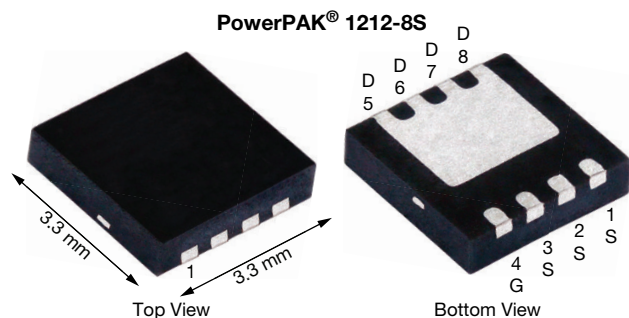


P-Channel 40 V (D-S) MOSFET



FEATURES

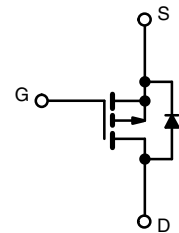
- New generation p-channel power MOSFET
- 100 % R_{DS} and UIS tested
- Ultra low $R_{DS} \times Q_g$ FOM product
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Battery management
- Load switch
- Motor drive control



P-Channel MOSFET

PRODUCT SUMMARY

V_{DS} (V)	-40
$R_{DS(on)}$ max. (Ω) at $V_{GS} = -10$ V	0.009
$R_{DS(on)}$ max. (Ω) at $V_{GS} = -4.5$ V	0.012
Q_g typ. (nC)	38.1
I_D (A)	-59.2
Configuration	Single

ORDERING INFORMATION

Package	PowerPAK 1212-8S
Lead (Pb)-free and halogen-free	SiSS4409DN-T1-GE3

ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V_{DS}	-40	V
Gate-source voltage	V_{GS}	± 20	V
Continuous drain current ($T_J = 150$ °C)	$T_C = 25$ °C	-59.2	A
	$T_C = 70$ °C	-36.3	
	$T_A = 25$ °C	-17.2 ^{b, c}	
	$T_A = 70$ °C	-13.7 ^{b, c}	
Pulsed drain current ($t = 100$ μ s)	I_{DM}	-200	A
Continuous source-drain diode current	$T_C = 25$ °C	-47.3	A
	$T_A = 25$ °C	-4.0 ^{b, c}	
Single pulse avalanche current	$L = 0.1$ mH	-30	mJ
Single pulse avalanche energy	E_{AS}	45	
Maximum power dissipation	$T_C = 25$ °C	56.8	W
	$T_C = 70$ °C	36.3	
	$T_A = 25$ °C	4.8 ^{b, c}	
	$T_A = 70$ °C	3.0 ^{b, c}	
Operating junction and storage temperature range	T_J, T_{stg}	-55 to +150	°C
Soldering recommendations (peak temperature) °C		260	

THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient ^b	R_{thJA}	21	26	°C/W
Maximum junction-to-case (drain)	R_{thJC}	1.8	2.2	

Notes

- $T_C = 25$ °C
- Surface mounted on 1" x 1" FR4 board
- $t = 10$ s
- See solder profile (www.vishay.com/doc?73257). The PowerPAK 1212-8S is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components
- Maximum under steady state conditions is 70 °C/W



SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
Static							
Drain-source breakdown voltage	V _{DS}	V _{GS} = 0 V, I _D = -250 μA	-40	-	-	V	
V _{DS} temperature coefficient	ΔV _{DS} /T _J	I _D = -1 mA	-	-34	-	mV/°C	
V _{GS(th)} temperature coefficient	ΔV _{GS(th)} /T _J	I _D = -250 μA	-	4.3	-		
Gate-source threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = -250 μA	-1.0	-	-2.3	V	
Gate-source leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V	-	-	100	nA	
Zero gate voltage drain current	I _{DSS}	V _{DS} = -40 V, V _{GS} = 0 V	-	-	-1	μA	
		V _{DS} = -40 V, V _{GS} = 0 V, T _J = 70 °C	-	-	-10		
Drain-source on-state resistance ^a	R _{DS(on)}	V _{GS} = -10 V, I _D = -15 A	-	0.0075	0.009	Ω	
		V _{GS} = -4.5 V, I _D = -15 A	-	0.0099	0.012		
Forward transconductance ^a	g _{fs}	V _{DS} = -15 V, I _D = -15 A	-	58	-	S	
Dynamic ^b							
Input capacitance	C _{iss}	V _{DS} = -20 V, V _{GS} = 0 V, f = 1 MHz	-	5670	-	pF	
Output capacitance	C _{oss}		-	345	-		
Reverse transfer capacitance	C _{rss}		-	330	-		
Total gate charge	Q _g	V _{DS} = -20 V, V _{GS} = -10 V, I _D = -15 A	-	84	126	nC	
Gate-source charge	Q _{gs}	V _{DS} = -20 V, V _{GS} = -4.5 V, I _D = -15 A	-	38.1	58		
Gate-drain charge	Q _{gd}		-	14	-		
Gate resistance	R _g	f = 1 MHz	-	12.2	-	Ω	
Turn-on delay time	t _{d(on)}	V _{DD} = -20 V, R _L = 2 Ω, I _D ≡ -10 A, V _{GEN} = -10 V, R _g = 1 Ω	1.0	2.2	4.0	ns	
Rise time	t _r		-	12	24		
Turn-off delay time	t _{d(off)}		-	5	10		
Fall time	t _f		-	50	100		
Turn-on delay time	t _{d(on)}	V _{DD} = -20 V, R _L = 2 Ω, I _D ≡ -10 A, V _{GEN} = -4.5 V, R _g = 1 Ω	-	9	18		
Rise time	t _r		-	31	62		
Turn-off delay time	t _{d(off)}		-	56	112		
Fall time	t _f		-	41	82		
			-	23	46		
Drain-Source Body Diode Characteristics							
Continuous source-drain diode current	I _S	T _C = 25 °C	-	-	-47.3		A
Pulse diode forward current	I _{SM}		-	-	-200		
Body diode voltage	V _{SD}	I _S = -5 A, V _{GS} = 0 V	-	-0.76	-1.2		V
Body diode reverse recovery time	t _{rr}	I _F = -10 A, di/dt = 100 A/μs, T _J = 25 °C	-	19	38	ns	
Body diode reverse recovery charge	Q _{rr}		-	12	24	nC	
Reverse recovery fall time	t _a		-	11	-	ns	
Reverse recovery rise time	t _b		-	8	-		

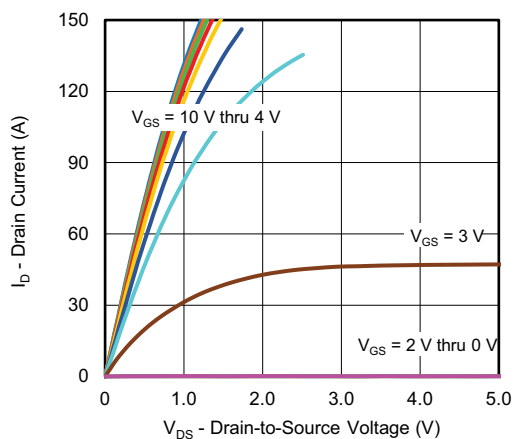
Notes

- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$
b. Guaranteed by design, not subject to production testing

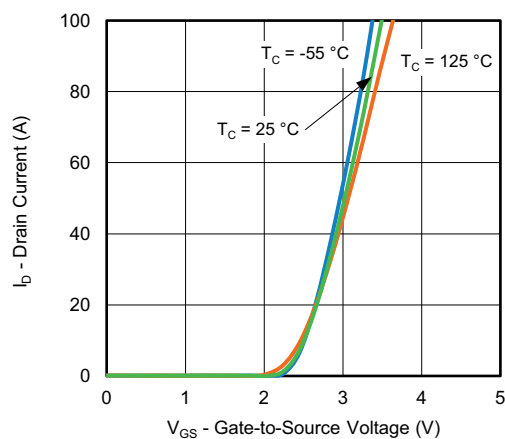
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



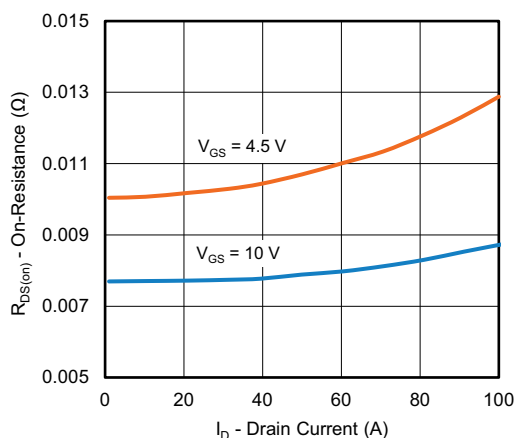
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



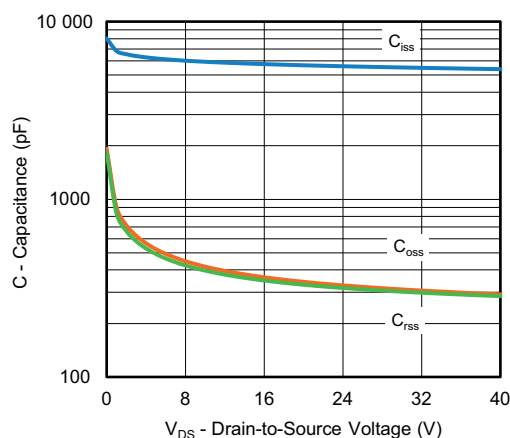
Output Characteristics



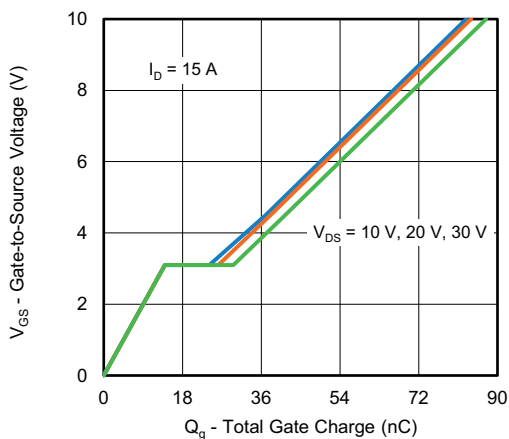
Transfer Characteristics



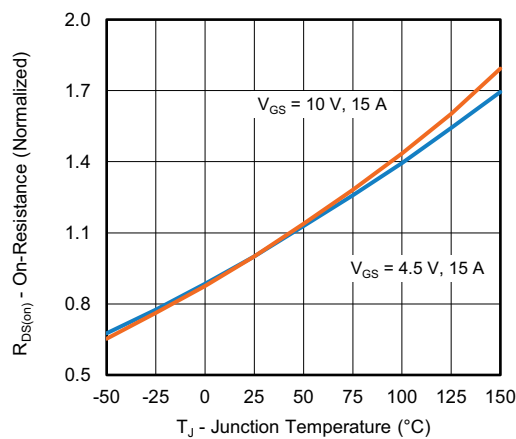
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



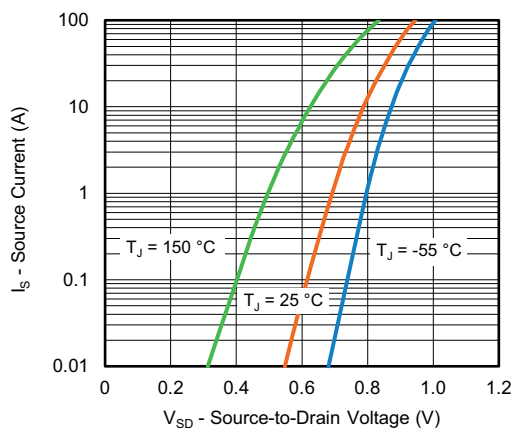
Gate Charge



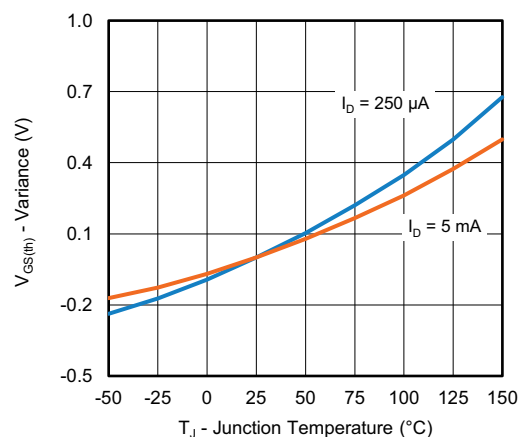
On-Resistance vs. Junction Temperature



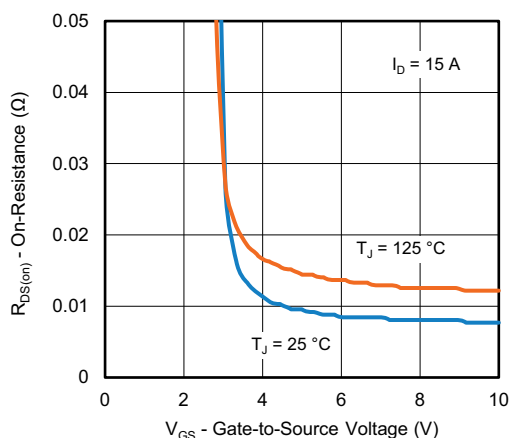
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



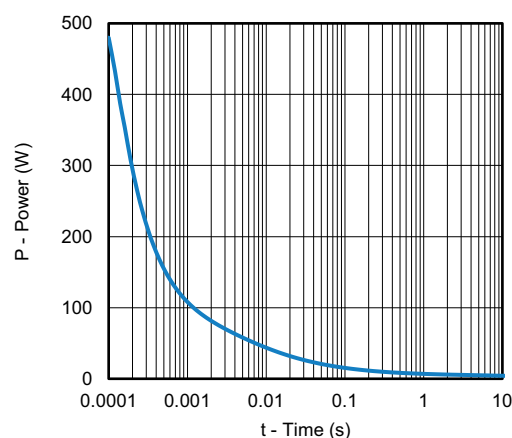
Source-Drain Diode Forward Voltage



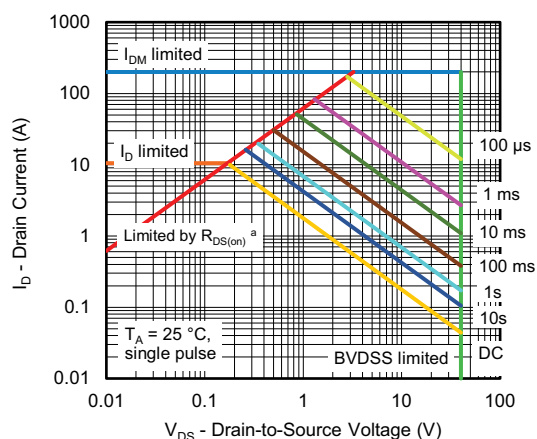
Threshold Voltage



On-Resistance vs. Gate-to-Source Voltage



Single Pulse Power, Junction-to-Ambient



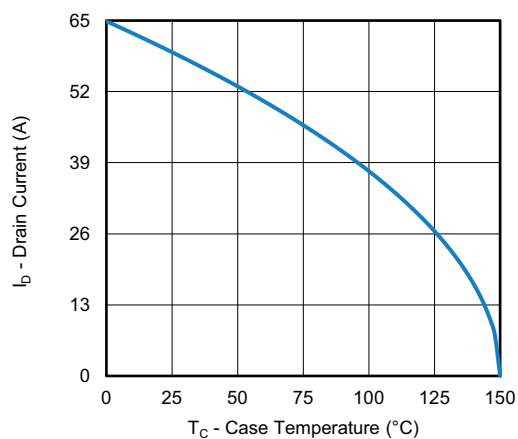
Safe Operating Area, Junction-to-Ambient

Note

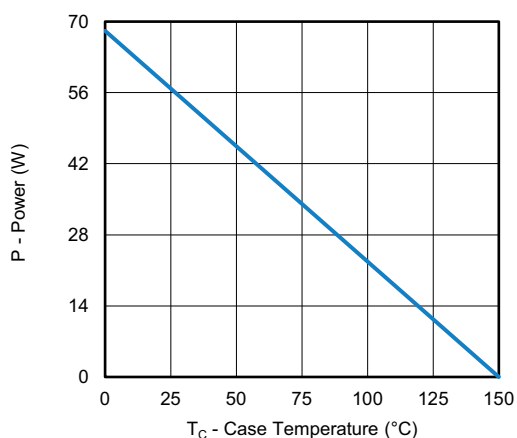
a. $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified



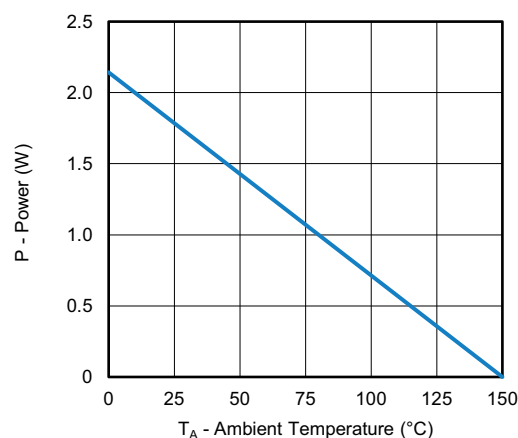
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating ^a



Single Pulse Power, Junction-to-Ambient



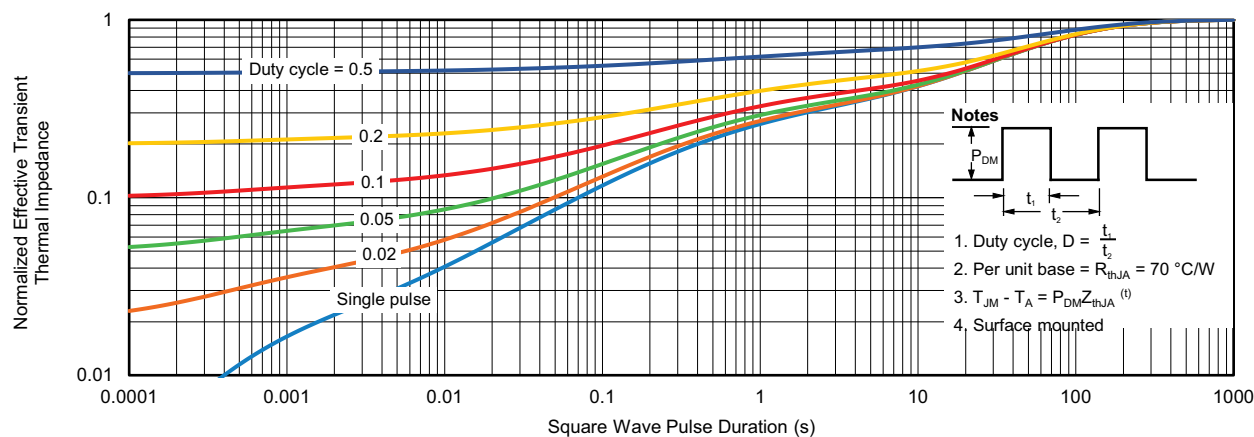
Power, Junction-to-Case

Note

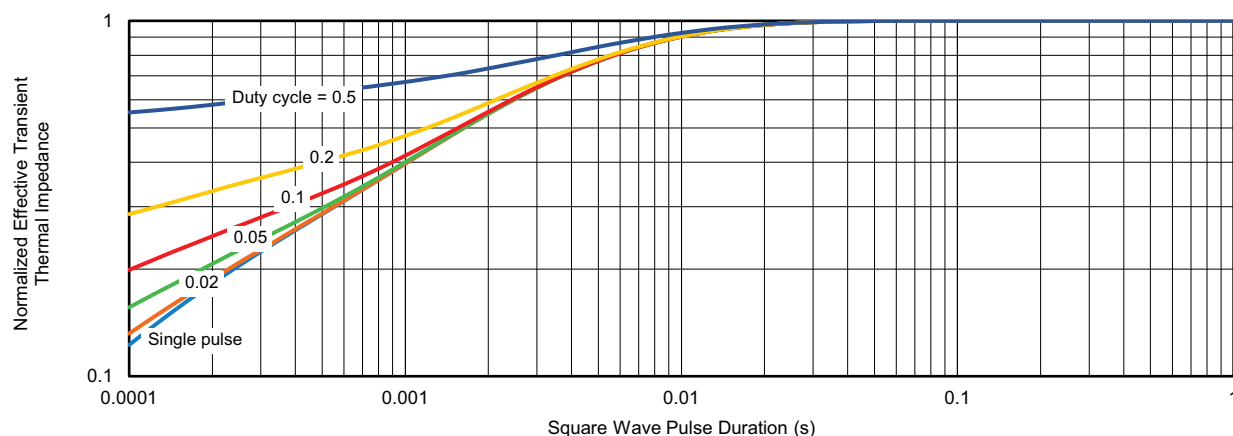
- a. The power dissipation P_D is based on T_J max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

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