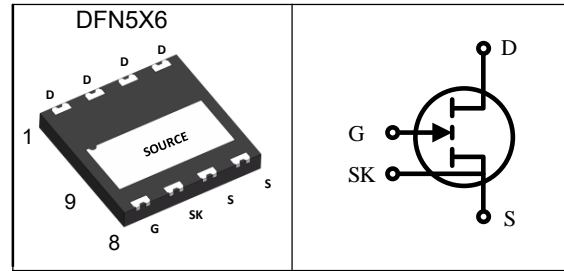


650V GaN Enhancement-mode Power Transistor
Features

- Enhancement mode transistor-Normally off power switch
- Ultra high switching frequency
- No reverse-recovery charge
- Low gate charge, low output charge
- RoHS, Pb-free-compliant

Pin Description

Applications

- AC-DC converters
- DC-DC converters
- Totem pole PFC
- Fast battery charging
- High density power conversion

| | | |
|------------------|-----|------------|
| V_{DSS} | 650 | V |
| $R_{DS(ON)-Typ}$ | 165 | m Ω |
| I_D | 10 | A |

Absolute Maximum Ratings ($T_C=25^\circ\text{C}$, Unless Otherwise Noted)

| Symbol | Parameter | Value | Unit |
|-----------------|---------------------------------|------------|------------------|
| V_{DSS} | Drain-Source Voltage | 650 | V |
| V_{GSS} | Gate source voltage, continuous | -1.4 to +7 | V |
| $V_{GSS,pulse}$ | Gate source voltage, pulsed | ± 20 | V |
| T_J | Maximum Junction Temperature | -55 to 150 | $^\circ\text{C}$ |
| T_{STG} | Storage Temperature Range | -55 to 150 | $^\circ\text{C}$ |
| $I_{D,pulse}$ | Pulse Drain Current Tested | 18 | A |
| I_D | Continuous Drain Current | 10 | A |
| P_D | Maximum Power Dissipation | 75 | W |

Thermal Characteristics

| Symbol | Parameter | Value | Unit |
|-----------------|--|-------|---------------------------|
| $R_{\theta JA}$ | Thermal Resistance-Junction to Ambient | 60.8 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JC}$ | Thermal Resistance-Junction to Case | 1.65 | $^\circ\text{C}/\text{W}$ |



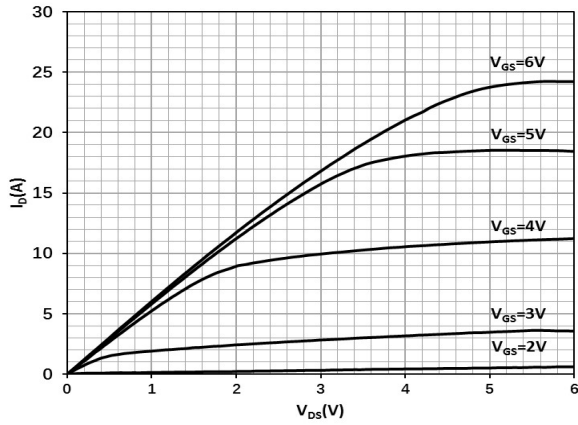
650V GaN Enhancement-mode Power Transistor

Electrical Characteristics ($T_J=25^{\circ}\text{C}$, Unless Otherwise Noted)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--|--|---|-----|-----|-----|-----------|
| Static Electrical Characteristics | | | | | | |
| BV_{DSS} | Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=250\mu A$ | 650 | --- | --- | V |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS}=650V, V_{GS}=0V$ | --- | 0.4 | 20 | μA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}=V_{GS}, I_D=11mA$ | 1.2 | 1.7 | 2.5 | V |
| I_{GSS} | Gate Leakage Current | $V_{GS}=6V, V_{DS}=0V$ | --- | 50 | --- | μA |
| $R_{DS(ON)}$ | Drain-Source On-state Resistance | $V_{GS}=6V, I_D=3A$ | --- | 165 | 240 | $m\Omega$ |
| Dynamic Characteristics | | | | | | |
| C_{iss} | Input Capacitance | $V_{DS}=400V,$ $V_{GS}=0V,$ Freq.=1MHz | --- | 79 | --- | pF |
| C_{oss} | Output Capacitance | | --- | 25 | --- | |
| C_{rss} | Reverse Transfer Capacitance | | --- | 0.2 | --- | |
| $C_{o(er)}$ | Effective output capacitance, energy related | $V_{DS}=0$ to 400V, $V_{GS}=0V$ | --- | 36 | --- | pF |
| $C_{o(tr)}$ | Effective output capacitance, time related | | --- | 52 | --- | |
| Q_{OSS} | Output charge | $V_{DS}=0$ to 400V, $V_{GS}=0V$ | --- | 21 | --- | nC |
| $T_{d(on)}$ | Turn-on Delay Time | $V_{DS}=400V, V_{GS}=6V,$ $I_D=6A, R_{on}=10\Omega, R_{off}=2\Omega$ | --- | 2 | --- | nS |
| T_r | Turn-on Rise Time | | --- | 5 | --- | |
| $T_{d(off)}$ | Turn-off Delay Time | | --- | 4 | --- | |
| T_f | Turn-off Fall Time | | --- | 6 | --- | |
| Q_g | Total Gate Charge | $V_{DS}=400V, V_{GS}=6V, I_D=3A$ | --- | 2 | --- | nC |
| Q_{gs} | Gate-Source Charge | | --- | 0.2 | --- | |
| Q_{gd} | Gate-Drain Charge | | --- | 0.7 | --- | |
| Source-Drain Characteristics | | | | | | |
| V_{SD} | Diode Forward Voltage | $I_S=3A, V_{GS}=0V$ | --- | 2.6 | --- | V |
| $I_{S, pulse}$ | Pulsed current, reverse | $V_{GS} = 6V; t_{PULSE} = 300 \mu s$ | --- | --- | 18 | A |
| t_{rr} | Reverse Recovery Time | $I_S=3A, V_{DS}=400V$ | --- | 0 | --- | nS |
| Q_{rr} | Reverse Recovery Charge | | --- | 0 | --- | nC |
| I_{rm} | Peak reverse recovery current | | --- | 0 | --- | A |

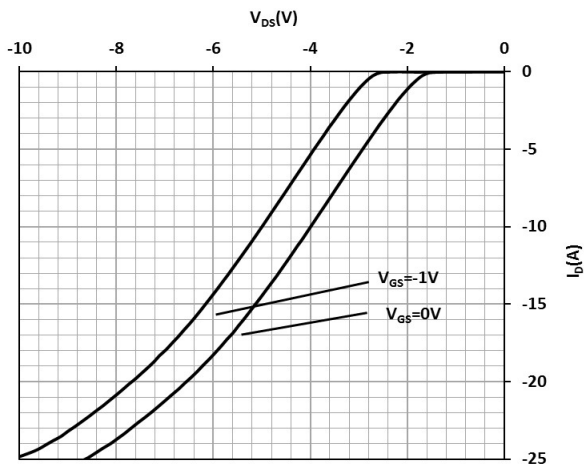
650V GaN Enhancement-mode Power Transistor
Typical Characteristics

Figure 1 Typ. output characteristics



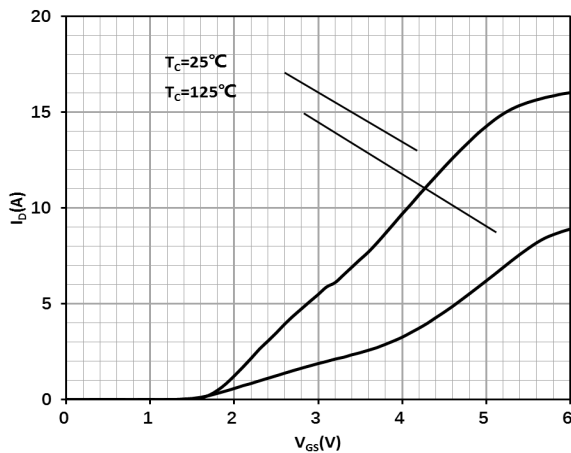
$$I_D = f(V_{DS}, V_{GS}); T_j = 25^\circ\text{C}$$

Figure 5 Typ. channel reverse characteristics



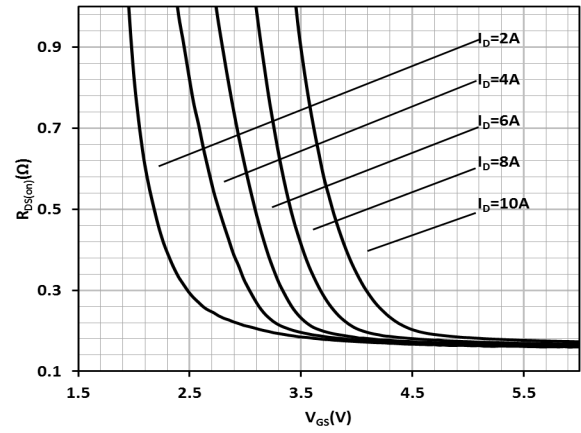
$$I_D = f(V_{DS}, V_{GS}); T_j = 25^\circ\text{C}$$

Figure 9 Typ. transfer characteristics



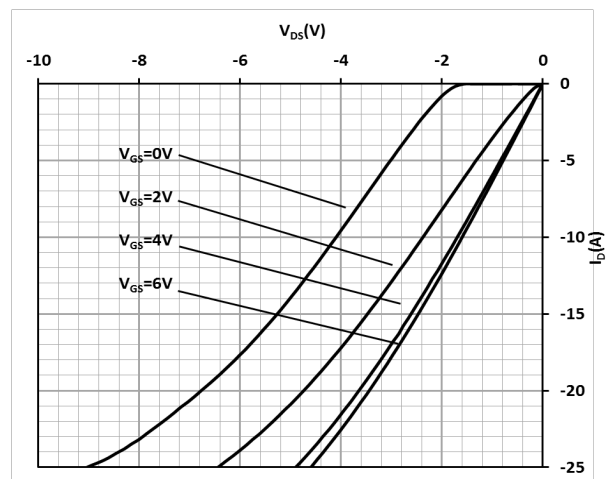
$$I_D = f(V_{GS}); V_{DS} = 3\text{V}$$

Figure 3 Typ. Drain-source on-state resistance



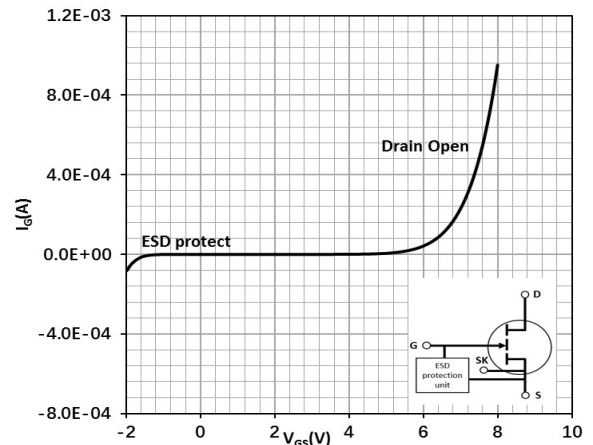
$$R_{DS(on)} = f(I_D, V_{GS}); T_j = 25^\circ\text{C}$$

Figure 7 Typ. channel reverse characteristics



$$I_D = f(V_{DS}, V_{GS}); T_j = 25^\circ\text{C}$$

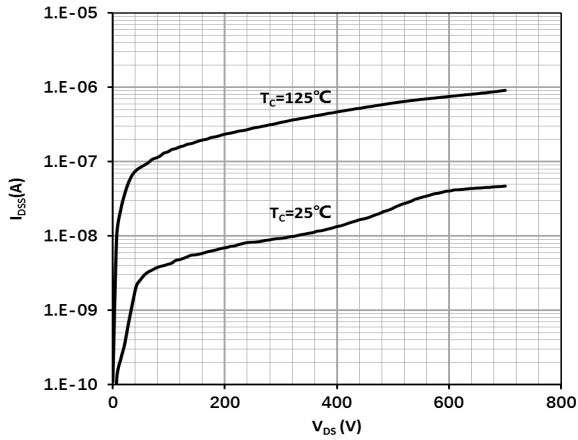
Figure 10 Typ. Gate-to-Source leakage



$$I_G = f(V_{GS}); I_G \text{ reverse turn on by ESD unit}$$

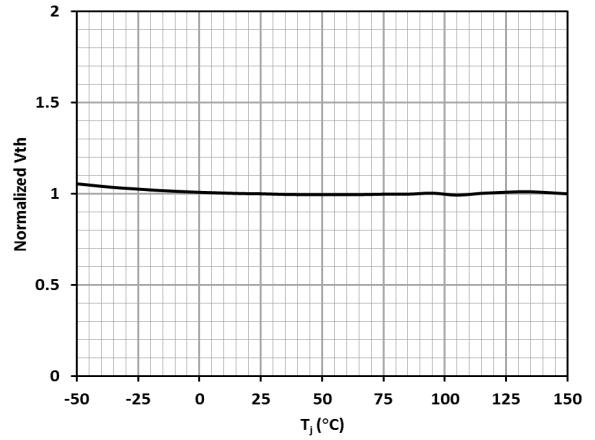
650V GaN Enhancement-mode Power Transistor

Figure 11 Drain-source leakage characteristics



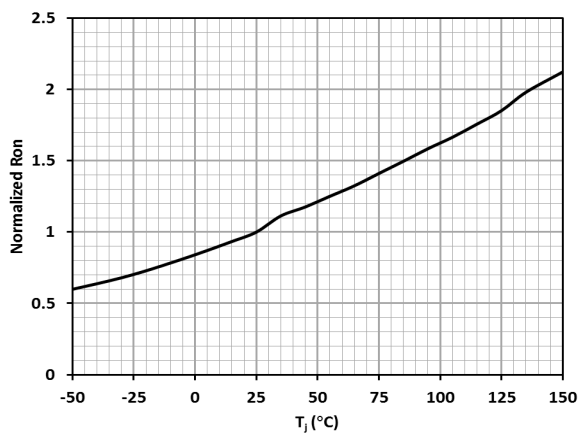
$$I_{DSS} = f(V_{DS}); V_{GS} = 0 \text{ V}$$

Figure 12 Gate threshold voltage



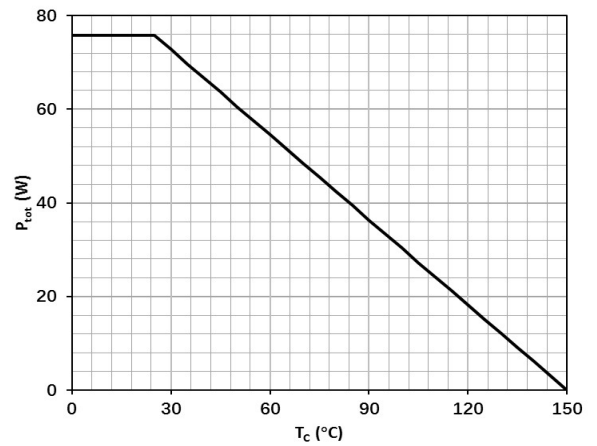
$$V_{TH} = f(T_J); V_{GS} = V_{DS}; I_D = 11 \text{ mA}$$

Figure 13 Drain-source on-state resistance



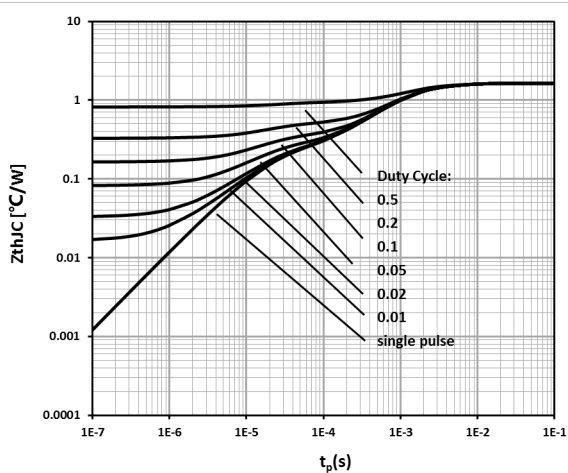
$$R_{DS(on)} = f(T_J); I_D = 3 \text{ A}; V_{GS} = 6 \text{ V}$$

Figure 14 Power dissipation



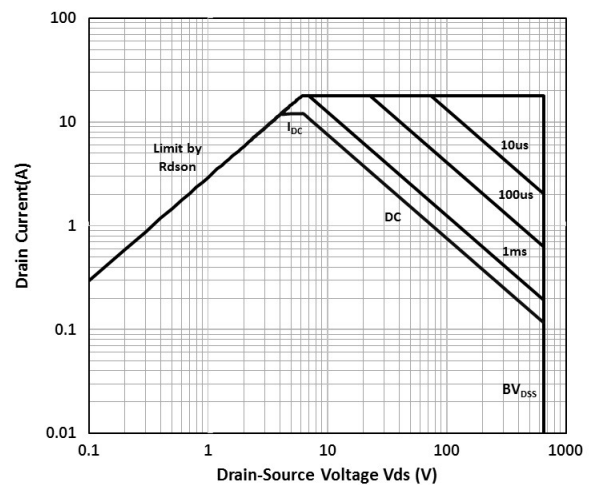
$$P_{tot} = f(T_c)$$

Figure 15 Max. transient thermal impedance



$$Z_{thJC} = f(t_p, D)$$

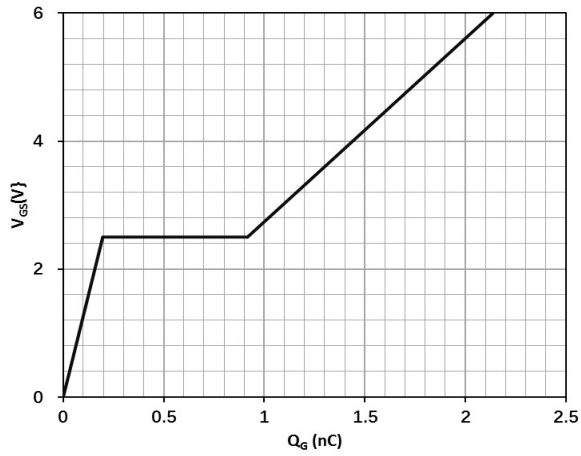
Figure 16 Safe operating area



$$I_D = f(V_{DS}); T_c = 25 \text{ °C}$$

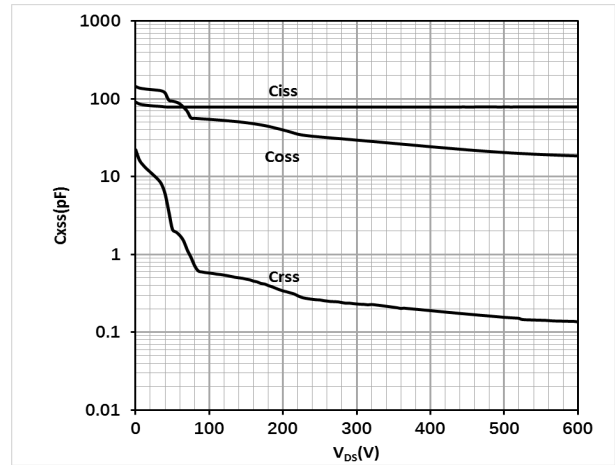
650V GaN Enhancement-mode Power Transistor

Figure 18 Typ. gate charge



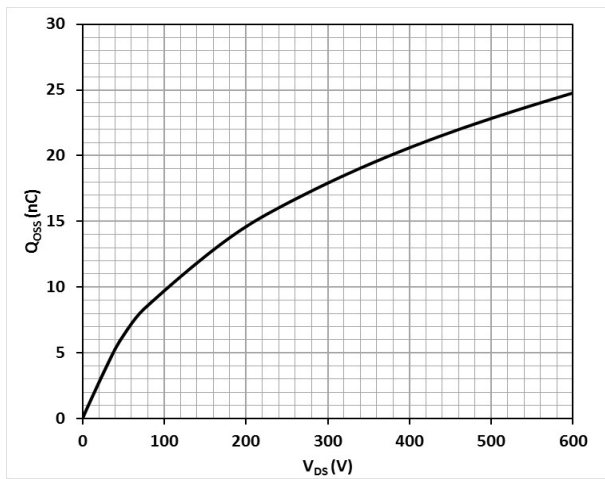
$$V_{GS} = f(Q_G); V_{DCLINK} = 400 \text{ V}; I_D = 3 \text{ A}$$

Figure 19 Typ. capacitances



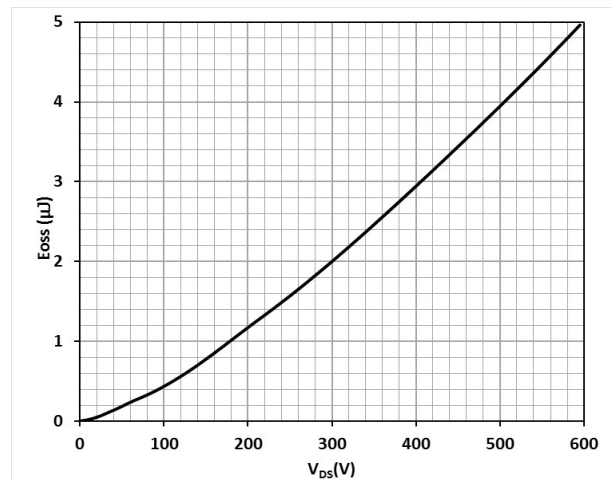
$$C_{XSS} = f(V_{DS}); \text{Freq.} = 100 \text{ kHz}$$

Figure 20 Typ. output charge

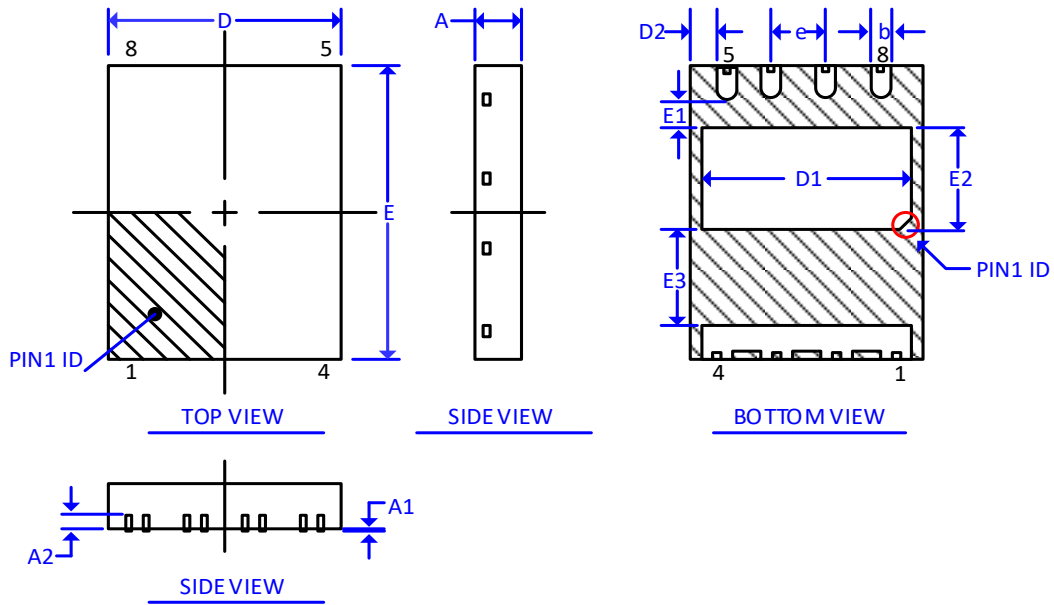


$$Q_{OSS} = f(V_{DS}); \text{Freq.} = 100 \text{ kHz}$$

Figure 21 Typ. Coss stored Energy



$$E_{OSS} = f(V_{DS}); \text{Freq.} = 100 \text{ kHz}$$

650V GaN Enhancement-mode Power Transistor
DFN5X6 Package Outline Dimensions


| SYMBOL | DIMENSION | | | SYMBOL | DIMENSION | | |
|--------|------------|-----------|------|--------|------------|-------|-------|
| | MIN | NOM | MAX | | MIN | NOM | MAX |
| A | 0.80 | 0.90 | 1.00 | E | 6.00 B.S.C | | |
| A1 | 0.00 | 0.02 | 0.05 | E1 | 0.40 | 0.50 | 0.60 |
| A2 | --- | 0.203 ref | --- | E2 | 1.95 | 2.05 | 2.15 |
| b | 0.40 | 0.45 | 0.50 | E3 | --- | 2.1 | --- |
| D | 5.00 B.S.C | | | e | 1.27 B.S.C | | |
| D1 | 4.16 | 4.26 | 4.36 | L | 0.575 | 0.675 | 0.775 |
| D2 | 0.27 | 0.37 | 0.47 | | | | |