



December 2005

FRFET™

FQB6N40CF 400V N-Channel MOSFET

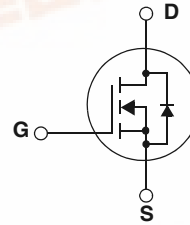
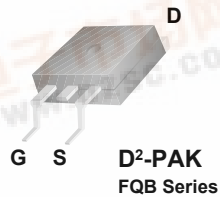
Features

- 6A, 400V, $R_{DS(on)} = 1.1 \Omega @ V_{GS} = 10V$
- Low gate charge (typical 16nC)
- Low C_{rss} (typical 15pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Fast recovery body diode (typical 70ns)

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 efficiency switched mode power supplies, electronic lamp ballasts based on half bridge topology.



Absolute Maximum Ratings

Symbol	Parameter	FQB6N40CF	Units
V_{DSS}	Drain-Source Voltage	400	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	6	A
		3.8	A
I_{DM}	Drain Current - Pulsed (Note 1)	24	A
V_{GSS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	270	mJ
I_{AR}	Avalanche Current (Note 1)	6	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	11.3	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	113	W
	- Derate above 25°C	0.9	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	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FQB6N40CF	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.1	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	40	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	$^\circ\text{C/W}$

* When mounted on the minimum pad size recommended (PCB Mount)

FQB6N40CF 400V N-Channel MOSFET

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQB6N40CF	FQB6N40CFTM	D ² -PAK	330mm	24mm	800

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	400	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.54	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 400 V, V _{GS} = 0 V	--	--	10	μA
		V _{DS} = 320 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	2.0	--	4.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 3 A	--	0.9	1.1	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 3 A (Note 4)	--	4.7	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	--	480	625	pF
C _{oss}	Output Capacitance		--	80	105	pF
C _{rss}	Reverse Transfer Capacitance		--	15	20	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 200 V, I _D = 6A, R _G = 25 Ω	--	13	35	ns
t _r	Turn-On Rise Time		--	65	140	ns
t _{d(off)}	Turn-Off Delay Time		--	21	55	ns
t _f	Turn-Off Fall Time		(Note 4, 5)	--	38	85
Q _g	Total Gate Charge	V _{DS} = 320 V, I _D = 6A, V _{GS} = 10 V	--	16	20	nC
Q _{gs}	Gate-Source Charge		--	2.3	--	nC
Q _{gd}	Gate-Drain Charge		(Note 4, 5)	--	8.2	--
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	6	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	24	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 6 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 6 A, dI _F / dt = 100 A/μs (Note 4)	--	70	--	ns
Q _{rr}	Reverse Recovery Charge		--	0.12	--	μC

NOTES:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 13.7mH, I_{AS} = 6A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 6A, 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

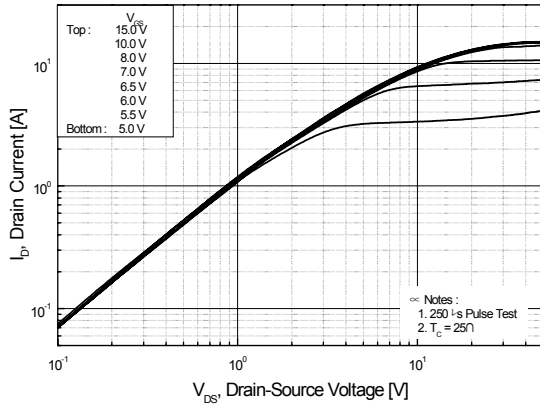


Figure 2. Transfer Characteristics

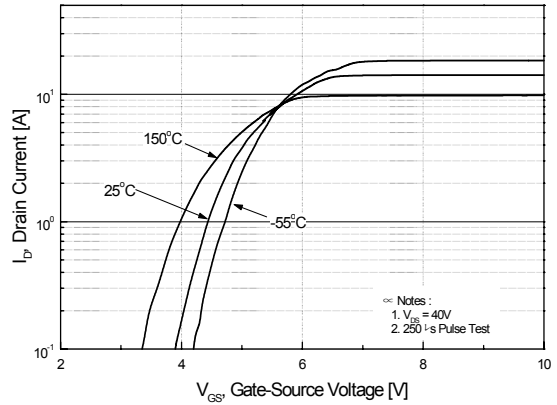


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

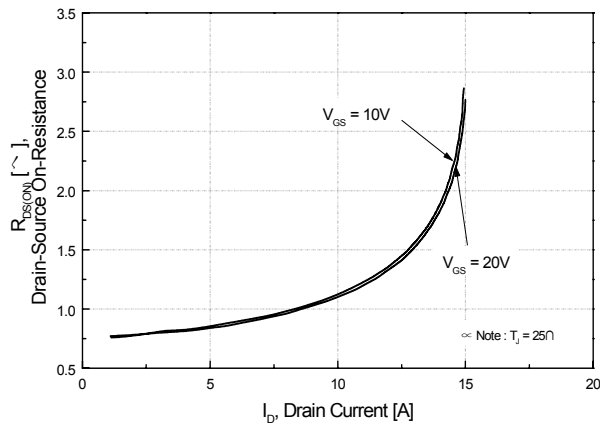


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

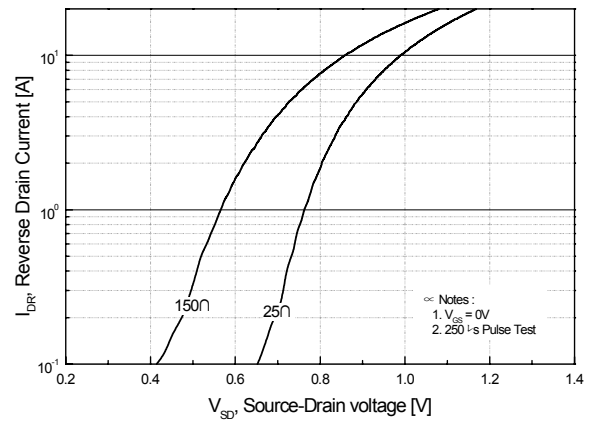


Figure 5. Capacitance Characteristics

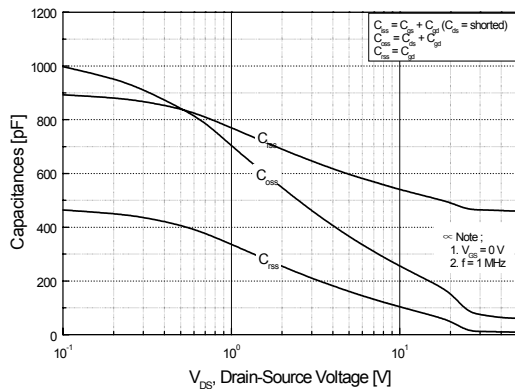
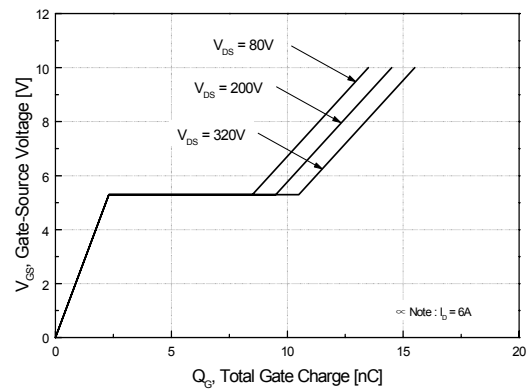


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

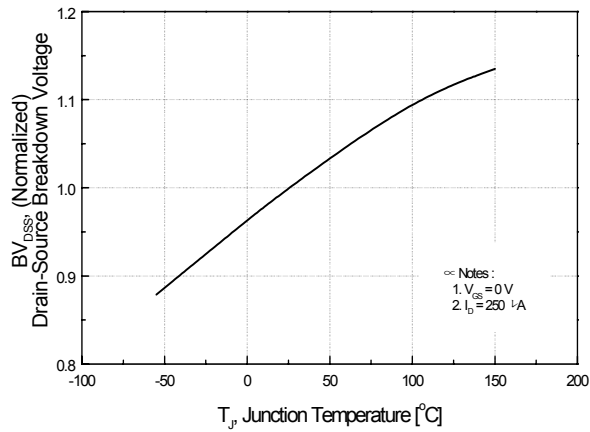


Figure 8. On-Resistance Variation vs. Temperature

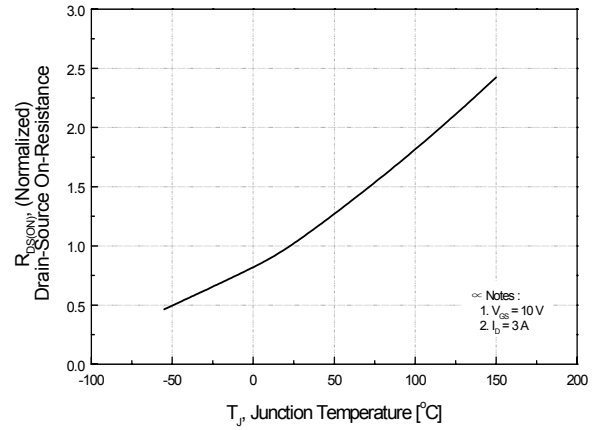


Figure 9. Maximum Safe Operating Area

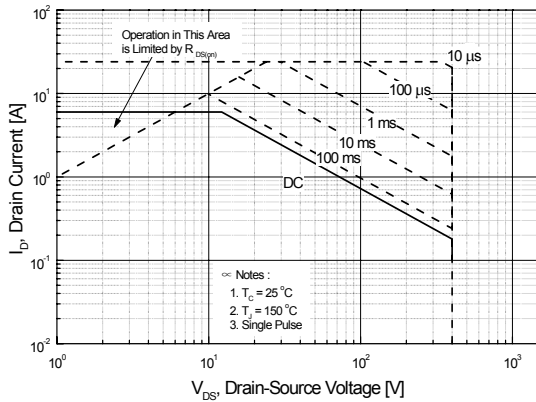


Figure 10. Maximum Drain Current vs. Case Temperature

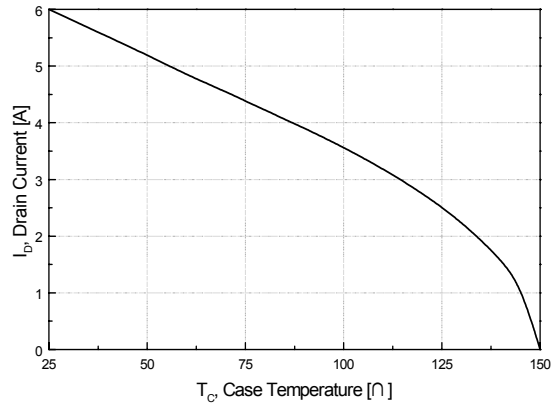
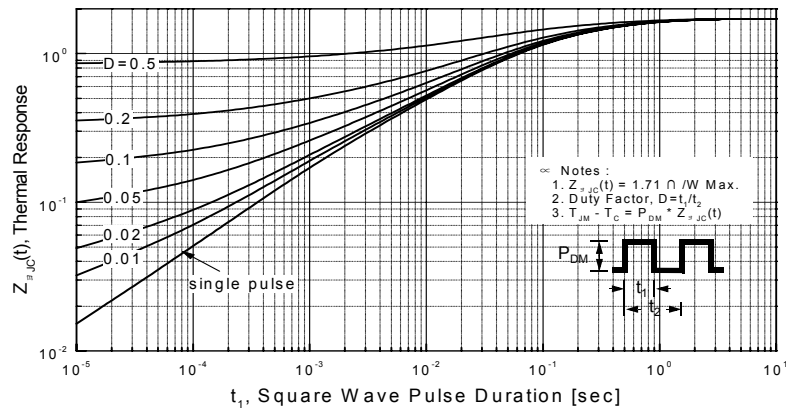
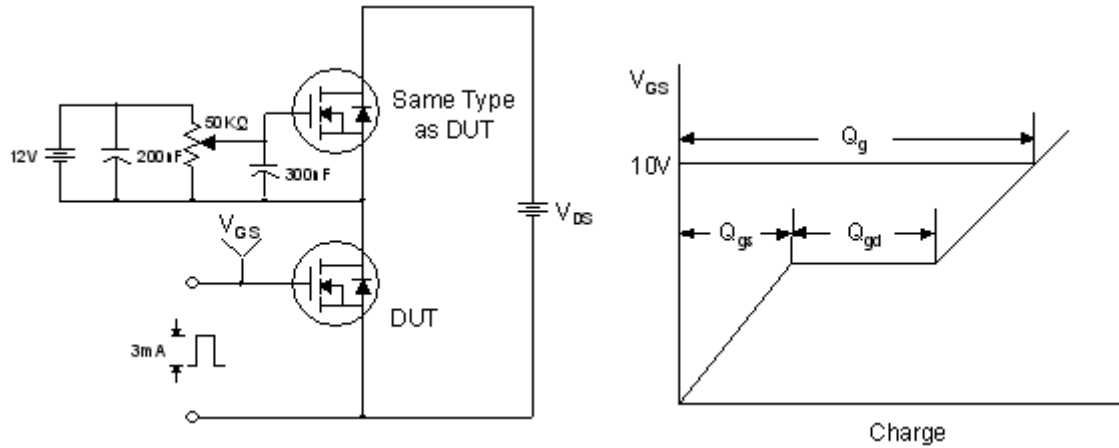


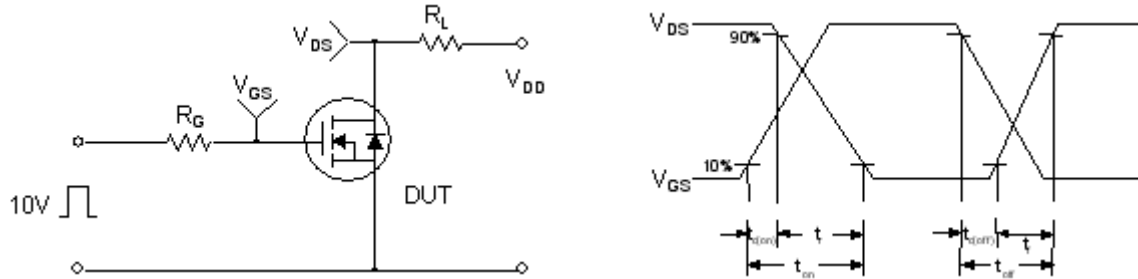
Figure 11. Transient Thermal Response Curve



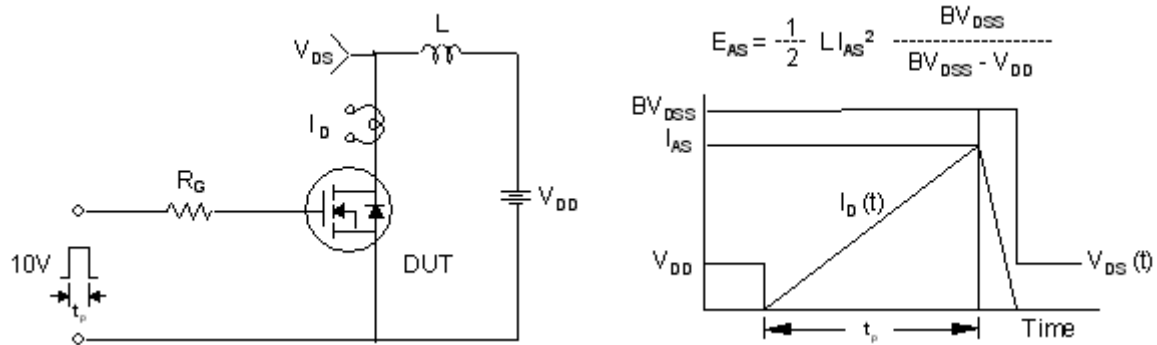
Gate Charge Test Circuit & Waveform



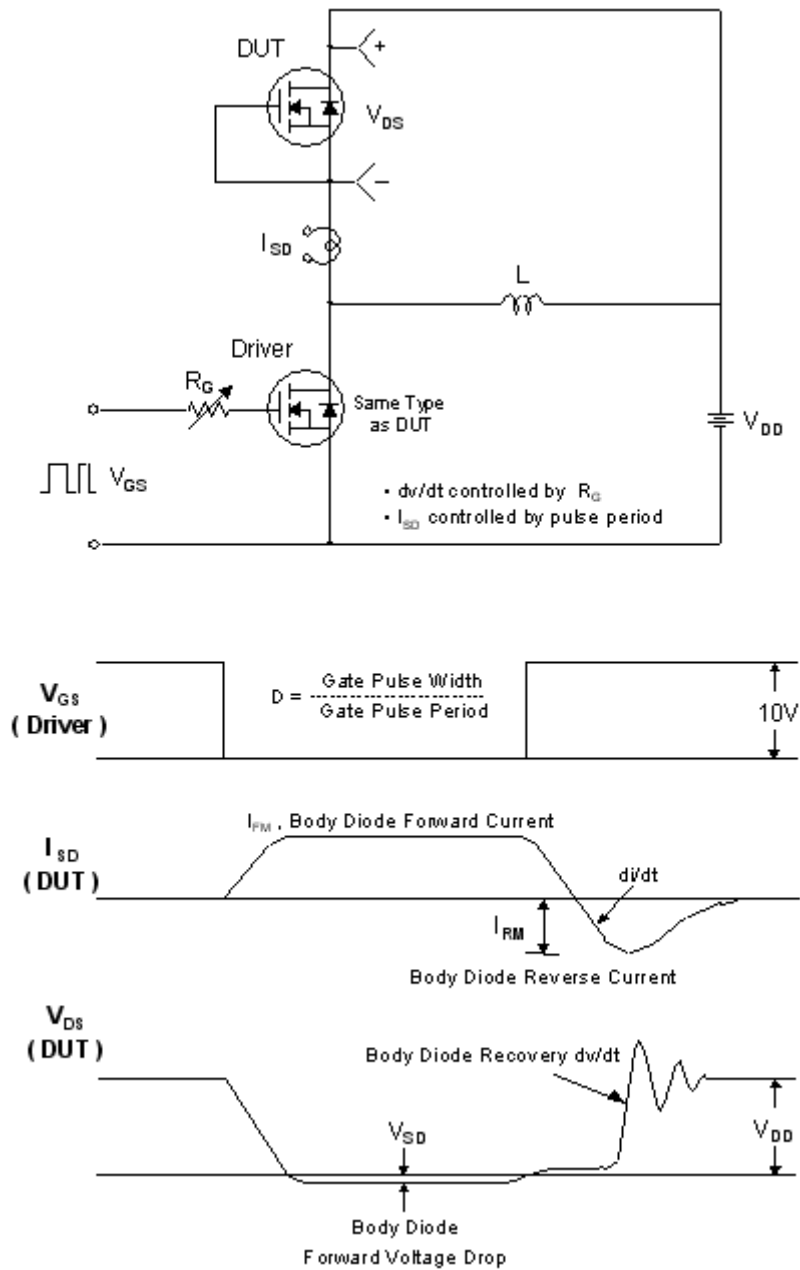
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

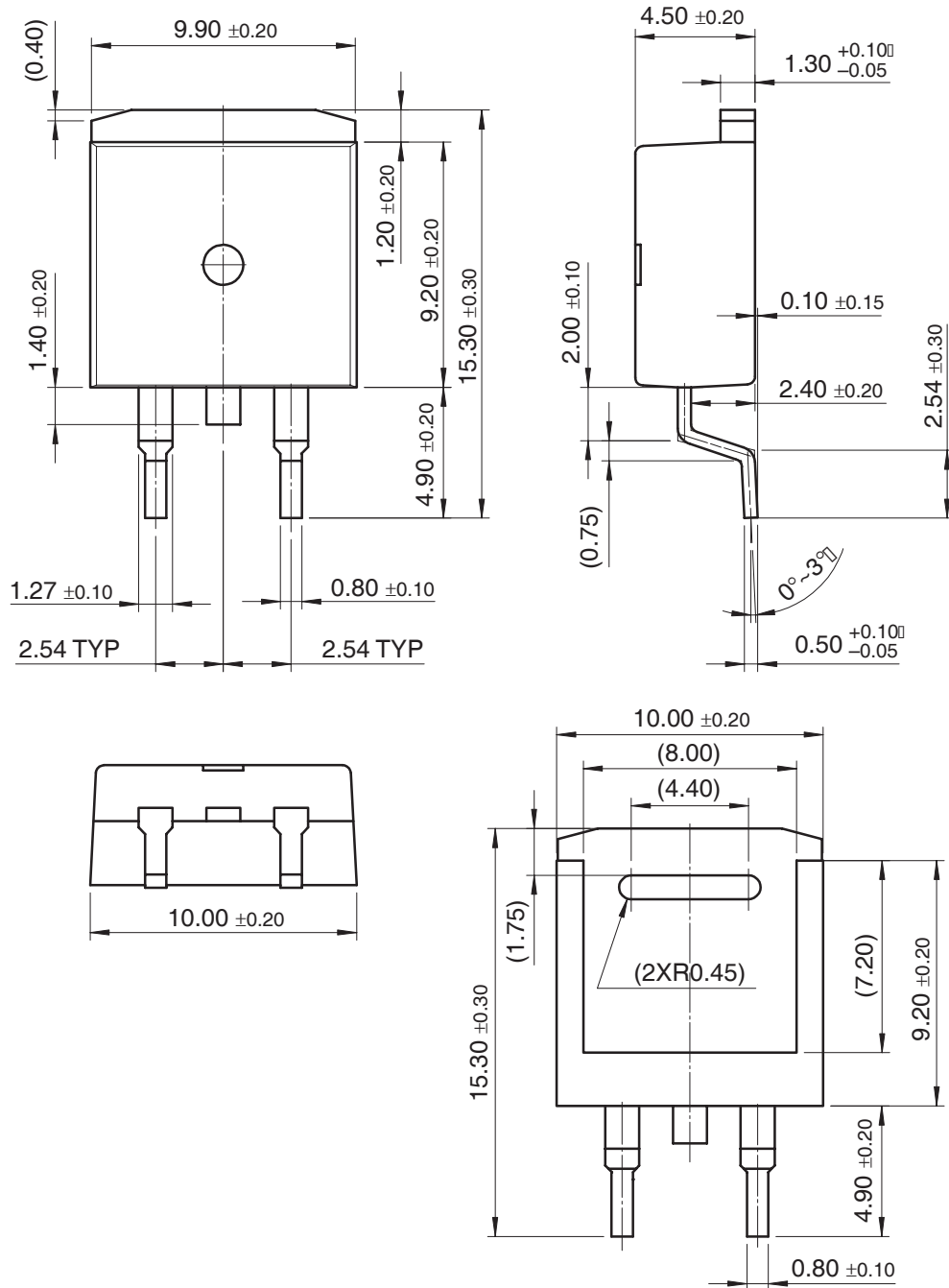


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

D²-PAK



Dimensions in Millimeters

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