STRH40N25FSY3

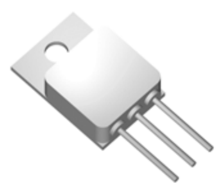
N-channel 250V - 0.084Ω - TO-254AA
Rad-hard low gate charge STripFET™ Power MOSFET

PRELIMINARY DATA

Features

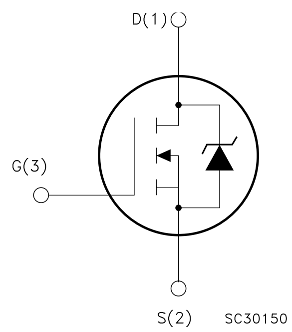
Type	V_{DSS}
STRH40N25FSY3	250V

- Low $R_{DS(on)}$
- Fast switching
- Single event effect (SEE) hardened
- Low total gate charge
- Light weight
- 100% avalanche tested
- Application oriented characterization
- Hermetically sealed
- Heavy ion SOA
- 100kRad TID
- SEL & SEGR with 34Mev/cm²/mg LET ions



TO-254AA

Internal schematic diagram



Description

This Power MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to improve immunity to space effect. It is therefore suitable as power switch in mainly high-efficiency DC-DC converters and Motor Control applications. It is also intended for any application with low gate charge drive requirements.

Applications

- Satellite
- High reliability applications

Order codes

Part number	Marking	Package	Packaging
STRH40N25FSY1 (1)	RH40N25FSY1	TO-254AA	Individual strip pack
STRH40N25FSY3 (2)	RH40N25FSY3	TO-254AA	Individual strip pack

1. Mil temp range
2. Space flights parts (full ESA flow screening)

Contents

1 Electrical ratings

Table 1. Absolute maximum ratings (pre-irradiation)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	250	V
V_{GS}	Gate-source voltage	±16	V
I_D (1)	Drain current (continuous) at T_C= 25°C	36	A
I_D (1)	Drain current (continuous) at T_C= 100°C	23	A
I_{DM} (2)	Drain current (pulsed)	144	A
P_{TOT} (1)	Total dissipation at T_C= 25°C	278	W
dv/dt (3)	Peak diode recovery voltage slope	4	V/ns
T_{stg}	Storage temperature	-55 to 150	°C
T_j	Max. operating junction temperature	150	°C

1. Rated according to the Rthj-case
2. Pulse width limited by safe operating area
3. $I_{SD} \leq$ 40A, di/dt $\leq$ 400A/µs, V_{DD} = 80% $V_{(BR)DSS}$

Table 2. Thermal data

Symbol	Parameter	Value	Unit
Rthj-case	Thermal resistance junction-case	0.45	°C/W
Rthc-s	Case-to-sink	0.21	°C/W
Rthj-amb	Thermal resistance junction -amb	48	°C/W

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj Max)	40	A
E_{AS}	Single pulse avalanche energy (starting Tj=25°C, Id=Iar, Vdd=50V)	320	mJ
E_{AR}	Repetitive avalanche	25	mJ

2 Electrical characteristics

(T_{CASE} = 25°C unless otherwise specified)

2.1 Pre-irradiation

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	80% BV_{Dss}			10	µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±16V			±100	nA
BV_{DSS}	Drain-to-source breakdown voltage	I_D = 1mA, V_{GS} = 0V	250			V
$V_{GS(th)}$	Gate threshold voltage	V_{DS} =V_{GS}, I_D = 1mA	2		4.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 12V, I_D = 20A		0.084	0.1	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} = 0V, f=1MHz, V_{GS}=12V		9100 650 45		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-to-source charge Gate-to-drain ("Miller") charge	V_{DD} = 200V, I_D = 40A, V_{GS}=12V		202 34 58	280 47 80	nC nC nC
R_G	Gate input resistance	f=1MHz Gate DC Bias=0 Test signal level=20mV open drain		1.4	3	Ω

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} = 125V, I_D =40 A, R_G = 4.7Ω, V_{GS} = 12V		33 80 123 145		ns ns ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD} I_{SDM} (1)	Source-drain current Source-drain current (pulsed)				36 144	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 40A, V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 40A, di/dt = 100A/µs V_{DD}= 50V, Tj = 150°C		484 8.4 35		ns µC A

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

2.2 Post-irradiation

The ST Rad-Hard Power MOSFETs are tested to verify the radiation capability. The technology is extremely resistant to assurance well functioning of the device inside the radiation environments. Every manufacturing lot is tested for total ionizing dose.

(@Tj=25°C up to 100Krad [a])

Table 8. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	80% BV_{Dss}			10	µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±16V			±100	nA
BV_{DSS}	Drain-to-source breakdown voltage	I_D = 1mA, V_{GS} = 0V	250			V
$V_{GS(th)}$	Gate threshold voltage	V_{DS} =V_{GS}, I_D = 1mA	2		4.5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 12V, I_D = 20A		0.084	0.1	Ω

a. According to ESCC 22900 specification, Co60 gamma rays, dose rags:0.1rad/sec.

Table 9. Single event effect, SOA[1]

Ion	Let (Mev/(mg/cm2))	Energy (MeV)	Range (µm)	V_{DS} (V) @V_{GS}0V
Kr	34	316	43	250
Xe	55.9	459	43	244

1. Rad-Hard Power MOSFETs have been characterized in heavy ion environment for single event effect (SEE). Single event effect characterization is illustrated

Table 10. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD} I_{SDM} [1]	Source-drain current Source-drain current (pulsed)				36 144	A A
V_{SD} [2]	Forward on voltage	I_{SD} = 40A, V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 40A, di/dt = 100A/µs V_{DD}= 50V, Tj = 150°C		484 8.4 35		ns µC A

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

2.3 Electrical characteristics (curves)

Figure 1. Safe operating area

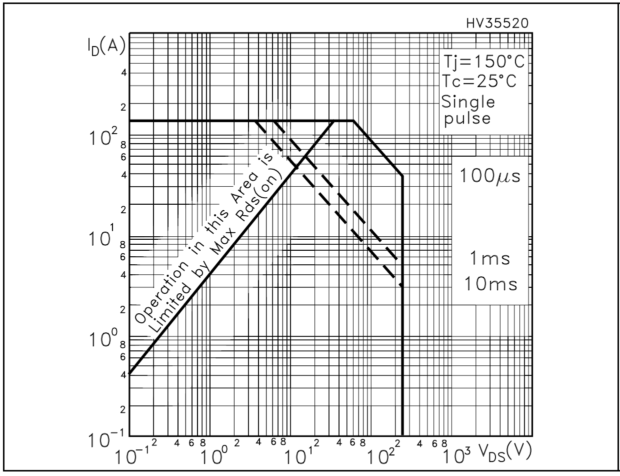


Figure 2. Thermal impedance

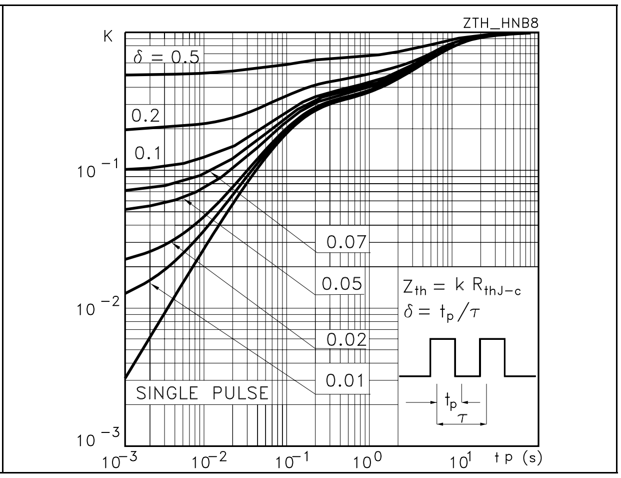


Figure 3. Output characteristics

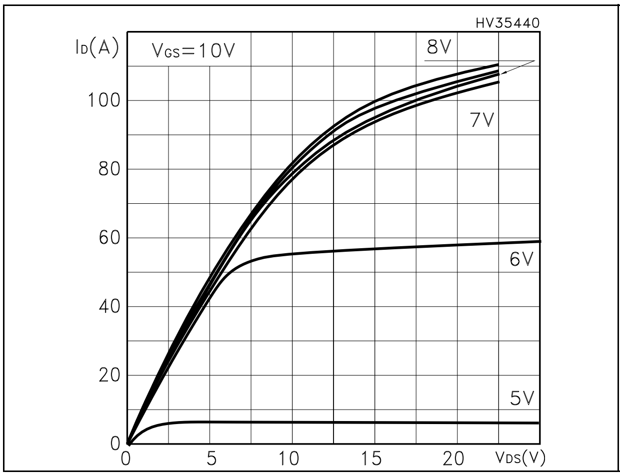


Figure 4. Transfer characteristics

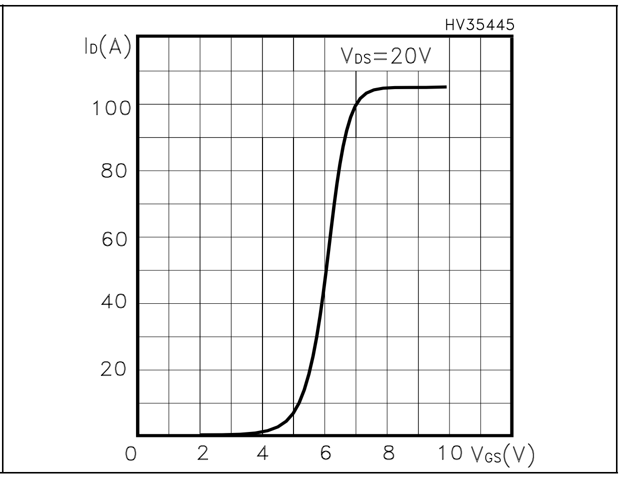


Figure 5. Gate charge vs. gate-source voltage

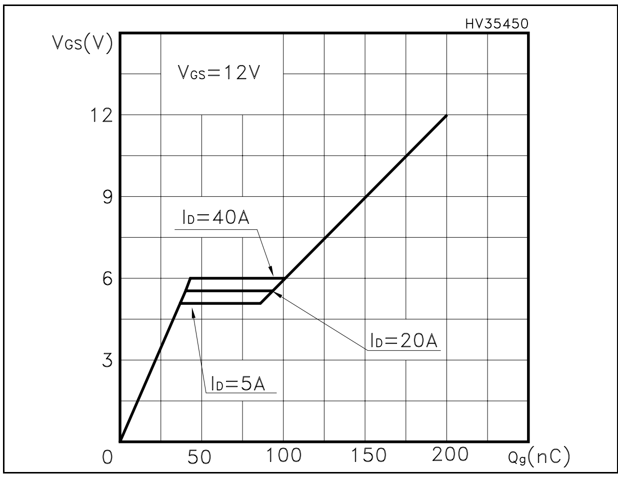


Figure 6. Capacitance variations

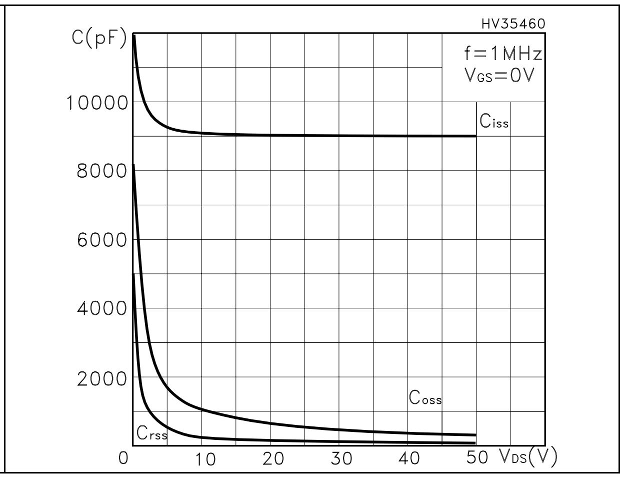


Figure 7. Normalized BV_{DSS} vs. temperature

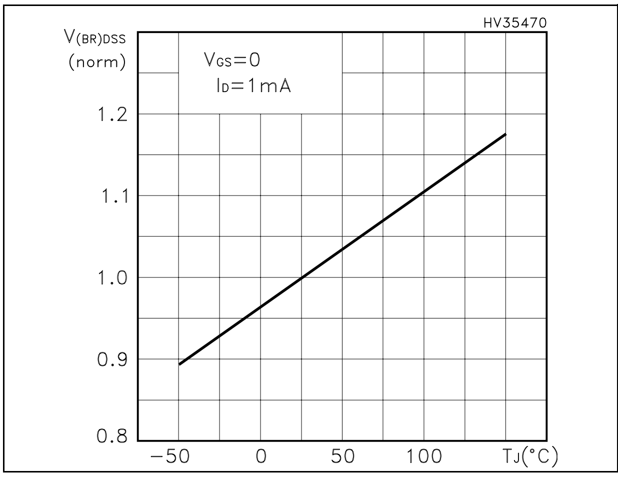


Figure 8. Static drain-source on resistance

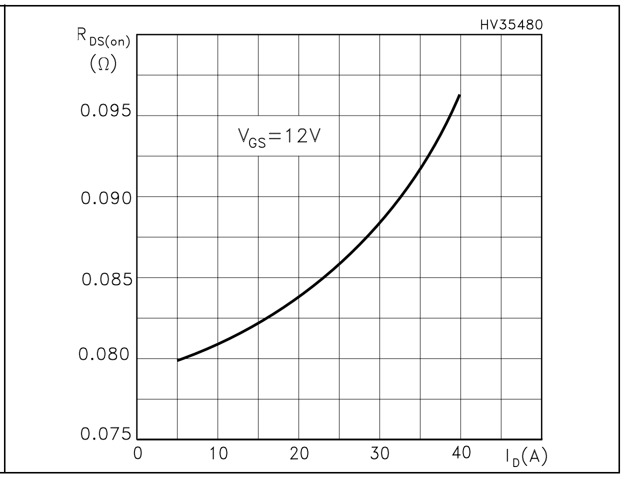


Figure 9. Normalized gate threshold voltage vs. temperature

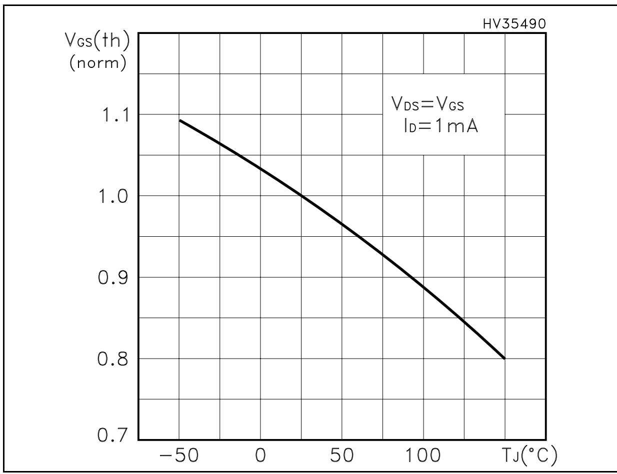


Figure 10. Normalized on resistance vs. temperature

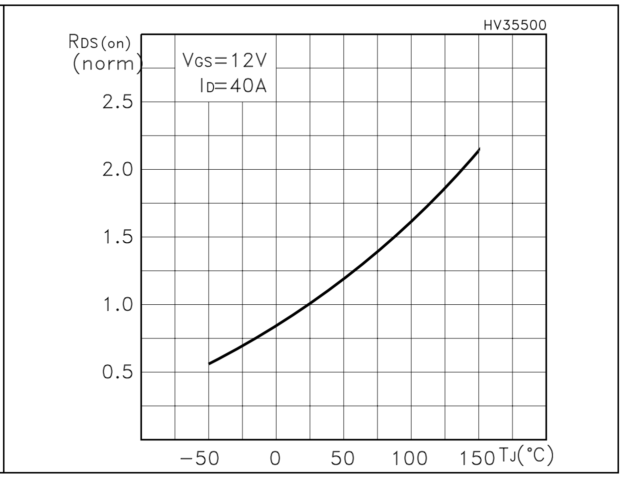
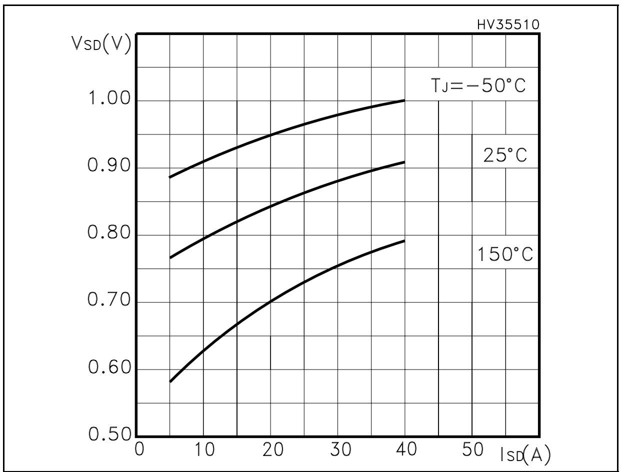
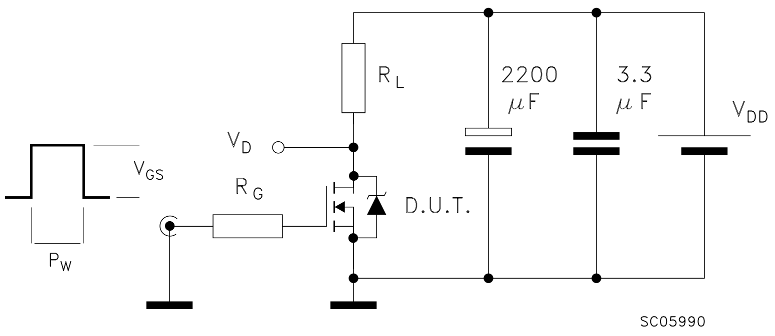


Figure 11. Source drain-diode forward characteristics



3 Test circuit

Figure 12. Switching times test circuit for resistive load (1)

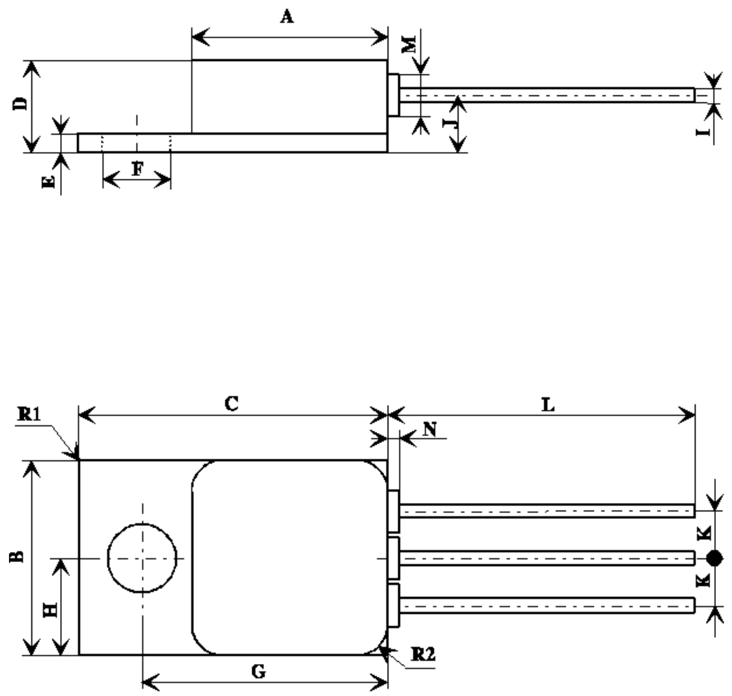


1. Max driver V_{GS} slope = 1V/ns (no DUT)

4 Package mechanical data

TO-254AA MECHANICAL DATA

DIM.	mm.			inch		
	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		0.80
D	6.32		6.60	0.249		0.260
E	1.02		1.27	0.040		0.050
F	3.53		3.78	0.139		0.149
G	16.89		17.40	0.665		0.685
H		6.86			0.270	
I	0.89		1.14	0.035		0.045
J		3.81			0.150	
K		3.81			0.150	
L	12.95		14.50	0.510		0.570
M		3.05			0.120	
N			0.71			0.025
R1			1.0			0.040
R2		1.65			0.065	



5 Revision history

Table 11. Revision history

Date	Revision	Changes
18-Dec-2006	1	First release
02-Mar-2007	2	Some values changed on *Table 4* and *Table 8*