FAIRCHILD SEMICONDUCTOR®

SuperFET™

FCP11N60F/FCPF11N60F
600V N-Channel MOSFET

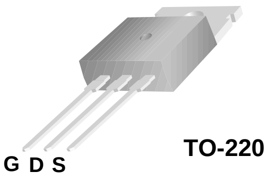
Features

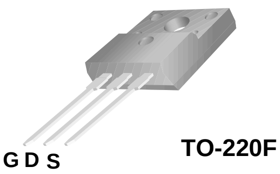
- 650V @T_J = 150°C
- Typ. $R_{DS(on)}$ = 0.32Ω
- Fast Recovery Type (t_{rr} = 120ns)
- Ultra Low Gate Charge (typ. Q_g = 40nC)
- Low Effective Output Capacitance (typ. C_{oss}eff.=95pF)
- 100% avalanche tested

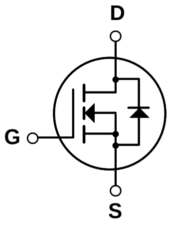
Description

SuperFET™ is, Farichild's proprietary, new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance.

This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. Consequently, SuperFET is very suitable for various AC/DC power conversion in switching mode operation for system miniaturization and higher efficiency.







Absolute Maximum Ratings

Symbol	Parameter		FCP11N60F	FCPF11N60F	Units
I_D	Drain Current - Continuous (T_C = 25°C)		11	11 *	A
	- Continuous (T_C = 100°C)		7	7 *	A
I_{DM}	Drain Current - Pulsed	(Note 1)	33	33 *	A
V_{GSS}	Gate-Source Voltage		± 30		V
E_{AS}	Single Pulsed Avalanche Energy	(Note 2)	340		mJ
I_{AR}	Avalanche Current	(Note 1)	11		A
E_{AR}	Repetitive Avalanche Energy	(Note 1)	12.5		mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5		V/ns
P_D	Power Dissipation (T_C = 25°C)		125	36 *	W
	- Derate above 25°C		1.0	0.29 *	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150		°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300		°C

* Drain current limited by maximum junction termperature.

Thermal Characteristics

Symbol	Parameter	FCP11N60F	FCPF11N60F	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.0	3.5	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.5	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	62.5	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCP11N60F	FCP11N60F	TO-220	--	--	50
FCPF11N60F	FCPF11N60F	TO-220F	--	--	50

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA, T_J = 25°C	600	--	--	V
		V_{GS} = 0 V, I_D = 250 μA, T_J = 150°C	--	650	--	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.6	--	V/°C
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	V_{GS} = 0 V, I_D = 11 A	--	700	--	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 600 V, V_{GS} = 0 V	--	--	10	μA
		V_{DS} = 480 V, T_C = 125°C	--	--	100	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30 V, V_{DS} = 0 V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30 V, V_{DS} = 0 V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 5.5 A	--	0.32	0.38	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40 V, I_D = 5.5 A (Note 4)	--	9.7	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	1148	1490	pF
C_{oss}	Output Capacitance		--	671	870	pF
C_{rss}	Reverse Transfer Capacitance		--	63	82	pF
C_{oss}	Output Capacitance	V_{DS} = 480 V, V_{GS} = 0 V, f = 1.0 MHz	--	35	--	pF
C_{oss} eff.	Effective Output Capacitance	V_{DS} = 0V to 480 V, V_{GS} = 0 V	--	95	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 300 V, I_D = 11 A, R_G = 25 Ω (Note 4, 5)	--	34	80	ns
t_r	Turn-On Rise Time		--	98	205	ns
$t_{d(off)}$	Turn-Off Delay Time		--	119	250	ns
t_f	Turn-Off Fall Time		--	56	120	ns
Q_g	Total Gate Charge	V_{DS} = 480 V, I_D = 11 A, V_{GS} = 10 V (Note 4, 5)	--	40	52	nC
Q_{gs}	Gate-Source Charge		--	7.2	--	nC
Q_{gd}	Gate-Drain Charge		--	21	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	11	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	33	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 11 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 11 A, dI_F / dt = 100 A/μs (Note 4)	--	120	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.8	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. I_{AS} = 5.5A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 11A, di/dt ≤ 200A/μs, V_{DD} ≤ $BV_{DSS,}$ Starting T_J = 25°C
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

Typical Performance Characteristics

Figure 1. On-Region Characteristics

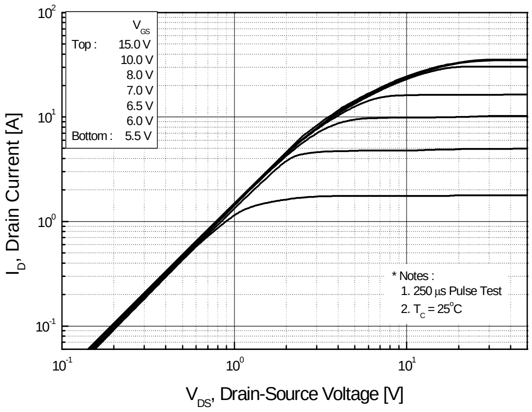


Figure 2. Transfer Characteristics

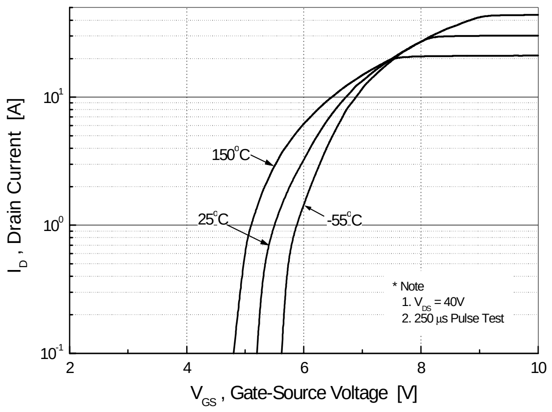


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

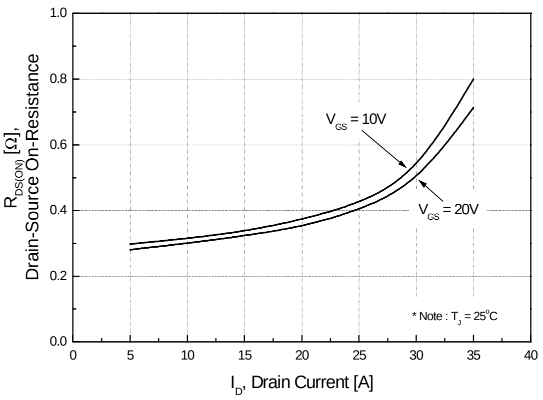


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

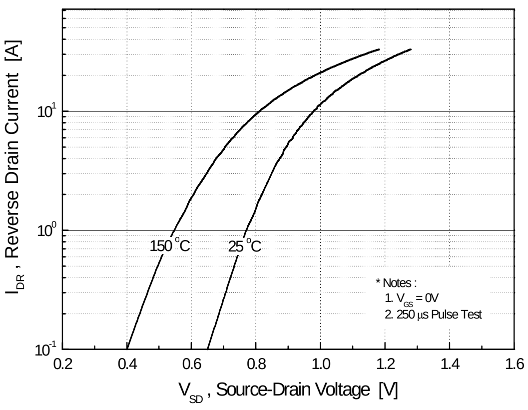


Figure 5. Capacitance Characteristics

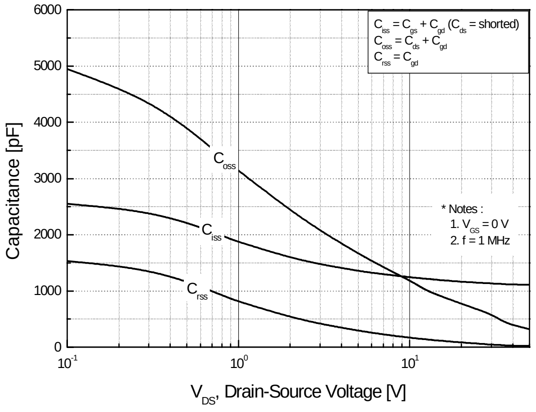
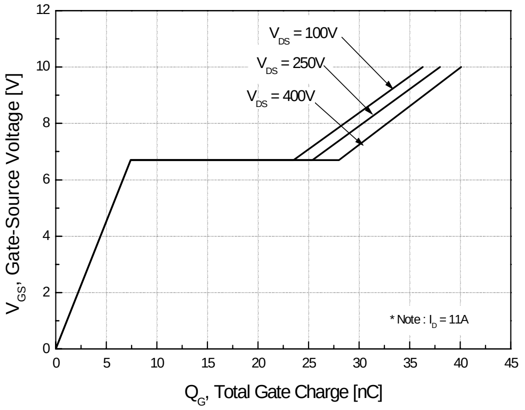


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

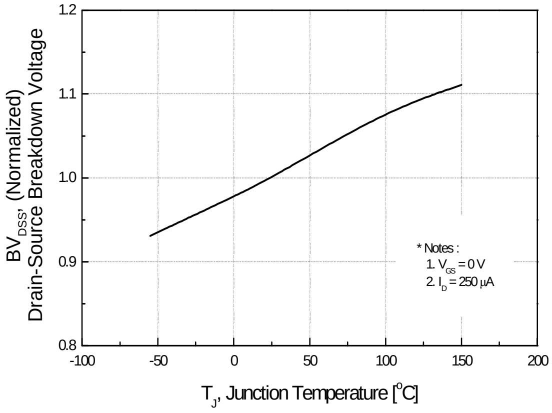


Figure 8. On-Resistance Variation vs. Temperature

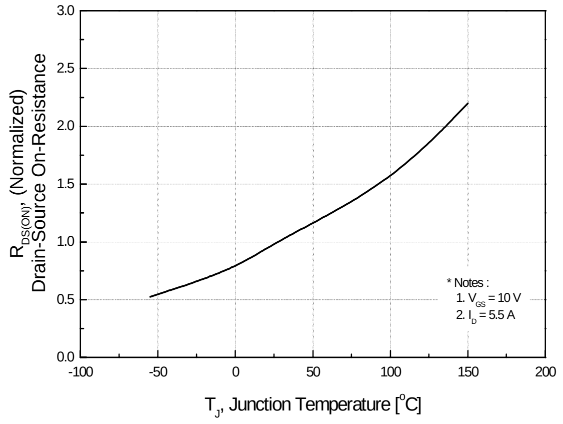


Figure 9-1. Safe Operating Area for FCP11N60F

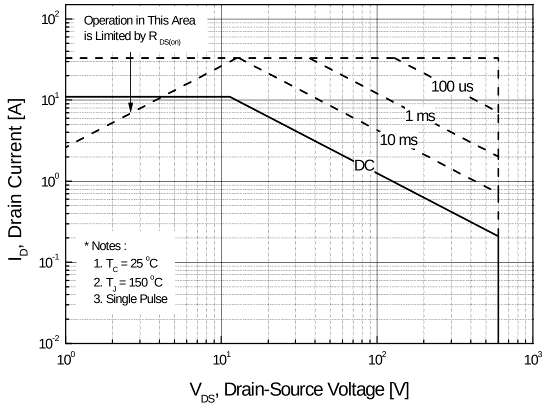


Figure 9-2. Safe Operating Area for FCPF11N60F

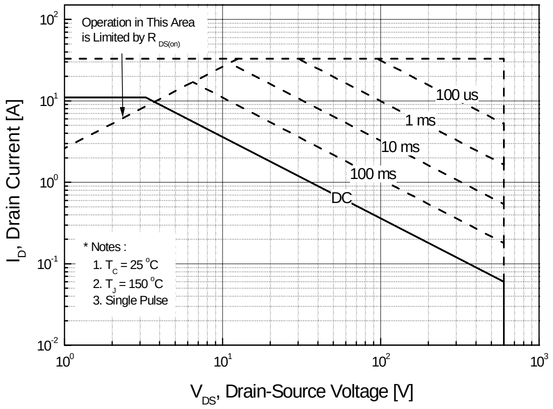
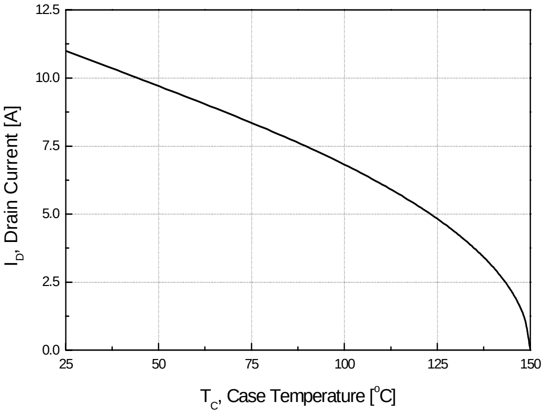


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FCP11N60F

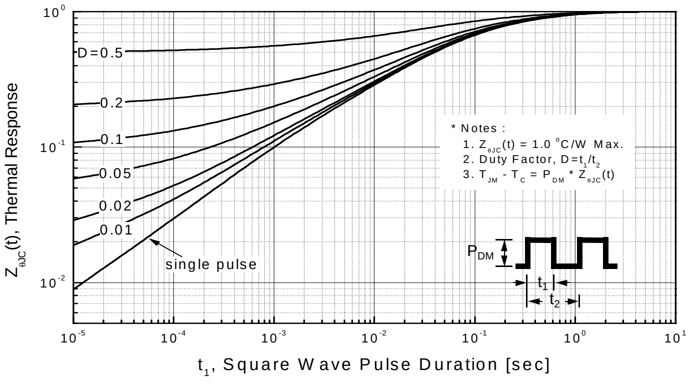
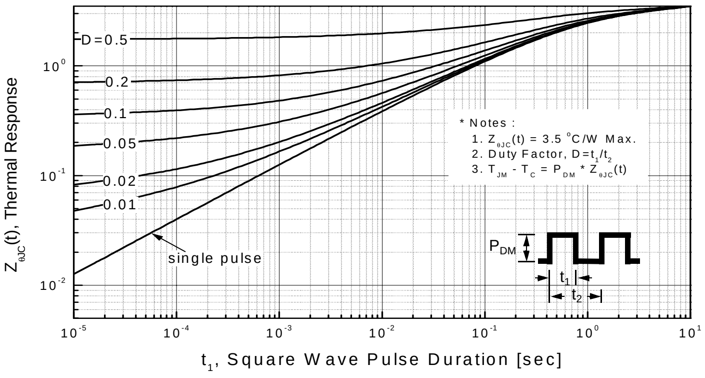
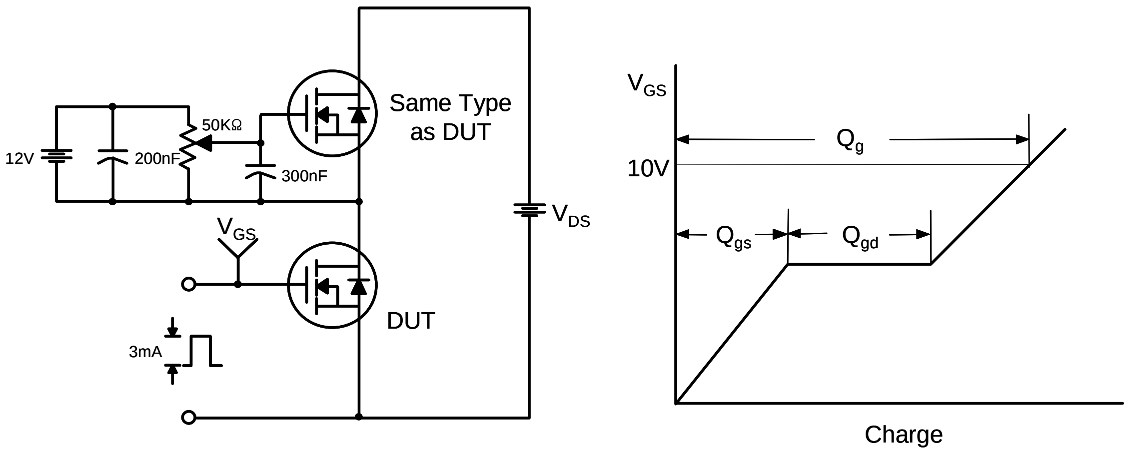


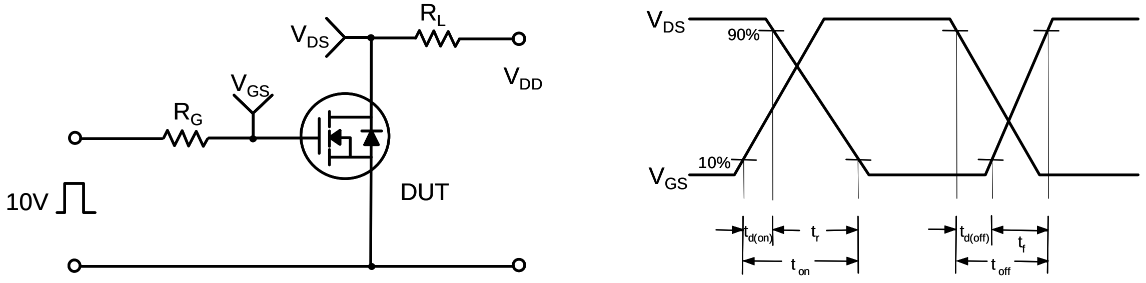
Figure 11-2. Transient Thermal Response Curve for FCPF11N60F



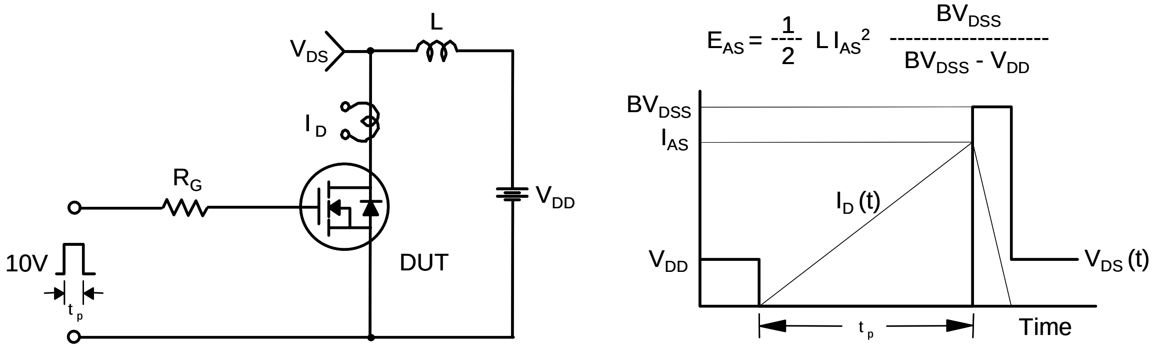
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms

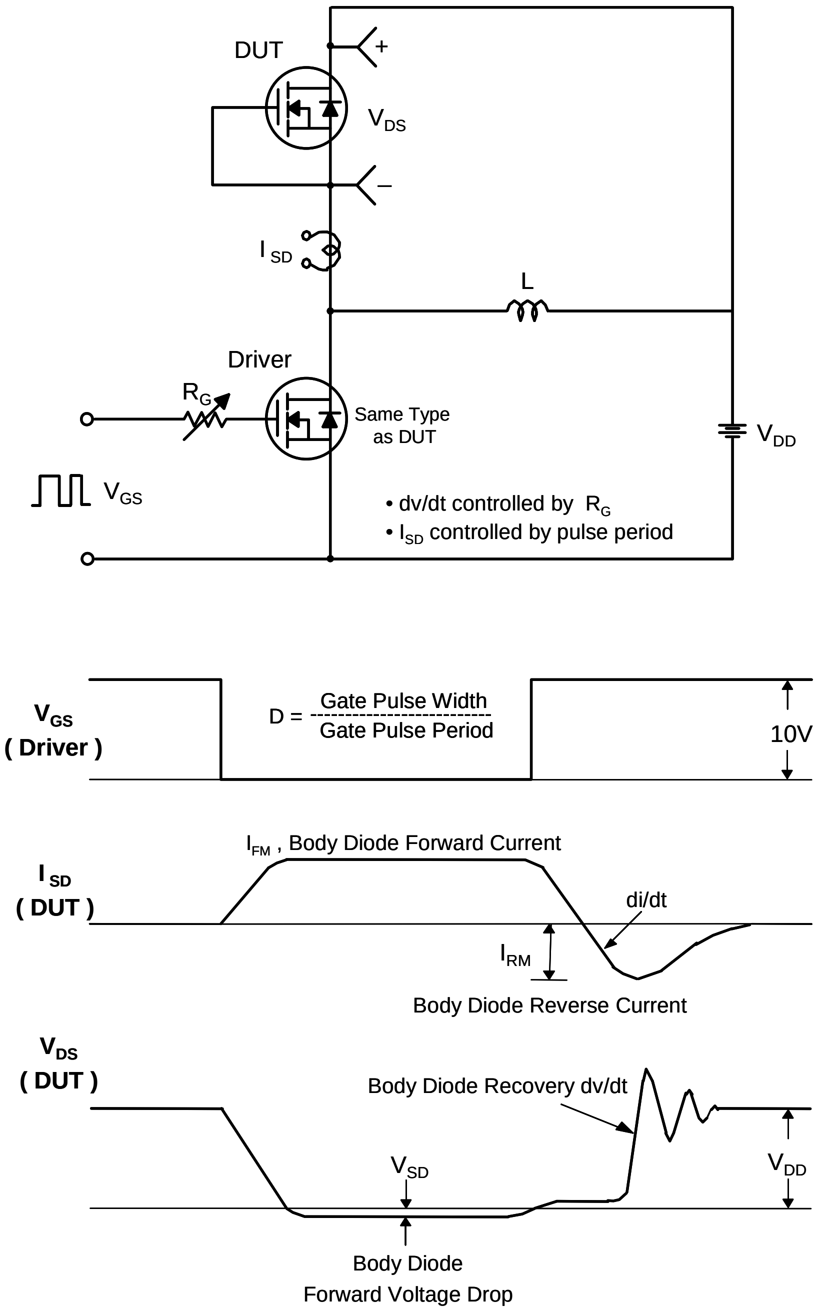


Unclamped Inductive Switching Test Circuit & Waveforms



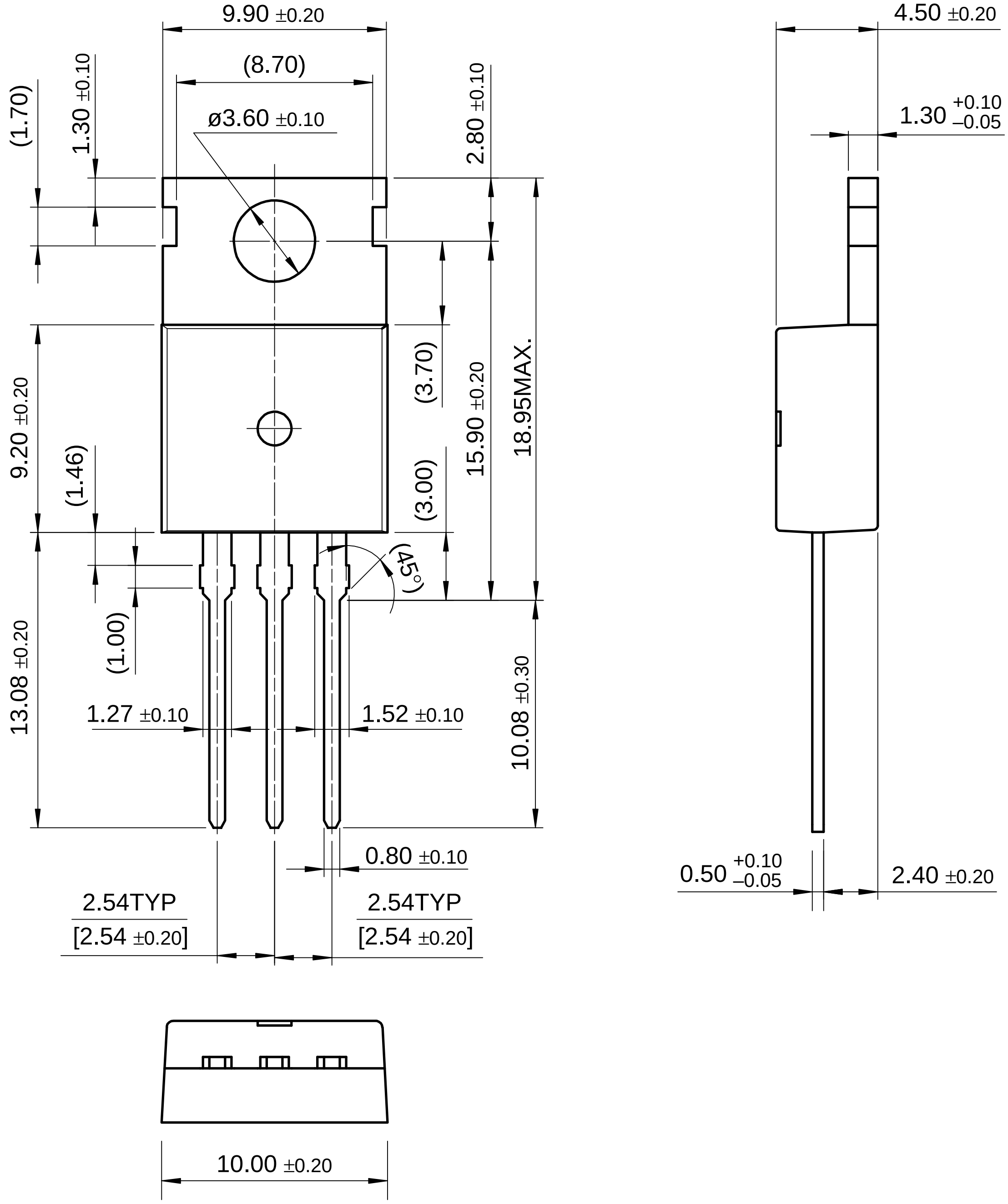
$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

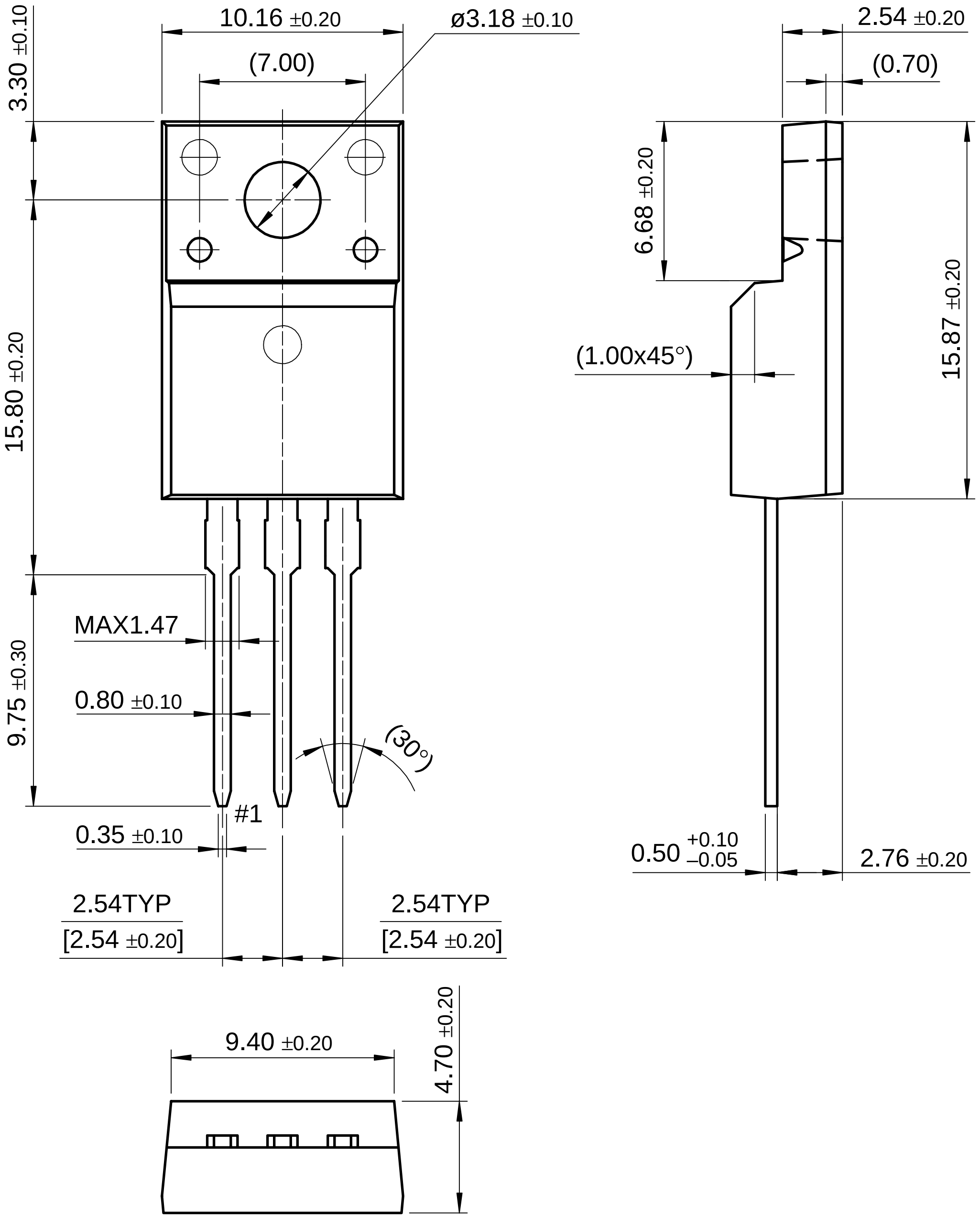
TO-220



Dimensions in Millimeters

Mechanical Dimensions (Continued)

TO-220F



Dimensions in Millimeters

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