

EFC4C012NL

Power MOSFET for 3-Cells Lithium-ion Battery Protection 30 V, 6.5 mΩ, 19 A, Dual N-Channel, WLCSP6

This N-Channel Power MOSFET is produced using ON Semiconductor's trench technology, which is specifically designed to minimize gate charge and ultra low on resistance.

This device is suitable for applications of Notebook PC.

Features

- Ultra Low On-Resistance
- Low Gate Charge
- Common-Drain type
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- 3-Cells Lithium-ion Battery Charging and Discharging Switch

SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS at $T_A = 25^\circ\text{C}$ (Note 1)

Parameter	Symbol	Value	Unit
Source to Source Voltage	V_{SSS}	30	V
Gate to Source Voltage	V_{GSS}	± 20	V
Source Current (DC)	I_S	19	A
Source Current (Pulse) $PW \leq 10 \mu\text{s}$, duty cycle $\leq 1\%$	I_{SP}	76	A
Total Dissipation (Note 2)	P_T	2.5	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)	$R_{\theta JA}$	50	$^\circ\text{C/W}$

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

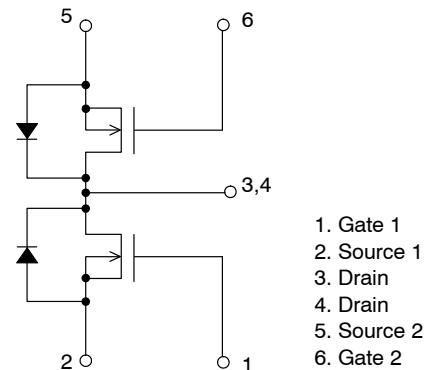


ON Semiconductor®

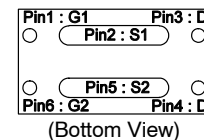
www.onsemi.com

V_{SSS}	$R_{SS(on)}$ Max	I_S Max
30 V	6.5 mΩ @ 10 V	19 A
	8.4 mΩ @ 8 V	
	13 mΩ @ 4.5 V	

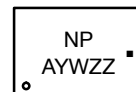
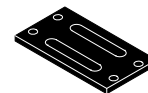
ELECTRICAL CONNECTION N-CHANNEL



PIN ASSIGNMENT



MARKING DIAGRAM



WLCSP6
CASE 567SZ

A = Assembly Location
Y = Year
W = Work Week
ZZ = Assembly Lot
▪ = Pb-Free Package

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

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ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$ (Note 1)

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Source to Source Breakdown Voltage	$V_{(BR)SSS}$	$I_S = 1\text{ mA}$, $V_{GS} = 0\text{ V}$	30			V
Zero-Gate Voltage Source Current	I_{SSS}	$V_{SS} = 24\text{ V}$, $V_{GS} = 0\text{ V}$			1	μA
Gate to Source Leakage Current	I_{GSS}	$V_{GS} = 20\text{ V}$, $V_{SS} = 0\text{ V}$			200	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{SS} = 10\text{ V}$, $I_S = 1\text{ mA}$	1.3		2.2	V
Static Source to Source On-State Resistance	$R_{SS(on)}$	$V_{GS} = 10\text{ V}$, $I_S = 5\text{ A}$	3.7	5.0	6.5	$\text{m}\Omega$
		$V_{GS} = 8\text{ V}$, $I_S = 5\text{ A}$	4.0	5.3	8.4	$\text{m}\Omega$
		$V_{GS} = 4.5\text{ V}$, $I_S = 5\text{ A}$	5.5	7.3	13	$\text{m}\Omega$
Turn-ON Delay Time	$t_{d(on)}$	$V_{SS} = 15\text{ V}$, $V_{GS} = 10\text{ V}$ $I_S = 5\text{ A}$, $R_g = 5\text{ k}\Omega$ Switching Test Circuit		2.7		μs
Rise Time	t_r			2.0		μs
Turn-OFF Delay Time	$t_{d(off)}$			26		μs
Fall Time	t_f			5.7		μs
Total Gate Charge	Q_g	$V_{SS} = 15\text{ V}$, $V_{GS} = 4.5\text{ V}$ $I_S = 5\text{ A}$		18		nC
Forward Source to Source Voltage	$V_{F(S-S)}$	$I_S = 5\text{ A}$, $V_{GS} = 0\text{ V}$, Power Time = 1ms		0.75	1.2	V

2. 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.

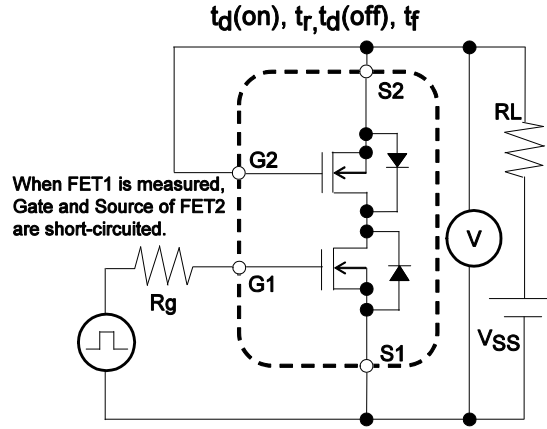


Figure 1. Switching Test Circuit

TYPICAL CHARACTERISTICS

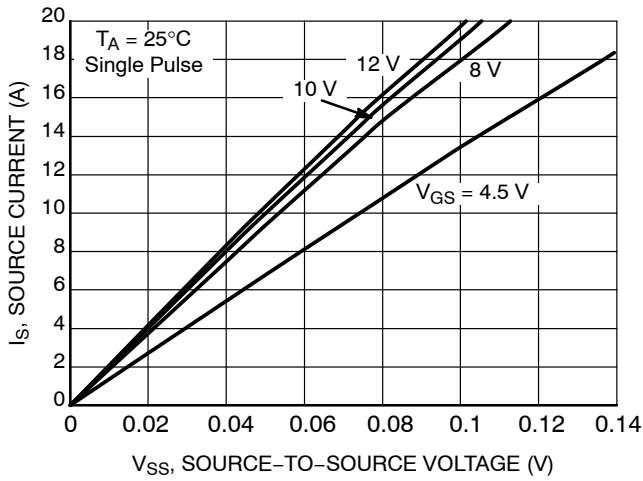


Figure 2. On-Region Characteristics

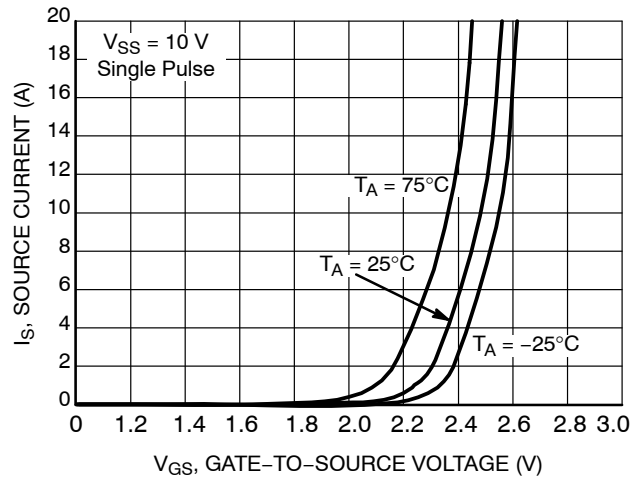


Figure 3. Transfer Characteristics

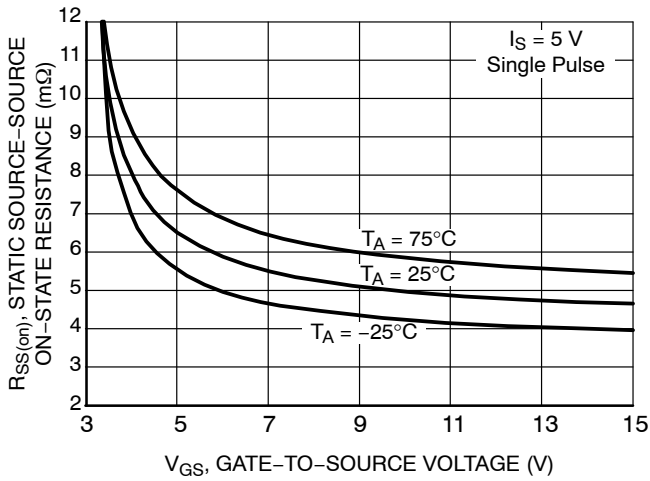


Figure 4. On-Resistance vs. Gate-to-Source Voltage

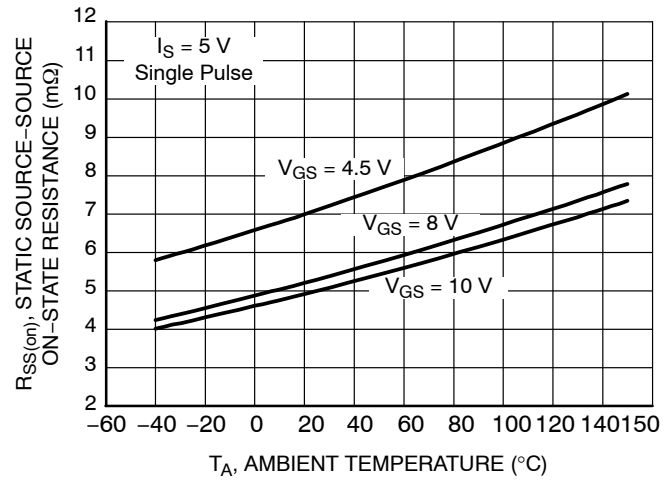


Figure 5. On-Resistance vs. Temperature

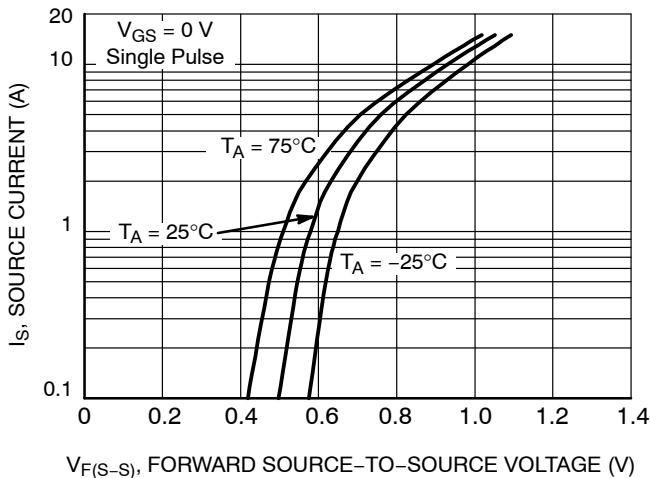


Figure 6. Forward Source-to-Source Voltage vs. Current

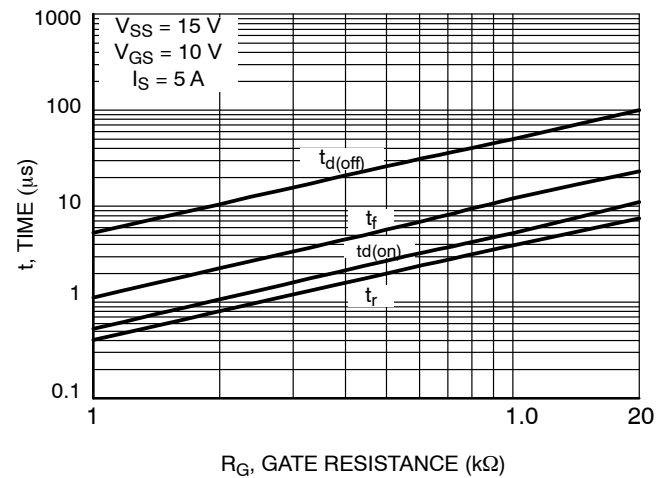


Figure 7. Switching Time vs. Gate Resistance

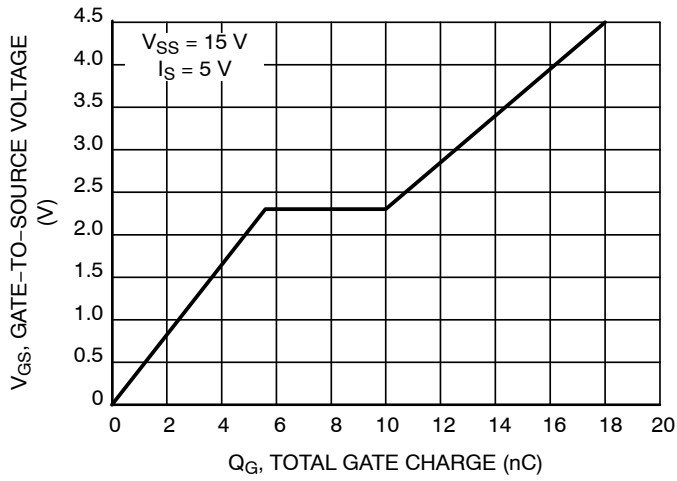


Figure 8. Gate-to-Source Voltage vs. Total Charge

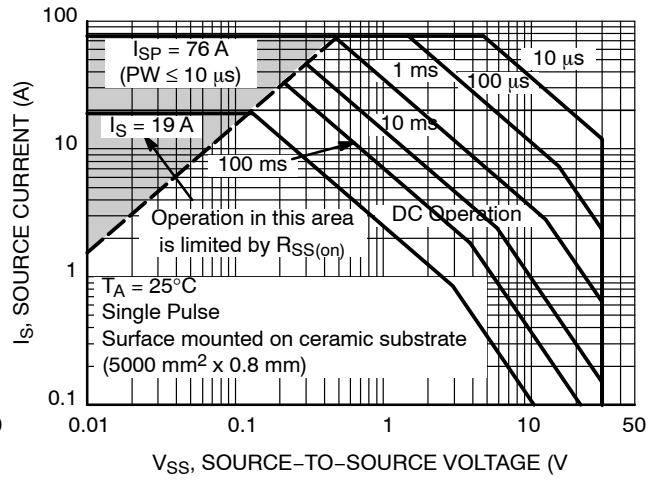


Figure 9. Safe Operating Area

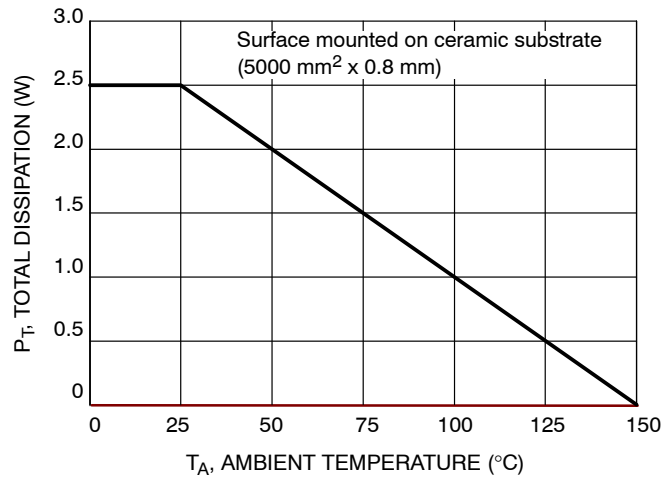


Figure 10. Total Dissipation vs. Temperature

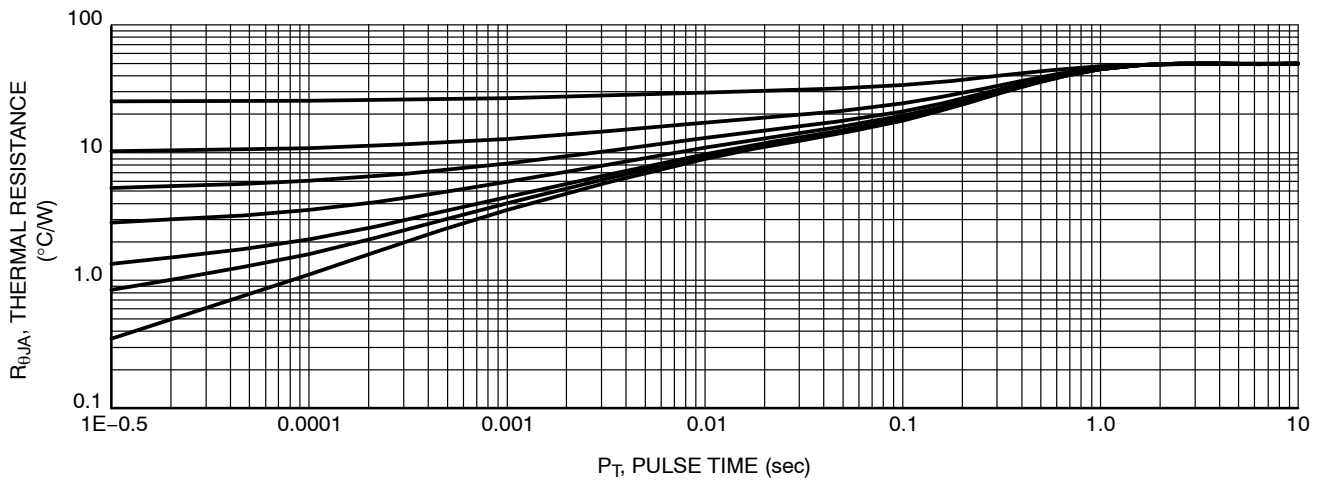


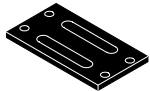
Figure 11. Thermal Response

EFC4C012NL

ORDERING INFORMATION

Device	Marking	Package	Shipping (Qty / Packing) [†]
EFC4C012NLTDG	NP	WLCSP6 3.5x1.9x0.21 (Pb-Free / Halogen Free)	5000 / Tape & Reel

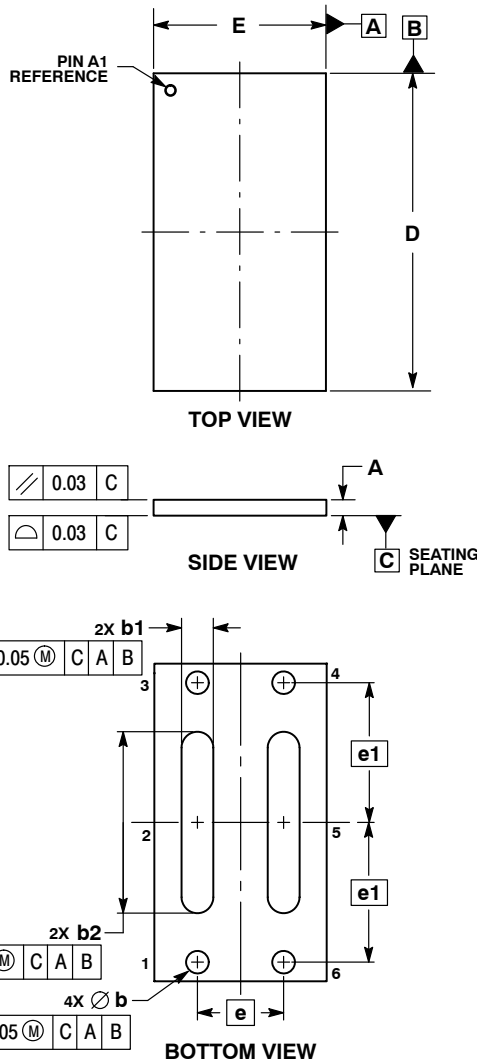
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



SCALE 4:1

WLCSP6 3.5x1.9x0.21
CASE 567SZ
ISSUE A

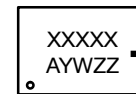
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NOTES:

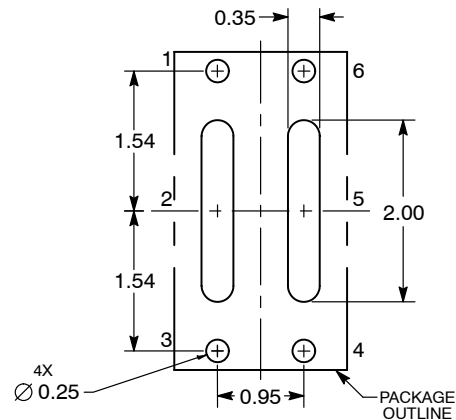
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.19	0.21	0.23
b	0.22	0.25	0.28
b1	0.32	0.35	0.38
b2	1.97	2.00	2.03
D	3.47	3.50	3.53
E	1.87	1.90	1.93
e	0.95 BSC		
e1	1.54 BSC		

GENERIC MARKING DIAGRAM*


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*


DIMENSIONS: MILLIMETERS

*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 3.5x1.9x0.21	PAGE 1 OF 1

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