
Two-Wire Unipolar Hall Effect Switches

FEATURES

- High chopping frequency
- AEC-Q100 qualified production
- Supports a wide voltage range
 - 3.3V to 24V
 - Operation from unregulated supply
- Wide operating temperature range
 - -40°C to 160°C
- Reverse-battery protection
- Output short-circuit protection
- High EMC immunity
- Package
 - 3-pin SOT23 -(SO)
 - 3-pin TO-92(UA)
- VDD-de-rating

APPLICATIONS

- Seat position detection
- Seat belt
- Transmission
- Wiper motors
- Roof motor module

DESCRIPTION

The SC25891 is a Hall-effect unipolar switch designed in BCD process technology. The device integrates a voltage regulator, Hall sensor with dynamic offset cancellation system, Schmitt trigger and an open-drain output driver, all in a single package.

The wide operating voltage range and extended choice of temperature range make it suitable for use in automotive, industrial and consumer applications.

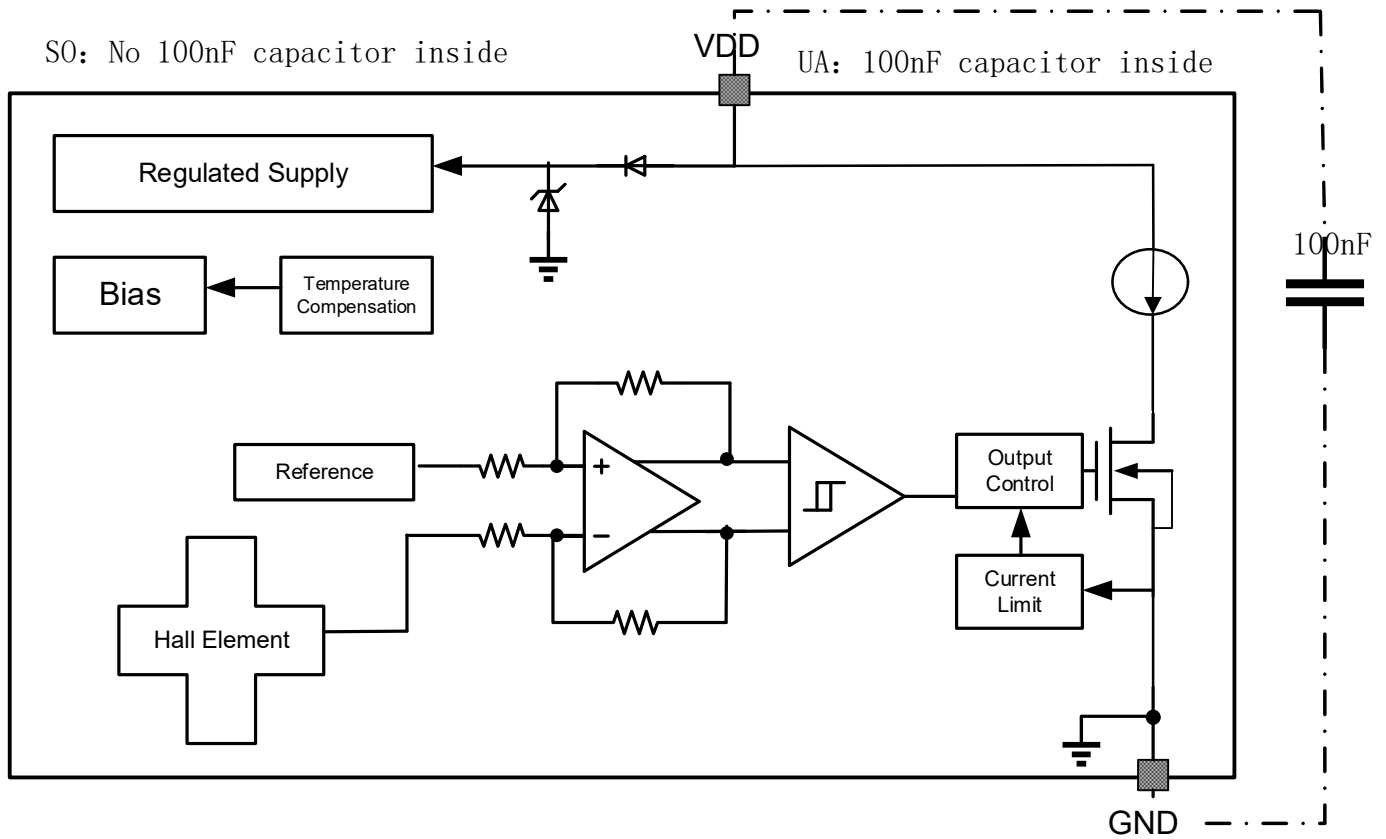
The device is available in a 3-pin SOT-23 (SO) and TO-92(UA) package. Both are lead (Pb) free, with 100% matte tin lead frame plating.



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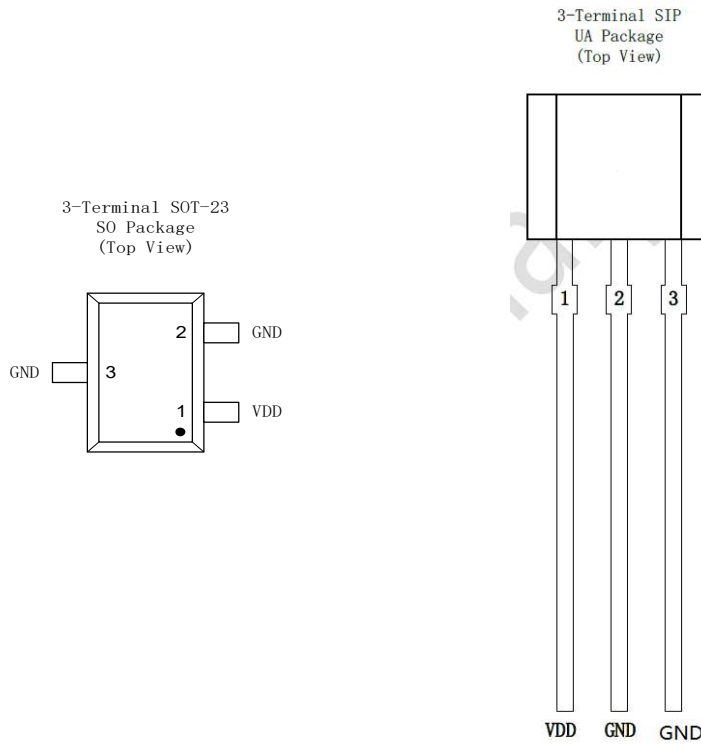
BLOCK DIAGRAM.



ORDERING INFORMATION

Part Number	Package	I _{dd_Low}	I _{dd_High}	B _{OP} (Typ.)	B _{RP} (Typ.)
SC25891SOR-A	SOT23	6mA	14mA	+8.7mT	+7.3mT
SC25891UA	TO-92	6mA	14mA	+8.7mT	+7.3mT

PIN CONFIGURATION



Name	Terminal Number		Type	Description
	SO	UA		
VDD	1	1	PWR	3 to 24V power supply
GND	3	2	GND	GND
NC	2	3	GND	Recommended to GND

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range(-40 ~ 160°C) (unless otherwise noted) ⁽¹⁾

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	V _{DD}	-0.5 ⁽²⁾	28	V
Operating ambient temperature	T _A	-40	160	°C
Maximum junction temperature	T _J	-55	165	°C
Storage temperature	T _{STG}	-65	175	°C

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

⁽²⁾ SC258XX series have no function to survive under reverse supply voltage. Customer must add protection circuits(e.g. Diodes) to Limit reverse current.

ESD PROTECTION

ESD tests according to: standard AEC-Q100-002

Parameter	Symbol	Rating	Units
ESD-Protection (HBM)	V _{ESD}	±8	KV
ESD-Protection (CDM)	V _{ESD}	±2	KV

THERMAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Rating	Units
R _{θJA}	UA Package thermal resistance	Single-layer PCB, with copper limited to solder pads	200	°C/W
R _{θJA}	SO Package thermal resistance	Single-layer PCB, with copper limited to solder pads	300	°C/W

VDD-Derating



OPERATING CHARACTERISTICS

(1) Maximum voltage must be adjusted for power dissipation and junction temperature, see Thermal Characteristics

Electrical Characteristics

DC Operating Parameters VDD = 5.0V, TJ = -40°C to 165°C

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
SUPPLY CHARACTERISTICS						
V _{DD}	Operating voltage (1)	TJ < TJ(Max.)	3	--	24	V
I _{DD_Low}	Operating supply current	VDD=12V, TA=-40°C ~160°C	5	6	6.9	mA
I _{DD_High}	Operating supply current	VDD=12V, TA=-40°C ~160°C	12	14	17	mA
t _{on}	Power-on time	VPULL=5V, Rpull=1K, C=20pF, B=150Gs	--	35	50	μS
OUTPUT CHARACTERISTICS						
t _d	Output delay time	VDD=12V, Rpull=1K, C=20pF, B=±150Gs	--	--	25	μS
Sr	Output Slew Rate	VDD=12V, Rsen=100 Ω, CBYP=100nF, Clord=20pF, TA=-40°C ~160°C	0.1	-0.5	1	μS
F _{sw}	Maximum switching frequency	VDD=12V, Bop set up to ±150Gs, 5KHz~100KHz, Step 5KHz	20	-	-	KHz
Fc	Chopping frequency	VDD=12V		800		KHz

Magnetic Characteristics

DC Operating Parameters VDD = 5.0V, TJ = -40°C to 165°C

SC25891SOR-A						
B _{OP}	Operated point	T _J =-40°C to 160°C	6.5	8.7	11.5	mT
B _{RP}	Release point		5.2	7.3	10	mT
B _{HYS}	Hysteresis		-	1.4	-	mT

1mT=10GS

Magnetic flux density, *B*, is indicated as a negative value for North-polarity magnetic fields, and as a positive value for South-polarity magnetic fields.

FUNCTION DESCRIPTION

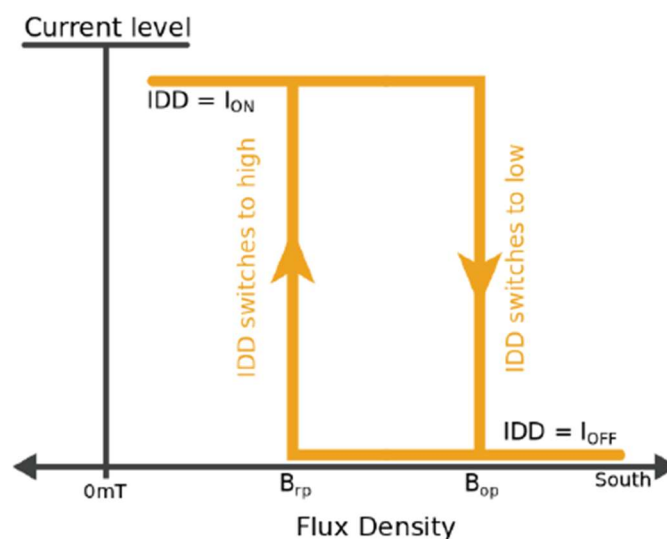
The SC25891 device is a chopper-stabilized Hall sensor with a digital output for magnetic sensing applications. The device can be powered with a supply voltage between 3V and 24V. The device does not operate when -0.5 to 2.5V is applied to the VDD terminal (with respect to the GND terminal). In addition, the device can withstand voltages up to 28V for transient durations.

The output of SC25891 switches low (turns on) when a magnetic field (South polarity) perpendicular to the Hall element exceeds the operate point threshold, B_{OP} . After turn-on, the output is capable of sinking 30mA and the output voltage is $V_{Q(sat)}$. When the magnetic field is reduced below the release point, B_{RP} , the device output goes high (turns off). The difference in the magnetic operate and release points is the hysteresis, B_{HYS} , of the device. This built-in hysteresis allows clean switching of the output even in the presence of external mechanical vibration and electrical noise.

An external output pull-up resistor is required on the OUT terminal. The OUT terminal can be pulled up to V_{DD} or to a different voltage supply. This allows for easier interfacing with controller circuits.

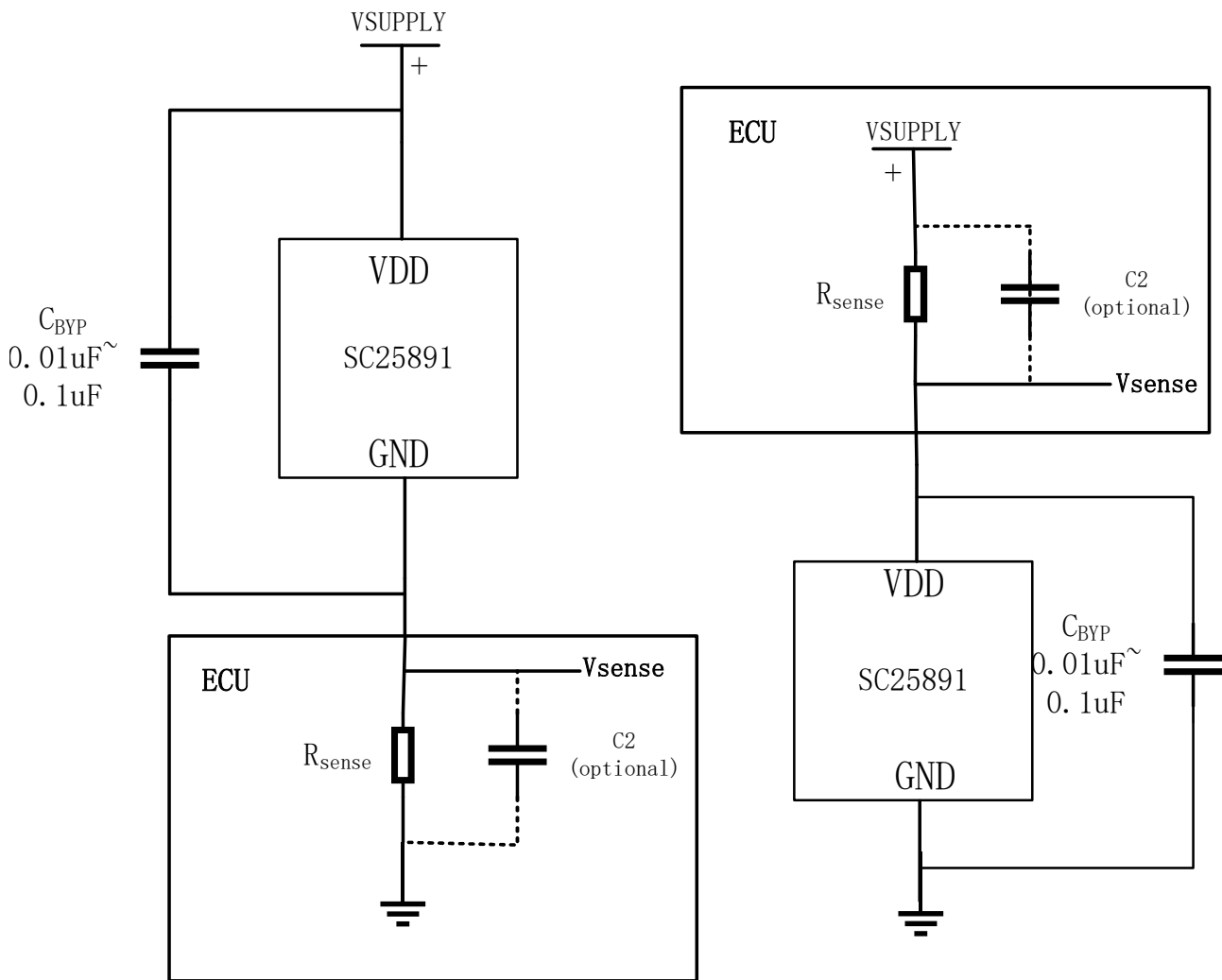
Transfer Function

Powering-on the device in the hysteresis region, less than B_{OP} and higher than B_{RP} , allows an indeterminate output state. The correct state is attained after the first excursion beyond B_{OP} or B_{RP} . If the field strength is greater than B_{OP} , then the output is pulled low. If the field strength is less than B_{RP} , the output is released.



TYPICAL APPLICATION

It is strongly recommended that an external bypass capacitor, CBYP, be connected (in close proximity to the Hall sensor) between the supply and ground of the device to guarantee correct performance under harsh environmental conditions and to reduce noise from internal circuitry. As is shown in Figure Below, a 0.01 μF capacitor is typical. Use of a larger bypass capacitor may result in a slower output slew rate, and should be evaluated according to the requirements set forth by the application. Additionally, an optional output load capacitor may be added in parallel with the sense resistor for increased signal filtering and EMC immunity

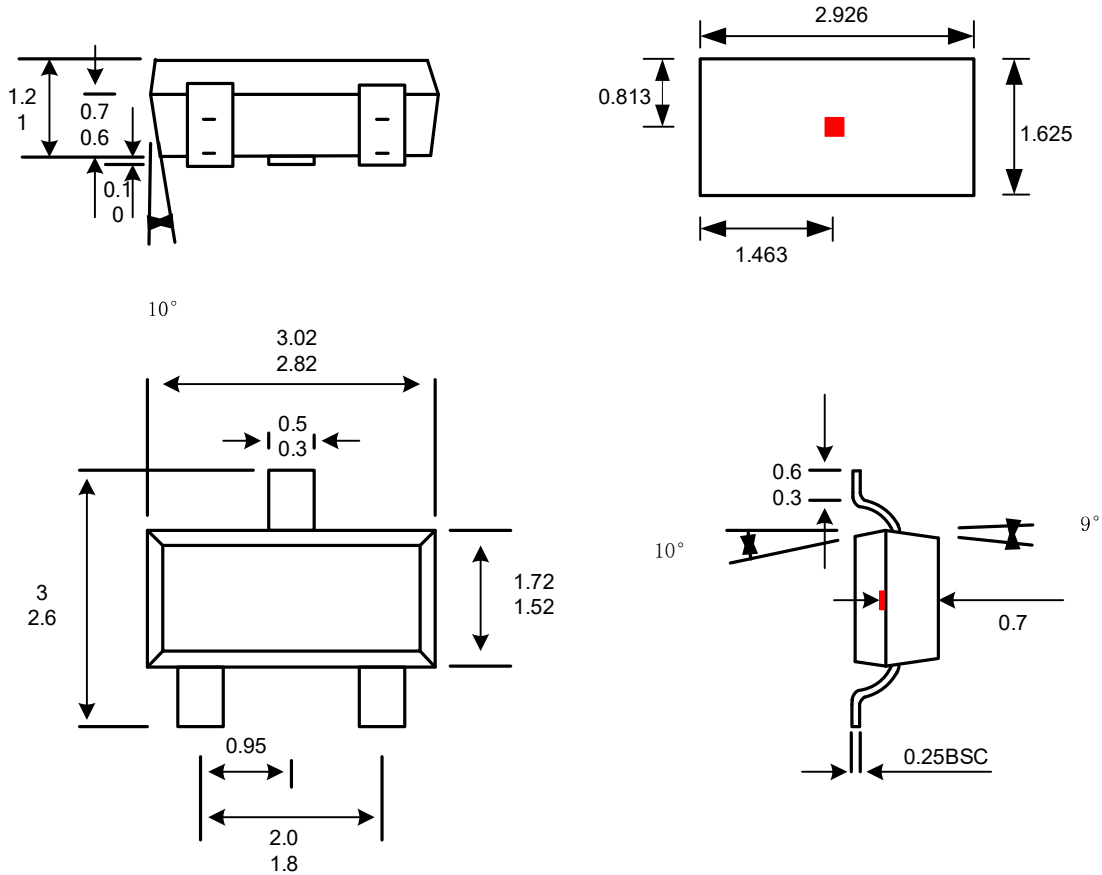


注释：UA 芯片内部有 100nf 滤波电容；SO 芯片内部没有电容，需要外部增加。

PACKAGE INFORMATION “SO”

**3-Terminal
SO Package**

Dimension:mm

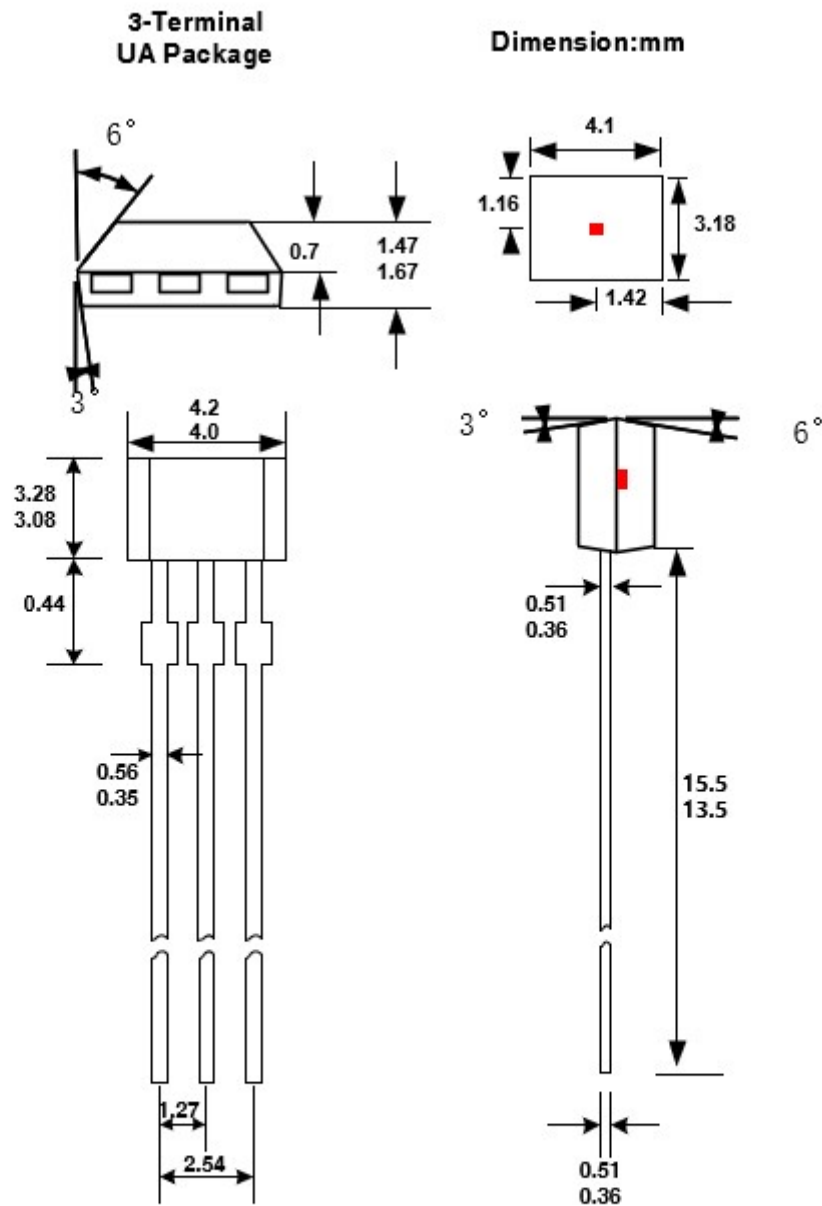


Notes:

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.
3. Red mark is Hall element

Where no tolerance is specified, dimension is nominal.

PACKAGE INFORMATION “UA”



Notes:

1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.
3. Red mark is Hall element

Where no tolerance is specified, dimension is nominal.

REVISION HISTORY

Revision	Date	Description
Rev0.1	2022-9-08	Preliminary datasheet
Rev0.2	2022-12-5	Preliminary datasheet update
Rev0.3	2023-01-06	Publish datasheet update
Rev E1.0	2023-04-10	Unified datasheet format
Rev E1.1	2023-06-27	Update VDD de-rating curve
Rev E1.2	2023-07-03	Add TO-92 Package
Rev A1.0	2024-05-12	Formal version release