MOSFET – Power, Dual N-Channel, for 1-2 Cells Lithium-ion Battery Protection

24 V, 45 mΩ, 6 A

EFC4612R-S

This Power MOSFET features a low on−state resistance. This device is suitable for applications such as power switches of portable machines. Best suited for 1−2 cells lithium−ion battery applications.

Features

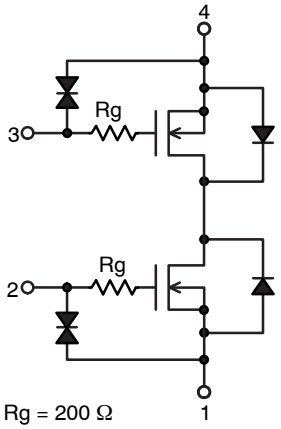
- 2.5 V Drive
- Common−Drain Type
- ESD Diode−Protected Gate
- Pb−Free, Halide Free and RoHS Compliant

Applications

- 1−2 Cells Lithium−ion Battery Charging and Discharging Switch

V_{SSS}	$R_{SS(on)}$ Max	I_S Max
24 V	45 mΩ @ 4.5 V	6 A
	48 mΩ @ 4.0 V	
	50 mΩ @ 3.7 V	
	57 mΩ @ 3.1 V	
	72 mΩ @ 2.5 V	

ELECTRICAL CONNECTION N−Channel



Rg = 200 Ω

1. Source 1
2. Gate 1
3. Gate 2
4. Source 2

SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS at T_A = 25°C

Parameter	Symbol	Value	Unit
Source to Source Voltage	V_{SSS}	24	V
Gate to Source Voltage	V_{GSS}	±12	V
Source Current (DC)	I_S	6	A
Source Current (Pulse) PW ≤ 10 μs, duty cycle ≤ 1%	I_{SP}	60	A
Total Dissipation (Note 2)	P_T	1.6	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−55 to +150	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE RATINGS

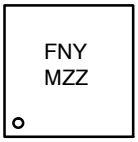
Parameter	Symbol	Value	Unit
Junction to Ambient (Note 1)	$R_{\theta JA}$	78.1	°C/W

1. Surface mounted on ceramic substrate (5000 $mm^2 \times 0.8$ mm).



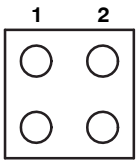
WLCSP4, 1.3 × 1.3 / EFCP1313−4CC−037 CASE 567DP

MARKING DIAGRAM



FN = Specific Device Code
Y = Year
M = Month
ZZ = Assembly Lot Number

PIN CONNECTIONS



1. Source 1
2. Gate 1
3. Gate 2
4. Source 2

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

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ELECTRICAL CHARACTERISTICS at T_A = 25°C

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Source to Source Breakdown Voltage	$V_{(BR)SSS}$	I_S = 1 mA, V_{GS} = 0 V (Figure 1)	24	–	–	V
Zero−Gate Voltage Source Current	I_{SSS}	V_{SS} = 20 V, V_{GS} = 0 V (Figure 1)	–	–	1	μA
Gate to Source Leakage Current	I_{GSS}	V_{GS} = ±8 V, V_{SS} = 0 V (Figure 2)	–	–	±10	μA
Gate Threshold Voltage	V_{GS}(th)	V_{SS} = 10 V, I_S = 1 mA (Figure 3)	0.5	–	1.3	V
Forward Transconductance	g_{FS}	V_{SS} = 10 V, I_S = 3 A (Figure 4)	–	3.1	–	S
Static Source to Source On−State Resistance	R_{SS}(on)1	V_{GS} = 4.5 V, I_S = 3 A (Figure 5)	24	39	45	mΩ
	R_{SS}(on)2	V_{GS} = 4.0 V, I_S = 3 A (Figure 5)	25	41	48	mΩ
	R_{SS}(on)3	V_{GS} = 3.7 V, I_S = 3 A (Figure 5)	27.5	43	50	mΩ
	R_{SS}(on)4	V_{GS} = 3.1 V, I_S = 3 A (Figure 5)	31.5	48	57	mΩ
	R_{SS}(on)5	V_{GS} = 2.5 V, I_S = 3 A (Figure 5)	33.5	58	72	mΩ
Turn−ON Delay Time	t_d(on)	V_{SS} = 10 V, V_{GS}= 4.5 V, I_S = 3 A (Figure 6)	–	20	–	ns
Rise Time	t_r		–	230	–	ns
Turn−OFF Delay Time	t_d(off)		–	130	–	ns
Fall Time	t_f		–	210	–	ns
Total Gate Charge	Qg	V_{SS} = 10 V, V_{GS} = 4.5 V, I_S = 6 A (Figure 7)	–	7	–	nC
Forward Source to Source Voltage	$V_{F(S-S)}$	I_S = 3 A, V_{GS} = 0 V (Figure 8)	–	0.8	1.2	V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

Test Circuit are Example of Measuring FET1 Side

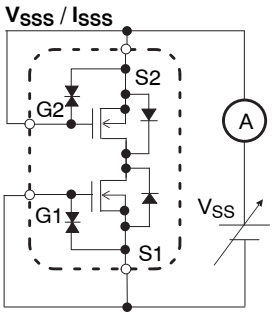
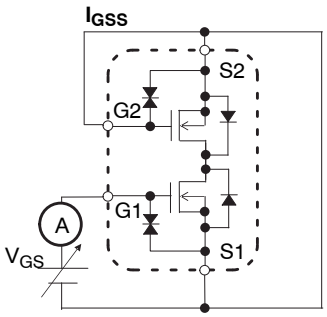
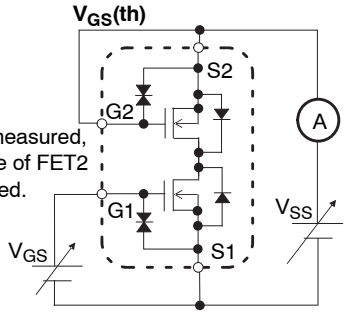


Figure 1. Test Circuit 1



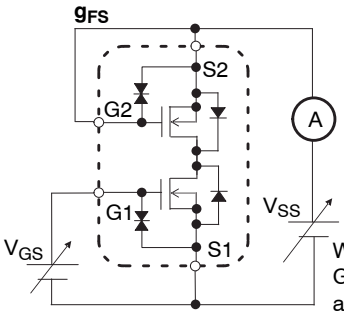
When FET1 is measured, Gate and Source of FET2 are short−circuited.

Figure 2. Test Circuit 2



When FET1 is measured, Gate and Source of FET2 are short−circuited.

Figure 3. Test Circuit 3



When FET1 is measured, Gate and Source of FET2 are short−circuited.

Figure 4. Test Circuit 4

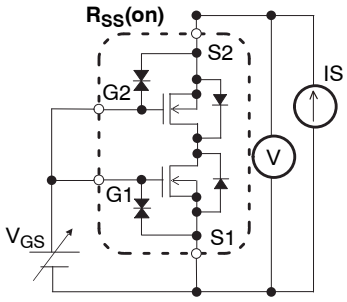
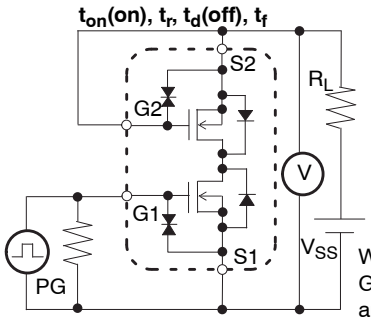


Figure 5. Test Circuit 5



When FET1 is measured, Gate and Source of FET2 are short−circuited.

Figure 6. Test Circuit 6

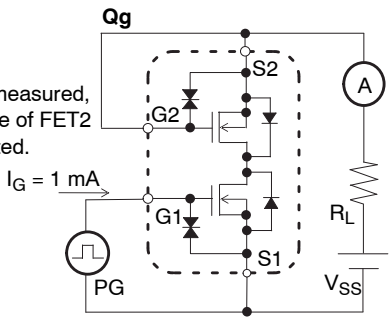
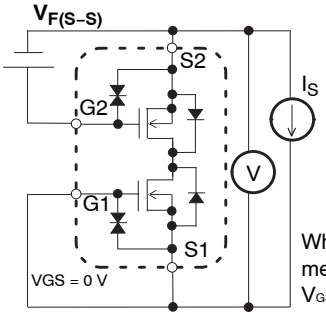


Figure 7. Test Circuit 7



When FET1 is measured,+4.5 V is added to V_{GS} of FET2.

Figure 8. Test Circuit 8

NOTE: When FET2 is measured, the position of FET1 and FET2 is switched.

TYPICAL CHARACTERISTICS

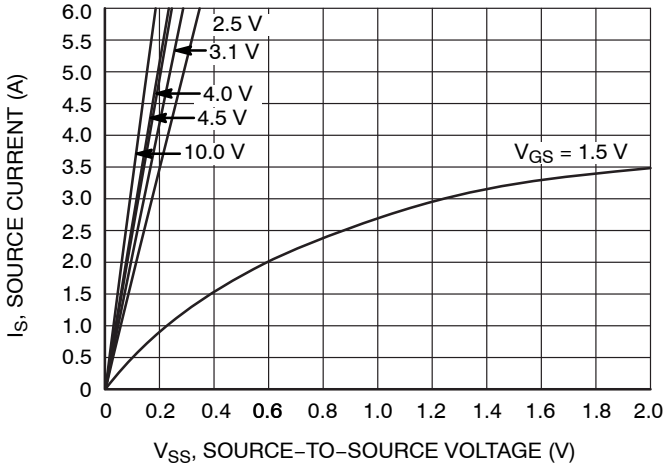


Figure 9. I_S – V_{SS}

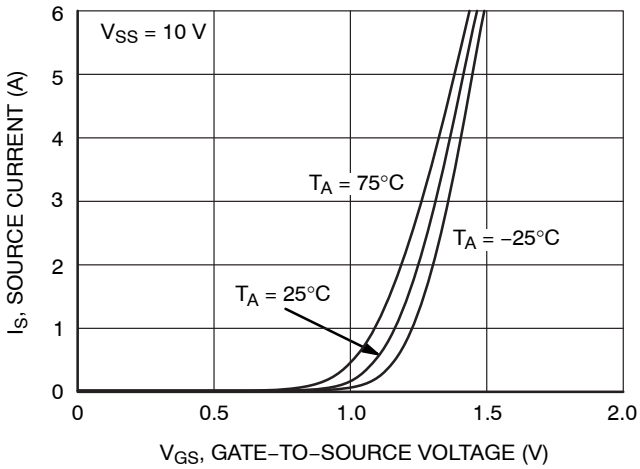


Figure 10. I_S – V_{GS}

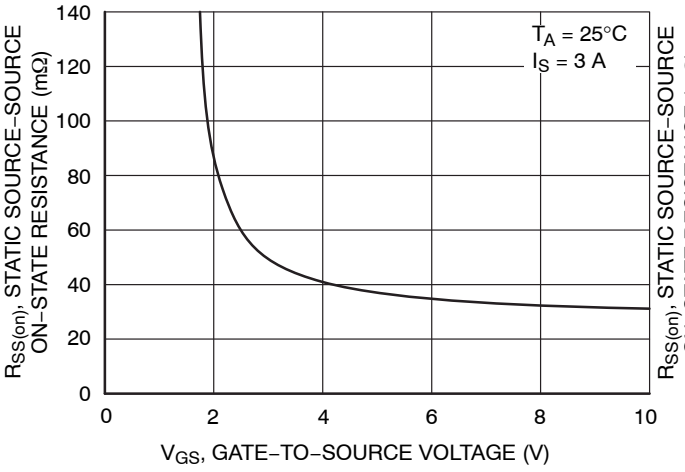


Figure 11. $R_{SS(on)}$ – V_{GS}

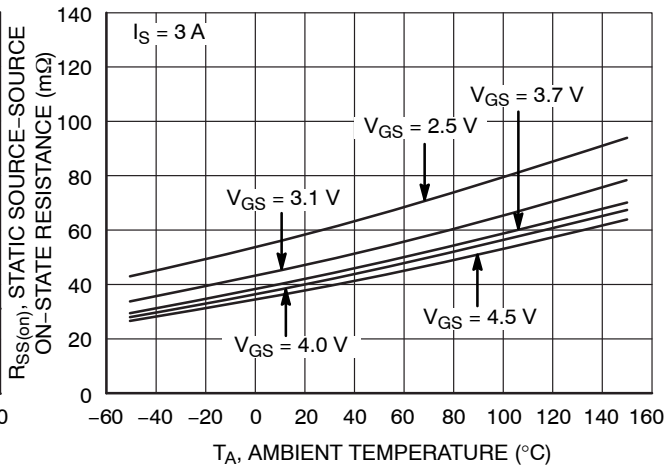


Figure 12. $R_{SS(on)}$ – T_A

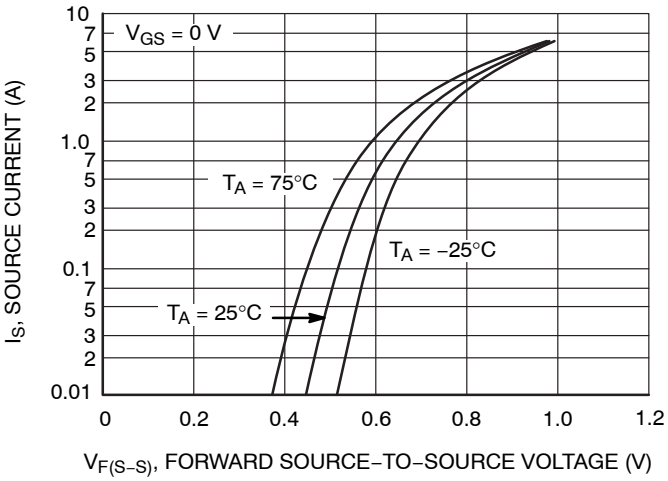


Figure 13. I_S – $V_{F(S-S)}$

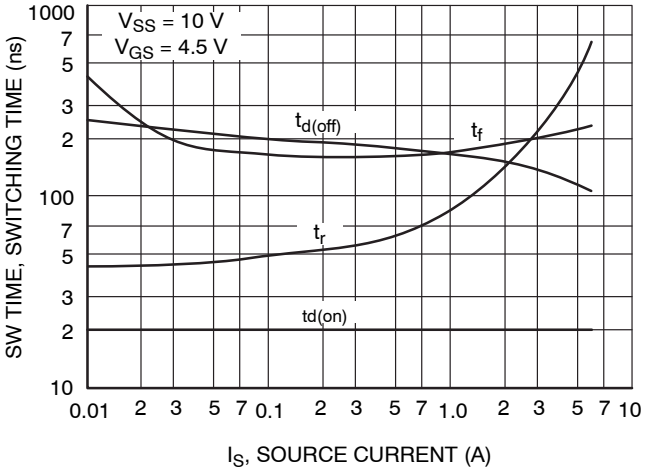


Figure 14. SW Time – I_S

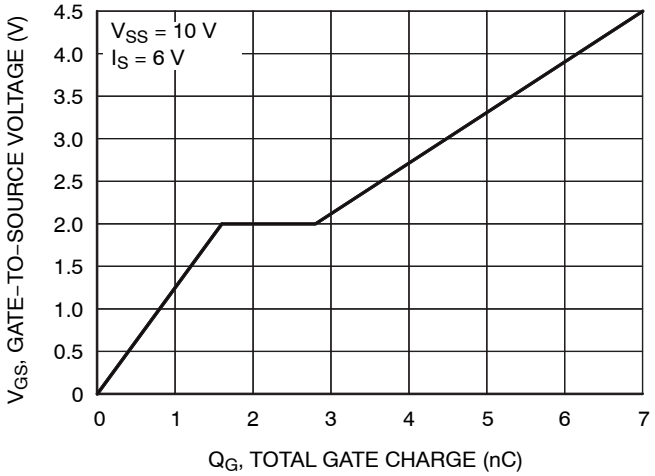


Figure 15. V_{GS} – Qg

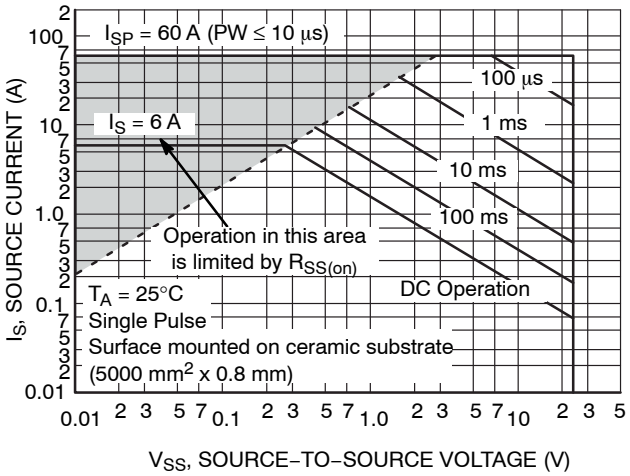


Figure 16. SOA

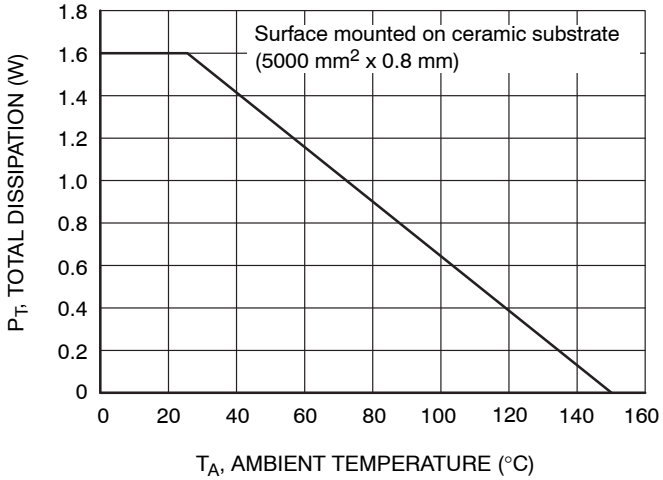


Figure 17. P_T – T_A

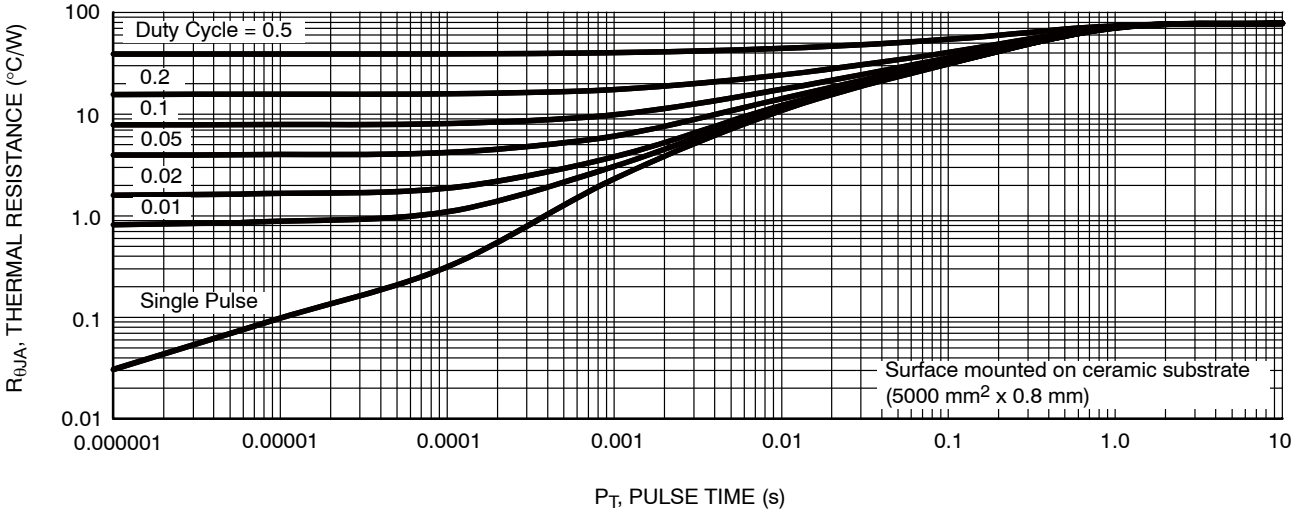


Figure 18. $R_{\theta JA}$ – Pulse Time

ORDERING INFORMATION

Device	Marking	Package	Shipping† (Qty / Packing)
EFC4612R−S−TR	FN	WLCSP4, 1.3 ×1.3 / EFCP1313−4CC−037 (Pb−Free and Halide Free)	5000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PACKAGE DIMENSION

(Unit: mm)

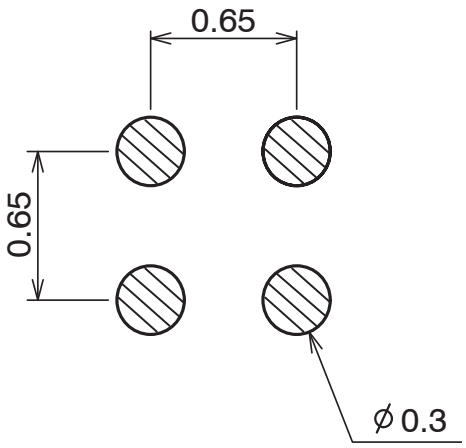
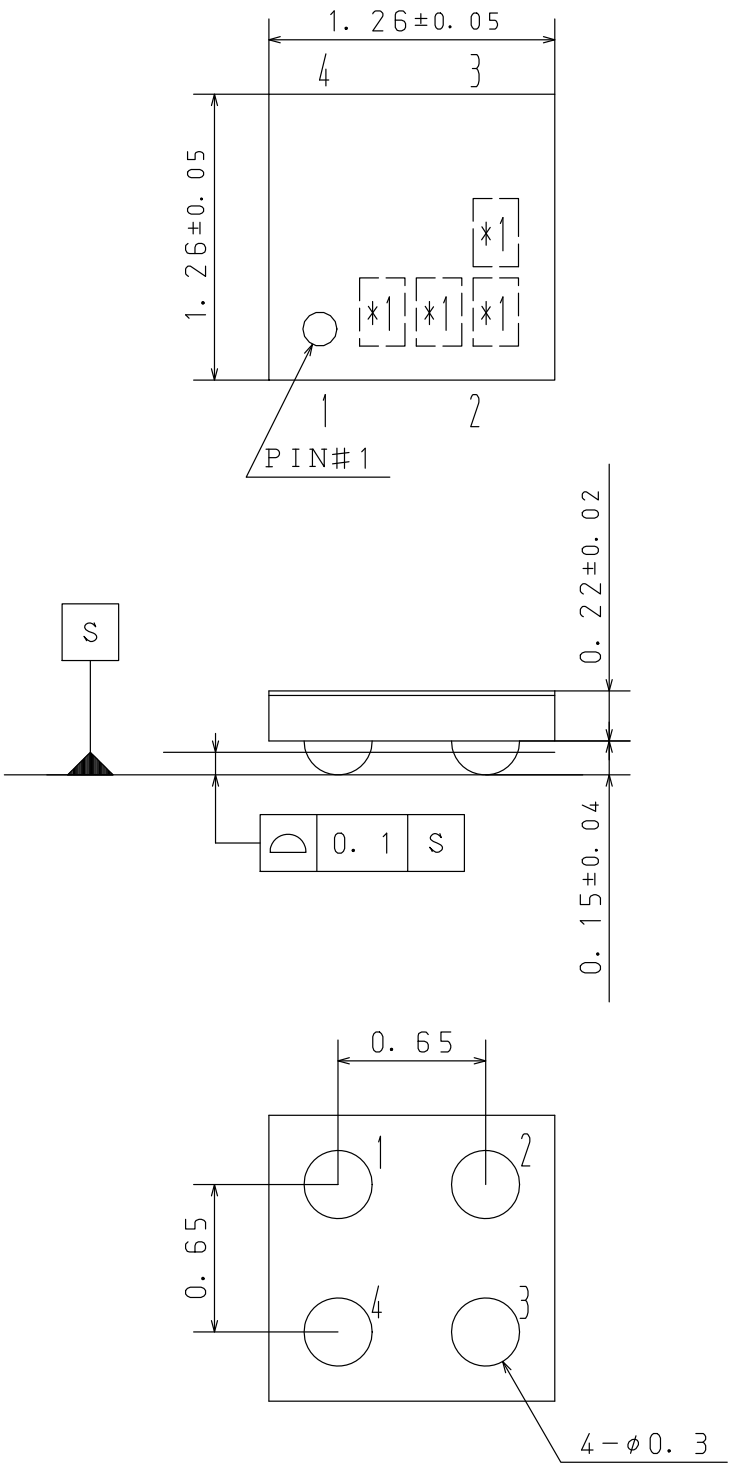


Figure 19. Recommended Soldering Footprint

WLCSP4, 1.3x1.3 / EFCP1313−4CC−037
CASE 567DP
ISSUE O

DATE 29 FEB 2012



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DESCRIPTION:	**WLCSP4 1.3X1.3 / EFCP1313−4CC−037**		**PAGE 1 OF 1**

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