

# N-Channel 40-V (D-S) MOSFET

## PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
40	0.0028 at $V_{GS} = 10$ V	50	38 nC
	0.0032 at $V_{GS} = 4.5$ V	50	

## FEATURES

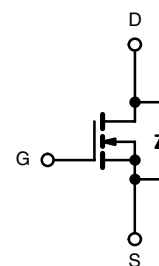
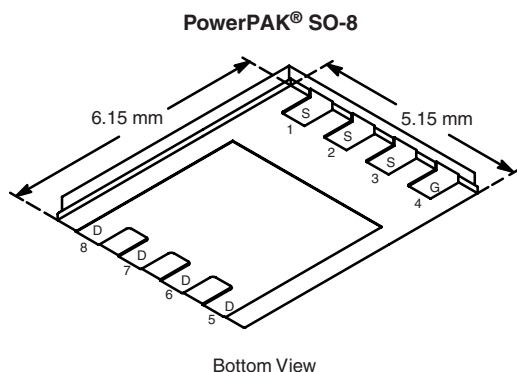
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 %  $R_g$  Tested
- 100 % UIS Tested



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

## APPLICATIONS

- Synchronous Rectification
- Secondary Side DC/DC



N-Channel MOSFET

Ordering Information: SiR414DP-T1-GE3 (Lead (Pb)-free and Halogen-free)

## ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ\text{C}$ , unless otherwise noted

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		$V_{DS}$	40	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150\text{ }^{\circ}\text{C}$ )	$T_C = 25\text{ }^{\circ}\text{C}$	$I_D$	50 <sup>a</sup>	A
	$T_C = 70\text{ }^{\circ}\text{C}$		50 <sup>a</sup>	
	$T_A = 25\text{ }^{\circ}\text{C}$		33 <sup>b, c</sup>	
	$T_A = 70\text{ }^{\circ}\text{C}$		26 <sup>b, c</sup>	
Pulsed Drain Current		$I_{DM}$	70	
Continuous Source-Drain Diode Current	$T_C = 25\text{ }^{\circ}\text{C}$	$I_S$	50 <sup>a</sup>	
	$T_A = 25\text{ }^{\circ}\text{C}$		4.9 <sup>b, c</sup>	
Single Pulse Avalanche Current	L = 0.1 mH	$I_{AS}$	40	
Single Pulse Avalanche Energy		$E_{AS}$	80	mJ
Maximum Power Dissipation	$T_C = 25\text{ }^{\circ}\text{C}$	$P_D$	83	W
	$T_C = 70\text{ }^{\circ}\text{C}$		53	
	$T_A = 25\text{ }^{\circ}\text{C}$		5.4 <sup>b, c</sup>	
	$T_A = 70\text{ }^{\circ}\text{C}$		3.4 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to 150	$^{\circ}\text{C}$
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>			260	

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, f</sup>	$R_{thJA}$	18	23	$^\circ\text{C/W}$
Maximum Junction-to-Case (Drain)	$R_{thJC}$	1.0	1.5	

Notes:

a. Package Limited.

b. Surface Mounted on 1" x 1" FR4 board.

c.  $t = 10$  s.

d. See Solder Profile ([www.vishay.com/ppg?64727](http://www.vishay.com/ppg?64727)). The PowerPAK SO-8 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.

e. Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.

f. Maximum under Steady State conditions is  $65^\circ\text{C/W}$ .

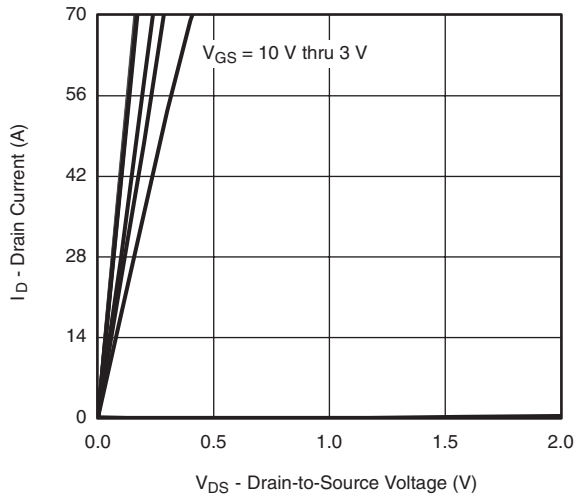
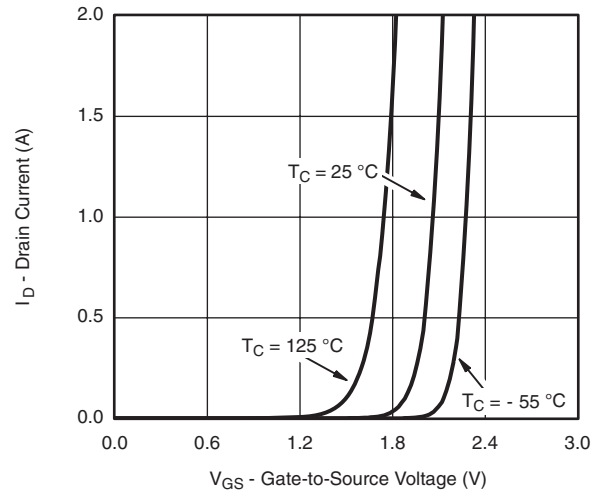
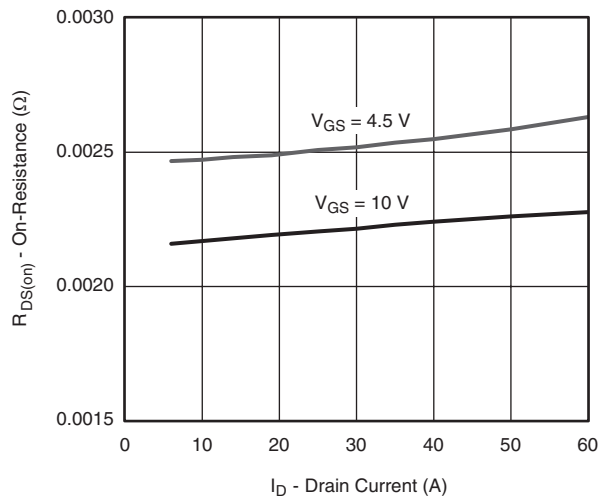
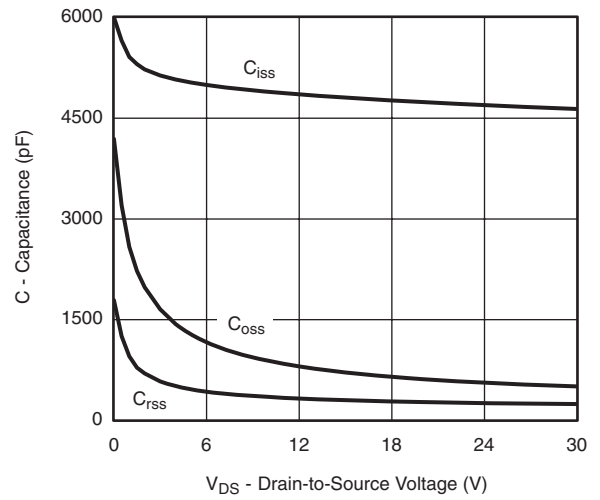
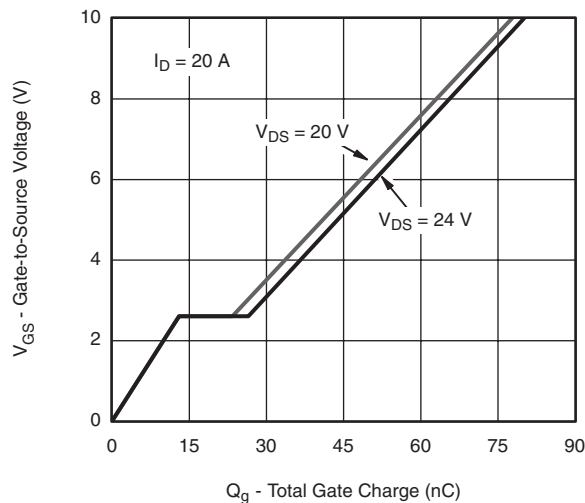
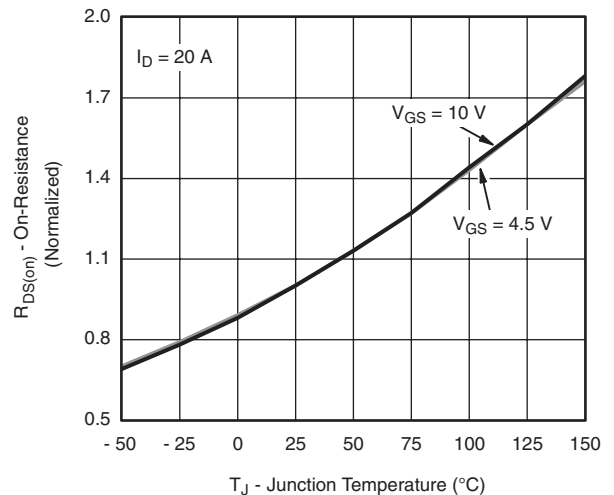
SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	40			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA		43		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 6		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.0		2.5	V
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>DS</sub> = 40 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			10	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 10 V	30			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		0.0023	0.0028	Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 20 A		0.0026	0.0032	
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A		102		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, f = 1 MHz		4750		pF
Output Capacitance	C <sub>oss</sub>			610		
Reverse Transfer Capacitance	C <sub>rss</sub>			275		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		78	117	nC
		V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 20 A		38	57	
Gate-Source Charge	Q <sub>gs</sub>			13		
Gate-Drain Charge	Q <sub>gd</sub>			11		
Gate Resistance	R <sub>g</sub>	f = 1 MHz	0.2	0.7	1.4	Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 2 Ω I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		14	25	ns
Rise Time	t <sub>r</sub>			9	18	
Turn-Off Delay Time	t <sub>d(off)</sub>			41	65	
Fall Time	t <sub>f</sub>			9	18	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 2 Ω I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω		33	42	
Rise Time	t <sub>r</sub>			22	35	
Turn-Off Delay Time	t <sub>d(off)</sub>			42	65	
Fall Time	t <sub>f</sub>			13	25	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			50	A
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				60	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 5 A		0.75	1.1	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 10 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C		40	60	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			48	72	nC
Reverse Recovery Fall Time	t <sub>a</sub>			24		ns
Reverse Recovery Rise Time	t <sub>b</sub>			16		

Notes:

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

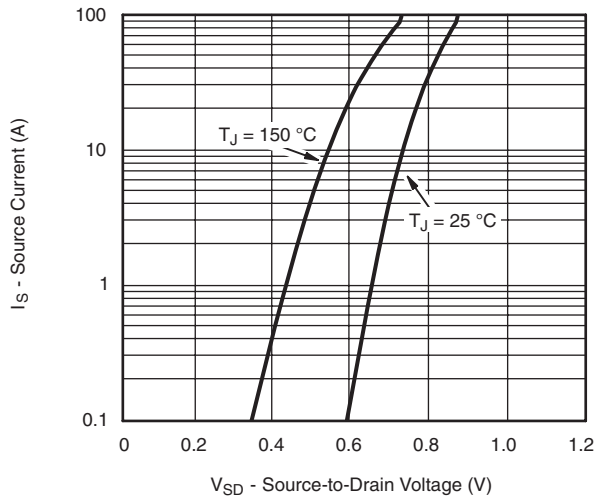
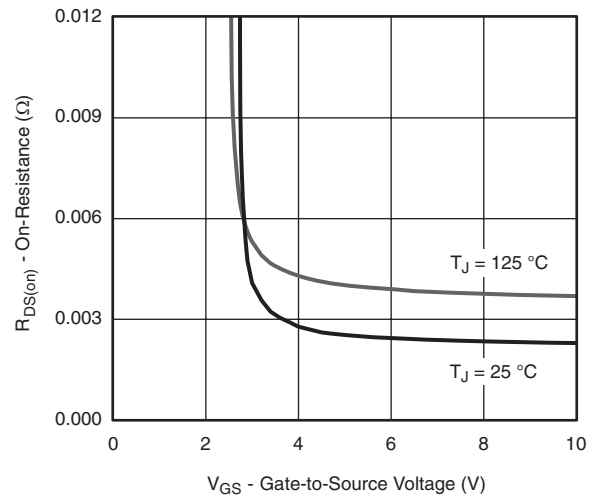
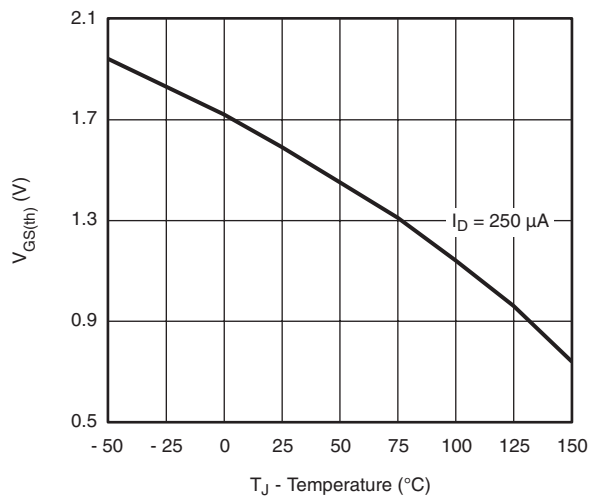
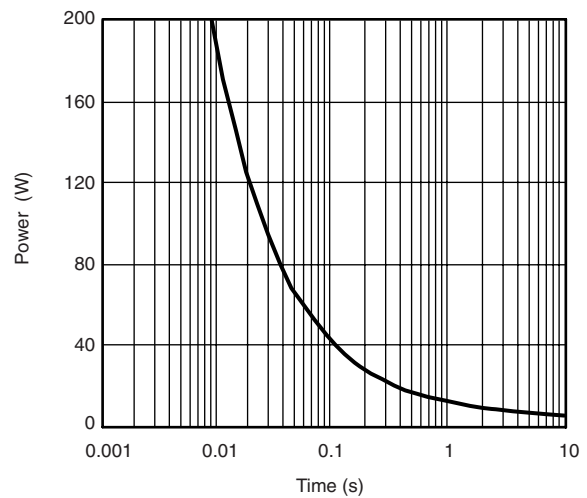
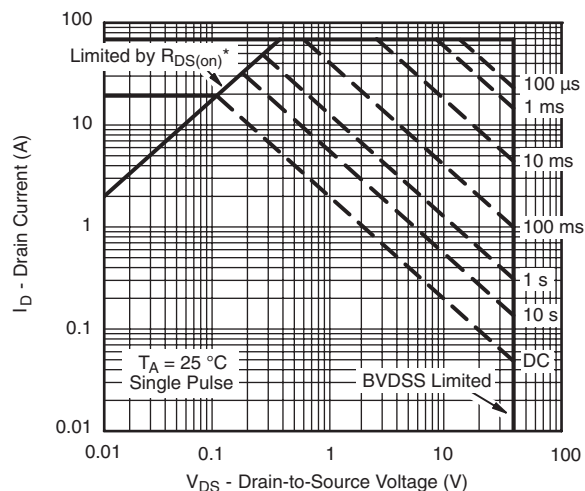
b. Guaranteed by design, not subject to production testing.

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**

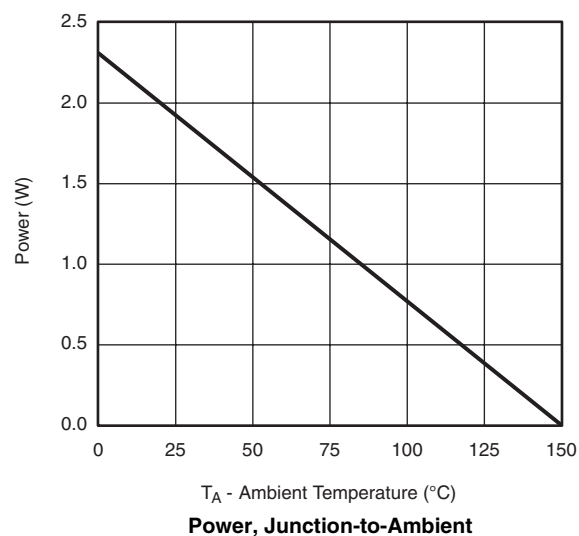
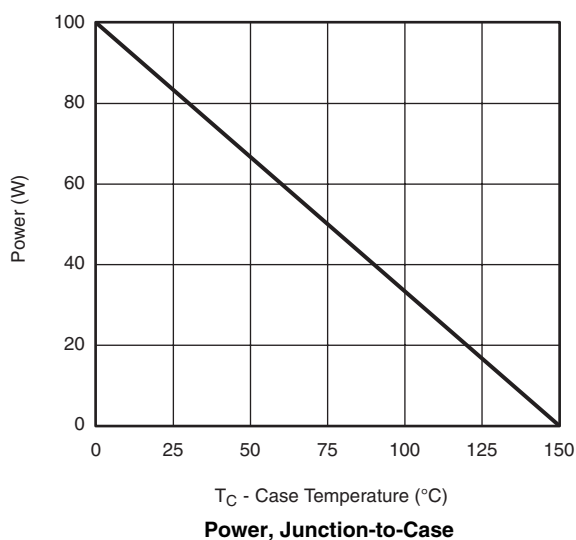
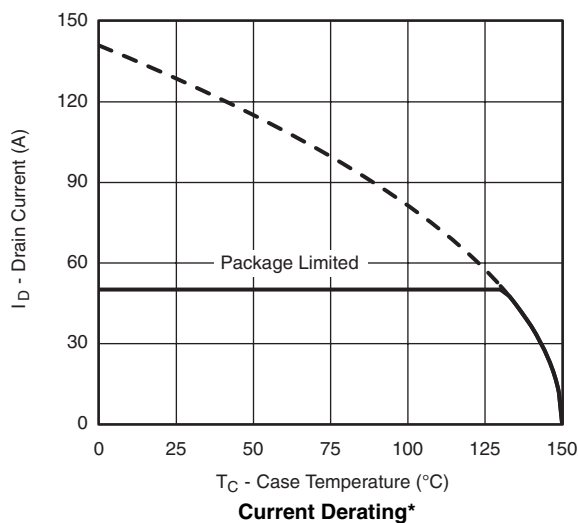
**SiR414DP**

Vishay Siliconix

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Source-Drain Diode Forward Voltage****On-Resistance vs. Gate-to-Source Voltage****Threshold Voltage****Single Pulse Power, Junction-to-Ambient**\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified**Safe Operating Area, Junction-to-Ambient**



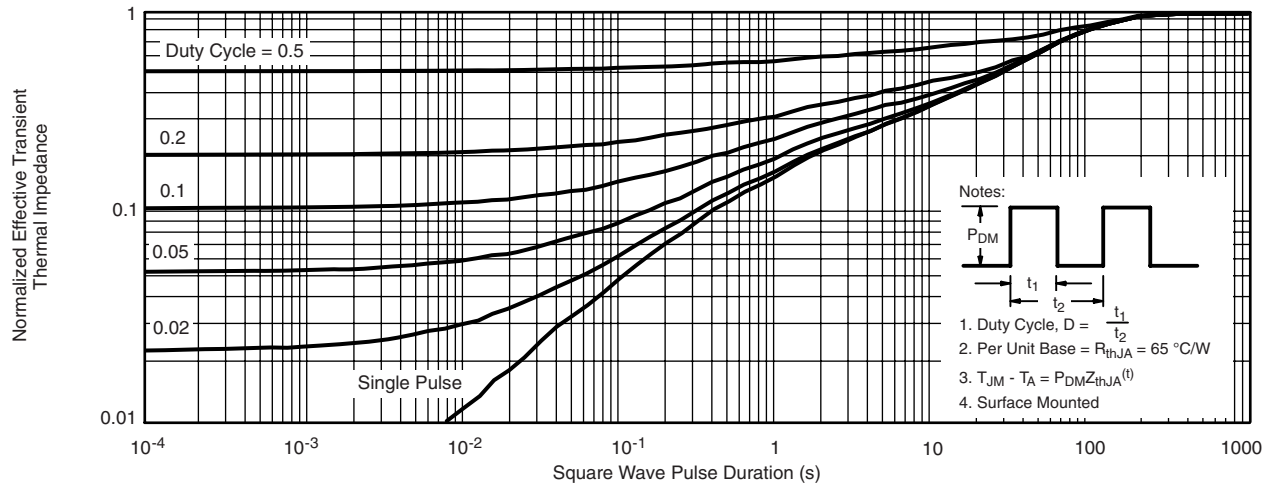
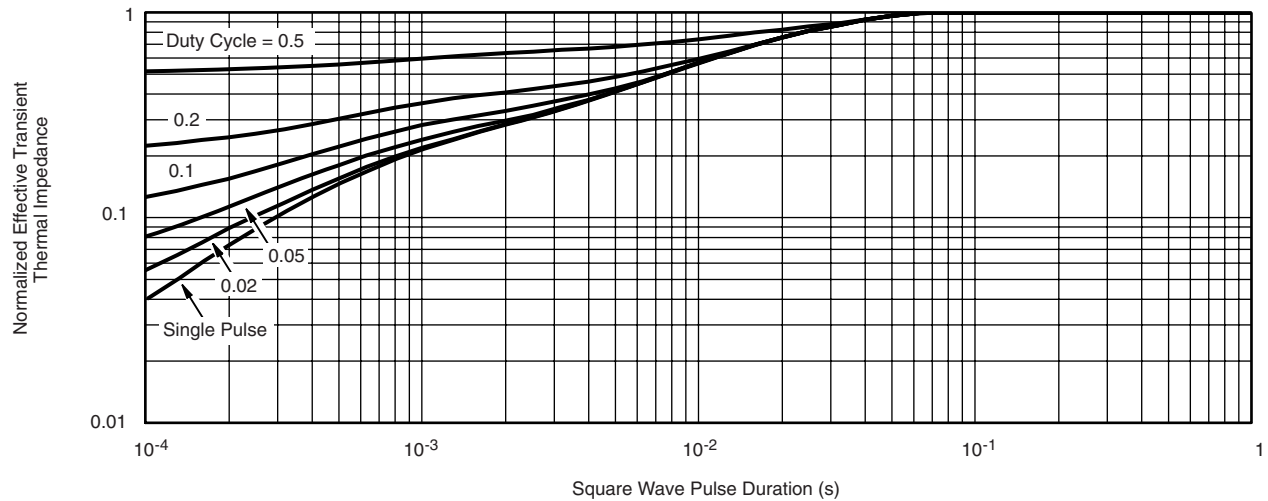
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



\* 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.

## SiR414DP

Vishay Siliconix

**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?64727](http://www.vishay.com/ppg?64727).

## PowerPAK® SO-8, (Single/Dual)



### Notes

1. Inch will govern.
2. Dimensions exclusive of mold gate burrs.
3. Dimensions exclusive of mold flash and cutting burrs.

DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.97	1.04	1.12	0.038	0.041	0.044
A1		-	0.05	0	-	0.002
b	0.33	0.41	0.51	0.013	0.016	0.020
c	0.23	0.28	0.33	0.009	0.011	0.013
D	5.05	5.15	5.26	0.199	0.203	0.207
D1	4.80	4.90	5.00	0.189	0.193	0.197
D2	3.56	3.76	3.91	0.140	0.148	0.154
D3	1.32	1.50	1.68	0.052	0.059	0.066
D4	0.57 typ.			0.0225 typ.		
D5	3.98 typ.			0.157 typ.		
E	6.05	6.15	6.25	0.238	0.242	0.246
E1	5.79	5.89	5.99	0.228	0.232	0.236
E2 (for AL product)	3.30	3.48	3.66	0.130	0.137	0.144
E2 (for other product)	3.48	3.66	3.84	0.137	0.144	0.151
E3	3.68	3.78	3.91	0.145	0.149	0.154
E4 (for AL product)	0.58 typ.			0.023 typ.		
E4 (for other product)	0.75 typ.			0.030 typ.		
e	1.27 BSC			0.050 BSC		
K (for AL product)	1.45 typ.			0.057 typ.		
K (for other product)	1.27 typ.			0.050 typ.		
K1	0.56	-	-	0.022	-	-
H	0.51	0.61	0.71	0.020	0.024	0.028
L	0.51	0.61	0.71	0.020	0.024	0.028
L1	0.06	0.13	0.20	0.002	0.005	0.008
θ	0°	-	12°	0°	-	12°
W	0.15	0.25	0.36	0.006	0.010	0.014
M	0.125 typ.			0.005 typ.		
ECN: C13-0702-Rev. K, 20-May-13						
DWG: 5881						

## RECOMMENDED MINIMUM PADS FOR PowerPAK® SO-8 Single



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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