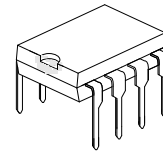


**US1702**

Preliminary

LINEAR INTEGRATED CIRCUIT**HIGH PERFORMANCE
CURRENT MODE POWER
SWITCH****■ DESCRIPTION**

The UTC **US1702** is an integrated PWM controller and Power MOSFET specifically designed for current mode operation with minimal external components. The UTC **US1702** is designed to provide several special enhancements to satisfy the needs, for example, Power-Saving mode for low standby power (<0.3W), Frequency Hopping, Constant Output Power Limiting, Over Current Protection (OCP), Over Voltage Protection (OVP), Under Voltage Lock Out (UVLO), and Over Temperature Protection (OTP) etc. IC will be shutdown or can auto-restart in certain situations.



DIP-8

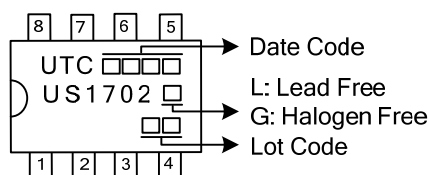
■ FEATURE

- * Internal High Voltage Start-up Circuit
- * Internal 700V Power MOSFET
- * Lower than 0.3W Standby Power Design
- * Gate Output Maximum Voltage Clamp(15V)
- * Over temperature protection
- * Over voltage protection
- * Leading edge blanking
- * Cycle-by-Cycle current limiting
- * Under Voltage Lock Out

■ ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
US1702L-D08-T	US1702G-D08-T	DIP-8	Tube

US1702L-D08-T (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube (2) D08: DIP-8 (3) L: Lead Free, G: Halogen Free and Lead Free
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■ MARKING

Pin diagram of the 74VHC04 hex inverters. The package is shown with pins 1 through 8. Pin 1 is GND, Pin 2 is GND, Pin 3 is FB, and Pin 4 is V_{CC} on the left side. On the right side, Pin 8 is Drain, Pin 7 is Drain, Pin 6 is Drain, and Pin 5 is Drain. A semi-circular notch is located at the top center of the package.

PIN NO.	PIN NAME	DESCRIPTION
1、2	GND	Ground
3	FB	Feedback
4	V _{CC}	Supply voltage
5~8	Drain	Power MOSFET drain



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■ **ABSOLUTE MAXIMUM RATING** ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Switching Drain Source Voltage	$V_{DS(SW)}$	700	V
Supply Voltage	V_{CC}	30	V
Feedback Current	I_{FB}	3	mA
Junction Temperature	T_J	+150	$^{\circ}\text{C}$
Operating Temperature	T_{OPR}	-40 ~ +125	$^{\circ}\text{C}$
Storage Temperature	T_{STG}	-50 ~ +150	$^{\circ}\text{C}$

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.

■ **OPERATING RANGE**

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{CC}	8.6 ~ 22	V

■ **ELECTRICAL CHARACTERISTICS** ($T_A=25^{\circ}\text{C}$, $V_{CC}=15\text{V}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SUPPLY SECTION						
Start Up Charge Current	I_{CH}	$V_{DS}=100\text{V}$, $V_{CC}=0\sim V_{CCON}$			1	mA
Start Up Current	I_{ST}	$V_{CC}=V_{CCON}-0.2\text{V}$		6	45	μA
Supply Current with switch	I_{OP}	$I_{FB}=0.5\text{mA}$, $I_D=50\text{mA}$		2	6.5	mA
UNDER-VOLTAGE LOCKOUT SECTION						
Start Threshold Voltage	V_{CCON}		13.5	15	16.5	V
Min. Operating Voltage	V_{CCOFF}		8	9	10	V
INTERNAL VOLTAGE REFERENCE						
CONTROL SECTION						
I_{FB} to I_D Current Gain	G_{FB-D}			560		
Feedback Source Shutdown Current	I_{FBSD}			900		μA
FB Pin Input Impedance	R_{FB}			1200		Ω
Burst-Mode Out FB Voltage	$V_{FB(OUT)}$			0.94		V
Burst-Mode Enter FB Voltage	$V_{FB(IN)}$			1.05		V
Normal initial Switching frequency	$F_{(SW)}$		54	60	66	kHz
Frequency Deviation VS V_{CC}	F_{DV}	$V_{CC}=10$ to 22V			5	%
Frequency Deviation VS Temperature	F_{DT}	$T_A=-40$ to 105°C			5	%
PROTECTION SECTION						
OVP threshold	V_{OVP}			23		V
OTP threshold	$T_{(THR)}$		130	150	170	$^{\circ}\text{C}$
CURRENT LIMITING SECTION						
Peak Current Limitation	I_{LIM}	$V_{FB}=0\text{V}$	0.56	0.7	0.84	A
Minimum Turn On Time	$t_{ON(MIN)}$			680		nS
POWER MOSFET SECTION						
Drain-Source Breakdown Voltage	V_{DSS}	$V_{FB}=2\text{V}$, $I_D=250\mu\text{A}$	700			V
Turn-on voltage between gate and source	V_{TH}	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	2		4	V
Off State Drain Current	I_{DSS}	$V_{DS}=500\text{V}$, $V_{FB}=2\text{V}$			100	μA
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=0.4\text{A}$			5	Ω
Rise Time	t_R	$V_{DD}=300\text{V}$, $I_D=4.0\text{A}$ $R_G=25\Omega$ (Note 1, 2)		45	100	ns
Fall Time	t_F			35	80	ns
Drain Capacitance	C_{OSS}	$V_{DS}=25\text{V}$		40		pF

Notes: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
2. Essentially independent of operating temperature

■ FUNCTIONAL DESCRIPTION

The internal reference voltages and bias circuit work at $V_{CC} > V_{THD(ON)}$, and shutdown at $V_{CC} < V_{CC(MIN)}$.

(1) High Voltage Start up switch Circuit

At startup, an internal high-voltage current source supplies the internal bias and charges the external capacitor connected to the V_{CC} pin. When V_{CC} reaches $V_{THD(ON)}$, the IC begins switching and the internal high-voltage current source is disabled. The IC continues its normal switching operation and the power is supplied from the auxiliary transformer winding unless V_{CC} goes below the stop voltage of $V_{CC(MIN)}$.

(2) Switching Frequency Limit

The UTC US1702 have a constant switching frequency of 60kHz.

(3) Protection section

The IC takes on more protection functions such as OVP and OTP etc. In case of those failure modes for continual blanking time, the driver is shut down. At the same time, IC enters auto-restart, V_{CC} power on and driver is reset after V_{CC} power on again.

OVP

OVP will shutdown the switching of the power MOSFET whenever $V_{CC} > V_{OVP}$. The OVP case as followed Fig. 1 the test circuit as followed Fig. 2.

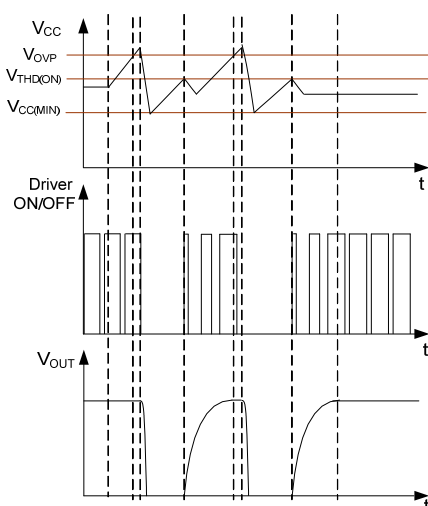


Fig.1 OVP case

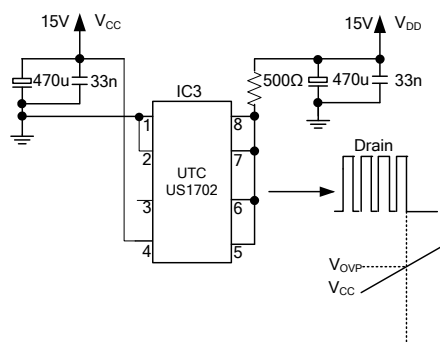


Fig.2 OVP test circuit

OTP

OTP will shut down driver and latch-off when junction temperature $T_J > T_{(THR)}$, and IC will be release on when temperature decreasing under $T_{(THR)} - 30$ and powering on again.

(4) The Gain of FB pin to Drain Current Limiting

$$I_{LIM} = G_{FB-D} \times 0.23V \times (R2 \parallel R1)$$

(5) Driver Output Section

The driver-stage drives the gate of the MOSFET and is optimized to minimize EMI and to provide high circuit efficiency. This is done by reducing the switch on slope when reaching the MOSFET threshold. This is achieved by a slope control of the rising edge at the driver's output. The output driver is clamped by an internal 15V Zener diode in order to protect power MOSFET transistors against undesirable gate over voltage.

(6) Inside Power MOSFET

Specific Power MOSFET parameter is as "Power MOSFET SECTION" in electrical characteristics table.

■ TYPICAL APPLICATION CIRCUIT

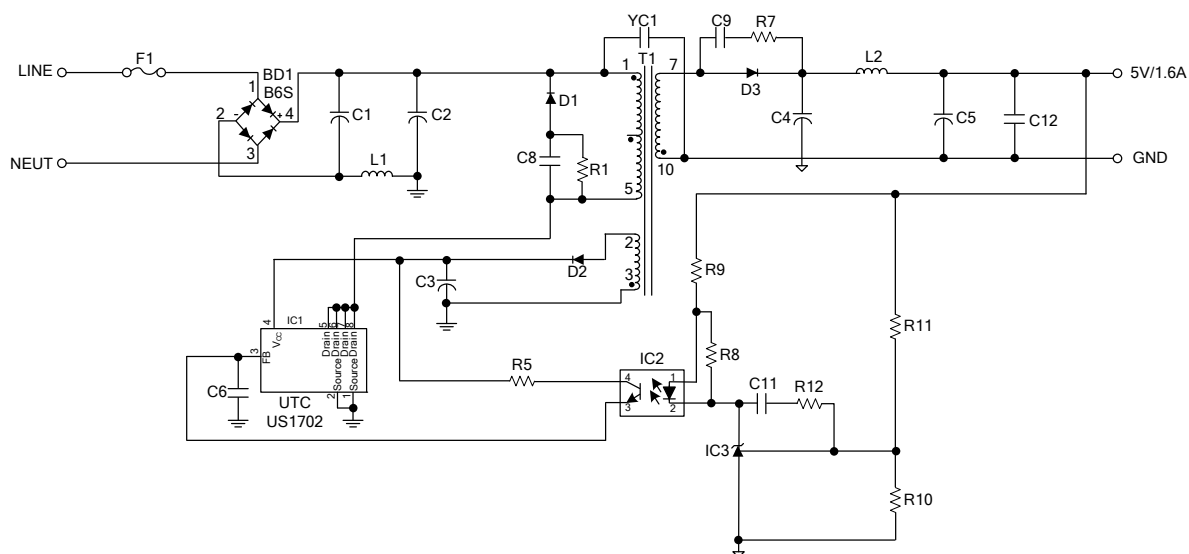


Fig. 3 UTC **US1702** Typical Application Circuit

Table1. Components reference description for UTC US1702 application circuit

DESIGNATOR	PART TYPE		DESIGNATOR	PART TYPE		DESIGNATOR	PART TYPE
C1	10μF/400V		R1	100KΩ		D1	FR107
C2	10μF/400V		R5	6.8KΩ		D2	RS1D
C3	10μF/50V		R7	30Ω		D3	SR39
C4	470μF/16V		R8	2.2KΩ		IC1	US1702
C5	220μF/16V		R9	510Ω		IC2	PC-817
C6	103pF		R10	5.1KΩ		IC3	TL431
C8	102pF/1KV		R11	5.1KΩ		YC1	102pF/400V
C9	102pF/100V		R12	15KΩ		T1	EE-19
C11	103pF					L1	1mH
C12	103pF					L2	2μH
						F1	1A/250V
						BD1	B6S

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