

N-Channel 40 V (D-S) MOSFET

PRODUCT SUMMARY			
V _{DS} (V)	R _{DS(on)} (Ω) MAX.	I _D (A) ^d	Q _g (TYP.)
40	0.0033 at V _{GS} = 10 V	90	87
	0.0041 at V _{GS} = 4.5 V	90	

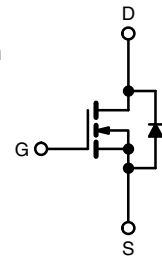
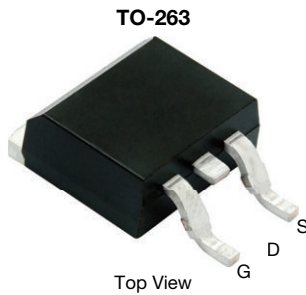
FEATURES

- TrenchFET[®] Power MOSFET
- 100 % R_g and UIS tested
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

APPLICATIONS

- Power supply
 - Secondary synchronous rectification
- DC/DC converter
- Power tools



N-Channel MOSFET

Ordering Information:

SUM90N04-3m3P-E3 (Lead (Pb)-free)

ABSOLUTE MAXIMUM RATINGS (T _C = 25 °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V _{DS}	40	V
Gate-Source Voltage		V _{GS}	± 20	
Continuous Drain Current (T _J = 150 °C)	T _C = 25 °C	I _D	90 ^d	A
	T _C = 70 °C		90 ^d	
Pulsed Drain Current (t = 300 μs)		I _{DM}	160	
Avalanche Current		I _{AS}	60	
Single Avalanche Energy ^a	L = 0.1 mH	E _{AS}	180	mJ
Maximum Power Dissipation ^a	T _C = 25 °C	P _D	125 ^b	W
	T _A = 25 °C ^c		3.1	
Operating Junction and Storage Temperature Range		T _J , T _{stg}	-55 to 150	°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}	1	

Notes

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



SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	40	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	1	-	2.5	
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$	-	-	± 250	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 40\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	1	μA
		$V_{DS} = 40\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	-	50	
		$V_{DS} = 40\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 150\text{ }^\circ\text{C}$	-	-	250	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq 10\text{ V}$, $V_{GS} = 10\text{ V}$	50	-	-	A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$, $I_D = 22\text{ A}$	-	0.0027	0.0033	Ω
		$V_{GS} = 4.5\text{ V}$, $I_D = 20\text{ A}$	-	0.0034	0.0041	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 15\text{ V}$, $I_D = 20\text{ A}$	-	169	-	S
Dynamic ^b						
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$, $V_{DS} = 20\text{ V}$, $f = 1\text{ MHz}$	-	5286	-	μF
Output Capacitance	C_{oss}		-	705	-	
Reverse Transfer Capacitance	C_{rss}		-	283	-	
Total Gate Charge ^c	Q_g	$V_{DS} = 20\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 20\text{ A}$	-	87	131	nC
Gate-Source Charge ^c	Q_{gs}		-	15.3	-	
Gate-Drain Charge ^c	Q_{gd}		-	12.2	-	
Gate Resistance	R_g	$f = 1\text{ MHz}$	0.5	2.7	5.4	Ω
Turn-On Delay Time ^c	$t_{d(on)}$	$V_{DD} = 20\text{ V}$, $R_L = 2\text{ }\Omega$ $I_D \cong 10\text{ A}$, $V_{GEN} = 10\text{ V}$, $R_g = 1\text{ }\Omega$	-	11	20	ns
Rise Time ^c	t_r		-	7	14	
Turn-Off Delay Time ^c	$t_{d(off)}$		-	45	68	
Fall Time ^c	t_f		-	7	14	
Drain-Source Body Diode Ratings and Characteristics ($T_C = 25\text{ }^\circ\text{C}$) ^b						
Continuous Current	I_S		-	-	90	A
Pulsed Current	I_{SM}		-	-	160	
Forward Voltage ^a	V_{SD}	$I_F = 10\text{ A}$, $V_{GS} = 0\text{ V}$	-	0.72	1.2	V
Reverse Recovery Time	t_{rr}	$I_F = 10\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$	-	42	63	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$		-	2.5	3.8	A
Reverse Recovery Charge	Q_{rr}		-	52	78	nC

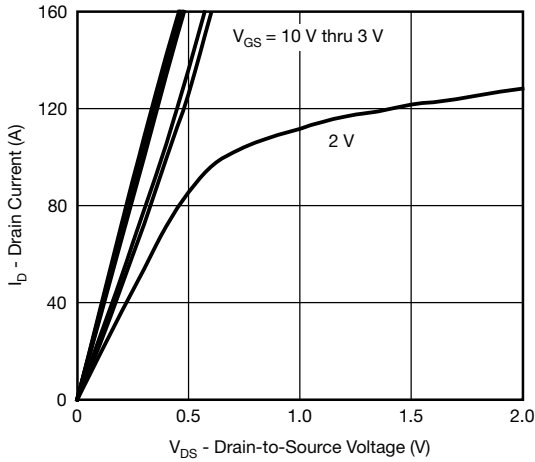
Notes

- 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.

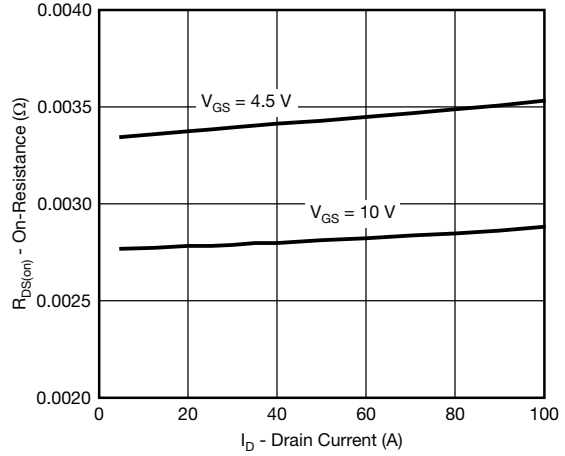
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



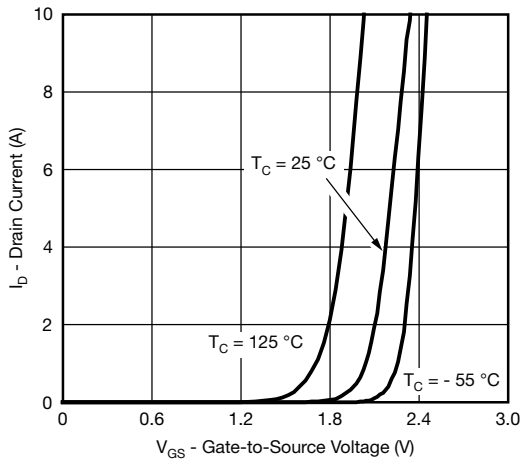
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



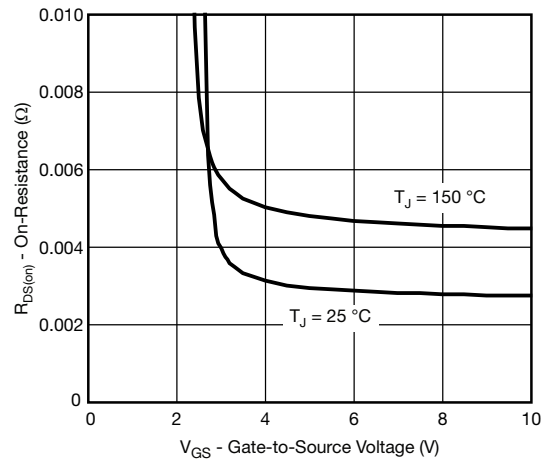
Output Characteristics



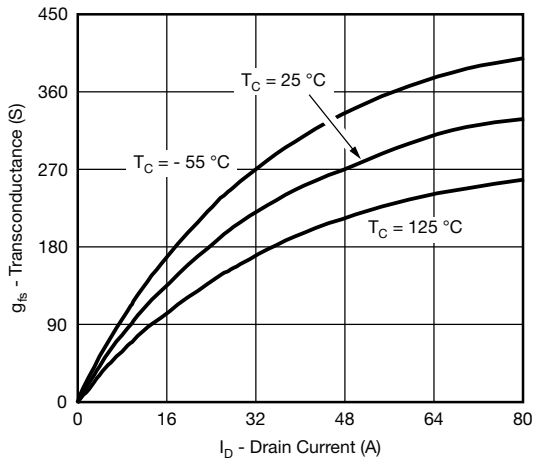
On-Resistance vs. Drain Current



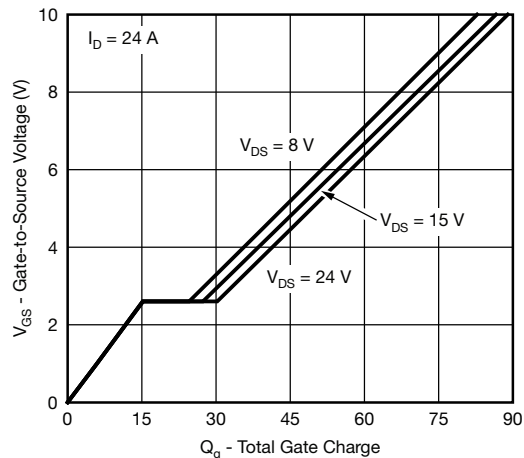
Transfer Characteristics



On-Resistance vs. Gate-to-Source Voltage



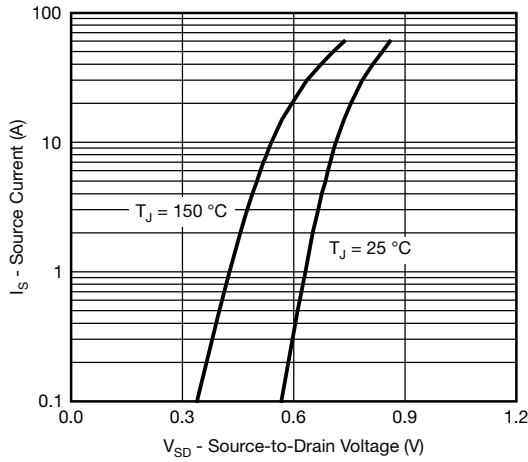
Transconductance



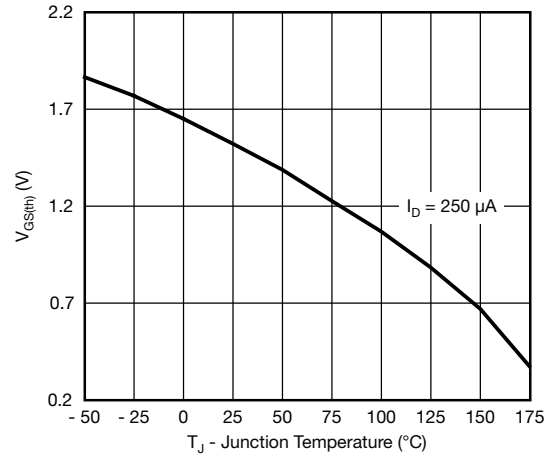
Gate Charge



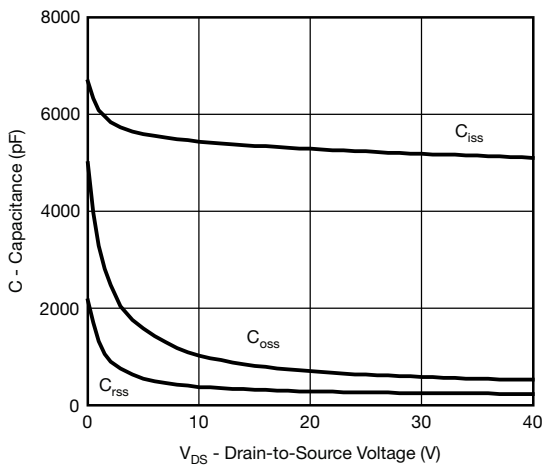
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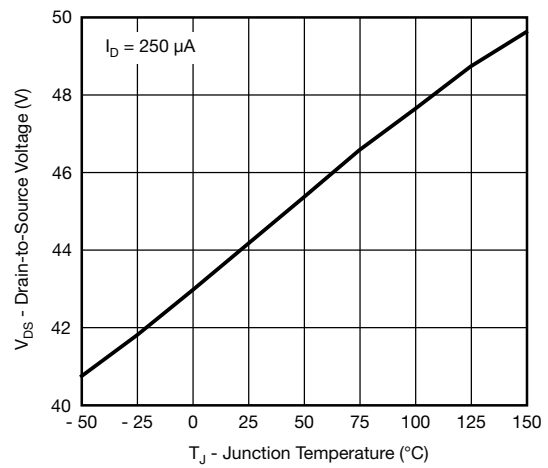
Source-Drain Diode Forward Voltage



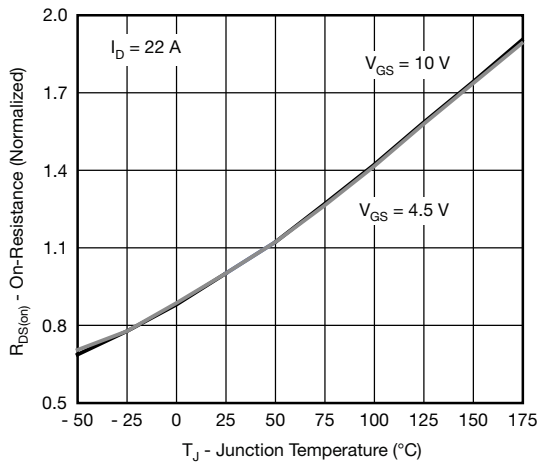
Threshold Voltage



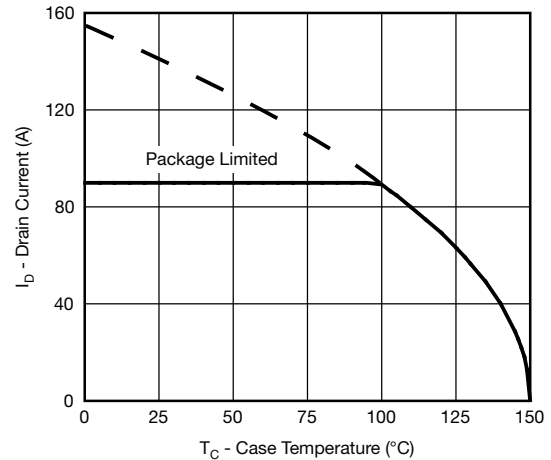
Capacitance



Drain Source Breakdown vs. Junction Temperature



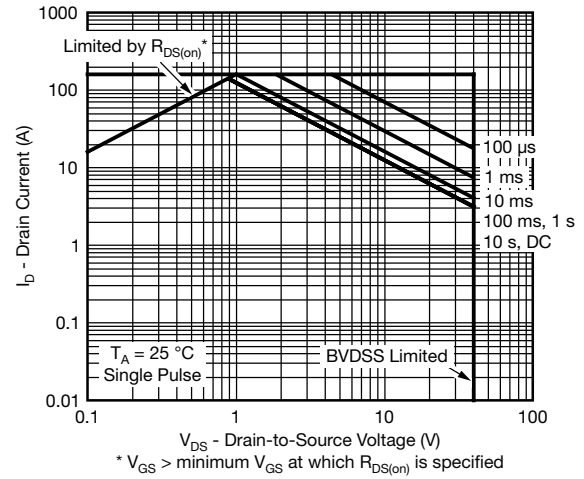
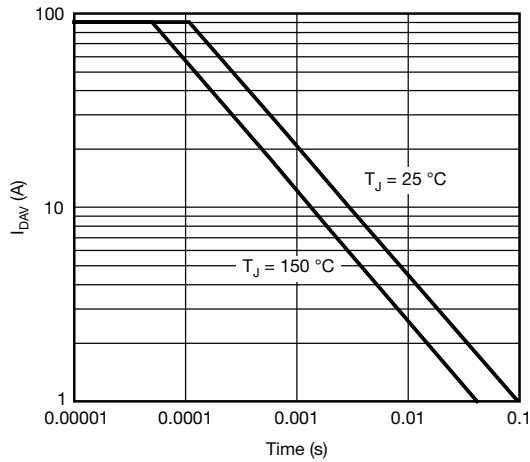
On-Resistance vs. Junction Temperature



Current Derating

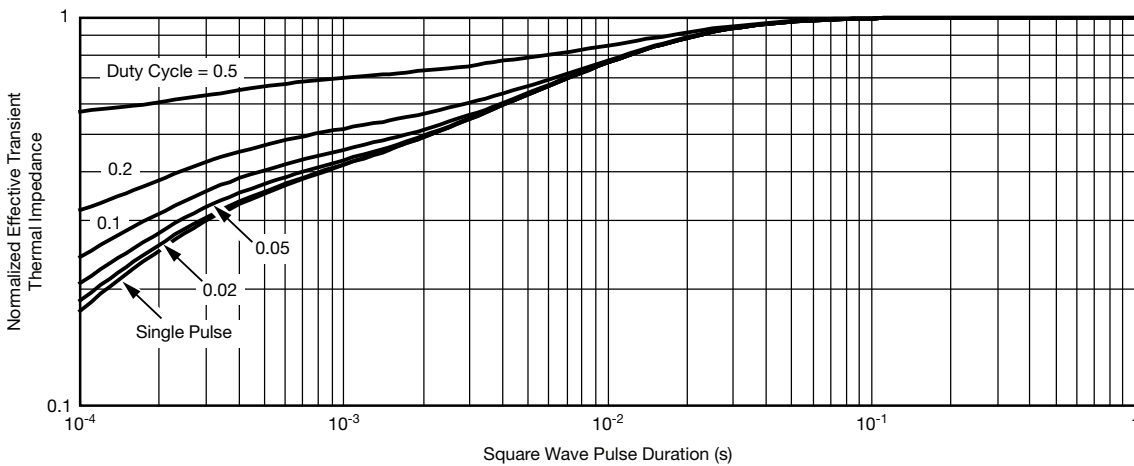


TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Single Pulse Avalanche Current Capability vs. Time

Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

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TO-263 (D²PAK): 3-LEAD



DIM.	INCHES		MILLIMETERS		
	MIN.	MAX.	MIN.	MAX.	
A	0.160	0.190	4.064	4.826	
b	0.020	0.039	0.508	0.990	
b1	0.020	0.035	0.508	0.889	
b2	0.045	0.055	1.143	1.397	
c*	Thin lead	0.013	0.018	0.330	0.457
	Thick lead	0.023	0.028	0.584	0.711
c1	Thin lead	0.013	0.017	0.330	0.431
	Thick lead	0.023	0.027	0.584	0.685
c2	0.045	0.055	1.143	1.397	
D	0.340	0.380	8.636	9.652	
D1	0.220	0.240	5.588	6.096	
D2	0.038	0.042	0.965	1.067	
D3	0.045	0.055	1.143	1.397	
D4	0.044	0.052	1.118	1.321	
E	0.380	0.410	9.652	10.414	
E1	0.245	-	6.223	-	
E2	0.355	0.375	9.017	9.525	
E3	0.072	0.078	1.829	1.981	
e	0.100 BSC		2.54 BSC		
K	0.045	0.055	1.143	1.397	
L	0.575	0.625	14.605	15.875	
L1	0.090	0.110	2.286	2.794	
L2	0.040	0.055	1.016	1.397	
L3	0.050	0.070	1.270	1.778	
L4	0.010 BSC		0.254 BSC		
M	-	0.002	-	0.050	
ECN: T13-0707-Rev. K, 30-Sep-13					
DWG: 5843					

Notes

- Plane B includes maximum features of heat sink tab and plastic.
- No more than 25 % of L1 can fall above seating plane by max. 8 mils.
- Pin-to-pin coplanarity max. 4 mils.
- *: Thin lead is for SUB, SYB.
Thick lead is for SUM, SYM, SQM.
- Use inches as the primary measurement.
- This feature is for thick lead.

RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

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