

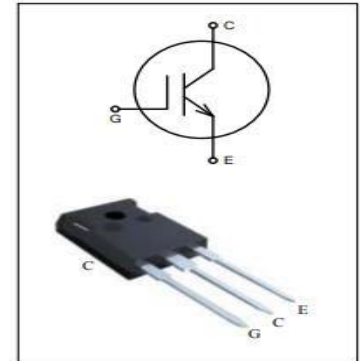


**TO247-3 Plastic-Encapsulate IGBT**

**CCG40Q120KAH**

IGBT in Trench FS Technology

$V_{(BR)CES}$	$V_{CEsat}$		$I_C$	
1200 V	$T_{vj}=25^{\circ}C$	1.80V@40A	$T_{vj}=25^{\circ}C$	80A
	$T_{vj}=150^{\circ}C$	2.15V@40A	$T_{vj}=100^{\circ}C$	40A



**Features:**

- 1200V Trench field-stop technology
- Low conduction and switching losses
- Positive temperature coefficient of forward voltage
- Short Circuit withstand time-10 $\mu$ s
- AEC Q101 qualified

**Applications:**

- Automobile PTC
- Short-Circuit Protector

**Key Performance and Package Parameters**

Type	VCE	$I_C$	$V_{CEsat}$ , $T_{vj}=25^{\circ}C$	$T_{vjmax}$	Marking	Package
CCG40Q120KAH	1200V	40A	1.80V	175 $^{\circ}C$	CCG40Q120KAH	PG-TO247-3



## TO247-3 Plastic-Encapsulate IGBT

### Maximum Ratings

For optimum lifetime and reliability, cloudchild recommends operating conditions that do not exceed 80% of the maximum ratings stated in this datasheet.

Parameter	Symbol	Value	Unit
Collector-emitter voltage	VCE	1200	V
DC collector current, limited by $T_{vjmax}$ $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	$I_C$	80.0 40.0	A
Pulsed collector current, $t_p$ limited by $T_{vjmax}$	$I_{Cpuls}$	160.0	A
Gate-emitter voltage	VGE	$\pm 20$	V
Short circuit withstand time VGE = 15.0V, VCC $\leq$ 600V Allowed number of short circuits < 1000 Time between short circuits: $\geq$ 1.0s $T_{vj} = 175^\circ\text{C}$	tSC	10	$\mu\text{s}$
Power dissipation $T_C = 25^\circ\text{C}$	$P_{tot}$	484.0	W
Operating junction temperature	$T_{vj}$	-40...+175	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55...+175	$^\circ\text{C}$
Soldering temperature, wave soldering 1.6mm (0.063in.) from case for 10s		260	$^\circ\text{C}$
Mounting torque, M3 screw Maximum of mounting processes: 3	M	0.6	Nm

### Thermal Resistance

Parameter Characteristic	Symbol	Conditions	Max. Value	Unit
IGBT thermal resistance, junction - case	$R_{th(j-c)}$	/	0.31	K/W
Thermal resistance junction - ambient	$R_{th(j-a)}$	/	42	K/W



**TO247-3 Plastic-Encapsulate IGBT**

Electrical Characteristic, at  $T_{vj} = 25^{\circ}\text{C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Static Characteristic</b>						
Collector-emitter breakdown voltage	$V_{(BR)CE S}$	$V_{GE} = 0V, I_C = 1mA$	1200	-	-	V
Collector-emitter saturation voltage	$V_{CEsat}$	$V_{GE} = 15.0V, I_C = 40.0A$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	-	1.80	2.10	V
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 1.60mA, V_{CE} = V_{GE}$	5.5	5.8	6.5	V
Zero gate voltage collector current	$I_{CES}$	$V_{CE} = 1200V, V_{GE} = 0V$ $T_{vj} = 25^{\circ}\text{C}$ $T_{vj} = 150^{\circ}\text{C}$	-	-	100.0 1000.0	$\mu A$
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0V, V_{GE} = 20V$	-100	-	100	nA
Transconductance	$g_{fs}$	$V_{CE} = 20V, I_C = 15.0A$	-	20.0	-	S

Electrical Characteristic, at  $T_{vj} = 25^{\circ}\text{C}$ , unless otherwise specified

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>Dynamic Characteristic</b>						
Input capacitance	$C_{ies}$	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$	-	2720	-	pF
Output capacitance	$C_{oes}$		-	200	-	
Reverse transfer capacitance	$C_{res}$		-	135	-	
Gate charge	$Q_G$	$V_{CC} = 960V, I_C = 40.0A, V_{GE} = 15V$	-	230	-	nC
Internal emitter inductance measured 5mm from case	$L_E$		-	12.0	-	nH



## TO247-3 Plastic-Encapsulate IGBT

### Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>IGBT Characteristic, at <math>T_{vj} = 25^{\circ}\text{C}</math></b>						
Turn-on delay time	$t_{d(on)}$	$T_{vj} = 25^{\circ}\text{C}$ , $V_{CC} = 600\text{V}$ , $I_C = 40.0\text{A}$ , $V_{GE} = -7.5/15.0\text{V}$ , $R_{G(on)} = 10.0\Omega$ , $R_{G(off)} = 10.0\Omega$ , $L_{\sigma} = 70\text{nH}$ , $C_{\sigma} = 67\text{pF}$	-	30	-	ns
Rise time	$t_r$		-	40	-	ns
Turn-off delay time	$t_{d(off)}$		-	290	-	ns
Fall time	$t_f$		-	90	-	ns
Turn-on energy	$E_{on}$		-	3.55	-	mJ
Turn-off energy	$E_{off}$		-	1.55	-	mJ
Total switching energy	$E_{ts}$		-	5.15	-	mJ

### Switching Characteristic, Inductive Load

Parameter	Symbol	Conditions	Value			Unit
			min.	typ.	max.	
<b>IGBT Characteristic, at <math>T_{vj} = 150^{\circ}\text{C}</math></b>						
Turn-on delay time	$t_{d(on)}$	$T_{vj} = 150^{\circ}\text{C}$ , $V_{CC} = 600\text{V}$ , $I_C = 40.0\text{A}$ , $V_{GE} = -7.5/15.0\text{V}$ , $R_{G(on)} = 10.0\Omega$ , $R_{G(off)} = 10.0\Omega$ , $L_{\sigma} = 70\text{nH}$ , $C_{\sigma} = 67\text{pF}$	-	56	-	ns
Rise time	$t_r$		-	90	-	ns
Turn-off delay time	$t_{d(off)}$		-	423	-	ns
Fall time	$t_f$		-	152	-	ns
Turn-on energy	$E_{on}$		-	5.26	-	mJ
Turn-off energy	$E_{off}$		-	2.68	-	mJ
Total switching energy	$E_{ts}$		-	8.27	-	mJ



# TO247-3 Plastic-Encapsulate IGBT

## Typical Characteristic Curve

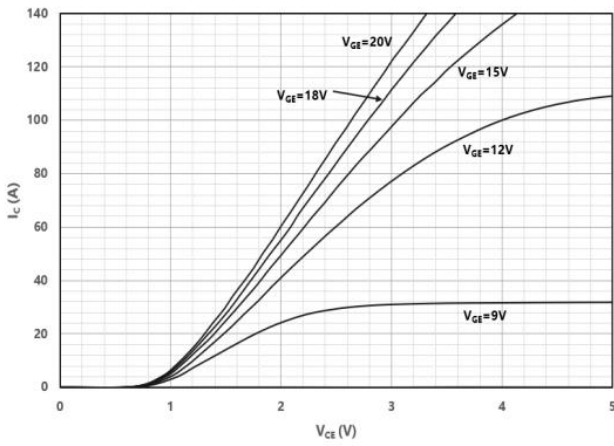


Fig.1 Typical Output Characteristic ( $T_j=25^\circ\text{C}$ )

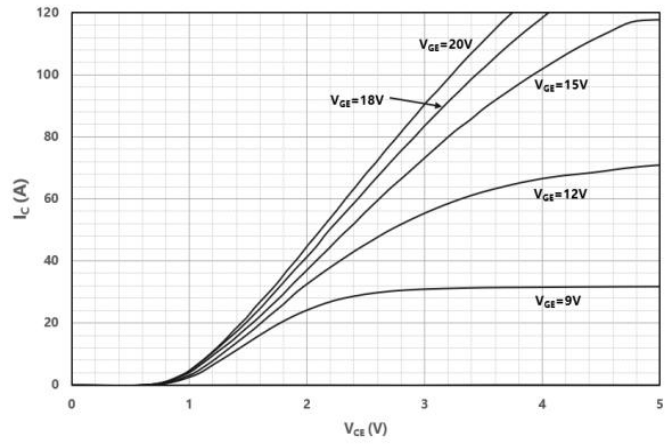


Fig.2 Typical Output Characteristic ( $T_j=150^\circ\text{C}$ )

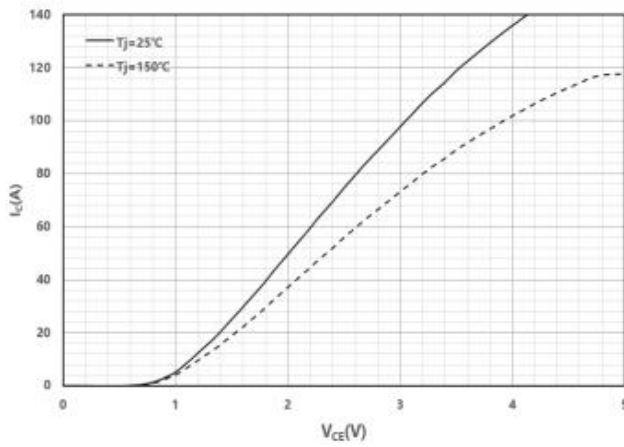


Fig.3 Typical Saturation Voltage Characteristic ( $V_{GE}=15\text{V}$ )

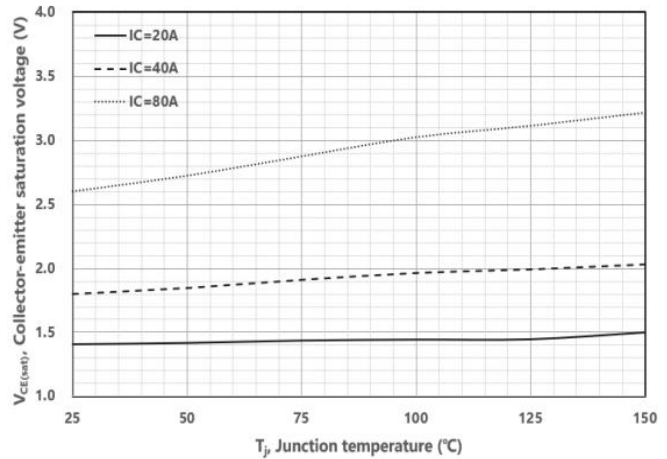


Fig.4 Typical Saturation Voltage Temperature Characteristic ( $V_{GE}=15\text{V}$ ,  $T_j=25^\circ\text{C}$ )

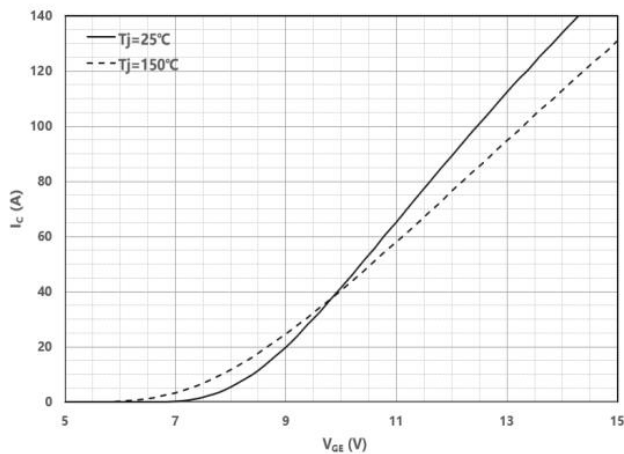


Fig.5 Typical Transfer Characteristic ( $V_{CE}=20\text{V}$ )

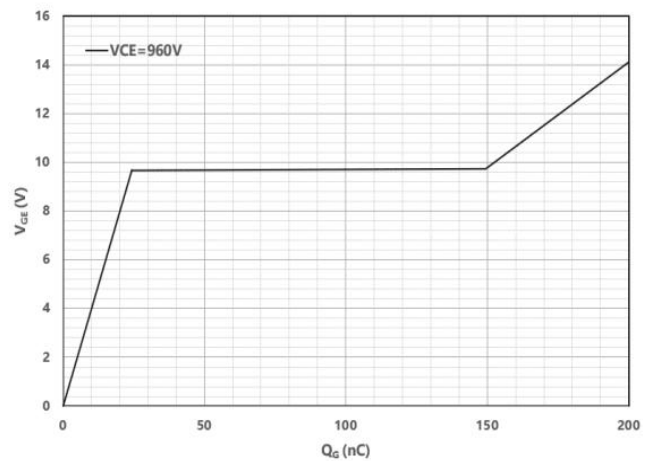
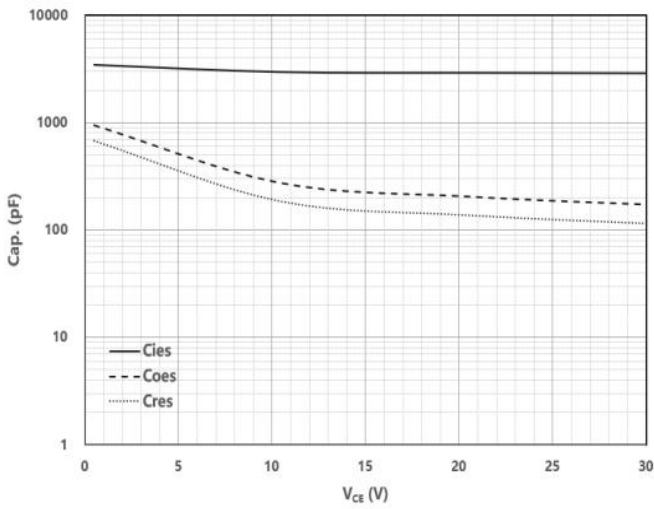


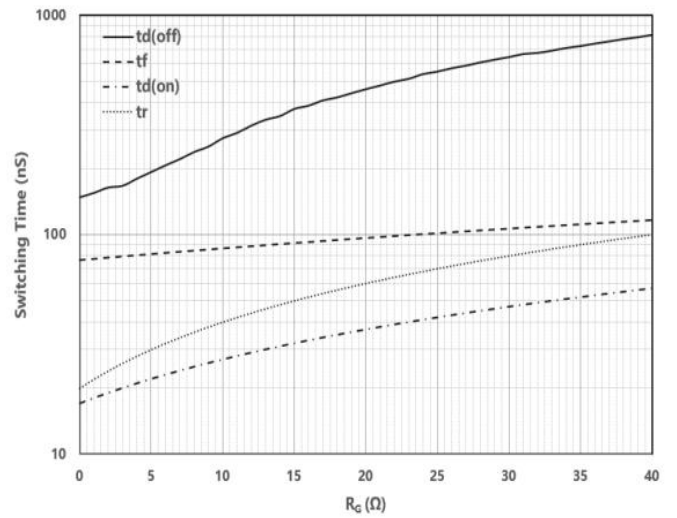
Fig.6 Typical Gate Charge



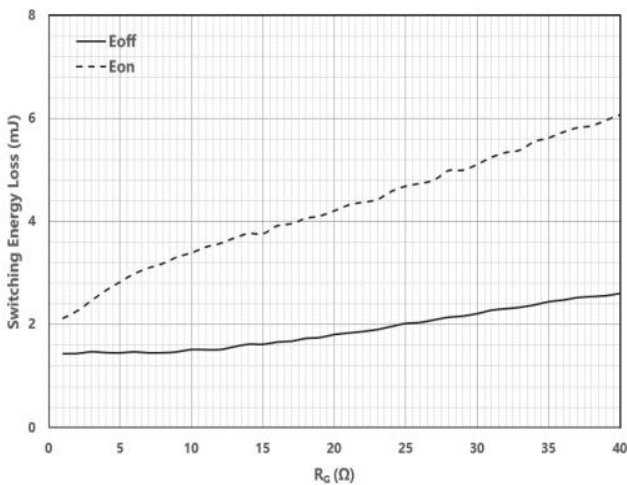
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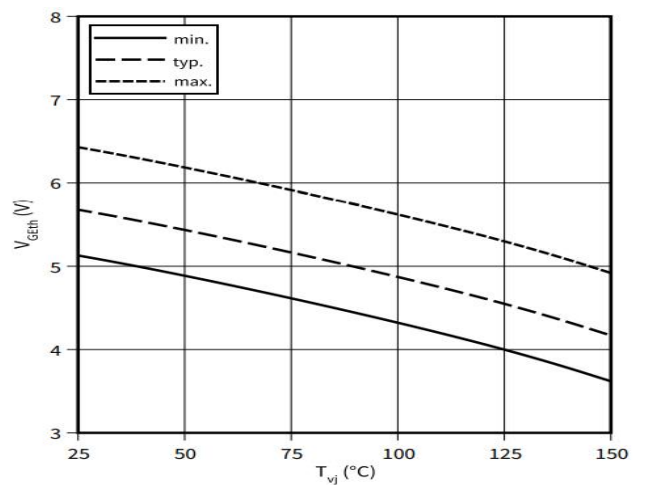
**Fig.7 Typical Capacitance Characteristic**  
( $V_{GE}=0V$ ,  $f=1MHz$ ,  $T_j=25^\circ C$ )



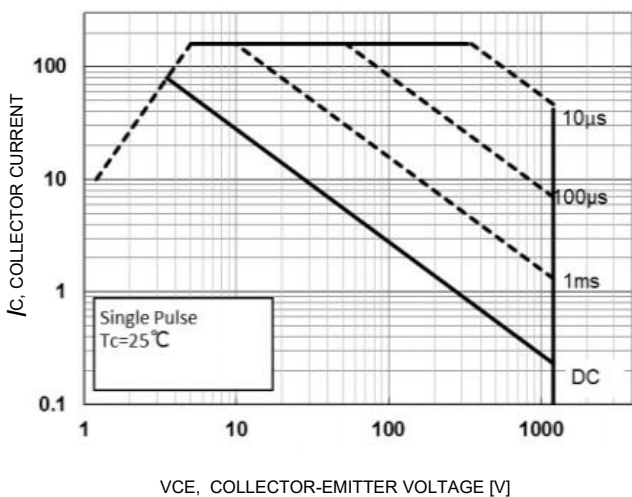
**Fig.8 Typical Switching Time vs  $R_G$ (Ind. load,**  
 **$V_{CE}=600V$ ,  $V_{GE}=15V/0V$ ,  $I_C=40A$ ,  $T_j=25^\circ C$ )**



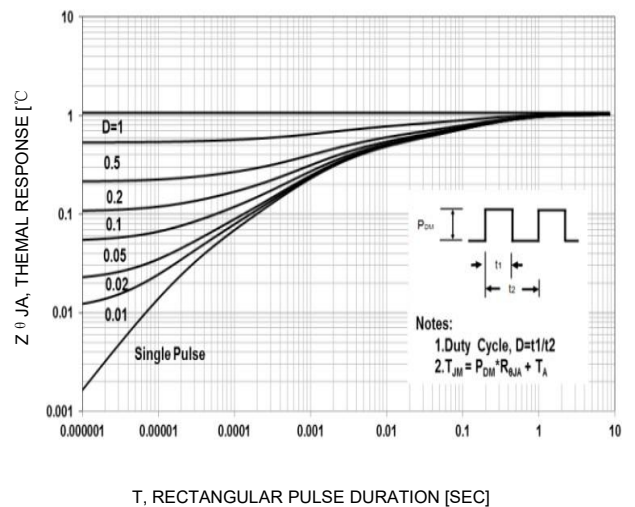
**Fig.9 Typical Switching Energy vs  $R_G$**   
**(Ind. load,  $V_{CE}=600V$ ,  $V_{GE}=15V/0V$ ,  $I_C=40A$ ,  $T_j=25^\circ C$ )**



**Fig.10 Gate-emitter threshold voltage as a function**  
**of junction temperature,  $V_{GE(th)} = f(T_{vj})$   $I_C = 0.85 mA$**



**Fig.11. Typical positive safe working area characteristics**



**Fig12. Typical transient thermal resistance characteristics**



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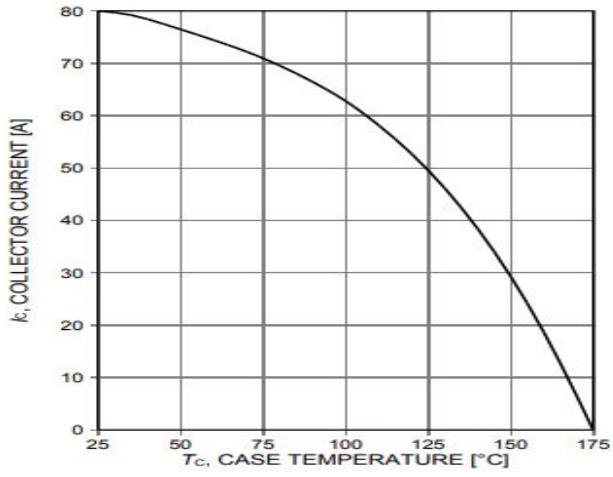
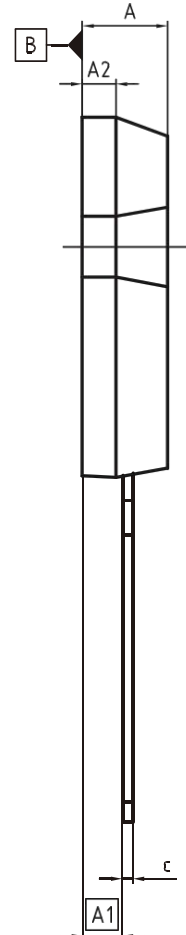
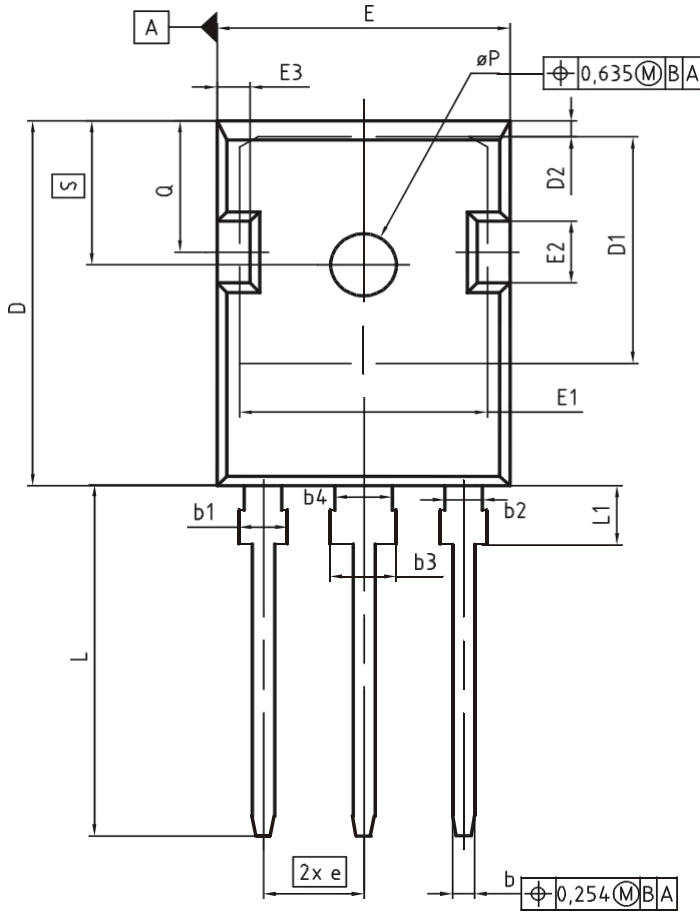


Fig13. Collector current as a function of case temperature



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PG-TO247-3 Outline Dimensions



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.83	5.21	0.190	0.205
A1	2.27	2.54	0.089	0.100
A2	1.85	2.16	0.073	0.085
b	1.07	1.33	0.042	0.052
b1	1.90	2.41	0.075	0.095
b2	1.90	2.16	0.075	0.085
b3	2.87	3.38	0.113	0.133
b4	2.87	3.13	0.113	0.123
c	0.55	0.68	0.022	0.027
D	20.80	21.10	0.819	0.831
D1	16.25	17.65	0.640	0.695
D2	0.95	1.35	0.037	0.053
E	15.70	16.13	0.618	0.635
E1	13.10	14.15	0.516	0.557
E2	3.68	5.10	0.145	0.201
E3	1.00	2.60	0.039	0.102
e	5.44 (BSC)		0.214 (BSC)	
N	3		3	
L	19.80	20.32	0.780	0.800
L1	4.10	4.47	0.161	0.176
øP	3.50	3.70	0.138	0.146
Q	5.49	6.00	0.216	0.236
S	6.04	6.30	0.238	0.248

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