



## Features

- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low  $R_{DS(on)}$
- Easy to drive and parallel
- Effectively lower down  $T_j$  and  $R_{th}$ , High anti-EMI ability
- RoHS Compliant

## Benefits

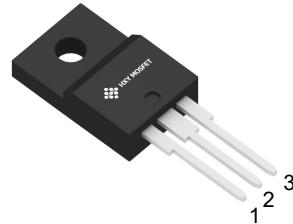
- Increased Power Density
- Faster Operating Frequency
- Reduction of Heat Sink Requirements
- Higher Efficiency
- Reduced EMI

## Applications

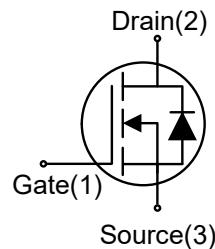
- Power Factor Correction Modules
- Switch Mode Power Supplies
- Power Inverters
- High Voltage DC/DC Converters



Ordering Part Number	Package	Brand
IPA65R190CFDXKSA2	TO-220F	HXY MOSFET



TO-220F



## Maximum Ratings (T<sub>c</sub> = 25 °C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
$V_{DSmax}$	Drain - Source Voltage	650	V	
$V_{GSmax}$	Gate - Source Voltage (dynamic)	-5/+26	V	
$V_{GSop}$	Gate - Source Voltage (static)	0/+15	V	
$I_D$	Continuous Drain Current	20	A	$T_C = 25^\circ\text{C}$
		16.5		$T_C = 100^\circ\text{C}$
$I_{D(pulse)}$	Pulsed Drain Current	30	A	Pulse width $t_P$ limited by $T_{jmax}$
$P_D$	Power Dissipation	52	W	$T_C = 25^\circ\text{C}$
		25		$T_C = 100^\circ\text{C}$
$T_J, T_{stg}$	Operating Junction and Storage Temperature	-55 to +175	°C	



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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(\text{BR})\text{DSS}}$	Drain-Source Breakdown Voltage	650		850	V	$V_{\text{GS}} = 0 \text{ V}, I_{\text{D}} = 1 \text{ mA}$	
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current		2	100	$\mu\text{A}$	$V_{\text{GS}} = 0 \text{ V}, V_{\text{DS}} = 750 \text{ V}$	
$I_{\text{GSS}+}$	Gate-Source Leakage Current			200	nA	$V_{\text{DS}} = 0 \text{ V}, V_{\text{GS}} = +22 \text{ V}$	
$I_{\text{GSS}-}$	Gate-Source Leakage Current			200	nA	$V_{\text{DS}} = 0 \text{ V}, V_{\text{GS}} = -10 \text{ V}$	
$V_{\text{GS}(\text{th})}$	Gate Threshold Voltage	2.2	3.5	4.2	V	$V_{\text{GS}} = V_{\text{DS}}, I_{\text{DS}} = 1 \text{ mA}, T_J = 25^\circ\text{C}$	Fig. 14
			2.6			$V_{\text{GS}} = V_{\text{DS}}, I_{\text{DS}} = 1 \text{ mA}, T_J = 175^\circ\text{C}$	
$R_{\text{DS}(\text{on})}$	Static Drain-Source On-Resistance		160	180	$\text{m}\Omega$	$V_{\text{GS}} = 15 \text{ V}, I_{\text{D}} = 6 \text{ A}, T_J = 25^\circ\text{C}$	Fig. 15
			195			$V_{\text{GS}} = 15 \text{ V}, I_{\text{D}} = 6 \text{ A}, T_J = 175^\circ\text{C}$	
$C_{\text{iss}}$	Input Capacitance		208		pF	$V_{\text{DS}} = 400 \text{ V}, f = 1 \text{ MHz}, V_{\text{GS}} = 0 \text{ V}$	Fig. 8
$C_{\text{oss}}$	Output Capacitance		18				
$C_{\text{rss}}$	Reverse Transfer Capacitance		1.8				
$Q_g$	Total Gate Charge		10.6		nC	$V_{\text{DD}} = 400 \text{ V}, V_{\text{GS}} = -5/18 \text{ V}, I_{\text{D}} = 5 \text{ A}$	Fig. 7
$Q_{\text{gs}}$	Gate-Source Charge		5.1				
$Q_{\text{gd}}$	Gate-Drain Charge		2.2				
$R_{\text{G}(\text{int})}$	Gate Input Resistance		1.2		$\Omega$	$f = 1 \text{ MHz}, I_{\text{D}} = 0 \text{ A}$	
$E_{\text{on}}$	Turn-On Switching Energy		25		$\mu\text{J}$	$V_{\text{DD}} = 400 \text{ V}, I_{\text{D}} = 5 \text{ A}, R_{\text{G}} = 10 \Omega, V_{\text{GS}} = -5/18 \text{ V}$	Fig. 12
$E_{\text{off}}$	Turn-Off Switching Energy		10				
$t_{\text{d}(\text{on})}$	Turn-On Delay Time		5		ns	$V_{\text{DD}} = 400 \text{ V}, I_{\text{D}} = 5 \text{ A}, R_{\text{G}} = 10 \Omega, V_{\text{GS}} = -5/18 \text{ V}$	
$t_r$	Rise Time		17				
$t_{\text{d}(\text{off})}$	Turn-Off Delay Time		8				
$t_f$	Fall Time		10				



### Reverse SiC Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
$V_{SD}$	Diode Forward Voltage	4.0		V	$V_{GS} = -4V, I_{SD} = 5A, T_J = 25^\circ C$	Fig. 16
		3.6			$V_{GS} = -4 V, I_{SD} = 5 A, T_J = 175^\circ C$	Fig. 17
$*I_{SD}$	Continuous Diode Forward Current		18	A	$T_c = 25^\circ C$	
			10		$T_c = 175^\circ C$	
$t_{rr}$	Reverse Recovery Time	50		ns	$I_{SD} = 5 A, di/dt = 1000 A/\mu s,$ $V_{DD} = 400 V, V_{GS} = -5 V$	
$Q_{rr}$	Reverse Recovery Charge	38		nC		
$I_{RRM}$	Peak Reverse Recovery Current	2.4		A		

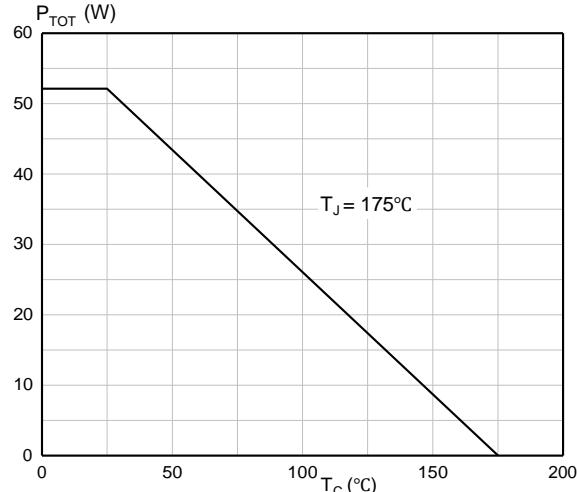
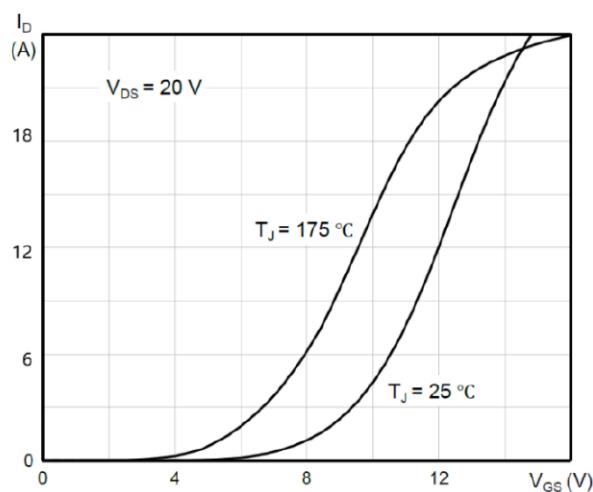
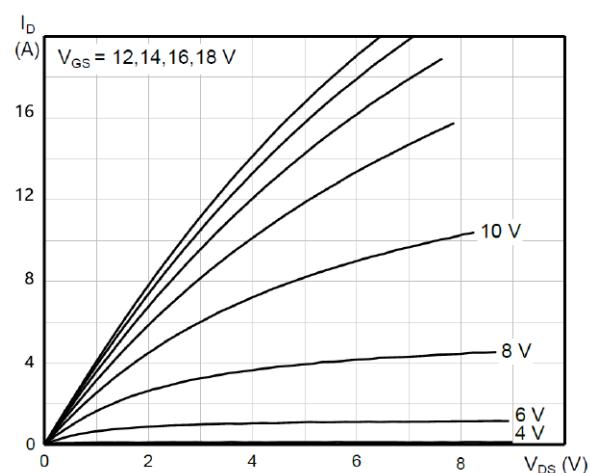
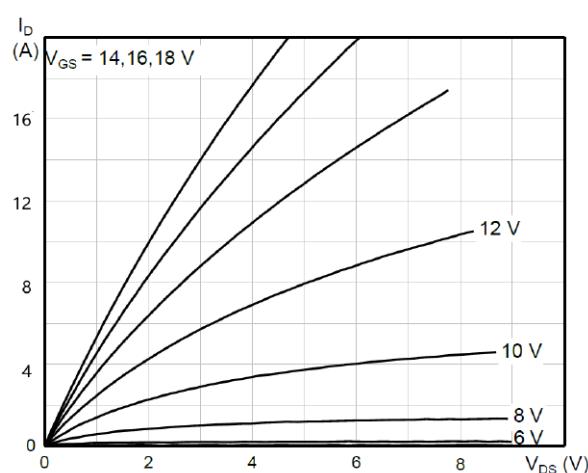
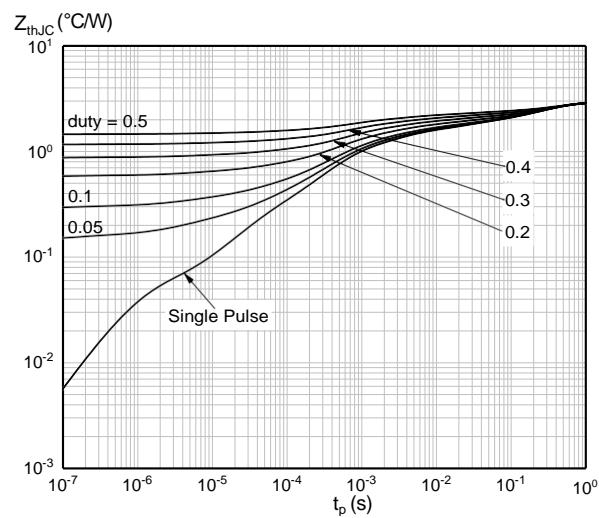
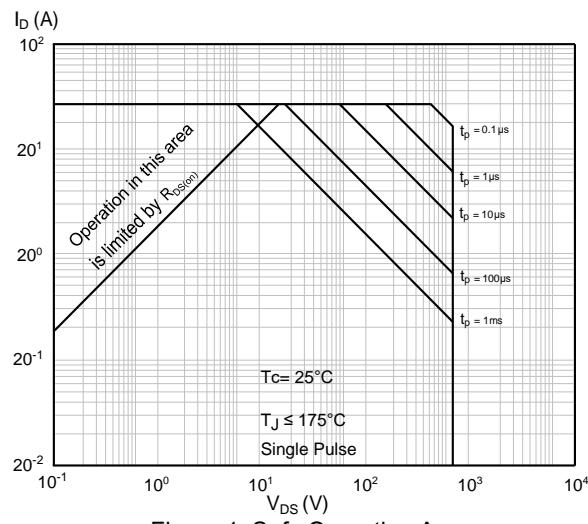
\* Depends on bonding wire

### Thermal Characteristics

Symbol	Parameter	Typ.	Unit	Test Conditions	Note
$R_{thJC}$	Thermal Resistance from Junction to Case	2.88	°C/W		Fig. 2
$R_{thJA}$	Thermal Resistance From Junction to Ambient	40			



## Typical Performance



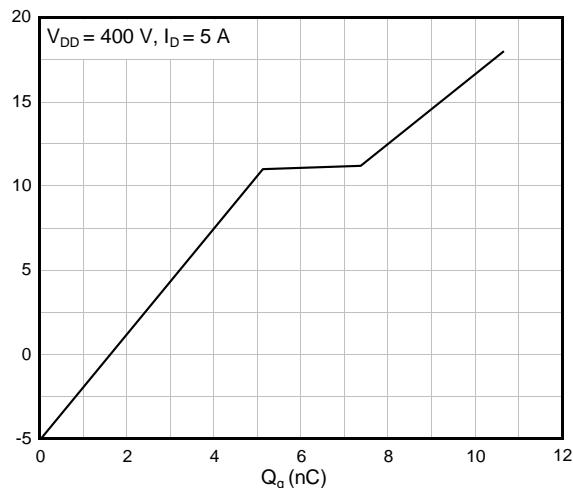


Figure 7. Typical Gate Charge Characteristics

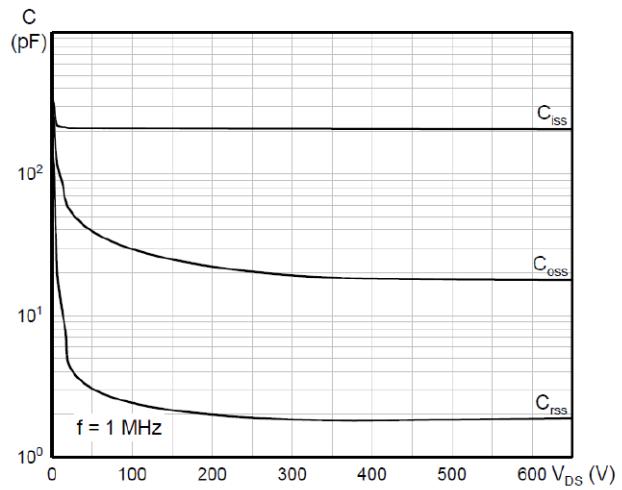


Figure 8. Typical Capacitance Characteristics

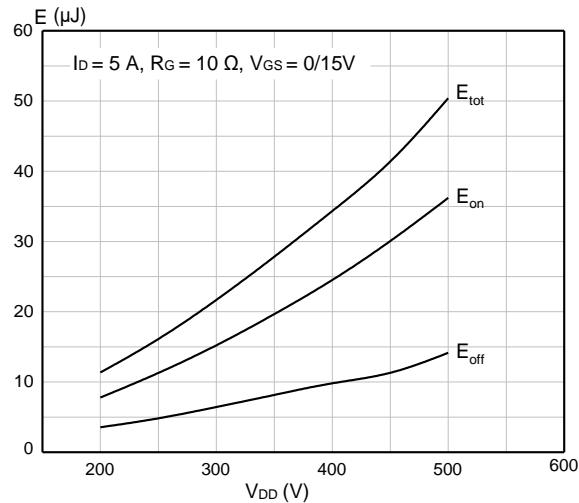


Figure 9. Typical Switching Energy vs. Supply Voltage

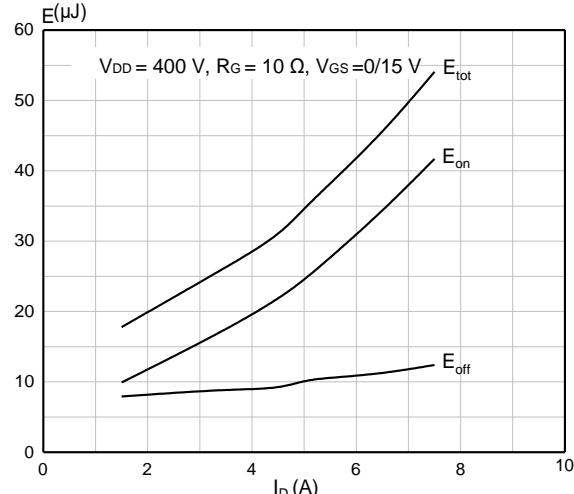


Figure 10. Typical Switching Energy vs. Drain Current

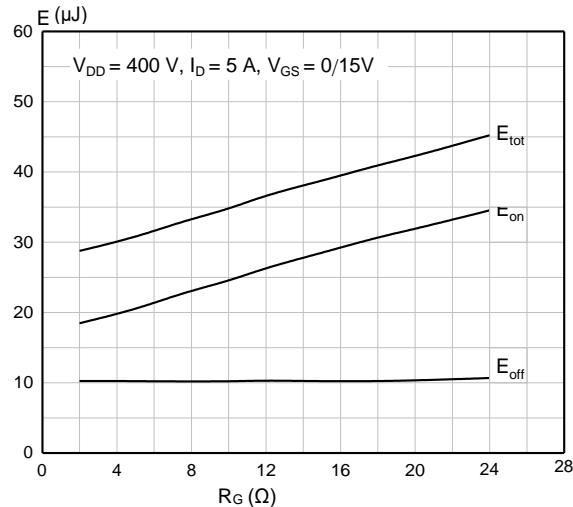


Figure 11. Switching Energy vs. Gate Resistance

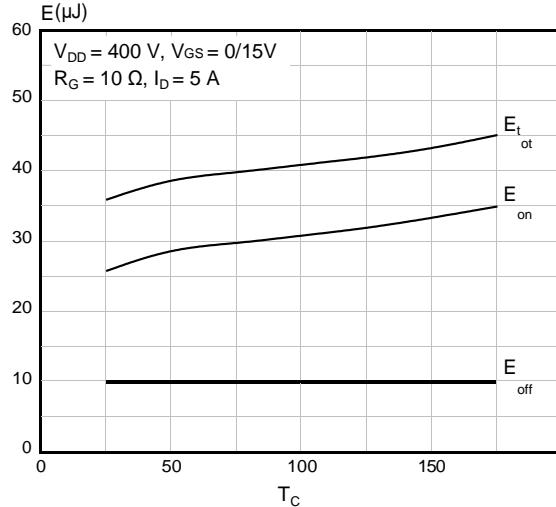


Figure 12. Typical Switching Energy vs. Temperature

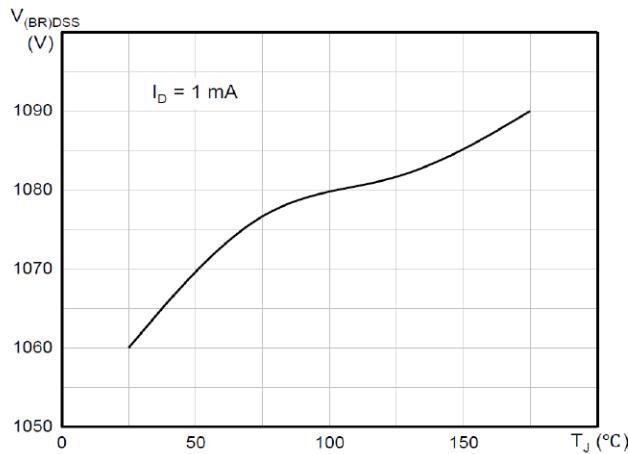


Figure 13. Breakdown Voltage vs. Temperature

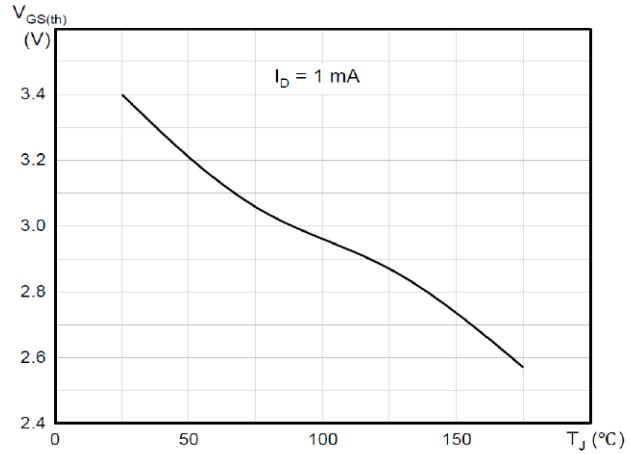


Figure 14. Gate Threshold vs. Temperature

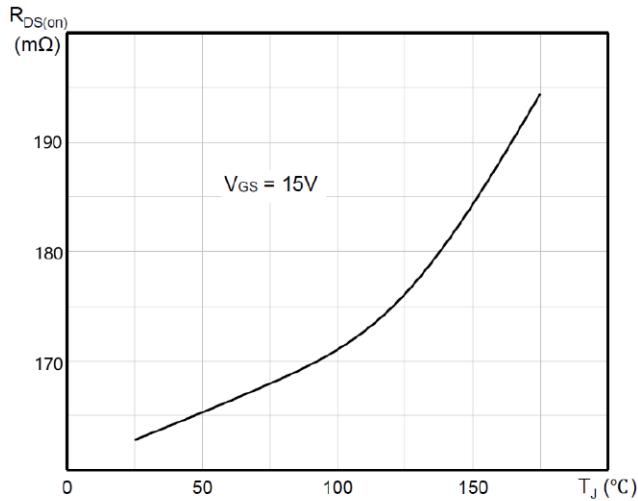


Figure 15. On-Resistance vs. Temperature

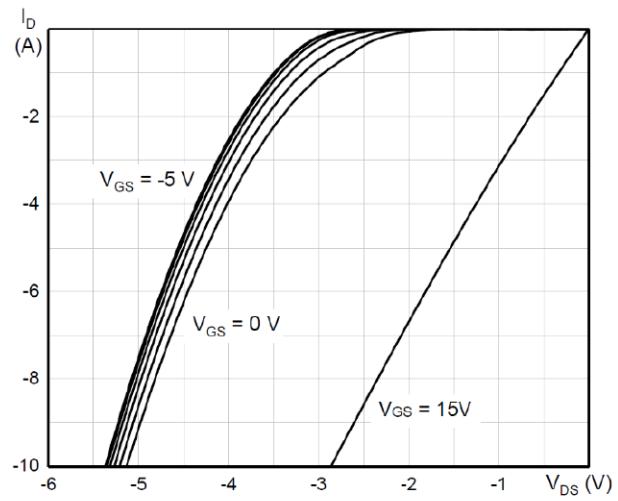
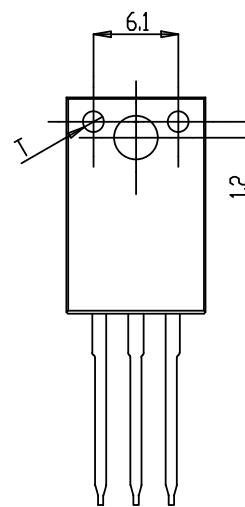
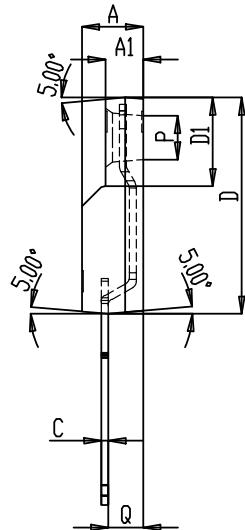
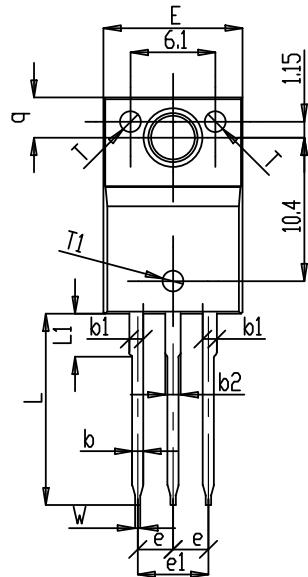


Figure 16. Body Diode Characteristics,  $T_J=25^\circ\text{C}$



## Package Dimensions

Package TO-220F



SYMBOL	MILLIMETERS			NOTES	SYMBOL	MILLIMETERS			NOTES
	Normal	MIN.	MAX.			Normal	MIN.	MAX.	
A	4.4	4.2	4.6		e1	5.08	5	5.12	
A1	2.7	2.5	2.9		L	13.90	13.5	14.4	
b	0.8	0.7	0.9		L1	3.12	2.8	3.3	
b1	1.07	0.9	1.3		P	3.14	3.00	3.20	
b2	1.17	1	1.4		Q	2.44	2.3	2.6	
C	0.5	0.4	0.6		q	2.87	2.6	3	
D	15.63	15.4	15.8		W	0.37	0.3	0.5	
D1	6.22	6	6.4		T	1.52	1.3	1.7	
E	10.06	9.7	10.3		T1	1.20	1.1	1.3	
e	2.54	2.5	2.58						



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