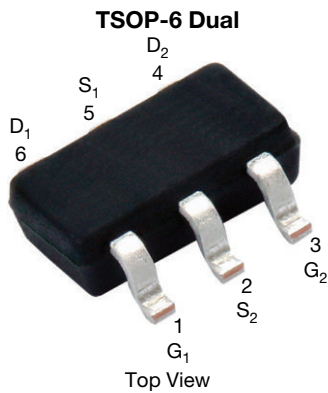


Automotive N- and P-Channel 20 V (D-S) MOSFET



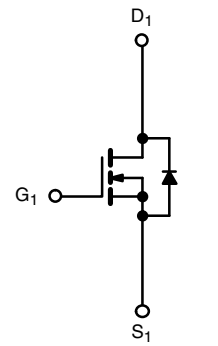
FEATURES

- TrenchFET® power MOSFET
- AEC-Q101 qualified
- 100 % R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

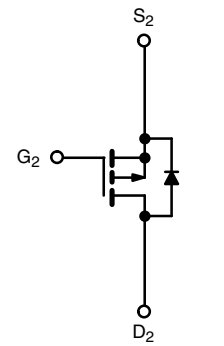
 AUTOMOTIVE
GRADE

RoHS
COMPLIANT
HALOGEN
FREE

PRODUCT SUMMARY		
	N-CHANNEL	P-CHANNEL
V _{DS} (V)	20	-20
R _{DS(on)} (Ω) at V _{GS} = 4.5 V	0.077	0.166
R _{DS(on)} (Ω) at V _{GS} = ± 2.5 V	0.120	0.318
I _D (A)	3.57	-2.5
Configuration	Dual	
Package	TSOP-6	



N-Channel MOSFET



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C, unless otherwise noted)				
PARAMETER	SYMBOL	N-CHANNEL	P-CHANNEL	UNIT
Drain-Source Voltage	V _{DS}	20	-20	V
Gate-Source Voltage	V _{GS}	± 12	± 12	
Continuous Drain Current (T _J = 150 °C) ^a	I _D	T _C = 25 °C	3.57	A
		T _C = 125 °C	2	
Pulsed Drain Current	I _{DM}	12	-10	A
Continuous Source Current (Diode Conduction) ^a	I _S	2.1	-2.1	
Maximum Power Dissipation ^a	P _D	T _C = 25 °C	1.67	W
		T _C = 125 °C	0.56	
Unclamped Inductive Surge UIS	I _{AV}	3.3	3	A
Operating Junction and Storage Temperature Range	T _J , T _{stg}	-55 to +175		°C

THERMAL RESISTANCE RATINGS					
PARAMETER	SYMBOL	N-CHANNEL	P-CHANNEL	UNIT	
		MAX.	MAX.		
Maximum Junction-to-Ambient ^a	Steady State	R _{thJA}	150	150	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	R _{thJF}	90	90	

Note

a. Surface mounted on 1" x 1" FR4 board.



SPECIFICATIONS (T _J = 25°C, unless otherwise noted)								
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT	
Static								
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		N-Ch	0.6	-	1.5	V
		V _{DS} = V _{GS} , I _D = -250 μA		P-Ch	-0.6	-	-1.5	
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 12 V		N-Ch	-	-	± 100	nA
				P-Ch	-	-	± 100	
Zero Gate Voltage Drain Current	I _{DSS}	V _{GS} = 0 V	V _{DS} = 30 V	N-Ch	-	-	1	μA
		V _{GS} = 0 V	V _{DS} = -30 V	P-Ch	-	-	-1	
		V _{GS} = 0 V	V _{DS} = 30 V, T _J = 55 °C	N-Ch	-	-	5	
		V _{GS} = 0 V	V _{DS} = -30 V, T _J = 55 °C	P-Ch	-	-	-5	
On-State Drain Current ^a	I _{D(on)}	V _{GS} = 4.5 V	V _{DS} ≥ 5 V	N-Ch	5	-	-	A
		V _{GS} = -4.5 V	V _{DS} ≤ -5 V	P-Ch	-5	-	-	
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 4.5 V	I _D = 1 A	N-Ch	-	0.049	0.077	Ω
		V _{GS} = -4.5 V	I _D = -1 A	P-Ch	-	0.140	0.166	
		V _{GS} = 2.5 V	I _D = 1 A	N-Ch	-	0.066	0.120	
		V _{GS} = -2.5 V	I _D = -1 A	P-Ch	-	0.265	0.318	
Forward Transconductance ^a	g _{fs}	V _{DS} = 5 V, I _D = 1 A		N-Ch	-	10	-	S
		V _{DS} = -5 V, I _D = -1 A		P-Ch	-	3	-	
Diode Forward Voltage ^a	V _{SD}	I _S = 1.05 A, V _{GS} = 0 V		N-Ch	-	0.80	1.10	V
		I _S = -1.05 A, V _{GS} = 0 V		P-Ch	-	-0.83	-1.10	
Dynamic ^b								
Total Gate Charge	Q _g	V _{GS} = 4.5 V	V _{DS} = 10 V, I _D = 1 A	N-Ch	-	1.8	2.5	nC
		V _{GS} = -4.5 V	V _{DS} = -10 V, I _D = -1 A	P-Ch	-	2.4	3.5	
Gate-Source Charge	Q _{gs}	V _{GS} = 4.5 V	V _{DS} = 10 V, I _D = 1 A	N-Ch	-	0.3	-	nC
		V _{GS} = -4.5 V	V _{DS} = -10 V, I _D = -1 A	P-Ch	-	0.4	-	
Gate-Drain Charge	Q _{gd}	V _{GS} = 4.5 V	V _{DS} = 10 V, I _D = 1 A	N-Ch	-	0.4	-	nC
		V _{GS} = -4.5 V	V _{DS} = -10 V, I _D = -1 A	P-Ch	-	0.7	-	
Gate Resistance	R _g	f = 1 MHz		N-Ch	3.4	-	9.1	Ω
				P-Ch	3.4	-	9.1	
Turn-On Delay Time	t _{d(on)}	N-Channel V _{DD} = 10 V, R _L = 10 Ω I _D ≅ 1 A, V _{GEN} = 10 V, R _g = 1 kΩ		N-Ch	-	9	12	ns
Rise Time	t _r			P-Ch	-	7	11	
		Turn-Off Delay Time	t _{d(off)}	P-Channel V _{DD} = -10 V, R _L = 10 Ω I _D ≅ -1 A, V _{GEN} = -10 V, R _g = 1 kΩ		N-Ch	-	
P-Ch	-					16	22	
Fall Time	t _f			N-Ch	-	22	28	
				P-Ch	-	29	40	
				N-Ch	-	8	12	
				P-Ch	-	14	24	

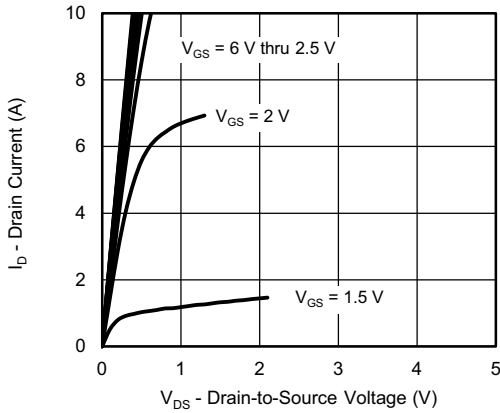
Notes

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

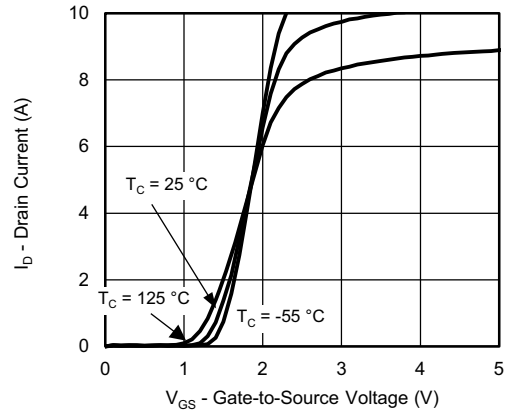
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



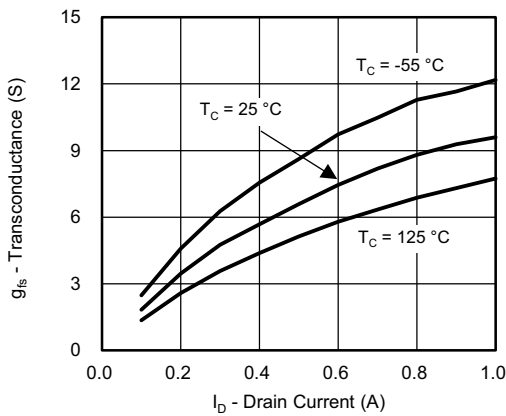
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)



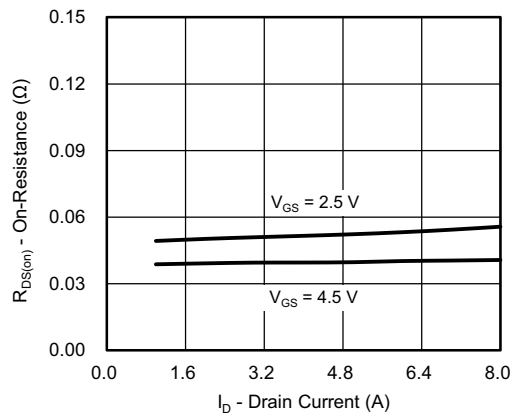
Output Characteristics



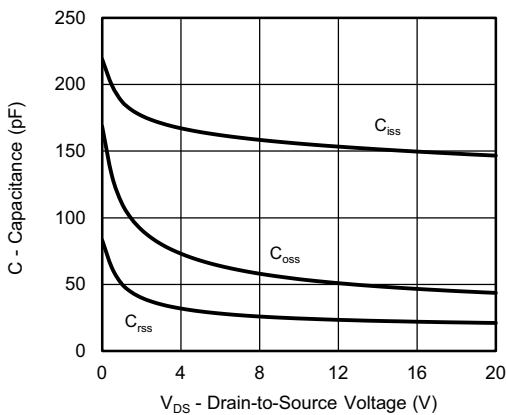
Transfer Characteristics



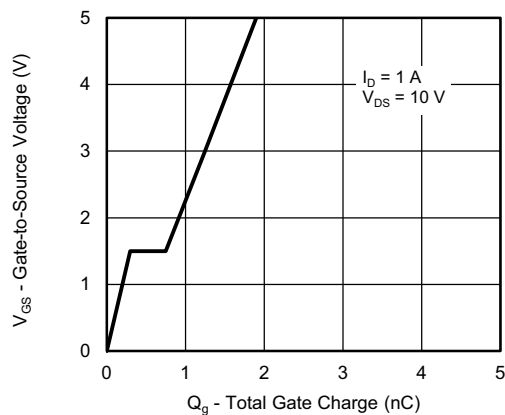
Transconductance



On-Resistance vs. Drain Current



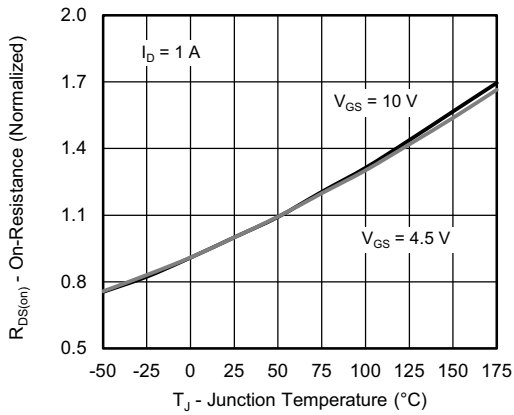
Capacitance



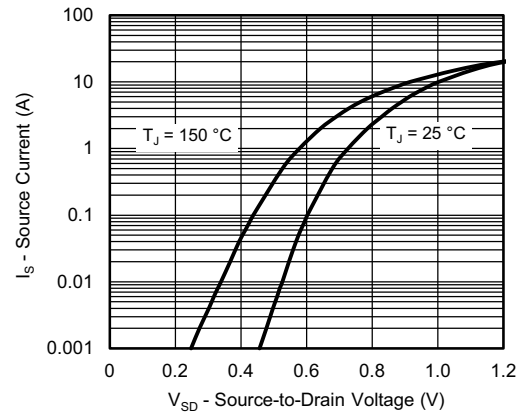
Gate Charge



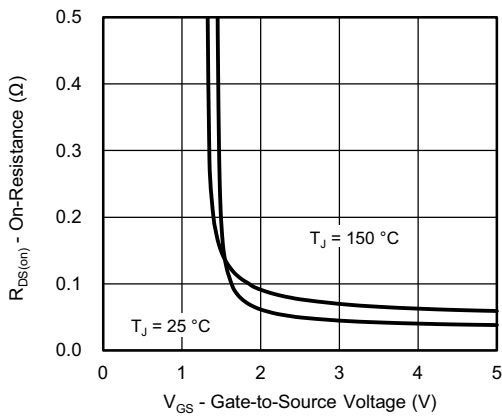
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)



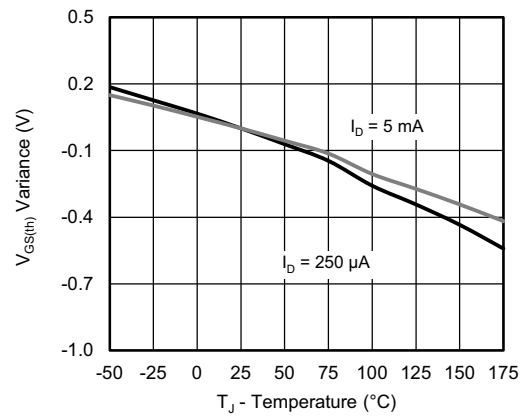
On-Resistance vs. Junction Temperature



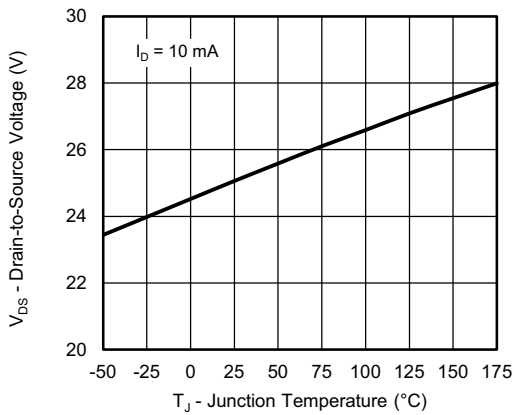
Source-Drain Diode Forward Voltage



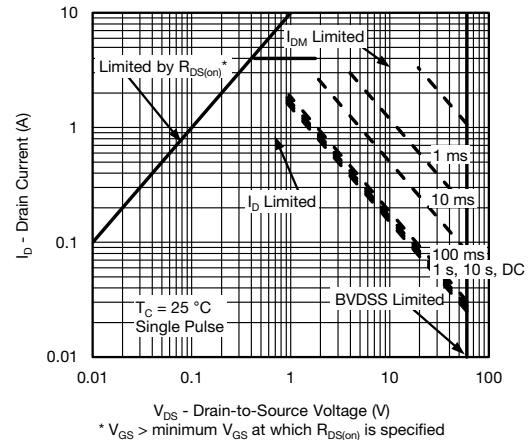
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



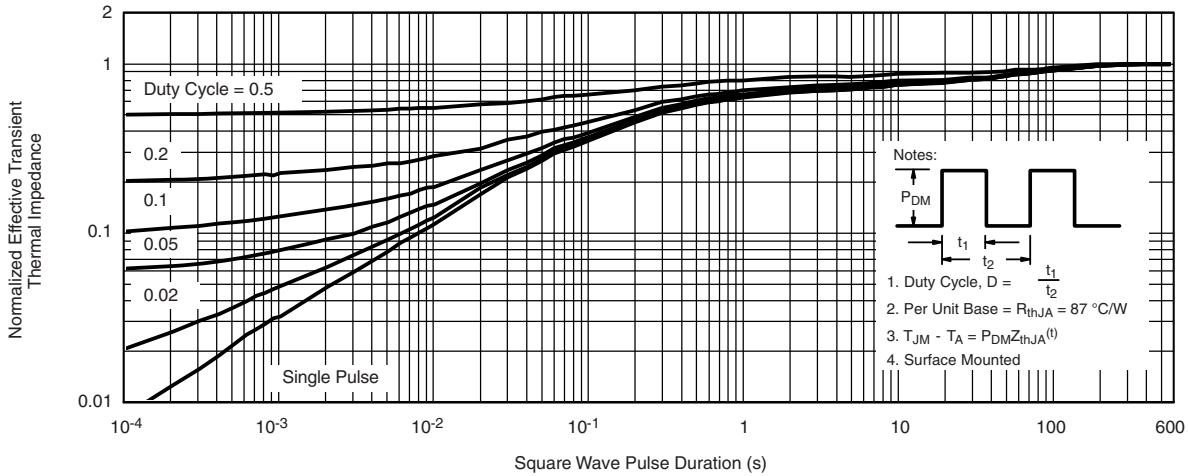
Drain Source Breakdown vs. Junction Temperature



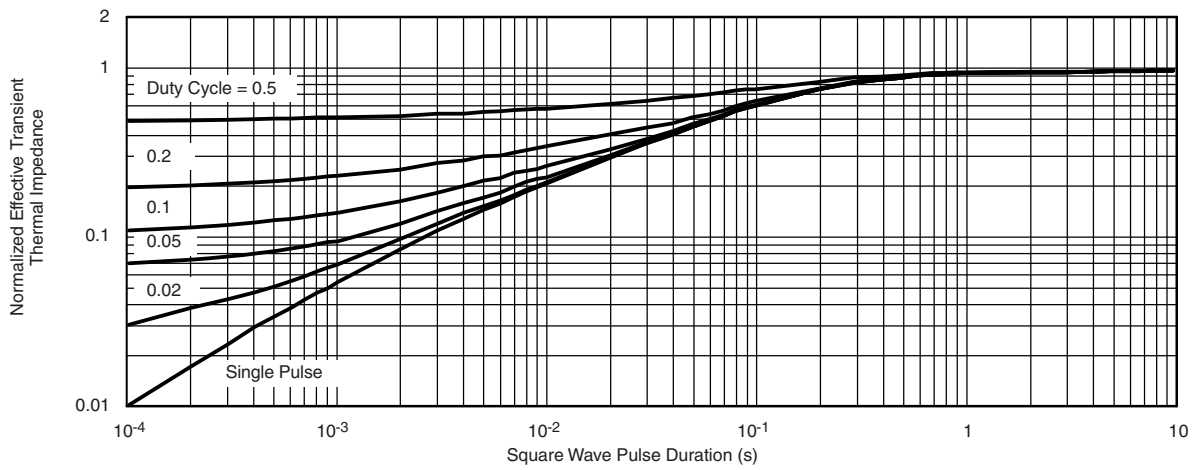
Safe Operating Area, Junction-to-Case



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

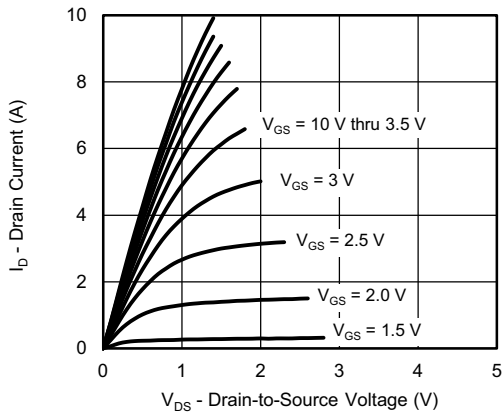


Normalized Thermal Transient Impedance, Junction-to-Ambient

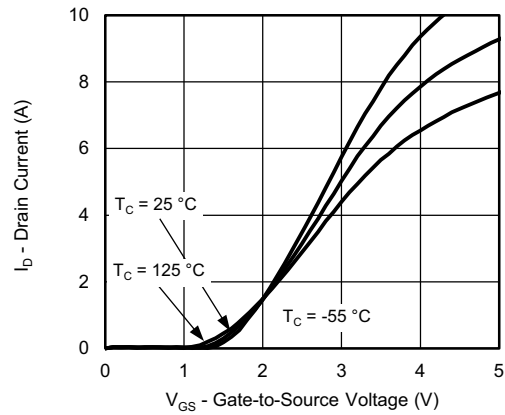


Normalized Thermal Transient Impedance, Junction-to-Foot

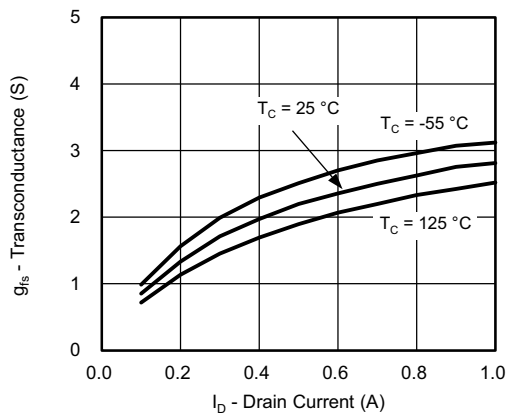
P-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)



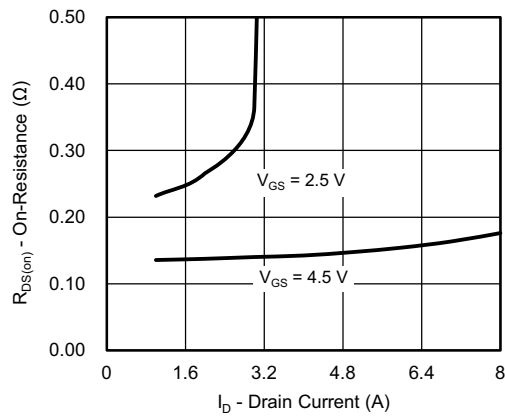
Output Characteristics



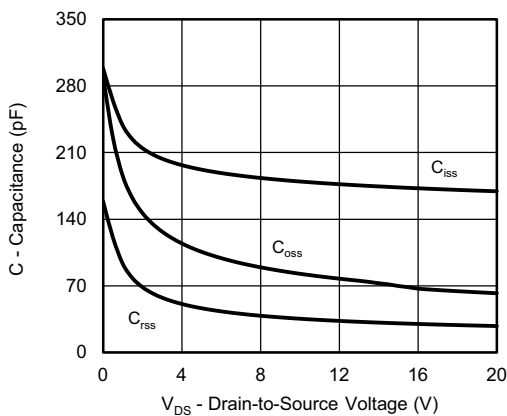
Transfer Characteristics



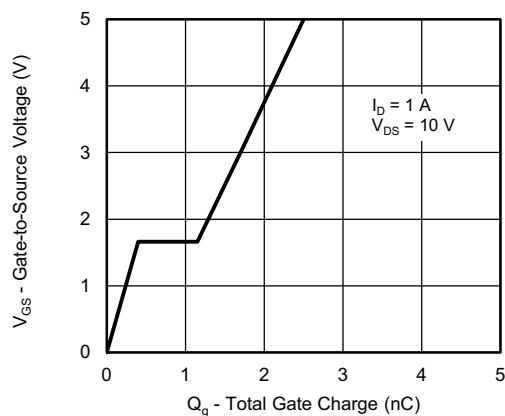
Transconductance



On-Resistance vs. Drain Current

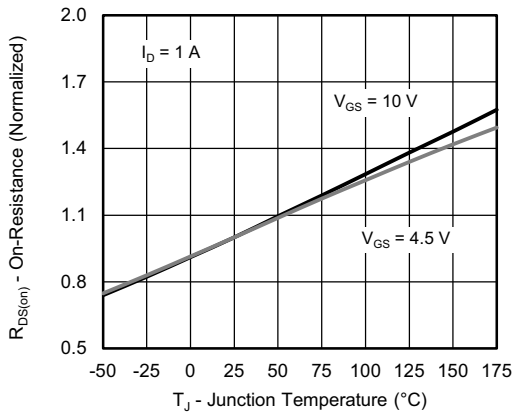


Capacitance

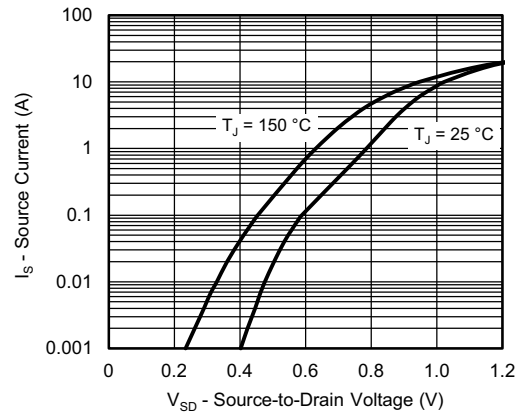


Gate Charge

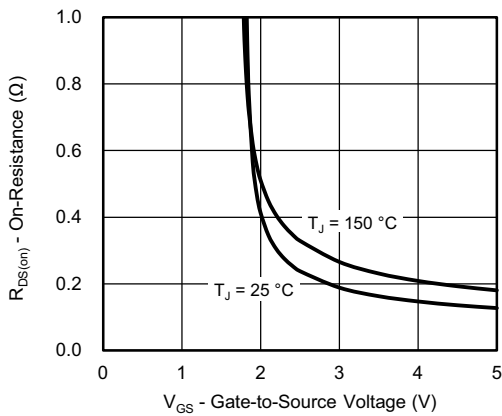
P-CHANNEL TYPICAL CHARACTERISTICS (25 °C unless otherwise noted)



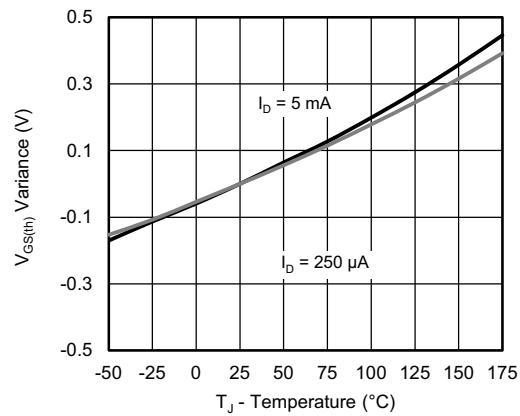
On-Resistance vs. Junction Temperature



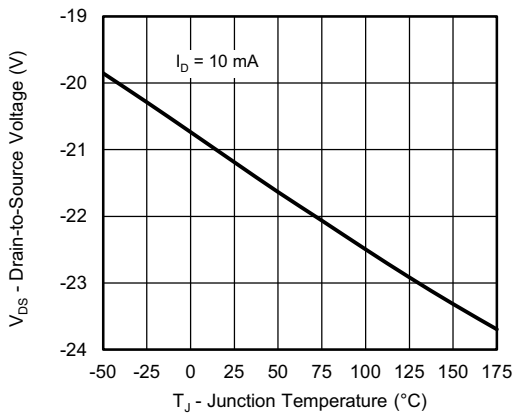
Source-Drain Diode Forward Voltage



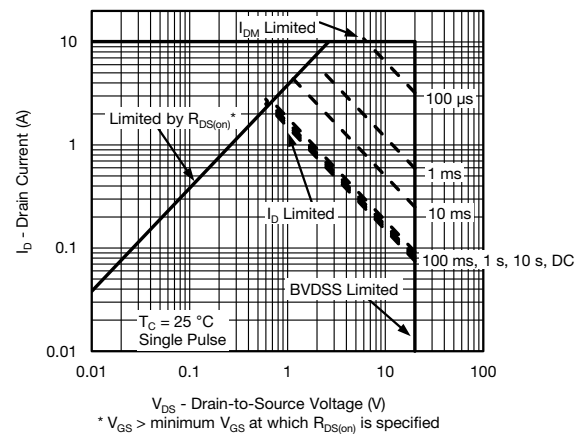
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



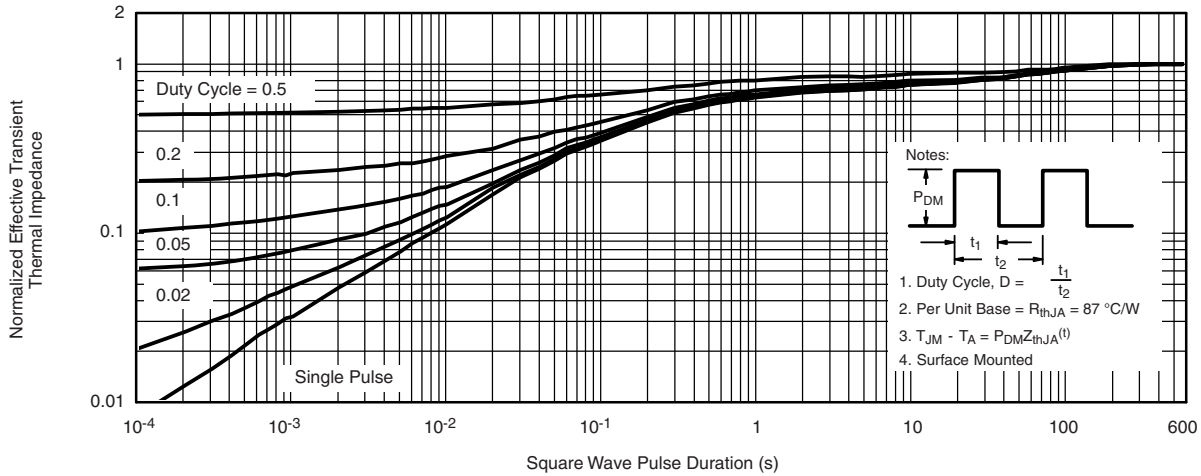
Drain Source Breakdown vs. Junction Temperature



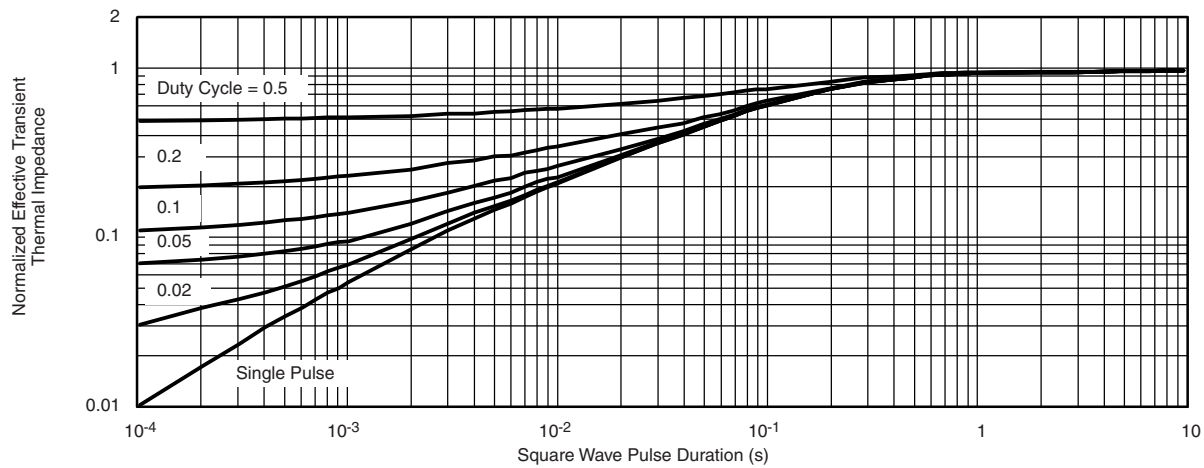
Safe Operating Area, Junction-to-Case



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



Normalized Thermal Transient Impedance, Junction-to-Ambient

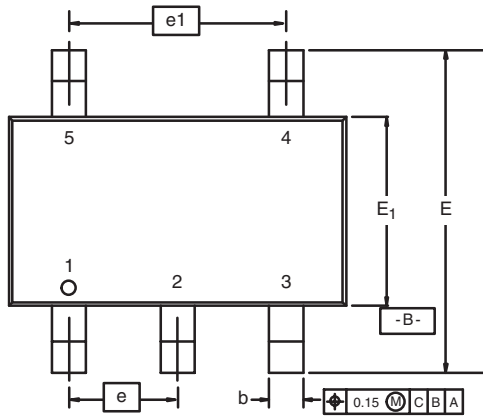


Normalized Thermal Transient Impedance, Junction-to-Foot

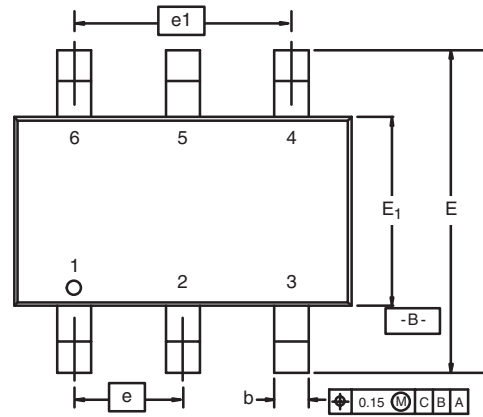
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TSOP: 5/6-LEAD

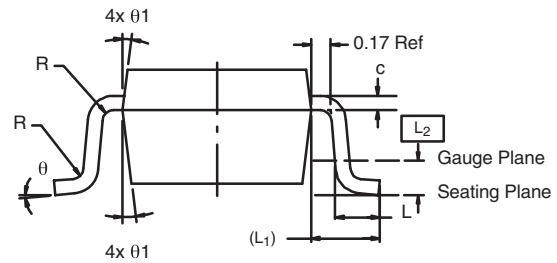
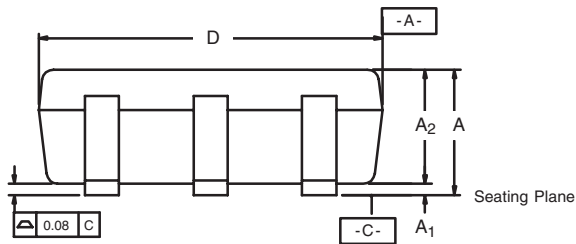
JEDEC Part Number: MO-193C



5-LEAD TSOP



6-LEAD TSOP



Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.91	-	1.10	0.036	-	0.043
A₁	0.01	-	0.10	0.0004	-	0.004
A₂	0.90	-	1.00	0.035	0.038	0.039
b	0.30	0.32	0.45	0.012	0.013	0.018
c	0.10	0.15	0.20	0.004	0.006	0.008
D	2.95	3.05	3.10	0.116	0.120	0.122
E	2.70	2.85	2.98	0.106	0.112	0.117
E₁	1.55	1.65	1.70	0.061	0.065	0.067
e	0.95 BSC			0.0374 BSC		
e₁	1.80	1.90	2.00	0.071	0.075	0.079
L	0.32	-	0.50	0.012	-	0.020
L₁	0.60 Ref			0.024 Ref		
L₂	0.25 BSC			0.010 BSC		
R	0.10	-	-	0.004	-	-
θ	0°	4°	8°	0°	4°	8°
θ₁	7° Nom			7° Nom		
ECN: C-06593-Rev. I, 18-Dec-06						
DWG: 5540						

RECOMMENDED MINIMUM PADS FOR TSOP-6



Recommended Minimum Pads
Dimensions in Inches/(mm)

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