

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

**12 V, 5.8 mΩ, 17 A, Dual N-Channel**

## EFC2J013NUZ

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 ( $T_A = 25^\circ\text{C}$ )

Parameter	Symbol	Value	Unit
Source to Source Voltage	$V_{SSS}$	12	V
Gate to Source Voltage	$V_{GSS}$	$\pm 8$	V
Source Current (DC)	$I_S$	17	A
Source Current (Pulse) $PW \leq 10 \mu\text{s}$ , duty cycle $\leq 1\%$	$I_{SP}$	68	A
Total Dissipation (Note 1)	$P_T$	1.8	W
Junction Temperature	$T_j$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	$-55$ to $+150$	$^\circ\text{C}$

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.

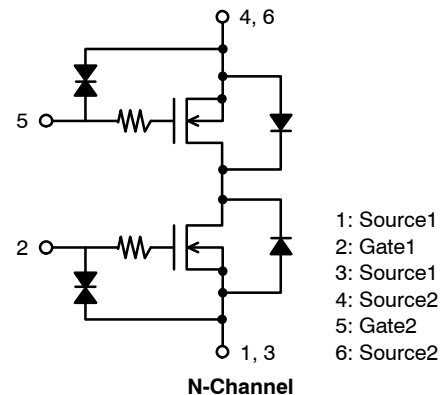
#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction to Ambient (Note 1)	$R_{\theta JA}$	69.4	$^\circ\text{C/W}$

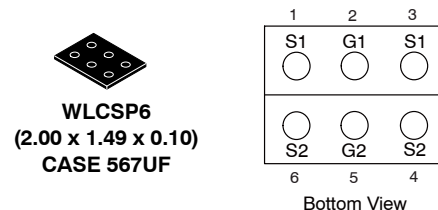
1. Surface mounted on ceramic substrate ( $5000 \text{ mm}^2 \times 0.8 \text{ mm}$ ).

$V_{SSS}$	$R_{SS(ON)} \text{ MAX}$	$I_S \text{ MAX}$
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	

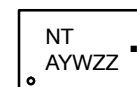
### ELECTRICAL CONNECTION



### PIN ASSIGNMENT



### MARKING DIAGRAM



NT = Specific Device Code  
A = Assembly Location  
Y = 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** ( $T_A = 25^\circ\text{C}$ )

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{(BR)SSS}$	Source to Source Breakdown Voltage	$I_S = 1\text{ mA}$ , $V_{GS} = 0\text{ V}$ , $V_{SSS}$ Test Circuit	12			V
$I_{SSS}$	Zero-Gate Voltage Source Current	$V_{SS} = 10\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 8\text{ V}$ , $V_{SS} = 0\text{ V}$			$\pm 1$	$\mu\text{A}$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{SS} = 6\text{ V}$ , $I_S = 1\text{ mA}$	0.4		1.3	V
$R_{SS(on)}$	Static Source to Source On-State Resistance	$I_S = 5\text{ A}$ , $V_{GS} = 4.5\text{ V}$	3.0	4.35	5.8	$\text{m}\Omega$
		$I_S = 5\text{ A}$ , $V_{GS} = 3.8\text{ V}$	3.2	4.6	6.2	$\text{m}\Omega$
		$I_S = 5\text{ A}$ , $V_{GS} = 3.1\text{ V}$	3.4	5.0	7.5	$\text{m}\Omega$
		$I_S = 5\text{ A}$ , $V_{GS} = 2.5\text{ V}$	3.8	5.6	9.0	$\text{m}\Omega$
$t_d(on)$	Turn-ON Delay Time	$V_{SS} = 5\text{ V}$ , $V_{GS} = 3.8\text{ V}$ , $I_S = 5\text{ A}$ $R_g = 10\text{ k}\Omega$ Switching Test Circuit		11		$\mu\text{s}$
$t_r$	Rise Time			26		$\mu\text{s}$
$t_d(off)$	Turn-OFF Delay Time			130		$\mu\text{s}$
$t_f$	Fall Time			73		$\mu\text{s}$
Qg	Total Gate Charge	$V_{SS} = 5\text{ V}$ , $V_{GS} = 4.5\text{ V}$ , $I_S = 5\text{ A}$		37		nC
$V_{F(S-S)}$	Forward Source to Source Voltage	$I_S = 3\text{ A}$ , $V_{GS} = 0\text{ V}$		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.

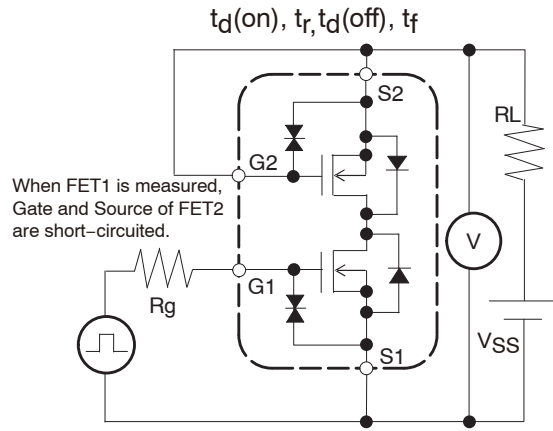


Figure 1. Switching Test Circuit

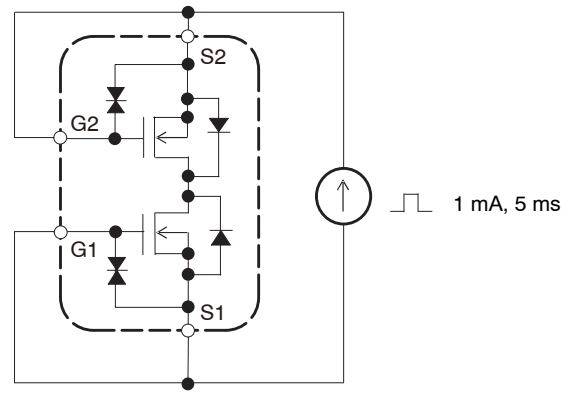


Figure 2.  $V_{SSS}$  Test Circuit

**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, [BRD8011/D](#).

TYPICAL CHARACTERISTICS

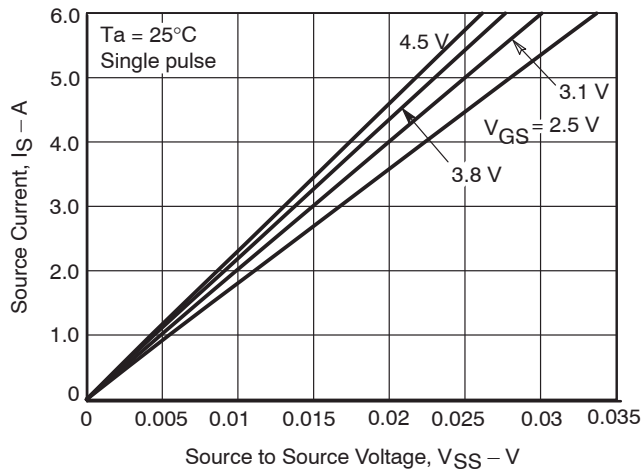


Figure 3. On-Region Characteristics

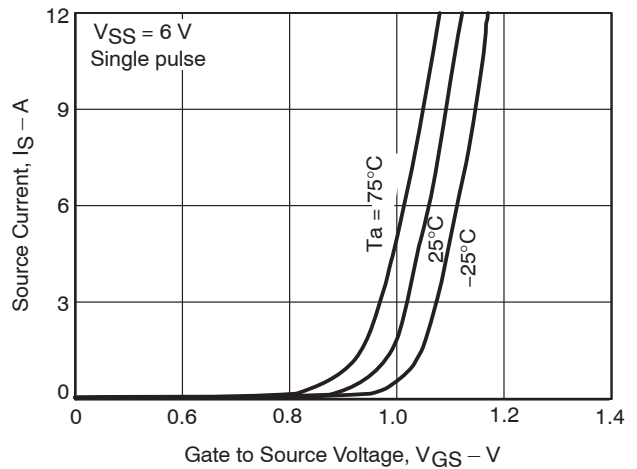


Figure 4. Transfer Characteristics

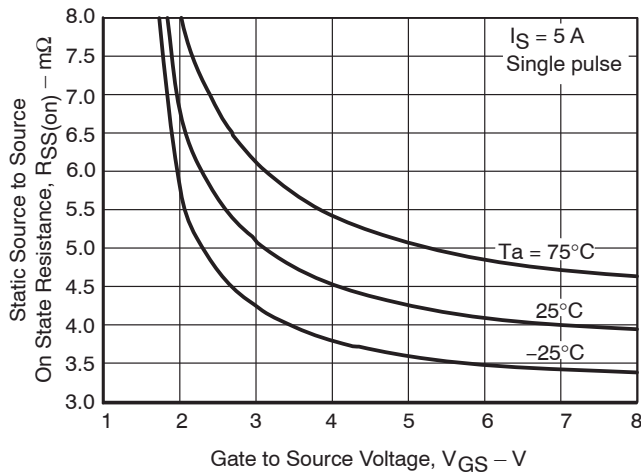


Figure 5. On-Resistance vs. Gate-to-Source Voltage

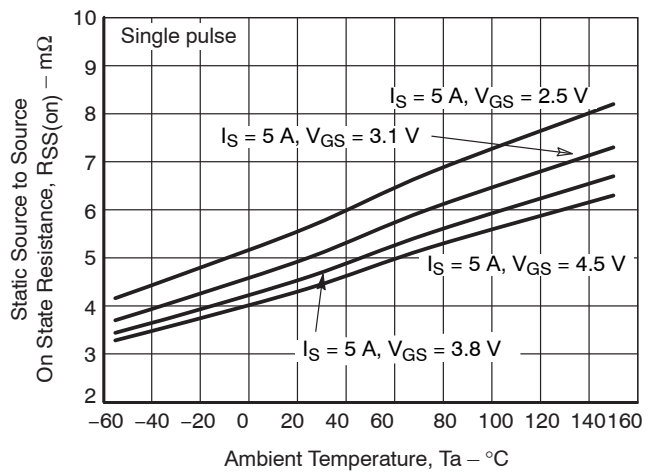


Figure 6. On-Resistance vs. Temperature

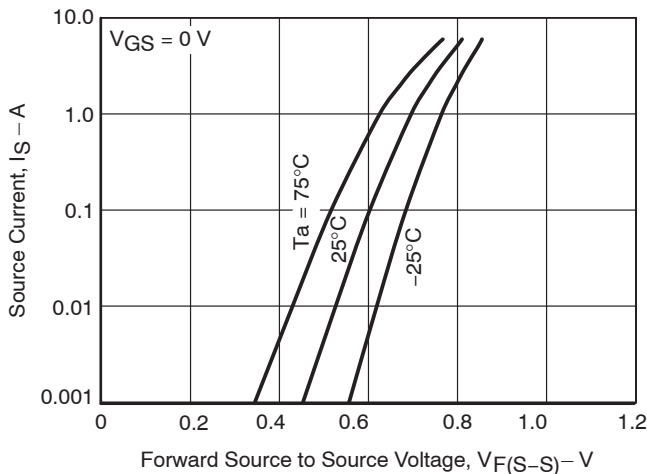


Figure 7. Forward Source-to-Source Voltage vs. Current

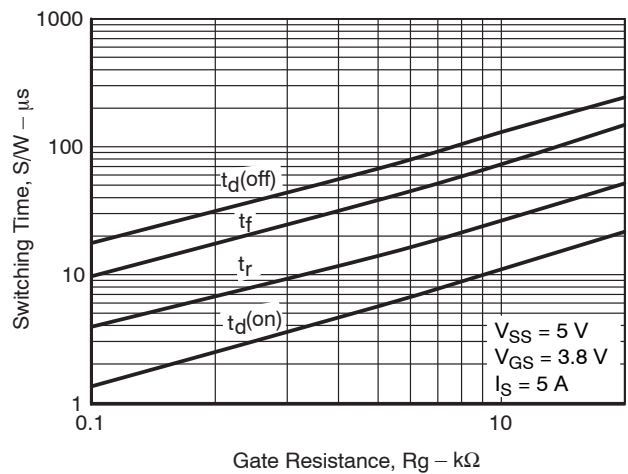


Figure 8. Switching Time vs. Gate Resistance

# EFC2J013NUZ

## TYPICAL CHARACTERISTICS

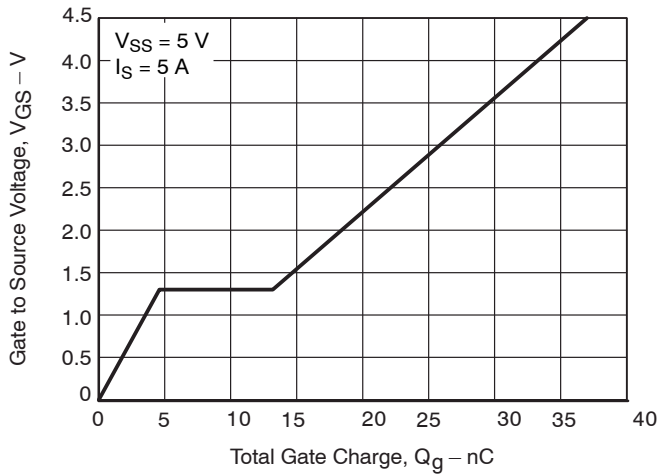


Figure 9. Gate-to-Source Voltage vs. Total Charge

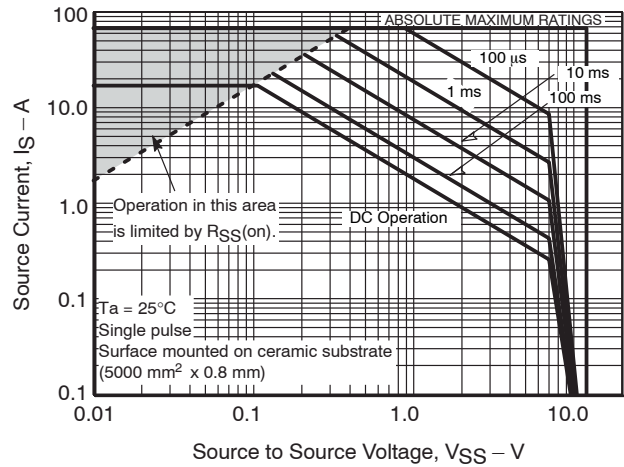


Figure 10. Safe Operating Area

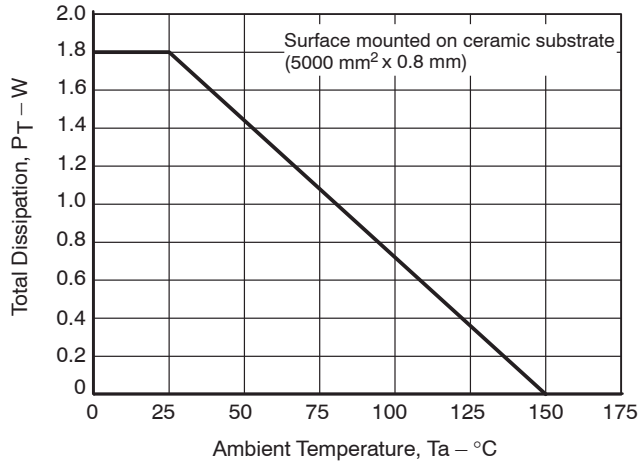


Figure 11. Total Dissipation vs. Temperature

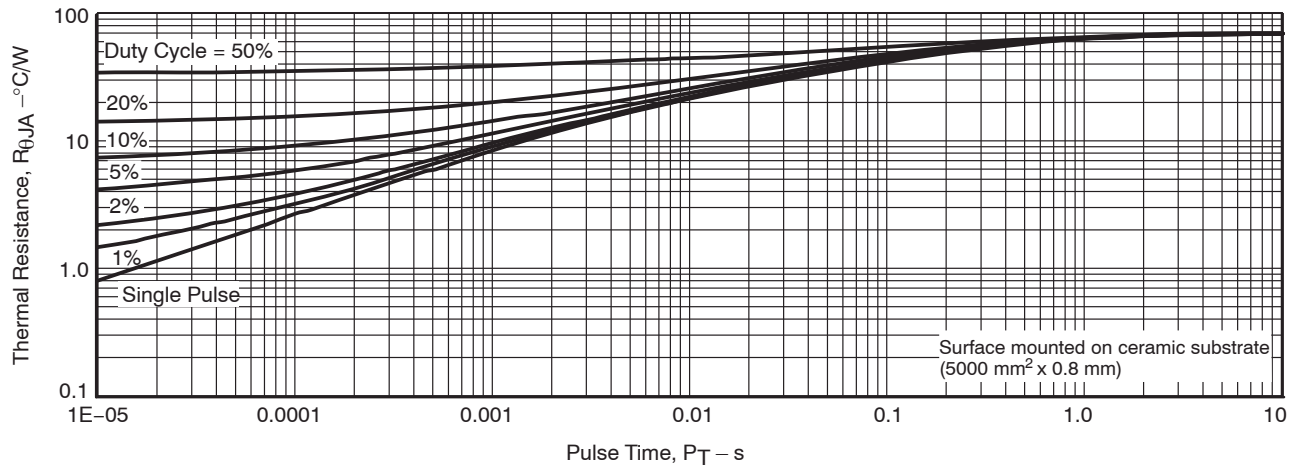


Figure 12. Thermal Response

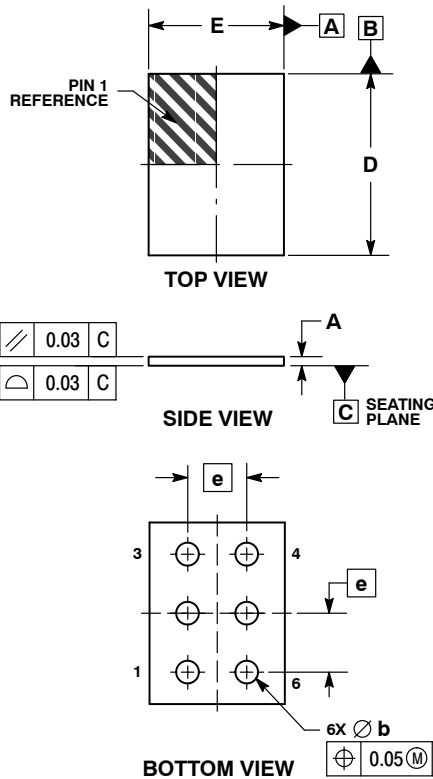
Note on Usage: Since the EFC2J013NUZ is a MOSFET product, please avoid using this device in the vicinity of highly charged objects. Please contact sales for use except the designated application.



SCALE 4:1

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

DATE 21 APR 2017

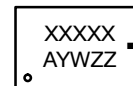


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.

MILLIMETERS			
DIM	MIN	NOM	MAX
A	0.08	0.10	0.12
b	0.27	0.30	0.33
D	1.95	2.00	2.05
E	1.44	1.49	1.54
e	0.65 BSC		

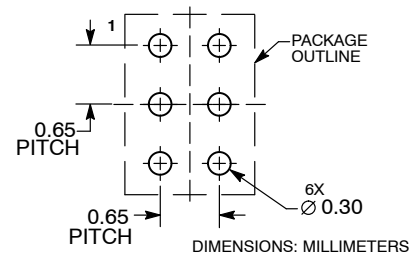
### GENERIC MARKING DIAGRAM\*



XXX = Specific Device Code  
A = Assembly Location  
Y = 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 **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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