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# EFC4612R-S

## Power MOSFET for 1-2 Cells Lithium-ion Battery Protection 24 V, 45 mΩ, 6 A, Dual N-Channel



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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, Halogen Free and RoHS compliance

### Applications

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

### SPECIFICATIONS

**ABSOLUTE MAXIMUM RATINGS** at Ta = 25°C (Note 1)

Parameter	Symbol	Value	Unit
Source to Source Voltage	V <sub>SSS</sub>	24	V
Gate to Source Voltage	V <sub>GSS</sub>	±12	V
Source Current (DC)	I <sub>S</sub>	6	A
Source Current (Pulse) PW ≤ 10 μs, duty cycle ≤ 1%	I <sub>SP</sub>	60	A
Total Dissipation (Note 2)	P <sub>T</sub>	1.6	W
Junction Temperature	T <sub>J</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

Note 1 : 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.

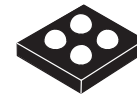
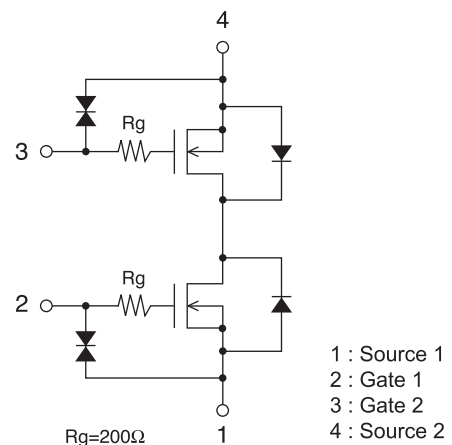
### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction to Ambient (Note 2)	R <sub>θJA</sub>	78.1	°C/W

Note 2 : Surface mounted on ceramic substrate(5000 mm<sup>2</sup> × 0.8 mm).

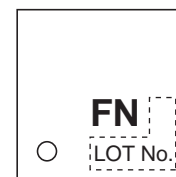
V <sub>SSS</sub>	R <sub>SS(on)</sub> Max	I <sub>S</sub> Max
24 V	45 mΩ @ 4.5 V	6 A
	48 mΩ @ 4.0 V	
	50 mΩ @ 3.7 V	
	57 mΩ @ 3.1 V	
	72 mΩ @ 2.5 V	

### ELECTRICAL CONNECTION N-Channel



WLCSP4, 1.3x1.3 / EFCP1313-4CC-037

### MARKING



### ORDERING INFORMATION

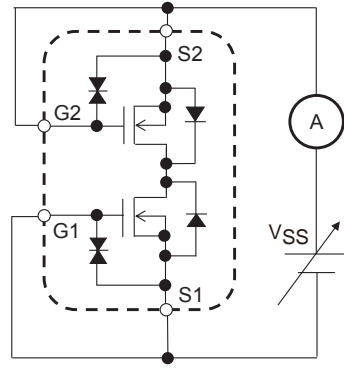
See detailed ordering and shipping information on page 7 of this data sheet.

**ELECTRICAL CHARACTERISTICS** at Ta = 25°C (Note 3)

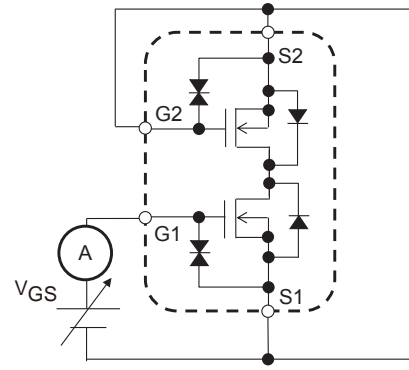
Parameter	Symbol	Conditions	Value			Unit
			min	typ	max	
Source to Source Breakdown Voltage	V(BR)SSS	IS = 1 mA, VGS = 0 V Test Circuit 1	24			V
Zero-Gate Voltage Source Current	ISSS	VSS = 20 V, VGS = 0 V Test Circuit 1			1	μA
Gate to Source Leakage Current	IGSS	VGS = ±8 V, VSS = 0 V Test Circuit 2			±10	μA
Gate Threshold Voltage	VGS(th)	VSS = 10 V, IS = 1 mA Test Circuit 3	0.5		1.3	V
Forward Transconductance	gFS	VSS = 10 V, IS = 3 A Test Circuit 4		3.1		S
Static Source to Source On-State Resistance	RSS(on)1	IS = 3 A, VGS = 4.5 V Test Circuit 5	24	39	45	mΩ
	RSS(on)2	IS = 3 A, VGS = 4.0 V Test Circuit 5	25	41	48	mΩ
	RSS(on)3	IS = 3 A, VGS = 3.7 V Test Circuit 5	27.5	43	50	mΩ
	RSS(on)4	IS = 3 A, VGS = 3.1 V Test Circuit 5	31.5	48	57	mΩ
	RSS(on)5	IS = 3 A, VGS = 2.5 V Test Circuit 5	33.5	58	72	mΩ
Turn-ON Delay Time	td(on)	VSS = 10 V, VGS = 4.5 V IS = 3 A Test Circuit 6		20		ns
Rise Time	tr			230		ns
Turn-OFF Delay Time	td(off)			130		ns
Fall Time	tf			210		ns
Total Gate Charge	Qg	VSS = 10 V, VGS = 4.5 V IS = 6 A Test Circuit 7		7		nC
Forward Source to Source Voltage	VF(S-S)	IS = 3 A, VGS = 0 V Test Circuit 8		0.8	1.2	V

Note 3 : 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 1  
V<sub>SSS</sub> / I<sub>SSS</sub>

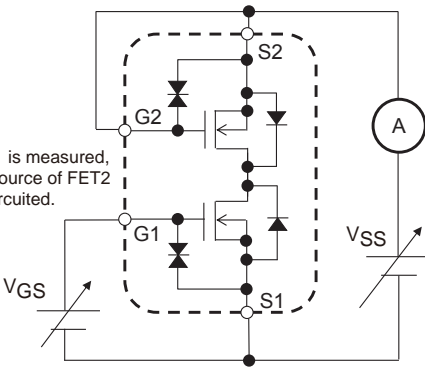


Test Circuit 2  
I<sub>GSS</sub>



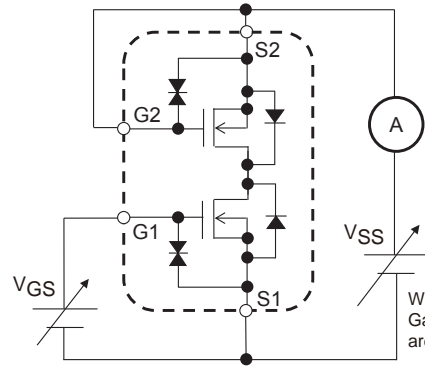
When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 3  
V<sub>GS(th)</sub>



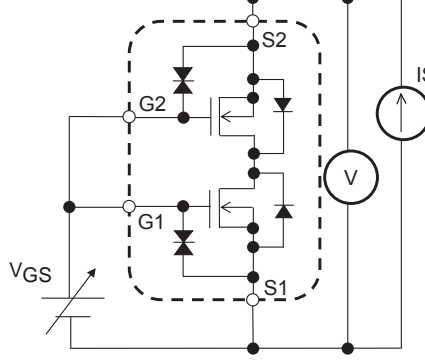
When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 4  
g<sub>FS</sub>

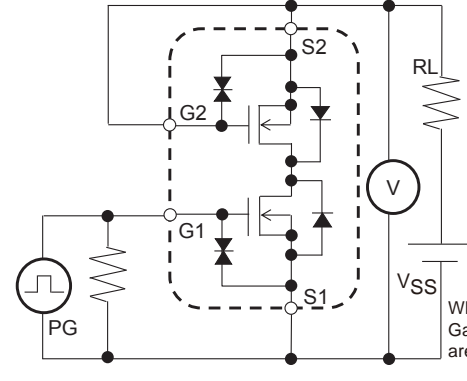


When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 5  
R<sub>SS(on)</sub>

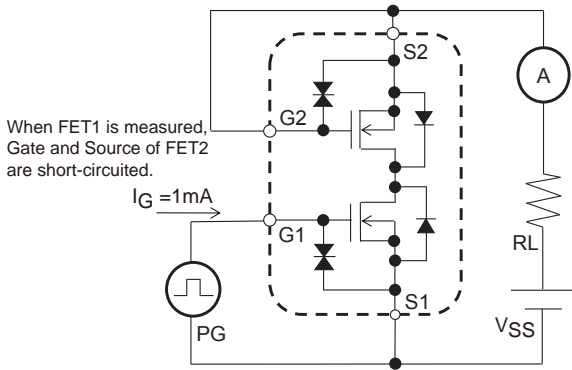


Test Circuit 6  
t<sub>d(on)</sub>, t<sub>r</sub>, t<sub>d(off)</sub>, t<sub>f</sub>



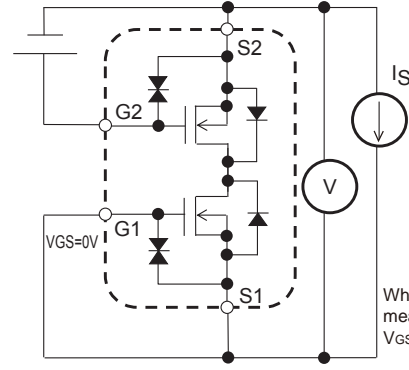
When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 7  
Q<sub>g</sub>



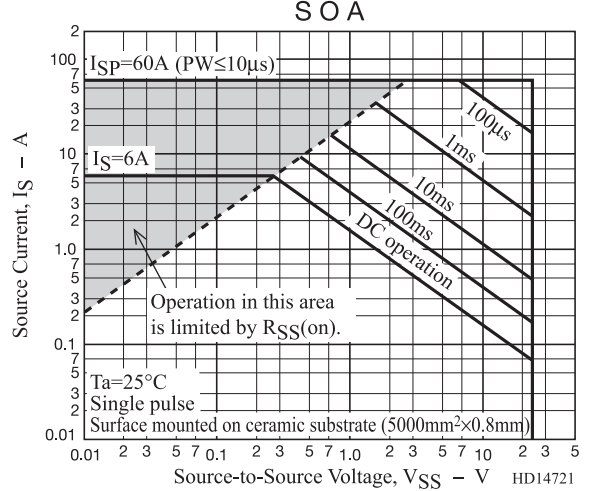
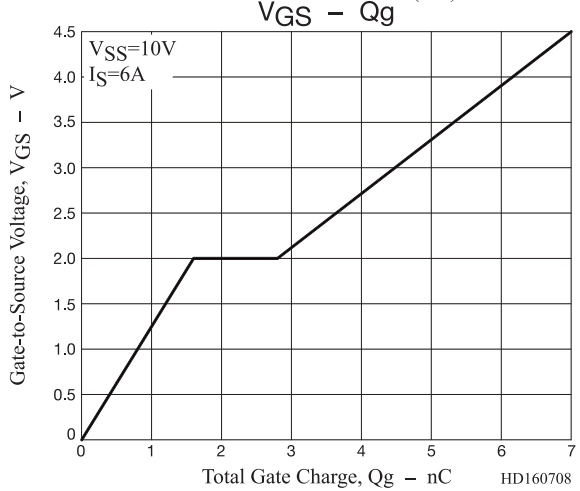
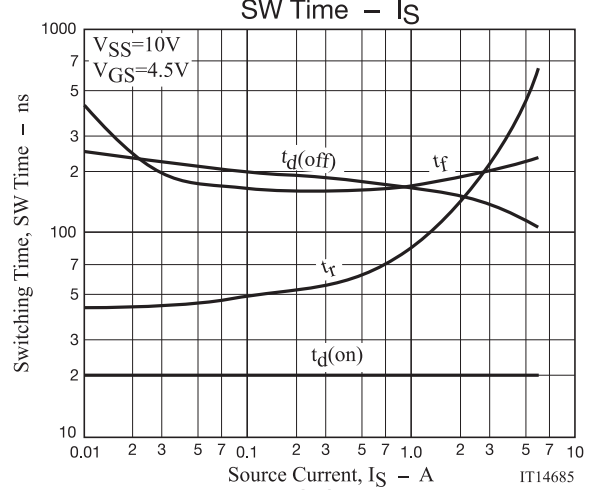
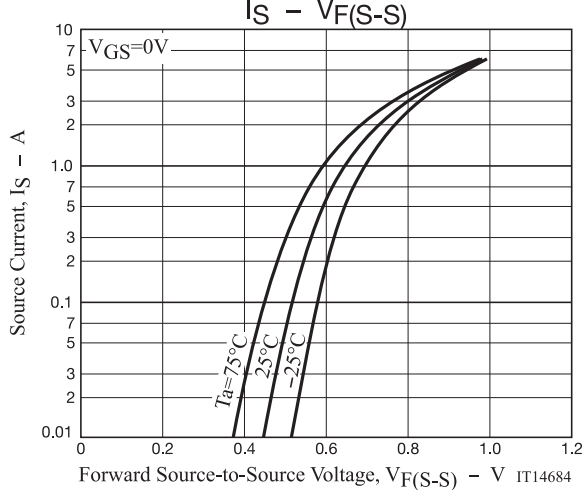
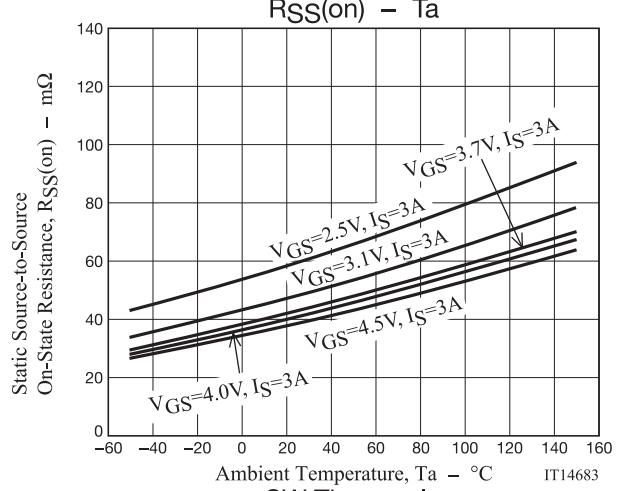
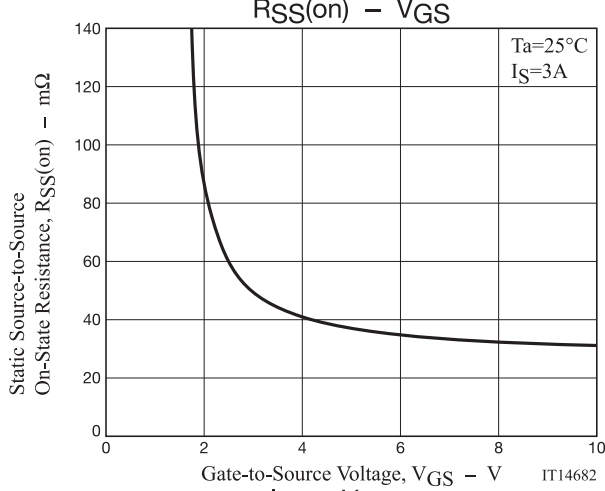
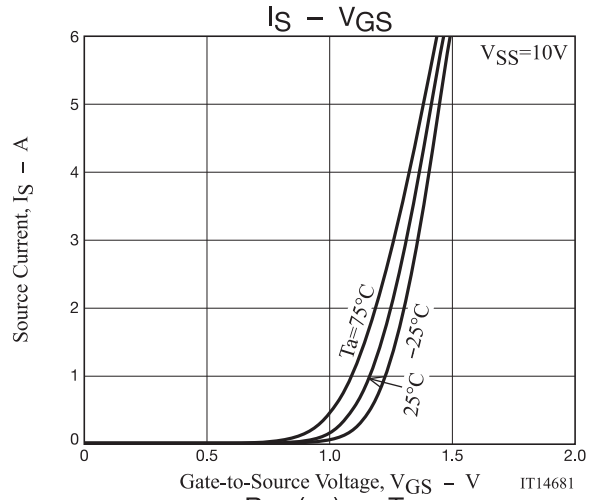
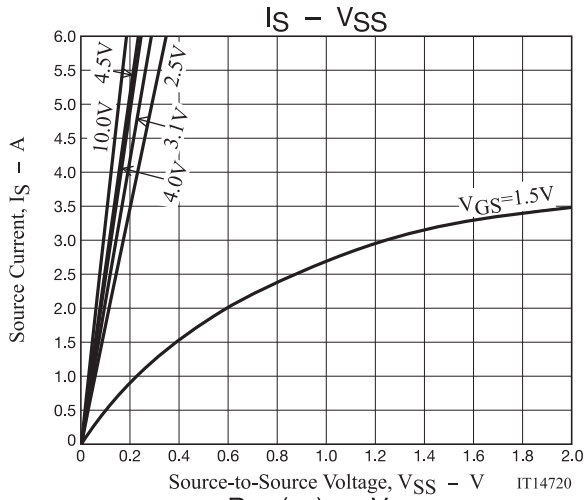
When FET1 is measured, Gate and Source of FET2 are short-circuited.

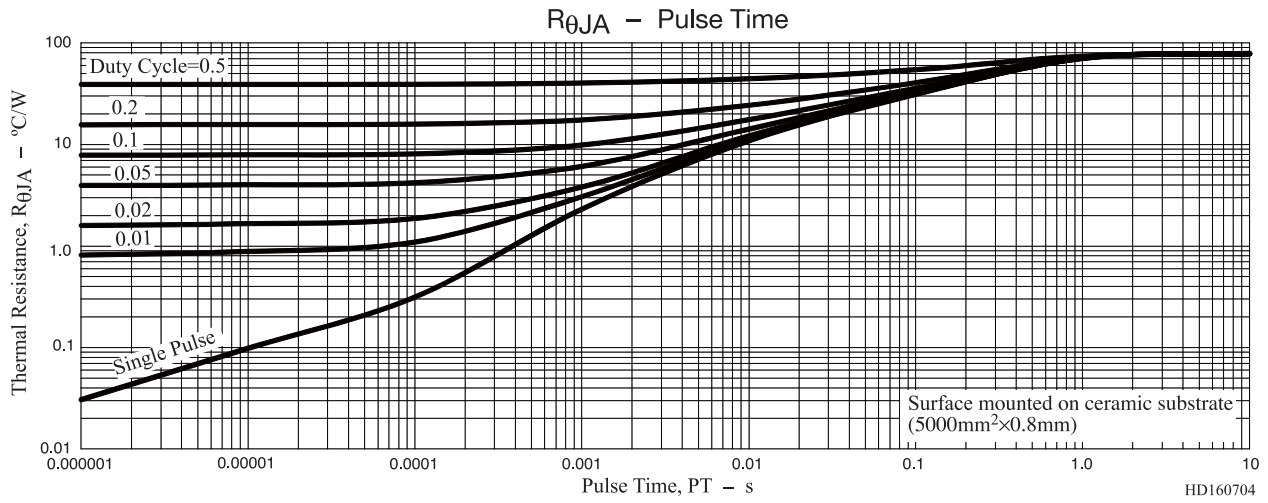
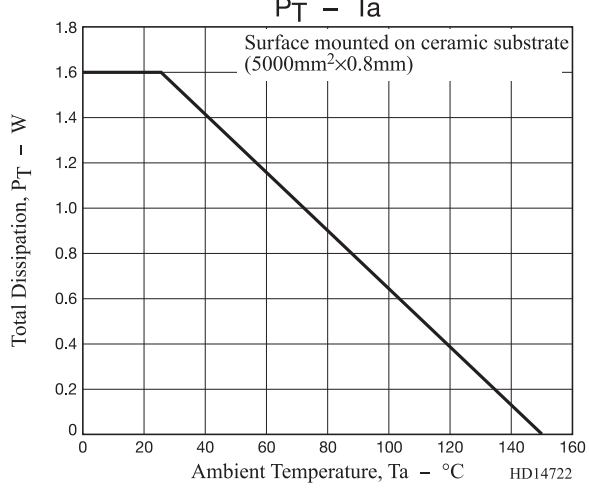
Test Circuit 8  
V<sub>F(S-S)</sub>



When FET1 is measured, +4.5V is added to V<sub>GS</sub> of FET2.

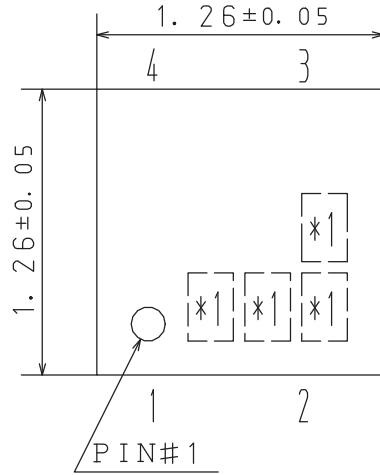
When FET2 is measured, the position of FET1 and FET2 is switched.



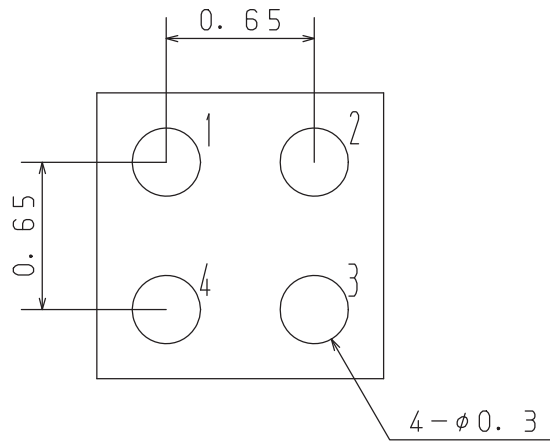
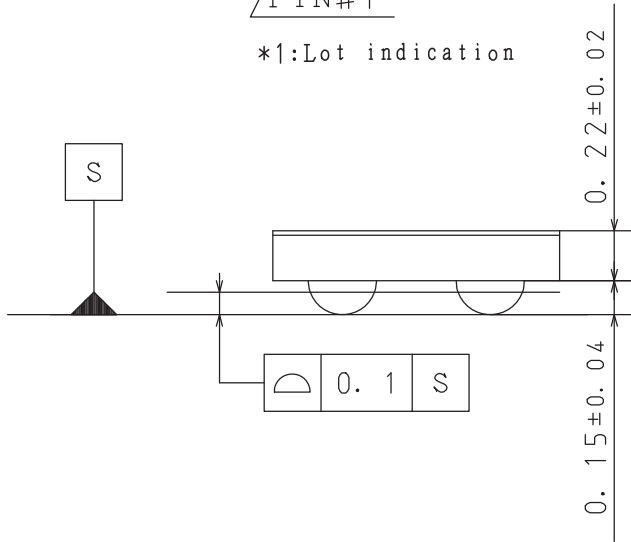


**WLCSP4, 1.3x1.3 / EFCP1313-4CC-037**  
CASE 567DP  
ISSUE 0

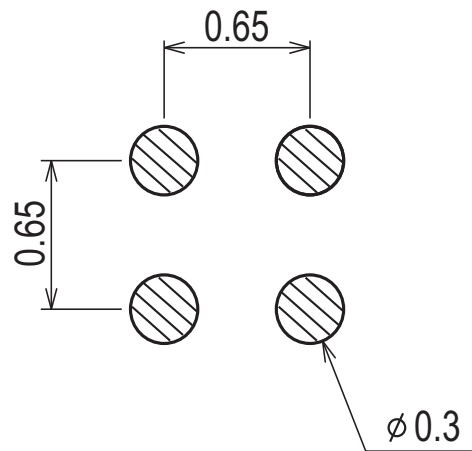
- 1 : Source1
- 2 : Gate1
- 3 : Gate2
- 4 : Source2



\*1: Lot indication



**RECOMMENDED  
SOLDERING FOOTPRINT**



**ORDERING INFORMATION**

Device	Marking	Package	Shipping (Qty / Packing)
EFC4612R-S-TR	FN	WLCSP4, 1.3 × 1.3 / EFCP1313-4CC-037 (Pb-Free / Halogen Free)	5,000 / 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. [http://www.onsemi.com/pub\\_link/Collateral/BRD8011-D.PDF](http://www.onsemi.com/pub_link/Collateral/BRD8011-D.PDF)

Note on usage : Since the EFC4612R-S is a MOSFET product, please avoid using this device in the vicinity of highly charged objects. Please contact sales for use except the designated application.

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