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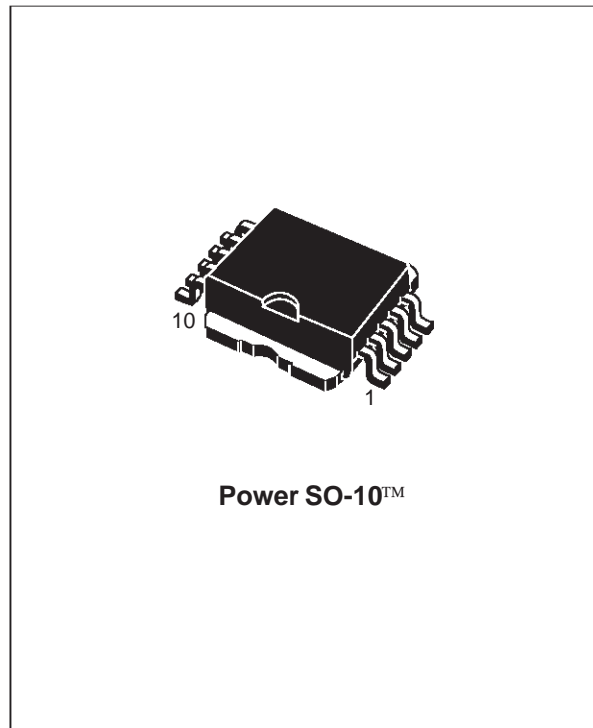
BLOCK DIAGRAM
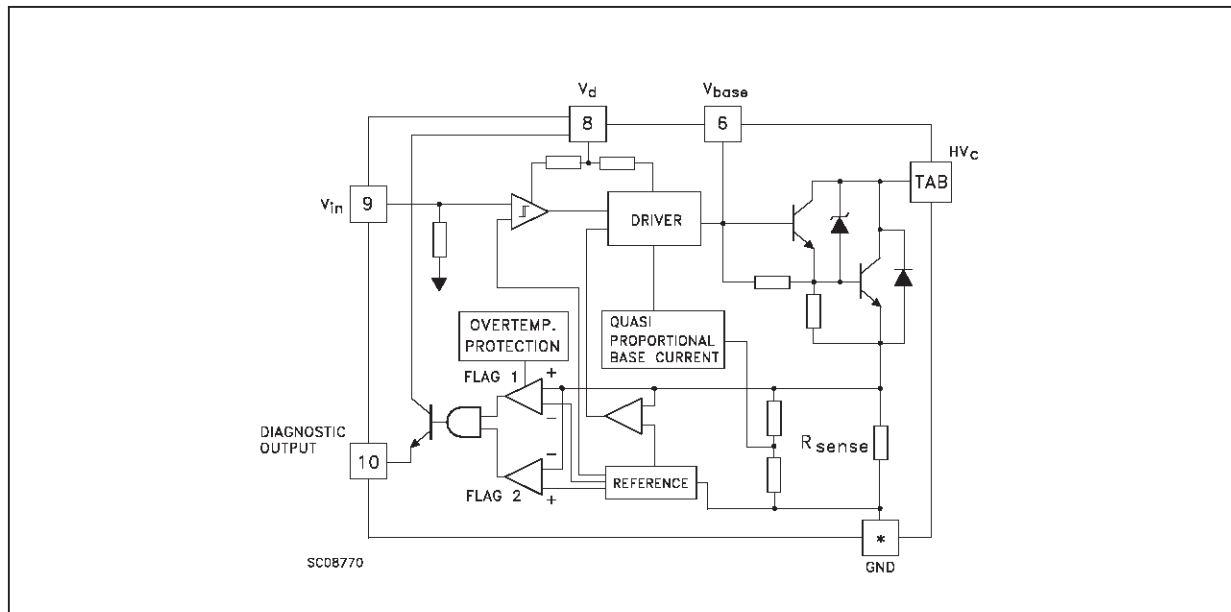
* Pins 1-5 = Power GND, Pin 6 signal GND. Pin 6 must be connected to pins 1-5 externally.

VB029SP

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	^{o}C
T_{stg}	Storage Temperature Range	-55 to 150	^{o}C

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction Case(MAX)	1.12	^{o}C/W
$R_{thj-amb}$	Thermal Resistance Junction Ambient(MAX)	62.5	^{o}C/W

CONNECTION DIAGRAM
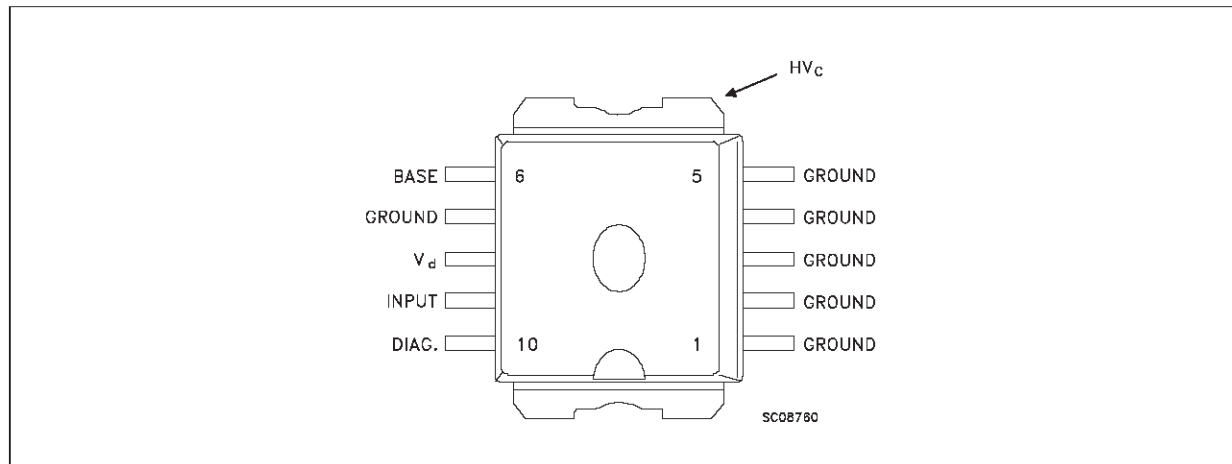
PIN FUNCTION

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 Ic Is Greater Than 3 A
8	Vd	Supply Voltage For The Power Stage

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

ELECTRICAL CHARACTERISTICS (V_b = 13.5 V; V_d = 5 V; T_j = 25 ^{o}C; R_{coil} = 510 mΩ; L_{coil} = 7 mH; unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{cl}	High Voltage Clamp	-40°C $\leq T_j \leq$ 125 ^{o}C $\quad$ I_{coil} = 6 A	320	360	420	V
$V_{ce(sat)}$	Saturation Voltage of The Power Stage Derating in Temperature	I_c = 7.6A; $\quad$ V_{in} = 4V -40°C $\leq T_j <$ 80 ^{o}C 80°C $\leq T_j \leq$ 125 ^{o}C			2.5 2.8	V V
$I_{d(stdby)}$	Stand-by Supply Current	V_{in} = 0.4 V			10	mA
$I_{d(on)}$	Power On Supply Current	V_{in} = 4 V $\quad I_c$ = 7.6 A -40°C $\leq T_j \leq$ 125 ^{o}C			230	mA
V_d	Driver Stage Supply Voltage		4.5		5.5	V
I_{cl}	Coil Current Limit	V_{in} = 4 V $\quad$ -40°C $\leq T_j \leq$ 125 ^{o}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_{in} = 4 V			200	µA
V_{diagH}	High Level Diagnostic Output Voltage	R_{EXT} = 22 KΩ $\quad$ (see fig. 1)	3.5	*	V_d	V
V_{diagL}	Low Level Diagnostic Output Voltage	R_{EXT} = 22 KΩ $\quad$ (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 A $\quad$ (see note2)		25		µs
t_{flc}	Fall Time Coil Current	I_c = 6 A		8		µs
$t_{d(diag)}$	Delay Time Diagnostic Current	R_{EXT} = 22 KΩ $\quad$ (see fig. 1)		1		µs
$t_{r(diag)}$	Rise Time Diagnostic Current	R_{EXT} = 22 KΩ $\quad$ (see fig. 1)		1		µs
$t_{f(diag)}$	Fall Time Diagnostic Current	R_{EXT} = 22 KΩ $\quad$ (see fig. 1)		1		µs
ΔI_{th}	Thermal Flag Shift on 1st Threshold	$T_J >$ 125 ^{o}C **	1			A
$E_{s/b}$	Single Pulse Avalanche Energy		300			mJ

Note 1: The primary coil current value Icl 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 - $V_{be(on)}$
** This thermal flag shift cannot be activated for lower then 125 ^{o}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 Vin of the VB029SP is fed from a low power signal generated by an external controller that determines both dwell time and ignition point.

During Vin high (≥ 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 Vin from high to low (typ. 1.9V threshold).

During the coil current switch-off, the primary voltage HVc is clamped at an internally set value Vcl, typically 360V.

The transition from saturation to desaturation, coil current limiting phase, must have the ability to accomodate 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 witch the 1st diagnostic is actived 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 lover than 125 ^{o}C.

As an example of its behaviour you can suppose a very simple motor managment 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:

Iflag info after X msec. (Iflag = 2.5A)

Iswitch off after K*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*X*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 Ω)

+100V/0.2msec (R_i = 10 Ω)

+50V/400msec (R_i = 4.2 Ω, with V_{IN} = 3 V)
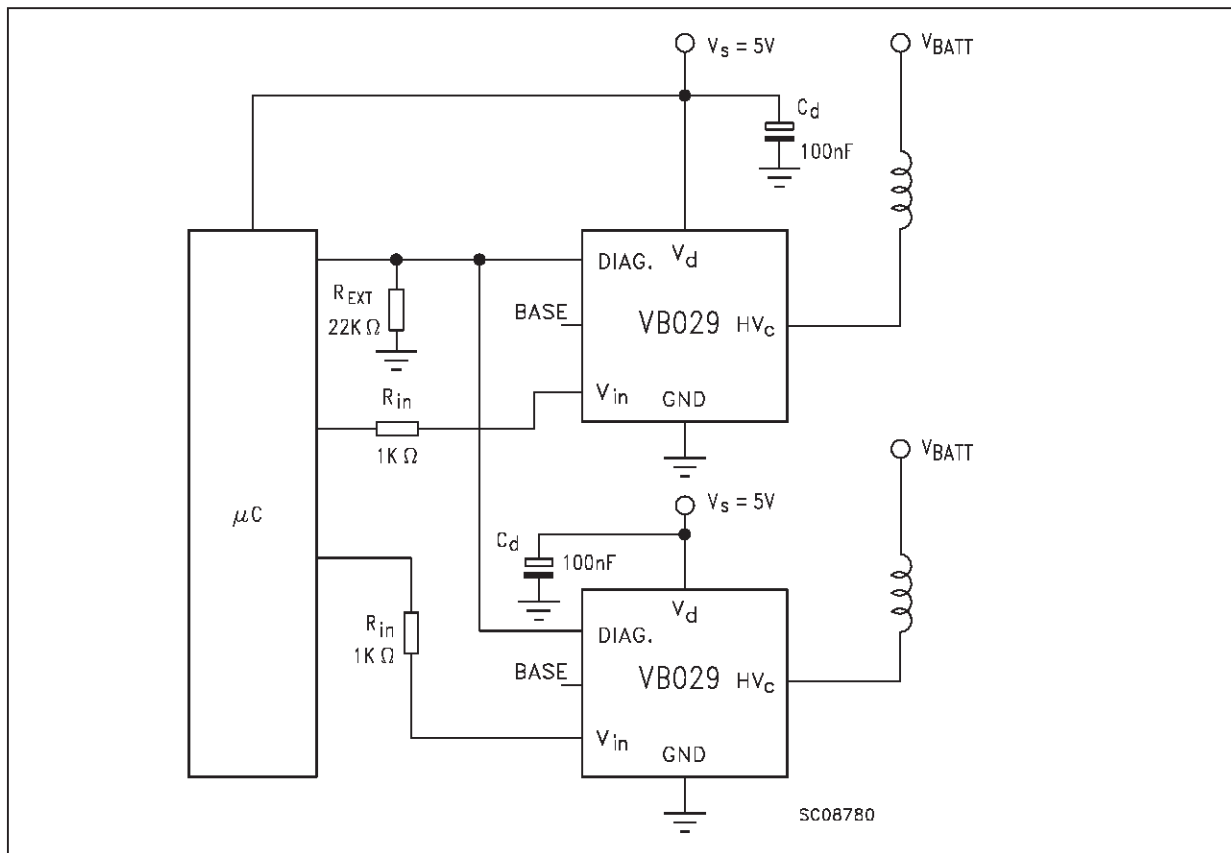
FIGURE 1: Application Circuit
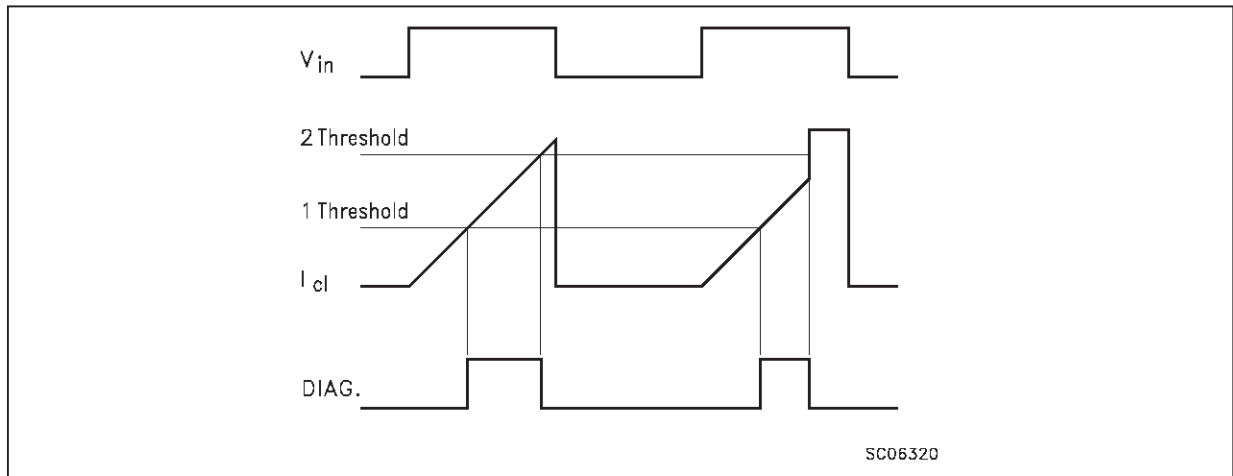
FIGURE 2: Switching Waveforms

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FIGURE 3: Maximum I_{cl} Versus Temperature
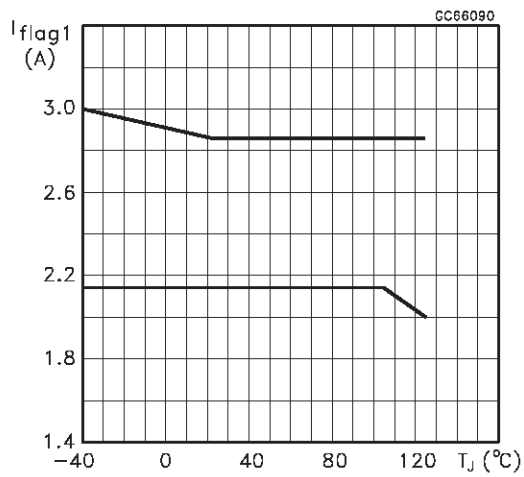
FIGURE 4: I_{flag1} Versus Temperature
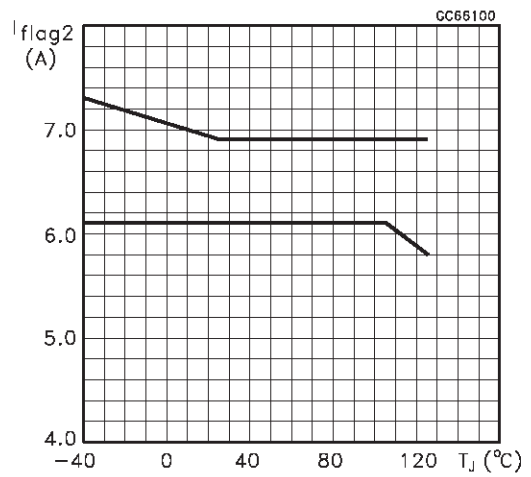
PowerSO-10 MECHANICAL DATA

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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