

FCP11N60/FCPF11N60

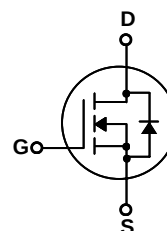
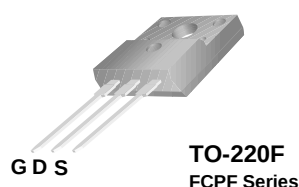
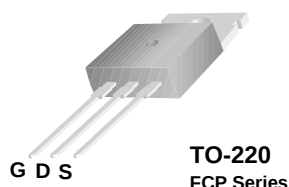
General Description

SuperFET™ is a new generation of high voltage MOSFETs from Fairchild with outstanding low on-resistance and low gate charge performance, a result of proprietary technology utilizing advanced charge balance mechanisms.

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.

Features

- 650V @T_j = 150°C
- Typ. R_{ds(on)}=0.32Ω
- Ultra low gate charge (typ. Q_g=40nC)
- Low effective output capacitance (typ. C_{oss,eff}=95pF)
- 100% avalanche tested



Absolute Maximum Ratings

T_C = 25°C unless otherwise noted

Symbol	Parameter	FCP11N60	FCPF11N60	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 temperature

Thermal Characteristics

Symbol	Parameter	FCP11N60	FCPF11N60	Units
R _{θJC}	Thermal Resistance, Junction-to-Case	1.0	3.5	°C/W
R _{θCS}	Thermal Resistance, Case-to-Sink	0.5	--	°C/W
R _{θJA}	Thermal Resistance, Junction-to-Ambient	62.5	62.5	°C/W

Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}, T_J = 25^\circ\text{C}$	600	--	--	V
		$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}, T_J = 150^\circ\text{C}$	--	650	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	--	0.6	--	V/ $^\circ\text{C}$
BV_{DS}	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 11\text{ A}$	--	700	--	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 5.5\text{ A}$	--	0.32	0.38	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 5.5\text{ A}$ (Note 4)	--	9.7	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	1148	1490	pF
C_{oss}	Output Capacitance		--	671	870	pF
C_{rss}	Reverse Transfer Capacitance		--	63	82	pF
C_{oss}	Output Capacitance	$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	35	--	pF
$C_{oss\text{ eff.}}$	Effective Output Capacitance	$V_{DS} = 0\text{ V to } 480\text{ V}, V_{GS} = 0\text{ V}$	--	95	--	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300\text{ V}, I_D = 11\text{ A},$ $R_G = 25\text{ }\Omega$	--	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	$V_{DS} = 480\text{ V}, I_D = 11\text{ A},$ $V_{GS} = 10\text{ V}$	--	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	--	390	--	ns
Q _{rr}	Reverse Recovery Charge	(Note 4)	--	5.7	--	μC

Notes:

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

Typical Characteristics

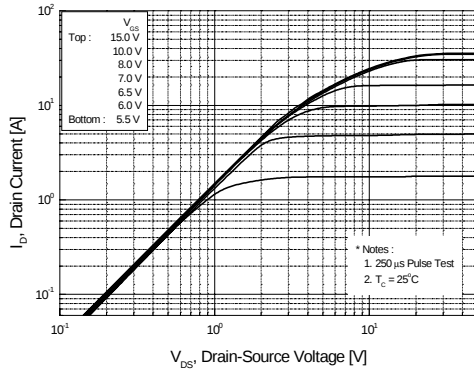


Figure 1. On-Region Characteristics

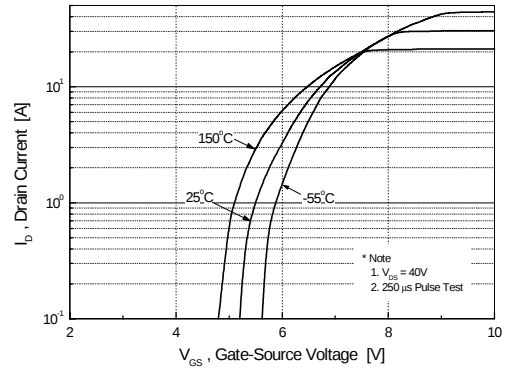


Figure 2. Transfer Characteristics

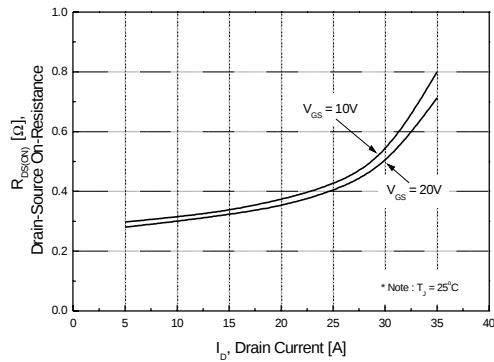


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

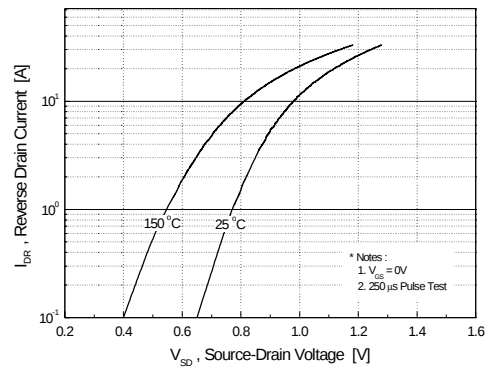


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

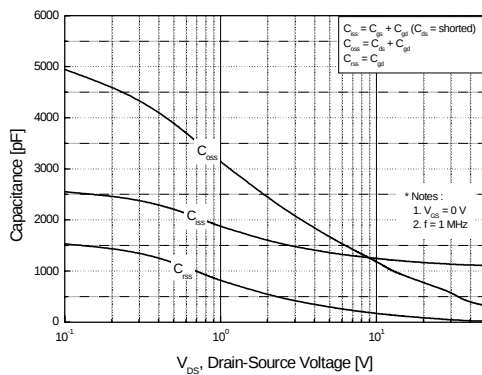


Figure 5. Capacitance Characteristics

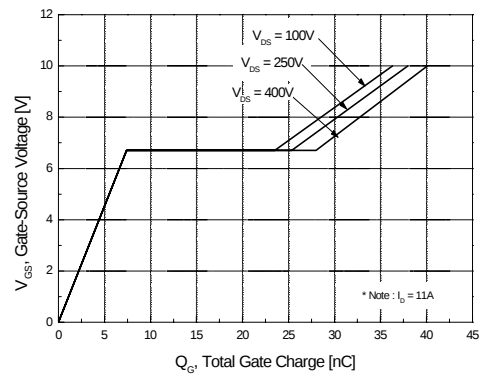


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

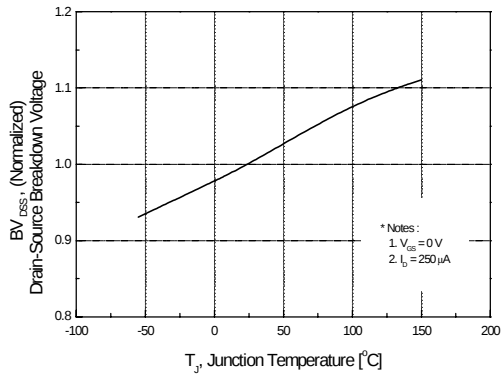


Figure 7. Breakdown Voltage Variation vs. Temperature

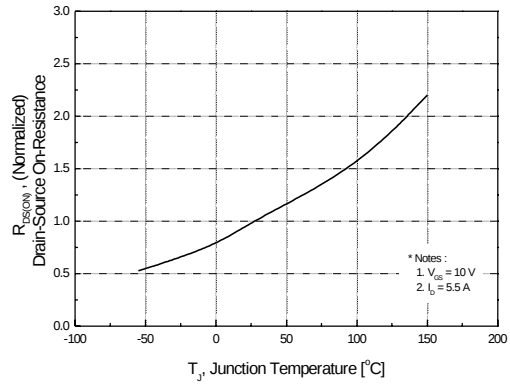


Figure 8. On-Resistance Variation vs. Temperature

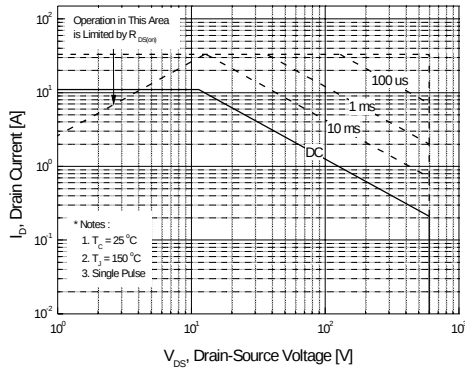


Figure 9-1. Maximum Safe Operating Area for FCP11N60

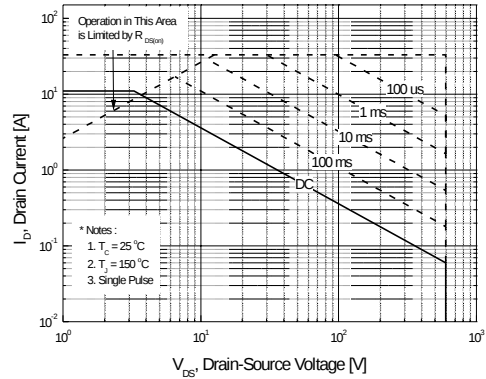


Figure 9-2. Maximum Safe Operating Area for FCPF11N60

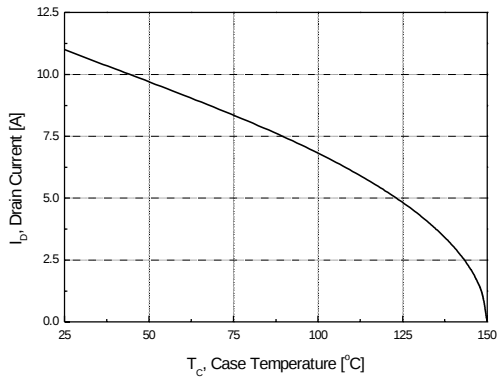


Figure 10. Maximum Drain Current vs. Case Temperature

Typical Characteristics (Continued)

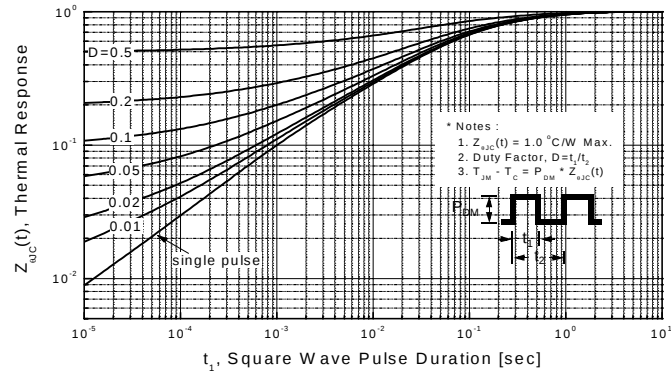


Figure 11-1. Transient Thermal Response Curve for FCP11N60

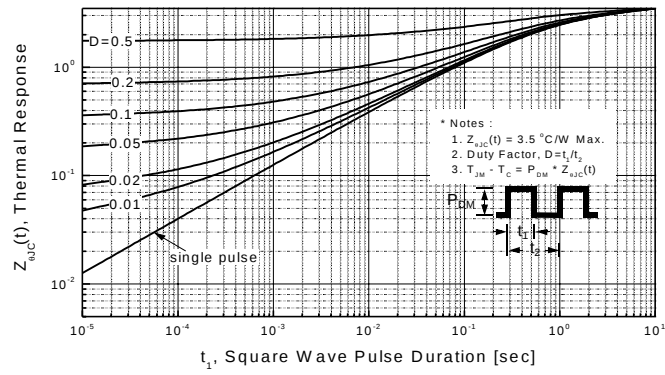
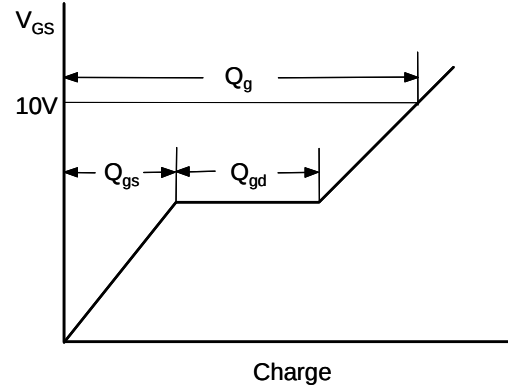
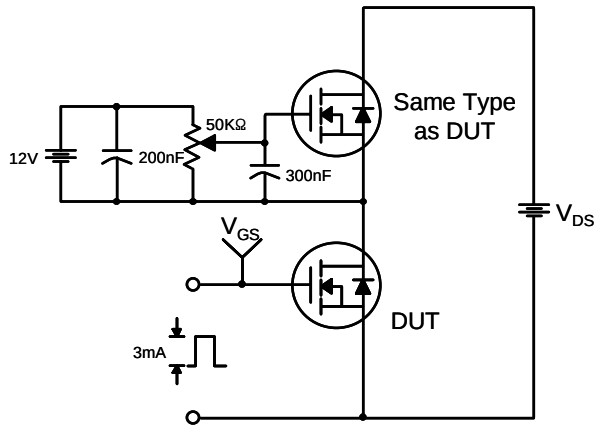
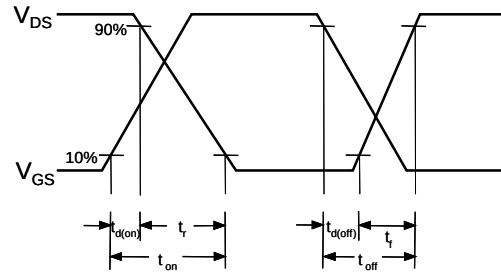
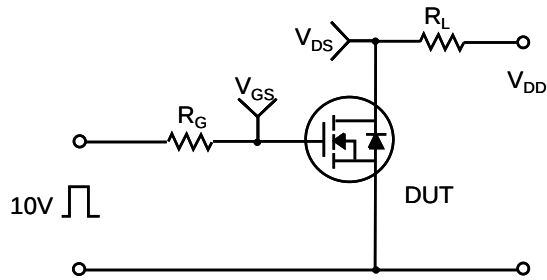


Figure 11-2. Transient Thermal Response Curve for FCPF11N60

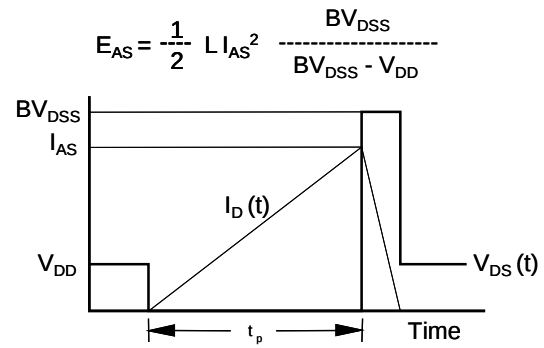
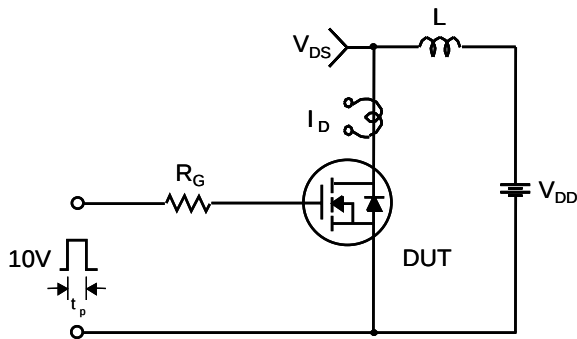
Gate Charge Test Circuit & Waveform



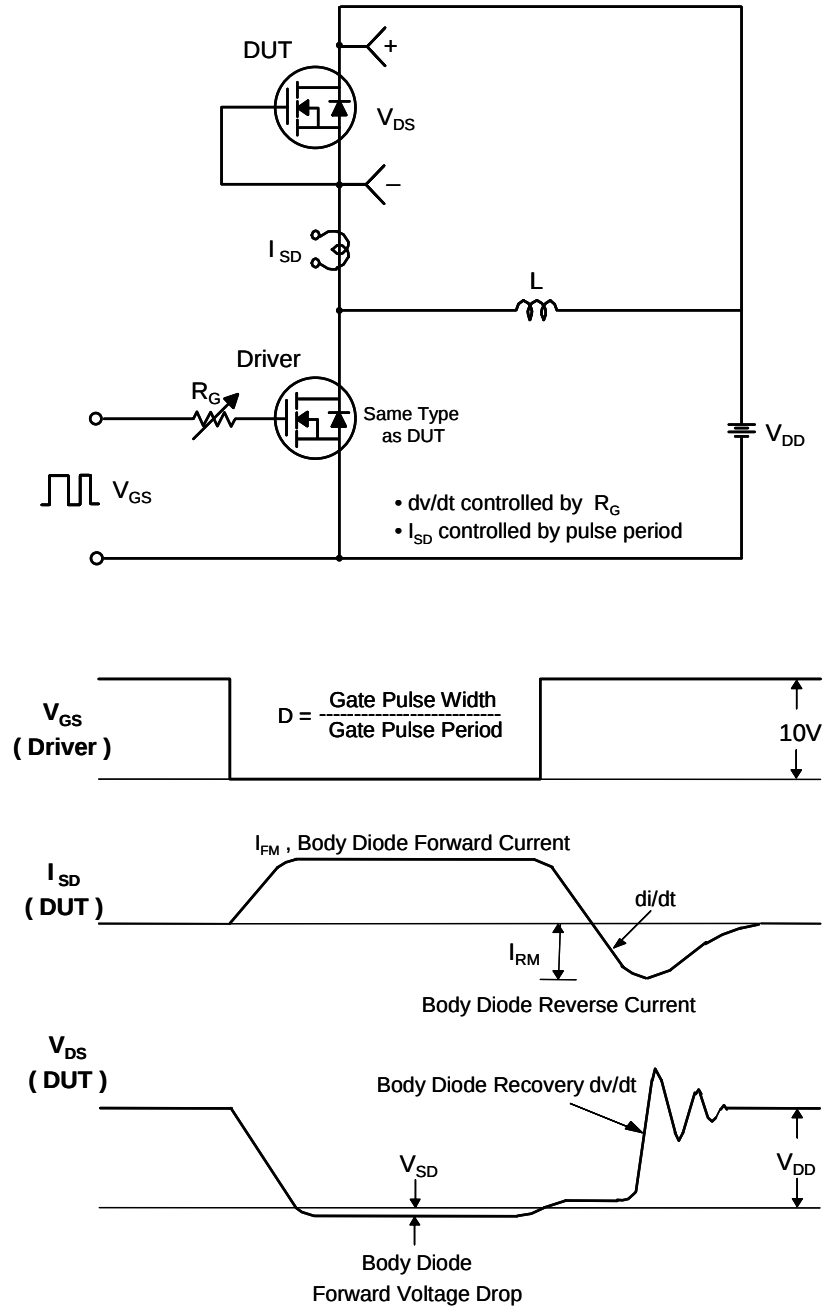
Resistive Switching Test Circuit & Waveforms



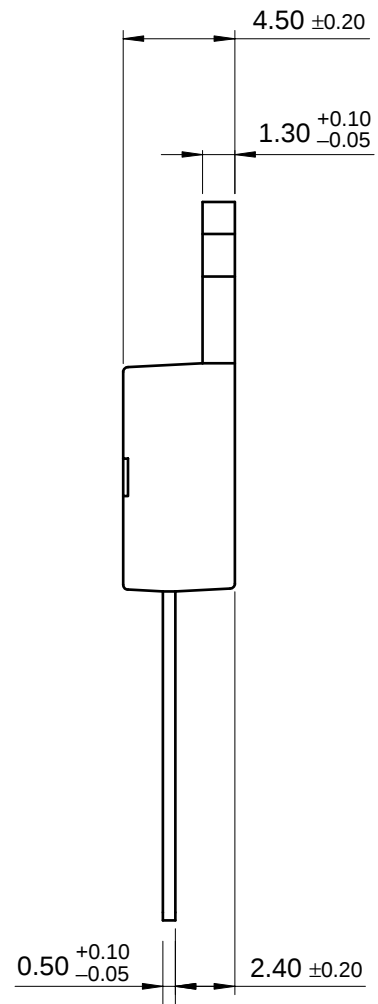
Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms



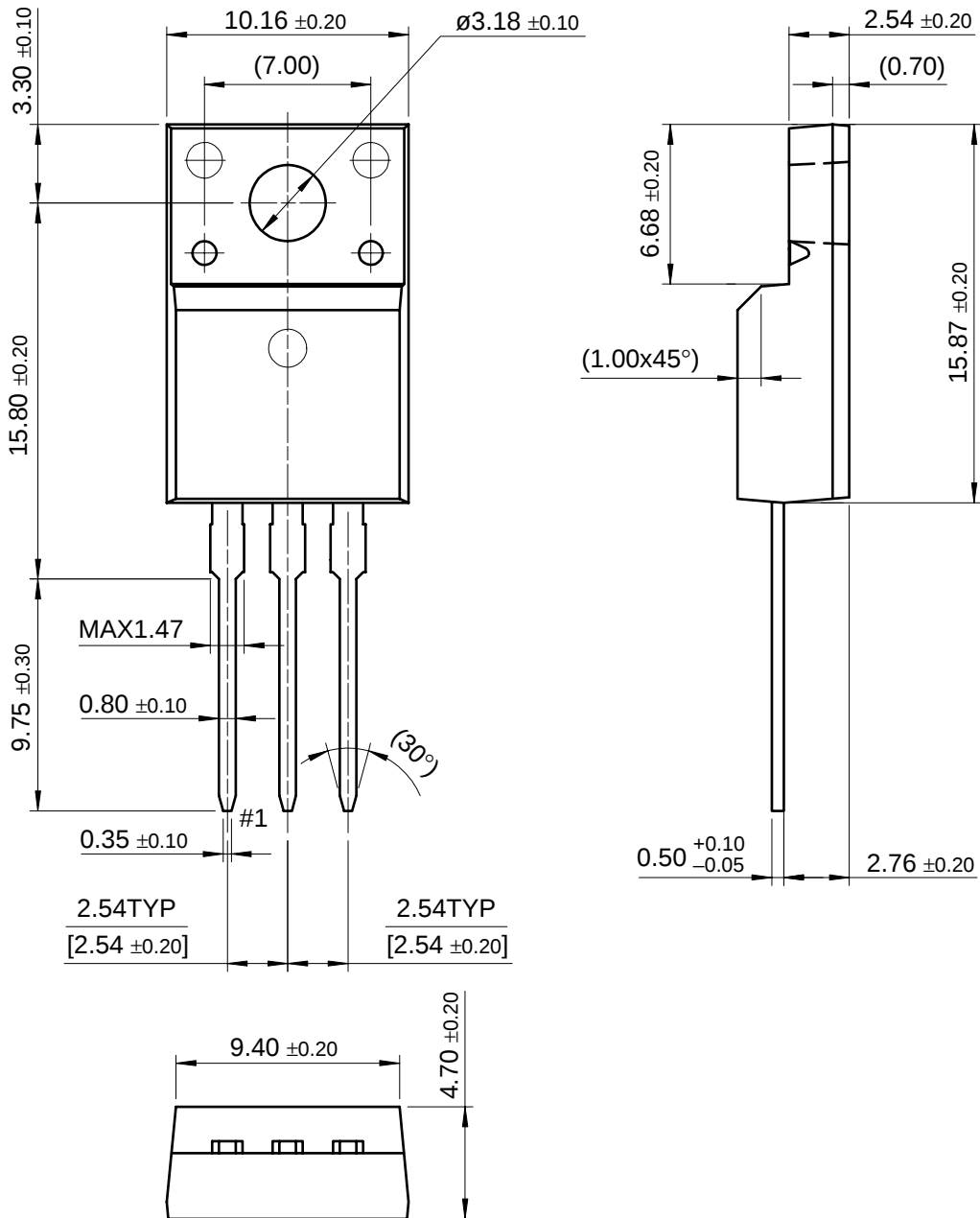
TO-220



Rev. B, March 2004

Package Dimensions

TO-220F



Dimensions in Millimeters

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