WSJM65R170X

Super-Junction Power MOSFET

Rev.01 - 20 February 2024 — Product data sheet

1. General description

WSJM65R170X is a high voltage N-channel MOSFET in TO220F package, which utilizes the advanced super-junction technology to provide superior FOM $R_{DS(on)}$ * Q_g among silicon based MOSFETs. It is particularly suitable for applications require extreme high efficiency and power density.

2. Features and benefits

- Superior FOM $R_{DS(on)}$ * Q_g
- Extremely low switching loss
- 100% avalanche tested

3. Applications

- high efficiency power supplies

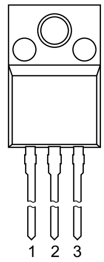
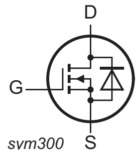
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Absolute maximum rating							
V_{DS}	drain-source voltage				650		V
V_{GS}	gate-source voltage				±30		V
I_D	continuous drain current	T_h = 25 °C	[1]		23		A
P_{tot}	power dissipation	T_h = 25 °C			36		W
T_j	junction temperature				-55 to 150		°C
Symbol	**Parameter**	**Conditions**	**Notes**	**Min**	**Typ**	**Max**	**Unit**
Static characteristics							
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = 10 V, I_D = 11 A		-	156	170	mΩ
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 11 A; V_{DS} = 400 V; V_{GS} = 10 V		-	38	-	nC
E_{OSS}	coss stored erergy	V_{GS} = 0 V; V_{DS} = 0 to 400 V		-	5.1	-	µJ

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	G	gate		
2	D	drain		
3	S	source		
mb	n.c.	mounting base; isolated		

6. Ordering information

Table 3. Ordering information

Type number	Package name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
WSJM65R170X	TO220F	WSJM65R170XQ	Tube	50	SOT186A	14-Nov-2013

7. Marking

Table 4. Marking codes

Type number	Marking codes
WSJM65R170X	WSJM 65R170X

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Notes	Values	Unit
V_{DS}	drain-source voltage			650	V
V_{GS}	gate-source voltage			±30	V
I_D	continuous drain current	T_h = 25 °C	[1]	23	A
		T_h = 100 °C	[1]	14	A
I_{DM}	pulsed drain current	T_h = 25 °C		72	A
P_{tot}	power dissipation	T_h = 25 °C		36	W
E_{AS}	single pulse drain−to-source avalanche	I_{AS} = 6.9 A; R_{GS} = 25 Ω; V_{DD} = 50 V; T_j = 25 °C		238	mJ
E_{AR}	repetitive avalanche energy	I_{AS} = 6.9 A; R_{GS} = 25 Ω; V_{DD} = 50 V; T_j = 25 °C		1.67	mJ
I_{AS}	avalanche current, single pulse			6.9	A
dv/dt	MOSFET dv/dt ruggedness			50	V/ns
dv/dt	reverse diode dv/dt			15	V/ns
dI_F/dt	maximum diode commutation speed			500	A/μs
T_{stg}	storage temperature			-55 to 150	°C
T_j	junction temperature			-55 to 150	°C

[1] Limited by maximum junction temperature, equivalent to TO220.

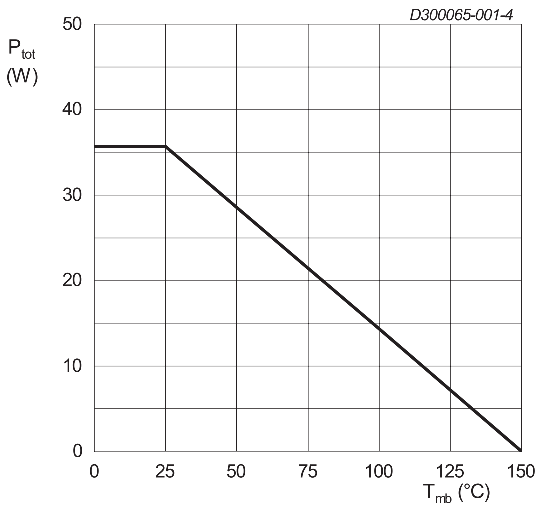


Fig. 1. Total power dissipation as a function of heatsink temperature

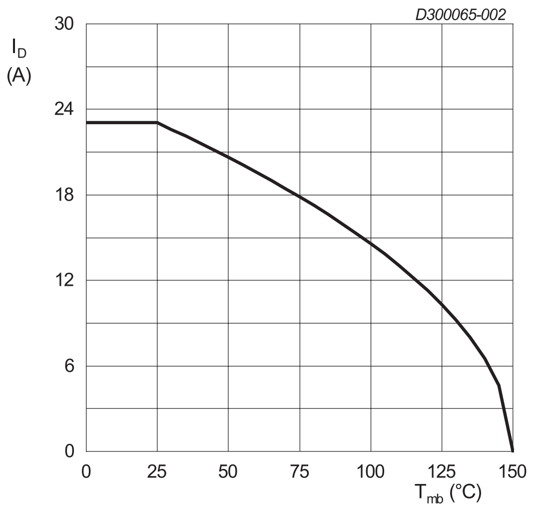


Fig. 2. Continuous Drain Current as a function of heatsink temperature

9. Thermal & Mechanical characteristics

Table 6. Thermal & Mechanical characteristics

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink			-	2.9	3.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	60	-	K/W

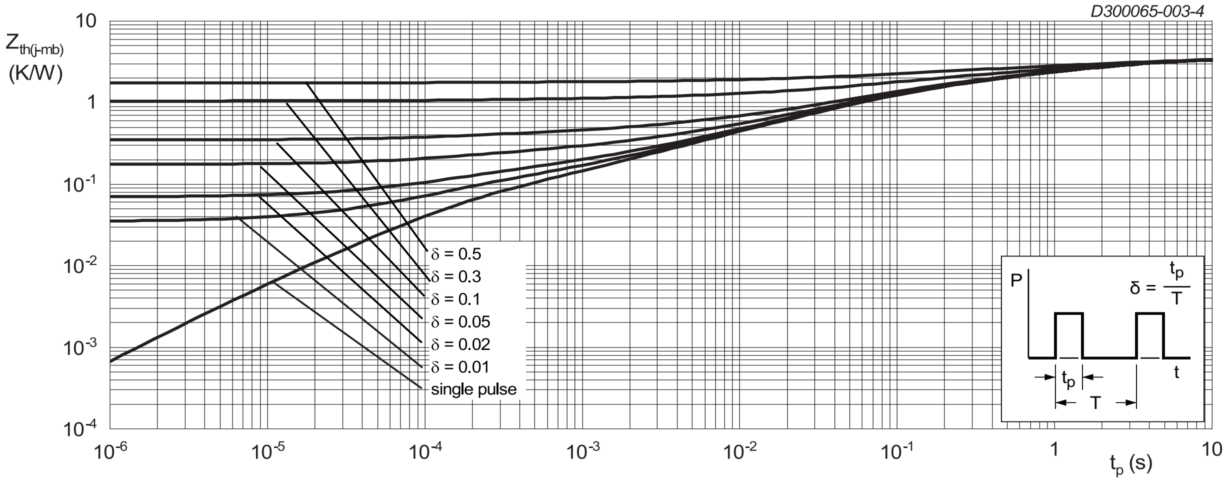


Fig. 3. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Characteristics

Table 7. Characteristics

T_j = 25 °C unless otherwise noted

Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
Static characteristics							
$V_{(BR)DSS}$	drain-source breakdown voltage	I_D = 250 µA; V_{GS} = 0 V		650	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	I_D = 250 µA; V_{DS} = V_{GS}		2.5	-	4.5	V
I_{DSS}	drain leakage current	V_{DS} = 650 V; V_{GS} = 0 V		-	-	1	µA
		V_{DS} = 650 V; V_{GS} = 0 V; T_j = 125 °C		-	-	10	µA
I_{GSS}	gate leakage current	V_{GS} = ±30 V; V_{DS} = 0 V		-	-	±100	nA
$R_{DS(on)}$	drain-source on-state resistance	V_{GS} = 10 V; I_D = 11 A		-	156	170	mΩ
R_G	gate resistance	f = 1 MHz		-	12	-	Ω
Dynamic characteristics							
$Q_{G(tot)}$	total gate charge	I_D = 11 A; V_{DS} = 400 V; V_{GS} = 10 V		-	38	-	nC
Q_{GS}	gate-source charge			-	8.7	-	nC
Q_{GD}	gate-drain charge			-	14	-	nC
C_{iss}	input capacitance	V_{DS} = 400 V; V_{GS} = 0 V; f = 1 MHz		-	1751	-	pF
C_{oss}	output capacitance			-	41	-	pF
C_{rss}	reverse transfer capacitance			-	2.3	-	pF
$C_{o(er)}$	effective output capacitance, energy related	V_{GS} = 0 V; V_{DS} = 0 to 400 V		-	64	-	pF
$C_{o(tr)}$	effective output capacitance, time related			-	370	-	pF
$t_{d(on)}$	turn-on delay time	V_{DS} = 400 V; V_{GS} = 10 V; R_G = 2 Ω; I_D = 11 A		-	21	-	ns
t_r	rise time			-	21	-	ns
$t_{d(off)}$	turn-off delay time			-	72	-	ns
t_f	fall time			-	11	-	ns
Source-drain diode							
V_{SD}	source-drain voltage	V_{GS} = 0 V; I_S = 11 A		-	0.8	1.1	V
I_S	body-diode continuous current	T_h = 25 °C		-	-	23	A
t_{rr}	reverse recovery time	V_R = 400 V; I_F = 11 A; dI_F/dt = 100 A/µs		-	285	-	ns
Q_{rr}	reverse recovered charge			-	3.8	-	µC
I_{rrm}	reverse recovery current			-	26	-	A

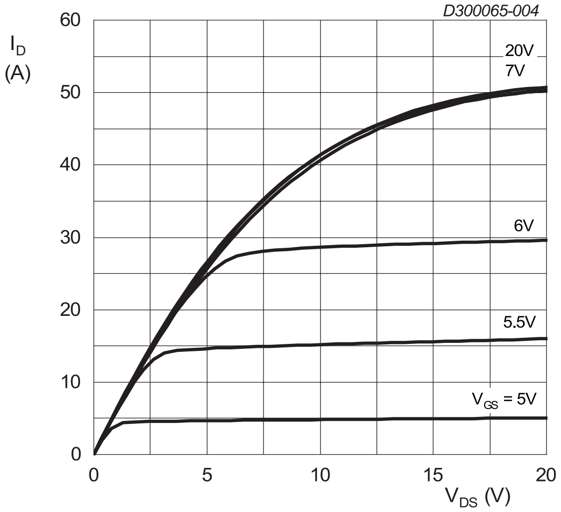
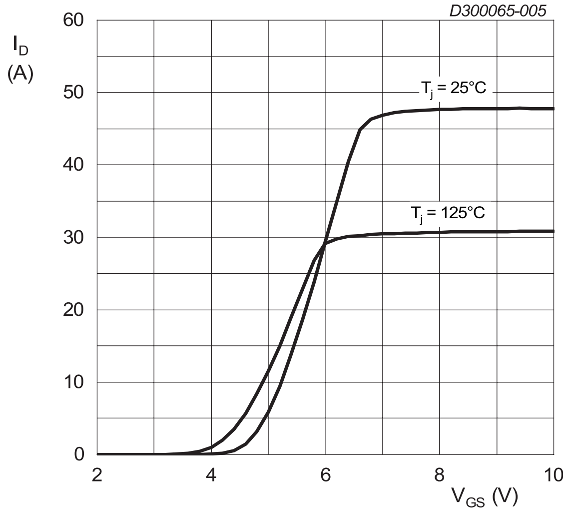
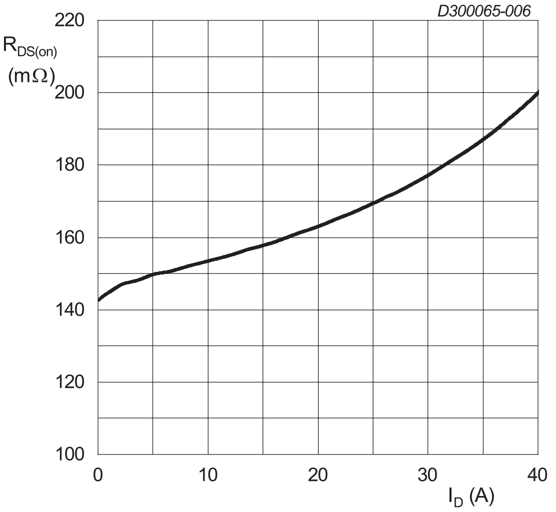


Fig. 4. Drain current as a function of drain-source voltage; typical values



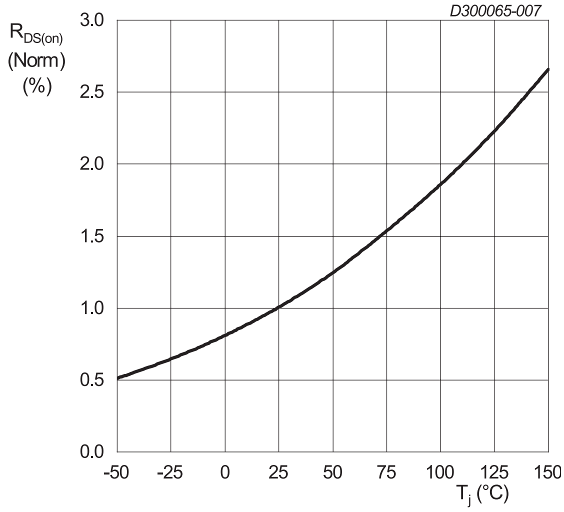
V_{DS} = 20 V

Fig. 5. Drain current as a function of gate-source voltage; typical values



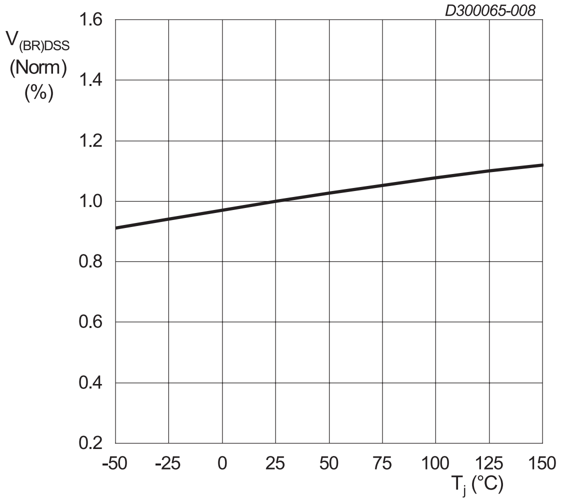
V_{GS} = 10 V

Fig. 6. Drain-source on-state resistance as a function of drain current; typical values



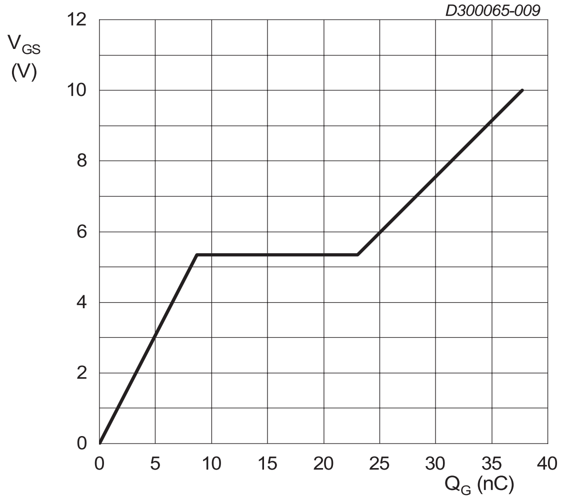
V_{GS} = 10 V; I_D = 11 A

Fig. 7. Normalized drain-source on-state resistance as a function of junction temperature



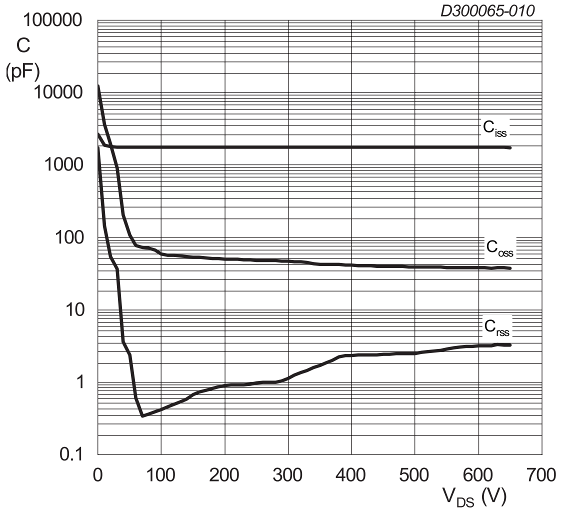
I_D = 250 µA

Fig. 8. Normalized drain-source breakdown voltage as a function of junction temperature



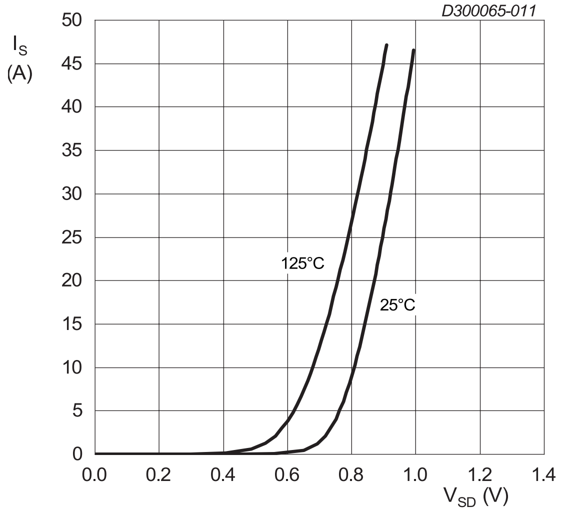
I_D = 11 A; V_{DS} = 400 V

Fig. 9. Gate-source voltage as a function of gate charge; typical values



V_{GS} = 0 V; f = 1 MHz

Fig 10. Capacitances as a function of drain-source voltage; typical values



V_{GS} = 0 V

Fig 11. Source current as a function of source-drain voltage; typical values

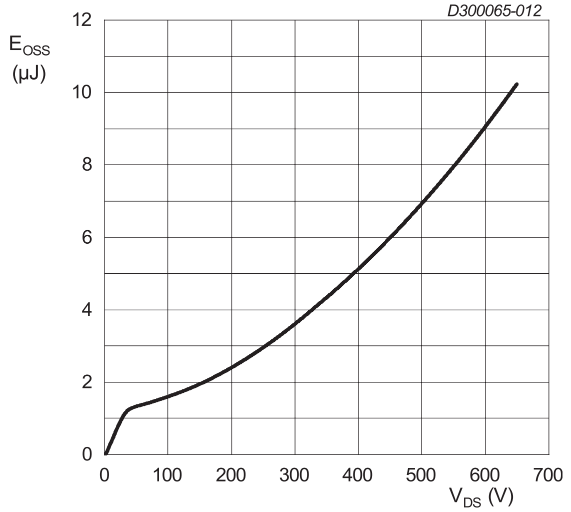
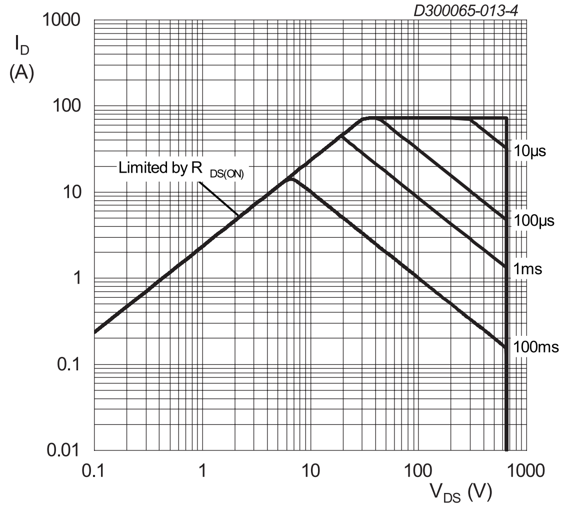


Fig. 12. Output capacitance stored energy as a function of drain-source voltage

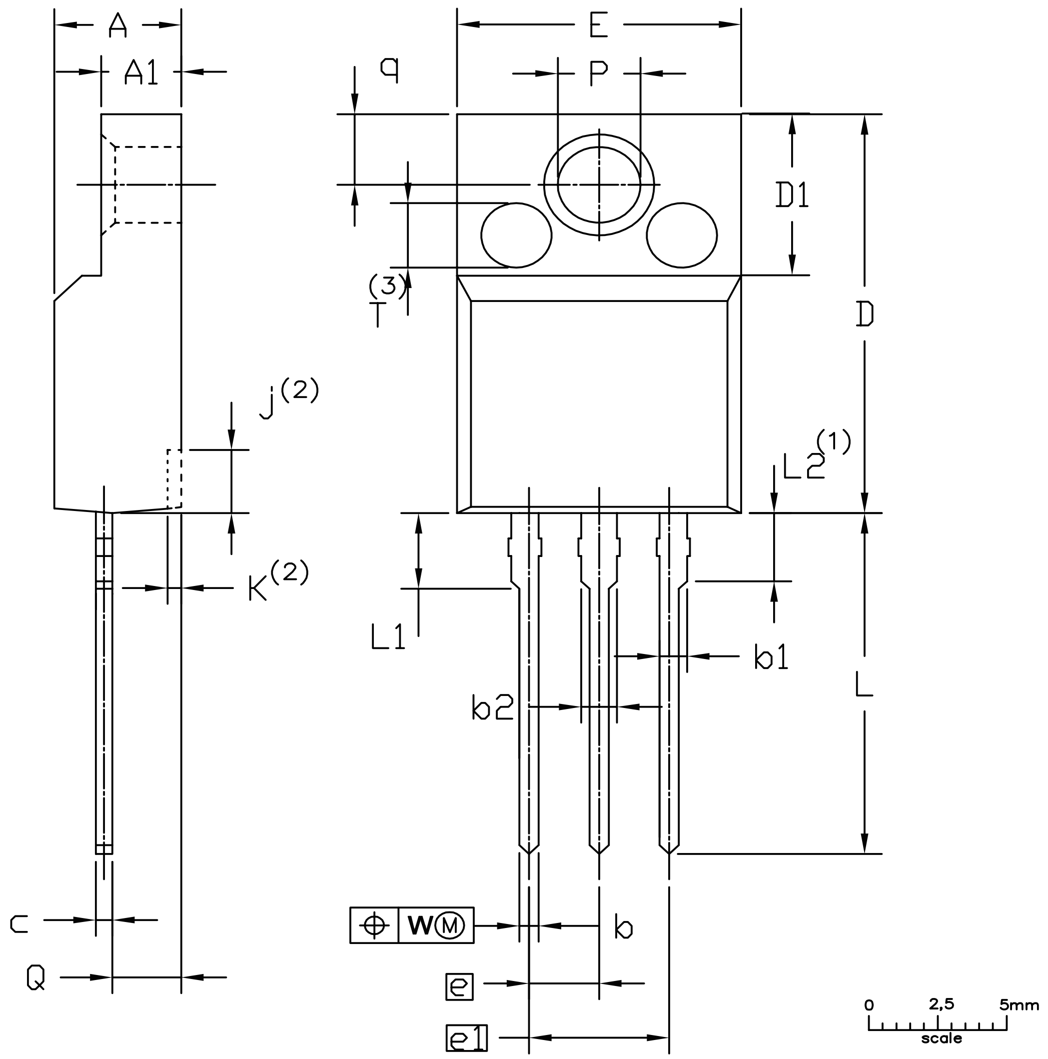


T_h = 25 °C

Fig. 13. Safe operating area

11. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"   SOT186A



UNIT	A	A_1	b	b_1	b_2	c	D	D_1	E	e	e_1	j(2)	K(2)	L	L_1	L_2(1) max.	P	Q	q	W	T(3)
mm	4.6	2.9	0.9	1.1	1.4	0.7	15.8	6.5	10.3	2.54	5.08	2.7	0.6	14.4	3.30	3	3.2	2.6	3.0	0.4	2.5
	4.0	2.5	0.7	0.9	1.0	0.4	15.2	6.3	9.7			1.7	0.4	13.5	2.79		3.0	2.3	2.6		

Notes
1. Terminal dimensions within this zone are uncotrolled
2. Dot lines area designs may vary
3. Eject pin mark is for reference only

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT186A		3 LEADS TO220F				2013-11-14

12. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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[2] The term 'short data sheet' is explained in section "Definitions".
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