# Power MOSFET for 1-Cell Lithium-ion Battery Protection

## 12 V, 5.8 m $\Omega$ , 17 A, Dual N-Channel

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-cell lithium-ion battery applications.

#### **Features**

- 2.5 V Drive
- 2 kV ESD HBM
- Common-Drain Type
- ESD Diode-Protected Gate
- These Devices are Pb–Free, Halogen Free/BFR Free and are RoHS Compliant

#### **Applications**

• 1-Cell Lithium-ion Battery Charging and Discharging Switch

#### **Specifications**

## ABSOLUTE MAXIMUM RATINGS $(T_A = 25^{\circ}C)$

Parameter	Symbol	Value	Unit
Source to Source Voltage	V <sub>SSS</sub>	12	V
Gate to Source Voltage	$V_{GSS}$	±8	V
Source Current (DC)	Is	17	Α
Source Current (Pulse) PW ≤ 10 μs, duty cycle ≤ 1%	I <sub>SP</sub>	68	А
Total Dissipation (Note 1)	P <sub>T</sub>	1.8	W
Junction Temperature	Tj	150	°C
Storage Temperature	T <sub>stg</sub>	-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)	$R_{\theta JA}$	69.4	°C/W

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

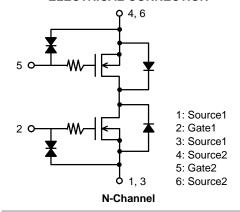


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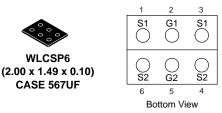
#### www.onsemi.com

V <sub>SSS</sub>	R <sub>SS(ON)</sub> MAX	I <sub>S</sub> MAX
12 V	5.8 mΩ @ 4.5 V	17 A
	6.2 mΩ @ 3.8 V	
	7.5 mΩ @ 3.1 V	
	9.0 mΩ @ 2.5 V	

#### **ELECTRICAL CONNECTION**



#### **PIN ASSIGNMENT**



#### **MARKING DIAGRAM**



NT = Specific Device Code A = Assembly Location

′ = Year

W = Work Week
ZZ = Assembly Lot

■ = Pb-Free Package

#### **ORDERING INFORMATION**

See detailed ordering and shipping information on page 2 of this data sheet.

#### **ELECTRICAL CHARACTERISTICS** (T<sub>A</sub> = 25°C)

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V <sub>(BR)SSS</sub>	Source to Source Breakdown Voltage	I <sub>S</sub> = 1 mA, V <sub>GS</sub> = 0 V, V <sub>SSS</sub> Test Circuit	12			V
I <sub>SSS</sub>	Zero-Gate Voltage Source Current	V <sub>SS</sub> = 10 V, V <sub>GS</sub> = 0 V			1	μΑ
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 8 \text{ V}, V_{SS} = 0 \text{ V}$			±1	μΑ
V <sub>GS</sub> (th)	Gate Threshold Voltage	V <sub>SS</sub> = 6 V, I <sub>S</sub> = 1 mA	0.4		1.3	V
R <sub>SS</sub> (on) Static Source to Source On-State Resistance		I <sub>S</sub> = 5 A, V <sub>GS</sub> = 4.5 V	3.0	4.35	5.8	mΩ
	Resistance	I <sub>S</sub> = 5 A, V <sub>GS</sub> = 3.8 V	3.2	4.6	6.2	mΩ
		I <sub>S</sub> = 5 A, V <sub>GS</sub> = 3.1 V	3.4	5.0	7.5	mΩ
		I <sub>S</sub> = 5 A, V <sub>GS</sub> = 2.5 V	3.8	5.6	9.0	mΩ
t <sub>d</sub> (on)	Turn-ON Delay Time	V <sub>SS</sub> = 5 V, V <sub>GS</sub> = 3.8 V, I <sub>S</sub> = 5 A		11		μS
t <sub>r</sub>	Rise Time	Rg = 10 kΩ Switching Test Circuit		26		μS
t <sub>d</sub> (off)	Turn-OFF Delay Time	]		130		μS
t <sub>f</sub>	Fall Time	]		73		μS
Qg	Total Gate Charge	V <sub>SS</sub> = 5 V, V <sub>GS</sub> = 4.5 V, I <sub>S</sub> = 5 A		37		nC
V <sub>F(S-S)</sub>	Forward Source to Source Voltage	I <sub>S</sub> = 3 A, V <sub>GS</sub> = 0 V		0.76	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.

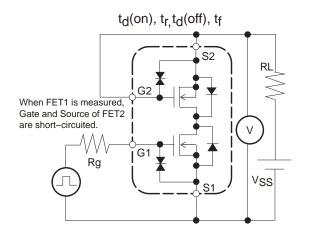


Figure 1. Switching Test Circuit

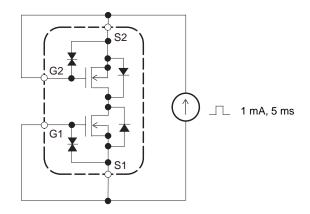


Figure 2.  $V_{\rm SSS}$  Test Circuit

#### **ORDERING INFORMATION**

Device	Marking	Package	Shipping <sup>†</sup> (Qty / Packing)
EFC2J013NUZTDG	NT	WLCSP6, 2.00 x 1.49 x 0.10 (Pb-Free / Halogen Free)	5,000 / Tape & Reel

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

#### **TYPICAL CHARACTERISTICS**

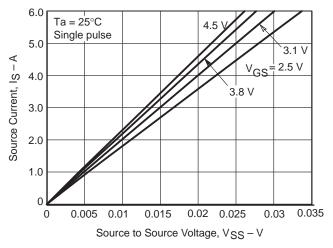


Figure 3. On-Region Characteristics

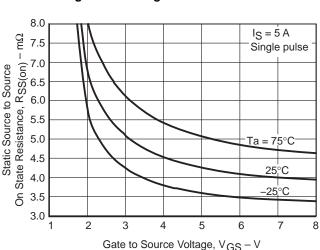


Figure 5. On-Resistance vs. Gate-to-Source Voltage

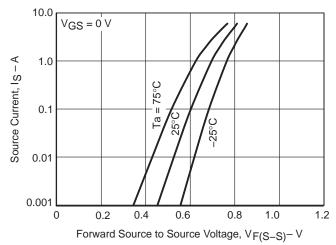


Figure 7. Forward Source-to-Source Voltage vs. Current

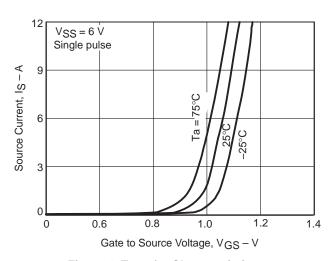


Figure 4. Transfer Characteristics

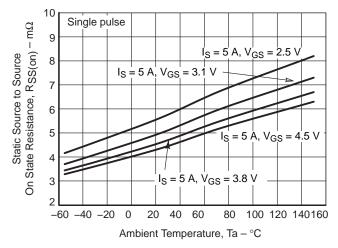


Figure 6. On-Resistance vs. Temperature

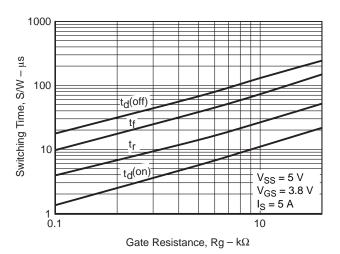


Figure 8. Switching Time vs. Gate Resistance

#### **TYPICAL CHARACTERISTICS**

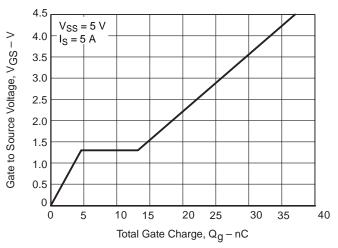


Figure 9. Gate-to-Source Voltage vs. Total Charge

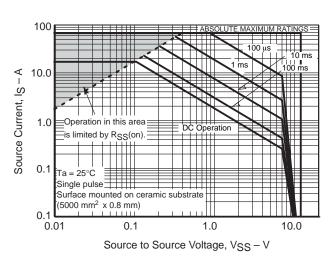


Figure 10. Safe Operating Area

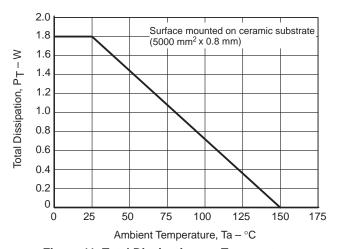


Figure 11. Total Dissipation vs. Temperature

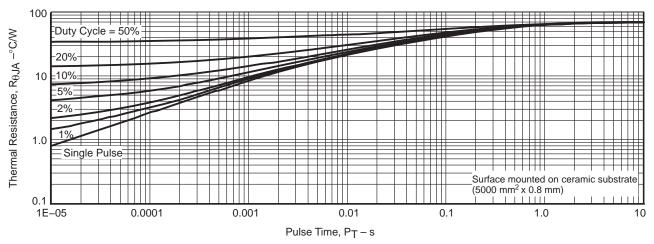


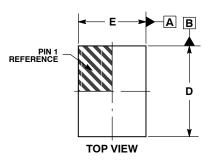
Figure 12. Thermal Response

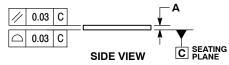
Note on Usage: Since the EFC2J013NUZ is a MOSFET product, please avoid using this device in the vicinity of highly charged objects. Please contact sales for use except the designated application.

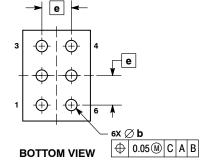


#### WLCSP6 2.00x1.49x0.10 CASE 567UF **ISSUE O**

**DATE 21 APR 2017** 







#### NOTES:

- ANTES.

  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

  2. CONTROLLING DIMENSION: MILLIMETERS.

	MILLIMETERS			
DIM	MIN	NOM	MAX	
Α	0.08	0.10	0.12	
b	0.27	0.30	0.33	
D	1.95	2.00	2.05	
Е	1.44	1.49	1.54	
е	0.65 BSC			

#### **GENERIC MARKING DIAGRAM\***



XXX = Specific Device Code

= Assembly Location

= Year

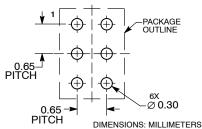
W = Work Week

ZZ = Assembly Lot

= Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot " ■" may or may not be present. Some products may not follow the Generic Marking.

#### **RECOMMENDED SOLDERING FOOTPRINT\***



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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DESCRIPTION:	WLCSP6 2.00x1.49x0.10		PAGE 1 OF 1

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105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru\_6 moschip.ru 4 moschip.ru 9