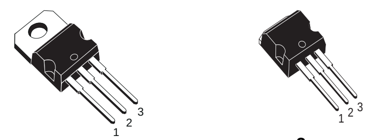
STP20NM50FD
STB20NM50FD-1

N-CHANNEL 500V - 0.22Ω - 20A TO-220/I²PAK
FDmesh™ Power MOSFET (with FAST DIODE)

TYPE	V_{DSS}	$R_{DS(on)}$	$R_{ds(on)}$*Q_g	I_D
STP20NM50FD	500V	<0.25Ω	8.36 Ω*nC	20 A
STB20NM50FD-1	500V	<0.25Ω	8.36 Ω*nC	20 A

- TYPICAL R_{DS}(on) = 0.22Ω
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- 100% AVALANCHE TESTED
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE
- TIGHT PROCESS CONTROL AND HIGH MANUFACTURING YIELDS

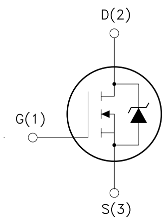


TO-220

I²PAK
(Tabless TO-220)

DESCRIPTION
The FDmesh™ associates all advantages of reduced on-resistance and fast switching with an intrinsic fast-recovery body diode. It is therefore strongly recommended for bridge topologies, in particular ZVS phase-shift converters.

INTERNAL SCHEMATIC DIAGRAM



SC06140

APPLICATIONS
- ZVS PHASE-SHIFT FULL BRIDGE CONVERTERS FOR SMPS AND WELDING EQUIPMENT

ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP20NM50FD	P20NM50FD	TO-220	TUBE
STB20NM50FD-1	B20NM50FD-1	I²PAK	TUBE

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{GS} = 0)	500	V
V_{DGR}	Drain-gate Voltage (R_{GS} = 20 kΩ)	500	V
V_{GS}	Gate- source Voltage	±30	V
I_D	Drain Current (continuous) at T_C = 25°C	20	A
I_D	Drain Current (continuous) at T_C = 100°C	14	A
I_{DM} (●)	Drain Current (pulsed)	80	A
P_{TOT}	Total Dissipation at T_C = 25°C	192	W
	Derating Factor	1.2	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	20	V/ns
T_{stg}	Storage Temperature	–65 to 150	°C
T_j	Max. Operating Junction Temperature	150	°C

(●) Pulse width limited by safe operating area
(1) $I_{SD} \leq 20A$, di/dt ≤ 200 A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$.

THERMAL DATA

Rthj-case	Thermal Resistance Junction-case	Max	0.65	°C/W
Rthj-amb	Thermal Resistance Junction-ambient	Max	62.5	°C/W
T_l	Maximum Lead Temperature For Soldering Purpose		300	°C

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max)	10	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C, $I_D = I_{AR}$, V_{DD} = 35 V)	700	mJ

ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)

ON/OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	I_D = 250 µA, V_{GS} = 0	500			V
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = Max Rating V_{DS} = Max Rating, T_C = 125 °C			1 10	µA µA
I_{GSS}	Gate-body Leakage Current (V_{DS} = 0)	V_{GS} = ±30V			±100	nA
$V_{GS(th}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static Drain-source On Resistance	V_{GS} = 10V, I_D = 10A		0.22	0.25	Ω

ELECTRICAL CHARACTERISTICS (CONTINUED)
DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$, I_D = 10A		9		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25V, f = 1 MHz, V_{GS} = 0		1380 290 40		pF pF pF
$C_{oss\ eq.}$ (2)	Equivalent Output Capacitance	V_{GS} = 0V, V_{DS} = 0V to 400V		130		pF
R_g	Gate Input Resistance	f=1 MHz Gate DC Bias=0 Test Signal Level=20mV Open Drain		2.8		Ω

(1) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
(2) $C_{oss\ eq.}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DSS}.

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	V_{DD} = 250V, I_D = 10 A R_G = 4.7Ω V_{GS} = 10V (see test circuit, Figure 3)		22 20		ns ns
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD} = 400V, I_D = 20A, V_{GS} = 10V		38 18 10	53	nC nC nC

SWITCHING OFF

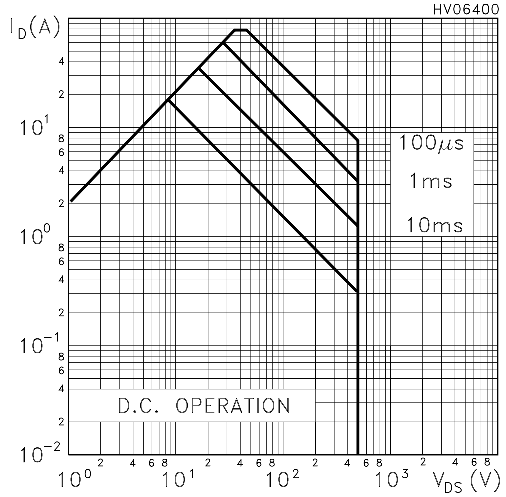
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	V_{DD} = 400V, I_D = 20 A, R_G = 4.7Ω, V_{GS} = 10V (see test circuit, Figure 5)		6 15 30		ns ns ns

SOURCE DRAIN DIODE

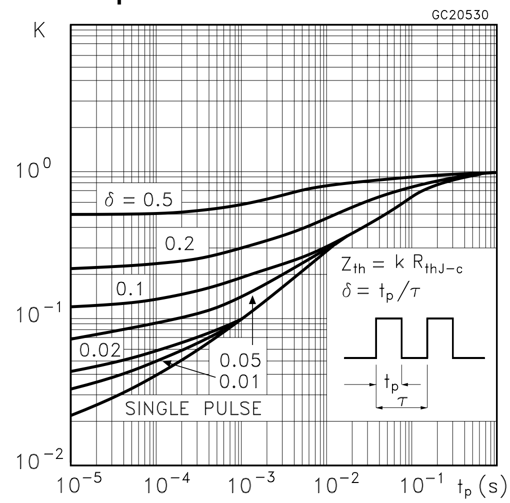
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (2)	Source-drain Current Source-drain Current (pulsed)				20 80	A A
V_{SD} (1)	Forward On Voltage	I_{SD} = 20 A, V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 20 A, di/dt = 100A/µs, V_{DD} = 60V, T_j = 150°C (see test circuit, Figure 5)		245 2 16		ns µC A

Note: 1. Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
2. Pulse width limited by safe operating area.

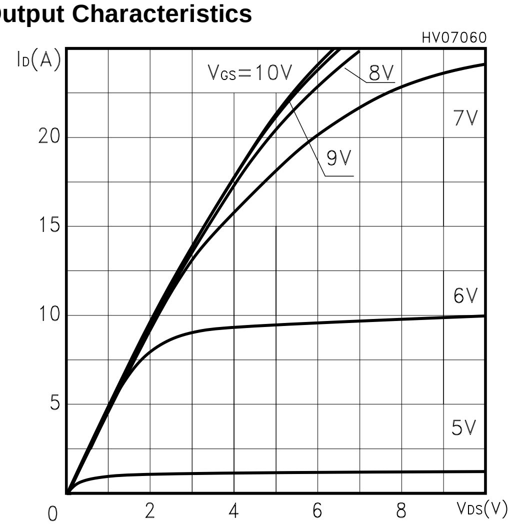
Safe Operating Area For TO-220 / I²PAK



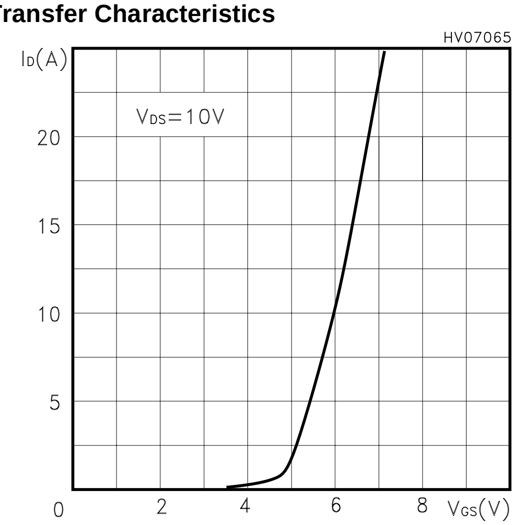
Thermal Impedance For TO-220 / I²PAK



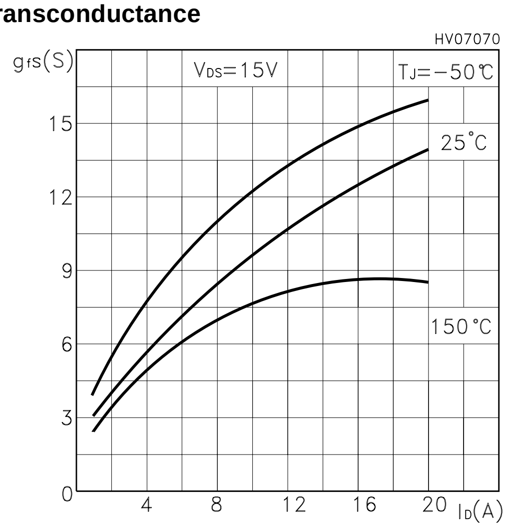
Output Characteristics



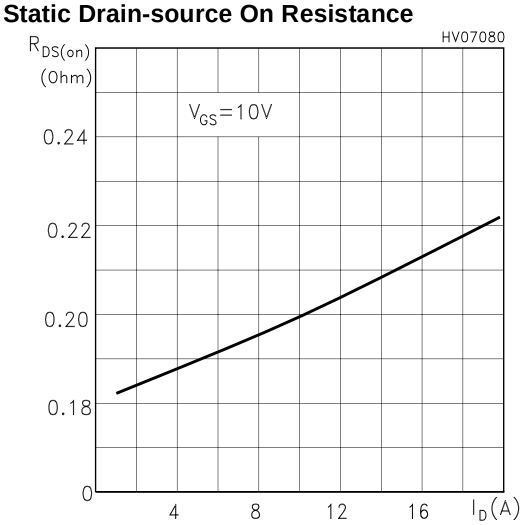
Transfer Characteristics



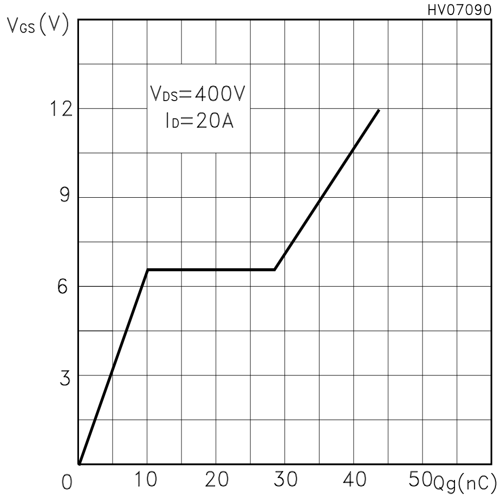
Transconductance



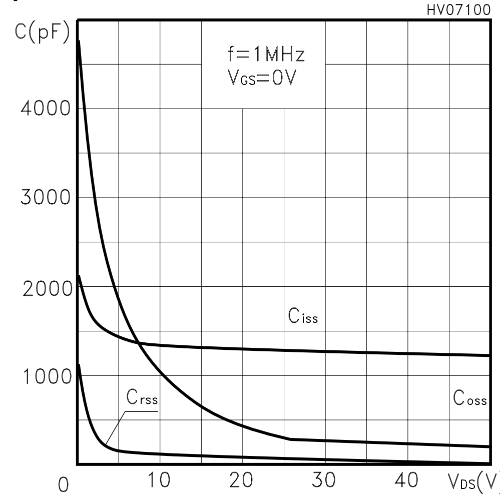
Static Drain-source On Resistance



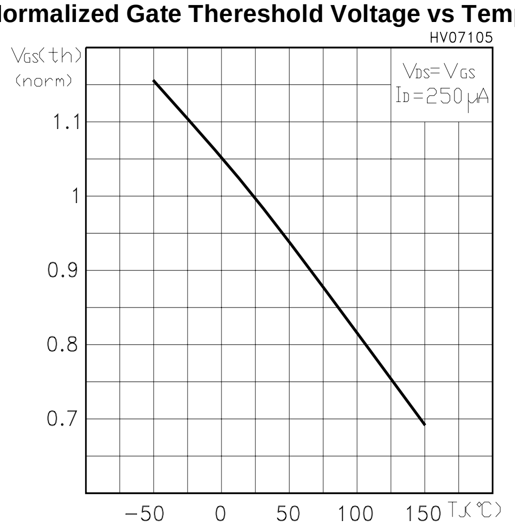
Gate Charge vs Gate-source Voltage



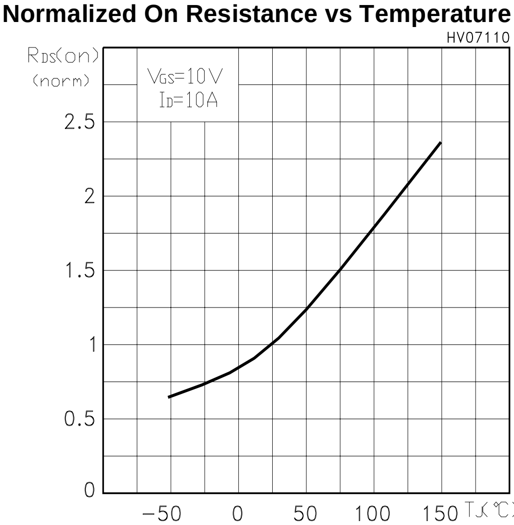
Capacitance Variations



Normalized Gate Thereshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

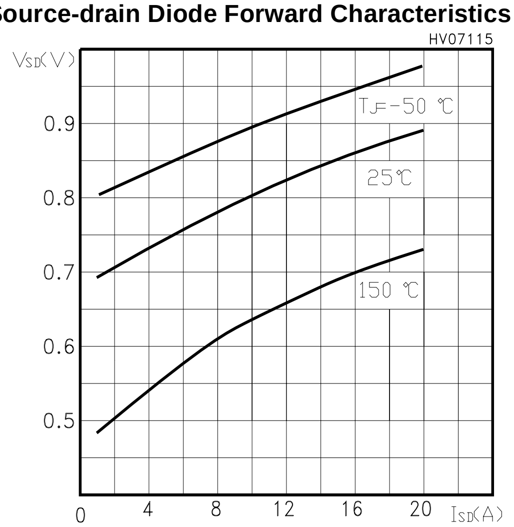


Fig. 1: Unclamped Inductive Load Test Circuit

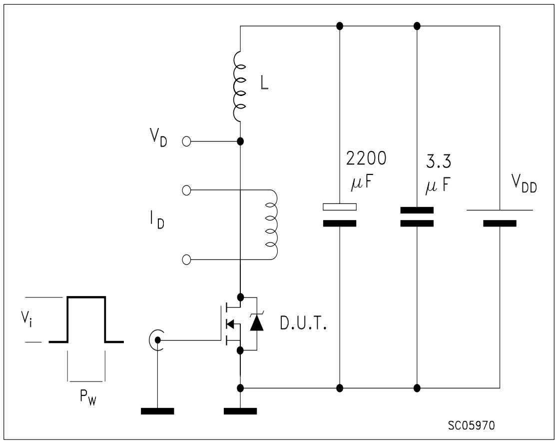


Fig. 2: Unclamped Inductive Waveform

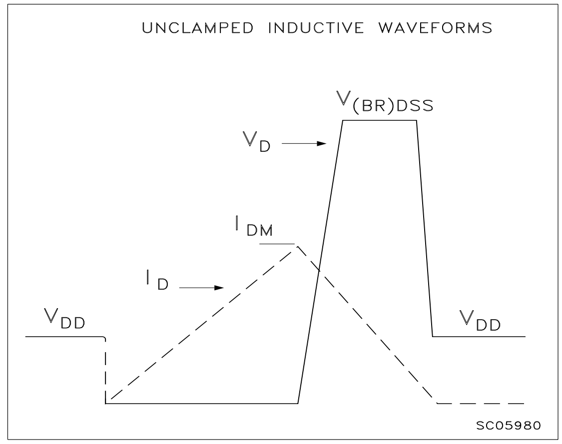


Fig. 3: Switching Times Test Circuit For Resistive Load

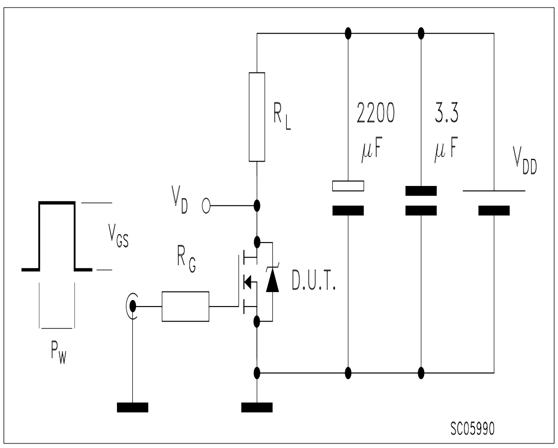


Fig. 4: Gate Charge test Circuit

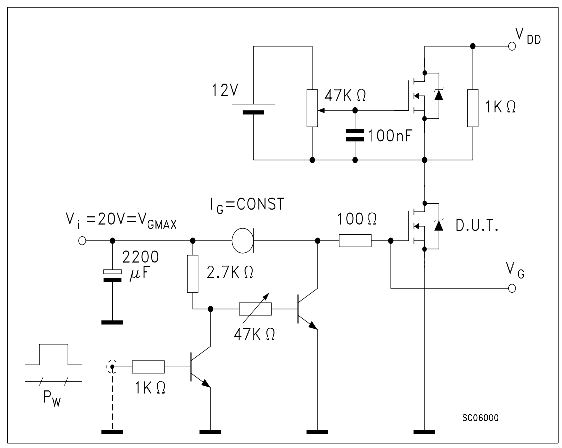
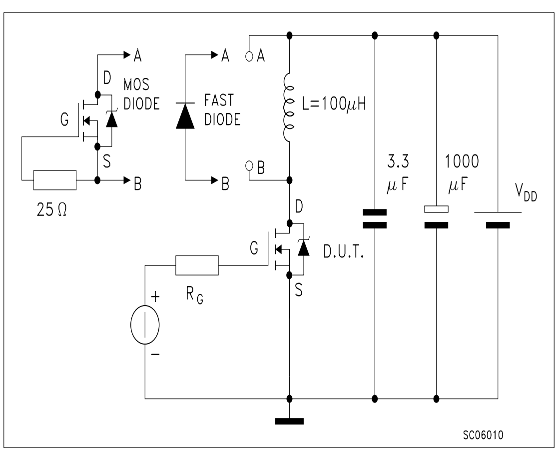
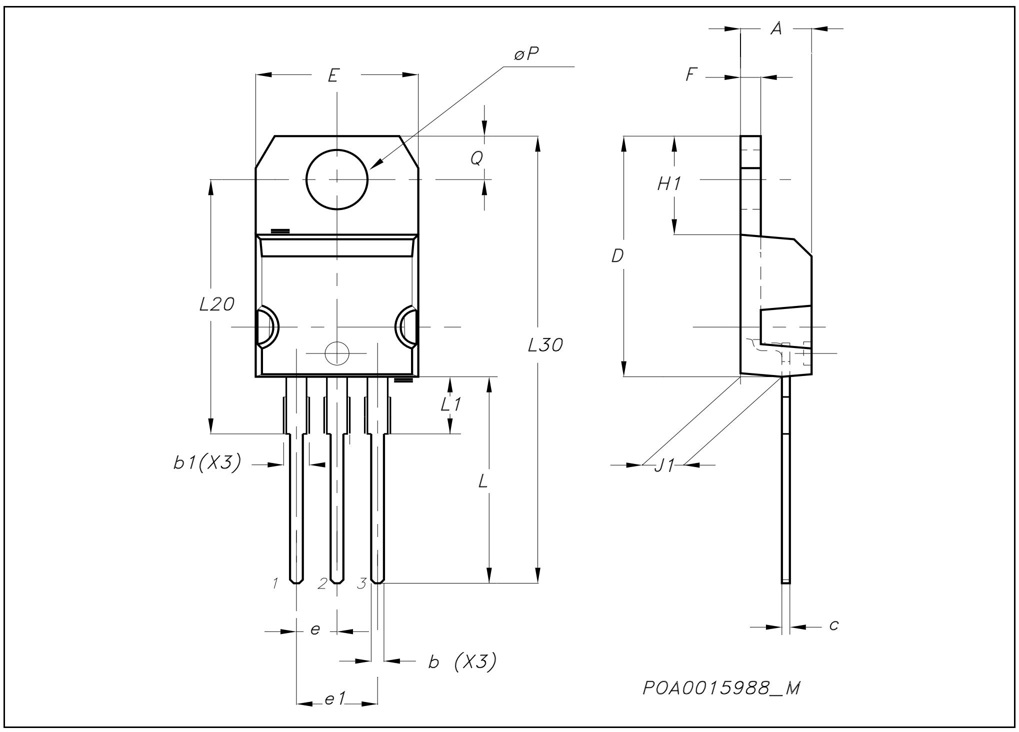


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



TO-220 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



TO-262 (I^2PAK) MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		0.410
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L2	1.27		1.40	0.050		0.055