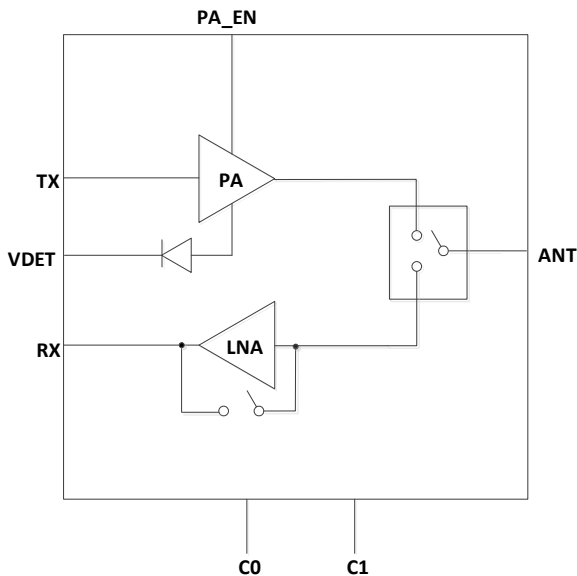




### 5GHz WLAN 802.11ax Front-End Module



#### Description

KCT8539SD is a highly integrated RF Front-End Integrated Circuit incorporates key RF functionality needed for IEEE 802.11a/n/ac/ax WLAN systems operating in the 5.15-5.85GHz range. KCT8539SD integrates a high-efficiency high-linearity power amplifier (PA), a low noise amplifier (LNA) with bypass, the associated matching network, and harmonic filters all in one device.

KCT8539SD has simple and low-voltage control logic, and requires minimal external components. A DC voltage output power detector is also integrated for accurately monitoring of output power from the PA.

KCT8539SD is assembled in a compact, low-profile 3x3x0.75mm 16-lead QFN package. KCT8539SD is the ideal RF front-end solution for implementing 5GHz high-power WLAN systems supporting multiple standards including 802.11a/n/ac/ax.

#### Applications

- ▶ 802.11ax networking and personal computing systems
- ▶ PC cards, PCMCIA cards, Mini-cards, and half mini-cards
- ▶ WLAN-enable wireless video systems

#### FEATURES

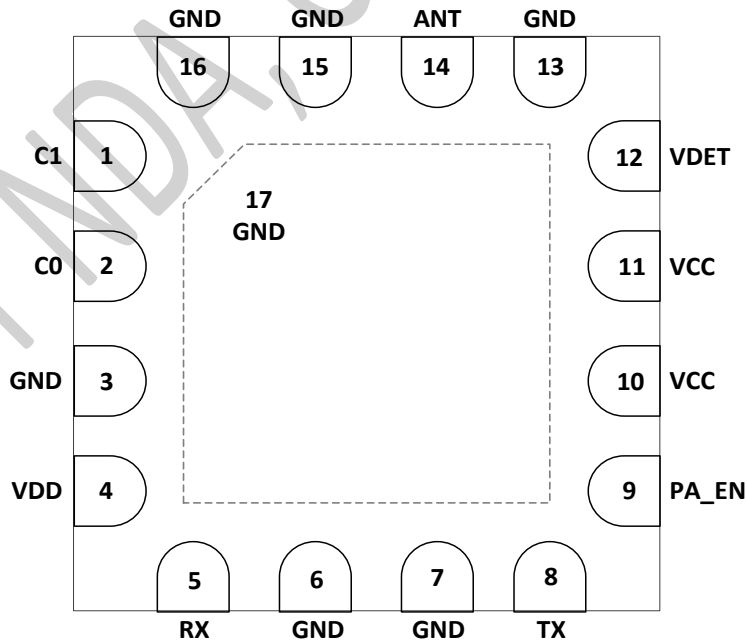
- ▶ Integrated 802.11ax 5GHz PA, LNA with bypass and T/R switch
- ▶ Fully-matched input and output
- ▶ Nominal operating voltage at 5V
- ▶ Integrated power detector
- ▶ Transmit gain: 30dB at 5V
- ▶ Receive gain: 14dB at 5V
- ▶ Output power: +18dBm @ -43dB DEVM, HE160/MCS11, 5V  
+20dBm @ -40dB DEVM, HE160/MCS11, 5V  
+21.5dBm @ -35dB DEVM, VHT80/MCS9, 5V  
+22.5dBm @ -30dB DEVM, HT20/MCS7, 5V
- ▶ ESD protection circuitry on all PINs
- ▶ Minimal external components required
- ▶ Small package: QFN-16L, 3mm x 3mm x 0.75mm (MSL3, 260°C per JEDEC J-STD-020)
- ▶ ROHS and REACH Compliant



**PIN ASSIGNMENTS**

Pin Number	Pin Name	Description
1	C1	Switch Control logic 1
2	C0	Switch Control logic 0
3,6,7,13,15,16,17	GND	Ground – Must be connected to ground in the application circuit
4	VDD	LNA supply voltage
5	RX	RF output port from LNA or Bypass
8	TX	RF input port from the Transceiver
9	PA_EN	PA enable
10,11	VCC	PA supply voltage
12	VDET	Detector output voltage
14	ANT	Antenna port – RF signal from the PA or RF signal applied to the LNA

**PIN-OUT DIAGRAM (Top View)**





### ABSOLUTE MAXIMUM RATINGS

Parameters	Units	Min	Max	Conditions
DC Supply Voltage	V	-0.5	+6.0	VDD and VCC Pins
DC Input on Control pins	V	-0.5	+3.6	All Control Pins
Maximum TX Input Power (50ohm load, No Damage)	dBm		+12	
LNA On Maximum RX Input Power (No Damage)	dBm		+18	
Bypass Mode Maximum RX Input Power (No Damage)	dBm		+26	
Storage Temperature	°C	-40	+150	
Junction Temperature	°C		+160	
Thermal Resistance ( $\theta_{JC}$ )	°C/W		+35	
Ruggedness (Pin =10dBm, No Permanent Damage)	VSWR		20:1	

**NOTE:** Sustained operation at or above the Absolute Maximum Ratings for any one or combinations of the above parameters may result in permanent damage to the device and is not recommended.

All Maximum RF Input Power Ratings assume 50-ohm terminal impedance.

### NOMINAL OPERATING CONDITIONS

Parameters	Units	Min	Typical	Max	Conditions
DC Supply Voltage	V	4.75	5	5.25	VDD and VCC Pins
Control Pin Voltage- Logic High	V	1.6		3.6	
Control Pin Voltage- Logic Low	V	0		0.4	
Control Pin DC Current C0 C1	μA		150 150		@1.6V
Operating Temperature	°C	-40	+25	+85	

### KCT8539SD ELECTRICAL SPECIFICATIONS

(VDD=VCC =5V, T = 25 °C, All Unused Ports Terminated with 50Ω, Unless Otherwise Noted)

Parameters	Units	Min	Typ	Max	Conditions
Frequency Range	GHz	5.15		5.85	
<b>Transmit Mode</b>					
Small Signal Gain	dB	28	30	33	CW Signal; Input Power=-25dBm
Gain Flatness	dB		±0.7		Across any 160MHz bandwidth
Output Power	dBm	+18 +20.5 +21.5 +24.5	+18 +20 +21.5 +22.5 +25.5		With -50dB EVM source, AT off: HE160/MCS11/200μs, -43dB DEVM, Preamble only HE160/MCS11/200μs, -40dB DEVM, Preamble only VHT80/MCS9/200μs, -35dB DEVM, Preamble only HT20/MCS7/200μs, -30dB DEVM, Preamble only HT20/MCS0, Mask Compliance



Parameters	Units	Min	Typ	Max	Conditions
Current Consumption	mA	195	215	240	Modulated Signal, 100% duty cycle @ No RF @+18dBm @+21.5dBm @+22.5dBm @+25.5dBm
		220	260	300	
		250	305	360	
		270	325	380	
		360	415	470	
Harmonic 2nd Harmonics 3rd Harmonics	dBm/MHz		-30 -45	-25 -40	Pout=+25.5dBm, HT20/MCS0 Signal
Output Power of P1dB	dBm	27	28.5		
Power Detector Output	V	0.19	0.27	0.35	@ No RF @+18dBm @+21.5dBm @+25.5dBm
		0.45	0.53	0.61	
		0.62	0.71	0.8	
		0.91	1.00	1.09	
Input Return Loss	dB		6		
Output Return Loss	dB		9		
Isolation	dB	38	44		From ANT to RX Pin From TX to RX Pin
			8		
PA Switching Time	ns		350		From 50% logic level change to 90%/10% power level TX <-> SD
<b>Receive Mode – LNA On</b>					
Gain	dB	11.5	14	16.5	
2.4G Rejection	dB		25		
Input Power of P1dB	dBm	-8	-4.5		
Noise Figure	dB		3.1		
Input Return Loss	dB		6		
Output Return Loss	dB		10		
Isolation	dB	18	23		From ANT to TX Pin From RX to TX Pin
		26	34		
Switching Time	ns		300 250		From 50% logic level change to 90%/10% power level LNA <-> TX LNA <-> Bypass
LNA current	mA		17		
<b>Receive Bypass Mode</b>					
Insertion Loss	dB	2	4	6	
Input Power of P1dB	dBm	17	19		
Input Return Loss	dB		8		
Output Return Loss	dB		15		
Isolation	dB	32	37		From ANT to TX Pin From RX to TX Pin
		28	34		
Bypass Current	mA	0.2	0.5	1	



**PRODUCT QUALIFICATION**

Parameters	Units	Min	Max	Conditions
ESD – Human Body Mode	V		1000	HBM
ESD – Charge Device Mode	V		2000	CDM
HTOL	/	1000hours		Refer to JSED22-A108, JESD85

**ESD HANDLING:** *Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection.*

*Industry-standard ESD handling precautions should be used at all times.*

**CONTROL LOGIC TABLE**

PAEN	C1	C0	Mode of Operation
1	1	0	Transmit Mode
0	0	1	Receive LNA Mode
0	1	1	Bypass Mode
0	0	0	Shutdown Mode

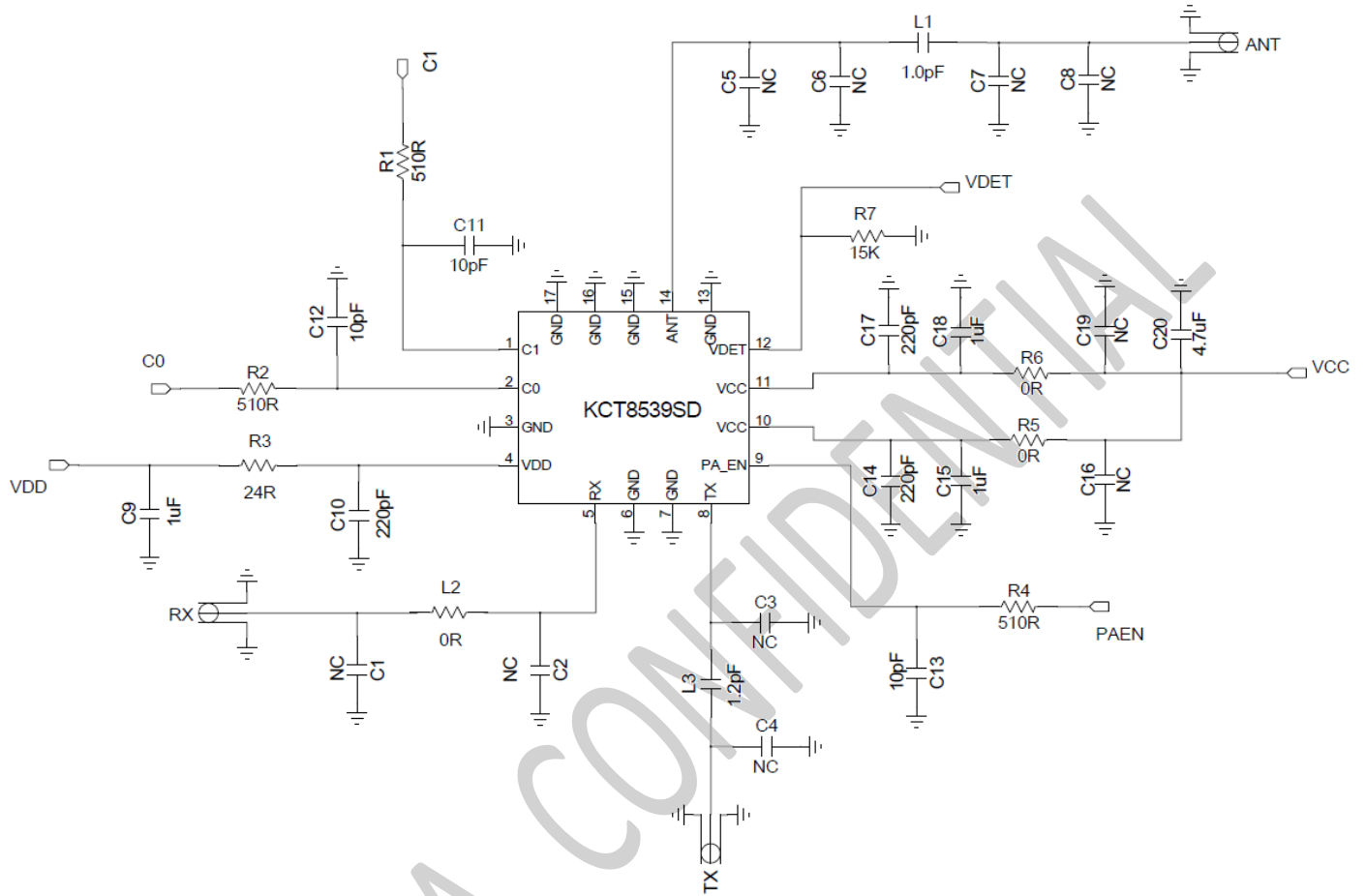
Note: "1" denotes high voltage state (>1.6V) at Control Pins  
"0" denotes low voltage state (<0.4V) at Control Pins  
510Ω series resistor may be required for each control line

**ORDERING INFORMATION**

Product Description	Product Part Number	Package Type	Package Quantity
KCT8539SD: 5GHz WLAN Front-End Module	KCT8539SD	13" tape and reel	5000pcs / reel



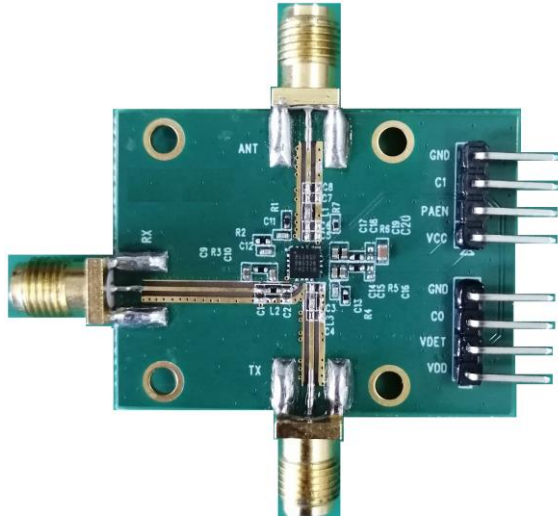
### APPLICATION SCHEMATIC



KCT NDA, CONFIDENTIAL



EVB PICTURE and EVB BOM



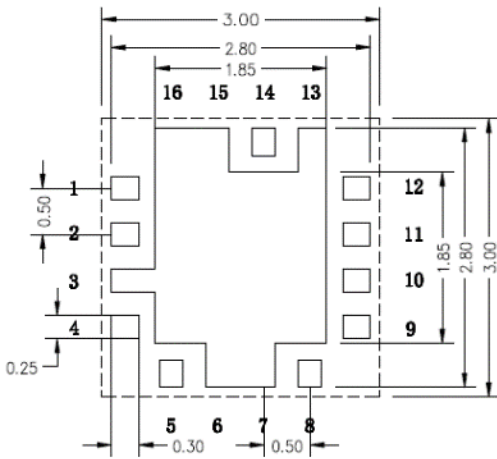
[EVB Assembly]

Reference	Value	Footprint	Notes
L1	1.0PF	0402	Murata X5R/X7R series
L3	1.2PF	0402	Murata X5R/X7R series
C11,C12,C13	10PF	0402	Murata X5R/X7R series
C10,C14,C17	220PF	0402	Murata X5R/X7R series
C9,C15,C18	1 $\mu$ F	0402	Murata X5R/X7R series
C20	4.7 $\mu$ F	0603	Murata X5R/X7R series
R3	24ohm	0402	Yageo RC0402 series
L2,R5,R6	0ohm	0402	Yageo RC0402 series
R7	15Kohm	0402	Yageo RC0402 series
R1,R2,R4	510ohm	0402	Yageo RC0402 series Control pin protect resistor

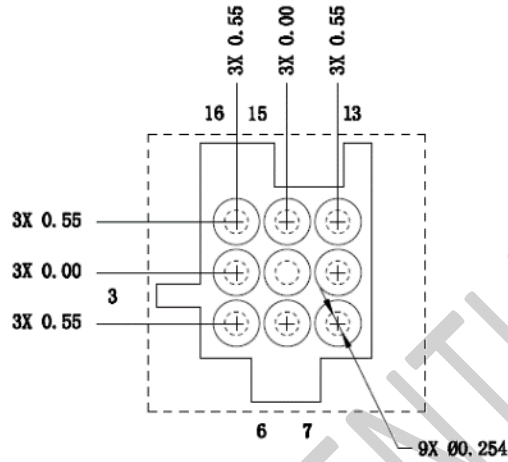
[EVB BOM]



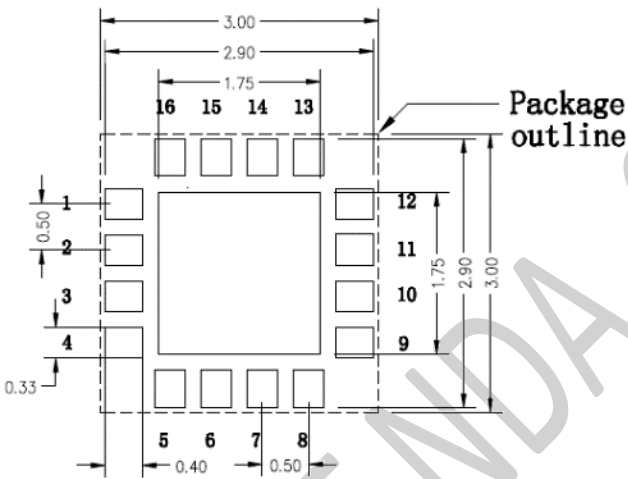
PCB LAYOUT FOOTPRINT (All dimensions are in millimeters)



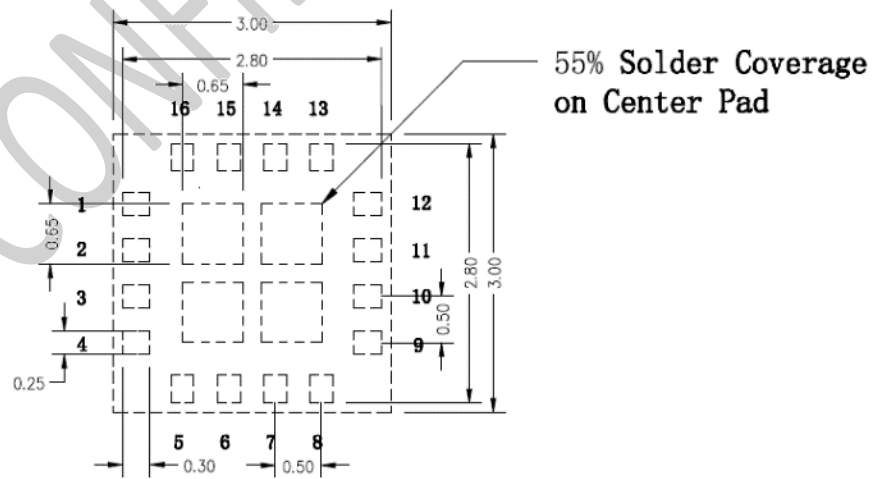
Board Metal



Via Pattern



Solder Mask Pattern

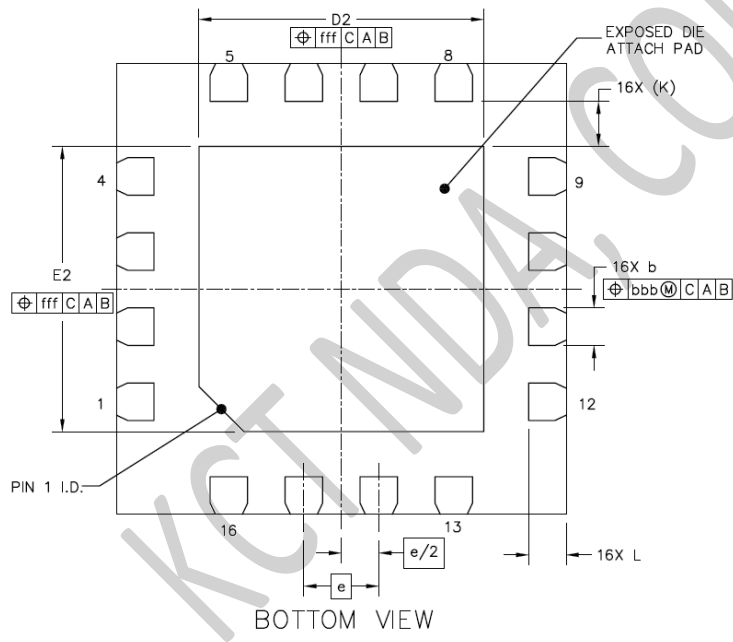
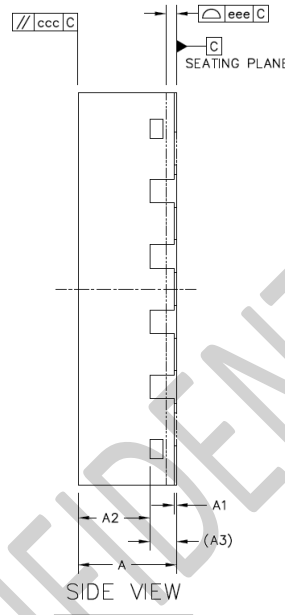
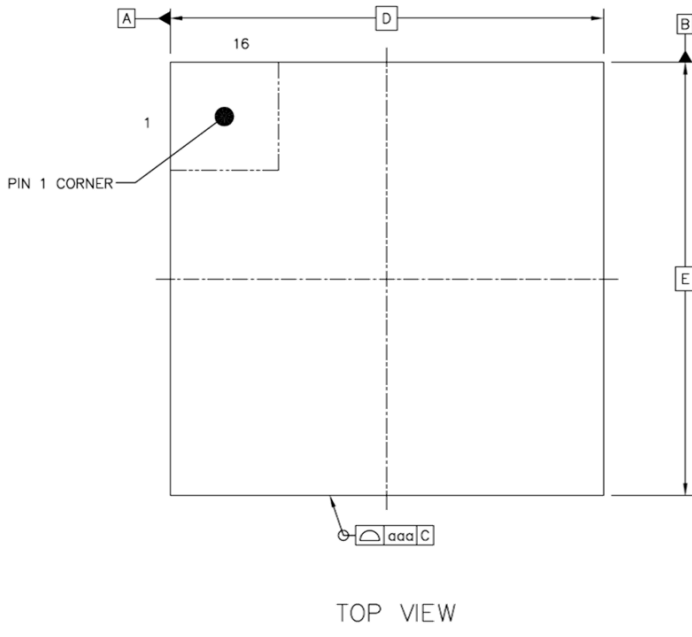


Stencil Pattern





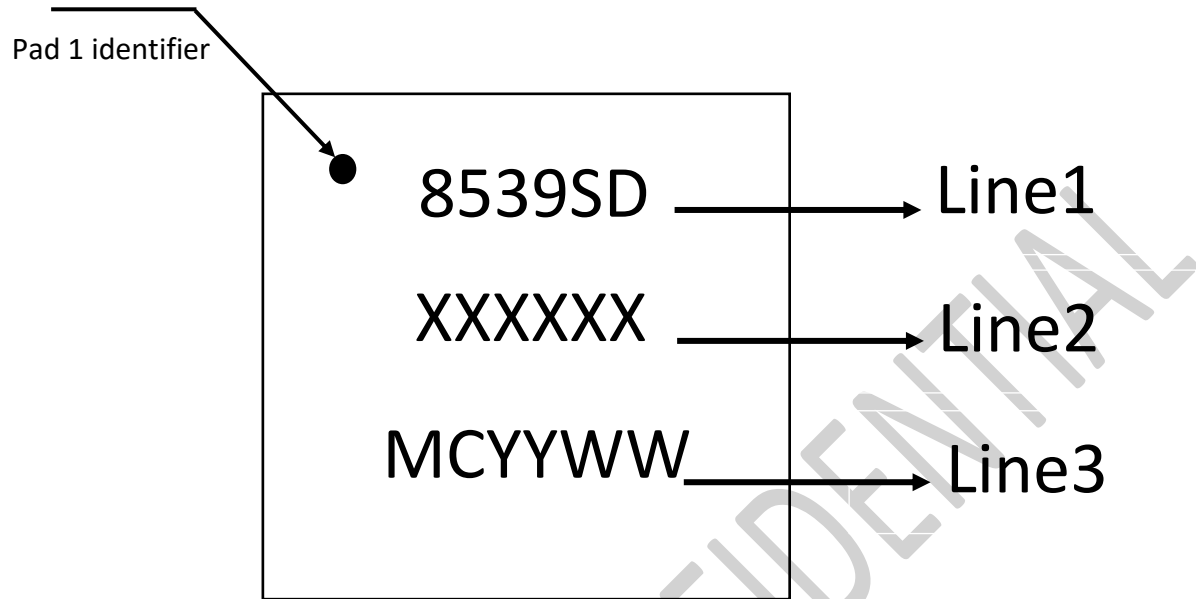
Package Dimensions (All dimensions are in millimeters)



	SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS	A	0.7	0.75	0.8
STAND OFF	A1	0	0.02	0.05
MOLD THICKNESS	A2	---	0.55	---
L/F THICKNESS	A3	0.203 REF		
LEAD WIDTH	b	0.2	0.25	0.3
BODY SIZE	X	D		
	Y	E		
LEAD PITCH	e	0.5 BSC		
EP SIZE	X	D2	1.8	1.9
	Y	E2	1.8	1.9
LEAD LENGTH	L	0.15	0.25	0.35
LEAD TIP TO EXPOSED PAD EDGE	K	0.3 REF		
PACKAGE EDGE TOLERANCE	aaa	0.1		
MOLD FLATNESS	ccc	0.1		
COPLANARITY	eee	0.08		
LEAD OFFSET	bbb	0.1		
EXPOSED PAD OFFSET	fff	0.1		



PART MARKING



Line	Marking	Description
1	8539SD	Product name
2	XXXXXX	Lot information
3	MCYYWW	MC: Manufacturer Code YYWW: YY year WW week