SGS-THOMSON MICROELECTRONICS

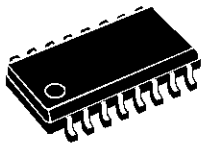
ICC01-400B5

Application Specific Discretes
A.S.D.™

IGNITION CONTROL CIRCUIT

FEATURES AND BENEFITS

- MONOLITHIC CIRCUIT FOR CAPACITANCE DISCHARGE SYSTEM CONTROL.
- DEDICATED THYRISTOR STRUCTURE FOR IGNITION OPERATION.
- APPLICATION SPECIFIC DISCRETES (ASD™).
- SURFACE AREA REDUCTION.
- SO16 PACKAGE.



SO16
(Plastic)

DESCRIPTION

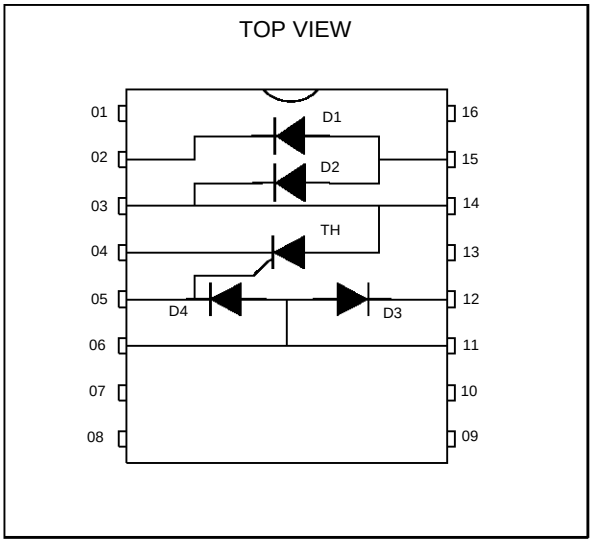
The ICC01 is a high-performance planar-diffused technology adapted to rugged environment conditions.

It has been developed especially for small engines using a capacitor discharge technique for ignition operation.
The ICC01 assumes electronics control of the ignition system.

- Pin 2 : Motor stop
- Pin 4/6/11 : Ground
- Pin 5 : Sensor
- Pin 3/14 : Ignition capacitor
- Pin 12/15 : Charging, winding
- Pin 1/7/8/9/10/13/16 : Not connected

See basic application and functionality page 4.

FUNCTIONAL DIAGRAM



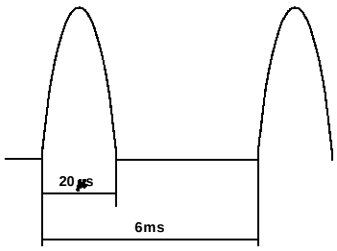
ABSOLUTE MAXIMUM RATINGS : THYRISTOR TH

Symbol	Parameter		Value	Unit
I_{TRM}	Repetitive peak on-state current (Note1)	Tl=110 °C	100	A
I_{TSM}	Non repetitive surge peak on-state current Tj initial = T_j = 25°C	tp = 20 µs	150	A
		tp = 10 ms	5	A
V_{DRM}	Repetitive peak off-state voltage	T_j = 125°C	400	V

ABSOLUTE MAXIMUM RATINGS : DIODES

Symbol	Parameter		Value				Unit
			D1	D2	D3	D4	
I_{FRM}	Repetitive peak forward current (Note 1)	Tl= 110 °C	1	100	100	1	A
I_{FSM}	Non repetitive surge forward current Tj initial = T_j = 25°C	tp = 20 µs	15	150	150	15	A
		tp = 10 ms	2	5	5	2	A
V_{RRM}	Repetitive peak off-state voltage	Tj= 125 °C	25	400	400	25	V

Note 1: Test current waveform



ABSOLUTE MAXIMUM RATINGS : FOR ALL DEVICES (ICC01)

Symbol	Parameter	Value	Unit
T_{stg} T_j	Storage temperature range Operating junction temperature range	- 40 to + 150 - 40 to + 150	°C
Tl	Maximum lead temperature for soldering during 10s	260	°C

THERMAL RESISTANCES

Symbol	Parameter	Value	Unit
Rth(j-a)	Thermal resistance junction to ambient	90	°C/W

ELECTRICAL CHARACTERISTICS : THYRISTOR TH

Symbol	Test Conditions			Value	Unit
I_{GT}	V_D=12V (DC) R_L=33Ω	Tj= 25°C	MAX	1	mA
V_{GT}	V_D=12V (DC) R_L=33Ω	Tj= 25°C	MAX	1.5	V
V_{TM}	I_{TM} = 4A tp ≤ 1ms	Tj= 25°C	MAX	1.9	V
I_{DRM}	V_{DRM} rated	Tj= 25°C	MAX	50	µA
		Tj= 125°C	MAX	1	mA

ELECTRICAL CHARACTERISTICS : DIODE D1/D4

Symbol	Test Conditions			Value	Unit
I_R	VR = V_{RRM}	Tj= 25°C	MAX	50	µA
		Tj= 120°C	MAX	1	mA
V_F	I_F = 100 mA tp ≤ 1ms	Tj= 25°C	MAX	1.2	V

ELECTRICAL CHARACTERISTICS : DIODE D2/D3

Symbol	Test Conditions			Value	Unit
I_R	V_R = V_{RRM}	Tj= 25°C	MAX	50	µA
		Tj= 125°C	MAX	1	mA
V_F	I_F = 4 A tp ≤ 1ms	Tj= 25°C	MAX	1.9	V

ORDERING INFORMATION

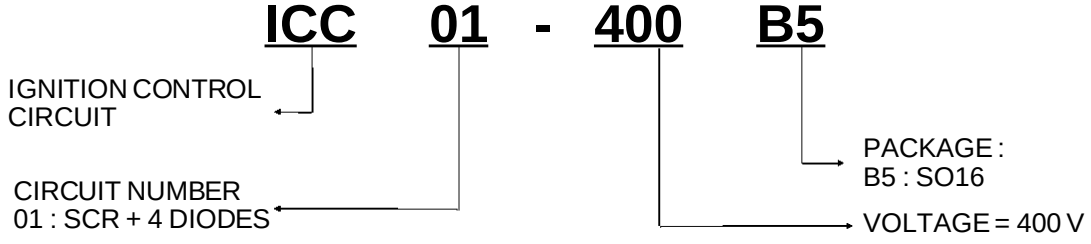


Fig.1 : Relative variation of gate trigger current versus junction temperature.

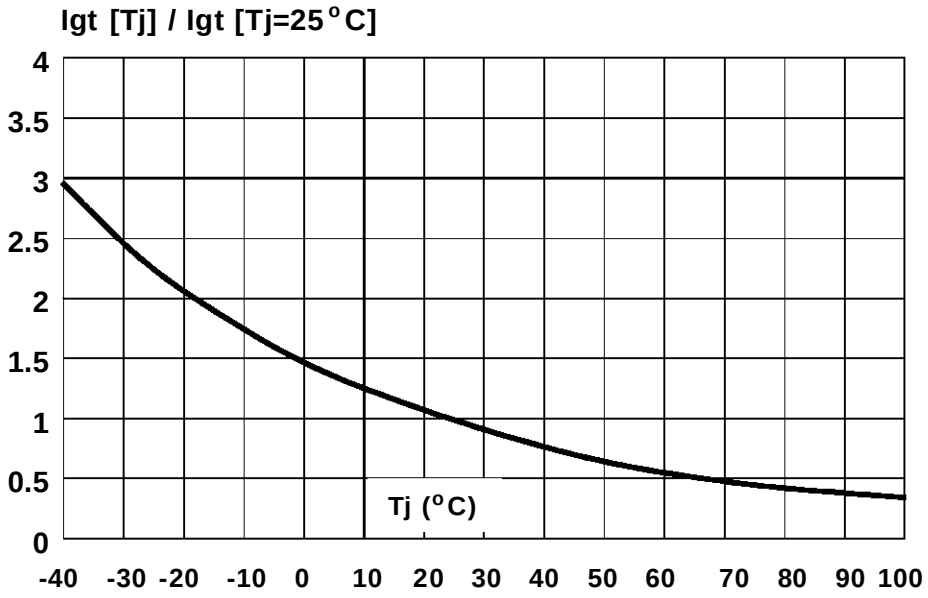
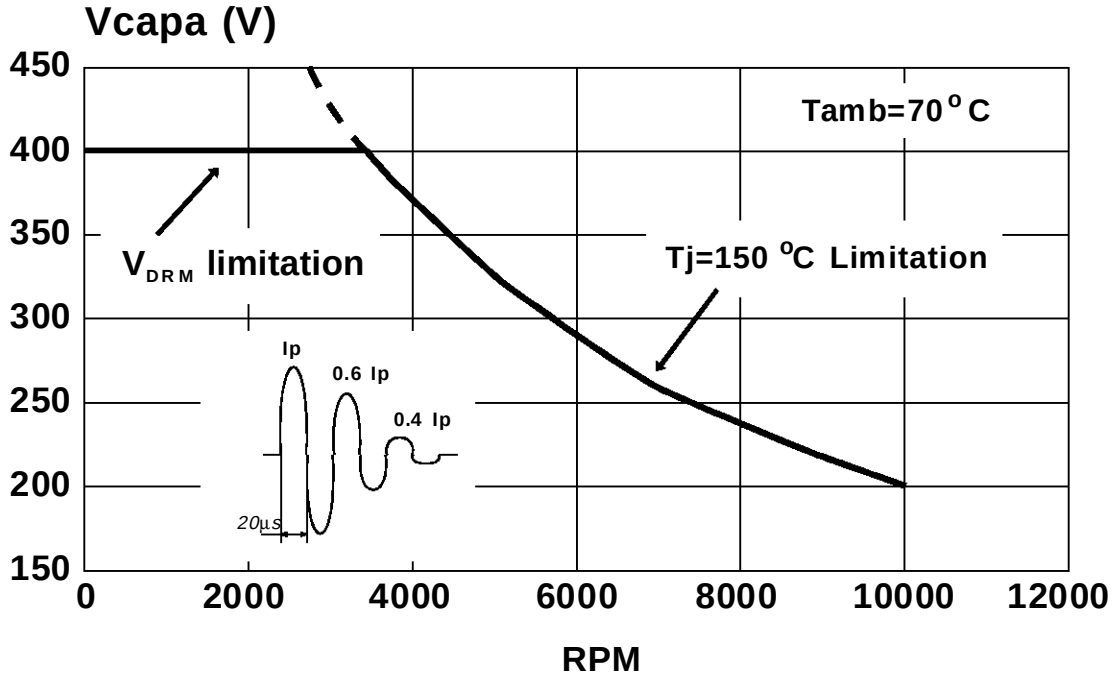
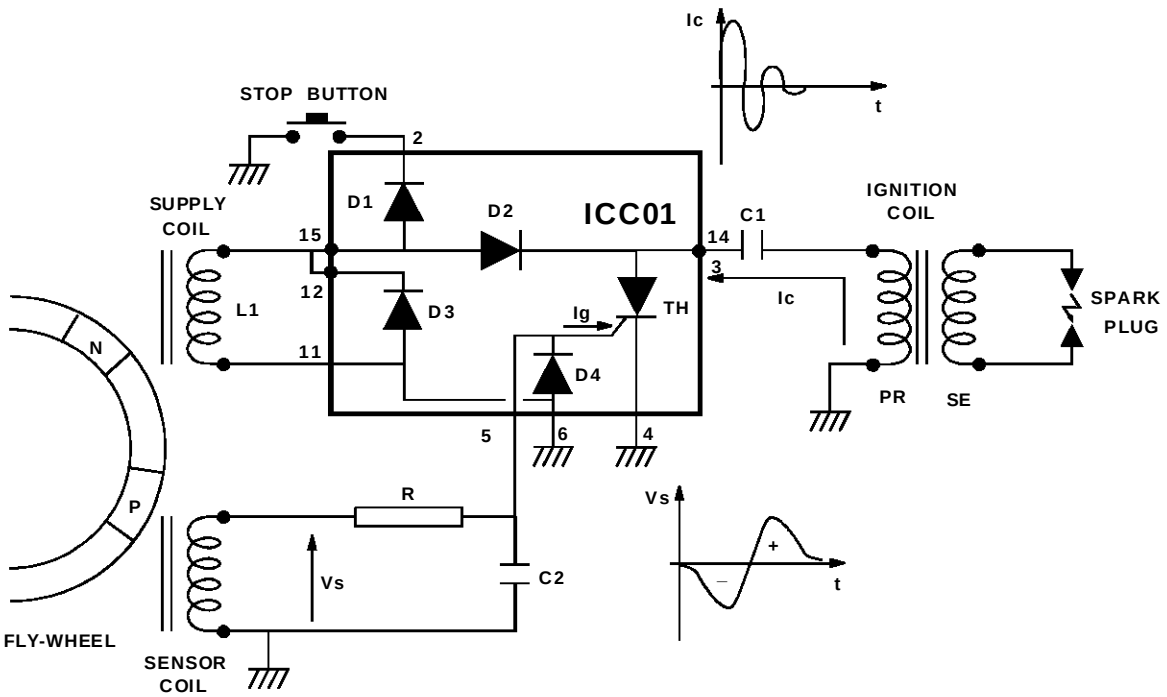


Fig.2 : Safety limitation curve of the capacitor voltage variation versus RPM @ tp=20µs.



BASIC APPLICATION



see functional diagram page 1

The applications using the capacitive ignition system (CDI) operate in 3 phases.

PHASE 1
Storage of the energy in the capacitor C1

PHASE 2
Discharge of the capacitor C1 and spark generation to the ignition coil.

PHASE 3
Engine stop.

1) ENERGY STORAGE IN C1

The coil L1 generates an alternative voltage. Its positive part charges the capacitor C1 through the diode D2.

The negative waves are clamped by the diode D3.

2) SPARK GENERATION

For each fly-wheel revolution the sensor coil produces a bidirectional pulse Vs and triggers the ignition coil.

The negative sinewave generated is clamped by D4 while the positive sinewave initiates a current I_G through the thyristor gate (Th)

The firing of the SCR causes an alternating discharge current Ic through the capacitor C1.

The positive parts of this current flow in the loop C1, Th and the primary of the ignition coil PR.

The negative parts flow through C1, PR and both diodes D3 and D2.

3) ENGINE STOP

The engine stop is obtained by short circuiting the supply coil L1 (stop button). The diode D1 avoids the accidental connection of battery voltage.

R RESISTOR CALCULATION

The purpose of the resistor R is to limit the current I_G through the thyristor gate. Its maximum value can be calculated as follow :
R max = (Vs min - V_{GT} max) / 2 I_{GT} max

POWER LOSSES (For 20µs - see note 1)

The following equations can be used to evaluate power losses :

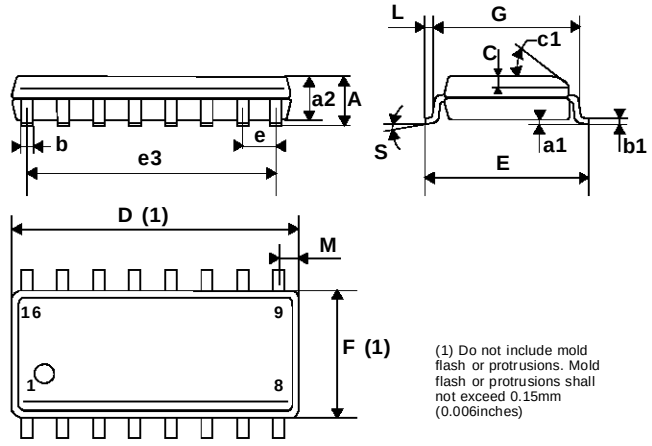
For TH V_{TO} = 2.65V Rt = 0.110 Ω
For D3 V_{FO} = 1.73V Rd = 0.075 Ω

PROTECTION AGAINST PARASITIC SPIKES

The capacitor C2 in relation with R acts as a filter and avoids the unexpected firing of the thyristor due to parasitic spikes. Good results have been obtained with 10nF capacitance.

PACKAGE MECHANICAL DATA

SO16 (Plastic)



(1) Do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm (0.006inches)

REF.	DIMENSIONS					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45°(typ.)					
D	9.8		10	0.386		0.394
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F	3.8		4.0	0.150		0.158
G	4.6		5.3	0.181		0.209
L	0.4		1.27	0.016		0.050
M			0.62			0.024
S	8°(typ.)					

Marking : ICC1-400
Weight : 0.15 g