CS5124, CS5126

High Performance, Integrated Current Mode PWM Controllers

The CS5124/6 is a fixed frequency current mode controller designed specifically for DC–DC converters found in the telecommunications industry. The CS5124/6 integrates many commonly required current mode power supply features and allows the power supply designer to realize substantial cost and board space savings. The product matrix is as follows:

CS5124: 400 kHz w/V_{BIAS} Pin, 195 mV first current sense threshold.

CS5126: 200 kHz w/SYNC Pin, 335 mV first current sense threshold.

The CS5124/6 integrates the following features: Internal Oscillator, Slope Compensation, Sleep On/Off, Undervoltage Lock Out, Thermal Shutdown, Soft Start Timer, Low Voltage Current Sense for Resistive Sensing, Second Current Threshold for Pulse by Pulse Over Current Protection, a Direct Optocoupler Interface and Leading Edge Current Blanking.

The CS5124/6 has supply range of 7.7 V to 20 V and is available in 8 pin SO narrow package.

Features

- Line UVLO Monitoring
- Low Current Sense Voltage for Resistive Current Sensing
- External Synchronization to Higher or Lower Frequency Oscillator (CS5126 Only)
- Bias for Start Up Circuitry (CS5124 Only)
- Thermal Shutdown
- Sleep On/Off Pin
- Soft Start Timer
- Leading Edge Blanking
- Direct Optocoupler Interface
- 90 ns Propagation Delay
- 35 ns Driver Rise and Fall Times
- Sleep Mode

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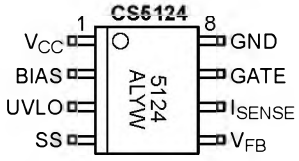
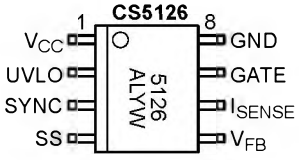
SO–8
D SUFFIX
CASE 751

PIN CONNECTIONS AND MARKING DIAGRAM





A = Assembly Location
WL, L = Wafer Lot
YY, Y = Year
WW, W = Work Week

ORDERING INFORMATION

Device	Package	Shipping
CS5124XD8	SO–8	95 Units/Rail
CS5124XDR8	SO–8	2500 Tape & Reel
CS5126XD8	SO–8	95 Units/Rail
CS5126XDR8	SO–8	2500 Tape & Reel

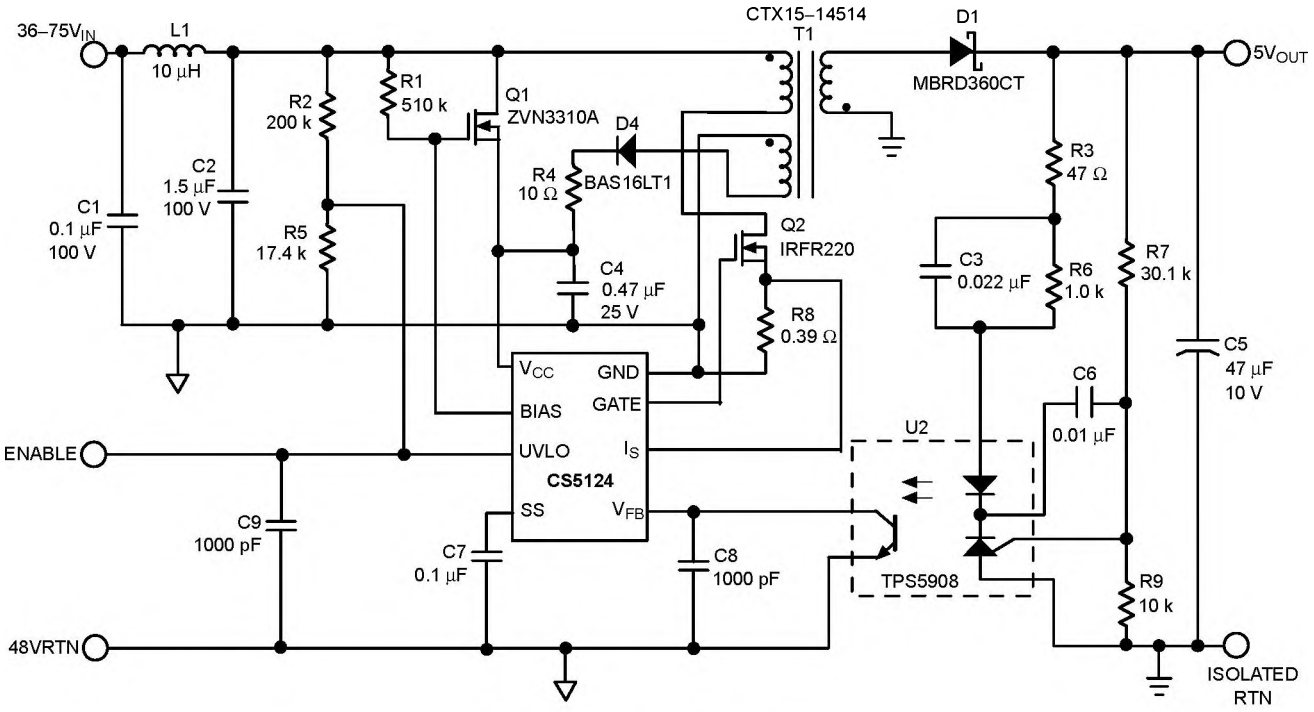


Figure 1. Application Diagram

MAXIMUM RATINGS*

Rating		Value	Unit
Operating Junction Temperature, T_J		–40 to 135	°C
Storage Temperature Range, T_S		–40 to 150	°C
ESD Susceptibility (Human Body Model)		2.0	kV
Lead Temperature Soldering:	Reflow: (SMD styles only) (Note 1)	230 peak	°C

1. 60 second maximum above 183°C.

*The maximum package power dissipation must be observed.

MAXIMUM RATINGS

PIN NAME	PIN SYMBOL	V_{MAX}	V_{MIN}	I_{SOURCE}	I_{SINK}
V_{CC} Power Input	V_{CC}	20 V	–0.3 V	1.0 mA	1.5 A Peak 200 mA DC
Clock Synchronization Input	SYNC (CS5126)	20 V	–0.3 V	1.0 mA	1.0 mA
V_{CC} Clamp Output	V_{BIAS} (CS5124)	20 V	–0.3 V	1.0 mA	1.0 mA
UVLO Shutdown Input	UVLO	6.0 V	–0.3 V	1.0 mA	1.0 mA
Soft Start Capacitor Input	SS	6.0 V	–0.3 V	1.0 mA	2.0 mA
Voltage Feedback Input	V_{FB}	6.0 V	–0.3 V	3.0 mA	20 mA
Current Sense Input	I_{SENSE}	6.0 V	–0.3 V	1.0 mA	1.0 mA
Ground	GROUND	0 V	0 V	1.5 A peak 200 mA DC	1.0 mA
Gate Drive Output	GATE	20 V	–0.3 V	1.5 A peak 200 mA DC	1.5 A peak 200 mA DC

ELECTRICAL CHARACTERISTICS ($-40°C \le T_J \le 125°C$; $-40°C \le T_A \le 105°C$, $7.60\ V \le V_{CC} \le 20\ V$, UVLO = 3.0 V, I_{SENSE} = 0 V, $C_{V(CC)}$ = 0.33 μF, C_{GATE} = 1.0 nF (ESR = 10 Ω); C_{SS} = 470 pF; $C_{V(FB)}$ = 100 pF, unless otherwise specified.)

Characteristic	Test Conditions	Min	Typ	Max	Unit
General					
I_{CC} Operating – V_{GATE} not switching	–	–	10	13	mA
I_{CC} at V_{CC} Low	V_{CC} = 6.0 V	–	500	750	μA
I_{CC} Sleep	V_{UVL} = 1.0 V	–	210	275	μA
Low V_{CC} Lockout					
V_{CC} Turn–on Threshold Voltage	–	7.2	7.7	8.3	V
V_{CC} Turn–off Threshold Voltage	–	6.8	7.3	7.8	V
V_{CC} Hysteresis	–	350	425	500	mV
UVLO					
Sleep Threshold Voltage	UVLO decreasing	1.5	1.8	2.3	V
Sleep Threshold Voltage	UVLO increasing	–	1.88	2.45	V
Sleep Hysteresis	–	35	85	150	mV
UVLO Turn–off Threshold Voltage	Note 2	2.3	2.45	2.6	V
UVLO Turn–on Threshold Voltage	Note 2	2.50	2.63	2.76	V
UVLO Hysteresis	Turn–on – Turn–off ($-40°C \le T_J \le 100°C$) Note 2	170	185	200	mV
UVLO Hysteresis	Turn–on – Turn–off ($100°C \le T_J \le 125°C$) Note 2	50	185	400	mV
UVLO Input Bias Current	–	–1.0	–	1.0	μA
UVLO Clamp	With UVLO sinking 1.0 mA	5.0	7.5	12	V
V_{CC} Clamp and BIAS Pin	**CS5124 Only. Connect an NFET as follows: BIAS = G, V_{CC} = S, V_{IN} = D.**				
V_{CC} Clamp Voltage	$36\ V \le V_{IN} \le 60\ V$, $200\ nF \le C_{SS} \le 500\ nF$, R = 500 k	7.275	7.9	8.625	V
BIAS Minimum Voltage	Measure Voltage on BIAS with: $10\ V \le V_{CC} \le 20\ V$ & $50\ \mu A \le I_{BIAS} \le 1.0\ mA$	1.6	2.8	4.0	V
BIAS Clamp	With BIAS pin sinking 1.0 mA	12	15	20	V
200 kHz Oscillator	**CS5126 Only**				
Operating Frequency	–	175	200	225	kHz
Max Duty Cycle Clamp	–	78	82.5	85	%
Slope Compensation (Normal operation)	–	12	18	23	mV/μs
Slope Compensation (Synchronized operation)	Note 2	7.0	12	16	mV/μs
SYNC Input Threshold Voltage	–	1.0	2.0	3.0	V
SYNC Input Impedance	Measured with SYNC = 1.0 V & 10 V	50	120	230	kΩ
400 kHz Oscillator	**CS5124 Only**				
Operating Frequency	–	360	400	440	kHz
Max Duty Cycle Clamp	–	80.0	82.5	85.0	%
Slope Compensation	–	15	21	26	mV/μs

2. Not tested in production. Specification is guaranteed by design.

ELECTRICAL CHARACTERISTICS (continued) ($-40°C \le T_J \le 125°C$; $-40°C \le T_A \le 105°C$, 7.60 V $\le V_{CC} \le$ 20 V, UVLO = 3.0 V, I_{SENSE} = 0 V, $C_{V(CC)}$ = 0.33 μF, C_{GATE} = 1.0 nF (ESR = 10 Ω); C_{SS} = 470 pF; $C_{V(FB)}$ = 100 pF, unless otherwise specified.)

Characteristic	Test Conditions	Min	Typ	Max	Unit
Soft Start					
Soft Start Charge Current	–	7.0	10	13	μA
Soft Start Discharge Current	–	0.5	10.0	–	mA
V_{SS} Voltage when V_{FB} Begins to Rise	V_{FB} = 300 mV	1.40	1.62	1.80	V
Peak Soft Start Charge Voltage	–	4.7	4.9	–	V
Valley Soft Start Discharge Voltage	–	200	275	400	mV
Current Sense	**CS5124 Only**				
First Current Sense Threshold	At max duty cycle	170	195	215	mV
Second Current Sense Threshold	–	250	275	315	mV
I_{SENSE} to GATE Prop. Delay	0 to 700 mV pulse into I_{SENSE} (after blanking time)	60	90	130	ns
Leading Edge Blanking Time	0 to 400 mV pulse into I_{SENSE}	90	130	180	ns
Internal Offset	Note 3	–	60	–	mV
Current Sense	**CS5126 Only**				
First Current Sense Threshold	At max duty cycle	300	335	360	mV
Second Current Sense Threshold	–	485	525	575	mV
I_{SENSE} to GATE Prop. Delay	0 to 800 mV pulse into I_{SENSE} (after blanking time)	60	90	130	ns
Leading Edge Blanking Time	0 to 550 mV pulse into I_{SENSE}	110	175	210	ns
Internal Offset	Note 3	–	125	–	mV
Voltage Feedback					
V_{FB} Pull–up Res.	–	2.9	4.3	8.1	kΩ
V_{FB} Clamp Voltage	CS5124 Only	2.63	2.90	3.15	V
V_{FB} Clamp Voltage	CS5126 Only	2.40	2.65	290	V
V_{FB} Fault Voltage Threshold	–	460	490	520	mV
Output Gate Drive					
Maximum Sleep Pull–down Voltage	V_{CC} = 6.0 V, I_{OUT} = 1.0 mA	–	1.2	2.0	V
GATE High (AC)	Series resistance < 1.0 Ω, Note 3	V_{CC} – 1.0	V_{CC} – 0.5	–	V
GATE Low (AC)	Series resistance < 1.0 Ω, Note 3	–	0.0	0.5	V
GATE High Clamp Voltage	V_{CC} = 20 V	11.0	13.5	16.0	V
Rise Time	Measure GATE rise time, 1.0 V < GATE < 9.0 V V_{CC} = 12 V	–	45	65	ns
Fall TIme	Measure GATE fall time, 9.0 V > GATE > 1.0 V V_{CC} = 12 V	–	25	55	ns
Thermal Shutdown					
Thermal Shutdown Temperature	Note 3 GATE low	135	150	165	°C
Thermal Enable Temperature	Note 3 GATE switching	100	125	150	°C
Thermal Hysteresis	Note 3	15	25	35	°C

3. Not tested in production. Specification is guaranteed by design.

PACKAGE THERMAL DATA

Parameter		SO–8	Unit
$R_{\Theta JC}$	Typical	45	°C/W
$R_{\Theta JA}$	Typical	165	°C/W