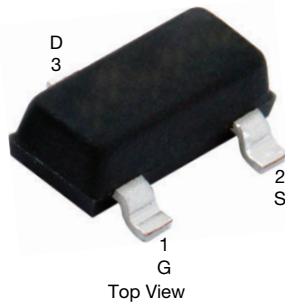


## P-Channel 12 V (D-S) MOSFET

SOT-23 (TO-236)



Marking code: O3

PRODUCT SUMMARY	
$V_{DS}$ (V)	-12
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -4.5$ V	0.035
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -2.5$ V	0.045
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -1.8$ V	0.059
$Q_g$ typ. (nC)	9
$I_D$ (A) <sup>a</sup>	-5.1
Configuration	Single

ORDERING INFORMATION	
Package	SOT-23 (TO-236)
Lead (Pb)-free	Si2333CDS-T1-E3
Lead (Pb)-free and halogen-free	Si2333CDS-T1-GE3

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		$V_{DS}$	-12	V
Gate-source voltage		$V_{GS}$	$\pm 8$	
Continuous drain current ( $T_J = 150$ °C)	$T_C = 25$ °C	$I_D$	-7.1	A
	$T_C = 70$ °C		-5.7	
	$T_A = 25$ °C		-5.1 <sup>b, c</sup>	
	$T_A = 70$ °C		-4.0 <sup>b, c</sup>	
Pulsed drain current		$I_{DM}$	-20	
Continuous source-drain diode current	$T_C = 25$ °C	$I_S$	-1.0	
	$T_A = 25$ °C		-0.63 <sup>b, c</sup>	
Maximum power dissipation	$T_C = 25$ °C	$P_D$	2.5	W
	$T_C = 70$ °C		1.6	
	$T_A = 25$ °C		1.25 <sup>b, c</sup>	
	$T_A = 70$ °C		0.8 <sup>b, c</sup>	
Operating junction and storage temperature range		$T_J, T_{stg}$	-55 to +150	°C

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient <sup>b, d</sup>	$t \leq 5$ s	$R_{thJA}$	75	100	°C/W
Maximum junction-to-case (drain)	Steady state	$R_{thJC}$	40	50	

**Notes**

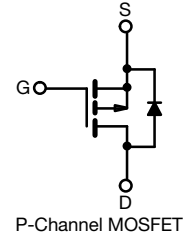
- $T_C = 25$  °C
- Surface mounted on 1" x 1" FR4 board
- $t = 5$  s
- Maximum under steady state conditions is 166 °C/W

**FEATURES**

- TrenchFET<sup>®</sup> power MOSFET
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

**APPLICATIONS**

- Load switch
- PA switch


**RoHS**  
 COMPLIANT  
 HALOGEN  
**FREE**  
 Available




SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA	-12	-	-	V
V <sub>DS</sub> temperature coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = -250 μA	-	-13	-	mV/°C
V <sub>GS(th)</sub> temperature coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>		-	2.6	-	
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA	-0.4	-	-1	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 8 V	-	-	± 100	nA
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = -12 V, V <sub>GS</sub> = 0 V	-	-	-1	μA
		V <sub>DS</sub> = -12 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C	-	-	-10	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≤ -5 V, V <sub>GS</sub> = -4.5 V	-20	-	-	A
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -5.1 A	-	0.0285	0.035	Ω
		V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -4.5 A	-	0.036	0.045	
		V <sub>GS</sub> = -1.8 V, I <sub>D</sub> = -2.0 A	-	0.046	0.059	
Forward transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = -5 V, I <sub>D</sub> = -5.3 A	-	18.5	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	C <sub>ISS</sub>	V <sub>DS</sub> = -6 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	1225	-	pF
Output capacitance	C <sub>OSS</sub>		-	315	-	
Reverse transfer capacitance	C <sub>rSS</sub>		-	260	-	
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> = -6 V, V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -5.1 A	-	15	25	nC
		V <sub>DS</sub> = -6 V, V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -5.1 A	-	9	15	
Gate-source charge	Q <sub>gs</sub>	V <sub>DS</sub> = -6 V, V <sub>GS</sub> = -2.5 V, I <sub>D</sub> = -5.1 A	-	1.9	-	
Gate-drain charge	Q <sub>gd</sub>		-	3.8	-	
Gate resistance	R <sub>g</sub>	f = 1 MHz	-	4	-	Ω
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = -6 V, R <sub>L</sub> = 6 Ω, I <sub>D</sub> = -1 A, V <sub>GEN</sub> = -4.5 V, R <sub>g</sub> = 1 Ω	-	13	20	ns
Rise time	t <sub>r</sub>		-	35	60	
Turn-off delay time	t <sub>d(off)</sub>		-	45	70	
Fall time	t <sub>f</sub>		-	12	20	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	-	-	-1	A
Pulse diode forward current <sup>a</sup>	I <sub>SM</sub>		-	-	-20	
Body diode voltage	V <sub>SD</sub>	I <sub>S</sub> = -1.0 A	-	-0.7	-1.2	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = -1.0 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C	-	32	50	ns
Body diode reverse recovery charge	Q <sub>rr</sub>		-	20	40	nC
Reverse recovery fall time	t <sub>a</sub>		-	16	-	ns
Reverse recovery rise time	t <sub>b</sub>		-	16	-	

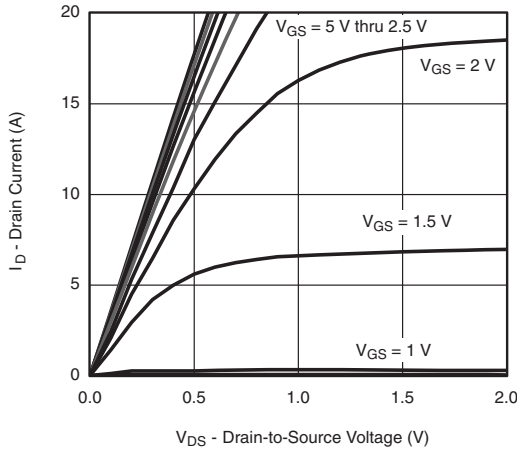
**Notes**

- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %
- b. Guaranteed by design, not subject to production testing

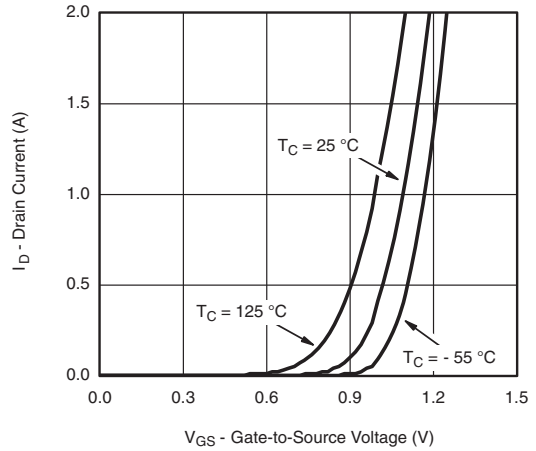
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



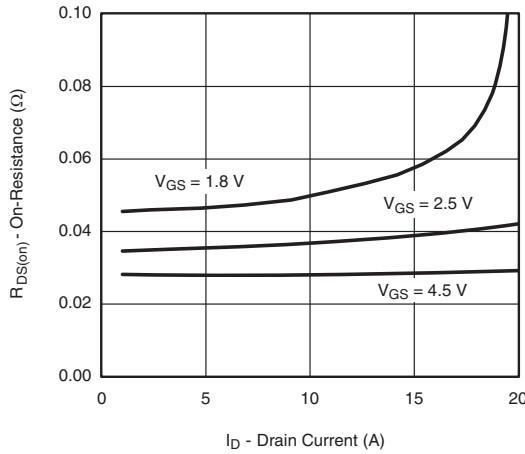
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



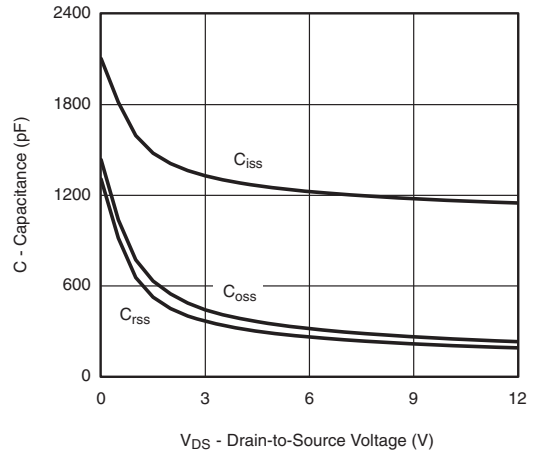
Output Characteristics



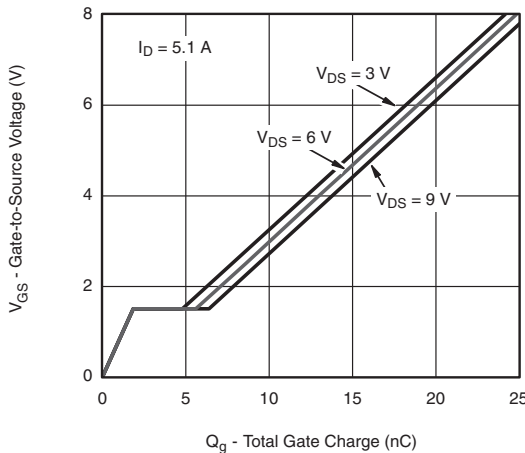
Transfer Characteristics



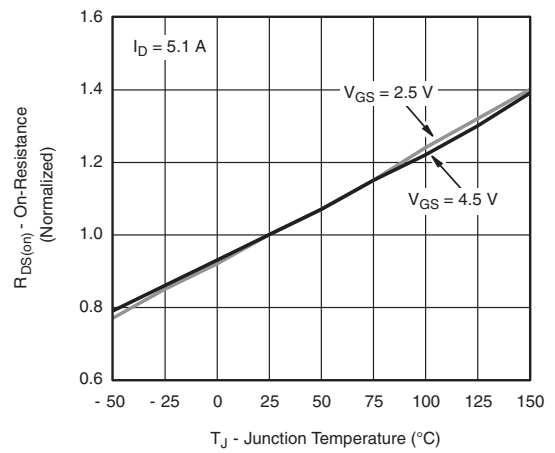
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



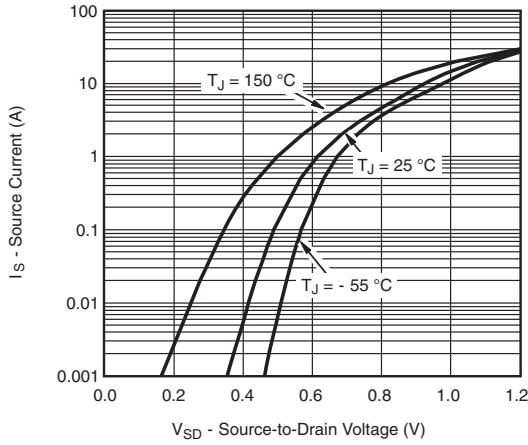
Gate Charge



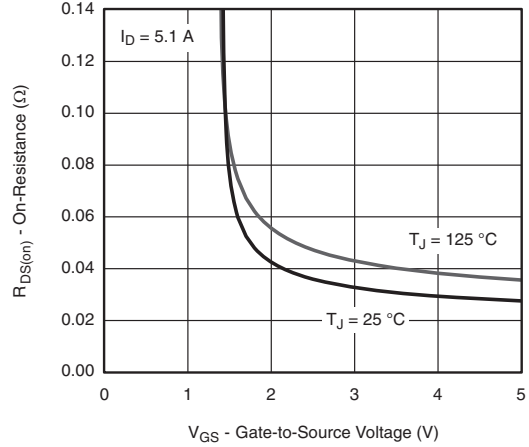
On-Resistance vs. Junction Temperature



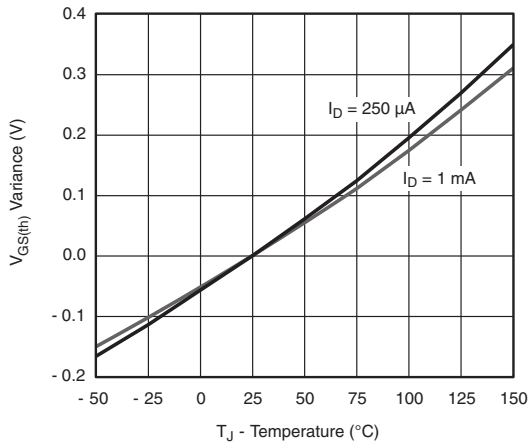
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



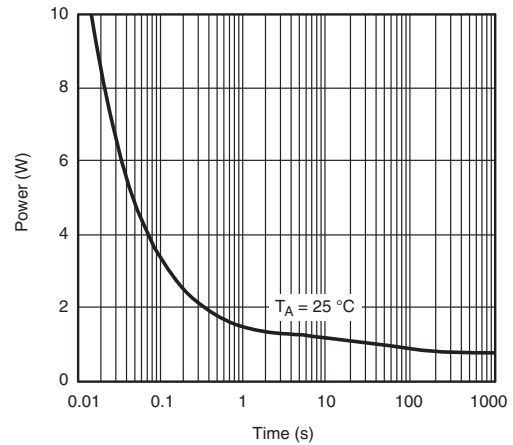
Source-Drain Diode Forward Voltage



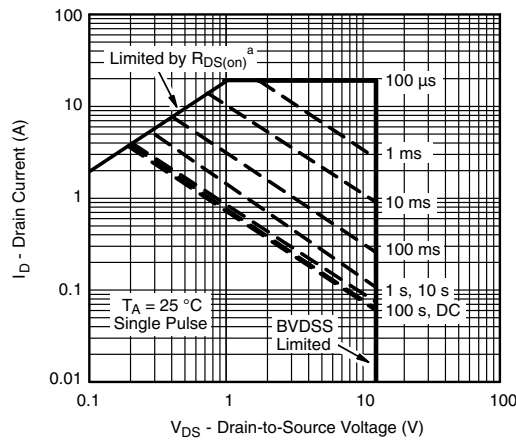
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power



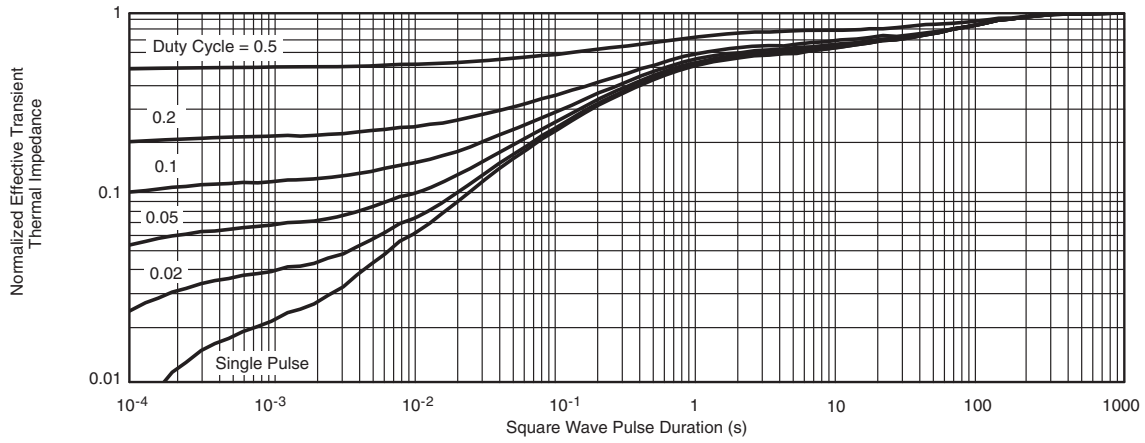
Safe Operating Area

Note

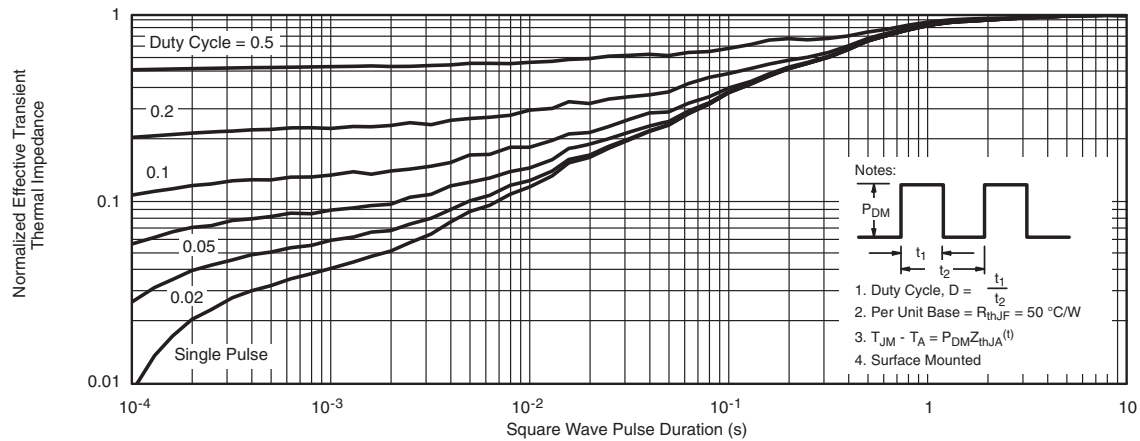
a.  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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## SOT-23 (TO-236): 3-LEAD



Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	0.89	1.12	0.035	0.044
A <sub>1</sub>	0.01	0.10	0.0004	0.004
A <sub>2</sub>	0.88	1.02	0.0346	0.040
b	0.35	0.50	0.014	0.020
c	0.085	0.18	0.003	0.007
D	2.80	3.04	0.110	0.120
E	2.10	2.64	0.083	0.104
E <sub>1</sub>	1.20	1.40	0.047	0.055
e	0.95 BSC		0.0374 Ref	
e <sub>1</sub>	1.90 BSC		0.0748 Ref	
L	0.40	0.60	0.016	0.024
L <sub>1</sub>	0.64 Ref		0.025 Ref	
S	0.50 Ref		0.020 Ref	
q	3°	8°	3°	8°

ECN: S-03946-Rev. K, 09-Jul-01  
 DWG: 5479

## RECOMMENDED MINIMUM PADS FOR SOT-23



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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