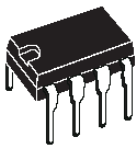
VIPer53 - E

OFF-line primary switch

General features

Type	European (195 - 265Vac)	US / Wide range (85 - 265 Vac)
DIP-8	50W	30W
PowerSO-10™	65W	40W

PowerSO-10



DIP-8

Features

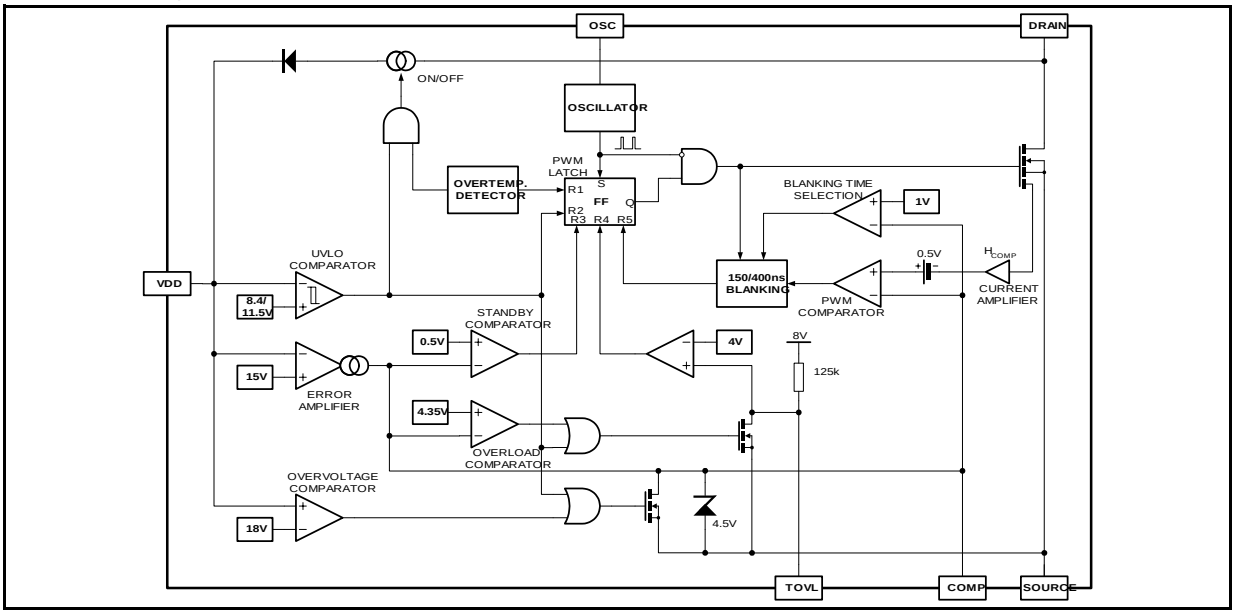
- Switching frequency up to 300kHz
- Current limitation
- Current mode control with adjustable limitation
- Soft start and shut-down control
- Automatic burst mode in standby condition (“Blue Angel“ compliant)
- Undervoltage lockout with Hysteresis
- HIgh voltage star-tup current source
- Overtemperature protection
- Overload and short-circuit control

Description

The VIPer53-E combines an enhanced current mode PWM controller with a high voltage MDMesh Power Mosfet in the same package. Typical applications cover offline power supplies with a secondary power capability ranging up to 30W in wide range input voltage, or 50W in single European voltage range and DIP-8 package, with the following benefits:

- Overload and short circuit controlled by feedback monitoring and delayed device reset.
- Efficient standby mode by enhanced pulse skipping.
- Primary regulation or secondary loop failure protection through high gain error amplifier.

Block diagram



1 Electrical data

1.1 Maximum rating

Stressing the device above the rating listed in the “Absolute Maximum Ratings” table may cause permanent damage to the device. These are stress ratings only and operation of the device at these or any other conditions above those indicated in the Operating sections of this specification is not implied. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability. Refer also to the STMicroelectronics SURE Program and other relevant quality documents.

Table 1. Absolute maximum rating

Symbol	Parameter	Value	Unit
V_{DS}	Continuous drain source voltage (T_J= 25 ... 125°C) (1)	-0.3 ... 620	V
I_D	Continuous drain current	Internally limited	A
V_{DD}	Supply voltage	0 ... 19	V
V_{OSC}	OSC input voltage range	0 ... V_{DD}	V
I_{COMP} I_{TOVL}	COMP and TOVL input current range (1)	-2 ... 2	mA
V_{ESD}	Electrostatic discharge: Machine model (R = 0Ω; C = 200pF) Charged device model	 200 1.5	 V kV
T_J	Junction operating temperature	Internally limited	°C
T_C	Case operating temperature	-40 to 150	°C
T_{STG}	Storage temperature	-55 to 150	°C

1. In order to improve the ruggedness of the device versus eventual drain overvoltages, a resistance of 1kΩ should be inserted in series with the TOVL pin.\

1.2 Thermal data

Table 2. Thermal data

Symbol	Parameter		PowerSO-10 (1)	DIP-8 (2)	Unit
R_{thJC}	Thermal Resistance Junction-case	Max	2	20	°C/W
R_{thJA}	Thermal Resistance Ambient-case	Max	60	80	°C/W

1. When mounted on a standard single-sided FR4 board with 50mm² of Cu (at least 35 mm thick) connected to the DRAIN pin.
2. When mounted on a standard single-sided FR4 board with 50mm² of Cu (at least 35 mm thick) connected to the device tab.

2 Electrical characteristics

T_J = 25°C, V_{DD} = 13V, unless otherwise specified

Table 3. Power section

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-source voltage	I_D = 1mA; V_{COMP} = 0V	620			V
I_{DSS}	Off state drain current	V_{DS} = 500V; V_{COMP} = 0V; T_J = 125°C			150	µA
$R_{DS(on)}$	Static drain-source On state resistance	I_D = 1A; V_{COMP} = 4.5V; V_{TOVL} = 0V T_J = 25°C T_J = 100°C		0.9	 1 1.7	 Ω Ω
t_{fv}	Fall time	I_D = 0.2A; V_{IN} = 300V (1)		100		ns
t_{rv}	Rise time	I_D = 1A; V_{IN} = 300V (1)		50		ns
C_{oss}	Drain capacitance	V_{DS} = 25V		170		pF
C_{Eon}	Effective output capacitance	200V < V_{DSon} < 400V (2)		60		pF

1. On clamped inductive load
2. This parameter can be used to compute the energy dissipated at turn on E_{ton} according to the initial drain to source voltage V_{DSon} and the following formula:

$$E_{ton} = \frac{1}{2} \cdot C_{Eon} \cdot 300^2 \cdot \left(\frac{V_{DSon}}{300}\right)^{1.5}$$

Table 4. Oscillator section

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
F_{OSC1}	Oscillator frequency initial accuracy	R_T = 8kΩ; C_T = 2.2nF *Figure 12 on page 12*	95	100	105	kHz
F_{OSC2}	Oscillator frequency total variation	R_T = 8kΩ; C_T = 2.2nF *Figure 16 on page 14* V_{DD} = V_{DDon} ... V_{DDovp}; T_J = 0 ... 100°C	93	100	107	kHz
V_{OSChi}	Oscillator peak voltage			9		V
V_{OSClo}	Oscillator valley voltage			4		V

Table 5. Supply section

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{DSstart}$	Drain voltage starting threshold	V_{DD} = 5V; I_{DD} = 0mA		34	50	V
I_{DDch1}	Startup charging current	V_{DD} = 0 ... 5V; V_{DS} = 100V *Figure 5 on page 10*		-12		mA
I_{DDch2}	Startup charging current	V_{DD} = 10V; V_{DS} = 100V *Figure 5.*		-2		mA
$I_{DDchoff}$	Startup charging current in thermal shutdown	V_{DD} = 5V; V_{DS} = 100V *Figure 7.* $T_J > T_{SD} - T_{HYST}$	0			mA
I_{DD0}	Operating supply current not switching	F_{sw} = 0kHz; V_{COMP} = 0V		8	11	mA
I_{DD1}	Operating supply current switching	F_{sw} = 100kHz		9		mA
V_{DDoff}	V_{DD} undervoltage shutdown threshold	*Figure 5 on page 10*	7.5	8.4	9.3	V
V_{DDon}	V_{DD} startup threshold	*Figure 5.*	10.2	11.5	12.8	V
V_{DDhyst}	V_{DD} threshold hysteresis	*Figure 5.*	2.6	3.1		V
V_{DDovp}	V_{DD} Overvoltage shutdown threshold	*Figure 5.*	17	18	19	V

Table 6. Error amplifier section

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{DDreg}	V_{DD} regulation point	I_{COMP} = 0mA *Figure 11. on page 11*	14.5	15	15.5	V
ΔV_{DDreg}	V_{DD} regulation point total variation	I_{COMP} = 0mA; T_J = 0 ... 100°C		2		%
G_{BW}	Unity gain bandwidth	From Input = V_{DD} to Output = V_{COMP} I_{COMP} = 0mA *Figure 14* and *15*		700		kHz
AV_{OL}	Voltage gain	I_{COMP} = 0mA *Figure 14* and *15*	40	45		dB
G_m	DC transconductance	V_{COMP} = 2.5V *Figure 11.*	1	1.4	1.8	mS
V_{COMPlo}	Output low level	I_{COMP} = -0.4mA; V_{DD} = 16V		0.2		V
V_{COMPhi}	Output high level	I_{COMP} = 0.4mA; V_{DD}=14V(1)		4.5		V
I_{COMPlo}	Output sinking current	V_{COMP} = 2.5V; V_{DD} = 16V *Figure 11. on page 11*		-0.6		mA
I_{COMPhi}	Output sourcing current	V_{COMP} = 2.5V; V_{DD}= 14V *Figure 11.*		0.6		mA

1. In order to insure a correct stability of the error amplifier, a capacitor of 10nF (minimum value: 8nF) should always be present on the COMP pin.

Table 7. PWM comparator section

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
H_{COMP}	ΔV_{COMP} / ΔI_{DPEAK}	V_{COMP} = 1 ... 4 V *Figure 10.* dI_D/dt = 0	1.7	2	2.3	V/A
V_{COMPos}	V_{COMP} Offset	dI_D/dt = 0 *Figure 10. on page 11*		0.5		V
I_{Dlim}	Peak drain current limitation	I_{COMP} = 0mA; V_{TOVL} = 0V *Figure 10.* dI_D/dt = 0	1.7	2	2.3	A
I_{Dmax}	Drain current capability	V_{COMP} = $V_{COMPovl}$; V_{TOVL} = 0V dI_D/dt = 0	1.6	1.9	2.3	A
t_d	Current sense delay to Turn-Off	I_D = 1A		250		ns
V_{COMPbl}	V_{COMP} blanking time change threshold	*Figure 6 on page 10*		1		V
t_{b1}	Blanking time	V_{COMP} < V_{COMPBL} *Figure 6.*	300	400	500	ns
t_{b2}	Blanking time	V_{COMP} > V_{COMPBL} *Figure 6.*	100	150	200	ns
t_{ONmin1}	Minimum On time	V_{COMP} < V_{COMPBL}	450	600	750	ns
t_{ONmin2}	Minimum On time	V_{COMP} > V_{COMPBL}	250	350	450	ns
$V_{COMPoff}$	V_{COMP} Shutdown Threshold	*Figure 9 on page 11*		0.5		V

Table 8. Overload protection section

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{COMPovl}$	V_{COMP} overload threshold	I_{TOVL} = 0mA (1) *Figure 4 on page 9*		4.35		V
$V_{DIFFovl}$	V_{COMPhi} to $V_{COMPovl}$ voltage difference	V_{DD} = V_{DDoff} ... V_{DDreg}; I_{TOVL}= 0mA *Figure 4.* (1)	50	150	250	mV
V_{OVLth}	V_{TOVL} overload threshold	*Figure 4.*		4		V
t_{OVL}	Overload delay	C_{OVL} = 100nF *Figure 4.*		8		ms

1. $V_{COMPovl}$ is always lower than V_{COMPhi}

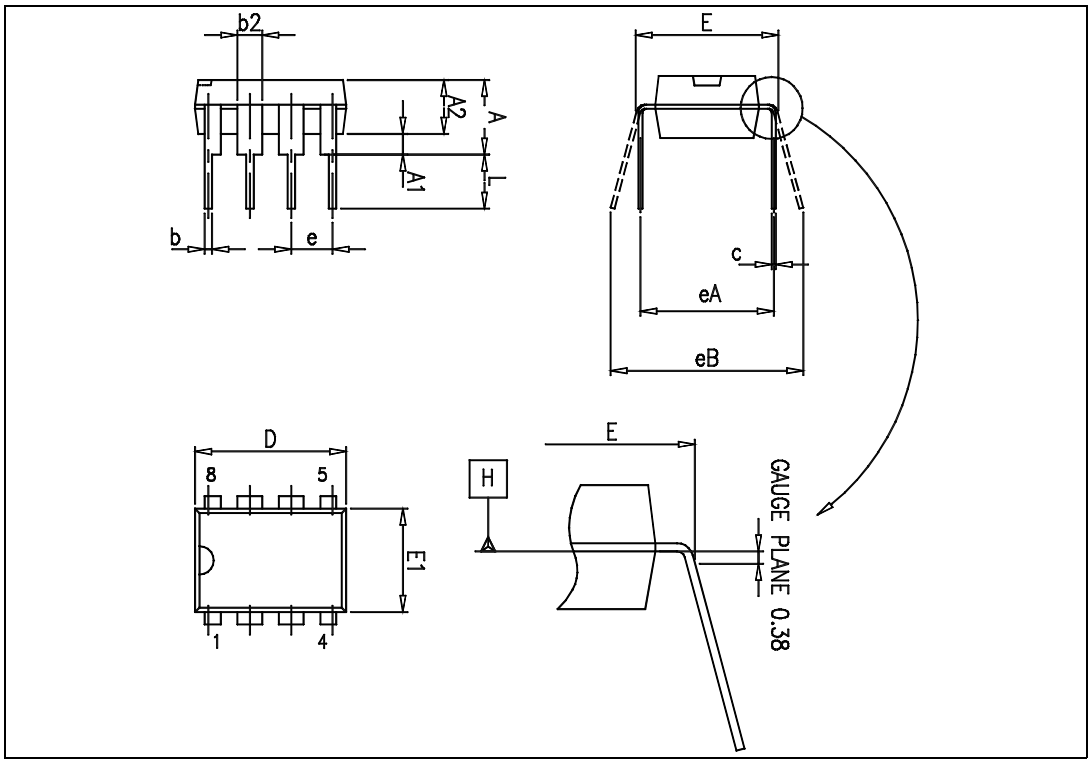
Table 9. Over temperature Protection Section

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
T_{SD}	Thermal shutdown temperature	*Figure 7 on page 10*	140	160		°C
T_{HYST}	Thermal shutdown hysteresis	*Figure 7 on page 10*		40		°C

Table 11. DIP8 mechanical data

Dimensions			
Ref.	Databook (mm)		
	Nom.	Min	Max
A			5.33
A1	0.38		
A2	2.92	3.30	4.95
b	0.36	0.46	0.56
b2	1.14	1.52	1.78
c	0.20	0.25	0.36
D	9.02	9.27	10.16
E	7.62	7.87	8.26
E1	6.10	6.35	7.11
e		2.54	
eA		7.62	
eB			10.92
L	2.92	3.30	3.81
Package Weight	Gr. 470		

Figure 25. Package dimensions



15 Order codes

Table 13. Order codes

Part Number	Package	Shipment
VIPer53DIP-E	DIP-8	Tube
VIPer53SP-E	PowerSO-10	Tube
VIPer53SPTR - E	PowerSO-10	Tape and reel