

# N-Channel 30-V (D-S) MOSFET with Sense Terminal

## PRODUCT SUMMARY

$V_{(BR)DSS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
30	0.013 at $V_{GS} = 10$ V	50 <sup>a</sup>
	0.017 at $V_{GS} = 4.5$ V	48 <sup>a</sup>

## FEATURES

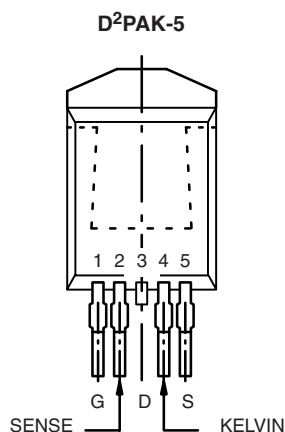
- TrenchFET<sup>®</sup> Power MOSFET Plus Current Sensing Diode
- Low Thermal Resistance Package



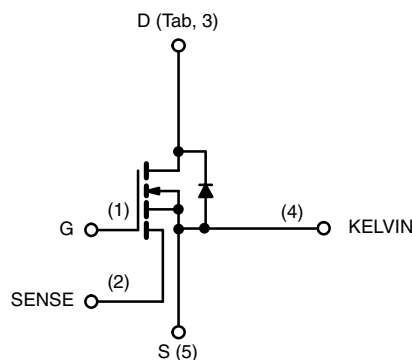
Available  
**RoHS\***  
COMPLIANT

## APPLICATIONS

- Industrial



Ordering Information: SUM50N03-13LC-E3 (Lead (Pb)-free)



N-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 175$ °C)	$I_D$	50 <sup>a</sup>	A
		32 <sup>a</sup>	
Pulsed Drain Current	$I_{DM}$	100	
Avalanche Current	$I_{AR}$	25	
Repetitive Avalanche Energy <sup>b</sup>	$E_{AR}$	31	mJ
Maximum Power Dissipation <sup>b</sup>	$P_D$	83 <sup>c</sup>	W
		2.7 <sup>d</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 175	°C

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Limit	Unit
Junction-to-Ambient	$R_{thJA}$	55	°C/W
Junction-to-Case	$R_{thJC}$	1.8	

Notes:

- Package limited.
- Duty cycle  $\leq 1$  %.
- See SOA curve for voltage derating.
- When mounted on 1" square PCB (FR-4 material).

\* Pb containing terminations are not RoHS compliant, exemptions may apply.

MOSFET SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$	30			V
Gate-Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_{DS} = 250\text{ }\mu\text{A}$	1		3	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ }^{\circ}\text{C}$			50	
		$V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 175\text{ }^{\circ}\text{C}$			150	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} = 5\text{ V}$ , $V_{GS} = 10\text{ V}$	50			A
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = 10\text{ V}$ , $I_D = 25\text{ A}$		0.010	0.013	$\Omega$
		$V_{GS} = 10\text{ V}$ , $I_D = 25\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$		0.016	0.021	
		$V_{GS} = 10\text{ V}$ , $I_D = 25\text{ A}$ , $T_J = 175\text{ }^{\circ}\text{C}$		0.018	0.024	
		$V_{GS} = 4.5\text{ V}$ , $I_D = 24\text{ A}$		0.014	0.017	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}$ , $I_D = 25\text{ A}$	30			S
Dynamic <sup>b</sup>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$		1960		pF
Output Capacitance	$C_{oss}$			380		
Reverse Transfer Capacitance	$C_{rss}$			180		
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{DS} = 15\text{ V}$ , $V_{GS} = 20\text{ V}$ , $I_D = 50\text{ A}$		35	50	nC
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			7.6		
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			5.6		
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = 15\text{ V}$ , $R_L = 0.3\text{ }\Omega$ $I_D \cong 50\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_G = 2.5\text{ }\Omega$		10	20	ns
Rise Time <sup>c</sup>	$t_r$			93	180	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			30	60	
Fall Time <sup>c</sup>	$t_f$			10	20	
Source-Drain Diode Ratings and Characteristics $T_C = 25\text{ }^{\circ}\text{C}$ <sup>b</sup>						
Continuous Current	$I_S$				50	A
Pulsed Current	$I_{SM}$				100	
Forward Voltage <sup>a</sup>	$V_{SD}$	$I_F = 50\text{ A}$ , $V_{GS} = 0\text{ V}$		1.3	1.6	V
Reverse Recovery Time	$t_{rr}$	$I_F = 50\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		35	70	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$			1.5		A
Reverse Recovery Charge	$Q_{rr}$			0.026		$\mu\text{C}$
Current Sense Characteristics						
Current Sensing Ratio	$r$	$I_D = 1\text{ A}$ , $V_{GSS} = 10\text{ V}$ , $R_{SENSE} = 1.1\text{ }\Omega$	420	520	620	
Mirror Active Resistance	$r_{m(on)}$	$V_{GS} = 10\text{ V}$ , $I_D = 10\text{ mA}$		3.5		$\Omega$

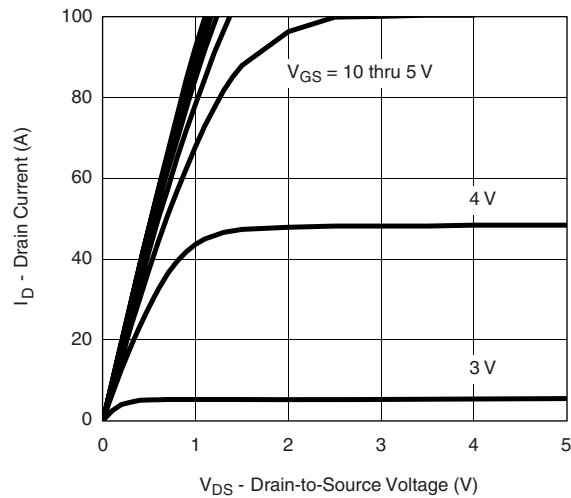
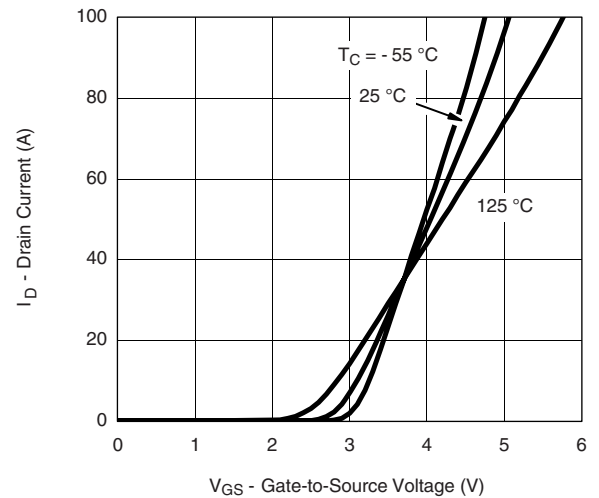
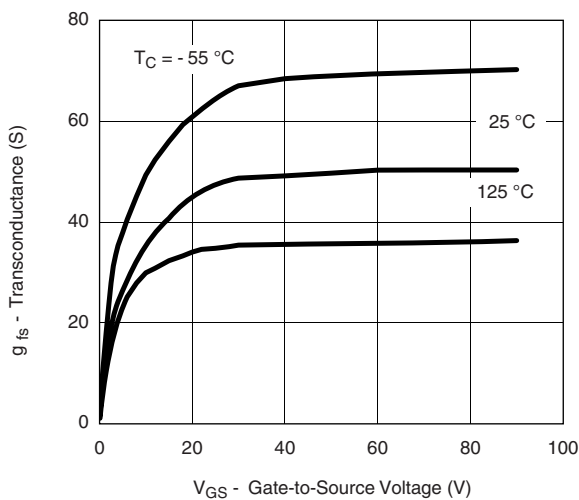
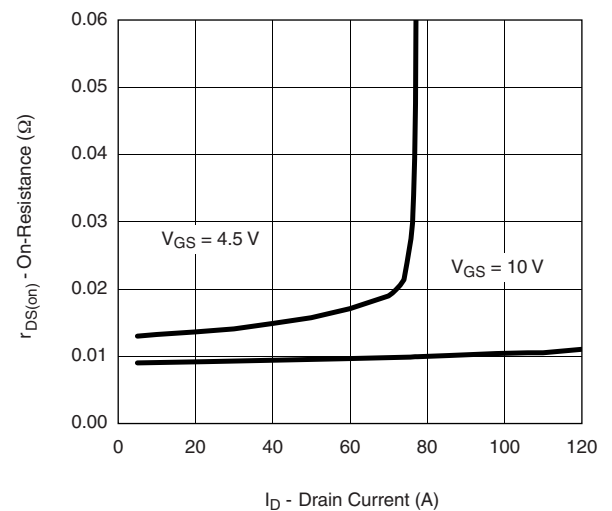
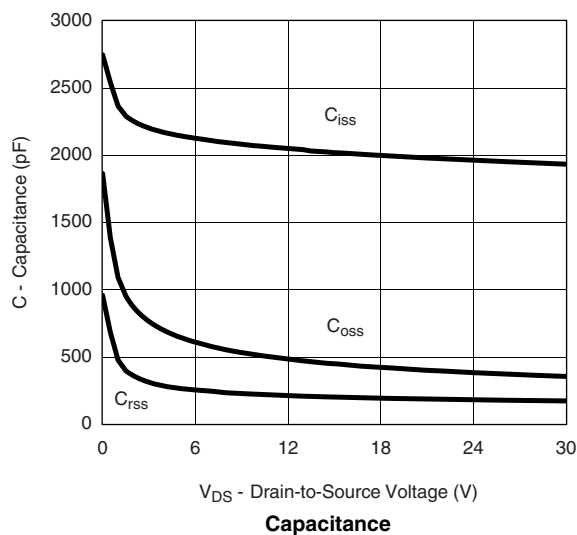
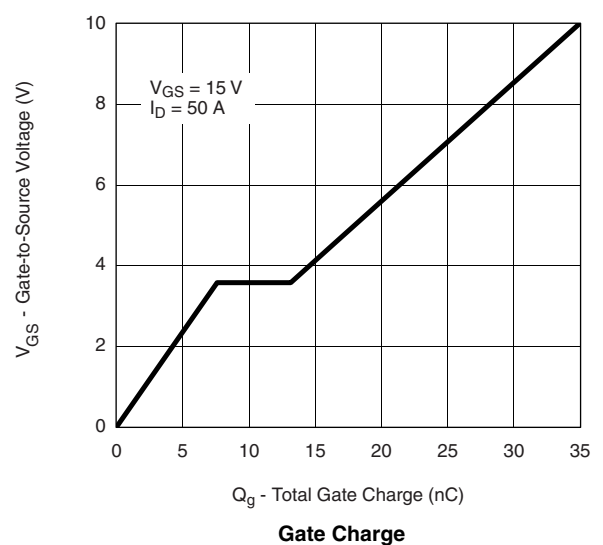
Notes:

a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

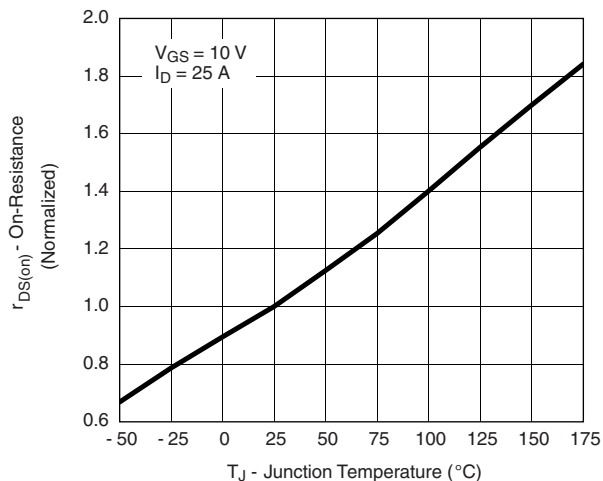
b. Guaranteed by design, not subject to production testing.

c. Independent of operating temperature.

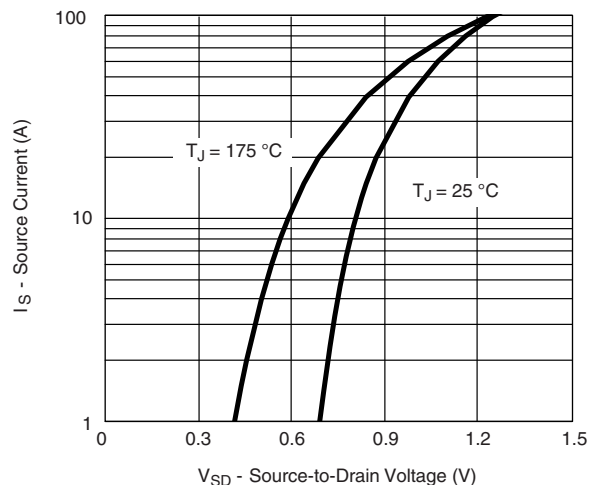
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Output Characteristics****Transfer Characteristics****Transconductance****On-Resistance vs. Drain Current****Capacitance****Gate Charge**

## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

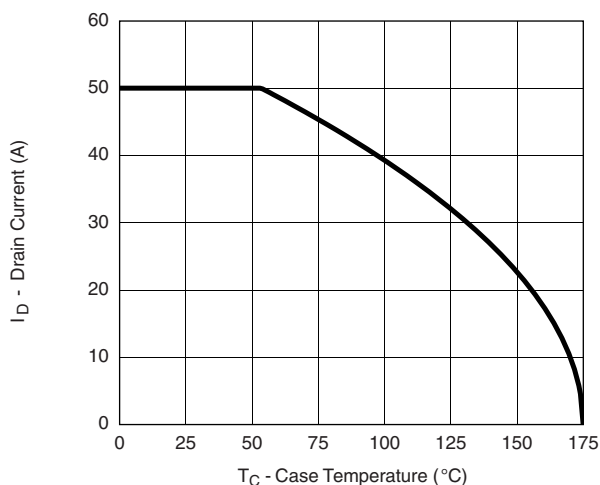


On-Resistance vs. Junction Temperature

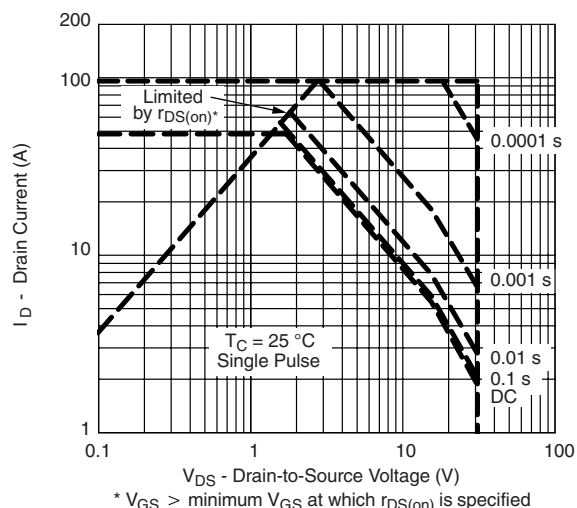


Source-Drain Diode Forward Voltage

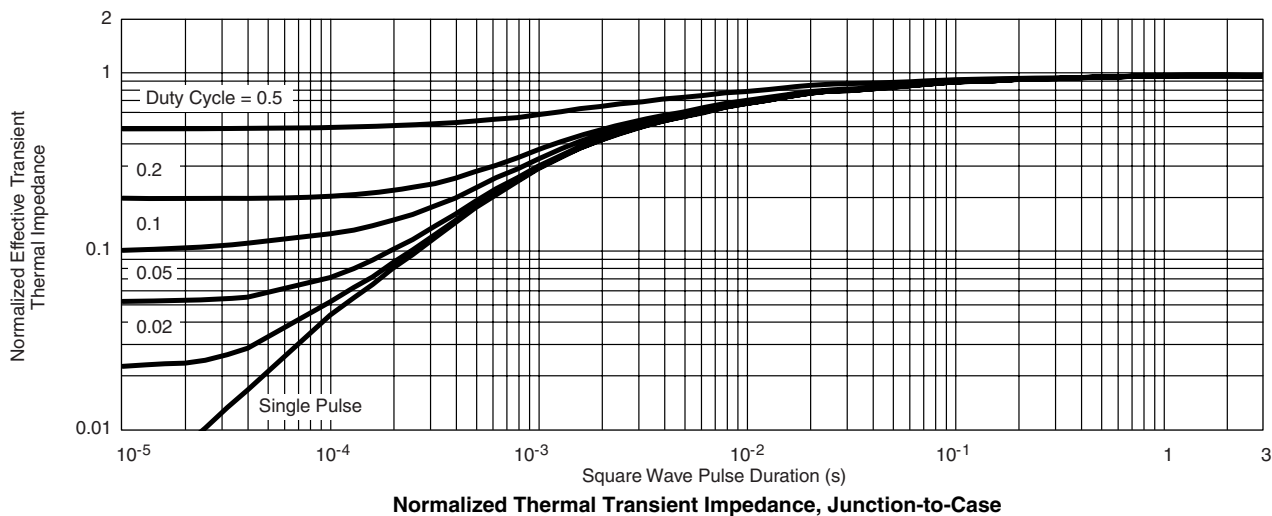
## THERMAL RATINGS



Maximum Drain Current vs. Case Temperature

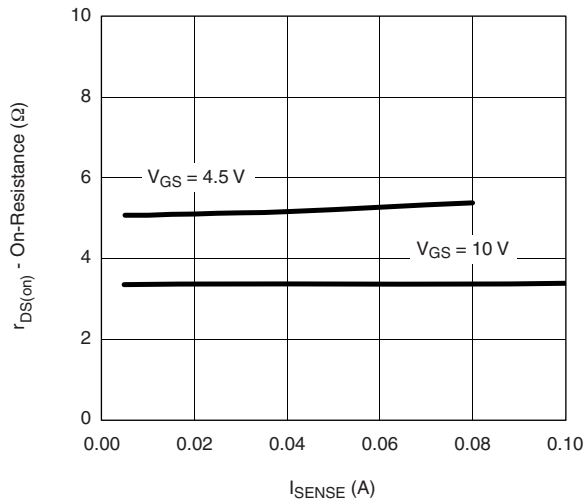


Safe Operating Area

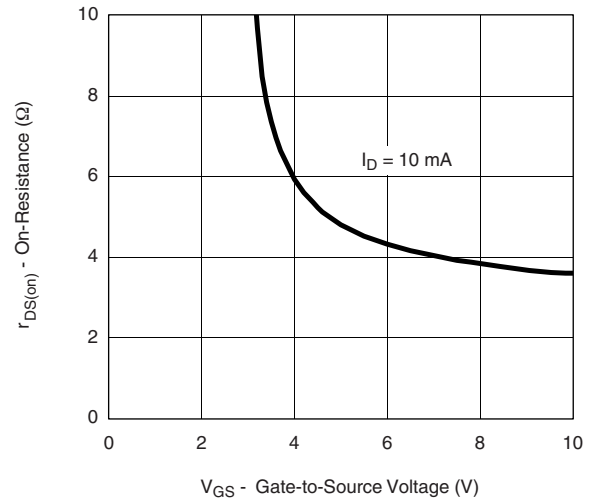


Normalized Thermal Transient Impedance, Junction-to-Case

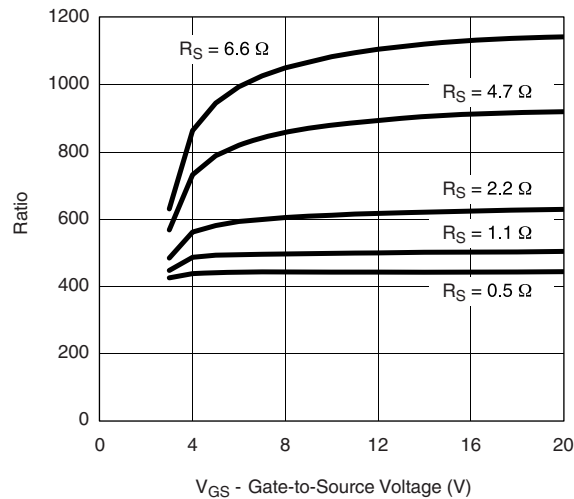
## SENSE DIE TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



On-Resistance vs. Sense Current



On-Resistance vs. Gate-Source Voltage



Current Ratio ( $I_{MAIN}/I_S$ ) vs. Gate-Source Voltage (Figure 1)

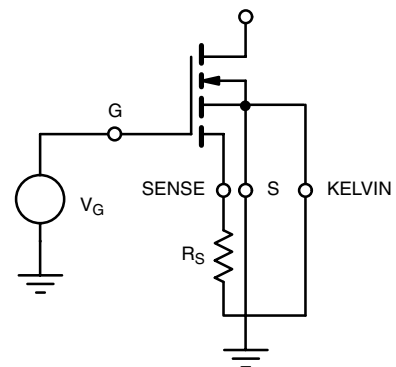


Figure 1.

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 <http://www.vishay.com/ppg?71804>



## 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.

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.

## Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**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.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**