

EFC6604R

Power MOSFET for 1-Cell Lithium-ion Battery Protection 12V, 9.0mΩ, 13A, Dual N-Channel



ON Semiconductor®

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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

- 2.5V drive
- 2kV 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 at $T_a = 25^\circ\text{C}$ (Note 1)

Parameter	Symbol	Value	Unit
Source to Source Voltage	V_{SSS}	12	V
Gate to Source Voltage	V_{GSS}	± 12	V
Source Current (DC)	I_S	13	A
Source Current (Pulse) $PW \leq 10\mu\text{s}$, duty cycle $\leq 1\%$	I_{SP}	60	A
Total Dissipation Surface mounted on ceramic substrate (5000mm ² × 0.8mm)	P_T	1.6	W
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	-55 to +150	°C

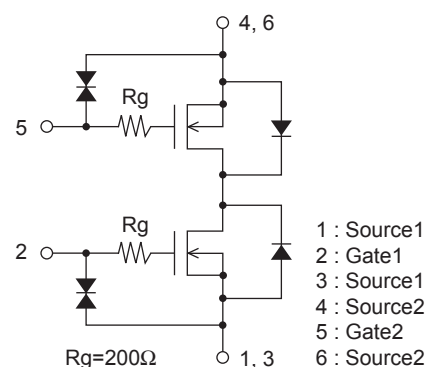
Note 1 : Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE RATINGS

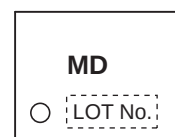
Parameter	Symbol	Value	Unit
Junction to Ambient Surface mounted on ceramic substrate (5000mm ² × 0.8mm)	$R_{\theta JA}$	78.1	°C/W

V_{SSS}	$R_{SS(on)}$ Max	I_S Max
12V	9.0mΩ @ 4.5V	13A
	9.7mΩ @ 4.0V	
	10.0mΩ @ 3.8V	
	12.7mΩ @ 3.1V	
	17.7mΩ @ 2.5V	

ELECTRICAL CONNECTION N-Channel



MARKING



ORDERING INFORMATION

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

EFC6604R

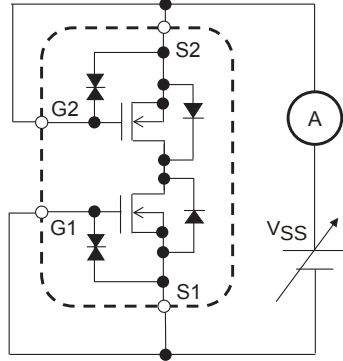
ELECTRICAL CHARACTERISTICS at Ta = 25°C (Note 2)

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Source to Source Breakdown Voltage	V(BR)SSS	IS=1mA, VGS=0V Test Circuit 1	12			V
Zero-Gate Voltage Source Current	ISS	VSS=10V, VGS=0V Test Circuit 1			1	μA
Gate to Source Leakage Current	IGSS	VGS=±8V, VSS=0V Test Circuit 2			±1.0	μA
Gate Threshold Voltage	VGS(th)	VSS=6V, IS=1mA Test Circuit 3	0.5		1.3	V
Forward Transconductance	gFS	VSS=6V, IS=3A Test Circuit 4		13.7		S
Static Source to Source On-State Resistance	RSS(on)1	IS=3A, VGS=4.5V Test Circuit 5	6.0	7.5	9.0	mΩ
	RSS(on)2	IS=3A, VGS=4.0V Test Circuit 5	6.4	8.1	9.7	mΩ
	RSS(on)3	IS=3A, VGS=3.8V Test Circuit 5	6.7	8.4	10.0	mΩ
	RSS(on)4	IS=3A, VGS=3.1V Test Circuit 5	7.8	9.8	12.7	mΩ
	RSS(on)5	IS=3A, VGS=2.5V Test Circuit 5	10.0	12.6	17.7	mΩ
Turn-ON Delay Time	td(on)	VSS=6V, VGS=4.5V, IS=3A Test Circuit 6		300		ns
Rise Time	tr			1200		ns
Turn-OFF Delay Time	td(off)			5200		ns
Fall Time	tf			3900		ns
Total Gate Charge	Qg	VSS=6V, VGS=4.5V, IS=13A Test Circuit 7		29		nC
Forward Source to Source Voltage	VF(S-S)	IS=3A, VGS=0V Test Circuit 8		0.75	1.2	V

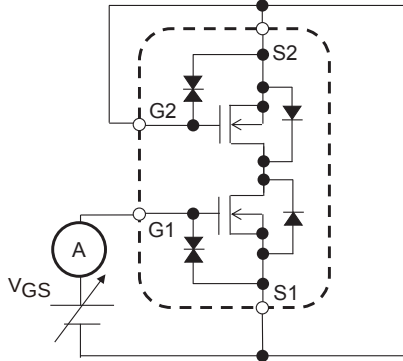
Note 2 : Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted.
Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

Test circuits are example of measuring FET1 side

Test Circuit 1
 V_{SSS} / I_{SSS}

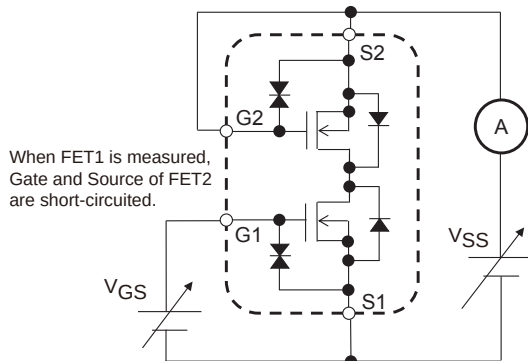


Test Circuit 2
 I_{GSS}



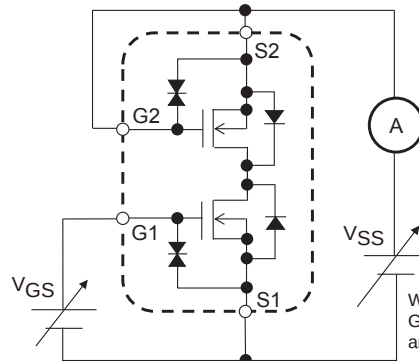
When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 3
 $V_{GS(th)}$



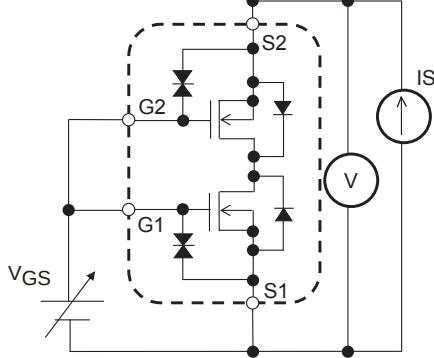
When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 4
 g_{FS}

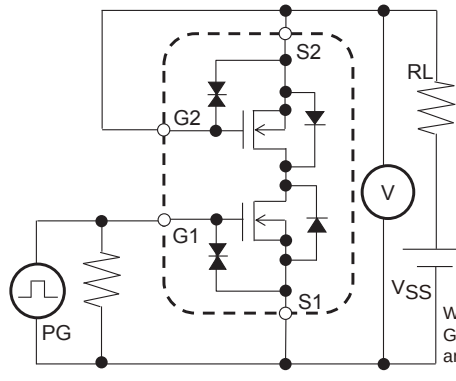


When FET1 is measured, Gate and Source of FET2 are short-circuited.

Test Circuit 5
 $R_{SS(on)}$

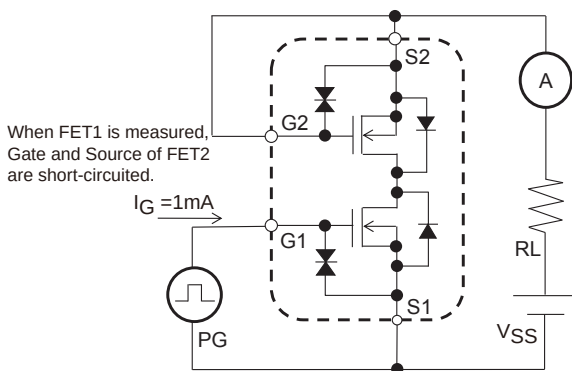


Test Circuit 6
 $t_{d(on)}$, t_r , $t_{d(off)}$, t_f



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

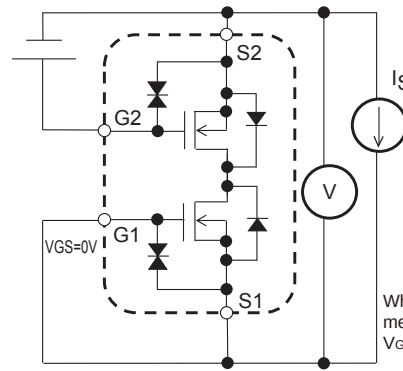
Test Circuit 7
 Q_g



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

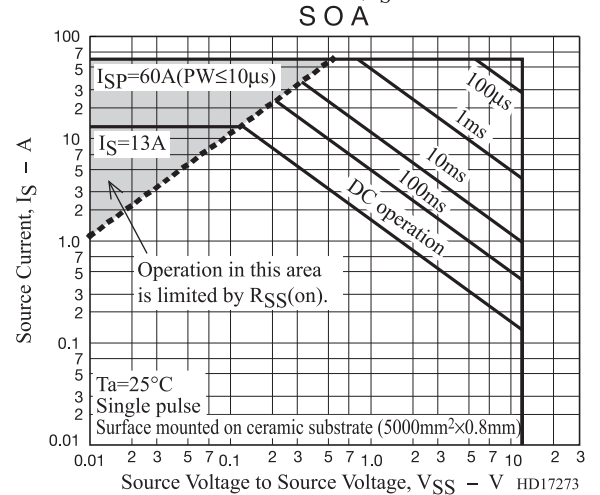
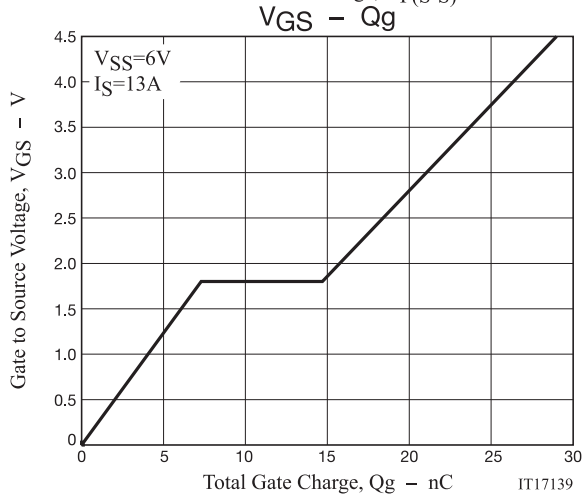
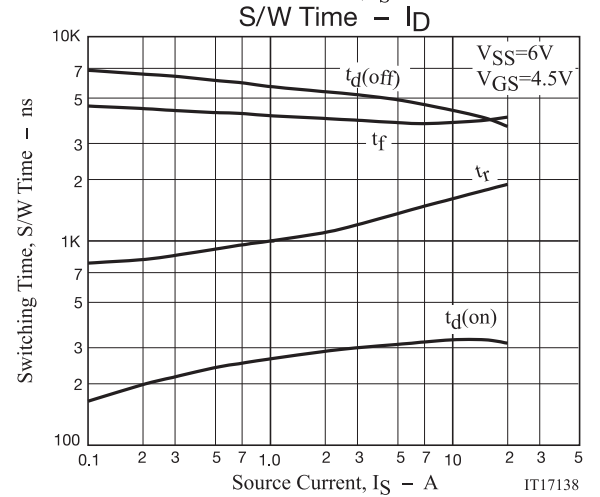
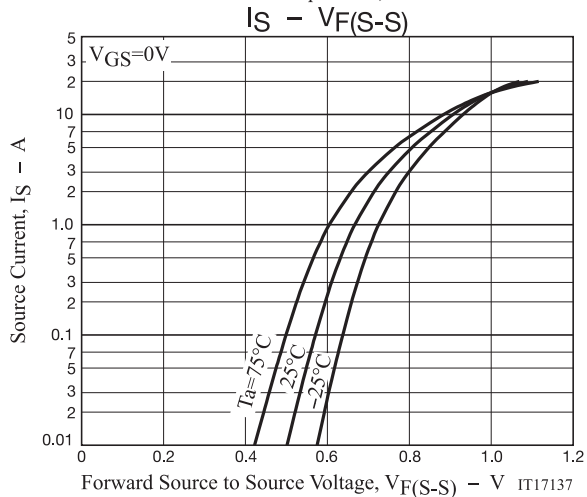
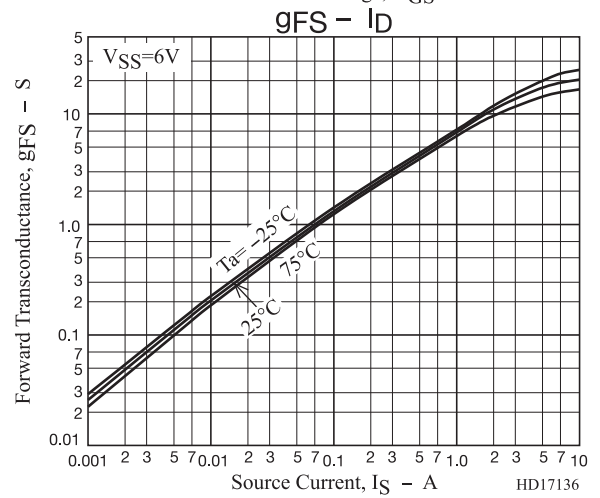
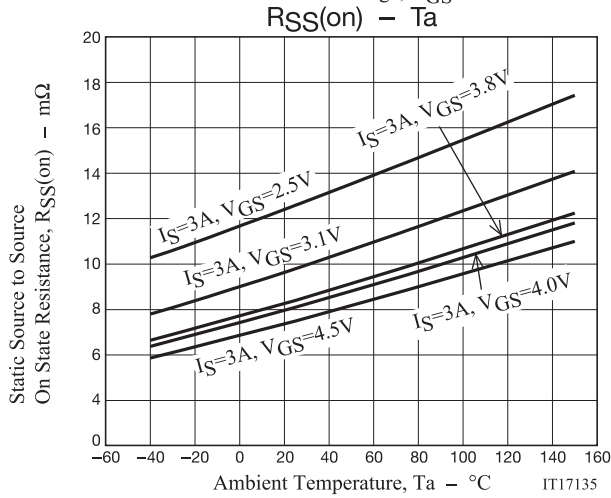
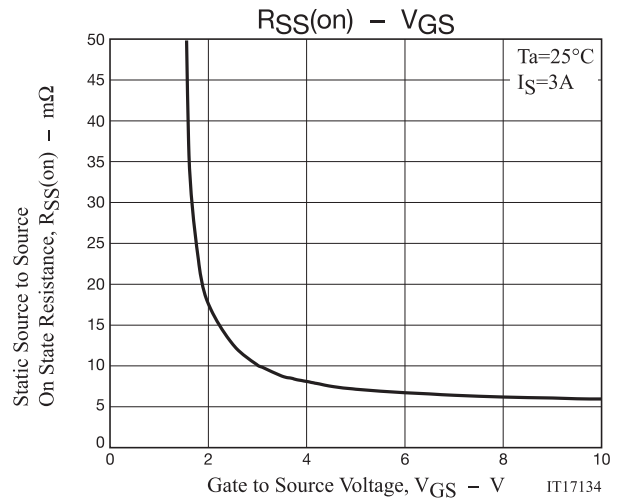
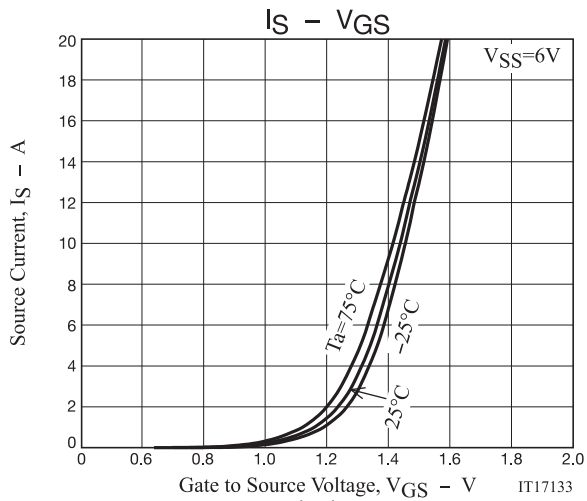
$I_G = 1mA$

Test Circuit 8
 $V_F(S-S)$

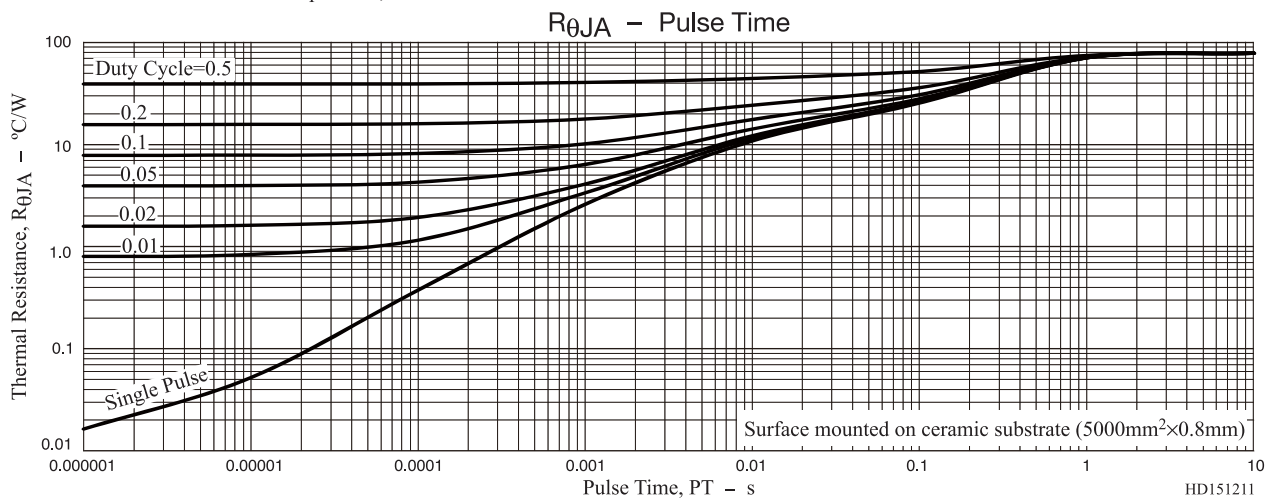
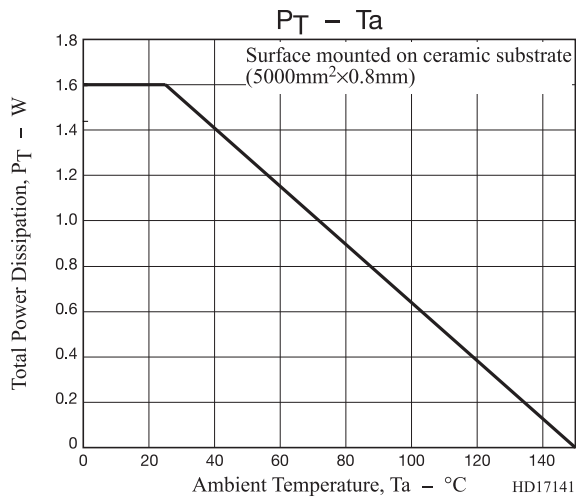


When FET1 is measured, +4.5V is added to V_{GS} of FET2.

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



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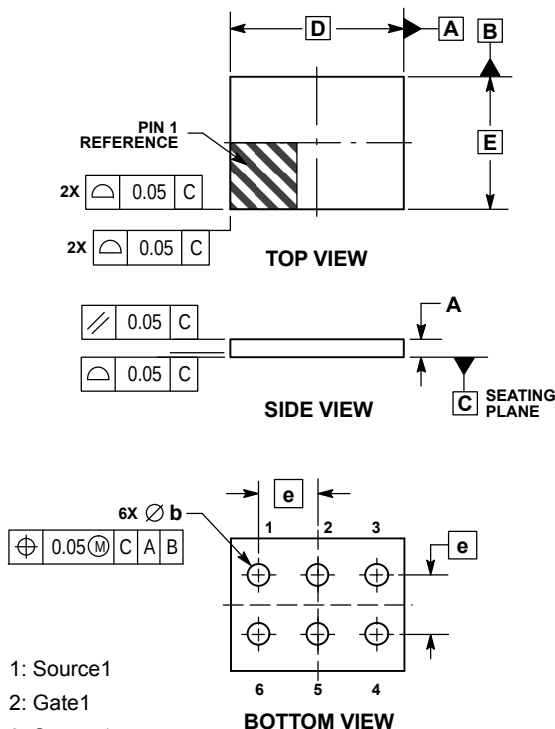


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PACKAGE DIMENSIONS

unit : mm

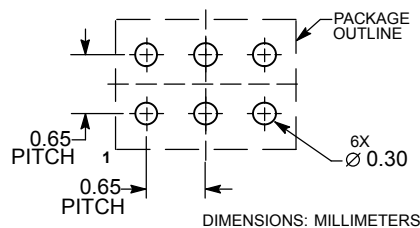
WLCSP6 1.91x1.46 / EFCP1915-6CE-020
CASE 614AC
ISSUE B



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

DIM	MILLIMETERS	
	MIN	MAX
A	0.18	0.22
b	0.27	0.33
D	1.91 BSC	
E	1.46 BSC	
e	0.65 BSC	

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.

ORDERING INFORMATION

Device	Marking	Package	Shipping (Qty / Packing)
EFC6604R-TR	MD	WLCSP6 1.91x1.46 / EFCP1915-6CE-020 (Pb-Free / Halogen Free)	5,000 / 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. http://www.onsemi.com/pub_link/Collateral/BRD8011-D.PDF

Note on usage : Since the EFC6604R 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.

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