1.Basic Features

- Overload protection
- Current limitation
- Short circuit protection
- Over temperature protection
- Over voltage protection
- Clamp of inductive loads
- Fast demagnetization of inductive loads
- CMOS compatible input
- CMOS diagnostic output function
- Open load detection
- Reverse battery protection with external resistor
- Electrostatic discharge (ESD) protection
- Green Product (RoHS compliant)
- AEC-Q100 qualified

2.Description

RM77090ES is a Smart High side High Current Power Switch, Reverse battery protection by self turn on of power MOSFET, current controlled input and diagnostic feedback with load current sense.It can connect to various loads such as inductive loads, resistive loads, capacitive loads, etc. RM77090ES integrates multiple protection functions. Overload protection, Current limitation, Short circuit protection, Over temperature protection, Over voltage protection, Clamp of negative voltage at output, Fast deenergizing of inductive loads, Electrostatic discharge (ESD) protection.

3.Application

- Power switch with current sense diagnostic feedback for 12V and 24 V DC grounded loads
- All types of resistive, inductive and capacitive loads
- Replaces electromechanical relays, fuses and discrete circuits

4.Product Summary

Overvoltage protection	$V_{bb(AZ)}$	63	V
Operating voltage range	$V_{bb(ON)}$	4.5...42	V
On-state resistance	R_{ON}	90	mΩ
Nominal load current	$I_{L(NOM)}$	1.4	A
Current limitation	$I_{L(SCr)}$	5	A

5.Ordering Code

Device	Package Type	Marking	Materials	Package			Package Qty
RM77090ES	ESOP8L	RM77090ES	Halogen free	Tape&reel	10 reels/box	40k/ box	4000/reel

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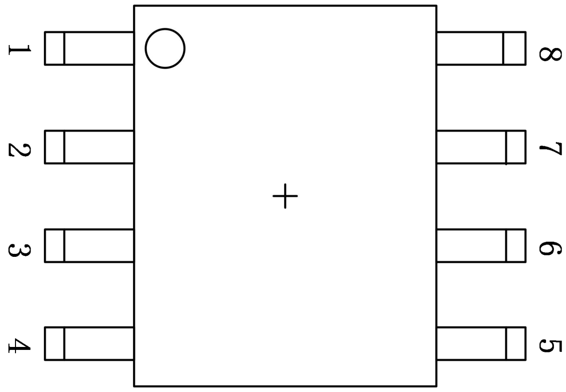
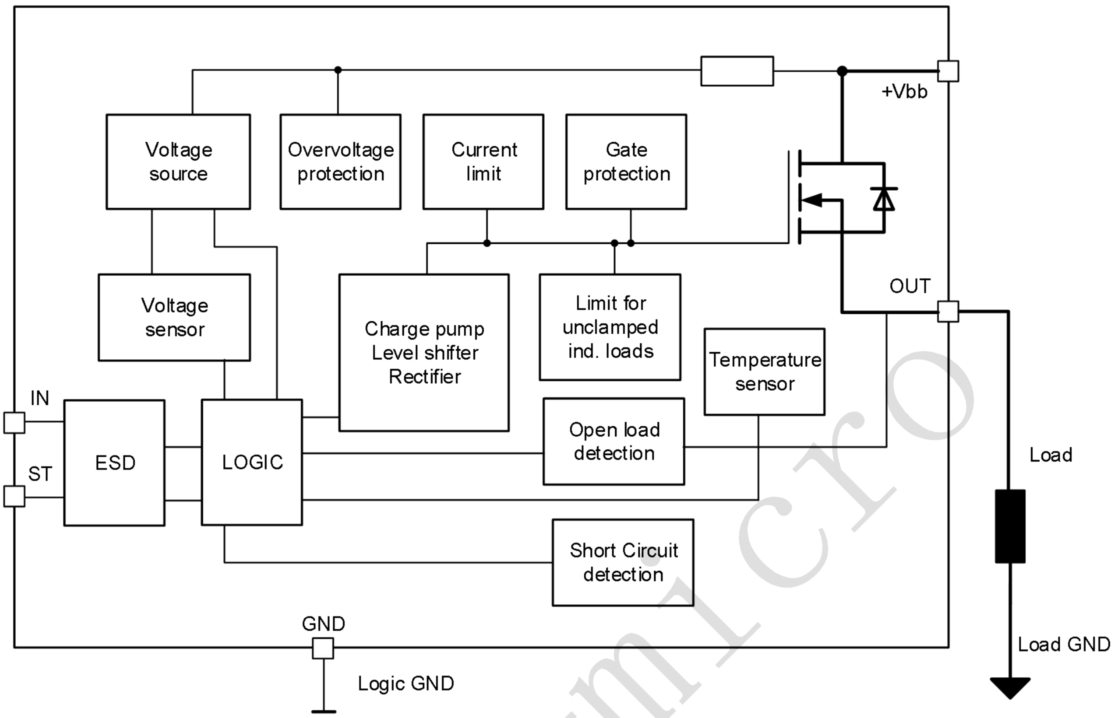
6.Pin Configuration



Pin	Symbol	Function
1	GND	GrouND; Ground connection
2	IN	Input;has an internal pull up; activates the power switch in case of short to ground
3	Vbb	Supply voltage;Positive power supply voltage
4	ST	Diagnostic feedback;
5	NC	Not Connected; No internal connection to the chip
6	OUT	OUTput ;Output to the load
7	OUT	OUTput ;Output to the load
8	NC	Not Connected; No internal connection to the chip
PAD	Vbb	Supply voltage;Positive power supply voltage

7.Block Diagram



8.Absolute Maximum Ratings

T_j = 25°C; (unless otherwise specified)

Parameter	Symbol	Values	Unit
Supply voltage	V_S	63	V
Supply voltage for Load dump protection	$V_{Loaddump}$	80	V
Power dissipation(DC)	P	167	W
Junction temperature	T_j	-40 to 150	℃
Ambient temperature	T_a	-40 to 125	℃
Storage temperature	T_{stg}	-55 to 150	℃
Thermal resistance junction - ambient (free air)	R_{thJA}	159.7	K/W

Notes:

1. Stresses above the ones listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

9.Electrical Characteristics

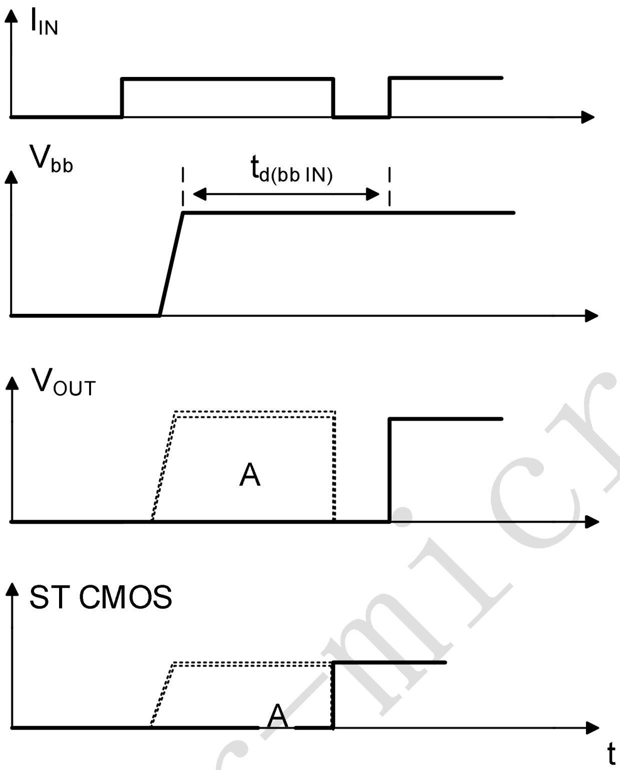
T_J = 25°C, V_{bb}=24V; (unless otherwise specified)

Symbol	Parameter	Test Condition	Values			Unit
			Min	Typ	Max	
R_{ON}	On-state resistance	I_L=1A, T_j=25℃	-	90	150	mΩ
		I_L=1A, T_j=150℃	-	220	300	
$I_{L(NOM)}$	Nominal load current	V_{on}=0.5V	1.4	-	-	A
t_{on}	Turn-ON time	R_L=24Ω, V_{IN}Turn-ON time to 90% V_{OUT}	-	-	130	us
t_{off}	Turn-OFF time	R_L=24Ω, V_{IN}Turn-OFF time to 10% V_{OUT}	-	-	80	us
$dV/dt_{(on)}$	Turn-ON Slew rate	R_L=24Ω, From 10% to 30% V_{OUT}	2	-	10	V/us
$dV/dt_{(off)}$	Turn-OFF Slew rate	R_L=24Ω, From 70% to 40% V_{OUT}	2	-	10	V/us
$V_{bb(on)}$	Operating voltage	T_j=-40...+150℃	4.5		42	V
$V_{bb(under)}$	Undervoltage shutdown	T_j=-40...+150℃	2.9	-	4.3	V
$V_{bIN(u\ rst)}$	Undervoltage restart of charge pump	T_j=-40...+150℃	2.9	-	5.1	V
$\Delta V_{bb(under)}$	Undervoltage threshold	$\Delta V_{bb(under)}=V_{bIN(urst)}-V_{bb(under)}$ T_j=-40...+150℃	-	0.2	-	V
$I_{bb(off)}$	Standby current	V_{IN}=0, I_{ST}=0, T_j=25℃	-	-	23	uA
$I_{L(SCp)}$	Initial peak short circuit current limit	$V_{ON}>V_{ON(SC)}$	-	12	20	A
$I_{L(SCr)}$	Repetitive short circuit current limit		5	-	-	A
$t_{d(SC)}$	Short circuit shutdown delay after input pos. slope	T_j=-40...+150℃	80	-	400	us
$V_{ON(CL)}$	Output clamp (inductive load switch off)	$V_{OUT}=V_{bb}-V_{ON(CL)}$, I_L=30mA	50	60	70	V
T_{jt}	Thermal overload trip temperature	I_L=1A	150	-	-	℃
$V_{bb(over)}$	Overvoltage shutdown	T_j=-40...+150℃	42	-	52	V
$V_{bb(o\ rst)}$	Overvoltage restart	T_j=-40...+150℃	42	-	-	V
$\Delta V_{bb(over)}$	Overvoltage hysteresis	T_j=-40...+150℃	-	0.2	-	V
$V_{bb(AZ)}$	Overvoltage protection	I_{bb}=4mA T_j=-40...+150℃	63	67	-	V
I_{GND}	Operating current	V_{IN}=5V, V_{bb}=42V	-	1	1.5	mA
$-V_{bb}$	Reverse battery voltage		-	-	32	V
$V_{IN(ON)}$	Input turn-on threshold voltage	T_j=-40...+150℃	1.5	-	2.4	V
$V_{IN(OFF)}$	Input turn-off threshold voltage	T_j=-40...+150℃	1.0	-	-	V
ΔV_{IN}	Input threshold hysteresis	T_j=-40...+150℃	0.2	0.5	0.6	V
$I_{IN(OFF)}$	Off state input current	V_{IN}=0.4V	10	-	30	uA
$I_{IN(ON)}$	On state input current	V_{IN}=5V	10	-	50	uA
$t_{d(ST)}$	Status invalid after positive input slope	T_j=-40...+150℃	-	-	1000	us

$I_{L(OL)}$	Open load detection current		-	-	200	mA
$V_{ST(high)}$ $V_{ST(low)}$	Status output (open drain)		4.9 0	- -	6.30 0.4	V

10.Timing diagrams

Figure 1a: Vbb turn on



In case of too early V_{IN}=high the device may not turn on (curve A)

Figure2a:Switching a lamp

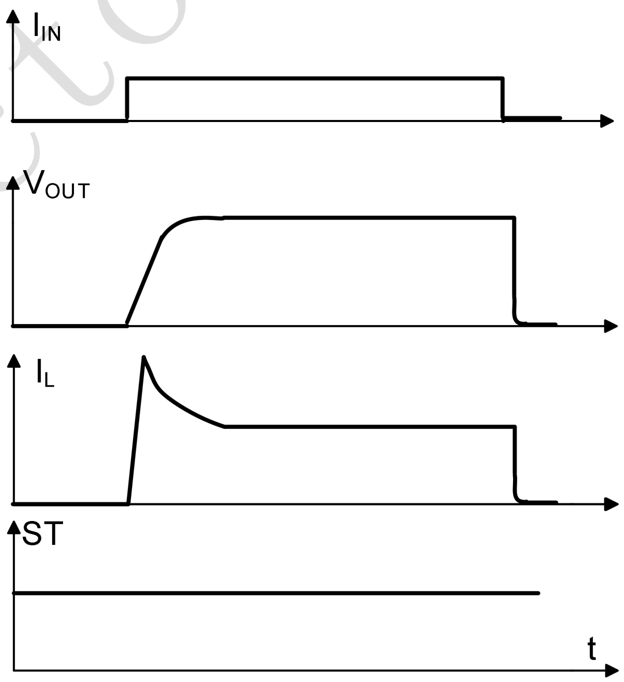


Figure 2b:Switching an inductive load

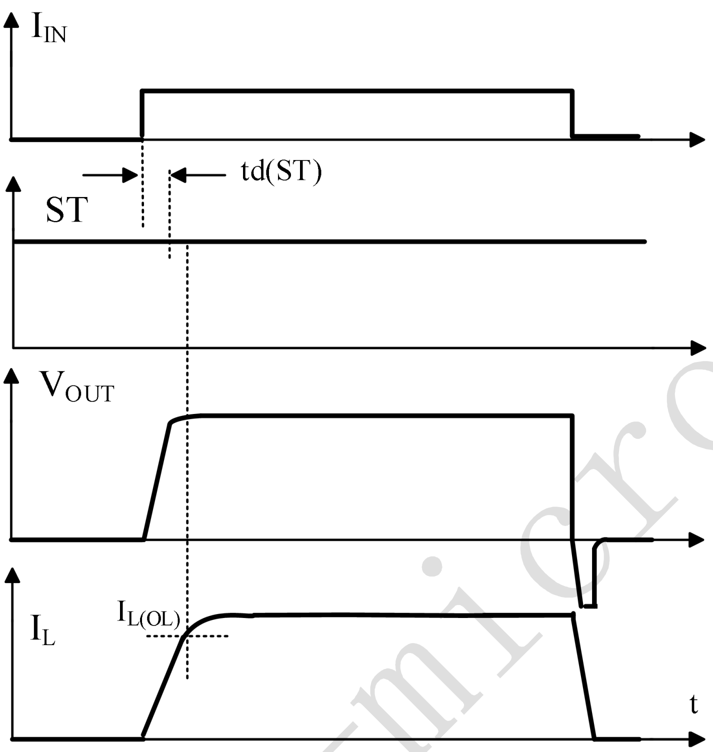
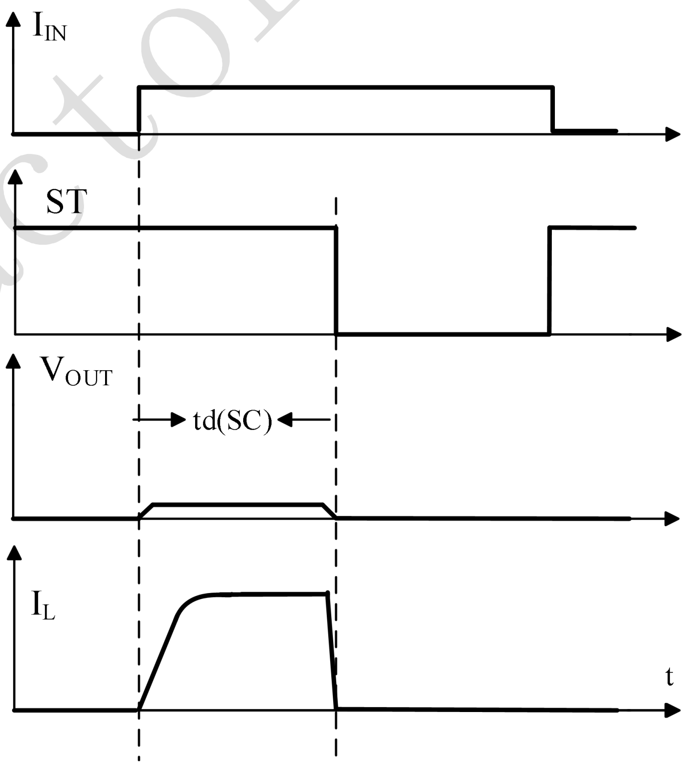


Figure 3a:Short circuit



V_{bb}-V_{OUT}>8.3V, $t_{d(SC)}$=200us

Figure 3b:Turn on into overload

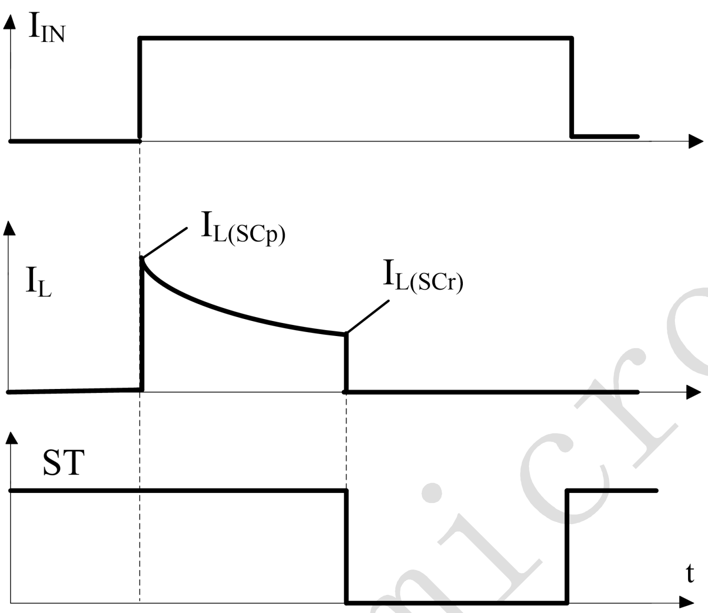


Figure3c: Short circuit while on

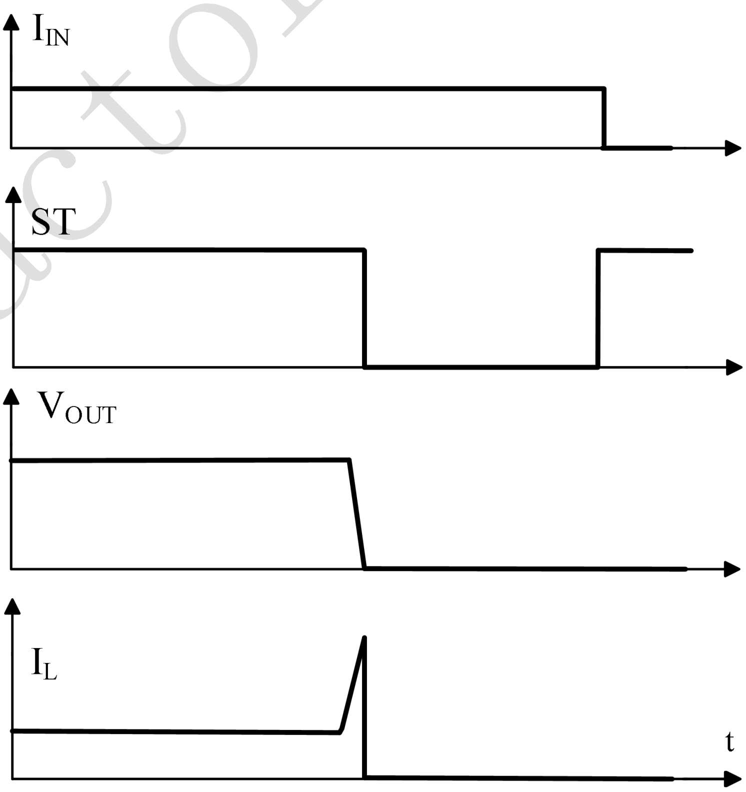


Figure4a: Overtemperature

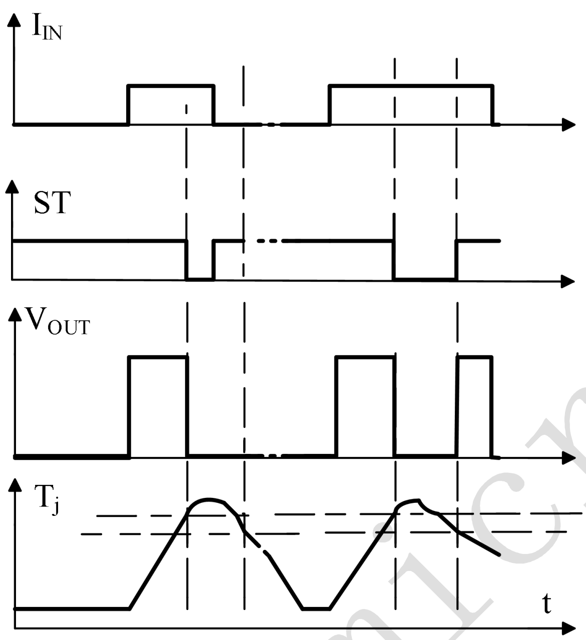


Figure5a: Open load: detection in ON-state, turn on/off to open load

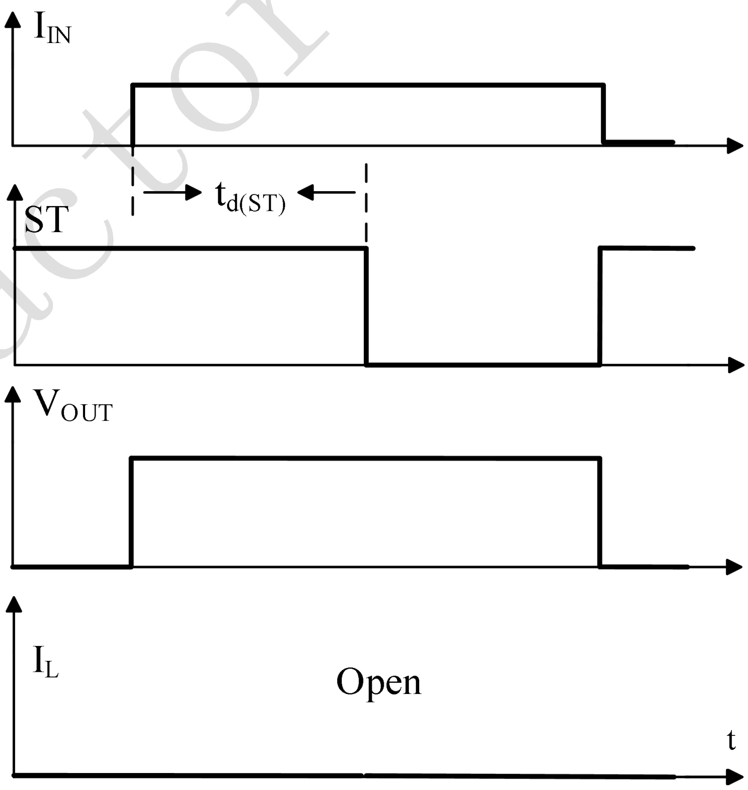


Figure5b:Open load: detection in ON-state, open load occurs in on-state

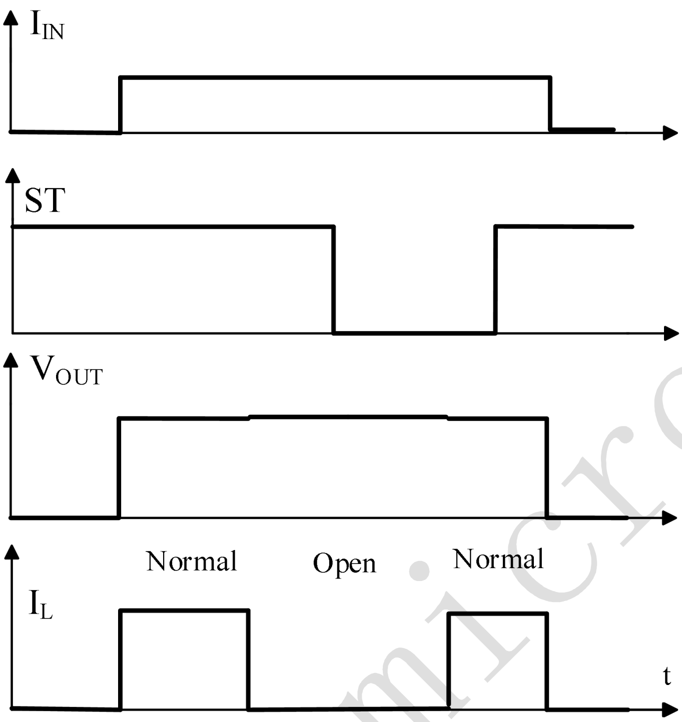


Figure6a: Undervoltage

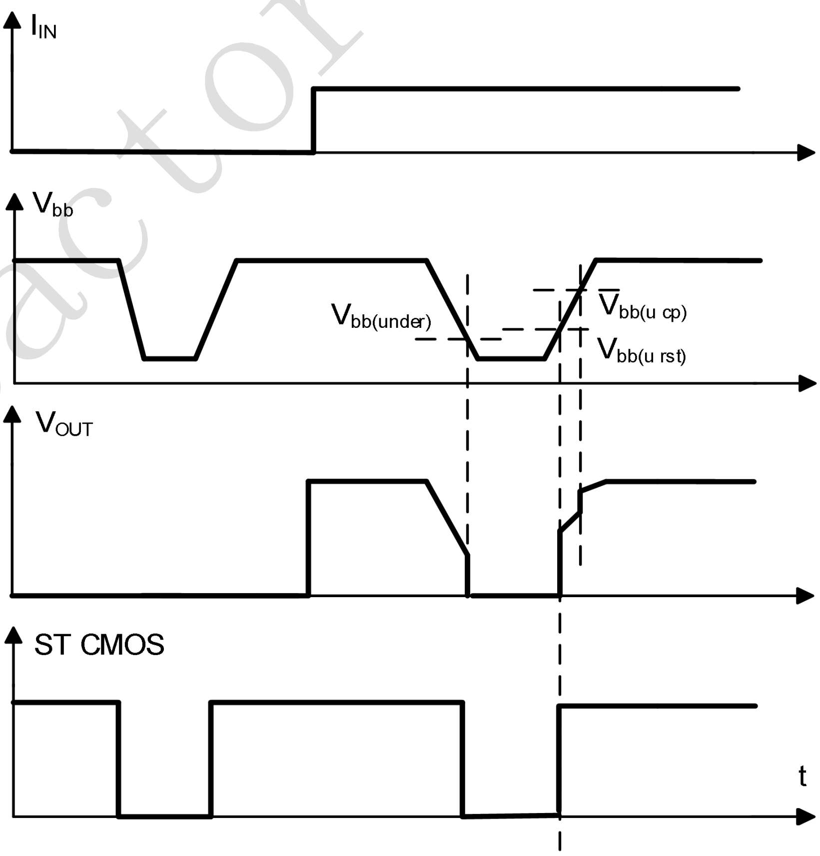


Figure6b:Undervoltage restart of charge pump

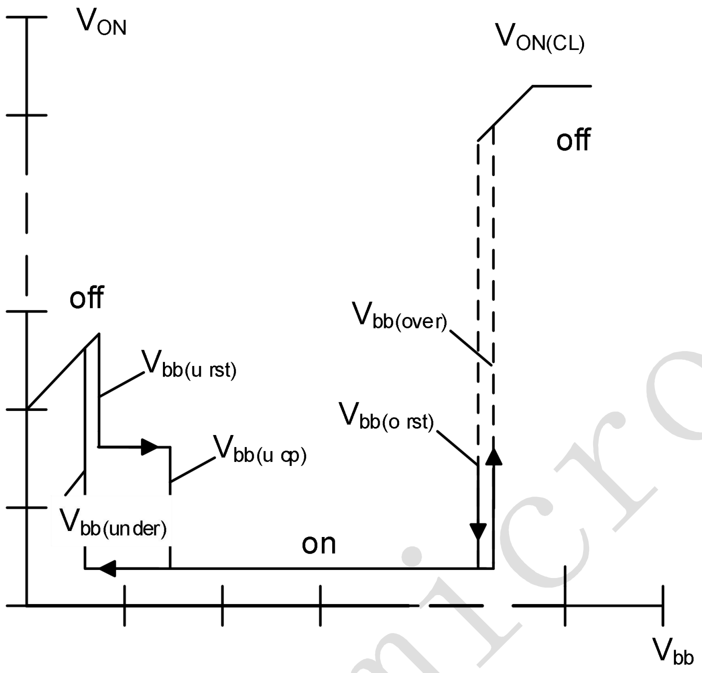
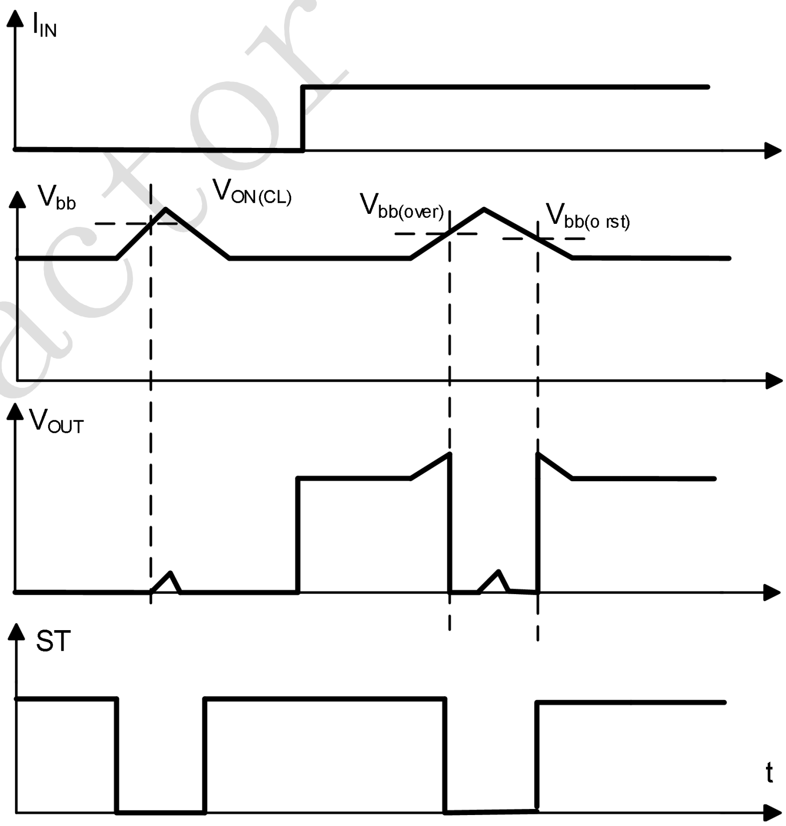


Figure7a: Overvoltage



11.Truth Table

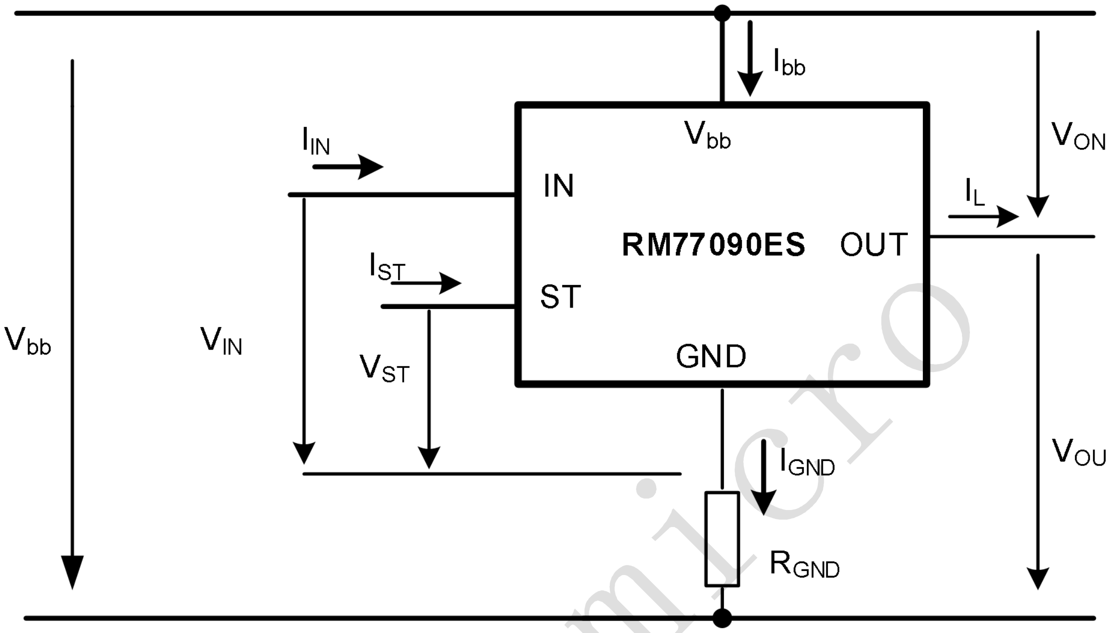
Operation Mode	Input	output	status
Normal operation	L H	L H	H H
Open Load	L H	Z[1)] H	H L
Short circuit to GND	L H	L L	H L
Short circuit to Vbb	L H	H H	H L[2)]
Overtemperature	L H	L L	H L
Undervoltage	L H	L L	L[3)] L[3)]
Overvoltage	L H	L L	H H

L = "Low" Level, H = "High" Leve

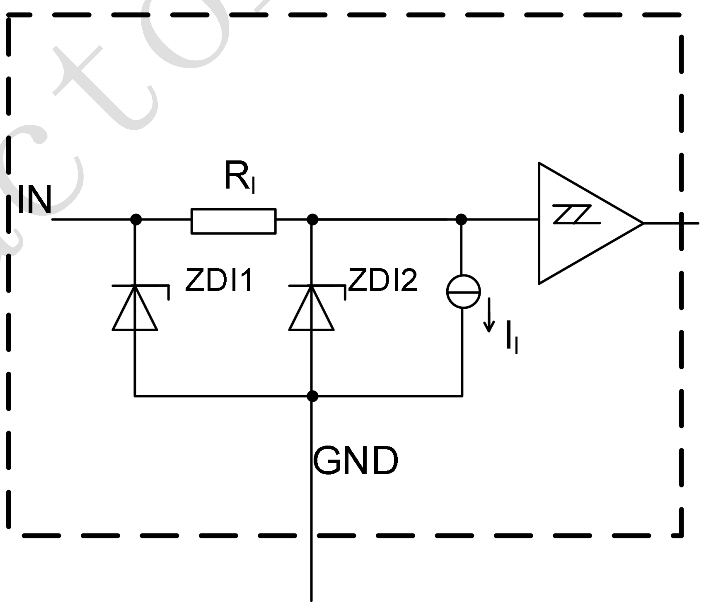
1) Power Tube Off, Output High Resistance
2) When the low resistance is short of vbb and out, it can be detected by the open circuit detection function
3) Undervoltage shutdown without sinking current capability

12.Functions

12.1 Terms

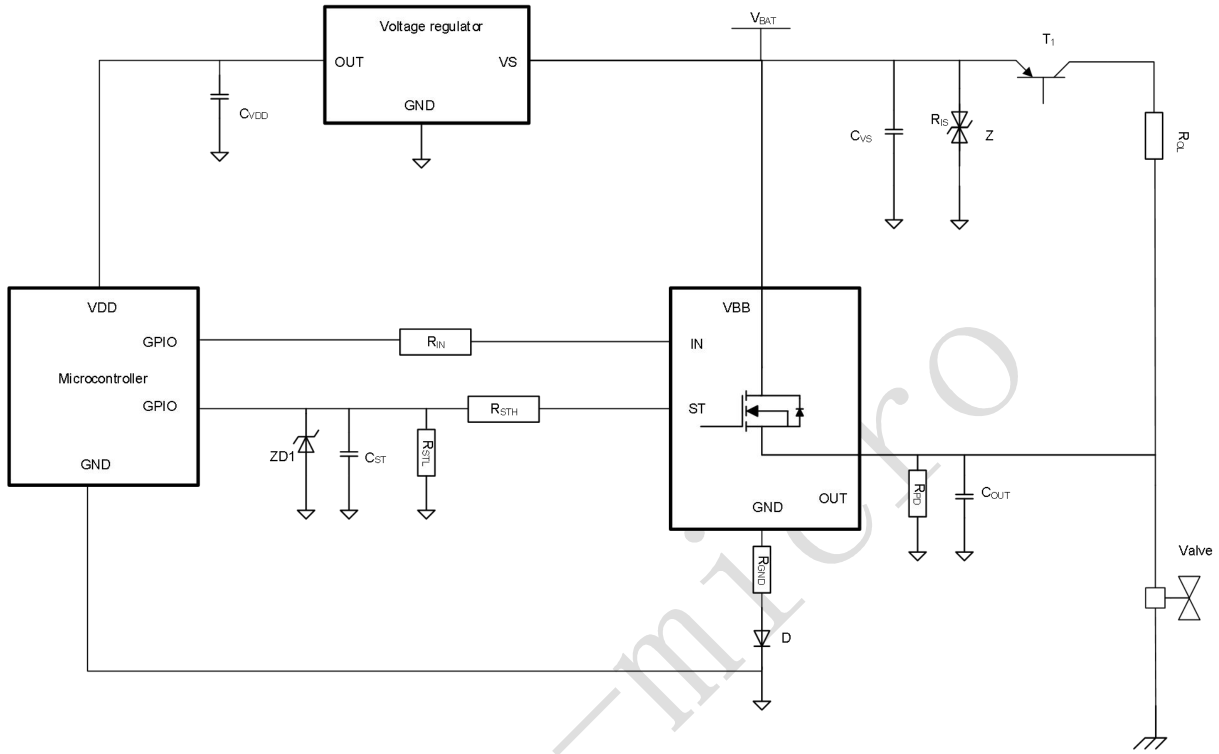


12.2 Input circuit (ESD protection)



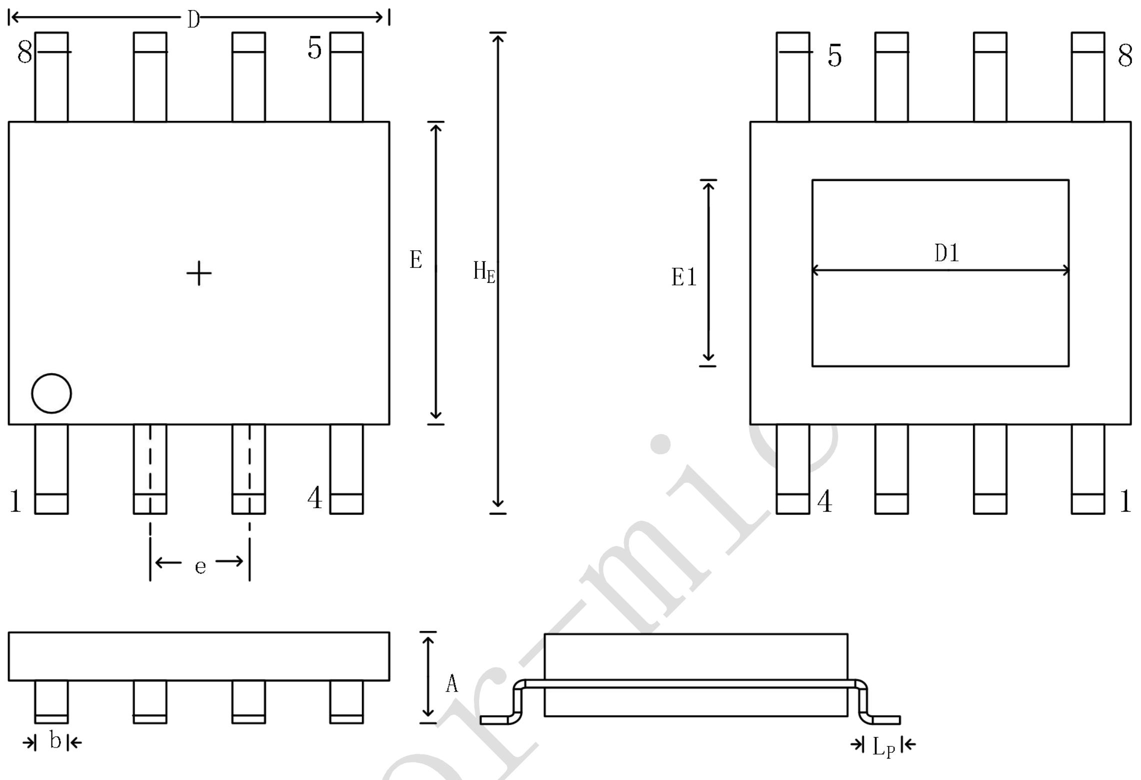
The use of ESD zener diodes as voltage clamp at DC conditions is not recommended.

13.Application Information



14.Package

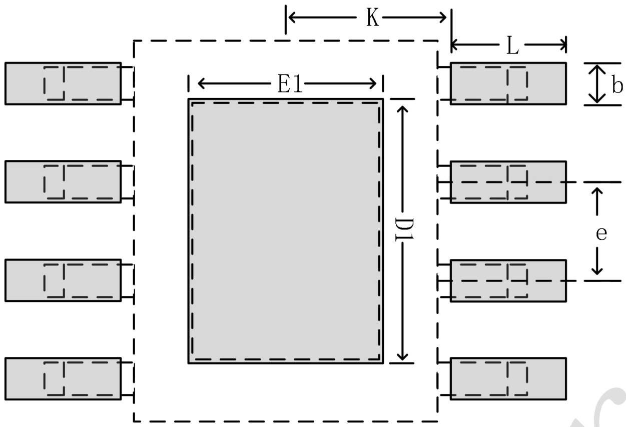
ESOP8L



Unit :mm

Symbol	MIN	NOM	MAX
D	4.70	4.90	5.10
E	3.70	3.90	4.10
H_E	6	6.20	6.40
e	1.27BSC		
D1	3.10	3.30	3.50
E1	2.20	2.40	2.60
A	1.35	1.55	1.75
b	0.35	0.42	0.49
L_P	0.40	0.825	1.25

15.Recommended Soldering Footprint



Unit : mm

Symbol	NOM	Symbol	NOM
e	1.27	D1	3.6
b	0.6	E1	2.7
L	1.8	K	2.1

16.Revision History

Version	Change Description	Date
1.0	Initial Version	2024/08/16