SGS-THOMSON MICROELECTRONICS

L6287

POWER COMBO DRIVER

PRELIMINARY DATA

DESCRIPTION

The F-VHS Motor Driver COMBO IC includes a double three phase brushless motor driver plus a DC full bridge motor driver for VCR application.

The package is SDIP42 (38+2+2 pin ground frame).
The device is realized in BCD technology with power LDMOS output stages.

The gate drive for high side stages is provided by an internal charge pump with two external capacitors. The first three phase motor driver is devoted to the DRUM motor control.
The phase sequence update signal is provided initially by an external start-up signal (FSTART), whose frequency is internally divided by four, while, during normal operation, is provided by an optical tacho converter signal.
This signal is used as clock and reset for the state machine.

The regulation of the speed is externally provided by means of PWM signal generated by the µP (DPWM), without external sensing resistor. The feedback to the µP unit is given by a suitable open drain output signal (PUD) synchronized by the internal state machine.

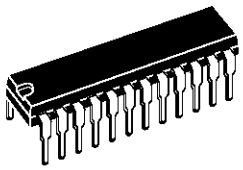
The second three phase motor driver is devoted to the CAPSTAN control. While the DRUM will always spin in a fixed direction, the CAPSTAN motor needs a more sophisticated logic to control the changes in spin direction.

The motor position detection is carried out by means of three comparators for Hall effect sensors. The loop regulation for this motor is still provided by the µP with the signals CPWM and CDIR.

The LOADING motor section include a full bridge DC motor driver. The motor operations are directly set by the inputs LPWM, LDIR according to the truth table reported on the page 5.

The device also includes a circuit for early thermal alarm, last thermal alarm and thermal shutdown with hysteresys. The output of this stage is an open drain, kept ON during normal operations.

The THERM signal follows the inverted FSTART signal between early warning and last warning temperature, while remains in high impedance (OFF) after lastwarning temperature and during thermal shutdown.



SDIP42

ORDERING NUMBER: L6287

The STANDBY state of the device is imposed by

- THERMAL SHUTDOWN
- UNDERVOLTAGE ON VCC SUPPLY
- EXTERNAL SIGNAL FSTART;

This state is imposed automatically after a defined time-out.
The time-out is realized by sensing the falling edges of the FSTART signal: if no edges are recorded for a time interval greater than a certain time constant, the STANDBY condition is generated.

The time constant is defined by the external capacitor CTO.

In the STANDBY state the main functions (upper power stages, opto decoder, etc) of the device are turned off in order to minimize the power consumption.

The device also implement a HEATER function. The HEATER transistor is OFF during thermal shutdown, undervoltage condition and during normal working mode.

The HEATER transistor is driven ON when the external STANDBY condition is present according to the following table:

FSTART	HIGH	LOW
HEATER	OFF	ON

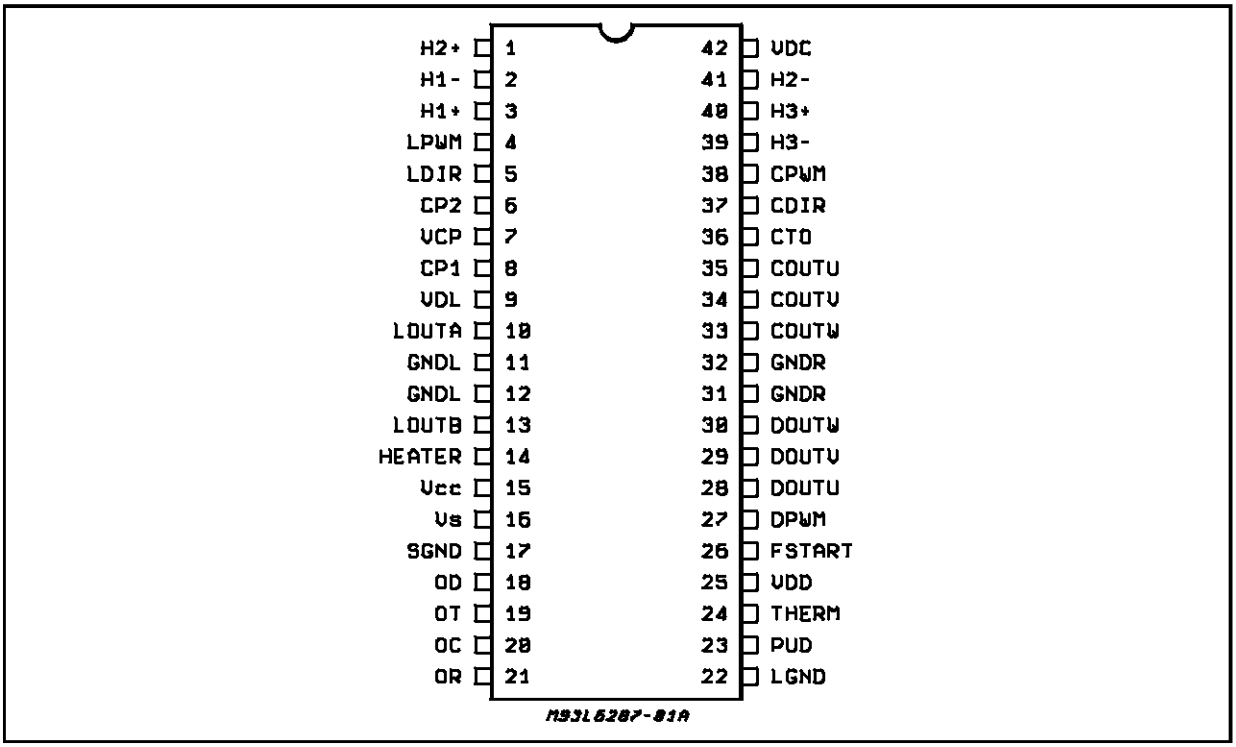
During the ON condition, the specified heater Ron is not guaranteed if all the voltage supplies are not at their minimum nominal value.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DD}	Drum Supply Voltage	20	V (**)
V_{DC}	Capstan Supply Voltage	20	V (**)
V_{DL}	Loading Supply Voltage	20	V (**)
UPPER POWER $V_{DS\ MAX}$	Motor Output to Ground Voltage	20	V(***)
LOWER POWER $V_{DS\ MAX}$	Motor Output to Supply Voltage	20	V (***)
V_{CC}	Logic Supply Voltage	7	V
V_S	Special Supply Voltage	7	V
I_{p1}	Loading Motor Peak Current (T_{on} = 1µs Duty Cycle = 2%)	1.6	A
I_{pd}	Drum Motor Peak Current (T_{on} = 1µs Duty Cycle = 2%)	1.4	A
I_{pc}	Capstan Motor Peak Current (T_{on} = 1µs Duty Cycle = 2%)	1.8	A
V_{il}	Logic Input Low State Voltage	-0.1	V
V_{ih}	Logic Input High State Voltage	7	V
V_{therm}	Open Drain Maximum Voltage	7	V
V_{heat}	Open Drain Maximum Voltage	20	V (**)

(**) Not operative - STANDBY condition
(***) Each motor driver

PINS CONNECTION

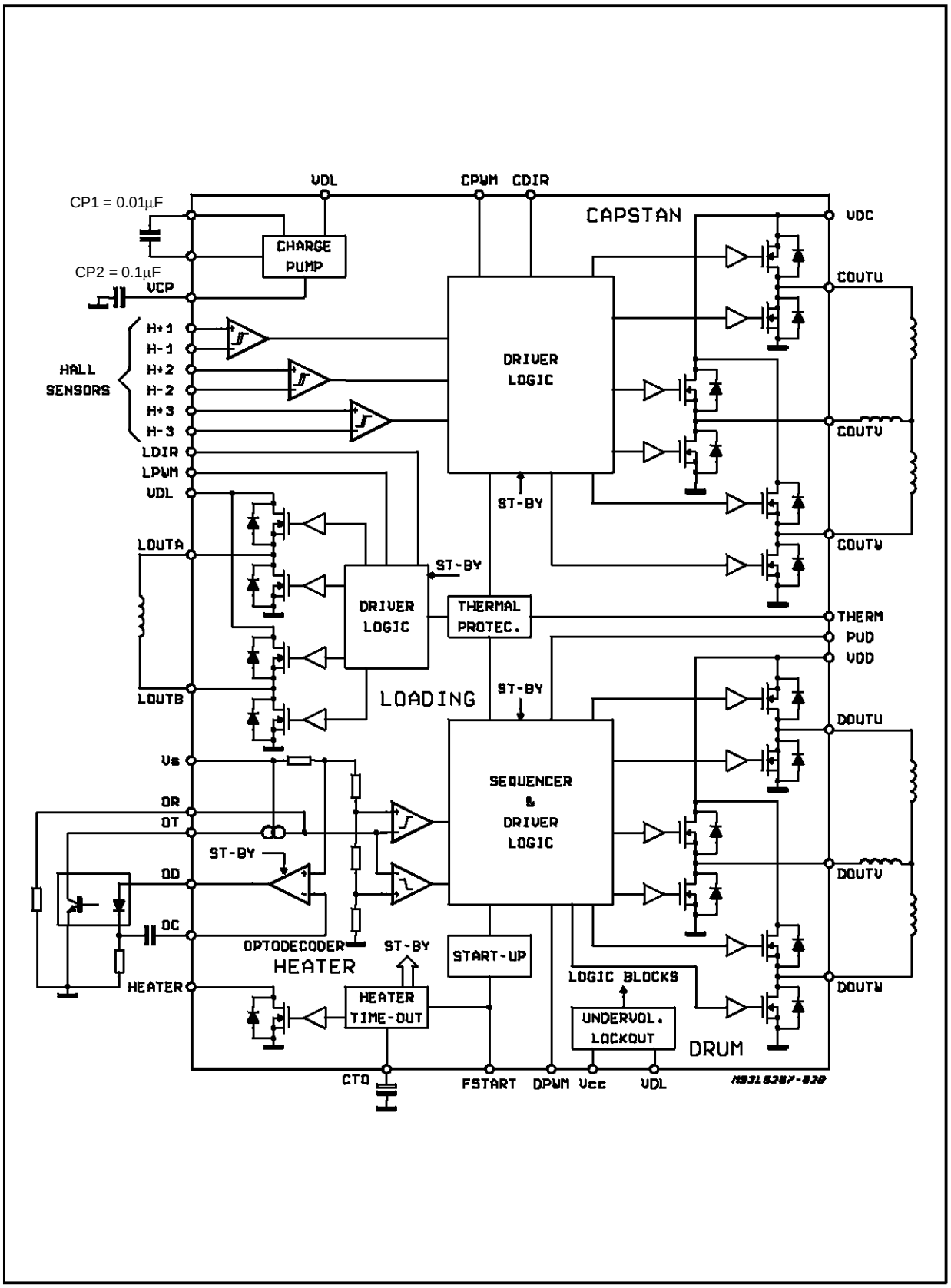


THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{thj\text{-}amb}$	Thermal Resistance Junction to Ambient	48	°C/W
$R_{th\ j\text{-}pins}$	Thermal Resistance Junction to Pin	15	°C/W

Note: Batwing pin.

BLOCK DIAGRAM



PIN DESCRIPTION

VOLTAGE SUPPLIES (The power supply voltage V_{DD}, V_{DC}, V_{DL} must be connected toghether externally)	
V_{DD}	Power supply voltage for drump motor
V_{DC}	Power supply voltage for capstan motor
V_{DL}	Power supply voltage for loading motor and charge pump
V_{CC}	Logic voltage supply
LGND	Logic Ground
GND R	Capstan + drum power ground
GND L	Loading + Charge pump Power ground
V_S	Analog voltage supply
SGND	Analog ground
Note: The V_{CC} and V_S Power Supply must be together either at maximum or minimum value.	
DRUM MOTOR	
DOUT U	Winding Output U
DOUT V	Winding Output V
DOUT W	Winding Output W
DPWM	PWM logic pulse input. Control signal generated by µP for dump motor current regulation.
PUD	Logic output position feedback generated by the translator logic
OD	Optocoupler diode output
OC	External capacitor for tacho-converter integrator
OT	Input for optocoupler transistor
OR	Tacho-converter external resistor. This resistor defines the full-light current level of the tacho.
CAPSTAN MOTOR	
COUT U	Winding Output U
COUT V	Winding Output V
COUT W	Winding Output W
CPWM	PWM logic pulse input. Control signal generated by µP for current regulation.
CDIR	Motor Direction Logic Input Signal
H1+	Hall sensor differential input
H1-	
H2+	Hall sensor differential input
H2-	
H3+	Hall sensor differential input
H3-	
LOADING MOTOR	
LOUT A	Winding Output A
LOUT B	Winding Output B
LPWM	PWM logic input.
LDIR	Direction logic input
SERVICES	
HEATER	Open drain output for heater resistor
V_{CP}	Charge pump storage capacitor pin
CP1	Bootstrap Capacitor pin
CP2	Bootstrap Capacitor pin
THERM	Open drain thermal alarm output
FSTART	Start-up logic signal for drum motor
CTO	Time out capacitor output

ELECTRICAL CHARACTERISTICS (Tj = 0 to125°C; V_{CC} = V_S = 5V ±5%; V_{DC} = V_{DL} = V_{DD} = 10 to 18V; unless otherwise specified.)

POWER SUPPLY

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
(#)V_{DD}	Drum Power Supply Voltage		10		18	V
(#)V_{DC}	Capstan Power Supply Voltage		10		18	V
(#)V_{DL}	Loading Power Supply Voltage		10		18	V
V_{CC}	Logic Power Supply Voltage		4.5		5.5	V
V_S	Sensor Power Supply Voltage		4.75		5.25	V
V_{CCth}	Undervoltage Threshold		3.6		4.4	V

 # WARNING
The functionality of the I.C. is guaranted in this voltage range. Nevertheless the specified operating voltages (V_{DC}, V_{DD}, V_{DL}), must be selected according to the load characteristics. Proper cautions must be taken in the application in order to assure that the drain-source voltage across each output power transistor does not exceed 20V max.

LOADING MOTOR

ACTIVATION TRUTH TABLE

INPUT		OUTPUT	
LPWM	LDIR	LOUTA	LOUTB
0	0	LOW	LOW
0	1	LOW	LOW
1	0	HIGH	LOW
1	1	LOW	HIGH

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
R_{DSH}	High Side R_{DSonH}				2	Ω
R_{DSL}	Low Side RDSonL				2	Ω
(*)I_{OL}	DC Output Current				800	mA
(*)I_{pl}	Peak Output Current	DUTY CYCLE = 10%; t_{ON} = 500ms			1	A

DRUM MOTOR

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
I_{cd}	DC Output Current				400	mA
(*)I_{cdp}	Peak Output Current				600	mA
(*)I_{pdb}	Peak Output Current	DUTY CYCLE = 10%; t_{ON} = 500ms			800	mA
R_{DSH}	High Side RDSonH				1.6	Ω
R_{DSL}	Low Side RDSonL				1.6	Ω

CAPSTAN MOTOR

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
I_{co}	DC Output Current				800	mA
(*)I_{cop}	Peak Output Current				1	A
(*)I_{pob}	Peak Output Current	DUTY CYCLE = 10%; t_{ON} = 1ms			1.5	A
R_{DSH}	High Side RDSonH				1	Ω
R_{DSL}	Low Side RDSonL				1	Ω

(*) WARNING
These current values are compatible with the structure of the IC power structure. Nevertheless the use of these current levels could produce junction temperatures that force IC outside of the operative range due to the thermal characteristics of the choosen package.

ELECTRICAL CHARACTERISTICS (continued)

DRUM TACHO CONVERTER

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
I_{od}	Open Loop Output Current	V_{od} = 1V; I_{oc} = 100µA (Note 1)	30		60	mA
I_{ot}	Full Light Current Range		0.5		3	mA
I_{oc}	Sink Current	V_{or} = 0; I_{od} = 0	0.2		0.5	µA
I_{ot} vs I_{or}	Mismatch			5	10	%
V_{ref}	Opto Resistor Reference Voltage	V_S = 4.75V	3.36		3.72	V
		V_S = 5V	3.54		3.91	V
		V_S = 5.25V	3.72		4.11	V
V_{OC}	Open Loop Opto Capacitor Voltage	V_{OD} = 1V see Fig. 1 V_S = 4.75V V_S = 5V V_S = 5.25V	2.75			V
V_{thr1}	Clock Threshold Voltage	V_S = 4.75V	2.19		2.42	V
		V_S = 5V	2.30		2.54	V
		V_S = 5.25V	2.42		2.67	V
V_{thr2}	Reset Threshold Voltage	V_S = 4.75V	0.30		0.33	V
		V_S = 5V	0.32		0.35	V
		V_S = 5.25V	0.33		0.37	V
t_{pud}	µP Syncro Pulse Duration		1		3	µs
I_{pud1}	Open Drain Sink Current	V_O = 0.4V	5			mA

Note 1: The suggested C_{opt} external capacitor value is 5µF (±5%)

HALL COMPARATOR

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{in}	Input Voltage Range		0.5		2.7	V
I_b	Input Bias Current				1	µA
V_{of}	Input Offset Voltage				8	mV
V_{hy}	Switchable Hysteresys	Vref = 1.5V;	10		40	mV

THERMAL PROTECTION

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
I_{therm}	Open Drain Sink Current	V_{out} = 0.4V (see note 1)	5			mA
T_s	Shutdown Temperature		155	170	185	°C
T_{sdh}	Shutdown Hysteresis			60		°C
T_{al1}	Early Warning Temperature			Ts -40		°C
T_{al2}	Last Warning Temperature	(see note 2)		Ts -20		°C

NOTE 1: Therm output stage is on in the normal temperature range

NOTE 2: In the Tal-Tll temperature range therm signal follows the inverted Fstart signal. After Tll temperature this output is always in high impedance. If thermal shutdown is reached this pin will remain in this state until the shutdown hysteresys will be recovered.

HEATER

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
R_{dsheat}	Heater R_{DSon}				3	ohm
V_{heat}	Heater Voltage				18	V

ELECTRICAL CHARACTERISTICS (continued.)

LOGIC LEVELS FOR DIGITAL INPUTS (C_{PWM}, C_{DIR}, D_{PWM}, F_{START}, L_{PWM}, L_{DIR})

A pull up resistor R_i is connected between the C_{DIR}, F_{START}, L_{PWM}, L_{DIR} inputs pads; C_{PWM} and D_{PWM} are left unconnected.

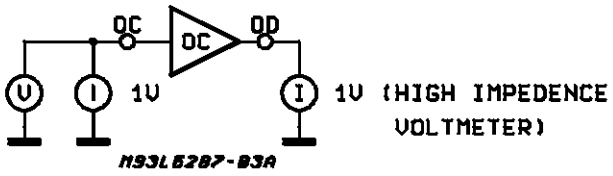
Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{il}	Input Low Voltage				0.8	V
V_{ih}	Input High Voltage		2			V
R_i	Pull Up Resistor		3.5		10.5	Kohm

TIME OUT STAGE

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
I_{cto}	Time Out Output Current	(Note 1)	5		20	uA

Note 1: The suggested external capacitor value is C_{to} = 1µF (±20% max) for f_{START} = 20KHz.

Figure 1: Optocircuit Open Loop OC Voltage.



SDIP42 PACKAGE MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5.08			0.20
A1	0.51			0.020		
A2	3.05	3.81	4.57	0.120	0.150	0.180
B	0.36	0.46	0.56	0.0142	0.0181	0.0220
B1	0.76	1.02	1.14	0.030	0.040	0.045
c	0.23	0.25	0.38	0.0090	0.0098	0.0150
D	37.85	38.10	38.35	1.490	1.50	1.510
E	15.24		16.00	0.60		0.629
E1	12.70	13.72	14.48	0.50	0.540	0.570
e		1.778			0.070	
e1		15.24			‘0.60	
e2			18.54			0.730
e3			1.52			0.060
L	2.54	3.30	3.56	0.10	0.130	0.140