



SSL21082/SSL21084

Mains dimmable LED controller IC

Rev. 5.1 — 8 January 2013

Product data sheet

1. General description

The SSL21082 and SSL21084 are high-voltage Integrated Circuits (IC) for driving retrofit LED lamps in general lighting applications. They enable the implementation of a very compact low-cost system solution. The IC's have an integrated internal HV switch and work as Boundary Conduction Mode (BCM) buck converter.

The SSL21082 and SSL21084 are supplied by a start-up bleeder resistor, a dV/dt supply using capacitive coupling from the drain or any other auxiliary supply. The IC supply current is low. An internal clamp limits the supply voltage.

They have accurate output current control and can be operated using Pulse-Width Modulation (PWM) dimming. In addition, several protection features are available such as easy external temperature feedback.

The main benefits of this IC include:

- Small Printed-Circuit Board (PCB) footprint and compact solution
- High efficiency (up to 90 %) for non-dimmable high power factor solutions
- High power factor (>0.9)
- Ease of integration and many protection features
- Low electronic Bill Of Material (BOM)
- Mains phase-cut dimmable using external components
- Highly flexible IC for use in buck, buck/boost and flyback modes
- Single inductor used for non-isolated configurations because of internal demagnetization detection and dV/dt supply

The IC range is designed to start-up directly from the HV supply using an internal high-voltage current source. An internal clamp limits the supply voltage.



2. Features and benefits

- LED controller IC for driving strings of LEDs or high-voltage LED modules from a rectified mains supply
- Power-efficient boundary conduction mode operation with:
 - ◆ No reverse recovery losses in freewheel diode
 - ◆ Zero-Current Switching (ZCS) for switch turn-on
 - ◆ Zero-voltage or valley switching for switch turn-off
 - ◆ Minimal required inductance value and size
- Fast transient response through cycle-by-cycle current control:
 - ◆ No overshoot or undershoot in the LED current
- Simple high input power factor solution (>0.9)
- Internal Protection features:
 - ◆ UnderVoltage LockOut (UVLO)
 - ◆ Leading-Edge Blanking (LEB)
 - ◆ OverCurrent Protection (OCP)
 - ◆ Short-winding protection (SWP); SSL21082T/SSL21084T only
 - ◆ Internal OverTemperature Protection (OTP)
 - ◆ Brownout protection
- Mains phase cut dimmable LED driver solution:
 - ◆ Supports both leading-edge and trailing-edge dimmers
 - ◆ Easy external temperature protection with a single NTC
 - ◆ Open output protection using external components
 - ◆ Compatible with wall switches with built-in indication light during standby
- IC lifetime easily matches or surpasses LED lamp lifetime
- Input current distributed evenly over the phase, reducing required output capacitor size and bleeder dissipation

3. Applications

The SSL21082 and SSL21084 are intended for mains dimmable compact LED lamps for single mains input voltages. Mains input voltages include 100 V (AC), 120 V (AC) and 230 V (AC).

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage	operating range	[1] 8	-	16	V
R_{DSon}	drain-source on-state resistance	SSL21082T and SSL21082AT; $T_j = 25\text{ }^{\circ}\text{C}$	2.05	2.3	2.55	Ω
		SSL21082T and SSL21082AT; $T_j = 125\text{ }^{\circ}\text{C}$	3.05	3.45	3.85	Ω
		SSL21084T and SSL21084AT; $T_j = 25\text{ }^{\circ}\text{C}$	4	5	6	Ω
		SSL21084T and SSL21084AT; $T_j = 125\text{ }^{\circ}\text{C}$	6	7.5	9	Ω
I_{DRAIN}	current on pin DRAIN	SSL21082T and SSL21082AT	-2	-	+2	A
		SSL21084T and SSL21084AT	-1	-	1	A
V_{DRAIN}	voltage on pin DRAIN	SSL21082T and SSL21082AT	-0.4	-	300	V
		SSL21084T and SSL21084AT	-0.4	-	600	V
f_{conv}	conversion frequency		-	100	-	kHz

[1] An internal clamp sets the supply voltage. The current into the VCC pin must not exceed the maximum I_{DD} value (see [Table 4](#)).

5. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
SSL21082T	SO12	plastic small package outline body; 12 leads; body width 3.9 mm	SOT1196-1
SSL21082AT			
SSL21084T			
SSL21084AT			

6. Block diagram

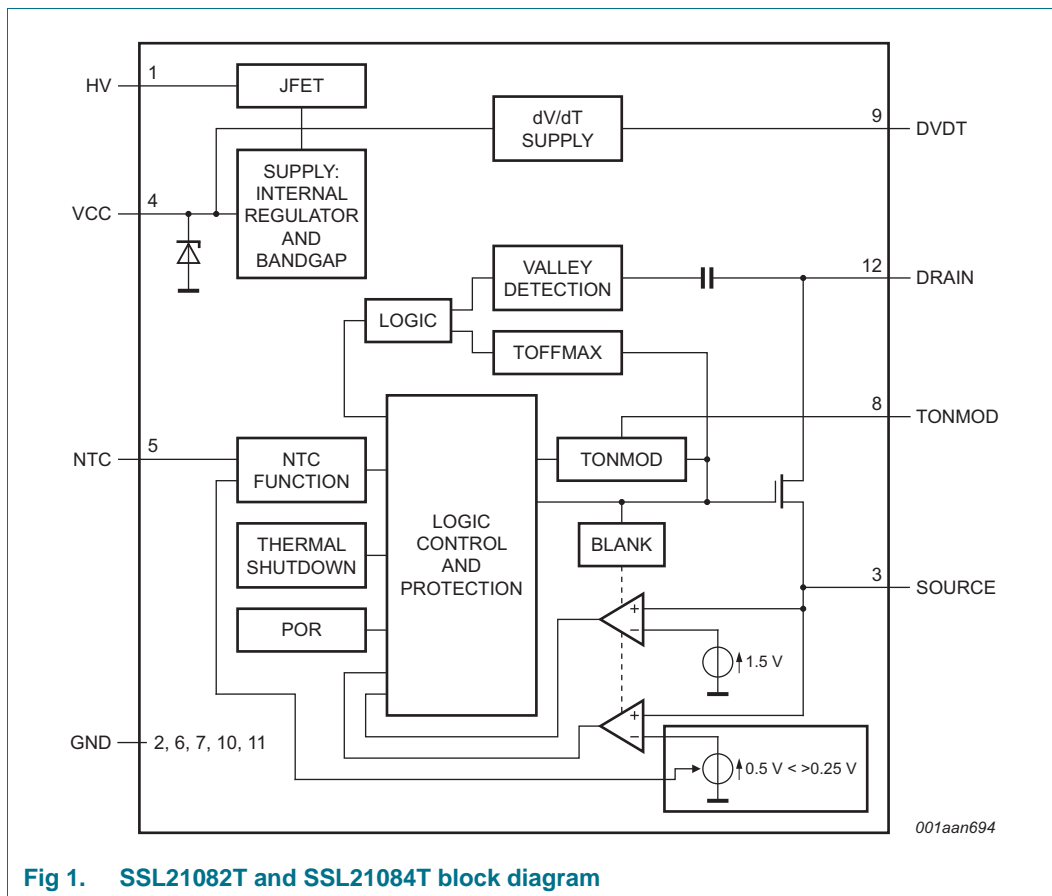


Fig 1. SSL21082T and SSL21084T block diagram

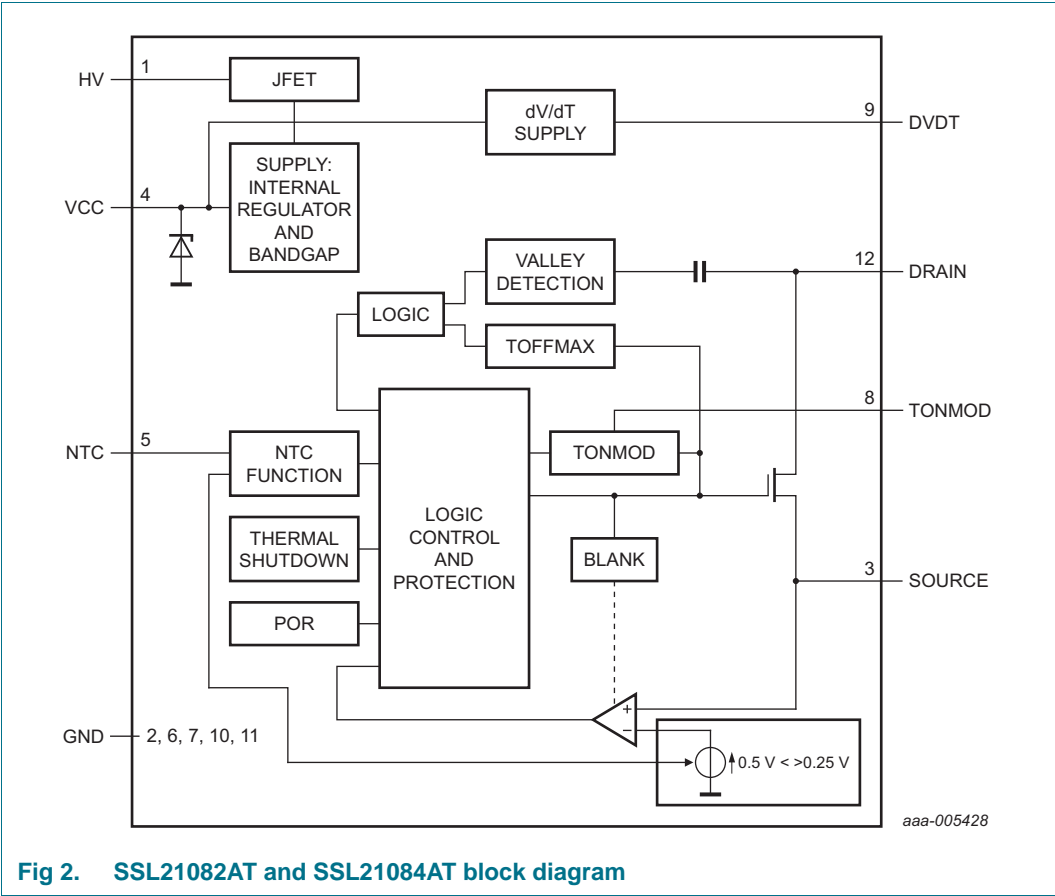
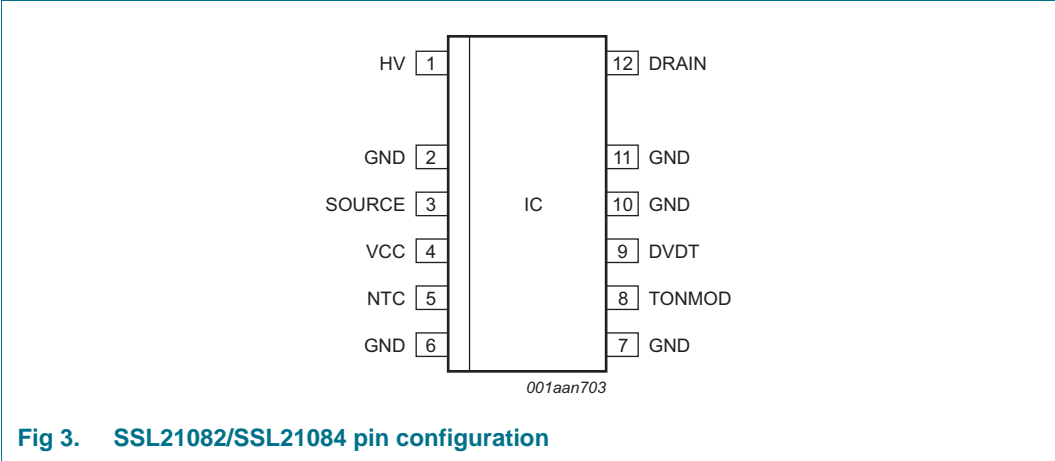


Fig 2. SSL21082AT and SSL21084AT block diagram

7. Pinning information

7.1 Pinning



7.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
HV	1	high-voltage supply pin
GND	2, 6, 7, 10, 11	ground
SOURCE	3	low-side external switch
VCC	4	supply voltage
NTC	5	temperature protection input
TONMOD	8	on time modulation input
DVDT	9	AC supply pin
DRAIN	12	high-side external switch

8. Functional description

8.1 Introduction

The SSL21082 and SSL21084 are controller IC solutions for small form factor mains phase-cut dimmable LED lamps in isolated and non-isolated applications.

8.2 Converter operation

The converter in the SSL21082 and SSL21084 is a Boundary Conduction Mode (BCM), peak current controlled system. See [Figure 4](#) for the basic application diagram. See [Figure 5](#) for relevant the waveforms.

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 MOSFET is switched on. The amplitude of the current build-up in L is proportional to the voltage drop over the inductor and the time that the MOSFET switch is on. When the MOSFET is switched off, the energy in the inductor is released towards the output. The current then falls at a rate proportional to the value of V_O . The LED current I_{LED} depends on the peak current through the inductor (SSL21082/SSL21084 controlled) and on the dimmer angle while it is optimized for a high-power factor. A new cycle is started once the inductor current I_L is zero. This quasi-resonant operation results in higher efficiency.

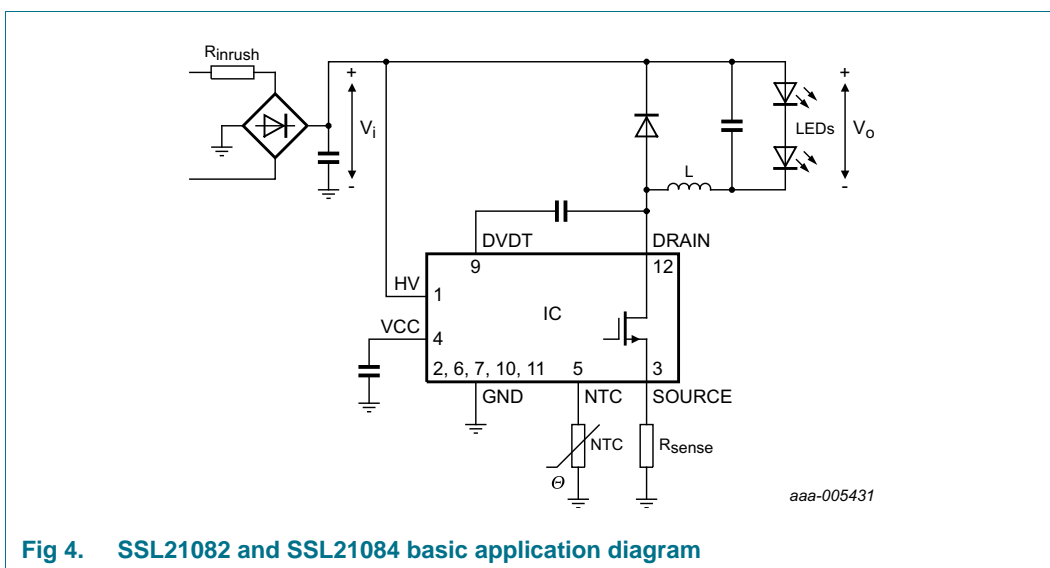


Fig 4. SSL21082 and SSL21084 basic application diagram

8.3 Valley detection

A new cycle is started when the primary switch is switched on (see [Figure 5](#)). In the following sections, “on” represents the conductive state and off the non-conductive state.

Following time t_1 , when the peak current is detected on the SOURCE pin, the switch is turned off and the secondary stroke starts at t_2 . When the secondary stroke is completed with the coil current at t_3 equaling zero, the drain voltage starts to oscillate at approximately the $V_i - V_O$ level. The peak to peak amplitude equals $2 \times V_O$. In tapped buck topology, this amplitude is multiplied by the ratio of the windings.

A special feature, called valley detection is an integrated part of the SSL21082 and SSL21084 circuitry. Dedicated built-in circuitry connected to the DRAIN pin, senses when the voltage on the drain of the switch reaches its lowest value. The next cycle is then started at t_{00} and as a result the capacitive switching losses are reduced. A valley is detected and accepted When both the frequency of the oscillations and the voltage swing are within the range specified (f_{ring} and $\Delta V_{vrec(min)}$) for detection. $\Delta V_{vrec(min)}$ is the voltage differential between the HV (pin) in and the DRAIN pin. 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.

A series resistance can be included at the drain sensing pin for flyback mode to remove the high-frequency ringing caused by the transformer leakage inductance.

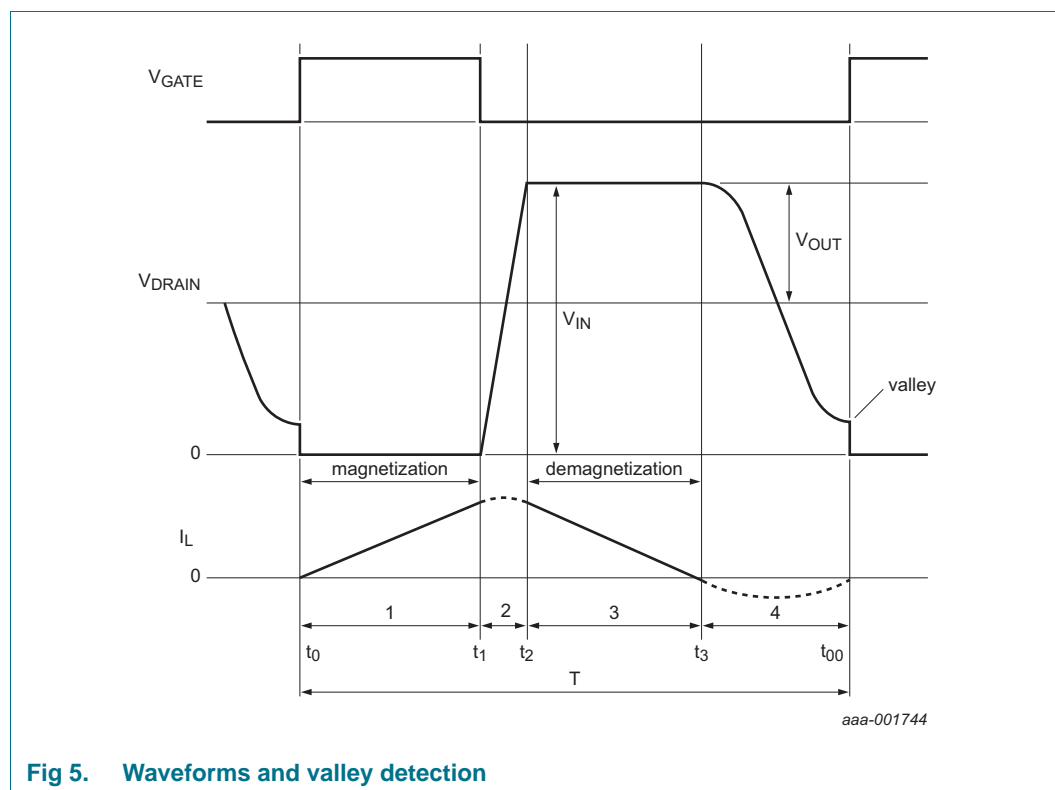


Fig 5. Waveforms and valley detection

8.4 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): T versions only
- LED overtemperature control and protection
- An optional output OverVoltage Protection circuit is implemented using external components and the NTC pin.

The internal OTP and LED over temperature protections are safe-restart protections. The IC halts, causing V_{CC} to fall below $V_{CC(stop)}$ and triggers a start-up. When V_{CC} drops lower than $V_{CC(rst)}$, the IC resets the latch protection mode. If V_{CC} drops below $V_{CC(stop)}$, the IC halts. Switching starts only when no fault condition exists.

8.4.1 UnderVoltage LockOut (UVLO)

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

8.4.2 Leading-Edge Blanking (LEB)

To prevent false detection of the short-winding or overcurrent, a blanking time following switch-on is implemented. When the 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.

8.4.3 OverCurrent Protection (OCP)

The SSL21082 and SSL21084 contains a highly accurate peak current detector. It triggers when the voltage on 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 $t_{d(ocp-swoff)}$ between overcurrent detection and the actual closure of the switch. 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.

8.4.4 OverTemperature Protection (OTP)

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

8.4.5 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 must remain constant, the input current would otherwise increase to a level that is too large for the input circuitry. In the SSL21082 and SSL21084, there is a maximum limit on the on-time of switch $t_{on(high)}$.

In buck mode, 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.

8.4.6 t_{on} control

The $t_{on(high)}$ can be lowered by connecting a capacitor to the TONMOD pin. The external capacitor is charged during the primary stroke with I_{TONMOD} . If the V_{TONMOD} level is reached before the $t_{on(high)}$ time, the switch is turned off and the secondary stroke starts. When a capacitor is not connected to the pin, V_{TONMOD} is reached quickly. Shorter than the minimum limit of 1 μs . In this case or when the TONMOD pin is grounded, the internal time constant, $t_{on(high)}$ determines the maximum on-time. This function is used to control the converter operation over the mains cycle which enables the design of a mains dimmable driver.

8.4.7 Short-winding protection

This protection activates when there is a steep rising current on the SOURCE pin. This current occurs when there is very small or an inductor is not present between the input voltage and DRAIN pin. When the voltage on the SOURCE pin is > 1.5 V after the Leading-edge blanking time, the latched protection is triggered.

This feature is only available with the SSL21082T and SSL21084T versions.

8.5 VCC supply

The SSL21082 and SSL21084 can be supplied using three methods:

- Under normal operation, the voltage swing on the DVDT pin is internally rectified to provide current on 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.
- Using an auxiliary winding, the voltage can be rectified and 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 on 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 external supply is stable. The SSL21082 and SSL21084 have 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 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} , an external Zener diode is not needed in the supply circuit.

8.5.1 VCC regulator

During supply dips, the input voltage can drop too low to supply the required IC current. Under these conditions, if the VCC voltage drops lower than $V_{CC(swon)reg}$ level, a second regulator is started. Its function is to fill in the required supply current which the external supply does not deliver. It prevents the IC going into UVLO. When the VCC voltage is higher than $V_{CC(swon)reg}$ level, the regulator is turned off.

8.6 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 this pin, the IC can be powered without another external power connection. This solution provides a compact effective solution without introducing high-power losses and without the need for an additional inductor winding.

8.7 NTC functionality and PWM dimming

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 dimming). The pin has an internal current source which generates a current $I_{\text{offset(NTC)}}$. An NTC resistor, for monitoring the LED temperature, can be directly connected to the NTC pin. Depending on the resistance value and the corresponding NTC pin voltage, the converter reacts as shown in [Figure 6](#)

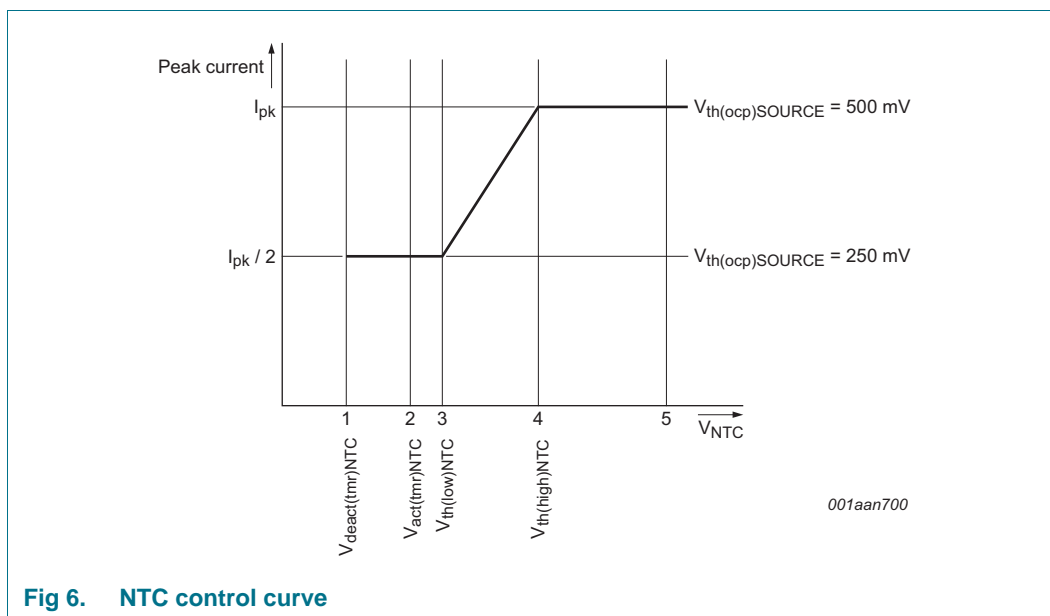


Fig 6. NTC control curve

When the voltage on the NTC pin is higher than $V_{\text{th(high)NTC}}$, see [Figure 6\(4\)](#), the converter delivers nominal output current. When the voltage is lower than this level, the peak current is gradually reduced until $V_{\text{th(low)NTC}}$ is reached, see [Figure 6\(3\)](#). The peak current is now half the peak current of nominal operation. When $V_{\text{act(tmr)NTC}}$ is passed, see [Figure 6\(2\)](#), a timer starts to run which distinguishes between the following situations:

- If the low-level $V_{\text{deact(tmr)NTC}}$ is not reached within time $t_{\text{to(deact)NTC}}$ [Figure 6\(1\)](#), 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 $V_{\text{th(high)NTC}}$, see [Figure 6\(4\)](#). 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 $V_{\text{deact(tmr)NTC}}$ is reached within the time $t_{\text{to(deact)NTC}}$ [Figure 6\(1\)](#), it is assumed the pin is pulled down externally. The restart function is not triggered. Instead, the output current is reduced to zero. PWM dimming can be implemented this way. The output current rises again when the voltage is higher than $V_{\text{deact(tmr)NTC}}$.

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 6\(3\)](#), the convertor starts with half of the maximum current. The output current slowly increases to maximum when $V_{th(high)NTC}$ [Figure 6\(4\)](#) is reached.

8.8 Mains dimmer compatibility

The SSL21082/SSL21084 provides mains dimmer compatibility using dynamic t_{on} control. This control is used to shape an input current waveform to provide the most effective current to load the dimmer over most of the mains cycle. In the dimmed position, the output current is controlled both by the conductive phase of the dimmer and the slope current control of the TONMOD function. An additional advantage of this method is a high-power factor.

The additional dimming range is achieved by modulating the charge current of the capacitor connected to the TONMOD pin.

8.9 Heat sink

In SSL21082/SSL21084 applications, the PCB copper acts as the heat sink. The IC has thermal leads (GND pins 2, 6, 10 and 11) for enhanced heat transfer from die to the PCB copper heat sink. The thermal lead connection can drastically reduce thermal resistance. [Equation 1](#) shows the relationship between the maximum allowable power dissipation and the thermal resistance from junction to ambient.

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

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 4. 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	SO12 package	-	1	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	+20	V
V _{DRAIN}	voltage on pin DRAIN	SSL21082	−0.4	+300	V
		SSL21084	−0.4	+600	
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
V _{TONMOD}	voltage on pin TONMOD	current limited	−0.4	+5.2	V
Currents					
I _{DD}	supply current	on pin VCC	[2] -	20	mA
I _{DRAIN}	current on pin DRAIN	SSL21082	−2	+2	mA
		SSL21084	−1	+2	mA
I _{SOURCE}	current on pin SOURCE	SSL21082	−2	+2	mA
		SSL21084	−1	+1	mA
I _{DVDT}	current on pin DVDT	duration 20 μs maximum	-	1.3	mA
Electrostatic discharge					
V _{ESD}	electrostatic discharge voltage	human body model; all pins except DRAIN and HV	[3] −2	+2	kV
		human body model; DRAIN and HV	−1	+1	kV
		charged device	[4] −500	+500	V

[1] The current into the VCC pin must not exceed the maximum I_{DD} value.

[2] An internal clamp sets the supply voltage.

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

[4] 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 5. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air; PCB: 2 cm × 3 cm; 2-layer; 35 μ m Cu per layer	121	K/W
		in free air; PCB: JEDEC 2s2p	53	K/W
Ψ_{j-top}	thermal resistance from junction to top	top package temperature measured at the warmest point on top of the case	3.4	K/W

11. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
f _{conv}	conversion frequency		-	100	-	kHz
High-voltage						
I _{leak(DRAIN)}	leakage current on pin DRAIN	SSL21082; V _{DRAIN} = 300 V	-	-	10	μA
		SSL21084; V _{DRAIN} = 600 V	-	-	10	μA
I _{leak(HV)}	leakage current on pin HV	SSL21082; V _{HV} = 300 V	-	-	30	μA
		SSL21084; V _{HV} = 600 V	-	-	30	μA
Supply						
V _{CC}	supply voltage	operating range	11 8	-	16	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	-	4.5	V
V _{CC(rst)}	reset supply voltage		4.5	5	5.5	V
V _{CC(swon)reg}	regulator switch-on supply voltage		8.75	9.25	9.75	V
V _{CC(swoff)reg}	regulator switch-off supply voltage		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(INT)}	internal supply current	normal operation	-	1.3	-	mA
Capability						
I _{sup(high)HV}	high supply current on pin HV	Standby: V _{HV} = 40 V; V _{CC} < V _{CC(stop)}	1	1.3	1.6	mA
		Regulator on: V _{HV} = 40 V; V _{CC} < V _{CC(swon)reg} after start-up	2	2.3	2.6	mA

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Current and SWP						
V _{th(ocp)SOURCE}	overcurrent protection threshold voltage on pin SOURCE	ΔV/Δt = 0.1 V/μs	480	500	520	mV
		ΔV/Δt = 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	ΔV/Δt = 0.1 V/μs	-	75	100	ns
t _{leb}	leading edge blanking time	overcurrent protection	260	300	340	ns
Δt _{leb}	leading edge blanking time difference	between t _{leb} for OCP and SWP	30	50	-	ns
V _{th(SWP)SOURCE}	short-winding protection threshold voltage on pin SOURCE	SSL21082T/SSL21084T only	1.4	1.5	1.6	V
Valley detection						
(ΔV/Δt) _{vrec}	valley recognition voltage change with time	on pin DRAIN	-30	-20	-10	V/μs
f _{ring}	ringing frequency		[2] 200	550	1000	kHz
ΔV _{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						
V _{th(TONMOD)}	threshold voltage on pin TONMOD		3.75	4	4.25	V
I _{offset(TONMOD)}	offset current on pin TONMOD		-37	-43	-48	μA
t _{on(high)}	high on-time		12.5	15	17.5	μs
MOSFET output stage						
V _{BR(DRAIN)}	breakdown voltage on pin DRAIN	SSL21082; T _j > 0 °C	300	–	-	V
		SSL21084; T _j > 0 °C	600	-	-	V
R _{DSon}	drain-source on-state resistance	SSL21082; T _j = 25 °C	2.05	2.3	2.55	Ω
		SSL21082; T _j = 125 °C	3.05	3.45	3.85	Ω
		SSL21084; T _j = 25 °C	4	5	6	Ω
		SSL21084; T _j = 125 °C	6	7.5	9	Ω
(dV/dt) _{f(DRAIN)}	fall rate of change of voltage on pin DRAIN	SSL21082; C _{DRAIN} = 150 pF, R _{SOURCE} = 2.2 Ω	-	1.2	-	V/ns
		SSL21084; C _{DRAIN} = 75 pF, R _{SOURCE} = 2.2 Ω	[2] -	1.5	-	V/ns
NTC functionality						
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	0.3	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

Table 6. Characteristics ...continued

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Temperature protection						
$T_{th(otp)}$	overtemperature protection activation threshold temperature		160	170	180	°C
$T_{th(rel)otp}$	overtemperature protection release threshold temperature		90	100	110	°C

[1] An internal clamp sets the supply voltage. The current into the VCC pin must not exceed the maximum I_{DD} value (see [Table 4](#)).

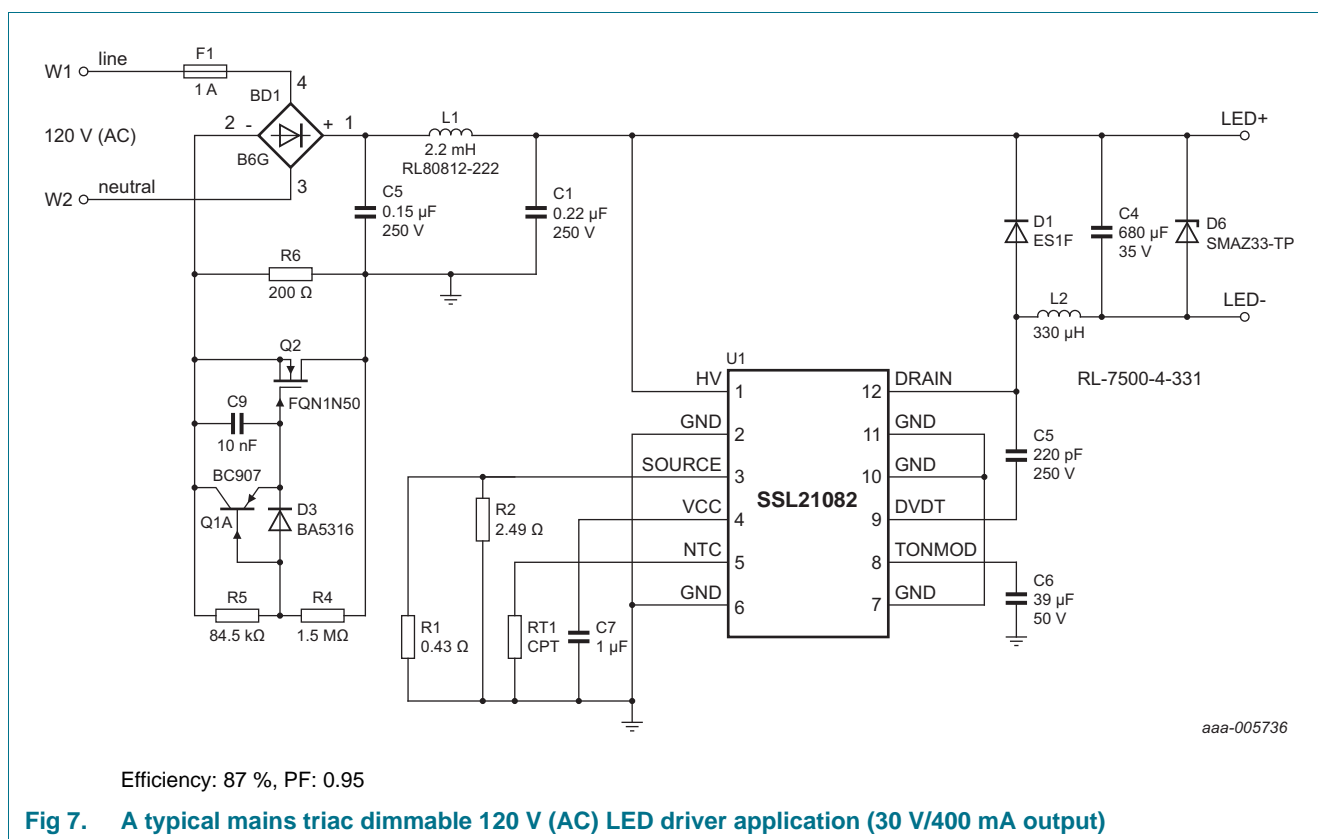
[2] This parameter is not tested during production, by design it is guaranteed

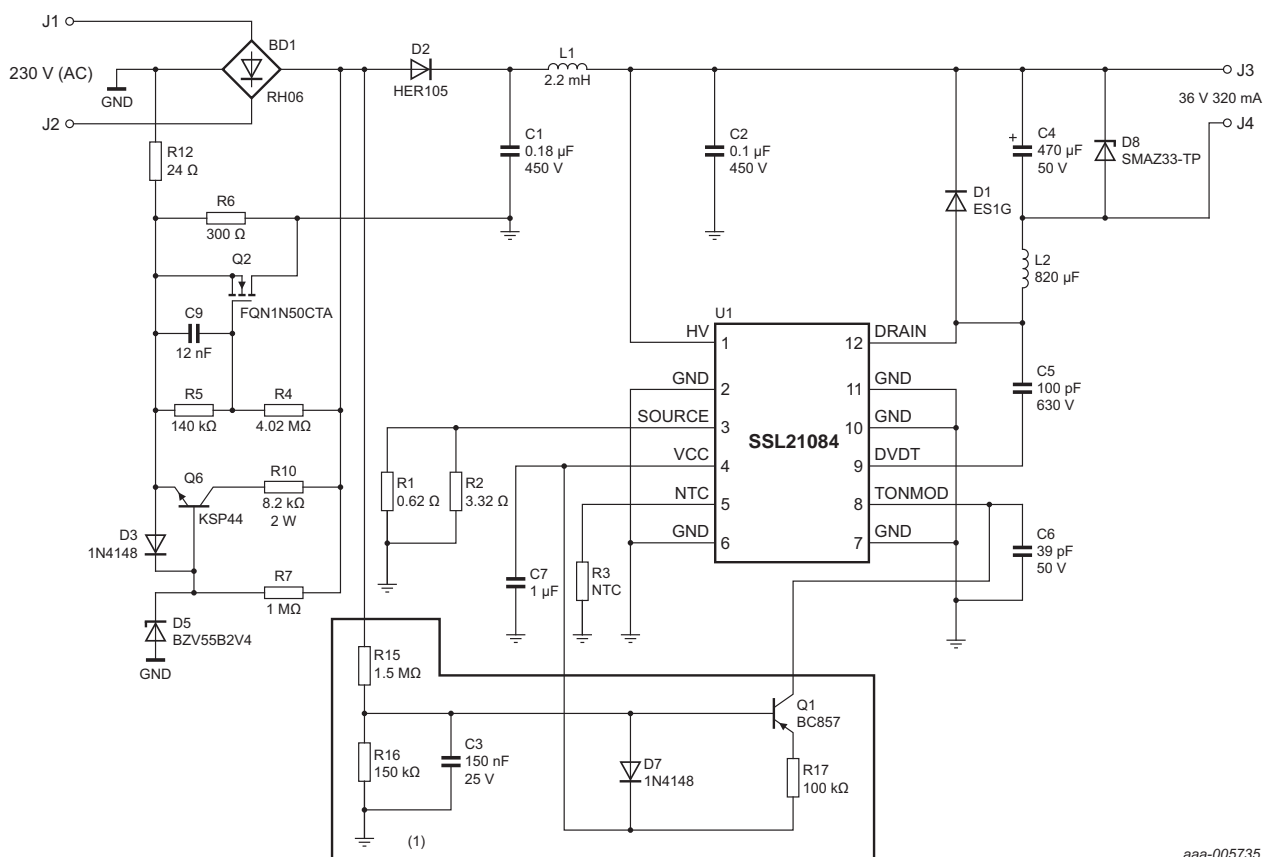
12. Application information

An LED driver with the SSL21082 and SSL21084 can be a buck, tapped buck or flyback converter operating in BCM (see [Figure 8](#)). The tapped buck option offers the advantage of larger duty factor and less peak current through the MOSFET switch, resulting in higher efficiency and higher converter ratio. The recommended voltage swing on the DRAIN pin is limited by the $\Delta V_{\text{vrec(min)}}$ parameter. With a tapped buck configuration, this limitation is overcome enabling lower output voltages.

It is recommended for 230 V applications that a TVS is placed after the rectifier bridge to limit maximum voltage over the bus. In mains dimmable solutions, the bus voltage can become substantially higher than the nominal mains voltage without clamping because of line resonance and rectification. This can destroy the electrolytic capacitors, IC or MOSFET. Open string protection can be added using the auxiliary winding voltage to pull-down the NTC pin voltage. In addition, the TVS prevents voltage spikes due to for example lighting surges.

Further information can be found in the *SSL21082 and SSL21084 application note*.





Efficiency: 86 %, PF: 0.91 .

(1) optional for deep dimming.

Fig 8. A typical mains dimmable tapped 230 V (AC) LED driver application (36 V/320 mA output)

13. Package outline

SO12: plastic small outline package; 12 leads; body width 3.9 mm

SOT1196-1

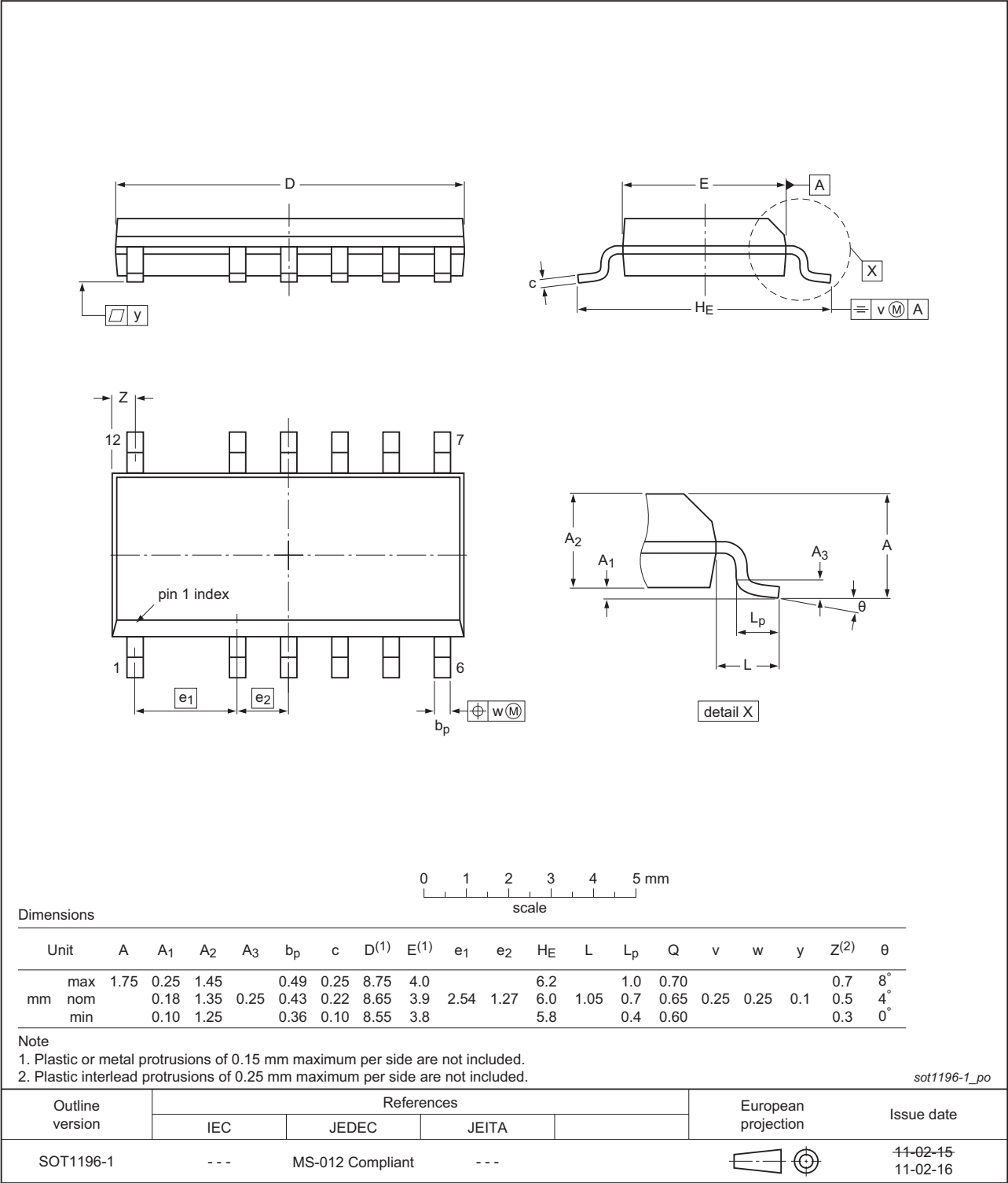


Fig 9. Package outline SOT1196-1 (SO12)

14. Abbreviations

Table 7. Abbreviations

Acronym	Description
BCM	Boundary Conduction Mode
LEB	Leading-Edge Blanking
LED	Light Emitting Diode
MOSFET	Metal-Oxide Semiconductor Field-Effect Transistor
OCP	OverCurrent Protection
OTP	OverTemperature Protection
PCB	Printed-Circuit Board
PWM	Pulse-Width Modulation
TVS	Transient Voltage Suppression
UVLO	UnderVoltage LockOut
ZCS	Zero-Current Switching

15. Revision history

Table 8. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
SSL21082_SSL21084 v.5.1	20130108	Product data sheet	-	SSL21082_SSL21084 v.5
Modifications:	<ul style="list-style-type: none">• Table 1 “Quick reference data” has been updated.• Table 2 “Ordering information” has been updated.• Figure 4 “SSL21082 and SSL21084 basic application diagram” has been updated.• Table 4 “Limiting values” has been updated.• Table 6 “Characteristics” has been updated.			
SSL21082_SSL21084 v.5	20121026	Product data sheet	-	SSL2108_SER v.4
SSL2108_SER v.4	20120508	Product data sheet	-	SSL21081T_2T_3T_4T v.3.1
SSL21081T_2T_3T_4T v.3.1	20120222	Product data sheet	-	SSL21081T_2T_3T_4T v.3
SSL21081T_2T_3T_4T v.3	20120214	Product data sheet	-	SSL21081T_2T_3T_4T v.2
SSL21081T_2T_3T_4T v.2	20111206	Preliminary data sheet	-	SSL2108X v.1
SSL2108X v.1	20110909	Preliminary data sheet	-	-

16. Legal information

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Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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