



# STC03DE170

## HYBRID EMITTER SWITCHED BIPOLAR TRANSISTOR ESBT™ 1700 V - 3 A - 0.55 Ω

**Table 1: General Features**

$V_{CS(ON)}$	$I_C$	$R_{CS(ON)}$
1 V	1.8 A	0.55 Ω

- LOW EQUIVALENT ON RESISTANCE
- VERY FAST-SWITCH, UP TO 150 KHz
- SQUARED RBSOA, UP TO 1700 V
- VERY LOW  $C_{ISS}$  DRIVEN BY  $R_G = 4.7 \Omega$

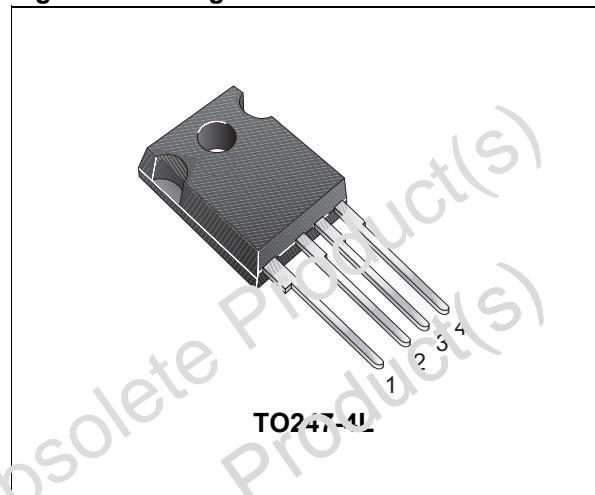
**APPLICATION**

- AUX SMPS FOR THREE PHASE MAINS

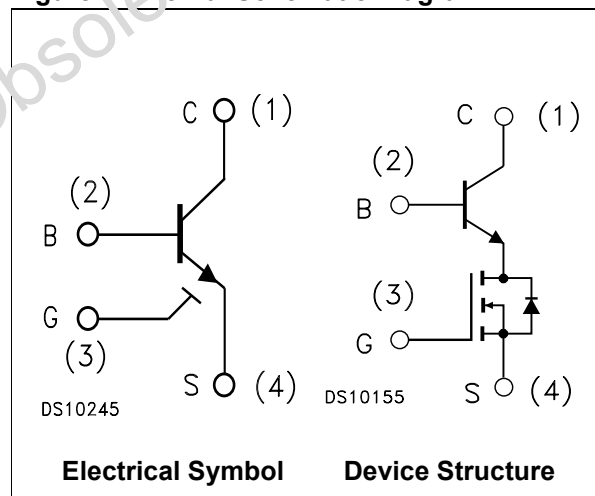
**DESCRIPTION**

The STC03DE170 is manufactured in a hybrid structure, using dedicated high voltage Bipolar and low voltage MOSFET technologies, aimed to providing the best performance in ESBT topology. The STC03DE170 is designed for use in aux flyback smps for any three phase application.

**Figure 1: Package**



**Figure 2: Internal Schematic Diagram**



**Table 2: Order Code**

Part Number	Marking	Package	Packaging
STC03DE170	STC03DE170	TO247-4L	TUBE

**Table 3: Absolute Maximum Ratings**

Symbol	Parameter	Value	Unit
V <sub>CS(SS)</sub>	Collector-Source Voltage (V <sub>BS</sub> = V <sub>GS</sub> = 0 V)	1700	V
V <sub>BS(OS)</sub>	Base-Source Voltage (I <sub>C</sub> = 0, V <sub>GS</sub> = 0 V)	30	V
V <sub>SB(OS)</sub>	Source-Base Voltage (I <sub>C</sub> = 0, V <sub>GS</sub> = 0 V)	9	V
V <sub>GS</sub>	Gate-Source Voltage	± 20	V
I <sub>C</sub>	Collector Current	3	A
I <sub>CM</sub>	Collector Peak Current (t <sub>p</sub> < 5ms)	6	A
I <sub>B</sub>	Base Current	2	A
I <sub>BM</sub>	Base Peak Current (t <sub>p</sub> < 1ms)	4	A
P <sub>tot</sub>	Total Dissipation at T <sub>C</sub> = 25 °C	100	W
T <sub>stg</sub>	Storage Temperature	-65 to 125	°C
T <sub>J</sub>	Max. Operating Junction Temperature	125	°C

**Table 4: Thermal Data**

Symbol	Parameter	Unit
R <sub>thj-case</sub>	Thermal Resistance Junction-Case Max	1 °C/W

**Table 5: Electrical Characteristics (T<sub>case</sub> = 25 °C unless otherwise specified)**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I <sub>CS(SS)</sub>	Collector-Source Current (V <sub>BS</sub> = V <sub>GS</sub> = 0 V)	V <sub>CS(SS)</sub> = 1700 V			100	μA
I <sub>BS(OS)</sub>	Base-Source Current (I <sub>C</sub> = 0, V <sub>GS</sub> = 0 V)	V <sub>BS(OS)</sub> = 30 V			10	μA
I <sub>SB(OS)</sub>	Source-Base Current (I <sub>C</sub> = 0, V <sub>GS</sub> = 0 V)	V <sub>SB(OS)</sub> = 9 V			100	μA
I <sub>GS(OS)</sub>	Gate-Source Leakage	V <sub>GS</sub> = ± 20 V			500	nA
V <sub>CS(ON)</sub>	Collector-Source ON Voltage	V <sub>GS</sub> = 10 V I <sub>C</sub> = 1.8 A I <sub>B</sub> = 0.36 A V <sub>GS</sub> = 10 V I <sub>C</sub> = 0.7 A I <sub>B</sub> = 70 mA		1 1	1.5 1.3	V V
h <sub>FE</sub>	DC Current Gain	I <sub>C</sub> = 1.8 A V <sub>CS</sub> = 1 V V <sub>GS</sub> = 10 V I <sub>C</sub> = 0.7 A V <sub>CS</sub> = 1 V V <sub>GS</sub> = 10 V	3.5 6	5 10		
V <sub>BS(ON)</sub>	Base-Source ON Voltage	V <sub>GS</sub> = 10 V I <sub>C</sub> = 1.8 A I <sub>B</sub> = 0.36 A V <sub>GS</sub> = 10 V I <sub>C</sub> = 0.7 A I <sub>B</sub> = 70 mA		1 0.8	1.2 1	V V
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>BS</sub> = V <sub>GS</sub> I <sub>B</sub> = 250 μA	1.5	2.2	3	V
C <sub>iss</sub>	Input Capacitance	V <sub>CS</sub> = 25 V f = 1MHz V <sub>GS</sub> = V <sub>CB</sub> = 0		750		pF
Q <sub>GS(tot)</sub>	Gate-Source Charge	V <sub>CS</sub> = 15 V V <sub>GS</sub> = 10 V V <sub>CB</sub> = 0 I <sub>C</sub> = 1.8 A		12.5		nC
t <sub>s</sub>	INDUCTIVE LOAD Storage Time	V <sub>GS</sub> = 10 V R <sub>G</sub> = 47 Ω V <sub>Clamp</sub> = 1200 V		760		ns
t <sub>f</sub>	Fall Time	t <sub>p</sub> = 4 μs I <sub>C</sub> = 1.8 A I <sub>B</sub> = 0.36 A		14		ns

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_s$ $t_f$	INDUCTIVE LOAD Storage Time Fall Time	$V_{GS} = 10\text{ V}$ $R_G = 47\ \Omega$ $t_p = 4\ \mu\text{s}$ $V_{Clamp} = 1200\text{ V}$ $I_C = 0.7\text{ A}$ $I_B = 70\text{ mA}$		690 32		ns ns
$V_{CSW}$	Maximum Collector-Source Voltage without Snubber	$R_G = 47\ \Omega$ $h_{FE} = 5\text{ A}$ $I_C = 3\text{ A}$	1500			V
$V_{CS(dyn)}$	Collector-Source Dynamic Voltage (500 ns)	$V_{CC} = V_{Clamp} = 400\text{ V}$ $R_G = 47\ \Omega$ $I_B = 0.1\text{ A}$ $t_{peak} = 500\text{ ns}$ $V_{GS} = 10\text{ V}$ $I_C = 0.5\text{ A}$ $I_{Bpeak} = 1\text{ A}$		3.9		V
$V_{CS(dyn)}$	Collector-Source Dynamic Voltage (1 $\mu\text{s}$ )	$V_{CC} = V_{Clamp} = 400\text{ V}$ $R_G = 47\ \Omega$ $I_B = 0.1\text{ A}$ $t_{peak} = 500\text{ ns}$ $V_{GS} = 10\text{ V}$ $I_C = 0.5\text{ A}$ $I_{Bpeak} = 1\text{ A}$		2.2		V

Figure 3: Safe Operating Area

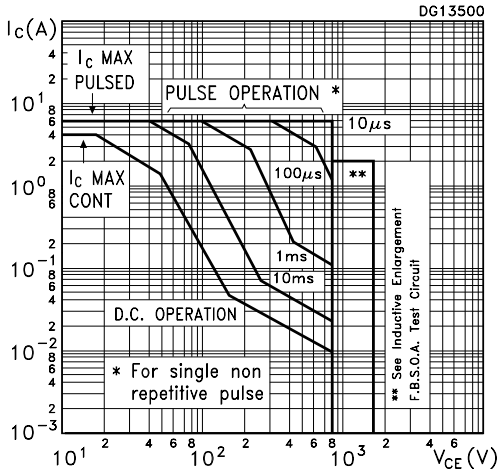


Figure 4: Reverse Biased Safe Operating Area

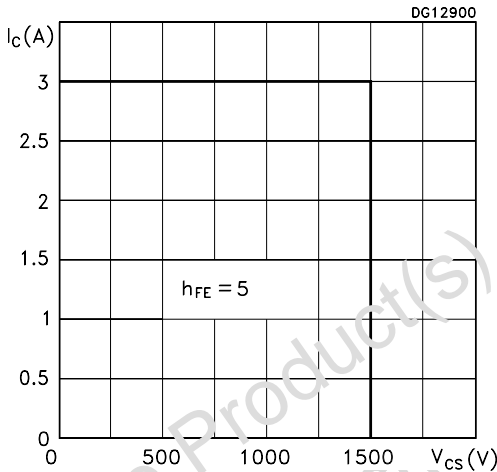


Figure 5: DC Current Gain

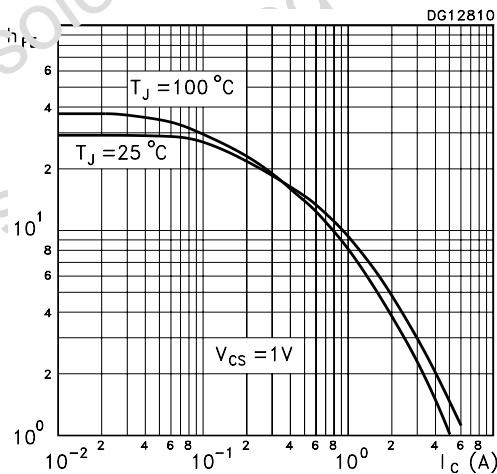


Figure 6: Output Characteristics

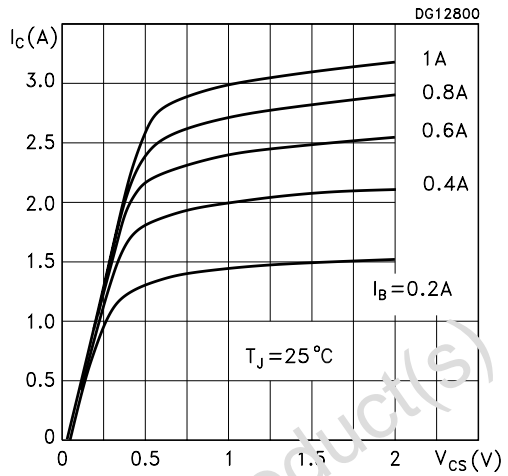


Figure 7: Gate Threshold Voltage vs Temperature

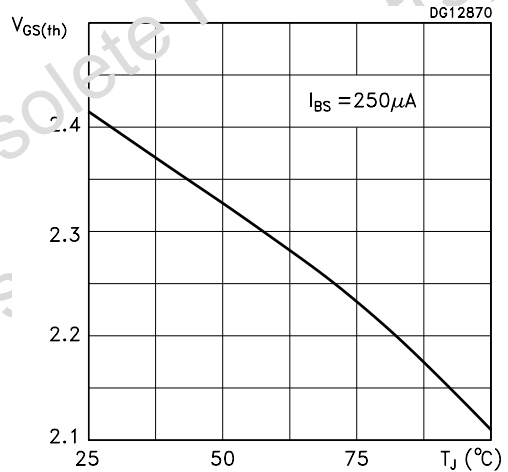


Figure 8: DC Current Gain

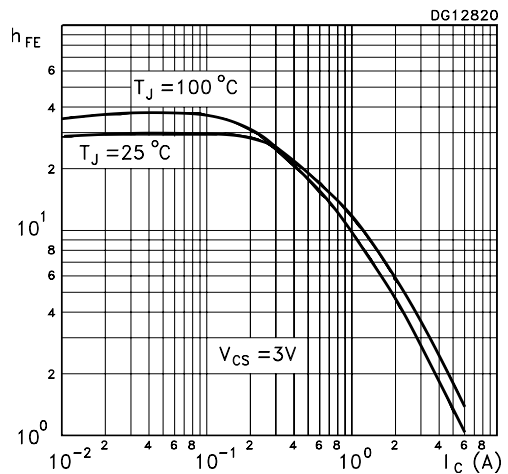


Figure 9: Collector-Source On Voltage

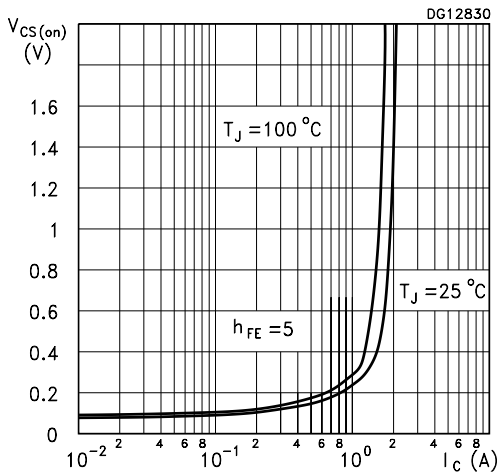


Figure 10: Base-Source On Voltage

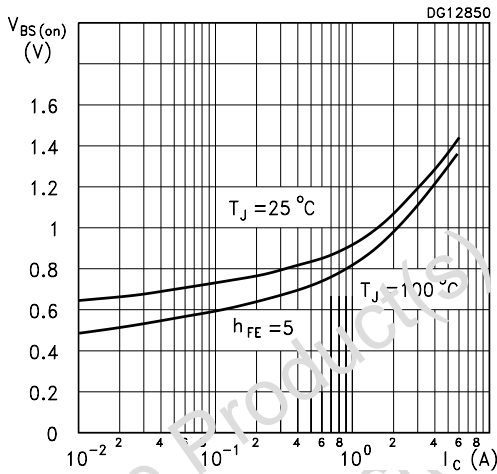


Figure 11: Inductive Load Switching Time

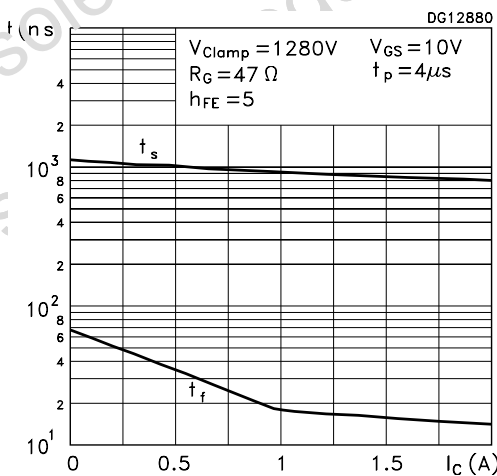


Figure 12: Collector-Source On Voltage

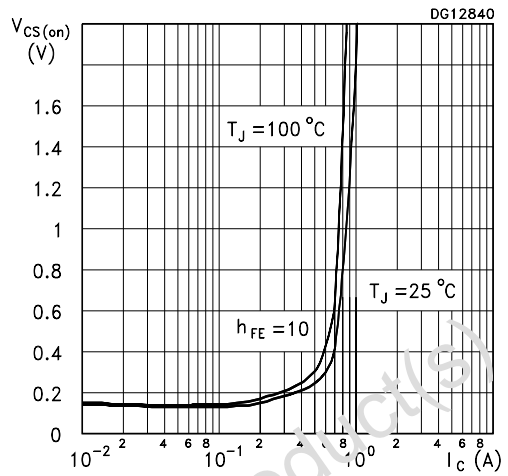


Figure 13: Base-Source On Voltage

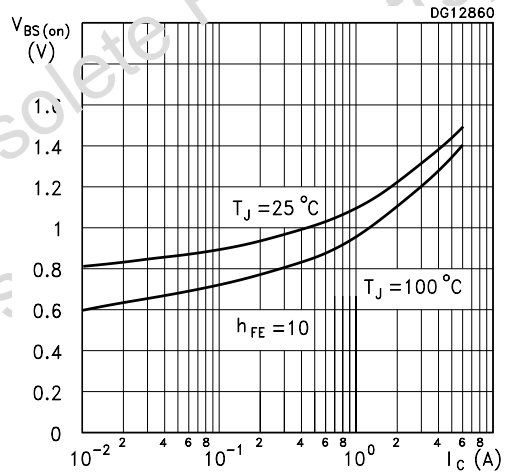


Figure 14: Inductive Load Switching Time

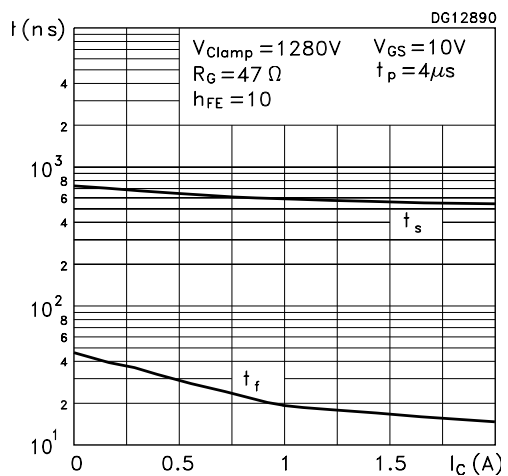


Figure 15: Dynamic Collector-Emitter Saturation Voltage

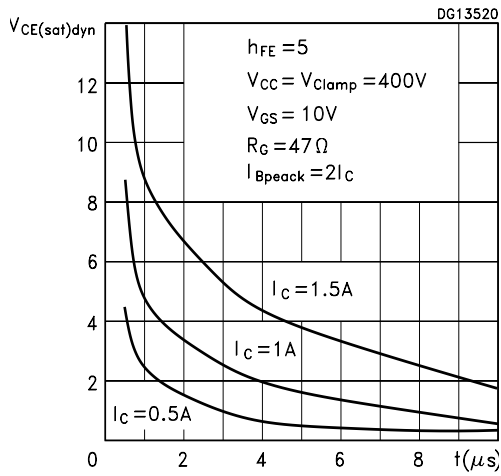


Figure 16: Inductive Load Enlargement FBSOA Circuit

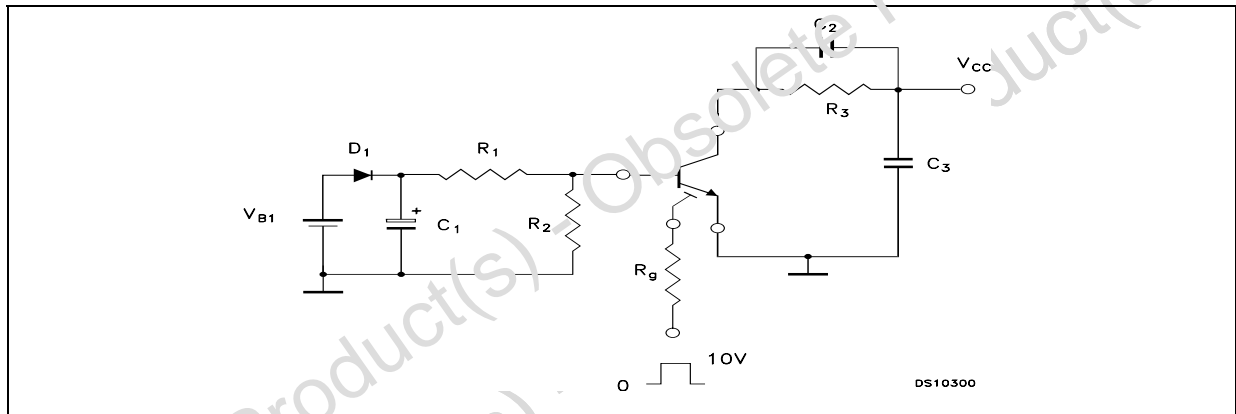
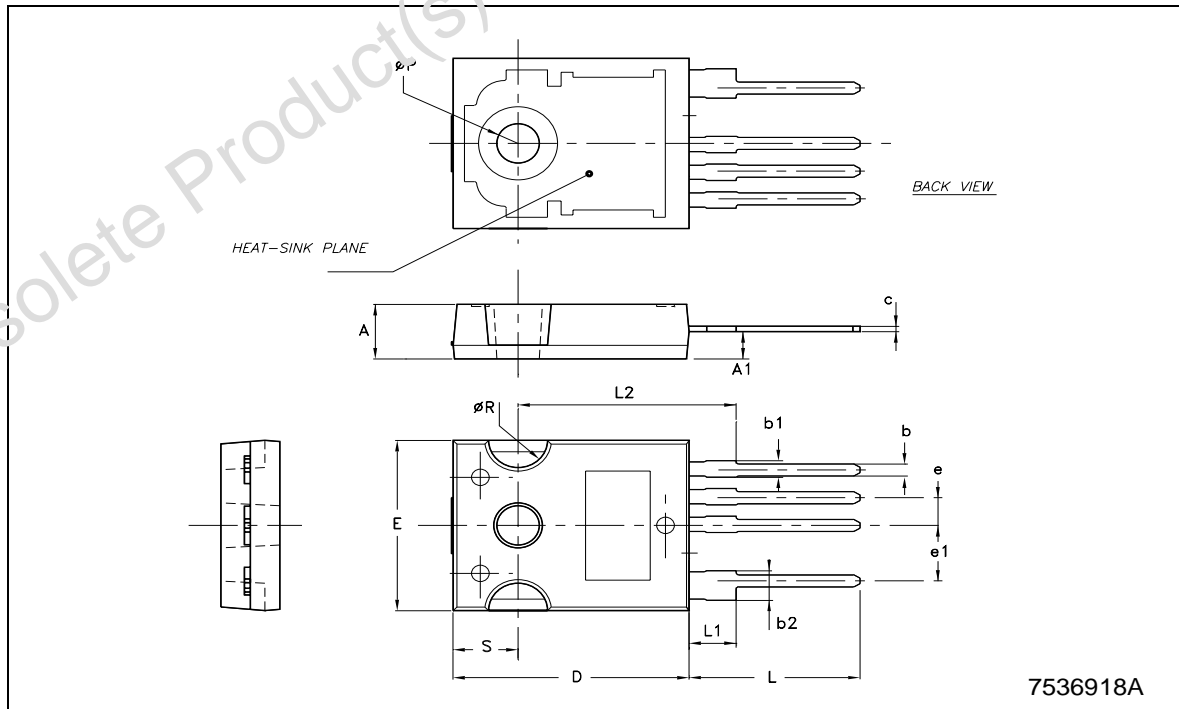


Table 6: Components, Values

$V_{B1} = 4.13V$	$C_1 = 220nF$
$D_1 = 5A157$	$C_2 \leq 70pF$
$R_1 = 1\Omega$	$C_3 = 50nF$
$R_2 = 100\Omega$	$V_g = 10V$
$R_3 = V_{CC} / I_{Cn}$	Pulse Time = $5\mu s$
$R_g = 47\Omega$	

## TO247-4L MECHANICAL DATA

DIM.	mm		
	MIN.	TYP.	MAX.
A	4.85		5.15
A1	2.20		2.60
b	0.95	1.10	1.30
b1	1.30		1.70
b2	2.50		2.90
c	0.40		0.90
D	19.85		20.15
E	15.45		15.75
e		2.54	
e1		5.08	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
ØP	3.55		3.65
ØR	4.50		5.50
S		5.50	



**Table 7: Revision History**

Date	Release	Change Designator
13-Sep-2004	1	First Release.
04-Oct-2004	2	Figure 15 has been updated on page 6.

Obsolete Product(s) - Obsolete Product(s)  
Obsolete Product(s) - Obsolete Product(s)



Obsolete Product(s) - Obsolete Product(s)

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