P-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω) MAX.	I_D (A) [a, e]	Q_g (TYP.)
-20	0.023 at V_{GS} = -4.5 V	-9.3	36 nC
	0.027 at V_{GS} = -2.5 V	-6.2	
	0.040 at V_{GS} = -1.8 V	-5.1	

FEATURES

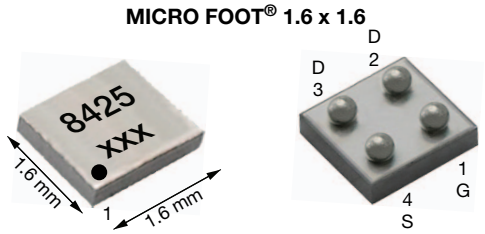
- TrenchFET® Power MOSFET
- Low-on resistance
- Ultra-small 1.6 mm x 1.6 mm maximum outline
- Ultra-thin 0.6 mm maximum height
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE

MICRO FOOT® 1.6 x 1.6

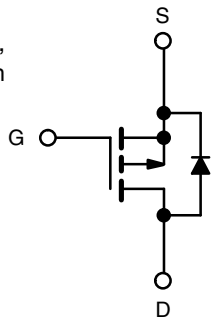


Backside View

Bump Side View

APPLICATIONS

- Low on-resistance load switch, charger switch and battery switch for portable devices
  - Low power consumption
  - Increased battery life



P-Channel MOSFET

Marking Code: 8425

Ordering Information:
Si8425DB-T1-E1 (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}	± 10	
Continuous Drain Current (T_J = 150 °C)	T_A = 25 °C	I_D	-9.3 [a]	A
	T_A = 70 °C		-7.4 [a]	
	T_A = 25 °C		-5.9 [b]	
	T_A = 70 °C		-4.7 [b]	
Pulsed Drain Current (t = 300 µs)		I_{DM}	-25	
Continuous Source-Drain Diode Current	T_A = 25 °C	I_S	-2.3 [a]	
	T_A = 25 °C		-0.92 [b]	
Maximum Power Dissipation	T_A = 25 °C	P_D	2.7 [a]	W
	T_A = 70 °C		1.8 [a]	
	T_A = 25 °C		1.1 [b]	
	T_A = 70 °C		0.73 [b]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to 150	°C
Package Reflow Conditions [c]	V_{PR}		260	
	IR / convection		260	

Notes

a. Surface mounted on 1" x 1" FR4 board with full copper, t = 5 s.
b. Surface mounted on 1" x 1" FR4 board with minimum copper, t = 5 s.
c. Refer to IPC / JEDEC® (J-STD-020), no manual or hand soldering.
d. In this document, any reference to case represents the body of the MICRO FOOT device and foot is the bump.
e. Based on T_A = 25 °C.

For technical questions, contact: pmostechsupport@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum Junction-to-Ambient [a,b]	t = 5 s	R_{thJA}	35	45	°C/W
Maximum Junction-to-Ambient [c,d]	t = 5 s	R_{thJA}	85	110	

Notes
a. Surface mounted on 1" x 1" FR4 board with full copper, t = 5 s.
b. Maximum under steady state conditions is 85 °C/W.
c. Surface mounted on 1" x 1" FR4 board with minimum copper, t = 5 s.
d. Maximum under steady state conditions is 175 °C/W.

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)

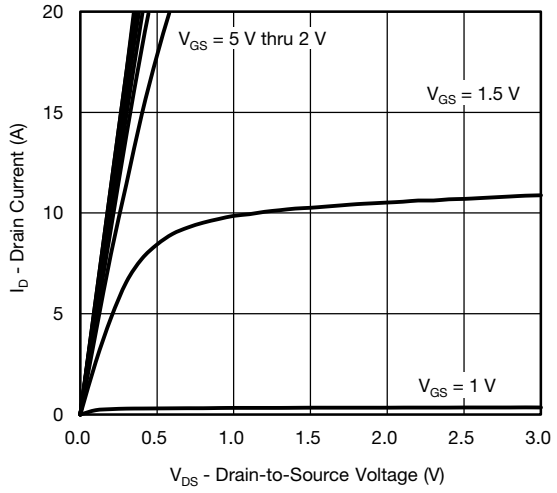
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = -250 µA	-20	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = -250 µA	-	-10	-	mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		-	2.8	-	
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = -250 µA	-0.4	-	-0.9	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 10 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 = 70 °C	-	-	-10	
On-State Drain Current [a]	$I_{D(on)}$	$V_{DS} \leq$ -5 V, V_{GS} = -4.5 V	-5	-	-	A
Drain-Source On-State Resistance [a]	$R_{DS(on)}$	V_{GS} = -4.5 V, I_D = -2 A	-	0.018	0.023	Ω
		V_{GS} = -2.5 V, I_D = -1 A	-	0.021	0.027	
		V_{GS} = -1.8 V, I_D = -1 A	-	0.027	0.040	
Forward Transconductance [a]	g_{fs}	V_{DS} = -10 V, I_D = -2 A	-	18	-	S
Dynamic [b]						
Input Capacitance	C_{iss}	V_{DS} = -10 V, V_{GS} = 0 V, f = 1 MHz	-	2800	-	pF
Output Capacitance	C_{oss}		-	370	-	
Reverse Transfer Capacitance	C_{rss}		-	305	-	
Total Gate Charge	Q_g	V_{DS} = -10 V, V_{GS} = -10 V, I_D = -2 A	-	73	110	nC
		V_{DS} = -10 V, V_{GS} = -4.5 V, I_D = -2 A	-	36	55	
Gate-Source Charge	Q_{gs}		-	5.2	-	
Gate-Drain Charge	Q_{gd}		-	7.3	-	
Gate Resistance	R_g	V_{GS} = -0.1 V, f = 1 MHz	-	15	-	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = -10 V, R_L = 5 Ω $I_D \cong$ -2 A, V_{GEN} = -4.5 V, R_g = 1 Ω	-	25	50	ns
Rise Time	t_r		-	25	50	
Turn-Off Delay Time	$t_{d(off)}$		-	300	600	
Fall Time	t_f		-	100	200	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = -10 V, R_L = 5 Ω $I_D \cong$ -2 A, V_{GEN} = -10 V, R_g = 1 Ω	-	7	15	
Rise Time	t_r		-	10	20	
Turn-Off Delay Time	$t_{d(off)}$		-	430	860	
Fall Time	t_f		-	100	200	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	T_A = 25 °C	-	-	-2.3 [c]	A
Pulse Diode Forward Current	I_{SM}		-	-	-25	
Body Diode Voltage	V_{SD}	I_S = -2 A, V_{GS} = 0 V	-	-0.7	-1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = -2 A, dI/dt = 100 A/µs, T_J = 25 °C	-	255	510	ns
Body Diode Reverse Recovery Charge	Q_{rr}		-	510	1000	nC
Reverse Recovery Fall Time	t_a		-	50	-	ns
Reverse Recovery Rise Time	t_b		-	205	-	

Notes
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Surface mounted on 1" x 1" FR4 board with full copper, t = 5 s.

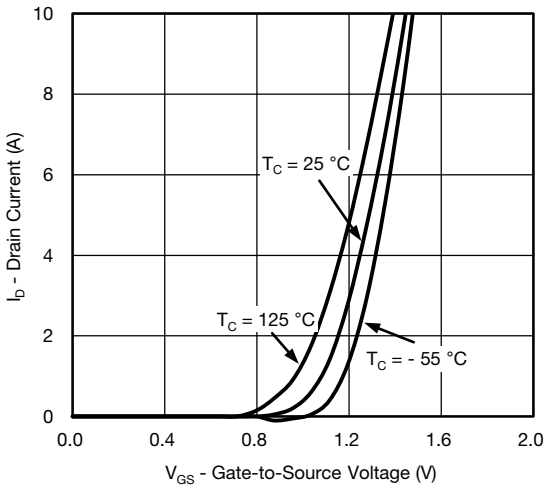
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

For technical questions, contact: pmostechsupport@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

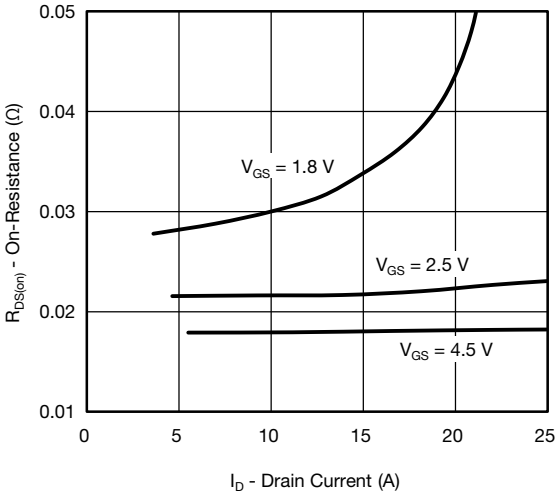
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



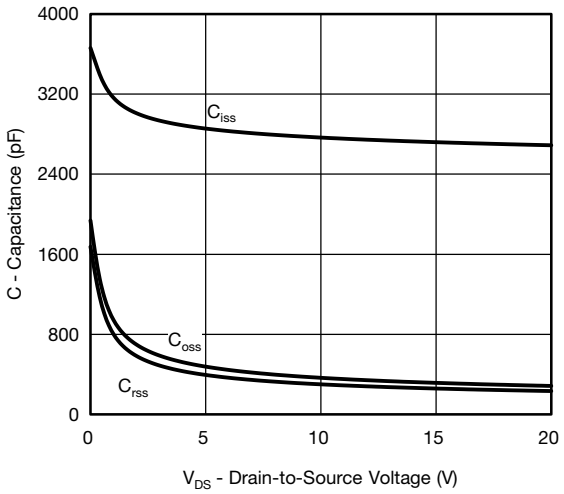
Output Characteristics



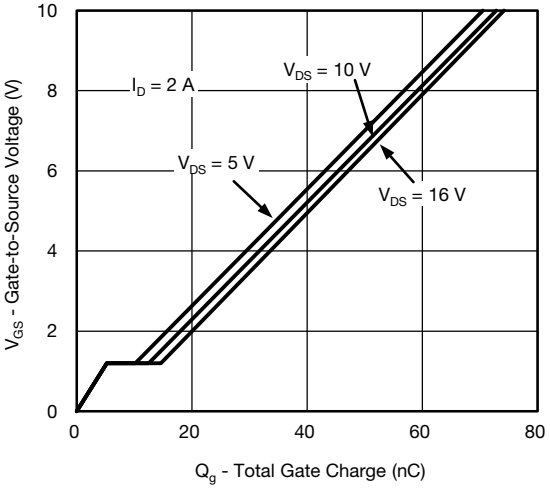
Transfer Characteristics



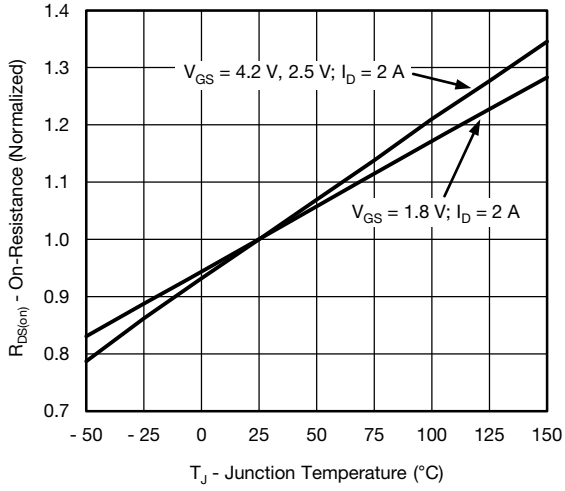
On-Resistance vs. Drain Current



Capacitance



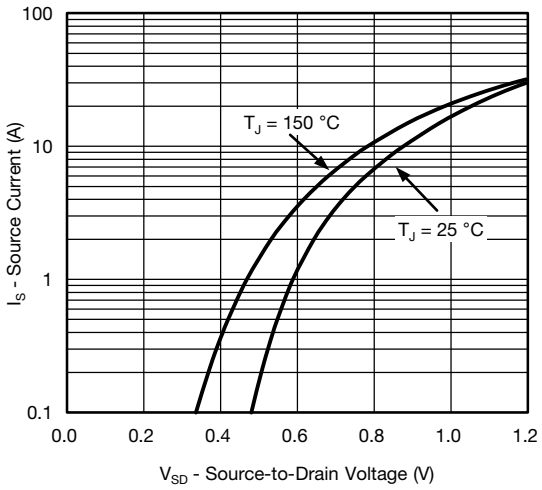
Gate Charge



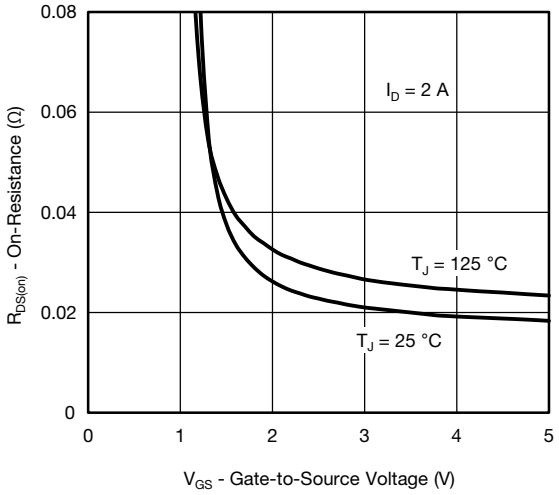
On-Resistance vs. Junction Temperature

For technical questions, contact: pmostechsupport@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

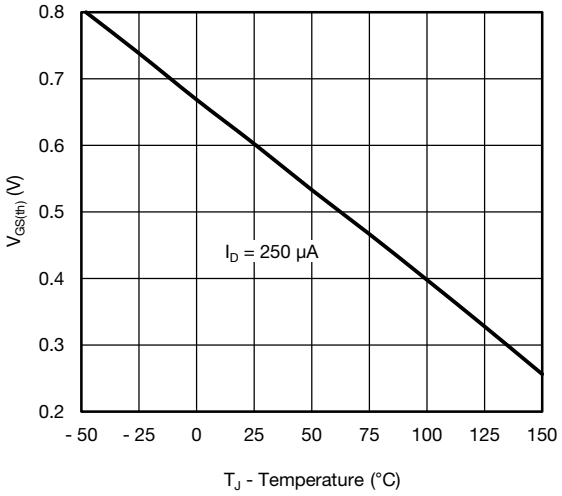
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



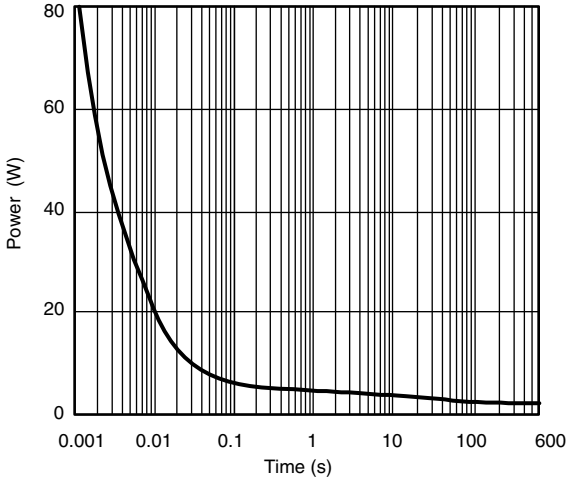
Source-Drain Diode Forward Voltage



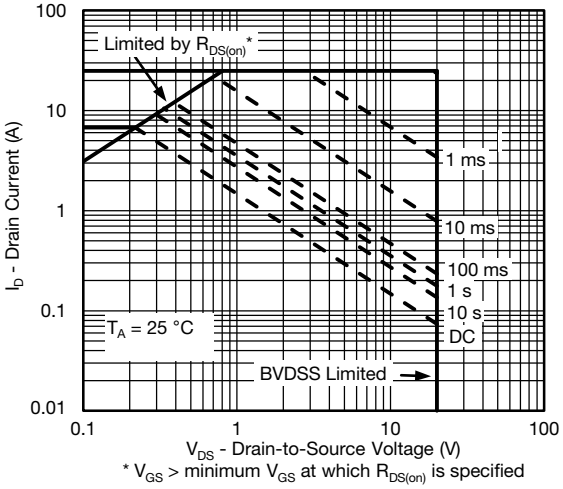
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



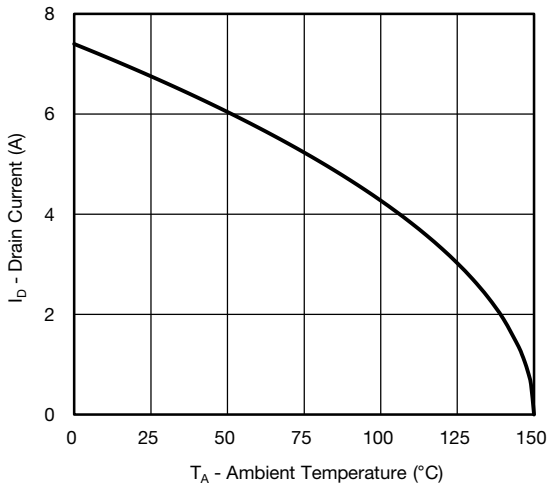
Single Pulse Power, Junction-to-Ambient



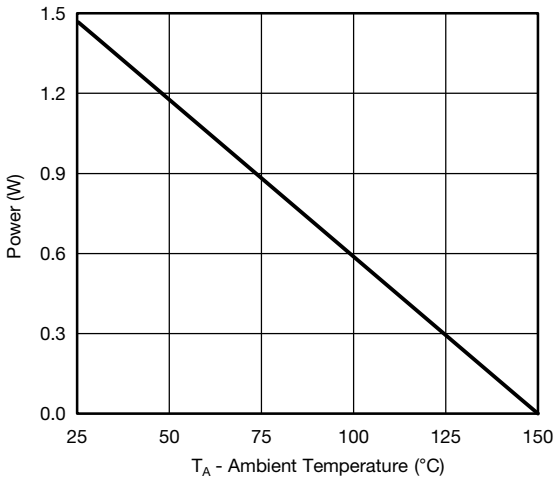
Safe Operating Area, Junction-to-Ambient

For technical questions, contact: pmostechsupport@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating [a]



Power Derating

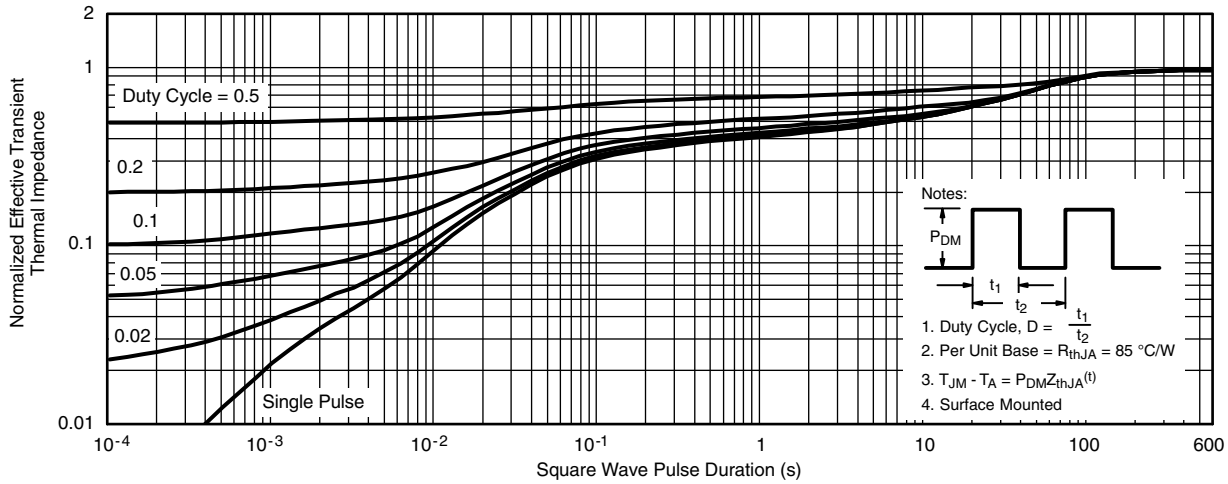
Notes

- When mounted on 1" x 1" FR4 with full copper.

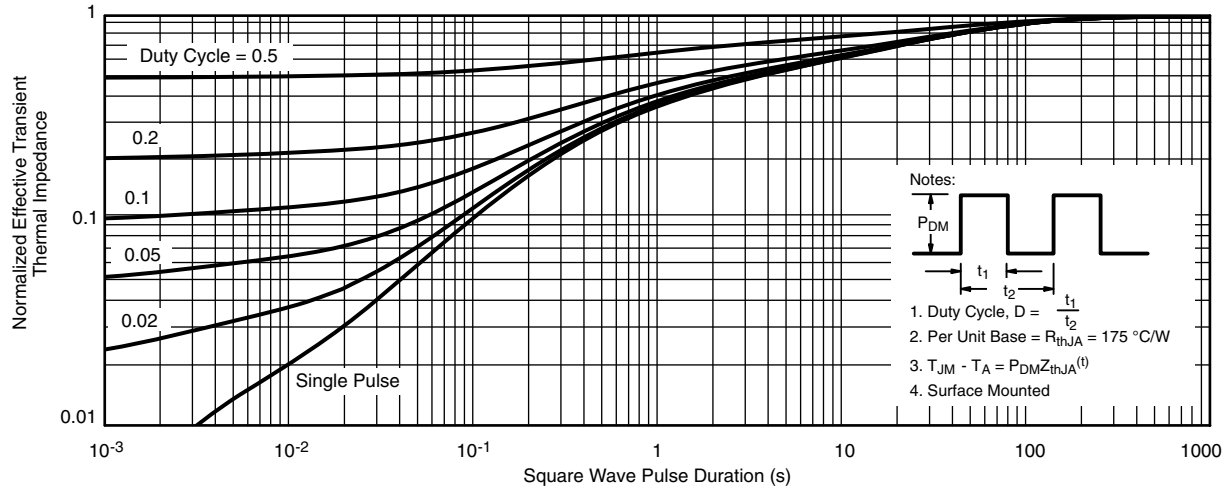
a. The power dissipation P_D is based on $T_{J\ (max.)}$ = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package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

For technical questions, contact: pmostechsupport@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient (1" x 1" FR4 Board with Full Copper)

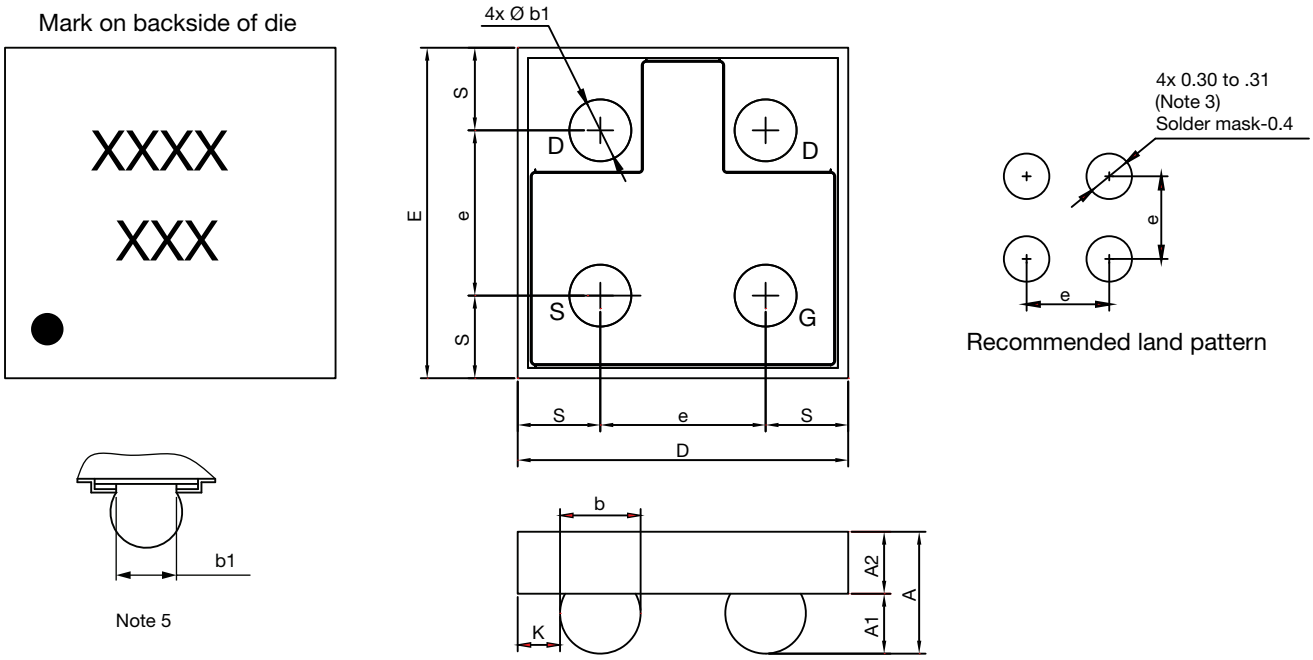


Normalized Thermal Transient Impedance, Junction-to-Ambient (1" x 1" FR4 Board with Minimum Copper)

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?63909.

For technical questions, contact: pmostechsupport@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

MICRO FOOT®: 4-Bumps
(1.6 mm x 1.6 mm, 0.8 mm Pitch, 0.290 mm Bump Height)



Notes

1. Bumps are 95.5/3.8/0.7 Sn/Ag/Cu.
2. Backside surface is coated with a Ti/Ni/Ag layer.
3. Non-solder mask defined copper landing pad.
4. Laser marks on the silicon die back.
5. “b1” is the diameter of the solderable substrate surface, defined by an opening in the solder resist layer solder mask defined.
6. • is the location of pin 1

DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.550	0.575	0.600	0.0217	0.0226	0.0236
A1	0.260	0.275	0.290	0.0102	0.0108	0.0114
A2	0.290	0.300	0.310	0.0114	0.0118	0.0122
b	0.370	0.390	0.410	0.0146	0.0153	0.0161
b1		0.300			0.0118	
e		0.800			0.0314	
s	0.360	0.380	0.400	0.0141	0.0150	0.0157
D	1.520	1.560	1.600	0.0598	0.0614	0.0630
E	1.520	1.560	1.600	0.0598	0.0614	0.0630
K	0.155	0.185	0.215	0.0061	0.0073	0.0085

Note

- Use millimeters as the primary measurement.

ECN: T15-0175-Rev. A, 27-Apr-15
DWG: 6038

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

PCB Design and Assembly Guidelines For MICRO FOOT® Products

Johnson Zhao

INTRODUCTION

Vishay Siliconix's MICRO FOOT product family is based on a wafer-level chip-scale packaging (WL-CSP) technology that implements a solder bump process to eliminate the need for an outer package to encase the silicon die. MICRO FOOT products include power MOSFETs, analog switches, and power ICs.

For battery powered compact devices, this new packaging technology reduces board space requirements, improves thermal performance, and mitigates the parasitic effect typical of leaded packaged products. For example, the 6–bump MICRO FOOT Si8902EDB common drain power MOSFET, which measures just 1.6 mm x 2.4 mm, achieves the same performance as TSSOP–8 devices in a footprint that is 80% smaller and with a 50% lower height profile (Figure 1). A MICRO FOOT analog switch, the 6–bump DG3000DB, offers low charge injection and 1.4 W on–resistance in a footprint measuring just 1.08 mm x 1.58 mm (Figure 2).

Vishay Siliconix MICRO FOOT products can be handled with the same process techniques used for high-volume assembly of packaged surface-mount devices. With proper attention to PCB and stencil design, the device will achieve reliable performance without underfill. The advantage of the device's small footprint and short thermal path make it an ideal option for space-constrained applications in portable devices such as battery packs, PDAs, cellular phones, and notebook computers.

This application note discusses the mechanical design and reliability of MICRO FOOT, and then provides guidelines for board layout, the assembly process, and the PCB rework process.

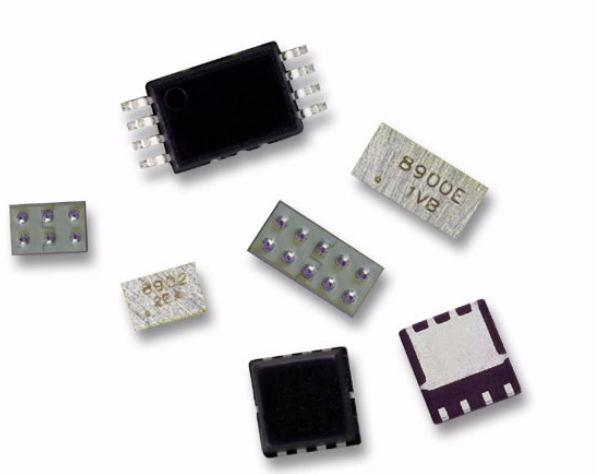


FIGURE 1. 3D View of MICRO FOOT Products Si8902DB and Si8900EDB

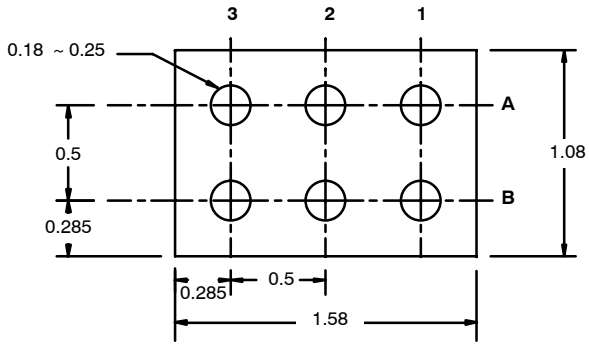


FIGURE 2. Outline of MICRO FOOT CSP & Analog Switch DG3000DB

TABLE 1
Main Parameters of Solder Bumps in MICRO FOOT Designs

MICRO FOOT CSP	Bump Material	Bump Pitch*	Bump Diameter*	Bump Height*
MICRO FOOT CSP MOSFET	Eutectic Solder: 63Sm/37Pb	0.8	0.37-0.41	0.26-0.29
MICRO FOOT CSP Analog Switch		0.5	0.18-0.25	0.14-0.19
MICRO FOOT UCSP Analog Switch		0.5	0.32-0.34	0.21-0.24

* All measurements in millimeters

MICRO FOOT'S DESIGN AND RELIABILITY

As a mechanical, electrical, and thermal connection between the device and PCB, the solder bumps of MICRO FOOT products are mounted on the top active surface of the die. Table 1 shows the main parameters for solder bumps used in MICRO FOOT products. A silicon nitride passivation layer is applied to the active area as the last masking process in fabrication,ensuring that the device passes the pressure pot test. A green laser is used to mark the backside of the die without damaging it. Reliability results for MICRO FOOT products mounted on a FR-4 board without underfill are shown in Table 2.

TABLE 2
MICRO FOOT Reliability Results

Test Condition C: –65° to 150°C	>500 Cycles
Test condition B: –40° to 125°C	>1000 Cycles
121°C @ 15PSI 100% Humidity Test	96 Hours

The main failure mechanism associated with wafer-level chip-scale packaging is fatigue of the solder joint. The results shown in Table 2 demonstrate that a high level of reliability can be achieved with proper board design and assembly techniques.

BOARD LAYOUT GUIDELINES

Board materials. Vishay Siliconix MICRO FOOT products are designed to be reliable on most board types, including organic boards such as FR-4 or polyamide boards. The package qualification information is based on the test on 0.5-oz. FR-4 and polyamide boards with NSMD pad design.

Land patterns. Two types of land patterns are used for surface-mount packages. Solder mask defined (SMD) pads have a solder mask opening smaller than the metal pad (Figure 3), whereas on-solder mask defined (NSMD) pads have a metal pad smaller than the solder-mask opening (Figure 4).

NSMD is recommended for copper etch processes, since it provides a higher level of control compared to SMD etch processes. A small-size NSMD pad definition provides more area (both lateral and vertical) for soldering and more room for escape routing on the PCB. By contrast, SMD pad definition introduces a stress -concentration point near the solder mask on the PCB side that may result in solder joint cracking under extreme fatigue conditions.

Copper pads should be finished with an organic solderability preservative (OSP) coating. For electroplated nickel-immersion gold finish pads, the gold thickness must be less than 0.5 μm to avoid solder joint embrittlement.

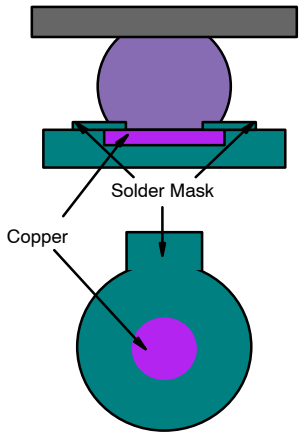


FIGURE 3. SMD

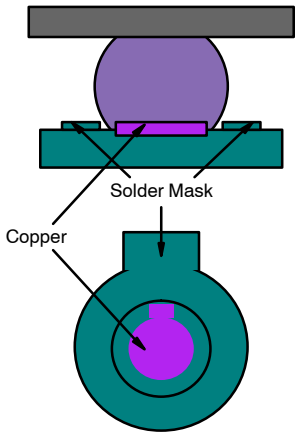


FIGURE 4. NSMD

Board pad design. The landing-pad size for MICRO FOOT products is determined by the bump pitch as shown in Table 3. The pad pattern is circular to ensure a symmetric, barrel-shaped solder bump.

TABLE 3
Dimensions of Copper Pad and Solder Mask Opening in PCB and Stencil Aperture

Pitch	Copper Pad	Solder Mask Opening	Stencil Aperture
0.80 mm	0.30 ± 0.01 mm	0.41 ± 0.01 mm	0.33 ± 0.01 mm in ciircle aperture
0.50 mm	0.17 ± 0.01 mm	0.27 ± 0.01 mm	0.30 ± 0.01 mm in square aperture

ASSEMBLY PROCESS

MICRO FOOT products' surface-mount-assembly operations include solder paste printing, component placement, and solder reflow as shown in the process flow chart (Figure 5).

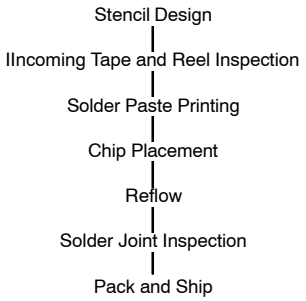


FIGURE 5. SMT Assembly Process Flow

Stencil design. Stencil design is the key to ensuring maximum solder paste deposition without compromising the assembly yield from solder joint defects (such as bridging and extraneous solder spheres). The stencil aperture is dependent on the copper pad size, the solder mask opening, and the quantity of solder paste.

In MICRO FOOT products, the stencil is 0.125-mm (5-mils) thick. The recommended apertures are shown in Table 3 and are fabricated by laser cut.

Solder-paste printing. The solder-paste printing process involves transferring solder paste through pre-defined apertures via application of pressure.

In MICRO FOOT products, the solder paste used is UP78 No-clean eutectic 63 Sn/37Pb type3 or finer solder paste.

Chip pick-and-placement. MICRO FOOT products can be picked and placed with standard pick-and-place equipment. The recommended pick-and-place force is 150 g. Though the part will self-center during solder reflow, the maximum placement offset is 0.02 mm.

Reflow Process. MICRO FOOT products can be assembled using standard SMT reflow processes. Similar to any other package, the thermal profile at specific board locations must be determined. Nitrogen purge is recommended during reflow operation. Figure 6 shows a typical reflow profile.

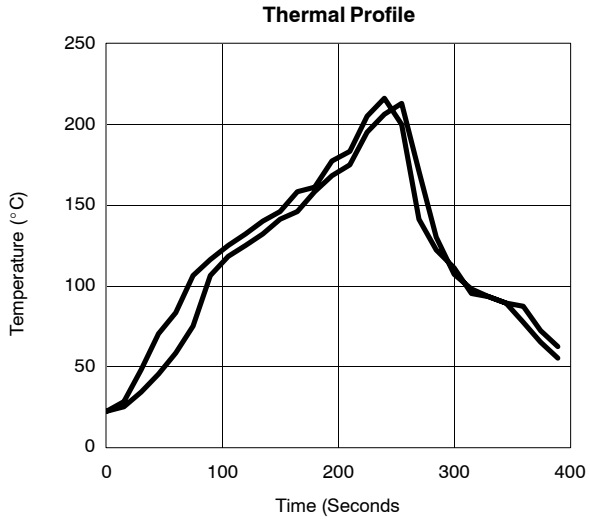


FIGURE 6. Reflow Profile

PCB REWORK

To replace MICRO FOOT products on PCB, the rework procedure is much like the rework process for a standard BGA or CSP, as long as the rework process duplicates the original reflow profile. The key steps are as follows:

1. Remove the MICRO FOOT device using a convection nozzle to create localized heating similar to the original reflow profile. Preheat from the bottom.
2. Once the nozzle temperature is +190°C, use tweezers to remove the part to be replaced.
3. Resurface the pads using a temperature-controlled soldering iron.
4. Apply gel flux to the pad.
5. Use a vacuum needle pick-up tip to pick up the replacement part, and use a placement jig to placed it accurately.
6. Reflow the part using the same convection nozzle, and preheat from the bottom, matching the original reflow profile.

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

© 2026 VISHAY INTERTECHNOLOGY, INC. ALL RIGHTS RESERVED

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

ENTEGRECİ

Bu belge www.entegreci.com üzerinden sunulmaktadır.

Elektronik komponent tedarikinde Entegreci

Entegreci, Eskişehir merkezli, Türkiye geneline satış yapan bir elektronik komponent mağazasıdır. Entegreler (IC), mikrodenetleyiciler, transistörler, diyotlar, pasif elemanlar, konnektörler, modüller ve geliştirme kartları tek adetten seri üretim adetlerine kadar satılır. Ürün sayfalarında güncel stok durumunu, fiyatı ve datasheet bağlantısını bulabilirsiniz.

Parça koduyla arama

Üretici parça numarasını yazın; stok ve fiyatı hemen görün.

www.entegreci.com

Ürün kategorileri

Entegreden kapasitöre tüm elektronik komponent kategorileri.

Kategorilere göz atın

Üreticiler

Aradığınız üreticinin ürünlerini tek sayfada inceleyin.

Üreticileri görün

Toplu alım ve teklif

Listede olmayan ya da yüksek adetli parçalar için teklif isteyin.

Teklif isteyin

www.entegreci.com | **destek@entegreci.com** | **0850 305 90 34**

Entegreci is an online electronic components store based in Türkiye. Search by manufacturer part number to see stock, prices and datasheets for integrated circuits, microcontrollers, transistors, passive components and connectors, or request a quote for parts that are not listed.

Bu sayfa Entegreci tarafından eklenmiştir. Belgenin önceki sayfaları asıl yayıncısına aittir ve içeriği değiştirilmemiştir; en güncel sürüm için belgenin yayıncısına başvurun.