Equipment /area	Make and Model	Equipment Description	wafer size compatibility	QMF use / purpose	Typical Standard Operation Procedure (SOP) performance	Process possible/ not qualified SOP
				Housing lithography processing equipment and surfs can	- Cleanroom class class 10 / M2.5 / ISO 4 - yellow light - temperature 21 +/-0.2° - RH 45 +/- 3%	
Lithography area / suite						
HMDS oven	YES 3/10	HMDS vacuum bake vapour prime and anhydrous ammonia gas image reversal system	configured for 150mm wafers and fragments - up to 200mm	Provides HMDS treatment to overcome photoresist adhesion issues on Si, poly Si, SiO2, Silicon oxynitride, BPSG, TiN, TiW +?. Process effective for up to 3 weeks		
Resist coat	SSE OPTIcoat ST22+	Recipe driven resist coater - resist pump auto dispense - edge bead removal - up to 10,000rpm - spin resolution 1rpm - accuracy 2 rpm - acceleration up to 50,000 rpm /sec	configured for 150mm wafers and fragments - up to 200mm	Recipe controlled precise photoresist coat of wafers and fragments	AZ 6612 resist - 150mm wafer - %U: < 0.5% - Thickness: 1µm - Edge bead removal: 5mm	second resist pump available
Soft bake	SSE OPTIcoat ST22+	Hot plate - with or without vacuum clamp - up to 300° - 0.1° C resolution - uniformity @100° < 0.5°	configured for 150mm wafers and fragments - up to 200mm	Precise resist thermal treatment: - prior to exposure - post exposure - post development	part of process flow	
Exposure	Quintel Ultra µ line7000	Front side mask aligner - 5 exposure modes - alignment <0.5µm	configured for 150mm wafers and fragments - up to 200mm	-865 -p(r)-7(nf)-8(i)4ale n(t)-8a(r)-7gentd s		

				Housing of none lithography processing and analytical equipment	- Cleanroom class 1000 / M4.5 / ISO6 - temperature 21 +/-1°
Wet processing					
Wet bench for RCA cleaning - Non contaminating	Weslan	Custom build - heated bath system RCA clean SC1 , HF (circulation and filter bath - no heating) and SC2 baths Piranha clean bath Quick dump rinser x 2 3 temperature control baths Quick dump rinsers x2 Megasonic bath - particle removal	up to 150mm wafer	RCA clean to remove metal ion contamination of incoming and processed SiC wafers - 4 bath system with quick dump rinse systems - processing baths SC1, 1%HF, SC2, Piranha	(shows improvement in std CV measurements)
Wet bench for non ion critical contamination applications	SPS		up tp 150mm wafer		

Deposition and etch						
Epitaxial SiC growth	Griffith MkI system	proprietary design - under patent application	up to 150mm	Epitaxial SiC on Si growth - Research and development - n type - p type - n and p film stacks	Uniformity <1% 2mm edge exclusion Typical Thickness - nanometres to over 1µm	
Epitaxial SiC growth	MkII SPTS - Epiflx R+D		2" to 300mm	Research and development of device quality SiC on Si films Qualification of production reactor Application specific process development	Uniformity <1% 2mm edge exclusion Typical Thickness - nanometres to over 1µm	
Plasma etch	LAM 480	plasma etch	150mm wafer handling	isotropic dielectric plasma etch - SiO2, Si3N4, polymers and photoresist	Features >3µm SiO2 etch non -uniformity <+/- 6% 5mm edge exclusion	
Plasma etch	STS LPX ICP SR including wafer cooling from electrostatic clamping	Advanced process capability -up to 200mm wafer compatible -Electrostatic chuck -load lock -versatile for many different applications -reactor used in volume production for metal etch (Al etch metallisation)	150mm wafer handling	SiC etch research and development Other research development applications as required gases available include: Ar, O2, N2, NO, C4F8, SF6, Cl2, HCl, SiCl4, BCl3, HBr …..		Poly Silicon etch SiO2 etch Al and Al alloy etch Ti and TiN etch note: volume production proven chamber for metal etching
Resist strip and plasma etch	Tegal 915	Barrel plasma etch system for striping or etching batches od wafers	batch processing up to 200mm wafers	Resist strip or fluorine etching process gases: O2, SF6	Max batch size 150 x 100mm wafers 100 x 125mm 100 x 150mm 50x 200mm	Plasma etching of resist / organics where etch uniformity is not critical. Isotropic etching of SiO2/ Si3N4 / SiC / ??
Atmospheric furnace	Hi Tech furnaces UK	Small batch cantilever furnace - custom build - auto wafer unload/load with door opening - upto 25 wafer load - temperature across flat zone typically << 0.5° - temperature up to 1300°C - upto 8 gas lines	up to 200mm	Research and development of high quality growth of SiO2 on SiC. - also used for Si oxidation - gases include O2, Water vapour, NO, N2O, HCl - Temperature to >1300° C	Dry oxide growth on 150mm Si wafers -20 wafer batch -Uniformity <2% 3mm edge exclusion -Wafer to wafer non uniformity <2% @ 1000°	Wet oxidation from water bubbler enabling faster and thicker oxide growth
LPCVD furnace	Hi Tech furnaces UK	Small batch cantilever furnace - auto wafer unload/load with door opening - upto 25 wafer load - temperature across flat zone typically <<1° - temperature up to 750°C - upto 8 gas lines	up to 200mm	Deposition of polysilicon and Low Temperature Oxide gases available SiH4, N2, O2 ++ Polysi from SiH4 - undoped LTO from SiH4 + O2	Poly Si - 150mm wafers - growth rate 90nm/min - uniformity <3% 3 mm edge exclusion - uniformity <1% wafer to wafer 8 wafer load LTO - good electrical isolation - uniformity ~10% 20mm edge exclusion	
Atmospheric furnace	Hi Tech furnaces UK	Small batch cantilever furnace - custom build - auto wafer unload/load with door opening - upto 25 wafer load - temperature across flat zone typically << 0.5° - temperature up to 1200°C - upto 4 gas lines	up to 150mm wafers - 200mm conversion possible	Solid source doping of Si and polysi		P type - boron doping N type - phos doping
Vacuum ovens -2 off	MTI	max 250°	up to 200mm	storage of n and p type solid source diffusion dopants		

Metal and dielectric deposition by sputtering	Surrey Nano Systems - Gamma	DC and RF sputter capability - 4 100mm targets - load lock degas - RF sputter etch - Platen temp up to 850° - reactive sputtering - O2 and N2 - closed loop plasma spectrum analyser reactive sputter control	up to 200mm	DC and RF magnetron sputtering - Degas in load lock to 250° - 4 x 100mm targets - RF bias and etch - substrate temp to 800° - reactive sputtering with N2 and or O2 - metallisation for device fabrication Ti/ TiN /Al film stack, Ni, ++	Aluminium 1% Si 300° C < 5% non uniformity Reflectivity relative to Si @ 435nm > 195% @ 480nm > 210%	Ni deposition Al deposition Ti deposition TiN deposition Cr deposition Si deposition ++
MOCVD -housed in QMF annex	Aixtron 200RF/4S (commissioning Q1 2014)		2"	Epitaxial deposition AlN /GaN, alloys, MQW		

Cleanroom analysis equipment

thin film measurement	Nanospec AFT 210 system	Non contact optical measurement of films	up to 200mm with manual rotation of wafer	Quick (<10sec) and accurate measurement of:

non cleanroom equipment

Dicing saw	Disco 2HST	fully automatic dicing saw	up to 150mm wafers	wafer dicing - blades for Si, SiC and sapphire
Tube furnace - 70mm dia	Labec - custom design		Up to 50mm dia	Anneal, oxidation -gases N2, Ar, O2 - temp to 1400° C
Tube furnace - 75mm dia	Carbolite		Up to 50mm dia	Vacuum processing -inert gas
Evaporator for metal deposition	Jeol - JEE-4X	Thermal evaporator for small samples - SEM coater	< 3cm square samples	simple metallisation of small samples
DC sputter system	Emitech K575x		<2cm square samples	SEM sample coater and non critical metallisation - stage to 200° - 2 x 1" target turbo pumped R+D use mainly for dielectric films
RF sputter -metal and dielectric deposition	Originally Denton	GU converted Denton evaporator to RF sputter heated platen for up to 20mm samples	small samples	- 100mm target - gases Ar, O2 turbo pumped

Electrical test and physical analysis

SEM	Jeol JSM 6510LV - 2009	Tungsten filament 3nm resolution low and high vacuum modes	up to 150mm	Imaging SiC films, lithography, etch profiles etc
Profileometer	Tencor alpha-step 200		100mm	Surface roughness determination - step height measurements to determine etch rates >2nqre0oT /P <</MCID 135 >>BDC-66.5d3.36 62 Tf 0.-0.00position