FAIRCHILD
SEMICONDUCTOR®

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UniFET™

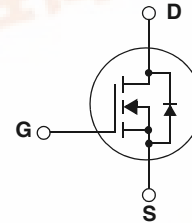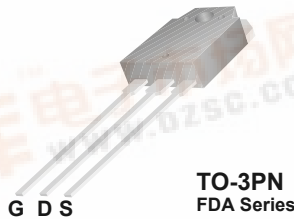# FDA15N65

650V N-Channel MOSFET

Features

- 16A, 650V, $R_{DS(on)}$ = 0.44Ω @V_{GS} = 10 V
- Low gate charge (typical 48.5 nC)
- Low C_{rss} (typical 23.6 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switched mode power supplies and active power factor correction.

TO-3PN
FDA Series

G D S

D

G

S

Absolute Maximum Ratings

Symbol	Parameter			FDA15N65	Unit
V_{DSS}	Drain-Source Voltage			650	V
I_D	Drain Current	- Continuous (T_C = 25°C)		16	A
		- Continuous (T_C = 100°C)		9.6	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	64	A
V_{GSS}	Gate-Source voltage			± 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	637	mJ
I_{AR}	Avalanche Current		(Note 1)	16	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	26	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	4.5	V/ns
P_D	Power Dissipation (T_C = 25°C)			260	W
		- Derate above 25°C		2.1	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range			-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			300	°C

Thermal Characteristics

Symbol	Parameter	Min.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.48	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.24	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDA15N65	FDA15N65	TO-3PN	--	--	30

Electrical Characteristics $T_C = 25°C$ unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0V$, $I_D = 250\mu A$, $T_J = 25°C$	650	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu A$, Referenced to 25°C	--	0.65	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650V$, $V_{GS} = 0V$ $V_{DS} = 520V$, $T_C = 125°C$	-- --	-- --	1 10	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30V$, $V_{DS} = 0V$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30V$, $V_{DS} = 0V$	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\mu A$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10V$, $I_D = 8A$	--	0.36	0.44	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40V$, $I_D = 8A$ (Note 4)	--	19.2	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25V$, $V_{GS} = 0V$, f = 1.0MHz	--	2380	3095	pF
C_{oss}	Output Capacitance		--	295	385	pF
C_{rss}	Reverse Transfer Capacitance		--	23.6	35.5	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 325V$, $I_D = 15A$ $R_G = 21.7\Omega$	--	65	140	ns
t_r	Turn-On Rise Time		--	125	260	ns
$t_{d(off)}$	Turn-Off Delay Time		--	105	220	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	65	140	ns
Q_g	Total Gate Charge	$V_{DS} = 520V$, $I_D = 15A$ $V_{GS} = 10V$	--	48.5	63.0	nC
Q_{gs}	Gate-Source Charge		--	14.0	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	21.2	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	16	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	64	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0V$, $I_S = 16A$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0V$, $I_S = 15A$ $dI_F/dt = 100A/\mu s$	--	496	--	ns
Q_{rr}	Reverse Recovery Charge	(Note 4)	--	5.69	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 4.6mH, I_{AS} = 16A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. $I_{SD} \leq$ 16A, di/dt $\leq$ 200A/μs, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C
4. Pulse Test: Pulse width $\leq$ 300μs, Duty Cycle $\leq$ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

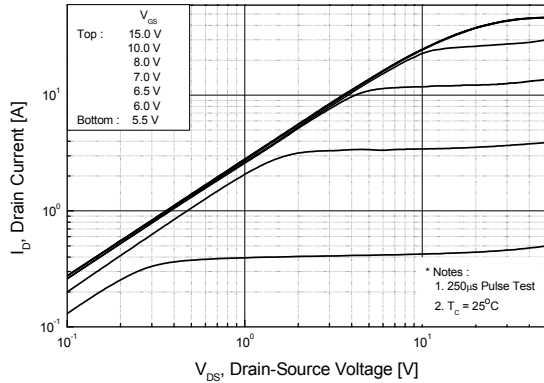# Typical Performance Characteristics

Figure 1. On-Region Characteristics
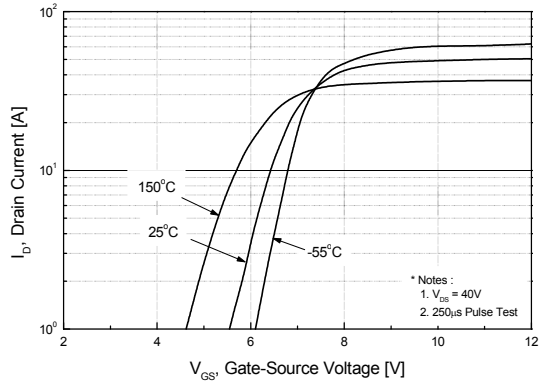

Figure 2. Transfer Characteristics

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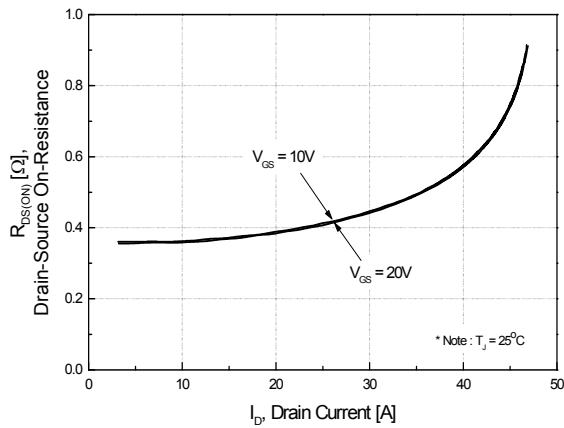

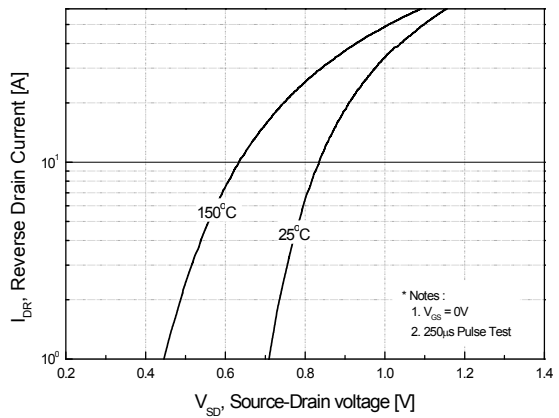### Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue
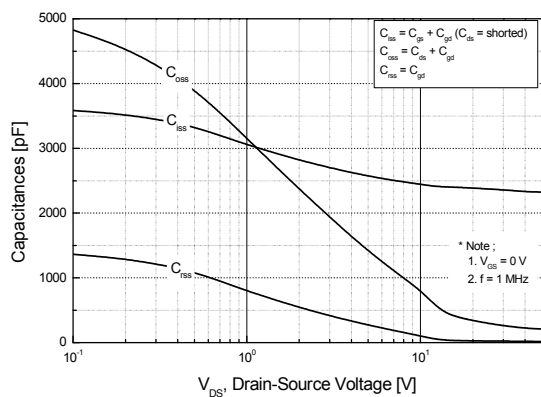

Figure 5. Capacitance Characteristics

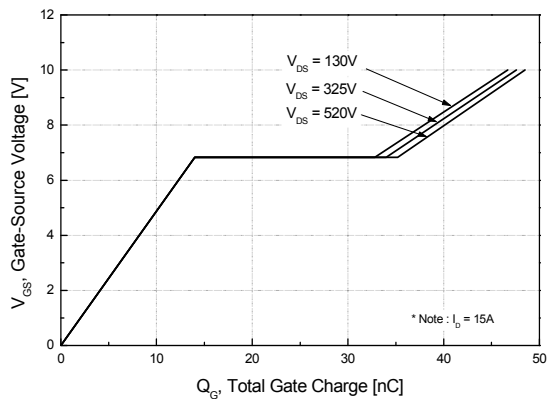### Figure 6. Gate Charge Characteristics

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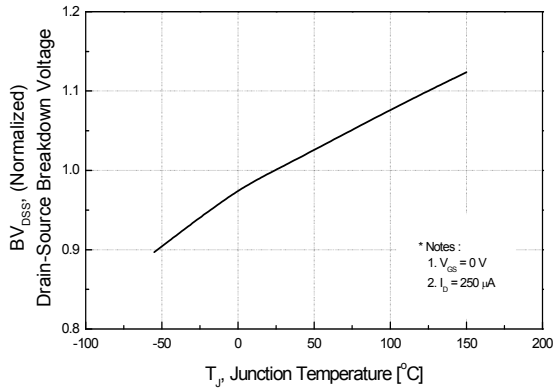
**Figure 7. Breakdown Voltage Variation
vs. Temperature**

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

X-axis: T_J, Junction Temperature [°C]
Y-axis: BV_{DSS}, (Normalized) Drain-Source Breakdown Voltage

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

* Notes :
1. V_{GS} = 10 V
2. I_D = 8 A

X-axis: T_J, Junction Temperature [°C]
Y-axis: $R_{DS(ON)}$, (Normalized) Drain-Source On-Resistance
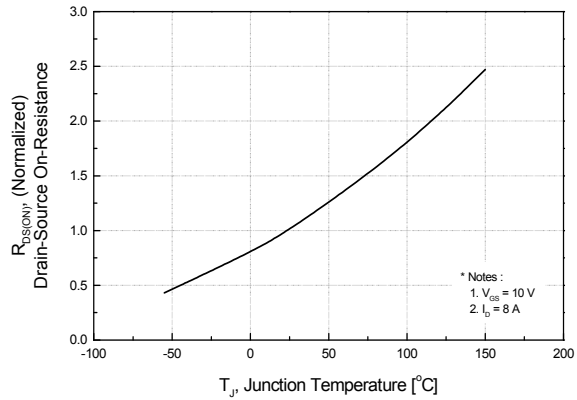
Figure 9. Safe Operating Area

10 μs
100 μs
1 ms
10 ms
100 ms
DC

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

* Notes :
1. T_C = 25 °C
2. T_J = 150 °C
3. Single Pulse
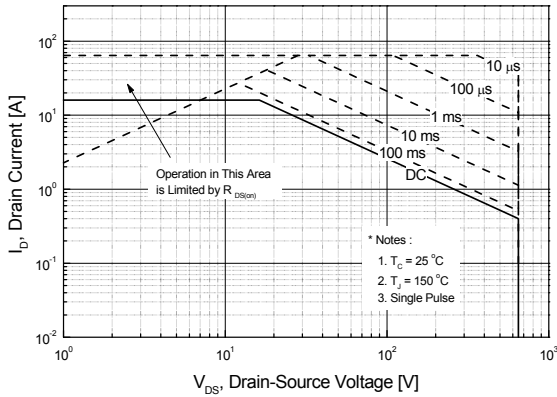
X-axis: V_{DS}, Drain-Source Voltage [V]
Y-axis: I_D, Drain Current [A]

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

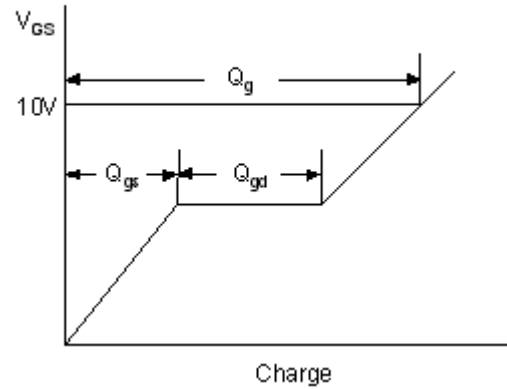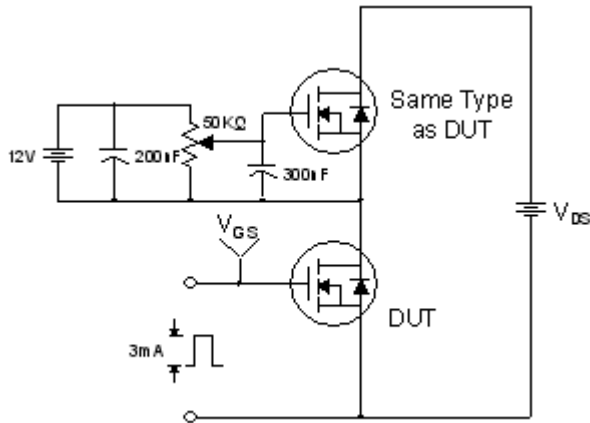X-axis: T_C, Case Temperature [°C]
Y-axis: I_D, Drain Current [A]
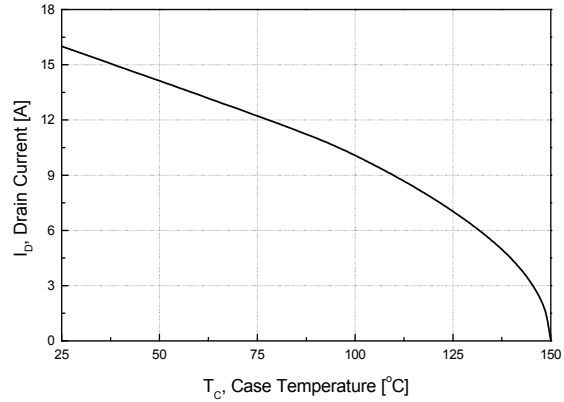
Figure 11. Transient Thermal Response Curve

D = 0.5
0.2
0.1
0.05
0.02
0.01
single pulse

P_{DM}
t_1
t_2

* Notes :
1. $Z_{θJC}(t)$ = 0.48 °C/W Max.
2. Duty Factor, D = t_1/t_2
3. $T_{JM} - T_C = P_{DM} * Z_{θJC}(t)$

X-axis: t_1, Square Wave Pulse Duration [sec]
Y-axis: $Z_{θJC}(t)$, Thermal Response
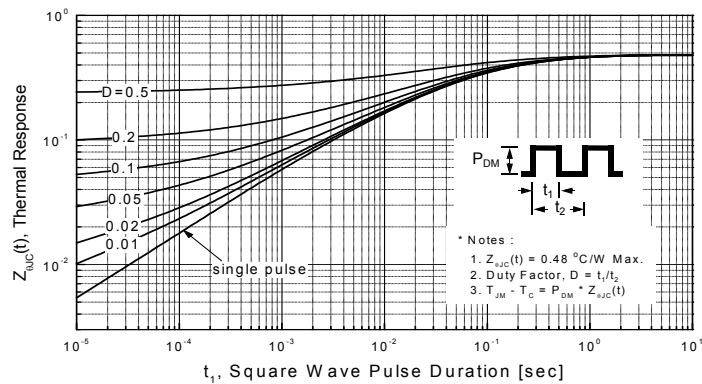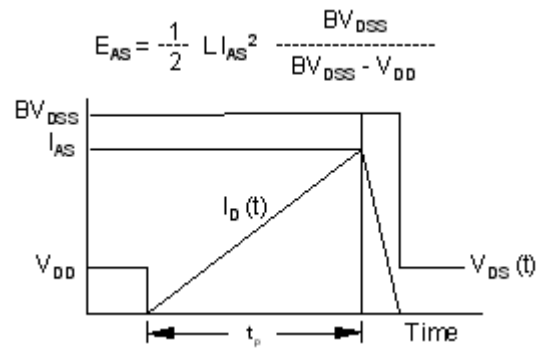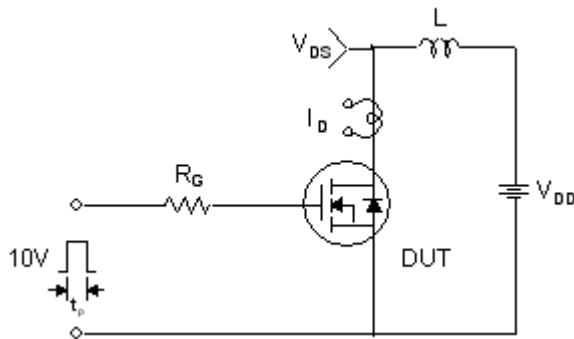
Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms
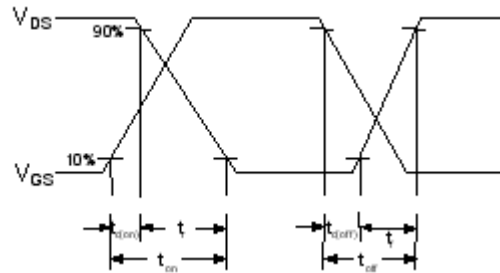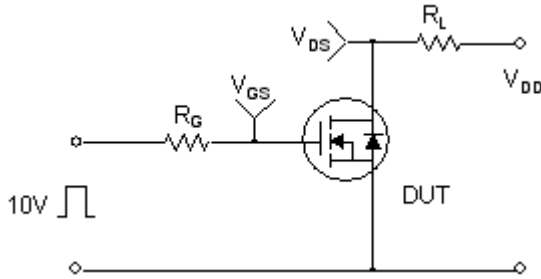
Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} \, L \, I_{AS}^2 \; \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
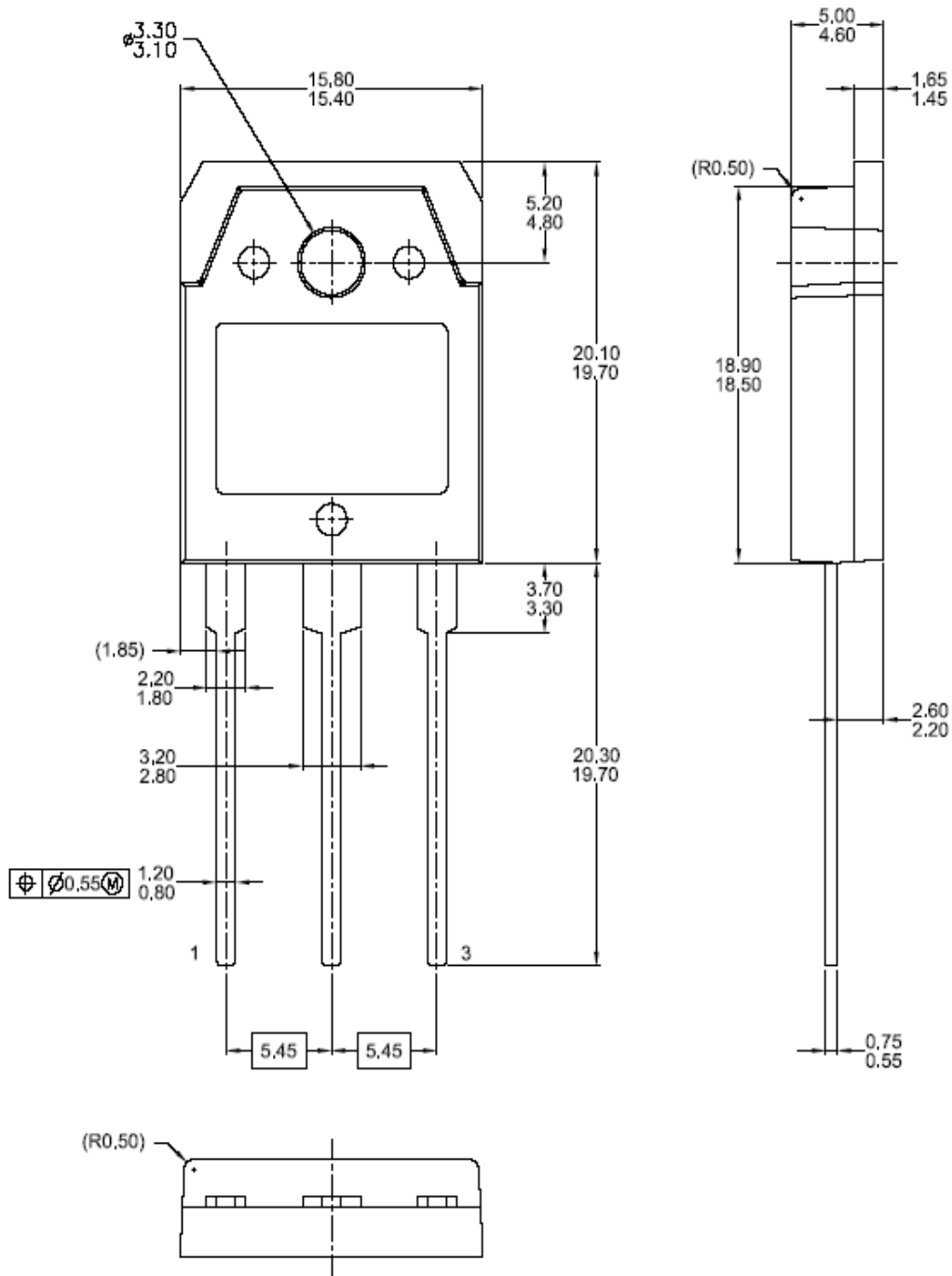
Peak Diode Recovery dv/dt Test Circuit & Waveforms
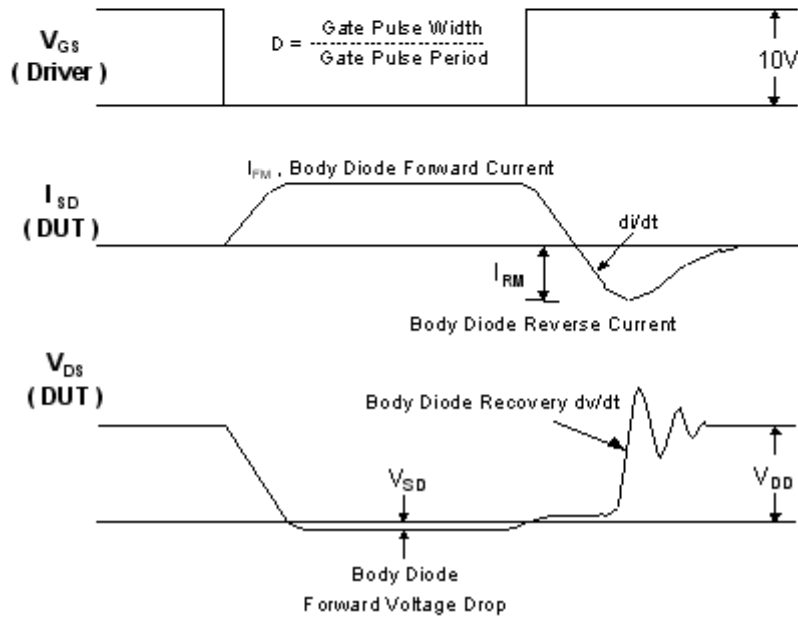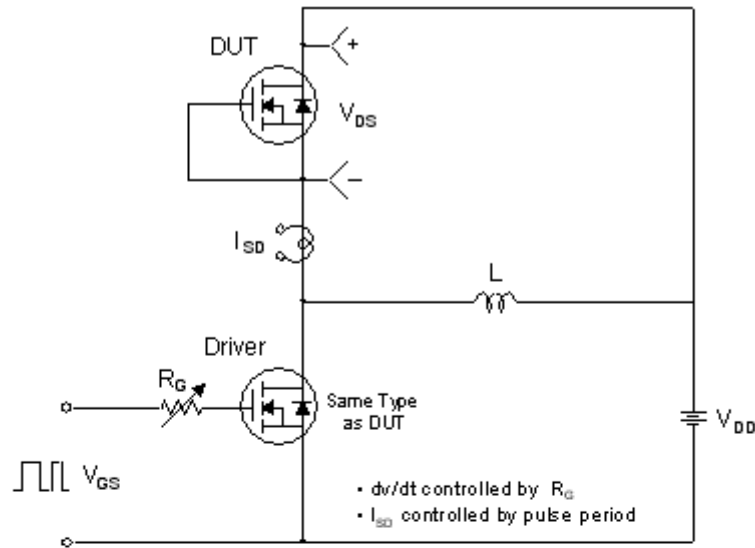
Mechanical Dimensions

TO-3PN

Dimensions in Millimeters

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