

# Automotive N-Channel 40 V (D-S) 175 °C MOSFET

## PRODUCT SUMMARY

$V_{DS}$ (V)	40
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10$ V	0.0018
$I_D$ (A)	200
Configuration	Single
Package	TO-263-7L

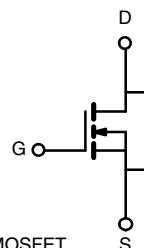
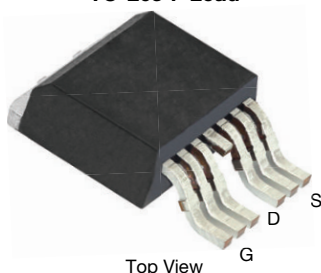
## FEATURES

- TrenchFET® power MOSFET
- Package with low thermal resistance
- 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-263 7-Lead



N-Channel MOSFET

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

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current	$I_D$	$T_C = 25$ °C <sup>a</sup>	200
		$T_C = 125$ °C	192
Continuous Source Current (Diode Conduction) <sup>a</sup>	$I_S$	200	A
Pulsed Drain Current <sup>b</sup>	$I_{DM}$	600	
Single Pulse Avalanche Current	$I_{AS}$	85	
Single Pulse Avalanche Energy	$E_{AS}$	361	mJ
Maximum Power Dissipation <sup>b</sup>	$P_D$	$T_C = 25$ °C	375
		$T_C = 125$ °C	125
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +175	°C

## THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient	$R_{thJA}$	40	°C/W
Junction-to-Case (Drain)	$R_{thJC}$	0.4	

### Notes

- Package limited.
- Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %.
- When mounted on 1" square PCB (FR4 material).
- Parametric verification ongoing.



SPECIFICATIONS (T <sub>C</sub> = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA		40	-	-	V
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA		2.5	3.0	3.5	
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 40 V	-	-	1	μA
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 40 V, T <sub>J</sub> = 125 °C	-	-	50	
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 40 V, T <sub>J</sub> = 175 °C	-	-	250	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>GS</sub> = 10 V	V <sub>DS</sub> ≥ 5 V	200	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A	-	0.0015	0.0018	Ω
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A, T <sub>J</sub> = 125 °C	-	-	0.0028	
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 30 A, T <sub>J</sub> = 175 °C	-	-	0.0034	
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 30 A		-	198	-	S
Dynamic <sup>b</sup>							
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 25 V, f = 1 MHz	-	13 880	17 350	pF
Output Capacitance	C <sub>oss</sub>			-	1414	1770	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	840	1050	
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	V <sub>DS</sub> = 20 V, I <sub>D</sub> = 120 A	-	206	310	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			-	50	-	
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			-	44	-	
Gate Resistance	R <sub>g</sub>	f = 1 MHz		0.25	0.8	1.8	Ω
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 0.17 Ω I <sub>D</sub> ≅ 120 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		-	26	39	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			-	21	32	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			-	68	102	
Fall Time <sup>c</sup>	t <sub>f</sub>			-	12	18	
Source-Drain Diode Ratings and Characteristics <sup>b</sup>							
Pulsed Current <sup>a</sup>	I <sub>SM</sub>			-	-	600	A
Forward Voltage	V <sub>SD</sub>	I <sub>F</sub> = 80 A, V <sub>GS</sub> = 0 V		-	0.86	1.5	V

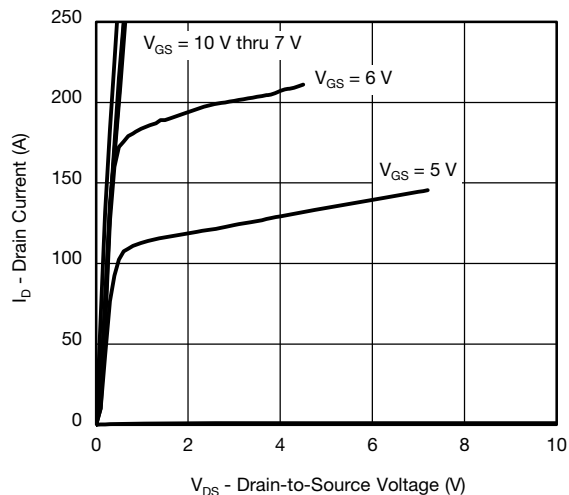
**Notes**

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

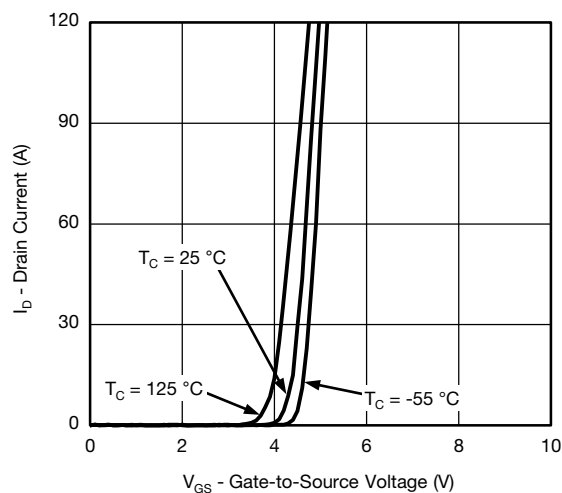
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



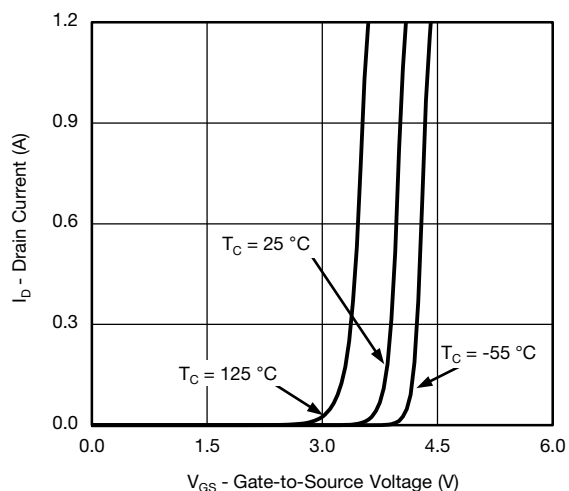
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



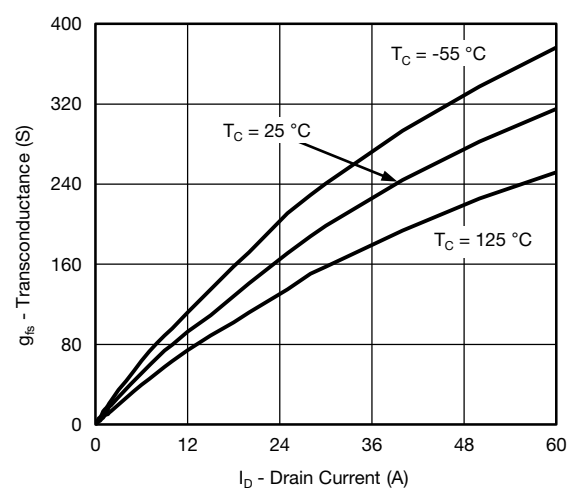
**Output Characteristics**



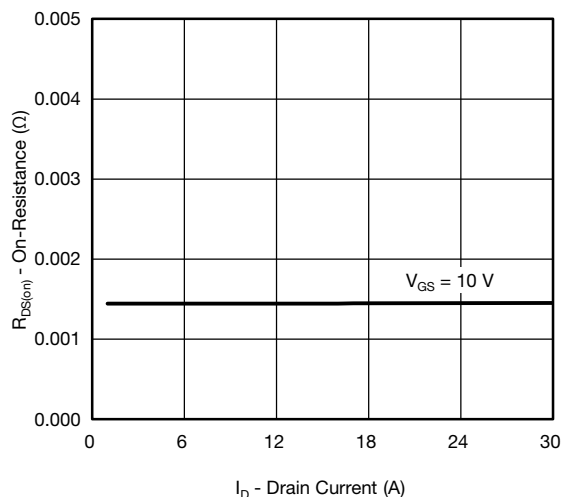
**Transfer Characteristics**



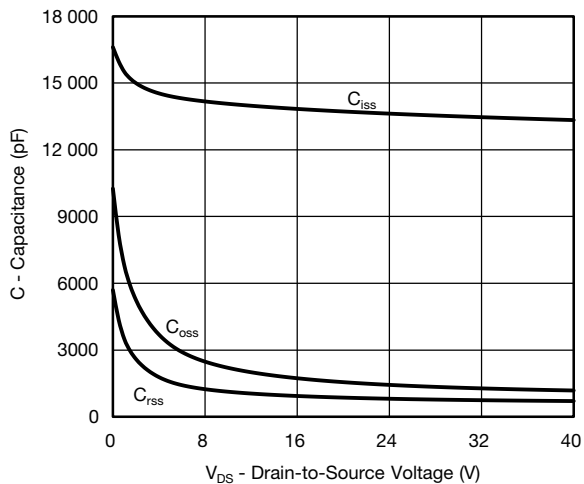
**Transfer Characteristics**



**Transconductance**



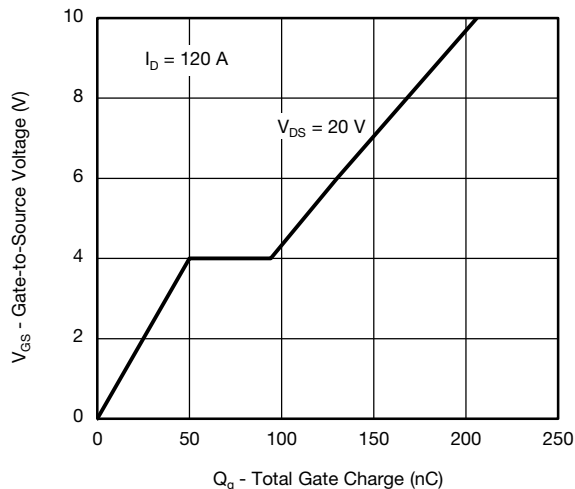
**On-Resistance vs. Drain Current**



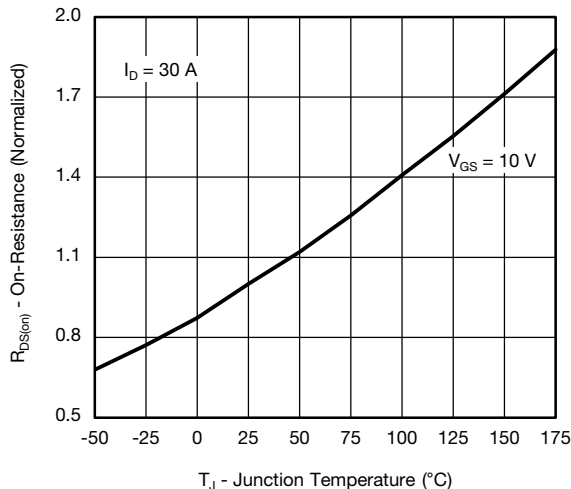
**Capacitance**



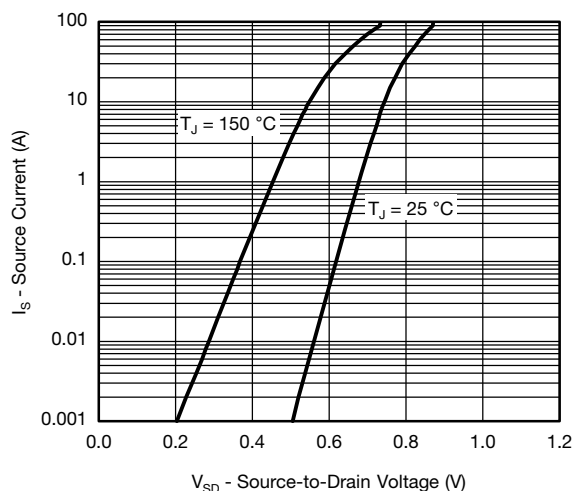
**TYPICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)



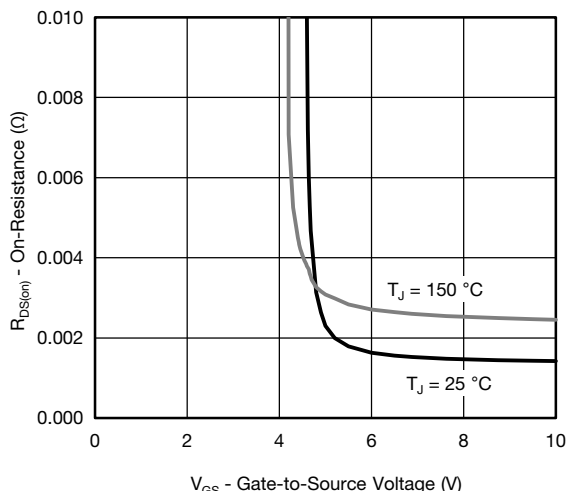
**Gate Charge**



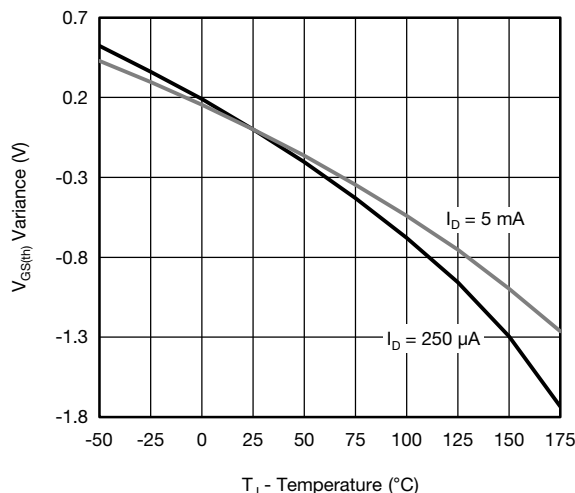
**On-Resistance vs. Junction Temperature**



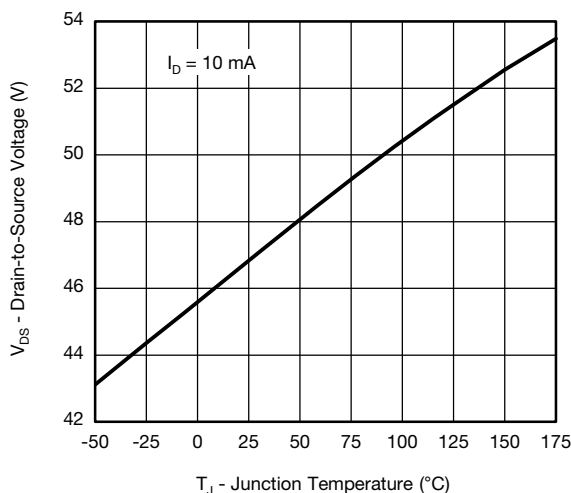
**Source Drain Diode Forward Voltage**



**On-Resistance vs. Gate-to-Source Voltage**



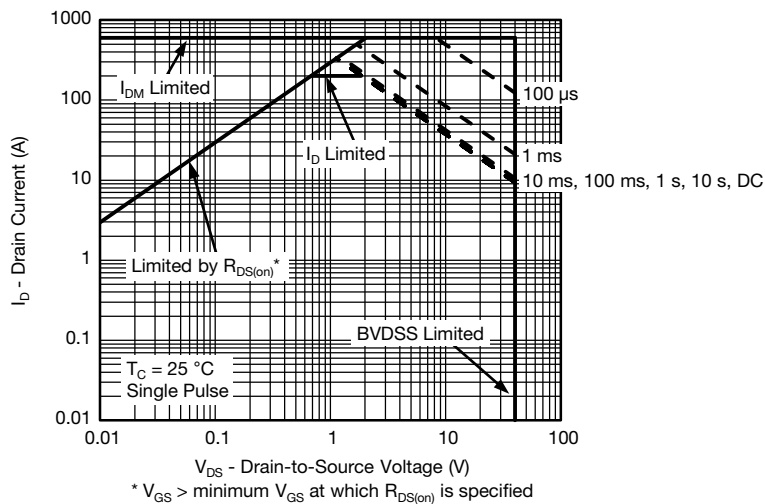
**Threshold Voltage**



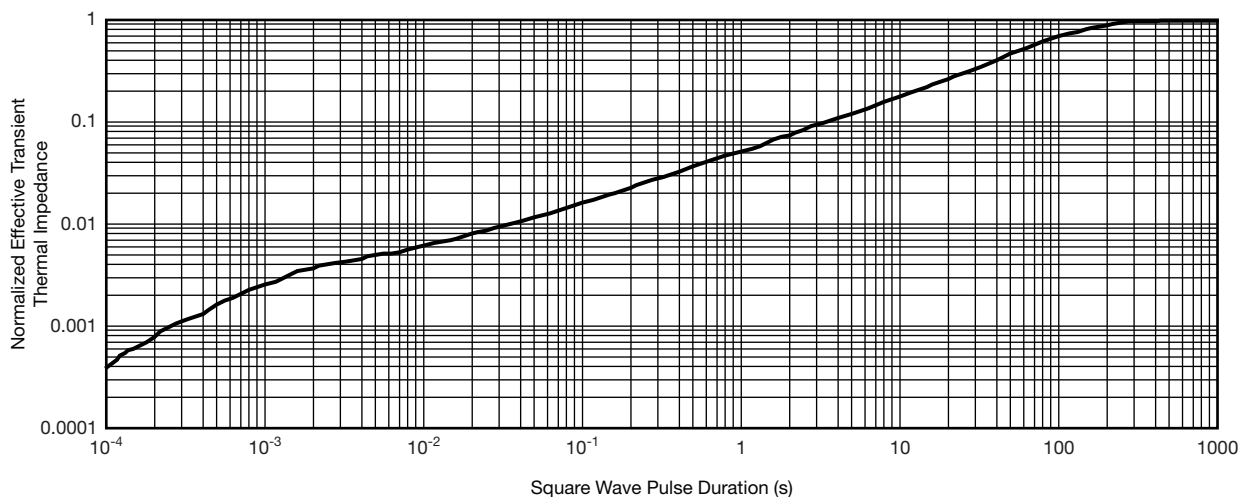
**Drain Source Breakdown vs. Junction Temperature**



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



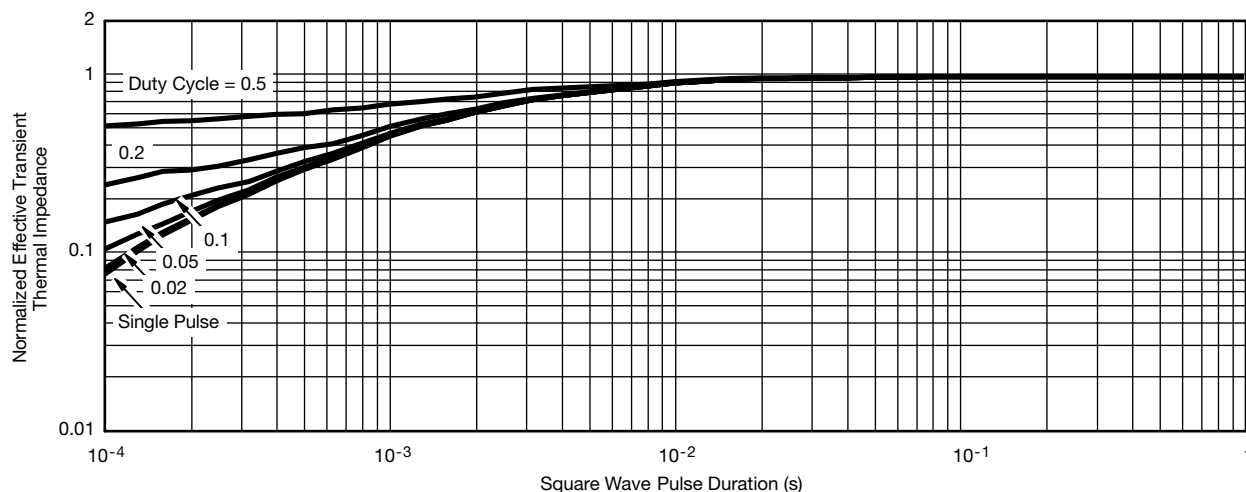
**Safe Operating Area**



**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 ( $25\text{ }^{\circ}\text{C}$ )
  - 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.

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?67184](http://www.vishay.com/ppg?67184).



REVISION HISTORY <sup>a</sup>		
REVISION	DATE	DESCRIPTION OF CHANGE
B	04-Aug-15	• Revised $R_g$ minimum limit

**Note**

a. As of April 2014

**D<sup>2</sup>PAK / TO-263 and TO-262**

Ordering codes for the SQ rugged series power MOSFETs in the D<sup>2</sup>PAK / TO-263 and TO-262 packages:

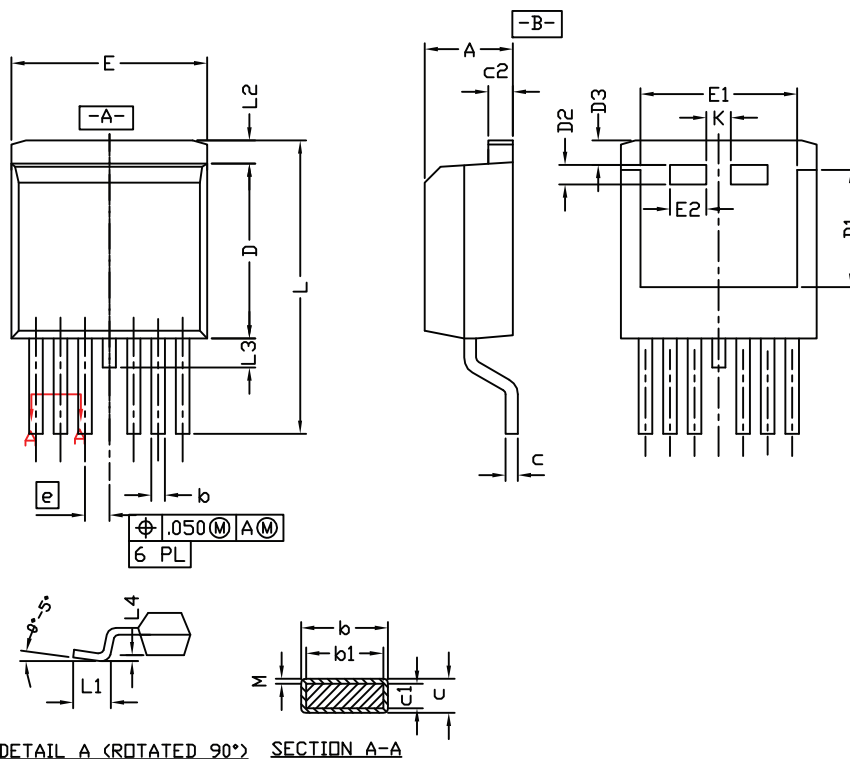
DATASHEET PART NUMBER	OLD ORDERING CODE <sup>a</sup>	NEW ORDERING CODE
SQM100N04-2m7	SQM100N04-2M7-GE3	SQM100N04-2M7_GE3
SQM100N10-10	SQM100N10-10-GE3	SQM100N10-10_GE3
SQM110N05-06L	SQM110N05-06L-GE3	SQM110N05-06L_GE3
SQM110P06-8m9L	SQM110P06-8M9L-GE3	SQM110P06-8M9L_GE3
SQM120N02-1m3L	SQM120N02-1M3L-GE3	SQM120N02-1M3L_GE3
SQM120N03-1m5L	SQM120N03-1M5L-GE3	SQM120N03-1M5L_GE3
SQM120N04-1m7	SQM120N04-1M7-GE3	SQM120N04-1M7_GE3
SQM120N04-1m7L	SQM120N04-1M7L-GE3	SQM120N04-1M7L_GE3
SQM120N04-1m9	SQM120N04-1M9-GE3	SQM120N04-1M9_GE3
SQM120N06-06	SQM120N06-06-GE3	SQM120N06-06_GE3
SQM120N06-3m5L	SQM120N06-3M5L-GE3	SQM120N06-3M5L_GE3
SQM120N10-09	SQM120N10-09-GE3	SQM120N10-09_GE3
SQM120N10-3m8	SQM120N10-3M8-GE3	SQM120N10-3M8_GE3
SQM120P04-04L	SQM120P04-04L-GE3	SQM120P04-04L_GE3
SQM120P06-07L	SQM120P06-07L-GE3	SQM120P06-07L_GE3
SQM200N04-1m1L	SQM200N04-1M1L-GE3	SQM200N04-1M1L_GE3
SQM200N04-1m7L	SQM200N04-1M7L-GE3	SQM200N04-1M7L_GE3
SQM200N04-1m8	SQM200N04-1M8-GE3	SQM200N04-1M8_GE3
SQM25N15-52	SQM25N15-52-GE3	SQM25N15-52_GE3
SQM35N30-97	SQM35N30-97-GE3	SQM35N30-97_GE3
SQM40N10-30	SQM40N10-30-GE3	SQM40N10-30_GE3
SQM40N15-38	SQM40N15-38-GE3	SQM40N15-38_GE3
SQM40P10-40L	SQM40P10-40L-GE3	SQM40P10-40L_GE3
SQM47N10-24L	SQM47N10-24L-GE3	SQM47N10-24L_GE3
SQM50020EL	-	SQM50020EL_GE3
SQM50N04-4m0L	SQM50N04-4M0L-GE3	SQM50N04-4M0L_GE3
SQM50N04-4m1	SQM50N04-4M1-GE3	SQM50N04-4M1_GE3
SQM50P03-07	SQM50P03-07-GE3	SQM50P03-07_GE3
SQM50P04-09L	SQM50P04-09L-GE3	SQM50P04-09L_GE3
SQM50P06-15L	SQM50P06-15L-GE3	SQM50P06-15L_GE3
SQM50P08-25L	SQM50P08-25L-GE3	SQM50P08-25L_GE3
SQM60N06-15	SQM60N06-15-GE3	SQM60N06-15_GE3
SQM60N20-35	SQM60N20-35-GE3	SQM60N20-35_GE3
SQM85N15-19	SQM85N15-19-GE3	SQM85N15-19_GE3
SQV120N10-3m8	SQV120N10-3m8-GE3	SQV120N10-3m8_GE3
SQV120N06-4m7L	-	SQV120N06-4m7L_GE3

**Note**

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



## D<sup>2</sup>PAK (TO-263-7L) Case Outline



### Notes

1. Plane B includes maximum features of heat sink tab and plastic.
2. No more than 25 % of L1 can fall above seating plane by max. 8 mils.
3. Pin to pin coplanarity max. 4 mils.
4. Lead thickness 25 mils.
5. For SUM part numbers lead thickness is 24 mils to 29 mils.
6. For reference only.
7. Use inches as the primary measurement.
8. This feature is only for SUM.

DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.160	0.190	4.064	4.826
b	0.020	0.039	0.508	0.990
b1	0.020	0.035	0.508	0.889
b2	0.045	0.055	1.143	1.397
c* SUB	0.012	0.018	0.305	0.457
c* SUM	0.022	0.028	0.559	0.711
c1	0.018	0.025	0.457	0.635
c2	0.045	0.055	1.143	1.397
D	0.340	0.380	8.636	9.652
D1	0.220	0.240	5.588	6.096
D2	0.038	0.042	0.965	1.067
D3	0.045	0.055	1.143	1.397
E	0.380	0.410	9.652	10.414
E1	0.245	-	6.223	-
E2	0.072	0.078	1.829	1.981
e	0.050 BSC		1.27 BSC	
K	0.045	0.055	1.143	1.397
L	0.575	0.625	14.605	15.875
L1	0.090	0.110	2.286	2.794
L2	0.040	0.055	1.016	1.397
L3	0.050	0.070	1.270	1.778
L4	0.010 BSC		0.254 BSC	
M	-	0.002	-	0.050
ECN: T13-0709-Rev. B, 30-Sep-13				
DWG: 6006				



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