TELEDYNE COMPONENTS

TC18C46 TC18C47
TC28C46 TC28C47
TC38C46 TC38C47

CMOS CURRENT MODE PWM CONTROLLER

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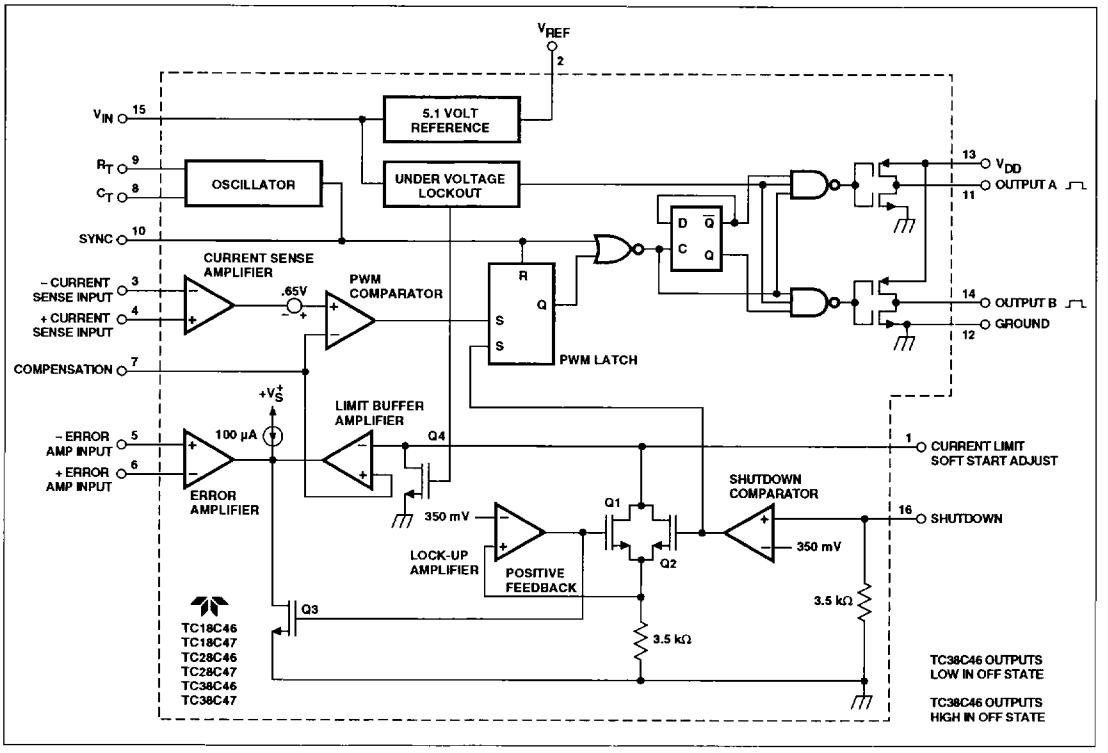
FEATURES

- Isolated Output Drive
- Low Power CMOS Construction
- Low Supply Current ..... 2 mA Typ
- Wide Supply Voltage Operation ..... 8V to 18V
- Latch-Up Immunity ..... 500 mA on Outputs
- Above and Below Rail Input Protection 6V
- High Output Drive ..... 500 mA Peak
- Current Mode Control
- Fast Rise/Fall Time ..... 50 ns @ 1000 pF
- High Frequency Operation ..... 500 kHz
- UV Hysteresis Guaranteed
- Shutdown Pin Available
- Double Ended
- Soft Start
- Low Prop Delay Current Amp to Output ..... < 350 ns Typ
- Low Prop Delay Shutdown to Output ..... < 400 ns Typ
- TC38C46/47 Pin Compatible with Unitrode UC3846/3847
- ESD Protected ..... ±2 kV

BLOCK DIAGRAM



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TC38C46 TC38C47

GENERAL DESCRIPTION

The TC38C46/47 are current mode CMOS PWM control ICs. These only draw 2 mA supply current, so they can be driven without a costly 50-60 Hz transformer. The output drive stage is capable of high drive currents, 300 mA typical.

The TC38C46/47 are pin compatible with earlier bipolar products so that designers can easily update older designs. A number of improvements have been added.

This second generation part has been designed with an isolated drive stage. Unlike its cousin, the TC170, the output stage of the TC38C46/47 can be run from a separate power supply such as a secondary winding on an output transformer. This allows for bootstrap start-up of the power supply.

ORDERING INFORMATION

Part No.	Configuration	Pkg./Temperature
TC18C46MJE	Non-Inverting	16-Pin CerDIP –55 to +125°C
TC18C47MJE	Inverting	16-Pin CerDIP –55 to +125°C
TC28C46EOE	Non-Inverting	16-Pin SOIC (wide) –40 to +85°C
TC28C46EPE	Non-Inverting	16-Pin Plastic DIP –40 to +85°C
TC28C47EOE	Non-Inverting	16-Pin SOIC (wide) –40 to +85°C
TC28C47EPE	Non-Inverting	16-Pin Plastic DIP –40 to +85°C
TC38C46COE	Non-Inverting	16-Pin SOIC (wide) 0 to +70°C
TC38C46CPE	Non-Inverting	16-Pin Plastic DIP 0 to +70°C
TC38C47COE	Inverting	16-Pin SOIC (wide) 0 to +70°C
TC38C47CPE	Inverting	16-Pin Plastic DIP 0 to +70°C

ABSOLUTE MAXIMUM RATINGS

Output Current, Source or Sink (Pins 1, 14) ..... 500 mA
Analog Inputs (Pins 3, 4, 5, 6, 16) ..... –0.3V to $+V_{IN}$
Reference Output Current (Pin 2) ..... –30 mA
Sync Output Current (Pin 10) ..... –5 mA
Error Amplifier Output Current (Pin 7) ..... –5 mA
Soft Start Sink Current (Pin 1) ..... 50 mA
Oscillator Charging Current (Pin 9) ..... 5 mA
Supply Voltage 18V
Maximum Chip Temperature ..... 150 °C
Storage Temperature ..... –65°C to +150°C
Lead Temperature (10 sec) ..... 300 °C
Package Thermal Resistance
- CerDIP $R_{\theta J\text{-}A}$ ..... 150°C/W
- CerDIP $R_{\theta J\text{-}C}$ ..... 55°C/W
- PDIP $R_{\theta J\text{-}A}$ ..... 125°C/W
- PDIP $R_{\theta J\text{-}C}$ ..... 45°C/W
- SOIC $R_{\theta J\text{-}A}$ ..... 250°C/W
- SOIC $R_{\theta J\text{-}A}$ ..... 75°C/W

NOTES: 1. All voltages are with respect to Ground, Pin 13. Currents are positive into, negative out of the specified terminal.
2. Static-sensitive device. Unused devices must be stored in conductive material. Protect devices from static discharge and static fields. Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to Absolute Maximum Rating Conditions for extended periods may affect device reliability.

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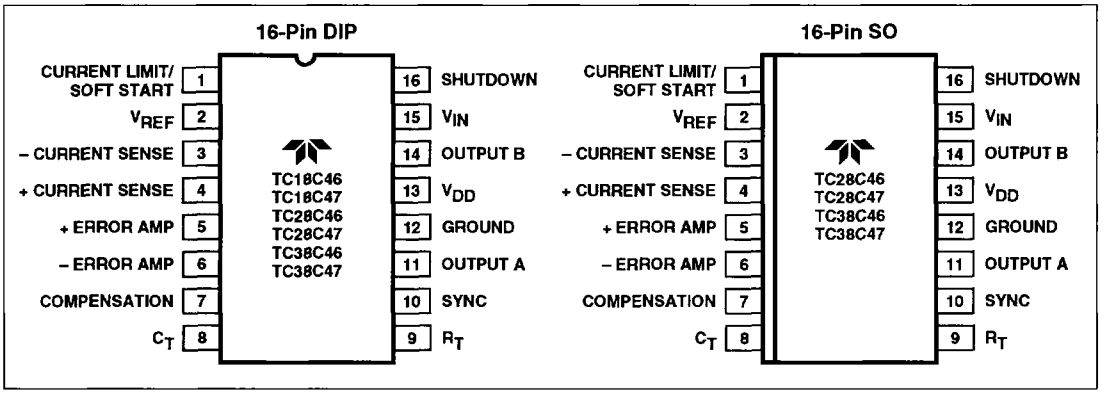
TC38C46 TC38C47

PIN CONFIGURATION



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ELECTRICAL CHARACTERISTICS: unless otherwise stated, these specifications apply for T_A = –55°C to +125°C for TC18C46/TC18C47; –40°C to +85°C for the TC28C46/TC28C47; and 0°C to +70°C for the TC38C46/TC38C47; $V_{IN} = V_{DD}$ = 16V; R_T = 30.1k; C_T = 270 pF.

		TC18C46/47 TC28C46/47			TC38C46/47			
Parameter	**Test Conditions**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**
Reference Section								
Output Voltage	T_j = 25°C, I_O = 1 mA	5.05	5.1	5.15	5	5.1	5.20	V
Line Regulation	V_{IN} = 8V to 16V	—	±4	±20	—	±4	±20	mV
Load Regulation	I_O = 1mA to 10 mA	—	±4	±20	—	±4	±20	mV
Temp Coefficient	Over Operating Range, (note 1)	—	±0.2	±0.5	—	±0.2	±0.5	mV/°C
Total Output Range	Line, Load, and Temperature (note 1)	4.97	—	5.24	4.94	—	5.26	V
Long Term Drift	T_j = 125°C, 1000 Hrs (note 1)	—	±50	—	—	±50	—	mV
Short Circuit Output Current	V_{REF} = 0V	20	—	70	20	—	70	mA
Output Noise Voltage	10 Hz ≤ f ≤ 10 kHz, T_j = 25°C (note 1)	—	22	—	—	22	—	μV(rms)
Oscillator Section								
Initial Accuracy	T_j = 25°C	96.5	102	106.5	96.5	101	106.5	kHz
Voltage Coefficient	V_{IN} = 8V to 16V	—	±.1	±1.5	—	±.1	±1.5	%/V
Temp Coefficient	Over Operating Range (note 1)	—	±.04	±0.06	—	±.04	±0.06	%/°C
Clock Ramp Reset Current		1.2	2	3	1.2	2	3	mA
Osc Ramp Amplitude		3.6	3.8	4	3.6	3.8	4	V
Sync Output High Level	(note 1)	V_{DD} –0.5	—	—	V_{DD} –0.5	—	—	V
Sync Output Low Level	(note 1)	—	—	0.5	—	—	0.5	V
Sync Input High Level	Pin 8 = 0V, (note 1)	12	8.5	—	12	8.5	—	V
Sync Input Low Level	Pin 8 = 0V, (note 1)	—	8.5	5	—	8.5	5	V
Sync Input Current	Sync Voltage = 5.25V, Pin 8 = 0V	—	±5	±50	—	±5	±50	nA

ELECTRICAL CHARACTERISTICS (Cont): unless otherwise stated, these specifications apply for T_A = –55°C to +125°C for TC18C46/TC18C47; –40°C to +85°C for the TC28C46/TC28C47; and 0°C to +70°C for the TC38C46/TC38C47; $V_{IN} = V_{DD}$ = 16V; R_T = 30.1k; C_T = 270 pF.

		TC18C46/47 TC28C46/47			TC38C46/47			
Parameter	**Test Conditions**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**
Error Amp Section								
Input Offset Voltage		—	±5	±25	—	±5	±25	mV
Input Bias Current		—	±10	±100	—	±0.1	±0.5	nA
Input Offset Current		—	±10	±100	—	±0.1	±0.5	nA
Open Loop Voltage Gain	ΔV_O = 1V to 6V, R_L = 100k	70	90	—	70	90	—	dB
Gain Bandwidth Product	T_f = 25°C (note 1)	0.7	1	—	0.7	1	—	MHz
CMRR	V_{CM} = 0V to 11V	70	90	—	70	90	—	dB
PSRR	V_{IN} = 8V to 16V	70	90	—	70	90	—	dB
Output Sink Current	V(EA –) = 5V, V(EA+) = 4.9V, V(COMP) = 1.2V	2	4	—	2	4	—	mA
Output Source Current	V(EA –) = 5V, V(EA+) = 5.1V, V(COMP) = 2.5V	5	10	—	5	10	—	mA
High Level Output Volt	R_L = (COMP) 5 kΩ to GND, A_{CL} = 300	4.9	5	5.1	4.9	5	5.1	V
Low Level Output Volt	R_L = (COMP) 5 kΩ to GND, A_{CL} = 300	—	0.4	0.9	—	0.4	0.9	V
Slew Rate		1.3	2	—	1.3	2	—	V/µs
Current Sense Section								
Amplifier Gain	(notes 2, 3)	2.7	3	3.4	2.7	3	3.4	V
Max Differential Input Signal ($V_{Pin\ 4}$-$V_{Pin\ 3}$)	(note 2)	1.1	1.5	1.8	1.1	1.5	1.8	V
Input Offset Voltage	(note 2)	0.4	0.65	0.85	0.4	0.65	0.85	V
CMRR	V_{CM} = 1V to 12V, (note 2)	40	60	—	40	60	—	dB
PSRR	V_{IN} = 8V to 16V, (note 2)	40	60	—	40	60	—	dB
Input Bias Current	(note 1)	—	±1	±100	—	±1	±100	nA
Input Offset Current	(note 1)	—	±0.1	±2	—	±0.1	±2	nA
Input Common Mode Range	(note 1)	0	—	11	0	—	11	V
Delay to Outputs	T_f = 25°C, (note 1)	150	225	400	150	225	400	ns
Current Limit Adjust Section								
Current Limit Voltage Offset		—	±1	±25	—	±1	±25	mV
Input Impedance	(Shutdown Unlatched)	3	3.5	4	30	3.5	4	kΩ
Shutdown Terminal Section								
Threshold Voltage		320	360	400	320	360	400	mV
Input Voltage Range	(note 1)	0	—	V_{IN}	0	—	V_{IN}	V
Min Latching Current ($I_{Pin\ 1}$)	(note 4)	140	—	—	140	—	—	µA
Max Non-Latching Current (I_{Pin1})	(note 5)	—	—	65	—	—	65	µA
Min Pulse Width	(note 1)	100	50	—	100	50	—	ns
Delay to Outputs	(note 1)	125	250	400	125	250	400	ns

ELECTRICAL CHARACTERISTICS (Cont): unless otherwise stated, these specifications apply for T_A = –55°C to +125°C for TC18C46/TC18C47; –40°C to +85°C for the TC28C46/TC28C47; and 0°C to +70°C for the TC38C46/TC38C47; $V_{IN} = V_{DD}$ = 16V; R_T = 30.1k; C_T = 270 pF.

		TC18C46/47 TC28C46/47			TC38C46/47			
Parameter	**Test Conditions**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**
Output Section								
Output Low Level $r_{DS\ (ON)}$	I_{SINK} = 20 mA	—	10	20	—	10	20	Ω
Output High Level $r_{DS\ (ON)}$	I_{SOURCE} = 20 mA	—	20	35	—	20	35	Ω
Output Rise Time	C_L = 1 mF	—	55	90	—	55	90	ns
Output Fall Time	C_L = 1 mF	—	55	90	—	55	90	ns
Under Voltage Lockout Section								
Under Voltage Threshold		6.6	7	7.3	6.6	7	7.3	V
Start Threshold		7.5	7.8	8	7.5	7.8	8	V
Threshold Hysteresis		0.6	0.8	1	0.6	0.8	1	V
Total Standby Current								
Supply Current		—	1.2	2.5	—	1.2	2	mA
Start-Up Current		—	250	350	—	250	350	µA

NOTES: 1. These parameters, although guaranteed over the recommended operating conditions, are not 100% tested in production.
2. Parameter measured at trip point of latch with $V_{Pin\ 6} = V_{REF}$, $V_{Pin\ 16}$ = 0V.
3. Amplifier gain is defined as: $G = \frac{DV_{Pin\ 7}}{DV_{Pin\ 4}}$; $DV_{Pin\ 4}$ = 0V to 1V
4. Current into Pin 1 guaranteed to latch circuit in shutdown state.
5. Current into Pin 1 guaranteed not to latch circuit in shutdown state.