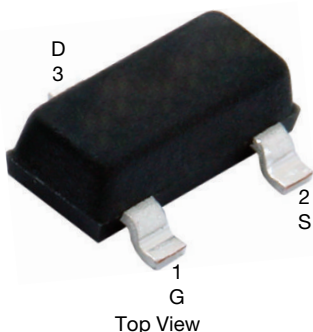


N-Channel 60 V (D-S) MOSFET

SOT-23 (TO-236)

Marking code: 7K

PRODUCT SUMMARY	
V_{DS} (V)	60
$R_{DS(on)}$ max. (Ω) at $V_{GS} = 10$ V	2
Q_g typ. (nC)	0.4
I_D (A)	0.3
Configuration	Single

FEATURES

- Low on-resistance: $2\ \Omega$
- Low threshold: 2 V (typ.)
- Low input capacitance: 25 pF
- Fast switching speed: 25 ns
- Low input and output leakage
- TrenchFET® power MOSFET
- 2000 V ESD protection
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details



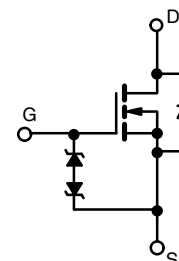
RoHS*
Available
HALOGEN
FREE
Available

BENEFITS

- Low offset voltage
- Low voltage operation
- Easily driven without buffer
- High speed circuits
- Low error voltage

APPLICATIONS

- Direct logic-level interface: TTL/CMOS
- Drivers:
relays, solenoids, lamps, hammers,
display, memories, transistors, etc.
- Battery operated systems
- Solid state relays



N-Channel MOSFET

ORDERING INFORMATION	
Package	SOT-23
Lead (Pb)-free	2N7002K-T1-E3
Lead (Pb)-free and halogen-free	2N7002K-T1-GE3

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\ ^\circ\text{C}$, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V_{DS}	60	V
Gate-source voltage		V_{GS}	± 20	
Continuous drain current ($T_J = 150\ ^\circ\text{C}$) ^b	$T_A = 25\ ^\circ\text{C}$	I_D	0.3	A
	$T_A = 100\ ^\circ\text{C}$		0.19	
Pulsed drain current ^a		I_{DM}	0.8	
Power dissipation ^b	$T_A = 25\ ^\circ\text{C}$	P_D	0.35	W
	$T_A = 100\ ^\circ\text{C}$		0.14	
Maximum junction-to-ambient ^b		R_{thJA}	350	$^\circ\text{C/W}$
Operating junction and storage temperature range		T_J, T_{stg}	-55 to +150	$^\circ\text{C}$

Notes

- Pulse width limited by maximum junction temperature
- Surface mounted on FR4 board



SPECIFICATIONS (T _A = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP. ^a	MAX.	UNIT
Static						
Drain-source breakdown voltage	V _{DS}	V _{GS} = 0 V, I _D = 10 μA	60	-	-	V
Gate-threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	1	-	2.5	
Gate-body leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V	-	-	± 10	μA
		V _{DS} = 0 V, V _{GS} = ± 15 V	-	-	1	
		V _{DS} = 0 V, V _{GS} = ± 10 V	-	-	± 150	nA
		V _{DS} = 0 V, V _{GS} = ± 10 V, T _J = 85 °C	-	-	± 1000	
		V _{DS} = 0 V, V _{GS} = ± 5 V	-	-	± 100	
Zero gate voltage drain current	I _{DSS}	V _{DS} = 60 V, V _{GS} = 0 V	-	-	1	μA
		V _{DS} = 60 V, V _{GS} = 0 V, T _J = 125 °C	-	-	500	
On-state drain current ^b	I _{D(on)}	V _{GS} = 10 V, V _{DS} = 7.5 V	800	-	-	mA
		V _{GS} = 4.5 V, V _{DS} = 10 V	500	-	-	
Drain-source on-resistance ^b	R _{DS(on)}	V _{GS} = 10 V, I _D = 500 mA	-	-	2	Ω
		V _{GS} = 4.5 V, I _D = 200 mA	-	-	4	
Forward transconductance ^b	g _{fs}	V _{DS} = 10 V, I _D = 200 mA	100	-	-	mS
Diode forward voltage	V _{SD}	I _S = 200 mA, V _{GS} = 0 V	-	-	1.3	V
Dynamic ^{a, b}						
Total gate charge	Q _g	V _{DS} = 10 V, V _{GS} = 4.5 V I _D ≅ 250 mA	-	0.4	0.6	nC
Input capacitance	C _{iss}	V _{DS} = 25 V, V _{GS} = 0 V f = 1 MHz	-	30	-	pF
Output capacitance	C _{oss}		-	6	-	
Reverse transfer capacitance	C _{rss}		-	2.5	-	
Switching ^{a, c}						
Turn-on time	t _{d(on)}	V _{DD} = 30 V, R _L = 150 Ω I _D ≅ 200 mA, V _{GEN} = 10 V, R _g = 10 Ω	-	-	25	ns
Turn-off time	t _{d(off)}		-	-	35	

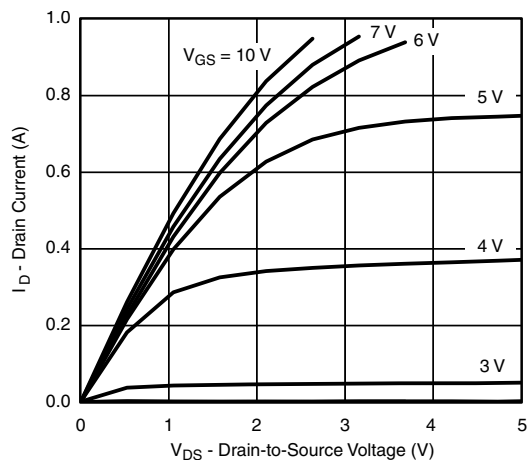
Notes

- a. For DESIGN AID ONLY, not subject to production testing
b. Pulse test: pulse width $\leq 300\text{ }\mu\text{s}$ duty cycle $\leq 2\%$
c. Switching time is essentially independent of operating temperature

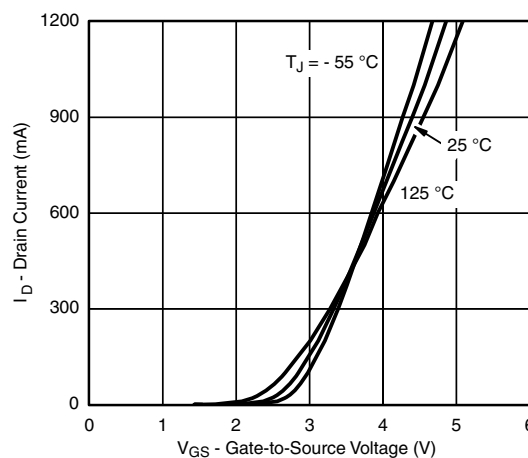
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



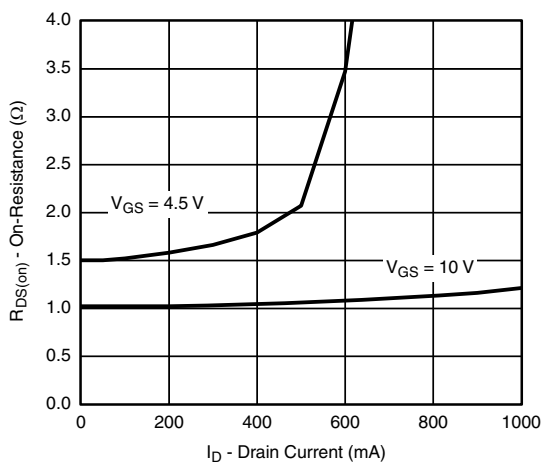
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



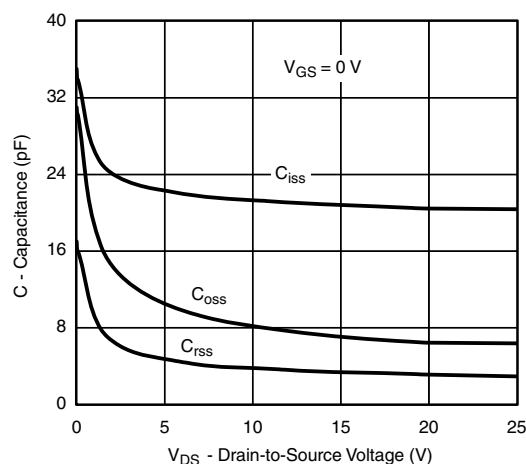
Output Characteristics



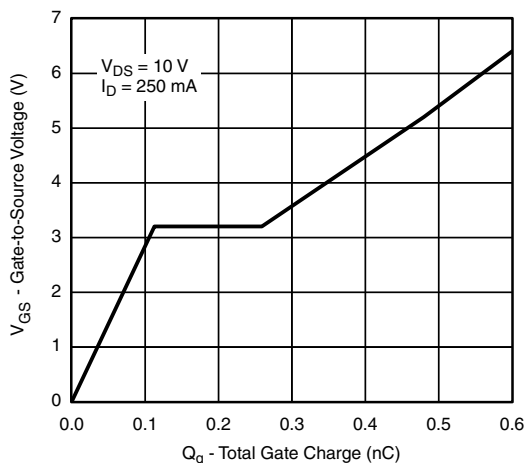
Transfer Characteristics



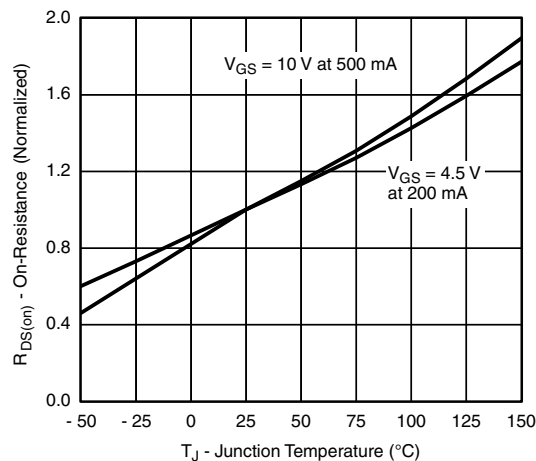
On-Resistance vs. Drain Current



Capacitance



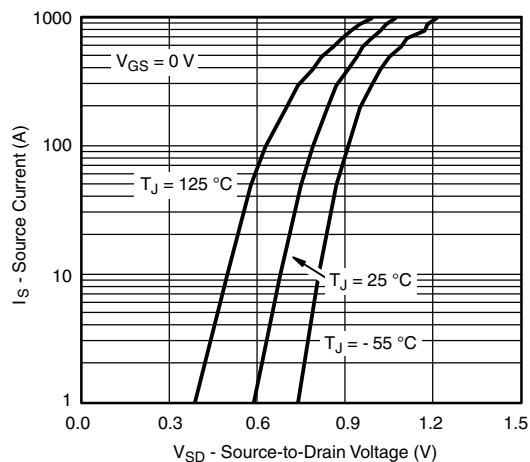
Gate Charge



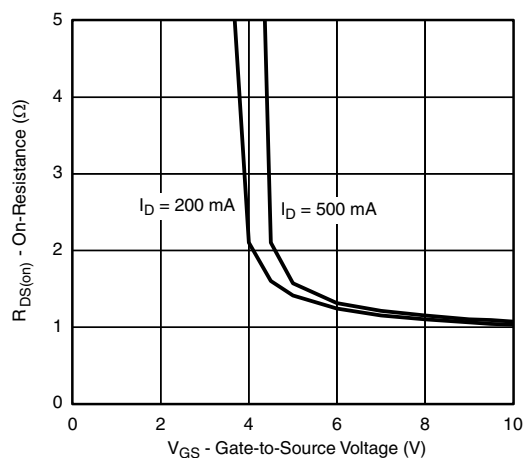
On-Resistance vs. Junction Temperature



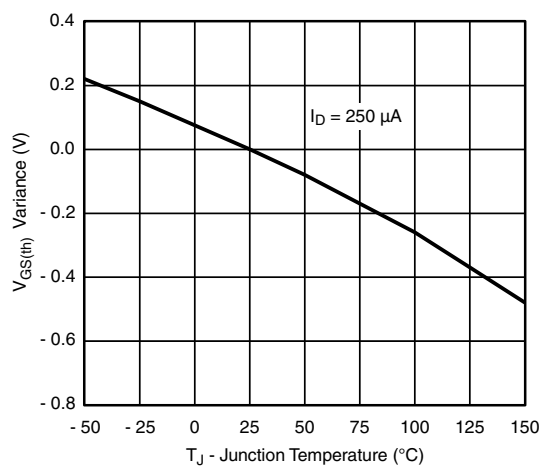
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



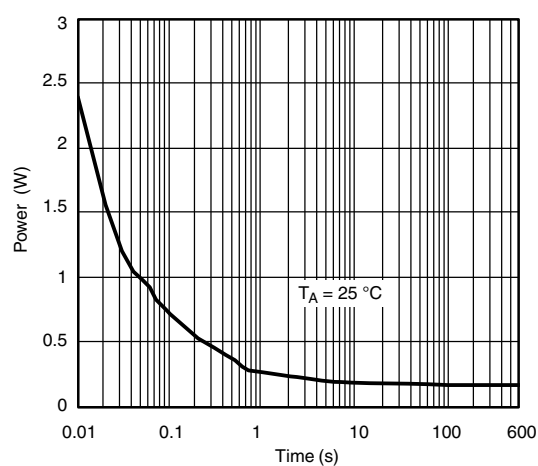
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-Source Voltage



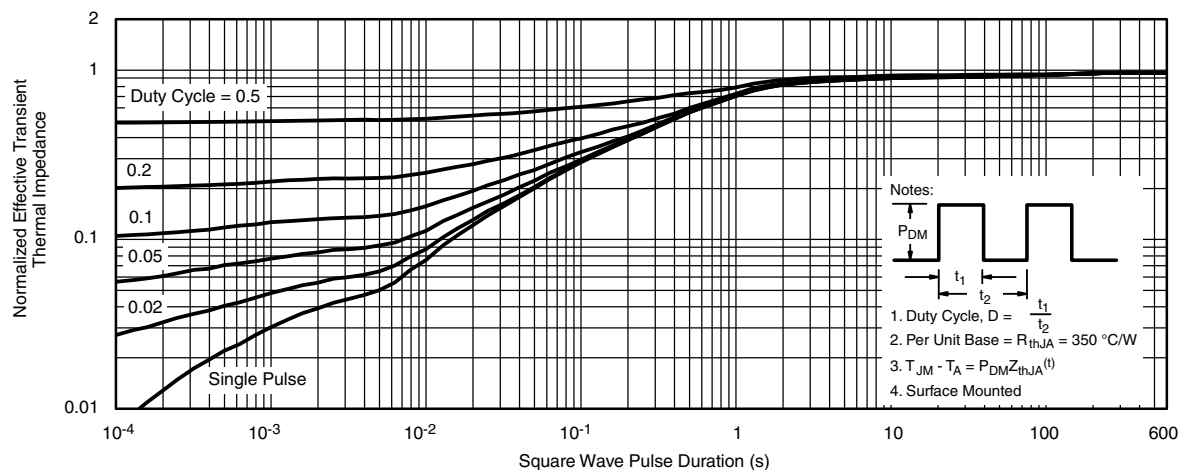
Threshold Voltage Variance Over Temperature



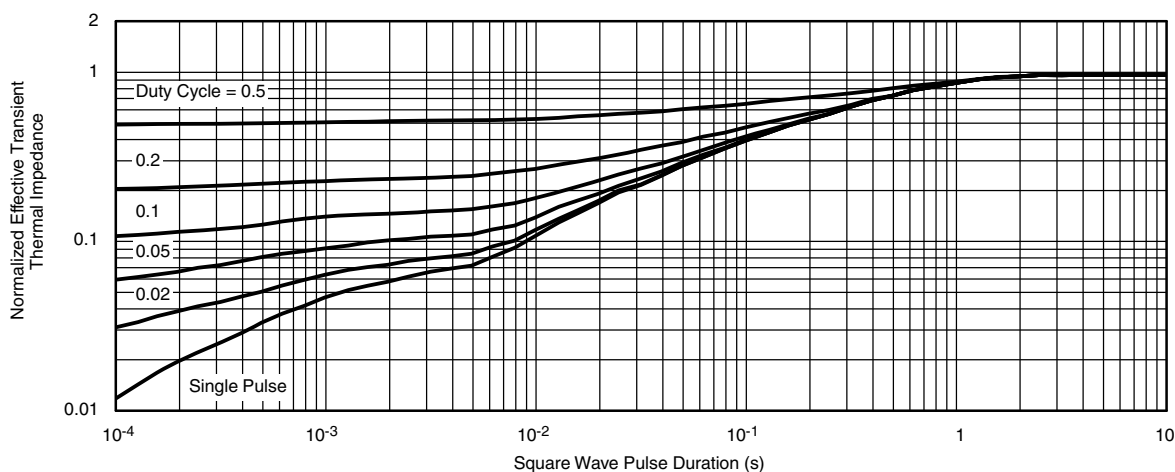
Single Pulse Power, Junction-to-Ambient



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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?71333.

SOT-23 (TO-236): 3-LEAD



Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	0.89	1.12	0.035	0.044
A ₁	0.01	0.10	0.0004	0.004
A ₂	0.88	1.02	0.0346	0.040
b	0.35	0.50	0.014	0.020
c	0.085	0.18	0.003	0.007
D	2.80	3.04	0.110	0.120
E	2.10	2.64	0.083	0.104
E ₁	1.20	1.40	0.047	0.055
e	0.95 BSC		0.0374 Ref	
e ₁	1.90 BSC		0.0748 Ref	
L	0.40	0.60	0.016	0.024
L ₁	0.64 Ref		0.025 Ref	
S	0.50 Ref		0.020 Ref	
q	3°	8°	3°	8°
ECN: S-03946-Rev. K, 09-Jul-01				
DWG: 5479				

RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads
Dimensions in Inches/(mm)

[Return to Index](#)



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.