



July 2006

# FDY302NZ

## Single N-Channel 2.5V Specified PowerTrench<sup>®</sup> MOSFET

### General Description

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

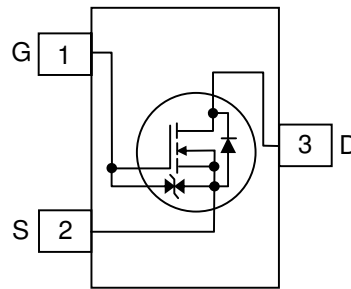
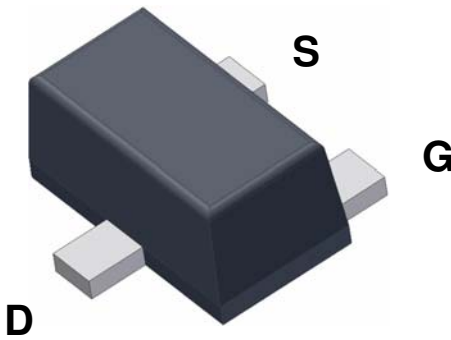
### Applications

- Li-Ion Battery Pack



### Features

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



### Absolute Maximum Ratings T<sub>A</sub>=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain-Source Voltage	20	V
$V_{GS}$	Gate-Source Voltage	$\pm 12$	V
$I_D$	Drain Current – Continuous (Note 1a)	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	°C

### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	200	°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

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

#### On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	0.6	1.0	1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		3		mV/°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	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 600\text{ mA}$		1.8		S

#### Dynamic Characteristics

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

#### Switching Characteristics (Note 2)

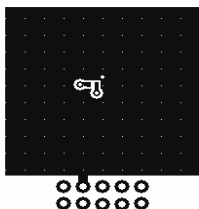
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 10\text{ V}, I_D = 1\text{ A},$		6	12	ns
$t_r$	Turn-On Rise Time	$V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$		8	16	ns
$t_{d(off)}$	Turn-Off Delay Time			8	16	ns
$t_f$	Turn-Off Fall Time			2.4	4.8	ns
$Q_g$	Total Gate Charge	$V_{DS} = 10\text{ V}, I_D = 600\text{ mA},$		0.8	1.1	nC
$Q_{gs}$	Gate-Source Charge	$V_{GS} = 4.5\text{ V}$		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 1in<sup>2</sup> 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

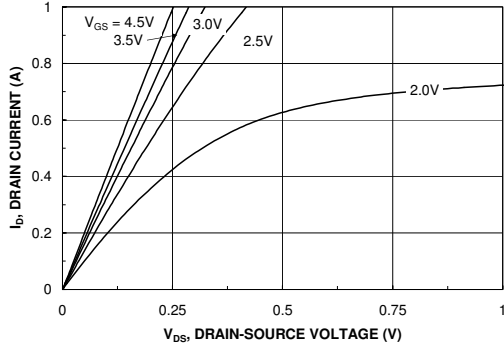


Figure 1. On-Region Characteristics.

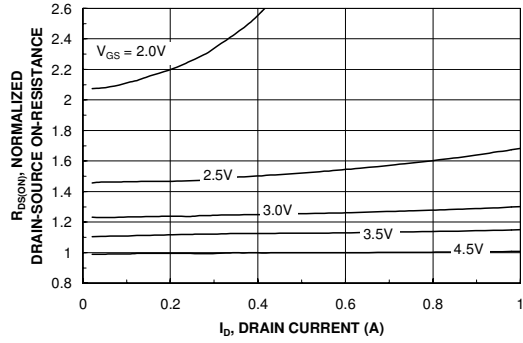


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

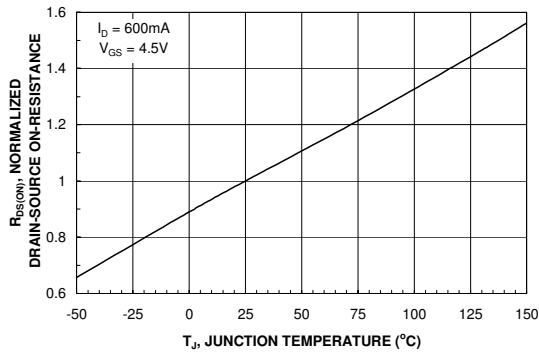


Figure 3. On-Resistance Variation with Temperature.

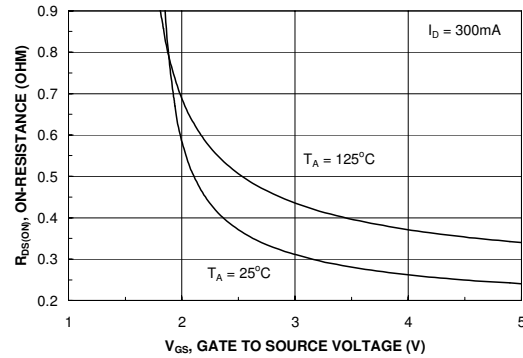


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

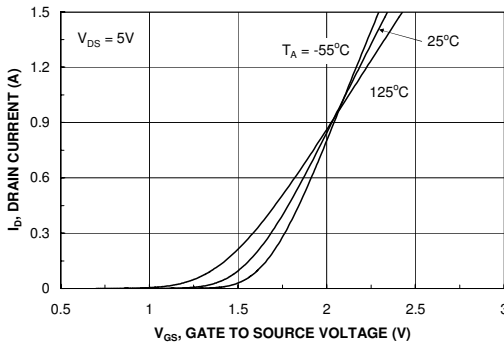


Figure 5. Transfer Characteristics.

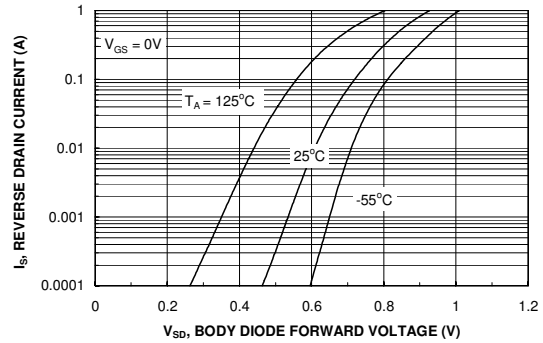


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

### Typical Characteristics

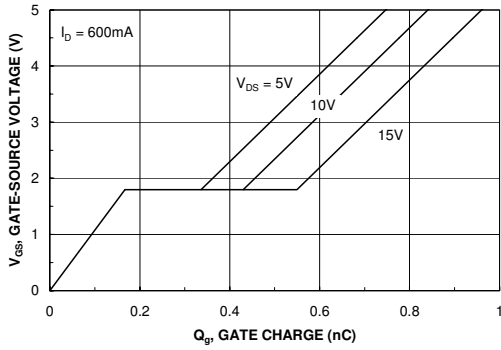


Figure 7. Gate Charge Characteristics.

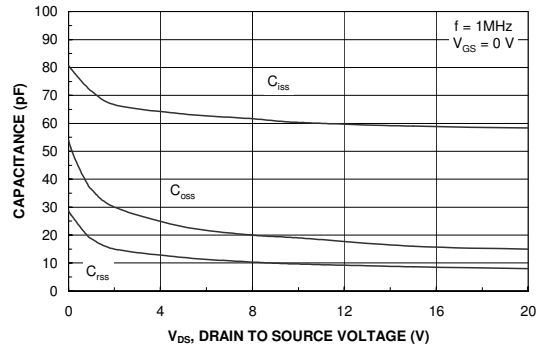


Figure 8. Capacitance Characteristics.

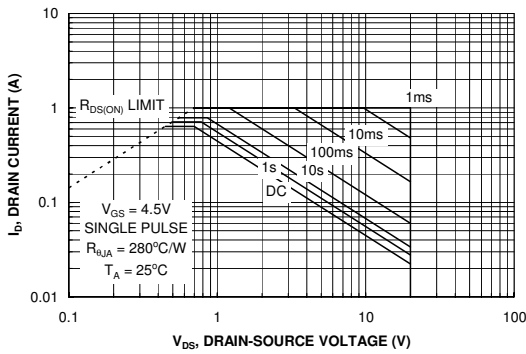


Figure 9. Maximum Safe Operating Area.

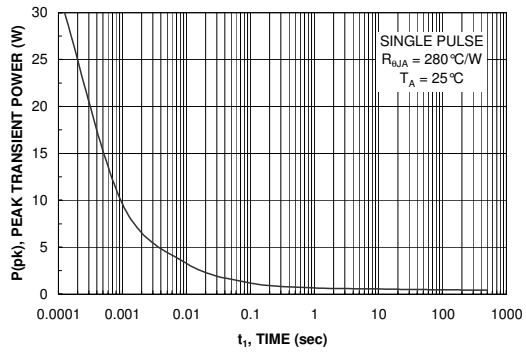


Figure 10. Single Pulse Maximum Power Dissipation.

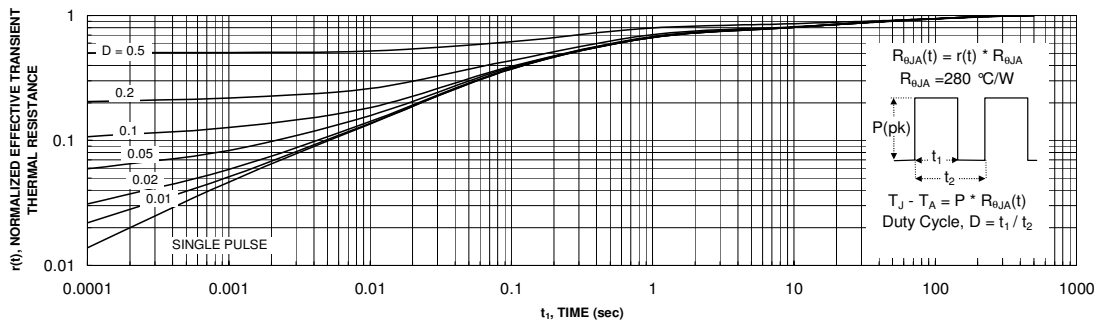
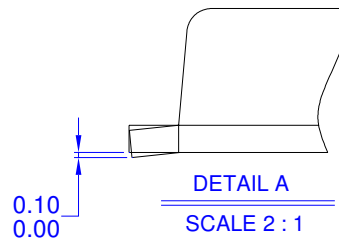
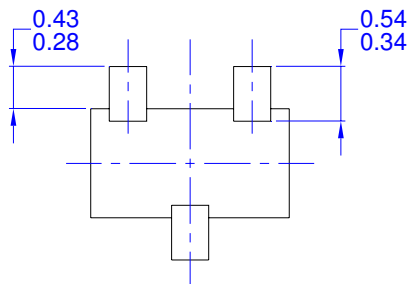
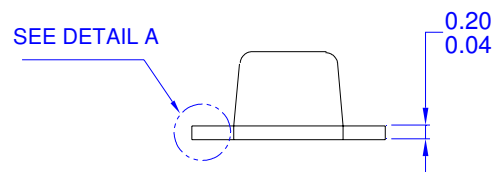
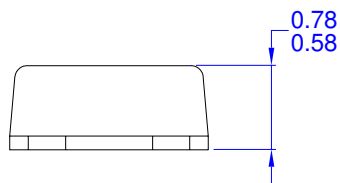
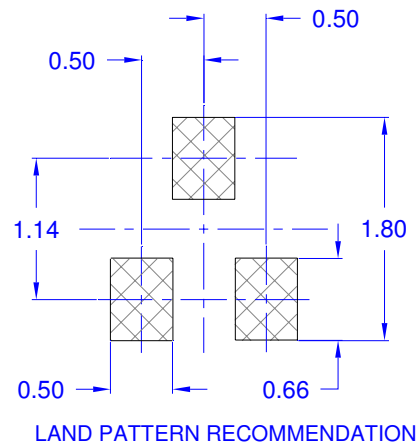
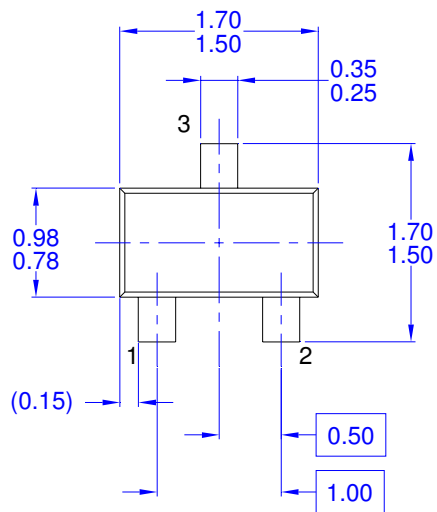


Figure 11. Transient Thermal Response Curve.

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

Dimensional Outline and Pad Layout






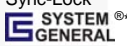


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