April 2001

## FDW2502PZ

### Dual P-Channel 2.5V Specified PowerTrench<sup>®</sup> MOSFET

### **General Description**

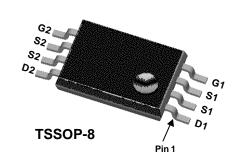
This PChannel 2.5V specified MOSFET is a rugged gate version of Fairchild's Semiconductor's advanced PowerTrench process. It has been optimized for power management applications with a wide range of gate drive voltage (2.5V - 12V).

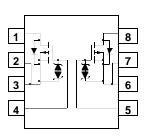
### Applications

- Load switch
- Motor drive
- DC/DC conversion
- Power management

### Features

- -4.4 A, -20 V.  $R_{DS(ON)}$  = 35 m $\Omega$  @ V<sub>GS</sub> = -4.5 V  $R_{DS(ON)}$  = 57 m $\Omega$  @ V<sub>GS</sub> = -2.5 V
- Extended  $V_{GSS}$  range (±12V) for battery applications.
- ESD protection diode (note 3).
- High performance trench technology for extremely low  $R_{\text{DS}(\text{ON})}$  .
- Low profile TSSOP-8 package.





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

Symbol	Parameter		Ratings	Units
V <sub>DSS</sub>	Drain-Source Voltage		-20	V
V <sub>GSS</sub>	Gate-Source Voltage		±12	V
Ь	Drain Current – Continuous	(Note 1a)	-4.4	А
	- Pulsed		-30	
PD	Power Dissipation for Single Operation	(Note 1a)	1.0	W
		(Note 1b)	0.6	
T <sub>J</sub> , T <sub>S⊺G</sub>	Operating and Storage Junction Tempera	ature Range	-55 to +150	
Therma	al Characteristics			
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	t (Note 1a)	125	
		(Note 1b)	208	
	Je Marking and Ordering Info Marking Device R		208 Tape width	Quantity

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Off CharacteristicsOff Characteristics $\Delta T_J$ Drain-Source Breakdown Voltage $V_{GS} = 0$ V, $b = -250 \mu$ A, Referenced to $25^{\circ}$ C $-17$ $mV/r^{\circ}$ $\Delta T_J$ Coefficient $b = -250 \mu$ A, Referenced to $25^{\circ}$ C $-17$ $mV/r^{\circ}$ $\Delta T_J$ Coefficient $V_{DS} = -16$ V, $V_{OS} = 0$ V $-11 \mu$ A $\Delta GaserGate-Body Leakage, ForwardV_{OS} = -12 V, V_{DS} = 0 V-10 \muA\Delta GaserGate-Body Leakage, ReverseV_{OS} = -12 V, V_{DS} = 0 V-10 \muAOn Characteristics(Note 2)On Characteristics(Note 2)V_{GS(m)}Gate Threshold Voltageb = -250 \muA, Referenced to 25^{\circ}C3.1mV/r^{\circ}\Delta T_JTemperature CoefficientV_{OS} = -4.5 V, b = -4.4 A, T_J = 125^{\circ}C3956m\Omega\Delta T_S(m)Static Drain-SourceV_{OS} = -4.5 V, b = -4.4 A, T_J = 125^{\circ}C3956m\Omega\Delta T_SDensistanceV_{OS} = -4.5 V, b = -4.4 A17SD_{S(m)}On-State Drain CurrentV_{OS} = -4.5 V, b = -4.4 A17SD_{S(m)}On-State Drain CurrentV_{OS} = -5 V, b = -4.4 A17SD_{S(m)}On-State Drain CurrentV_{OS} = -5 V, b = -4.4 A17SD_{S(m)}On-State Drain CurrentV_{OS} = -5 V, b = -4.4 A17SD_{S(m)}On-State Drain CurrentV_{OS} = -5 V, b = -4.4 A17SD_{S(m)}On-State Drain Current$		_	T <sub>A</sub> =25°C unless otherwise noted				1
	Symbol	Parameter	Test Conditions	Min	Тур	Max	Units
NBV Dask AT AT DeficientBreakdown Voltage Temperature b = -250 µA, Referenced to 25°C17mV/r mV/rAT DessZero Gate Voltage Drain Current $V_{DS} = -16$ V, $V_{CS} = 0$ V11µACasseGate-Body Leakage, Forward $V_{GS} = -12$ V, $V_{DS} = 0$ V10µACasseGate-Body Leakage, Reverse $V_{GS} = 12$ V, $V_{DS} = 0$ V10µAOn Characteristics(Note 2) $V_{OS} = 12$ V, $V_{DS} = 0$ V10µAOn Characteristics(Note 2) $V_{OS} = -250$ µA, Referenced to 25°C3.1mV/rVGS(m)Gate Threshold Voltage AT Temperature Coefficient $b = -250$ µA, Referenced to 25°C3.1mV/rATTemperature Coefficient $b = -250$ µA, Referenced to 25°C3.1mV/rATTemperature Coefficient $b = -250$ µA, Referenced to 25°C3.1mV/rATTemperature Coefficient $V_{CS} = -4.5$ V, $b = -4.4$ A3.5mQ/rATTemperature Coefficient $V_{CS} = -4.5$ V, $b = -3.3$ A4357Do(m)On-State Drain Current $V_{CS} = -5$ V, $b = -3.4$ A17SDynamic CharacteristicsNos $V_{DS} = -5$ V, $b = -4.4$ A17SDynamic CharacteristicsNos $V_{DS} = -5$ V, $b = -4.4$ A17SDynamic CharacteristicsNos $V_{DS} = -5$ V, $b = -4.4$ A17SDynamic CharacteristicsNos $V_{DS} = -5$ V, $b = -4.4$ A17SDynamic CharacteristicsNos $V_{DS} = -5$ V,	Off Char	acteristics					
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	BV <sub>DSS</sub>	Drain–Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, \text{ I}_{D} = -250 \mu\text{A}$	-20			V
GaseGate-Body Leakage, Forward $V_{GS} = -12$ V, $V_{DS} = 0$ V $-10$ $\mu A$ CossGate-Body Leakage, Reverse $V_{GS} = 12$ V $V_{DS} = 0$ V10 $\mu A$ On Characteristics(Note 2) $V_{GS(m)}$ Gate Threshold Voltage $V_{DS} = V_{GS}$ , $b = -250 \ \mu A$ $-0.4$ $-1.0$ $-1.5$ V $\Delta T_{J}$ Temperature Coefficient $b = -250 \ \mu A$ $-0.4$ $-1.0$ $-1.5$ V $\Delta T_{J}$ Temperature Coefficient $b = -250 \ \mu A$ , Referenced to $25^{\circ}$ C $3.1$ mV/r $\Delta T_{J}$ Temperature Coefficient $b = -250 \ \mu A$ , $A_{J}_{J} = 125^{\circ}$ C $3.8$ $35$ $\Delta T_{J}$ Temperature Coefficient $V_{GS} = -4.5$ V, $b = -4.4$ A, $T_{J} = 125^{\circ}$ C $3.9$ $56$ $\Delta T_{S}$ Forward Trans conductance $V_{DS} = -5$ V, $b = -3.3$ A $43$ $57$ $D(m)$ On-State Drain Current $V_{GS} = -4.5$ V, $V_{DS} = -5$ V $-30$ A $A_{TS}$ Forward Trans conductance $V_{DS} = -5$ V, $b = -4.4$ A $17$ S $Dynamic CharacteristicsV_{DS} = -10 V, V_{CS} = 0 V, f = 1.0 MHz1330pFC_{rss}Reverse Transfer CapacitanceV_{DS} = -10 V, V_{CS} = 0 V, f = 1.0 MHz1225Switching Characteristics (Note 2)u_{CO}1330pFC_{rss}Reverse Transfer CapacitanceV_{DS} = -10 V, b = -1 A, V_{CS} = -4.5 V, R_{SE} = 6 \Omega1440 nc\Delta_{adm}Turn-On Delay TimeV_{DS} = -5 V, V_{CS} = -5 V, V_{CS} = -4.5 V<$	$\frac{\Delta BV_{DSS}}{\Delta T_J}$		$I_D = -250 \ \mu\text{A}$ , Referenced to $25^{\circ}\text{C}$		-17		mV/ºC
GSSRGate-Body Leakage, Reverse $V_{GS} = 12 \vee V_{DS} = 0 \vee$ 10 $\mu A$ On Characteristics(Note 2) $V_{GS(m)}$ Gate Threshold Voltage $V_{DS} = V_{GS}$ , $b = -250 \mu A$ , Referenced to $25^{\circ}C$ 3.1mV/2 $\Delta T_J$ Temperature Coefficient $b = -250 \mu A$ , Referenced to $25^{\circ}C$ 3.1mV/2 $\Delta T_J$ Temperature Coefficient $b = -250 \mu A$ , Referenced to $25^{\circ}C$ 3.1mV/2 $\Delta T_J$ Temperature Coefficient $b = -250 \mu A$ , Referenced to $25^{\circ}C$ 3.1mV/2 $\Delta T_J$ Temperature Coefficient $V_{GS} = -4.5 V$ , $b = -4.4 A$ , $T_J = 125^{\circ}C$ 3956 $\Delta T_S$ On-Resistance $V_{GS} = -4.5 V$ , $b = -3.3 A$ 4357 $D(on)$ On-State Drain Current $V_{GS} = -4.5 V$ , $b = -3.3 A$ 4357 $\Delta T_S$ Forward Trans conductance $V_{DS} = -5 V$ , $b = -3.3 A$ 4357 $D(on)$ On-State Drain Current $V_{GS} = -10 V$ , $V_{GS} = 0 V$ , $b = -4.4 A$ 17S $Dynamic Characteristics$ $V_{DS} = -10 V$ , $V_{GS} = 0 V$ , $b = -4.4 A$ 17S $Dynamic Characteristics(Note 2)V_{DS} = -10 V, V_{GS} = 0 V, b = -3.4 A17SD_{Cas}Input CapacitanceV_{DS} = -10 V, V_{GS} = 0 V, b = -10 V, V_{GS} = 0 V, f = 1.0  MHz1225nsC_{ras}Reverse Transfer CapacitanceV_{DS} = -4.5 V, R_{GEN} = 6 \Omega60100nsc_{adm}Turm-On Bielay TimeV_{DS} = -4.5 V, R_{GEN} = 6 \Omega60100ns$	DSS	Zero Gate Voltage Drain Current	$V_{DS} = -16 V$ , $V_{GS} = 0 V$			-1	μA
On Characteristics(Note 2) $V_{GS(h)}$ Gate Threshold Voltage $V_{DS} = V_{GS}$ , $b = -250 \ \mu$ A, Referenced to $25^{\circ}$ C3.1mV/2 $\Delta T_J$ Gate Threshold Voltage $b = -250 \ \mu$ A, Referenced to $25^{\circ}$ C3.1mV/2 $\Delta T_J$ Temperature Coefficient $b = -250 \ \mu$ A, Referenced to $25^{\circ}$ C3.1mV/2 $\Delta T_J$ Static Drain–Source $V_{GS} = -4.5 \ V$ , $b = -4.4 \ A$ , $T_J = 125^{\circ}$ C3956 $On-Resistance$ $V_{GS} = -4.5 \ V$ , $b = -3.3 \ A$ 4357 $On-State Drain Current$ $V_{GS} = -4.5 \ V$ , $V_{DS} = -5 \ V$ -30A $Q_{FS}$ Forward Transconductance $V_{DS} = -5 \ V$ , $b = -4.4 \ A$ 17S <b>Dynamic Characteristics</b> $V_{DS} = -5 \ V$ , $b = -4.4 \ A$ 17S $O_{GS}$ Output Capacitance $V_{DS} = -10 \ V$ , $V_{GS} = 0 \ V$ , $552 \ PF$ $C_{SS}$ Nutre 2) $(an)$ 11330 $PF$ $(an)$ Turn-On Delay Time $V_{DS} = -10 \ V$ , $b = -1 \ A$ ,1940 $a$ $a$ $a$ $a$ $a$ $a$ $a$ Turn-On Rise Time $V_{DS} = -5 \ V$ , $R_{GEN} = 6 \ \Omega$ 601000 \ ns $a$ Turn-Off Delay Time $V_{GS} = -4.5 \ V$ , $b = -4.4 \ A$ , $a$ $a$ $a$ $a$ $a$ $a$ $a$ $a$ $a$ Turn-Off Delay Time $V_{DS} = -5 \ V$ , $R_{GEN} = 6 \ \Omega$ $a$ Turn-Off Delay Time $V_{DS} = -5 \ V$	GSSF	Gate-Body Leakage, Forward	$V_{GS} = -12 V$ , $V_{DS} = 0 V$			-10	μA
$V_{GS(m)}$ Gate Threshold Voltage $V_{DS} = V_{GS}$ , $b = -250 \ \mu A$ $-0.4$ $-1.0$ $-1.5$ $V$ $\Delta T_{J}$ Gate Threshold Voltage Temperature Coefficient $b = -250 \ \mu A$ , Referenced to $25^{\circ}C$ $3.1$ mV/2 $\Delta T_{J}$ Static Drain–Source On–Resistance $V_{GS} = -4.5 \ V$ , $b = -4.4 \ A$ , $T_{J} = 125^{\circ}C$ $3.9$ $56 \ MC$ $On-Resistance$ $V_{GS} = -4.5 \ V$ , $b = -3.3 \ A$ $43 \ 57$ $57 \ MC$ $43 \ 57$ $D(m)$ On–State Drain Current $V_{GS} = -4.5 \ V$ , $b = -3.3 \ A$ $43 \ 57$ $57 \ MC$ $D(m)$ On–State Drain Current $V_{GS} = -4.5 \ V$ , $b = -3.3 \ A$ $43 \ 57$ $57 \ MC$ $D(m)$ On–State Drain Current $V_{GS} = -4.5 \ V$ , $b = -3.3 \ A$ $43 \ 57$ $57 \ MC$ $D(m)$ On–State Drain Current $V_{GS} = -4.5 \ V$ , $b = -3.3 \ A$ $43 \ 57$ $7 \ MC$ $D(m)$ On–State Drain Current $V_{GS} = -4.5 \ V$ , $b = -3.3 \ A$ $43 \ 57$ $7 \ MC$ $D(m)$ On–State Drain Current $V_{GS} = -4.5 \ V$ , $b = -3.3 \ A$ $43 \ 57$ $7 \ MC$ $D(m)$ On–State Drain Current $V_{DS} = -10 \ V$ , $b = -4.4 \ A$ $17 \ S$ $552 \ PF$ $C_{rss}$ Reverse Transfer Capacitance $V_{DS} = -10 \ V$ , $b = -1 \ A$ , $19 \ 40 \ ns$ $a(m)$ Turn–On Blay Time $V_{DS} = -4.5 \ V$ , $R_{GEN} = 6 \ \Omega$ $60 \ 100 \ ns$ $a(m)$ Turn–Onf Eal Time $V_{DS} = -5 \ V$ , $k = -4.4 \ A$ , $14 \ 20 \ nC$ $a_{gs}$ Gate–Charge $V_{DS} = -5 \ V$ , $k = -4.4 \ A$ , $3.0 \ nC$ <td>GSSR</td> <td>Gate-Body Leakage, Reverse</td> <td><math display="block">V_{GS} = 12 V \qquad V_{DS} = 0 V</math></td> <td></td> <td></td> <td>10</td> <td>μA</td>	GSSR	Gate-Body Leakage, Reverse	$V_{GS} = 12 V \qquad V_{DS} = 0 V$			10	μA
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	On Char	acteristics (Note 2)	· · · · · ·				
$\Delta T_{j}$ Temperature Coefficient $b = -250 \ \mu A$ , Referenced to $25^{\circ}C$ $3.1$ mV/2 $Bos(on)$ Static Drain–Source On–Resistance $V_{GS} = -4.5 \ V$ , $b = -4.4 \ A$ , $T_{j} = 125^{\circ}C$ $39$ $56$ $m\Omega$ $D(on)$ On–State Drain Current $V_{GS} = -4.5 \ V$ , $b = -4.4 \ A$ , $T_{j} = 125^{\circ}C$ $43$ $57$ $43$ $57$ $D(on)$ On–State Drain Current $V_{GS} = -4.5 \ V$ , $b = -3.3 \ A$ $43$ $57$ $A$ $D(on)$ On–State Drain Current $V_{GS} = -5 \ V$ , $b = -3.3 \ A$ $17$ $S$ <b>Dynamic Characteristics</b> $V_{DS} = -5 \ V$ , $b = -4.4 \ A$ $17$ $S$ <b>Dynamic Characteristics</b> $V_{DS} = -5 \ V$ , $b = -4.4 \ A$ $17$ $S$ <b>Dynamic Characteristics</b> $V_{DS} = -10 \ V$ , $V_{CS} = 0 \ V$ , $f = 1.0 \ MHz$ $1330 \ PF$ <b>Cras</b> Reverse Transfer Capacitance $V_{DS} = -10 \ V$ , $V_{CS} = 0 \ V$ , $f = 1.0 \ MHz$ $122 \ 25 \ ns$ <b>Switching Characteristics</b> (Note 2) $1330 \ PF$ $PF$ <b>d</b> (on)Turn–On Rise Time $4 \ ODP$ $V_{DD} = -10 \ V$ , $b = -1 \ A$ , $V_{CS} = -4.5 \ V$ , $R_{GEN} = 6 \ \Omega$ $12 \ 25 \ ns$ $a$ Turm–Off Fall Time $37 \ To$ $37 \ To$ $70 \ ns$ $a_{Q_0}$ Gate–Drain Charge $V_{DS} = -5 \ V$ , $b = -4.4 \ A$ , $V_{CS} = -4.5 \ V$ $3.0 \ nC$ $a_{Q_0}$ Gate–Drain Charge $V_{DS} = -5 \ V$ , $V_{CS} = 0 \ A$ $3.0 \ nC$ $a_{Q_0}$ Gate–Drain Charge $V_{DS} = -5 \ V$ , $V_{CS} = -4.5 \ V$ $3.9 \ nC$ $a_{Q_0}$ Gate–Drain Charge	V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250 \ \mu A$	-0.4	-1.0	-1.5	V
On-Resistance $V_{GS} = -4.5 V_{,b} = -4.4 A, T_J = 125 °C$ 3956m22 $V_{GS} = -2.5 V, b = -3.3 A$ $A$ $57$ $A$ $D(m)$ On-State Drain Current $V_{GS} = -4.5 V, V_{DS} = -5 V$ $-30$ $A$ $Prs$ Forward Trans conductance $V_{DS} = -5 V, b = -4.4 A$ $17$ $S$ <b>Dynamic Characteristics</b> $V_{DS} = -5 V, b = -4.4 A$ $17$ $S$ <b>Dynamic Characteristics</b> $V_{DS} = -10 V, V_{CS} = 0 V, f = 1.0 MHz$ $1330$ $pF$ $C_{rss}$ Input Capacitance $V_{DS} = -10 V, V_{CS} = 0 V, f = 1.0 MHz$ $153$ $pF$ $C_{rss}$ Reverse Transfer Capacitance $V_{DS} = -10 V, V_{CS} = 0 V, f = 1.0 MHz$ $153$ $pF$ Switching Characteristics(Note 2) $f = 1.0 MHz$ $153$ $pF$ $C_{rss}$ Reverse Transfer Capacitance $V_{DD} = -10 V, V_{CS} = 0 A, f = 160 V, f = 160 V$	$\frac{\Delta V_{GS(th)}}{\Delta T_J}$		• •		3.1		mV/ºC
JPSForward Transconductance $V_{DS} = -5 V$ , $I_D = -4.4 A$ 17SDynamic Characteristics $V_{DS} = -5 V$ , $I_D = -4.4 A$ 17SCissInput Capacitance $V_{DS} = -10 V$ , $V_{GS} = 0 V$ , f = 1.0 MHz1330pFCossOutput Capacitance $V_{DS} = -10 V$ , $V_{GS} = 0 V$ , f = 1.0 MHz1330pFSwitching Characteristics (Note 2)V_{DD} = -10 V, $I_D = -10 V$ , $I_D = -1 A$ , $V_{GS} = -4.5 V$ , $R_{GEN} = 6 \Omega$ 1225nsadomTurn-On Delay Time r r $V_{DD} = -10 V$ , $I_D = -1 A$ , $V_{GS} = -4.5 V$ , $R_{GEN} = 6 \Omega$ 1225nsadomTurn-Off Delay Time r r $V_{DS} = -5 V$ , $R_{GEN} = 6 \Omega$ 1420nc $Q_g$ Total Gate Charge $Q_{gd}$ $V_{DS} = -5 V$ , $I_D = -4.4 A$ , $V_{GS} = -4.5 V$ 3.0nc $Q_{gd}$ Gate-Drain Charge $V_{DS} = -5 V$ , $I_D = -4.4 A$ , $V_{GS} = -4.5 V$ 3.0ncDrain-Source Diode Characteristics and Maximum RatingssMaximum Continuous Drain-Source Diode Forward Current-0.83A $(a_{DD}$ Drain-Source Diode Forward $V_{CS} = -0 V$ , $I_D = -0.83 A$ (Into a) $-0.7$ $-12$ $V_{CS}$	R <sub>DS(on)</sub>		V <sub>GS</sub> = -4.5 V,I <sub>D</sub> = -4.4 A,T <sub>J</sub> =125°C		39	56	mΩ
Dynamic CharacteristicsCissInput Capacitance $V_{DS} = -10 \text{ V},  V_{GS} = 0 \text{ V},  1330  pF$ CossOutput Capacitance $f = 1.0 \text{ MHz}$ $552  pF$ CrssReverse Transfer Capacitance $153  pF$ Switching Characteristics (Note 2) $153  pF$ $a(on)$ Turn-On Delay Time $V_{DD} = -10 \text{ V},  b = -1 \text{ A},  19  40  ns$ $r$ Turn-On Rise Time $V_{DD} = -10 \text{ V},  b = -1 \text{ A},  19  40  ns$ $a(off)$ Turn-Off Delay Time $V_{CS} = -4.5 \text{ V},  R_{GEN} = 6 \Omega$ $f$ Turn-Off Fall Time $37  70  ns$ $A_g$ Total Gate Charge $V_{DS} = -5 \text{ V},  b = -4.4 \text{ A},  3.0  nC$ $A_{gd}$ Gate-Drain Charge $V_{DS} = -4.5 \text{ V}$ $3.9  nC$ Drain-Source Diode Characteristics and Maximum Ratings $s$ Maximum Continuous Drain-Source Diode Forward Current $-0.83 \text{ A}$	D(on)	On–State Drain Current	$V_{GS} = -4.5 \text{ V},  V_{DS} = -5 \text{ V}$	-30			А
$D_{iss}$ Input Capacitance $V_{DS} = -10 \text{ V},  V_{GS} = 0 \text{ V},  f = 1.0 \text{ MHz}$ $1330$ $pF$ $C_{oss}$ Output Capacitance $V_{DS} = -10 \text{ V},  V_{GS} = 0 \text{ V},  f = 1.0 \text{ MHz}$ $552$ $pF$ $C_{rss}$ Reverse Transfer Capacitance $f = 1.0 \text{ MHz}$ $153$ $pF$ Switching Characteristics (Note 2) $V_{DD} = -10 \text{ V},  I_D = -1 \text{ A},  19 \text{ 40 ns}$ $122 \text{ 25 ns}$ $a(on)$ Turn-On Delay Time $V_{DD} = -10 \text{ V},  I_D = -1 \text{ A},  19 \text{ 40 ns}$ $600 \text{ 100 ns}$ $a(off)$ Turn-Off Delay Time $V_{OS} = -4.5 \text{ V},  R_{GEN} = 6 \Omega$ $600 \text{ 100 ns}$ $a_{g}$ Total Gate Charge $V_{DS} = -5 \text{ V},  V_{GS} = -4.5 \text{ V}$ $144 \text{ 20 nC}$ $Q_{g}$ Gate-Source Charge $V_{OS} = -4.5 \text{ V}$ $100 \text{ ns}$ $Q_{gd}$ Gate-Drain Charge $V_{OS} = -4.5 \text{ V}$ $100 \text{ ns}$ $S$ Maximum Continuous Drain-Source Diode Forward $-0.83 \text{ A}$ $(a_{22})$ Drain-Source Diode Forward $V_{OS} = 0.47 \text{ hz}$	<b>g</b> fs	Forward Transconductance			17		S
$D_{iss}$ Input Capacitance $V_{DS} = -10 \text{ V},  V_{GS} = 0 \text{ V},  f = 1.0 \text{ MHz}$ $1330$ $pF$ $C_{oss}$ Output Capacitance $V_{DS} = -10 \text{ V},  V_{GS} = 0 \text{ V},  f = 1.0 \text{ MHz}$ $552$ $pF$ $C_{rss}$ Reverse Transfer Capacitance $f = 1.0 \text{ MHz}$ $153$ $pF$ Switching Characteristics (Note 2) $V_{DD} = -10 \text{ V},  I_D = -1 \text{ A},  19 \text{ 40 ns}$ $122 \text{ 25 ns}$ $a(on)$ Turn-On Delay Time $V_{DD} = -10 \text{ V},  I_D = -1 \text{ A},  19 \text{ 40 ns}$ $600 \text{ 100 ns}$ $a(off)$ Turn-Off Delay Time $V_{OS} = -4.5 \text{ V},  R_{GEN} = 6 \Omega$ $600 \text{ 100 ns}$ $a_{g}$ Total Gate Charge $V_{DS} = -5 \text{ V},  V_{GS} = -4.5 \text{ V}$ $144 \text{ 20 nC}$ $Q_{g}$ Gate-Source Charge $V_{OS} = -4.5 \text{ V}$ $100 \text{ ns}$ $Q_{gd}$ Gate-Drain Charge $V_{OS} = -4.5 \text{ V}$ $100 \text{ ns}$ $S$ Maximum Continuous Drain-Source Diode Forward $-0.83 \text{ A}$ $(a_{22})$ Drain-Source Diode Forward $V_{OS} = 0.47 \text{ hz}$	Dynamic	Characteristics					
CossOutput Capacitance $f = 1.0 \text{ MHz}$ $552$ $pF$ CrssReverse Transfer Capacitance $f = 1.0 \text{ MHz}$ $153$ $pF$ Switching Characteristics (Note 2)Vote 2) $V_{DD} = -10 \text{ V}$ , $I_D = -1 \text{ A}$ , $V_{DD} = -1 \text{ A}$ , $V_{GS} = -4.5 \text{ V}$ , $R_{GEN} = 6 \Omega$ $12$ $25$ $ns$ $d(off)$ Turn-Off Delay Time $V_{DD} = -10 \text{ V}$ , $I_D = -1 \text{ A}$ , $V_{GS} = -4.5 \text{ V}$ , $R_{GEN} = 6 \Omega$ $60$ $100$ $ns$ $q_{g}$ Total Gate Charge $V_{DS} = -5 \text{ V}$ , $V_{DS} = -5 \text{ V}$ , $V_{GS} = -4.5 \text{ V}$ $14$ $20$ $nC$ $Q_{gd}$ Gate-Drain Charge $V_{DS} = -5 \text{ V}$ , $V_{DS} = -4.5 \text{ V}$ $3.0$ $nC$ $Drain-Source Diode Characteristics and Maximum RatingssMaximum Continuous Drain-Source Diode Forward Current-0.83 \text{ A}v_{DS}Drain-Source Diode ForwardV_{CS} = 0 \text{ V}, h = -0.83 \text{ A}v_{DS} = -0.7 \text{ m}^2 2v_{DS}$	Ciss				1330		pF
CrissReverse Transfer Capacitance153pFSwitching Characteristics (Note 2) $V_{DOE} = -10 \text{ V}$ , $I_D = -1 \text{ A}$ ,1225ns $d(on)$ Turn-On Delay Time $V_{DD} = -10 \text{ V}$ , $I_D = -1 \text{ A}$ ,1940ns $d(off)$ Turn-Off Delay Time $V_{CS} = -4.5 \text{ V}$ , $R_{GEN} = 6 \Omega$ 60100ns $f_t$ Turn-Off Fall Time $V_{DS} = -5 \text{ V}$ , $R_{GEN} = 6 \Omega$ 60100ns $Q_g$ Total Gate Charge $V_{DS} = -5 \text{ V}$ , $V_{DS} = -4.5 \text{ V}$ 1420nC $Q_{gd}$ Gate-Drain Charge $V_{DS} = -4.5 \text{ V}$ $I_D = -4.4 \text{ A}$ ,3.0nC $Drain-Source Diode Characteristics and Maximum Ratings3.9nC0.00.0SMaximum Continuous Drain-Source Diode ForwardV_{CR} = 0 \text{ V}, h = -0.83 \text{ A} (Net 2)-0.7 \text{ ms}^2$	Coss	Output Capacitance			552		pF
$Turn-On Delay TimeV_{DD} = -10 \text{ V},  I_D = -1 \text{ A},  19  40  \text{ns}rTurn-On Rise TimeV_{DD} = -10 \text{ V},  I_D = -1 \text{ A},  19  40  \text{ns}d(off)Turn-Off Delay TimeV_{CS} = -4.5 \text{ V},  R_{GEN} = 6 \Omega60  100  \text{ns}rTurn-Off Fall Time37  70  \text{ns}37  70  \text{ns}Q_gTotal Gate ChargeV_{DS} = -5 \text{ V},  V_{GS} = -4.5 \text{ V}14  20  \text{nC}Q_{gs}Gate-Drain ChargeV_{DS} = -5 \text{ V},  V_{GS} = -4.5 \text{ V}3.0  \text{nC}Q_{gd}Gate-Drain ChargeV_{SS} = -4.5 \text{ V}3.9  \text{nC}Drain-Source Diode Characteristics and Maximum RatingssMaximum Continuous Drain-Source Diode Forward Current-0.83 \text{ A}v_{cs} = 0 \text{ V},  h = -0.83 \text{ A}v_{cs} = 0.7  -1.2  Vv_{cs} = 0.7  -1.2  V$	Crss	Reverse Transfer Capacitance			153		pF
$Turn-On Delay TimeV_{DD} = -10 \text{ V},  I_D = -1 \text{ A},  19  40  \text{ns}rTurn-On Rise TimeV_{DD} = -10 \text{ V},  I_D = -1 \text{ A},  19  40  \text{ns}d(off)Turn-Off Delay TimeV_{CS} = -4.5 \text{ V},  R_{GEN} = 6 \Omega60  100  \text{ns}rTurn-Off Fall Time37  70  \text{ns}37  70  \text{ns}Q_gTotal Gate ChargeV_{DS} = -5 \text{ V},  V_{GS} = -4.5 \text{ V}14  20  \text{nC}Q_{gs}Gate-Drain ChargeV_{DS} = -5 \text{ V},  V_{GS} = -4.5 \text{ V}3.0  \text{nC}Q_{gd}Gate-Drain ChargeV_{SS} = -4.5 \text{ V}3.9  \text{nC}Drain-Source Diode Characteristics and Maximum RatingssMaximum Continuous Drain-Source Diode Forward Current-0.83 \text{ A}v_{cs} = 0 \text{ V},  h = -0.83 \text{ A}v_{cs} = 0.7  -1.2  Vv_{cs} = 0.7  -1.2  V$	Switchin	g Characteristics (Note 2)					
$d_{(off)}$ Turn-Off Delay Time $V_{GS} = -4.5 \text{ V}$ , $R_{GEN} = 6 \Omega$ $60$ $100$ ns $a_{(off)}$ Turn-Off Fall Time $V_{GS} = -4.5 \text{ V}$ , $R_{GEN} = 6 \Omega$ $60$ $100$ ns $\Omega_{g}$ Total Gate Charge $V_{DS} = -5 \text{ V}$ , $V_{DS} = -5 \text{ V}$ , $V_{GS} = -4.5 \text{ V}$ $14$ $20$ nC $\Omega_{gd}$ Gate-Drain Charge $V_{DS} = -5 \text{ V}$ , $V_{GS} = -4.5 \text{ V}$ $14$ $20$ nC $\Omega_{gd}$ Gate-Drain Charge $V_{DS} = -4.5 \text{ V}$ $I_D = -4.4 \text{ A}$ , $3.0$ $nC$ Drain-Source Diode Characteristics and Maximum Ratings $3.9$ $nC$ sMaximum Continuous Drain-Source Diode Forward Current $-0.83 \text{ A}$ $A$ $V_{GS} = -0.7 \text{ m}^2$ $V_{GS} = 0.0 \text{ V}$ , $h = -0.83 \text{ A}$ $(hint 3)$ $-0.7 \text{ m}^2$	t <sub>d(on)</sub>	Turn–On Delay Time			12	25	ns
Initial CharacteristicsInitial CharacteristicsInitial CharacteristicsInitial Characteristics $a_{dom}$ Turn-Off Fall Time $37$ 70ns $Q_g$ Total Gate Charge $V_{DS} = -5 V$ , $V_{GS} = -4.5 V$ $14$ 20nC $Q_{gd}$ Gate-Drain Charge $V_{GS} = -4.5 V$ $3.0$ nC $Drain-Source Diode Characteristics and Maximum Ratings3.9nCsMaximum Continuous Drain-Source Diode Forward-0.83 AAV_{GS} = -0.17V_{GS} = -0.17-0.77-1.2$	tr	Turn–On Rise Time	$V_{DD} = -10 V$ , $I_D = -1 A$ ,		19	40	ns
Qg   Total Gate Charge   V <sub>DS</sub> = -5 V, V <sub>GS</sub> = -4.4 A, V <sub>GS</sub> = -4.5 V   14   20   nC     Qgd   Gate-Drain Charge   V <sub>GS</sub> = -4.5 V   Ib = -4.4 A, V <sub>GS</sub> = -4.5 V   3.0   nC     Drain-Source Diode Characteristics and Maximum Ratings   3.9   nC     S   Maximum Continuous Drain-Source Diode Forward Current   -0.83   A     Var   Drain-Source Diode Forward   Var   -0.7   -1.2   V	t <sub>d(off)</sub>	Turn–Off Delay Time			60	100	ns
Qgs   Gate-Source Charge   V <sub>DS</sub> = -5 V, V <sub>GS</sub> = -4.4 A, V <sub>GS</sub> = -4.5 V   3.0   nC     Qgd   Gate-Drain Charge   3.9   nC     Drain-Source Diode Characteristics and Maximum Ratings   3.9   nC     s   Maximum Continuous Drain-Source Diode Forward Current   -0.83   A     (an   Drain-Source Diode Forward   Vac = 0.14 A, Vac = 0.83 A   (https://doi.org/10.10000000000000000000000000000000000	t <sub>f</sub>	Turn–Off Fall Time	1		37	70	ns
Ags   Gate-Source Charge   V <sub>GS</sub> = -4.5 V   3.0   nc     Agd   Gate-Drain Charge   V <sub>GS</sub> = -4.5 V   3.9   nC     Drain-Source Diode Characteristics and Maximum Ratings   3.9   nC     s   Maximum Continuous Drain-Source Diode Forward Current   -0.83   A     (an   Drain-Source Diode Forward   Vac = 0.14 (bits 2)   -0.7   -1.2   V	Qg	Total Gate Charge			14	20	nC
Qgd   Gate-Drain Charge   3.9   nC     Drain-Source Diode Characteristics and Maximum Ratings   -0.83   A     s   Maximum Continuous Drain-Source Diode Forward Current   -0.83   A     (an   Drain-Source Diode Forward   Van = 0.03 A   (an = 0.7 - 1.2   V	Q <sub>gs</sub>	Gate-Source Charge			3.0		nC
s Maximum Continuous Drain–Source Diode Forward Current -0.83 A   Urain–Source Diode Forward Vox = 0.14 = -0.83 A	Q <sub>gd</sub>	Gate–Drain Charge	VGS - 4.5 V		3.9		nC
s Maximum Continuous Drain–Source Diode Forward Current -0.83 A   Urain–Source Diode Forward Vox = 0.14 = -0.83 A	Drain-So	ource Diode Characteristics	and Maximum Ratings				
Drain–Source Diode Forward $V_{co} = 0.7$ $h = -0.83$ A (Matrix 2)	ls					-0.83	А
	V <sub>SD</sub>	Drain-Source Diode Forward			-0.7	-1.2	V

Notes:

1. R<sub>8,4</sub> 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.

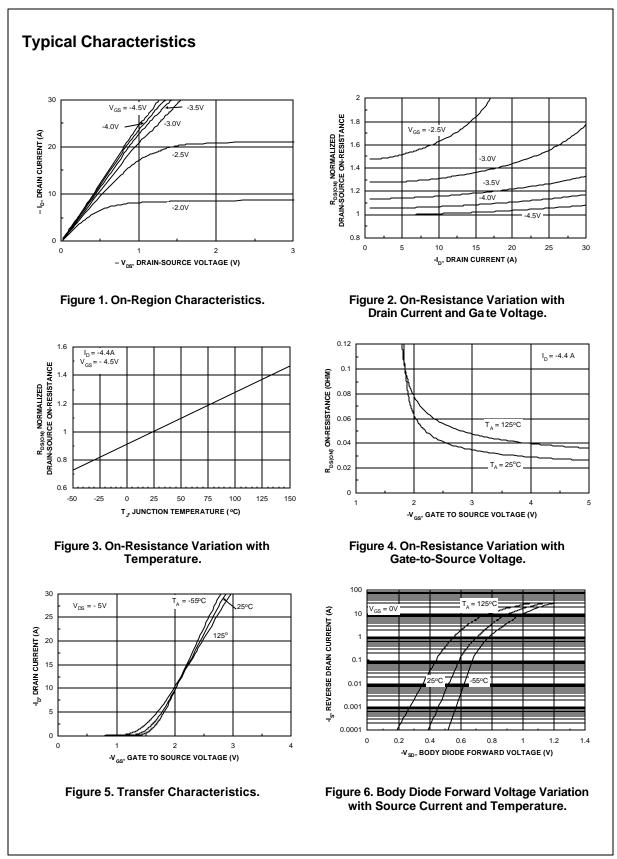
a)  $R_{\theta,JA} \, is \, 125^{\circ} C/W$  (steady state) when mounted on 1 inch² copper pad on FR-4.

b)  $R_{\theta,JA}$  is 208°C/W (steady state) when mounted on minimum copper pad on FR-4.

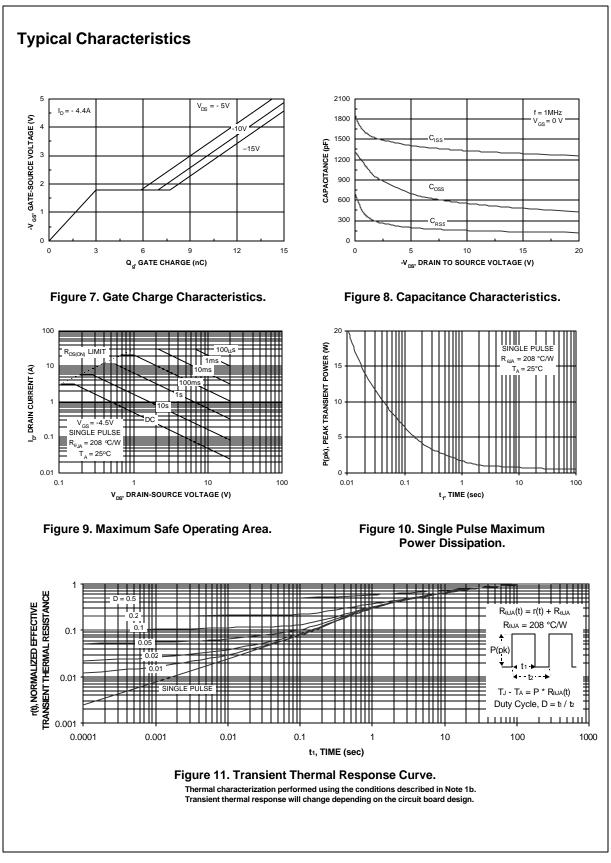
2. Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0.

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

# FDW2502PZ



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FDW2502PZ

FDW2502PZ Rev. C (W)

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