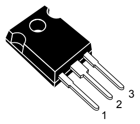
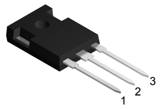
STW75N60DM6, STWA75N60DM6

Datasheet

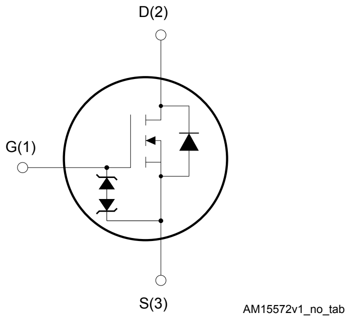
N-channel 600 V, 32 mΩ typ., 72 A MDmesh™ DM6 Power MOSFETs in TO-247 and TO-247 long leads packages



TO-247



TO-247 long leads



Features

Order codes	V_{DS}	$R_{DS(on)}$ max.	I_D
STW75N60DM6	600 V	36 mΩ	72 A
STWA75N60DM6			

- Fast-recovery body diode
- Lower $R_{DS(on)}$ per area vs previous generation
- Low gate charge, input capacitance and resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness
- Zener-protected

Applications

- Switching applications

Description

These high voltage N-channel Power MOSFETs are part of the MDmesh™ DM6 fast recovery diode series. Compared with the previous MDmesh fast generation, DM6 combines very low recovery charge (Q_{rr}), recovery time (t_{rr}) and excellent improvement in $R_{DS(on)}$ * area with one of the most effective switching behaviors available in the market for the most demanding high efficiency bridge topologies and ZVS phase-shift converters.

Product status link
STW75N60DM6
STWA75N60DM6

Product summary	
Order code	**STW75N60DM6**
Marking	75N60DM6
Package	TO-247
Packing	Tube
Order code	**STWA75N60DM6**
Marking	75N60DM6
Package	TO-247 long leads
Packing	Tube

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{GS}	Gate-source voltage	±25	V
I_D	Drain current (continuous) at T_C = 25 °C	72	A
I_D	Continuous collector current at T_C = 100 °C	45	A
I_D (1)	Drain current (pulsed)	240	A
P_{TOT}	Total dissipation at T_C = 25 °C	446	W
dv/dt(2)	Peak diode recovery voltage slope	50	V/ns
dv/dt(3)	MOSFET dv/dt ruggedness	50	V/ns
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Operating junction temperature range		

1. *Pulse width limited by safe operating area.*
2. *$I_{SD} \leq 72$ A, di/dt ≤ 900 A/µs; V_{DS}(peak) < $V_{(BR)DSS}$, V_{DD} = 400 V*
3. *$V_{DS} \leq 480$ V*

Table 2. Thermal data

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

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	9	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, I_D = I_{AR}; V_{DD} = 50 V)	1.7	J

2 Electrical characteristics

T_C = 25 °C unless otherwise specified

Table 4. On/off states

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			1	µA
		V_{GS} = 0 V, V_{DS} = 600 V, T_J = 125 °C(1)			100	
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V			±5	µA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_C = 250 µA	3.25	4	4.75	V
$R_{DS(on)}$	Static drain-source on-resistance	V_{GS} = 10 V, I_D= 36 A		32	36	mΩ

1. *Defined by design, not subject to production test.*

Table 5. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 100 V, f = 1 MHz, V_{GS} = 0 V	-	4850	-	pF
C_{oes}	Output capacitance		-	380	-	
C_{rss}	Reverse transfer capacitance		-	3.5	-	
$C_{oss\ eq.}$(1)	Equivalent output capacitance	V_{DS} = 0 to 480 V, V_{GS} = 0 V	-	771	-	
R_G	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	2.3	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 72 A, V_{GS} = 0 to 10 V (see Figure 14. Test circuit for gate charge behavior)	-	117	-	nC
Q_{gs}	Gate-source charge		-	24	-	nC
Q_{gd}	Gate-drain charge		-	71	-	nC

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

Table 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 36 A, R_G = 4.7 Ω (see Figure 13. Test circuit for resistive load switching times and Figure 18. Switching time waveform	-	36	-	ns
t_r	Rise time		-	107	-	ns
$t_{d(off)}$	Turn-off delay time		-	102	-	ns
t_f	Current fall time		-	10	-	ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		72	A

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SDM} (1)	Source-drain current (pulsed)		-		240	A
V_{SD} (2)	Forward on voltage	V_{GS} = 0 V, I_{SD} = 72 A	-		1.6	V
t_{rr}	Reverse recovery time	I_{SD} = 72 A, di/dt = 100 A/µs, V_{DD} = 60 V, (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	140		ns
Q_{rr}	Reverse recovery charge		-	0.7		µC
I_{RRM}	Reverse recovery current		-	10		A
t_{rr}	Reverse recovery time	I_{SD} = 72 A, di/dt = 100 A/µs, V_{DD} = 60 V, T_J = 150 °C (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	260		ns
Q_{rr}	Reverse recovery charge		-	3.1		µC
I_{RRM}	Reverse recovery current		-	24		A

1. *Pulse width is limited by safe operating area*
2. *Pulsed: pulse duration = 300 µs, duty cycle 1.5%*

3 Electrical characteristics (curves)

Figure 1. Safe operating area

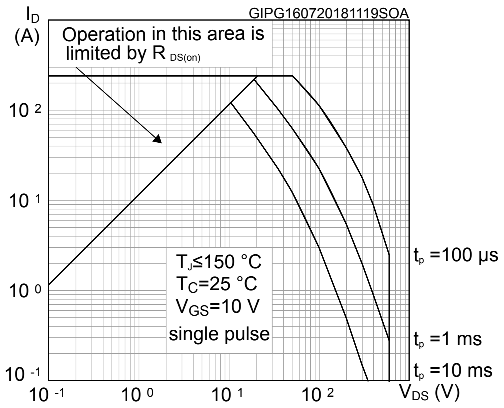


Figure 2. Thermal impedance

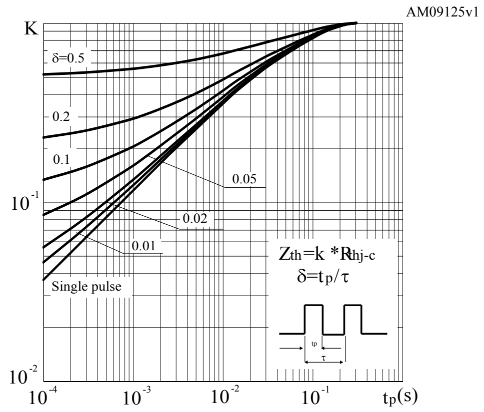


Figure 3. Output characteristics

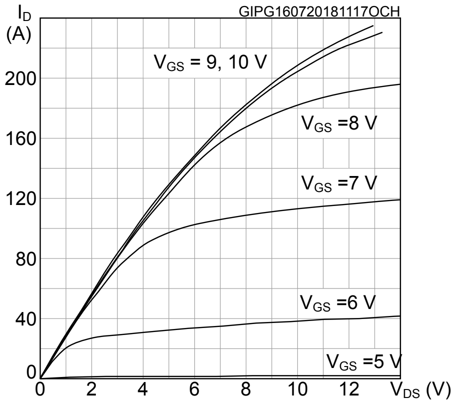


Figure 4. Transfer characteristics

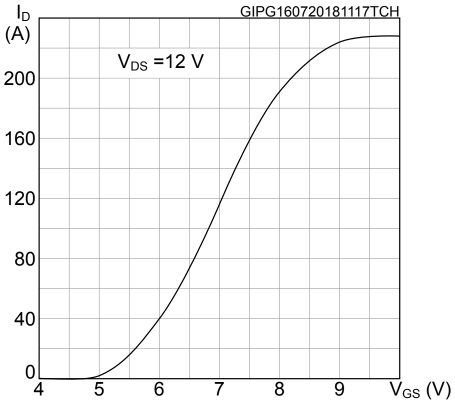


Figure 5. Gate charge vs gate-source voltage

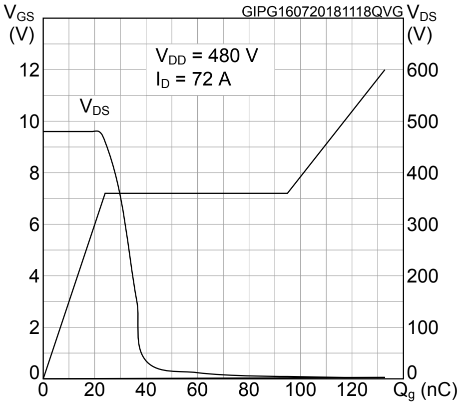


Figure 6. Static drain-source on-resistance

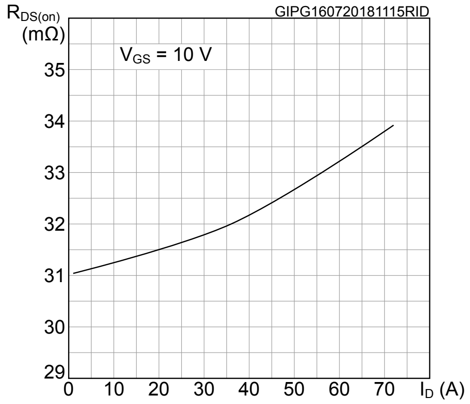


Figure 7. Capacitance variations

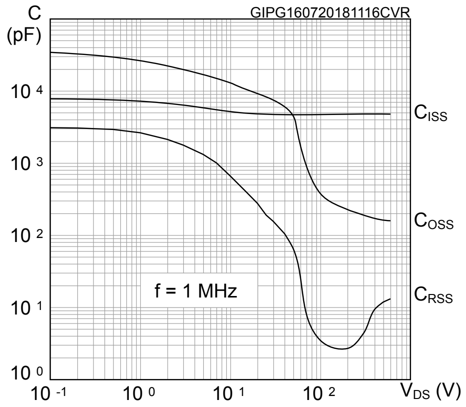


Figure 8. Normalized gate threshold voltage vs temperature

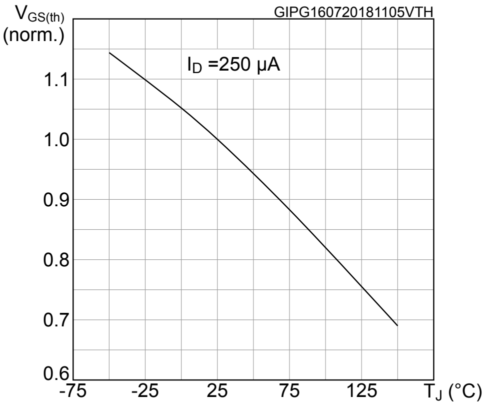


Figure 9. Normalized on-resistance vs temperature

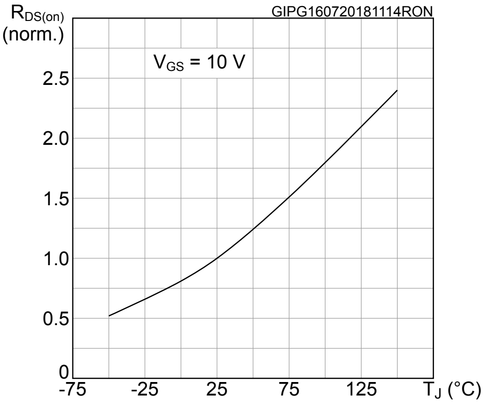


Figure 10. Normalized $V_{(BR)DSS}$ vs temperature

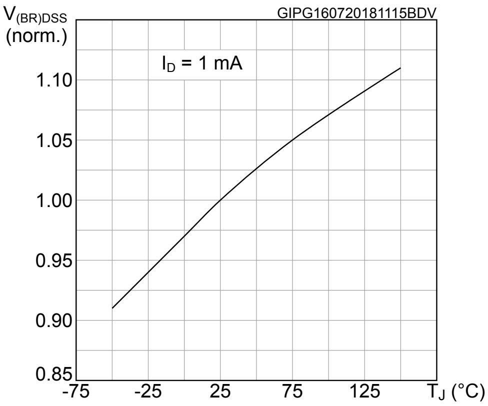


Figure 11. Output capacitance stored energy

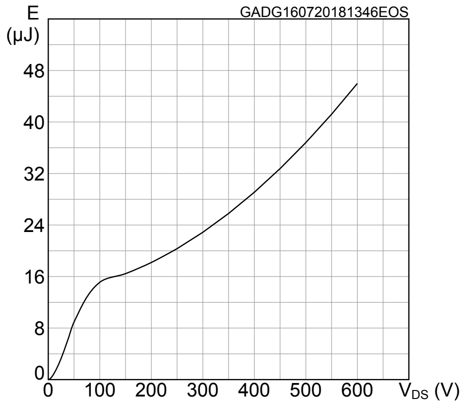
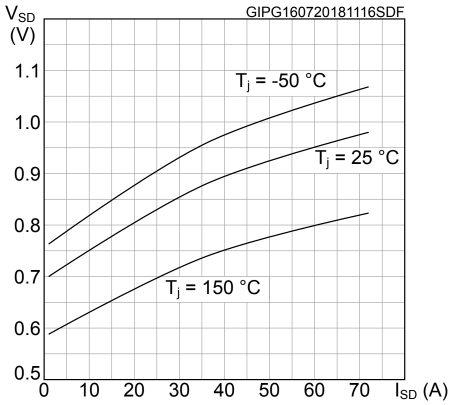


Figure 12. Source-drain diode forward characteristics



4 Test circuits

Figure 13. Test circuit for resistive load switching times

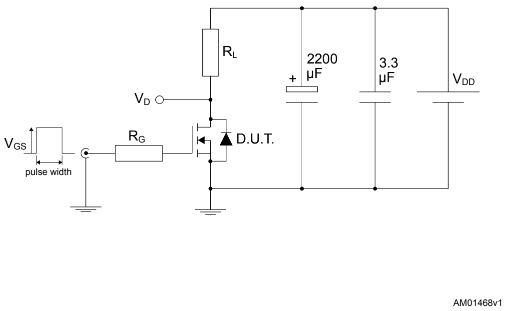


Figure 14. Test circuit for gate charge behavior

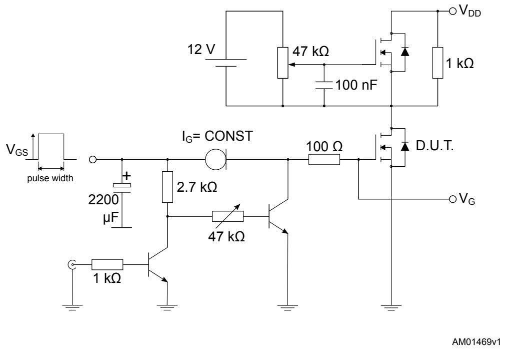


Figure 15. Test circuit for inductive load switching and diode recovery times

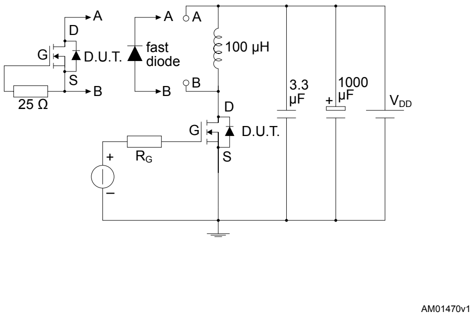


Figure 16. Unclamped inductive load test circuit

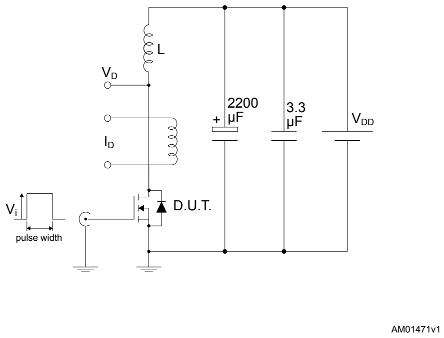


Figure 17. Unclamped inductive waveform

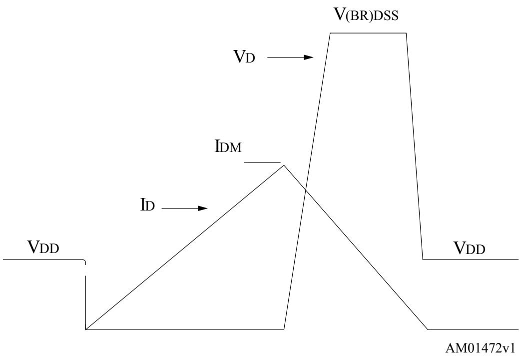
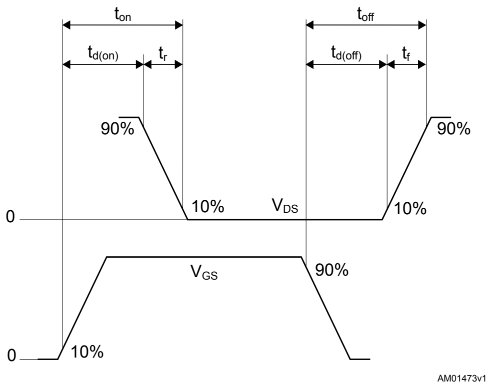


Figure 18. Switching time waveform

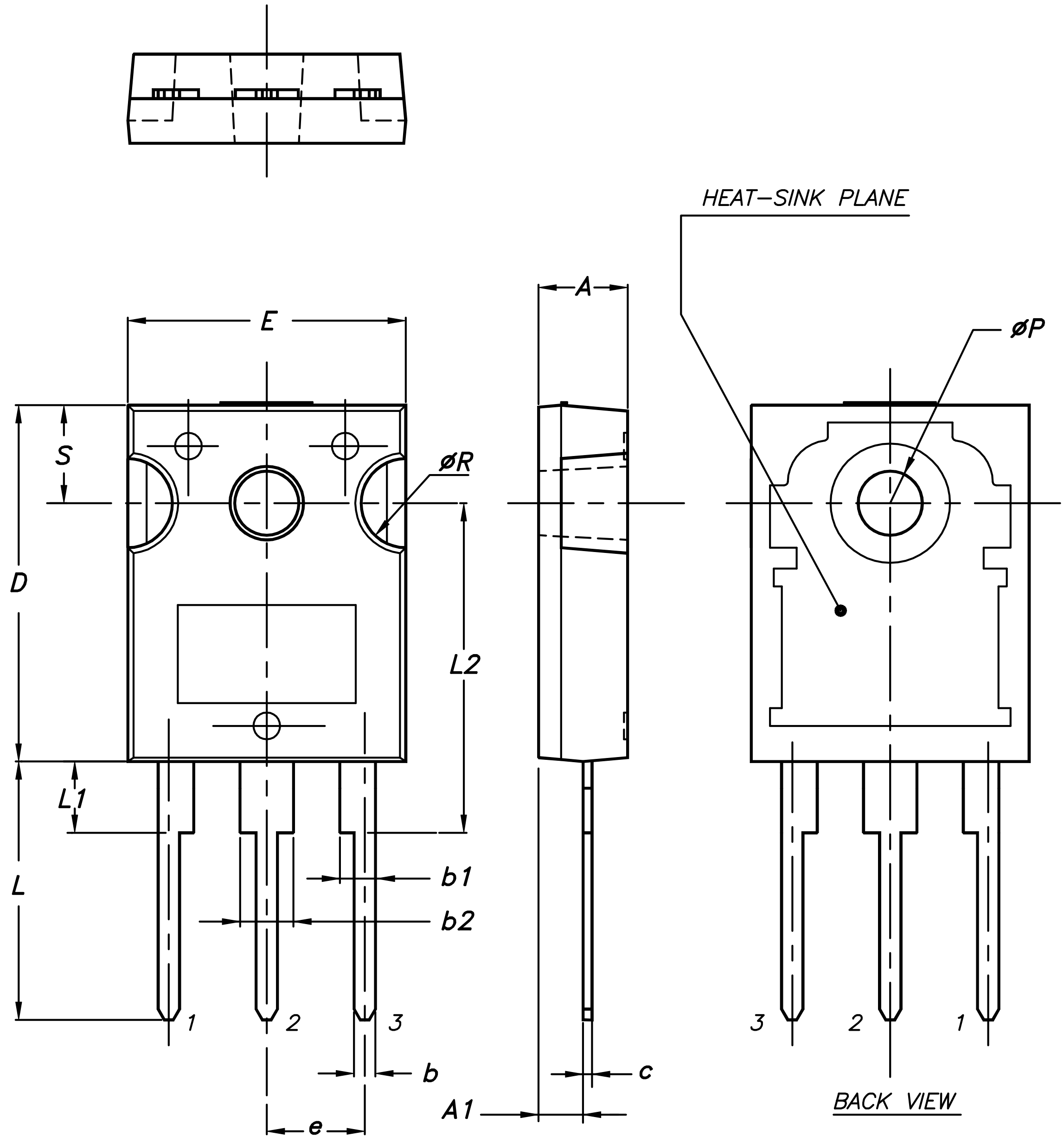


5 Package information

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.

5.1 TO-247 package information

Figure 19. TO-247 package outline



0075325_9

Table 8. TO-247 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e	5.30	5.45	5.60
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S	5.30	5.50	5.70

5.2 TO-247 long leads package information

Figure 20. TO-247 long leads package outline

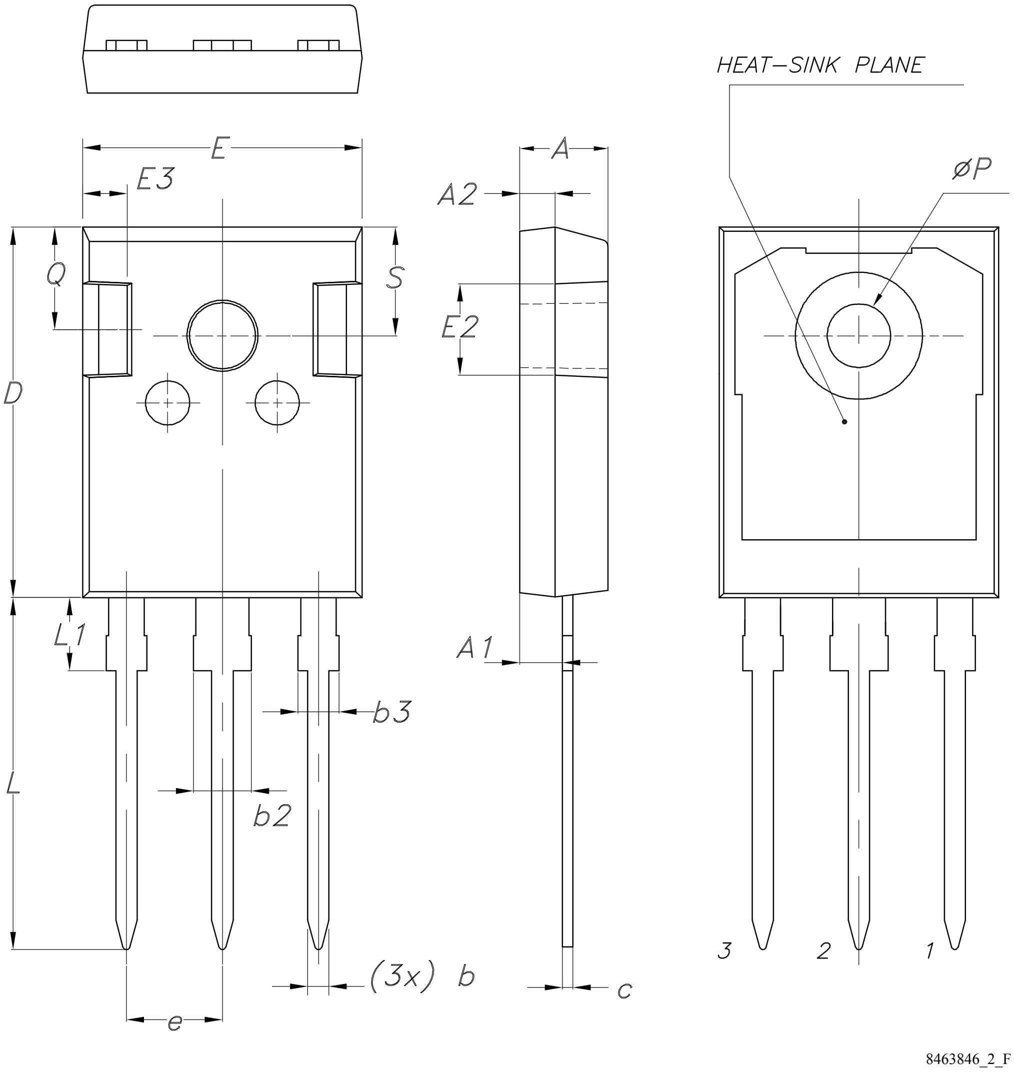


Table 9. **TO-247 long leads package mechanical data**

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

Revision history

Table 10. **Document revision history**

Date	Revision	Changes
16-Oct-2017	1	First release.
03-Aug-2018	2	Modified Table 1. Absolute maximum ratings, Table 3. Avalanche characteristics, Table 4. On/off states, Table 5. Dynamic characteristics, Table 6. Switching times and Table 7. Source drain diode. Added Section 3 Electrical characteristics (curves). Minor text changes.

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