

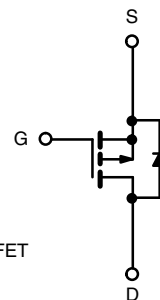
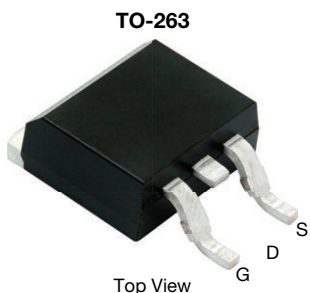
# P-Channel 40 V (D-S) 175 °C MOSFET

## PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>d</sup>
-40	0.0042 at $V_{GS} = -10$ V	-110
	0.0062 at $V_{GS} = -4.5$ V	-110

## FEATURES

- TrenchFET® Power MOSFET
- Low thermal resistance
- Material categorization:  
For definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT


## Ordering Information:

SUM110P04-04L-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	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 175$ °C) <sup>d</sup>	$I_D$	$T_C = 25$ °C	A
		$T_C = 125$ °C	
Pulsed Drain Current	$I_{DM}$	-240	
Avalanche Current	$I_{AS}$	-75	
Single Pulse Avalanche Energy <sup>a</sup>	$E_{AS}$	281	mJ
Power Dissipation	$P_D$	$T_C = 25$ °C	W
		$T_A = 25$ °C <sup>b</sup>	
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 <sup>b</sup>	$R_{thJA}$	40	°C/W
Junction-to-Case	$R_{thJC}$	0.4	

## Notes

- Duty cycle  $\leq 1$  %.
- When mounted on 1" square PCB (FR-4 material).
- See SOA curve for voltage derating.
- Limited by package.



SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA	-40			V
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA	-1		-3	
Gate-Body Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = -40 V, V <sub>GS</sub> = 0 V			-1	μA
		V <sub>DS</sub> = -40 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C			-50	
		V <sub>DS</sub> = -40 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C			-250	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = -5 V, V <sub>GS</sub> = -10 V	-120			A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -30 A		0.0034	0.0042	Ω
		V <sub>GS</sub> = -10 V, I <sub>D</sub> = -30 A, T <sub>J</sub> = 125 °C			0.0063	
		V <sub>GS</sub> = -10 V, I <sub>D</sub> = -30 A, T <sub>J</sub> = 175 °C			0.0076	
		V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -20 A		0.005	0.0062	
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = -15 V, I <sub>D</sub> = -30 A	20			S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -25 V, f = 1 MHz		11 200		pF
Output Capacitance	C <sub>oss</sub>			1650		
Reverse Transfer Capacitance	C <sub>rss</sub>			1200		
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>DS</sub> = -20 V, V <sub>GS</sub> = -10 V, I <sub>D</sub> = -110 A		235	350	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			45		
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			65		
Gate Resistance	R <sub>g</sub>			3		Ω
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = -20 V, R <sub>L</sub> = 0.18 Ω I <sub>D</sub> ≐ -110 A, V <sub>GEN</sub> = -10 V, R <sub>g</sub> = 2.5 Ω		25	40	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			30	45	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			190	300	
Fall Time <sup>c</sup>	t <sub>f</sub>			110	165	
Source-Drain Diode Ratings and Characteristics (T <sub>C</sub> = 25 °C) <sup>b</sup>						
Continuous Current	I <sub>S</sub>				-110	A
Pulsed Current	I <sub>SM</sub>				-240	
Forward Voltage <sup>a</sup>	V <sub>SD</sub>	I <sub>F</sub> = -85 A, V <sub>GS</sub> = 0 V		-1	-1.5	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = -85 A, dI/dt = 100 A/μs		65	100	ns
Peak Reverse Recovery Current	I <sub>RM(REC)</sub>			-3.7	-5.6	A
Reverse Recovery Charge	Q <sub>rr</sub>				0.12	0.28

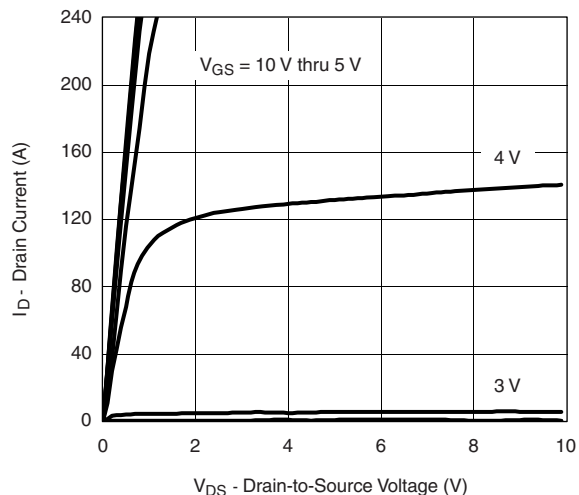
**Notes**

- 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.

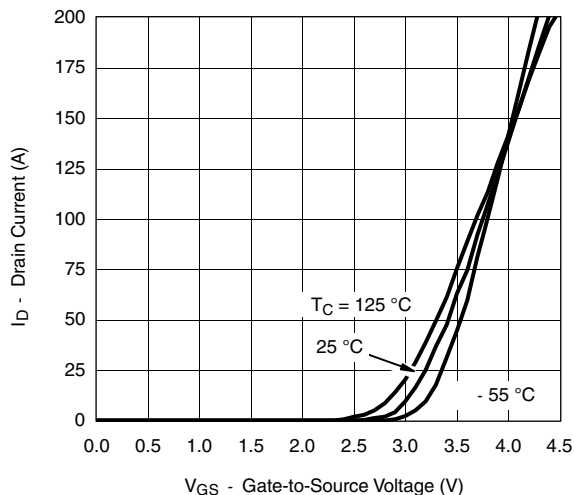
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



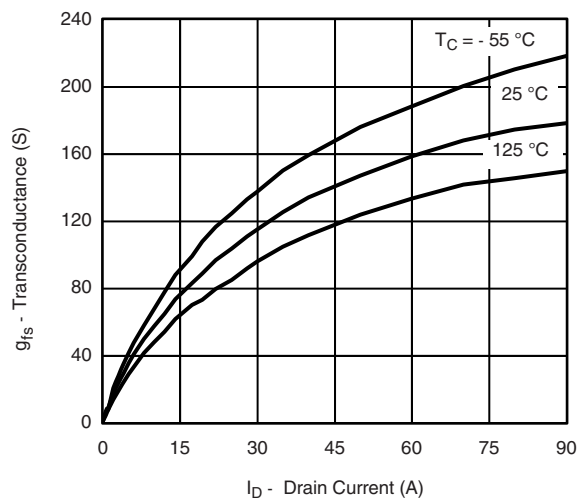
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



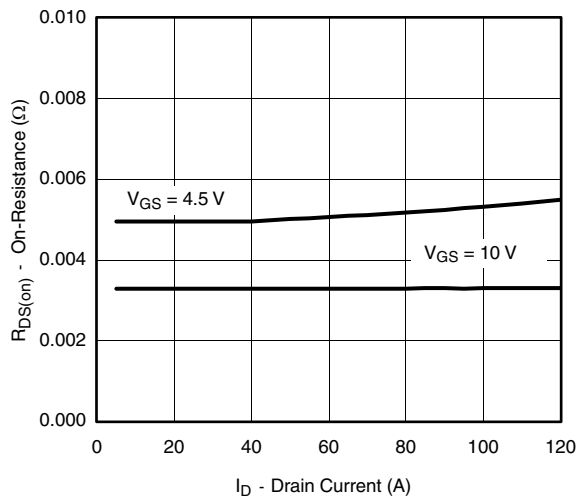
**Output Characteristics**



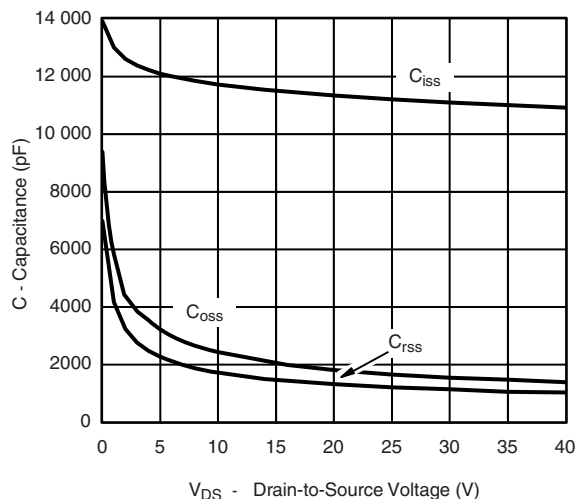
**Transfer Characteristics**



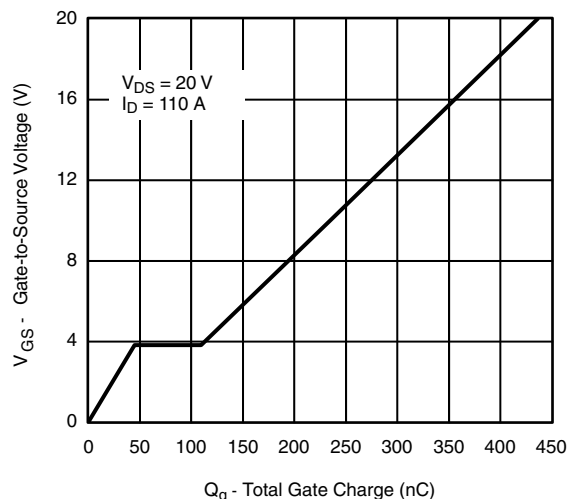
**Transconductance**



**On-Resistance vs. Drain Current**



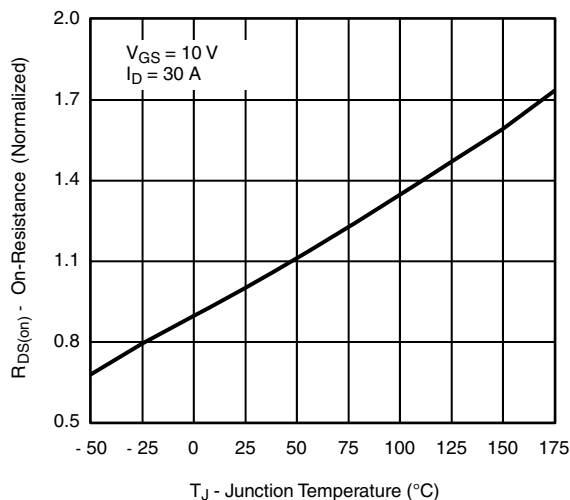
**Capacitance**



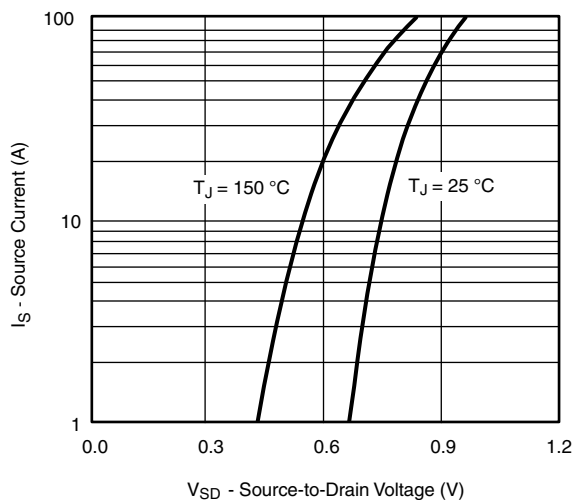
**Gate Charge**



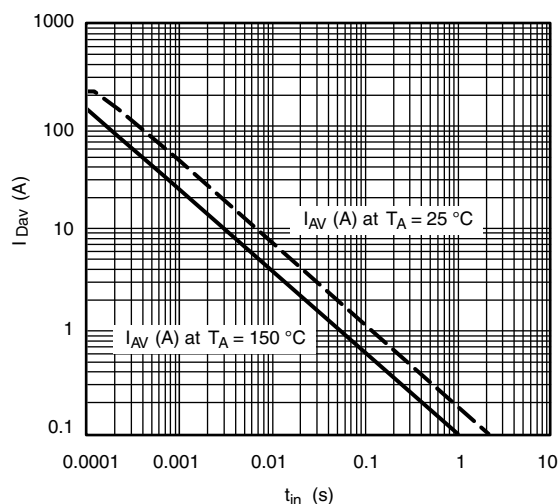
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



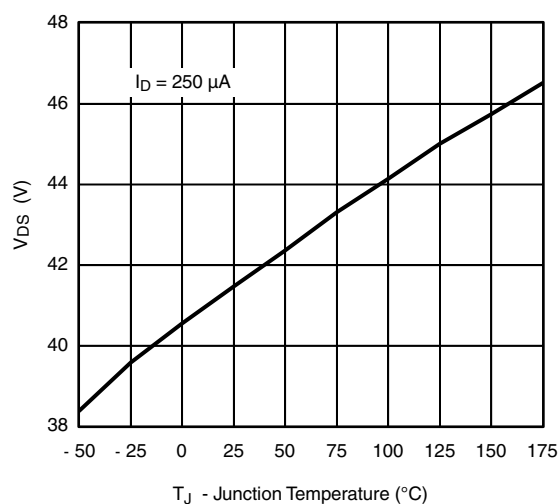
**On-Resistance vs. Junction Temperature**



**Source-Drain Diode Forward Voltage**



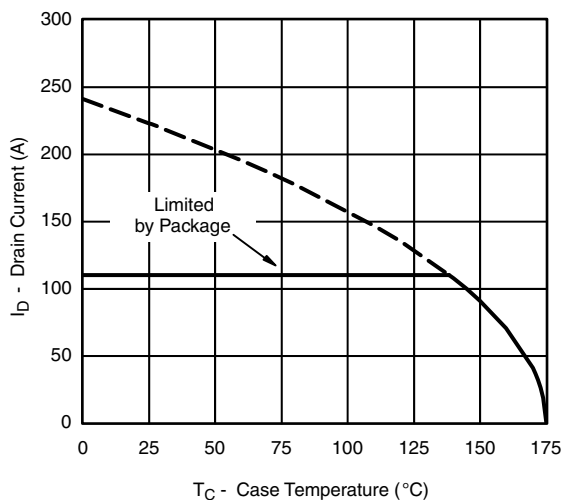
**Avalanche Current vs. Time**



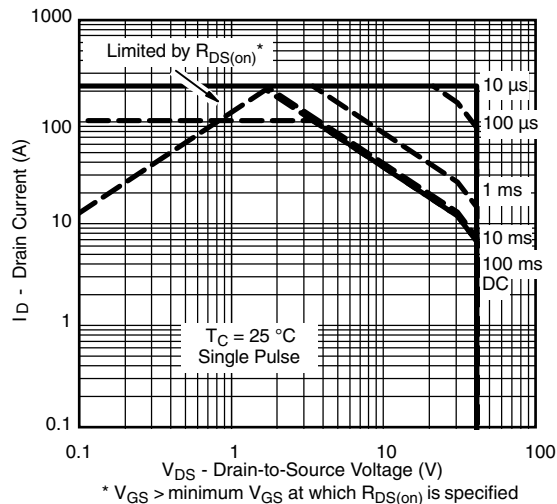
**Drain Source Breakdown vs. Junction Temperature**



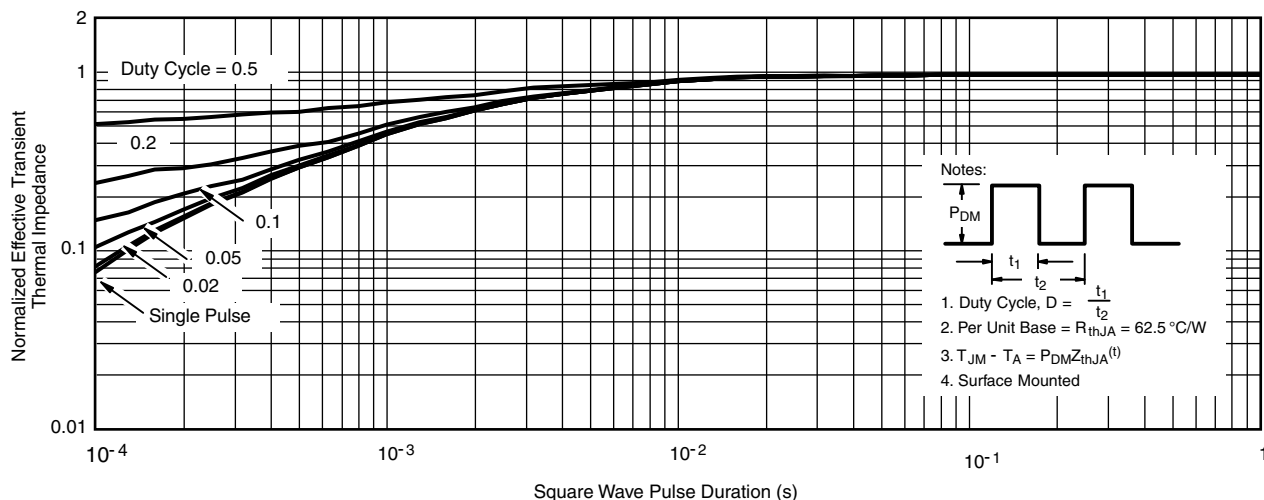
## THERMAL RATINGS



Maximum Avalanche and Drain Current vs. Case Temperature



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

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## TO-263 (D<sup>2</sup>PAK): 3-LEAD



DETAIL A (ROTATED 90°)



SECTION A-A

### Notes

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

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DWG: 5843

**RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead**



Recommended Minimum Pads  
 Dimensions in Inches/(mm)

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