Pulse width modulation circuit

summary

SG3524 is a pulse width modulation circuit used for switching power supply. It contains a reference voltage source, error amplifier, oscillator, pulse width modulation, pulse width control trigger, dual-way alternating output, current limiting circuit and turn-off circuit.

The circuit can be used for any polarity switch power supply control, transformer coupled DC-DC switch power supply, transformer boosting and polarity conversion, and other power supply applications.

SG3524 Operating temperature is 0 to +70 .

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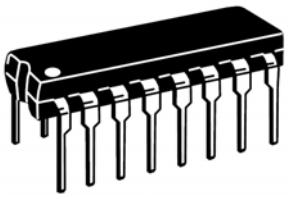

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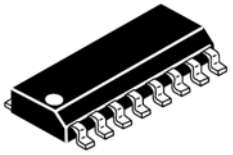
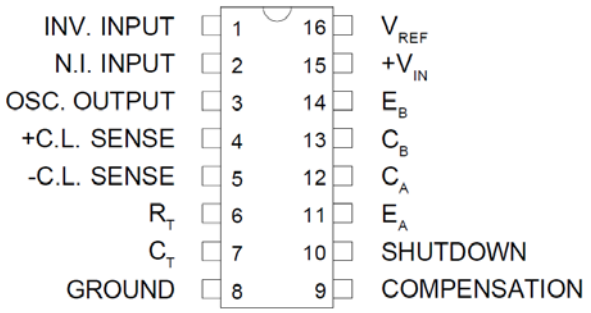


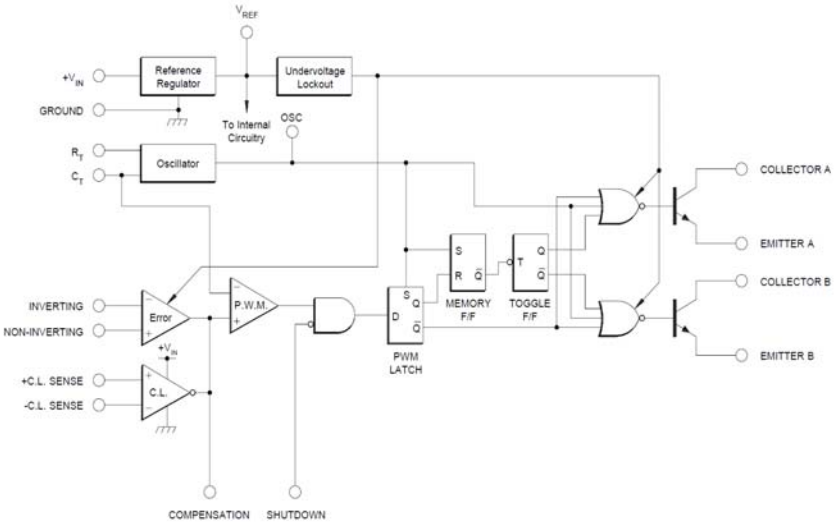
Pin diagram



main features

- It has a 5V reference voltage source.
- Oscillation frequency range of 100Hz to 300KHz.
- Good external synchronization capabilities.
- It has two 50mA outputs.
- Contains a current limiting circuit.
- Complete PWM control circuit.
- Single end or push-pull output.
- The total current consumption of the power supply is less than 10mA.

Internal function block diagram


V_{REF}
$+V_{IN}$
Reference Regulator
Undervoltage Lockout
GROUND
To Internal Circuitry
OSC
R_T
C_T
Oscillator
COLLECTOR A
EMITTER A
COLLECTOR B
EMITTER B
INVERTING
NON-INVERTING
Error
P.W.M.
S
R
Q
MEMORY F/F
T
TOGGLE F/F
D
PWM LATCH
+C.L. SENSE
-C.L. SENSE
C.L.
COMPENSATION
SHUTDOWN

Extreme parameters (absolute maximum rating, if no other provisions, Tamb = 25)

Name (symbol)	Price	Unit
Input voltage (Vin)	42	V
Collector voltage	40	V
Logic input voltage	-0.3~5.5	V
Current limiting foot difference input (Vsense)	-0.3~0.3	V
Output current per channel	100	mA
Baseline voltage load	40	mA
Charging current at the oscillation end	5	mA
Junction temperature	150	℃
Operating ambient temperature	0~70	℃

Recommend working conditions

Name (symbol)	Price	Unit
Input voltage (Vin)	8~40	V
Collector voltage	0~40	V
The common mode input voltage of the error amplifier	1.8~3.4	V
Current limiting foot difference input (Vsense)	-0.3~0.3	V
Output current per channel	0~50	mA
Baseline voltage load	0~20	mA
Charging current at the oscillation end	0.03~2	mA
Oscillation frequency	0.1~300	KHz
Oscillating resistance (Rt)	1.8~100	KΩ
Oscillating capacitor (Ct)	1~1000	nF
Junction temperature	150	℃
Operating ambient temperature	0~70	℃

Electrical parameters (Vin=20V, TA=25 unless otherwise specified)

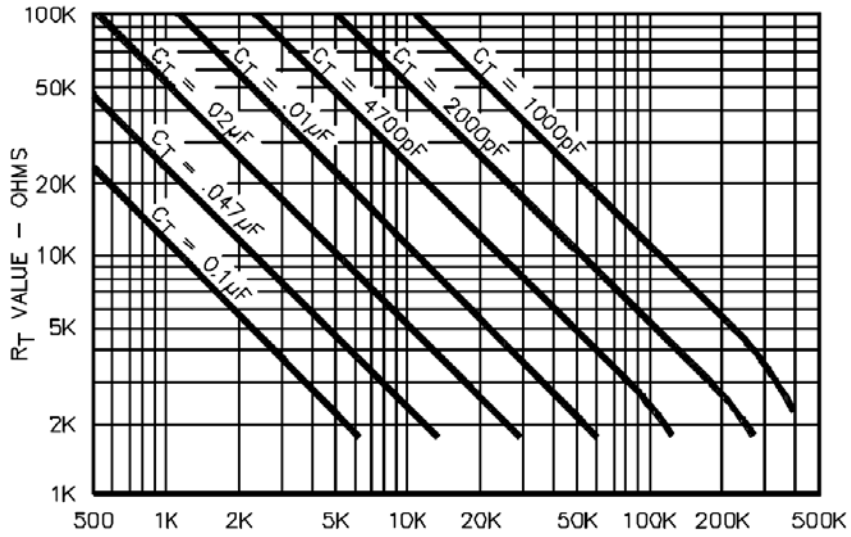
Symbol	Parameter	Condition	SG3524			Unit
			MIN.	TYP.	MAX.	
Reference voltage section Vref (IL = 0mA when not specified)						
Vref	Output voltage		4.8	5.0	5.2	V
Line Reg	Voltage linearity	Vin=8V~40V			30	mV
Load Reg	Load linearity	IL = 0 to 20mA			50	mV
Short current	Base short-circuit current	VREF = 0V	25		150	mA
Oscillation part Oscillator (FOSC = 40KHz, RT = 2.9KW, CT =0.01uF when no description)						
Fosc	Oscillation frequency		36		44	KHz
	Frequency voltage drift	VIN = 8V to 40V			1	%
MaxFosc	Maximum oscillation frequency	RT = 2K, CT = 1nF	200	400		KHz
	Oscillating waveform peak		3		3.9	V
	Oscillating waveform valley		0.6		1.2	V
Pulse Width	Oscillation pulse width		0.3		1.5	us
Error amplifier part EA (Vcm=2.5V when no description is given)						
Vio	Input offset voltage				10	mV
Ib	Input bias current				10	uA
Iio	Input offset current				2	uA
Av	DC open-loop gain		60			dB
Vol	Output low level	VPIN 1 - VPIN 2 > 150mV		0.2	0.5	V
Voh	Output high level	VPIN 2 - VPIN 1 > 150mV	3.8	4.2		V
CMR	Input common mode suppression	VCM = 1.8V to 3.4V	70			dB
PWM comparator section						
Min Duty	Minimum duty cycle	VCOMP = 0.5V			0	%
Max Duty	Maximum duty cycle	VCOMP = 3.6V	45	49		%
Current limiting circuit section Current Limit Amplifier (VCM = 0V)						
Vsense	Enter the threshold voltage		180		220	mV
Ib	Input bias current				200	uA
The circuit is turned off at Shutdown						
Vth	Turn off the thresh-old voltage		0.5	0.8	1.2	V
Output section (each output)						
Cleak	Collector leakage current	VCE = 40V			50	uA
Vcsat	Collector voltage	IC = 50mA			2	V

	drop					

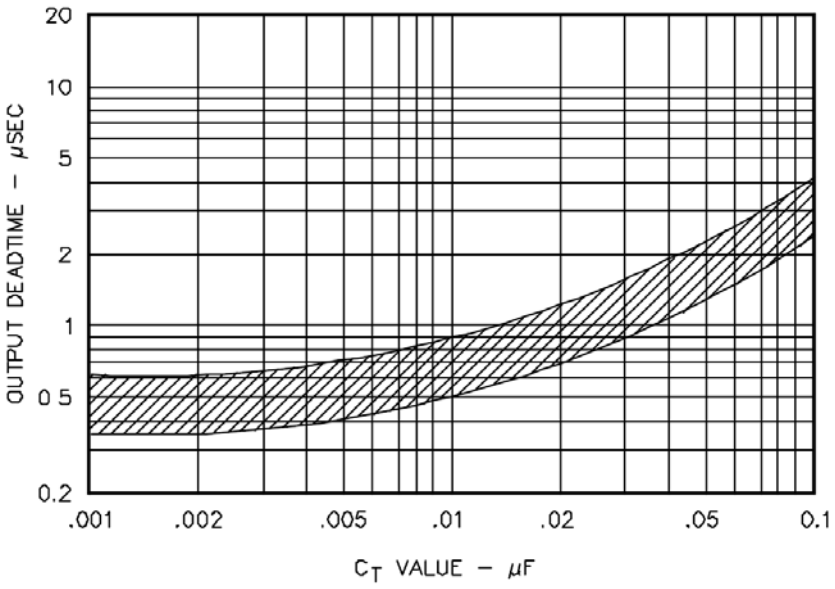
Symbol	Parameter	Condition	SG3524			Unit
			MIN.	TYP.	MAX.	
Ve	Output voltage of the emitter	IE = 50mA	17			V
Rise time	Cathode output rise time	RC = 2K			0.4	us
Fall time	Collector output fall time	RC = 2K			0.2	us
The circuit as a whole						
Icc	Static operating current	VIN = 40V			10	mA

Applications and annotations

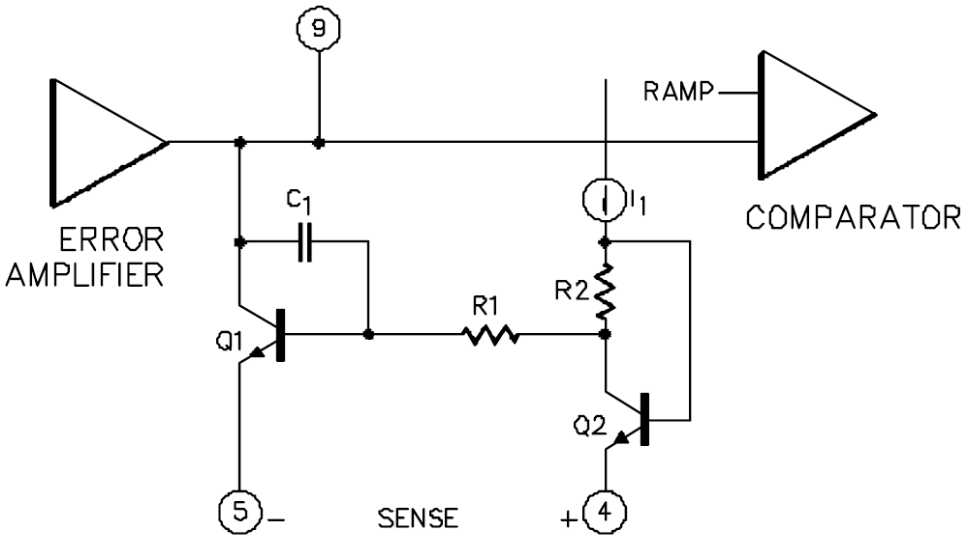
1. Table 1 (Relationship between oscillation frequency and Rt, Ct)



2. Table 2 (Relationship between dead time and Ct)

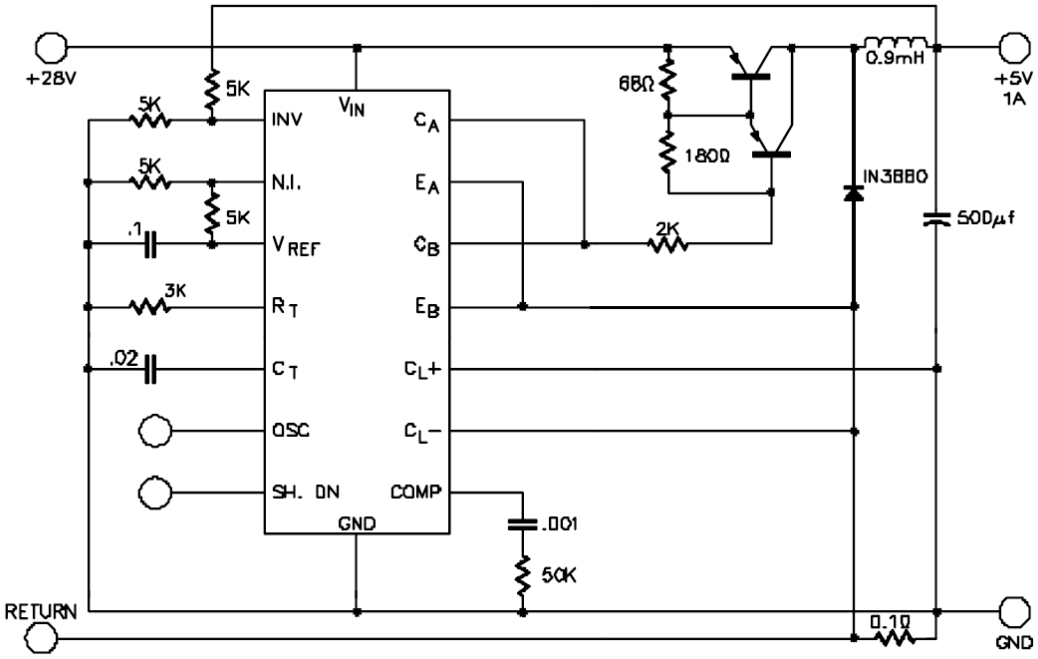


3. Internal current limiting circuit wiring diagram

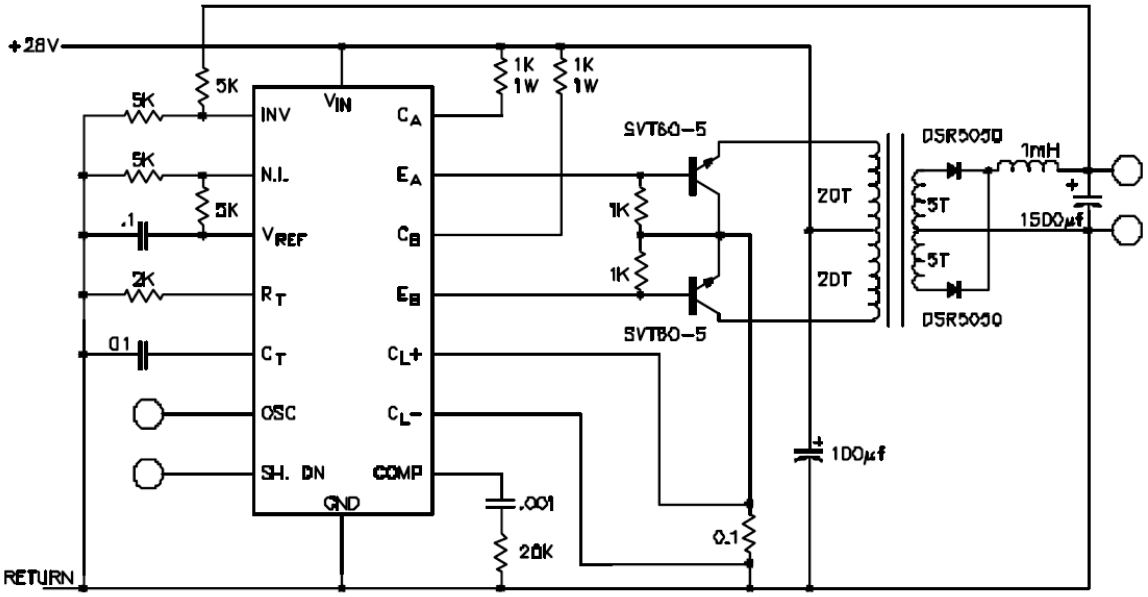


$$\text{C.L. Threshold} = V_{BE}(Q1) + I_1 \cdot R_2 - V_{BE}(Q2) = I_1 \cdot R_2$$
$$\sim 200\ \text{mV}$$

4.Single-ended output application (terminal output control can reach 0~90% duty cycle)



5.Push-pull output application



package

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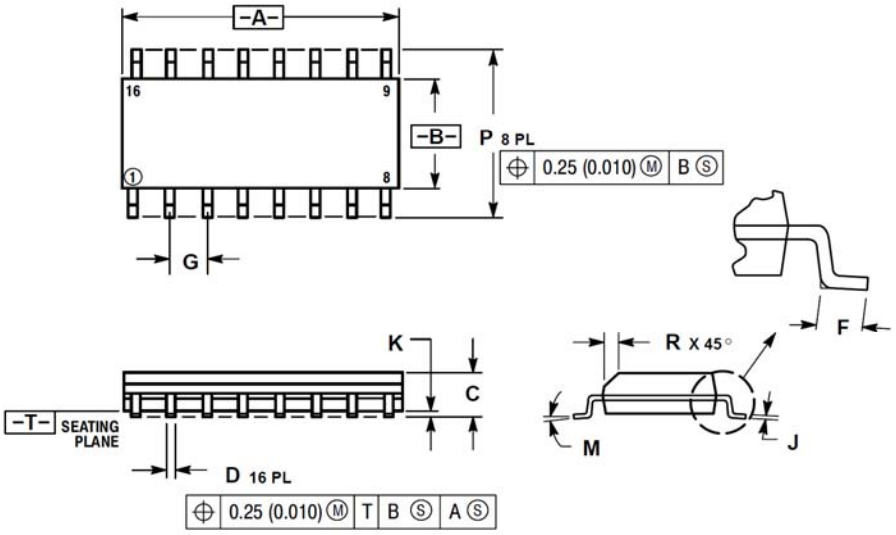

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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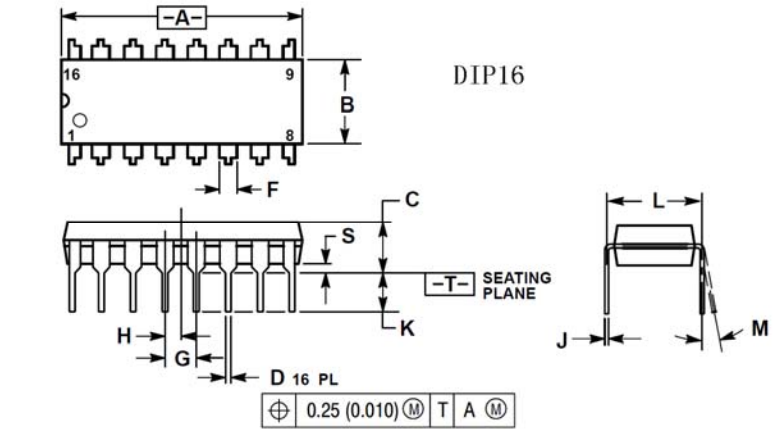

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01