

FCP11N60F/FCPF11N60F 600V N-Channel MOSFET

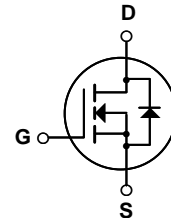
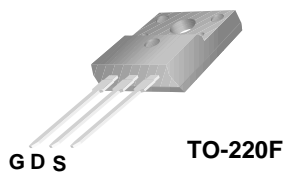
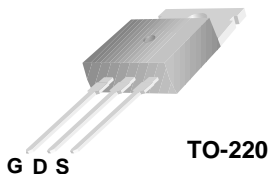
Features

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

Description

SuperFET™ is, Fairchild'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 ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	11	11 *	A
		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 ($T_C = 25^\circ\text{C}$) - Derate above 25°C	125	36 *	W
		1.0	0.29 *	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		$^\circ\text{C}$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300		$^\circ\text{C}$

* Drain current limited by maximum junction temperature.

Thermal Characteristics

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

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	
ΔBV _{DSS} /ΔT _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	--	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		(Note 4, 5)	--	56	120	ns
Q _g	Total Gate Charge	V _{DS} = 480 V, I _D = 11 A, V _{GS} = 10 V	--	40	52	nC	
Q _{gs}	Gate-Source Charge		(Note 4, 5)	--	7.2	--	nC
Q _{gd}	Gate-Drain Charge		(Note 4, 5)	--	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

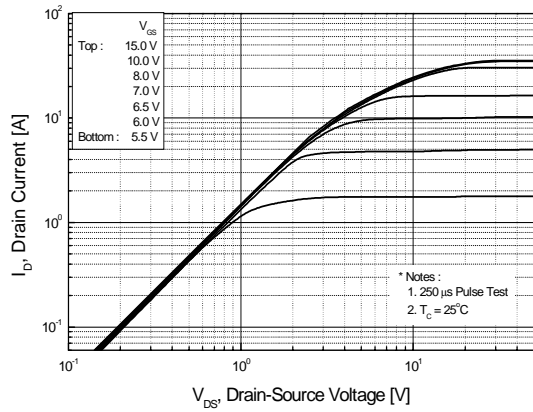


Figure 2. Transfer Characteristics

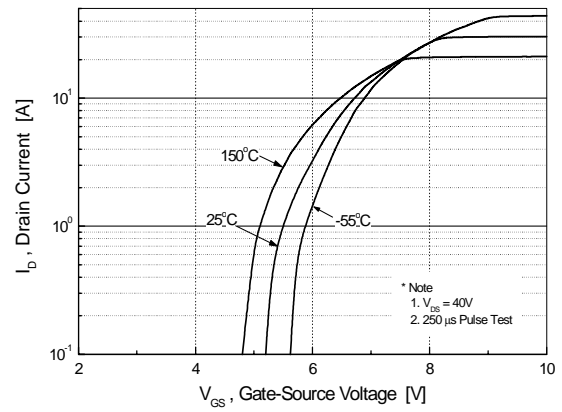


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

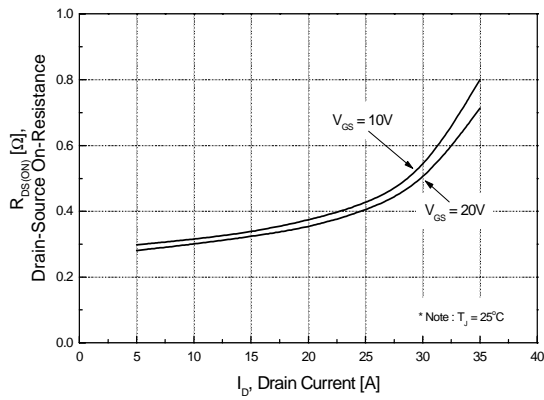


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

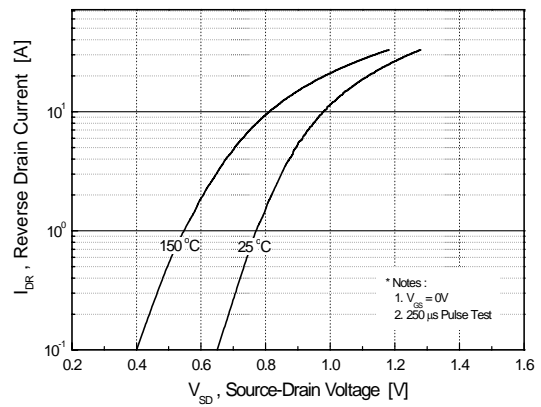


Figure 5. Capacitance Characteristics

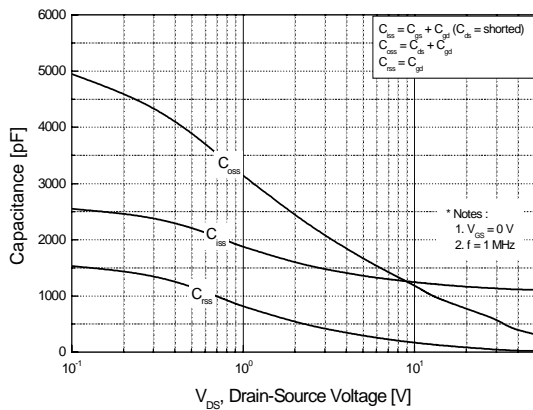
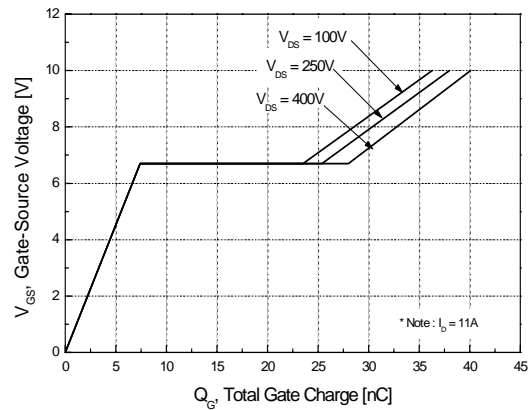


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

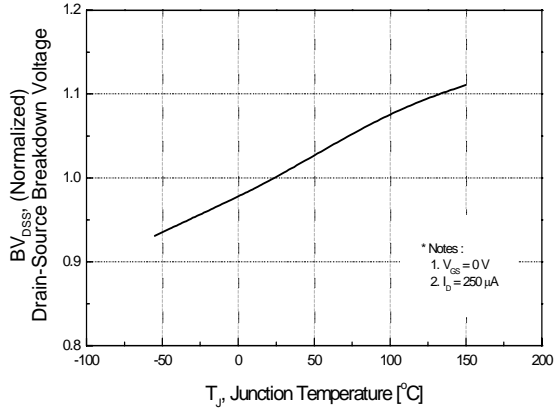


Figure 8. On-Resistance Variation vs. Temperature

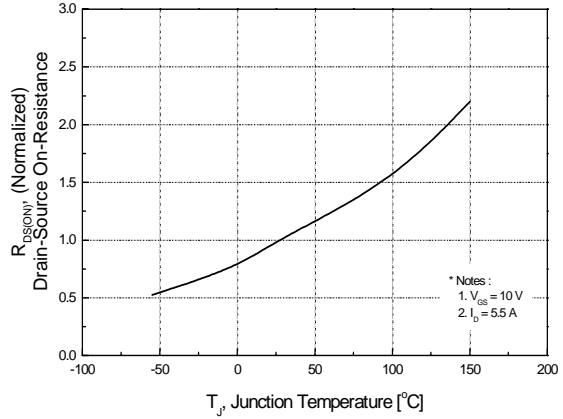


Figure 9-1. Safe Operating Area for FCP11N60F

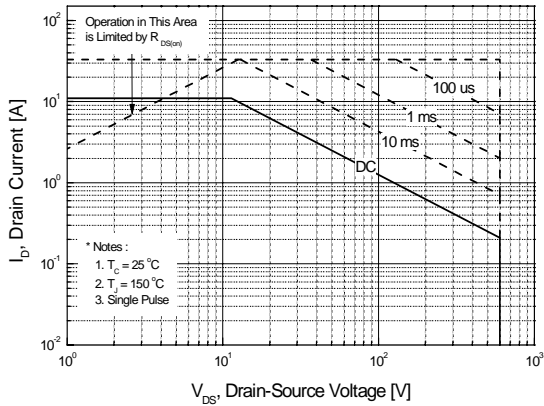


Figure 9-2. Safe Operating Area for FCPF11N60F

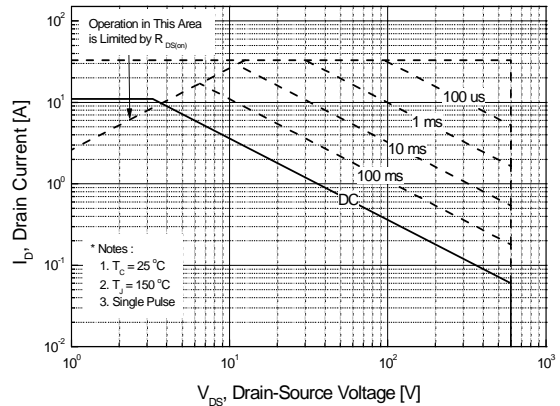
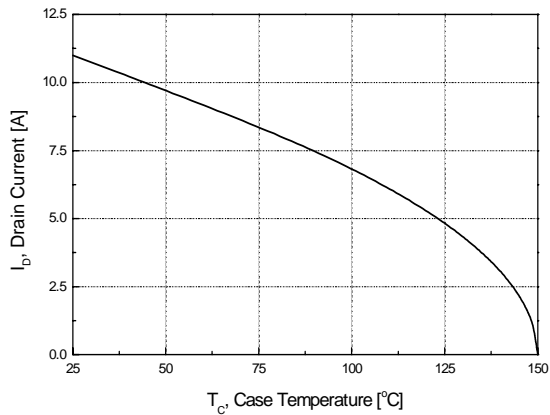


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FCP11N60F

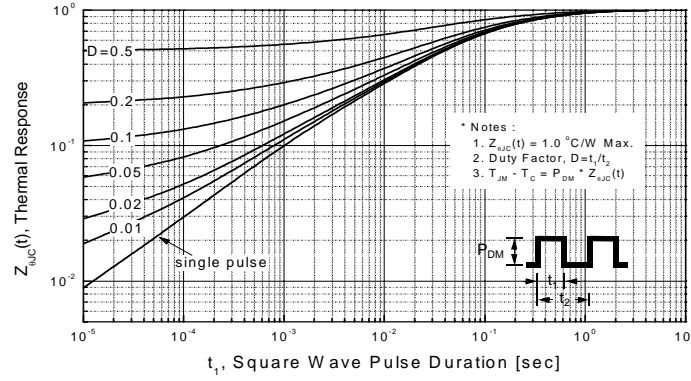
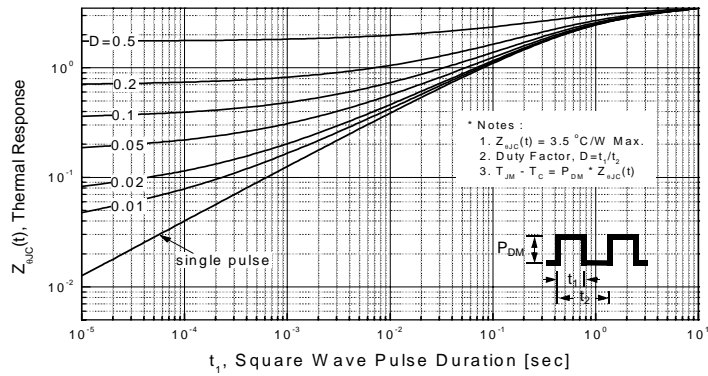
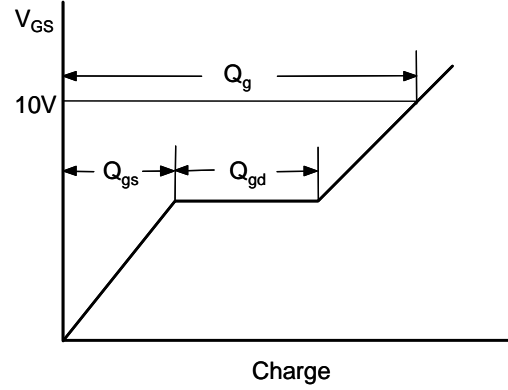
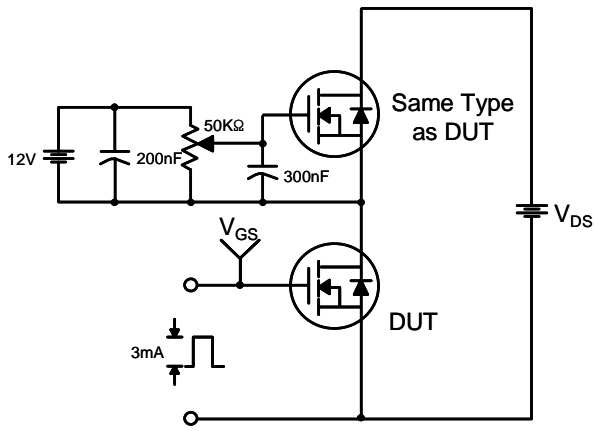


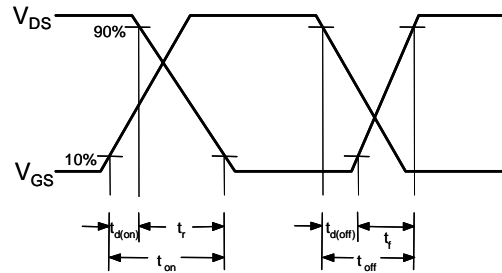
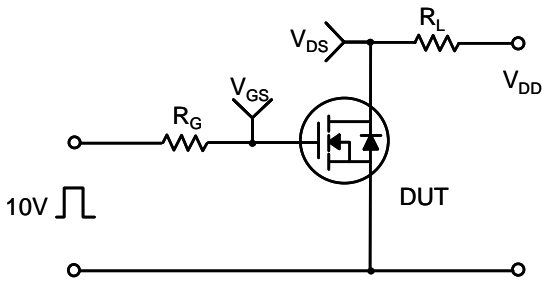
Figure 11-2. Transient Thermal Response Curve for FCPF11N60F



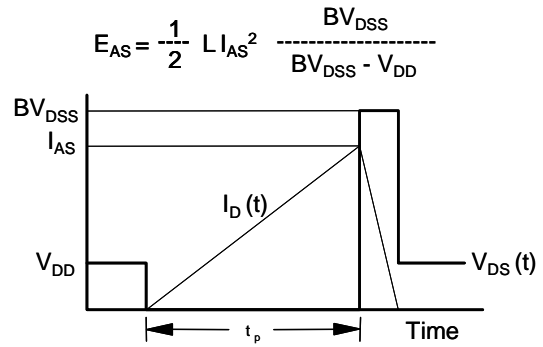
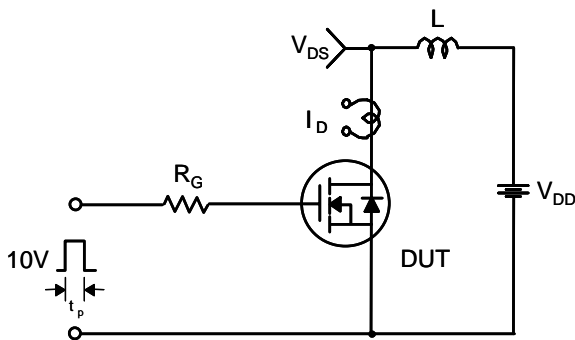
Gate Charge Test Circuit & Waveform



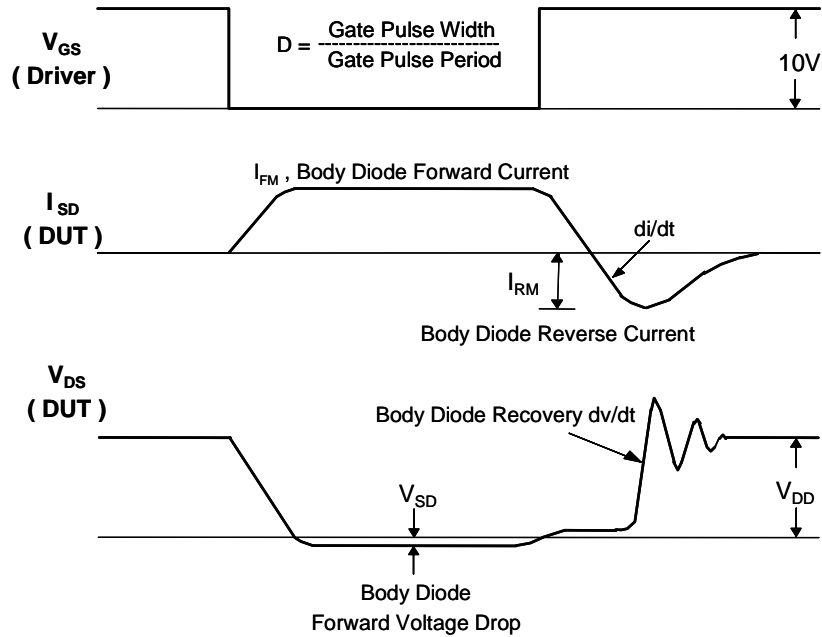
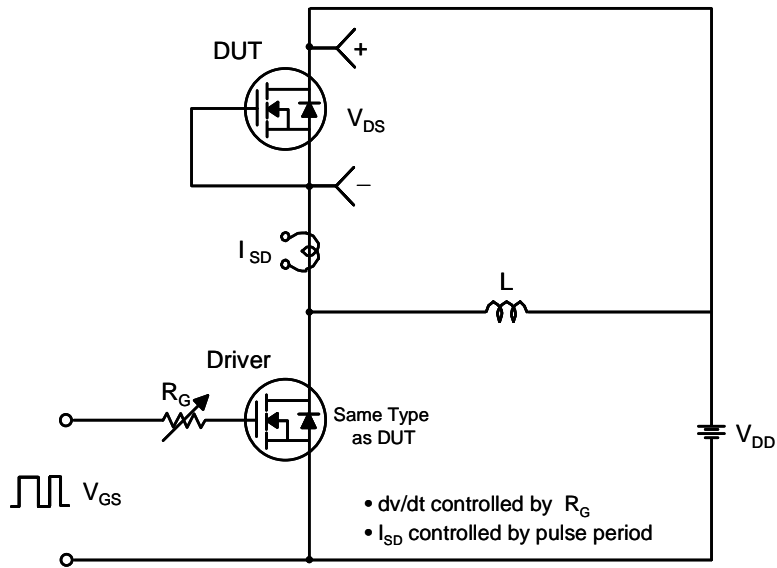
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

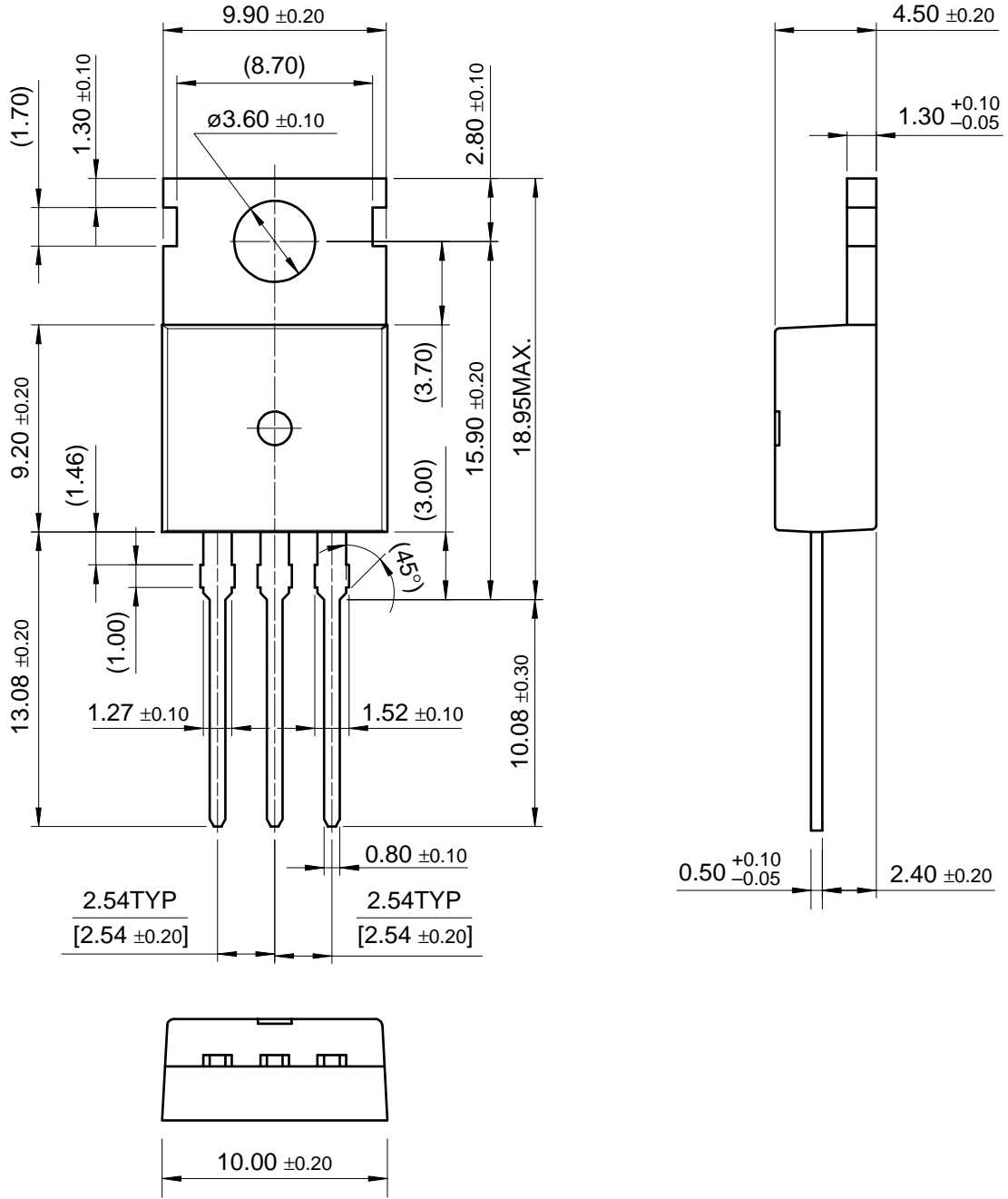


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

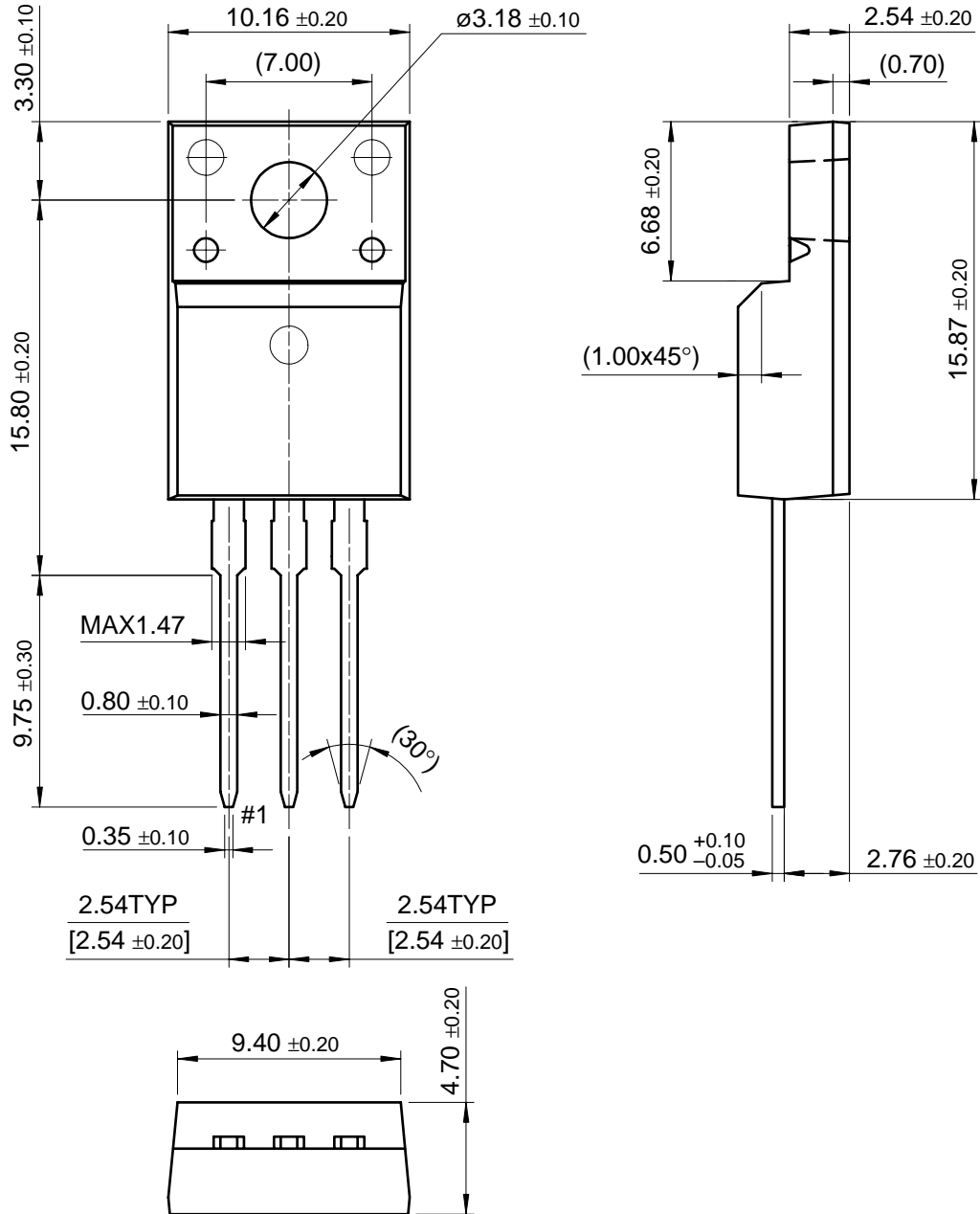
TO-220



Dimensions in Millimeters

Mechanical Dimensions (Continued)

TO-220F



Dimensions in Millimeters

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