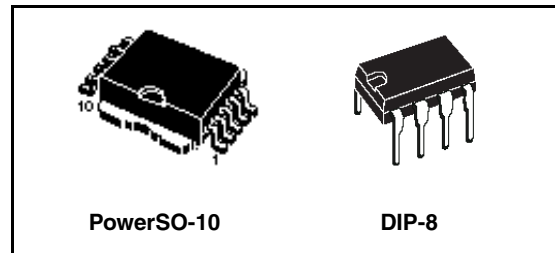


OFF-line primary switch

General features

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



Features

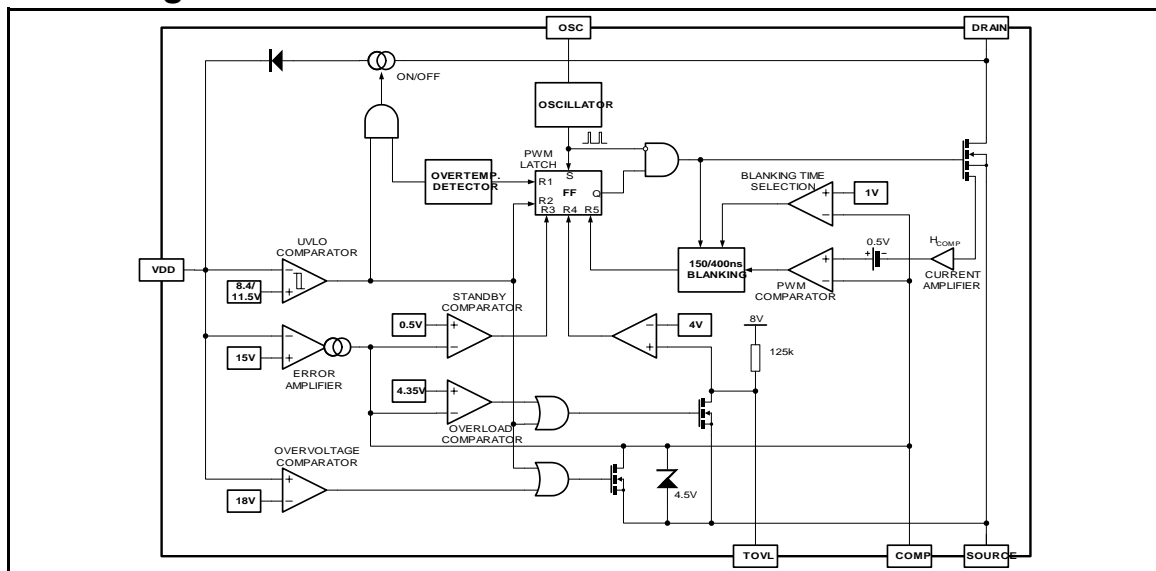
- Switching frequency up to 300kHz
- Current limitation
- Current mode control with adjustable limitation
- Soft start and shut-down control
- Automatic burst mode in standby condition ("Blue Angel" compliant)
- Undervoltage lockout with Hysteresis
- High voltage start-up current source
- Overtemperature 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 ($T_J = 25 \dots 125^\circ\text{C}$) ⁽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 ($R = 0\Omega$; $C = 200\text{pF}$) Charged device model	200 1.5	V kV
T_J	Junction operating temperature	Internally limited	$^\circ\text{C}$
T_C	Case operating temperature	-40 to 150	$^\circ\text{C}$
T_{STG}	Storage temperature	-55 to 150	$^\circ\text{C}$

1. In order to improve the ruggedness of the device versus eventual drain overvoltages, a resistance of $1\text{k}\Omega$ 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	$^\circ\text{C}/\text{W}$
R_{thJA}	Thermal Resistance Ambient-case	Max	60	80	$^\circ\text{C}/\text{W}$

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

2 Electrical characteristics

$T_J = 25^\circ\text{C}$, $V_{DD} = 13\text{V}$, unless otherwise specified

Table 3. Power section

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain-source voltage	$I_D = 1\text{mA}$; $V_{COMP} = 0\text{V}$	620			V
I_{DSS}	Off state drain current	$V_{DS} = 500\text{V}$; $V_{COMP} = 0\text{V}$; $T_J = 125^\circ\text{C}$			150	μA
$R_{DS(on)}$	Static drain-source On state resistance	$I_D = 1\text{A}$; $V_{COMP} = 4.5\text{V}$; $V_{TOVL} = 0\text{V}$ $T_J = 25^\circ\text{C}$ $T_J = 100^\circ\text{C}$		0.9	1 1.7	Ω Ω
t_{fv}	Fall time	$I_D = 0.2\text{A}$; $V_{IN} = 300\text{V}^{(1)}$		100		ns
t_{rv}	Rise time	$I_D = 1\text{A}$; $V_{IN} = 300\text{V}^{(1)}$		50		ns
C_{OSS}	Drain capacitance	$V_{DS} = 25\text{V}$		170		pF
C_{Eon}	Effective output capacitance	$200\text{V} < V_{DSon} < 400\text{V}^{(2)}$		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	$R_T = 8\text{k}\Omega$; $C_T = 2.2\text{nF}$ <i>Figure 12 on page 12</i>	95	100	105	kHz
F_{OSC2}	Oscillator frequency total variation	$R_T = 8\text{k}\Omega$; $C_T = 2.2\text{nF}$ <i>Figure 16 on page 14</i> $V_{DD} = V_{DDon} \dots V_{DDovp}$; $T_J = 0 \dots 100^\circ\text{C}$	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	$V_{DD} = 0 \dots 5V$; $V_{DS} = 100V$ <i>Figure 5 on page 10</i>		-12		mA
I_{DDch2}	Startup charging current	$V_{DD} = 10V$; $V_{DS} = 100V$ <i>Figure 5.</i>		-2		mA
$I_{DDchoff}$	Startup charging current in thermal shutdown	$V_{DD} = 5V$; $V_{DS} = 100V$ <i>Figure 7.</i> $T_J > T_{SD} - T_{HYST}$	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	<i>Figure 5 on page 10</i>	7.5	8.4	9.3	V
V_{DDon}	V_{DD} startup threshold	<i>Figure 5.</i>	10.2	11.5	12.8	V
V_{DDhyst}	V_{DD} threshold hysteresis	<i>Figure 5.</i>	2.6	3.1		V
V_{DDovp}	V_{DD} Overvoltage shutdown threshold	<i>Figure 5.</i>	17	18	19	V

Table 6. Error amplifier section

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{DDreg}	V_{DD} regulation point	$I_{COMP} = 0mA$ <i>Figure 11. on page 11</i>	14.5	15	15.5	V
ΔV_{DDreg}	V_{DD} regulation point total variation	$I_{COMP} = 0mA$; $T_J = 0 \dots 100^\circ C$		2		%
G_{BW}	Unity gain bandwidth	From Input = V_{DD} to Output = V_{COMP} $I_{COMP} = 0mA$ <i>Figure 14 and 15</i>		700		kHz
AV_{OL}	Voltage gain	$I_{COMP} = 0mA$ <i>Figure 14 and 15</i>	40	45		dB
G_m	DC transconductance	$V_{COMP} = 2.5V$ <i>Figure 11.</i>	1	1.4	1.8	mS
V_{COMPl0}	Output low level	$I_{COMP} = -0.4mA$; $V_{DD} = 16V$		0.2		V
V_{COMPh1}	Output high level	$I_{COMP} = 0.4mA$; $V_{DD} = 14V^{(1)}$		4.5		V
I_{COMPl0}	Output sinking current	$V_{COMP} = 2.5V$; $V_{DD} = 16V$ <i>Figure 11. on page 11</i>		-0.6		mA
I_{COMPh1}	Output sourcing current	$V_{COMP} = 2.5V$; $V_{DD} = 14V$ <i>Figure 11.</i>		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}	$\Delta V_{COMP} / \Delta I_{DPEAK}$	$V_{COMP} = 1 \dots 4 \text{ V}$ <i>Figure 10.</i> $dI_D/dt = 0$	1.7	2	2.3	V/A
$V_{COMPpos}$	V_{COMP} Offset	$dI_D/dt = 0$ <i>Figure 10. on page 11</i>		0.5		V
I_{Dlim}	Peak drain current limitation	$I_{COMP} = 0 \text{ mA}$; $V_{TOVL} = 0 \text{ V}$ <i>Figure 10.</i> $dI_D/dt = 0$	1.7	2	2.3	A
I_{Dmax}	Drain current capability	$V_{COMP} = V_{COMPovl}$; $V_{TOVL} = 0 \text{ V}$ $dI_D/dt = 0$	1.6	1.9	2.3	A
t_d	Current sense delay to Turn-Off	$I_D = 1 \text{ A}$		250		ns
V_{COMPbl}	V_{COMP} blanking time change threshold	<i>Figure 6 on page 10</i>		1		V
t_{b1}	Blanking time	$V_{COMP} < V_{COMPBL}$ <i>Figure 6.</i>	300	400	500	ns
t_{b2}	Blanking time	$V_{COMP} > V_{COMPBL}$ <i>Figure 6.</i>	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	<i>Figure 9 on page 11</i>		0.5		V

Table 8. Overload protection section

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

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

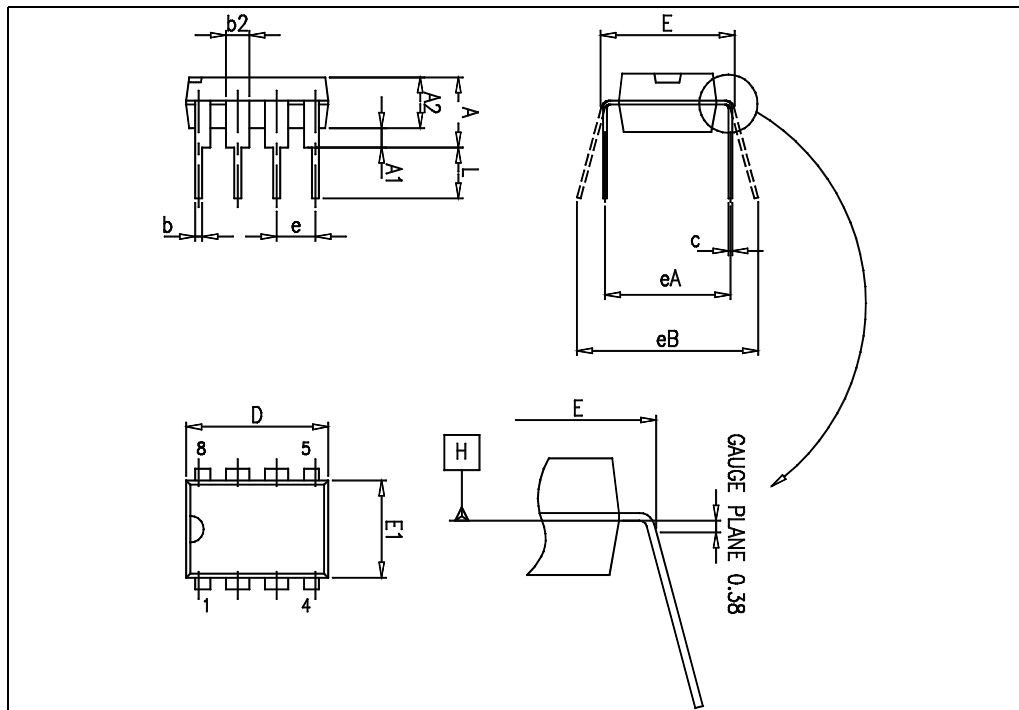
Table 9. Over temperature Protection Section

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