

MSD4N40

400V N-Channel MOSFET

Description

The MSD4N40 is a N-channel enhancement-mode MOSFET , providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness. The TO-252 package is universally preferred for all commercial-industrial applications

Features

- Originative New Design
- 100% EAS Test
- Rugged Gate Oxide Technology
- Extremely Low Intrinsic Capacitances
- Remarkable Switching Characteristics
- Unequalled Gate Charge : 25 nC (Typ.)
- Extended Safe Operating Area
- Lower RDS(ON) : 0.78 Ω (Typ.) @VGS=10V
- RoHS compliant package

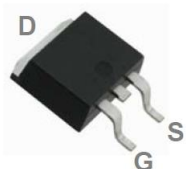
Application

- Low power battery chargers
- Switch mode power supply (SMPS)
- DC-AC converters.

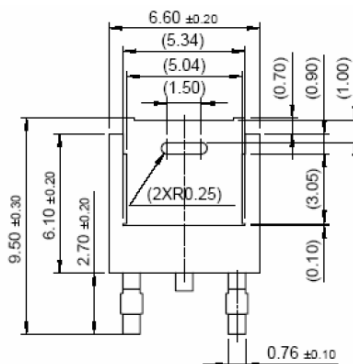
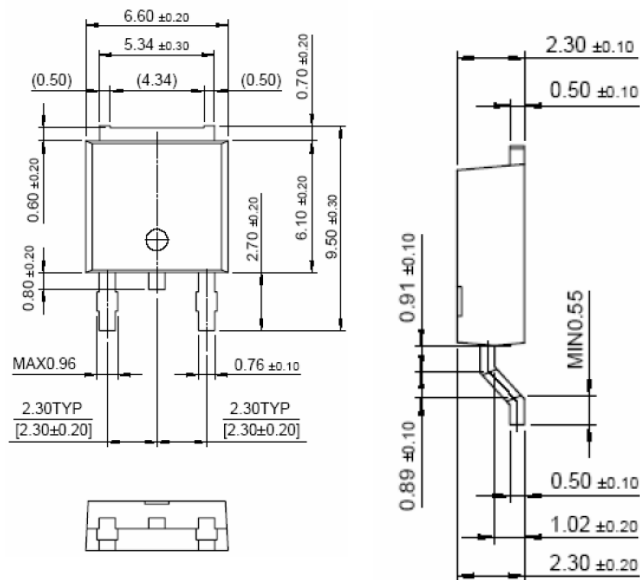
Packing & Order Information

Part No./ R : 2,500/Reel

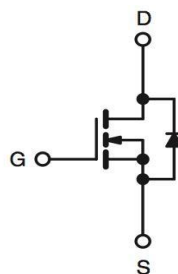
Part No./ T : 80/Tube , 4,000/Box



**RoHS
COMPLIANT**



Graphic symbol



MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings (Tc=25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
V _{DSS}	Drain-Source Voltage	400	V
V _{GS}	Gate-Source Voltage	±30	V
I _D	Continuous Drain Current (TC=25°C)	4.5	A
	Continuous Drain Current (Tc=100°C)	3.0	A

MSD4N40

400V N-Channel MOSFET

Absolute Maximum Ratings (T_c=25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
I _{DM}	Pulsed Drain Current	22	A
EAS	Single Pulsed Avalanche Energy	270	mJ
EAR	Repetitive Avalanche Energy	7.3	mJ
dV/dt	Peak Diode Recovery dV/dt	4.5	V/ns
P _D	Power Dissipation (T _C =25°C)	2.5	W
	- Derate above 25°C	0.38	W
T _J /T _{STG}	Operating Junction and Storage Temperature	-55 to +150	°C
T _L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	°C

- Drain current limited by maximum junction temperature

Thermal Resistance Characteristics (T_c=25°C unless otherwise noted)

Symbol	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case	--	1.72	°C/W
R _{θJA}	Junction-to- Ambient	--	83.3	

On Characteristics

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
V _{GS}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	2.0	--	4.0	V
R _{DS(ON)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 2.25 A	--	0.78	0.9	Ω

Off Characteristics

Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D =250μA	400	--	--	V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	--	0.54	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 400 V, V _{GS} = 0 V V _{DS} = 320 V, T _C = 125°C	--	--	1 10	μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30 V, V _{DS} = 0 V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30 V, V _{DS} = 0 V	--	--	-100	nA

MSD4N40

400V N-Channel MOSFET

Dynamic Characteristics						
Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
C_{ISS}	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ $F = 1.0\text{MHz}$	--	480	625	pF
C_{OSS}	Output Capacitance		--	80	105	pF
C_{RSS}	Reverse Transfer Capacitance		--	15	20	pF
$t_{d(on)}$	Turn-On Time	$V_{DS} = 200 \text{ V}, I_D = 4.5 \text{ A},$ $R_G = 25 \Omega$	--	15	35	ns
t_r	Turn-On Time		--	65	140	ns
$t_{d(off)}$	Turn-Off Delay Time		--	23	55	ns
t_f	Turn-Off Fall Time		--	40	85	ns
Q_g	Total Gate Charge	$V_{DS} = 320 \text{ V}, I_D = 4.5 \text{ A},$ $V_{GS} = 10 \text{ V}$	--	16	20	nC
Q_{gs}	Gate-Source Charge		--	2.3	--	nC
Q_{gd}	Gate-Drain Charge		--	8.5	--	nC

Source-Drain Diode Maximum Ratings and Characteristics						
Symbol	Parameter	Test Conditions	Min	Typ.	Max.	Units
I_S	Continuous Source-Drain Diode Forward Current		--	--	4.5	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	18	
V_{SD}	Source-Drain Diode Forward Voltage	$I_S = 4.5 \text{ A}, V_{GS} = 0 \text{ V}$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$I_S = 4.5 \text{ A}, V_{GS} = 0 \text{ V}$ $diF/dt = 100\text{A}/\mu\text{s}$	--	230	--	ns
Q_{rr}	Reverse Recovery Charge		--	1.7	--	μC

NOTE:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $I_{AS}=4.5\text{A}, V_{DD}=50\text{V}, R_G=25\Omega,$ Starting $T_J = 25^\circ\text{C}$
3. $I_{SD}\leq 4.5\text{A}, di/dt\leq 300\text{A}/\mu\text{s}, V_{DD}\leq BVDSS,$ Starting $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse Width $\leq 300\mu\text{s},$ Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature

MSD4N40

400V N-Channel MOSFET

■ Characteristics Curve

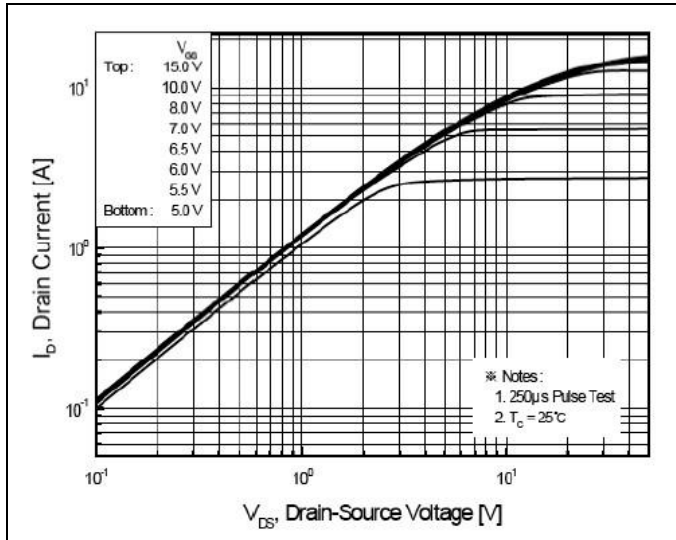


FIG.1-ON REGION CHARACTERISTICS

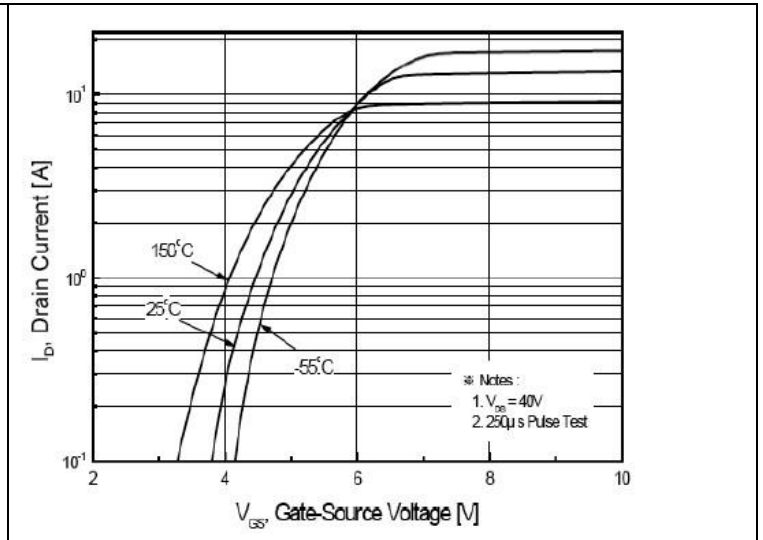


FIG.2-TRANSFER CHARACTERISTICS

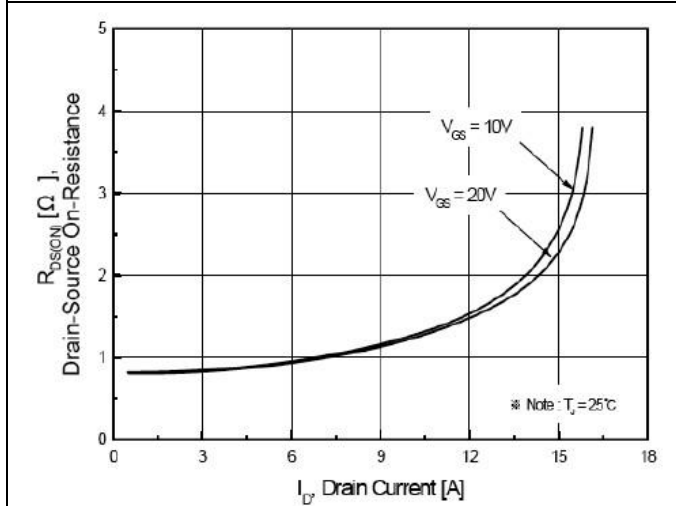


FIG.3-ON RESISTANCE VARIATION VS DRAIN CURRENT AND GATE VOLTAGE

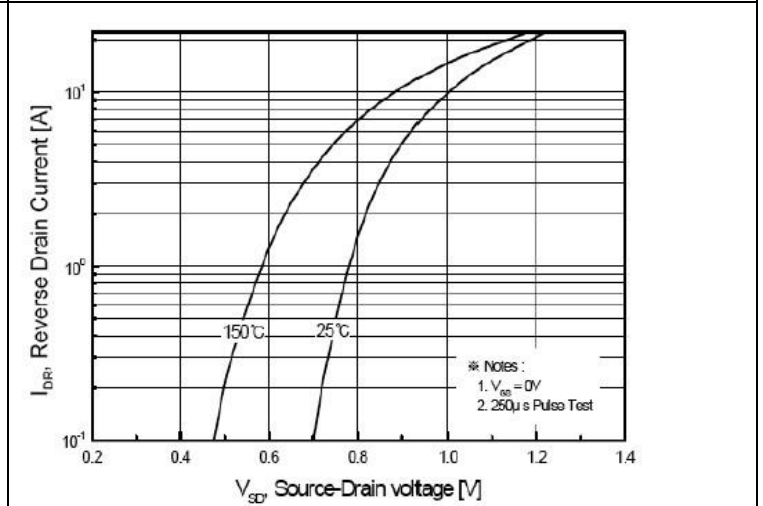


FIG.4-BODY DIODE FORWARD VOLTAGE VARIATION WITH SOURCE CURRENT AND TEMPERATURE

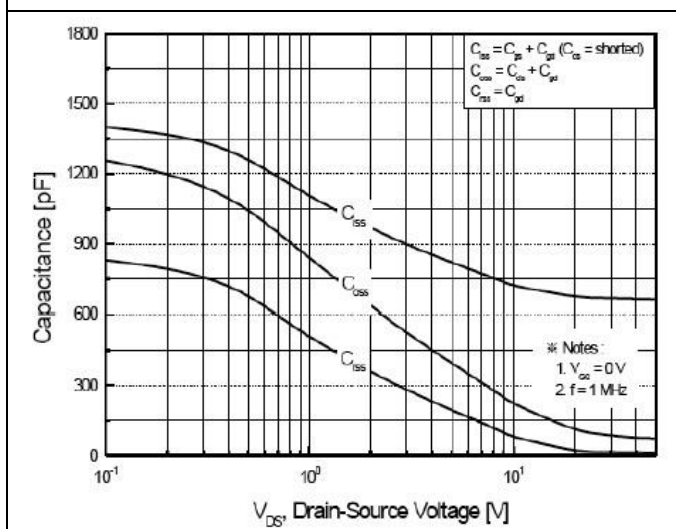


FIG.5-CAPACITANCE CHARACTERISTICS

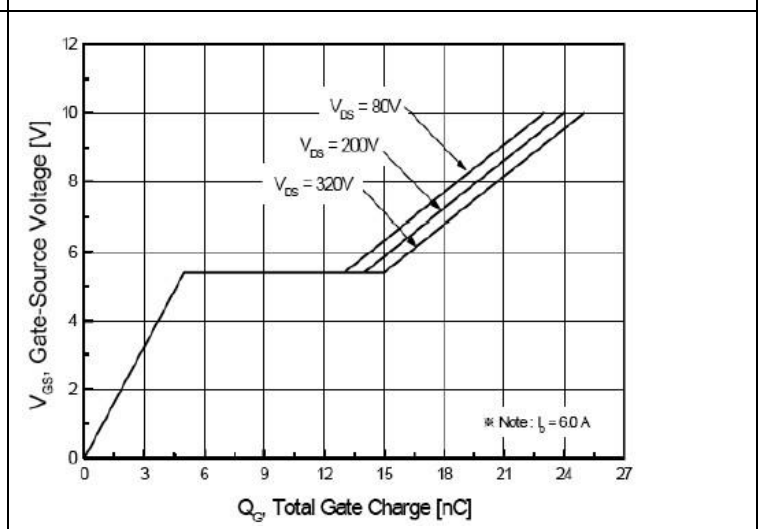


FIG.6-GATE CHARGE CHARACTERISTICS

MSD4N40

400V N-Channel MOSFET

■ Characteristics Curve

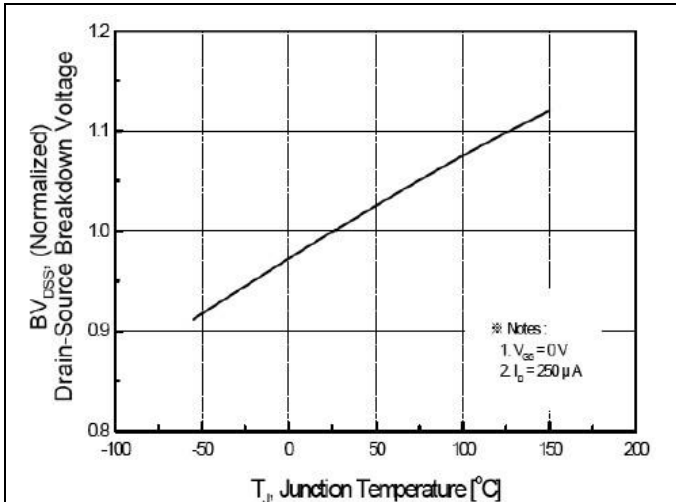


FIG. 7-BREAKDOWN VOLTAGE VARIATION VS TEMPERATURE

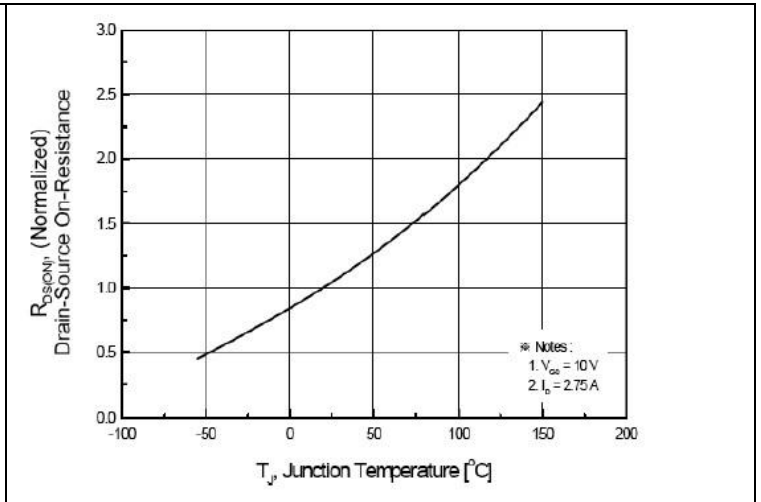


FIG. 8-ON-RESISTANCE VARIATION VS TEMPERATURE

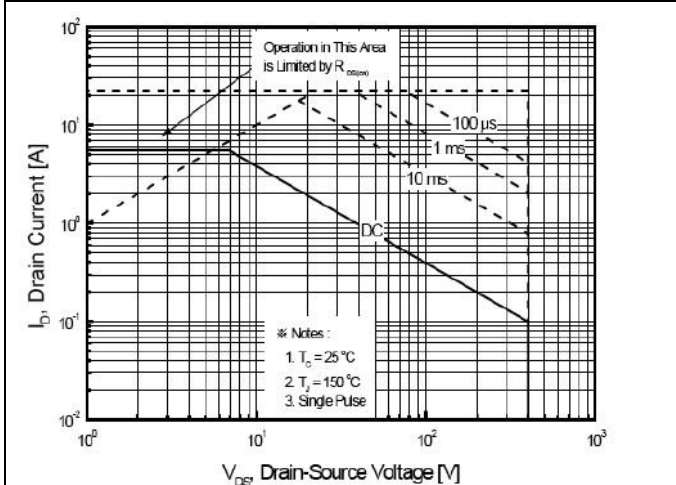


FIG. 9-MAXIMUM SAFE OPERATING AREA

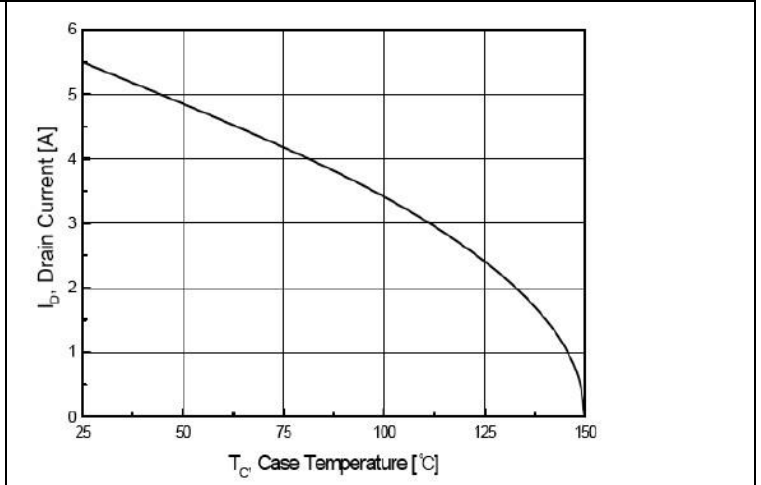


FIG. 10-MAXIMUM DRAIN CURRENT VS CASE TEMPERATURE

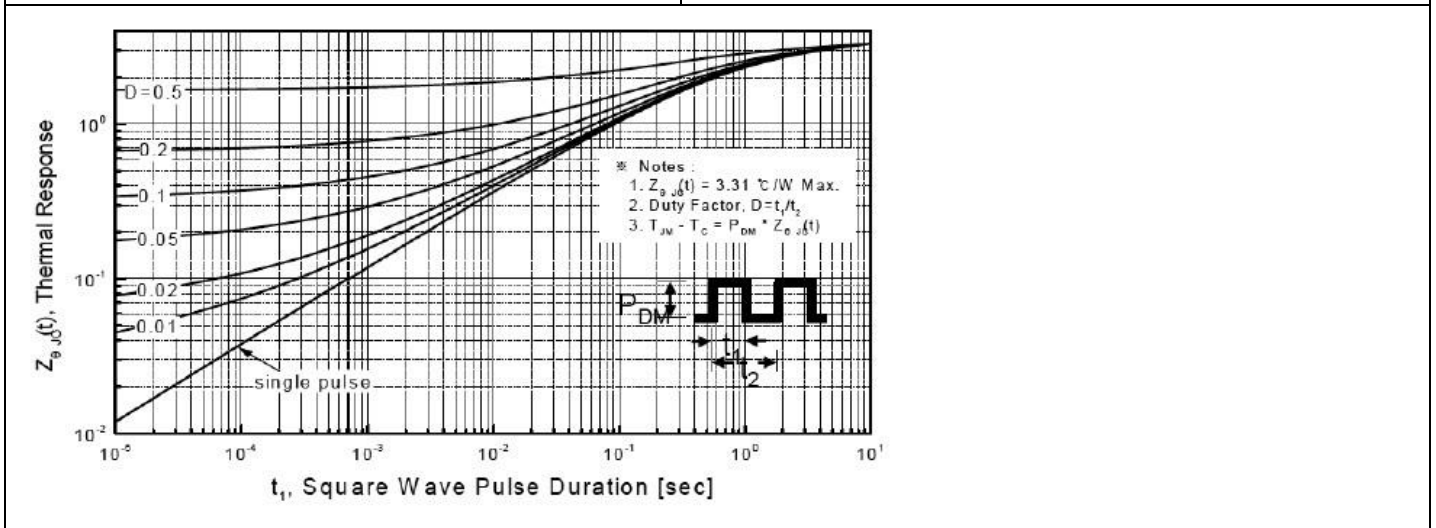


FIG. 11-TRANSIENT THERMAL RESPONSE CURVE

MSD4N40

400V N-Channel MOSFET

■ Characteristics Test Circuit & Waveform

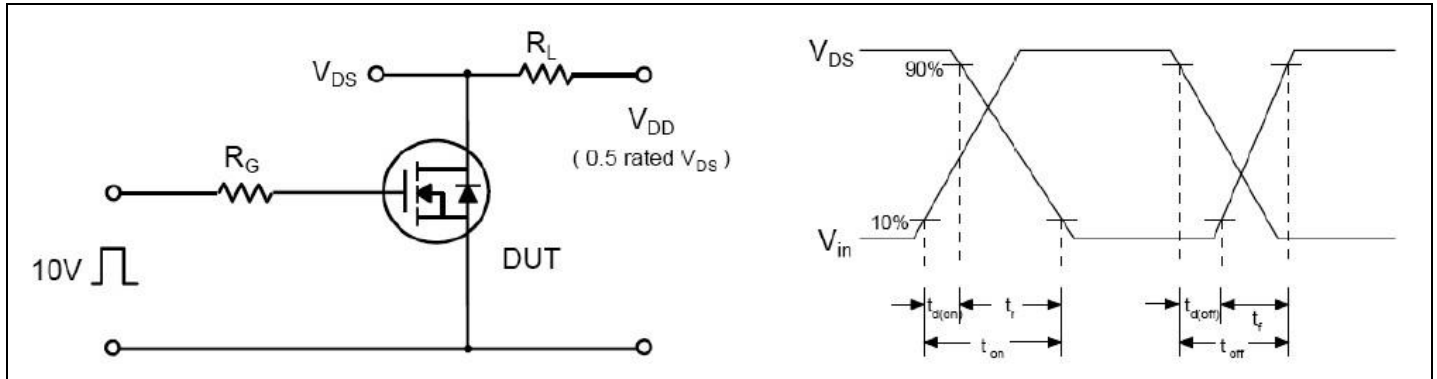


Fig 12. Resistive Switching Test Circuit & Waveforms

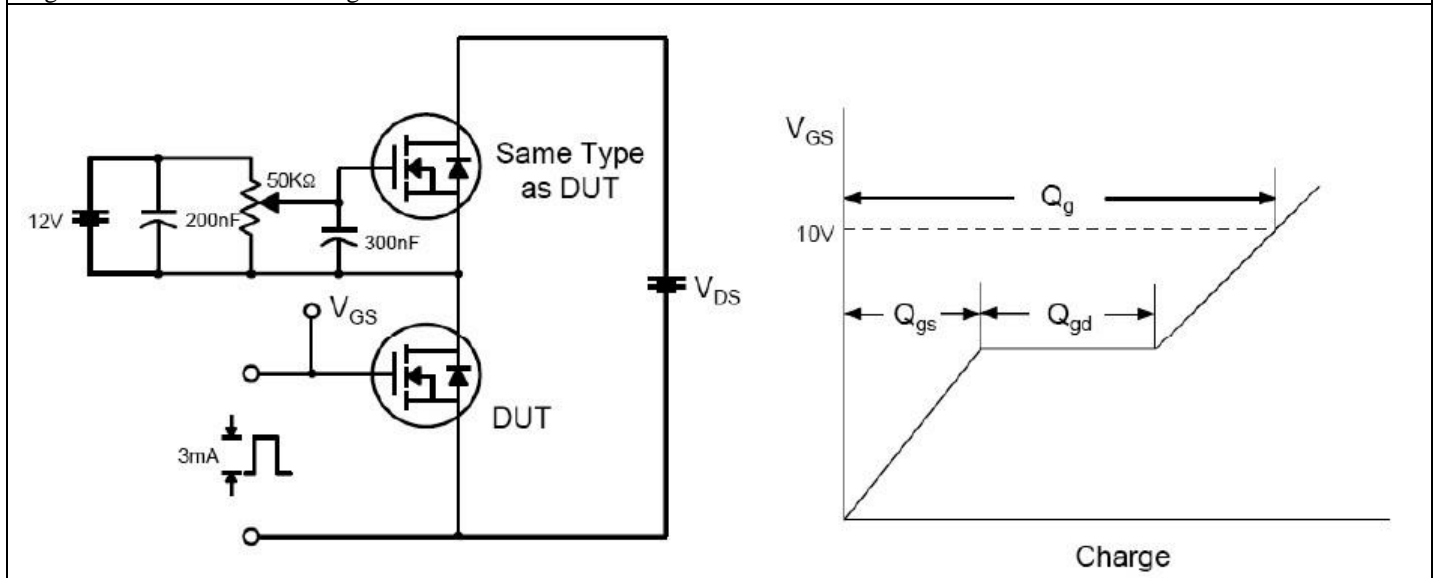


Fig 13. Gate Charge Test Circuit & Waveform

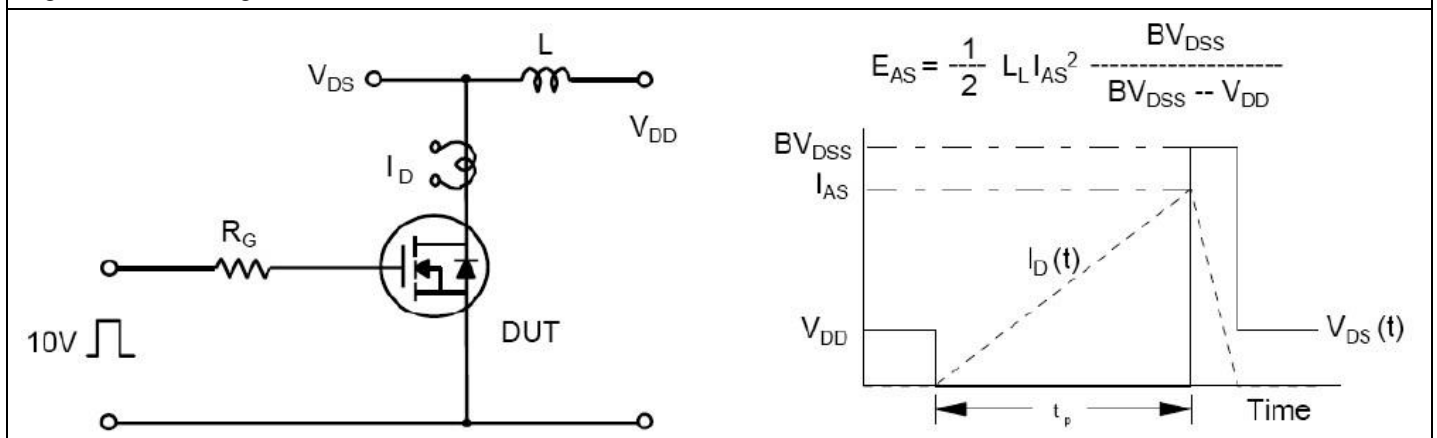


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

MSD4N40

400V N-Channel MOSFET

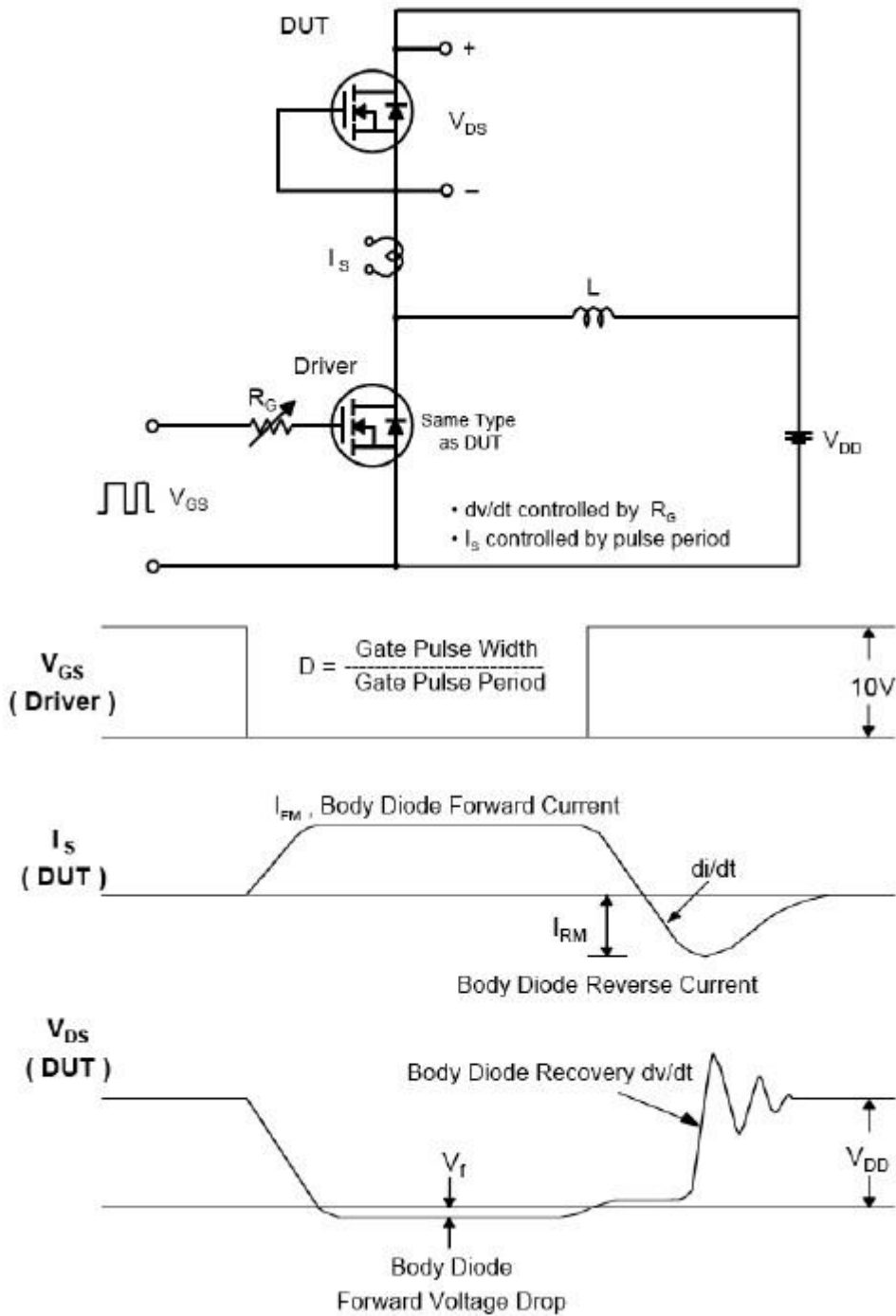


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

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