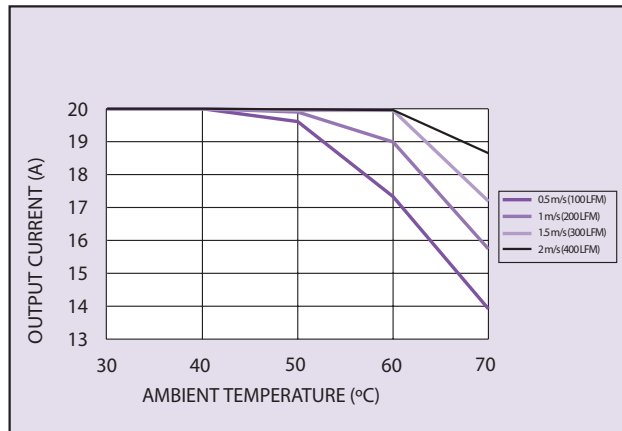


Figure 10: Thermal Derating Curve 12 Vin

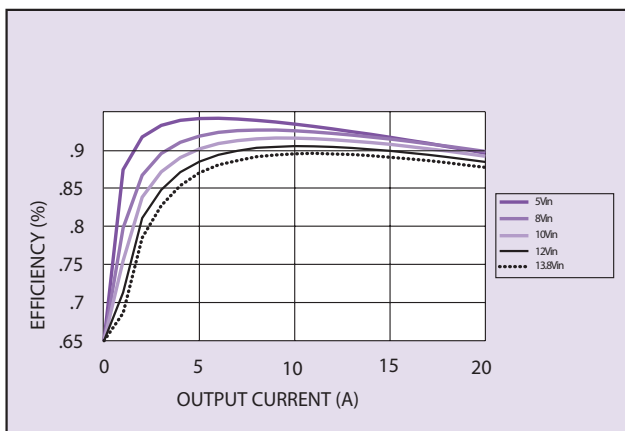


Figure 11: Efficiency

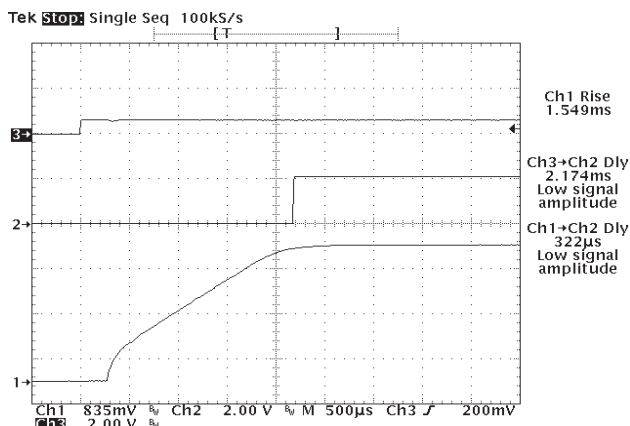


Figure 12: Control On/Off
(Channel 1: Output Voltage, Channel 3: Enable)

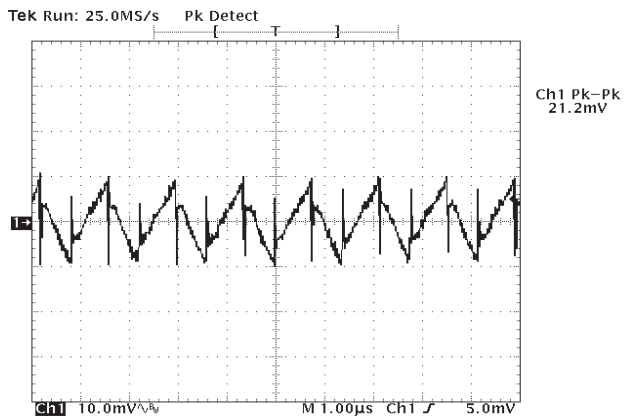


Figure 13: Typical Output Ripple

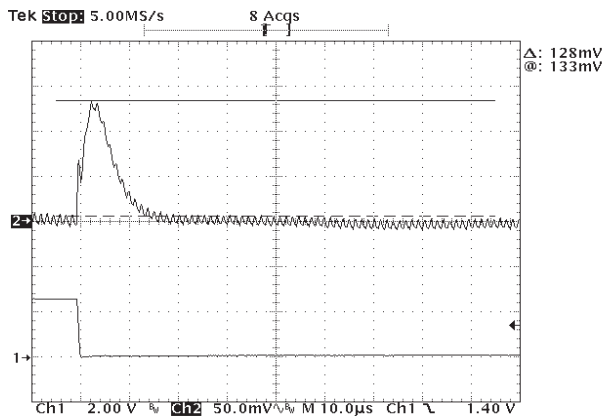


Figure 14: Transient Response 100% - 75%
(Channel 1: Current Step at 3.5 A/div,
Channel 2: Output Voltage Deviation)

2.5 V Setpoint

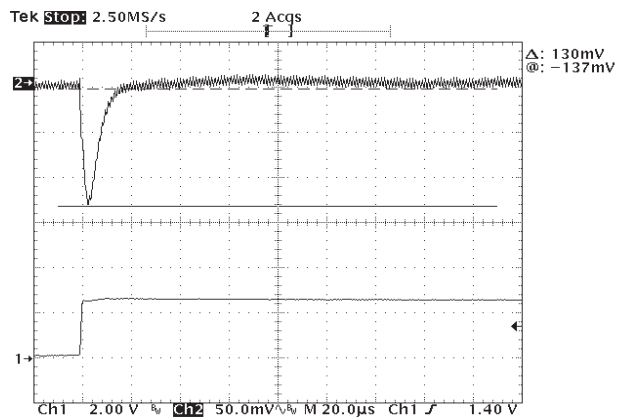


Figure 15: Transient Response 75% - 100%
(Channel 1: Current Step at 3.8 A/div,
Channel 2: Output Voltage Deviation)

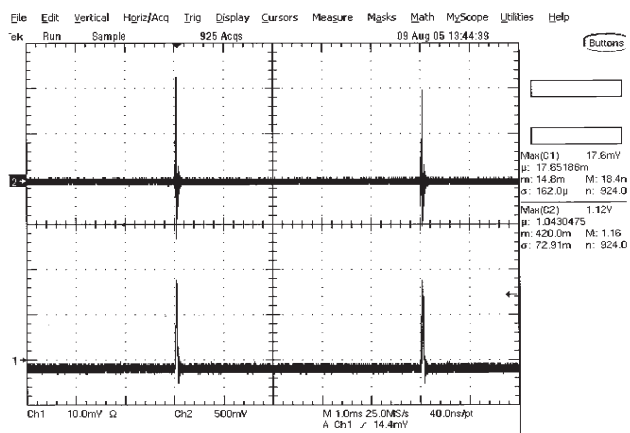


Figure 16: Short Circuit Characteristic
(Channel 1: Output Current at 20 A/div,
Channel 2: Output Voltage)

5 V Setpoint

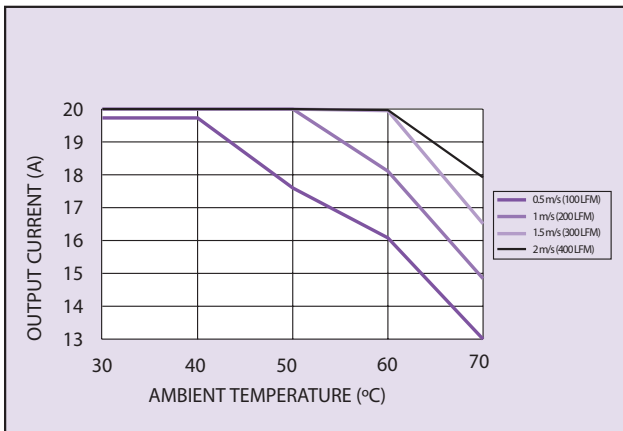


Figure 17: Thermal Derating Curve 12 Vin

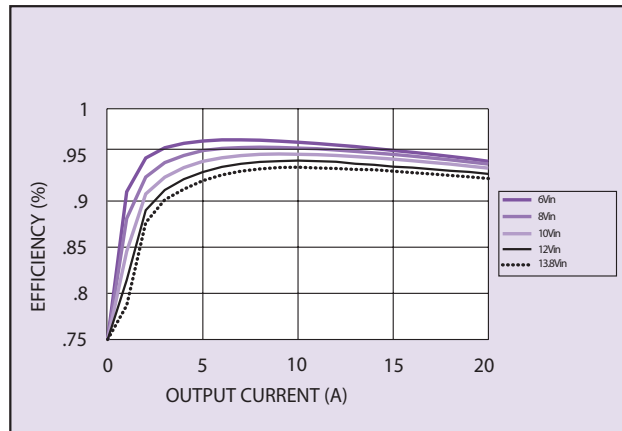


Figure 18: Efficiency

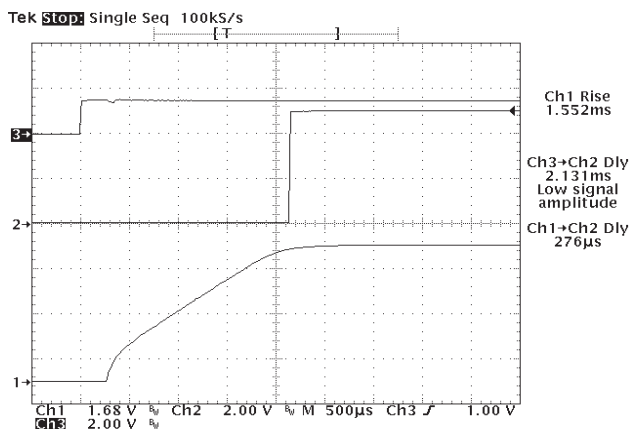


Figure 19: Control On/Off
(Channel 1: Output Voltage, Channel 3: Enable)

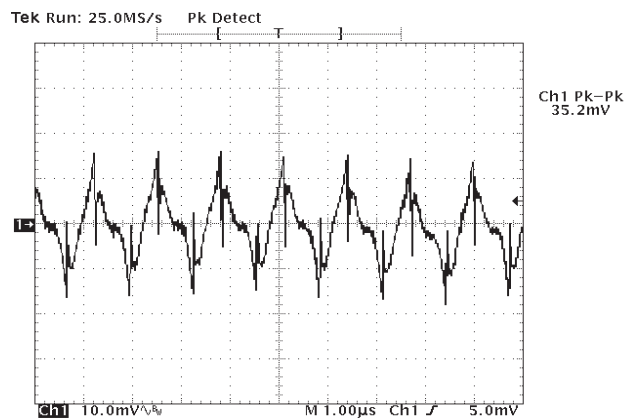


Figure 20: Typical Output Ripple

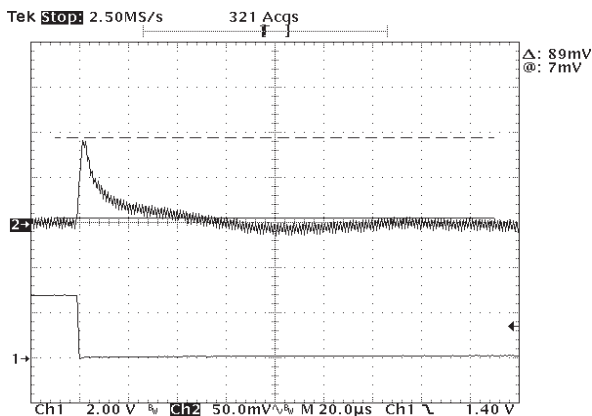


Figure 21: Transient Response 100% - 75%
(Channel 1: Current Step at 3.8 A/div,
Channel 2: Output Voltage Deviation)

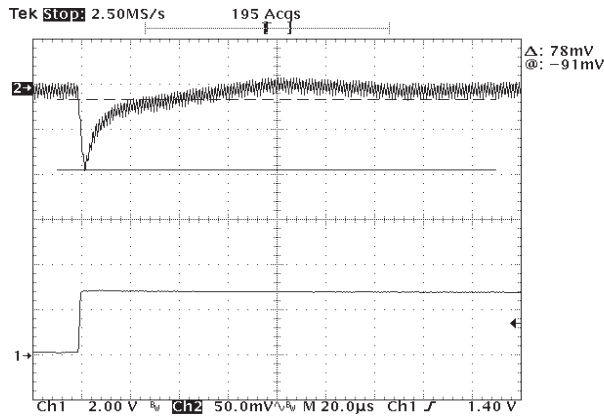


Figure 22: Transient Response 75% - 100%
(Channel 1: Current Step at 3.8 A/div,
Channel 2: Output Voltage Deviation)

5 V Setpoint

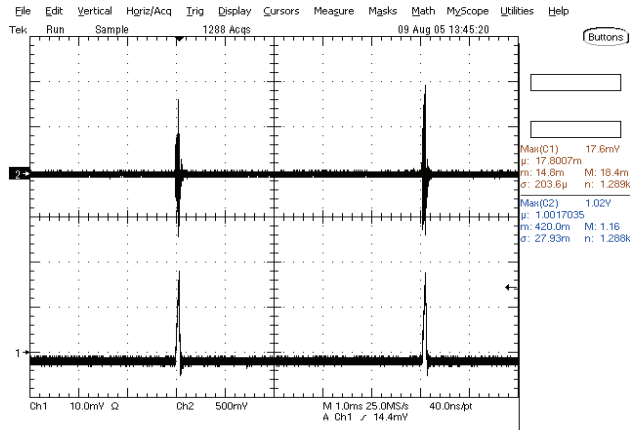


Figure 23: Short Circuit Characteristic
 (Channel 1: Output Current at 20 A/div,
 Channel 2: Output Voltage)

Pin Connections

Pin No.	Function
1	Vout
2	Trim
3	Ground
4	Power good
5	Enable
6	Vin
7	Remote Sense (+)
8	Remote Sense (-)
8	*Mech Support
10	*Mech Support

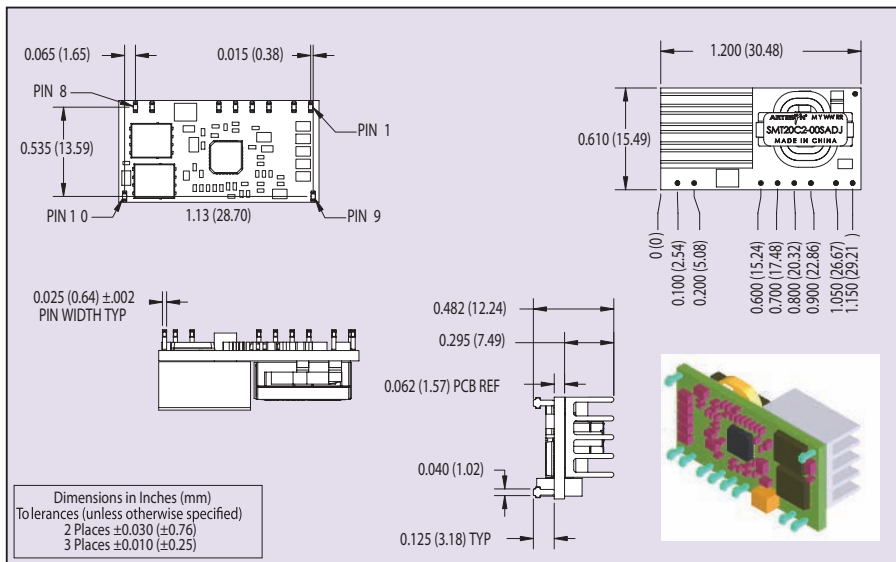


Figure 26: Mechanical Drawing - Surface Mount

Note 1

Thermal reference point is defined as the highest temperature measured at any one of the specified thermal reference points. See Application Note 188.

Note 2

The control pin is referenced to Ground.

Note 3

The SIL20C2 is supplied as standard with positive logic. Control input pulled low: Unit Disabled
Control input left open: Unit Enabled

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