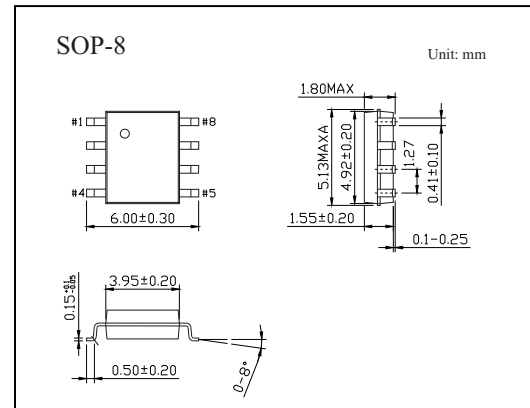


## Critical Conduction GreenLine SMPS Controller

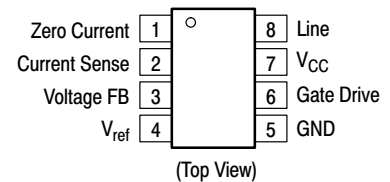
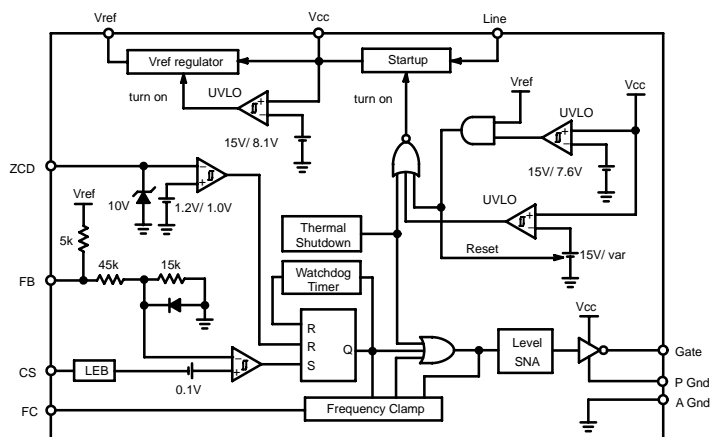
## MC33364

## ■ Features

- Lossless Off-Line Startup
- Leading Edge Blanking for Noise Immunity
- Watchdog Timer to Initiate Switching
- Operating Temperature Range -25°C to +125°C
- Shutdown Capability
- Over Temperature Protection
- Optional/Adjustable Frequency Clamp to Limit EMI



## ■ Functional Block Diagram

■ Absolute Maximum Ratings  $T_a = 25^\circ\text{C}$ 

Parameter	Symbol	Rating	Unit
Power Supply Voltage (Operating)	Vcc	16	V
Line Voltage	Vline	700	V
Current Sense, Compensation, Voltage Feedback, Restart Delay and Zero Current Input Voltage	Vin1	-1.0 to +10	V
Zero Current Detect Input	Iin	±5.0	mA
Restart Diode Current	Iin	5.0	mA
Maximum Power Dissipation @ $T_A = 70^\circ\text{C}$	PD	550	mW
Thermal Resistance, Junction to Air	RθJA	145	°C/W
Operating Junction Temperature	TJ	150	°C
Operating Ambient Temperature	TA	-25 to +125	°C
Storage Temperature Range	Tstg	-55 to +150	°C

## MC33364

■ ELECTRICAL CHARACTERISTICS ( $V_{CC} = 15.5\text{ V}$ , for typical values  $T_A = 25^\circ\text{C}$ , for min/max values  $T_J = -25\text{ to }125^\circ\text{C}$ )

Parameter	Symbol	Test conditons	Min	Typ	Max	Unit
<b>VOLTAGE REFERENCE</b>						
Reference Output Voltage	$V_{ref}$	$I_{out} = 0\text{ mA}$ , $T_J = 25^\circ\text{C}$	4.90	5.05	5.20	V
Line Regulation	Regline	$V_{CC} = 10\text{ V to }20\text{ V}$		2.0	50	mV
Load Regulation	Regload	$I_{out} = 0\text{ mA to }5.0\text{ mA}$		0.3	50	mV
Maximum $V_{ref}$ Output Current	$I_o$			5		mA
Reference Undervoltage Lockout Threshold	$V_{th}$			4.5		V
<b>ZERO CURRENT DETECTOR</b>						
Input Threshold Voltage	$V_{th}$	$V_{in}$ Decreasing	0.9	1.0	1.1	V
Hysteresis	$V_H$	$V_{in}$ Decreasing		200		mV
Input Clamp Voltage - High State - Low State	$V_{IH}$	$I_{DET} = 3.0\text{ mA}$	9.0	10.33	12	V
	$V_{IL}$	$I_{DET} = 3.0\text{ mA}$	-1.1	-0.75	-0.5	
<b>CURRENT SENSE COMPARATOR</b>						
Input Bias Current	$I_{IB}$	$V_{CS} = 0\text{ to }2.0\text{ V}$	-0.5	0.02	0.5	$\mu\text{A}$
Built In Offset	$V_{IO}$		50	108	170	mV
Feedback Pin Input Range	$V_{FB}$		1.1	1.24	1.4	V
Feedback Pin to Output Delay	$t_{DLY}$		100	232	400	ns
<b>DRIVE OUTPUT</b>						
Source Resistance	$R_{OH}$	Drive = 0 V, $V_{Gate} = V_{CC} \pm 1.0\text{ V}$	10	36	70	$\Omega$
Sink Resistance	$R_{OL}$	Drive = $V_{CC}$ , $V_{Gate} = 1.0\text{ V}$	5	11	25	
Output Voltage Rise Time (25% ? 75%)	$t_r$	$C_L = 1.0\text{ nF}$		67	150	ns
Output Voltage Fall Time (75% ? 25%)	$t_f$	$C_L = 1.0\text{ nF}$		28	50	ns
Output Voltage in Undervoltage	$V_{O(UV)}$	$V_{CC} = 7.0\text{ V}$ , $I_{sink} = 1.0\text{ mA}$		0.01	0.03	V
<b>LEADING EDGE BLANKING</b>						
Delay to Current Sense Comparator Input	$t_{PHL(in/out)}$	$V_{FB} = 2.0\text{ V}$ , $V_{CS} = 0\text{ V to }4.0\text{ V step}$ , $C_L = 1.0\text{ nF}$		250		ns
<b>THERMAL SHUTDOWN</b>						
Shutdown	$T_{sd}$	Junction Temperature Increasing		180		$^\circ\text{C}$
Hysteresis	$T_H$	Junction Temperature Decreasing		50		
<b>TIMER</b>						
Watchdog Timer	$t_{DLY}$		200	360	700	$\mu\text{s}$
<b>UNDERVOLTAGE LOCKOUT</b>						
Startup Threshold	$V_{th(on)}$	$V_{CC}$ Decreasing	14	15	16	V
Minimum Operating Voltage After Turn?On	$V_{Shutdown}$	$V_{CC}$ Decreasing	6.5	7.6	8.5	V
<b>FREQUENCY CLAMP</b>						
Internal FC Function	$f_{max}$	pin open	104	126	145	kHz
Internal FC Function	$f_{max}$	pin grounded	400	564	800	kHz
Frequency Clamp Input Threshold	$V_{th(FC)}$		1.89	1.95	2.01	V
Frequency Clamp Control Current Range (Sink)	$I_{Control}$		30	70	110	$\mu\text{A}$
Dead Time	$T_d$	FC pin = 1.7 V	3.0	5.0	6.5	$\mu\text{s}$

### MC33364

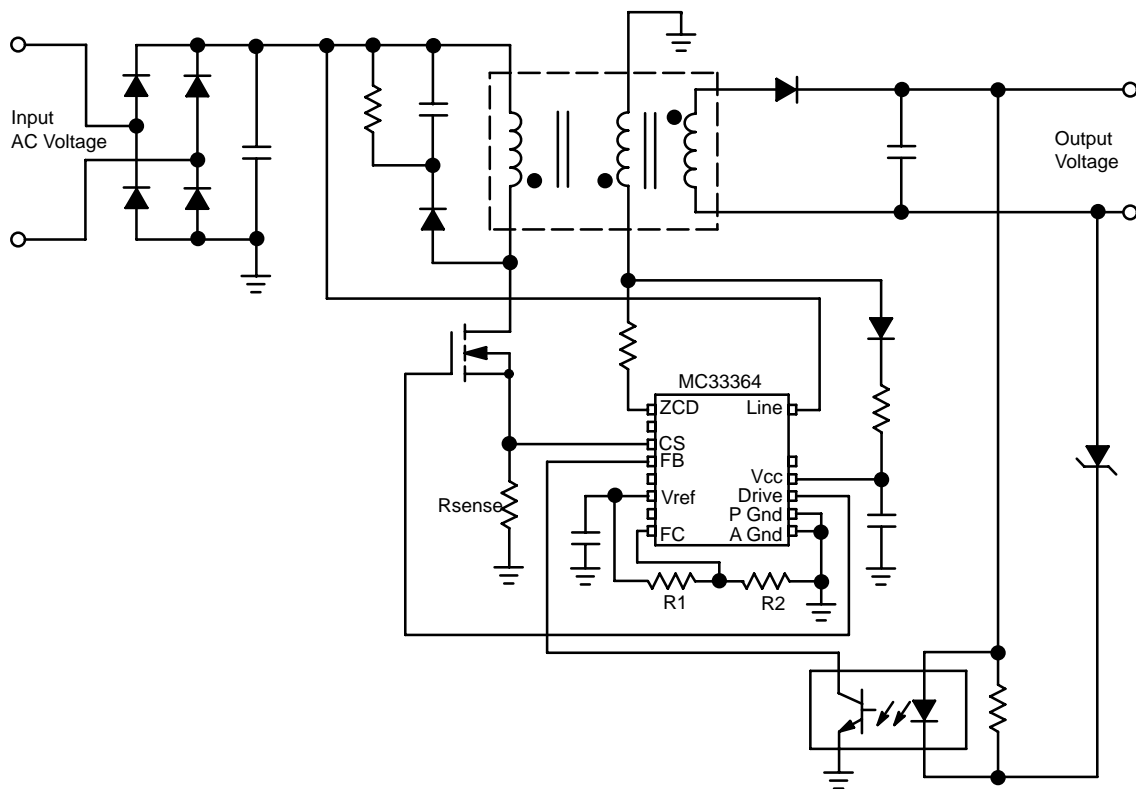
■ ELECTRICAL CHARACTERISTICS ( $V_{CC} = 15.5\text{ V}$ , for typical values  $T_A = 25^\circ\text{C}$ , for min/max values  $T_J = -25\text{ to }125^\circ\text{C}$ )

Parameter	Symbol	Test conditons	Min	Typ	Max	Unit
<b>TOTAL DEVICE</b>						
Line Startup Current ( $V_{Line} = 50\text{ V}$ )	$I_{Line}$	$V_{CC} = V_{th(on)} ? 1.0\text{ V}$	5.0	8.5	12	mA
Restart Delay Time	$t_{DLY}$	$V_{CC} = V_{th(on)} ? 1.0\text{ V}$		100		ms
Line Pin Leakage	$I_{Line}$	$V_{Line} = 500\text{ V}$	0.5	32	70	$\mu\text{A}$
Line Startup Current	$I_{Line}$	$V_{CC} = 0\text{ V}, V_{Line} = 50\text{ V}$	6.0	10	12	mA
Vcc Dynamic Operating Current	$I_{CC}$	50 kHz, $C_L = 1.0\text{ nF}$	1.5	2.75	4.5	mA
Vcc Off State Consumption	$I_{CC\ off}$	$V_{CC} = 11\text{ V}$	300	544	800	$\mu\text{A}$

■ Marking

Marking	MC33364
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■ Typical Application Circuit



# MC33364

## ■ Typical Application Circuit

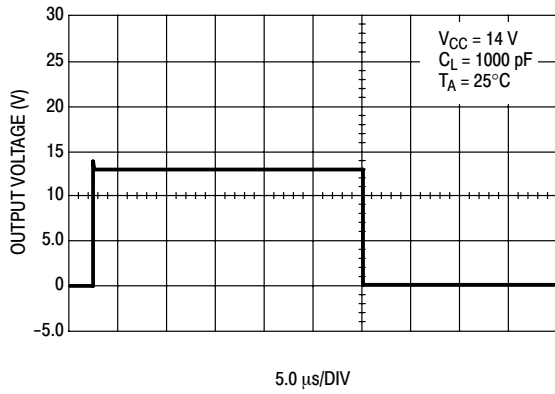


Figure 1. Drive Output Waveform

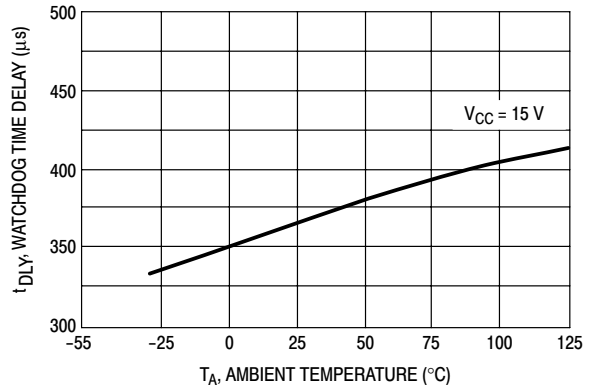


Figure 2. Watchdog Timer Delay versus Temperature

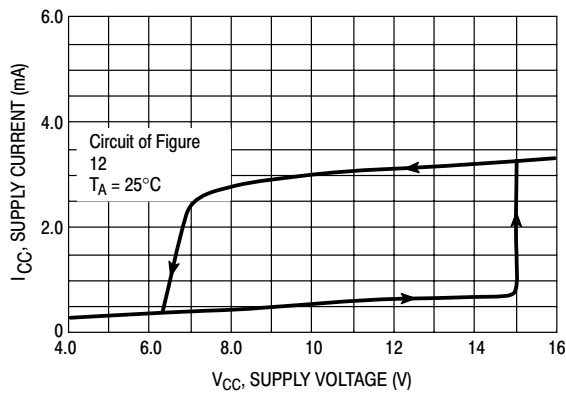


Figure 3. Supply Current versus Supply Voltage

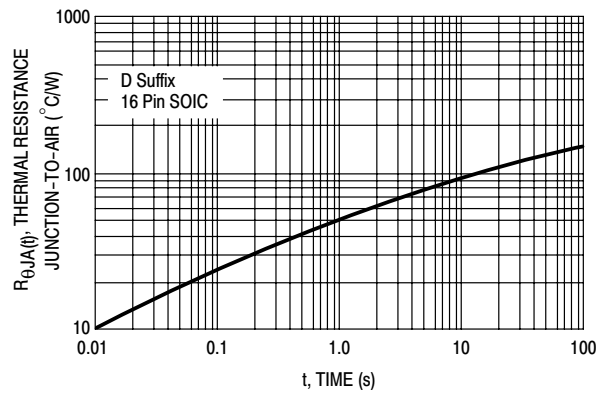


Figure 4. Transient Thermal Resistance

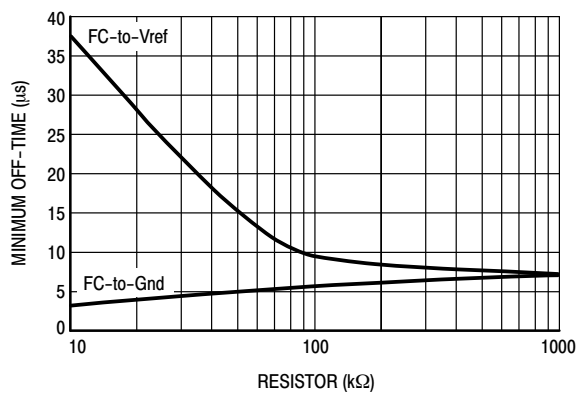


Figure 5. Minimum Off-time versus Timing Resistor on the FC Pin

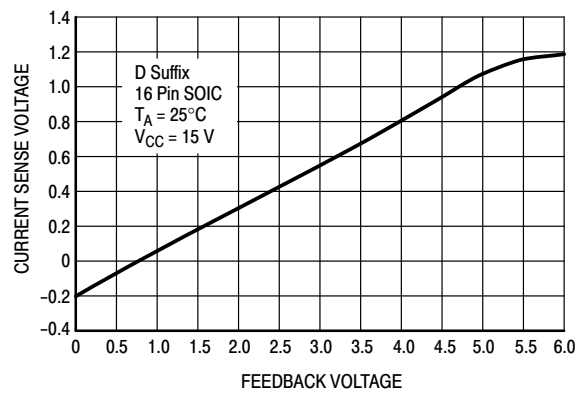


Figure 6. Feedback Voltage versus Current Sense Voltage