

# MOSFET – Power, Dual, N-Channel, for 3-Cells Lithium-ion Battery Protection, WLCSP8

**30 V, 2.6 mΩ, 30 A**



**ON Semiconductor®**

[www.onsemi.com](http://www.onsemi.com)

## EFC4C002NL

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 Drone or 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	$V_{GSS}$	$\pm 20$	V
Source Current (DC)	$I_S$	30	A
Source Current (Pulse) $PW \leq 10 \mu\text{s}$ , Duty Cycle $\leq 1\%$	$I_{SP}$	120	A
Total Dissipation (Note 1)	$P_T$	2.6	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.

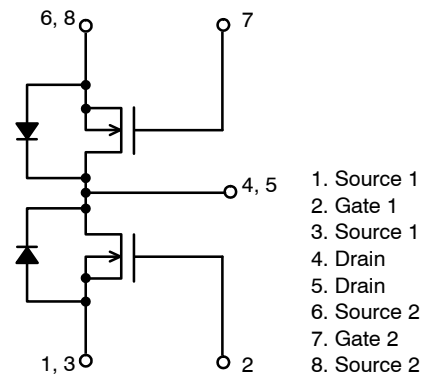
### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction to Ambient (Note 1)	$R_{\theta JA}$	48	$^\circ\text{C/W}$

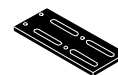
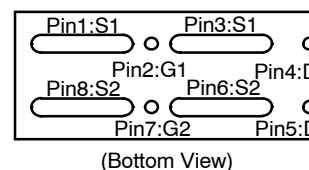
1. Surface mounted on ceramic substrate ( $5000 \text{ mm}^2 \times 0.8 \text{ mm}$ ).

$V_{SSS}$	$R_{SS(on)}$ Max	$I_S$ Max
30 V	2.6 mΩ @ 10 V	30 A
	3.3 mΩ @ 8 V	
	5.1 mΩ @ 4.5 V	

### ELECTRICAL CONNECTION N-Channel

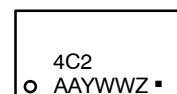


### PIN ASSIGNMENT



**WLCSP8  
CASE 567MC**

### MARKING DIAGRAM



4C2 = Specific Device Code  
AA = Assembly Location  
Y = Year  
WW = Work Week  
Z = Lot Traceability  
▪ = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# EFC4C002NL

## ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Source to Source Breakdown Voltage	$V_{(BR)SSS}$	$I_S = 1\text{ mA}, V_{GS} = 0\text{ V}$ Test Circuit 1	30			V
Zero-Gate Voltage Source Current	$I_{SSS}$	$V_{SS} = 24\text{ V}, V_{GS} = 0\text{ V}$ Test Circuit 1			1	$\mu\text{A}$
Gate to Source Leakage Current	$I_{GSS}$	$V_{GS} = 20\text{ V}, V_{SS} = 0\text{ V}$ Test Circuit 2			200	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{SS} = 10\text{ V}, I_S = 1\text{ mA}$ Test Circuit 3	1.3		2.2	V
Forward Transconductance	$g_{FS}$	$V_{SS} = 10\text{ V}, I_S = 10\text{ A}$ Test Circuit 4		16		S
Static Source to Source On-State Resistance	$R_{SS(on)}$	$V_{GS} = 10\text{ V}, I_S = 10\text{ A}$ Test Circuit 5	1.5	2.0	2.6	$\text{m}\Omega$
		$V_{GS} = 8\text{ V}, I_S = 10\text{ A}$ Test Circuit 5	1.6	2.1	3.3	$\text{m}\Omega$
		$V_{GS} = 4.5\text{ V}, I_S = 10\text{ A}$ Test Circuit 5	2.2	2.9	5.1	$\text{m}\Omega$
Static Drain to Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_S = 1\text{ A}$		10		$\text{m}\Omega$
Gate Resistance	$R_G$			3		$\Omega$
Turn-ON Delay Time	$t_d(on)$	$V_{SS} = 15\text{ V}, V_{GS} = 10\text{ V}$ $I_S = 10\text{ A}$ Test Circuit 6		40		ns
Rise Time	$t_r$			750		ns
Turn-OFF Delay Time	$t_d(off)$			280		ns
Fall Time	$t_f$			105		ns
Input Capacitance	$C_{iss}$	$V_{SS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		6.200		pF
Total Gate Charge	$Q_g$	$V_{SS} = 15\text{ V}, V_{GS} = 4.5\text{ V}, I_S = 15\text{ A}$ Test Circuit 7		45		nC
Forward Source to Source Voltage	$V_{F(S-S)}$	$I_S = 10\text{ A}, V_{GS} = 0\text{ V}$ Test Circuit 8		0.75	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.

Test circuits are example of measuring FET1 side.

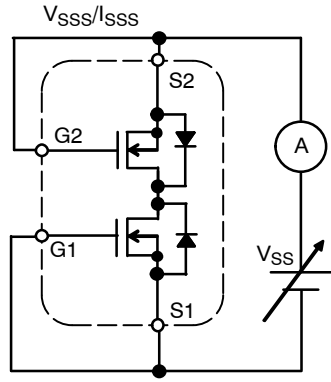


Figure 1. Test Circuit 1

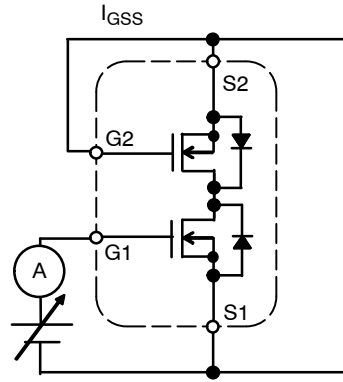
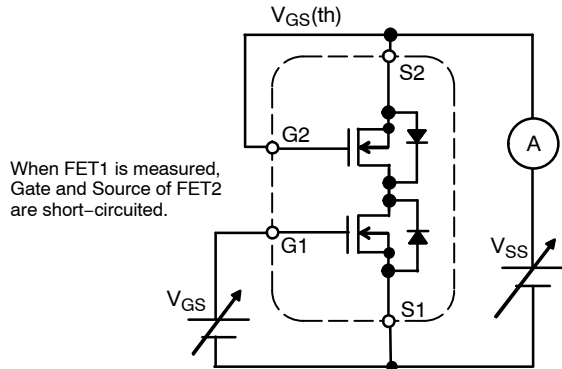


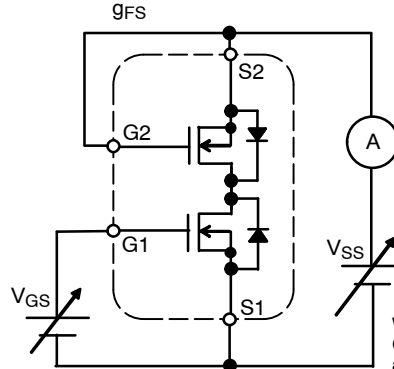
Figure 2. Test Circuit 2

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



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

Figure 3. Test Circuit 3



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

Figure 4. Test Circuit 4

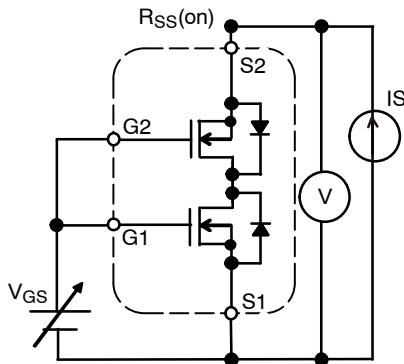
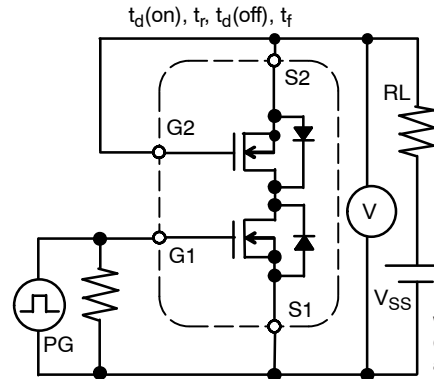
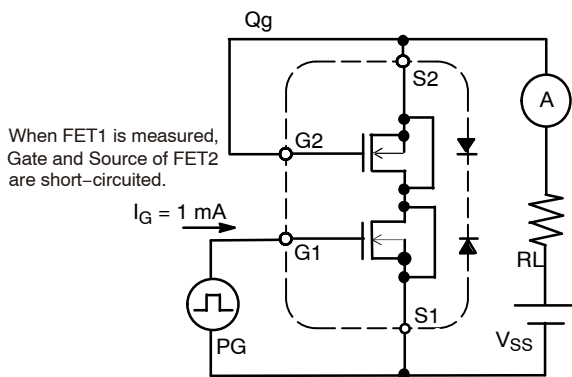


Figure 5. Test Circuit 5



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

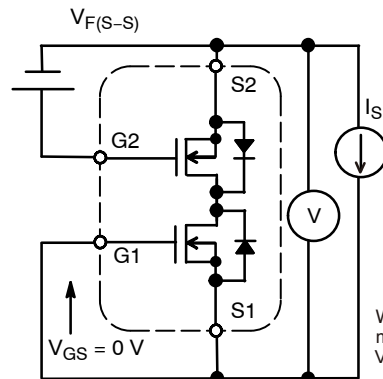
Figure 6. Test Circuit 6



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

$I_G = 1 \text{ mA}$

Figure 7. Test Circuit 7



When FET1 is measured, +10 V is added to  $V_{GS}$  of FET2.

Figure 8. Test Circuit 8

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

TYPICAL CHARACTERISTICS

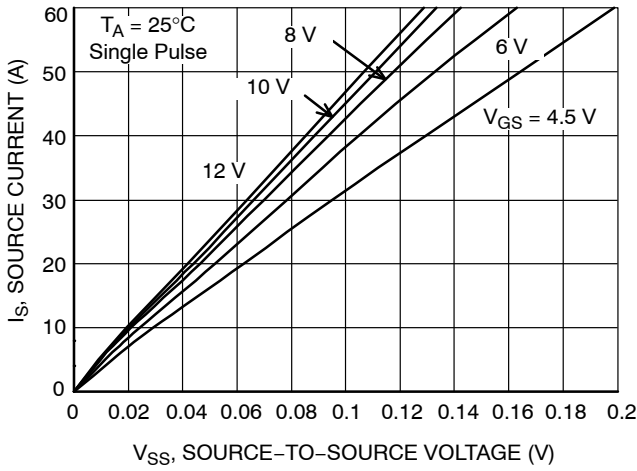


Figure 9. On-Region Characteristics

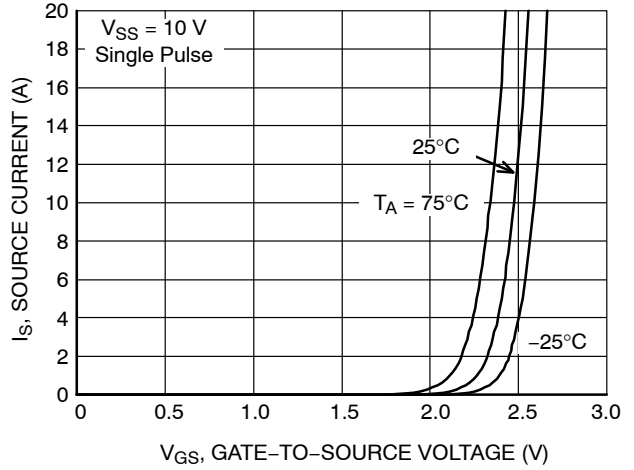


Figure 10. Transfer Characteristics

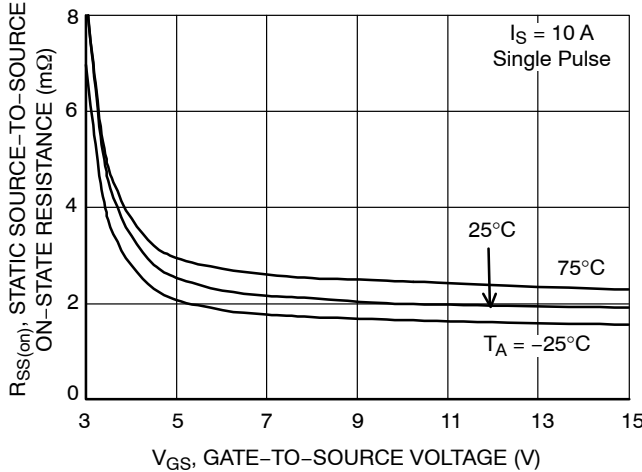


Figure 11. On-Resistance vs. Gate-to-Source Voltage

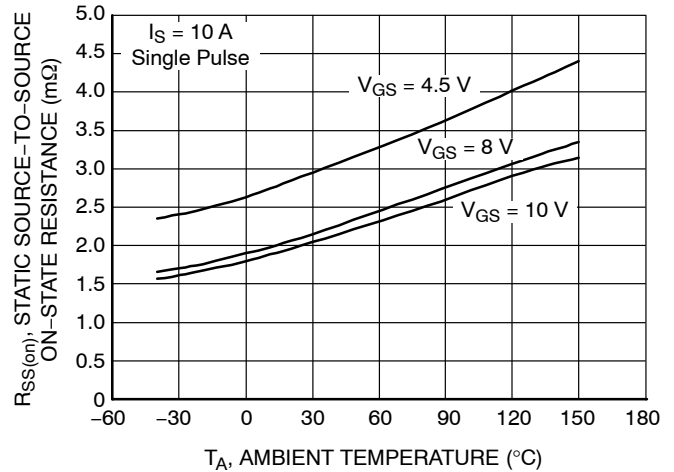


Figure 12. On-Resistance vs. Temperature

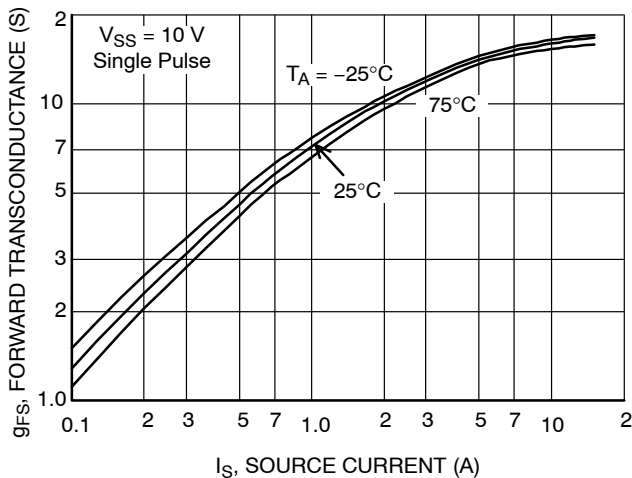


Figure 13. Forward Transconductance vs. Current

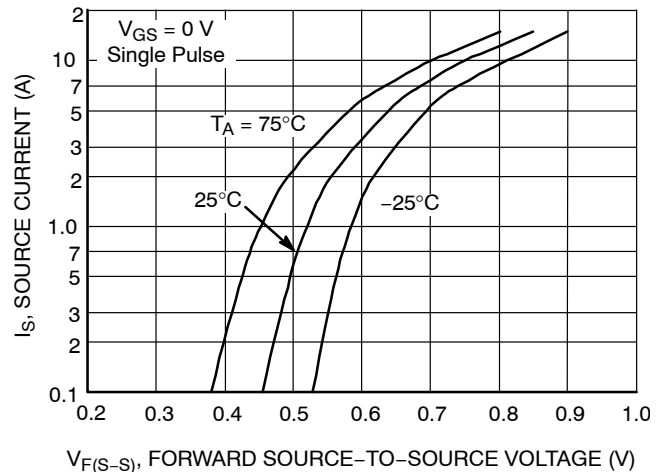


Figure 14. Forward Source-to-Source Voltage vs. Current

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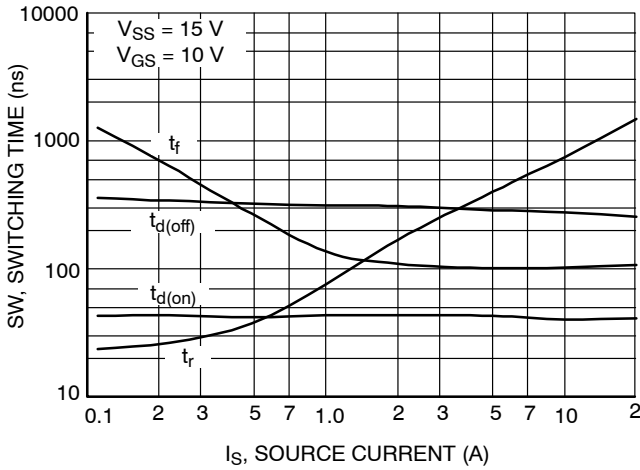


Figure 15. Switching Time vs. Current

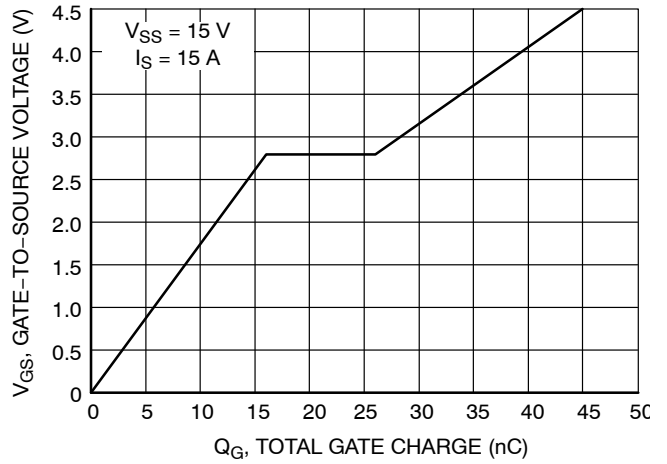


Figure 16. Gate-to-Source Voltage vs. Total Gate Charge

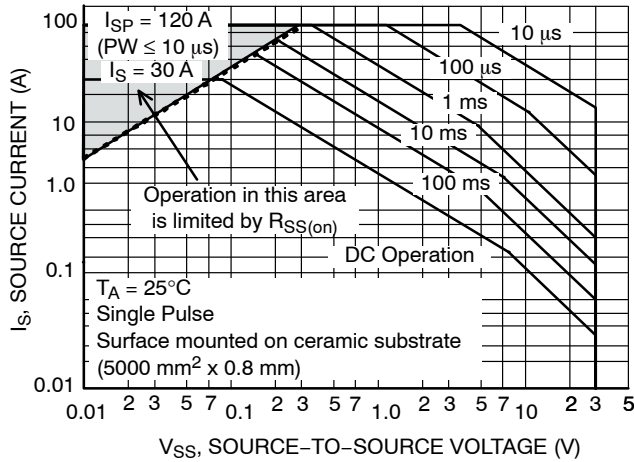


Figure 17. Safe Operating Area

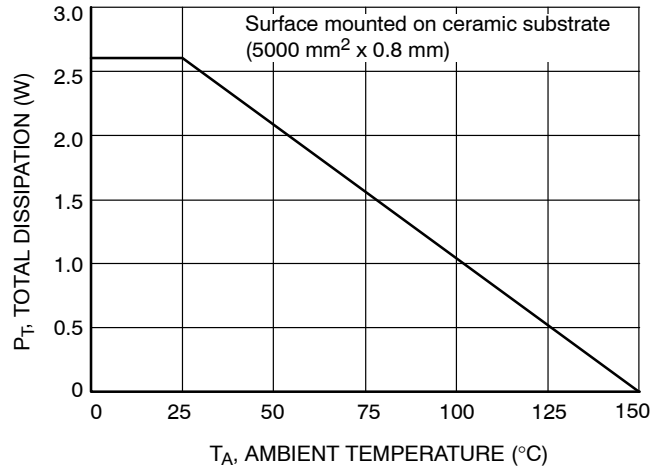


Figure 18. Total Dissipation vs. Temperature

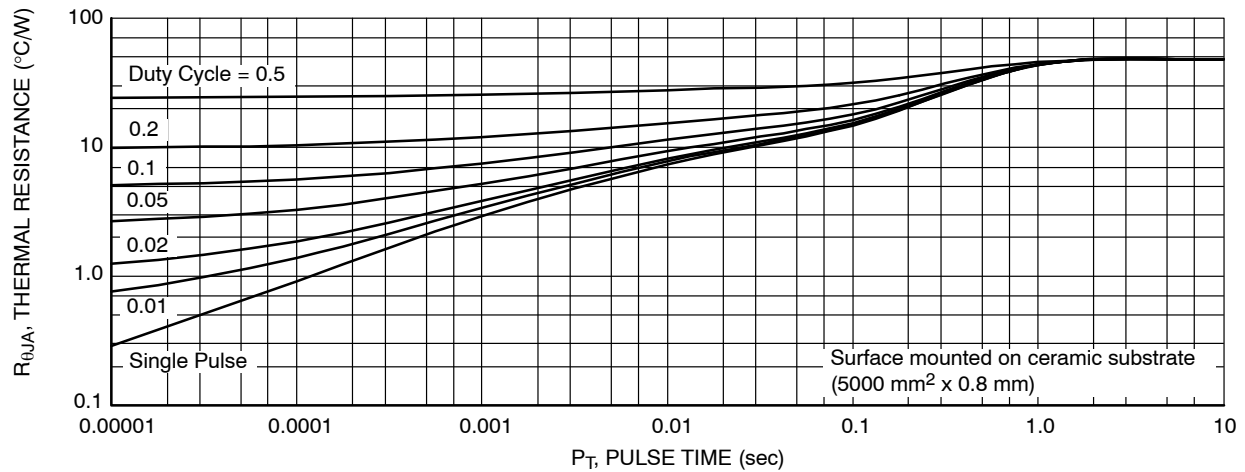


Figure 19. Thermal Response

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## ORDERING INFORMATION

Device	Marking	Package	Shipping (Qty / Packing) <sup>†</sup>
EFC4C002NLTDG	NP	WLCSP8 6.00x2.50 (Pb-Free / Halogen Free)	5000 / 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.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

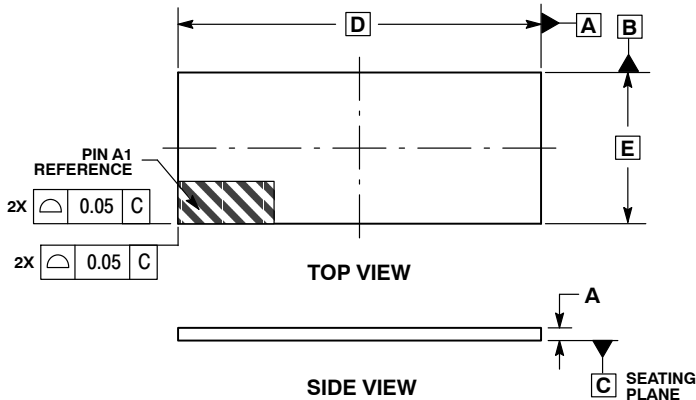
ON Semiconductor®



WLCSP8, 6.00x2.50 / EFCP6025-8EGJ-021  
CASE 567MC  
ISSUE O

SCALE 2:1

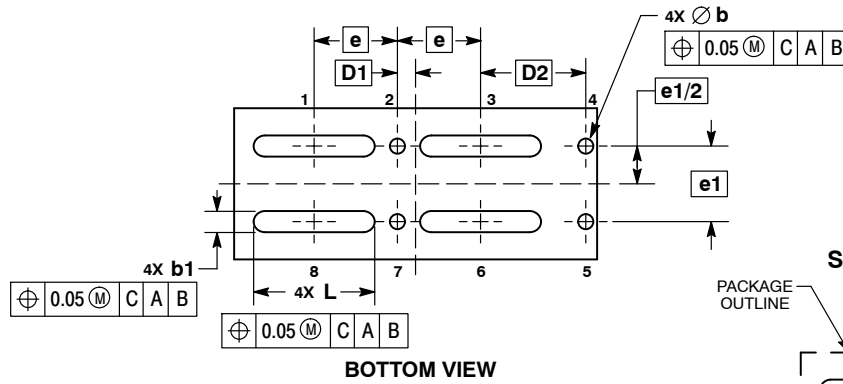
DATE 22 JUL 2015



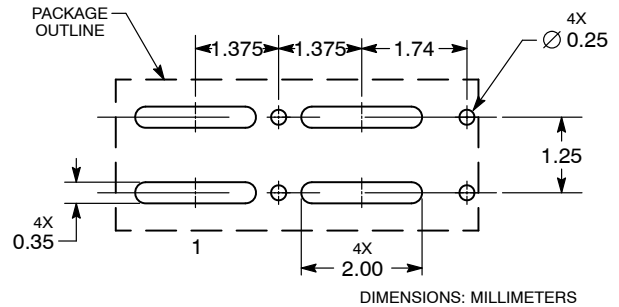
NOTES:

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

DIM	MILLIMETERS	
	MIN	MAX
A	0.19	0.23
b	0.22	0.28
b1	0.32	0.38
D	5.95	6.05
D1	0.305 BSC	
D2	1.740 BSC	
E	2.45	2.55
e	1.375 BSC	
e1	1.25 BSC	
L	1.97	2.03



**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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<b>DESCRIPTION:</b>	<b>WLCSP8, 6.00X2.50 / EFCP6025-8EGJ-021</b>	<b>PAGE 1 OF 1</b>

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