

# MOSFET – N-Channel, POWERTRENCH®

60 V, 77 A, 4.1 mΩ

## FDPF041N06BL1-F154

### Description

This N-Channel MOSFET is produced using ON Semiconductor's advanced POWERTRENCH process that has been tailored to minimize the on-state resistance while maintaining superior switching performance.

### Features

- $R_{DS(on)} = 3.5 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 77 \text{ A}$
- Low FOM  $R_{DS(on)} * Q_G$
- Low Reverse Recovery Charge,  $Q_{rr}$
- Soft Reverse Recovery Body Diode
- Enables Highly Efficiency in Synchronous Rectification
- Fast Switching Speed
- 100% UIL Tested
- These Devices are Pb-Free and are RoHS Compliant

### Applications

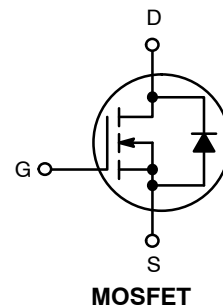
- Synchronous Rectification for ATX / Server / Telecom PSU
- Battery Protection Circuit
- Motor Drives and Uninterruptible Power Supplies
- Renewable System



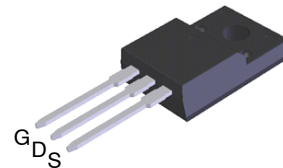
ON Semiconductor®

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$V_{DS}$	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
60 V	4.1 mΩ @ 10 V	77 A

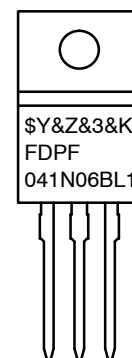


MOSFET



TO-220F Ultra Narrow Lead  
CASE 221BN

### MARKING DIAGRAM



\$Y = ON Semiconductor Logo  
&Z = Assembly Plant Code  
&3 = Data Code (Year & Week)  
&K = Lot  
FDPF041N06BL1 = Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FDPF041N06BL1–F154

## ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C, Unless otherwise noted)

Symbol	Parameter		Value	Unit
V <sub>DSS</sub>	Drain to Source Voltage		60	V
V <sub>GSS</sub>	Gate to Source Voltage		±20	V
I <sub>D</sub>	Drain Current	– Continuous (T <sub>C</sub> = 25°C, Silicon Limited)	77	A
		– Continuous (T <sub>C</sub> = 100°C, Silicon Limited)	55	
I <sub>DM</sub>	Drain Current	– Pulsed (Note 1)	308	A
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		365	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		6.0	V/ns
P <sub>D</sub>	Power Dissipation	(T <sub>C</sub> = 25°C)	44.1	W
		– Derate Above 25°C	0.29	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range		–55 to +175	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 3 mH, I<sub>AS</sub> = 15.6 A, starting T<sub>J</sub> = 25°C.
3. I<sub>SD</sub> ≤ 100 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C.

## THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction to Case, Max.	3.4	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient, Max.	62.5	°C/W

## PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Quantity
FDPF041N06BL1–F154	FDPF041N06BL1	TO–220F (Pb–Free)	50 Units / Tube

# FDPF041N06BL1-F154

## ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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### OFF CHARACTERISTICS

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}$ , $V_{GS} = 0\ \text{V}$	60	–	–	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	–	0.03	–	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48\ \text{V}$ , $V_{GS} = 0\ \text{V}$	–	–	1	$\mu\text{A}$
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 20\ \text{V}$ , $V_{DS} = 0\ \text{V}$	–	–	$\pm 100$	nA

### ON CHARACTERISTICS

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = 250\ \mu\text{A}$	2	–	4	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}$ , $I_D = 77\ \text{A}$	–	3.5	4.1	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\ \text{V}$ , $I_D = 77\ \text{A}$	–	125	–	S

### DYNAMIC CHARACTERISTICS

$C_{iss}$	Input Capacitance	$V_{DS} = 30\ \text{V}$ , $V_{GS} = 0\ \text{V}$ , $f = 1\ \text{MHz}$	–	4280	5690	pF
$C_{oss}$	Output Capacitance		–	1050	1400	pF
$C_{rss}$	Reverse Transfer Capacitance		–	23	–	pF
$C_{oss(er)}$	Energy Related Output Capacitance	$V_{DS} = 30\ \text{V}$ , $V_{GS} = 0\ \text{V}$	–	1787	–	pF
$Q_{g(tot)}$	Total Gate Charge at 10 V	$V_{DS} = 30\ \text{V}$ , $I_D = 100\ \text{A}$ , $V_{GS} = 10\ \text{V}$ (Note 4)	–	53	69	nC
$Q_{gs}$	Gate to Source Gate Charge		–	23	–	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		–	8	–	nC
$V_{plateau}$	Gate Plateau Voltage		–	5.7	–	V
$Q_{sync}$	Total Gate Charge Sync.	$V_{DS} = 0\ \text{V}$ , $I_D = 50\ \text{A}$	–	48.6	–	nC
$Q_{oss}$	Output Charge	$V_{DS} = 30\ \text{V}$ , $V_{GS} = 0\ \text{V}$	–	63.8	–	nC

### SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\ \text{V}$ , $I_D = 100\ \text{A}$ , $V_{GS} = 10\ \text{V}$ , $R_{GEN} = 4.7\ \Omega$ (Note 4)	–	29	68	ns
$t_r$	Turn-On Rise Time		–	22	54	ns
$t_{d(off)}$	Turn-Off Delay Time		–	38	86	ns
$t_f$	Turn-Off Fall Time		–	11	32	ns
ESR	Equivalent Series Resistance (G-S)	$f = 1\ \text{MHz}$	–	0,8	–	$\Omega$

### DRAIN-SOURCE DIODE CHARACTERISTICS

I <sub>S</sub>	Maximum Continuous Source to Drain Diode Forward Current		–	–	77	A
I <sub>SM</sub>	Maximum Pulsed Source to Drain Diode Forward Current		–	–	308	A
V <sub>SD</sub>	Source to Drain Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 77 A	–	–	1.25	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 100 A, dI <sub>F</sub> /dt = 100 A/μs	–	65	–	ns
Q <sub>rr</sub>	Reverse Recovery Charge		–	63	–	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Essentially independent of operating temperature typical characteristics.

TYPICAL PERFORMANCE CHARACTERISTICS

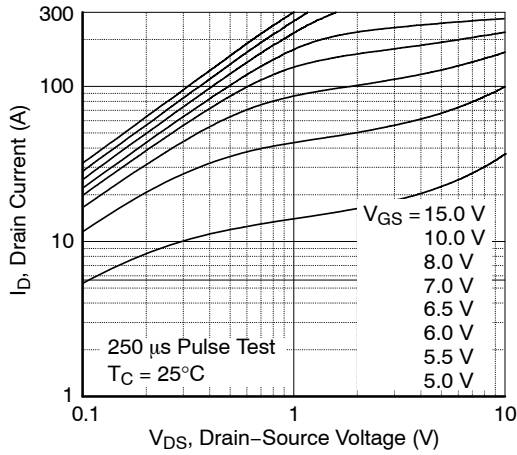


Figure 1. On-Region Characteristics

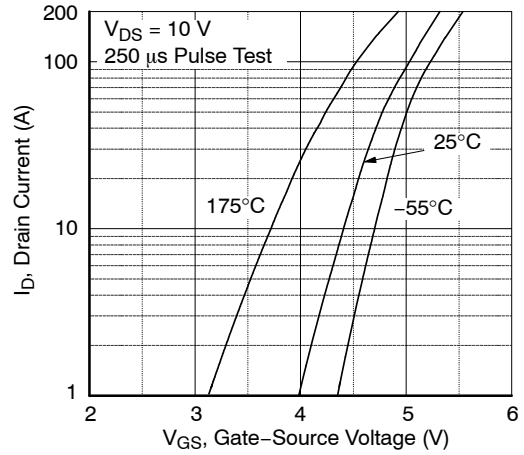


Figure 2. Transfer Characteristics

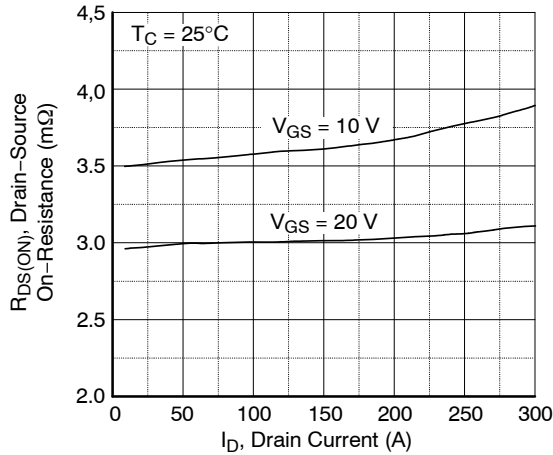


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

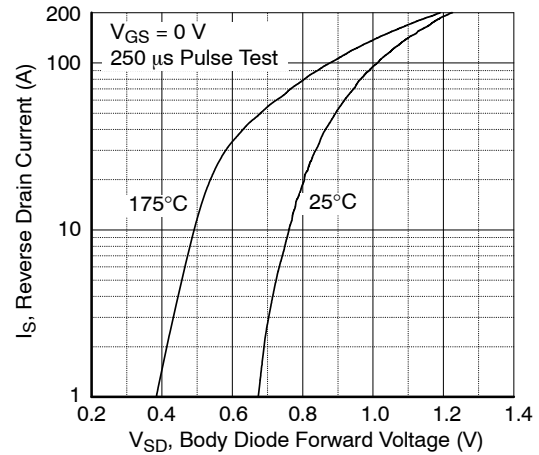


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

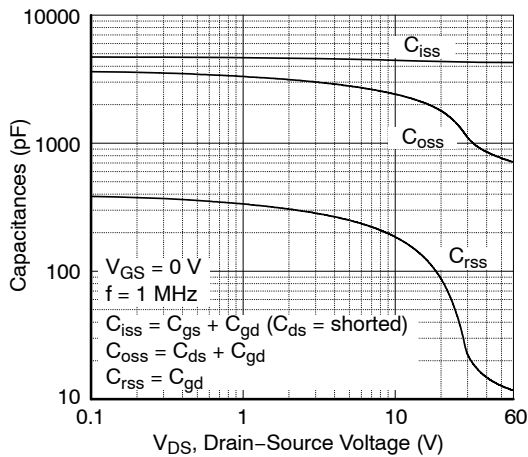


Figure 5. Capacitance Characteristics

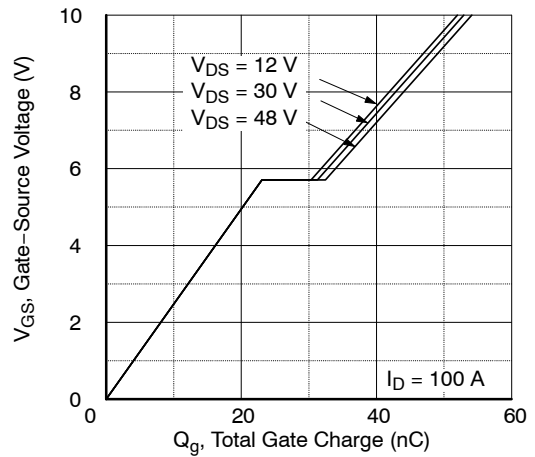


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

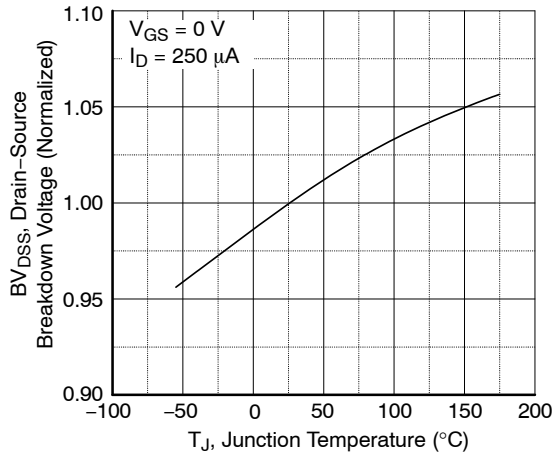


Figure 7. Breakdown Voltage Variation vs. Temperature

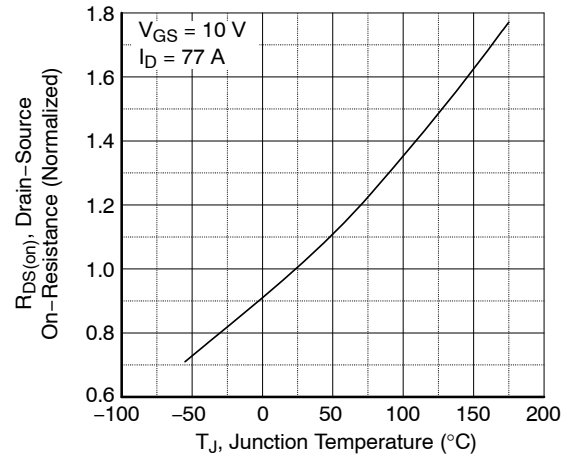


Figure 8. On-Resistance Variation vs. Temperature

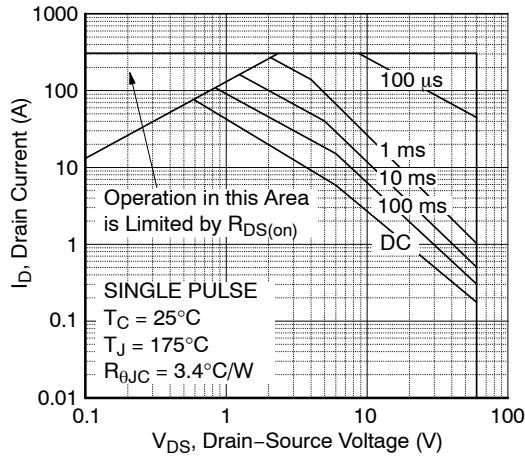


Figure 9. Maximum Safe Operating Area vs. Case Temperature

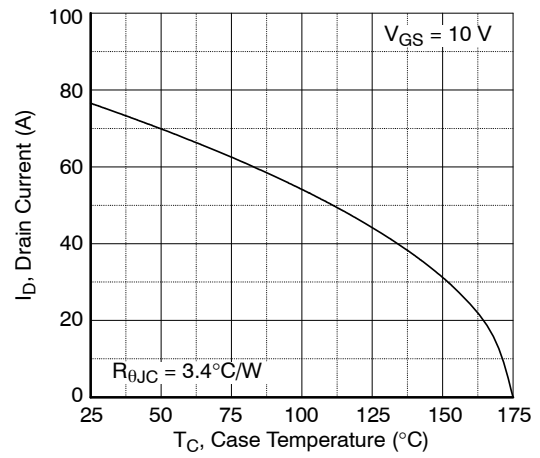


Figure 10. Maximum Drain Current

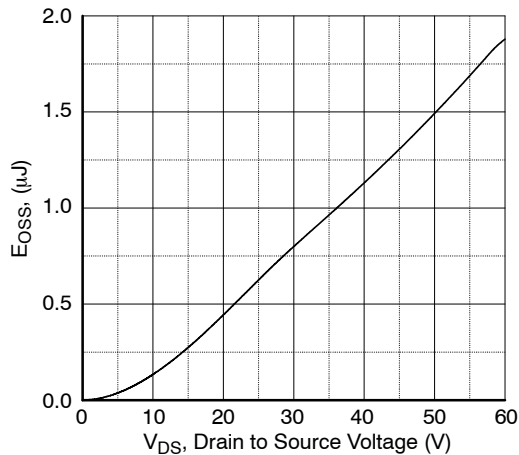


Figure 11.  $E_{OSS}$  vs. Drain to Source Voltage

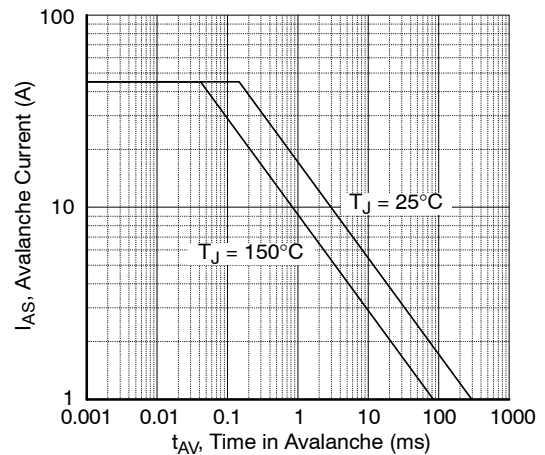


Figure 12. Unclamped Inductive Switching Capability

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

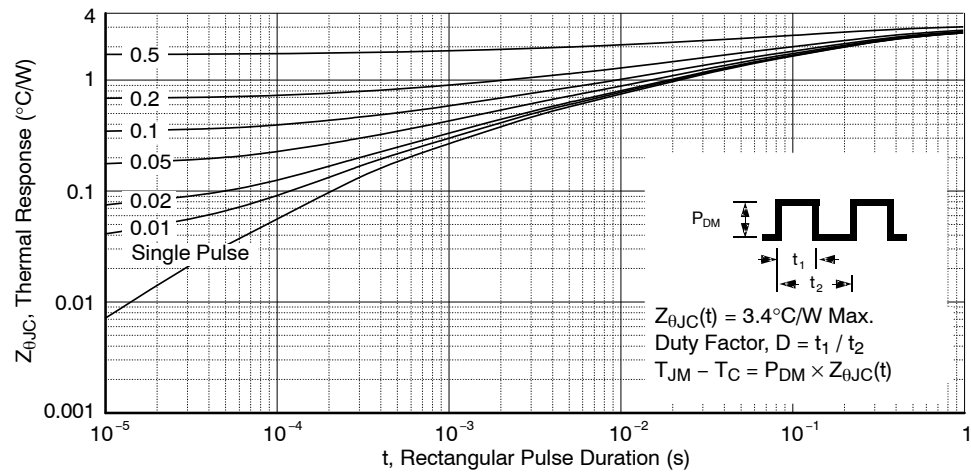


Figure 13. Transient Thermal Response Curve

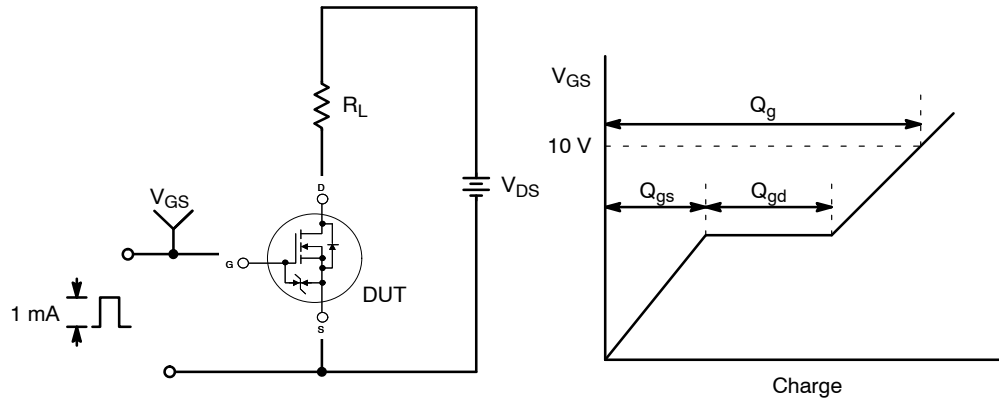


Figure 14. Gate Charge Test Circuit & Waveform

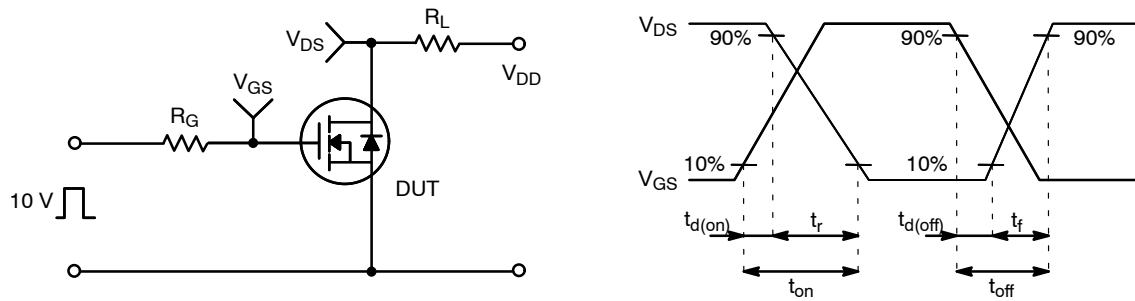


Figure 15. Resistive Switching Test Circuit & Waveforms

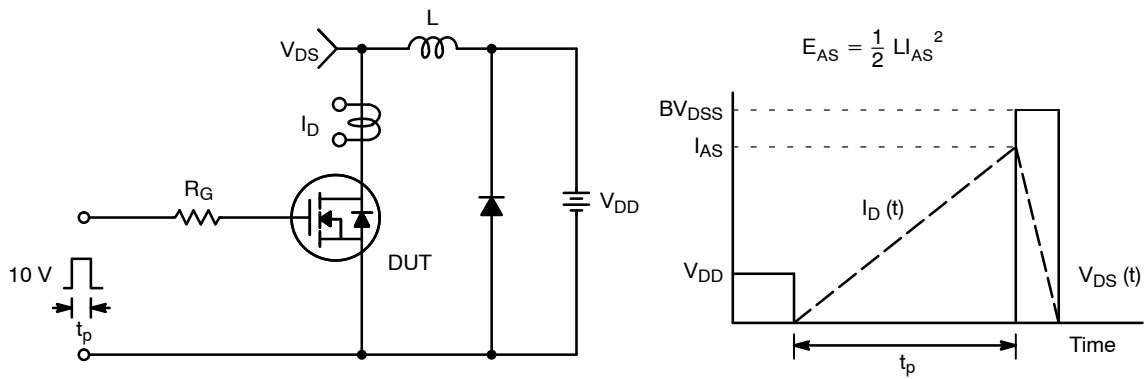


Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms

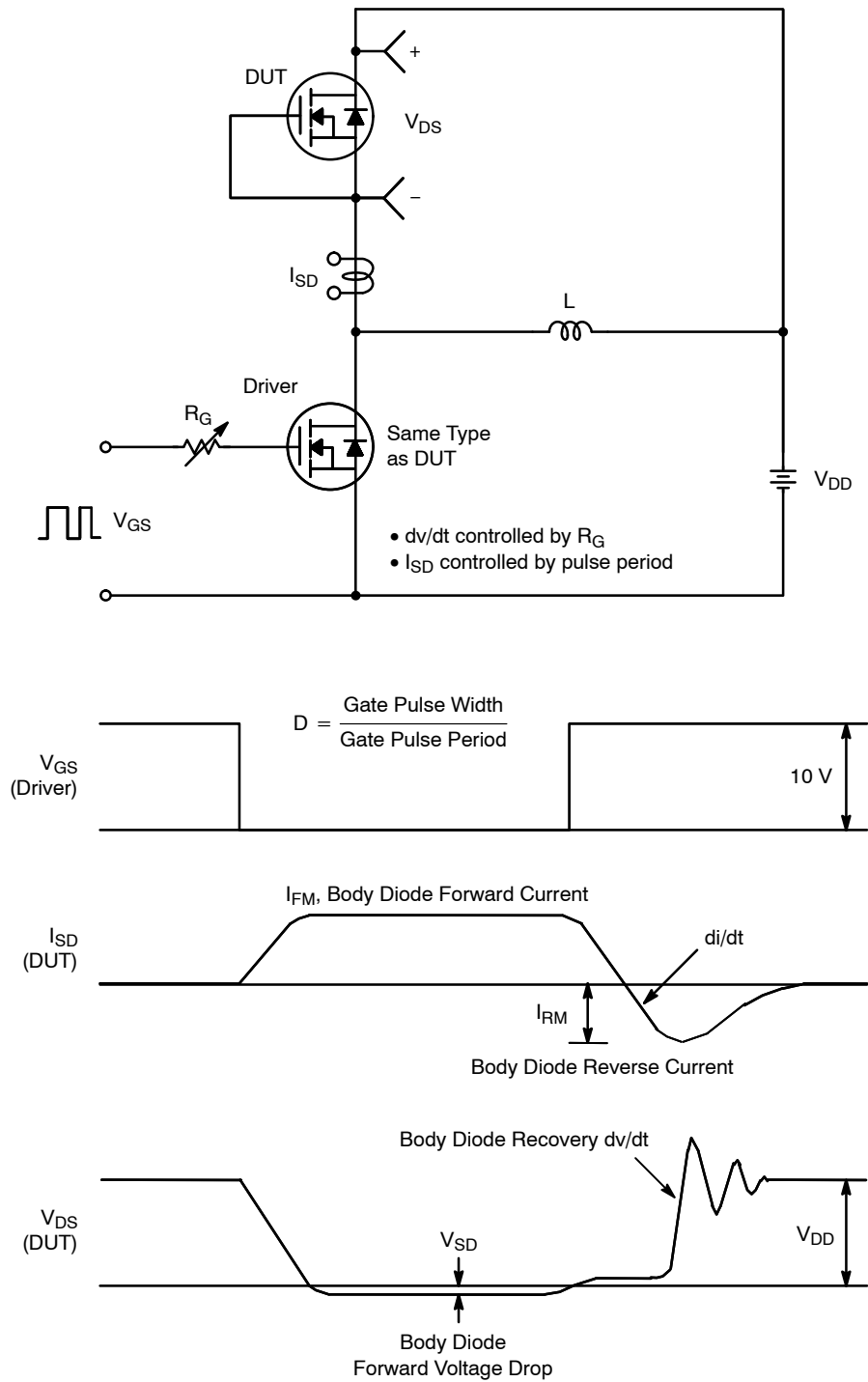


Figure 17. Peak Diode Recovery  $dv/dt$  Test Circuit & Waveforms



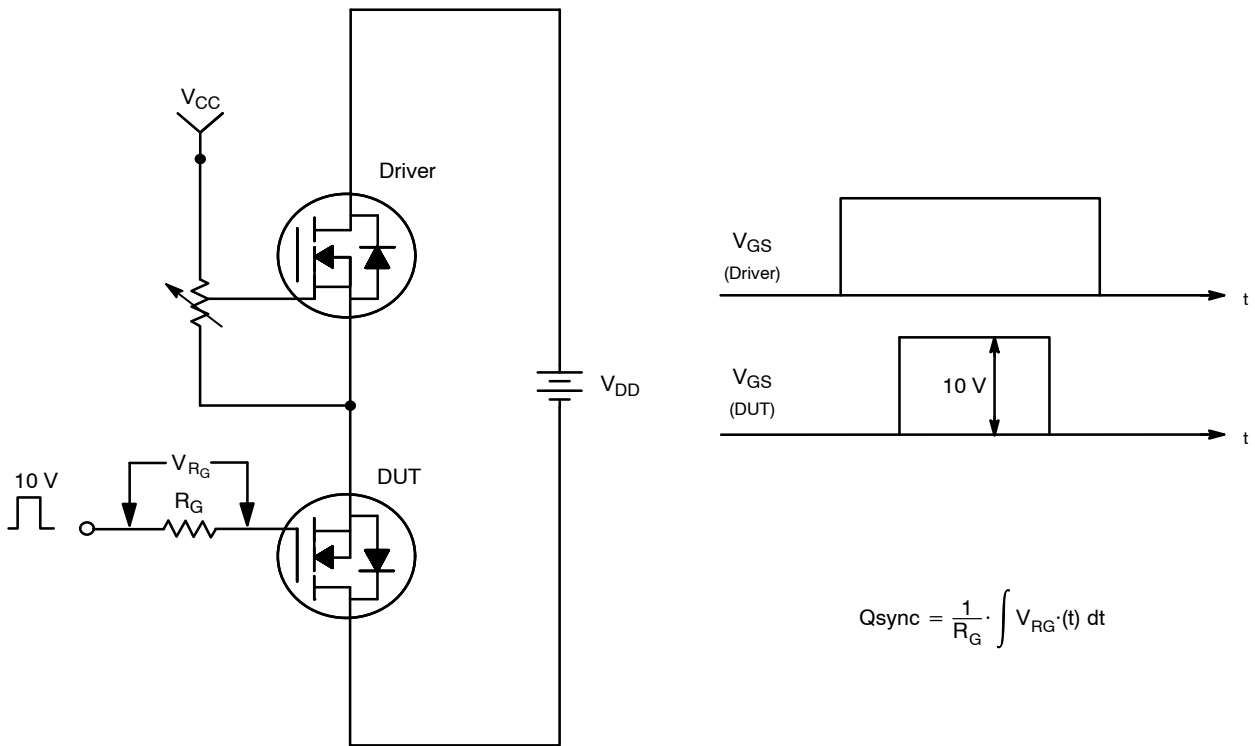


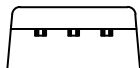
Figure 18. Total Gate Charge  $Q_{sync}$ . Test Circuit & Waveforms

### TO-220 FULLPACK, 3-LEAD (ULTRA NARROW LEAD)

CASE 221BN

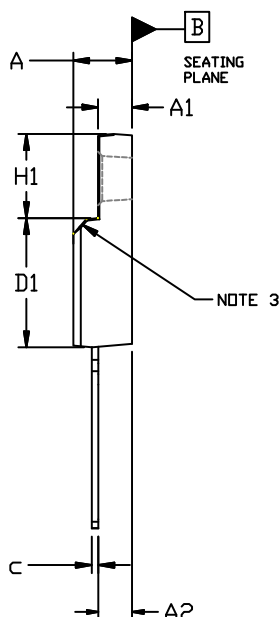
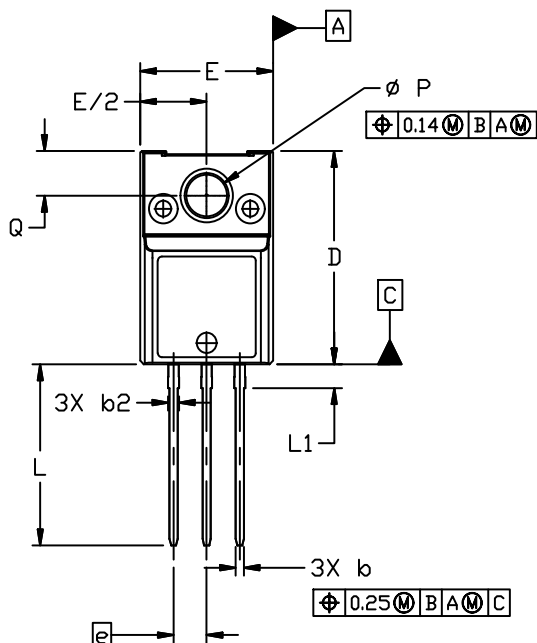
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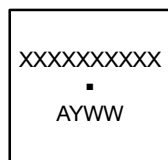
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. CONTOUR UNCONTROLLED IN THIS AREA.
4. DIMENSIONS EXCLUDE BURRS, MOLD FLASH, AND TIE BAR PROTRUSIONS.



DIM	MILLIMETERS		
	MIN.	NDM.	MAX.
A	4.60	4.70	4.80
A1	2.50	2.60	2.70
A2	2.47	2.57	2.67
b	0.56	0.63	0.69
b2	---	---	0.90
c	0.46	0.53	0.59
D	15.80	16.00	16.20
D1	9.58	9.68	9.78
E	10.00	10.20	10.40
e	2.54 BSC		
H1	6.32 REF		
L	13.45	13.60	13.75
L1	1.70	1.80	1.90
P	3.00	3.10	3.20
Q	3.25	3.35	3.45

#### GENERIC MARKING DIAGRAM\*



XXXX = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 WW = Work Week  
 ■ = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

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DESCRIPTION:	TO-220 FULLPACK, 3-LEAD (ULTRA NARROW LEAD)	PAGE 1 OF 1

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