



## VB325SP

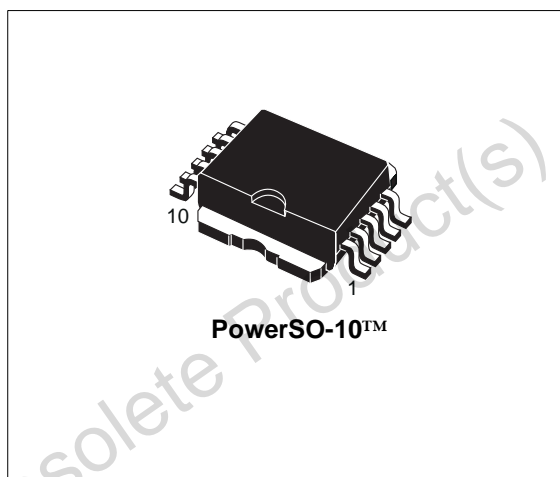
# HIGH VOLTAGE IGNITION COIL DRIVER POWER I.C.

TYPE	$V_{cl}$	$I_{cl}$	$I_{cc}$
VB325SP	380V	10A	150mA

- 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
- LOW VOLTAGE CLAMP THERMAL SHUTDOWN

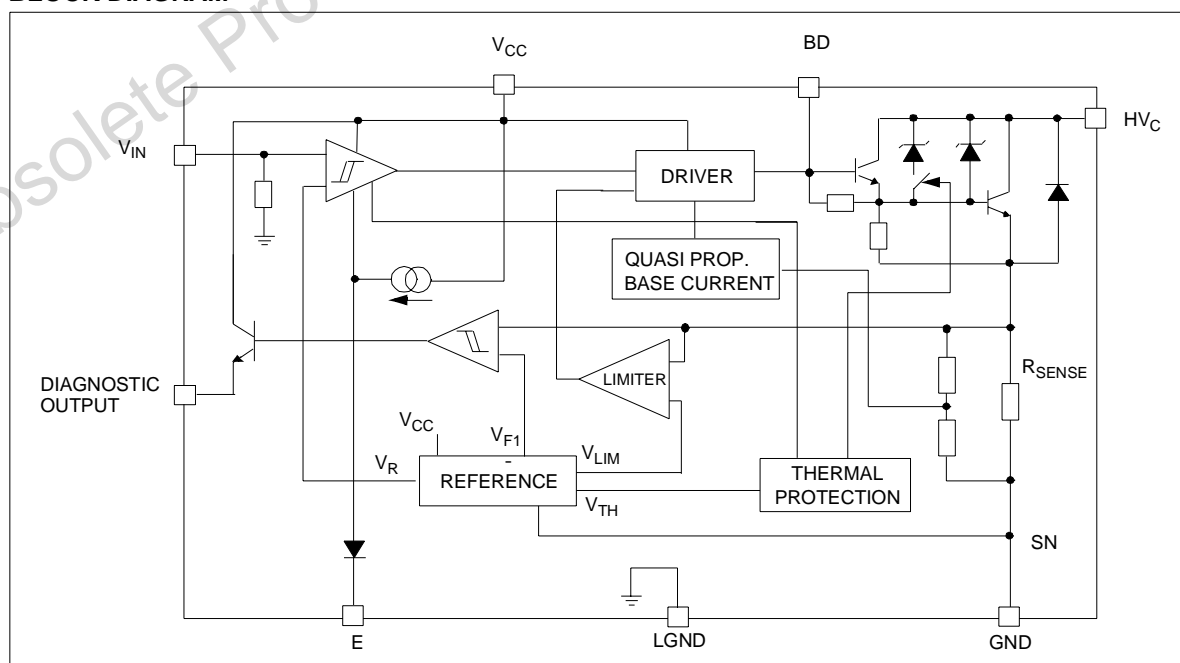
### DESCRIPTION

The VB325SP is a high voltage power integrated circuit made using the STMicroelectronics VIPower™ M1-3 technology, with vertical current flow power darlington and logic level compatible driving circuit. The enable pin allows to externally block the switch when the input is on. Built-in protection circuit for coil current limiting and collector voltage clamping allows the device to be used as smart, high voltage, high current interface



in advanced electronic ignition system. If the input signal from the micro happens to remain high, the device protects itself against over-heating by forcing collector current to smooth decrease (low voltage clamp feature) and no undesired spark occurs (see figure 4).

### 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	$\pm 10.5$	A
$V_{CC}$	Driving stage supply voltage	-0.3 to 7	V
$I_s$	Driving circuitry supply current	$\pm 200$	mA
$I_{s(gnd)}$	DC current on Ground pin	$\pm 1$	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 ( $T_c=25^\circ\text{C}$ )	125	W
$E_{s/b}$	Self Clamped Energy during Output Power Clamping (See figure 2)	275	mJ
$V_{ESD}$	ESD voltage ( $HV_C$ pin)	$\pm 4$	KV
$V_{ESD}$	ESD voltage (Enable pin)	+ 1.5 ; -2	KV
$V_{ESD}$	ESD voltage (Other pins)	$\pm 2$	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	$^\circ\text{C}$
$T_{stg}$	Storage temperature Range	-55 to 150	$^\circ\text{C}$
$V_E$	Maximum Enable Voltage	-0.3 to 5.5	V
$I_E$	Maximum Enable Current	$\pm 150$	$\mu\text{A}$

## THERMAL DATA

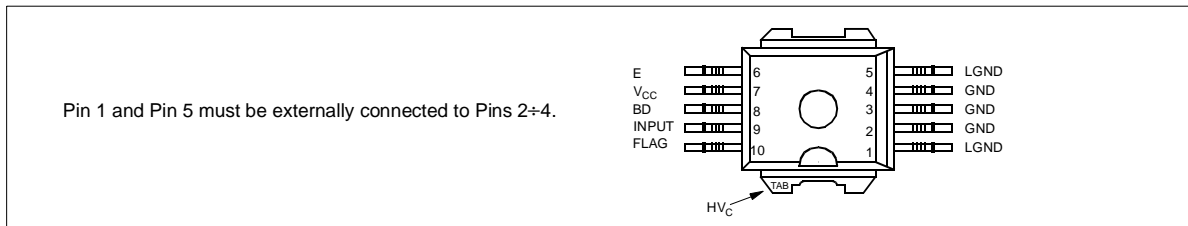
Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case (MAX)	1	$^\circ\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-ambient (MAX)	51	$^\circ\text{C/W}$

## PIN FUNCTION

No	Name	Function
1 - 5	LGND	Signal Ground
2 - 3 - 4	GND	Emitter Power Ground
6	E	Enable (*)
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	$HV_C$	Primary Coil Output Driver (Open Collector)

(\*) When grounded the Input is Enabled

## CONNECTION DIAGRAM (TOP VIEW)



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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{cl}$	High Voltage Clamp	$I_{coil}=6.5A$	320	380	420	V
$V_{lcl}$	Low Voltage Clamp	$I_{coil}=6.5A$ ; $T_j=T_{sd}$	30	40	50	V
$V_{ce(sat)}$	Power Stage Saturation Voltage	$I_C=6A$ ; $V_{IN}=4V$		1.5	2	V
$I_{CC(stdby)}$	Stand-by Supply Current	IN=Off			11	mA
$I_{CC}$	DC Logic Current	$V_b=16V$ ; $I_C=6.5A$ ; $f=100Hz$ ; Load = Coil; $V_{CC}=5.5V$			40	mA
$I_{CC(peak)}$	Peak DC Logic Current during On Phase	$I_C=6.5A$		100	150	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)	9		11	A
$I_{c(off)}$	Output Off State Current	IN=Off; $V_{HVC}=24V$ ; $V_{CC}=5V$ ; $T_j=25^{\circ}C$			5	mA
$V_{INH}$	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
$V_{IN(hyst)}$	Input Threshold Hysteresis		0.4			V
$I_{INH}$	High Level Input Current	$V_{IN}=4V$			100	$\mu A$
$I_{INL}$	Low Level Input Current	$V_{IN}=0.8V$	0		30	$\mu A$
$I_{INpd}$	Input Active Pull Down	$V_{IN}=4V$	10		100	$\mu A$
$V_{diagH}$	High Level Flag Output Voltage	$R_{EXT}=22K\Omega$ ; $C_{EXT}=1nF$ (See note 3)	$V_{CC} - 1$		$V_{CC}$	V
$V_{diagL}$	Low Level Flag Output Voltage	$R_{EXT}=22K\Omega$ ; $C_{EXT}=1nF$ (See note 3)			0.5	V
$I_{diagTH}$	Coil Current Level Threshold	$T_j=25^{\circ}C$	4.25	4.5	4.75	A
$I_{diagTD}$	Coil Current Level Threshold Drift	(See figure 1)				
$I_{diag}$	High Level Flag Output Current	$I_C > I_{diagTH}$ ; $V_{diag}=3V$	0.5			mA
$I_{diag(leak)}$	Leakage Current on Flag Output	$V_{IN}=Low$ ; $V_{CC}=5.5V$			10	$\mu A$
$V_F$	Antiparallel Diode Forward Voltage	$I_C = -1A$			2	V
$E_{s/b}$	Single Pulse Avalanche Energy	$L=6mH$ ; $I_C=8A$		180		mJ
$t_{ON}$	Turn-on time	$R_C=0.5\Omega$ ; $L_C=3.75mH$ ; $T_j=25^{\circ}C$ ; $V_{bat}=13V$ (See figure 6)		1	5	$\mu s$
$t_{OFF}$	Turn-off time	$R_C=0.5\Omega$ ; $L_C=3.75mH$ ; $I_C=6.5A$ ; $T_j=25^{\circ}C$ ; $V_{bat}=13V$ (See figure 6)		15	25	$\mu s$
$T_{sd}$	Thermal shut-down intervention		150			$^{\circ}C$
$V_{EH}$	High Level Enable Voltage	$V_{IN}=V_{INH}$ ; OUT=Off (See Note 4)	2			V
$V_{EL}$	Low Level Enable Voltage	$V_{OUT}$ free to follow $V_{IN}$			0.40	V

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.

Note 4: if ENABLE pin is floating OUT=Off for every input status.

(\*) Internally Limited

**ELECTRICAL CHARACTERISTICS** (continued)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$I_{EH}$	High Level Enable Current	$V_E=5V$			500	$\mu A$
$I_{EL}$	Low Level Enable Current	$V_E<0.4V$	- 200			$\mu A$
$V_{BD(off)}$	Base Darlington Voltage Off	$V_E=V_{EH}$			1	V
$V_{BD(on)}$	Base Darlington Voltage On	$V_{IN}=V_{INH}; V_E=V_{EL}; I_C=6.5A$	1.8			V

**PRINCIPLE OF OPERATION**

The VB325SP 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 VB325SP is fed from a low power signal generated by an external controller that determines both dwell time and ignition point. During  $V_{in}$  high ( $\geq 4V$ ) the VB325SP 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 380V. The transition from saturation to desaturation, coil current limiting phase, must have the ability to accommodate 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**

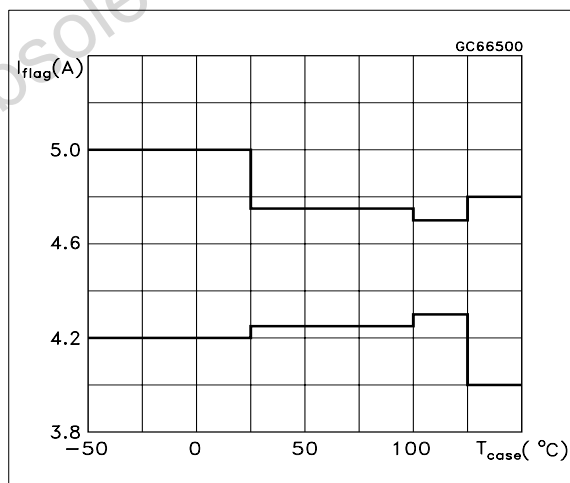
The VB325SP can withstand the following transients of the battery line:

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

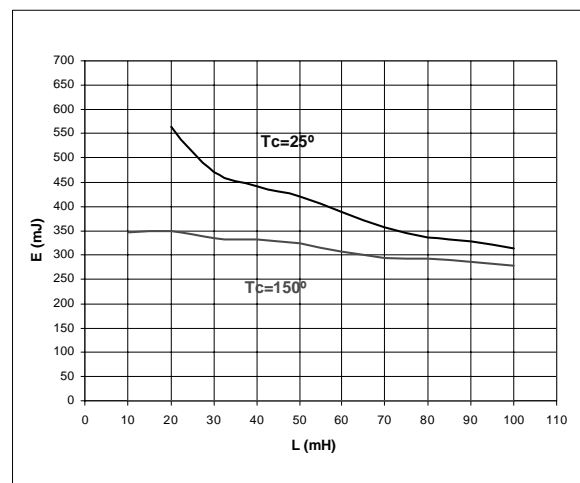
+100V/0.2msec ( $R_i=10\ \Omega$ )

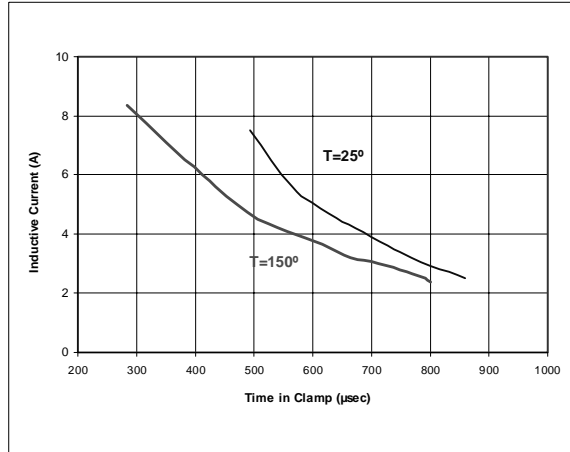
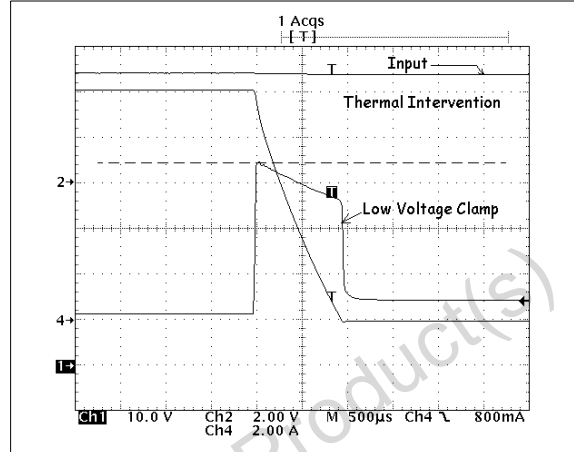
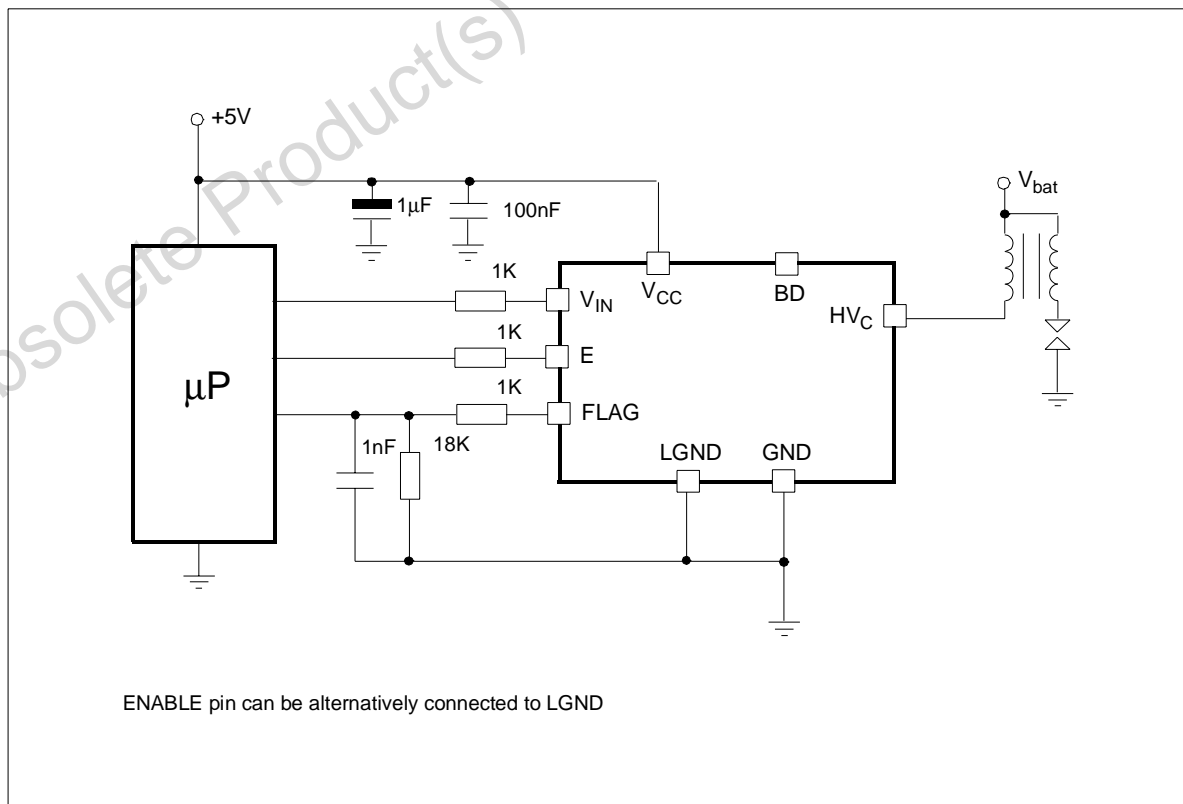
+50V/400msec ( $R_i=4.2\ \Omega$ , with  $V_{IN}=3V$ )

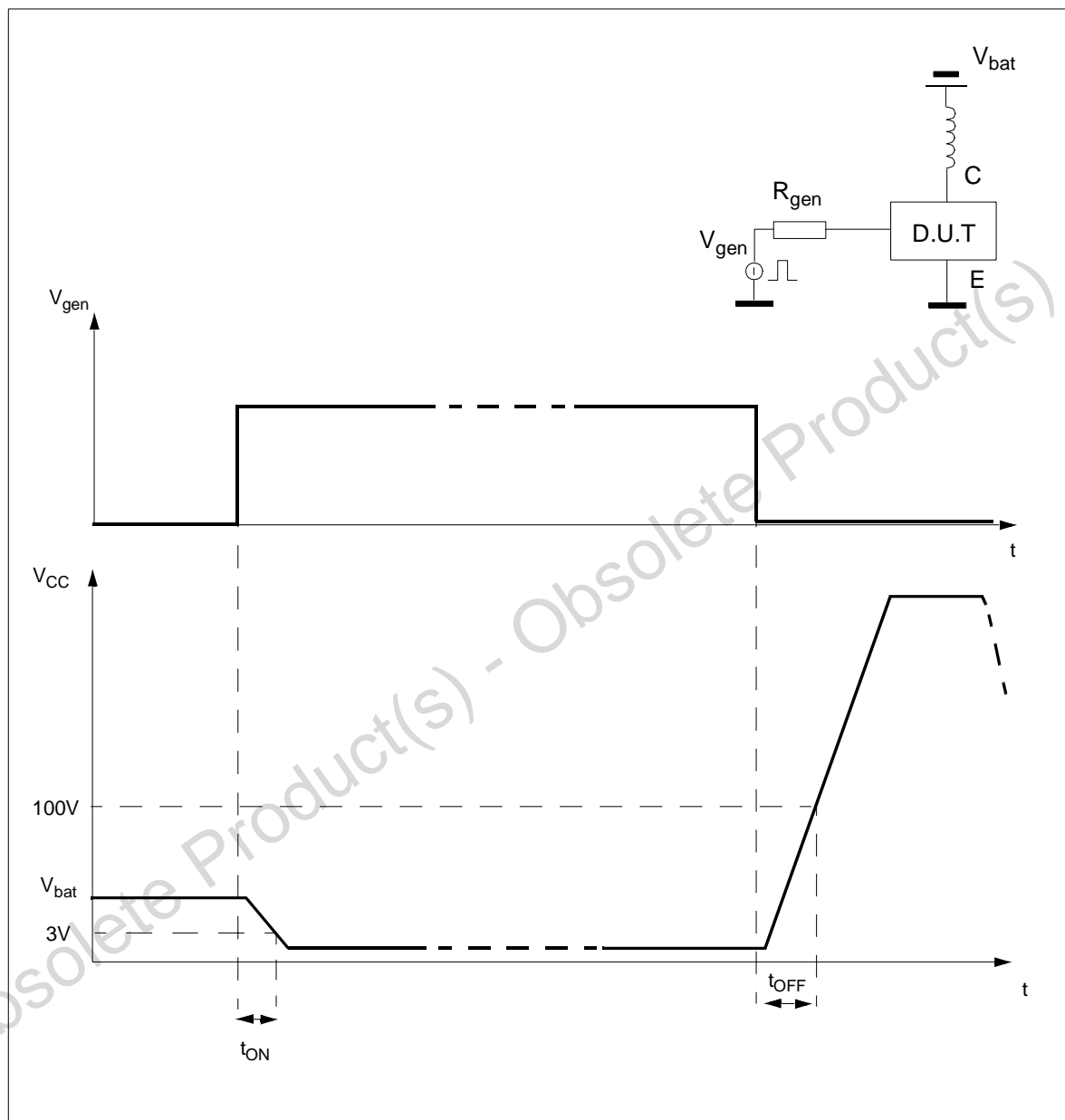
**Figure 1:** Flag current Vs. temperature



**Figure 2:** Single pulse avalanche energy capability



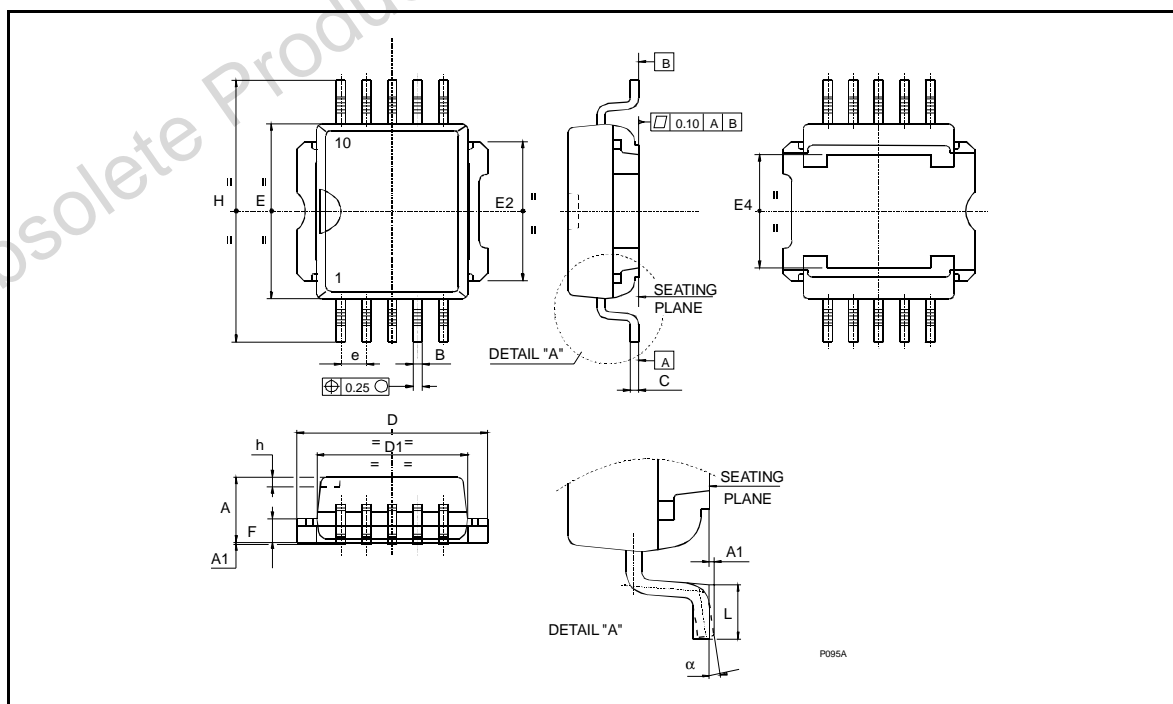
**Figure 3:** Self Clamped Inductive Switching Current Vs. Time**Figure 4:** Low voltage clamp feature**Figure 5:** Typical application diagram

**Figure 6:** Switching time for inductive load

# PowerSO-10™ MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	3.35		3.65	0.132		0.144
A (*)	3.4		3.6	0.134		0.142
A1	0.00		0.10	0.000		0.004
B	0.40		0.60	0.016		0.024
B (*)	0.37		0.53	0.014		0.021
C	0.35		0.55	0.013		0.022
C (*)	0.23		0.32	0.009		0.0126
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
E2	7.20		7.60	0.283		300
E2 (*)	7.30		7.50	0.287		0.295
E4	5.90		6.10	0.232		0.240
E4 (*)	5.90		6.30	0.232		0.248
e		1.27			0.050	
F	1.25		1.35	0.049		0.053
F (*)	1.20		1.40	0.047		0.055
H	13.80		14.40	0.543		0.567
H (*)	13.85		14.35	0.545		0.565
h		0.50			0.002	
L	1.20		1.80	0.047		0.070
L (*)	0.80		1.10	0.031		0.043
$\alpha$	0°		8°	0°		8°
$\alpha$ (*)	2°		8°	2°		8°

(\*) Muar only POA P013P







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