

650V 290mohm Super-Junction Power MOSFET
AK3S65N2K9FMF

Description:

This SJ device provides good FOM performance, better EMI for customer application.

Features:

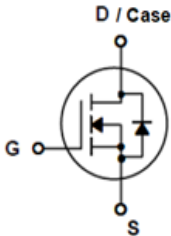
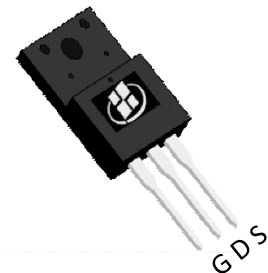
- EMI-Friendly
- RoHS compliant
- Halogen-free

Applications:

- High Frequency Switching
- Quick Charging and Adapter

Key Performance Parameters:

Parameter	Value	Unit
V_{DS}	650	V
$R_{DS(on), max} @V_{GS} = 10\text{ V}$	290	mΩ
I_D	15	A



Ordering Information:

Ordering Code	Package Type	Marking Code	Form	Packing
AK3S65N2K9FMF	TO-220F	3S65N2K9FMF	Tube	See the detail package information

Maximum Ratings ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Units
V_{DS}	Drain - Source Voltage	650	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) ^(Note 1)	15	A
	Drain Current - Continuous ($T_C = 100^\circ\text{C}$)	9.5	A
I_{DM}	Drain Current - Pulsed ^(Note 2)	45	A
V_{GS}	Gate - Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy ^(Note 3)	84	mJ
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	44	W
dV/dT	MOSFET dv/dt ruggedness, $V_{DS} = 0 \dots 480 \text{ V}$	50	V/ns
	Reverse diode dv/dt, $V_{DS} = 0 \dots 480 \text{ V}$	15	V/ns
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction - to - Case, Steady State	2.8	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction - to - Ambient, Steady State ^(Note 4)	55	$^\circ\text{C/W}$

Notes:

1. The max drain current rating limited by maximum junction temperature
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. $L = 75 \text{ mH}$, $V_{DD} = 100 \text{ V}$, $I_{AS} = 1.5 \text{ A}$, $R_G = 25 \Omega$, Starting $T_J = 25^\circ\text{C}$
4. Mount on minimum PCB layout

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Static Characteristics						
V _{(BR)DSS}	Drain - Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250 μA	650			V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650 V, V _{GS} = 0 V			10	μA
I _{GSS}	Gate Leakage Current	V _{GS} = ± 30 V, V _{DS} = 0 V			±100	nA
V _{GS(th)}	Gate Threshold voltage	V _{DS} = V _{GS} , I _D = 250 μA	2.6	3.6	4.6	V
R _{DS(ON)}	Drain - Source on - state resistance	V _{GS} = 10 V, I _D = 7.5 A		260	290	mΩ
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0 V, f = 1 MHz		647		pF
C _{oss}	Output Capacitance			20		pF
C _{rss}	Reverse Transfer Capacitance			7		pF
C _{o(er)}	Effective output capacitance, energy related	V _{DS} = 0...400 V, V _{GS} = 0 V		34		pF
C _{o(tr)}	Effective output capacitance, time related	V _{DS} = 0...400 V, V _{GS} = 0 V, I _D =constant		224		pF
R _g	Gate Resistance	f = 1 MHz		20		Ω
Switching Characteristics						
t _{d(on)}	Turn On Delay Time	V _{DD} = 400 V , I _D = 8A, V _{GS} = 10 V, R _G = 2 Ω		77		ns
t _r	Rise Time			7		ns
t _{d(off)}	Turn Off Delay Time			35		ns
t _f	Fall Time			6		ns
Q _g	Total Gate Charge	V _{DD} = 400 V , I _D = 8 A, V _{GS} = 10 V		22		nC
Q _{gs}	Gate - Source Charge			4		nC
Q _{gd}	Gate - Drain Charge			12		nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Body - Diode Forward Current				15	A
I _{SM}	Maximum Pulsed Body - Diode Forward Current				45	A
V _{SD}	Diode Forward Voltage	V _{GS} = 0 V, I _S = 15 A		1.28		V
t _{rr}	Reverse recovery time	V _{DD} = 400 V, I _D = 8 A, di/dt = 100 A/μs		71.5		ns
Q _{rr}	Reverse recovery charge			0.29		μC
I _{rrm}	Peak Reverse Recovery Current			8		A

Electrical Characteristics Diagrams

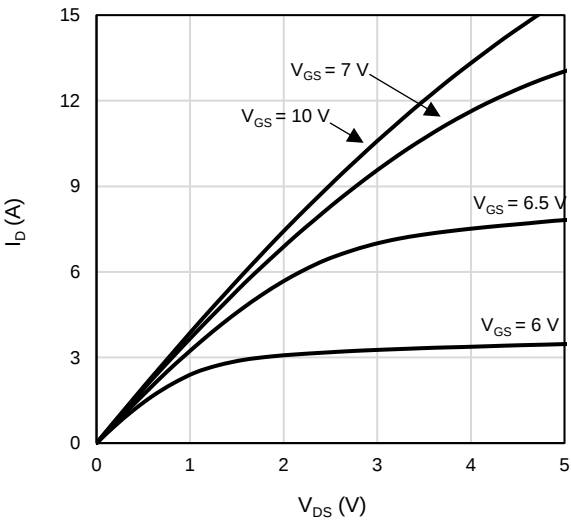


Figure 1: On-Region Characteristics

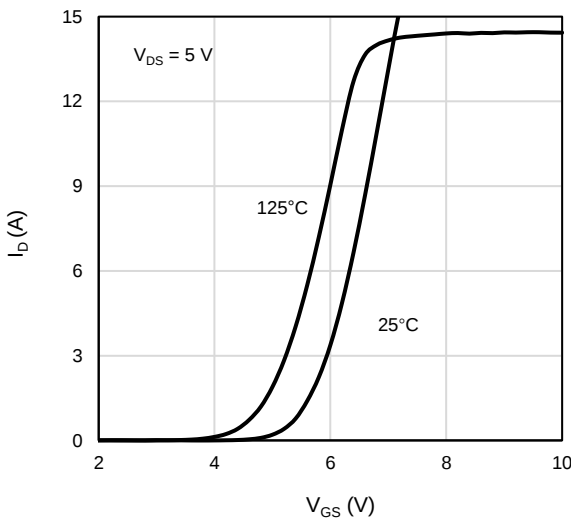


Figure 2: Transfer Characteristics

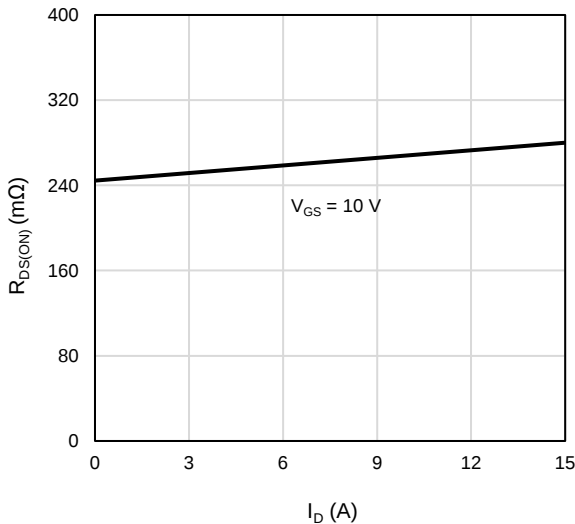


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

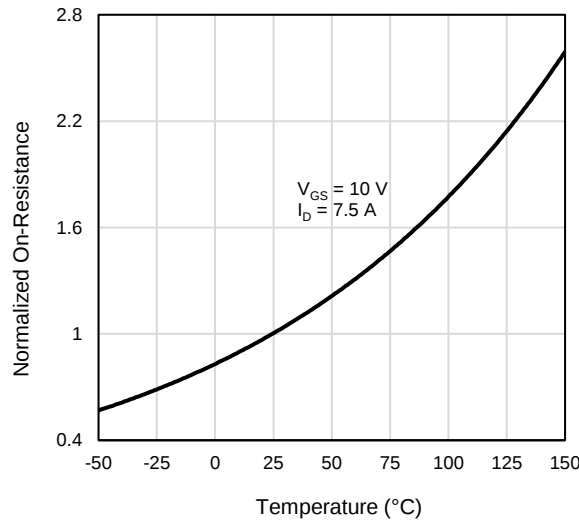


Figure 4: On-Resistance vs. Junction Temperature

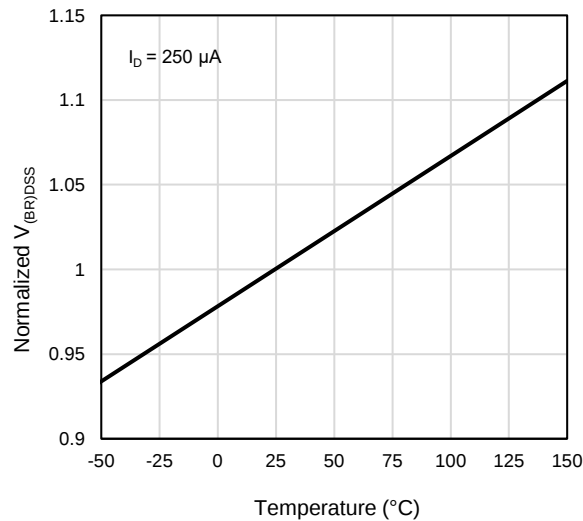


Figure 5: Breakdown Voltage vs. Junction Temperature

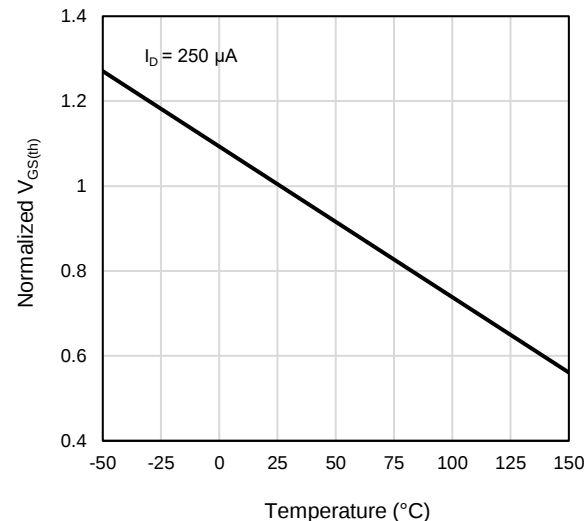


Figure 6: Threshold Voltage vs. Junction Temperature

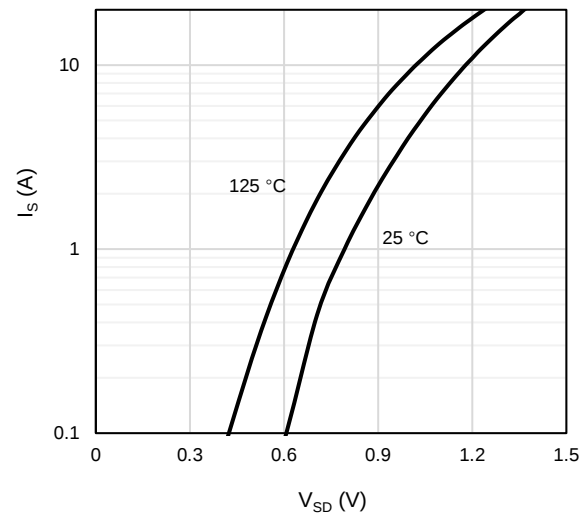


Figure 7: Body-Diode Characteristics

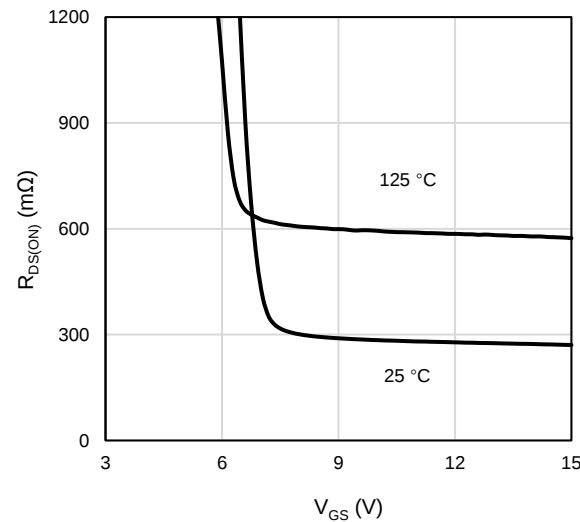


Figure 8: On-Resistance vs. Gate-Source Voltage

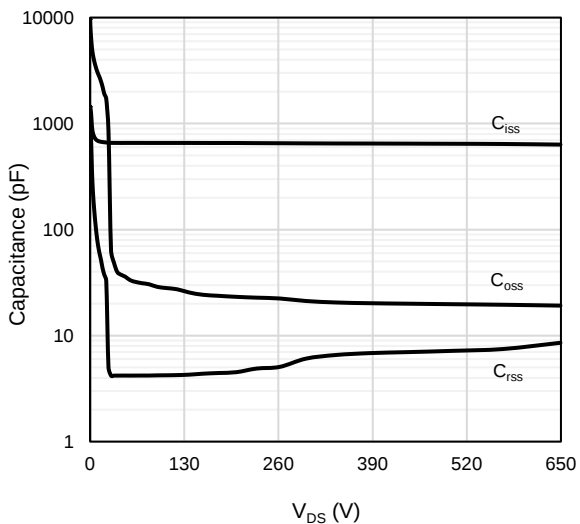


Figure 9: Capacitance Characteristics

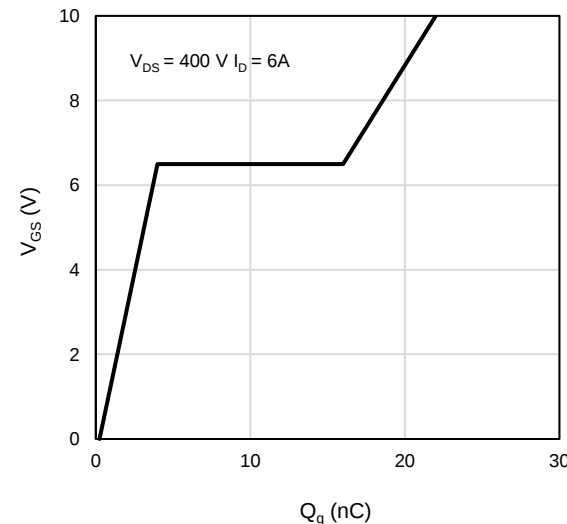


Figure 10: Gate-Charge Characteristics

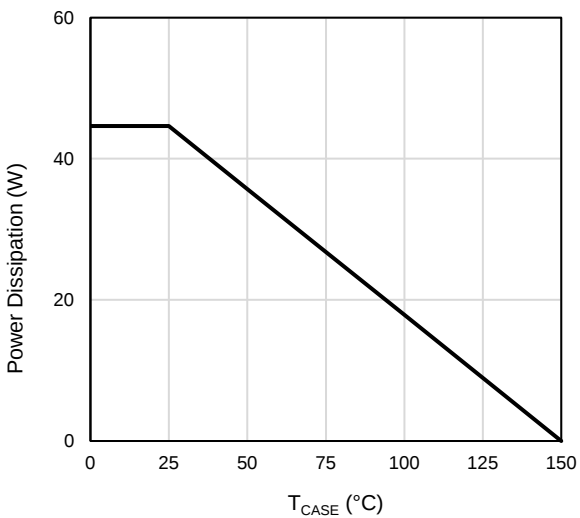


Figure 11: Power De-rating

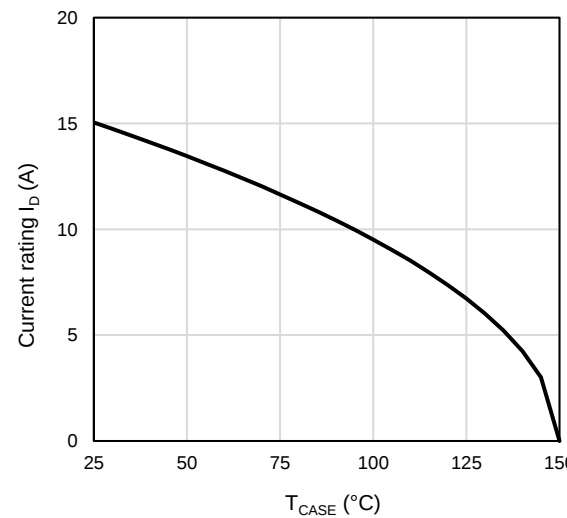


Figure 12: Current De-rating

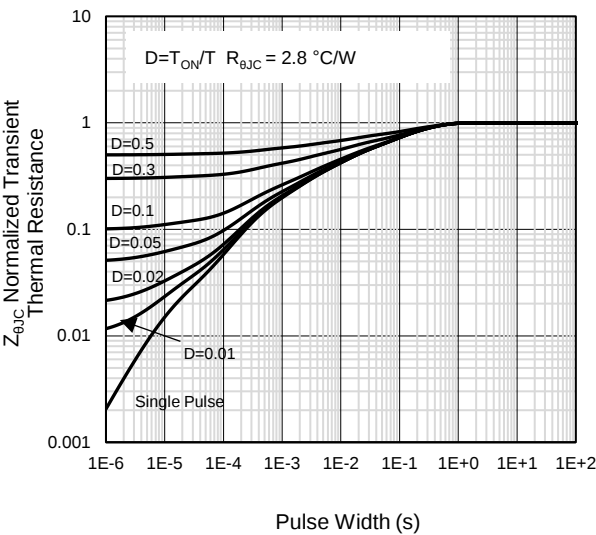


Figure 13: Normalized Maximum Transient Thermal Impedance

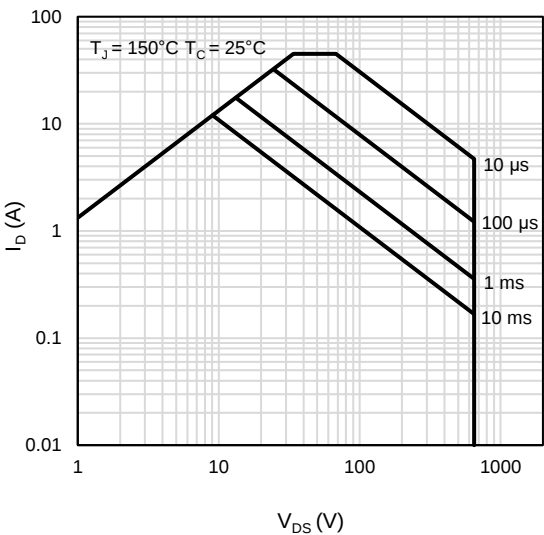
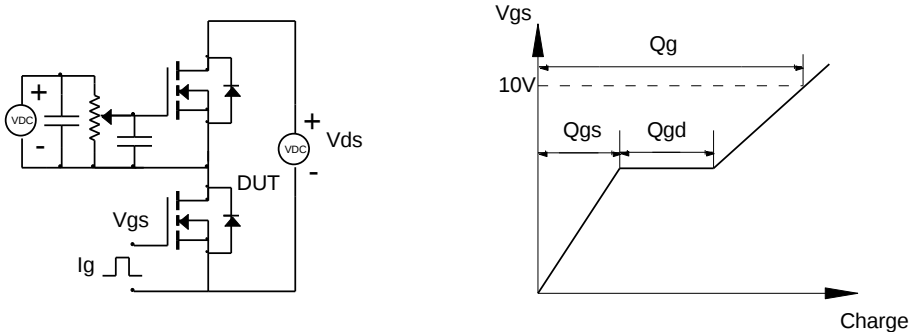


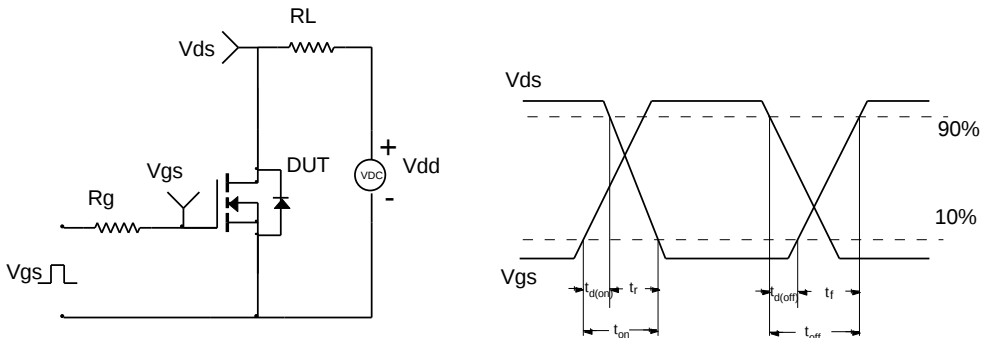
Figure 14: Maximum Forward Biased Safe Operating Area

Test Circuit and Waveform

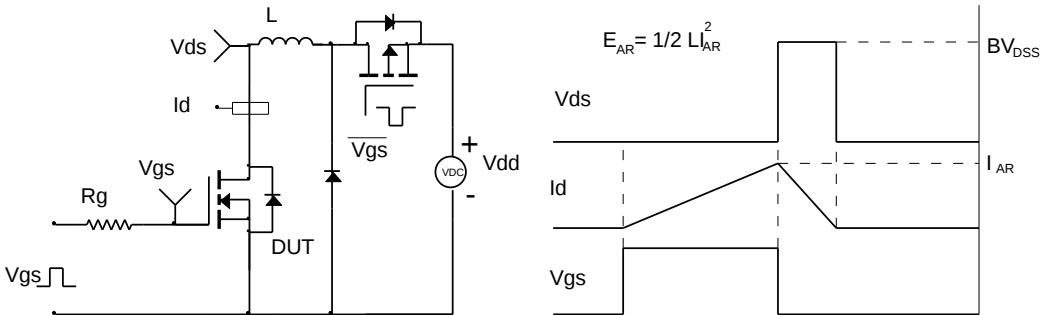
Gate Charge Test Circuit & Waveform



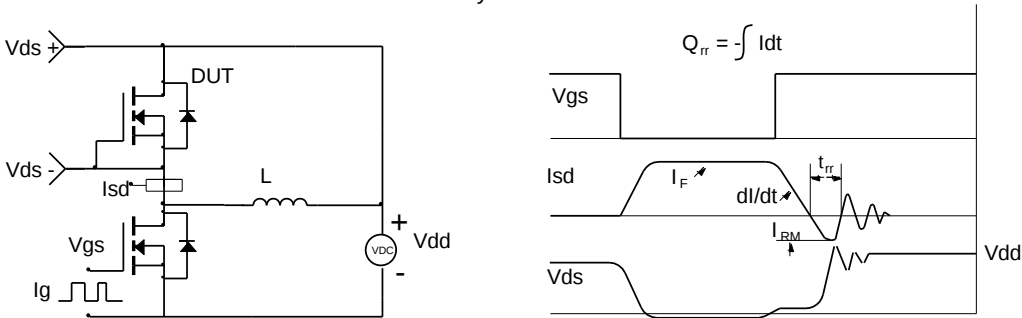
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



Revision History

Revision	Released	Remark
Rev.1.1	2025	

Disclaimer

The information given in this document describes the independent performance of the product, but similar performance is not guaranteed under other working conditions, and cannot be guaranteed when installed with other products or equipment. To achieve the required performance of the product in actual scenarios, the customer should conduct a complete application test to assess the functionality of the product.

Alkaidsemi assumes no responsibility for equipment failures result from using products at values that exceed the ratings, operating conditions, or other parameters listed in the product specifications.

The product described in this specification is not applicable for aerospace or other applications which requires high reliability. Customers using or selling these products for use in medical, life-saving, or life-sustaining applications do so at their own risk and agree to fully indemnify.

Due to product or technical improvements, the information described or contained herein may be changed without prior notice.