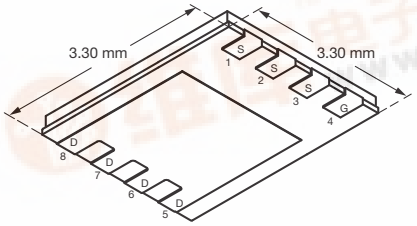
Automotive
P-Channel 12 V (D-S) 175 °C MOSFET

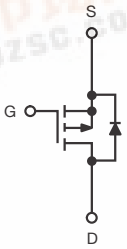
PRODUCT SUMMARY	
V_{DS} (V)	- 12
$R_{DS(on)}$ (Ω) at V_{GS} = - 4.5 V	0.020
$R_{DS(on)}$ (Ω) at V_{GS} = - 2.5 V	0.026
I_D (A)	- 16
Configuration	Single

PowerPAK® 1212-8



Bottom View

Part Marking Code: Q007



P-Channel MOSFET

FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- TrenchFET® Power MOSFET
- Compliant to RoHS Directive 2002/95/EC
- AEC-Q101 Qualified[d]
- Find out more about Vishay's Automotive Grade Product Requirements at: www.vishay.com/applications

AUTOMOTIVE GRADE
Pb-free
RoHS COMPLIANT
HALOGEN FREE

ORDERING INFORMATION	
Package	PowerPAK 1212-8
Lead (Pb)-free and Halogen-free	SQS405EN-T1-GE3

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

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	- 12	V
Gate-Source Voltage		V_{GS}	± 8	V
Continuous Drain Current[a]	T_C = 25 °C	I_D	- 16	A
	T_C = 125 °C		- 16	A
Continuous Source Current (Diode Conduction)[a]		I_S	- 16	A
Pulsed Drain Current[b]		I_{DM}	- 64	A
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	- 19	A
Single Pulse Avalanche Energy	L = 0.1 mH	E_{AS}	18	mJ
Maximum Power Dissipation[b]	T_C = 25 °C	P_D	39	W
	T_C = 125 °C	P_D	13	W
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to + 175	°C
Soldering Recommendations (Peak Temperature)[e, f]			260	°C

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-Ambient	PCB Mount[c]	R_{thJA}	81	°C/W
Junction-to-Case (Drain)		R_{thJC}	3.8	°C/W

Notes

a. Package limited.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
c. When mounted on 1" square PCB (FR4 material).
d. Parametric verification ongoing.
e. See solder profile (www.vishay.com/ppg?73257). The PowerPAK 1212-8 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.
f. Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.

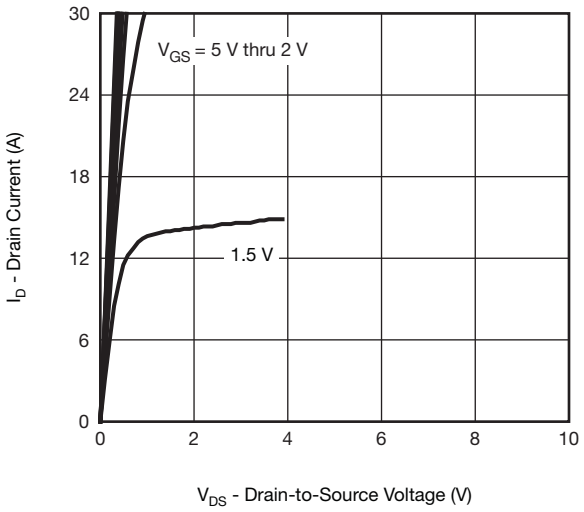
SPECIFICATIONS (T_C = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = - 250 µA		- 12	-	-	V
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = - 250 µA		- 0.45	- 0.6	- 1.0	
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 8 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V	V_{DS} = - 12 V	-	-	- 1	µA
		V_{GS} = 0 V	V_{DS} = - 12 V, T_J = 125 °C	-	-	- 50	
		V_{GS} = 0 V	V_{DS} = - 12 V, T_J = 175 °C	-	-	- 150	
On-State Drain Current[a]	$I_{D(on)}$	V_{GS} = - 4.5 V	V_{DS} ≤ - 5 V	- 20	-	-	A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = - 4.5 V	I_D = - 13.5 A	-	0.014	0.020	Ω
		V_{GS} = - 2.5 V	I_D = - 12 A	-	0.017	0.026	
Forward Transconductance[b]	g_{fs}	V_{DS} = - 6 V, I_D = - 13.5 A		-	34	-	S
Dynamic[b]							
Input Capacitance	C_{iss}	V_{GS} = 0 V	V_{DS} = - 6 V, f = 1 MHz	-	2210	2650	pF
Output Capacitance	C_{oss}			-	840	1010	
Reverse Transfer Capacitance	C_{rss}			-	660	800	
Total Gate Charge[c]	Q_g	V_{GS} = - 8 V	V_{DS} = - 6 V, I_D = - 10 A	-	49.8	75	nC
Gate-Source Charge[c]	Q_{gs}			-	3.8	5.9	
Gate-Drain Charge[c]	Q_{gd}			-	8.2	15	
Turn-On Delay Time[c]	$t_{d(on)}$	V_{DD} = - 6 V, R_L = 0.6 Ω I_D ≅ - 1.5 A, V_{GEN} = - 4.5 V, R_g = 1 Ω		-	27	34.5	ns
Rise Time[c]	t_r			-	29	35	
Turn-Off Delay Time[c]	$t_{d(off)}$			-	59	72	
Fall Time[c]	t_f			-	26	32	
Source-Drain Diode Ratings and Characteristics[b]							
Pulsed Current[a]	I_{SM}			-	-	- 64	A
Forward Voltage	V_{SD}	I_F = - 10 A, V_{GS} = 0 V		-	- 0.8	- 1.1	V

Notes

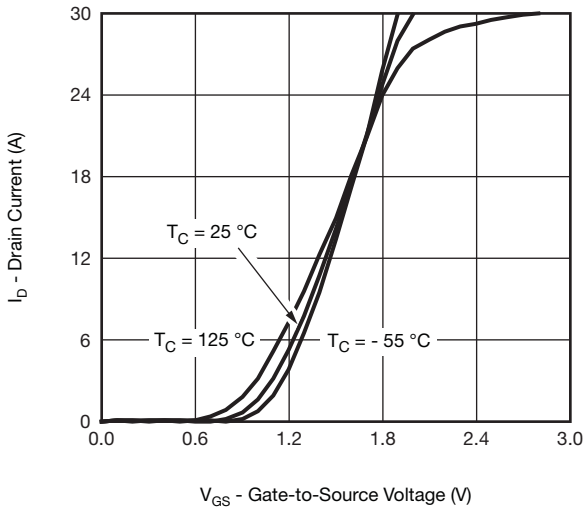
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

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.

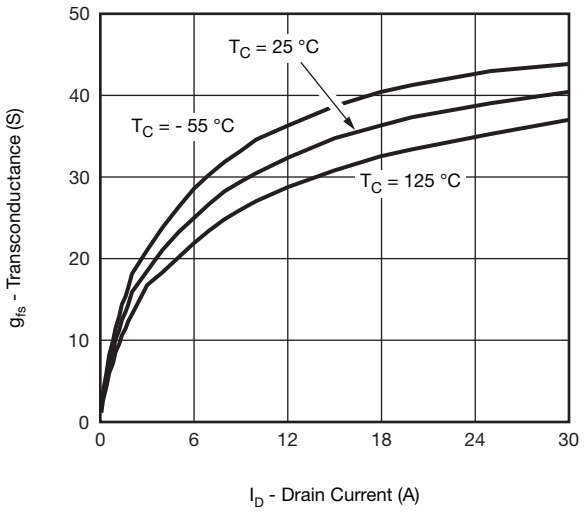
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



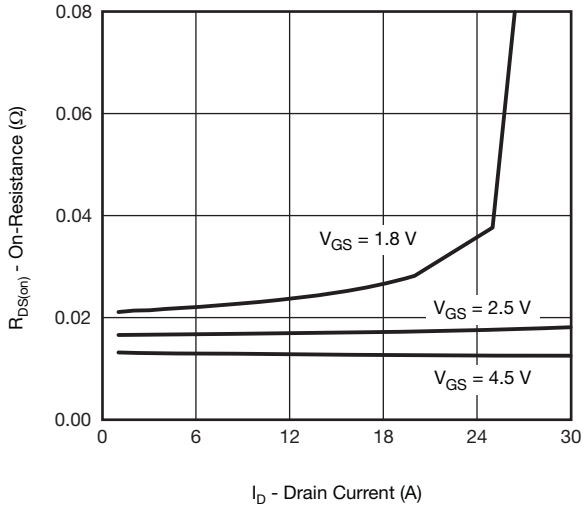
Output Characteristics



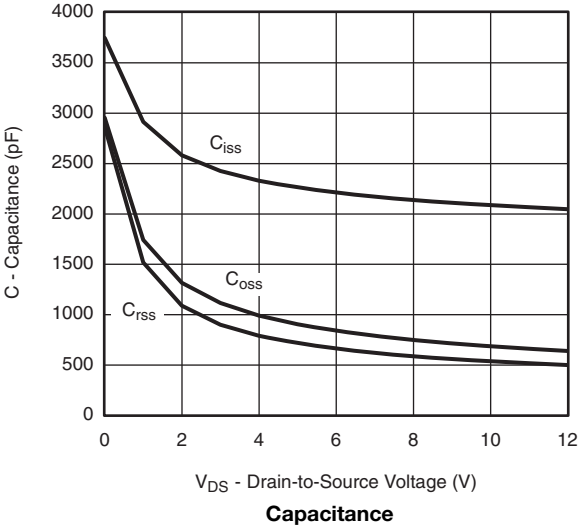
Transfer Characteristics



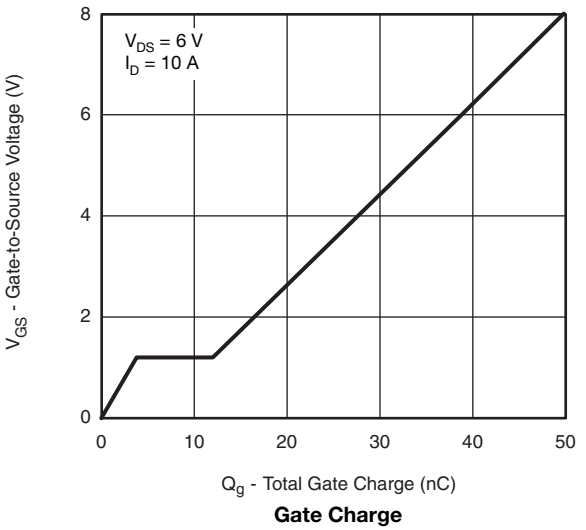
Transconductance



On-Resistance vs. Drain Current

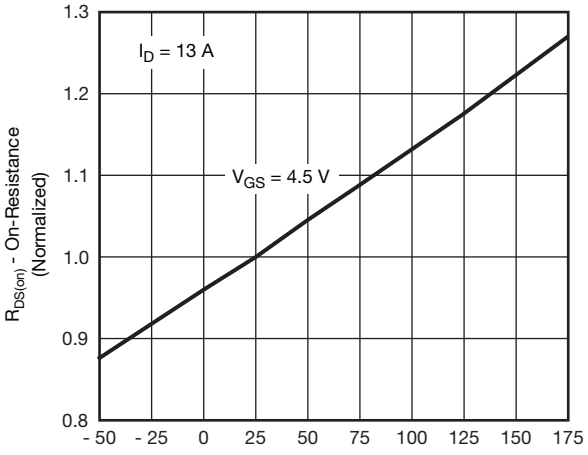


Capacitance



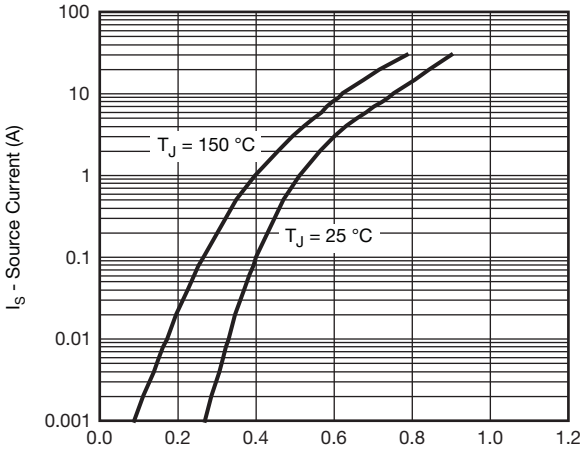
Gate Charge

TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



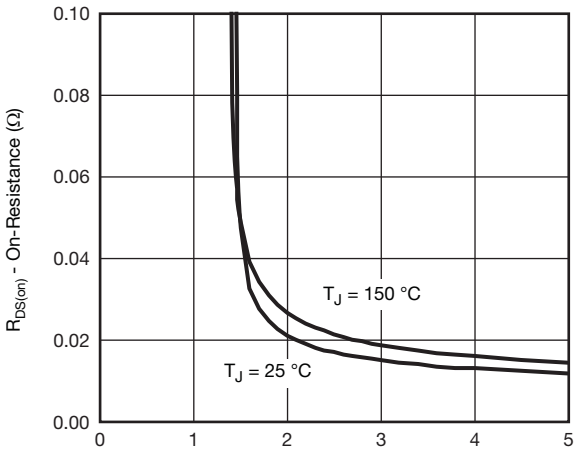
T_J - Junction Temperature (°C)

On-Resistance vs. Junction Temperature



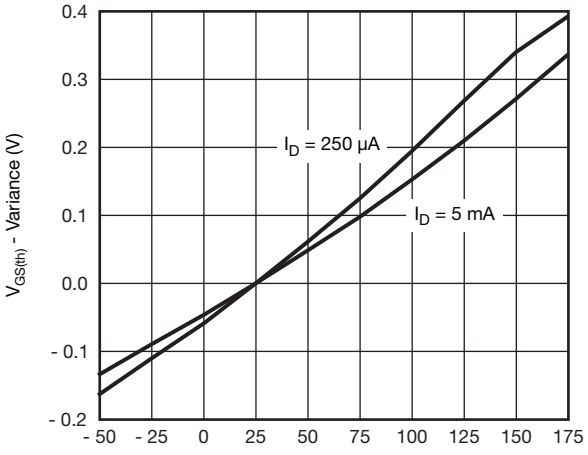
V_{SD} - Source-to-Drain Voltage (V)

Source Drain Diode Forward Voltage



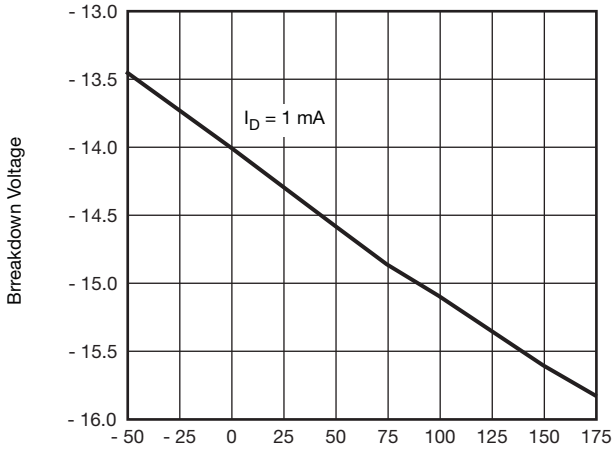
V_{GS} - Gate-to-Source Voltage (V)

On-Resistance vs. Gate-to-Source Voltage



T_J - Junction Temperature (°C)

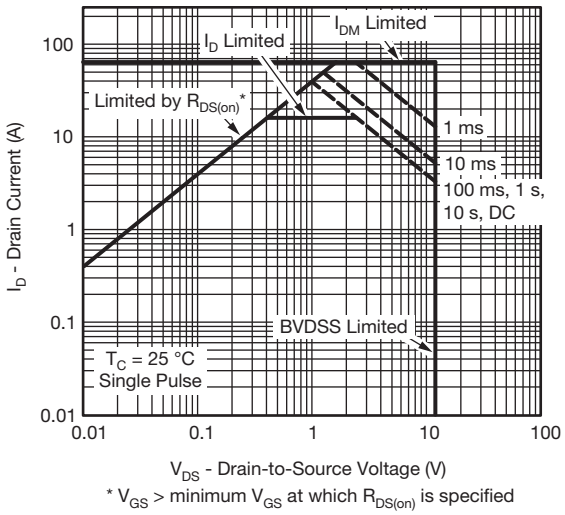
Threshold Voltage



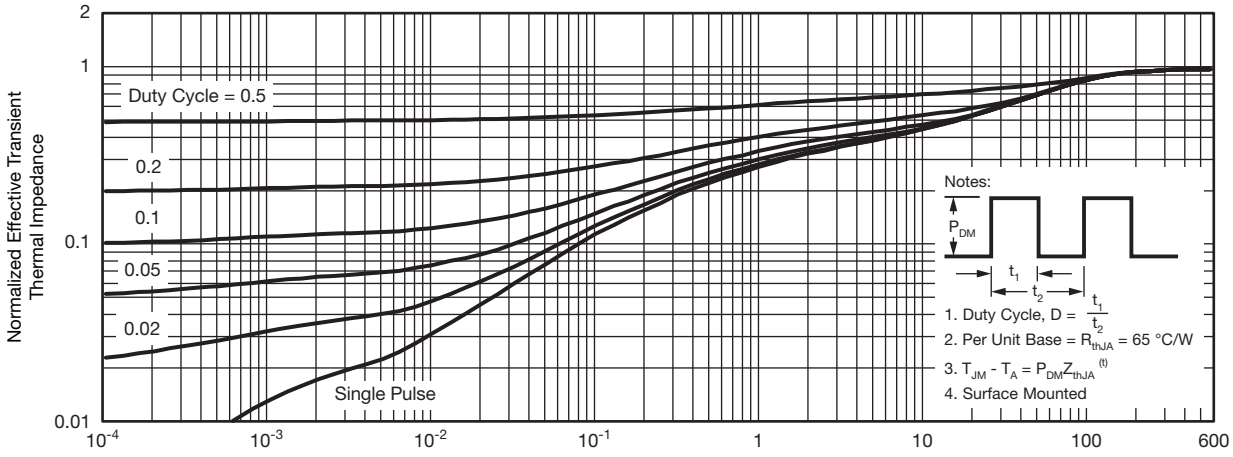
T_J - Junction Temperature (°C)

Drain Source Breakdown vs. Junction Temperature

THERMAL RATINGS (T_A = 25 °C, unless otherwise noted)

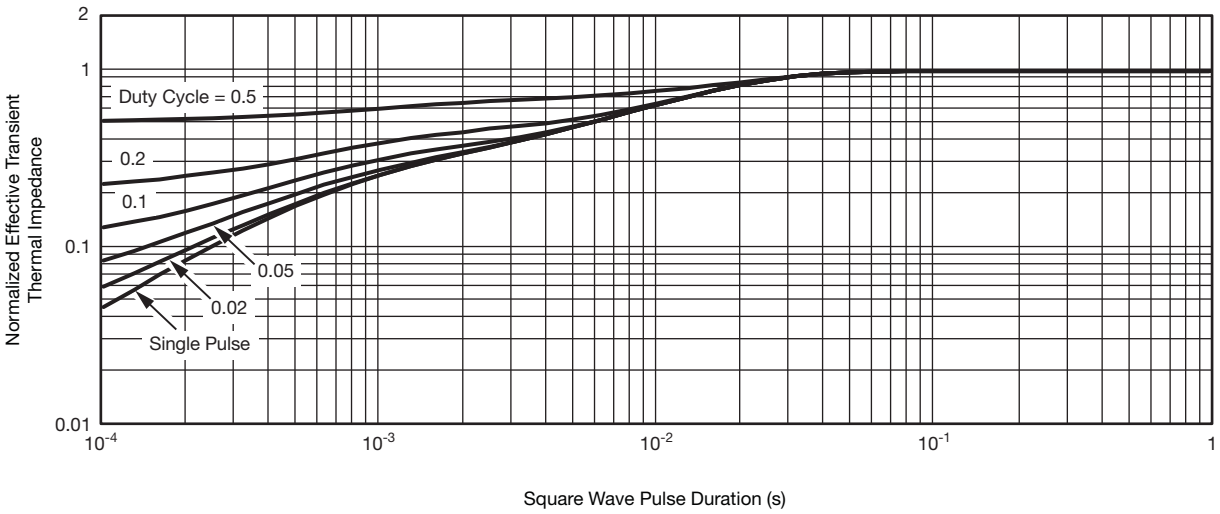


Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Ambient

THERMAL RATINGS (T_A = 25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Case

Note

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction-to-Case (25 °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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