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ON Semiconductor®

# FDY1002PZ

## Dual P-Channel (-1.5 V) Specified PowerTrench® MOSFET

-20 V, -0.83 A, 0.5 Ω

### Features

- Max  $r_{DS(on)}$  = 0.5 Ω at  $V_{GS} = -4.5$  V,  $I_D = -0.83$  A
- Max  $r_{DS(on)}$  = 0.7 Ω at  $V_{GS} = -2.5$  V,  $I_D = -0.70$  A
- Max  $r_{DS(on)}$  = 1.2 Ω at  $V_{GS} = -1.8$  V,  $I_D = -0.43$  A
- Max  $r_{DS(on)}$  = 1.8 Ω at  $V_{GS} = -1.5$  V,  $I_D = -0.36$  A
- HBM ESD protection level = 1400 V (Note 3)
- RoHS Compliant

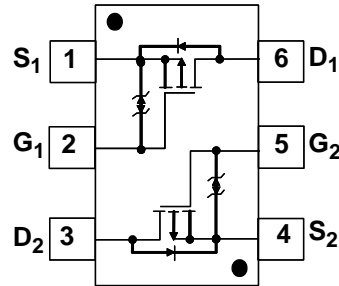
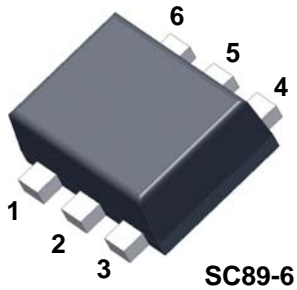


### General Description

This Dual P-Channel MOSFET has been designed using ON Semiconductor's advanced Power Trench process to optimize the  $r_{DS(on)}$  at  $V_{GS} = -1.5$  V.

### Application

- Li-Ion Battery Pack



### MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain to Source Voltage	-20	V
$V_{GS}$	Gate to Source Voltage	±8	V
$I_D$	Drain Current -Continuous (Note 1a)	-0.83	A
	-Pulsed	-1.0	
$P_D$	Power Dissipation (Note 1a)	0.625	W
	Power Dissipation (Note 1b)	0.446	
$T_J, T_{STG}$	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	Package	Reel Size	Tape Width	Quantity
G	FDY1002PZ	SC89-6	7"	8 mm	3000 units

FDY1002PZ Dual P-Channel (-1.5 V) Specified PowerTrench® MOSFET

## Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = -250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-11		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}$ , $V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 8\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 10$	$\mu\text{A}$

### On Characteristics (Note 2)

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = -250\text{ }\mu\text{A}$	-0.4	-0.7	-1.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On-Resistance	$V_{GS} = -4.5\text{ V}$ , $I_D = -0.83\text{ A}$		0.28	0.5	$\Omega$
		$V_{GS} = -2.5\text{ V}$ , $I_D = -0.70\text{ A}$		0.36	0.7	
		$V_{GS} = -1.8\text{ V}$ , $I_D = -0.43\text{ A}$		0.47	1.2	
		$V_{GS} = -1.5\text{ V}$ , $I_D = -0.36\text{ A}$		0.62	1.8	
		$V_{GS} = -4.5\text{ V}$ , $I_D = -0.83\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$		0.39	0.85	
$g_{FS}$	Forward Transconductance	$V_{DD} = -5\text{ V}$ , $I_D = -0.83\text{ A}$		2		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		100	135	pF
$C_{oss}$	Output Capacitance			23	35	pF
$C_{rss}$	Reverse Transfer Capacitance			18	30	pF

### Switching Characteristics (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{ V}$ , $I_D = -0.83\text{ A}$ $V_{GS} = -4.5\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		3.5	10	ns
$t_r$	Rise Time			2.9	10	ns
$t_{d(off)}$	Turn-Off Delay Time			23	37	ns
$t_f$	Fall Time			13	23	ns
$Q_g$	Total Gate Charge	$V_{DD} = -10\text{ V}$ , $I_D = -0.83\text{ A}$ $V_{GS} = -4.5\text{ V}$		2.2	3.1	nC
$Q_{gs}$	Gate to Source Charge			0.3		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			0.6		nC

### Drain-Source Diode Characteristics and Maximum Rating

$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-0.52	A	
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = -0.52\text{ A}$ (Note 2)		-1.0	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -0.83\text{ A}$ , $dI_F/dt = 100\text{ A}/\mu\text{s}$		18	31	ns
$Q_{rr}$	Reverse Recovery Charge			3.8	10	nC

#### Notes:

- $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.



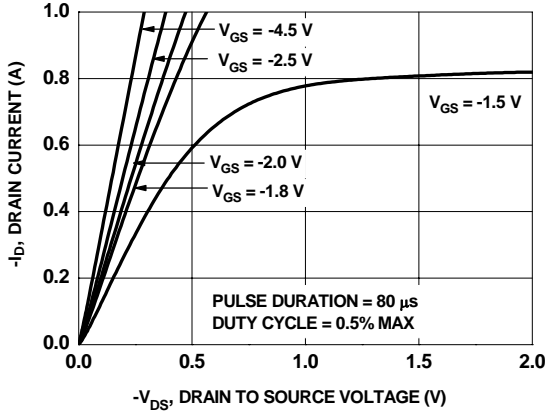
a) 200  $^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



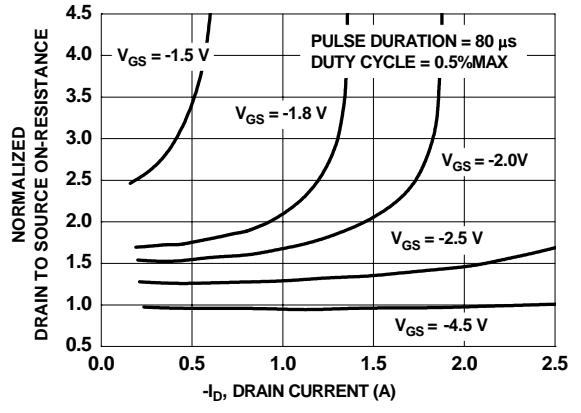
b) 280  $^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

- Pulse Test : Pulse Width < 300 us, Duty Cycle < 2.0%
- The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

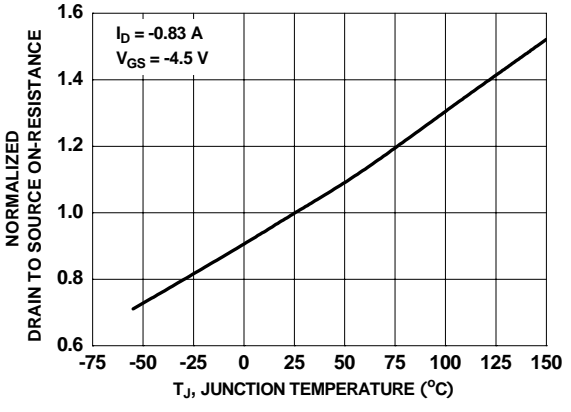
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



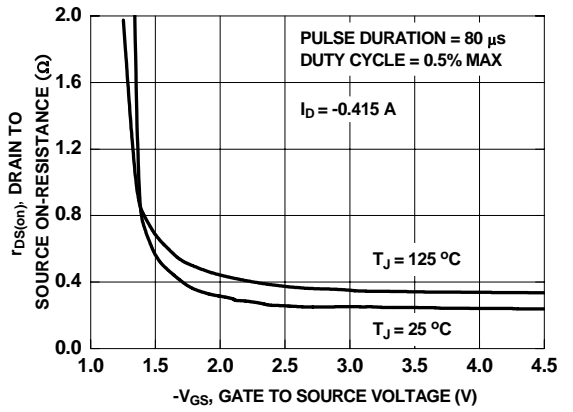
**Figure 1. On Region Characteristics**



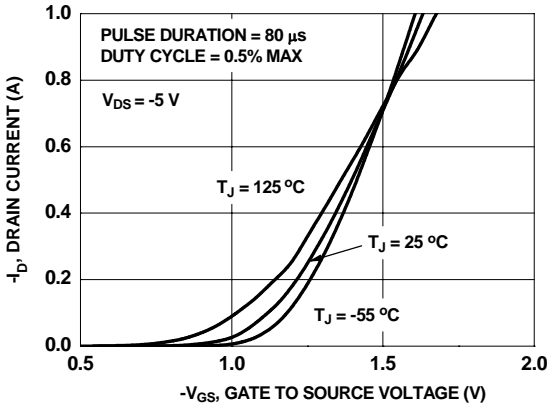
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



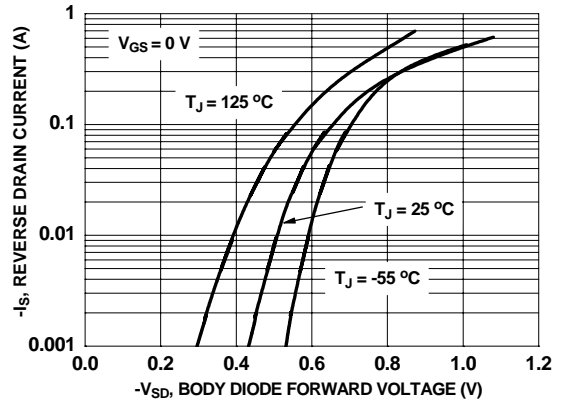
**Figure 3. Normalized On Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**

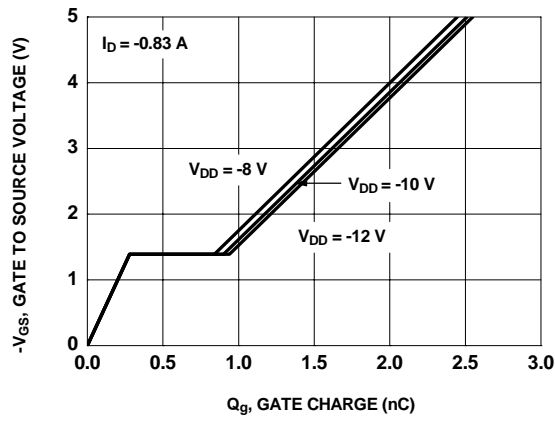


**Figure 5. Transfer Characteristics**

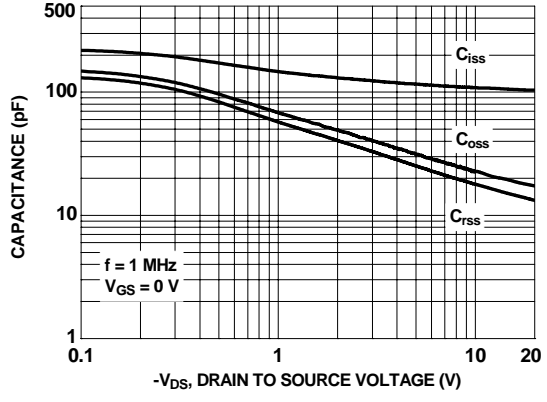


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

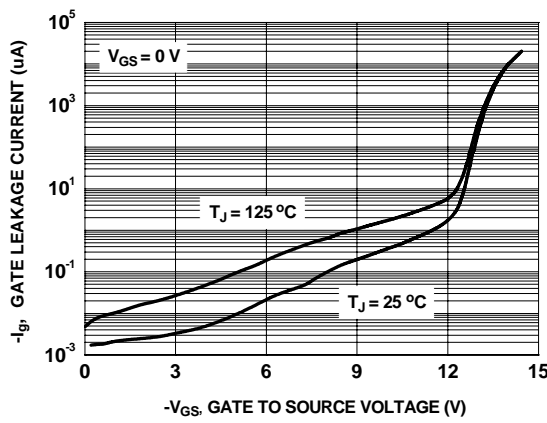
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



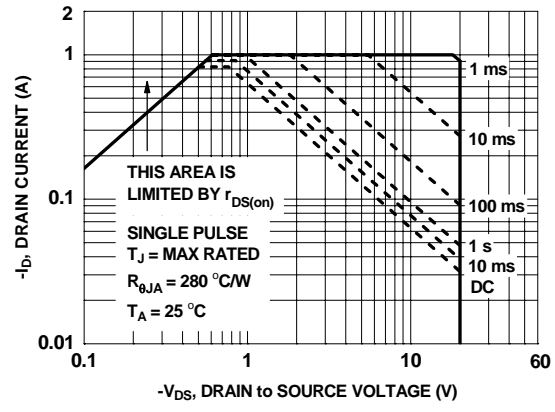
**Figure 7. Gate Charge Characteristics**



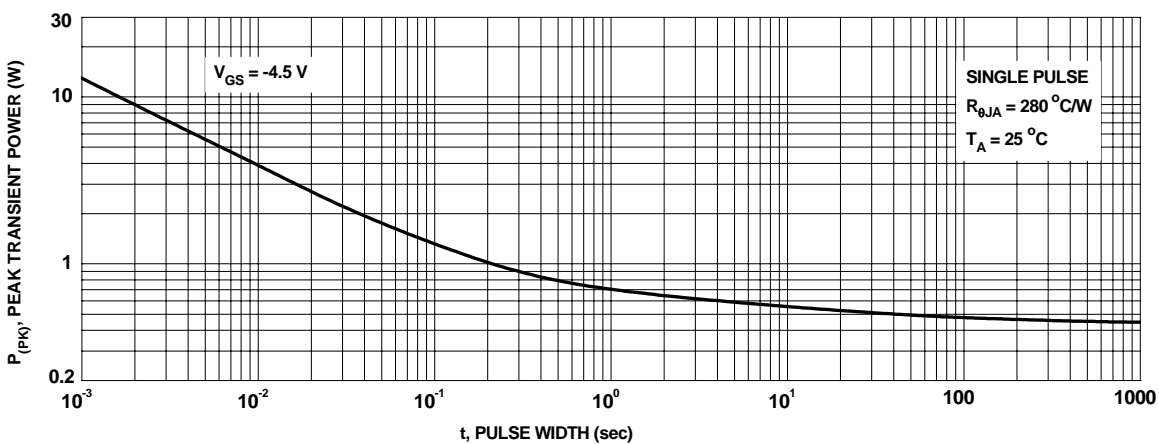
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Gate Leakage Current vs Gate to Source Voltage**

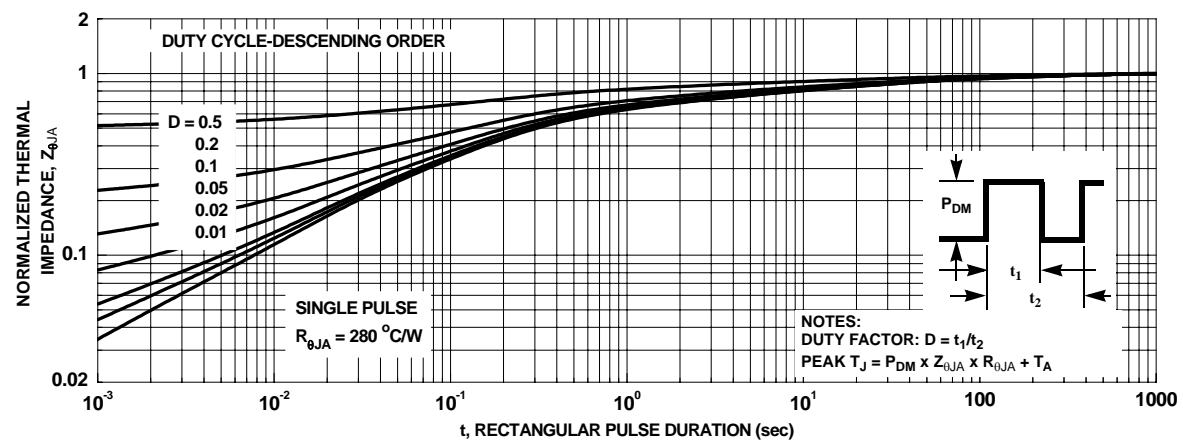


**Figure 10. Forward Bias Safe Operating Area**




**Figure 11. Single Pulse Maximum Power Dissipation**

**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



**Figure 12. Junction-to-Ambient Transient Thermal Response Curve**

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