

Current Mode PWM Controller ME8139A Series

General Description

The ME8139A is a highly integrated current mode PWM controller with a high voltage GaN of 650V optimized for high performance off-line power converters. ME8139A features a constant power mode. VDD low startup current and low operating current contribute to a tiny power consumption and reliable power on startup.

ME8139A features a auto-tuning circuit combined with a steering charge pump, reducing the stress of secondary synchronous rectifier effectively.

ME8139A offers a wide VDD supply range from 9.5V to 52V. The IC operates in a maximum frequency of 130KHz @Full Load, As the load gradually decreases, the IC operates in Green Mode and Extended Burst Mode to minimize the standby power loss. EMI performance is also optimized by Frequency Jittering and Peak Current Jittering.

ME8139A offers comprehensive protection coverage including Cycle-by-Cycle current limiting (OCP), Over Load Protection (OLP), VDD Under Voltage Lockout (UVLO), Over Temperature Protection (OTP), VDD Over Voltage Protection (VDD OVP), Leading Edge Blanking (LEB) and CS Open Protection (SCB).

Applications

- General Power Supply
- Adaptor

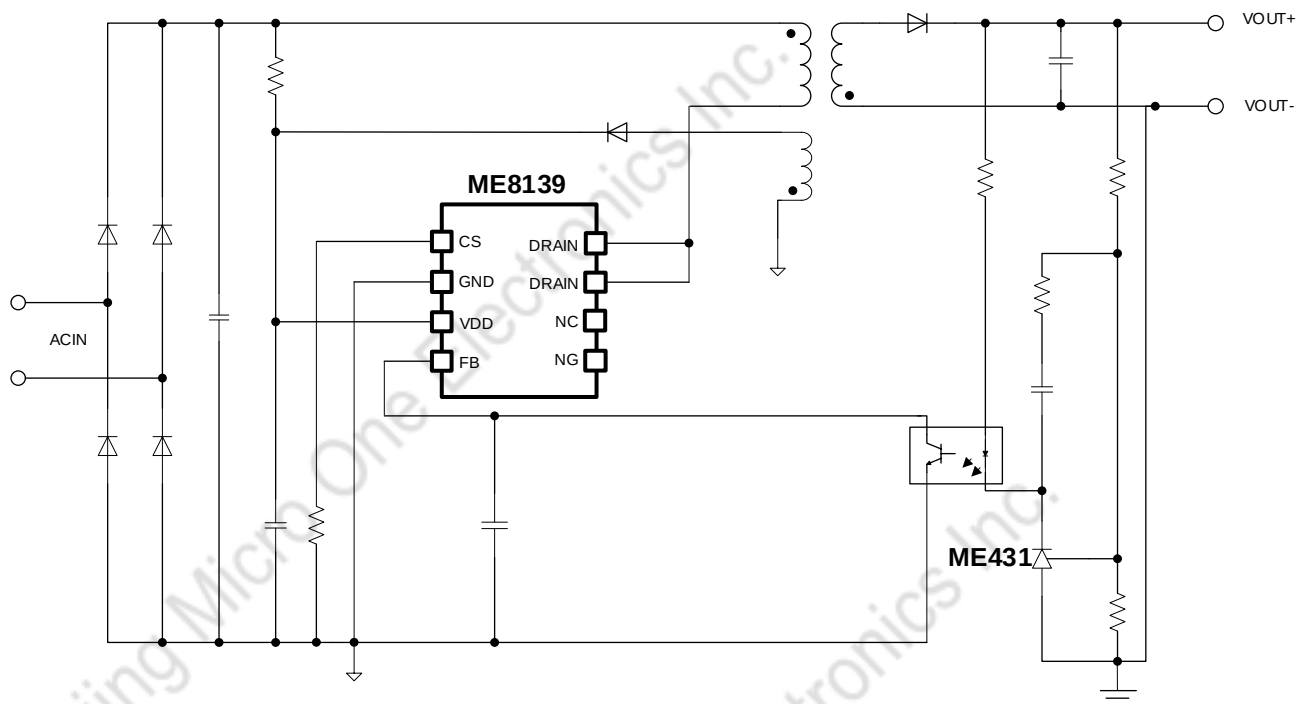
Features

- Integrated 650V GaN
- Ultra Low start-up and quiescent current
- Wide VDD range from 9.5V to 52V
- Constant power mode
- Built-in soft start to reduce VDS stress
- Frequency Jittering and Peak Current Jittering
- Extended Burst Mode Control
- Auto-tuning soft Drive
- Internal Synchronized Slope Compensation
- Protection coverage with auto recovery
 - Cycle-by-Cycle current limiting (OCP)
 - Over Load Protection (OLP)
 - VDD Under Voltage Lockout (UVLO)
 - VDD Over Voltage Protection (VDD OVP)
 - Over Temperature Protection (OTP)
 - Leading Edge Blanking (LEB)
 - CS Open Protection (SCB)

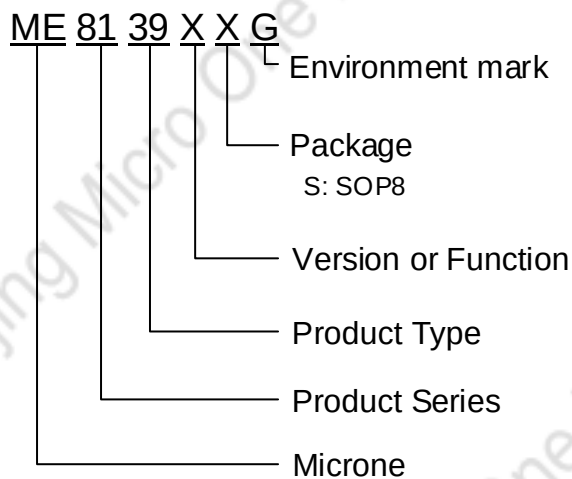
Package

- 8-pin SOP8

Typical Application Circuit



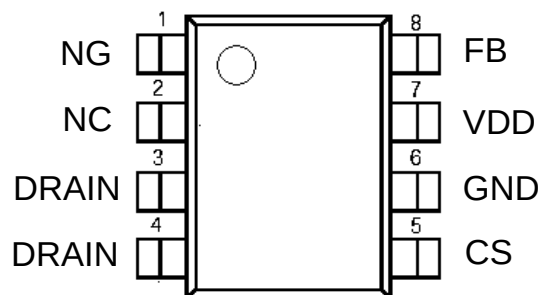
Selection Guide



Product Series	Product Description
ME8139ASG	Package: SOP8, 20W full voltage

Note: If you need other voltage and package, please contact our sales staff.

Pin Configuration

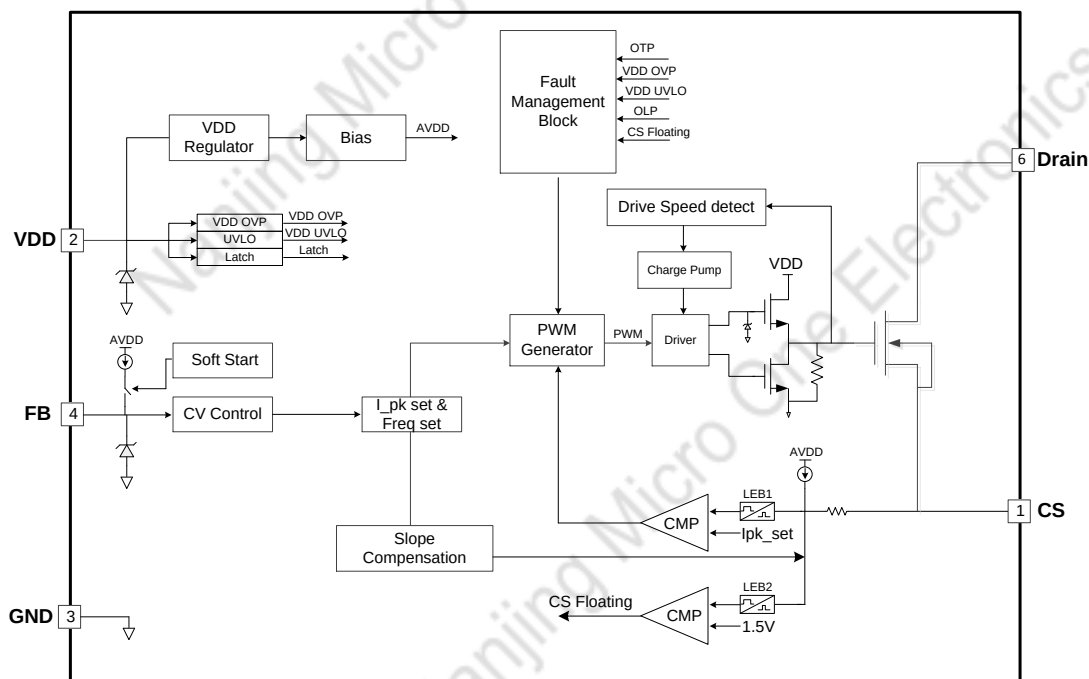


SOP8

Pin Assignment

Pin No.	Symbol	Functions
1	NG	The Source of GaN, No need to connect during application
2	NC	No Connection
3,4	Drain	Drain of the GaN
5	CS	Current Sense
6	GND	Ground
7	VDD	Power Supply
8	FB	Feedback

Block Diagram



Absolute Maximum Ratings

Parameter	Ratings	Unit
Drain Voltage	-0.3~650	V
VDD DC Supply Voltage	-0.3~82	V
VDD operating current	0~10	mA
FB, CS Input Voltage	-0.3~7	V
Thermal resistance (Junction to ambient) θ_{JA}	136	°C/W
Continuous Total Power Dissipation P_D	0.92	W
Operating ambient temperature T_A	-40~+85	°C
Min/Max Storage junction temperature	-55~+150	°C
Maximum junction temperature T_J	-40~+150	°C
Welding Temperature	+260 (10s)	°C
ESD (HBM)	±2000	V
ESD (CDM)	±2000	V

Note:

1. Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product.
2. The maximum allowable power dissipation is a function of the maximum junction temperature $T_{J(MAX)}$, the junction-to-ambient thermal resistance θ_{JA} , and the ambient temperature T_A . The maximum allowable continuous power dissipation at any ambient temperature is calculated by $P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA}$.
3. The θ_{JA} values given in this table are for comparison with other packages only and cannot be used for design purposes. They do not represent the performance achieved in real-world applications.

Recommended Operating Condition

Parameter	Ratings	Unit
VDD Input Voltage	9.5~52	V
Operating Ambient Temperature	-40~+85	°C

Electrical Characteristics

(T_A = 25°C, VDD=16V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Unit
Supply Voltage (VDD)						
I _{Start}	Start-Up Current Sourced from VDD Pin	VDD=16V	-	5	-	μA
VDD_ON	VCC Under Voltage Lockout Enter		15	17.5	20	V
VDD_OFF	Under-Voltage Lockout Voltage of VDD Pin		8	9.5	11	V
VDD_OVP	VDD Over Voltage Protection Threshold voltage	FB=2.5V, ramp up VDD until gate clock is off	50	52	54	V
I _q	VDD Standby current	FB=0, CS=0, VDD=24V	-	240	700	μA
I _{Fault}	VDD Pull down current @ Fault Condition	VDD=24V@Fault condition	-	1.2	1.4	mA
I _{oper}	Operation Current	VDD=24V, FB=2.8V, CS=0	2.5	-	-	mA
Feedback Input Section (FB Pin)						
V _{FB_OPEN}	FB open Loop Voltage	FB Floating, CS=0	4	4.2	4.5	V
R _{FB}	FB Input Impedance		18	20	22	KΩ
I _{FB_SHORT}	FB pin short circuit current	FB=0, CS=0	190	210	230	μA
V _{FB_OLP}	Open loop Protection FB threshold	VDD=20V, Ramp up FB until gate clock is off	3	3.1	3.2	V
V _{FB_ECO}	ECO Mode threshold		2.1	2.2	2.3	V
V _{FB_DPWM}	DPWM threshold		1.6	1.7	1.8	V
V _{FBL}	The threshold enter burst mode		0.7	0.8	0.9	V
V _{FBH}	The threshold exit burst mode		0.9	1	1.1	V
T _{ss}	Internal Soft start time		4	6	8	ms
Current Sense Input (CS Pin)						
T _{ON_MIN}	Minimum On Time		400	450	500	ns
T _{LEB}	Leading edge Blanking Time		250	300	350	ns
V _{cs_min}	CS minimum Voltage		170	200	230	mV
V _{cs_max}	CS maximum Voltage		770	800	830	mV
V _{sc}	CS open Protection threshold		1.4	1.5	1.6	V
D _{Max}	Maximum duty cycle		70%	75%	80%	
Oscillator						
F _{max}	Maximum Frequency for operation	FB=3V	120	130	140	KHz
F _{min}	Burst Mode Switch Frequency	FB=1V	21	23	25	KHz
ΔF _{jitter}	Frequency jittering		-	±8%	-	
ΔI _{pk}	I _{pk} jittering		-	±3%	-	
GaN Drain						
BVD _{ss}	GaN V _{ds} Breakdown Voltage		650	-	-	V
R _{dson}	Static Drain-Source On-Resistance		-	0.8	1.04	Ω
Thermal Protection						
OTP IN			-	170	-	°C
OTP OUT			-	125	-	°C

Operation Description

The ME8139A is a highly integrated current mode PWM controller with a high voltage GaN of 650V optimized for high performance off-line power converters. VDD low startup current and low operating current contribute to a tiny power consumption and reliable power on startup.

ME8139A features a auto-tuning circuit combined with a steering charge pump, reducing the stress of secondary synchronous rectifier effectively.

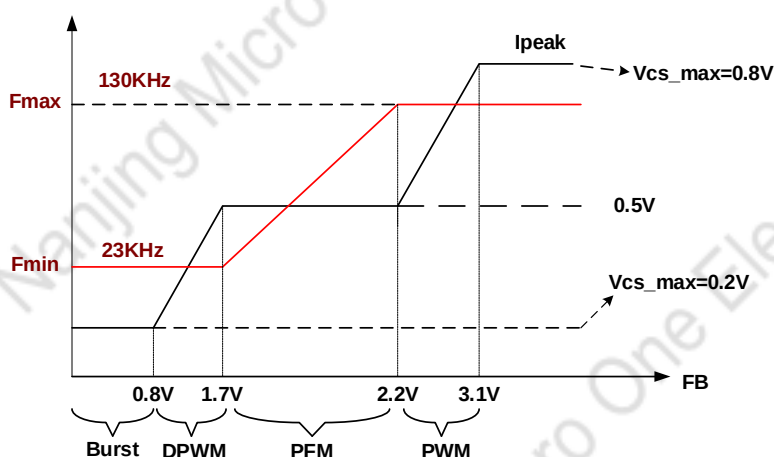
ME8139A also offers a wide VDD supply range from 9.5V to 52V and operates in a maximum frequency of 130KHz @Full Load, As the load gradually decreases, the IC operates in Green Mode and Extended Burst Mode to minimize the standby power loss. EMI performance is also optimized by Frequency Jittering and Peak Current Jittering. The good supply system reliability is also achieved with Multiple auto-recovery Protection features.

Start up Control

Startup current of ME8139A is set to be extremely low so that VDD could be charged up above UVLO threshold easily by a large external resistor tied to Vbuck .

When VDD reaches VDD_ON(typical 17.5V), the controller detect fault condition, If the fault status=1, VDD then begins to fall because the controller bias current is at I_Fault(Typically 1.2mA) and the auxiliary supply voltage is not present. When VDD falls to VDD_OFF (typically 9.5V), the current source turns back on and charges VDD. This Cycle repeats indefinitely until Fault status=0.

Frequency and Ipk set



During the full load power operation, ME8139A operates at a 130KHz frequency, As the load gradually decreases , the IC operates in Green Mode and Extended Burst Mode to minimize the standby power loss. Ipk control is also achieved by DPWM & PWM control loop.

Current Sensing and Leading Edge Blanking

Cycle-by-Cycle current limiting is offered in ME8139A current Mode PWM control. The switch current is detected by a sense resistor into the CS pin. An internal leading edge blanking circuit chops off the sensed voltage

spike at initial internal GaN on state due to a snubber diode reverse recovery and surge gate current of GaN during the blanking period.

Extended Burst Mode Operation

At zero load or light load condition, majority of the power dissipation in a switching mode power supply is from switching loss on the GaN transistor, the core loss of the transformer and the loss on the snubber circuit. The magnitude of power loss is in proportion to the switching frequency. Lower switching frequency leads to the reduction on the power loss and thus conserves the energy.

The switching frequency is internally adjusted at no load or light load condition. The switch frequency reduces at light/no load condition to improve the conversion efficiency. At light load or no load condition, the FB input drops below burst mode threshold level and device enters Burst Mode control. The Gate drive output switches only when VCC 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 and reduces the standby power consumption to the greatest extend. The nature of high frequency switching also reduces the audio noise at any loading conditions.

Soft Start

Soft-start is achieved by ramping up an internal reference, VSSTART, and comparing it to the current sense signal. VSSTART ramps up from 0 V once the controller initially powers up. The peak current set point is then limited by the VSSTART ramp resulting in a gradual increase of the switch current during start-up. The soft-start duration, is typically 4 ms.

Auto-tuning soft drive

ME8139A features a auto-tuning circuit combined with a steering charge pump, reducing the stress of secondary synchronous rectifier effectively.

Constant power mode

When ME8139A is applied to a PD charger, as the output voltage changes, the output current changes in reversing, ensures that the total output power remains unchanged.

Protection Controls

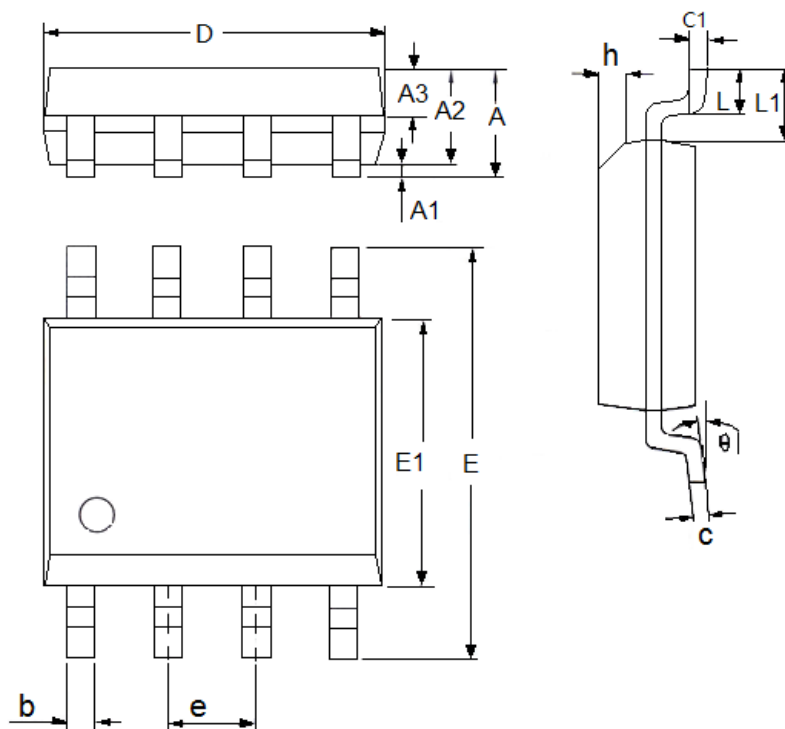
Good power supply system reliability is achieved with its rich protection features including Cycle-by-Cycle current limiting (OCP), Over Load Protection (OLP), CS short protection, CS floating protection, over voltage protection (OVP), and Under Voltage Lockout on VCC (UVLO).

Package Quantity

Package Type	Minimum Packing QTY	UNITS	Small Box	Large BOX
SOP8	3000	Tape & Reel	6K	48K

Package Information

- Package Type: SOP8



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.3	1.8	0.0512	0.0709
A1	0.05	0.25	0.002	0.0098
A2	1.25	1.65	0.0492	0.065
A3	0.5	0.7	0.0197	0.0276
b	0.3	0.51	0.0118	0.0201
c	0.17	0.25	0.0067	0.0098
D	4.7	5.1	0.185	0.2008
E	5.8	6.2	0.2283	0.2441
E1	3.8	4	0.1496	0.1575
e	1.27(TYP)		0.05(TYP)	
h	0.25	0.5	0.0098	0.0197
L	0.4	1.27	0.0157	0.05
L1	1.04(TYP)		0.0409(TYP)	
θ	0	8°	0	8°
c1	0.25(TYP)		0.0098(TYP)	

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