
eKTH5515

**Capacitive Touchpad
Controller**

**Product
Specification**

DOC. DRAFT


ELAN MICROELECTRONICS CORP.
July 2015



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Specification Revision History

Doc. Version	Revision Description	Date
Draft		2015/07/07

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2 General Description

The eKTH5515 is a single-chip capacitive touch panel controller with high resolution ADC and powerful DSP. With mighty computing power, the controller can take care of lots of touch panel algorithm, even the multi-finger identification or gesture reorganization. It adopts mutual capacitance approaches which support true multi-touch capability. It provides high voltage (up to 11V) driving signals for a touch sensor. With the high voltage, it provides excellent noise immunity.

The EKTH5515 provides several packages with different TX and RX traces as below.

Part Number	Package	Size (mm)	TX	RX	USB	I2C
EKTH5515SU	BGA168	5x13x0.8	44	72	Yes	Yes

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3 Features

- Mutual Capacitive Sensing Techniques
- Up to 10-finger detection and simultaneous tracking
- Support pen frequency range: 15 KHz ~ 200 KHz
- Support high pen voltage: 25V
- Windows 10 pen compliant
- Up to 100 Hz report rate
- Sensor size up to 15 inch diagonal supported at 5mm electrode pitch (EKTH5515SU)

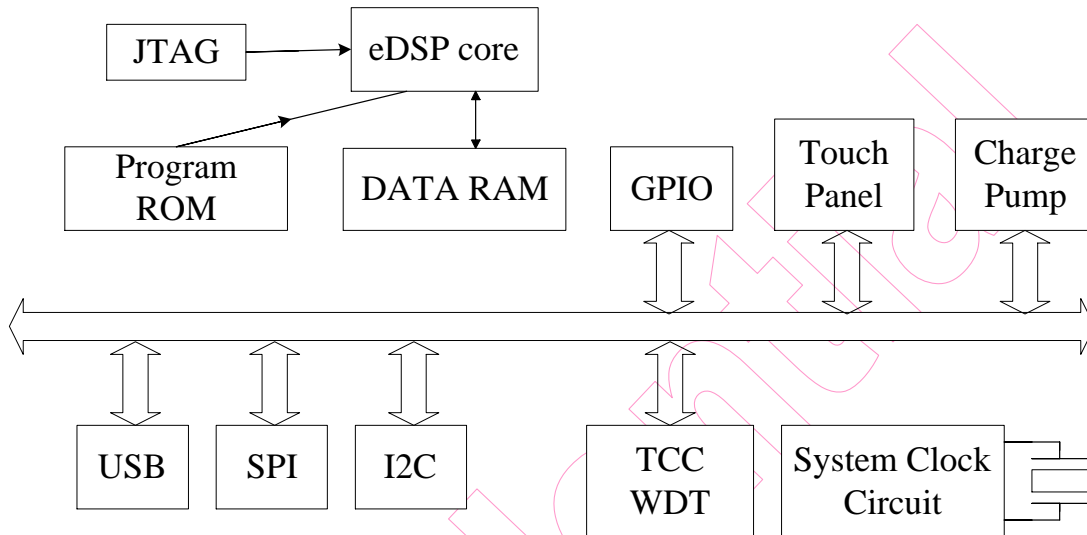
Low power and wide voltage operation:

- 3.15V to 3.6V supply voltage (Ripple < 100mV)
- 1.8V to 3.6V host interface voltage
- 1.8V chip core for low power operation

- Response time to touch less than 40ms
- Self-calibrating - no host side calibration needed
- USB (USB 2.0 Full Speed) with LPM (Link Power Management), I2C (100/400 kHz) or SPI (3M Max) interface options
- In-system reprogramming supported
- Flash data retention 10 years; flash endurance 1K cycles
- RoHS compliant
- Halogen Free
- Noise suppression including hardware filtering for AC charger noise mitigation
- 3 Operating Modes
Normal
Idle
Sleep
- High voltage (up to 11V) driving signals for a touch sensor
- Operating Temperature Range: -40°C to +85°C

4 Block Diagram

As shown in the block diagram below and as per our general description, the eKTH5515 uses a modified Harvard architecture in such a way that the memory is organized into two separate fields, namely, Program ROM and Data RAM. As the memories are separate, the central processing unit can read/write data at the same time.



5 Pin Description

Name	Type	Description
AGND	Power	Analog ground.
AVCC30	Power	3.0V Regulator output.
VCC33	Power	3.3V power supply.
VCC18	Power	1.8V regulator output for digital kernel. The trace of the connected capacitor should be less than 10mm.
DGND	Power	Digital ground.
VCCIO	Power	Power supply for IO pad.
RST_M	I	Global reset input. Low active.
RST_S	I	Global reset input. Low active.
PA7	I/O	General Purpose IO.
PA3/PA14	I/O	General Purpose IO.
PA2/PA13	I/O	General Purpose IO.
PA1/PA12	I/O	General Purpose IO.
PA0/PA11	I/O	General Purpose IO.
PA5	I/O	General Purpose IO.
PA4	I/O	General Purpose IO.
PA9	I/O	General Purpose IO.
PA10	I/O	General Purpose IO.
PB5	I/O	General Purpose IO.
PB4	I/O	General Purpose IO.
UD_DP	AIO	USB Interface
UD_DM	AIO	USB Interface
XOUT	AO	12M XTAL output for USB (The frequency tolerance is ± 50 ppm)
XIN	AI	12M XTAL Input for USB (The frequency tolerance is ± 50 ppm)
PA15	I/O	General Purpose IO.
PA8	I/O	General Purpose IO.
C2N	Power	Cathode of charge pump capacitor.
C2P	Power	Anode of charge pump capacitor.
C1P	Power	Anode of charge pump capacitor.
C1N	Power	Cathode of charge pump capacitor.
C3P	Power	Anode of charge pump capacitor.



VOUT	Power	Charge pump output voltage.
VH	Power	High Voltage regulator output for Driving traces.
TX[44:01]	AO	Touch panel driving traces. (EKTH5515SU)
RX[36:01] RX[76:41]	AI	Touch panel sensing traces. (EKTH5515SU)

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6 Pinout

6.1 EKTH5515SU BGA168 Pinout



7 Absolute Maximum Ratings

Parameter	Applicable Pins	Symbol	Condition	Rating	Unit
Voltage from VCC33 to DGND and AGND	–	–	–	-0.5 ~ +4.0	V
Voltage from any pin to DGND and AGND	–	–	–	-0.5 ~ +4.0	
Operating Temperature Range	–	T_A	–	-40 to +85	°C
Storage Temperature Range	–	T_{STR}	–	-65 to +125	

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8 Electrical Characteristics

DC Electrical Characteristics

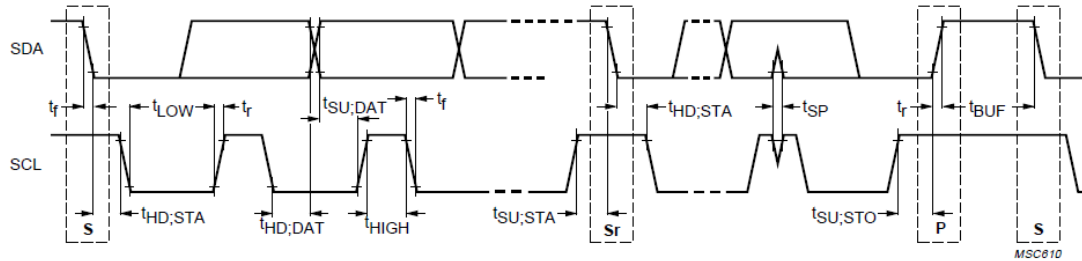
VCCIO: 1.8V~3.6V ; VCC33: 3.15V~3.6V

Parameter	Pins	Symbol	Condition	Rated Value			Unit
				Min.	Typ.	Max.	
Power supply voltage	Power	VCC33	—	3.15	3.3	3.6	V
	Power	VCCIO	—	1.8	3.3	3.6	
Input voltage	—	V_{IH}	—	$VCCIO \times 0.7$	—	$VCCIO$	V
	—	V_{IL}	—	0	—	$VCCIO \times 0.3$ *Note 5	
Pull-up resistor	I/O pins	R_{PU}	—	—	66	—	$k\Omega$
Pull-down resistor	I/O pins	R_{PD}	—	—	15	—	$k\Omega$
Output drive current	I/O pins	I_{OH}	VCCIO=3.3V VOH=2.4V	8 or 3.5 *Note 1	14 or 5.5 *Note 1	—	mA
Output drive current	I/O pins	I_{OL}	VCCIO =3.3V VOL=0.4V	5.5 or 2.5 *Note 1	11 or 4 *Note 1	—	
Output drive current	I/O pins	I_{OH}	VCCIO=1.8V VOH=1.5V	2 or 0.8 *Note 1	3 or 1 *Note 1	—	
Output drive current	I/O pins	I_{OL}	VCCIO =1.8V VOL=0.4V	4.5 or 2 *Note 1	7 or 2.5 *Note 1	—	
Normal mode Current consumption @ Report rate 100Hz	Power	I_{NORMAL}	VCC33=3.3V	—	65	125	mA
Idle mode Current consumption	Power	I_{IDLE}	VCC33=3.3V	—	20	40	mA
Sleep mode Current consumption *Note 2	Power	I_{SLEEP}	VCC33=3.3V	—	1.65	2	mA

Note 1: There are two drive/sink currents selectable through register setting.

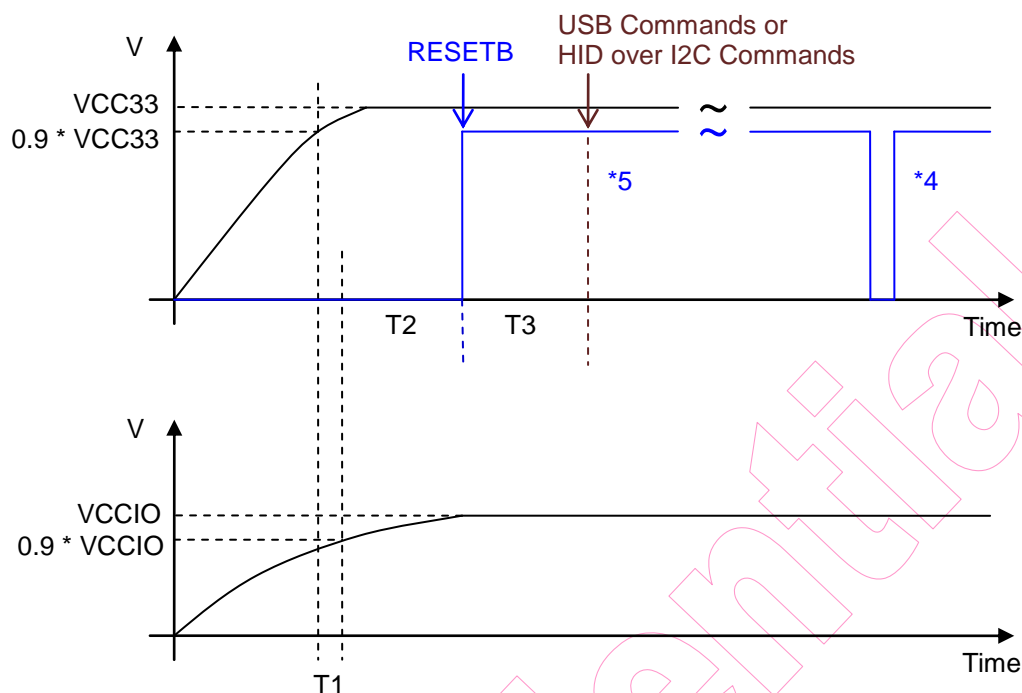
Note 2: There is no Sleep mode when the interface is USB.

I2C AC Electrical Characteristics



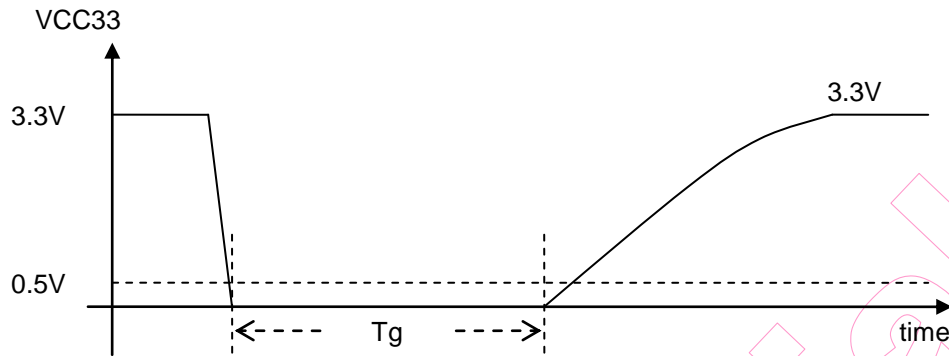
PARAMETER	SYMBOL	STANDARD MODE		FAST MODE		UNIT
		MIN	MAX	MIN	MAX	
SCL clock frequency	f_{SCL}	0	100	0	400	kHz
Hold time (repeated) START condition. After this period, the first clock pulse is generated	$t_{HD,STA}$	4.0	-	0.6	-	μs
LOW period of the SCL clock	t_{LOW}	4.7	-	1.3	-	μs
HIGH period of the SCL clock	t_{HIGH}	4.0	-	0.6	-	μs
Set-up time for a repeated START condition	$t_{SU,STA}$	4.7	-	0.6	-	μs
Data hold time:	$t_{HD,DAT}$	200.0	-	200.0	-	ns
Data set-up time	$t_{SU,DAT}$	250	-	100	-	ns
Rise time of both SDA and SCL signals	t_f	-	1000	20	300	ns
Fall time of both SDA and SCL signals	t_f	-	300	20	300	ns
Set-up time for STOP condition	$t_{SU,STO}$	4.0	-	0.6	-	μs
Bus free time between a STOP and START condition	t_{BUF}	4.7	-	1.3	-	μs
Capacitive load for each bus line	C_b	-	400	-	400	pF
Noise margin at the LOW level for each connected device (including hysteresis)	V_{nL}	$0.1V_{DD}$	-	$0.1V_{DD}$	-	V
Noise margin at the HIGH level for each connected device (including hysteresis)	V_{nH}	$0.2V_{DD}$	-	$0.2V_{DD}$	-	V

9 Power-on Sequence



- * 1. T1 must be ≥ 0 sec. T1: the time difference between $0.9V_{CC33}$ and $0.9V_{CCIO}$.
T2 must be ≥ 500 usec. T2: the time difference between $0.9V_{CCIO}$ and RESETB.
- * 2. RESETB is a Schmitt Trigger input.
The spec is as follows: $V_{IH}=1.73V/V_{IL} = 1.13V @ V_{CCIO}=3.3V$
 $V_{IH}=1.03V/V_{IL} = 0.608V @ V_{CCIO}=1.8V$
- * 3. In case a user wants to reset the controller without powering off, pull low the RESETB for more than two system clocks. It should be ≥ 500 usec.
- * 4. In case of USB, T3 ≥ 20 ms. The host should NOT send USB commands until 20ms after RESETB is pulled high.
In case of HID over I2C, T3 ≥ 300 ms. The host should NOT send HID over I2C commands until 300ms after RESETB is pulled high.
- * 5. The touch panel scanning frequency is 80K~150KHz, so the power supply should NOT have noises in this frequency range.

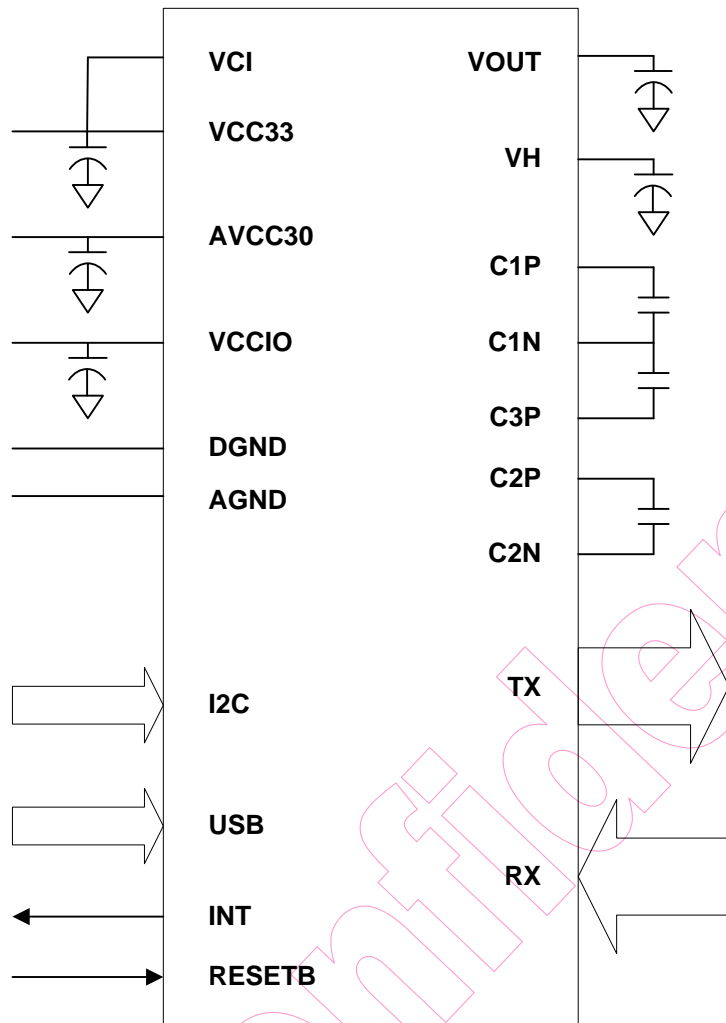
9.1 Power Off and then Power On Sequence



During power off, the VCC33 must be lower than 0.5V for at least 10us (i.e. $T_g > 10\text{ us}$) to make sure the touch controller be correctly reset.

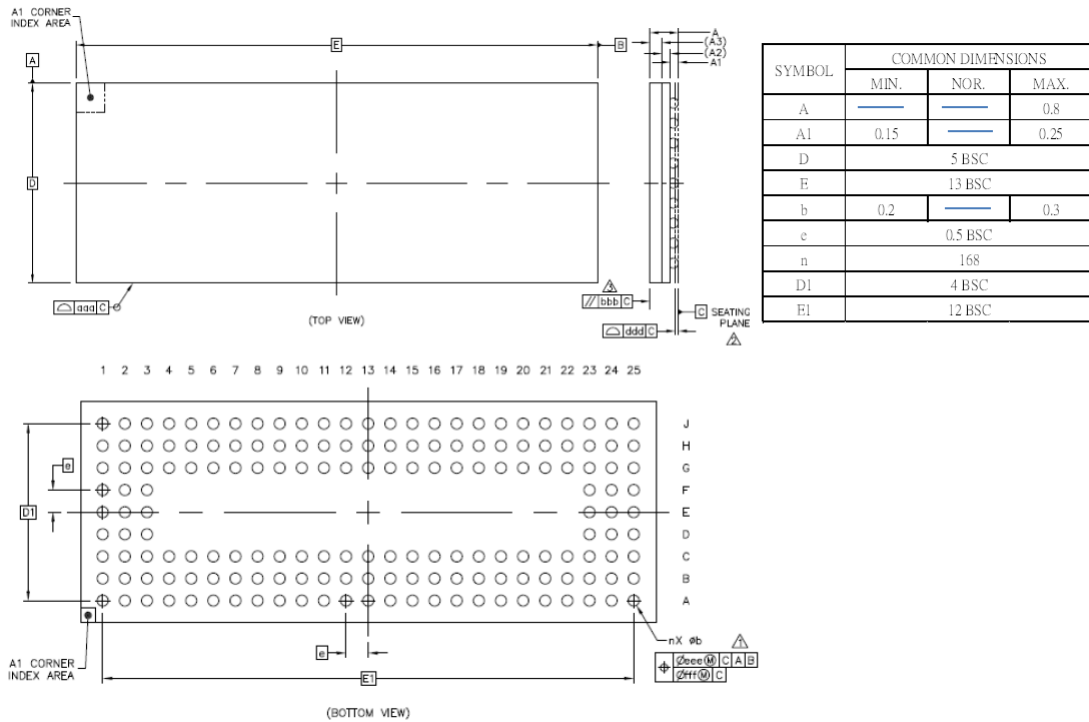
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10 Application Circuits



11 Package Outlines

11.1 BGA168 Package Outline (5x13x0.8mm)



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A.1 ESD Information:

Item	Criteria	Reference Standard
HBM	Min. 2KV	MIL-STD-883E Method 3015.7
MM	Min. 200V	EIA/JESD22-A115-A
Latch Up	Min. 100mA	JEDEC-JC-78

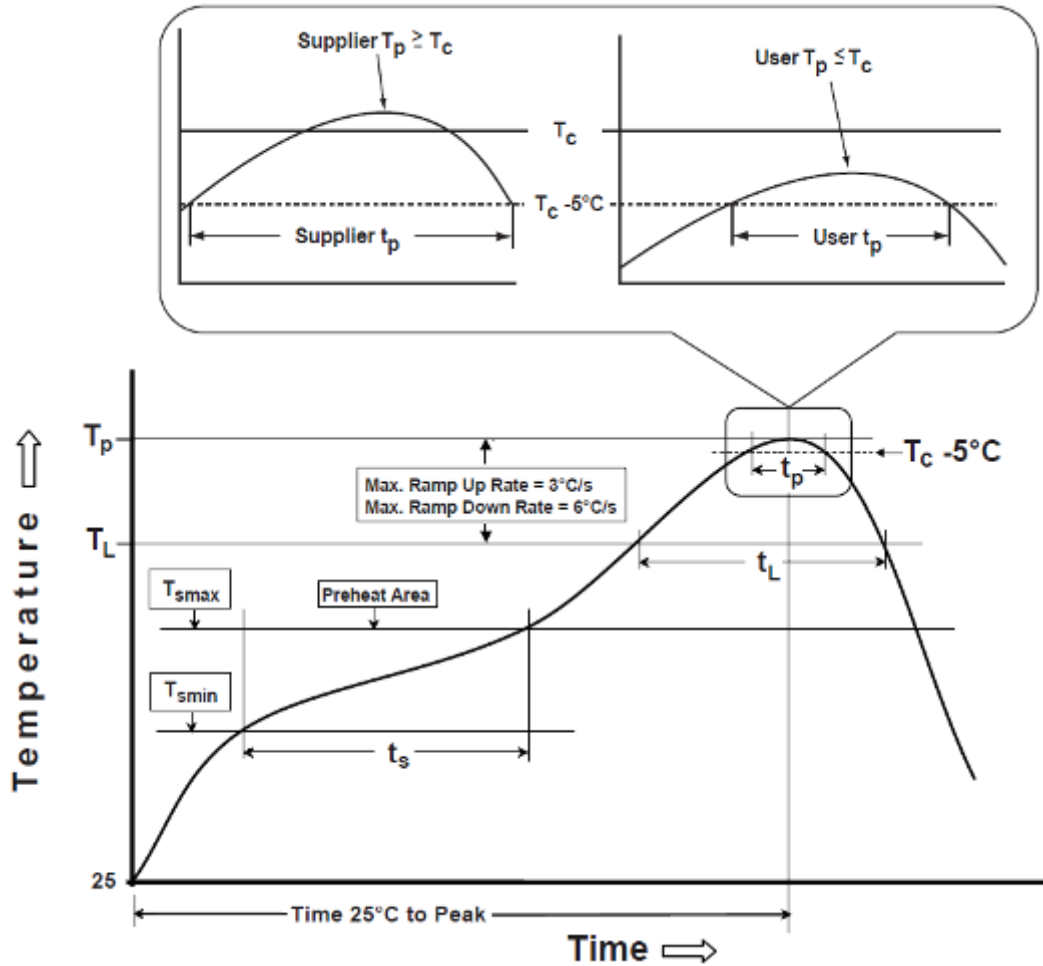
A.2 Moisture Sensitivity Level

Moisture Sensitivity Level	MSL 3	IPC/JEDEC J-STD-020
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A.3 Recommended Reflow Profile

Profile Feature	Pb-Free Assembly
Preheat/Soak Temperature Min (T _{min}) Temperature Max (T _{max}) Time (ts) from (T _{min} to T _{max})	150 °C 200 °C 60-120 seconds
Ramp-up rate (TL to T _p)	3 °C/second max.
Liquidous temperature (TL) Time (t _L) maintained above TL	217 °C 60-150 seconds
Peak package body temperature (T _p)	260 °C
Time (t _p)* within 5 °C of the specified classification temperature (T _c)	30* seconds
Ramp-down rate (T _p to TL)	6 °C/second max.
Time 25 °C to peak temperature	8 minutes max.

Classification Profile J-STD-020D



A.4 IC Marking Meanings

IC Marking	Meanings
ELAN	Logo
XXXXXXXXXX	IC P/N
XXXXXX	Lot Number
YYWWDD	Date code

