REGULATING PULSE WIDTH MODULATOR

DESCRIPTION

The SG1524B is a pulse width modulator for switching power supplies which features improved performance over industry standards like the SG1524. A direct pin-for-pin replacement for the earlier device, it combines advanced processing techniques and circuit design to provide improved reference accuracy, and extended common mode range at the error amplifier and current limit inputs. A DC-coupled flip-flop eliminates triggering and glitch problems, and a PWM data latch prevents edge oscillations. The circuit incorporates true digital shutdown for high speed response, while an undervoltage lockout circuit prevents spurious outputs when the supply voltage is too low for stable operation. Full double-pulse suppression logic insures alternating output pulses when the Shutdown pin is used for pulse-by-pulse current limiting. The SG1524B is specified for operation over the full military ambient temperature range of -55°C to 125°C. The SG2524B is characterized for the industrial range of -25°C to 85°C, and the SG3524B is designed for the commercial range of 0°C to 70°C.

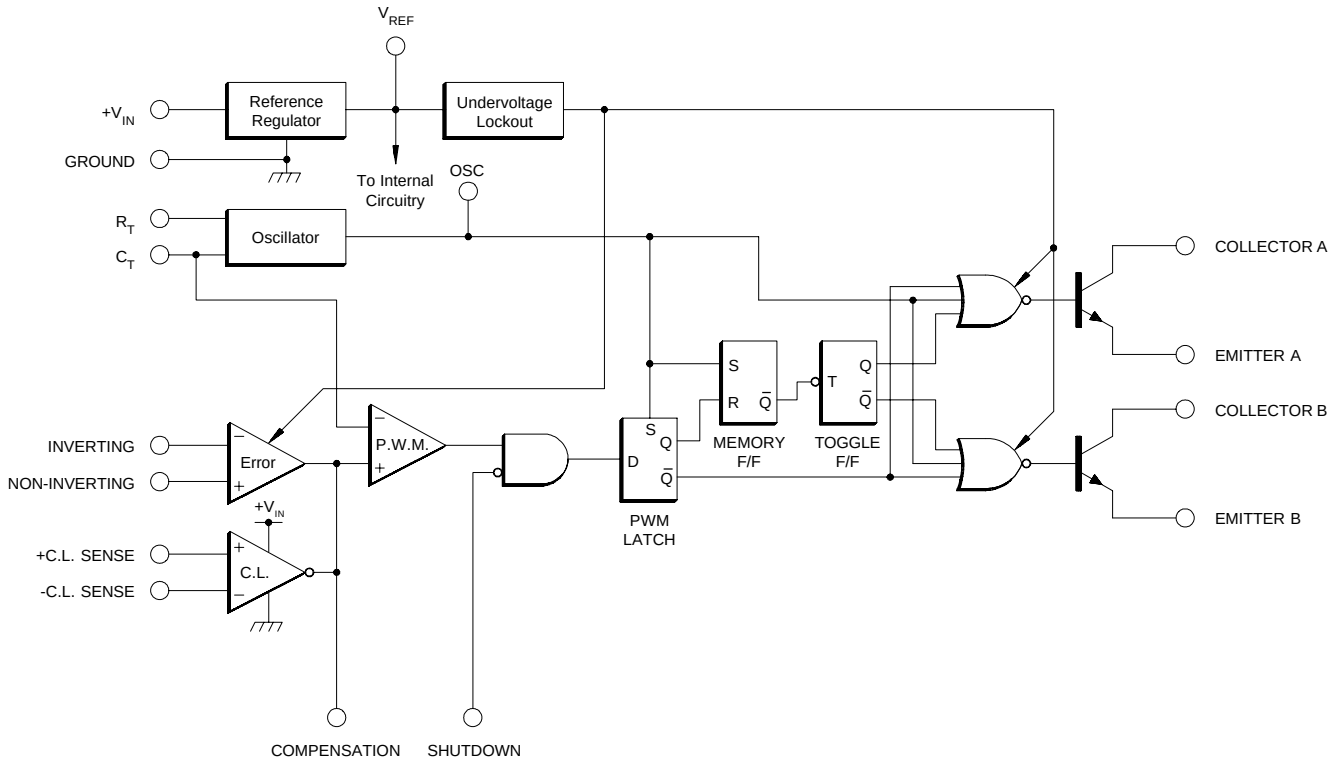
FEATURES

- **7V to 40V operation**
- **5V reference trimmed to ±1%**
- **100Hz to 400KHz oscillator range**
- **Excellent external sync capability**
- **Dual 100mA output transistors**
- **Wide current limit common mode range**
- **DC-coupled toggle flip-flop**
- **PWM data latch**
- **Undervoltage lockout**
- **Full double-pulse suppression logic**
- **60V output collectors**

HIGH RELIABILITY FEATURES - SG1524B

- **Available to MIL-STD-883 and DESC SMD**
- **Scheduled for MIL-M-38510 QPL listing**
- **Radiation data available**
- **LMI level "S" processing available**

DESCRIPTION



LINFINITY Microelectronics Inc.
11861 Western Avenue ∞ Garden Grove, CA 92841
(714) 898-8121 ∞ FAX: (714) 893-2570

ABSOLUTE MAXIMUM RATINGS (Note 1)

Input Voltage ($+V_{IN}$) 42V
Collector Voltage 60V
Logic Inputs ..... -0.3V to 5.5V
Current Limit Sense Inputs ..... -0.3V to V_{IN}
Output Current (each transistor) 200mA
Reference Load Current 50mA
Oscillator Charging Current 5mA
Operating Junction Temperature
  Hermetic (J, L Packages) ..... 150°C
  Plastic (N, DW Packages) ..... 150°C
Storage Temperature Range ..... -65°C to 150°C
Lead Temperature (Soldering, 10 seconds) ..... 300°C

Note 1. Values beyond which damage may occur.

THERMAL DATA

J Package:
  Thermal Resistance-Junction to Case, θ_{JC} ..... 30°C/W
  Thermal Resistance-Junction to Ambient, θ_{JA} ..... 80°C/W
N Package:
  Thermal Resistance-Junction to Case, θ_{JC} ..... 40°C/W
  Thermal Resistance-Junction to Ambient, θ_{JA} ..... 65°C/W
DW Package:
  Thermal Resistance-Junction to Case, θ_{JC} ..... 40°C/W
  Thermal Resistance-Junction to Ambient, θ_{JA} ..... 95°C/W
L Package:
  Thermal Resistance-Junction to Case, θ_{JC} ..... 35°C/W
  Thermal Resistance-Junction to Ambient, θ_{JA} ..... 120°C/W

Note A. Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.
Note B. The above numbers for θ_{JC} are maximums for the limiting thermal resistance of the package in a standard mounting configuration. The θ_{JA} numbers are meant to be guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

RECOMMENDED OPERATING CONDITIONS (Note 2)

Input Voltage ($+V_{IN}$) ..... 7V to 40V
Collector Voltage ..... 0V to 60V
Error Amp Common Mode Range ..... 2.3V to V_{REF}
Current Limit Sense Common Mode Range ..... 0V to V_{IN}-2.5V
Output Current (each transistor) ..... 0 to 100mA
Reference Load Current ..... 0 to 20mA
Oscillator Charging Current ..... 25µA to 1.8mA
Oscillator Frequency Range ..... 100Hz to 400KHz
Oscillator Timing Resistor (R_T) ..... 2KΩ to 150KΩ
Oscillator Timing Capacitor (C_T) ..... 1nF to 0.1µF
Operating Ambient Temperature Range
  SG1524B ..... -55°C to 125°C
  SG2524B ..... -25°C to 85°C
  SG3524B ..... 0°C to 70°C

Note 2: Range over which the device is functional.

ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, these specifications apply over the operating ambient temperatures for SG1524B with $-55°C \le T_A \le 125°C$, SG2524B with $-25°C \le T_A \le 85°C$, SG3524B with $0°C \le T_A \le 70°C$, and $+V_{IN} = 20V$. Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

Parameter	Test Conditions	SG1524B/2524B			SG3524B			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Reference Section (Note 3)								
Output Voltage	$T_J = 25°C$	4.95	5.00	5.05	4.90	5.00	5.10	V
Line Regulation	$V_{IN} = 7V$ to 40V		3	20		3	30	mV
Load Regulation	$I_L = 0$ to 20mA		5	30		5	50	mV
Temperature Stability (Note 7)	Over Operating Temperature Range		15	50		15	50	mV
Total Output Voltage Range	Over Line, Load and Temperature	4.90		5.10	4.80		5.20	V
Short Circuit Current	$V_{REF} = 0V$	25	50	120	25	50	120	mA
Undervoltage Lockout Section								
Threshold Voltage		4.3	4.5	4.7	4.2	4.5	4.9	V

Note 3. $I_L = 0mA$

LINFINITY Microelectronics Inc.
11861 Western Avenue ∞ Garden Grove, CA 92841
(714) 898-8121 ∞ FAX: (714) 893-2570

ELECTRICAL CHARACTERISTICS (continued)

Parameter	Test Conditions	SG1524B/2524B			SG3524B			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Oscillator Section (Note 4)								
Initial Accuracy	T_J = 25°C	42	45	48	40	45	50	KHz
Voltage Stability	V_{IN} = 7V to 40V		0.1	1		0.1	1	%
Temperature Stability (Note 7)	Over Operating Range		1	2		1	2	%
Minimum Frequency (Note 7)	R_T = 150KΩ, C_T = 0.1µF		50	140		50	120	Hz
Maximum Frequency	R_T = 2KΩ, C_T = 470pF	400	600		400	600		KHz
Sawtooth Peak Voltage	V_{IN} = 40V		3.5	3.9		3.5	3.9	V
Sawtooth Valley Voltage	V_{IN} = 7V	0.6	1		0.6	1		V
Clock Amplitude		3.0	4.0		3.0	4.0		V
Clock Pulse Width		0.2	0.5	1.2	0.2	0.5	1.2	µs
Error Amplifier Section (Note 5)								
Input Offset Voltage	$R_S \leq$ 2KΩ		0.5	5		2	10	mV
Input Bias Current			1	5		1	10	µA
Input Offset Current				1			1	µA
DC Open Loop Gain	$R_L \geq$10MΩ	60	78		60	78		dB
Output Low Level	I_{SINK} = 100µA; $V_{PIN\ 1}$ - $V_{PIN\ 2} \geq$ 150mV		0.2	0.5		0.2	0.5	V
Output High Level	I_{SOURCE} = 100µA; $V_{PIN\ 2}$ - $V_{PIN\ 1} \geq$ 150mV	3.8	4.2		3.8	4.2		V
Common Mode Rejection	V_{CM} = 2.3V to V_{REF}	70	90		70	90		dB
Supply Voltage Rejection	V_{IN} = 7V to 40V	76	100		76	100		dB
Gain-Bandwidth Product (Note 7)	T_J = 25°C	1	2		1	2		MHz
P.W.M. Comparator (Note 4)								
Minimum Duty Cycle	V_{COMP} = 0.5V			0			0	%
Maximum Duty Cycle	V_{COMP} = 3.9V	45	49		45	49		%
Current Limit Amplifier Section (Note 6)								
Sense Voltage		180	200	220	170	200	230	mV
Input Bias Current			-3	-10		-3	-10	µA
Shutdown Input Section								
HIGH Input Voltage		2.0			2.0			V
HIGH Input Current	$V_{SHUTDOWN}$ = 5.0V		0.1	1		0.1	1	mA
LOW Input Voltage				0.6			0.6	V
Output Section (each transistor)								
Collector Leakage Current	V_{CE} = 60V			50			50	µA
Collector Saturation Voltage	I_C = 10mA		0.2	0.4		0.2	0.4	V
	I_C = 100mA		1.0	2.0		1.0	2.0	V
Emitter Output Voltage	I_E = 10mA	17.5	19		17.5	19		V
	I_E = 100mA	17	18		17	18		V
Emitter Voltage Rise Time (Note 7)	R_E = 2KΩ, T_A = 25°C		0.2	0.5		0.2	0.5	µs
Collector Voltage Fall Time	R_C = 2KΩ, T_A = 25°C		0.1	0.2		0.1	0.2	µs
Power Consumption								
Standby Current	V_{IN} = 40V, $V_{SHUTDOWN}$ = 2.0V		5	12		5	12	mA

Note 4. F_{OSC} = 45KHz (R_T = 2700Ω, C_T = .01µF)
Note 5. V_{CM} = 2.3V to V_{REF}
Note 6. V_{CM} = 0V to 17.5V
Note 7. These parameters, although guaranteed over the recommended operating conditions, are not tested in production.

LINFINITY Microelectronics Inc.
11861 Western Avenue ∞ Garden Grove, CA 92841
(714) 898-8121 ∞ FAX: (714) 893-2570

TYPICAL CHARACTERISTIC CURVES

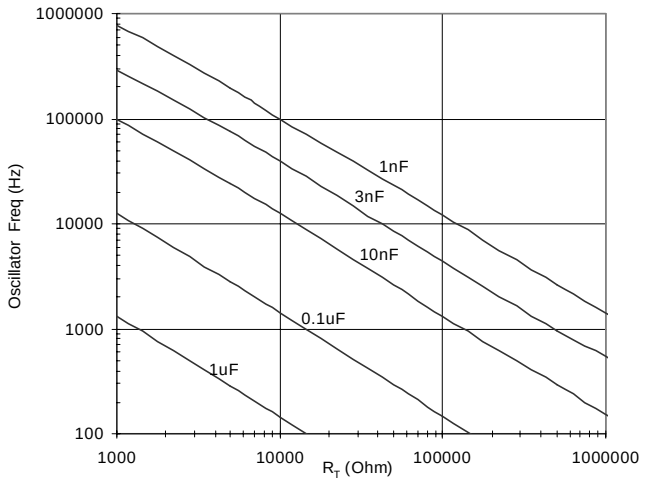


Figure 1
Oscillator Frequency vs. Timing Resistor and Capacitor
V_{IN}=20V, T_A=25°C

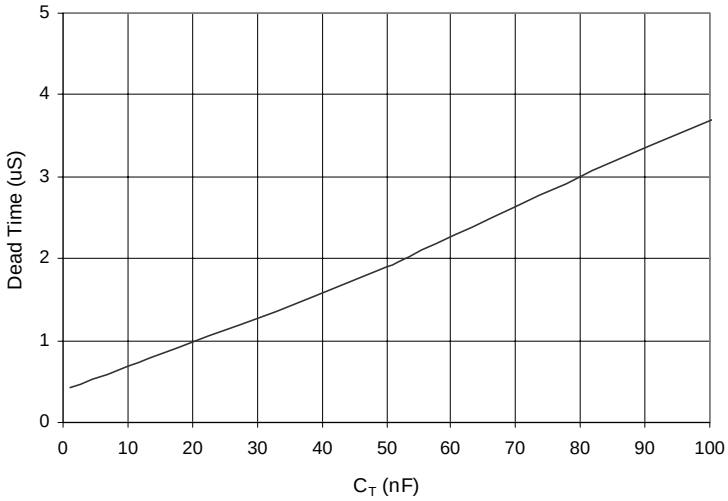


Figure 2
SG1524B Dead Time vs. Timing capacitance (R_T=2.7k)
V_{IN}=20V, T_A=25°C

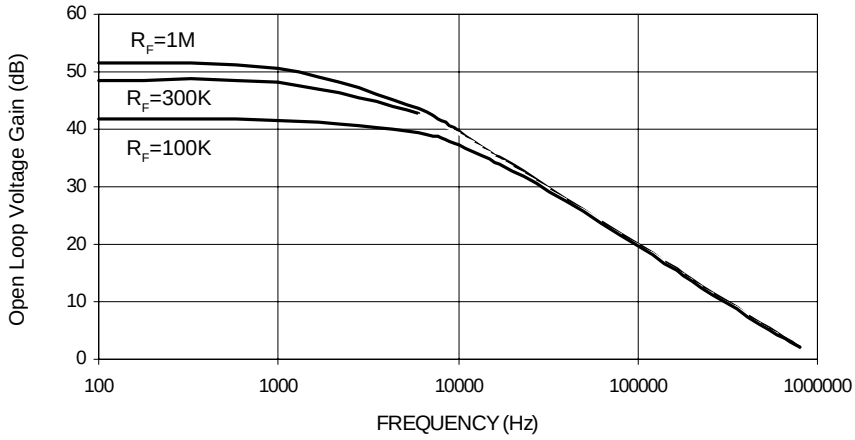
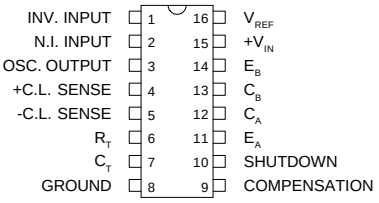
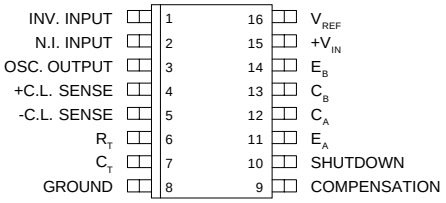
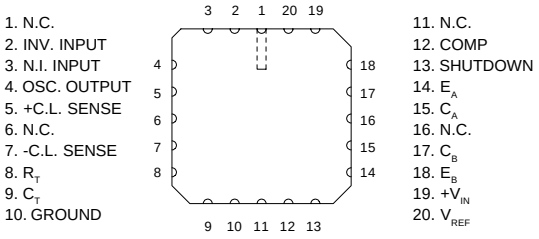


Figure 3
SG1524B Error Amp Voltage Gain vs. Freq over R_F
V_{IN}=20V, T_A=25°C

LINFINITY Microelectronics Inc.
11861 Western Avenue ∞ Garden Grove, CA 92841
(714) 898-8121 ∞ FAX: (714) 893-2570

CONNECTION DIAGRAMS & ORDERING INFORMATION (See Notes Below)

Package	Part No.	Ambient Temperature Range	Connection Diagram
16-PIN CERAMIC DIP J - PACKAGE	SG1524BJ/883B SG1524BJ/DESC SG1524BJ SG2524BJ SG3524BJ	-55°C to 125°C -55°C to 125°C -55°C to 125°C -25°C to 85°C 0°C to 70°C	
16-PIN PLASTIC DIP N - PACKAGE	SG2524BN SG3524BN	-25°C to 85°C 0°C to 70°C	
16-PIN WIDE BODY PLASTIC S.O.I.C. DW - PACKAGE	SG2524BDW SG3524BDW	-25°C to 85°C 0°C to 70°C	
20-PIN CERAMIC LEADLESS CHIP CARRIER L- PACKAGE	SG1524BL/883B SG1524BL	-55°C to 125°C -55°C to 125°C	

1. N.C.
2. INV. INPUT
3. N.I. INPUT
4. OSC. OUTPUT
5. +C.L. SENSE
6. N.C.
7. -C.L. SENSE
8. R_T
9. C_T
10. GROUND

11. N.C.
12. COMP
13. SHUTDOWN
14. E_A
15. C_A
16. N.C.
17. C_B
18. E_B
19. $+V_{IN}$
20. V_{REF}

Note 1. Contact factory for JAN and DESC product availablity.
2. All packages are viewed from the top.

LINFINITY Microelectronics Inc.
11861 Western Avenue ∞ Garden Grove, CA 92841
(714) 898-8121 ∞ FAX: (714) 893-2570