

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

PRODUCT SUMMARY

V_{DS} (V)	40
$R_{DS(on)}$ (Ω) at $V_{GS} = 10$ V	0.032
$R_{DS(on)}$ (Ω) at $V_{GS} = 4.5$ V	0.046
I_D (A)	8
Configuration	Single

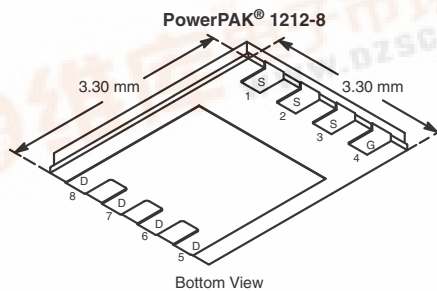
FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Typical ESD Protection 800 V
- 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

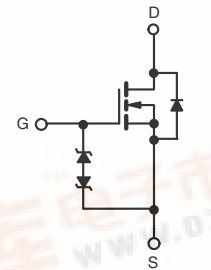
AUTOMOTIVE
GRADE



RoHS
COMPLIANT
HALOGEN
FREE



Bottom View



N-Channel MOSFET

Part Marking Code: Q010

ORDERING INFORMATION

Package	PowerPAK 1212-8
Lead (Pb)-free and Halogen-free	SQS464EEN-T1-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}	± 20	
Continuous Drain Current ^a	I_D	8	A
		8	
Continuous Source Current (Diode Conduction) ^a	I_S	8	
Pulsed Drain Current ^b	I_{DM}	32	
Single Pulse Avalanche Current	I_{AS}	10	mJ
Single Pulse Avalanche Energy	E_{AS}	5	
Maximum Power Dissipation ^b	P_D	33	W
		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	R_{thJA}	81	°C/W
Junction-to-Case (Drain)	R_{thJC}	4.5	

Notes

- Package limited.
- Pulse test; pulse width ≤ 300 μ s, duty cycle ≤ 2 %.
- When mounted on 1" square PCB (FR4 material).
- Parametric verification ongoing.
- 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.
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.



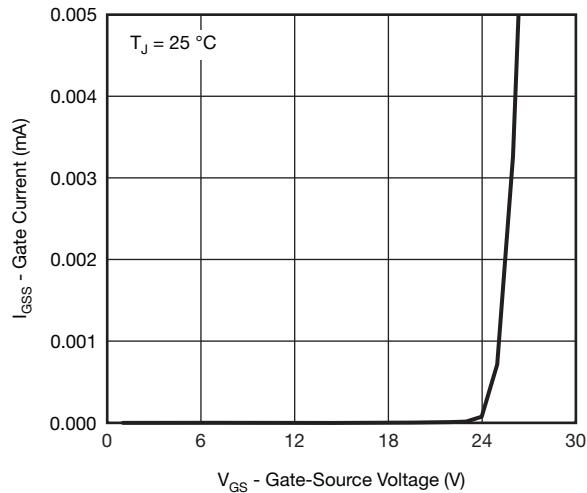
SPECIFICATIONS (T _C = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA		40	-	-	V
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA		1.5	2.0	2.5	
Gate-Source 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} = 40 V	-	-	1	μA
		V _{GS} = 0 V	V _{DS} = 40 V, T _J = 125 °C	-	-	50	
		V _{GS} = 0 V	V _{DS} = 40 V, T _J = 175 °C	-	-	150	
On-State Drain Current ^a	I _{D(on)}	V _{GS} = 10 V	V _{DS} ≥ 5 V	20	-	-	A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V	I _D = 5 A	-	0.022	0.032	Ω
		V _{GS} = 10 V	I _D = 5 A, T _J = 125 °C	-	0.035	0.050	
		V _{GS} = 10 V	I _D = 5 A, T _J = 175 °C	-	0.042	0.060	
		V _{GS} = 4.5 V	I _D = 4 A	-	0.037	0.046	
Forward Transconductance ^b	g _{fs}	V _{DS} = 10 V, I _D = 5 A		-	14	-	S
Dynamic ^b							
Input Capacitance	C _{iss}	V _{GS} = 0 V	V _{DS} = 20 V, f = 1 MHz	-	540	650	pF
Output Capacitance	C _{oss}			-	120	145	
Reverse Transfer Capacitance	C _{rss}			-	80	95	
Total Gate Charge ^c	Q _g	V _{GS} = 10 V	V _{DS} = 20 V, I _D = 6 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} = 20 V, R _L = 13.3 Ω I _D ≅ 1.5 A, V _{GEN} = 10 V, R _g = 1 Ω		-	6	8	ns
Rise Time ^c	t _r			-	11	14	
Turn-Off Delay Time ^c	t _{d(off)}			-	17	21	
Fall Time ^c	t _f			-	9	11	
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

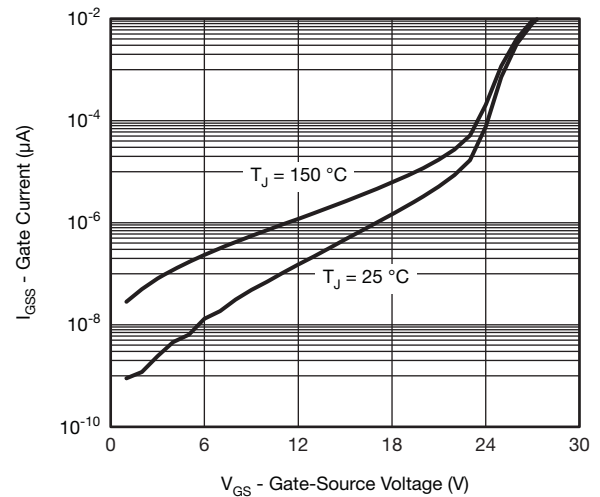
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

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.

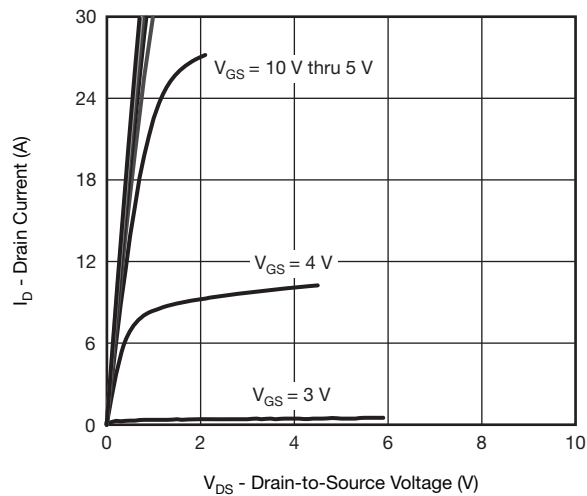
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)



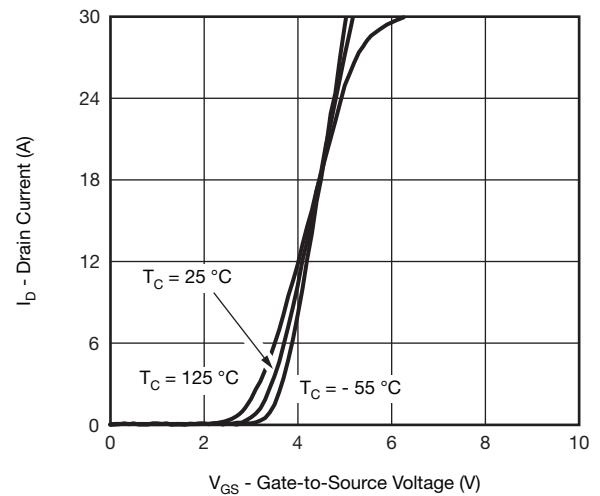
Gate Current vs. Gate-Source Voltage



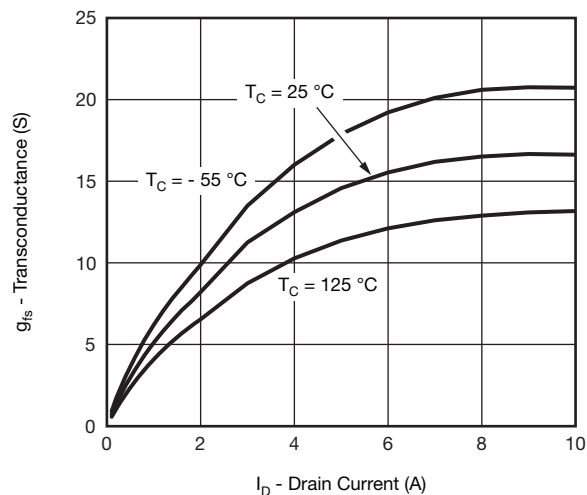
Gate Current vs. Gate-Source Voltage



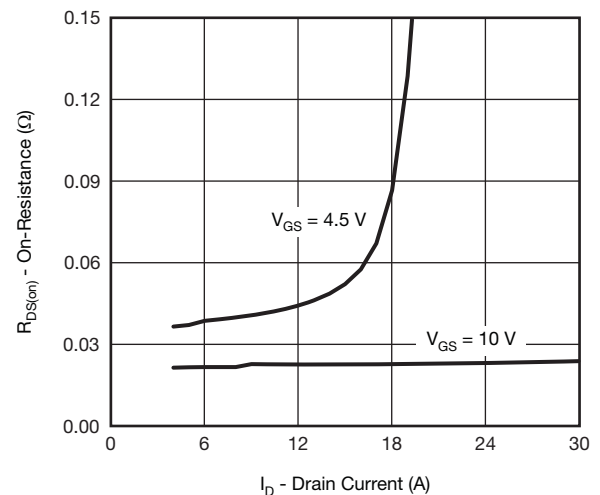
Output Characteristics



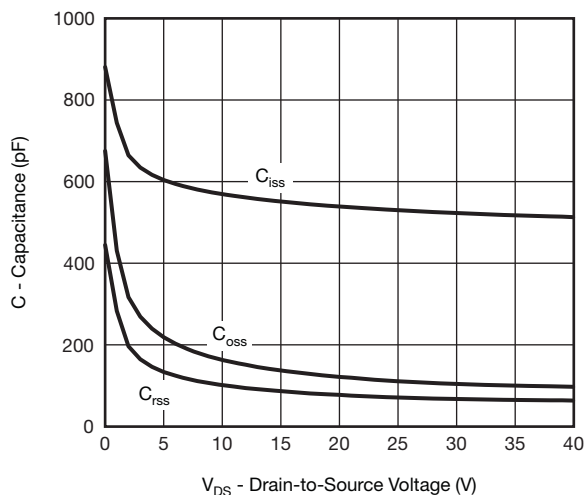
Transfer Characteristics



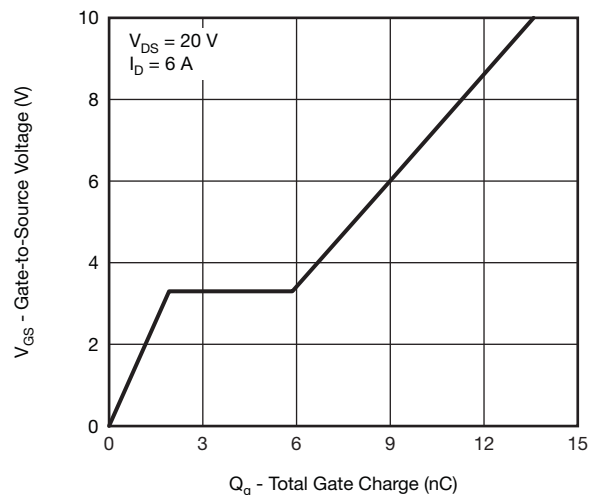
Transconductance



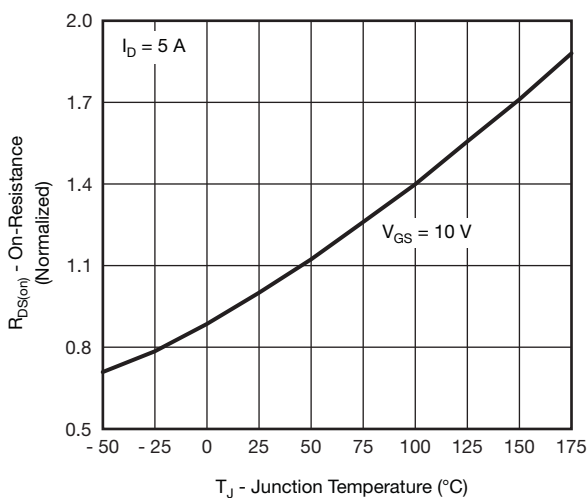
On-Resistance vs. Drain Current

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


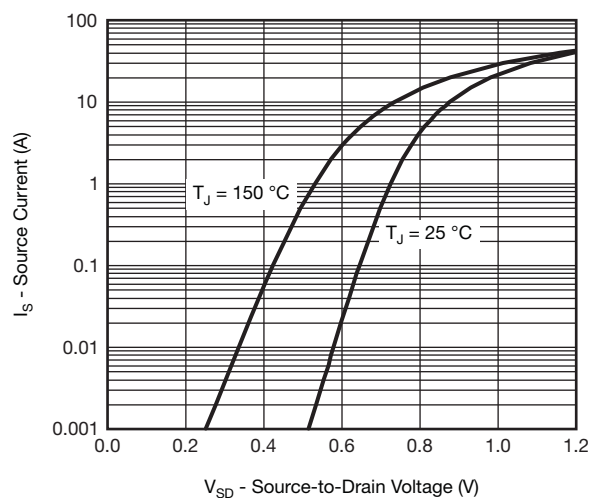
Capacitance



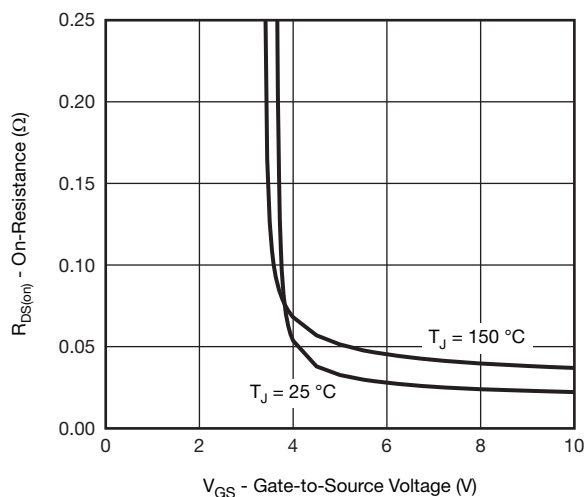
Gate Charge



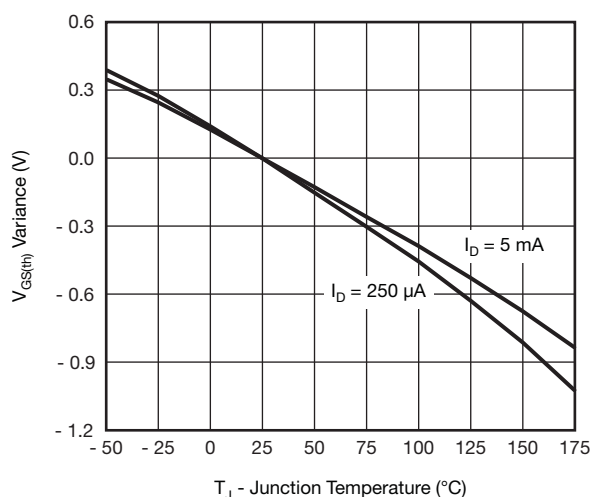
On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage

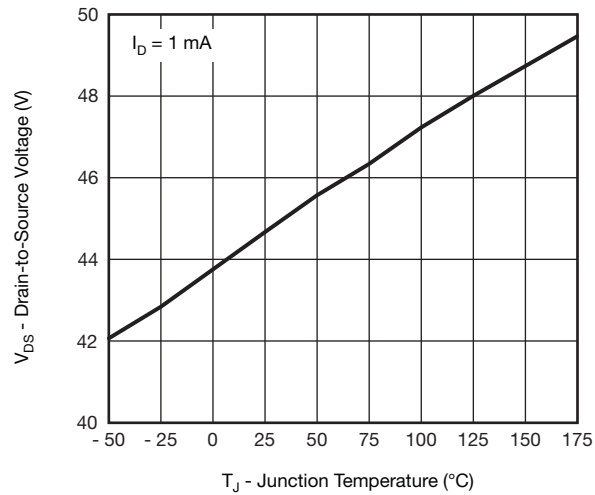


On-Resistance vs. Gate-to-Source Voltage



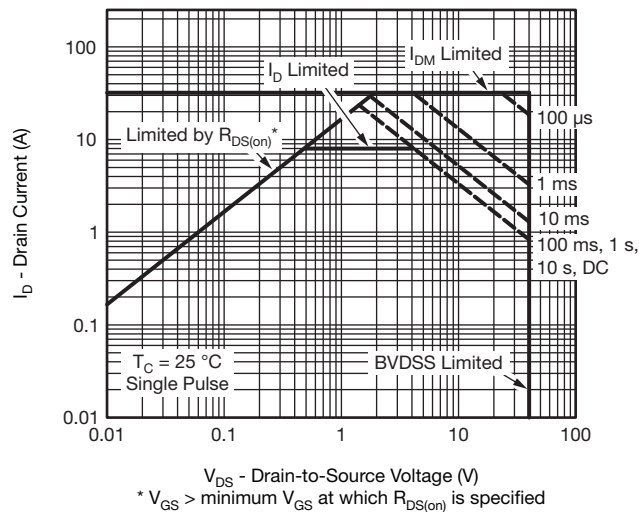
Threshold Voltage

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

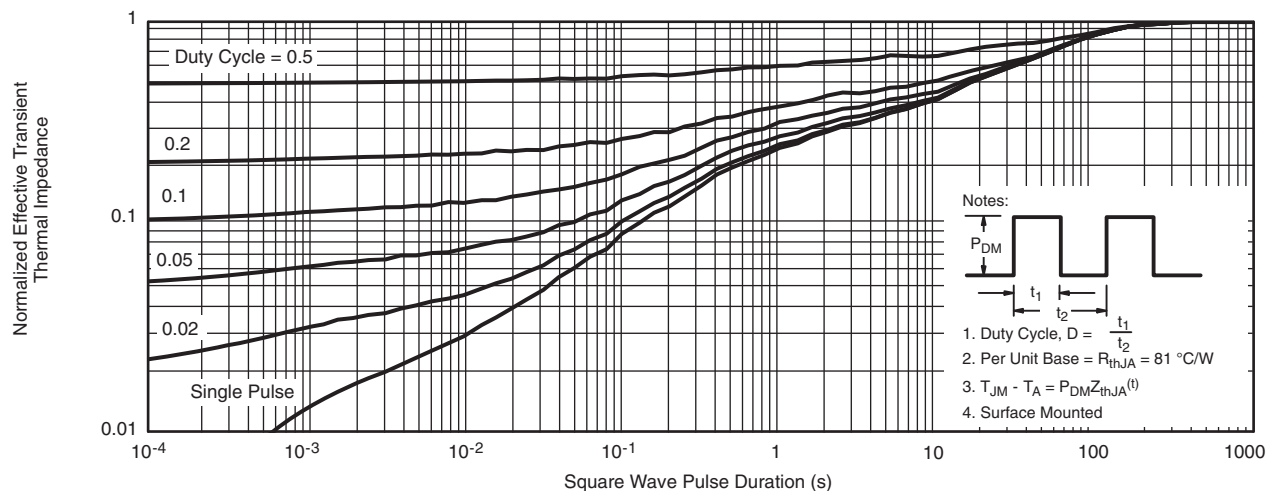
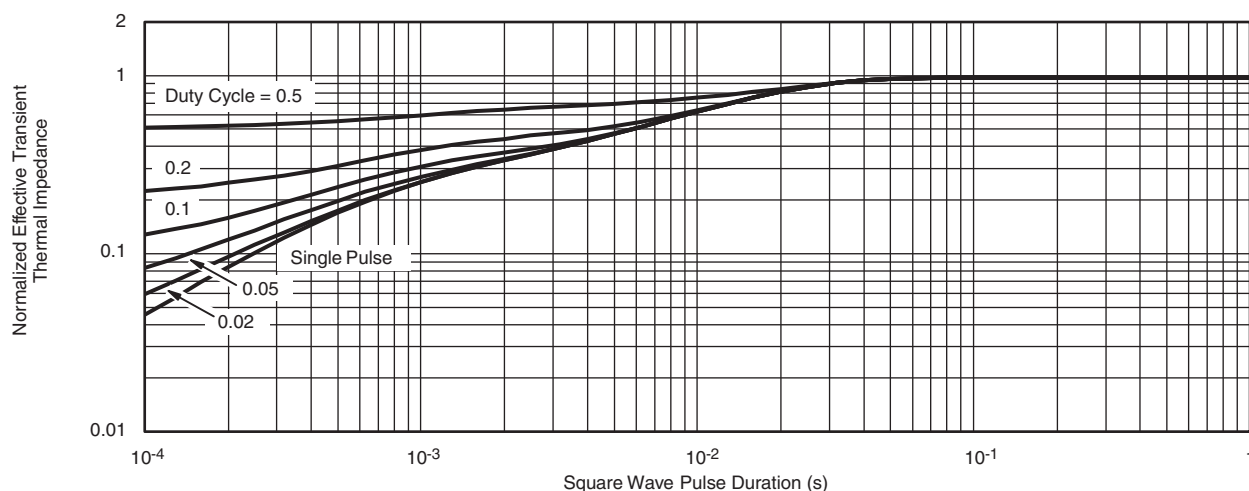


Drain Source Breakdown vs. Junction Temperature

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



Safe Operating Area

THERMAL RATINGS ($T_A = 25\text{ }^{\circ}\text{C}$, 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 ($25\text{ }^{\circ}\text{C}$)
 - 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 $1\text{''} \times 1\text{''} \times 0.062\text{''}$, 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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