

N-channel 650 V, 0.35 Ω typ., 12 A MDmesh™ II Power MOSFET in a TO-220FP ultra narrow leads package

Datasheet - production data

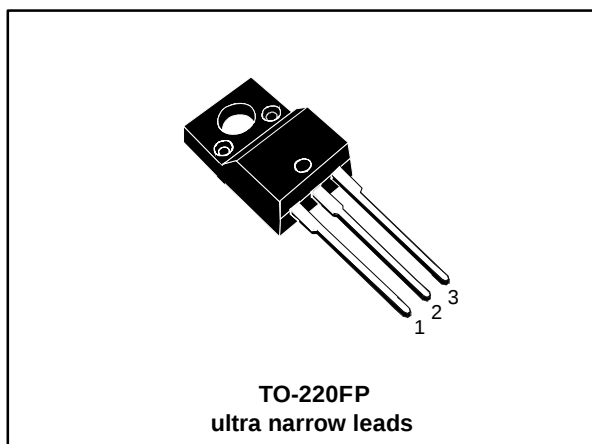
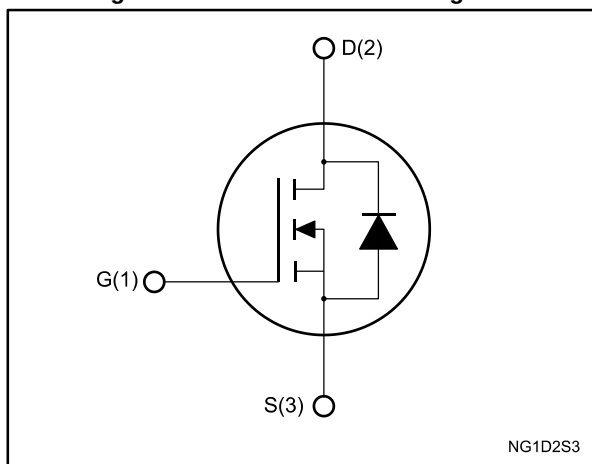


Figure 1: Internal schematic diagram



Features

Order code	V _{DS}	R _{DS(on)} max	I _D
STFU15NM65N	650 V	0.38 Ω	12 A

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

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a 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.

Table 1: Device summary

Order code	Marking	Package	Packaging
STFU15NM65N	15NM65N	TO-220FP ultra narrow leads	Tube

Contents

1	Electrical ratings	3
2	Electrical characteristics	4
	2.1 Electrical characteristics (curves).....	6
3	Test circuit	8
4	Package information	9
	4.1 TO-220FP ultra narrow leads package information.....	9
5	Revision history	11

1 Electrical ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain source voltage	650	V
V_{GS}	Gate source voltage	± 25	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^{\circ}\text{C}$	12 ⁽¹⁾	A
	Drain current (continuous) at $T_C = 100\text{ }^{\circ}\text{C}$	7.56	
I_{DM} ⁽²⁾	Drain current (pulsed)	48	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^{\circ}\text{C}$	30	W
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink ($t = 1\text{ s}$; $T_C = 25\text{ }^{\circ}\text{C}$)	2500	V
dv/dt ⁽³⁾	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature	- 55 to 150	$^{\circ}\text{C}$
T_j	Operating junction temperature		

Notes:⁽¹⁾Limited by maximum junction temperature.⁽²⁾Pulse width limited by safe operating area.⁽³⁾ $I_{SD} \leq 12\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$; $V_{DSpeak} \leq V_{(BR)DSS}$, $V_{DD} = 80\% V_{(BR)DSS}$.

Table 3: Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	4.17	$^{\circ}\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	

Table 4: Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not repetitive (pulse width limited by T_{jmax})	3	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^{\circ}\text{C}$, $I_D = I_{AR}$; $V_{DD} = 50\text{ V}$)	187	mJ

2 Electrical characteristics

(T_C = 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 V	650			V
I _{DSS}	Zero gate voltage drain current (V _{GS} = 0)	V _{DS} = 650 V			1	μA
		V _{DS} = 650 V, T _C = 125 °C			100	μA
I _{GSS}	Gate-body leakage current (V _{DS} = 0)	V _{GS} = ± 25 V			±100	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 = 6 A		0.35	0.38	Ω

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{DS} = 50 V, f = 1 MHz, V _{GS} = 0 V	-	983	-	pF
C _{oss}	Output capacitance		-	57	-	
C _{rss}	Reverse transfer capacitance		-	4.5	-	
C _{oss eq. (1)}	Equivalent output capacitance	V _{DS} = 0 to 520 V, V _{GS} = 0 V	-	146	-	pF
R _G	Intrinsic gate resistance	f = 1 MHz open drain	-	4.9	-	Ω
Q _g	Total gate charge	V _{DD} = 520 V, I _D = 12 A, V _{GS} = 10 V	-	33.3	-	nC
Q _{gs}	Gate-source charge		-	5.7	-	
Q _{gd}	Gate-drain charge		-	17	-	

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} = 325 V, I _D = 6 A, R _G = 4.7 Ω, V _{GS} = 10 V	-	55.5	-	ns
t _r	Rise time		-	8.5	-	
t _{d(off)}	Turn-off delay time		-	14	-	
t _f	Fall time		-	11.4	-	

Table 8: Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		12	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)		-		48	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 12\text{ A}$, $V_{GS} = 0\text{ V}$	-		1.6	V
t_{rr}	Reverse recovery time	$I_{SD} = 12\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$	-	428		ns
Q_{rr}	Reverse recovery charge		-	4.7		μC
I_{RRM}	Reverse recovery current		-	21.5		A
t_{rr}	Reverse recovery time	$I_{SD} = 12\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $V_{DD} = 60\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$	-	570		ns
Q_{rr}	Reverse recovery charge		-	6.2		μC
I_{RRM}	Reverse recovery current		-	22		A

Notes:

⁽¹⁾Pulse width limited by safe operating area.

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

2.1 Electrical characteristics (curves)

Figure 2: Safe operating area

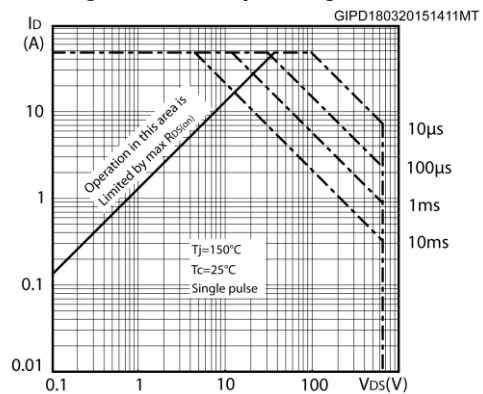


Figure 3: Thermal impedance

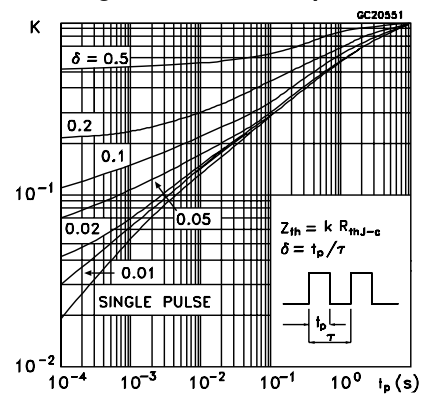


Figure 4: Output characteristics

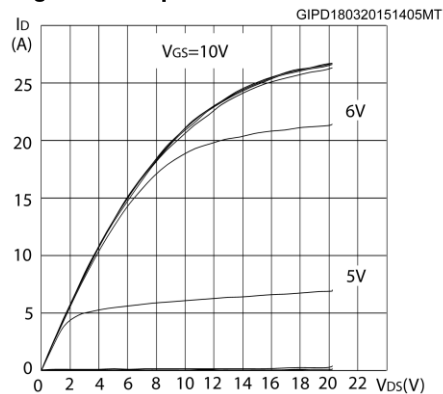


Figure 5: Transfer characteristics

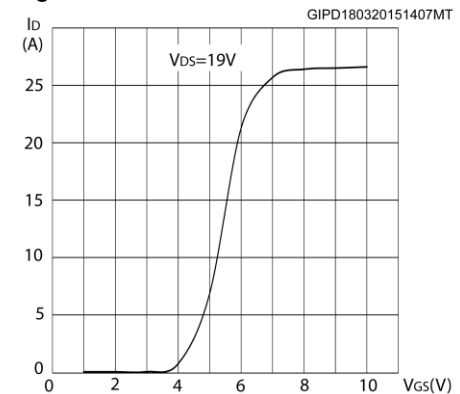


Figure 6: Static drain-source on-resistance

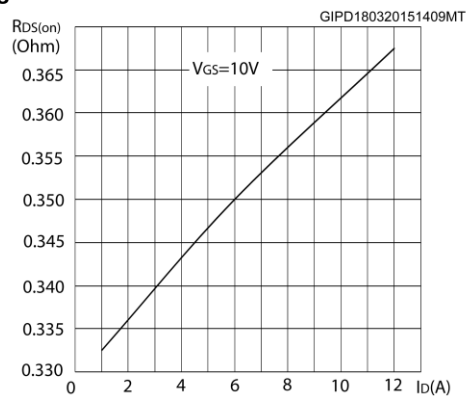


Figure 7: Gate charge vs gate-source voltage

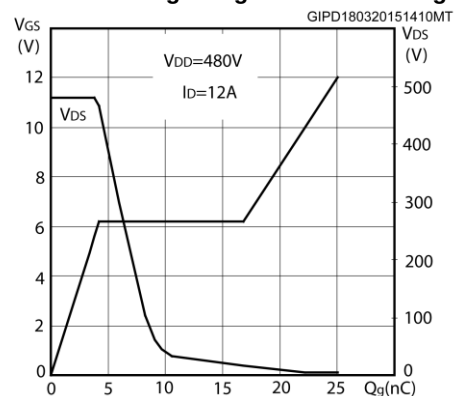


Figure 8: Capacitance variations

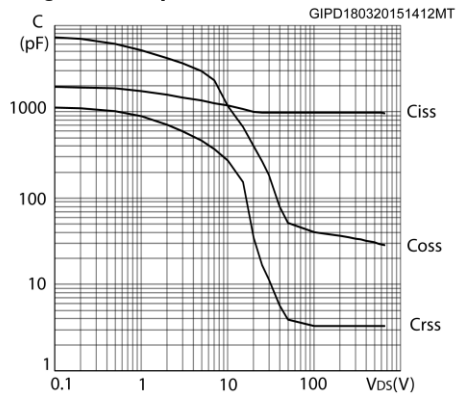


Figure 9: Normalized gate threshold voltage vs temperature

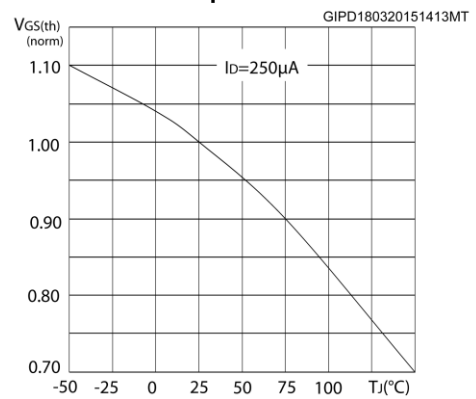


Figure 10: Normalized on-resistance vs temperature

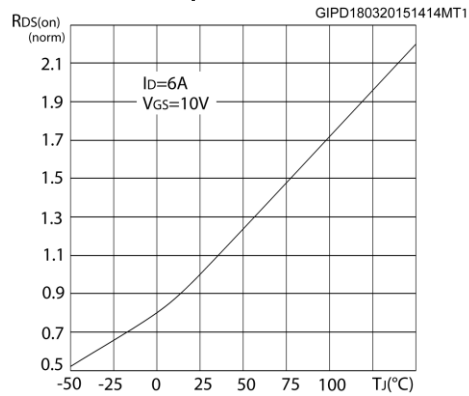
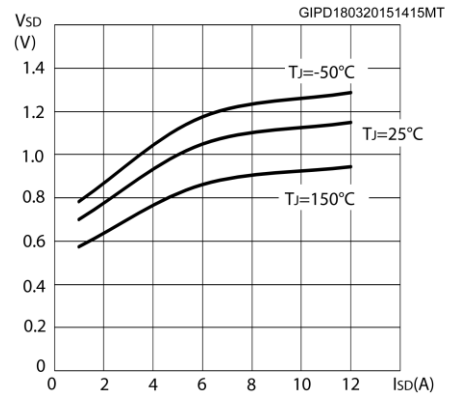
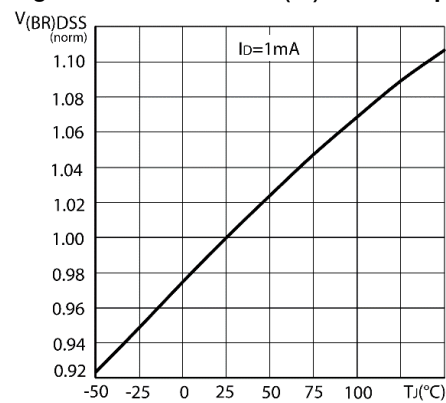
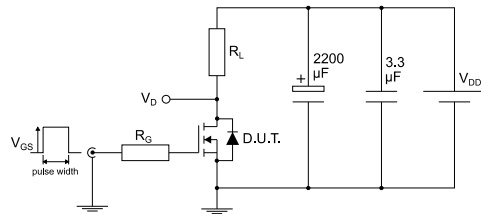


Figure 11: Source-drain diode forward characteristics

Figure 12: Normalized $V_{(BR)DSS}$ vs temperature

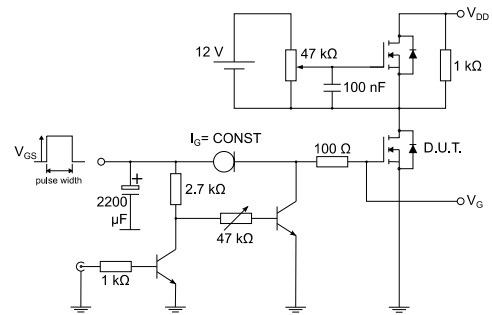
3 Test circuit

Figure 13: Test circuit for resistive load switching times



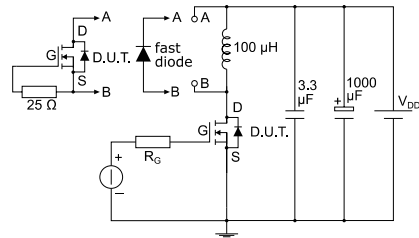
AM01468v1

Figure 14: Test circuit for gate charge behavior



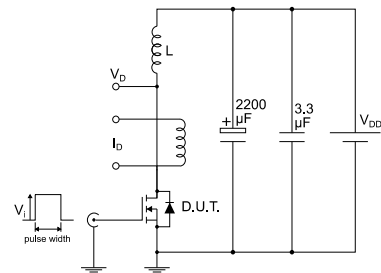
AM01469v1

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



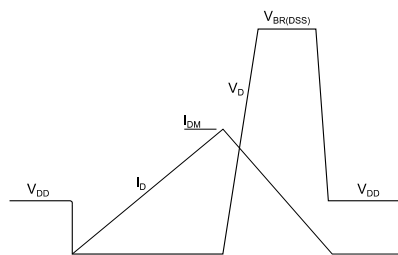
AM01470v1

Figure 16: Unclamped inductive load test circuit



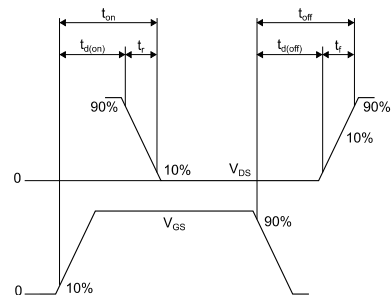
AM01471v1

Figure 17: Unclamped inductive waveform



AM01472v1

Figure 18: Switching time waveform



AM01473v1

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-220FP ultra narrow leads package information

Figure 19: TO-220FP ultra narrow leads package outline

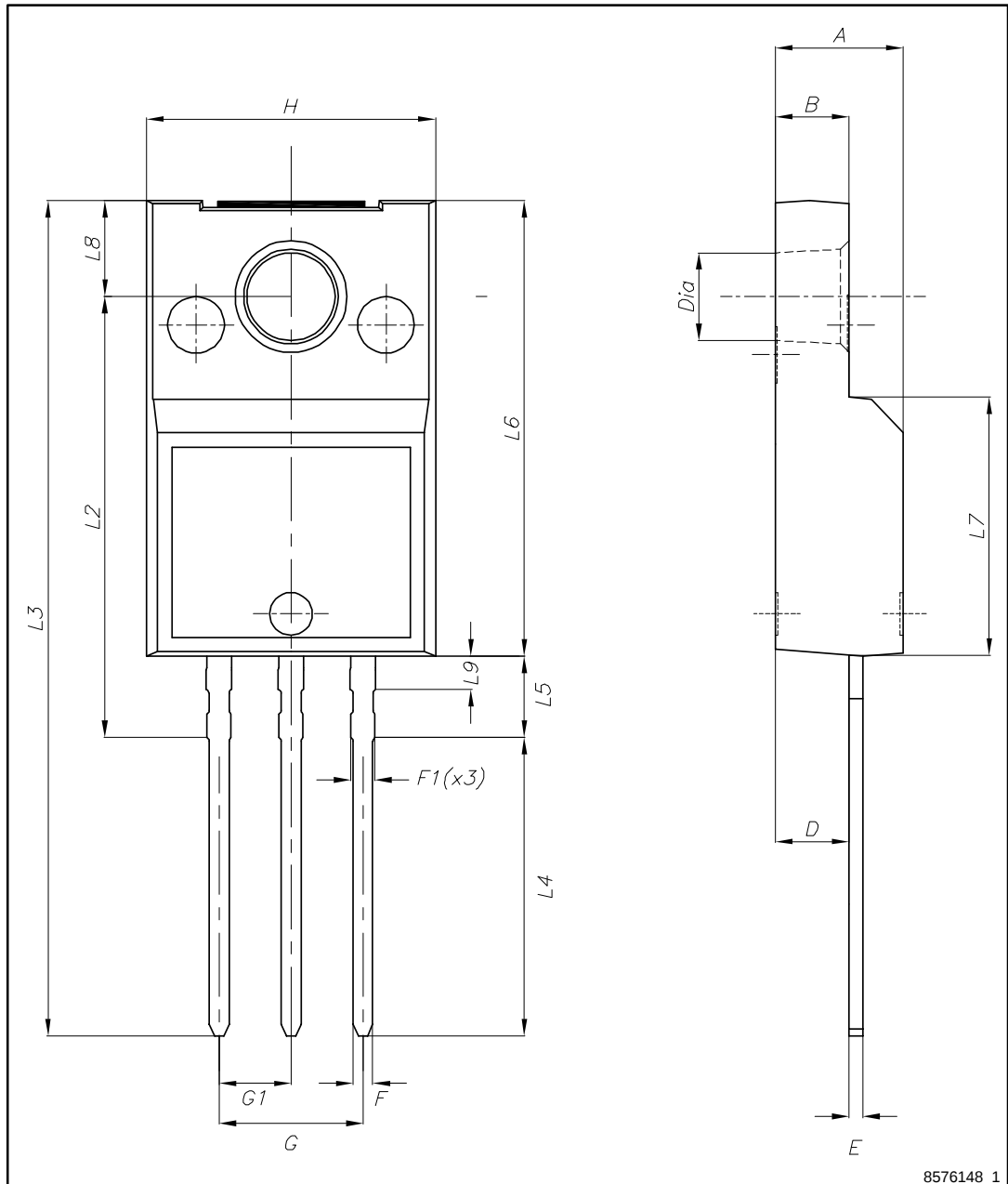


Table 9: TO-220FP ultra narrow leads mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
B	2.50		2.70
D	2.50		2.75
E	0.45		0.60
F	0.65		0.75
F1	-		0.90
G	4.95		5.20
G1	2.40	2.54	2.70
H	10.00		10.40
L2	15.10		15.90
L3	28.50		30.50
L4	10.20		11.00
L5	2.50		3.10
L6	15.60		16.40
L7	9.00		9.30
L8	3.20		3.60
L9	-		1.30
Dia.	3.00		3.20

5 Revision history

Table 10: Document revision history

Date	Revision	Changes
16-Mar-2015	1	Initial release
09-Sep-2015	2	Datasheet status promoted from preliminary to production data.

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. 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.

© 2015 STMicroelectronics – All rights reserved

Данный компонент на территории Российской Федерации

Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9