

BSP04NL018SK1

N-Channel Power MOSFET

40 V, 240 A, 1.8 mΩ

Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency. It has been optimized for low gate charge, low $R_{DS(on)}$, fast switching speed.

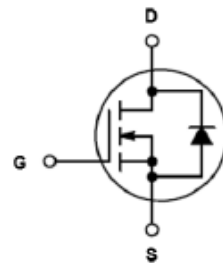
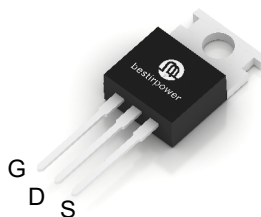
Applications

- Motor Driver
- DC/DC Converter
- Battery Management System

Features

BV_{DSS}	I_D	$R_{DS(on),max}$	$Q_{rr,typ}$
40 V	240 A	1.8 mΩ	60 nC

- $R_{DS(on),MAX}=1.8m\Omega@V_{GS}=10V$
- $R_{DS(on),MAX}=2.5m\Omega@V_{GS}=4.5V$
- Low gate Charge (typical 74.8nC)
- Low C_{rss} (typical 36pF)
- Low On-Resistance
- Excellent FoM(figure of merit)
- 100% UIS and Rg tested



Absolute Maximum Ratings ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		40	V
V_{GSS}	Gate to Source Voltage		± 20	V
I_D	Continuous Drain Current, ($T_C = 25^\circ\text{C}$) ¹⁾		240	A
	Continuous Drain Current, ($T_C = 100^\circ\text{C}$) ¹⁾		168	
I_{DM}	Drain Current (2)	Pulsed	960	A
E_{AS}	Single Pulsed Avalanche Energy (3)		694	mJ
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	187	W
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.67	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	50	

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}, T_J = 25^\circ\text{C}$	-	-	1	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = \pm 20\text{ V}$	-	-	± 100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1	-	2.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}, I_D = 40\text{ A}$	-	1.55	1.8	mΩ

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}, f = 1.0\text{ MHz}$	-	5059	-	pF
C_{oss}	Output Capacitance		-	1730	-	pF
C_{rss}	Reverse transfer capacitance		-	36	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	$V_{GS} = 10\text{ V}, V_{DD} = 20\text{ V}, I_D = 40\text{ A}$	-	74.8	-	nC
Q_{gs}	Gate to Source Charge		-	16.6	-	nC
Q_{gd}	Gate to Drain "Miller" Charge		-	11.2	-	nC
R_G	Gate Resistance	$f = 1\text{ MHz}$	-	5.6	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 10\text{ V}, V_{DD} = 20\text{ V}, R_G = 3\text{ }\Omega, I_D = 40\text{ A}$	-	13	-	ns
t_r	Turn-On Rise Time		-	34	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	44	-	ns
t_f	Turn-Off Fall Time		-	20	-	ns

Source-Drain Diode Characteristics

I_S	Continuous Diode Forward Current	$T_J = 25^\circ\text{C}, I_S = 40\text{ A}, V_{GS} = 0\text{ V}$	-	240	-	A
$I_{S\text{ pulse}}$	Diode Pulsed Current ²⁾		-	960	-	
V_{SD}	Diode Forward Voltage	$T_J = 25^\circ\text{C}, I_S = 40\text{ A}, V_{GS} = 0\text{ V}$	-	0.8	1.4	V
t_{rr}	Reverse Recovery Time	$I_F = 40\text{ A}, diF/dt = 100\text{ A/us}$	-	50	-	ns
Q_{rr}	Reverse Recovery Charge		-	60	-	nC

Notes

- 1) Limited by maximum junction temperature.
- 2) Repetitive Rating: Pulse width limited by maximum junction temperature.
- 3) $L=0.5\text{ mH}, R_G=25\text{ }\Omega, V_{GS}=10\text{ V}, V_{DD}=20\text{ V}, \text{ Start } T_J=25^\circ\text{C}$.

Typical Performance Characteristics

Figure 1. Transient Thermal Impedance

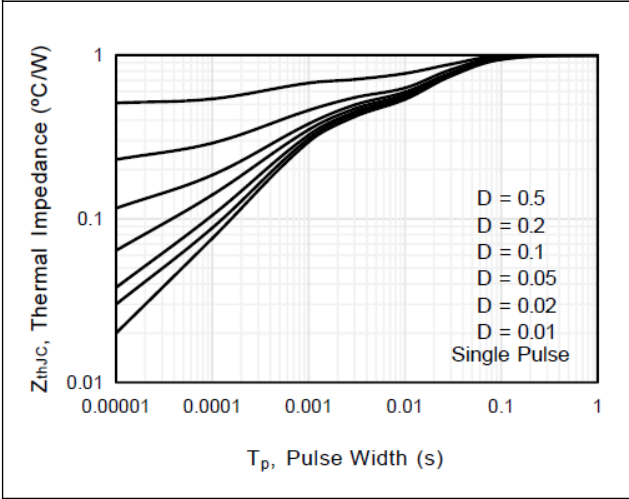


Figure 2 . Safe Operation Area

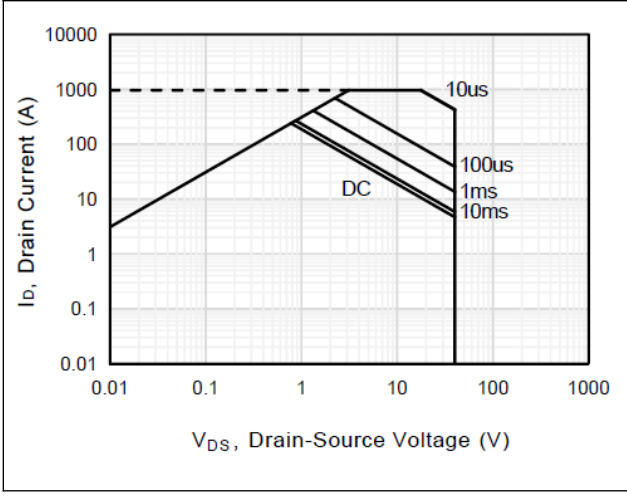


Figure 3 . Output Characteristics

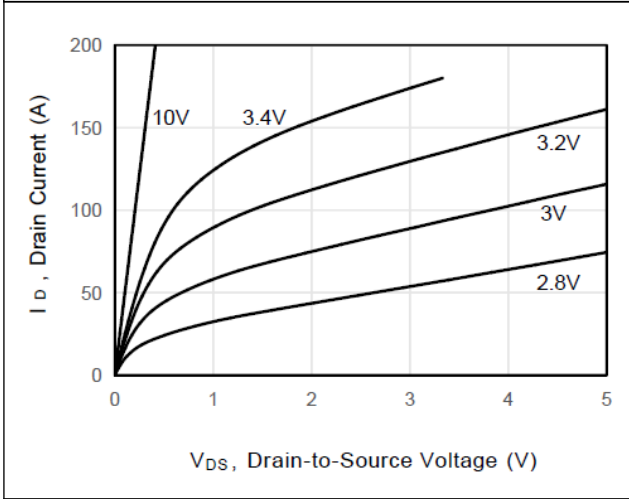


Figure 4 . Transfer Characteristics

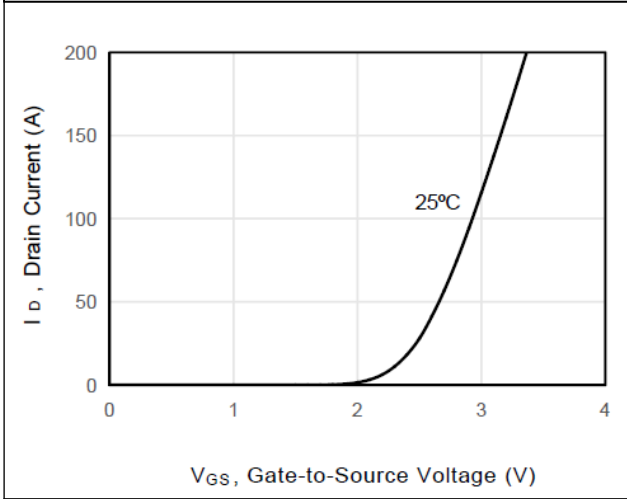


Figure 5 . On-Resistance vs Drain Current

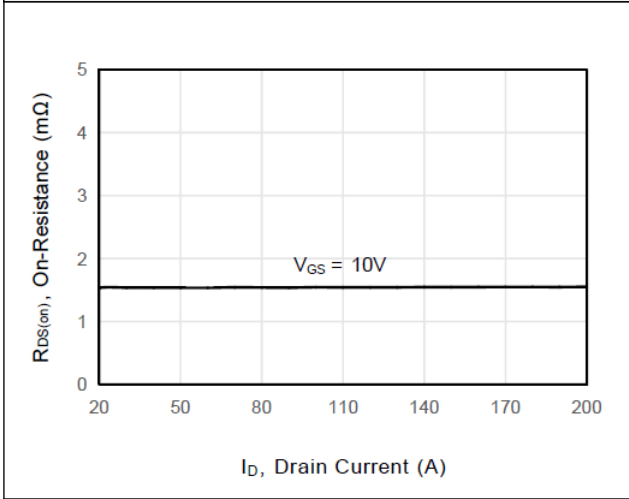
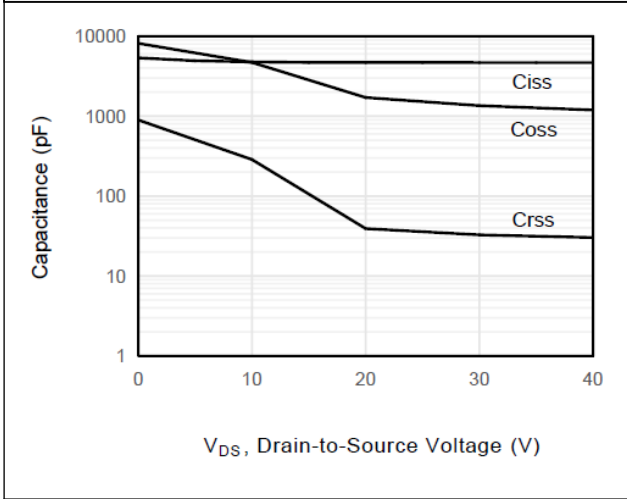


Figure 6 . Capacitance



Typical Performance Characteristics

Figure 7 . Gate Charge

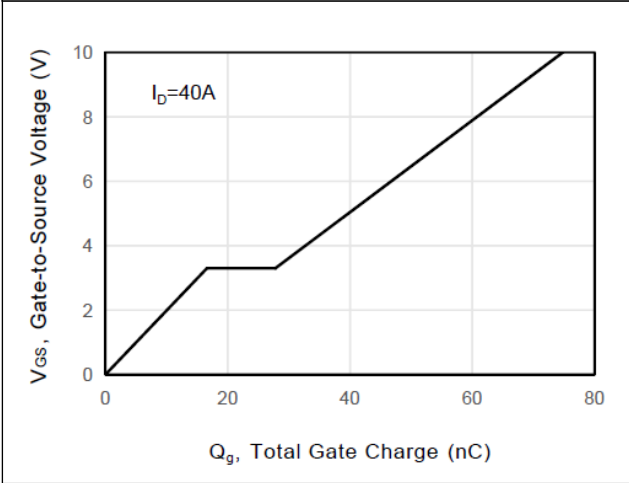


Figure 8 . Body Diode Forward Voltage

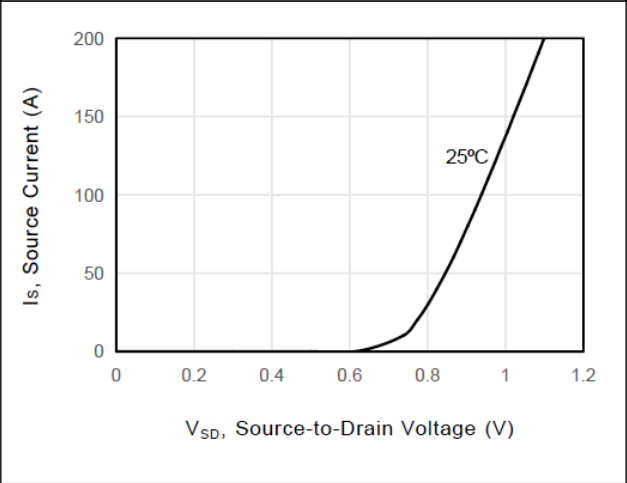


Figure 9. Breakdown Voltage vs Junction Temperature

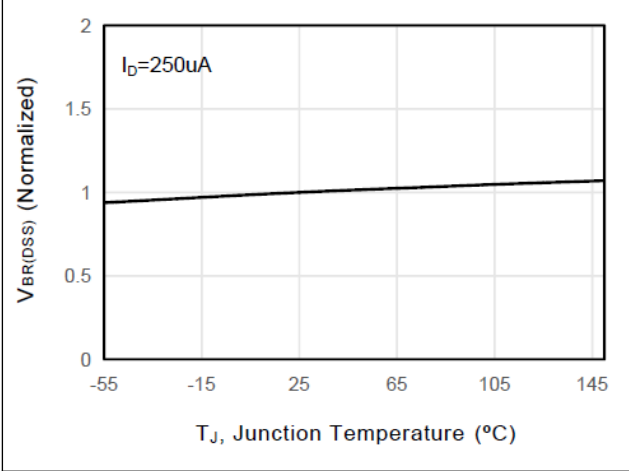


Figure 10. On-Resistance vs Temperature

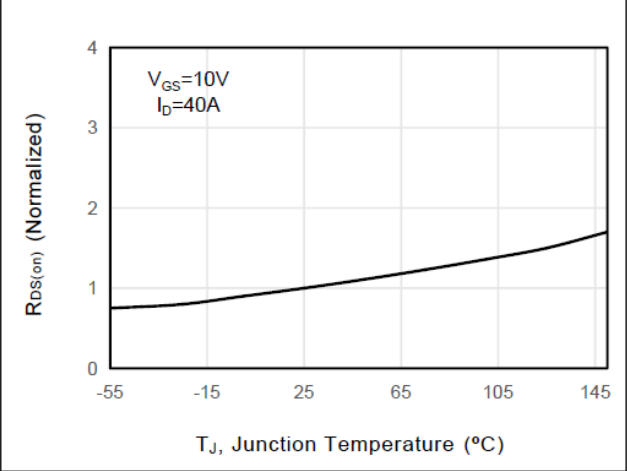
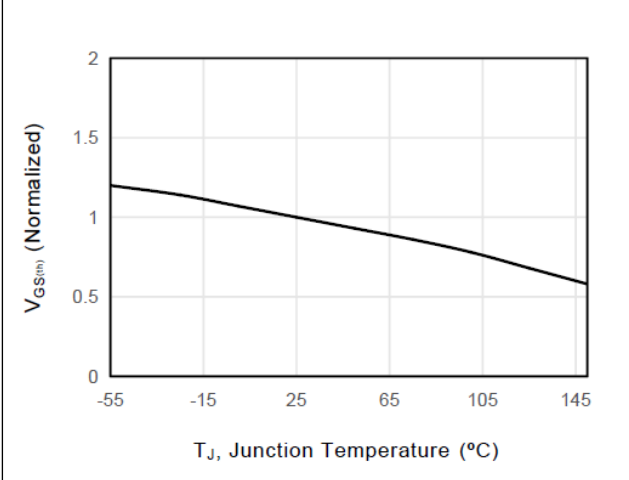


Figure 11. $V_{GS(th)}$ vs Junction Temperature



Test Circuits

Figure 12: Gate Charge Test Circuit and Waveform

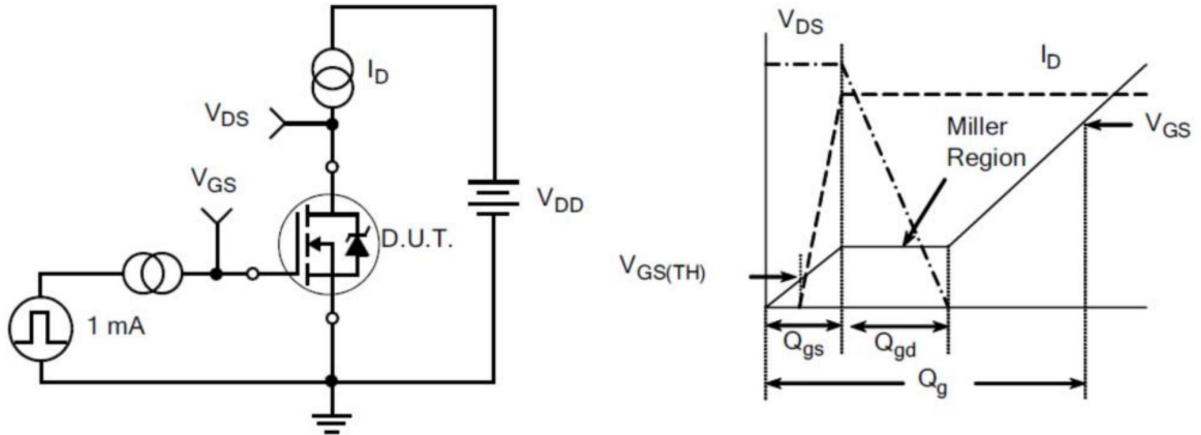


Figure 13: Resistive Switching Test Circuit and Waveform

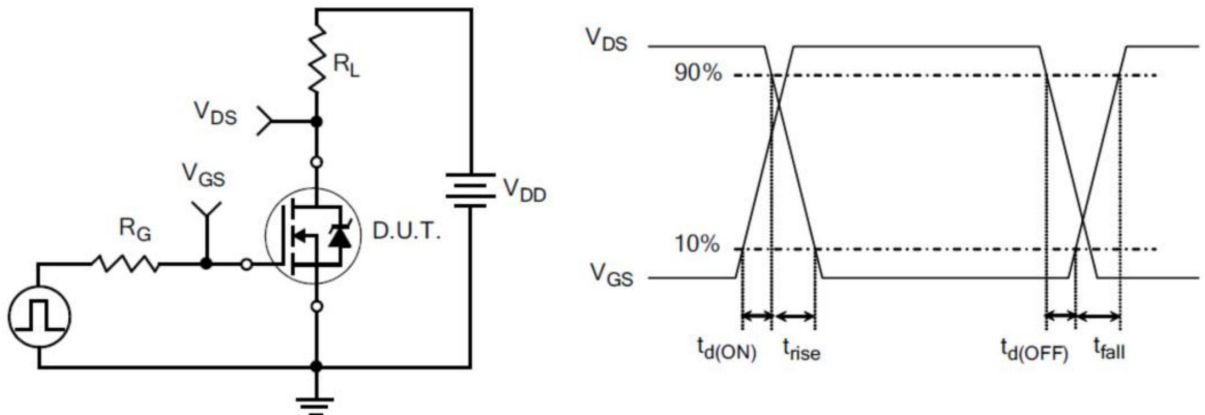
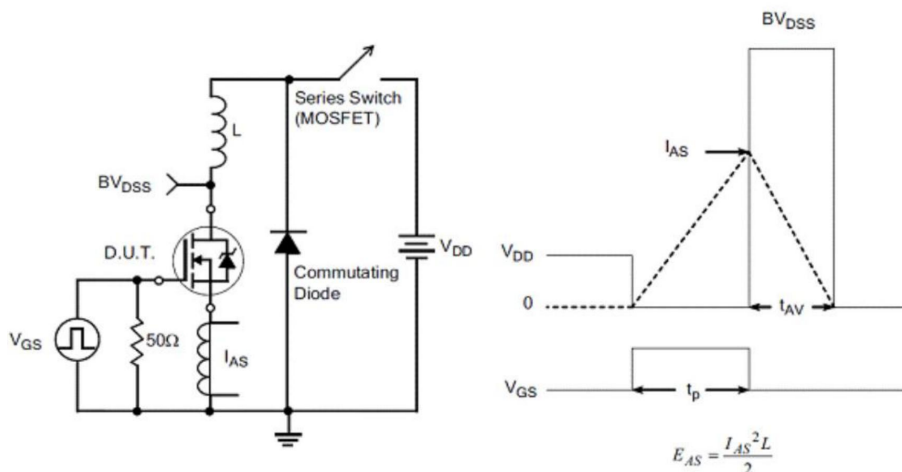
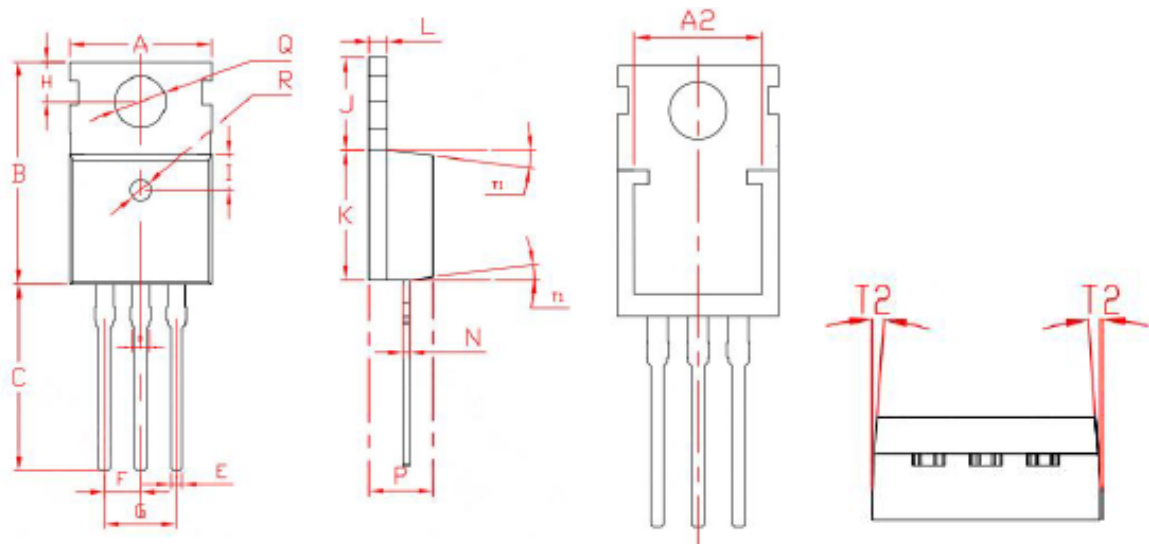


Figure 14: Unclamped Inductive Switching Test Circuit and Waveform



Package Outlines

TO220-3L



SYMBOL	MIN	NON	MAX
A	9.80	10.00	10.20
A2		8	
B	15.55	15.70	15.85
C	12.75	13.10	13.17
D		1.27	
E		0.80	
F		2.54	
G		5.08	
H	2.73	2.80	2.87
I		2.5	
J	6.40	6.50	6.60
K	9.10	9.20	9.25
L	1.29	1.30	1.32
N	0.48	0.50	0.56
0	2.35	2.4	2.5
P	4.4	4.5	4.7
Q	3.5	3.6	3.63
R	1.4	1.5	1.6
T1	6°	7°	8°
T2	2°	3°	4°

* Dimensions in millimeters

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BSP04NL018SK1	BSP04NL018SK1	TO220-3L	Tube	50 units

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