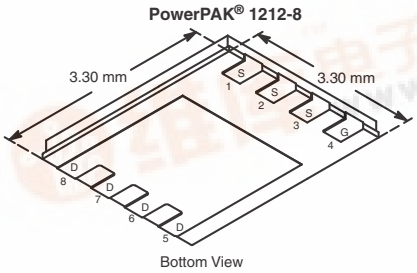
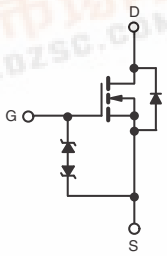
Automotive
N-Channel 60 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY	
V_{DS} (V)	60
$R_{DS(on)}$ (Ω) at V_{GS} = 10 V	0.048
$R_{DS(on)}$ (Ω) at V_{GS} = 4.5 V	0.074
I_D (A)	8
Configuration	Single



Bottom View



N-Channel MOSFET

Part Marking Code: Q009

FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- Typical ESD Protection 800 V[g]
- TrenchFET® Power MOSFET
- Compliant to RoHS Directive 2002/95/EC
- AEC-Q101 Qualified[d]
- Find out more about Vishay's Automotive Grade Product Requirements at: www.vishay.com/applications

AUTOMOTIVE GRADE
Pb-free
RoHS COMPLIANT
HALOGEN FREE

ORDERING INFORMATION

Package	PowerPAK 1212-8
Lead (Pb)-free and Halogen-free	SQS466EEN-T1-GE3

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[a]	T_C = 25 °C	I_D	8	A
	T_C = 125 °C		8	
Continuous Source Current (Diode Conduction)[a]		I_S	8	
Pulsed Drain Current[b]		I_{DM}	32	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	9	
Single Pulse Avalanche Energy		E_{AS}	4	mJ
Maximum Power Dissipation[b]	T_C = 25 °C	P_D	33	W
	T_C = 125 °C		11	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to + 175	°C
Soldering Recommendations (Peak Temperature)[e, f]			260	

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-Ambient	PCB Mount[c]	R_{thJA}	81	°C/W
Junction-to-Case (Drain)		R_{thJC}	4.5	

Notes

a. Package limited.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
c. When mounted on 1" square PCB (FR4 material).
d. Parametric verification ongoing.
e. See solder profile (www.vishay.com/ppg?73257). The PowerPAK 1212-8 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.
f. Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.
g. The diode connected between the gate and source serves only as protection ESD. No gate overvoltage rating is implied.

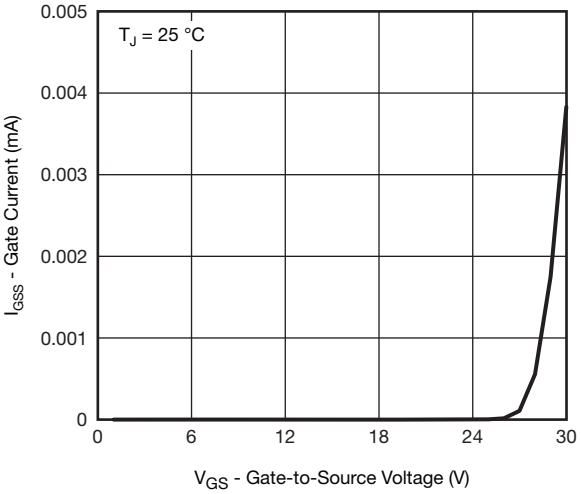
SPECIFICATIONS (T_C = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA		60	-	-	V
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA		1.5	2.0	2.5	
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 12 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	10	-	-	A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 3.2 A	-	0.030	0.048	Ω
		V_{GS} = 10 V	I_D = 3.2 A, T_J = 125 °C	-	0.052	0.083	
		V_{GS} = 10 V	I_D = 3.2 A, T_J = 175 °C	-	0.065	0.104	
		V_{GS} = 4.5 V	I_D = 3 A	-	0.042	0.074	
Forward Transconductance[b]	g_{fs}	V_{DS} = 15 V, I_D = 3.2 A		-	10	-	S
Dynamic[b]							
Input Capacitance	C_{iss}	V_{GS} = 0 V	V_{DS} = 30 V, f = 1 MHz	-	520	625	pF
Output Capacitance	C_{oss}			-	85	100	
Reverse Transfer Capacitance	C_{rss}			-	55	65	
Total Gate Charge[c]	Q_g	V_{GS} = 10 V	V_{DS} = 30 V, I_D = 5.4 A	-	14	21	nC
Gate-Source Charge[c]	Q_{gs}			-	2	-	
Gate-Drain Charge[c]	Q_{gd}			-	4	-	
Turn-On Delay Time[c]	$t_{d(on)}$	V_{DD} = 30 V, R_L = 5.5 Ω I_D ≅ 5.4 A, V_{GEN} = 10 V, R_g = 1 Ω		-	7	9	ns
Rise Time[c]	t_r			-	10	12	
Turn-Off Delay Time[c]	$t_{d(off)}$			-	15	18	
Fall Time[c]	t_f			-	7	9	
Source-Drain Diode Ratings and Characteristics[b]							
Pulsed Current[a]	I_{SM}			-	-	32	A
Forward Voltage	V_{SD}	I_F = 4 A, V_{GS} = 0 V		-	0.8	1.2	V

Notes

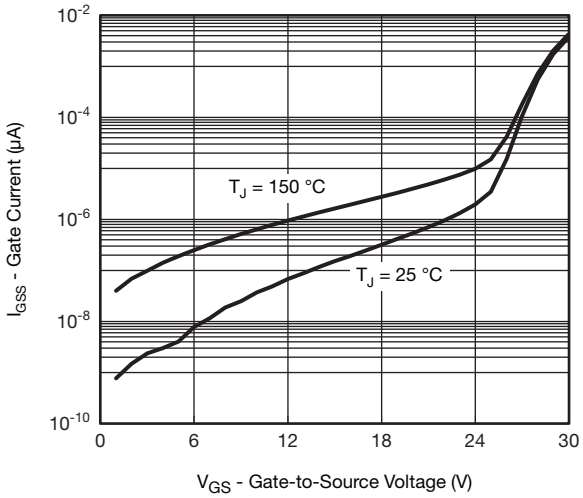
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

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.

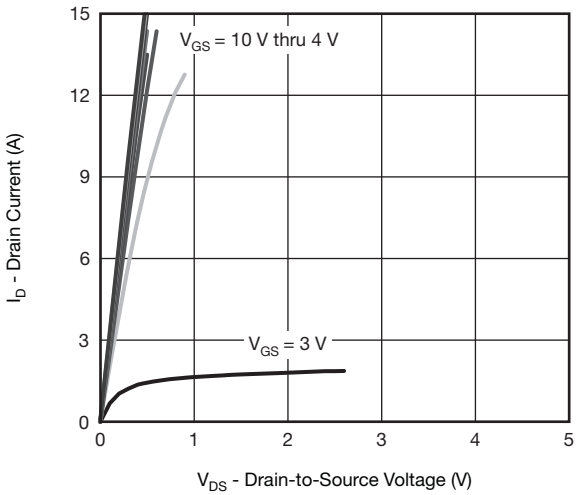
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



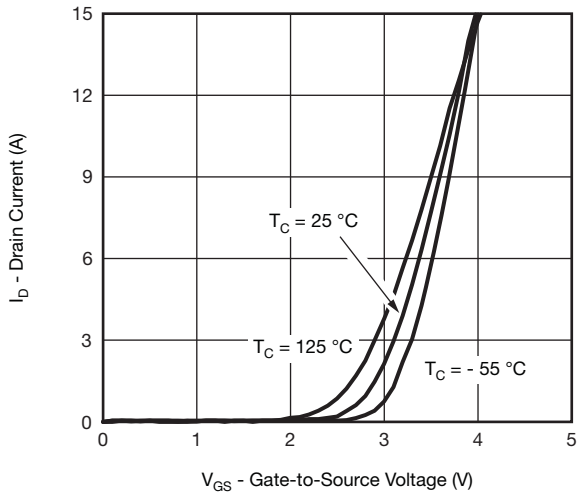
Gate Current vs. Gate-Source Voltage



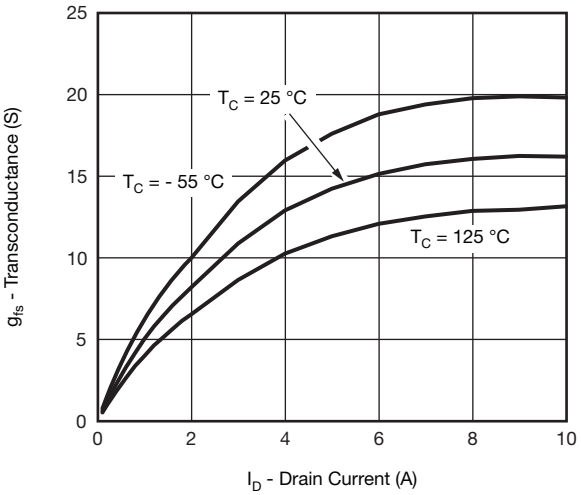
Gate Current vs. Gate-Source Voltage



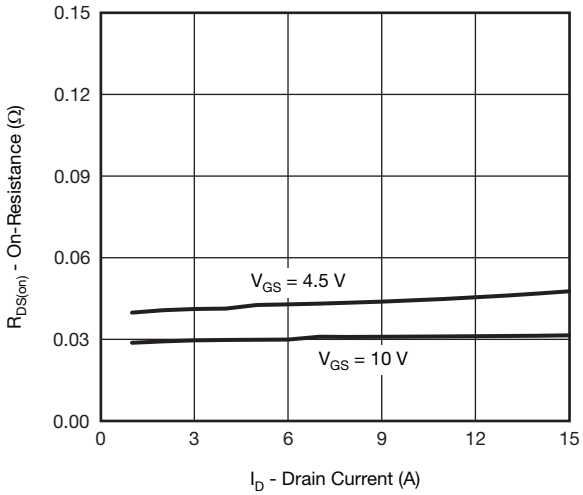
Output Characteristics



Transfer Characteristics

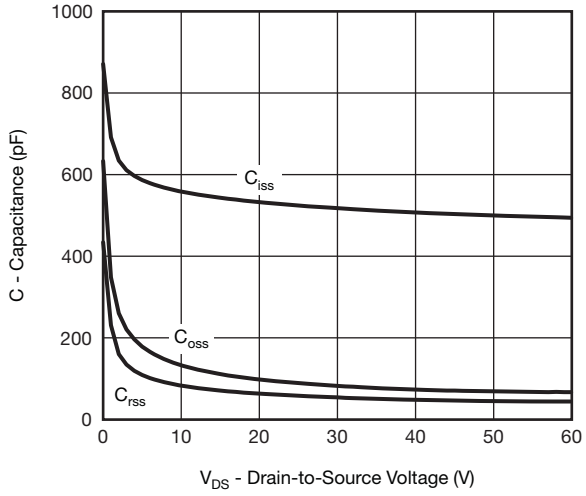


Transconductance

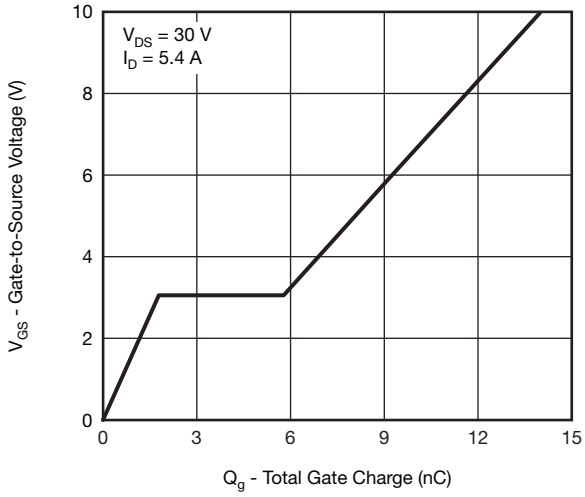


On-Resistance vs. Drain Current

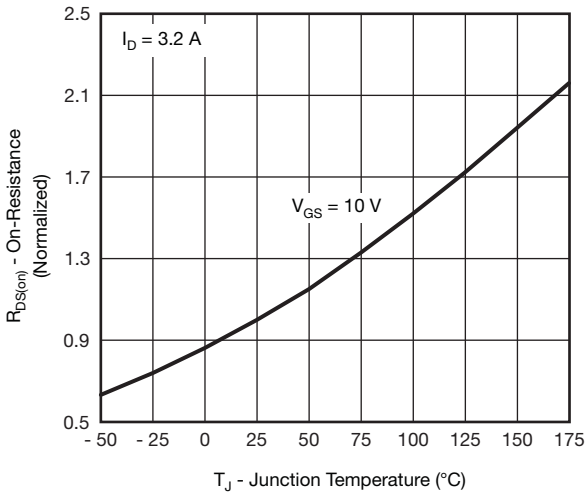
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)



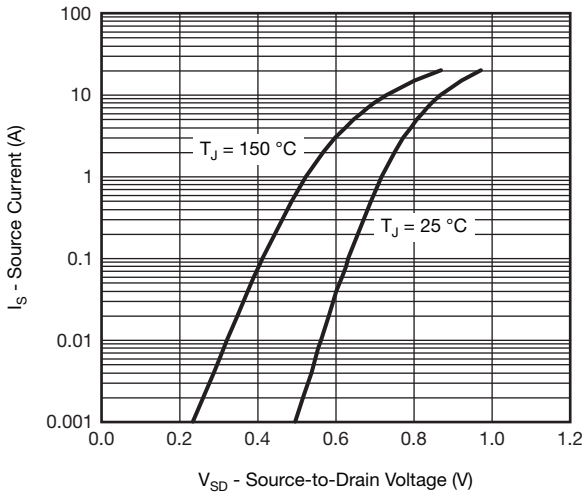
Capacitance



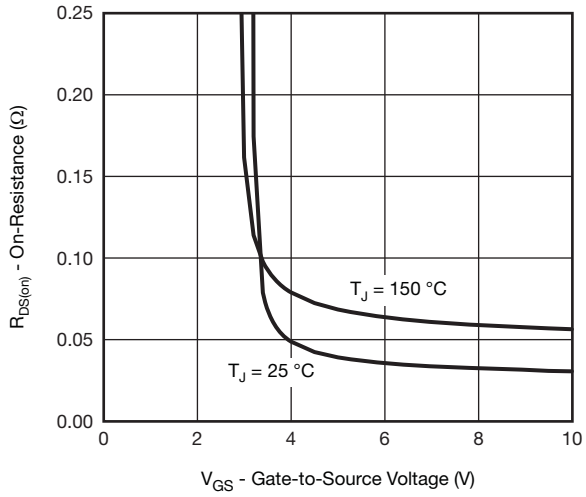
Gate Charge



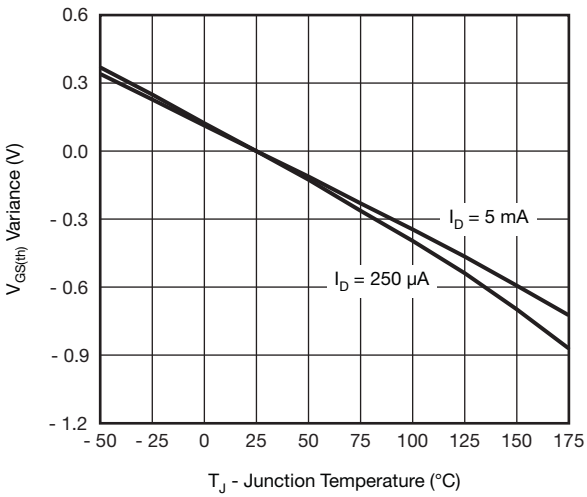
On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage

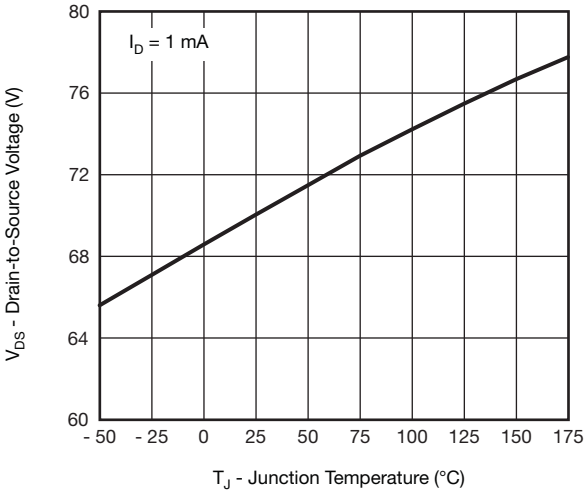


On-Resistance vs. Gate-to-Source Voltage



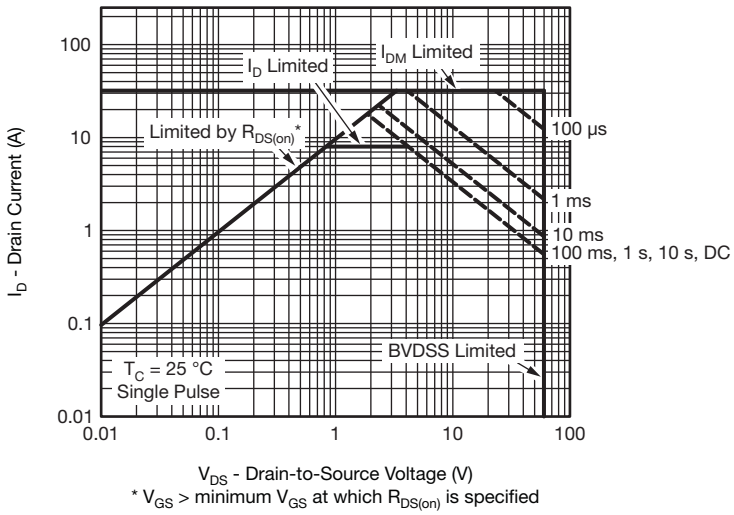
Threshold Voltage

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



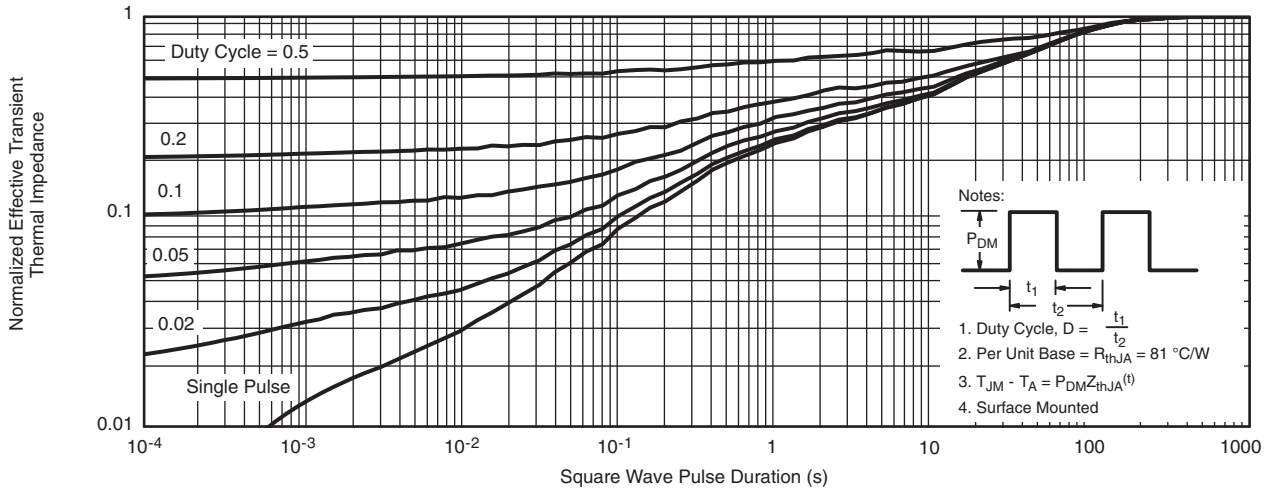
Drain Source Breakdown vs. Junction Temperature

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

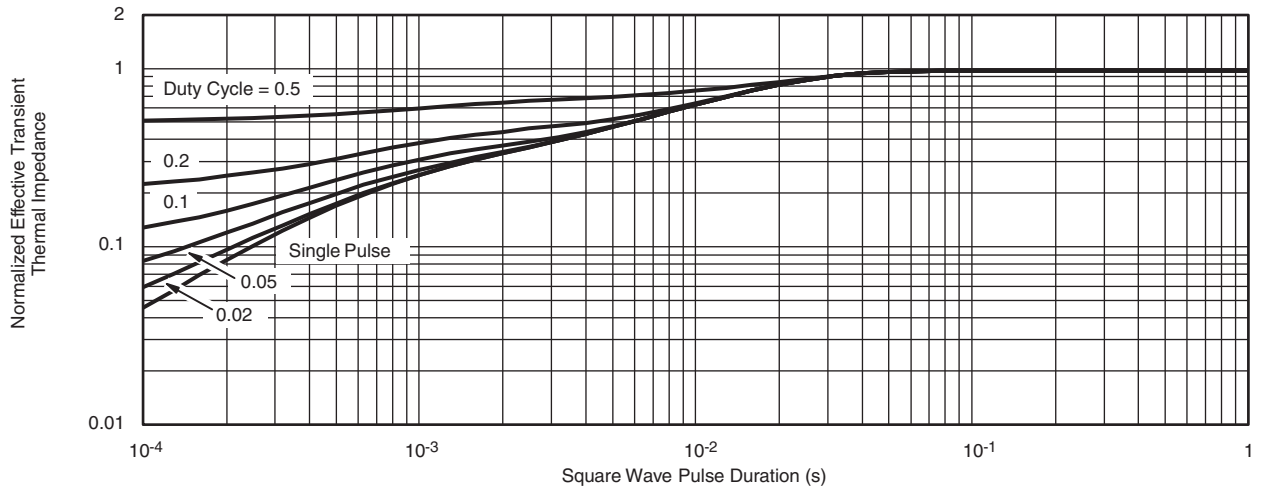


Safe Operating Area

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



Normalized Thermal Transient Impedance, Junction-to-Ambient



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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