HARRIS SEMICONDUCTOR

2N7273D, 2N7273R 2N7273H

Radiation Hardened N-Channel Power MOSFETs

REGISTRATION PENDING
Currently Available as FRS130 (D, R, H)

January 1993

T-39-11

Features

- 12A, 100V, RDS(on) = 0.195Ω
- Second Generation Rad Hard MOSFET Results From New Design Concepts
- Gamma
  - Meets Pre-Rad Specifications to 100KRAD(Si)
  - Defined End Point Specs at 300KRAD(Si) and 1000KRAD(Si)
  - Performance Permits Limited Use to 3000KRAD(Si)
- Gamma Dot
  - Survives 3E9RAD(Si)/sec at 80% BVDSS Typically
  - Survives 2E12 Typically If Current Limited to IDM
- Photo Current - 1.5nA Per-RAD(Si)/sec Typically
- Neutron
  - Pre-RAD Specifications for 3E13 Neutrons/cm^2
  - Usable to 3E14 Neutrons/cm^2
- Single Event - Typically Survives 1E5Ions/cm^2 Having an LET ≤ 35MeV/mg/cm^2 and a Range ≥ 30µm at 80% BVDSS

Description

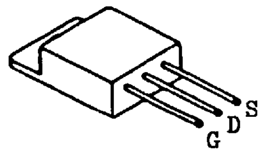
The Harris Semiconductor Sector has designed a series of SECOND GENERATION hardened power MOSFETs of both N and P channel enhancement types with ratings from 100V to 500V, 1A to 60A, and on resistance as low as 25mΩ. Total dose hardness is offered at 100K RAD(Si) and 1000KRAD(Si) with neutron hardness ranging from 1E13n/cm^2 for 500V product to 1E14n/cm^2 for 100V product. Dose rate hardness (GAMMA DOT) exists for rates to 1E9 without current limiting and 2E12 with current limiting. Heavy ion survival from signal event drain burn-out exists for linear energy transfer (LET) of 35 at 80% of rated voltage.

This MOSFET is an enhancement-mode silicon-gate power field effect transistor of the vertical DMOS (VDMOS) structure. It is specially designed and processed to exhibit minimal characteristic changes to total dose (GAMMA) and neutron (n^o) exposures. Design and processing efforts are also directed to enhance survival to heavy ion (SEE) and/or dose rate (GAMMA DOT) exposure.

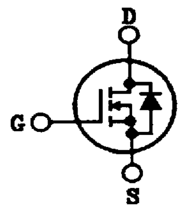
This part may be supplied as a die or in various packages other than shown above. Reliability screening is available as either non TX (commercial), TX equivalent of MIL-S-19500, TXV equivalent of MIL-S-19500, or space equivalent of MIL-S-19500. Contact the Harris Semiconductor High-Reliability Marketing group for any desired deviations from the data sheet.

Package

TO-257AA



Symbol



Absolute Maximum Ratings (TC = +25°C) Unless Otherwise Specified

		2N7273D, R, H	UNITS
Drain-Source Voltage	VDS	100	V
Drain-Gate Voltage (RGS = 20kΩ)	VDGR	100	V
Continuous Drain Current			
TC = +25°C	ID	12	A
TC = +100°C	ID	7	A
Pulsed Drain Current	IDM	36	A
Gate-Source Voltage	VGS	±20	V
Maximum Power Dissipation			
TC = +25°C	PT	50	W
TC = +100°C	PT	20	W
Derated Above +25°C		0.40	W/°C
Inductive Current, Clamped, L = 100µH, (See Test Figure)	ILM	36	A
Continuous Source Current (Body Diode)	IS	12	A
Pulsed Source Current (Body Diode)	ISM	36	A
Operating And Storage Temperature	TJC, TSTG	-55 to +150	°C
Lead Temperature (During Soldering)			
Distance > 0.063 in. (1.6mm) From Case, 10s Max	TL	300	°C

CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper I.C. Handling Procedures.

File Number 3219

Specifications 2N7273D, 2N7273R, 2N7273H - Registration Pending

Pre-Radiation Electrical Specifications TC = +25°C, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS	LIMITS MIN	LIMITS MAX	UNITS
Drain-Source Breakdown Volts	BVDSS	VGS = 0, ID = 1mA	100	-	V
Gate-Threshold Volts	VGS(th)	VDS = VGS, ID = 1mA	2.0	4.0	V
Gate-Body Leakage Forward	IGSSF	VGS = +20V	-	100	nA
Gate-Body Leakage Reverse	IGSSR	VGS = -20V	-	100	nA
Zero-Gate Voltage Drain Current	IDSS1 IDSS2 IDSS3	VDS = 100V, VGS = 0 VDS = 80V, VGS = 0 VDS = 80V, VGS = 0, TC = +125°C	- - -	1 0.025 0.25	mA
Rated Avalanche Current	IAR	Time = 20µs	-	36	A
Drain-Source On-State Volts	VDS(on)	VGS = 10V, ID = 12A	-	2.46	V
Drain-Source On Resistance	RDS(on)	VGS = 10V, ID = 7A	-	0.195	Ω
Turn-On Delay Time	td(on)	VDD = 50V, ID = 12A	-	44	ns
Rise Time	tr	Pulse Width = 3µs	-	428	
Turn-Off Delay Time	td(off)	Period = 300µs, Rg = 25Ω	-	128	
Fall Time	tf	0 ≤ VGS ≤ 10 (See Test Circuit)	-	108	
Gate-Charge Threshold	QG(th)	VDD = 50V, ID = 12A IGS1 = IGS2 0 ≤ VGS ≤ 20	1	4	nc
Gate-Charge On State	QG(on)		18	72	
Gate-Charge Total	QGM		33	134	
Plateau Voltage	VGP		3	14	V
Gate-Charge Source	QGS		3	14	nc
Gate-Charge Drain	QGD		9	38	
Diode Forward Voltage	VSD	ID = 12A, VGD = 0	0.6	1.8	V
Reverse Recovery Time	TT	I = 12A; dI/dt = 100A/µs	-	600	ns
Junction-To-Case	Rθjc		-	2.5	°C/W
Junction-To-Ambient	Rθja	Free Air Operation	-	60	

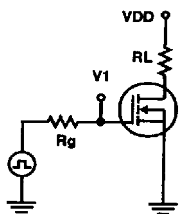


FIGURE 1. SWITCHING TIME TESTING

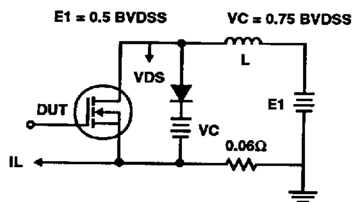


FIGURE 2. CLAMPED INDUCTIVE SWITCHING, ILM

Post-Radiation Electrical Specifications

TC = +25°C, Unless Otherwise Specified

PARAMETER		SYMBOL	TYPE	TEST CONDITIONS	LIMITS MIN	LIMITS MAX	UNITS
Drain-Source Breakdown Volts	(Note 4, 6)	BVDSS	2N7273D, R	VGS = 0, ID = 1mA	100	-	V
	(Note 5, 6)	BVDSS	2N7273H	VGS = 0, ID = 1mA	95	-	V
Gate-Source Threshold Volts	(Note 4, 6)	VGS(th)	2N7273D, R	VGS = VDS, ID = 1mA	2.0	4.0	V
	(Note 3, 5, 6)	VGS(th)	2N7273H	VGS = VDS, ID = 1mA	1.5	4.5	V
Gate-Body Leakage Forward	(Note 4, 6)	IGSSF	2N7273D, R	VGS = 20V, VDS = 0	-	100	nA
	(Note 5, 6)	IGSSF	2N7273H	VGS = 20V, VDS = 0	-	200	nA
Gate-Body Leakage Reverse	(Note 2, 4, 6)	IGSSR	2N7273D, R	VGS = -20V, VDS = 0	-	100	nA
	(Note 2, 5, 6)	IGSSR	2N7273H	VGS = -20V, VDS = 0	-	200	nA
Zero-Gate Voltage Drain Current	(Note 4, 6)	IDSS	2N7273D, R	VGS = 0, VDS = 80V	-	25	µA
	(Note 5, 6)	IDSS	2N7273H	VGS = 0, VDS = 80V	-	100	µA
Drain-Source On-State Volts	(Note 1, 4, 6)	VDS(on)	2N7273D, R	VGS = 10V, ID = 12A	-	2.46	V
	(Note 1, 5, 6)	VDS(on)	2N7273H	VGS = 16V, ID = 12A	-	3.69	V
Drain-Source On Resistance	(Note 1, 4, 6)	RDS(on)	2N7273D, R	VGS = 10V, ID = 7A	-	0.195	Ω
	(Note 1, 5, 6)	RDS(on)	2N7273H	VGS = 14V, ID = 7A	-	0.293	Ω

NOTES:

1. Pulse test, 300µs max
2. Absolute value
3. Gamma = 300KRAD(Si)
4. Gamma = 10KRAD(Si) for "D", 100KRAD(Si) for "R". Neutron = 3E13
5. Gamma = 1000KRAD(Si). Neutron = 3E13
6. Insitu Gamma bias must be sampled for both VGS = +10V, VDS = 0V and VGS = 0V, VDS = 80% BVDSS
7. Gamma data taken 4/17/90 on TA 17631 devices by GE ASTRO SPACE; EMC/SURVIVABILITY LABORATORY; KING OF PRUSSIA, PA 19401
8. Single event drain burnout testing by Titus, J.L., et al of NWSC, Crane, IN at Brookhaven Nat. Lab. Dec 11-14, 1989
9. Neutron derivation, HARRIS Application note AN-8831, Oct. 1988

Typical Performance Characteristics