

Automotive N-Channel 60 V (D-S) 175 °C MOSFET

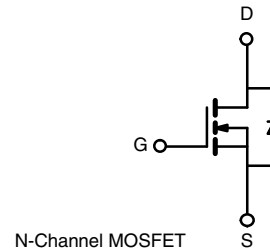
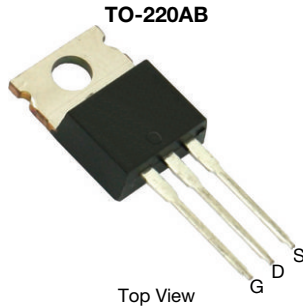
 AUTOMOTIVE
GRADE

RoHS
COMPLIANT
HALOGEN
FREE

PRODUCT SUMMARY	
V_{DS} (V)	60
$R_{DS(on)}$ (Ω) at $V_{GS} = 10$ V	0.006
I_D (A)	119
Configuration	Single
Package	TO-220

FEATURES

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



ABSOLUTE MAXIMUM RATINGS ($T_C = 25$ °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	60	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current	$T_C = 25$ °C	I_D	119	A
	$T_C = 125$ °C		68	
Continuous Source Current (Diode Conduction) ^a		I_S	120	
Pulsed Drain Current ^b		I_{DM}	480	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	65	
Single Pulse Avalanche Energy		E_{AS}	211	
Maximum Power Dissipation ^b	$T_C = 25$ °C	P_D	175	W
	$T_C = 125$ °C		56	
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}	40	°C/W
Junction-to-Case (Drain)		R_{thJC}	0.88	

Notes

- Package limited.
- Pulse test; pulse width ≤ 300 μ s, duty cycle ≤ 2 %.
- When mounted on 1" square PCB (FR4 material).
- Parametric verification ongoing.



SPECIFICATIONS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0, I_D = 250\text{ }\mu\text{A}$		60	-	-	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}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}$	$V_{DS} = 60\text{ V}$	-	-	1	μA
		$V_{GS} = 0\text{ V}$	$V_{DS} = 60\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	50	
		$V_{GS} = 0\text{ V}$	$V_{DS} = 60\text{ V}, T_J = 175\text{ }^\circ\text{C}$	-	-	250	
On-State Drain Current ^a	$I_{D(on)}$	$V_{GS} = 10\text{ V}$	$V_{DS} \geq 5\text{ V}$	120	-	-	A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 30\text{ A}$	-	0.0045	0.0060	Ω
		$V_{GS} = 10\text{ V}$	$I_D = 30\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	-	0.0104	
		$V_{GS} = 10\text{ V}$	$I_D = 30\text{ A}, T_J = 175\text{ }^\circ\text{C}$	-	-	0.0129	
Forward Transconductance ^b	g_{fs}	$V_{DS} = 15\text{ V}, I_D = 30\text{ A}$		-	94	-	S
Dynamic ^b							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	-	5196	6495	μF
Output Capacitance	C_{oss}			-	708	885	
Reverse Transfer Capacitance	C_{rss}			-	336	420	
Total Gate Charge ^c	Q_g	$V_{GS} = 10\text{ V}$	$V_{DS} = 30\text{ V}, I_D = 75\text{ A}$	-	96.5	145	nC
Gate-Source Charge ^c	Q_{gs}			-	24.6	-	
Gate-Drain Charge ^c	Q_{gd}			-	27.2	-	
Gate Resistance	R_g	f = 1 MHz		0.3	1	1.7	Ω
Turn-On Delay Time ^c	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 0.4\text{ }\Omega$ $I_D \cong 75\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		-	16	24	ns
Rise Time ^c	t_r			-	14	21	
Turn-Off Delay Time ^c	$t_{d(off)}$			-	34	51	
Fall Time ^c	t_f			-	9	14	
Source-Drain Diode Ratings and Characteristics ^b							
Pulsed Current ^a	I_{SM}			-	-	480	A
Forward Voltage	V_{SD}	$I_F = 75\text{ A}, V_{GS} = 0$		-	0.9	1.5	V

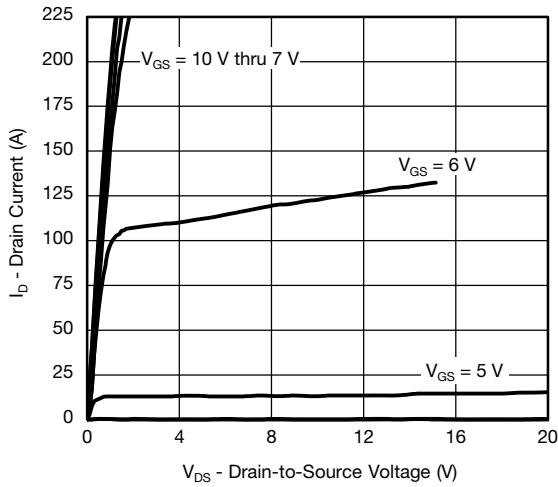
Notes

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

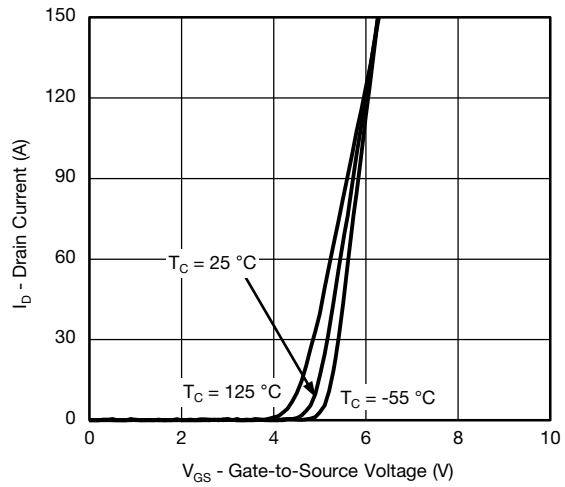
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



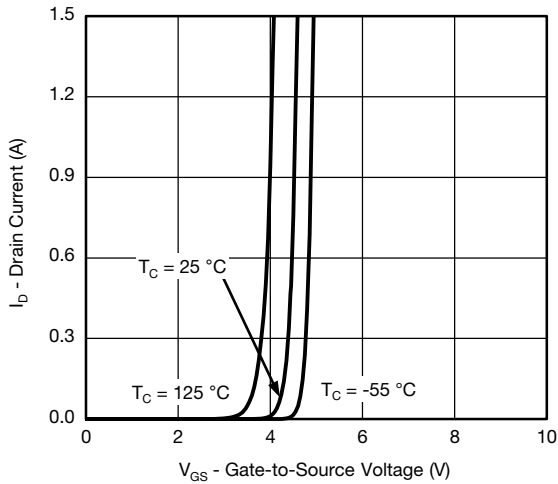
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



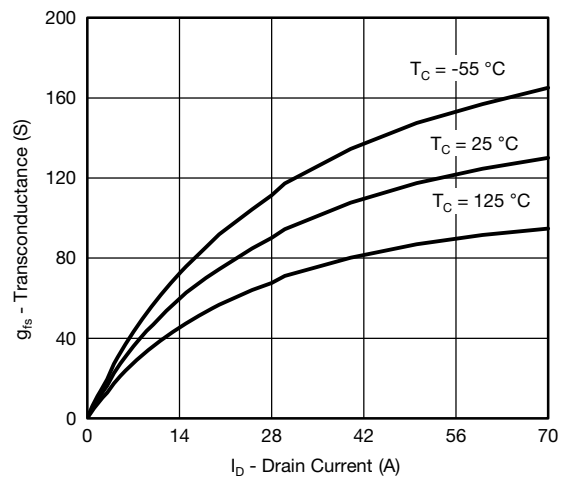
Output Characteristics



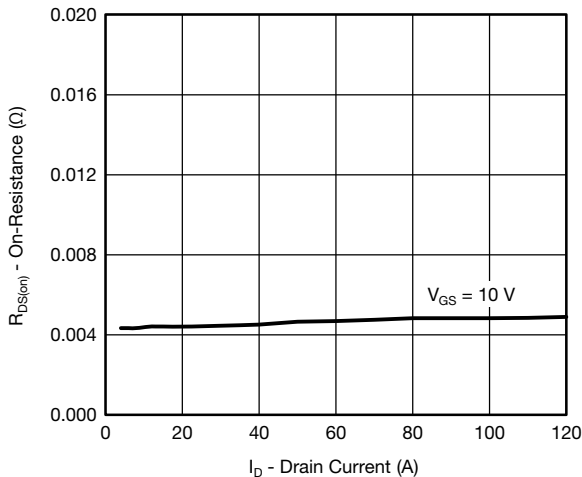
Transfer Characteristics



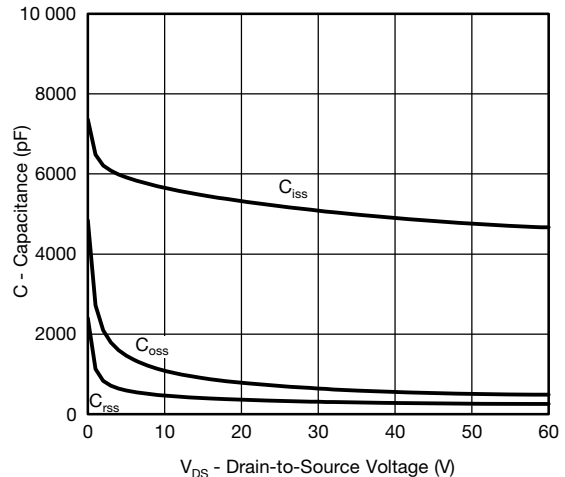
Transfer Characteristics



Transconductance



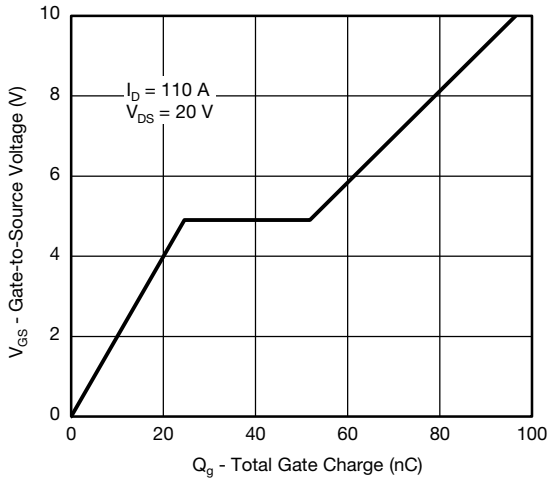
On-Resistance vs. Drain Current



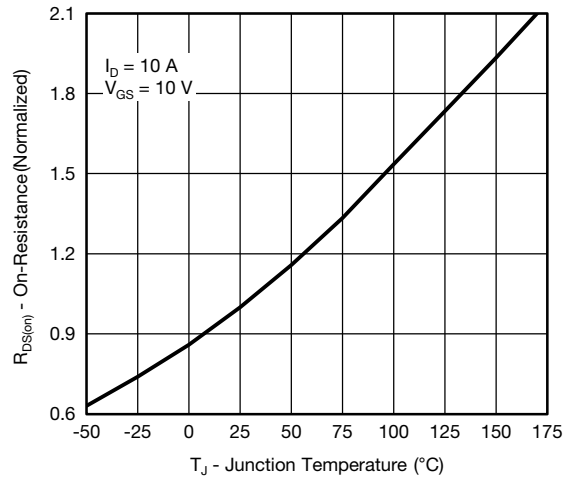
Capacitance



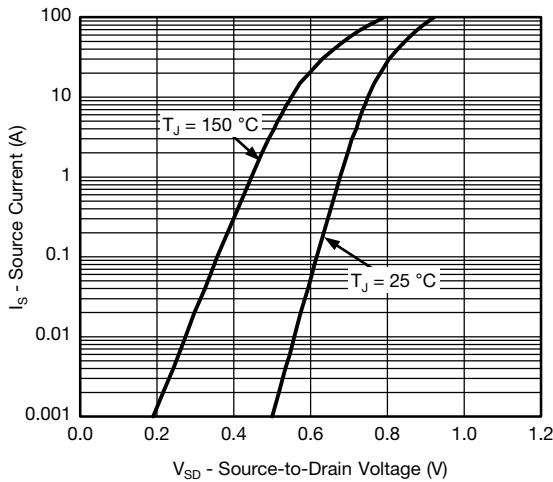
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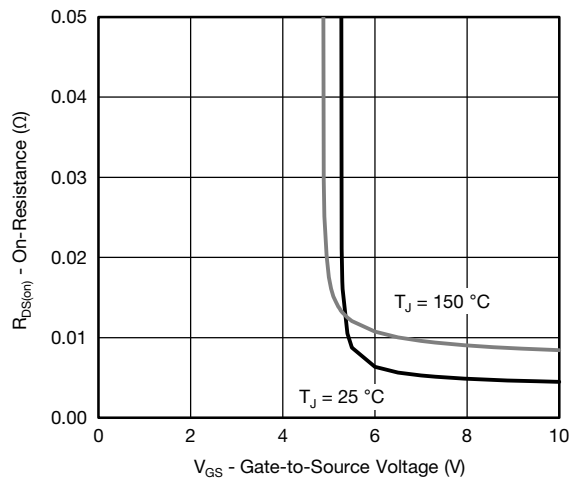
Gate Charge



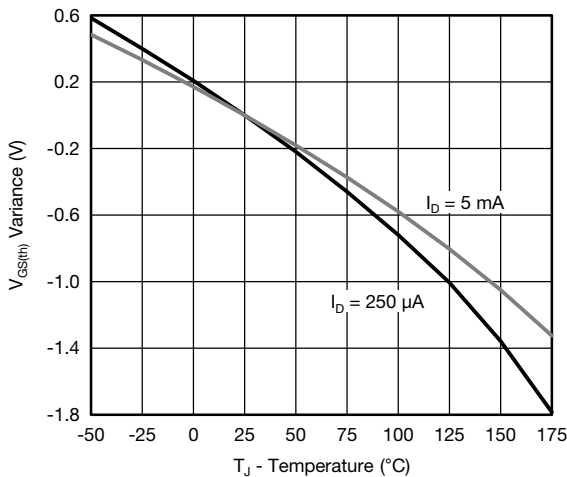
On-Resistance vs. Junction Temperature



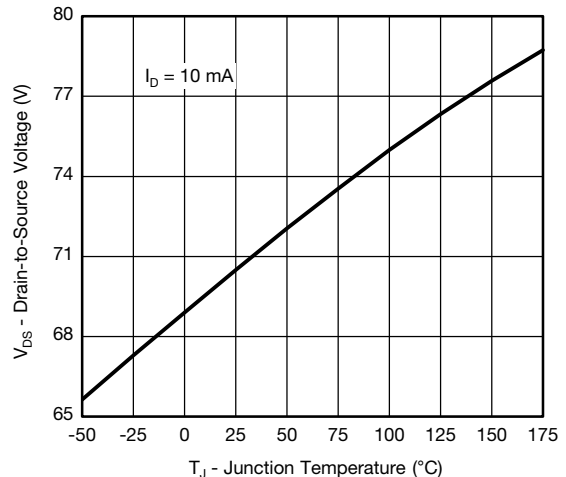
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



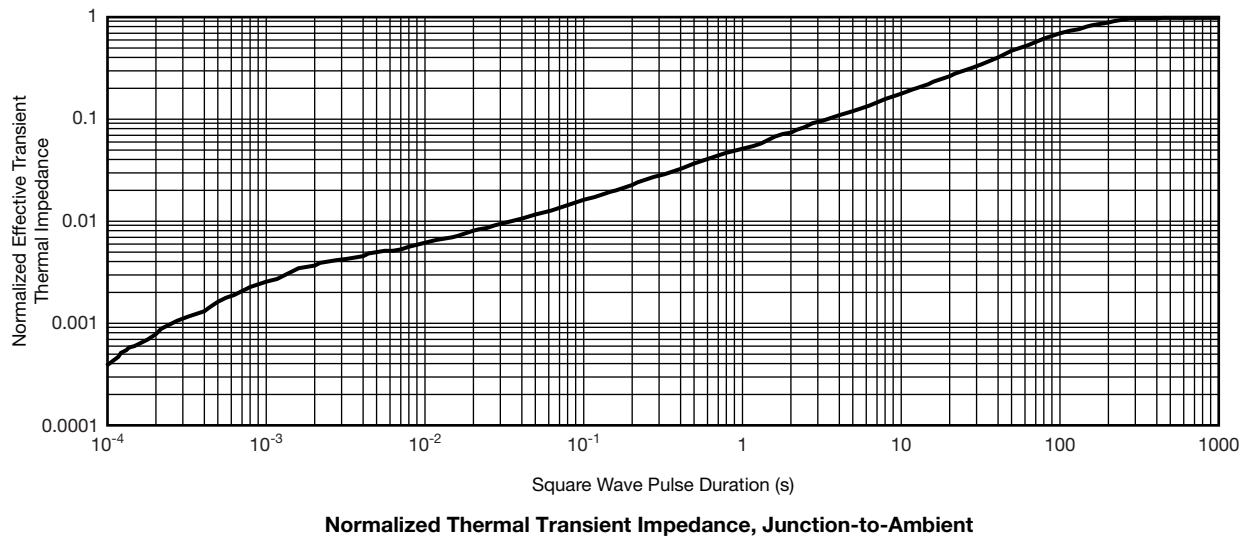
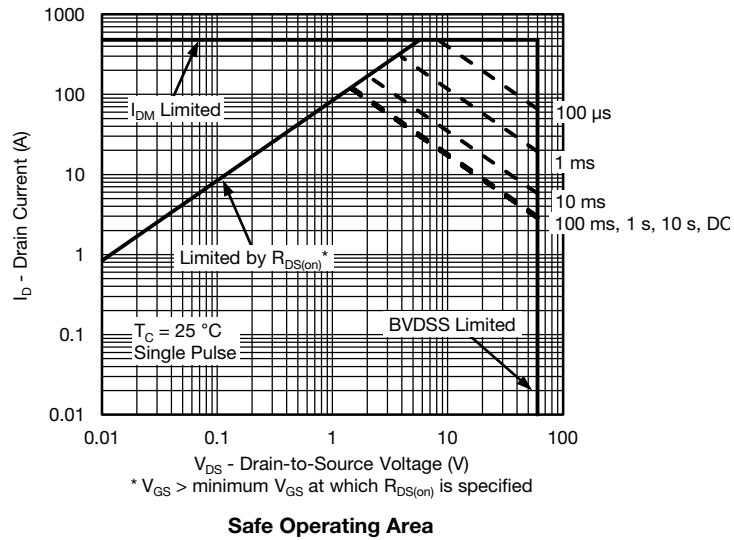
Threshold Voltage



Drain Source Breakdown vs. Junction Temperature

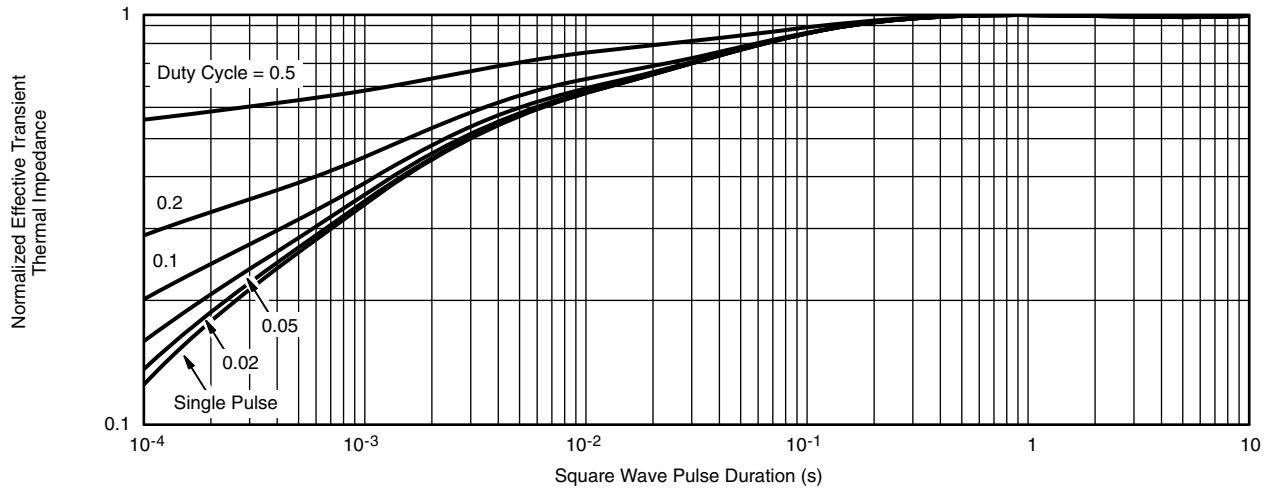


THERMAL RATINGS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)





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 ^a		
REVISION	DATE	DESCRIPTION OF CHANGE
B	04-Aug-15	• Revised R _g minimum limit

Note

a. As of April 2014



TO-220

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

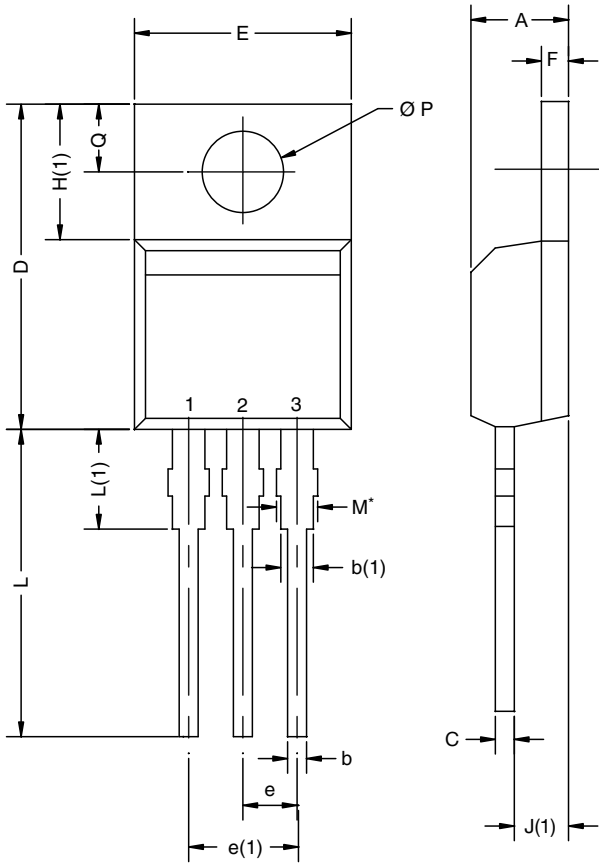
DATASHEET PART NUMBER	OLD ORDERING CODE ^a	NEW ORDERING CODE
SQP100P06-9m3L	-	SQP100P06-9M3L_GE3
SQP120N06-06	-	SQP120N06-06_GE3
SQP120N06-3m5L	SQP120N06-3M5L-GE3	SQP120N06-3M5L_GE3
SQP120N10-09	SQP120N10-09-GE3	SQP120N10-09_GE3
SQP120N10-3m8	SQP120N10-3M8-GE3	SQP120N10-3M8_GE3
SQP25N15-52	-	SQP25N15-52_GE3
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
$\varnothing P$	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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