

Automotive silicon carbide Power MOSFET 650 V, 200 A, 10 mΩ (typ., T<sub>J</sub>= 150 °C) in a Max247-T long lead

Datasheet - preliminary data

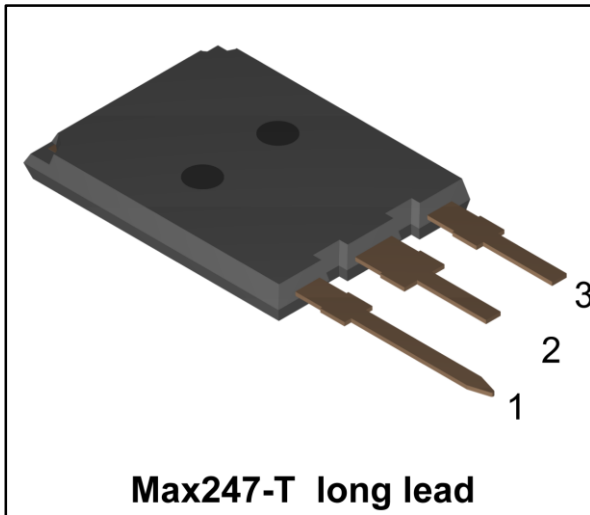
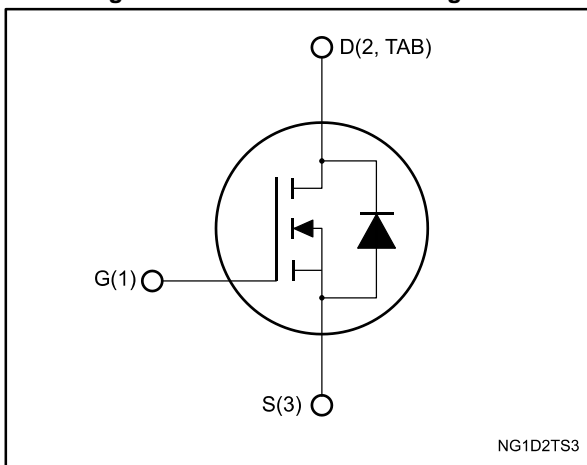


Figure 1: Internal schematic diagram



## Features

- Designed for Automotive applications
- Very tight variation of on-resistance vs. temperature
- Very high operating temperature capability (200 °C)
- Very fast and robust intrinsic body diode
- Low capacitance

## Applications

- Inverter for traction
- Motor drives
- DC-DC converters

## Description

This silicon carbide Power MOSFET has been developed using ST's advanced and innovative 2<sup>nd</sup> generation SiC MOSFET technology. The device features remarkably low on-resistance per unit area and very good switching performance. The variation of both on-resistance and switching losses is almost independent of junction temperature.

Table 1: Device summary

Order code	Marking	Package	Packaging
SCTYA200N65G2TAG	SCT200N65G2TAG	Max247-T long lead	Tube

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# 1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	-10 to 22	V
	Gate-source voltage (recommended operational values)	-5 to 20	
$I_D$	Drain current (continuous) at $T_C = 25\text{ °C}$ (limited by die)	200	A
	Drain current (continuous) at $T_C = 25\text{ °C}$ (limited by package)	172	
	Drain current (continuous) at $T_C = 100\text{ °C}$	160	
$I_D^{(1)}$	Drain current (pulsed)	340	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ °C}$	580	W
$T_J$	Operating junction temperature range	-55 to 200	°C
$T_{stg}$	Storage temperature range		

**Notes:**

(1)Pulse width limited by safe operating area.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.30	°C/W
$R_{thj-amb}$	Thermal resistance junction-amb max	30	°C/W

## 2 Electrical characteristics

(T<sub>case</sub> =25 °C unless otherwise specified)

**Table 4: On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 mA	650			V
I <sub>DSS</sub>	Zero gate voltage drain current	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 650 V			25	μA
		V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 650 V, T <sub>J</sub> =150 °C <sup>(1)</sup>			100	μA
I <sub>GSS</sub>	Gate-body leakage current	V <sub>DS</sub> =0 V, V <sub>GS</sub> = +22 V			250	nA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 2 mA	1.9	2.8		V
R <sub>DS(on)</sub>	Static drain-source on-resistance	V <sub>GS</sub> = 20 V, I <sub>D</sub> = 95 A		9.0	12.5	mΩ
		V <sub>GS</sub> = 20 V, I <sub>D</sub> = 95 A T <sub>J</sub> = 150 °C		10.0		mΩ
		V <sub>GS</sub> = 20 V, I <sub>D</sub> = 95 A T <sub>J</sub> = 200 °C		11.5		mΩ

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test.

**Table 5: Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>iss</sub>	Input capacitance	V <sub>GS</sub> =0 V, V <sub>DS</sub> =400 V, f=1 MHz	-	7400	-	pF
C <sub>oss</sub>	Output capacitance		-	650	-	pF
C <sub>rss</sub>	Reverse transfer capacitance		-	175	-	pF
R <sub>G</sub>	Intrinsic gate resistance	f = 1 MHz, I <sub>D</sub> =0 A	-	0.9	-	Ω
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 95 A V <sub>GS</sub> =0 to 20 V	-	440	-	nC
Q <sub>gs</sub>	Gate-source charge		-	74	-	nC
Q <sub>gd</sub>	Gate-drain charge		-	179	-	nC

**Table 6: Switching energy (inductive load)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
E <sub>on</sub>	Turn-on switching energy	V <sub>DD</sub> = 400 V, I <sub>D</sub> = 95 A, R <sub>G</sub> = 2.2 Ω, V <sub>GS</sub> = -5 to 20 V	-	580	-	μJ
E <sub>off</sub>	Turn-off switching energy		-	1075	-	μJ

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Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 400\text{ V}$ , $I_D = 95\text{ A}$ , $R_G = 2.2\ \Omega$ , $V_{GS} = -5\text{ to }20\text{ V}$	-	TBD	-	ns
$t_r$	Rise time		-	TBD	-	ns
$t_{d(off)}$	Turn-off delay time		-	TBD	-	ns
$t_f$	Fall time		-	TBD	-	ns

Table 8: Reverse SiC diode characteristics

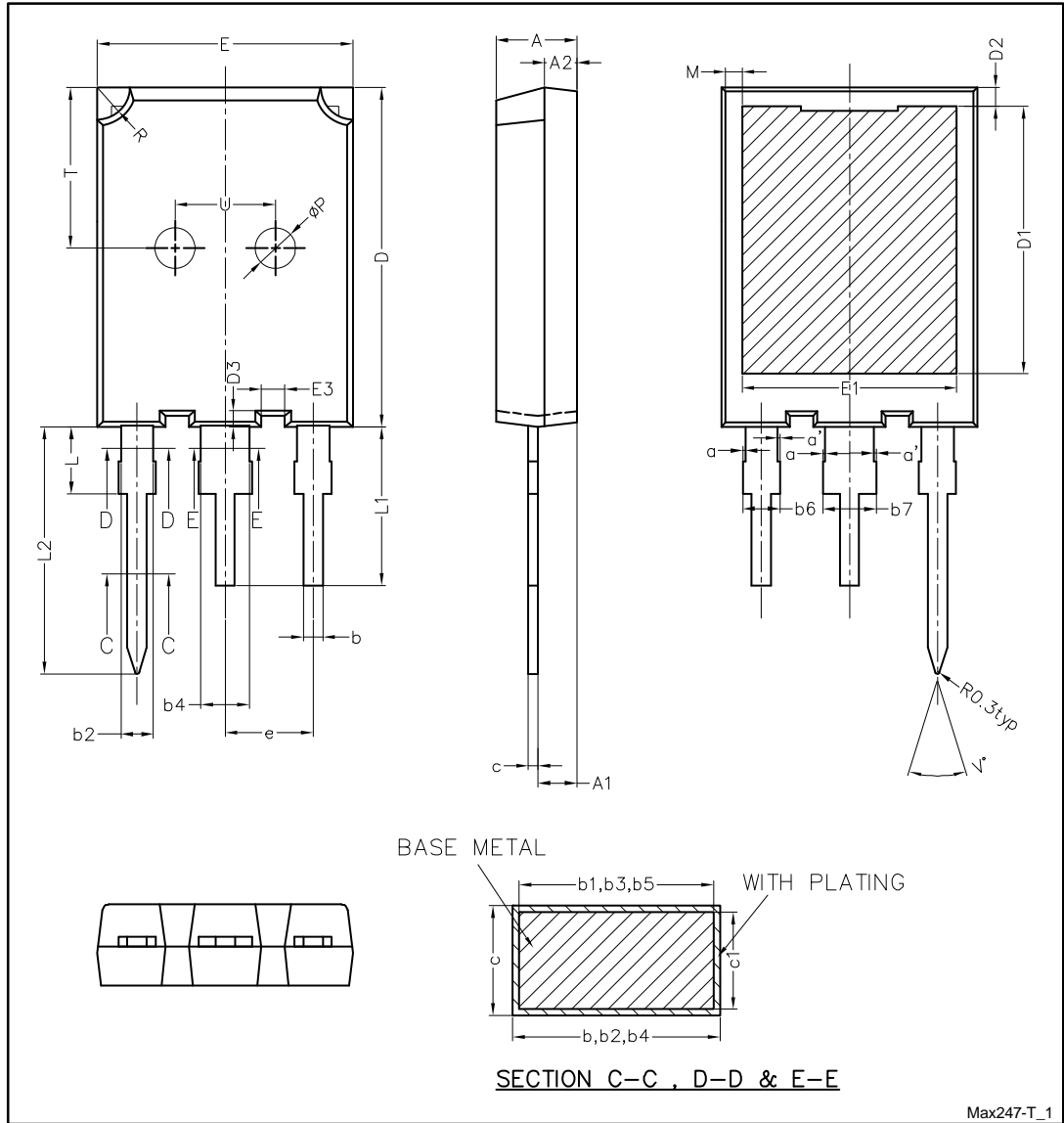
Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$V_{SD}$	Diode forward voltage	$I_{SD} = 50\text{ A}$ , $V_{GS} = 0\text{ V}$	-	3.5	-	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 95\text{ A}$ , $di/dt = 4000\text{ A}/\mu\text{s}$ , $V_{DD} = 400\text{ V}$	-	30	-	ns
$Q_{rr}$	Reverse recovery charge		-	970		nC
$I_{RRM}$	Reverse recovery current		-	49.5		A

### 3 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK® is an ST trademark.

#### 3.1 Max247-T long lead package information

Figure 2: Max247-T long lead package outline



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Table 9: Max247-T long lead package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
a	0		0.15
a'	0		0.15
b	1.16		1.26
b1	1.15	1.20	1.22
b2	1.96		2.06
b3	1.95	2.00	2.02
b4	2.96		3.06
b5	2.95	3.00	3.02
b6			2.25
b7			3.25
c	0.59		0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.17	1.35
D3	0.75	1.00	1.25
E	15.70	15.80	15.90
E1	13.10	13.26	13.50
E3	1.35	1.45	1.55
e	5.34	5.44	5.54
L			4.30
L1	9.80	9.42	10.18
L2	14.89	15.27	15.65
M	0.70		1.30
P	2.40	2.50	2.60
R	1.90	2.00	2.10
T	9.80		10.20
U	6.00		6.40
V	35°		45°

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## 4 Revision history

Table 10: Document revision history

Date	Revision	Changes
09-Feb-2016	1	First release.
04-Jul-2016	2	Updated title, applications and description in cover page. Updated <i>Table 2: "Absolute maximum ratings"</i> , <i>Table 4: "On /off states"</i> , <i>Table 5: "Dynamic"</i> and <i>Table 8: "Reverse SiC diode characteristics"</i> . Minor text changes.



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