

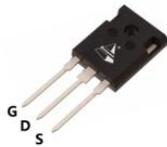


N-channel Power MOSFET

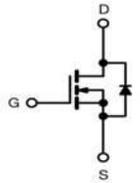
PRODUCT SUMMARY	
V_{DS} (V) at T_J max.	700
$R_{DS(on)}$ max. at 25°C (mΩ)	$V_{GS}=10V$ 38
Q_g max. (nC)	250
Q_{gs} (nC)	33
Q_{gd} (nC)	65
Configuration	single

Features

- New Technology For High Voltage Device
- $I_D=69A(V_{GS}=10V)$
- Ultra Low Gate Charge
- Improved dv/dt Capability
- RoHS Compliant



TO-247



Schematic diagram

Applications

- Switching Mode Power Supplies (SMPS)
- Power factor correction (PFC)
- Uninterruptible Power Supply (UPS)

ORDERING INFORMATION	
Device	SPA65R38G
Device Package	TO-247
Marking	65R38G

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise noted)			
Parameter	Symbol	Limit	Unit
Drain to Source Voltage	V_{DSS}	650	V
Continuous Drain Current (@ $T_C=25^\circ\text{C}$)	I_D	69 ⁽¹⁾	A
Continuous Drain Current (@ $T_C=100^\circ\text{C}$)		43 ⁽¹⁾	A
Drain current pulsed ⁽²⁾	I_{DM}	276 ⁽¹⁾	A
Gate to Source Voltage	V_{GS}	± 30	V
Single pulsed Avalanche Energy ⁽³⁾	E_{AS}	2300	mJ
MOSFET dv/dt ruggedness (@ $V_{DS}=0\sim 400V$)	dv/dt	30	V/ns
Peak diode Recovery dv/dt ⁽⁴⁾	dv/dt	20	V/ns
Total power dissipation (@ $T_C=25^\circ\text{C}$)	P_D	625	W
Derating Factor above 25°C		5	W/°C
Operating Junction Temperature & Storage Temperature	T_{STG}, T_J	-55 to + 150	°C
Maximum lead temperature for soldering purpose	T_L	260	°C

Notes

1. Drain current is limited by maximum junction temperature.
2. Repetitive rating : pulse width limited by junction temperature.
3. $L = 47\text{mH}$, $I_{AS} = 10A$, $V_{DD} = 50V$, $R_G=25\Omega$, Starting at $T_J = 25^\circ\text{C}$
4. $I_{SD} \leq I_D$, $di/dt = 100A/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting at $T_J = 25^\circ\text{C}$



THERMAL CHARACTERISTICS			
Parameter	Symbol	Value	Unit
Thermal resistance, Junction to case	R_{thjc}	0.2	°C/W
Thermal resistance, Junction to ambient	R_{thja}	34	°C/W

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise specified)						
Parameter	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
Drain to source breakdown voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	650	--	--	V
Breakdown voltage temperature coefficient	$\Delta BV_{DSS} / \Delta T_J$	$I_D=250\mu A$, referenced to 25°C	--	0.7	--	V/°C
Drain to source leakage current	I_{DSS}	$V_{DS}=650V, V_{GS}=0V$	--	--	1	μA
		$V_{DS}=650V, T_C=125^\circ\text{C}$	--	--	10	μA
Gate to source leakage current, forward	I_{GSS}	$V_{GS}=30V, V_{DS}=0V$	--	--	100	nA
Gate to source leakage current, reverse		$V_{GS}=-30V, V_{DS}=0V$	--	--	-100	nA
On Characteristics						
Gate threshold voltage	$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.5	--	4.5	V
Drain to source on state resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=33A$	--	32	38	m Ω
Forward Transconductance	G_{fs}	$V_{DS} = 30 V, I_D = 33A$	--	52	--	S
Dynamic Characteristics						
Input capacitance	C_{iss}	$V_{GS}=0V, V_{DS}=200V, f=1\text{MHz}$	--	7850	--	pF
Output capacitance	C_{oss}		--	250	--	
Reverse transfer capacitance	C_{rss}		--	12	--	
Turn on delay time	$t_{d(on)}$	$V_{DS}=380V, I_D=33A, R_G=18\Omega, V_{GS}=10V$	--	84	--	ns
Rising time	t_r		--	77	--	
Turn off delay time	$t_{d(off)}$		--	510	--	
Fall time	t_f		--	120	--	
Total gate charge	Q_g	$V_{DS}=520V, V_{GS}=10V, I_D=33A$	--	200	250	nC
Gate-source charge	Q_{gs}		--	32	--	
Gate-drain charge	Q_{gd}		--	64	--	

SOURCE TO DRAIN DIODE RATINGS CHARACTERISTICS						
Parameter	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous source current	I_S	Integral reverse p-n Junction diode in the MOSFET	--	--	69	A
Pulsed source current	I_{SM}		--	--	276	A
Diode forward voltage drop.	V_{SD}	$I_S=69A, V_{GS}=0V$	--	0.9	1.3	V
Reverse recovery time	T_{rr}	$I_S=33A, V_{GS}=0V,$	--	508	--	ns
Reverse recovery Charge	Q_{rr}	$di/dt=100A/\mu s$	--	10	--	μC



Fig1. Output characteristics

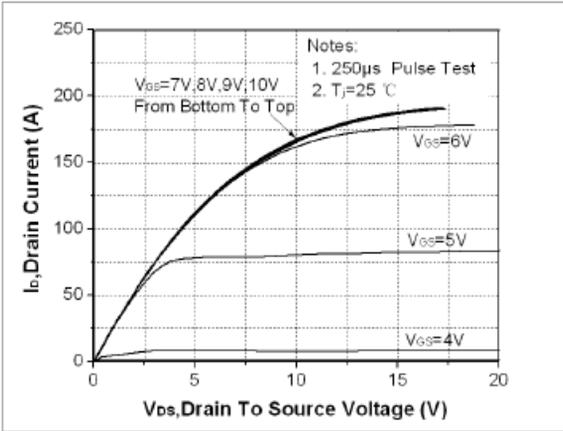


Fig2. R_{ds(on)} vs. Drain Current and Gate Voltage

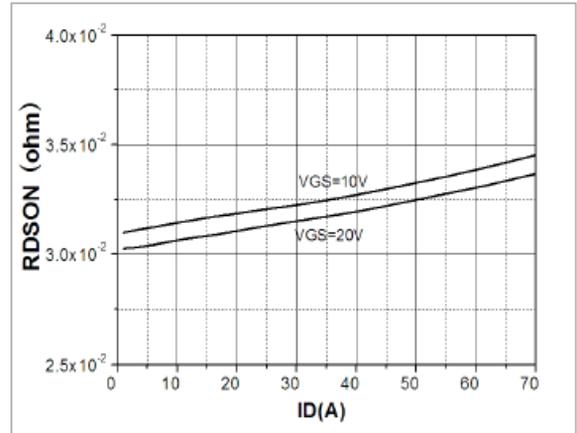


Fig3. Gate charge characteristics

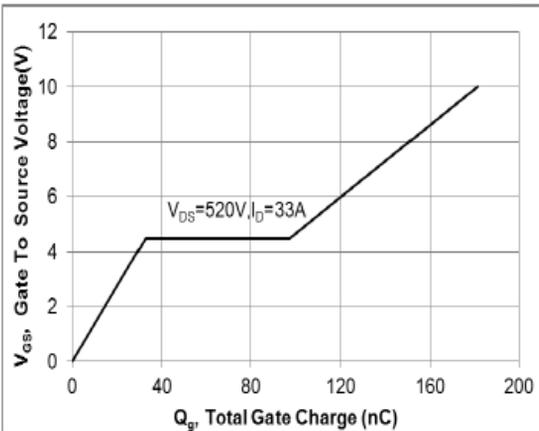


Fig 4. Capacitance Characteristics

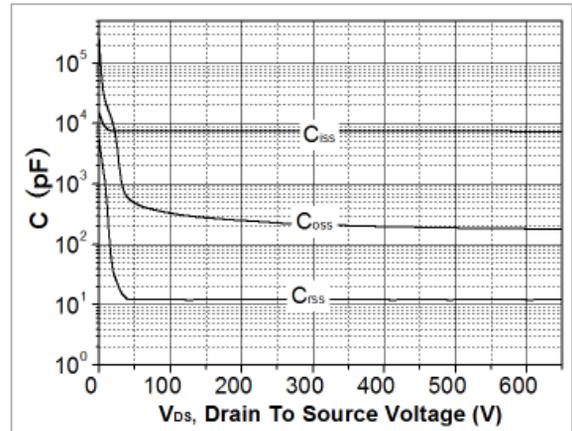


Fig 5. R_{DS(ON)} vs junction temperature

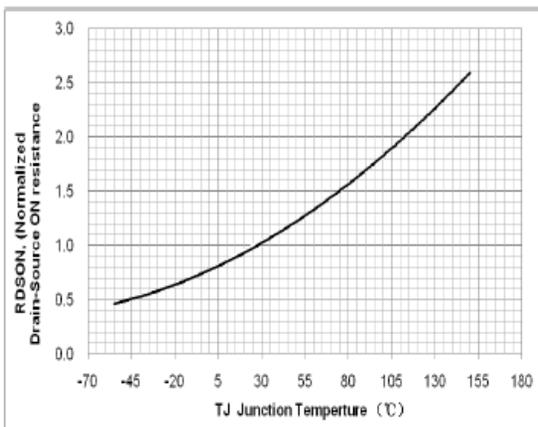


Fig 6. Temperature vs. Drain-to-Source Voltage

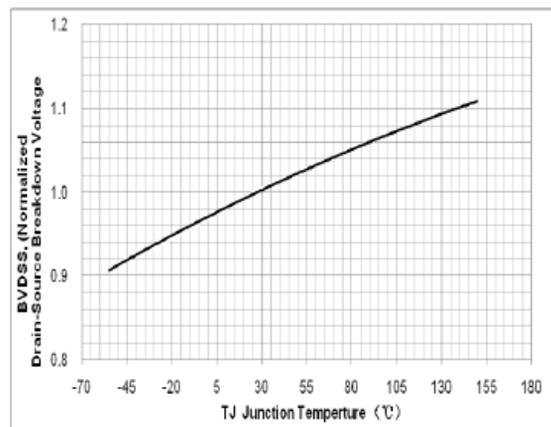


Fig 7 . Safe operating area

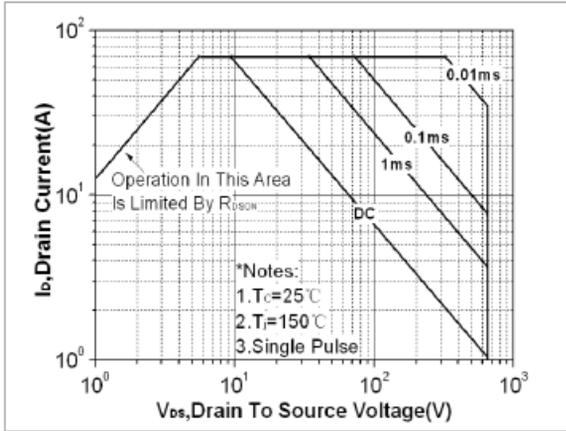


Fig 8 . Transient thermal impedance

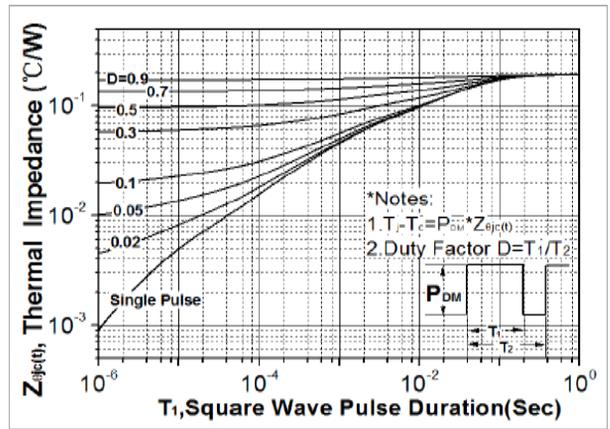


Fig 9. Forward characteristics of reverse diode

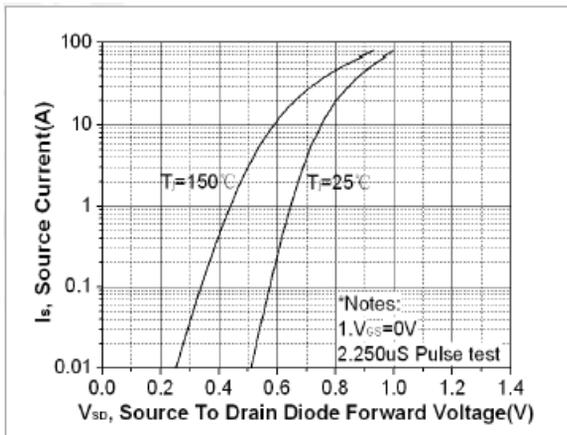


Fig 10. Gate charge test circuit & waveform

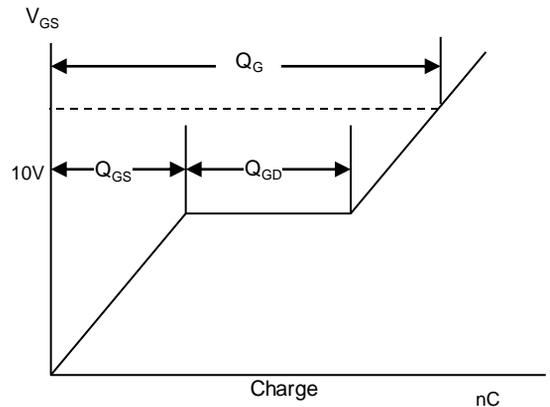
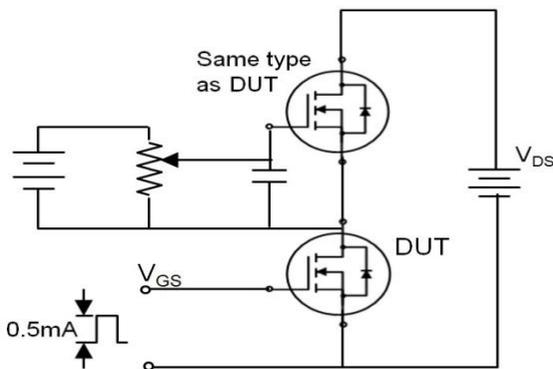


Fig 11. Switching time test circuit & waveform

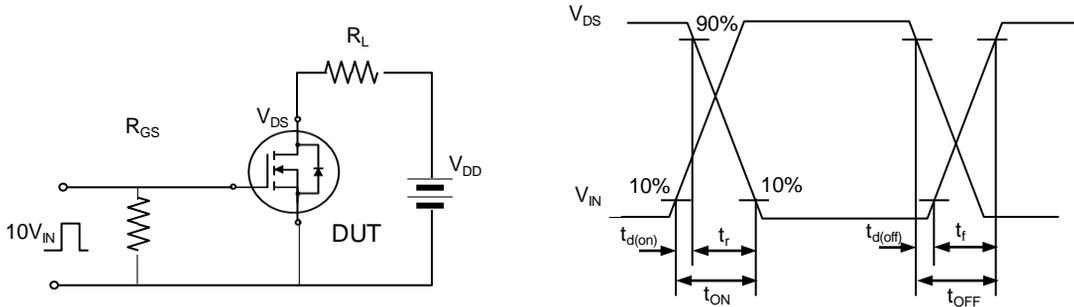


Fig 12. Unclamped Inductive switching test circuit & waveform

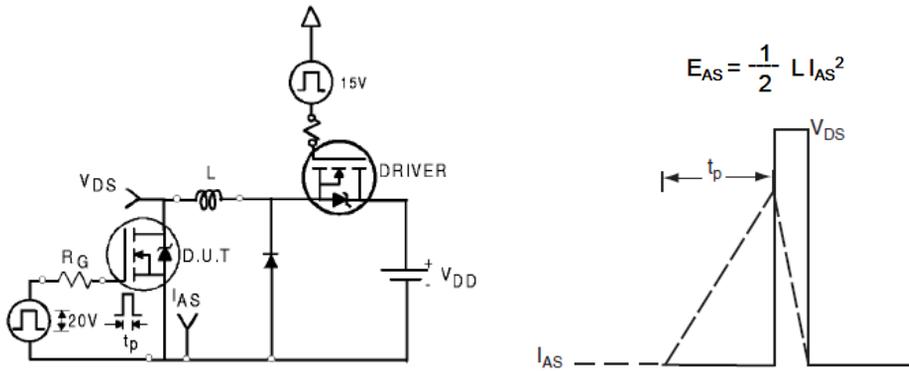
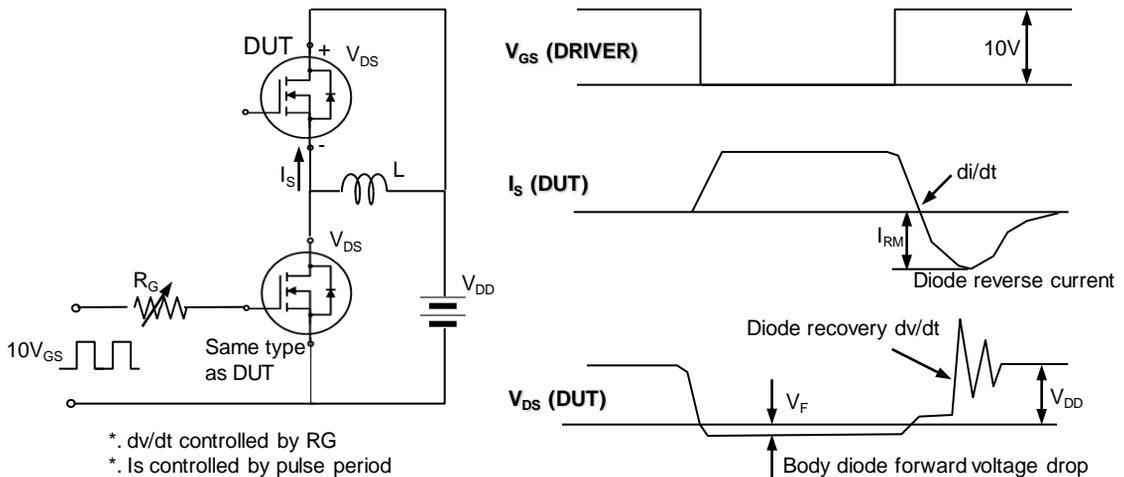


Fig 13. Peak diode recovery dv/dt test circuit & waveform





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