

Single N-Channel 2.5V Specified PowerTrench® MOSFET

General Description

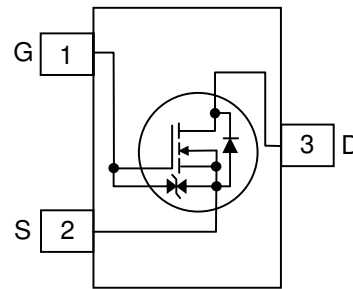
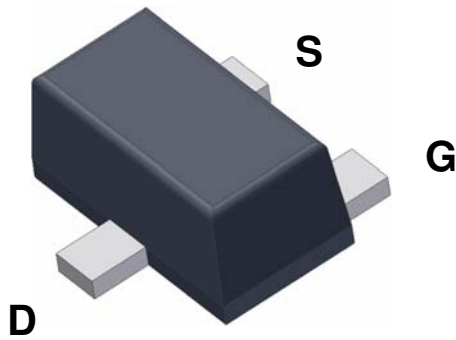
This Single N-Channel MOSFET has been designed using Toohong Semiconductor's advanced Power Trench process to optimize the $R_{DS(ON)}$ @ $V_{GS} = 2.5V$.

Applications

- Li-Ion Battery Pack

Features

- 600 mA, 20 V $R_{DS(ON)} = 300\text{ m}\Omega$ @ $V_{GS} = 4.5\text{ V}$
 $R_{DS(ON)} = 500\text{ m}\Omega$ @ $V_{GS} = 2.5\text{ V}$
- ESD protection diode (note 3)
- RoHS Compliant



Absolute Maximum Ratings

$T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Unit
V_{DS}	Drain-Source Voltage	20	V
V_{GS}	Gate-Source Voltage	± 12	V
I_D	Drain Current – Continuous (Note 1a) – Pulsed	600	mA
		1000	
P_D	Power Dissipation (Steady State) (Note 1a) (Note 1b)	625	mW
		446	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to $+150$	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	200	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1b)	280	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
E	FDY302NZ	7 "	8 mm	3000 units

Electrical Characteristics

$T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain–Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C		15		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}$			1	μA
I_{GSS}	Gate–Body Leakage,	$V_{GS} = \pm 12\text{ V}, V_{DS} = 0\text{ V}$			± 10	μA
		$V_{GS} = \pm 4.5\text{ V}, V_{DS} = 0\text{ V}$			± 1	μA

On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.6	1.0	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C		3		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 4.5\text{ V}, I_D = 600\text{ mA}$ $V_{GS} = 2.5\text{ V}, I_D = 500\text{ mA}$ $V_{GS} = 1.8\text{ V}, I_D = 150\text{ mA}$ $V_{GS} = 4.5\text{ V}, I_D = 600\text{ mA}, T_J = 125^\circ\text{C}$		0.24 0.36 0.70 0.35	0.30 0.50 1.20 1.00	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 600\text{ mA}$		1.8		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		60		pF
C_{oss}	Output Capacitance			20		pF
C_{rss}	Reverse Transfer Capacitance			10		pF

Switching Characteristics (Note 2)

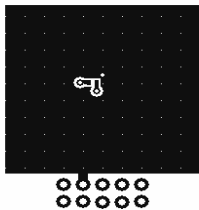
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = 10\text{ V}, I_D = 1\text{ A},$ $V_{GS} = 4.5\text{ V}, R_{GEN} = 6\text{ }\Omega$		6	12	ns
t_r	Turn–On Rise Time			8	16	ns
$t_{d(off)}$	Turn–Off Delay Time			8	16	ns
t_f	Turn–Off Fall Time			2.4	4.8	ns
Q_g	Total Gate Charge	$V_{DS} = 10\text{ V}, I_D = 600\text{ mA},$ $V_{GS} = 4.5\text{ V}$		0.8	1.1	nC
Q_{gs}	Gate–Source Charge			0.16		nC
Q_{gd}	Gate–Drain Charge			0.26		nC

Drain–Source Diode Characteristics and Maximum Ratings

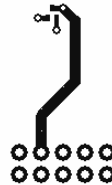
V_{SD}	Drain–Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 150\text{ mA}$ (Note 2)		0.7	1.2	V
t_{rr}	Diode Reverse Recovery Time	$I_F = 600\text{ mA},$		8		nS
Q_{rr}	Diode Reverse Recovery Charge	$di_F/dt = 100\text{ A}/\mu\text{s}$		1		nC

Notes:

1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 200°C/W when mounted on a 1 in^2 pad of 2 oz copper



b) 280°C/W when mounted on a minimum pad of 2 oz copper
Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < $300\mu\text{s}$,
Duty Cycle < 2.0%

3. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

Typical Characteristics

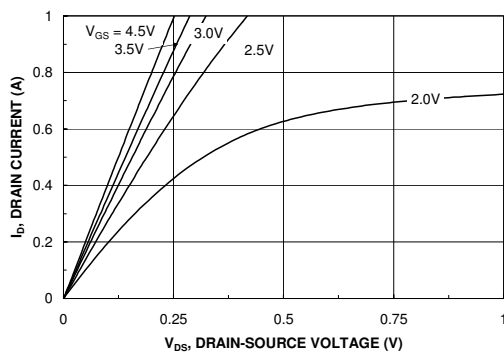


Figure 1. On-Region Characteristics.

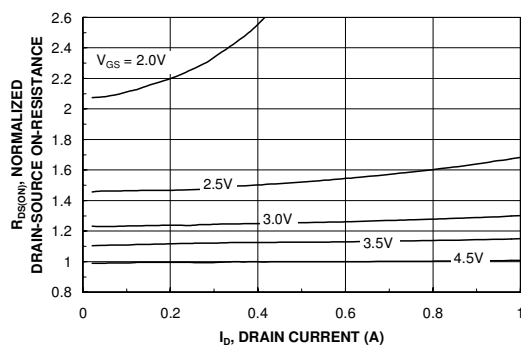


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

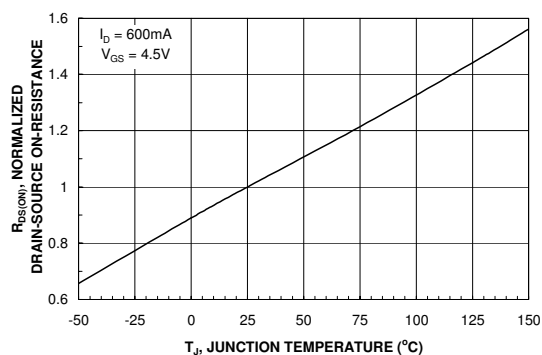


Figure 3. On-Resistance Variation with Temperature.

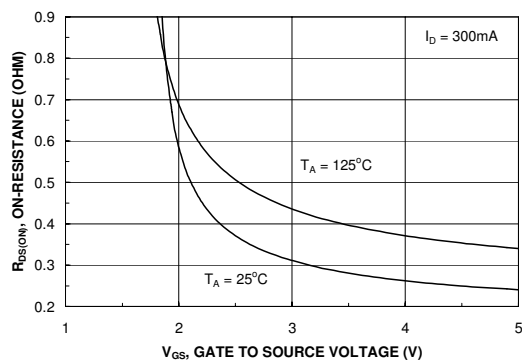


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

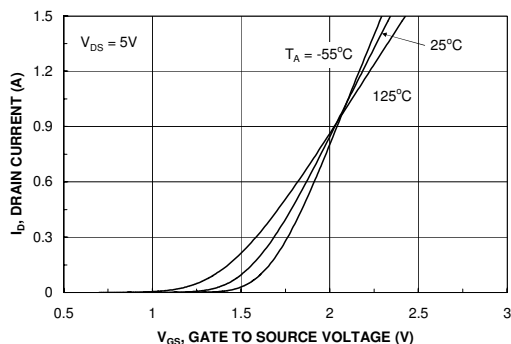


Figure 5. Transfer Characteristics.

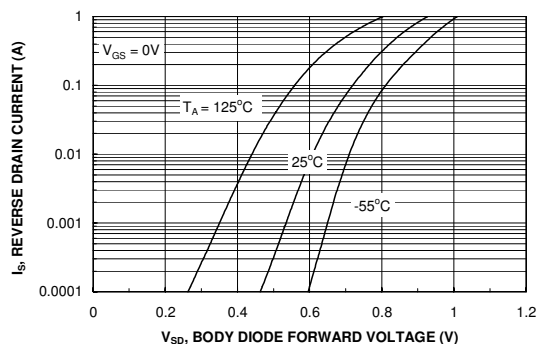


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

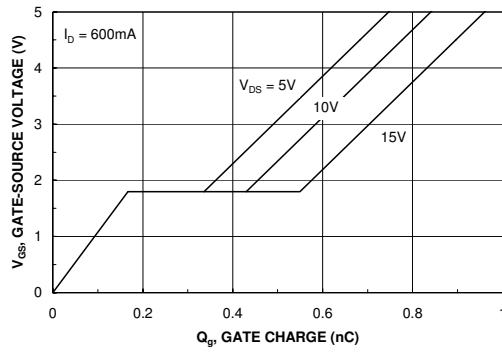


Figure 7. Gate Charge Characteristics.

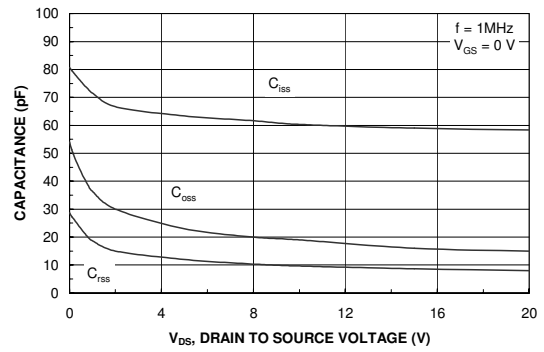


Figure 8. Capacitance Characteristics.

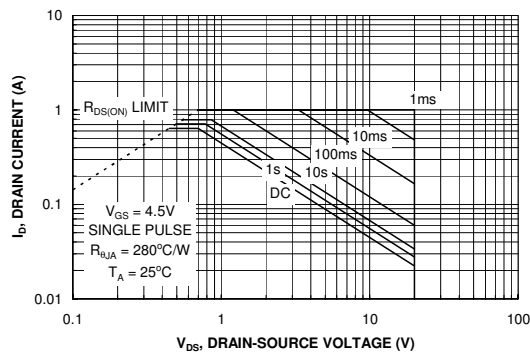


Figure 9. Maximum Safe Operating Area.

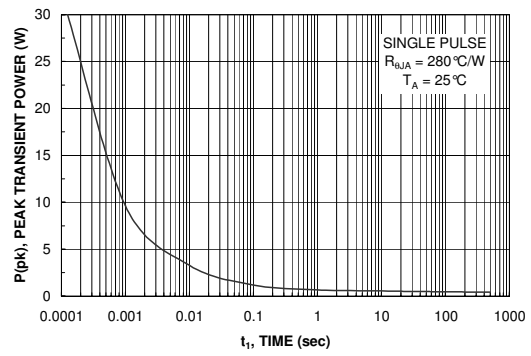


Figure 10. Single Pulse Maximum Power Dissipation.

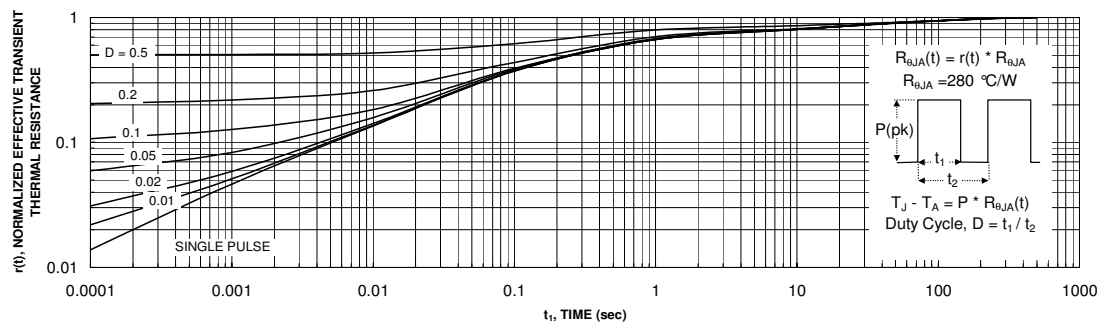


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.