

FS40SM-5-VB Datasheet

N-Channel 250 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ)
250	0.040 at $V_{GS} = 10$ V	60	95
	0.045 at $V_{GS} = 6$ V	55	

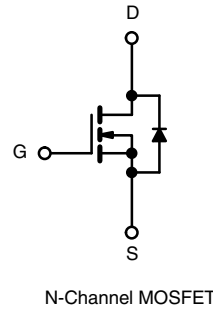
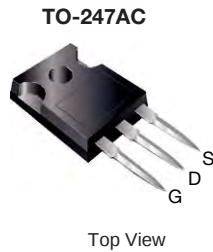
FEATURES

- Trench Power MOSFETS
- 175 °C Junction Temperature
- New Low Thermal Resistance Package
- Compliant to RoHS Directive 2002/95/EC



APPLICATIONS

- Industrial



ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	250	V
Gate-Source Voltage	V_{GS}	± 30	
Continuous Drain Current ($T_J = 175$ °C)	I_D	60	A
		35	
Pulsed Drain Current	I_{DM}	200	
Avalanche Current	I_{AR}	35	mJ
Repetitive Avalanche Energy ^a	E_{AR}	61	
Maximum Power Dissipation ^a	P_D	300 ^b	W
		3.75	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 175	°C

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Limit	Unit
Junction-to-Ambient (PCB Mount) ^c	R_{thJA}	40	°C/W
Junction-to-Case (Drain)	R_{thJC}	0.5	

Notes:

- a. Duty cycle ≤ 1 %.
 b. See SOA curve for voltage derating.
 c. When mounted on 1" square PCB (FR-4 material).

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min .	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{DS} = 0 V, I _D = 250 μA	250			V
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	2		4	
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 30 V			± 250	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 250 V, V _{GS} = 0 V			1	μA
		V _{DS} = 250 V, V _{GS} = 0 V, T _J = 125 °C			50	
		V _{DS} = 250 V, V _{GS} = 0 V, T _J = 175 °C			250	
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≥ 5 V, V _{GS} = 10 V	70			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V, I _D = 30 A		0.040		Ω
		V _{GS} = 10 V, I _D = 30 A, T _J = 125 °C		0.091		
		V _{GS} = 10 V, I _D = 30 A, T _J = 175 °C		0.123		
		V _{GS} = 6 V, I _D = 25 A		0.045		
Forward Transconductance ^a	g _{fs}	V _{DS} = 15 V, I _D = 30 A		70		S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 25 V, f = 1 MHz		5000		pF
Output Capacitance	C _{oss}			300		
Reverse Transfer Capacitance	C _{rss}			170		
Total Gate Charge ^c	Q _g	V _{DS} = 125 V, V _{GS} = 10 V, I _D = 45 A		95	140	nC
Gate-Source Charge ^c	Q _{gs}			28		
Gate-Drain Charge ^c	Q _{gd}			34		
Gate Resistance	R _g	f = 1 MHz		1.6		Ω
Turn-On Delay Time ^c	t _{d(on)}	V _{DD} = 100 V, R _L = 2.78 Ω I _D ≅ 45 A, V _{GEN} = 10 V, R _g = 2.5 Ω		22	35	ns
Rise Time ^c	t _r			220	330	
Turn-Off Delay Time ^c	t _{d(off)}			40	60	
Fall Time ^c	t _f			145	220	
Source-Drain Diode Ratings and Characteristics (T _C = 25 °C) ^b						
Continuous Current	I _S				45	A
Pulsed Current	I _{SM}				70	
Forward Voltage ^a	V _{SD}	I _F = 45 A, V _{GS} = 0 V		1	1.5	V
Reverse Recovery Time	t _{rr}	I _F = 45 A, di/dt = 100 A/μs		150	225	ns
Peak Reverse Recovery Current	I _{RM(REC)}			12	18	A
Reverse Recovery Charge	Q _{rr}			0.9	2	μC

Notes:

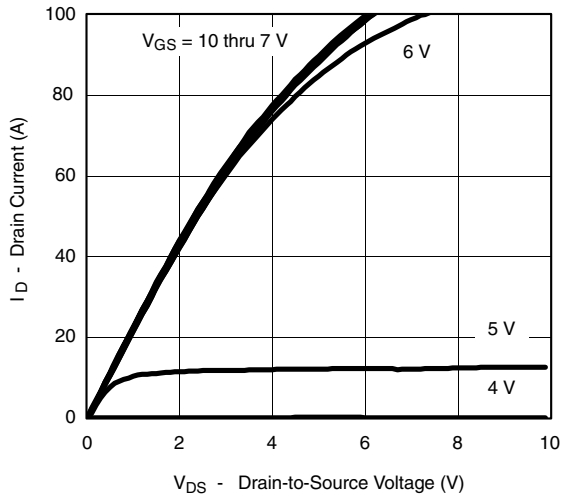
a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

b. Guaranteed by design, not subject to production testing.

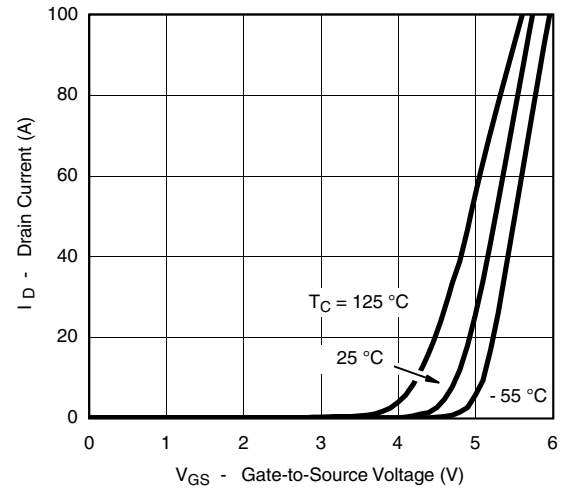
c. Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

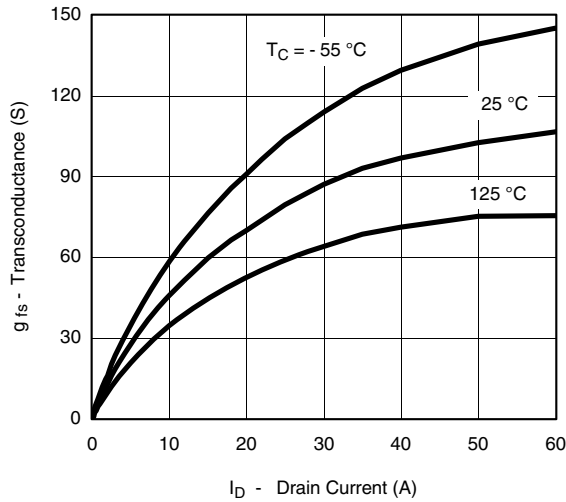
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



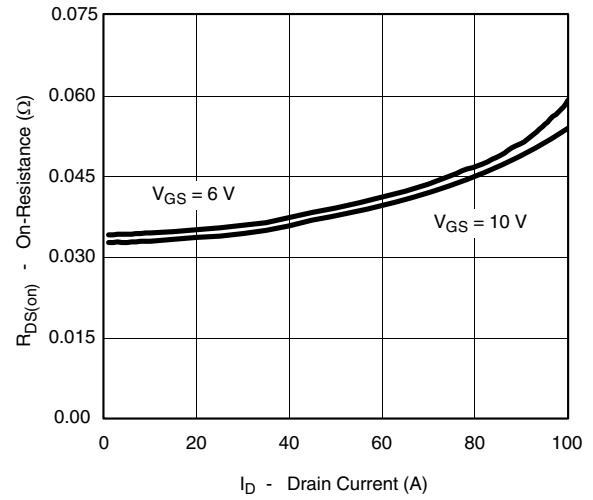
Output Characteristics



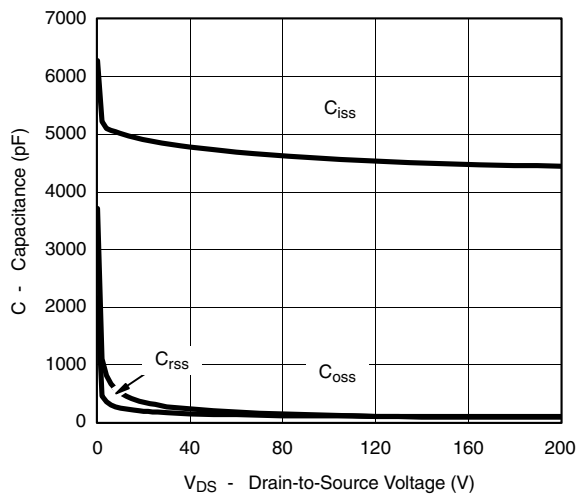
Transfer Characteristics



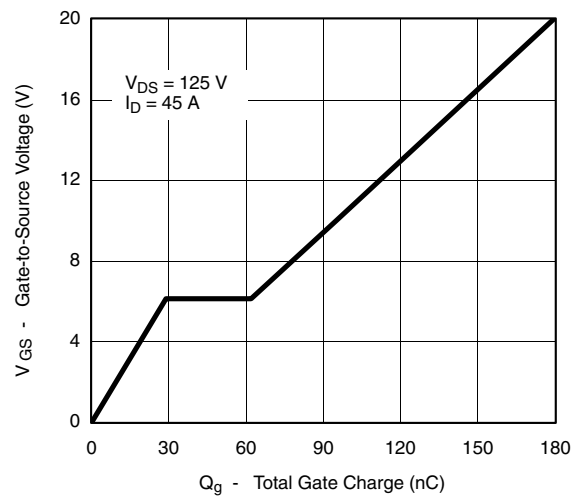
Transconductance



On-Resistance vs. Drain Current

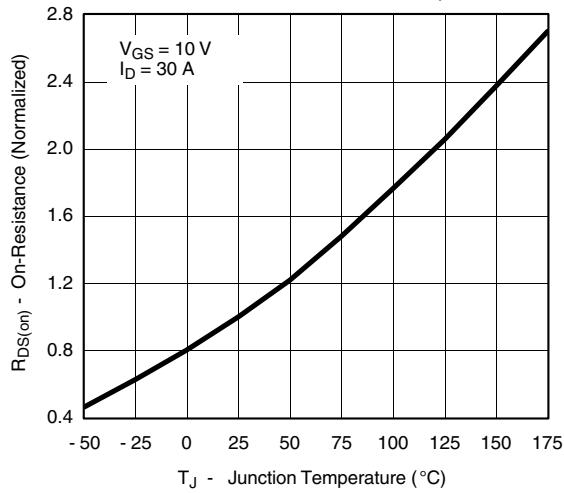


Capacitance

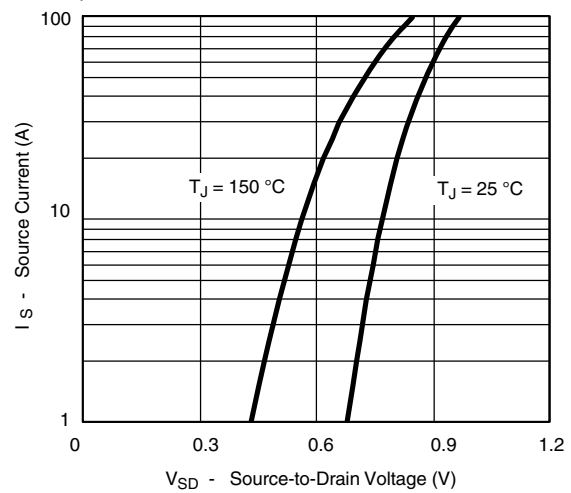


Gate Charge

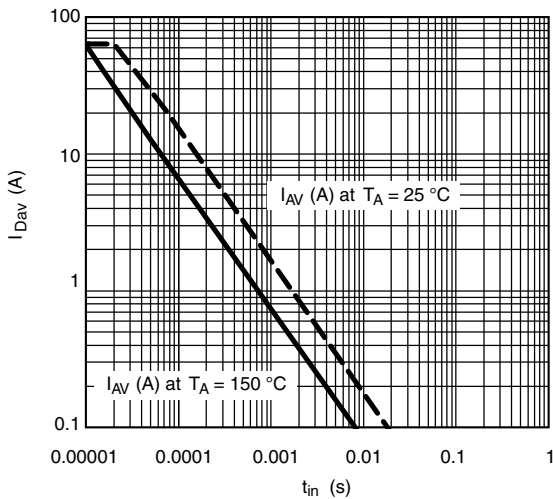
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



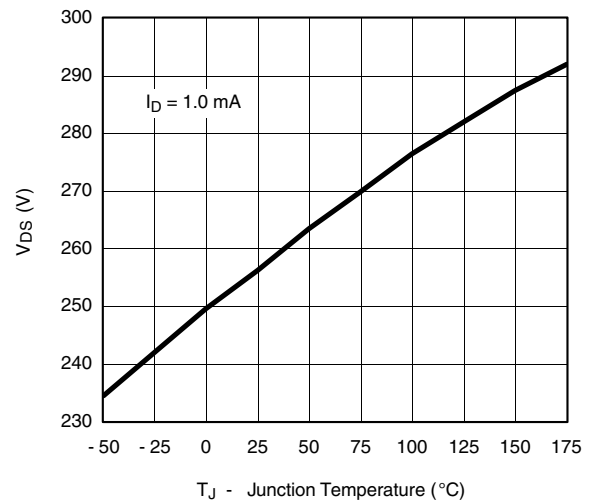
On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage



Avalanche Current vs. Time

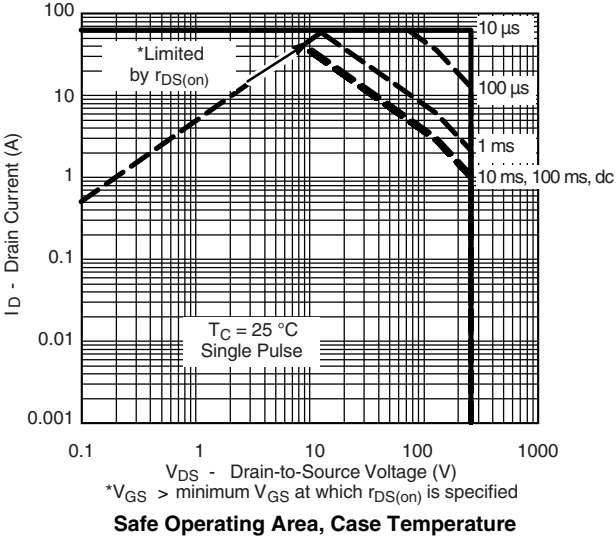


Drain Source Breakdown vs. Junction Temperature

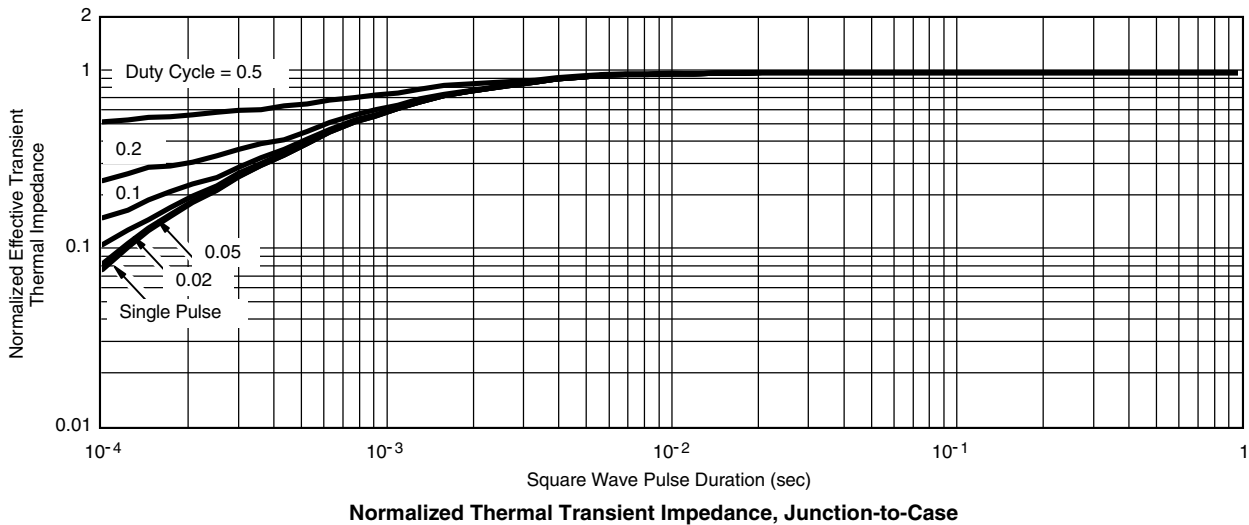
THERMAL RATINGS



Maximum Avalanche and Drain Current vs. Case Temperature

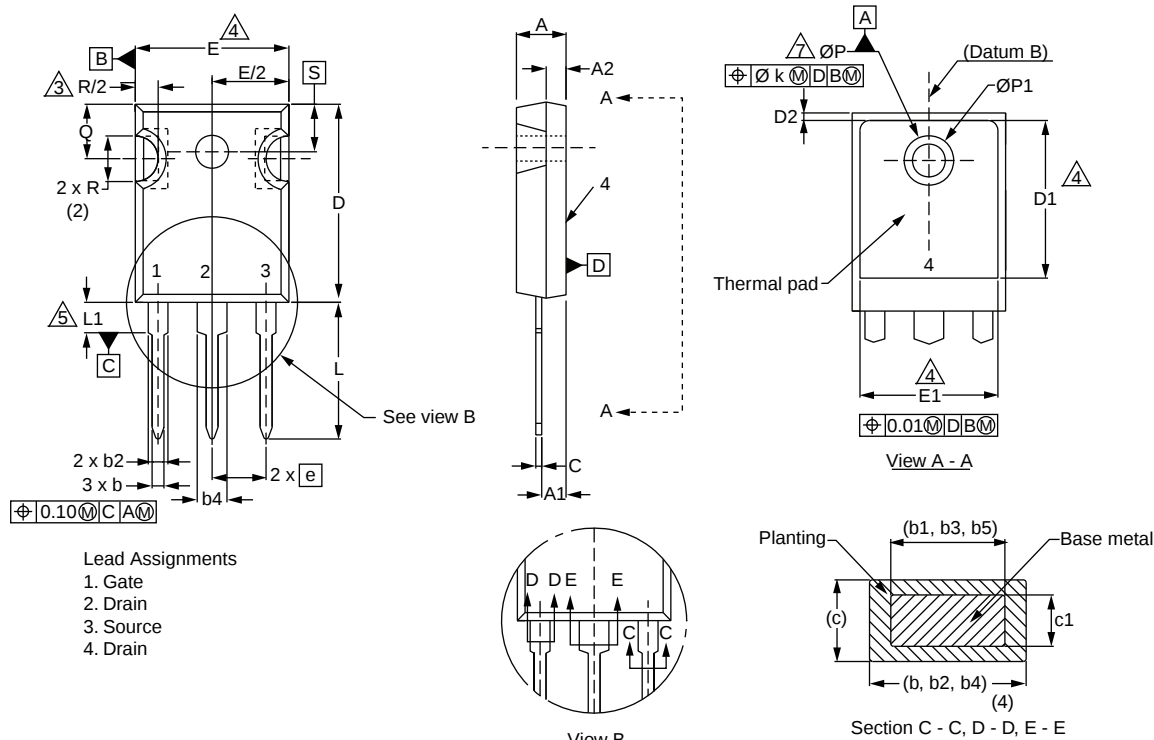


Safe Operating Area, Case Temperature



Normalized Thermal Transient Impedance, Junction-to-Case

TO-247AC (High Voltage)



DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.58	5.31	0.180	0.209
A1	2.21	2.59	0.087	0.102
A2	1.17	2.49	0.046	0.098
b	0.99	1.40	0.039	0.055
b1	0.99	1.35	0.039	0.053
b2	1.53	2.39	0.060	0.094
b3	1.65	2.37	0.065	0.093
b4	2.42	3.43	0.095	0.135
b5	2.59	3.38	0.102	0.133
c	0.38	0.86	0.015	0.034
c1	0.38	0.76	0.015	0.030
D	19.71	20.82	0.776	0.820
D1	13.08	-	0.515	-

DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
D2	0.51	1.30	0.020	0.051
E	15.29	15.87	0.602	0.625
E1	13.72	-	0.540	-
e	5.46 BSC		0.215 BSC	
Ø k	0.254		0.010	
L	14.20	16.25	0.559	0.640
L1	3.71	4.29	0.146	0.169
N	7.62 BSC		0.300 BSC	
Ø P	3.51	3.66	0.138	0.144
Ø P1	-	7.39	-	0.291
Q	5.31	5.69	0.209	0.224
R	4.52	5.49	0.178	0.216
S	5.51 BSC		0.217 BSC	

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