

## N-channel 1050 V, 0.110 $\Omega$ typ., 46 A MDmesh™ DK5 Power MOSFET in an ISOTOP package

Datasheet - production data

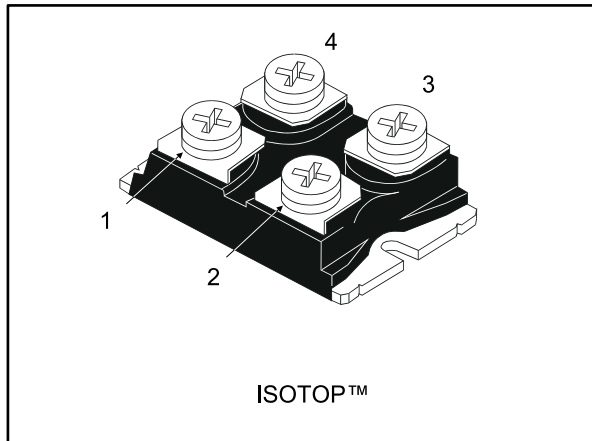
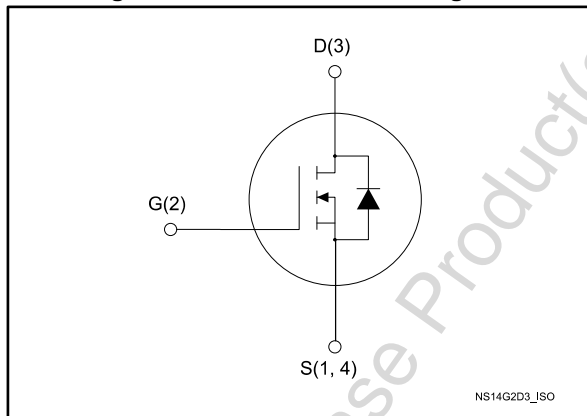


Figure 1: Internal schematic diagram



### Features

Order code	V <sub>DS</sub>	R <sub>DS(on)</sub> max.	I <sub>D</sub>	P <sub>TOT</sub>
STE60N105DK5	1050 V	0.120 $\Omega$	46 A	680 W

- Fast-recovery body diode
- Best R<sub>DS(on)</sub> x area
- Low gate charge, input capacitance and resistance
- 100% avalanche tested
- Extremely high dv/dt ruggedness

### Applications

- Switching applications

### Description

This very high voltage N-channel Power MOSFET is part of the MDmesh™ DK5 fast recovery diode series. The MDmesh™ DK5 combines very low recovery charge (Q<sub>rr</sub>) and recovery time (t<sub>rr</sub>) with an excellent improvement in R<sub>DS(on)</sub> \* area and one of the most effective switching behaviors, ideal for half bridge and full bridge converters.

Table 1: Device summary

Order code	Marking	Packages	Packaging
STE60N105DK5	60N105DK5	ISOTOP	Tube

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Prerelease Product(s) - Prerelease Product(s)



# 1 Electrical ratings

**Table 2: Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{GS}$	Gate-source voltage	$\pm 30$	V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	46	A
	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	30	A
$I_{DM}^{(1)}$	Drain current (pulsed)	184	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	680	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	50	V/ns
$dv/dt^{(3)}$	MOSFET $dv/dt$ ruggedness	50	V/ns
$V_{ISO}$	Insulation withstand voltage (AC-RMS)	2.5	kV
$T_j$	Operating junction temperature range	-55 to 150	$^\circ\text{C}$
$T_{stg}$	Storage temperature range		

**Notes:**

(1) Pulse width limited by safe operating area

(2)  $I_{SD} \leq 23\text{ A}$ ,  $di/dt \leq 400\text{ A}/\mu\text{s}$ ;  $V_{DS\text{ peak}} \leq V_{(BR)DSS}$ ,  $V_{DD} = 525\text{ V}$

(3)  $V_{DS} \leq 840\text{ V}$

**Table 3: Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.184	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient	30	

**Table 4: Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AS}$	Single pulse avalanche energy (pulse width limited by $T_{JMAX}$ )	16	A
$E_{AS}$	Single pulse avalanche energy (starting $T_J = 25\text{ }^\circ\text{C}$ , $I_D = I_{AS}$ , $V_{DD} = 50\text{ V}$ )	1550	mJ

## 2 Electrical characteristics

(T<sub>CASE</sub> = 25 °C unless otherwise specified)

Table 5: On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source breakdown voltage	I <sub>D</sub> = 1 mA, V <sub>GS</sub> = 0 V	1050			V
I <sub>DSS</sub>	Zero gate voltage drain current	V <sub>DS</sub> = 1050 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 1050 V, V <sub>GS</sub> = 0 V, T <sub>C</sub> = 125 °C <sup>(1)</sup>			50	μA
I <sub>GSS</sub>	Gate-body leakage current	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±10	μA
V <sub>GS(th)</sub>	Gate threshold voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 100 μA	3	4	5	V
R <sub>DS(on)</sub>	Static drain-source on-resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23 A		0.110	0.120	Ω

**Notes:**

<sup>(1)</sup>Defined by design, not subject to production test

Table 6: Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C <sub>iss</sub>	Input capacitance	V <sub>DS</sub> = 100 V, f = 1 MHz, V <sub>GS</sub> = 0 V	-	6675	-	pF
C <sub>OSS</sub>	Output capacitance		-	370	-	pF
C <sub>rSS</sub>	Reverse transfer capacitance		-	10	-	pF
C <sub>o(tr)</sub> <sup>(1)</sup>	Equivalent capacitance time related	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 0 to 840 V	-	630	-	pF
C <sub>o(er)</sub> <sup>(2)</sup>	Equivalent capacitance energy related		-	219	-	
R <sub>G</sub>	Intrinsic gate resistance	f = 1 MHz open drain	-	3	-	Ω
Q <sub>g</sub>	Total gate charge	V <sub>DD</sub> = 840 V, I <sub>D</sub> = 46 A, V <sub>GS</sub> = 10 V (see Figure 15: "Test circuit for gate charge behavior")	-	204	-	nC
Q <sub>gs</sub>	Gate-source charge		-	36	-	nC
Q <sub>gd</sub>	Gate-drain charge		-	133	-	nC

**Notes:**

<sup>(1)</sup>Time related is defined as a constant equivalent capacitance giving the same charging time as C<sub>OSS</sub> when V<sub>DS</sub> increases from 0 to 80% V<sub>DSS</sub>.

<sup>(2)</sup>Energy related is defined as a constant equivalent capacitance giving the same stored energy as C<sub>OSS</sub> when V<sub>DS</sub> increases from 0 to 80% V<sub>DSS</sub>.

Table 7: Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 525 \text{ V}$ , $I_D = 23 \text{ A}$ , $R_G = 4.7 \text{ } \Omega$ , $V_{GS} = 10 \text{ V}$ (see <a href="#">Figure 14: "Test circuit for resistive load switching times"</a> and <a href="#">Figure 19: "Switching time waveform"</a> )	-	40.6	-	ns
$t_r$	Rise time		-	64.5	-	ns
$t_{d(off)}$	Turn-off delay time		-	262	-	ns
$t_f$	Fall time		-	49.5	-	ns

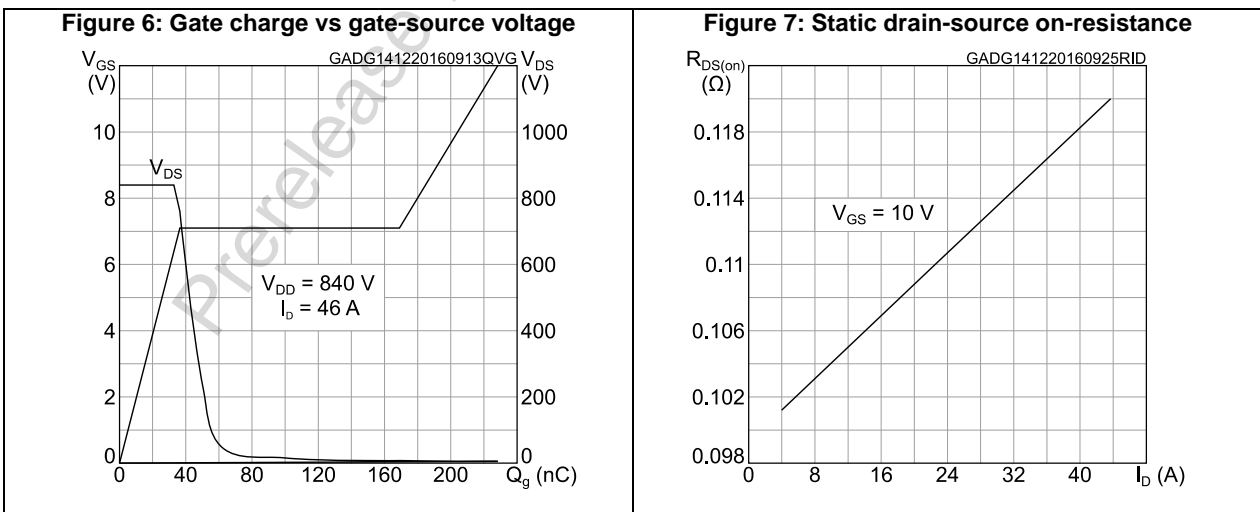
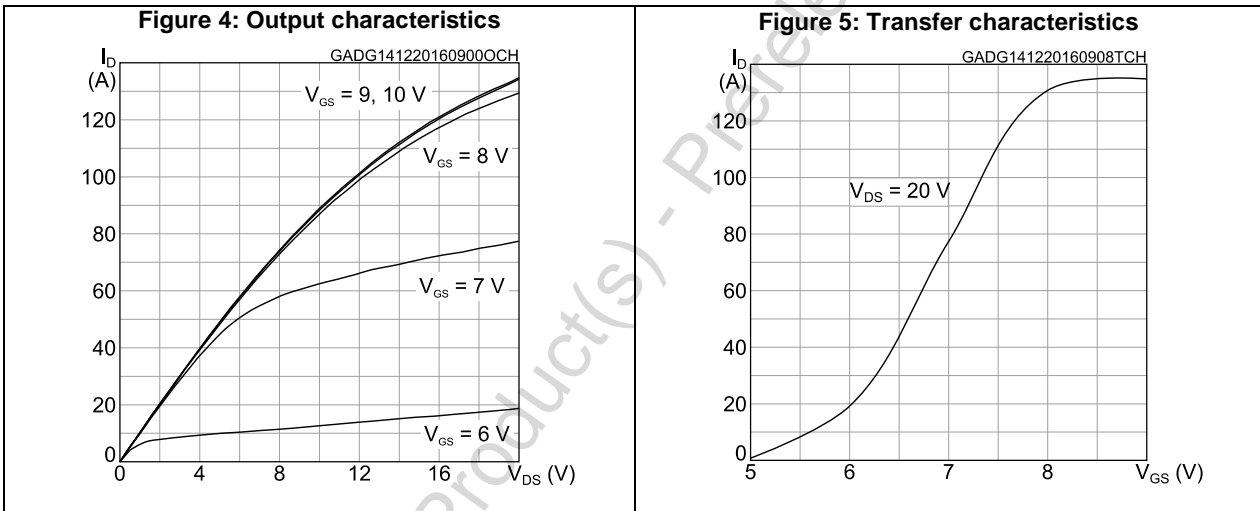
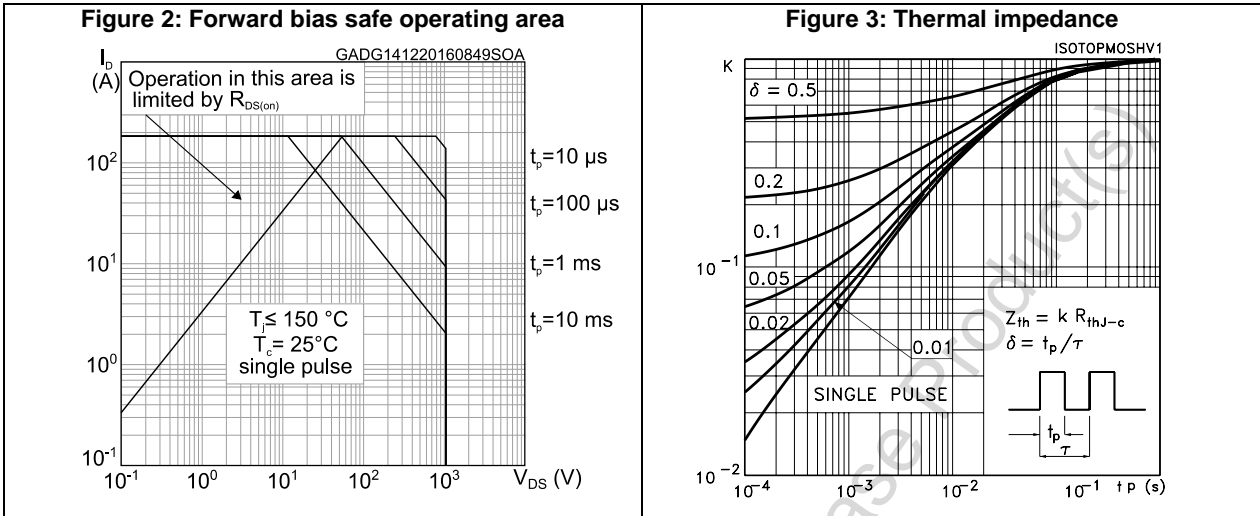
Table 8: Source drain diode

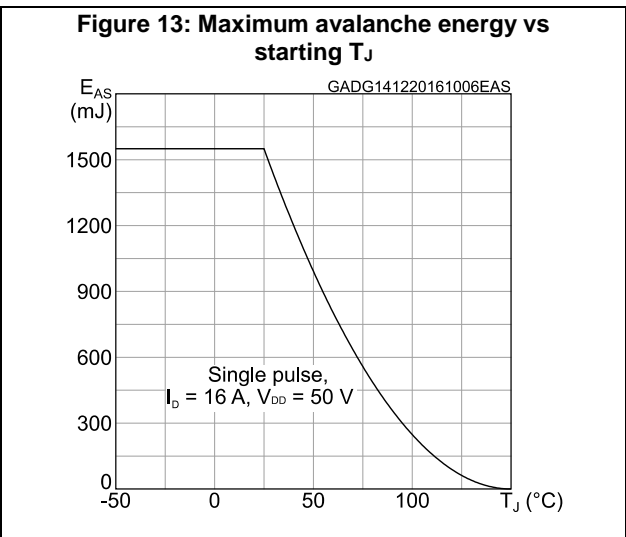
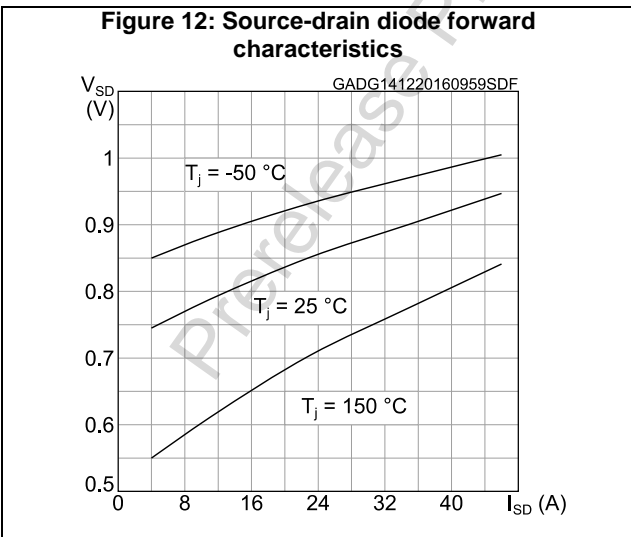
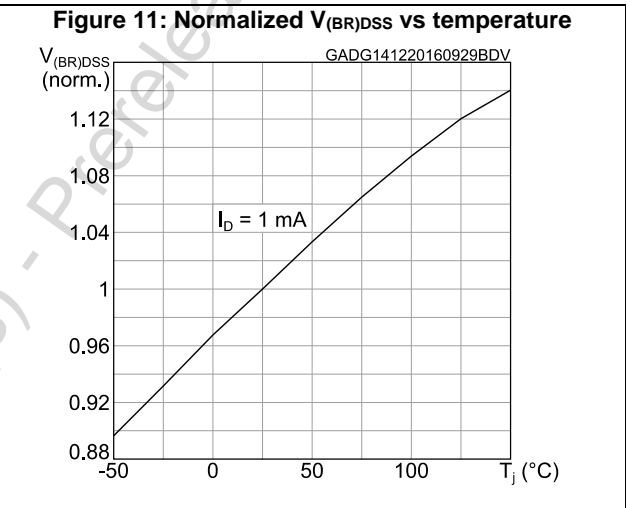
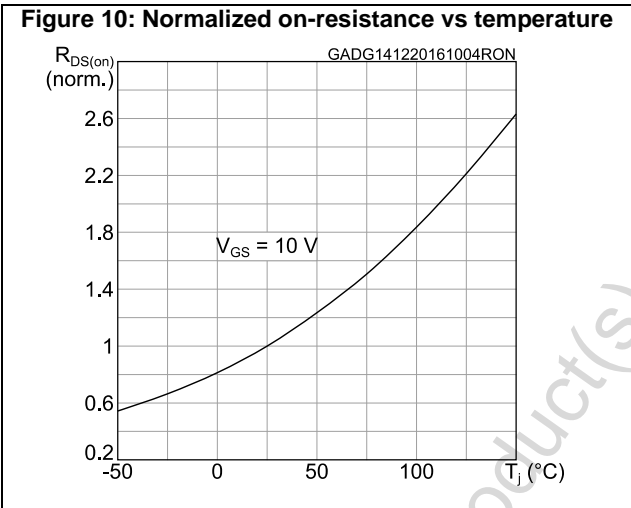
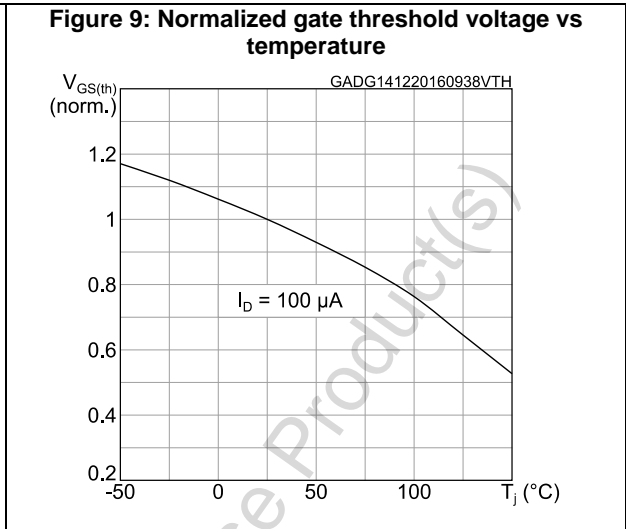
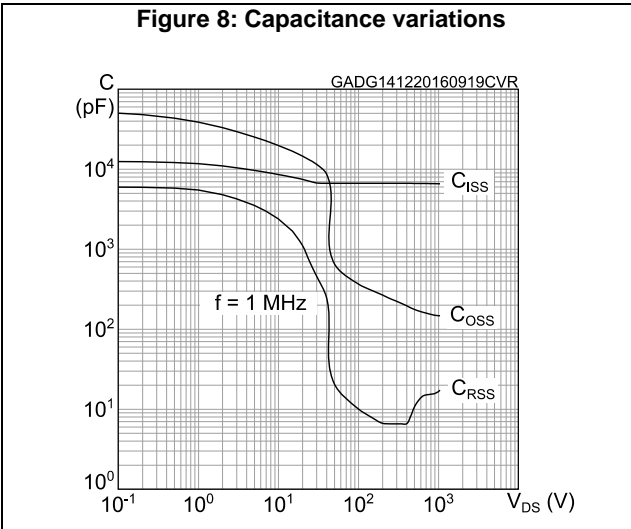
Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current		-		46	A
$I_{SDM}$	Source-drain current (pulsed)		-		184	A
$V_{SD}^{(1)}$	Forward on voltage	$I_{SD} = 46 \text{ A}$ , $V_{GS} = 0 \text{ V}$	-		1.5	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 46 \text{ A}$ , $V_{DD} = 60 \text{ V}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ (see <a href="#">Figure 16: "Test circuit for inductive load switching and diode recovery times"</a> )	-	273		ns
$Q_{rr}$	Reverse recovery charge		-	3		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	23		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 46 \text{ A}$ , $V_{DD} = 60 \text{ V}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ , $T_j = 150 \text{ } ^\circ\text{C}$ (see <a href="#">Figure 16: "Test circuit for inductive load switching and diode recovery times"</a> )	-	477		ns
$Q_{rr}$	Reverse recovery charge		-	10		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current		-	42		A

**Notes:**

(1) Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)





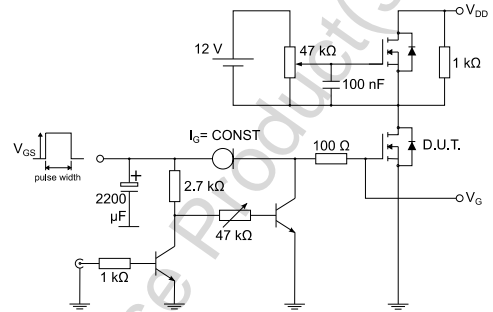
### 3 Test circuits

**Figure 14: Test circuit for resistive load switching times**



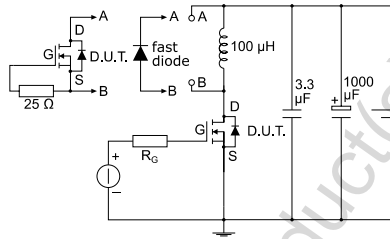
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**Figure 15: Test circuit for gate charge behavior**



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



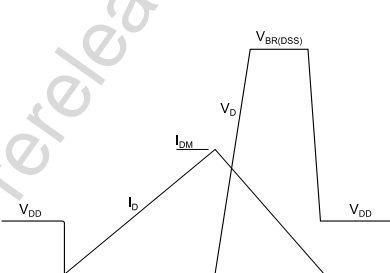
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**Figure 17: Unclamped inductive load test circuit**



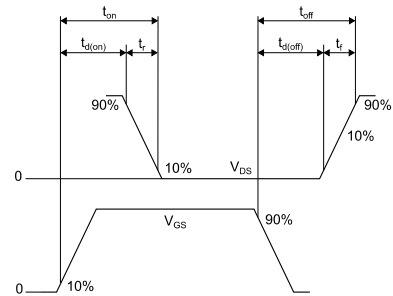
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**Figure 18: Unclamped inductive waveform**



AM01472v1

**Figure 19: 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](http://www.st.com). ECOPACK® is an ST trademark.

Prerelease Product(s) - Prerelease Product(s)



Table 9: 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
ØP	4		4.30
P1	4		4.40
S	30.10		30.30

## 5 Revision history

**Table 10: Document revision history**

Date	Revision	Changes
24-Jan-2013	1	First release
16-Dec-2016	2	Datasheet status promoted from preliminary to production data. Updated title, features, description and internal schematic diagram on cover page. Updated <a href="#">Section 1: "Electrical ratings"</a> . Updated <a href="#">Section 2: "Electrical characteristics"</a> . Added <a href="#">Section 2.1: "Electrical characteristics (curves)"</a> . Minor text changes

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