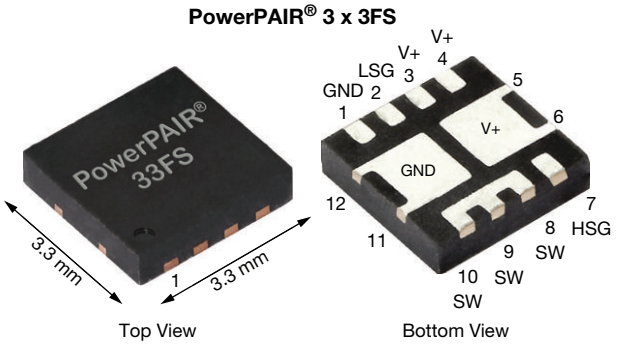
Dual N-Channel 40 V (D-S) MOSFET

PowerPAIR® 3 x 3FS



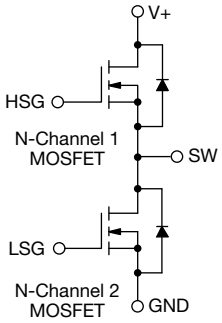
FEATURES

- TrenchFET® Gen IV power MOSFET
- Symmetric dual n-channel
- Flip chip technology optimal thermal design
- High side and low side MOSFETs form optimized combination for 50 % duty cycle
- Optimized R_{DS} - Q_g and R_{DS} - Q_{gd} FOM elevates efficiency for high frequency switching
- 100 % R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT
HALOGEN FREE

APPLICATIONS

- Synchronous buck
- Computer / server peripherals
- Half bridge
- POL
- Telecom DC/DC



PRODUCT SUMMARY	
V_{DS} (V)	40
$R_{DS(on)}$ max. (Ω) at V_{GS} = 10 V	0.0053
$R_{DS(on)}$ max. (Ω) at V_{GS} = 4.5 V	0.0072
Q_g typ. (nC)	8.0
I_D (A)	77.1 [a]
Configuration	Dual

ORDERING INFORMATION	
Package	PowerPAIR 3 x 3FS
Lead (Pb)-free and halogen-free	SIZF4412DT-T1-GE3

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C, unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V_{DS}	40	V
Gate-source voltage		V_{GS}	+20 / -16	
Continuous drain current (V_{GS} = 10 V, T_J = 150 °C)	T_C = 25 °C	I_D	77.1	A
	T_C = 70 °C		61.7	
	T_A = 25 °C		21.6 [b, c]	
	T_A = 70 °C		17.3 [b, c]	
Pulsed drain current (V_{GS} = 10 V, t = 100 µs)		I_{DM}	150	
Continuous source current (MOSFET diode conduction)	T_C = 25 °C	I_S	47.3	
	T_A = 25 °C		3.7 [b, c]	
Single pulse avalanche current	L = 0.1 mH	I_{AS}	15	
Single pulse avalanche energy		E_{AS}	11.25	mJ
Maximum power dissipation	T_C = 25 °C	P_D	56.8	W
	T_C = 70 °C		36.4	
	T_A = 25 °C		4.5 [b, c]	
	T_A = 70 °C		2.9 [b, c]	
Operating junction and storage temperature range		T_J, T_{stg}	-55 to +150	°C
Soldering recommendations (peak temperature)			260	

Notes

a. T_C = 25 °C
b. Surface mounted on 1" x 1" FR4 board
c. t = 10 s

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient [a, b]	t ≤ 10 s	R_{thJA}	22	28	°C/W
Maximum junction-to-case (drain)	Steady state	R_{thJC}	1.7	2.2	

Notes

a. Surface mounted on 1" x 1" FR4 board

b. Maximum under steady state conditions is 64 °C/W

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 = 1 mA	40	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	I_D = 10 mA	-	30	-	mV/°C
$V_{GS(th)}$ temperature coefficient	$\Delta V_{GS(th)}/T_J$	I_D = 250 µA	-	4.3	-	mV/°C
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	1	-	2.5	V
Gate-source leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = +20 V / -16 V	-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V	-	-	1	µA
		V_{DS} = 40 V, V_{GS} = 0 V, T_J = 75 °C	-	-	10	
Drain-source on-state resistance [a]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 10 A	-	0.0042	0.0053	Ω
		V_{GS} = 4.5 V, I_D = 10 A	-	0.0060	0.0072	
Forward transconductance [a]	g_{fs}	V_{DS} = 10 V, I_D = 10 A	-	55	-	S
Dynamic [b]						
Input capacitance	C_{iss}	V_{DS} = 20 V, V_{GS} = 0 V, f = 1 MHz	-	1380	-	pF
Output capacitance	C_{oss}		-	272	-	
Reverse transfer capacitance	C_{rss}		-	24	-	
Output charge	Q_{oss}	V_{DS} = 20 V, V_{GS} = 0 V	-	10.4	-	nC
Total gate charge	Q_g	V_{DS} = 20 V, V_{GS} = 10 V, I_D = 10 A	-	17.4	26.5	nC
		V_{DS} = 20 V, V_{GS} = 4.5 V, I_D = 10 A	-	8	12	
Gate-source charge	Q_{gs}		-	4.1	-	
Gate-drain charge	Q_{gd}		-	1.1	-	
Gate resistance	R_g	f = 1 MHz	1.4	2.9	5.0	Ω
Turn-on delay time	$t_{d(on)}$	V_{DD} = 20 V, R_L = 2 Ω, I_D ≅ 15 A, V_{GEN} = 10 V, R_g = 1 Ω	-	9	18	ns
Rise time	t_r		-	4	8	
Turn-off delay time	$t_{d(off)}$		-	20	40	
Fall time	t_f		-	4	8	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 20 V, R_L = 2 Ω, I_D ≅ 15 A, V_{GEN} = 4.5 V, R_g = 1 Ω	-	18	36	
Rise time	t_r		-	70	140	
Turn-off delay time	$t_{d(off)}$		-	20	40	
Fall time	t_f		-	9	18	
Drain-source Body Diode Characteristics						
Continuous source-drain diode current	I_S	T_C = 25°C	-	-	47.3	A
Pulse diode forward current	I_{SM}		-	-	150	
Body diode voltage	V_{SD}	I_S = 5 A, V_{GS} = 0 V	-	0.74	1.2	V
Body diode reverse recovery time	t_{rr}	I_F = 10 A, di/dt = 100 A/µs, T_J = 25 °C	-	20	40	ns
Body diode reverse recovery charge	Q_{rr}		-	8	16	nC
Reverse recovery fall time	t_a		-	9	-	ns
Reverse recovery rise time	t_b		-	11	-	

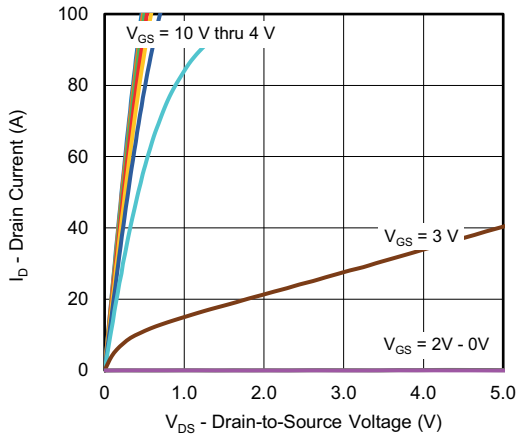
Notes

a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %

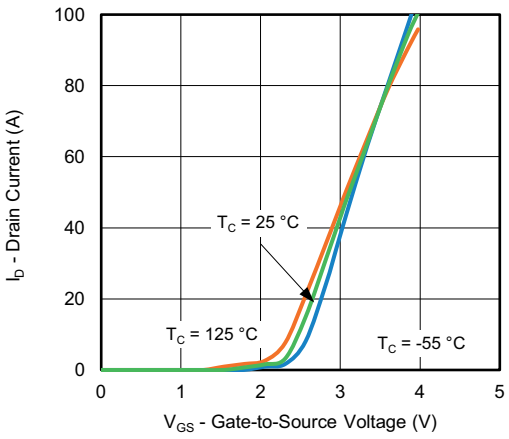
b. Guaranteed by design, not subject to production testing

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.

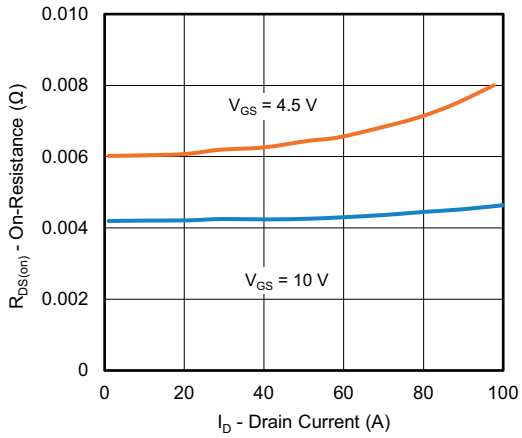
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



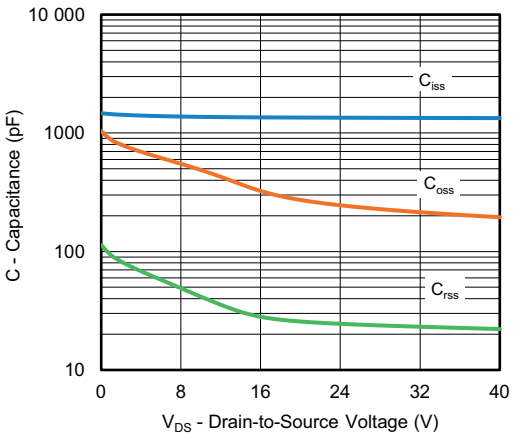
Output Characteristics



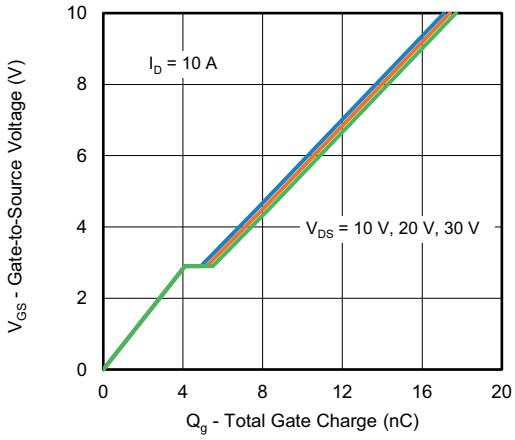
Transfer Characteristics



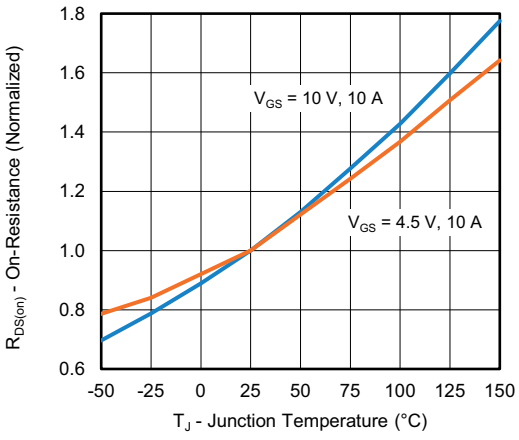
On-Resistance vs. Drain Current and Gate



Capacitance

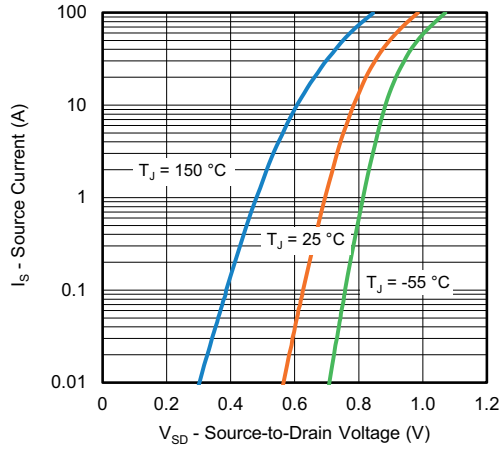


Gate Charge

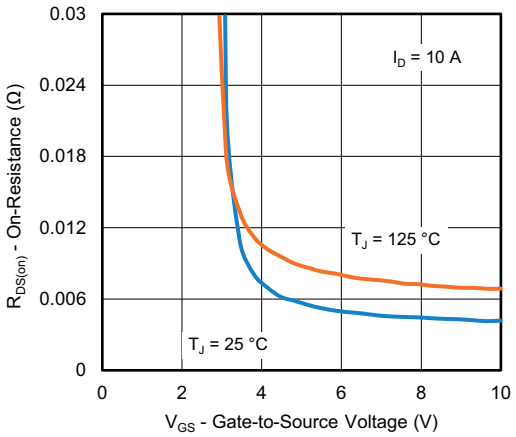


On-Resistance vs. Junction Temperature

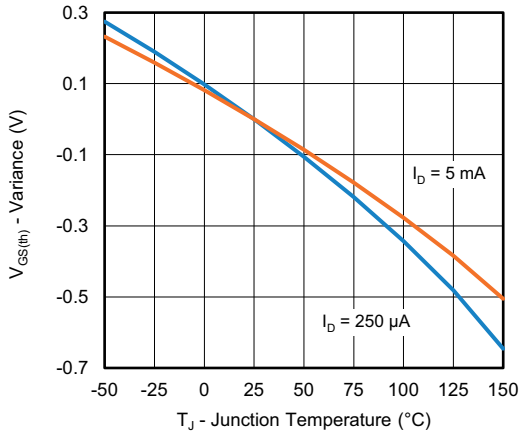
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



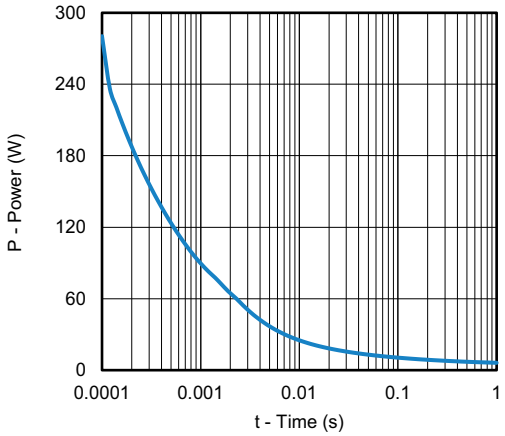
Source-Drain Diode Forward Voltage



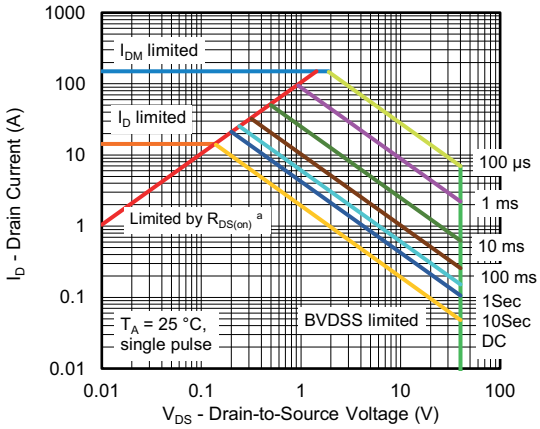
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power

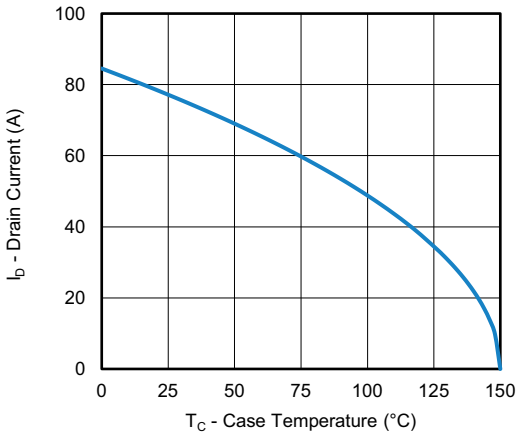


Safe Operating Area, Junction to Ambient

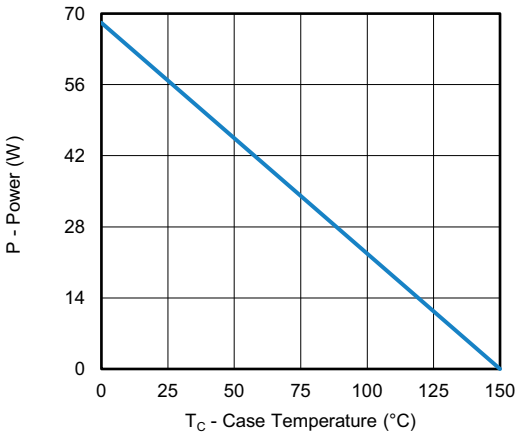
Note

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

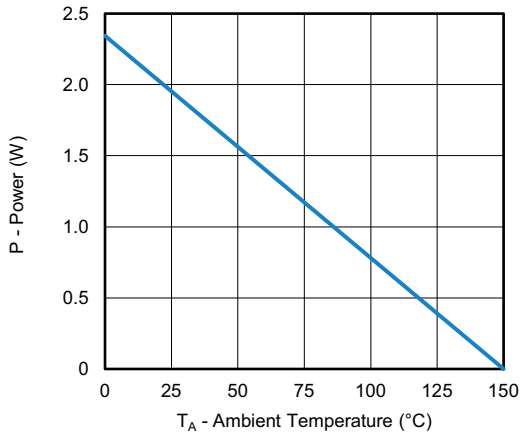
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating [a]



Power, Junction-to-Case



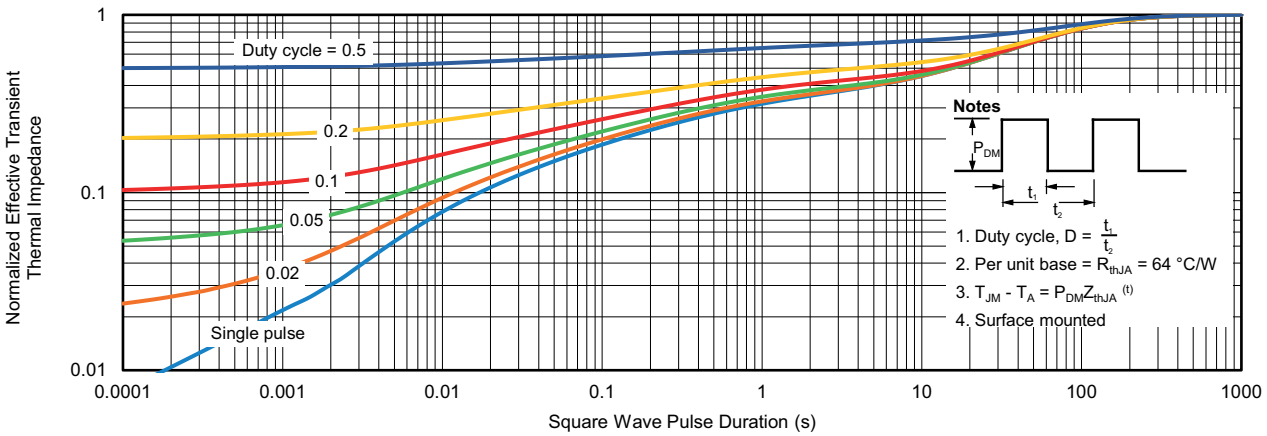
Power, Junction-to-Ambient

Notes

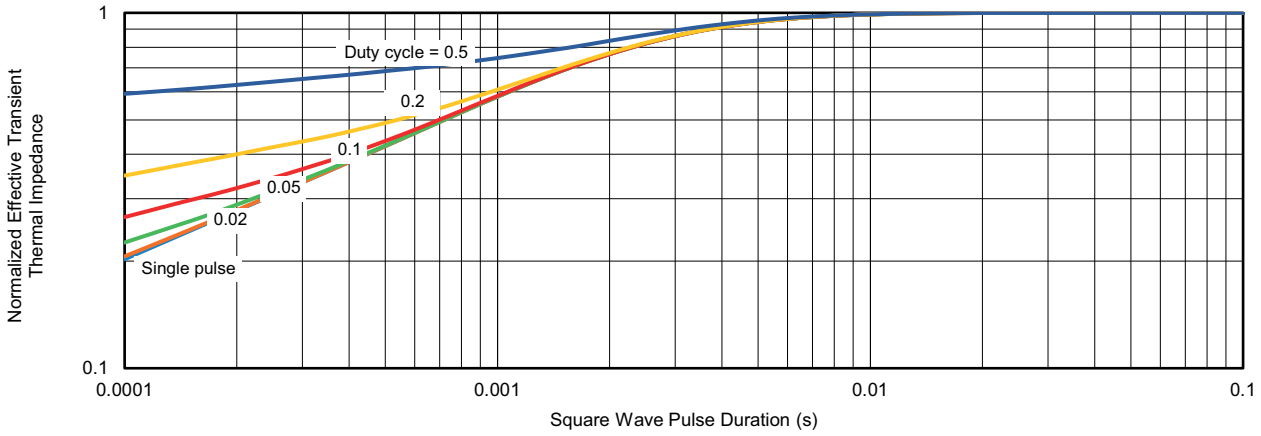
a. The power dissipation P_D is based on T_J max. = 150 °C, using junction-to-ambient thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit

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

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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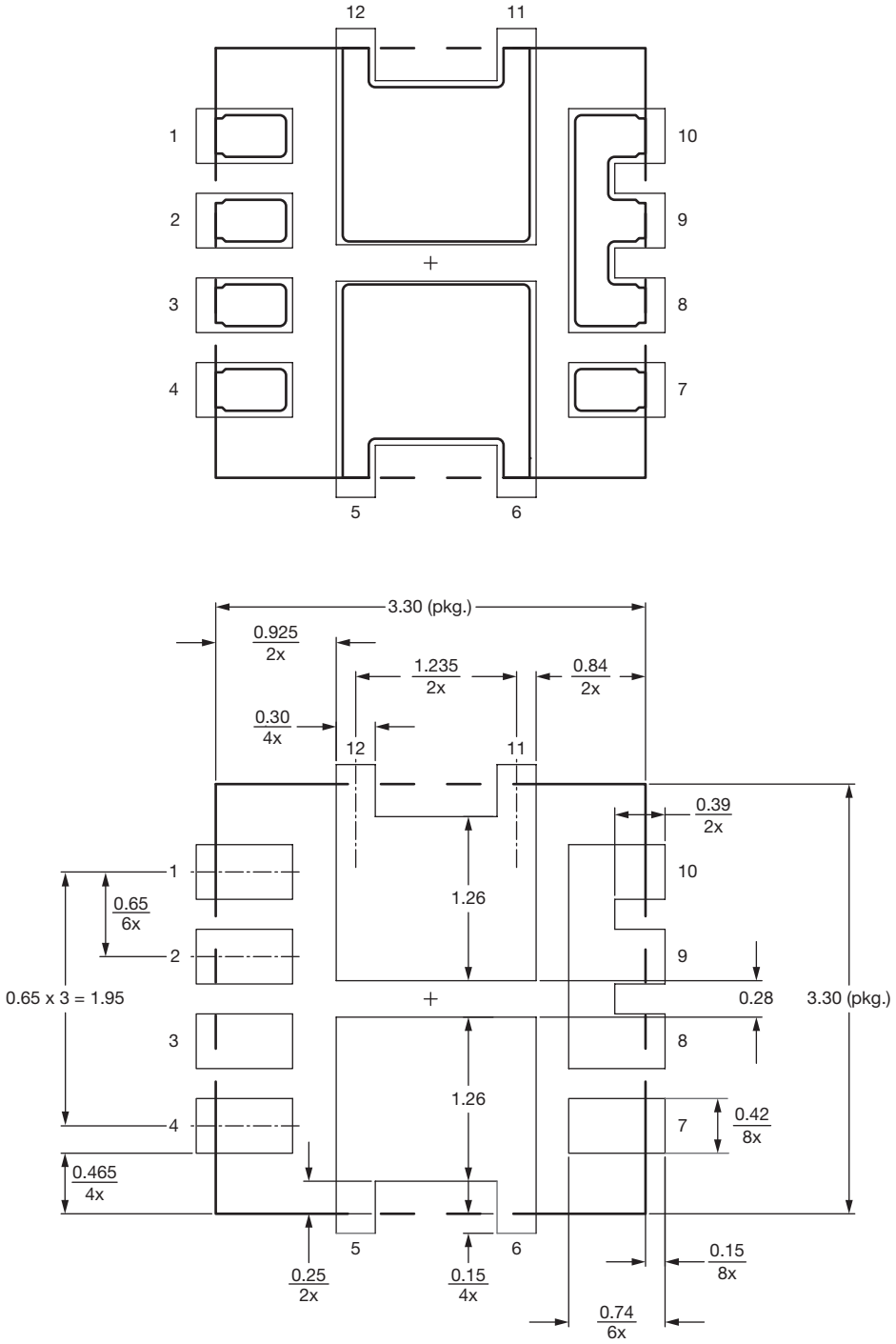
Recommended Land Pattern
PowerPAIR® 3 x 3FS BWL



Note

- Dimensions in mm

ECN: T23-0180-Rev. B, 16-May-2023 DWG: 3006

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