

Distributor Training
29-30 Mar 2007, Shanghai

PrimePACK™

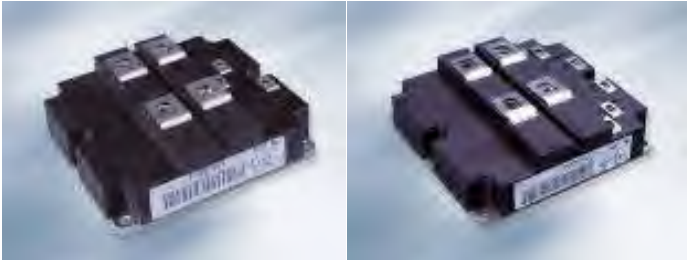
The New High Power IGBT Modules



What is PrimePACK™?

Existing High Power Modules

IHM 1700V
1600V
1200V



IHV 3.3kV
6.5kV

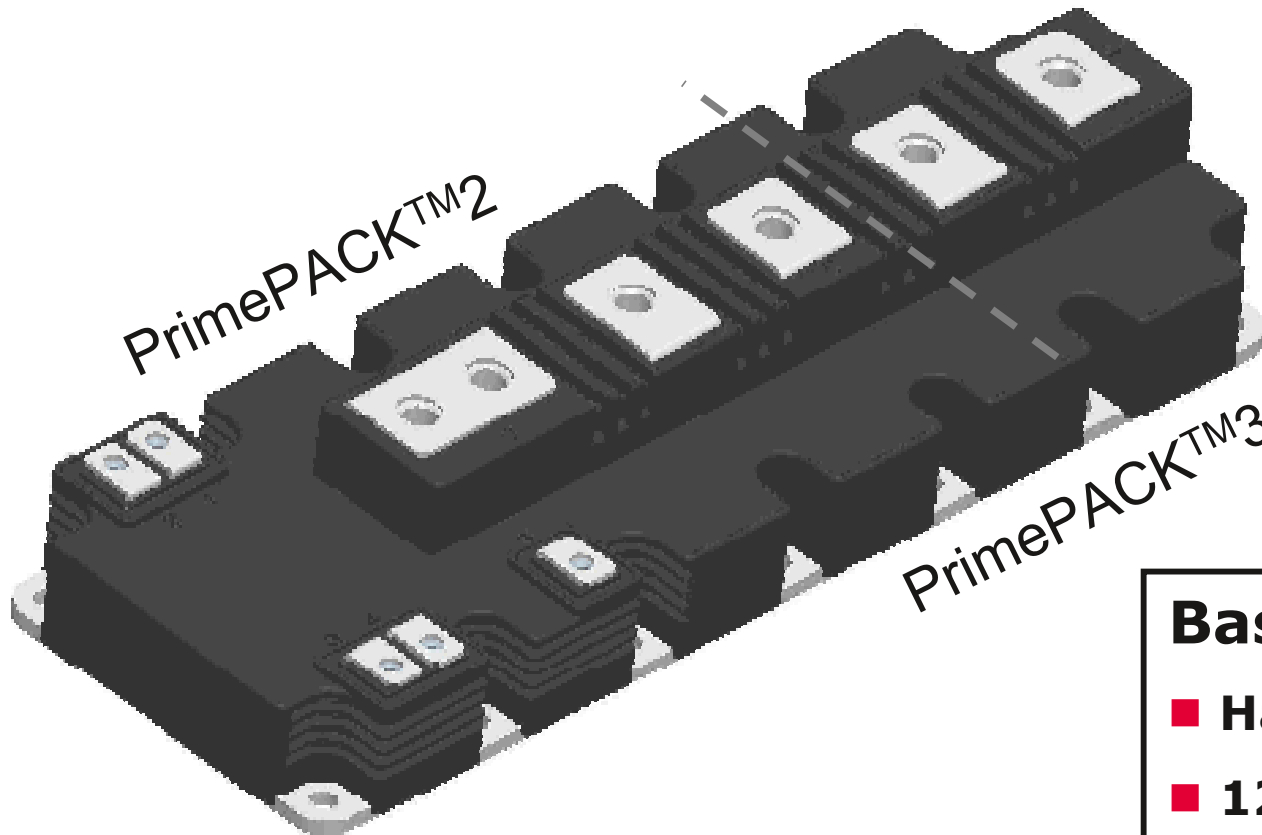


new! High Power Modules
PrimePACK™ 1700V
1200V

What is PrimePACK™?

Modular Design of Package Footprint

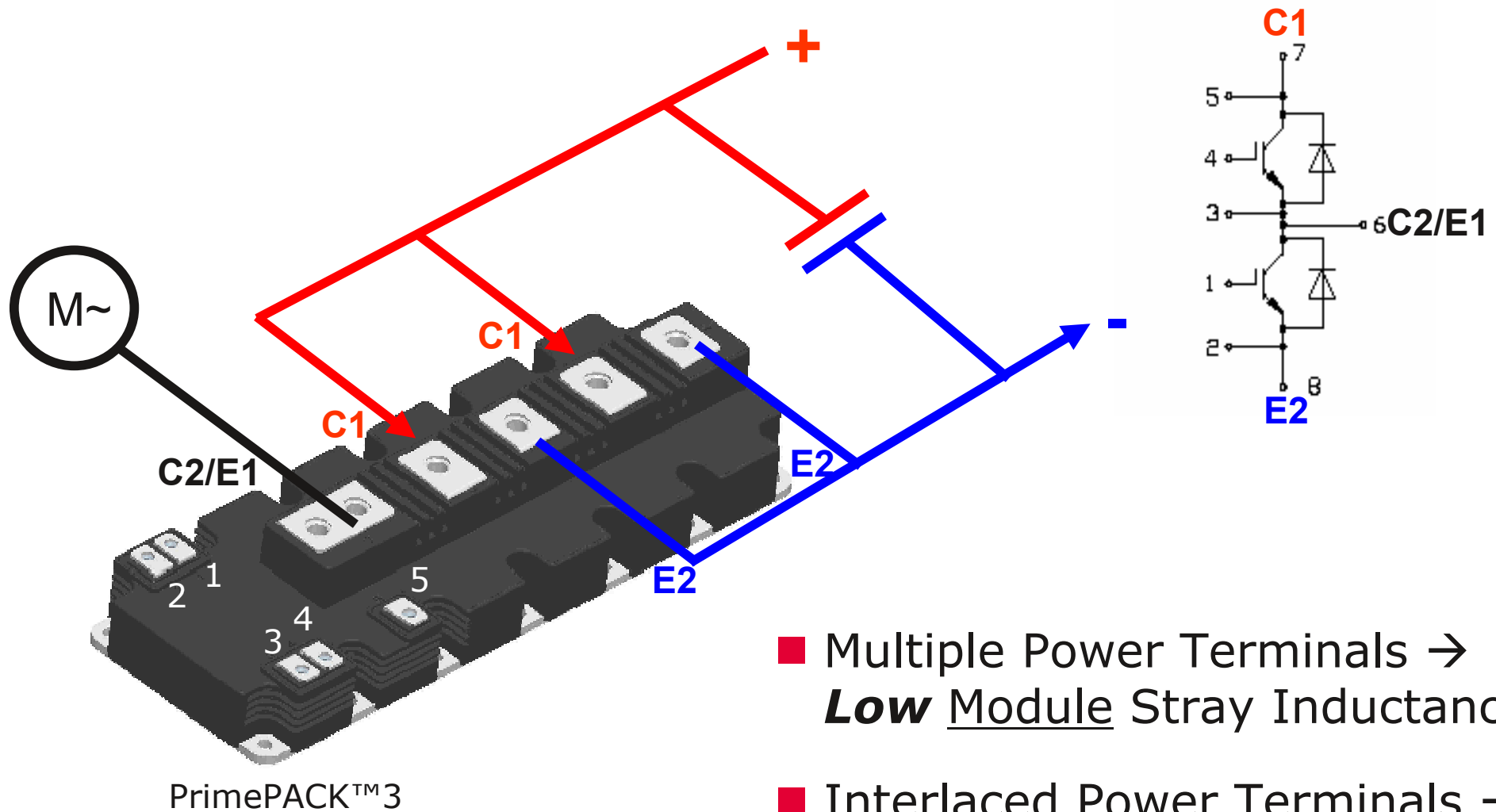
- PrimePACK™2 (89 x 172mm): up to 900A & 650A
- PrimePACK™3 (89 x 250mm): up to 1400A & 1000A



Basic Properties

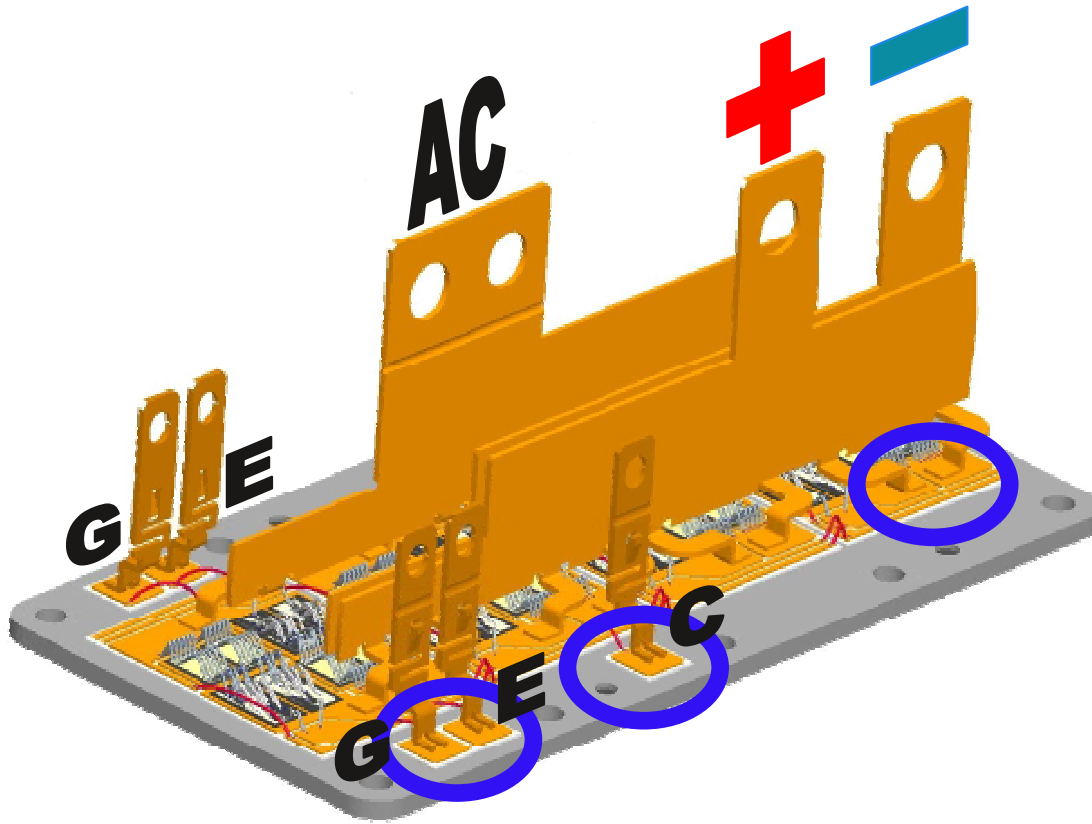
- Half Bridge
- 1200V & 1700V

How is PrimePACK™?



- Multiple Power Terminals → **Low** Module Stray Inductance
- Interlaced Power Terminals → **Low** Bus-bar Stray Inductance

How is PrimePACK™ ?



PrimePACK™2: Internal Layout

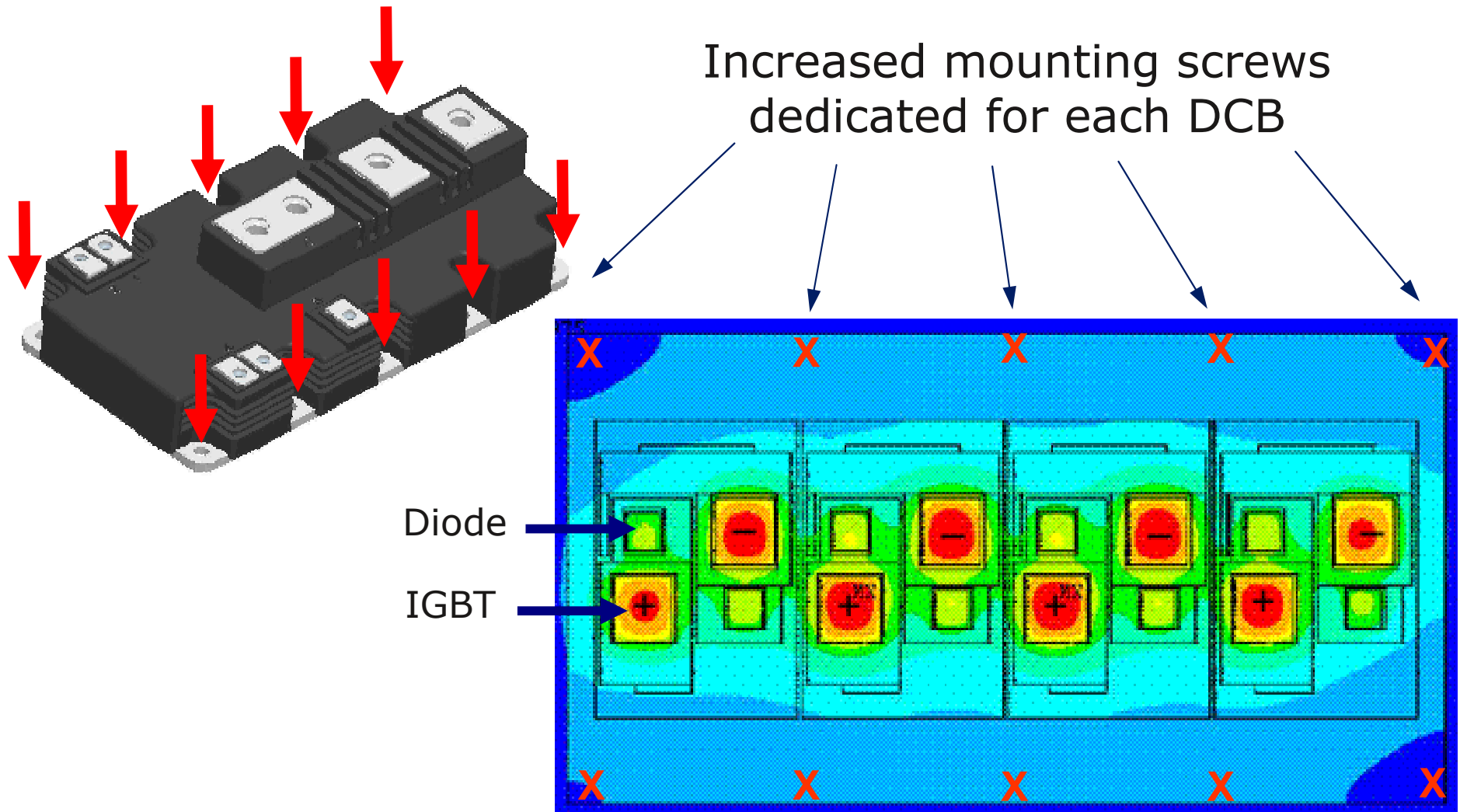
Internal Bus Bar

- **Low** Module Stray Inductance*
- **Welding** instead of soldering increasing mechanical robustness
- **Optimized** Cost

* PrimePACK™2: ~ 18 nH

* PrimePACK™3: ~ 10 nH

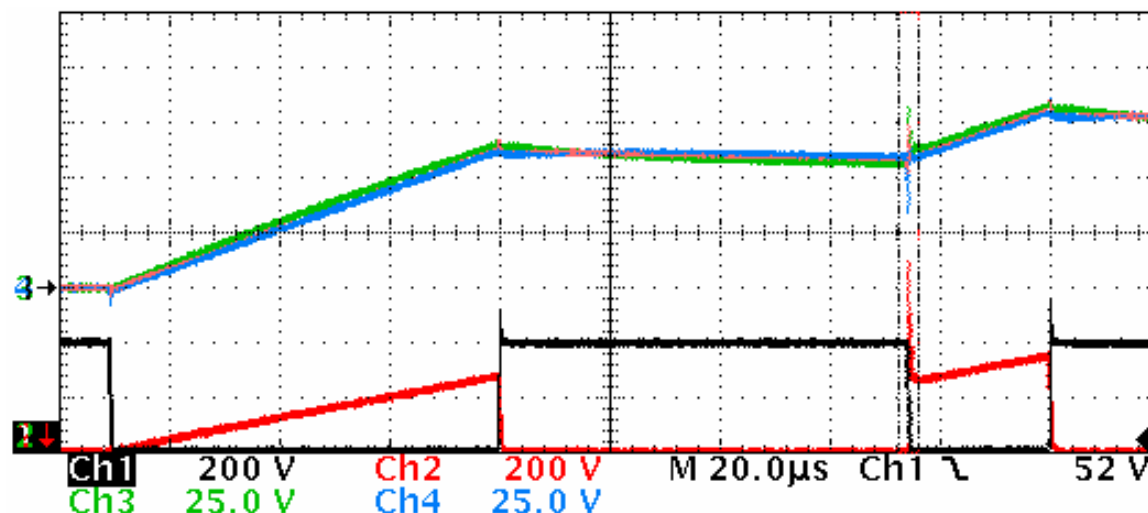
How is PrimePACK™?



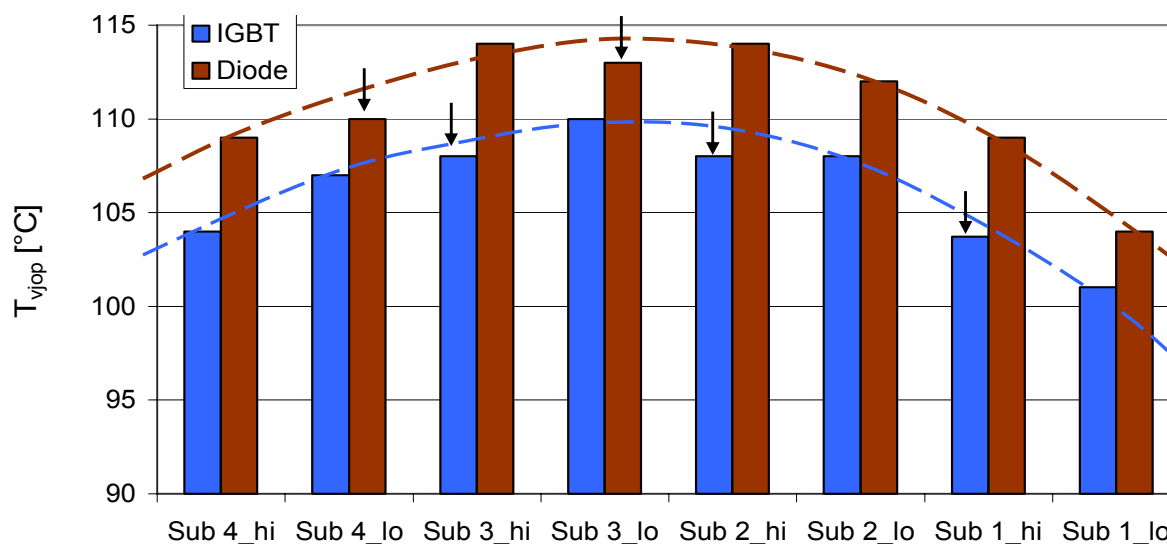
Result in: **Low** Thermal Resistance R_{thCH} (Case-Heatsink)

How is PrimePACK™?

Good Current
Sharing
(DCB1&4)

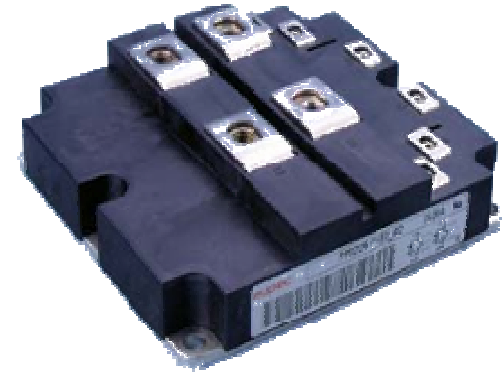
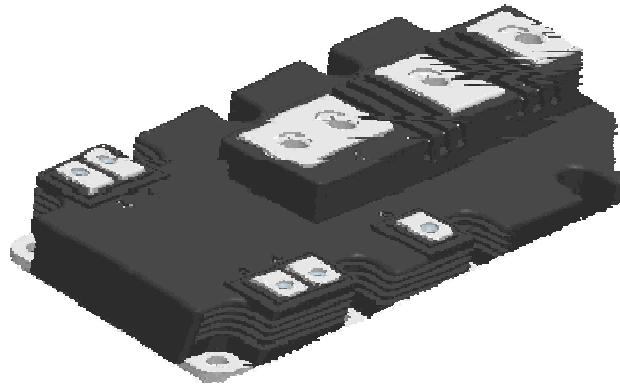


Symmetrical
Power Sharing
(DCB1-4)



Temperature of
Each IGBT &
Diode Chip

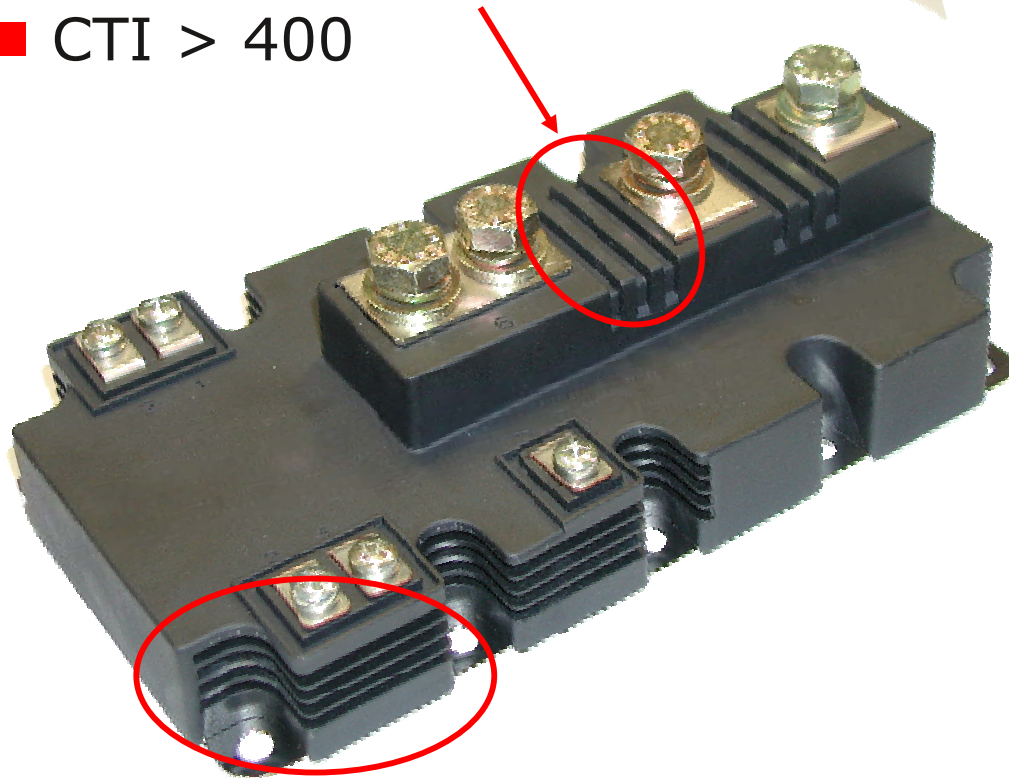
How is PrimePACK™?



	PrimePACK™ 2: FF650R17IE4	IHM 140x130: FF600R17KE3
Current / Voltage	600A / 1700V	600A / 1700V
Mounting Area	17.2cm x 8.9cm=153cm² (-14%)	13cm x 14cm=182cm²
RthCH	4 K/kW (-30%)	6 K/kW
Weight	825g (-45%)	1500g
Stray Inductance	18nH (-60%)	45nH

How is PrimePACK™

- Creepage 33mm
- Clearance 19mm
- CTI > 400



- High Creepage & Clearance Distance for Highly Contaminated Environment
- Meets Safety Standard: up to 3300V Impulse Voltage (Over Voltage Class 2, Pollution Degree 3)

IGBT4 for PrimePACK™

- **IGBT4** – 2nd Generation of Trench-Fieldstop Technology
- Three Versions of IGBT4 optimized for different application requirements
 - IGBT4 - High Power Chip (**P4**) → **Softer than E3**
 - IGBT4 - Medium Power Chip (**E4**) → **Faster than E3; As soft as E3**
 - IGBT4 - Low Power Chip (T4) → *Faster than T3; same softness as T3*
 - Increased junction temperature **Tvjop=150°C / Tvjmax=175°C**
- 10μS Short Circuit Robustness at 150°C
- PrimePACK™ use P4 (IP4) and E4 (IE4)



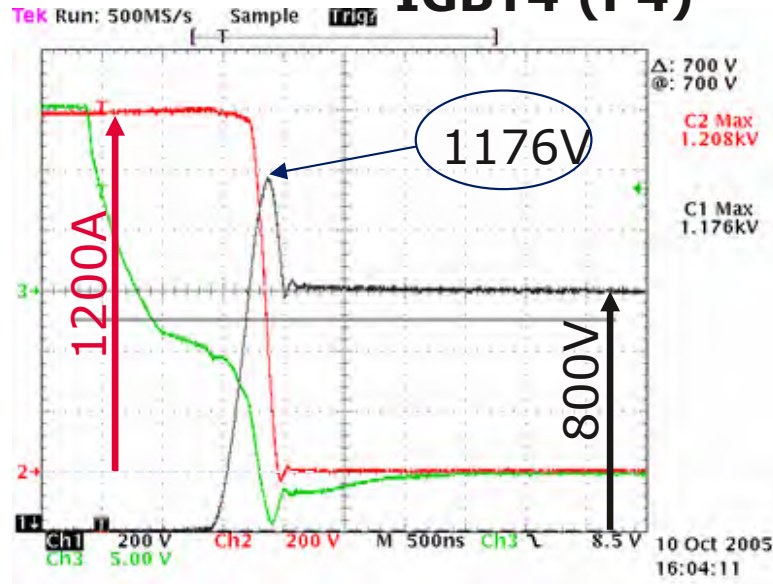
- **EmCon4** – 4th Generation of EmCon Diode (Freewheeling)
- Two versions of EmCon4 optimized for different application requirements
 - EmCon4 High Power → **Improved Softness**
 - EmCon4 Low- & Medium Power → **Improved Softness**
 - Increased junction temperature $T_{vjop}=150^{\circ}\text{C}$ / $T_{vjmax}=175^{\circ}\text{C}$
- PrimePACK™ use EmCon4 High Power (IP4) and EmCon4 Medium Power (IE4)



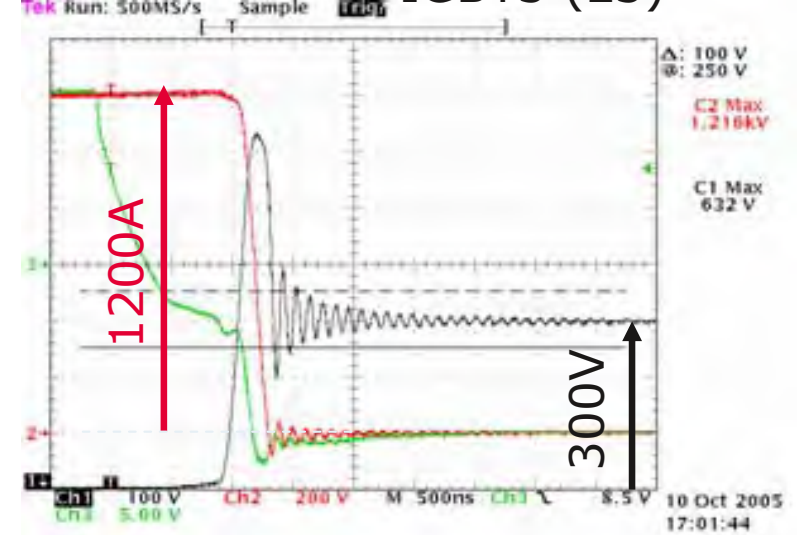
IGBT4 & EmCon4 vs. IGBT3 & EmConFAST

IGBT Turn-off

IGBT4 (P4)

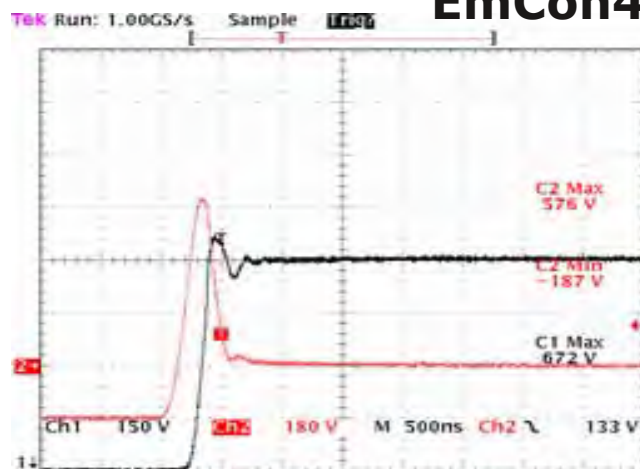


IGBT3 (E3)



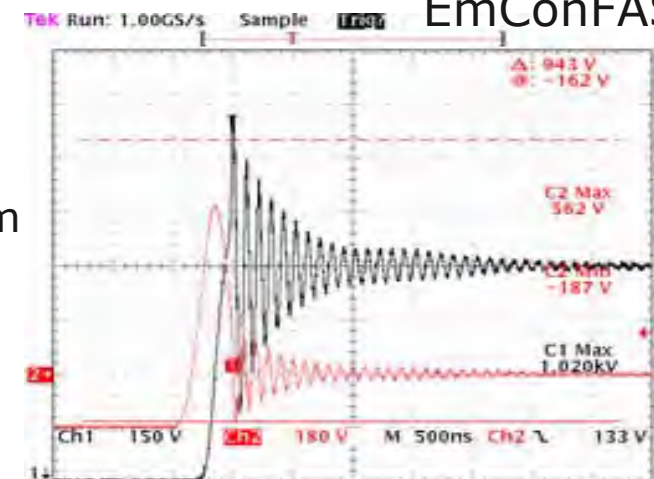
Diode Turn-off

EmCon4



$I = 1/10 I_{nom}$
 $T_j = T_{vjmax}$

EmConFAST



What else – Reliability!

PrimePACK™ use:

- Improved Bonding Technology plus IGBT4 ($T_{vjop} = 150^{\circ}\text{C}$)
 - Same Power Cycling (PC) Capability @ $T_{jmax} = 150^{\circ}\text{C}$
 - Nearly **Doubled** PC Capability @ $T_{jmax} = 125^{\circ}\text{C}$
- Rugged Al_2O_3 Substrate plus Cu Baseplate
 - **Improved** Thermal Cycling (TC) Capability

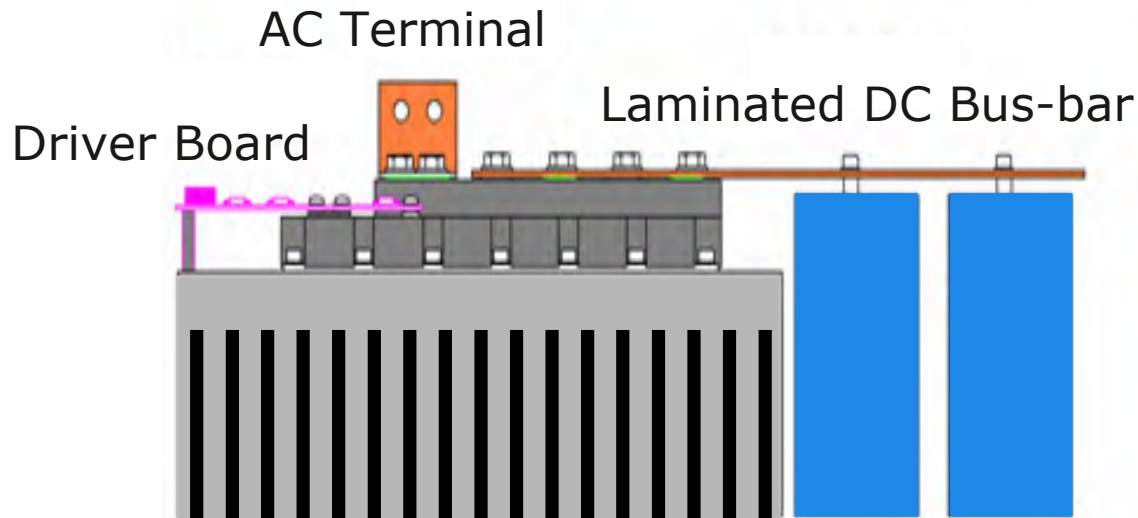


Product Range of PrimePACK™



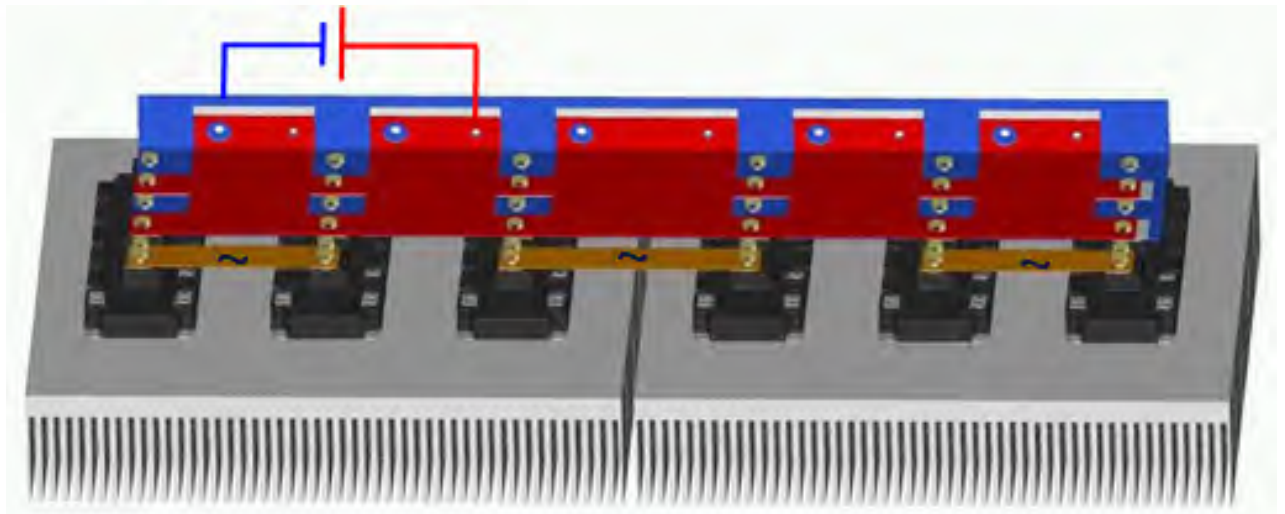
I_c [A]	1200V Half Bridge	1700V Half Bridge
400		FF450R17IE4
450	FF450R12IE4	
600	FF600R12IE4	FF650R17IE4
900	FF900R12IE4	FF1000R17IE4
1400	FF1400R12IP4	
Footprint:	PrimePACK™ 2: 172x89	
	PrimePACK™ 3: 250x89	

Application of PrimePACK™



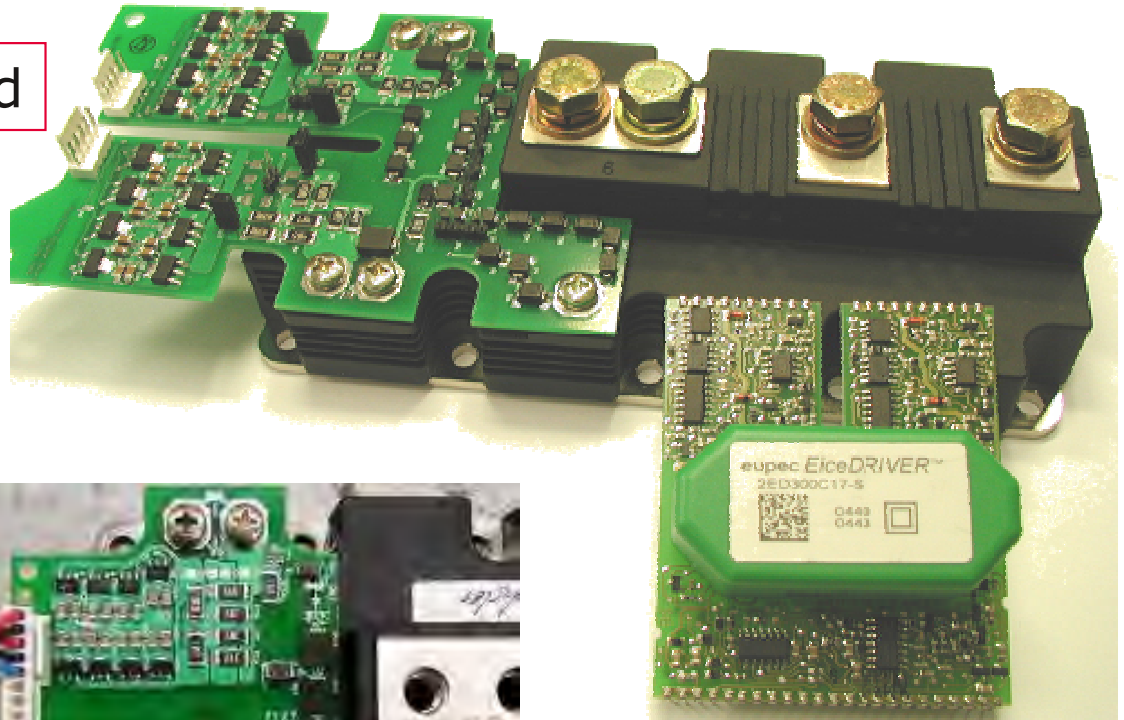
Example 1:
System Arrangement

Example 2:
Parallel Operation

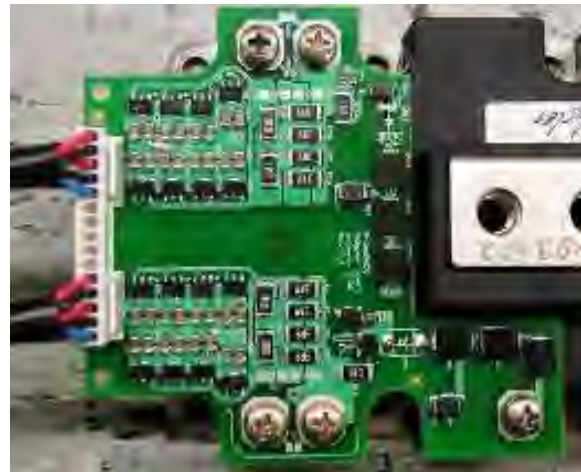


Application of PrimePACK™

Evaluation Board



2ED300C17-S/ST
+ Adaptor Board

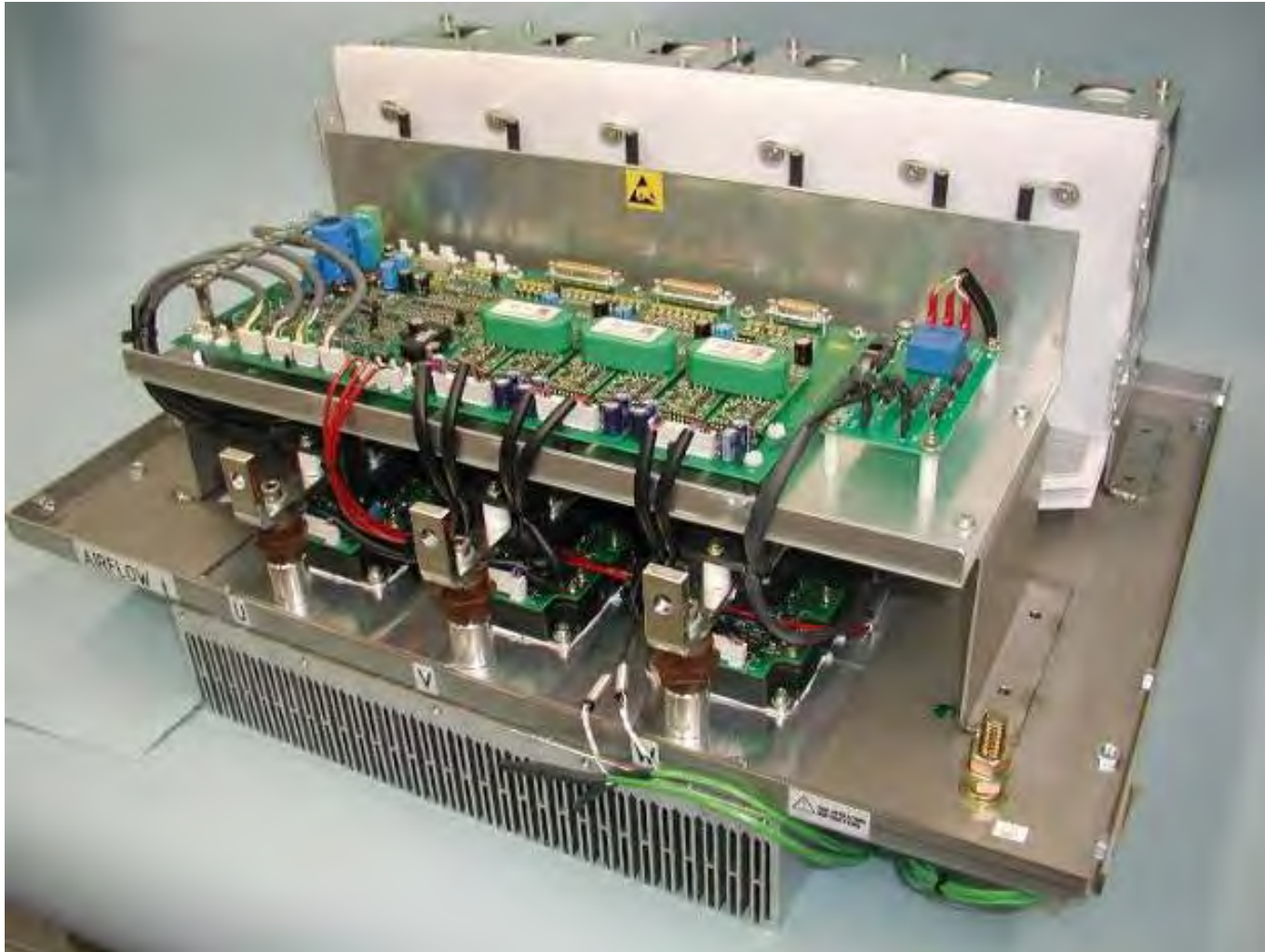


Adaptor Board for
PrimePACK™

EiceDRIVER™
2ED300C17-S/ST

Application of PrimePACK™

ModSTACK™ with PrimePACK™



Summary

- Available for 1200V & 1700V Half-bridge with Modular Design
- Low Stray Inductance (vs. IHM 140x130: -60%)
- Low Thermal Resistance R_{thCH} (vs. to IHM 140x130: -30%)
- Low Weight (vs. IHMA: -45%)
- Increased Mechanical Robustness
- High Creepage (33mm) & Clearance Distance (19mm)
- Using IGBT4 & EmCon4 with Improved Softness
- Operating Temperature $T_{vjop} = 150^{\circ}\text{C}$
- Improved Reliabilities (PC & TC)
- Slim Module Design Ease Module Paralleling
- Application Support with Driver Solution
- Target Applications: High-power Drives & UPS, Electric Vehicles

Thank you for your attention!

Any Questions?