N-channel 600 V, 60 mΩ typ., 42 A MDmesh M2 Power MOSFET in a TO247-4 package

TO247-4

Drain(1, TAB)

Gate(4)

Driver source (3)

Power source (2)

AM10177v2Z
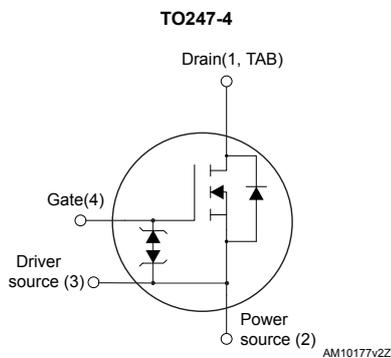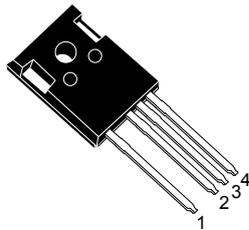
Features

Order code	V_{DS} @ $T_{Jmax.}$	$R_{DS(on)}$max.	I_D
STW48N60M2-4	650 V	70 mΩ	42 A

- Excellent switching performance thanks to the extra driving source pin
- Extremely low gate charge
- Excellent output capacitance (C_{oss}) profile
- 100% avalanche tested
- Zener-protected

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using MDmesh M2 technology. Thanks to its strip layout and an improved vertical structure, the device exhibits low on-resistance and optimized switching characteristics, rendering it suitable for the most demanding high efficiency converters.

Product status
STW48N60M2-4

Device summary	
Order code	STW48N60M2-4
Marking	48N60M2
Package	TO247-4
Packing	Tube

DS10507 - Rev 4 - April 2020
For further information contact your local STMicroelectronics sales office.

www.st.com

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	42	A
I_D	Drain current (continuous) at T_C = 100 °C	26	A
I_{DM} [1]	Drain current (pulsed)	168	A
P_{TOT}	Total power dissipation at T_C = 25 °C	300	W
dv/dt [2]	Peak diode recovery voltage slope	15	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. $I_{SD} \leq 42$ A, di/dt ≤ 400 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	0.42	°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 $T_{jmax.}$)	7	A
E_{AS}	Single pulse avalanche energy (starting T_j = 25 °C, $I_D = I_{AR}$; V_{DD} = 50 V)	1	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_C = 125 °C[1]			100	µA
I_{GSS}	Gate-body leakage current	V_{DS} = 0 V, V_{GS} = ±25 V			±10	µA
$V_{GS(th)}$	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 = 21 A		60	70	mΩ

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

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{GS} = 0 V, V_{DS} = 100 V, f = 1 MHz	-	3060	-	pF
C_{oss}	Output capacitance		-	143	-	pF
C_{rss}	Reverse transfer capacitance		-	4.3	-	pF
$C_{oss\ eq.}$[1]	Equivalent output capacitance	V_{GS} = 0 V, V_{DS} = 0 to 480 V	-	630	-	pF
R_G	Intrinsic gate resistance	f = 1 MHz, I_D = 0 A	-	4.6	-	Ω
Q_g	Total gate charge	V_{DD} = 480 V, I_D = 42 A,	-	70	-	nC
Q_{gs}	Gate-source charge	V_{GS} = 0 to 10 V	-	10.5	-	nC
Q_{gd}	Gate-drain charge	(see Figure 14. Test circuit for gate charge behavior)	-	31	-	nC

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 6. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD} = 300 V, I_D = 21 A,	-	TBD	-	ns
t_r	Rise time	R_G = 4.7 Ω, V_{GS} = 10 V	-	TBD	-	ns
$t_{d(off)}$	Turn-off delay time	(see Figure 13. Switching times test circuit for resistive load and Figure 17. Unclamped inductive waveform)	-	TBD	-	ns
t_f	Fall time		-	TBD	-	ns

Table 7. Source-drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		42	A
I_{SDM}[1]	Source-drain current (pulsed)		-		168	A
V_{SD}[2]	Forward on voltage	$V_{GS} = 0$ V, $I_{SD} = 21$ A	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 42$ A, di/dt = 100 A/µs $V_{DD} = 60$ V (see Figure 15. Test circuit for inductive load switching and diode recovery times)	-	487		ns
Q_{rr}	Reverse recovery charge		-	9.1		µC
I_{RRM}	Reverse recovery current		-	37.5		A
t_{rr}	Reverse recovery time	$I_{SD} = 42$ 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)	-	605		ns
Q_{rr}	Reverse recovery charge		-	12.5		µC
I_{RRM}	Reverse recovery current		-	41.5		A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area
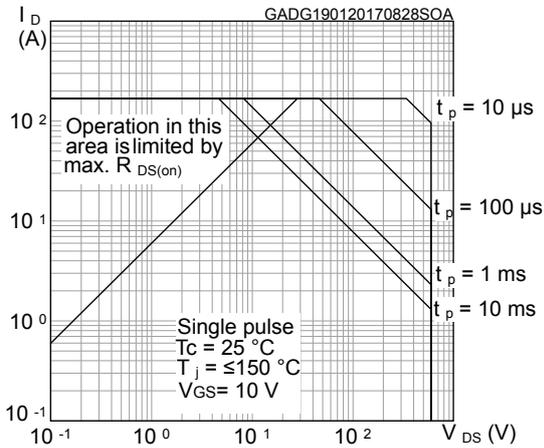
Figure 2. Thermal impedance
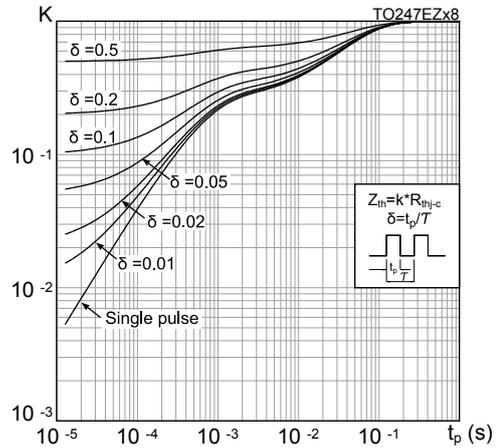
Figure 3. Output characteristics
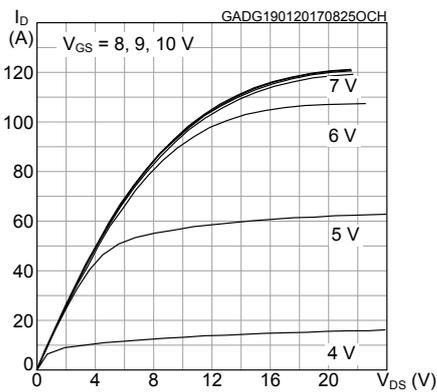
**Figure 4. Transfer characteristics**
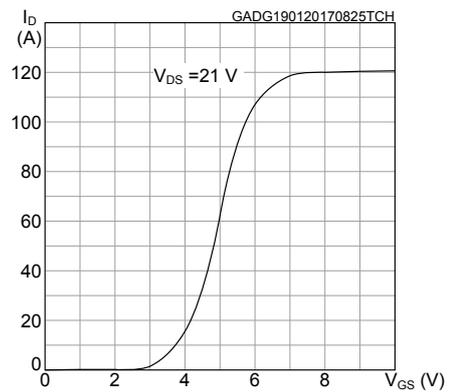
**Figure 5. Gate charge vs gate-source voltage**
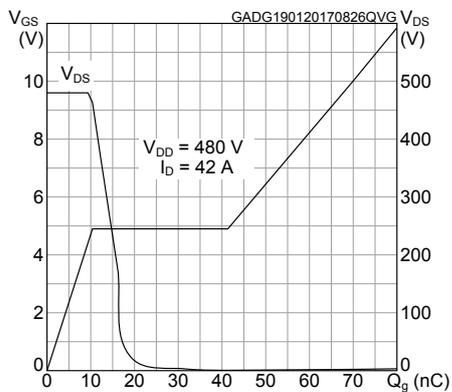
**Figure 6. Static drain-source on-resistance**
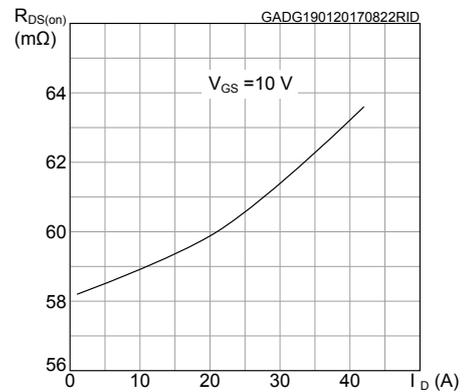
Figure 7. Capacitance variations
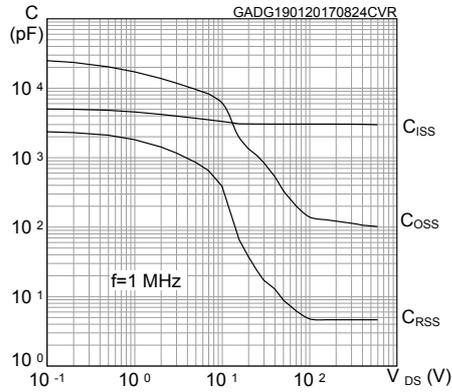
**Figure 8. Output capacitance stored energy**
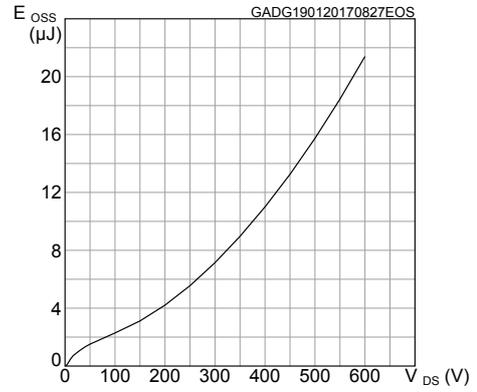
**Figure 9. Normalized gate threshold voltage vs temperature**
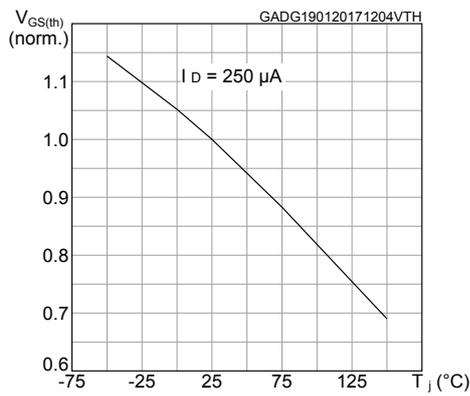
Figure 10. Normalized on-resistance vs temperature
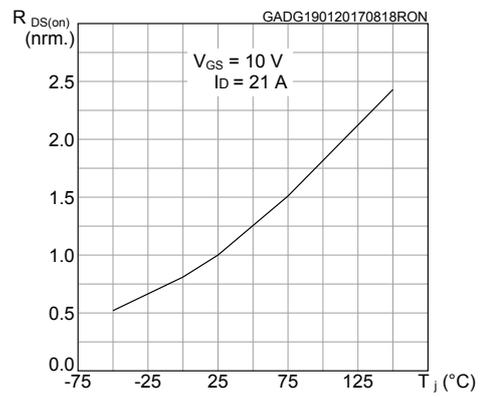

**Figure 11. Normalized $V_{(BR)DSS}$ vs temperature**
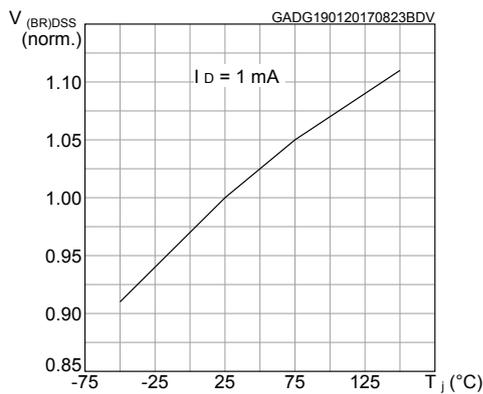

Figure 12. Source-drain diode forward characteristics
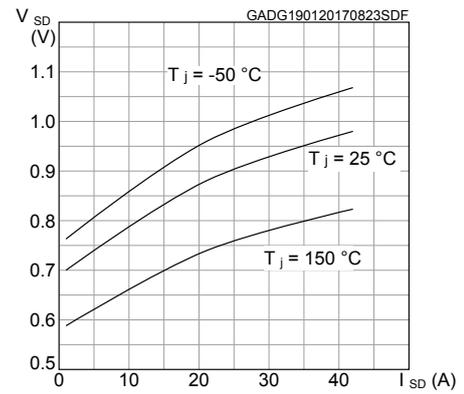
3 Test circuits

**Figure 13. Switching times test circuit for resistive load**
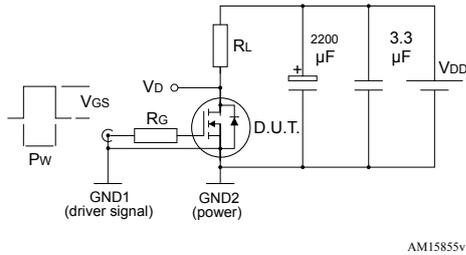
Figure 14. Test circuit for gate charge behavior
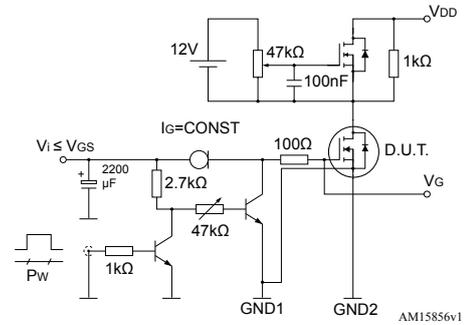
**Figure 15. Test circuit for inductive load switching and diode recovery times**
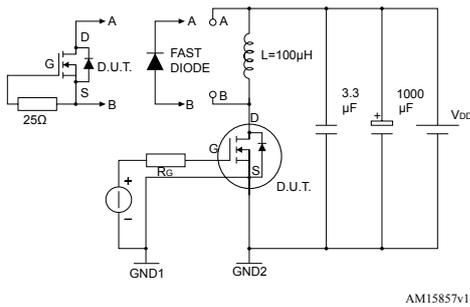
**Figure 16. Unclamped inductive load test circuit**
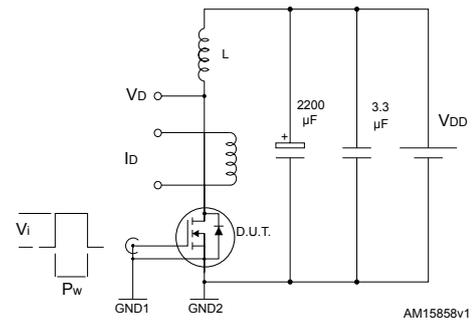
Figure 17. Unclamped inductive waveform
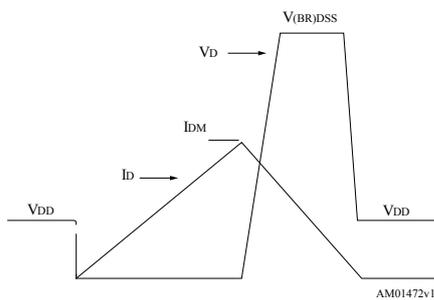
Figure 18. Switching time waveform
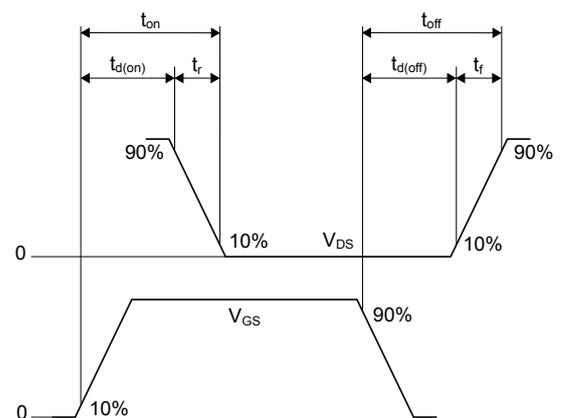
4 Package information

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 TO247-4 package information

Figure 19. TO247-4 package outline
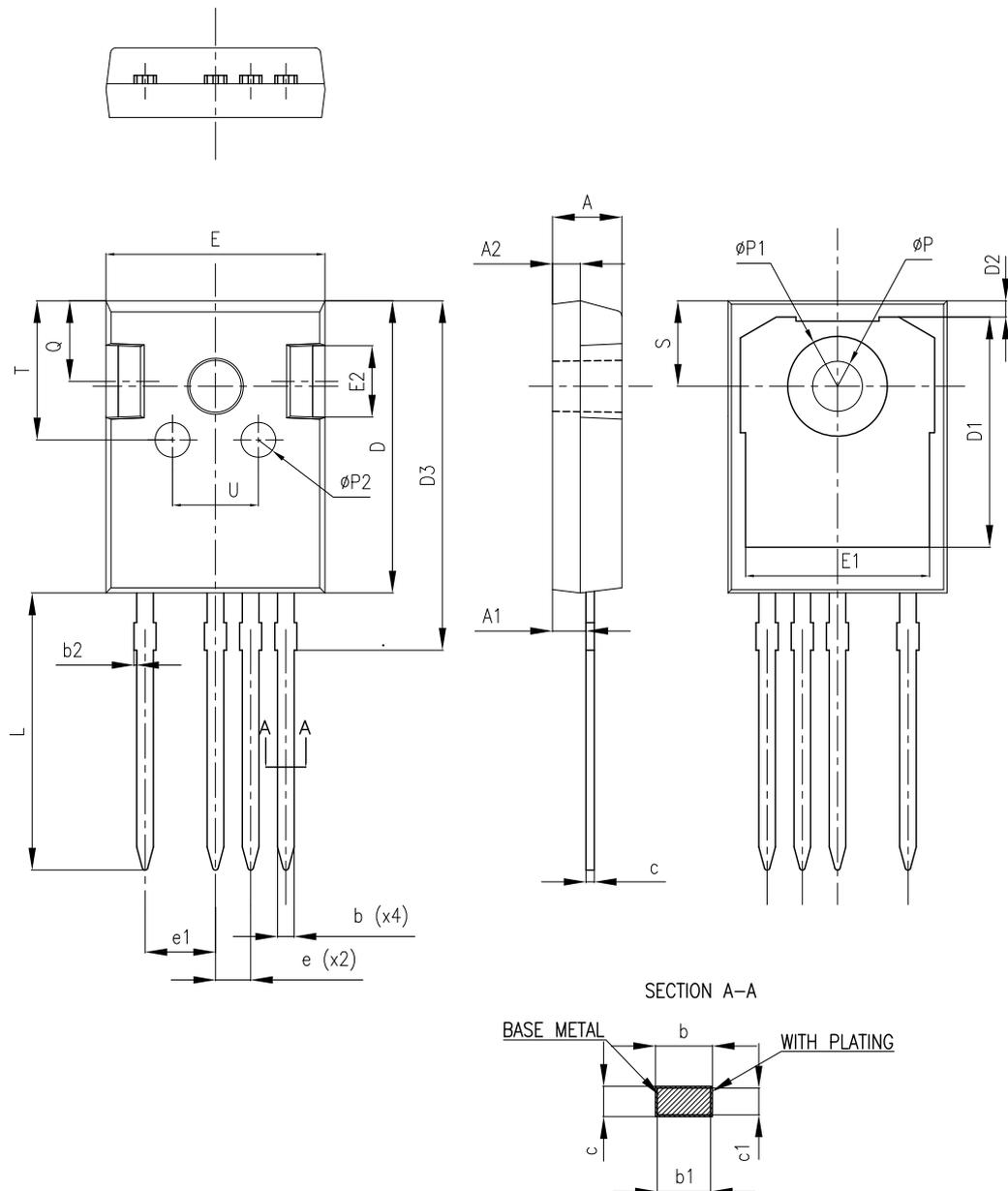
8405626_2

Table 8. TO247-4 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		1.29
b1	1.15	1.20	1.25
b2	0		0.20
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	1.20	1.35
D3	24.97	25.12	25.27
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	2.44	2.54	2.64
e1	4.98	5.08	5.18
L	19.80	19.92	20.10
P	3.50	3.60	3.70
P1			7.40
P2	2.40	2.50	2.60
Q	5.60		6.00
S		6.15	
T	9.80		10.20
U	6.00		6.40

Revision history

Table 9. Document revision history

Date	Revision	Changes
25-Jul-2014	1	Initial release.
30-Jan-2015	2	Added section *Electrical characteristics (curves)*.
20-Jan-2017	3	Updated *Table 2: "Absolute maximum ratings"*, *Table 4: "On /off-states"*, *Table 5: "Dynamic"*, *Table 6: "Switching times"* and *Table 7: "Sourcedrain diode"*. Updated *Section 2.2: "Electrical characteristics (curves)"*.
02-Apr-2020	4	Updated Table 6. Switching times. Minor text changes.

Contents

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST's terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers' products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, please refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for MOSFET *category:*

Click to view products by STMicroelectronics *manufacturer:*

Other Similar products are found below :

614233C 648584F IRFD120 JANTX2N5237 FCA20N60_F109 FDZ595PZ 2SK2545(Q,T) 405094E 423220D TPCC8103,L1Q(CM MIC4420CM-TR VN1206L SBVS138LT1G 614234A 715780A NTNS3166NZT5G SSM6J414TU,LF(T 751625C BUK954R8-60E DMN3404LQ-7 NTE6400 SQJ402EP-T1-GE3 2SK2614(TE16L1,Q) 2N7002KW-FAI DMN1017UCP3-7 EFC2J004NUZTDG ECH8691-TL-W FCAB21350L1 P85W28HP2F-7071 DMN1053UCP4-7 NTE221 NTE2384 NTE2903 NTE2941 NTE2945 NTE2946 NTE2960 NTE2967 NTE2969 NTE2976 NTE455 NTE6400A NTE2910 NTE2916 NTE2956 NTE2911 DMN2080UCB4-7 TK10A80W,S4X(S SSM6P69NU,LF DMP22D4UFO-7B