



## 5GHz WLAN 802.11ax Front-End Module

### Description

KCT8539S-1 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. KCT8539S-1 integrates a high-efficiency high-linearity power amplifier (PA), a low noise amplifier (LNA) with bypass, the associated matching network, LO rejection, and harmonic filters all in one device.

KCT8539S-1 has simple and low-voltage control logic, and requires minimal external components. A power detector is also integrated for accurately monitoring of output power from the PA.

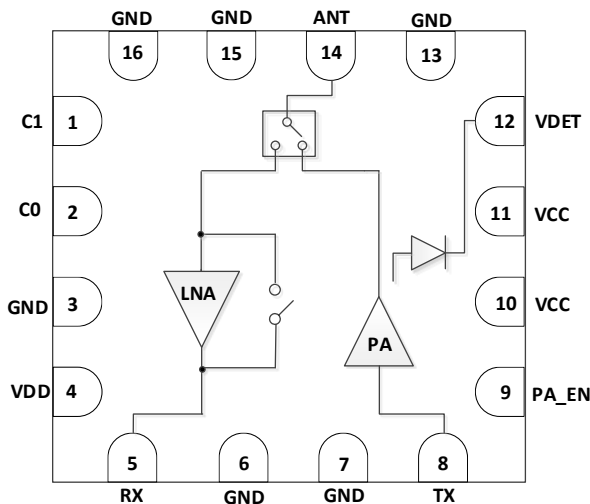
KCT8539S-1 is assembled in a compact, low-profile 3x3x0.57mm 16-lead MIS package. KCT8539S-1 is the ideal RF front-end solution for implementing 5GHz high-power WLAN systems supporting multiple standards including 802.11a/n/ac/ax.

### Applications

- ▶ 802.11ax Wi-Fi Devices
- ▶ Mini-cards & half mini-cards
- ▶ Wi-Fi Media Gateways
- ▶ Consumer Electronics
- ▶ PC cards, PCMCIA,
- ▶ Access Points / Routers
- ▶ Set Top Boxes / Wireless IPTVs
- ▶ Other 5GHz ISM Platforms

### FEATURES

- ▶ Integrated 802.11ax 5GHz PA, LNA with bypass and T/R switch
- ▶ Fully-matched input and output
- ▶ Integrated power detector
- ▶ Transmit gain: 32dB at 5V
- ▶ Receive gain: 17dB at 5V
- ▶ Noise Figure: 1.7dB at 5V
- ▶ Output power: +21.5dBm @-40dB DEVM, HE160/MCS11, 5V  
+22.5dBm @-35dB DEVM, VHT80/MCS9, 5V  
+23.5dBm @-30dB DEVM, HT20/MCS7, 5V
- ▶ ESD protection circuitry on all PINs
- ▶ Minimal external components required
- ▶ Small package: MIS16-pin, 3mm x 3mm x0.57mm (MSL3, 260 °C per JEDEC J-STD-020)
- ▶ ROHS and REACH Compliant

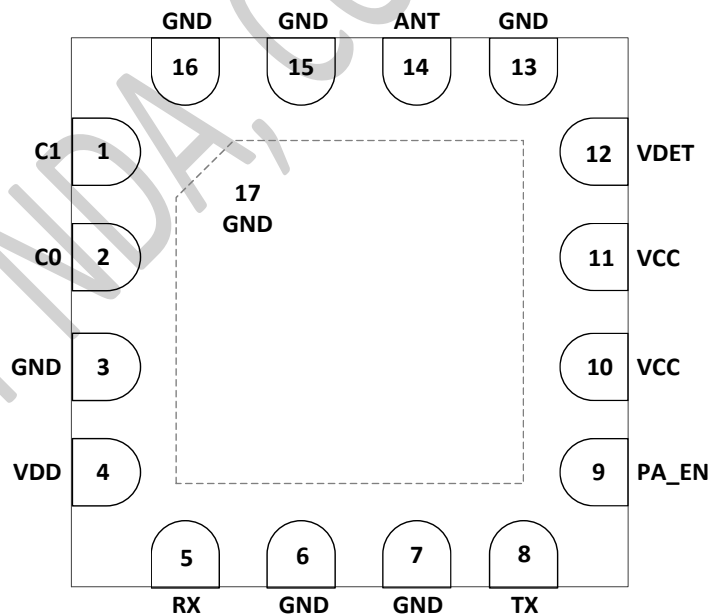




**PIN ASSIGNMENTS**

Pin Number	Pin Name	Description
1	C1	Switch Control pin 1
2	C0	Switch Control pin 0
3,6,7,13,15,16,17	GND	Ground – Must be connected to ground in the application circuit
4	VDD	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	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
TX Maximum Input Power (50ohm load, NO Damage)	dBm		+17	
LNA On Mode Maximum Input Power	dBm		+18	
Bypass Mode Maximum Input Power	dBm		+26	
Storage Temperature	°C	-40	+150	
Junction Temperature	°C		+165	
Thermal Resistance( $\theta_{JC}$ )	°C/W		+35	

*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 PAEN C1 C0	uA		400 330 330		VCC=VDD=3.3V
Operating Temperature	°C	-40	+25	+85	

### KCT8539S-1 ELECTRICAL SPECIFICATIONS

*(VCC=VDD=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		32		
Output Power	dBm		+21.5 +22.5 +23.5 +26.5		HE160/MCS11, -40dB DEVM, Preamble only VHT80/MCS9, -35dB DEVM, Preamble only HT20/MCS7, -30dB DEVM, Preamble only HT20/MCS0, Mask Compliance



Parameters	Units	Min	Typ	Max	Conditions
Output Power of P1dB	dBm		29.5		
Current	mA		160 280 300 325 435		100% duty modulated signal @No RF @+21.5dBm @+22.5dBm @+23.5dBm @+26.5dBm
Harmonic 2nd Harmonics 3rd Harmonics	dBm/MHz		-35 -50		Pout=+26.5dBm,HT20-MCS0 Signal
Input Return Loss	dB		10		
Output Return Loss	dB		8		
Isolation	dB		44 13		From ANT to RX Pin From TX to RX Pin
Power Detector Output	V		0.20 0.34 0.75 0.81 0.91		100% duty modulated signal @No RF @+10dBm @+21.5dBm @+23.5dBm @+26.5dBm
Power Detector Output Impedance	ohm		3K		
<b>Receive Mode – LNA On</b>					
Gain	dB		17		
Gain @2.4G band	dB		-21		
Input Power of P1dB	dBm		-5		
Noise Figure	dB		1.7		
Input Return Loss	dB		8		
Output Return Loss	dB		8		
Isolation	dB		22 39		From ANT to TX Pin From RX to TX Pin
Switching Time	ns		200 200		From 50% logic level change to 90%/10% power level LNA ↔ Bypass RX ↔ TX
RX Current	mA		30		
<b>Receive Bypass Mode</b>					
Insertion Loss	dB		4		
Input Power of P1dB	dBm		22		
Input Return Loss	dB		13		
Output Return Loss	dB		7		
Isolation	dB		44 39		From ANT to TX Pin From RX to TX Pin
Bypass Current	mA		1		



## PRODUCT QUALIFICATION

Parameters	Units	Min	Max	Conditions
ESD – Human Body Mode	V		1500	HBM
ESD – Charge Device Mode	V		2000	CDM

**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

PA_EN	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

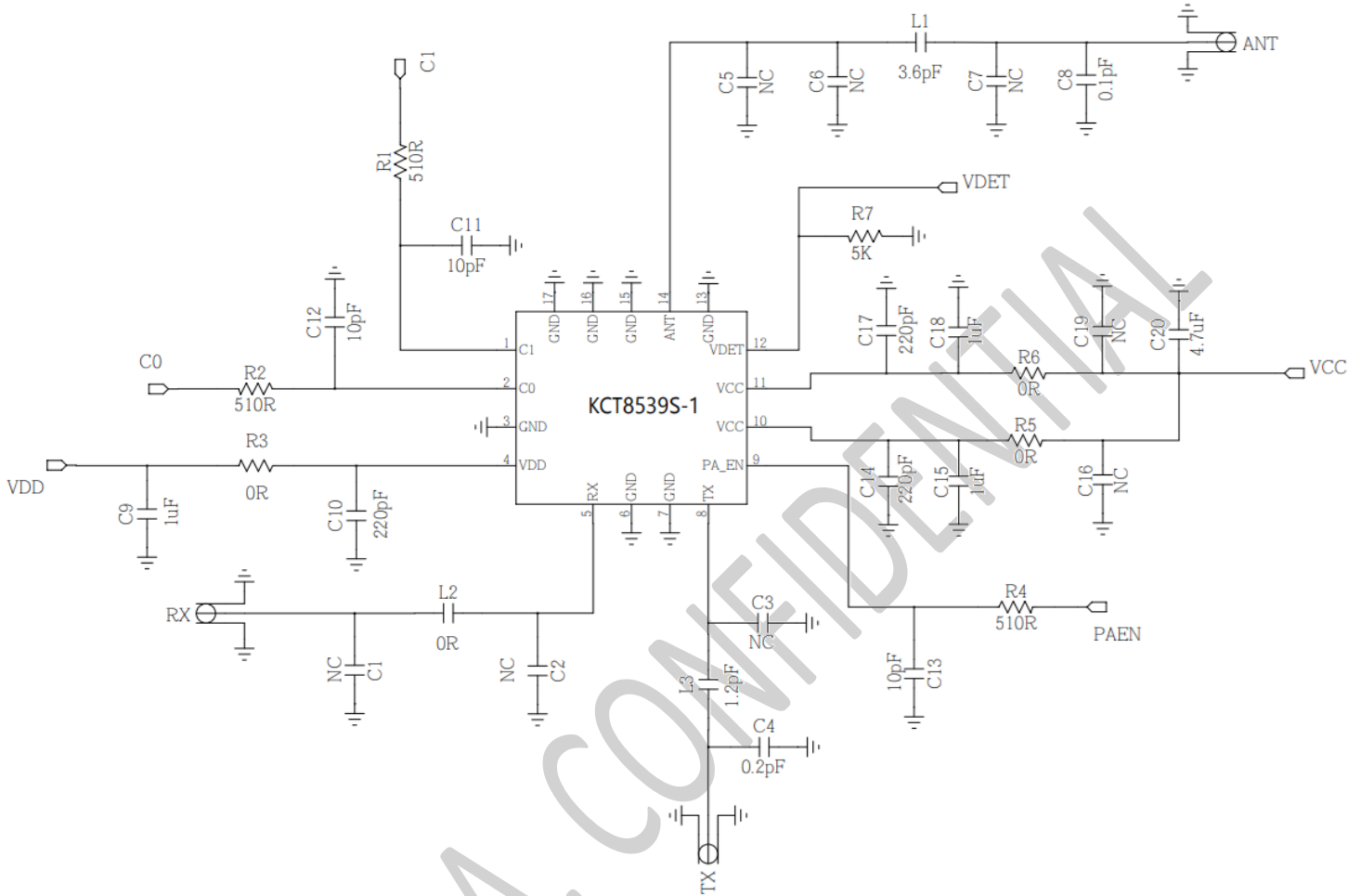
Note: "1" denotes high voltage state (>1.6V)  
"0" denotes low voltage state (<0.4V) at Control Pins  
510Ω series resistor may be required for each control line

## ORDERING INFORMATION

Product Description	Product Part Number	Package Type	Package Quantity
KCT8539S-1: 5GHz WLAN Front-End Module	KCT8539S-1	13" tape and reel	5000pcs / reel



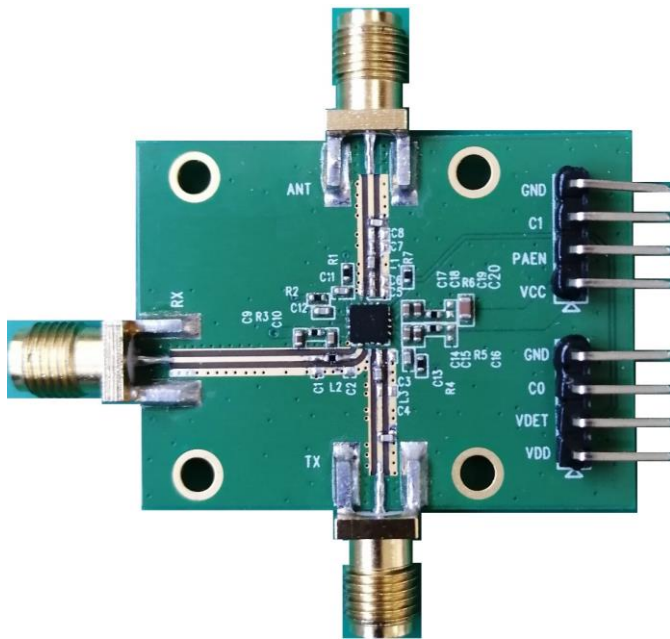
### APPLICATION SCHEMATIC



KCT NDA, CONFIDENTIAL



EVB PICTURE and EVB BOM



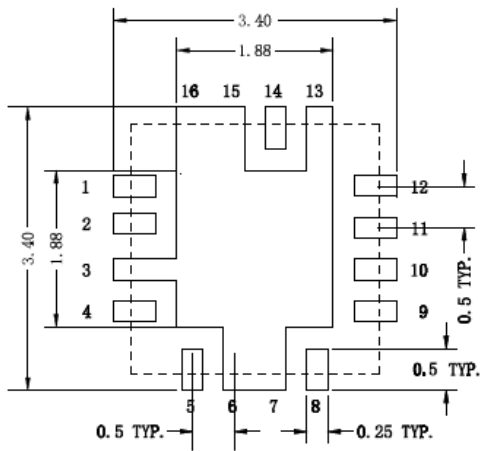
[EVB Assembly]

Designator	Value	Footprint	Notes
C8	0.1PF	0402	X5R/X7R
L1	3.6PF	0402	X5R/X7R
C4	0.2PF	0402	X5R/X7R
L3	1.2PF	0402	X5R/X7R
C11,C12,C13	10PF	0402	X5R/X7R
C10,C14,C17	220PF	0402	X5R/X7R
C9,C15,C18	1 $\mu$ F	0402	X5R/X7R
C20	4.7 $\mu$ F	0603	X5R/X7R
R3,R5,R6,L2	0ohm	0402	Series Pad
R7	5.1Kohm	0402	Det. load
R1,R2,R4	510ohm	0402	Series Pad

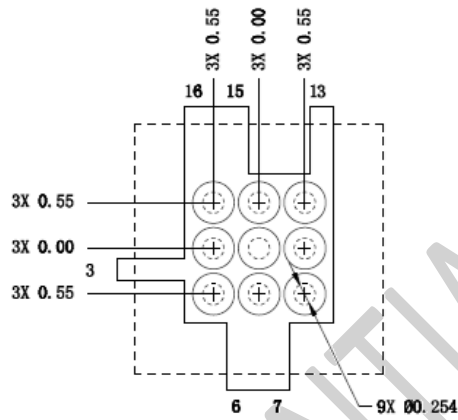
[EVB BOM]



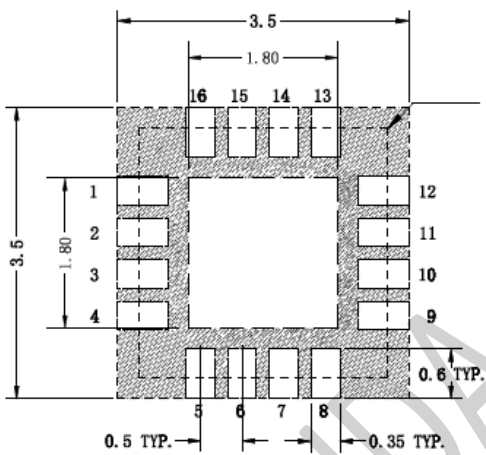
### PCB LAYOUT FOOTPRINT (All dimensions are in millimeters)



Board Metal

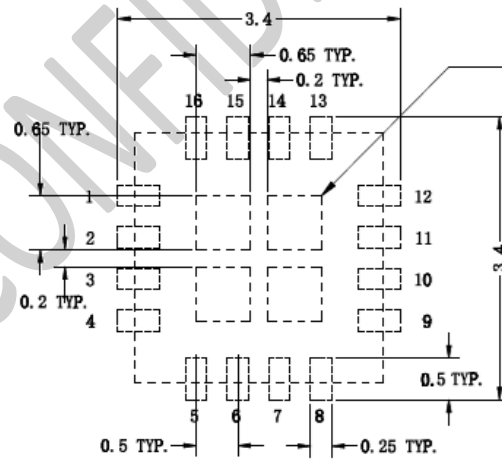


Via Pattern



Solder Mask Pattern

Package outline

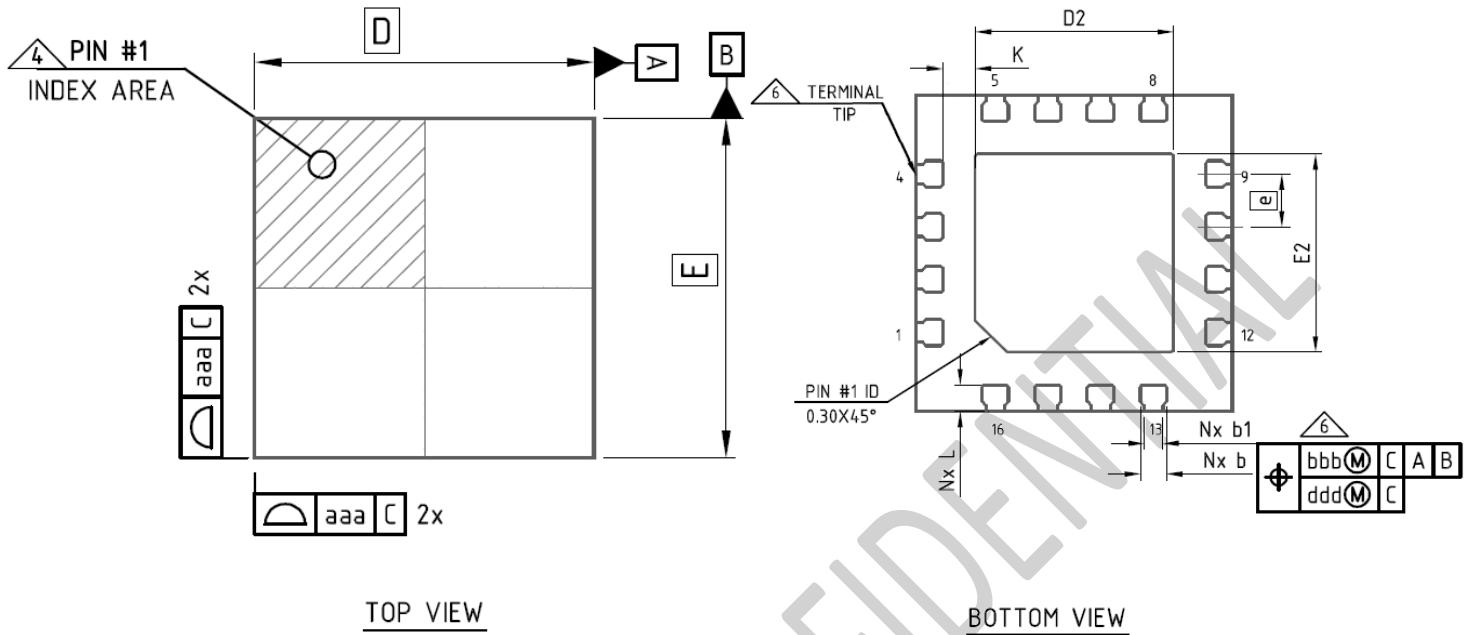


Stencil Pattern





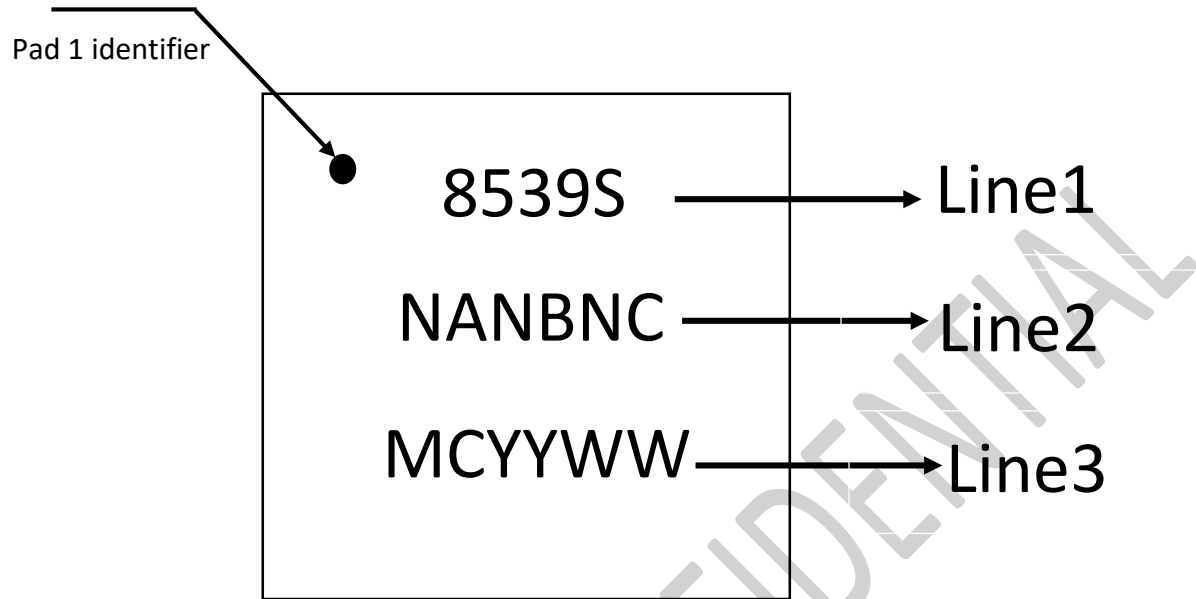
PACKAGE DIMENSIONS (All dimensions are in millimeters)



Dimension Table					
Symbol	Thickness	0.57			NOTE
		MINIMUM	NOMINAL	MAXIMUM	
A		0.52	0.57	0.62	
A1		0.00	---	0.008	
A3		---	0.120 Ref	---	
b		0.20	0.25	0.30	6
b1		0.13	0.18	0.23	6
D		3.00 BSC			
E		3.00 BSC			
e		0.50 BSC			
D2		1.78	1.88	1.98	
E2		1.78	1.88	1.98	
L		0.15	0.25	0.35	
K		0.31 REF			
aaa		0.05			
bbb		0.10			
ccc		0.10			
ddd		0.05			
eee		0.08			
N		16			3
ND		4			5
NE		4			5
NOTES		1,2			
LF PART NO		446059			



PART MARKING



Line	Marking	Description
1	8539S	Product name
2	NANBNC	DIE lot 1:NA DIE lot 2:NB DIE lot 3:NC
3	MCYYWW	MC: Manufacturer Code YYWW: YY year WW week