
Unipolar Hall Effect Switches

Description

The SC113X Hall-Effect switch series is monolithic integrated circuits with tighter magnetic specifications, designed to operate continuously over extended temperatures to +150°C, and are more stable with both temperature and supply voltage changes. The negative compensation slope is optimized to match the negative temperature coefficient of low cost magnets.

Each device includes a voltage regulator for operation with supply voltages of 3.8 to 40V volts, quadratic Hall-voltage generator, temperature compensation circuitry, small-signal amplifier, Schmitt trigger, and an open-collector output to sink up to 40mA.

Features and Benefits

- 3.8 to 40V supply voltage
- High transient voltage protection
- 40mA sinking capability
- High ESD rating
- 3-pin SIP, 3-pin SOT-89 and SOT-23 packages are available
- RoHs compliant

Potential Applications

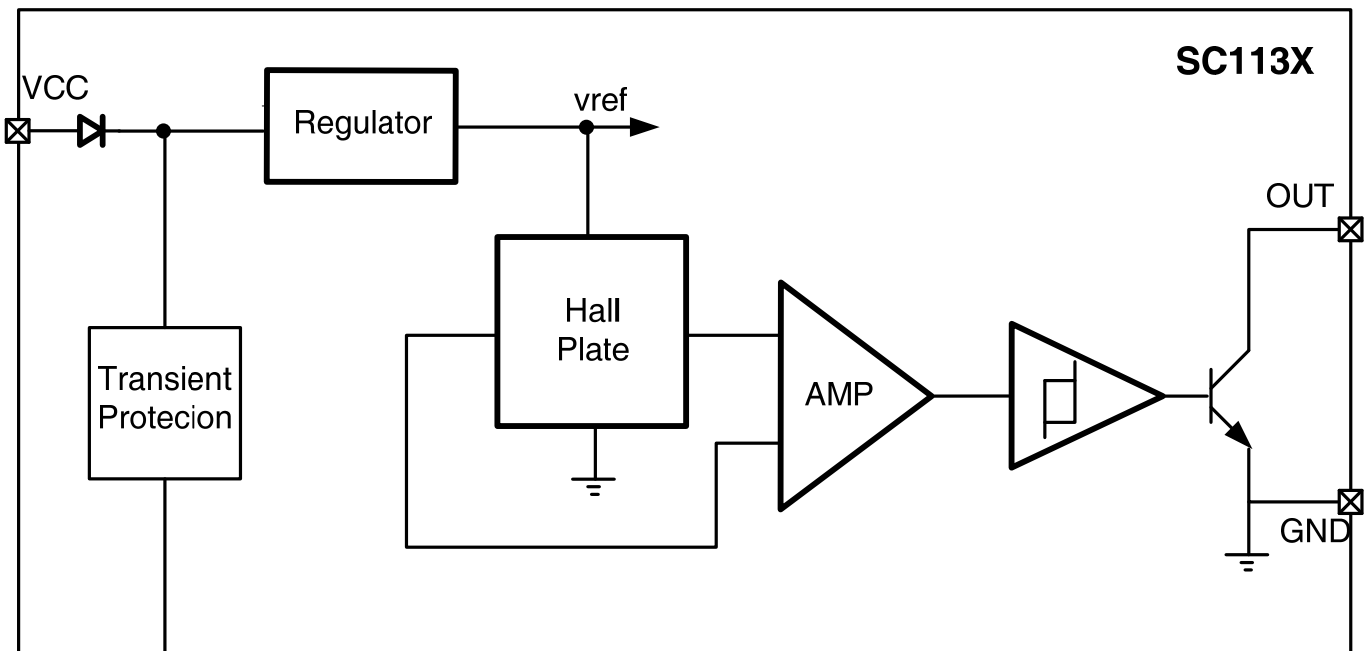
- Brushless DC motor
- Position sensor
- Motor and fan control
- Auto-motive transmission position

Device Information

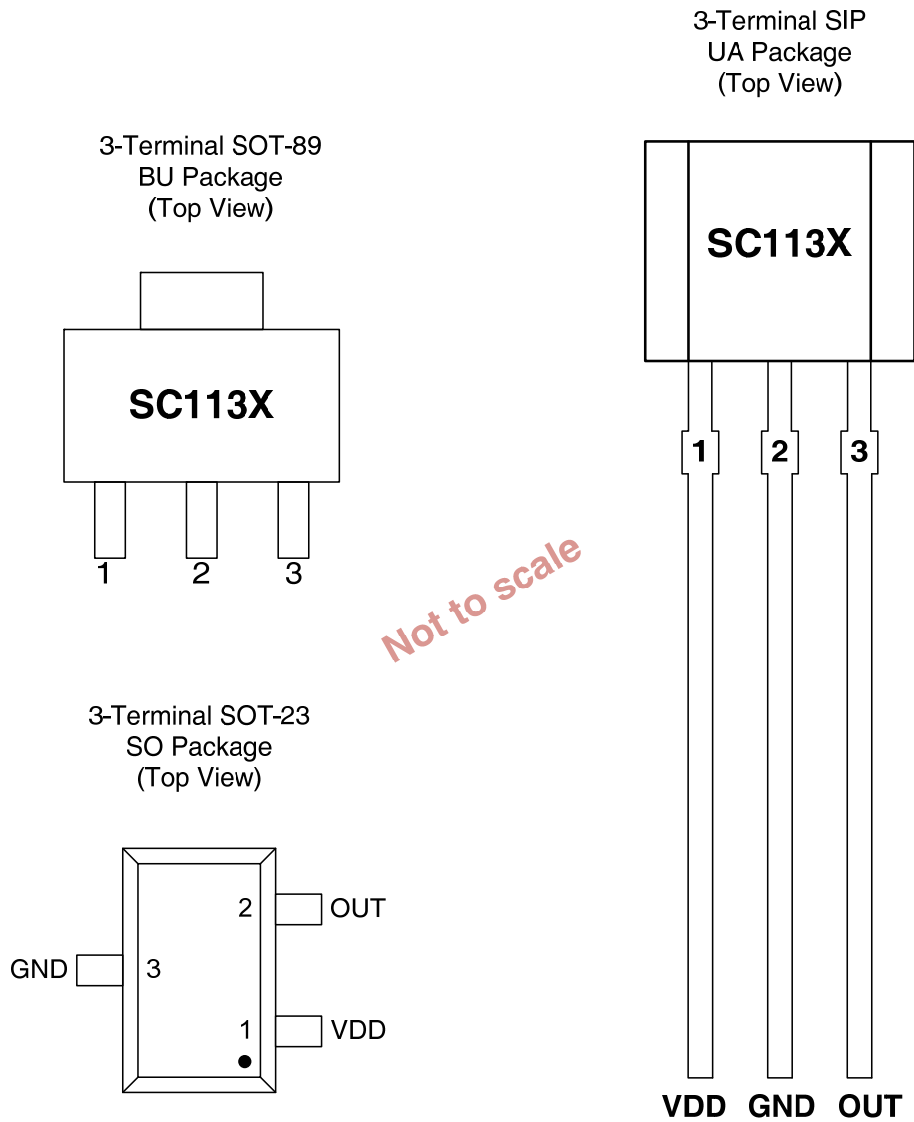
Part Number	Packing	Mounting	Ambient, T _A	B _{OP} (Typ.)	B _{RP} (Typ.)
SC1133UA	Bulk, 1000 pieces/bag	SIP3	-40°C to 150°C	+8.0mT	+5.5mT
SC1133SO-N	Reel, 3000pieces/reel	SOT-23		-8.0mT	-5.5mT
SC1134UA	Bulk, 1000 pieces/bag	SIP3	-40°C to 150°C	+12.0mT	+9.5mT
SC1134BU	Reel, 1000pieces/reel	SOT-89			
SC1134SO-N	Reel, 3000pieces/reel	SOT-23		-12.0mT	-9.5mT
SC1138UA	Bulk, 1000 pieces/bag	SIP3	-40°C to 150°C	+25.0mT	+20.0mT
SC1138SO-N	Reel, 3000pieces/reel	SOT-23		-25.0mT	-20.0mT

Block Diagram

The circuit includes Hall generator, amplifier and Schmitt-Trigger on one chip. The internal reference provides the supply voltage for the components. A magnetic field perpendicular to the chip surface induces a voltage at the Hall probe. This voltage is amplified and switches as a Schmitt-Trigger with open-collector output. A protection diode against reverse power supply is integrated.



Pin Description



Name	Terminal		Type	Description
	Number			
	UA/BU	SO		
VDD	1	1	PWR	3.8 to 40 V power supply
GND	2	3	Ground	Ground terminal
OUT	3	2	Output	Open-drain output

Absolute Maximum Ratings

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

Parameter	Symbol	Min.	Max.	Units
Power supply voltage	V _{CC}	-40 ⁽²⁾	60	V
Output terminal voltage	V _{OUT}	-0.5	60	V
Output terminal current sink	I _{SINK}	0	50	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.

Electrical Characteristics

over operating free-air temperature range (V_{CC} =5V, unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V _{CC}	Operating voltage ⁽¹⁾	T _J < T _J (Max.)	3.8	--	40	V
V _{CCR}	Reverse supply voltage	T _A =25°C	-40	--	--	V
I _{CC}	Operating supply current	V _{CC} =3.8 to 40 V	--	4.0	10	mA
I _{QL}	Off-state leakage current	Output Hi-Z	--	--	3	uA
V _{SAT}	Output saturation voltage	I _Q =20mA, T _A =25°C	--	--	300	mV
t _r	Output rise time	R1=1Kohm Co=20pF	--	--	1.5	uS
t _f	Output fall time	R1=1Kohm Co=20pF	--	--	1.5	uS

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

⁽²⁾ 1mT=10Gs

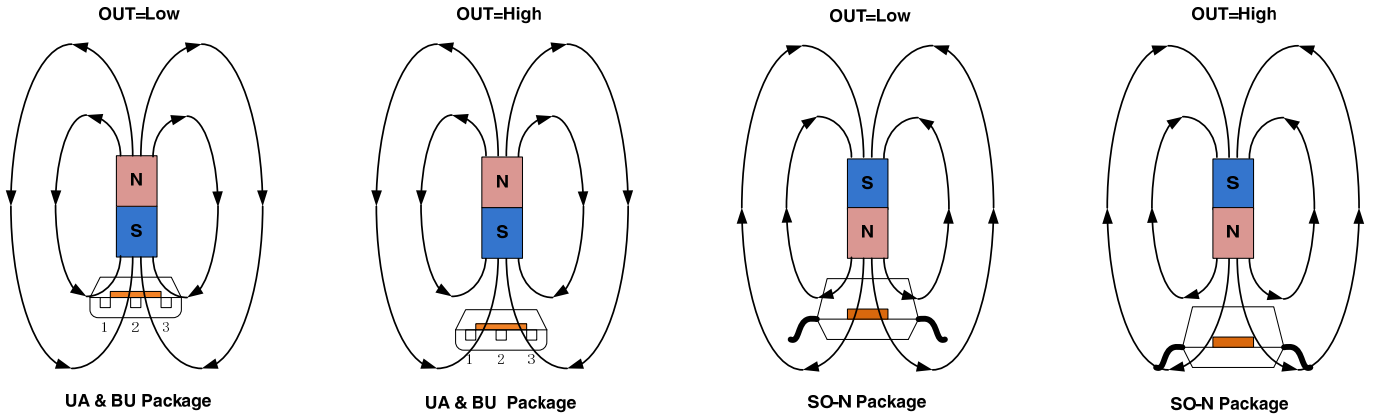
Magnetic Characteristics

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
f _{BW}	Bandwidth		--	--	100	kHz
SC1133 +8.0 / +5.5 mT						
B _{OP}	Operated point	T _A =25°C	5.5	8.0	11.5	mT
B _{RP}	Release point		1.5	5.5	10.0	mT
B _{HYS}	Hysteresis		--	2.5	--	mT
SC1134 +12.0 / +9.5 mT						
B _{OP}	Operated point	T _A =25°C	9.5	12.0	16.5	mT
B _{RP}	Release point		5.5	9.5	14.0	mT
B _{HYS}	Hysteresis		--	2.5	--	mT
SC1138 +25.0 / +20.0 mT						
B _{OP}	Operated point	T _A =25°C	20.5	25.0	29.5	mT
B _{RP}	Release point		14.5	20.0	25.5	mT
B _{HYS}	Hysteresis		--	5.0	--	mT

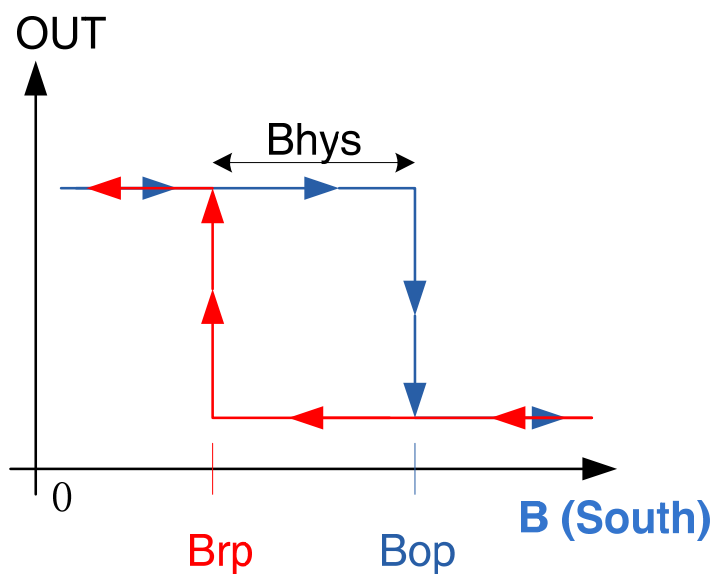
Field Direction Definition

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

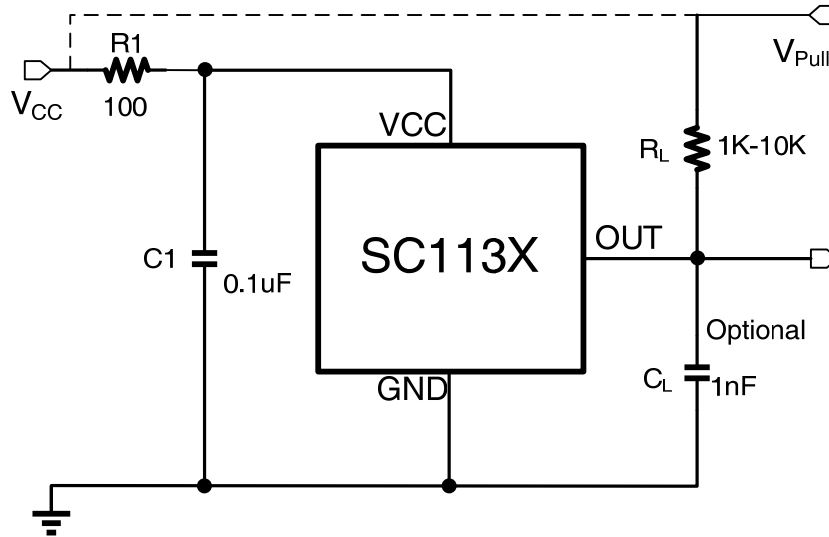


Transfer Function

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 SC113X 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. R1 is for improved CI performance, and could be 100 or 200 Ω typically.

The SC113X device output stage uses an open-drain NPN transistor, and it is rated to sink up to 40mA 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 vaule for C_L based on the system bandwidth specifications as:

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

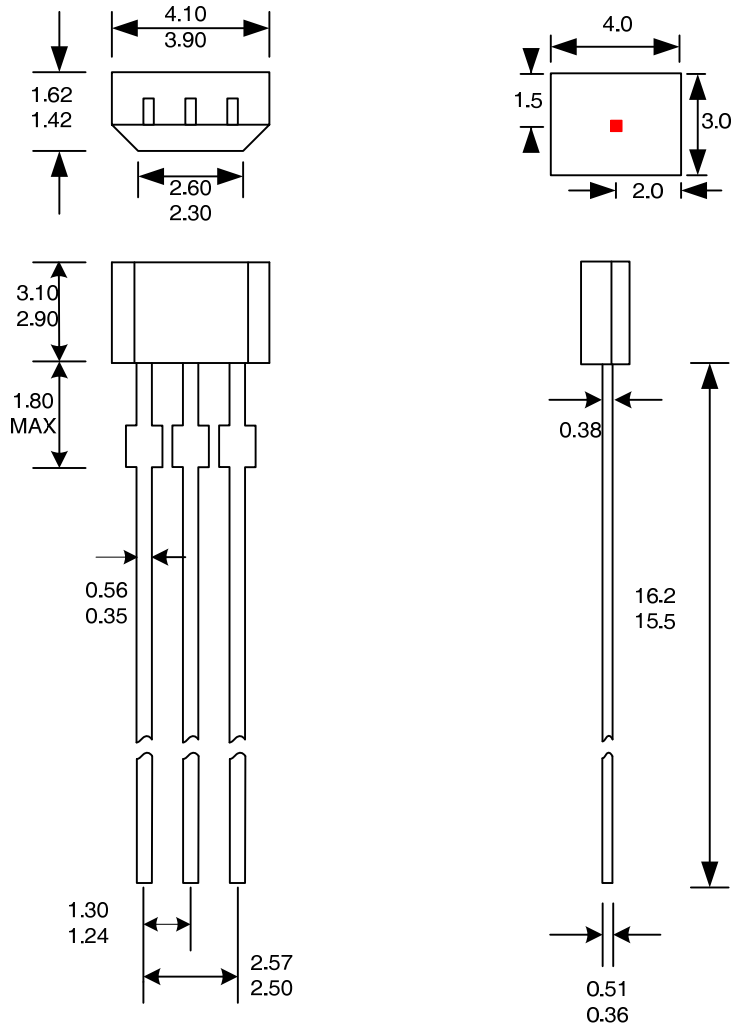
Most applications do not require this C_L filtering capacitor.

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

Mechanical Dimensions

3-Terminal UA Package

Dimension:mm



Notes:

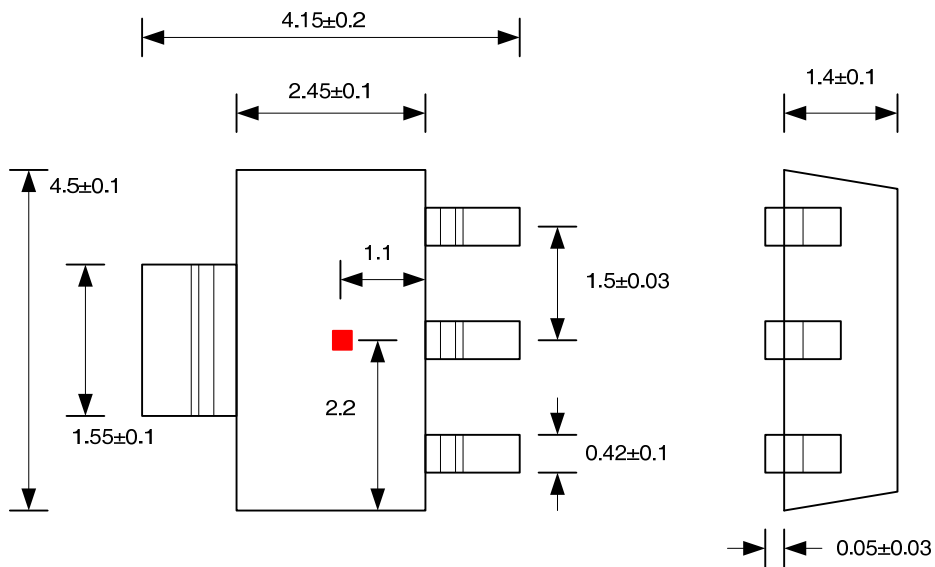
1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

Mechanical Dimensions

3-Terminal BU Package

Dimension: mm



Notes:

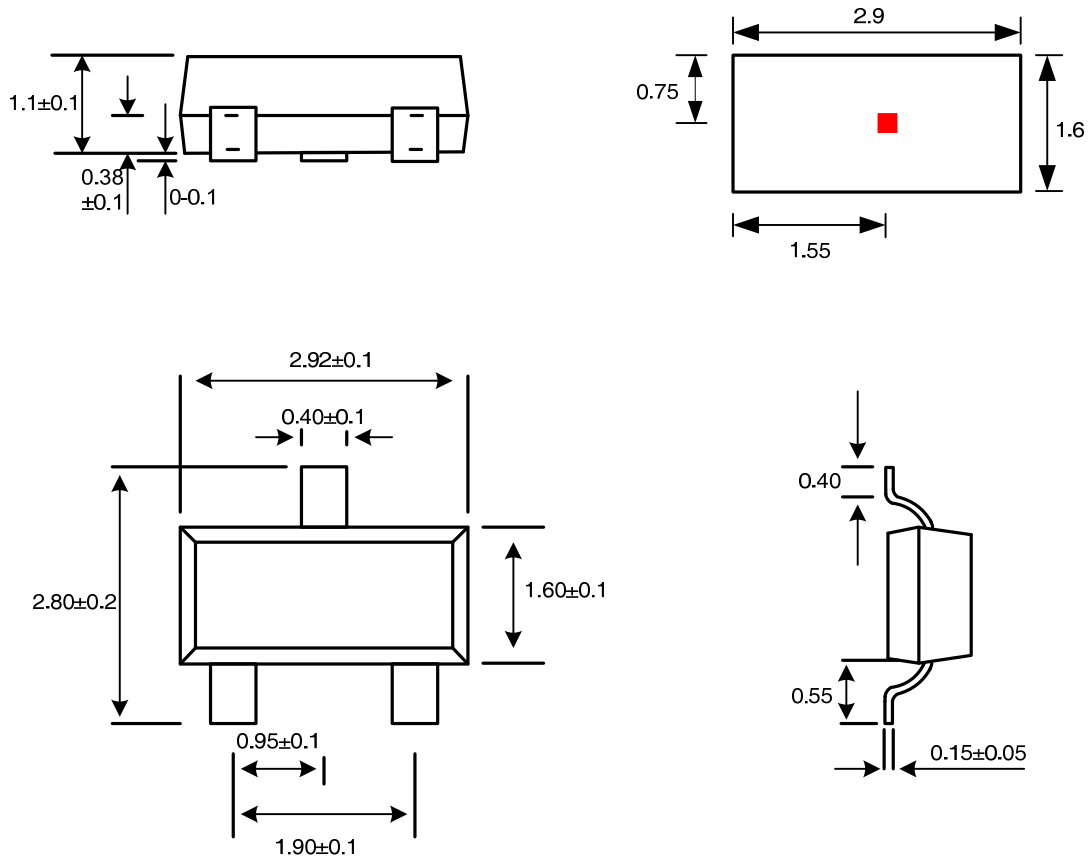
1. Exact body and lead configuration at vendor's option within limits shown.
2. Height does not include mold gate flash.

Where no tolerance is specified, dimension is nominal.

Mechanical Dimensions

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.

Where no tolerance is specified, dimension is nominal.

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[GN 55.4-ND-26-20,3-5](#) [GN 55.4-ND-7,5-4-1,5](#)