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ON Semiconductor®

# FDC3612

## 100V N-Channel PowerTrench® MOSFET

### General Description

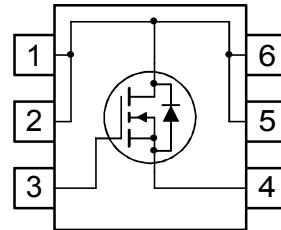
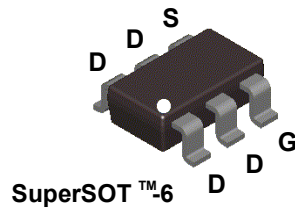
This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low  $R_{DS(ON)}$  and fast switching speed.

### Applications

- DC/DC converter

### Features

- 2.6 A, 100 V  $R_{DS(ON)} = 125 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(ON)} = 135 \text{ m}\Omega @ V_{GS} = 6 \text{ V}$
- High performance trench technology for extremely low  $R_{DS(ON)}$
- Low gate charge (14nC typ)
- High power and current handling capability
- Fast switching speed



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

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	100	V
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current – Continuous (Note 1a)	2.6	A
		– Pulsed	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	37	mJ
$P_D$	Maximum Power Dissipation (Note 1a)	1.6	W
		(Note 1b)	
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

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

### Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
.362	FDC3612	7"	8mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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**Drain-Source Avalanche Ratings** (Note 2)

$W_{DSS}$	Drain-Source Avalanche Energy	Single Pulse, $V_{DD} = 50\text{ V}$ , $I_D = 2.6\text{ A}$			90	mJ
$I_{AR}$	Drain-Source Avalanche Current				2.6	A

**Off Characteristics**

$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$ , $I_D = 250\ \mu\text{A}$	100			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		99		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 80\text{ V}$ , $V_{GS} = 0\text{ V}$			10	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage, Forward	$V_{GS} = 20\text{ V}$ , $V_{DS} = 0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage, Reverse	$V_{GS} = -20\text{ V}$ , $V_{DS} = 0\text{ V}$			-100	nA

**On Characteristics** (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250\ \mu\text{A}$	2	2.3	4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		-6		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 2.6\text{ A}$ $V_{GS} = 6.0\text{ V}$ , $I_D = 2.5\text{ A}$ $V_{GS} = 10\text{ V}$ , $I_D = 2.6\text{ A}$ ; $T_J = 125^\circ\text{C}$		86 91 157	125 135 240	m $\Omega$
$I_{D(on)}$	On-State Drain Current	$V_{GS} = 10\text{ V}$ , $V_{DS} = 5\text{ V}$	10			A
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{ V}$ , $I_D = 2.6\text{ A}$		10		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 50\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$		660		pF
$C_{oss}$	Output Capacitance			55		pF
$C_{riss}$	Reverse Transfer Capacitance			40		pF
$R_g$	Gate Resistance		0.1	1.4	3.0	$\Omega$

**Switching Characteristics** (Note 2)

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\text{ V}$ , $I_D = 1\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\ \Omega$		6	11	ns
$t_r$	Turn-On Rise Time			3.5	7	ns
$t_{d(off)}$	Turn-Off Delay Time			23	37	ns
$t_f$	Turn-Off Fall Time			3.7	7.4	ns
$Q_g$	Total Gate Charge	$V_{DS} = 50\text{ V}$ , $I_D = 2.6\text{ A}$ , $V_{GS} = 10\text{ V}$		14	20	nC
$Q_{gs}$	Gate-Source Charge			2.3		nC
$Q_{gd}$	Gate-Drain Charge			3.6		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)		0.76	1.2	V
$t_{rr}$	Diode Reverse Recovery Time	$I_F = 2.6\text{ A}$		31		nS
$Q_{rr}$	Diode Reverse Recovery Charge	$dI_F/dt = 100\text{ A}/\mu\text{s}$ (Note 2)		56		nC

**Notes:**

- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient 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.
  - $78^\circ\text{C/W}$  when mounted on a  $1\text{ in}^2$  pad of 2oz copper on FR-4 board.
  - $156^\circ\text{C/W}$  when mounted on a minimum pad.
- Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$
- $E_{AS}$  of 37 mJ is based on starting  $T_J = 25^\circ\text{C}$ ; N-ch:  $L = 3\text{ mH}$ ,  $I_{AS} = 5\text{ A}$ ,  $V_{DD} = 100\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.3\text{ mH}$ ,  $I_{AS} = 11\text{ A}$ .

### Typical Characteristics

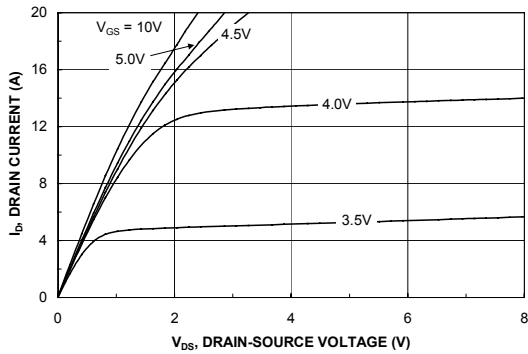


Figure 1. On-Region Characteristics.

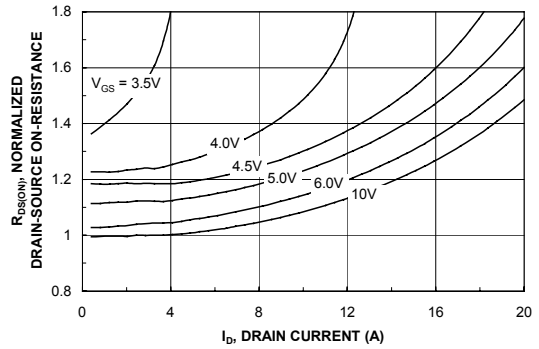


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

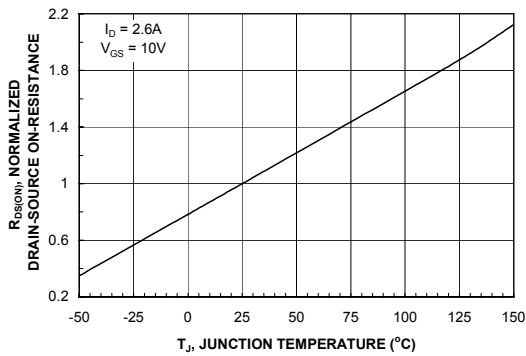


Figure 3. On-Resistance Variation with Temperature.

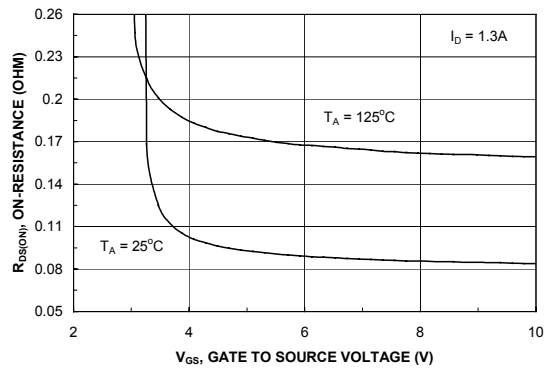


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

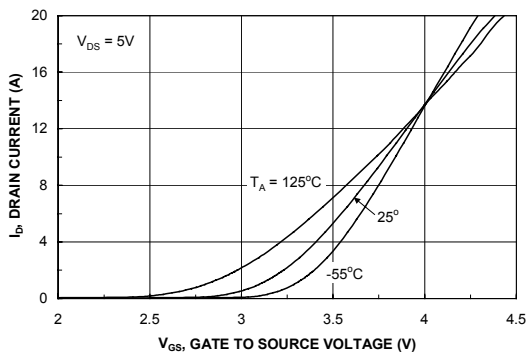


Figure 5. Transfer Characteristics.

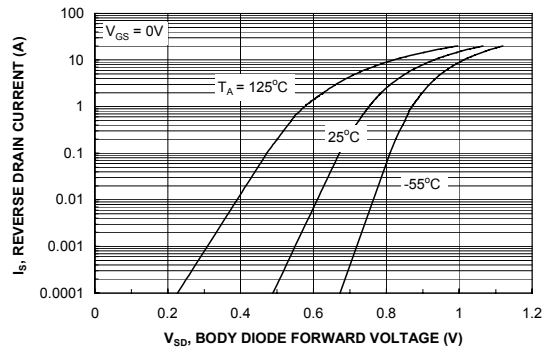
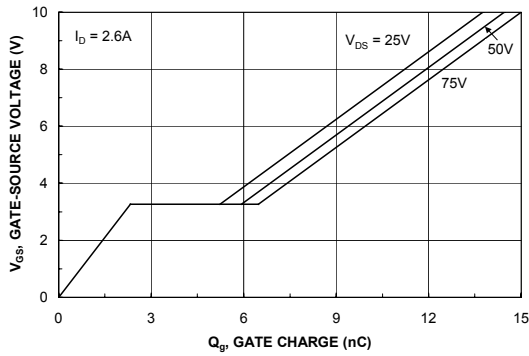
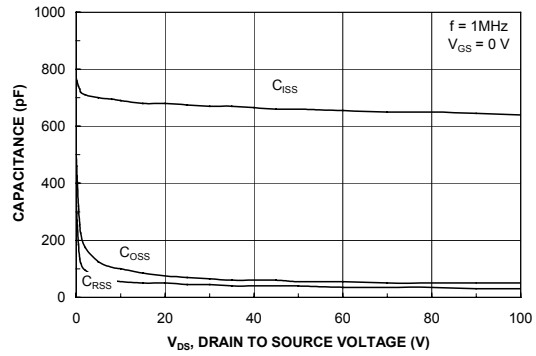


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

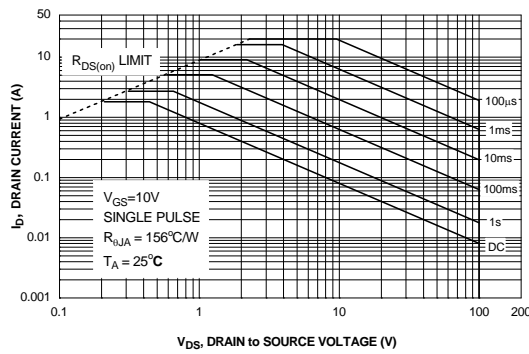
### Typical Characteristics



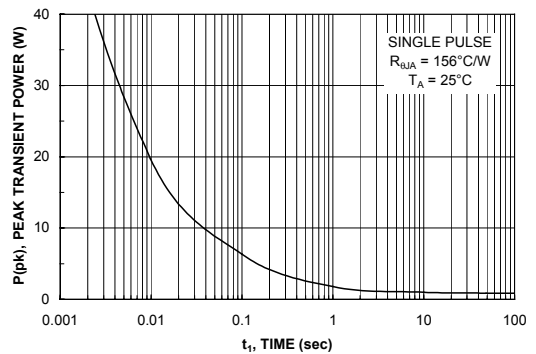
**Figure 7. Gate Charge Characteristics.**



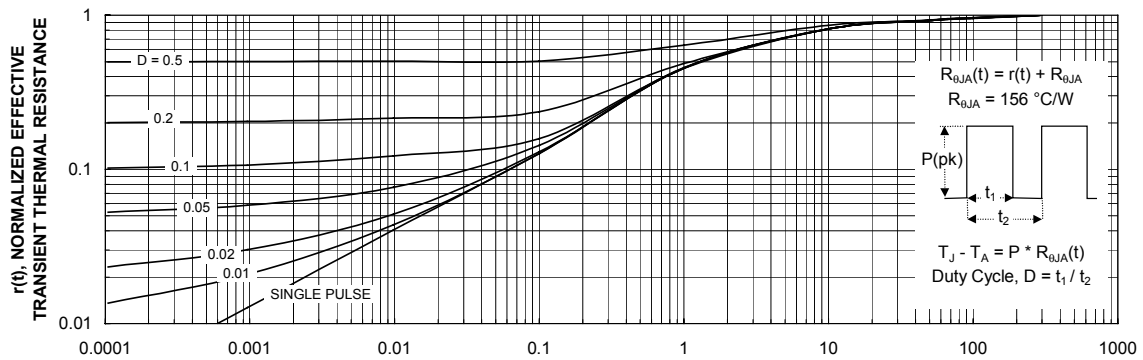
**Figure 8. Capacitance Characteristics.**



**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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