

## 1. General description

WSJM65R099DW is a high voltage N-channel MOSFET in TO247 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
- Integrated ultrafast body diode
- 100% avalanche tested

## 3. Applications

- EV charger
- High efficiency power supplies
- On board charger
- Inverters

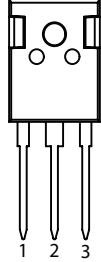
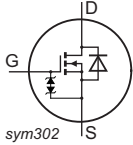
## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Notes	Values			Unit
<b>Absolute maximum rating</b>							
$V_{DS}$	drain-source voltage			650			V
$V_{GS}$	gate-source voltage			±30			V
$I_D$	continuous drain current	$T_{mb} = 25\text{ °C}$		32			A
$P_{tot}$	power dissipation	$T_{mb} = 25\text{ °C}$		240			W
$T_j$	junction temperature			-55 to 150			°C
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Static characteristics</b>							
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}, I_D = 16\text{ A}$		-	82	99	mΩ
<b>Dynamic characteristics</b>							
$Q_{G(tot)}$	total gate charge	$I_D = 16\text{ A}; V_{DS} = 400\text{ V}; V_{GS} = 10\text{ V}$		-	57	-	nC
$E_{OSS}$	coss stored energy	$V_{GS} = 0\text{ V}; V_{DS} = 0\text{ to }400\text{ V}$		-	7	-	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	D	mounting base; connected to drain		

## 6. Ordering information

**Table 3. Ordering information**

Type number	Package name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
WSJM65R099DW	TO247	WSJM65R099DWQ	Tube	30	TO247N	20-July-2016

## 7. Marking

**Table 4. Marking codes**

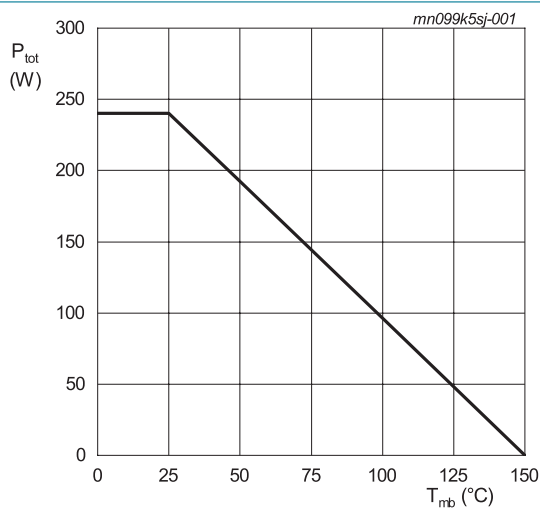
Type number	Marking codes
WSJM65R099DW	WSJM 65R099DW

## 8. Limiting values

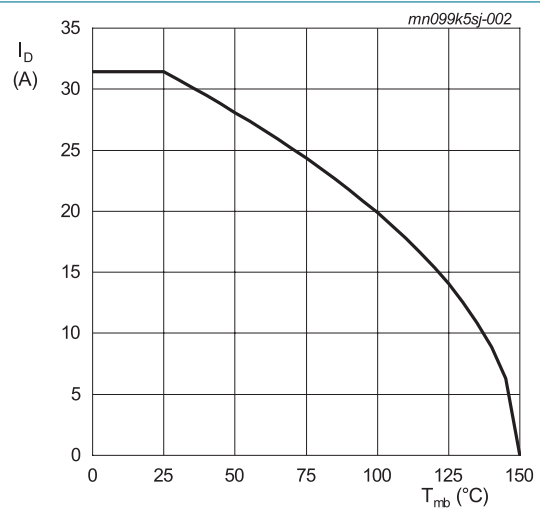
**Table 5. Limiting values**

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			$\pm 30$	V
$I_D$	continuous drain current	$T_{mb} = 25\text{ }^\circ\text{C}$		32	A
		$T_{mb} = 100\text{ }^\circ\text{C}$		20	A
$I_{DM}$	pulsed drain current	$T_{mb} = 25\text{ }^\circ\text{C}$		128	A
$P_{tot}$	power dissipation	$T_{mb} = 25\text{ }^\circ\text{C}$		240	W
$E_{AS}$	single pulse drain-to-source avalanche	$I_{AS} = 6.4\text{ A}$ ; $R_{GS} = 25\text{ }\Omega$ ; $V_{DD} = 50\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$		204	mJ
$E_{AR}$	repetitive avalanche energy	$I_{AS} = 6.4\text{ A}$ ; $R_{GS} = 25\text{ }\Omega$ ; $V_{DD} = 50\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$		0.72	mJ
$I_{AS}$	avalanche current, single pulse			6.4	A
dv/dt	MOSFET dv/dt ruggedness			64	V/ns
dv/dt	reverse diode dv/dt			50	V/ns
dI <sub>r</sub> /dt	maximum diode commutation speed			850	A/ $\mu$ s
$T_{stg}$	storage temperature			-55 to 150	$^\circ\text{C}$
$T_j$	junction temperature			-55 to 150	$^\circ\text{C}$



**Fig. 1. Normalized total power dissipation as a function of mounting base temperature**

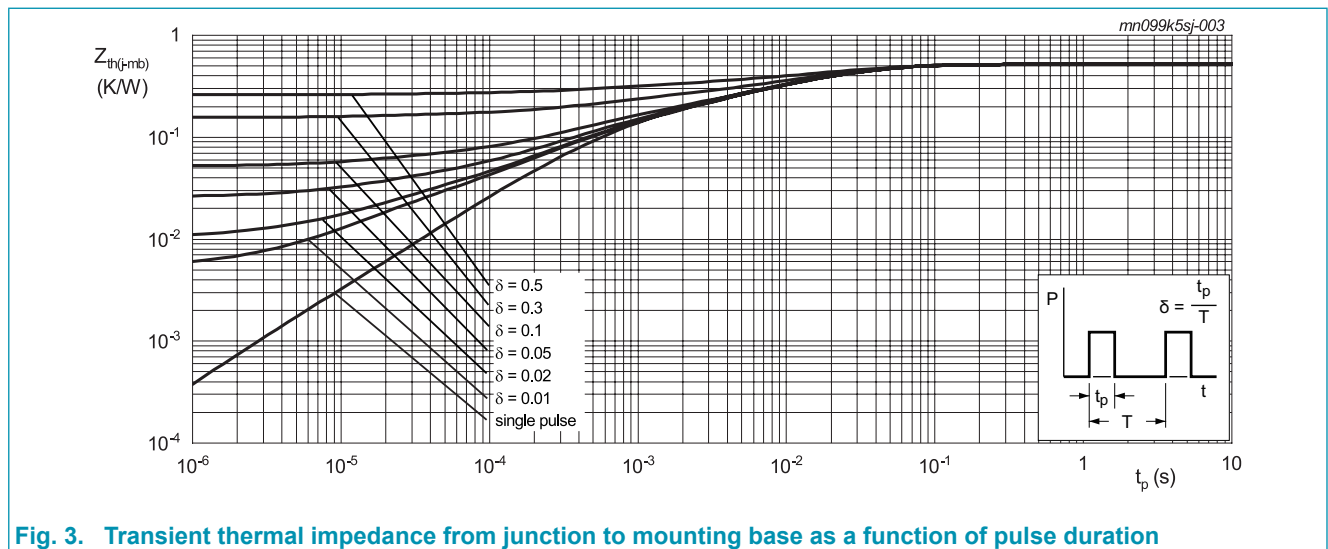


**Fig. 2. Continuous Drain Current as a function of mounting base temperature**

## 9. Thermal & Mechanical characteristics

**Table 6. Thermal & Mechanical characteristics**

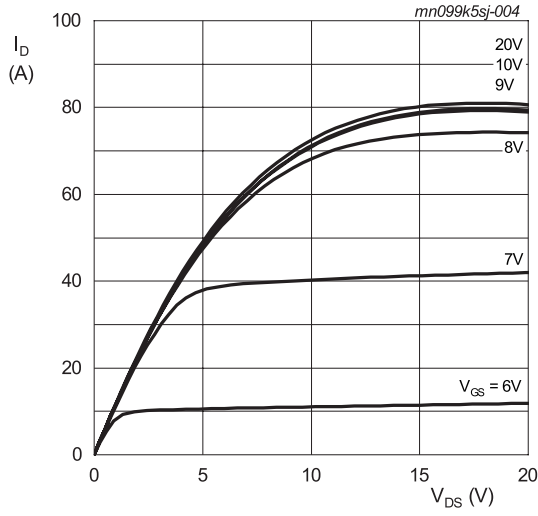
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
$R_{th(j-mb)}$	thermal resistance from junction to mounting base			-	0.4	0.52	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	45	-	K/W



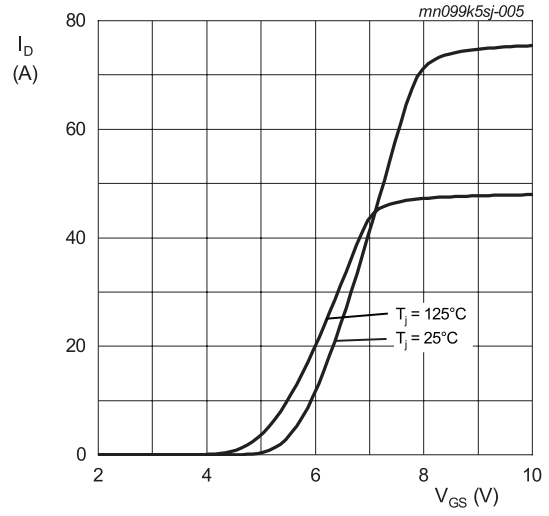
## 10. Characteristics

**Table 7. Characteristics**
 $T_j = 25\text{ °C}$  unless otherwise noted

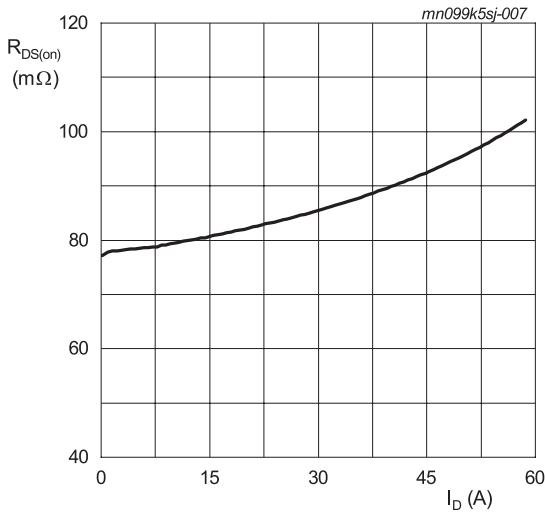
Symbol	Parameter	Conditions	Notes	Min	Typ	Max	Unit
<b>Static characteristics</b>							
$V_{(BR)DSS}$	drain-source breakdown voltage	$I_D = 1\text{ mA}; V_{GS} = 0\text{ V}$		650	-	-	V
$V_{GS(th)}$	gate-source threshold voltage	$I_D = 250\text{ }\mu\text{A}; V_{DS} = V_{GS}$		3	-	5	V
$I_{DSS}$	drain leakage current	$V_{DS} = 650\text{ V}; V_{GS} = 0\text{ V}$		-	-	10	$\mu\text{A}$
		$V_{DS} = 650\text{ V}; V_{GS} = 0\text{ V}; T_j = 125\text{ °C}$		-	100	-	$\mu\text{A}$
$I_{GSS}$	gate leakage current	$V_{GS} = \pm 30\text{ V}; V_{DS} = 0\text{ V}$		-	-	$\pm 500$	nA
$R_{DS(on)}$	drain-source on-state resistance	$V_{GS} = 10\text{ V}; I_D = 16\text{ A}$		-	82	99	m $\Omega$
$R_G$	gate resistance	$f = 1\text{ MHz}$		-	32	-	$\Omega$
<b>Dynamic characteristics</b>							
$Q_{G(tot)}$	total gate charge	$I_D = 16\text{ A}; V_{DS} = 400\text{ V}; V_{GS} = 10\text{ V}$		-	57	-	nC
$Q_{GS}$	gate-source charge			-	16	-	nC
$Q_{GD}$	gate-drain charge			-	22	-	nC
$C_{iss}$	input capacitance	$V_{DS} = 400\text{ V}; V_{GS} = 0\text{ V}; f = 250\text{ kHz}$		-	2797	-	pF
$C_{oss}$	output capacitance			-	44	-	pF
$C_{rss}$	reverse transfer capacitance			-	1.6	-	pF
$C_{o(er)}$	effective output capacitance, energy related	$V_{GS} = 0\text{ V}; V_{DS} = 0\text{ to }400\text{ V}$		-	88	-	pF
$C_{o(tr)}$	effective output capacitance, time related			-	731	-	pF
$t_{d(on)}$	turn-on delay time	$V_{DS} = 400\text{ V}; V_{GS} = 10\text{ V}; R_G = 2\text{ }\Omega;$ $I_D = 16\text{ A}$		-	129	-	ns
$t_r$	rise time			-	15	-	ns
$t_{d(off)}$	turn-off delay time			-	225	-	ns
$t_f$	fall time			-	9.1	-	ns
<b>Source-drain diode</b>							
$V_{SD}$	source-drain voltage	$V_{GS} = 0\text{ V}; I_S = 16\text{ A}$		-	0.94	1.2	V
$I_S$	body-diode continuous current	$T_{mb} = 25\text{ °C}$		-	-	32	A
$t_{rr}$	reverse recovery time	$V_R = 400\text{ V}; I_F = 16\text{ A}; di_F/dt = 100\text{ A}/\mu\text{s}$		-	142	-	ns
$Q_{rr}$	reverse recovered charge			-	1	-	$\mu\text{C}$
$I_{rrm}$	reverse recovery current			-	14	-	A



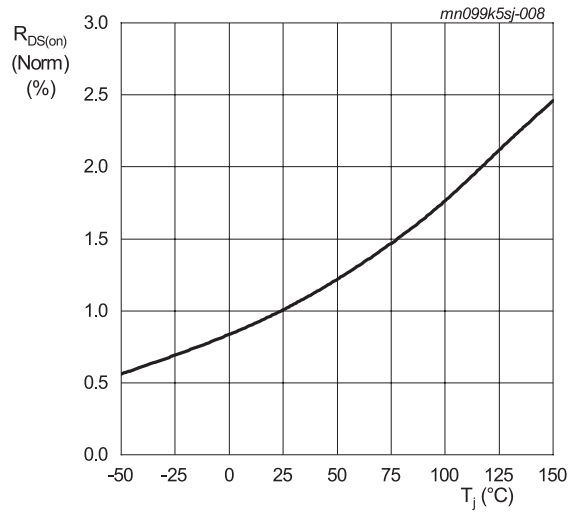
**Fig. 4. Drain current as a function of drain-source voltage; typical values**



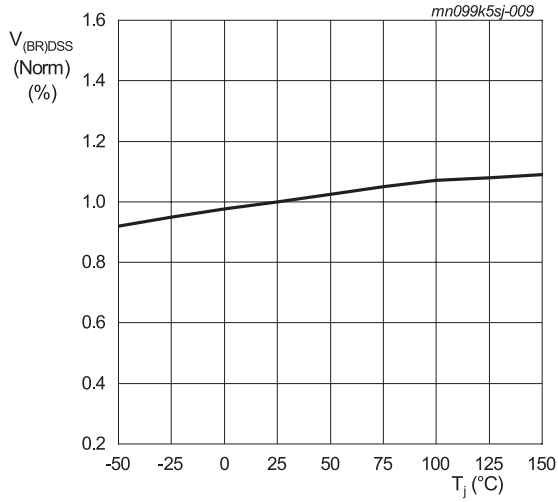
$V_{DS} = 20 V$   
**Fig. 5. Drain current as a function of gate-source voltage; typical values**



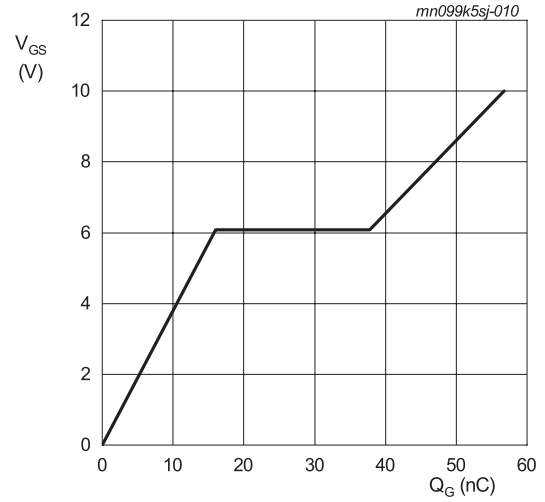
$V_{GS} = 10 V$   
**Fig. 6. Drain-source on-state resistance as a function of drain current; typical values**



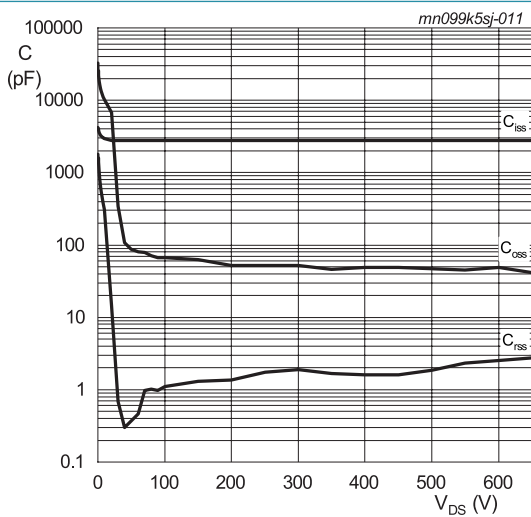
$V_{GS} = 10 V; I_D = 16 A$   
**Fig. 7. Normalized drain-source on-state resistance as a function of junction temperature**



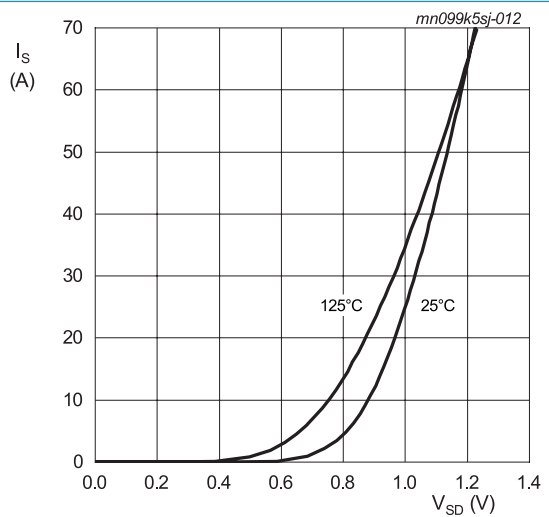
$I_D = 1 \text{ mA}$   
**Fig. 8. Normalized drain-source breakdown voltage as a function of junction temperature**



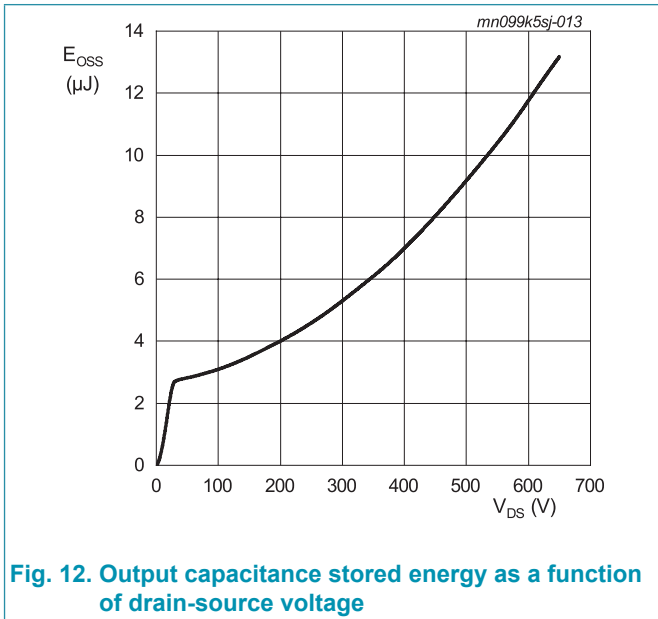
$I_D = 16 \text{ A}; V_{DS} = 400 \text{ V}$   
**Fig. 9. Gate-source voltage as a function of gate charge; typical values**



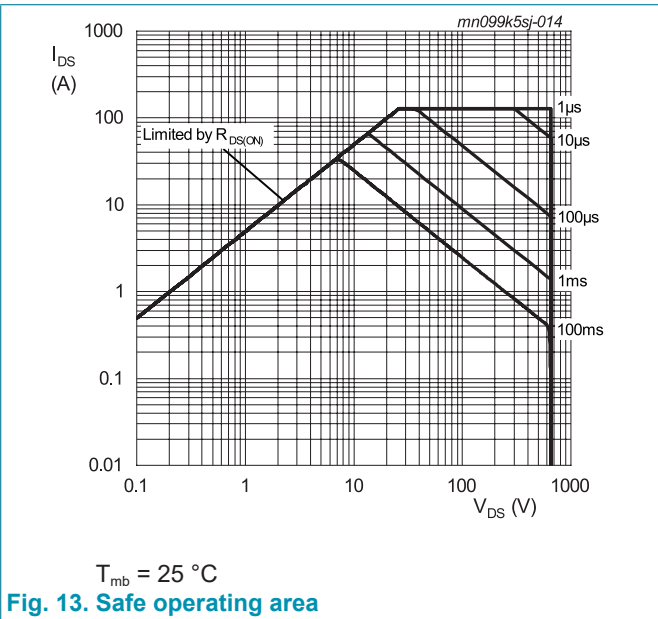
$V_{GS} = 0 \text{ V}; f = 250 \text{ kHz}$   
**Fig 10. Capacitances as a function of drain-source voltage; typical values**



$V_{GS} = 0 \text{ V}$   
**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**



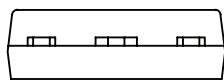
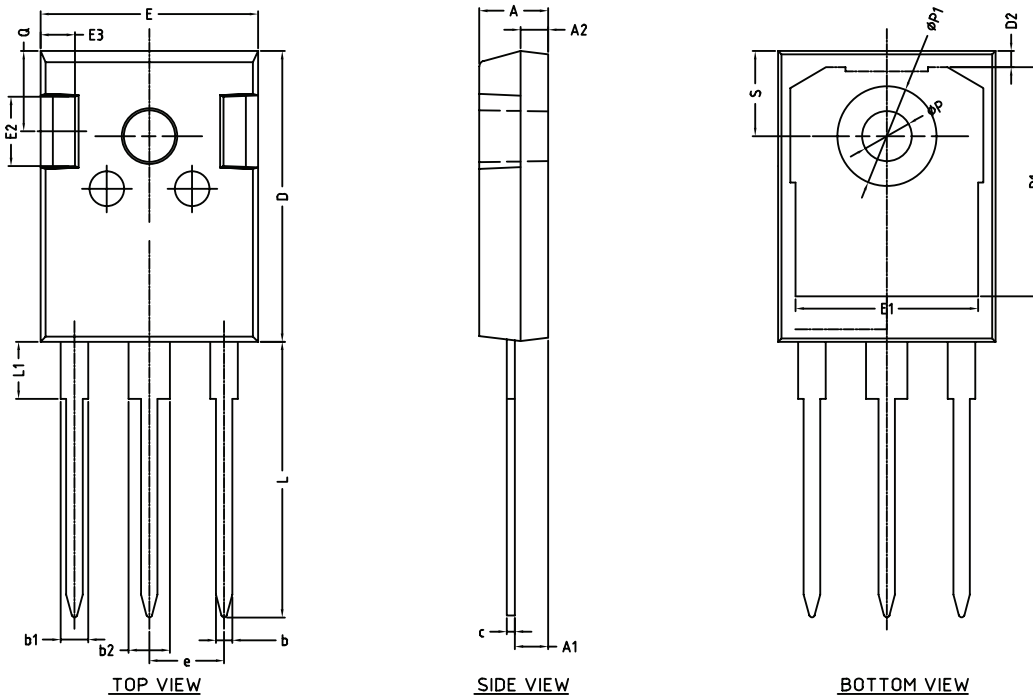
**Fig. 13. Safe operating area**



### 11. Package outline

Plastic single-ended through-hole package; heatsink mounted; 1 mounting hole; 3-lead TO-247

SOT429N



SIDE VIEW

UNIT	A	A1	A2	b	b1	b2	c	D	D1	D2	E	E1	E2	E3	e	L	L1	P	P1	q	S	
mm	MAX	5.20	2.60	2.10	1.40	2.20	3.20	0.70	21.10	16.85	1.35	15.90	13.50	5.20	2.60	5.45	20.10	4.75	3.70	7.40	6.00	6.25
	MIN	4.70	2.20	1.90	1.00	1.80	2.80	0.50	20.90	16.25	1.05	15.70	13.10	4.80	2.40		19.80	-	3.50	-	5.60	6.05

OUTLINE VERSION	REFERENCES				PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT429N		TO-247				

## 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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