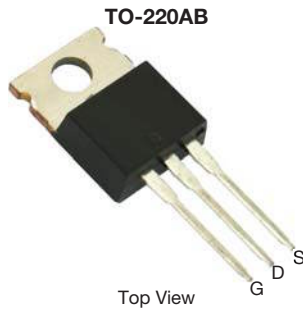


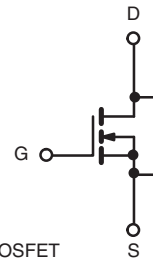
# Automotive N-Channel 250 V (D-S) 175 °C MOSFET



## FEATURES

- TrenchFET® power MOSFET
- Package with low thermal resistance
- AEC-Q101 qualified
- 100 % R<sub>g</sub> and UIS tested
- Material categorization:  
for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

 AUTOMOTIVE  
GRADE

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


PRODUCT SUMMARY	
V <sub>DS</sub> (V)	250
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = 10 V	0.0300
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = 7.5 V	0.0320
I <sub>D</sub> (A)	53
Configuration	Single
Package	TO-220

ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V <sub>DS</sub>	250	V
Gate-source voltage		V <sub>GS</sub>	± 20	
Continuous drain current	T <sub>C</sub> = 25 °C	I <sub>D</sub>	53	A
	T <sub>C</sub> = 125 °C		30	
Continuous source current (diode conduction) <sup>a</sup>		I <sub>S</sub>	120	
Pulsed drain current <sup>b</sup>		I <sub>DM</sub>	180	
Single pulse avalanche current	L = 0.1 mH	I <sub>AS</sub>	41	
Single pulse avalanche energy		E <sub>AS</sub>	84	
Maximum power dissipation <sup>b</sup>	T <sub>C</sub> = 25 °C	P <sub>D</sub>	250	W
	T <sub>C</sub> = 125 °C		83	
Operating junction and storage temperature range		T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C

THERMAL RESISTANCE RATINGS				
PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-ambient	PCB mount <sup>c</sup>	R <sub>thJA</sub>	40	°C/W
Junction-to-case (drain)		R <sub>thJC</sub>	0.6	

### Notes

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



SPECIFICATIONS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		250	-	-	V
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.5	3.0	3.5	
Gate-source leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$		-	-	$\pm 100$	nA
Zero gate voltage drain current	$I_{DSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 250\text{ V}$	-	-	1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$	$V_{DS} = 250\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	50	
		$V_{GS} = 0\text{ V}$	$V_{DS} = 250\text{ V}, T_J = 175\text{ }^\circ\text{C}$	-	-	600	
On-state drain current <sup>a</sup>	$I_{D(on)}$	$V_{GS} = 10\text{ V}$	$V_{DS} \geq 5\text{ V}$	30	-	-	A
Drain-source on-state resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 15\text{ A}$	-	0.0244	0.0300	$\Omega$
		$V_{GS} = 7.5\text{ V}$	$I_D = 10\text{ A}$	-	0.0260	0.0320	
		$V_{GS} = 10\text{ V}$	$I_D = 15\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	-	0.0641	
		$V_{GS} = 10\text{ V}$	$I_D = 15\text{ A}, T_J = 175\text{ }^\circ\text{C}$	-	-	0.0853	
Forward transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 15\text{ A}$		-	50	-	S
<b>Dynamic <sup>b</sup></b>							
Input capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	-	2880	4050	$\mu\text{F}$
Output capacitance	$C_{oss}$			-	1480	2100	
Reverse transfer capacitance	$C_{rss}$			-	58	85	
Total gate charge <sup>c</sup>	$Q_g$	$V_{GS} = 10\text{ V}$	$V_{DS} = 125\text{ V}, I_D = 10\text{ A}$	-	50	75	nC
Gate-source charge <sup>c</sup>	$Q_{gs}$			-	12	-	
Gate-drain charge <sup>c</sup>	$Q_{gd}$			-	15	-	
Gate Resistance	$R_g$	f = 1 MHz		1.40	2.84	4.40	$\Omega$
Turn-on delay time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = 125\text{ V}, R_L = 12.5\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		-	14	30	ns
Rise time <sup>c</sup>	$t_r$			-	6	15	
Turn-off delay time <sup>c</sup>	$t_{d(off)}$			-	38	60	
Fall time <sup>c</sup>	$t_f$			-	10	20	
<b>Source-Drain Diode Ratings and Characteristics <sup>b</sup></b>							
Pulsed current <sup>a</sup>	$I_{SM}$			-	-	180	A
Forward voltage	$V_{SD}$	$I_F = 20\text{ A}, V_{GS} = 0\text{ V}$		-	0.82	1.5	V
Body diode reverse recovery time	$t_{rr}$	$I_F = 10\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		-	155	310	ns
Body diode reverse recovery charge	$Q_{rr}$			-	933	1900	nC
Reverse recovery fall time	$t_a$			-	122	-	ns
Reverse recovery rise time	$t_b$			-	33	-	
Body diode peak reverse recovery current	$I_{RM(REC)}$			-	-11.6	-	A

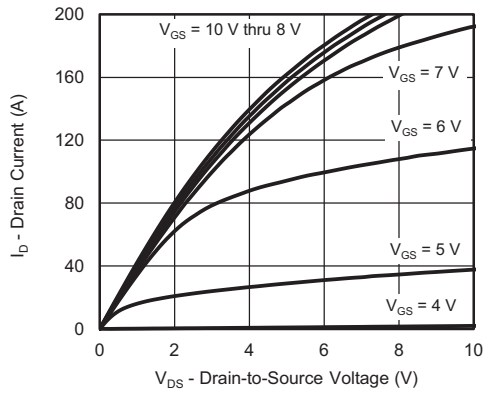
**Notes**

- 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

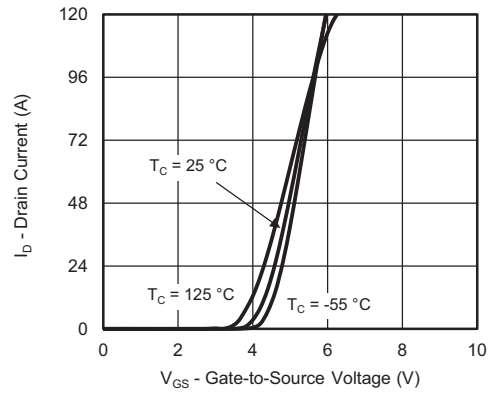
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



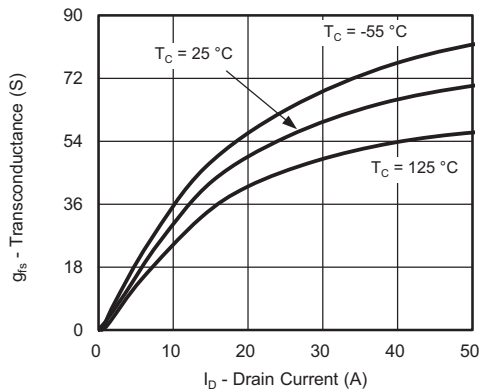
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



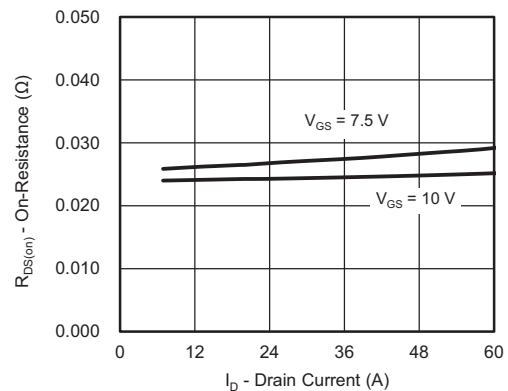
Output Characteristics



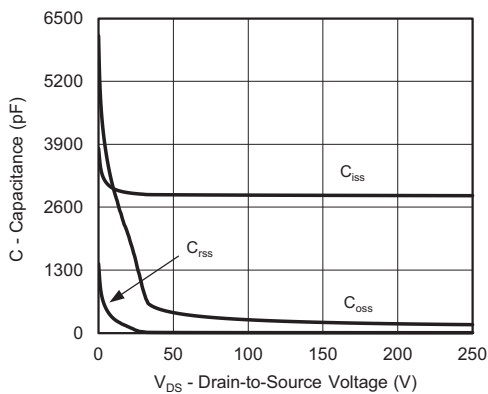
Transfer Characteristics



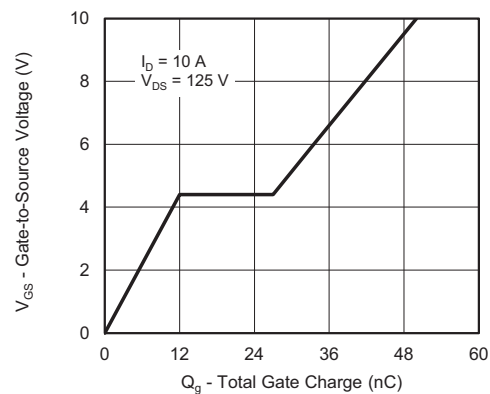
Transconductance



On-Resistance vs. Drain Current

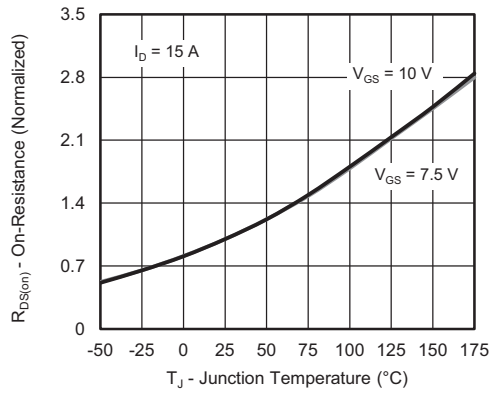


Capacitance

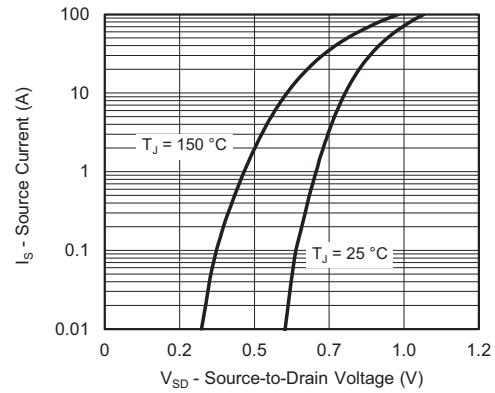


Gate Charge

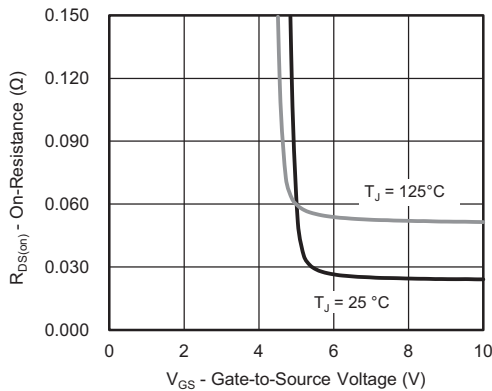
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



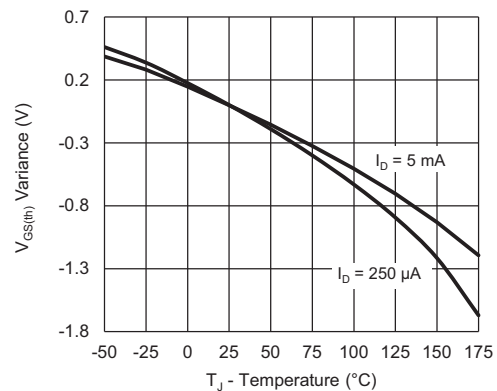
**On-Resistance vs. Junction Temperature**



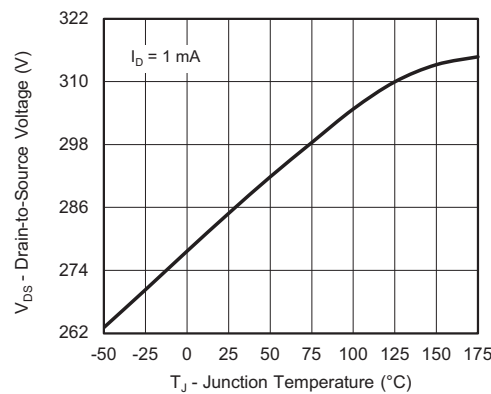
**Source Drain Diode Forward Voltage**



**On-Resistance vs. Gate-to-Source Voltage**



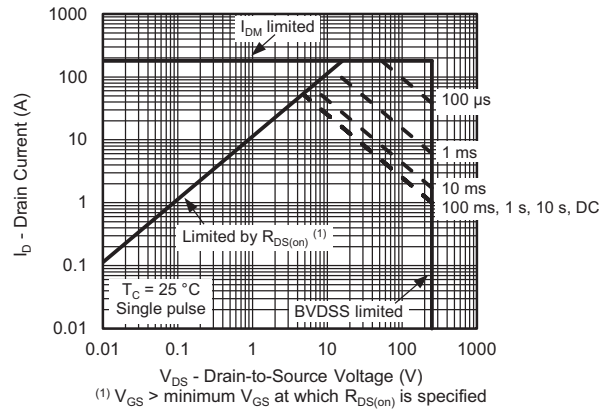
**Threshold Voltage**



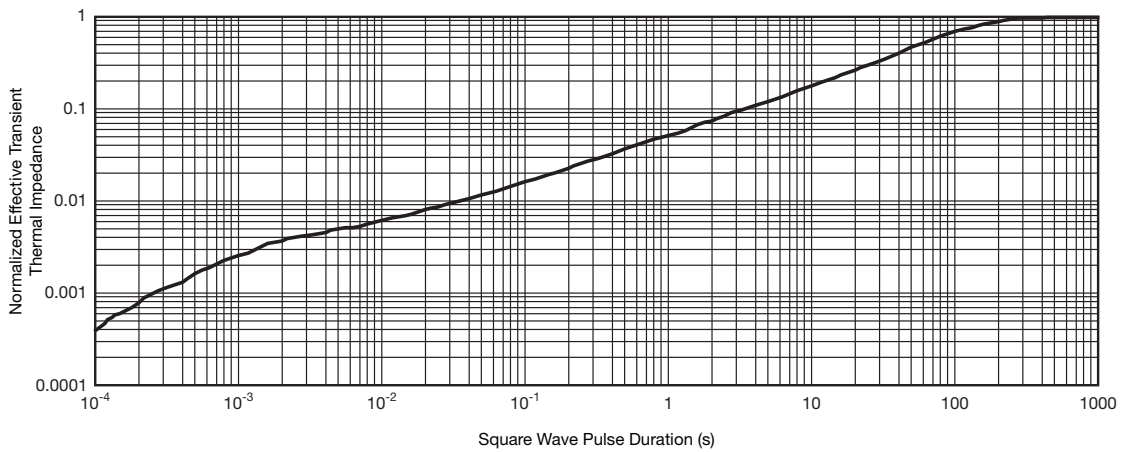
**Drain Source Breakdown vs. Junction Temperature**



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



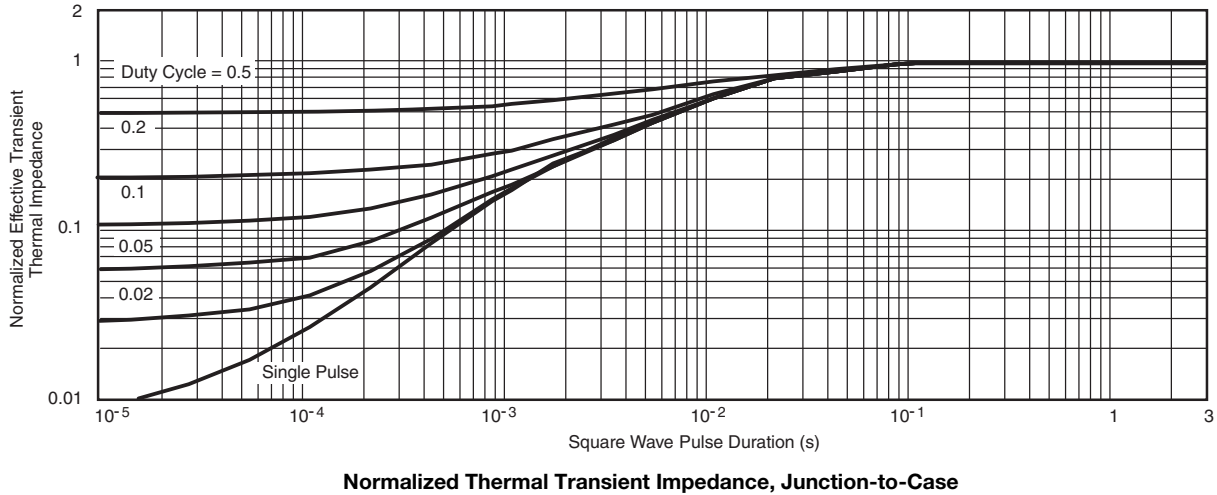
**Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Ambient**



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



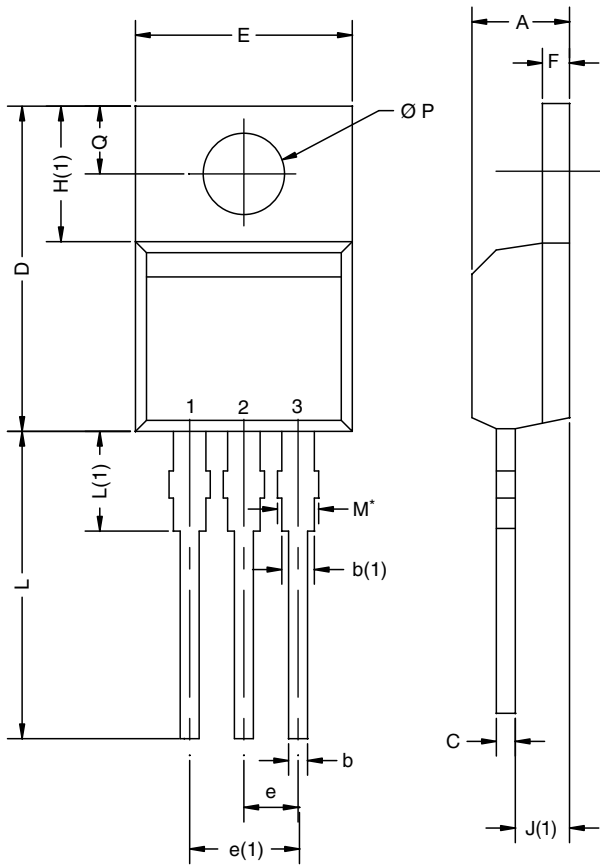
**Note**

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction to Ambient ( $25\text{ }^\circ\text{C}$ )
  - Normalized Transient Thermal Impedance Junction to Case ( $25\text{ }^\circ\text{C}$ )
 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-220AB

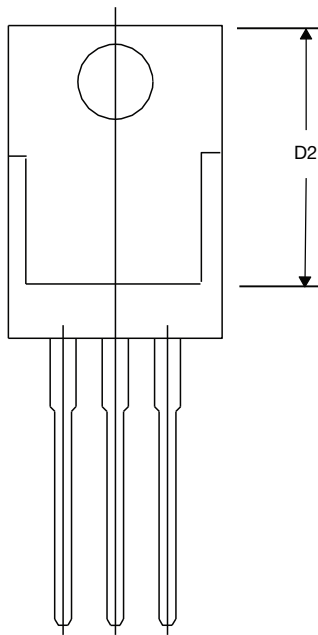


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
D2	12.19	12.70	0.480	0.500
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	6.09	6.48	0.240	0.255
J(1)	2.41	2.92	0.095	0.115
L	13.35	14.02	0.526	0.552
L(1)	3.32	3.82	0.131	0.150
$\varnothing P$	3.54	3.94	0.139	0.155
Q	2.60	3.00	0.102	0.118

ECN: T14-0413-Rev. P, 16-Jun-14  
DWG: 5471

**Note**

\* M = 1.32 mm to 1.62 mm (dimension including protrusion)  
Heatsink hole for HVM





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