

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

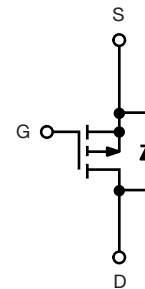
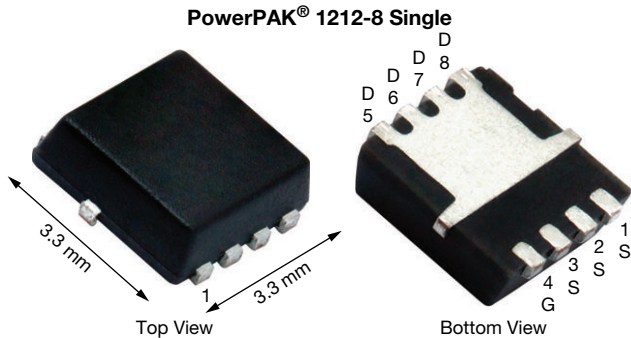
 AUTOMOTIVE
GRADE

RoHS
COMPLIANT
HALOGEN
FREE

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

FEATURES

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



P-Channel MOSFET

Marking Code: Q022

ORDERING INFORMATION	
Package	PowerPAK 1212-8
Lead (Pb)-free and Halogen-free	SQS405ENW-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	
Continuous Drain Current ^a	I_D	$T_C = 25$ °C	-16
		$T_C = 125$ °C	-16
Continuous Source Current (Diode Conduction) ^a	I_S	-16	A
Pulsed Drain Current ^b	I_{DM}	-64	mJ
Single Pulse Avalanche Current	I_{AS}	-19	
Single Pulse Avalanche Energy			
Maximum Power Dissipation ^b	P_D	$T_C = 25$ °C	39
		$T_C = 125$ °C	13
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 to +175	°C
Soldering Recommendations (Peak Temperature) ^{e, f}		260	

THERMAL RESISTANCE RATINGS			
PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient	R_{thJA}	81	°C/W
Junction-to-Case (Drain)			

Notes

- Package limited.
- Pulse test; pulse width ≤ 300 μ s, duty cycle ≤ 2 %.
- When mounted on 1" square PCB (FR4 material).
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.



SPECIFICATIONS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0, I_D = -250\text{ }\mu\text{A}$		-12	-	-	V
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$		-0.45	-0.6	-1	
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 8\text{ V}$		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}$	$V_{DS} = -12\text{ V}$	-	-	-1	μA
		$V_{GS} = 0\text{ V}$	$V_{DS} = -12\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	-50	
		$V_{GS} = 0\text{ V}$	$V_{DS} = -12\text{ V}, T_J = 175\text{ }^\circ\text{C}$	-	-	-150	
On-State Drain Current ^a	$I_{D(on)}$	$V_{GS} = -4.5\text{ V}$	$V_{DS} \leq -5\text{ V}$	-20	-	-	A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}$	$I_D = -13.5\text{ A}$	-	0.014	0.020	Ω
		$V_{GS} = -4.5\text{ V}$	$I_D = -13.5\text{ A}$	-	-	0.024	
		$V_{GS} = -4.5\text{ V}$	$I_D = -13.5\text{ A}$	-	-	0.026	
		$V_{GS} = -2.5\text{ V}$	$I_D = -12\text{ A}$	-	0.017	0.026	
Forward Transconductance ^b	g_{fs}	$V_{DS} = -6\text{ V}, I_D = -13.5\text{ A}$		-	34	-	S
Dynamic ^b							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$	$V_{DS} = -6\text{ V}, f = 1\text{ MHz}$	-	2210	2650	μF
Output Capacitance	C_{oss}			-	840	1010	
Reverse Transfer Capacitance	C_{rss}			-	660	800	
Total Gate Charge ^c	Q_g	$V_{GS} = -8\text{ V}$	$V_{DS} = -6\text{ V}, I_D = -10\text{ A}$	-	49.8	75	nC
Gate-Source Charge ^c	Q_{gs}			-	3.8	5.9	
Gate-Drain Charge ^c	Q_{gd}			-	8.2	15	
Gate Resistance	R_g	f = 1 MHz		1.1	2.4	4	Ω
Turn-On Delay Time ^c	$t_{d(on)}$	$V_{DD} = -6\text{ V}, R_L = 0.6\text{ }\Omega$ $I_D \cong -1.5\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\text{ }\Omega$		-	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}	$I_F = -10\text{ A}, V_{GS} = 0$		-	-0.8	-1.1	V

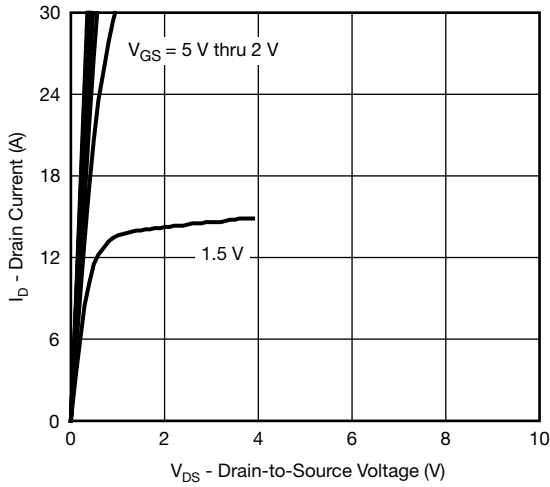
Notes

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

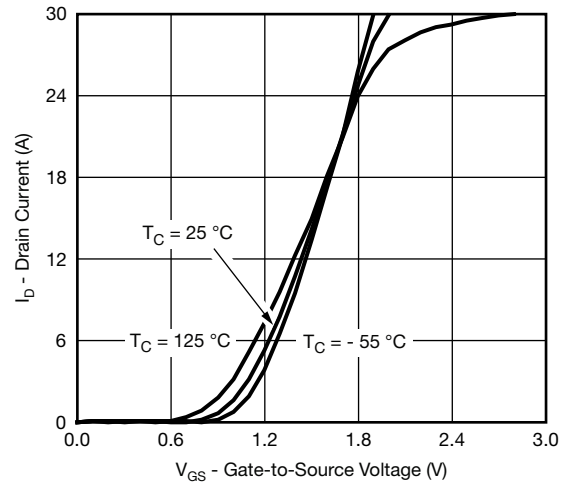
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



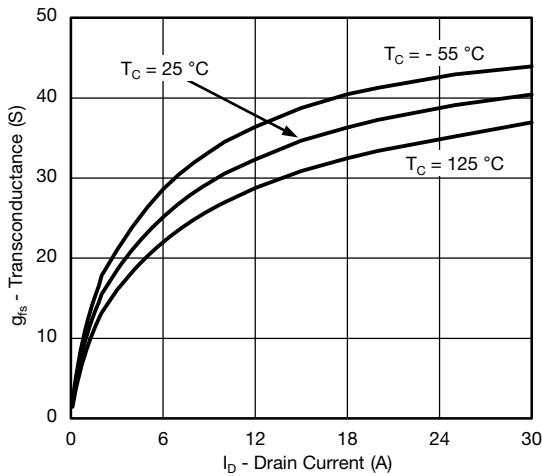
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



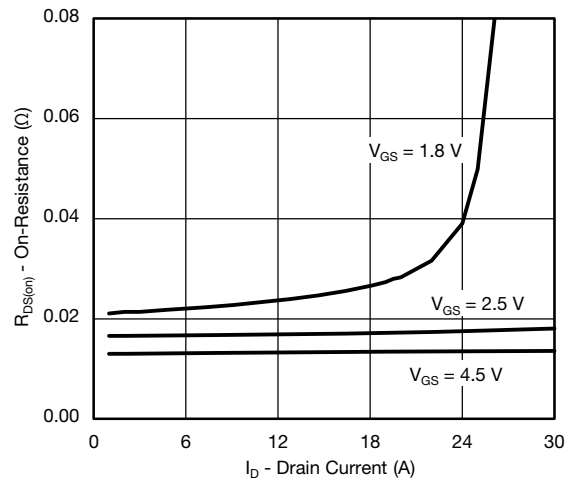
Output Characteristics



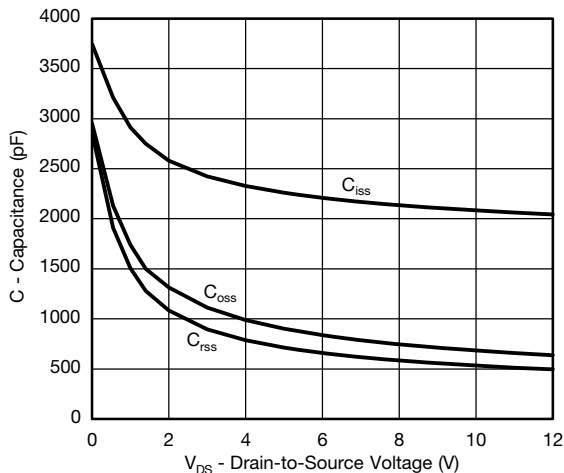
Transfer Characteristics



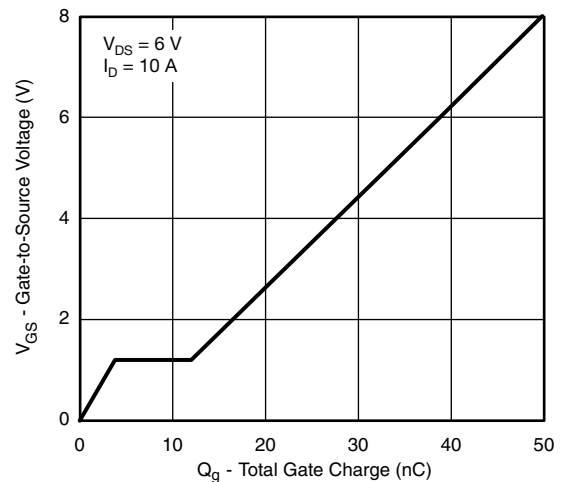
Transconductance



On-Resistance vs. Drain Current

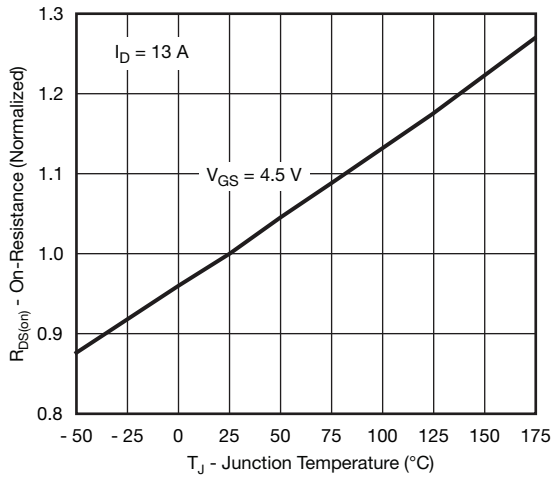


Capacitance

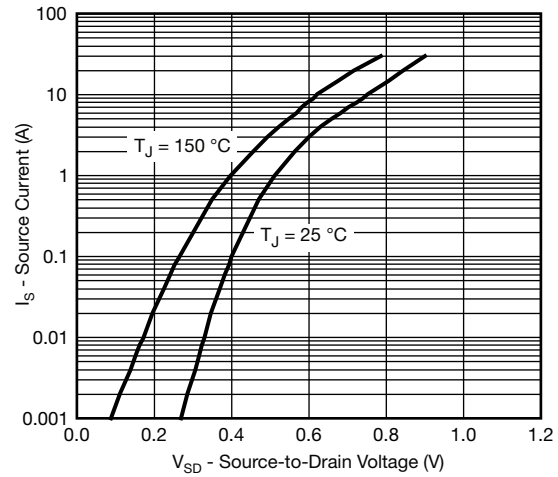


Gate Charge

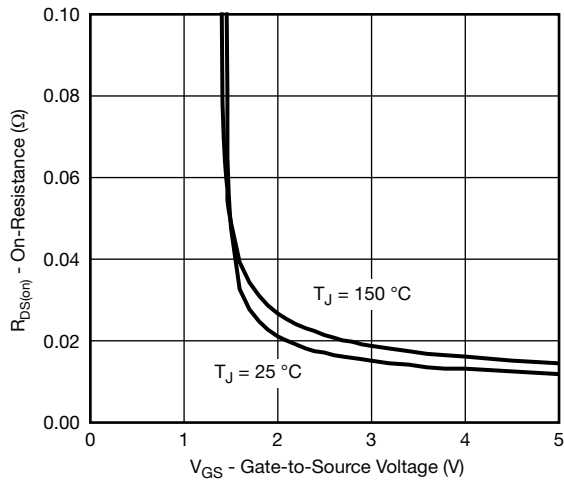
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



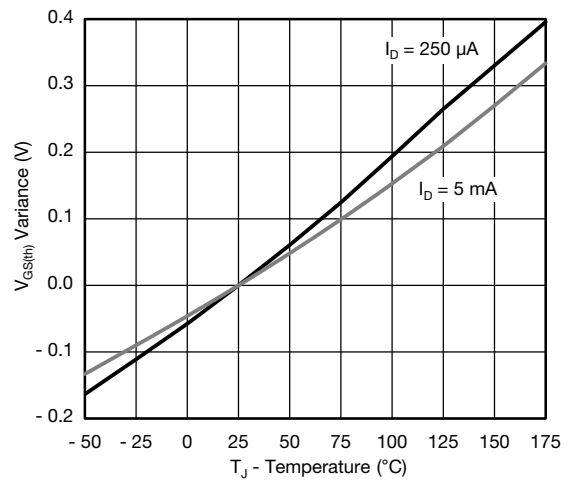
On-Resistance vs. Junction Temperature



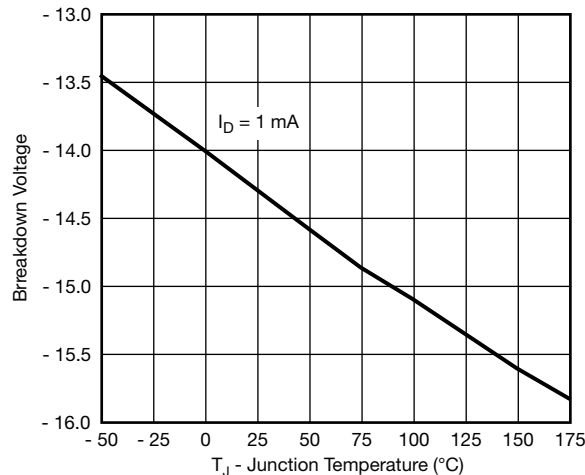
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



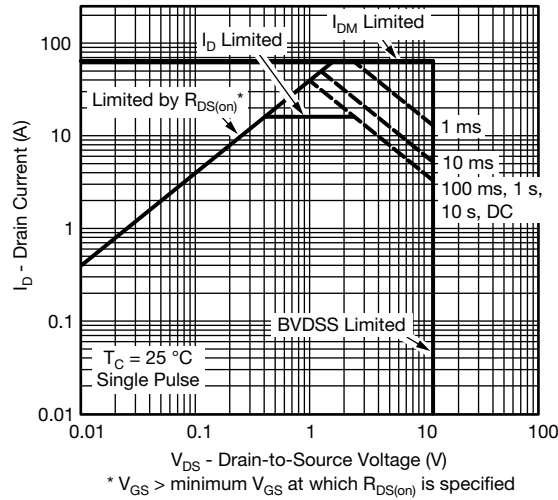
Threshold Voltage



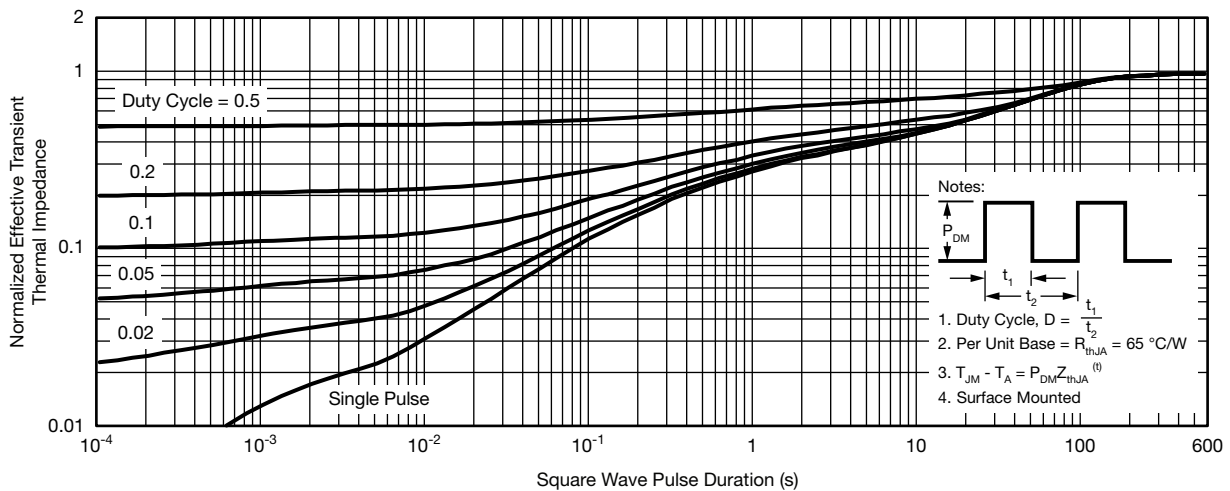
Drain Source Breakdown vs. Junction Temperature



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



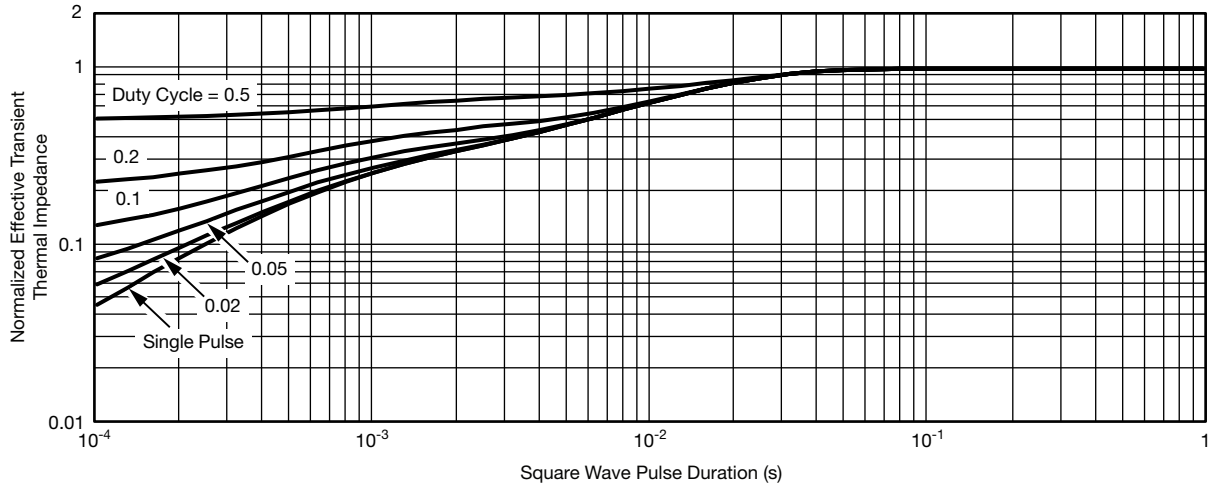
Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Ambient



THERMAL RATINGS ($T_A = 25\text{ }^\circ\text{C}$, 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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PowerPAK® 1212-8 and PowerPAK 1212-8W

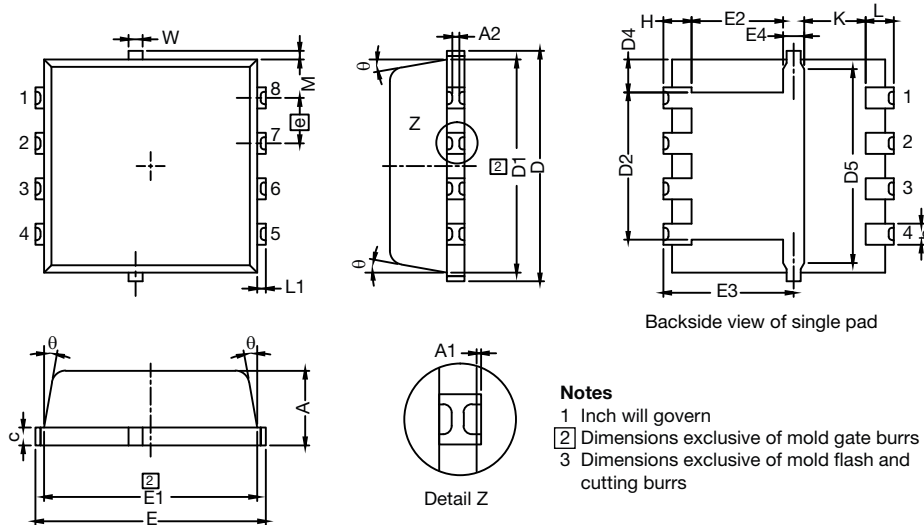
Ordering codes for the SQ rugged series power MOSFETs in the PowerPAK 1212-8 and PowerPAK 1212-8W packages:

DATASHEET PART NUMBER	OLD ORDERING CODE ^a	NEW ORDERING CODE
SQ7414AEN	SQ7414AEN-T1-GE3	SQ7414AEN-T1_GE3
SQ7414AENW	-	SQ7414AENW-T1_GE3
SQ7415AEN	SQ7415AEN-T1-GE3	SQ7415AEN-T1_GE3
SQ7415AENW	-	SQ7415AENW-T1_GE3
SQS401EN	SQS401EN-T1-GE3	SQS401EN-T1_GE3
SQS401ENW	-	SQS401ENW-T1_GE3
SQS405EN	SQS405EN-T1-GE3	SQS405EN-T1_GE3
SQS405ENW	-	SQS405ENW-T1_GE3
SQS420EN	SQS420EN-T1-GE3	SQS420EN-T1_GE3
SQS423EN	SQS423EN-T1-GE3	SQS423EN-T1_GE3
SQS460EN	SQS460EN-T1-GE3	SQS460EN-T1_GE3
SQS462EN	SQS462EN-T1-GE3	SQS462EN-T1_GE3
SQS482EN	SQS482EN-T1-GE3	SQS482EN-T1_GE3
SQS484EN	SQS484EN-T1-GE3	SQS484EN-T1_GE3
SQS490EN	SQS490EN-T1-GE3	SQS490EN-T1_GE3
SQS840EN	SQS840EN-T1-GE3	SQS840EN-T1_GE3
SQS850EN	SQS850EN-T1-GE3	SQS850EN-T1_GE3

Note

a. Old ordering code is obsolete and no longer valid for new orders

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
θ	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: C14-1253-Rev. A, 21-Jan-15						
DWG: 6032						



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