160A DC-DC Step-Down Power Converter Chip-Scale Module

Features

- 16 phase buck converter with fully integrated power switches and inductors
- Peak efficiency of 90 % for 1.8 V to 0.75 V conversion with 96 A output current
- Efficiency of 89 % for 1.8 V to 0.75 V conversion with 160 A output current
- Wide loop bandwidth: 5MHz
- Differential point-of-load (PoL) sensing
- Gang operation up to 64 devices in parallel
- Automatic phase shedding
- Telemetry: Input Voltage, Output Voltage, Output Current and Temperature
- Fault response: UVLO, OVP, UVP, OCP, OCP Warn, VRHOT, and OTP
- 1 MHz PMBus 1.4 compliant serial interface
- 50 MHz AVSBus 2.0 compliant serial interface enabling Dynamic Voltage Scaling (DVS)

Applications

- High performance multi-core systems-on-chip
- GPUs, TPUs, ASICs and FPGAs
- Data center processors

General Description

The Fe1766 is a single output, 16-phase interleaved buck converter with a fully integrated powertrain, including power inductors. The Fe1766's digital interface provides complete power management and monitoring with fast and precise voltage control, fast transient response times, and high bandwidth regulation. Its high switching frequency powertrain includes high performance FETs and capacitors that drive the industry's most advanced power inductors, all in a single device. Its tiny size delivers the best in class current density; reducing board area, layout complexity, and component count.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
VIN Voltage Range	V_{IN}	AVDD18 $\geq V_{IN}$	1.2	1.8	2.0	V
Output Voltage Range	V_{OUT}	$V_{IN} \geq$ 1.8V	0.25		1.5	V
Conversion Ratio	$M = \frac{V_{OUT}}{V_{IN}}$	$V_{IN} <$ 1.8V			83.3	%
Output Voltage Resolution	$V_{OUT,RES}$			1.7		mV
Steady State Output Current	$I_{OUT,TDC}$				160	A
Number of Powertrain Phases	N_{PHASES}		2		16	Phases
Width	W		4.400	4.420	4.440	mm
Length	L		8.010	8.030	8.050	mm
Area	A			35.5		mm^2
Thickness	T		0.954	0.974	0.994	mm
Current Density (TDC)	$j_{max,TDC}$				4.5	$\frac{A}{mm^2}$
DC Line Regulation	$\left(\frac{\Delta V_{OUT}}{V_{OUT}}\right)_{Line}$	V_{IN}=[1.2,2.0]V		$\pm$ 0.5		%
DC Load Regulation	$\left(\frac{\Delta V_{OUT}}{V_{OUT}}\right)_{Load}$	I_{OUT}=[0,160]A		$\pm$ 0.5		%
Switching Frequency	f_{SW}		5	15	100	MHz
Junction Temperature	T_J		-40		125	°C
Thermal Resistance Junction to Top	$\Theta_{JC,TOP}$			0.2		$\frac{°C}{W}$
Thermal Resistance Junction to Bottom	$\Theta_{JC,BOT}$			3.1		$\frac{°C}{W}$