



ON Semiconductor®

## FQB25N33TM-F085

### 330V N-Channel MOSFET

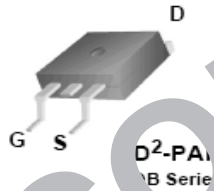
#### Features

- 25A, 330V,  $R_{DS(on)} = 0.23\Omega$  @  $V_{GS} = 10V$
- 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 specially 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 efficiency switched mode power supplies, active power factor correction, electronic lamp ballast based on half bridge topology.



#### Absolute Maximum Ratings

Symbol	Parameter	Ratings	Units
$V_{DS}$	Drain-Source Voltage	330	V
	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	25	A
	- Continuous ( $T_C = 100^\circ\text{C}$ )	16.0	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	100	A
$V_{GS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulse Avalanche Energy (Note 2)	370	mJ
$I_{AR}$	Avalanche Current (Note 1)	25	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	37	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
$P_D$	Power Dissipation ( $T_A = 25^\circ\text{C}$ ) *	3.1	W
	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	250	W
	- Derate above $25^\circ\text{C}$	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)

FQB25N33TM-F085 330V N-Channel MOSFET

### Package Marking and Ordering Information

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

### Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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#### Off Characteristics

$B_{VDSS}$	Drain-Source Breakdown Voltage	$I_D = 250\mu\text{A}, V_{GS} = 0\text{V}$	330	--	--	V
$\frac{\Delta B_{VDSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.34	--	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 330\text{V}, V_{GS} = 0\text{V}$ $V_{DS} = 264\text{V}, T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{V}, V_{DS} = 0\text{V}$	--	--	10	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{V}, V_{DS} = 0\text{V}$	--	--	100	nA

#### On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	3.0	--	5.0	V
$R_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = 10\text{V}, I_D = 12\text{A}$	--	0.18	0.23	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10\text{V}, I_D = 12\text{A}$ (Note 4)	--	1	--	S

#### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}$	--	1510	2010	pF
$C_{oss}$	Output Capacitance	$f = 1.0\text{MHz}$	--	290	385	pF
$C_{rss}$	Reverse Transfer Capacitance		--	40	60	pF

#### Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time		--	20	35	ns
$t_r$	Turn-On Rise Time	$V_{DD} = 165\text{V}, I_D = 25\text{A}$ $R_{GS} = 25\Omega$	--	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
$Q_{g(TO)}$	Turn-On Gate Charge	$V_{DS} = 29\text{V}, I_D = 25\text{A}$	--	58	75	nC
$Q_{gs}$	Gate to Source Gate Charge	$V_{GS} = 5\text{V}$	--	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	$V_{GS} = 0, I_S = 25\text{A}$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0, I_S = 25\text{A}$	--	275	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di/dt = 100\text{A}/\mu\text{s}$ (Note 4)	--	3.6	--	$\mu\text{C}$

#### Notes:

- 1: Repetitive Rating : Pulse width Limited by maximum junction temperature
- 2:  $L = 1.79\text{mH}, I_{AS} = 25\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$
- 3:  $I_{SD} \leq 25\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq B_{VDSS}$ , Starting  $T_J = 25^\circ\text{C}$
- 4: Pulse Test : Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$
- 5: Essentially independent of operating temperature

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

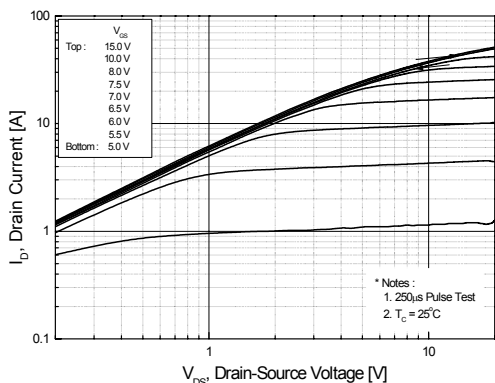


Figure 2. Transfer Characteristics

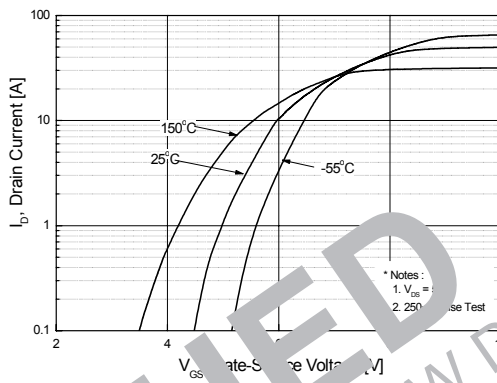


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

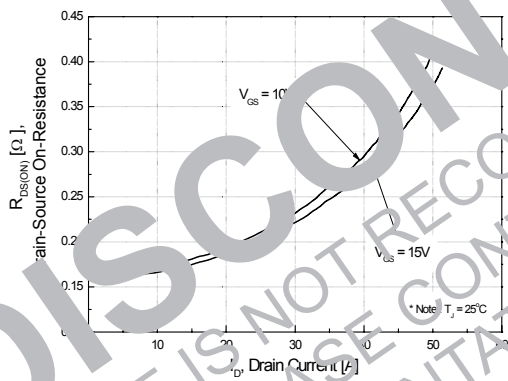


Figure 4. Forward Diode Forward Voltage Variation vs. Source Current and Temperature

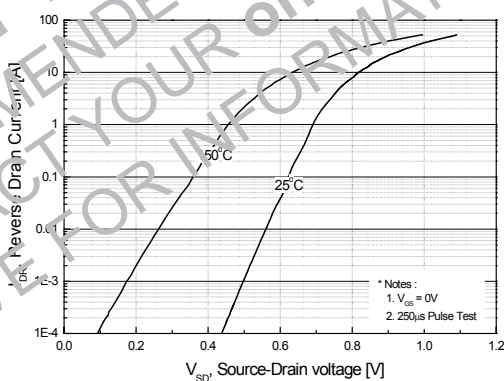


Figure 5. Capacitance Characteristics

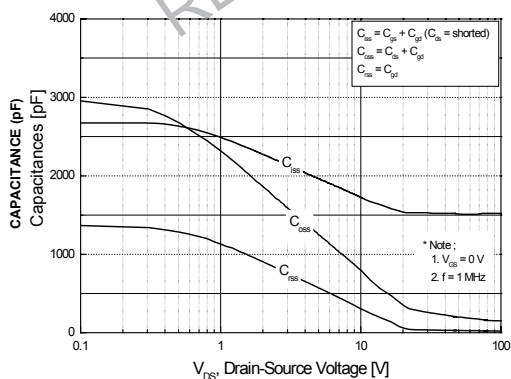
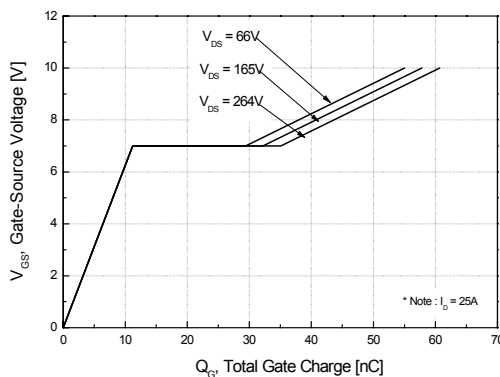
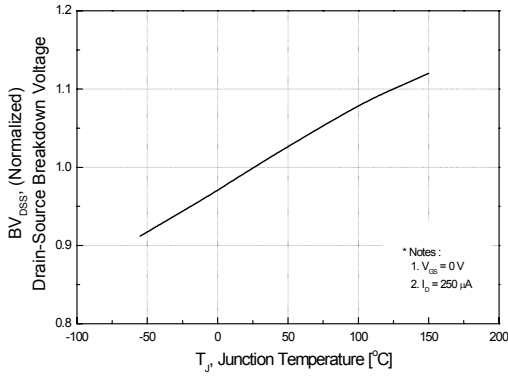


Figure 6. Gate Charge Characteristics

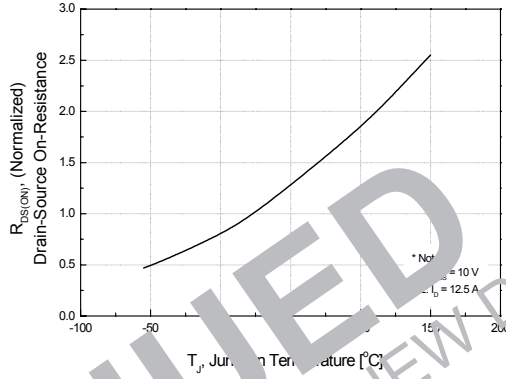


**Typical Performance Characteristics (Continued)**

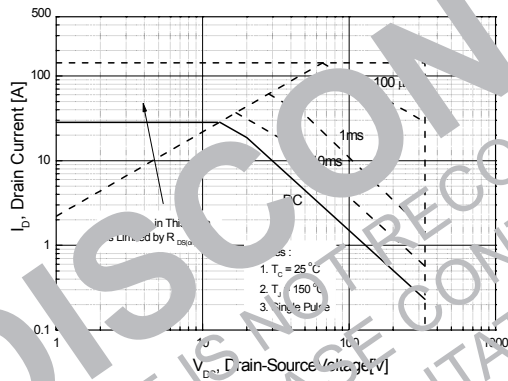
**Figure 7. Breakdown Voltage Variation vs. Temperature**



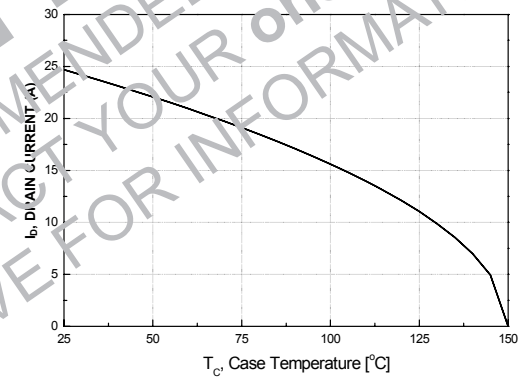
**Figure 8. On-Resistance Variation vs. Temperature**



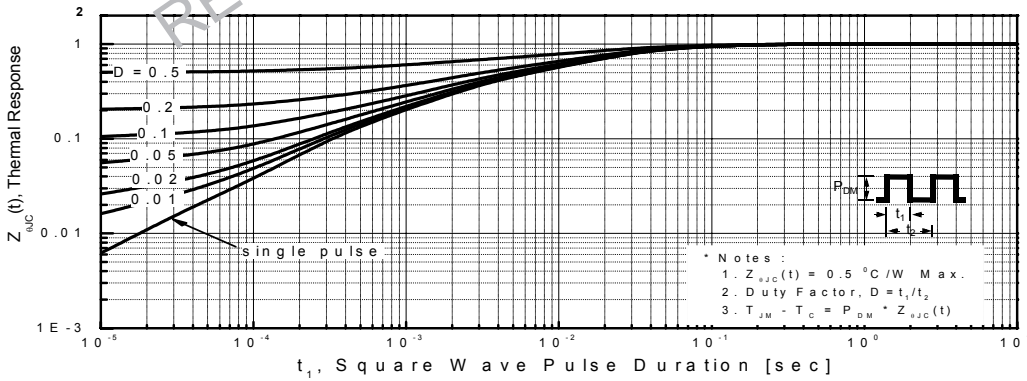
**Figure 9. Maximum Safe Operating Area**



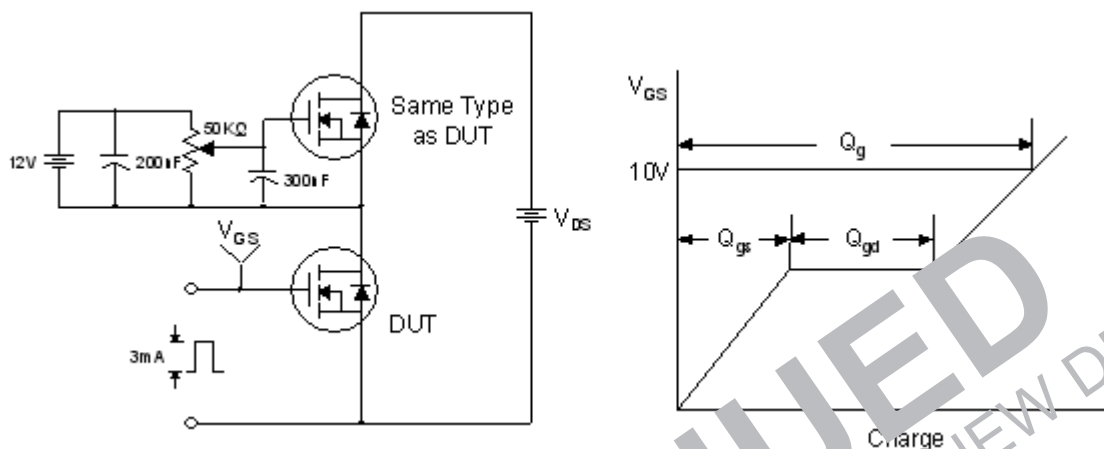
**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Transient Thermal Response Curve**



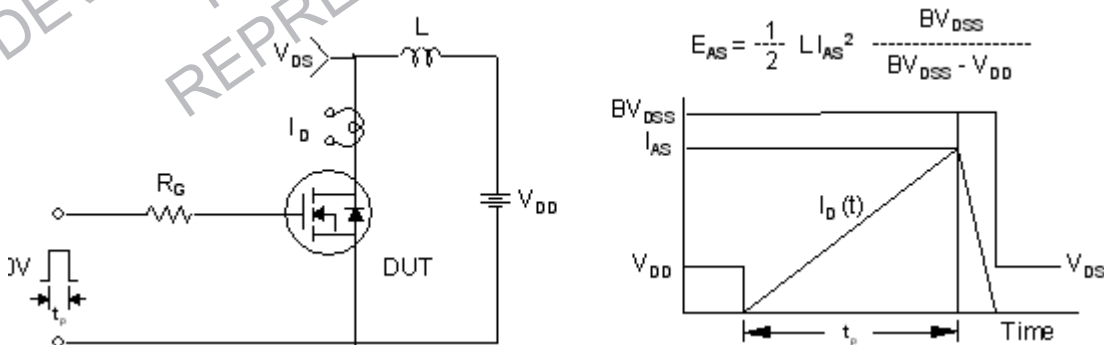
**Gate Charge Test Circuit & Waveform**



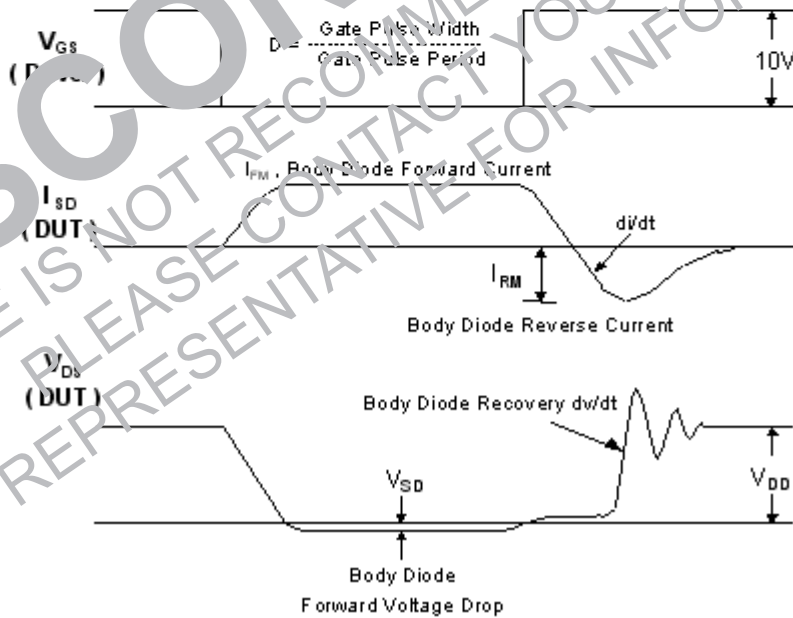
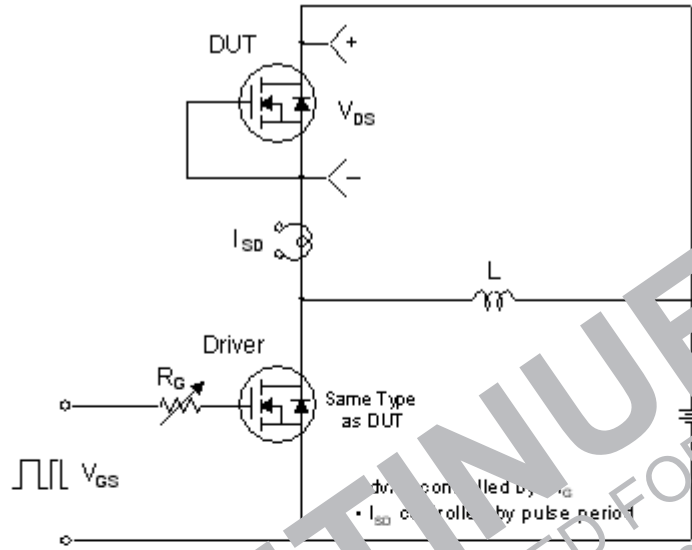
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**




Peak Diode Recovery dv/dt Test Circuit & Waveforms



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