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ON Semiconductor®

# FDMC8321LDC

## N-Channel Dual Cool™ 33 PowerTrench® MOSFET 40 V, 108 A, 2.5 mΩ

### Features

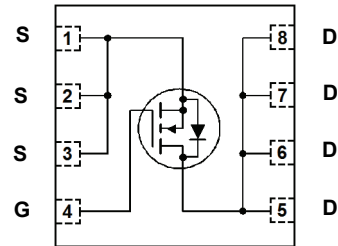
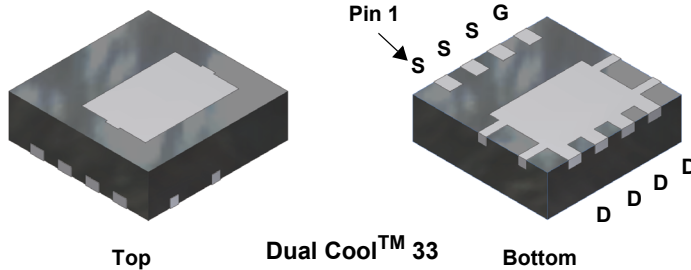
- Dual Cool™ Top Side Cooling PQFN package
- Max  $r_{DS(on)}$  = 2.5 mΩ at  $V_{GS} = 10$  V,  $I_D = 27$  A
- Max  $r_{DS(on)}$  = 4.1 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 21$  A
- High performance technology for extremely low  $r_{DS(on)}$
- RoHS Compliant

### General Description

This N-Channel MOSFET is produced using ON Semiconductor's advanced PowerTrench® process. Advancements in both silicon and Dual Cool™ package technologies have been combined to offer the lowest  $r_{DS(on)}$  while maintaining excellent switching performance by extremely low Junction-to-Ambient thermal resistance.

### Applications

- Primary DC-DC Switch
- Motor Bridge Switch
- Synchronous Rectifier



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

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain to Source Voltage	40	V
$V_{GS}$	Gate to Source Voltage	$\pm 20$	V
$I_D$	Drain Current -Continuous	$T_C = 25^\circ\text{C}$	108
	-Continuous	$T_A = 25^\circ\text{C}$ (Note 1a)	27
	-Pulsed	(Note 4)	320
$E_{AS}$	Single Pulse Avalanche Energy	(Note 3)	181
$P_D$	Power Dissipation	$T_C = 25^\circ\text{C}$	56
	Power Dissipation	$T_A = 25^\circ\text{C}$ (Note 1a)	2.9
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	(Note 1)	2.2	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	42	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
8321LD	FDMC8321LDC	Dual Cool™ 33	13 "	12 mm	3000 units

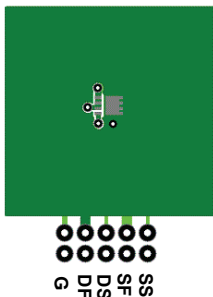
FDMC8321LDC N-Channel Dual Cool™ 33 PowerTrench® MOSFET

## Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case (Top Source)	5.0	$^{\circ}\text{C}/\text{W}$
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Bottom Drain)	2.2	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	42	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	105	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1c)	29	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1d)	40	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1e)	19	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1f)	23	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1g)	30	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1h)	79	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1i)	17	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1j)	26	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1k)	12	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1l)	16	

**Notes:**

1.  $R_{\theta JA}$  is determined with the device mounted on a FR-4 board using a specified pad of 2 oz copper as shown below.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a. 42  $^{\circ}\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b. 105  $^{\circ}\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

- c. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- d. Still air, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
- e. Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- f. Still air, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper
- g. 200FPM Airflow, No Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- h. 200FPM Airflow, No Heat Sink, minimum pad of 2 oz copper
- i. 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- j. 200FPM Airflow, 20.9x10.4x12.7mm Aluminum Heat Sink, minimum pad of 2 oz copper
- k. 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, 1 in<sup>2</sup> pad of 2 oz copper
- l. 200FPM Airflow, 45.2x41.4x11.7mm Aavid Thermalloy Part # 10-L41B-11 Heat Sink, minimum pad of 2 oz copper

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

3.  $E_{AS}$  of 181 mJ is based on starting  $T_J = 25^{\circ}\text{C}$ ,  $L = 3 \text{ mH}$ ,  $I_{AS} = 11 \text{ A}$ ,  $V_{DD} = 40 \text{ V}$ ,  $V_{GS} = 10 \text{ V}$ . 100% tested at  $L = 0.1 \text{ mH}$ ,  $I_{AS} = 35 \text{ A}$ .

4. Pulse Id measured at 250 $\mu\text{s}$ , refer to Fig 11 SOA graph for more details.

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

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	40			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		39		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 32\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\text{ }\mu\text{A}$	1.0	1.7	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-6		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 27\text{ A}$		2.0	2.5	m $\Omega$
		$V_{GS} = 4.5\text{ V}$ , $I_D = 21\text{ A}$		2.8	4.1	
		$V_{GS} = 10\text{ V}$ , $I_D = 27\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$		3.0	3.8	
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\text{ V}$ , $I_D = 27\text{ A}$		126		S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 20\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		2832	3965	pF
$C_{oss}$	Output Capacitance			777	1090	pF
$C_{rss}$	Reverse Transfer Capacitance			66	105	pF
$R_g$	Gate Resistance		0.1	0.7	2.5	$\Omega$

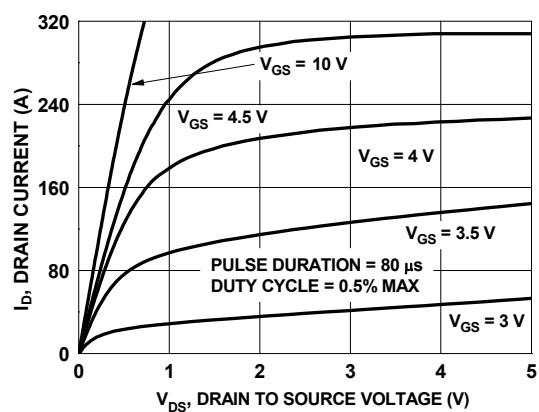
**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 20\text{ V}$ , $I_D = 27\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		13	23	ns
$t_r$	Rise Time			5.5	11	ns
$t_{d(off)}$	Turn-Off Delay Time			31	50	ns
$t_f$	Fall Time			4.8	10	ns
$Q_{g(TOT)}$	Total Gate Charge at 10 V	$V_{DD} = 20\text{ V}$ , $I_D = 27\text{ A}$		43	60	nC
$Q_{g(TOT)}$	Total Gate Charge at 5 V			22	31	nC
$Q_{gs}$	Total Gate Charge			7.1		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			6.1		nC

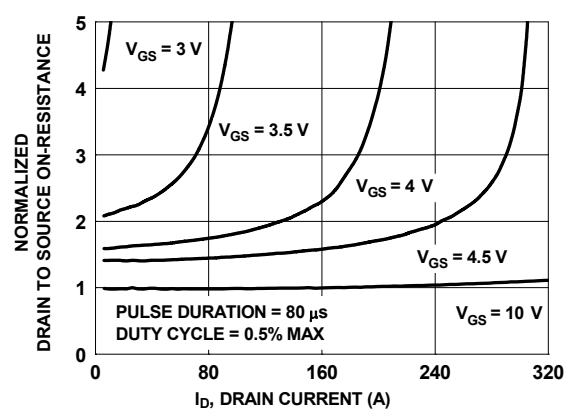
**Drain-Source Diode Characteristics**

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 2.3\text{ A}$ (Note 2)		0.7	1.2	V
		$V_{GS} = 0\text{ V}$ , $I_S = 27\text{ A}$ (Note 2)		0.8	1.3	
$t_{rr}$	Reverse Recovery Time	$I_F = 27\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		31	50	ns
$Q_{rr}$	Reverse Recovery Charge			11	20	nC

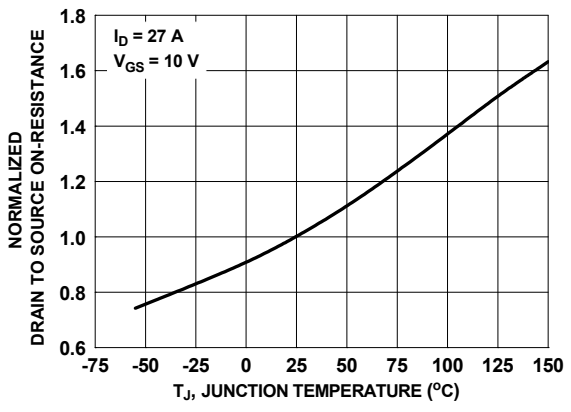
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



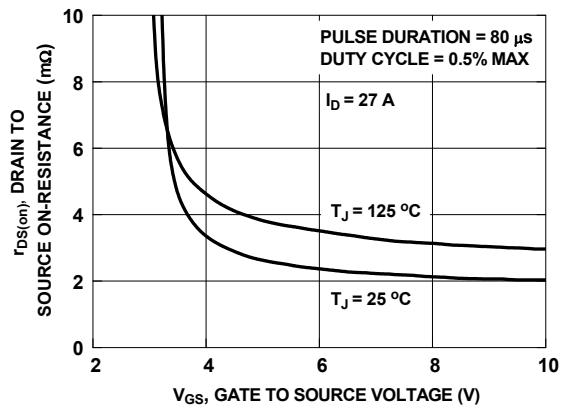
**Figure 1. On Region Characteristics**



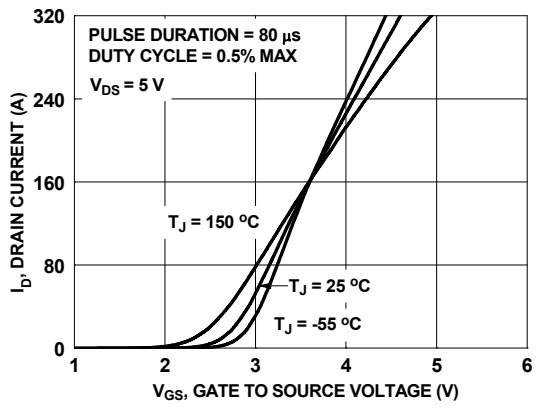
**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**



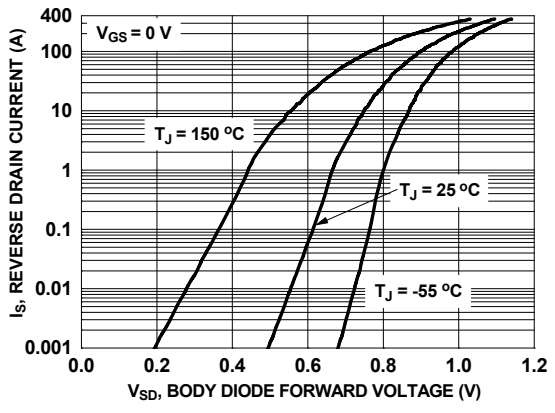
**Figure 3. Normalized On Resistance vs Junction Temperature**



**Figure 4. On-Resistance vs Gate to Source Voltage**

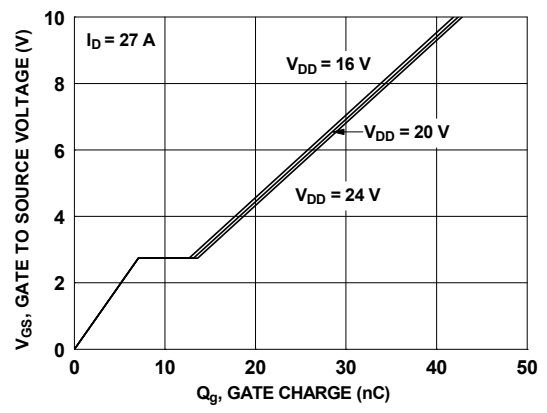


**Figure 5. Transfer Characteristics**

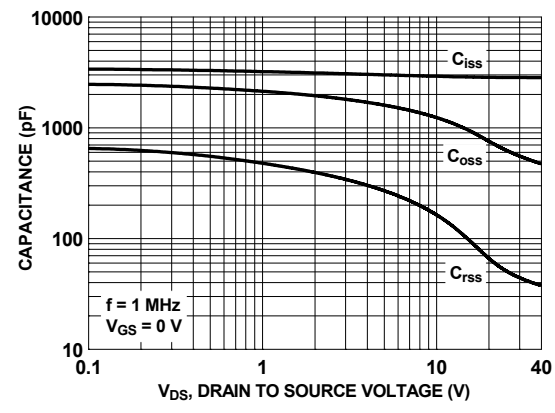


**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

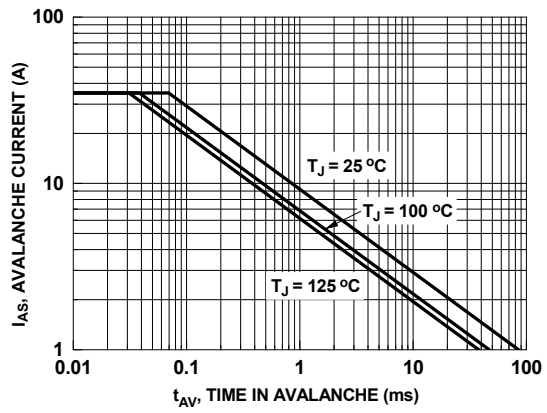
**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted



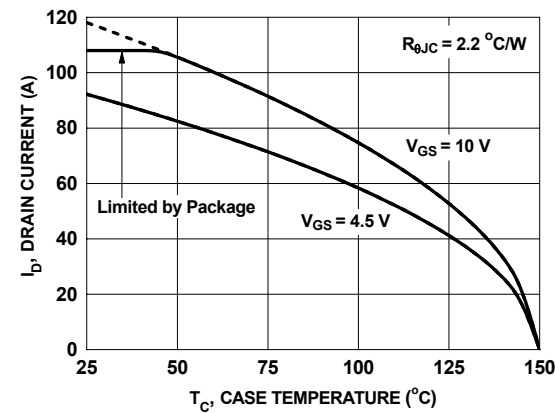
**Figure 7. Gate Charge Characteristics**



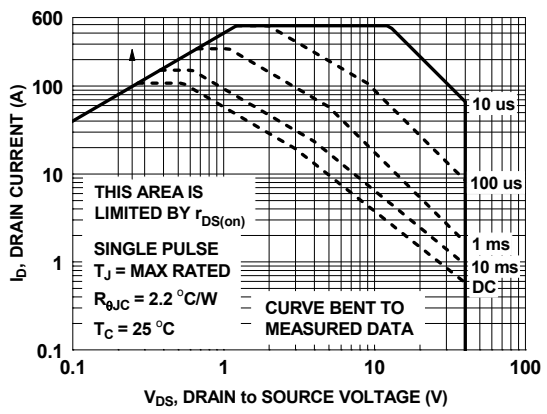
**Figure 8. Capacitance vs Drain to Source Voltage**



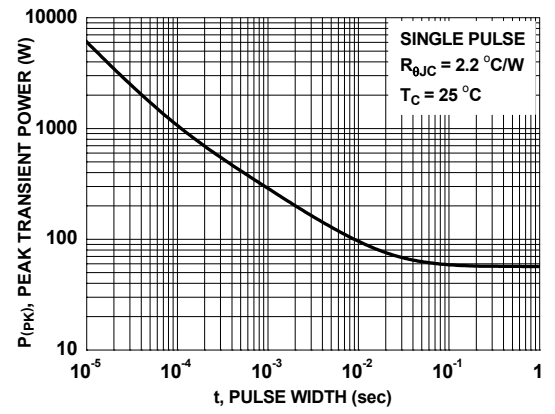
**Figure 9. Unclamped Inductive Switching Capability**



**Figure 10. Maximum Continuous Drain Current vs Case Temperature**

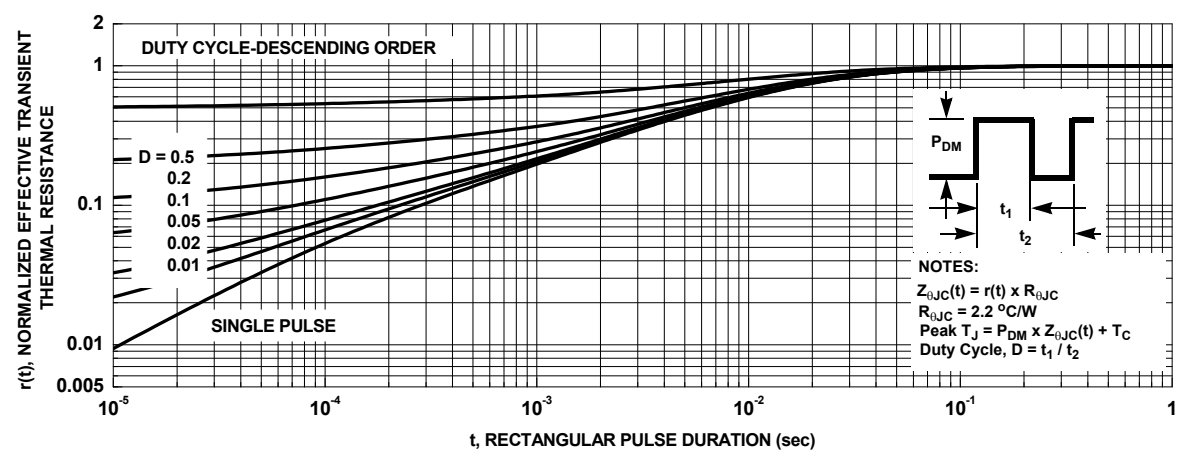


**Figure 11. Forward Bias Safe Operating Area**



**Figure 12. Single Pulse Maximum Power Dissipation**

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



**Figure 13. Junction-to-Case Transient Thermal Response Curve**

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