

# Si6433DQ

## 20V P-Channel PowerTrench® MOSFET

### General Description

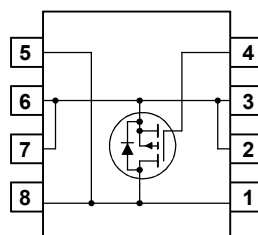
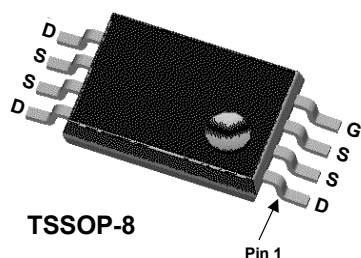
This P-Channel 1.8V specified MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance and yet maintain low gate charge for superior switching performance.

### Applications

- Power management
- Load switch

### Features

- -4.5 A, -20 V.  $R_{DS(ON)} = 47\text{ m}\Omega @ V_{GS} = -4.5\text{ V}$   
 $R_{DS(ON)} = 65\text{ m}\Omega @ V_{GS} = -2.5\text{ V}$   
 $R_{DS(ON)} = 100\text{ m}\Omega @ V_{GS} = -1.8\text{ V}$
- $R_{DS(ON)}$  rated for use with 1.8 V logic
- Low gate charge (13nC typical)
- High performance trench technology for extremely low  $R_{DS(ON)}$
- Low profile TSSOP-8 package



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

Symbol	Parameter	Rated	Units
V <sub>DSS</sub>	Drain-Source Voltage	-20	V
V <sub>GSS</sub>	Gate-Source Voltage	±8	V
I <sub>D</sub>	Drain Current – Continuous (Note 1a) – Pulsed	-4.5	A
		-40	
P <sub>D</sub>	Power Dissipation for Single Operation (Note 1a) (Note 1b)	1.3	W
		0.6	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Junction Temperature Range	-55 to +150	°C

### Thermal Characteristics

Symbol	Parameter	Rated	Units
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient (Note 1a) (Note 1b)	87	°C/W
		133	°C/W

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
6433	Si6433DQ	13"	16mm	3000 units

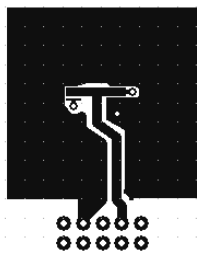
## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	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 $25^\circ\text{C}$		-14		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSSF}$	Gate–Body Leakage, Forward	$V_{GS} = 8\text{ V}, V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate–Body Leakage, Reverse	$V_{GS} = -8\text{ V}, V_{DS} = 0\text{ V}$			-100	nA
<b>On Characteristics (Note 2)</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-0.4	-0.8	-1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		2.5		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = -4.5\text{ V}, I_D = -4.5\text{ A}$ $V_{GS} = -2.5\text{ V}, I_D = -3.7\text{ A}$ $V_{GS} = -1.8\text{ V}, I_D = -3\text{ A}$ $V_{GS} = -4.5\text{ V}, I_D = -4.5\text{ A}, T_J = 125^\circ\text{C}$		37 50 77 48	47 65 100 65	m $\Omega$
$I_{D(on)}$	On–State Drain Current	$V_{GS} = -4.5\text{ V}, V_{DS} = -5\text{ V}$	-20			A
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}, I_D = -4.5\text{ A}$		16		S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V},$		1193		pF
$C_{oss}$	Output Capacitance	$f = 1.0\text{ MHz}$		193		pF
$C_{rss}$	Reverse Transfer Capacitance			96		pF
<b>Switching Characteristics (Note 2)</b>						
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = -10\text{ V}, I_D = -1\text{ A},$		11	20	ns
$t_r$	Turn–On Rise Time	$V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$		9	18	ns
$t_{d(off)}$	Turn–Off Delay Time			36	57	ns
$t_f$	Turn–Off Fall Time			19	34	ns
$Q_g$	Total Gate Charge	$V_{DS} = -10\text{ V}, I_D = -4.5\text{ A},$		13	18	nC
$Q_{gs}$	Gate–Source Charge	$V_{GS} = -4.5\text{ V}$		2.5		nC
$Q_{gd}$	Gate–Drain Charge			3.6		nC
<b>Drain–Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain–Source Diode Forward Current				-1.1	A
$V_{SD}$	Drain–Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = -1.1\text{ A}$ (Note 2)		-0.7	-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)  $87^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper.



- b)  $133^\circ\text{C/W}$  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%

### Typical Characteristics

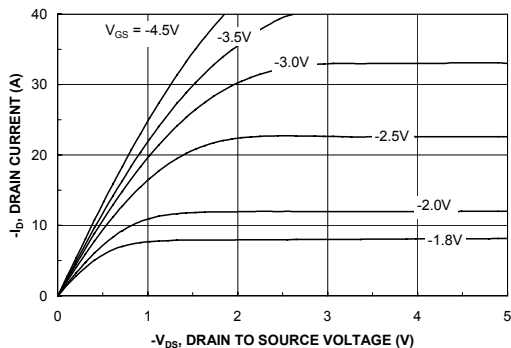


Figure 1. On-Region Characteristics.

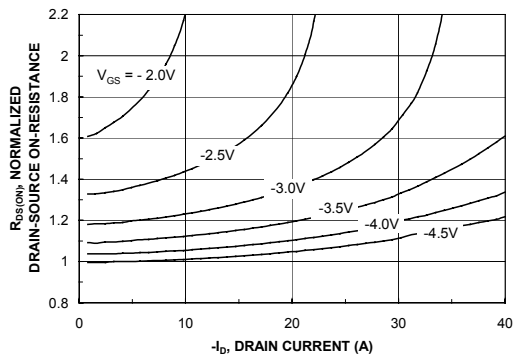


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

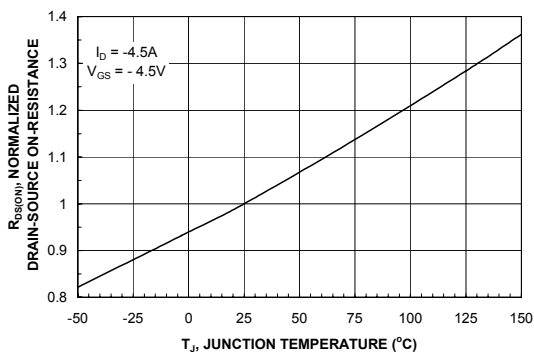


Figure 3. On-Resistance Variation with Temperature.

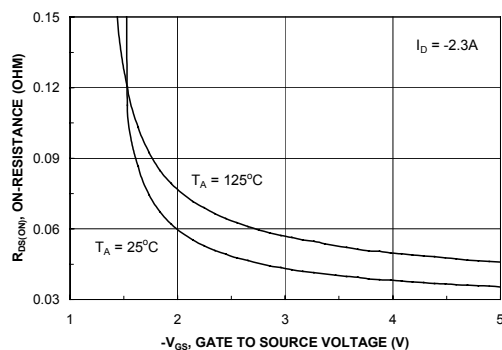


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

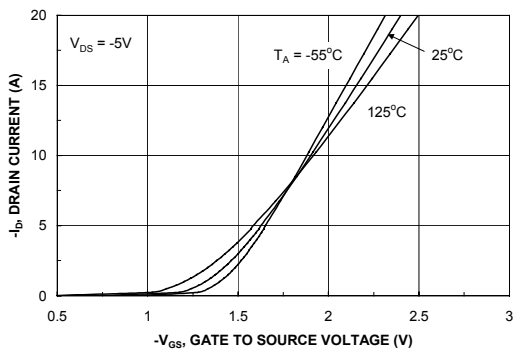


Figure 5. Transfer Characteristics.

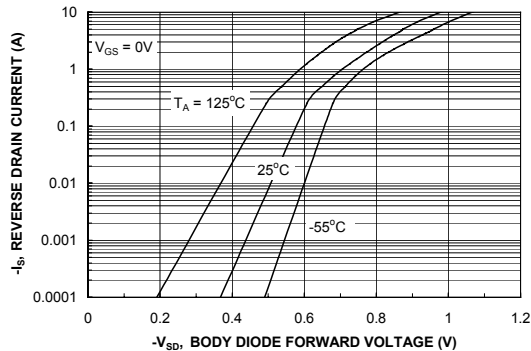


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

### Typical Characteristics

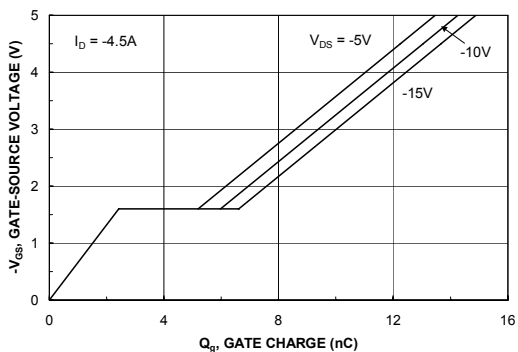


Figure 7. Gate Charge Characteristics.

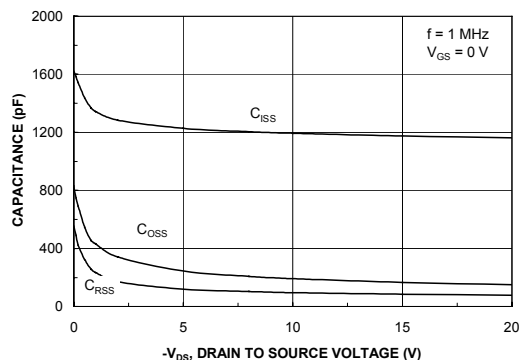


Figure 8. Capacitance Characteristics.

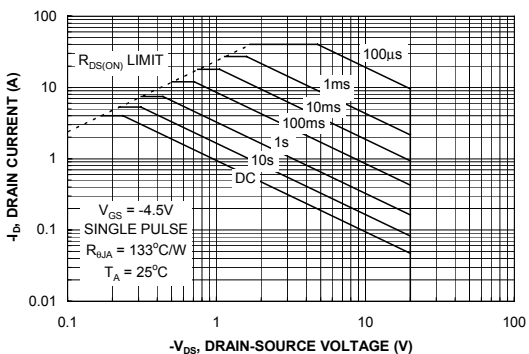


Figure 9. Maximum Safe Operating Area.

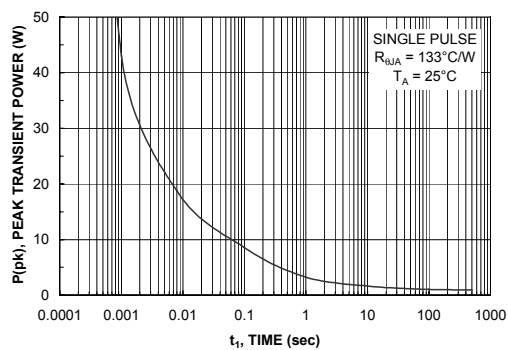


Figure 10. Single Pulse Maximum Power Dissipation.

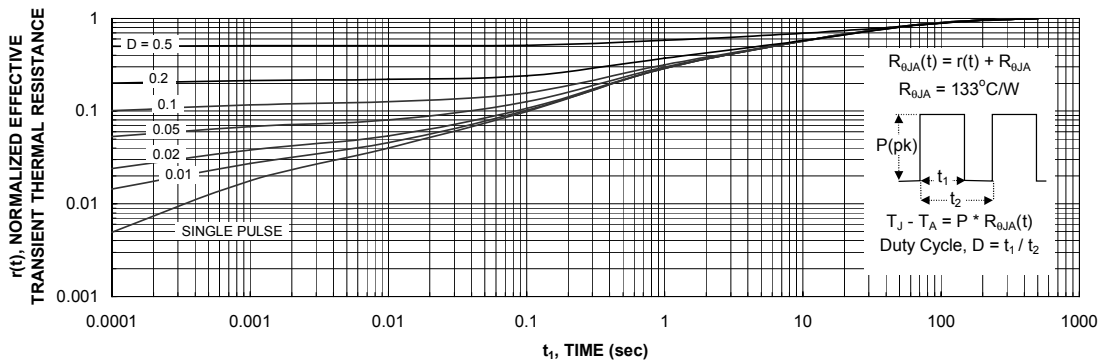


Figure 11. Transient Thermal Response Curve.

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

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