



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

PRODUCT SUMMARY	
V <sub>DS</sub> (V)	40
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = 10 V	0.0036
I <sub>D</sub> (A)	100
Configuration	Single
Package	TO-220

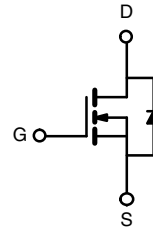
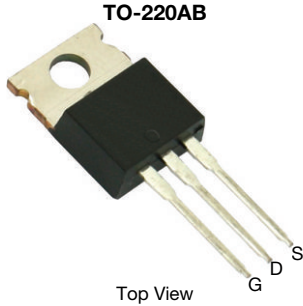
### FEATURES

- TrenchFET® power MOSFET
- Package with low thermal resistance
- AEC-Q101 qualified <sup>d</sup>
- 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



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V <sub>DS</sub>	40	V
Gate-Source Voltage		V <sub>GS</sub>	± 20	
Continuous Drain Current	T <sub>C</sub> = 25 °C <sup>a</sup>	I <sub>D</sub>	100	A
	T <sub>C</sub> = 125 °C		74	
Continuous Source Current (Diode Conduction) <sup>a</sup>		I <sub>S</sub>	100	
Pulsed Drain Current <sup>b</sup>		I <sub>DM</sub>	400	
Single Pulse Avalanche Current	L = 0.1 mH	I <sub>AS</sub>	60	
Single Pulse Avalanche Energy		E <sub>AS</sub>	180	
Maximum Power Dissipation <sup>b</sup>	T <sub>C</sub> = 25 °C	P <sub>D</sub>	120	W
	T <sub>C</sub> = 125 °C		40	
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>	1.25	

### Notes

- Package limited.
- Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
- When mounted on 1" square PCB (FR-4 material).
- Parametric verification ongoing.



SPECIFICATIONS (T <sub>C</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	40	-	-	V
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2.5	3.0	3.5	
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V	-	-	± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 40 V	-	-	1	μA
		V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 40 V, T <sub>J</sub> = 125 °C	-	-	50	
		V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 40 V, T <sub>J</sub> = 175 °C	-	-	250	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> ≥ 5 V	50	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A	-	0.0030	0.0036	Ω
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A, T <sub>J</sub> = 125 °C	-	-	0.0060	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A, T <sub>J</sub> = 175 °C	-	-	0.0072	
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 30 A	-	200	-	S
<b>Dynamic <sup>b</sup></b>						
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25 V, f = 1 MHz	-	5700	7200	pF
Output Capacitance	C <sub>oss</sub>		-	600	750	
Reverse Transfer Capacitance	C <sub>rss</sub>		-	264	330	
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 20 V, I <sub>D</sub> = 50 A	-	90	135	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>		-	25	-	
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>		-	15	-	
Gate Resistance	R <sub>g</sub>	f = 1 MHz	0.7	1.5	2.8	Ω
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 0.4 Ω I <sub>D</sub> ≅ 50 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω	-	12	18	ns
Rise Time <sup>c</sup>	t <sub>r</sub>		-	10	15	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>		-	35	53	
Fall Time <sup>c</sup>	t <sub>f</sub>		-	9	14	
<b>Source-Drain Diode Ratings and Characteristics <sup>b</sup></b>						
Pulsed Current <sup>a</sup>	I <sub>SM</sub>		-	-	400	A
Forward Voltage	V <sub>SD</sub>	I <sub>F</sub> = 70 A, V <sub>GS</sub> = 0 V	-	0.9	1.5	V

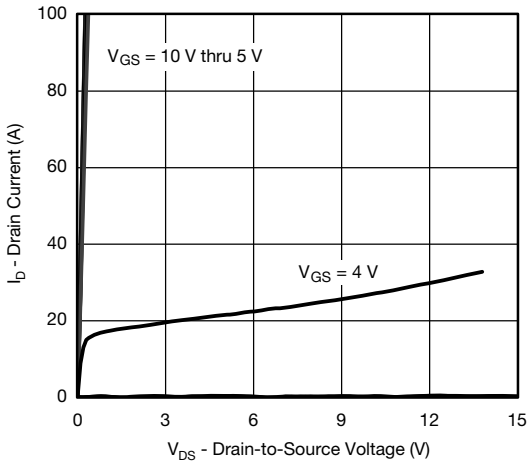
**Notes**

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

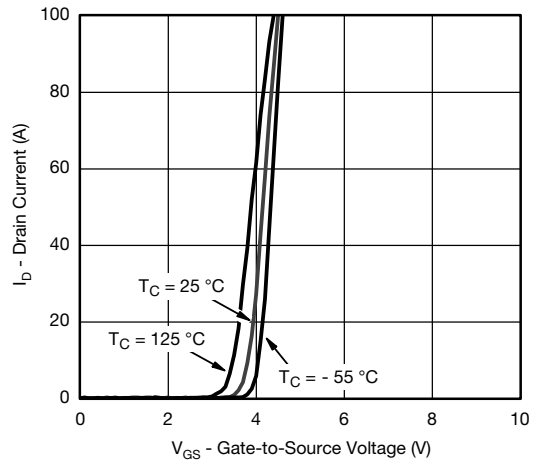
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



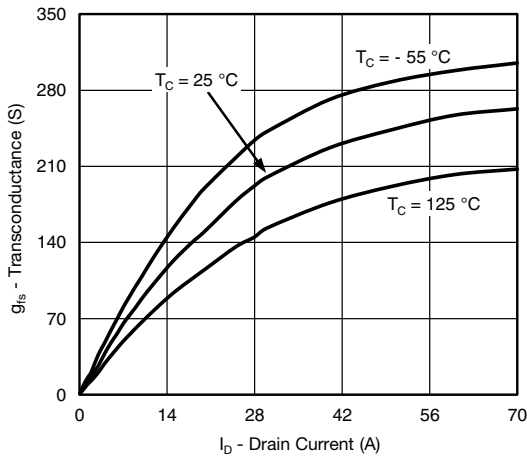
## TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



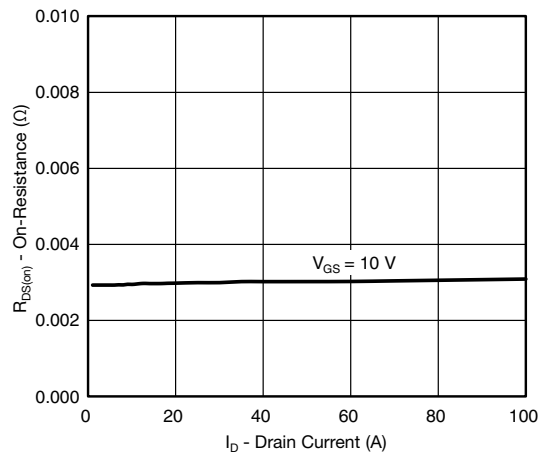
Output Characteristics



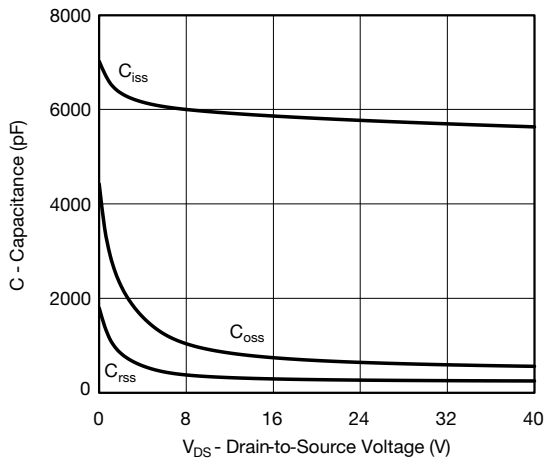
Transfer Characteristics



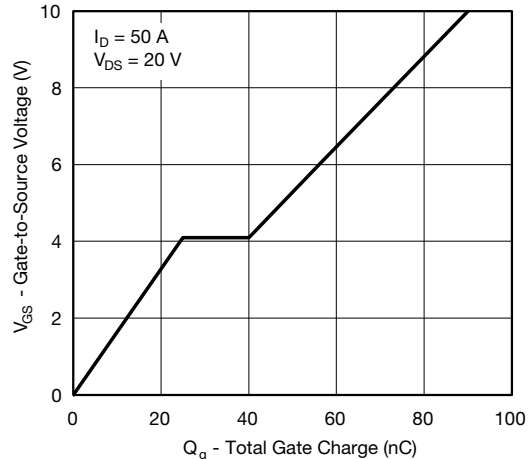
Transconductance



On-Resistance vs. Drain Current



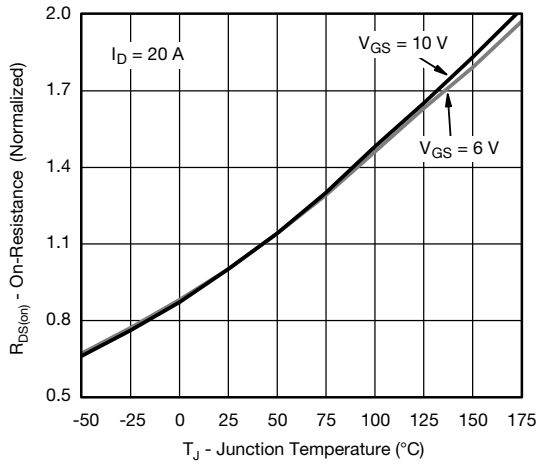
Capacitance



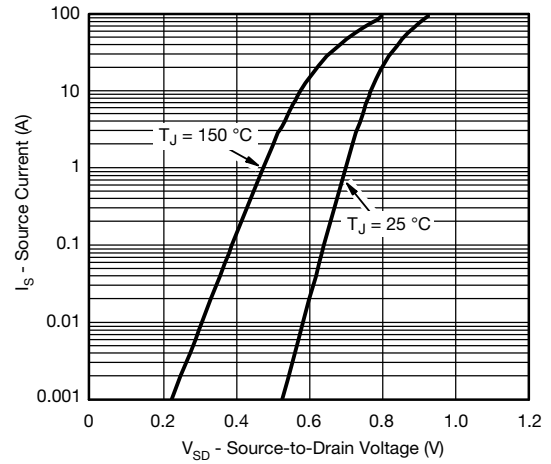
Gate Charge



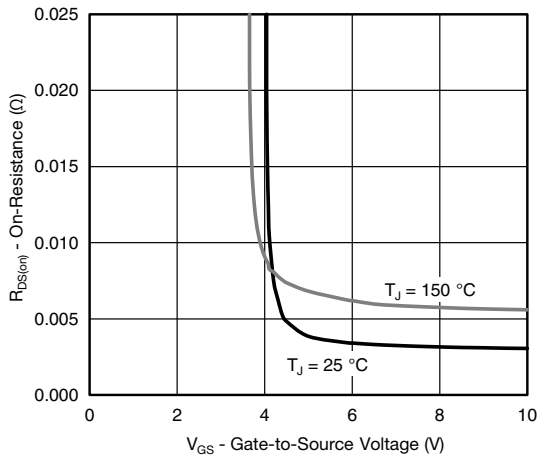
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



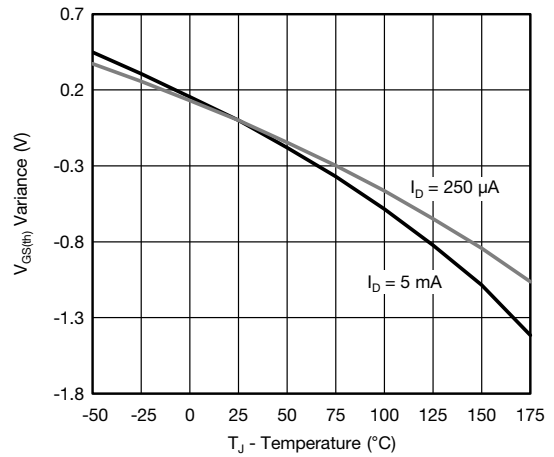
On-Resistance vs. Junction Temperature



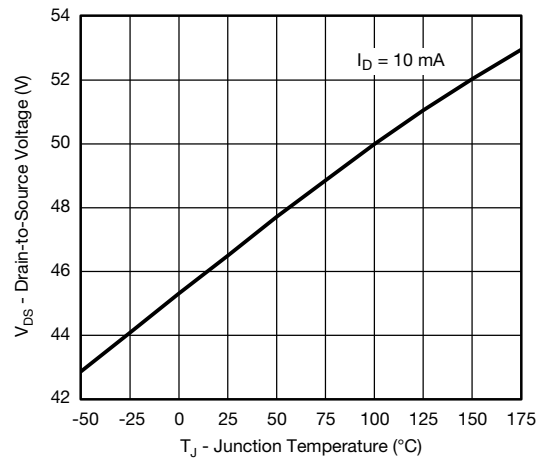
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



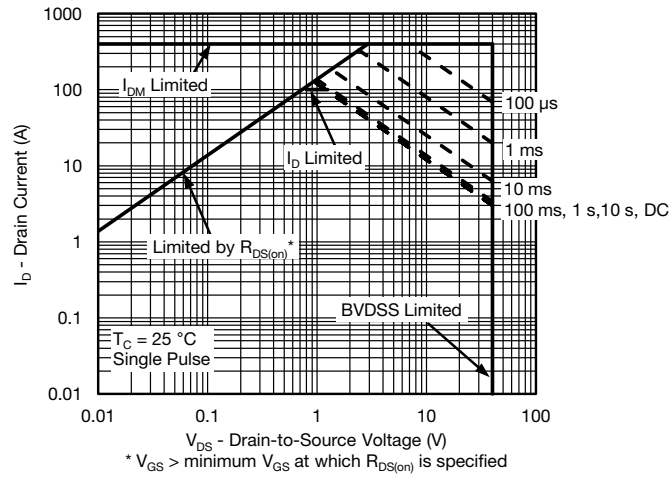
Threshold Voltage



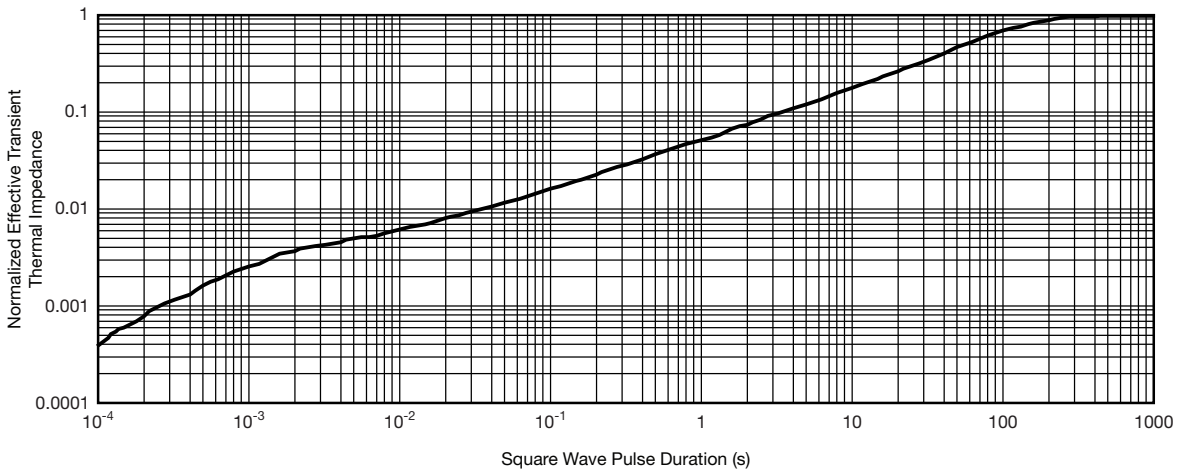
Drain Source Breakdown vs. Junction Temperature



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



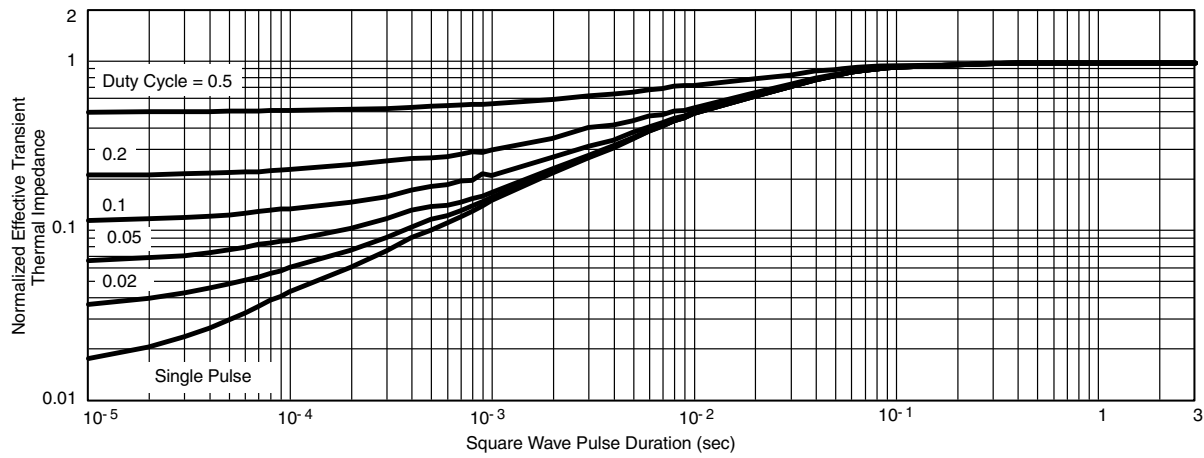
**Safe Operating Area**



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



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



**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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REVISION HISTORY <sup>a</sup>		
REVISION	DATE	DESCRIPTION OF CHANGE
B	04-Nov-15	• Changed capacitance, gate charge, gate resistance, and rise time

**Note**

a. As of Apr 2014



## TO-220

Ordering codes for the SQ rugged series power MOSFETs in the TO-220 package:

DATASHEET PART NUMBER	OLD ORDERING CODE <sup>a</sup>	NEW ORDERING CODE
SQP100N04-3m6	-	SQP100N04-3M6_GE3
SQP100P06-9m3L	-	SQP100P06-9M3L_GE3
SQP120N06-06	-	SQP120N06-06_GE3
SQP120N06-3m5L	SQP120N06-3M5L-GE3	SQP120N06-3M5L_GE3
SQP120N10-09	SQP120N10-09-GE3	SQP120N10-09_GE3
SQP120N10-3m8	SQP120N10-3M8-GE3	SQP120N10-3M8_GE3
SQP25N15-52	-	SQP25N15-52_GE3
SQP50N06-09L	SQP50N06-09L-GE3	SQP50N06-09L_GE3
SQP50P03-07	SQP50P03-07-GE3	SQP50P03-07_GE3
SQP60N06-15	SQP60N06-15-GE3	SQP60N06-15_GE3
SQP90P06-07L	SQP90P06-07L-GE3	SQP90P06-07L_GE3

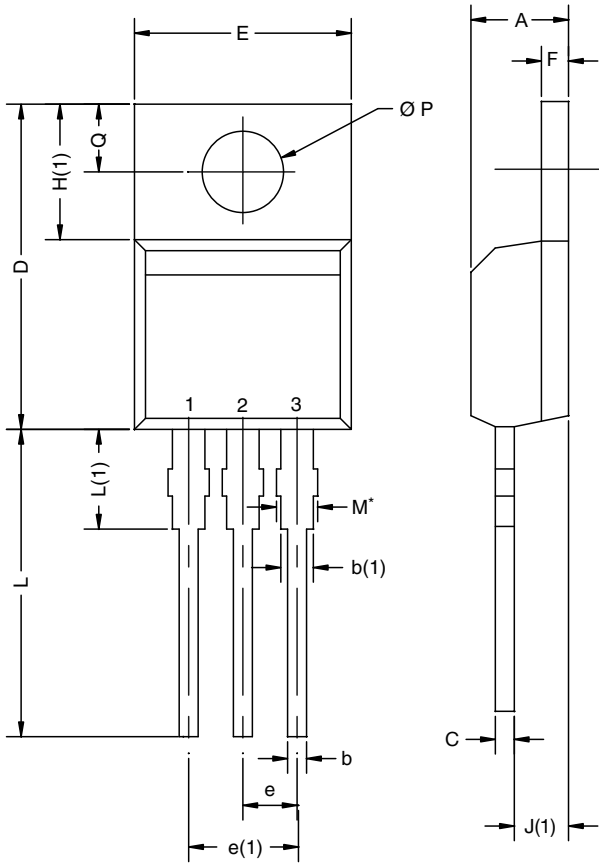
**Note**

a. Old ordering code is obsolete and no longer valid for new orders





TO-220AB

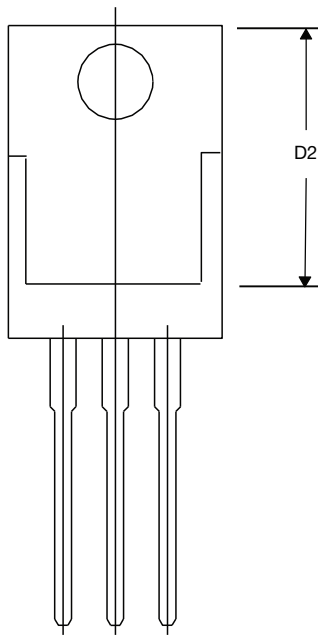


DIM.	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.25	4.65	0.167	0.183
b	0.69	1.01	0.027	0.040
b(1)	1.20	1.73	0.047	0.068
c	0.36	0.61	0.014	0.024
D	14.85	15.49	0.585	0.610
D2	12.19	12.70	0.480	0.500
E	10.04	10.51	0.395	0.414
e	2.41	2.67	0.095	0.105
e(1)	4.88	5.28	0.192	0.208
F	1.14	1.40	0.045	0.055
H(1)	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
Ø 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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