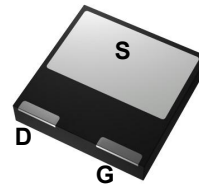
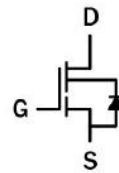


Features

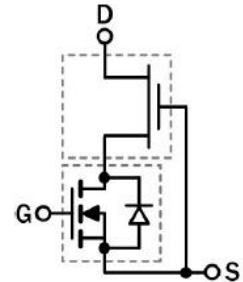
- 650V, 13 A, $R_{DS(on)}(typ.) = 130m\Omega @ V_{GS} = 8V$
- Very low Q_{RR}
- Reduced Crossover Loss
- Easy to drive with commonly-used gate drivers
- Enables AC-DC bridgeless totem-pole PFC designs
 - Increased power density
 - Reduced system size and weight
 - Overall lower system cost
- Achieves increased efficiency in both hard- and soft switched circuits



DFN8X8-3L
Bottom View



Cascode Schematic Symbol



Cascode Device Structure

Application

- Power adapters
- Low power SMPS
- Lighting

Absolute Maximum Ratings (T_C = 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
P _D	Maximum power Dissipation @T _C = 25°C		52	W
I _D	Drain Current-Continuous	T _C = 25°C ^b	13	A
	Drain Current-Continuous	T _C = 100°C ^b	8.4	A
I _{DM}	Drain Current-Pulsed	Pulse Width = 10μs	60	A
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 _{θJC}	Thermal Resistance Junction-Case	2.4	°C/W
R _{θJA}	Thermal Resistance Junction-Ambient ^d	50	°C/W

Electrical Characteristics ($T_J = 25^\circ \text{C}$ 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	$V_{GS} = 0V, V_{DS} = 650V$ $T_J = 25^\circ \text{C}$	-	2.2	20	μA
		$V_{GS} = 0V, V_{DS} = 650V$ $T_J = 150^\circ \text{C}$	-	10	-	μA
I_{GSS}	Gate-to-source Leakage Current	$V_{DS} = 0V, V_{GS} = \pm 20V$	-	-	± 100	nA

■ On Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 500\mu A$	3.3	4.0	4.8	V
$R_{DS(on)eff}$	On Resistance	$V_{GS} = 10V, I_D = 10A$ $T_J = 25^\circ \text{C}$	-	130	180	m Ω
		$V_{GS} = 10V, I_D = 10A$ $T_J = 150^\circ \text{C}$	-	280	-	

■ Dynamic Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
C_{ISS}	Input Capacitance	$V_{GS} = 0V,$ $V_{DS} = 400V$ $f = 1MHz$	-	598	-	pF
C_{OSS}	Output Capacitance		-	30	-	
C_{RSS}	Transfer Capacitance		-	1	-	
$C_{o(er)}$	Output Capacitance, energy related	$V_{GS} = 0V,$ $V_{DS} = 0 \sim 400V$	-	43	-	pF
$C_{o(tr)}$	Output Capacitance, time related		-	85	-	

■ On Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 0 \sim 12V,$ $V_{DS} = 400V,$ $I_D = 10A,$ $R_g = 70\Omega$	-	13	-	ns
t_r	Turn-On Rise Time		-	25	-	
$t_{d(off)}$	Turn-Off Delay Time		-	47	-	
t_f	Turn-Off Fall Time		-	34	-	
Q_G	Total Gate Charge	$V_{GS} = 0 \sim 10V,$ $V_{DS} = 400V,$ $I_D = 8.5A$	-	8.0	-	nC
Q_{GS}	Gate-Source Charge		-	3.3	-	
Q_{GD}	Gate-Drain Charge		-	2.0	-	
Q_{OSS}	Output Charge	$V_{GS} = 0V, V_{DS} = 0 \sim 400V$	-	34	-	nC

■ Drain-Source Diode Characteristics

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
I_S	Reverse Current	$V_{GS} = 0\text{ V}$	-	-	13	A
V_{SD}	Reverse Voltage	$V_{GS} = 0\text{ V}, I_S = 10\text{ A}$	-	2.4	-	V
		$V_{GS} = 0\text{ V}, I_S = 5\text{ A}$	-	1.6	-	V
t_{RR}	Reverse Recovery Time	$I_S = 10\text{ A}, V_{DS} = 400\text{ V},$ $di/dt = 1000\text{ A}/\mu\text{s}$	-	31	-	ns
Q_{RR}	Reverse Recovery Charge		-	40	-	nC

Notes:

- In off-state, spike duty cycle $D < 0.01$, spike duration $< 1\mu\text{s}$.
- For increased stability at high current operation.
- Reflow MSL3.
- Device on one layer epoxy PCB for drain connection (vertical and without air stream cooling, with 6cm^2 copper area and $70\mu\text{m}$ thickness).

Typical Characteristics ($T_c = 25^\circ\text{C}$ unless otherwise noted)

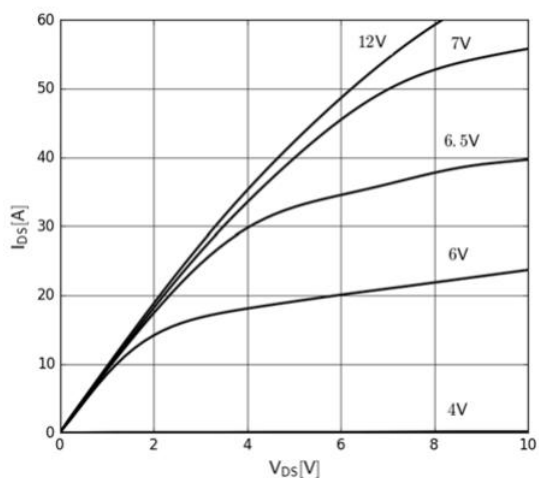


Figure 1. Typical Output Characteristics $T_J = 25^\circ\text{C}$
Parameter: V_{GS}

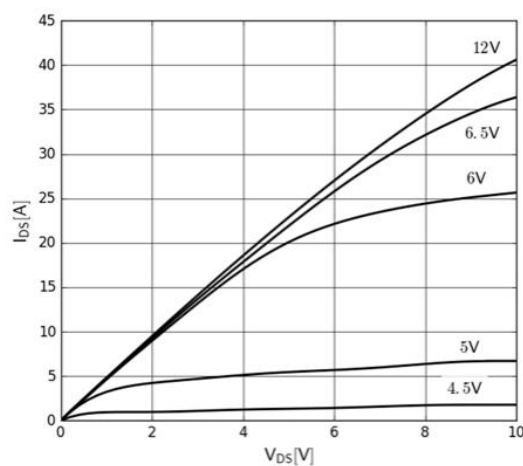


Figure 2. Typical Output Characteristics $T_J = 150^\circ\text{C}$
Parameter: V_{GS}

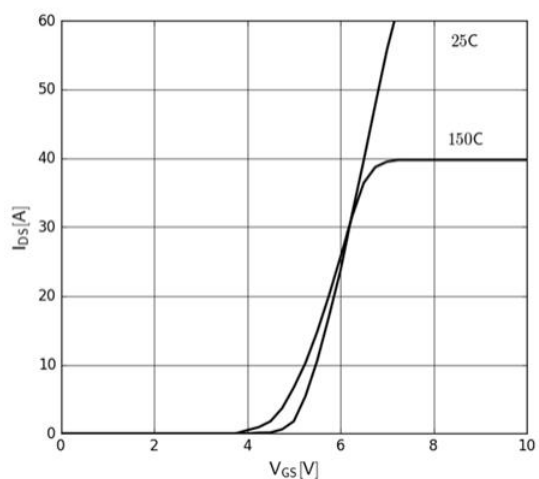


Figure 3. Typical Transfer Characteristics $V_{DS} = 10\text{V}$
Parameter: T_J

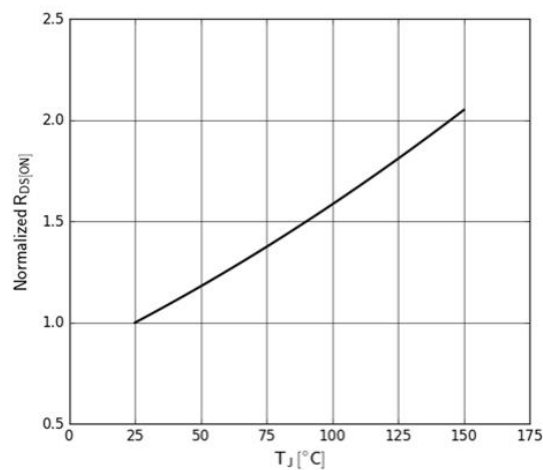


Figure 4. Normalized On-resistance
 $I_D = 16\text{ A}$, $V_{GS} = 10\text{ V}$

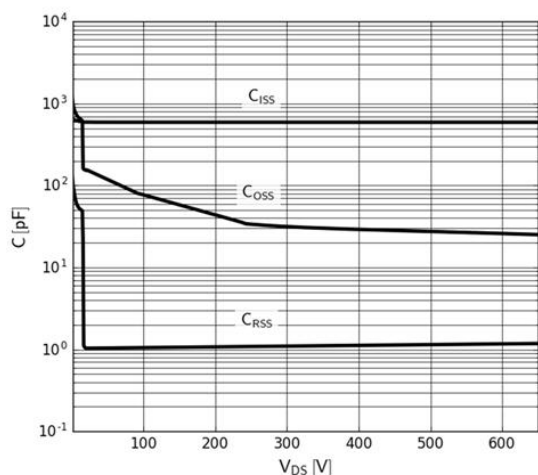


Figure 5. Typical Capacitance
 $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$

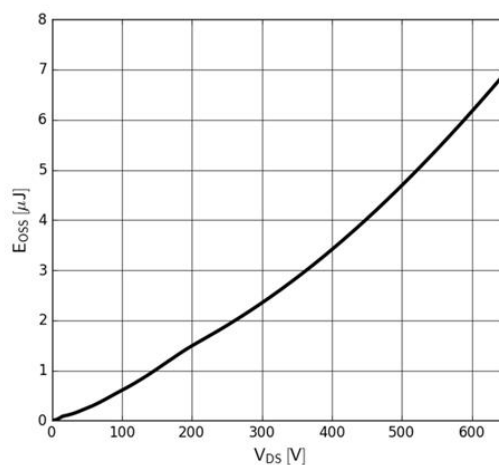


Figure 6. Typical C_{OSS} Stored Energy

Typical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted)

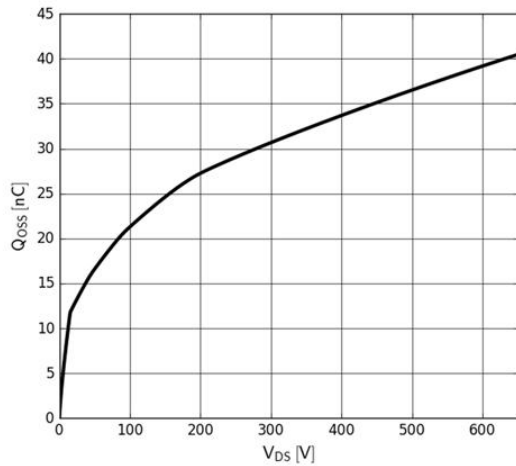


Figure 7. Typical Q_{oss}

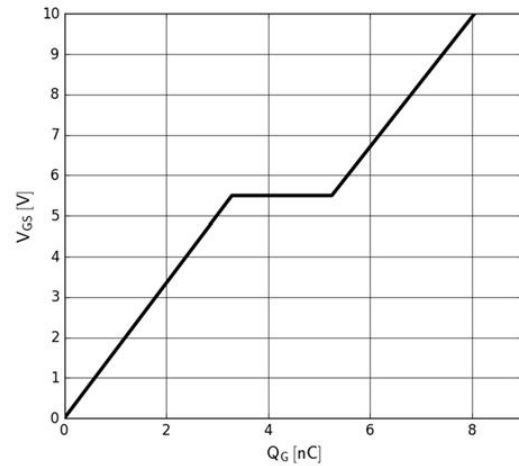


Figure 8. Typical Gate Charge

$I_{DS} = 10\text{A}$, $V_{DS} = 400\text{V}$

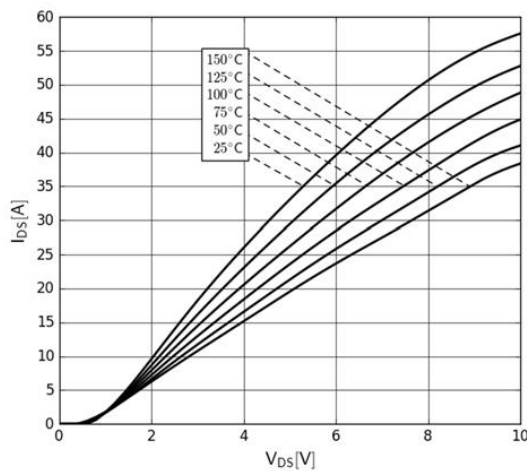


Figure 9. Forward Characteristics of Rev. Diode
 $I_S = f(V_{SD})$, Parameter T_J

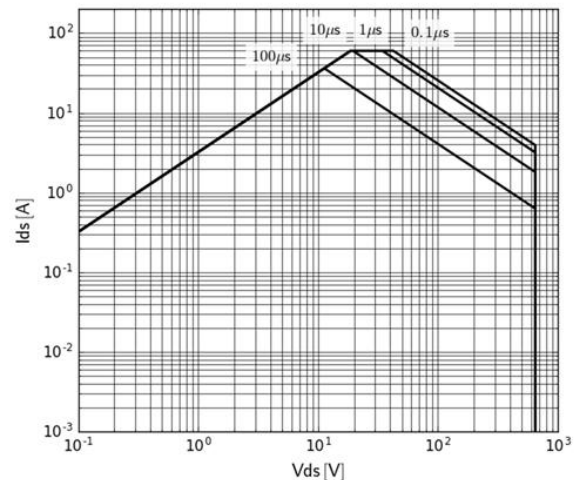


Figure 10. Safe Operating Area $T_C = 25^\circ\text{C}$
(calculated based on thermal limit)

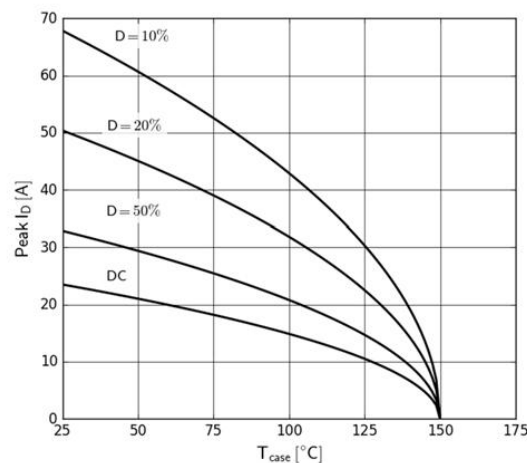


Figure 11. Current Derating
Pulse width $\leq 10\mu\text{s}$, $V_{GS} \geq 10\text{V}$

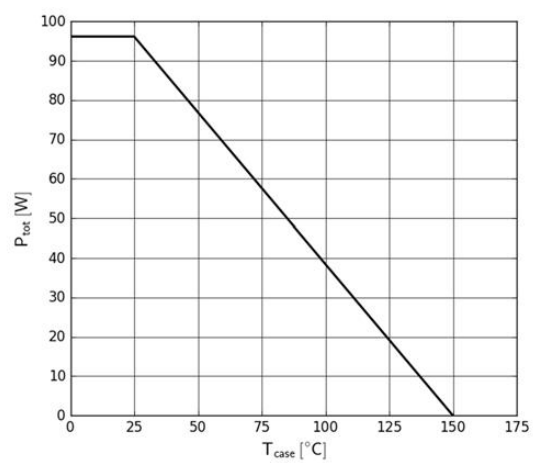


Figure 12. Power Dissipation

Typical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise noted)

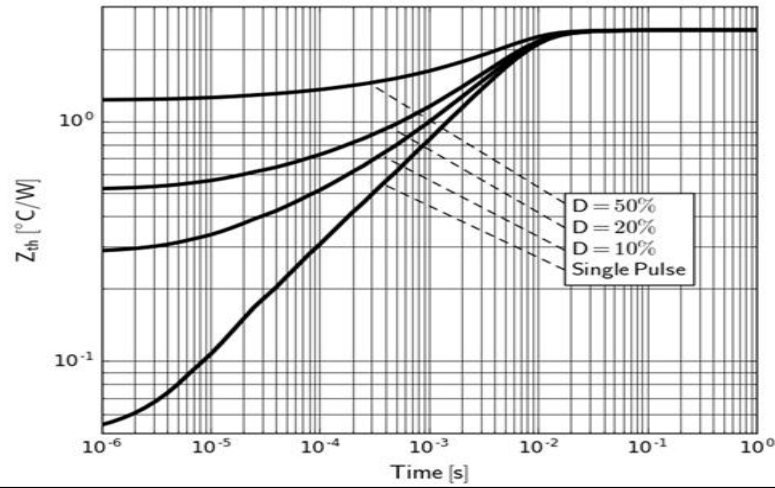


Figure 13. Transient Thermal Resistance

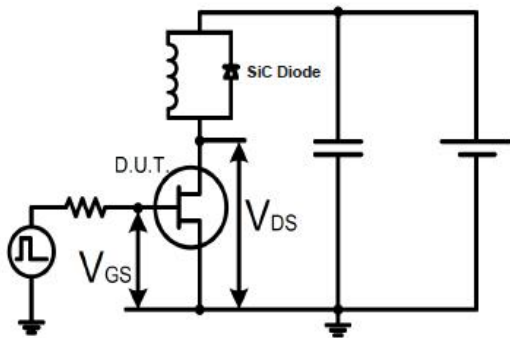


Figure 14. Switching Time Test Circuit

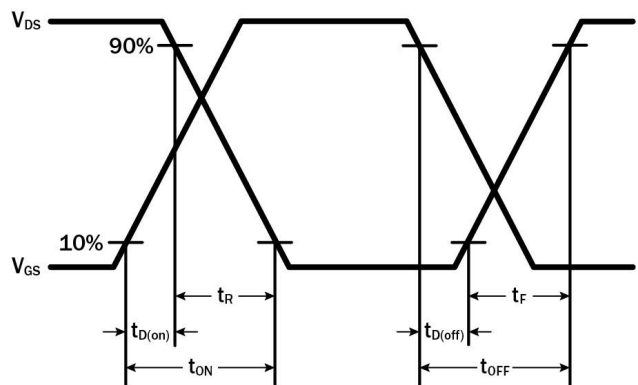


Figure 15. Switching Time Waveform

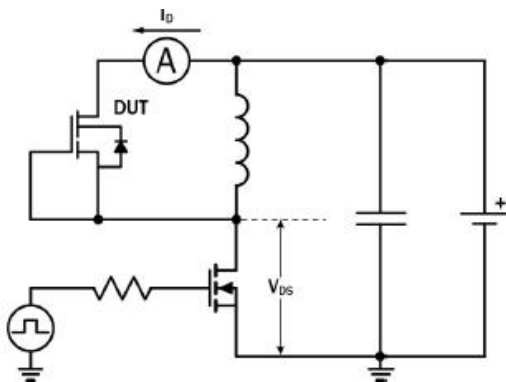


Figure 16. Diode Characteristics Test Circuit

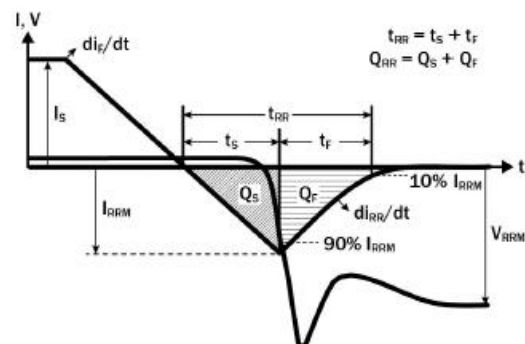
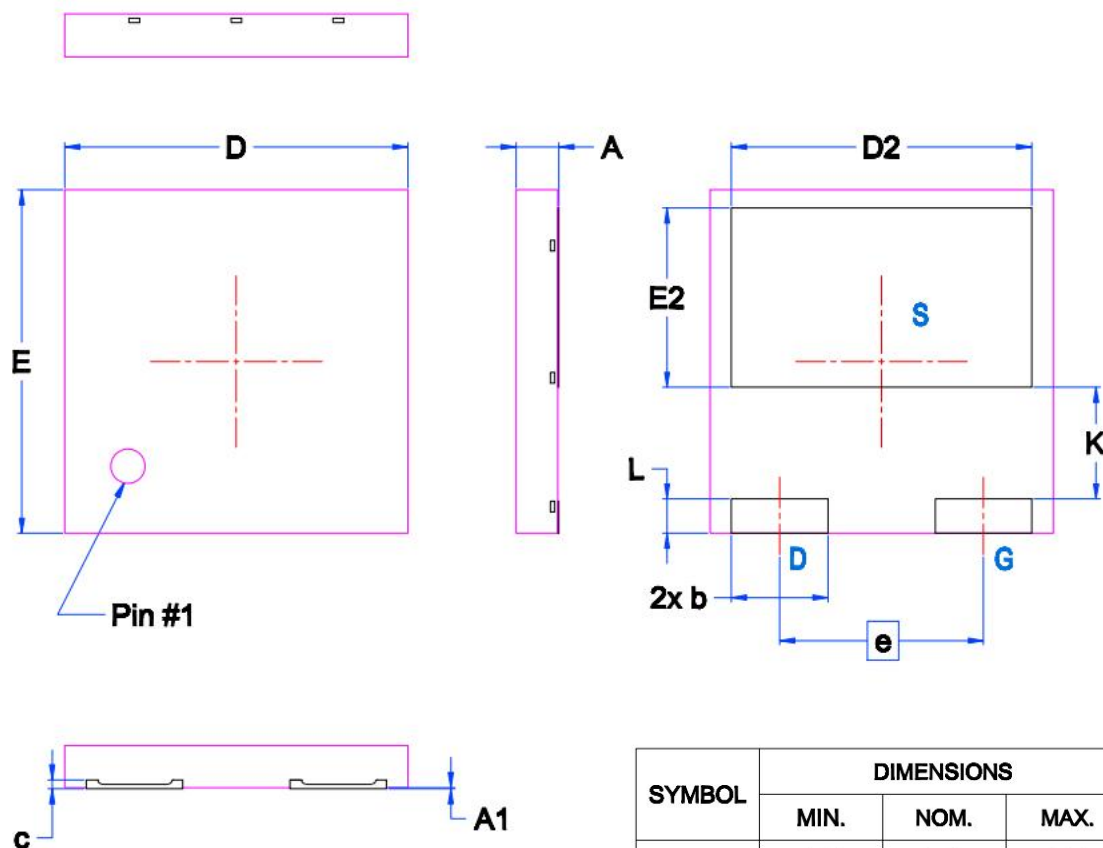


Figure 17. Diode Recovery Waveform

■ DFN8X8-3L Package Information



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	—	0.05
b	2.20	2.25	2.30
c	0.20 REF.		
D	7.90	8.00	8.10
D2	6.85	7.00	7.15
E	7.90	8.00	8.10
E2	4.03	4.18	4.33
e	4.75 BSC		
K	2.50	—	—
L	0.70	0.80	0.90

■ Revision History

Version	Date	Subjects (major changes since last revision)
0.1	2021-12-10	Preliminary Version
1.0	2022-08-16	Datasheet Complete