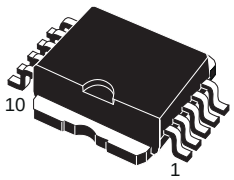
VB025BSP

HIGH VOLTAGE IGNITION COIL DRIVER POWER IC

TYPE	V_{cl}	I_{cl}	I_d
VB025BSP	380 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



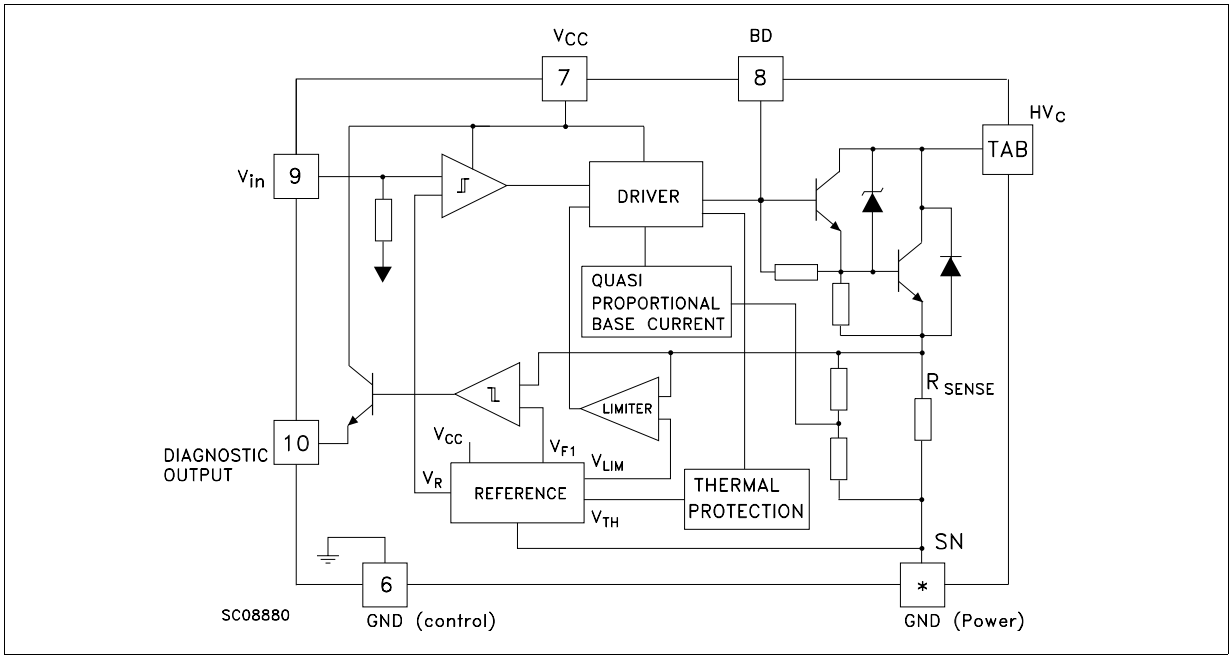
PowerSO-10

DESCRIPTION

The VB025BSP 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 VB025BSP to be used as a smart, high voltage, high current interface in advanced electronic ignition systems.

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
HV_C	Collector Voltage (Internally Limited)	-0.3 to V_{clamp}	V
I_C	Collector Current (Internally Limited)	10	A
$I_{C(gnd)}$	DC Current on Emitter Power	± 10.5 (∗)	A
V_{CC}	Driving Stage Supply Voltage	-0.3 to 7	V
I_s	Driving Circuitry Supply Current	± 200	mA
$I_{s(gnd)}$	DC Current on Ground Pin	± 1	A
V_{in}	Input Voltage	-0.3 to V_{CC} + 0.3	V
I_{in}	Maximum Input Current	100	mA
f_{in}	Logic Input Frequency in Operative Mode	DC to 150	Hz
$V_{out(flag)}$	Output Voltage Primary Threshold Current Level	-0.3 to V_{CC} + 0.3	V
$I_{out(flag)}$	Flag Output Current	100	mA
P_{max}	Power Dissipation (T_C = 105 ^oC)	TBD	W
$E_{s/b}$	Clamped Energy During Output Power Clamping	300	mJ
V_{ESD}	ESD Voltage (HVC Pin)	± 4	KV
V_{ESD}	ESD Voltage (Other Pins)	± 2	KV
I_{BD}	Input Darlington Base Current	150	mA
V_{BD}	Input Darlington Base Voltage	Internally Limited	V
T_j	Operating Junction Temperature	-40 to 150	^oC
T_{stg}	Storage Temperature Range	-55 to 150	^oC

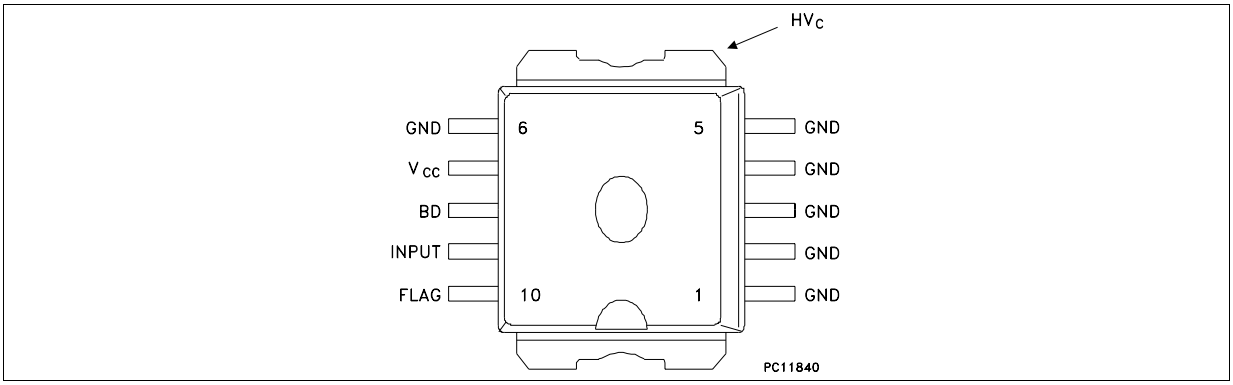
(∗) With 10 mils Al wire

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction Case	(MAX)	1.2	$^oC/W$
R_{thj-h}	Thermal Resistance Junction Heatsink with FR4	(MAX)	TBD (✯)	$^oC/W$
T_{sold}	Lead Temperature During Soldering	(MAX)	TBD (✯)	^oC

(✯) see application note AN515/1094 on VIPower data-book 1st edition.

CONNECTION DIAGRAM



PIN FUNCTION

No	NAME	FUNCTION
1-5	GND	Emitter Power Ground
6	GND	Control Ground (*)
7	V_{CC}	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 ($5.3V < V_b < 24V$; $V_{CC} = 5\ V \pm 10\%$; $-40^oC < T_j < 125^oC$; $R_{coil} = 580\ m\Omega$; $L_{coil} = 3.75\ mH$; unless otherwise specified; see note 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{cl}	High Voltage Clamp	$I_{coil} = 6.5\ A$	320	380	420	V
$V_{ce(sat)}$	Saturation Voltage of The Power Stage	$I_c = 7.5A$; $V_{in} = 4V$			TBD	V
$I_{CC(stdby)}$	Stand-by Supply Current	IN = OFF			10	mA
I_{CC}	DC Logic Current	$V_b = 16\ V$ $I_c = 6.5\ A$ $f = 100\ Hz$ Load = Coil $V_{CC} = 5.5V$			40	mA
$I_{CC(peak)}$	Peak DC Logic Current During On Phase	$I_c = 7.5\ A$ (see figure 1)			TBD	mA
V_{CC}	DC Logic Voltage		4.5		5.5	V
I_{cl}	Coil Current Limit	$-40^oC < T_j < 125^oC$ (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	$V_{CC} = 5\ V$ VBat = 13.5 V $R_{LOAD} = 1K\Omega$; Input Floating			0.8	mA
T_{Ic_ctr}	Thermal Temperature Output Current Control	OUT = ON (see figure 2)	150		(*)	^oC
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

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 V			100	µA
I_{inL}	Low Level Input Current	V_{in} = 0.8 V			-100	µA
I_{inpd}	Input Active Pull-Down	V_{in} = 4 V	10		100	µA
V_{diagH}	High Level Flag Output Voltage	R_{EXT} = 22 KΩ C_{EXT} = 1 nF (see note 3)	V_{CC}-1		V_{CC}	V
V_{diagL}	Low Level Flag Output Voltage	R_{EXT} = 22 KΩ C_{EXT} = 1 nF (see note 3)			0.5	V
I_{diagTH}	Coil Current Level Threshold	T_j = 25°C (see figure 1)	4.25	4.5	4.75	A
I_{diagTD}	Coil Current Level Threshold Drift	(see figure 3)				
I_{diag}	High Level Flag Output Current	$I_C > I_{diagTH}$ V_{diag} = 3 V	0.5	TBD		mA
$I_{diag(leak)}$	Leakage Current On Flag Output	V_{in} = LOW V_{CC} = 5.5V			10	µA
V_F	Antiparallel Diode Forward Voltage	I_c = -1 A			2	V
$E_{s/b}$	Single Pulse Avalanche Energy	L = 6 mH I_C = 8 A (see figure 4)	180			mJ
t_{pHL}	Turn-on Delay Time of Coil Current	R_c = 0.5 Ω L_c = 3.75 mH (see figure 5)		TBD		µs
t_{pLH}	Turn-off Delay Time of Coil Current	R_c = 0.5 Ω L_c = 3.75 mH I_c =6.5A (see figure 5)		TBD		µs

Note 1: Parametric degradation are allowed with 5.3 < V_b < 10V and V_b > 24V.
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 VB025BSP 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 VB025BSP 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 VB025BSP 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 380V.

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 4.5A, the feedback signal is turned high and it remains so, until the input voltage is turned-off.

OVERVOLTAGE

The VB025BSP 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)

Fig. 1 Main Waveforms During On Phase

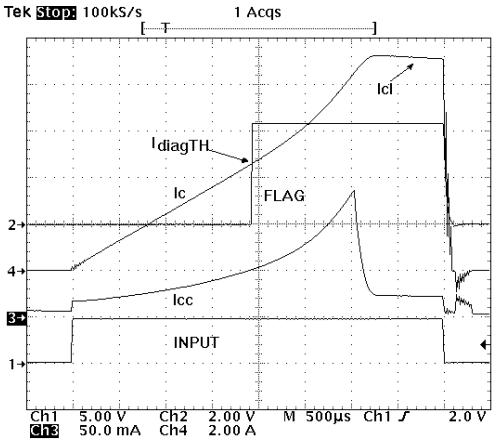


Fig. 2 Output Current Waveform After Thermal Protection Activation

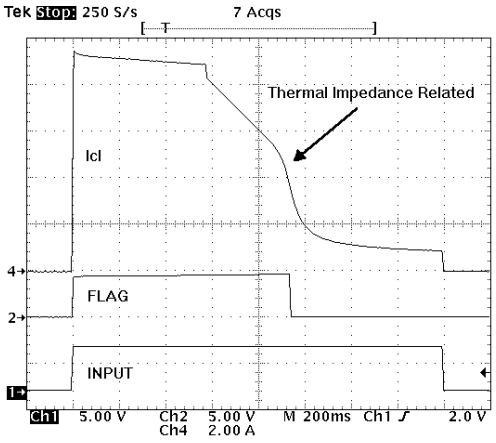


Fig. 3 Flag Current Versus Temperature

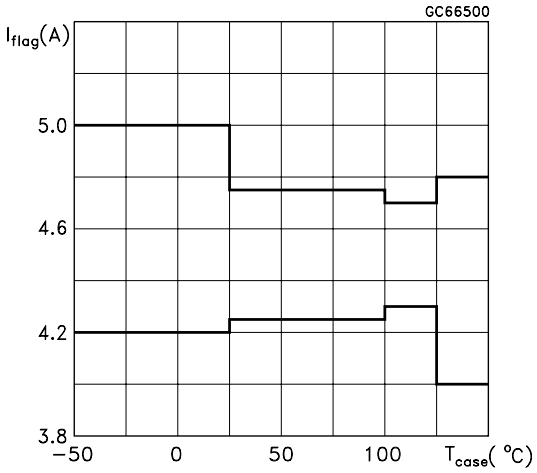


FIG. 4 Single Pulse Typical Es/b Curve

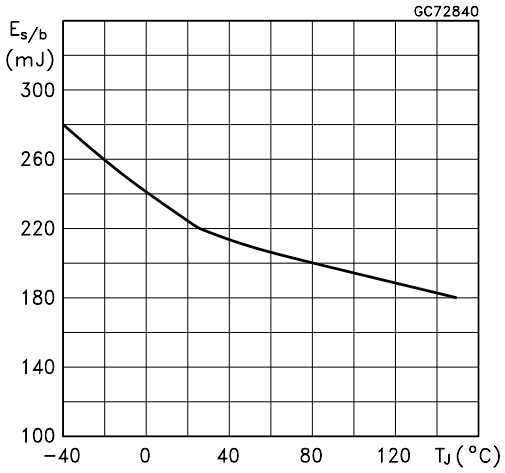
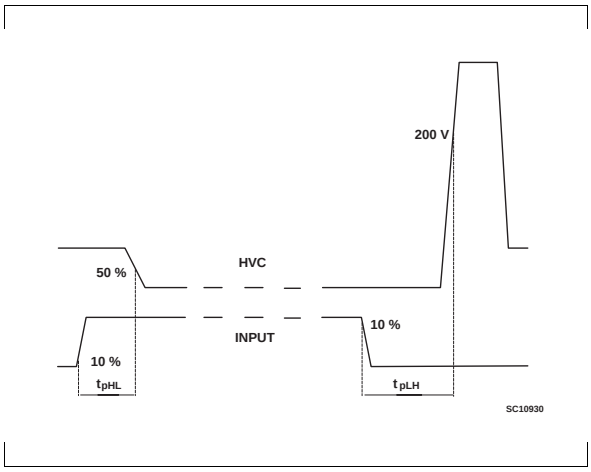
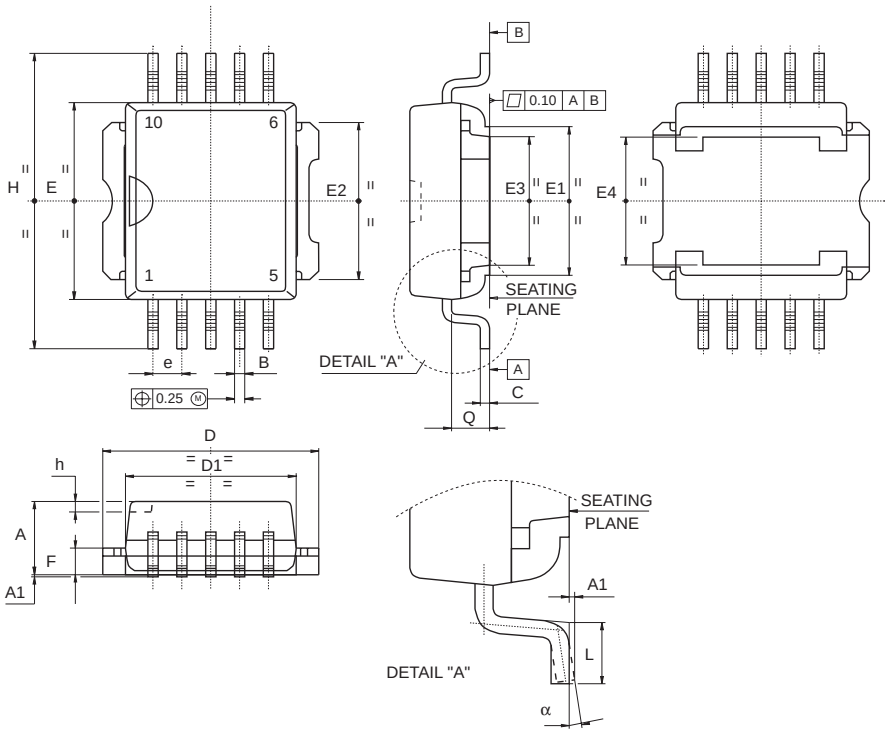


FIG. 5 Propagation Times Definitions.



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	
α	0°		8°			



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