

MOSFET - N-Channel QFET®

600 V, 3.4 Ω, 3.0 A

FQP3N60C

General Description

This N-Channel enhancement mode power MOSFET is produced using ON Semiconductor'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

- 3.0 A, 600 V, $R_{DS(on)} = 3.4 \Omega$ (Max.) at $V_{GS} = 10$ V, $I_D = 1.5$ A
- Low Gate Charge (Typ. 10.5 nC)
- Low C_{rss} (Typ. 5.0 pF)
- 100% Avalanche Tested
- This is a Pb-Free Device

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

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain-Source Voltage	600	V
V_{GSS}	Gate-Source Voltage	± 30	V
I_D	Drain Current	Continuous ($T_C = 25^\circ\text{C}$)	3
		Continuous ($T_C = 100^\circ\text{C}$)	1.8
I_{DM}	Drain Current	Pulsed (Note 1)	12
E_{AS}	Single Pulse Avalanche Energy (Note 2)	150	mJ
I_{AR}	Avalanche Current (Note 1)	3	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	7.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	75
		Derate above 25°C	0.62
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.

1. Repetitive rating: pulse-width limited by maximum junction temperature
2. $L = 30$ mH, $I_{AS} = 3$ A, $V_{DD} = 50$ V, $R_G = 25 \Omega$, starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 3$ A, $di/dt \leq 200$ A/ μs , $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$

THERMAL CHARACTERISTICS

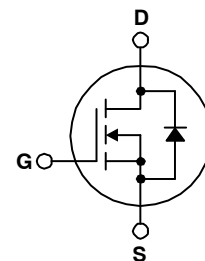
Symbol	Parameter	Ratings	Unit
$R_{\theta JC}$	Maximum Thermal Resistance, Junction to Case	1.67	$^\circ\text{C/W}$
$R_{\theta JA}$	Maximum Thermal Resistance, Junction to Ambient	62.5	$^\circ\text{C/W}$



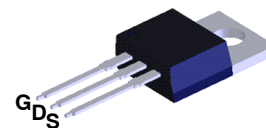
ON Semiconductor®

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V_{DS}	$R_{DS(on)}$ MAX	I_D MAX
600 V	$3.4 \Omega @ 10$ V	3.0 A

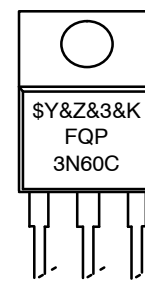


N-Channel MOSFET



TO-220-3LD
CASE 340AT

MARKING DIAGRAM



\$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&3	= Data Code (Year & Week)
&K	= Lot Code
FQP3N60C	= Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping
FQP3N60C	TO-220-3LD (Pb-Free)	50 Units/Tube

FQP3N60C

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 to Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	600	–	–	V
ΔBV _{DSS} /ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	–	0.6	–	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600 V, V _{GS} = 0 V	–	–	1	μA
		V _{DS} = 480 V, T _C = 125 °C	–	–	10	
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 _{GS} = V _{DS} , I _D = 250 μA	2.0	–	4.0	V
R _{DS(on)}	Static Drain–Source On–Resistance	V _{GS} = 10 V, I _D = 1.5 A	–	2.8	3.4	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 1.5 A	–	3.5	–	S

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	–	435	565	pF
C _{oss}	Output Capacitance		–	45	60	pF
C _{rss}	Reverse Transfer Capacitance		–	5	8	pF

SWITCHING CHARACTERISTICS

t _{d(on)}	Turn-On Delay Time	V _{DD} = 300 V, I _D = 3 A, R _G = 25 Ω (Note 4)	–	12	34	ns
t _r	Turn–On Rise Time		–	30	70	ns
t _{d(off)}	Turn-Off Delay Time		–	35	80	ns
t _f	Turn–Off Fall Time		–	35	80	ns
Q _g	Total Gate Charge	V _{DS} = 480 V, I _D = 3 A, V _{GS} = 10 V (Note 4)	–	10.5	14	nC
Q _{gs}	Gate–Source Charge		–	2.1	–	nC
Q _{gd}	Gate–Drain Charge		–	4.5	–	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I _S	Maximum Continuous Drain–Source Diode Forward Current		–	–	3	A
I _{SM}	Maximum Pulsed Drain–Source Diode Forward Current		–	–	12	A
V _{SD}	Drain–Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 3 A	–	–	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 3 A, dI _F /dt = 100 A/μs	–	260	–	ns
Q _{rr}	Reverse Recovery Charge		–	1.6	–	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.

4. Essentially independent of operating temperature.

TYPICAL PERFORMANCE CHARACTERISTICS

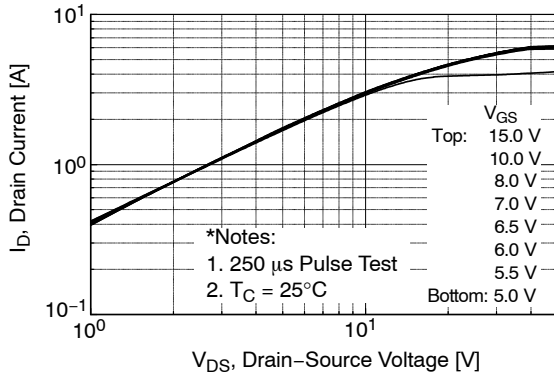


Figure 1. On-Region Characteristics

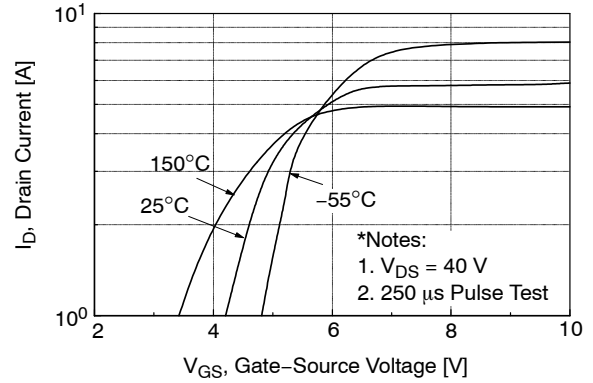


Figure 2. Transfer Characteristics

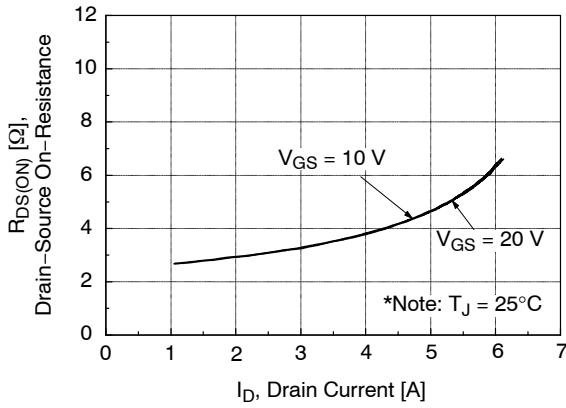


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

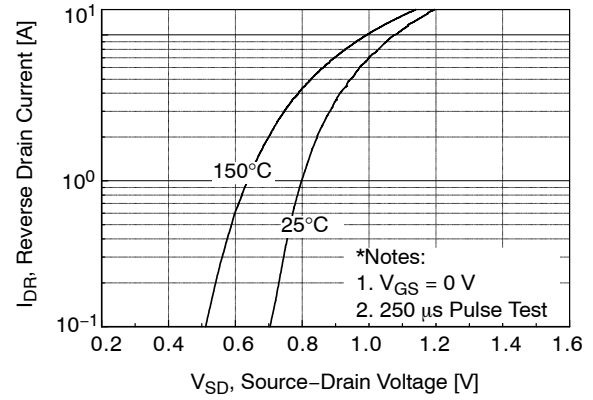


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

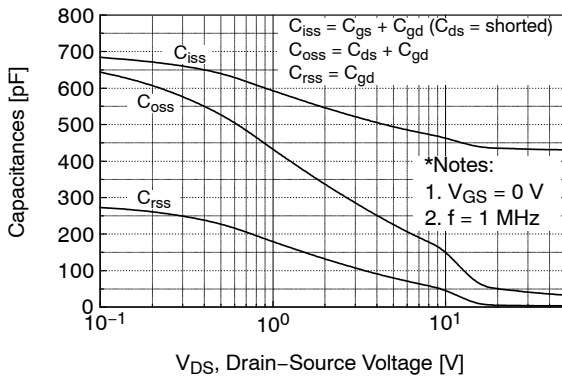


Figure 5. Capacitance Characteristics

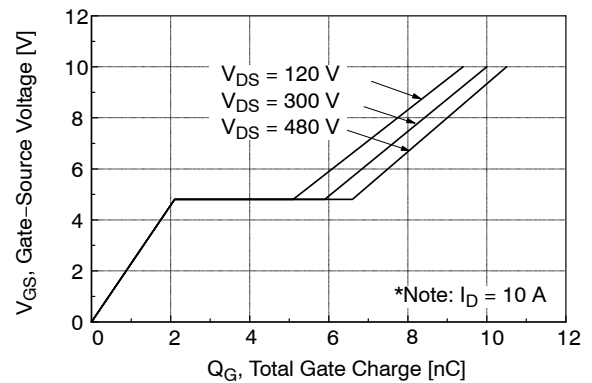


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS

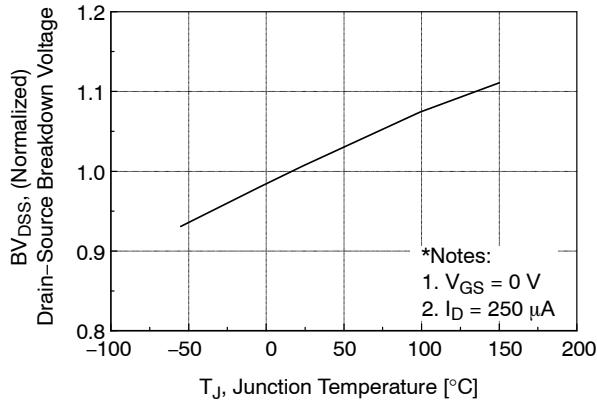


Figure 7. Breakdown Voltage Variation vs. Temperature

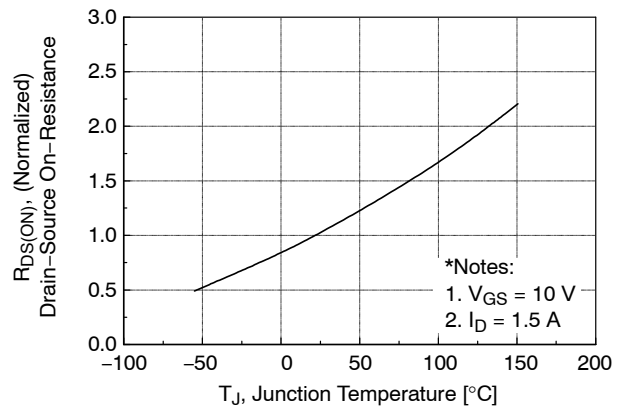


Figure 8. On-Resistance Variation vs. Temperature

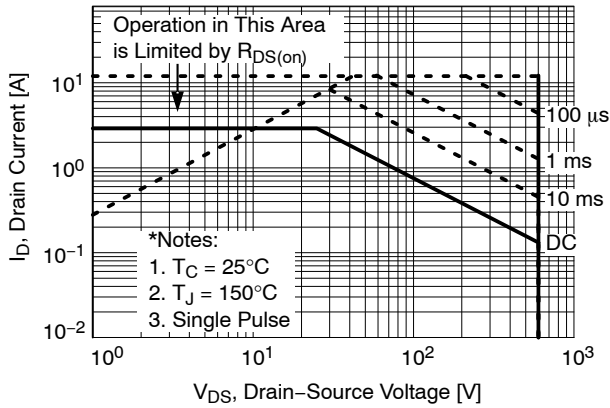


Figure 9. Maximum Safe Operating Area

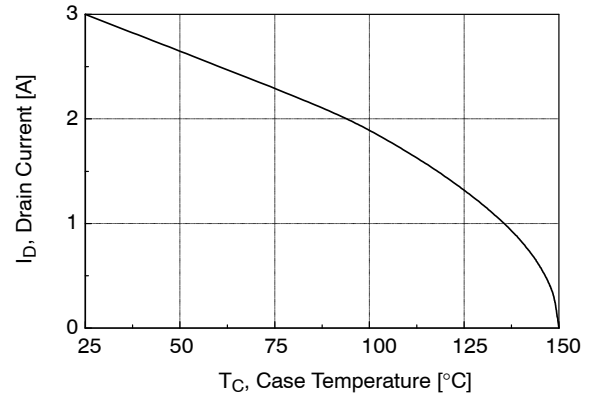


Figure 10. Maximum Drain Current vs. Case Temperature

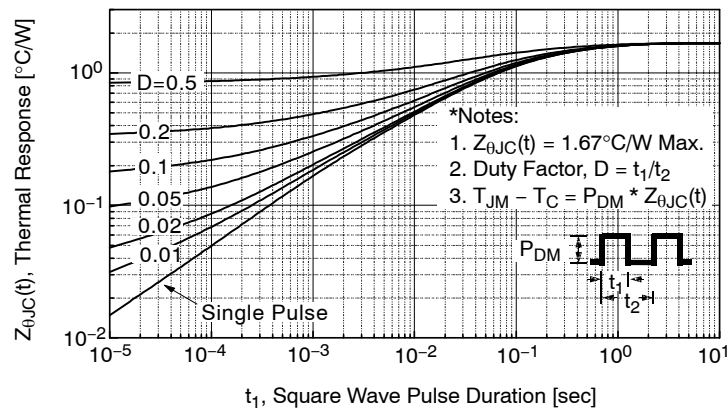


Figure 11. Transient Thermal Response Curve

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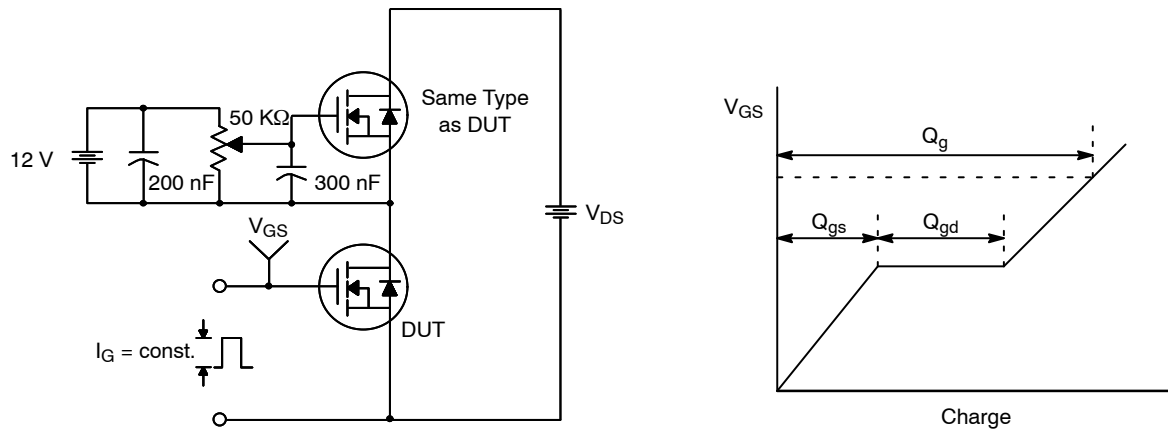


Figure 12. Gate Charge Test Circuit & Waveform

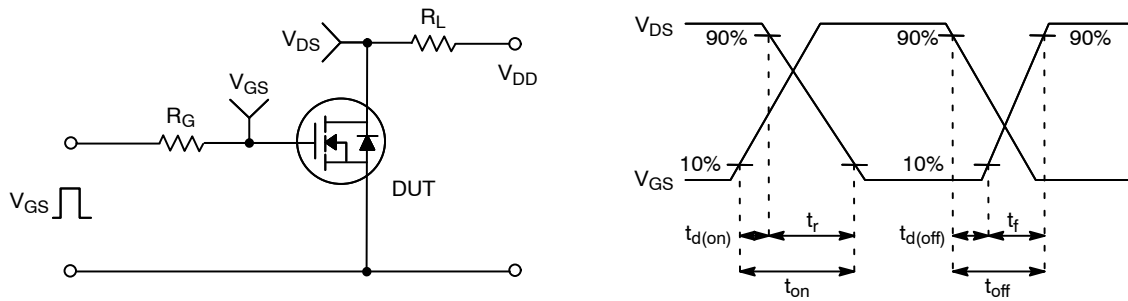


Figure 13. Resistive Switching Test Circuit & Waveforms

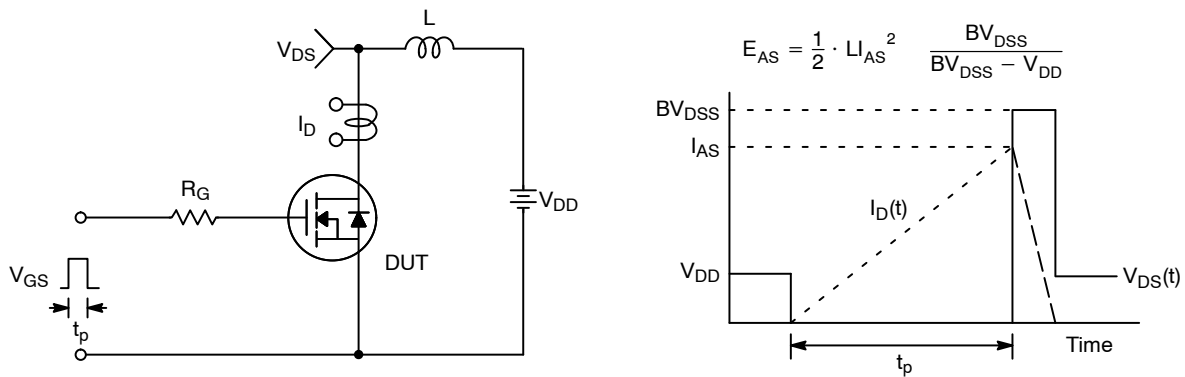


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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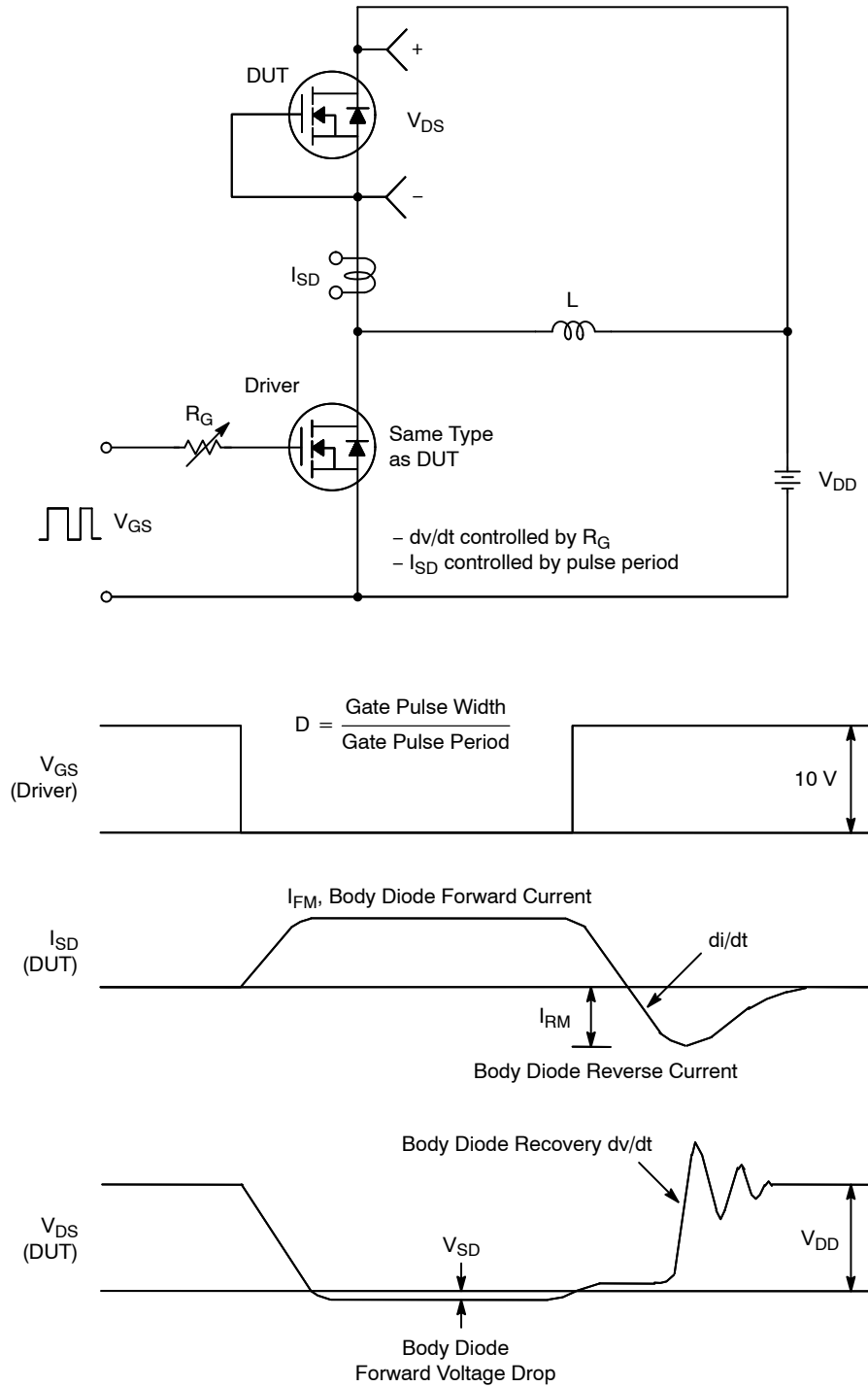


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



TO-220-3LD
CASE 340AT
ISSUE B

DATE 08 AUG 2022

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	4.00	--	4.70
A1	SEE NOTE "F"		
A2	2.10	--	2.85
b	0.55	--	1.00
b2	1.10	--	1.62
b4	1.42	--	1.62
c	0.36	--	0.60
D	13.90	--	16.30
D1	8.13	--	9.40
D2	11.50	--	14.30
D3	15.42	--	16.51
E	9.65	--	10.67
E1	7.59	--	8.65
e	2.40	--	2.67
H1	6.06	--	6.69
L	12.70	--	14.04
L1	2.70	--	4.10
P	3.50	--	4.00
Q	2.50	--	3.40
z	2.13 REF		
z1	2.06 REF		
θ	3°	--	5°

IF PRESENT, SEE NOTE "D"

GENERIC
MARKING DIAGRAM*



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

*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.



NOTES:

- A) REFERENCE JEDEC, TO-220, VARIATION AB
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS COMMON TO ALL PACKAGE SUPPLIERS EXCEPT WHERE NOTED [].
- D) LOCATION OF MOLDED FEATURE MAY VARY (LOWER LEFT CORNER, LOWER CENTER AND CENTER OF THE PACKAGE)
- E) DOES NOT COMPLY JEDEC STANDARD VALUE.
- F) "A1" DIMENSIONS AS BELOW:
SINGLE GAUGE = 0.51 - 0.61
DUAL GAUGE = 1.10 - 1.45
- G) PRESENCE IS SUPPLIER DEPENDENT
- H) SUPPLIER DEPENDENT MOLD LOCKING HOLES IN HEATSINK.

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