

## Velosti N-channel 650V, 2A, 3.55Ω Power MOSFET

### Description

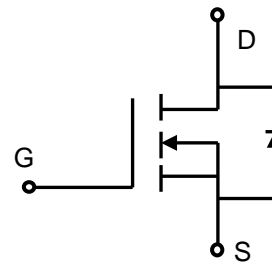
Velosti Power MOSFET is fabricated using advanced super junction technology. The resulting device has extremely low on resistance, making it especially suitable for applications which require superior power density and outstanding efficiency.

### Features

- ◆ Ultra low  $R_{DS(on)}$
- ◆ Ultra low gate charge (typ.  $Q_g = 6\text{nC}$ )
- ◆ Low  $C_{rss}$  (typ. 2 pF)
- ◆ 100% UIS tested
- ◆ RoHS compliant

### Product Summary

$V_{DS} @ T_{j,max}$	700V
$R_{DS(on),max}$	3.55Ω
$I_{DM}$	5A
$Q_{g,typ}$	6nC



N-Channel MOSFET



### Absolute Maximum Ratings

Parameter	Symbol	VSV65R355B2	Unit
Drain-Source Voltage	$V_{DS}$	650	V
Continuous drain current ( $T_C = 25^\circ\text{C}$ )	$I_D$	2	A
( $T_C = 100^\circ\text{C}$ )		1.2	A
Pulsed drain current <sup>1)</sup>	$I_{DM}$	5	A
Gate-Source voltage	$V_{GS}$	$\pm 30$	V
Avalanche energy, single pulse <sup>2)</sup>	$E_{AS}$	50	mJ
Avalanche energy, repetitive <sup>1)</sup>	$E_{AR}$	0.07	mJ
Avalanche current, repetitive <sup>1)</sup>	$I_{AR}$	2	A
Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_D$	25	W
- Derate above 25°C		0.2	W/°C
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	°C
Continuous diode forward current	$I_S$	2	A
Diode pulse current	$I_{S,pulse}$	5	A

### Thermal Characteristics

Parameter	Symbol	VSV65R355B2	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	5	°C/W
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	75	°C/W

**Package Marking and Ordering Information**

Device	Device Package	Marking
VSV65R355B2	TO-252	VSV65R355B2

**Electrical Characteristics**  $T_c = 25^\circ\text{C}$  unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>Static characteristics</b>						
Drain-source breakdown voltage	$BV_{DSS}$	$V_{GS}=0\text{ V}, I_D=0.25\text{ mA}$	650	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=0.25\text{ mA}$	2.5	3.5	4.5	V
Drain cut-off current	$I_{DSS}$	$V_{DS}=650\text{ V}, V_{GS}=0\text{ V},$ $T_j = 25^\circ\text{C}$	-	-	1	$\mu\text{A}$
Gate leakage current, Forward	$I_{GSSF}$	$V_{GS}=30\text{ V}, V_{DS}=0\text{ V}$	-	-	100	nA
Gate leakage current, Reverse	$I_{GSSR}$	$V_{GS}=-30\text{ V}, V_{DS}=0\text{ V}$	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=1\text{ A}$ $T_j = 25^\circ\text{C}$ $T_j = 150^\circ\text{C}$	- - -	3.1 7.4	3.55 -	$\Omega$
Gate resistance	$R_G$	$f=1\text{ MHz}, \text{open drain}$	-	3.2	-	$\Omega$
<b>Dynamic characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$	-	150	-	pF
Output capacitance	$C_{oss}$		-	100	-	
Reverse transfer capacitance	$C_{rss}$		-	2	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 300\text{ V}, I_D = 1\text{ A}$ $R_G = 25\Omega, V_{GS}=10\text{ V}$	-	13	-	ns
Rise time	$t_r$		-	16	-	
Turn-off delay time	$t_{d(off)}$		-	25	-	
Fall time	$t_f$		-	15	-	
<b>Gate charge characteristics</b>						
Gate to source charge	$Q_{gs}$	$V_{DD}=480\text{ V}, I_D=1\text{ A},$ $V_{GS}=0\text{ to }10\text{ V}$	-	1	-	nC
Gate to drain charge	$Q_{gd}$		-	4	-	
Gate charge total	$Q_g$		-	6	-	
Gate plateau voltage	$V_{plateau}$		-	6.1	-	V
<b>Reverse diode characteristics</b>						
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=1\text{ A}$	-	-	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=50\text{ V}, I_F=2\text{ A},$ $dI_F/dt=100\text{ A}/\mu\text{s}$	-	160	-	ns
Reverse recovery charge	$Q_{rr}$		-	0.6	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	7	-	A

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 1.2\text{ A}, V_{DD} = 60\text{ V}, R_G = 25\Omega, \text{Starting } T_j = 25^\circ\text{C}$

### Electrical Characteristics Diagrams

Figure 1. On-Region Characteristics

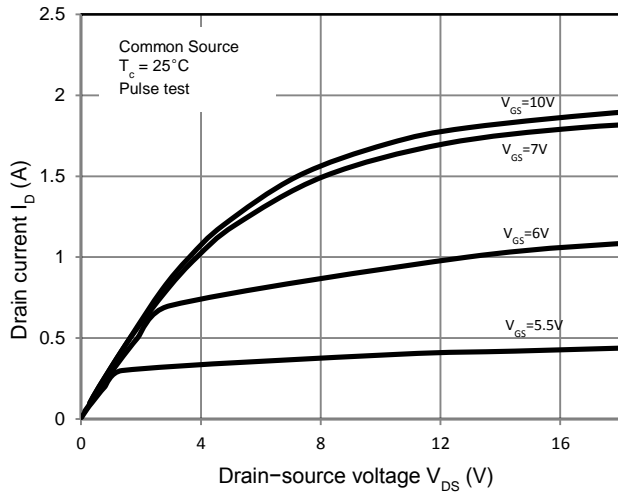


Figure 2. Transfer Characteristics

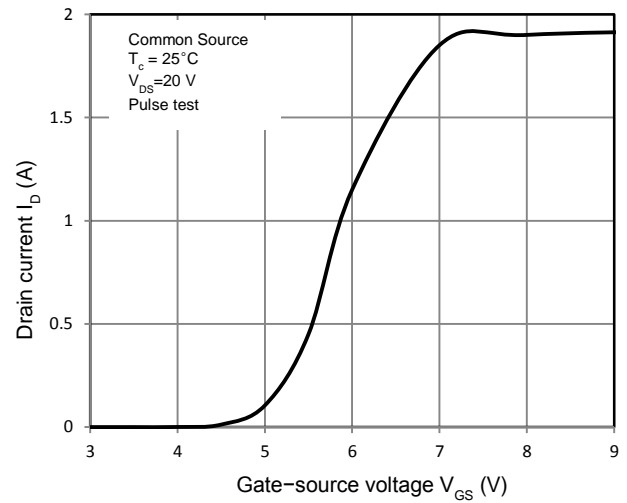


Figure 3. On-Resistance Variation vs. Drain Current

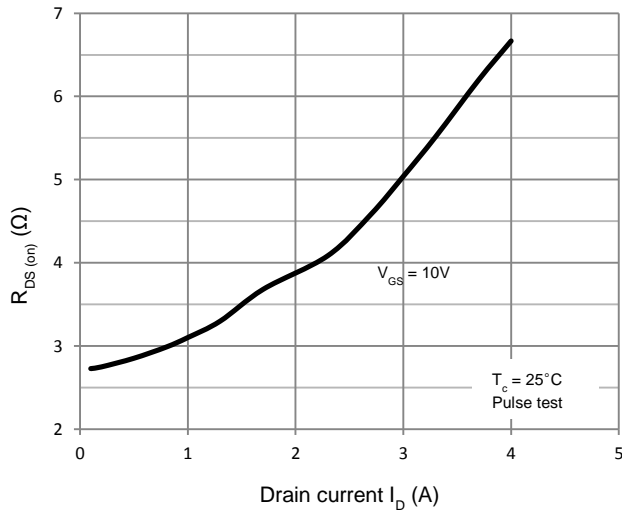


Figure 4. Threshold Voltage vs. Temperature

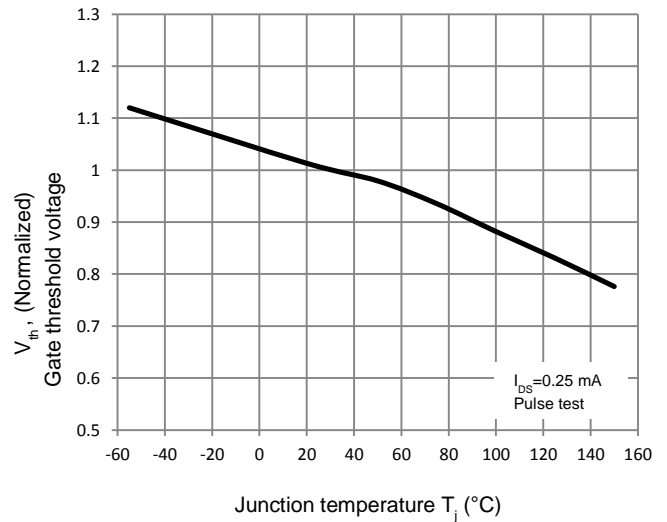


Figure 5. Breakdown Voltage vs. Temperature

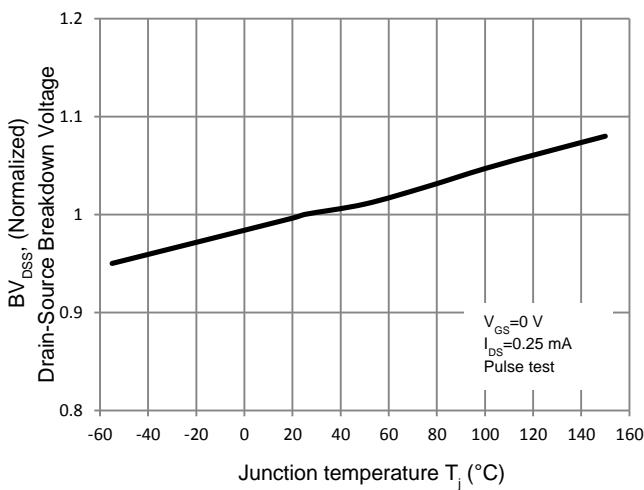


Figure 6. On-Resistance vs. Temperature

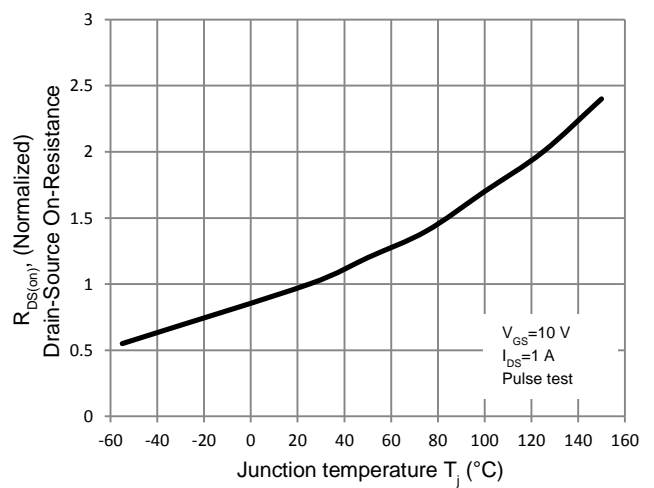


Figure 7. Capacitance Characteristics

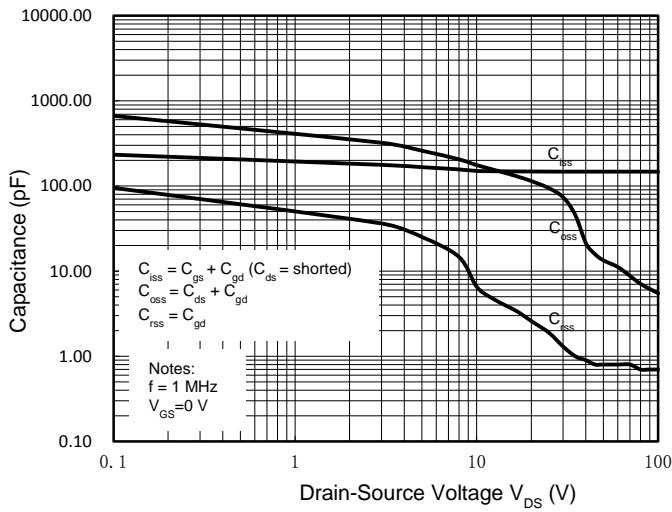


Figure 8. Gate Charge Characteristics

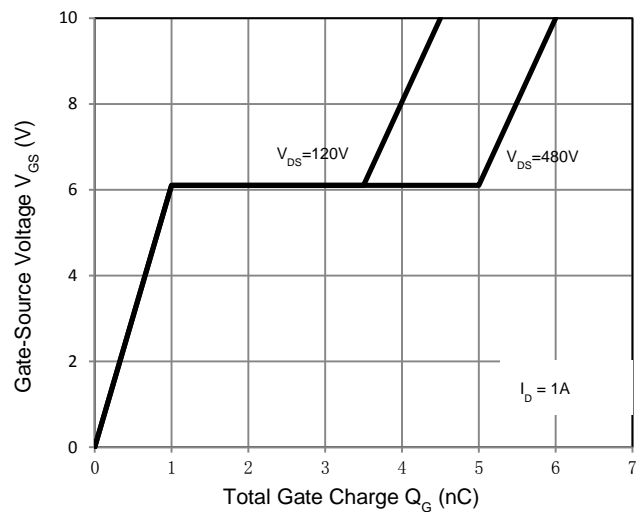


Figure 9. Maximum Safe Operating Area

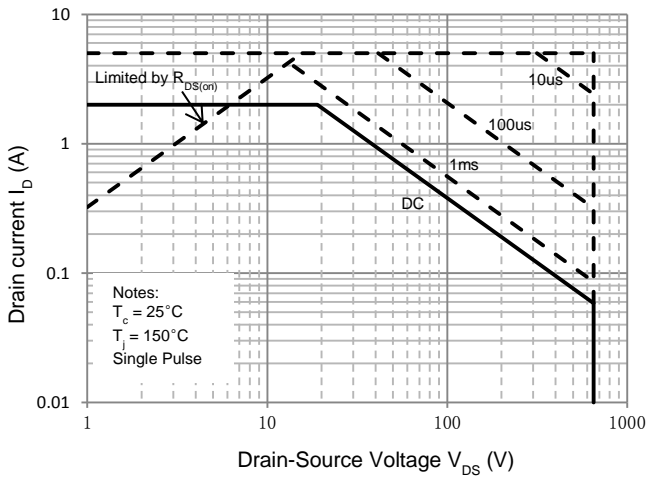


Figure 10. Power Dissipation vs. Temperature

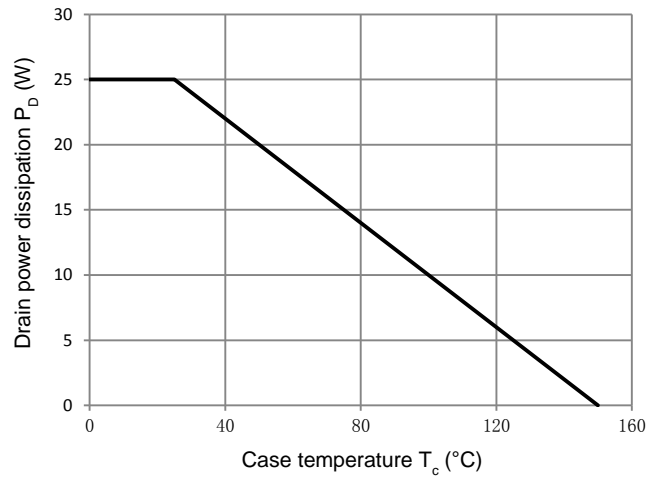
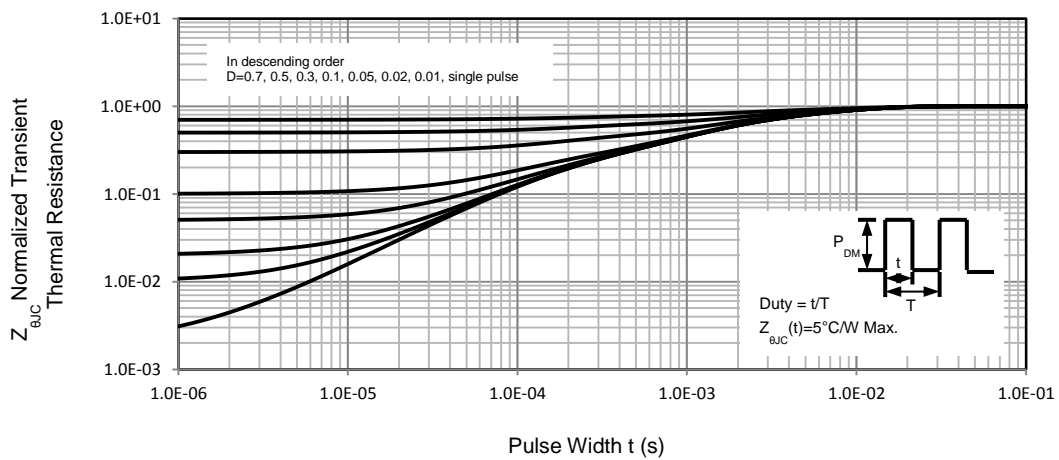
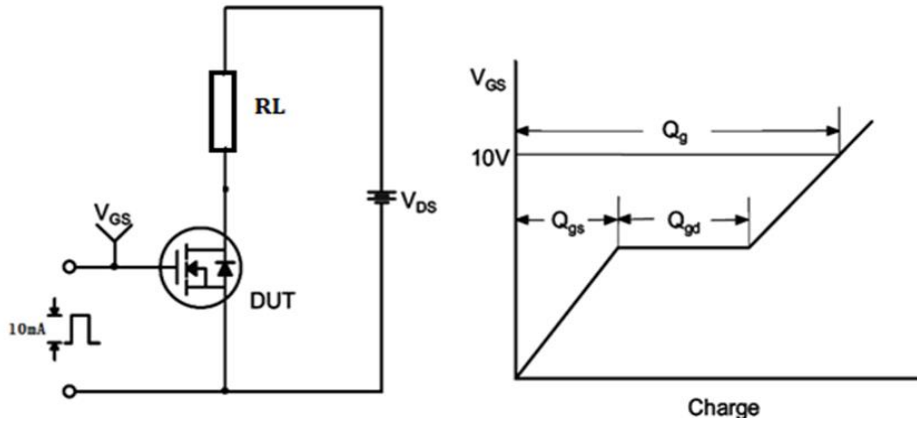


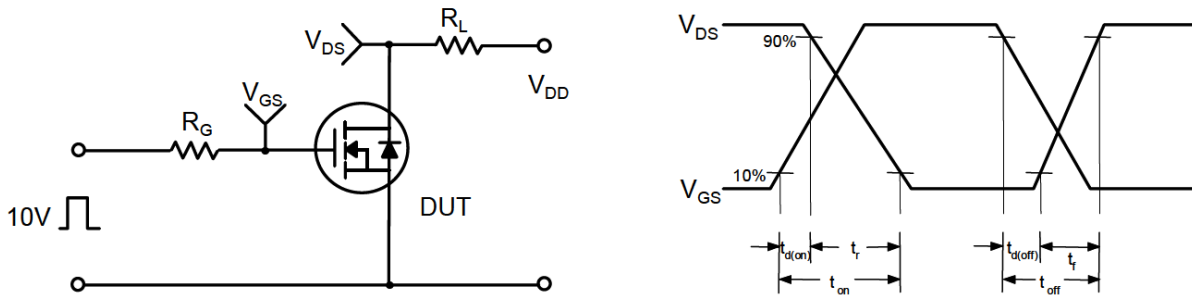
Figure 11. Transient Thermal Response Curve



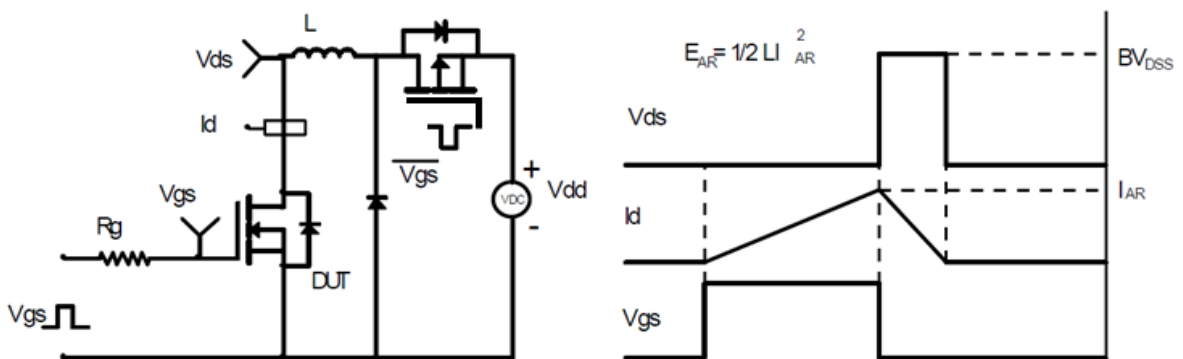
### Gate Charge Test Circuit & Waveform



### Switching Test Circuit & Waveforms

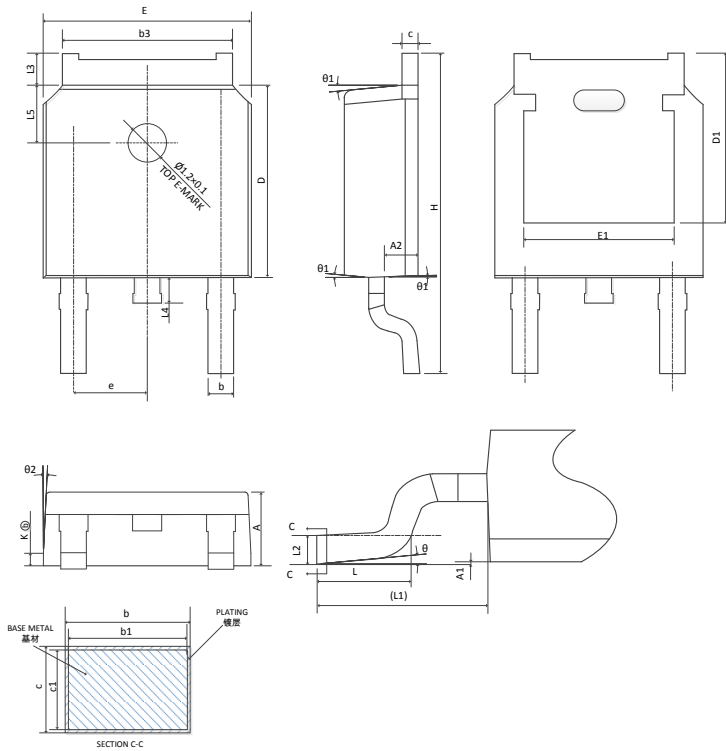


### Unclamped Inductive Switching Test Circuit & Waveforms



### Mechanical Dimensions for TO-252

#### COMMON DIMENSIONS



SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.00	—	0.10
A2	0.97	1.07	1.17
b	0.72	0.78	0.85
b1	0.71	0.76	0.81
b3	5.23	5.33	5.46
c	0.47	0.53	0.58
c1	0.46	0.51	0.56
D	6.00	6.10	6.20
D1	5.30REF		
E	6.50	6.60	6.70
E1	4.70	4.83	4.92
e	2.286BSC		
H	9.90	10.10	10.30
L	1.40	1.50	1.70
L1	2.90REF		
L2	0.51BSC		
L3	0.90	—	1.25
L4	0.60	0.80	1.00
L5	1.70	1.80	1.90
θ	0°	—	8°
θ1	5°	7°	9°
θ2	5°	7°	9°
K	0.40REF		

## Revision History

Date	Revision	Changes
2012-5-9	2.0	First release
2012-12-10	2.1	Updated page header
2013-1-9	2.2	Fixed display error in Mac OS environment
2013-11-6	2.3	Revised label marks of figure 4-6.
2013-11-22	2.4	Changed label $T_c$ to $T_j$ in figure 4-6. Unified the display format of $R_{DS(on)}$ .