SGS-THOMSON MICROELECTRONICS

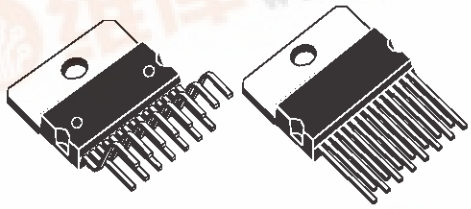
VN410

SMART DIRECTION INDICATOR 2 CHANNEL DRIVERS

TYPE	$V_{DSS(cl)}$	I_n (✯)	R_{on}
VN410	60V	4.8 A	0.07 Ω

I_n (✯) : ISO definition nominal current for high side automotive switches.

- LOAD CURRENT UP TO 15A PER CHANNEL
- OVER VOLTAGE PROTECTION
- UNDER VOLTAGE PROTECTION
- DOUBLE FLASHING FREQUENCY IN LOW LOAD CONDITION
- CYCLE BY CYCLE POWER LIMITATION
- BUZZER DRIVER
- TRAILER INDICATION



MULTIWATT-15
Order Codes :

(vertical)	(In Line)
VN410	VN410(012Y)

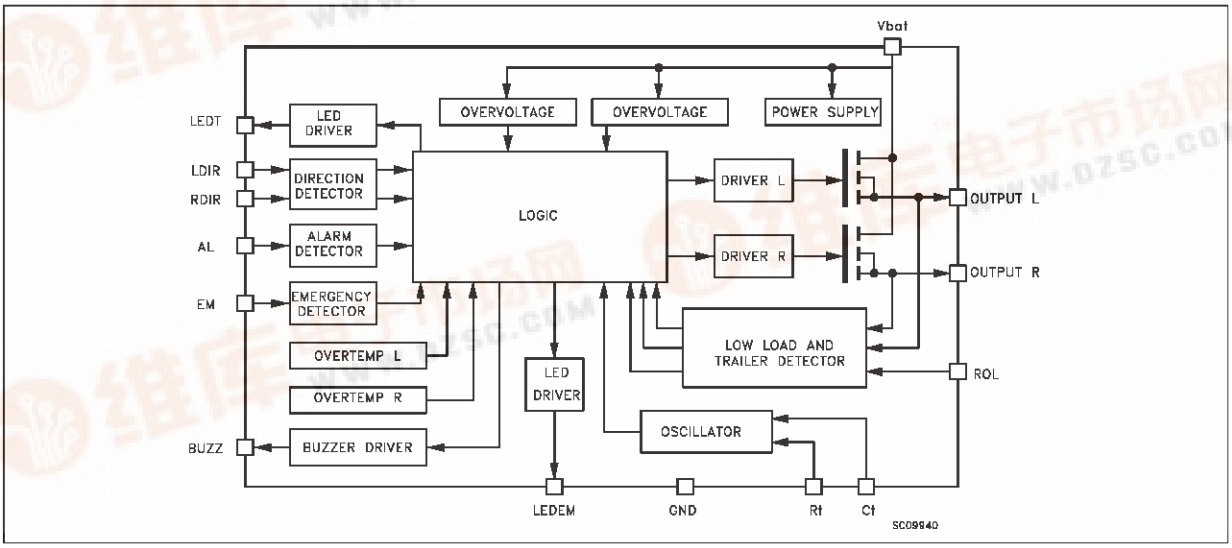
DESCRIPTION

The VN410 is a monolithic device made using SGS-THOMSON Vertical Intelligent Power Technology, integrating all the features needed to implement a complete automotive flashing system.

This device has two identical power channels, so the informations are are specified for only one. R_t, C_t pins are connected to an external R, C network which fixes the flashing frequency. LDIR, RDIR direction inputs activate the corresponding output (or none). EM inputs turns on both power outputs for emergency flashing, which is reflected by flashing red LED connected to LEDEM output. AL input can be connected to an anti-theft alarm system, making both power outputs flashing. In case of low load (burned lamp) buzzer frequency and outputs flashing will double, thus indicating a fault condition (direction mode only).

In case of overloading of the power outputs, built-in-thermal shutdown circuits will reduce duty cycle so as to keep maximum junction temperature within safe limits. Rol pin is connected to an external resistor to detect a burned lamp and a trailer connection. LEDT is connected to an external green LED which indicates the trailer connection.

BLOCK DIAGRAM

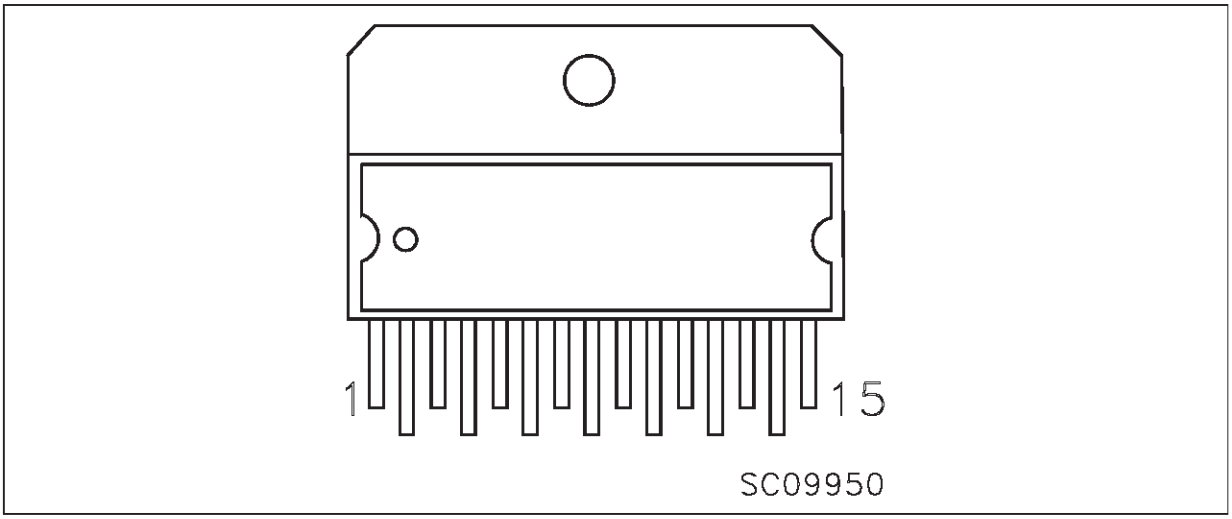


ABSOLUTE MAXIMUM RATING

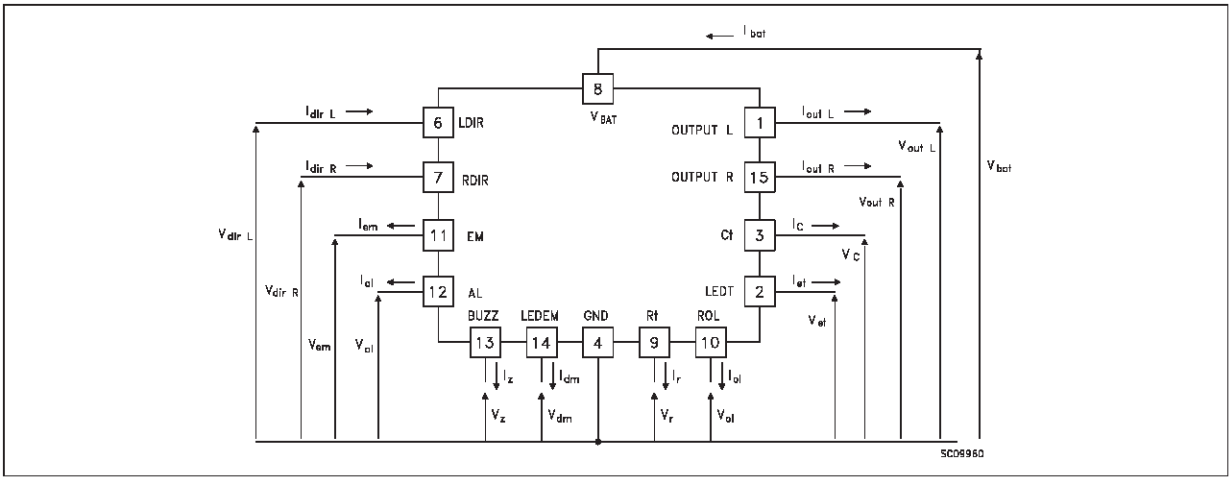
Symbol	Parameter	Value	Unit
-Vbat	Reverse Supply Voltage	-12	V
$V_{BR(DSS)}$	Drain-Source Breakdown Voltage	60 (Internally clamped)	V
V_{p1}	Breakdown Voltage in Pad : LEDEM (V_{bat} < 15V) (V_{bat} > 15V)	V_{bat} 15	V V
I_{p1}	Breakdown Current in Pad : RT, CT, ROL LDIR,RDIR	+/- 10 -10/+100	mA mA
I_{Out}	Maximum DC Load Current	15	A
V_{gnd}	Voltage Drop Between ground connections (see note 1)	0.4	V
I_R	Reverse Output Current	-15	A
V_{esd}	Electrostatic Discharge (R = 1.5 kΩ, C = 100 pF)	2000	V
P_{tot}	Power Dissipation at $T_c \leq 25\ ^oC$	Internally Limited	W
T_j	Junction Operating Temperature	Internally Limited	^oC
T_{stg}	Storage Temperature	-55 to 150	^oC

Note 1: In case the voltage drops beetween ground connection exceed 0.4V, extenal resistors in series with EM pin and AL pin are needed (if these pins are used) to prevent damages to the device. The value of these resistors is 100Ω.

CONNECTION DIAGRAM



CURRENT AND VOLTAGE CONVENTIONS



ELECTRICAL TRANSIENTS REQUIREMENTS

ISO T/R 7637/1 Test Pulse	TEXT LEVELS				
	I	II	III	IV	Delays and Impedance
1	-25 V	-50 V	-75 V	-100 V	2 ms, 10 Ω
2	+25 V	+50 V	+75 V	+100 V	0.2 ms, 10 Ω
3a	-25 V	-50 V	-100 V	-150 V	100 µs, 50 Ω
3b	+25 V	+50 V	+75 V	+100 V	100 µs, 50 Ω
4	-4 V	-5 V	-6 V	-7 V	100 ms, 0.01 Ω
5	+26.5	+46.5	+66.5	+86.5	400 ms, 2 Ω

ISO T/R 7637/1 Test Pulse	TEXT LEVELS RESULTS *				
	I	II	III	IV	
1	C	C	E	E	
2	C	C	E	E	
3a	C	C	C	C	
3b	C	C	C	C	
4	C	C	C	C	
5	C	C	E	E	

* :with an external capacitor of 22nF connected between V_{bat} and GND, with loads connected (2 bulbs per channel),and with a maximum of 10µH output inductance.

CLASS	CONTENTS
C	All function of the device are performed as designed after exposure to disturbance.
E	One or more functions of the device is not performed as designed after exposure and cannot be returned to proper operation without replacing the device.

THERMAL DATA

$R_{thj\text{-}case}$	Thermal Resistance Junction-case (1)	Max	1.5	°C/W

ELECTRICAL CHARACTERISTICS (10V < V_{CC} < 18 V; - 40 °C < T_J < 125 °C unless otherwise specified)

POWER

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{bat}	Operating Voltage		6	13	18	V
R_{on}	On State Resistance (per Channel)	T_C= 25 °C V_{bat} = 13 V I_{out}= $I_{nominal}$			0.07	Ω
I_{sq}	Supply Quiescent Current	T_C= 25 °C V_{bat} = 13 V Off State			100	µA

SWITCHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$(di/dt)_{on}$	Turn-on Current Slope	R_{load} = 2.7 Ω; T_C= 25 °C; V_{bat} =13 V		0.01		A/µs
$(di/dt)_{off}$	Turn-off Current Slope	R_{load} = 2.7 Ω; T_C= 25 °C; V_{bat} =13 V		0.01		A/µs

FLASHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
f_b	Flashing frequency (normal operation)	R_t = 2400 Ω C_t =100 nF	2	4	1.6	Hz
δ_1	Duty Cycle	Direction Indicator Flashing Mode		0.45		
δ_2	Duty Cycle	Emergency and Alarm Flashing Mode		0.35		
I_{dir} L I_{dir} R	Direction Currents	R_1 = 470 Ω; R_2 = 470 Ω; T_C= 25 °C	5	20	40	mA
I_{em}	Emergency Source Current	V_{em} = 1 V; T_C= 25 °C	5	20	40	mA
I_{al}	Alarm Source Current	V_{al} = 2 V; T_C= 25 °C	5	20	40	mA
I_{dm1}	LED Source Current (emergency flashing)	LEDEM pin short circuited to GND	35		120	mA
I_{dm2}	LED Sink Current (emergency flashing)		15		70	mA
I_{et}	LED Current (trailer indicator)	LEDT pin short circuited to GND	35		120	mA
I_z	Buzzer Current	BUZZ pin short circuited to GND	250		1000	mA
T_z	On Time Buzzer	Rt = 3000 Ω; C_t = 100 nF		348		ms
T_{fz}	Buzzer Filter Time	Rt = 3000 Ω; C_t = 100 nF	8		28	ms
T_{al}	Alarm Filtering Time	Rt = 3000 Ω; C_t = 100 nF	15		40	ms
I_{df1}	Current Threshold for Double Frequency	R_{ol} = 1000 Ω; V_{bat} = 10 V	1.94		3.04	A
I_{df2}	Current Threshold for Double Frequency	R_{ol} = 1000 Ω; V_{bat} = 18 V	2.64		4.22	A
I_{t1}	Current Threshold for Trailer Detection	R_{ol} = 1000 Ω; V_{bat} = 10 V	3.52		4.56	A

ELECTRICAL CHARACTERISTICS (continued)

FLASHING

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{t2}	Current Threshold for Trailer Detection	Rol = 1000 W; Vbat = 18 V	4.81		6.33	A

PROTECTIONS

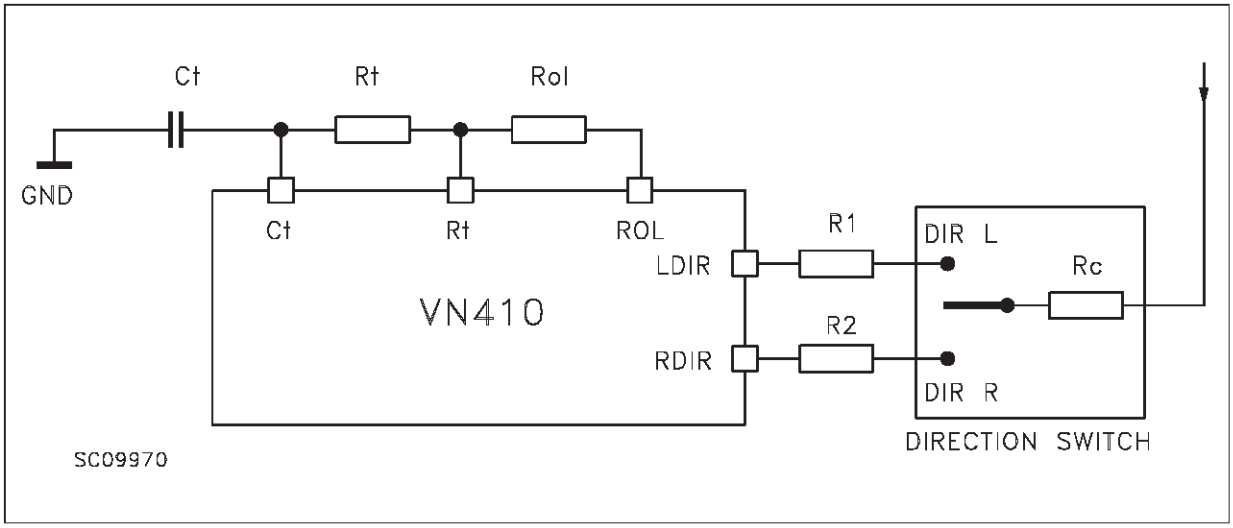
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{usd}	Under Voltage Shut-down				6	V
T_{pl}	Thermal Limitation Temperature		140		200	°C
T_{pr}	Thermal Limitation Reset Temperature		125			°C
V_{ov}	Over Voltage Shut-down		18		24	V
V_{cl}	Drain-Source Clamp Voltage	Iout = I_n = 4.8 A	60		80	V

EXTERNAL COMPONENTS CHARACTERISTICS (Application Ratings)

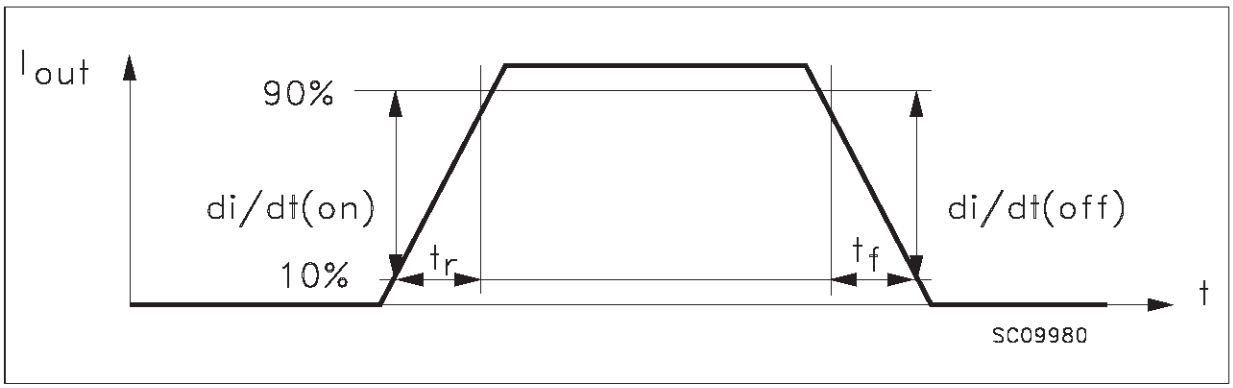
Symbol	Parameter	Min.	Typ.	Max.	Unit
R_t	External Resistor for Oscillator		3000		Ω
C_t	External Capacitor for Oscillator		100		nF
R_1	External Direction Resistor	447	470	493	Ω
R_2	External Direction Resistor	447	470	493	Ω
R_C	Switch Contact Resistor		0.1	10	Ω
R_{ol}	External Resistor for Double Frequency and Trailer Detections	857	866	875	Ω
I_{lk}	Connector Leakage Current Between Input Direction Pins and Vbat Pin			2	mA
L_{out}	Output Inductance			10	µH

V_{ig}

EXTERNAL COMPONENTS DIAGRAM



SWITCHING PARAMETERS TEST CONDITIONS



TRUTH TABLE

Conditions	AI	Em	Dir R	Dir L	OUT R	OUT L
Normal Operation	H_{iz} H_{iz} H_{iz} H_{iz} A	Hiz H_{iz} H_{iz} L X	O O C X X	O C O X X	L L A A A	L A L A A
Over-voltage	X	X	X	X	L	L
Under-voltage	X	X	X	X	L	L
Power Overload	In that case, the duty cycle will be reduced so as to keep the junction temperature below T_{pl}					

H_{iz} = high impedance, L= low level, X= unspecified, A=active, O=open, C=closed.

FUNCTIONAL DESCRIPTION

- NORMAL OPERATION

The right or left channel is activated by the corresponding position of the direction indicator through the direction input pins. Each time an output (or both) is activated, the buzzer is also activated through the BUZZ pin at the double frequency than the output(s). In emergency case, if the emergency button is activated the two channels are turned on. At the same time the emergency red LED is flashing. An anti-theft alarm can be connected to the AL pin, in that condition if the anti-theft alarm is used the two channels are activated.

- UNDER-VOLTAGE OR OVER-VOLTAGE CONDITION

In case the device detects an undervoltage or an overvoltage condition the activated channel(s) are automatically switched off whatever the input commands (LDIR, RDIR, AL, EM)

- TRAILER OPERATION

The trailer detection is achieved with the ROL external resistor. In that case the green trailer LED is flashing through the pin LEDT in synchronism with the outputs.

- LOW LOAD CONDITION

The low load detection is achieved with the ROL external resistor connected between ROL pin and RT pin. If a low load condition has been detected the output flashing frequency on the guilty channel and the buzzer frequency will be double (in direction mode only) .

- POWER LIMITATION CONDITION

In case of overloading of the power outputs the duty cycle is reduced internally by the device itself so as to keep maximum junction temperature within safe limits.

- CHIP GROUND DISCONNECTION

If GND pin is disconnected, the device will switch off provided V_{bat} does not exceed 18V.

FIGURE 2: Switching Waveforms

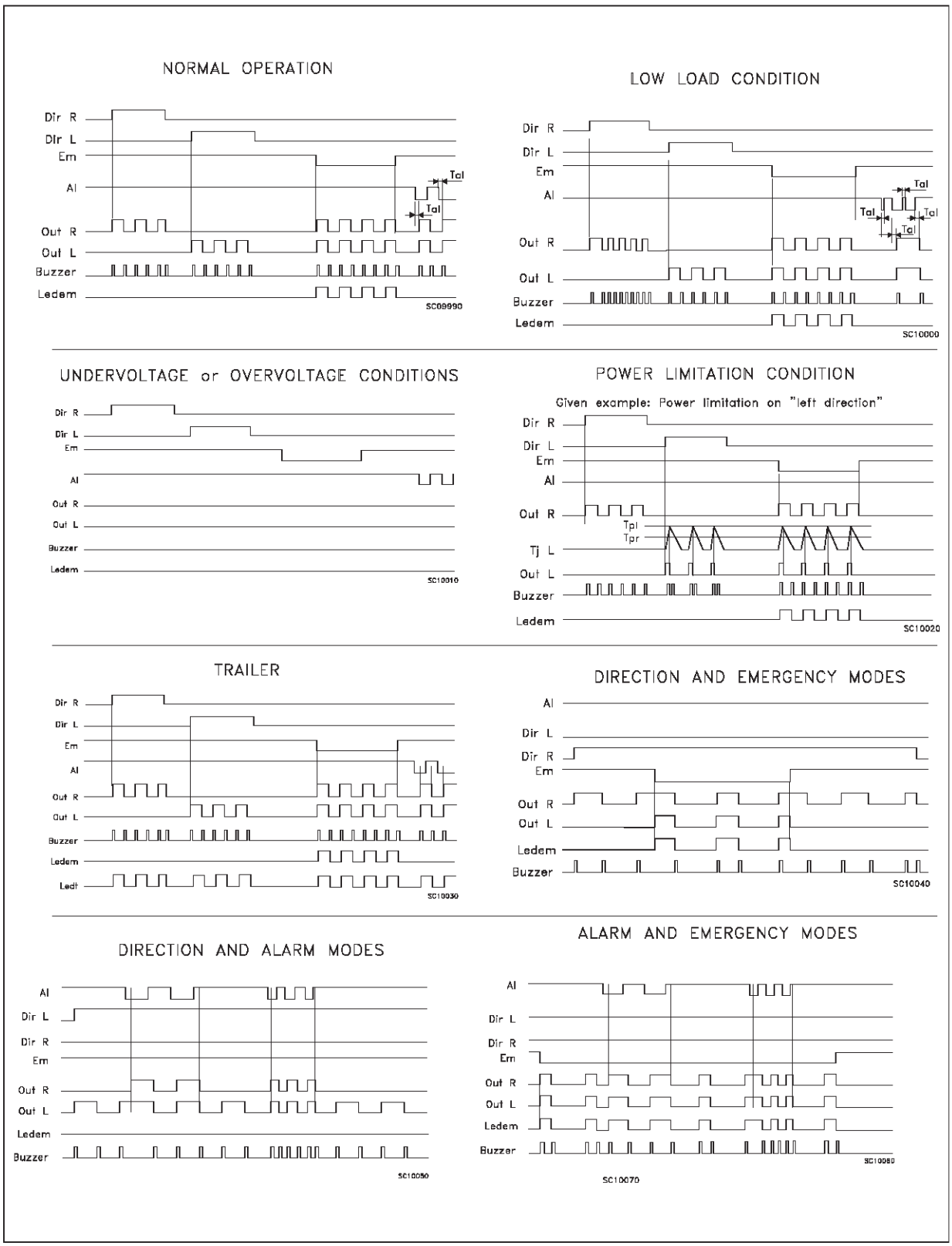
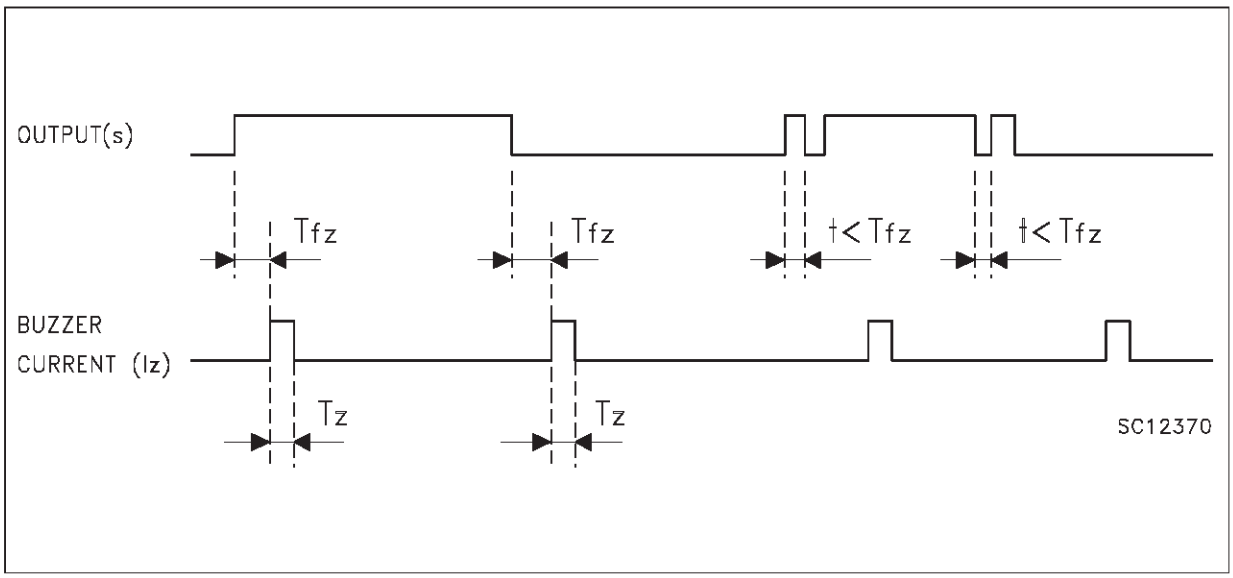
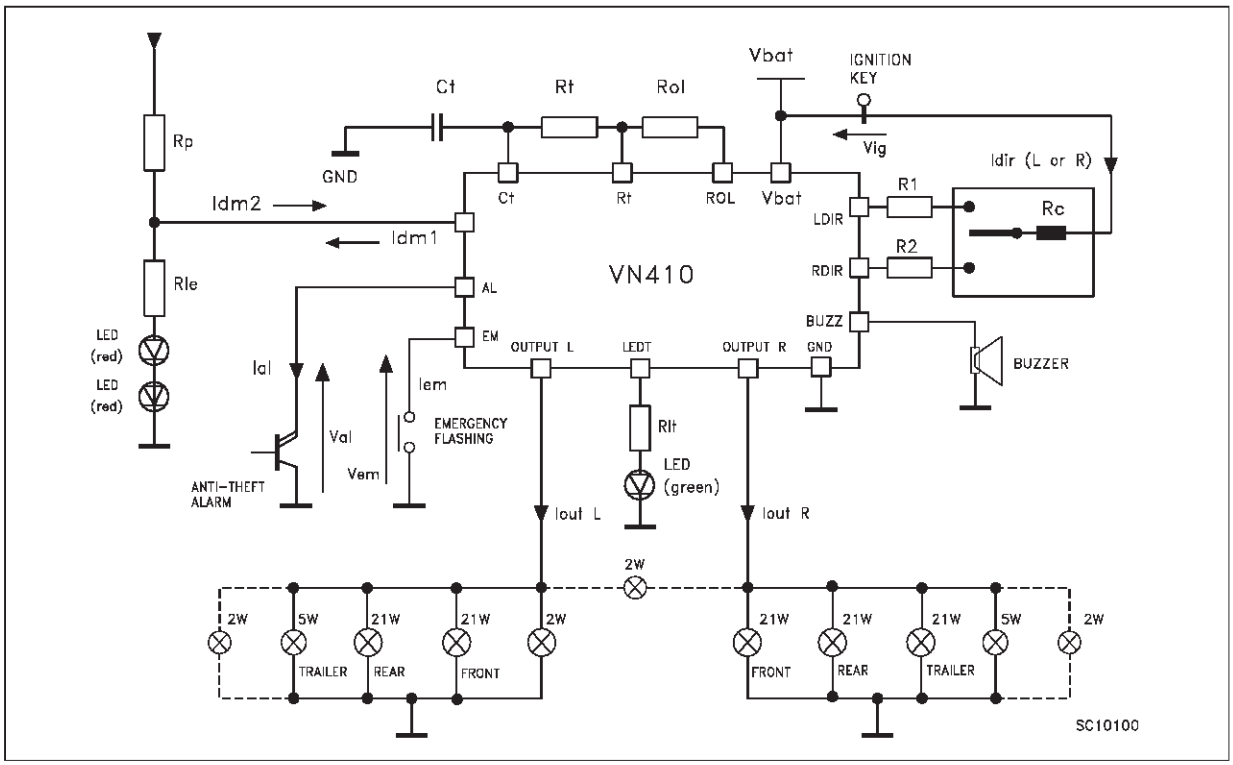


FIGURE 3: Buzzer Functionality

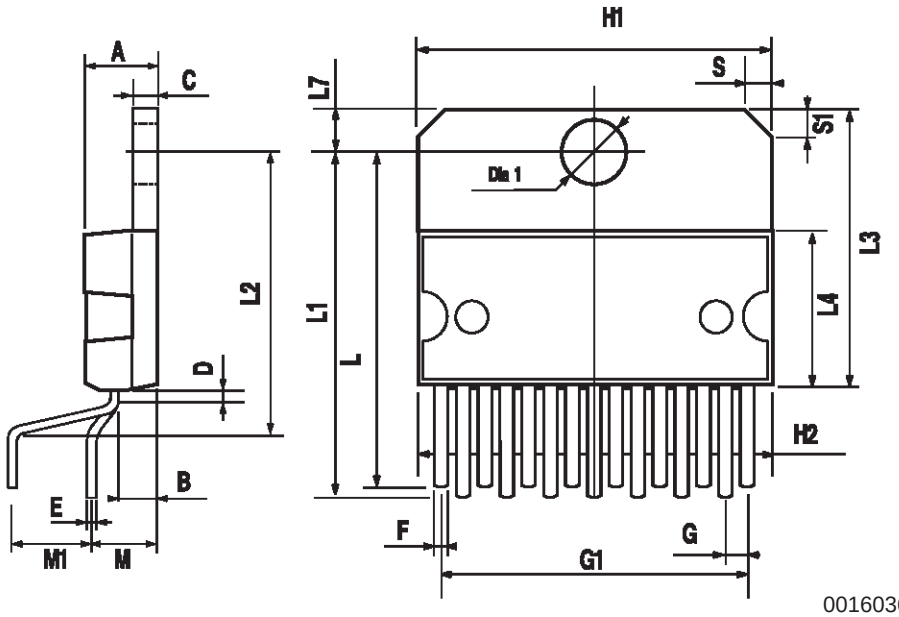


TYPICAL APPLICATION DIAGRAM



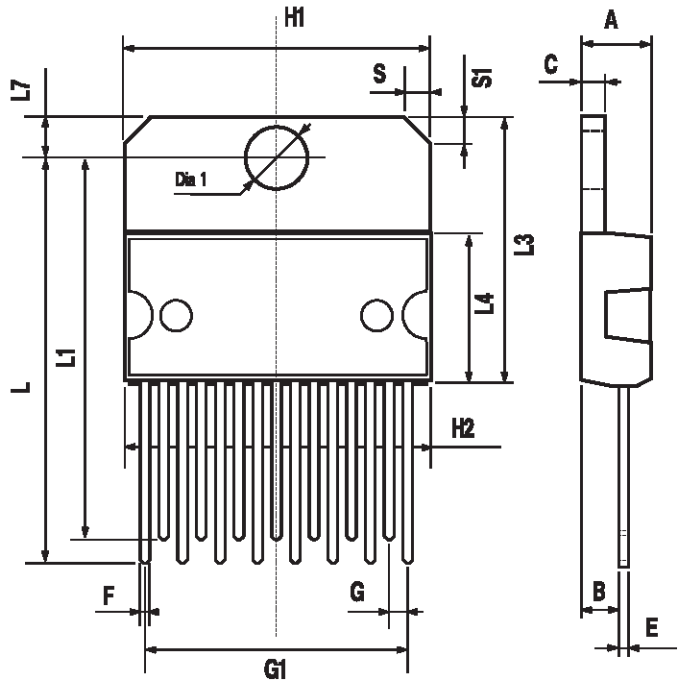
MULTIWATT-15 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
D		1			0.039	
E	0.49		0.55	0.019		0.022
F	0.66		0.75	0.026		0.030
G	1.02	1.27	1.52	0.040	0.050	0.060
G1	17.53	17.78	18.03	0.690	0.700	0.710
H1	19.6			0.772		
H2			20.2			0.795
L	21.9	22.2	22.5	0.862	0.874	0.886
L1	21.7	22.1	22.5	0.854	0.870	0.886
L2	17.65		18.1	0.695		0.713
L3	17.25	17.5	17.75	0.679	0.689	0.699
L4	10.3	10.7	10.9	0.406	0.421	0.429
L7	2.65		2.9	0.104		0.114
M	4.25	4.55	4.85	0.167	0.179	0.191
M1	4.63	5.08	5.53	0.182	0.200	0.218
S	1.9		2.6	0.075		0.102
S1	1.9		2.6	0.075		0.102
Dia1	3.65		3.85	0.144		0.152



MULTIWATT-15 (In-Line) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			5			0.197
B			2.65			0.104
C			1.6			0.063
E	0.49		0.55	0.019		0.022
F	0.66		0.75	0.026		0.030
G	1.14	1.27	1.4	0.045	0.050	0.055
G1	17.57	17.78	17.91	0.692	0.700	0.705
H1	19.6			0.772		
H2			20.2			0.795
L	26.55		27.05	1.045		1.065
L1(*)	25.35		25.8	0.998		1.016
L3	17.25	17.5	17.75	0.679	0.689	0.699
L4	10.3	10.7	10.9	0.406	0.421	0.429
L7	2.65		2.9	0.104		0.114
S	1.9		2.6	0.075		0.102
S1	1.9		2.6	0.075		0.102
Dia1	3.65		3.85	0.144		0.152



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