



STRH80P6FSY3

P-channel 60V - 0.021Ω - TO-254AA
Rad-hard low gate charge STripFET™ Power MOSFET

General features

Type	V _{DSS}
STRH80P6FSY3	60V

- 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

Description

This Power MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to sustain high TID and provide immunity to heavy ion effects. It is therefore suitable as power switch in mainly high-efficiency DC-DC converters. It is also intended for any application with low gate charge drive requirements.

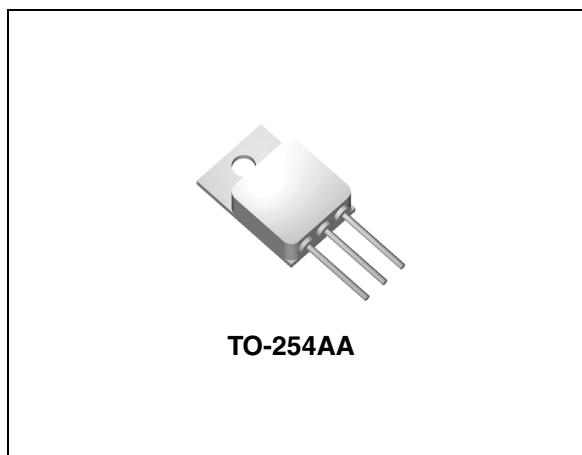
Application

- Satellite
- High reliability

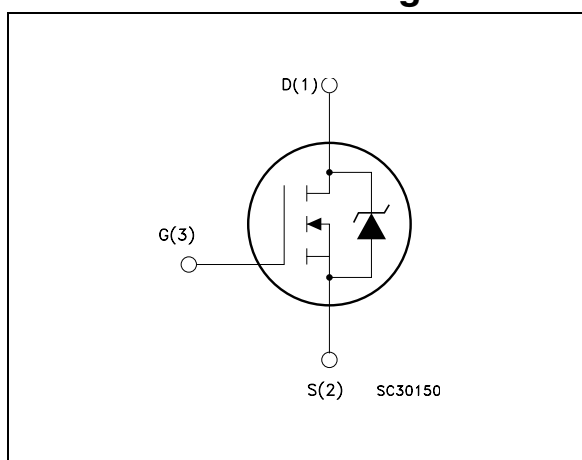
Order codes

Part number	Marking	Package	Packaging
STRH80P6FSY1 ⁽¹⁾	RH80P6FSY1	TO-254AA	Individual strip pack
STRH80P6FSY3 ⁽²⁾	RH80P6FSY3	TO-254AA	Individual strip pack

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



Internal schematic diagram



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1 Electrical ratings

Table 1. Absolute maximum ratings (pre-irradiation)

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	60	V
V_{GS}	Gate-source voltage	± 18	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	80	A
$I_D^{(1)}$	Drain current (continuous) at $T_C = 100^\circ\text{C}$	50	A
$I_{DM}^{(2)}$	Drain current (pulsed)	320	A
$P_{TOT}^{(1)}$	Total dissipation at $T_C = 25^\circ\text{C}$	250	W
$dv/dt^{(3)}$	Peak diode recovery voltage slope	2	V/ns
T_{stg}	Storage temperature	-55 to 150	$^\circ\text{C}$
T_j	Max. operating junction temperature	150	$^\circ\text{C}$

1. Rated according to the Rthj-case
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 80\text{A}$, $di/dt \leq 117\text{A}/\mu\text{s}$, $V_{DD} = 80\%V_{(BR)DSS}$

Table 2. Thermal data

Symbol	Parameter	Value	Unit
Rthj-case	Thermal resistance junction-case	0.5	$^\circ\text{C}/\text{W}$
Rthc-s	Case-to-sink	0.21	$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal resistance junction -amb	48	$^\circ\text{C}/\text{W}$

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j Max)	40	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 42\text{V}$)	2303	mJ
E_{AR}	Repetitive avalanche	50	mJ

Note: For the P-channel MOSFET actual polarity of voltages and current has to be reversed

2 Electrical characteristics

($T_{CASE} = 25^{\circ}C$ 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 ($V_{DS} = 0$)	$V_{GS} = \pm 18V$			± 100	nA
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu A, V_{GS} = 0V$	100			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	$V_{GS} = 12V, I_D = 40A$		0.021	0.024	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	$V_{DS} = 25V, f=1MHz,$ $V_{GS}=0V$		8500 1521 640		pF pF pF
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 30V, I_D = 40A,$ $V_{GS}=12V$		291 30 66	405 42 92	nC nC nC
R_G	Gate input resistance	$f=1MHz$ Gate DC Bias=0 Test signal level=20mV open drain		1.2	2.5	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	$V_{DD} = 30V, I_D = 80A,$ $R_G = 4.7\Omega, V_{GS} = 12V$		32 214 182 115		ns ns ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD}	Source-drain current				80	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				320	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 80A, V_{GS} = 0$			1.1	V
t_{rr}	Reverse recovery time	$I_{SD} = 80A, di/dt = 100A/\mu s$ $V_{DD} = 20V, T_j = 25^\circ C$		350		ns
Q_{rr}	Reverse recovery charge			5.4		μC
I_{RRM}	Reverse recovery current			31		A
t_{rr}	Reverse recovery time	$I_{SD} = 80A, di/dt = 100A/\mu s$ $V_{DD} = 20V, T_j = 150^\circ C$		460		ns
Q_{rr}	Reverse recovery charge			9		μC
I_{RRM}	Reverse recovery current			39		A

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

(@ $T_j=25^\circ C$ 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 ($V_{DS} = 0$)	$V_{GS} = \pm 18V$			± 100	nA
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu A, V_{GS} = 0V$	100			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	$V_{GS} = 12V, I_D = 40A$		0.021	0.024	Ω

- a. According to ESCC 22900 specification, Co60 gamma rays, dose rate: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	60
Xe	55.9	459	43	48

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}	Source-drain current				80	A
I _{SDM} ⁽¹⁾	Source-drain current (pulsed)				320	A
V _{SD} ⁽²⁾	Forward on voltage	I _{SD} = 80A, V _{GS} = 0			1.1	V
t _{rr}	Reverse recovery time	I _{SD} = 80A, di/dt = 100A/µs V _{DD} = 20V, T _j = 25°C		350		ns
Q _{rr}	Reverse recovery charge		5.4		µC	
I _{RRM}	Reverse recovery current		31		A	
t _{rr}	Reverse recovery time	I _{SD} = 80A, di/dt = 100A/µs V _{DD} = 20V, T _j = 150°C		460		ns
Q _{rr}	Reverse recovery charge		9		µC	
I _{RRM}	Reverse recovery current		39		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

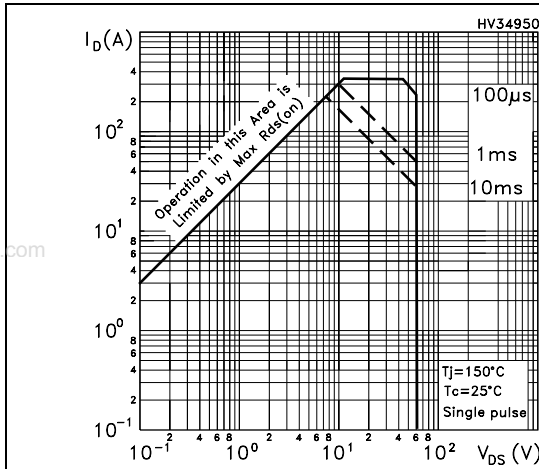


Figure 2. Thermal impedance

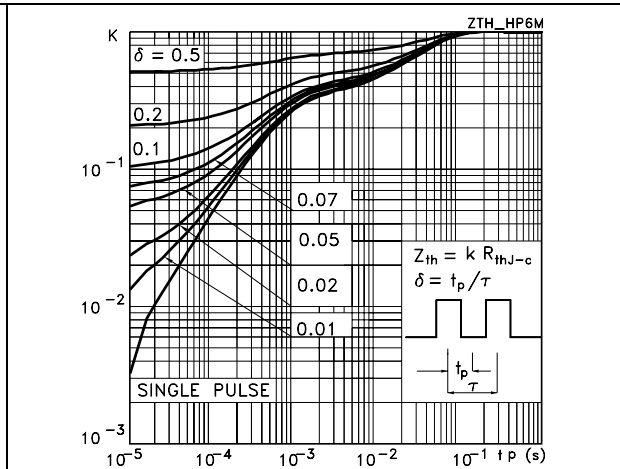


Figure 3. Output characteristics

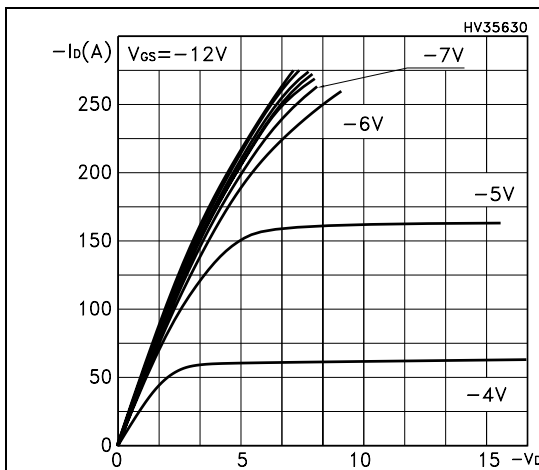


Figure 4. Transfer characteristics

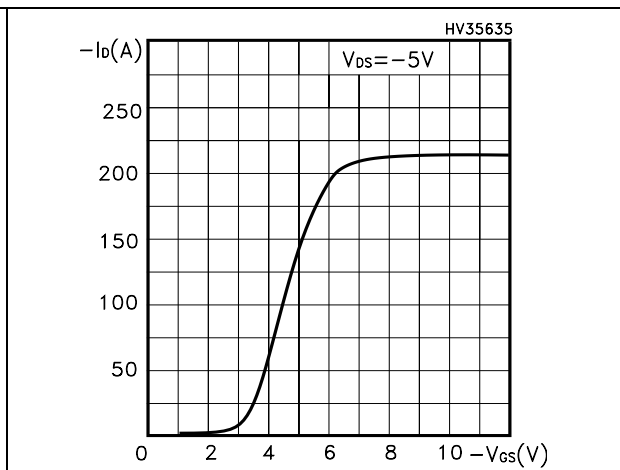


Figure 5. Gate charge vs gate-source voltage

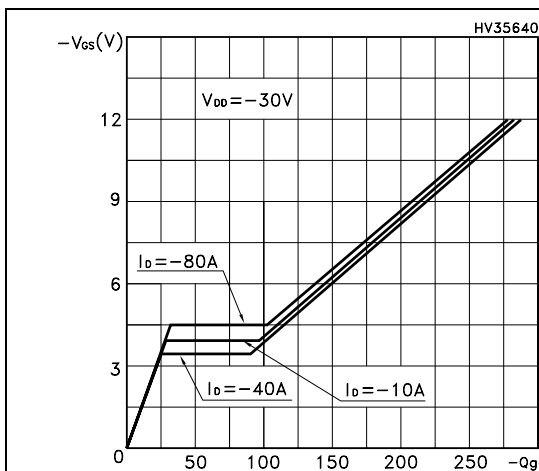


Figure 6. Capacitance variations

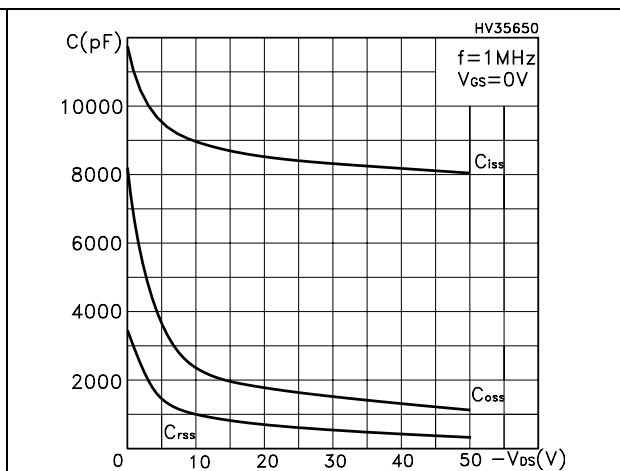


Figure 7. Normalized BV_{DSS} vs temperature Figure 8. Static drain-source on resistance

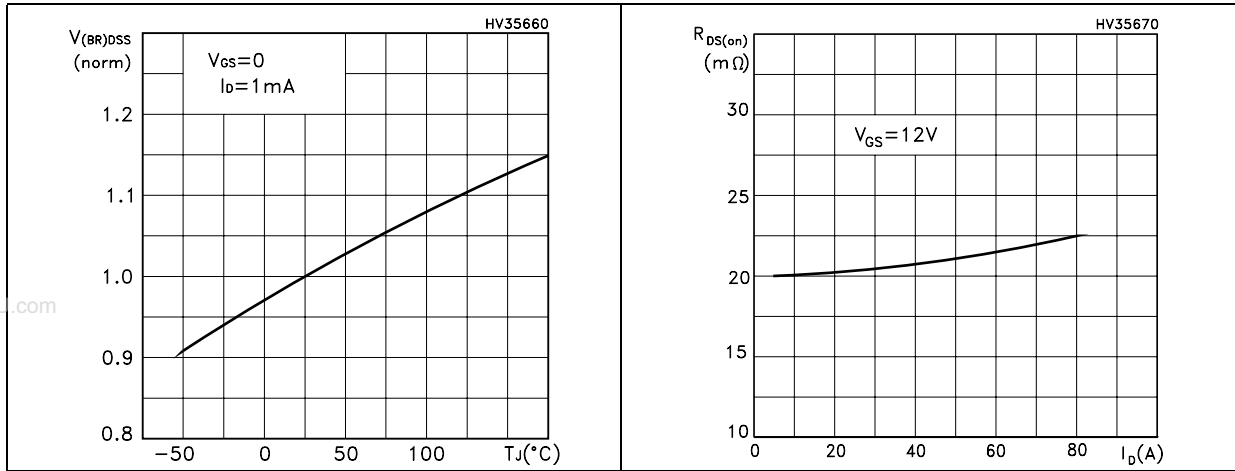


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

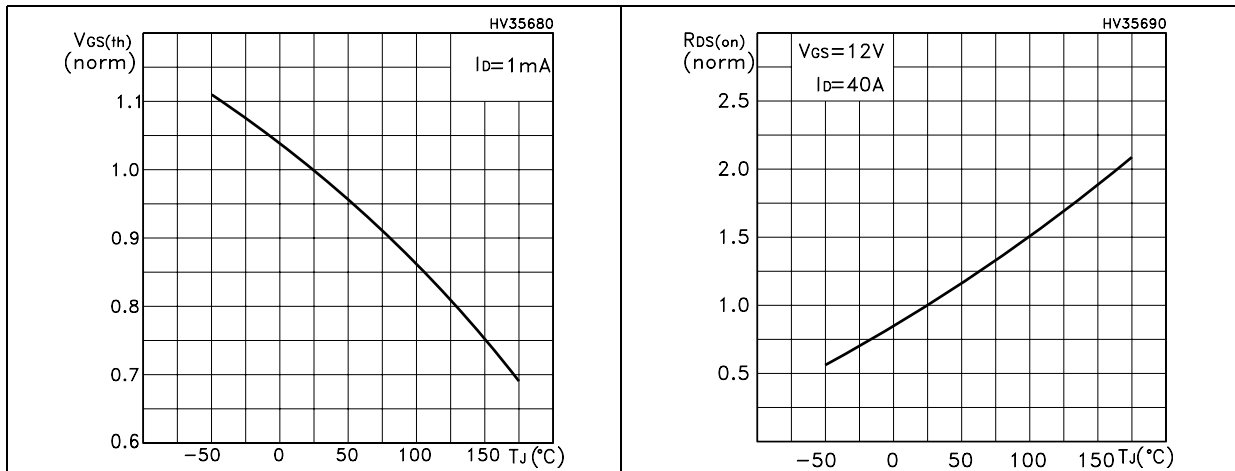
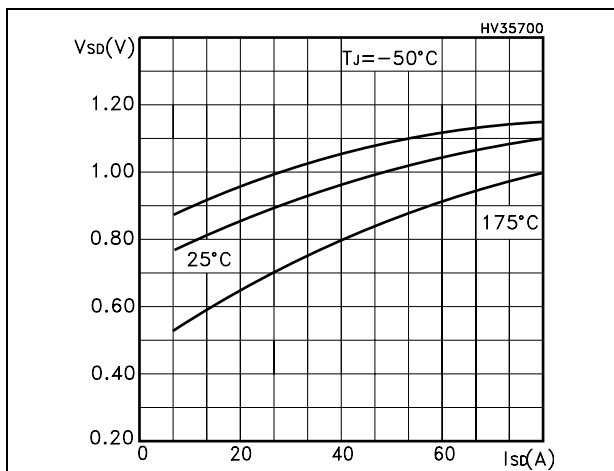
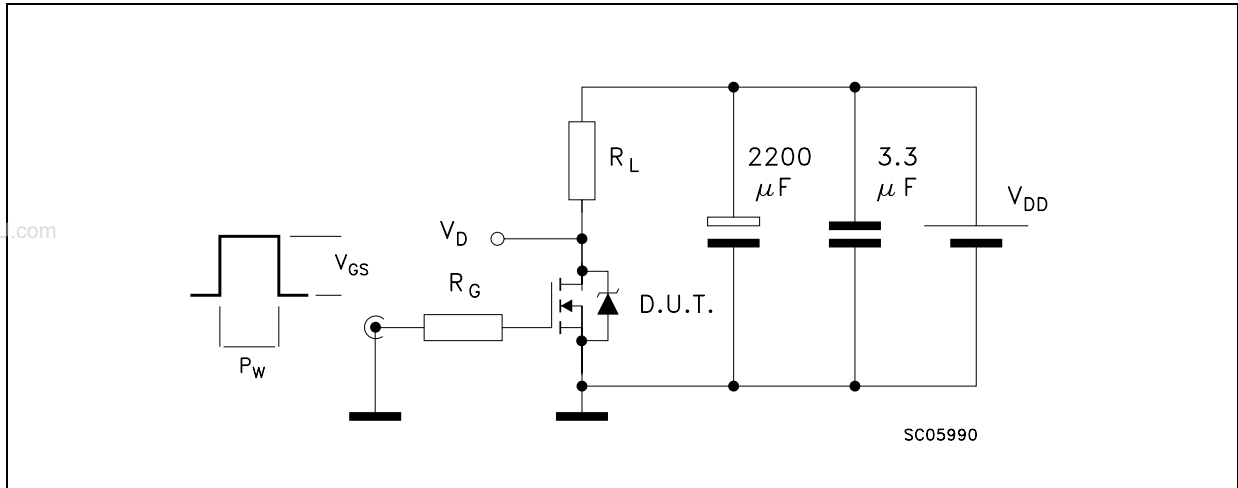


Figure 11. Source drain-diode forward characteristics



3 Test circuit

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

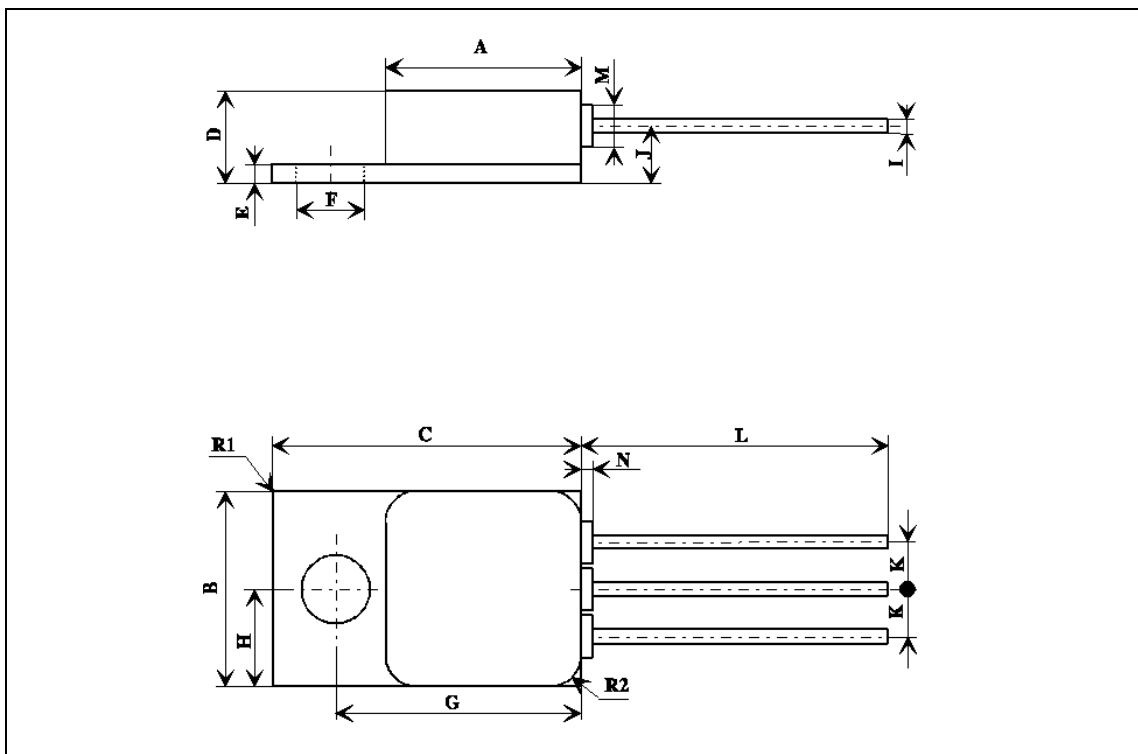


1. Max driver V_{GS} slope = 1V/ns (no DUT)

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
19-Mar-2007	2	Complete version

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