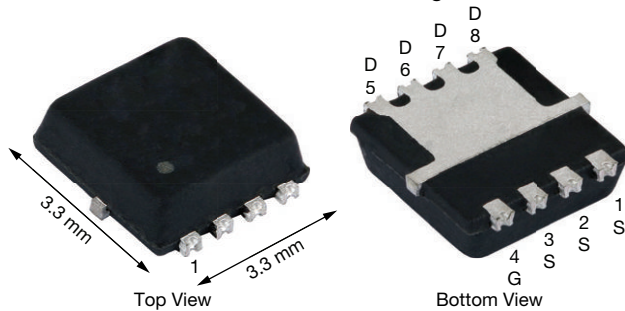


Automotive N-Channel 60 V (D-S) 175 °C MOSFET

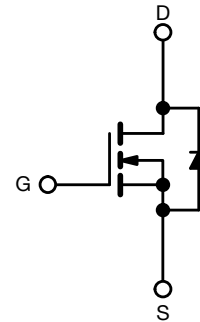
PowerPAK® 1212-8W Single

Marking code: Q038

PRODUCT SUMMARY	
V_{DS} (V)	60
$R_{DS(on)}$ (Ω) at $V_{GS} = 10$ V	0.0230
$R_{DS(on)}$ (Ω) at $V_{GS} = 4.5$ V	0.0350
I_D (A)	18
Configuration	Single
Package	PowerPAK 1212-8W

FEATURES

- TrenchFET® power MOSFET
- AEC-Q101 qualified
- 100 % R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

 AUTOMOTIVE
GRADE

RoHS
COMPLIANT
HALOGEN
FREE


N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V_{DS}	60	V
Gate-source voltage		V_{GS}	± 20	
Continuous drain current	$T_C = 25$ °C ^a	I_D	18	A
	$T_C = 125$ °C		15.5	
Continuous source current (diode conduction) ^a		I_S	18	
Pulsed drain current ^b		I_{DM}	55	
Single pulse avalanche current	L = 0.1 mH	I_{AS}	16	
Single pulse avalanche energy		E_{AS}	12.8	
Maximum power dissipation ^b	$T_C = 25$ °C	P_D	33	W
	$T_C = 125$ °C		11	
Operating junction and storage temperature range		T_J, T_{stg}	-55 to +175	°C
Soldering recommendations (peak temperature) ^{d, e}			260	

THERMAL RESISTANCE RATINGS				
PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-ambient	PCB mount ^c	R_{thJA}	81	°C/W
Junction-to-case (drain)		R_{thJC}	4.5	

Notes

- Package limited
- Pulse test; pulse width ≤ 300 μ s, duty cycle ≤ 2 %
- When mounted on 1" square PCB (FR4 material)
- See solder profile (www.vishay.com/doc?73257). The PowerPAK 1212-8W 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



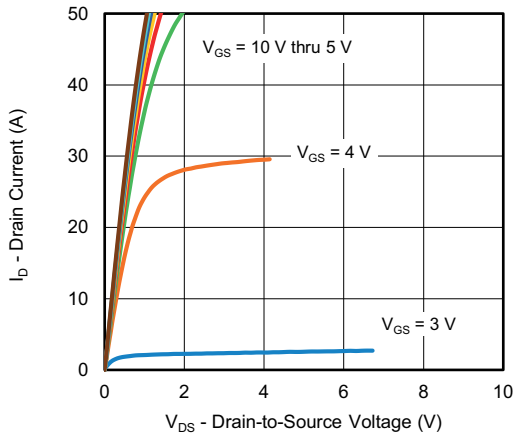
SPECIFICATIONS (T _C = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
Static							
Drain-source breakdown voltage	V _{DS}	V _{GS} = 0, I _D = 250 μA	60	-	-	V	
Gate-source threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	1.5	2.0	2.5		
Gate-source leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V	-	-	± 100	nA	
Zero gate voltage drain current	I _{DSS}	V _{GS} = 0 V, V _{DS} = 60 V	-	-	1	μA	
		V _{GS} = 0 V, V _{DS} = 60 V, T _J = 125 °C	-	-	50		
		V _{GS} = 0 V, V _{DS} = 60 V, T _J = 175 °C	-	-	150		
On-state drain current ^a	I _{D(on)}	V _{GS} = 10 V, V _{DS} ≥ 5 V	15	-	-	A	
Drain-source on-state resistance ^a	R _{DS(on)}	V _{GS} = 10 V, I _D = 2.4 A	-	0.0187	0.0230	Ω	
		V _{GS} = 10 V, I _D = 2.4 A, T _J = 125 °C	-	-	0.0373		
		V _{GS} = 10 V, I _D = 2.4 A, T _J = 175 °C	-	-	0.0462		
		V _{GS} = 4.5 V, I _D = 1.8 A	-	0.0282	0.0350		
Forward transconductance ^b	g _{fs}	V _{DS} = 15 V, I _D = 2.4 A	-	9.6	-	S	
Dynamic ^b							
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 25 V, f = 1 MHz	-	620	870	pF	
Output capacitance	C _{oss}		-	257	360		
Reverse transfer capacitance	C _{rss}		-	17	24		
Total gate charge ^c	Q _g	V _{GS} = 10 V, V _{DS} = 30 V, I _D = 5 A	-	8.9	14	nC	
Gate-source charge ^c	Q _{gs}		-	2.4	-		
Gate-drain charge ^c	Q _{gd}		-	0.9	-		
Gate resistance	R _g	f = 1 MHz	0.19	0.38	0.57	Ω	
Turn-on delay time ^c	t _{d(on)}	V _{DD} = 30 V, R _L = 15 Ω I _D ≅ 2 A, V _{GEN} = 10 V, R _g = 1 Ω	-	8	15	ns	
Rise time ^c	t _r		-	4	8		
Turn-off delay time ^c	t _{d(off)}		-	15	25		
Fall time ^c	t _f		-	5	10		
Source-Drain Diode Ratings and Characteristic ^b							
Pulsed current ^a	I _{SM}		-	-	55	A	
Forward voltage	V _{SD}	I _F = 2.4 A, V _{GS} = 0 V	-	0.78	1.1	V	
Body diode reverse recovery time	t _{rr}	I _F = 2 A, di/dt = 100 A/μs	-	18	32	ns	
Body diode reverse recovery charge	Q _{rr}		-	10.5	22	nC	
Reverse recovery fall time	t _a		-	10	-	ns	
Reverse recovery rise time	t _b		-	8	-		
Body diode peak reverse recovery current	I _{RM(REC)}			-	-1.1	-	A

Notes

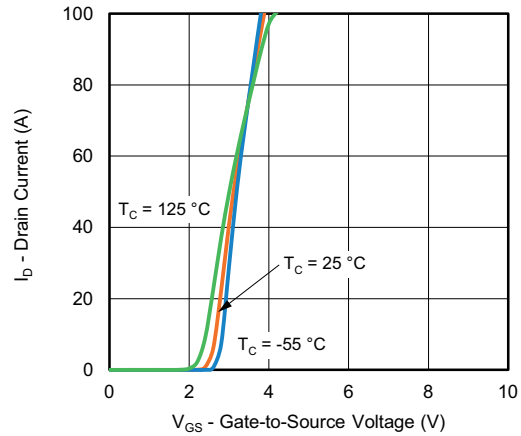
- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %
- b. Guaranteed by design, not subject to production testing
- c. Independent of operating temperature

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.

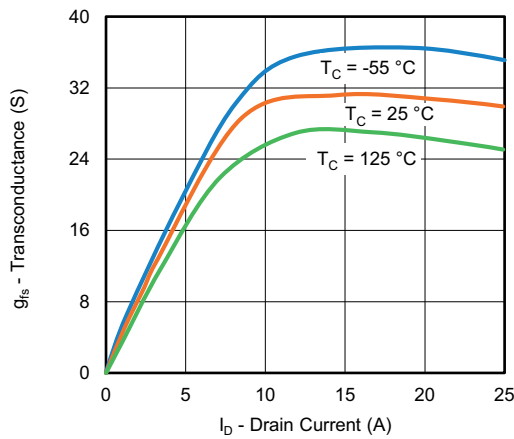
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



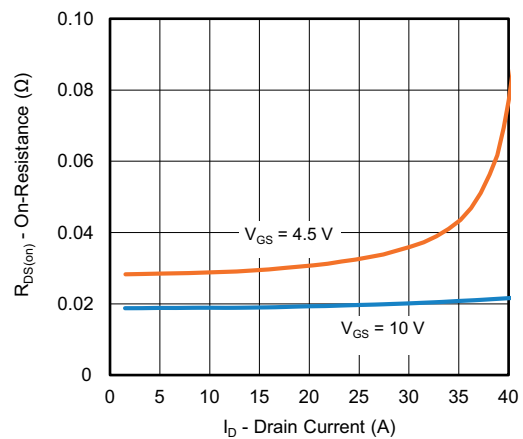
Output Characteristics



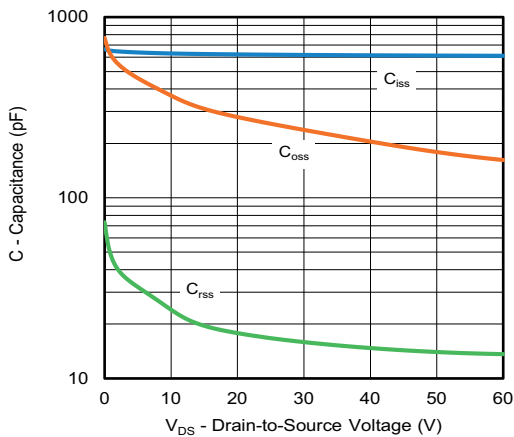
Transfer Characteristics



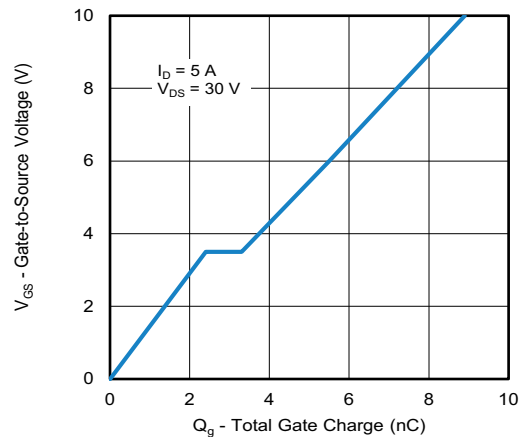
Transconductance



On-Resistance vs. Drain Current

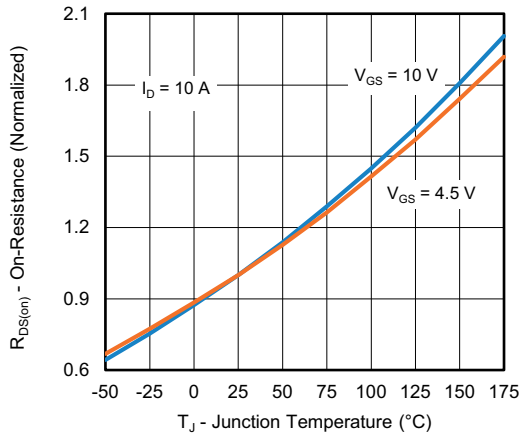


Capacitance

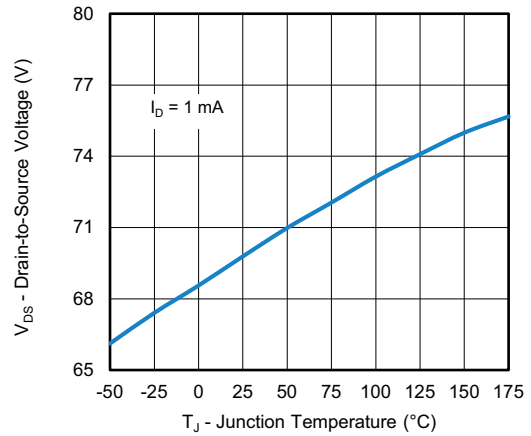


Gate Charge

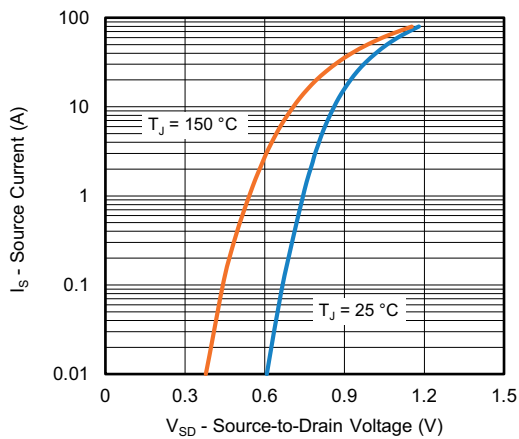
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



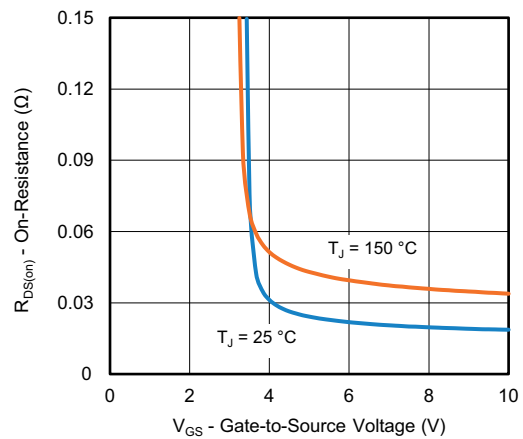
On-Resistance vs. Junction Temperature



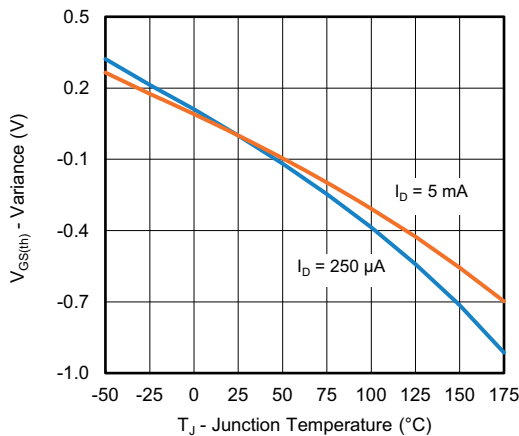
Drain Source Breakdown vs. Junction Temperature



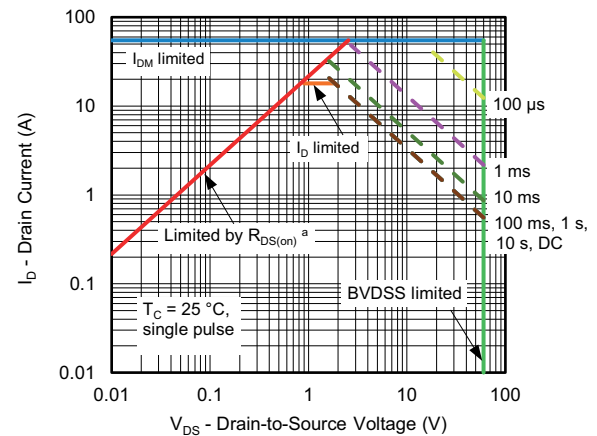
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



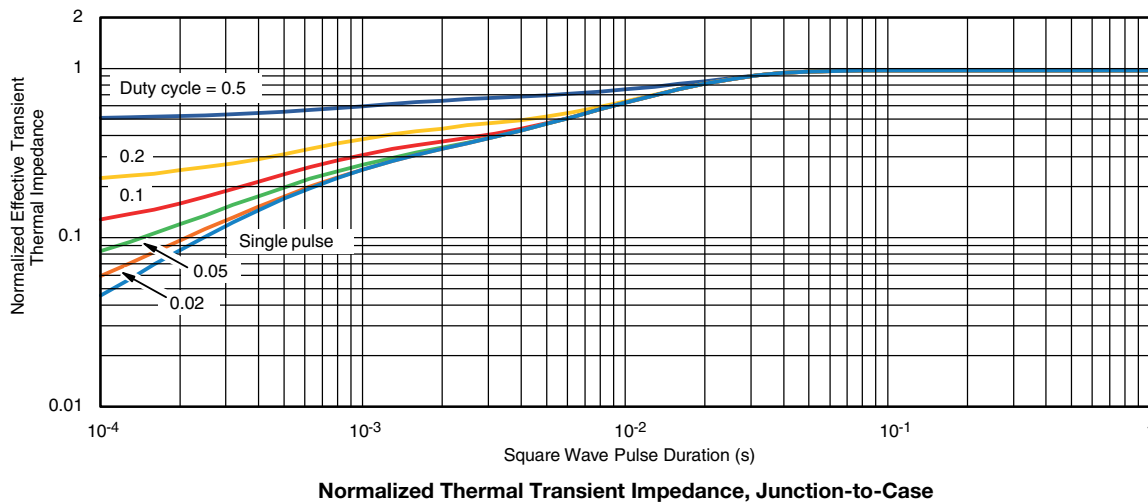
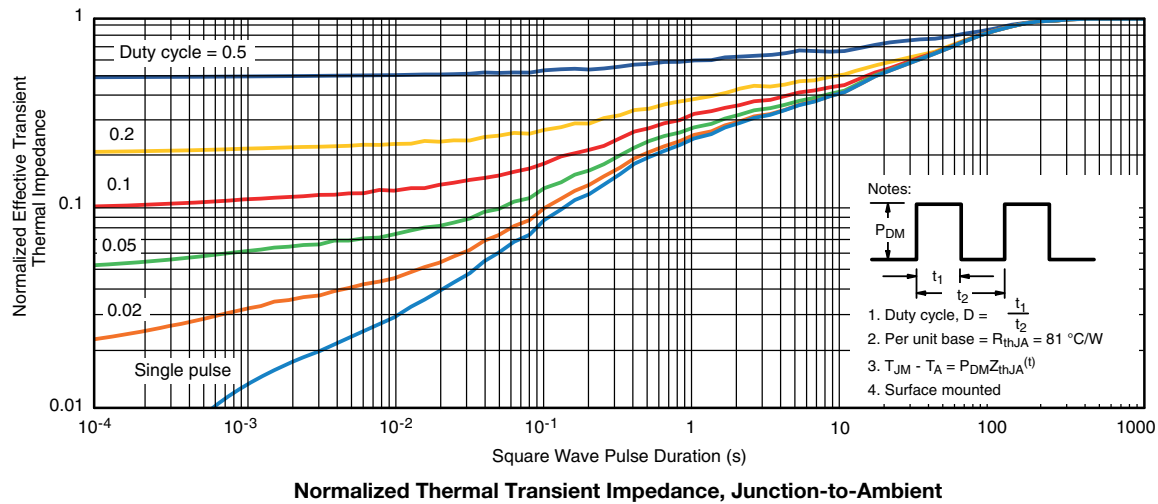
Safe Operating Area

Note

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



THERMAL RATINGS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)

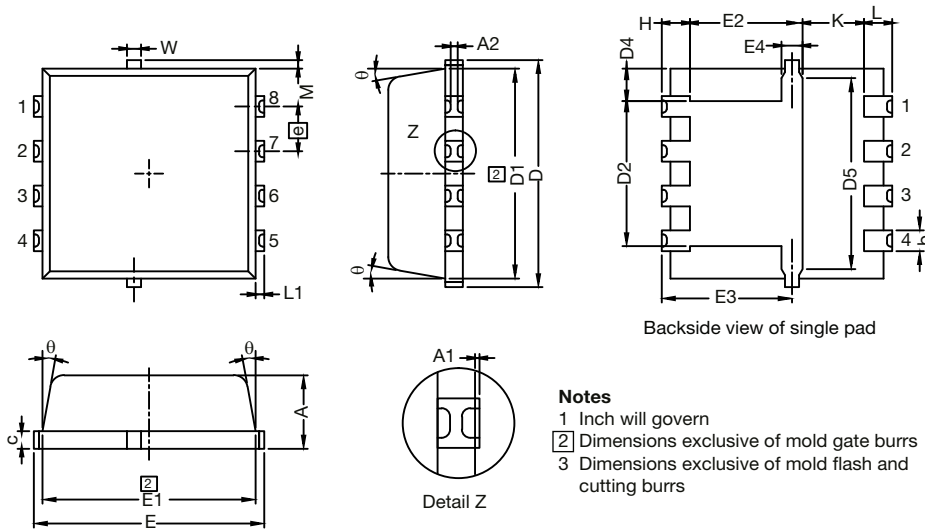


Note

- The characteristics shown in the two graphs
 - Normalized Transient Thermal Impedance Junction-to-Ambient ($25\text{ }^\circ\text{C}$)
 - Normalized Transient Thermal Impedance Junction-to-Case ($25\text{ }^\circ\text{C}$)
 are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions

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PowerPAK® 1212-8W Case Outline



DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.97	1.04	1.12	0.038	0.041	0.044
A1	0	-	0.05	0	-	0.002
A2	0	-	0.13	0	-	0.005
b	0.23	0.30	0.41	0.009	0.012	0.016
c	0.23	0.28	0.33	0.009	0.011	0.013
D	3.20	3.30	3.40	0.126	0.130	0.134
D1	2.95	3.05	3.15	0.116	0.120	0.124
D2	1.98	2.11	2.24	0.078	0.083	0.088
D4	0.47 typ.			0.0185 typ.		
D5	2.3 typ.			0.090 typ.		
E	3.20	3.30	3.40	0.126	0.130	0.134
E1	2.95	3.05	3.15	0.116	0.120	0.124
E2	1.47	1.60	1.73	0.058	0.063	0.068
E3	1.75	1.85	1.98	0.069	0.073	0.078
E4	0.34 typ.			0.013 typ.		
e	0.65 BSC.			0.026 BSC		
K	0.86 typ.			0.034 typ.		
H	0.30	0.41	0.51	0.012	0.016	0.020
L	0.30	0.43	0.56	0.012	0.017	0.022
L1	0.06	0.13	0.20	0.002	0.005	0.008
theta	0°	-	12°	0°	-	12°
W	0.15	0.25	0.36	0.006	0.010	0.014
M	0.125 typ.			0.005 typ.		

ECN: C15-1530-Rev. B, 16-Nov-15
 DWG: 6032

RECOMMENDED MINIMUM PADS FOR PowerPAK® 1212-8 Single



Recommended Minimum Pads
Dimensions in Inches/(mm)

[Return to Index](#)



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