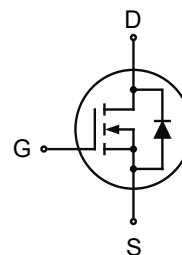


Features

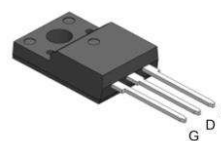
- 650V,20A
 $R_{DS(ON)} < 190m\Omega @ V_{GS}=10V$ TYP: $150m\Omega$
- Super junction technology
- Extremely low on resistance
- Fast Switching
- Low Gate Charge



Schematic Diagram

Applications

- Switched mode power supplies (SMPS)
- Charger
- LED
- Power Supply



TO-220F

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity (PCS)
C65R190FMF	APC65R190FMF	TO-220F	-	-	1000

ABSOLUTE MAXIMUM RATINGS ($T_J=25^{\circ}C$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	± 30	V
Continuous Drain Current ($T_c=25^{\circ}C$)	I_D	20	A
Continuous Drain Current ($T_c=100^{\circ}C$)	I_D	12	A
Pulsed Drain Current ⁽¹⁾	I_{DM}	80	A
Single Pulsed Avalanche Energy ⁽²⁾	E_{AS}	210	mJ
Drain Power Dissipation	P_D	24	W
Thermal Resistance from Junction to Case	$R_{\theta JC}$	5.27	$^{\circ}C/W$
Thermal Resistance- Junction to Ambient	$R_{\theta JA}$	65	$^{\circ}C/W$
Junction Temperature	T_J	150	$^{\circ}C$
Storage Temperature	T_{STG}	-55~ +150	$^{\circ}C$

MOSFET ELECTRICAL CHARACTERISTICS($T_J=25^{\circ}\text{C}$ unless otherwise noted)

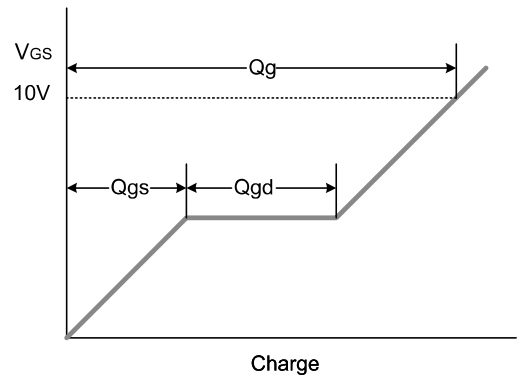
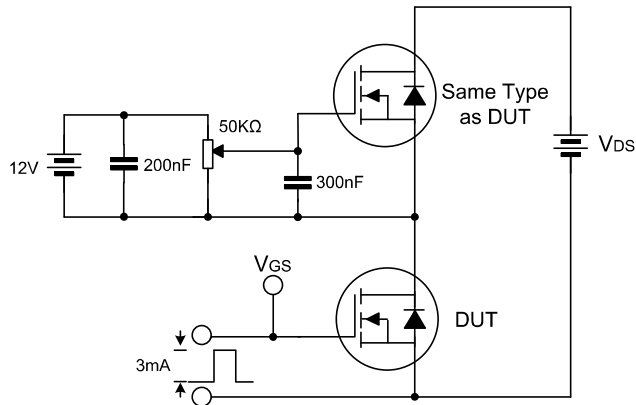
Parameter	Symbol	Test Condition	Min	Type	Max	Unit
Static Characteristics						
Drain-source breakdown voltage	V _{(BR)DSS}	V _{GS} = 0V, I _D =250μA	650	-	-	V
Zero gate voltage drain current	I _{DSS}	V _{DS} =650V, V _{GS} = 0V	-	-	1	uA
		V _{DS} =650V, V _{GS} = 0V T _J =150℃		1		uA
Gate-body leakage current	I _{GSS}	V _{GS} = ±30V, V _{DS} = 0V	-	-	±100	nA
Gate threshold voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	3.0	-	4.0	V
Drain-source on-resistance	R _{DS(on)}	V _{GS} =10V, I _D =10A	-	150	190	mΩ
Dynamic characteristics						
Input Capacitance	C _{iss}	V _{DS} =100V, V _{GS} =0V, f =1.0MHz	-	1377	-	pF
Output Capacitance	C _{oss}		-	65	-	
Reverse Transfer Capacitance	C _{rss}		-	1.5	-	
Gate Resistance	R _g	f =1.0MHz		7		Ω
Switching characteristics						
Turn-on delay time	t _{d(on)}	V _{DD} =400V, I _D =10A, R _G =25Ω, V _G =10V	-	38	-	ns
Turn-on rise time	t _r		-	29	-	
Turn-off delay time	t _{d(off)}		-	180	-	
Turn-off fall time	t _f		-	24	-	
Total Gate Charge	Q _g	V _{DS} =400V, I _D =10A, V _{GS} =10V	-	41	-	nC
Gate-Source Charge	Q _{gs}		-	8.5	-	
Gate-Drain Charge	Q _{gd}		-	17	-	
Source-Drain Diode characteristics						
Diode Forward voltage	V _{SD}	T _c =25℃, V _{GS} =0V, I _S =9A	-	0.84	1.0	V
Diode Forward current	I _S	T _c =25℃	-	-	20	A
Body Diode Reverse Recovery Time	trr	T _c =25℃, IF=10A,di/dt=100A/us		195		ns
Body Diode Reverse Recovery Charge	Qrr	T _c =25℃, IF=10A,di/dt=100A/us		4.32		uc

Notes:

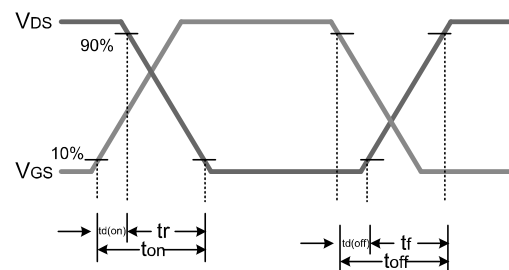
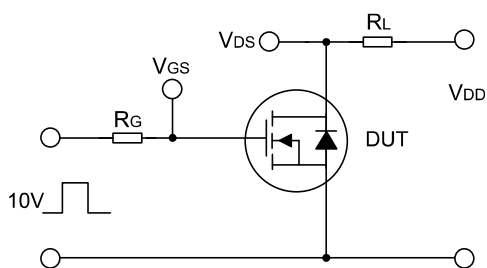
1. Pluse width limited by maximum junction temperature
2. $L=20\text{mH}$, $I_{AS}=4.6A$, $V_{DD}=50V$, $V_G=10V$, $R_G=25\Omega$, starting $T_J=25^{\circ}\text{C}$
3. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$
4. Essentially independent of operating temperature

Test Circuit

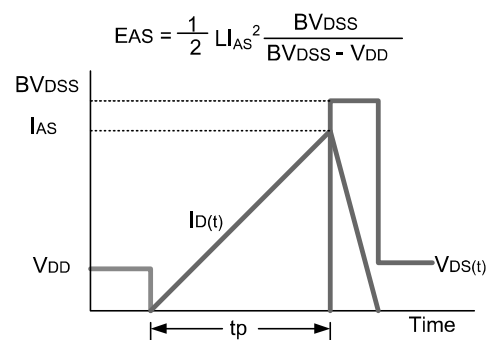
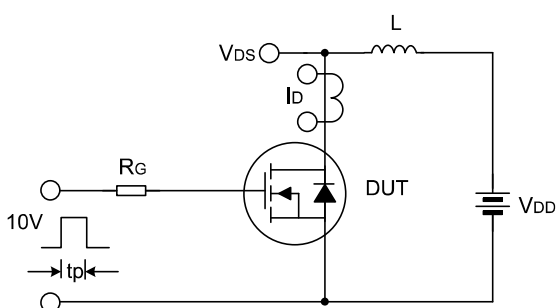
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveform



Typical Performance Characteristics

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

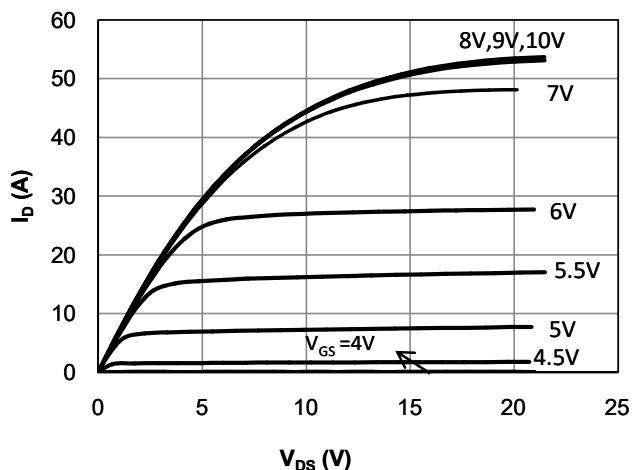


Fig 2. Output Characteristics ($T_j=150^\circ\text{C}$)

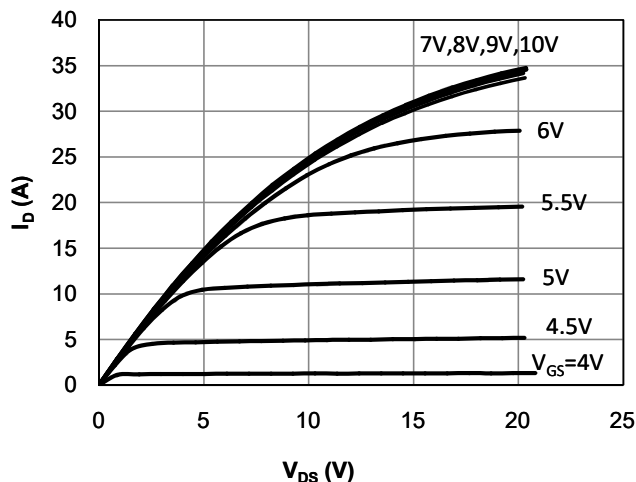


Fig 3: Transfer Characteristics

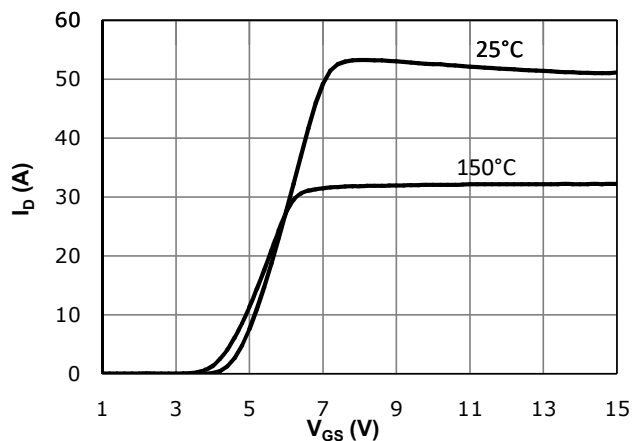


Fig 4: V_{TH} vs. T_j Temperature Characteristics

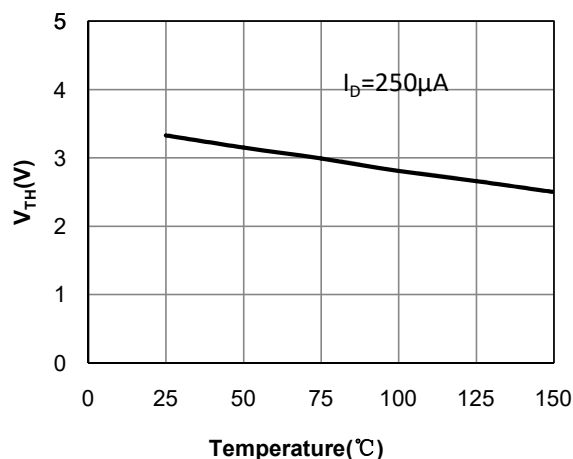


Fig 5: $R_{DS(on)}$ vs. I_{DS} Characteristics ($T_j=25^\circ\text{C}$)

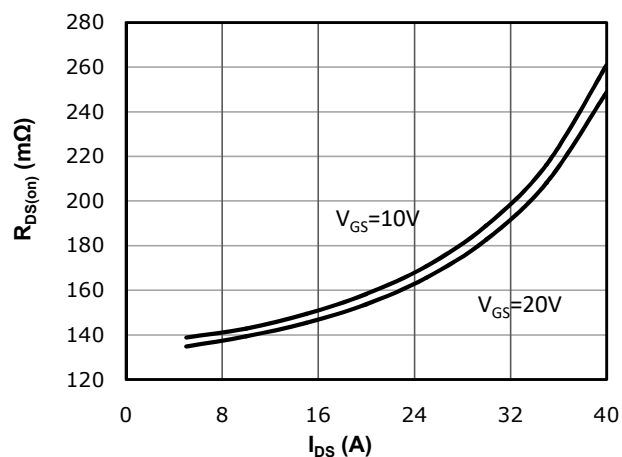
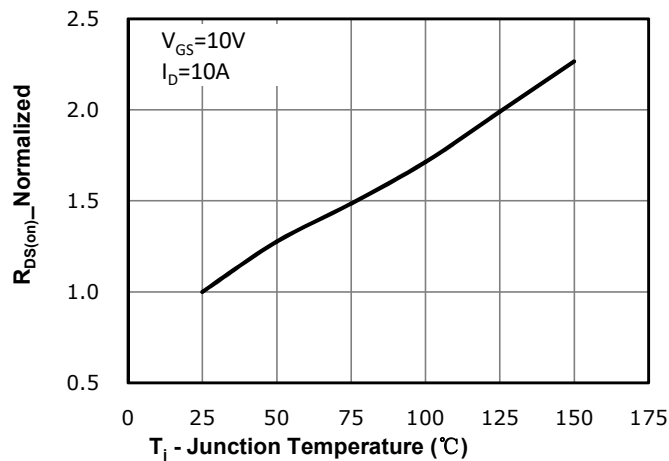


Fig 6: $R_{DS(on)}$ vs. Temperature



Typical Performance Characteristics

Fig 7: BV_{DSS} vs. Temperature

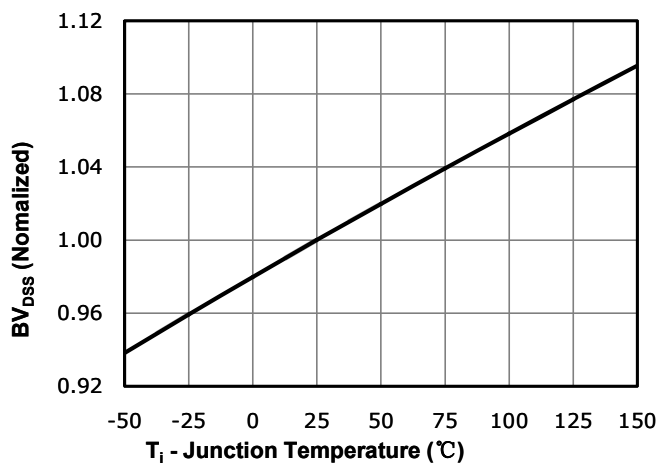


Fig 8: $R_{DS(on)}$ vs. Gate Voltage

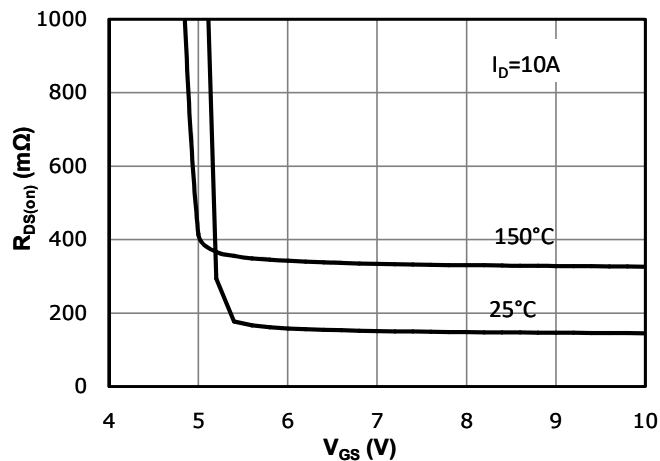


Fig 9: Body-diode Forward Characteristics

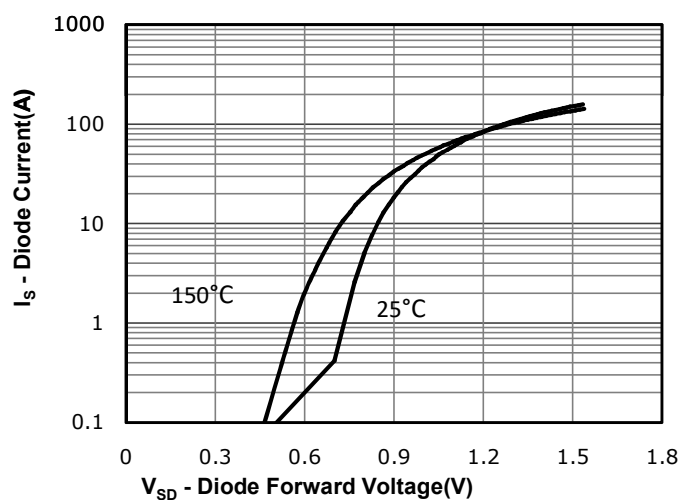


Fig 10: Gate Charge Characteristics

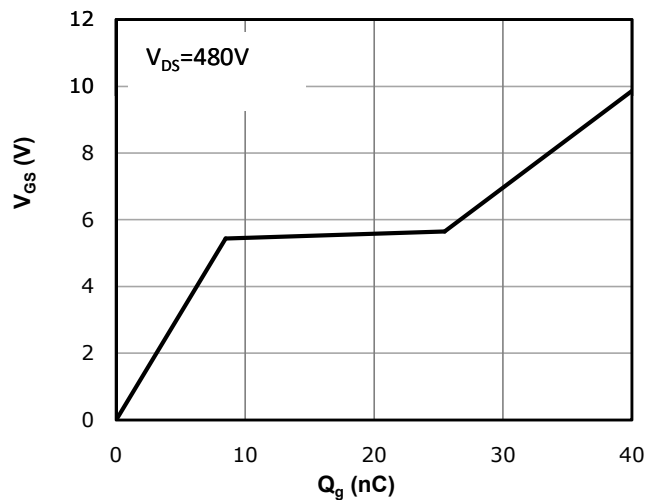


Fig 11: Capacitance Characteristics

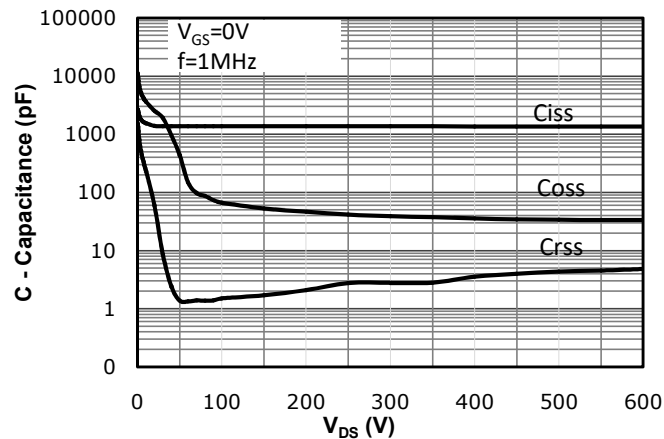
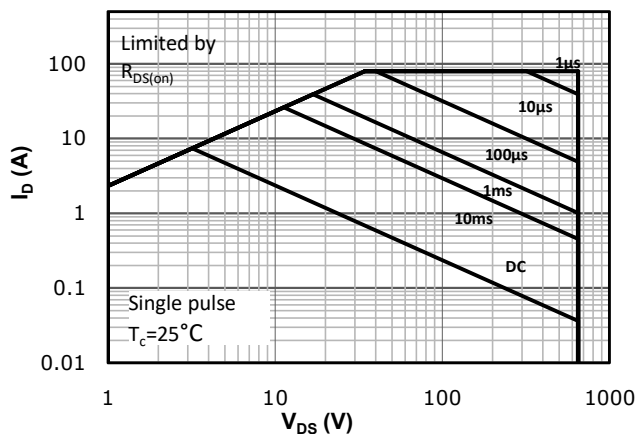
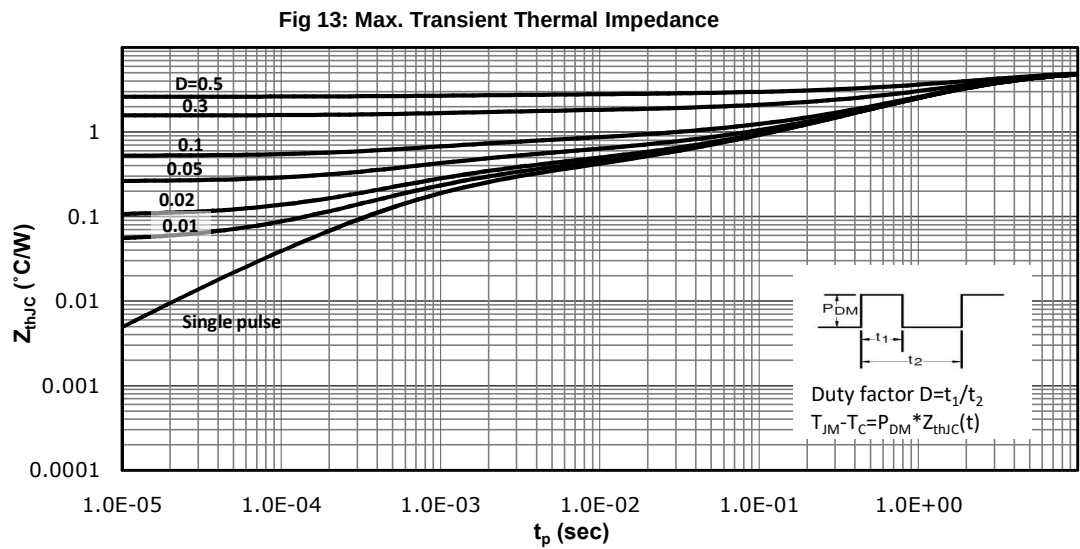


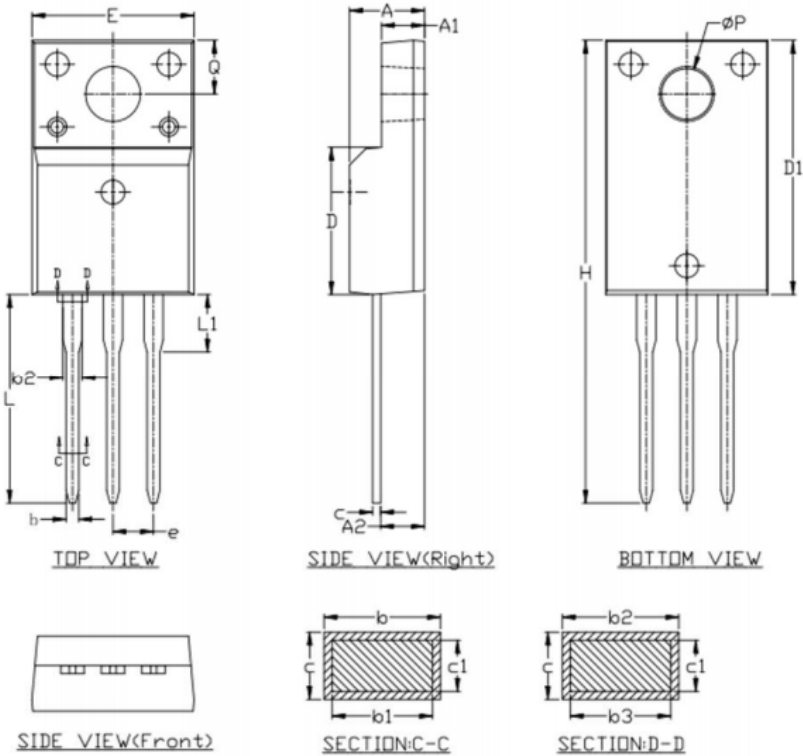
Fig 12: Safe Operating Area



Typical Performance Characteristics



Package Dimensions
TO-220F



DIM SYMBOL	MIN.	NOM.	MAX.
A	4.600	4.700	4.800
A1	2.600	2.700	2.800
A2	2.660	2.760	2.860
b	0.740	0.840	0.940
b1	0.700	0.800	0.900
b2	1.140	1.240	1.340
b3	1.100	1.200	1.300
c	0.440	0.540	0.640
c1	0.400	0.500	0.600
D	9.090	9.190	9.290
D1	15.770	15.870	15.970
E	10.060	10.160	10.260
e	2.540 BSC.		
H	28.800	29.000	29.200
L	12.930	13.130	13.330
L1	3.400	3.600	3.800
øP	3.080	3.180	3.280
Q	3.150	3.350	3.550

Revision History

Revision	Release	Remark
V1.0	2024/05/11	Initial Release

Disclaimer

The information given in this document describes the independent performance of the product, but similar performance is not guaranteed under other working conditions, and cannot be guaranteed when installed with other products or equipment. To achieve the required performance of the product in actual scenarios, the customer should conduct a complete application test to assess the functionality of the product.

Allpower assumes no responsibility for equipment failures result from using products at values that exceed the ratings, operating conditions, or other parameters listed in the product specifications.

The product described in this specification is not applicable for aerospace or other applications which requires high reliability. Customers using or selling these products for use in medical, life-saving, or life-sustaining applications do so at their own risk and agree to fully indemnify.

Due to product or technical improvements, the information described or contained herein may be changed without prior notice.