FAIRCHILD
SEMICONDUCTOR®

FDP8440

N-Channel PowerTrench® MOSFET

40V, 277A, 2.2mΩ

Features

- $R_{DS(on)}$ = 1.64mΩ (Typ.)@ V_{GS} = 10V, I_D = 80A
- $Q_{g(tot)}$ = 345nC (Typ.)@ V_{GS} = 10V
- Low Miller Charge
- Low Q_{RR} Body Diode
- UIS Capability (Single Pulse and Repetitive Pulse)
- RoHS Compliant

Application

- Automotive Engine Control
- Powertrain Management
- Motors, Solenoids
- Electronic Steering
- Integrated Starter/ Alternator
- Distributed Power Architectures and VRMs
- Primary Switch for 12V Systems

TO-220
FDP Series

G D S

D

G

S
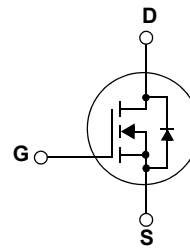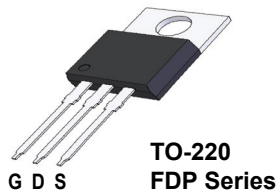
MOSFET Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter			Ratings	Units
V_{DSS}	Drain to Source Voltage			40	V
V_{GSS}	Gate to Source Voltage			±20	V
I_D	Drain Current	- Continuous (T_C = 25°C, Silicon Limited) - Continuous (T_C = 100°C, Silicon Limited) - Continuous (T_C = 25°C, Package Limited)		277* 196* 100	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	500	A
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	1682	mJ
P_D	Power Dissipation	(T_C = 25°C)		306	W
		- Derate above 25°C		2.04	W/°C
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

*Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 100A.

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.49	°C/W
$R_{\theta CS}$	Thermal Resistance, Case to Sink (Typ.)	0.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDP8440	FDP8440	TO-220	N/A	N/A	50units

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Conditions		Min	Typ	Max	Units
Off Characteristics							
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA		40	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 32V		--	--	1	μA
		V_{GS} = 0V	T_C = 150°C	--	--	250	μA
I_{GSS}	Gate to Body Leakage Current	V_{GS} = ±20V		--	--	±100	nA
On Characteristics							
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA		1	--	3	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 4.5V, I_D = 80A		--	1.88	2.4	
		V_{GS} = 10V, I_D = 80A		--	1.64	2.2	mΩ
		V_{GS} = 10V, I_D = 80A, T_C = 175°C		--	3.00	4.4	
Dynamic Characteristics							
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz		--	18600	24740	pF
C_{oss}	Output Capacitance			--	1840	2450	pF
C_{rss}	Reverse Transfer Capacitance			--	1400	2100	pF
R_G	Gate Resistance	V_{GS} = 0.5V, f = 1MHz		--	1.1	--	Ω
$Q_{g(tot)}$	Total Gate Charge at 10V	V_{GS} = 0V to 10V	V_{DD} = 20V I_D = 80A I_g = 1.0mA	--	345	450	nC
$Q_{g(2)}$	Threshold Gate Charge	V_{GS} = 0V to 2V		--	32.5	--	nC
Q_{gs}	Gate to Source Gate Charge			--	49	--	nC
Q_{gs2}	Gate Charge Threshold to Plateau			--	16.5	--	nC
Q_{gd}	Gate to Drain "Miller" Charge			--	74	--	nC
Switching Characteristics (V_{GS} = 10V)							
t_{ON}	Turn-On Time	V_{DD} = 20V, I_D = 80A V_{GS} = 10V, R_{GEN} = 7Ω		--	175	360	ns
$t_{d(on)}$	Turn-On Delay Time			--	43	95	ns
t_r	Rise Time			--	130	275	ns
$t_{d(off)}$	Turn-Off Delay Time			--	435	875	ns
t_f	Fall Time			--	290	590	ns
t_{OFF}	Turn-Off Time			--	730	1470	ns
Drain-Source Diode Characteristics and Maximum Ratings							
V_{SD}	Source to Drain Diode Voltage	I_{SD} = 80A		--	--	1.25	V
		I_{SD} = 40A		--	--	1.0	V
t_{rr}	Reverse Recovery Time	I_{SD} = 75A, dI_{SD}/dt = 100A/μs		--	59	--	ns
Q_{RR}	Reverse Recovery Charge	I_{SD} = 75A, dI_{SD}/dt = 100A/μs		--	77	--	nC

NOTES:

1: Pulse width limited by maximum junction temperature.

2: Starting T_J = 25°C, L = 1mH, I_{AS} = 58A, V_{DD} = 36V, V_{GS} = 10V.

Typical Performance Characteristics

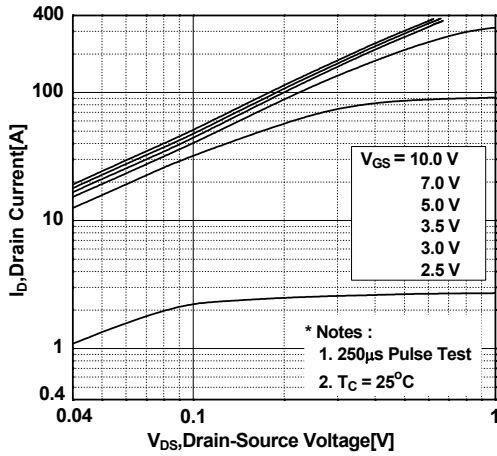### Figure 1. On-Region Characteristics

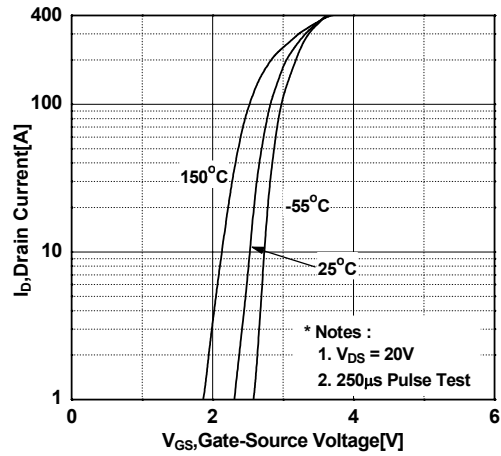### Figure 2. Transfer Characteristics

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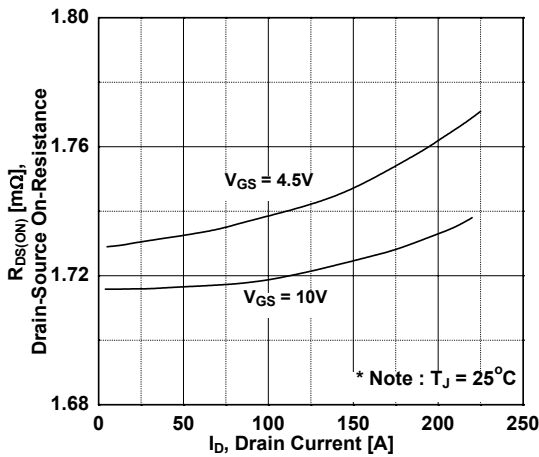

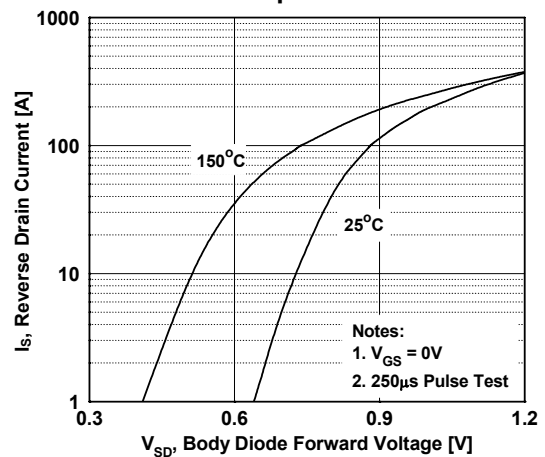### Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

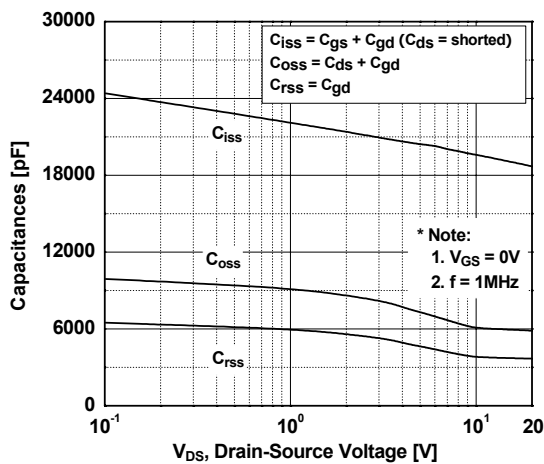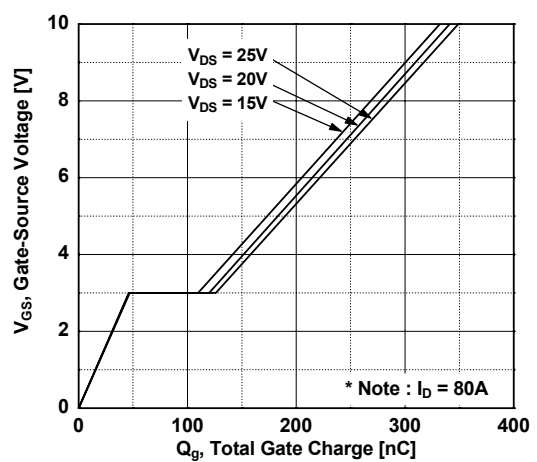### Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics

Typical Performance Characteristics (Continued)
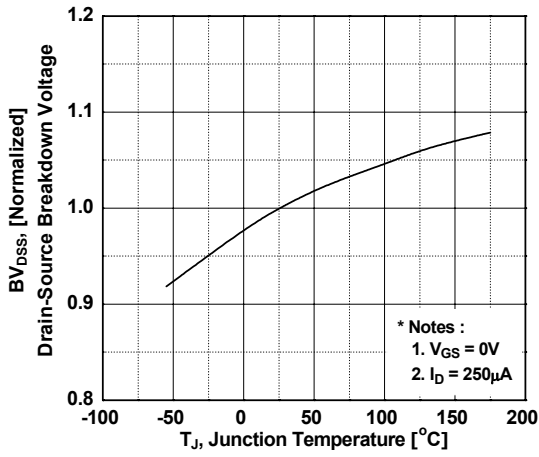
**Figure 7. Breakdown Voltage Variation
vs. Temperature**

* Notes :
1. V_{GS} = 0V
2. I_D = 250µA

**Figure 8. On-Resistance Variation
vs. Temperature**

* Notes :
1. V_{GS} = 10V
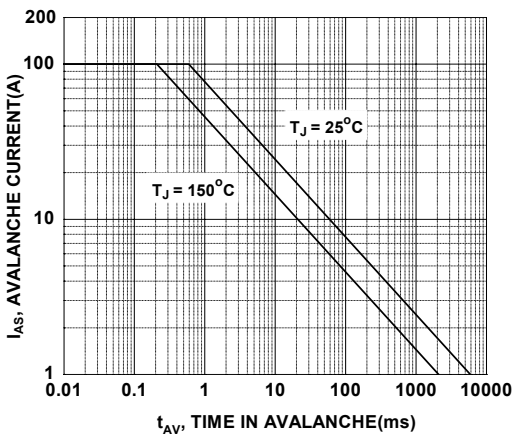2. I_D = 80A
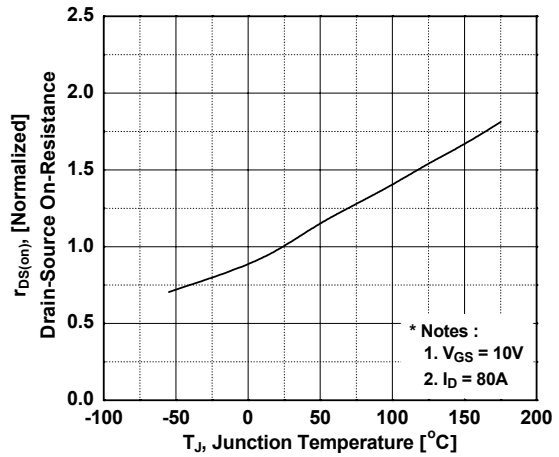
**Figure 9. Unclamped Inductive Switching
Capability**

T_J = 25°C

T_J = 150°C

Figure 10. Safe Operating Area

100µs

1ms

10ms

100ms

Operation in This Area
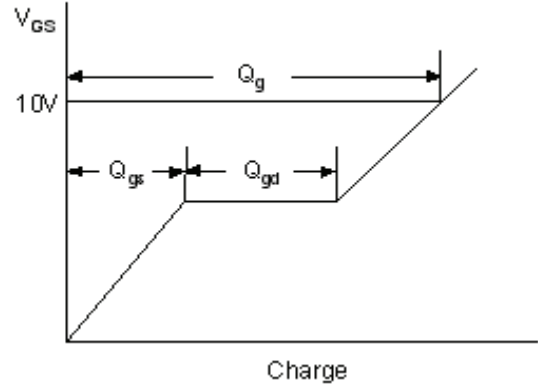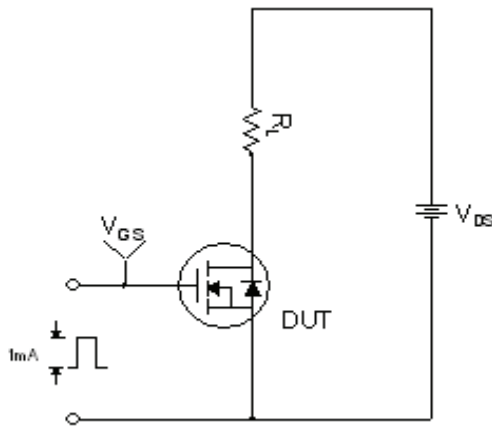is Limited by $R_{DS(on)}$

*Notes:
1. T_C = 25°C
2. T_J = 175°C
3. Single Pulse
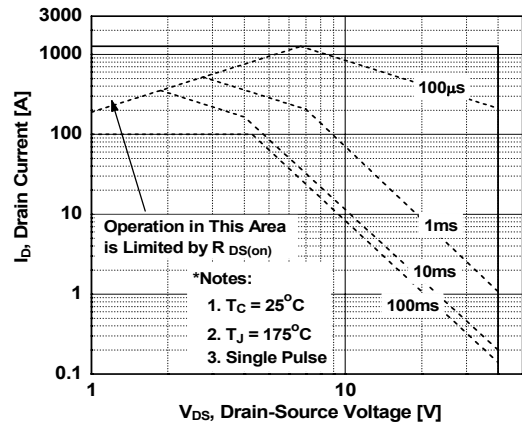
Figure 11. Transient Thermal Response Curve

0.5
0.2
0.1
0.05
0.02
0.01
Single pulse

P_{DM}
t_1
t_2

* Notes :
1. $Z_{θJC}(t)$ = 0.49°C/W Max.
2. Duty Factor, D=t_1/t_2
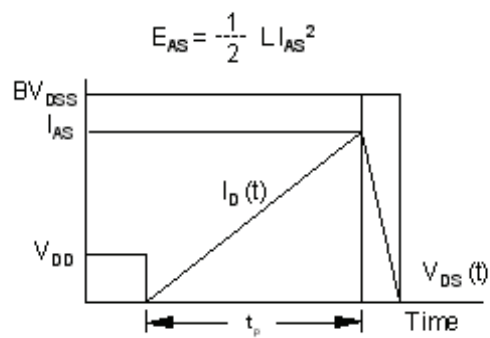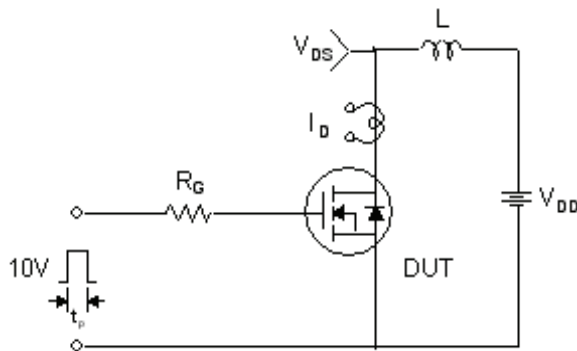3. T_{JM} - T_C = P_{DM} * $Z_{θJC}(t)$
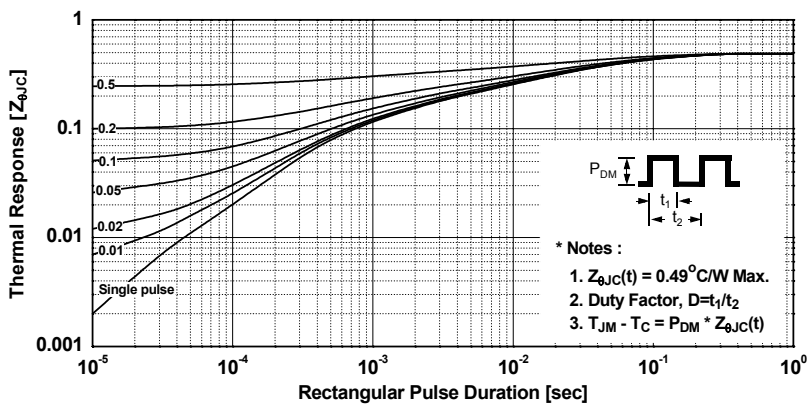
Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms
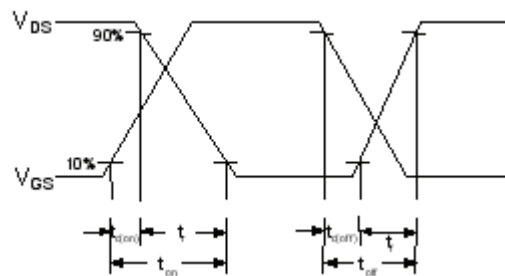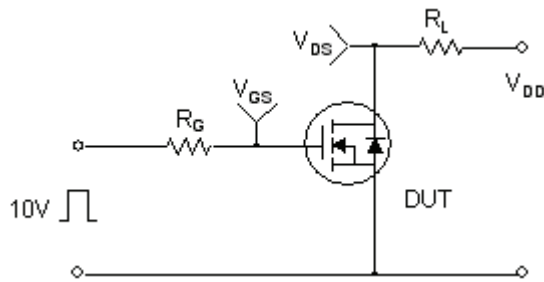
Unclamped Inductive Switching Test Circuit & Waveforms
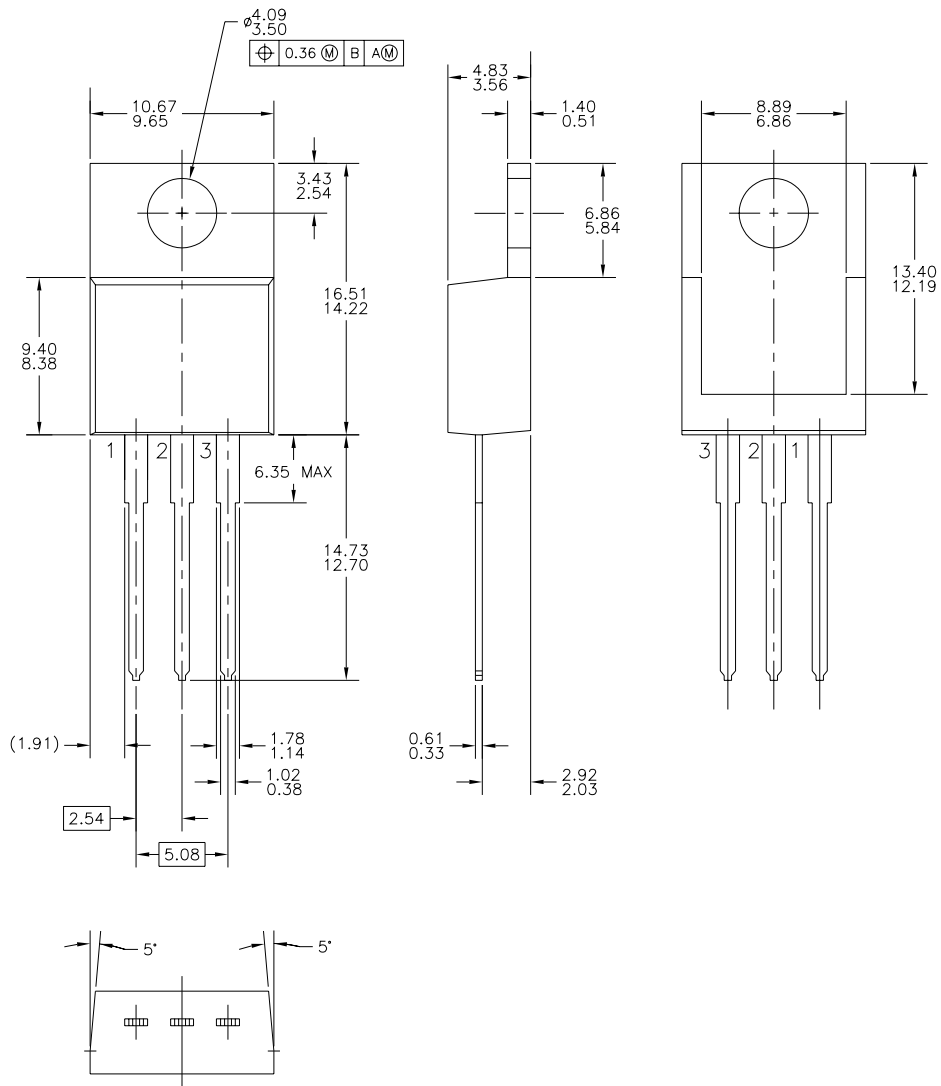
$$E_{AS} = \frac{1}{2} L I_{AS}^2$$

Peak Diode Recovery dv/dt Test Circuit & Waveforms

DUT

V_{DS}

I_{SD}

L

Driver

R_G

Same Type as DUT

V_{GS}

V_{DD}

- dv/dt controlled by R_G
- I_{SD} controlled by pulse period

V_{GS}
(Driver)

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$

10V

I_{SD}
(DUT)

I_{FM} . Body Diode Forward Current

di/dt

I_{RM}

Body Diode Reverse Current

V_{DS}
(DUT)

Body Diode Recovery dv/dt

V_{SD}

V_{DD}

Body Diode
Forward Voltage Drop
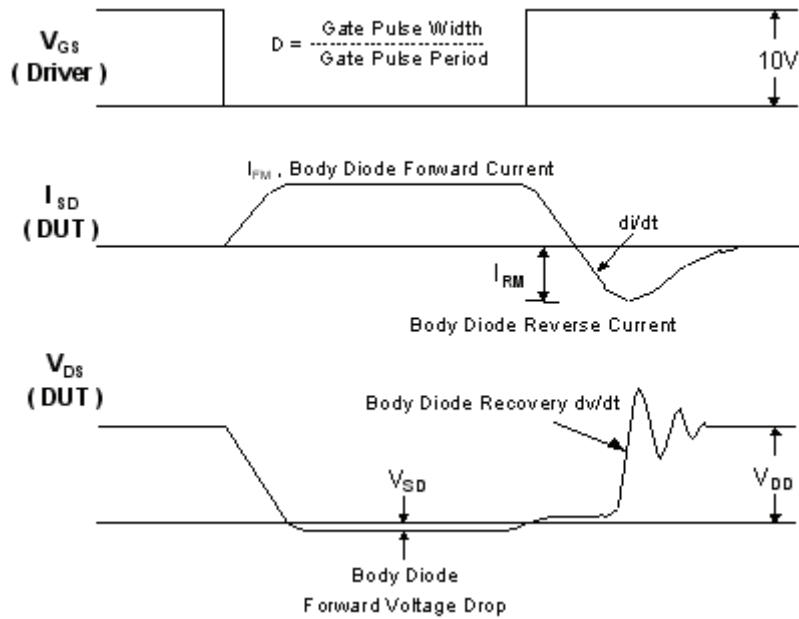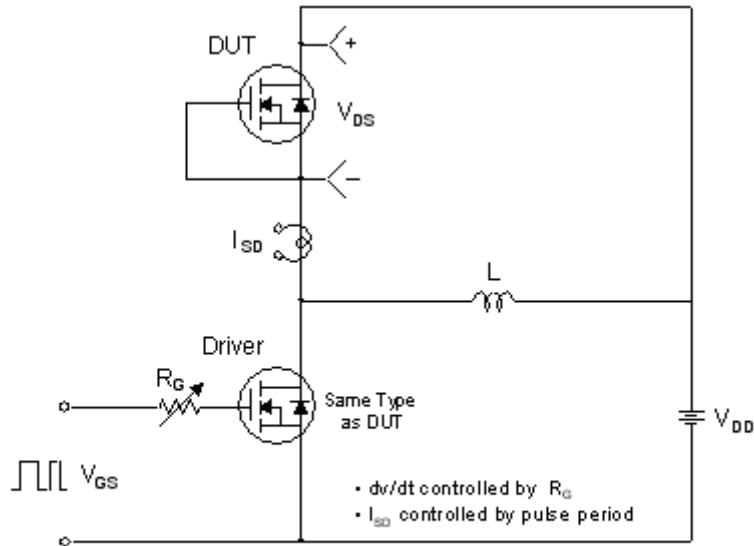
Mechanical Dimensions

TO-220

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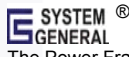CROSSVOLT™
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Rev. I37