

Power MOSFET

PRODUCT SUMMARY	
V _{DS} (V)	200
R _{DS(on)} (Ω)	V _{GS} = 10 V 1.5
Q _g (Max.) (nC)	8.2
Q _{gs} (nC)	1.8
Q _{gd} (nC)	4.5
Configuration	Single

FEATURES

- Dynamic dV/dt Rating
- Repetitive Avalanche Rated
- Surface Mount (IRFR210, SiHFR210)
- Straight Lead (IRFU210, SiHFU210)
- Available in Tape and Reel
- Fast Switching
- Ease of Paralleling
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912



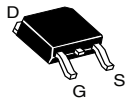
RoHS
COMPLIANT
HALOGEN
FREE
Available

DESCRIPTION

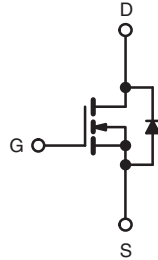
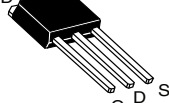
Third generation power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The DPAK is designed for surface mounting using vapor phase, infrared, or wave soldering techniques. The straight lead version (IRFU, SiHFU series) is for through-hole mounting applications. Power dissipation levels up to 1.5 W are possible in typical surface mount applications.

DPAK (TO-252)



IPAK (TO-251)



N-Channel MOSFET

ORDERING INFORMATION					
Package	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	DPAK (TO-252)	IPAK (TO-251)
Lead (Pb)-free and Halogen-free	SiHFR210-GE3	SiHFR210TRL-GE3 ^a	-	SiHFR210TRR-GE3 ^a	SiHFU210-GE3
Lead (Pb)-free	IRFR210PbF	IRFR210TRLPbF ^a	IRFR210TRPbF ^a	-	IRFU210PbF
	SiHFR210-E3	SiHFR210TL-E3 ^a	SiHFR210T-E3 ^a	-	SiHFU210-E3

Note

- a. See device orientation.

ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted)				
PARAMETER	SYMBOL		LIMIT	UNIT
Drain-Source Voltage	V _{DS}		200	V
Gate-Source Voltage	V _{GS}		± 20	
Continuous Drain Current	V _{GS} at 10 V	T _C = 25 °C	2.6	A
		T _C = 100 °C	1.7	
Pulsed Drain Current ^a	I _{DM}		10	W/°C
Linear Derating Factor			0.20	
Linear Derating Factor (PCB Mount) ^e			0.020	
Single Pulse Avalanche Energy ^b	E _{AS}		95	mJ
Avalanche Current ^a	I _{AR}		2.7	A
Repetitive Avalanche Energy ^a	E _{AR}		2.5	mJ
Maximum Power Dissipation	T _C = 25 °C		25	W
	T _A = 25 °C		2.5	
Peak Diode Recovery dV/dt ^c	dV/dt		5.0	V/ns
Operating Junction and Storage Temperature Range	T _J , T _{stg}		- 55 to + 150	°C
Soldering Recommendations (Peak Temperature) ^d	for 10 s		260	

Notes

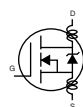

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
 b. V_{DD} = 50 V, starting T_J = 25 °C, L = 28 mH, R_g = 25 Ω, I_{AS} = 2.6 A (see fig. 12).
 c. I_{SD} ≤ 2.6 A, di/dt ≤ 70 A/μs, V_{DD} ≤ V_{DS}, T_J ≤ 150 °C.
 d. 1.6 mm from case.
 e. When mounted on 1" square PCB (FR-4 or G-10 material).



THERMAL RESISTANCE RATINGS					
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	-	110	°C/W
Maximum Junction-to-Ambient (PCB Mount) ^a	R_{thJA}	-	-	50	
Maximum Junction-to-Case (Drain)	R_{thJC}	-	-	5.0	

Note

a. When mounted on 1" square PCB (FR-4 or G-10 material).

SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		200	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = 1\text{ mA}$		-	0.30	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$		-	-	25	μA
		$V_{DS} = 160\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	250	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 1.6\text{ A}^b$	-	-	1.5	Ω
Forward Transconductance	g_{fs}	$V_{DS} = 50\text{ V}, I_D = 1.6\text{ A}^b$		0.80	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$, see fig. 5		-	140	-	μF
Output Capacitance	C_{oss}			-	53	-	
Reverse Transfer Capacitance	C_{rss}			-	15	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 3.3\text{ A}, V_{DS} = 160\text{ V}$, see fig. 6 and 13 ^b	-	-	8.2	nC
Gate-Source Charge	Q_{gs}			-	-	1.8	
Gate-Drain Charge	Q_{gd}			-	-	4.5	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 100\text{ V}, I_D = 3.3\text{ A}, R_g = 24\text{ }\Omega, R_D = 30\text{ }\Omega$, see fig. 10 ^b		-	8.2	-	ns
Rise Time	t_r			-	17	-	
Turn-Off Delay Time	$t_{d(off)}$			-	14	-	
Fall Time	t_f			-	8.9	-	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact 		-	4.5	-	nH
Internal Source Inductance	L_S			-	7.5	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	2.6	A
Pulsed Diode Forward Current ^a	I_{SM}			-	-	10	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = 2.6\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	2.0	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 3.3\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$		-	150	310	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	0.60	1.4	μC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)					

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11).
- b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$.



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

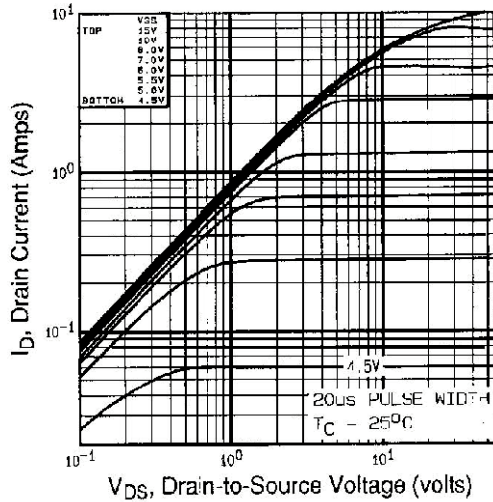


Fig. 1 - Typical Output Characteristics, $T_C = 25\text{ }^\circ\text{C}$

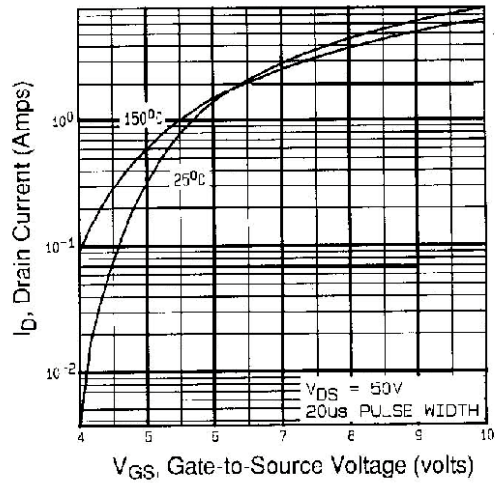


Fig. 3 - Typical Transfer Characteristics

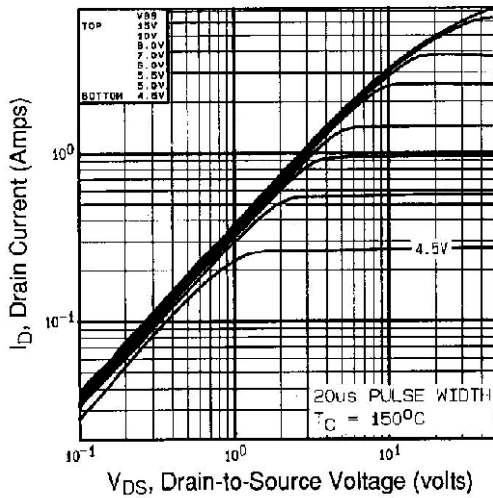


Fig. 2 - Typical Output Characteristics, $T_C = 150\text{ }^\circ\text{C}$

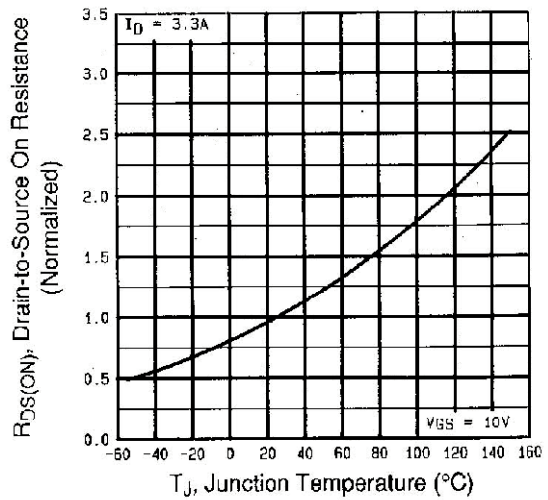


Fig. 4 - Normalized On-Resistance vs. Temperature

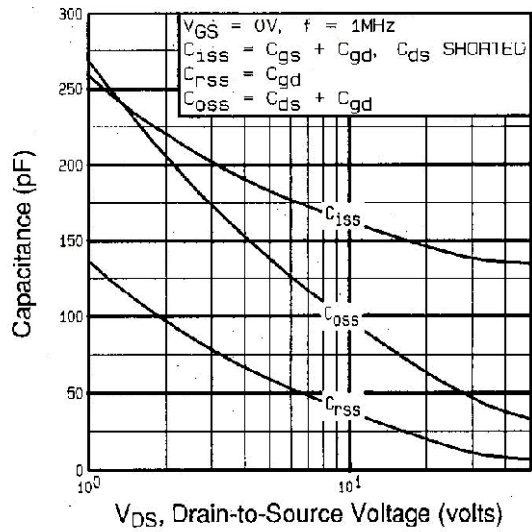


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

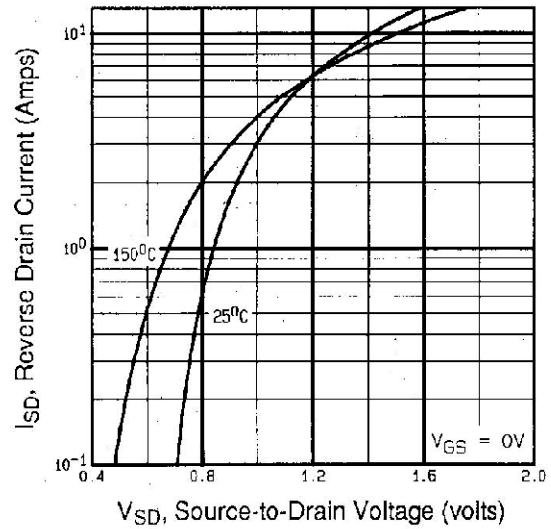


Fig. 7 - Typical Source-Drain Diode Forward Voltage

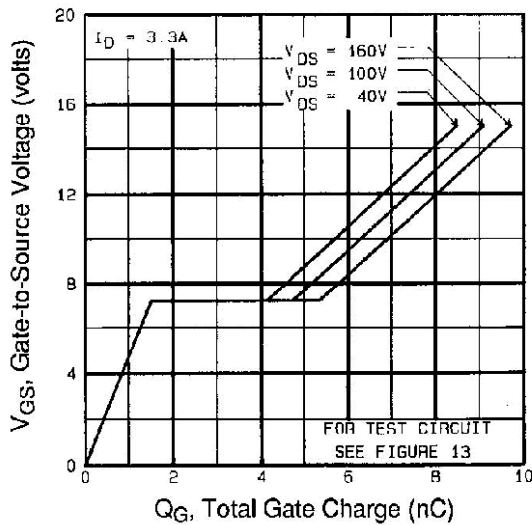


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

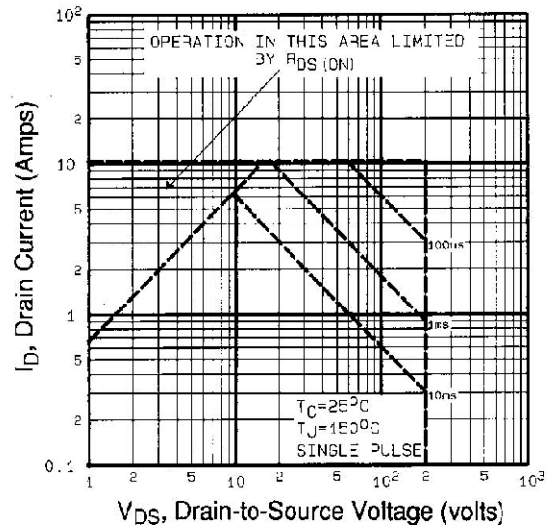


Fig. 8 - Maximum Safe Operating Area

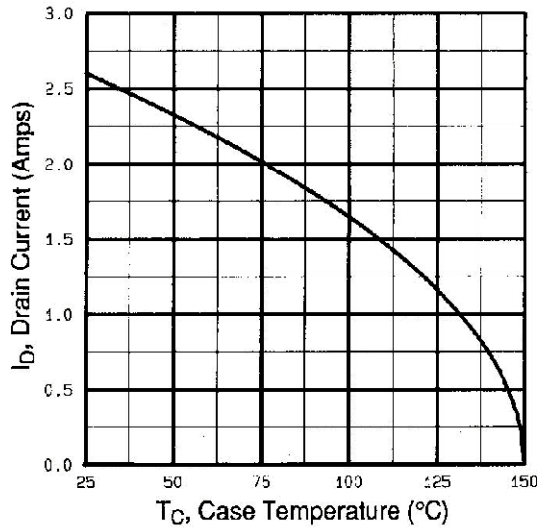


Fig. 9 - Maximum Drain Current vs. Case Temperature



Fig. 10a - Switching Time Test Circuit

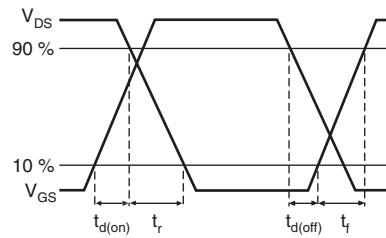


Fig. 10b - Switching Time Waveforms

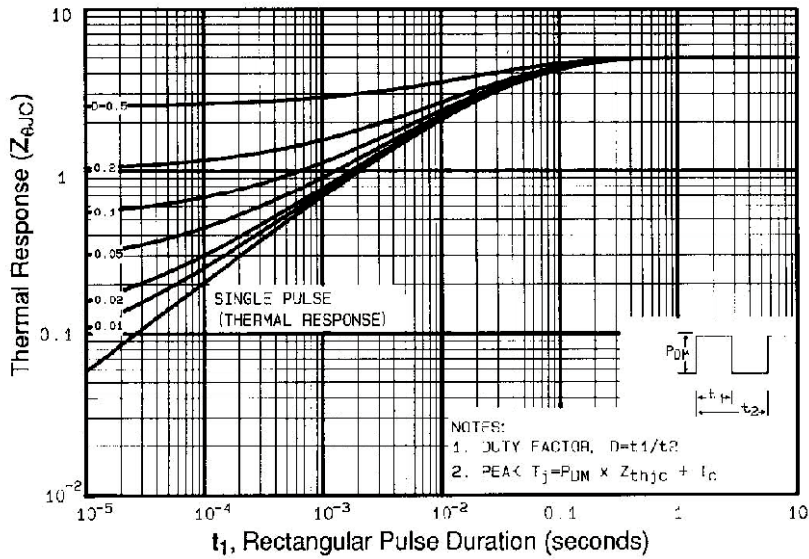


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

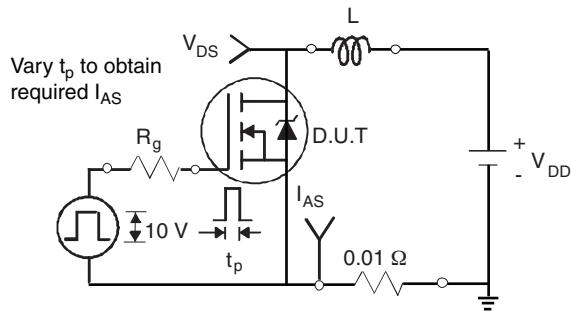


Fig. 12a - Unclamped Inductive Test Circuit



Fig. 12b - Unclamped Inductive Waveforms

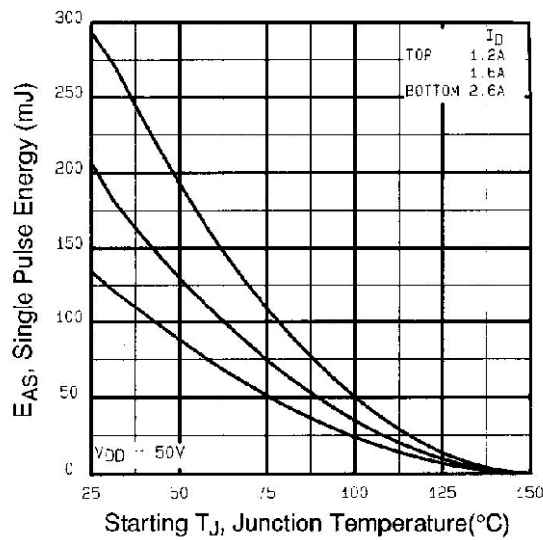


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

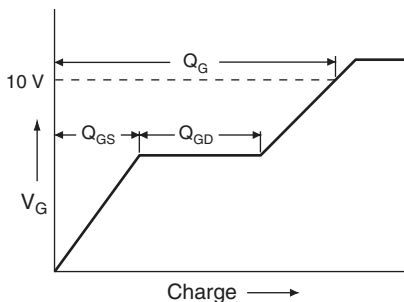


Fig. 13a - Basic Gate Charge Waveform

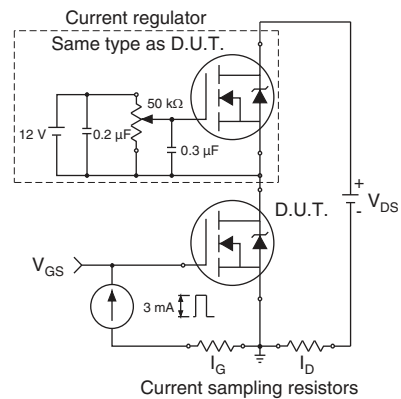


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note

a. $V_{GS} = 5\text{ V}$ for logic level devices

Fig. 14 - For N-Channel

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?91268.



TO-252AA Case Outline



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.38	0.086	0.094
A1	-	0.127	-	0.005
b	0.64	0.88	0.025	0.035
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
C	0.46	0.61	0.018	0.024
C2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	4.10	-	0.161	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
H	9.40	10.41	0.370	0.410
e	2.28 BSC		0.090 BSC	
e1	4.56 BSC		0.180 BSC	
L	1.40	1.78	0.055	0.070
L3	0.89	1.27	0.035	0.050
L4	-	1.02	-	0.040
L5	1.01	1.52	0.040	0.060
ECN: T16-0236-Rev. P, 16-May-16 DWG: 5347				

Notes

- Dimension L3 is for reference only.

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads
Dimensions in Inches/(mm)

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