



ON Semiconductor®

## FDC658AP

### Single P-Channel Logic Level PowerTrench® MOSFET

-30V, -4A, 50mΩ

#### General Description

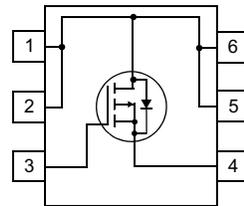
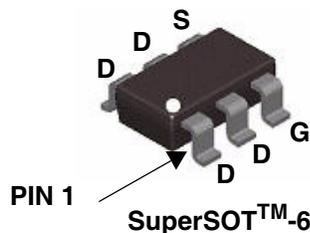
This P-Channel Logic Level MOSFET is produced using ON Semiconductor advanced PowerTrench process. It has been optimized for battery power management applications.

#### Applications

- Battery management
- Load switch
- Battery protection
- DC/DC conversion

#### Features

- Max  $r_{DS(on)}$  = 50 mΩ @  $V_{GS} = -10\text{ V}$ ,  $I_D = -4\text{ A}$
- Max  $r_{DS(on)}$  = 75 mΩ @  $V_{GS} = -4.5\text{ V}$ ,  $I_D = -3.4\text{ A}$
- Low Gate Charge
- High performance trench technology for extremely low  $r_{DS(on)}$
- RoHS Compliant



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

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain-Source Voltage	-30	V
$V_{GS}$	Gate-Source Voltage	±25	V
$I_D$	Drain Current - Continuous (Note 1a)	-4	A
	- Pulsed	-20	
$P_D$	Maximum Power dissipation (Note 1a)	1.6	W
	(Note 1b)	0.8	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	°C

#### Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	78	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	30	°C/W

#### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
.58A	FDC658AP	7inch	8mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , Referenced to $25^\circ\text{C}$		-22		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{GS} = 0\text{V}, V_{DS} = -24\text{V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage	$V_{GS} = \pm 25\text{V}, V_{DS} = 0\text{V}$			$\pm 100$	nA

**On Characteristics** (Note 2)

$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu\text{A}$	-1	-1.8	-3	V
$\frac{\Delta V_{GS(TH)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , Referenced to $25^\circ\text{C}$		4		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain-Source On-Resistance	$I_D = -4\text{A}, V_{GS} = -10\text{V}$		44	50	m $\Omega$
		$I_D = -3.4\text{A}, V_{GS} = -4.5\text{V}$		67	75	
		$I_D = -4\text{A}, V_{GS} = -10\text{V}$ , $T_J = 125^\circ\text{C}$		60	70	
$I_{D(ON)}$	On-State Drain Current	$V_{GS} = -10\text{V}, V_{DS} = -5\text{V}$	-20			A
$g_{FS}$	Forward Transconductance	$I_D = -4\text{A}, V_{DS} = -5\text{V}$		8.4		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = -15\text{V}, V_{GS} = 0\text{V}$ , $f = 1\text{MHz}$		470	680	pF
$C_{oss}$	Output Capacitance			126	180	pF
$C_{rss}$	Reverse Transfer Capacitance			61	90	pF

**Switching Characteristics** (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15\text{V}, I_D = -1\text{A}$ , $V_{GS} = -10\text{V}, R_{GEN} = 6\Omega$		7	14	ns
$t_r$	Turn-On Rise Time			12	22	ns
$t_{d(off)}$	Turn-Off Delay Time			16	29	ns
$t_f$	Turn-Off Fall Time			6	12	ns
$Q_g$	Total Gate Charge			6	8.1	nC
$Q_{gs}$	Gate-Source Charge	$V_{DS} = -15\text{V}, I_D = -4\text{A}$ , $V_{GS} = -5\text{V}$		2.1		nC
$Q_{gd}$	Gate-Drain Charge			2		nC

**Drain-Source Diode Characteristics and Maximum Ratings**

$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-1.3	A
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -1.3\text{A}$ (Note 2)	-0.77	-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)  $78^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



b)  $156^\circ\text{C/W}$  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

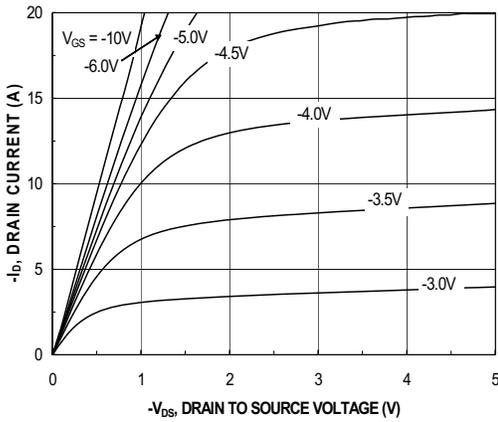


Figure 1. On-Region Characteristics

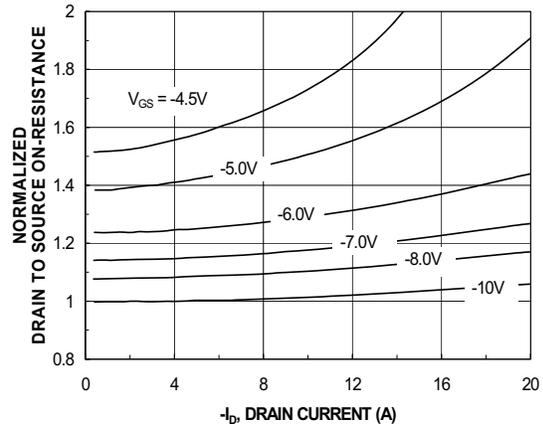


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

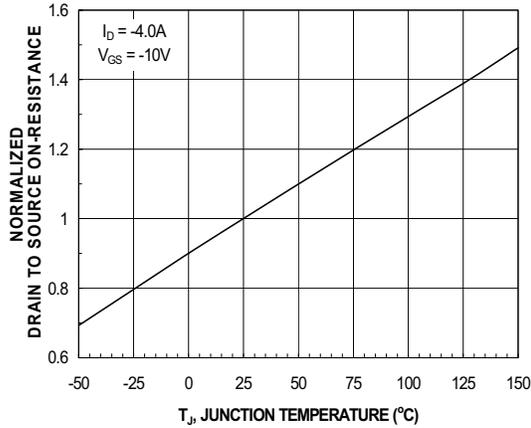


Figure 3. Normalized On-Resistance vs Junction Temperature

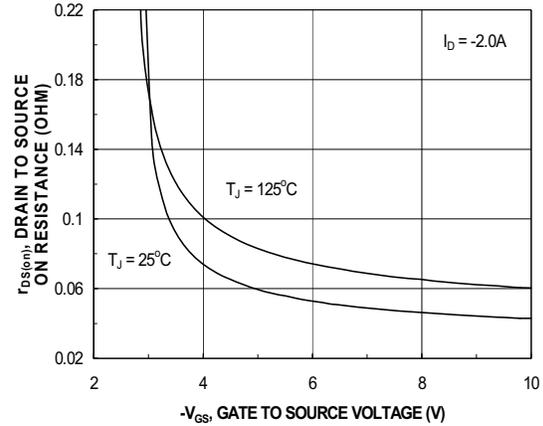


Figure 4. On-Resistance vs Gate to Source Voltage

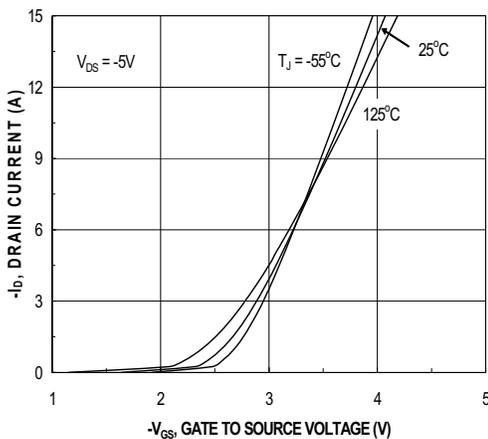


Figure 5. Transfer Characteristics

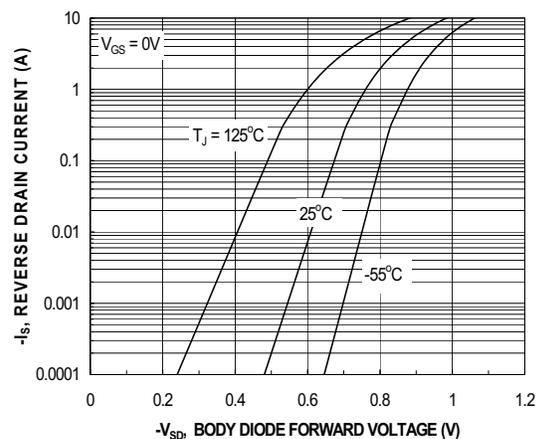


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

## Typical Characteristics

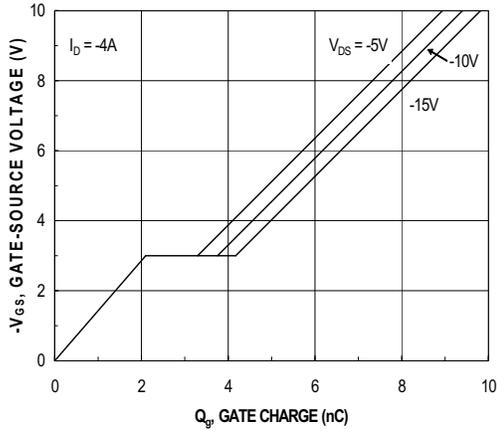


Figure 7. Gate Charge Characteristics

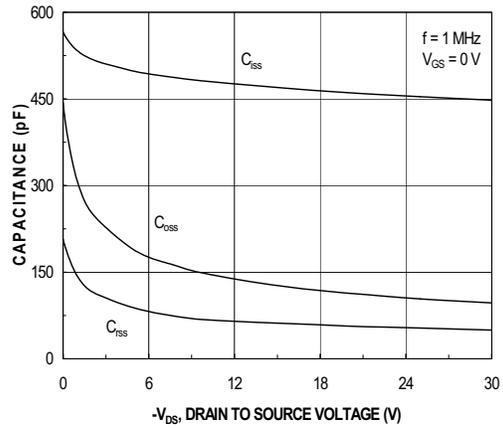


Figure 8. Capacitance vs Drain to Source Voltage

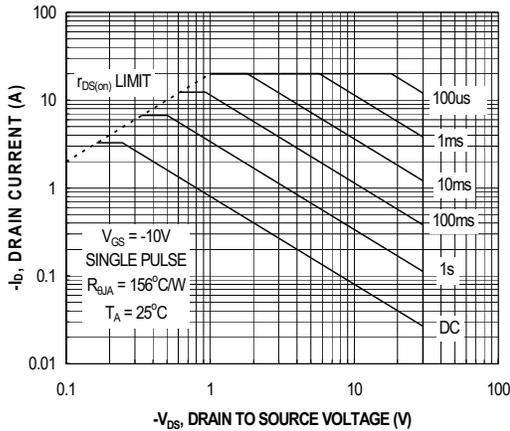


Figure 9. Forward Bias Safe Operating Area

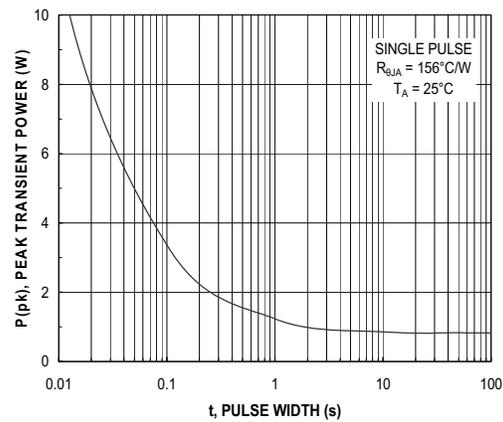


Figure 10. Single Pulse Maximum Power Dissipation

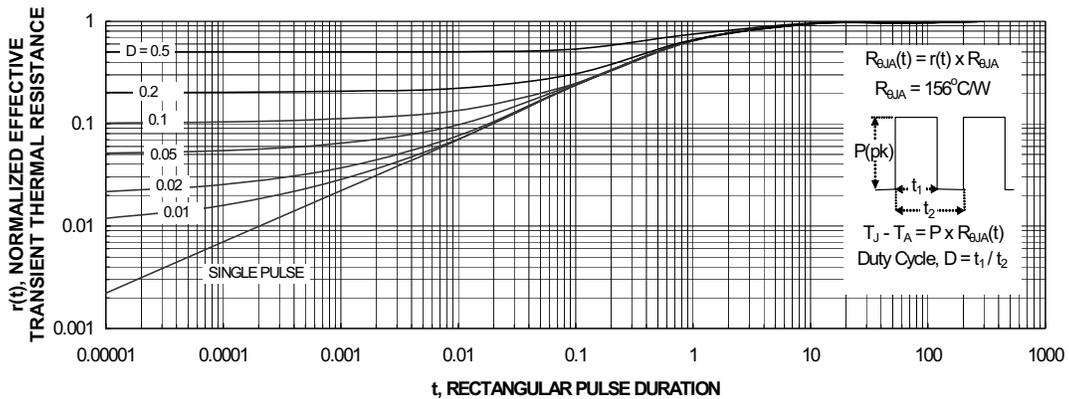


Figure 11. Transient Thermal Response Curve

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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