

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

### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
20	0.015 at $V_{GS} = 4.5$ V	12	21 nC
	0.017 at $V_{GS} = 2.5$ V	12	
	0.021 at $V_{GS} = 1.8$ V	12	

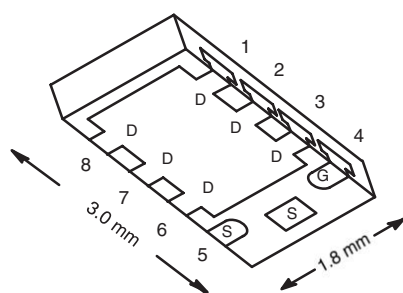
### FEATURES

- Halogen-free
- TrenchFET® Power MOSFET
- New Thermally Enhanced PowerPAK® ChipFET® Package
  - Small Footprint Area
  - Low On-Resistance
  - Thin 0.8 mm Profile



**RoHS**  
COMPLIANT

PowerPAK ChipFET Single

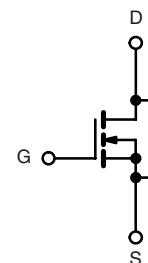
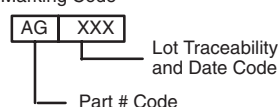


Bottom View

### APPLICATIONS

- Load Switch, PA Switch, and for Portable Applications
- Point-of-Load

Marking Code



N-Channel MOSFET

Ordering Information: Si5486DU-T1-GE3 (Lead (Pb)-free and Halogen-free)

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	
Continuous Drain Current ( $T_J = 150$ °C)	$T_C = 25$ °C	12 <sup>a</sup>	A
	$T_C = 70$ °C	12 <sup>a</sup>	
	$T_A = 25$ °C	11.6 <sup>b, c</sup>	
	$T_A = 70$ °C	9.3 <sup>b, c</sup>	
Pulsed Drain Current	$I_{DM}$	40	A
Continuous Source-Drain Diode Current	$T_C = 25$ °C	12 <sup>a</sup>	
	$T_A = 25$ °C	2.6 <sup>b, c</sup>	
Maximum Power Dissipation	$T_C = 25$ °C	31	W
	$T_C = 70$ °C	20	
	$T_A = 25$ °C	3.1 <sup>b, c</sup>	
	$T_A = 70$ °C	2 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°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>	$R_{thJA}$	34	40	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	3	4	

Notes:

a. Package limited.

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

c.  $t = 5$  s.

d. See Solder Profile (<http://www.vishay.com/ppg?73257>). The PowerPAK ChipFET 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 90 °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	20			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA		21		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 3.4		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	0.4		1	V
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 8 V			± 100	ns
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 20 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> = 4.5 V	40			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 7.7 A		0.012	0.015	Ω
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 7.3 A		0.014	0.017	
		V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 4.8 A		0.017	0.021	
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 7.7 A		46		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz		2100		pF
Output Capacitance	C <sub>oss</sub>			310		
Reverse Transfer Capacitance	C <sub>rss</sub>			180		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 8 V, I <sub>D</sub> = 9.3 A		36	54	nC
		V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 9.3 A		21	32	
Gate-Source Charge	Q <sub>gs</sub>			3.3		
Gate-Drain Charge	Q <sub>gd</sub>			3.1		
Gate Resistance	R <sub>g</sub>	f = 1 MHz		5		Ω
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, R <sub>L</sub> = 1.1 Ω I <sub>D</sub> ≅ 9.3 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω		10	15	ns
Rise Time	t <sub>r</sub>			15	25	
Turn-Off Delay Time	t <sub>d(off)</sub>			50	75	
Fall Time	t <sub>f</sub>			15	25	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, R <sub>L</sub> = 1.1 Ω I <sub>D</sub> ≅ 9.3 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		7	15	
Rise Time	t <sub>r</sub>			15	25	
Turn-Off Delay Time	t <sub>d(off)</sub>			55	85	
Fall Time	t <sub>f</sub>			10	15	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			12	A
Pulse Diode Forward Current	I <sub>SM</sub>				40	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 9.1 A, V <sub>GS</sub> = 0 V		0.8	1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 9.3 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C		30	60	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			17	30	nC
Reverse Recovery Fall Time	t <sub>a</sub>			12		ns
Reverse Recovery Rise Time	t <sub>b</sub>			18		

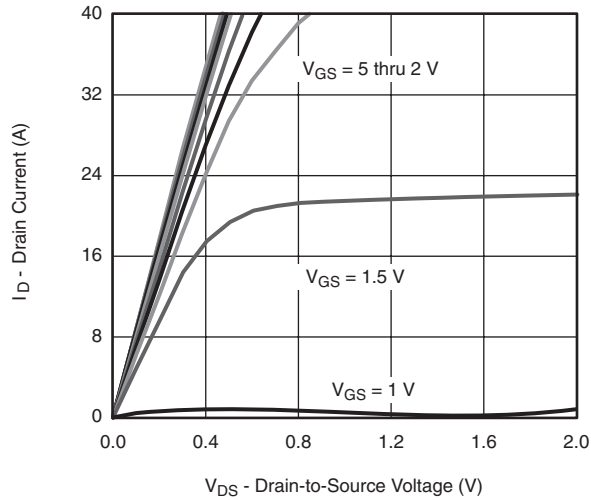
Notes:

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

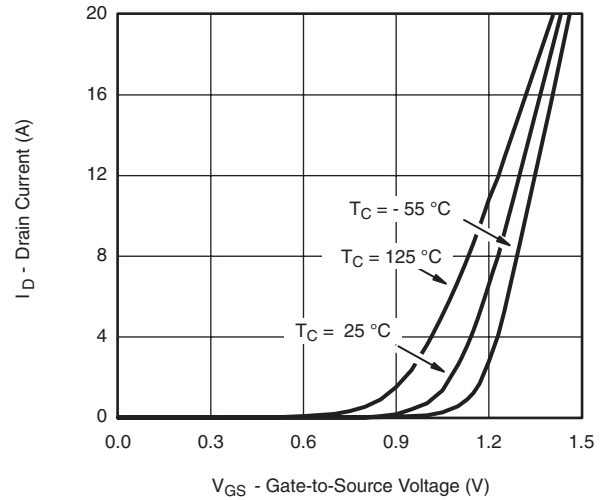
b. Guaranteed by design, not subject to production testing.

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.

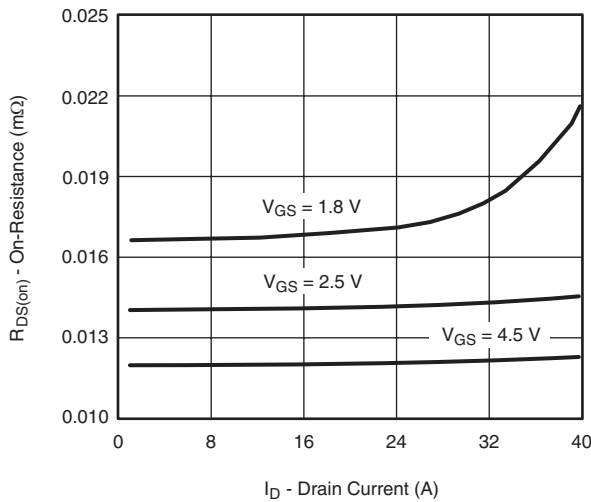
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



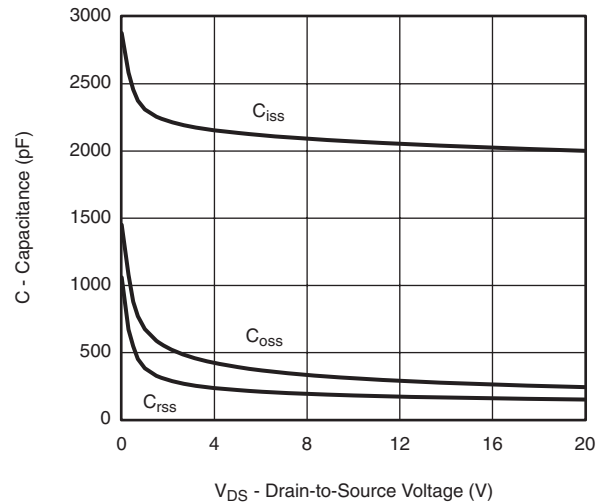
Output Characteristics



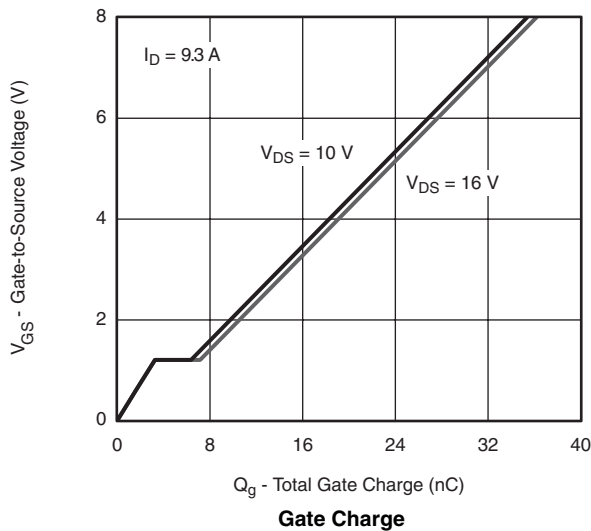
Transfer Characteristics



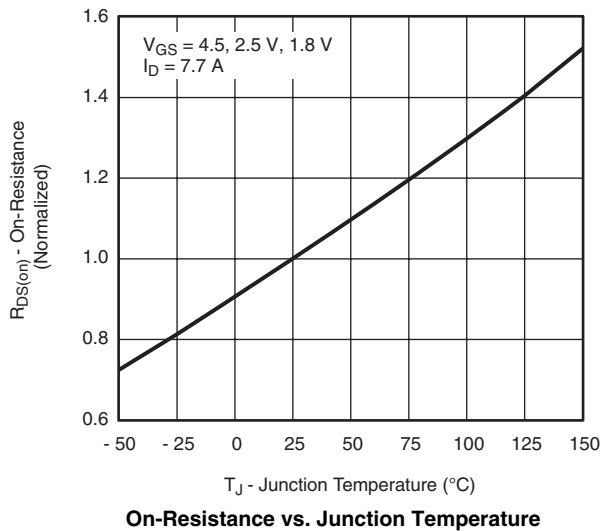
On-Resistance vs. Drain Current and Gate Voltage



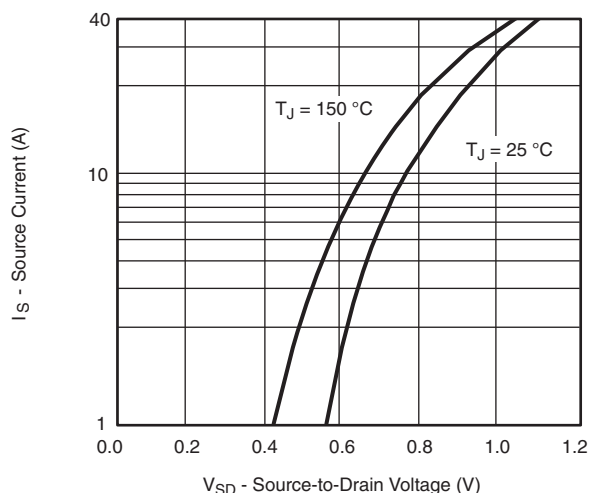
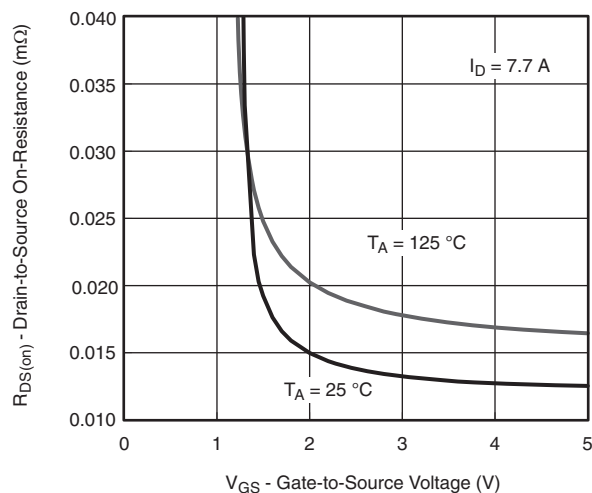
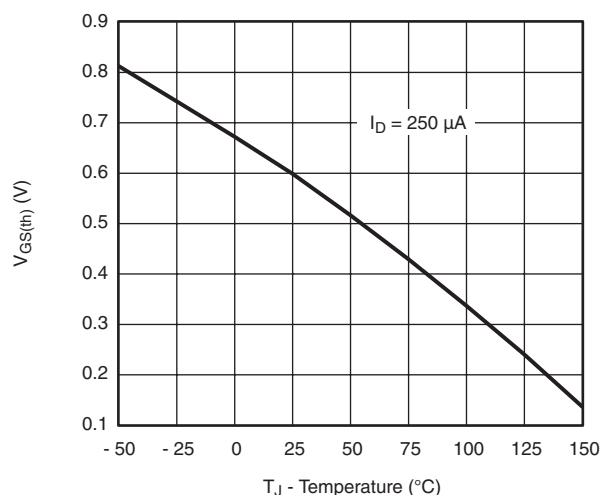
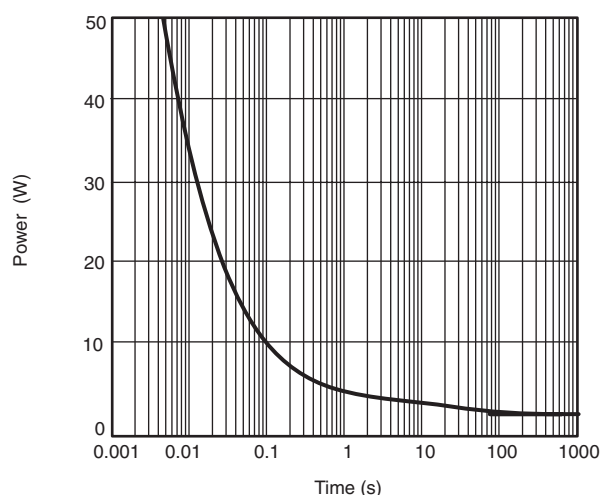
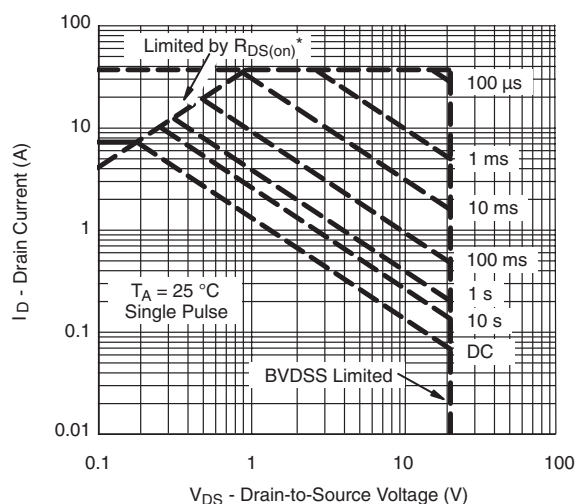
Capacitance



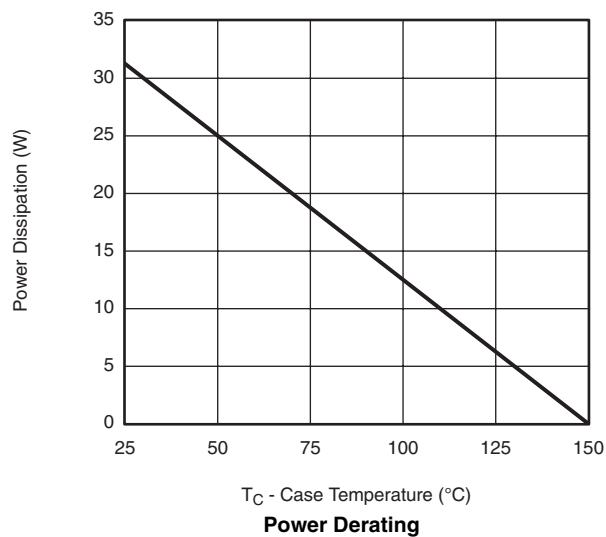
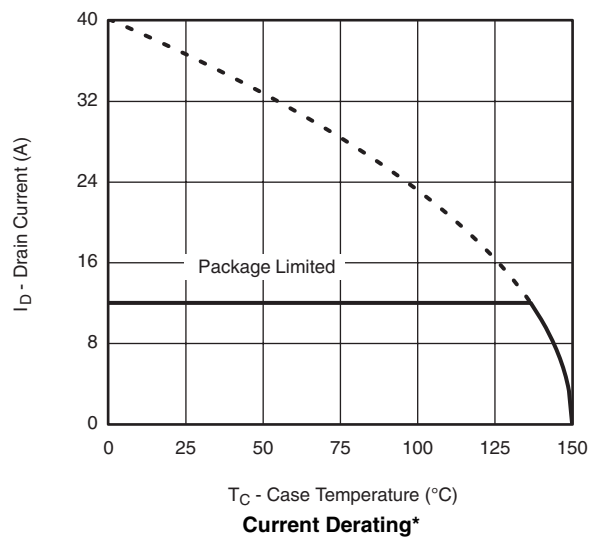
Gate Charge



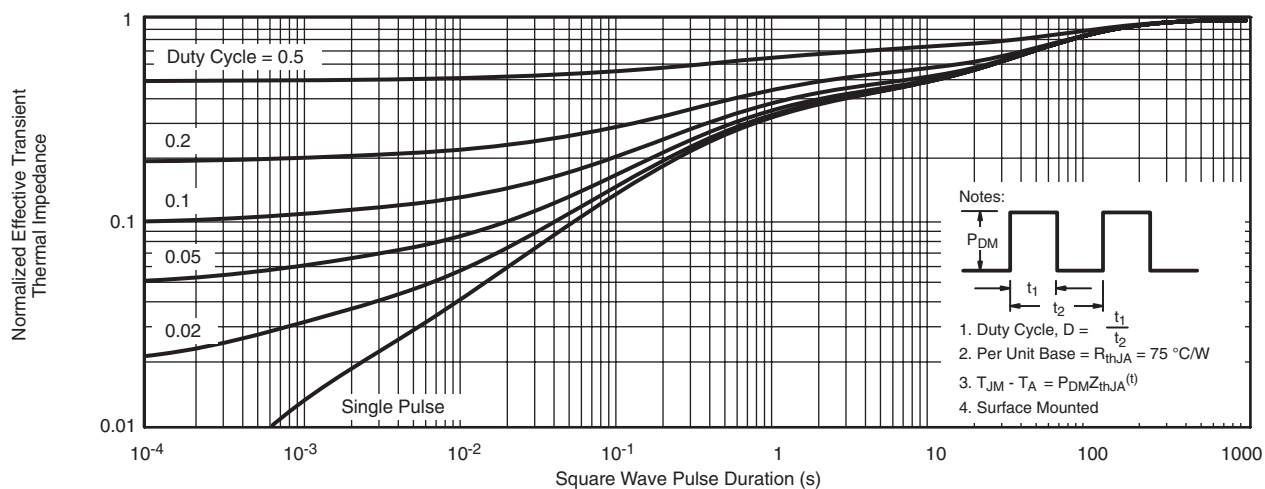
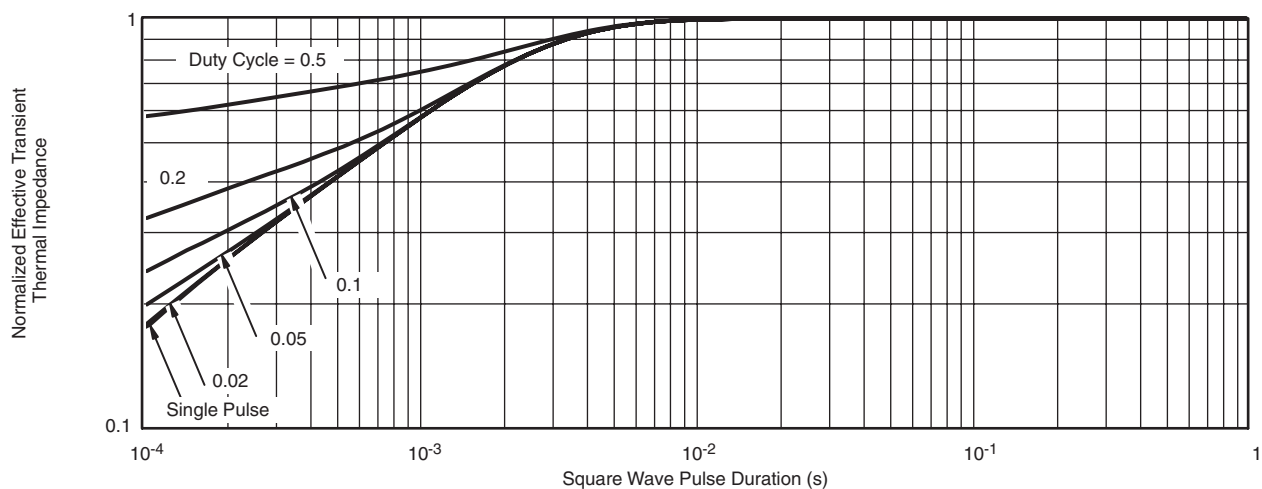
On-Resistance vs. Junction Temperature

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Source-Drain Diode Forward Voltage****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

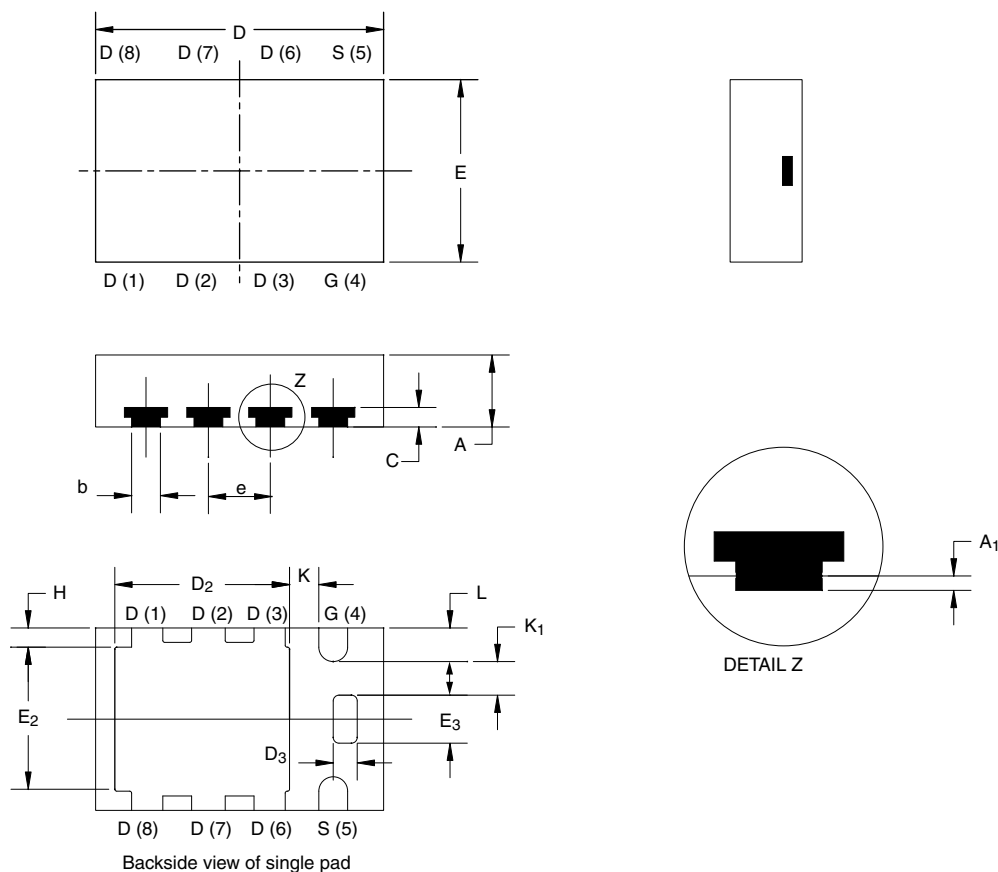


\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package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

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

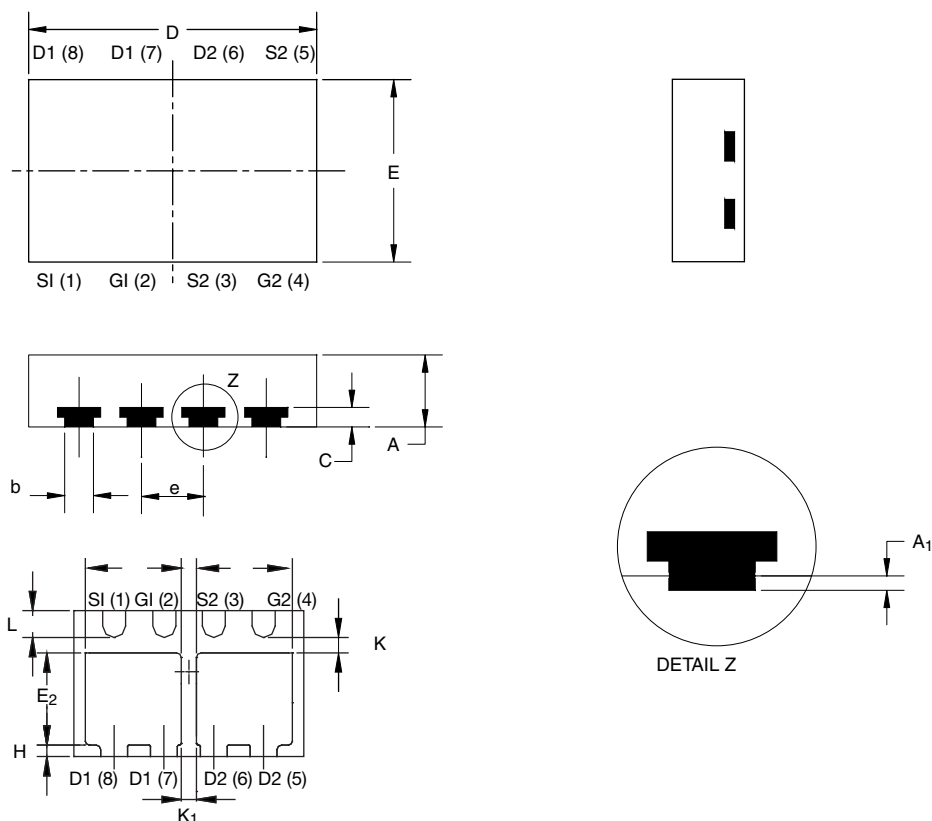
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## PowerPAK® ChipFET® SINGLE PAD



DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.85	0.028	0.030	0.033
A <sub>1</sub>	0	-	0.05	0	-	0.002
b	0.25	0.30	0.35	0.010	0.012	0.014
C	0.15	0.20	0.25	0.006	0.008	0.010
D	2.92	3.00	3.08	0.115	0.118	0.121
D <sub>2</sub>	1.75	1.87	2.00	0.069	0.074	0.079
D <sub>3</sub>	0.20	0.25	0.30	0.008	0.010	0.012
E	1.82	1.90	1.98	0.072	0.075	0.078
E <sub>2</sub>	1.38	1.50	1.63	0.054	0.059	0.064
E <sub>3</sub>	0.45	0.50	0.55	0.018	0.020	0.022
e	0.65 BSC			0.026 BSC		
H	0.15	0.20	0.25	0.006	0.008	0.010
K	0.25	-	-	0.010	-	-
K <sub>1</sub>	0.30	-	-	0.012	-	-
L	0.30	0.35	0.40	0.012	0.014	0.016

## PowerPAK® ChipFET® DUAL PAD



Backside view of dual pad

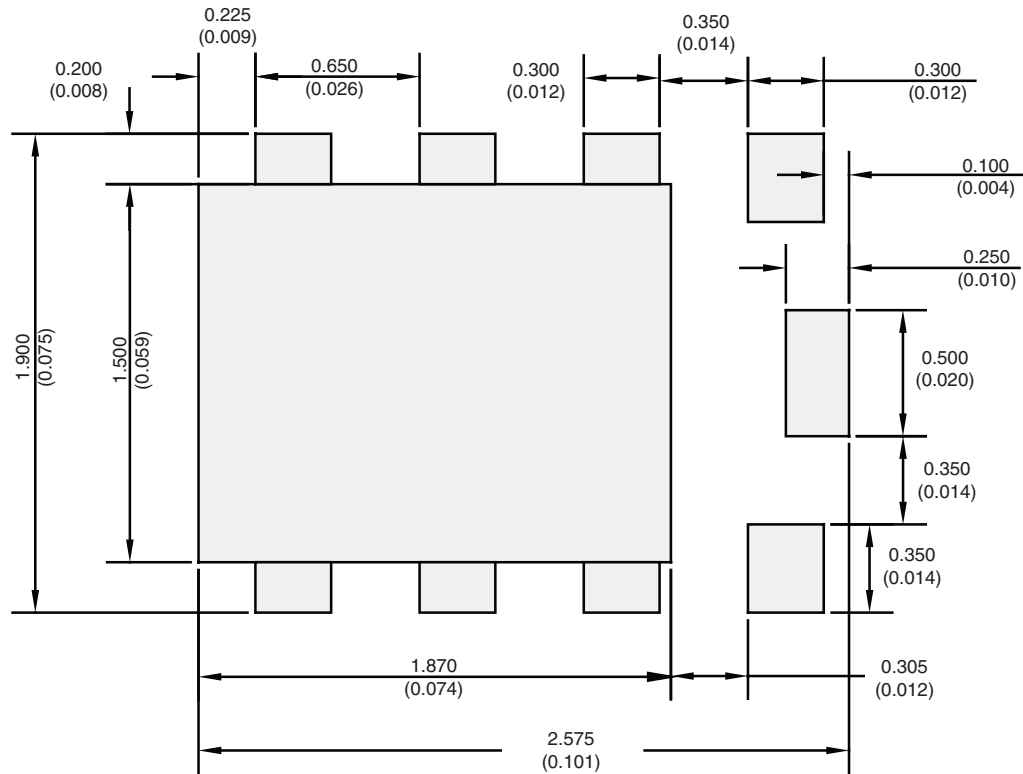
DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.85	0.028	0.030	0.033
A <sub>1</sub>	0	-	0.05	0	-	0.002
b	0.25	0.30	0.35	0.010	0.012	0.014
C	0.15	0.20	0.25	0.006	0.008	0.010
D	2.92	3.00	3.08	0.115	0.118	0.121
D <sub>2</sub>	1.07	1.20	1.32	0.042	0.047	0.052
E	1.82	1.90	1.98	0.072	0.075	0.078
E <sub>2</sub>	0.92	1.05	1.17	0.036	0.041	0.046
e	0.65 BSC			0.026 BSC		
H	0.15	0.20	0.25	0.006	0.008	0.010
K	0.20	-	-	0.008	-	-
K <sub>1</sub>	0.20	-	-	0.008	-	-
L	0.30	0.35	0.40	0.012	0.014	0.016

ECN: C10-0618-Rev. C, 19-Jul-09

DWG: 5940



## RECOMMENDED MINIMUM PADS FOR PowerPAK® ChipFET® Single



Recommended Minimum Pads  
Dimensions in mm/(Inches)

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