

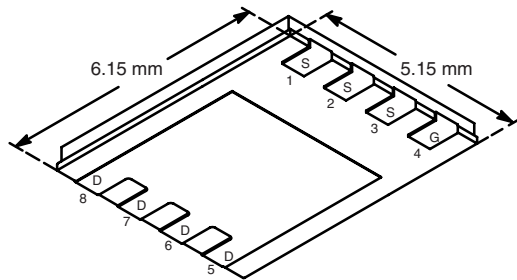


N-Channel 20-V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ.)
20	0.00160 at $V_{GS} = 10$ V	60	64.5 nC
	0.00175 at $V_{GS} = 4.5$ V	60	
	0.00225 at $V_{GS} = 2.5$ V	60	

PowerPAK® SO-8



Bottom View

Ordering Information: SiR404DP-T1-GE3 (Lead (Pb)-free and Halogen-free)

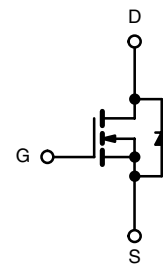
FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Gen III Power MOSFET
- 100 % R_g Tested
- 100 % UIS Tested
- 2.5 V and 3.3 V Gate Drive MOSFET for dc-to-dc Applications
- Compliant to RoHS Directive 2002/95/EC



APPLICATIONS

- Fixed Telecom
- OR-ing
- POL



N-Channel MOSFET

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	20	V
Gate-Source Voltage	V_{GS}	± 12	
Continuous Drain Current ($T_J = 150^\circ\text{C}$)	I_D	$T_C = 25^\circ\text{C}$	A
		$T_C = 70^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
		$T_A = 70^\circ\text{C}$	
Pulsed Drain Current	I_{DM}	100	mJ
Continuous Source-Drain Diode Current	I_S	$T_C = 25^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
Single Pulse Avalanche Current	I_{AS}	50	
Single Pulse Avalanche Energy	E_{AS}	125	
Maximum Power Dissipation	P_D	$T_C = 25^\circ\text{C}$	W
		$T_C = 70^\circ\text{C}$	
		$T_A = 25^\circ\text{C}$	
		$T_A = 70^\circ\text{C}$	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature) ^{d, e}		260	

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{b, f}	R_{thJA}	15	20	$^\circ\text{C/W}$
Maximum Junction-to-Case (Drain)	R_{thJC}	0.9	1.2	

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?73257). 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 54°C/W .

SiR404DP

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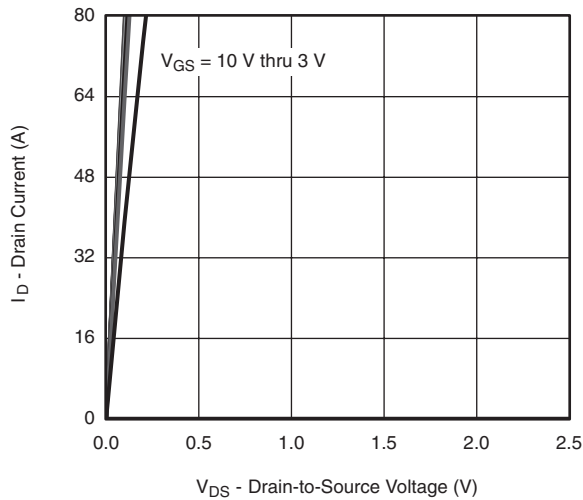
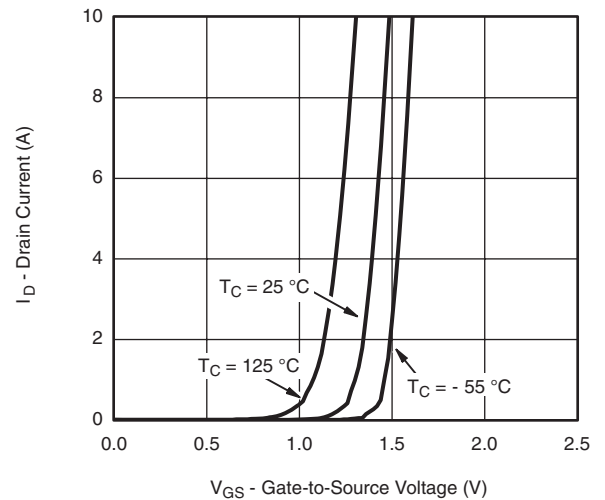
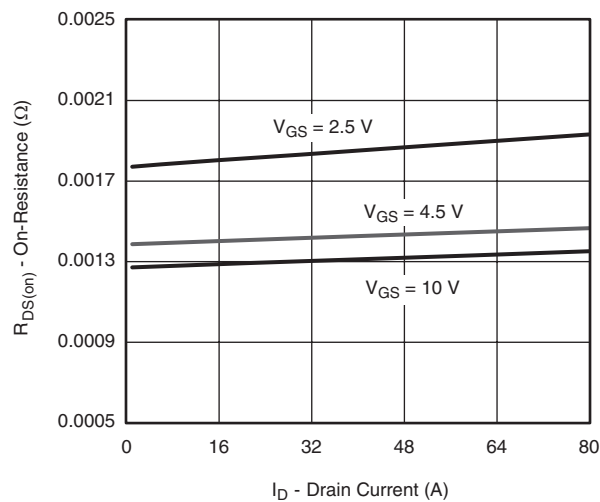
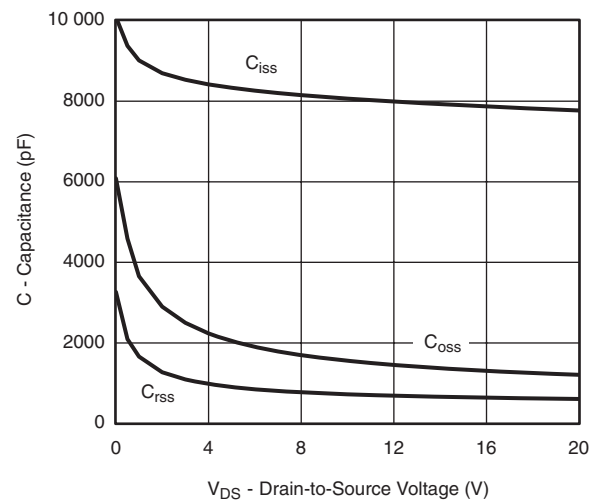
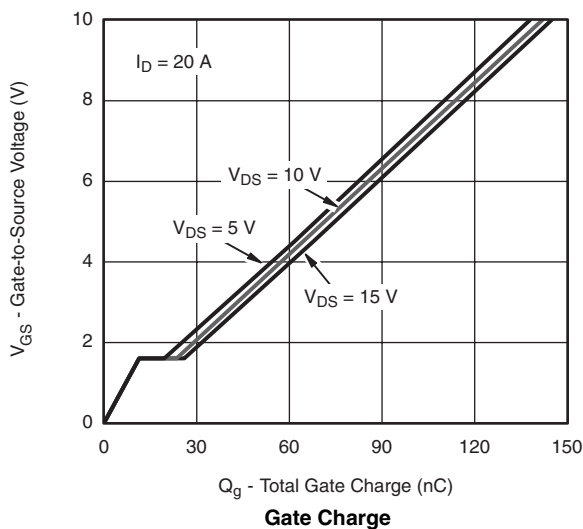
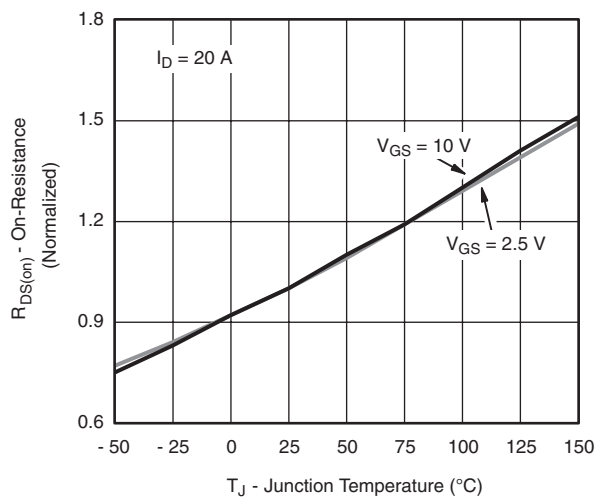
SPECIFICATIONS T _J = 25 °C, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	20			V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA		17		mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J			- 4.4		
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	0.6		1.5	V
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 12 V			± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 20 V, V _{GS} = 0 V			1	μA
		V _{DS} = 20 V, V _{GS} = 0 V, T _J = 55 °C			10	
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≥ 5 V, V _{GS} = 10 V	30			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V, I _D = 20 A		0.0013	0.00160	Ω
		V _{GS} = 4.5 V, I _D = 20 A		0.0014	0.00175	
		V _{GS} = 2.5 V, I _D = 15 A		0.0018	0.00225	
Forward Transconductance ^a	g _{fs}	V _{DS} = 10 V, I _D = 20 A		150		S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{DS} = 10 V, V _{GS} = 0 V, f = 1 MHz		8130		pF
Output Capacitance	C _{oss}			1570		
Reverse Transfer Capacitance	C _{rss}			735		
Total Gate Charge	Q _g	V _{DS} = 10 V, V _{GS} = 2.5 V, I _D = 20 A		36.5		nC
		V _{DS} = 10 V, V _{GS} = 3.3 V, I _D = 20 A		47.5		
		V _{DS} = 10 V, V _{GS} = 4.5 V, I _D = 20 A		64.5	97	
Gate-Source Charge	Q _{gs}			11.4		
Gate-Drain Charge	Q _{gd}			12.1		
Gate Resistance	R _g	f = 1 MHz	0.2	1.0	2	Ω
Turn-On Delay Time	t _{d(on)}	V _{DD} = 10 V, R _L = 1.0 Ω I _D ≅ 10 A, V _{GEN} = 10 V, R _g = 1 Ω		14	28	ns
Rise Time	t _r			9	18	
Turn-Off Delay Time	t _{d(off)}			68	120	
Fall Time	t _f			9	18	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 10 V, R _L = 1.0 Ω I _D ≅ 10 A, V _{GEN} = 4.5 V, R _g = 1 Ω		35	60	
Rise Time	t _r			20	40	
Turn-Off Delay Time	t _{d(off)}			123	210	
Fall Time	t _f			26	50	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C			60	A
Pulse Diode Forward Current ^a	I _{SM}				100	
Body Diode Voltage	V _{SD}	I _S = 5 A		0.65	1.1	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = 10 A, dI/dt = 100 A/μs, T _J = 25 °C		38	75	ns
Body Diode Reverse Recovery Charge	Q _{rr}			36	72	nC
Reverse Recovery Fall Time	t _a			21		ns
Reverse Recovery Rise Time	t _b			17		

Notes:

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

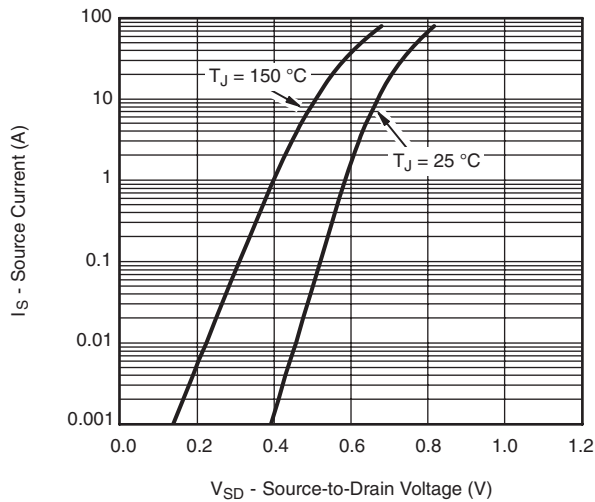
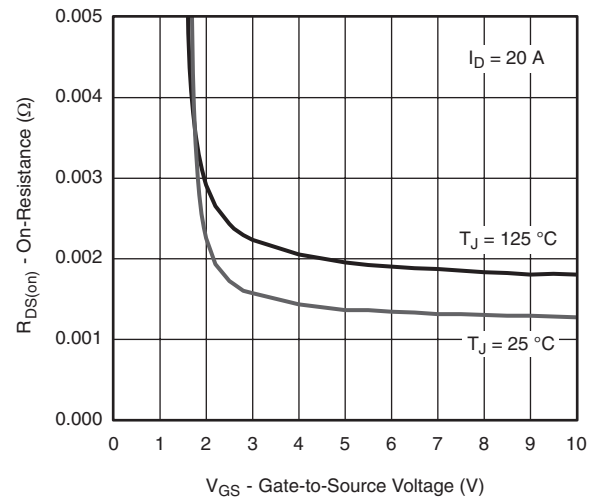
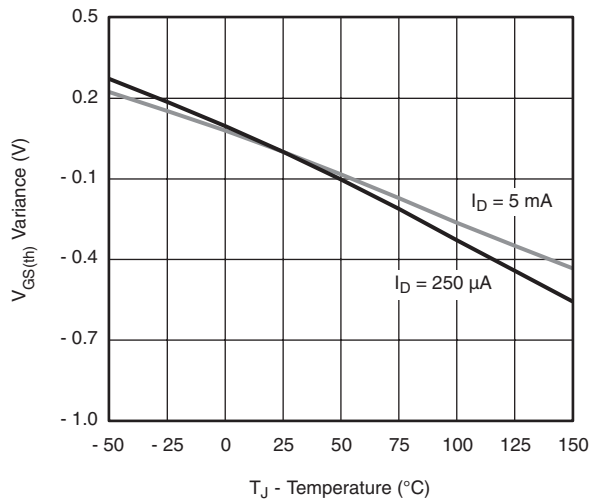
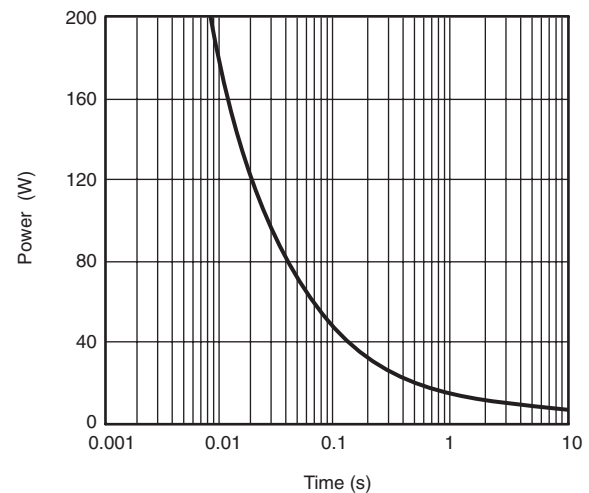
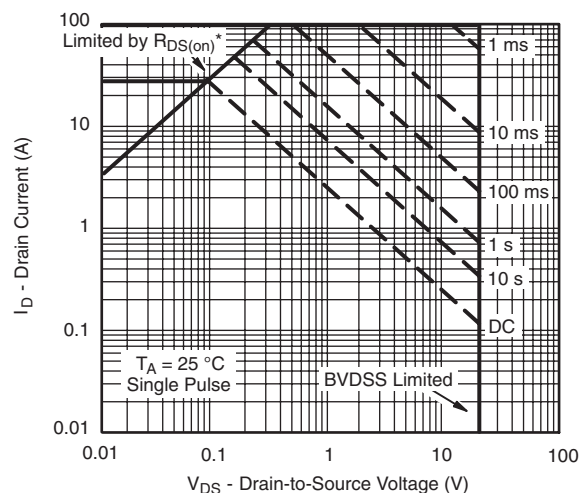
b. Guaranteed by design, not subject to production testing.

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.

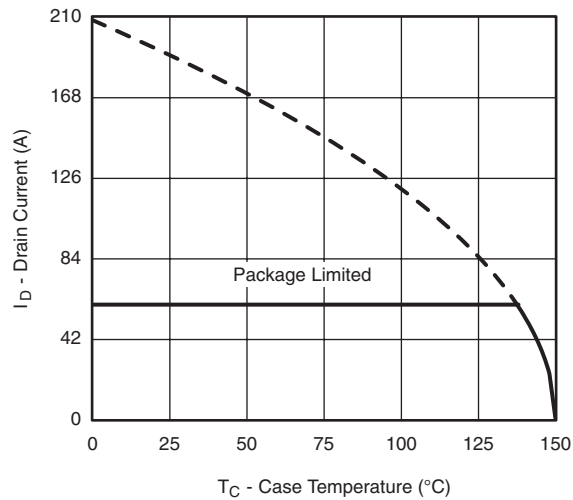
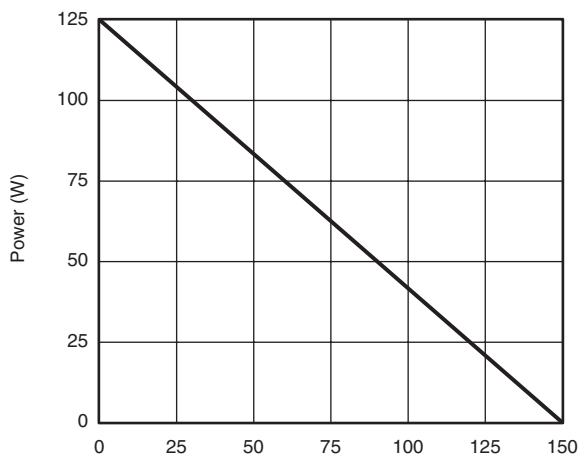
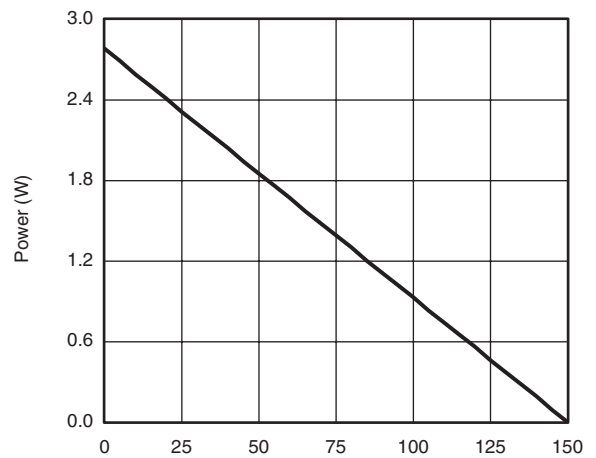

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Output Characteristics

Transfer Characteristics

On-Resistance vs. Drain Current and Gate Voltage

Capacitance

Gate Charge

On-Resistance vs. Junction Temperature

SiR404DP

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**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**

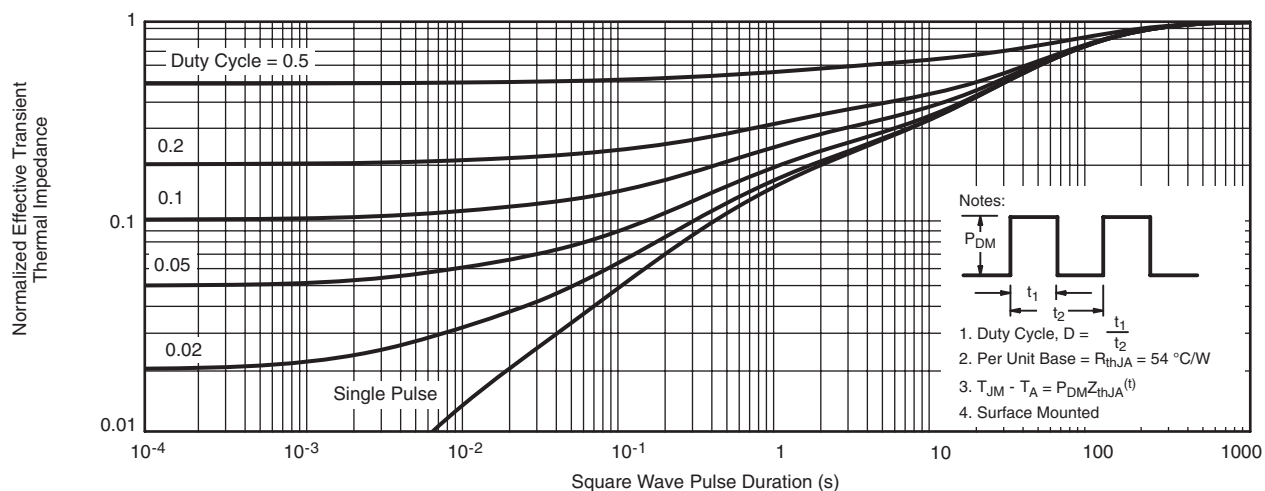
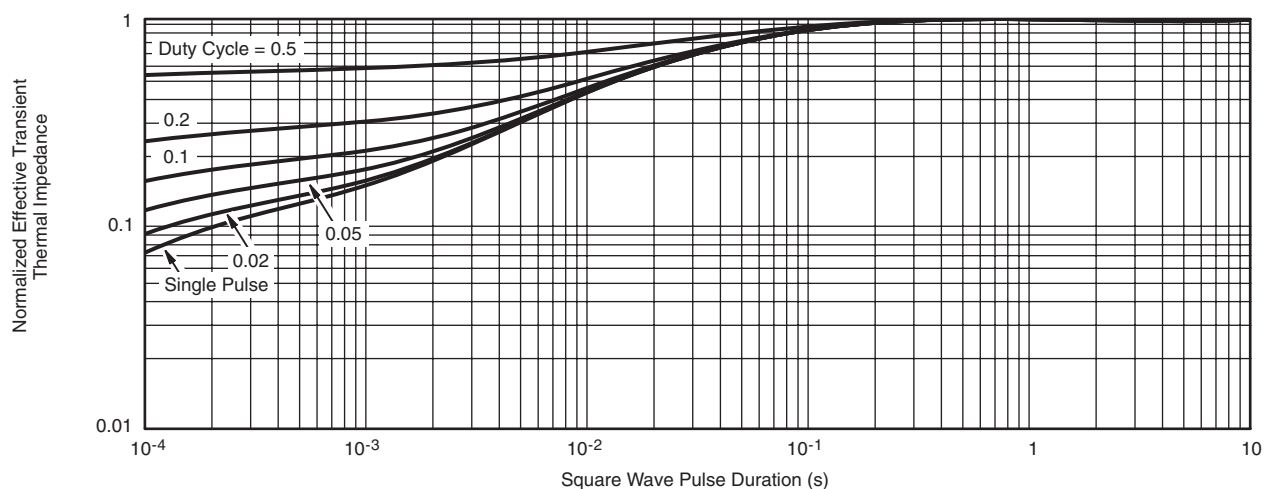
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified
Safe Operating Area, Junction-to-Ambient


TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Current Derating*

Power, Junction-to-Case

Power, Junction-to-Ambient

* 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.

SiR404DP

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**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Normalized Thermal Transient Impedance, Junction-to-Ambient****Normalized Thermal Transient Impedance, Junction-to-Case**

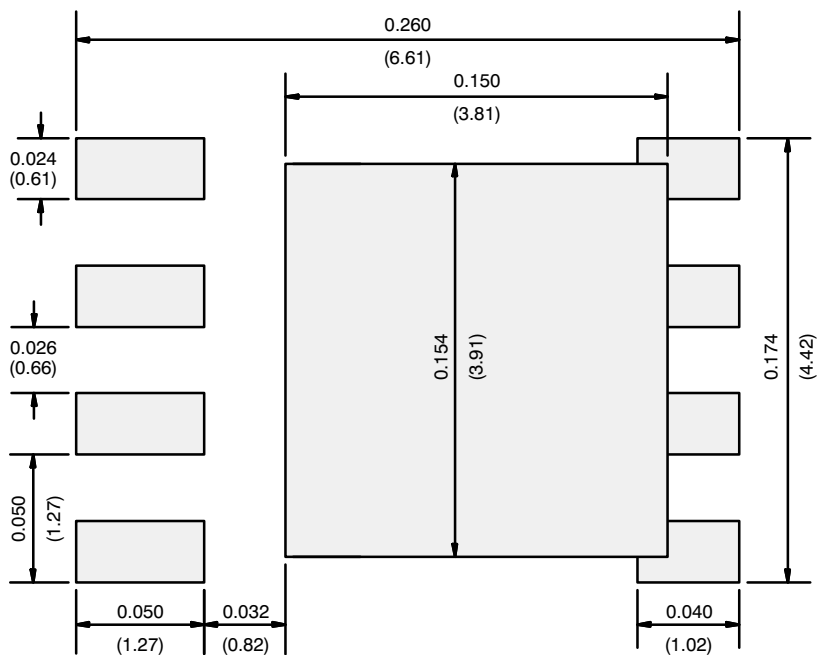
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PowerPAK® SO-8, (Single/Dual)



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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