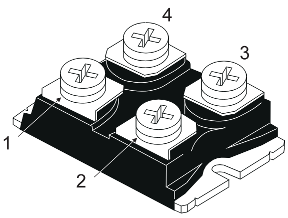
STE140NF20D

N-channel 200 V, 0.010 Ω, 140 A, ISOTOP STripFET™ II with fast recovery diode Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D
STE140NF20D	200 V	< 0.012 Ω	140 A

- Exceptional dv/dt capability
- Low gate charge
- 100% avalanche tested



ISOTOP

Application

Switching applications

Description

This Power MOSFET is produced using STMicroelectronics' unique STripFET™ process, which is specifically designed to minimize input capacitance and gate charge. The device offers extremely fast switching performance thanks to the intrinsic fast body diode, making the device ideal for hard switching topologies.

Figure 1. Internal schematic diagram

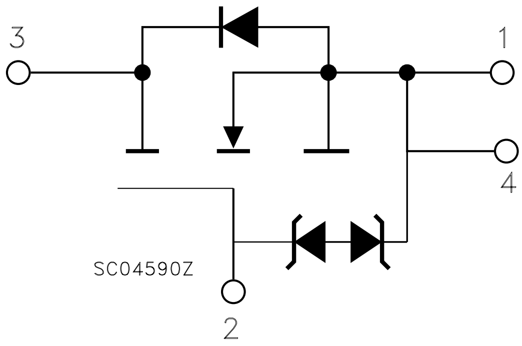


Table 1. Device summary

Order code	Marking	Package	Packaging
STE140NF20D	140NF20D	ISOTOP	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	200	V
V_{GS}	Gate-source voltage	± 20	V
I_D (1)	Drain current (continuous) at T_C = 25 °C	140	A
I_D (1)	Drain current (continuous) at T_C=100 °C	88	A
I_{DM} (2)	Drain current (pulsed)	560	A
P_{TOT} (2)	Total dissipation at T_C = 25 °C	500	W
I_{AR} (3)	Avalanche current, repetitive or not repetitive	140	A
E_{AS} (4)	Single pulse avalanche energy	800	mJ
dv/dt(5)	Peak diode recovery voltage slope	25	V/ns
V_{ISO}	Insulation winthstand voltage (AC-RMS)	2500	V
T_J T_{stg}	Operating junction temperature Storage temperature	- 55 to 150	°C

1. The value is rated according $R_{thj\text{-}pcb}$
2. Pulse width limited by safe operating area
3. Pulse width limited by Tjmax
4. Strating Tj = 25 °C, $I_D = I_{AR}$, V_{DD} = 50 V
5. $I_{SD} \leq$ 30 A, di/dt $\leq$ 1000 A/µs, $V_{DD} \leq$ 80% $V_{(BR)DSS}$

Table 3. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	0.25	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	40	°C/W

2 Electrical characteristics

(T_{CASE} = 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	I_D = 1 mA, V_{GS}= 0	200			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = max rating, V_{DS} =max rating @125 °C			10 100	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±21 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= 70 A		0.010	0.012	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 25 V, f=1 MHz, V_{GS}=0	-	11100 2190 334	-	pF pF pF
$C_{o(tr)}$ (1)	Equivalent capacitance time related	V_{DS} = 0 to 160 V, V_{GS} = 0,	-	1525	-	pF
$C_{o(er)}$ (2)	Equivalent capacitance energy related		-	1139	-	pF
R_g	Intrinsic gate resistance	f = 1 MHz open drain	-	1.4	-	Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 160 V, I_D = 140 A, V_{GS}= 10 V *(see Figure 16)*	-	338 47 183	-	nC nC nC

1. Time related 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}
2. Energy related is defined as a constant equivalent capacitance giving the same stored energy 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
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 100 V, I_D= 70 A, R_G=4.7 Ω, V_{GS} =10 V *(see Figure 15)*	-	232 218 283 250	-	ns ns ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current		-		140	A
I_{SDM}(1)	Source-drain current (pulsed)		-		560	A
V_{SD}(2)	Forward on voltage	I_{SD} = 140 A, V_{GS}=0	-		1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 140 A, di/dt = 100 A/µs, V_{DD}= 60 V	-	190 1.4 14		ns nC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 140 A, di/dt = 100 A/µs, V_{DD}= 60 V, Tj=150 °C	-	257 2.4 18		ns µC 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 2. Safe operating area

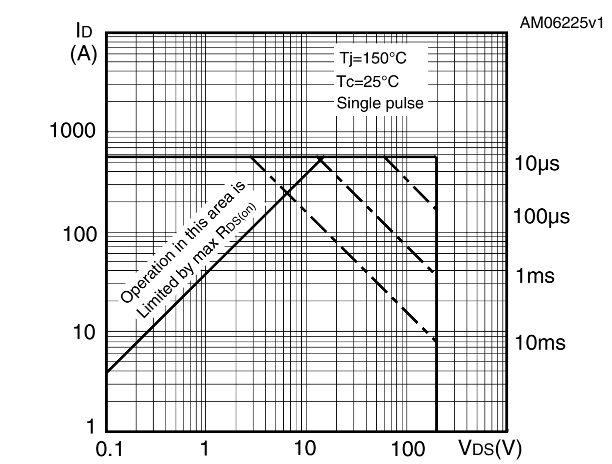


Figure 3. Thermal impedance

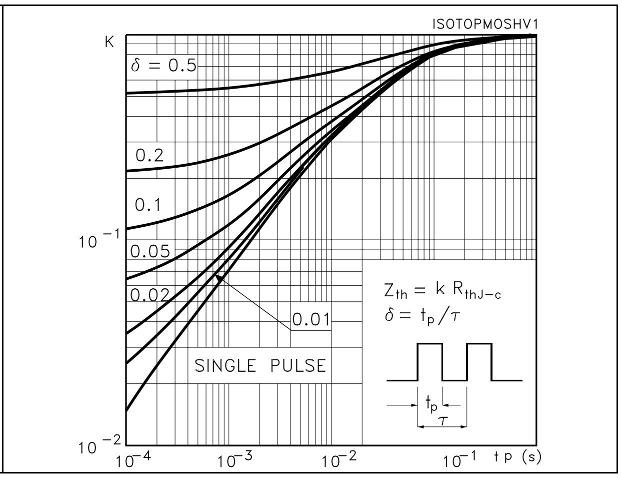


Figure 4. Output characteristics

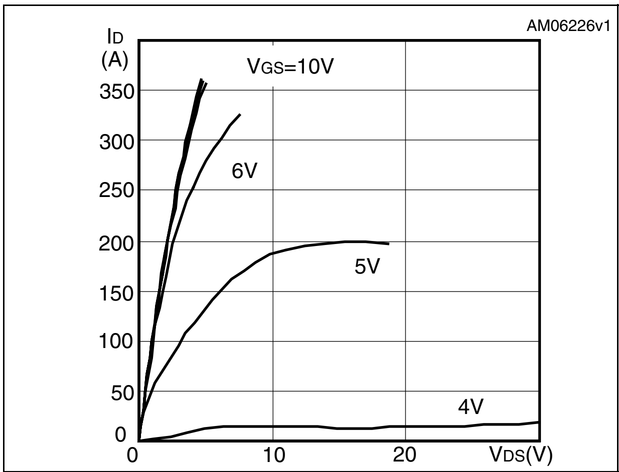


Figure 5. Transfer characteristics

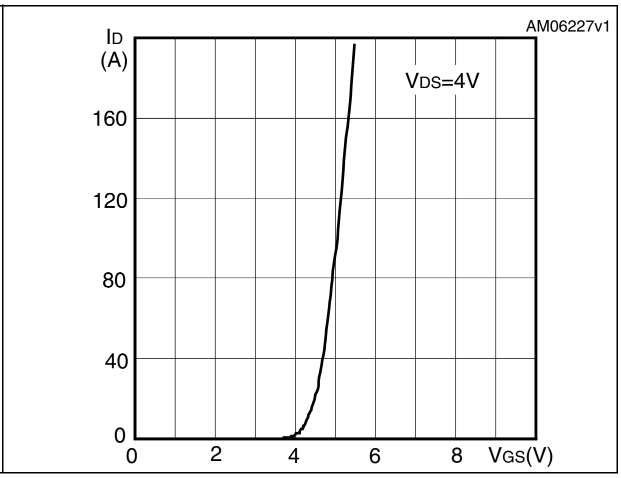


Figure 6. Gate charge vs gate-source voltage

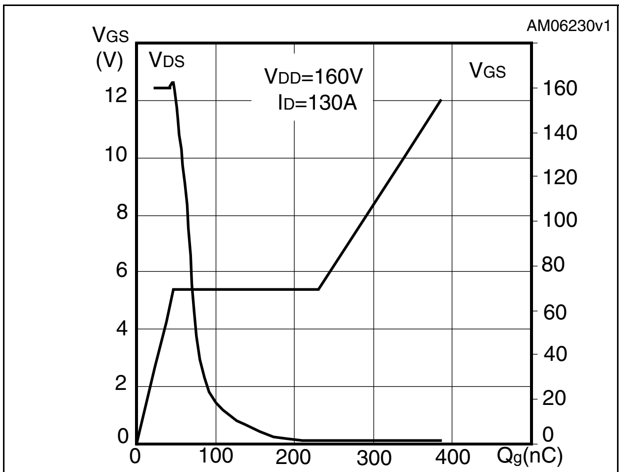


Figure 7. Static drain-source on resistance

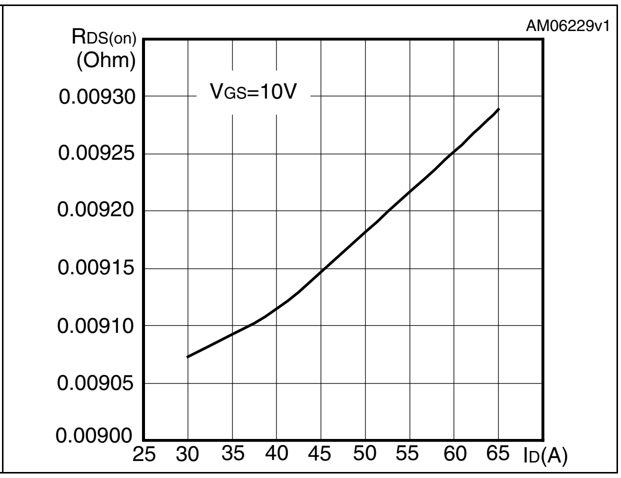


Figure 8. Capacitance variations

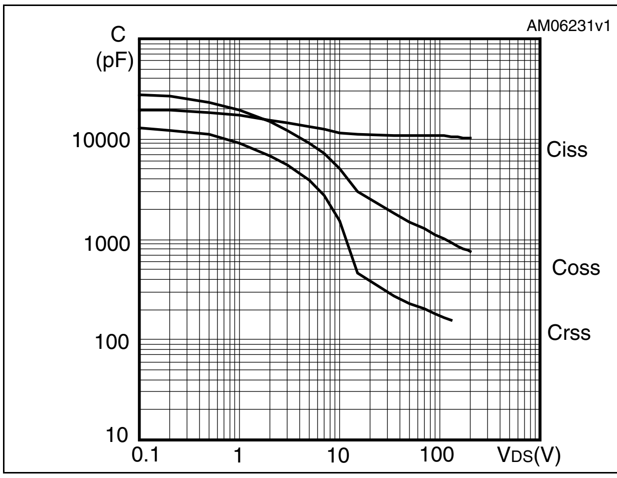


Figure 9. Output capacitance stored energy

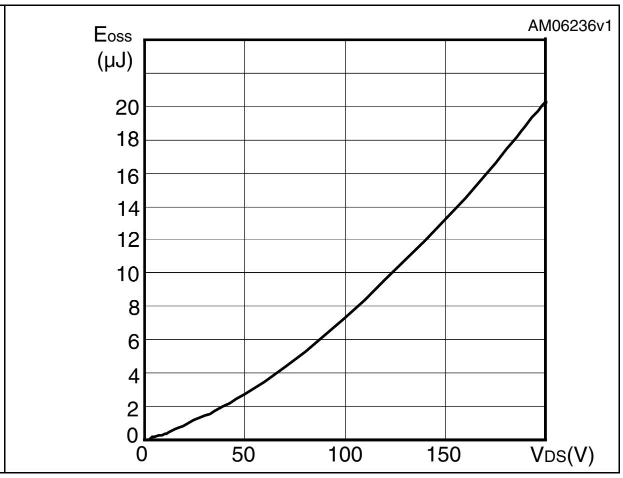


Figure 10. Normalized gate threshold voltage vs temperature

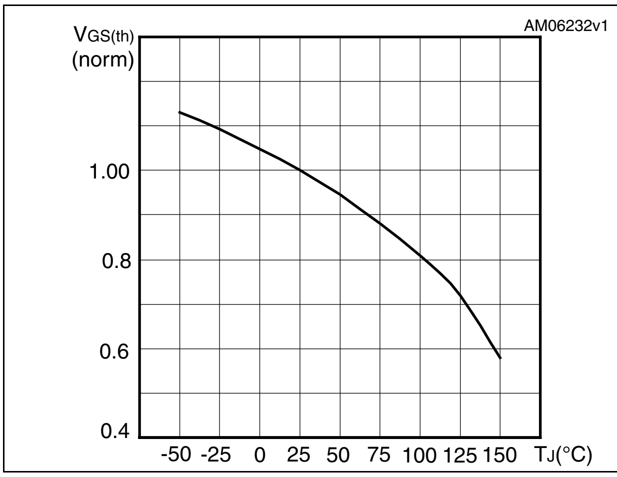


Figure 11. Normalized on resistance vs temperature

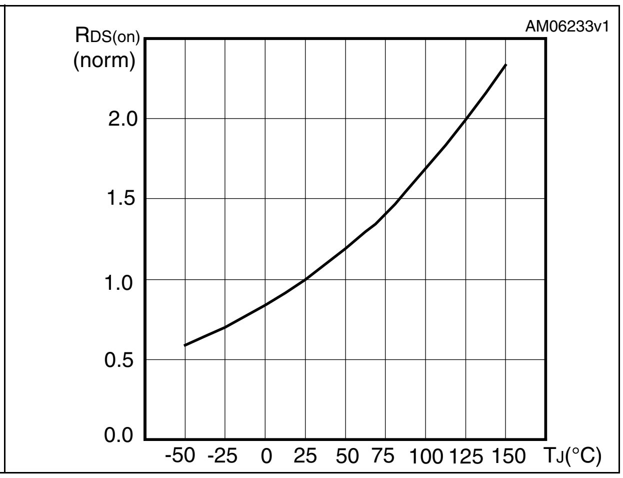


Figure 12. Source-drain diode forward characteristics

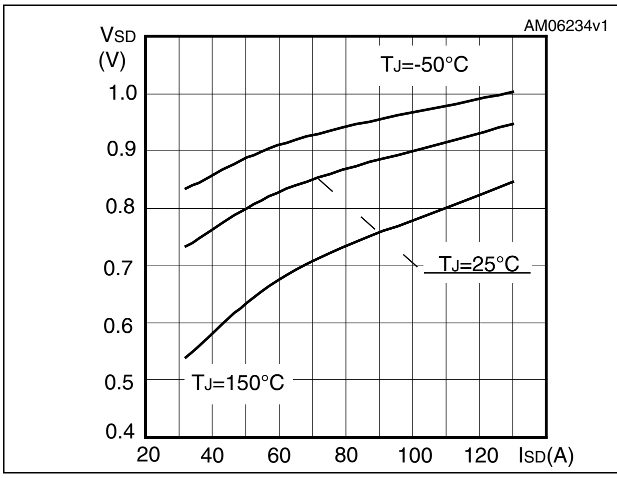


Figure 13. Normalized B_{VDSS} vs temperature

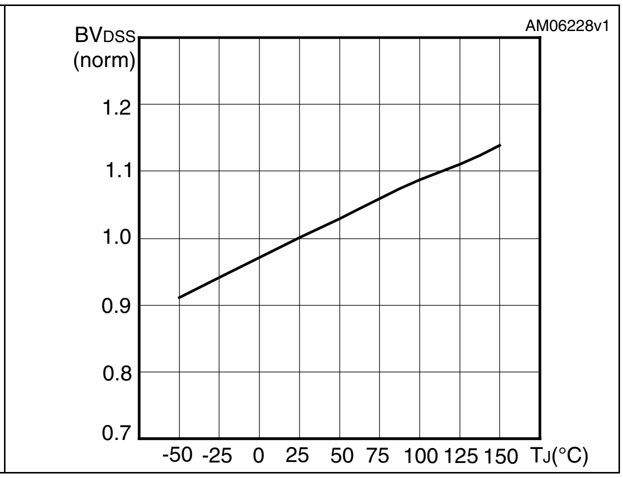
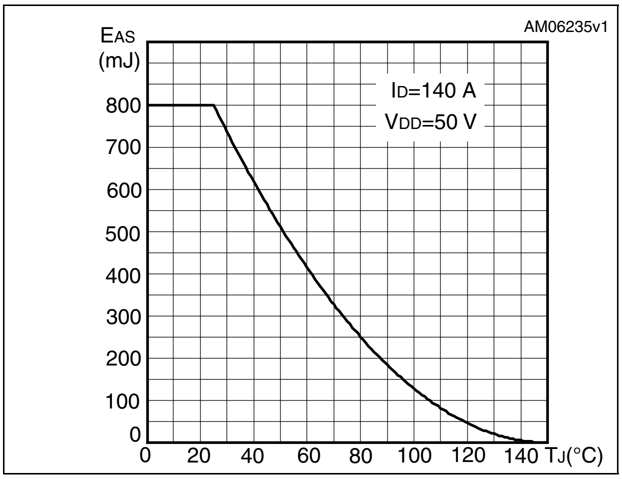


Figure 14. Maximum avalanche energy vs starting Tj



3 Test circuits

Figure 15. Switching times test circuit for resistive load

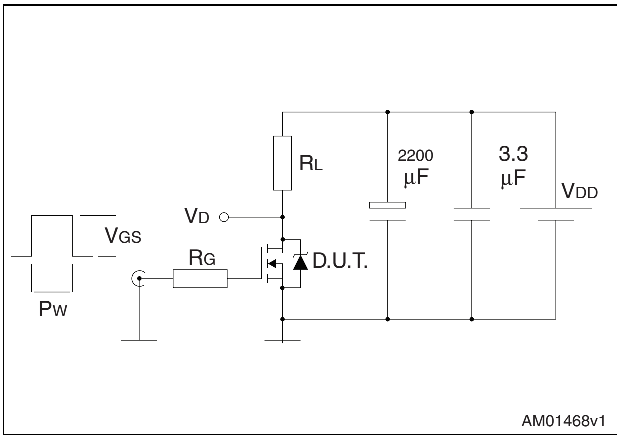


Figure 16. Gate charge test circuit

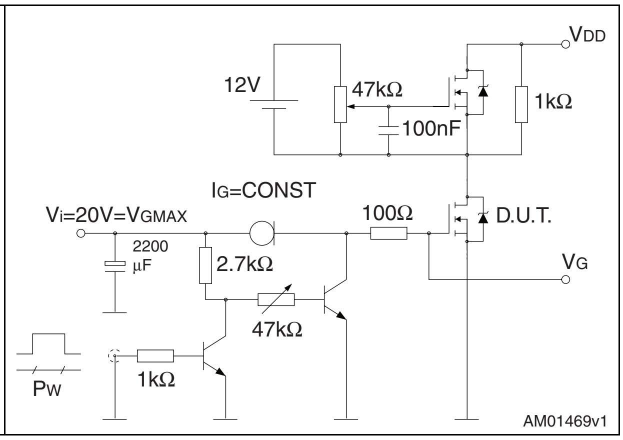


Figure 17. Test circuit for inductive load switching and diode recovery times

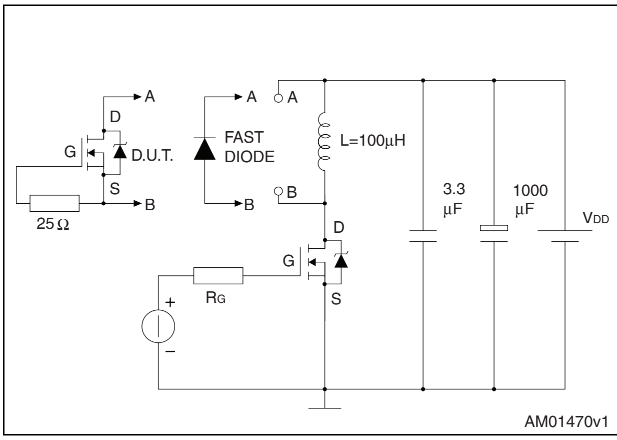


Figure 18. Unclamped inductive load test circuit

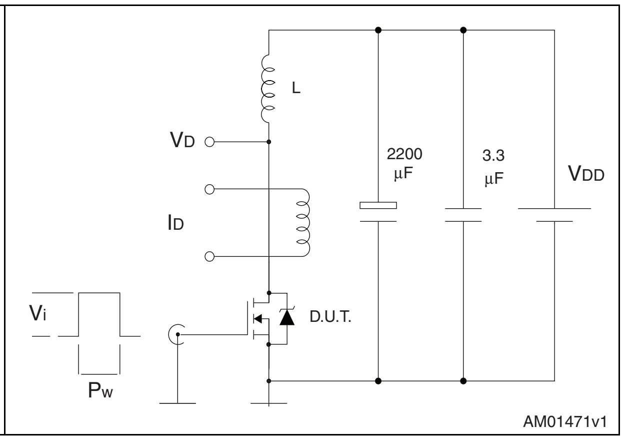


Figure 19. Unclamped inductive waveform

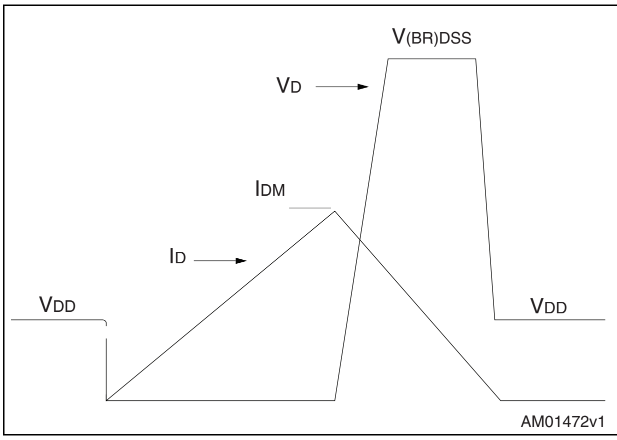
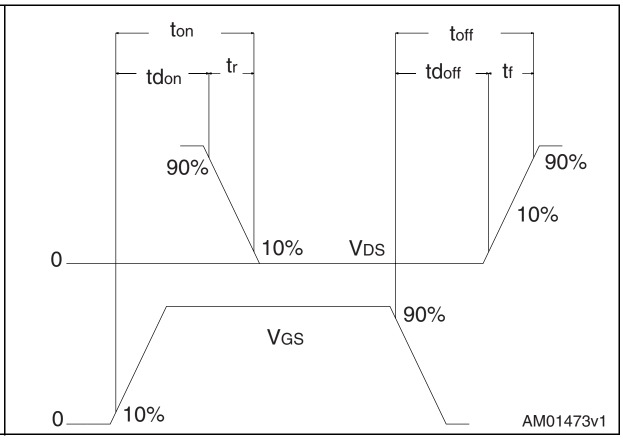


Figure 20. Switching time waveform



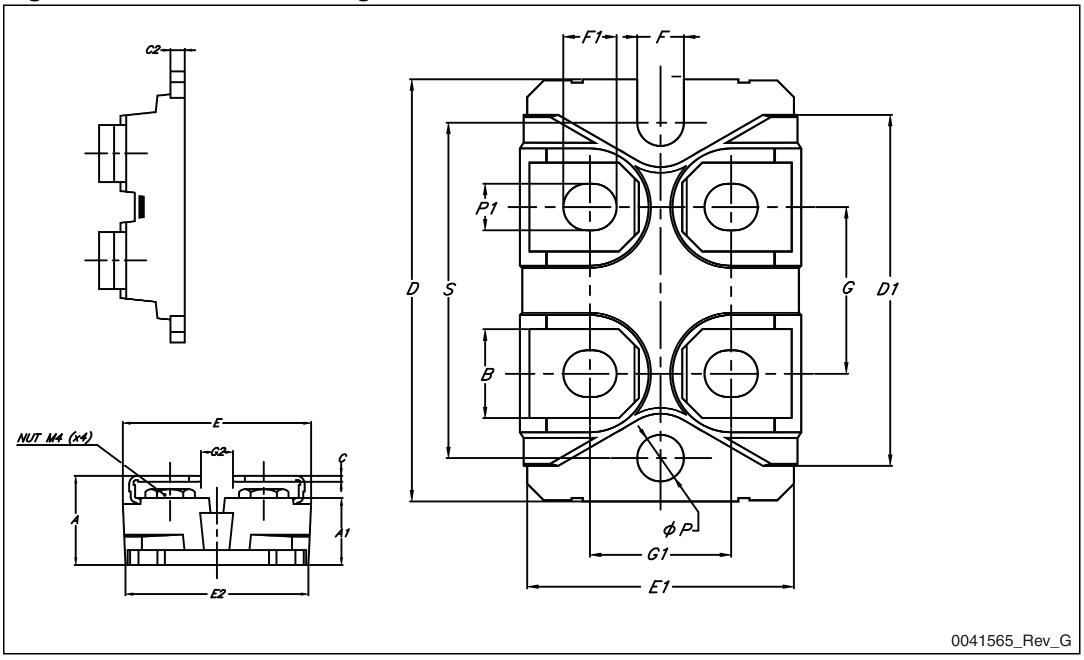
4 Package mechanical data

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.

Table 8. ISOTOP mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	11.80		12.20
A1	8.90		9.10
B	7.80		8.20
C	0.75		0.85
C2	1.95		2.05
D	37.80		38.20
D1	31.50		31.70
E	25.15		25.50
E1	23.85		24.15
E2		24.80	
G	14.90		15.10
G1	12.60		12.80
G2	3.50		4.30
F	4.10		4.30
F1	4.60		5
ϕP	4		4.30
P1	4		4.40
S	30.10		30.30

Figure 21. ISOTOP drawing



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
27-Jan-2009	1	First release
18-Jan-2010	2	Document status promoted from preliminary data to datasheet.
01-Jul-2010	3	Inserted V_{ISO} parameter in *Table 2: Absolute maximum ratings*

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