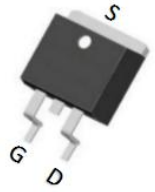
MGB31N65H

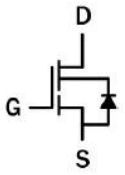
650V GaN Power Transistor (FET)

Features

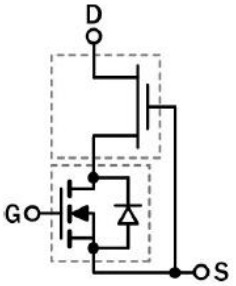
- 650V, 9A, $R_{DS(on)}$(typ.) = 240mΩ@VGS = 12V.
- Very low Q_{RR}
- Reduced Crossover Loss
- Easy to drive with commonly-used gate drivers
- Excellent QG x RDS(on) figure of merit (FOM)
- RoHS compliant and Halogen-free



TO-263
Bottom View



Cascode Schematic Symbol



Cascode Device Structure

Application

- High efficiency power supplies
- High efficiency USB PD adapters
- Other consumer electronics

Absolute Maximum Ratings （Tc = 25° C unless otherwise noted）

Symbol	Parameter		Limit	Unit
V_{DS}	Drain-Source Voltage		650	V
$V_{(TR)DSS}$	Transient Drain to Source Voltage [a]		800	V
V_{GSS}	Gate-Source Voltage		± 20	V
I_D	Drain Current-Continuous	T_C = 25°C [b]	9	A
	Drain Current-Continuous	T_C = 100°C [b]	6	A
I_{DM}	Drain Current-Pulsed	Pulse Width = 100μs	21	A
P_D	Maximum power Dissipation @T_C = 25°C		38	W
T_C	Operating Temperature Case		-55 to +150	°C
T_J	Operating Temperature Junction		-55 to +150	°C
T_S	Storage Temperature		-55 to +150	°C
T_{SOLD}	Soldering Peak Temperature [c]		260	°C

Thermal Characteristics

Symbol	Parameter	Typical	Unit
$R_{\theta JC}$	Thermal Resistance Junction-Case	3.3	°C/W
$R_{\theta JA}$	Thermal Resistance Junction-Ambient [d]	50	°C/W

Electrical Characteristics（T_J = 25° C unless otherwise noted）

■ Off Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$V_{(BL)DSS}$	Reverse Breakdown Voltage	V_{GS} = 0V	650	-	-	V
I_{DSS}	Reverse Leakage Current	V_{GS} = 0V, V_{DS} = 650V T_J = 25°C	-	-	20	μA
		V_{GS} = 0V, V_{DS} = 650V T_J = 150°C	-	50	-	μA
I_{GSS}	Gate-to-source Leakage Current	V_{DS} = 0V, V_{GS} = ±20V	-	-	±150	nA

■ On Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D =500μA	3.0	4.0	5.0	V
$R_{DS(on)eff}$	On Resistance	V_{GS} = 12V, I_D =4A T_J = 25°C	-	240	300	mΩ
		V_{GS} = 12V, I_D =4A T_J = 150°C	-	480	-	

■ Dynamic Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
C_{ISS}	Input Capacitance	V_{GS} = 0 V, V_{DS} = 400 V f=1MHz	-	321	-	pF
C_{OSS}	Output Capacitance		-	16	-	
C_{RSS}	Transfer Capacitance		-	0.6	-	
$C_{o(er)}$	Output Capacitance, energy related	V_{GS} = 0 V, V_{DS} = 0~400 V	-	25	-	pF
$C_{o(tr)}$	Output Capacitance, time related		-	67	-	
Q_{OSS}	Output Charge		-	27	-	nC

■ On Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	V_{GS} = 0~12 V, V_{DS} = 400 V , I_D = 6 A , Rg = 47 Ω	-	23	-	ns
t_r	Turn-On Rise Time		-	10	-	
$t_{d(off)}$	Turn-Off Delay Time		-	37	-	
t_f	Turn-Off Fall Time		-	8	-	
Q_G	Total Gate Charge	V_{GS} = 0~12 V, V_{DS} = 400 V , I_D = 6 A	-	7	-	nC
Q_{GS}	Gate-Source Charge		-	2.2	-	
Q_{GD}	Gate-Drain Charge		-	2	-	

■ Drain-Source Diode Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{SD}	Reverse Voltage	V_{GS} = 0V, I_S = 3 A	-	1.4	-	V
		V_{GS} = 0V, I_S = 6 A	-	2.1	-	V
t_{RR}	Reverse Recovery Time	I_S = 6 A ,V_{DS}= 400V, di/dt = 1000 A/μs	-	16	-	ns
Q_{RR}	Reverse Recovery Charge		-	27	-	nC

Notes:

a. In off-state, spike duty cycle D<0.01, spike duration <1μs .

b. For increased stability at high current operation.

c. Reflow MSL3 .

d. Device on one layer epoxy PCB for drain connection (vertical and without air stream cooling, with 6cm^2 copper area and 70μm thickness).

Typical Characteristics (T_C = 25°C unless otherwise noted)

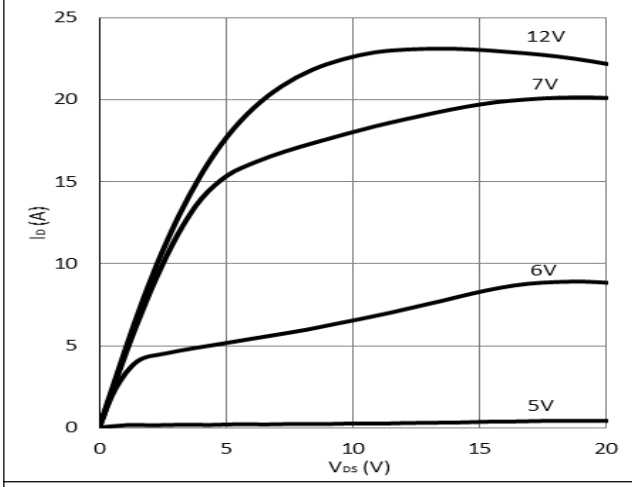


Figure 1. Typical Output Characteristics T_J=25°C
Parameter: V_{GS}

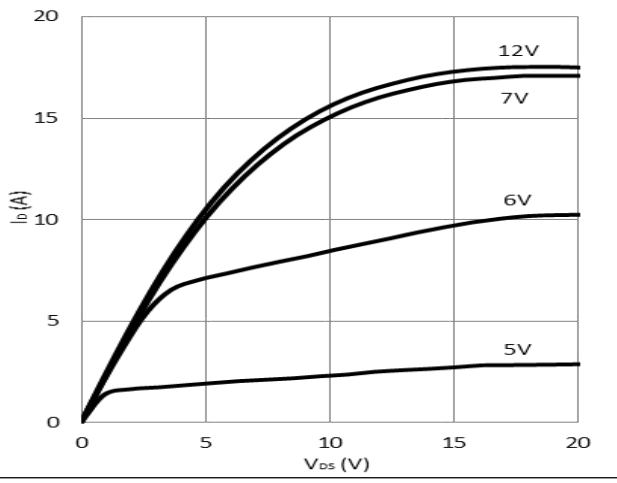


Figure 2. Typical Output Characteristics T_J = 150°C
Parameter: V_{GS}

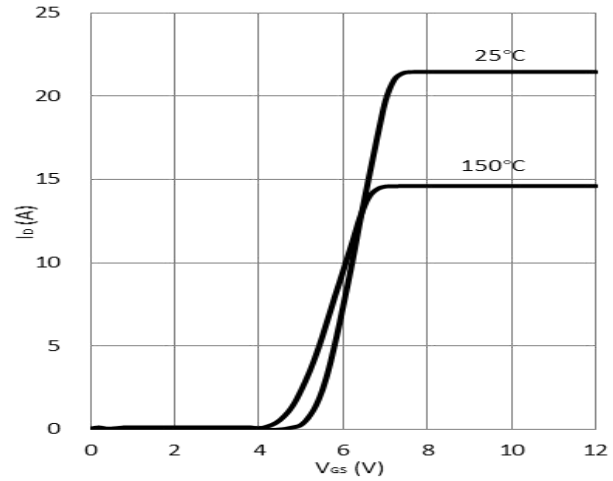


Figure 3. Typical Transfer Characteristics V_{DS}=10V
Parameter: T_J

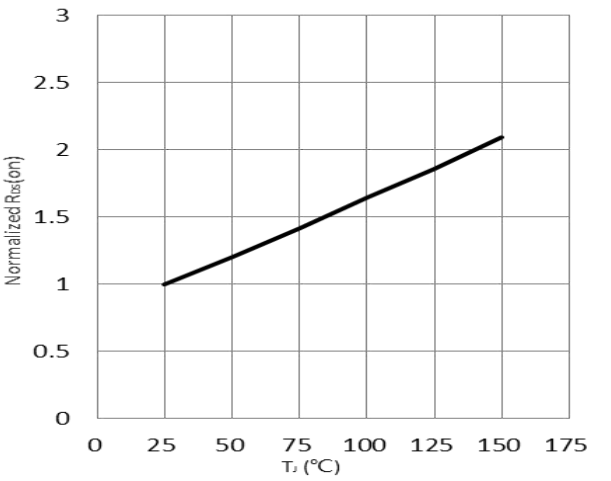


Figure 4. Normalized On-resistance
I_D = 4 A, V_{GS} = 12 V

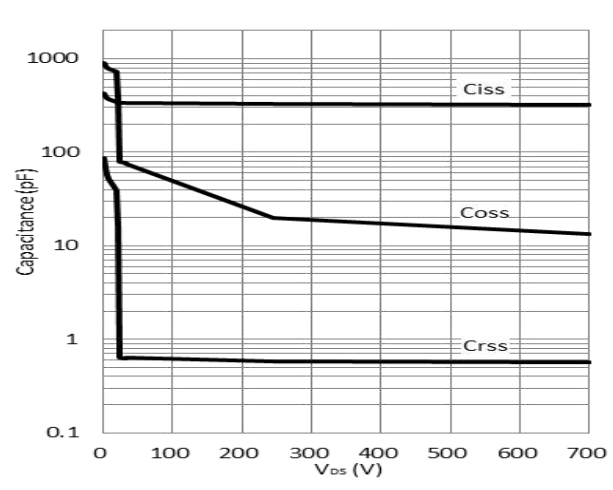


Figure 5. Typical Capacitance
V_{GS} = 0V, f = 1MHz

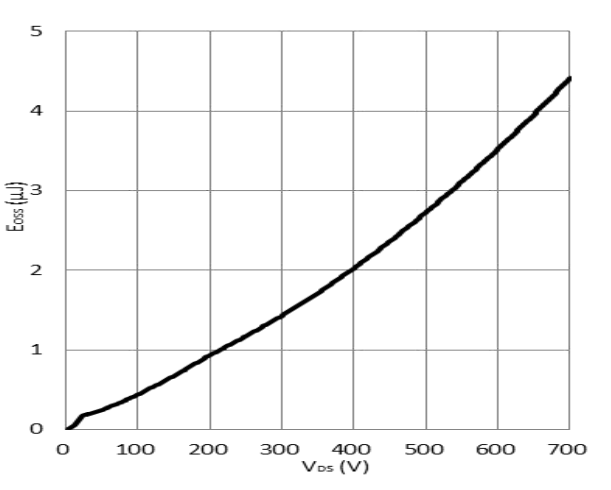


Figure 6. Typical C_{OSS} Stored Energy

Typical Characteristics (T_C = 25°C unless otherwise noted)

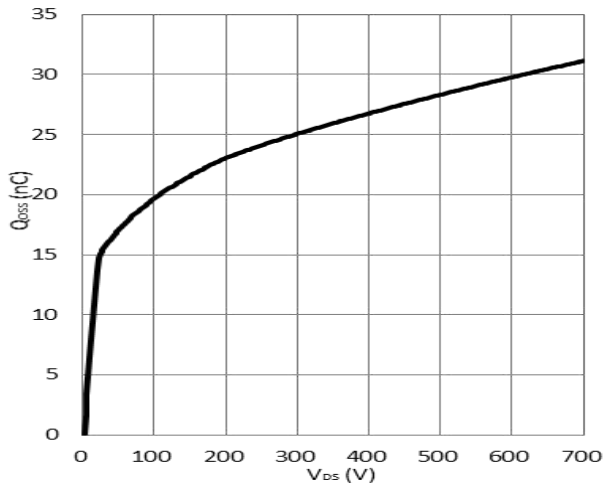


Figure 7. Typical Q_{OSS}

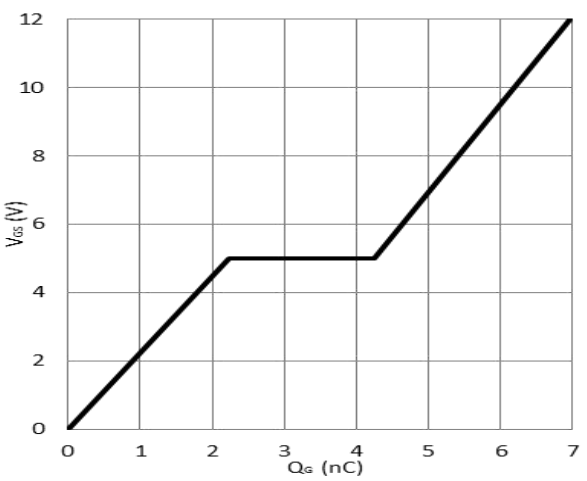


Figure 8. Typical Gate Charge
I_{DS} = 6A, V_{DS} = 400V

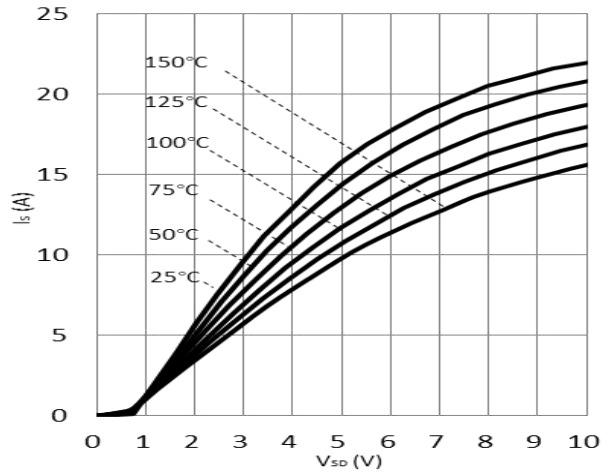


Figure 9. Forward Characteristics of Rev. Diode $I_S = f(V_{SD})$, Parameter T_J

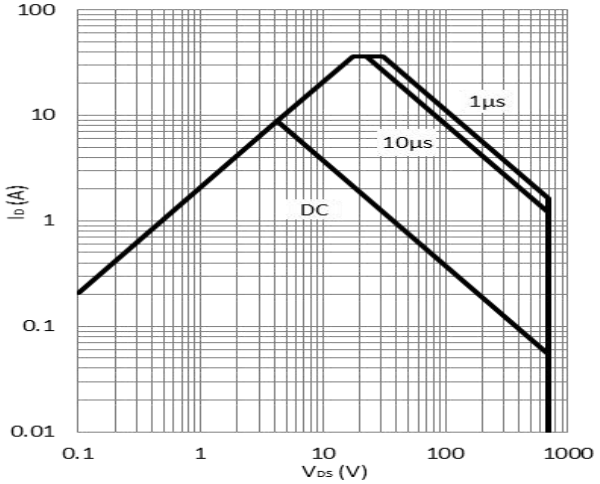


Figure 10. Safe Operating Area T_C = 25°C (calculated based on thermal limit)

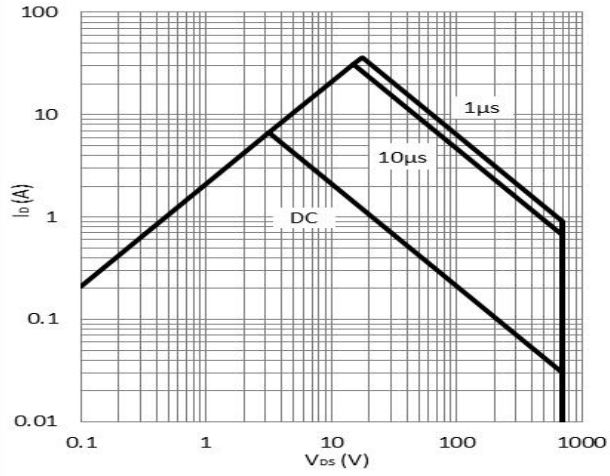


Figure 11. Safe Operating Area T_C = 80°C (calculated based on thermal limit)

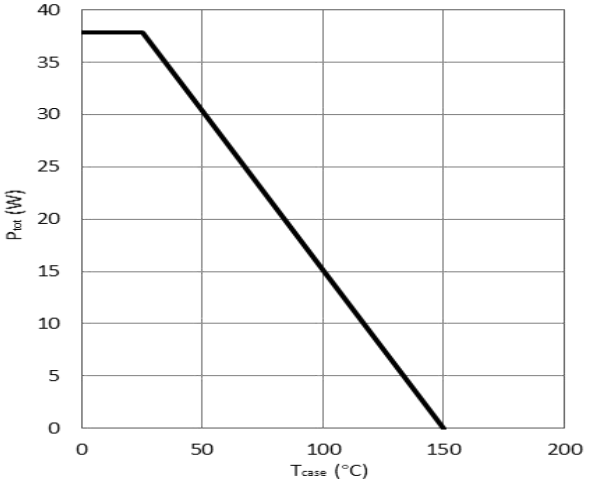


Figure 12. Power Dissipation

Typical Characteristics (T_C = 25°C unless otherwise noted)

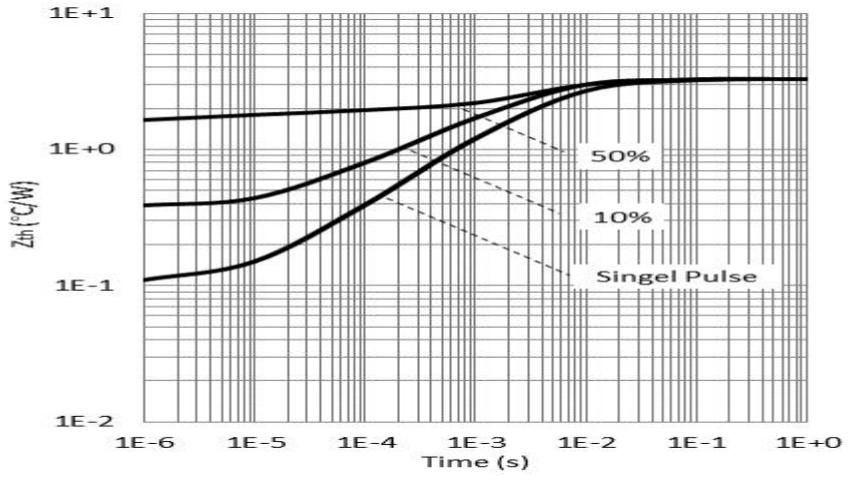


Figure 13. Transient Thermal Resistance

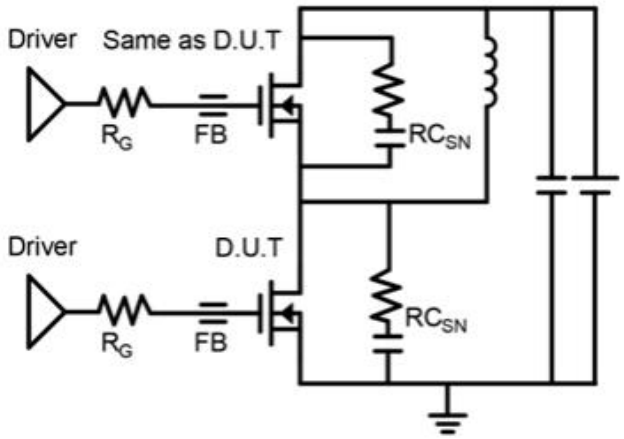


Figure 14. Switching Time Test Circuit

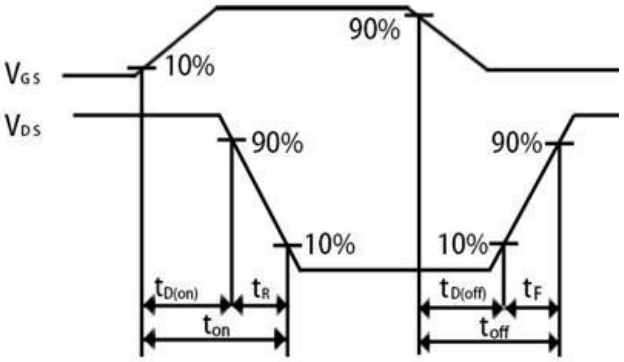


Figure 15. Switching Time Waveform

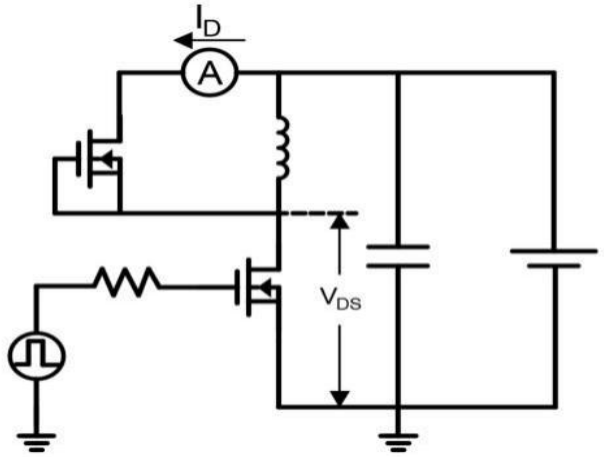


Figure 16. Diode Characteristics Test Circuit

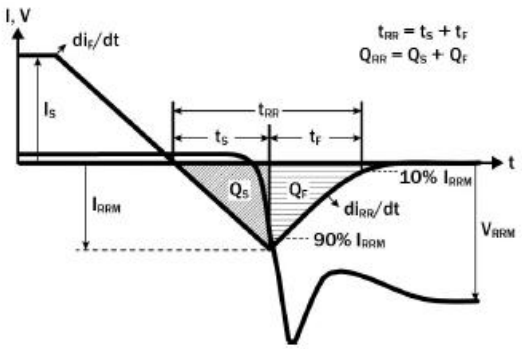
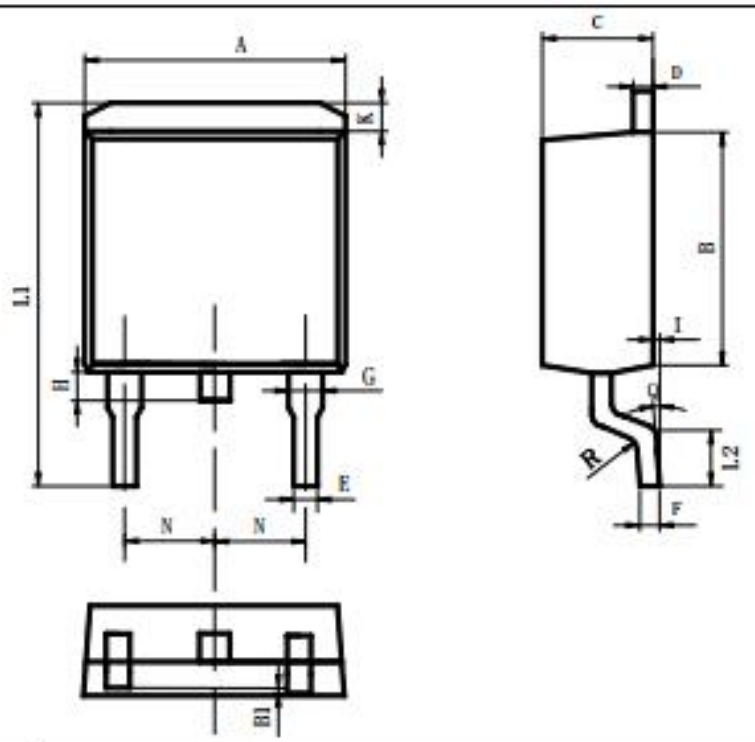


Figure 17. Diode Recovery Waveform

■ TO-263 Package Information



SYMBOL	Millimeter		
	Min	Nom	Max
A	9.80	10.10	10.40
B	8.90	9.20	9.50
B1	0.00	0.05	0.10
C	4.40	4.60	4.80
D	1.16	1.25	1.37
E	0.70	0.80	0.95
F	0.30	0.45	0.60
G	1.07	1.27	1.47
H	1.30	1.55	1.80
K	0.95	1.15	1.37
L1	14.50	15.50	16.50
L2	1.90	2.40	2.90
I	0.00	0.10	0.20
Q	0°	4°	8°
R		0.40	
N	2.39	2.49	2.69

■ Revision History

Version	Date	Subjects (major changes since last revision)
0.1	2023-05-07	Preliminary Version
1.0	2024-10-10	Datasheet Complete