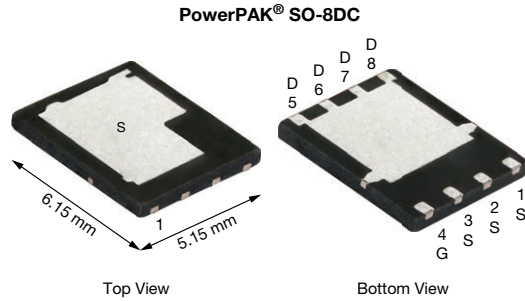


## N-Channel 30 V (D-S) MOSFET



### FEATURES

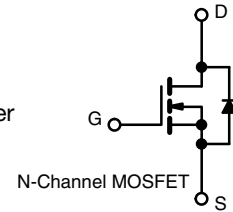
- TrenchFET® Gen IV power MOSFET
- Optimized  $Q_g$ ,  $Q_{gd}$ , and  $Q_{gd}/Q_{gs}$  ratio reduces switching related power loss
- Top side cooling feature provides additional venue for thermal transfer
- 100 %  $R_g$  and UIS tested
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### APPLICATIONS

- Synchronous rectification
- High power density DC/DC
- Synchronous buck converter
- OR-ing
- Load switching
- Battery management



PRODUCT SUMMARY	
$V_{DS}$ (V)	30
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 10$ V	0.00080
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 4.5$ V	0.00115
$Q_g$ typ. (nC)	48
$I_D$ (A)	100 <sup>a, g</sup>
Configuration	Single

ORDERING INFORMATION	
Package	PowerPAK SO-8DC
Lead (Pb)-free and halogen-free	SiDR390DP-T1-GE3

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	$V_{DS}$	30	V
Gate-source voltage	$V_{GS}$	+20 / -16	V
Continuous drain current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	100 <sup>a</sup>
		$T_C = 70$ °C	100 <sup>a</sup>
		$T_A = 25$ °C	69.9 <sup>b, c</sup>
		$T_A = 70$ °C	55.9 <sup>b, c</sup>
Pulsed drain current ( $t = 100$ $\mu$ s)	$I_{DM}$	400	A
Continuous source-drain diode current	$I_S$	$T_C = 25$ °C	100
		$T_A = 25$ °C	5.6 <sup>b, c</sup>
Single pulse avalanche current	$I_{AS}$	40	
Single pulse avalanche energy	$E_{AS}$	80	mJ
Maximum power dissipation	$P_D$	$T_C = 25$ °C	125
		$T_C = 70$ °C	80
		$T_A = 25$ °C	6.25 <sup>b, c</sup>
		$T_A = 70$ °C	4 <sup>b, c</sup>
Operating junction and storage temperature range	$T_J, T_{stg}$	-55 to +150	°C
Soldering recommendations (peak temperature) <sup>c</sup>		260	

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient <sup>b</sup>	$R_{thJA}$	15	20	°C/W
Maximum junction-to-case (drain)	$R_{thJC}$	0.8	1	
Maximum junction-to-case (source)	$R_{thJC}$	1.1	1.4	

### 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 PowerPAK SO-8DC 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 54 °C/W
- $T_C = 25$  °C



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	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$	30	-	-	V	
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$	-	17.5	-	mV/ $^\circ\text{C}$	
$V_{GS(th)}$ temperature coefficient	$\Delta V_{GS(th)}/T_J$		-	-6.3	-		
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	0.8	-	2	V	
Gate-source leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}$ , $V_{GS} = +20, -16\text{ V}$	-	-	$\pm 100$	nA	
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	1	$\mu\text{A}$	
		$V_{DS} = 30\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 55\text{ }^\circ\text{C}$	-	-	10		
On-state drain current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}$ , $V_{GS} = 10\text{ V}$	50	-	-	A	
Drain-source on-state resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$ , $I_D = 20\text{ A}$	-	0.00065	0.00080	$\Omega$	
		$V_{GS} = 4.5\text{ V}$ , $I_D = 15\text{ A}$	-	0.00090	0.00115		
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}$ , $I_D = 20\text{ A}$	-	110	-	S	
<b>Dynamic <sup>b</sup></b>							
Input capacitance	$C_{ISS}$	$V_{DS} = 15\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$	-	10 180	-	pF	
Output capacitance	$C_{OSS}$		-	3290	-		
Reverse transfer capacitance	$C_{RSS}$		-	306	-		
$C_{RSS}/C_{ISS}$ ratio			-	0.031	0.062		
Total gate charge	$Q_g$	$V_{DS} = 15\text{ V}$ , $V_{GS} = 10\text{ V}$ , $I_D = 20\text{ A}$	-	102	153	nC	
Gate-source charge	$Q_{gs}$	$V_{DS} = 15\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_D = 20\text{ A}$	-	48	72		
Gate-drain charge	$Q_{gd}$		-	22	-		
Output charge	$Q_{oss}$		-	4.7	-		
Gate resistance	$R_g$	$V_{DS} = 15\text{ V}$ , $V_{GS} = 0\text{ V}$	-	105	-		
Turn-on delay time	$t_{d(on)}$	$f = 1\text{ MHz}$	0.5	1.3	2.5	$\Omega$	
Rise time	$t_r$		$V_{DD} = 15\text{ V}$ , $R_L = 0.75\text{ }\Omega$ $I_D \cong 20\text{ A}$ , $V_{GEN} = 10\text{ V}$ , $R_g = 1\text{ }\Omega$	-	15	30	ns
Turn-off delay time	$t_{d(off)}$			-	16	32	
Fall time	$t_f$			-	46	90	
Turn-on delay time	$t_{d(on)}$	-		10	20		
Rise time	$t_r$	-		51	100		
Turn-off delay time	$t_{d(off)}$	-		63	120		
Fall time	$t_f$	-		78	155		
Fall time	$t_f$	-		27	34		
<b>Drain-Source Body Diode Characteristics</b>							
Continuous source-drain diode current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	-	-	100	A	
Pulse diode forward current ( $t_p = 100\text{ }\mu\text{s}$ )	$I_{SM}$		-	-	400		
Body diode voltage	$V_{SD}$	$I_S = 10\text{ A}$	-	0.68	1.1	V	
Body diode reverse recovery time	$t_{rr}$	$I_F = 20\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $T_J = 25\text{ }^\circ\text{C}$	-	68	135	ns	
Body diode reverse recovery charge	$Q_{rr}$		-	98	180	nC	
Reverse recovery fall time	$t_a$		-	29	-	ns	
Reverse recovery rise time	$t_b$		-	39	-		

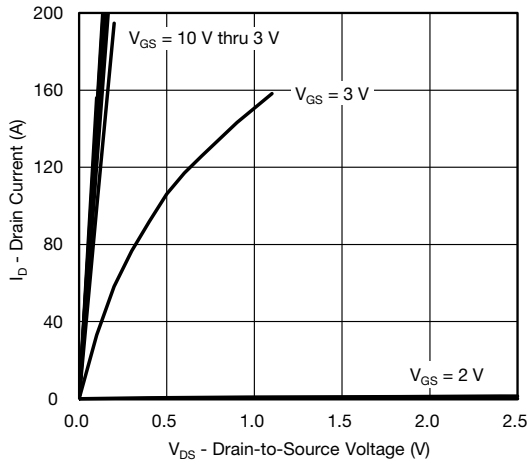
**Notes**

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

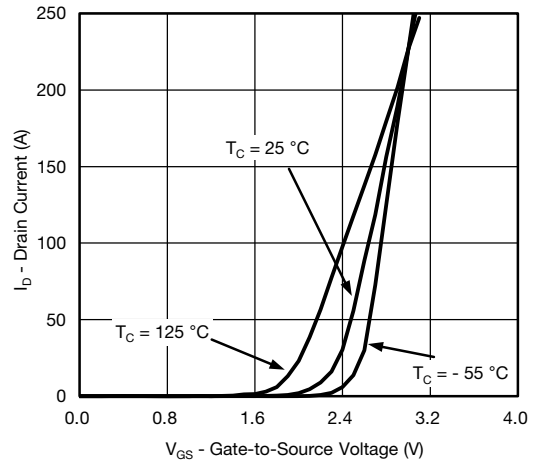
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



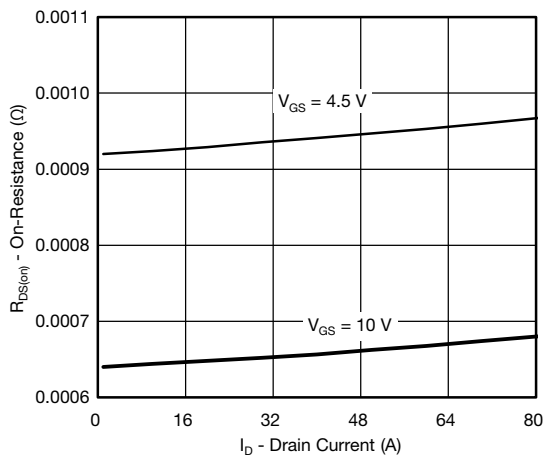
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



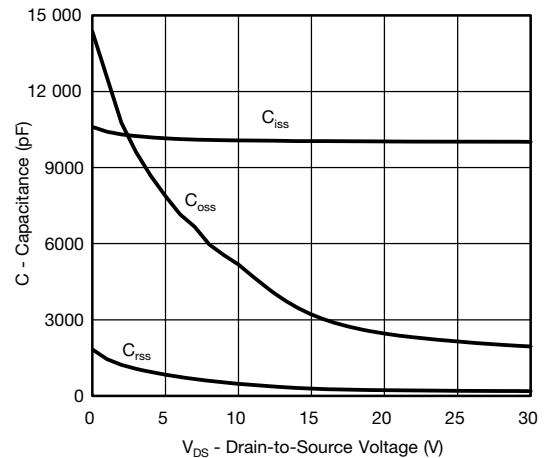
**Output Characteristics**



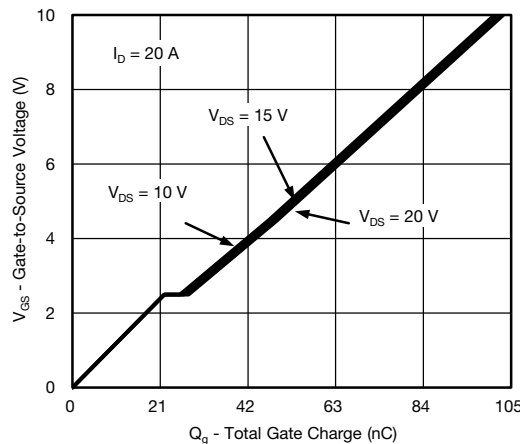
**Transfer Characteristics**



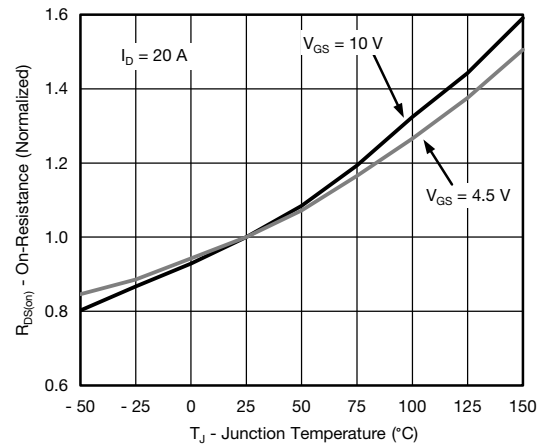
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**



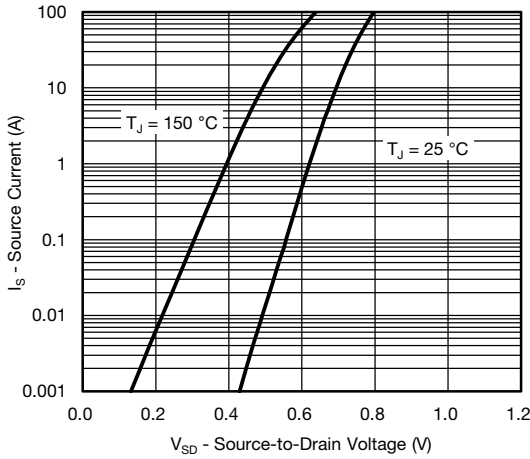
**Gate Charge**



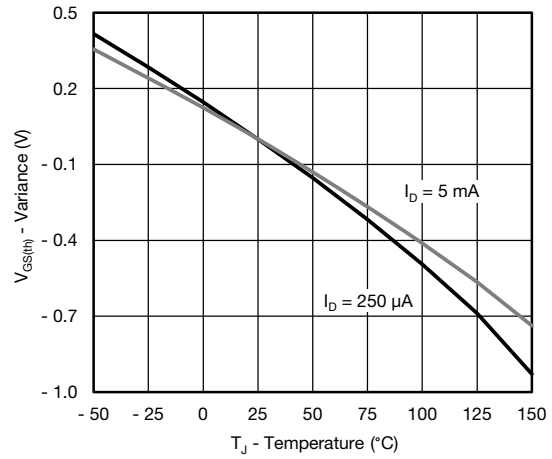
**On-Resistance vs. Junction Temperature**



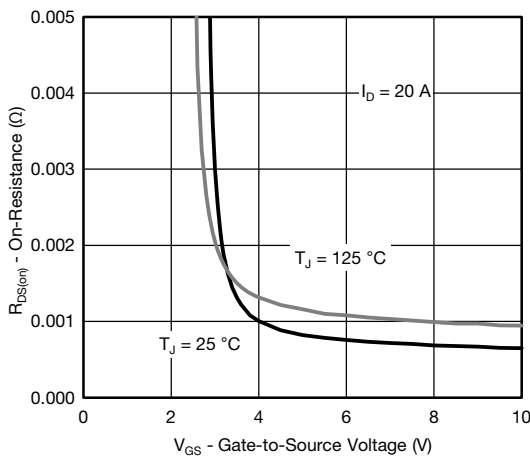
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



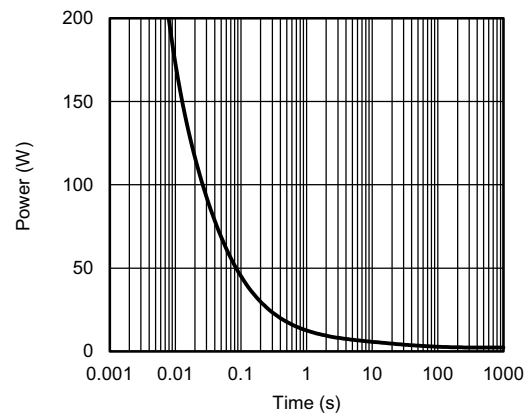
**Source-Drain Diode Forward Voltage**



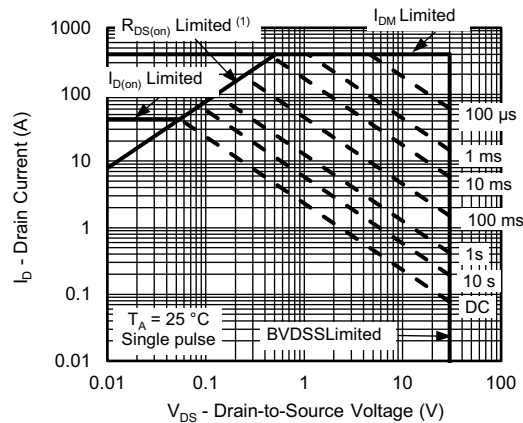
**Threshold Voltage**



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



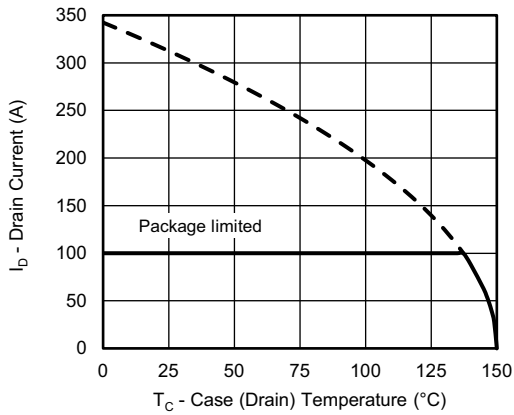
**Single Pulse Power, Junction-to-Ambient**



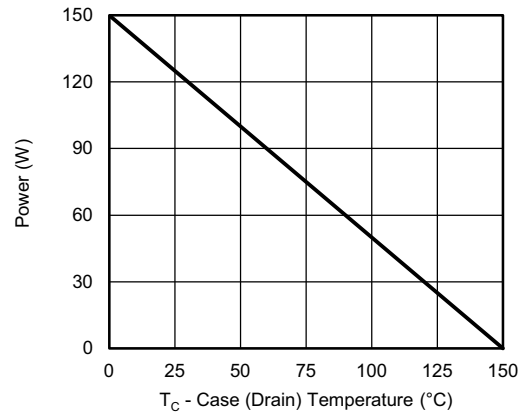
**Safe Operating Area, Junction-to-Ambient**



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



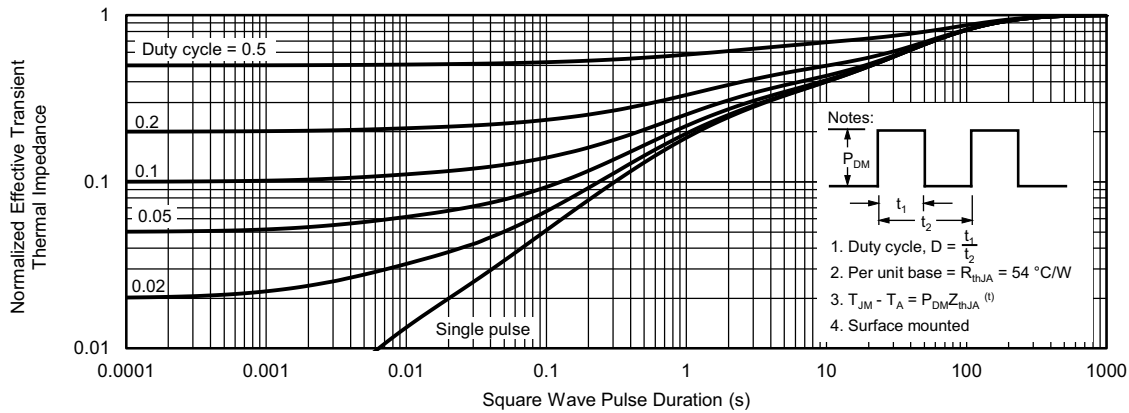
Current Derating <sup>a</sup>



Power, Junction-to-Case

Note

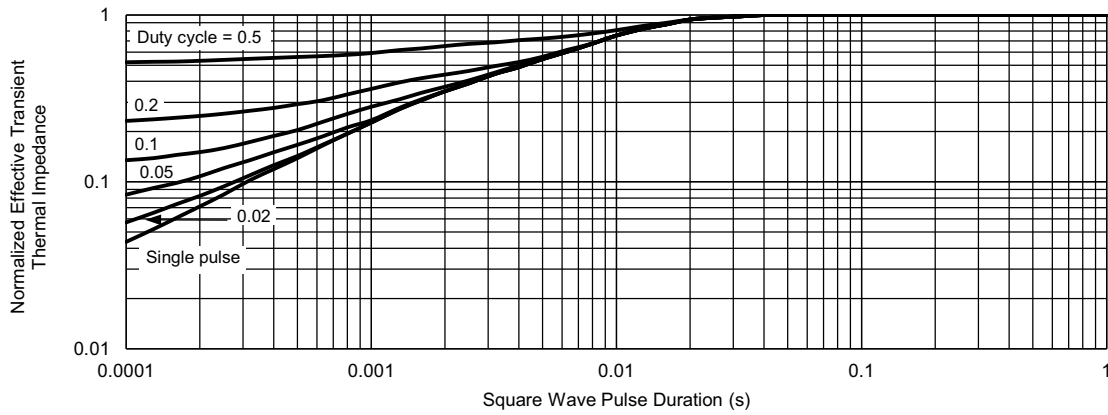
a. The power dissipation  $P_D$  is based on  $T_J$  max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package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



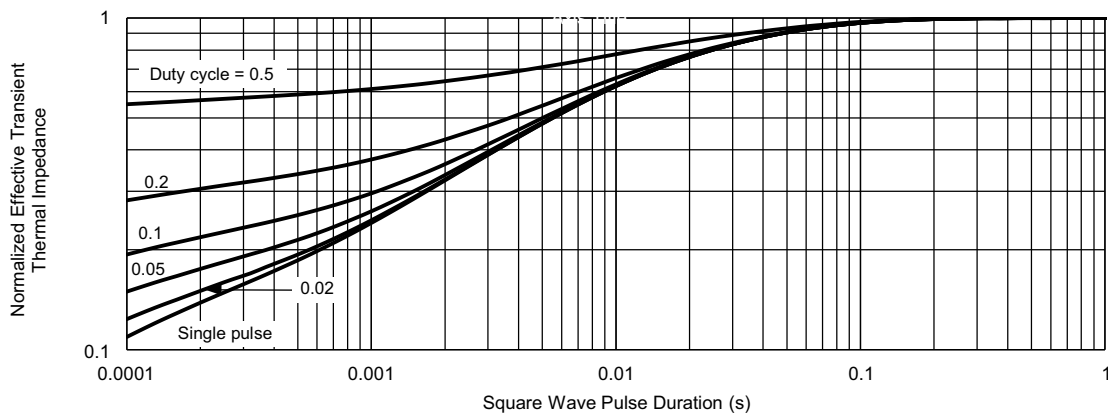
Normalized Thermal Transient Impedance, Junction-to-Ambient



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



**Normalized Thermal Transient Impedance, Junction-to-Case (Drain)**



**Normalized Thermal Transient Impedance, Junction-to-Case (Source)**

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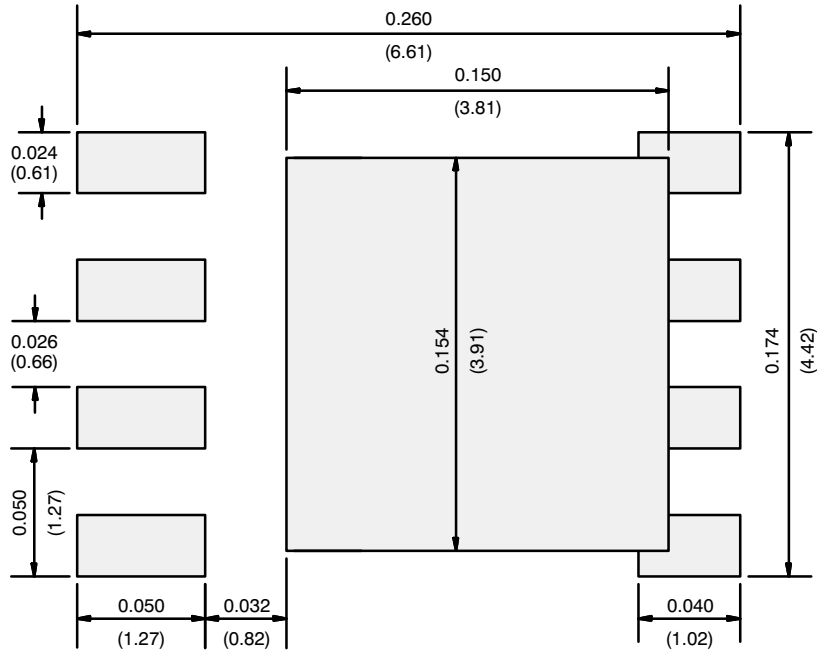
# PowerPAK® SO-8 Double Cooling Case Outline



DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.51	0.56	0.61	0.020	0.022	0.024
A1	0.00	0.02	0.05	0.000	0.001	0.002
b	0.36	0.41	0.46	0.014	0.016	0.018
c	0.15	0.20	0.25	0.006	0.008	0.010
D	4.90	5.00	5.10	0.193	0.197	0.201
D1	3.71	3.76	3.81	0.146	0.148	0.150
e	1.27 BSC			0.050 BSC		
E	5.90	6.00	6.10	0.232	0.236	0.240
E1	3.60	3.65	3.70	0.142	0.144	0.146
E2	0.46 typ.			0.018 typ.		
H	0.49	0.54	0.59	0.019	0.021	0.023
K	1.22	1.27	1.32	0.048	0.050	0.052
K1	0.64 typ.			0.025 typ.		
L	0.49	0.54	0.59	0.019	0.021	0.023
M1	3.85	3.90	3.95	0.152	0.154	0.156
M2	2.74	2.79	2.84	0.108	0.110	0.112
M3	1.06	1.11	1.16	0.042	0.044	0.046
M4	0.56 typ.			0.022 typ.		
N	8			8		
T1	4.51	4.56	4.61	0.178	0.180	0.182
T2	2.58	2.63	2.68	0.102	0.104	0.106
T3	1.88	1.93	1.98	0.074	0.076	0.078
T4	0.97 typ.			0.038 typ.		
T5	0.48 typ.			0.019 typ.		

ECN: T21-0014-Rev. B, 08-Feb-2021  
DWG: 6048

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



Recommended Minimum Pads  
Dimensions in Inches/(mm)

[Return to Index](#)





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