

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

12 V, 3.2 mΩ, 27 A

## EFC6611R

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
- Pb-Free, Halogen Free and RoHS Compliance

### Applications

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

### SPECIFICATIONS

#### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

Parameter	Symbol	Value	Unit
Source to Source Voltage	V <sub>SSS</sub>	12	V
Gate to Source Voltage	V <sub>GSS</sub>	±8	V
Source Current (DC)	I <sub>S</sub>	27	A
Source Current (Pulse) PW ≤ 100 μs, Duty Cycle ≤ 1%	I <sub>SP</sub>	100	A
Total Dissipation Surface mounted on ceramic substrate (5000 mm <sup>2</sup> × 0.8 mm)	P <sub>T</sub>	2.5	W
Junction Temperature	T <sub>j</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

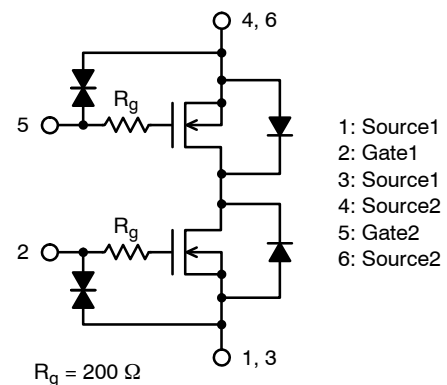
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

#### THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction to Ambient Surface mounted on ceramic substrate (5000 mm <sup>2</sup> × 0.8 mm)	R <sub>θJA</sub>	50	°C/W

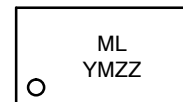
V <sub>SSS</sub>	R <sub>SS(on)</sub> MAX	I <sub>S</sub> MAX
12 V	3.2 mΩ @ 4.5 V	27 A
	3.2 mΩ @ 4.0 V	
	3.2 mΩ @ 3.8 V	
	4.4 mΩ @ 3.1 V	
	6.3 mΩ @ 2.5 V	

### ELECTRICAL CONNECTION N-Channel



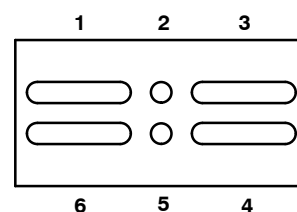
### MARKING DIAGRAM

CSP6, 1.77x3.54/  
EFCP3517-6DGH-020  
CASE 568AL



ML = Device Code  
Y = Year of Production  
M = Month of Assembly Operation  
ZZ = Assembly Lot Number

### PIN CONNECTIONS



1: Source1      4: Source2  
2: Gate1        5: Gate2  
3: Source1      6: Source2

### ORDERING INFORMATION

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

# EFC6611R

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Source to Source Breakdown Voltage	V <sub>(BR)SSS</sub>	I <sub>S</sub> = 1 mA, V <sub>GS</sub> = 0 V (Test Circuit 1)	12	–	–	V
Zero-Gate Voltage Source Current	I <sub>SSS</sub>	V <sub>SS</sub> = 10 V, V <sub>GS</sub> = 0 V (Test Circuit 1)	–	–	1	μA
Gate to Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±8 V, V <sub>SS</sub> = 0 V (Test Circuit 2)	–	–	±1	μA
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>SS</sub> = 6 V, I <sub>S</sub> = 1 mA (Test Circuit 3)	0.5	–	1.3	V
Forward Transconductance	g <sub>FS</sub>	V <sub>SS</sub> = 6 V, I <sub>S</sub> = 3 A (Test Circuit 4)	–	19	–	S
Static Source to Source On-State Resistance	R <sub>SS(on)1</sub>	I <sub>S</sub> = 5 A, V <sub>GS</sub> = 4.5 V (Test Circuit 5)	1.8	2.3	3.2	mΩ
	R <sub>SS(on)2</sub>	I <sub>S</sub> = 5 A, V <sub>GS</sub> = 4.0 V (Test Circuit 5)	1.9	2.4	3.2	mΩ
	R <sub>SS(on)3</sub>	I <sub>S</sub> = 5 A, V <sub>GS</sub> = 3.8 V (Test Circuit 5)	2.0	2.6	3.2	mΩ
	R <sub>SS(on)4</sub>	I <sub>S</sub> = 5 A, V <sub>GS</sub> = 3.1 V (Test Circuit 5)	2.1	3.3	4.4	mΩ
	R <sub>SS(on)5</sub>	I <sub>S</sub> = 5 A, V <sub>GS</sub> = 2.5 V (Test Circuit 5)	2.7	4.0	6.3	mΩ
Turn-ON Delay Time	t <sub>d(on)</sub>	V <sub>SS</sub> = 6 V, V <sub>GS</sub> = 4.5 V, I <sub>S</sub> = 3 A (Test Circuit 6)	–	80	–	ns
Rise Time	t <sub>r</sub>		–	570	–	ns
Turn-OFF Delay Time	t <sub>d(off)</sub>		–	38,000	–	ns
Fall Time	t <sub>f</sub>		–	17,700	–	ns
Total Gate Charge	Q <sub>g</sub>	V <sub>SS</sub> = 6 V, V <sub>GS</sub> = 4.5 V, I <sub>S</sub> = 27 A (Test Circuit 7)	–	100	–	nC
Forward Source to Source Voltage	V <sub>F(S-S)</sub>	I <sub>S</sub> = 3 A, V <sub>GS</sub> = 0 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.

## ORDERING INFORMATION

Device	Marking	Package	Shipping (Qty / Packing) <sup>†</sup>
EFC6611R-TF	ML	CSP6, 1.77 × 3.54 EFCP3517-6DGH-020 (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](#).

TEST CIRCUITS ARE EXAMPLE OF MEASURING FET1 SIDE

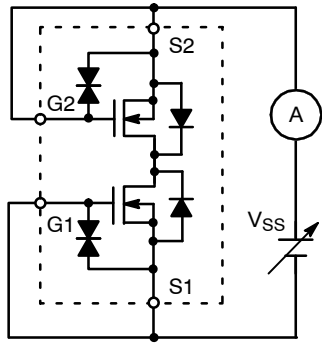


Figure 1. Test Circuit 1 -  $V_{SS}/I_{SS}$

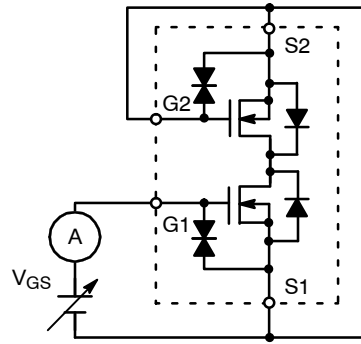


Figure 2. Test Circuit 2 -  $I_{GSS}$

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

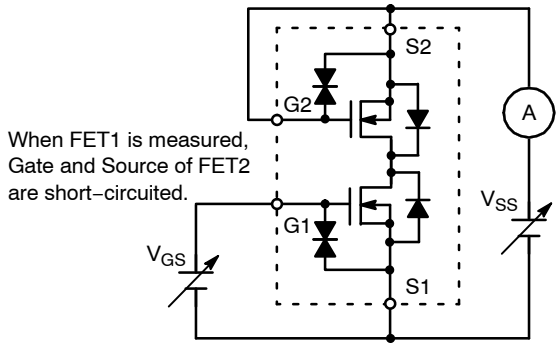


Figure 3. Test Circuit 3 -  $V_{GS(th)}$

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

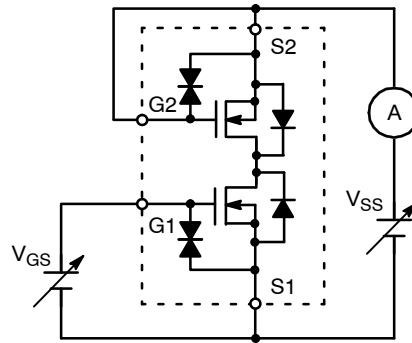


Figure 4. Test Circuit 4 -  $g_{FS}$

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

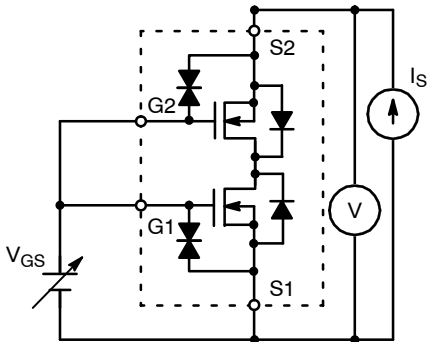


Figure 5. Test Circuit 5 -  $R_{SS(on)}$

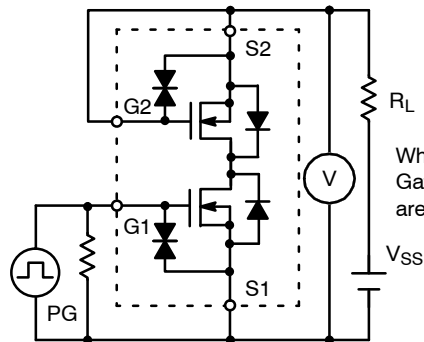


Figure 6. Test Circuit 6 -  $t_{d(on)}$ ,  $t_r$ ,  $t_{d(off)}$ ,  $t_f$

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

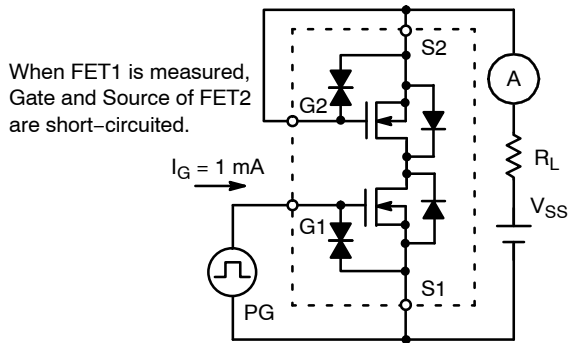


Figure 7. Test Circuit 7 -  $Q_g$

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

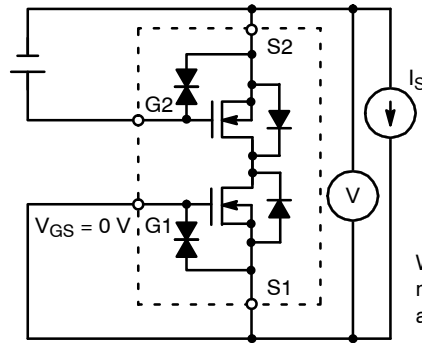


Figure 8. Test Circuit 8 -  $V_{F(s-s)}$

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

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

TYPICAL CHARACTERISTICS

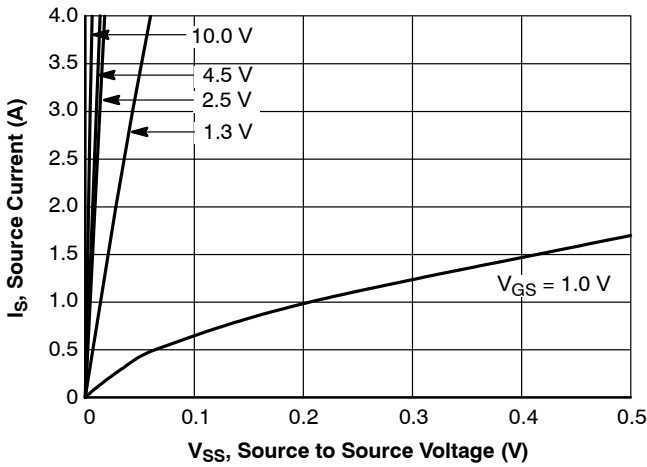


Figure 9.  $I_S - V_{SS}$

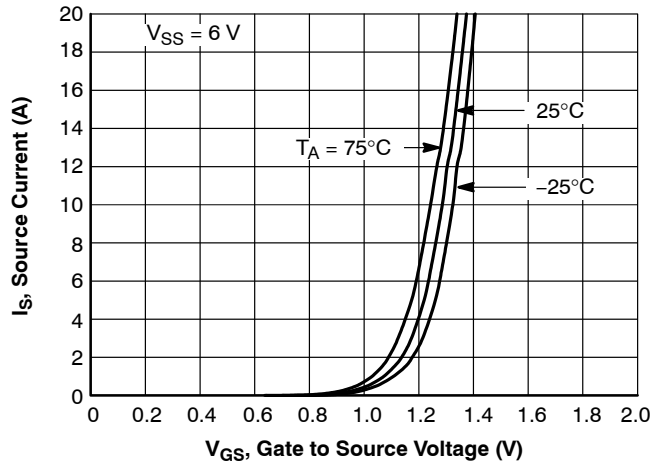


Figure 10.  $I_S - V_{GS(th)}$

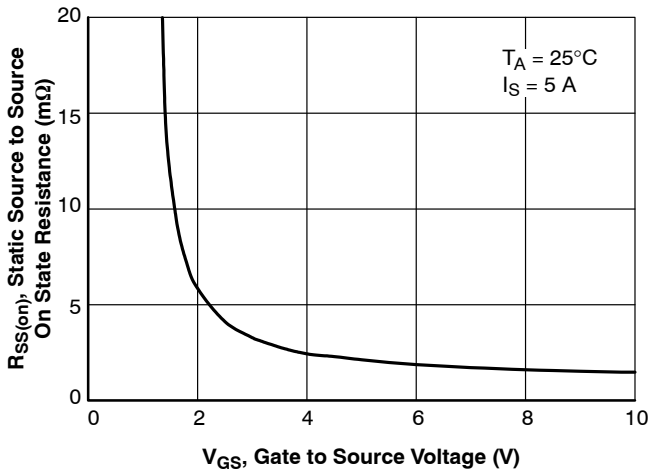


Figure 11.  $R_{SS(on)} - V_{GS}$

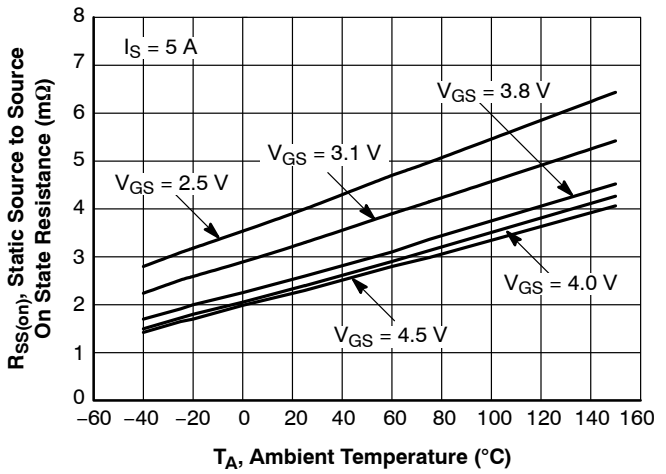


Figure 12.  $R_{SS(on)} - T_A$

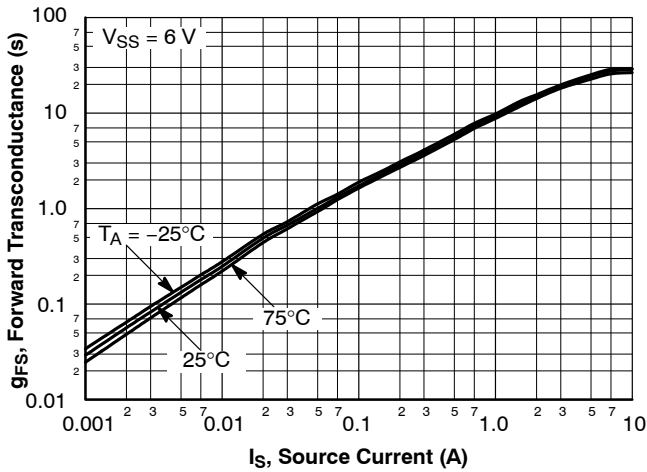


Figure 13.  $g_{FS} - I_S$

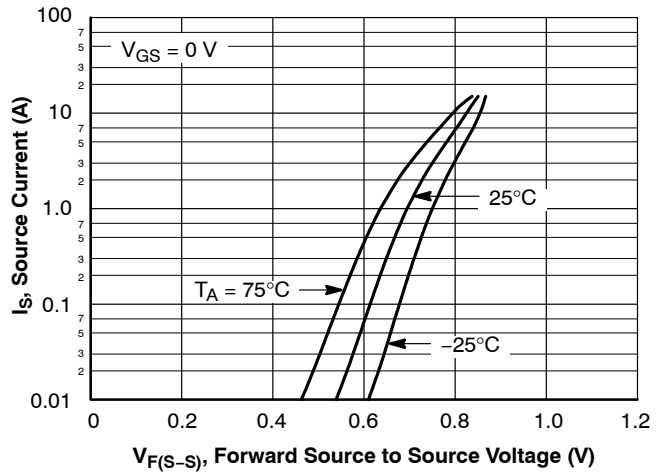


Figure 14.  $I_S - V_{F(S-S)}$

TYPICAL CHARACTERISTICS (Continued)

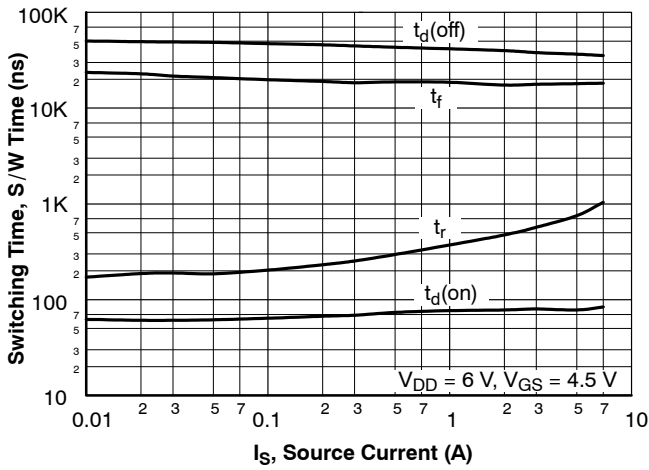


Figure 15. S/W Time –  $I_S$

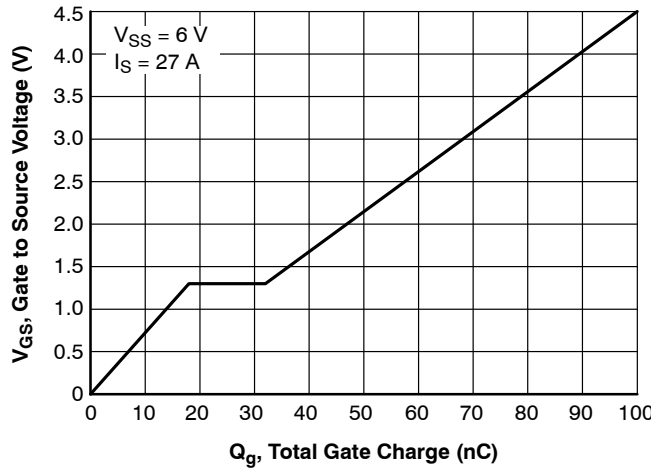


Figure 16.  $V_{GS} - Q_g$

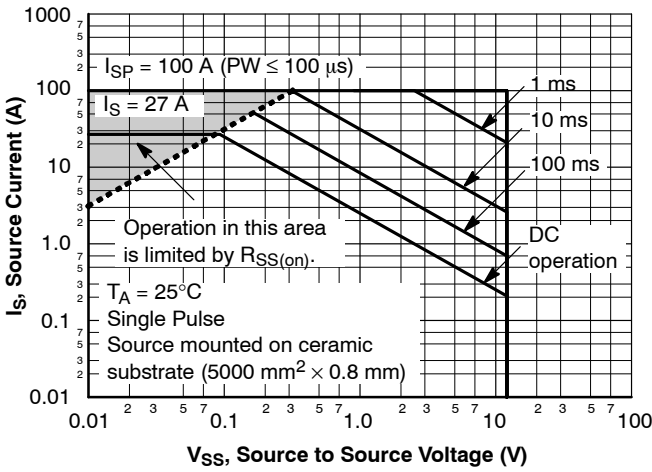


Figure 17. SOA

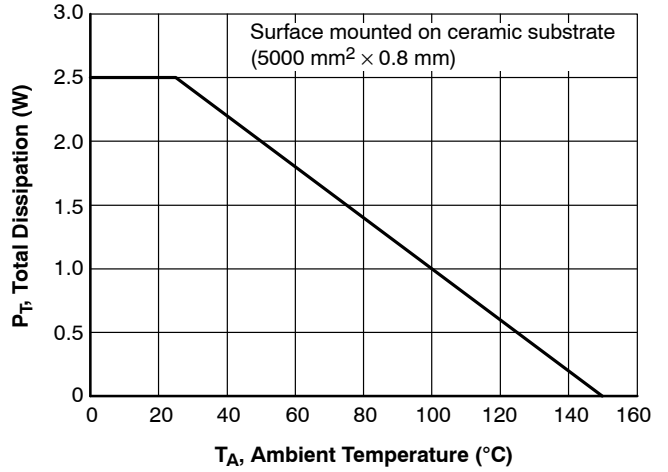


Figure 18.  $P_T - T_A$

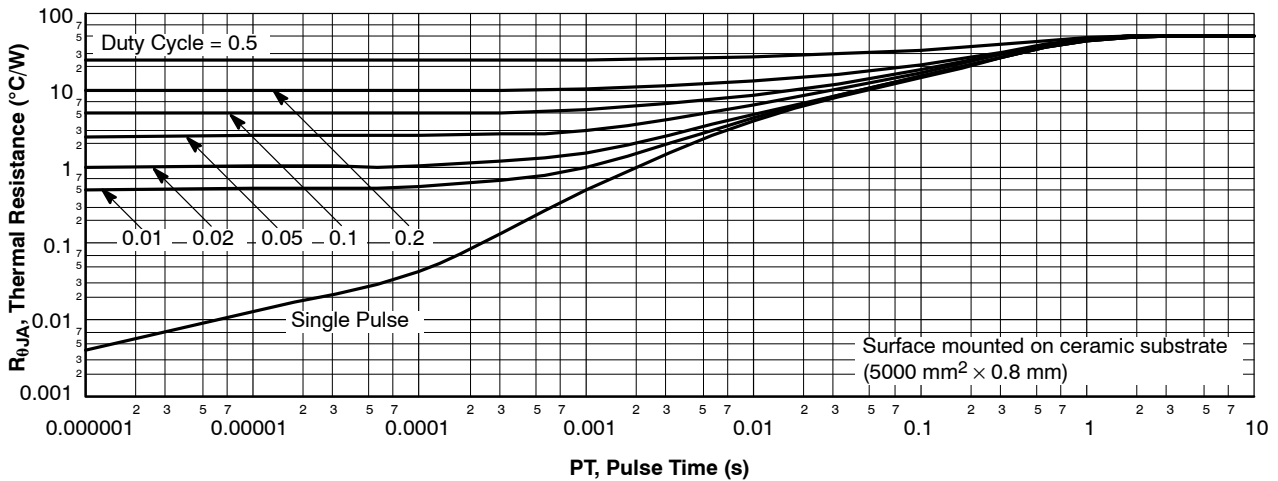
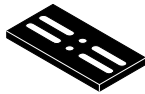


Figure 19.  $R_{\theta JA} - \text{Pulse Time}$

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

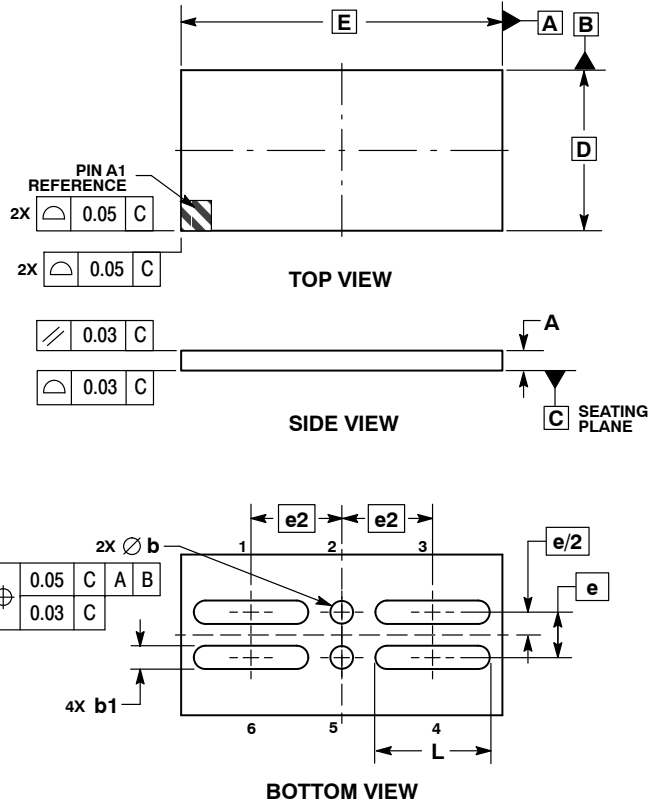
ON Semiconductor®



SCALE 4:1

CSP6, 1.77x3.54 / EFCP3517-6DGH-020  
CASE 568AL  
ISSUE O

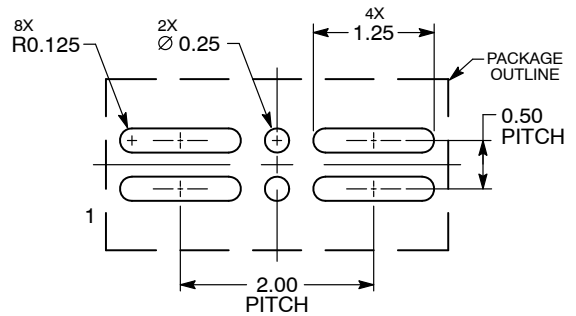
DATE 23 OCT 2013



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

DIM	MILLIMETERS	
	MIN	MAX
A	---	0.22
b	0.22	0.28
b1	0.22	0.28
D	1.77 BSC	
E	3.54 BSC	
e	0.50 BSC	
e2	1.00 BSC	
L	1.22	1.28

### 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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