


**VB026BSP**

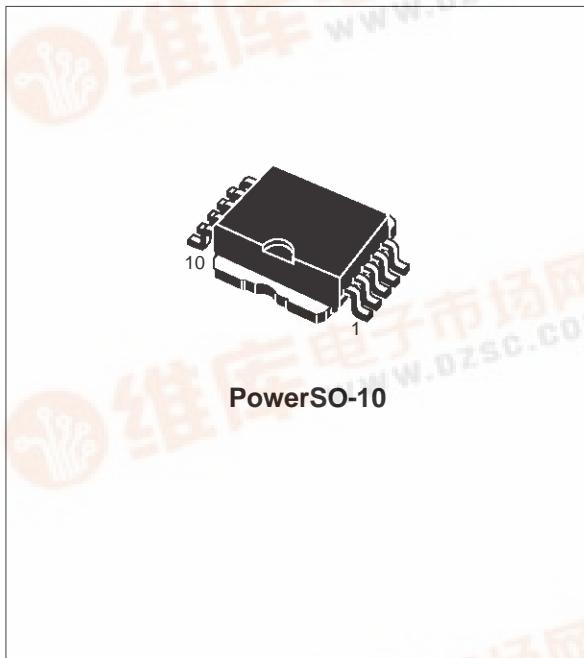
## HIGH VOLTAGE IGNITION COIL DRIVER POWER IC

TYPE	$V_{cl}$	$I_{cl}$	$I_d$
VB026BSP	360 V	9 A	100 mA

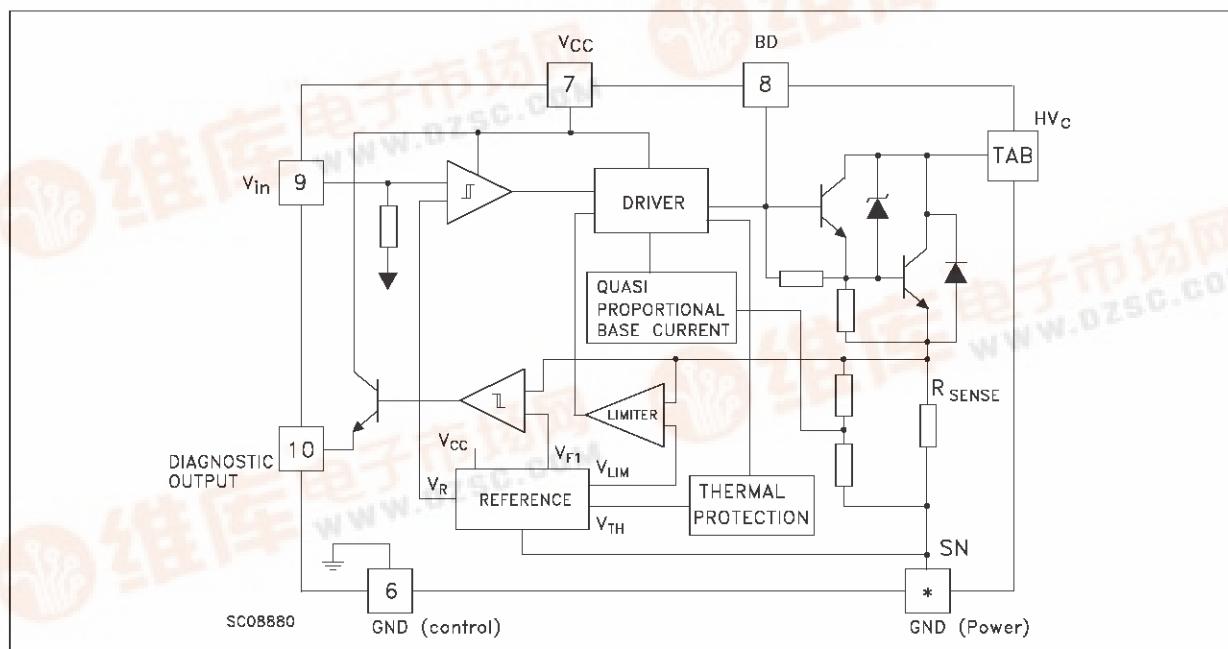
- PRIMARY COIL VOLTAGE INTERNALLY SET
- COIL CURRENT LIMIT INTERNALLY SET
- LOGIC LEVEL COMPATIBLE INPUT
- DRIVING CURRENT QUASI PROPORTIONAL TO COLLECTOR CURRENT
- SINGLE FLAG-ON COIL CURRENT

### DESCRIPTION

The VB026BSP is a high voltage power integrated circuit made using STMicroelectronics VIPower Technology, with vertical current flow power darlington and logic level compatible driving circuit. Built-in protection circuits for coil current limiting and collector voltage clamping allows the VB026BSP to be used as a smart, high voltage, high current interface in advanced electronic ignition systems.



### BLOCK DIAGRAM



## VB026BSP

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### ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
HVC	Collector Voltage (Internally Limited)	-0.3 to V <sub>clamp</sub>	V
I <sub>c</sub>	Collector Current (Internally Limited)	10	A
I <sub>c(gnd)</sub>	DC Current on Emitter Power	± 10.5 (*)	A
V <sub>CC</sub>	Driving Stage Supply Voltage	-0.3 to 7	V
I <sub>s</sub>	Driving Circuitry Supply Current	± 200	mA
I <sub>s(gnd)</sub>	DC Current on Ground Pin	± 1	A
V <sub>in</sub>	Input Voltage	-0.3 to V <sub>CC</sub> + 0.3	V
I <sub>in</sub>	Maximum Input Current	100	mA
f <sub>in</sub>	Logic Input Frequency in Operative Mode	DC to 150	Hz
V <sub>out(flag)</sub>	Output Voltage Primary Threshold Current Level	-0.3 to V <sub>CC</sub> + 0.3	V
I <sub>out(flag)</sub>	Flag Output Current	100	mA
I <sub>BD</sub>	Input Darlington Base Current	150	mA
V <sub>BD</sub>	Input Darlington Base Voltage	Internally Limited	V
P <sub>max</sub>	Power Dissipation (TC = 105 °C)	TBD	W
E <sub>s/b</sub>	Clamped Energy During Output Power Clamping	300	mJ
V <sub>ESD</sub>	ESD Voltage (HVC Pin)	± 4	KV
V <sub>ESD</sub>	ESD Voltage (Other Pins)	± 2	KV
T <sub>j</sub>	Operating Junction Temperature	-40 to 150	°C
T <sub>stg</sub>	Storage Temperature Range	-55 to 150	°C

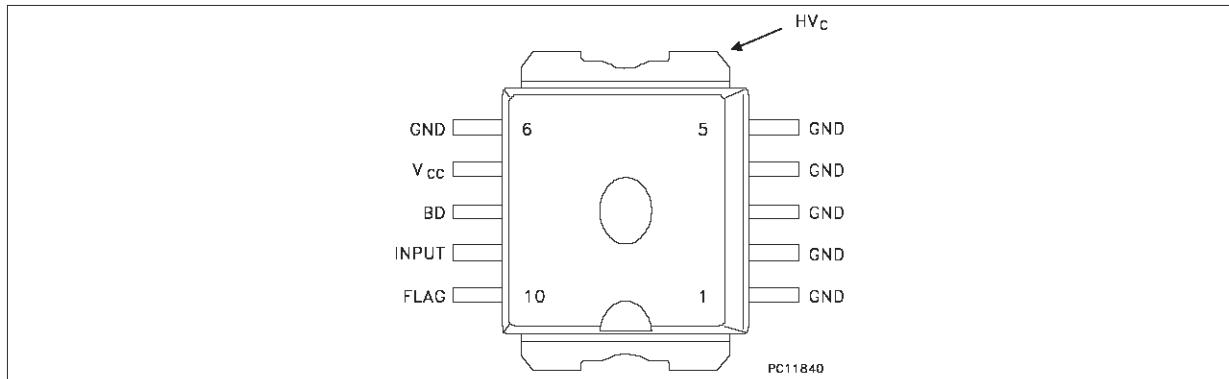
(\*) With 10 mils Al wire

### THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction Case (MAX)	1.2	°C/W
R <sub>thj-h</sub>	Thermal Resistance Junction Heatsink with FR4 (MAX)	TBD (*)	°C/W
T <sub>sold</sub>	Lead Temperature During Soldering (MAX)	TBD (*)	°C

(\*) see application note AN515 on VIPower databook 1<sup>st</sup> edition

## CONNECTION DIAGRAM



## PIN FUNCTION

No	NAME	FUNCTION
1-5	GND	Emitter Power Ground
6	GND	Control Ground (*)
7	Vcc	Logic Supply Voltage
8	BD	Base Darlington
9	INPUT	Logic Input Channel (Internal Pull-down)
10	FLAG	Diagnostic Output Signal (Open Emitter)
TAB	HVC	Primary Coil Output Driver (Open Collector)

(\*) Pin 6 must be connected to pins 1-5 externally

**ELECTRICAL CHARACTERISTICS** ( $5.3V < V_b < 24V$ ;  $V_{CC} = 5V \pm 10\%$ ;  $-40^\circ C < T_j < 125^\circ C$ ;  $R_{coil} = 580 \text{ m}\Omega$ ;  $L_{coil} = 3.75 \text{ mH}$ ; unless otherwise specified; see note 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CL}$	High Voltage Clamp	$I_{coil} = 6.5 \text{ A}$	320	360	420	V
$V_{CE(sat)}$	Saturation Voltage of The Power Stage	$I_c = 7.5 \text{ A}; V_{in} = 4V$			TBD	V
$I_{d(standby)}$	Stand-by Supply Current	IN = OFF			10	mA
$I_{CC}$	DC Logic Current	$V_b = 16 \text{ V} \quad I_c = 6.5 \text{ A} \quad f = 100 \text{ Hz}$ Load = Coil $V_{CC} = 5.5V$			40	mA
$I_{CC(peak)}$	Peak DC Logic Current During On Phase	$I_c = 7.5 \text{ A}$ (see figure 1)			TBD	mA
$V_{CC}$	DC Logic Voltage		4.5		5.5	V
$I_{CL}$	Coil Current Limit	$-40^\circ C < T_j < 125^\circ C$ (see note 2 and figure 1)	9		11	A
$I_{c(leak)}$	Output leakage Current	IN = OFF $V_{HVC} = 24V$			0.8	mA
$I_{C(infl)}$	Collector Current with Floating Input	$V_{CC} = 5 \text{ V} \quad V_{BAT} = 13.5 \text{ V}$ $R_{LOAD} = 1K\Omega$ ; Input Floating			0.8	mA
$T_{shdw}$	Thermal Temperature Output Current Control	OUT = ON (see figure 2)	150		(*)	$^\circ C$
$V_{inH}$	High Level Input Voltage	$V_{CC} = 4.5V$	4		$V_{CC}$	V
$V_{inL}$	Low Level Input Voltage	$V_{CC} = 5.5V$	-0.3		0.8	V

## VB026BSP

### ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{in(hys)}$	Input Threshold Hysteresis		0.4			V
$I_{inH}$	High Level Input Current	$V_{in} = 4 \text{ V}$			100	$\mu\text{A}$
$I_{inL}$	Low Level Input Current	$V_{in} = 0.8 \text{ V}$			-100	$\mu\text{A}$
$I_{inpD}$	Input Active Pull-Down	$V_{in} = 4 \text{ V}$	10		100	$\mu\text{A}$
$V_{diagH}$	High Level Flag Output Voltage	$R_{EXT} = 22 \text{ k}\Omega \quad C_{EXT} = 1 \text{ nF}$ (see note 3)	$V_{cc-1}$		$V_{cc}$	V
$V_{diagL}$	Low Level Flag Output Voltage	$R_{EXT} = 22 \text{ k}\Omega \quad C_{EXT} = 1 \text{ nF}$ (see note 3)			0.5	V
$I_{diagTH}$	Coil Current Level Threshold	$T_j = 25^\circ\text{C}$ (see figure 1)	6.15	6.5	6.85	A
$I_{diagTD}$	Coil Current Level Threshold Drift	(see figure 3)				
$I_{diag}$	High Level Flag Output Current	$I_c > I_{diagTH} \quad V_{diag} = 3\text{V}$	0.5	TBD		$\text{mA}$
$I_{diag(leak)}$	Leakage Current On Flag Output	$V_{in} = \text{LOW} \quad V_{cc} = 5.5\text{V}$			10	$\mu\text{A}$
$V_F$	Antiparallel Diode Forward Voltage	$I_c = -1 \text{ A}$			2	V
$E_{s/b}$	Single Pulse Avalanche Energy	$I_c = 8\text{A} \quad L_c = 6 \text{ mH}$ (see figure 4)	180			$\text{mJ}$
$t_{pHL}$	Turn-on Delay Time of Coil Current	$R_c = 0.5 \Omega \quad L_c = 3.75 \text{ mH}$ (see figure 5)		TBD		$\mu\text{s}$
$t_{pLH}$	Turn-off Delay Time of Coil Current	$R_c = 0.5 \Omega \quad L_c = 3.75 \text{ mH} \quad I_c = 6.5\text{A}$ (see figure 5)		TBD		$\mu\text{s}$

Note 1: Parametric degradation are allowed with  $5.3 < V_b < 10\text{V}$  and  $V_b > 24\text{V}$ .

Note 2: The primary coil current value  $I_{cl}$  must be measured 1ms after desaturation of the power stage.

Note 3: No Internal Pull-Down

(\*) Internally limited

### PRINCIPLE OF OPERATION

The VB026BSP 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 VB026BSP is fed from a low power signal generated by an external controller that determines both dwell time and ignition point. During  $V_{in}$  high ( $\geq 4\text{V}$ ) the VB026BSP 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 accomodate an overvoltage. A maximum overshoot of 20V is allowed.

### FEEDBACK

When the collector current exceeds 6.5A, the feedback signal is turned high and it remains so, until the input voltage is turned-off.

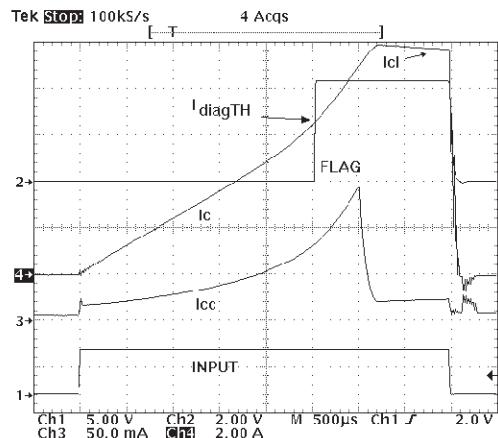
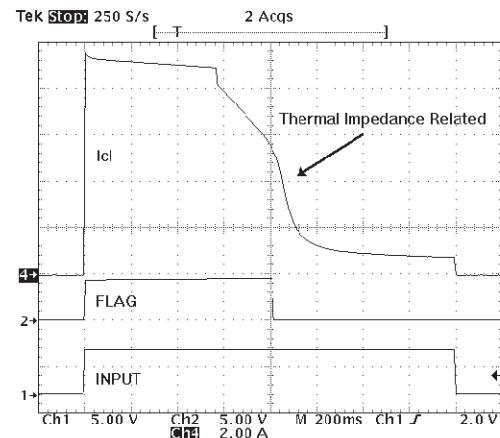
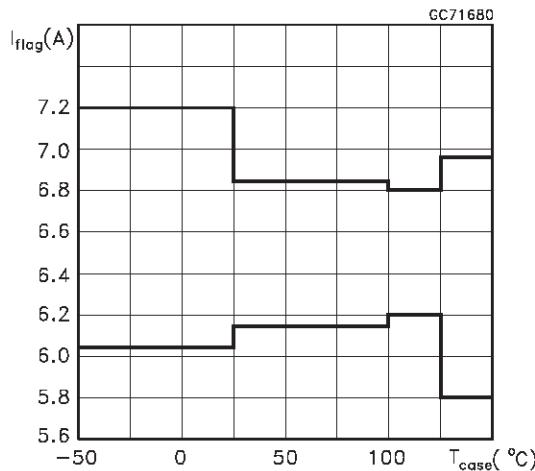
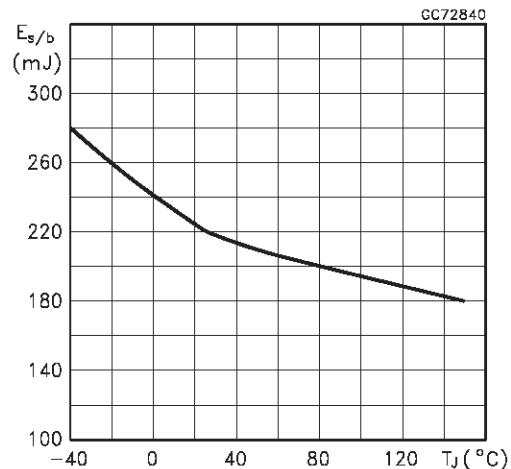
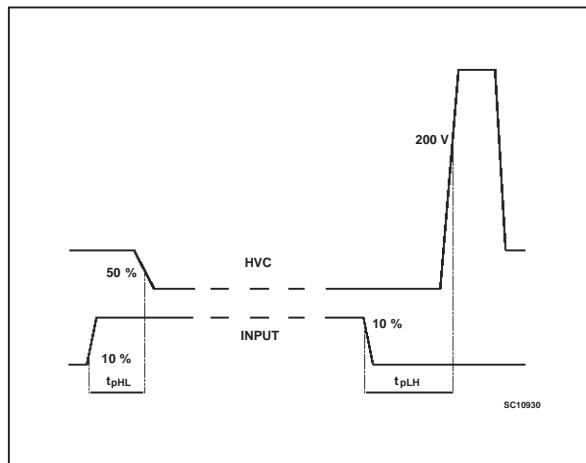
### OVERVOLTAGE

The VB026BSP can withstand the following transients of the battery line:

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

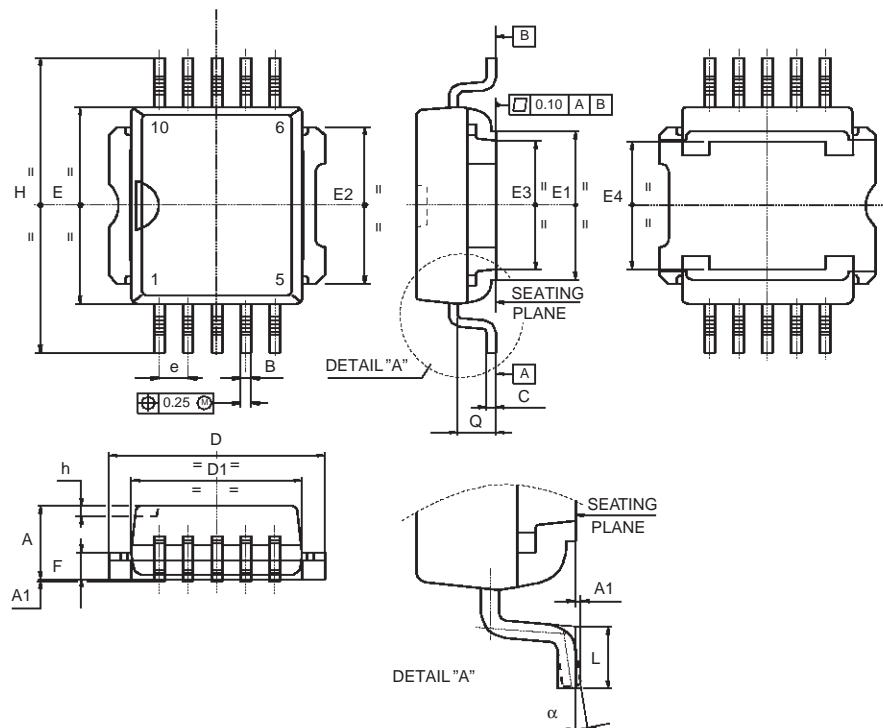
+100V/0.2msec ( $R_i = 10 \Omega$ )

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

**Fig. 1** Main Waveforms During On Phase**Fig. 2** Output Current Waveform After Thermal Protection Activation**Fig. 3** Flag Current Versus Temperature**FIG. 4** Single Pulse Typical Es/b Curve**FIG. 5** Propagation Times Definitions.

## 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	
$\alpha$	0°		8°			



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