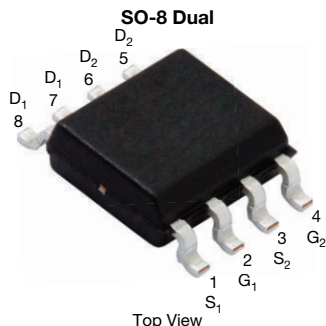


N- and P-Channel 60 V (D-S) MOSFET



FEATURES

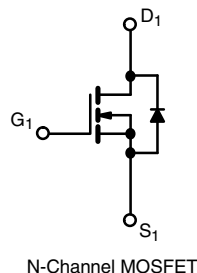
- TrenchFET® power MOSFET
- 100 % R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



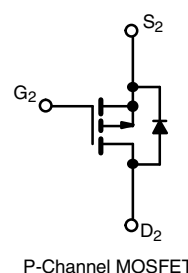
RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

- CCFL Inverter



N-Channel MOSFET



P-Channel MOSFET

PRODUCT SUMMARY

	N-CHANNEL	P-CHANNEL
V_{DS} (V)	60	-60
$R_{DS(on)}$ (Ω) at $V_{GS} = \pm 10$ V	0.058	0.120
$R_{DS(on)}$ (Ω) at $V_{GS} = \pm 4.5$ V	0.072	0.150
Q_g typ. (nC)	6	8
I_D (A) ^a	5.3	-3.9
Configuration	N- and p-pair	

ORDERING INFORMATION

Package	SO-8
Lead (Pb)-free	Si4559ADY-T1-E3
Lead (Pb)-free and halogen-free	Si4559ADY-T1-GE3

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

PARAMETER	SYMBOL	N-CHANNEL	P-CHANNEL	UNIT
Drain-source voltage	V_{DS}	60	-60	V
Gate-source voltage	V_{GS}	± 20	± 20	
Continuous drain current ($T_J = 150^\circ\text{C}$)	I_D	5.3	-3.9	A
		4.3	-3.2	
		4.3 ^{b, c}	-3 ^{b, c}	
		3.4 ^{b, c}	-2.4 ^{b, c}	
Pulsed drain current (10 μs pulse width)	I_{DM}	20	-25	
Source drain current diode current	I_S	2.6	-2.8	
		1.7 ^{b, c}	-1.7 ^{b, c}	
Pulsed source-drain current	I_{SM}	20	-25	
Single pulse avalanche current	I_{AS}	11	15	
Single pulse avalanche energy	E_{AS}	6.1	11	mJ
Maximum power dissipation	P_D	3.1	3.4	W
		2	2.2	
		2 ^{b, c}	2 ^{b, c}	
		1.3 ^{b, c}	1.3 ^{b, c}	
Operating junction and storage temperature range	T_J, T_{stg}	-55 to +150		$^\circ\text{C}$

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	N-CHANNEL		P-CHANNEL		UNIT
			TYP.	MAX.	TYP.	MAX.	
Maximum junction-to-ambient ^{b, d}	t ≤ 10 s	R _{thJA}	55	62.5	53	62.5	°C/W
Maximum junction-to-foot (drain)	Steady state	R _{thJF}	33	40	30	37	

Notes

- Based on $T_C = 25^\circ\text{C}$
- Surface mounted on 1" x 1" FR4 board
- $t = 10$ s
- Maximum under steady state conditions is 110 $^\circ\text{C/W}$ for N-channel and P-channel



SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP. ^a	MAX.	UNIT
Static							
Drain-source breakdown voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	N-Ch	60	-	-	V
		V _{GS} = 0 V, I _D = -250 μA	P-Ch	-60	-	-	
V _{DS} temperature coefficient	ΔV _{DS} /T _J	I _D = 250 μA	N-Ch	-	55	-	mV
		I _D = -250 μA	P-Ch	-	-50	-	
V _{GS(th)} temperature coefficient	ΔV _{GS(th)} /T _J	I _D = 250 μA	N-Ch	-	-6	-	
		I _D = -250 μA	P-Ch	-	4	-	
Gate threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	N-Ch	1	-	3	V
		V _{DS} = V _{GS} , I _D = -250 μA	P-Ch	-1	-	-3	
Gate-body leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V	N-Ch	-	-	100	nA
			P-Ch	-	-	-100	
Zero gate voltage drain current	I _{DSS}	V _{DS} = 60 V, V _{GS} = 0 V	N-Ch	-	-	1	μA
		V _{DS} = -60 V, V _{GS} = 0 V	P-Ch	-	-	-1	
		V _{DS} = 60 V, V _{GS} = 0 V, T _J = 55 °C	N-Ch	-	-	10	
		V _{DS} = -60 V, V _{GS} = 0 V, T _J = 55 °C	P-Ch	-	-	-10	
On-state drain current ^b	I _{D(on)}	V _{DS} ≥ 5 V, V _{GS} = 10 V	N-Ch	20	-	-	A
		V _{DS} ≤ -5 V, V _{GS} = -10 V	P-Ch	-25	-	-	
Drain-source on-state resistance ^b	R _{DS(on)}	V _{GS} = 10 V, I _D = 4.3 A	N-Ch	-	0.046	0.058	Ω
		V _{GS} = -10 V, I _D = -3.1 A	P-Ch	-	0.100	0.120	
		V _{GS} = 4.5 V, I _D = 3.9 A	N-Ch	-	0.059	0.072	
		V _{GS} = -4.5 V, I _D = -0.2 A	P-Ch	-	0.126	0.150	
Forward transconductance ^b	g _{fs}	V _{DS} = 15 V, I _D = 4.3 A	N-Ch	-	15	-	S
		V _{DS} = -15 V, I _D = -3.1 A	P-Ch	-	8.5	-	
Dynamic ^a							
Input capacitance	C _{iss}	N-Channel V _{DS} = 15 V, V _{GS} = 0 V, f = 1 MHz P-Channel V _{DS} = -15 V, V _{GS} = 0 V, f = 1 MHz	N-Ch	-	665	-	pF
Output capacitance	C _{oss}		P-Ch	-	650	-	
			N-Ch	-	75	-	
Reverse transfer capacitance	C _{rss}		P-Ch	-	95	-	
		N-Ch	-	40	-		
		P-Ch	-	60	-		
		Total gate charge	Q _g	V _{DS} = 30 V, V _{GS} = 10 V, I _D = 4.3 A	N-Ch	-	13
V _{DS} = -30 V, V _{GS} = -10 V, I _D = -3.1 A	P-Ch			-	14.5	22	
Gate-source charge	Q _{gs}	N-Channel V _{DS} = 30 V, V _{GS} = 4.5 V, I _D = 4.3 A P-Channel V _{DS} = -30 V, V _{GS} = -4.5 V, I _D = -3.1 A	N-Ch	-	6	9	
			P-Ch	-	8	12	
			N-Ch	-	2.3	-	
			P-Ch	-	2.2	-	
Gate-drain charge	Q _{gd}	N-Ch	-	2.6	-		
		P-Ch	-	3.7	-		
Gate resistance	R _g	f = 1 MHz	N-Ch	-	2	3	Ω
			P-Ch	-	14	20	



SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)								
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP. ^a	MAX.	UNIT	
Dynamic ^a								
Turn-on delay time	t _{d(on)}	N-Channel V _{DD} = 30 V, R _L = 8.8 Ω I _D ≅ 3.4 A, V _{GEN} = 4.5 V, R _g = 1 Ω	N-Ch	-	15	25	ns	
			P-Ch	-	30	45		
Rise time	t _r		N-Ch	-	65	100		
			P-Ch	-	70	105		
Turn-off delay time	t _{d(off)}	P-Channel V _{DD} = -30 V, R _L = 12.5 Ω I _D ≅ -2.4 A, V _{GEN} = -4.5 V, R _g = 1 Ω	N-Ch	-	15	25		
			P-Ch	-	40	60		
Fall time	t _f		N-Ch	-	10	15		
			P-Ch	-	30	45		
Turn-on delay time	t _{d(on)}	N-Channel V _{DD} = 30 V, R _L = 8.8 Ω I _D ≅ 3.4 A, V _{GEN} = 10 V, R _g = 1 Ω	N-Ch	-	10	15		
			P-Ch	-	10	15		
Rise time	t _r		N-Ch	-	15	25		
			P-Ch	-	13	20		
Turn-off delay time	t _{d(off)}		N-Ch	-	20	30		
			P-Ch	-	35	55		
Fall time	t _f		N-Ch	-	10	15		
			P-Ch	-	30	45		
Drain-Source Body Diode Characteristics								
Continuous source-drain diode current	I _S	T _C = 25 °C	N-Ch	-	-	2.6	A	
			P-Ch	-	-	-2.8		
Pulse diode forward current ^a	I _{SM}		N-Ch	-	-	20		
			P-Ch	-	-	-25		
Body diode voltage	V _{SD}	I _S = 1.7 A	N-Ch	-	0.8	1.2	V	
		I _S = -2 A	P-Ch	-	-0.8	-1.2		
Body diode reverse recovery time	t _{rr}	N-Channel I _F = 1.7 A, di/dt = 100 A/μs, T _J = 25 °C	N-Ch	-	30	60	ns	
			P-Ch	-	30	50		
Body diode reverse recovery charge	Q _{rr}		P-Channel I _F = -2 A, di/dt = -100 A/μs, T _J = 25 °C	N-Ch	-	32	50	nC
				P-Ch	-	35	60	
Reverse recovery fall time	t _a			N-Ch	-	25	-	ns
				P-Ch	-	16	-	
Reverse recovery rise time	t _b		N-Ch	-	5	-		
			P-Ch	-	14	-		

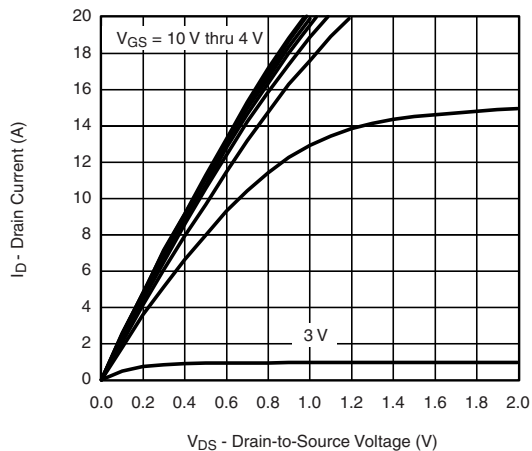
Notes

- a. Guaranteed by design, not subject to production testing
b. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$

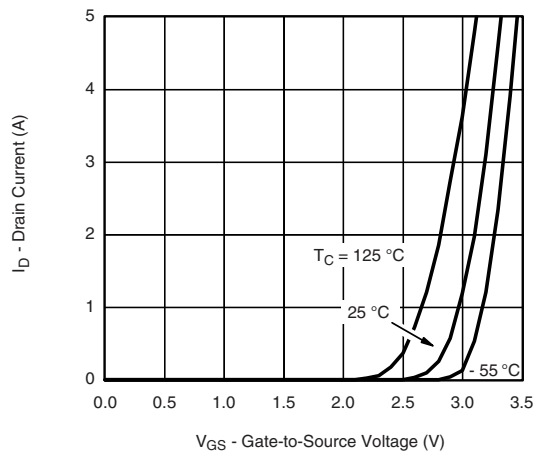
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



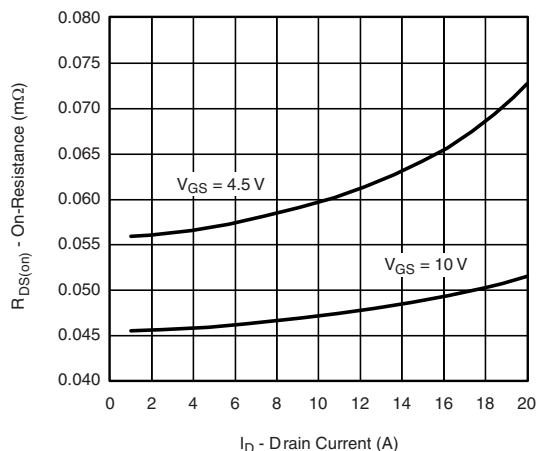
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



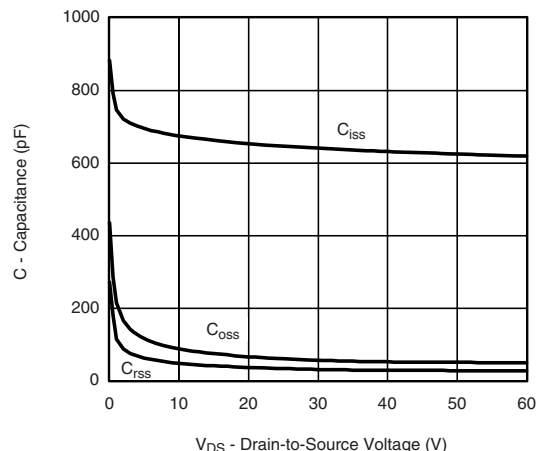
Output Characteristics



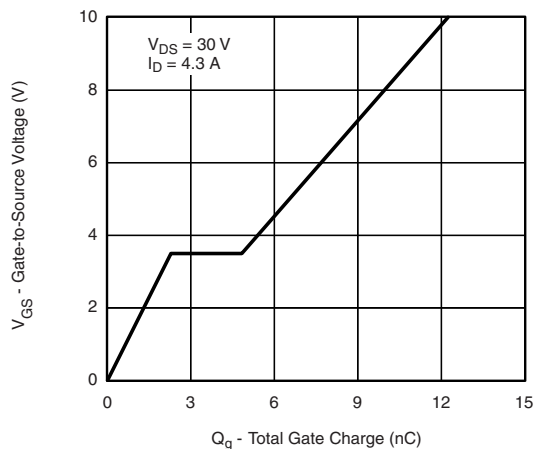
Transfer Characteristics



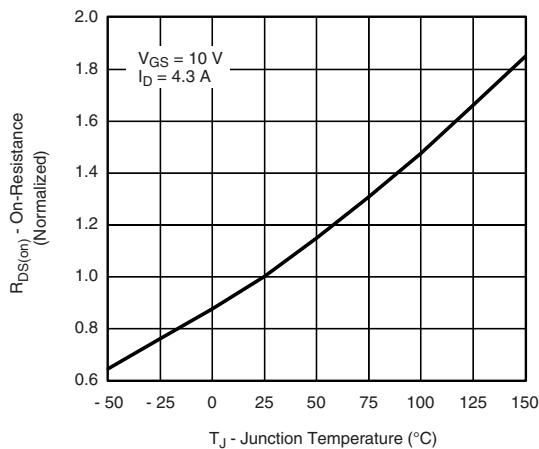
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



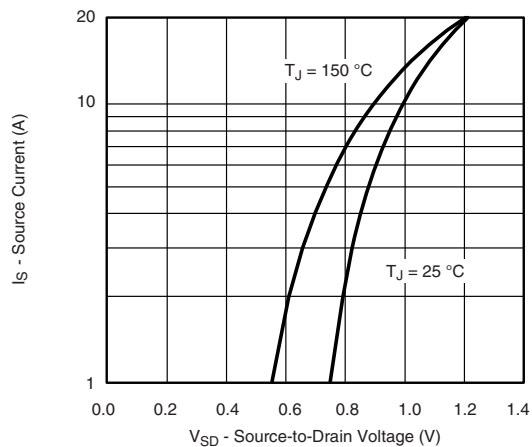
Gate Charge



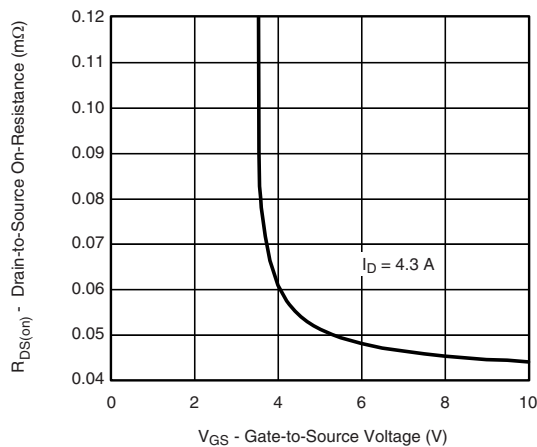
On-Resistance vs. Junction Temperature



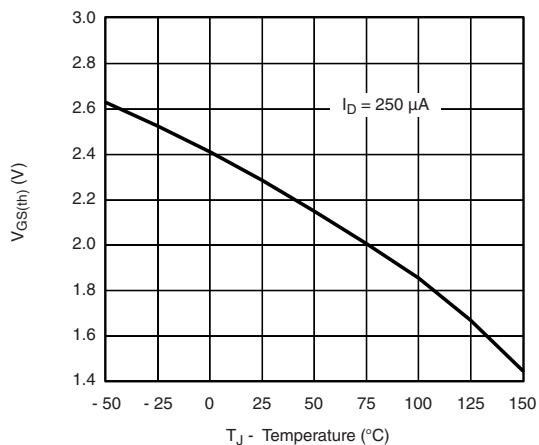
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



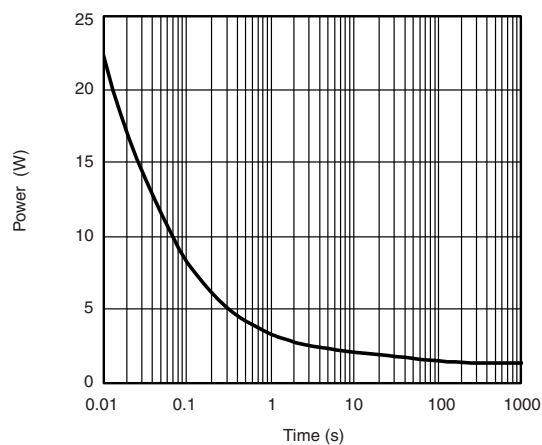
Source-Drain Diode Forward Voltage



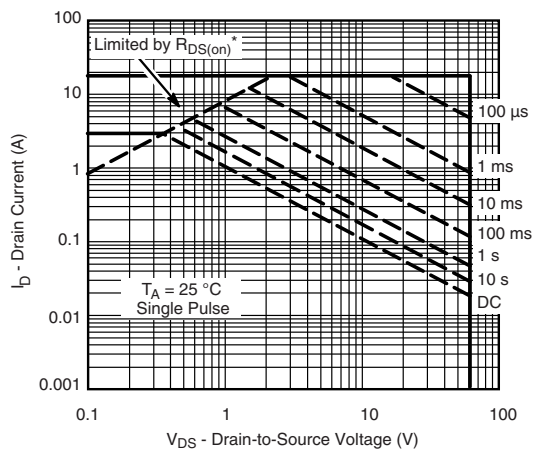
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

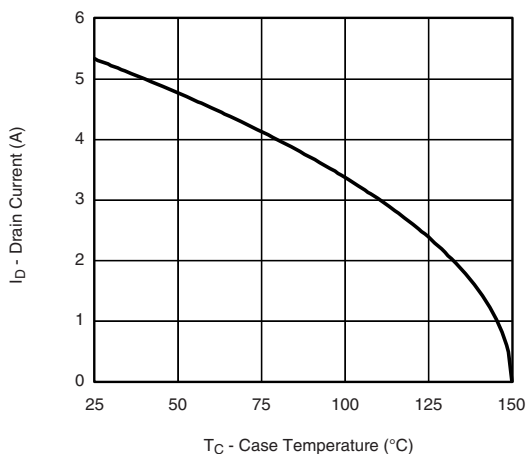
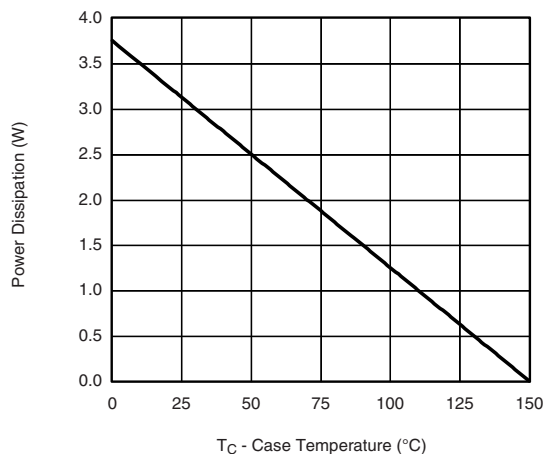
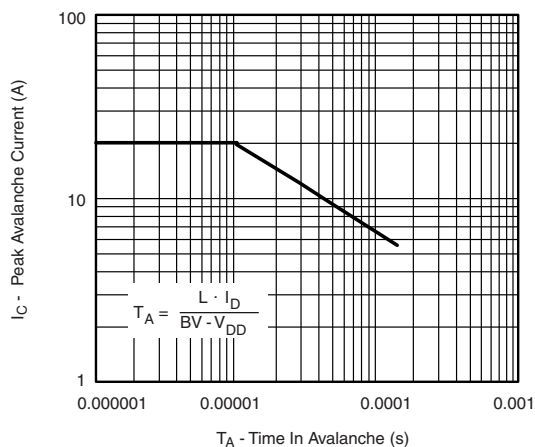


Single Pulse Power, Junction-to-Ambient



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

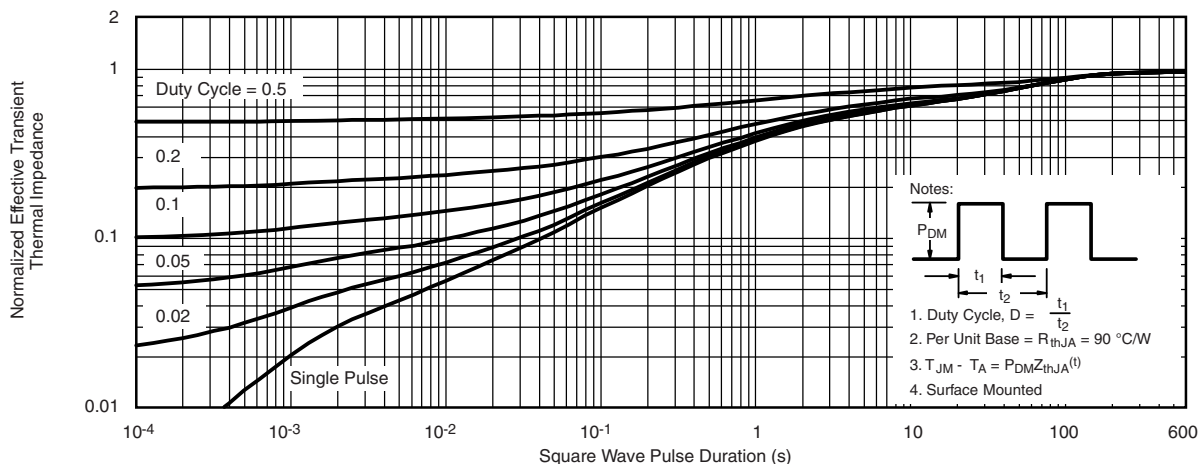
Safe Operating Area

**N-CHANNEL TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)**Current Derating ^a****Power Derating****Single Pulse Avalanche Capability****Note**

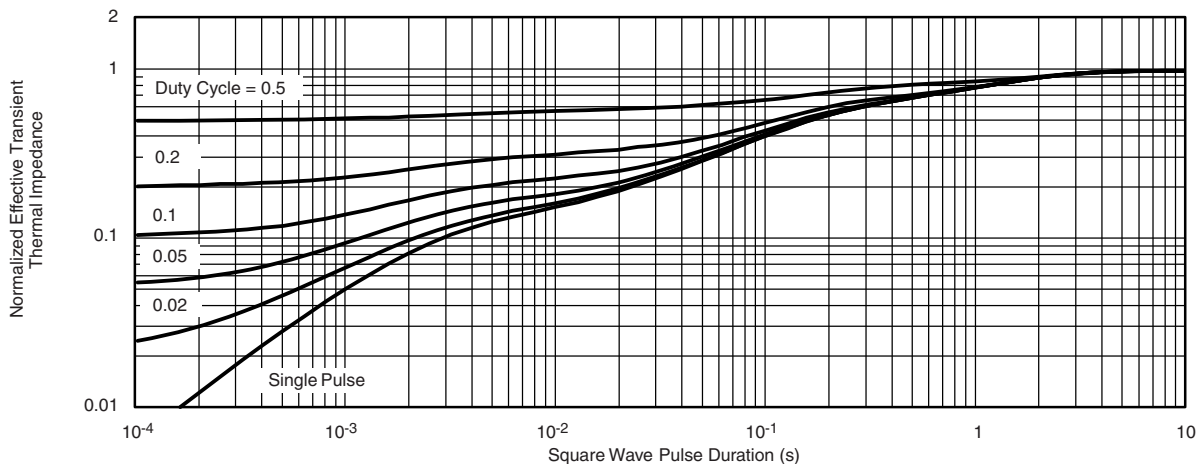
- a. The power dissipation P_D is based on $T_J \text{ max} = 150\text{ °C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit



N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



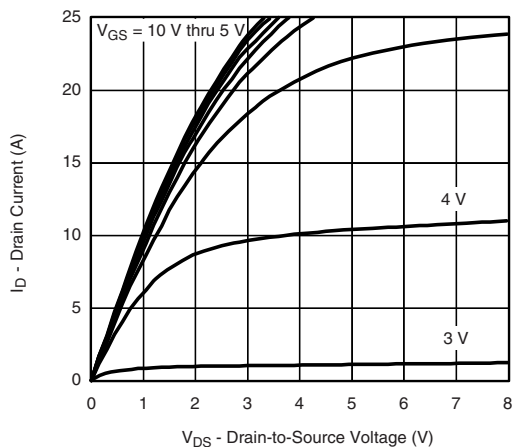
Normalized Thermal Transient Impedance, Junction-to-Ambient



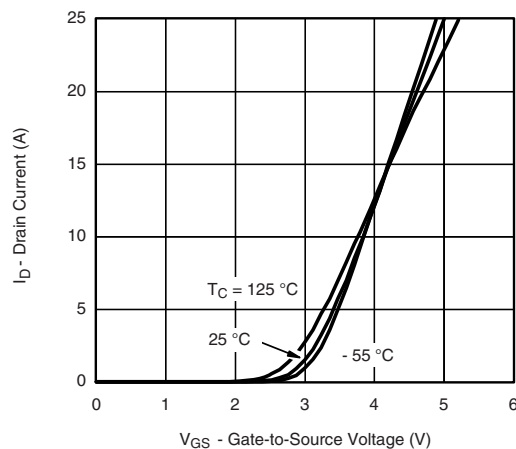
Normalized Thermal Transient Impedance, Junction-to-Case



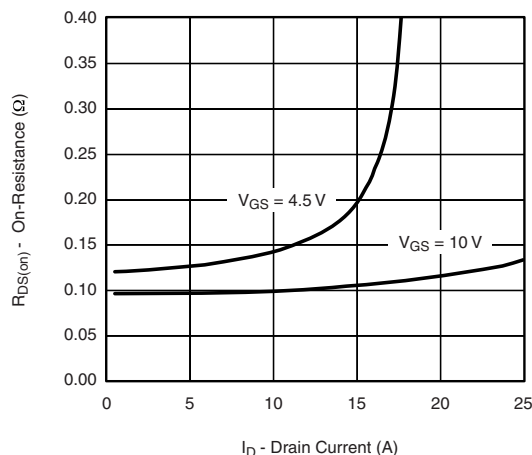
P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



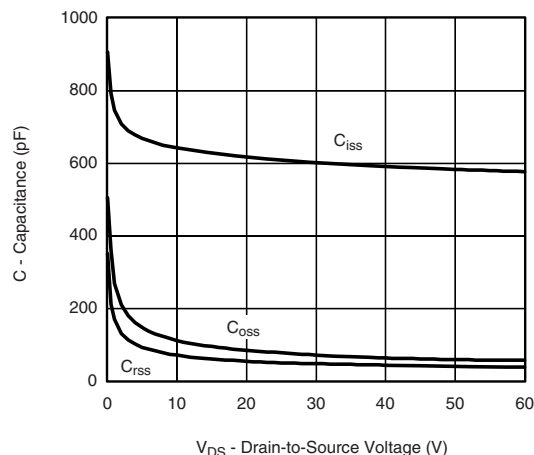
Output Characteristics



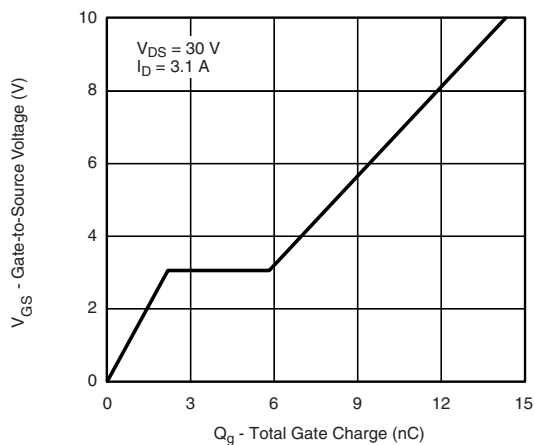
Transfer Characteristics



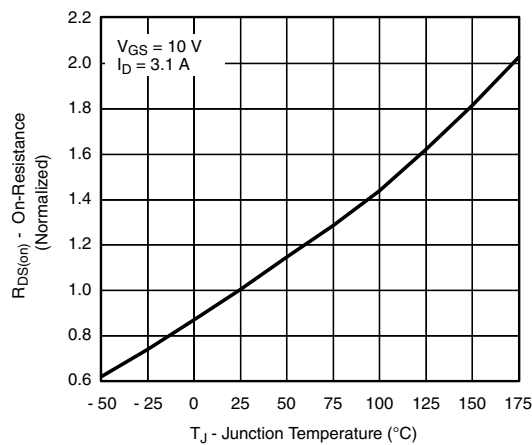
On-Resistance vs. Drain Current



Capacitance



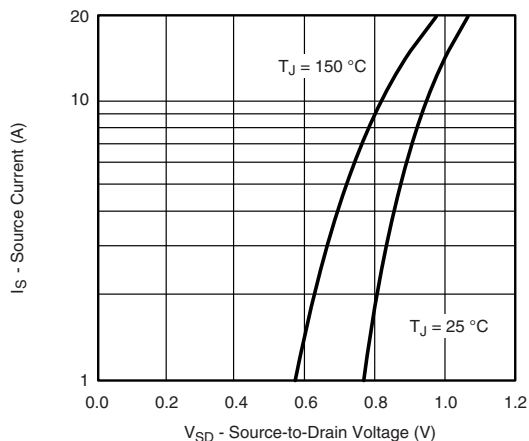
Gate Charge



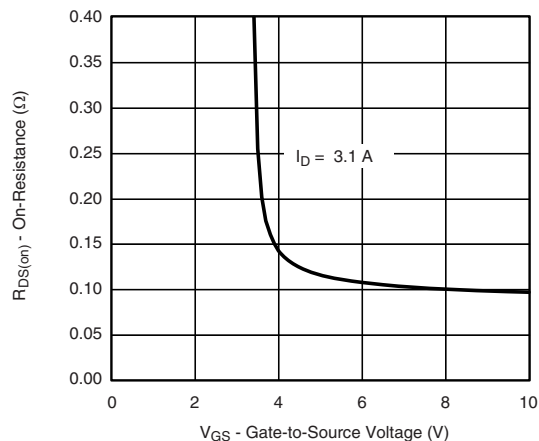
On-Resistance vs. Junction Temperature



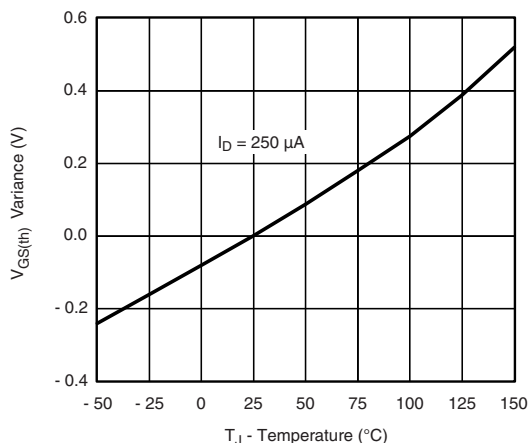
P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



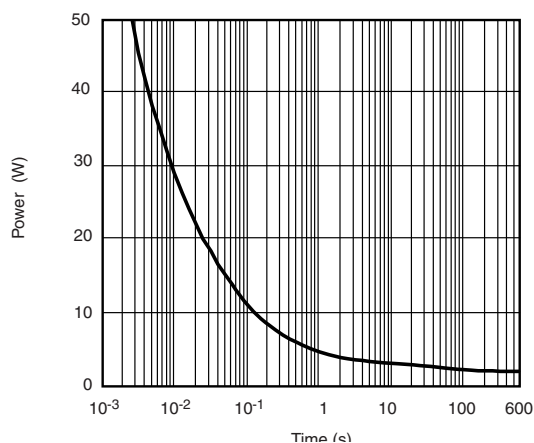
Source-Drain Diode Forward Voltage



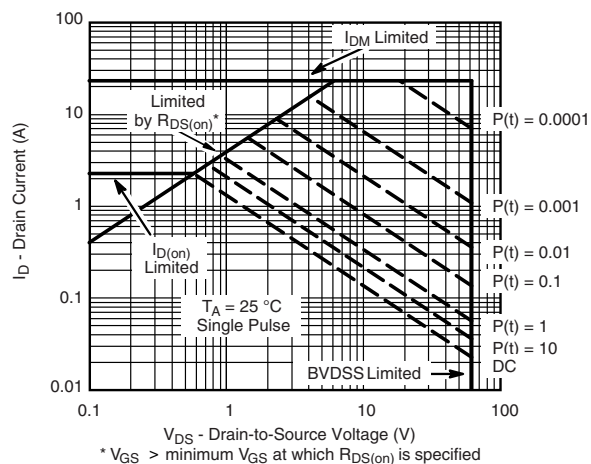
On-Resistance vs. Gate-to-Source Voltage



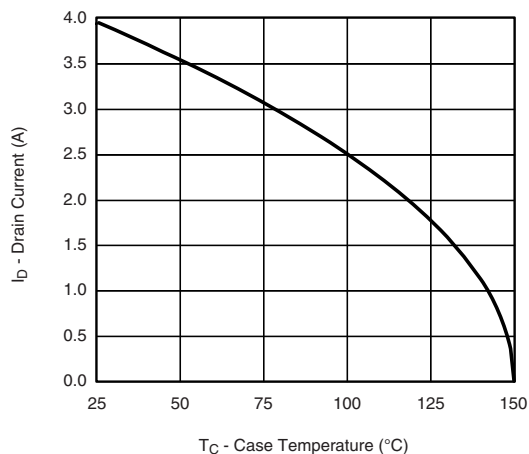
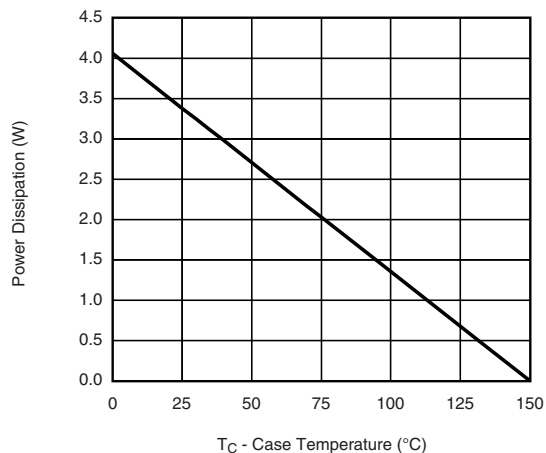
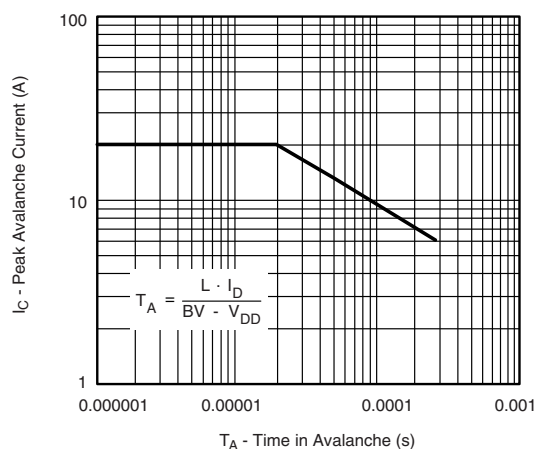
Threshold Voltage



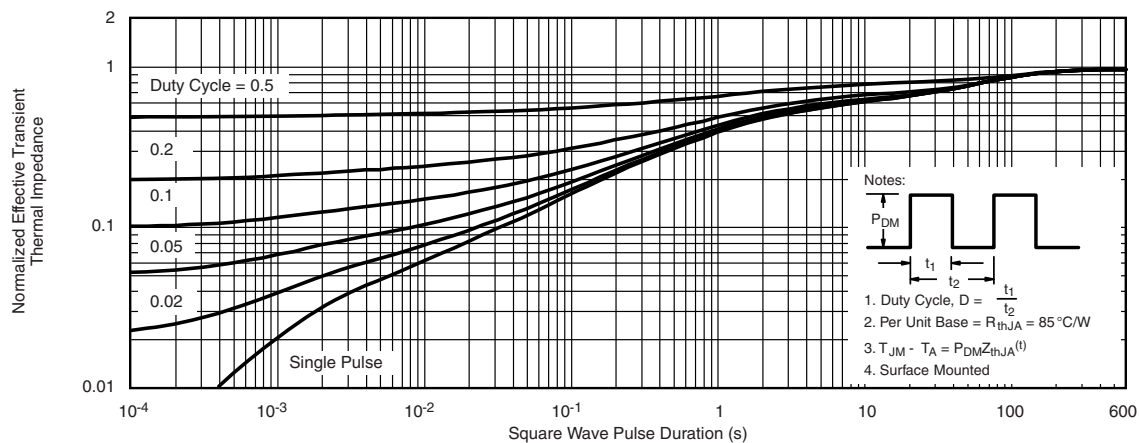
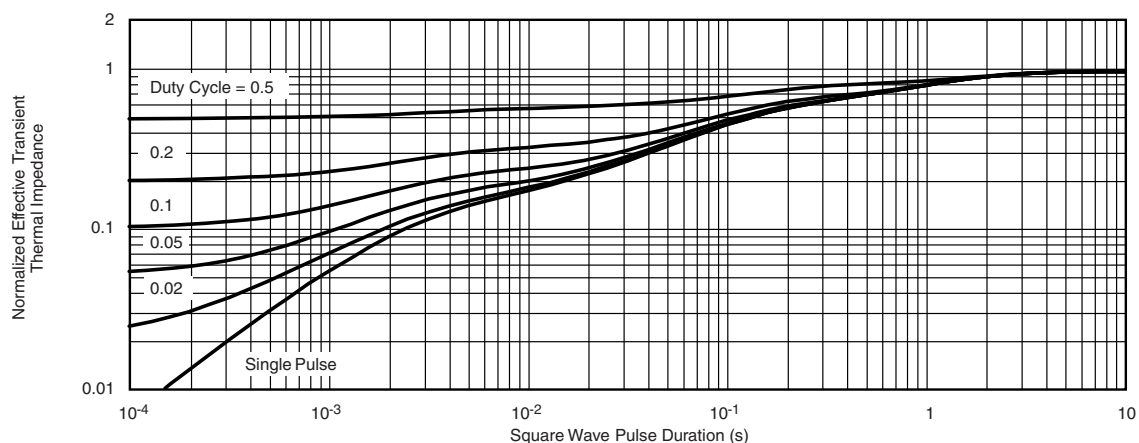
Single Pulse Power



Safe Operating Area, Junction-to-Case

P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Current Derating ^a

Power Derating, Junction-to-Foot

Single Pulse Avalanche Capability
Note

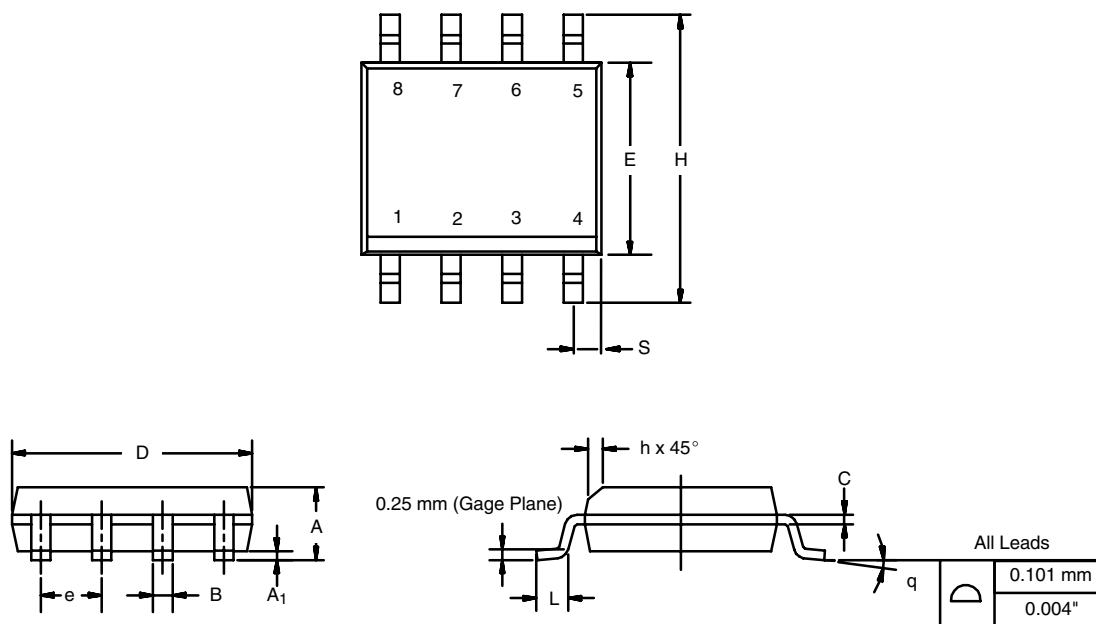
- a. The power dissipation P_D is based on $T_J \text{ max} = 150 \text{ °C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit

P-CHANNEL 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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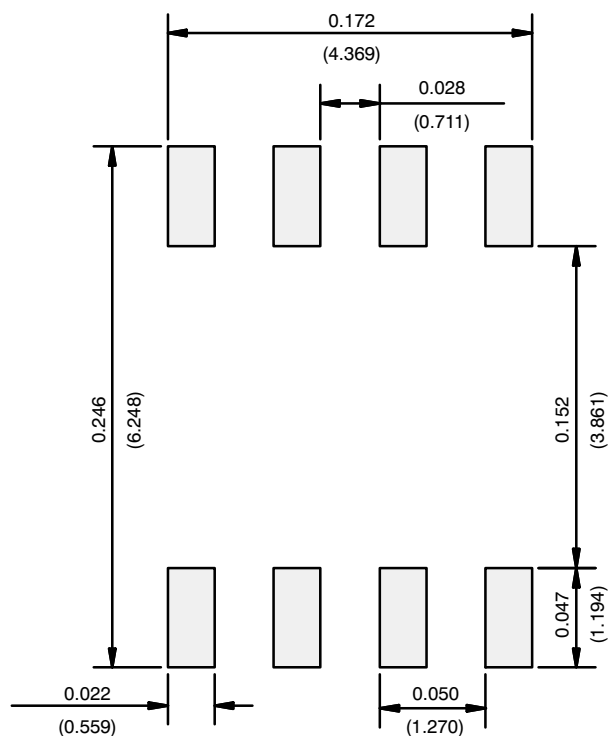
SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A ₁	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°	8°	0°	8°
S	0.44	0.64	0.018	0.026
ECN: C-06527-Rev. I, 11-Sep-06				
DWG: 5498				

RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads
Dimensions in Inches/(mm)

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