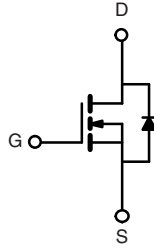
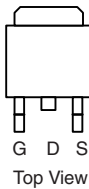


## Automotive N-Channel 40 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V)	40
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10$ V	0.0018
$I_D$ (A)	120
Configuration	Single

**TO-263**


N-Channel MOSFET

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- Package with Low Thermal Resistance
- AEC-Q101 Qualified<sup>d</sup>
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2002/95/EC

 AUTOMOTIVE  
GRADE

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

ORDERING INFORMATION	
Package	TO-263
Lead (Pb)-free and Halogen-free	SQM120N04-1m8-GE3

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-Source Voltage	$V_{DS}$	40	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$		
Continuous Drain Current <sup>a</sup>	$I_D$	$T_C = 25$ °C	A	
		$T_C = 125$ °C		120
Continuous Source Current (Diode Conduction) <sup>a</sup>	$I_S$	120	A	
Pulsed Drain Current <sup>b</sup>	$I_{DM}$	480		
Single Pulse Avalanche Current	$I_{AS}$	85		
Single Pulse Avalanche Energy	$E_{AS}$	361		mJ
Maximum Power Dissipation <sup>b</sup>	$P_D$	$T_C = 25$ °C	375	W
		$T_C = 125$ °C	125	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to + 175	°C	

THERMAL RESISTANCE RATINGS			
PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient	$R_{thJA}$	40	°C/W
Junction-to-Case (Drain)	$R_{thJC}$	0.4	

#### Notes

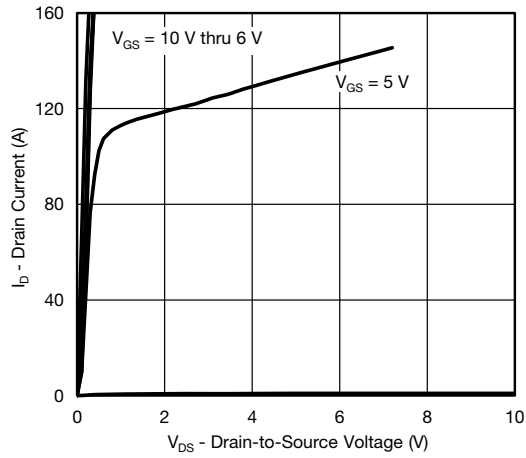
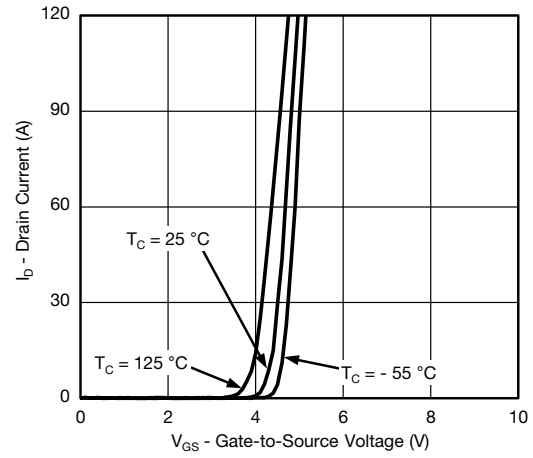
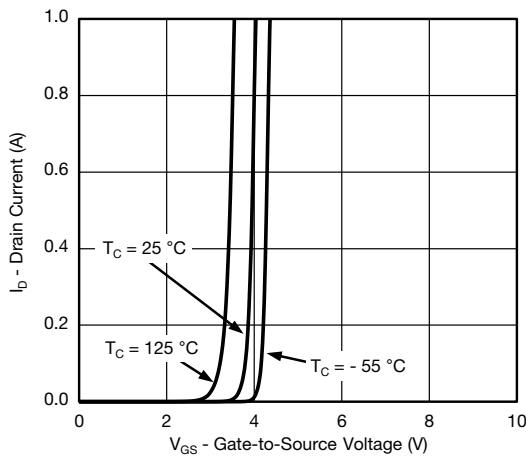
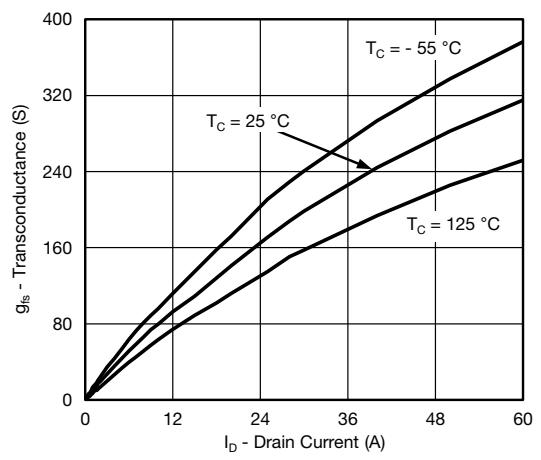
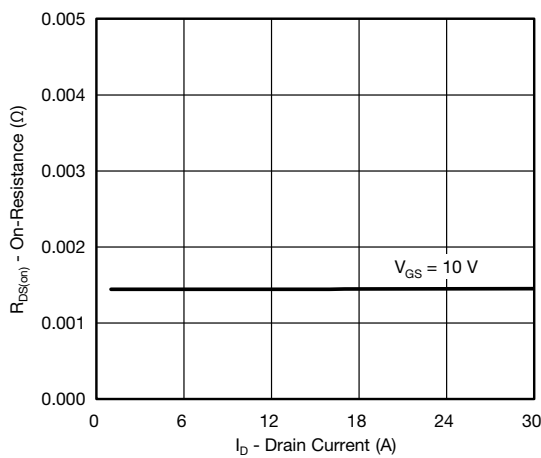
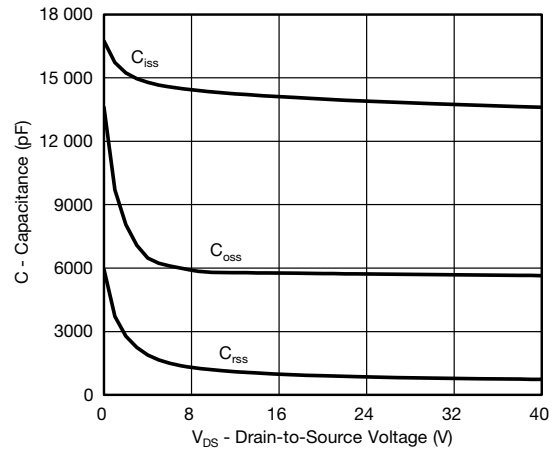
- Package limited.
- Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %.
- When mounted on 1" square PCB (FR-4 material).
- Parametric verification ongoing.

<b>SPECIFICATIONS</b> ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0, I_D = 250\text{ }\mu\text{A}$	40	-	-	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	$I_{DSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 40\text{ V}$	-	-	1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$	$V_{DS} = 40\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	50	
		$V_{GS} = 0\text{ V}$	$V_{DS} = 40\text{ V}, T_J = 175\text{ }^\circ\text{C}$	-	-	250	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{GS} = 10\text{ V}$	$V_{DS} \geq 5\text{ V}$	120	-	A	
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 30\text{ A}$	-	0.0015	0.0018	$\Omega$
		$V_{GS} = 10\text{ V}$	$I_D = 30\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	-	0.0028	
		$V_{GS} = 10\text{ V}$	$I_D = 30\text{ A}, T_J = 175\text{ }^\circ\text{C}$	-	-	0.0034	
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 30\text{ A}$	-	198	-	S	
<b>Dynamic<sup>b</sup></b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	-	13 880	17 350	$\text{pF}$
Output Capacitance	$C_{oss}$			-	5720	7150	
Reverse Transfer Capacitance	$C_{rss}$			-	840	1050	
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{GS} = 10\text{ V}$	$V_{DS} = 20\text{ V}, I_D = 120\text{ A}$	-	206	310	nC
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			-	50	-	
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			-	44	-	
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		0.57	1.14	1.71	$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = 20\text{ V}, R_L = 0.17\text{ }\Omega$ $I_D \cong 120\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		-	26	39	ns
Rise Time <sup>c</sup>	$t_r$			-	21	32	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			-	68	102	
Fall Time <sup>c</sup>	$t_f$			-	12	18	
<b>Source-Drain Diode Ratings and Characteristics<sup>b</sup></b>							
Pulsed Current <sup>a</sup>	$I_{SM}$			-	-	480	A
Forward Voltage	$V_{SD}$	$I_F = 80\text{ A}, V_{GS} = 0$		-	0.86	1.5	V

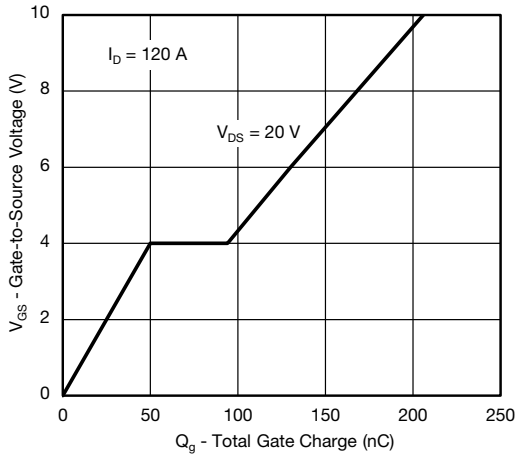
### Notes

- 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.

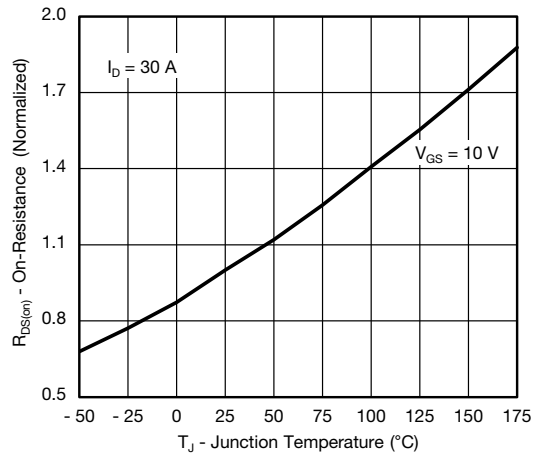
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

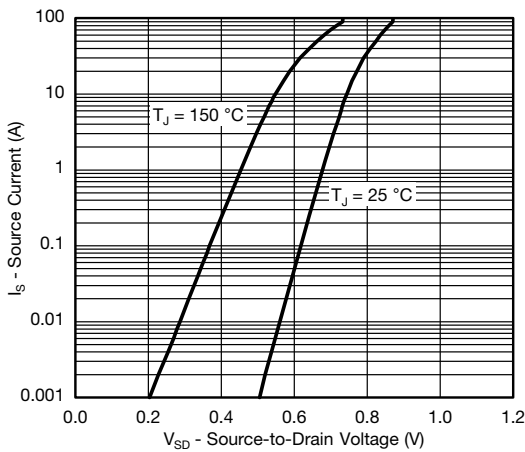
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



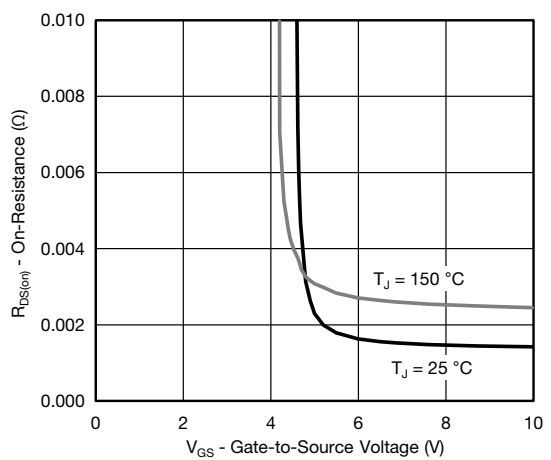
**Gate Charge**



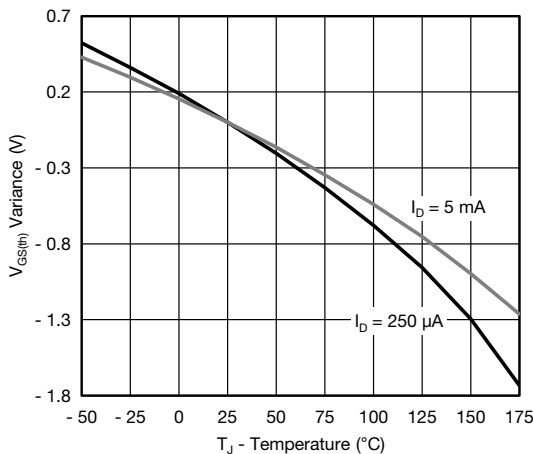
**On-Resistance vs. Junction Temperature**



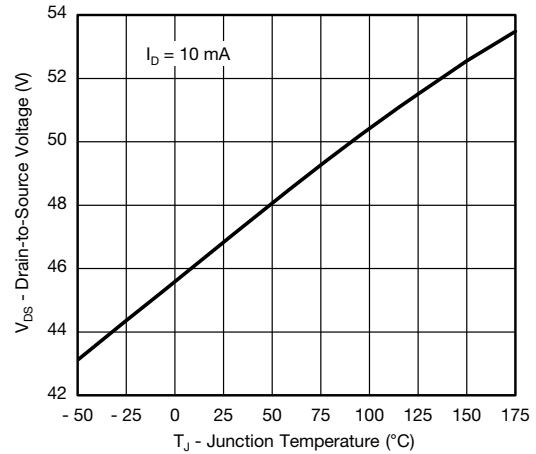
**Source Drain Diode Forward Voltage**



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

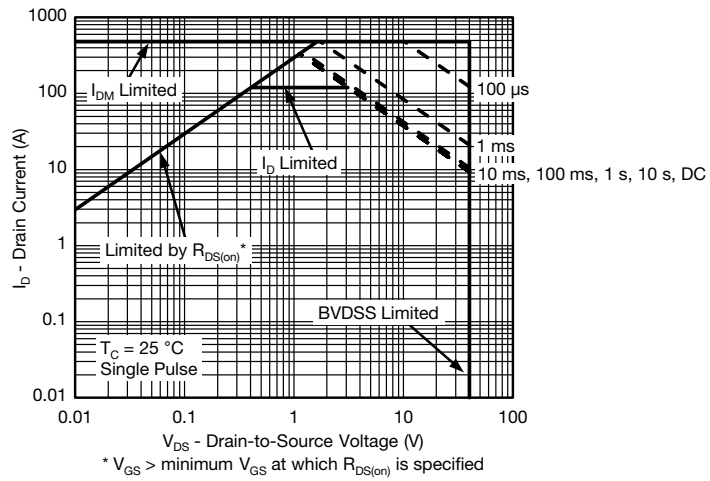


**Threshold Voltage**

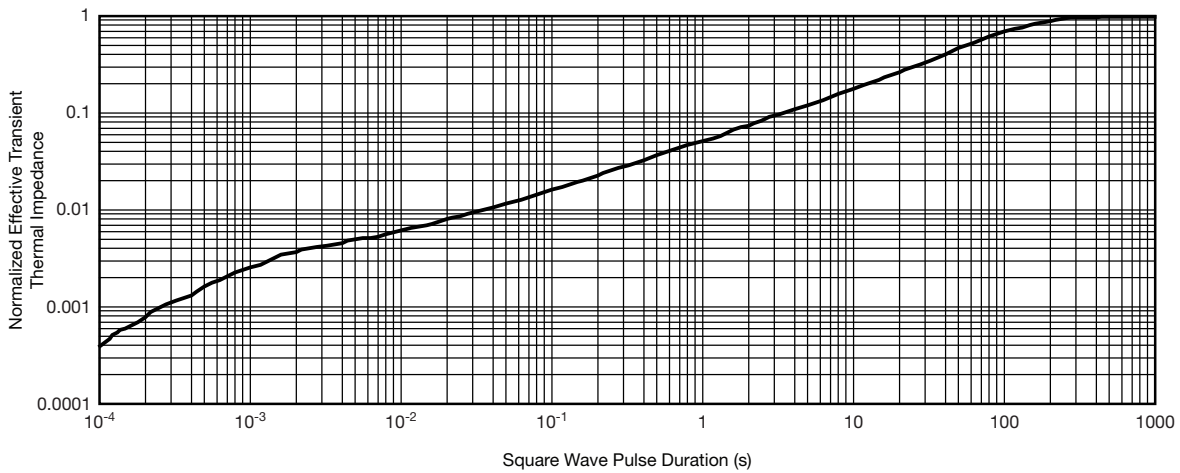


**Drain Source Breakdown vs. Junction Temperature**

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

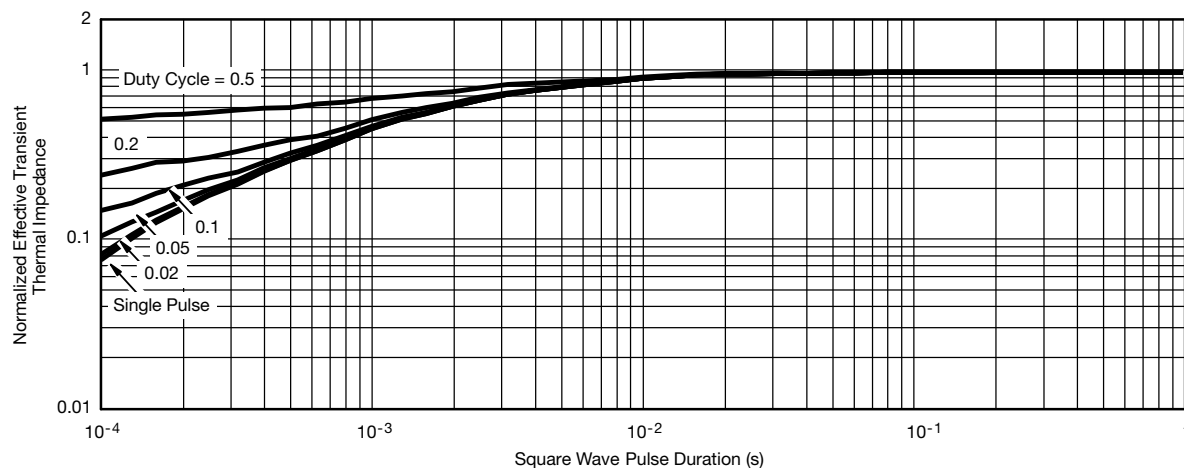


**Safe Operating Area**



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

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



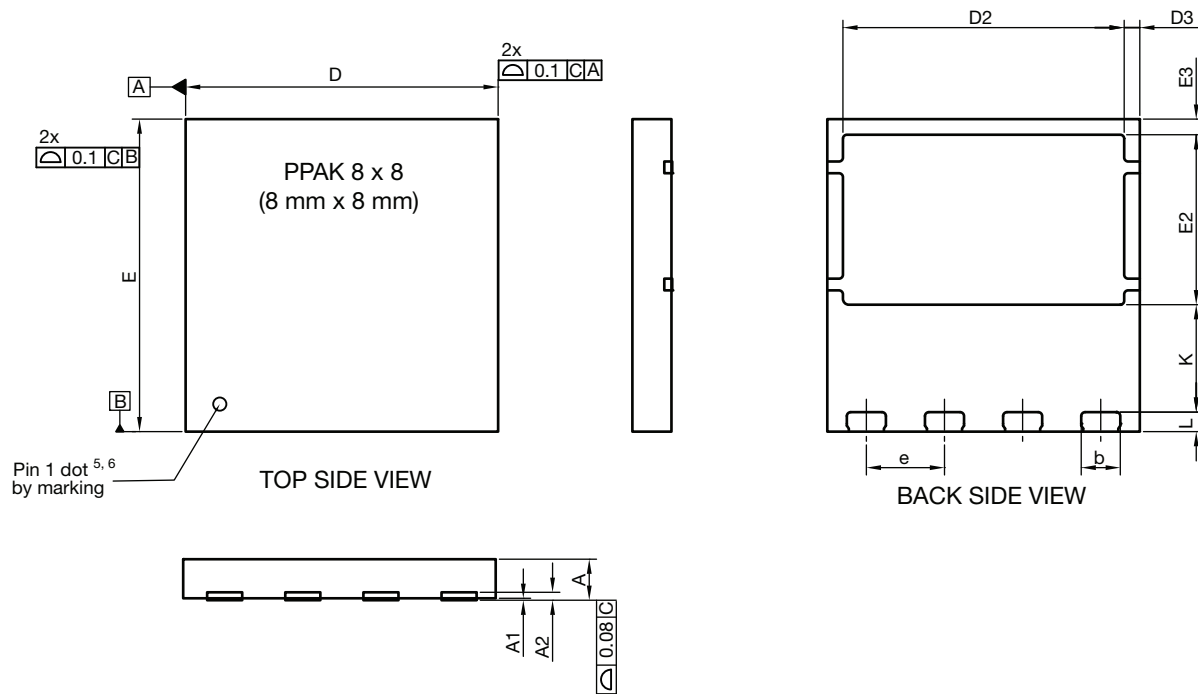
**Normalized Thermal Transient Impedance, Junction-to-Case**

### Note

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction to Ambient ( $25\text{ }^\circ\text{C}$ )
  - 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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## PowerPAK<sup>®</sup> 8 x 8 Case Outline



DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.95	1.00	1.05	0.037	0.039	0.041
A1	0.00	-	0.05	0.000	-	0.002
A2	020 ref.			0.008 ref.		
b	0.95	1.00	1.05	0.037	0.039	0.041
D	7.90	8.00	8.10	0.311	0.315	0.319
D2	7.10	7.20	7.30	0.280	0.283	0.287
D3	0.40 BSC			0.016 BSC		
e	2.00 BSC			0.079 BSC		
E	7.90	8.00	8.10	0.311	0.315	0.319
E2	4.30	4.35	4.40	0.169	0.171	0.173
E3	0.40 BSC			0.016 BSC		
K	2.75 BSC			0.108 BSC		
L	0.45	0.50	0.55	0.018	0.020	0.022
N <sup>(3)</sup>	8			8		

**Notes**

- (1) Use millimeters as the primary measurement
- (2) Dimensioning and tolerances conform to ASME Y14.5 M - 1994
- (3) N is the number of terminals
- (4) The pin 1 identifier must be existed on the top surface of the package by using indentation mark or other feature of package body
- (5) Exact shape and size of this feature is optional

ECN: E20-0518-Rev. B, 28-Sep-2020  
 DWG: 6041

## TO-263 (D<sup>2</sup>PAK): 3-LEAD



DIM.	INCHES		MILLIMETERS		
	MIN.	MAX.	MIN.	MAX.	
A	0.160	0.190	4.064	4.826	
b	0.020	0.039	0.508	0.990	
b1	0.020	0.035	0.508	0.889	
b2	0.045	0.055	1.143	1.397	
c*	Thin lead	0.013	0.018	0.330	0.457
	Thick lead	0.023	0.028	0.584	0.711
c1	Thin lead	0.013	0.017	0.330	0.431
	Thick lead	0.023	0.027	0.584	0.685
c2	0.045	0.055	1.143	1.397	
D	0.340	0.380	8.636	9.652	
D1	0.220	0.240	5.588	6.096	
D2	0.038	0.042	0.965	1.067	
D3	0.045	0.055	1.143	1.397	
D4	0.044	0.052	1.118	1.321	
E	0.380	0.410	9.652	10.414	
E1	0.245	-	6.223	-	
E2	0.355	0.375	9.017	9.525	
E3	0.072	0.078	1.829	1.981	
e	0.100 BSC		2.54 BSC		
K	0.045	0.055	1.143	1.397	
L	0.575	0.625	14.605	15.875	
L1	0.090	0.110	2.286	2.794	
L2	0.040	0.055	1.016	1.397	
L3	0.050	0.070	1.270	1.778	
L4	0.010 BSC		0.254 BSC		
M	-	0.002	-	0.050	
ECN: T13-0707-Rev. K, 30-Sep-13					
DWG: 5843					

### Notes

- Plane B includes maximum features of heat sink tab and plastic.
- No more than 25 % of L1 can fall above seating plane by max. 8 mils.
- Pin-to-pin coplanarity max. 4 mils.
- \*: Thin lead is for SUB, SYB.  
Thick lead is for SUM, SYM, SQM.
- Use inches as the primary measurement.
- This feature is for thick lead.



**RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead**



Recommended Minimum Pads  
Dimensions in Inches/(mm)

[Return to Index](#)



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