Smart High-Side Power Switch
RM7601KSS Datasheet

1.Basic Features

- Current controlled input
- Overload protection
- Current limitation
- Short circuit protection
- Over temperature protection
- Over voltage protection
- Clamp of inductive loads
- Fast demagnetization of inductive loads
- Very low standby current
- Green product(RoHS compliant)
- AEC-Q100 qualified
- Electrostatic discharge (ESD) protection

2.Description

RM7601KSS is a smart high-side 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.

RM7601KSS 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

- Current controlled power switch for 12V, 24V and 42V DC application
- All types of resistive, inductive and capacitive loads
- Replaces electromechanical relays, fuses and discrete circuits

4.Product Summary

Overvoltage protection	$V_{bb(AZ)}$	62	V
Operating voltage	$V_{bb(ON)}$	4.9...60	V
On-state resistance	R_{ON}	800	mΩ
Nominal load current	$I_{L(NOM)}$	0.2	A
Short circuit current limit	$I_{L(SCP)}$	1.3	A

5.Ordering Code

Product	Package	Marking	Materials	Package			Package Qty
RM7601KSS	SOT-223	RM7601KSS	Halogen free	Tape&reel	10 reels /box	30k/ box	3000/reel

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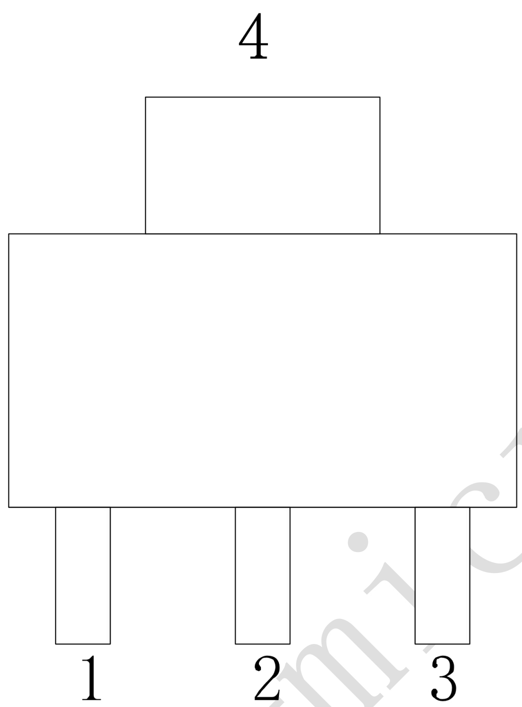
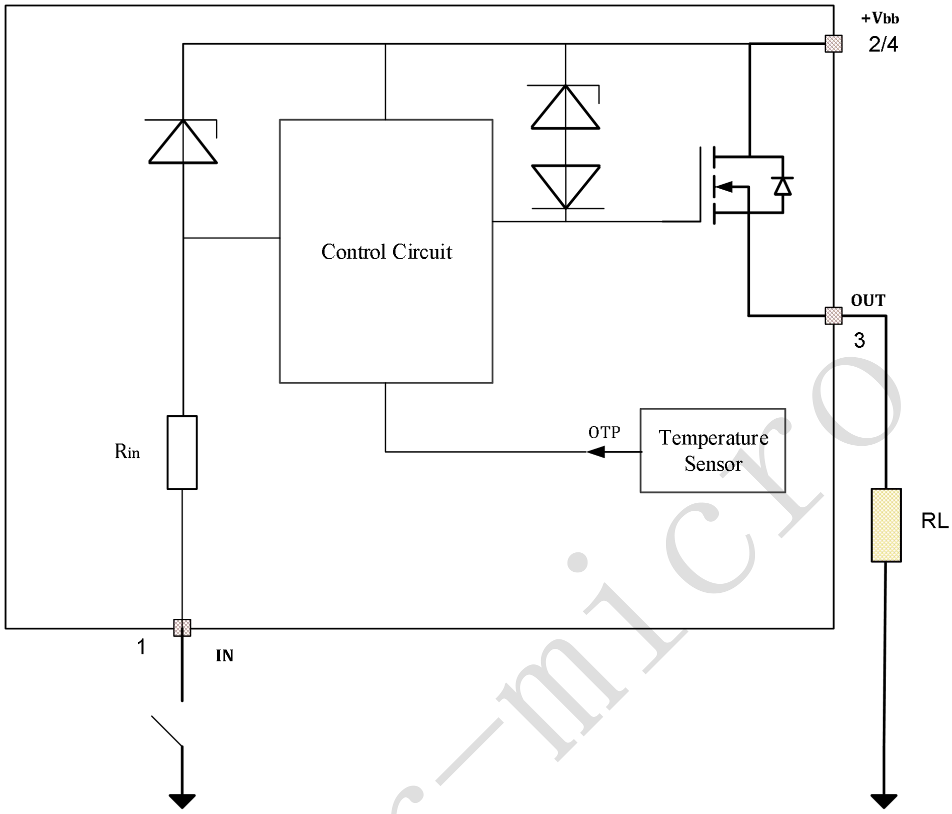
6.Pin Configuration



Pin	Symbol	Function
1	IN	Input; activates the power switch in case of connection to GND.
2	Vbb	Supply Voltage; positive power supply voltage
3	OUT	Output; output to the load
4	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_{bb}	60	V
Load dump protection $V_{LoadDump}$ = V_A+Vs, V_{bb} = 13.5V, R_I = 2Ω, t_d = 400ms, IN = low or high	$V_{Loaddump}$	93.5	V
Power dissipation(DC)	P_{tot}	1.7	W
Ambient temperature	T_a	-40 to 125	℃
Junction temperature	T_j	-40 to 150	℃
Storage temperature	T_{stg}	-55 to 150	℃

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 = -40°C to +150°C, V_{bb} = 24V; (unless otherwise specified)

Symbol	Parameter	Test Condition	Values Min	Values Typ	Values Max	Unit
$I_{bb(off)}$	Standby current	PIN1 = open, T_j = 150℃	-	2	10	uA
R_{dson}	On-state resistance	V_{bb} = 9...52V, I_L = 150mA, T_j = 25℃	-	0.8	1.5	Ω
		V_{bb} = 9...52V, I_L = 150mA, T_j = 150℃	-	1.1	3	Ω
$V_{bb(on)}$	Operating voltage	R_{load} = 270Ω	4.9	-	60	V
$I_{L(nom)}$	Nominal load current	T_a = 85℃, T_j<150℃	0.2	-	-	A
I_{off}	Off state Input current	V_{out}≤0.5V, R_L = 270Ω, T_j = 25℃	-	-	0.15	mA
I_{on}	On state Input current	V_{out}≥13V, R_L = 270Ω, T_j = 25℃	-	0.1	1	mA
$V_{bIN(u)}$	Undervoltage protection	V_{IN} = 5V, R_{load} = 270Ω	3.5	-	4.5	V
$V_{bb(ucp)}$	Undervoltage restart of charge pump	V_{IN} = 5V, R_{load} = 270Ω	3.85	-	4.8	V
T_{jt}	Thermal overload trip temperature	V_{bb} = 13.5V, V_{IN} = 5V, R_{load} = 65Ω	150	-	-	℃
$V_{bbin(AZ)}$	Overvoltage protection	I_{bb} = 1mA	62	68	-	V
$I_{L(SCp)}$	Initial peak Short circuit current limit	T_m = 100us, V_{bb} = 13.5V	0.2	1.3	2	A
$V_{ON(CL)}$	Output clamp (inductive load switch off)	V_{out} = V_{bb}-$V_{ON(CL)}$, I_{bb} = 4mA	60	-	-	V
E_{AS}	Inductive load switch-off energy dissipation	I_L = 150mA	1	-	-	J
t_{on}	Turn-ON time	V_{bb} = 13.5V, R_L = 270Ω, T_j = 25℃, V_{IN} = (V_{bb} to 0V) to 90%V_{OUT}	-	30	100	us
t_{off}	Turn-OFF time	V_{bb} = 13.5V, R_L = 270Ω, T_j = 25℃, V_{IN} = (0V to V_{bb}) to 10%V_{OUT}	-	30	140	us
t_{on_delay}	Turn-ON delay time	V_{bb} = 13.5V, R_L = 270Ω, T_j = 25℃, V_{IN} = (V_{bb} to 0V) to 10%V_{OUT}	-	20	100	us
t_{off_delay}	Turn-OFF delay time	V_{bb} = 13.5V, R_L = 270Ω, T_j = 25℃, V_{IN} = (0V to V_{bb}) to 90%V_{OUT}	-	20	100	us
dv/dt_{on}	Slew rate on	V_{bb} = 13.5V, R_L = 270Ω, T_j = 25℃, From 10% to 30% V_{OUT}	-	2.5	4	V/us
$-dv/dt_{off}$	Slew rate off	V_{bb} = 13.5V, R_L = 270Ω, T_j = 25℃, From 70% to 40% V_{OUT}	-	1.7	4	V/us

$-V_{on}$	Drain-source diode voltage	I_F = 0.2A, I_{in}≤0.05mA	-	-	1.2	V
I_S	Continuous reverse drain current	T_j = 25℃	-	-	0.2	A

10.Timing diagrams

Figure 1: V_{bb} turn on

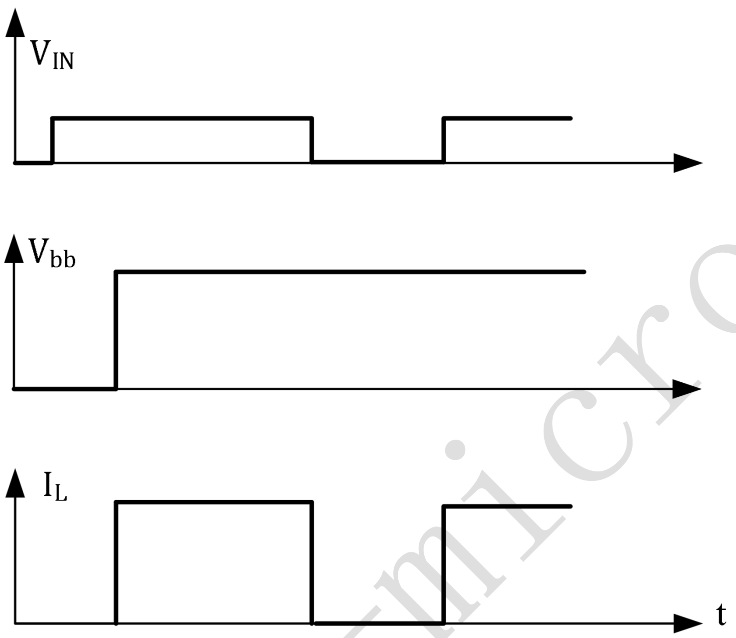


Figure 2a: Switching a resistive load, turn on/off time and slew rate definition

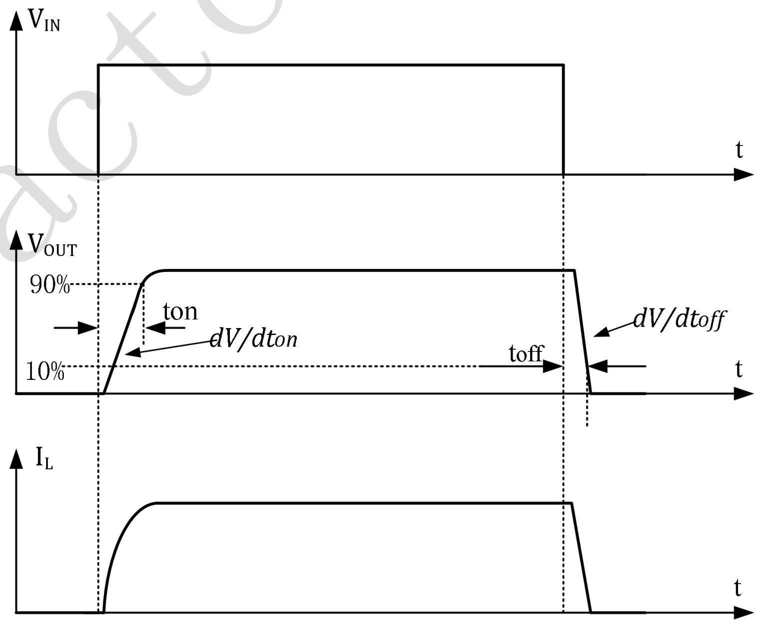


Figure 2b: Switching a lamp

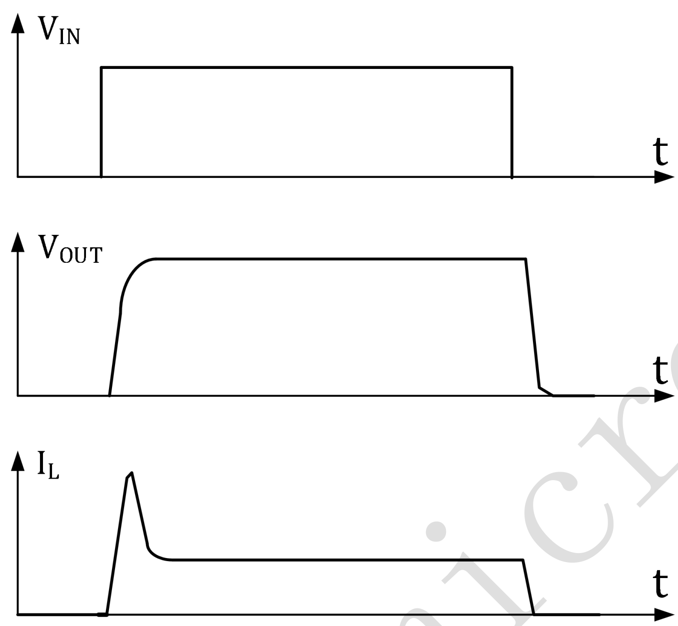


Figure 2c: Switching an inductive load

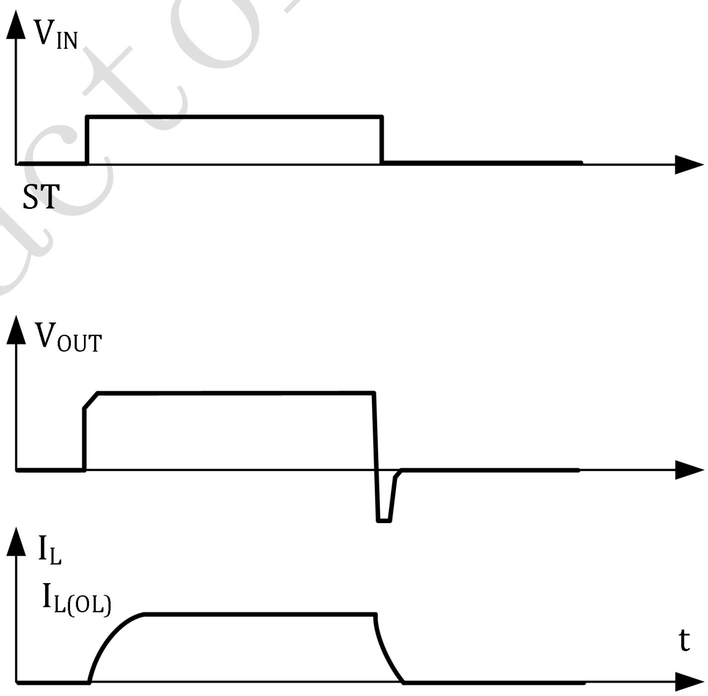


Figure 3a: Turn on into short circuit, shut down by overtemperature, restart by cooling

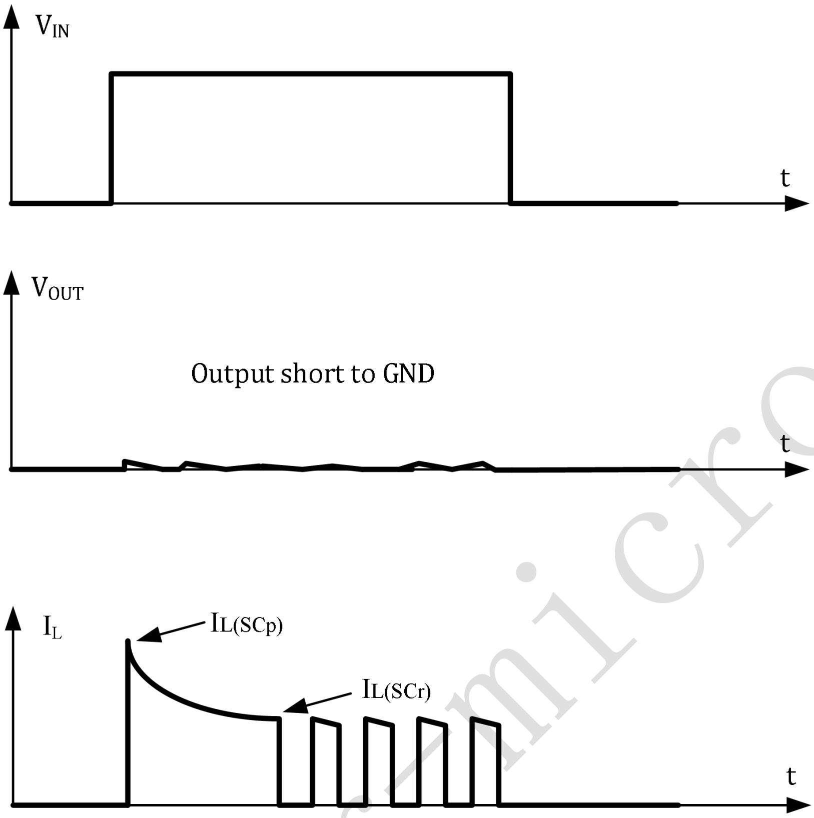


Figure 3b:Short circuit in on-state shut down by overtemperature, restart by cooling

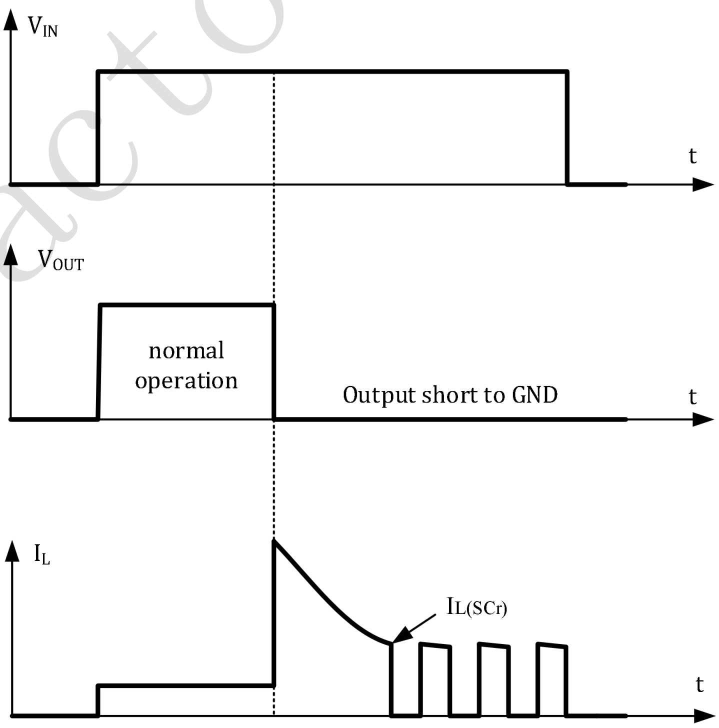
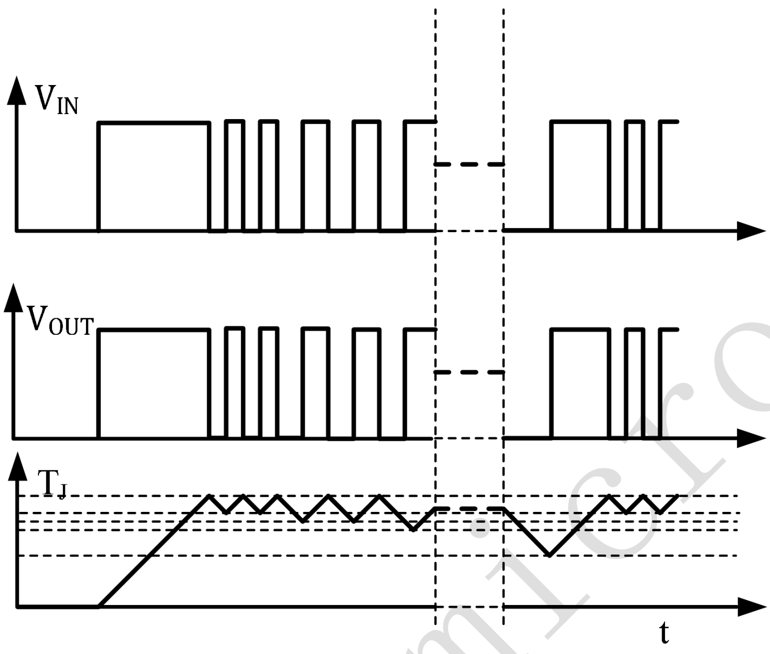
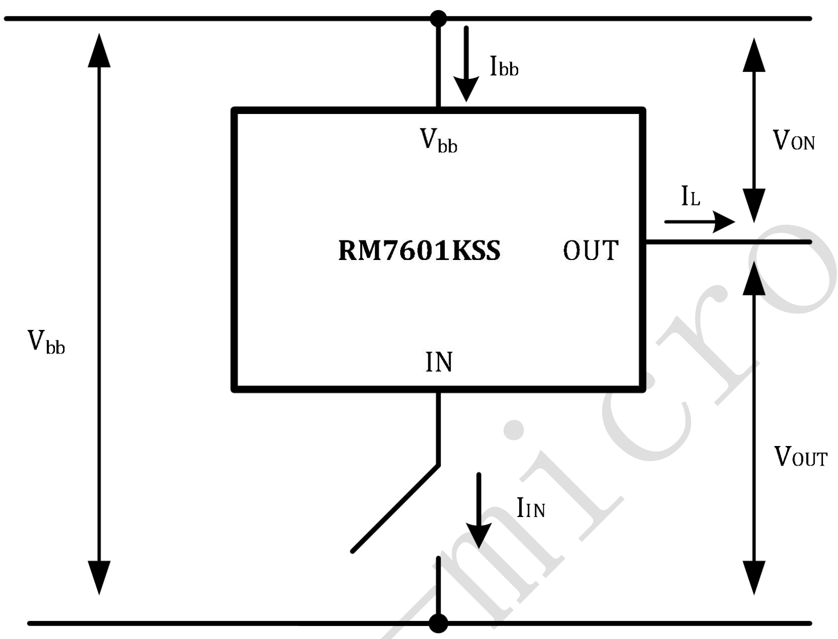


Figure 4a:Overtemperature

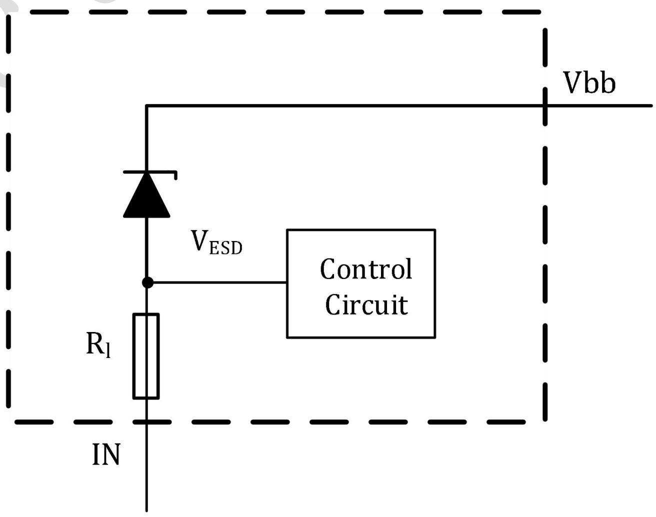


11.Functions

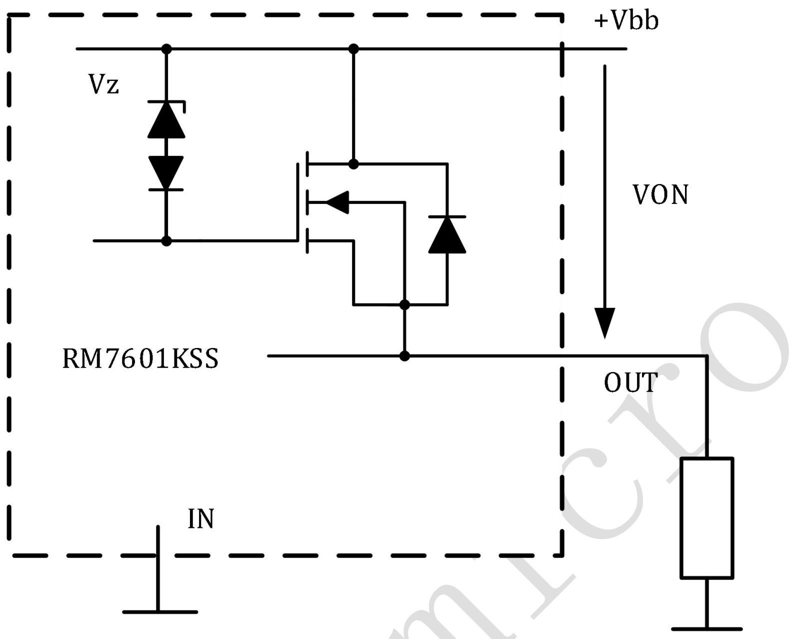
11.1 Terms



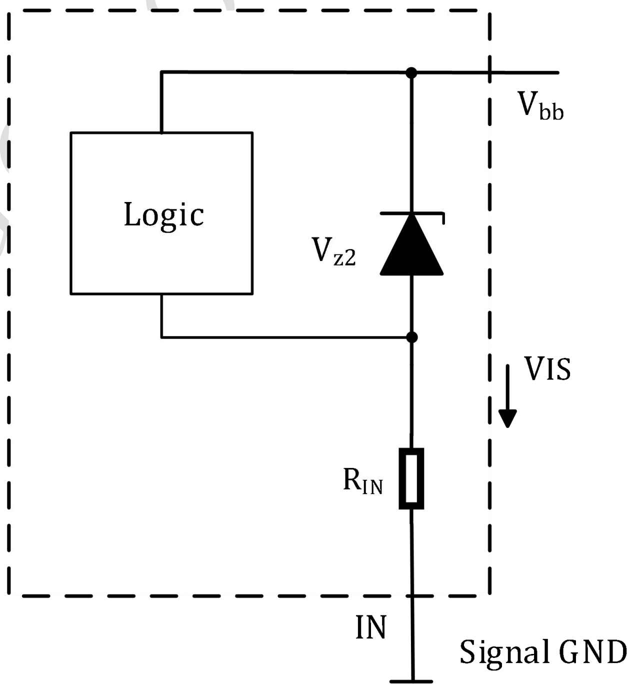
11.2 Input circuit (ESD protection)



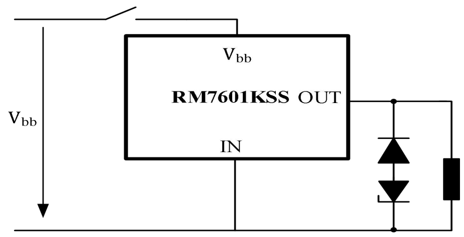
11.3 Inductive and overvoltage output clamp

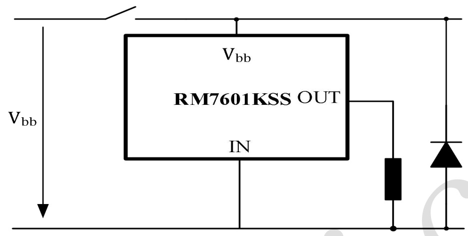


11.4 Overvoltage protection of logic part

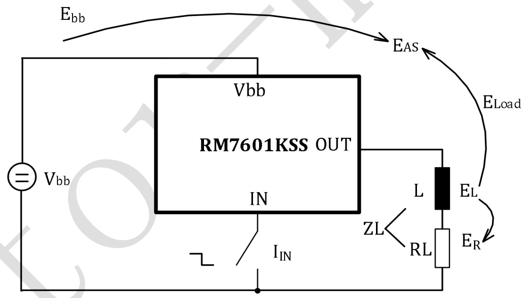


11.5 V_{bb} disconnect with charged inductive load





11.6 Inductive load switch-off energy dissipation



Energy stored in load inductance:

$$E_L = 1/2 * L * I_L^2$$

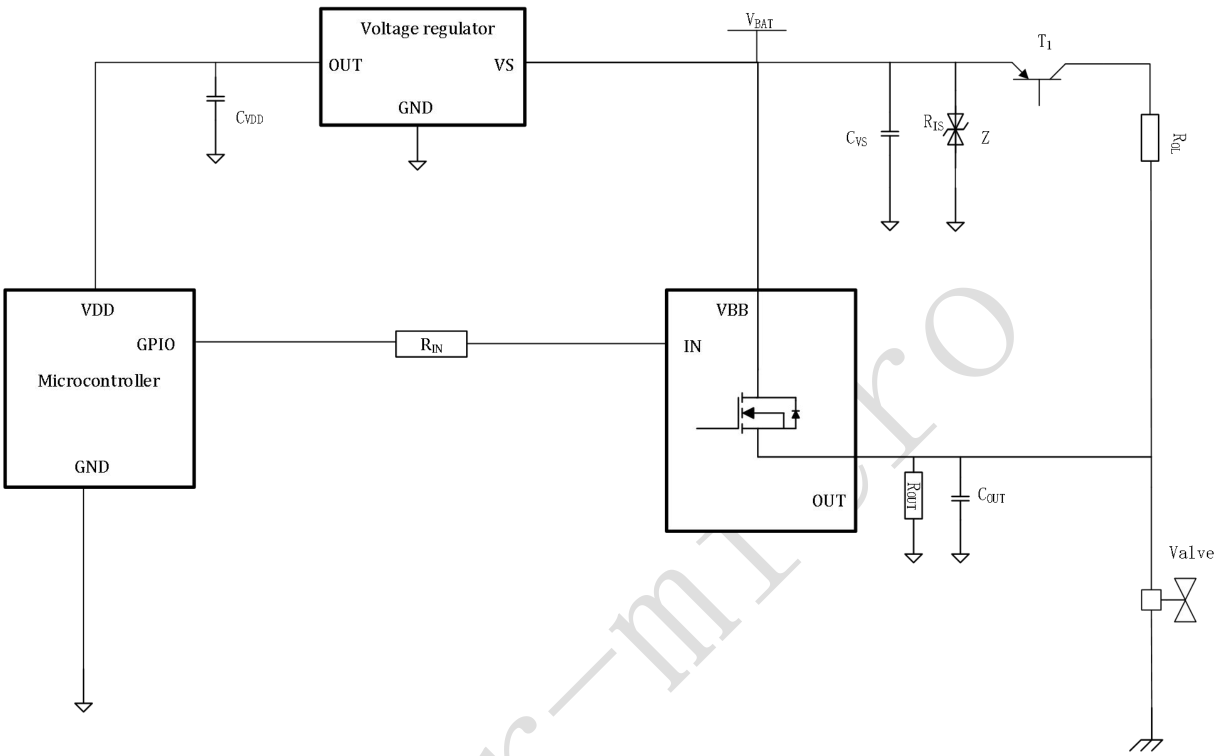
While demagnetizing load inductance, the energy dissipated in RM7601KSS is :

$$E_{AS} = E_{bb} + E_L - E_R = \int V_{ON(CL)} * i_L(t)dt$$

with an approximate solution for RL > 0Ω:

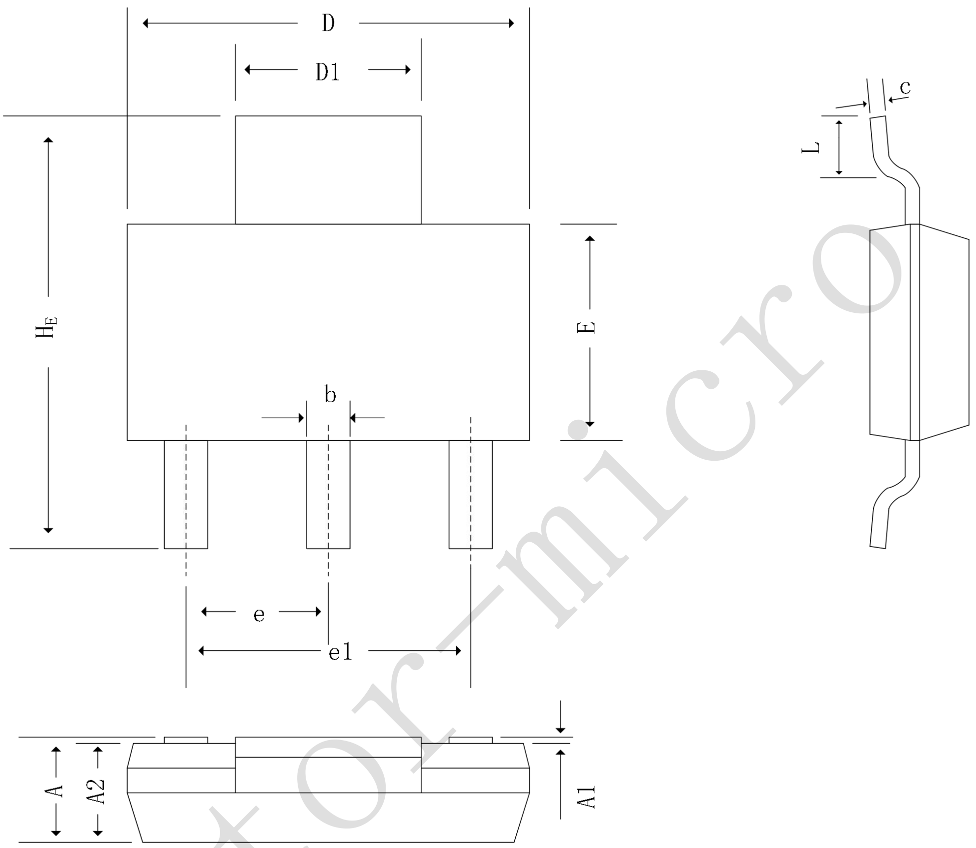
$$E_{AS} = \frac{I_L * L}{2R_L}(V_{bb} + |V_{OUT(CL)}|)\ln(1 + \frac{R_L * I_L}{|V_{OUT(CL)}|})$$

12.Application Information



13.Package

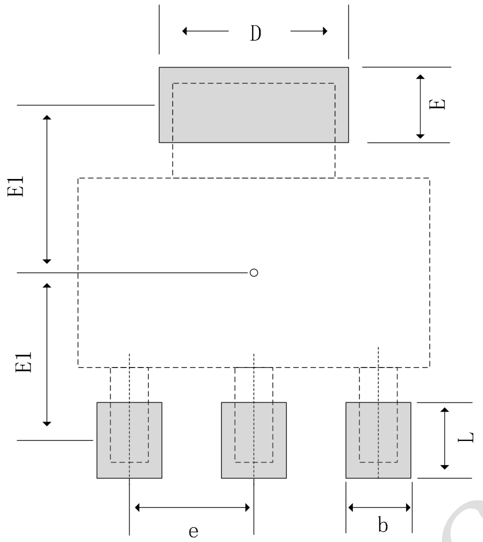
SOT-223



Unit :mm

Symbol	MIN	NOM	MAX
A	/	/	1.80
A1	0.02	/	0.10
A2	1.50	1.60	1.70
b	0.66	0.71	0.84
c	0.23	0.30	0.35
D	6.30	6.50	6.70
D1	2.90	3.00	3.10
E	3.30	3.50	3.70
H_E	6.70	7.00	7.30
e	2.300(BSC)		
e1	4.600(BSC)		
L	0.750	/	/

14.Recommended Soldering Footprint



Unit:mm

Symbol	NOM	Symbol	NOM
D	3.5	E	1.4
E1	3.1	L	1.4
b	1.2	e	2.3

15.Revision History

Version	Change Description	Date
1.0	Initial Version	2024/08/13