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

PRODUCT SUMMARY [d]	
V_{DS} (V)	60
$R_{DS(on)}$ (Ω) at V_{GS} = 10 V	0.042
$R_{DS(on)}$ (Ω) at V_{GS} = 4.5 V	0.060
I_D (A)	15
Configuration	Single
Package	TO-252

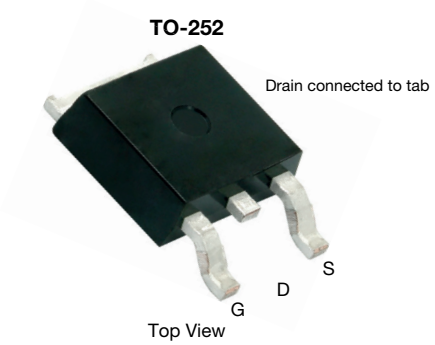
FEATURES

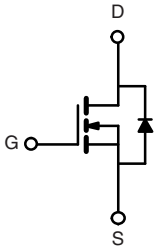
- TrenchFET® power MOSFET
- 100 % R_g and UIS tested
- AEC-Q101 qualified
- Package with low thermal resistance
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

RoHS COMPLIANT

HALOGEN FREE





N-Channel MOSFET

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 [a]	I_D	15	A
	T_C = 125 °C		10	
Continuous Source Current (Diode Conduction) [a]		I_S	15	
Pulsed Drain Current [b]		I_{DM}	50	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	18	
Single Pulse Avalanche Energy		E_{AS}	16.2	mJ
Maximum Power Dissipation [b]	T_C = 25 °C	P_D	37	W
	T_C = 125 °C		11	
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}	4	

Notes

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

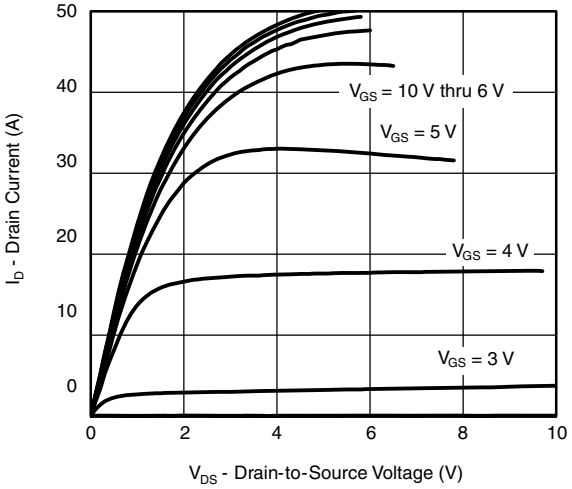
SPECIFICATIONS (T_C = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA		60	-	-	V
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA		1.5	2	2.5	
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} = 60 V	-	-	1	µA
		V_{GS} = 0 V	V_{DS} = 60 V, T_J = 125 °C	-	-	50	
		V_{GS} = 0 V	V_{DS} = 60 V, T_J = 175 °C	-	-	150	
On-State Drain Current [a]	$I_{D(on)}$	V_{GS} = 10 V	V_{DS} ≥ 5 V	30	-	-	A
Drain-Source On-State Resistance [a]	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 10 A	-	0.036	0.042	Ω
		V_{GS} = 10 V	I_D = 10 A, T_J = 125 °C	-	-	0.075	
		V_{GS} = 10 V	I_D = 10 A, T_J = 175 °C	-	-	0.090	
		V_{GS} = 4.5 V	I_D = 10 A, T_J = 125 °C	-	0.092	-	
		V_{GS} = 4.5 V	I_D = 10 A, T_J = 175 °C	-	0.110	-	
		V_{GS} = 4.5 V	I_D = 10 A	-	0.048	0.060	
Forward Transconductance [b]	g_{fs}	V_{DS} = 15 V, I_D = 6 A		-	11	-	S
Dynamic [b]							
Input Capacitance	C_{iss}	V_{GS} = 0 V	V_{DS} = 25 V, f = 1 MHz	-	425	535	pF
Output Capacitance	C_{oss}			-	95	120	
Reverse Transfer Capacitance	C_{rss}			-	40	50	
Total Gate Charge [c]	Q_g	V_{GS} = 10 V	V_{DS} = 30 V, I_D = 15 A	-	9.5	15	nC
Gate-Source Charge [c]	Q_{gs}			-	1.7	-	
Gate-Drain Charge [c]	Q_{gd}			-	2.5	-	
Gate Resistance	R_g	f = 1 MHz		1.2	2.5	5.4	Ω
Turn-On Delay Time [c]	$t_{d(on)}$	V_{DD} = 30 V, R_L = 2 Ω I_D ≅ 15 A, V_{GEN} = 10 V, R_g = 1 Ω		-	5	8	ns
Rise Time [c]	t_r			-	10	15	
Turn-Off Delay Time [c]	$t_{d(off)}$			-	13	20	
Fall Time [c]	t_f			-	8	12	
Source-Drain Diode Ratings and Characteristics [b]							
Pulsed Current [a]	I_{SM}			-	-	50	A
Forward Voltage	V_{SD}	I_F = 10 A, V_{GS} = 0 V		-	0.9	1.2	V
Reverse Recovery Time	t_{rr}	I_F = 15 A, dI/dt = 100 A/µs		-	29	60	ns

Notes

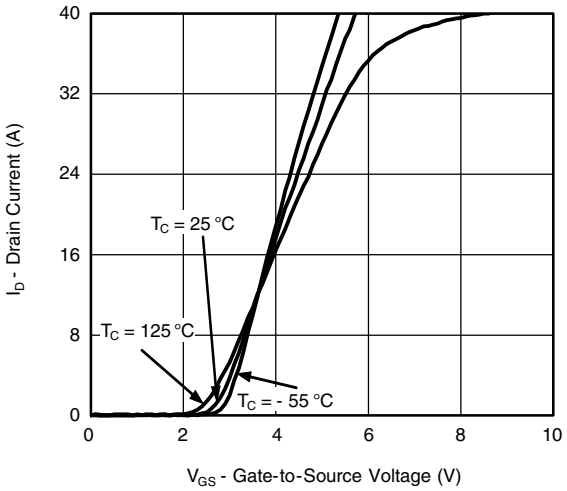
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

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.

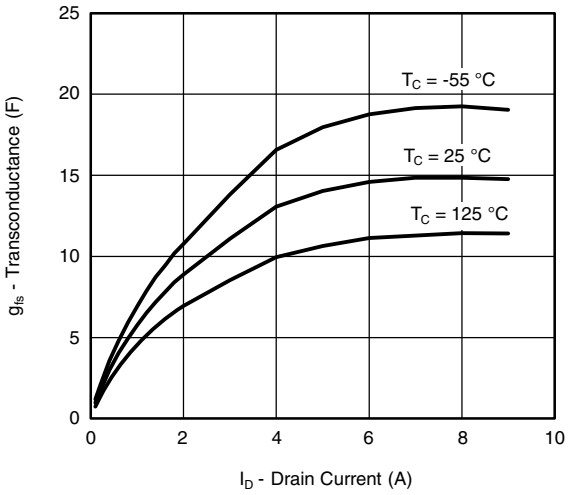
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



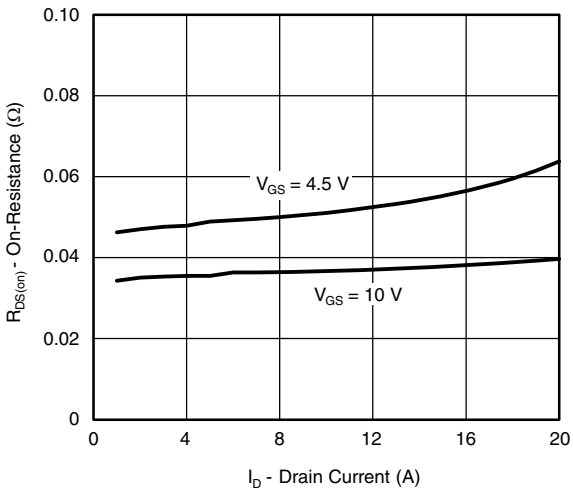
Output Characteristics



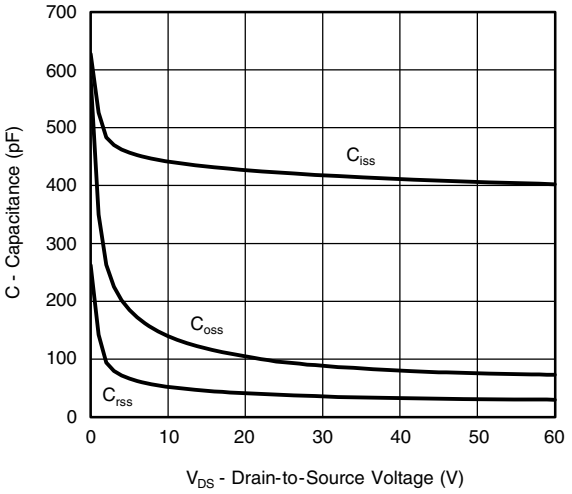
Transfer Characteristics



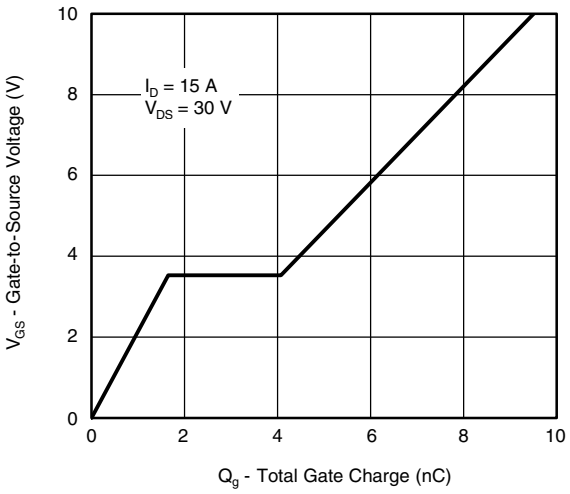
Transconductance



On-Resistance vs. Drain Current

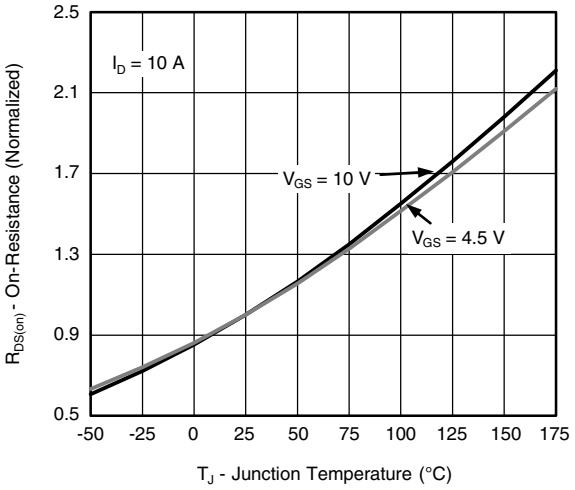


Capacitance

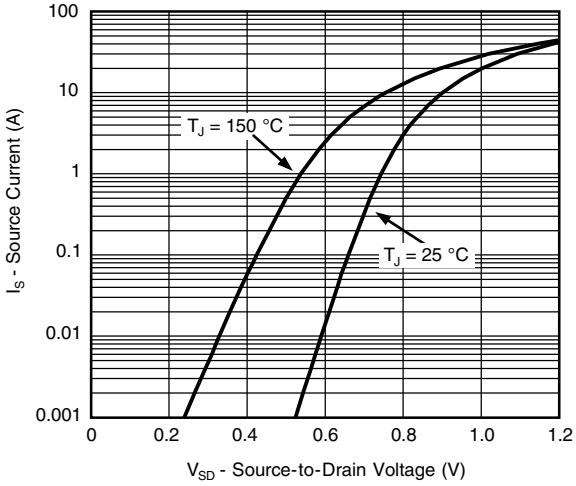


Gate Charge

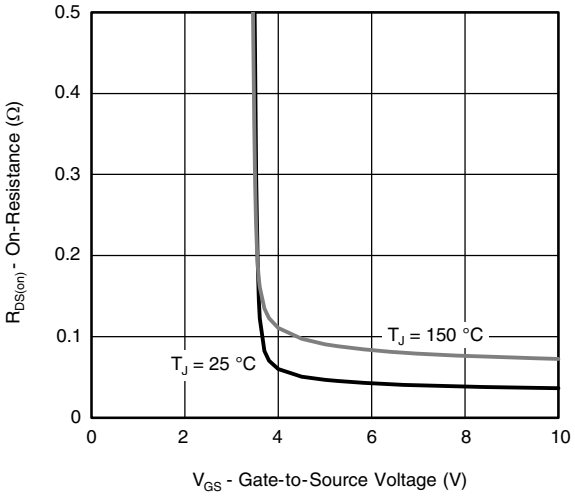
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



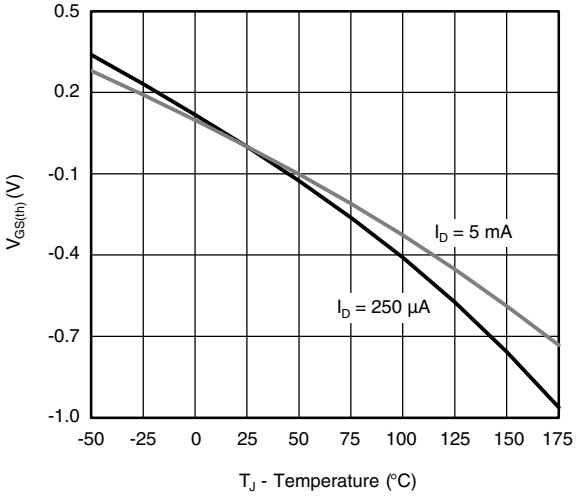
On-Resistance vs. Junction Temperature



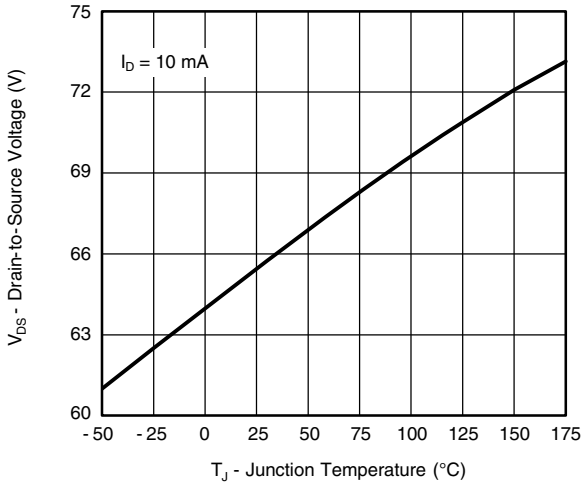
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage

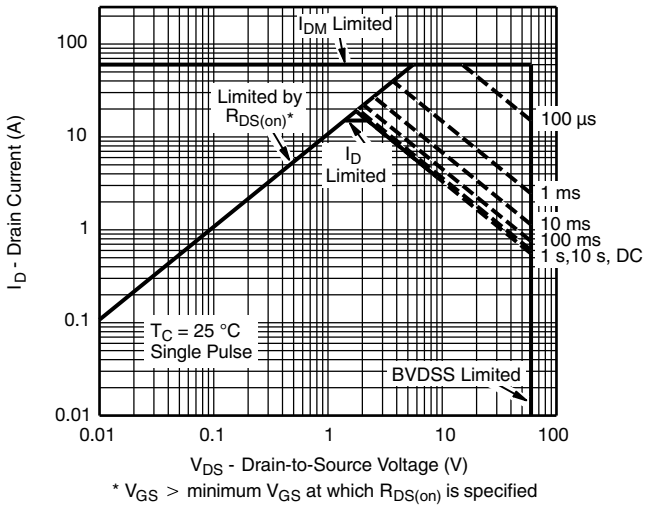


Threshold Voltage

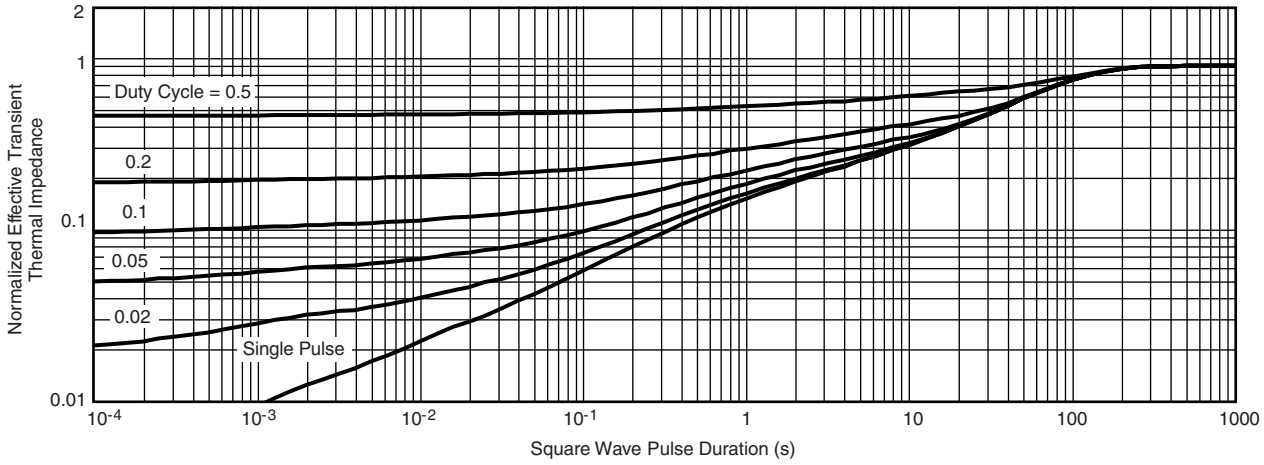


On-Resistance vs. Junction Temperature

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

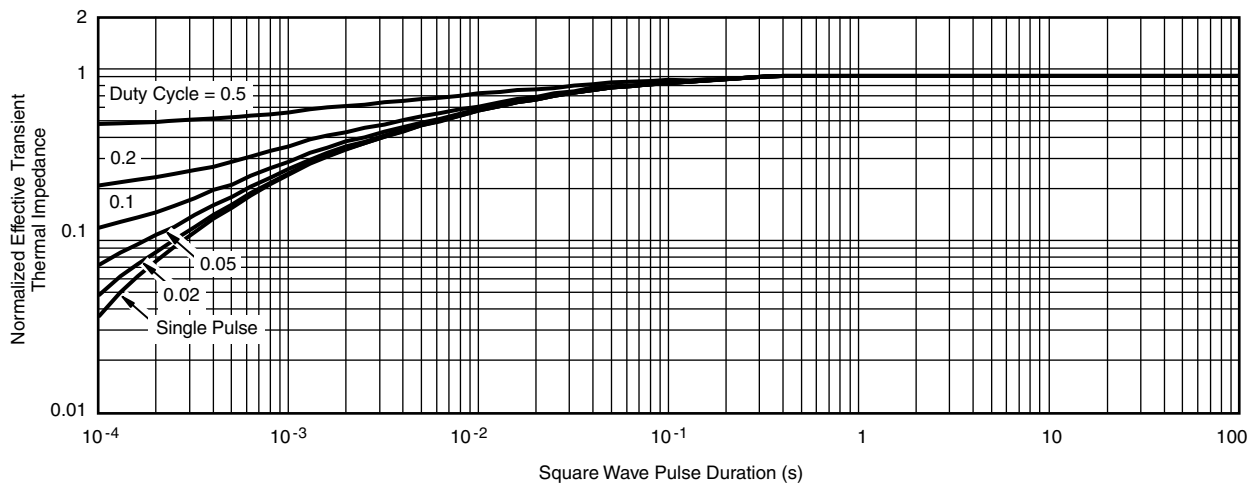


Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Ambient

THERMAL RATINGS (T_A = 25 °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
G	04-Aug-15	• Revised R_g minimum limit

Note

a. As of April 2014

DPAK / TO-252 and Reverse DPAK

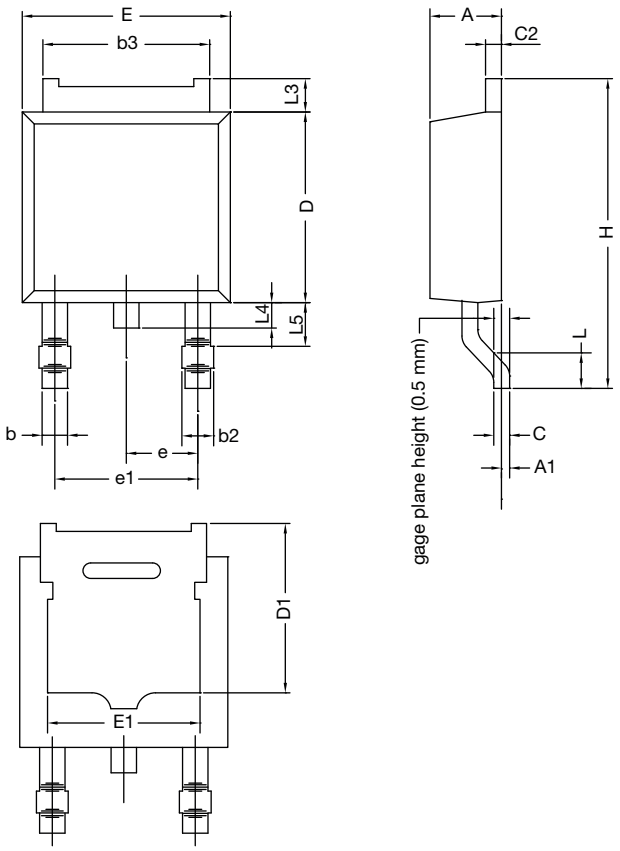
Ordering codes for the SQ rugged series power MOSFETs in the DPAK / TO-252 and Reverse DPAK packages:

DATASHEET PART NUMBER	OLD ORDERING CODE [a]	NEW ORDERING CODE
SQD07N25-350H	SQD07N25-350H-GE3	**SQD07N25-350H_GE3**
SQD100N03-3m2L	SQD100N03-3M2L-GE3	**SQD100N03-3M2L_GE3**
SQD100N03-3m4	SQD100N03-3M4-GE3	**SQD100N03-3M4_GE3**
SQD100N04-3m6	SQD100N04-3M6-GE3	**SQD100N04-3M6_GE3**
SQD100N04-3m6L	SQD100N04-3M6L-GE3	**SQD100N04-3M6L_GE3**
SQD10N30-330H	SQD10N30-330H-GE3	**SQD10N30-330H_GE3**
SQD15N06-42L	SQD15N06-42L-GE3	**SQD15N06-42L_GE3**
SQD19P06-60L	SQD19P06-60L-GE3	**SQD19P06-60L_GE3**
SQD23N06-31L	SQD23N06-31L-GE3	**SQD23N06-31L_GE3**
SQD25N06-22L	SQD25N06-22L-GE3	**SQD25N06-22L_GE3**
SQD25N15-52	SQD25N15-52-GE3	**SQD25N15-52_GE3**
SQD30N05-20L	SQD30N05-20L-GE3	**SQD30N05-20L_GE3**
SQD40N06-14L	SQD40N06-14L-GE3	**SQD40N06-14L_GE3**
SQD40N10-25	SQD40N10-25-GE3	**SQD40N10-25_GE3**
SQD40P10-40L	SQD40P10-40L-GE3	**SQD40P10-40L_GE3**
SQD45P03-12	SQD45P03-12-GE3	**SQD45P03-12_GE3**
SQD50N04-5m6	SQD50N04-5M6-GE3	**SQD50N04-5M6_GE3**
SQD50N05-11L	SQD50N05-11L-GE3	**SQD50N05-11L_GE3**
SQD50N06-09L	SQD50N06-09L-GE3	**SQD50N06-09L_GE3**
SQD50N10-8m9L	SQD50N10-8M9L-GE3	**SQD50N10-8M9L_GE3**
SQD50P03-07	SQD50P03-07-GE3	**SQD50P03-07_GE3**
SQD50P04-13L	SQD50P04-13L-GE3	**SQD50P04-13L_GE3**
SQD50P04-09L	SQD50P04-09L-GE3	**SQD50P04-09L_GE3**
SQD50P06-15L	SQD50P06-15L-GE3	**SQD50P06-15L_GE3**
SQD50P08-25L	SQD50P08-25L-GE3	**SQD50P08-25L_GE3**
SQD50P08-28	SQD50P08-28-GE3	**SQD50P08-28_GE3**
SQD90P04-9m4L	SQD90P04-9M4L-GE3	**SQD90P04-9M4L_GE3**
SQD97N06-6m3L	SQD97N06-6M3L-GE3	**SQD97N06-6M3L_GE3**
SQR40N10-25	SQR40N10-25-GE3	**SQR40N10-25_GE3**
SQR50N04-3m8	SQR50N04-3M8-GE3	**SQR50N04-3M8_GE3**

Note

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

TO-252AA Case Outline

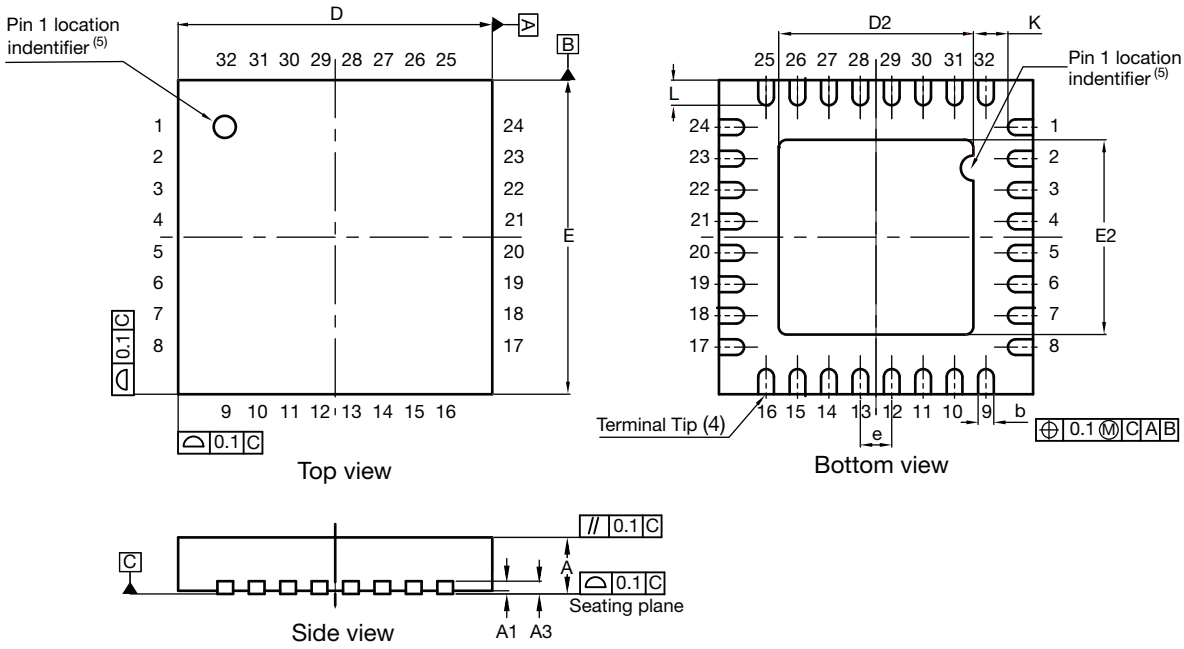


	MILLIMETERS		INCHES	
DIM.	MIN.	MAX.	MIN.	MAX.
A	2.18	2.38	0.086	0.094
A1	-	0.127	-	0.005
b	0.64	0.88	0.025	0.035
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
C	0.46	0.61	0.018	0.024
C2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	4.10	-	0.161	-
E	6.35	6.73	0.250	0.265
E1	4.32	-	0.170	-
H	9.40	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: T13-0592-Rev. A, 02-Sep-13 DWG: 6019				

Note

- Dimension L3 is for reference only.

QFN32 5 x 5 Case Outline



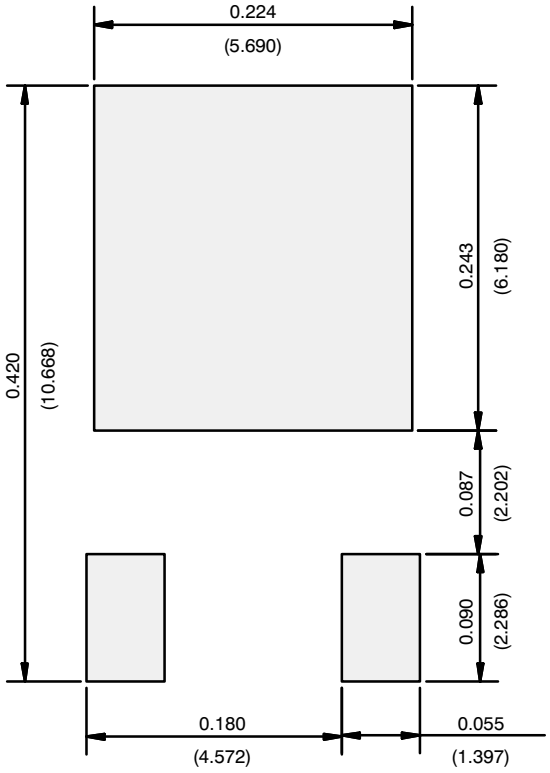
DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.75	0.85	0.95	0.029	0.033	0.037
A1	0.00	-	0.05	0.000	-	0.002
A3	0.20 ref.			0.008 ref.		
b	0.18	0.25	0.30	0.007	0.010	0.012
D	5.00 BSC			0.197 BSC		
D2	3.00	3.10	3.20	0.118	0.122	0.126
e	0.50 BSC			0.020 BSC		
E	5.00 BSC			0.197 BSC		
E2	3.00	3.10	3.20	0.118	0.122	0.126
K	0.20	-	-	0.008	-	-
L	0.30	0.40	0.50	0.012	0.016	0.020
N (3)	32			32		
Nd (3)	8			8		
Ne (3)	8			8		

Notes

(1) Use millimeters as the primary measurement
(2) Dimensioning and tolerances conform to ASME Y14.5M. - 1994
(3) N is the number of terminals,
Nd is the number of terminals in X-direction and
Ne is the number of terminals in Y-direction.
(4) Dimension b applies to plated terminal and is measured between 0.15 mm and 0.30 mm from terminal tip
(5) The pin #1 identifier must be existed on the top surface of the package by using indentation mark or other feature of package body
(6) Package warpage max. 0.05 mm

S14-2079-Rev. A, 20-Oct-14
DWG: 6027

RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)



Recommended Minimum Pads
Dimensions in Inches/(mm)

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