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, current controlled input. 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

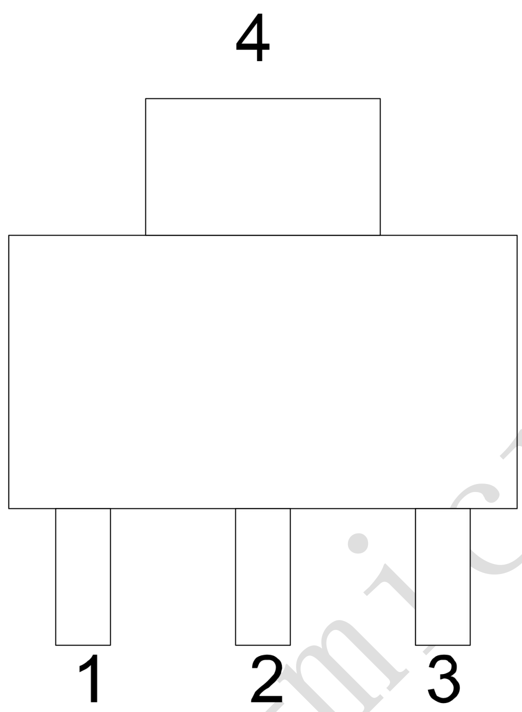
Over voltage protection	$V_{bb(AZ)}$	62	V
Operating voltage	$V_{bb(ON)}$	4.9...60	V
On-state resistance	R_{ON}	800	mΩ
Nominal load current	$I_{L(NOM)}$	0.2	A
Short circuit current limit	$I_{L(SCP)}$	1.3	A

5.Ordering Code

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

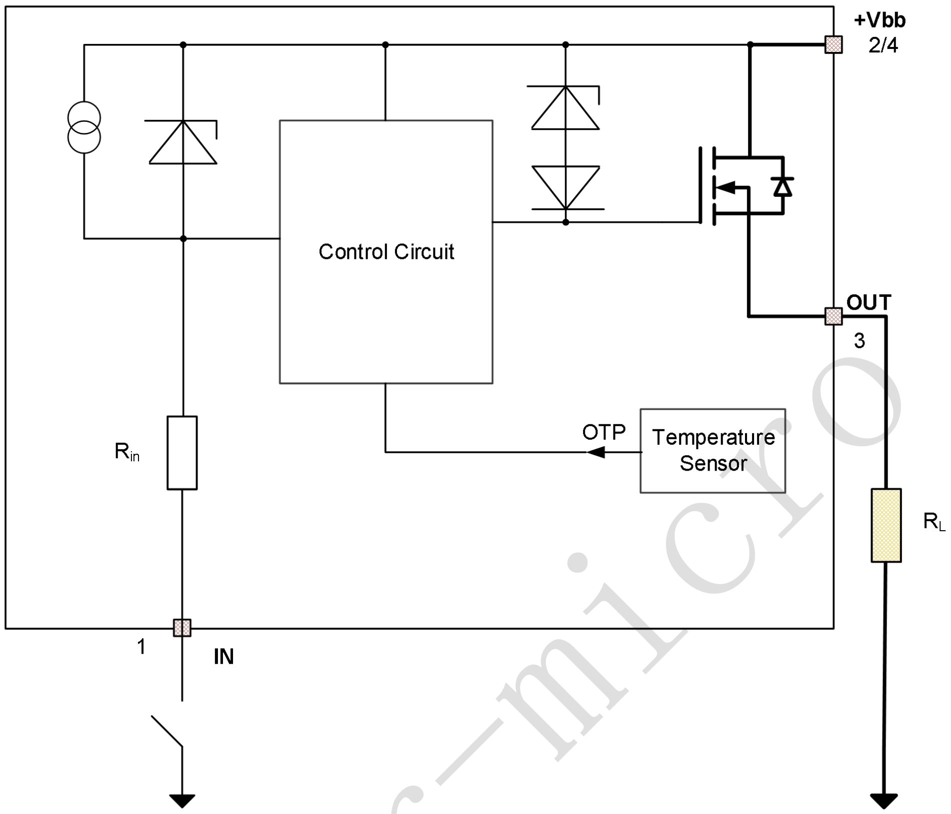
Table of Contents

6.Pin Configuration



Pin	Symbol	Function
1	IN	Input; activates the power switch in case of connection to GND.
2/4	V_{bb}	Supply Voltage; positive power supply voltage
3	OUT	Output; output to the load

7.Block Diagram



8.Absolute Maximum Ratings

T_J=25°C; (unless otherwise specified)

Parameter	Symbol	Values	Unit	Note or Test Condition
Supply voltage	V_{bb}	60	V	
Load dump protection	$V_{Loaddump}$	93.5	V	$V_{LoadDump}=V_A+V_s$, V_{bb}=13.5V, R_I=2Ω, I_L=150mA t_d=400ms, IN=low or high,
Maximum current through the input pin (DC)	I_{IN}	-15 to 15	mA	
Power dissipation(DC)	P_{tot}	1.3	W	T_A=25°C
Ambient temperature	T_a	-40 to 125	℃	
Junction temperature	T_j	-40 to 150	℃	
Storage temperature	T_{stg}	-55 to 150	℃	
Thermal resistance junction-ambient (free air):	R_{thJA}	36	K/W	T_A=100°C
Thermal resistance chip-case	R_{thJC}	20.84	K/W	
Inductive load switch-off energy dissipation	E_{AS}	1	J	I_L=150mA

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			Unit
			Min	Typ	Max	
$I_{bb(off)}$	Standby current	IN=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℃	-	1.5	3	Ω
$V_{bb(on)}$	Operating voltage	R_L=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℃	-	0.4	1	mA
$V_{bb(u)}$	Undervoltage protection	V_{IN}=5V, R_L=270Ω	3.5	-	4.5	V
$V_{bb(ucp)}$	Undervoltage restart of charge pump	V_{IN}=5V, R_L=270Ω	3.85	-	4.9	V
T_{jt}	Thermal overload trip temperature	V_{bb}=13.5V, V_{IN}=5V, R_L=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
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
d_V/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
$-d_V/dt_{off}$	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

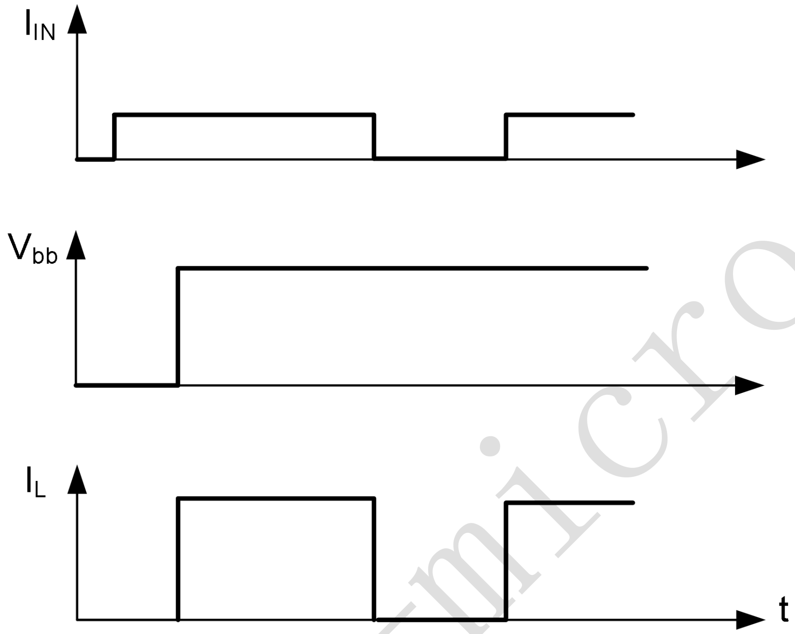


Figure 2a: Switching a resistive load, turn on/off time and slew rate definition

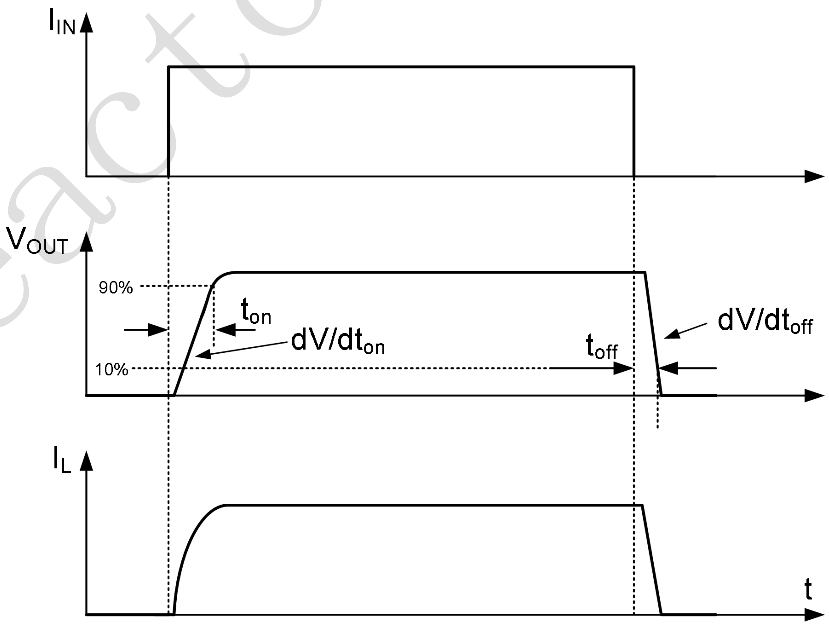


Figure 2b: Switching a lamp

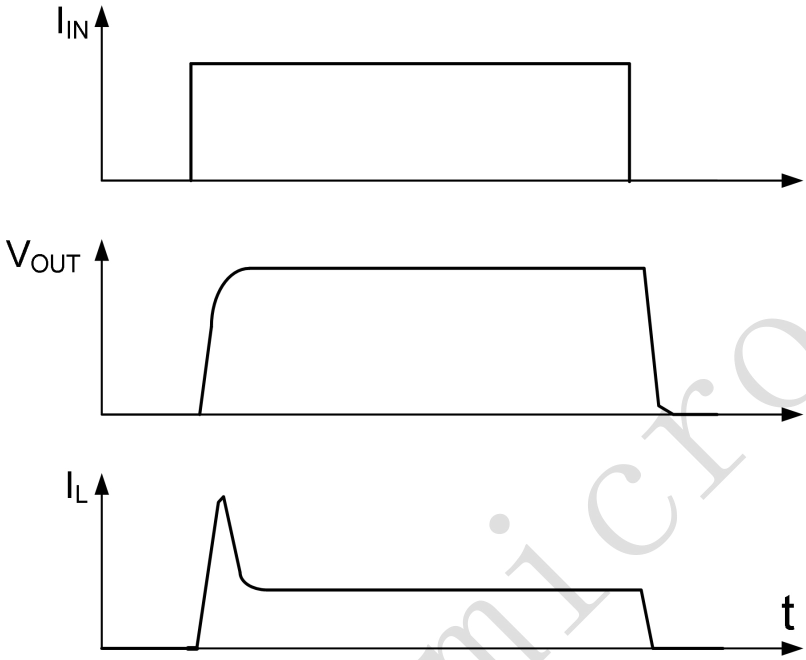


Figure 2c: Switching an inductive load

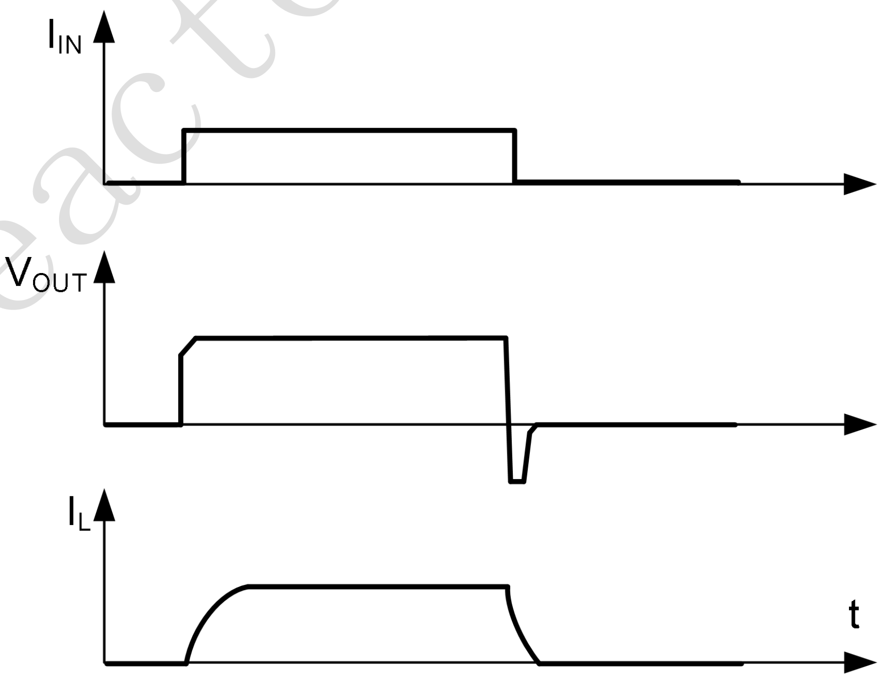


Figure 3a: Turn on into short circuit, shut down by overtemperature, restart by cooling

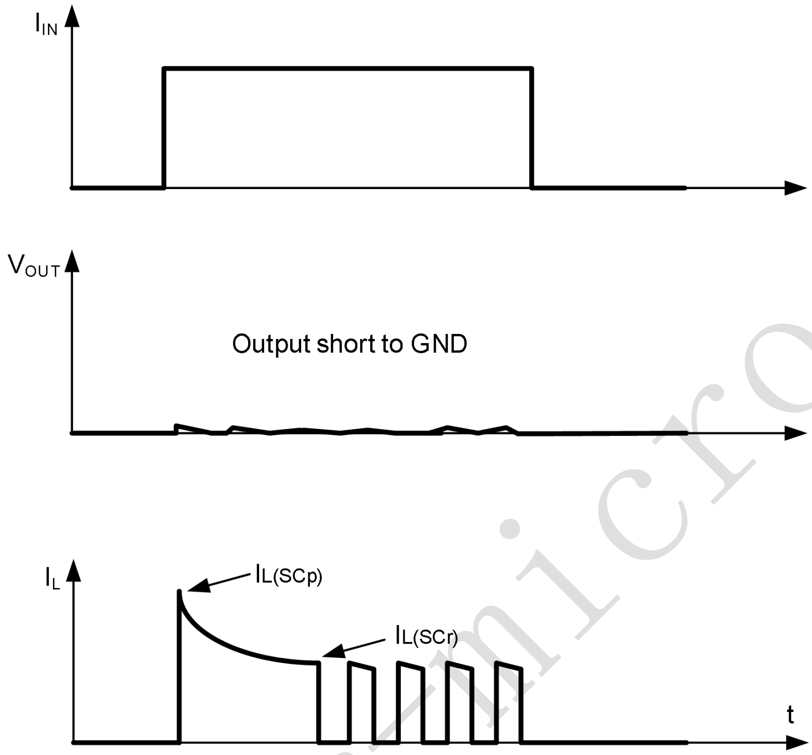


Figure 3b:Short circuit in on-state shut down by overtemperature, restart by cooling

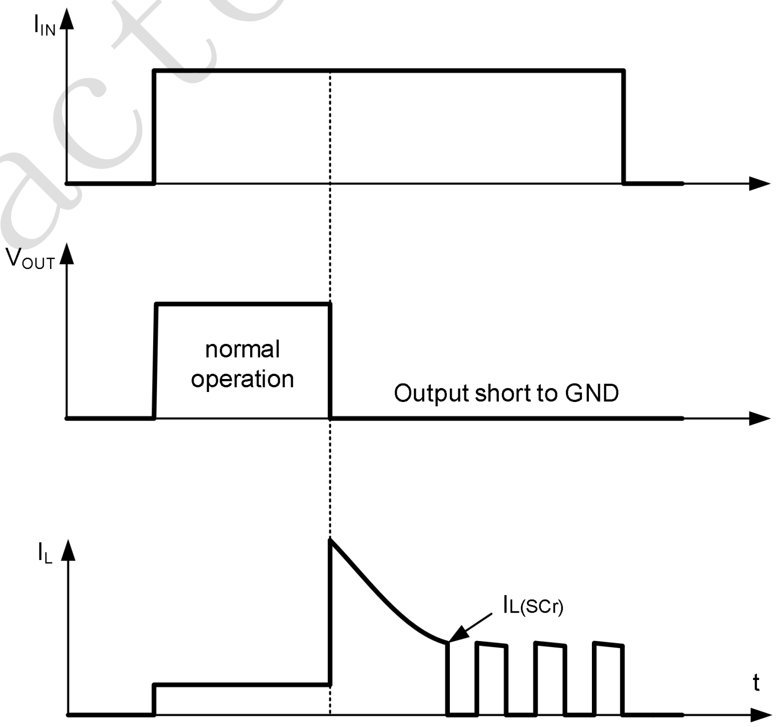
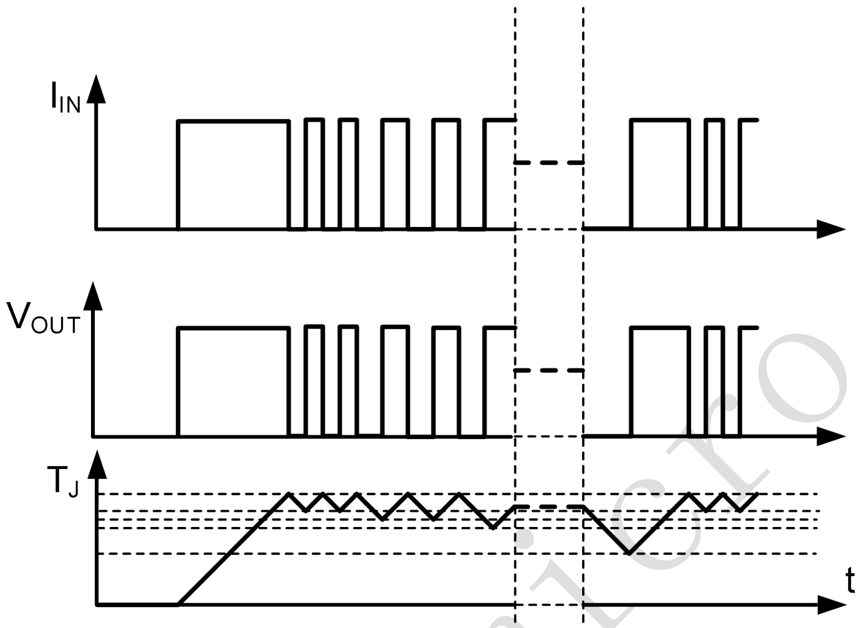
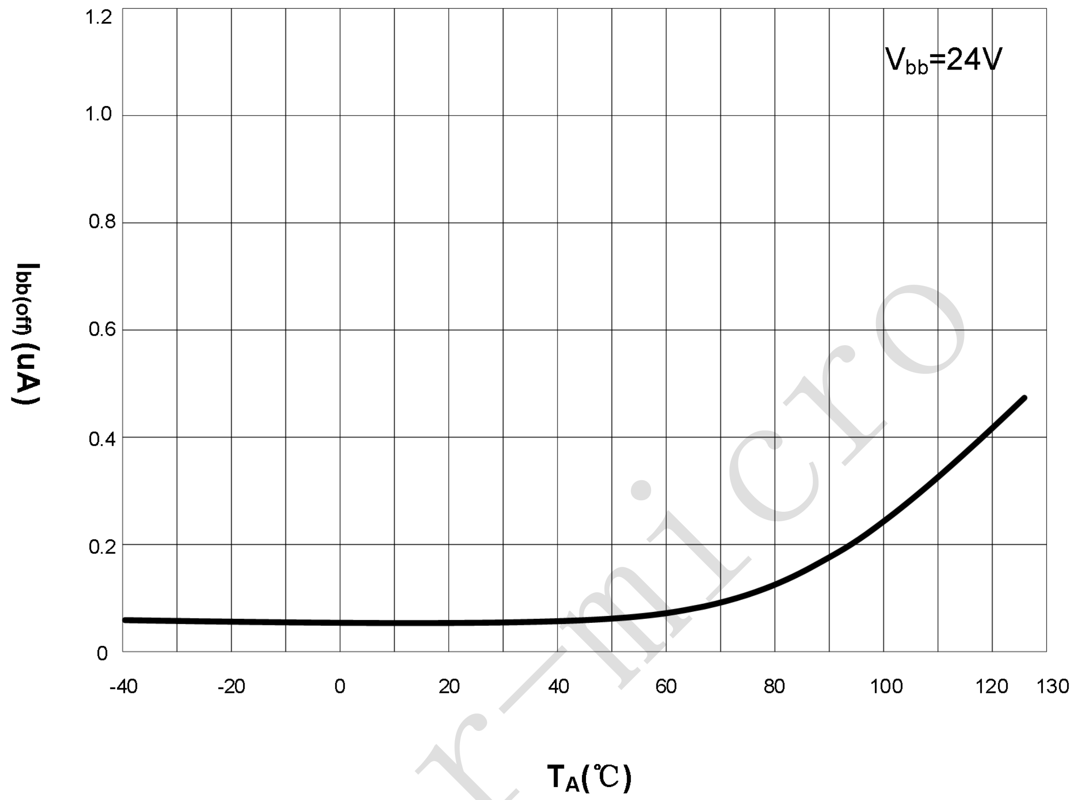


Figure 4a:Overtemperature

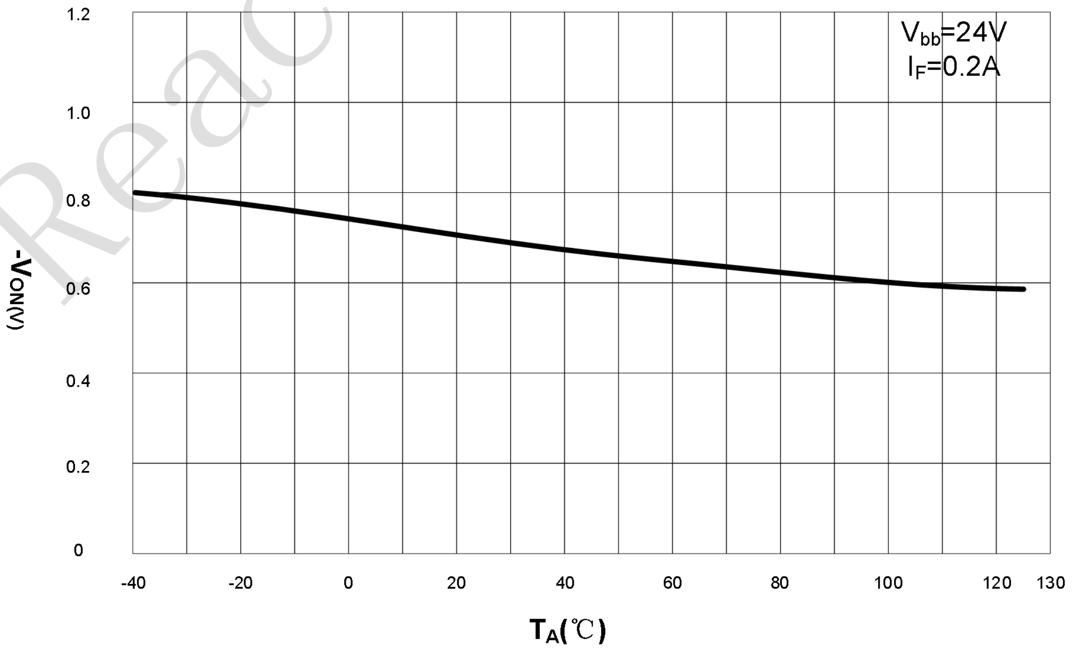


11.General Product Characteristics

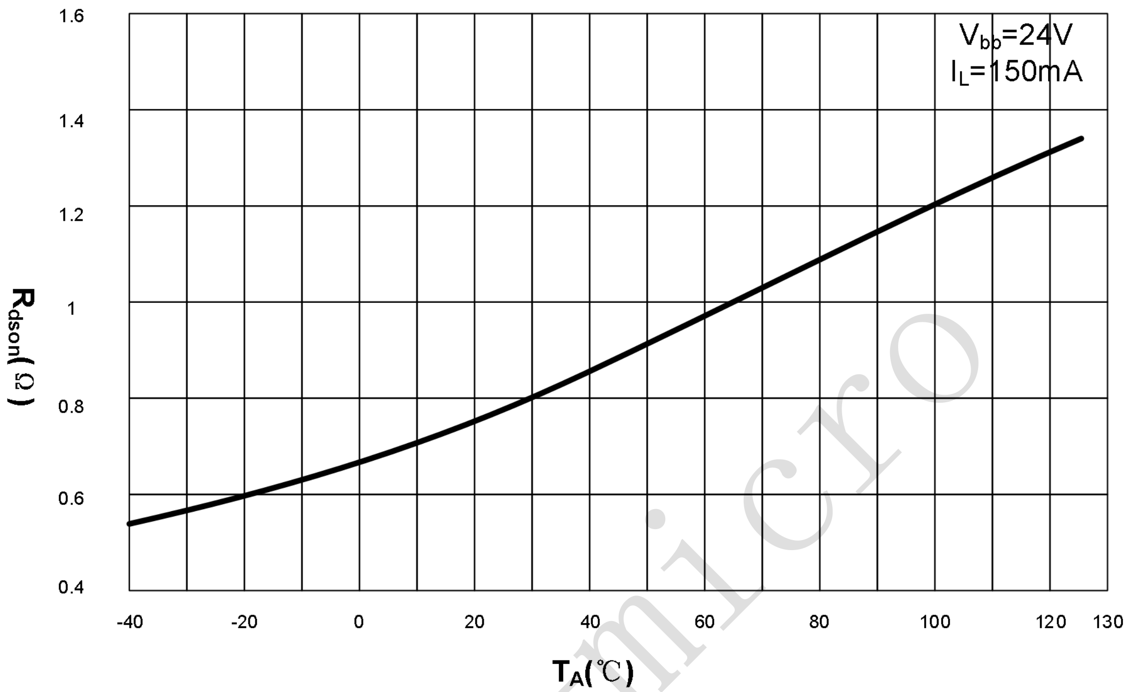
11.1 Standby Current



11.2 Drain-source diode voltage

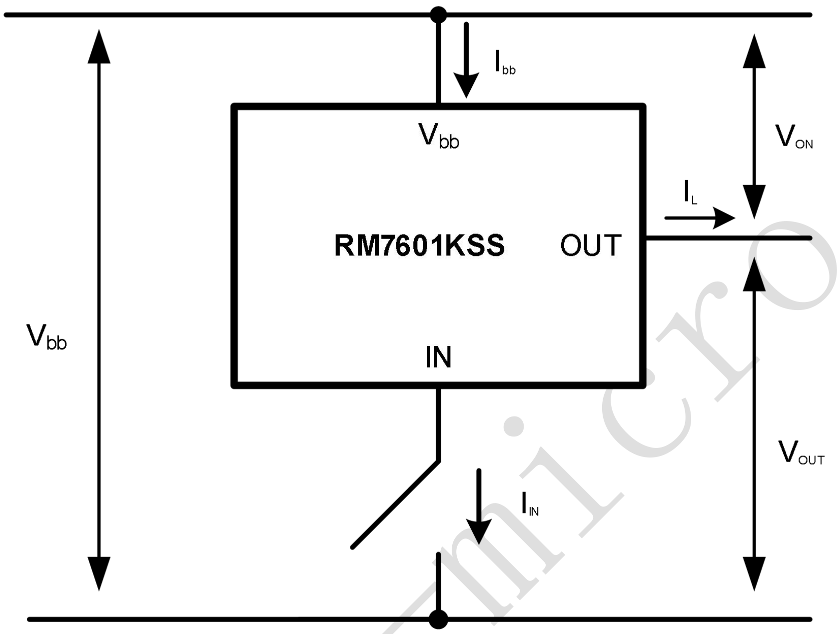


11.3 ON-State Resistance

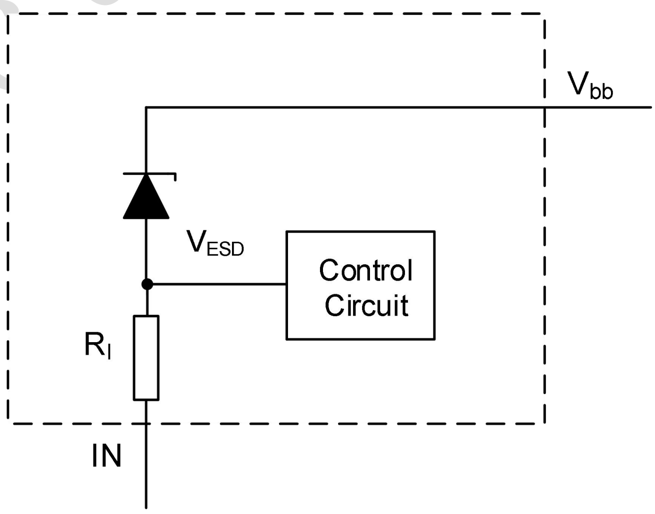


12.Functions

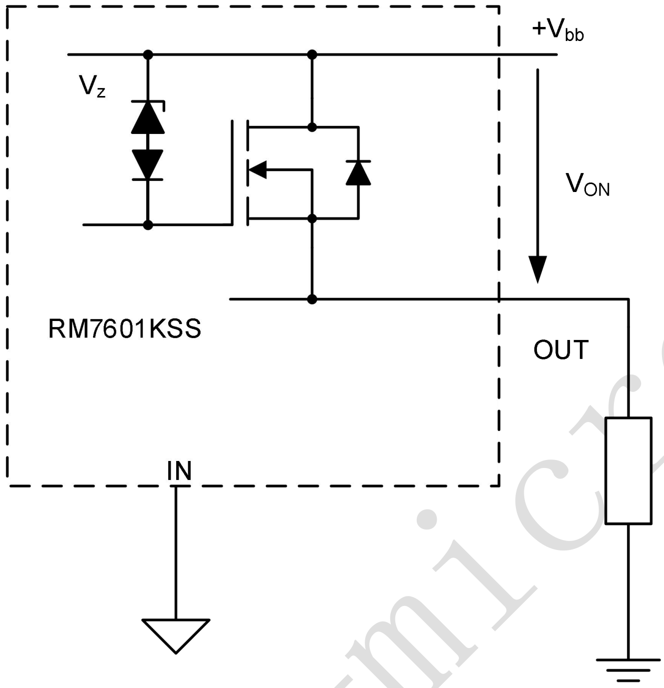
12.1 Terms



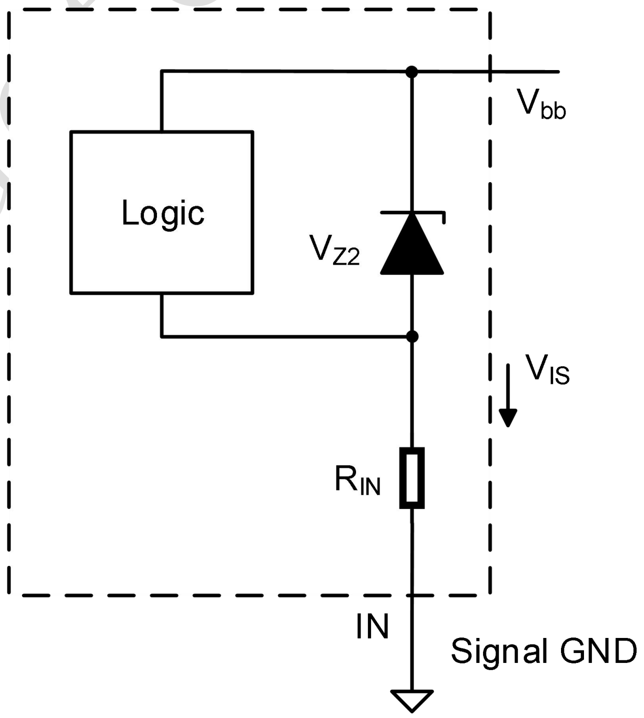
12.2 Input circuit (ESD protection)



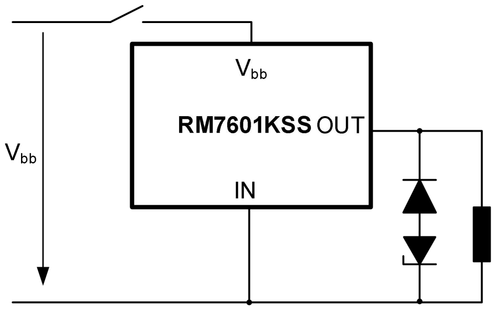
12.3 Inductive and overvoltage output clamp

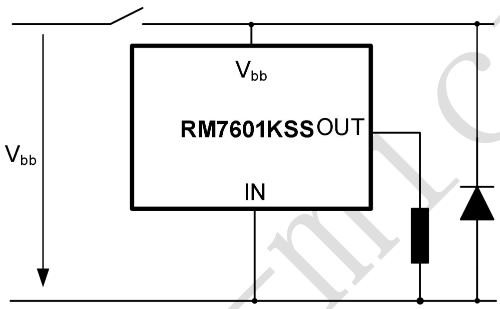


12.4 Overvoltage protection of logic part

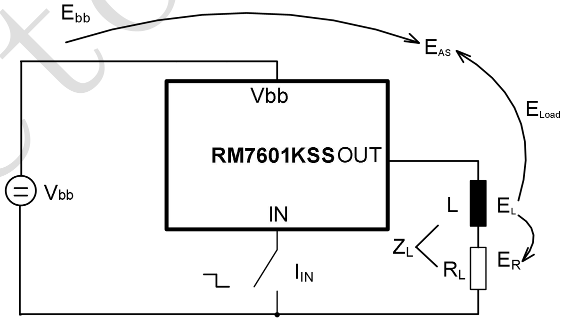


12.5 V_{bb} disconnect with charged inductive load





12.6 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 :

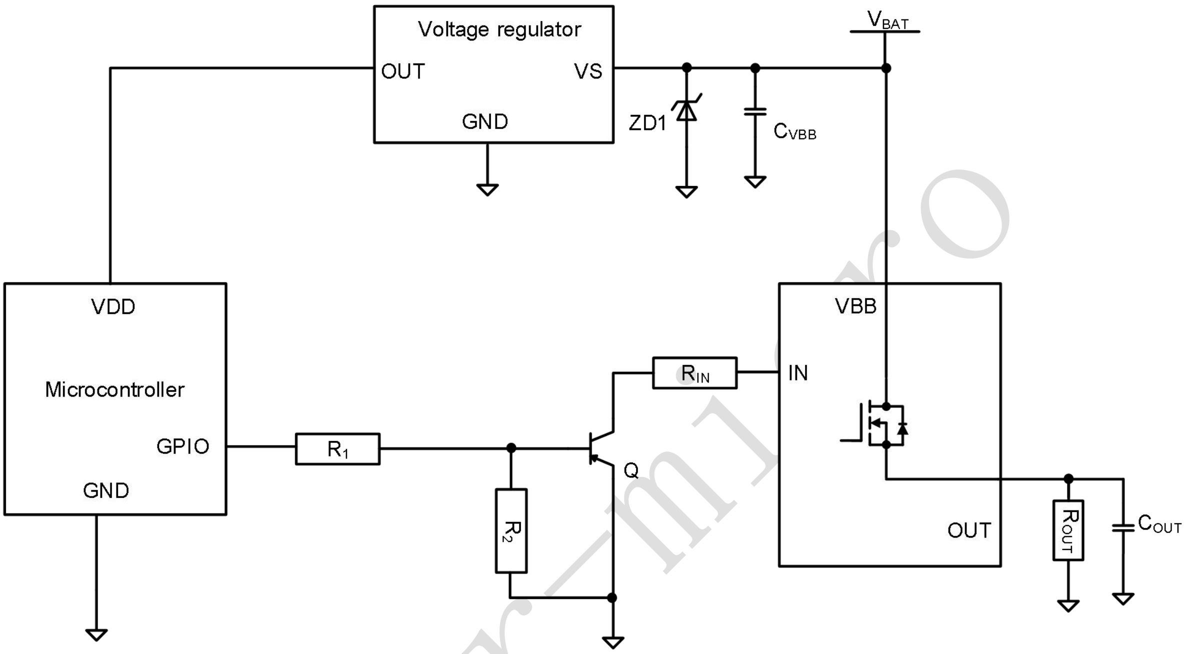
$$E_{AS} = E_{bb} + E_L - E_R = \int V_{ON(CL)} * i_L(t)dt$$

with an approximate solution for RL > 0Ω:

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

13.Application Information

Note: The following information is given as a hint for the implementation of the device only and shall not be regarded as a description or warranty of a certain functionality, condition or quality of the device.



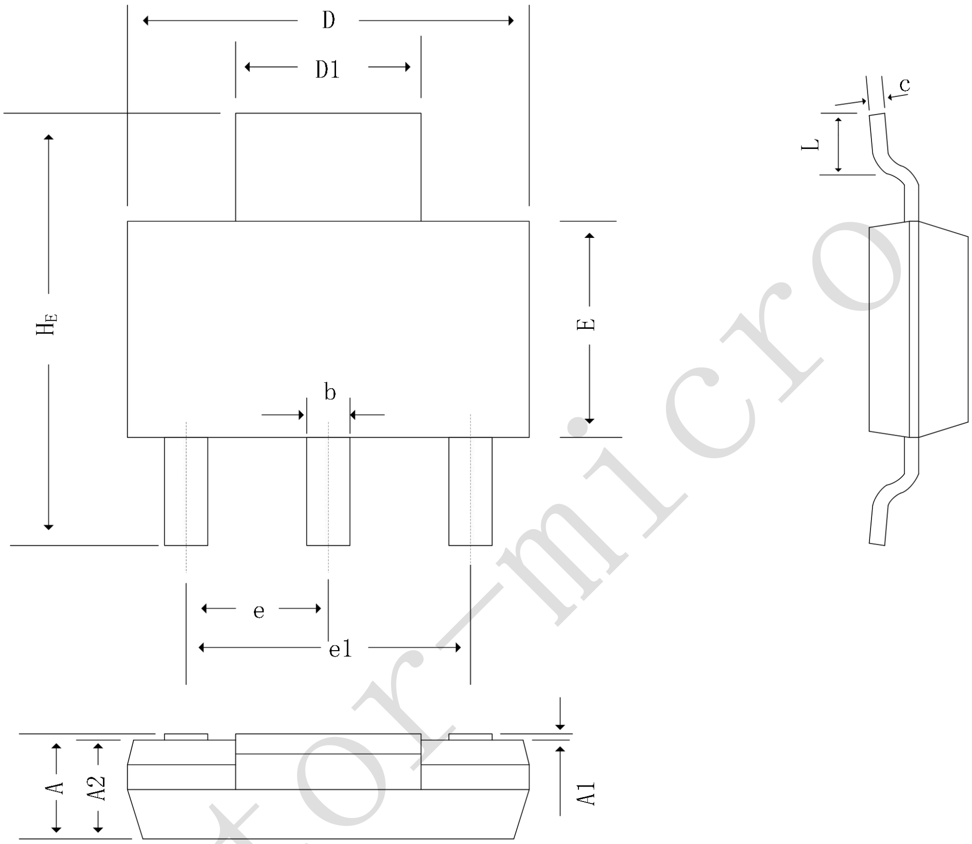
Note: This is a very simplified example of an application circuit.The function must be verified in the real application.

Bill of Material

Reference	Value	Reference	Value
R_{IN}	1KΩ	R_{OUT}	47KΩ
R_1	1KΩ	C_{OUT}	10nF
R_2	10KΩ	Q	NPN
C_{VBB}	100nF	ZD1	62V Zener diode

14.Package

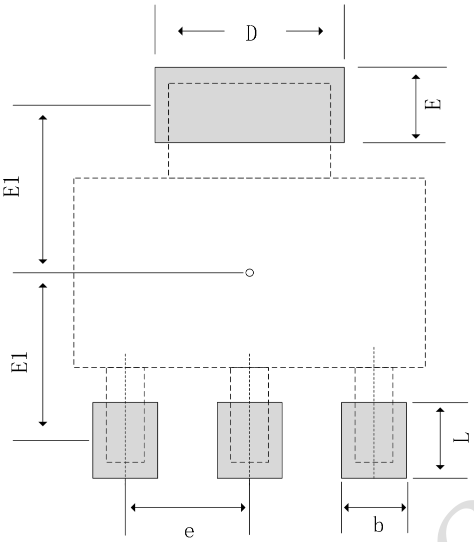
SOT-223



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	/	/

15.Recommended Soldering Footprint



Unit:mm

Symbol	NOM	Symbol	NOM
D	3.00	E	1.4
E1	3.1	L	1.4
b	0.71	e	2.3

16.Revision History

Version	Change Description	Date
1.0	Initial Version	2024/08/13
1.1	1) Added certain parameter in the Absolute Maximum Ratings 2) Revised certain parameter in the Electrical Characteristics table. 3) Added curves showing parameter variations with ambient temperature;	2025/11/03