



SUPER-SEMI



## SUPER-MOSFET

Super Junction Metal Oxide Semiconductor Field Effect Transistor

800V Super Junction Power MOSFET  
SS\*80R1K3S

Rev. 1.2  
Aug. 2019

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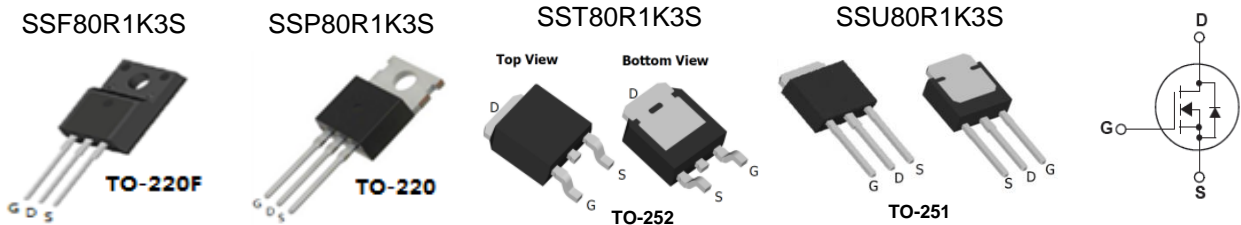
# SSF80R1K3S/SSP80R1K3S/SST80R1K3S/SSU80R1K3S 800V N-Channel MOSFET

## Description

SJ-FET is new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance. This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. SJ-FET is suitable for various AC/DC power conversion in switching mode operation for higher efficiency.

## Features

- Multi-Epi process SJ-FET
- 850V @T<sub>J</sub> = 150 °C
- Typ. R<sub>DS(on)</sub> = 1.1Ω
- Ultra Low Gate Charge (typ. Q<sub>g</sub> = 6.5nC)
- 100% avalanche tested



## Absolute Maximum Ratings

Symbol	Parameter	SSP_T_U80R1K3S	SSF80R1K3S	Unit
V <sub>DSS</sub>	Drain-Source Voltage	800		V
I <sub>D</sub>	Drain Current -Continuous (TC = 25°C) -Continuous (TC = 100°C)	4.4* 2.8*		A
I <sub>DM</sub>	Drain Current - Pulsed (Note 1)	12*		A
V <sub>GSS</sub>	Gate-Source voltage	±30		V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	46		mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	1		A
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	0.2		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15		V/ns
dV <sub>ds</sub> /dt	Drain Source voltage slope (V <sub>ds</sub> =640V)	50		V/ns
P <sub>D</sub>	Power Dissipation (TC = 25°C)	37	26	W
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150		°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		°C

\* Drain current limited by maximum junction temperature. Maximum duty cycle D=0.75.

## Thermal Characteristics

Symbol	Parameter	SSP_T_U80R1K3S	SSF80R1K3S	Unit
R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	3.41	4.9	°C/W
R <sub>θCS</sub>	Thermal Resistance, Case-to-Sink Typ.	0.5	-	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient	62	80	°C/W



# Electrical Characteristics TC = 25°C unless otherwise noted

SSF80R1K3S/SSP80R1K3S/SST80R1K3S/SSU80R1K3S 800V N-Channel MOSFET

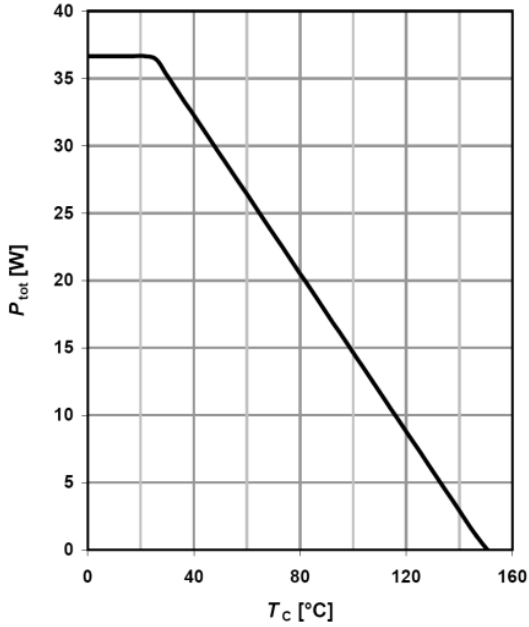
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA, T <sub>J</sub> = 25°C	800	-	-	V
		V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA, T <sub>J</sub> = 150°C	-	850	-	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250μA, Referenced to 25°C	-	0.6	-	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 800V, V <sub>GS</sub> = 0V -T <sub>J</sub> = 150°C	-	-	1	μA
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	-	-	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V	-	-	-100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.5	3.5	4.5	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 2.5A	-	1.1	1.3	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40V, I <sub>D</sub> = 5A	-	4	-	S
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz	-	290	-	pF
C <sub>oss</sub>	Output Capacitance		-	88	-	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	8	-	pF
<b>Switching Characteristics</b>						
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 400V, I <sub>D</sub> = 2.5A, R <sub>G</sub> = 25Ω (Note 4)	-	19	-	ns
t <sub>r</sub>	Turn-On Rise Time		-	19	-	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		-	36	-	ns
t <sub>f</sub>	Turn-Off Fall Time		-	21	-	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 450V, I <sub>D</sub> = 2.5A, V <sub>GS</sub> = 10V (Note 4)	-	6.5	-	nC
Q <sub>gs</sub>	Gate-Source Charge		-	1.5	-	nC
Q <sub>gd</sub>	Gate-Drain Charge		-	2.6	-	nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		-	-	4.5	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		-	-	14	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0V, I <sub>S</sub> = 5A	-	0.9	1.5	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>R</sub> = 400V, V <sub>GS</sub> = 0V, I <sub>F</sub> = 5A, dI <sub>F</sub> /dt = 100A/μs	-	550	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	3.8	-	μC
I <sub>rrm</sub>	Peak reverse recovery Current		-	12	-	A

## NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I<sub>AS</sub> = 1A, V<sub>DD</sub> = 50V, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ I<sub>D</sub>, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Essentially Independent of Operating Temperature Typical Characteristics

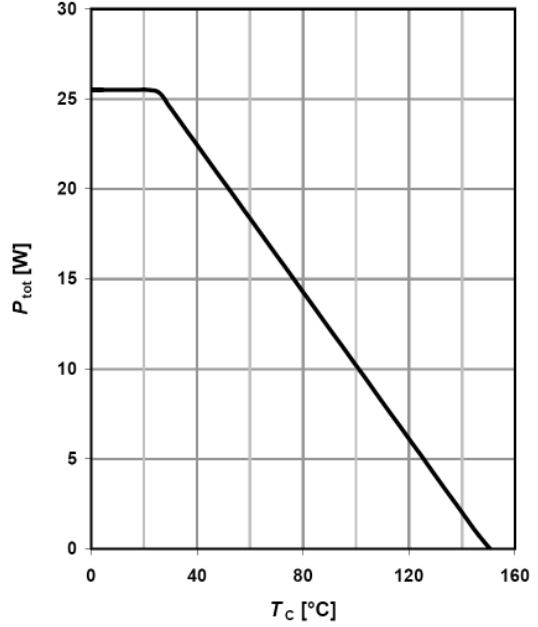
### 1 Power dissipation(TO-220,TO-252,TO-251)

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



### 2 Power dissipation(TO-220 FULL PAK)

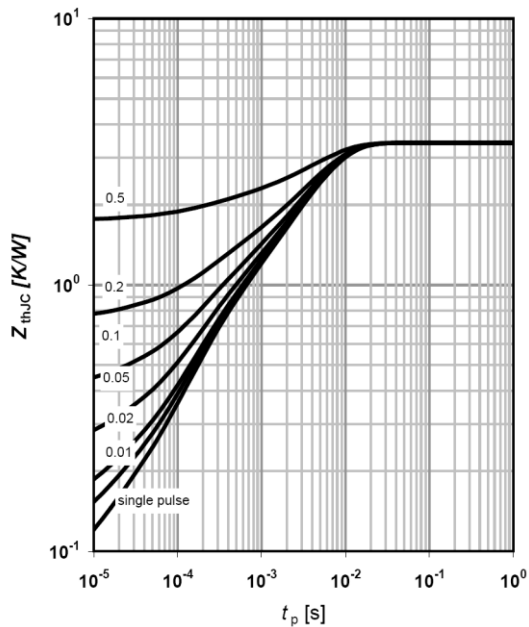
$$P_{tot}=f(T_c)$$



### 3 Max. transient thermal impedance (TO-220,TO-252,TO-251)

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

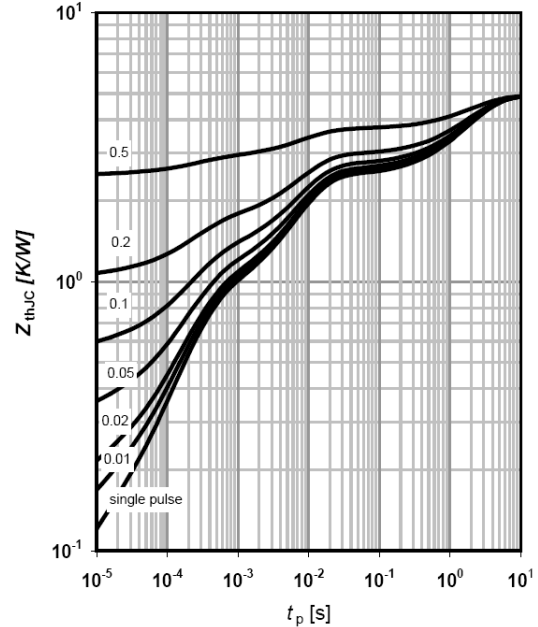
parameter:  $D=t_p/T$



### 4 Max. transient thermal impedance (TO-220 FULL PAK)

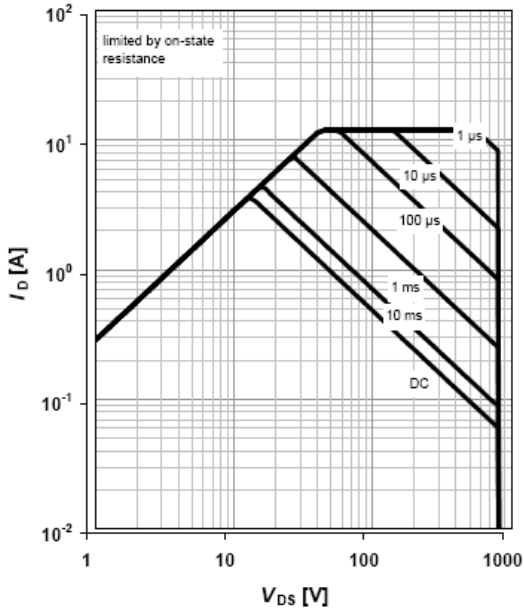
$$Z_{thJC}=f(t_p)$$

parameter:  $D=t_p/T$



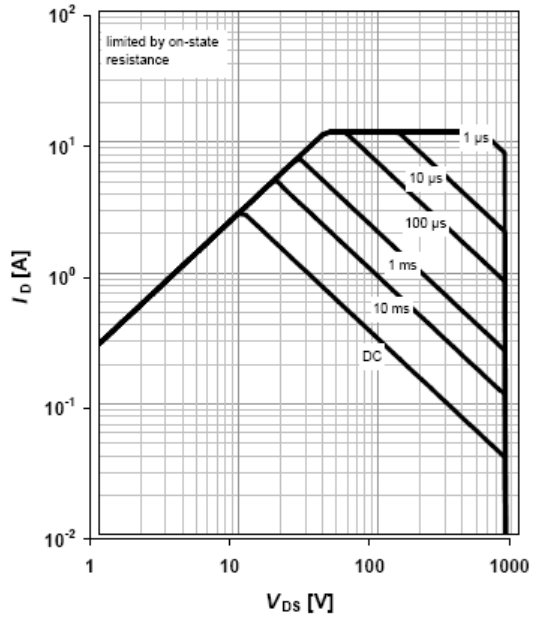
## 5 Safe operating area (TO-220,TO-252,TO-251)

$I_D=f(V_{DS})$ ;  $T_C=25^\circ\text{C}$ ;  $D=0$   
parameter:  $t_p$



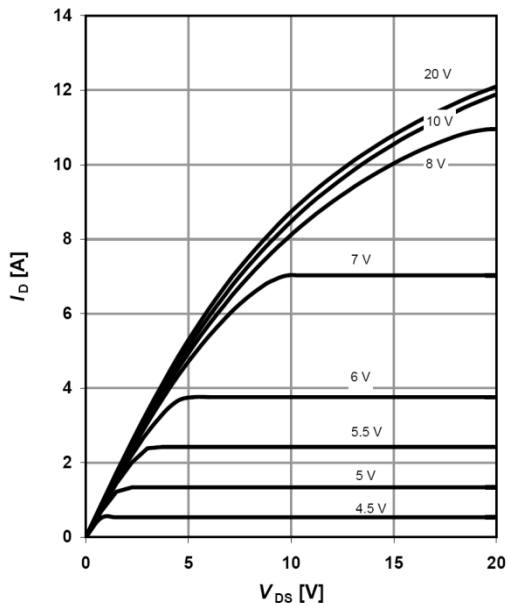
## 6 Safe operating area (TO-220 FULL PAK)

$I_D=f(V_{DS})$ ;  $T_C=25^\circ\text{C}$ ;  $D=0$   
parameter:  $t_p$



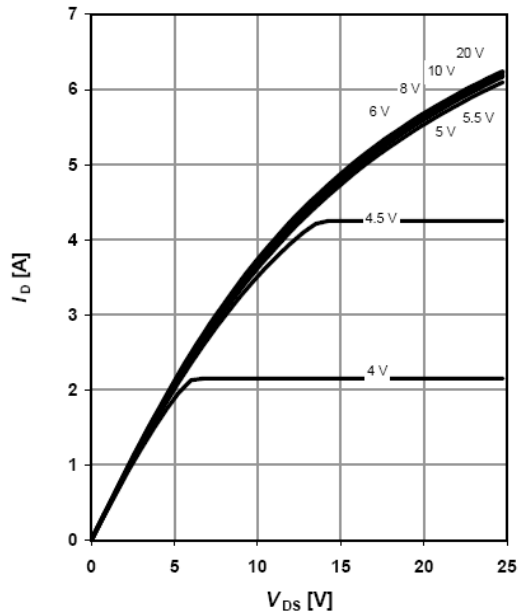
## 7 Typ. output characteristics

$I_D=f(V_{DS})$ ;  $T_J=25^\circ\text{C}$   
parameter:  $V_{GS}$



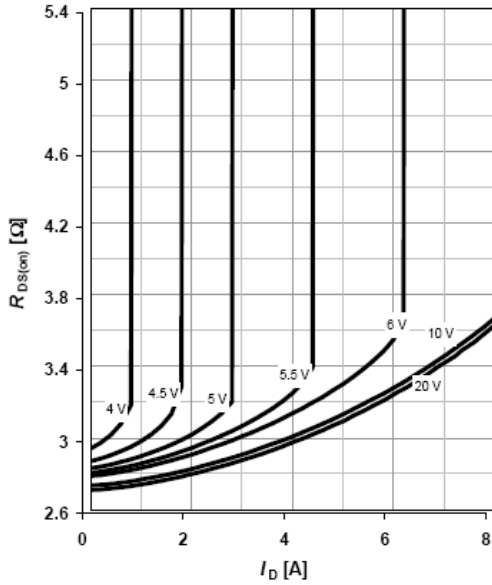
## 8 Typ. output characteristics

$I_D=f(V_{DS})$ ;  $T_J=150^\circ\text{C}$   
parameter:  $V_{GS}$



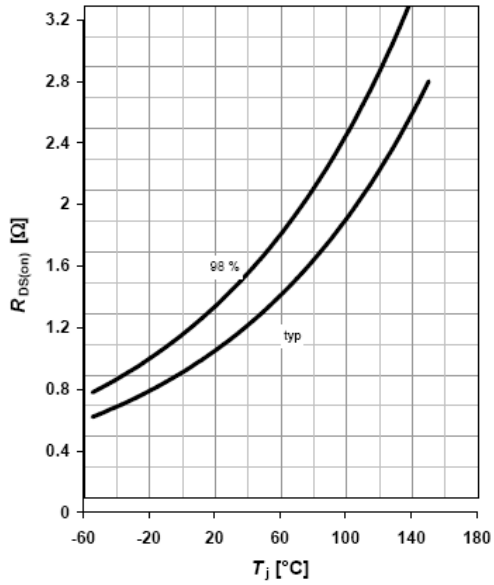
### 9 Typ. drain-source on-state resistance

$R_{DS(on)}=f(I_D)$ ;  $T_J=125^\circ\text{C}$   
parameter:  $V_{GS}$



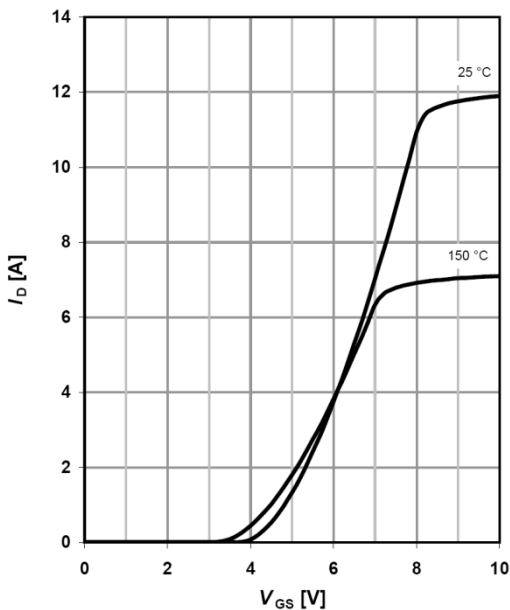
### 10 Drain-source on-state resistance

$R_{DS(on)}=f(T_J)$ ;  $I_D=2.5\text{ A}$ ;  
 $V_{GS}=10\text{V}$



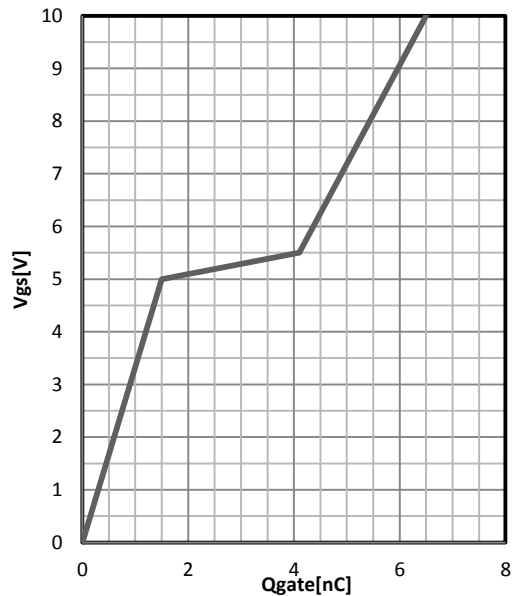
### 11 Typ. transfer characteristics

$I_D=f(V_{GS})$ ;  $V_{DS}=20\text{V}$   
parameter:  $T_J$



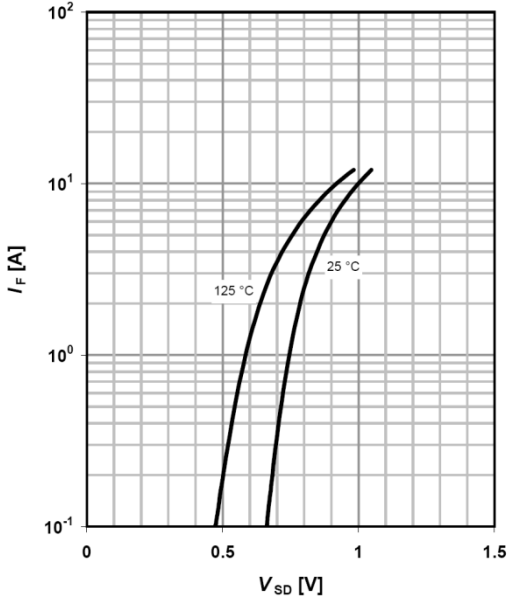
### 12 Typ. gate charge

$V_{GS}=f(Q_{gate})$ ,  $I_D=2\text{A}$  pulsed  
parameter:  $V_{DD}$



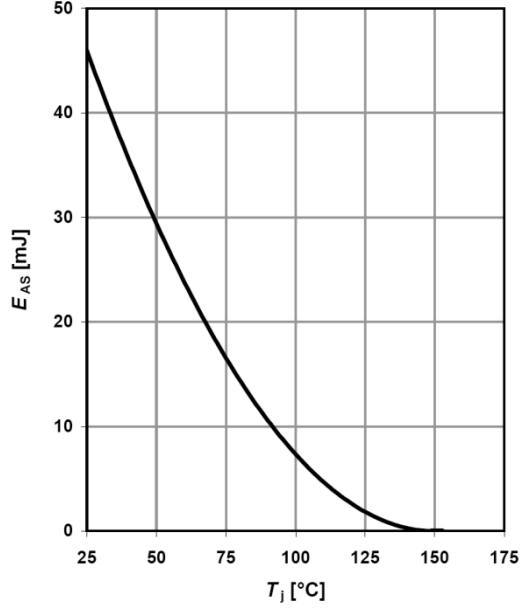
### 13 Forward characteristics of reverse diode

$I_F = f(V_{SD})$ ;  
parameter:  $T_j$



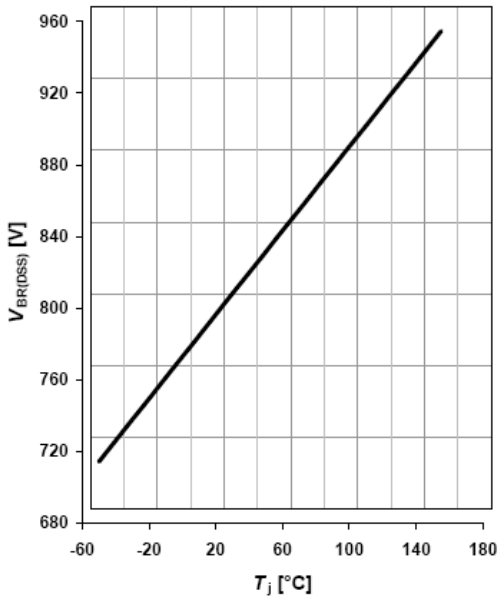
### 14 Avalanche energy

$E_{AS} = f(T_j)$ ;  $I_D = 1A$ ;  
 $V_{DD} = 50V$



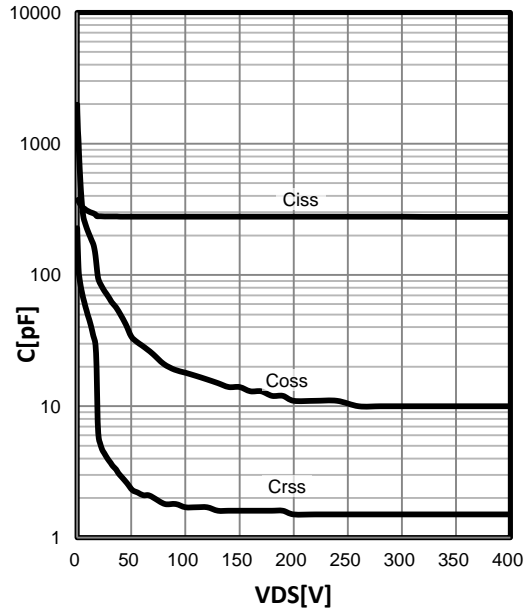
### 15 Drain-source breakdown voltage

$V_{BR(DSS)} = f(T_j)$ ;  $I_D = 0.25mA$



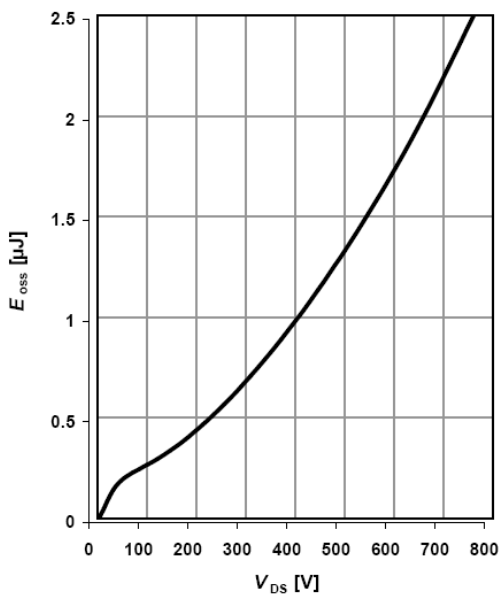
### 16 Typ. capacitances

$C = f(V_{DS})$ ;  $V_{GS} = 0V$ ;  $f = 1MHz$



## 17 Typ. Coss stored energy

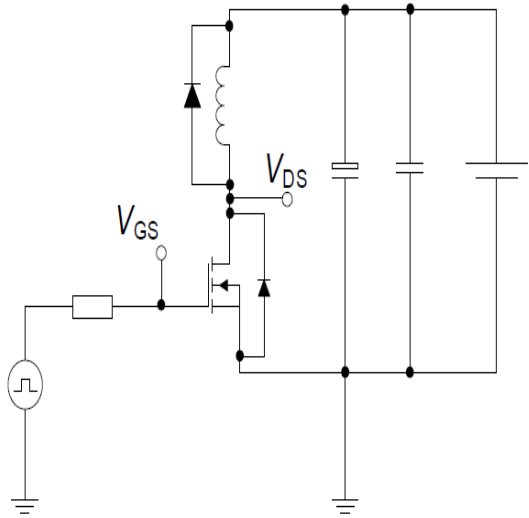
$$E_{oss} = f(V_{DS})$$



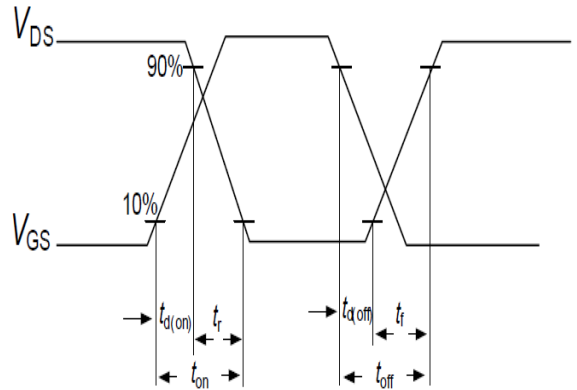


Switching times test circuit and waveform for inductive load

Switching times test circuit for inductive load

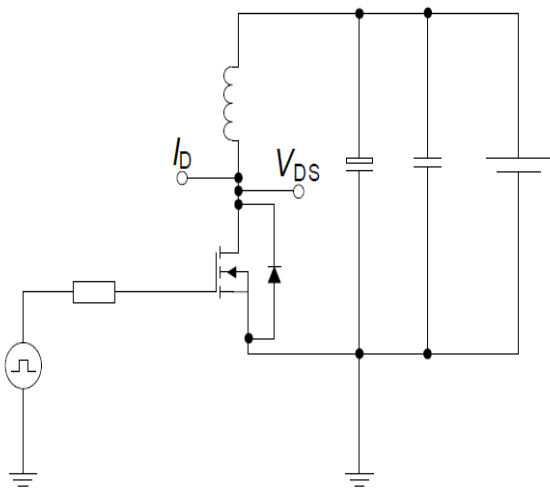


Switching time waveform

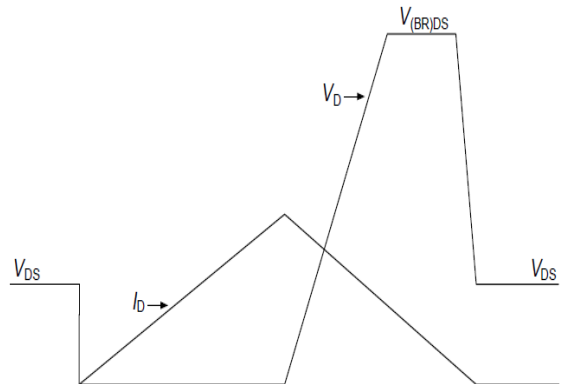


Unclamped inductive load test circuit and waveform

Unclamped inductive load test circuit

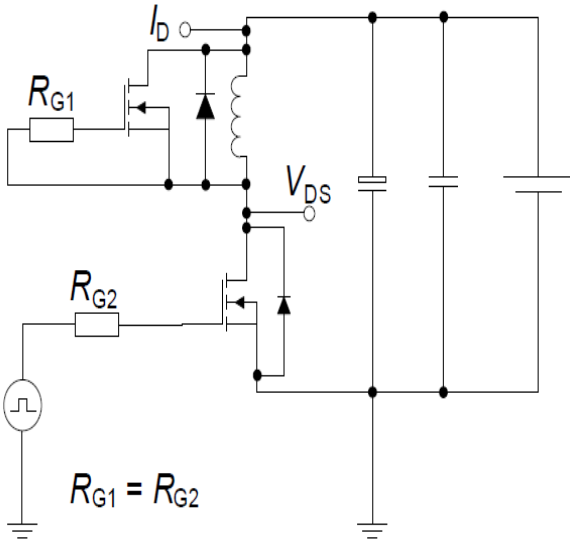


Unclamped inductive waveform

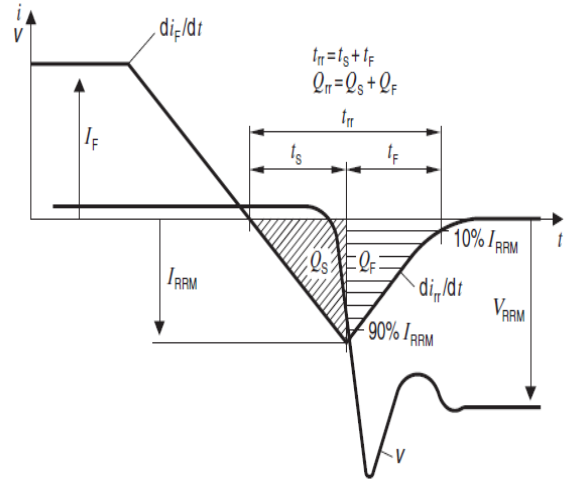


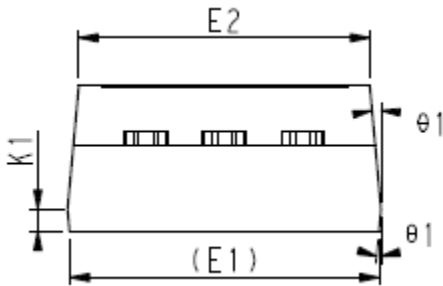
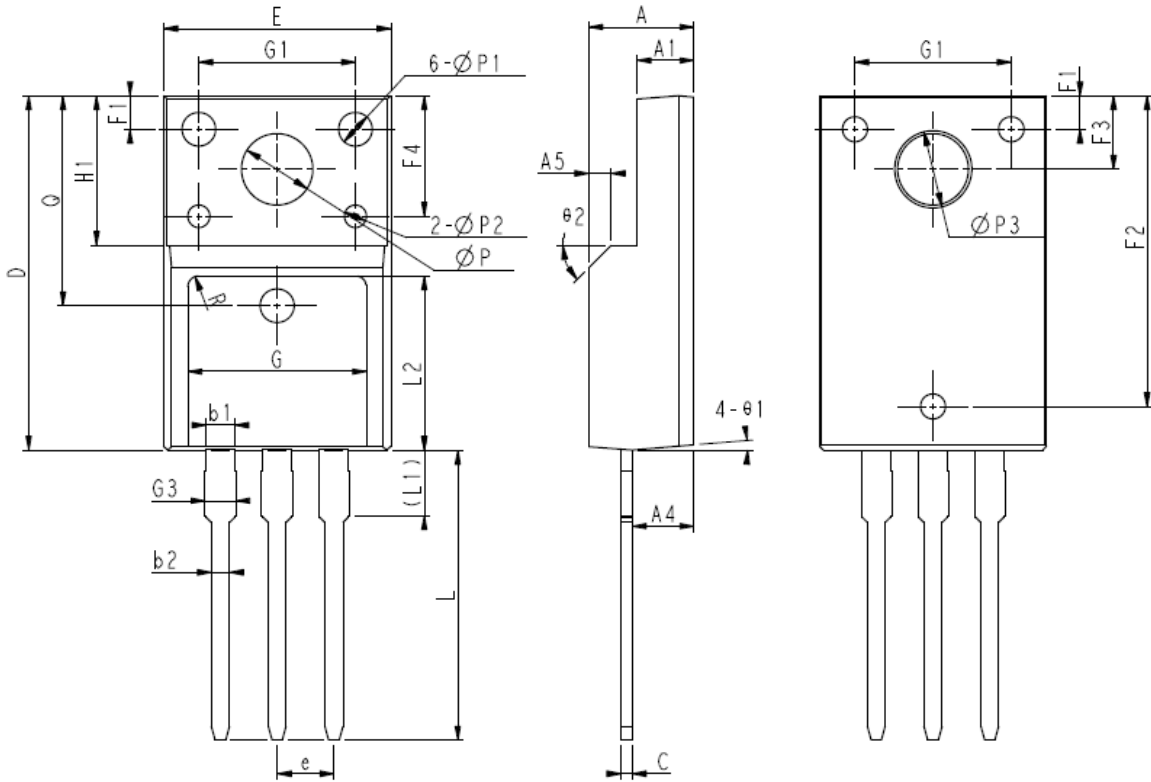
Test circuit and waveform for diode characteristics

Test circuit for diode characteristics



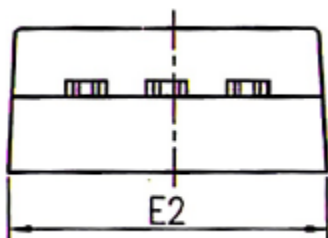
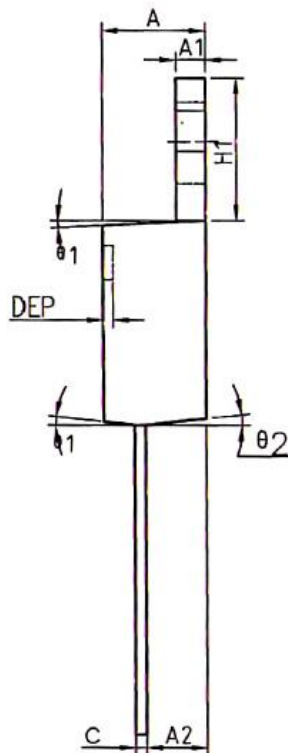
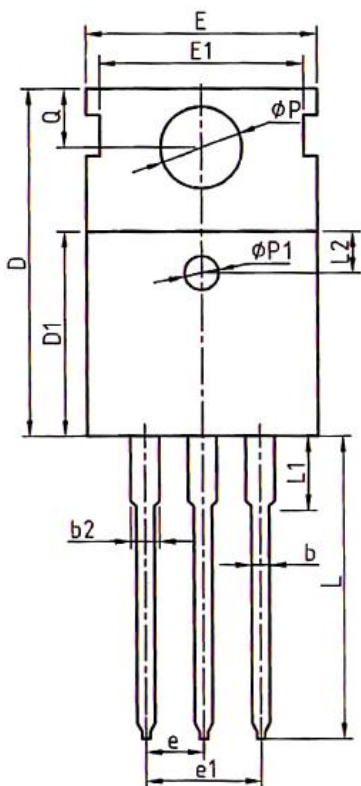
Diode recovery waveform





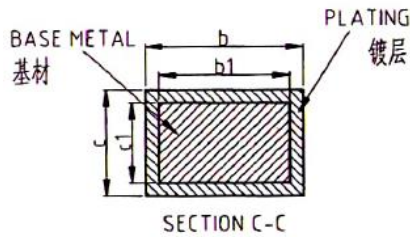
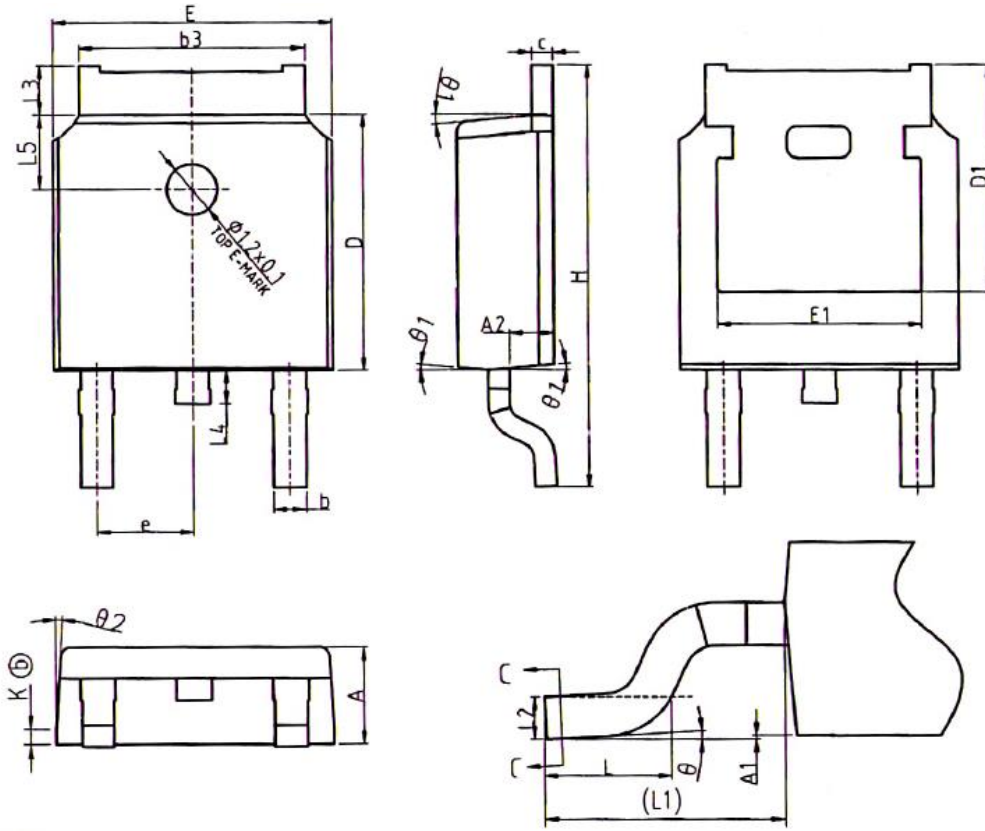
COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NOM	MAX
E	10.00	10.16	10.32
E1	9.94	10.04	10.14
E2	9.36	9.46	9.56
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A4	2.66	2.76	2.86
A5	1.00REF		
c	0.45	0.50	0.60
D	15.67	15.87	16.07
Q	9.40REF		
H1	6.70REF		
e	2.54BSC		
$\Phi P$	3.18REF		
L	12.78	12.98	13.18
L1	2.83	2.93	3.03
L2	7.70	7.80	7.90
$\Phi P1$	1.40	1.50	1.60
$\Phi P2$	0.95	1.00	1.05
$\Phi P3$	3.45REF		
$\theta 1$	3°	5°	7°
$\theta 2$	-	45°	-
F1	1.00	1.50	2.00
F2	13.80	13.90	14.00
F3	3.20	3.30	3.40
F4	5.30	5.40	5.50
G	7.80	8.00	8.20
G1	6.90	7.00	7.10
G3	1.25	1.35	1.45
b1	1.23	1.28	1.38
b2	0.75	0.80	0.90
K1	0.65	0.70	0.75
R	0.50REF		



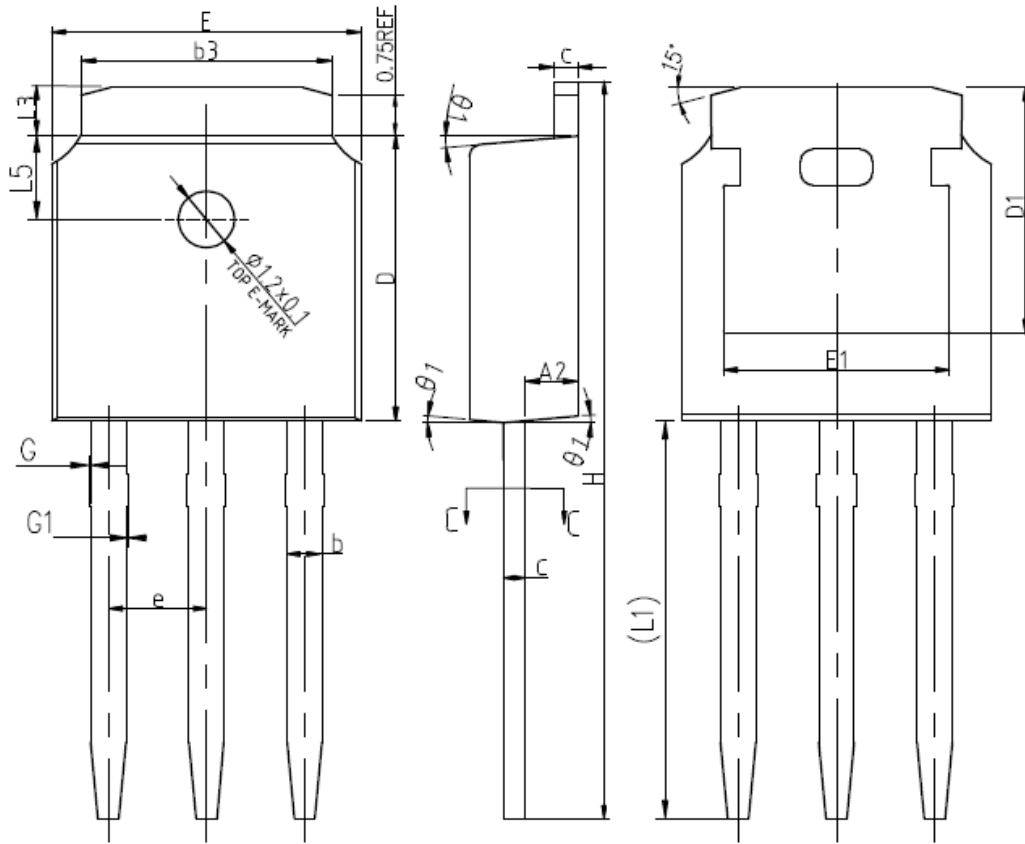
### COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NDM	MAX
A	4.40	4.57	4.70
A1	1.27	1.30	1.37
A2	2.35	2.40	2.50
b	0.77	0.80	0.90
b2	1.17	1.27	1.36
c	0.48	0.50	0.56
D	15.40	15.60	15.80
D1	9.00	9.10	9.20
DEP	0.05	0.10	0.20
E	9.80	10.00	10.20
E1	-	8.70	-
E2	9.80	10.00	10.20
$\phi P1$	1.40	1.50	1.60
e	2.54BSC		
e1	5.08BSC		
H1	6.40	6.50	6.60
L	12.75	13.50	13.65
L1	-	3.10	3.30
L2	2.50REF		
$\phi P$	3.50	3.60	3.63
Q	2.73	2.80	2.87
$\theta 1$	5°	7°	9°
$\theta 2$	1°	3°	5°
$\theta 3$	1°	3°	5°

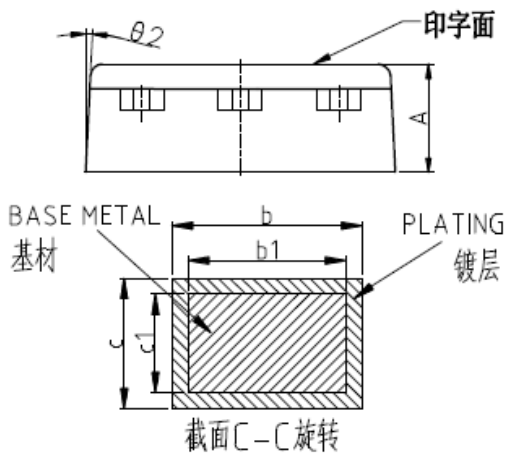


COMMON DIMENSIONS

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		



COMMON DIMENSIONS



SYMBOL	MM		
	MIN	NOM	MAX
A	2.20	2.30	2.38
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	16.10	16.40	16.60
L1	9.20	9.40	9.60
L3	0.90	1.02	1.25
L5	1.70	1.80	1.90
theta 1	5°	7°	9°
theta 2	5°	7°	9°



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[IPS70R2K0CEAKMA1](#) [RJK60S3DPP-E0#T2](#) [RJK60S5DPK-M0#T0](#) [APT5010JVFR](#) [APT12031JFLL](#) [APT12040JVR](#) [DMN3404LQ-7](#)  
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