



ON Semiconductor®

## FDC6304P Digital FET, Dual P-Channel

### General Description

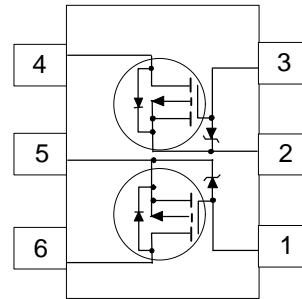
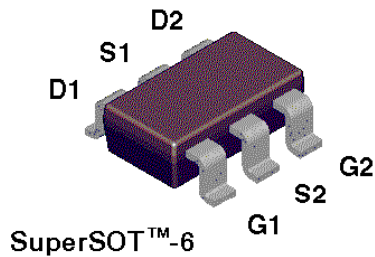
These P-Channel enhancement mode field effect transistor are produced using ON Semiconductor's proprietary, high cell density, DMOS technology. This very high density process is tailored to minimize on-state resistance at low gate drive conditions. This device is designed especially for application in battery power applications such as notebook computers and cellular phones. This device has excellent on-state resistance even at gate drive voltages as low as 2.5 volts.

### Features

- 25 V, -0.46 A continuous, -1.0 A Peak.  
 $R_{DS(ON)} = 1.5 \Omega @ V_{GS} = -2.7 V$   
 $R_{DS(ON)} = 1.1 \Omega @ V_{GS} = -4.5 V.$
- Very low level gate drive requirements allowing direct operation in 3V circuits.  $V_{GS(th)} < 1.5 V.$
- Gate-Source Zener for ESD ruggedness. >6kV Human Body Model.



Mark: .304



### Absolute Maximum Ratings $T_A = 25^\circ C$ unless otherwise noted

Symbol	Parameter	FDC6304P	Units
$V_{DSS}$	Drain-Source Voltage	-25	V
$V_{GSS}$	Gate-Source Voltage	-8	V
$I_D$	Drain Current	- Continuous	-0.46
		- Pulsed	-1
$P_D$	Maximum Power Dissipation	(Note 1a)	0.9
		(Note 1b)	0.7
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to 150	$^\circ C$
ESD	Electrostatic Discharge Rating MIL-STD-883D Human Body Model (100pf / 1500 Ohm)	6.0	kV

### THERMAL CHARACTERISTICS

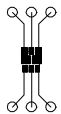
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	140	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	60	$^\circ C/W$

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

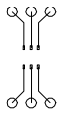
Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-25			V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	$I_D = -250\text{ }\mu\text{A}$ , Referenced to $25\text{ }^\circ\text{C}$		-22		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
				$T_J = 55\text{ }^\circ\text{C}$		-10
$I_{GSS}$	Gate - Body Leakage Current	$V_{GS} = -8\text{ V}, V_{DS} = 0\text{ V}$			-100	nA
<b>ON CHARACTERISTICS (Note 2)</b>						
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Temp. Coefficient	$I_D = -250\text{ }\mu\text{A}$ , Referenced to $25\text{ }^\circ\text{C}$		2.1		mV/ $^\circ\text{C}$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-0.65	-0.86	-1.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -2.7\text{ V}, I_D = -0.25\text{ A}$		1.22	1.5	$\Omega$
				0.87	1.1	
				$T_J = 125\text{ }^\circ\text{C}$	1.21	2
$I_{D(on)}$	On-State Drain Current	$V_{GS} = -2.7\text{ V}, V_{DS} = -5\text{ V}$	-0.5			A
				$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-1	
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -0.5\text{ A}$		0.8		S
<b>DYNAMIC CHARACTERISTICS</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		62		pF
$C_{oss}$	Output Capacitance			35		pF
$C_{rss}$	Reverse Transfer Capacitance			9.5		pF
<b>SWITCHING CHARACTERISTICS (Note 2)</b>						
$t_{D(on)}$	Turn - On Delay Time	$V_{DD} = -6\text{ V}, I_D = -0.5\text{ A},$ $V_{GS} = -4.5\text{ V}, R_{GEN} = 50\text{ }\Omega$		7	20	ns
$t_r$	Turn - On Rise Time			8	20	ns
$t_{D(off)}$	Turn - Off Delay Time			55	110	ns
$t_f$	Turn - Off Fall Time			35	70	ns
$Q_g$	Total Gate Charge		$V_{DS} = -5\text{ V}, I_D = -0.25\text{ A},$ $V_{GS} = -4.5\text{ V}$		1.1	1.5
$Q_{gs}$	Gate-Source Charge			0.32		nC
$Q_{gd}$	Gate-Drain Charge			0.28		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current				-0.5	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -0.5\text{ A}$ (Note 2)		-0.88	-1.2	V

**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.  $140\text{ }^\circ\text{C/W}$  on a  $0.125\text{ in}^2$  pad of 2oz copper.



b.  $180\text{ }^\circ\text{C/W}$  on a  $0.005\text{ in}^2$  pad of 2oz copper.

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

## Typical Electrical Characteristics

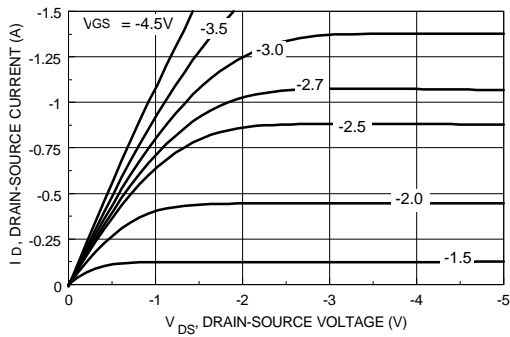


Figure 1. On-Region Characteristics.

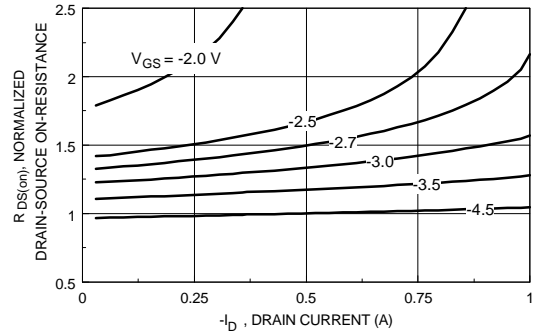


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

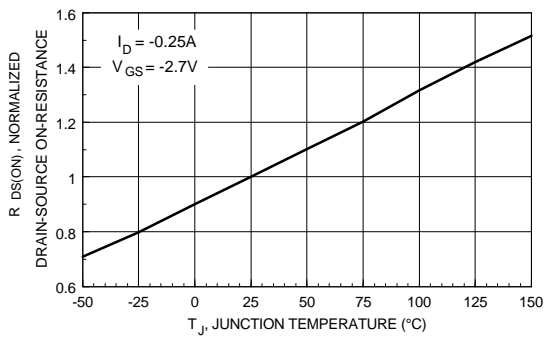


Figure 3. On-Resistance Variation with Temperature.

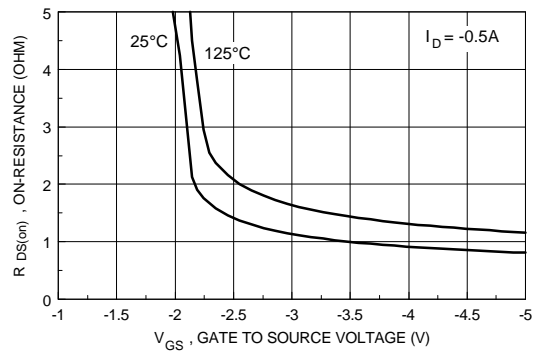


Figure 4. On-Resistance Variation with Gate-To-Source Voltage.

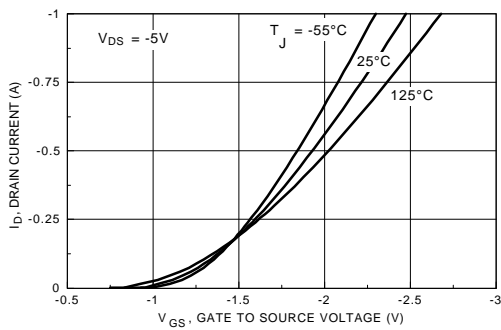


Figure 5. Transfer Characteristics.

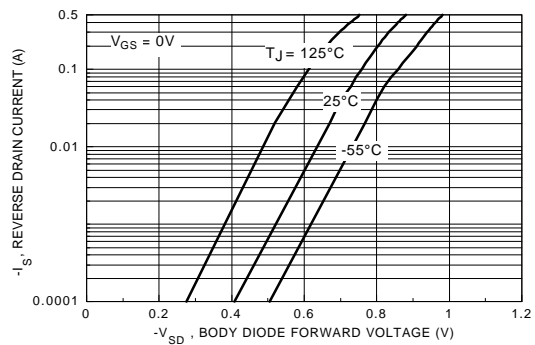


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Electrical And Thermal Characteristics

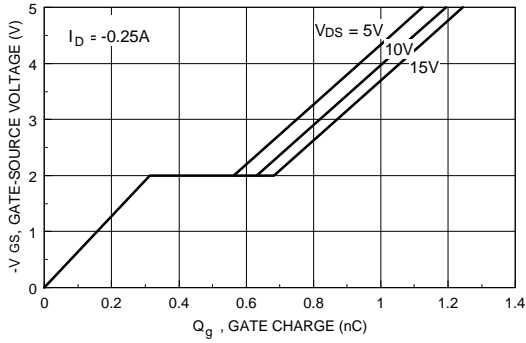


Figure 7. Gate Charge Characteristics.

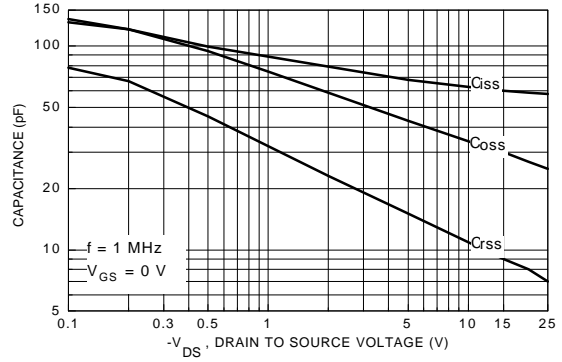


Figure 8. Capacitance Characteristics.

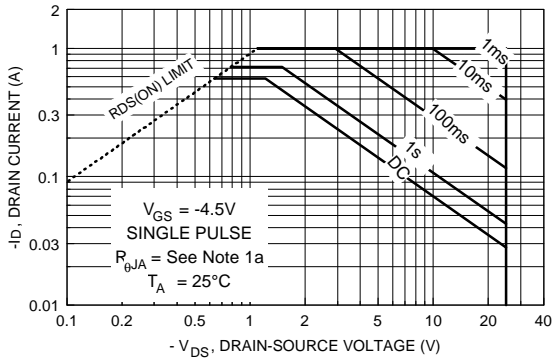


Figure 9. Maximum Safe Operating Area.

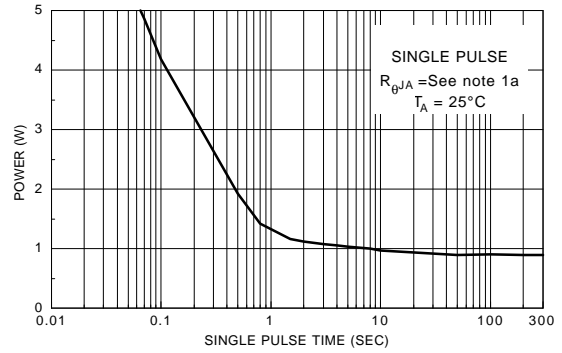


Figure 10. Single Pulse Maximum Power Dissipation.

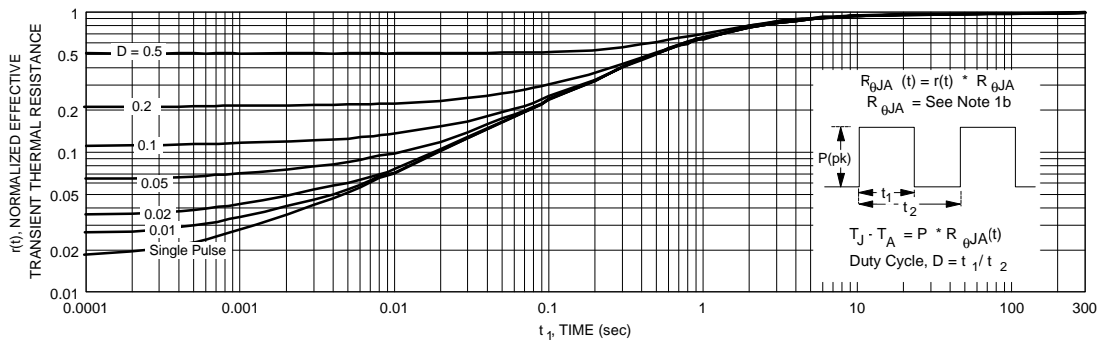


Figure 11. Transient Thermal Response Curve.

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

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