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ON Semiconductor®

FQB25N33TM-F085
330V N-Channel MOSFET

Features

- 25A, 330V, $R_{DS(on)}$ = 0.23Ω @V_{GS} = 10V
- Low gate charge (typical 58nC)
- Low Crss (typical 40pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Qualified to AEC Q101
- RoHS Compliant

General Description

These N-Channel enhancement mode power field effect transistors are produced using ON Semiconductor's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimized 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 efficient switched mode power supplies, active power factor correction, electronic lamp ballast based on half bridge topology.

D²-PAK
FQB Series
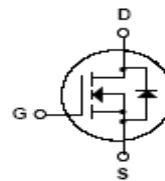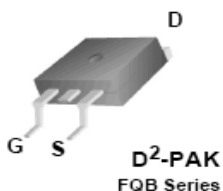
Absolute Maximum Ratings

Symbol	Parameter			Ratings	Units
V_{DSS}	Drain-Source Voltage			330	V
I_D	Drain Current - Continuous (T_C = 25°C)			25	A
	- Continuous (T_C = 100°C)			16.0	A
I_{DM}	Drain Current - Pulsed	(Note 1)		100	A
V_{GSS}	Gate -Source Voltage			±30	V
E_{AS}	Single Pulse Avalanche Energy	(Note 2)		370	mJ
I_{AR}	Avalanche Current	(Note 1)		25	A
E_{AR}	Repetitive Avalance Energy	(Note 1)		37	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)		4.5	V/ns
P_D	Power Dissipation (T_A = 25°C) *			3.1	W
	Power Dissipation (T_C = 25°C)			250	W
	- Derate above 25°C			2.0	W/°C
T_J, T_{STG}	Operating and Storage Temperature			-55 to +150	°C
T_L	Maximum lead temperature for soldering purposes, 1/8 from case for 5 seconds			300	°C

Thermal Characteristics

Symbol	Parameter	Ratings	Units
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient *	40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	°C/W

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

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQB25N33	FQB25N33TM-F085	D2-PAK	330mm	24mm	800

Electrical Characteristics T_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
B_{VDSS}	Drain-Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V	330	--	--	V
$\Delta B_{VDSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	--	0.34	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 330V, V_{GS} = 0V	--	--	1	μA
		V_{DS} = 264V, T_C =125°C	--	--	10	
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30V, V_{DS} = 0V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Forward	V_{GS} = -30V, V_{DS} = 0V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	3.0	--	5.0	V
$R_{DS(on)}$	Drain to Source On Resistance	V_{GS} = 10V, I_D = 12.5A,	--	0.18	0.23	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50V, I_D = 12.5A, (Note 4)	--	1	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	1510	2010	pF
C_{oss}	Output Capacitance		--	290	385	pF
C_{rss}	Reverse Transfer Capacitance		--	40	60	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 165V, I_D = 25A, R_{GS} = 25Ω	--	20	35	ns
t_r	Turn-On Rise Time		--	100	160	ns
$t_{d(off)}$	Turn-Off Delay Time	(Note 4, 5)	--	90	145	ns
t_f	Turn-Off Fall Time		--	70	110	ns
$Q_{g(TOT)}$	Total Gate Charge	V_{DS} = 297V, I_D = 25A, V_{GS} = 15V,	--	58	75	nC
Q_{gs}	Gate to Source Gate Charge		--	11.2	--	nC
Q_{gd}	Gate to Drain Charge	(Note 4, 5)	--	21	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	25	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	100	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0, I_S = 25A	--	--	1.5	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0, I_S = 25A, dI_F/dt = 100A/μs (Note 4)	--	275	--	ns
Q_{rr}	Reverse Recovery Charge		--	3.6	--	μC

Notes:
1: Repetitive Rating : Pluse width Limited by maximum junction temperature
2: L = 1.79mH, I_{AS} = 25A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3: I_{SD} ≤ 25A, 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

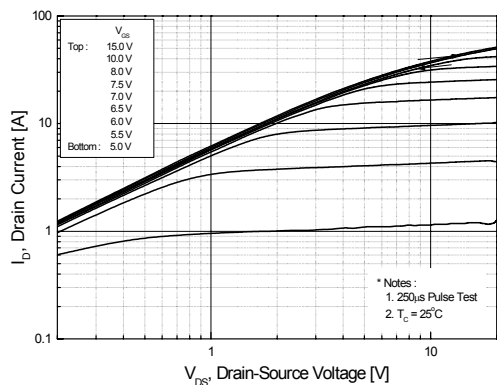### Figure 1. On-Region Characteristics

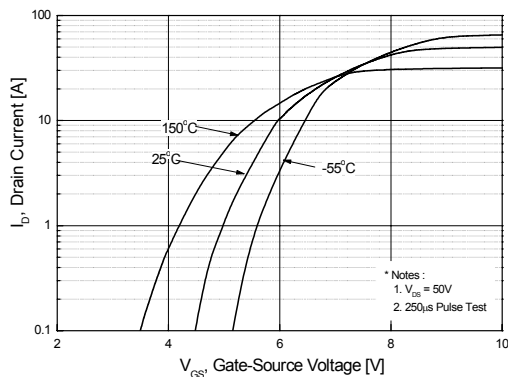### Figure 2. Transfer Characteristics

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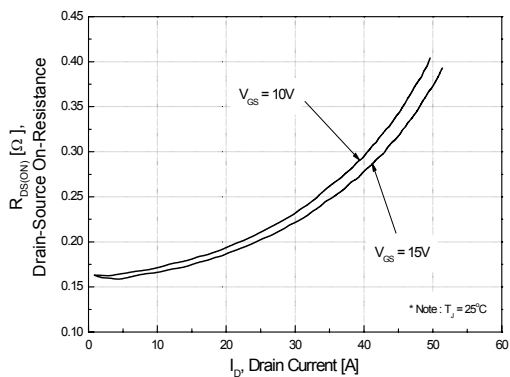

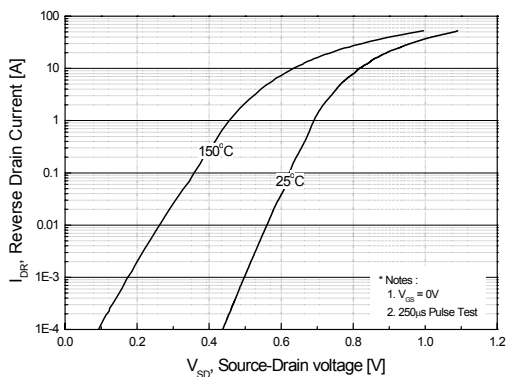### Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

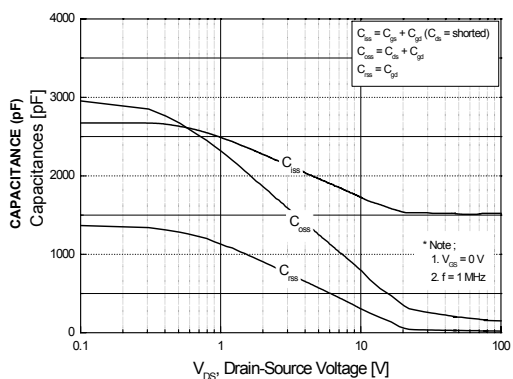### Figure 5. Capacitance Characteristics

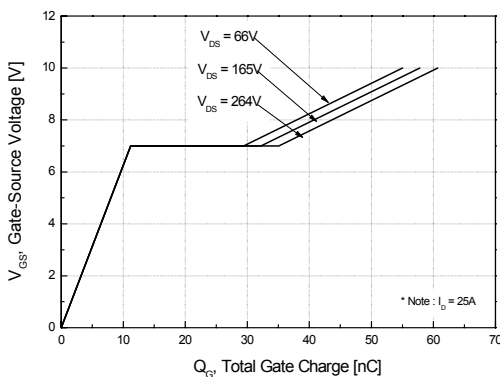### Figure 6. Gate Charge Characteristics

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Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

* Notes :
1. V_{GS} = 0 V
2. I_D = 250 μA
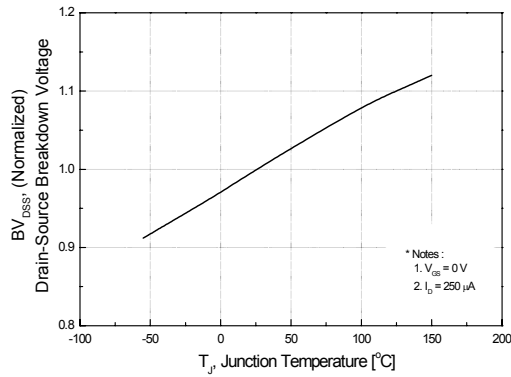
Figure 8. On-Resistance Variation vs. Temperature

* Notes :
1. V_{GS} = 10 V
2. I_D = 12.5 A
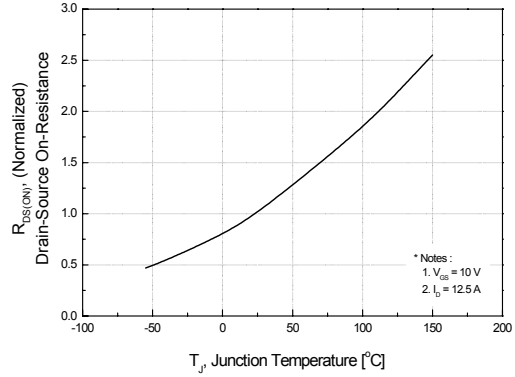
Figure 9. Maximum Safe Operating Area

Operation in This Area is Limited by $R_{DS(on)}$

* Notes :
1. T_C = 25 °C
2. T_J = 150 °C
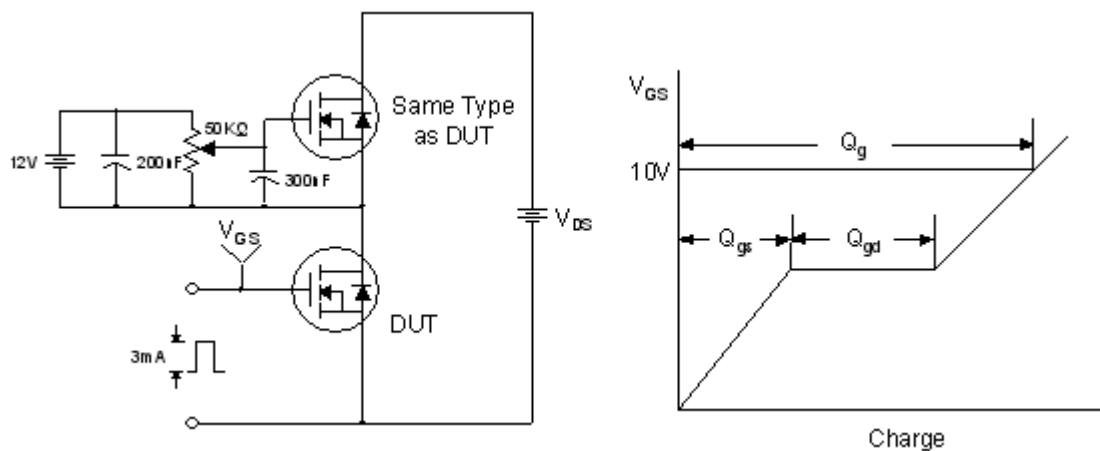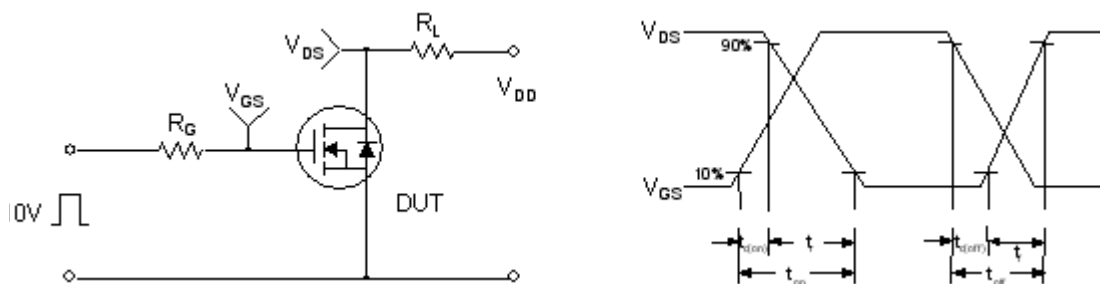3. Single Pulse
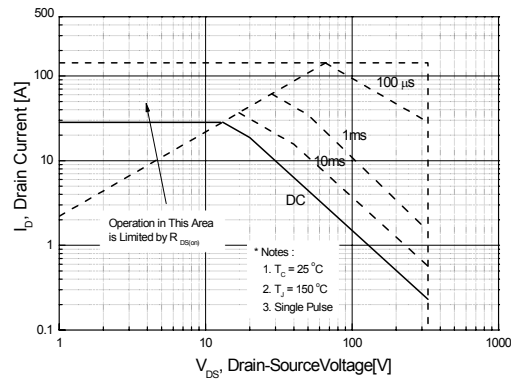
Figure 10. Maximum Drain Current vs. Case Temperature
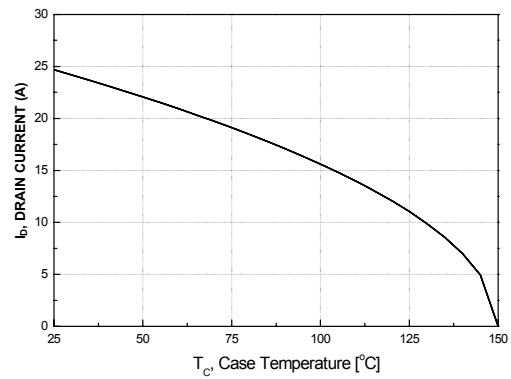
Figure 11. Transient Thermal Response Curve

* Notes :
1. $Z_{θJC}(t)$ = 0.5 °C/W Max.
2. Duty Factor, D = t_1/t_2
3. $T_{JM} - T_C = P_{DM} * Z_{θJC}(t)$

single pulse
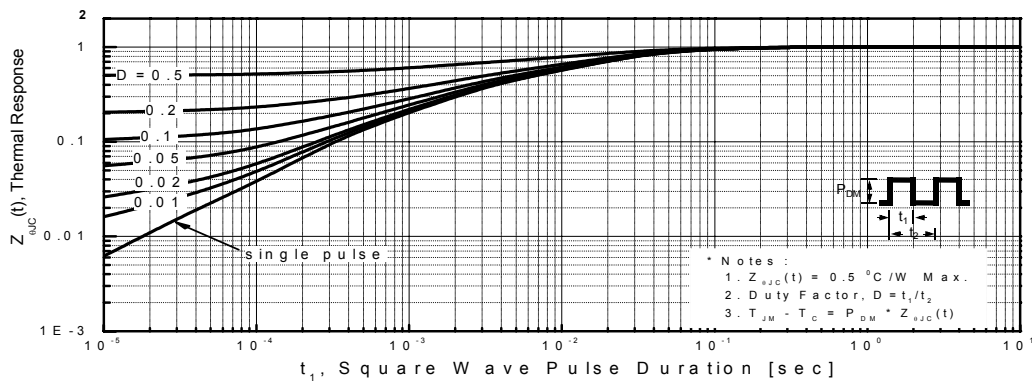
Gate Charge Test Circuit & Waveform

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
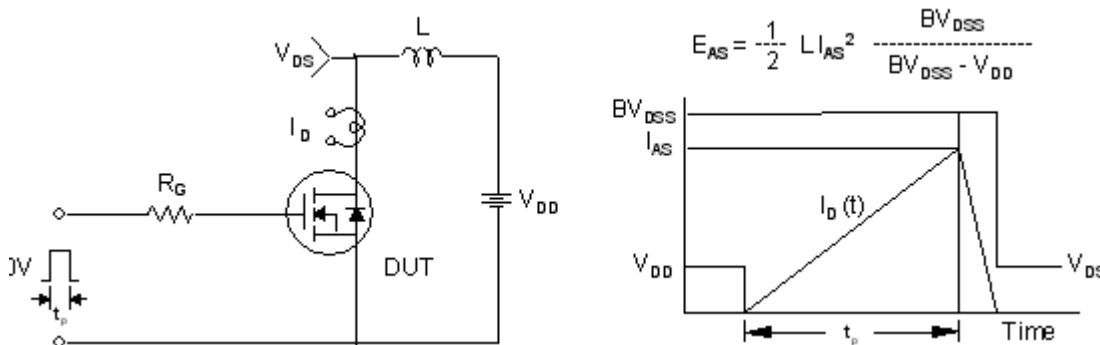
Peak Diode Recovery dv/dt Test Circuit & Waveforms

DUT

V_{DS}

I_{SD}

L

Driver

R_G

Same Type
as DUT

V_{GS}

V_{DD}

- dv/dt controlled by R_G
- I_{SD} controlled by pulse period

V_{GS}
(Driver)

$D = \dfrac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$

10V

I_{SD}
(DUT)

I_{FM}, Body Diode Forward Current

di/dt

I_{RM}

Body Diode Reverse Current

V_{DS}
(DUT)

Body Diode Recovery dv/dt

V_{SD}

V_{DD}

Body Diode
Forward Voltage Drop

PUBLICATION ORDERING INFORMATION

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