

USB PORT TRANSIENT SUPPRESSORS

FEATURES

- Qualified for Automotive Applications
- Design to Protect Submicron 3-V or 5-V Circuits from Noise Transients
- Port ESD Protection Capability Exceeds:
 - 15-kV Human Body Model
 - 2-kV Machine Model
- Available in a WCSP Chip-Scale Package
- Stand-Off Voltage . . . 6 V Min
- Low Current Leakage . . . 1 μ A Max at 6 V
- Low Capacitance . . . 35 pF Typ

APPLICATIONS

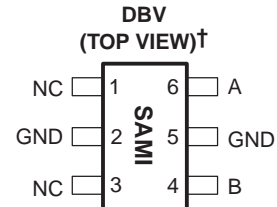
- USB 1.1 Host, Hub, or Peripheral Ports

DESCRIPTION

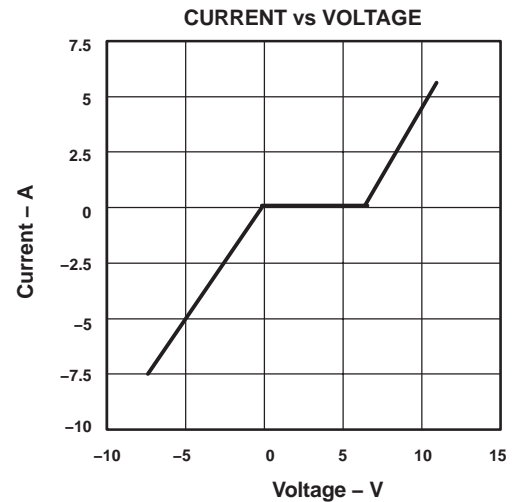
The SN65220 is a single transient voltage suppressor designed to provide electrical noise transient protection to universal serial bus (USB) 1.1 ports. Note that the input capacitance of the device makes it unsuitable for high-speed USB 2.0 applications.

Any cabled I/O can be subjected to electrical noise transients from various sources. These noise transients can cause damage to the USB transceiver and/or the USB ASIC if they are of sufficient magnitude and duration.

USB ports are typically implemented in 3-V or 5-V digital CMOS with limited ESD protection. The SN65220 can significantly increase the port ESD protection level and reduce the risk of damage to the circuits of the USB port. The IEC1000-4-2 ESD performance of the SN65220 is measured at the system level. Therefore, system design impacts the results of these tests. A high compliance level may be attained with proper board design and layout.

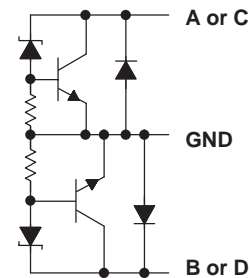


NC – No internal connection
[†]When read horizontally, pin 1 is the bottom left pin.



NOTE A: Typical current versus voltage curve was derived using the IEC 1.2/50- μ s surge waveform.

EQUIVALENT SCHEMATIC DIAGRAM



(One Suppressor Shown)

NOTE: All GND terminals should be connected to ground.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

IEC1000-4-2 COMPLIANCE LEVEL

IEC1000-4-2 COMPLIANCE LEVEL	MAXIMUM TEST VOLTAGE	
	CONTACT DISCHARGE (kV)	AIR DISCHARGE (kV)
1	2	2
2	4	4
3	6	8
4	8	15

PACKAGE/ORDERING INFORMATION†

PRODUCT	SUPPRESSORS	T _A	PACKAGE‡	PACKAGE DESIGNATOR	MARKED AS	ORDER NUMBER
SN65220	1	-40°C to 85°C	SOT23-6	DBV	SAMI	SN65220IDBVRQ1 (Mini Reel)

† For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at <http://www.ti.com>.

‡ Package drawings, thermal data, and symbolization are available at <http://www.ti.com/packaging>.

ABSOLUTE MAXIMUM RATINGS

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

	UNIT
Continuous power dissipation	See Dissipation Rating Table
Electrostatic discharge	15 kV ⁽²⁾ , 2 kV ⁽³⁾
Peak power dissipation, P _{D(peak)}	60 W
Peak forward surge current, I _{FSM}	3 A
Peak reverse surge current, I _{RSM}	-9 A
Storage temperature range, T _{stg}	-65°C to 150°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.

(2) Human Body Model – Tested in accordance with JEDEC Standard 22, Test Method A114-A.

(3) Charged Device Model – Tested in accordance with JEDEC Standard 22, Test Method C101.

DISSIPATION RATING TABLE

PACKAGE	T _A ≤ 25°C POWER RATING	DERATING FACTOR ABOVE T _A = 25°C‡	T _A = 70°C POWER RATING	T _A = 85°C POWER RATING
DBV	385 mW	3.1 mW/°C	246 mW	200 mW

‡ This is the inverse of the junction-to-ambient thermal resistance when board-mounted and with no air flow.

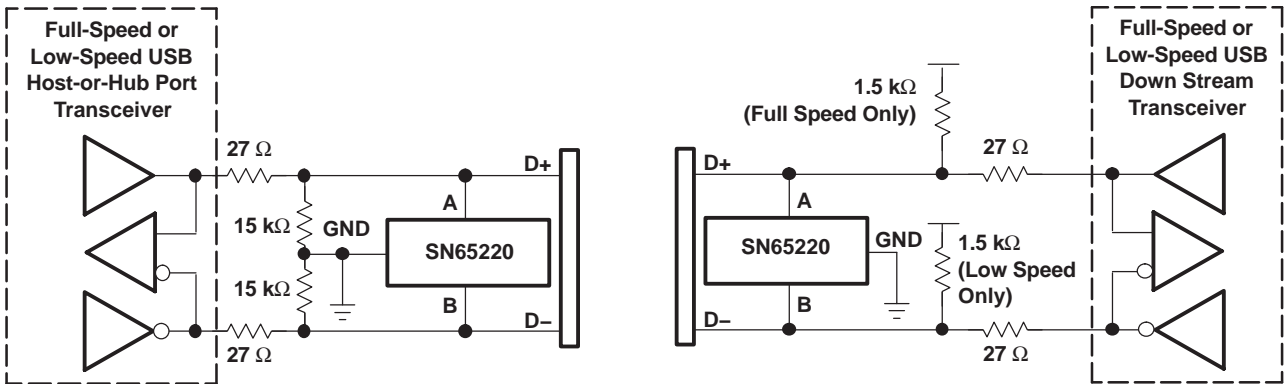
recommended operating conditions

	MIN	MAX	UNIT
Operating free-air temperature, T _A	-40	85	°C

electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_{lkg}	Leakage current	$V_I = 6\text{ V}$ at A, B, C, or D terminals			1	μA
$V_{(BR)}$	Breakdown voltage	$V_I = 1\text{ mA}$ at A, B, C, or D terminals	6.5	7	8	V
C_{IN}	Input capacitance to ground	$V_I = 0.4 \sin(4E6\pi t) + 0.5\text{ V}$		35		pF

APPLICATION INFORMATION



PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package Pins	Package qty Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
SN65220IDBVRQ1	Last Time Buy	Production	SOT-23 (DBV) 6	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	SAMI
SN65220IDBVRQ1.A	Last Time Buy	Production	SOT-23 (DBV) 6	3000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	SAMI

(1) **Status:** For more details on status, see our [product life cycle](#).

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "-" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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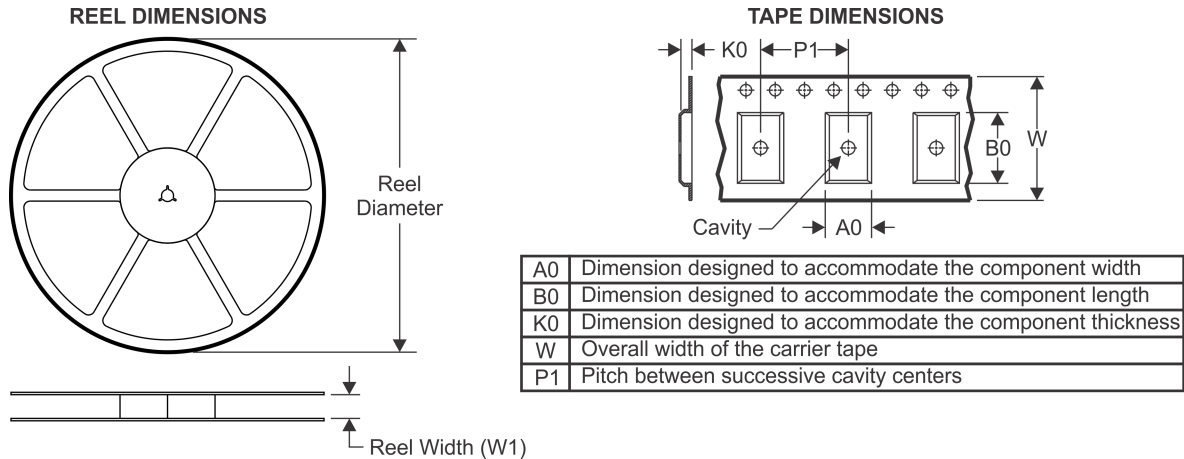
OTHER QUALIFIED VERSIONS OF SN65220-Q1 :

- Catalog : [SN65220](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN65220IDBVRQ1	SOT-23	DBV	6	3000	180.0	9.0	3.15	3.2	1.4	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

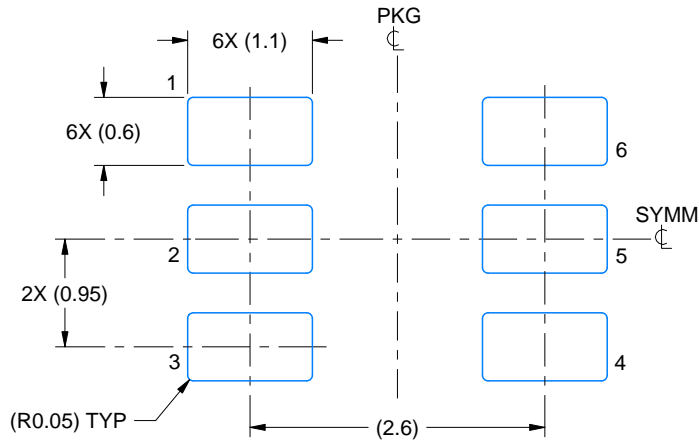
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN65220IDBVRQ1	SOT-23	DBV	6	3000	182.0	182.0	20.0

EXAMPLE BOARD LAYOUT

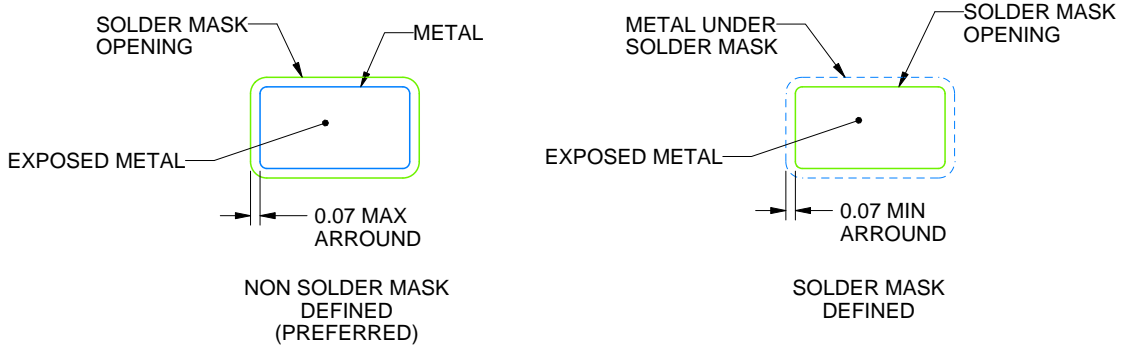
DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X



SOLDER MASK DETAILS

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NOTES: (continued)

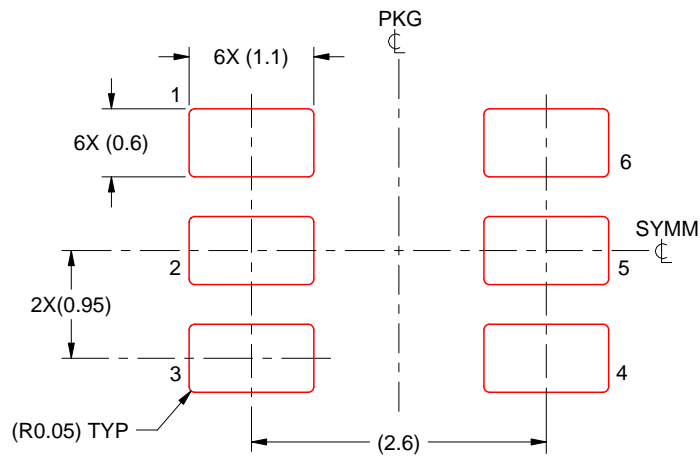
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBV0006A

SOT-23 - 1.45 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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Last updated 10/2025