

10A Fully-Integrated Synchronous Boost Converter

Features

- 2.7V ~ 12V Input Voltage Operation.
- 4.5V ~ 12.6V Output Voltage Range
- 91% Efficient DC/DC Converter
- 10A Switch Current
- Resistor-Programmable Switch Peak Current Limit
- Adjustable Switching Frequency: 200kHz to 2.2MHz
- 4ms Built-in Soft Start Time
- Output Overvoltage Protection at 13.2V
- Cycle-by-Cycle Overcurrent Protection
- Built-In OTP Protection
- AQFN2.5X2.0-11 Package.

Applications

- Battery-powered Products
- Portable POS terminal
- E-Cigarette
- Power Bank

General Description

The G2281 is a high efficiency, synchronous, COT, boost converter. The G2281 has wide input voltage range from 2.7V to 12V to support applications with single cell or two cell Lithium batteries. The device has 10A switch current capability and is capable of providing an output voltage up to 12.6V.

The G2281 uses adaptive constant off-time peak current control topology to regulated the output voltage. In moderate to heavy load condition, the G2281 works in the PWM mode. In light load condition, the device works in PFM mode. The switching frequency in the PWM mode is adjustable ranging from 200kHz to 2.2MHz by an external resistor. An adjustable switching peak current limit function is also implanted in G2281. In addition, 13.2V output overvoltage protection, cycle-by-cycle overcurrent protection, and thermal shutdown protection are also embedded.

The G2281 is available in AQFN2.5x2.0-11 package.

Ordering Information

ORDER NUMBER	MARKING	TEMP. RANGE	PACKAGE (Green)
G2281M91D	2281	-40°C~+85°C	AQFN2.5X2.0-11

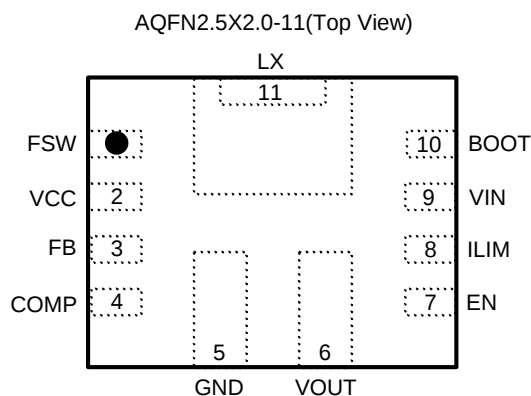
Note: M9: AQFN2.5X2.0-11

1: Bonding code

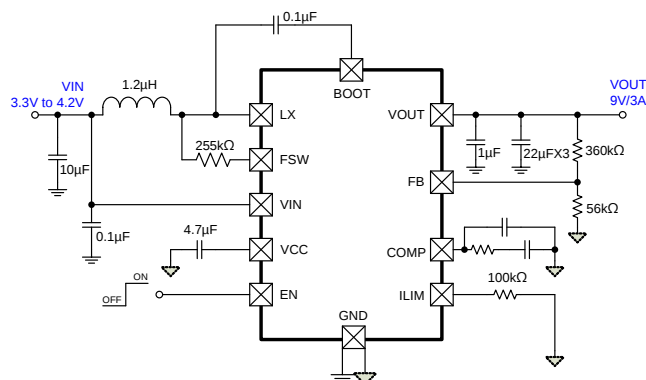
D: Tape & Reel

Green : Lead Free / Halogen Free

Pin Configuration



Typical Application Circuit



Absolute Maximum Ratings

BOOT -0.3V to (LX+7)V
 LX -0.3V to +14.5V (20V for < 5nS)
 VIN, FSW, VOUT -0.3V to +14.5V
 All other Pins -0.3V to +7V
 Thermal Resistance Junction to Ambient (θ_{JA})
 AQFN2.5X2.0-11 38°C/W
 Continuous Power Dissipation ($T_A=25^\circ\text{C}$)
 AQFN2.5X2.0-11 3.45W

Operating Ambient Temperature -40°C to +150°C
 Storage Temperature Range -65°C to +150°C
 Reflow Temperature (soldering, 10 sec) 260°C
 ESD Susceptibility (Human Body Mode) 2KV
 ESD Susceptibility (Machine Mode) 200V

* The package is placed on a 4-layer PCB (1oz). Please refer to EV Board PCB Layout Section.

- Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
- Device is ESD sensitive. Handling precaution recommended. The Human Body model is a 100pF capacitor discharged through a 1.5K Ω resistor into each pin.

Electrical characteristics

($V_{IN}=3.6\text{V}$, $V_{OUT}=9\text{V}$, $T_A=25^\circ\text{C}$, unless otherwise specified)

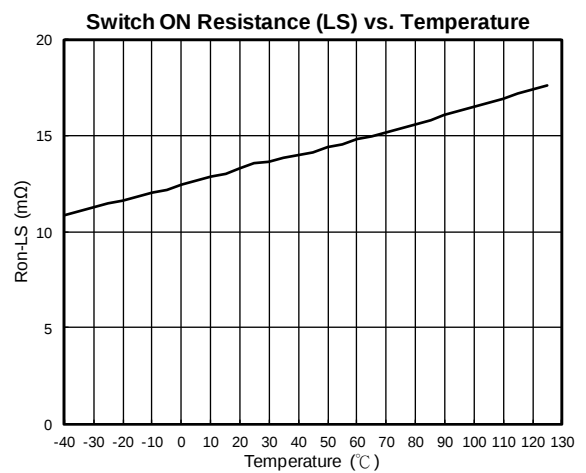
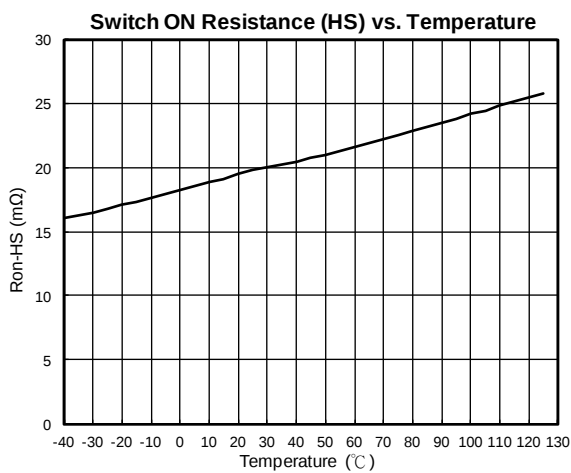
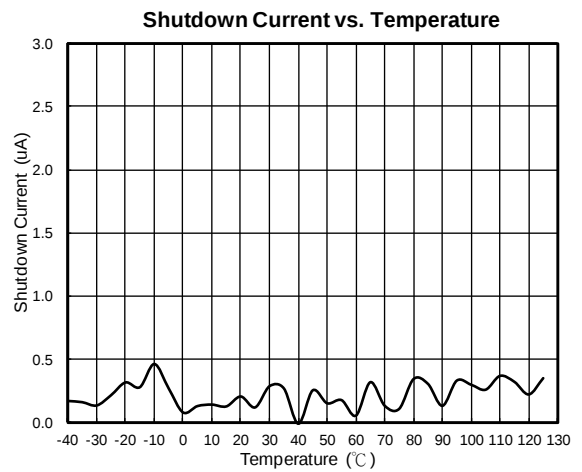
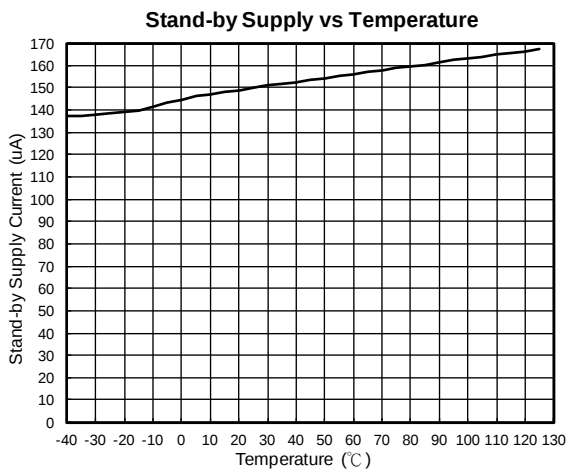
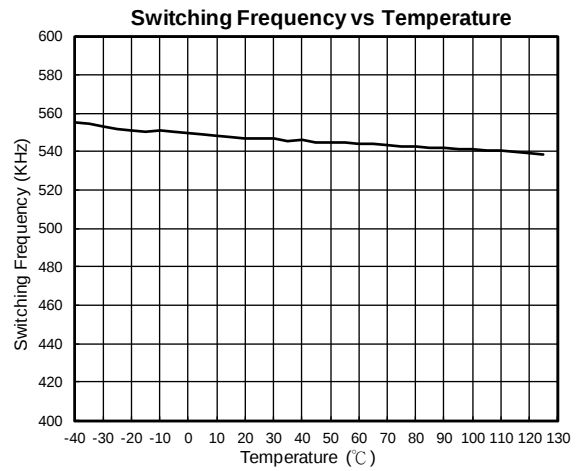
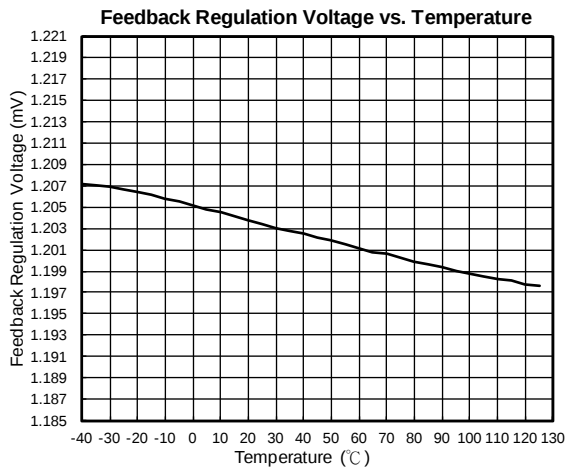
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
GENERAL						
VIN Operating Voltage	V_{VIN}		2.7	---	12	V
VIN Under Voltage Threshold	V_{VINR_UVLO}	VIN rising	---	2.6	2.7	V
	V_{VINL_UVLO}	VIN falling	---	2.4	2.5	V
VCC Under Voltage Threshold	V_{VCC_UVLO}		---	1.9	---	V
Stand-by Supply Current	I_{VIN}	IC enabled, Zero output loading, $V_{FB}=1.3\text{V}$,	---	1	3	μA
	I_{VOUT}	$V_{OUT}=12\text{V}$, $R_{ILIM}=100\text{k}\Omega$	---	130	250	μA
Shutdown Current	I_{SD}	IC disabled, $V_{EN}=0\text{V}$	---	1	3	μA
Boost Converter						
Output Voltage Range	V_{OUT}		4.5	---	12.6	V
Feedback Regulation Voltage	V_{REF}		1.185	1.203	1.221	V
FB pin leakage current	I_{LKG_FB}	$V_{FB}=1.2\text{V}$	---	---	100	nA
Soft-start time	T_{SS}		2	4	6	mS
COMP sink current	I_{SINK_COMP}	$V_{FB}=V_{REF}+200\text{mV}$, $V_{COMP}=1.5\text{V}$	19	24	29	μA
COMP source current	I_{SOURCE_COMP}	$V_{FB}=V_{REF}-200\text{mV}$, $V_{COMP}=1.5\text{V}$	19	24	29	μA
High clamp voltage at COMP pin	V_{CCLPH}	$V_{FB}=1\text{V}$, $R_{ILIM}=100\text{k}\Omega$	---	2.02	---	V
Low clamp voltage at COMP pin	V_{CCLPL}	$V_{FB}=1.5\text{V}$, $R_{ILIM}=100\text{k}\Omega$	---	1.28	---	V
Error Amplifier transconductance	G_{EA}	$V_{COMP}=1.5\text{V}$	160	190	230	$\mu\text{A/V}$
Switching Frequency	F_{SW}	$R_{FSW}=255\text{k}\Omega$, $V_{IN}=3.3\text{V}$, $V_{OUT}=9\text{V}$	500	600	700	kHz
Minimum on time	t_{ON_min}	$R_{FSW}=255\text{k}\Omega$, $V_{IN}=3.3\text{V}$, $V_{OUT}=9\text{V}$	100	130	200	ns
Switch ON Resistance	R_{ON_HS}	High side MOSFET	---	27	44	$\text{m}\Omega$
	R_{ON_LS}	Low side MOSFET	---	19	31	$\text{m}\Omega$
Peak Current Limit Threshold	I_{LIM_1}	$R_{ILIM}=127\text{k}\Omega$	7.3	8.1	8.9	A
	I_{LIM_2}	$R_{ILIM}=100\text{k}\Omega$	9.3	10.3	11.3	
ILIM Reference Voltage	V_{ILIM}		1.185	1.203	1.221	V

Electrical characteristics (Continued)

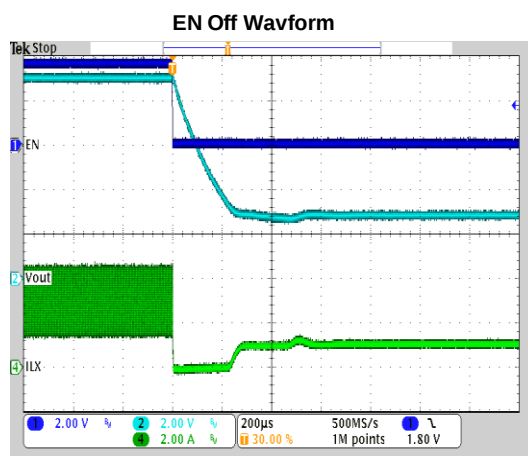
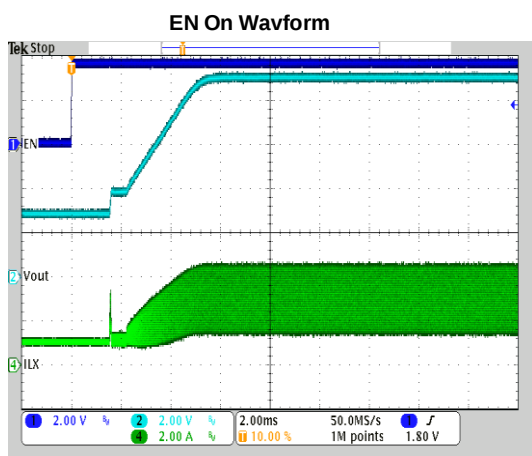
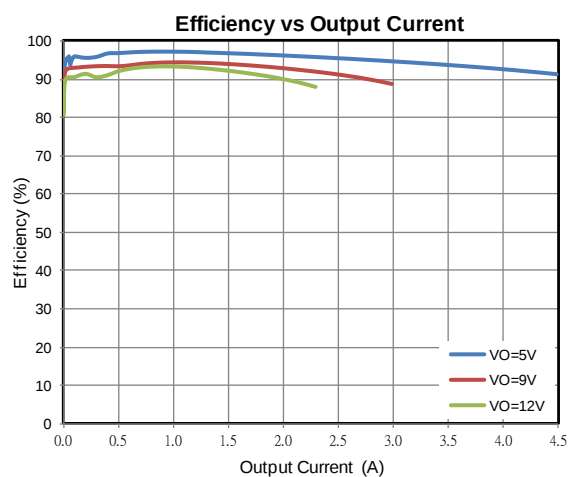
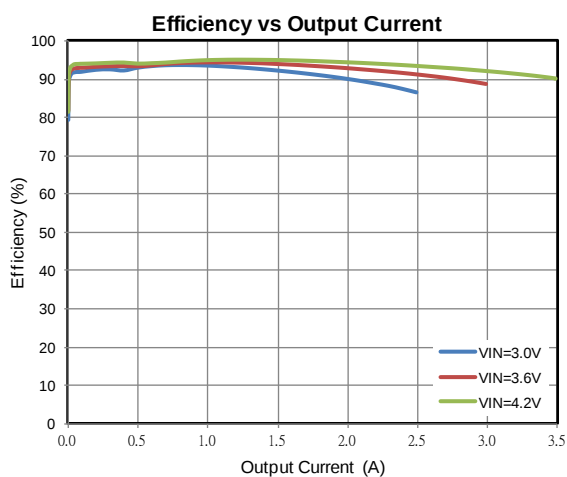
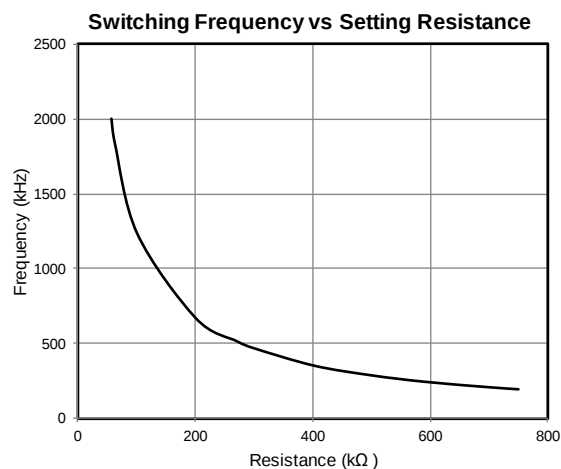
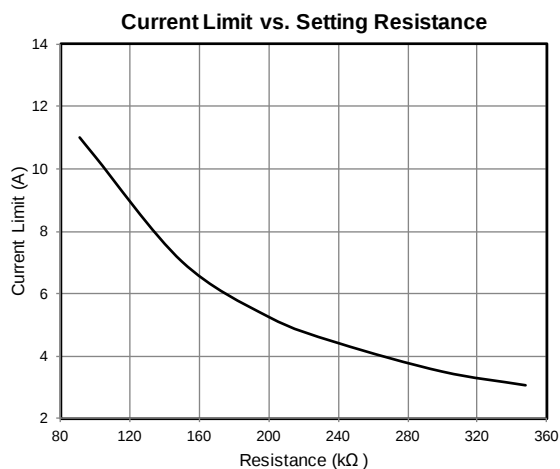
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Protection						
Output overvoltage protection threshold	V_{OVP}	V_{OUT} rising	12.7	13.2	13.6	V
Thermal Shutdown Detect	T_{SD}		---	150	---	°C
Thermal Shutdown Hysteresis	ΔT_{SD}		---	20	---	°C
Control Signal						
EN Logic-Input Threshold	V_{TH}	High threshold	1.2	---	---	V
	V_{TL}	Low threshold	---	---	0.4	V
EN internal pull-down resistance	R_{EN}		---	800	---	k Ω

Typical Performance Characteristics

(VIN=3.6V, VOUT=9V, L1=1.5uH, TA=25 °C, unless otherwise noted.)

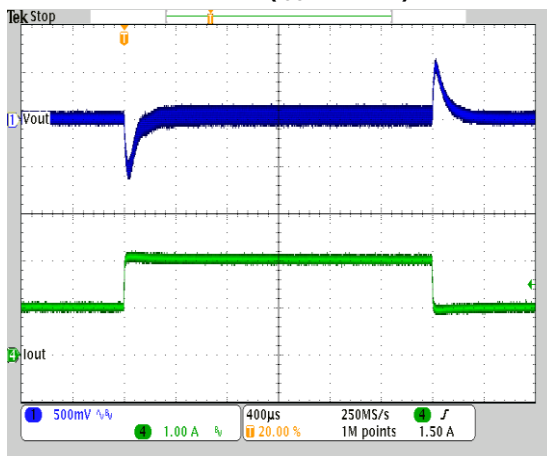


Typical Performance Characteristics (continued)

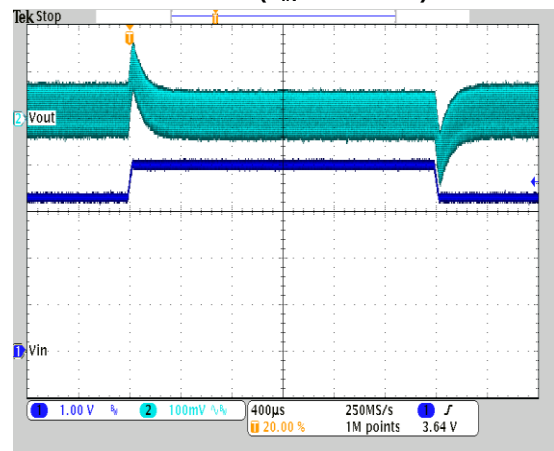


Typical Performance Characteristics (continued)

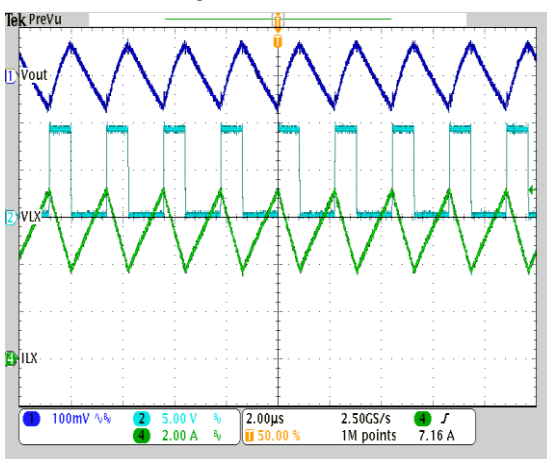
Load Transient ($I_{OUT}=1$ to 2A)



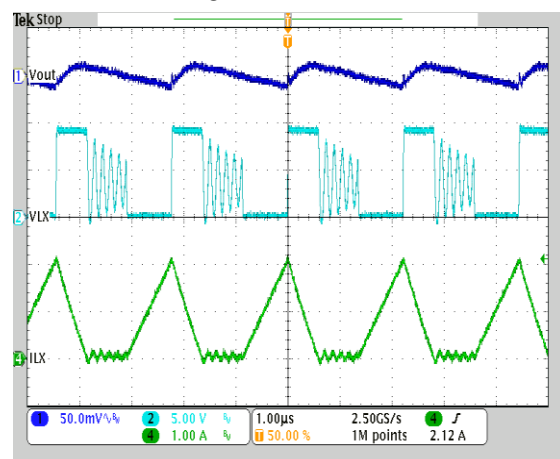
Line Transient ($V_{IN}=3.3$ to 4.0V)



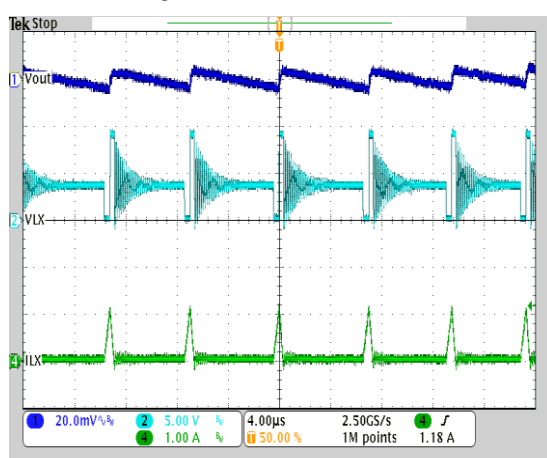
Switching Waveforms in CCM



Switching Waveforms in DCM



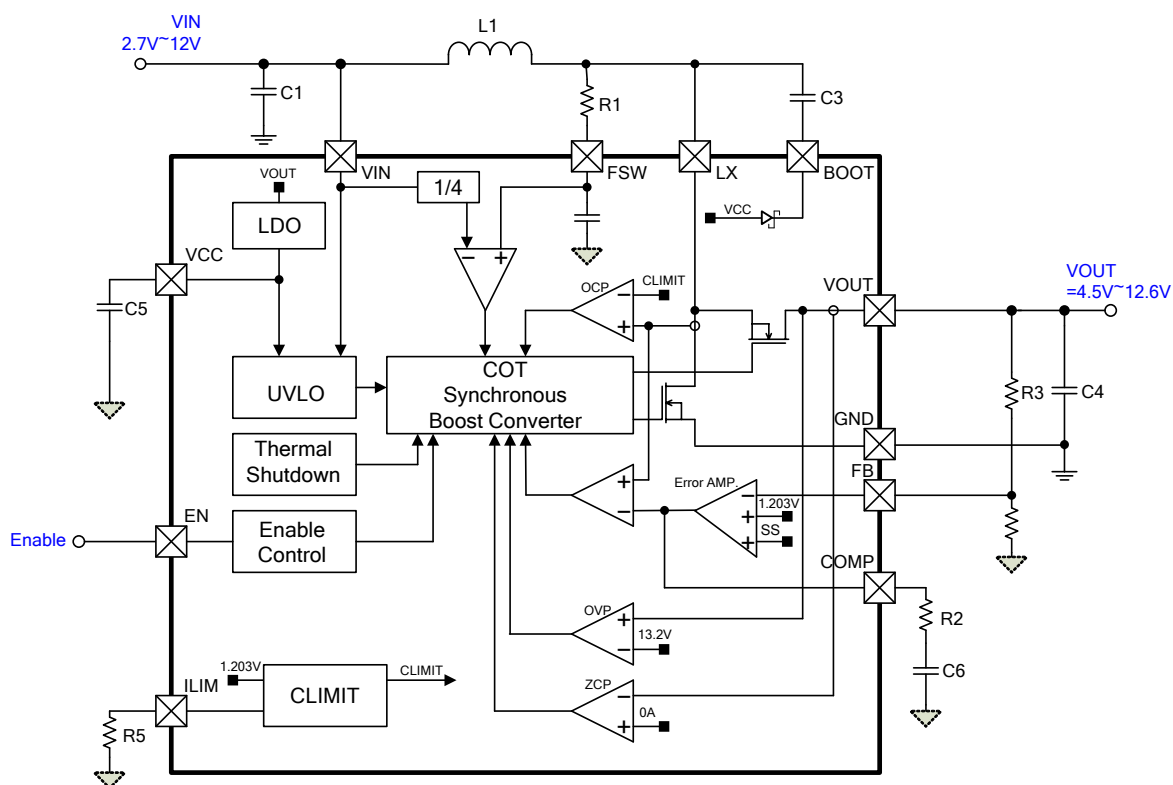
Switching Waveforms in PFM Mode



Pin Description

Pin No	NAME	FUNCTION
1	FSW	The switching frequency is programmed by a resistor between this pin and the LX pin.
2	VCC	Output of the internal regulator. Bypass with a 1uF or greater ceramic capacitor to GND
3	FB	Voltage feedback. Connect to the center tape of a resistor divider to program the output voltage.
4	COMP	Output of the internal error amplifier, the loop compensation network should be connected between this pin and the GND pin.
5	GND	Ground of the IC
6	VOU	Output Voltage of Boost Converter.
7	EN	Chip Enable Control Input.
8	ILIM	Adjustable switch peak current limit. An external resister should be connected between this pin and the GND pin.
9	VIN	Power supply input of Boost Converter. Bypass with a 10uF or greater ceramic capacitor to GND.
10	BOOT	Power supply for high-side MOSFET gate driver. A ceramic capacitor of 0.1uF must be connected between this pin and the LX pin.
11	LX	Inductor switch node of Boost Converter.

Block Diagram



Function Description

Soft-Start

The G2281 has a built-in soft start function to prevent high inrush current during start-up. When the EN pin is pulled high, the G2281 begins soft start. The soft start time is typically 4ms.

Under Voltage Lockout

The G2281 has both VIN UVLO and VCC UVLO function. When the voltage at the VIN pin drops below UVLO threshold V_{IN_UVLO} (2.4V typ.), which is typically 2.4V, or the voltage of VCC drops below V_{CC_UVLO} (1.9V typ.), the device stops switching.

Adjustable Switching Frequency

The switching frequency is set by resistor connected between FSW pin and the LX pin of the G2281. The resistor value required for a desired frequency can be calculated using equation as below:

$$R_{FREQ} = \frac{\frac{V_{IN}}{V_{OUT}} \times \frac{1}{f_{SW}} - t_{DELAY}}{C_{FREQ} \times \ln\left(\frac{4 \times V_{OUT}}{4 \times V_{OUT} - V_{IN}}\right)}$$

Where

- ♦ R_{FREQ} is the resistance connected between the FSW pin and the LX pin
- ♦ $C_{FREQ}=23pF$
- ♦ f_{SW} is the desired switching frequency
- ♦ $t_{DELAY}=50ns$
- ♦ V_{IN} is the input voltage
- ♦ V_{OUT} is the output voltage

Adjustable Peak Current Limit

The internal cycle-by-cycle current limit is adopted in the G2281. The low-side switch is turned off immediately as soon as the switch current touches the limit, set by a resistor at the ILIM pin to ground.

The current limit is set using the equation as below:

$$I_{LIM} = \frac{1030000}{R_{ILIM}}$$

Where

- ♦ R_{ILIM} is the resistance between the ILIM pin and ground
- ♦ I_{LIM} is the switch peak current limit

When the resistor value is 100k Ω , the current limit is 10.3A.

Overvoltage Protection

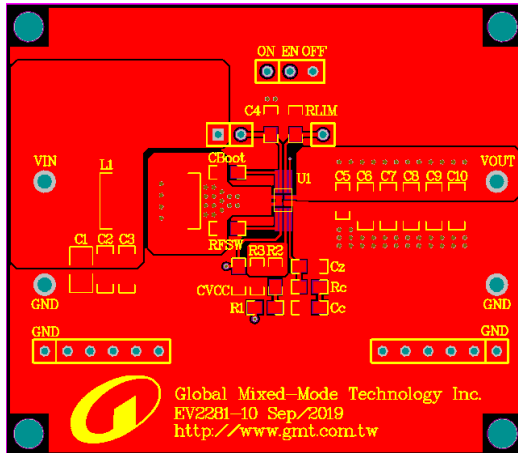
If the output voltage at the VOUT pin is detected above 13.2V, the G2281 turn off the low-side switch immediately, and turn on the high-side switch. The high-side switch is kept in on state until the zero-current threshold is detected. When the output voltage drops below the overvoltage threshold, the low-side switch is turn on. This function prevents overvoltage on the output and secures the circuits connected to the output from excessive overvoltage.

Thermal Shutdown

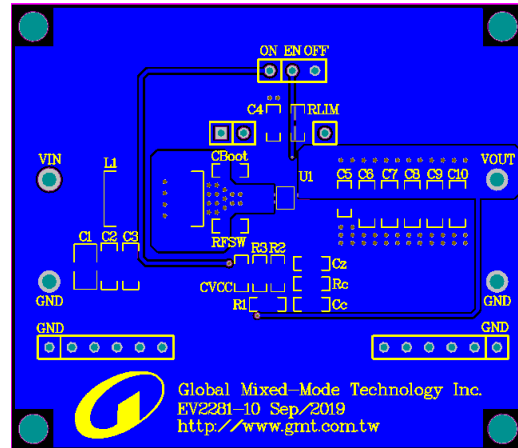
A thermal shutdown is implemented to prevent damage due to excessive heat and power dissipation. Typically, the thermal shutdown happens at a junction temperature of 150°C. When the thermal shutdown is triggered, the device stops switching until the junction temperature fall below typically 130°C, the the device starts switching again.

PCB layout

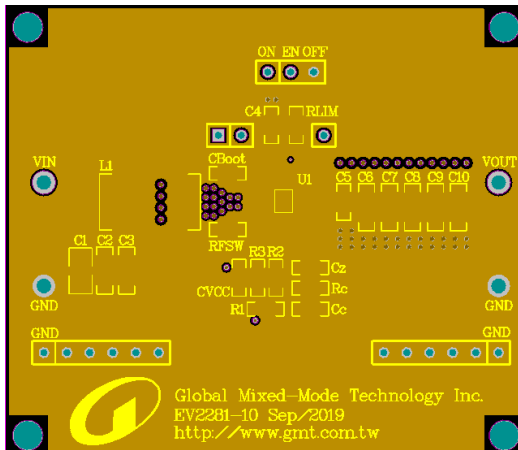
Top Layer



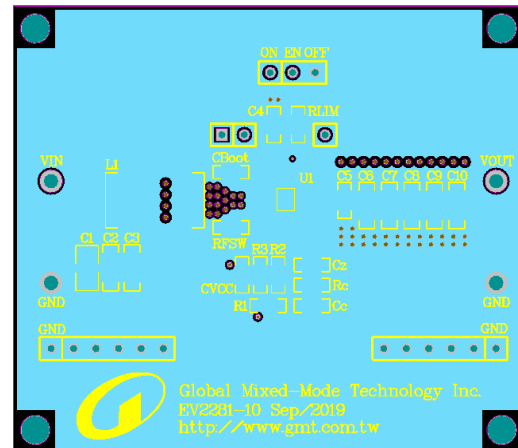
Bottom Layer

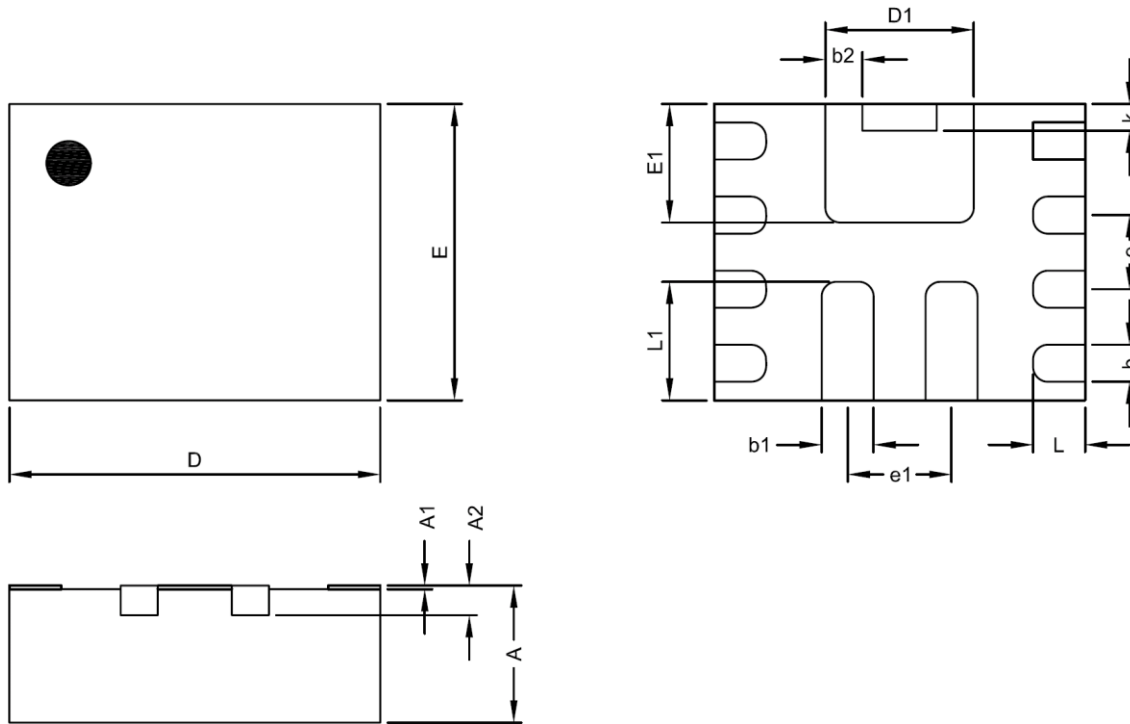


Internal Layer 1 (GND)

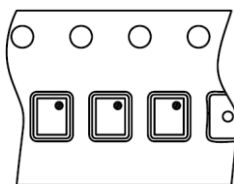


Internal Layer 2 (GND)



Package Information

AQFN2.5X2.0-11 Package

Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.80	0.90	1.00	0.0315	0.0354	0.0394
A1	0.00	---	0.05	0.0000	---	0.0020
A2	0.20 REF			0.0079 REF		
D	2.40	2.50	2.60	0.0945	0.0984	0.1024
E	1.90	2.00	2.10	0.0748	0.0787	0.0827
D1	0.90	1.00	1.10	0.0354	0.0394	0.0433
E1	0.70	0.80	0.90	0.0276	0.0315	0.0354
b	0.20	0.25	0.30	0.0079	0.0098	0.0118
b1	0.30	0.35	0.40	0.0118	0.0138	0.0157
b2	0.25 REF			0.0098 REF		
e	0.50 BSC			0.0197 BSC		
e1	0.70 BSC			0.0276 BSC		
L	0.25	0.35	0.45	0.0098	0.0138	0.0177
L1	0.70	0.80	0.90	0.0276	0.0315	0.0354
K	0.18 REF			0.0071 REF		

Taping Specification


Feed Direction

PACKAGE	Q'TY/REEL
AQFN2.5X2.0-11	3,000 ea

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