EFC4612R-S

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

ON Semiconductor®

www.onsemi.com

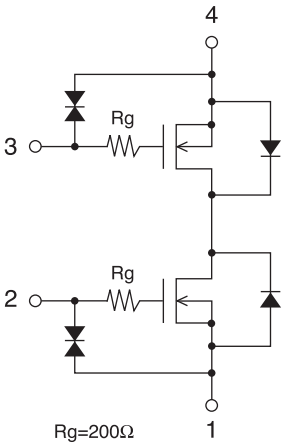
This Power MOSFET features a low on-state resistance. This device is suitable for applications such as power switches of portable machines. Best suited for 1-2 cells lithium-ion battery applications.

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	

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

ELECTRICAL CONNECTION
N-Channel



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

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

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.

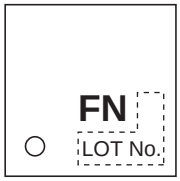
THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction to Ambient (Note 2)	$R_{\theta JA}$	78.1	°C/W

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

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

MARKING



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

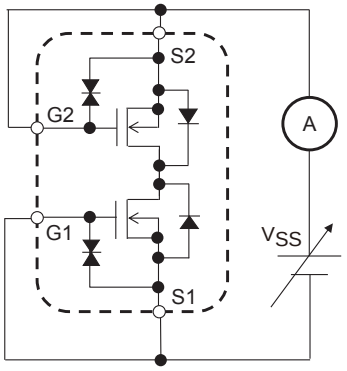
ELECTRICAL CHARACTERISTICS at Ta = 25°C (Note 3)

Parameter	Symbol	Conditions		Value			Unit
				min	typ	max	
Source to Source Breakdown Voltage	$V_{(BR)SSS}$	I_S = 1 mA, V_{GS} = 0 V	Test Circuit 1	24			V
Zero-Gate Voltage Source Current	I_{SSS}	V_{SS} = 20 V, V_{GS} = 0 V	Test Circuit 1			1	μA
Gate to Source Leakage Current	I_{GSS}	V_{GS} = ±8 V, V_{SS} = 0 V	Test Circuit 2			±10	μA
Gate Threshold Voltage	$V_{GS}(th)$	V_{SS} = 10 V, I_S = 1 mA	Test Circuit 3	0.5		1.3	V
Forward Transconductance	g_{FS}	V_{SS} = 10 V, I_S = 3 A	Test Circuit 4		3.1		S
Static Source to Source On-State Resistance	$R_{SS}(on)1$	I_S = 3 A, V_{GS} = 4.5 V	Test Circuit 5	24	39	45	mΩ
	$R_{SS}(on)2$	I_S = 3 A, V_{GS} = 4.0 V	Test Circuit 5	25	41	48	mΩ
	$R_{SS}(on)3$	I_S = 3 A, V_{GS} = 3.7 V	Test Circuit 5	27.5	43	50	mΩ
	$R_{SS}(on)4$	I_S = 3 A, V_{GS} = 3.1 V	Test Circuit 5	31.5	48	57	mΩ
	$R_{SS}(on)5$	I_S = 3 A, V_{GS} = 2.5 V	Test Circuit 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	Test Circuit 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	Test Circuit 7		7		nC
Forward Source to Source Voltage	$V_{F(S-S)}$	I_S = 3 A, V_{GS} = 0 V	Test Circuit 8		0.8	1.2	V

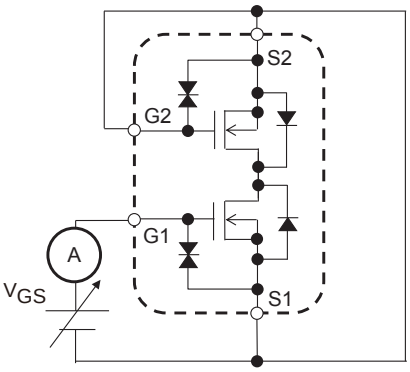
Note 3 : Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

Test circuits are example of measuring FET1 side

Test Circuit 1
V_{SSS} / I_{SSS}

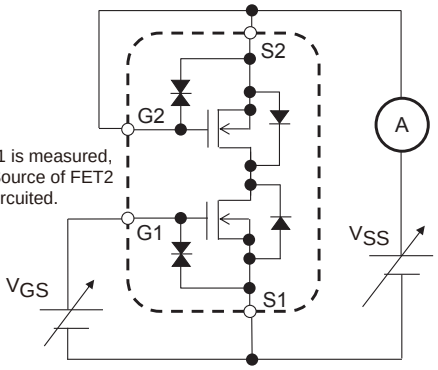


Test Circuit 2
I_{GSS}



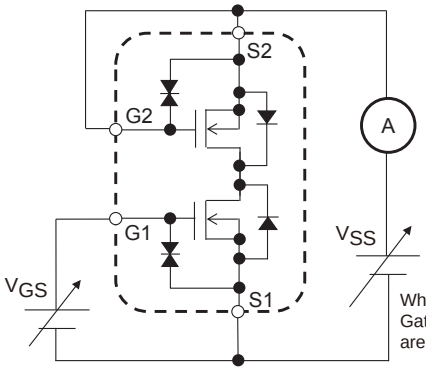
When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 3
$V_{GS(th)}$



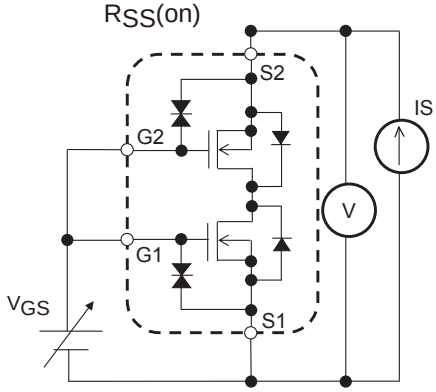
When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 4
g_{FS}

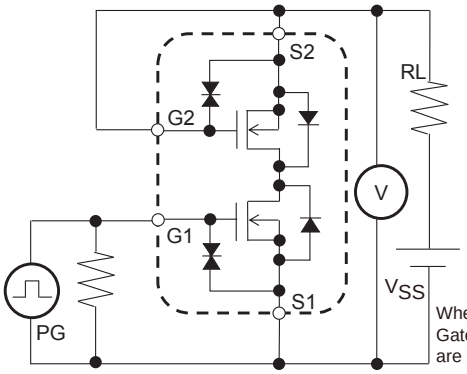


When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 5
$R_{SS(on)}$

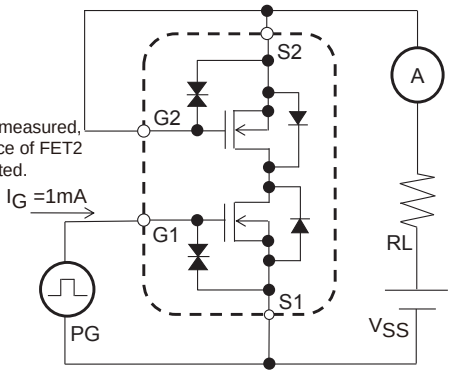


Test Circuit 6
$t_{d(on)}$, t_r, $t_{d(off)}$, t_f



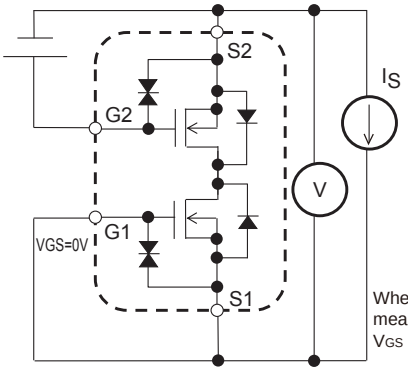
When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 7
Qg



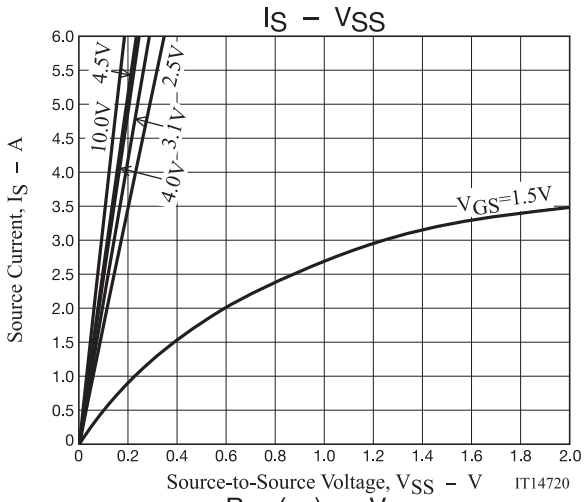
When FET1 is measured, Gate and Source of FET2 are short-circuited.

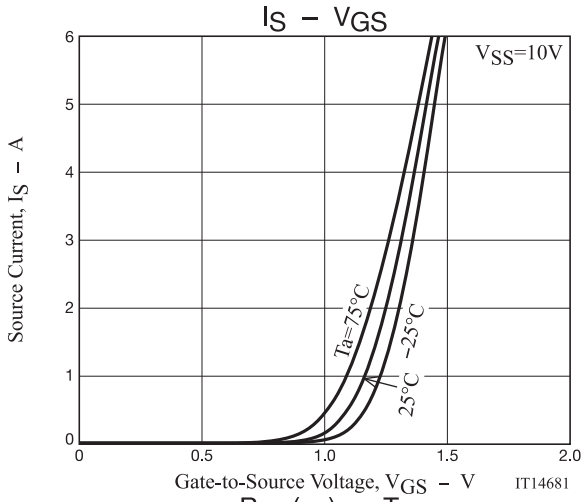
Test Circuit 8
$V_{F(S-S)}$

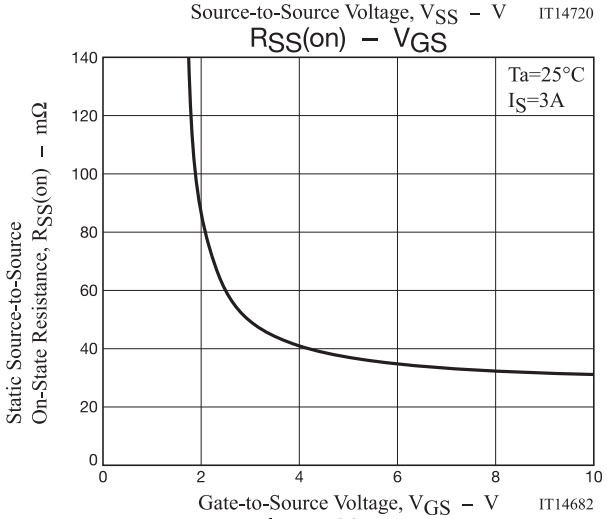


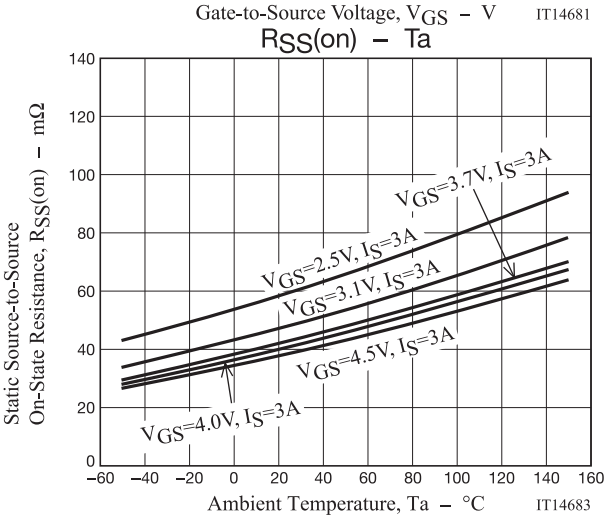
When FET1 is measured,+4.5V is added to V_{GS} of FET2.

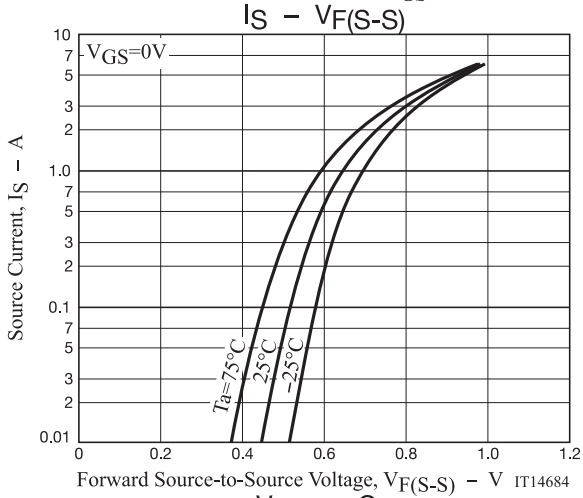
When FET2 is measured, the position of FET1 and FET2 is switched.

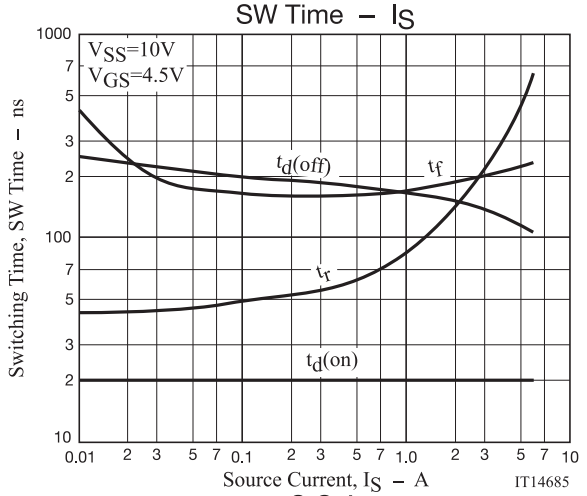


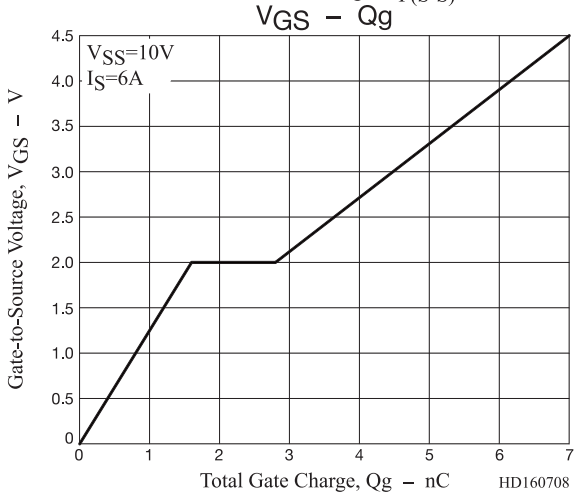


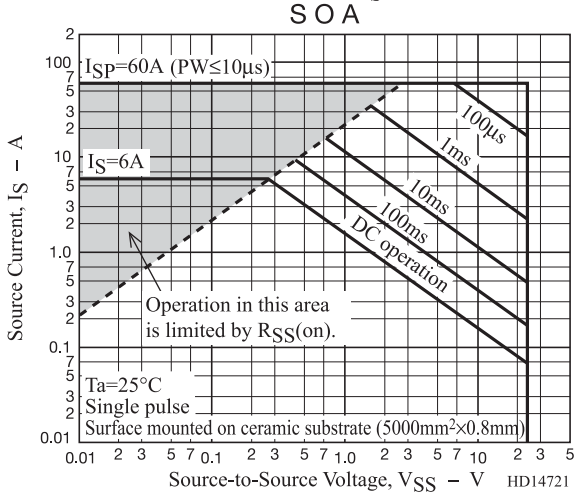


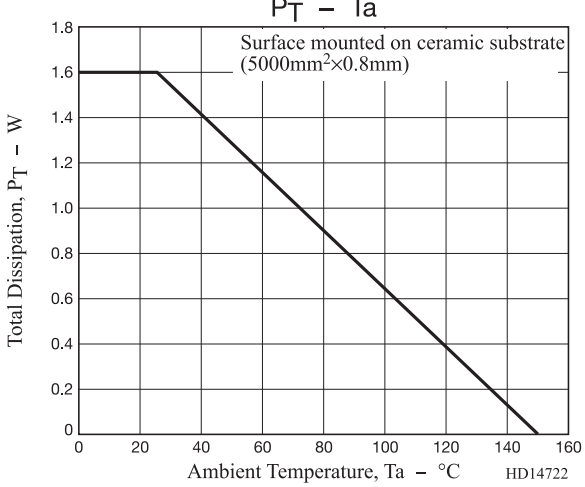


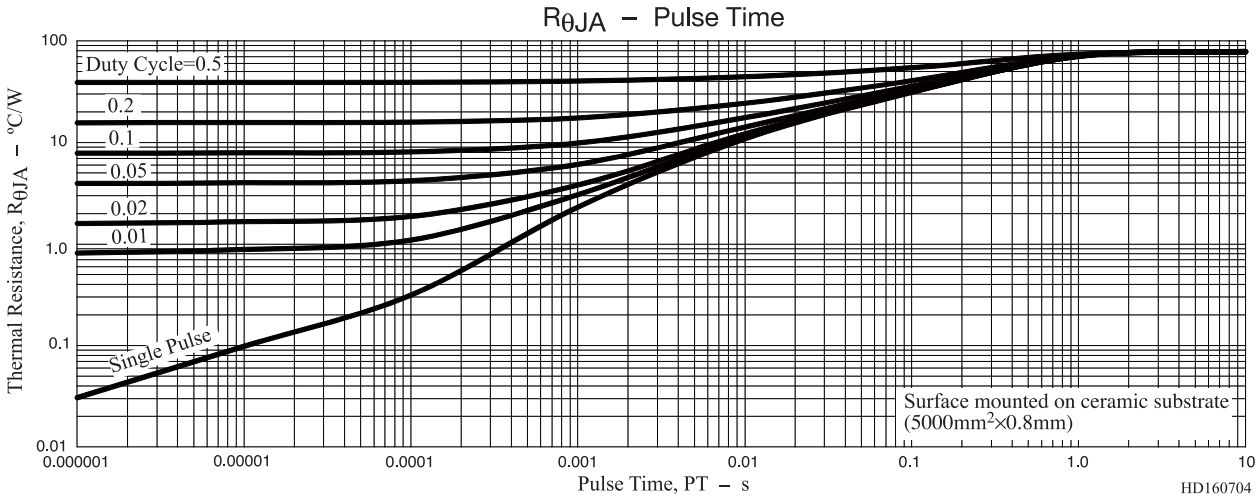








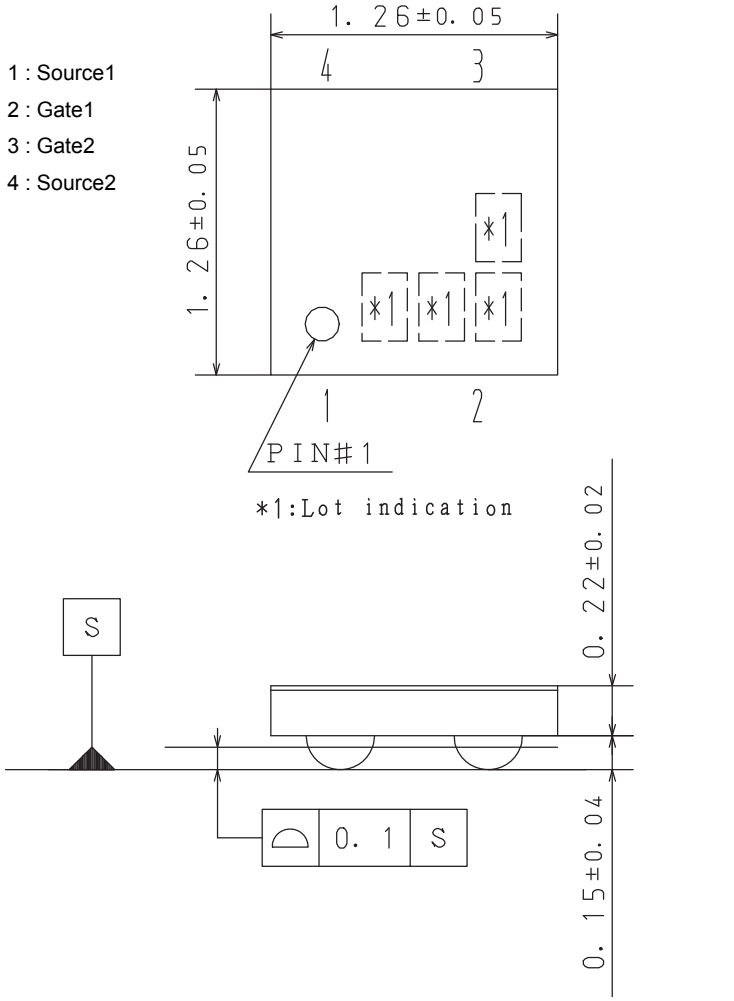




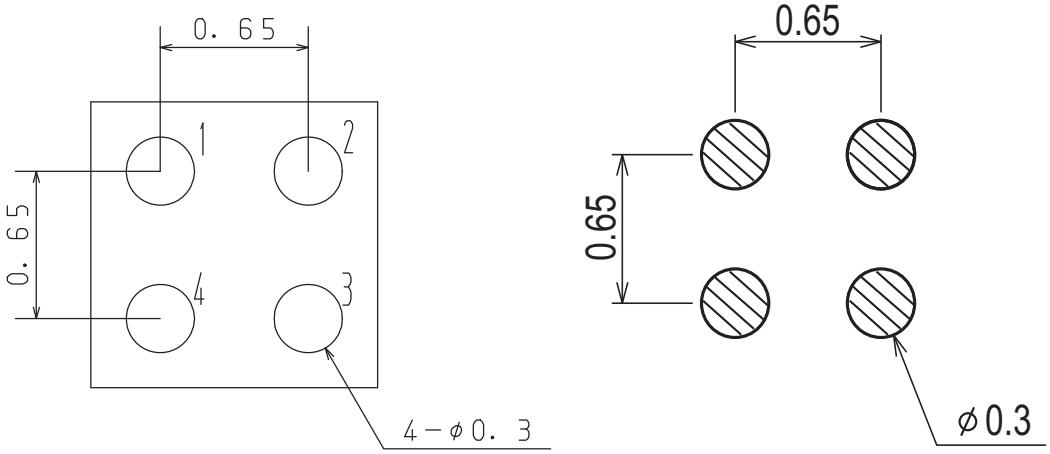
PACKAGE DIMENSIONS
unit : mm

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

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



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

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.