



## Dual N-Channel 30 V (D-S) MOSFETs

PRODUCT SUMMARY				
	V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω) Max.	I <sub>D</sub> (A)	Q <sub>g</sub> (Typ.)
Channel-1	30	0.024 at V <sub>GS</sub> = 10 V	12 <sup>a</sup>	3.8 nC
		0.030 at V <sub>GS</sub> = 4.5 V	12 <sup>a</sup>	
Channel-2	30	0.0135 at V <sub>GS</sub> = 10 V	16 <sup>a</sup>	7.3 nC
		0.017 at V <sub>GS</sub> = 4.5 V	16 <sup>a</sup>	

### FEATURES

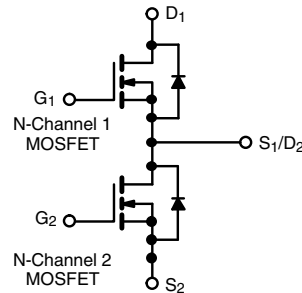
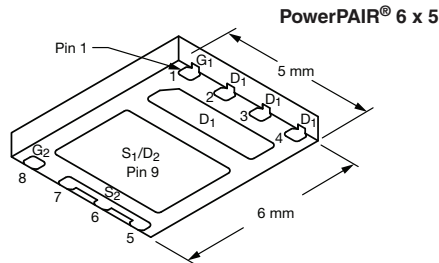
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFETs
- 100 % R<sub>g</sub> and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



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

### APPLICATIONS

- Notebook System Power
- POL
- Low Current DC/DC



Ordering Information: SiZ904DT-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)				
Parameter	Symbol	Channel-1	Channel-2	Unit
Drain-Source Voltage	V <sub>DS</sub>	30	30	V
Gate-Source Voltage	V <sub>GS</sub>	± 20		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	12 <sup>a</sup>	16 <sup>a</sup>
		T <sub>C</sub> = 70 °C	12 <sup>a</sup>	16 <sup>a</sup>
		T <sub>A</sub> = 25 °C	9.5 <sup>b, c</sup>	14.5 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	7.6 <sup>b, c</sup>	11.6 <sup>b, c</sup>
Pulsed Drain Current (t = 300 μs)	I <sub>DM</sub>	30	40	A
Source Drain Current Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	12 <sup>a</sup>	
		T <sub>A</sub> = 25 °C	3.2 <sup>b, c</sup>	4 <sup>b, c</sup>
Single Pulse Avalanche Current	I <sub>AS</sub>	10	15	mJ
Single Pulse Avalanche Energy	E <sub>AS</sub>	5	11	
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	20	33
		T <sub>C</sub> = 70 °C	12.9	21
		T <sub>A</sub> = 25 °C	3.8 <sup>b, c</sup>	4.8 <sup>b, c</sup>
		T <sub>A</sub> = 70 °C	2.4 <sup>b, c</sup>	3.1 <sup>b, c</sup>
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150		°C
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260		

THERMAL RESISTANCE RATINGS							
Parameter	Symbol	Channel-1		Channel-2		Unit	
		Typ.	Max.	Typ.	Max.		
Maximum Junction-to-Ambient <sup>b, f</sup>	R <sub>thJA</sub>	25	33	20	26	°C/W	
Maximum Junction-to-Case (Drain)	R <sub>thJC</sub>	4.7	6.2	3	3.8		

Notes:

- Package limited.
- Surface mounted on 1" x 1" FR4 board.
- t = 10 s.
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). The PowerPAIR is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.
- Maximum under steady state conditions is 68 °C/W for Channel-1 and 61 °C/W for Channel-2.

SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	Ch-1	30			V
		$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	Ch-2	30			
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$	Ch-1		35		mV/ $^\circ\text{C}$
		$I_D = 250\text{ }\mu\text{A}$	Ch-2		33		
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	$I_D = 250\text{ }\mu\text{A}$	Ch-1		- 4.5		
		$I_D = 250\text{ }\mu\text{A}$	Ch-2		- 5		
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	Ch-1	1		2.5	V
		$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	Ch-2	1.2		2.5	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$	Ch-1			$\pm 100$	nA
			Ch-2			$\pm 100$	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$	Ch-1			1	$\mu\text{A}$
		$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$	Ch-2			1	
		$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$	Ch-1			5	
		$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$	Ch-2			5	
On-State Drain Current <sup>b</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	Ch-1	20			A
		$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	Ch-2	20			
Drain-Source On-State Resistance <sup>b</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 7.8\text{ A}$	Ch-1		0.020	0.024	$\Omega$
		$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$	Ch-2		0.0105	0.0135	
		$V_{GS} = 4.5\text{ V}, I_D = 7\text{ A}$	Ch-1		0.024	0.030	
		$V_{GS} = 4.5\text{ V}, I_D = 7\text{ A}$	Ch-2		0.0135	0.017	
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 7.8\text{ A}$	Ch-1		17		S
		$V_{DS} = 10\text{ V}, I_D = 10\text{ A}$	Ch-2		24		
<b>Dynamic<sup>a</sup></b>							
Input Capacitance	$C_{iss}$	Channel-1 $V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	Ch-1		435		pF
			Ch-2		846		
Output Capacitance	$C_{oss}$	Channel-2 $V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$	Ch-1		95		
			Ch-2		187		
Reverse Transfer Capacitance	$C_{rss}$		Ch-1		42		
			Ch-2		72		
Total Gate Charge	$Q_g$	$V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 7.8\text{ A}$	Ch-1		8	12	nC
		$V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 10\text{ A}$	Ch-2		15.4	23	
Gate-Source Charge	$Q_{gs}$	Channel-1 $V_{DS} = 15\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 7.8\text{ A}$	Ch-1		3.8	6	
			Ch-2		7.3	11	
Gate-Drain Charge	$Q_{gd}$	Channel-2 $V_{DS} = 15\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$	Ch-1		1.4		
			Ch-2		2.3		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	Ch-1	0.6	3.2	6.4	$\Omega$
			Ch-2	0.2	0.8	1.6	

Notes:

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

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



<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
<b>Dynamic<sup>a</sup></b>							
Turn-On Delay Time	$t_{d(on)}$	Channel-1 $V_{DD} = 15\text{ V}$ , $R_L = 2.4\ \Omega$ $I_D \cong 6.3\text{ A}$ , $V_{GEN} = 4.5\text{ V}$ , $R_g = 1\ \Omega$	Ch-1		15	30	ns
Rise Time	$t_r$		Ch-2		15	30	
Turn-Off Delay Time	$t_{d(off)}$	Channel-2 $V_{DD} = 15\text{ V}$ , $R_L = 1.5\ \Omega$ $I_D \cong 10\text{ A}$ , $V_{GEN} = 4.5\text{ V}$ , $R_g = 1\ \Omega$	Ch-1		12	24	
			Ch-2		12	24	
Fall Time	$t_f$		Ch-1		13	26	
			Ch-2		13	26	
Turn-On Delay Time	$t_{d(on)}$	Channel-1 $V_{DD} = 15\text{ V}$ , $R_L = 2.4\ \Omega$ $I_D \cong 6.3\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 1\ \Omega$	Ch-1		10	20	
			Ch-2		10	20	
Rise Time	$t_r$		Ch-1		5	10	
			Ch-2		9	18	
Turn-Off Delay Time	$t_{d(off)}$	Channel-2 $V_{DD} = 15\text{ V}$ , $R_L = 1.5\ \Omega$ $I_D \cong 10\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 1\ \Omega$	Ch-1		10	20	
			Ch-2		9	18	
Fall Time	$t_f$		Ch-1		15	30	
			Ch-2		14	28	
			Ch-1		10	20	
			Ch-2		8	16	
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	Ch-1			12	A
			Ch-2			16	
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$		Ch-1			30	A
			Ch-2			40	
Body Diode Voltage	$V_{SD}$	$I_S = 6.3\text{ A}$ , $V_{GS} = 0\text{ V}$	Ch-1		0.8	1.2	V
		$I_S = 3\text{ A}$ , $V_{GS} = 0\text{ V}$	Ch-2		0.78	1.2	
Body Diode Reverse Recovery Time	$t_{rr}$	Channel-1 $I_F = 6.3\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $T_J = 25\text{ }^\circ\text{C}$	Ch-1		15	30	ns
			Ch-2		17	34	
Body Diode Reverse Recovery Charge	$Q_{rr}$	Channel-2 $I_F = 10\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $T_J = 25\text{ }^\circ\text{C}$	Ch-1		7	15	nC
			Ch-2		9.5	19	
Reverse Recovery Fall Time	$t_a$		Ch-1		9		ns
			Ch-2		10		
Reverse Recovery Rise Time	$t_b$		Ch-1		6		
			Ch-2		7		

Notes:

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

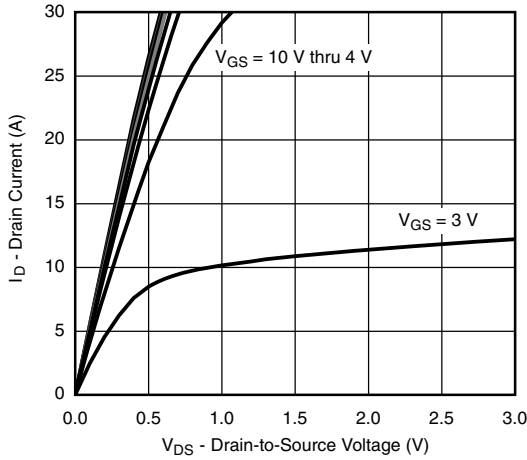
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

# SiZ904DT

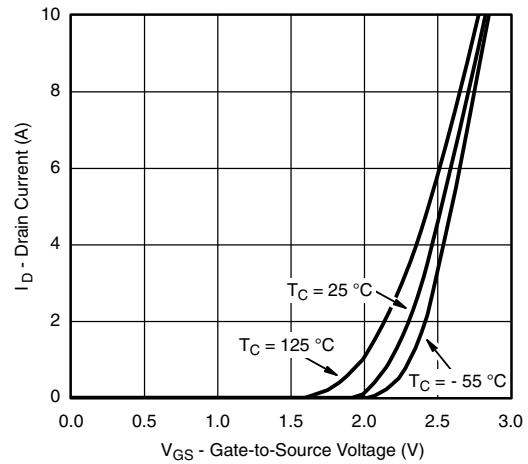
Vishay Siliconix



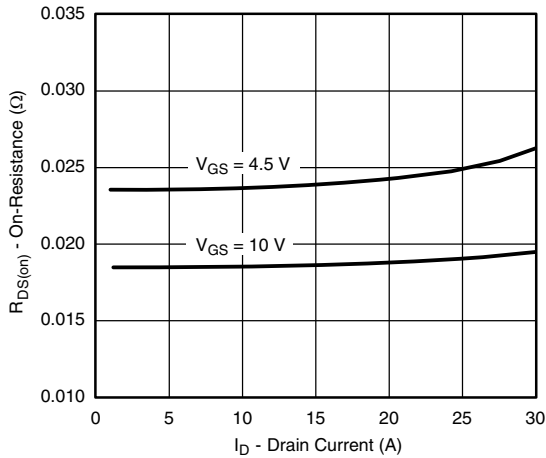
## CHANNEL-1 TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



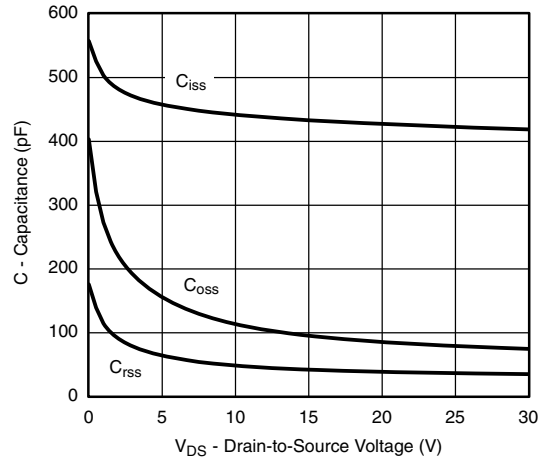
Output Characteristics



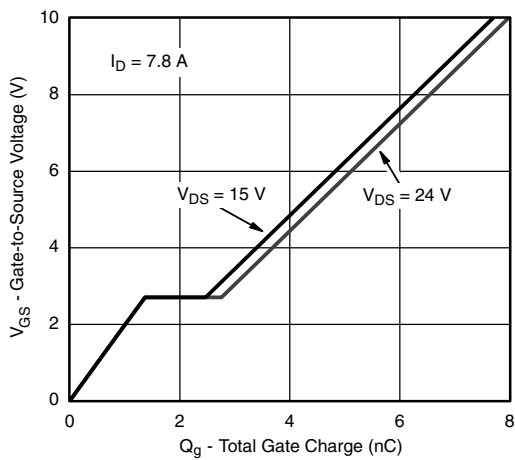
Transfer Characteristics



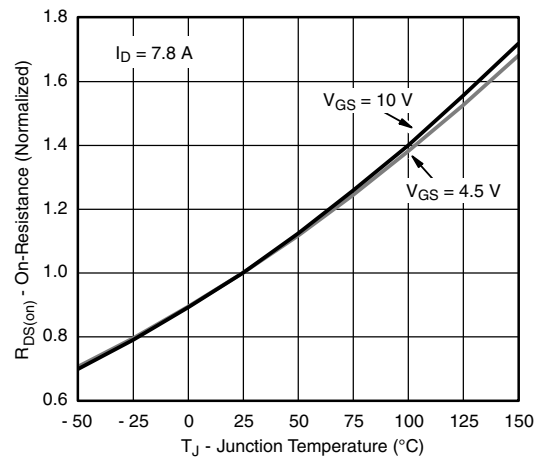
On-Resistance vs. Drain Current



Capacitance



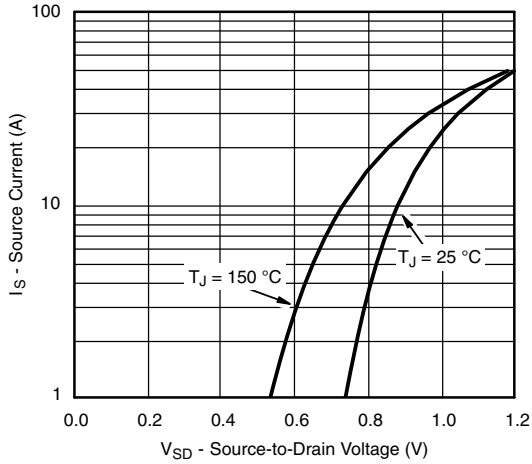
Gate Charge



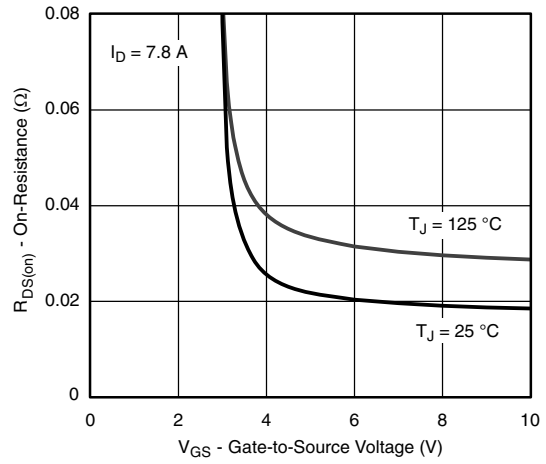
On-Resistance vs. Junction Temperature



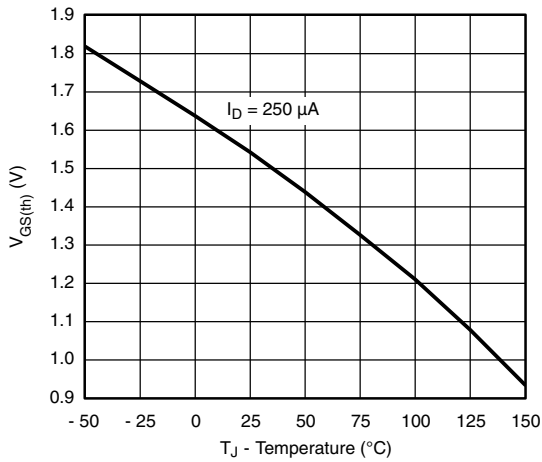
**CHANNEL-1 TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



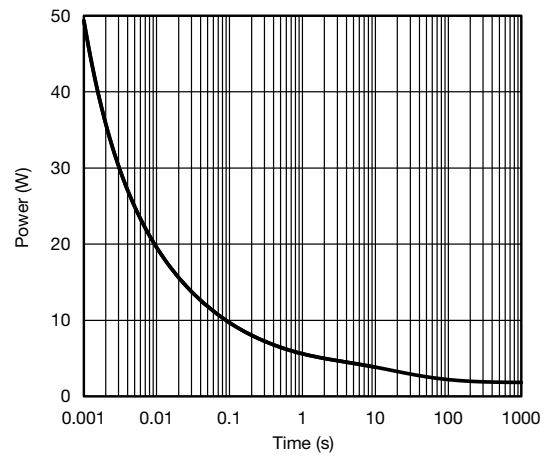
**Source-Drain Diode Forward Voltage**



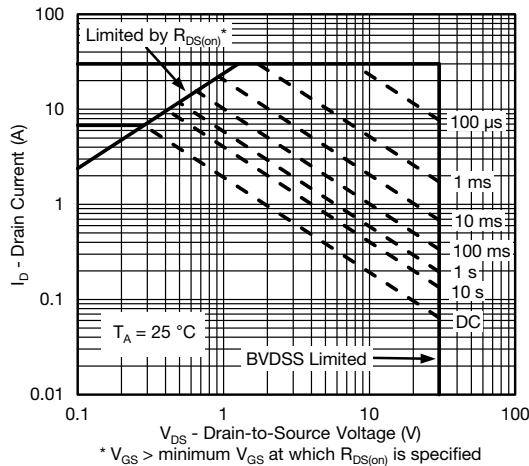
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



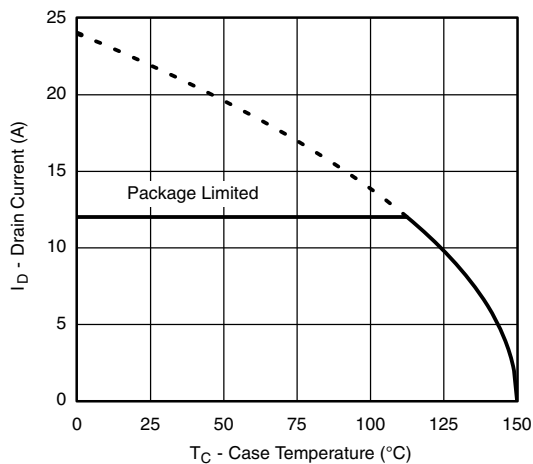
**Single Pulse Power**



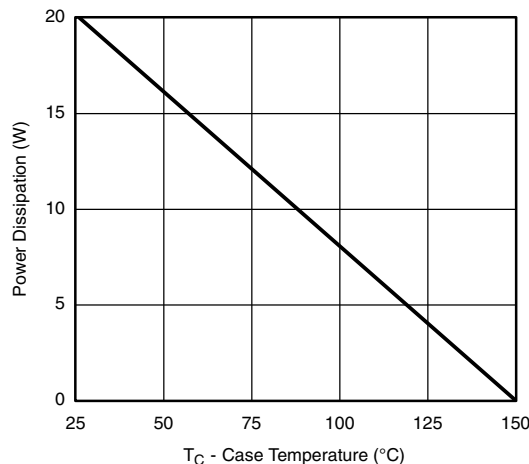
**Safe Operating Area, Junction-to-Ambient**



**CHANNEL-1 TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Current Derating\***

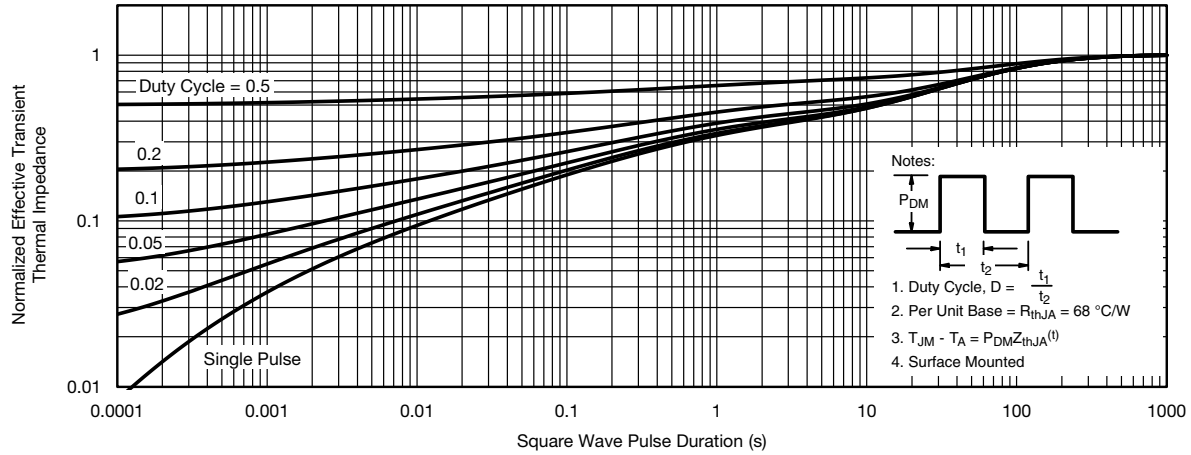


**Power, Junction-to-Case**

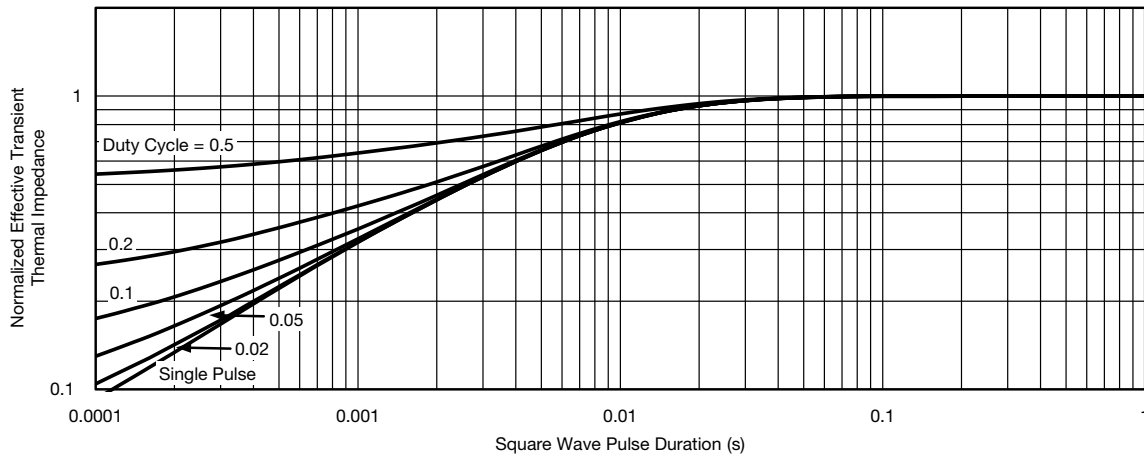
\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150\text{ °C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



**CHANNEL-1 TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Normalized Thermal Transient Impedance, Junction-to-Ambient**



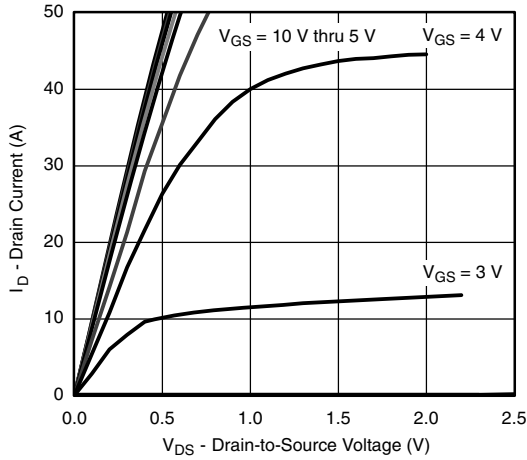
**Normalized Thermal Transient Impedance, Junction-to-Case**

# SiZ904DT

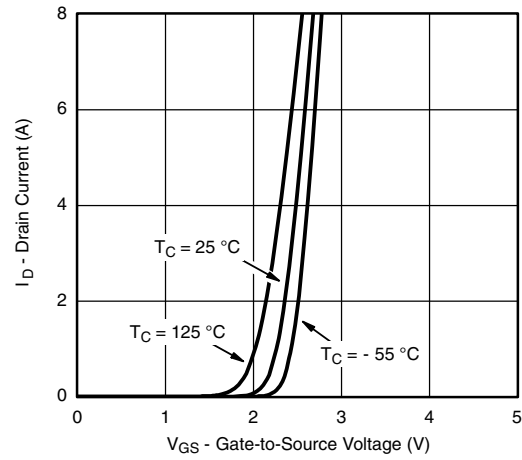
Vishay Siliconix



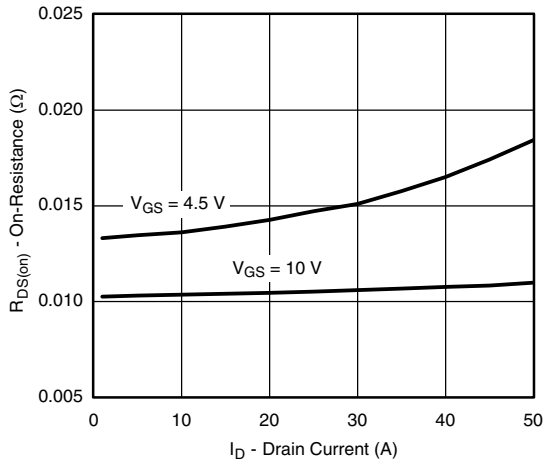
## CHANNEL-2 TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



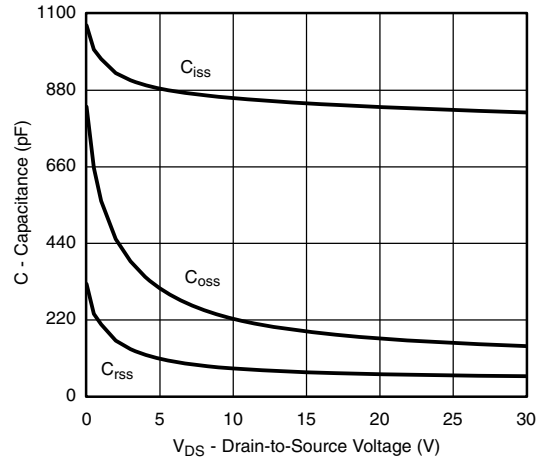
Output Characteristics



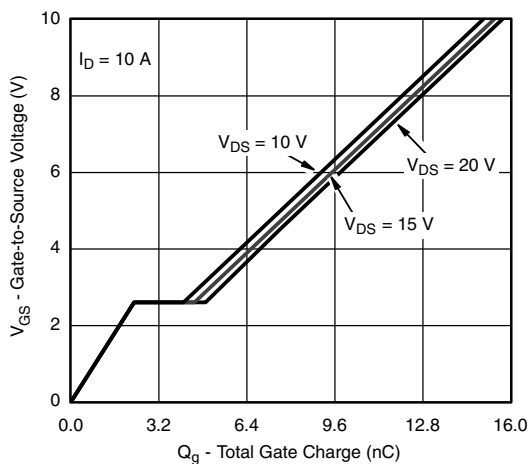
Transfer Characteristics



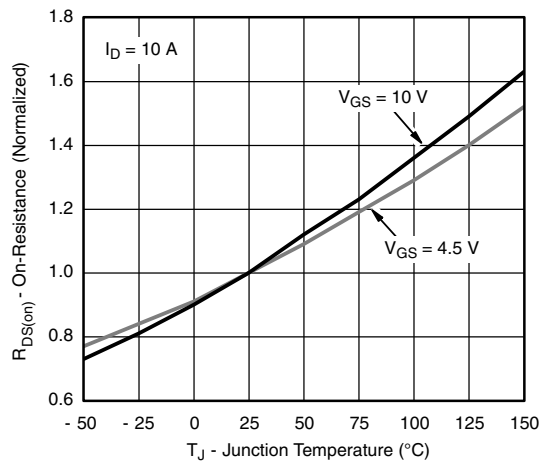
On-Resistance vs. Drain Current



Capacitance



Gate Charge

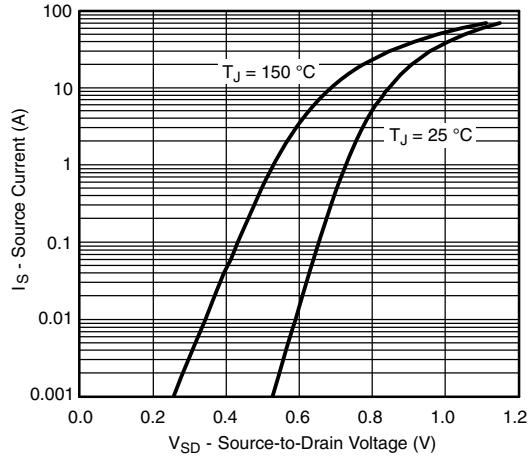


On-Resistance vs. Junction Temperature

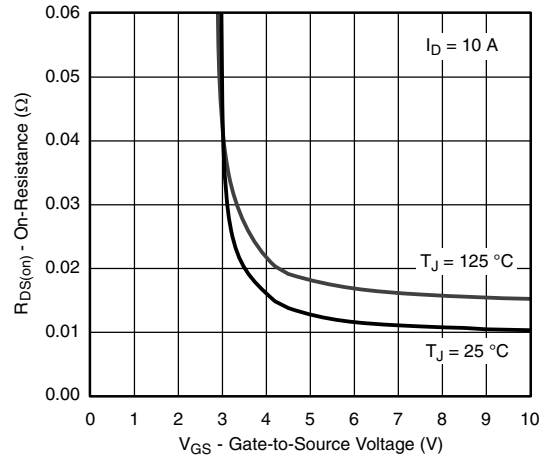




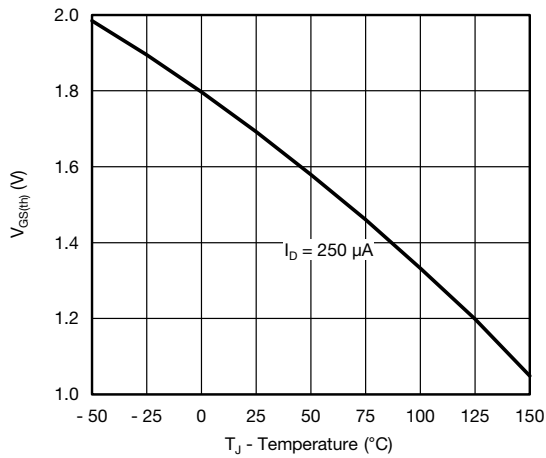
**CHANNEL-2 TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



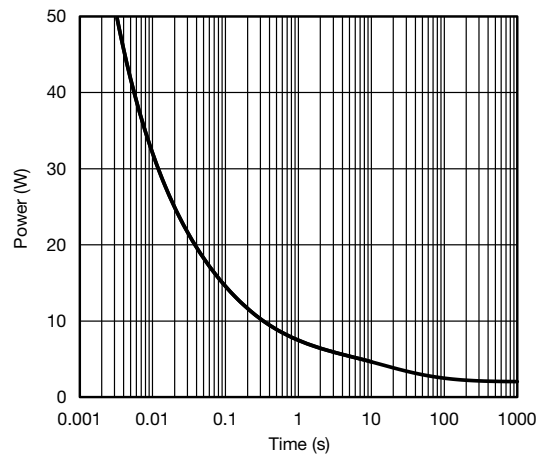
**Source-Drain Diode Forward Voltage**



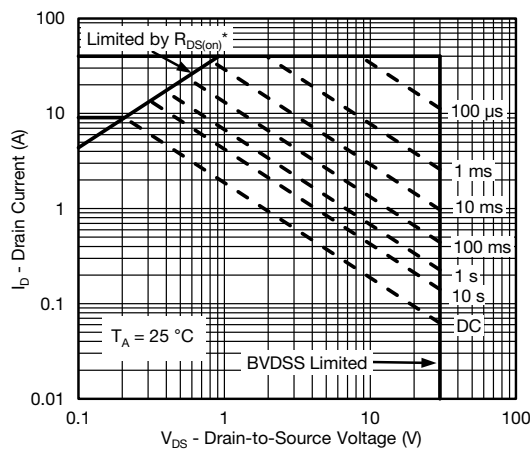
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



**Single Pulse Power**



\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

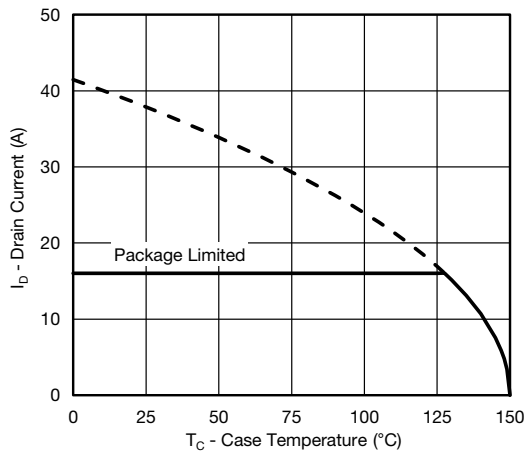
**Safe Operating Area, Junction-to-Ambient**

# SiZ904DT

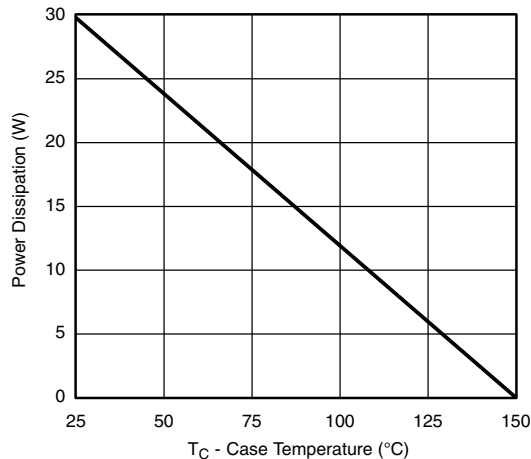
Vishay Siliconix



## CHANNEL-2 TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating\*

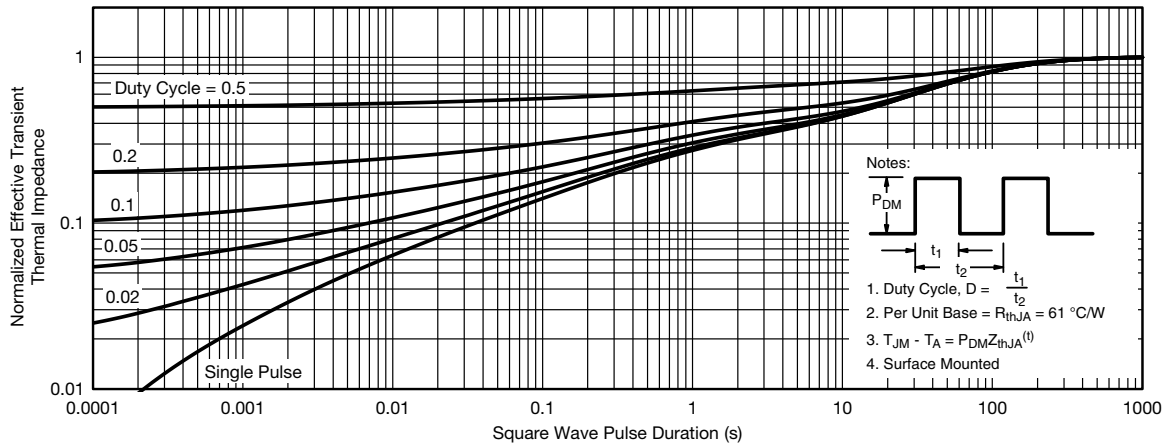


Power, Junction-to-Case

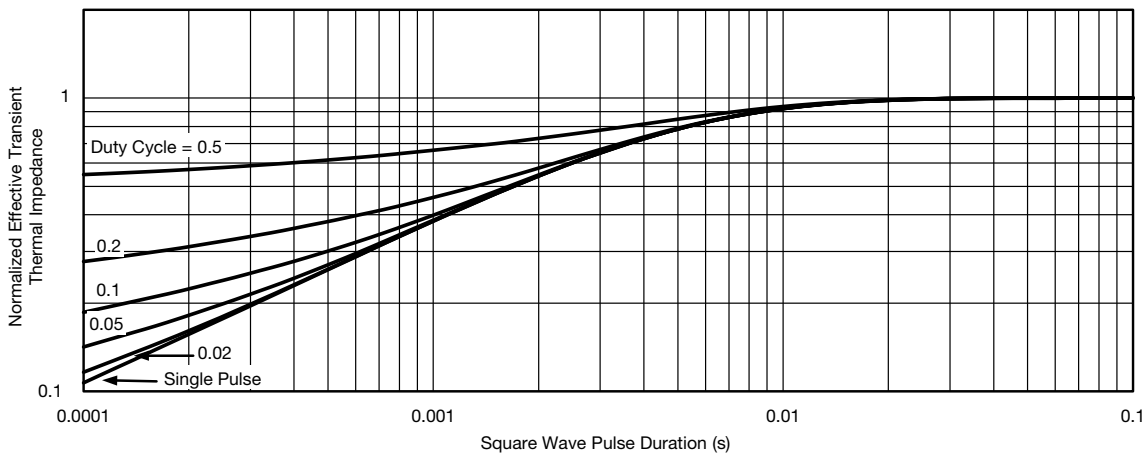
\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



**CHANNEL-2 TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



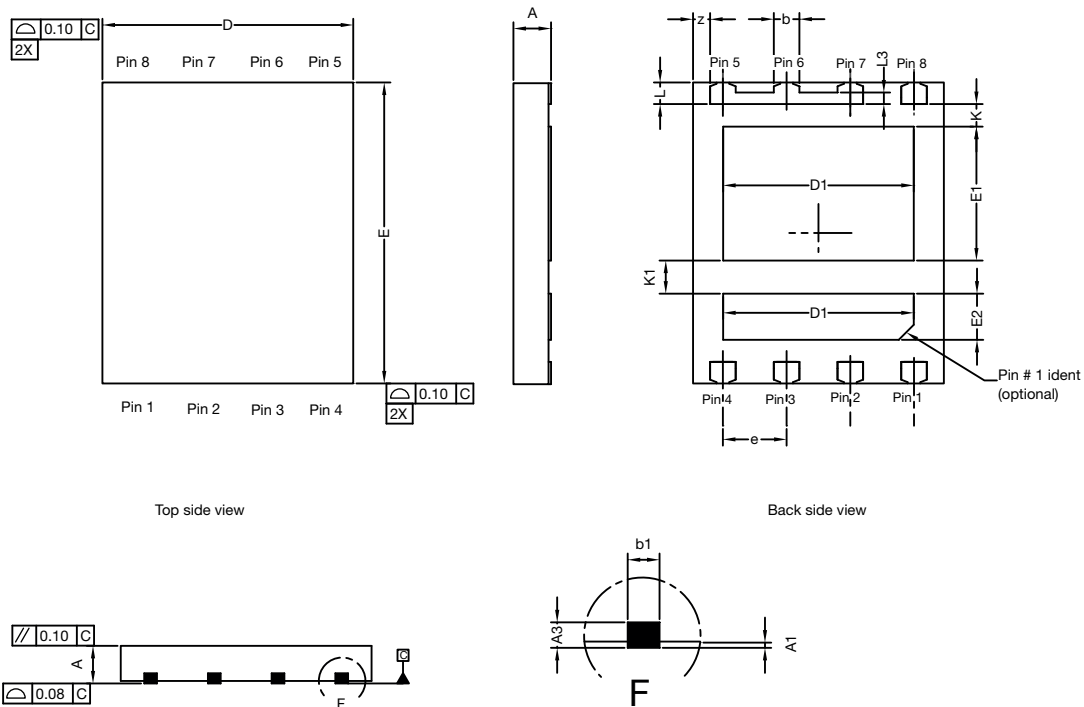
**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**Normalized Thermal Transient Impedance, Junction-to-Case**

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?63482](http://www.vishay.com/ppg?63482).

## PowerPAIR® 6 x 5 Case Outline



Top side view

Back side view

DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.028	0.030	0.032
A1	0.00	-	0.10	0.000	-	0.004
A3	0.15	0.20	0.25	0.006	0.007	0.009
b	0.43	0.51	0.61	0.017	0.020	0.024
b1	0.25 BSC			0.010 BSC		
D	4.90	5.00	5.10	0.192	0.196	0.200
D1	3.75	3.80	3.85	0.148	0.150	0.152
E	5.90	6.00	6.10	0.232	0.236	0.240
E1 Option AA (for W/B)	2.62	2.67	2.72	0.103	0.105	0.107
E1 Option AB (for BWL)	2.42	2.47	2.52	0.095	0.097	0.099
E2	0.87	0.92	0.97	0.034	0.036	0.038
e	1.27 BSC			0.050 BSC		
K Option AA (for W/B)	0.45 typ.			0.018 typ.		
K Option AB (for BWL)	0.65 typ.			0.025 typ.		
K1	0.66 typ.			0.025 typ.		
L	0.33	0.43	0.53	0.013	0.017	0.020
L3	0.23 BSC			0.009 BSC		
z	0.34 BSC			0.013 BSC		
ECN: T14-0782-Rev. C, 22-Dec-14						
DWG: 6005						



# Recommended Minimum PAD for PowerPAIR® 6 x 5



**Note**

- Linear dimensions are in black, the same information is provided in ordinate dimensions which are in blue.



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