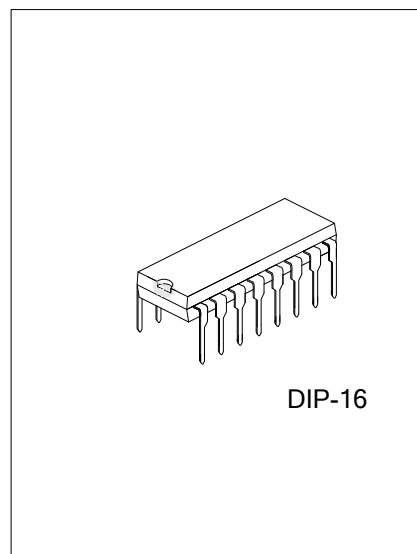




## 3521

CMOS IC

### PWM CONTROLLER WITH SUPERVISORY CIRCUIT FOR SWITCHING POWER SUPPLY



DIP-16

#### DESCRIPTION

UTC **3521** PWM controller is designed for switching mode power supply for PCs. It provides all the functions necessary to monitor and control the output of the power supply. Remote ON/OFF control, power good circuitry, some protection features against over-voltage and over-power are implements.

#### FEATURES

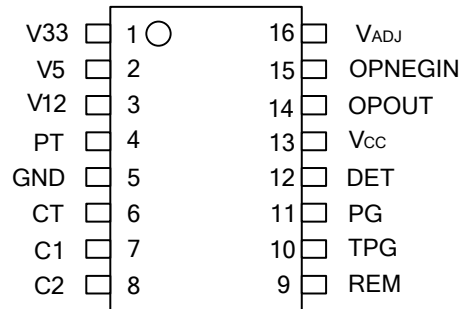
- \* Over-Voltage Protection for 3.3V, 5V and 12V
- \* Under-Voltage Detection for 3.3V, 5V and 12V
- \* Over-Power Protection
- \* Remote ON/OFF Function
- \* Power Good Circuitry
- \* Delay Time for PG Signal
- \* Delay Time for Over-Voltage and Under-Voltage Protection
- \* On-Chip Oscillator and Error Amplifier

#### ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free Plating	Halogen Free		
3521L-D16-T	3521G-D16-T	DIP-16	Tube

<p>3521L-D16-T</p> <p>(1)Packing Type (2)Package Type (3)Lead Free</p>	<p>(1) T: Tube (2) D16: DIP-16 (3) L: Lead Free, G: Halogen Free</p>
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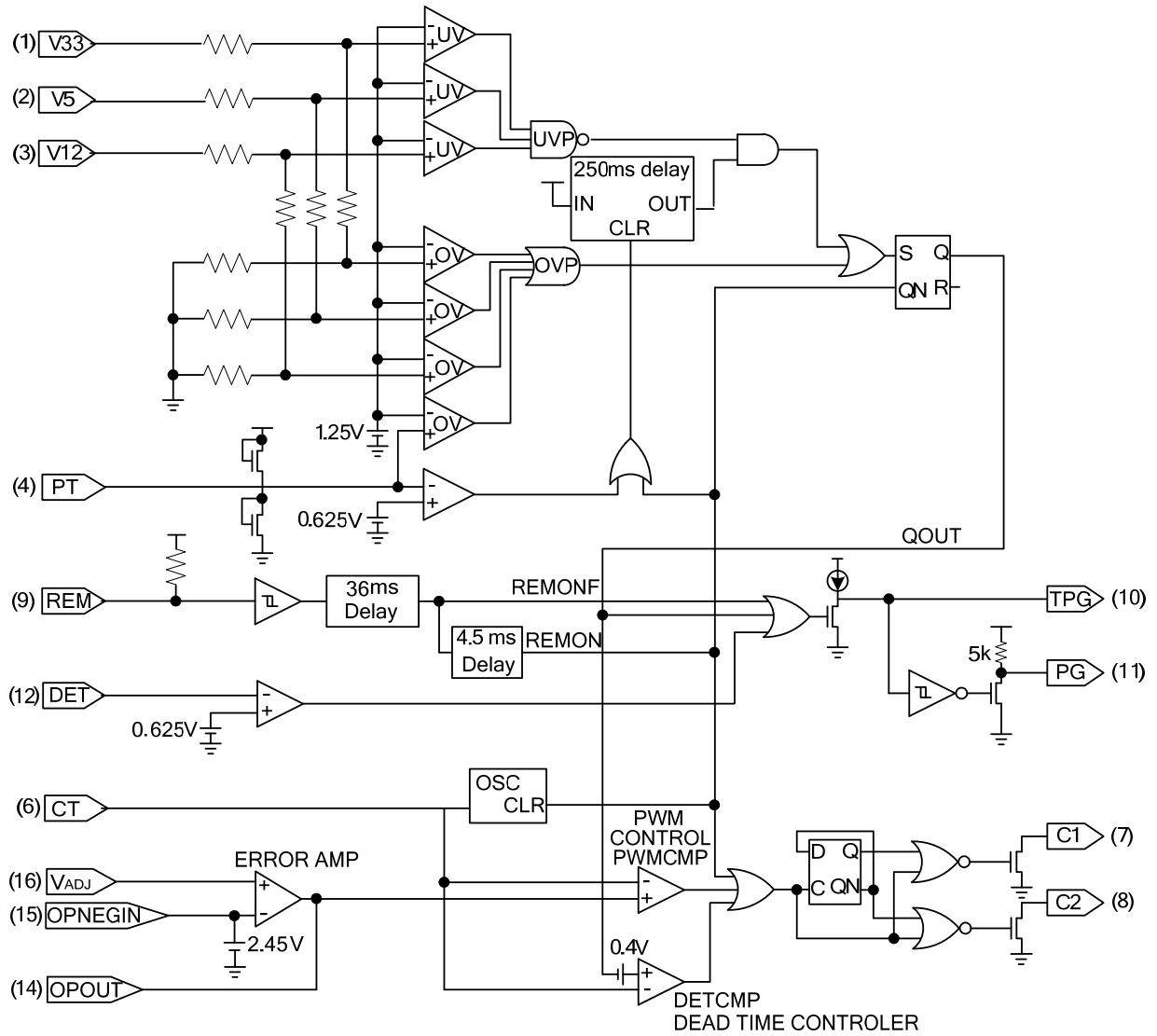
### ■ PIN CONFIGURATION



### ■ PIN DESCRIPTION

PIN NO.	PIN NAME	TYPE	FUNCTIONS
1	V33	I	OVP/UVI Input For 3.3V
2	V5	I	OVP/UVI Input For 5V
3	V12	I	OVP/UVI Input For 12V
4	PT	I	Additional OVP Protection
5	GND	P	Ground
6	CT		Cap FOR Oscillation Frequency
7	C1	O	Output 1
8	C2	O	Output 2
9	REM	I	Remote ON/OFF Pin.
10	TPG		Power Good Delay Time Setting
11	PG	O	Power Good Signal Out.
12	DET	I	Power Good Signal Detection Input
13	V <sub>CC</sub>	P	Supply Voltage For IC
14	OPOUT	O	OP AMP Output
15	OPNEGIN	I	OP AMP Negative Input
16	V <sub>ADJ</sub>	I	Voltage Adjust Pin

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS ( $V_{CC}=5.5V$ , unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V_{CC}$	5.5	V
Drain Output Voltage	$V_{CC1}, V_{CC2}$	5.5	V
Drain Output Current	$I_{CC1}, I_{CC2}$	200	mA
Power Dissipation	$P_D$	200	mW
Operating Temperature	$T_{OPR}$	-10 ~ +70	°C
Storage Temperature	$T_{STG}$	-65 ~ +150	°C

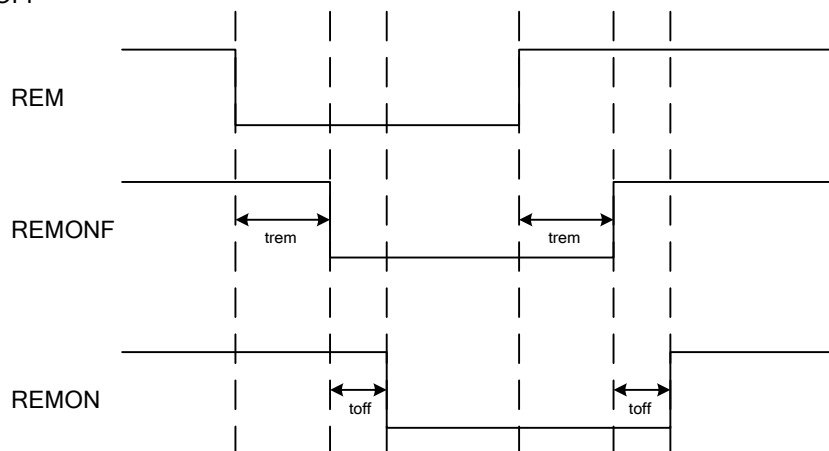
Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ ELECTRICAL CHARACTERISTICS ( $T_a=25^{\circ}C$ ,  $V_{CC}=5V$ , unless otherwise specified)

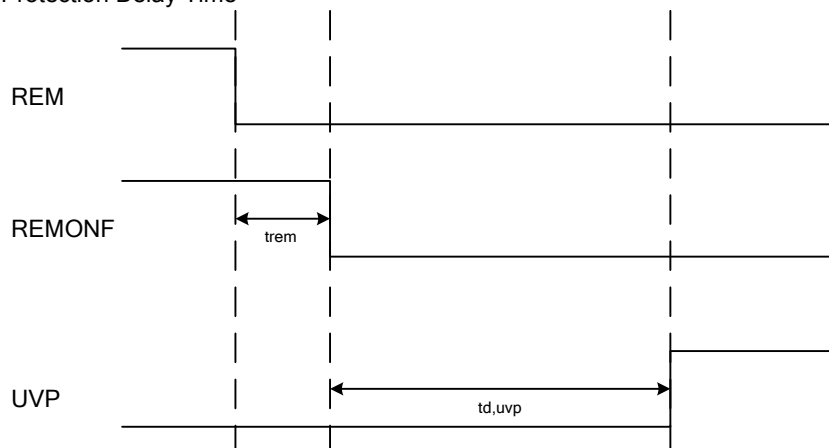
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>DEAD TIME CONTROL SECTION</b>						
Input Threshold Voltage	$V_{I(THR)}$	ZERO DUTY CYCLE		3.0	3.5	V
		MAX. DUTY CYCLE		0.1		
<b>ERROR AMP SECTION</b>						
Opneg Bias Voltage		OPNEG OPEN	2.35	2.45	2.55	V
Close Loop Voltage Gain	$G_{VC}$	0.5V ~ 3.5V		65		dB
Cross Over Point		0dB		320		KHz
<b>OUTPUT SECTION</b>						
Output Saturation Voltage	$V_{DSSAT}$	$I_D=200mA$		1.1	1.3	V
Drain Off-State Current	$I_{D(OFF)}$	$V_{CC}=V_D=V_S=0V$		2	10	$\mu A$
Rising Time	$t_R$	$R_{PULL-UP}=1 K\Omega$		100	200	ns
Falling Time	$t_F$	$R_{PULL-UP}=1 K\Omega$		50	200	ns
<b>PROTECTION SECTION</b>						
Over Voltage Protection (OVP)	V33		3.8	4.1	4.4	V
	V5		5.8	6.2	6.6	
	V12		4.38	4.64	4.90	
	$P_T$		1.2	1.25	1.3	
Under Voltage Protection (UVP)	V33		1.78	1.98	2.18	V
	V5		2.70	3.00	3.30	
	V12		2.11	2.37	2.63	
UVP Disable Voltage	$P_T$		0.54	0.62	0.70	V
UVP Delay Time	$t_{DLY}$		100	250	500	ms
<b>REMOTE ON/OFF SECTION</b>						
REM High Input Voltage	$V_{IH}$		2.0			V
REM Low Input Voltage	$V_{IL}$				0.8	V
REM Pull High Voltage	$V_{H(PULL)}$		2.0		5.25	V
REM Delay Time	$t_{DLY}$		30	36	42	ms
REM Off Delay Time	$t_{DLY(OFF)}$		3.5	4.5	5.5	ms
<b>POWER GOOD SECTION</b>						
Detecting Input Voltage	$V_{I(DET)}$		0.54	0.62	0.70	V
Output Saturation Voltage	$V_{O(SAT)}$	$I_{PG}=10mA$		0.2	0.4	V
Charging Current For TPG	$I_{CHAR}$			30		$\mu A$
PG Output Pull-up Resistor	$R_{O(PULL-UP)}$			5		K $\Omega$
PG Output Load Resistor	$R_{O(LOAD)}$		0.5	1	2	K $\Omega$
PG Delay Time	$t_{DLY}$	$C=2.2\mu F$	100	250	500	ms
<b>TOTAL DEVICE</b>						
Standby Supply Current	$I_{CC}$			10	20	mA
<b>OSCILLATION SECTION</b>						
Oscillation Frequency	$F_{OSC}$	$C_T=2200P$	50		70	KHz
Frequency Change With TEMP.	$F_{OSC/T}$	$C_T=2200P$		2		%

## ■ FUNCTION DESCRIPTION

### (1) REMOTE ON/OFF



### (2) Under Voltage Protection Delay Time



### (3) Pulse Width Modulation

The output pulse width modulation is generated by comparison of the saw-tooth waveform from the capacitor  $C_T$  to the feedback of the voltage.

Therefore, an increase in feedback control signal amplitude causes a linear decrease of the output pulse width.

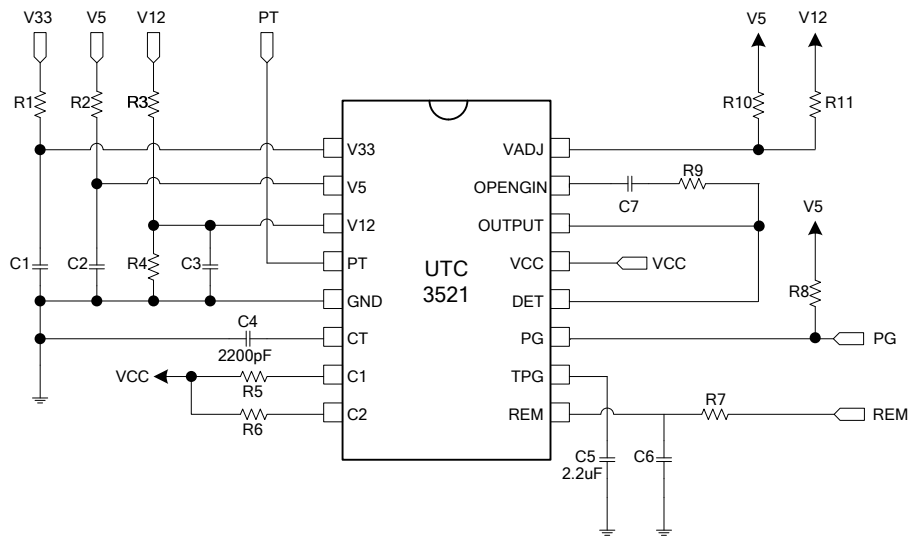
### (4) Protection Control of the Soft-Start

The soft-start function is to reduce the large current surge during power-up or preventing the output voltages ( $V_{33}/V_5/V_{12}$ ) reaches the Over Voltage Protection level.

### (5) The function of PT

This signal is prepared for extra Over Voltage Protection Input ( $V_{PT} > 1.25V$ ) or another Disable Under Voltage Protection function ( $V_{PT} < 0.62V$ ).

■ APPLICATION CIRCUIT



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