GRM2010
6.5MHz to 10MHz, 2.3V to 5.5V, 1A, 3D Buck PowerSoC

GENERAL DESCRIPTION

The GRM2010 is a highly integrated power delivery sub-system SoC device of voltage Buck DC/DC power conversion. It integrates power inductor, input and output filter capacitors, power switches and voltage regulation circuit in a proprietary 3D structure. The compact and low profile device is in a LGA package of 2.0mm × 2.0mm × 1.1mm, allowing the system to achieve high density.

GRM2010-1.8 has up to 10MHz synchronous switching Buck converter. GRM2010 uses constant on-time pulse width modulation (PWM) control scheme for excellent stability and transient response.

The GRM2010 device has a unique 3D structure that lowers the thermal impedance from the top to the bottom below general lead-framed LGA packages. The device structure has significantly enhanced thermal conductivity. Other key features include under-voltage lockout (UVLO), integrated soft-start to limit inrush current at startup and over-voltage protection, over-current protection and thermal shutdown detection.

The GRM2010 is available in a Green LGA-2×2-8AL package.

FEATURES

- **3D Integrated SoC Device with Power IC, Power Inductor, Input Capacitor and Output Capacitor**
- **High Switching Frequency: 10MHz/8MHz/6.5MHz**
- **2.3V to 5.5V Input Voltage Range**
- **Fixed Output Voltages: 1.2V, 1.5V, 1.6V, 1.8V, 2.5V and 3.3V**
- **1A Output Current**
- **Forced PWM Mode**
- **95% Peak Efficiency**
- **Fast Load Transient Response**
- **100% Duty Cycle**
- **Active Output Discharge**
- **Logic Enable Input, Soft-Start and Input Under-Voltage Lockout**
- **Hiccup Over-Current Protection and Thermal Shutdown**
- **Improved EMC and No Acoustic Noise in any Operation Conditions**
- **Super Ease-of-Use in System Designs**
- **Available in a Green LGA-2×2-8AL Package**

APPLICATIONS

Optical Modules
Handheld Communication Devices
Space and Height Constrained Designs
Battery Operated Systems
Low EMI Systems

SIMPLIFIED SCHEMATIC

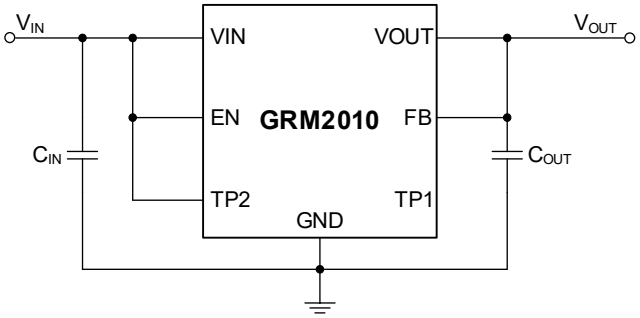


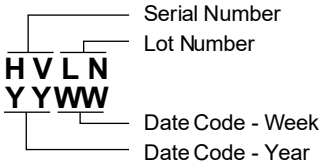
Figure 1. Simplified Schematic

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
GRM2010-1.2	LGA-2×2-8AL	-40℃ to +125℃	GRM2010-1.2LGA-R	H1LN YYWW	Tape and Reel, 3000
GRM2010-1.5	LGA-2×2-8AL	-40℃ to +125℃	GRM2010-1.5LGA-R	H4LN YYWW	Tape and Reel, 3000
GRM2010-1.6	LGA-2×2-8AL	-40℃ to +125℃	GRM2010-1.6LGA-R	H7LN YYWW	Tape and Reel, 3000
GRM2010-1.8	LGA-2×2-8AL	-40℃ to +125℃	GRM2010-1.8LGA-R	H6LN YYWW	Tape and Reel, 3000
GRM2010-2.5	LGA-2×2-8AL	-40℃ to +125℃	GRM2010-2.5LGA-R	H2LN YYWW	Tape and Reel, 3000
GRM2010-3.3	LGA-2×2-8AL	-40℃ to +125℃	GRM2010-3.3LGA-R	H3LN YYWW	Tape and Reel, 3000

MARKING INFORMATION

NOTE: YYWW = Date Code.



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage ..... -0.3V to 6V
Voltage on Other Pins, VOUT, FB, EN, TP1, TP2 .....
..... -0.3V to V_{IN} + 0.3V
Package Thermal Resistance
LGA-2×2-8AL, θ_{JA} ..... 112.9℃/W
LGA-2×2-8AL, θ_{JB} ..... 29.1℃/W
LGA-2×2-8AL, θ_{JC} ..... 49.5℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (1) (2)
HBM ..... ±4000V
CDM ..... ±2000V

NOTES:

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.

2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

RECOMMENDED OPERATING CONDITIONS

Supply Voltage ..... 2.3V to 5.5V
Output Current ..... 0A to 1A
Input Capacitor ..... 10μF (TYP)
Output Capacitor ..... 4.7μF (TYP)
Operating Ambient Temperature Range ..... -40℃ to +125℃
Operating Junction Temperature Range ..... -40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

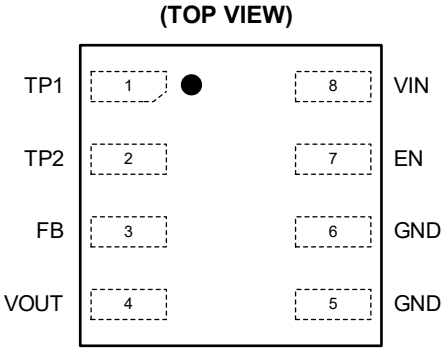
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION



PIN DESCRIPTION

PIN	NAME	TYPE	FUNCTION
1	TP1	—	Test Pin. It must be soldered to PCB but not be electrically connected to any external signal, ground, or voltage.
2	TP2	—	Test Pin. It must be soldered to PCB and connect to VIN.
3	FB	I	Feedback Input. Connect to output voltage.
4	VOUT	O	Voltage Output Power Pin. Connect it to output capacitors.
5, 6	GND	G	Input Capacitor, Output Capacitor and IC Ground.
7	EN	I	Enable. Part is active when EN > 1.2V. Part is disabled when EN < 0.4V. Do not leave this pin floating.
8	VIN	P	Power Supply Input. Connect to power source with a minimum 10μF ceramic capacitor.

NOTE: I = input, O = output, P = power, G = ground.

ELECTRICAL CHARACTERISTICS

(V_{OUT} = 1.2V, V_{IN} = V_{EN} = 2.3V to 5.5V, T_A = -40℃ to +125℃, typical values are at V_{IN} = 3.6V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DC Characteristics							
Supply Voltage	V_{IN}			2.3		5.5	V
Device Activated Voltage	V_{UVLO}	V_{IN} falling		1.74	1.87	2.06	V
	V_{UVLO_HYS}	V_{IN} rising			175		mV
Device Input Current	I_Q	V_{IN} = 3.6V, no load, no switching			0.26	0.60	mA
Shutdown Current	I_{SHDN}	V_{IN} = 3.6V, no load, EN = GND			0.08	1.5	μA
Integrated Power Switches, Inductor and Capacitors							
Inductance of the Integrated Inductor	L	At 500kHz			165		nH
Capacitance of the Integrated Input Capacitor	C_{IN}	At 1kHz			100		nF
Capacitance of the Integrated Output Capacitor	C_{OUT}	At 1kHz			100		nF
Total PWM-On Resistance	R_{PWM_ON}	PWM on, resistance from VIN to VOUT, T_A = +25℃			193	235	mΩ
Total PWM-Off Resistance	R_{PWM_OFF}	PWM off, resistance from VOUT to GND, T_A = +25℃			130	175	mΩ
PMOS On-Switch Current Limit	I_{LIM_P}				1.6		A
Switching Frequency	f_{SW}	V_{IN} = 2.8V			6.5		MHz
Output Characteristics							
Output Voltage Accuracy	V_{OUT}	V_{IN} = 3.6V		1.178	1.2	1.222	V
Load Regulation		V_{IN} = 3.3V, I_{LOAD} = 0A to 1A			0.4		%
Line Regulation		V_{IN} = 2.3V to 5.5V, I_{LOAD} = 1A			3		%
Load Current Limit	I_{LIM_LOAD}	V_{IN} = 3.6V		1			A
Enable Turn-On Delay	t_{EN}	V_{IN} = 3.6V, time from EN high to 10% of V_{OUT} nominal			150		μs
Soft-Start Time	t_{SS}	V_{IN} = 3.6V, time from EN high to 95% of V_{OUT} nominal			440		μs
Output Discharge Resistance	R_{DIS}	V_{EN} = 0V			17		Ω
Performance							
Efficiency	η	V_{IN} = 3.3V	I_{LOAD} = 0.2A		83.28		%
			I_{LOAD} = 0.6A		86.11		
			I_{LOAD} = 1.0A		82.61		
Logic Inputs: EN							
Logic High Voltage	V_{IH}			1.2			V
Logic Low Voltage	V_{IL}					0.4	V
Input Leakage Current	I_{EN}				0.01	1	μA
Thermal Shutdown Protection							
Thermal Shutdown	T_{SD}				135		℃
Thermal Shutdown Hysteresis	T_{HYST}				15		℃

ELECTRICAL CHARACTERISTICS (continued)

(V_{OUT} = 1.5V, V_{IN} = V_{EN} = 2.3V to 5.5V, T_A = -40℃ to +125℃, typical values are at V_{IN} = 3.6V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DC Characteristics							
Supply Voltage	V_{IN}			2.3		5.5	V
Device Activated Voltage	V_{UVLO}	V_{IN} falling		1.74	1.86	2.09	V
	V_{UVLO_HYS}	V_{IN} rising			180		mV
Device Input Current	I_Q	V_{IN} = 3.6V, no load, no switching			0.26	0.60	mA
Shutdown Current	I_{SHDN}	V_{IN} = 3.6V, no load, EN = GND			0.12	1.5	μA
Integrated Power Switches, Inductor and Capacitors							
Inductance of the Integrated Inductor	L	At 500kHz			165		nH
Capacitance of the Integrated Input Capacitor	C_{IN}	At 1kHz			100		nF
Capacitance of the Integrated Output Capacitor	C_{OUT}	At 1kHz			100		nF
Total PWM-On Resistance	R_{PWM_ON}	PWM on, resistance from VIN to VOUT, T_A = +25℃			193	235	mΩ
Total PWM-Off Resistance	R_{PWM_OFF}	PWM off, resistance from VOUT to GND, T_A = +25℃			130	175	mΩ
PMOS On-Switch Current Limit	I_{LIM_P}				1.6		A
Switching Frequency	f_{SW}	V_{IN} = 2.5V			8		MHz
Output Characteristics							
Output Voltage Accuracy	V_{OUT}	V_{IN} = 3.6V		1.473	1.5	1.527	V
Load Regulation		V_{IN} = 3.3V, I_{LOAD} = 0A to 1A			0.6		%
Line Regulation		V_{IN} = 2.3V to 5.5V, I_{LOAD} = 1A			2.5		%
Load Current Limit	I_{LIM_LOAD}	V_{IN} = 3.6V		1			A
Enable Turn-On Delay	t_{EN}	V_{IN} = 3.6V, time from EN high to 10% of V_{OUT} nominal			150		μs
Soft-Start Time	t_{SS}	V_{IN} = 3.6V, time from EN high to 95% of V_{OUT} nominal			360		μs
Output Discharge Resistance	R_{DIS}	V_{EN} = 0V			17		Ω
Performance							
Efficiency	η	V_{IN} = 3.3V	I_{LOAD} = 0.2A		86.81		%
			I_{LOAD} = 0.6A		88.09		
			I_{LOAD} = 1.0A		84.57		
Logic Inputs: EN							
Logic High Voltage	V_{IH}			1.2			V
Logic Low Voltage	V_{IL}					0.4	V
Input Leakage Current	I_{EN}				0.01	1	μA
Thermal Shutdown Protection							
Thermal Shutdown	T_{SD}				135		℃
Thermal Shutdown Hysteresis	T_{HYS}				15		℃

ELECTRICAL CHARACTERISTICS (continued)

(V_{OUT} = 1.6V, V_{IN} = V_{EN} = 2.3V to 5.5V, T_A = -40℃ to +125℃, typical values are at V_{IN} = 3.6V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DC Characteristics							
Supply Voltage	V_{IN}			2.3		5.5	V
Device Activated Voltage	V_{UVLO}	V_{IN} falling		1.74	1.96	2.1	V
	V_{UVLO_HYS}	V_{IN} rising			130		mV
Device Input Current	I_Q	V_{IN} = 3.6V, no load, no switching			0.26	0.60	mA
Shutdown Current	I_{SHDN}	V_{IN} = 3.6V, no load, EN = GND			0.12	1.5	μA
Integrated Power Switches, Inductor and Capacitors							
Inductance of the Integrated Inductor	L	At 500kHz			165		nH
Capacitance of the Integrated Input Capacitor	C_{IN}	At 1kHz			100		nF
Capacitance of the Integrated Output Capacitor	C_{OUT}	At 1kHz			100		nF
Total PWM-On Resistance	R_{PWM_ON}	PWM on, resistance from VIN to VOUT, T_A = +25℃			193	235	mΩ
Total PWM-Off Resistance	R_{PWM_OFF}	PWM off, resistance from VOUT to GND, T_A = +25℃			130	175	mΩ
PMOS On-Switch Current Limit	I_{LIM_P}				1.6		A
Switching Frequency	f_{SW}	V_{IN} = 2.5V			8		MHz
Output Characteristics							
Output Voltage Accuracy	V_{OUT}	V_{IN} = 3.6V		1.570	1.6	1.630	V
Load Regulation		V_{IN} = 3.3V, I_{LOAD} = 0A to 1A			0.7		%
Line Regulation		V_{IN} = 2.3V to 5.5V, I_{LOAD} = 1A			2		%
Load Current Limit	I_{LIM_LOAD}	V_{IN} = 3.6V		1.0			A
Enable Turn-On Delay	t_{EN}	V_{IN} = 3.6V, time from EN high to 10% of V_{OUT} nominal			150		μs
Soft-Start Time	t_{SS}	V_{IN} = 3.6V, time from EN high to 95% of V_{OUT} nominal			360		μs
Output Discharge Resistance	R_{DIS}	V_{EN} = 0V			17		Ω
Performance							
Efficiency	η	V_{IN} = 3.3V	I_{LOAD} = 0.2A		88.06		%
			I_{LOAD} = 0.6A		88.24		
			I_{LOAD} = 1.0A		84.17		
Logic Inputs: EN							
Logic High Voltage	V_{IH}			1.2			V
Logic Low Voltage	V_{IL}					0.4	V
Input Leakage Current	I_{EN}				0.01	1	μA
Thermal Shutdown Protection							
Thermal Shutdown	T_{SD}				135		℃
Thermal Shutdown Hysteresis	T_{HYS}				15		℃

ELECTRICAL CHARACTERISTICS (continued)

(V_{OUT} = 1.8V, V_{IN} = V_{EN} = 2.3V to 5.5V, T_A = -40℃ to +125℃, typical values are at V_{IN} = 3.6V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DC Characteristics							
Supply Voltage	V_{IN}			2.3		5.5	V
Device Activated Voltage	V_{UVLO}	V_{IN} falling		1.74	1.88	2.06	V
	V_{UVLO_HYS}	V_{IN} rising			160		mV
Device Input Current	I_Q	V_{IN} = 3.6V, no load, no switching			0.26	0.60	mA
Shutdown Current	I_{SHDN}	V_{IN} = 3.6V, no load, EN = GND			0.26	1.5	μA
Integrated Power Switches, Inductor and Capacitors							
Inductance of the Integrated Inductor	L	At 500kHz			165		nH
Capacitance of the Integrated Input Capacitor	C_{IN}	At 1kHz			100		nF
Capacitance of the Integrated Output Capacitor	C_{OUT}	At 1kHz			100		nF
Total PWM-On Resistance	R_{PWM_ON}	PWM on, resistance from VIN to VOUT, T_A = +25℃			193	235	mΩ
Total PWM-Off Resistance	R_{PWM_OFF}	PWM off, resistance from VOUT to GND, T_A = +25℃			130	175	mΩ
PMOS On-Switch Current Limit	I_{LIM_P}				1.6		A
Switching Frequency	f_{SW}	V_{IN} = 3.0V			10		MHz
Output Characteristics							
Output Voltage Accuracy	V_{OUT}	V_{IN} = 3.6V		1.771	1.8	1.829	V
Load Regulation		V_{IN} = 3.3V, I_{LOAD} = 0A to 1A			0.9		%
Line Regulation		V_{IN} = 2.3V to 5.5V, I_{LOAD} = 1A			2		%
Load Current Limit	I_{LIM_LOAD}	V_{IN} = 3.6V		1.0			A
Enable Turn-On Delay	t_{EN}	V_{IN} = 3.6V, time from EN high to 10% of V_{OUT} nominal			150		μs
Soft-Start Time	t_{SS}	V_{IN} = 3.6V, time from EN high to 95% of V_{OUT} nominal			330		μs
Output Discharge Resistance	R_{DIS}	V_{EN} = 0V			17		Ω
Performance							
Efficiency	η	V_{IN} = 3.3V	I_{LOAD} = 0.2A		90.85		%
			I_{LOAD} = 0.6A		89.89		
			I_{LOAD} = 1.0A		86.74		
Logic Inputs: EN							
Logic High Voltage	V_{IH}			1.2			V
Logic Low Voltage	V_{IL}					0.4	V
Input Leakage Current	I_{EN}				0.01	1	μA
Thermal Shutdown Protection							
Thermal Shutdown	T_{SD}				135		℃
Thermal Shutdown Hysteresis	T_{HYS}				15		℃

ELECTRICAL CHARACTERISTICS (continued)

(V_{OUT} = 2.5V, V_{IN} = V_{EN} = 2.3V to 5.5V, T_A = -40℃ to +125℃, typical values are at V_{IN} = 3.6V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DC Characteristics							
Supply Voltage	V_{IN}			2.5		5.5	V
Device Activated Voltage	V_{UVLO}	V_{IN} falling		1.70	1.86	2.10	V
	V_{UVLO_HYS}	V_{IN} rising			185		mV
Device Input Current	I_Q	V_{IN} = 3.6V, no load, no switching			0.26	0.60	mA
Shutdown Current	I_{SHDN}	V_{IN} = 3.6V, no load, EN = GND			0.21	1.5	μA
Integrated Power Switches, Inductor and Capacitors							
Inductance of the Integrated Inductor	L	At 500kHz			165		nH
Capacitance of the Integrated Input Capacitor	C_{IN}	At 1kHz			100		nF
Capacitance of the Integrated Output Capacitor	C_{OUT}	At 1kHz			100		nF
Total PWM-On Resistance	R_{PWM_ON}	PWM on, resistance from VIN to VOUT, T_A = +25℃			193	235	mΩ
Total PWM-Off Resistance	R_{PWM_OFF}	PWM off, resistance from VOUT to GND, T_A = +25℃			130	175	mΩ
PMOS On-Switch Current Limit	I_{LIM_P}				1.6		A
Switching Frequency	f_{SW}	V_{IN} = 5.0V			8		MHz
Output Characteristics							
Output Voltage Accuracy	V_{OUT}	V_{IN} = 3.6V		2.462	2.5	2.538	V
Load Regulation		V_{IN} = 3.3V, I_{LOAD} = 0A to 1A			0.3		%
Line Regulation		V_{IN} = 3.3V to 5.5V, I_{LOAD} = 1A			1.8		%
Load Current Limit	I_{LIM_LOAD}	V_{IN} = 3.6V		1.0			A
Enable Turn-On Delay	t_{EN}	V_{IN} = 4.5V, time from EN high to 10% of V_{OUT} nominal			150		μs
Soft-Start Time	t_{SS}	V_{IN} = 4.5V, time from EN high to 95% of V_{OUT} nominal			300		μs
Output Discharge Resistance	R_{DIS}	V_{EN} = 0V			17		Ω
Performance							
Efficiency	η	V_{IN} = 3.3V	I_{LOAD} = 0.2A		93.97		%
			I_{LOAD} = 0.6A		93.22		
			I_{LOAD} = 1.0A		90.71		
Logic Inputs: EN							
Logic High Voltage	V_{IH}			1.2			V
Logic Low Voltage	V_{IL}					0.4	V
Input Leakage Current	I_{EN}				0.01	1	μA
Thermal Shutdown Protection							
Thermal Shutdown	T_{SD}				135		℃
Thermal Shutdown Hysteresis	T_{HYS}				15		℃

ELECTRICAL CHARACTERISTICS (continued)

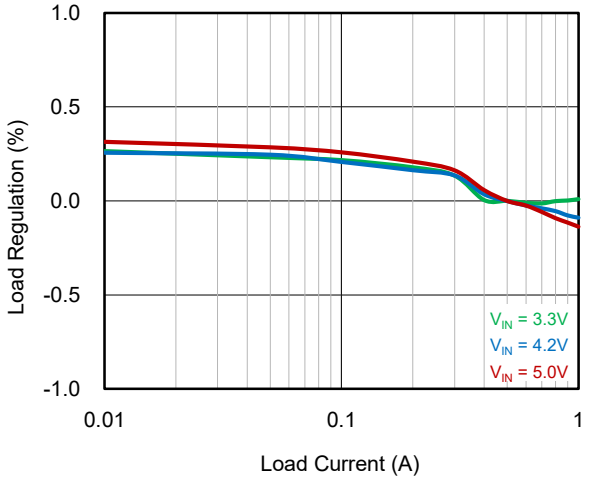
(V_{OUT} = 3.3V, V_{IN} = V_{EN} = 2.3V to 5.5V, T_A = -40℃ to +125℃, typical values are at V_{IN} = 3.6V and T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DC Characteristics							
Supply Voltage	V_{IN}			3.3		5.5	V
Device Activated Voltage	V_{UVLO}	V_{IN} falling		1.70	1.95	2.10	V
	V_{UVLO_HYS}	V_{IN} rising			210		mV
Device Input Current	I_Q	V_{IN} = 5.0V, no load, no switching			0.26	0.60	mA
Shutdown Current	I_{SHDN}	V_{IN} = 5.0V, no load, EN = GND			0.16	1.5	μA
Integrated Power Switches, Inductor and Capacitors							
Inductance of the Integrated Inductor	L	At 500kHz			165		nH
Capacitance of the Integrated Input Capacitor	C_{IN}	At 1kHz			100		nF
Capacitance of the Integrated Output Capacitor	C_{OUT}	At 1kHz			100		nF
Total PWM-On Resistance	R_{PWM_ON}	PWM on, resistance from VIN to VOUT, T_A = +25℃			193	235	mΩ
Total PWM-Off Resistance	R_{PWM_OFF}	PWM off, resistance from VOUT to GND, T_A = +25℃			130	175	mΩ
PMOS On-Switch Current Limit	I_{LIM_P}				1.6		A
Switching Frequency	f_{SW}	V_{IN} = 5.0V			8		MHz
Output Characteristics							
Output Voltage Accuracy	V_{OUT}	V_{IN} = 3.6V		3.246	3.3	3.358	V
Load Regulation		V_{IN} = 5.0V, I_{LOAD} = 0A to 1A			0.3		%
Line Regulation		V_{IN} = 3.6V to 5.0V, I_{LOAD} = 1A			2.1		%
Load Current Limit	I_{LIM_LOAD}	V_{IN} = 3.6V		1.0			A
Enable Turn-On Delay	t_{EN}	V_{IN} = 5.0V, time from EN high to 10% of V_{OUT} nominal			150		μs
Soft-Start Time	t_{SS}	V_{IN} = 5.0V, time from EN high to 95% of V_{OUT} nominal			285		μs
Output Discharge Resistance	R_{DIS}	V_{EN} = 0V			17		Ω
Performance							
Efficiency	η	V_{IN} = 5.0V	I_{LOAD} = 0.2A		89.55		%
			I_{LOAD} = 0.6A		93.23		
			I_{LOAD} = 1.0A		92.23		
Logic Inputs: EN							
Logic High Voltage	V_{IH}			1.2			V
Logic Low Voltage	V_{IL}					0.4	V
Input Leakage Current	I_{EN}				0.01	1	μA
Thermal Shutdown Protection							
Thermal Shutdown	T_{SD}				135		℃
Thermal Shutdown Hysteresis	T_{HYS}				15		℃

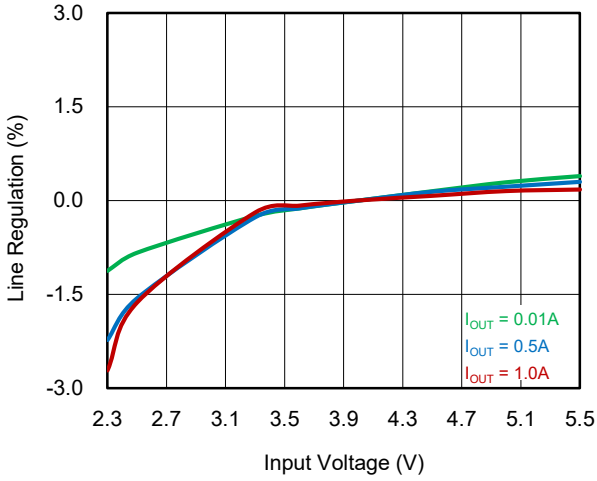
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = +25℃, V_{IN} = 3.3V, V_{OUT} = 1.2V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

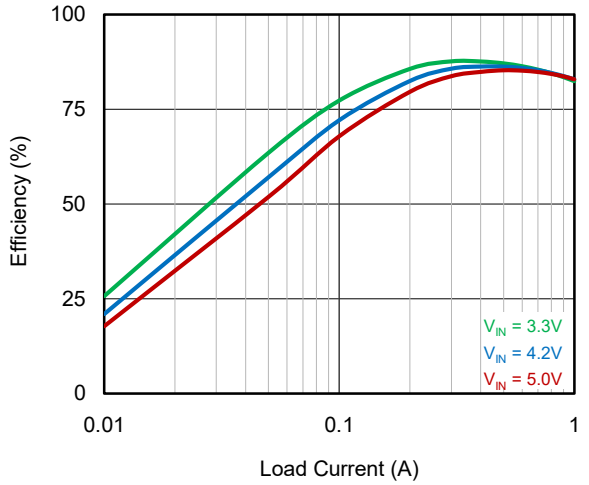
Load Regulation



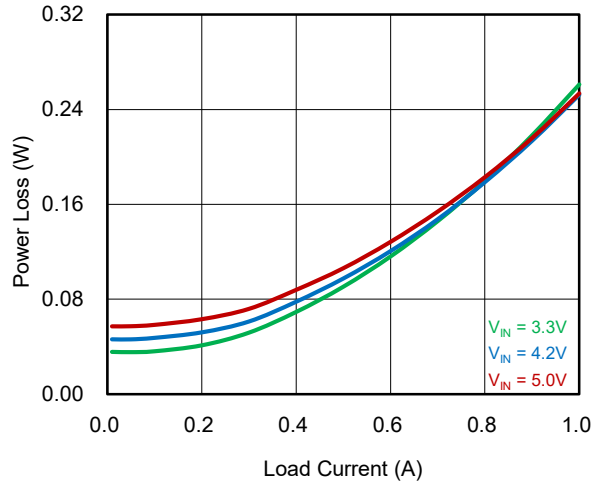
Line Regulation



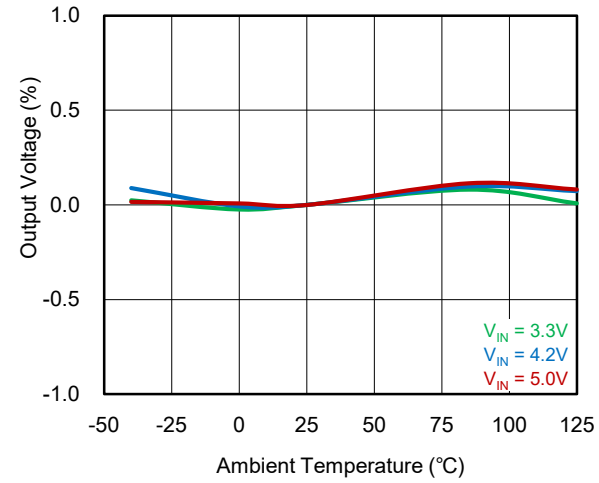
Efficiency



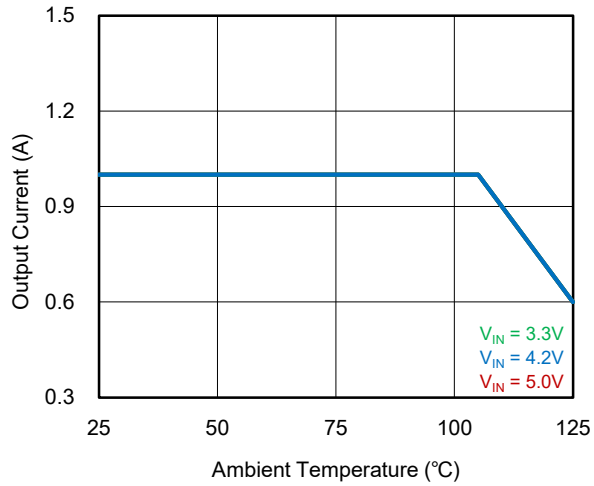
Power Loss



Output Voltage vs. Temperature



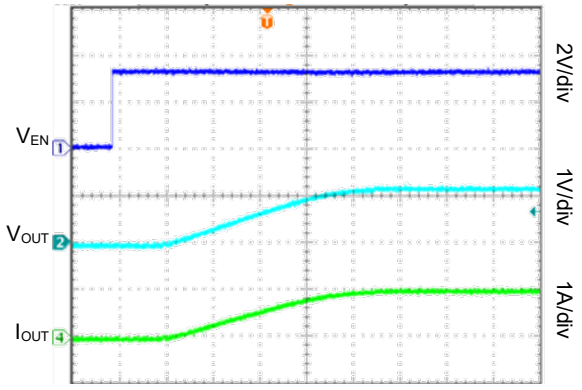
Thermal Derating



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

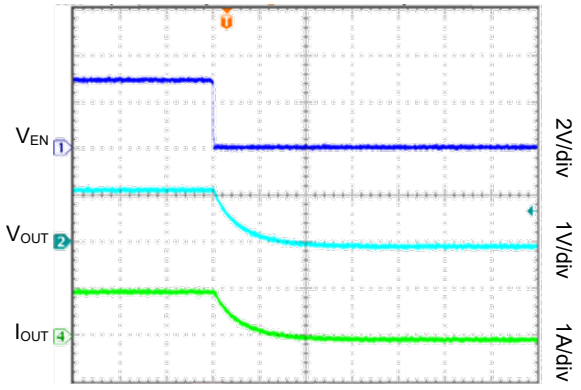
T_A = +25℃, V_{IN} = 3.3V, V_{OUT} = 1.2V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

Startup (I_{OUT} = 1A)



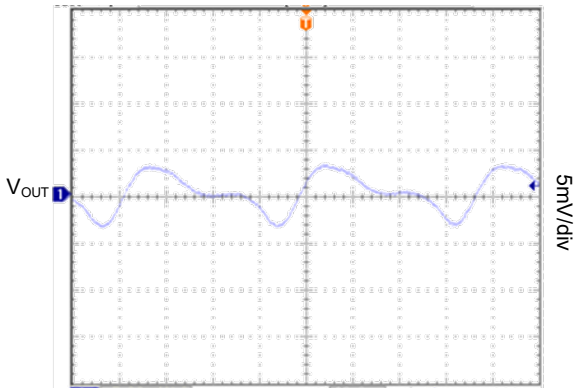
Time (100μs/div)

Shutdown (I_{OUT} = 1A)



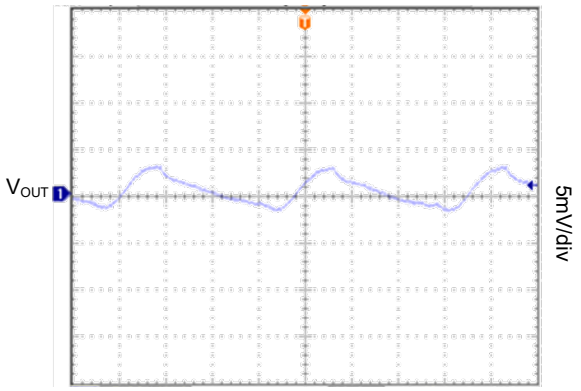
Time (10μs/div)

Output Ripple (I_{OUT} = 0A)



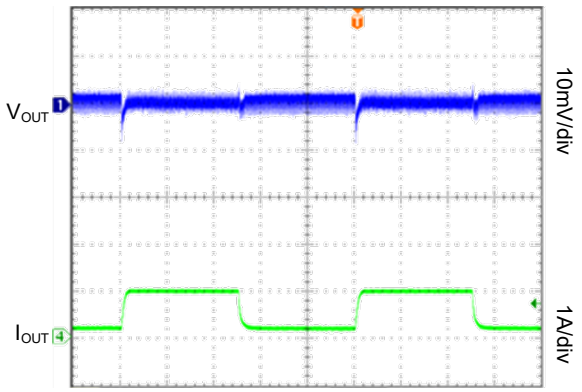
Time (40ns /div)

Output Ripple (I_{OUT} = 1A)



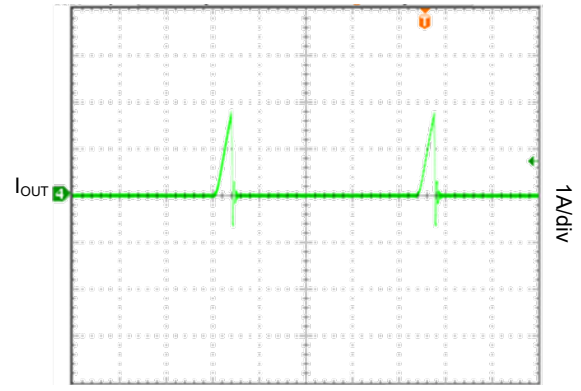
Time (40ns/div)

Load Transient Response (I_{OUT} = 0.2A to 1.0A)



Time (400μs/div)

SCP Hiccup

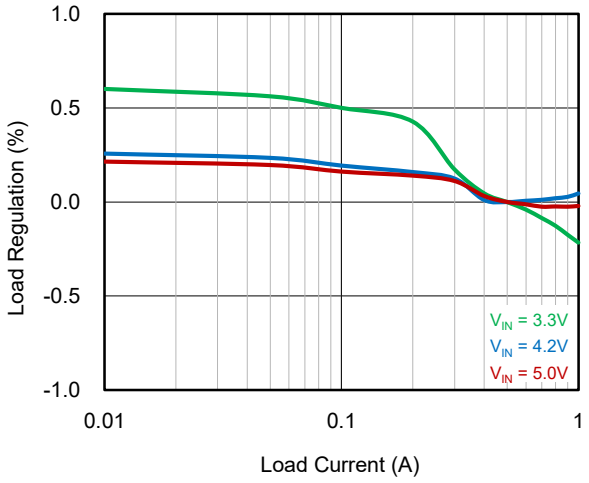


Time (400μs/div)

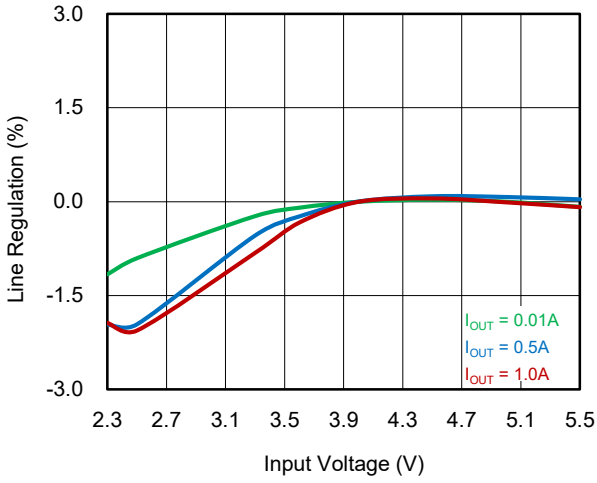
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{IN} = 3.3V, V_{OUT} = 1.5V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

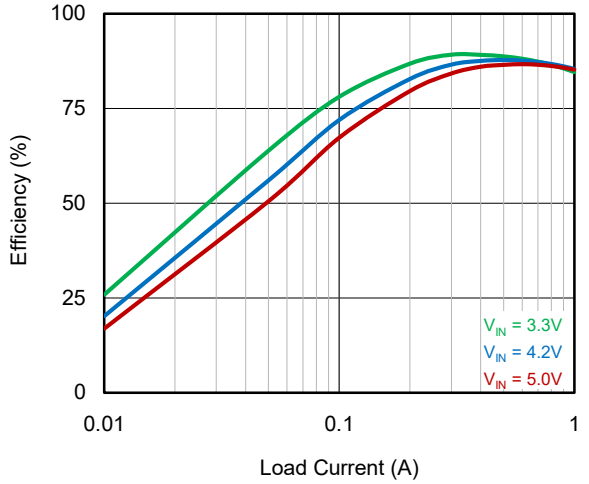
Load Regulation



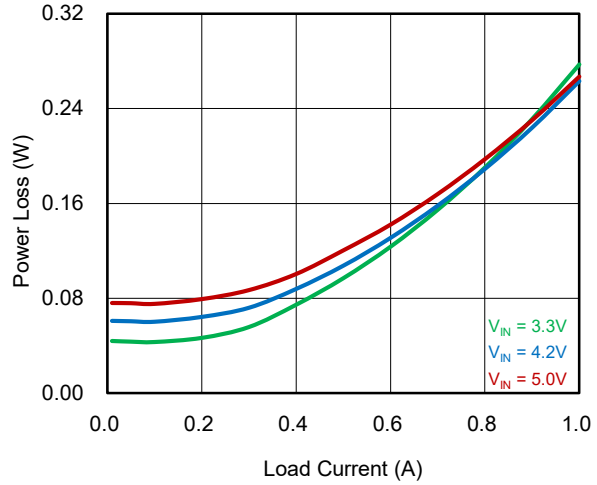
Line Regulation



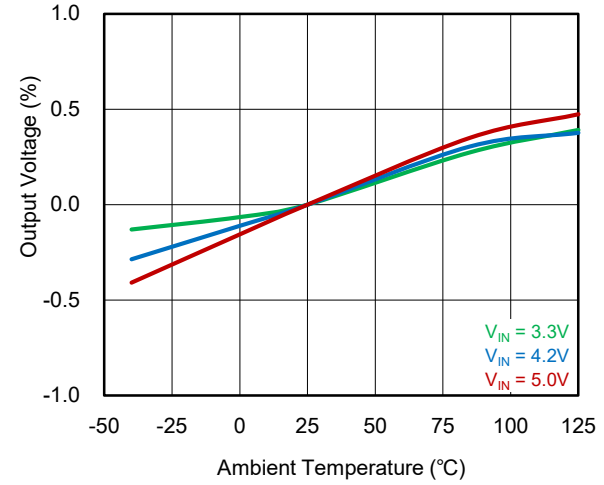
Efficiency



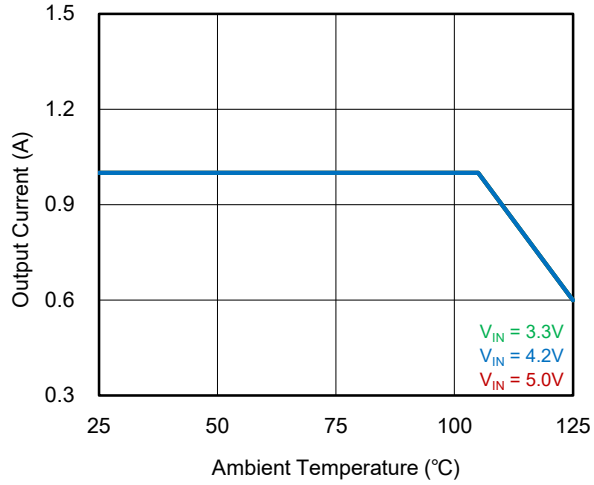
Power Loss



Output Voltage vs. Temperature



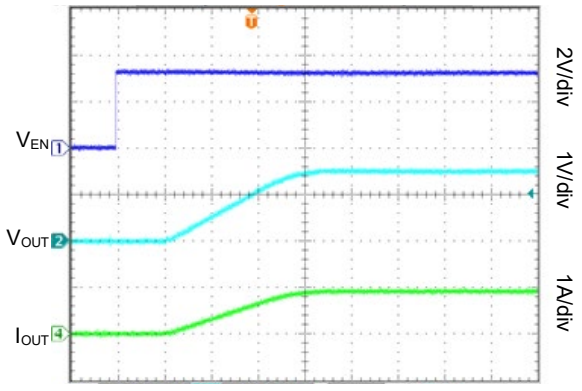
Thermal Derating



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

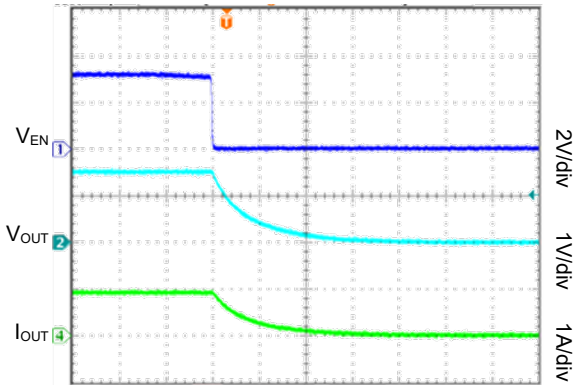
T_A = +25℃, V_{IN} = 3.3V, V_{OUT} = 1.5V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

Startup (I_{OUT} = 1A)



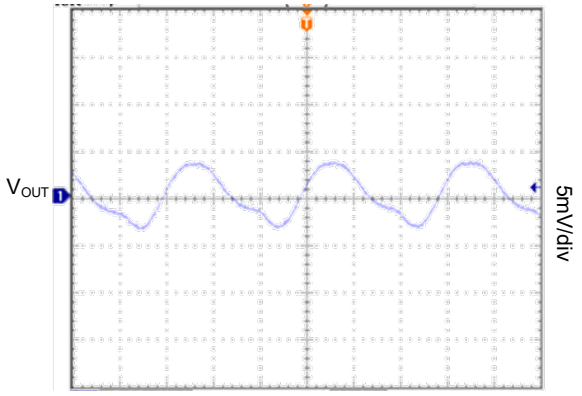
Time (100μs/div)

Shutdown (I_{OUT} = 1A)



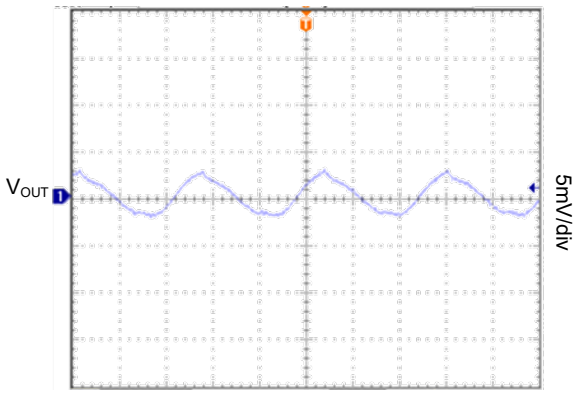
Time (10μs/div)

Output Ripple (I_{OUT} = 0A)



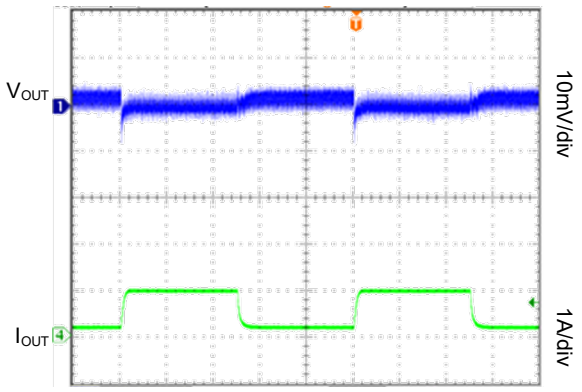
Time (40ns/div)

Output Ripple (I_{OUT} = 1A)



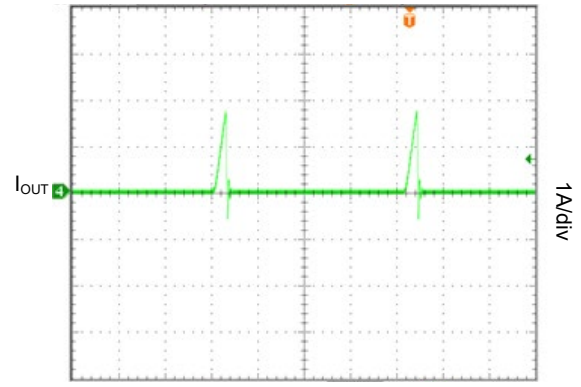
Time (40ns/div)

Load Transient Response (I_{OUT} = 0.2A to 1.0A)



Time (400μs/div)

SCP Hiccup

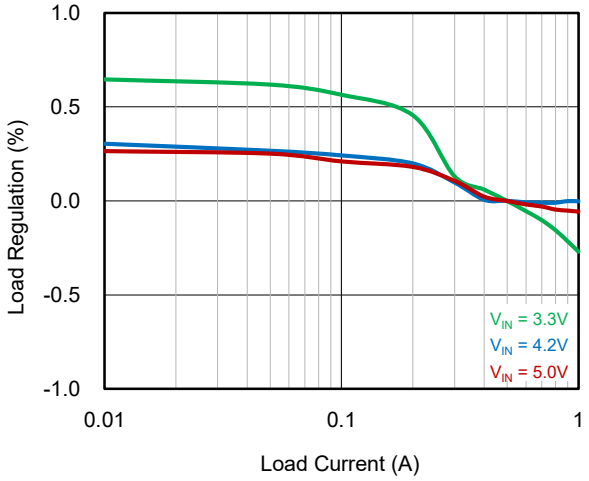


Time (400μs/div)

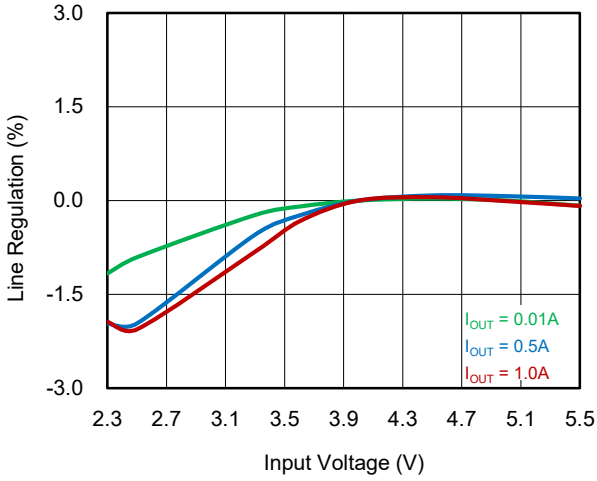
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{IN} = 3.3V, V_{OUT} = 1.6V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

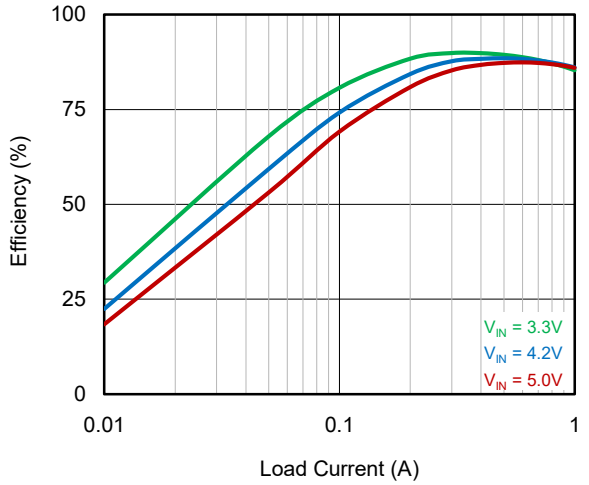
Load Regulation



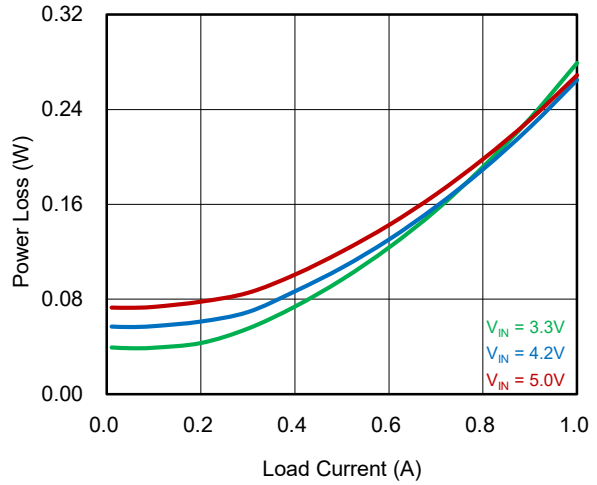
Line Regulation



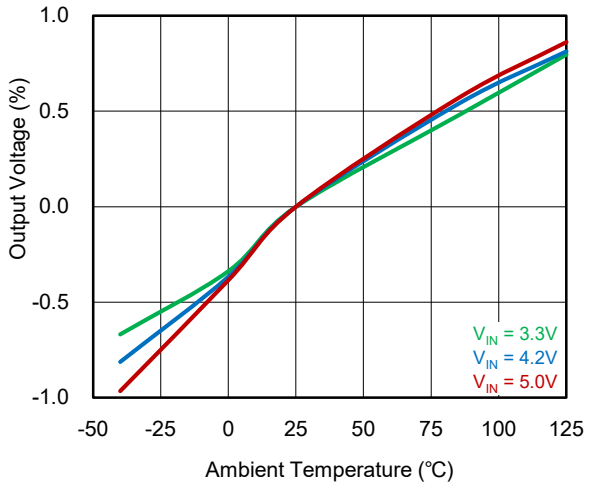
Efficiency



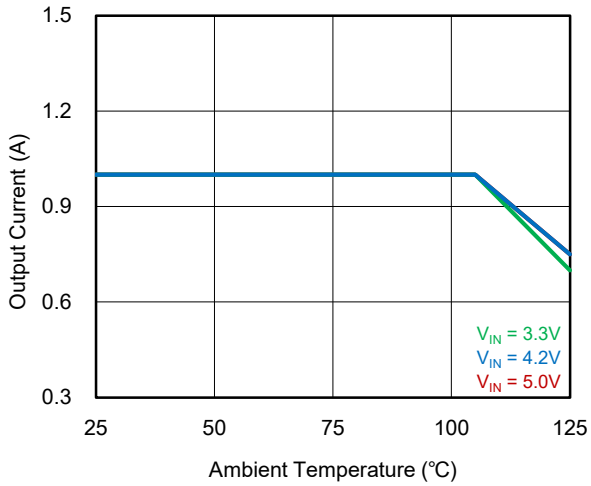
Power Loss



Output Voltage vs. Temperature



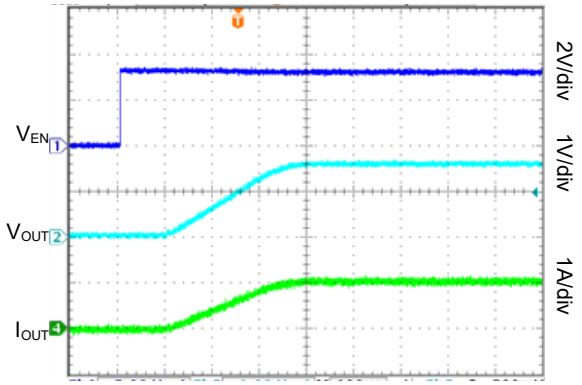
Thermal Derating



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

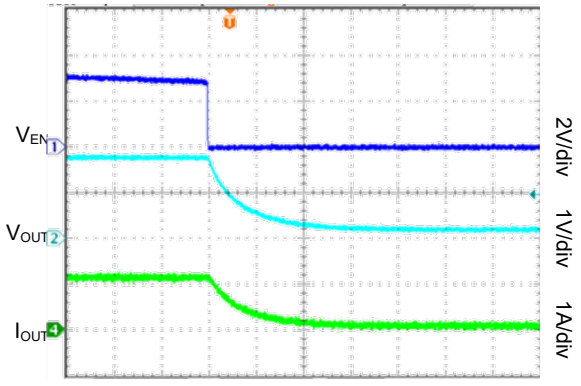
T_A = +25℃, V_{IN} = 3.3V, V_{OUT} = 1.6V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

Startup (I_{OUT} = 1A)



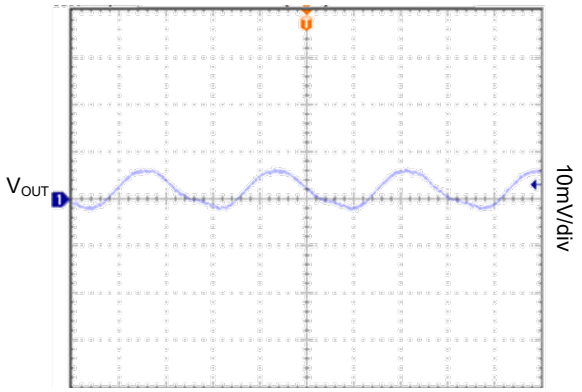
Time (100μs/div)

Shutdown (I_{OUT} = 1A)



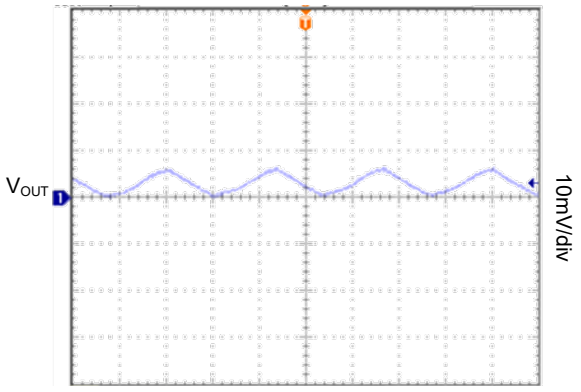
Time (10μs/div)

Output Ripple (I_{OUT} = 0A)



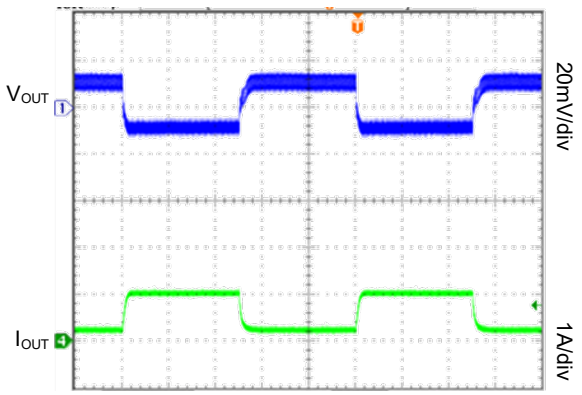
Time (40ns/div)

Output Ripple (I_{OUT} = 1A)



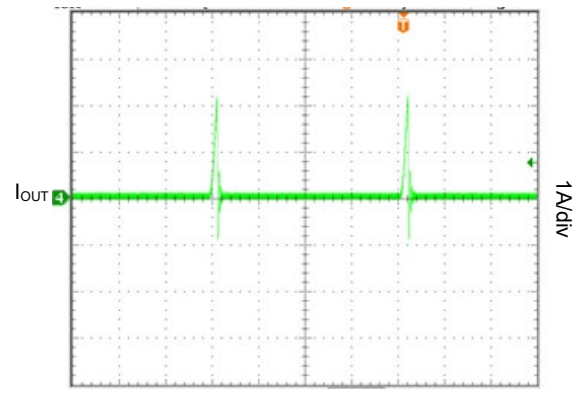
Time (40ns/div)

Load Transient Response (I_{OUT} = 0.2A to 1.0A)



Time (400μs/div)

SCP Hiccup

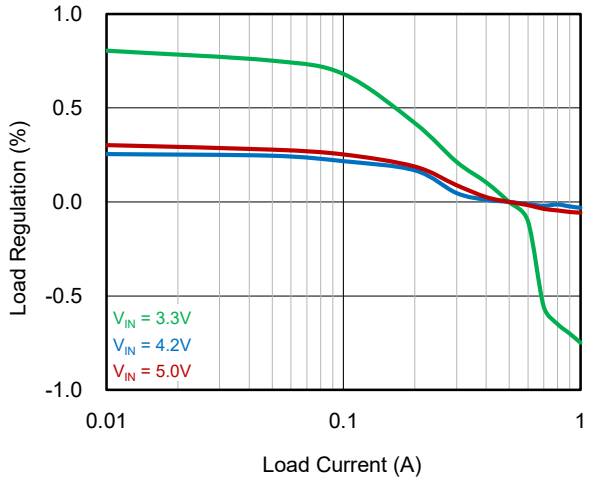


Time (400μs/div)

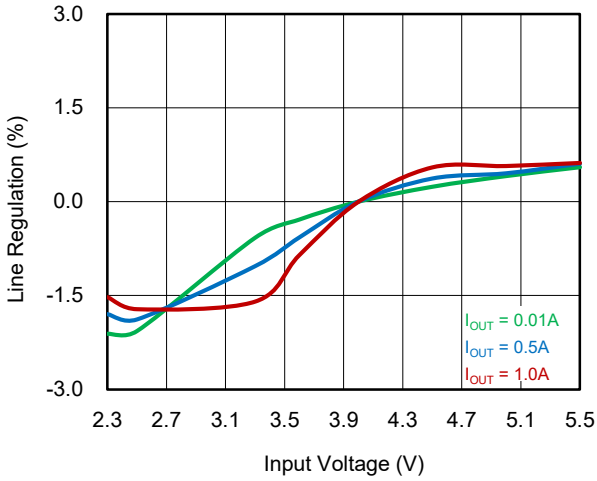
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{IN} = 3.3V, V_{OUT} = 1.8V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

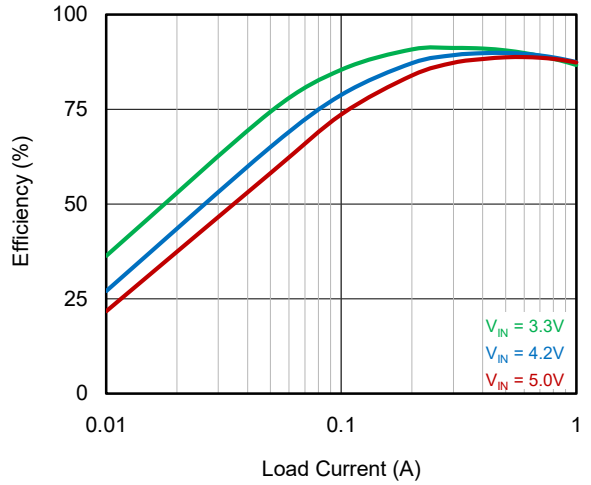
Load Regulation



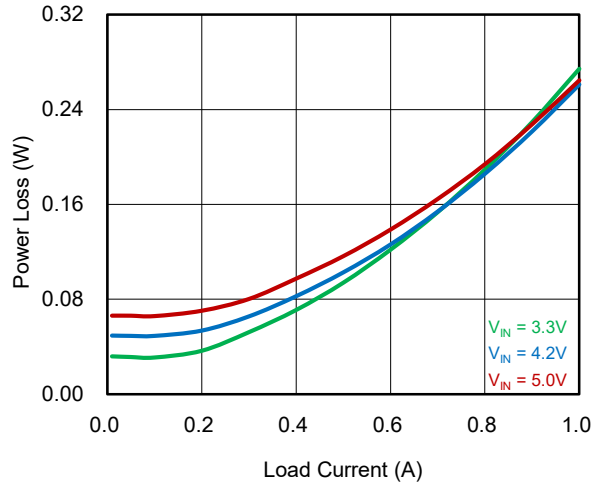
Line Regulation



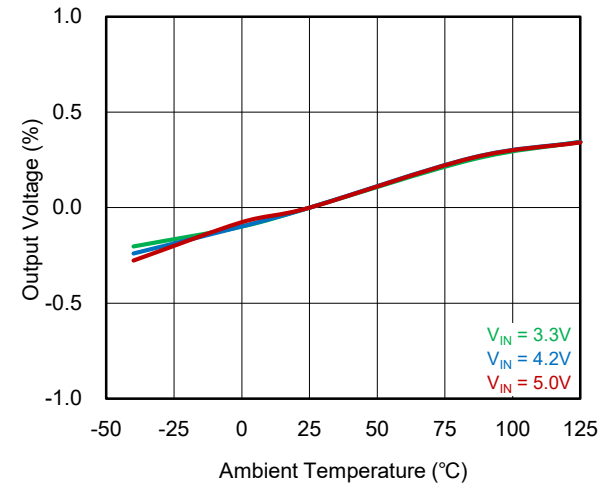
Efficiency



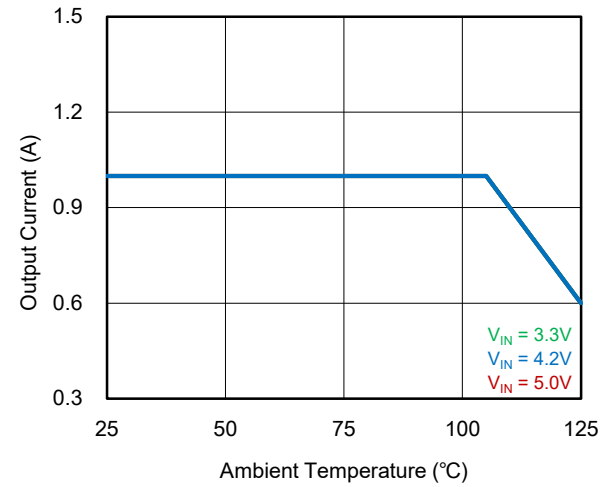
Power Loss



Output Voltage vs. Temperature



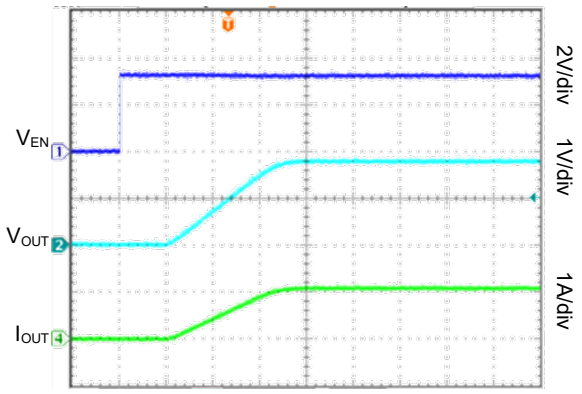
Thermal Derating



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

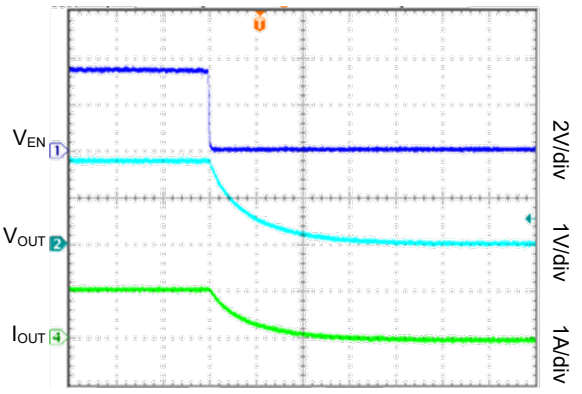
T_A = +25℃, V_{IN} = 3.3V, V_{OUT} = 1.8V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

Startup (I_{OUT} = 1 A)



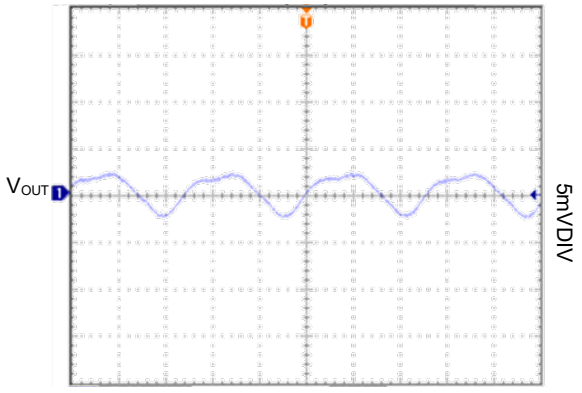
Time (100μs/div)

Shutdown (I_{OUT} = 1A)



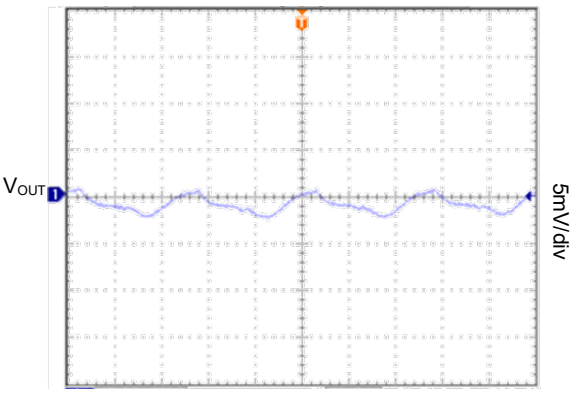
Time (10μs/div)

Output Ripple (I_{OUT} = 0A)



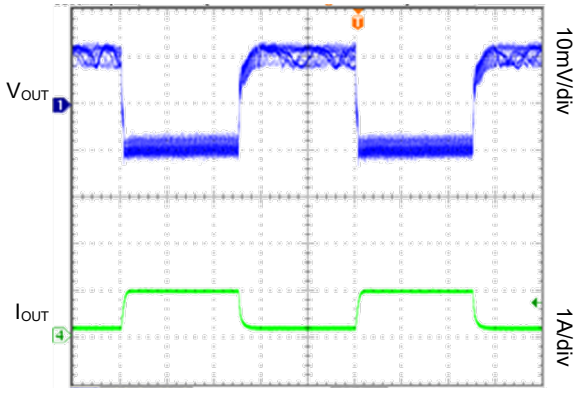
Time (40ns/div)

Output Ripple (I_{OUT} = 1A)



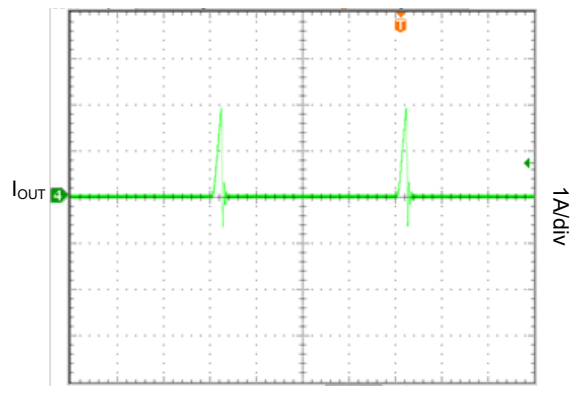
Time (40ns/div)

Load Transient Response (I_{OUT} = 0.2A to 1.0A)



Time (400μs/div)

SCP Hiccup

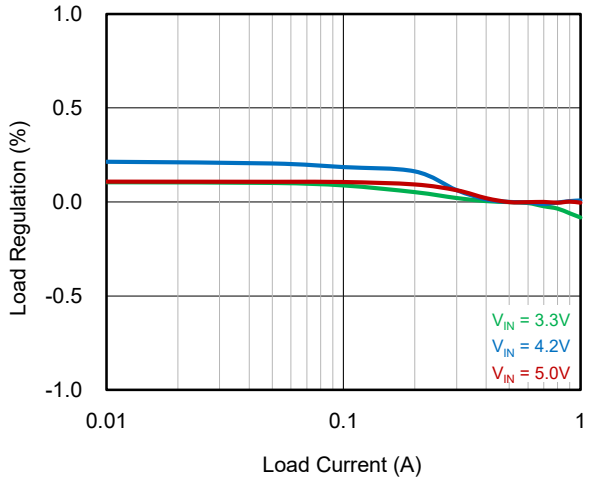


Time (400μs/div)

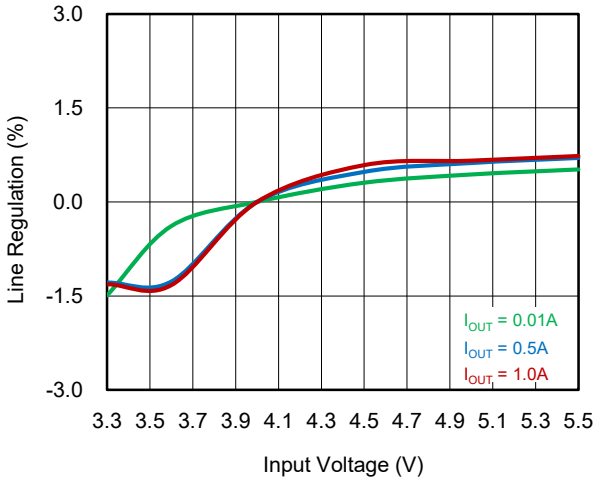
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{IN} = 3.3V, V_{OUT} = 2.5V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

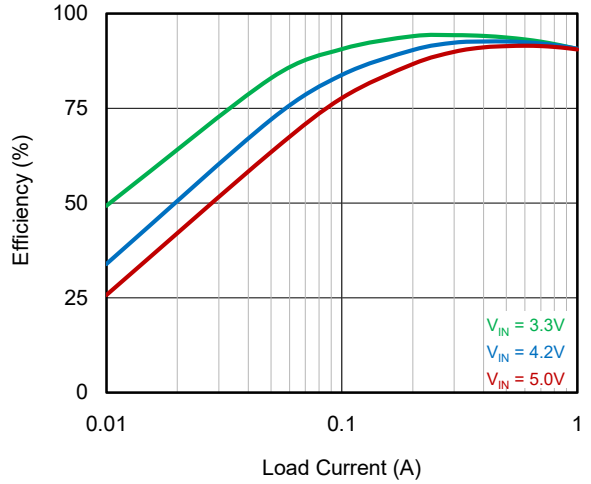
Load Regulation



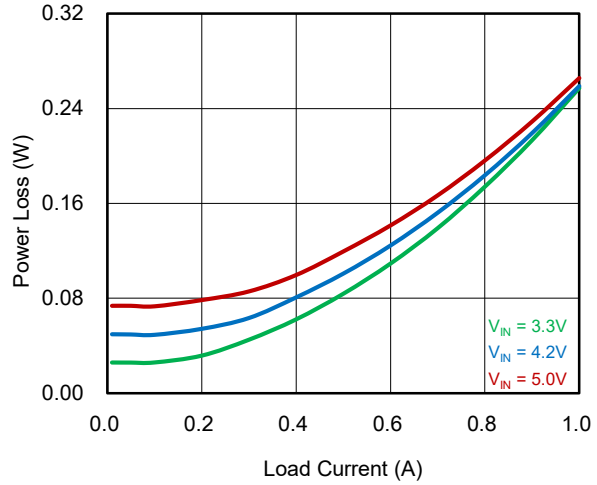
Line Regulation



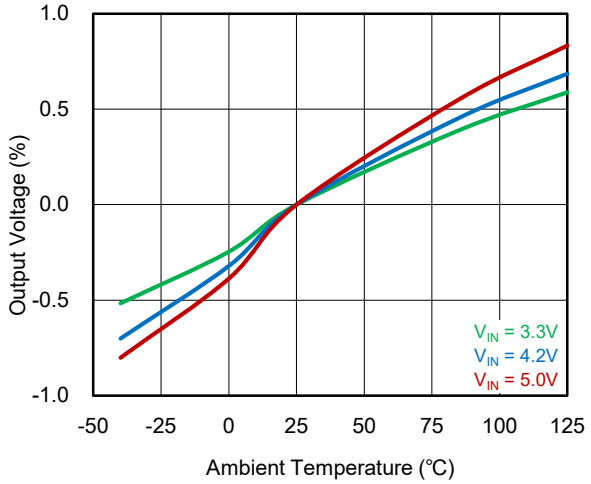
Efficiency



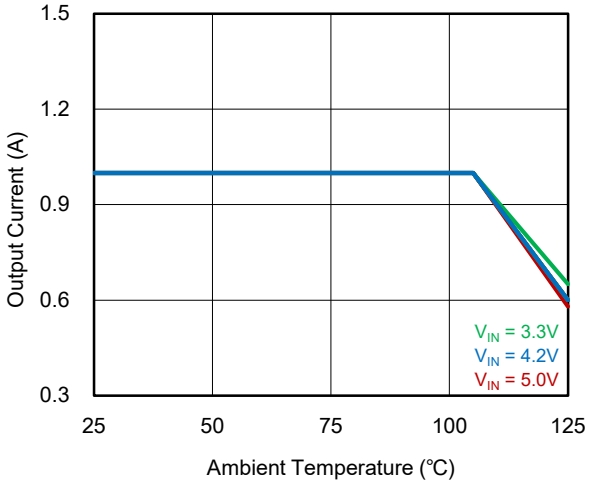
Power Loss



Output Voltage vs. Temperature



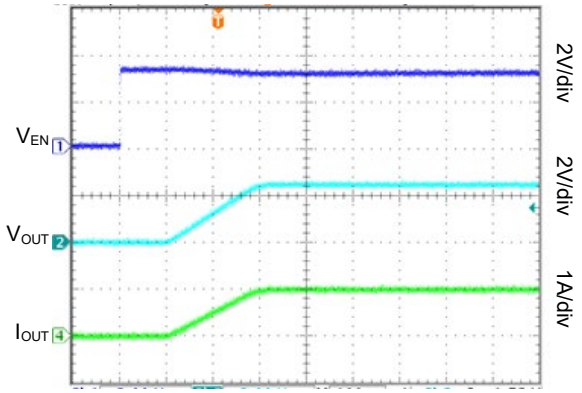
Thermal Derating



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

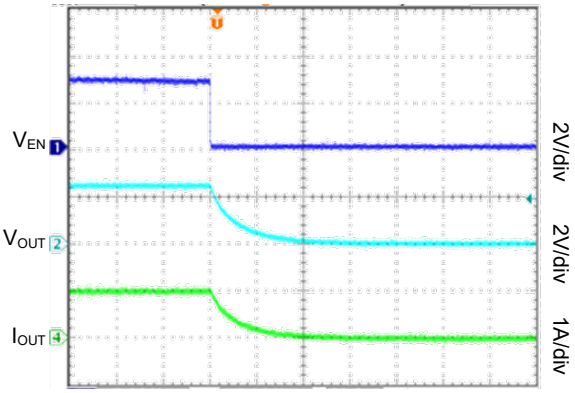
T_A = +25℃, V_{IN} = 3.3V, V_{OUT} = 2.5V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

Startup (I_{OUT} = 1A)



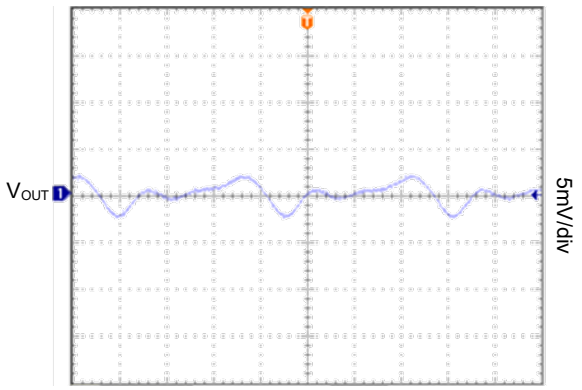
Time (100μs/div)

Shutdown (I_{OUT} = 1A)



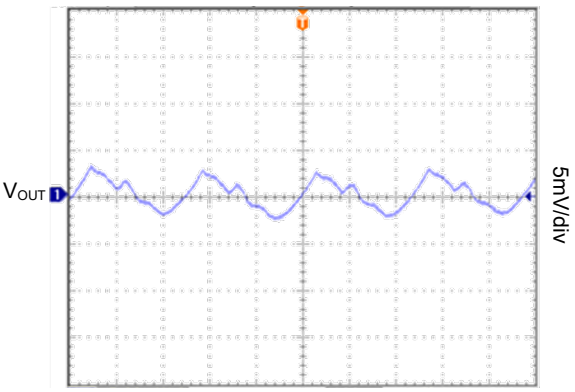
Time (20μs/div)

Output Ripple (I_{OUT} = 0A)



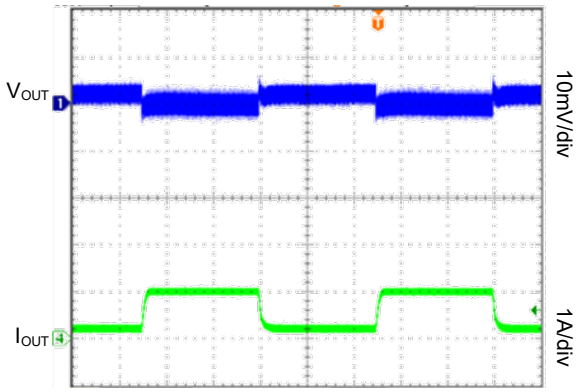
Time (40ns/div)

Output Ripple (I_{OUT} = 1A)



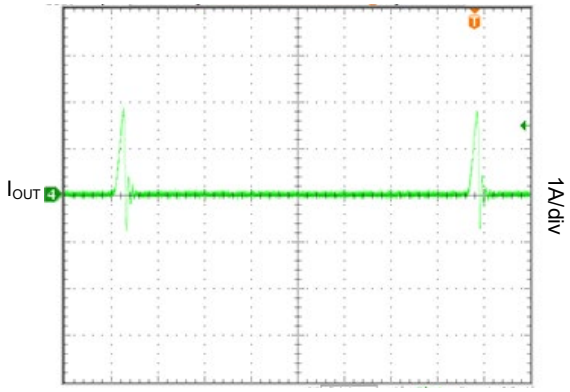
Time (100ns/div)

Load Transient Response (I_{OUT} = 0.2A to 1.0A)



Time (400μs/div)

SCP Hiccup

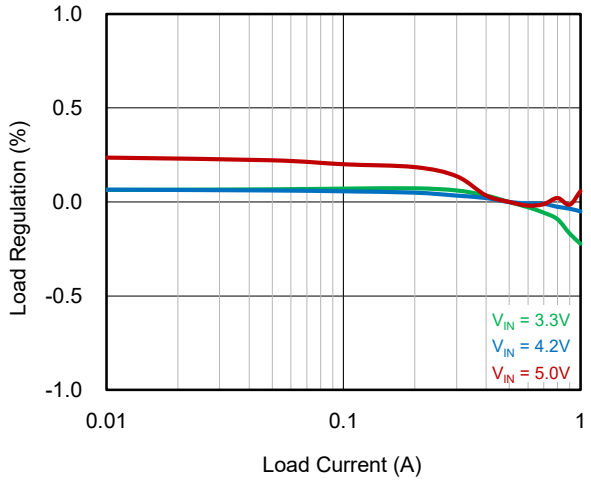


Time (200μs/div)

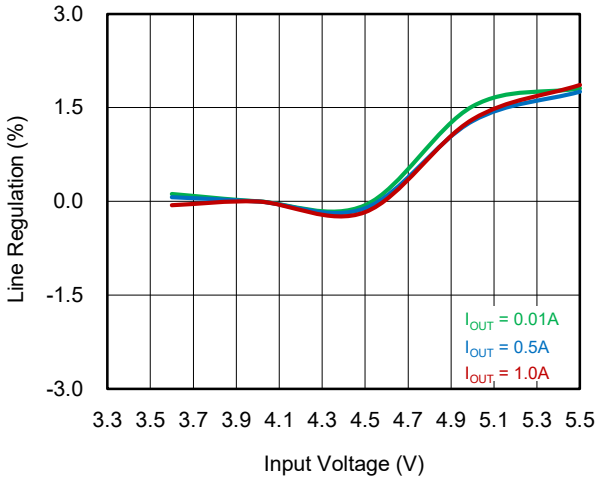
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{IN} = 5V, V_{OUT} = 3.3V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

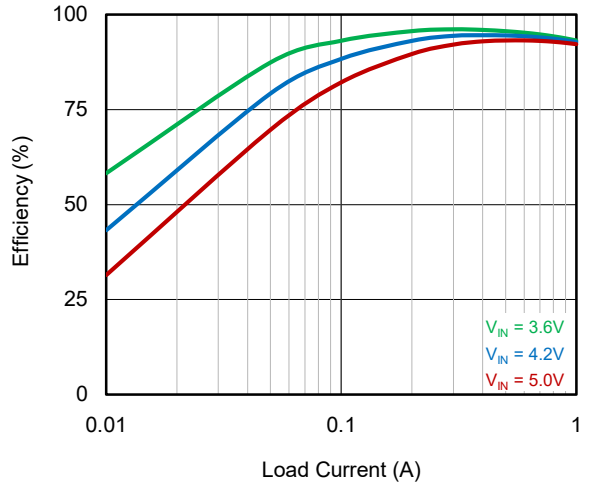
Load Regulation



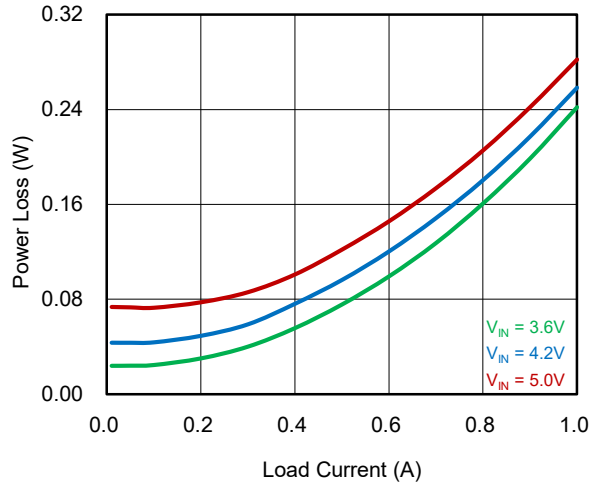
Line Regulation



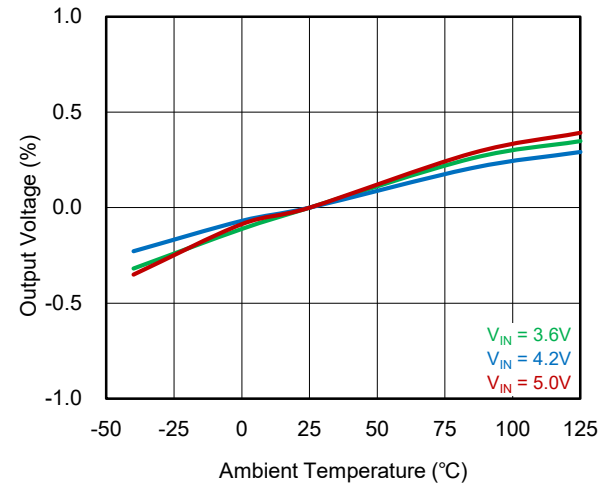
Efficiency



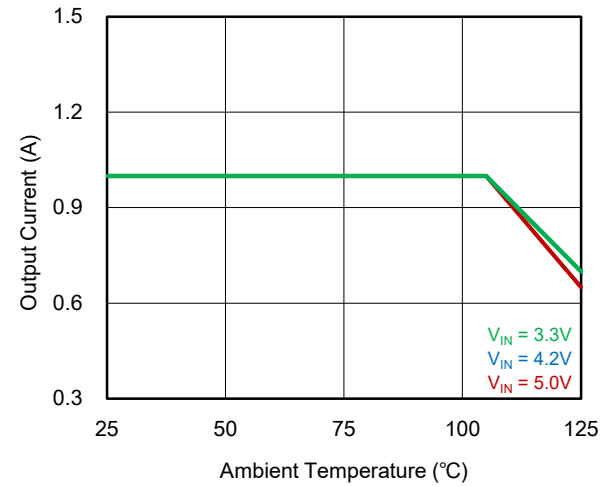
Power Loss



Output Voltage vs. Temperature



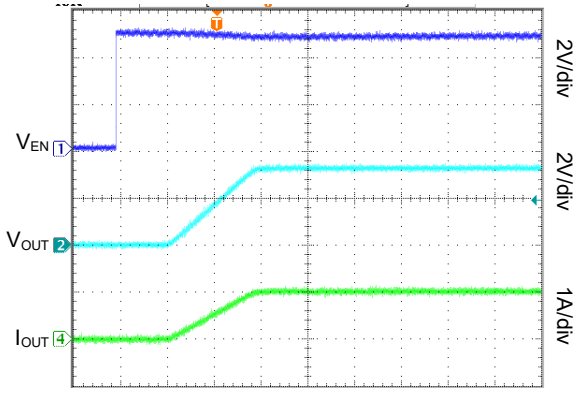
Thermal Derating



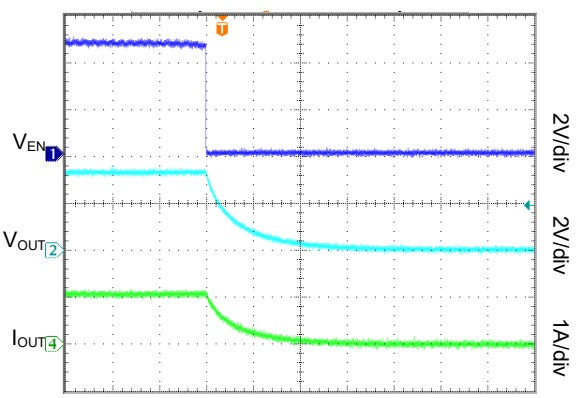
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = +25℃, V_{IN} = 5V, V_{OUT} = 3.3V, C_{IN} = 10μF + 0.1μF, and C_{OUT} = 4.7μF, unless other noted.

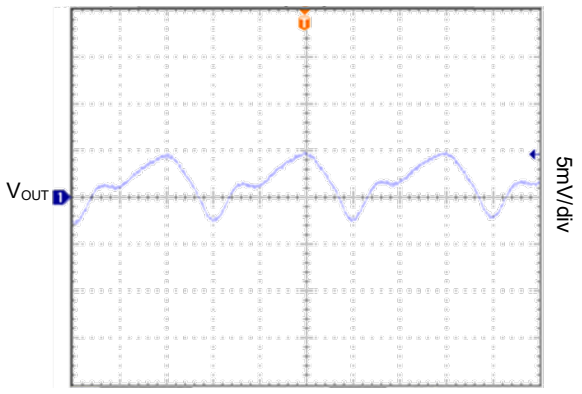
Startup (I_{OUT} = 1A)



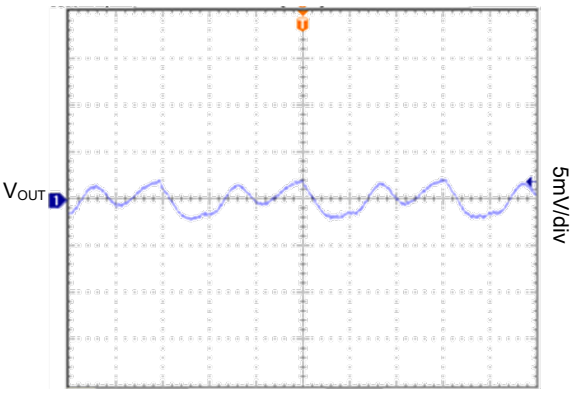
Shutdown (I_{OUT} = 1A)



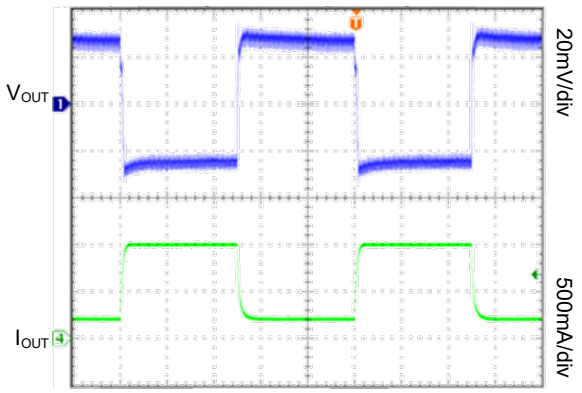
Output Ripple (I_{OUT} = 0A)



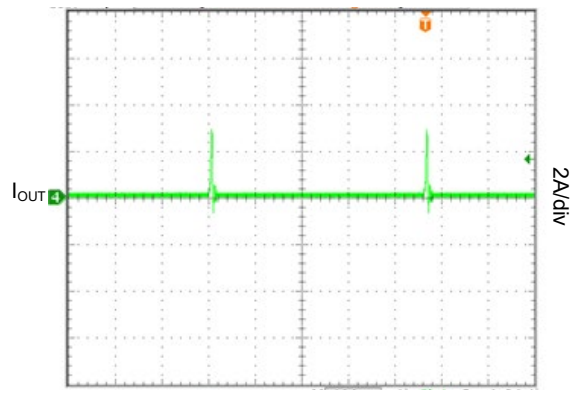
Output Ripple (I_{OUT} = 1A)



Load Transient Response (I_{OUT} = 0.2A to 1.0A)



SCP Hiccup



FUNCTIONAL BLOCK DIAGRAM

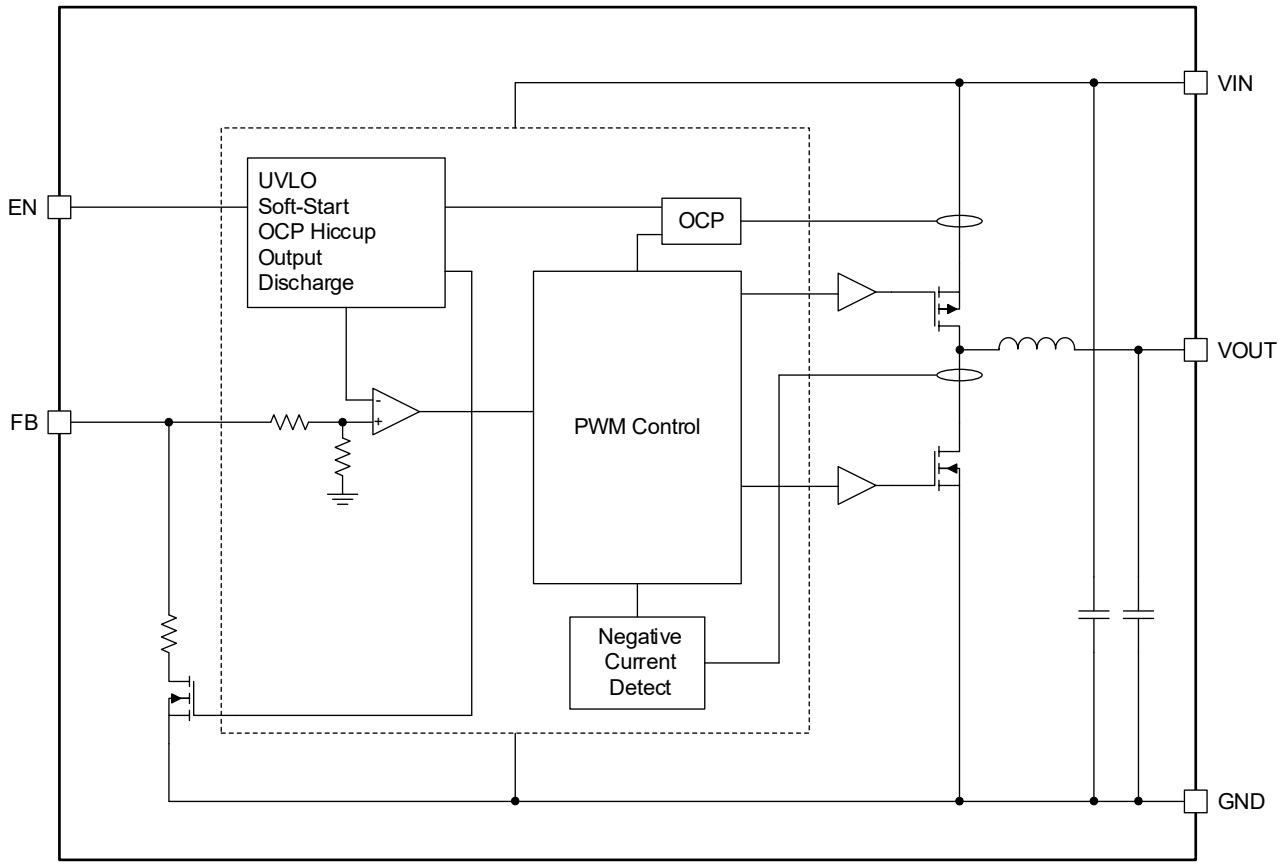


Figure 2. Block Diagram

DETAILED DESCRIPTION

Overview

The GRM2010 is synchronous DC/DC PowerSoC available with switching frequency up to 10MHz. Operating from an input voltage between 2.3V and 5.5V, the PowerSoC can deliver up to 1A of load current at a fixed output voltage.

Enable

Setting the EN pin to logic high enables the device. Alternatively, the device is disabled when the EN voltage is set to logic low. In this state the IC draws less than 1μA of current and the output is pulled down to ground through a resistive load (R_{DIS}).

Active Output Discharge

When the device is disabled through the EN pin, a discharge path for the output capacitor is created between VOUT and GND through a 17Ω resistor (R_{DIS}).

Under-Voltage Lockout (UVLO)

If the voltage on VIN pin falls below its under-voltage lockout threshold, the device will be disabled. The device resumes operation when the power supply goes back above UVLO threshold.

Soft-Start

When the device is enabled, internal soft-start circuitry causes V_{OUT} to ramp up over a period of 300μs (GRM2010-2.5) to limit inrush current. This feature protects a high impedance source from being pulled to a lower voltage as the device turns on.

Modes of Operation

If the input voltage ever gets too close to the target output voltage, such that regulation can no longer be maintained, the PowerSoC will enter 100% duty cycle mode. In this mode the high-side switch is ON, connecting the input and output together to deliver a voltage as close to the target as possible.

Over-Current Protection

The device has over-current protection to prevent damage to the device and inductor during over-current conditions.

Peak current protection occurs at 1.6A. After hitting 16 consecutive cycles of peak current limit, the output will be disabled. After being disabled for 1.5ms, the device will be re-enabled, and a new soft-start cycle will begin.

Thermal Shutdown

The device thermal shutdown protection is enabled if the chip temperature exceeds +135℃. Once the temperature drops below +120℃, the device will be re-enabled, and a new soft-start cycle will begin.

APPLICATION INFORMATION

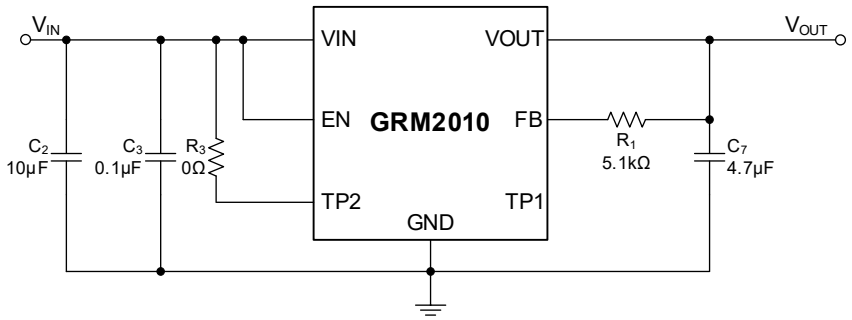


Figure 3. Application Circuit

Table 1. Recommended Components

Output Voltage (V)	Part	Value	Package
1.2, 1.5, 1.6, 1.8, 2.5, 3.3	C_2	10μF, 16V, X7R, ±5%	0805
	C_3	0.1μF, 10V, X7R, ±5%	0603
	C_7	4.7μF, 25V, X7R, ±5%	0603
	R_1	5.1kΩ, ±1%	0603
	R_3	0Ω, ±1%	0603

Layout Guidelines and Example

A well-designed and manufactured PCB is important for all switching power supplies, especially for those operate at high switching frequency.

If the layout is not fulfilled carefully, not only PowerSoC performance could be degraded but also stability or EMI issue may be introduced. Hence, care must be taken in board layout to achieve the specified performance.

Please use the following guidelines when designing PCBs:

- Keep components placement as compact as possible.
- Place a low-ESR input capacitor as close to VIN and GND as possible.
- Minimize the area of TP1 pin trace to limit high frequency radiation.
- Keep FB trace away from noisy components and traces (e.g., TP1).
- Use wide and short traces for the main current paths.
- Ground pins of PowerSoC must be strongly connected to PCB ground with low inductance and impedance.
- Place common and unbroken ground for C_{IN} and C_{OUT}.
- Reduce excessive thermal relief vias and keep them away from TP1.

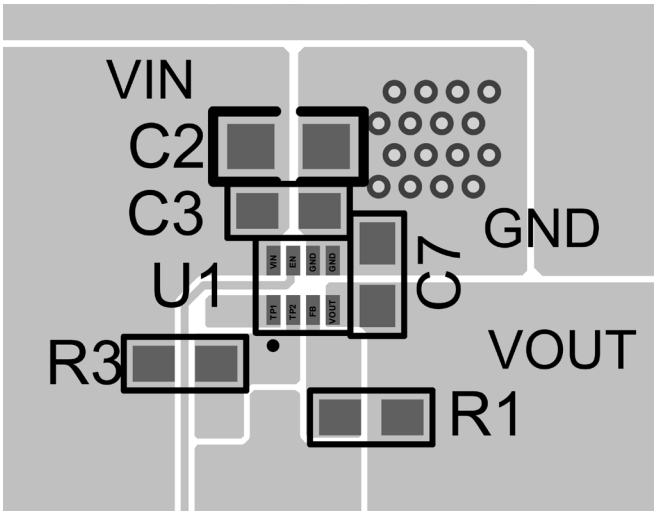


Figure 4. Layout Top Layer

EMI PERFORMANCE

V_{IN} = 5V, V_{OUT} = 1.2V, I_{LOAD} = 1A

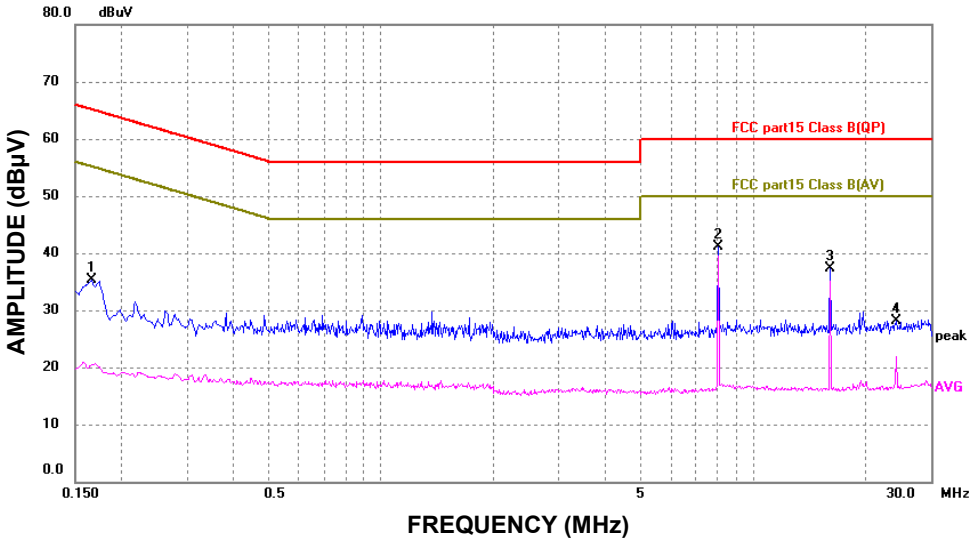


Figure 5. Conducted EMI Measurement

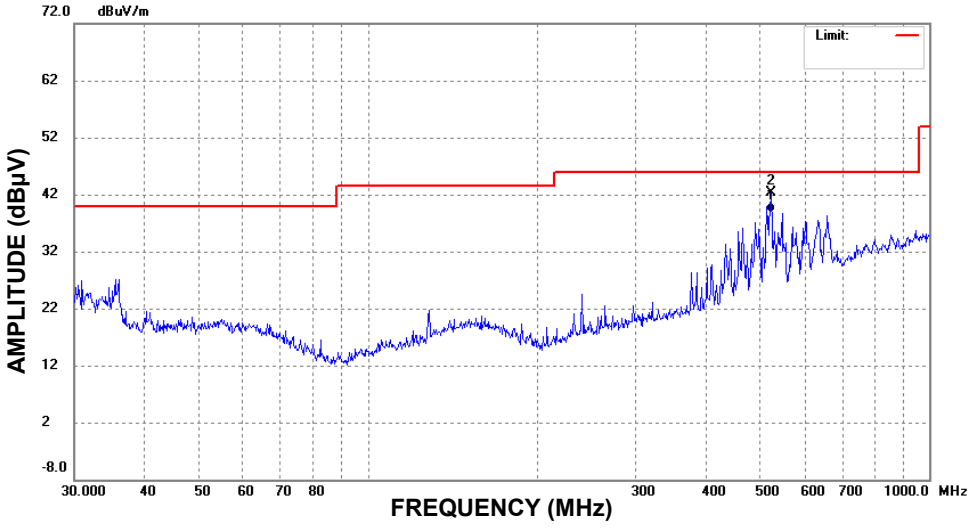


Figure 6. Radiated EMI Measurement

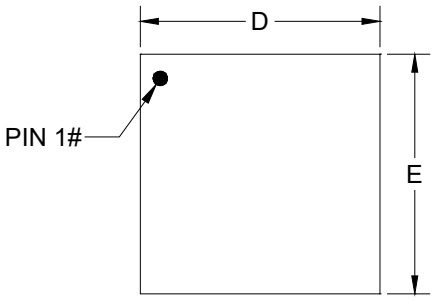
REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

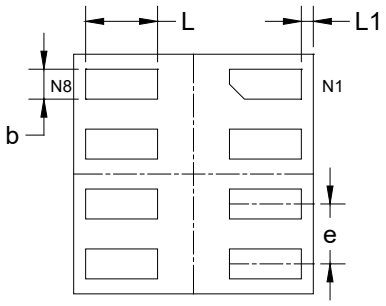
Changes from Original to REV.A (DECEMBER 2025)	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

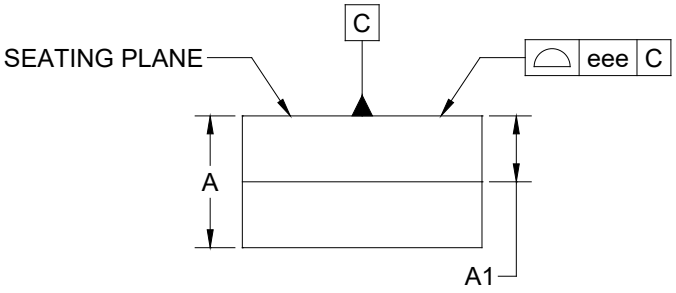
LGA-2×2-8AL



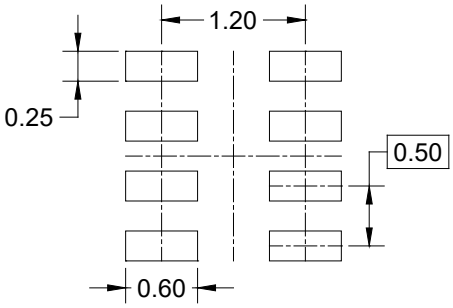
TOP VIEW



BOTTOM VIEW



SIDE VIEW



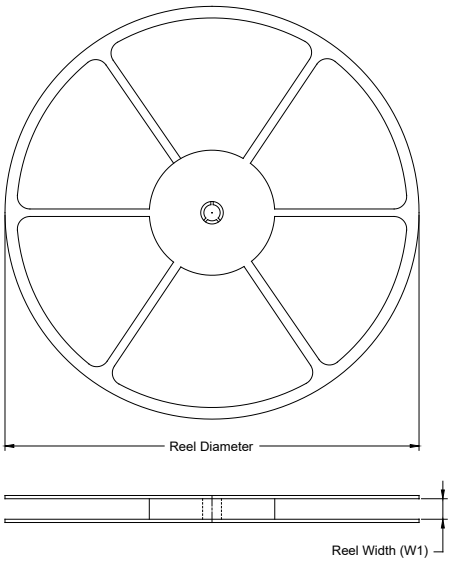
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.100
A1	0.550 REF		
b	0.200	-	0.300
D	1.850	-	2.150
E	1.850	-	2.150
e	0.500 BSC		
L	0.550	-	0.650
L1	0.100 REF		
eee	0.100		

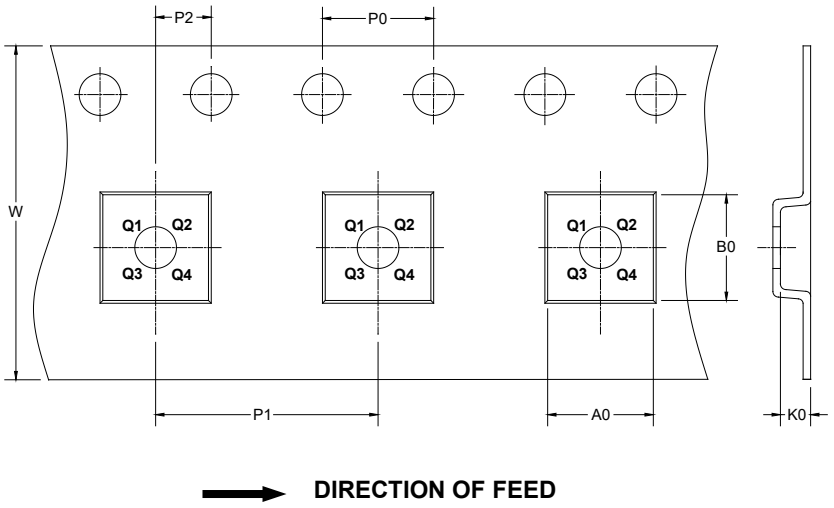
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



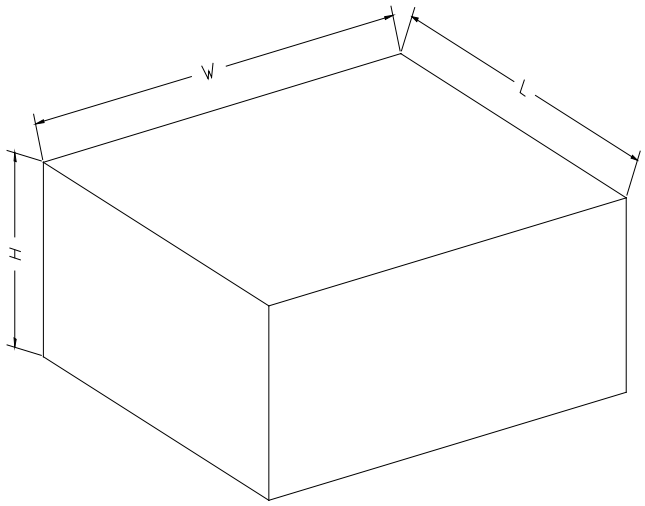
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
LGA-2×2-8AL	7"	9.5	2.3	2.3	1.2	4	4	2	8	Q1

DD0001

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7″ (Option)	368	227	224	8
7″	442	410	224	18

DD0002