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STW43NM60N

N-channel 600 V, 0.075 Ω , 35 A MDmesh™ II Power MOSFET
TO-247

Features

Type	V _{DSS} (@T _{jmax})	R _{DS(on)} max	I _D
STW43NM60N	650 V	<0.088 Ω	35 A

- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Application

- Switching applications

Description

This series of devices implements second generation MDmesh™ technology. This revolutionary Power MOSFET associates a new vertical structure to the Company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

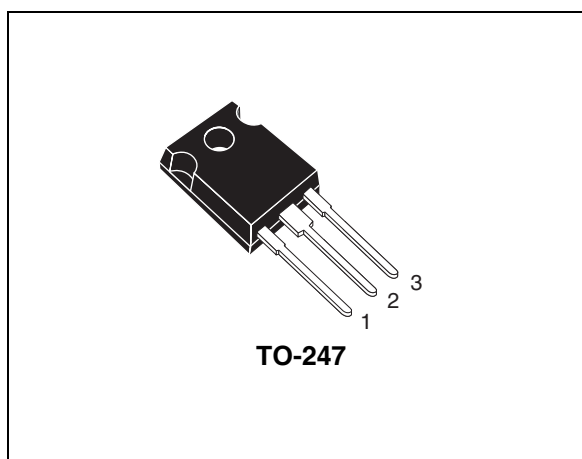


Figure 1. Internal schematic diagram

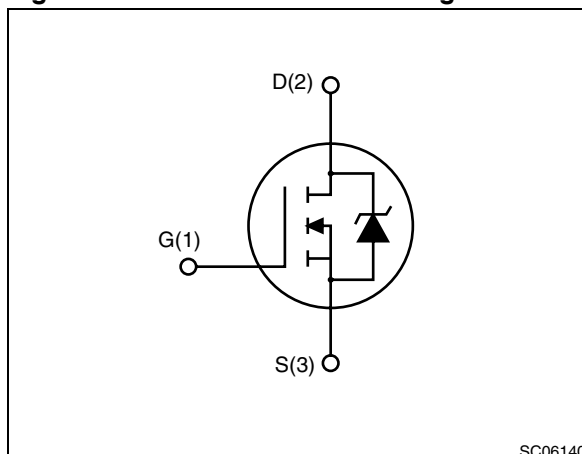


Table 1. Device summary

Order code	Marking	Package	Packaging
STW43NM60N	43NM60N	TO-247	Tube

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
2.1	Electrical characteristics (curves)	6
3	Test circuits	8
4	Package mechanical data	9
5	Revision history	11

STW43NM60N

Electrical ratings

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	600	V
V_{GS}	Gate- source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	35	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	22	A
$I_{DM}^{(1)}$	Drain current (pulsed)	140	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	255	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature	-55 to 150	$^\circ\text{C}$
T_j	Max. operating junction temperature	150	$^\circ\text{C}$

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 35\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DD} = 80\% V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.49	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	$^\circ\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j Max)	14	A
E_{AS}	Single pulse avalanche energy (starting $T_j=25\text{ }^\circ\text{C}$, $I_D=I_{AS}$, $V_{DD}=50\text{ V}$)	1000	mJ

Electrical characteristics

STW43NM60N

2 Electrical characteristics

(T_{CASE} = 25 °C unless otherwise specified)

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V _{(BR)DSS}	Drain-source breakdown voltage	I _D = 1 mA, V _{GS} = 0	600			V
dv/dt ⁽¹⁾	Drain source voltage slope	V _{DD} =480 V, I _D = 35 A, V _{GS} =10 V		30		V/ns
I _{DSS}	Zero gate voltage drain current (V _{GS} = 0)	V _{DS} = Max rating V _{DS} = Max rating, @125 °C			1 100	μA μA
I _{GSS}	Gate-body leakage current (V _{DS} = 0)	V _{GS} = ± 20 V			100	nA
V _{GS(th)}	Gate threshold voltage	V _{DS} = V _{GS} , I _D = 250 μA	2	3	4	V
R _{DS(on)}	Static drain-source on resistance	V _{GS} = 10 V, I _D = 17.5 A		0.075	0.088	Ω

1. Characteristic value at turn off on inductive load

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g _{fs} ⁽¹⁾	Forward transconductance	V _{DS} =15 V, I _D = 17.5 A		17		S
C _{iss} C _{oss} C _{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V _{DS} = 50 V, f = 1 MHz, V _{GS} = 0		4200 290 30		pF pF pF
C _{oss eq.} ⁽²⁾	Equivalent output capacitance	V _{GS} = 0, V _{DS} = 0 to 480 V		600		pF
Q _g Q _{gs} Q _{gd}	Total gate charge Gate-source charge Gate-drain charge	V _{DD} = 480 V, I _D = 35 A, V _{GS} = 10 V, <i>(see Figure 15)</i>		130 22 66		nC nC nC
R _g	Gate input resistance	f=1 MHz Gate DC Bias=0 Test signal level = 20 mV open drain		1.4		Ω

1. Pulsed: Pulse duration = 300 μs, duty cycle 1.5%

2. 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_{DS}

STW43NM60N
Electrical characteristics
Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$, $I_D = 17.5\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ <i>(see Figure 14)</i>		25		ns
t_r	Rise time			45		ns
$t_{d(off)}$	Turn-off delay time			130		ns
t_f	Fall time			60		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current				35	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				140	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 35\text{ A}$, $V_{GS} = 0$			1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 35\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$ <i>(see Figure 16)</i>		540		ns
Q_{rr}	Reverse recovery charge			12		μC
I_{RRM}	Reverse recovery current			44		A
t_{rr}	Reverse recovery time	$I_{SD} = 35\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ <i>(see Figure 16)</i>		660		ns
Q_{rr}	Reverse recovery charge			14		μC
I_{RRM}	Reverse recovery current			45		A

1. Pulse width limited by safe operating area

 2. Pulsed: Pulse duration = 300 μs , duty cycle 1.5%

Electrical characteristics

STW43NM60N

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

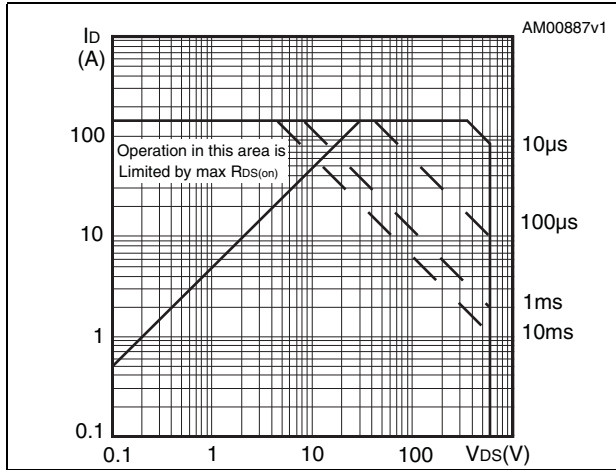


Figure 3. Thermal impedance

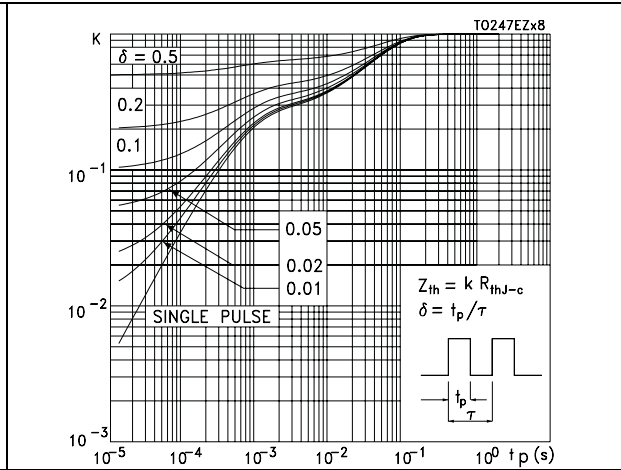


Figure 4. Output characteristics

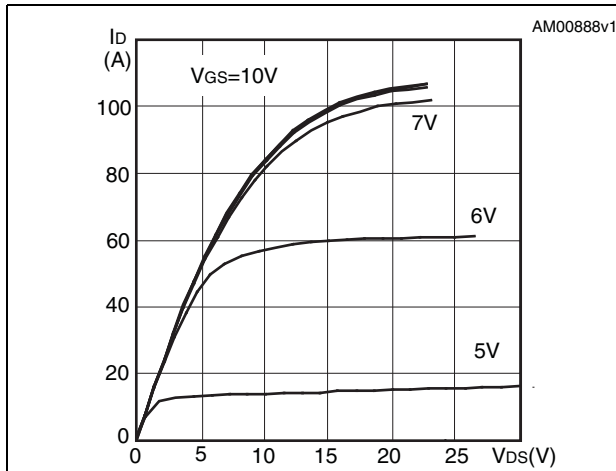


Figure 5. Transfer characteristics

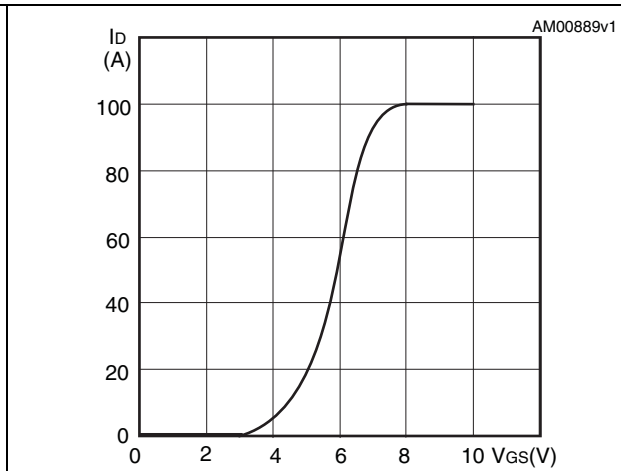


Figure 6. Transconductance

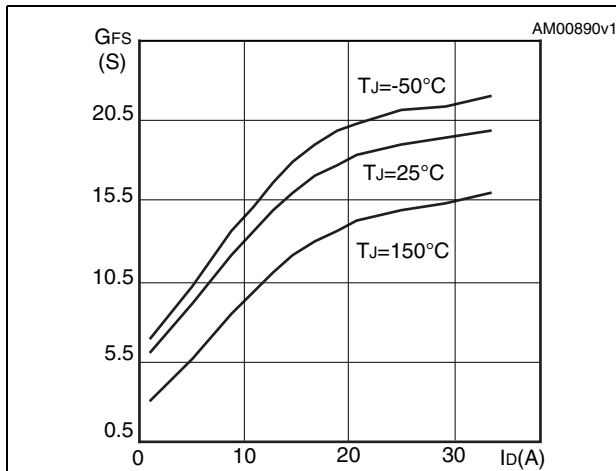
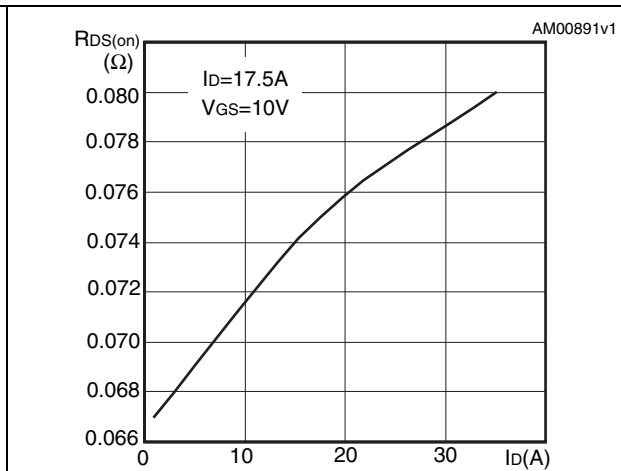


Figure 7. Static drain-source on resistance



STW43NM60N

Electrical characteristics

Figure 8. Gate charge vs gate-source voltage **Figure 9. Capacitance variations**

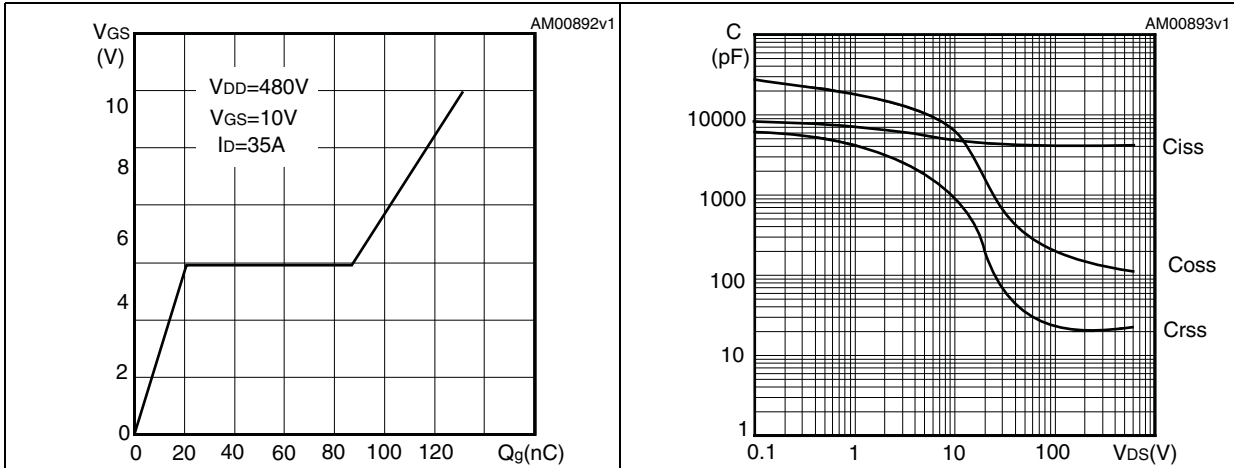


Figure 10. Normalized gate threshold voltage vs temperature **Figure 11. Normalized on resistance vs temperature**

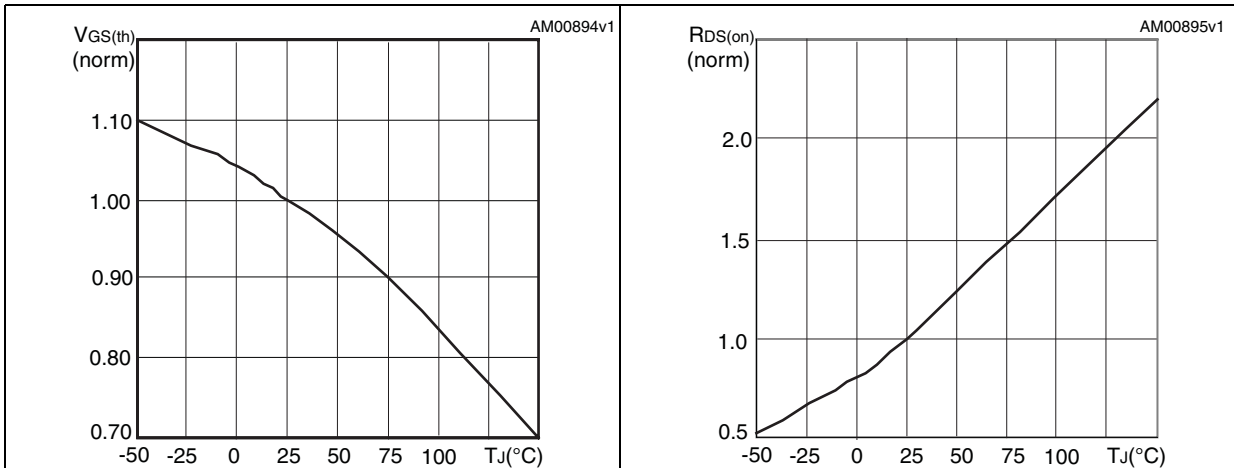
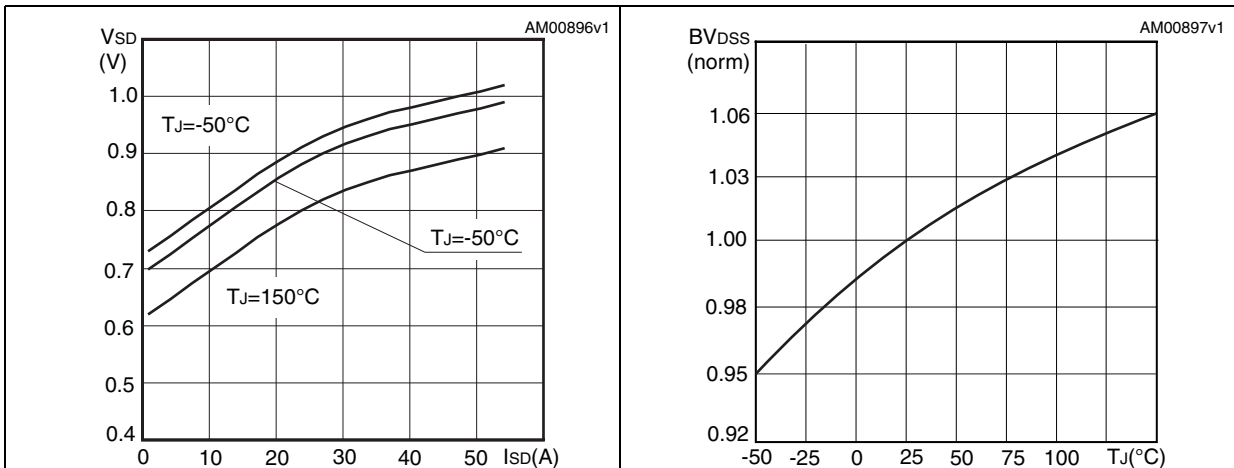


Figure 12. Source-drain diode forward characteristics **Figure 13. Normalized B_{VDSS} vs temperature**



3 Test circuits

Figure 14. Switching times test circuit for resistive load

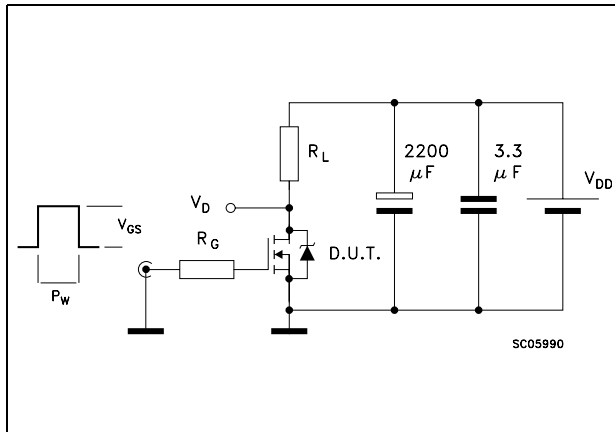


Figure 15. Gate charge test circuit

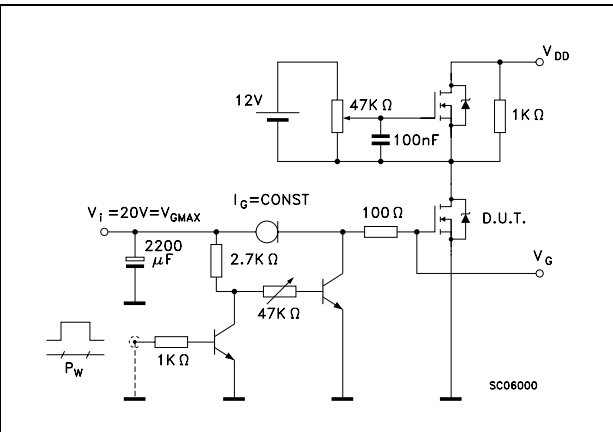


Figure 16. Test circuit for inductive load switching and diode recovery times

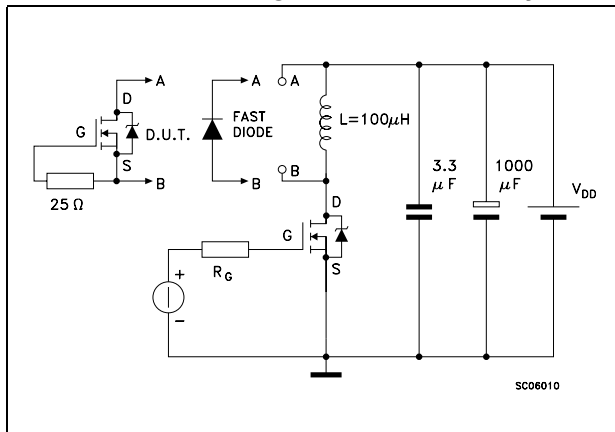


Figure 17. Unclamped inductive load test circuit

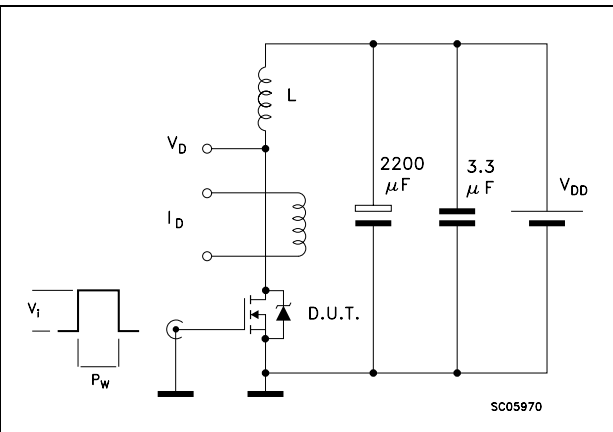


Figure 18. Unclamped inductive waveform

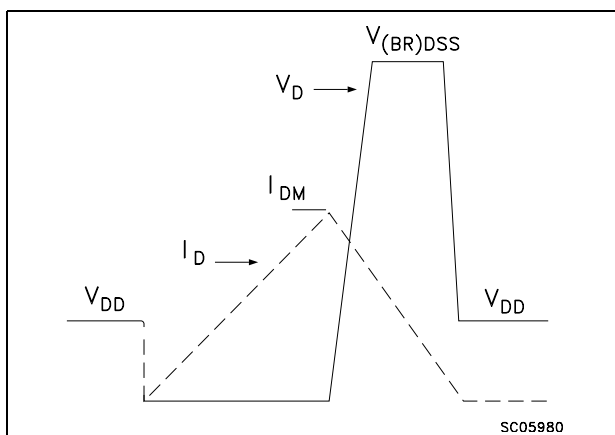
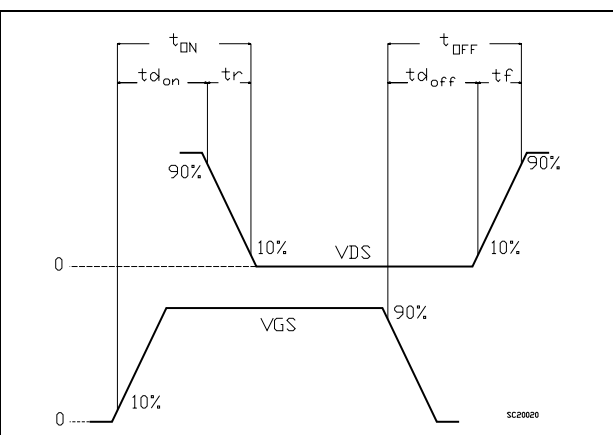


Figure 19. Switching time waveform



4 Package mechanical data

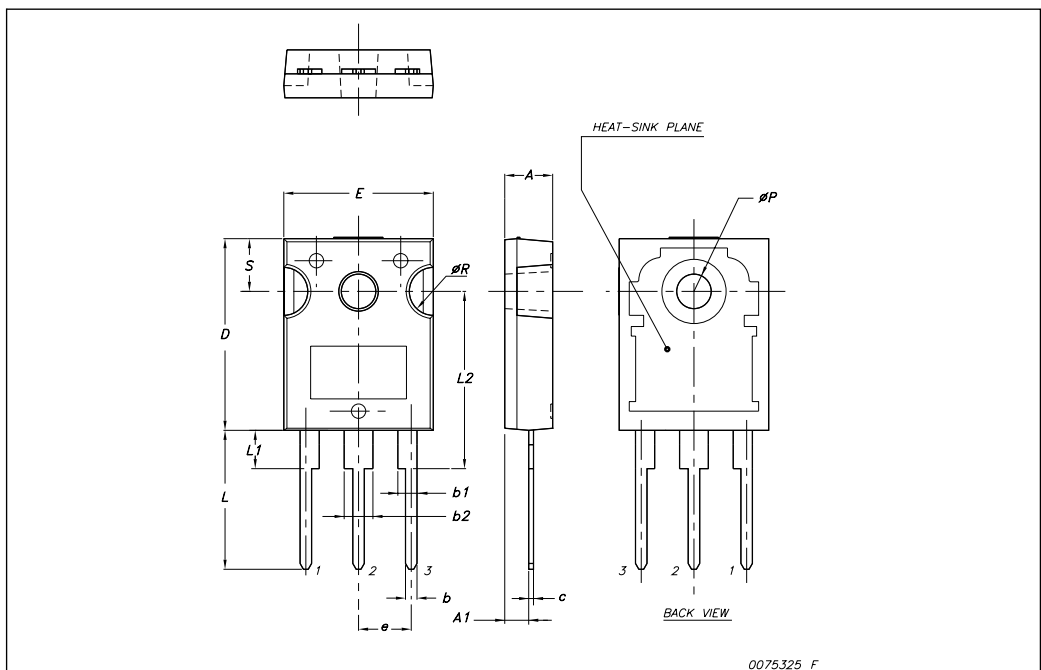
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Package mechanical data

STW43NM60N

TO-247 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		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
16-Nov-2007	1	First release
23-Sep-2008	2	Document status promoted from preliminary data to datasheet.
14-Jan-2009	3	V_{GS} value has been modified in Table 2: Absolute maximum ratings

STW43NM60N

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