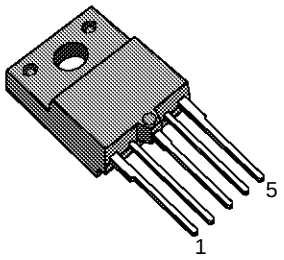
SGS-THOMSON MICROELECTRONICS

VB020

HIGH VOLTAGE IGNITION COIL DRIVER POWER IC

TYPE	V_{cl}	I_{cl}	I_d
VB020	400 V	6 A	150 mA

- PRIMARY COIL VOLTAGE INTERNALLY SET
- COIL CURRENT LIMIT INTERNALLY SET
- LOGIC LEVEL COMPATIBLE INPUT
- OVERVOLTAGE PROTECTION OF THE DRIVING AND CONTROL CIRCUIT



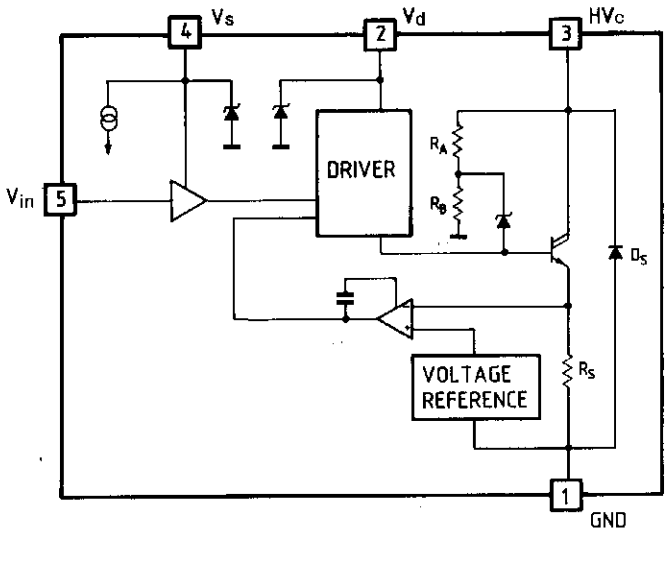
ISOWATT5

DESCRIPTION

The VB020 is a high voltage power integrated circuit made using SGS-THOMSON Microelectronics Vertical Intelligent Power 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 VB020 to be used as a smart, high voltage, high current interface in advanced electronic ignition systems.

BLOCK DIAGRAM



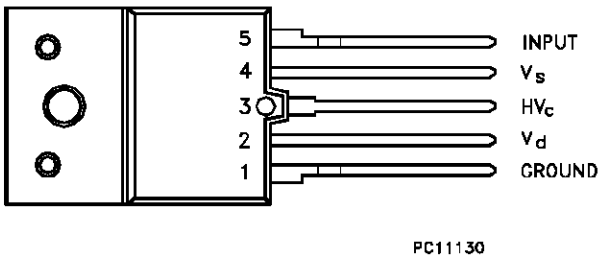
ABSOLUTE MAXIMUM RATING

Symbol	Parameter	Value	Unit
HV_C	Collector Voltage	Internally Limited	V
I_c	Collector Current	Internally Limited	A
V_d	Driving Stage Supply Voltage	24	V
I_d	Driving Circuitry Supply Current	350	mA
V_{in}	Maximum Input Voltage	V_s	V
V_s	Control Circuitry Supply Voltage	24	V
I_s	Control Circuitry Supply Current	200	mA
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)	2.5	$^oC/W$
$R_{thj\text{-}amb}$	Thermal Resistance Junction Ambient	(MAX)	30	$^oC/W$

PIN CONFIGURATION



PIN FUNCTION

No	NAME	FUNCTION
1	GND	Emitter Power and Control Ground
2	Vd	Driver Stage Supply Voltage
3	HV_C	Output to The Primary Coil
4	Vs	Control Circuit Supply Voltage
5	INPUT	

ELECTRICAL CHARACTERISTICS ($V_b = V_{CC} = 12$ V; $T_{amb} = 25\ ^oC$; $V_{in} = 0.4$ V; $R_S = 300\ \Omega$; $R_D = 50\ \Omega$; $R_{coil} = 500\ m\Omega$; $L_{coil} = 6mH$ unless otherwise specified, see figure 1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{cl}	High Voltage Clamp	Functional Test see figs. 3 e 4	320		460	V
$V_{ce(sat)}$	Saturation Voltage of The Power Stage	$I_c = 5A$; $I_d = 40mA$; $V_{in} = 5V$ pulsed $t_{on} = 300\ \mu s$ $f_{osc} = 1$ Hz		1.5	2	V
$I_{s(on)}$	Control Circuit Supply Current	$V_{in} = 4$ V		10	25	mA
$I_{s(stand\text{-}by)}$	Control Circuit Stand-by Current	$V_{in} = 0.4$ V		5	15	mA
V_s	Control Circuit Supply Voltage		5.6		8.5	V
$I_{d(on)}$	Driver Stage Supply Current	$V_{in} = 4$ V		150	350	mA
$I_{d(stand\text{-}by)}$	Driver Stage Stand-by Current	$V_{in} = 0.4$ V			1	mA
V_d	Driver Stage Supply Voltage		5		17	V
I_{cl}	Coil Current Limit	Functional Test see figs. 3 e 4	5.5	6	6.5	A
V_{inH}	High Level Input Voltage	$I_c = 5$ A	2.4		V_s	V
V_{inL}	Low Level Input Voltage	$I_c < 2$ mA $HV_c = V_b$	0		0.8	V
I_{inH}	High Level Input Current	$V_{in} = 2.4$ V			100	µA
t_s	Storage Time	$I_c = 6$ A see figs. 1 e 2		20	30	µs
t_f	Fall Time	$I_c = 6$ A see figs. 1 e 2 & Note 1			12	µs
$E_{s/b}$	Second Breakdown Energy Clamped	$I_c = 6$ A $V_{CC} = 12$ V	300			mJ

Note 1: $V_{clamp} = 300$ V externally set

PRINCIPLE OF OPERATION

The VB020 is a high voltage, power integrated circuit with a logic level compatible input.

This part is intended for use in ignition modules or integrated into an ignition coil assembly.

The input, V_{in}, of the VB020 is fed with a logic level signal generated by an external controller or processor that determines both dwell time and ignition point. When V_{in} is high (>2.4V) the VB020 power output transistor conducts and a current controlled by the IC logic flows in the ignition coil.

The current is held constant at a level set internally by the P.I.C. until the ignition point, when Vin is driven low. During the turn-off of the transistor, the primary voltage is clamped at an internally set value, Vcl. typically 400V, in case accidental secondary open circuit conditions occur.

The transition from saturation to desaturation coil current limiting phase implies a maximum overshoot of 0.85 times the supply voltage without requiring an external RC network for frequncy compensation.

OVERVOLTAGE

The VB020 can withstand the following transient on the battery line:

-120V/2msec ($R_i = 10\ \Omega$)
100V/1msec ($R_i = 10\ \Omega$)
50V/400msec ($R_i = 2\ \Omega$, $V_{in} = 3$ V)

Figure 1 : Test Circuit.

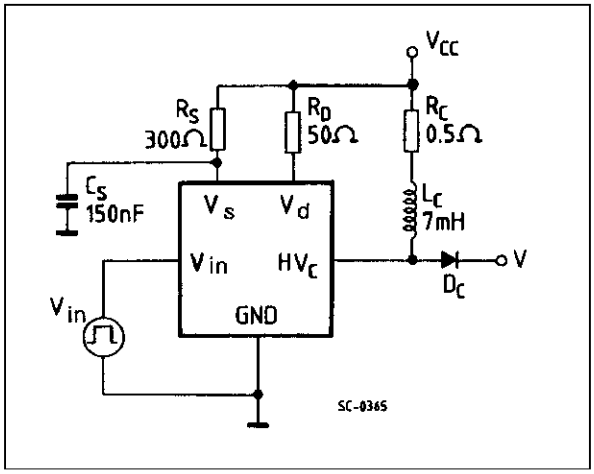


Figure 2 : Resistive Switching Waveform.

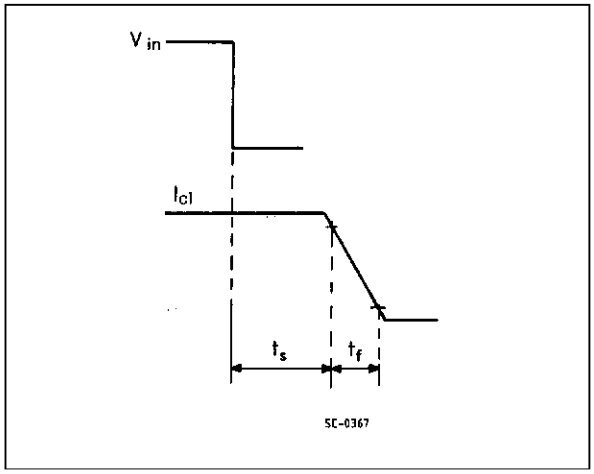
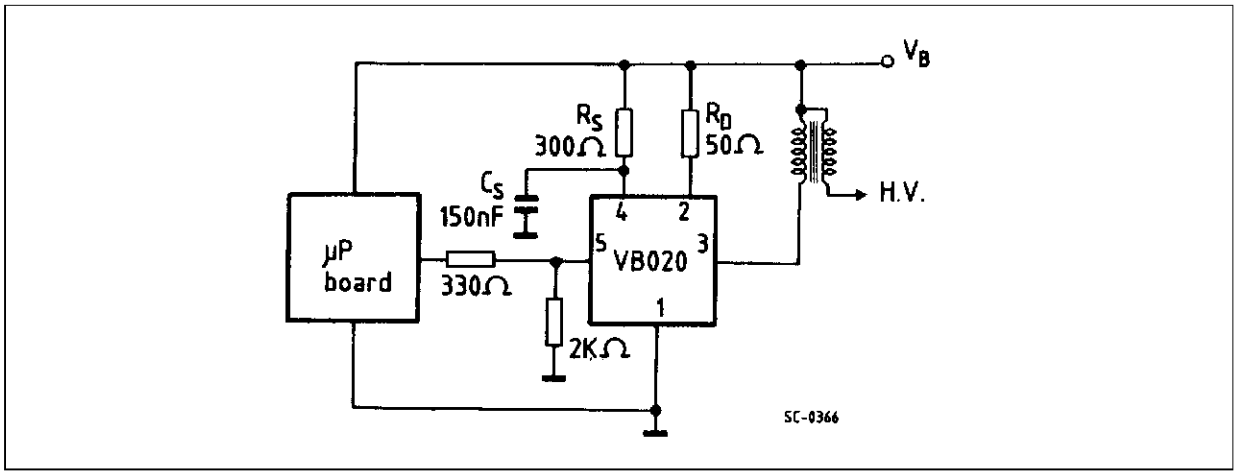
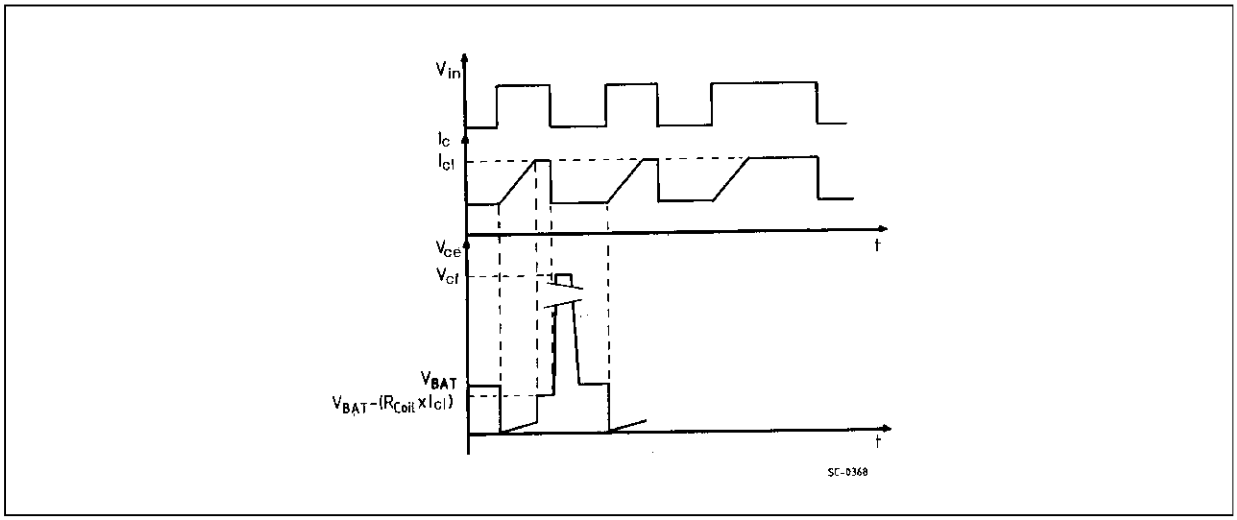


Figure 3 : Application Circuit.



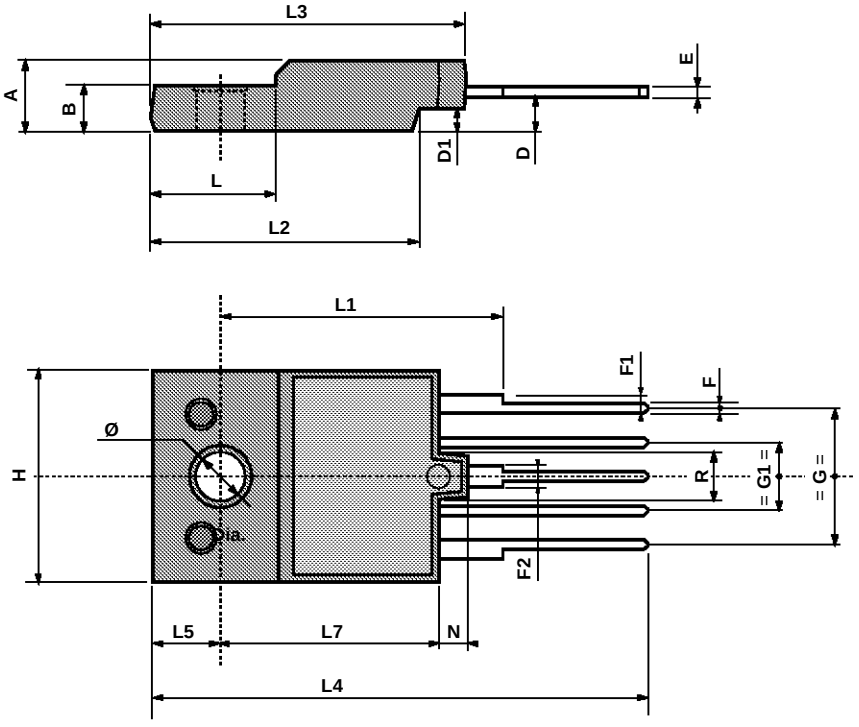
Coil data: primary resistance R_C = 0.4 - 0.5 ohm.
primary inductance L_C = 6 - 8 mH.

Figure 4: Input Voltage and Output Current Waveform.



ISOWATT5 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	5.35		5.65	0.210		0.222
B	3.3		3.8	0.130		0.149
D	2.95		3.1	0.116		0.122
D1	1.88		2.08	0.074		0.081
E	0.45		1	0.017		0.039
F	0.75		1	0.029		0.039
F1		1.5			0.059	
F2		1.3			0.051	
G		10.16			0.400	
G1		5.08			0.200	
H	15.8		16.2	0.622		0.637
L		9			0.354	
L1	20.25		20.75	0.797		0.817
L2	19.10		19.9	0.751		0.783
L3	22.8		23.6	0.897		0.929
L4	34.9		36.9	1.374		1.452
L5	4.85		5.25	0.190		0.206
L7		16			0.630	
N	2.1		2.3	0.082		0.090
R		3.1			0.122	
∅	3.5		3.7	0.138		0.145



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