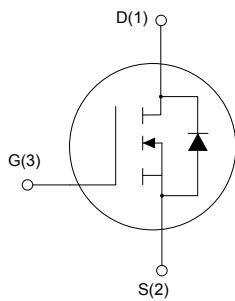
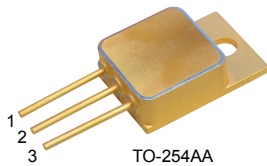


## Rad-Hard 100 V, 48 A N-channel Power MOSFET



SC30150

### Features

$V_{DS}$	$I_D$	$R_{DS(on)}$ typ.	$Q_g$
100 V	48 A	30 m $\Omega$	135 nC

- Fast switching
- 100% avalanche tested
- Hermetic package
- 50 krad
- SEE radiation hardened

### Description

The STRH100N10 is a N-channel Power MOSFET developed with the Rad-hard STripFET technology in hermetic TO-254AA package.

Specifically designed to sustain Total Ionized Dose and immunity to heavy ion effects, it is qualified as per ESCC 5205/021 detail specification. In case of discrepancies between this datasheet and the relevant agency specification, the latter takes precedence.

### Product summary

Product status link
<a href="#">STRH100N10</a>

Product summary					
Part number	Quality level	ESCC part number	Package	Lead finish	Radiation level
STRH100N10HY1	Engineering model	-	TO-254AA	Gold	-
STRH100N10HYG	ESCC flight	5205/021		Solder dip	50 krad
STRH100N10HYT					

Note: See Table 8. Ordering information.

# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}^{(1)}$	Drain-source voltage ( $V_{GS} = 0$ )	100	V
$V_{GS}^{(2)}$	Gate-source voltage	$\pm 20$	V
$I_D^{(3)}$	Drain current (continuous) at $T_{case} = 25\text{ }^\circ\text{C}$	48	A
	Drain current (continuous) at $T_{case} = 100\text{ }^\circ\text{C}$	30	A
$I_{DM}^{(4)}$	Drain current (pulsed)	192	A
$P_{TOT}$	Total power dissipation at $T_{case} = 25\text{ }^\circ\text{C}$	170	W
$dv/dt^{(5)}$	Peak diode recovery voltage slope	2.6	V/ns
$T_{op}$	Operating temperature range	-55 to 150	$^\circ\text{C}$
$T_j$	Max. operating junction temperature range	150	$^\circ\text{C}$

1. This rating is guaranteed at  $T_j \geq 25\text{ }^\circ\text{C}$  (see [Figure 9](#)).
2. This value is guaranteed over the full range of temperature.
3. Rated according to the  $R_{thj-case} + R_{thc-s}$
4. Pulse width limited by safe operating area.
5.  $I_{SD} \leq 48\text{ A}$ ,  $di/dt \leq 100\text{ A}/\mu\text{s}$ ,  $V_{DD} = 80\%V_{(BR)DSS}$ .

**Table 2. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case (maximum)	0.52	$^\circ\text{C}/\text{W}$
$R_{thc-s}$	Thermal resistance case-sink (typical)	0.21	$^\circ\text{C}/\text{W}$

**Table 3. Avalanche data**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive, (pulse width limited by $T_j$ max)	24	A
$E_{AS}^{(1)}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	954	mJ
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 110\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	280	mJ
$E_{AR}$	Repetitive pulse avalanche energy ( $V_{DD} = 50\text{ V}$ , $I_{AR} = 24\text{ A}$ , $f = 10\text{ KHz}$ , $T_j = 25\text{ }^\circ\text{C}$ , duty cycle = 50%)	60	mJ
$E_{AR}$	Repetitive pulse avalanche energy ( $V_{DD} = 50\text{ V}$ , $I_{AR} = 24\text{ A}$ , $f = 100\text{ KHz}$ , $T_j = 25\text{ }^\circ\text{C}$ , duty cycle = 10%)	24	
	Repetitive pulse avalanche energy ( $V_{DD} = 50\text{ V}$ , $I_{AR} = 24\text{ A}$ , $f = 100\text{ KHz}$ , $T_j = 110\text{ }^\circ\text{C}$ , duty cycle = 10%)	7.7	

1. Maximum rating value.

## 2 Electrical characteristics

**Table 4. Electrical characteristics ( $T_{amb} = 25\text{ °C}$  unless otherwise specified)**

Symbol	Parameter	Test conditions	Min.	Max.	Unit
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$80\% BV_{DSS}$		10	$\mu\text{A}$
		$80\% BV_{DSS}, T_C = 125\text{ °C}$		100	
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = 20\text{ V}$		100	nA
		$V_{GS} = -20\text{ V}$	-100		
		$V_{GS} = 20\text{ V}, T_C = 125\text{ °C}$		200	
		$V_{GS} = -20\text{ V}, T_C = 125\text{ °C}$	-200		
$BV_{DSS}^{(1)}$	Drain-to-source breakdown voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	100		V
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 1\text{ mA}, T_C = -55\text{ °C}$	2.1	5.5	V
		$V_{DS} = V_{GS}, I_D = 1\text{ mA}$	2.0	4.5	
		$V_{DS} = V_{GS}, I_D = 1\text{ mA}, T_C = 125\text{ °C}$	1.5	3.7	
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 12\text{ V}, I_D = 24\text{ A}$		0.035	$\Omega$
		$V_{GS} = 12\text{ V}, I_D = 24\text{ A}, T_C = 125\text{ °C}$		0.063	
$C_{iss}$	Input capacitance		3940	5910	pF
$C_{oss}^{(2)}$	Output capacitance	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}, V_{GS} = 0\text{ V}$	543	814	pF
$C_{rss}$	Reverse transfer capacitance		190	284	pF
$Q_g$	Total gate charge		108	162	nC
$Q_{gs}$	Gate-to-source charge	$V_{DD} = 50\text{ V}, I_D = 48\text{ A}, V_{GS} = 12\text{ V}$	21.6	32.4	nC
$Q_{gd}$	Gate-to-drain ("Miller") charge		36	54	nC
$R_G^{(2)}$	Gate input resistance	$f = 1\text{ MHz}$ gate DC bias = 0 test signal level = 20 mV open drain	1.2	2	$\Omega$
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 50\text{ V}, I_D = 24\text{ A}, R_G = 4.7\text{ }\Omega, V_{GS} = 12\text{ V}$	23.6	35.4	ns
$t_r$	Rise time		34.4	51.6	ns
$t_{d(off)}$	Turn-off delay time		79	119	ns
$t_f$	Fall time		33.6	50.4	ns
$I_{SD}$	Source-drain current			48	A
$I_{SDM}^{(3)}$	Source-drain current (pulsed)			192	A
$V_{SD}^{(4)}$	Forward on voltage	$I_{SD} = 48\text{ A}, V_{GS} = 0\text{ V}$		1.5	V
		$I_{SD} = 48\text{ A}, V_{GS} = 0\text{ V}, T_C = 125\text{ °C}$		1.275	V
$t_{rr}^{(2)}$	Reverse recovery time	$I_{SD} = 48\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 50\text{ V}, T_J = 25\text{ °C}$	332	498	ns
$t_{rr}^{(2)}$	Reverse recovery time	$I_{SD} = 48\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 50\text{ V}, T_J = 150\text{ °C}$	400	600	ns

1. This rating is guaranteed at  $T_J \geq 25\text{ °C}$  (see Figure 9).
2. Not tested in production, guaranteed by process.
3. Pulse width limited by safe operating area
4. Pulsed: pulse duration = 300  $\mu\text{s}$ , duty cycle  $\leq 1.5\%$

### 3 Radiation characteristics

This products is guaranteed in radiation as per ESCC 5205/025 and ESCC 22900 specification at 50 krad. Each lot tested in radiation is accepted according to the characteristics as per [Table 5](#).

#### 3.1 Total dose radiation (TID) testing

The bias with  $V_{GS} = +15\text{ V}$  and  $V_{DS} = 0\text{ V}$  is applied during irradiation exposure.

The parameters listed in [Table 5](#) are measured:

- Before irradiation
- After irradiation
- After 24 hrs at room temperature
- after 168 hrs at 100 °C anneal

**Table 5. Post-irradiation electrical characteristics ( $T_{amb} = 25\text{ °C}$  unless otherwise specified)**

Symbol	Parameter	Test conditions	Drift values $\Delta$	Unit
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	80% $BV_{DSS}$	10	$\mu\text{A}$
$I_{GSS}$	Gate body leakage current	$V_{GS} = 20\text{ V}$	20	nA
		$V_{GS} = -20\text{ V}$	-20	
$BV_{DSS}$	Drain-to-source breakdown voltage	$V_{GS} = 0\text{ V}$ , $I_D = 1\text{ mA}$	-25%	V
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 1\text{ mA}$	-50% / +10%	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 12\text{ V}$ , $I_D = 24\text{ A}$	$\pm 10\%$	$\Omega$
$V_{SD}^{(1)}$	Forward on voltage	$V_{GS} = 0\text{ V}$ , $I_{SD} = 48\text{ A}$	$\pm 10\%$	V

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

### 3.2 Single event effect RBSOA

This products is extremely resistant to heavy ion environment for single event effect (as per MIL-STD-750E, method 1080, bias circuit of Figure 2).

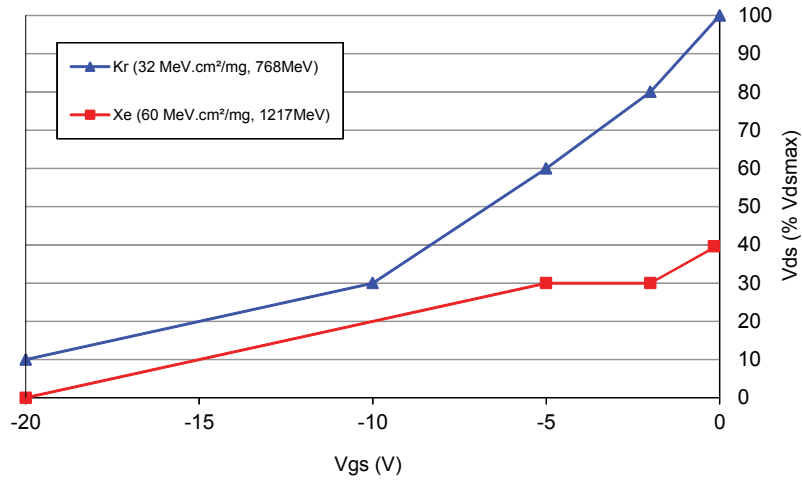
SEB and SEGR tests are performed with a fluence of  $3e+5$  ions/cm<sup>2</sup> with the following acceptance criteria:

- SEB test:  
drain voltage checked, trigger level is set to  $V_{DS} = -5$  V. Stop condition: as soon as a SEB occurs or if the fluence reaches  $3e+5$  ions/cm<sup>2</sup>.
- SEGR test:  
the gate current is monitored every 200 ms. A gate stress is performed before and after irradiation. Stop condition: as soon as the gate current reaches 100 nA (during irradiation or during PIGS test) or if the fluence reaches  $3e+5$  ions/cm<sup>2</sup>.

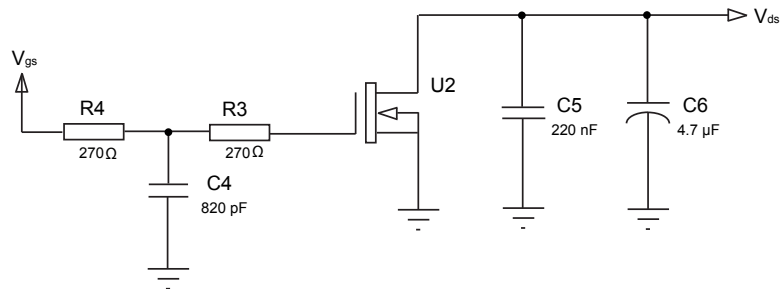
**Table 6. Single Event Effects (SEB and SEGR) RBSOA**

Ion	Let (Mev/(mg/cm <sup>2</sup> ))	Energy (MeV)	Range (μm)
Kr	32	768	94
Xe	60	1217	89

**Figure 1. Single event effect, SOA**



**Figure 2. Single event effect, bias circuit**

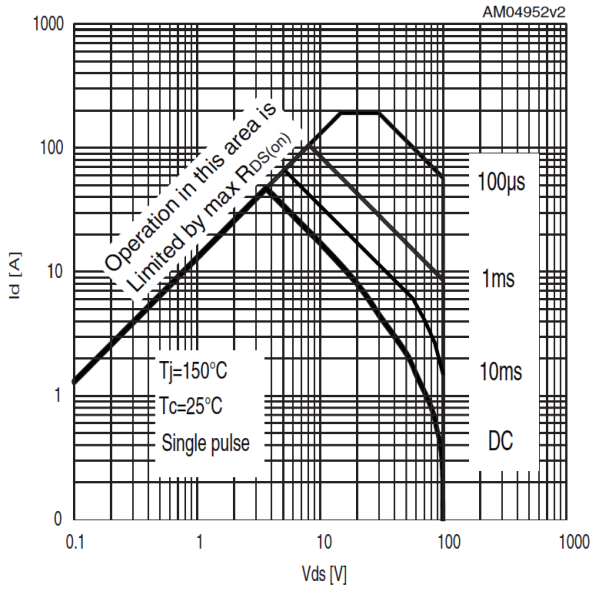


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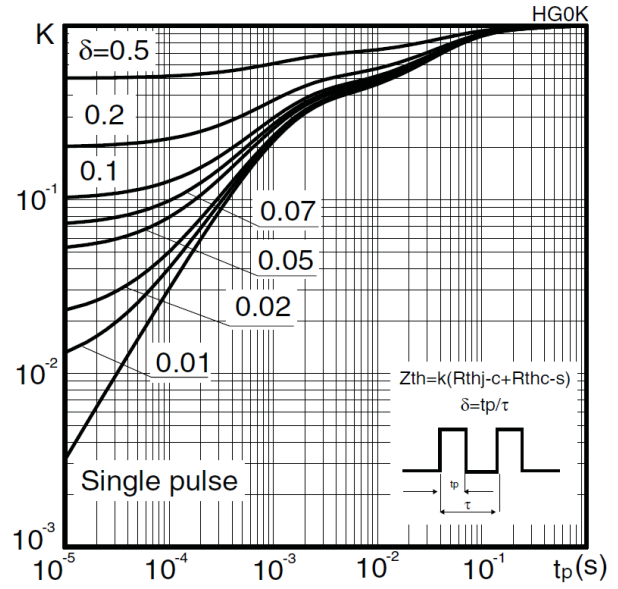
*Note:* Bias condition during radiation refer to Table 6.

## 4 Electrical characteristics (curves)

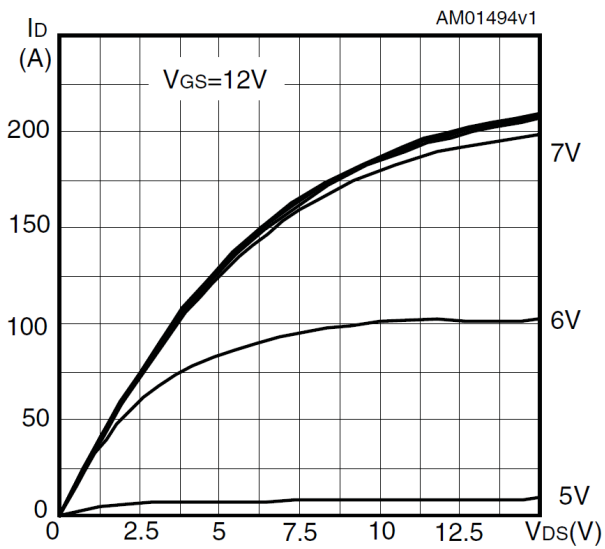
**Figure 3. Safe operating area**



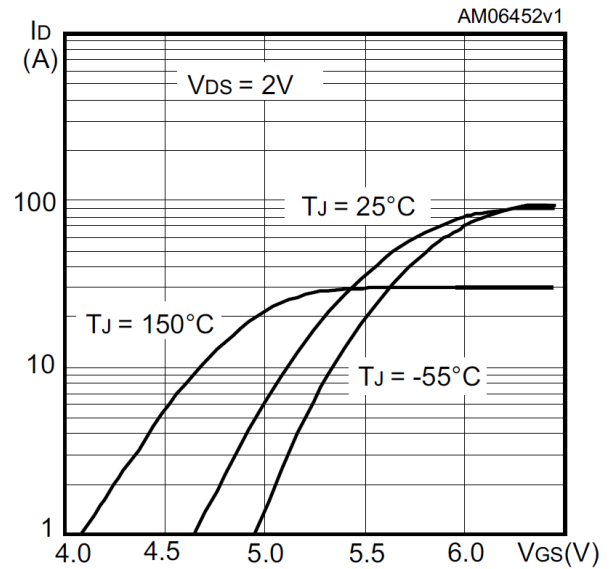
**Figure 4. Thermal impedance**



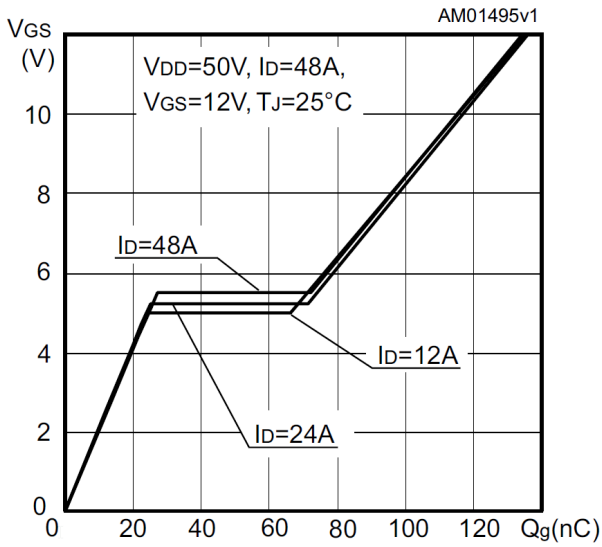
**Figure 5. Output characteristics**



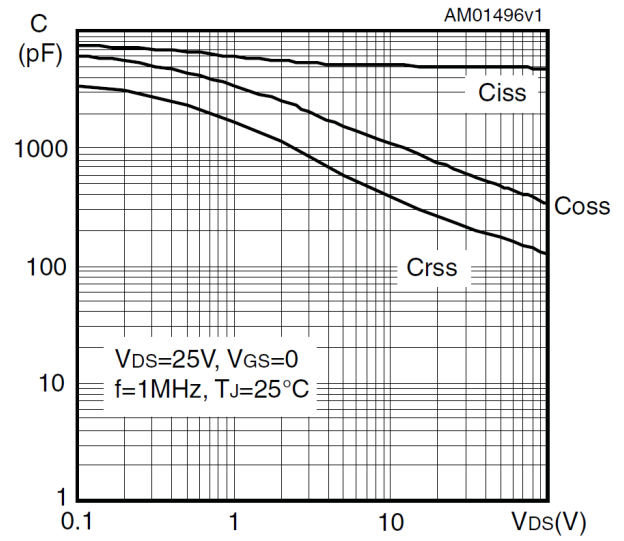
**Figure 6. Transfer characteristics**



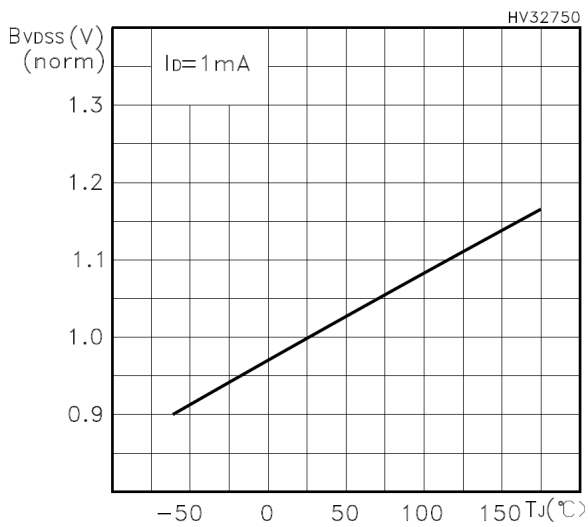
**Figure 7. Gate charge vs gate-source voltage**



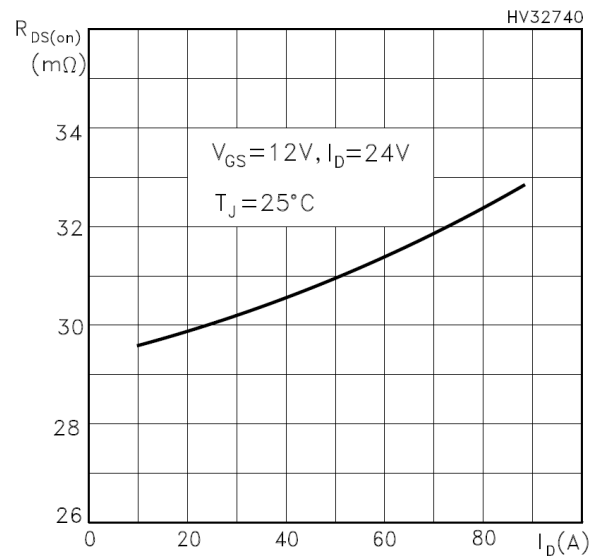
**Figure 8. Capacitance variations**



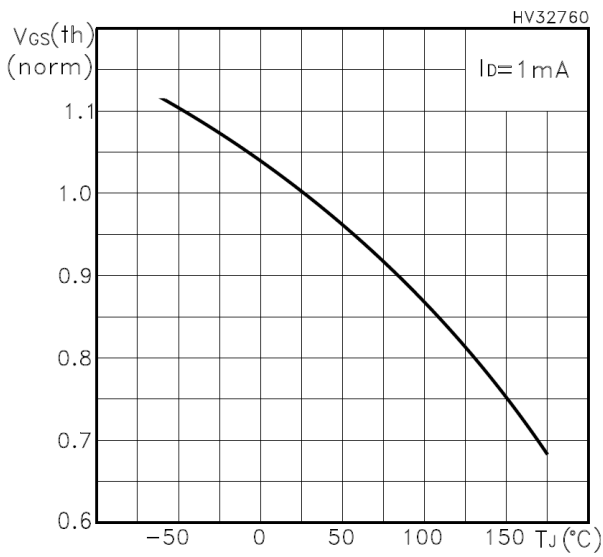
**Figure 9. Normalized  $BV_{DSS}$  vs temperature**



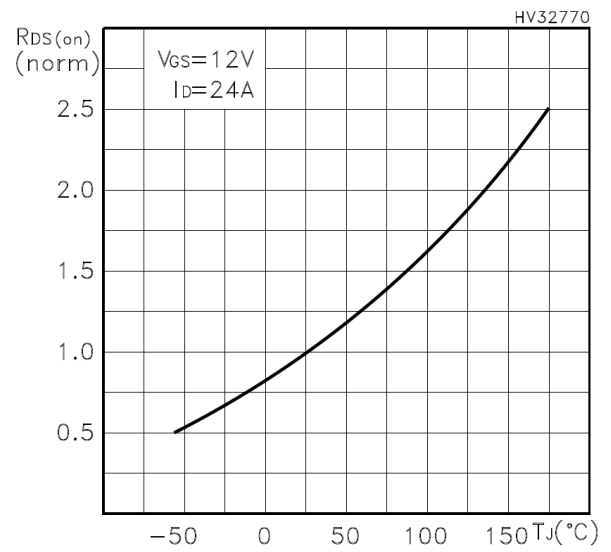
**Figure 10. Static drain-source on-resistance**



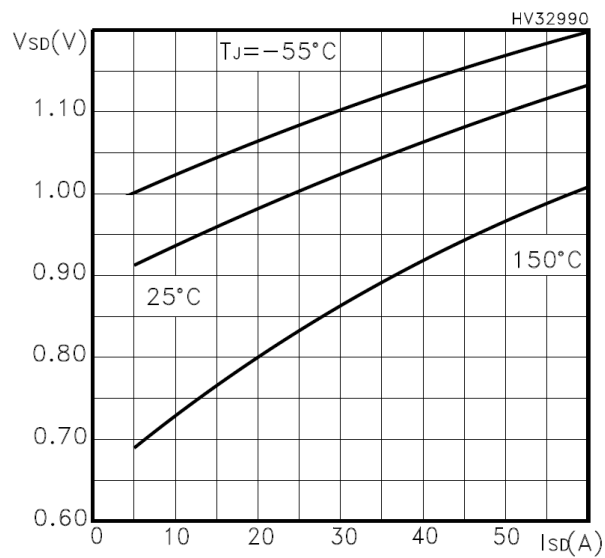
**Figure 11. Normalized gate threshold voltage vs temperature**



**Figure 12. Normalized on-resistance vs temperature**



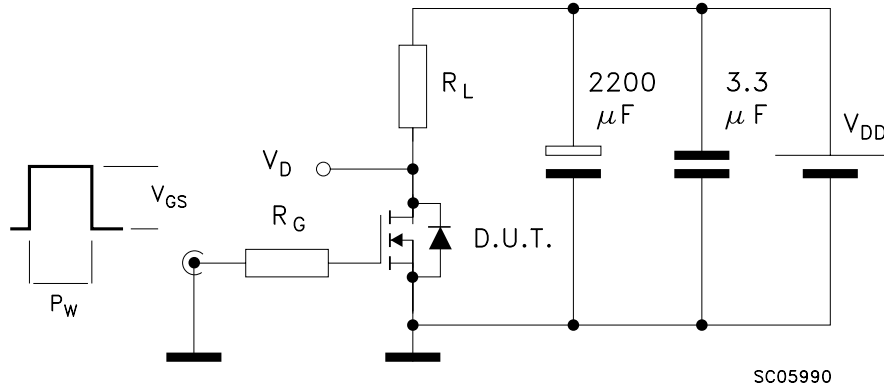
**Figure 13. Source drain-diode forward characteristics**





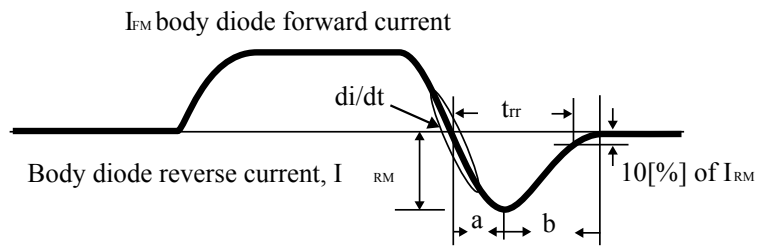
## 5 Test circuits

Figure 14. Switching times test circuit for resistive load



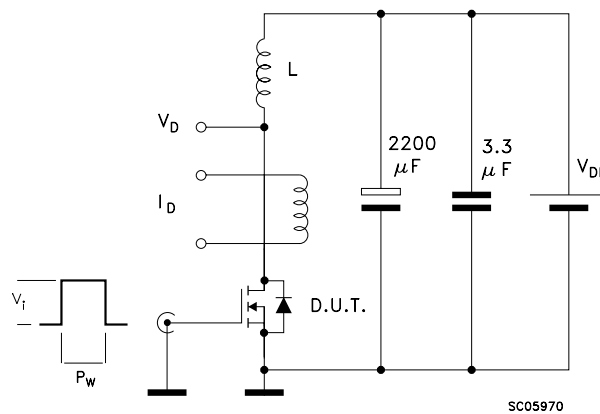
Note: Max driver  $V_{GS}$  slope = 1V/ns (no DUT)

Figure 15. Source drain diode waveform



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Figure 16. Unclamped inductive load test circuit (single pulse and repetitive)

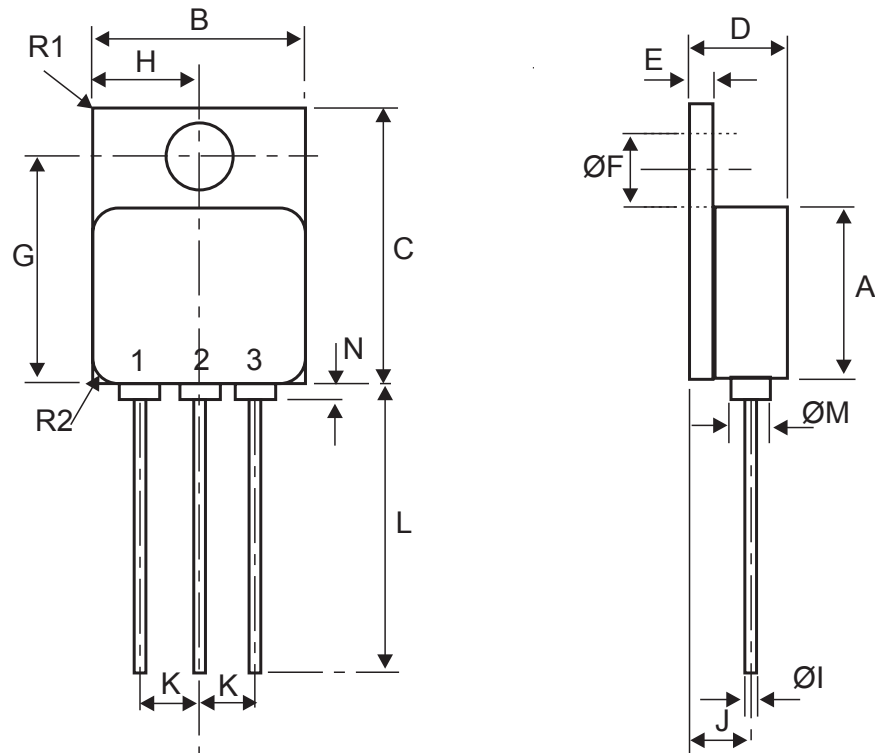


## 6 Package information

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.

### 6.1 TO-254AA package information

Figure 17. TO-254AA package outline



The TO-254-AA is a metallic package. It is not connected to any pin nor to the inside die.

0005824 rev13

**Table 7. TO-254AA package mechanical data**

Symbols	Dimensions (mm)			Dimension (inches)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	13.59		13.84	0.535		0.545
B	13.59		13.84	0.535		0.545
C	20.07		20.32	0.790		0.800
D	6.30		6.70	0.248		0.264
E	1.00		1.35	0.039		0.054
ØF	3.50		3.90	0.137		0.154
G	16.89		17.40	0.665		0.685
H		6.86			0.270	
ØI	0.89	1.14	2.00	0.035	0.045	0.079
J		3.81			0.150	
K		3.81			0.150	
L	12.95		14.50	0.510		0.571
ØM		3.05			0.120	
N			0.71			0.028
R1			1.00			0.039
R2		1.65			0.065	

## 7 Order codes

**Table 8. Ordering information**

Part number	Agency specification	Quality level	Radiation level	Package	Weight	Lead finish	Marking <sup>(1)</sup>	Packing
STRH100N10HY1		Engineering model	-	TO-254AA	10 g	Gold	STRH40P10HY1 + BeO	Strip pack
STRH100N10HYG	5205/021/01	ESCC flight	50 krad				520502501R + BeO	
STRH100N10HYT	5205/021/02		50 krad			Solder dip	520502502R + BeO	

1. Specific marking only. The full marking includes in addition: For the Engineering Models: ST logo, date code; country of origin (FR). For ESCC flight parts: ST logo, date code, country of origin (FR), ESA logo, serial number of the part within the assembly lot.

Contact ST sales office for information about specific conditions for products in die form.

## 8 Other information

### 8.1 Traceability information

Date code information is described in the table below.

**Table 9. Date codes**

Model	Date code <sup>(1)</sup>
EM	3yywwN
ESCC	yywwN

1. yy = year, ww = week number, N = lot index in the week.

### 8.2 Documentation

**Table 10. Documentation provided for each type of product**

Quality level	Radiation level	Documentation
Engineering model	-	Certificate of conformance
ESCC	50 krad	Certificate of conformance ESCC qualification maintenance lot reference Radiation data at 25 / 50 krad at 0.1 rad / s.

## Revision history

**Table 11. Document revision history**

Date	Version	Changes
13-May-2010	1	First release.
14-Jun-2010	2	Updated Table 1: Device summary.
18-Oct-2010	3	Updated Table 1, 5, 9 and 14.
23-Dec-2010	4	Updated Figure 2: Single event effect, SOA. and TO-254AA mechanical data.
25-Jul-2011	5	Updated order codes in Table 1: Device summary and Table 14: Ordering information. Minor text changes.
09-Nov-2011	6	Updated dynamic values on Table 6: Pre-irradiation dynamic, Table 7: Switching times (pre-irradiation) and Table 8: Source drain diode (pre-irradiation).
31-May-2013	7	Updated Table 1, Table 12, Table 14, Figure 2 and Section 7: Order codes. Minor text changes in Section 3: Radiation characteristics.
09-Apr-2014	8	Modified: Figure 2. Minor text changes.
17-Dec-2015	9	Updated features in cover page. Updated Table 5, Table 8, Table 9, Table 10, Table 11 and Table 15.
06-Apr-2016	10	Updated Table 8: Source drain diode (pre-irradiation). Minor text changes.
19-Jan-2021	11	Updated Product summary, <a href="#">Table 1</a> , <a href="#">Table 4</a> , <a href="#">Table 5</a> , <a href="#">Table 6</a> , <a href="#">Table 8</a> and <a href="#">Table 10</a> . Minor text changes.

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