VB027

# HIGH VOLTAGE IGNITION COIL DRIVER POWER IC

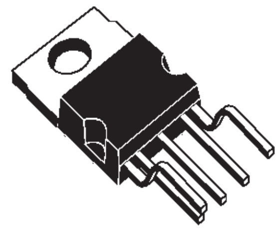
| TYPE | $V_{clamp}$ | $I_{cl}$ | $I_d$ |
|---|---|---|---|
| VB027 | 360 V | 8.5 A | 80 mA |

- 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

## DESCRIPTION

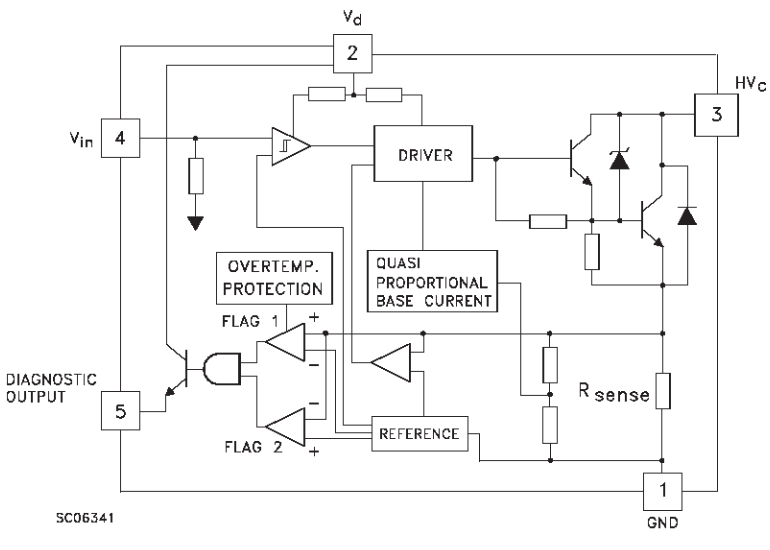
The VB027 is a high voltage power integrated circuits made using STMicroelectronics VIPower Technology, with vertical current flow power darlington and logic level compatible driving circuits.

Built-in protection circuits for coil current limiting and collector voltage clamping allows the VB027 to be used as a smart, high voltage, high current interface in advanced electronic ignition systems.



PENTAWATT HV

## BLOCK DIAGRAM




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

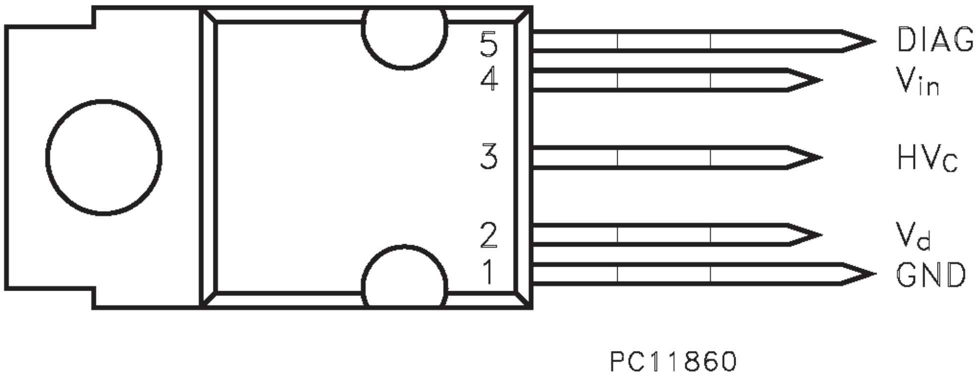
## ABSOLUTE MAXIMUM RATING

| 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 | 200 | mA |
| $V_{in}$ | Maximum Input Voltage | 10 | V |
| $T_j$ | Operating Junction Temperature | -40 to 150 | $^oC$ |
| $T_{stg}$ | Storage Temperature Range | -55 to 150 | $^oC$ |

## THERMAL DATA

| | | | |
|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction Case(MAX) | 1.12 | $^oC/W$ |
| $R_{thj\text{-}amb}$ | Thermal Resistance Junction Ambient(MAX) | 62.5 | $^oC/W$ |

## CONNECTION DIAGRAM




## PIN FUNCTION

| No | NAME | FUNCTION |
|---|---|---|
| 1 | GND | Emitter Power and Control Ground |
| 2 | Vd | Supply Voltage For The Power Stage |
| 3 | $HV_C$ | Output to The Primary Coil |
| 4 | INPUT | |
| 5 | DIAGNOSTIC | Output of a Logic Signal When Ic Is Greater Than 3 A |

**ELECTRICAL CHARACTERISTICS** ($V_b$ = 13.5 V; $V_d$ = 5 V; $T_j$ = 25 °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 ≤ $T_j$ ≤ 125 °C   $I_{coil}$ = 6 A | 300 | 360 | 400 | V |
| $V_{ce(sat)}$ | Saturation Voltage of The Power Stage | $I_c$ = 6A;   $V_{in}$ = 4V | | 1.5 | | V |
| $V_{ce(sat)dt}$ | Saturation Voltage of The Power Stage Derating in Temperature | $I_c$ = 6A;   $V_{in}$ = 4V<br>-40 °C ≤ $T_j$ ≤ 125 °C | | | 2 | 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   $I_c$ = 6 A<br>-40 °C ≤ $T_j$ ≤ 125 °C | | | 130 | mA |
| $V_d$ | Driver Stage Supply Voltage | | 4.5 | | 5.5 | V |
| $I_{cl}$ | Coil Current Limit | $V_{in}$ = 4 V   (see note 1) | 8 | 8.5 | 9 | A |
| $I_{cl(td)}$ | Coil Current Limit Drift With Temperature | See figure 3 | | | | |
| $V_{inH}$ | 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   (see fig. 1) | 3.5 | * | $V_d$ | V |
| $V_{diagL}$ | Low Level Diagnostic Output Voltage | $R_{EXT}$ = 22 KΩ   (see fig. 1) | | | 0.5 | V |
| $I_{diagTH1}$ | Diagnostic Current First Threshold | | 4.25 | 4.5 | 4.75 | A |
| $I_{diagTD1}$ | Diagnostic Current First Threshold Drift With Temperature | See figure 4 | | | | |
| $I_{diagTH2}$ | Diagnostic Current Second Threshold | | 5.45 | 5.8 | 6.15 | A |
| $I_{diagTD2}$ | Diagnostic Current Second Threshold Drift With Temperature | See figure 5 | | | | |
| $t_{dlc}$ | Delay Time Coil Current | $I_c$ = 6 A   (see note 2) | | 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   (see fig. 1) | | 1 | | μs |
| $t_{r(diag)}$ | Rise Time Diagnostic Current | $R_{EXT}$ = 22 KΩ   (see fig. 1) | | 1 | | μs |
| $t_{f(diag)}$ | Fall Time Diagnostic Current | $R_{EXT}$ = 22 KΩ   (see fig. 1) | | 1 | | μs |

Note 1: The primary coil current value Icl must be measured 1 ms afterdesaturation of the power stage.
Note 2: Time from input switching $V_{NEG}$ until collector voltage equal 200V.
* $V_d$ - $V_{be(on)}$

## PRINCIPLE OF OPERATION

The VB027 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 VB027 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 VB027 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.

## 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 VB027 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

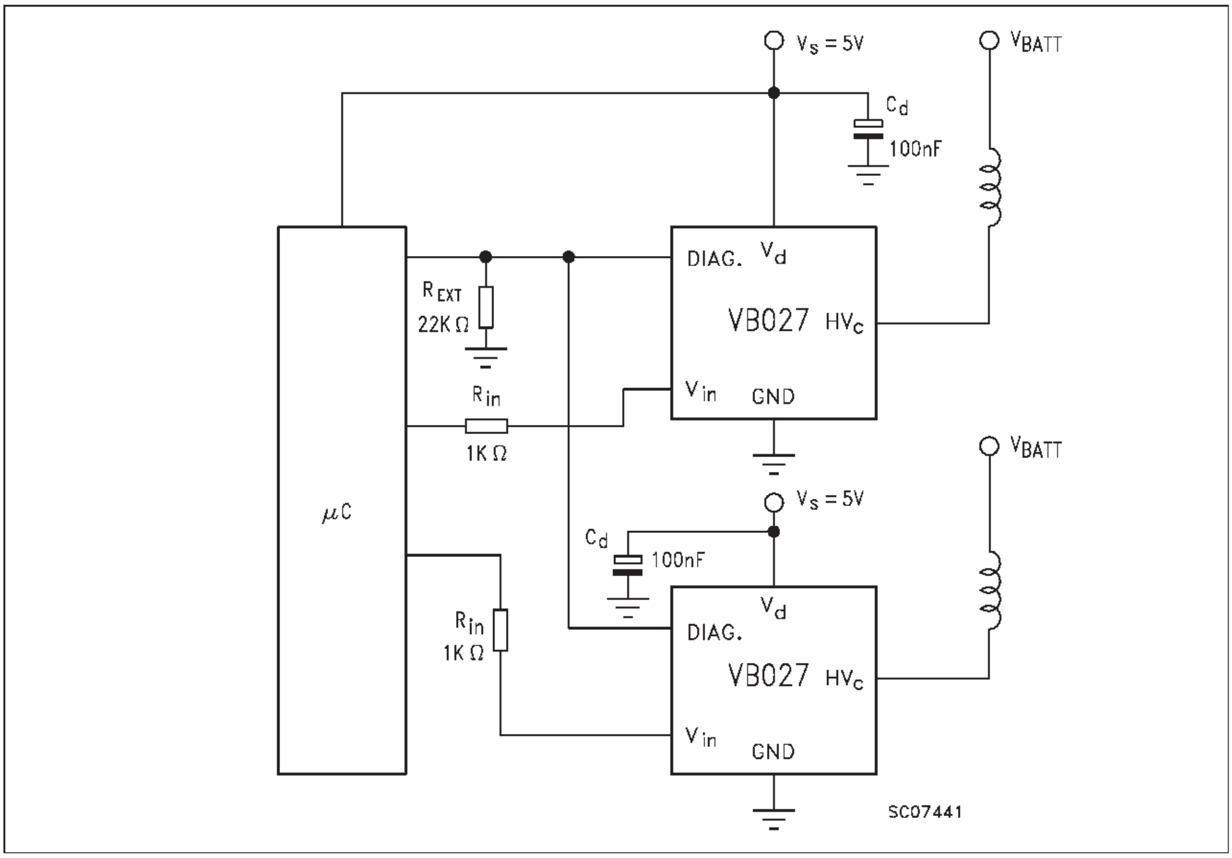


**FIGURE 2:** Switching Waveforms

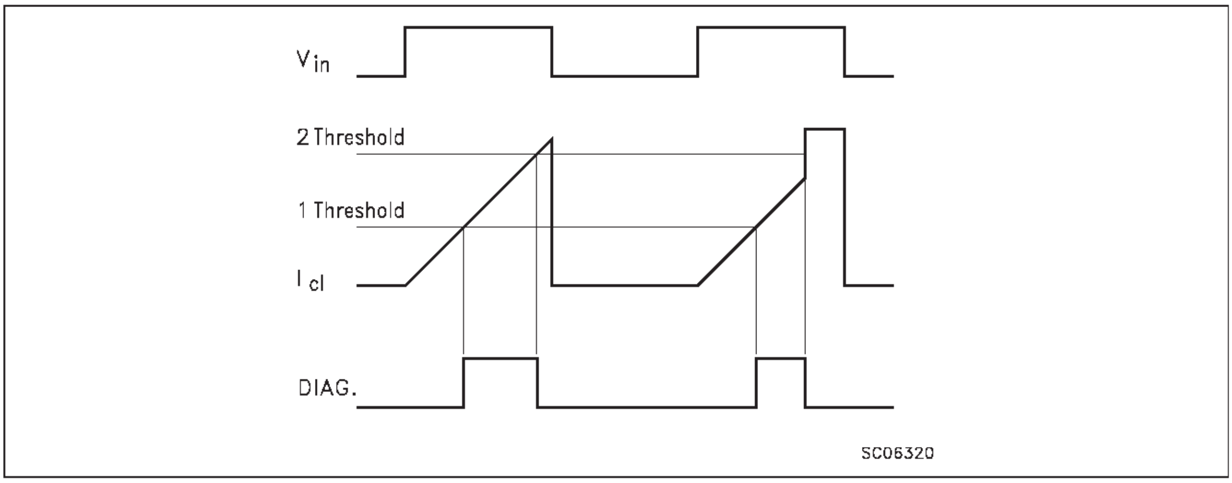



**FIGURE 3:** Maximum $I_{cl}$ Versus Temperature

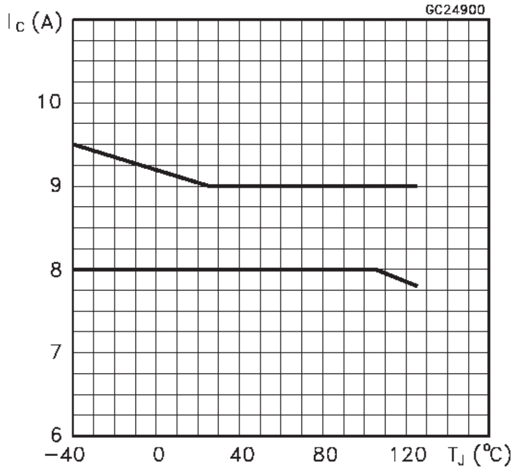



**FIGURE 4:** $I_{flag1}$ Versus Temperature

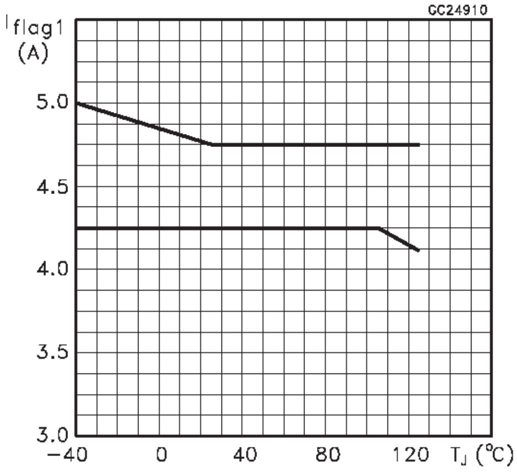
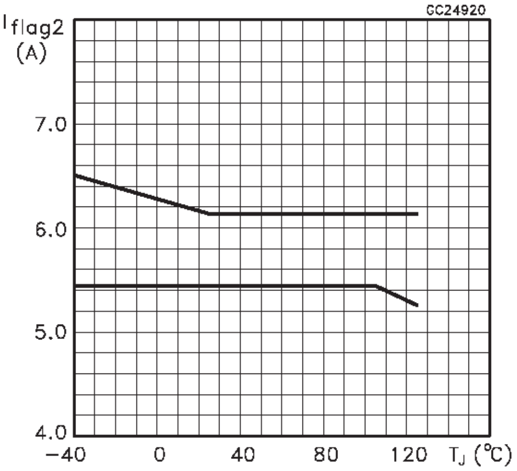
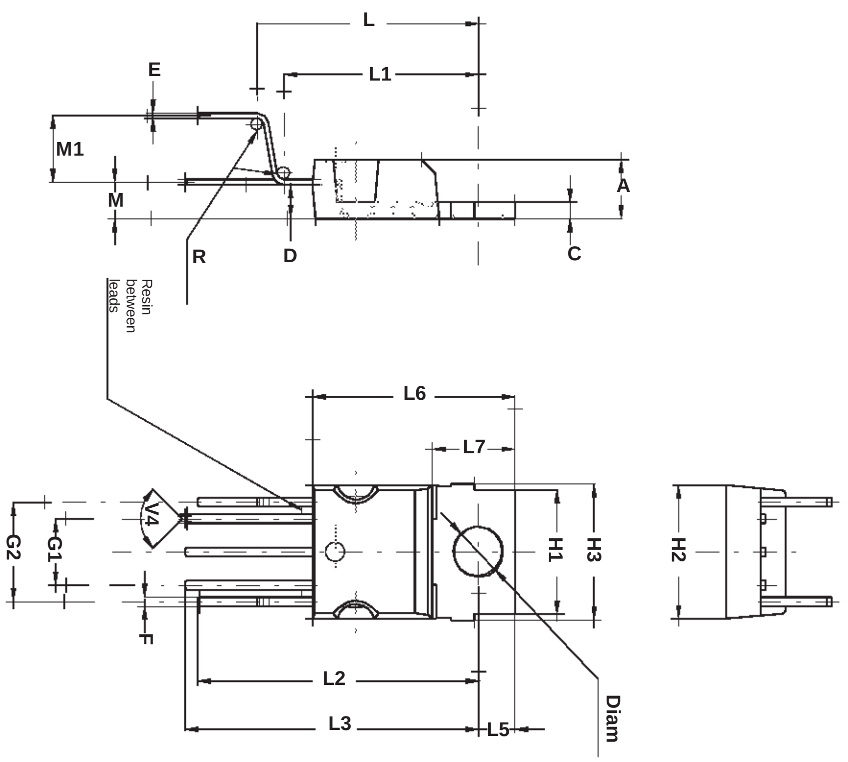



**FIGURE 5:** $I_{flag2}$ Versus Temperature



## PENTAWATT HV (VERTICAL) MECHANICAL DATA

| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.30 | | 4.80 | 0.169 | | 0.189 |
| C | 1.17 | | 1.37 | 0.046 | | 0.054 |
| D | 2.40 | | 2.80 | 0.094 | | 0.110 |
| E | 0.35 | | 0.55 | 0.014 | | 0.022 |
| F | 0.60 | | 0.80 | 0.024 | | 0.031 |
| G1 | 4.90 | | 5.28 | 0.193 | | 0.208 |
| G2 | 7.42 | | 7.82 | 0.292 | | 0.308 |
| H1 | 9.30 | | 9.70 | 0.366 | | 0.382 |
| H2 | | | 10.40 | | | 0.409 |
| H3 | 10.05 | | 10.40 | 0.396 | | 0.409 |
| L | 15.60 | | 17.30 | 0.614 | | 0.681 |
| L1 | 14.60 | | 15.22 | 0.575 | | 0.599 |
| L2 | 21.20 | | 21.85 | 0.835 | | 0.860 |
| L3 | 22.20 | | 22.82 | 0.874 | | 0.898 |
| L5 | 2.60 | | 3.00 | 0.102 | | 0.118 |
| L6 | 15.10 | | 15.80 | 0.594 | | 0.622 |
| L7 | 6.00 | | 6.60 | 0.236 | | 0.260 |
| M | 2.50 | | 3.10 | 0.098 | | 0.122 |
| M1 | 7.56 | | 8.16 | 0.298 | | 0.321 |
| R | | 0.50 | | | 0.020 | |
| V4 | | 90$^{o}$ | | | 90 | |
| Diam. | 3.70 | | 3.90 | 0.146 | | 0.154 |



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