

N-channel 600 V, 0.037 Ω typ., 66 A MDmesh™ DM2 Power MOSFET in a TO-247 long leads package

Datasheet - preliminary data

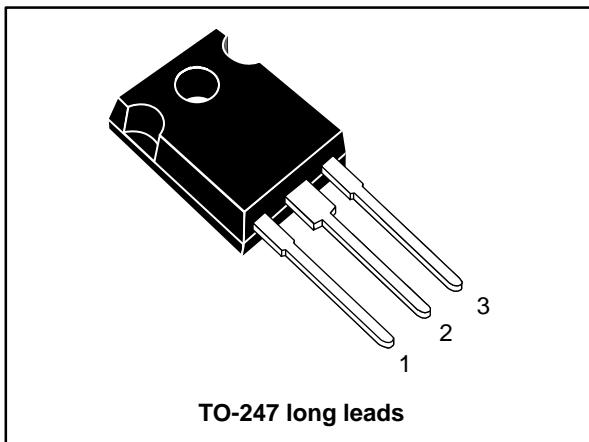
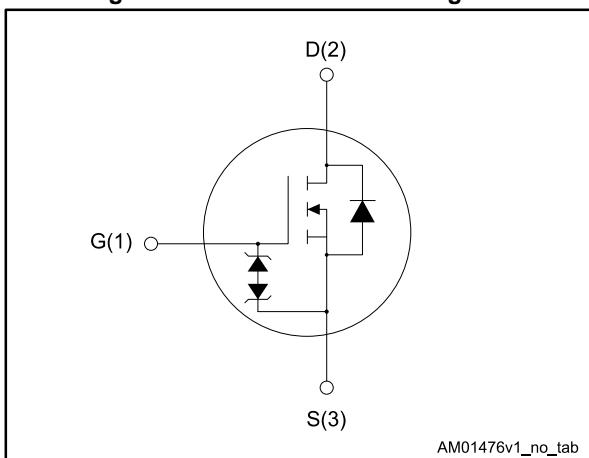


Figure 1: Internal schematic diagram



Features

Order code	V_{DS}	$R_{DS(on)}$ max.	I_D	P_{TOT}
STWA70N60DM2	600 V	0.042 Ω	66 A	446 W

- Fast-recovery body diode
- Extremely low gate charge and input capacitance
- Low on-resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

Applications

- Switching applications

Description

This high voltage N-channel Power MOSFET is part of the MDmesh™ DM2 fast recovery diode series. It offers very low recovery charge (Q_{rr}) and time (t_{rr}) combined with low $R_{DS(on)}$, rendering it suitable for the most demanding high efficiency converters and ideal for bridge topologies and ZVS phase-shift converters.

Table 1: Device summary

Order code	Marking	Package	Packing
STWA70N60DM2	70N60DM2	TO-247 long leads	Tube

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1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	± 25	V
I_D	Drain current (continuous) at $T_{case} = 25^\circ C$	66	A
	Drain current (continuous) at $T_{case} = 100^\circ C$	42	
$I_{DM}^{(1)}$	Drain current (pulsed)	264	A
P_{TOT}	Total dissipation at $T_{case} = 25^\circ C$	446	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	50	V/ns
$dv/dt^{(3)}$	MOSFET dv/dt ruggedness	50	
T_{stg}	Storage temperature	-55 to 150	$^\circ C$
T_j	Operating junction temperature		

Notes:

(1) Pulse width is limited by safe operating area.

(2) $I_{SD} \leq 66$ A, $di/dt = 900$ A/ μ s; V_{DS} peak < $V_{(BR)DSS}$, $V_{DD} = 400$ V.(3) $V_{DS} \leq 480$ V.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.28	$^\circ C/W$
$R_{thj-amb}$	Thermal resistance junction-ambient	50	

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (Pulse width limited by T_{jmax})	10	A
E_{AR}	Single pulse avalanche energy (starting $T_j = 25^\circ C$, $I_D = I_{AR}$, $V_{DD} = 50$ V)	1500	mJ

2 Electrical characteristics

($T_{case} = 25^\circ C$ unless otherwise specified)

Table 5: Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$V_{GS} = 0 V, I_D = 1 mA$	600			V
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0 V, V_{DS} = 600 V$			10	μA
		$V_{GS} = 0 V, V_{DS} = 600 V, T_{case} = 125^\circ C$			100	
I_{GSS}	Gate-body leakage current	$V_{DS} = 0 V, V_{GS} = \pm 25 V$			± 5	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	3	4	5	V
$R_{DS(on)}$	Static drain-source on-resistance	$V_{GS} = 10 V, I_D = 33 A$		0.037	0.042	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	$V_{DS} = 100 V, f = 1 MHz, I_D = 0 A$	-	5508	-	pF
C_{oss}	Output capacitance		-	241	-	
C_{rss}	Reverse transfer capacitance		-	2.8	-	
$C_{oss eq. (1)}$	Equivalent output capacitance	$V_{DS} = 0$ to $480 V, V_{GS} = 0 V$	-	470	-	pF
R_G	Intrinsic gate resistance	$f = 1 MHz, I_D = 0 A$	-	2	-	Ω
Q_g	Total gate charge	$V_{DD} = 480 V, I_D = 66 A, V_{GS} = 10 V$ (see Figure 15: "Gate charge test circuit")	-	120	-	nC
Q_{gs}	Gate-source charge		-	26	-	
Q_{gd}	Gate-drain charge		-	60	-	

Notes:

⁽¹⁾ $C_{oss eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS} .

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300 V, I_D = 33 A$ $R_G = 4.7 \Omega, V_{GS} = 10 V$ (see Figure 14: "Switching times test circuit for resistive load" and)	-	32	-	ns
t_r	Rise time		-	67	-	
$t_{d(off)}$	Turn-off delay time		-	112	-	
t_f	Fall time		-	10.4	-	

Table 8: Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		66	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		264	A
$V_{SD}^{(2)}$	Forward on voltage	$V_{GS} = 0 \text{ V}$, $I_{SD} = 66 \text{ A}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 66 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	150		ns
Q_{rr}	Reverse recovery charge		-	0.72		μC
I_{RRM}	Reverse recovery current		-	9.6		A
t_{rr}	Reverse recovery time	$I_{SD} = 66 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$, $V_{DD} = 60 \text{ V}$, $T_j = 150 \text{ }^\circ\text{C}$ (see Figure 16: "Test circuit for inductive load switching and diode recovery times")	-	250		ns
Q_{rr}	Reverse recovery charge		-	2.55		μC
I_{RRM}	Reverse recovery current		-	20.4		A

Notes:

(1) Pulse width is limited by safe operating area.

(2) Pulse test: pulse duration = 300 μs , duty cycle 1.5%.

2.1

Electrical characteristics (curves)

Figure 2: Safe operating area

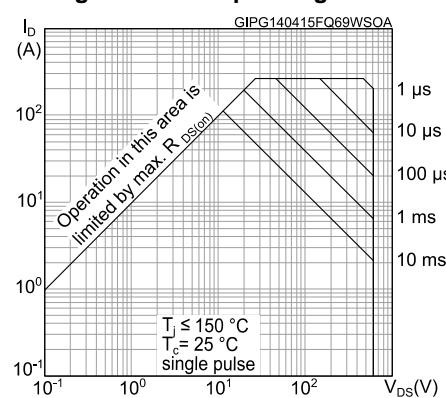


Figure 3: Thermal impedance

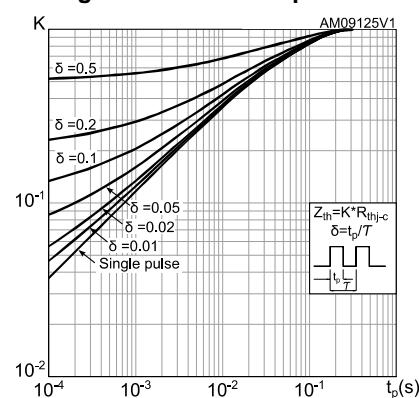


Figure 4: Output characteristics

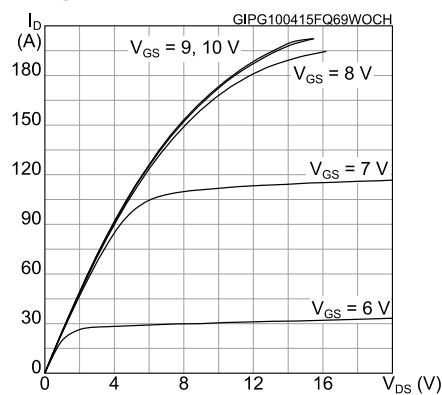


Figure 5: Transfer characteristics

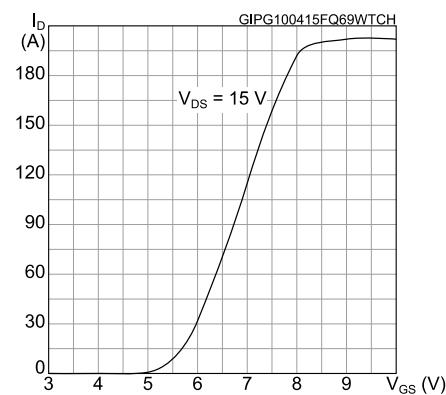


Figure 6: Gate charge vs gate-source voltage

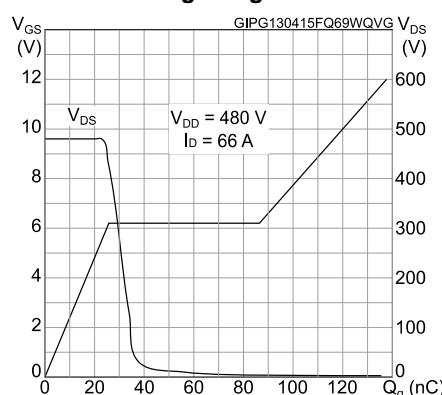


Figure 7: Static drain-source on-resistance

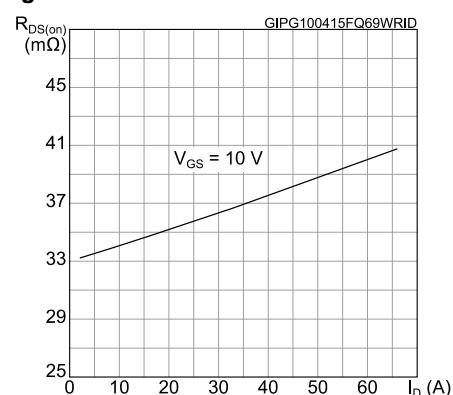


Figure 8: Capacitance variations

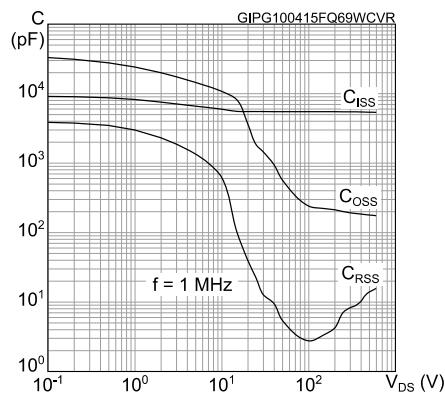


Figure 9: Normalized gate threshold voltage vs temperature

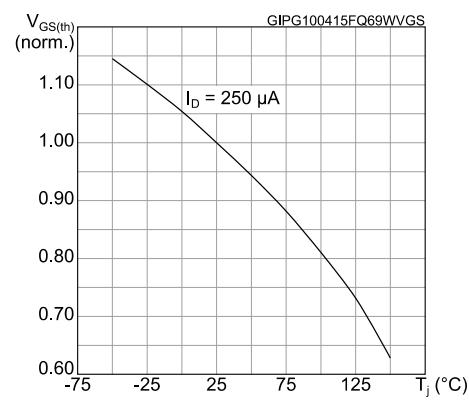


Figure 10: Normalized on-resistance vs temperature

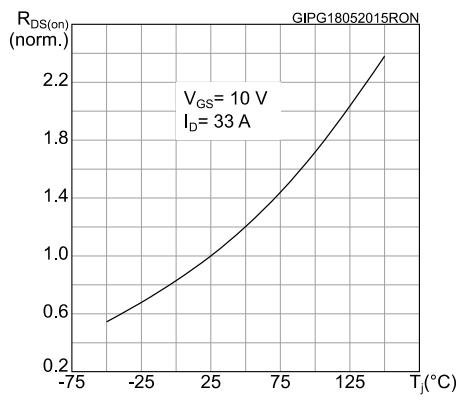


Figure 11: Normalized V(BR)DSS vs temperature

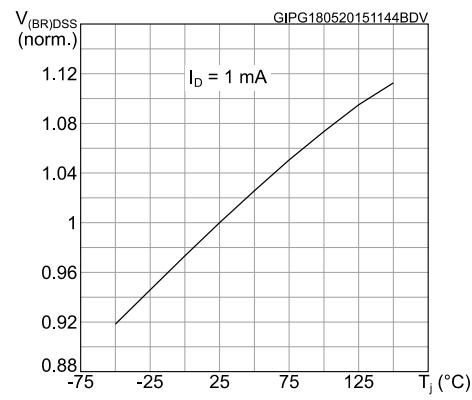


Figure 12: Output capacitance stored energy

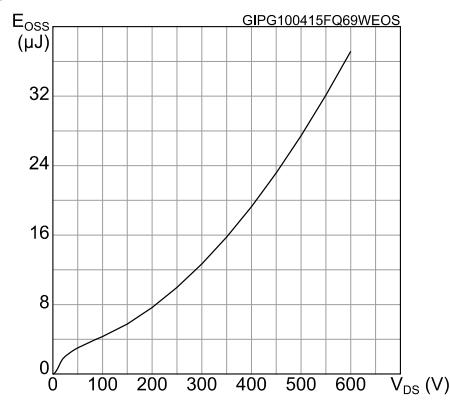
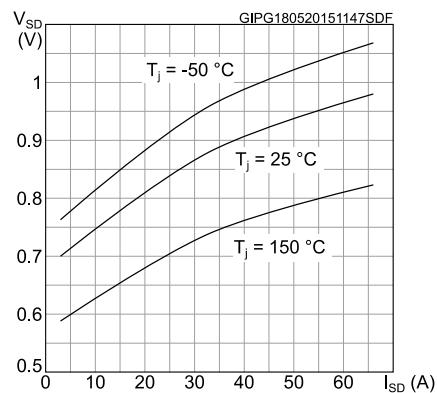


Figure 13: Source- drain diode forward characteristics



3 Test circuits

Figure 14: Switching times test circuit for resistive load

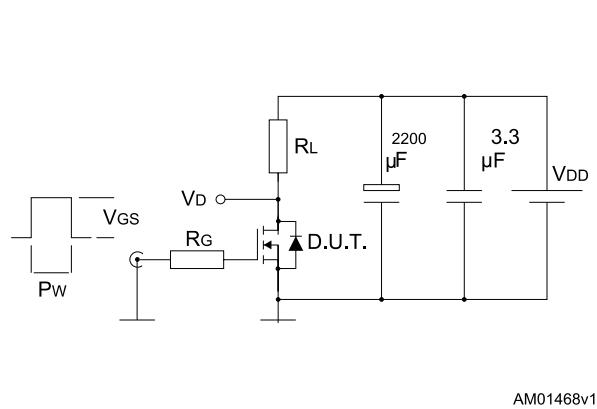


Figure 15: Gate charge test circuit

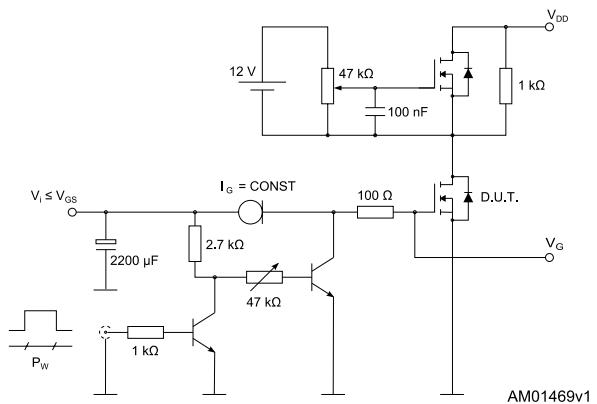


Figure 16: Test circuit for inductive load switching and diode recovery times

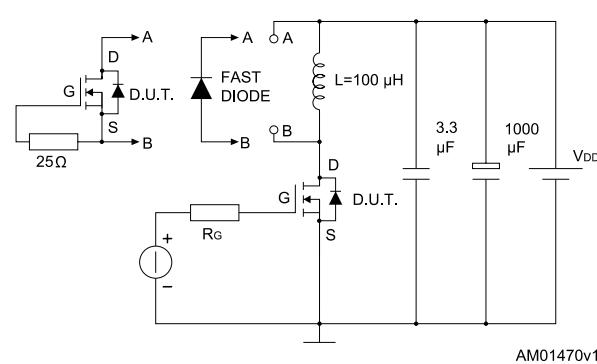


Figure 17: Unclamped inductive load test circuit

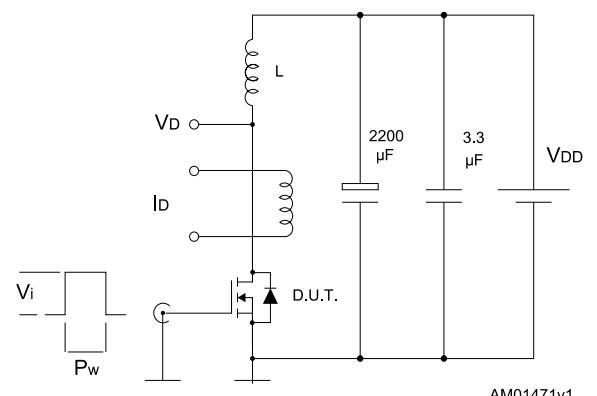


Figure 18: Unclamped inductive waveform

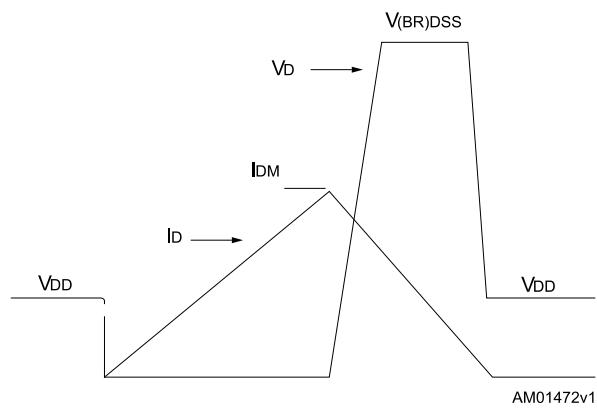
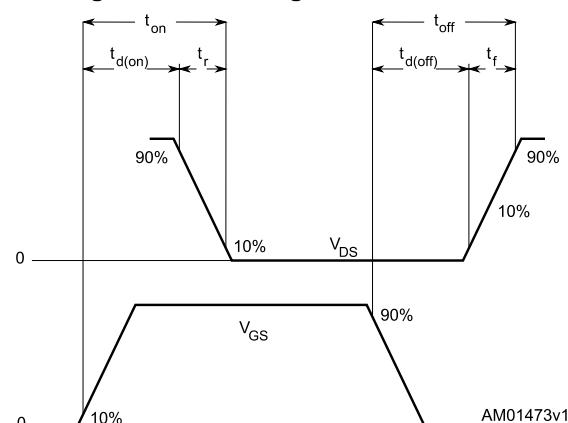


Figure 19: Switching time waveform



4 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. ECOPACK® is an ST trademark.

4.1 TO-247 long leads package information

Figure 20: TO-247 long leads package outline

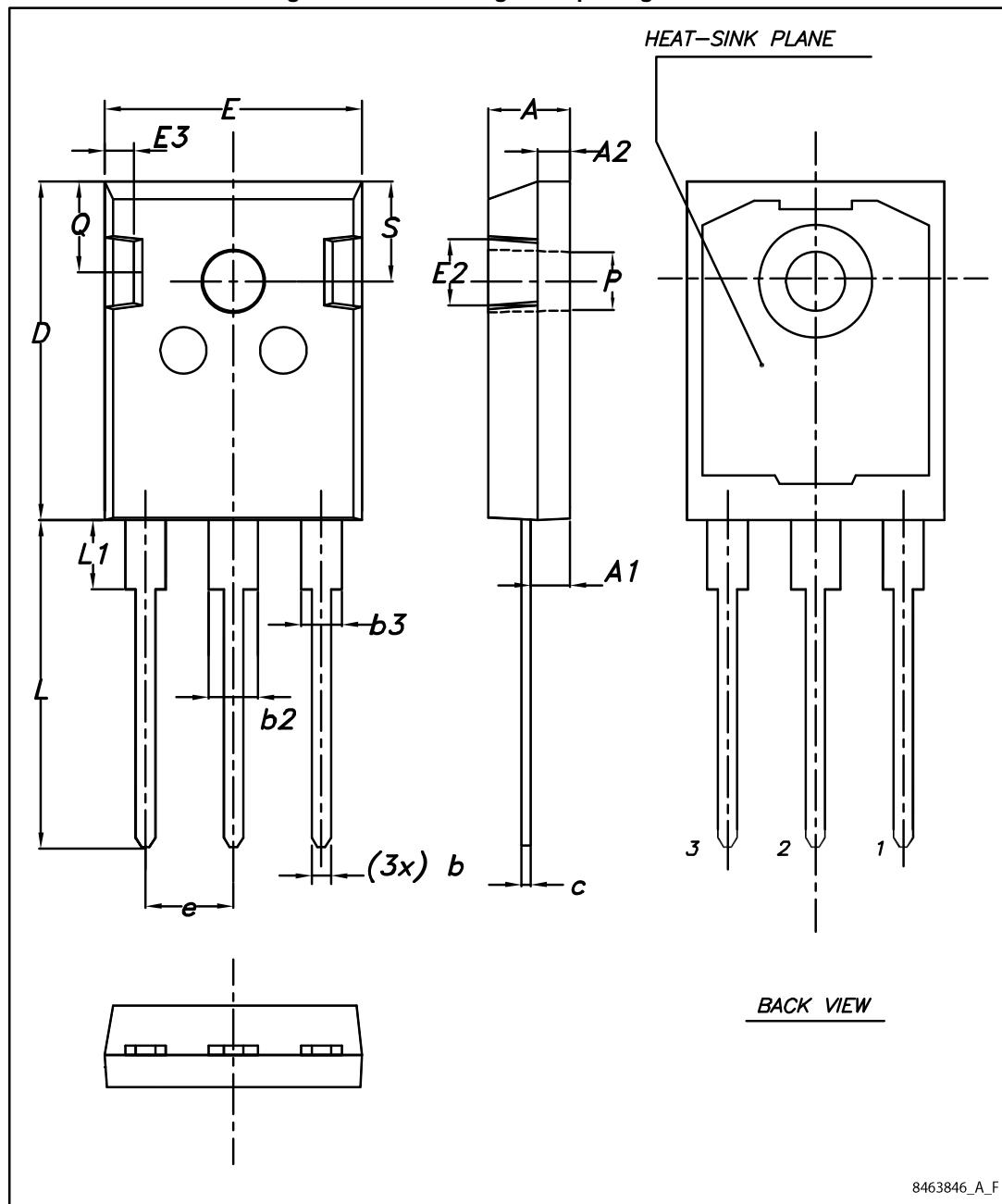


Table 9: TO-247 long leads package mechanical data

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
b	1.16		1.26
b2			3.25
b3			2.25
c	0.59		0.66
D	20.90	21.00	21.10
E	15.70	15.80	15.90
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.34	5.44	5.54
L	19.80	19.92	20.10
L1			4.30
P	3.50	3.60	3.70
Q	5.60		6.00
S	6.05	6.15	6.25

5 Revision history

Table 10: Document revision history

Date	Revision	Changes
19-May-2015	1	First release.

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