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December 2014



FDPF041N06BL1

N-Channel PowerTrench® MOSFET

60 V, 77 A, 4.1 mΩ

Features

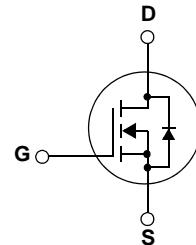
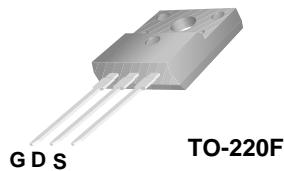
- $R_{DS(on)} = 3.5 \text{ mΩ}$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 77 \text{ A}$
- Low FOM $R_{DS(on)} \cdot Q_G$
- Low Reverse Recovery Charge, Q_{rr}
- Soft Reverse Recovery Body Diode
- Enables Highly Efficiency in Synchronous Rectification
- Fast Switching Speed
- 100% UIL Tested
- RoHS Compliant

Description

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

Applications

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



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

Symbol	Parameter		FDPF041N06BL1	Unit
V_{DSS}	Drain to Source Voltage		60	V
V_{GSS}	Gate to Source Voltage		± 20	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$, Silicon Limited)	77	A
		- Continuous ($T_C = 100^\circ\text{C}$, Silicon Limited)	55	
I_{DM}	Drain Current	- Pulsed	(Note 1)	A
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	44.1	W
		- Derate above 25°C	0.29	
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +175	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		300	°C

Thermal Characteristics

Symbol	Parameter	FDPF041N06BL1	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max	3.4	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max	62.5	

Package Marking and Ordering Information

Device Marking	Device	Package	Packaging Type	Quantity
FDPF041N06BL1	FDPF041N06BL1	TO-220F	Tube	50

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
$\Delta \text{BV}_{\text{DSS}}$ ΔT_J	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$, Referenced to 25°C	-	0.03	-	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{V}, V_{GS} = 0\text{V}$	-	-	1	μA
I_{GSS}	Gate to Body Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	-	-	± 100	nA

On Characteristics

$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	2	-	4	V
$R_{DS(\text{on})}$	Static Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 77\text{A}$	-	3.5	4.1	$\text{m}\Omega$
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	
$Q_{g(\text{tot})}$	Total Gate Charge at 10V		-	53	69	nC	
Q_{gs}	Gate to Source Gate Charge	$V_{DS} = 30\text{V}, I_D = 100\text{A}$ $V_{GS} = 10\text{V}$	-	23	-	nC	
Q_{gd}	Gate to Drain "Miller" Charge		-	8	-	nC	
V_{plateau}	Gate Plateau Volatge		(Note 4)	5.7	-	V	
Q_{sync}	Total Gate Charge Sync.	$V_{DS} = 0\text{V}, I_D = 50\text{A}$	(Note 5)	-	48.6	-	nC
Q_{oss}	Output Charge	$V_{DS} = 30\text{V}, V_{GS} = 0\text{V}$	-	63.8	-	nC	

Switching Characteristics

$t_{d(\text{on})}$	Turn-On Delay Time	$V_{DD} = 30\text{V}, I_D = 100\text{A}$ $V_{GS} = 10\text{V}, R_{\text{GEN}} = 4.7\Omega$	-	29	68	ns
t_f	Turn-On Rise Time		-	22	54	ns
$t_{d(\text{off})}$	Turn-Off Delay Time		-	38	86	ns
t_f	Turn-Off Fall Time		(Note 4)	11	32	ns
ESR	Equivalent Series Resistance (G-S)	$f = 1\text{MHz}$		-	0.8	Ω

Drain-Source Diode Characteristics

I_S	Maximum Continuous Drain to Source Diode Forward Current	-	-	77	A		
I_{SM}	Maximum Pulsed Drain to Source Diode Forward Current	-	-	308	A		
V_{SD}	Drain to Source Diode Forward Voltage	$V_{GS} = 0\text{V}, I_{SD} = 77\text{A}$	-	-	1.25 V		
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{V}, I_{SD} = 100\text{A}$	-	65	-	ns	
Q_{rr}	Reverse Recovery Charge	$dI_F/dt = 100\text{A}/\mu\text{s}$		-	63	-	nC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L = 3\text{mH}, I_{AS} = 15.6\text{A}$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 100\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq \text{BV}_{\text{DSS}}$, Starting $T_J = 25^\circ\text{C}$
4. Essentially Independent of Operating Temperature Typical Characteristics
5. See the test circuit in page 8

Typical Performance Characteristics

Figure 1. On-Region Characteristics

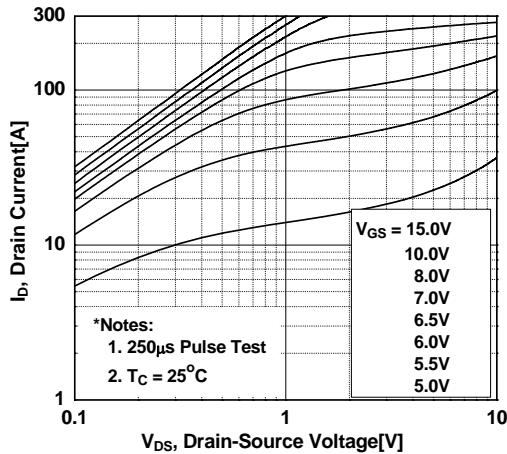


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

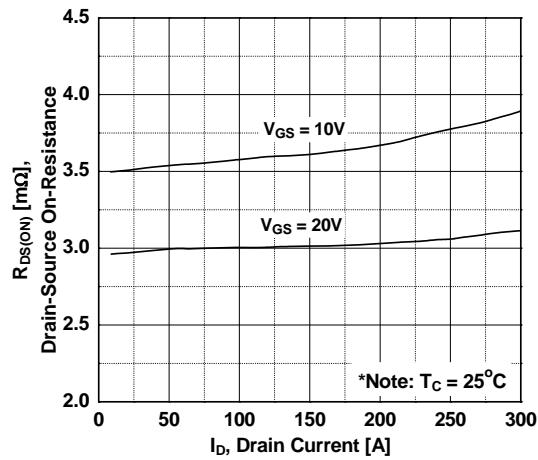


Figure 5. Capacitance Characteristics

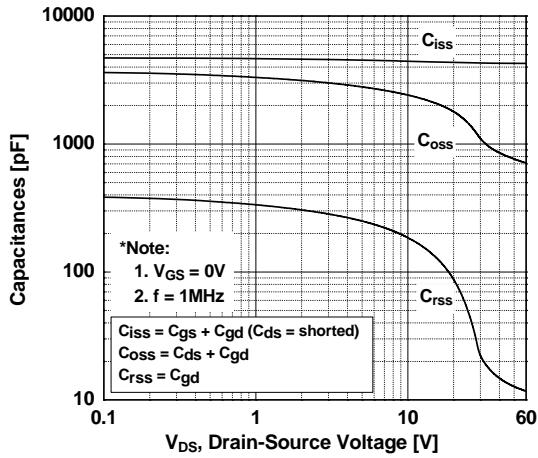


Figure 2. Transfer Characteristics

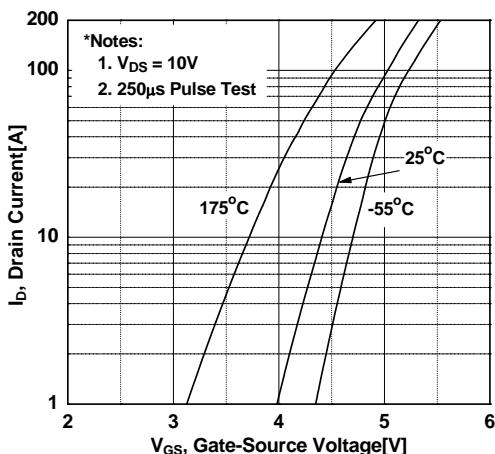


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

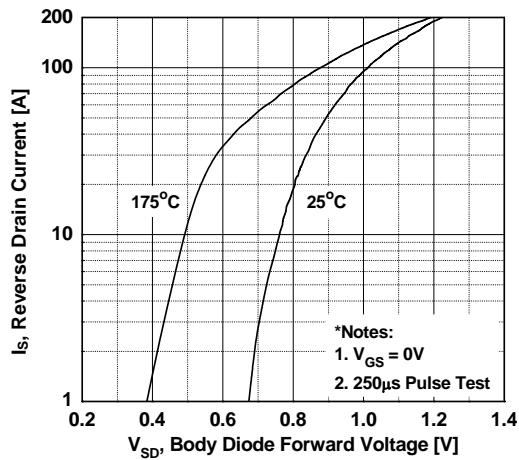
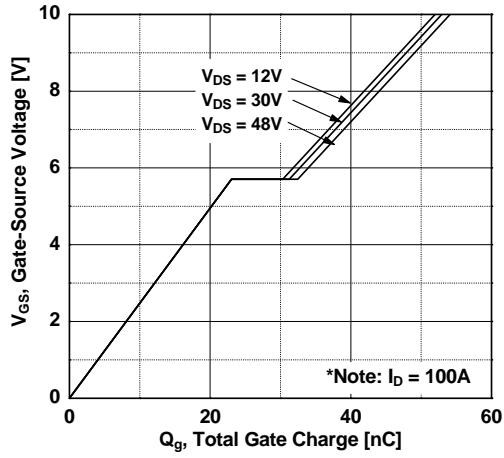


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

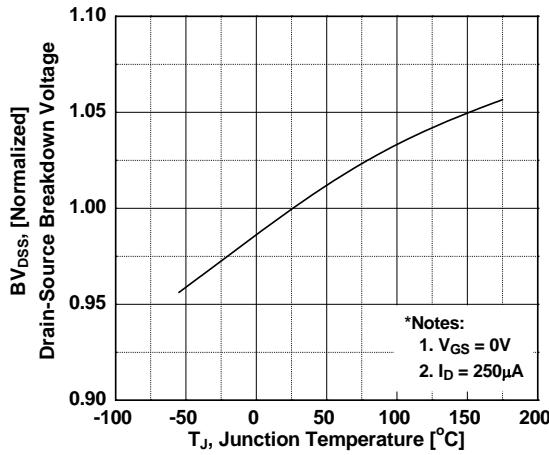


Figure 9. Maximum Safe Operating Area vs. Case Temperature

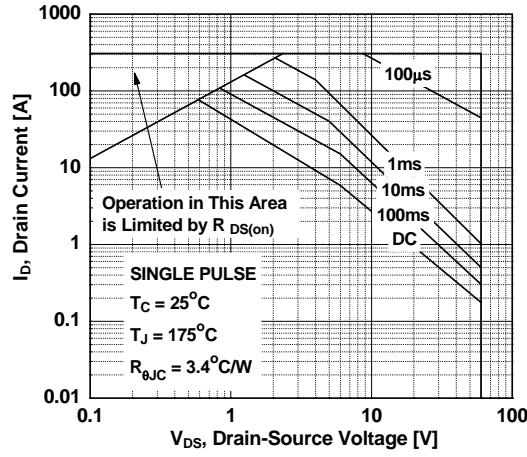


Figure 11. Eoss vs. Drain to Source Voltage

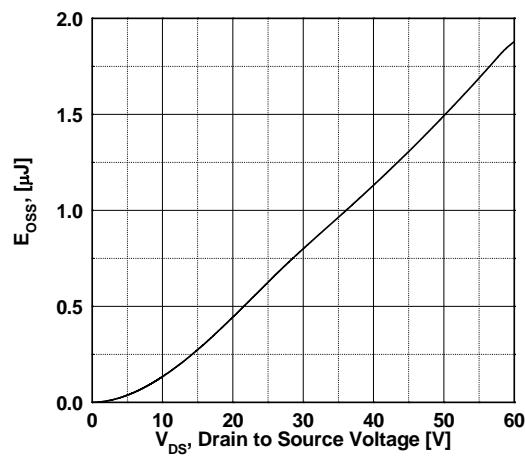


Figure 8. On-Resistance Variation vs. Temperature

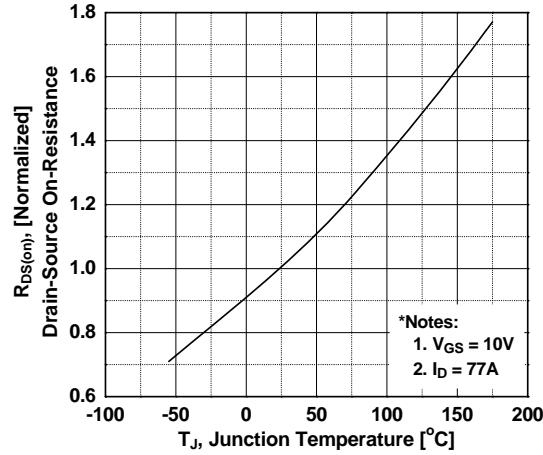


Figure 10. Maximum Drain Current

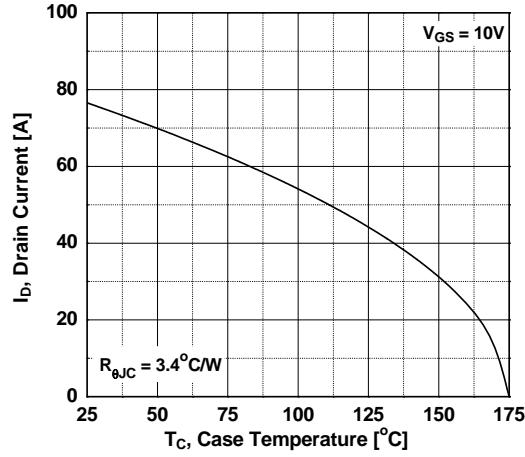
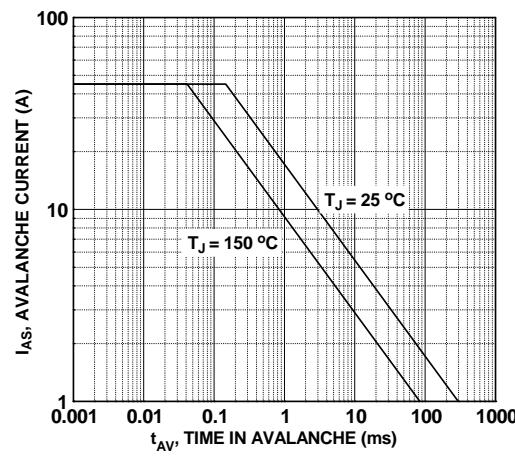
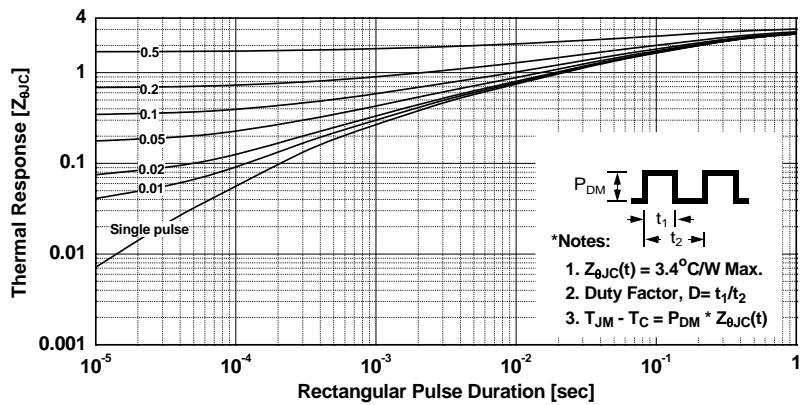


Figure 12. Unclamped Inductive Switching Capability

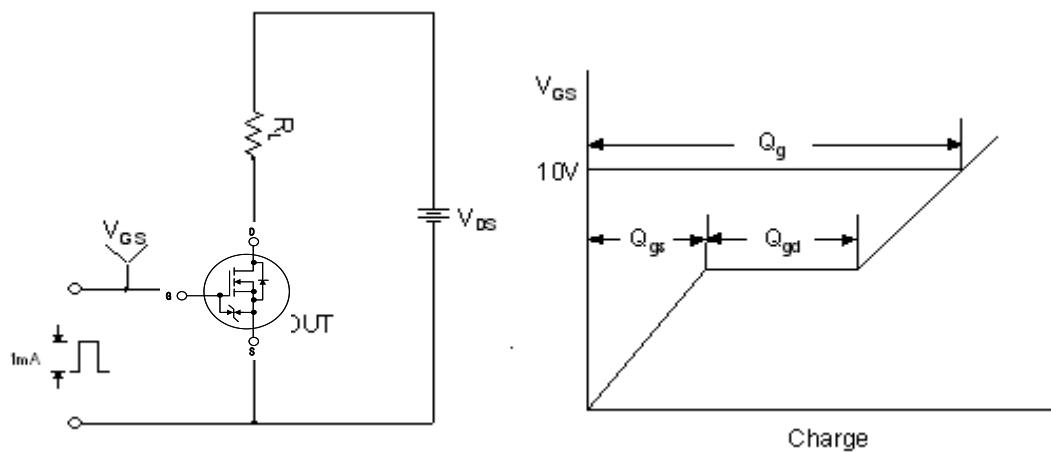


Typical Performance Characteristics (Continued)

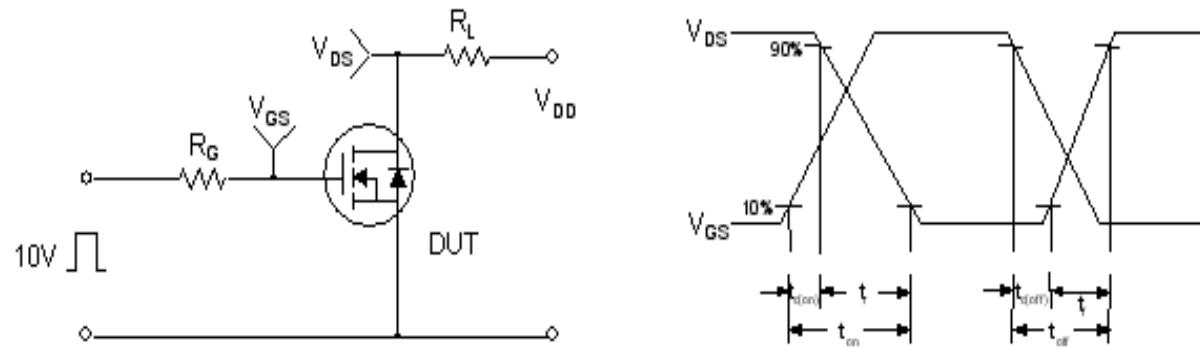
Figure 13. Transient Thermal Response Curve



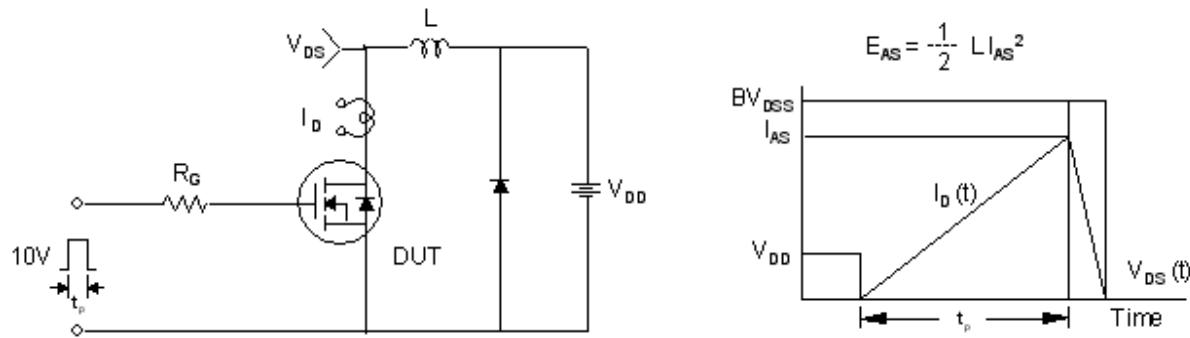
Gate Charge Test Circuit & Waveform



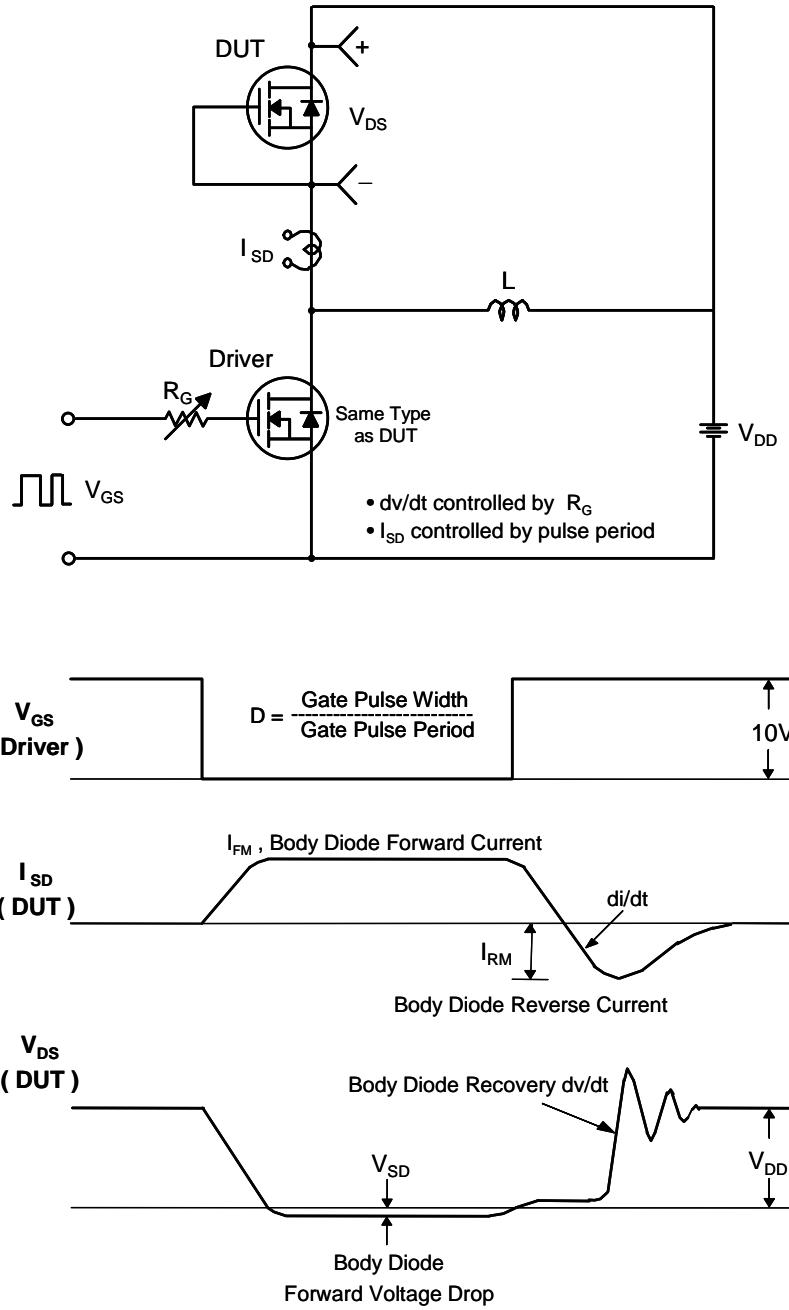
Resistive Switching Test Circuit & Waveforms



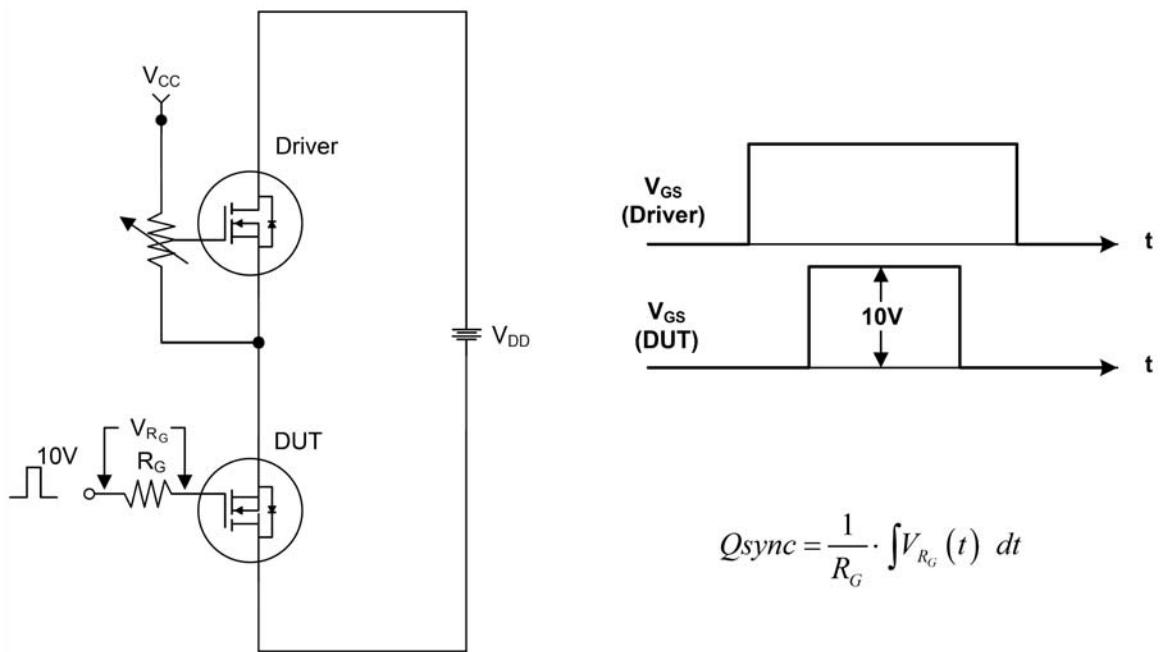
Unclamped Inductive Switching Test Circuit & Waveforms

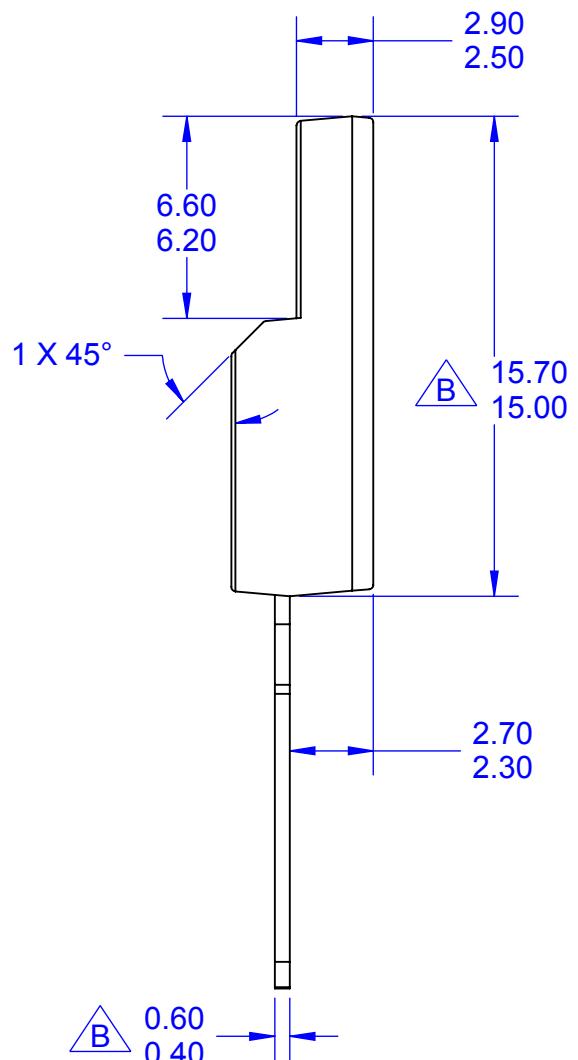
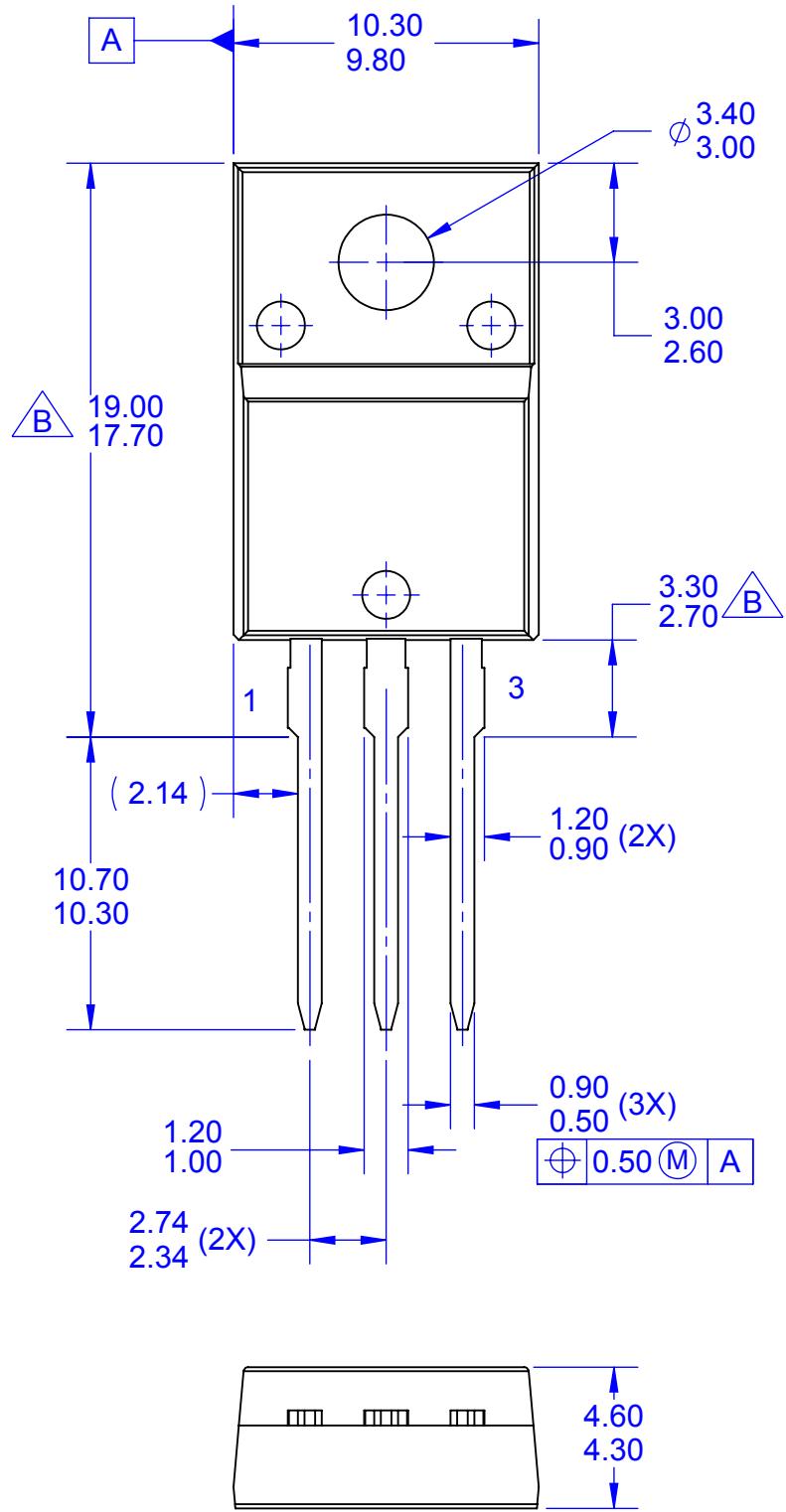


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Total Gate Charge Qsync. Test Circuit & Waveforms





NOTES:

A. EXCEPT WHERE NOTED CONFORMS TO
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 B. DOES NOT COMPLY EIAJ STD. VALUE.

C. ALL DIMENSIONS ARE IN MILLIMETERS.

D. DIMENSIONS ARE EXCLUSIVE OF BURRS,
MOLD FLASH AND TIE BAR PROTRUSIONS.

E. DIMENSION AND TOLERANCE AS PER ASME
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