



## F1962

## LINEAR INTEGRATED CIRCUIT

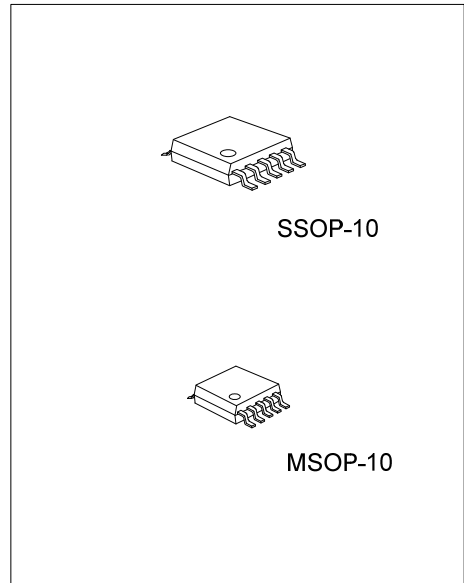
### SINGLE-PHASE FULL-WAVE MOTOR DRIVER IC

#### DESCRIPTION

The UTC **F1962** is a Single-phase full-wave motor driver designed specially for small DC fans. For example, CPU cooling fans.

#### FEATURES

- \* Wide Operating Voltage 5V or 12V Are Both Acceptable
- \* Built-In Hall Amplifier And Hall Bias Circuit
- \* Built-In Lockup And Thermal Protection With Automatic Recovery Circuits
- \* Rotation Detection Output
- \* Start/Stop Pin For Standby Mode Control

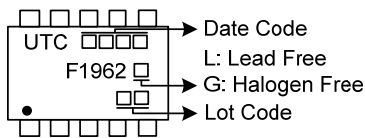


#### ORDERING INFORMATION

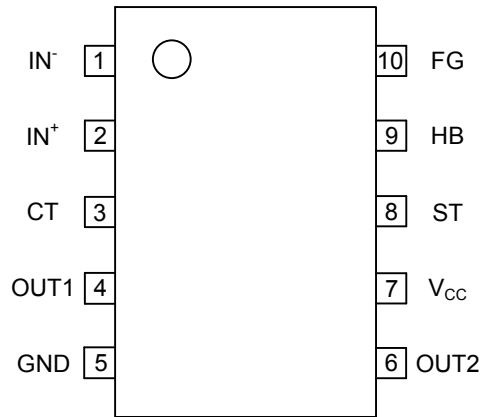
Ordering Number		Package	Packing
Lead Free	Halogen Free		
F1962L-R10-T	F1962G-R10-T	SSOP-10	Tube
F1962L-R10-R	F1962G-R10-R	SSOP-10	Tape Reel
F1962L-SM2-T	F1962G-SM2-T	MSOP-10	Tube
F1962L-SM2-R	F1962G-SM2-R	MSOP-10	Tape Reel

<p>F1962G-R10-T</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Green Package</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) R10: SSOP-10, SM2: MSOP-10</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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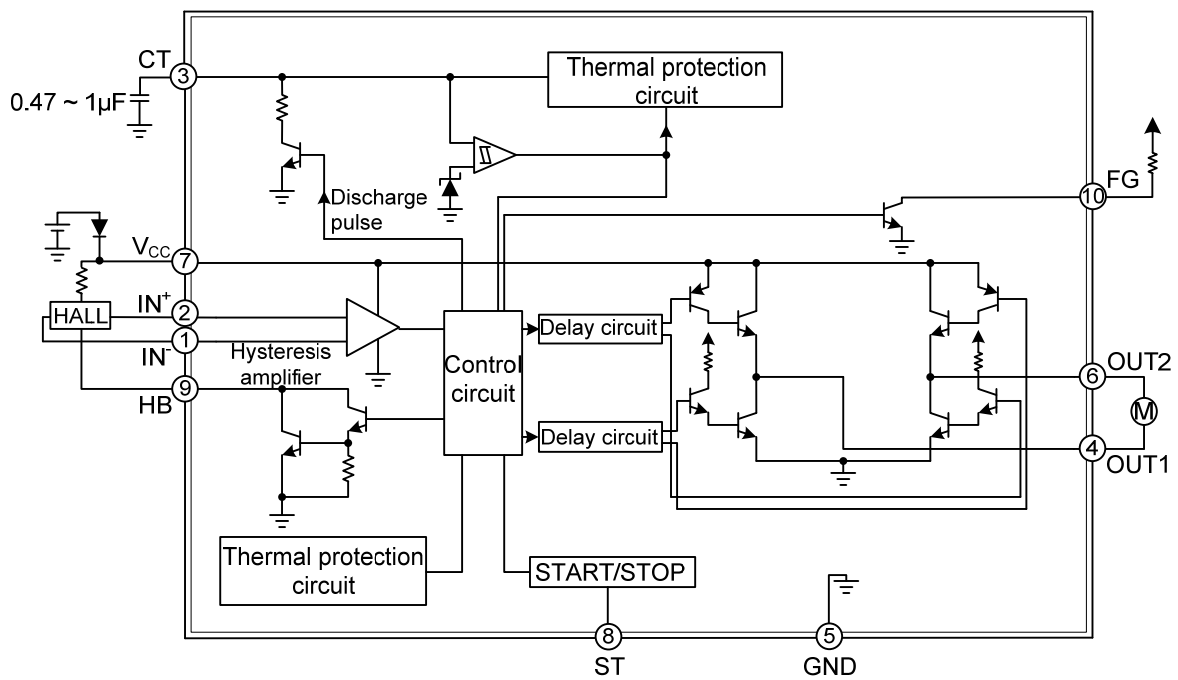
#### MARKING



## ■ PIN CONFIGURATION



## ■ BLOCK DIAGRAM



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

PARAMETER	SYMBOL	RATINGS	UNIT	
Maximum Supply Voltage	$V_{CC}(\text{max})$	18	V	
Maximum Output Current	$I_{OUT}(\text{max})$	0.5	A	
Maximum Output Withstand Voltage	$V_{OUT}(\text{max})$	18	V	
Maximum Output Withstand Voltage	$V_F(\text{max})$	17	V	
Maximum Output Current	$I_F(\text{max})$	5	mA	
	$I_R(\text{max})$	5	mA	
HB Maximum Output Current	$I_B(\text{max})$	10	mA	
ST Maximum Input Voltage	$V_{ST}(\text{max})$	15	V	
Allowable Power Dissipation (With Specified Substrate( Note 2))	SSOP-10	$P_D$	800	mW
	MSOP-10		650	mW
Junction Temperature	$T_J$	+150	$^{\circ}\text{C}$	
Operating Temperature	$T_{OPR}$	-30 ~ +85	$^{\circ}\text{C}$	
Storage Temperature	$T_{STG}$	-40 ~ +150	$^{\circ}\text{C}$	

Notes: 1. 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.

2. Specified substrate: 114.3×76.2×1.5mm<sup>3</sup> glass epoxy.

■ RECOMMENDED OPERATING RATINGS ( $T_A=25^{\circ}\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Power Supply Voltage	$V_{CC}$	3.8 ~ 16.8	V
ST Input High Level Voltage	$ST_H$	3 ~ 14	V
ST Input Low Level Voltage	$ST_L$	-0.3 ~ +0.4	V
Hall Input Common Mode Voltage Range	$V_{ICM}$	0.2 ~ $V_{CC}-1.5$	V

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

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Current Drain	$I_{CC}$	In drive mode (CT=[L], ST=[L])		8.0	10	mA
		In lockup protection mode (CT=[H], ST=[L])		2.2	3.1	mA
		In standby mode (ST=[H])		110	150	$\mu\text{A}$
Lockup Detection Capacitor Charge Current	$I_{CT}^1$		1.9	3.0	4.1	$\mu\text{A}$
Capacitor discharge current	$I_{CT}^2$		0.32	0.50	0.68	$\mu\text{A}$
Capacitor Charge/Discharge Current Ratio	$R_{CT}$	$R_{CD}=I_{CT}^1/I_{CT}^2$	5.5	6.5	7.5	
CT Charge Voltage	$V_{CT}^1$		2.55	2.75	2.95	V
CT Discharge Voltage	$V_{CT}^2$		1.6	1.8	2.0	V
Output Low Level Voltage	$V_{OL}$	$I_O=200\text{mA}$		0.2	0.3	V
Output High Level Voltage	$V_{OH}$	$I_O=200\text{mA}$	3.9	4.1		V
Hall Input Sensitivity	$V_{HN}$	Zero peak value (Including offset and hysteresis)		7	15	mV
Output Pin Low Voltage	$V_{FG}$	$I_{FG}=5\text{mA}$		0.1	0.3	V
Output Pin Leakage Current	$I_{FGL}$	$V_{FG}=15\text{V}$			30	$\mu\text{A}$
HB Output Low Voltage	$V_{HBL}$	$I_{HB}=5\text{mA}$		1.0	1.3	V
ST Pin Input Current	$I_{ST}$	$V_{ST}=5\text{V}$		75	100	$\mu\text{A}$

## ■ TRUTH TABLE

ST	IN <sup>-</sup>	IN <sup>+</sup>	CT	OUT1	OUT2	FG	HB	Mode
H				off	off	off	off	Standby
L	H	L	L	H	L	H	L	Rotating
	L	H		L	H	L		
			H	off	off		L	Lockup protection activated

## ■ DESIGN REFERENCE

### (1) V<sub>CC</sub> pin

Power supply pin for whole I<sub>C</sub>.

### (2) OUT1, OUT2 pins

Single-phase coil output pins.

Bipolar forward or reverse drive output determined by OUT1 or OUT2 high. Built-in regenerative circuit that regenerates kickback current between lower side NPN outputs if a diode is used for protection against reverse connection.

### (3) IN<sup>-</sup>, IN<sup>+</sup> pins

Hall signal input pins

The Hall signal is amplified into a square wave by the Hall amplifier with hysteresis characteristics of ±3.5 mV (typ.). The Hall signal amplitude should be 70 mV or more.

### (4) CT pin

This pin serves timing capacitor connecting pin between CT and GND.

The capacitor determines timing of the built-in lockup protection circuit for preventing coil burnout when motor is locked. Once normal motor rotating condition is restored, the automatic recovery circuit will reset itself.

Adjusting the capacitance alters the lockup detection time.

When a 0.47 mF capacitor is connected between CT and GND

Lockup detection time :approx. 0.5s

Lockup protection time/automatic recovery time :approx. 0.16s (output ON)

:approx. 1s (output OFF)

Connecting this pin to ground when lockup function is not used

### (6) FG pin

Open-collector output pin for rotation frequency detection.

When IN<sup>-</sup> = High and IN<sup>+</sup> = Low, then FG = Low

When IN<sup>-</sup> = Low and IN<sup>+</sup> = High, then FG = High

### (7) ST pin and HB pin

ST pin: When input to this pin is High, motor drive is stopped (OUT is high impedance).

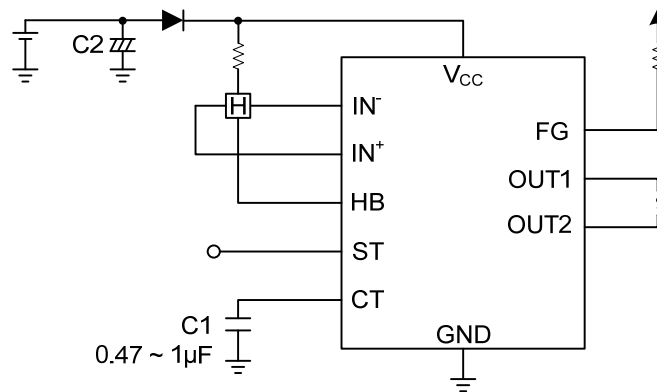
HB pin: Hall bias switching pin. At ST pin High input, Hall bias is switched to reduce current drain in fan standby mode.

If not used, both pins should be open.

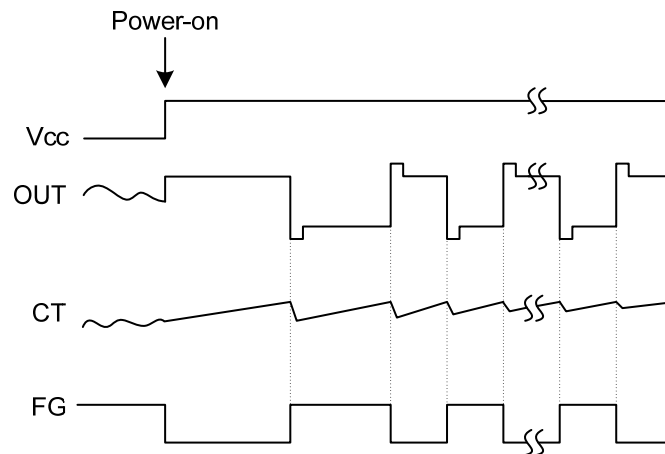
### (8) Thermal protection circuit

When junction temperature T<sub>J</sub> of IC is or over about 150°C, output current limiter is activated to protect against damage.

## ■ SAMPLE APPLICATION CIRCUIT

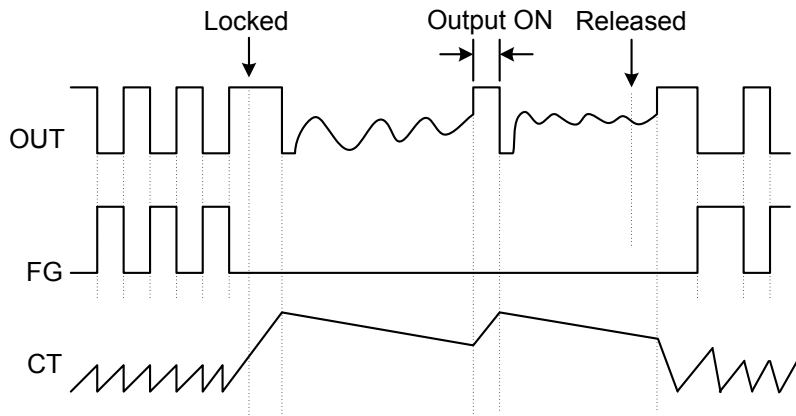


## Startup

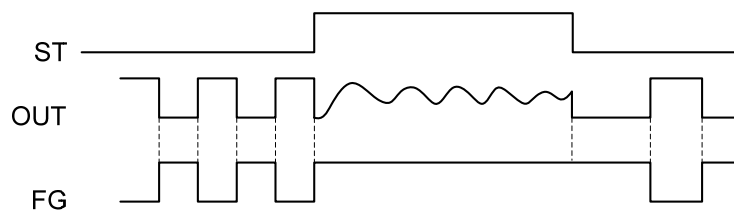


## ■ SAMPLE APPLICATION CIRCUIT (Cont.)

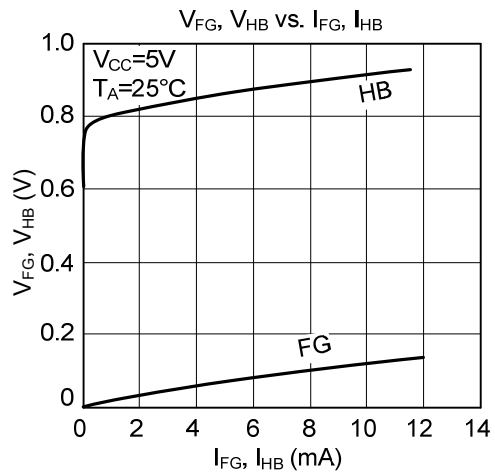
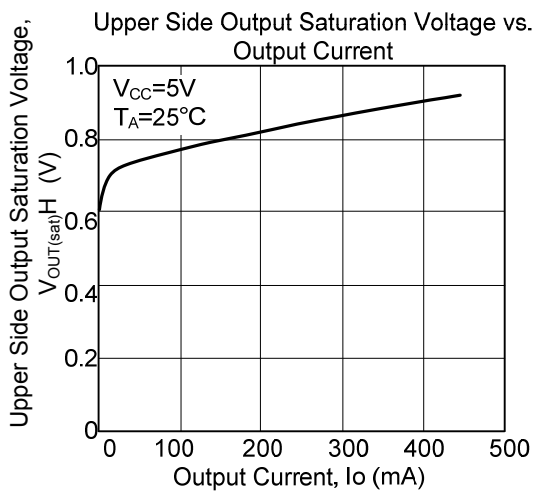
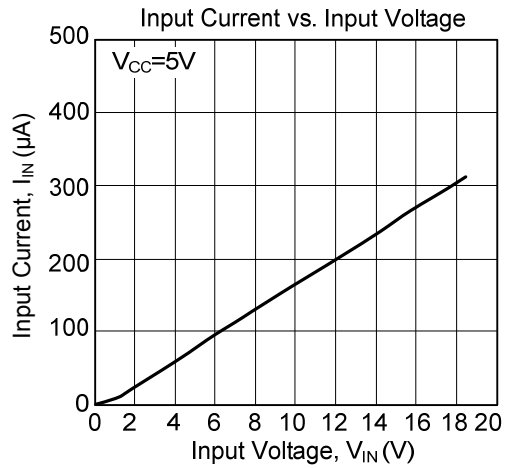
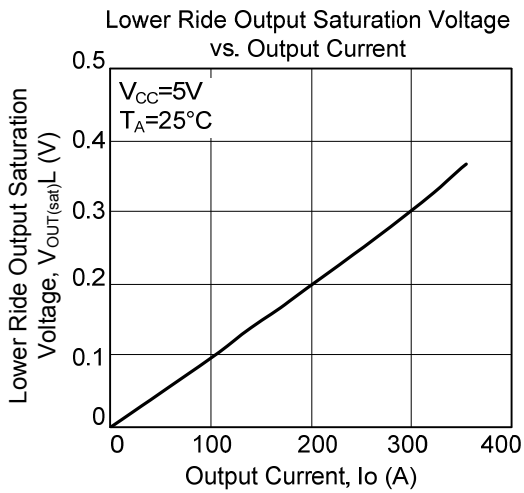
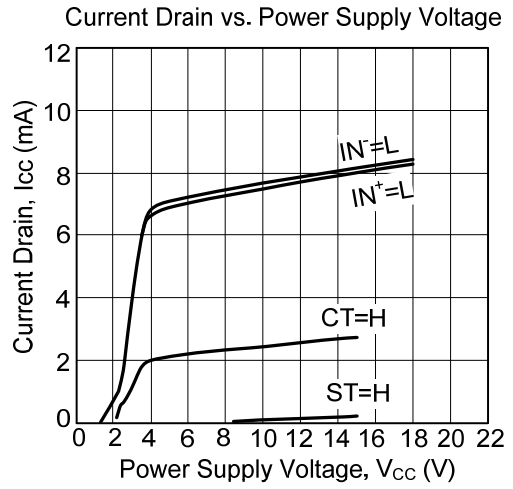
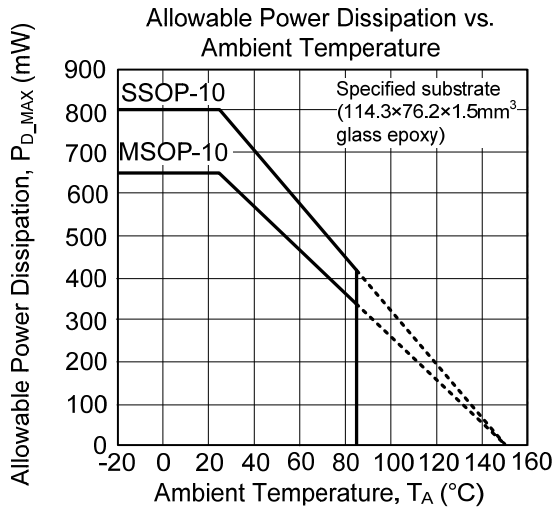
### Locked-up protection and automatic recovery curves



### Start or stop curve



■ TYPICAL CHARACTERISTICS



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