

TSM1412CU6 RF-VB Datasheet

N-Channel 30 V (D-S) MOSFET

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^{a, e}	Q_g (Typ.)
30	0.023 at $V_{GS} = 10$ V	4.5	4.2 nC
	0.027 at $V_{GS} = 4.5$ V	4.0	

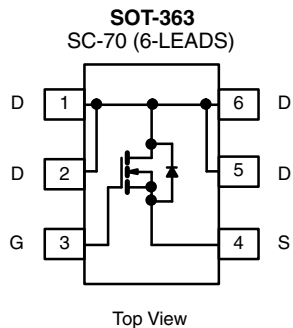
FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFET
- Low On-Resistance
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC


RoHS
 COMPLIANT

APPLICATIONS

- DC/DC Converters, High Speed Switching



ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	30	V
Gate-Source Voltage	V_{GS}	± 20	
Continuous Drain Current ($T_J = 150^\circ\text{C}$)	I_D	$T_C = 25^\circ\text{C}$ 4.5 ^e	A
		$T_C = 70^\circ\text{C}$ 4.0 ^e	
		$T_A = 25^\circ\text{C}$ 4.1 ^{b, c}	
		$T_A = 70^\circ\text{C}$ 3.6 ^{b, c}	
Pulsed Drain Current ($t = 300 \mu\text{s}$)	I_{DM}	25	A
Continuous Source-Drain Diode Current	I_S	$T_C = 25^\circ\text{C}$ 2.1	
		$T_A = 25^\circ\text{C}$ 1.1 ^{b, c}	
Maximum Power Dissipation	P_D	$T_C = 25^\circ\text{C}$ 2.5	W
		$T_C = 70^\circ\text{C}$ 1.6	
		$T_A = 25^\circ\text{C}$ 1.3 ^{b, c}	
		$T_A = 70^\circ\text{C}$ 0.8 ^{b, c}	
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature)		260	

THERMAL RESISTANCE RATINGS

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{b, d}	R_{thJA}	75	100	$^\circ\text{C/W}$
Maximum Junction-to-Foot (Drain)	R_{thJF}	40	50	

Notes:

a. Based on $T_C = 25^\circ\text{C}$.

b. Surface mounted on 1" x 1" FR4 board.

c. $t = 5$ s.

d. Maximum under steady state conditions is 166 $^\circ\text{C/W}$.

e. Package limited.

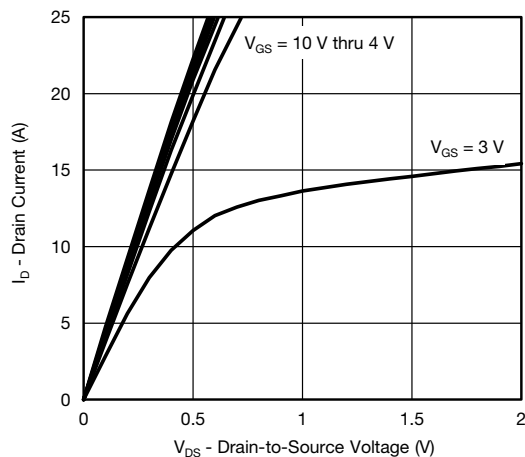
SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	30			V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA		30		mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J			- 4.8		
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	0.5		2.5	V
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 30 V, V _{GS} = 0 V			1	μA
		V _{DS} = 30 V, V _{GS} = 0 V, T _J = 70 °C			10	
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≤ 5 V, V _{GS} = 10 V	20			A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V, I _D = 3.5 A		0.023		Ω
		V _{GS} = 4.5 V, I _D = 3 A		0.027		
Forward Transconductance ^a	g _{fs}	V _{DS} = 15 V, I _D = 3.5 A		24		S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{DS} = 15 V, V _{GS} = 0 V, f = 1 MHz		424		pF
Output Capacitance	C _{oss}			100		
Reverse Transfer Capacitance	C _{rss}			42		
Total Gate Charge	Q _g	V _{DS} = 15 V, V _{GS} = 10 V, I _D = 3.5 A		8.2	13	nC
		V _{DS} = 15 V, V _{GS} = 4.5 V, I _D = 3.5 A		4.2	7	
Gate-Source Charge	Q _{gs}			1.4		
Gate-Drain Charge	Q _{gd}			1.4		
Gate Resistance	R _g	f = 1 MHz	2.5	12.6	25.2	Ω
Turn-On Delay Time	t _{d(on)}	V _{DD} = 15 V, R _L = 3.4 Ω I _D ≅ 4.4 A, V _{GEN} = 4.5 V, R _g = 1 Ω		6	12	ns
Rise Time	t _r			20	30	
Turn-Off Delay Time	t _{d(off)}			14	21	
Fall Time	t _f			10	20	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 15 V, R _L = 3.4 Ω I _D ≅ 4.4 A, V _{GEN} = 10 V, R _g = 1 Ω		3	6	
Rise Time	t _r			11	20	
Turn-Off Delay Time	t _{d(off)}			20	30	
Fall Time	t _f			7	14	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C			2.1	A
Pulse Diode Forward Current	I _{SM}				25	
Body Diode Voltage	V _{SD}	I _S = 4.4 A, V _{GS} = 0 V		0.82	1.2	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = 4.4 A, dI/dt = 100 A/μs, T _J = 25 °C		13	20	ns
Body Diode Reverse Recovery Charge	Q _{rr}			6	12	nC
Reverse Recovery Fall Time	t _a			8		ns
Reverse Recovery Rise Time	t _b			5		

Notes:

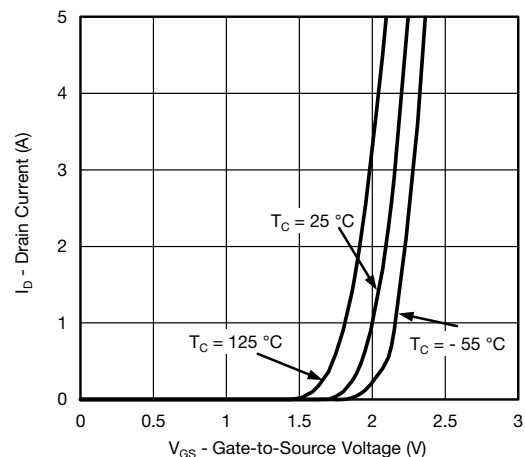
a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

b. Guaranteed by design, not subject to production testing.

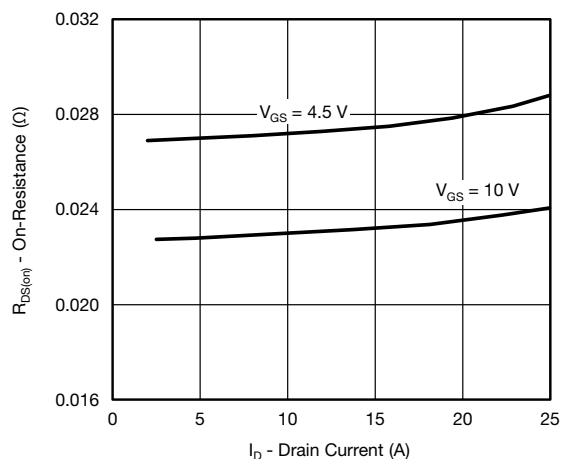
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)


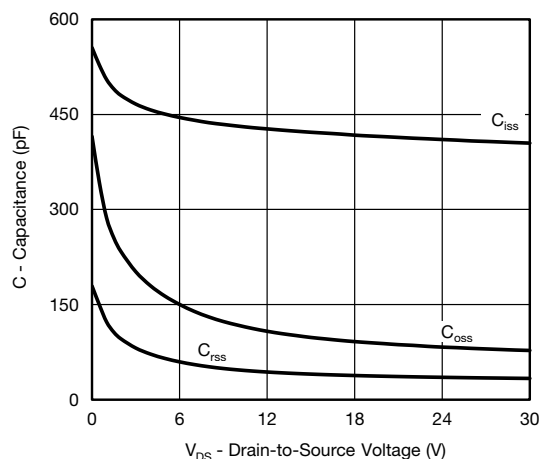
Output Characteristics



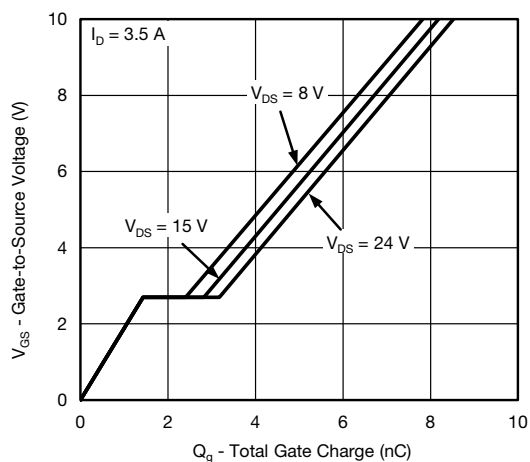
Transfer Characteristics



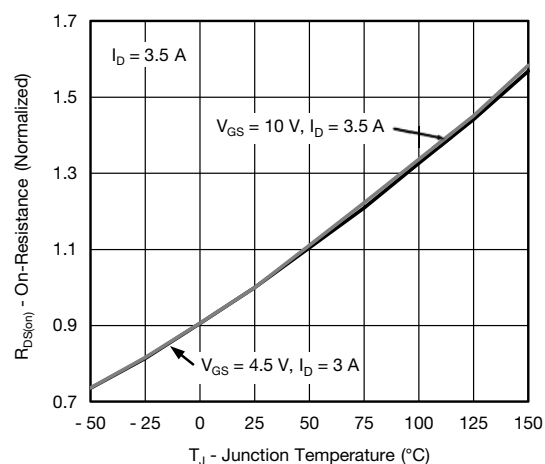
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

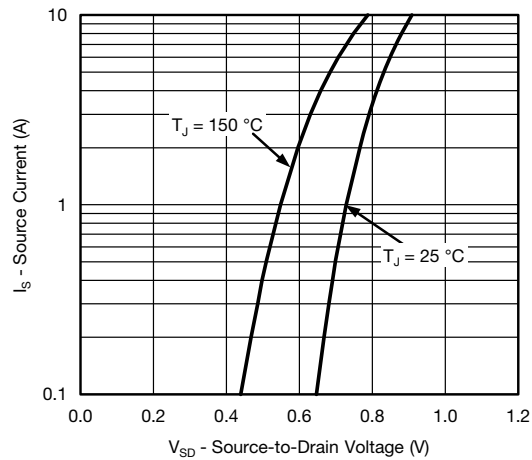


Gate Charge

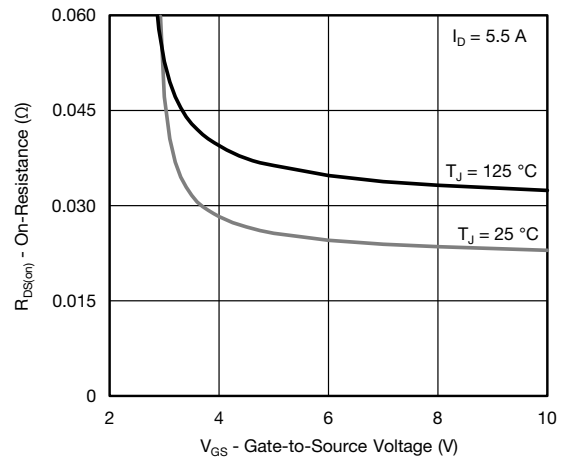


On-Resistance vs. Junction Temperature

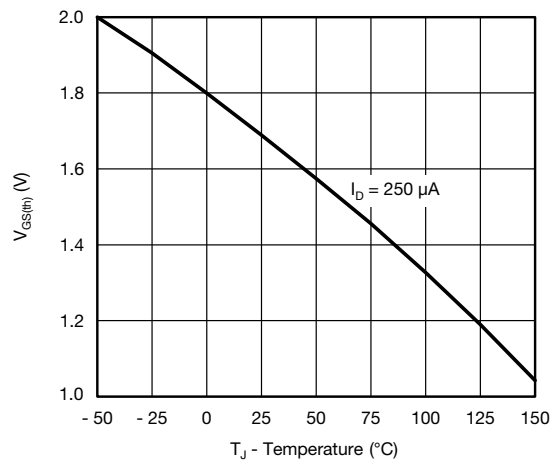
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



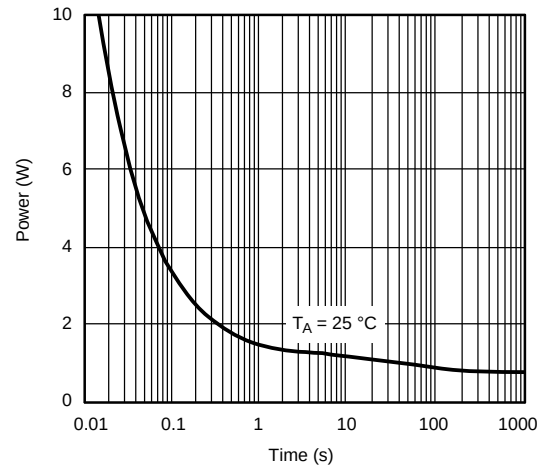
Source-Drain Diode Forward Voltage



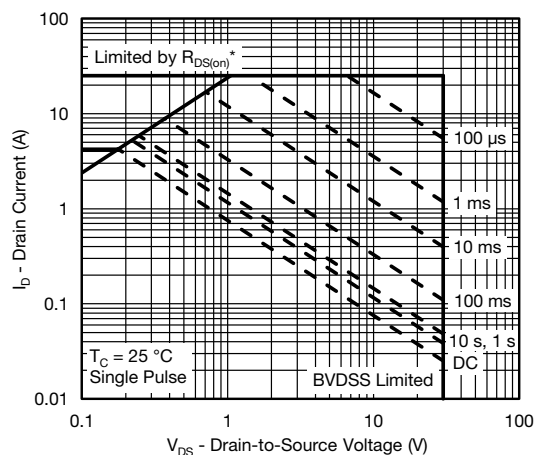
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

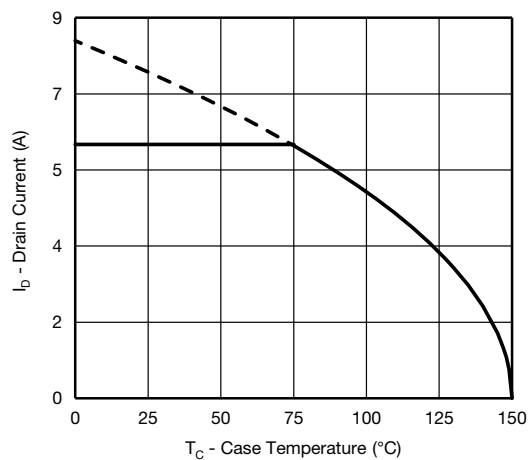
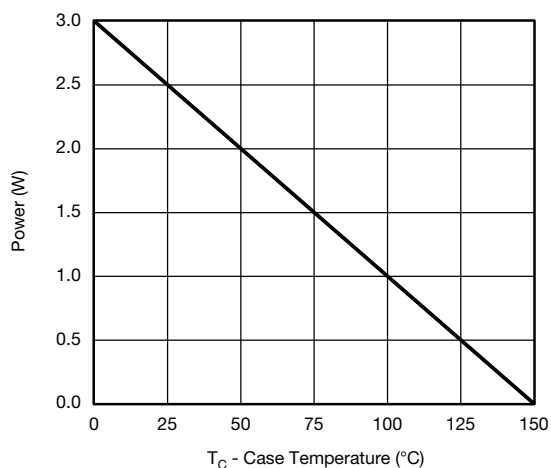
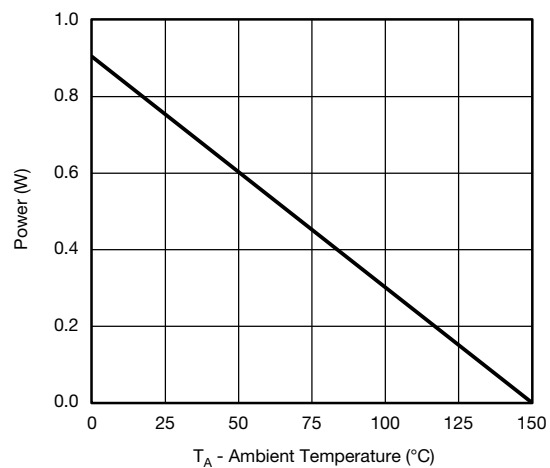


Single Pulse Power (Junction-to-Ambient)

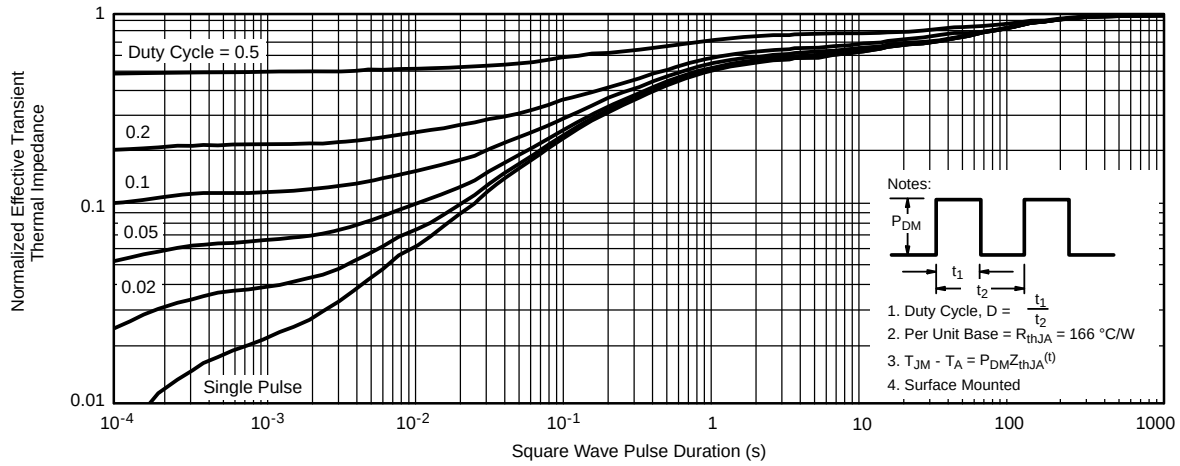
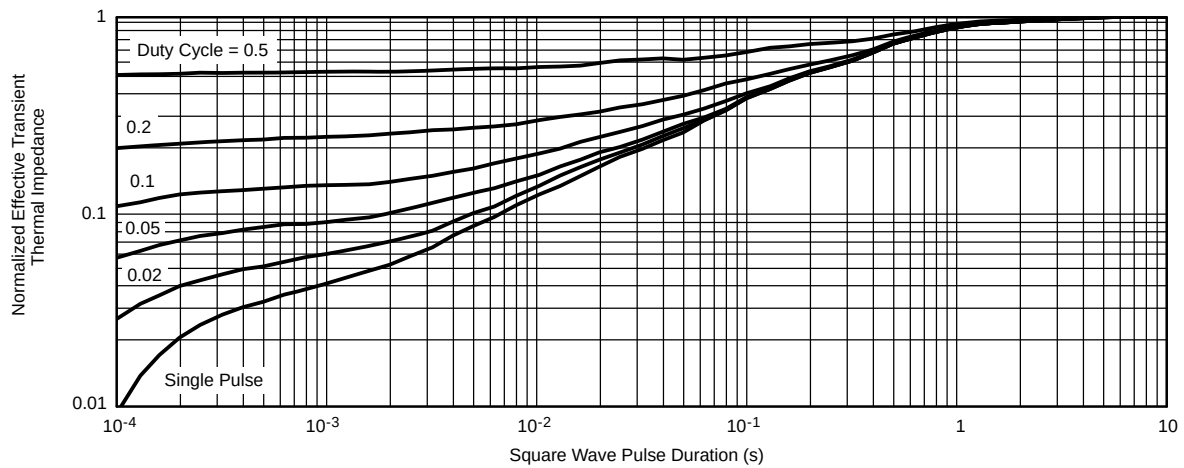


* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

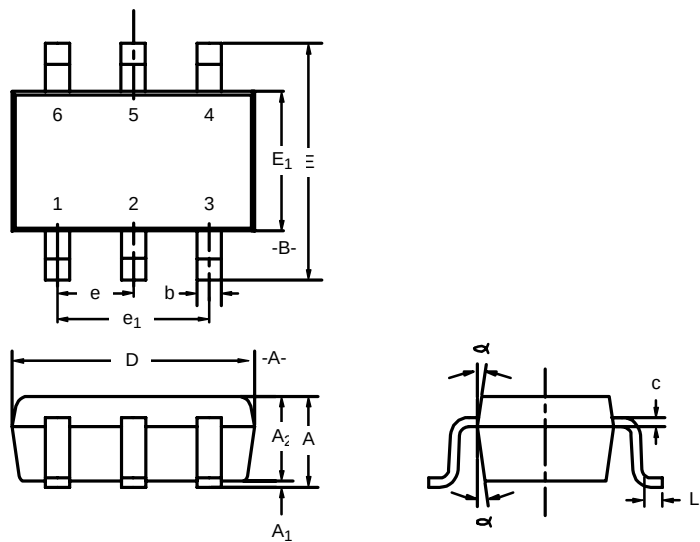
Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Current Derating*

Power Derating, Junction-to-Foot

Power Derating, Junction-to-Ambient

* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

Normalized Thermal Transient Impedance, Junction-to-Ambient

Normalized Thermal Transient Impedance, Junction-to-Foot

SC-70: 6-LEADS



	MILLIMETERS			INCHES		
Dim	Min	Nom	Max	Min	Nom	Max
A	0.90	—	1.10	0.035	—	0.043
A ₁	—	—	0.10	—	—	0.004
A ₂	0.80	—	1.00	0.031	—	0.039
b	0.15	—	0.30	0.006	—	0.012
c	0.10	—	0.25	0.004	—	0.010
D	1.80	2.00	2.20	0.071	0.079	0.087
E	1.80	2.10	2.40	0.071	0.083	0.094
E ₁	1.15	1.25	1.35	0.045	0.049	0.053
e	0.65BSC			0.026BSC		
e ₁	1.20	1.30	1.40	0.047	0.051	0.055
L	0.10	0.20	0.30	0.004	0.008	0.012
α	7°Nom			7°Nom		
ECN: S-03946—Rev. B, 09-Jul-01 DWG: 5550						

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