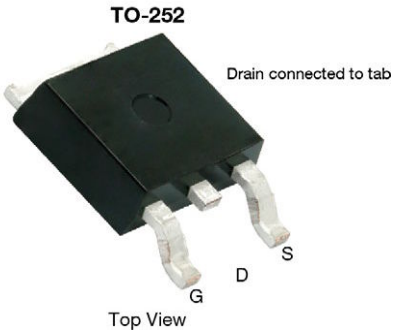
Automotive N-Channel 40 V (D-S) 175 °C MOSFET



FEATURES

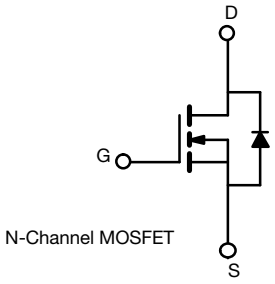
- TrenchFET® power MOSFET
- Package with low thermal resistance
- 100 % R_g and UIS tested
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

Pb-free

RoHS COMPLIANT

HALOGEN FREE



PRODUCT SUMMARY	
V_{DS} (V)	40
$R_{DS(on)}$ (Ω) at V_{GS} = 10 V	0.0060
$R_{DS(on)}$ (Ω) at V_{GS} = 4.5 V	0.0078
I_D (A)	30
Configuration	Single
Package	TO-252

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 [a]	T_C = 25 °C	I_D	30	A
	T_C = 125 °C		30	
Continuous source current (diode conduction) [a]		I_S	30	
Pulsed drain current [b]		I_{DM}	120	
Single pulse avalanche current	L = 0.1 mH	I_{AS}	24	
Single pulse avalanche energy		E_{AS}	28.8	mJ
Maximum power dissipation	T_C = 25 °C	P_D	62	W
	T_C = 125 °C		20	
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 [c]	R_{thJA}	50	°C/W
Junction-to-case (drain)		R_{thJC}	2.4	

Notes

a. Package limited
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %
c. When mounted on 1" square PCB (FR4 material)

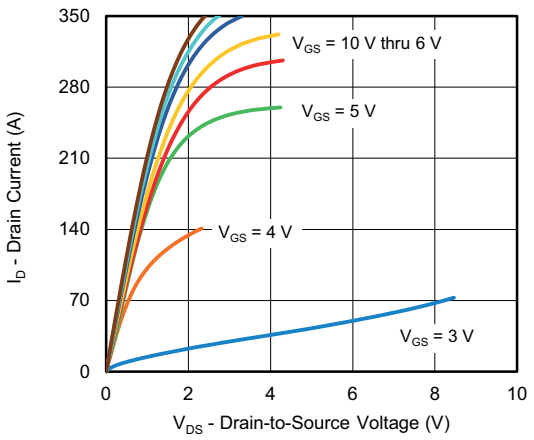
SPECIFICATIONS (T_C = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Drain-source breakdown voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA		40	-	-	V
Gate-source threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA		1.2	1.7	2.2	
Gate-source leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 20 V		-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	V_{GS} = 0 V	V_{DS} = 40 V	-	-	1	µA
		V_{GS} = 0 V	V_{DS} = 40 V, T_J = 125 °C	-	-	50	
		V_{GS} = 0 V	V_{DS} = 40 V, T_J = 175 °C	-	-	250	µA
On-state drain current [a]	$I_{D(on)}$	V_{GS} = 10 V	V_{DS} ≥ 5 V	20	-	-	A
Drain-source on-state resistance [a]	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 15 A	-	0.0046	0.0060	Ω
		V_{GS} = 4.5 V	I_D = 10 A	-	0.0060	0.0078	
		V_{GS} = 10 V	I_D = 15 A, T_J = 125 °C	-	-	0.0091	
		V_{GS} = 10 V	I_D = 15 A, T_J = 175 °C	-	-	0.0107	
Forward transconductance [b]	g_{fs}	V_{DS} = 15 V, I_D = 15 A		-	62	-	S
Dynamic [b]							
Input capacitance	C_{iss}	V_{GS} = 0 V	V_{DS} = 25 V, f = 1 MHz	-	1844	2600	pF
Output capacitance	C_{oss}			-	527	750	
Reverse transfer capacitance	C_{rss}			-	56	80	
Total gate charge [c]	Q_g	V_{GS} = 10 V	V_{DS} = 20 V, I_D = 15 A	-	34.5	52	nC
Gate-source charge [c]	Q_{gs}			-	6.1	-	
Gate-drain charge [c]	Q_{gd}			-	6.6	-	
Gate resistance	R_g	f = 1 MHz		1.45	2.91	4.37	Ω
Turn-on delay time [c]	$t_{d(on)}$	V_{DD} = 20 V, R_L = 1.33 Ω I_D ≅ 15 A, V_{GEN} = 10 V, R_g = 1 Ω		-	12	25	ns
Rise time [c]	t_r			-	7	15	
Turn-off delay time [c]	$t_{d(off)}$			-	28	50	
Fall time [c]	t_f			-	10	20	
Source-Drain Diode Ratings and Characteristics [b]							
Pulsed current [a]	I_{SM}			-	-	120	A
Forward voltage	V_{SD}	I_F = 15 A, V_{GS} = 0 V		-	0.83	1.5	V
Body diode reverse recovery time	t_{rr}	I_F = 10 A, di/dt = 100 A/µs		-	26	52	ns
Body diode reverse recovery charge	Q_{rr}			-	13	26	nC
Reverse recovery fall time	t_a			-	11	-	ns
Reverse recovery rise time	t_b			-	15	-	
Body diode peak reverse recovery current	$I_{RM(REC)}$			-	-0.86	-	A

Notes

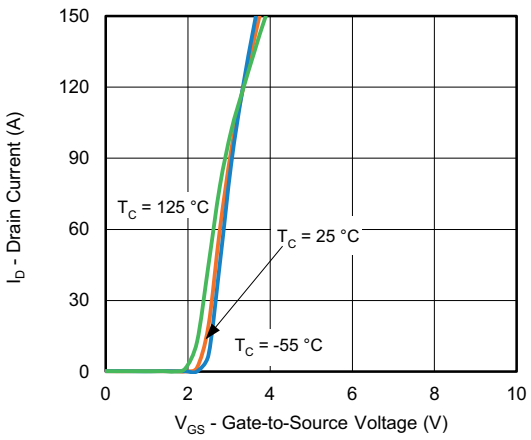
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %
b. Guaranteed by design, not subject to production testing
c. Independent of operating temperature

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.

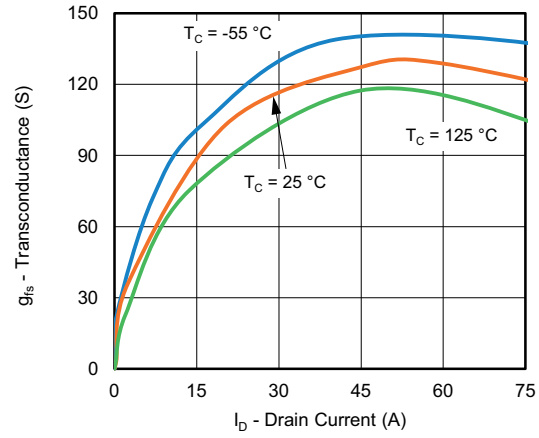
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



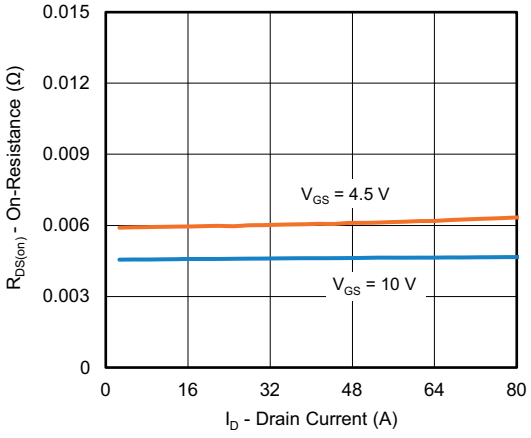
Output Characteristics



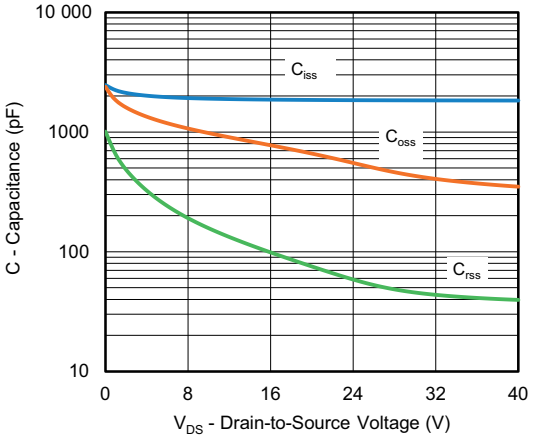
Transfer Characteristics



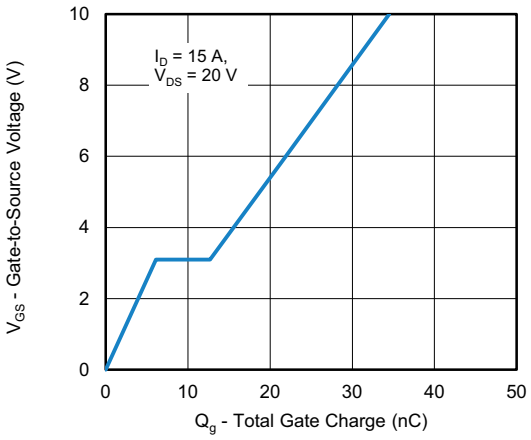
Transconductance



On-Resistance vs. Drain Current

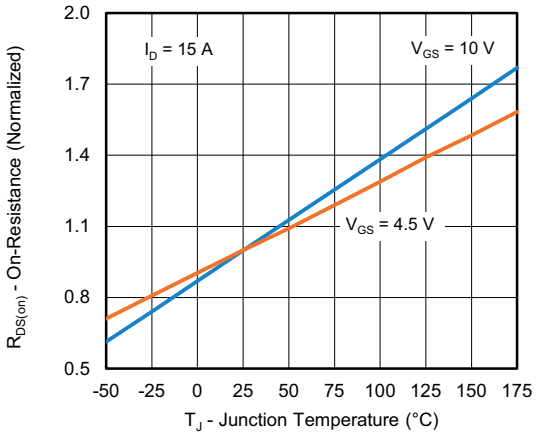


Capacitance

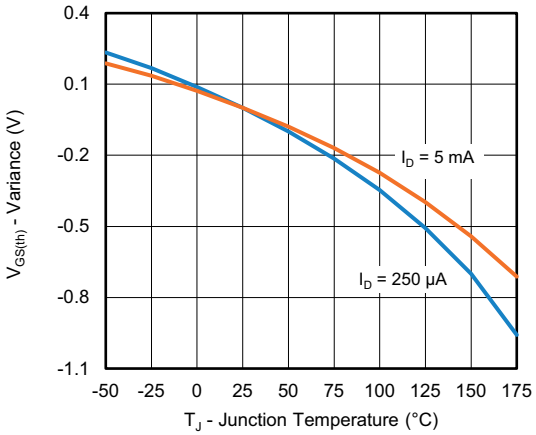


Gate Charge

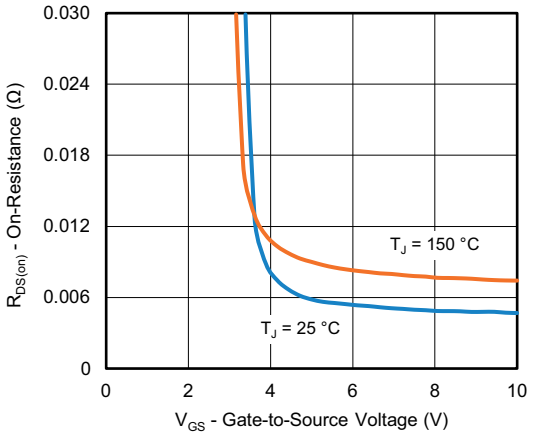
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



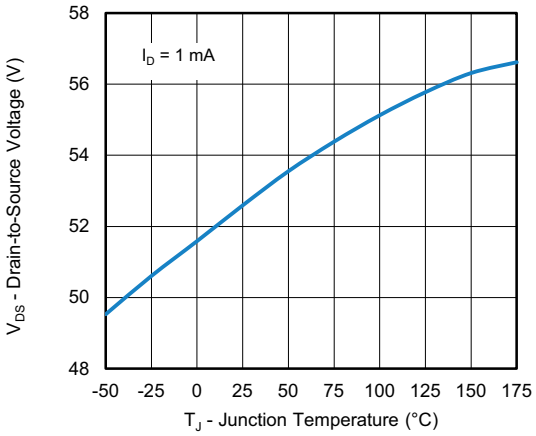
On-Resistance vs. Junction Temperature



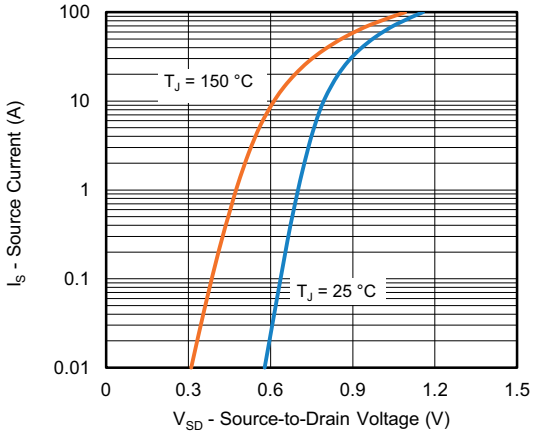
Threshold Voltage



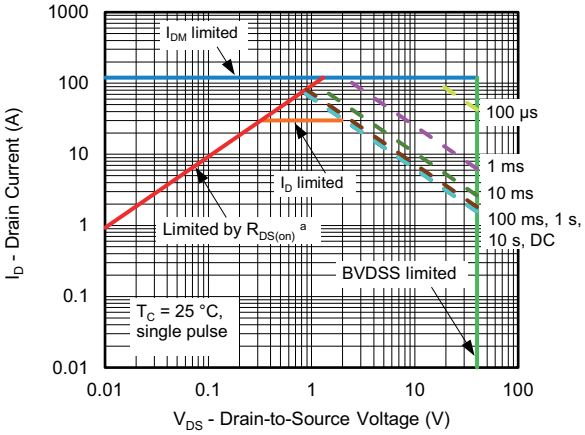
On-Resistance vs. Gate-to-Source Voltage



Drain Source Breakdown vs. Junction Temperature



Source Drain Diode Forward Voltage

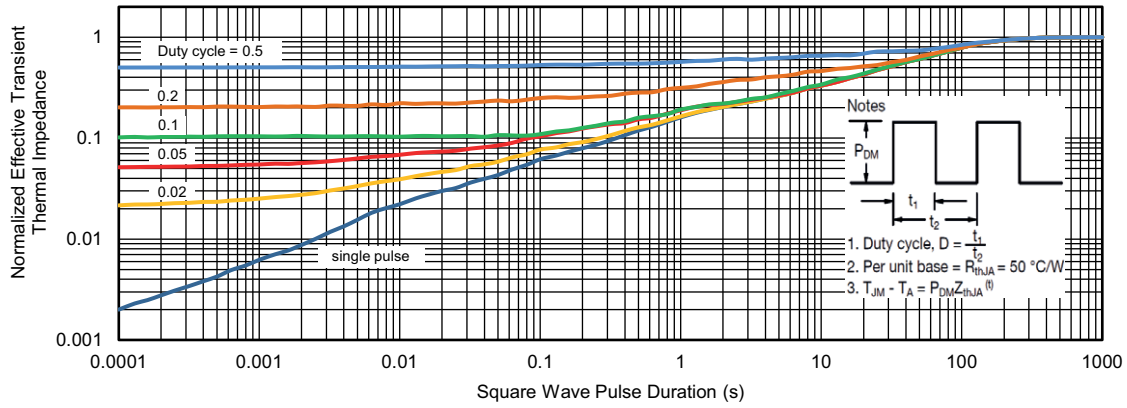


Safe Operating Area

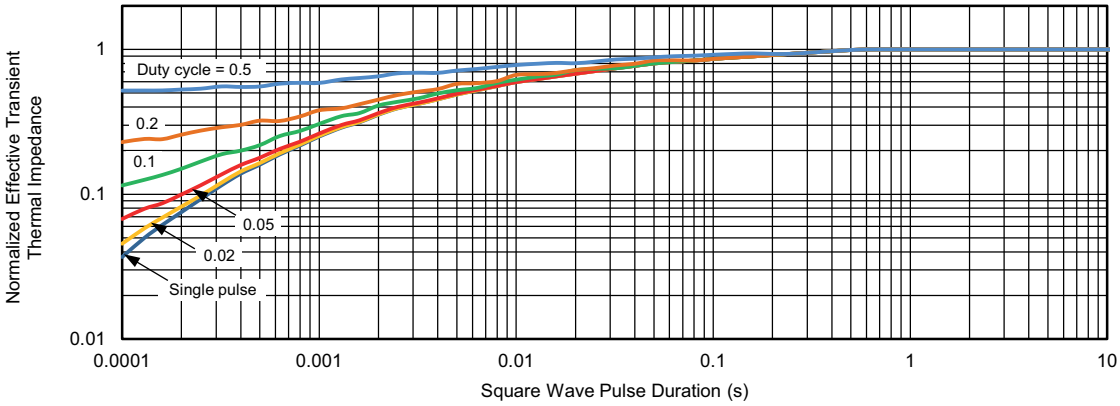
Note

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

THERMAL RATINGS (T_A = 25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

Note

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction-to-Case (25 °C)

  are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions

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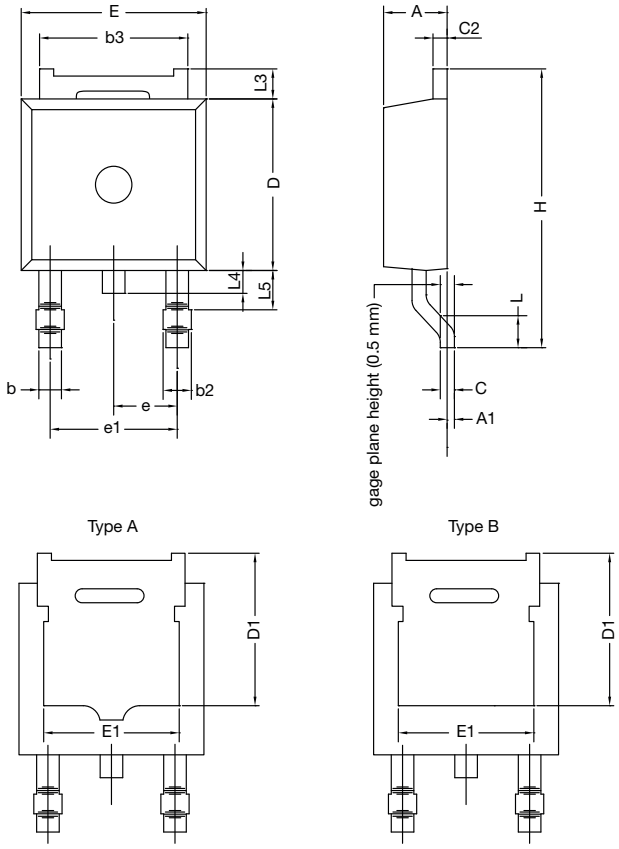
TO-252AA Case Outline

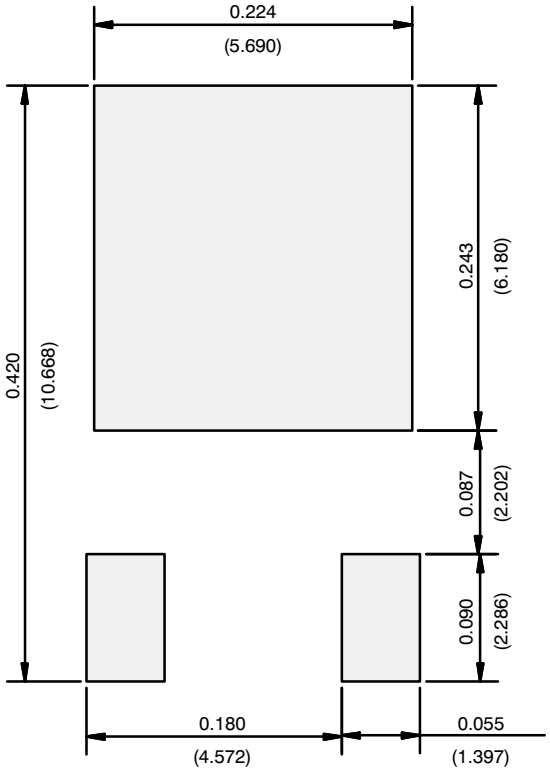


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.38	0.086	0.094
A1	-	0.127	-	0.005
b	0.64	0.88	0.025	0.035
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
C	0.46	0.61	0.018	0.024
C2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	4.10	-	0.161	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
H	9.40	10.41	0.370	0.410
e	2.28 BSC		0.090 BSC	
e1	4.56 BSC		0.180 BSC	
L	1.40	1.78	0.055	0.070
L3	0.89	1.27	0.035	0.050
L4	-	1.02	-	0.040
L5	1.01	1.52	0.040	0.060
ECN: T25-0122-Rev. C, 12-May-2025 DWG: 6019				

Notes

- Dimension L3 is for reference only
- Dimension D1 and E1 on type A and B is the same

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads
Dimensions in Inches/(mm)

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