

HIGH PERFORMANCE CURRENT MODE PWM CONTROLLERS

- 40ns output rise and 30ns output fall times
- -40°C to +85°C temp. range same as standard UC284x
- Low-power BiCMOS Process
- Very low start-up current (50µA typical)
- Low operating current (4mA typical)
- CMOS outputs with rail-to-rail swing
- ≥500kHz current-mode operation
- Pin-for-pin compatible with UC3842/3843/3844/3845(A)
- Trimmed oscillator discharge current
- UVLO with hysteresis
- Low cross-conduction currents

The GM38C4x are fixed frequency, high performance, current-mode PWM controllers. Gamma's BiCMOS devices are pin compatible with standard 384x bipolar devices but with several improvements.

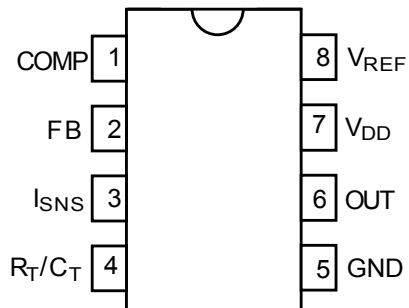
Undervoltage lockout circuitry allows the '42 and '44 versions to start up at 14.5V and operate down to 9V, and the '43 and '45 versions start at 8.4V with operation down to 7.6V. All versions operate up to 20V. When compared to bipolar 384x devices operating from a 15V supply, start-up current has been reduced to 50µA typical and operating current has been reduced to 4.0 mA typical. Decreased output rise and fall times drive larger MOSFETs, and rail-to-rail output capability increases efficiency, especially at lower supply voltages. The GM38C4x also features a trimmed oscillator discharge current and bandgap reference.

GM38C4x denotes 8-pin plastic DIP and SOP packages. GM38C4x-1 denotes 14-pin plastic DIP and SOP packages. 8-pin devices feature small size, while 14-pin devices separate the analog and power connections for improved performance and power dissipation.

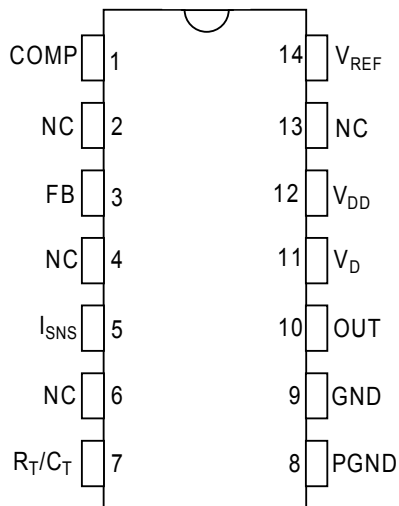
Applications:

- Current-mode, off-line, switched-mode power supplies
- Current-mode, dc-to-dc converters.
- Step-down "buck" regulators
- Step-up "boost" regulators
- Flyback, isolated regulators
- Forward converters
- Synchronous FET converters

PIN CONNECTIONS



DIP-8, SOP-8 (TOP VIEW)



DIP-14, SOP-14 (TOP VIEW)

**HIGH PERFORMANCE CURRENT MODE PWM CONTROLLERS**■ **PIN FUNCTIONS DESCRIPTION**

PIN 8-lead	PIN 14-lead	FUNCTION	DESCRIPTION
1	1	COMP	Compensation: Connect external compensation network to modify the error amplifier output.
	2	NC	Not internally connected.
2	3	FB	Feedback (Input): Error amplifier input. Feedback is 2.5V at desired output voltage.
	4	NC	Not internally connected.
3	5	I_{SNS}	Current Sense (Input): Current sense comparator input. Connect to current sensing resistor or current transformer.
	6	NC	Not internally connected.
4	7	R_T/C_T	Timing Resistor/Timing Capacitor: Connect external RC network to select switching frequency.
5		GND	Ground: Combined analog and power ground.
	8	PGND	Power Ground: N-channel driver transistor ground.
	9	AGND	Analog Ground: Controller circuitry ground.
6	10	OUT	Power Output: Totem-pole output.
	11	V_D	Power Supply (Input): P-channel driver transistor supply input. Return to power ground (PGND).
7	12	V_{DD}	Analog Supply (Input): Controller circuitry supply input. Return to analog ground (AGND).
	13	NC	Not internally connected.
8	14	V_{REF}	5V Reference (Output): Connect external RC network.


HIGH PERFORMANCE CURRENT MODE PWM CONTROLLERS
■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNITS
Zener Current Operation at $\geq 18V$ may require special precautions (Note 6)	I_{DD}	30	mA
Supply Voltage	V_{DD}	20	V
Switch Supply Voltage	V_D	20	V
Current Sense Voltage	V_{ISNS}	-0.3 to +5.5	V
Feedback Voltage	V_{FB}	-0.3 to +5.5	V
Output Current	I_{OUT}	0.5	A
Storage Temperature	T_A	-65 to +150	$^{\circ}C$

■ OPERATING RATINGS

PARAMETER		SYMBOL	VALUE	UNITS
Junction Temperature		T_J	150	$^{\circ}C$
Package Thermal Resistance	8-pin Plastic DIP	θ_{JA}	125	$^{\circ}C / W$
	8-pin SOIC	θ_{JA}	170	
	14-pin Plastic DIP	θ_{JA}	90	
	14-pin SOIC	θ_{JA}	145	

■ ORDERING INFORMATION

PART No.	PACKAGE			
	SOP-8	SOP-14	DIP-8	DIP-14
GM38C42A	GM38C42-S8	GM38C42-S14	GM38C42-D8	GM38C42-D14
GM38C43A	GM38C43-S8	GM38C43-S14	GM38C43-D8	GM38C43-D14
GM38C44A	GM38C44-S8	GM38C44-S14	GM38C44-D8	GM38C44-D14
GM38C45A	GM38C4A-S8	GM38C45-S14	GM38C45-D8	GM38C45-D14


HIGH PERFORMANCE CURRENT MODE PWM CONTROLLERS

- **ELECTRICAL CHARACTERISTICS** ($T_A = -40^{\circ}\text{C}$ to 85°C , Note 4, $V_{DD}=15\text{V}$, $C_T=3.3\text{nF}$, $R_T=11\text{k}\Omega$, unless otherwise noted)

CHARACTERISTICS	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Reference Section					
Output Voltage	$T_A=25^{\circ}\text{C}$, $I_O=1\text{mA}$	4.9	5.0	5.1	V
Line Regulation	$12\text{V} \leq V_{DD} \leq 25\text{V}$, $I_O=5\mu\text{A}$, Note 6		2	20	mV
Load Regulation	$1\text{mA} \leq I_O \leq 20\text{mA}$		1	25	mV
Temperature Stability	Note 1		0.2		mV/ $^{\circ}\text{C}$
Total Output Variation	Line, Load, Temp., Note1	4.82	5	5.18	V
Output Noise Voltage	$10\text{Hz} \leq f \leq 10\text{kHz}$, $T_A=25^{\circ}\text{C}$, Note1		50		μV
Long Term Stability	$T_A=125^{\circ}\text{C}$, 1000 hrs., Note 1		5	25	mV
Short Circuit Output Current		-30	-80	-180	mA
Oscillator Section					
Initial Accuracy	$T_A=25^{\circ}\text{C}$, Note 5	49	52	55	kHz
Voltage Stability	$12\text{V} \leq V_{DD} \leq 18\text{V}$, Note 6		0.2	1.0	%
Temperature Stability	$T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$, Note 1		0.04		% / $^{\circ}\text{C}$
Clock Ramp Reset Current	$T_A=25^{\circ}\text{C}$, $V_{RT/CT} = 2\text{V}$, $T_{\text{MIN}} \leq T_A \leq T_{\text{MAX}}$	7.7 7.2	8.4 8.4	9.0 9.5	mA
Amplitude	$V_{RT/CT}$ (peak to peak)		1.6		Vp-p
Error Amplifier Section					
Input Bias Current	$V_{FB} = 5\text{V}$		-0.1	-2	μA
Input Voltage	$V_{\text{COMP}} = 2.5\text{V}$	2.42	2.5	2.58	V
Open Loop Voltage Gain	$2\text{V} \leq V_O \leq 4\text{V}$	65	90		dB
Power Supply Rejection Ratio	$12\text{V} \leq V_{DD} \leq 18\text{V}$	60	70		dB
Output Sink Current	$V_{FB} = 2.7\text{V}$, $V_{\text{COMP}} = 1.1\text{V}$	2	14		mA
Output Source Current	$V_{FB} = 2.3\text{V}$, $V_{\text{COMP}} = 5\text{V}$	-0.5	-1		mA
High Output Voltage	$V_{FB} = 2.3\text{V}$, $R_L=15\text{k}\Omega$ to GND	5.0	6.8		V
Low Output Voltage	$V_{FB} = 2.7\text{V}$, $R_L=15\text{k}\Omega$ to V_{REF}		0.1	1.1	V
Unity Gain Bandwidth	Note 1	0.7	1.0		MHz
Current Sense Section					
Gain	Notes 2 and 3	2.85	3.0	3.15	V/V
Maximum Threshold	$V_{\text{COMP}} = 5\text{V}$, Note 2	0.9	1.0	1.1	V
PSRR	$12\text{V} \leq V_{DD} \leq 18\text{V}$, Note 2		70		dB
Input Bias Current			-0.1	-2	mA
Delay to Output			120	250	ns


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CHARACTERISTICS	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Section					
$R_{DS(ON)}$ High	$I_{SOURCE} = 200\text{ mA}$		20		Ω
$R_{DS(ON)}$ Low	$I_{SINK} = 200\text{ mA}$		11		
Rise Time	$T_A=25^{\circ}\text{C}$, $C_L = 1\text{ nF}$		40	80	ns
Fall Time	$T_A=25^{\circ}\text{C}$, $C_L = 1\text{ nF}$		30	60	ns
Undervoltage Lockout Section					
Start Threshold	GM38C42, GM38C44	13.5	14.5	15.5	V
	GM38C43, GM38C45	7.8	8.4	9.0	
Minimum Operating Voltage	GM38C42, GM38C44	8	9	10	V
	GM38C43, GM38C45	7.0	7.6	8.2	
PWM Section					
Maximum Duty Cycle	GM38C42, GM38C43	94	96		%
	GM38C44, GM38C45	46	50		
Minimum Duty Cycle				0	%
Total Standby Current					
Start-Up Current	$V_{DD}=13\text{V}$ for GM38C42, GM38C44 $V_{DD}=7.5\text{V}$ for GM38C43, GM38C45		50	200	μA
Operating Supply Current	$V_{FB} = V_{SNS} = 0\text{V}$		4	6	mA
Zener Voltage	$I_{DD} = 25\text{ mA}$, Note 6	30	37		V

Note 1: These parameters, although guaranteed, are not 100% tested in production.

Note 2: Parameter measured at trip point of latch with $V_{EA} = 0$.

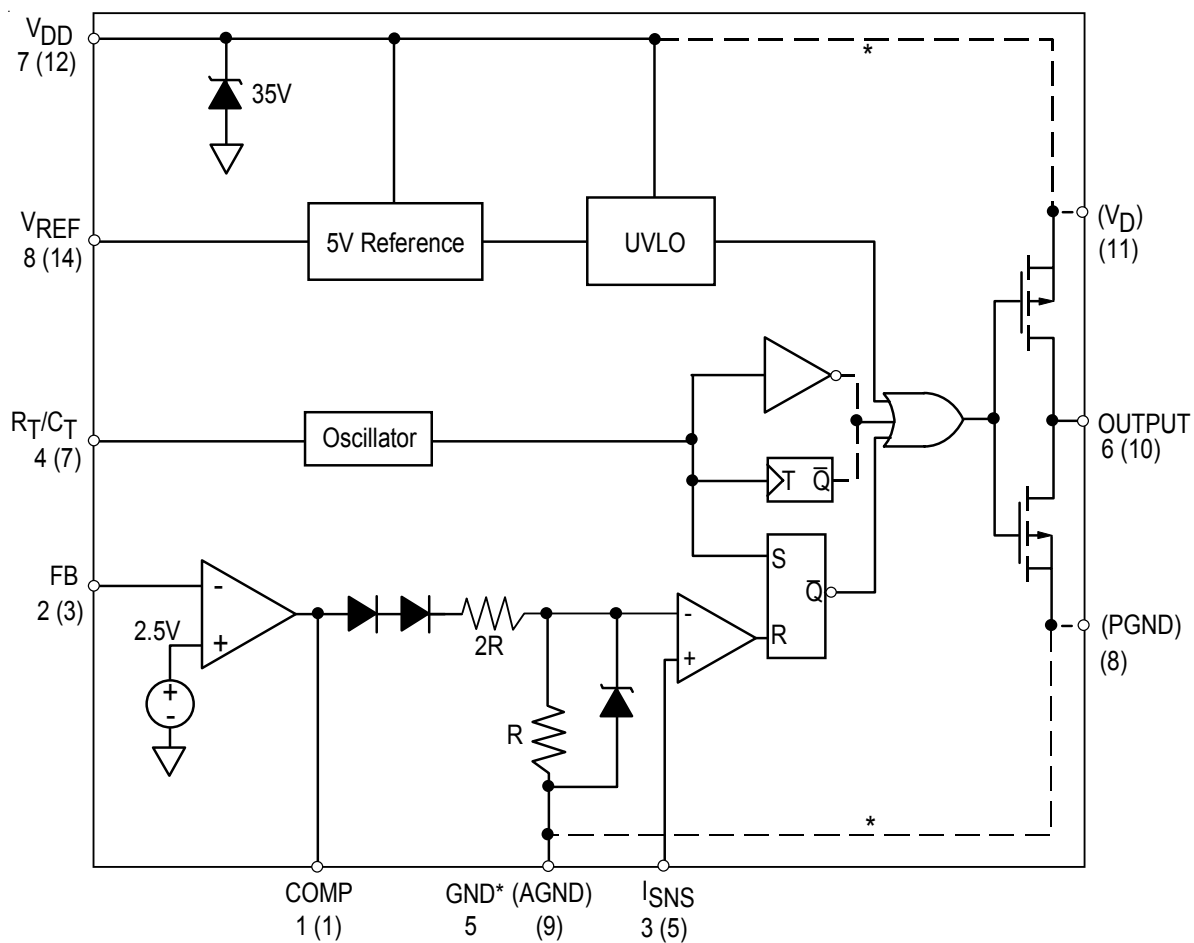
Note 3: Gain defined as:

$$A = \frac{\Delta V_{PIN1}}{V_{TH} (I_{SNS})} ; 0 \leq V_{TH} (I_{SNS}) \leq 0.8\text{V}$$

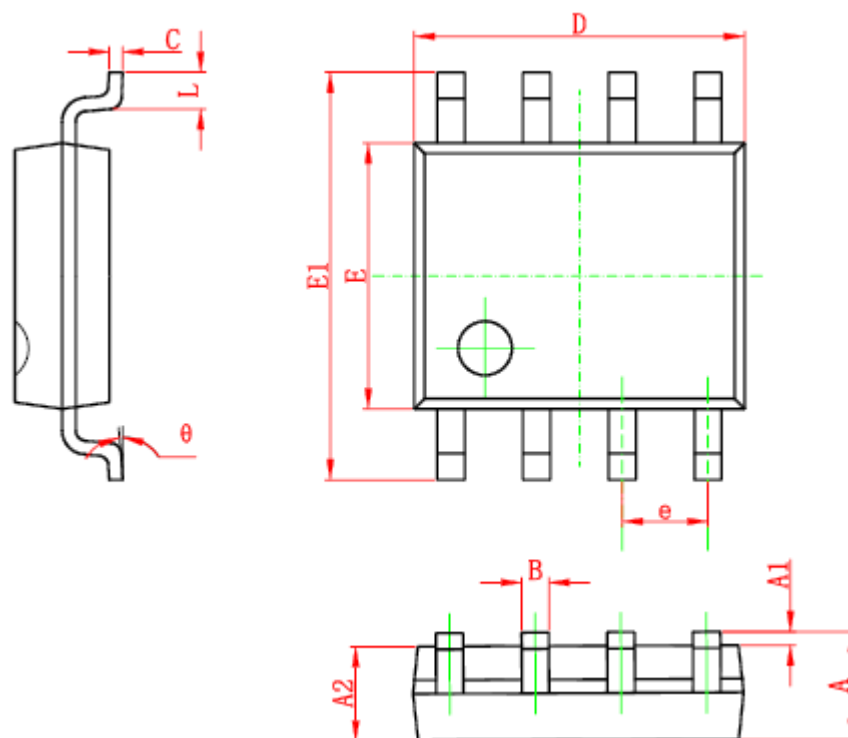
Note 4: Adjust V_{DD} above the start threshold before setting at 15V.

Note 5: Output frequency equals oscillator frequency for the GM38C42 and GM38C43. Output frequency for the GM38C44, and GM38C45 equals one half the oscillator frequency.

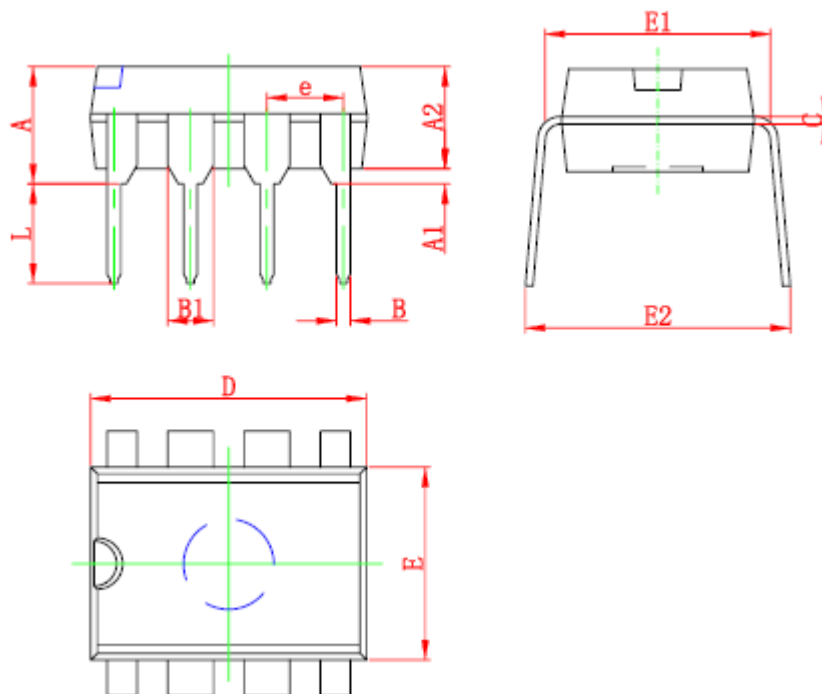
Note 6: On 8-pin version, 20V is maximum input on pin 7, as this is also the supply pin for the output stage. On 14-pin version, 40V is maximum for pin 12 and 20V maximum for pin 11.

HIGH PERFORMANCE CURRENT MODE PWM CONTROLLERS
FUNCTIONAL BLOCK DIAGRAM


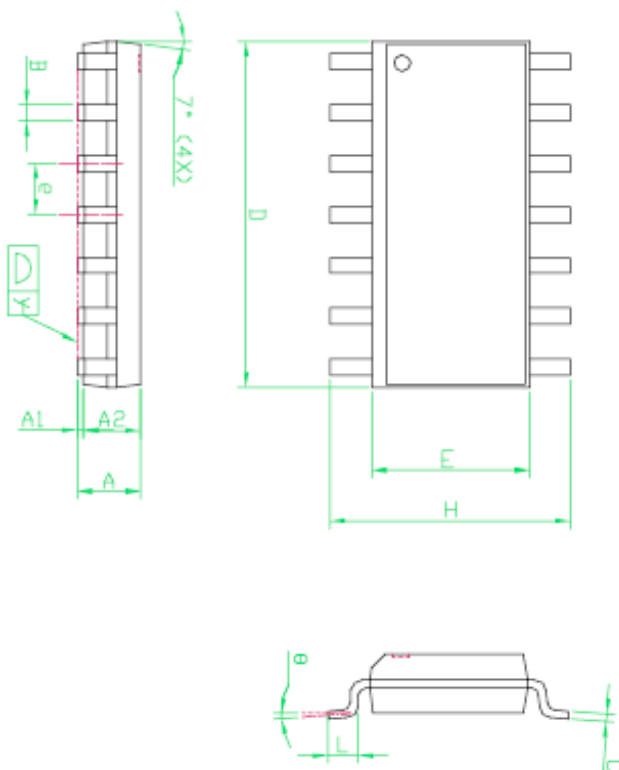
* 8-lead versions only
 () pins for 14-lead versions only

**HIGH PERFORMANCE CURRENT MODE PWM CONTROLLERS**■ **SOP-8 PACKAGE OUTLINE DIMENSIONS**

SYMBOL	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.45	1.75	0.057	0.069
A1	0.1	0.25	0.004	0.01
A2	1.35	1.55	0.053	0.061
B	0.306	0.506	0.012	0.02
C	0.153	0.253	0.006	0.01
D	4.81	5.01	0.189	1.197
E	3.84	4.04	0.151	0.159
E1	5.84	6.24	0.23	0.246
e	1.27		0.05	
L	0.45	1	0.018	0.039
θ	0°	8°	0°	8°

**HIGH PERFORMANCE CURRENT MODE PWM CONTROLLERS**■ **DIP-8 PACKAGE OUTLINE DIMENSIONS**

SYMBOL	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	3.71	4.31	0.146	0.17
A1	0.51		0.02	
A2	3.2	3.6	0.126	0.142
B	0.36	0.56	0.014	0.022
B1	1.374	1.674	0.054	0.066
C	0.204	0.404	0.008	0.016
D	9	9.4	0.354	0.37
E	6.2	6.6	0.244	0.26
E1	7.42	7.82	0.292	0.308
e	2.34	2.74	0.092	0.108
L	3.1	3.5	0.122	0.138
E2	8.3	9.1	0.327	0.358


HIGH PERFORMANCE CURRENT MODE PWM CONTROLLERS
■ SOP-14 PACKAGE OUTLINE DIMENSIONS


SYMBOL	Dimensions In Millimeters			Dimensions In Inches		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	1.60	1.75	0.053	0.063	0.069
A1	0.10		0.25	0.004		0.010
A2		1.45			0.057	
B	0.33		0.51	0.013		0.020
C	0.19		0.25	0.007		0.010
D	8.55		8.75	0.337		0.344
E	3.80		4.00	0.150		0.157
e		1.27			0.050	
H	5.80		6.20	0.228		0.244
L	0.40		1.27	0.016		0.050
y			0.10			0.004
θ	0°		8°	0°		8°

NOTE

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS
2. DIMENSION L IS MEASURED IN GAGE PLANE
3. TOLERANCE 0.10 mm UNLESS OTHERWISE SPECIFIED
4. CONTROLLING DIMENSION IS MILLIMETER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
5. FOLLOWED FROM JEDEC MS-012