MOSFET

Metal Oxide Semiconductor Field Effect Transistor

OptiMOS™

OptiMOS™ Power-MOSFET, 40 V

BSC014N04LS

Data Sheet

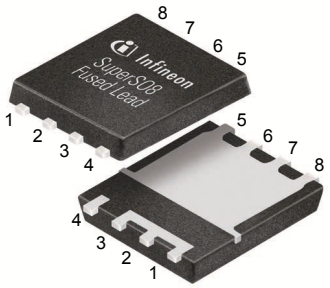
Rev. 2.2
Final

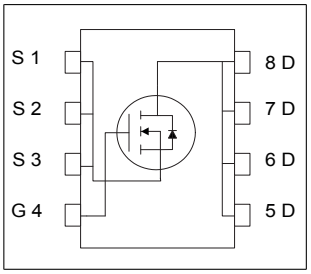
Power Management & Multimarket

1 Description

This N-channel MOSFET is optimized for low on-state resistance, gate charge and reverse recovery charge which make it a perfect choice for synchronous rectification in switched mode power supplies such as in servers.

TDSON-8 FL (enlarged source interconnection)





Features [1)]

- Optimized for synchronous rectification
- Very low on-state resistance $R_{DS(on)}$
- 100% avalanche tested
- Superior thermal resistance
- N-channel, logic level
- Qualified according to JEDEC for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21

Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	40	V
$R_{DS(on),max}$	1.4	mΩ
I_D	100	A
Q_{oss}	54	nC
Q_g(0V..10V)	61	nC

Type / Ordering Code	Package	Marking	Related Links
BSC014N04LS	SuperSO8 FL	014N04LS	-

[1)] J-STD20 and JESD22

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2 Maximum ratings

at T_j = 25 °C, unless otherwise specified

Table 2 Maximum ratings

at 25 °C

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	- - - - -	- - - - -	100 100 100 100 32	A	V_{GS}=10 V, T_C=25 °C V_{GS}=10 V, T_C=100 °C V_{GS}=4.5 V, T_C=25 °C V_{GS}=4.5 V, T_C=100 °C V_{GS}=10 V, T_A=25 °C, R_{thJA}=50 K/W
Pulsed drain current [1]	$I_{D,pulse}$	-	-	400	A	T_C=25 °C
Avalanche current, single pulse [2]	I_{AS}	-	-	50	A	T_C=25 °C
Avalanche energy, single pulse	E_{AS}	-	-	170	mJ	I_D=50 A, R_{GS}=25 Ω
Gate source voltage	V_{GS}	-	-	±20	V	-
Power dissipation	P_{tot}	- -	- -	96 2.5	W	T_C=25 °C T_A=25 °C, R_{thJA}=50 K/W
Operating and storage temperature	T_j, T_{stg}	-	-	-	°C	-

3 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case	R_{thJC}	- -	- -	1.3 20	K/W	bottom top
Device on PCB	R_{thJA}	-	-	50	K/W	6 cm^2 cooling area

[1] See figure 3 for more detailed information
[2] See figure 13 for more detailed information

4 Electrical characteristics

Table 4 Static characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Drain-source breakdown voltage	$V_{(BR)DSS}$	40	-	-	V	V_{GS}=0 V, I_D=1 mA
Gate threshold voltage	$V_{GS(th)}$	1.2	-	2	V	V_{DS}=V_{GS}, I_D=250 µA
Zero gate voltage drain current	I_{DSS}	- -	0.1 10	1 100	µA	V_{DS}=40 V, V_{GS}=0 V, T_j=25 °C V_{DS}=40 V, V_{GS}=0 V, T_j=125 °C
Gate-source leakage current	I_{GSS}	-	10	100	nA	V_{GS}=20 V, V_{DS}=0 V
Drain-source on-state resistance	$R_{DS(on)}$	- -	1.5 1.1	1.9 1.4	mΩ	V_{GS}=4.5 V, I_D=50 A V_{GS}=10 V, I_D=50 A
Gate resistance	R_G	-	0.9	-	Ω	-
Transconductance	g_{fs}	120	230	-	S	$\|V_{DS}\|>2\|I_D\|R_{DS(on)max}$, I_D=50 A

Table 5 Dynamic characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Input capacitance	C_{iss}	-	4300	-	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Output capacitance	C_{oss}	-	1200	-	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Reverse transfer capacitance	C_{rss}	-	100	-	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	8	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=50 A, $R_{G,ext}$=1.6 Ω
Rise time	t_r	-	9	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=50 A, $R_{G,ext}$=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	35	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=50 A, $R_{G,ext}$=1.6 Ω
Fall time	t_f	-	7	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=50 A, $R_{G,ext}$=1.6 Ω

Table 6 Gate charge characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	11	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate charge at threshold	$Q_{g(th)}$	-	6.9	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate to drain charge	Q_{gd}	-	9.8	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	14	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate charge total	Q_g	-	61	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	2.5	-	V	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate charge total	Q_g	-	31	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 4.5 V
Gate charge total, sync. FET	$Q_{g(sync)}$	-	24	-	nC	V_{DS}=0.1 V, V_{GS}=0 to 4.5 V
Output charge	Q_{oss}	-	54	-	nC	V_{DD}=20 V, V_{GS}=0 V

Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	96	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	400	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	0.82	1	V	V_{GS}=0 V, I_F=50 A, T_j=25 °C
Reverse recovery time	t_{rr}	-	32	-	ns	V_R=20 V, I_F=50A, di_F/dt=400 A/µs
Reverse recovery charge	Q_{rr}	-	98	-	nC	V_R=20 V, I_F=50A, di_F/dt=400 A/µs

5 Electrical characteristics diagrams

Table 8

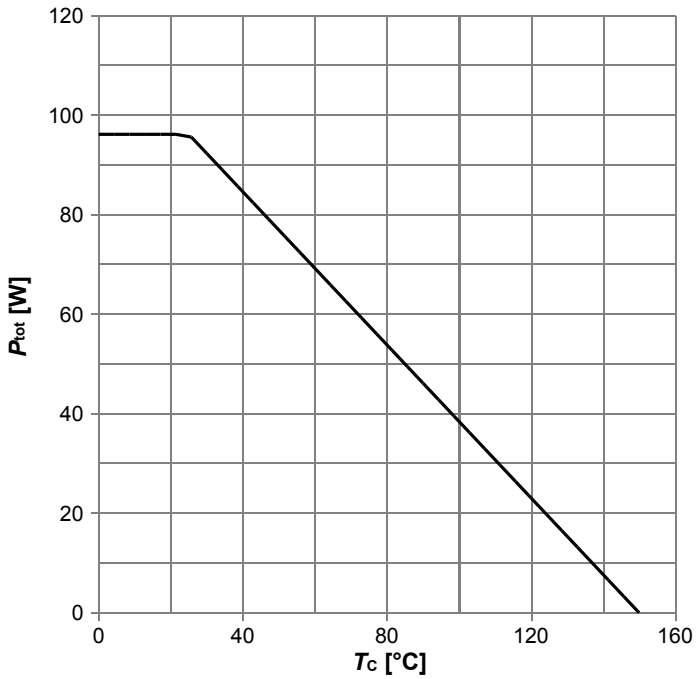
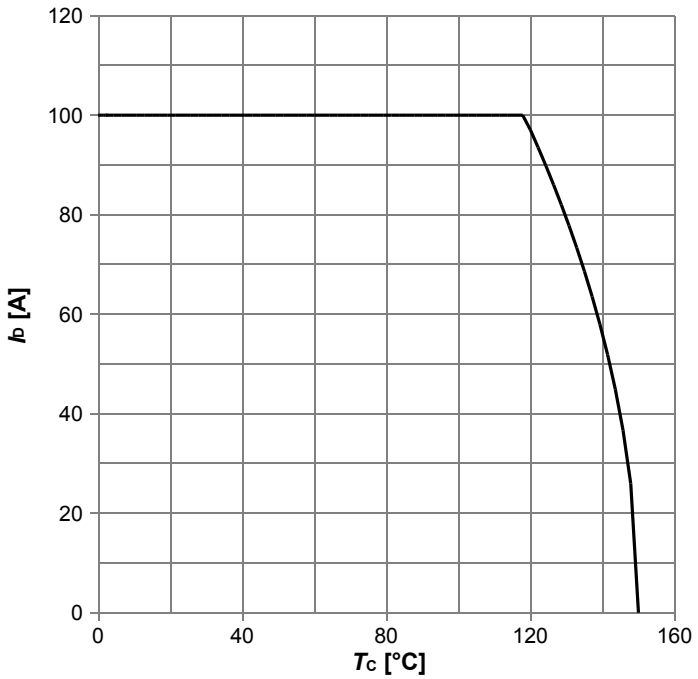
Diagram 1.Power dissipation	Diagram 2.Drain current
	
P_{tot}=f(T_C)	I_D=f(T_C); V_{GS}=10 V

Table 9

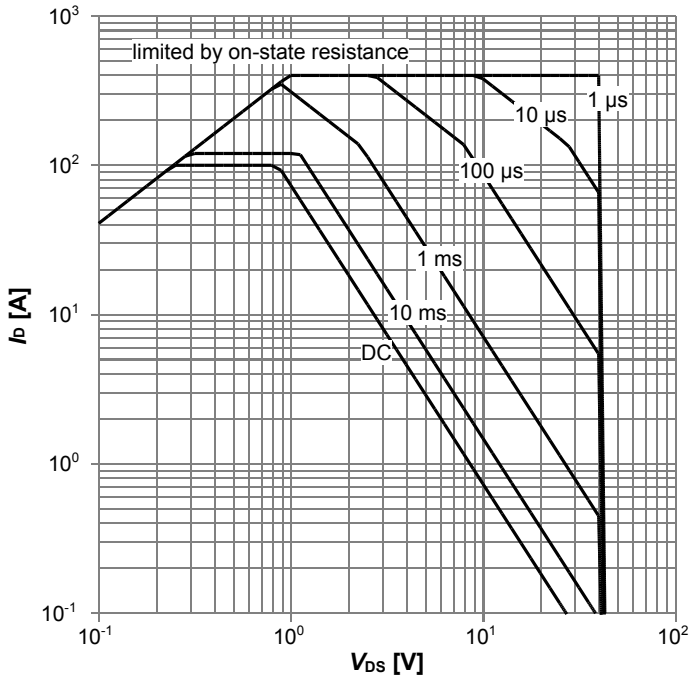
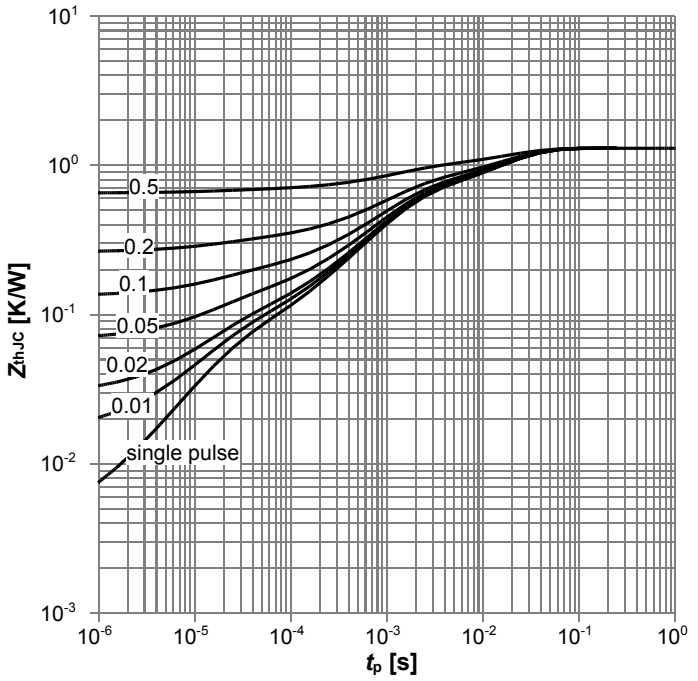
Diagram 3.Safe operating area	Diagram 4.Max. transient thermal impedance
	
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter: t_p	Z_{thJC}=f(t_p); parameter: D=t_p/T

Table 10

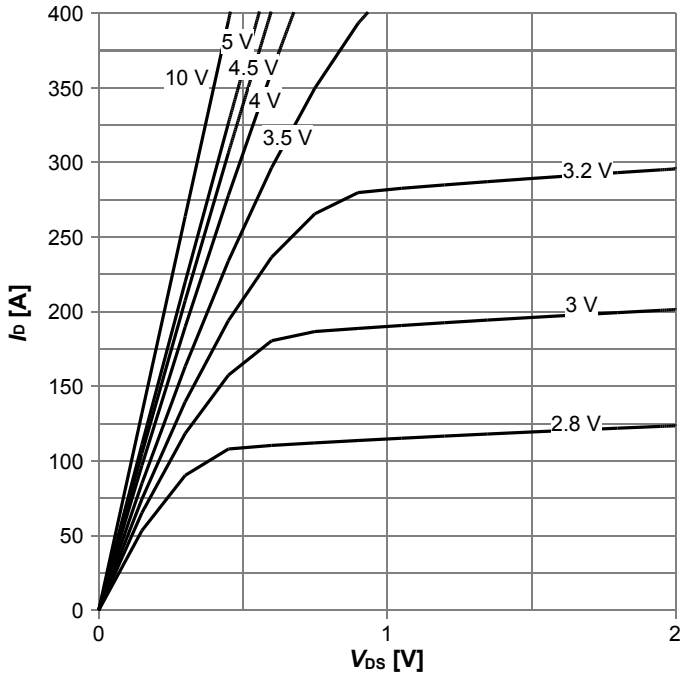
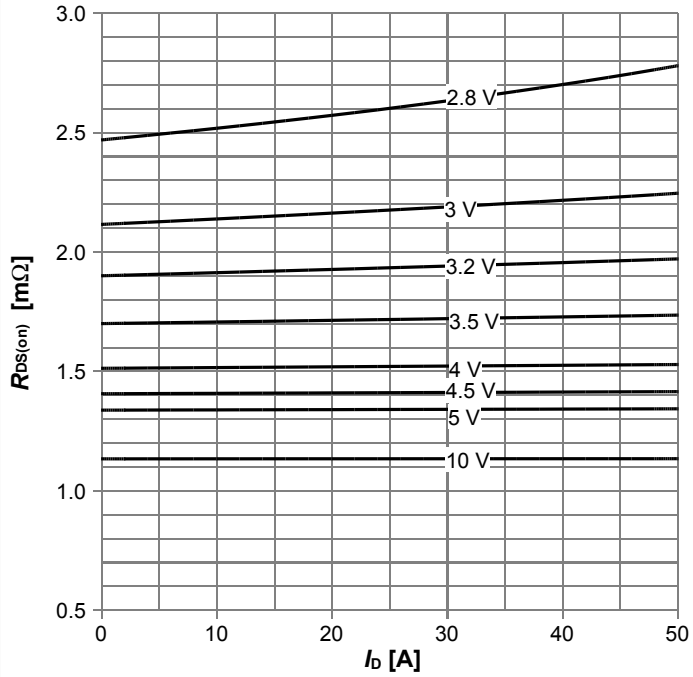
Diagram 5.Typ. output characteristics	Diagram 6.Typ. drain-source on resistance
	
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}	$R_{DS(on)}$=f(I_D); T_j=25 °C; parameter: V_{GS}

Table 11

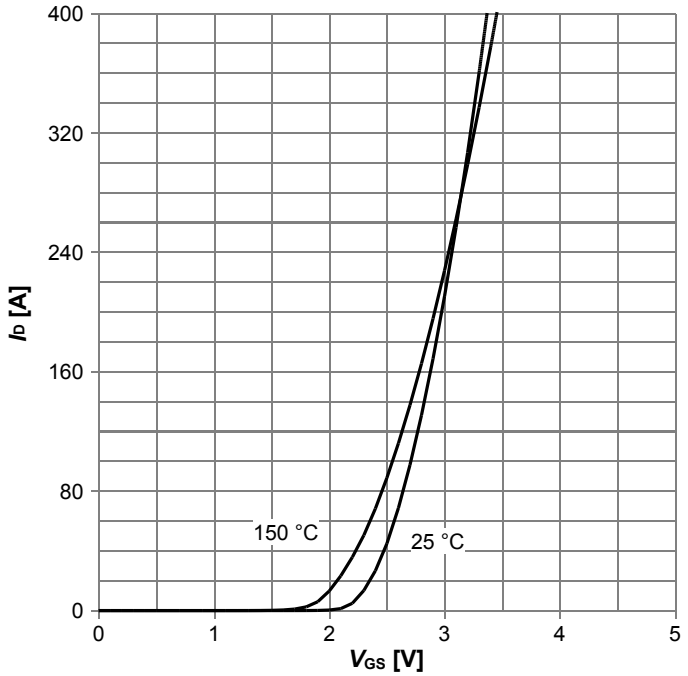
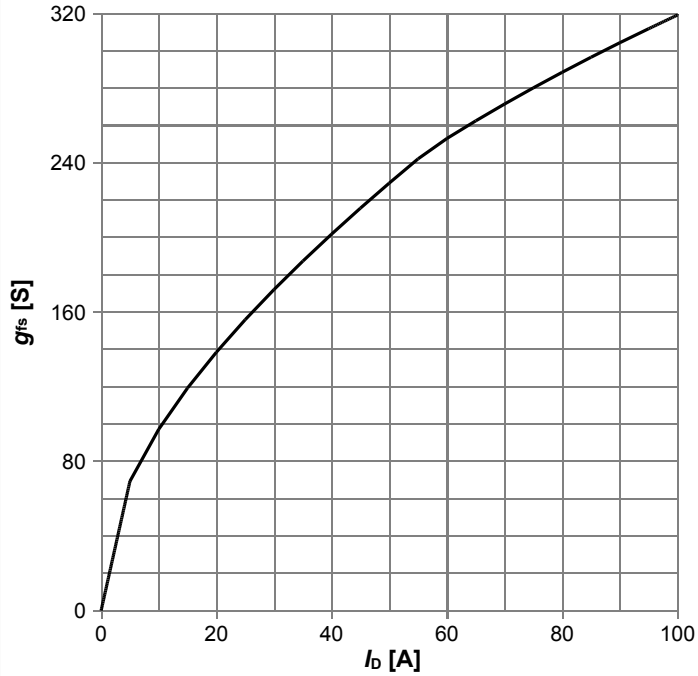
Diagram 7.Typ. transfer characteristics	Diagram 8.Typ. forward transconductance
	
I_D=f(V_{GS}); |V_{DS}|>2|I_D|$R_{DS(on)max}$; parameter: T_j	g_{fs}=f(I_D); T_j=25 °C

Table 12

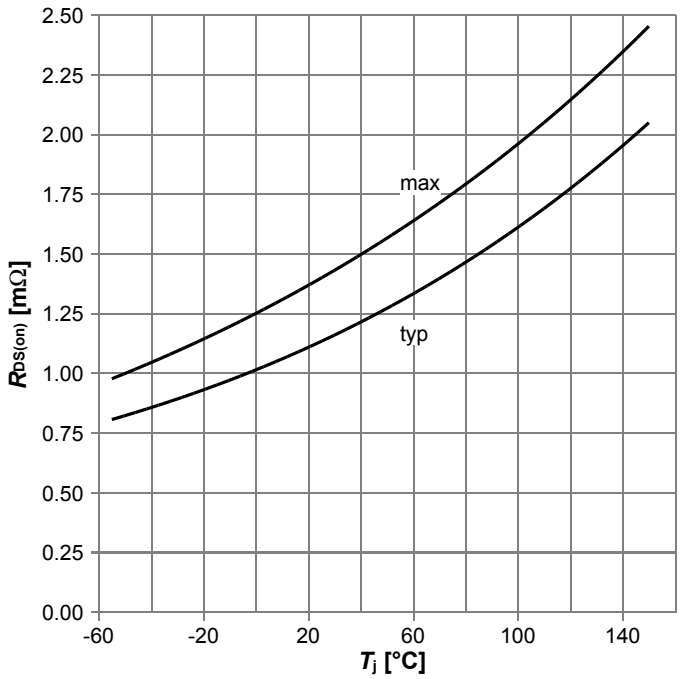
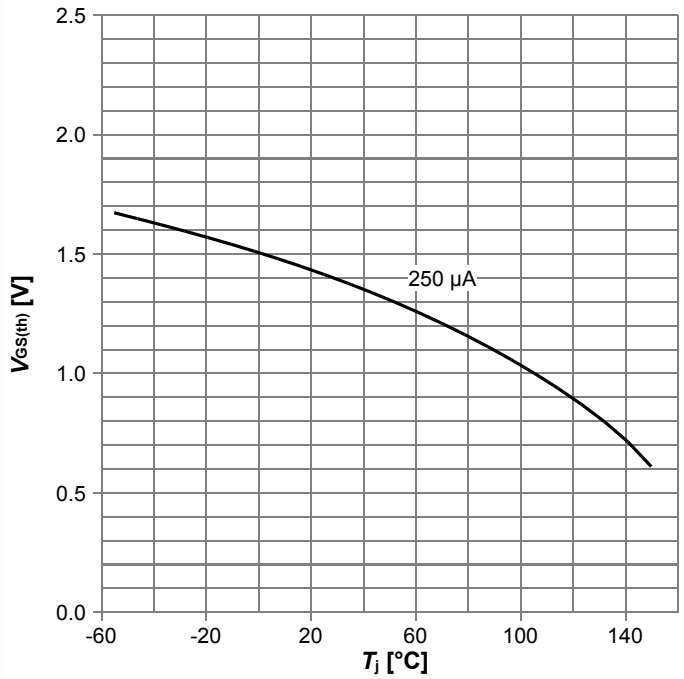
Diagram 9.Drain-source on-state resistance	Diagram 10.Typ. gate threshold voltage
	
$R_{DS(on)}$=f(T_j); I_D=50 A; V_{GS}=10 V	$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}; I_D=250 µA

Table 13

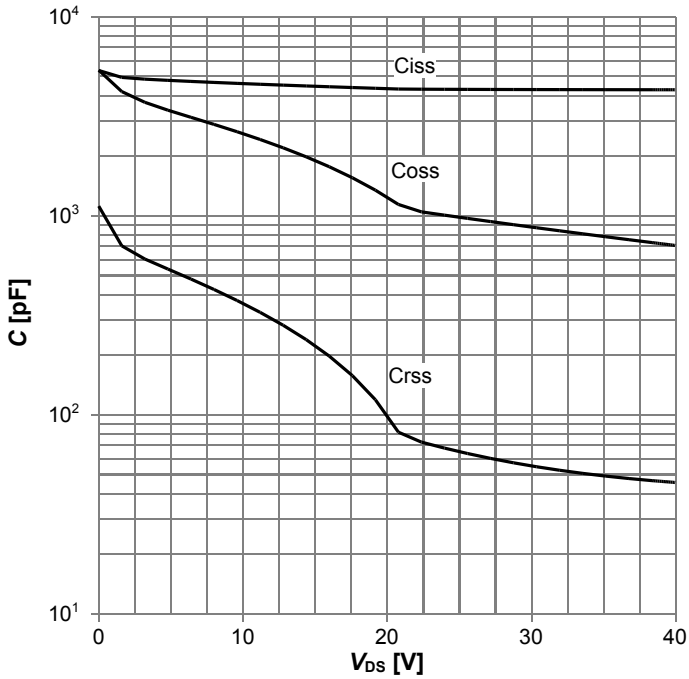
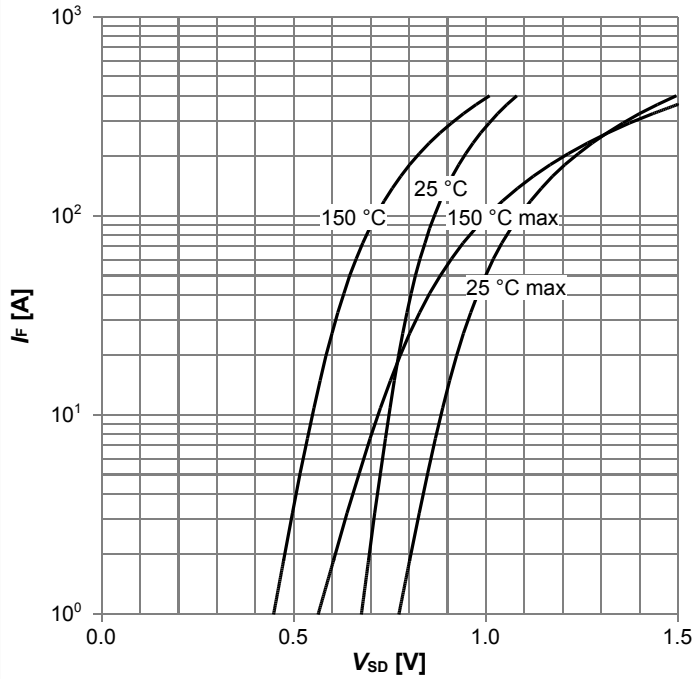
Diagram 11.Typ. capacitances	Diagram 12.Forward characteristics of reverse diode
	
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz	I_F=f(V_{SD}); parameter: T_j

Table 14

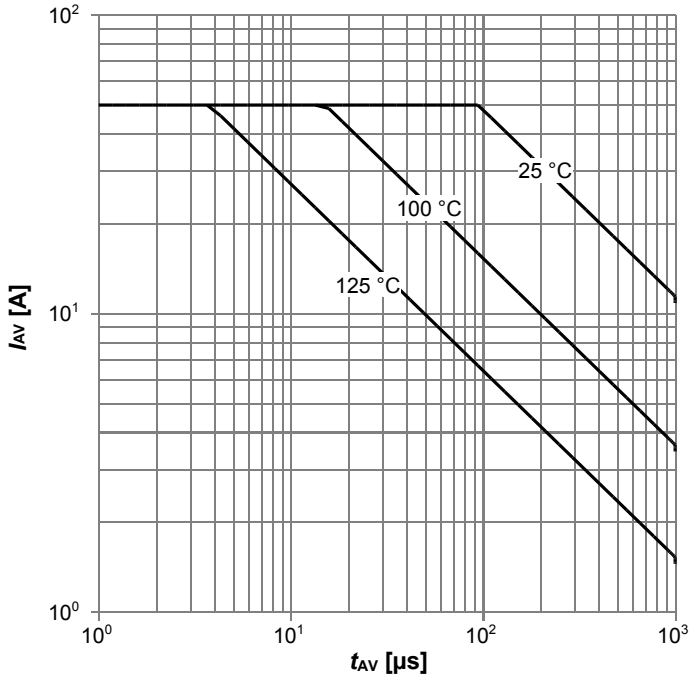
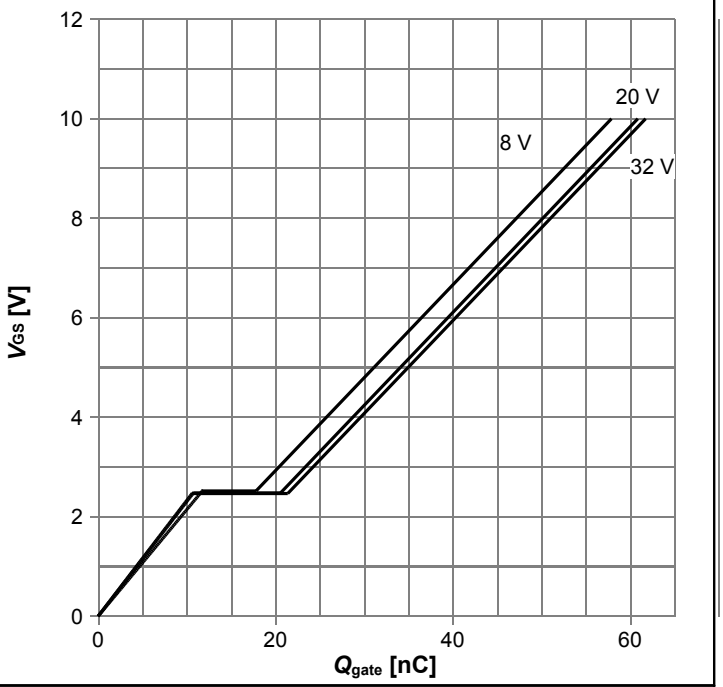
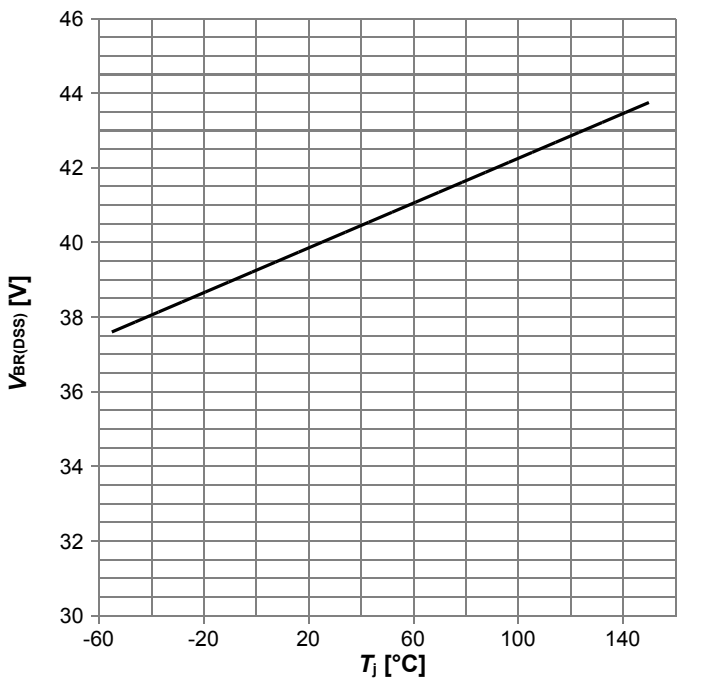
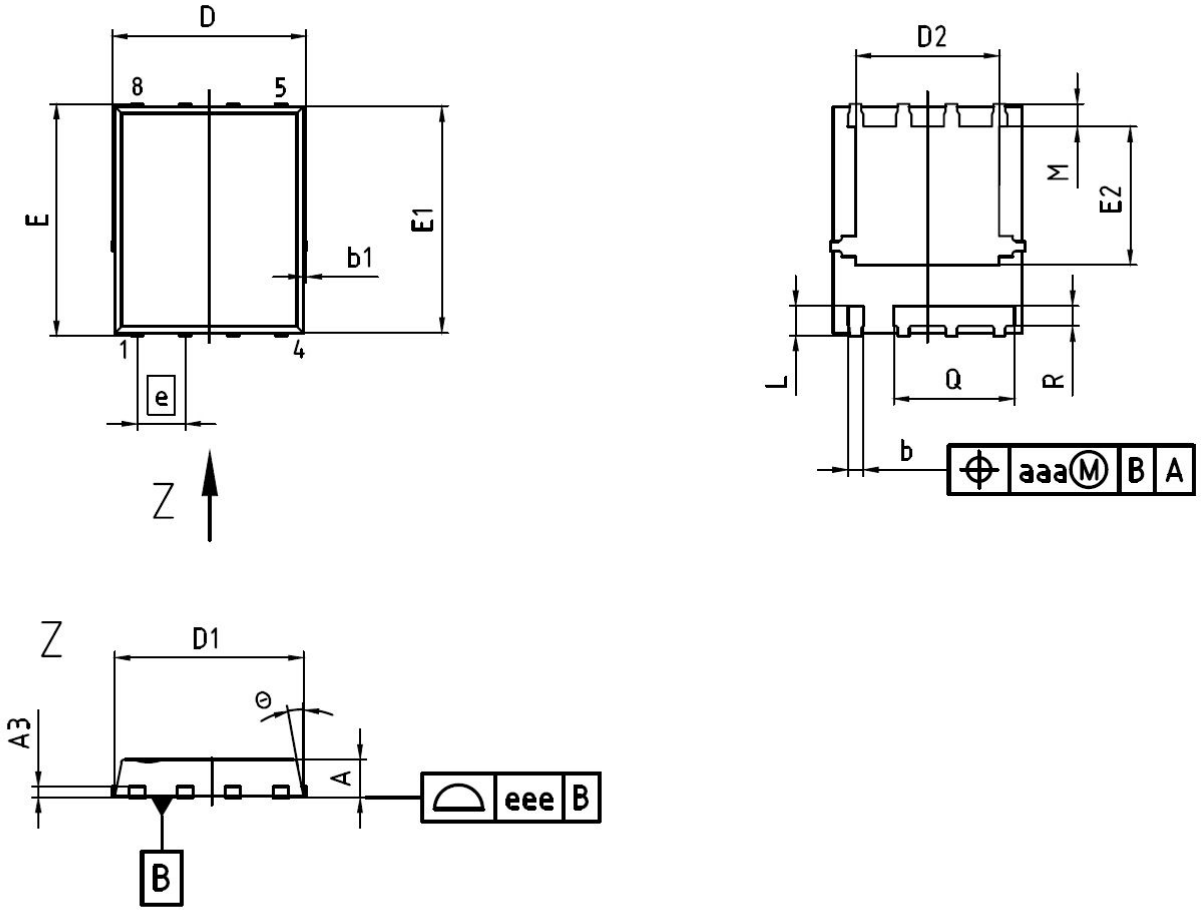
Diagram 13.Avalanche characteristics	Diagram 14.Typ. gate charge
	
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j(start)}$	V_{GS}=f(Q_{gate}); I_D=50 A pulsed; parameter: V_{DD}

Table 15

Diagram 15.Drain-source breakdown voltage

$V_{BR(DSS)}$=f(T_j); I_D=1 mA

6 Package Outlines



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.90	1.10	0.035	0.043
A3	0.25 (REF)		0.011 (REF)	
b	0.34	0.54	0.013	0.021
b1	0.02	0.22	0.001	0.009
D	5.15 (BSC)		0.203 (BSC)	
D1	5.00 (BSC)		0.197 (BSC)	
D2	3.70	4.40	0.146	0.173
E	6.15 (BSC)		0.242 (BSC)	
E1	6.00 (BSC)		0.236 (BSC)	
E2	3.40	3.80	0.134	0.150
e	1.27 (BSC)		0.050 (BSC)	
N	8		8	
L	0.74	0.84	0.029	0.033
M	0.45	0.66	0.018	0.026
Θ	8.5°	12°	8.5°	12°
Q	3.15	3.25	0.124	0.128
R	0.48	0.58	0.019	0.023
aaa	0.25		0.010	
eee	0.08		0.003	

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REVISION 01

Figure 1 Outline SuperSO8 FL, dimensions in mm/inches

Revision History

BSC014N04LS

Revision: 2013-02-27, Rev. 2.2

Previous Revision

Revision	Date	Subjects (major changes since last revision)
2.0	2012-10-11	Release of final version
2.1	2012-10-12	New diagram titles.
2.2	2013-02-27	Rev. 2.1

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