FEATURES

- Planar TMR-effect sensor ICs
- 3 to 24 V operation
- Automotive-grade ruggedness and fault tolerance
- Extended AEC-Q100 qualification
- Internal protection circuits enable 30V load dump compliance
- Output short-circuit and overvoltage protection
- Operation from –40°C to 125°C ambient temperature
- High EMC immunity
- Symmetrical latch switch-points
- Choice of output polarity
- Open-drain output
- Solid-state reliability

APPLICATIONS

- Automotive and industrial safety systems
- Industrial motors/encoders
- Trunk/door/liftgate/wiper motors
- Electronic power steering (EPS)
- Transmission actuators
- Automotive seat/sunroof motors

DESCRIPTION

The SC2498TSO families of TMR-effect latches are AEC-Q100 qualified for 24V automotive applications and compliant with ISO 26262:2011 ASIL A (pending confirmation). These sensors are temperature-stable and suited for operation over extended junction temperature ranges up to 125°C. The SC2498TSO families are available in several different magnetic sensitivities to offer flexible options for system design. They are available in active high and active low variants for ease of integration into electronic subsystems

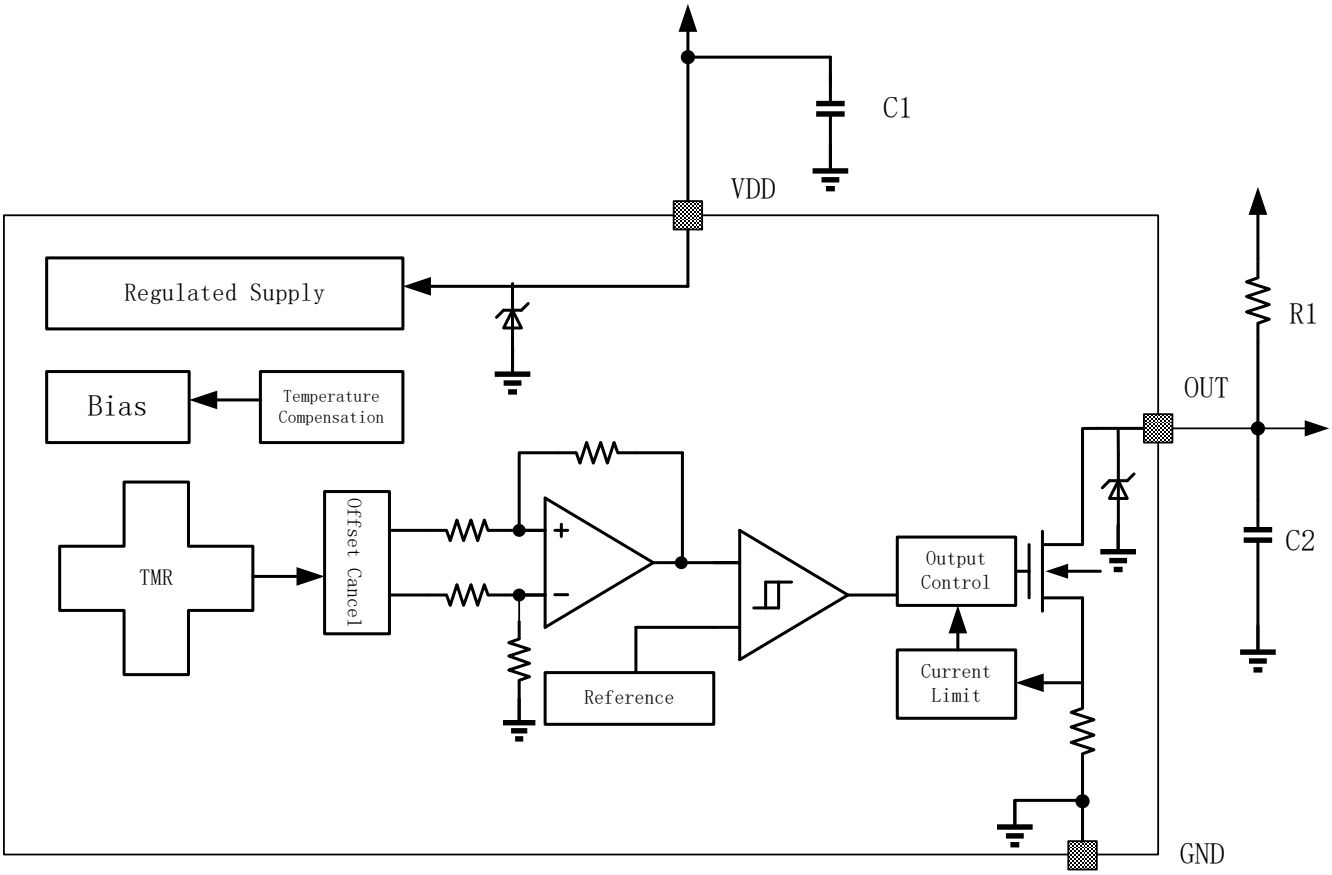
The SC2498TSO features a planar TMR-effect sensing element sensitive to magnetic flux parallel to the face of the IC package.

The devices include overvoltage protection for operating directly from an automobile battery, as well as protection from shorts to ground by limiting the output current until the short is removed. The device is especially suited for operation from unregulated supplies.

CONTENTS

Preliminary

BLOCK DIAGRAM.

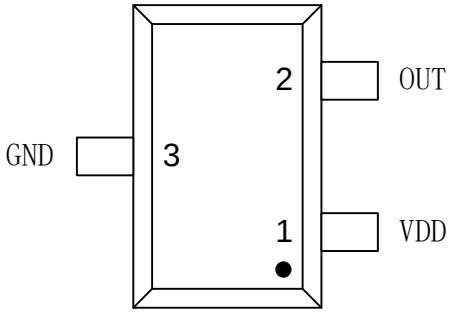


ORDERING INFORMATION

Part Number	Packing	Mounting	Ambient, T_A	B_{OP}(Typ.)	B_{RP}(Typ.)
SC2498TSO	3000pieces/reel	3-pin SOT-23	-40℃ to 125℃	+3.0mT	-3.0mT

TERMINAL CONFIGURATION

3-Terminal SOT-23
SO Package
(Top View)



Terminal		Type	Description
Name	Number		
VDD	1	PWR	3 to 24V power supply
GND	3	Ground	Ground terminal
OUT	2	Output	Open-drain output. The open drain requires a pull-up resistor.

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) (1)

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	V_{DD}	-18	33	V
Output terminal voltage	V_{OUT}	-0.5	33	V
Output terminal current sink	I_{SINK}	0	40	mA
Operating ambient temperature	T_A	-40	125	℃
Maximum junction temperature	T_J	-40	160	℃
Storage temperature	T_{STG}	-65	175	℃

(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.

ESD PROTECTION

Human Body Model (HBM) tests according to: standard AEC-Q100-002

Parameter	Symbol	Min.	Max.	Units
ESD1-HBM1)	V_{ESD}	-8	+8	KV
ESD2-HBM2)	V_{ESD}	-3.5	+3.5	KV

THERMAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Rating	Units
$R_{\theta JA}$	SO Package thermal resistance	Single-layer PCB, with copper limited to solder pads	313	℃/W

1) ESD1-HBM use typical application circuit to test

2) ESD2-HBM use bare chip to test

OPERATING CHARACTERISTICS

Electrical Characteristics

over operating free-air temperature range (V_{DD} = 5.0V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
SUPPLY CHARACTERISTICS						
V_{DD}	Operating voltage (1)	$T_J < T_J$(Max.)	3	--	24	V
I_{DD}	Operating supply current	VDD=3 to 24V	3.5	4.1	7	mA
t_{on}	Power-on time		--	19	25	μS
OUTPUT CHARACTERISTICS						
I_{QL}	Off-state leakage current	Output Hi-Z	--	--	1	μA
V_{SAT}	Output saturation voltage	VDD=5V, IO=20mA	--	250	500	mV
t_d	Output delay time	B=BRP to BOP	--	15	25	μS
t_r	Output rise time (10% to 90%)	R1=1Kohm Co=50pF	--	--	2	μS
t_f	Output fall time (90% to 10%)	R1=1Kohm Co=50pF	--	--	0.4	μS
ON-BOARD PROTETION						
OCP	Over current protection	Output on VPULL-UP<30V	30	45	60	mA
$V_{Z(SLY)}$	Supply Zener Clamp Voltage	IDD=IDD(max)+3mA	33	--	--	V
$V_{Z(OUT)}$	Output Zener Clamp Voltage	Output Hi-Z,IOUT=1.5mA	33	--	--	V

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

Magnetic Characteristics

over operating free-air temperature range (unless otherwise noted)

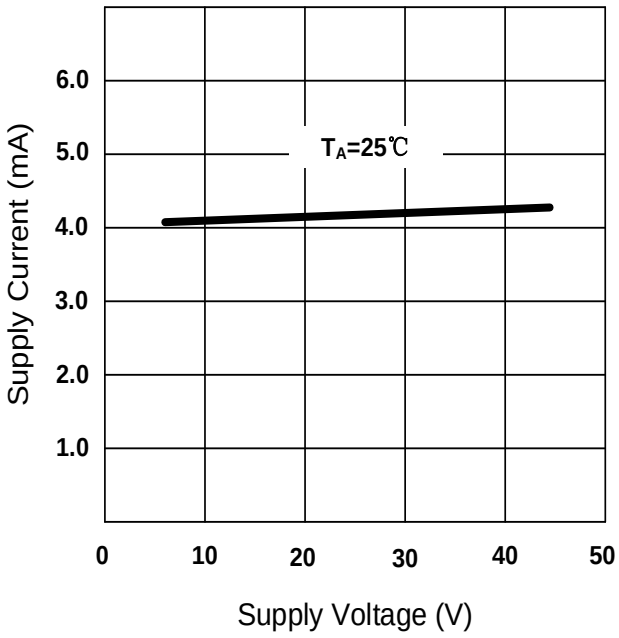
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
f_{BW}	Bandwidth		--	20	--	kHz
SC2498TSO						
B_{OP}	Operated point	TA=-40℃ to 125℃	1.0	3.0	5.0	mT
B_{RP}	Release point		-5.0	-3.0	-1.0	mT
B_{HYS}	Hysteresis		2.0	6.0	10.0	mT

1mT=10GS

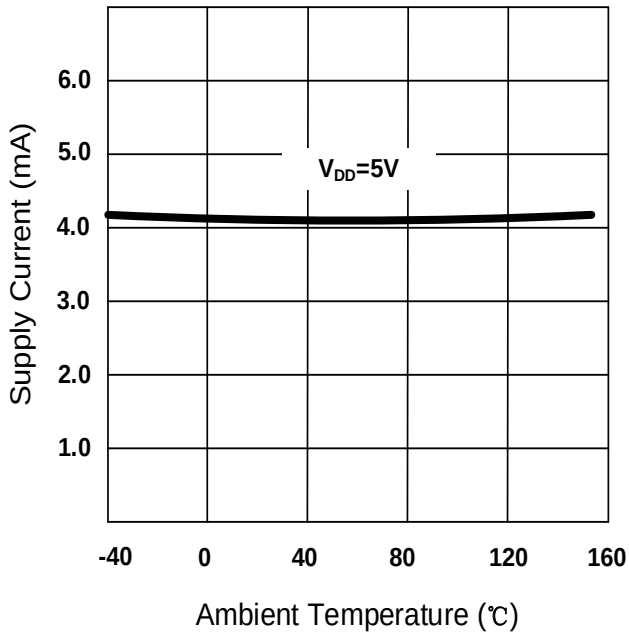
Magnetic flux density, B, is indicated as a negative value for North-polarity magnetic fields, and as a positive value for South-polarity magnetic fields.

TYPICAL CHARACTERISTIC

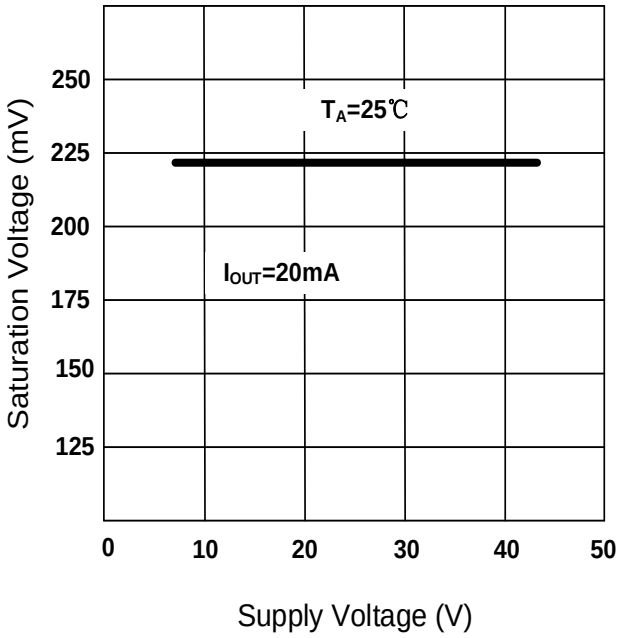
I_{DD} vs V_{DD}



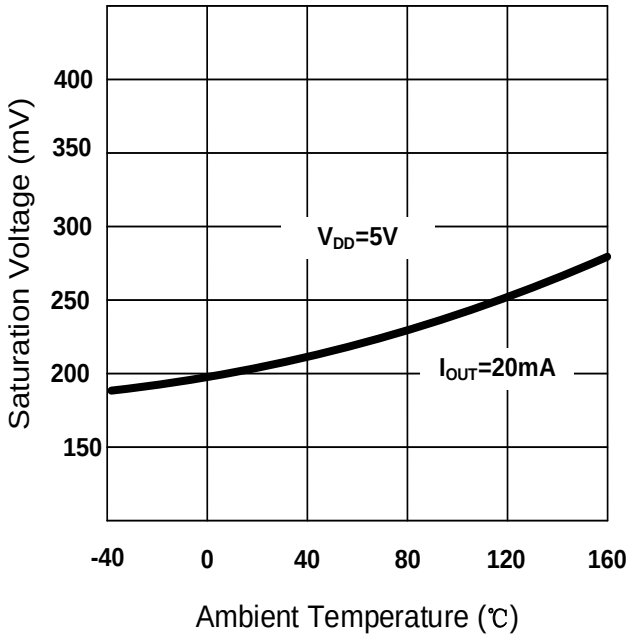
I_{DD} vs T_A



$V_{Q(sat)}$ vs V_{DD}

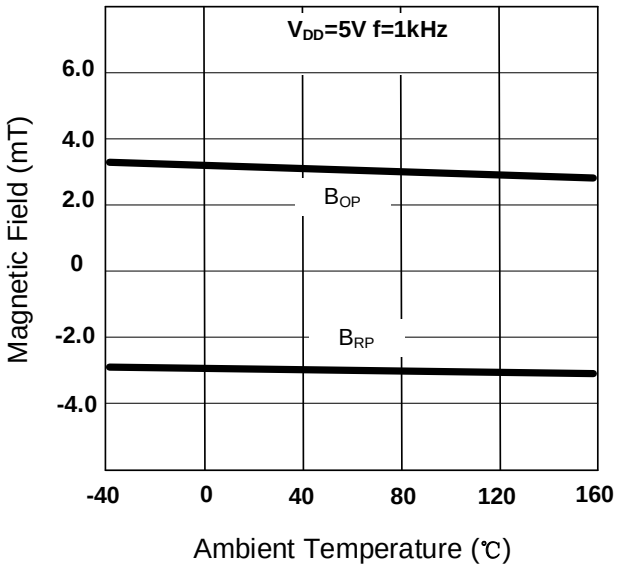


$V_{Q(sat)}$ vs T_A

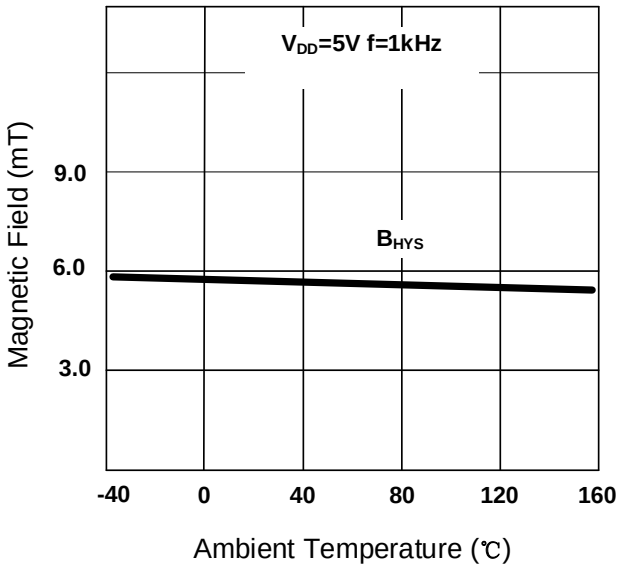


TYPICAL CHARACTERISTIC (Continued)

B_{OP} and B_{RP} vs T_A



B_{HYS} vs T_A

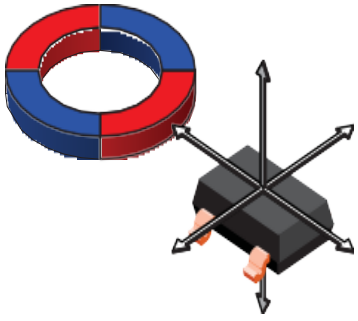


FUNCTION DESCRIPTION

The SC2498TSO are integrated TMR-effect sensor ICs with an open-drain output. The open-drain out- put is an NMOS transistor that actuates in response to a magnetic field. The direction of the applied magnetic field is parallel with the branded face for the SC2498TSO; The devices are offered in the SO package, a 3-pin surface-mount configuration.

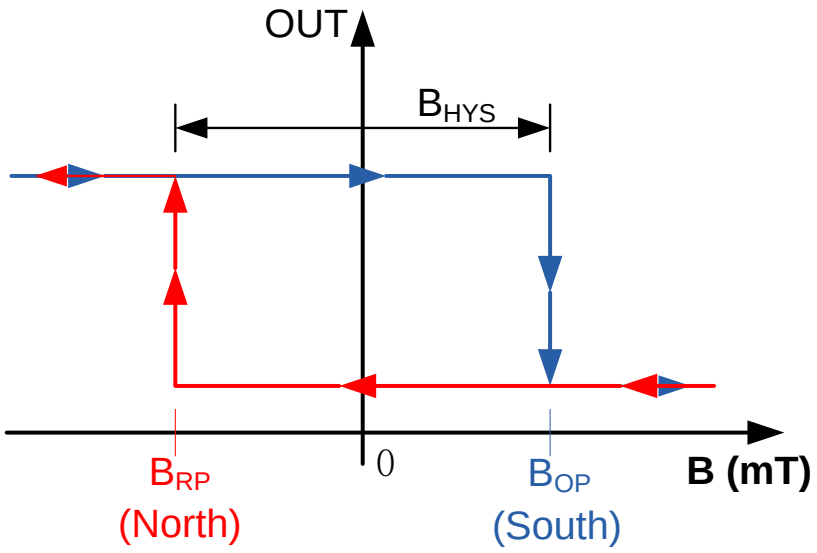
Field Direction Definition

A positive magnetic field is defined as a South pole near the Left side of the package.

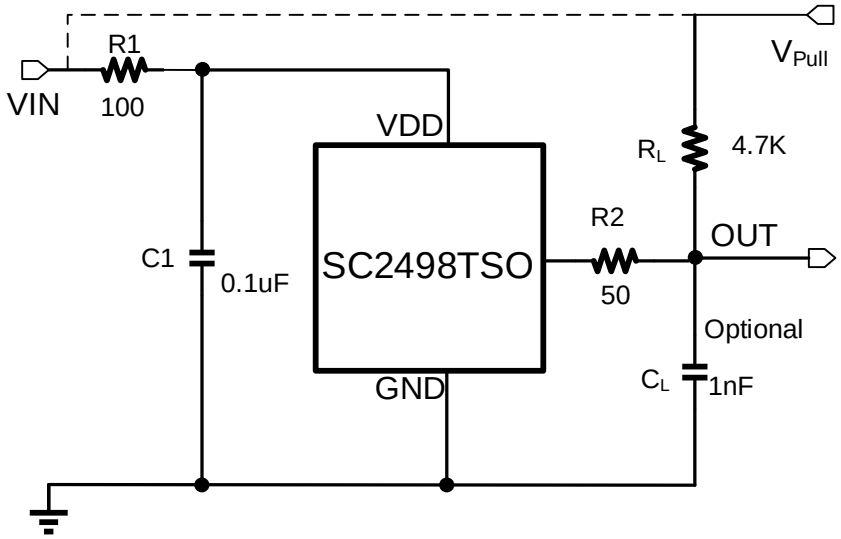


Transfer Function

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



The SC2498TSO contains an on-chip voltage regulator and can operate over a wide supply voltage range. In applications that operate the device from an unregulated power supply, transient protection must be added externally. For applications using a regulated line, EMI/RFI protection may still be required. It is recommended that C1 capacitor be connected to the ground in parallel near the VDD power end of the chip, with a typical value of 0.1μF. At the same time in the external optional series resistor R1 and output capacitance C_L used for enhanced protection circuit, its typical values for 100Ω and 1nF.

The SC2498TSO device output stage uses an open-drain NMOS, and it is rated to sink up to 30mA of current. For proper operation, calculate the value of the pull-up resistor R_L is required. The size of R_L is a tradeoff between OUT rise time and the load capacity when OUT is pulled low. A lower current is generally better, however faster transitions and bandwidth require a smaller resistor for faster switching.

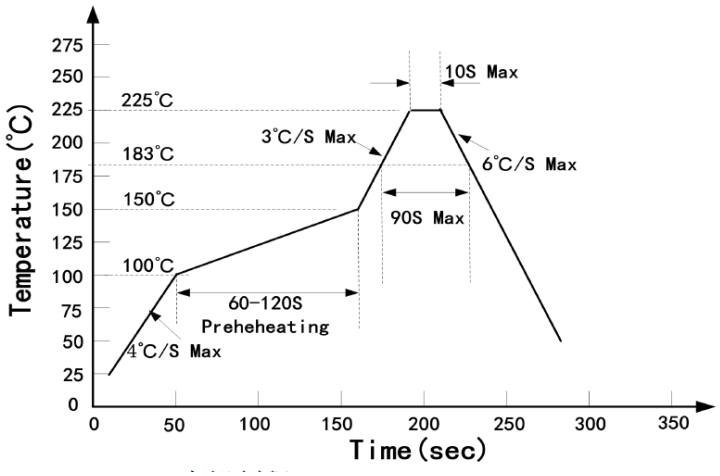
Select a value for C_L based on the system bandwidth specifications as:

$$CL = \frac{1}{2\pi \times R \times f\ (Hz)}$$

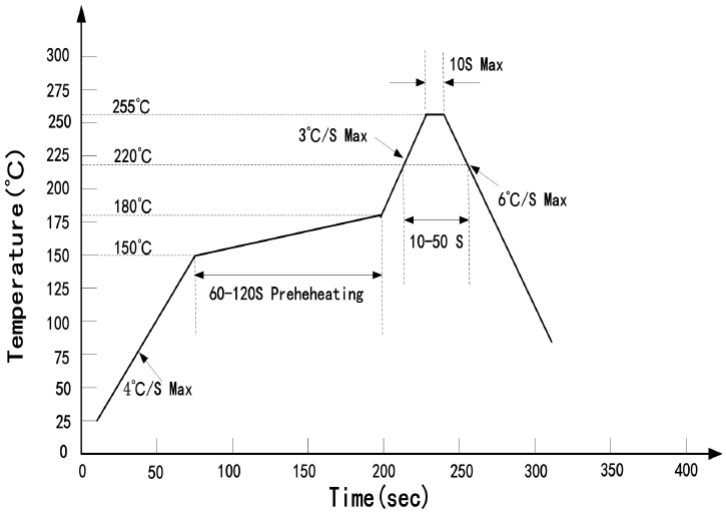
V_{PULL} is not restricted to VDD, and could be connected to other voltage reference. The allowable voltage range of this terminal is specified in the Absolute Maximum Ratings.

SOLDERING PROCESS

Reflow soldering



Lead-process



Lead-free process

Soldering iron process

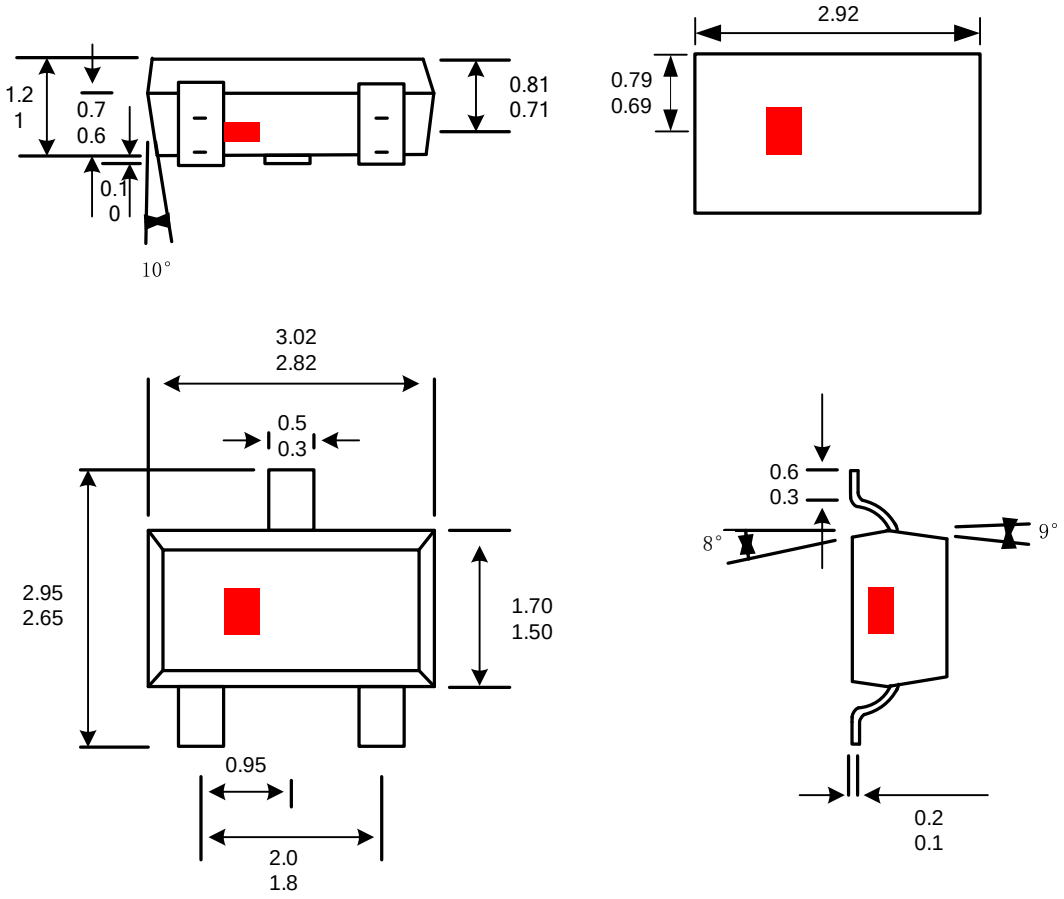
Soldering iron temperature: max 300 ˚C Soldering time；max 10 Seconds.

About SOT23 package, recommend hand soldering process, there is no soldering pad in 5mm away from IC PIN.

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 TMR element.*

Where no tolerance is specified, dimension is nominal.

REVISON HISTORY

Revision	Date	Description
Rev E0.1	2023-06-10	Preliminary datasheet
Rev E0.2	2023-07-17	Unified format
Rev A1.0	2023-10-14	Pre-production version