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ECH8693R

Power MOSFET
for 1-2 Cells Lithium-ion Battery Protection
24 V, 7 mΩ, 14 A, Dual N-Channel

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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 1-2 cells Lithium-ion Battery applications.

Features

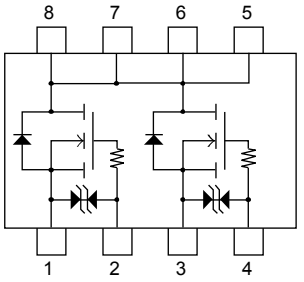
- Low On-Resistance
- 2.5 V drive
- Common-Drain Type
- ESD Diode-Protected Gate
- Built-in Gate Protection Resistor
- Pb-Free, Halogen Free and RoHS compliance

Typical Applications

- 1-2 cells Lithium-ion Battery Charging and Discharging Switch

V_{DSS}	R_{DS}(on) Max	I_D Max
24 V	7 mΩ @ 4.5 V	14 A
	7.5 mΩ @ 4.0 V	
	9.1 mΩ @ 3.1 V	
	10.5 mΩ @ 2.5 V	

ELECTRICAL CONNECTION
N-Channel



1 : Source1
2 : Gate1
3 : Source2
4 : Gate2
5 : Drain
6 : Drain
7 : Drain
8 : Drain

SPECIFICATIONS

ABSOLUTE MAXIMUM RATING at Ta = 25°C (Note 1)

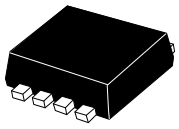
Parameter	Symbol	Value	Unit
Drain to Source Voltage	V_{DSS}	24	V
Gate to Source Voltage	V_{GSS}	±12.5	V
Drain Current (DC)	I_D	14	A
Drain Current (Pulse) PW ≤ 10 μs, duty cycle ≤ 1%	I_{DP}	60	A
Power Dissipation Surface mounted on ceramic substrate (900 mm^2 × 0.8 mm) 1 unit	P_D	1.4	W
Total Dissipation Surface mounted on ceramic substrate (900 mm^2 × 0.8 mm)	P_T	1.5	W
Junction Temperature	Tj	150	°C
Storage Temperature	Tstg	−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.

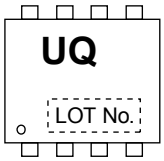
THERMAL RESISTANCE RATINGS

Parameter	Symbol	Value	Unit
Junction to Ambient Surface mounted on ceramic substrate (900 mm^2 × 0.8 mm) 1 unit	$R_{\theta JA}$	89.2	°C/W

MARKING



SOT-28FL / ECH8



ORDERING INFORMATION

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

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

Parameter	Symbol	Conditions	Value			Unit
			min	typ	max	
Drain to Source Breakdown Voltage	$V_{(BR)DSS}$	I_D = 1 mA, V_{GS} = 0 V	24			V
Zero-Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V			1	μA
Gate to Source Leakage Current	I_{GSS}	V_{GS} = ±8 V, V_{DS} = 0 V			±1	μA
Gate Threshold Voltage	$V_{GS}(th)$	V_{DS} = 10 V, I_D = 1 mA	0.5		1.3	V
Forward Transconductance	g_{FS}	V_{DS} = 10 V, I_D = 5 A		8		S
Static Drain to Source On-State Resistance	$R_{DS}(on)$	I_D = 5 A, V_{GS} = 4.5 V	4.4	5.6	7	mΩ
		I_D = 5 A, V_{GS} = 4.0 V	4.6	5.8	7.5	mΩ
		I_D = 5 A, V_{GS} = 3.1 V	5.2	6.5	9.1	mΩ
		I_D = 2.5 A, V_{GS} = 2.5 V	6	7.5	10.5	mΩ
Turn-ON Delay Time	$t_d(on)$	See Fig. 1 (Note 3)		545		ns
Rise Time	t_r			525		ns
Turn-OFF Delay Time	$t_d(off)$			18.65		μs
Fall Time	t_f			22.2		μs
Turn-ON Delay Time	$t_d(on)$	See Fig. 2 (Note 3)		545		ns
Rise Time	t_r			525		ns
Turn-OFF Delay Time	$t_d(off)$			1,130		μs
Fall Time	t_f			410		μs
Total Gate Charge	Qg	V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 14 A		13		nC
Gate to Source Charge	Qgs			3		nC
Gate to Drain “Miller” Charge	Qgd			2.4		nC
Forward Diode Voltage	V_{SD}	I_S = 14 A, V_{GS} = 0 V		0.78	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.

Note 3 : The fall switching time is dependent on the input pulse width.

Fig.1 Switching Time Test Circuit 1

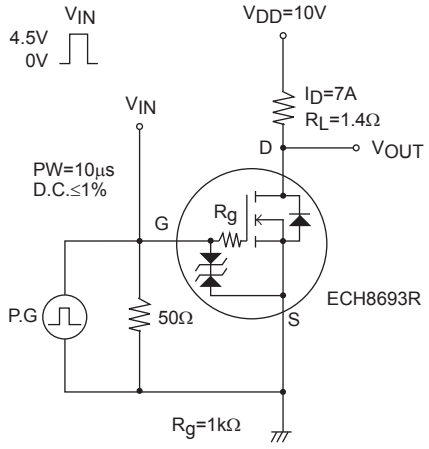
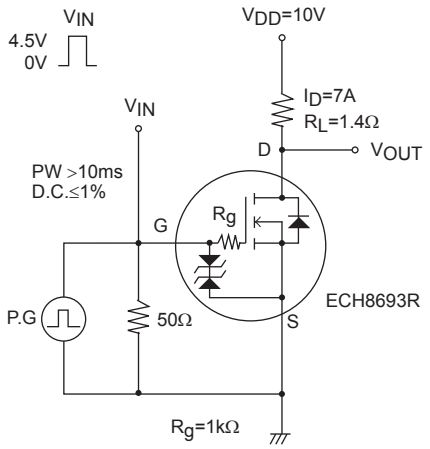
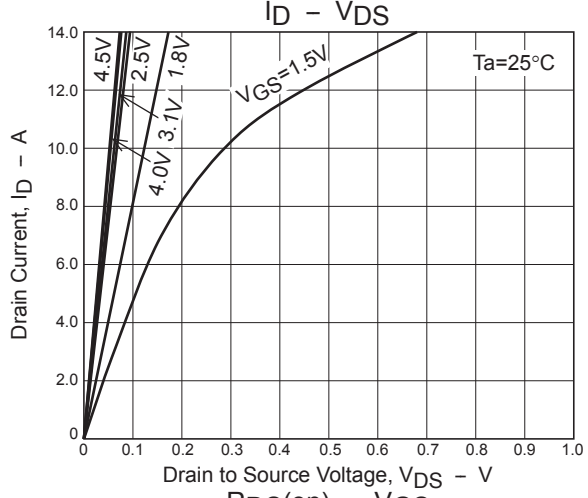
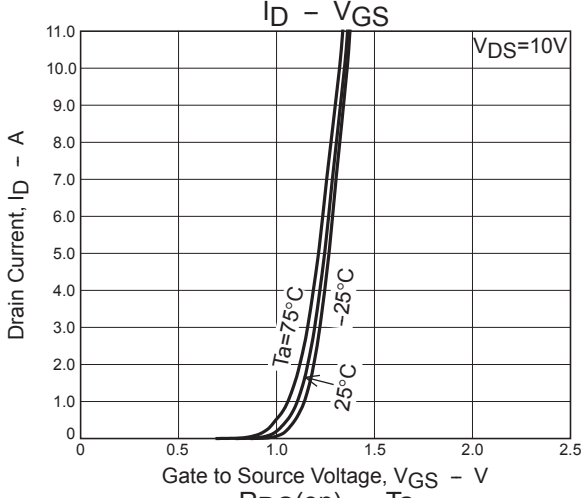
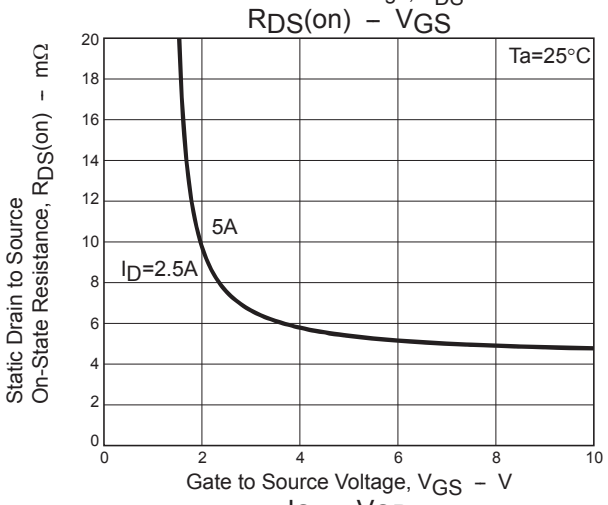


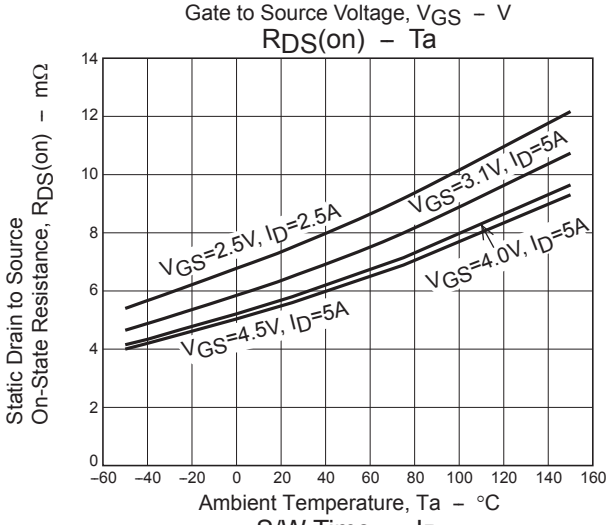
Fig.2 Switching Time Test Circuit 2

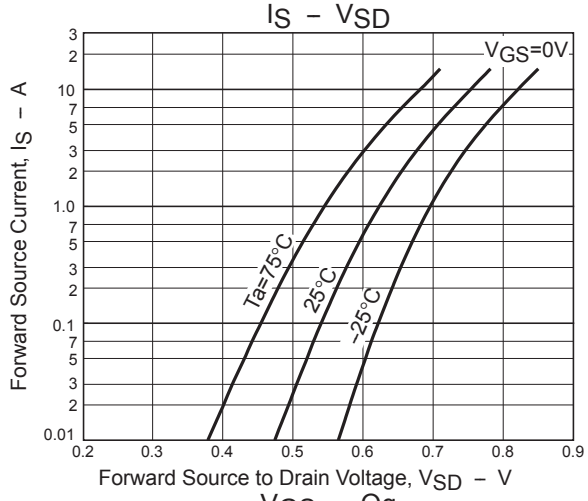


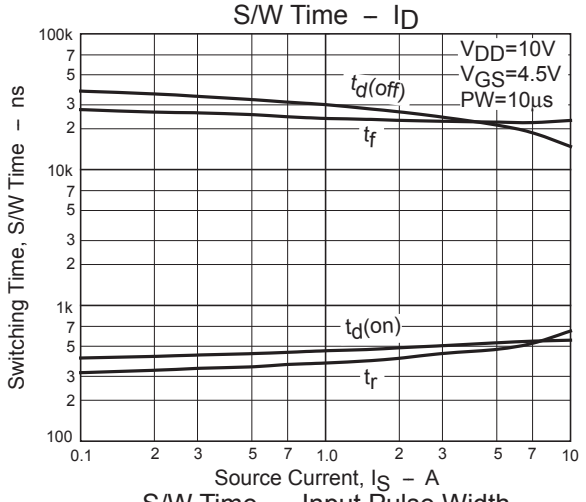

I_D – V_{DS}
Drain Current, I_D – A
Drain to Source Voltage, V_{DS} – V
Ta=25°C
4.5V
2.5V
1.8V
3.1V
4.0V
V_{GS}=1.5V

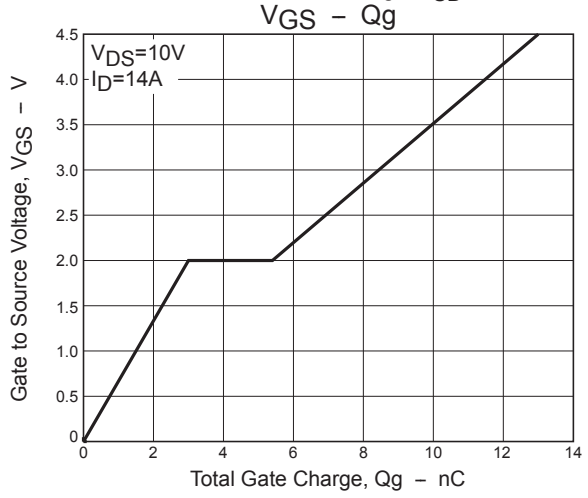

I_D – V_{GS}
Drain Current, I_D – A
Gate to Source Voltage, V_{GS} – V
V_{DS}=10V
Ta=75°C
–25°C
25°C

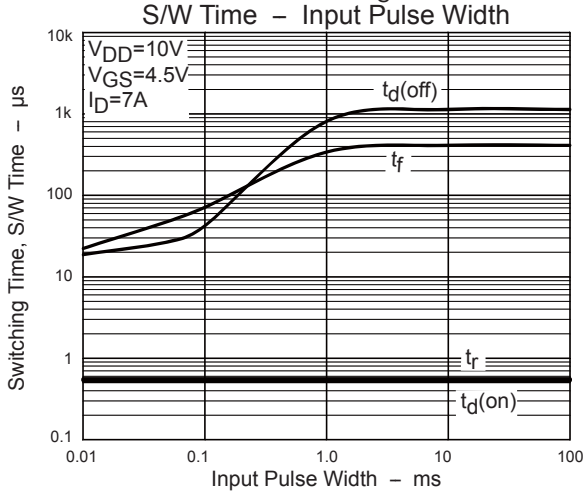

$R_{DS(on)}$ – V_{GS}
Static Drain to Source On-State Resistance, $R_{DS(on)}$ – mΩ
Gate to Source Voltage, V_{GS} – V
Ta=25°C
5A
I_D=2.5A

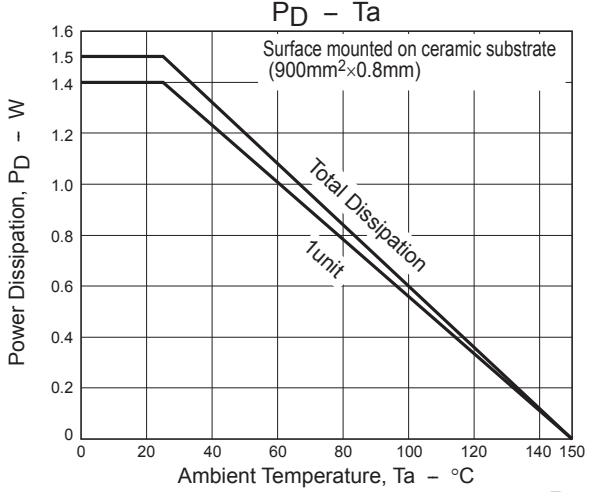

$R_{DS(on)}$ – Ta
Static Drain to Source On-State Resistance, $R_{DS(on)}$ – mΩ
Ambient Temperature, Ta – °C
V_{GS}=2.5V, I_D=2.5A
V_{GS}=3.1V, I_D=5A
V_{GS}=4.0V, I_D=5A
V_{GS}=4.5V, I_D=5A

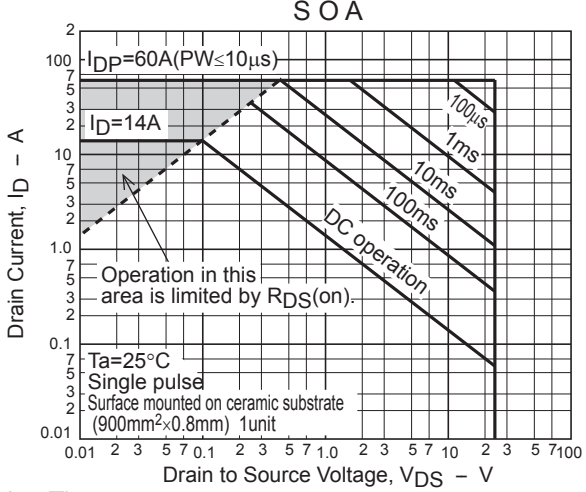

I_S – V_{SD}
Forward Source Current, I_S – A
Forward Source to Drain Voltage, V_{SD} – V
V_{GS}=0V
Ta=75°C
25°C
–25°C

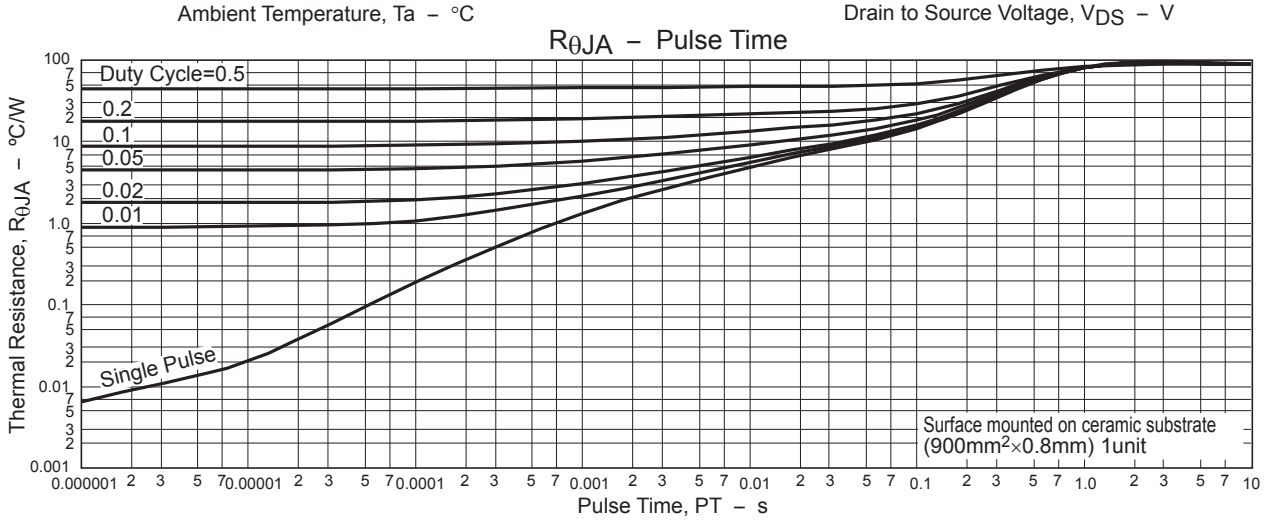

S/W Time – I_D
Switching Time, S/W Time – ns
Source Current, I_S – A
V_{DD}=10V
V_{GS}=4.5V
PW=10μs
$t_{d(off)}$
t_f
$t_{d(on)}$
t_r


V_{GS} – Qg
Gate to Source Voltage, V_{GS} – V
Total Gate Charge, Qg – nC
V_{DS}=10V
I_D=14A


S/W Time – Input Pulse Width
Switching Time, S/W Time – μs
Input Pulse Width – ms
V_{DD}=10V
V_{GS}=4.5V
I_D=7A
$t_{d(off)}$
t_f
t_r
$t_{d(on)}$


PD – Ta
Surface mounted on ceramic substrate
(900mm2×0.8mm)
Total Dissipation
1unit
Power Dissipation, PD – W
Ambient Temperature, Ta – °C

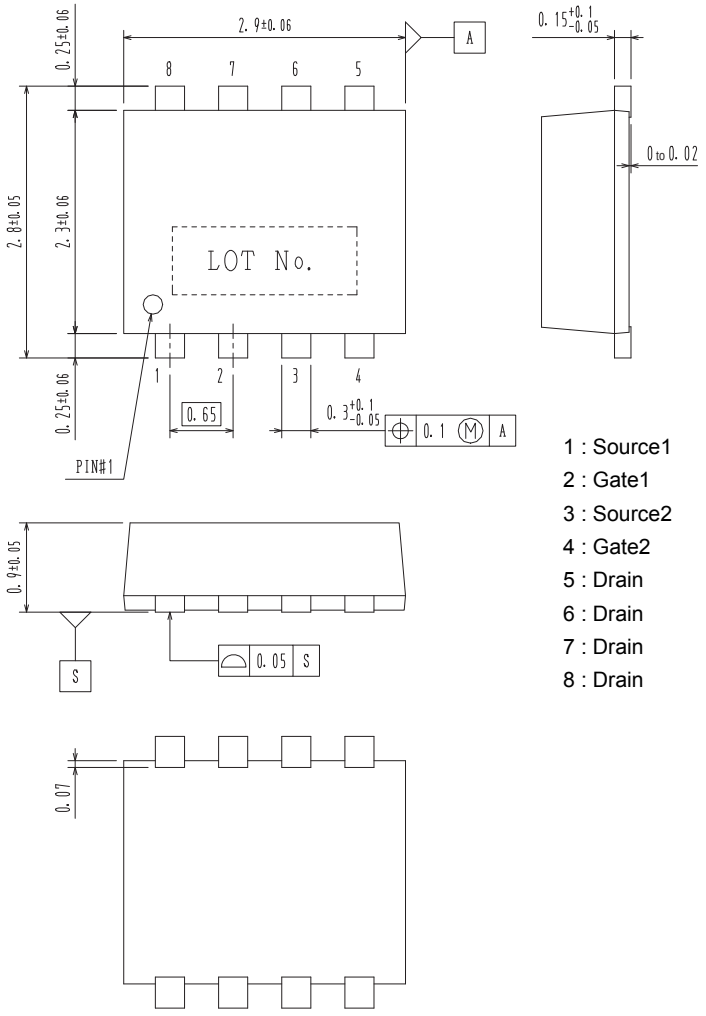

SOA
IDP=60A(PW≤10μs)
ID=14A
100μs
1ms
10ms
100ms
DC operation
Operation in this
area is limited by RDS(on).
Ta=25°C
Single pulse
Surface mounted on ceramic substrate
(900mm2×0.8mm) 1unit
Drain Current, ID – A
Drain to Source Voltage, VDS – V


RθJA – Pulse Time
Duty Cycle=0.5
0.2
0.1
0.05
0.02
0.01
Single Pulse
Surface mounted on ceramic substrate
(900mm2×0.8mm) 1unit
Thermal Resistance, RθJA – °C/W
Pulse Time, PT – s

PACKAGE DIMENSIONS

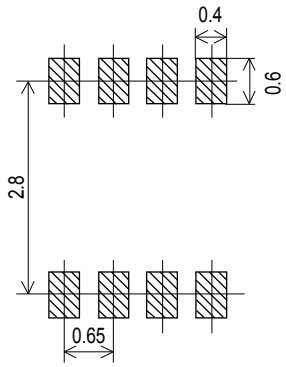
unit : mm

SOT-28FL / ECH8
CASE 318BF
ISSUE O



1 : Source1
2 : Gate1
3 : Source2
4 : Gate2
5 : Drain
6 : Drain
7 : Drain
8 : Drain

Recommended Soldering Footprint



ORDERING INFORMATION

Device	Marking	Package	Shipping (Qty / Packing)
ECH8693R-TL-W	UQ	SOT-28FL / ECH8 (Pb-Free / Halogen Free)	3,000 / 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 ECH8693R 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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