



VB029SP

HIGH VOLTAGE IGNITION COIL DRIVER POWER IC

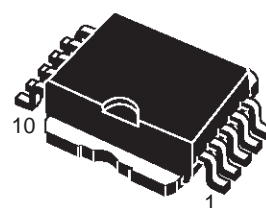
TYPE	V_{clamp}	I_{cl}	I_d
VB029SP	360 V	12 A	80 mA

- PRIMARY COIL VOLTAGE INTERNALLY SET
- COIL CURRENT LIMIT INTERNALLY SET
- LOGIC LEVEL COMPATIBLE INPUT
- DRIVING CURRENT QUASI PROPORTIONAL TO COLLECTOR CURRENT
- DOUBLE FLAG-ON COIL CURRENT
- DARLINGTON BASE ACCESSIBLE

DESCRIPTION

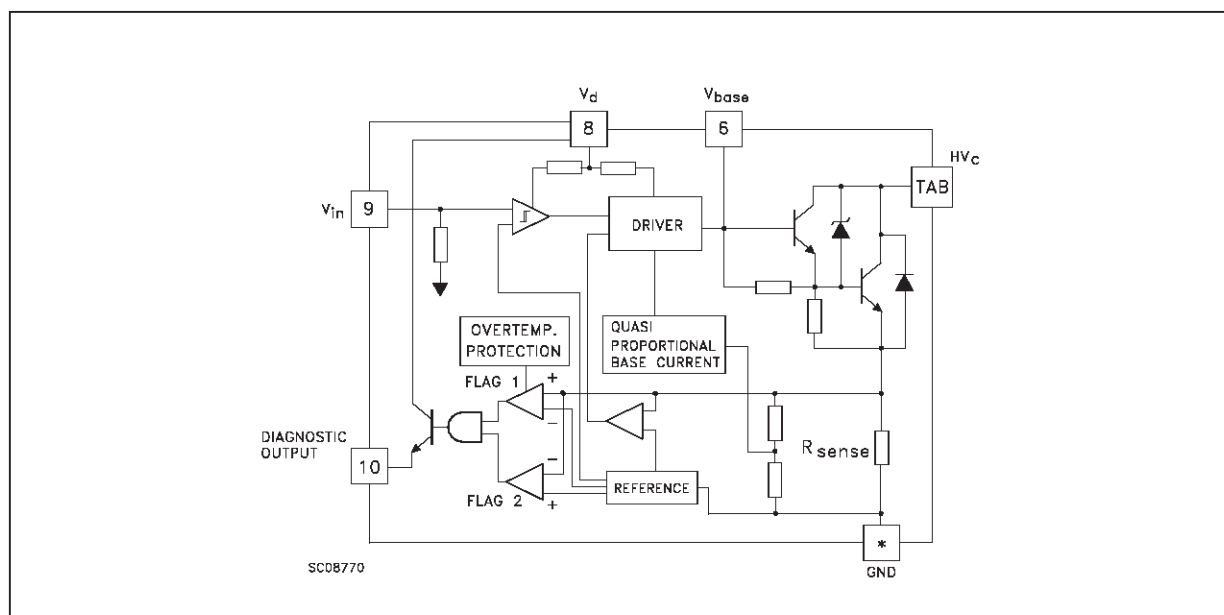
The VB029SP is a high voltage power integrated circuits made using STMicroelectronics VIPower Technology, with vertical current flow power darlington and logic level compatible driving circuits.

Built-in protection circuits for coil current limiting and collector voltage clamping allows the VB029SP to be used as a smart, high voltage, high current interface in advanced electronic ignition systems.



Power SO-10™

BLOCK DIAGRAM



* Pins 1-5 = Power GND, Pin 6 signal GND. Pin 6 must be connected to pins 1-5 externally.

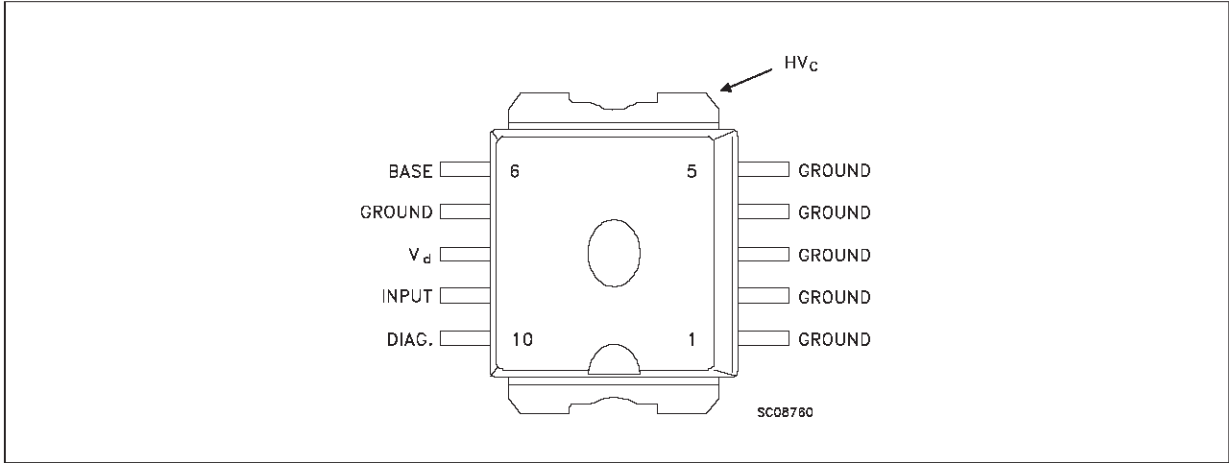
ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
HV _C	Collector Voltage	Internally Limited	V
I _C	Collector Current	Internally Limited	A
V _d	Driving Stage Supply Voltage	7	V
I _d	Driving Circuitry Supply Current	230	mA
V _{in}	Maximum Input Voltage	10	V
T _j	Operating Junction Temperature	-40 to 150	°C
T _{stg}	Storage Temperature Range	-55 to 150	°C

THERMAL DATA

R _{thj-case}	Thermal Resistance Junction Case(MAX)	1.12	°C/W
R _{thj-amb}	Thermal Resistance Junction Ambient(MAX)	62.5	°C/W

CONNECTION DIAGRAM



PIN FUNCTION

No	NAME	FUNCTION
1 - 5	GND	Emitter Power Ground
6	BASE	Darlington Base
7	GND	Control Ground
TAB	HV _C	Output to The Primary Coil
9	INPUT	
10	DIAGNOSTIC	Output of a Logic Signal When I _C Is Greater Than 3 A
8	V _d	Supply Voltage For The Power Stage

(*) PIN 7 must be connected to PINS 1 - 5 externally

ELECTRICAL CHARACTERISTICS ($V_b = 13.5\text{ V}$; $V_d = 5\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$; $R_{\text{coil}} = 510\text{ m}\Omega$;
 $L_{\text{coil}} = 7\text{ mH}$; unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{cl}	High Voltage Clamp	$-40^\circ\text{C} \leq T_j \leq 125\text{ }^\circ\text{C}$ $I_{\text{coil}} = 6\text{ A}$	320	360	420	V
$V_{\text{ce(sat)}}$	Saturation Voltage of The Power Stage Derating in Temperature	$I_c = 7.6\text{ A}$; $V_{\text{in}} = 4\text{ V}$ $-40^\circ\text{C} \leq T_j < 80\text{ }^\circ\text{C}$ $80^\circ\text{C} \leq T_j \leq 125\text{ }^\circ\text{C}$			2.5 2.8	V V
$I_{\text{d(stdby)}}$	Stand-by Supply Current	$V_{\text{in}} = 0.4\text{ V}$			10	mA
$I_{\text{d(on)}}$	Power On Supply Current	$V_{\text{in}} = 4\text{ V}$ $I_c = 7.6\text{ A}$ $-40^\circ\text{C} \leq T_j \leq 125\text{ }^\circ\text{C}$			230	mA
V_d	Driver Stage Supply Voltage		4.5		5.5	V
I_{cl}	Coil Current Limit	$V_{\text{in}} = 4\text{ V}$ $-40^\circ\text{C} \leq T_j \leq 125\text{ }^\circ\text{C}$ (see note 1)			12	A
V_{inH}	High Level Input Voltage		4		5.5	V
V_{inL}	Low Level Input Voltage		0		0.8	V
I_{inH}	High Level Input Current	$V_{\text{in}} = 4\text{ V}$			200	μA
V_{diagH}	High Level Diagnostic Output Voltage	$R_{\text{EXT}} = 22\text{ K}\Omega$ (see fig. 1)	3.5	*	V_d	V
V_{diagL}	Low Level Diagnostic Output Voltage	$R_{\text{EXT}} = 22\text{ K}\Omega$ (see fig. 1)			0.5	V
I_{diagTH1}	Diagnostic Current First Threshold		2.15	2.5	2.85	A
I_{diagTD1}	Diagnostic Current First Threshold Drift With Temperature	See figure 3				
I_{diagTH2}	Diagnostic Current Second Threshold		6.1	6.5	6.9	A
I_{diagTD2}	Diagnostic Current Second Threshold Drift With Temperature	See figure 4				
t_{dlc}	Delay Time Coil Current	$I_c = 6\text{ A}$ (see note2)		25		μs
t_{flc}	Fall Time Coil Current	$I_c = 6\text{ A}$		8		μs
$t_{\text{d(diag)}}$	Delay Time Diagnostic Current	$R_{\text{EXT}} = 22\text{ K}\Omega$ (see fig. 1)		1		μs
$t_{\text{r(diag)}}$	Rise Time Diagnostic Current	$R_{\text{EXT}} = 22\text{ K}\Omega$ (see fig. 1)		1		μs
$t_{\text{f(diag)}}$	Fall Time Diagnostic Current	$R_{\text{EXT}} = 22\text{ K}\Omega$ (see fig. 1)		1		μs
ΔI_{th}	Thermal Flag Shift on 1st Threshold	$T_j > 125\text{ }^\circ\text{C}$ **	1			A
$E_{\text{s/b}}$	Single Pulse Avalanche Energy		300			mJ

Note 1: The primary coil current value I_{cl} must be measured 1 ms after desaturation of the power stage.

Note 2: Time from input switching V_{NEG} until collector voltage equal 200V.

* $V_d - V_{\text{be(on)}}$

** This thermal flag shift cannot be activated for lower than $125\text{ }^\circ\text{C}$.

PRINCIPLE OF OPERATION

The VB029SP is mainly intended as a high voltage power switch device driven by a logic level input and interfaces directly to a high energy electronic ignition coil.

The input V_{in} of the VB029SP is fed from a low power signal generated by an external controller that determines both dwell time and ignition point.

During V_{in} high ($\geq 4V$) the VB029SP increases current in the coil to the desired, internally set current level.

After reaching this level, the coil current remains constant until the ignition point, that corresponds to the transition of V_{in} from high to low (typ. 1.9V threshold).

During the coil current switch-off, the primary voltage HV_c is clamped at an internally set value V_{cl} , typically 360V.

The transition from saturation to desaturation, coil current limiting phase, must have the ability to accommodate an overvoltage. A maximum overshoot of 20V is allowed.

THERMAL BEHAVIOUR

You can see in the block diagram of the VB029SP a box called overtemperature protection. The purpose of this circuit is to shift the current level at which the 1st diagnostic is activated down of about 1A.

This information can be managed by the micro that can take the corrective actions in order to reduce the power dissipation.

This block is not an effective protection but just

an overtemperature detection. The shift down of the 1st flag level cannot be present for temperatures lower than 125 °C.

As an example of its behaviour you can suppose a very simple motor management system in which the micro does just a simple arithmetic calculation to decide when to switch off the device after the 1st flag threshold.

EXAMPLE:

I_{flag} info after X msec. ($I_{flag} = 2.5A$)

Switch off after $K \cdot X$ msec.

As soon as the temperature rises over the overtemp. threshold, the 1st diagnostic is shifted to down to about 1.5A and in this example, the switch off current will be $K \cdot X \cdot 1.5/2.5$ helping the system to reduce the power dissipation.

As you can see this behaviour is not a protection but just a feedback for the micro.

FEEDBACK

When the collector current exceeds 4.5A, the feedback signal is turned high and it remains so, until the load current reaches 5.8A (second threshold), at that value, the feedback signal is turned low.

OVERVOLTAGE

The VB029SP can withstand the following transients of the battery line:

-100V/2msec ($R_i = 10 \Omega$)

+100V/0.2msec ($R_i = 10 \Omega$)

+50V/400msec ($R_i = 4.2 \Omega$, with $V_{IN} = 3 V$)

FIGURE 1: Application Circuit

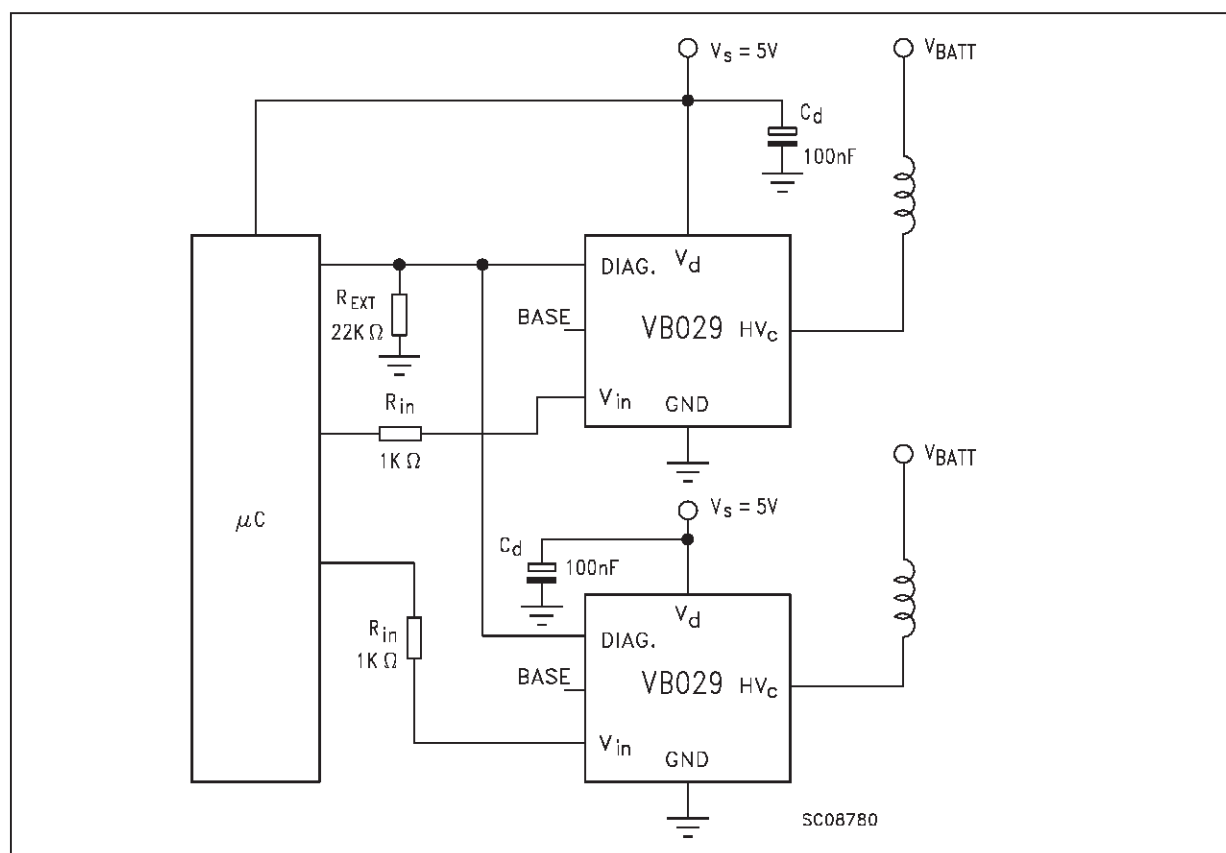


FIGURE 2: Switching Waveforms

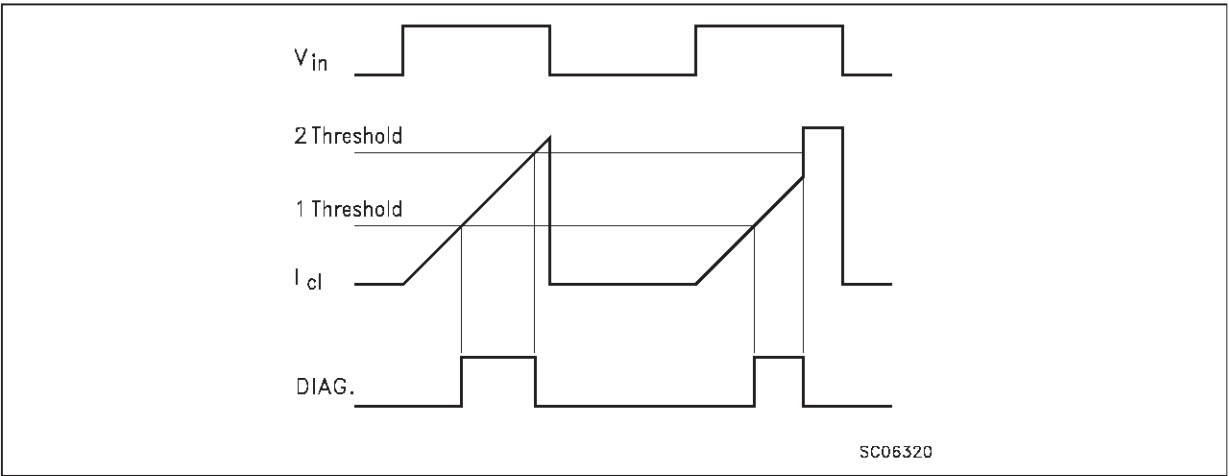


FIGURE 3: Maximum I_{cl} Versus Temperature

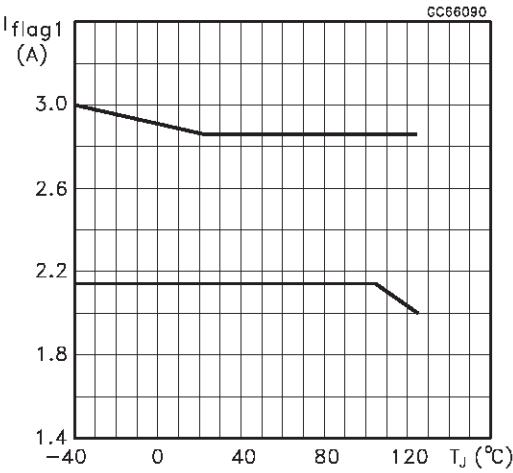
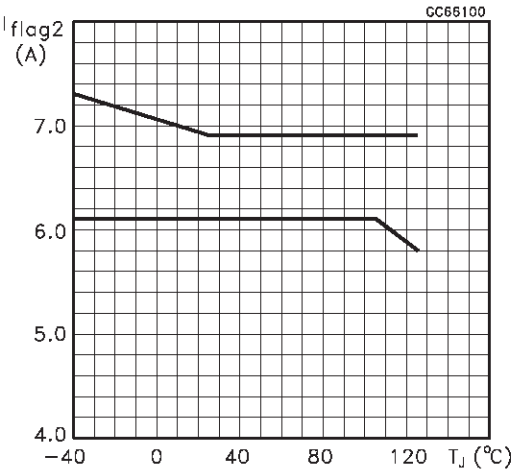
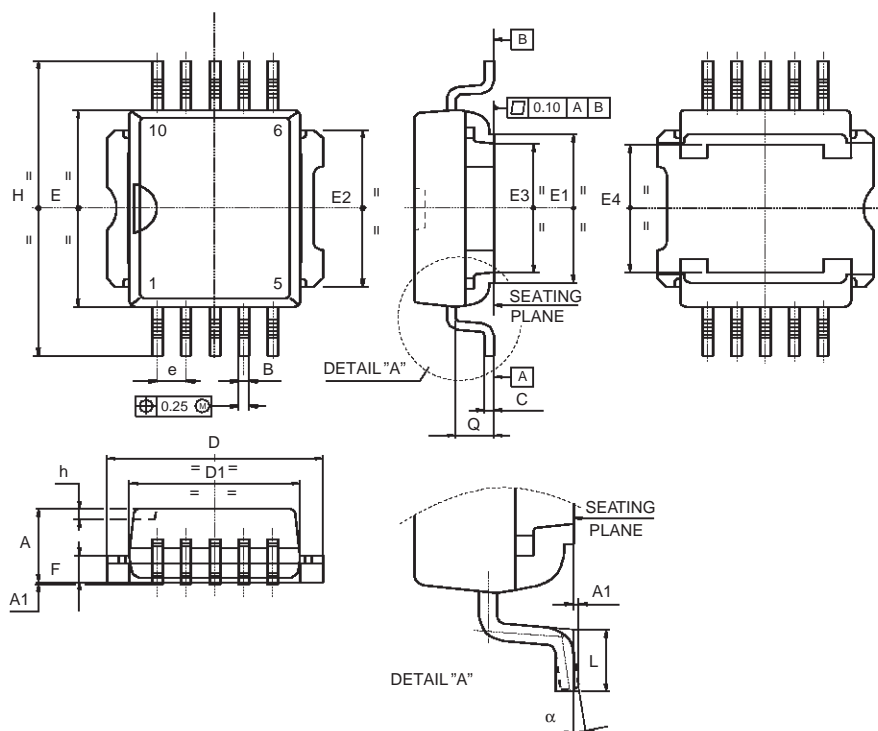


FIGURE 4: I_{flag1} Versus Temperature



PowerSO-10 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	3.35		3.65	0.132		0.144
A1	0.00		0.10	0.000		0.004
B	0.40		0.60	0.016		0.024
c	0.35		0.55	0.013		0.022
D	9.40		9.60	0.370		0.378
D1	7.40		7.60	0.291		0.300
E	9.30		9.50	0.366		0.374
E1	7.20		7.40	0.283		0.291
E2	7.20		7.60	0.283		0.300
E3	6.10		6.35	0.240		0.250
E4	5.90		6.10	0.232		0.240
e		1.27			0.050	
F	1.25		1.35	0.049		0.053
H	13.80		14.40	0.543		0.567
h		0.50			0.002	
L	1.20		1.80	0.047		0.071
q		1.70			0.067	
α	0°		8°			



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