

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

PRODUCT SUMMARY	
$V_{DS}$ (V)	60
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10$ V	0.009
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 4.5$ V	0.013
$I_D$ (A)	50
Configuration	Single

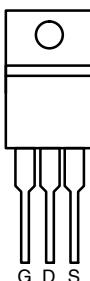
### FEATURES

- TrenchFET® Power MOSFET
- 100 %  $R_g$  and UIS Tested
- AEC-Q101 Qualified<sup>d</sup>
- Material categorization:  
For definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

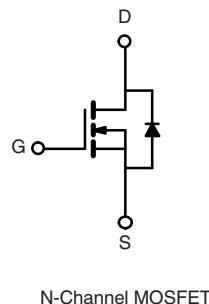



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

TO-220



Top View



### ORDERING INFORMATION

Package	TO-220
Lead (Pb)-free and Halogen-free	SQP50N06-09L-GE3

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

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		$V_{DS}$	60	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	
Continuous Drain Current	$T_C = 25$ °C <sup>a</sup>	$I_D$	50	A
	$T_C = 125$ °C		49	
Continuous Source Current (Diode Conduction) <sup>a</sup>		$I_S$	50	
Pulsed Drain Current <sup>b</sup>		$I_{DM}$	200	
Single Pulse Avalanche Current	$L = 0.1$ mH	$I_{AS}$	48	mJ
Single Pulse Avalanche Energy		$E_{AS}$	115	
Maximum Power Dissipation <sup>b</sup>	$T_C = 25$ °C	$P_D$	136	W
	$T_C = 125$ °C		45	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to + 175	°C

### THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-Ambient	PCB Mount <sup>c</sup>	$R_{thJA}$	50	°C/W
Junction-to-Case (Drain)		$R_{thJC}$	1.1	

#### Notes

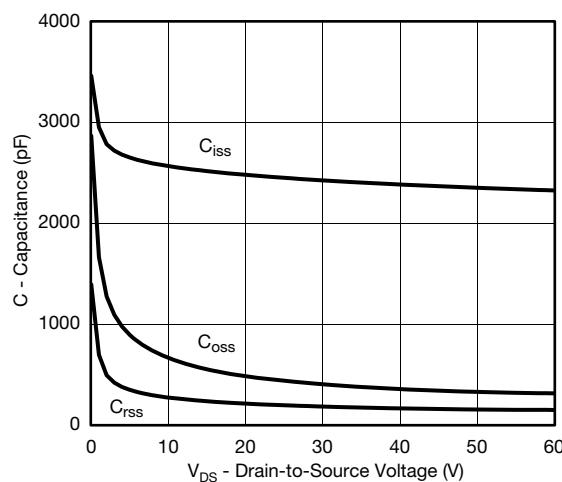
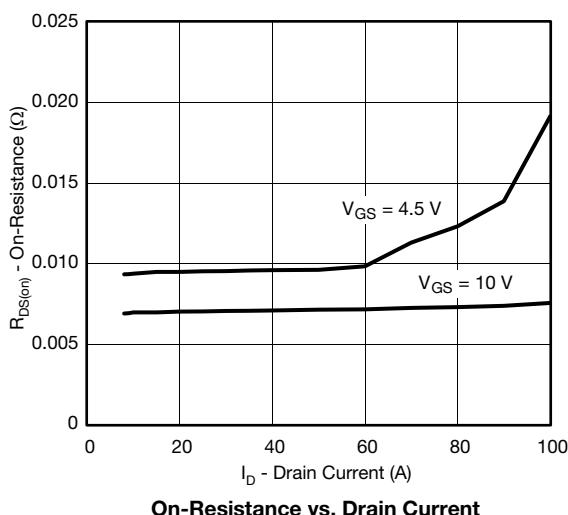
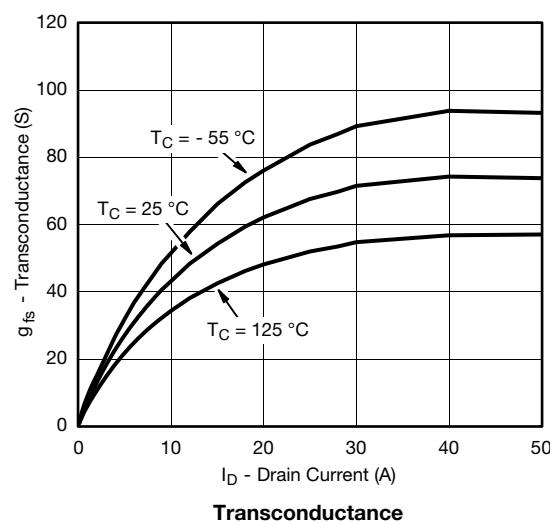
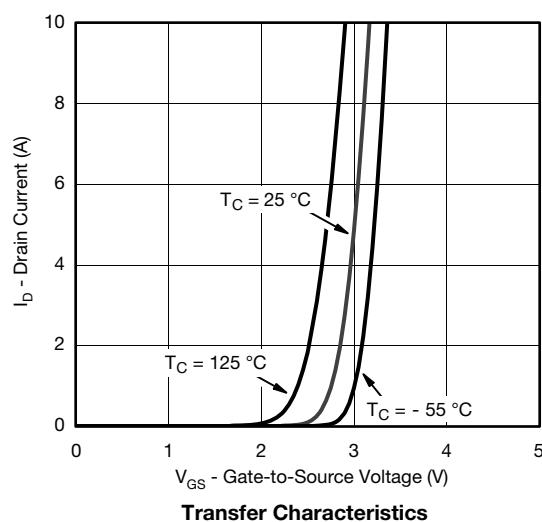
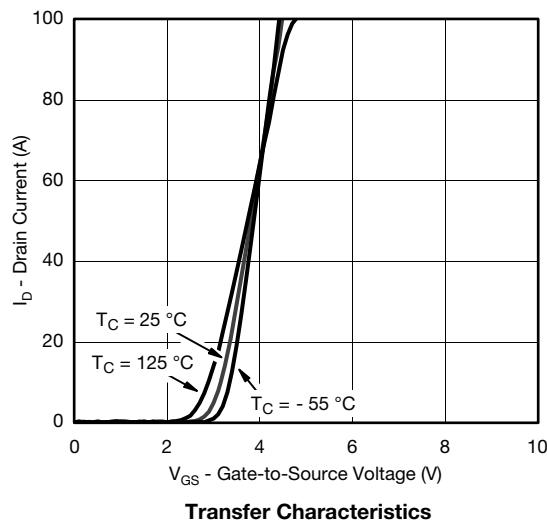
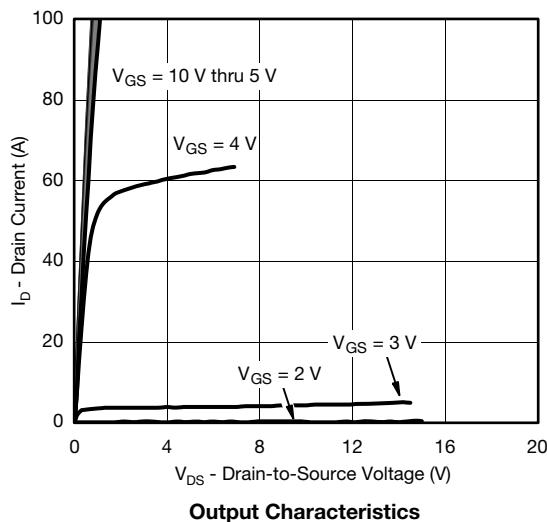
- Package limited.
- Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %.
- When mounted on 1" square PCB (FR-4 material).
- Parametric verification ongoing.

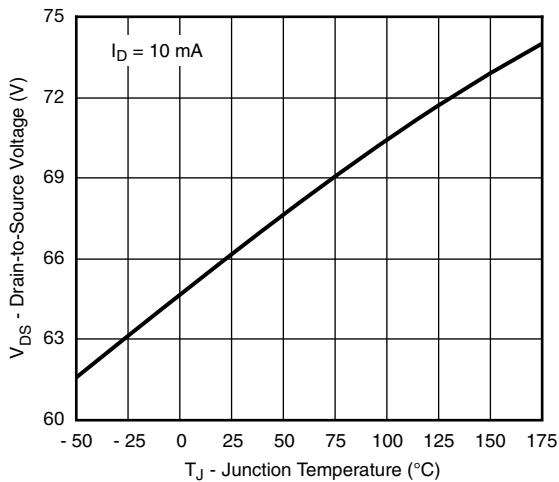
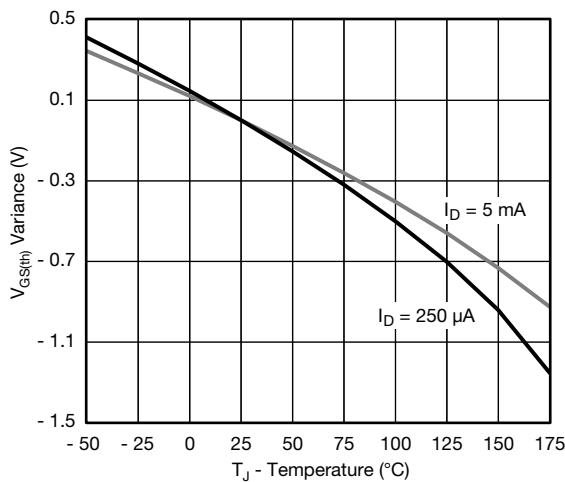
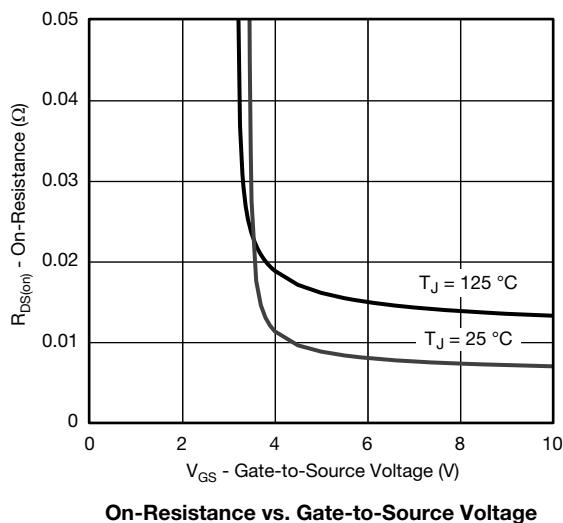
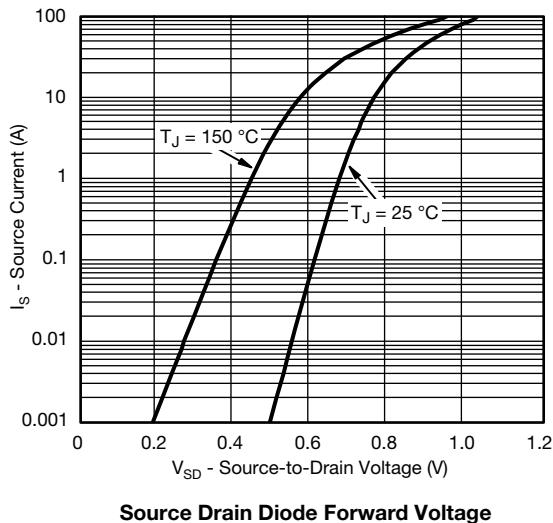
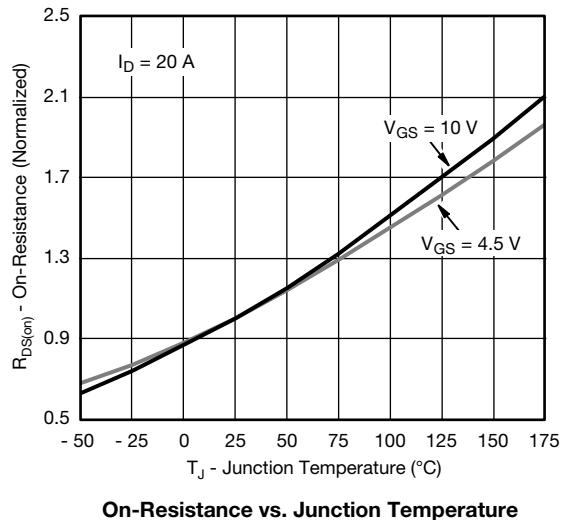
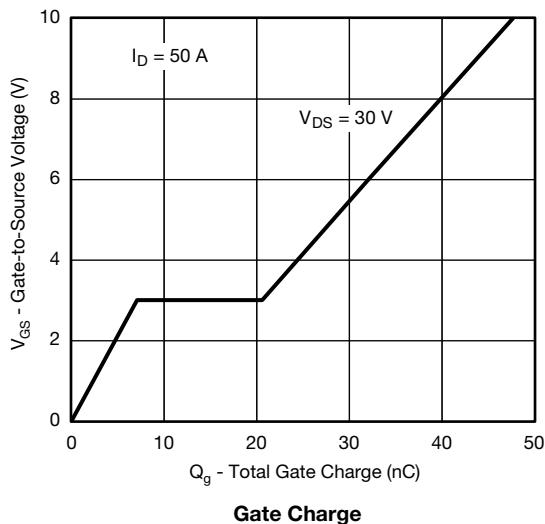
<b>SPECIFICATIONS</b> ( $T_C = 25^\circ\text{C}$ , unless otherwise noted)								
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT	
<b>Static</b>								
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$		60	-	-	V	
Gate-Source Threshold Voltage	$V_{GS(\text{th})}$	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$		1.5	2.0	2.5		
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 60\text{ V}$	-	-	1	$\mu\text{A}$	
		$V_{GS} = 0\text{ V}$	$V_{DS} = 60\text{ V}$ , $T_J = 125^\circ\text{C}$	-	-	50		
		$V_{GS} = 0\text{ V}$	$V_{DS} = 60\text{ V}$ , $T_J = 175^\circ\text{C}$	-	-	250		
On-State Drain Current <sup>a</sup>	$I_{D(\text{on})}$	$V_{GS} = 10\text{ V}$	$V_{DS} \geq 5\text{ V}$	50	-	-	A	
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(\text{on})}$	$V_{GS} = 10\text{ V}$	$I_D = 20\text{ A}$	-	0.0071	0.0090	$\Omega$	
		$V_{GS} = 10\text{ V}$	$I_D = 20\text{ A}$ , $T_J = 125^\circ\text{C}$	-	-	0.0160		
		$V_{GS} = 10\text{ V}$	$I_D = 20\text{ A}$ , $T_J = 175^\circ\text{C}$	-	-	0.0190		
		$V_{GS} = 4.5\text{ V}$	$I_D = 10\text{ A}$	-	0.0094	0.0130		
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}$ , $I_D = 20\text{ A}$		-	62	-	S	
<b>Dynamic<sup>b</sup></b>								
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$	-	2451	3065	pF	
Output Capacitance	$C_{oss}$			-	435	545		
Reverse Transfer Capacitance	$C_{rss}$			-	192	240		
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{GS} = 10\text{ V}$	$V_{DS} = 30\text{ V}$ , $I_D = 50\text{ A}$	-	48	72	nC	
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			-	7.1	-		
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			-	13.5	-		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		0.85	1.7	2.6	$\Omega$	
Turn-On Delay Time <sup>c</sup>	$t_{d(\text{on})}$	$V_{DD} = 30\text{ V}$ , $R_L = 0.6\text{ }\Omega$ $I_D \approx 50\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 1\text{ }\Omega$		-	10	15	ns	
Rise Time <sup>c</sup>	$t_r$			-	11	17		
Turn-Off Delay Time <sup>c</sup>	$t_{d(\text{off})}$			-	27	41		
Fall Time <sup>c</sup>	$t_f$			-	8	12		
<b>Source-Drain Diode Ratings and Characteristics<sup>b</sup></b>								
Pulsed Current <sup>a</sup>	$I_{SM}$			-	-	200	A	
Forward Voltage	$V_{SD}$	$I_F = 20\text{ A}$ , $V_{GS} = 0\text{ V}$		-	0.82	1.5	V	

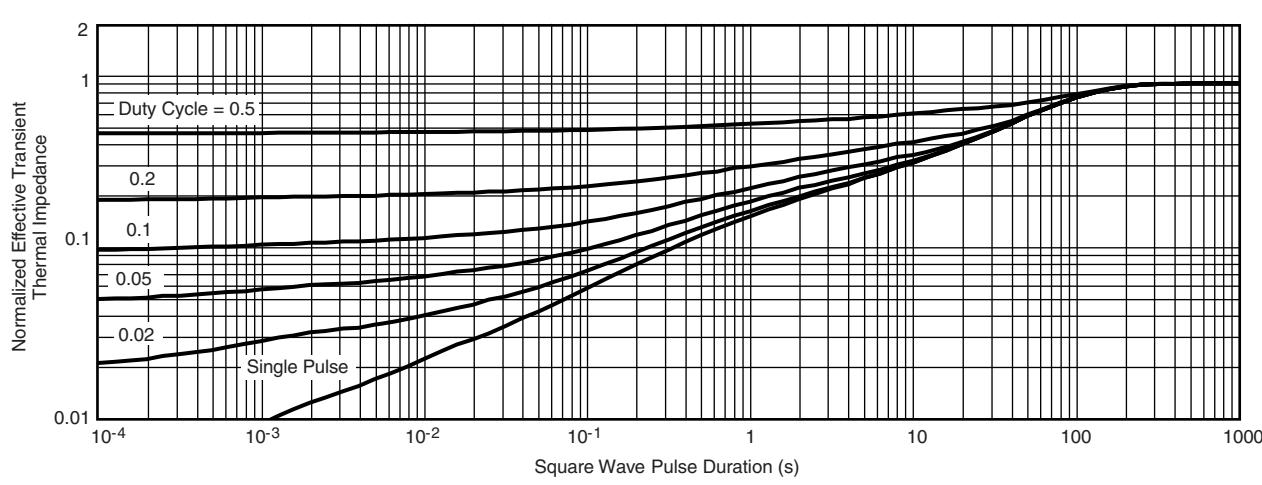
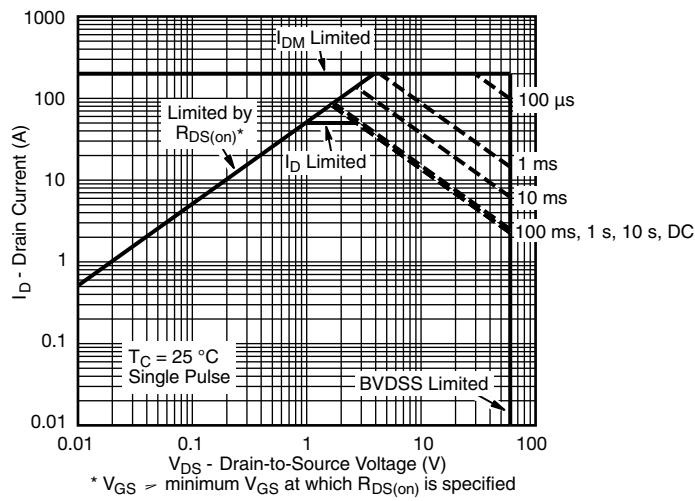
**Notes**

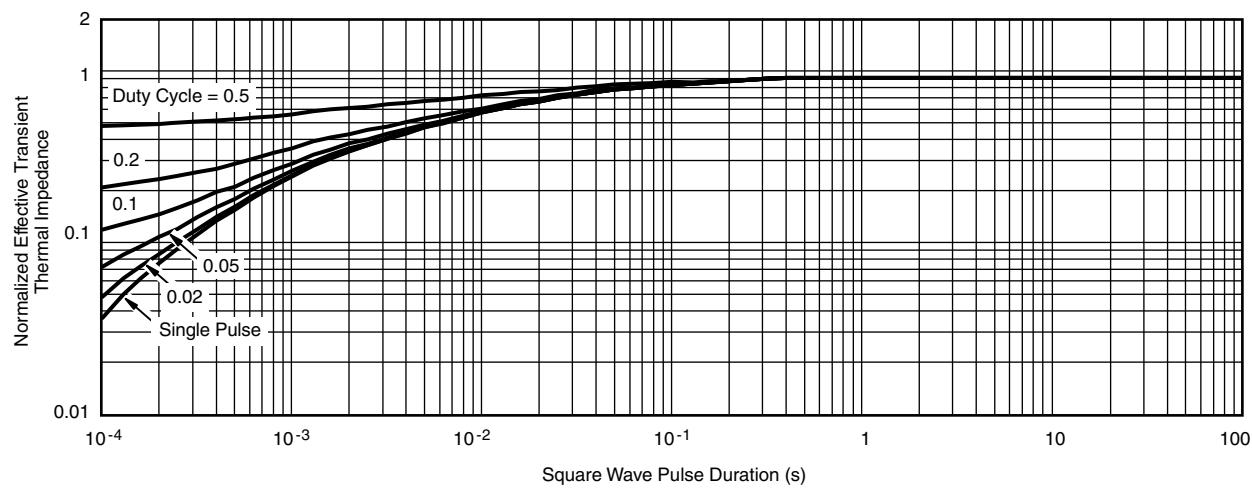
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\text{ \%}$ .
- b. Guaranteed by design, not subject to production testing.
- c. Independent of operating temperature.

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


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


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**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.

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?62664](http://www.vishay.com/ppg?62664).

## TO-220

Ordering codes for the SQ rugged series power MOSFETs in the TO-220 package:

DATASHEET PART NUMBER	OLD ORDERING CODE <sup>a</sup>	NEW ORDERING CODE
SQP100N04-3m6	-	SQP100N04-3M6_GE3
SQP100P06-9m3L	-	SQP100P06-9M3L_GE3
SQP120N06-06	-	SQP120N06-06_GE3
SQP120N06-3m5L	SQP120N06-3M5L-GE3	SQP120N06-3M5L_GE3
SQP120N10-09	SQP120N10-09-GE3	SQP120N10-09_GE3
SQP120N10-3m8	SQP120N10-3M8-GE3	SQP120N10-3M8_GE3
SQP25N15-52	-	SQP25N15-52_GE3
SQP50N06-09L	SQP50N06-09L-GE3	SQP50N06-09L_GE3
SQP50P03-07	SQP50P03-07-GE3	SQP50P03-07_GE3
SQP60N06-15	SQP60N06-15-GE3	SQP60N06-15_GE3
SQP90P06-07L	SQP90P06-07L-GE3	SQP90P06-07L_GE3

**Note**

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



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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

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