NAE12S03-B (EN42MCEL) DC-DC Converter

Technical Manual

Issue Draft

Date 2019-08-31

HUAWEI TECHNOLOGIES CO., LTD.

About This Document

Purpose

This document describes the NAE12S03-B (EN42MCEL) in terms of its physical structure, electrical characteristics, and simple application.

The figures provided in this document are for reference only.

Intended Audience

This document is intended for:

- Hardware engineers
- Software engineers
- System engineers
- Technical support engineers

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	Indicates a potentially hazardous situation which, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results. NOTICE is used to address practices not related to personal injury.
NOTE	Calls attention to important information, best practices and tips. NOTE is used to address information not related to personal injury, equipment damage, and environment deterioration.

Change History

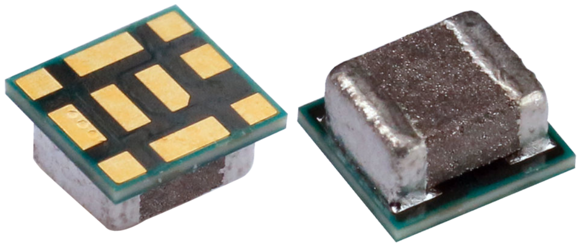
Changes between document issues are cumulative. The latest document issue contains all updates made in previous issues.

Issue Draft (2019-08-31)

This issue is the draft release.

Contents

1 Product Overview



The NAE12S03-B is a power supply in a package (PSiP) DC-DC converter with an input voltage range of 6.3 V to 14.0 V and the maximum output current of 3 A.

Operational Features

- Input voltage: 6.3 – 14.0 V
- Output current: 0 – 3 A
- Output voltage: 0.8 – 5.2 V
- Efficiency: 92% (50% load, V_{in} = 12 V; V_{out} = 5.2 V; T_A = 25°C)

Protection Features

- Input undervoltage protection
- Output overcurrent protection (constant current mode)
- Output short circuit protection (constant current mode)
- Overtemperature protection (automatic recovery)

Mechanical Features

- SMT
- Dimensions (L x W x H): 3.0 x 2.8 x 1.6 mm (0.118 x 0.110 x 0.063 in.)
- Weight: 0.05 g

Environmental Protection

- RoHS6 complaint, lead-free reflow soldering

Control Features

Remote on/off

Applications

Servers

Model Naming Convention

NAE	12	S	03	–	B
1	2	3	4		5

1 — Non-isolated, analog, package type

2 — Input voltage: 12 V

3 — Single output

4 — Output current: 3 A

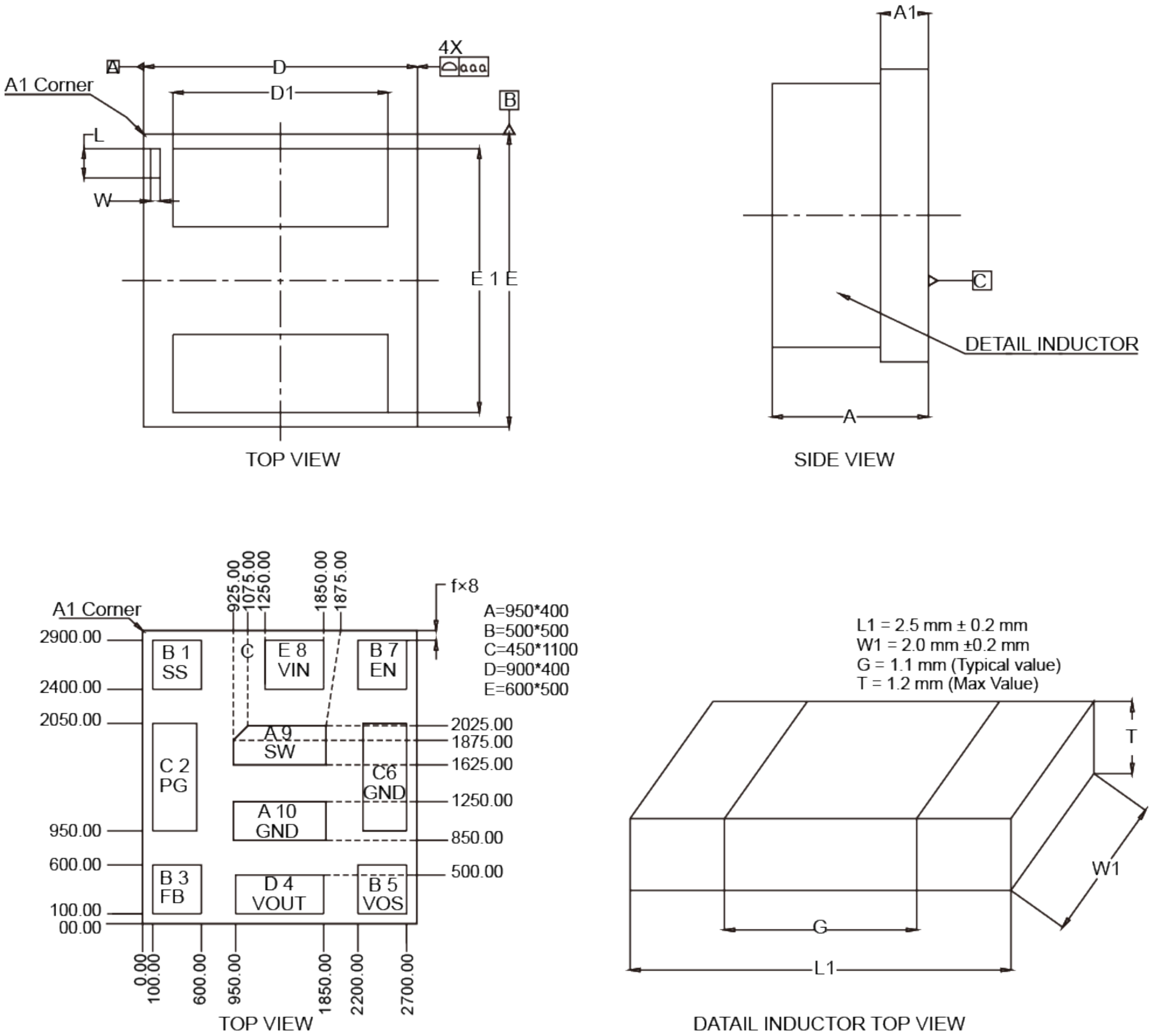
5 — Extension code

Mechanical Diagram

Figure 1-1 Mechanical diagram

NOTE

All dimensions are in the unit of µm unless otherwise specified. Tolerances: ±30 µm



Symbol	Min. (mm)	Typ. (mm)	Max. (mm)
A	-	-	1.60

Symbol	Min. (mm)	Typ. (mm)	Max. (mm)
A1	0.240	0.285	0.330
D	2.70	2.80	2.90
E	2.90	3.00	3.10
D1	2.15	2.20	2.25
E1	2.65	2.70	2.75
L	0.30 (typical value)		
W	0.10 (typical value)		
f	0.10 (typical value)		
aaa	0.08 (basic value)		

Table 1-1 Pin description

Name	Function
SS	Soft startup and voltage tracking pin. An external capacitor connected to this pin sets the internal reference voltage rise time.
PG	Power good signal. This is an open-drain signal. The pull-up resistor cannot be connected to any voltage higher than 6 V. If unused, leave it open.
FB	Output adjustment pin. A resistor divider connecting the feedback to the GND is used to set the desired output voltage.
V_{out}	Output pins. Connect these pins to loads and place output filter capacitors between these pins and GND pins.
VOS	Output voltage sense pin. This pin must be directly connected to the output capacitor.
EN	Enable pin. A high level enables the converter while a low level disables the converter.
V_{in}	Power input pins. Connect these pins to input power supply and place input filter capacitors between these pins and GND pins.
SW	Switching node of the circuit. This pin is used to check the switching frequency.
GND	Input and output power ground. Connect these pins to the ground electrode of the input and output filter capacitors.

2 Electrical Specifications

2.1 Absolute Maximum Ratings

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Input voltage (continuous)	-	-	15	V	V_{in} = 18 V, t ≤ 100 ms, or V_{in} = 19 V, t ≤ 1 ms, the converter must not be damaged.
Operating ambient temperature (T_A)	−40	-	85	°C	If the converter meets either of the conditions (T_A = −40°C to +85°C or T_j = −40°C to +125°C), it is acceptable.
Operating junction temperature (T_j)	−40	-	125	°C	
Storage temperature	−55	-	125	°C	-
Operating humidity	10	-	95	% RH	Non-condensing
External voltage applied to On/Off	−0.3	-	V_{in}+0.3	V	-

2.2 Input Characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Operating input voltage	6.3	12.0	14.0	V	V_{out} = 0.8 − 2.5 V
	9	12	14	V	V_{out} = 2.5 − 5.2 V
Maximum input current	-	-	5	A	V_{in} = 0 − 14 V; I_{out} = I_{onom}
No-load power	-	-	0.2	W	V_{in} = 12 V; V_{out} = 3.3 V; I_{out} = 0 A
Input capacitance	20	-	-	μF	Ceramic capacitor

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Inrush transient	-	-	7	A	100% load, V_{in} slew rate ≤ 10 V/ms, output capacitance = 44 µF
	-	-	2	A	No load, V_{in} slew rate ≤ 10 V/ms, output capacitance = 44 µF
Input ripple voltage (peak to peak)	-	-	500	mV	V_{in} = 6.3 – 14 V, oscilloscope bandwidth: 20 MHz
Altitude	-	4000	-	m	-

2.3 Output Characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Output voltage setpoint	– 2.0	-	2.0	% V_{oset}	V_{in} = 12 V; I_{out} = 50% I_{onom}
Output voltage	0.8	-	2.5	V	V_{in} = 6.3 – 14 V
	2.5	-	5.2	V	V_{in} = 9 – 14 V
Output current	0	-	3	A	V_{in} = 6.3 – 14 V, V_{out} = 0.8 – 2.5 V
	0		2	A	V_{in} = 9 – 14 V, V_{out} = 2.5 – 5.2 V
Line regulation	– 1	-	1	%	V_{in} = 6.3 – 14 V; I_{out} = I_{onom}
Load regulation	– 2	-	2	%	V_{in} = 6.3 – 14 V; I_{out} = I_{omin}–I_{onom}
Regulated voltage precision	– 3	-	3	%	V_{in} = 6.3 – 14 V; I_{out} = I_{omin}–I_{onom}
Temperature coefficient	– 0.02	-	0.02	%/°C	T_A = – 40°C to +85°C
External capacitance	44	-	544	µF	V_{out} = 0.8 – 5.2 V; 500 µF ceramic capacitor or 200 µF polymer aluminum capacitor + 300 µF ceramic capacitor
Output ripple and noise (peak to peak)	-	-	30	mV	V_{out} < 2.5 V; oscilloscope bandwidth: 20 MHz; CCM mode

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
	-	-	50	mV	V_{out} < 2.5 V; oscilloscope bandwidth: 20 MHz; DCM mode
	-	-	50	mV	$V_{out} \geq 2.5$ V; oscilloscope bandwidth: 20 MHz; CCM mode
	-	-	60	mV	$V_{out} \geq 2.5$ V; oscilloscope bandwidth: 20 MHz; DCM mode
Output voltage overshoot	-	-	5	%	Full range of V_{in}, I_{out}, and T_A
Output voltage rise time	0.50	1.65	6.00	ms	V_{out} = 0.8 – 5.2 V; from 10% V_{out} to 90% V_{out} after power-on through the EN signal
Switching frequency	-	2000	-	kHz	V_{out} = 1.8 V; I_{out} = 1 A

2.4 Protection Characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Input undervoltage Protection threshold Recovery threshold Hysteresis	- 2.6 2.8 0.1	- 2.7 2.9 0.2	- 2.8 3.0 0.4	- V V V	-
Output overcurrent protection	-	-	-	-	Constant current mode
Output short circuit protection	-	-	-	-	Constant current mode
Overtemperature protection Threshold Hysteresis	- 130 5	- 160 20	- 170 40	- °C °C	Overtemperature protection is implemented based on Tj. The converter internal temperature can be obtained by the thermal resistance model.

2.5 Dynamic Characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Overshoot amplitude Recovery time	- -	- -	5 200	% V_{out} µs	Current change rate: 5 A/µs Load: 25% – 50% – 25%; 50% – 75% – 50%

2.6 Efficiency

Parameter	Min.	Typ.	Max.	Units	Notes & Conditions
50% load	74.5	76.0	-	%	V_{in} = 12 V; V_{out} = 0.8 V; T_A = 25°C
	75.5	77.0	-	%	V_{in} = 12 V; V_{out} = 0.9 V; T_A = 25°C
	76.5	78.0	-	%	V_{in} = 12 V; V_{out} = 1.0 V; T_A = 25°C
	78.0	79.5	-	%	V_{in} = 12 V; V_{out} = 1.2 V; T_A = 25°C
	80.0	81.5	-	%	V_{in} = 12 V; V_{out} = 1.5 V; T_A = 25°C
	81.5	83.0	-	%	V_{in} = 12 V; V_{out} = 1.8 V; T_A = 25°C
	84.5	86.0	-	%	V_{in} = 12 V; V_{out} = 2.5 V; T_A = 25°C
	87.5	89.0	-	%	V_{in} = 12 V; V_{out} = 3.3 V; T_A = 25°C
	90.0	91.5	-	%	V_{in} = 12 V; V_{out} = 5.0 V; T_A = 25°C
	90.5	92.0	-	%	V_{in} = 12 V; V_{out} = 5.2 V; T_A = 25°C
100% load	65.0	66.5	-	%	V_{in} = 12 V; V_{out} = 0.8 V; T_A = 25°C
	66.5	68.0	-	%	V_{in} = 12 V; V_{out} = 0.9 V; T_A = 25°C
	68.0	69.5	-	%	V_{in} = 12 V; V_{out} = 1.0 V; T_A = 25°C
	70.5	72.0	-	%	V_{in} = 12 V; V_{out} = 1.2 V; T_A = 25°C
	73.5	75.0	-	%	V_{in} = 12 V; V_{out} = 1.5 V; T_A = 25°C
	76.0	77.5	-	%	V_{in} = 12 V; V_{out} = 1.8 V; T_A = 25°C
	79.5	81.0	-	%	V_{in} = 12 V; V_{out} = 2.5 V; T_A = 25°C
	86.0	87.5	-	%	V_{in} = 12 V; V_{out} = 3.3 V; T_A = 25°C

Parameter	Min.	Typ.	Max.	Units	Notes & Conditions
	89.0	90.5	-	%	V_{in} = 12 V; V_{out} = 5.0 V; T_A = 25°C
	89.5	91.0	-	%	V_{in} = 12 V; V_{out} = 5.2 V; T_A = 25°C

2.7 Other Characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Remote On/Off voltage Low level High level	- −0.2 0.9	- - -	- 0.3 V_{in}+0.3	- V V	Positive logic
PG high threshold (FB from low to high)	92	95	99	% V_{ref}	-
PG low threshold (FB from high to low)	87	90	94	% V_{ref}	-

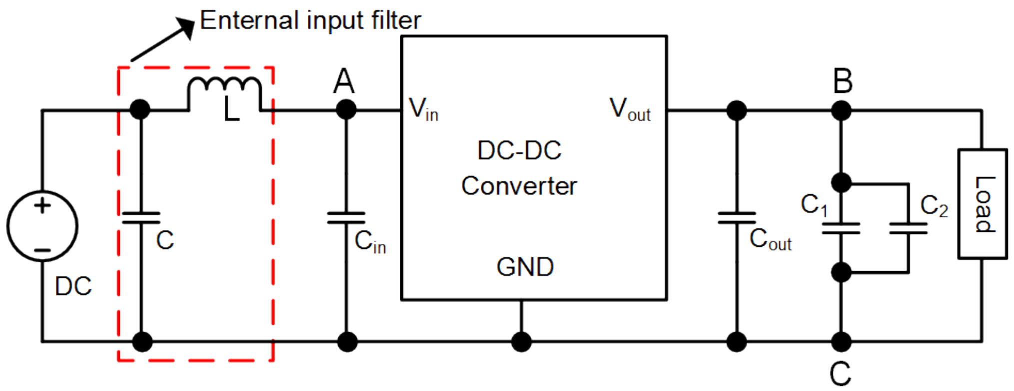
2.8 Reliability Characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes & Conditions
Mean time between failures (MTBF)	-	25	-	Million hours	Based on JEP122 and JESD85, Active energy Ea=0.7eV, T_{use} = 55℃, T_{stress} = 125℃, Confidence Level is 60%

3 Characteristic Curves

3.1 Test Setup Diagram & Fundamental Circuit Diagram

Figure 3-1 Test setup diagram

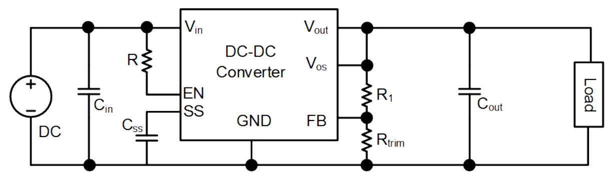


C_{in}: The 20 μF ceramic capacitor is recommended.	C_{out}: The 44 μF ceramic capacitor is recommended.
C_1: The 0.1 μF ceramic capacitor is recommended.	C_2: The 10 μF aluminum electrolytic capacitor is recommended.

NOTE

1. Measure the input current ripple at A shown in **Figure 3-1**.
2. During the test of input reflected ripple current, the input terminal must be connected to a 12 μH inductor and a 220 μF electrolytic capacitor.
3. Points B and C are used for testing the output voltage ripple.

Figure 3-2 Fundamental circuit diagram



C_{in}: The 20 µF ceramic capacitor is recommended.

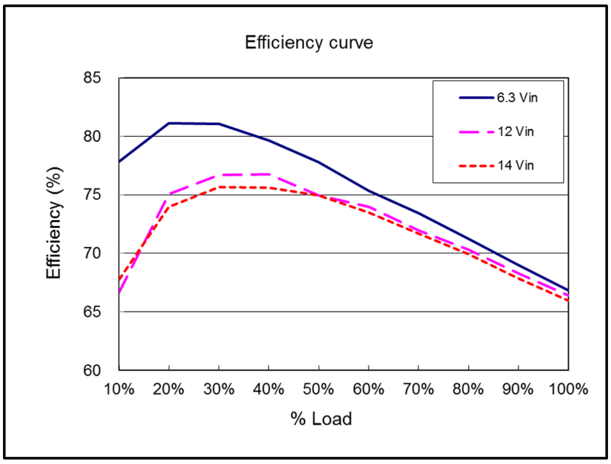
C_{out}: The 44 µF ceramic capacitor is recommended.

R_1: 10 kΩ

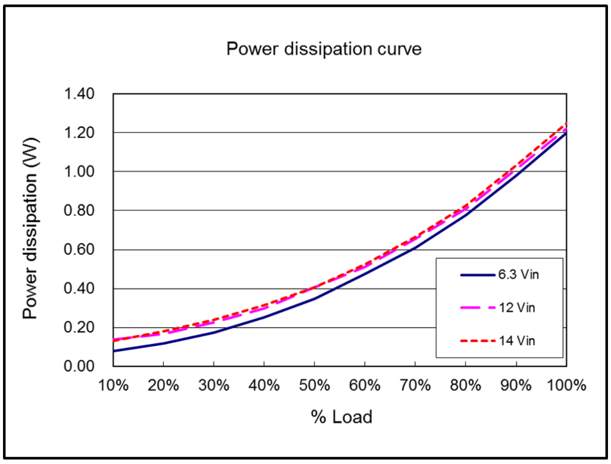
C_{ss}: The 3.3 nF ceramic capacitor is recommended.

3.2 Efficiency and Power Dissipation Curves

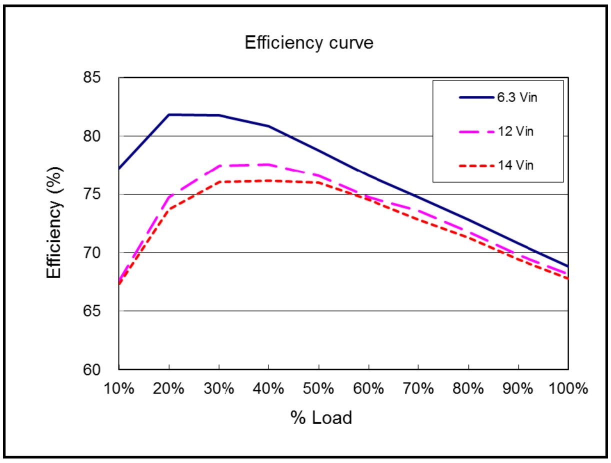
Conditions: T_A = 25°C, V_{in} = 12 V unless otherwise specified



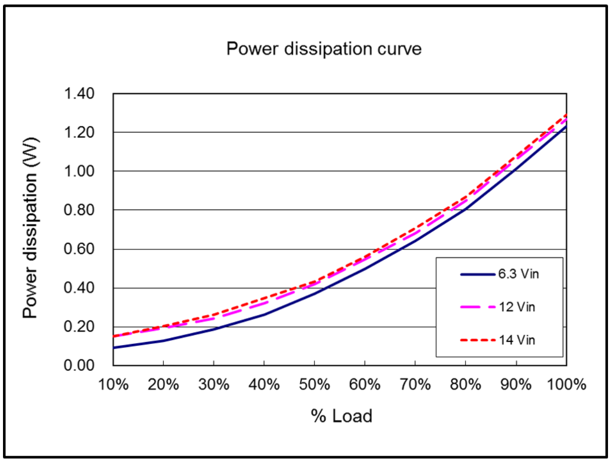
Efficiency curve (V_{out} = 0.8 V)



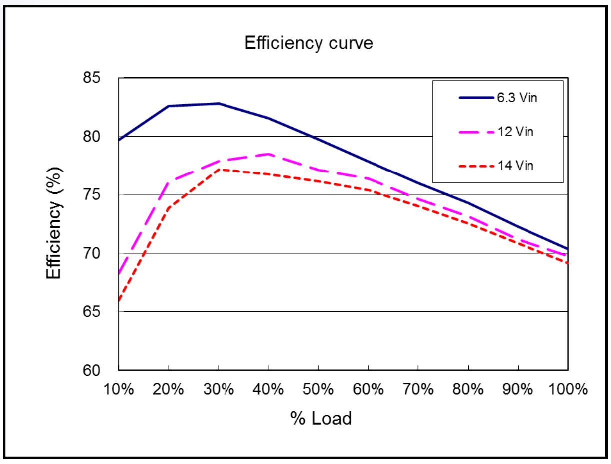
Power dissipation curve (V_{out} = 0.8 V)



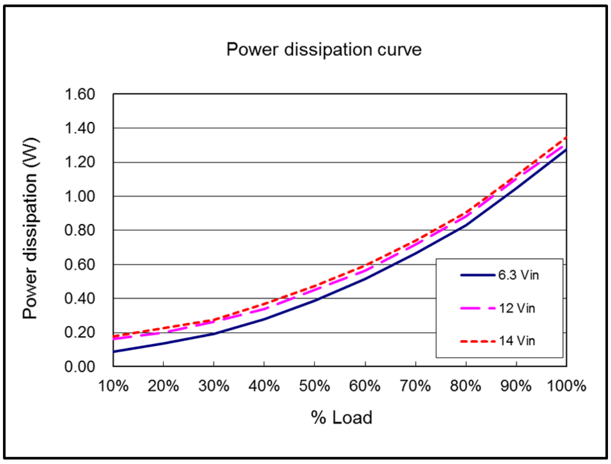
Efficiency curve (V_{out} = 0.9 V)



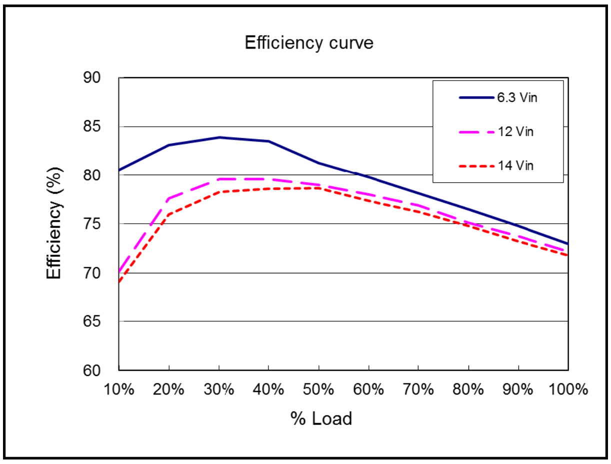
Power dissipation curve (V_{out} = 0.9 V)



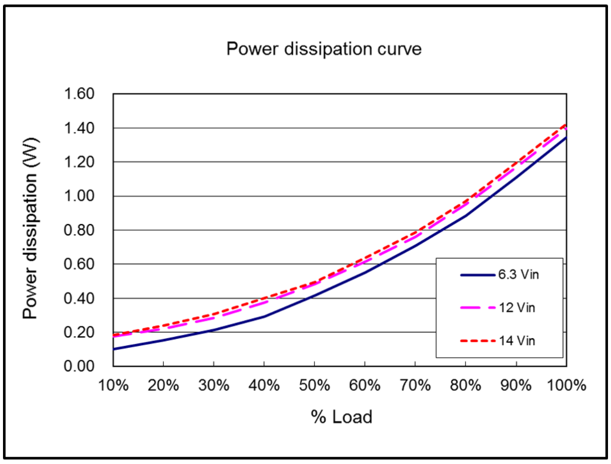
Efficiency curve (V_{out} = 1.0 V)



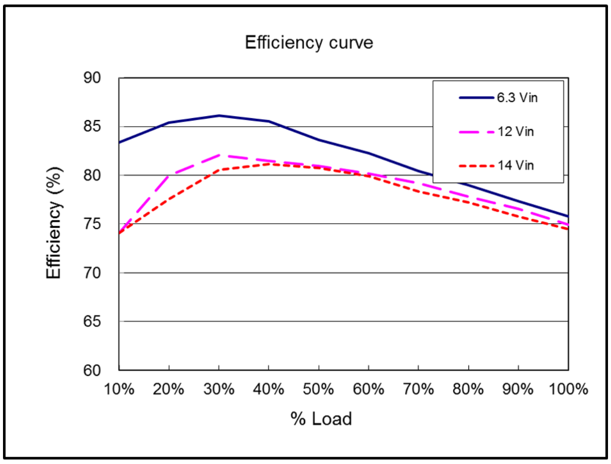
Power dissipation curve (V_{out} = 1.0 V)



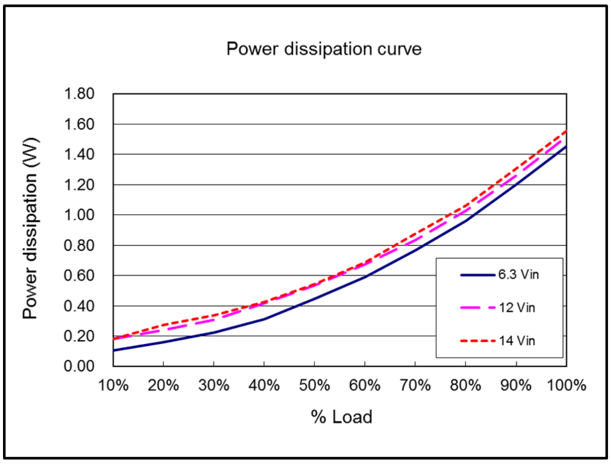
Efficiency curve (V_{out} = 1.2 V)



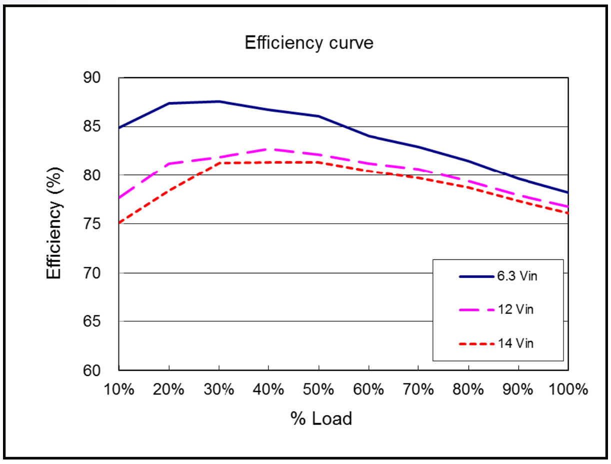
Power dissipation curve (V_{out} = 1.2 V)



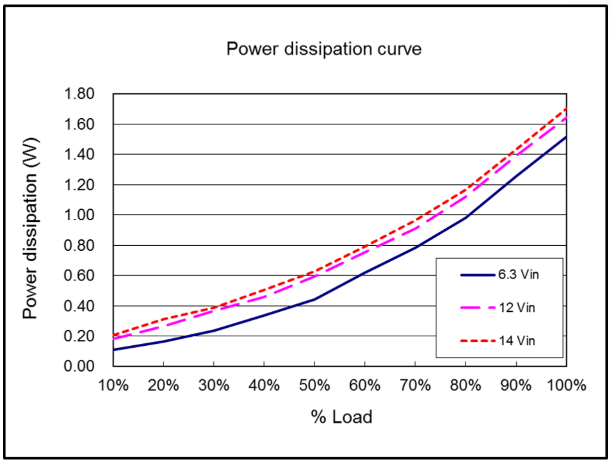
Efficiency curve (V_{out} = 1.5 V)



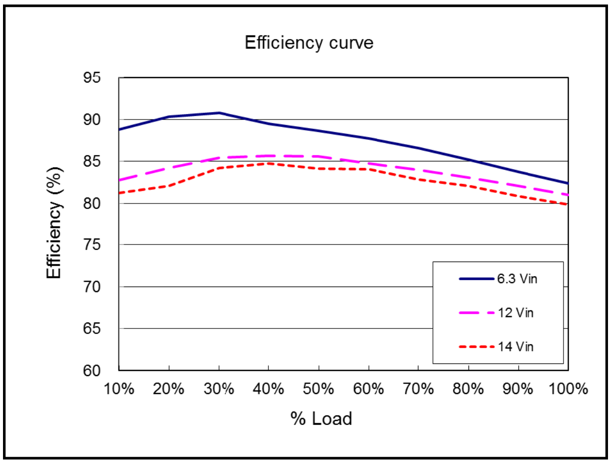
Power dissipation curve (V_{out} = 1.5 V)



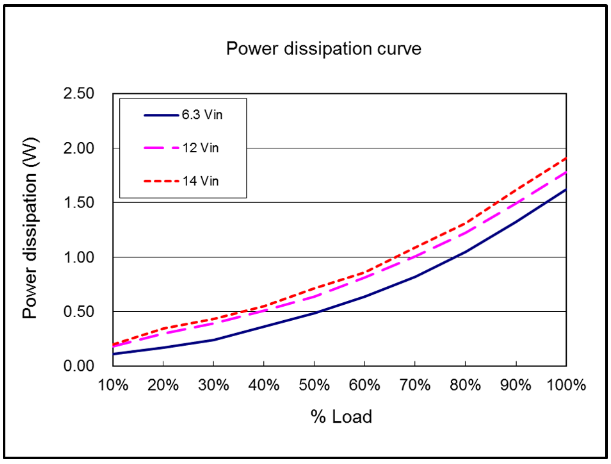
Efficiency curve (V_{out} = 1.8 V)



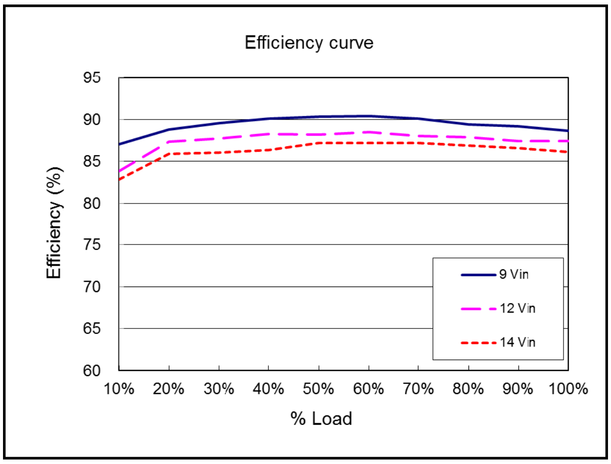
Power dissipation curve (V_{out} = 1.8 V)



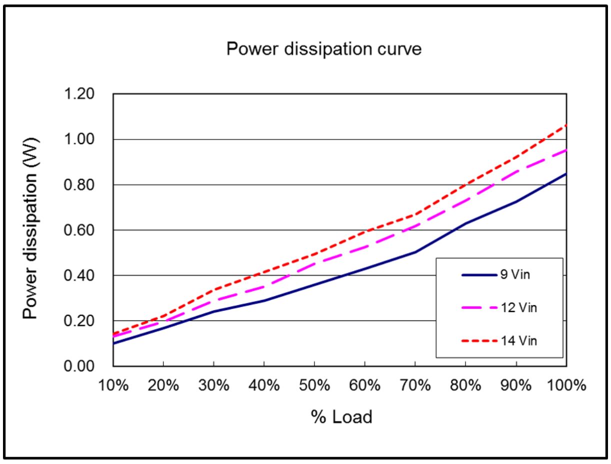
Efficiency curve (V_{out} = 2.5 V)



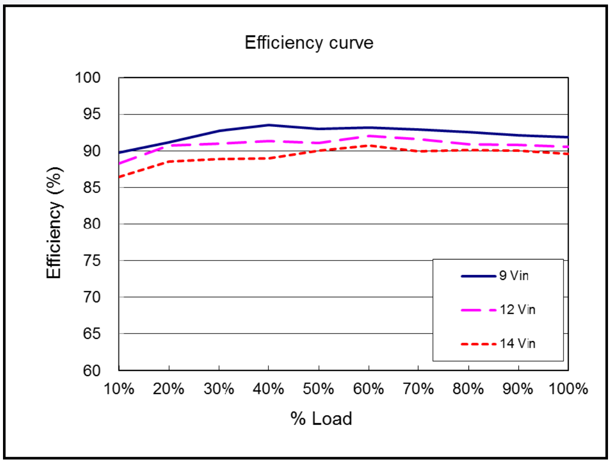
Power dissipation curve (V_{out} = 2.5 V)



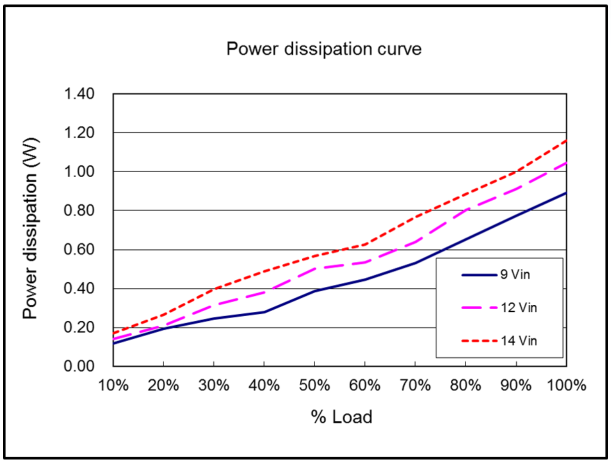
Efficiency curve (V_{out} = 3.3 V)



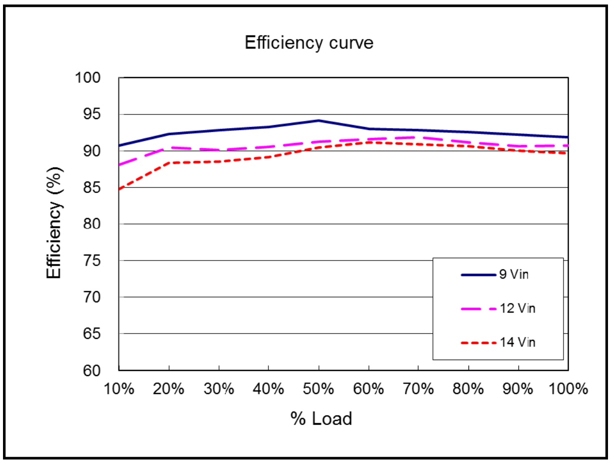
Power dissipation curve (V_{out} = 3.3 V)



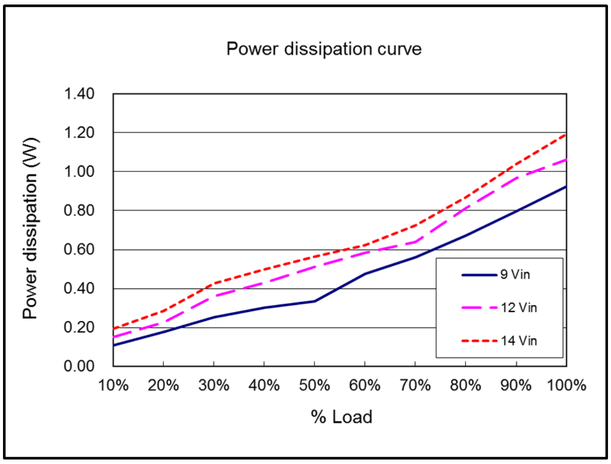
Efficiency curve (V_{out} = 5.0 V)



Power dissipation curve (V_{out} = 5.0 V)



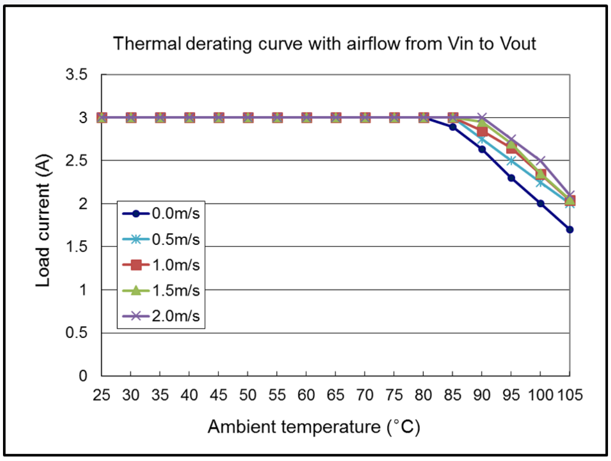
Efficiency curve (V_{out} = 5.2 V)

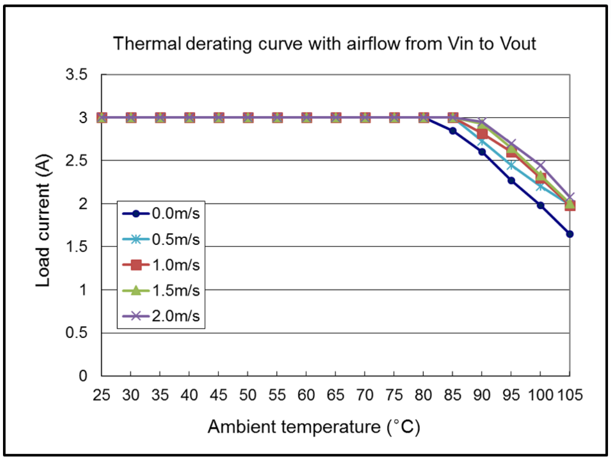


Power dissipation curve (V_{out} = 5.2 V)

3.3 Thermal Considerations

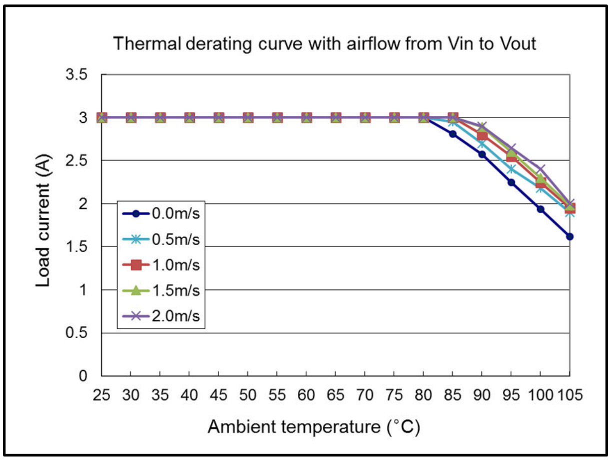
Sufficient airflow should be provided to ensure reliable operating of the converter. Therefore, thermal components are mounted on the top surface of the converter to dissipate heat to the surrounding environment by conduction, convection, and radiation. Proper airflow can be verified by measuring the temperature at the surface of the converter.

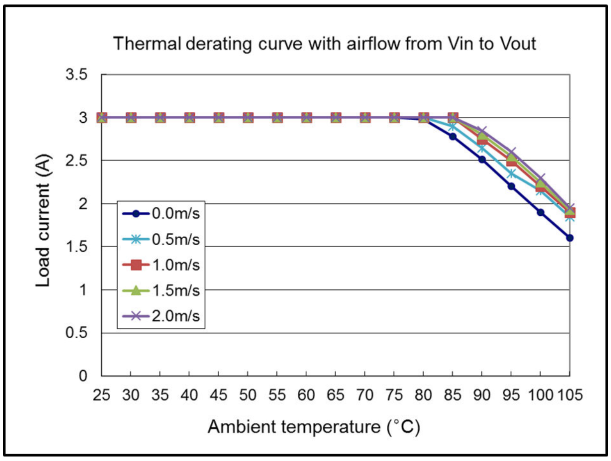




Thermal derating with airflow from V_{in} to V_{out} (V_{in} = 12 V; V_{out} = 0.8 V)

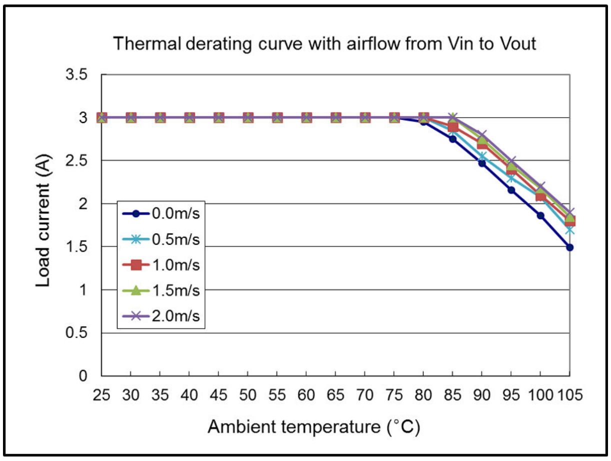
Thermal derating with airflow from V_{in} to V_{out} (V_{in} = 12 V; V_{out} = 0.9 V)

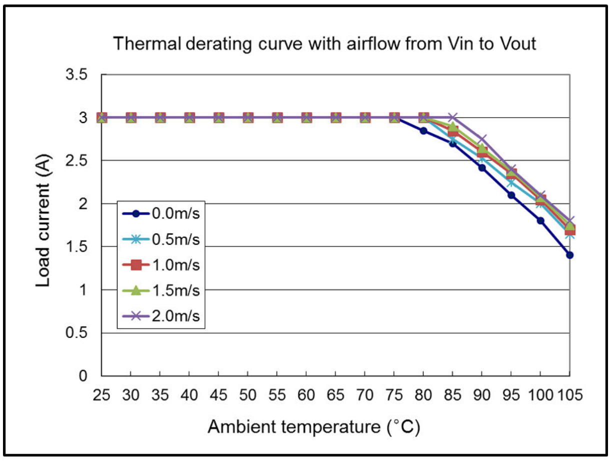




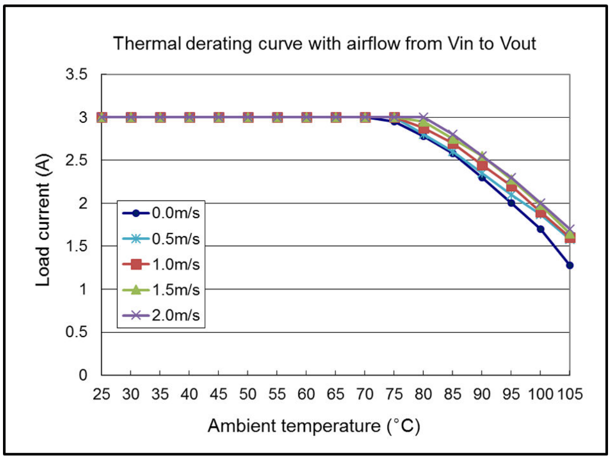
Thermal derating with airflow from V_{in} to V_{out} (V_{in} = 12 V; V_{out} = 1.0 V)

Thermal derating with airflow from V_{in} to V_{out} (V_{in} = 12 V; V_{out} = 1.2 V)

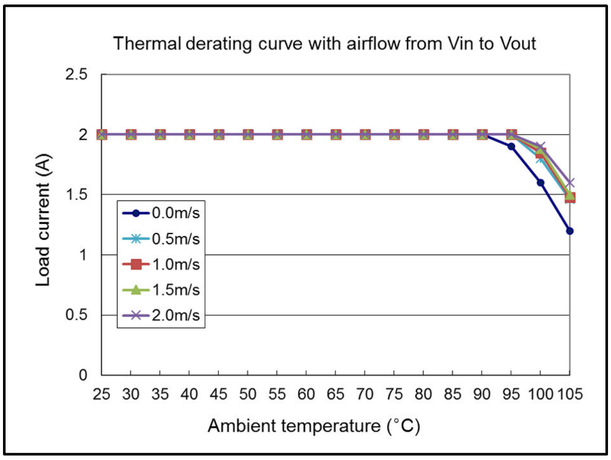




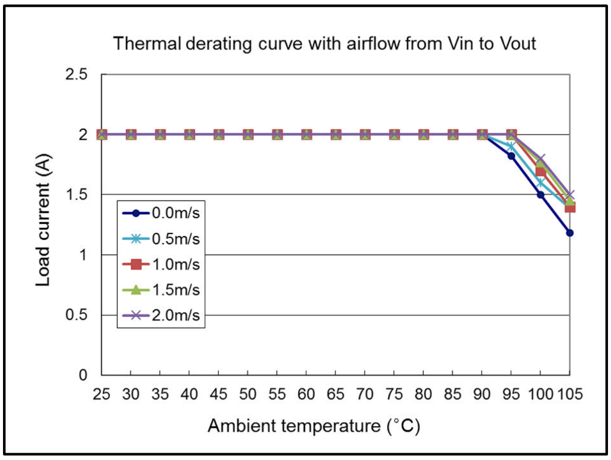
Thermal derating with airflow from V_{in} to V_{out} (V_{in} = 12 V; V_{out} = 1.5 V)



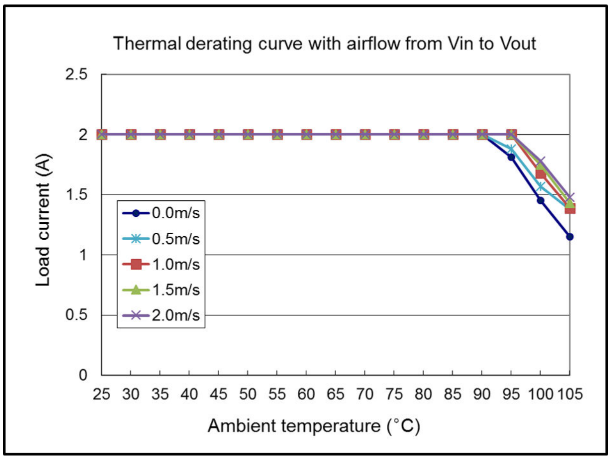
Thermal derating with airflow from V_{in} to V_{out} (V_{in} = 12 V; V_{out} = 1.8 V)



Thermal derating with airflow from V_{in} to V_{out} (V_{in} = 12 V; V_{out} = 2.5 V)



Thermal derating with airflow from V_{in} to V_{out} (V_{in} = 12 V; V_{out} = 3.3 V)

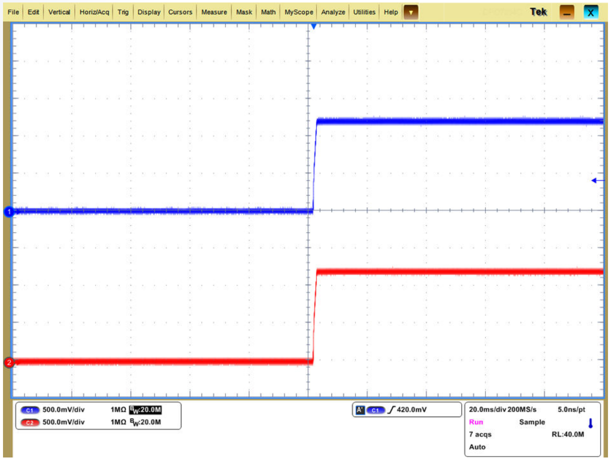


Thermal derating with airflow from V_{in} to V_{out} (V_{in} = 12 V; V_{out} = 5.0 V)

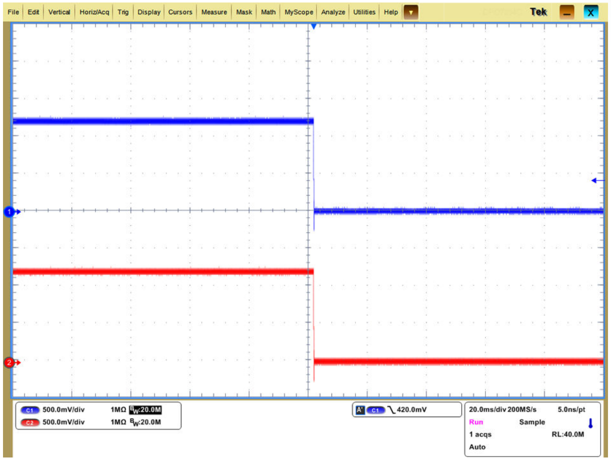
Thermal derating with airflow from V_{in} to V_{out} (V_{in} = 12 V; V_{out} = 5.2 V)

3.4 Turn-On/Turn-Off Waveforms

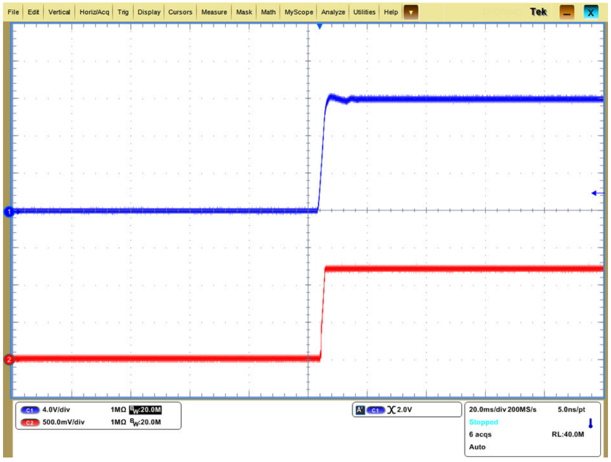
Conditions: T_A = 25°C, V_{in} = 12.0 V unless otherwise specified



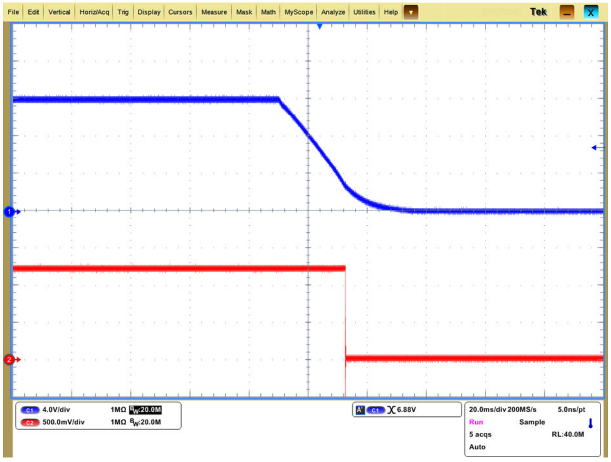
Startup from On/Off



Shutdown from On/Off

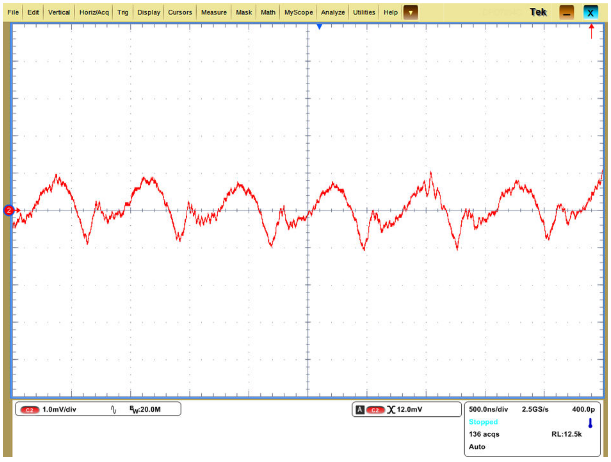


Startup by power-on



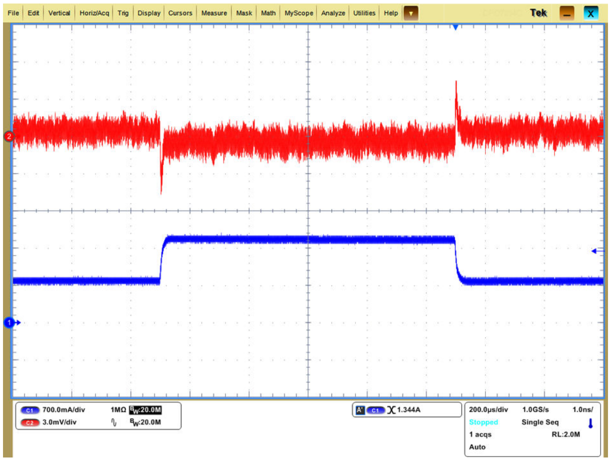
Shutdown by power-off

3.5 Output Ripple and Noise

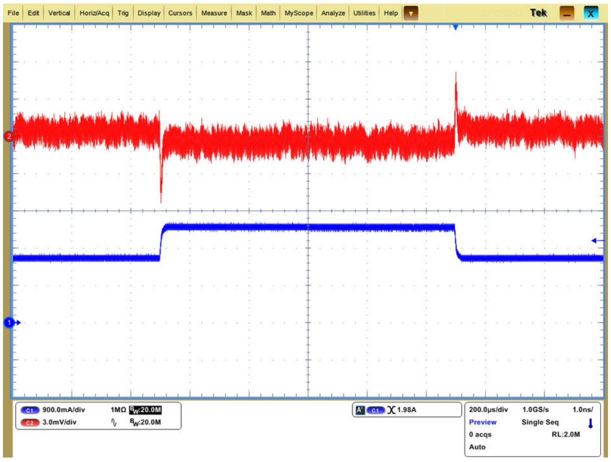


Output voltage ripple (for points B and C in the test setup diagram, T_A = 25°C, V_{in} = 12.0 V, I_{out} = 3.0 A)

3.6 Dynamic Load Waveform



Output voltage dynamic response (load: 25% − 50% − 25%, di/dt = 5 A/μs, T_A = 25°C)



Output voltage dynamic response (load: 50% − 75% − 50%, di/dt = 5 A/μs, T_A = 25°C)

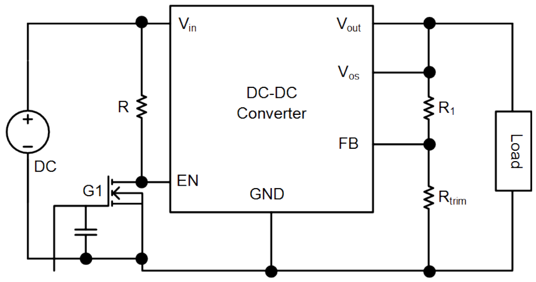
4 Control Features

4.1 Remote On/Off (EN)

Logic Enable	On/Off Pin Level	Module Status
Positive logic	Low level	Off
	High level	On

It is recommended that the On/Off pin be controlled with an open collector transistor or similar device.

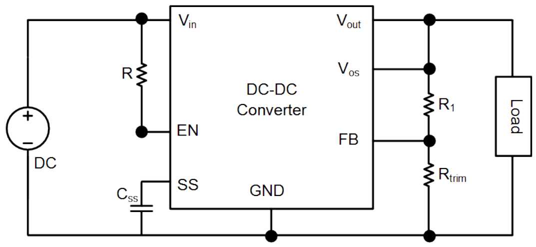
Figure 4-1 Circuit configuration for On/Off function



4.2 Output Voltage Trim (FB)

The output voltage can be adjusted by connecting an external resistor between the Trim (FB) pin and the GND pin.

Figure 4-2 R_{trim} external connections



The output voltage varies depending on R_{trim}.

NOTE

The trim resistor tolerance directly affects the output voltage accuracy.

Relationship between R_{trim} and V_{out}:

$$R_{trim} = \frac{8}{V_{out} - 0.8}$$

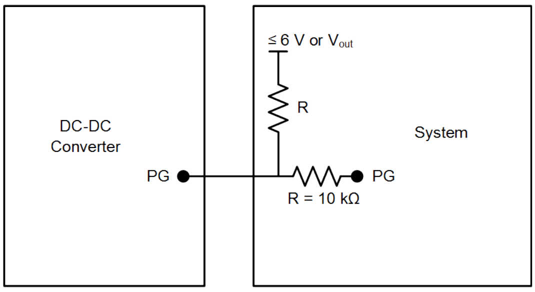
The following table describes the mapping between V_{out} and R_{trim}.

V_{out} (V)	R_{trim} (kΩ)
0.9	80
1.0	40
1.2	20
1.5	11.42857143
1.8	8
2.5	4.705882353
3.0	3.636363636
3.3	3.2
5.0	1.904761905
5.2	1.818181818

4.3 Power Good Signal (PG)

If the PG function is required, the PG pin needs to be pulled up to a high level (less than 6 V) through a resistor (greater than 3 kΩ), and a 10 kΩ resistor needs to be connected in series to filter the high-frequency PG noise. If the PG function is not required, the pin is left open.

Figure 4-3 Configuration diagram of PG



4.4 Voltage Tracking (SS)

An external capacitor connected to SS pin sets the internal reference voltage rise time.

5 Protection Features

Input Undervoltage Protection

The converter will shut down if the input voltage drops below the undervoltage protection threshold. The converter will start to work again if the input voltage reaches the input undervoltage recovery threshold.

Output Overcurrent Protection

The converter equipped with current limiting circuitry can provide protection from an output overload or short circuit condition. If the output current exceeds the output overcurrent protection setpoint, the converter will enter constant current mode. When the fault is rectified, the converter will automatically recover.

Overtemperature Protection

A temperature sensor on the converter senses the average temperature of the converter. It protects the converter from being damaged by high temperatures. When the temperature exceeds the overtemperature protection threshold, the output will shut down. The converter will turn on again when the temperature of the sensed location falls by the value of the overtemperature protection hysteresis.

6 Qualification Testing

Test Item	Test Condition	Samples	Remarks
Precondition	Visual inspection → Electrical test → C-SCAN/X-RAY → Bake (125°C, 24 hours) → Moisture soaking → Reflow (3 cycles, 260°C) → Visual inspection → Electrical test → C-SCAN/X-RAY		MSL 3 prior to reliability test
LTSL	$T_A \leq -55°C$	3 lots (25 PCS/ lot)	-
HTSL	$T_A \geq 125°C$	3 lots (77 PCS/ lot)	-
TC	–55°C to 125°C, 1000 cycles, no power	3 lots (77 PCS/ lot)	Test at 500/700/1000 cycle
TS	–55°C to 125°C, 1000 cycles, no power	3 lots (77 PCS/ lot)	Ramping rate >20°C/min only, test at 500/700/1000 cycles
ESD-HBM, CDM	$T_A = 25°C$; HBM ≥ 2000 V; CDM ≥ 500 V	3 PCS	-
Solderability	Steam aging: 8 h Pb-free: (245±5)°C/(5±0.5)s	22 pins	-
uHAST	130°C/110°C, 85% RH	3 lots (77 PCS/ lot)	-
HAST	130°C/110°C, 85% RH, Vcc	3 lots (77 PCS/ lot)	-
THB	85°C/85% RH, Vcc	3 lots (77 PCS/ lot)	-
HTOL	Rated input voltage, $T_j \geq 125℃$, 1000 Hours	3 lots (77 PCS/ lot)	-
PTC	–40℃ to 100℃, 10℃/min to 20℃/min, rated input voltage, 50% Load, 1000 cycles	3 lots (77 PCS/ lot)	-

Test Item	Test Condition	Samples	Remarks
HALT	Including high temperature step test, low temperature step test, random vibration step test and combined stress test.	5 – 10 PCS	-
Vibration	Random vibration: 5 to 500 Hz, PSD = $0.08g^2$/Hz, 1 hour in each axial. Sine vibration: 20 Hz to 2 kHz, 4 minutes/cycle, 4X in each orientation, 20G peak	5 – 10 PCS (per type)	-
Mechanical shock	0.5 ms duration, 1500g peak acceleration, 30 shocks	5 – 10 PCS	-
Dendrite test	High temperature (close to overtemperature protection threshold) with full load, 9 days	1 lot (10 PCS/ lot)	1. No power off 2. No dendrite under 50X microscope
Withstand mechanical strength (for converter)	70% compression of thermal conductive pad, 1mm/s	3 lots (33 PCS/ lot)	The appearance and electrical performance are normal. The electrical performance before and after the reliability test complies with the specifications.
Salt fog	Class B environment for 5 years: 2% NaCl, 90% RH, 35°C, 20 days	1 lot (16 PCS/ lot)	-
Damp dust	Class B environment for 10 years: dust for 6 days (30 mg/m^3) → steady damp heat test for 12 days (95% RH, 40°C) → cyclic damp heat test for 4 days (25°C–40°C, 95% RH)	1 lot (16 PCS/ lot)	-
Projection moire high temperature deformation test	Temperature range: 25°C–270°C	3 PCS	≤ 0.08 mm (lead-free package)

7 MSL Rating

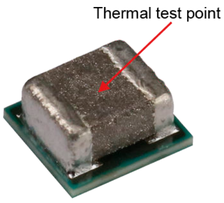
Store and transport the converter as required by the moisture sensitivity level (MSL) rating 3 specified in the IPC/JEDEC J-STD-033.

The surface of a soldered converter must be clean and dry. Otherwise, the assembly, test, or even reliability of the converter will be negatively affected.

8 Thermal Consideration

Thermal Test Point

Sufficient airflow should be provided to ensure reliable operating of the converter. Therefore, thermal components are mounted on the top surface of the converter to dissipate heat to the surrounding environment by conduction, convection, and radiation. Proper airflow can be verified by measuring the temperature at the surface of the converter.



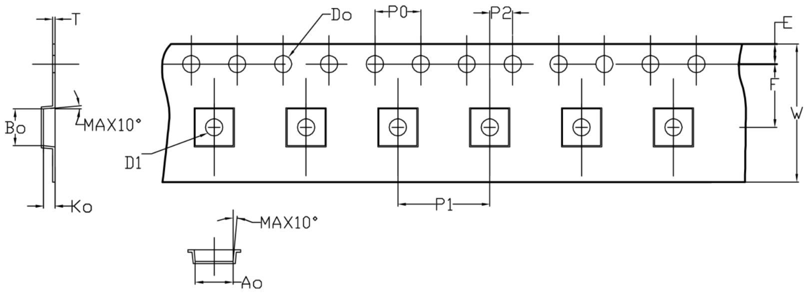
Power Dissipation

The converter power dissipation is calculated based on efficiency. The following formula reflects the relationship between the consumed power (P_d), efficiency (η), and output power (P_o): $P_d = P_o (1 - \eta)/\eta$

9 Package Information

The converter is supplied in tape and reel packaging. The following figure shows the tape dimensions.

Unit of measurement: mm



Item	W	A0	B0	K0	P0	E
Specifications	12.00±0.30	3.10±0.10	3.25±0.10	1.70±0.10	4.00±0.10	1.75±0.10
Item	F	D0	D1	P1	P2	T
Specifications	5.50±0.05	$1.50^{+0.10}_{-0.00}$	$1.50^{+0.10}_{-0.00}$	8.00±0.10	2.00+0.05	0.30+0.05

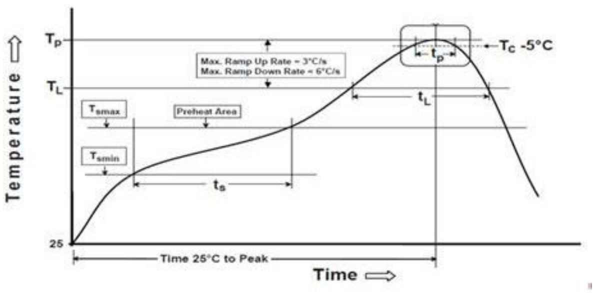
NOTE

- Carrier camber does not exceed 1 mm in 250 mm.
- Cumulative tolerance of 10 sprocket hole pitch: ±0.2 mm
- Material: ABS

10 Mechanical Consideration (Soldering)

The converter supports reflow soldering techniques. Wave soldering and hand soldering are not allowed. During the reflow process, the peak temperature must not exceed 260°C at any time.

Figure 10-1 Recommended reflow profile using lead-free solder



Item	JEDEC
Preheat and soak time: t_s (T_{smin}–T_{smax}: 150°C–200°C)	60 – 120s
Ramp-up rate (from T_L 217°C to T_p 260°C)	≤ 3°C/s
Liquidous temperature time – t_L ($T > T_L$ 217°C)	60 – 150s
Peak package body temperature (T_p)	260°C
Time within 5°C of the specified classification temperature (T_p – 5°C)	t_p < 30s
Ramp-down rate (from T_p to T_L)	≤ 6°C/s
Time from 25°C to peak temperature (from 25°C to T_p)	≤ 8 min



Huawei Technologies Co., Ltd.

Huawei Industrial Base
Bantian, Longgang
Shenzhen 518129
People's Republic of China

www.huawei.com