
High Sensitivity Omnipolar Hall-effect Sensor

FEATURES

- Digital Omni-polar Hall-Effect sensor
- High chopping frequency
- Very high sensitivity
- Superior temperature stability
- Supports a wide voltage range
 - 2.5 to 24V
 - Operating from unregulated supply
- Reverse battery protection (up to 28V)
- Over-voltage protection at all pins
- Robust EMC performance
- Solid-state reliability
- Small package
 - 3-pin SIP -(UA)
 - 3-pin SOT23 -(SO)

APPLICATIONS

- Flow meters
- Magnetic encoding
- Proximity sensing
- Garage door openers
- Power sliding doors
- Sunroofs motor

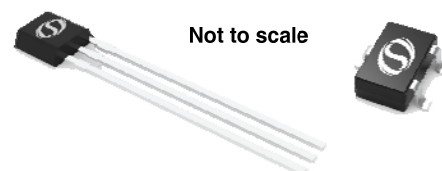
DESCRIPTION

The SC2464 family, produced with BiCMOS technology, is a chopper-stabilized Hall Effect Sensor that offers a magnetic sensing solution with superior sensitivity stability over temperature and integrated protection features.

Superior high-temperature performance is made possible through dynamic offset cancellation, which reduces the residual offset voltage normally caused by device over molding, temperature dependencies, and thermal stress. Each device includes on a single silicon chip a voltage regulator, Hall-voltage generator, small-signal amplifier, chopper stabilization, Schmitt trigger, and an open-drain output to sink up to 20mA.

An onboard regulator permits with supply voltages of 2.5 to 24V which makes the device suitable for a wide range of industrial and automotive applications

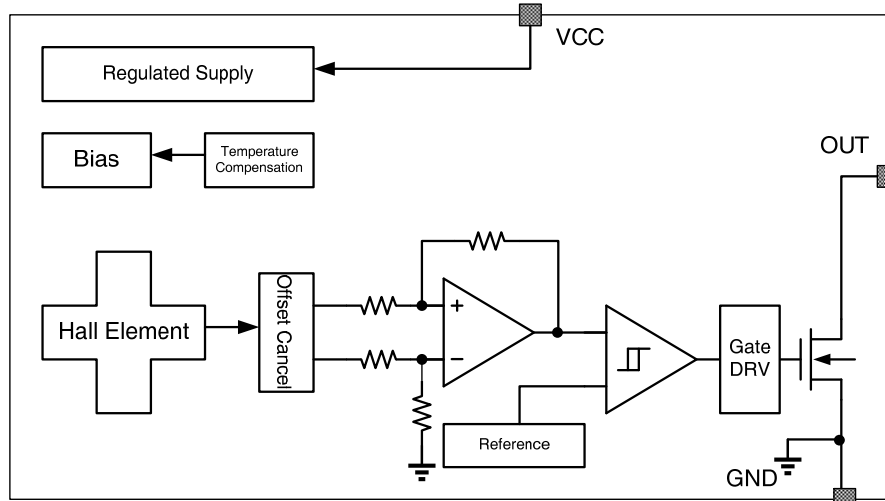
The SC2464 is available in a 3-pin SIP and a plastic SOT23-3 surface mount package. Both packages are lead (Pb) free, with 100% matte tin lead frame plating



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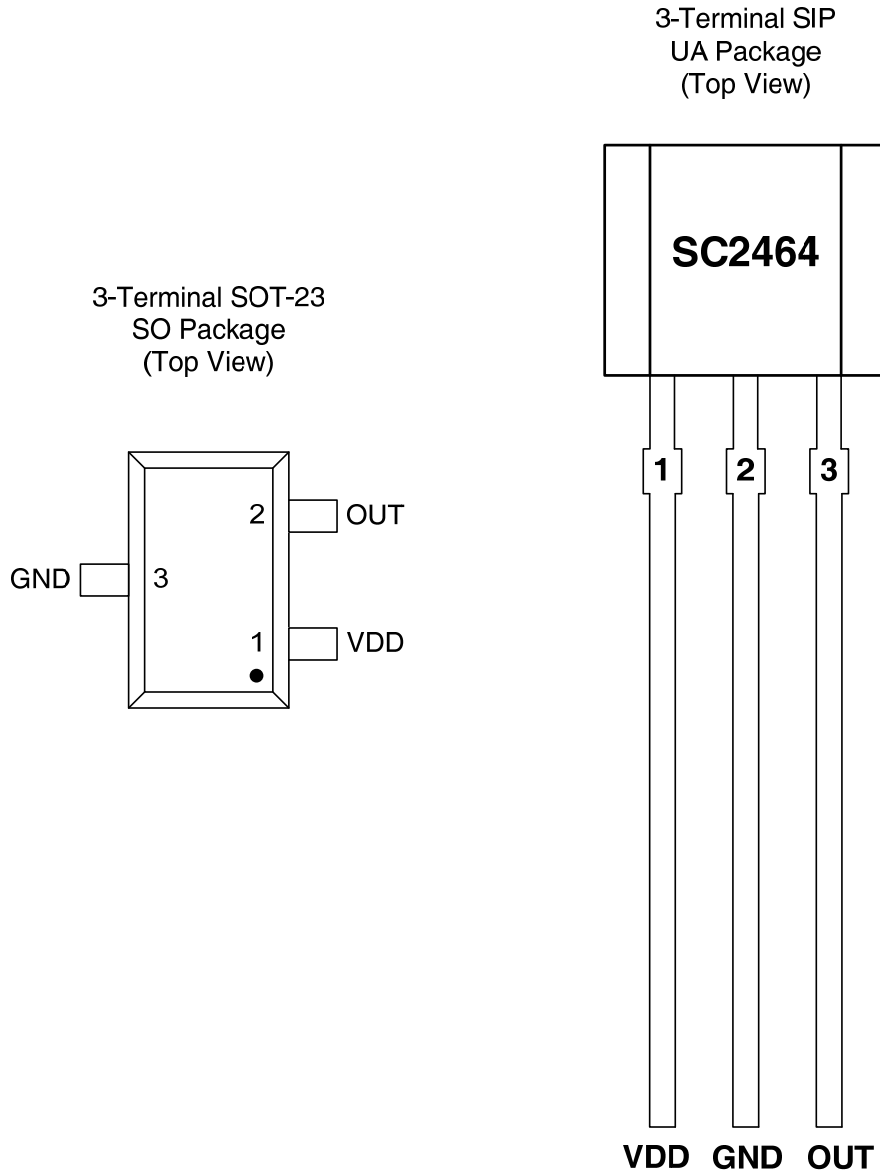
BLOCK DIAGRAM



ORDERING INFORMATION

Part Number	Packing	Mounting	Ambient, T _A	B _{OP} (Typ.)	B _{RP} (Typ.)
SC2464UA	Bulk, 1000 pieces/bag	3-pin SIP	-40°C to 150°C	±6.0mT	±5.0mT
SC2464SO	Reel, 3000pieces/reel	3-pin SOT23			

TERMINAL CONFIGURATION



Name	Terminal		Type	Description
	UA	SO		
VDD	1	1	PWR	2.5 to 24 V power supply
GND	2	3	Ground	Ground terminal
OUT	3	2	Output	Output terminal. 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}	-28 ⁽²⁾	28	V
Output terminal voltage	V _{OUT}	-0.5	28	V
Output terminal current sink	I _{SINK}	0	30	mA
Operating ambient temperature	T _A	-40	150	°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⁾ Ensured by design.

ESD PROTECTION

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

Parameter	Symbol	Min.	Max.	Units
ESD-Protection	V _{ESD}	-4	4	KV

THERMAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Rating	Units
R _{θA}	UA Package thermal resistance	Single-layer PCB, with copper limited to solder pads	166	°C/W
R _{θA}	SO Package thermal resistance	Single-layer PCB, with copper limited to solder pads	228	°C/W

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
V_{DD}	Operating voltage ⁽¹⁾	$T_J < T_{J(Max.)}$	2.5	--	24	V
V_{DDR}	Reverse supply voltage		-28	--	--	V
$I_{DD (off)}$	Operating supply current	$V_{DD}=2.5 \text{ to } 24 \text{ V, } T_A=25^\circ\text{C}$	1.1	1.8	2.6	mA
$I_{DD (on)}$		$V_{DD}=2.5 \text{ to } 24 \text{ V, } T_A=25^\circ\text{C}$	1.1	2.1	2.6	mA
t_{on}	Power-on time		--	35	50	μS
I_{QL}	Off-state leakage current	Output Hi-Z	--	--	1	μA
$R_{DS(on)}$	FET on-resistance	$V_{DD}=5V, I_o=10mA, T_A=25^\circ\text{C}$	--	20	--	Ω
		$V_{DD}=5V, I_o=10mA, T_A=125^\circ\text{C}$	--	30	--	Ω
t_d	Output delay time	$B=B_{RP}$ to B_{OP}	--	15	25	μS
t_r	Output rise time (10% to 90%)	$R1=1Kohm \text{ Co}=50pF$	--	--	0.5	μS
t_f	Output fall time (90% to 10%)	$R1=1Kohm \text{ Co}=50pF$	--	--	0.2	μS

⁽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)

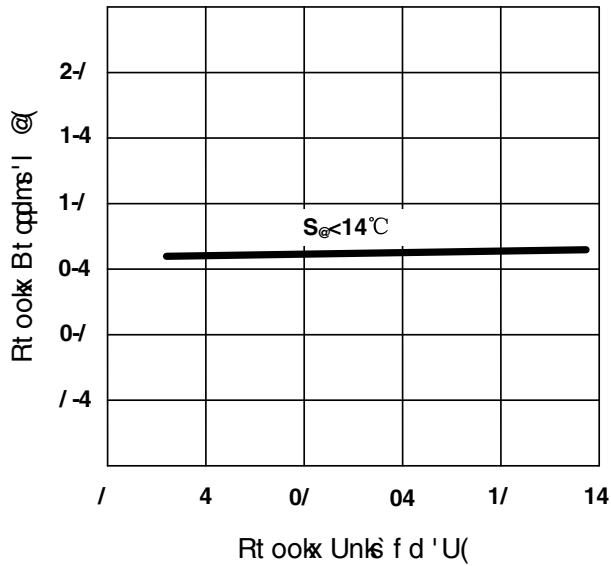
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
f_{BW}	Bandwidth		20	--	--	kHz
B_{OP}	Operated point	$T_A=-40^\circ\text{C} \text{ to } 125^\circ\text{C}$	4.5	6.0	7.5	mT
B_{RP}	Release point		3.5	5.0	6.5	mT
B_{HYS}	Hysteresis		--	1.0	--	mT

1mT=10Gs

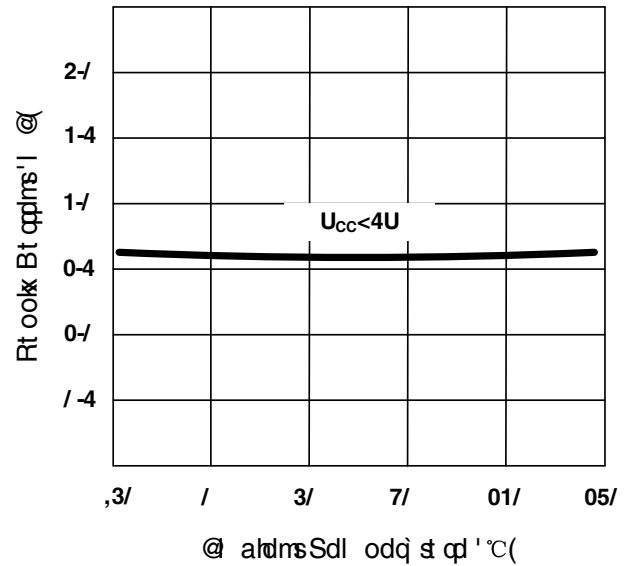
Magnetic flux density, B , is indicated as a negative value for North-polarity magnetic fields, and as a positive value for South-polarity magnetic fields.

TYPICAL CHARACTERISTIC

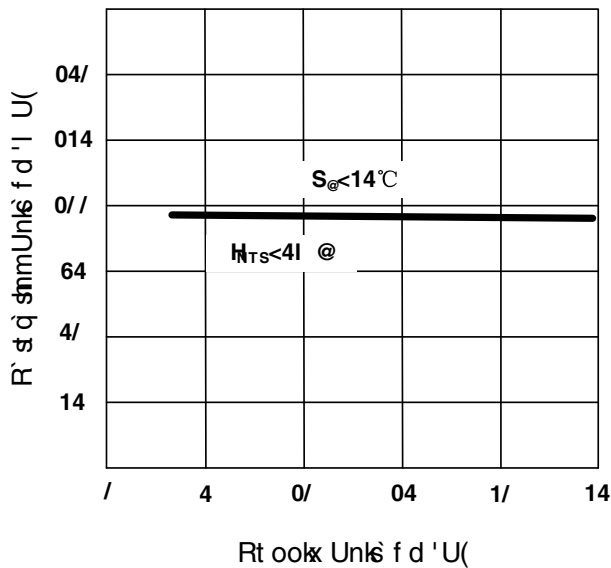
H_{CC} ur U_{CC}



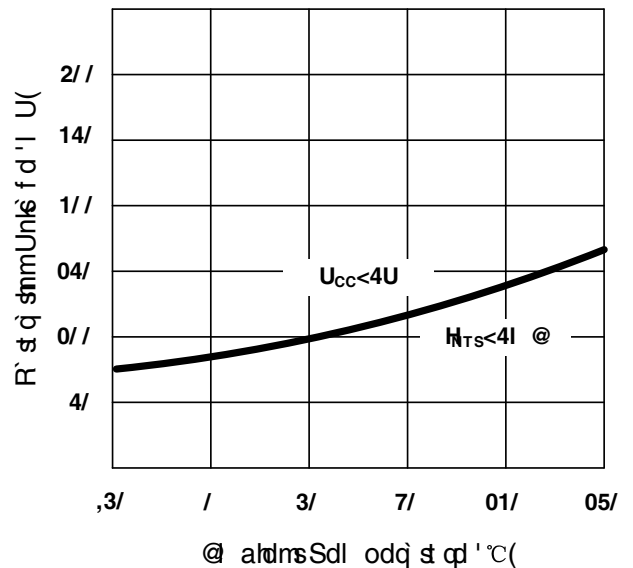
H_{CC} ur $S_{@}$



$U_{P,r}^{\prime} q$ ur U_{CC}

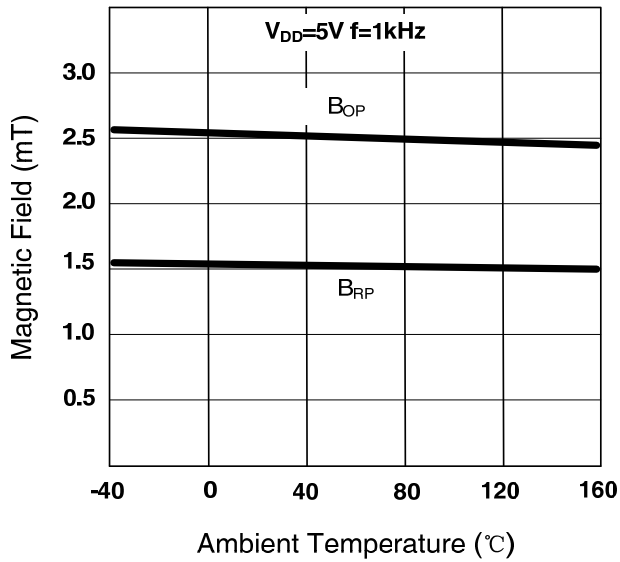


$U_{P,r}^{\prime} q$ ur $S_{@}$

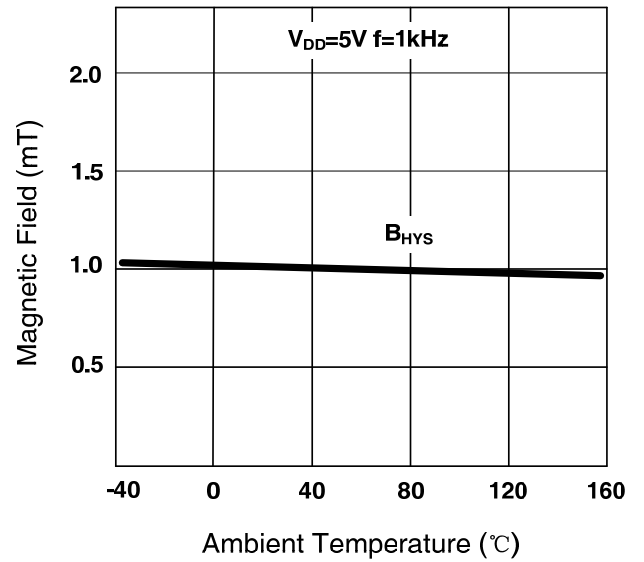


TYPICAL CHARACTERISTIC (Continued)

B_{OP} and B_{RP} vs T_A



B_{HYS} vs T_A



FUNCTIONAL DESCRIPTION

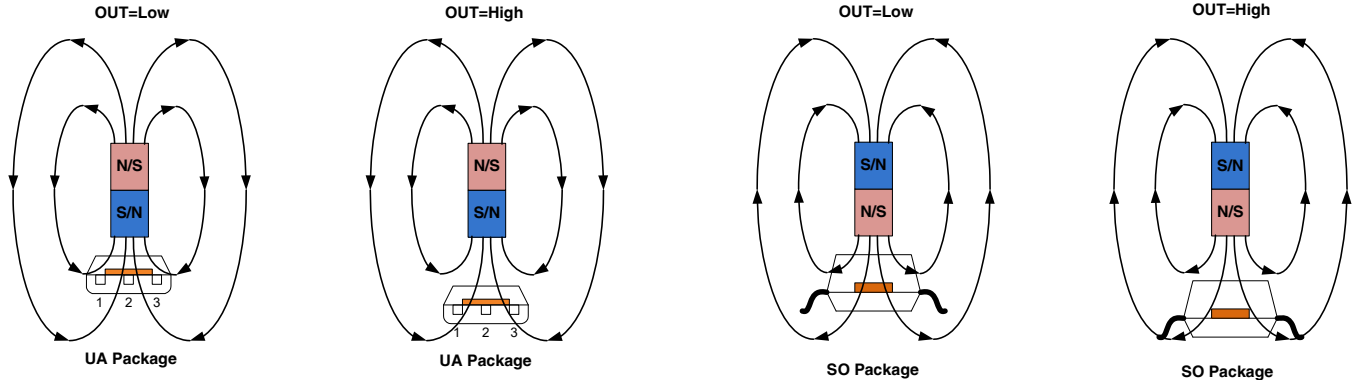
The SC2464 device is a chopper-stabilized Hall sensor with a digital latched output for magnetic sensing applications. The device can be powered with a supply voltage between 2.5 and 24V, and continuously survives continuous -28V reverse-battery conditions. The device does not operate when -28 to 2.2V is applied to the VDD terminal (with respect to the GND terminal). In addition, the device can withstand voltages up to 40V for transient durations.

The output of SC2464 switches low (turns on) when a magnetic field (South or North polarity) perpendicular to the Hall element exceeds the operate point threshold, B_{OP} . After turn-on, the output is capable of sinking 20mA 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.

Field Direction Definition

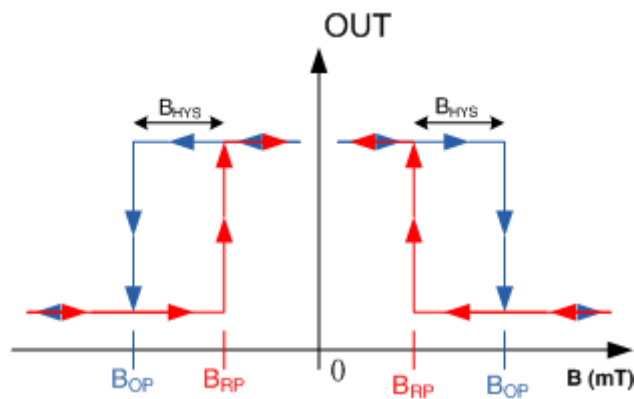
A positive magnetic field is defined as a South pole near the marked side of the package.



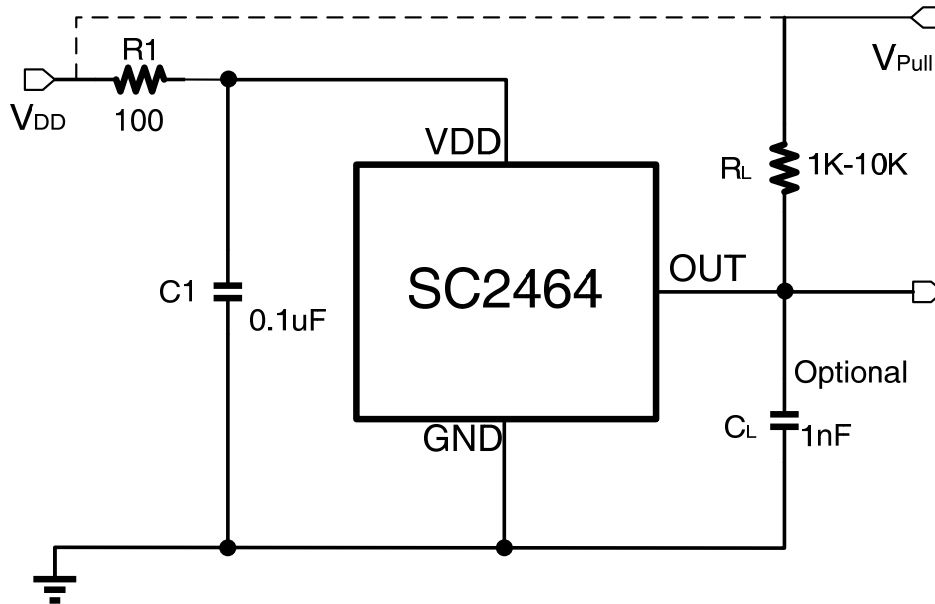
Transfer function

The SC2464 exhibits “Omni polar” magnetic characteristics. It means the device reacts to both North and South magnetic pole. The purpose is to detect the presence of any magnetic field applied on the device. This mode of operation simplifies customer production processes by avoiding the need to detect the Hall sensor pole active on the magnet used in the application. Therefore, the “Omni polar” magnetic behavior helps customers by removing the need of magnet pole detection system during production phase.

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 SC2464 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 0.1uF. At the same time in the external optional series resistor R1 and output capacitance CL used for enhanced protection circuit, its typical values for 100 Ω and 1 nF.

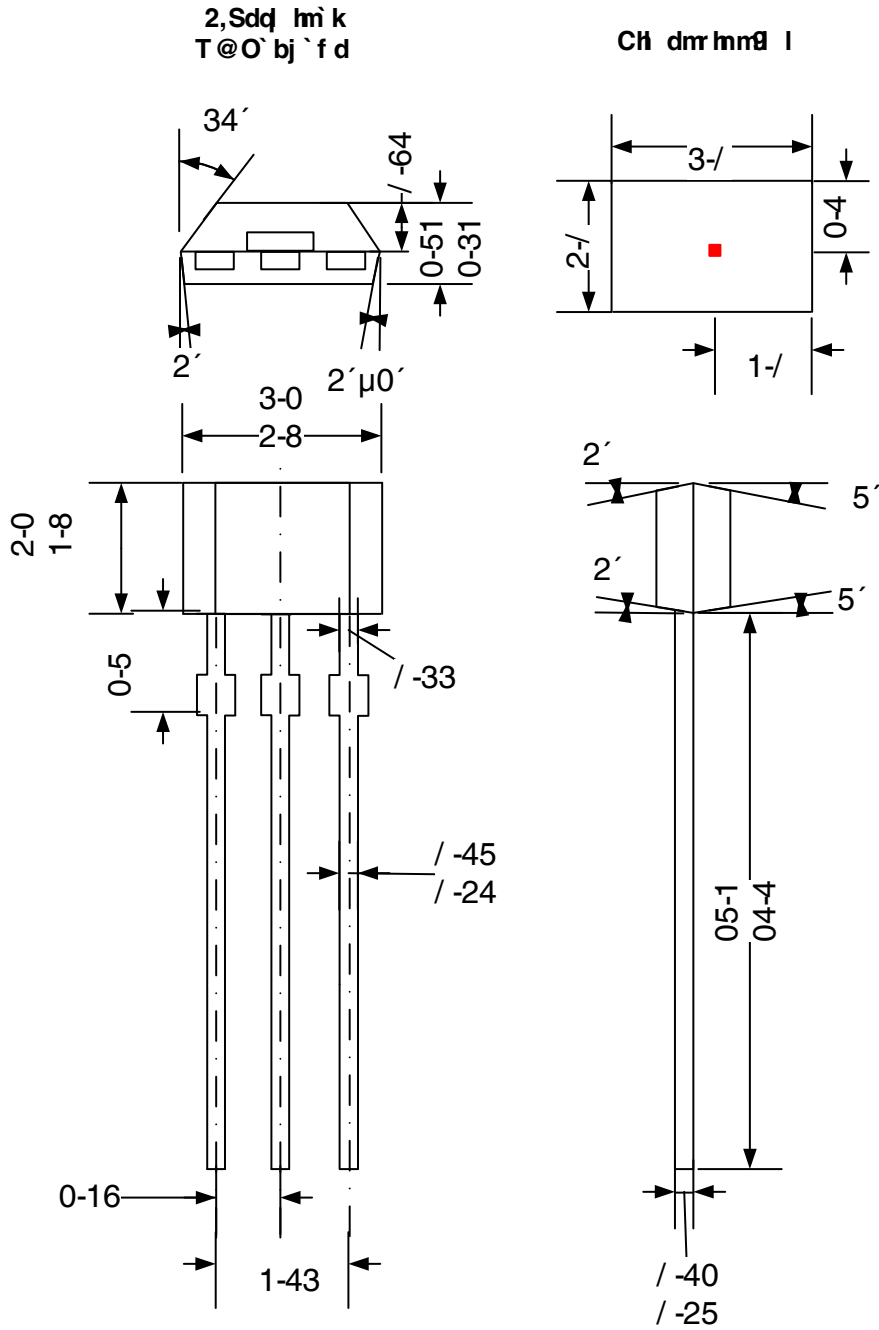
The SC2464 device output stage uses an open-drain NMOS, and it is rated to sink up to 20mA of current. For proper operation, calculate the value of the pull-up resistor RL is required. The size of RL is a tradeoff between OUT rise time and the load capacity when OUT is pulled low. A lower current is generally better, however faster transitions and bandwidth require a smaller resistor for faster switching.

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

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

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.

PACKAGE INFORMATION (UA)



Notes

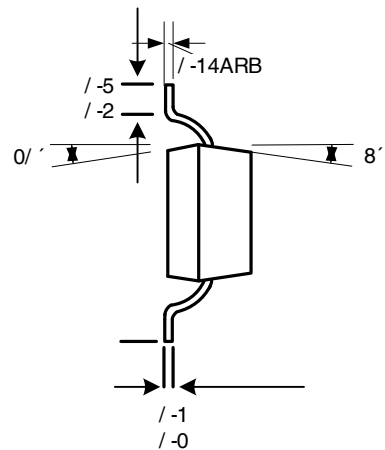
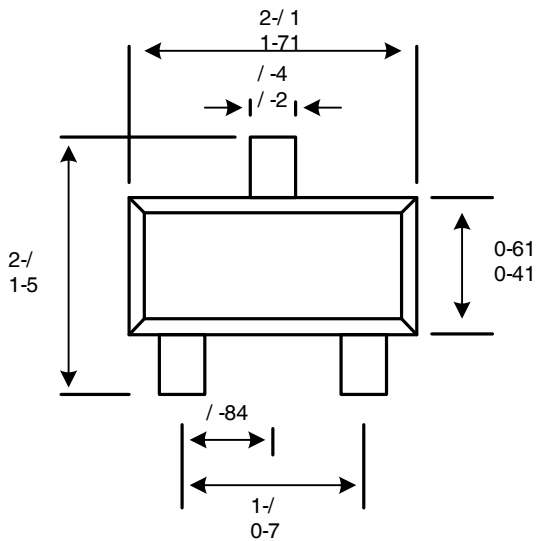
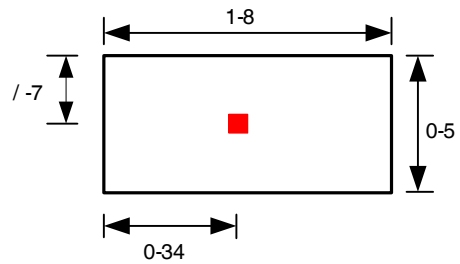
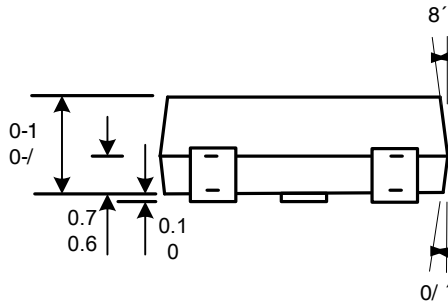
- 0- Dimensions are in millimeters unless otherwise specified.
- 1- Dimensions are in millimeters unless otherwise specified.

Vertical dimensions are to the top of the package unless otherwise specified.

PACKAGE INFORMATION (SO)

2, Sdd lmi k
RN O`bj` f d

Ch drr lmmr l



Mnsdr 9

- 0- Dw bsancx `mc kd` c bnrdf t q` sm` sudrcndf nosnmv lsglnk l r gnv m
- 1- Gdlf gscndr mshmbk cd l nlc f` sd d r g-

V gdq m snldq nbd hr rodblc+ch drr lmmr ml lmi k

REVISION HISTORY

Revision	Date	Description
RevA1.0	May-06-2020	Preliminary datasheet
RevA1.1	Nov-19-2020	Update format