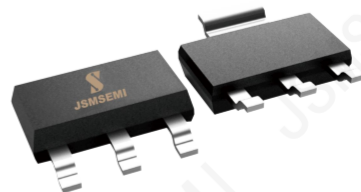


Description

The BSP75NQTA is a self-protected low-side MOSFET. It features monolithic overtemperature, overcurrent, overvoltage (active clamp) and ESD protected logic-level functionality. It is intended as a general-purpose switch.



SOT223

Features and Benefits

- Short-Circuit Protection with Auto Restart
- Overvoltage Protection (Active Clamp)
- Thermal Shutdown with Auto Restart
- Overcurrent Protection
- Input Protection (ESD)
- Load Dump Protection (Actively Protects Load)
- Logic-Level Input
- High Continuous Current Rating
- Lead-Free Finish; RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)

Product Summary

- Continuous Drain-Source Voltage: $V_{DS} = 60V$
- On-State Resistance: $500m\Omega$
- Max Nominal Load Current ($V_{IN} = 5V$): 1.1A
- Min Nominal Load Current ($V_{IN} = 5V$): 0.7A
- Clamping Energy: 550mJ

Applications

- Especially suited for loads with a high inrush current such as lamps and motors
- All types of resistive, inductive and capacitive loads in switching applications
- μC compatible power switches for 12V and 24V DC applications
- Automotive rated
- Replaces electromechanical relays and discrete circuits
- Linear mode capabilities - the current-limiting protection circuitry is designed to de-activate at low V_{DS} in order not to compromise the load current during normal operation. The maximum DC operating current is therefore determined by the thermal capability of the package/board combination rather than by the protection circuitry. This does not compromise the product's ability to self-protect at low V_{DS} .

Mechanical Data

- Package: SOT-223
- Package Material: Molded Plastic, "Green"
Molding Compound UL Flammability
Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish (e3)
- Weight: 0.112 grams (Approximate)

Ordering Information

Order number	Package	Marking	Operation Temperature Range	MSL Grade	Ship, Quantity	Green
BSP75NQTA	SOT-223	BSP75N	-40 to 150°C	1	T&R, 4000	RoHS

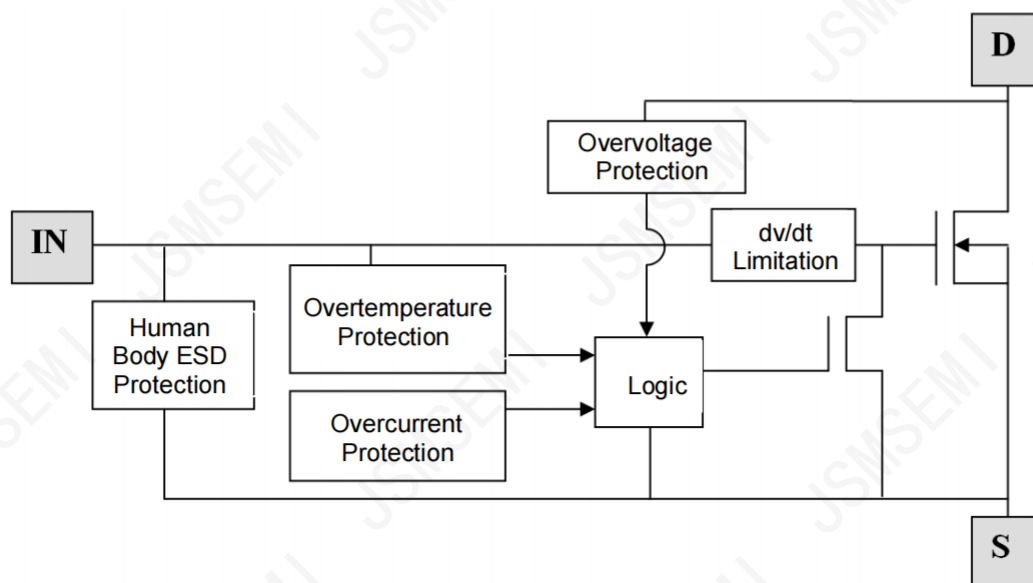
Absolute Maximum Ratings (@T_A = +25°C, unless otherwise specified.)

Parameter	Symbol	Value	Unit
Continuous Drain-Source Voltage	V _{DS}	60	V
Drain-Source Voltage for Short-Circuit Protection V _{IN} = 5V	V _{DS(SC)}	36	V
Drain-Source Voltage for Short-Circuit Protection V _{IN} = 10V	V _{DS(SC)}	20	V
Continuous Input Voltage	V _{IN}	-0.2 to 10	V
Peak Input Voltage	V _{IN}	-0.2 to 20	V
Operating Temperature Range	T _J	-40 to +150	°C
Storage Temperature Range	T _{STG}	-55 to +150	°C
Power Dissipation at T _A = +25°C (Note 5)	P _D	1.5	W
Power Dissipation at T _A = +25°C (Note 6)	P _D	0.6	W
Continuous Drain Current @ V _{IN} = 10V; T _A = +25°C (Note 5)	I _D	1.3	A
Continuous Drain Current @ V _{IN} = 5V; T _A = +25°C (Note 5)	I _D	1.1	A
Continuous Drain Current @ V _{IN} = 5V; T _A = +25°C (Note 6)	I _D	0.7	A
Continuous Source Current (Body Diode) (Note 5)	I _S	2.0	A
Pulsed Source Current (Body Diode) (Note 7)	I _S	3.3	A
Unclamped Single Pulse Inductive Energy	E _{AS}	550	mJ
Load Dump Protection	V _{LOAD_DUMP}	80	V
Electrostatic Discharge (Human Body Model)	V _{ESD}	4000	V
DIN Humidity Category, DIN 40 040	—	E	—
IEC Climatic Category, DIN IEC 68-1	—	40/150/56	—

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction to Ambient (Note 5)	R _{θJA}	83	°C/W
Junction to Ambient (Note 7)	R _{θJA}	45	°C/W
Junction to Ambient (Note 6)	R _{θJA}	208	°C/W

- Notes:
1. For a device surface-mounted on 25mm x 25mm x 1.6mm FR-4 board with a high coverage of single sided 2oz weight copper. Allocation of 6cm² copper 33% to source tab and 66% to drain pin with source tab and drain pin electrically isolated.
 2. For a device surface-mounted on FR-4 board with the minimum copper required for electrical connections.
 3. For a device surface-mounted on FR-4 board as (a) and measured at t ≤ 10s.

Functional Block Diagram


Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Conditions
Static Characteristics						
Drain-Source Clamp Voltage	V _{DS(AZ)}	60	70	75	V	I _D = 10mA
Off-State Drain Current	I _{DSS}	—	0.1	3	μA	V _{DS} = 12V, V _{IN} = 0V
Off-State Drain Current	I _{DSS}	—	3	15	μA	V _{DS} = 32V, V _{IN} = 0V
Input Threshold Voltage (Note 8)	V _{IN(TH)}	1	2.1	—	V	V _{DS} = V _{GS} , I _D = 1mA
Input Current	I _{IN}	—	0.7	1.2	mA	V _{IN} = 5V
Input Current	I _{IN}	—	1.5	2.7	mA	V _{IN} = 7V
Input Current	I _{IN}	—	4	7	mA	V _{IN} = 10V
Static Drain-Source On-State Resistance	R _{DS(ON)}	—	520	675	mΩ	V _{IN} = 5V, I _D = 0.7A
Static Drain-Source On-State Resistance	R _{DS(ON)}	—	385	550	mΩ	V _{IN} = 10V, I _D = 0.7A
Current Limit (Note 9)	I _{D(LIM)}	0.7	1.0	1.5	A	V _{IN} = 5V, V _{DS} > 5V
Current Limit (Note 9)	I _{D(LIM)}	1	1.8	2.3	A	V _{IN} = 10V, V _{DS} > 5V
Dynamic Characteristics						
Turn-On Time (V _{IN} to 90% I _D)	t _{ON}	—	3	—	μs	R _L = 22Ω, V _{IN} = 0V to 10V V _{DD} = 12V
Turn-Off Time (V _{IN} to 90% I _D)	t _{OFF}	—	13	—	μs	R _L = 22Ω, V _{IN} = 10V to 0V V _{DD} = 12V
Slew Rate On (70% to 50% V _{DD})	-dV _{DS} /dt _{ON}	—	8	—	V/μs	R _L = 22Ω, V _{IN} = 0V to 10V V _{DD} = 12V
Slew Rate Off (50% to 70% V _{DD})	dV _{DS} /dt _{ON}	—	3.2	—	V/μs	R _L = 22Ω, V _{IN} = 10V to 0V V _{DD} = 12V
Protection Functions (Note 10)						
Minimum Input Voltage for Overtemperature Protection	V _{PROT}	4.5	—	—	V	—
Thermal Overload Trip Temperature	T _{JT}	+150	+175	—	°C	—
Thermal Hysteresis	—	—	+1	—	°C	—
Unclamped Single Pulse Inductive Energy T _J = +25°C	E _{AS}	550	—	—	mJ	I _{D(ISO)} = 0.7A, V _{DD} = 32V
Unclamped Single Pulse Inductive Energy T _J = +150°C	E _{AS}	200	—	—	mJ	I _{D(ISO)} = 0.7A, V _{DD} = 32V
Inverse Diode						
Source-Drain Voltage	V _{SD}	—	—	1	V	V _{IN} = 0V, -I _D = 1.4A

- Notes:
- Protection features may operate outside spec for V_{IN} < 4.5V.
 - The drain current is limited to a reduced value when V_{DS} exceeds a safe level.
 - Integrated protection functions are designed to prevent IC destruction under fault conditions described in the datasheet. Fault conditions are considered as "outside" normal operating range. Protection functions are not designed for continuous, repetitive operation.

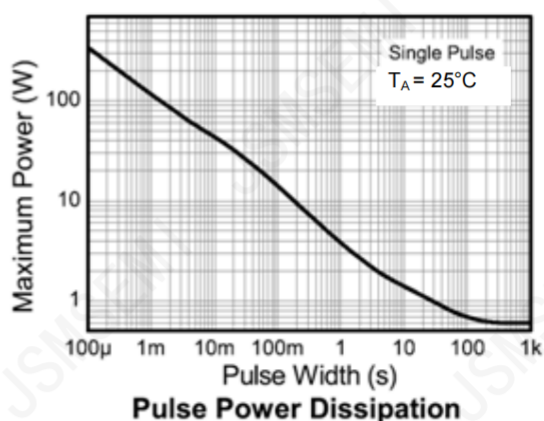
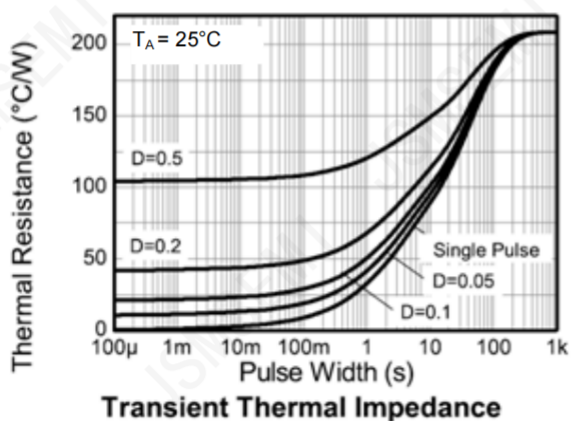
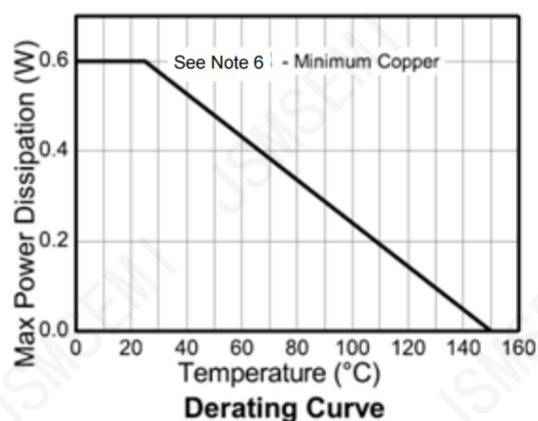
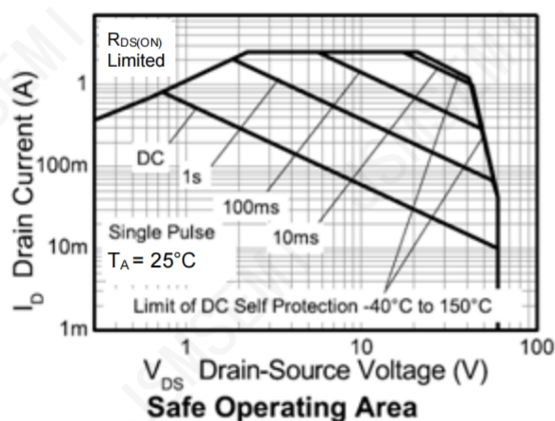
Application Information

The current-limit protection circuitry is designed to de-activate at low V_{DS} to prevent the load current from being unnecessarily restricted during normal operation. The design max DC operating current is therefore determined by the thermal capability of the package/board combination, rather than by the protection circuitry (see Typical Characteristics graphs). This does not compromise the products ability to self-protect at low V_{DS} . The overtemperature protection circuit trips at a minimum of $+150^{\circ}\text{C}$. So the available package dissipation reduces as the maximum required ambient temperature increases. This leads to the following maximum recommended continuous operating currents.

Minimum Copper Area Characteristics

For minimum copper condition as described in Note 6.

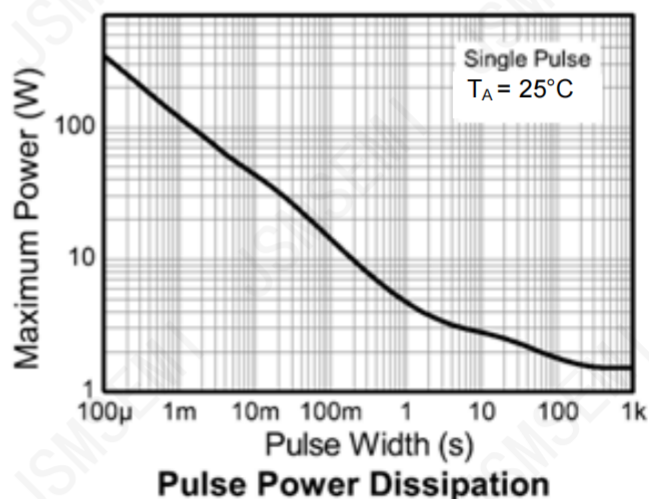
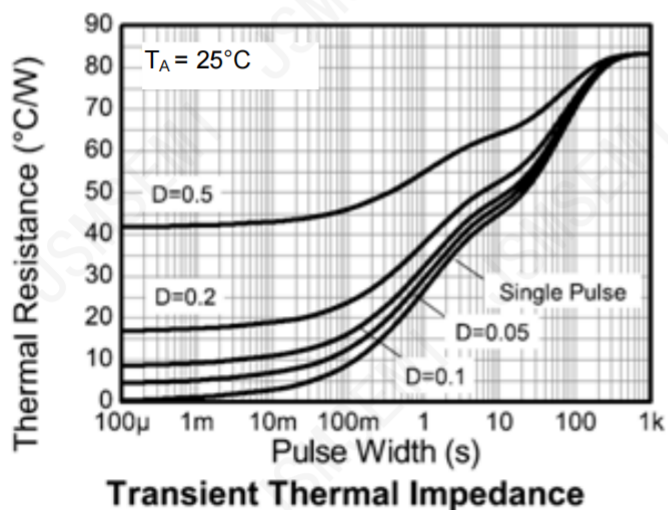
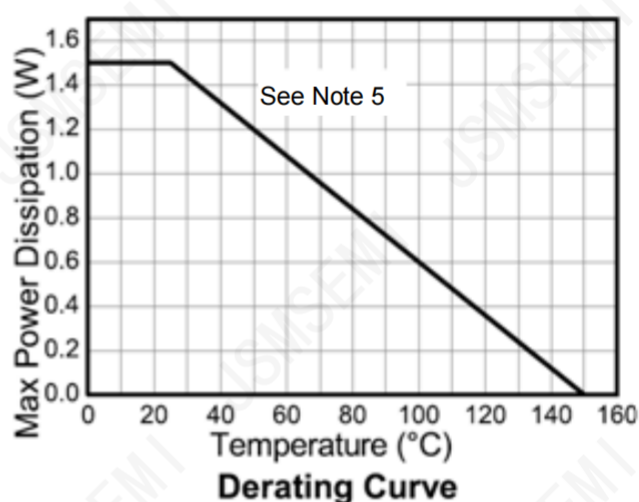
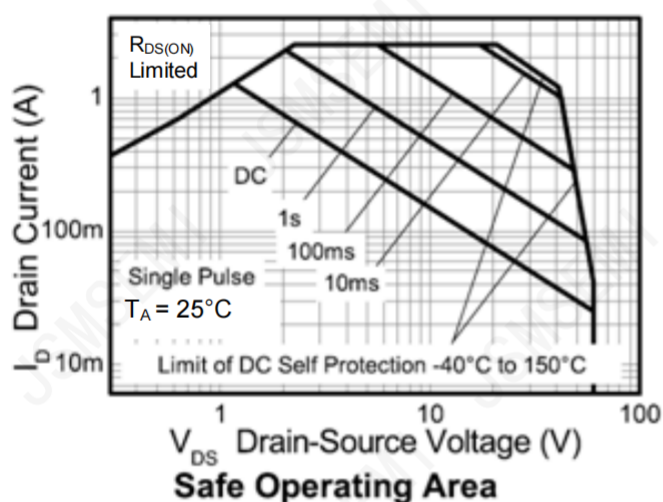
Max Ambient Temperature T_A	Maximum Continuous Current	
	$V_{IN} = 5V$	$V_{IN} = 10V$
$+25^{\circ}\text{C}$ at $V_{IN} = 5V$	720mA	840mA
$+70^{\circ}\text{C}$ at $V_{IN} = 5V$	575mA	670mA
$+85^{\circ}\text{C}$ at $V_{IN} = 5V$	520mA	605mA
$+125^{\circ}\text{C}$ at $V_{IN} = 5V$	320mA	375mA



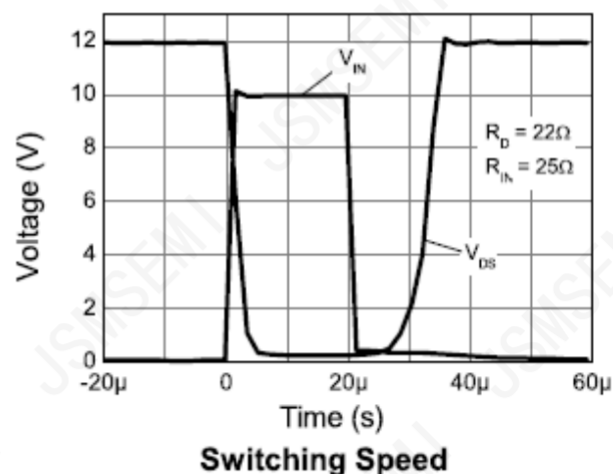
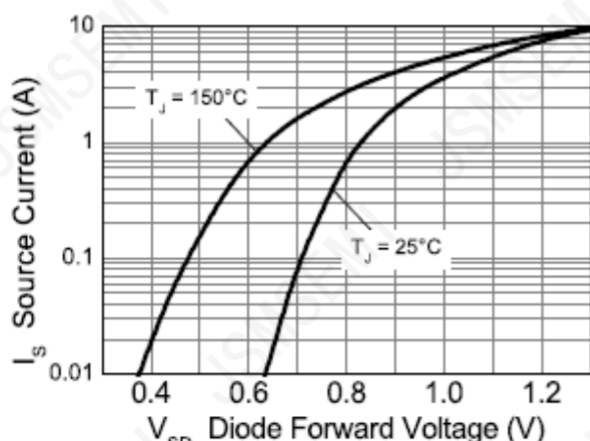
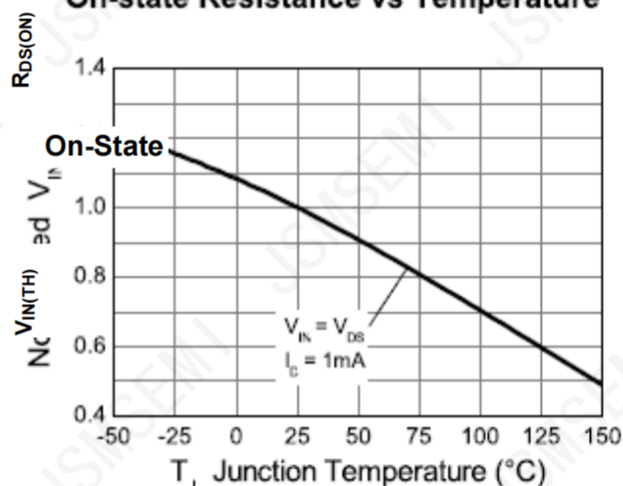
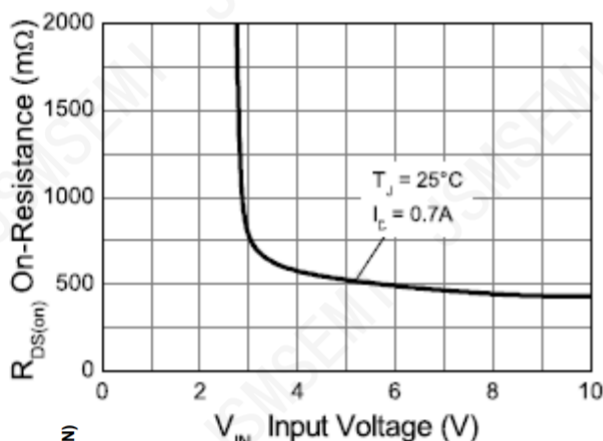
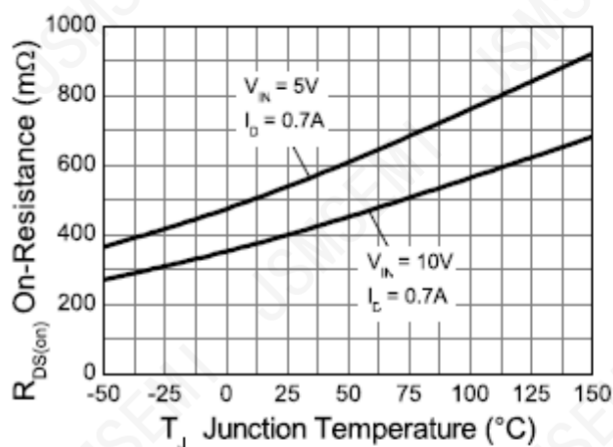
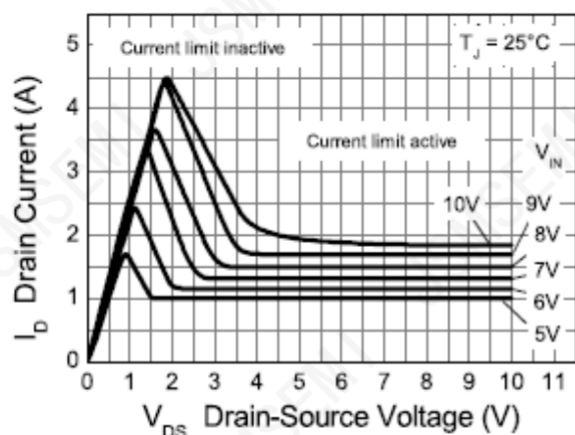
Large Copper Area Characteristics

For large copper area as described in Note 5.

Max Ambient Temperature T_A	Maximum Continuous Current	
	$V_{IN} = 5V$	$V_{IN} = 10V$
+25°C at $V_{IN} = 5V$	1140mA	1325mA
+70°C at $V_{IN} = 5V$	915mA	1060mA
+85°C at $V_{IN} = 5V$	825mA	955mA
+125°C at $V_{IN} = 5V$	510mA	590mA

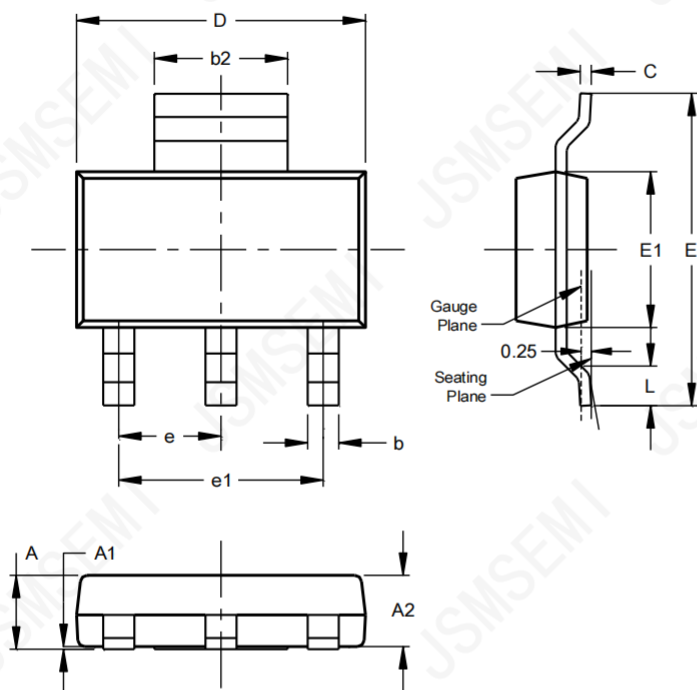


Typical Characteristics



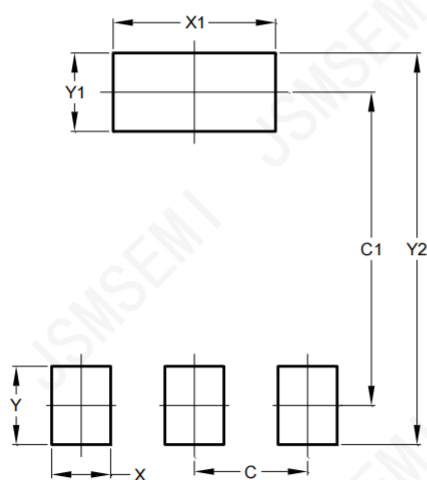
Package Outline Dimensions

SOT223



SOT223 (Type DN)			
Dim	Min	Max	Typ
A	--	1.70	--
A1	0.01	0.15	--
A2	1.50	1.68	1.60
b	0.60	0.80	0.70
b2	2.90	3.10	--
c	0.20	0.32	--
D	6.30	6.70	--
E	6.70	7.30	--
E1	3.30	3.70	--
e	--	--	2.30
e1	--	--	4.60
L	0.85	--	--
All Dimensions in mm			

Suggested Pad Layout



Dimensions	Value (in mm)
C	2.30
C1	6.40
X	1.20
X1	3.30
Y	1.60
Y1	1.60
Y2	8.00

Revision History

Rev.	Change	Date
V1.0	Initial version	6/27/2021

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