Self-oscillating Half-bridge Power IC

Features

● Integrated half-bridge 440V power MOSFET

● Floating channel designed for bootstrap operation

● Noise immunity of transient voltage

● Under-voltage lockout

● Programmable oscillator frequency

● Matched propagation delay for both channels

● Ultra low startup current of 75uA

● Shutdown function turns off both channels

● Low side output in phase with R_T

Applications

● Compact fluorescent lamps (CFL)

● Cathode compact fluorescent lamp (CCFL)

Description

GR6953 is a high voltage monolithic IC with integrated 440V half-bridge power MOSFET. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The front end features a programmable oscillator which is similar to the 555 timer. The output drivers feature a high pulse current buffer stage and an internal dead time designed for minimum driver cross-conduction. Propagation delays for the two channels are matched to simplify use in 50% duty cycle applications.

Ordering and Marking Information

GR6953 □ □

Package Code

J: DIP-8

RoHS Code

G: Green (Halogen Free) Device

DIP-8

GR6953
X X XXX

Code 1 ◄─┘ │ └─► Serial No.
Code 2

Code 1	8	9	A	B		G	H	I	J
Year	2008	2009	2010	2011	● ● ●	2016	2017	2018	2019
Code 2	1	2	3	4		9	A	B	C
Month	Jan.	Feb.	Mar.	Apr.		Sep.	Oct.	Nov.	Dec.
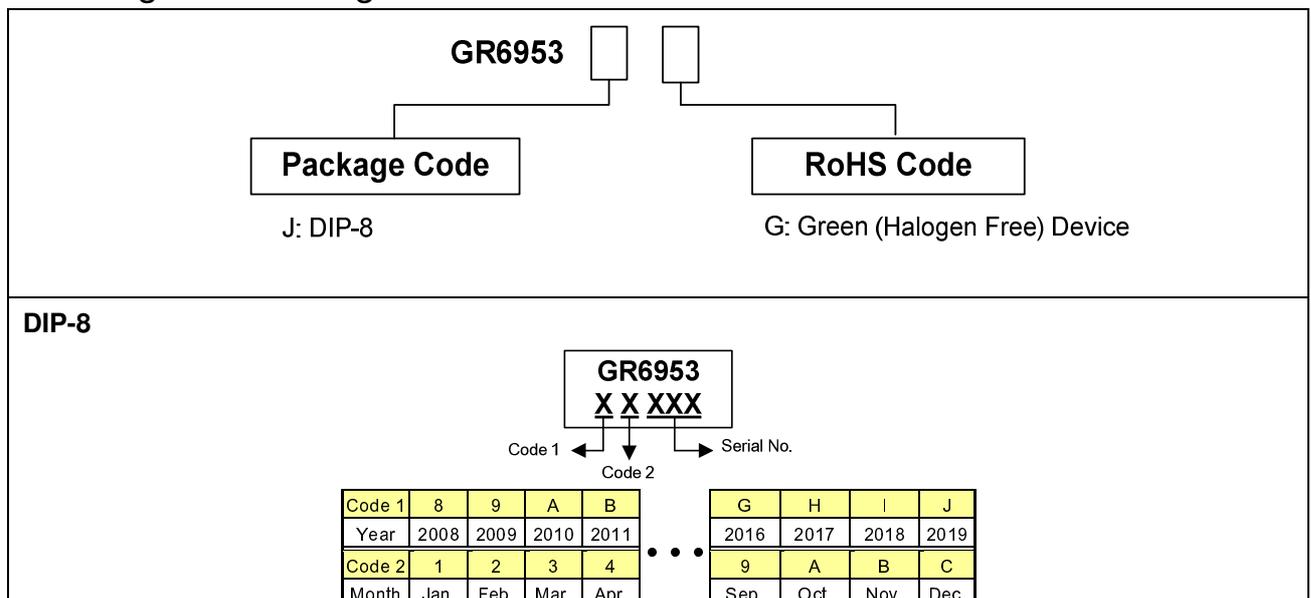
Grenergy OPTO Inc. reserves the right to make changes to improve reliability or manufacture ability without notice, and advise customers to obtain the latest version of relevant information to verify before placing orders.

Pin Configuration

TOP VIEW

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        ┌───────⌣───────┐
VCC  □──┤ 1           8 ├──□  VB
RT   □──┤ 2           7 ├──□  HV
CT   □──┤ 3           6 ├──□  VS
SGND □──┤ 4           5 ├──□  PGND
        └───────────────┘
```
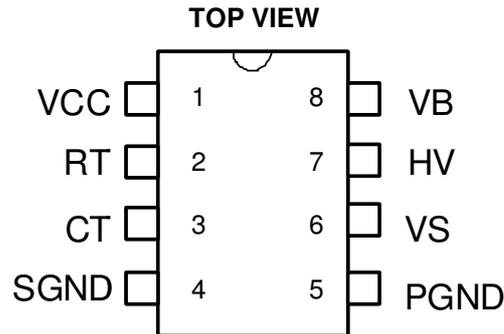
Pin Description

Pin No.	Name	Function
1	VCC	Low side and logic fixed supply
2	RT	Oscillator timing resistor input, in phase with HO for normal IC operation
3	CT	Oscillator timing capacitor input, the oscillator frequency according to the following equation: $f = 0.7213 / (RT \times CT)$
4	SGND	Signal ground
5	PGND	Low side MOSFET source
6	VS	High side floating supply return and power output
7	HV	High side MOSFET drain
8	VB	High side floating supply

Block Diagram
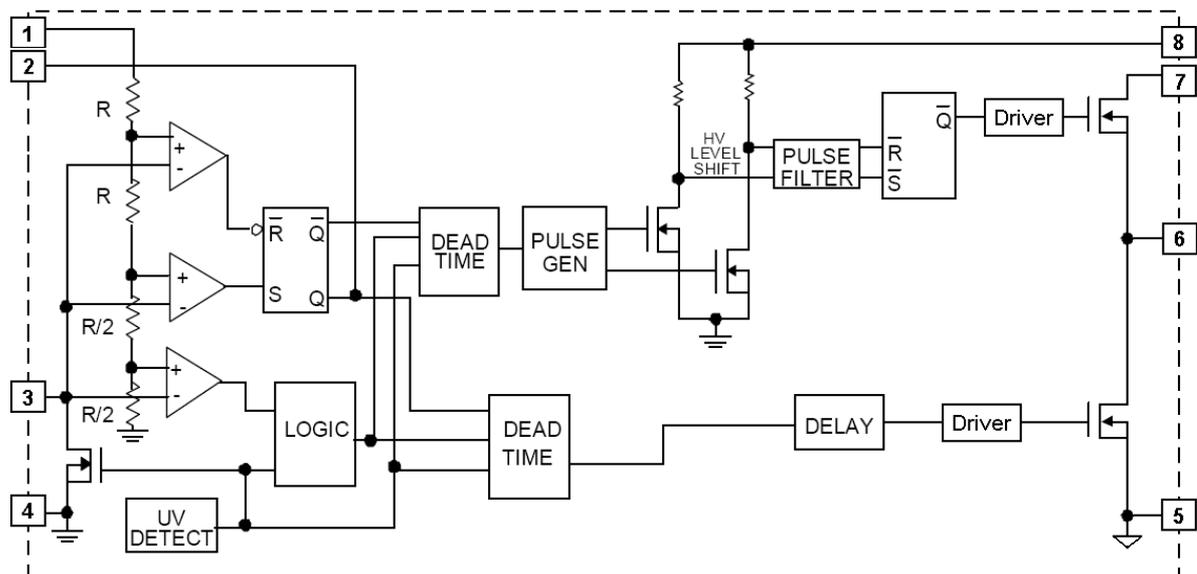
Absolute Maximum Ratings

Supply voltage VCC --- 19V

VB --- $-$0.3V ~ 440V

VS --- VB-25V ~ VB+0.3V

HV --- VS-0.3V ~ VB+0.3V

RT, CT -- $-$0.3V ~ VCC+0.3V

Junction temperature -- 150℃

Operating ambient temperature -- $-$20℃ ~ 85℃

Storage temperature range --- $-$65℃ ~ 150℃

DIP-8 package thermal resistance -- 100℃/W

Power dissipation (DIP-8, at ambient temperature = 85℃) -- 650mW

Lead temperature (All Pb free packages, soldering, 10sec) --- 260℃

ESD voltage protection, human body model --- 2KV

ESD voltage protection, machine model --- 200V

Recommended Operating Conditions

Item	Min.	Max.	Unit
Supply voltage VCC	10	18	V
Supply voltage VBS	VCC-0.7	18	V
Supply voltage HV		400	V
CFL (Input power)		23	W

Electrical Characteristics

(VCC = 12V, HV = 12V, Cboot = 0.1uF, CL = 1nF, CT = 1nF, Dboot is a ultra fast diode, and Ta = 25℃, unless otherwise specified. The VIN, VTH and IIN parameters are referenced to SGND = PGND = 0V)

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
LOW VOLTAGE SUPPLY CHARACTERISTICS						
Rising VCC under-voltage lockout threshold		V_{CCUV+}	8.1	9.0	9.9	V
Falling VCC under-voltage lockout threshold		V_{CCUV-}	7.2	8.0	8.8	V
VCC under-voltage lockout Hysteresis		V_{CCUVH}	0.5	1.0	1.5	V
Micropower startup VCC supply current	$V_{CC} \leq V_{CCUV}$	I_{QCCUV}	—	50	100	µA
Quiescent VCC supply current		I_{QCC}	—	160	300	µA
VCC operating voltage		Vop	10	12	18	V
OSCILLATOR I/O CHARACTERISTICS						
Oscillator frequency (CT=1nF)	RT = 36k	f_{osc}	19.4	20	20.6	kHz
	RT = 7.2k		94	100	106	kHz
RT pin duty cycle	f_{osc}<100kHz	d	48	50	52	%
CT pin current		I_{CT}	—	0.001	1.0	uA
UV-mode CT pin pulldown current	V_{CC} = 7V	I_{CTUV}	0.25	0.30	0.5	mA
Upper CT ramp voltage threshold		V_{CT+}	—	8.0	—	V
Lower CT ramp voltage threshold		V_{CT-}	—	4.0	—	V
CT voltage shutdown threshold		V_{CTSD}	4.0	4.1	4.2	V
High-level RT output voltage, VCC - VRT	I_{RT} = 100uA	V_{RT+}	—	10	50	mV
	I_{RT} = 1mA		—	100	300	mV
Low-level RT output voltage	I_{RT} = 100uA	V_{RT-}	—	10	50	mV
	I_{RT} = 1mA		—	100	300	mV
UV-mode RT output voltage	$V_{CC} \leq V_{CCUV}$	V_{RTUV}	—	0	100	mV
SD-Mode RT output voltage, VCC - VRT	I_{RT} = 100uA	V_{RTSD}	—	10	50	mV
	V_{CT} = 0V					mV
	I_{RT} = 1mA		—	100	300	mV
	V_{CT} = 0V					mV

Electrical Characteristics (Cont.)
BUILT-IN MOSFET CHARACTERISTICS

Parameter	Conditions	Symbol	Min.	Typ.	Max.	Unit
Drain – source break down voltage	V_{GS} = 0V, I_D =250uA	BV_{DSS}	440			V
Peak drain current @ V_{GS}=10V	Ta = 25℃	I_D			1.5	A
Drain - source on state resistance	V_{GS} =10V, ID=0.2A	Rds(on)		3.0	3.5	Ω
Drain – source leakage current	V_{DS} = 400V, V_{GS} = 0V, Tj = 25 °C	I_{DSS}			25	uA
	V_{DS} = 400V, V_{GS} = 0V, Tj = 125°C				250	
Gate threshold voltage	VDS = VGS, ID = 250uA	V_{TH}	2	3	4	V
Diode forward voltage	VDS = 0V, ID = 0.3A	V_{SD}			1.0	V

Input / Output Timing Diagram
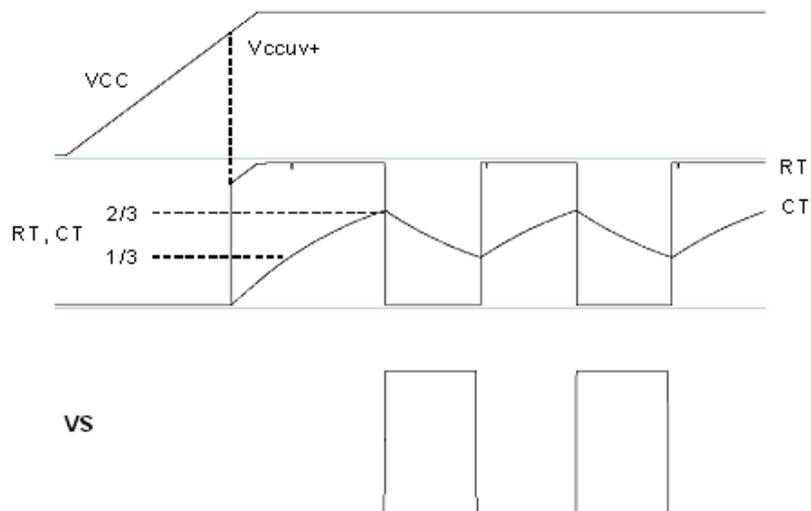
$$f_{osc} = 0.7213 / (RT \times CT) \quad (kHz)$$

Typical Performance Characteristics
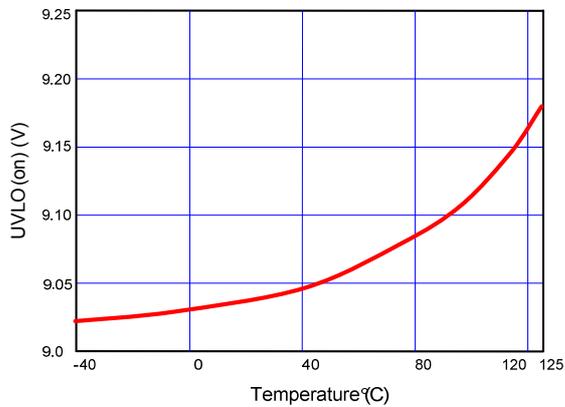
Fig. 1   UVLO(on) vs. Temperature
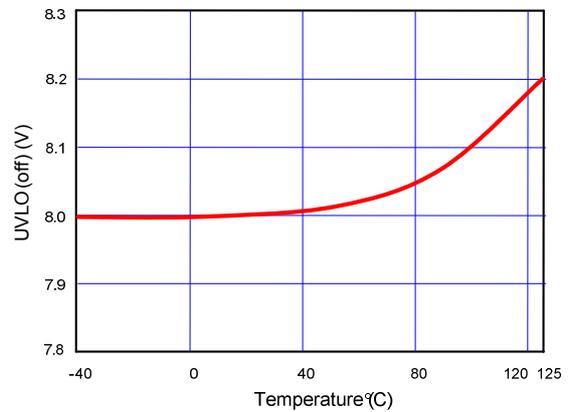
Fig. 2   UVLO(off) vs. Temperature
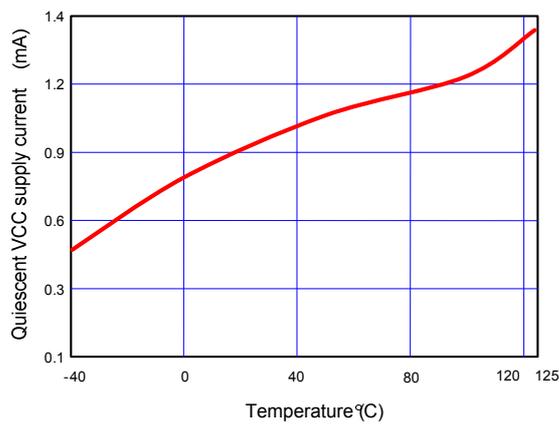
Fig. 3   Quiescent VCC supply current vs. Temperature
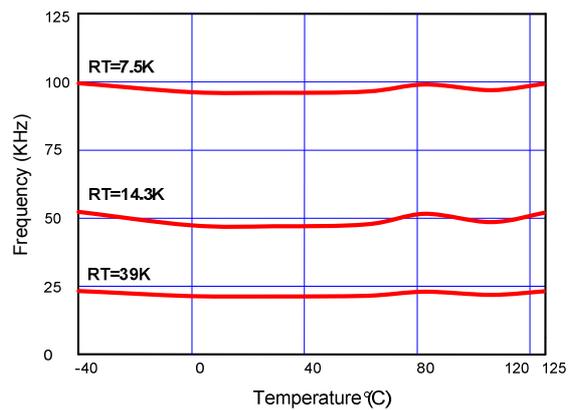

Fig.4   Frequency vs. Temperature
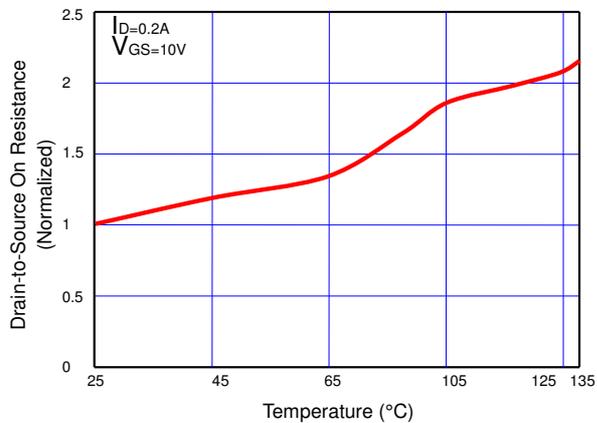
Fig. 5   Rds(on) vs. Temperature

Typical Application Circuit (220~240Vac 23W CFL)
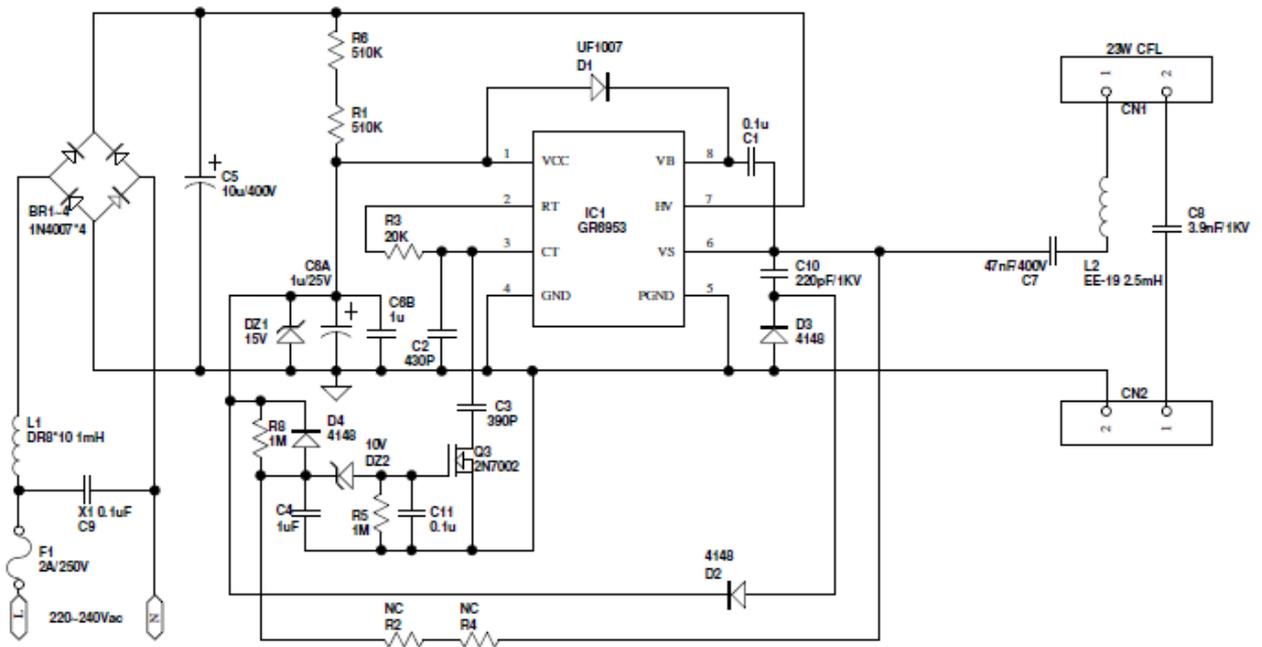
Package Information
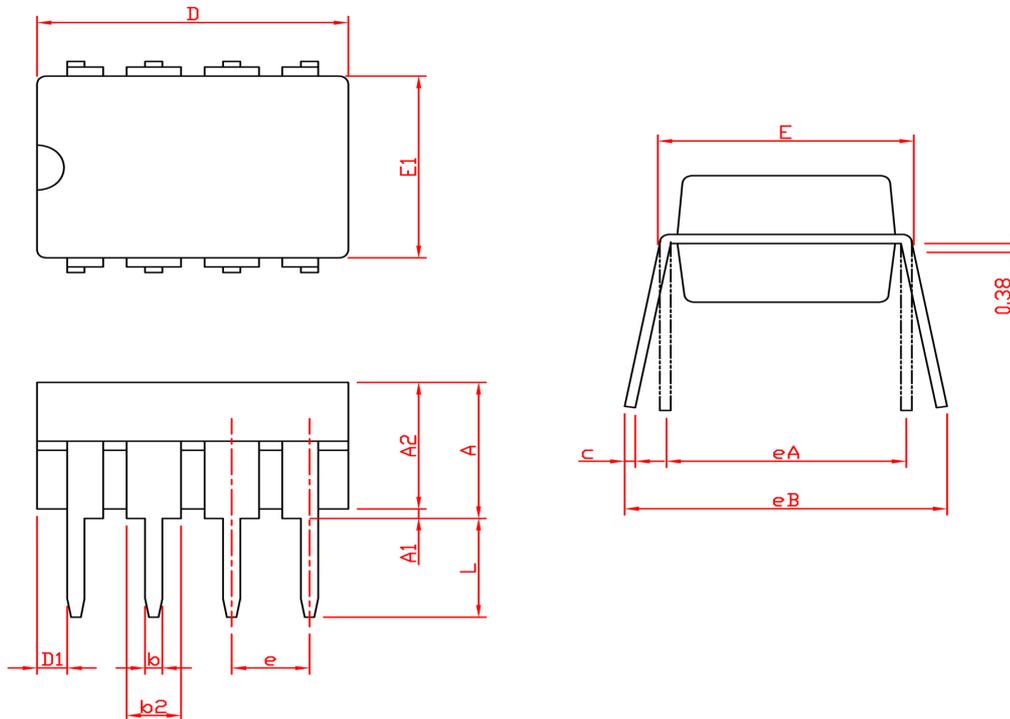
SYMBOL	DIP-8			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		5.33		0.210
A1	0.38		0.015	
A2	2.92	4.95	0.115	0.195
b	0.36	0.56	0.014	0.022
b2	1.14	1.78	0.045	0.070
c	0.20	0.35	0.008	0.014
D	9.01	10.16	0.355	0.400
D1	0.13		0.005	
E	7.62	8.26	0.300	0.325
E1	6.10	7.11	0.240	0.280
e	2.54 BSC		0.100 BSC	
eA	7.62 BSC		0.300 BSC	
eB		10.92		0.430
L	2.92	3.81	0.115	0.150

Note : 1. Followed from JEDEC MS-001 BA

2. Dimension D, D1 and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 10 mil.