GENERAL DESCRIPTION :

CRE2269 is a highly intergrated current mode PWM control IC for high performance, low standby power and cost effective offline flyback converter applications in abive 20W power level.

PWM switching frequency at normal operation is externally programmable and trimmed to tight range. At no load or light load condition, the IC operates in extended"birst mode"ti minimize switching loss.Lower standby power and higher conversion efficiency is thus achieved.

VDD low startup current and low operating current contribute to a reliable power on startup design withCRE2269. A large value resistor could thus be used in the startup circuit to minimize the standby power.

The internal slope compensation improves system large signal stability and reduces the possible subharmonic oscillation at high PWM duty cycle output. Leading-edge blanking on current sense input removes the signal glitch due to snubber circuit Diode reverse recovery. And greatly reduces the external component count and system cost in the design.

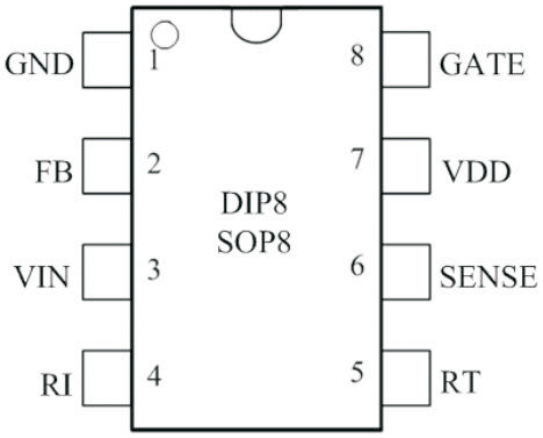
CRE2269 offers complete protection coverage with automatic self-recovery feature including Cycle-by-Cycle current limiting(OCP),over load protection(OLP),over temperature protection (OTP),VDD over voltage protection(OVP)and under voltage lockout(UVLO).The Gate-drive output is clamped to maximum 18V to protect the power MOSFET.

Excellent EMI performance is achieved with CRE proprietary frequency shuffking technique together with soft switching control at the totem pole gate drive output.The tone energy at the totem pole gate drive output. The tone energy at below 20KHZ is minimized in operation. Consequently, audio noise performance is greatly improved.

CRE2269 is offered in SOP-8 and DIP-8 packages.

FEATURES

- Extendend Burst Mode Control For Improved Efficiency and Minimum Standby Power Design
- Low VIN/VDD Startup Current(5uA) and Low Operating Current(2.4mA)
- Leading Edge Blanking on Current Sense Input
- Internal Synchronized Slope Compensation
- External Programmable PWM Switching Frequency
- Exernal Programmable Over Temperature Protection(OTP)
- Line Compensated Cycle-by-Cycle Over current Threshold Setting For Constant Output Current Limiting Over Universal Input Voltage Range(OCP)
- With orWithout On-chip VDD OVP for Output Over Voltage Protection
- Under Voltage Lockout with Hysteresis(UVLO)
- Gate Output Maximum Voltage Clamp(18V)
- Over Load Protection(OLP)
- CRE Proprietary Frequency Shuffling
- Technology for Improved EMI Performance

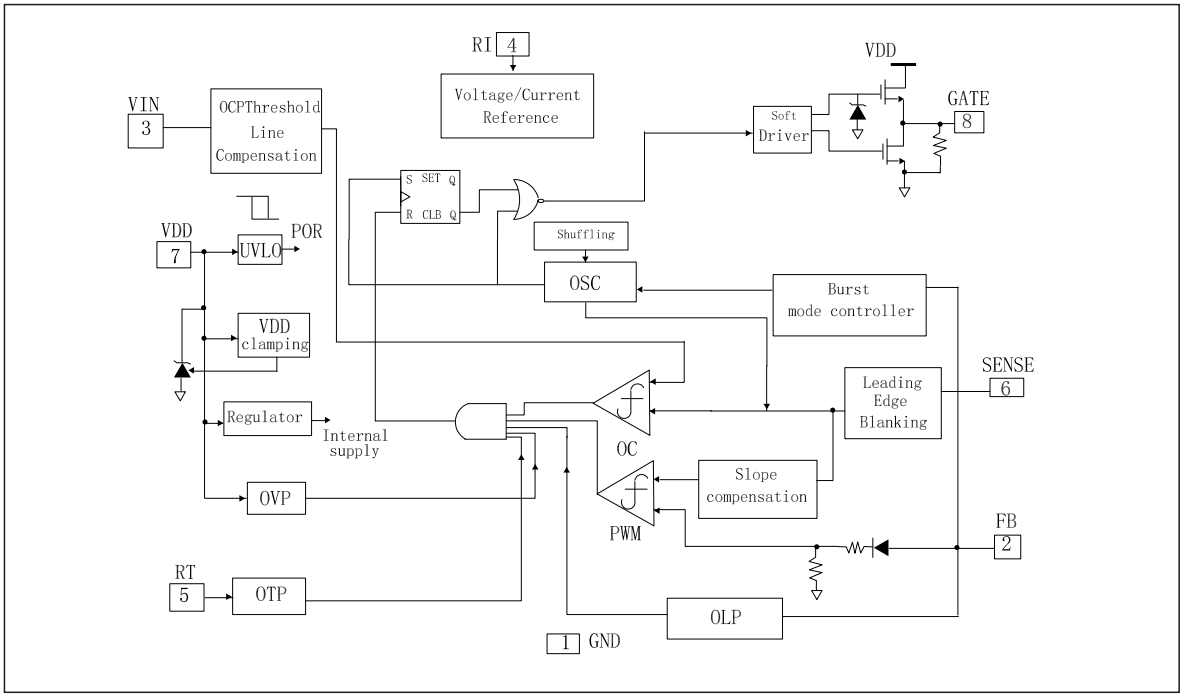


APPLICATIONS

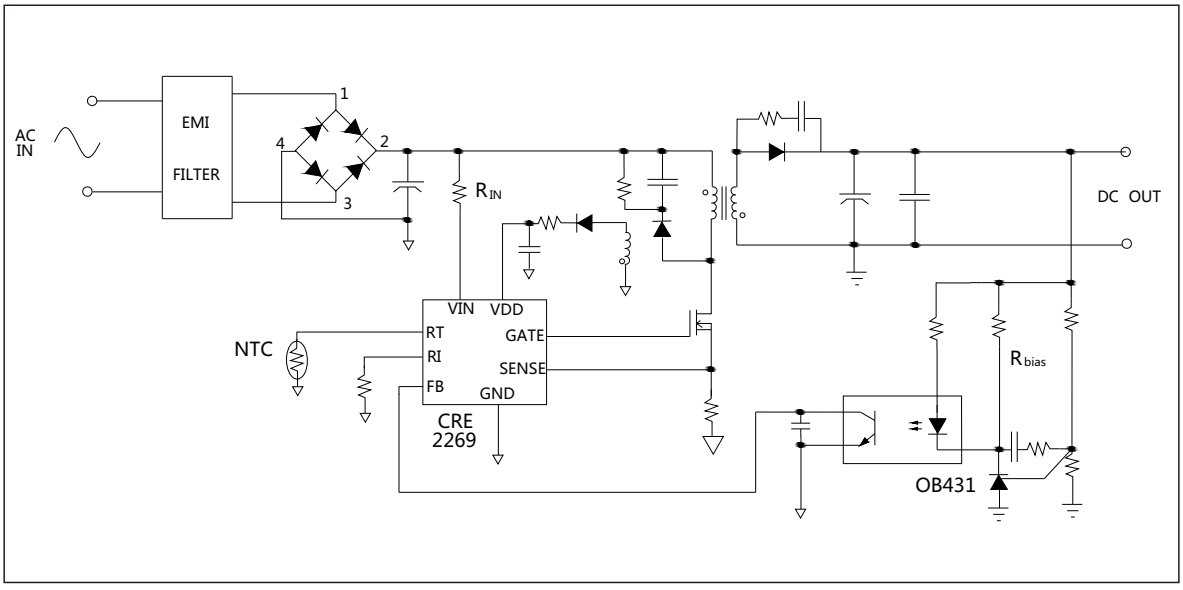
Offline AC/DC flyback converter for

- Battery Charger
- Power Adaptor
- Set-Top Box Power Supplies
- Open-frame SMPS

BLOCK DIAGRAM



TYPICAL APPLICATION



TERMINAL ASSIGNMENTS:

Pin Num	Pin Name	Description
1	GND	Ground
2	FB	Feedback input pin. PWM duty cycle is determined by voltage level into this pin and current-sense signal level at Pin 6.
3	VIN	Connected through a large value resistor to rectified line input for Start upchip supply and line voltage sensing.
4	RI	Internal Oscillator frequency setting pin. A resistor connected between RI and GND sets the PWM frequency.
5	RT	Temperature sensing input pin. Connected through a NTC resistor to GND.Once the voltage of the RT pin drops below a fixed limit of 1.05V, PWM output will be disabled.
6	SENSE	Current sense input pin. Connected to MOSFET current sensing resistor node.
7	VDD	DC power supply pin.
8	GATE	Totem-pole gate drive output for power MOSFET.

Absolute Maximum Ratings:

	Parameter	Value	Unit
VDD	VDD Input Voltage	30	V
VFB	VFB Input Voltage	-0.3 — 7	V
VSENSE	VSENSE Input Voltage to Sense Pin	-0.3 — 7	V
VRI	VRI Input Voltage to RI Pin	-0.3 — 7	V
VRT	VRT Input Voltage to RT Pin	-0.3 — 7	V
TJ	Min/Max Operating Junction Temperature	-20 — 150	℃
TSTG	Min/Max StorageTemperature	-55 — 150	℃
VCV	VDD Zener ClampVoltage	35	V
VCC	VDD DC Clamp Current	10	mA

NOTE: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, functional operation of the device at these or anyother conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute maximum-rated conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITION:

	Parameter	Value	Unit
VDD	VDD Supply Voltage	12 — 23	V
RI	RT Resistor Value	24	Kohm
TA	Operating Ambient Temperature	-20 — 85	℃

ESD INFORMATION

	Parameter	Value	Unit
VESD-HBM	Human Body Model	3	KV
VESD-MM	Machine Model on All Pins	250	V

ELECTRICAL CHARACTERISTICS

(TA= 25℃, VDD=16V, RI=24Kohm if not otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Supply Voltage (VDD)						
I_VDD_Startup	VDD Start up	VDD=15V Measure	-	5	20	uA

	Current	current intoVDD				
I_VDD_ Operation	Operation Current	VFB=3V	2.3	2.4	2.5	mA
UVLO(Enter)	VDD Under Voltage Lockout Enter		8.8	9.8	10.8	V
UVLO(Exit)	VDD Under Voltage Lockout Exit (Recovery)		13.5	14.5	15.5	V
OVP(ON)	VDD Over Voltage Protection Enter		25.0	26.5	27.0	V
OVP(OFF)	VDD Over Voltage Protection Exit (Recovery)		24.0	24.5	25.0	V
OVP_Hys	OVP(ON)- OVP(OFF)		-	2	-	V
VDD_Clamp	VDD Zener Clamp Voltage		-	37	-	V
Feedback Input Section (FB)						
VFB_Open	VFB Open Loop Voltage		5.8	6.0	6.2	V
IFB_Short	FB pin short circuit current	Short FB pin to GND and measure current	0.44	0.45	0.46	mA
VTH_OD			-	-	1.7	V
VTH_BM	Burst Mode FB Threshold Voltage		-	2.2	-	V
VTH_PL	Power Limiting FB Threshold Voltage		-	4.6	-	V
TD_PL	Power limiting Debounce Time		-	80	-	mSec
Current Sense Input (SENSE)						
T_blanking	Leading edge blanking time		-	250	-	nS
TD_OC	Over Current Detection and Control Delay	CL=1nf	-	120	-	nSec
VTH_OC_0		I(VIN)= 0uA	-	0.8	-	V
VTH_OC_1		I(VIN)=150uA	-	0.7	-	V
Oscillator						
FOSC	Normal Oscillation Frequency		55	60	65	KHz

△f_Temp	Frequency Temperature	-20℃ to 100℃	-	3	-	%
	Stability					
△f_VDD	Frequency Voltage Stability	VDD = 12-25V	-	3	-	%
RI_range	Operating RI Range		12	24	60	Kohm
V_RI_open	RI open load voltage		-	2.0	-	V
F_BM	Burst Mode Base Frequency		-	21	-	KHz
DC_max			-	78	-	%
DC_min			-	-	0	%
Gate Drive Output (GATE)						
VOL	Output Low Level	Io = -20 mA	-	-	0.15	V
VOH	Output High Level	Io = +20 mA	11.5	-	-	V
VG_Clamp	Output Clamp Voltage Level	VDD=20V	-	17.8	-	V
T_r	Output Rising Time	CL = 1nf	-	140	-	nSec
T_f	Output Falling Time	CL = 1nf	-	40	-	nSec
Over Temperature Protection						
I_RT	Output Current of RT pin		74	75	76	uA
VTH_OTP	OTP Threshold Voltage		-	1.1	-	V
VTH_OTP_off	OTP Recovery Threshold Voltage		-	1.3	-	V
V_RT_Open	RT Pin Open Voltage		3.56	3.58	3.60	V
Frequency Shuffling						
△f_OSC	Frequency Modulation range/Base frequency		-3	-	3	%
Freq_Shuffling	Shuffling Frequency	RI = 24Kohm	-	32	-	HZ

OPERATION DESCRIPTION

The CRE2269 is a highly integrated PWM controller IC optimized for offline flyback converter applications in above 20W power range.The extended burst mode control greatly reduces the standby power consumption and helps the design easily meet the international power conservation requirements.

◆ Startup Current and Start up Control

Startup current of CRE2269 is designed to be very low(5uA) so that VDD could be charged up above UVLO threshold level and device starts up quickly. Alarge value startup resistor can therefore be used to minimize the power loss yet reliable startup in application. For AC/DC adaptor with universal input range design, a 2 MΩ, 0.125W startup resistor could be used together with a VDD capacitor to provide a fast startup and yet low power dissipation designsolution.

◆ Operating Current

The Operating current of CRE2269 is low at 2.3mA. Good efficiency is achieved with CRE2269 low operating current together with extended burst mode control schemes

◆ Burst e Mode Operation

At zero load or light load condition, most of the power dissipation in a switching mode power supply is from switching loss on the MOSFET transistor, the core loss of the transformer and the loss on the snubber circuit. The magnitude of power loss is in proportion to the number of switching events within a fixed period of time. Reducing switching events leads to the reduction on the power loss and thus conserves the energy. CRE2269 self adjusts the switching mode according to the loading condition. At from no load to light/medium load condition, the FB input drops below burst mode threshold level (2.2V). Device enters Burst Mode control. The Gate drive output switches only when VDD voltage drops below a preset level and FB input is active to output an on state. Otherwise the gate drive remains at off state to minimize the switching loss thus reduce the standby power consumption to the greatest extend. The nature of high frequency switching also reduces the audio noise at any loading conditions.

◆ Oscillator Operation

A resistor connected between RI and GND sets the constant current source to charge/discharge the internal cap and thus the PWM oscillator frequency is determined. The relationship between RI and switching frequency follows the below equation within the specified RI in Kohm range at nominal loading operational condition.

◆Current g Sensing d and g Leading Edge Blanking

Cycle-by-Cycle current limiting is offered in CRE2269 current mode PWM control. The switch current is detected by a sense resistor into the sense pin. An internal leading edge blanking circuit chops off the sense voltage spike at initial MOSFET on state due to Snubber diode reverse recovery so that the external RC filtering on sense input is no longer needed. The current limit comparator is disabled and cannot turn off the external MOSFET during the blanking period. The PWM duty cycle is determined by the current sense input voltage and the FB input voltage.

◆ Frequency shuffling for EMI improvement

The frequency Shuffling/jittering (switching frequency modulation) is implementedin CRE2269.The oscillation frequency is modulated with a random source so that the tone energy is spread out. The spread spectrum minimizes the conduction band EMI and therefore eases the system design.

◆ Internal Synchronized Slope Compensation

Built-in slope compensation circuit adds voltage ramp onto the current sense input voltage for PWM generation. This greatly improves the close loop stability at CCM and prevents the sub-harmonic oscillation and thus reduces the output ripple voltage.

◆ Gate

CRE2269 Gate is connected to an external MOSFET gate for power switch control. Too weak the gate drive strength results in higher conduction and switch loss of MOSFET while too strong gate drive output compromises the EMI. A good tradeoff is achieved through the built-in totem pole gate design with right output strength and dead time control. The low idle loss and good EMI system design is easier to achieve with this dedicated control scheme. An internal 17.8V clamp is added for MOSFET gate protection at higher than expected VDD input.

◆ Over e Temperature Protection

An NTC resistor in series with a regular resistor should connect between RT and GND for temperature sensing and protection. NTC resistor value becomes lower when the ambient temperature rises. With the fixed internal current IRT flowing through the resistors, the voltage at RT pin becomes lower at high temperature. The internal OTP circuit is triggered and shutdown the MOSFET when the sensed input voltage is lower than VTH_OTP.

◆ Protection Controls

Good system reliability is achieved with CRE2269 ' s rich protection features including Cycle-by-Cycle current limiting (OCP), Over Load Protection (OLP), over temperature protection (OTP), on-chip VDD over voltage protection (OVP,optional) and under voltage lockout.(UVLO). The OCP threshold is input line voltage adjusted to compensate the increased output current limit at higher voltage caused by inherent Over-Current sensing and control delay. A constant output power limit is achieved with recommended reference design on CRE2269. At overload condition when FB input voltage exceeds power limit threshold value for more than 80mS, control circuit reacts to shut down the output power MOSFET. Device restarts when VDD voltage drops below UVLO limit.Similarly, control circuit shuts down the power MOSFET when an Over Temperature condition is detected. CRE2269 resumes the operation when temperature drops below the hysteresis value.VDD is supplied with transformer auxiliary winding output. It is clamped when VDD is higher than 37V. The power MOSFET is shut down when VDD drops below UVLO limit and device enters power on start-up sequence thereafter.