SSL21081/SSL21083

Compact non-dimmable LED driver IC

Rev. 5 — 31 March 2016 Product data sheet

1. General description

The SSL21081/SSL21083 are a range of high-voltage Integrated Circuits (ICs) for driving LED lamps in general mains non-dimmable lighting applications.

The main benefits of these products are:

- Small Printed-Circuit Board (PCB) footprint, and compact solution
- High efficiency (up to 95 %)
- Ease of integration
- Low electronic Bill Of Material (BOM)

These ICs incorporate a 300 V or 600 V MOSFET.

The ICs work as boundary conduction mode converters, typically in buck configuration. The IC range has been designed to start up directly from the HV supply by an internal high-voltage current source. Thereafter, the dV/dt supply is used with capacitive coupling from the drain, or any other auxiliary supply. This function provides full flexibility in the application design. The IC consumes 1.3 mA of supply current with an internal clamp limiting the supply voltage.

The ICs provide accurate output current control with LED current accuracy within 5 %. The ICs can be operated using Pulse-Width Modulation (PWM) current regulation and has many protection features including easy LED temperature feedback.

2. Features and benefits

- LED driver ICs for driving LED strings from a rectified mains supply
- High-efficiency switch mode buck driver product family:
  - SSL21081AT/SSL21081T: drivers with integrated 300 V (DC) power switches
  - SSL21083AT/SSL21083T: drivers with integrated 600 V (DC) power switches
- Controller with power-efficient boundary conduction mode of operation with:
  - No reverse recovery losses in freewheel diode
  - Zero Current Switching (ZCS) for turn-on of switch
  - Zero voltage or valley switching for turn-on of switch
  - Minimal required inductance value and size
- Direct PWM current regulation possible
- Fast transient response through cycle-by-cycle current control:
  - Negligible AC mains ripple at LED current and minimal total capacitor value

    - No over or undershoots in the LED current
- No binning on LED forward voltage required
- Internal Protections:
    - UnderVoltage LockOut (UVLO)
    - Leading-Edge Blanking (LEB)
    - OverCurrent Protection (OCP)
    - Short-Winding Protection (SWP) SSL21081T/SSL21083T only
    - Internal OverTemperature Protection (OTP)
    - Brownout protection
    - Output Short Protection (OSP)
- Low component count (see Figure 3) LED driver solution:
    - No Schottky diode required due to ZCS
    - No dim switch and high-side driver required for PWM current regulation
    - Easy external temperature protection with a single NTC resistor
    - Option for soft-start function
    - Compatible with wall switches with built-in indication light during standby[1]
- IC lifetime easily matches or surpasses LED lamp lifetime

3. Applications

SSL21081/SSL21083 products are intended for compact mains non-dimmable LED lighting applications with accurate fixed current output for single mains input voltages. Mains input voltages include 100 V (AC), 120 V (AC) and 230 V (AC). The output signal can be modulated using a PWM signal.

1. The Hotaru switch is a well known wall switch with built-in light

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{CC}	supply voltage	operating range	[1]	8	-	14	V
R_{DSon}	drain-source on-state resistance	SSL21083T/SSL21083AT; T_j = 25 °C		4	5	6	Ω
		SSL21083T/SSL21083AT; T_j = 125 °C		6	7.5	9	Ω
		SSL21081T/SSL21081AT; T_j = 25 °C		2.05	2.3	2.55	Ω
		SSL21081T/SSL21081AT; T_j = 125 °C		3.05	3.45	3.85	Ω
f_{conv}	conversion frequency			-	100	-	kHz
I_{DRAIN}	current on pin DRAIN	SSL21083T/SSL21083AT		−1	-	1	A
		SSL21081T/SSL21081AT		−2	-	2	A
V_{DRAIN}	voltage on pin DRAIN	SSL21083T/SSL21083AT		−0.4	-	600	V
		SSL21081T/SSL21081AT		−0.4	-	300	V

[1] The maximum operating voltage at V_{CC} can exceed 14 V when determined by the IC using the dV/Dt supply.

5. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
SSL21081T	SO8	plastic small package outline body; 8 leads; body width 3.9 mm	SOT96-1
SSL21083T			
SSL21081AT			
SSL21083AT			

5.1 Ordering options

Remark: All voltages are in V (AC) unless otherwise specified.

Table 3. Ordering options

Type	Input voltage	Internal MOSFET characteristics	Package	Short-winding protection
SSL21081T	100 V; 120 V	300 V (DC); 2 Ω	SO8	yes
SSL21081AT				no
SSL21083T	100 V; 120 V; 230 V	600 V (DC); 5 Ω	SO8	yes
SSL21083AT				no

6. Block diagram

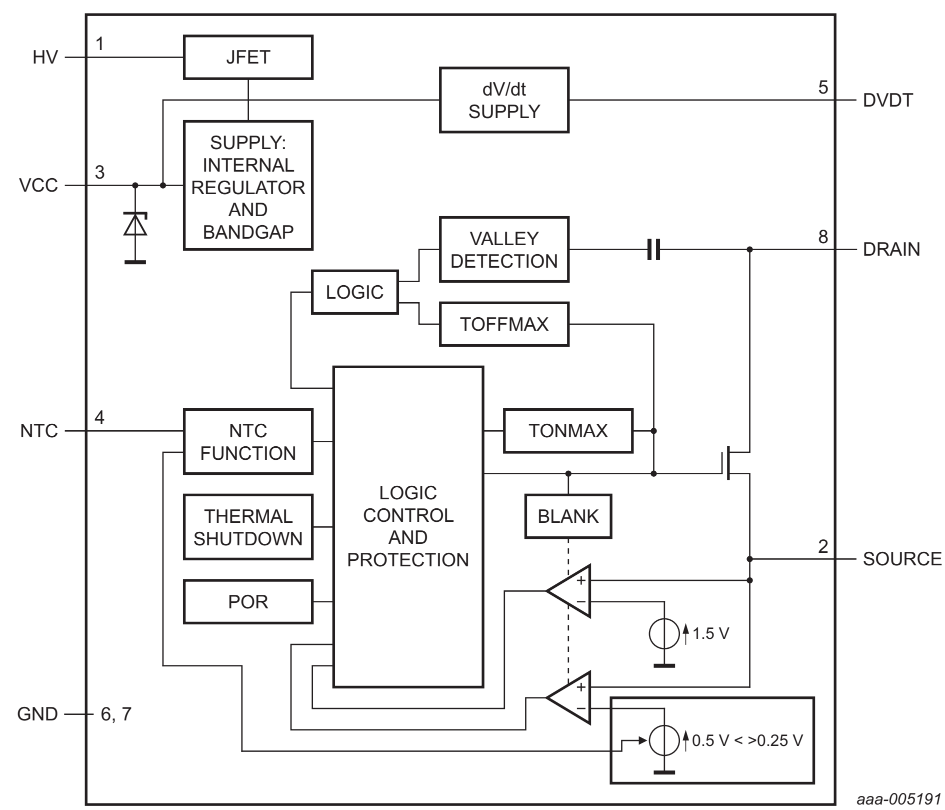


Fig 1. SSL21081/SSL21083 block diagram

7. Pinning information

7.1 Pinning

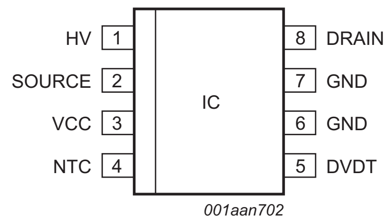


Fig 2. SSL21081/SSL21083 pin configuration (SO8)

7.2 Pin description

Table 4. Pin description

Symbol	Pin (SO8)	Description
HV	1	high-voltage supply pin
SOURCE	2	low-side internal switch
VCC	3	supply voltage
NTC	4	LED temperature protection input
DVDT	5	AC supply pin
GND	6, 7	ground
DRAIN	8	high-side internal switch

8. Functional description

8.1 Converter operation

The converter in the SSL21081/SSL21083 is a Boundary Conduction Mode (BCM), peak current controlled system. For the basic application diagram see Figure 3, for the waveforms see Figure 4. This converter type operates at the boundary between continuous and discontinuous mode. Energy is stored in inductor L each period that the switch is on. The inductor current I_L is zero when the internal MOSFET switch is switched on. Thereafter, the amplitude of the current build-up in L is proportional to $V_{IN} - V_{OUT}$ and the time that the internal MOSFET switch is on. When the internal MOSFET switch is switched off, the current continues to flow through the freewheel diode and the output capacitor. The current then falls at a rate proportional to the value of V_{OUT}. The LED current I_{LED} is almost equal to half the peak switch current. A new cycle is started, as soon as the inductor current I_L is zero.

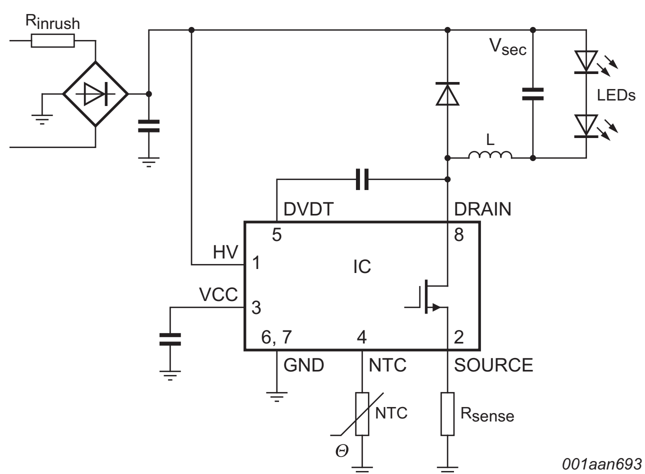


Fig 3. Basic SSL21081/SSL21083 application diagram

8.2 Valley detection

A new cycle is started when the primary switch is switched on (see Figure 4). Following time t_1, when the peak current is detected on the SOURCE pin, the switch is turned off and the secondary stroke starts (3). When the secondary stroke is complete and the coil current at t_3 equals zero, the drain voltage starts to oscillate around the $V_{IN} - V_{OUT}$ level. The amplitude equals V_{OUT}. A special feature, called valley detection is an integrated part of the SSL21081/SSL21083 circuitry. Dedicated built-in circuitry connected to the DRAIN pin, senses when the voltage on the drain of the switch has reached its lowest value. The next cycle is then started and as a result the capacitive switching losses are reduced.

A valley is detected and accepted if both the frequency of the oscillations and the voltage swing are within the range specified (f_{ring} and $\Delta V_{vrec(min)}$) for detection. If a valid valley is not detected, the secondary stroke is continued until the maximum off-time ($t_{off(high)}$) is reached, then the next cycle is started.

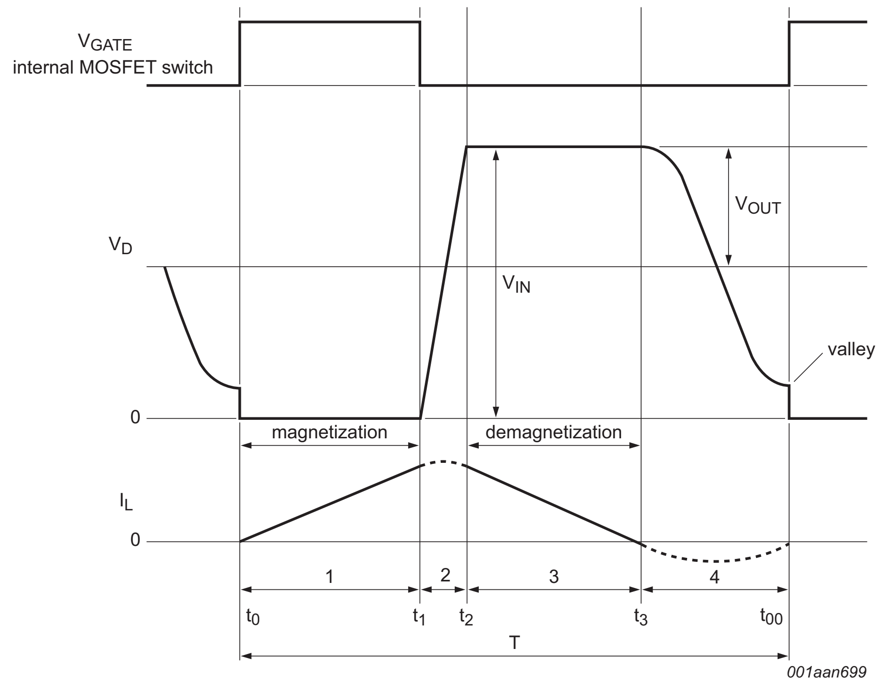


Fig 4. Buck waveforms and valley detection

8.3 Protective features

The IC has the following protective features:

- UnderVoltage LockOut (UVLO)
- Leading-Edge Blanking (LEB)
- OverCurrent Protection (OCP)
- Internal OverTemperature Protection (OTP)
- Brownout protection
- Short-Winding Protection (SWP) SSL21081T/SSL21083T only
- Output Short Protection (OSP)
- LED overtemperature control and protection

The SWP and the OSP are latched protections. These protections cause the IC to halt until a reset (a result of power cycling) is executed. When V_{CC} drops lower than $V_{CC(rst)}$, the IC resets the latch protection mode. The internal OTP and LED over temperature protections are safe-restart protections. The IC halts, causing V_{CC} to fall lower than $V_{CC(stop)}$, and instigates start-up. When V_{CC} drops lower than $V_{CC(rst)}$, the IC resets the latch protection mode. Switching starts only when no fault condition exists.

8.3.1 UnderVoltage LockOut (UVLO)

When the voltage on the VCC pin drops lower than $V_{CC(stop)}$, the IC stops switching. An attempt is then made to restart by supplying V_{CC} from the HV pin voltage.

8.3.2 Leading-Edge Blanking (LEB)

To prevent false detection of the short-winding or overcurrent, a blanking time following switch-on is implemented. When the internal MOSFET switch turns on there can be a short current spike due to capacitive discharge of voltage over the drain and source. During the LEB time (t_{leb}), the spike is disregarded.

8.3.3 OverCurrent Protection (OCP)

The SSL21081/SSL21083 contain a highly accurate built-in peak current detector. It triggers when the voltage at the SOURCE pin reaches the peak-level $V_{th(ocp)SOURCE}$. The current through the switch is sensed using a resistor connected to the SOURCE pin. The sense circuit is activated following LEB time t_{leb}. As the LED current is half the peak current (by design), it automatically provides protection for maximum LED current during operation. There is a propagation delay between overcurrent detection and the actual closure of the switch $t_{d(ocp-swoff)}$. Due to the delay, the actual peak current is slightly higher than the OCP level set by the resistor in series to the SOURCE pin.

8.3.4 OverTemperature Protection (OTP)

When the internal OTP function is triggered at a certain IC temperature ($T_{th(act)otp}$), the converter stops operating. The safe-restart protection is triggered and the IC restarts again with switching resuming when the IC temperature drops lower than $T_{th(rel)otp}$.

8.3.5 Brownout protection

Brownout protection is designed to limit the lamp power when the input voltage drops close to the output voltage level. Since the input power has to remain constant, the input current would otherwise increase to a level that is too large for the input circuitry. For the SSL21081/SSL21083, there is a maximum limit on the on-time $t_{on(high)}$. The rate of current rise in the coil during the on-phase is proportional to the difference between input voltage and output voltage. Therefore, the peak current cannot be reached before $t_{on(high)}$ and as a result the average output current to the LEDs is reduced.

8.3.6 Short-Winding Protection (SWP) SSL21081T/SSL21083T only

SWP activates if there is a steep rising current through the MOSFET and thus through the external resistor connected to the SOURCE pin. This current can occur when there is a short from the freewheel diode. Additionally, it occurs due to a small/shorted inductor between the input voltage and the DRAIN pin. If the voltage on the SOURCE pin is greater than 1.5 V, latched protection is triggered following LEB time t_{leb}. In addition, if V_{CC} drops lower than $V_{CC(rst)}$ the IC resets the latched protection mode.

8.3.7 Output Short Protection (OSP)

During the second stroke (switch-of time), if a valley is not detected within the off-time limit ($t_{off(high)}$), then typically the output voltage is less than the minimum limit allowed in the application. This condition can occur either during starting up or due to a short. A timer is started when $t_{off(high)}$ is detected, and is stopped only if a valid valley-detection occurs in one of the subsequent cycles.

If a valley is not detected for $t_{det(sc)}$, it is concluded that a real short-circuit exists and not start-up. The IC enters latched protection. If V_{CC} drops lower than $V_{CC(rst)}$, the IC resets the latched protection mode. During PWM current regulation, the OSP timer is paused during the off-cycle of the PWM signal.

8.4 VCC supply

The SSL21081/SSL21083 are supplied using three methods:

- Under normal operation, the voltage swing on the DVDT pin is rectified within the IC providing current towards the VCC pin
- At start-up, there is an internal current source connected to the HV pin. The current source provides internal power until either the dV/dt supply or an external current on the VCC pin provides the supply
- An external voltage source can be connected to the VCC pin

The IC starts up when the voltage at the VCC pin is higher than $V_{CC(startup)}$. The IC locks out (stops switching) when the voltage at the VCC pin is lower than $V_{CC(stop)}$. The hysteresis between the start and stop levels allows the IC to be supplied by a buffer capacitor until the dV/dt supply is settled. The SSL21081/SSL21083 has an internal V_{CC} clamp, which is an internal active Zener (or shunt regulator). This internal active Zener limits the voltage on the supply VCC pin to the maximum value of V_{CC}. If the maximum current of the dV/dt supply minus the current consumption of the IC (determined by the load on the gate drivers), is lower than the maximum value of I_{DD} no external Zener diode is needed in the dV/dt supply circuit.

8.5 DVDT pin supply (dV/dt)

The DVDT pin is connected to an internal single-sided rectification stage. When an alternating voltage with sufficient amplitude is supplied to the pin, the IC can be powered without any other external power connection. This solution provides an effective method to prevent the additional high-power losses, which would result if a regulator were used for continuously powering the IC. Unlike an auxiliary supply, additional inductor windings are not needed.

8.6 VCC regulator

During supply dips, the input voltage can drop too low to supply the required IC current through the DVDT pin. Under these conditions, if the VCC voltage drops lower than $V_{CC(swon)reg}$ level, another regulator with a current capability of up to $I_{sup(high)HV}$ is started. The job of the regulator is to fill in the required supply current, which the dV/dt supply does not deliver, thus preventing the IC going into UVLO. When the VCC voltage is higher than $V_{CC(swon)reg}$ level, the regulator is turned off.

8.7 NTC function and PWM current regulation

The NTC pin can be used as a control method for LED thermal protection. Alternatively, the pin can be used as an input to disable/enable light output using a digital signal (PWM current regulation). The pin has an internal current source that generates the current of $I_{offset(NTC)}$. An NTC resistor to monitor the LED temperature can be directly connected to the NTC pin. Depending on the resistance value and the corresponding voltage on the NTC pin, the converter reacts as shown in Figure 5.

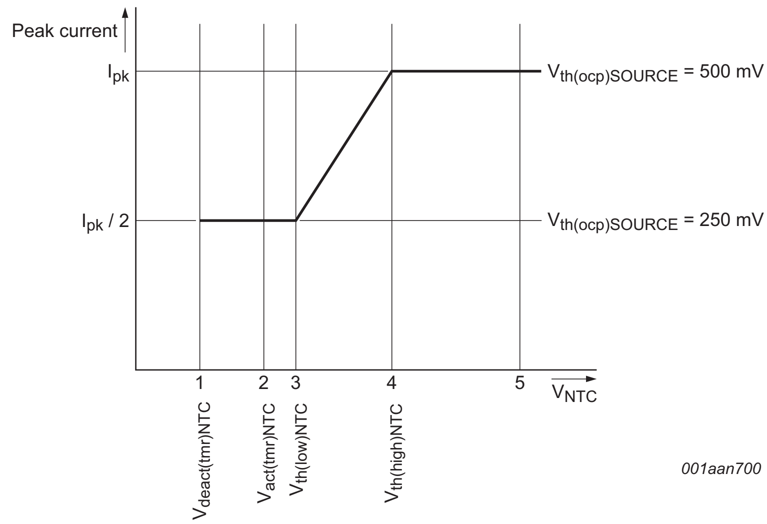


Fig 5. NTC control curve

When the voltage on the NTC pin is higher than $V_{th(high)NTC}$ see Figure 5 (4), the converter delivers nominal output current. When the voltage is lower than this level, the peak current is gradually reduced until $V_{th(low)NTC}$ is reached, see Figure 5 (3). The peak current is now half the peak current of nominal operation. When $V_{act(tmr)NTC}$ is passed, see Figure 5 (2) a timer starts to run to distinguish between the following situations:

- If the low-level $V_{deact(tmr)NTC}$ is not reached within time $t_{to(deact)NTC}$, Figure 5 (1) LED overtemperature is detected. The IC stops switching and attempts to restart from the HV pin voltage. Restart takes place when the voltage on NTC pin is higher than $V_{th(high)NTC}$, see Figure 5 (4). It is assumed that the reduction in peak current did not result in a lower NTC temperature and LED OTP is activated.
- If the low-level $V_{deact(tmr)NTC}$ is reached within the time $t_{to(deact)NTC}$, Figure 5 (1) it is assumed that the pin is pulled down externally. The restart function is not triggered. Instead, the output current is reduced to zero. PWM current regulation can be implemented this way. The output current rises again when the voltage is higher than $V_{deact(tmr)NTC}$.

8.7.1 Soft-start function

The NTC pin can be used to make a soft start function. During switch-on, the level on the NTC pin is low. By connecting a capacitor (in parallel with the NTC resistor), a time constant can be defined. The time constant causes the level on the NTC pin to increase slowly. When passing level $V_{th(low)NTC}$ Figure 5 (3), the convertor starts with half of the maximum current. The output current slowly increases to maximum when $V_{th(high)NTC}$ Figure 5 (4) is reached.

8.8 Heat sink

The copper of the PCB acts as the heat sink for SSL21081/SSL21083 applications.

Equation 1 shows the relation between the maximum allowable power dissipation P and the thermal resistance from junction to ambient.

$$R_{th(j-a)} = (T_{j(max)} - T_{amb}) / P \qquad (1)$$

Where:

$R_{th(j-a)}$ = thermal resistance from junction to ambient

$T_{j(max)}$ = maximum junction temperature

T_{amb} = ambient temperature

P = power dissipation

9. Limiting values

Table 5. Limiting values
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
General						
SR	slew rate	on pin DRAIN		–5	+5	V/ns
P_{tot}	total power dissipation	SO8 package		-	0.6	W
T_{amb}	ambient temperature			–40	+125	°C
T_j	junction temperature			–40	+150	°C
T_{stg}	storage temperature			–55	+150	°C
Voltages						
V_{CC}	supply voltage	continuous	[1]	–0.4	+14	V
V_{DRAIN}	voltage on pin DRAIN	600 V (DC) version		–0.4	+600	V
		300 V (DC) version		–0.4	+300	V
V_{HV}	voltage on pin HV	current limited		–0.4	+600	V
V_{SOURCE}	voltage on pin SOURCE	current limited		–0.4	+5.2	V
V_{NTC}	voltage on pin NTC	current limited		–0.4	+5.2	V
Currents						
I_{DD}	supply current	at pin VCC	[1]	-	20	mA
I_{DRAIN}	current on pin DRAIN	600 V (DC) version		–1	+1	A
		300 V (DC) version		–2	+2	A
I_{SOURCE}	current on pin SOURCE	600 V (DC) version		–1	+1	A
		300 V (DC) version		–2	+2	A
I_{DVDT}	current on pin DVDT	duration 20 μs maximum		-	1.3	A
V_{ESD}	electrostatic discharge voltage	human body model; (for all pins except DRAIN and HV)	[2]	–2	+2	kV
		human body model for DRAIN and HV		–1	+1	kV
		charged device	[3]	–500	+500	V

[1] An internal clamp sets the supply voltage and current limits.

[2] Human body model: equivalent to discharging a 100 pF capacitor through a 1.5 kΩ series resistor.

[3] Charged device model: equivalent to charging the IC up to 1 kV and the subsequent discharging of each pin down to 0 V over a 1 Ω resistor.

10. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air; SO8 package, PCB: 2 cm × 3 cm, 2-layer, 35 μm Cu per layer	142	K/W
		in free air; SO8 package; PCB: JEDEC 2s2p	72	K/W
$\Psi_{j\text{-}top}$	thermal resistance from junction to top	top package temperature measured at the warmest point on top of the case; SO8 package	3.4	K/W

11. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
f_{conv}	conversion frequency			-	100	-	kHz
High-voltage							
$I_{leak(DRAIN)}$	leakage current on pin DRAIN	V_{DRAIN} = 600 V (DC)		-	-	10	μA
		V_{DRAIN} = 300 V (DC)		-	-	10	μA
$I_{leak(HV)}$	leakage current on pin HV	V_{HV} = 600 V (DC)		-	-	30	μA
		V_{HV} = 300 V (DC)		-	-	30	μA
Supply							
V_{CC}	supply voltage	operating range	[1]	8	-	14	V
$V_{CC(startup)}$	start-up supply voltage			11	12	13	V
$V_{CC(stop)}$	stop supply voltage			8	9	10	V
$V_{CC(hys)}$	hysteresis of supply voltage	between $V_{CC(startup)}$ and $V_{CC(stop)}$		2	-	-	V
$V_{CC(rst)}$	reset supply voltage			4.5	5	5.5	V
$V_{CC(swon)reg}$	regulator switch-on supply voltage	insufficient dV/dt supply		8.75	9.25	9.75	V
$V_{CC(swoff)reg}$	regulator switch-off supply voltage	insufficient dV/dt supply		9.5	10	10.5	V
$V_{CC(reg)hys}$	regulator supply voltage hysteresis	$V_{CC(swoff)reg} - V_{CC(swon)reg}$		0.3	-	-	V
$V_{CC(regswon-stop)}$	supply voltage difference between regulator switch-on and stop	$V_{CC(swon)reg} - V_{CC(stop)}$		0.3	-	-	V
Consumption							
$I_{stb(HV)}$	standby current on pin HV	during start-up or in protection; V_{HV} = 100 V		300	350	400	μA
I_{CC}	supply current	normal operation		-	1.3	-	mA

Table 7. Characteristics *...continued*

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Capability							
$I_{sup(high)HV}$	high supply current on pin HV	Standby: V_{HV} = 40 V; VCC < $V_{CC(stop)}$		1	1.3	1.6	mA
		Regulator On: V_{HV} = 40 V; VCC < $V_{CC(swon)reg}$ after start-up		2	2.3	2.6	mA
Current and SWP							
$V_{th(ocp)SOURCE}$	overcurrent protection threshold voltage on pin SOURCE	$\Delta V/\Delta t$ = 0.1 V/μs		480	500	520	mV
		$\Delta V/\Delta t$ = 0.1 V/μs; V_{NTC} = 0.325 V		230	250	270	mV
$t_{d(ocp-swoff)}$	delay time from overcurrent protection to switch-off	$\Delta V/\Delta t$ = 0.1 V/μs		-	75	100	ns
t_{leb}	leading edge blanking time	overcurrent protection		260	300	340	ns
		short-winding protection		210	250	290	ns
Δt_{leb}	leading edge blanking time difference	between t_{leb} for overcurrent protection and short-winding protection		30	50	-	ns
$V_{th(swp)SOURCE}$	short-winding protection threshold voltage on pin SOURCE	SSL21081 and SSL21083T only		1.4	1.5	1.6	V
Valley detection							
$(\Delta V/\Delta t)_{vrec}$	valley recognition voltage change with time	on pin DRAIN		−30	−20	−10	V/μs
f_{ring}	ringing frequency		[2]	200	550	1000	kHz
$\Delta V_{vrec(min)}$	minimum valley recognition voltage difference	voltage drop on pin DRAIN		15	20	25	V
$t_{d(vrec-swon)}$	valley recognition to switch-on delay time			-	100	-	ns
Brownout detection							
$t_{on(high)}$	high on-time			12.5	15	17.5	μs
MOSFET output stage							
$V_{BR(DRAIN)}$	breakdown voltage on pin DRAIN	600 V (DC) version; T_j > 0 °C		600	-	-	V
		300 V (DC) version; T_j > 0 °C		300	-	-	V
R_{DSon}	drain-source on-state resistance	600 V (DC) version; T_j = 25 °C		4	5	6	Ω
		600 V (DC) version; T_j = 125 °C		6	7.5	9	Ω
		300 V (DC) version; T_j = 25 °C		2.05	2.3	2.55	Ω
		300 V (DC) version; T_j = 125 °C		3.05	3.45	3.85	Ω
$(dV/dt)_{f(DRAIN)}$	fall rate of change of voltage on pin DRAIN	300 V (DC) version; C_{DRAIN} = 150 pF, R_{SOURCE} = 2.2 Ω	[2]	-	1.2	-	V/ns
		600 V (DC) version; C_{DRAIN} = 75 pF; R_{SOURCE} = 1.2 Ω		-	1.5	-	V/ns

Table 7. Characteristics *…continued*

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
NTC function						
$V_{th(high)NTC}$	high threshold voltage on pin NTC		0.47	0.5	0.53	V
$V_{th(low)NTC}$	low threshold voltage on pin NTC		0.325	0.35	0.375	V
$V_{act(tmr)NTC}$	timer activation voltage on pin NTC		0.26	0.29	0.325	V
$V_{deact(tmr)NTC}$	timer deactivation voltage on pin NTC		0.17	0.2	0.23	V
$t_{to(deact)NTC}$	deactivation time-out time on pin NTC		33	46	59	μs
$I_{offset(NTC)}$	offset current on pin NTC		-	–47	-	μA
OSP						
$t_{det(sc)}$	short-circuit detection time		16	20	24	ms
$t_{off(high)}$	high off-time		30	36	42	μs
Temperature protections						
$T_{th(act)otp}$	overtemperature protection activation threshold temperature		160	170	180	°C
$T_{th(rel)otp}$	overtemperature protection release threshold temperature		90	100	110	°C

[1] The maximum operating voltage at VCC can exceed 14 V when determined by the IC using the dV/dt supply.

[2] This parameter is not tested during production, by design it is guaranteed.

12. SSL21081/SSL21083 buck configuration

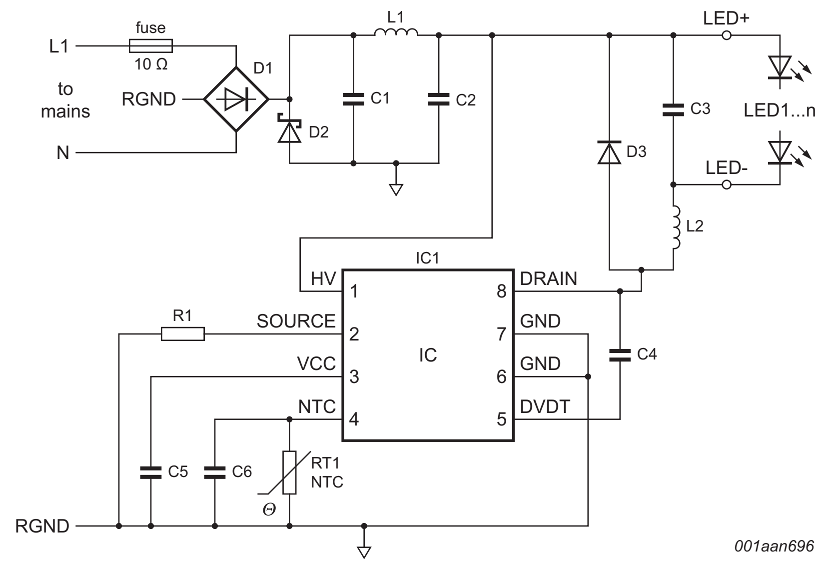
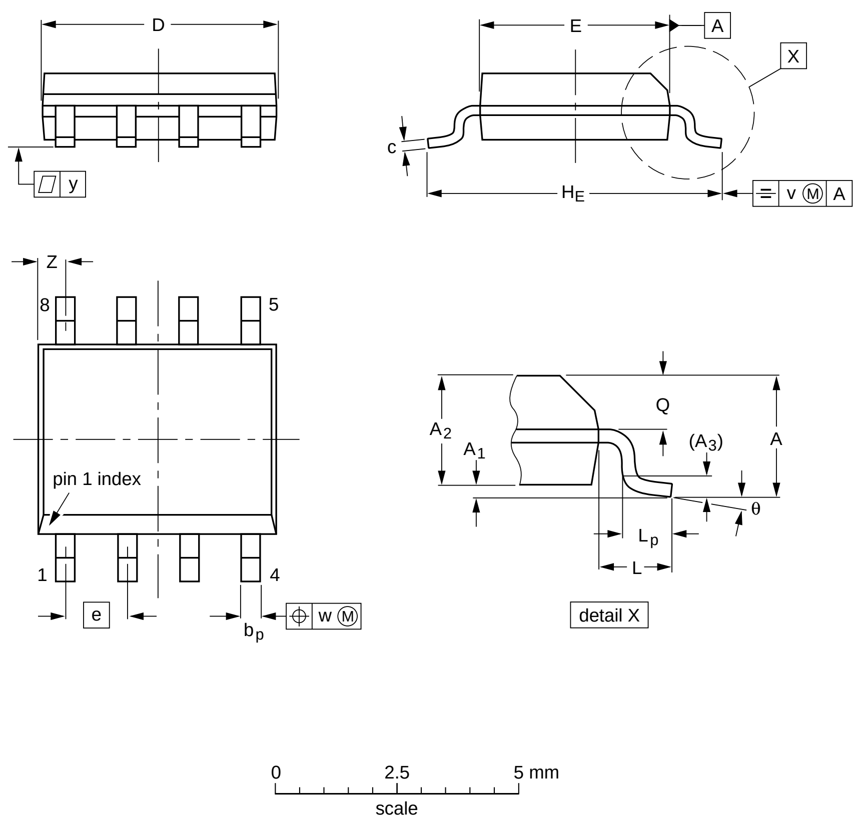


Fig 6. Buck configuration for SSL21081/SSL21083

Further application information can be found in the SSL21081/SSL21083 *application note*.

13. Package outline

SO8: plastic small outline package; 8 leads; body width 3.9 mm **SOT96-1**



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A_1	A_2	A_3	b_p	c	D(1)	E(2)	e	H_E	L	L_p	Q	v	w	y	Z(1)	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	5.0 4.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8^o 0^o
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.20 0.19	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Notes

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT96-1	076E03	MS-012				~~99-12-27~~ 03-02-18

Fig 7. Package outline SOT96-1 (SOT8)