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# **FDP19N40** N-Channel UniFET<sup>TM</sup> MOSFET 400 V, 19 A, 240 mΩ

# Features

- $R_{DS(on)}$  = 200 m $\Omega$  (Typ.) @ V<sub>GS</sub> = 10 V, I<sub>D</sub> = 9.5 A
- Low Gate Charge (Typ. 32 nC)
- Low C<sub>rss</sub> (Typ. 20 pF)
- 100% Avalanche Tested
- Improved dv/dt Capability
- RoHS Compliant

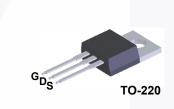
# Applications

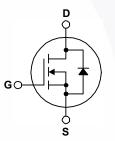
- Lighting
- Uninterruptible Power Supply
- AC-DC Power Supply

#### November 2013

# Description

UniFET<sup>TM</sup> MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.





# MOSFET Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted.

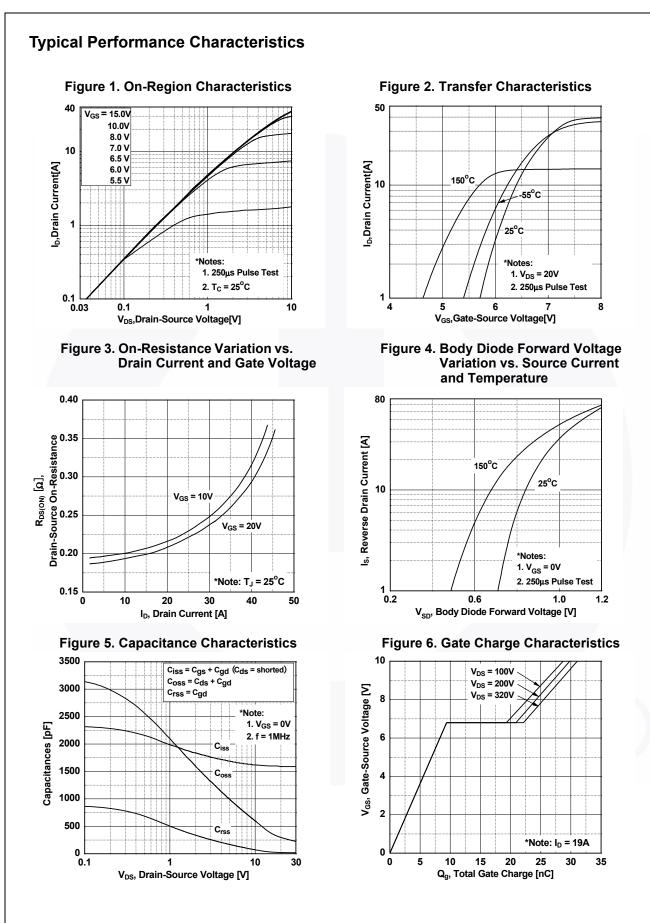
Symbol		Parameter		FDP19N40	Unit	
V <sub>DSS</sub>	Drain to Source Voltage			400	V	
V <sub>GSS</sub>	Gate to Source Voltage		±30	V		
I <sub>D</sub> C	Drain Current	- Continuous (T <sub>C</sub> = 25 <sup>o</sup> C)		19	А	
	Drain Current	- Continuous (T <sub>C</sub> = 100 <sup>o</sup> C)		11.4	— A	
I <sub>DM</sub>	Drain Current	- Pulsed	(Note 1)	76	A	
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		(Note 2)	542	mJ	
I <sub>AR</sub>	Avalanche Current (Note 1		(Note 1)	19	Α	
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)		(Note 1)	21.5	mJ	
dv/dt	Peak Diode Recovery du	//dt	(Note 3)	15	V/ns	
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25 <sup>o</sup> C)		215	W	
		- Derate Above 25°C		1.65	W/ºC	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range			-55 to +150	°C	
TL	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		r 5 Seconds	300	°C	

# **Thermal Characteristics**

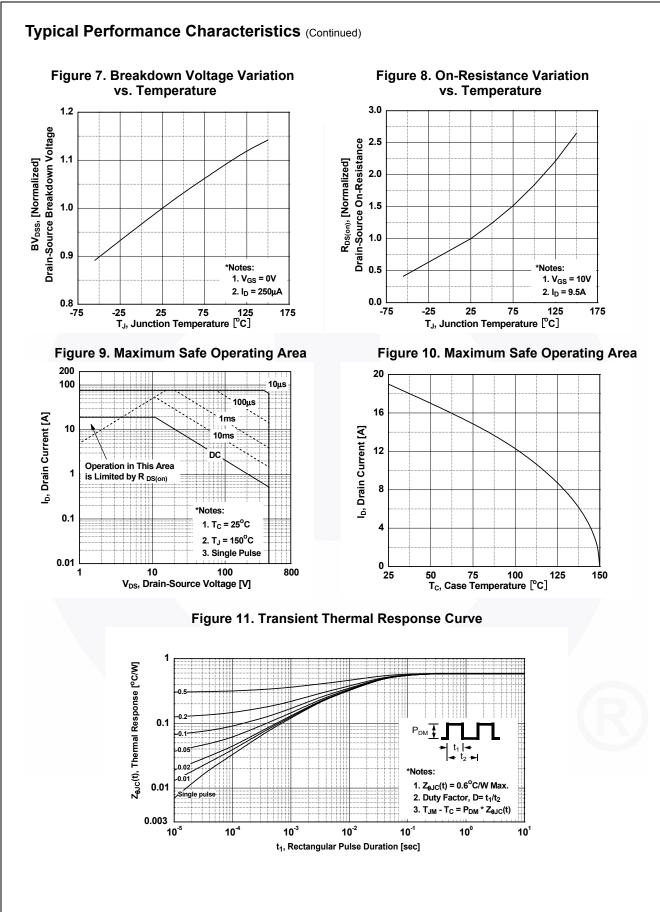
Symbol	Parameter	FDP19N40	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.6	°C/W
$R_{\thetaJA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	0/00

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0 FDP19N40 Characteristics T <sub>C</sub> = 2 Parameter ristics	TO-2 25°C unless	s otherwise no	Tube oted. est Condition	N/A		N/A	50	units
Parameter	25°C unless							
Parameter	_							
ristics			st contaition	IS	Min.	Тур.	Max.	Unit
Prain to Source Breakdown Volt	age	I <sub>D</sub> = 250 μA	, V <sub>GS</sub> = 0 V, <sup>-</sup>	Г. <sub>1</sub> = 25 <sup>о</sup> С	400	-	-	V
reakdown Voltage Temperature		$I_D = 250 \ \mu\text{A}$ , Referenced to $25^{\circ}\text{C}$		-	0.5	-	V/ºC	
Zero Gate Voltage Drain Current					-	-	1	μA
				,				nA
		•63 200	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,				1100	
ristics								T
Sate Threshold Voltage					3.0	-	5.0	V
	tance	00	5		-	-	0.24	Ω
orward Transconductance		V <sub>DS</sub> = 20 V,	I <sub>D</sub> = 9.5 A		-	18.3		S
aracteristics								
nput Capacitance					-	1590	2115	pF
Output Capacitance		V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1 MHz			-	255	340	pF
everse Transfer Capacitance				-	20	29	pF	
otal Gate Charge at 10V		V <sub>DS</sub> = 320 V	/, I <sub>D</sub> = 19 A,		-	32	40	nC
Sate to Source Gate Charge		V <sub>GS</sub> = 10 V		-	10	-	nC	
Sate to Drain "Miller" Charge				(Note 4)	-	13	-	nC
naracteristics								
urn-On Delay Time					-	31	72	ns
urn-On Rise Time		V <sub>DD</sub> = 200 V, I <sub>D</sub> = 19 A,		-	70	150	ns	
urn-Off Delay Time		V <sub>GS</sub> = 10 V,	$R_{G} = 25 \Omega$		-	82	174	ns
urn-Off Fall Time				(Note 4)	· · /	49	108	ns
Diode Characteristics								
laximum Continuous Drain to S	ource Diod	e Forward Cu	rrent		7 -	-	19	Α
					-	-	76	Α
rain to Source Diode Forward	/oltage	V <sub>GS</sub> = 0 V, I	<sub>SD</sub> = 19 A		-	-	1.4	V
everse Recovery Time		V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 19 A,			-	349		ns
everse Recovery Charge		$dI_F/dt = 100$	A/μs		-	3.56	-	μC
	coefficient ero Gate Voltage Drain Curren Gate to Body Leakage Current <b>ristics</b> Gate Threshold Voltage Static Drain to Source On Resis forward Transconductance <b>tracteristics</b> oput Capacitance put Capacitance output Capacitance teverse Transfer Capacitance otal Gate Charge at 10V Gate to Source Gate Charge Gate to Drain "Miller" Charge <b>tracteristics</b> urn-On Delay Time urn-On Rise Time urn-Off Fall Time <b>Diode Characteristics</b> aximum Continuous Drain to S aximum Pulsed Drain to Source rain to Source Diode Forward V everse Recovery Time everse Recovery Charge	Bioefficient   ero Gate Voltage Drain Current   Gate to Body Leakage Current   ristics   Gate Threshold Voltage   Bate to Characteristics   Bate to Drain "Miller" Charge   Bate to Drain Time   urn-On Delay Time   urn-Off Fall Time   Diode Characteristics   aximum Continuous Drain to Source Diode Formard Voltage   everse Recovery Time	coefficientID $250 \ \mu A$ ero Gate Voltage Drain Current $V_{DS} = 400 \ V_{DS} = 320 \ V_{DS} = 320 \ V_{DS} = 320 \ V_{CS} = 320 \ V_{CS} = 320 \ V_{CS} = 10 \ V_{CS} = 20 \ V_{CS} = 10 \ V_{CS$	coefficientID= 250 $\mu$ A, Referencedero Gate Voltage Drain Current $V_{DS} = 400 \vee, V_{GS} = 0 \vee$ Gate to Body Leakage Current $V_{GS} = 400 \vee, V_{GS} = 0 \vee$ risticsVGate Threshold Voltage $V_{GS} = \pm 30 \vee, V_{DS} = 0 \vee$ risticsSate Threshold Voltage $V_{GS} = \pm 30 \vee, V_{DS} = 0 \vee$ risticsSate Threshold Voltage $V_{GS} = 10 \vee, I_D = 9.5 \Lambda$ convard Transconductance $V_{DS} = 20 \vee, I_D = 9.5 \Lambda$ reverse Transfer Capacitance $V_{DS} = 25 \vee, V_{GS} = 0 \vee, f = 1 MHz$ reverse Transfer Capacitance $V_{DS} = 320 \vee, I_D = 19 \Lambda, V_{GS} = 10 \vee$ reverse Transfer Capacitance $V_{DS} = 320 \vee, I_D = 19 \Lambda, V_{GS} = 10 \vee$ reacteristics $V_{DD} = 200 \vee, I_D = 19 \Lambda, V_{GS} = 10 \vee, I_D = 19 \Lambda, V_{GS} = 10 \vee, I_D = 200 \vee, I_D = 19 \Lambda, V_{GS} = 10 \vee, I_D = 200 \vee, I_D = 19 \Lambda, V_{GS} = 10 \vee, I_D = 25 \Omega$ run-On Delay Time $V_{DD} = 200 \vee, I_D = 19 \Lambda, V_{GS} = 10 \vee, R_G = 25 \Omega$ run-Off Delay Time $V_{CS} = 0 \vee, I_S = 19 \Lambda, V_{GS} = 0 \vee, I_S = 19 \Lambda, V_{$	coefficientID= 250 µA, Referenced to 25°Cero Gate Voltage Drain Current $V_{DS} = 400 V, V_{GS} = 0 V$ Sate to Body Leakage Current $V_{GS} = 320 V, T_C = 125°C$ Sate to Body Leakage Current $V_{GS} = 320 V, V_{DS} = 0 V$ risticsSate Threshold Voltage $V_{GS} = 10 V, I_D = 9.5 A$ Sate Threshold Voltage $V_{GS} = 10 V, I_D = 9.5 A$ static Drain to Source On Resistance $V_{DS} = 20 V, I_D = 9.5 A$ static Drain to Source On Resistance $V_{DS} = 25 V, V_{GS} = 0 V, I_D = 9.5 A$ state to Body Leakage at 10V $V_{DS} = 25 V, V_{GS} = 0 V, I_D = 9.5 A$ state to Charge at 10V $V_{DS} = 320 V, I_D = 19 A, V_{GS} = 10 V$ state to Source Gate Charge $V_{DS} = 320 V, I_D = 19 A, V_{GS} = 10 V$ state to Drain "Miller" Charge $V_{DD} = 200 V, I_D = 19 A, V_{GS} = 10 V, R_G = 25 \Omega$ urn-On Delay Time $V_{DD} = 200 V, I_D = 19 A, V_{GS} = 10 V, R_G = 25 \Omega$ urn-Off Delay Time $V_{DD} = 200 V, I_D = 19 A, V_{GS} = 10 V, R_G = 25 \Omega$ urn-Off Fall Time $V_{DS} = 10 V, R_G = 25 \Omega$ stimum Continuous Drain to Source Diode Forward Currentaximum Pulsed Drain to Source Diode Forward Currentrain to Source Diode Forward Voltage $V_{GS} = 0 V, I_{SD} = 19 A, V_{GS} = 0 V, I_{SD} = 19 A, V_{SS} = 0$	coefficientID= 250 $\mu$ A, Referenced to 25°C-ero Gate Voltage Drain Current $V_{DS} = 400 \text{ V}, V_{GS} = 0 \text{ V}$ -Sate to Body Leakage Current $V_{GS} = 430 \text{ V}, V_{DS} = 0 \text{ V}$ -risticsSate Threshold Voltage $V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$ -risticsSate Threshold Voltage $V_{GS} = 10 \text{ V}, I_D = 9.5 \text{ A}$ -forward Transconductance $V_{GS} = 20 \text{ V}, I_D = 9.5 \text{ A}$ -orward Transconductance $V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ -futput Capacitance $V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ -futput Capacitance $V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ -take to Source Gate Charge $V_{DS} = 320 \text{ V}, I_D = 19 \text{ A},$ -valate to Source Gate Charge $V_{GS} = 10 \text{ V},$ -take to Drain "Miller" Charge $V_{DD} = 200 \text{ V}, I_D = 19 \text{ A},$ -urn-On Delay Time $V_{GS} = 10 \text{ V},$ urn-Off Delay Time $V_{GS} = 10 \text{ V},$ urn-Off Fall Time $V_{GS} = 00 \text{ V},$ urn-Off Fall Time $V_{GS} = 00 \text{ V},$ urn-Off Fall Time $V_{GS} = 00 \text{ V},$ urn-Off Fall Time $V_{GS} = 0 \text{ V},$ </td <td>coefficientID2.50 µA, Reference to 2.5°C-0.5ero Gate Voltage Drain Current<math>V_{DS} = 400 \text{ V}, V_{GS} = 0 \text{ V}</math>Sate to Body Leakage Current<math>V_{GS} = 400 \text{ V}, V_{DS} = 0 \text{ V}</math>sate to Body Leakage Current<math>V_{GS} = 125^{\circ}</math>CristicsSate Threshold Voltage<math>V_{GS} = V_{DS}, I_D = 250 \mu</math>A3.0risticsSate Threshold Voltage<math>V_{GS} = V_{DS}, I_D = 250 \mu</math>A3.0risticsSate Threshold Voltage<math>V_{GS} = 10 \text{ V}, I_D = 9.5 \text{ A}</math>-0.2forward Transconductance<math>V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, I_D = 9.5 \text{ A}</math>-18.3racteristicsput Capacitance<math>V_{DS} = 25 \text{ V}, V_{CS} = 0 \text{ V}, I_D = 9.5 \text{ A}</math>-1590otal Gate Charge at 10V<math>V_{DS} = 320 \text{ V}, I_D = 19 \text{ A}, V_{GS} = 10 \text{ V}</math>-32value to Source Gate Charge<math>V_{GS} = 10 \text{ V}, I_D = 19 \text{ A}, V_{CS} = 10 \text{ V}</math>-10value to Drain "Miller" Charge<math>V_{DD} = 200 \text{ V}, I_D = 19 \text{ A}, V_{CS} = 10 \text{ V}</math>-31urn-On Delay Time<math>V_{DS} = 10 \text{ V}, R_G = 25 \Omega</math>-82urn-Off Fall Time<math>V_{CS} = 0 \text{ V}, I_S = 19 \text{ A},32urn-Off Fall Time<math>V_{GS} = 0 \text{ V}, I_S = 19 \text{ A},verse Recovery Time<math>V_{GS} = 0 \text{ V}, I_S = 19 \text{ A},everse Recovery Charge<math>V_{GS} = 0 \text{ V}, I_S = 19 \text{ A},vers</math></math></math></math></td> <td><math display="block">\begin{array}{ c c c c c c c c c c c c c c c c c c c</math></td>	coefficientID2.50 µA, Reference to 2.5°C-0.5ero Gate Voltage Drain Current $V_{DS} = 400 \text{ V}, V_{GS} = 0 \text{ V}$ Sate to Body Leakage Current $V_{GS} = 400 \text{ V}, V_{DS} = 0 \text{ V}$ sate to Body Leakage Current $V_{GS} = 125^{\circ}$ CristicsSate Threshold Voltage $V_{GS} = V_{DS}, I_D = 250 \mu$ A3.0risticsSate Threshold Voltage $V_{GS} = V_{DS}, I_D = 250 \mu$ A3.0risticsSate Threshold Voltage $V_{GS} = 10 \text{ V}, I_D = 9.5 \text{ A}$ -0.2forward Transconductance $V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, I_D = 9.5 \text{ A}$ -18.3racteristicsput Capacitance $V_{DS} = 25 \text{ V}, V_{CS} = 0 \text{ V}, I_D = 9.5 \text{ A}$ -1590otal Gate Charge at 10V $V_{DS} = 320 \text{ V}, I_D = 19 \text{ A}, V_{GS} = 10 \text{ V}$ -32value to Source Gate Charge $V_{GS} = 10 \text{ V}, I_D = 19 \text{ A}, V_{CS} = 10 \text{ V}$ -10value to Drain "Miller" Charge $V_{DD} = 200 \text{ V}, I_D = 19 \text{ A}, V_{CS} = 10 \text{ V}$ -31urn-On Delay Time $V_{DS} = 10 \text{ V}, R_G = 25 \Omega$ -82urn-Off Fall Time $V_{CS} = 0 \text{ V}, I_S = 19 \text{ A},32urn-Off Fall TimeV_{GS} = 0 \text{ V}, I_S = 19 \text{ A},verse Recovery TimeV_{GS} = 0 \text{ V}, I_S = 19 \text{ A},everse Recovery ChargeV_{GS} = 0 \text{ V}, I_S = 19 \text{ A},vers$	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$

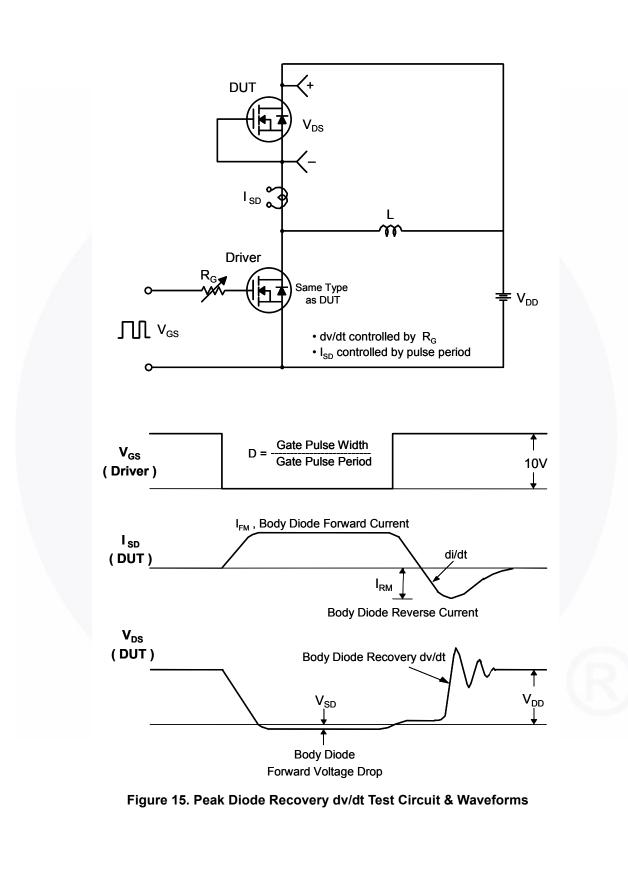


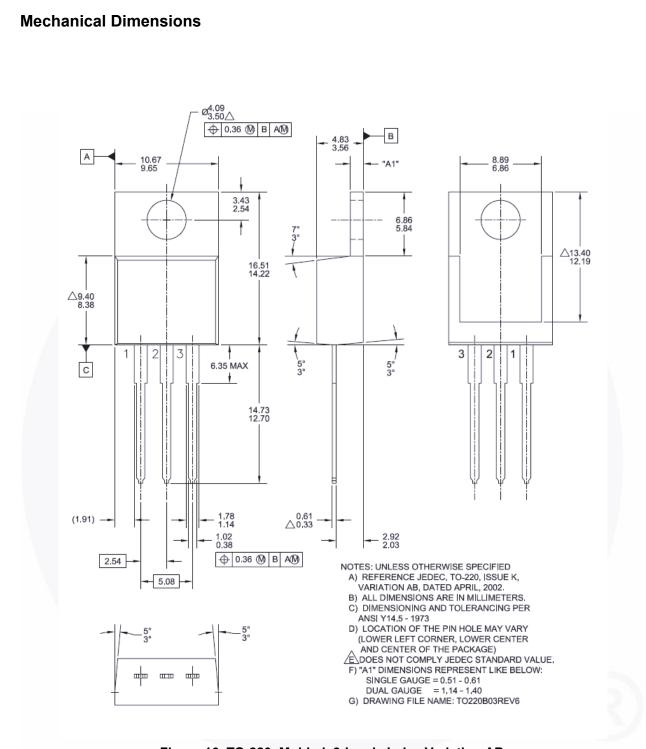
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 $V_{GS}$ ξ א  $\mathsf{Q}_\mathsf{g}$ FV<sub>DS</sub>  $\mathsf{Q}_{\mathsf{gd}}$  $\mathsf{Q}_{\mathsf{gs}}$ • DUT I<sub>G</sub> = const. Charge Figure 12. Gate Charge Test Circuit & Waveform R VDS V<sub>DS</sub> 90% ο V<sub>DD</sub> GS  $R_{G}$ 10% V<sub>GS</sub> DUT V<sub>GS</sub> ∏ 0 Figure 13. Resistive Switching Test Circuit & Waveforms L  $E_{AS} = \frac{1}{2} L I_{AS}^2$ V<sub>DS</sub>  $\mathsf{BV}_{\mathsf{DSS}}$ ID o  $I_{AS}$  $R_{G}$ ŧν<sub>DD</sub>  $I_{D}(t)$ V<sub>GS</sub> ]  $V_{DS}(t)$  $V_{\text{DD}}$ DUT Time t<sub>p</sub> Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

FDP19N40 — N-Channel UniFET<sup>TM</sup> MOSFET





# Figure 16. TO-220, Molded, 3-Lead, Jedec Variation AB

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Dual Cool™	Marking Small Speakers Sound Loude	r 🕗	TinyWire™
EcoSPARK <sup>®</sup>	and Better™	Saving our world, 1mW/W/kW at a time™	TranSiC™
EfficentMax™	MegaBuck™	SignalWise™	TriFault Detect™
ESBC™	MICROCOUPLER™	SmartMax™	TRUECURRENT®*
<b>m</b> e	MicroFET™	SMART START™	µSerDes™
+	MicroPak™	Solutions for Your Success™	μθειbes
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