

MOSFET – N-Channel, QFET

200 V, 9.0 A, 280 mΩ

FQD12N20L

Description

This N-Channel enhancement mode power MOSFET is produced using onsemi's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

Features

- 9.0 A, 200 V, $R_{DS(on)}$ = 280 mΩ (Max.) @ $V_{GS} = 10$ V, $I_D = 4.5$ A
- Low Gate Charge (Typ. 16 nC)
- Low C_{rss} (Typ. 17 pF)
- 100% Avalanche Tested

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise noted)

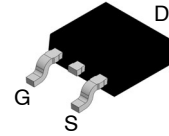
Symbol	Parameter	Rating	Unit
V_{DSS}	Drain-Source Voltage	200	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	9.0 A
		- Continuous ($T_C = 100^\circ\text{C}$)	5.7 A
I_{DM}	Drain Current	- Pulsed (Note 1)	36 A
V_{GSS}	Gate-Source Voltage	± 20	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	210	mJ
I_{AR}	Avalanche Current (Note 1)	9.0	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	5.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
P_D	Power Dissipation ($T_A = 25^\circ\text{C}$) *	2.5	W
	Power Dissipation ($T_C = 25^\circ\text{C}$)	55	W
	- Derate Above 25°C	0.44	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, 1/8" from Case for 5 seconds	300	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL CHARACTERISTICS

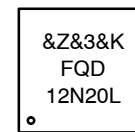
Symbol	Parameter	Rating	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	2.27	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Minimum Pad of 2-oz Copper), Max.	110	
	Thermal Resistance, Junction to Ambient (*1 in ² Pad of 2-oz Copper), Max.	50	

V_{DSS}	$R_{DS(on)}$ MAX	I_D MAX
200 V	280 mΩ @ 10 V	9.0 A

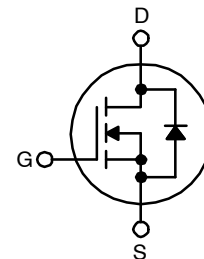


DPAK3 (TO-252 3 LD)
CASE 369AS

MARKING DIAGRAM



- &Z = Assembly Plant Code
- &3 = 3-Digit Date Code
- &K = 2-Digits Lot Run Traceability Code
- FQD12N20L = Device Code



N-Channel MOSFET

ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

FQD12N20L

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	200	-	-	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	-	0.14	-	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 200 V, V _{GS} = 0 V	-	-	1	μA
		V _{DS} = 160 V, T _C = 125°C	-	-	10	μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 20 V, V _{DS} = 0 V	-	-	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -20 V, V _{DS} = 0 V	-	-	-100	nA

ON CHARACTERISTICS

V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	1.0	-	2.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 4.5 A V _{GS} = 5 V, I _D = 4.5 A	-	0.22 0.25	0.28 0.32	Ω
g _{FS}	Forward Transconductance	V _{DS} = 30 V, I _D = 4.5 A	-	11.6	-	S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	-	830	1080	pF
C _{oss}	Output Capacitance		-	120	155	pF
C _{rss}	Reverse Transfer Capacitance		-	17	22	pF

SWITCHING CHARACTERISTICS

t _{d(on)}	Turn-On Delay Time	V _{DD} = 100 V, I _D = 11.6 A, R _G = 25 Ω (Note 4)	-	15	40	ns
t _r	Turn-On Rise Time		-	190	390	ns
t _{d(off)}	Turn-Off Delay Time		-	60	130	ns
t _f	Turn-Off Fall Time		-	120	250	ns
Q _g	Total Gate Charge	V _{DS} = 160 V, I _D = 11.6 A, V _{GS} = 5 V (Note 4)	-	16	21	nC
Q _{gs}	Gate-Source Charge		-	2.8	-	nC
Q _{gd}	Gate-Drain Charge		-	7.6	-	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I _S	Maximum Continuous Drain-Source Diode Forward Current	-	-	9.0	A	
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current	-	-	36	A	
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 9.0 A	-	-	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 11.6 A, di _F / dt = 100 A/μs	-	128	-	ns
Q _{rr}	Reverse Recovery Charge		-	0.56	-	μC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 3.9 mH, I_{AS} = 9.0 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 11.6 A, di/dt ≤ 300 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature.

FQD12N20L

TYPICAL CHARACTERISTICS

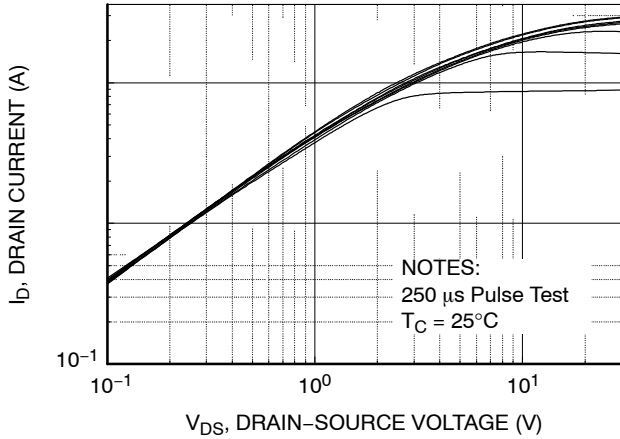


Figure 1. On-Region Characteristics

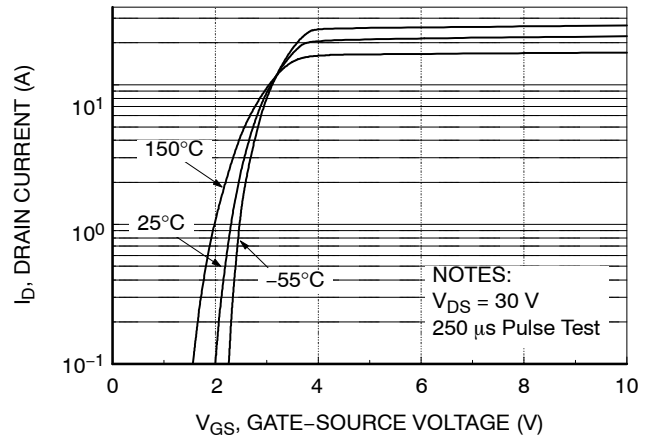


Figure 2. Transfer Characteristics

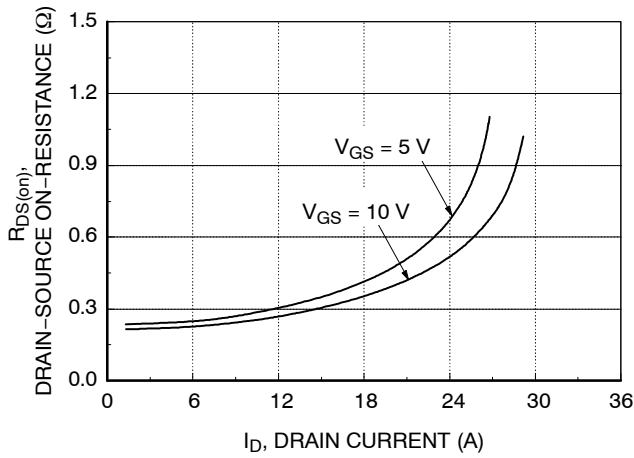


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

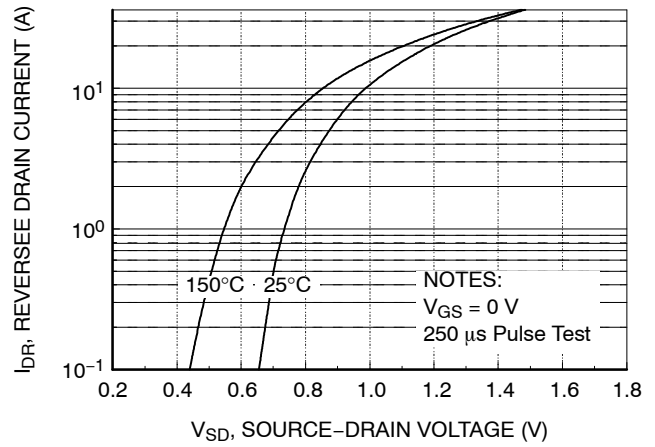


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

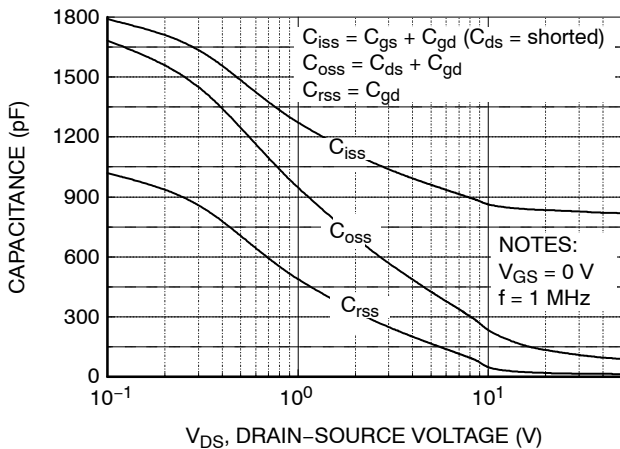


Figure 5. Capacitance Characteristics

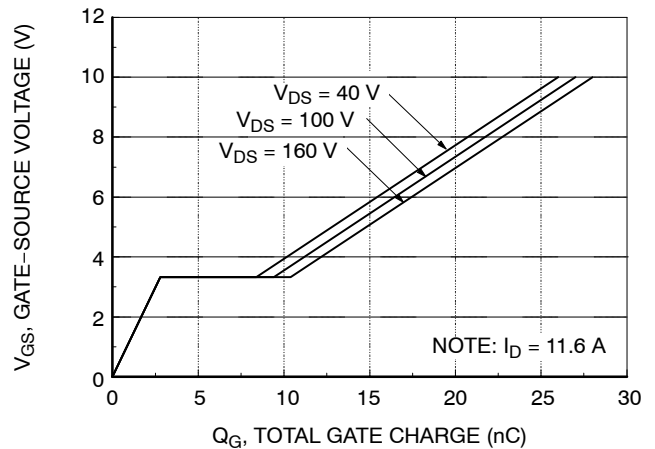


Figure 6. Gate Charge Characteristics

FQD12N20L

TYPICAL CHARACTERISTICS (continued)

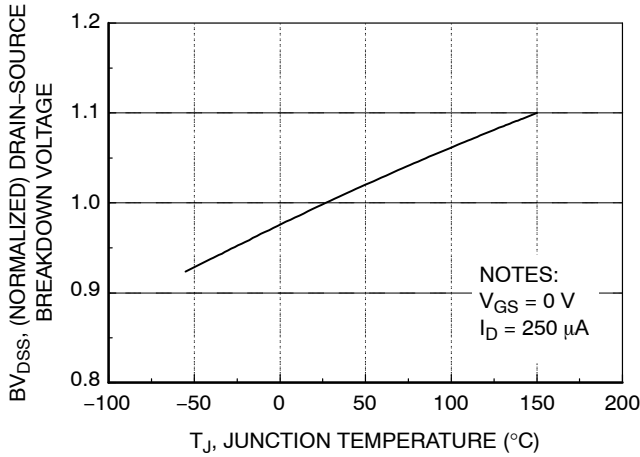


Figure 7. Breakdown Voltage Variation vs. Temperature

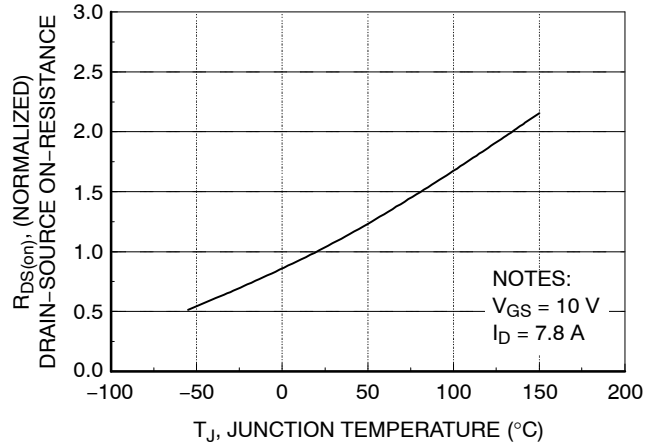


Figure 8. On-Resistance Variation vs. Temperature

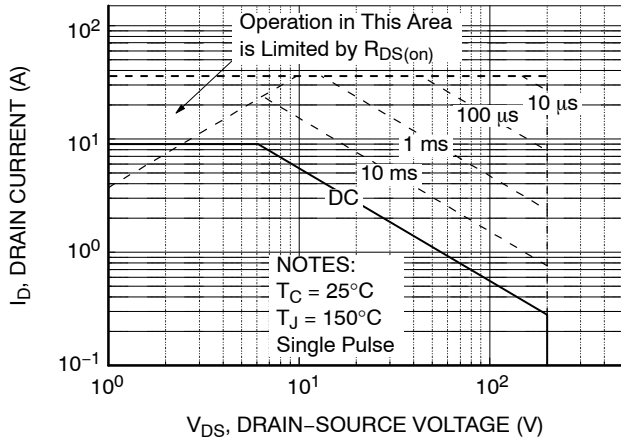


Figure 9. Maximum Safe Operating Area

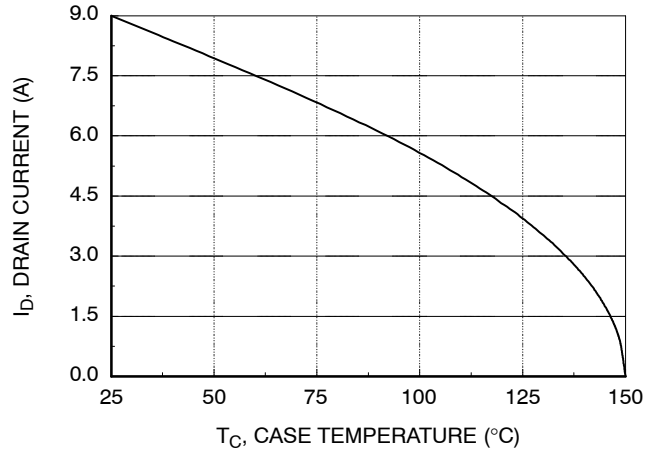


Figure 10. Maximum Drain Current vs. Case Temperature

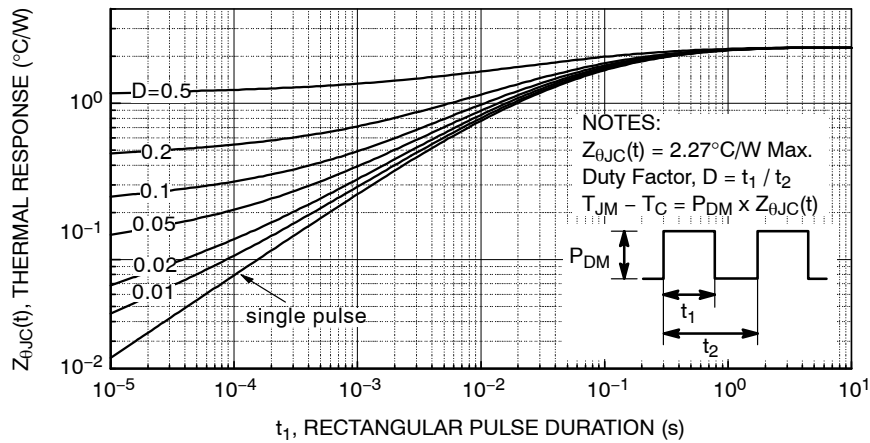
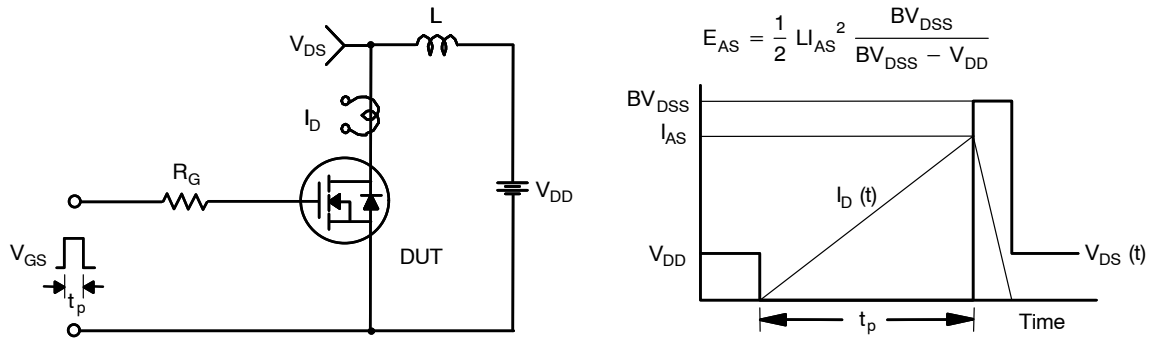
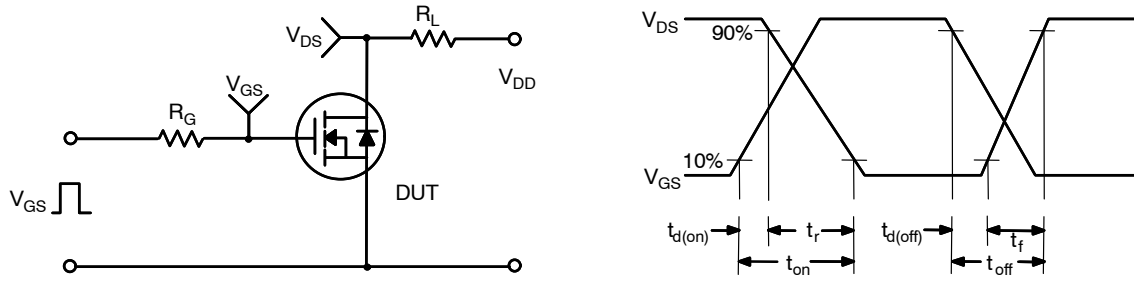
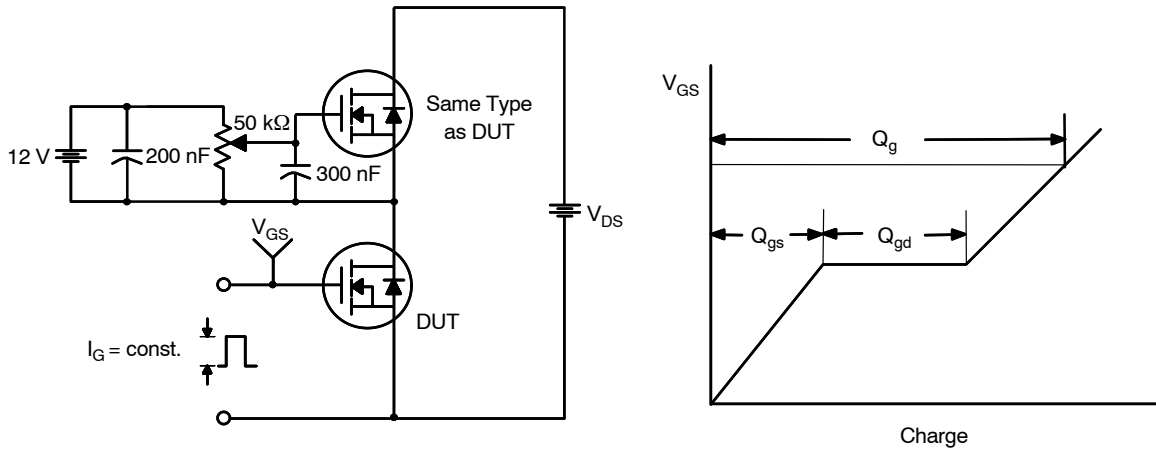


Figure 11. Transient Thermal Response Curve

FQD12N20L



FQD12N20L

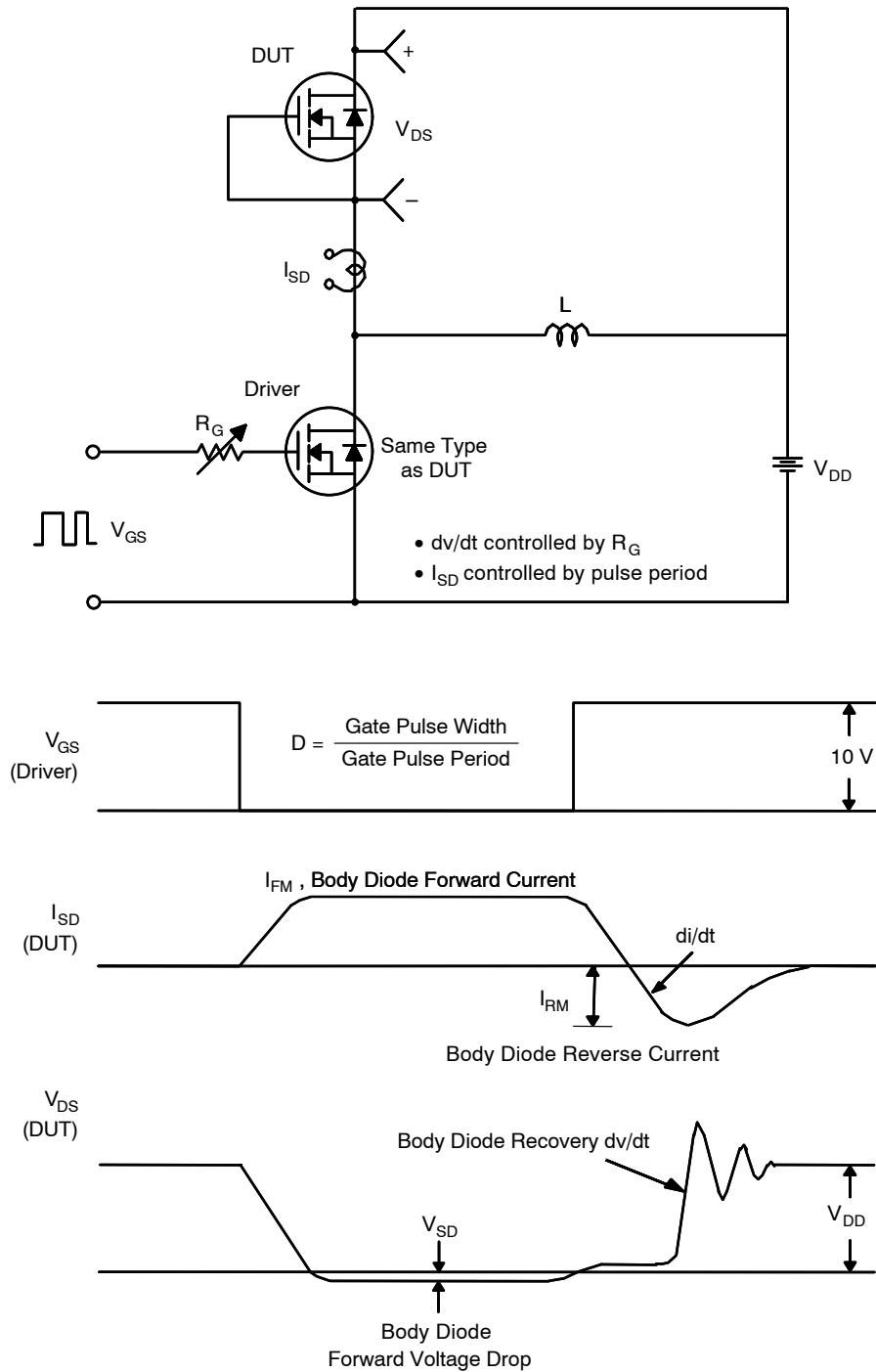


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

PACKAGE MARKING AND ORDERING INFORMATION

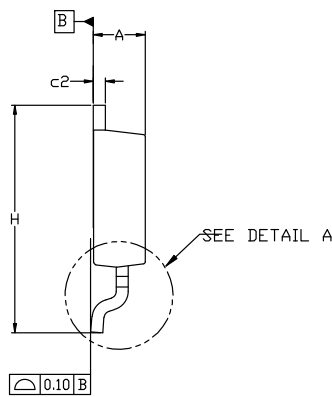
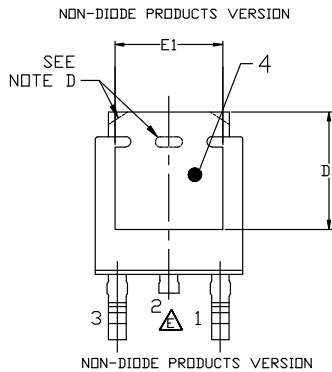
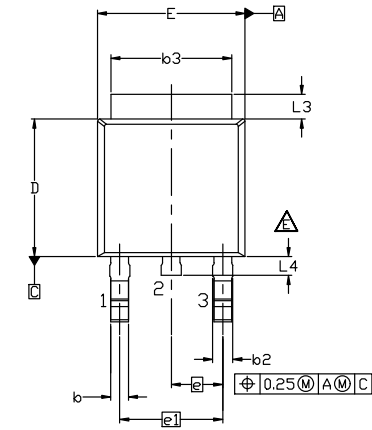
Device	Device Marking	Package	Shipping†
FQD12N20LTM	FQD12N20L	DPAK3 (TO-252 3 LD)	2500 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

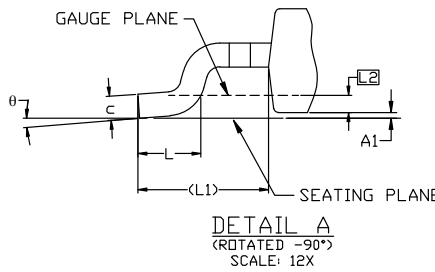


**DPAK3 6.10x6.54x2.29, 4.57P
CASE 369AS
ISSUE B**

DATE 20 DEC 2023



- NOTES: UNLESS OTHERWISE SPECIFIED
 A) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE F, VARIATION AA.
 B) ALL DIMENSIONS ARE IN MILLIMETERS.
 C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2018.
 D) SUPPLIER DEPENDENT MOLD LOCKING HOLES OR CHAMFERED CORNERS OR EDGE PROTRUSION.
 E) FOR DIODE PRODUCTS, L4 IS 0.25 MM MAX PLASTIC BODY STUB WITHOUT CENTER LEAD.
 F) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR EXTRUSIONS.
 G) LAND PATTERN RECOMMENDATION IS BASED ON IPC7351A STD TD228P991X239-3N.

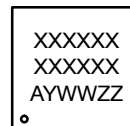


LAND PATTERN RECOMMENDATION

*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERM/D.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	2.18	2.29	2.39
A1	0.00	-	0.127
b	0.64	0.77	0.89
b2	0.76	0.95	1.14
b3	5.21	5.34	5.46
c	0.45	0.53	0.61
c2	0.45	0.52	0.58
D	5.97	6.10	6.22
D1	5.21	---	---
E	6.35	6.54	6.73
E1	4.32	---	---
e	2.286 BSC		
e1	4.572 BSC		
H	9.40	9.91	10.41
L	1.40	1.59	1.78
L1	2.90 REF		
L2	0.51 BSC		
L3	0.89	1.08	1.27
L4	---	---	1.02
θ	0°	---	10°

GENERIC MARKING DIAGRAM*



*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

- XXXX = Specific Device Code
- A = Assembly Location
- Y = Year
- WW = Work Week
- ZZ = Assembly Lot Code

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