MOSFET

Metal Oxide Semiconductor Field Effect Transistor

OptiMOS™

OptiMOS™ Power-MOSFET, 40 V

BSC010N04LS

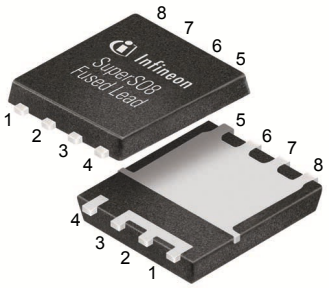
Data Sheet

Rev. 2.2
Final

Power Management & Multimarket

1 Description

TDSON-8 FL (enlarged source interconnection)



Features

- Optimized for sychronous rectification
- Very low on-resistance $R_{DS(on)}$
- 100% avalanche tested
- Superior thermal resistance
- N-channel, logic level
- Qualified according to JEDEC[1] for target applications
- Pb-free lead plating; RoHS compliant
- Halogen-free according to IEC61249-2-21
- Higher solder joint reliability due to enlarged source interconnection

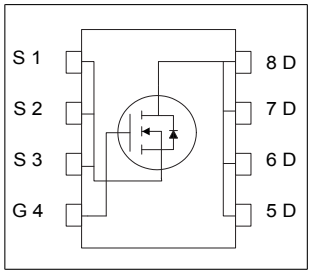


Table 1 Key Performance Parameters

Parameter	Value	Unit
V_{DS}	40	V
$R_{DS(on),max}$	1.0	mΩ
I_D	100	A
Q_{oss}	84	nC
Q_g(0V..10V)	95	nC

Type / Ordering Code	Package	Marking	Related Links
BSC010N04LS	TDSON-8 FL	010N04LS	-

[1] J-STD20 and JESD22

Table of Contents

2 Maximum ratings

at T_j = 25 °C, unless otherwise specified

Table 2 Maximum ratings

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Continuous drain current	I_D	- - - - -	- - - - -	100 100 100 100 38	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[1)]
Pulsed drain current[2)]	$I_{D,pulse}$	-	-	400	A	T_C=25 °C
Avalanche current, single pulse[3)]	I_{AS}	-	-	50	A	T_C=25 °C
Avalanche energy, single pulse	E_{AS}	-	-	330	mJ	I_D=50 A, R_{GS}=25 Ω
Gate source voltage	V_{GS}	-20	-	20	V	-
Power dissipation	P_{tot}	- -	- -	139 2.5	W	T_C=25 °C T_A=25 °C, R_{thJA}=50 K/W[1)]
Operating and storage temperature	T_j, T_{stg}	-55	-	150	°C	IEC climatic category; DIN IEC 68-1: 55/150/56

3 Thermal characteristics

Table 3 Thermal characteristics

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Thermal resistance, junction - case, bottom	R_{thJC}	-	0.5	0.9	K/W	-
Thermal resistance, junction - case, top	R_{thJC}	-	-	20	K/W	-
Device on PCB, 6 cm² cooling area[1)]	R_{thJA}	-	-	50	K/W	-

[1)] Device on 40 mm x 40 mm x 1.5 mm epoxy PCB FR4 with 6 cm² (one layer, 70 µm thick) copper area for drain connection. PCB is vertical in still air.
[2)] See figure 3 for more detailed information
[3)] 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	$R_{DS(on)}$	- -	1.0 0.85	1.3 1.0	mΩ	V_{GS}=4.5 V, I_D=50 A V_{GS}=10 V, I_D=50 A
Gate resistance[1)]	R_G	-	0.8	1.6	Ω	-
Transconductance	g_{fs}	140	270	-	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[1)]	C_{iss}	-	6800	9520	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Output capacitance[1)]	C_{oss}	-	1900	2660	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Reverse transfer capacitance[1)]	C_{rss}	-	160	320	pF	V_{GS}=0 V, V_{DS}=20 V, f=1 MHz
Turn-on delay time	$t_{d(on)}$	-	10	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=30 A, $R_{G,ext}$,ext=1.6 Ω
Rise time	t_r	-	12	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=30 A, $R_{G,ext}$,ext=1.6 Ω
Turn-off delay time	$t_{d(off)}$	-	46	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=30 A, $R_{G,ext}$,ext=1.6 Ω
Fall time	t_f	-	9	-	ns	V_{DD}=20 V, V_{GS}=10 V, I_D=30 A, $R_{G,ext}$,ext=1.6 Ω

[1)] Defined by design. Not subject to production test

Table 6 Gate charge characteristics[1)]

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Gate to source charge	Q_{gs}	-	16	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate charge at threshold	$Q_{g(th)}$	-	11	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate to drain charge[2)]	Q_{gd}	-	15	21	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Switching charge	Q_{sw}	-	21	-	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate charge total[2)]	Q_g	-	95	133	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate plateau voltage	$V_{plateau}$	-	2.4	-	V	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 10 V
Gate charge total[2)]	Q_g	-	49	69	nC	V_{DD}=20 V, I_D=50 A, V_{GS}=0 to 4.5 V
Gate charge total, sync. FET	$Q_{g(sync)}$	-	84	-	nC	V_{DS}=0.1 V, V_{GS}=0 to 10 V
Output charge[2)]	Q_{oss}	-	84	118	nC	V_{DD}=20 V, V_{GS}=0 V

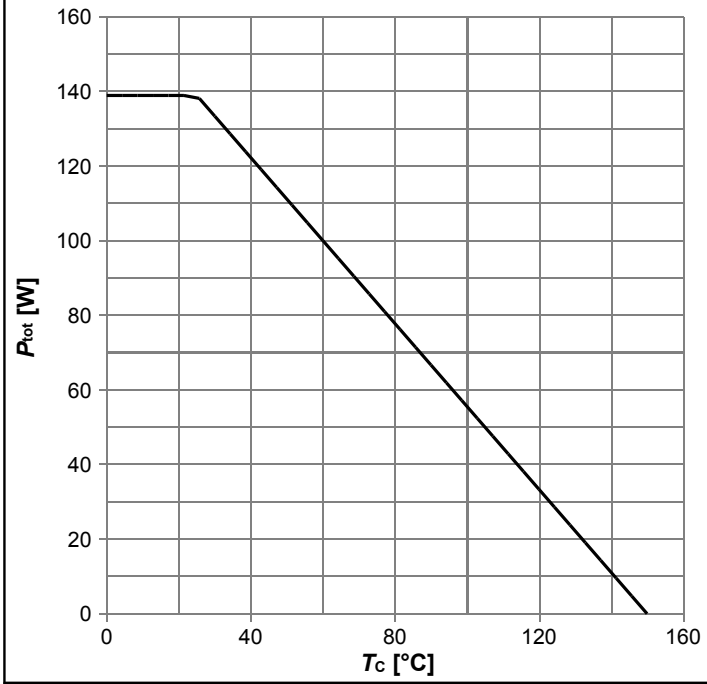
Table 7 Reverse diode

Parameter	Symbol	Values			Unit	Note / Test Condition
		Min.	Typ.	Max.		
Diode continuous forward current	I_S	-	-	100	A	T_C=25 °C
Diode pulse current	$I_{S,pulse}$	-	-	400	A	T_C=25 °C
Diode forward voltage	V_{SD}	-	0.81	1	V	V_{GS}=0 V, I_F=50 A, T_j=25 °C
Reverse recovery time[2)]	t_{rr}	-	36	72	ns	V_R=20 V, I_F=50A, di_F/dt=400 A/µs
Reverse recovery charge	Q_{rr}	-	50	-	nC	V_R=20 V, I_F=50A, di_F/dt=400 A/µs

[1)] See ″Gate charge waveforms″ for parameter definition
[2)] Defined by design. Not subject to production test

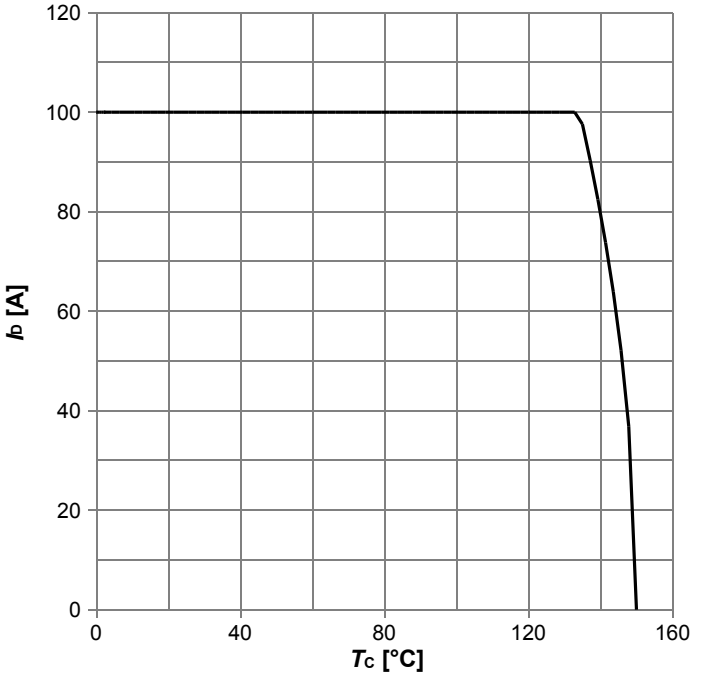
5 Electrical characteristics diagrams

Diagram 1: Power dissipation



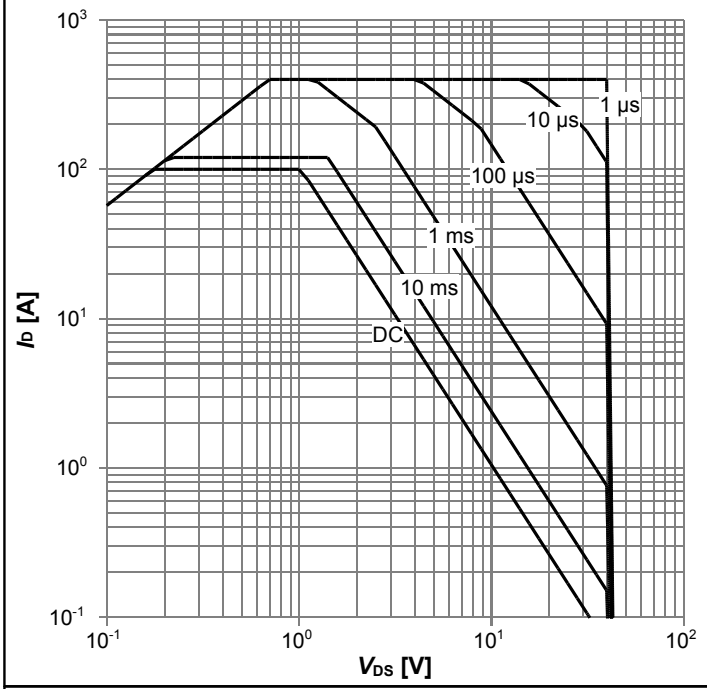
$P_{tot}=f(T_C)$

Diagram 2: Drain current



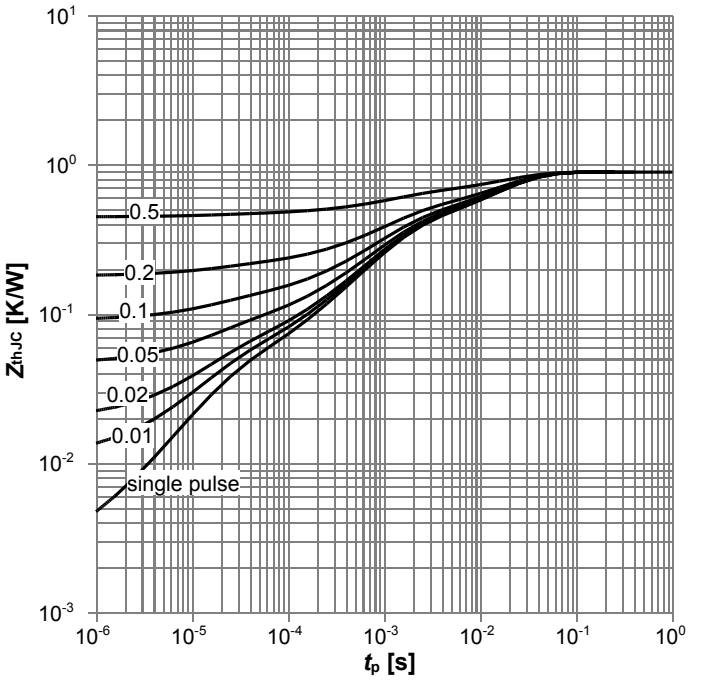
$I_D=f(T_C)$; $V_{GS}\geq 10$ V

Diagram 3: Safe operating area



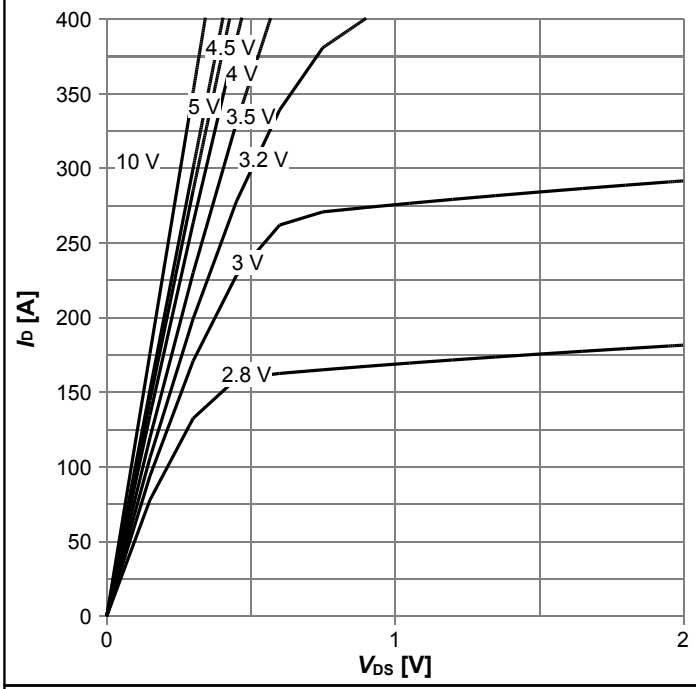
$I_D=f(V_{DS})$; T_C=25 °C; D=0; parameter: t_p

Diagram 4: Max. transient thermal impedance



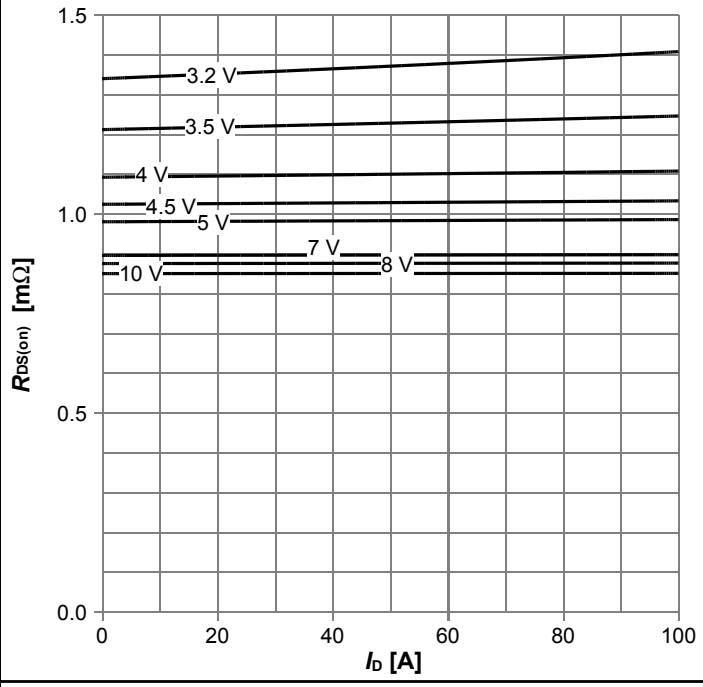
$Z_{thJC}=f(t_p)$; parameter: $D=t_p/T$

Diagram 5: Typ. output characteristics



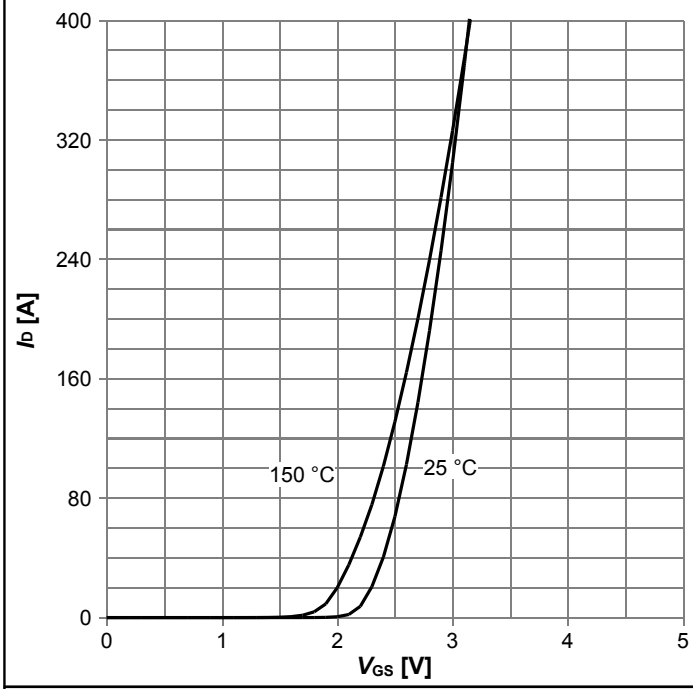
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}

Diagram 6: Typ. drain-source on resistance



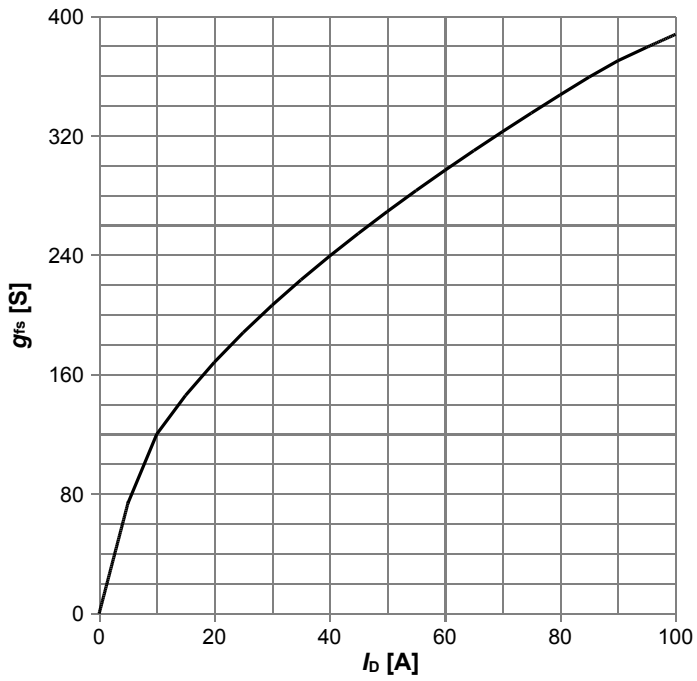
$R_{DS(on)}$=f(I_D); T_j=25 °C; parameter: V_{GS}

Diagram 7: Typ. transfer characteristics



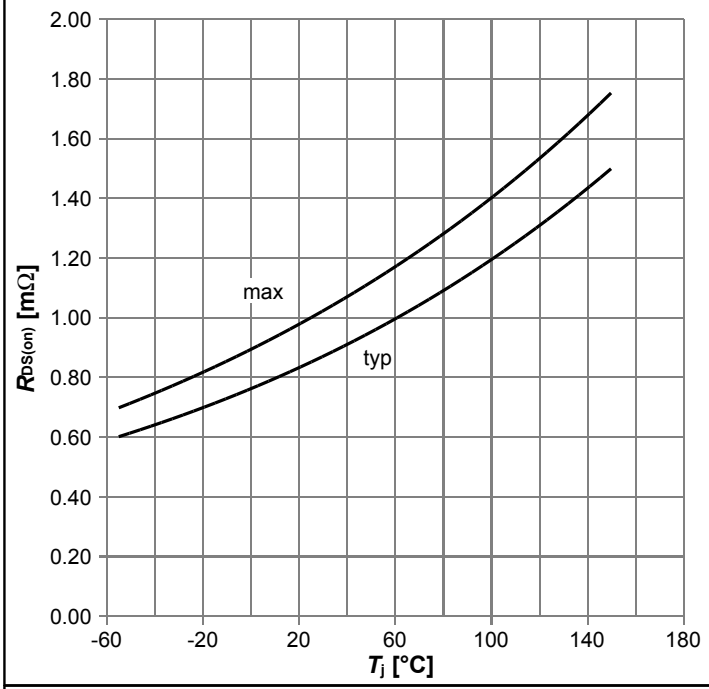
I_D=f(V_{GS}); |V_{DS}|>2|I_D|$R_{DS(on)max}$; parameter: T_j

Diagram 8: Typ. forward transconductance



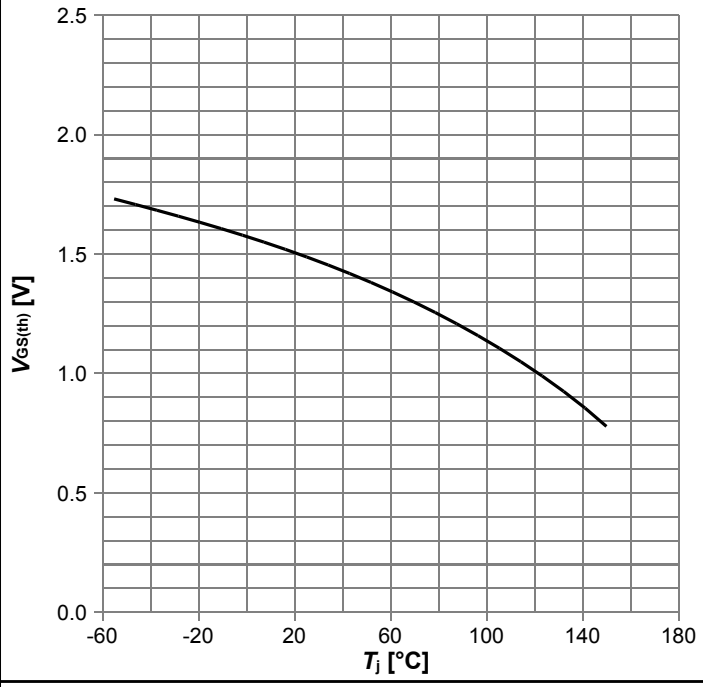
g_{fs}=f(I_D); T_j=25 °C

Diagram 9: Drain-source on-state resistance



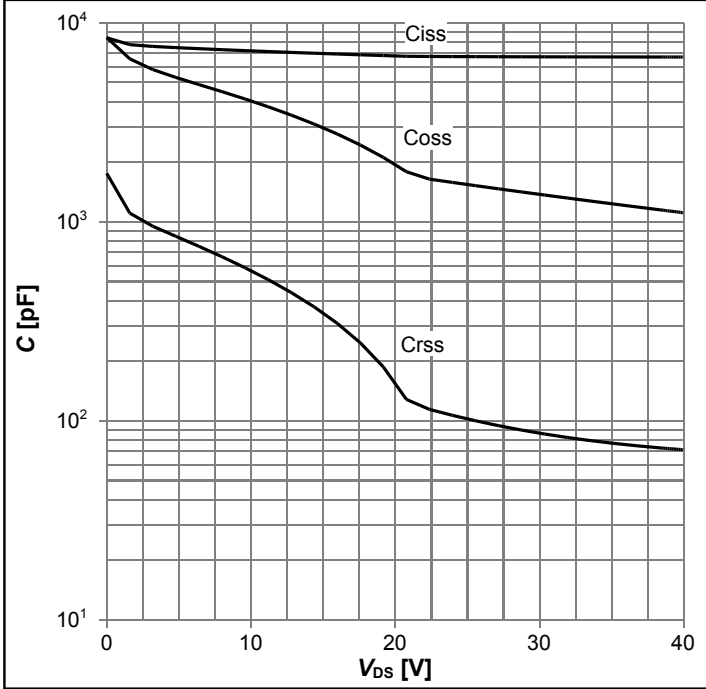
$R_{DS(on)}$=f(T_j); I_D=50 A; V_{GS}=10 V

Diagram 10: Typ. gate threshold voltage



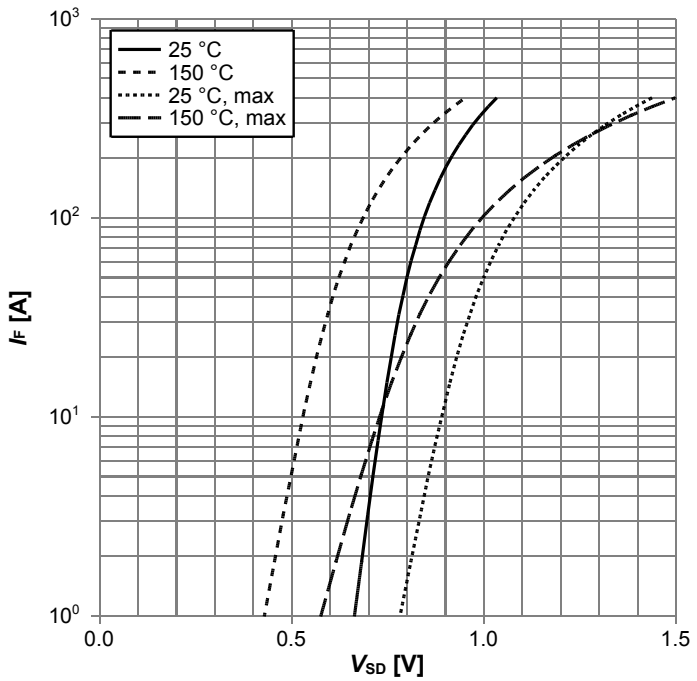
$V_{GS(th)}$=f(T_j); V_{GS}=V_{DS}; I_D=250 µA

Diagram 11: Typ. capacitances



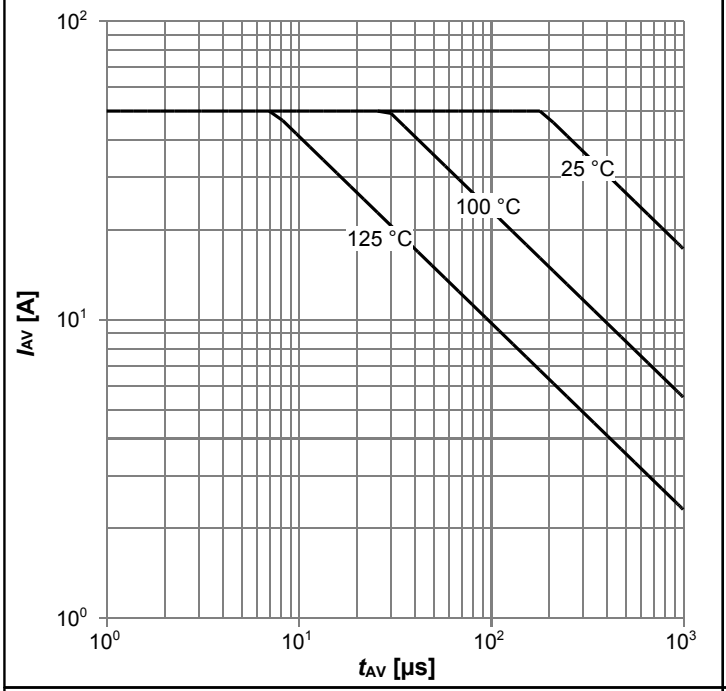
C=f(V_{DS}); V_{GS}=0 V; f=1 MHz

Diagram 12: Forward characteristics of reverse diode



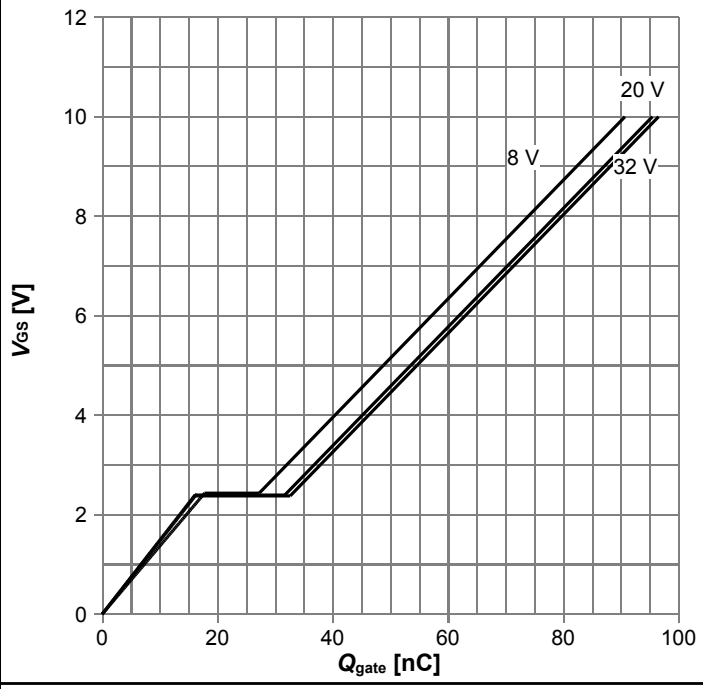
I_F=f(V_{SD}); parameter: T_j

Diagram 13: Avalanche characteristics



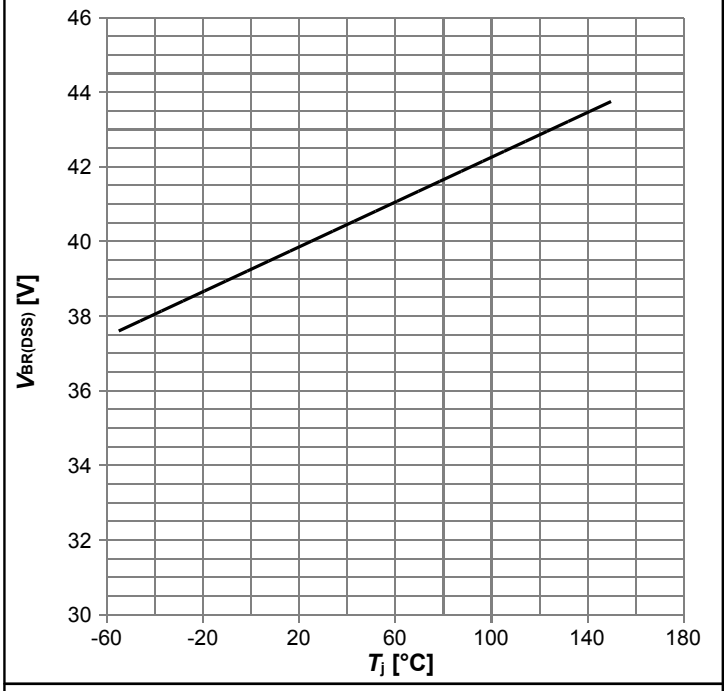
I_{AS}=f(t_{AV}); R_{GS}=25 Ω; parameter: $T_{j(start)}$

Diagram 14: Typ. gate charge



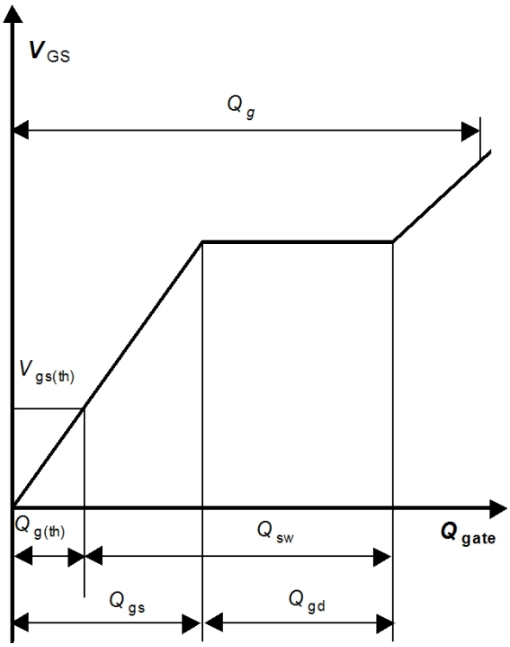
V_{GS}=f(Q_{gate}); I_D=50 A pulsed; parameter: V_{DD}

Diagram 15: Drain-source breakdown voltage

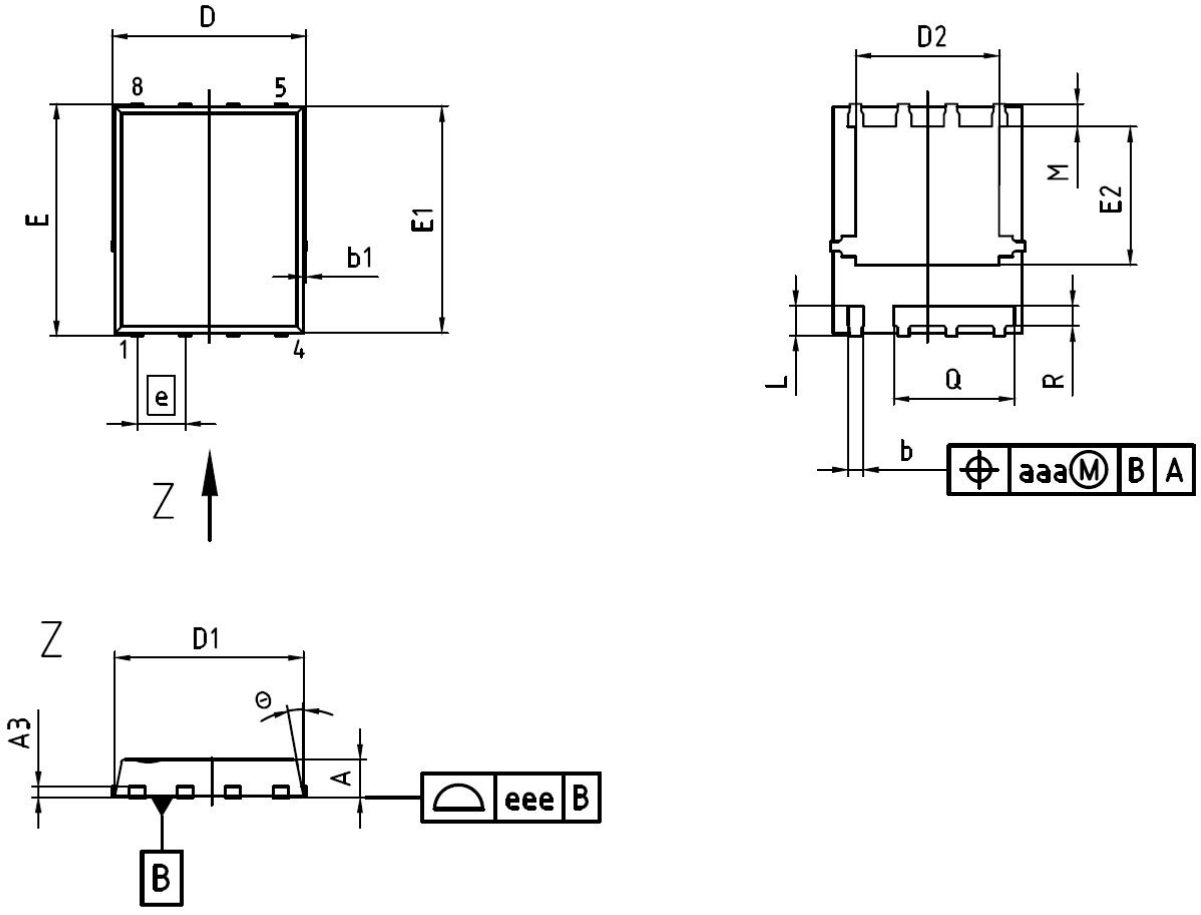


$V_{BR(DSS)}$=f(T_j); I_D=1 mA

Gate charge waveforms



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	

DOCUMENT NO.	Z8B00162237
SCALE	0, 2.5, 0, 2.5, 5mm
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ISSUE DATE	02-08-2011
REVISION	01

Figure 1 Outline TDSON-8 FL, dimensions in mm/inches

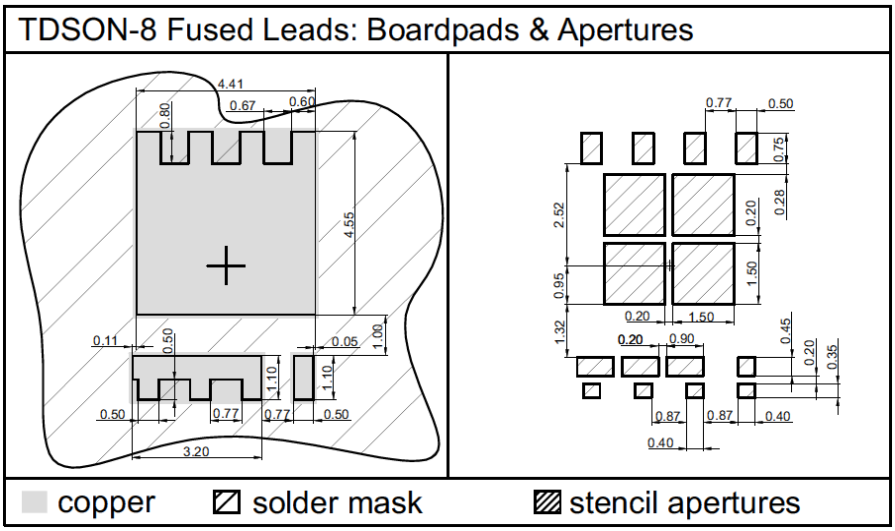

Figure 2 Outline Footprint TDSON-8 FL

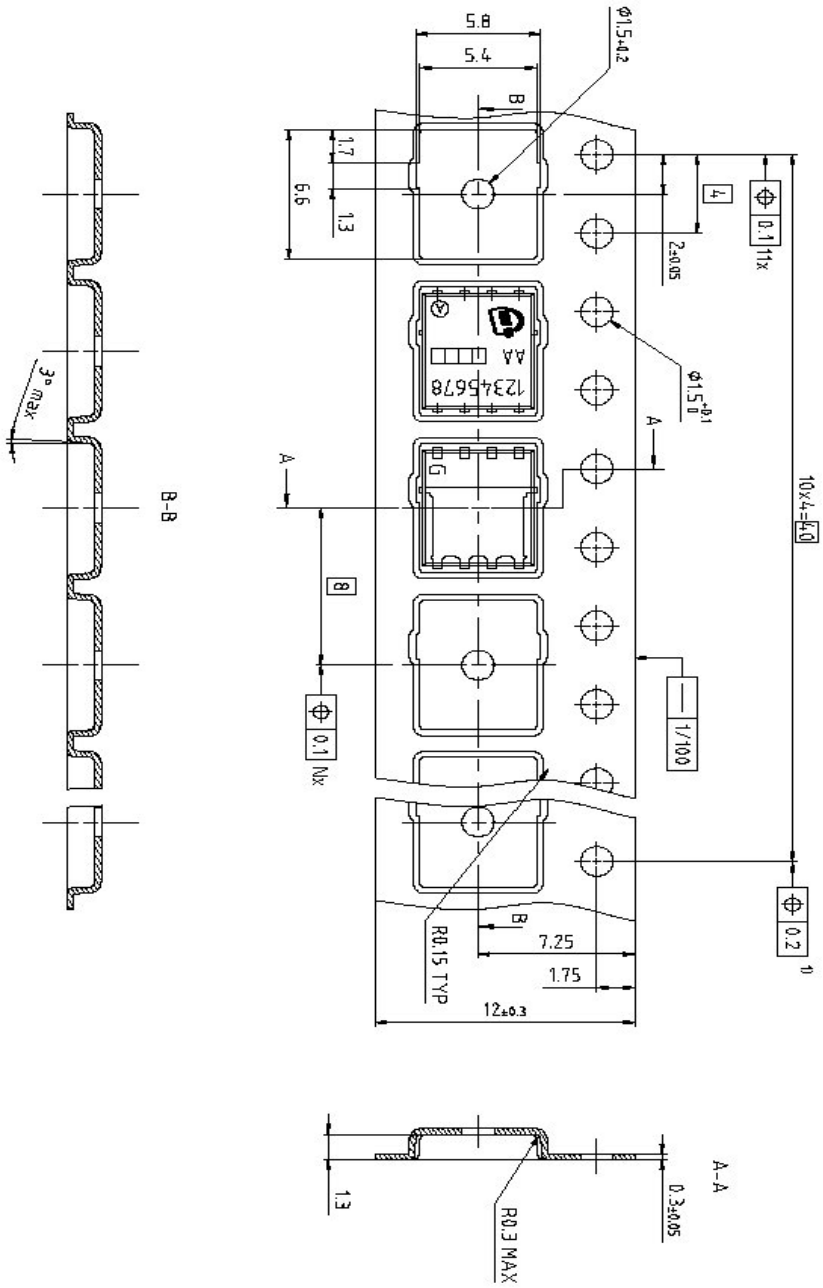

Figure 3 Outline TDSON-8 FL Tape

Revision History

BSC010N04LS

Revision: 2014-06-27, Rev. 2.2

Previous Revision		
Revision	Date	Subjects (major changes since last revision)
2.2	2014-06-27	Rev. 2.2

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