

Primary Side Regulation Controller ME8320-N

General Description

ME8320-N is a high performance, highly integrated QR(Quasi Resonant Mode) and Primary Side Regulation(PSR) controller for offline small power converter applications. It has high efficiency and low EMI. ME8320-N can meet EPS level 6 energy standard easily. The IC also has built-in cable drop compensation function, which can provide excellent CV performance.

ME8320-N integrates functions and protections of Under Voltage Lockout (UVLO), VDD Over Voltage Protection(VDD OVP), Output Over Voltage Protection (Output OVP), Soft Start, Cycle-by-cycle Current Limiting (OCP), All Pins Floating Protection, Gate Clamping, VDD Clamping.

Features

- Easily to Pass Energy Star EPS6.0
- Semi-valley Turn on for Higher Efficiency
- $\pm 5\%$ Constant Current (CC) and Constant Voltage (CV) Regulation at Universal AC Input
- Less than 60mW standby power
- Proprietary cable drop compensation
- Cycle-by-Cycle current limiting
- Built-in Leading Edge Blanking (LEB)
- All Pins Floating Protection
- Built-in Soft Start
- Output Over Voltage Protection
- VDD OVP & Clamp
- VDD Under Voltage Lockout (UVLO)
- Audio Noise Reduction
- Available in SOT23-6 package

Typical Application

- Battery chargers for cellular phones, cordless phones, PDA, digital cameras, etc
- Replaces linear transformer and RCC SMPS
- Small power adapter
- AC/DC LED lighting

Package

- 6-pin SOT23-6

Typical Application Circuit

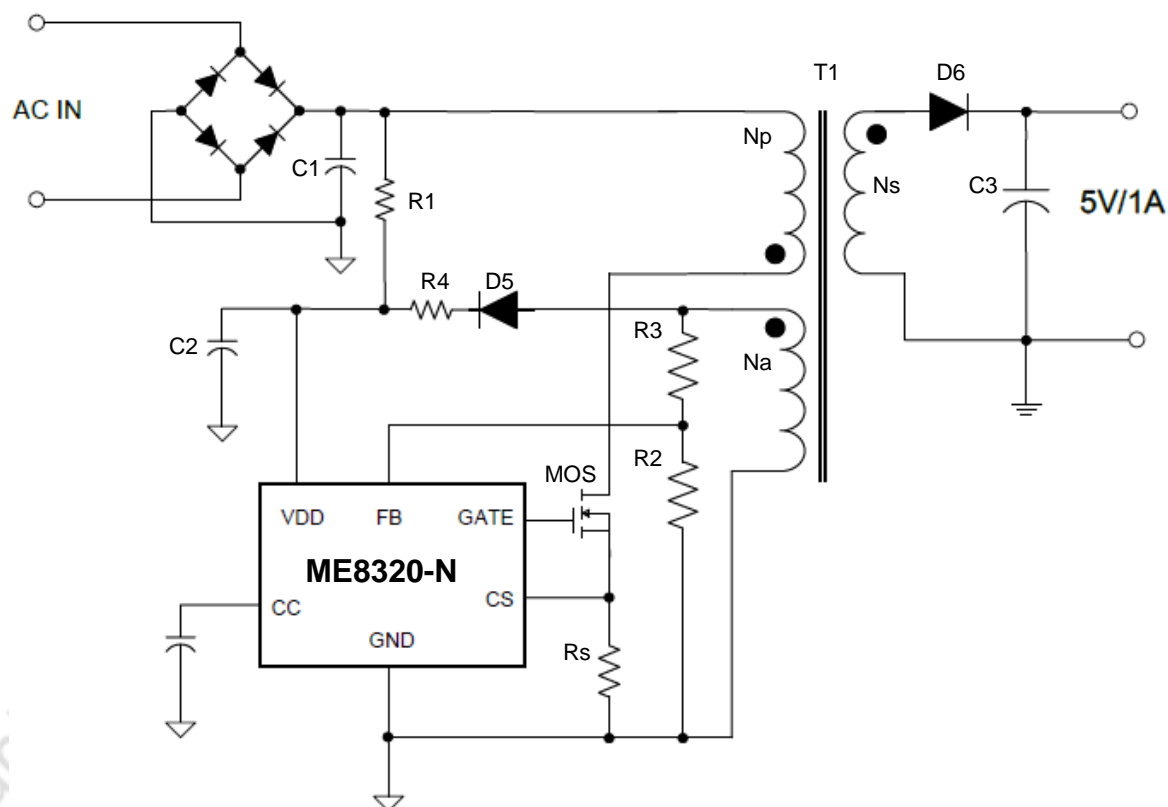
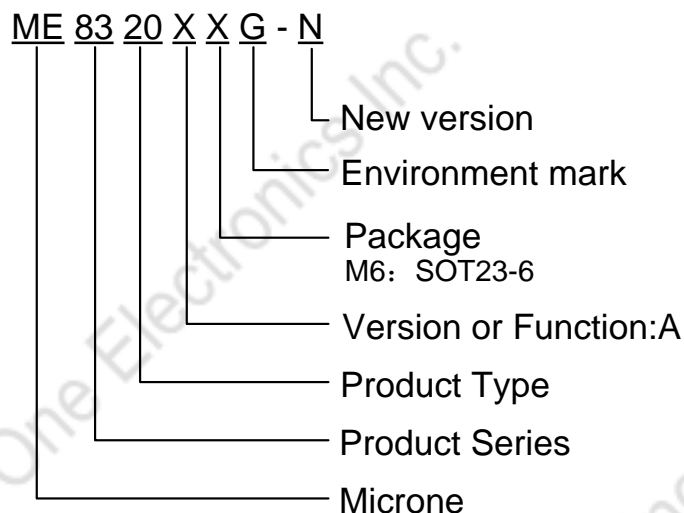


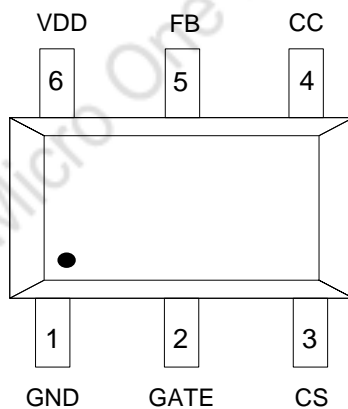
Figure.1 Typical Application of ME8320-N (5V/1A)

Selection Guide



product series	product description
ME8320AM6G-N	Package: SOT23-6

Pin Configuration& Pin Assignment



SOT23-6

Pin Assignment

Pin Number	Symbol	Function
1	GND	Ground
2	GATE	Totem-pole gate driver output to drive the external MOSFET
3	CS	Current sense
4	CC	Connect a capacitor between this pin and GND for CC regulation
5	FB	System feedback pin. This control input regulates both the output voltage in CV mode and output current in CC mode based on the flyback voltage of the auxiliary winding
6	VDD	Power Supply

Block Diagram

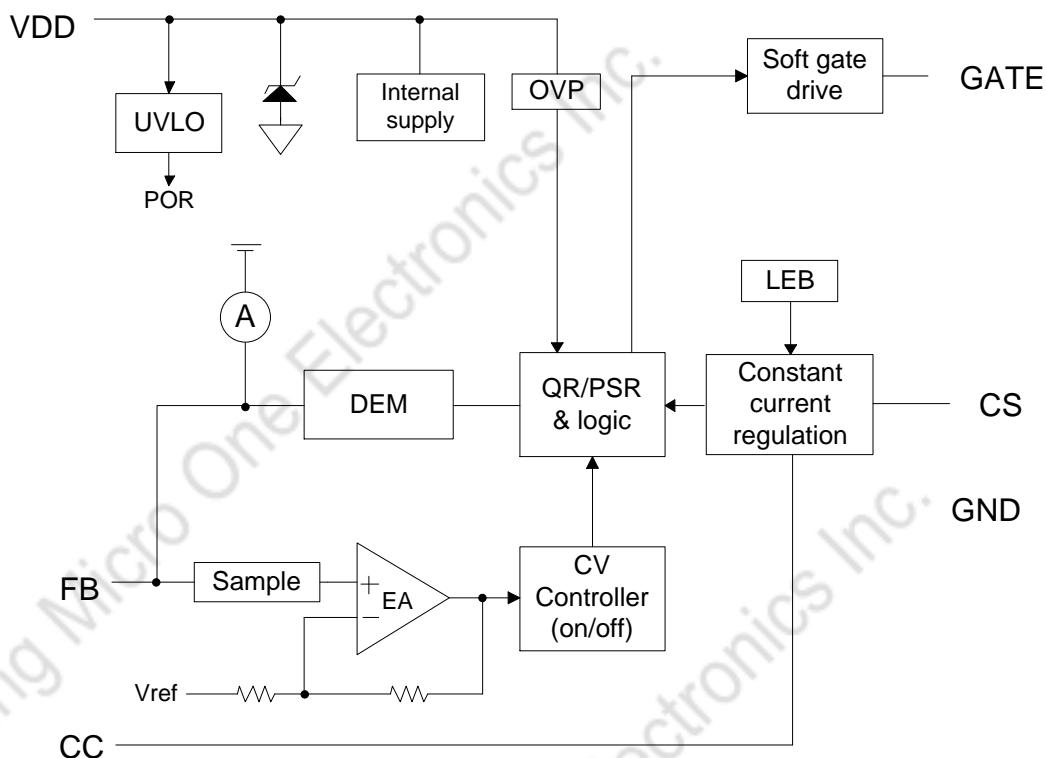


Figure.2 Functional Block Diagram of ME8320-N

Absolute Maximum Ratings

Parameter		Ratings	Unit
VDD DC supply Voltage		35	V
VDD DC clamp current		10	mA
GATE pin		20	V
CC, CS Voltage range		-0.3 ~ 7	V
FB Voltage range		-0.7 ~ 7	V
Storage Temperature range		-55~+150	°C
Maximum Junction Temperature		-40~+150	°C
Operating Ambient Temperature range		-40~85	°C
Lead temperature(Soldering, 10sec.)		260	°C
ESD capability, HBM(Human body model)		2	KV
ESD capability, MM(Machine model)		250	V
Thermal resistance (Junction to air) θ_{JA}	SOT23-6	200	°C/W
Continuous Total Power Dissipation P_D	SOT23-6	0.63	W

Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage.

These values must therefore not be exceeded under any conditions.

Recommended working condition

Parameter	Min	Typ.	Max	Unit
Power supply voltage, VDD	10	-	30	V
Operating Ambient Temperature	-40	-	85	°C
Maximum switching Frequency	-	120	-	KHz

Electrical Characteristics (Test conditions: VDD=16V, TA=25°C unless otherwise stated)

Item	Testing condition	Min	Typ.	Max	Unit
Supply Voltage (VDD) Section					
Start up Current I_{START}	VDD=UVLO(ON)-1V Measure current into VDD	-	2	20	μA
Operating Current I_{DD}	$V_{FB}=1V$, $CL=0.5nF$ VDD=20V	-	0.9	1.5	mA
VDD Under Voltage Lockout Enter (UVLO _{OFF})	VDD Falling	7.8	8.8	9.8	V
VDD Under Voltage Lockout Exit (Recovery) (UVLO _{ON})	VDD Rising	19.5	20.5	21.5	V
VDD Over voltage protection trigger(OVP)		32	34	36	V
VDD Zener clamp voltage (VDD_Clamp)	$I_{VDD}=7mA$	-	39	-	V
Feedback Input Section(FB Pin)					
Internal Error amplifier(EA) reference input $V_{FB_EA_Ref}$		1.98	2.0	2.02	V
Minimum OFF time T_{min_off}		-	2	-	μS
Maximum OFF time T_{max_off}		-	3.2	-	mS
Max cable compensation current I_{cable_max}		-	65	-	μA
Current Sense (CS pin)					
Leading Edge Blanking of CS, LEB		-	500	-	nS
Over Current detection and control delay T_{D_OC}	$CL=1nF$ at GATE	-	100	-	nS
Constant Current Section (CC Pin)					
Internal CC reference V_{CC_REF}		0.98	1	1.02	V
Gate Drive Output					
Output low level VOL	$I_o=20mA(sink)$	-	-	1	V
Output high level VOH	$I_o=20mA(source)$	7.5	-	-	V
Output clamp voltage level V_{G_Clamp}	VDD=24V	-	14.5	-	V
Rising Time, T_R	$CL=0.5nF$	-	700	-	nS
Falling Time, T_F	$CL=0.5nF$	-	35	-	nS
Temperature Protection		-	150	-	°C

Application Information

ME8320-N is a high performance, multi mode controlled, highly integrated QR (Quasi Resonant) Primary Side Regulation (PSR) controller. The built-in high precision CV/CC control with high level protection features make it very suitable for offline small power converter applications.

•Start-up current and start-up control

Start-up current of ME8320-N is designed to be very low (typically 2μA) so that VDD could be charged up above UVLOON threshold level and device starts up quickly. A large value start-up resistor can therefore be used to minimize the power loss yet reliable start-up in application.

•Operating current

The operating current in ME8320-N is as small as 1mA (typical). The small operating current results in higher efficiency and reduces the VDD hold-up capacitance requirement.

•QR/PSR Control

ME8320-N uses a proprietary QR/PSR control for high efficiency and low EMI. The IC works in Quasi-Resonant (QR) mode in Constant Current (CC) and Constant Voltage (CV) mode. In this way, the efficiency is boosted and the EMI is reduced greatly. The IC can easily meet EPS level 6 energy standard.

•Constant Current (CC) Regulation

ME8320-N can accurately control the output current by the internal current feedback control loop. The output mean current in constant current (CC) mode can be approximately expressed as:

$$I_{CC}(\text{mA}) = \frac{N}{2} \times \frac{500(\text{mV})}{R_{cs}(\Omega)}$$

In the equation above, N---The turn ratio of primary side winding to secondary side winding.

R_{cs} --- the sensing resistor connected between the MOSFET source to GND.

•Precision CV/CC Performance

In ME8320-N the parameters are trimmed to tight range, which makes the system CC/CV to have less than ±5% variation.

•Soft Start

ME8320-N features an internal soft start that slowly increases the threshold of cycle-by-cycle current limiting comparator during start-up sequence. It reduces the stress on the secondary diode during start-up. Every start-up process is followed by a soft start activation.

●Proprietary Cable Voltage Compensation in CV Mode

When it comes to cellular phone charger applications, the battery is located at the end of cable, which causes typically several percentage of voltage drop on the actual battery voltage. ME8320-N has a proprietary built-in cable voltage drop compensation block which can provide a constant output voltage at the end of the cable over the entire load range in CV mode.

●Leading Edge Blanking (LEB)

Each time the power MOSFET is switched on, a turn-on spike occurs across the sensing resistor. To avoid premature termination of the switching pulse, an internal leading edge blanking circuit is built in. During this blanking period (500ns, typical), the cycle-by-cycle current limiting comparator is disabled and cannot switch off the gate driver. Thus, external RC filter with a small time constant is enough for current sensing.

●Minimum and Maximum OFF Time

In ME8320-N, a minimum OFF time (typically 2us) is implemented to suppress ringing when GATE is off. The minimum OFF time is necessary in applications where the transformer has a large leakage inductance, particularly at low output voltages or start-up. The maximum OFF time in ME8320-N is typically 3ms, which provides a large range for frequency reduction. In this way, a low standby power of 100mW can be achieved.

●VDD OVP(Over Voltage Protection)

VDD OVP (Over Voltage Protection) is implemented in ME8320-N and it is a protection of auto-recovery mode.

●Pin Floating Protection

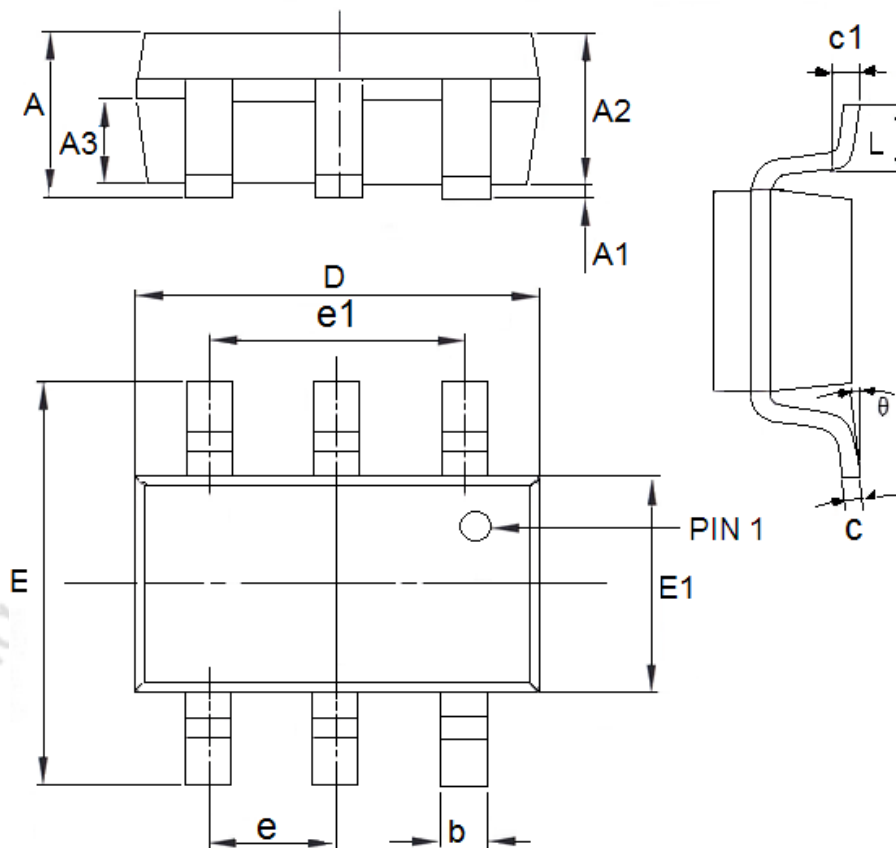
In ME8320-N, if pin floating situation occurs, the IC is designed to have no damage to system.

●Soft Gate Drive

ME8320-N has a soft totem-pole gate driver with optimized EMI performance. An internal 16V clamp is added for MOSFET gate protection at higher than expected VDD input.

Packaging Information

● SOT23-6



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.05	1.45	0.0413	0.0571
A1	0	0.15	0.0000	0.0059
A2	0.9	1.3	0.0354	0.0512
A3	0.55	0.75	0.0217	0.0295
b	0.25	0.5	0.0098	0.0197
c	0.1	0.25	0.0039	0.0098
D	2.7	3.12	0.1063	0.1228
e1	1.9(TYP)		0.0748(TYP)	
E	2.6	3.1	0.1024	0.1220
E1	1.4	1.8	0.0551	0.0709
e	0.95(TYP)		0.0374(TYP)	
L	0.25	0.6	0.0098	0.0236
θ	0	8°	0.0000	8°
c1	0.2(TYP)		0.0079(TYP)	

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