



-30V P-Channel Enhancement Mode MOSFET

■ **DESCRIPTION**

The 4409 is the P-Channel logic enhancement mode power field effect transistor is produced using high cell density advanced trench technology..

This high density process is especially tailored to minimize on-state resistance. These devices are particularly suited for low voltage application, notebook computer power management and other battery powered circuits where high-side switching

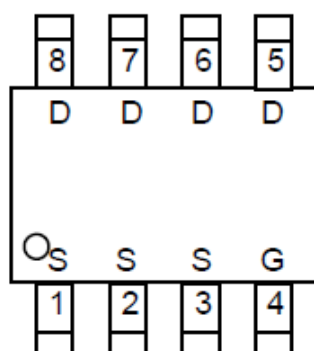
■ **FEATURE**

- ◆ **-30V/-15A, $R_{DS(ON)}=8m\Omega$ (typ.)@ $V_{GS}=-10V$**
- ◆ **-30V/-10A, $R_{DS(ON)}=10m\Omega$ (typ.)@ $V_{GS}=-4.5V$**
- ◆ Super high design for extremely low $R_{DS(ON)}$
- ◆ Exceptional on-resistance and Maximum DC current capability
- ◆ Full RoHS compliance
- ◆ SOP8 package design

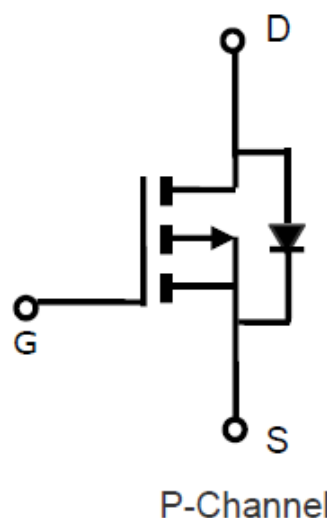
■ **APPLICATIONS**

- ◆ High Frequency Point-of-Load Synchronous
- ◆ Newworking DC-DC Power System
- ◆ Load Switch

■ **PIN CONFIGURATION**



TOP VIEW
SOP-8



P-Channel



■ PART NUMBER INFORMATION

4409A-BB C	A= Package Code S: SOP BB=Handing Code TR: Tape&Reel C=Lead Plating Code G: Green Product
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■ ORDERING INFORMATION

Part Number	Package Code	Package	Shipping
4409S-TRG	S	SOP8	2500EA / T&R

※ Year Code : 0~9

※ Week Code : A~Z(1-26); a~z(27~52)

※ G : Green Product. This product is RoHS compliant.

■ ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ Unless otherwise noted)

Symbol	Parameter		Typical	Unit
V_{DSS}	Drain-Source Voltage		-30	V
V_{GSS}	Gate-Source Voltage		± 20	V
I_D	Continuous Drain Current ($T_A=25^\circ\text{C}$)	$V_{GS}=10\text{V}$	-14	A
I_{DM}	Pulsed Drain Current		-70	A
I_S	Continuous Source Current (Diode Conduction)		-2.7	A
P_D	Power Dissipation	$T_A=25^\circ\text{C}$	3.0	W
		$T_A=70^\circ\text{C}$	2.1	
T_J	Operation Junction Temperature		150	$^\circ\text{C}$
T_{STG}	Storage Temperature Range		-55~+150	$^\circ\text{C}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient		85	$^\circ\text{C/W}$

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress rating only and functional device operation is not implied



■ **ELECTRICAL CHARACTERISTICS** ($T_A=25^\circ\text{C}$ Unless otherwise noted)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Static Parameters						
V _{(BR)DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =-250uA	-30			V
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =-250uA	-1.0	-1.3	-2.0	V
I _{GSS}	Gate Leakage Current	V _{DS} =0V, V _{GS} =±20V			±100	nA
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-24V, V _{GS} =0			-1	uA
		V _{DS} =-24V, V _{GS} =0 T _J =55℃			-5	
R _{DS(ON)}	Drain-Source On-Resistance	V _{GS} =-10V, I _D =-15A		8	11	mΩ
		V _{GS} =-4.5V, I _D =-10A		10	13	
Source-Drain Diode						
V _{SD}	Diode Forward Voltage	I _S =-1.0A, V _{GS} =0V		-0.71	-1.0	V
Dynamic Parameters						
Q _g	Total Gate Charge	V _{DS} =-15V V _{GS} =-4.5V I _D =-15A		37.08	48.2	nC
Q _{gs}	Gate-Source Charge			10.12	13.16	
Q _{gd}	Gate-Drain Charge			11.24	14.61	
C _{iss}	Input Capacitance	V _{DS} =-15V V _{GS} =0V f=1MHz		3887		pF
C _{oss}	Output Capacitance			577		
C _{rss}	Reverse Transfer Capacitance			425		
T _{d(on)}	Turn-On Time	V _{DS} =-15V I _D =-10A		19.52	39.04	nS
T _r				10.12	20.34	
T _{d(off)}	Turn-Off Time	V _{GEN} =-10V R _G =6Ω		137.6	275.2	
T _f				55.32	110.64	

Note: 1. Pulse test: pulse width $\leq$ 300uS, duty cycle $\leq$ 2%

2.Static parameters are based on package level with recommended wire bonding



■ **TYPICAL CHARACTERISTICS** (25 °C Unless Note)

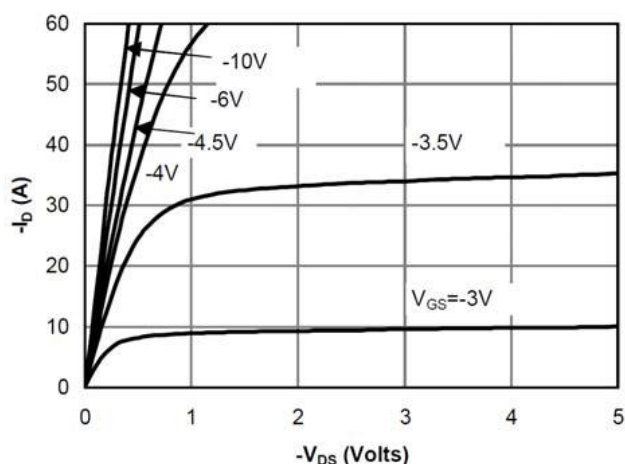


Fig 1: On-Region Characteristics

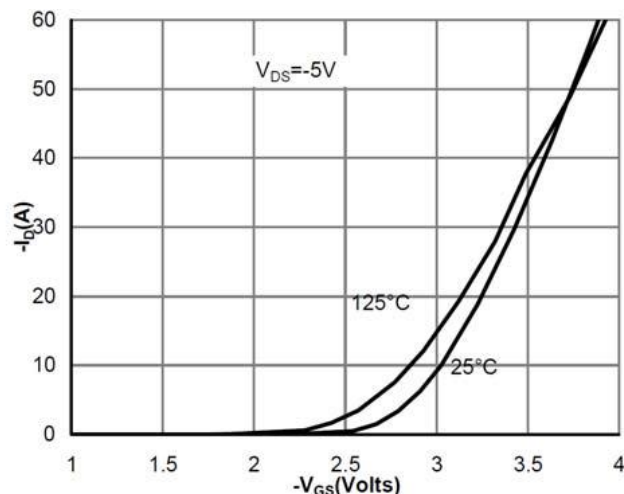


Figure 2: Transfer Characteristics

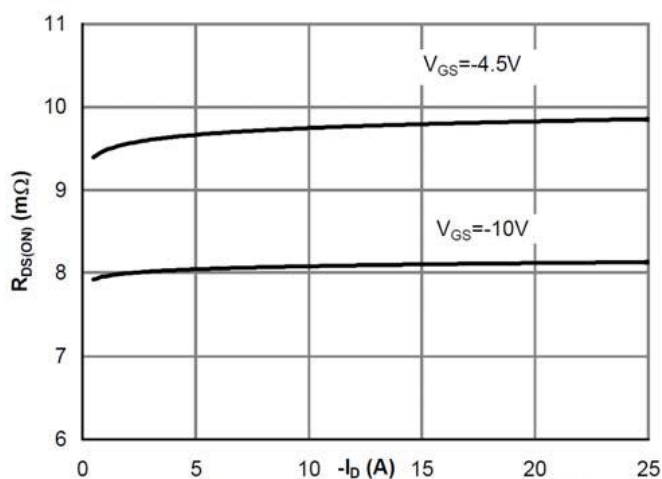


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

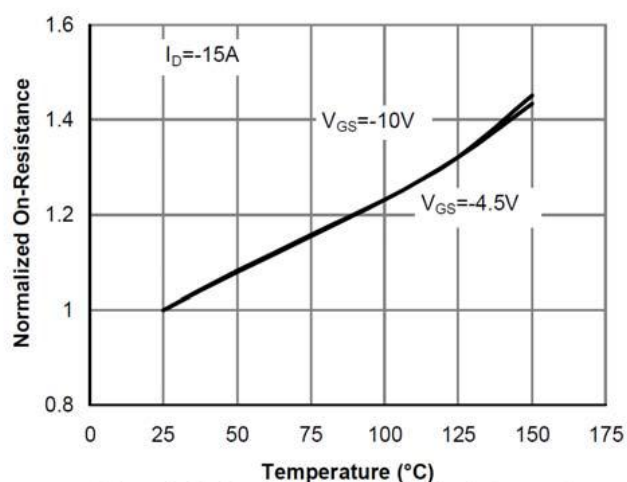


Figure 4: On-Resistance vs. Junction Temperature

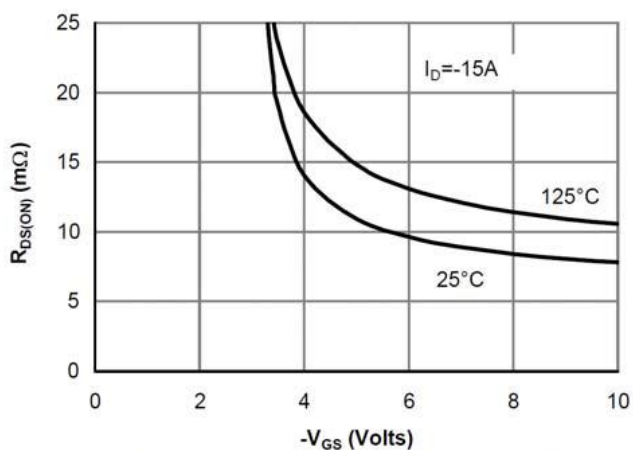


Figure 5: On-Resistance vs. Gate-Source Voltage

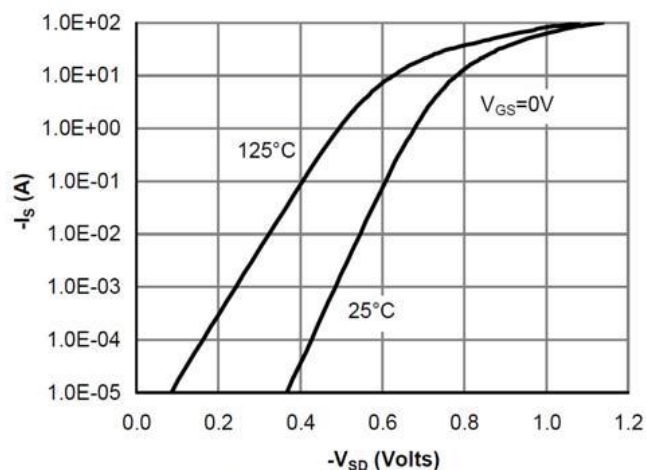


Figure 6: Body-Diode Characteristics



■ **TYPICAL CHARACTERISTICS** (continuous)

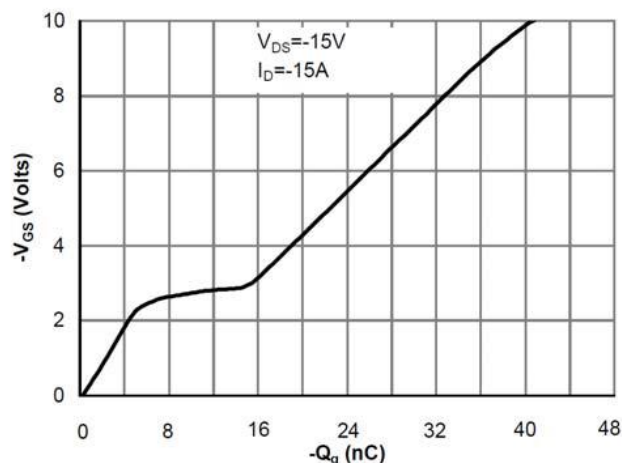


Figure 7: Gate-Charge Characteristics

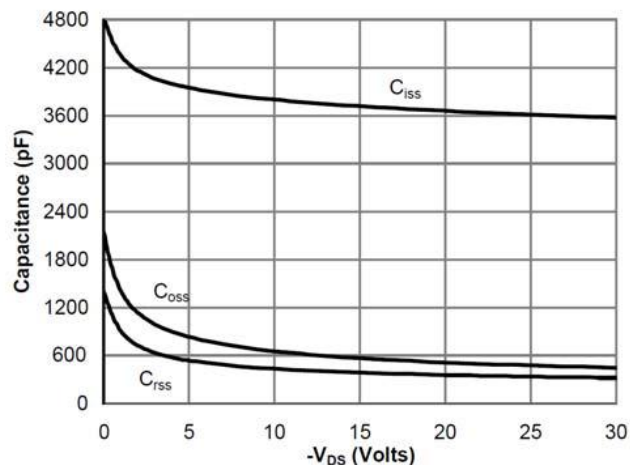


Figure 8: Capacitance Characteristics

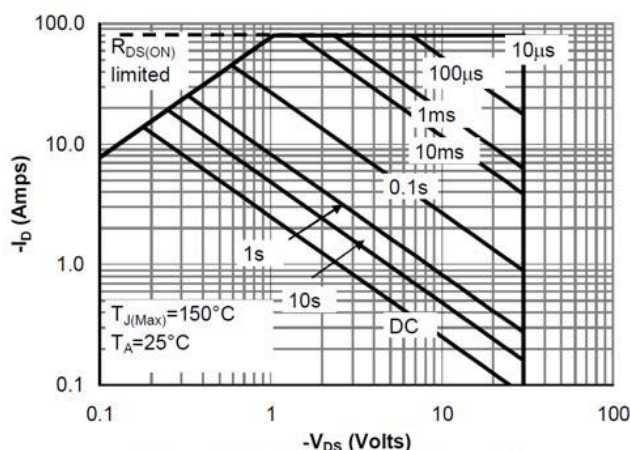


Figure 9: Maximum Forward Biased Safe Operating Area

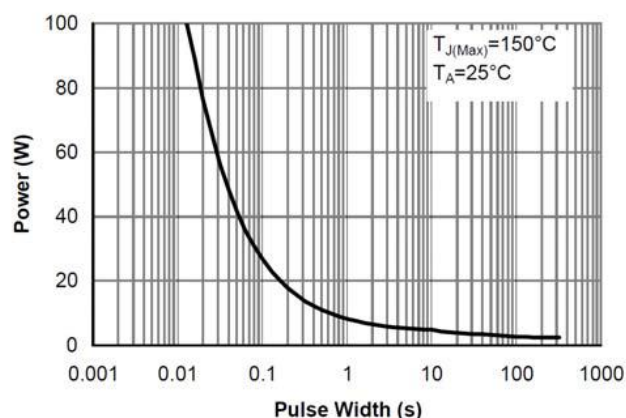


Figure 10: Single Pulse Power Rating Junction-to-Ambient

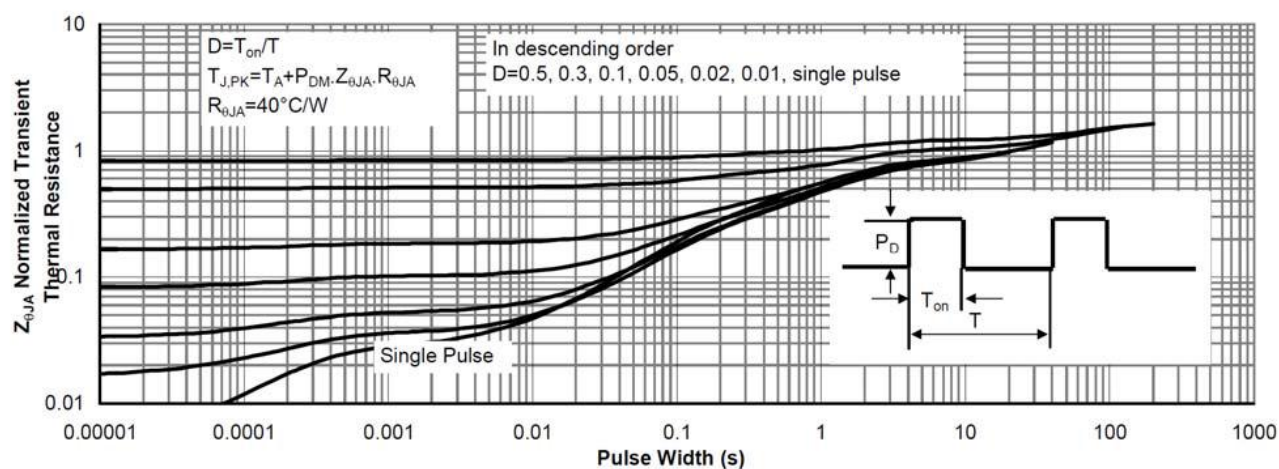
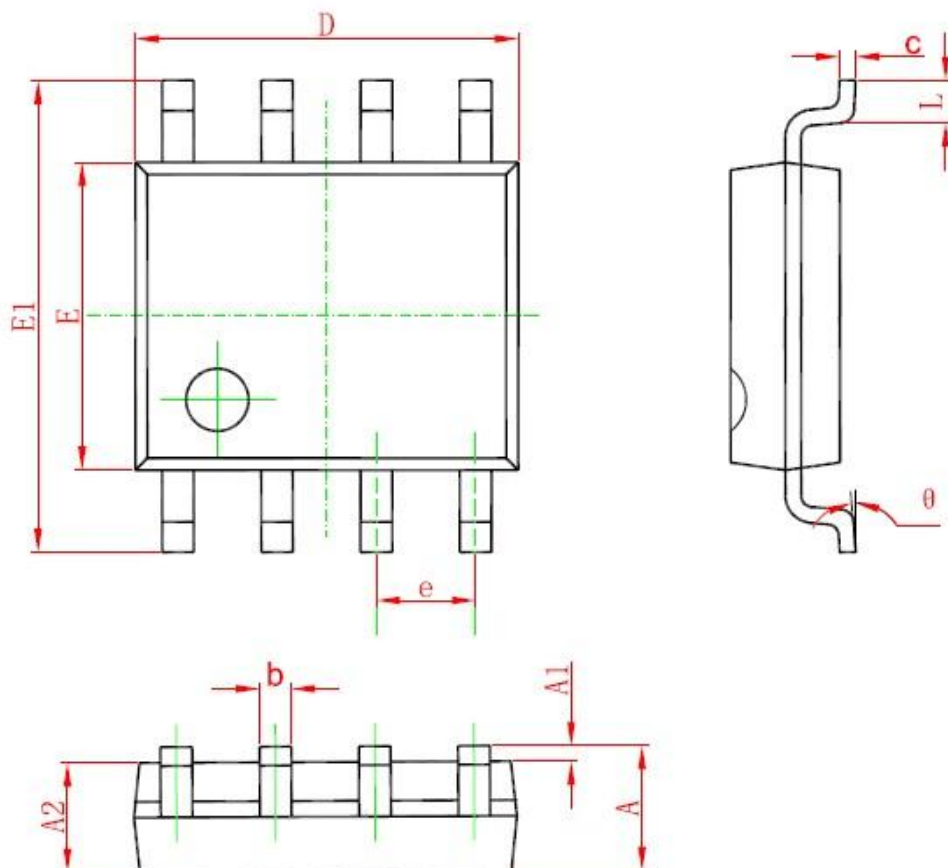


Figure 11: Normalized Maximum Transient Thermal Impedance

SOP8 PACKAGE OUTLINE DIMENSIONS

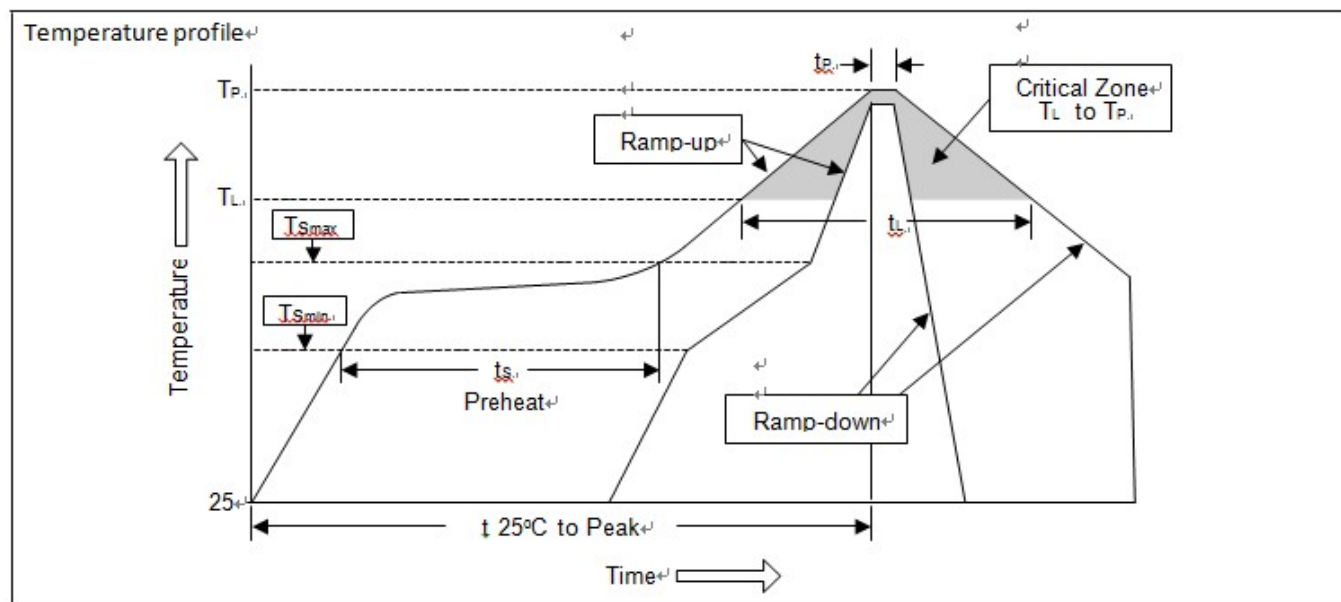


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

■ SOLDERING METHODS FOR UNIVERCHIP

Storage environment Temperature=10°C~35°C Humidity=65%±15%

Reflow soldering of surface mount device



Profile Feature	Sn-Pb Eutectic Assembly	Pb free Assembly
Average ramp-up rate (T _L to T _P)	<3°C/sec	<3°C/sec
Preheat		
-Temperature Min (T _{smin})	100°C	150°C
-Temperature Max (T _{smax})	150°C	200°C
-Time (min to max) (ts)	60~120 sec	60~180 sec
T _{smax} to T _L		
-Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above		
-Temperature (T _L)	183°C	217°C
-Time (t _L)	60~150 sec	60~150 sec
Peak Temperature (T _P)	240°C+0/-5°C	260°C+0/-5°C
Time within 5°C of actual Peak Temperature (t _p)	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<6 minutes



Flow (wave) soldering (solder dipping)

Product	Peak Temperature	Dipping Time
Pb device	245°C±5°C	5sec±1sec
Pb-Free device	260°C+0/-5°C	5sec±1sec



This integrated circuit can be damaged by ESD UniverChip Corporation recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedure can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.