



Features

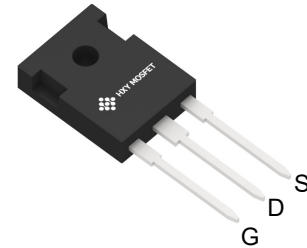
- 3rd generation SiC MOSFET technology
- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Halogen free, RoHS compliant

Benefits

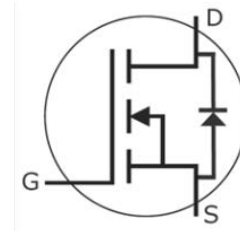
- Reduce switching losses and minimize gate ringing
- Higher system efficiency
- Reduce cooling requirements
- Increase power density
- Increase system switching frequency

Applications

- Renewable energy
- EV battery chargers
- High voltage DC/DC converters
- Switch Mode Power Supplies



TO-247



Ordering Part Number	Package	Marking
HC1M60120D	TO-247	HC1M60120D

Maximum Ratings ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	1200	V
Continuous drain current $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$	I_D	40 28	A
Pulsed drain current ($T_C = 25^\circ\text{C}$, t_p limited by T_{jmax})	$I_{D \text{ pulse}}$	80	A
Avalanche energy, single pulse ($L=10\text{mH}$)	E_{AS}	600	mJ
Gate-Source voltage	V_{GS}	-4/+18	V
Gate-Source voltage (Absolute maximum values)	V_{GSmax}	-8/+22	V
Power dissipation ($T_C = 25^\circ\text{C}$)	P_{tot}	214	W
Operating junction and storage temperature	T_J, T_{stg}	-55...+175	$^\circ\text{C}$

●Example of acceptable V_{GS} waveform





Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal resistance, junction – case. Max	R_{thJC}	0.70	°C/W
Thermal resistance, junction – ambient. Max	R_{thJA}	40	

Electrical Characteristic (at $T_J = 25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		

Static Characteristic

Drain-source breakdown voltage	BV_{DSS}	1200	-	-	V	$V_{GS}=0V, I_D=100\mu A$
Gate threshold voltage	$V_{GS(th)}$	2.3	2.8	3.6	V	$V_{DS}=V_{GS}, I_D=5mA$
Zero gate voltage drain current	I_{DSS}	-	1	10	μA	$V_{DS}=1200V, V_{GS}=0V$ $T_C=25^\circ C$
		-	5	-		$T_C=175^\circ C$
Gate-source leakage current	I_{GSS}	-		100	nA	$V_{GS}=18V, V_{DS}=0V$
Drain-source on-state resistance	$R_{DS(on)}$	-	60	75	m Ω	$V_{GS}=18V, I_D=20A,$ $T_J=25^\circ C$
		-	120	-		$T_J=175^\circ C$
Transconductance	g_{fs}	-	10	-	S	$V_{DS}=20V, I_D=20A$

Dynamic Characteristic

Input Capacitance	C _{iss}	-	940	-	pF	V _{DS} = 1000V V _{GS} = 0V T _J = 25°C V _{AC} = 25mV f = 1MHz
Output Capacitance	C _{oss}	-	59	-		
Reverse Transfer Capacitance	C _{rss}	-	4.1	-		
Gate Total Charge	Q _G	-	42	-	nC	V _{DS} = 800V V _{GS} = -4/18V I _D = 20A
Gate-Source charge	Q _{gs}	-	8	-		
Gate-Drain charge	Q _{gd}	-	20	-		
Turn-On Switching Energy	E _{ON}	-	330	-	μJ	V _{DD} = 800V V _{GS} = -4/+15V I _D = 20A R _G = 0Ω L = 120uH
Turn-Off Switching Energy	E _{OFF}	-	51	-		
Turn-on delay time	t _{d(on)}	-	21	-	ns	
Rise time	t _r	-	23	-		
Turn-off delay time	t _{d(off)}	-	16	-		
Fall time	t _f	-	19	-		
Gate resistance	R _G	-	1.7	-	Ω	V _{AC} = 25mV, f=1MHz



Body Diode Characteristic

Parameter	Symbol	Value			Unit	Test Condition
		min.	typ.	max.		
Body Diode Forward Voltage	V_{SD}		4.3		V	$V_{GS}=-4V, I_{SD}=10A,$ $T_J=25^{\circ}C$
			3.8			$V_{GS}=-4V, I_{SD}=10A,$ $T_J=175^{\circ}C$
Body Diode Reverse Recovery Time	t_{rr}	-	43	-	ns	$V_R = 800V, V_{GS} = -4V$ $I_D = 20A$ $di/dt = 700A/\mu S$ $T_J = 150^{\circ}C$
Body Diode Reverse Recovery Charge	Q_{rr}	-	413	-	nC	

Typical Performance Characteristics

Fig 1. Output Characteristic ($T_J=-40^{\circ}C$)

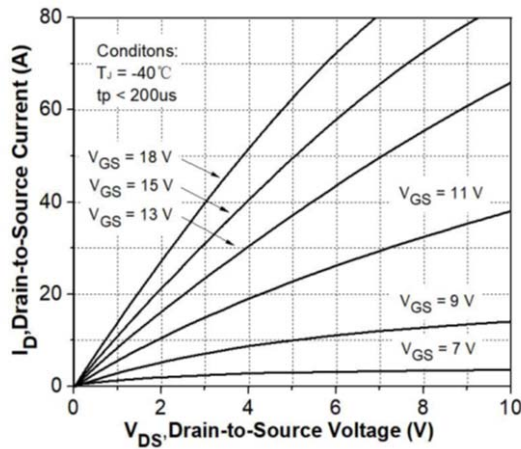


Fig 2. Output Characteristic ($T_J=25^{\circ}C$)

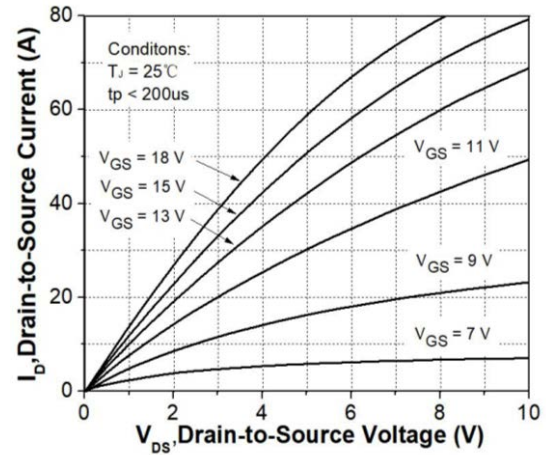


Fig 3. Output Characteristic ($T_J=175^{\circ}C$)

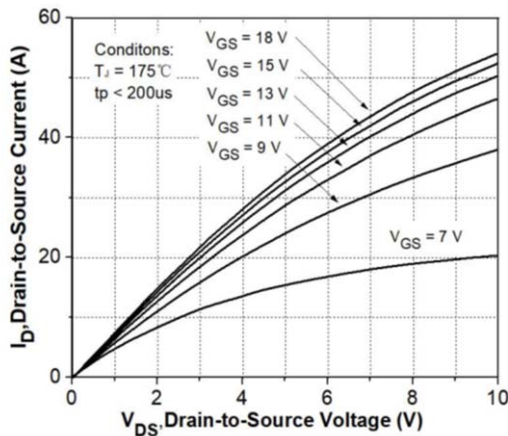


Fig 4: $R_{DS(on)}$ Vs I_{DS} Characteristic

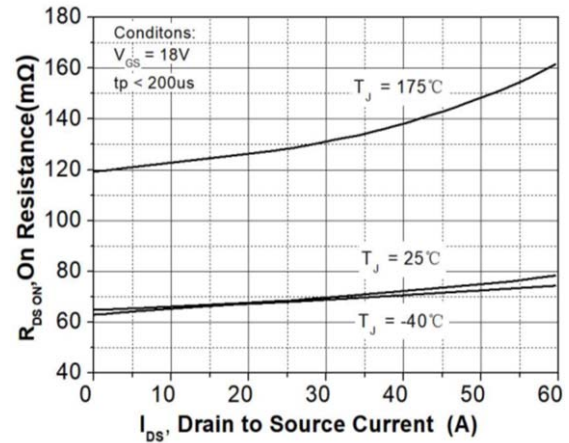




Fig 5: $R_{ds(on)}$ vs. Temperature

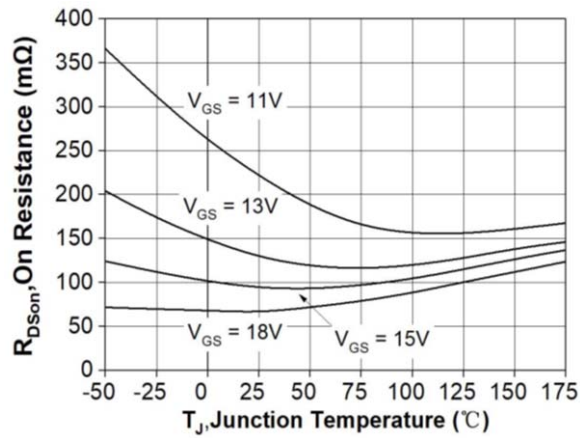


Fig 6: Transfer Characteristic

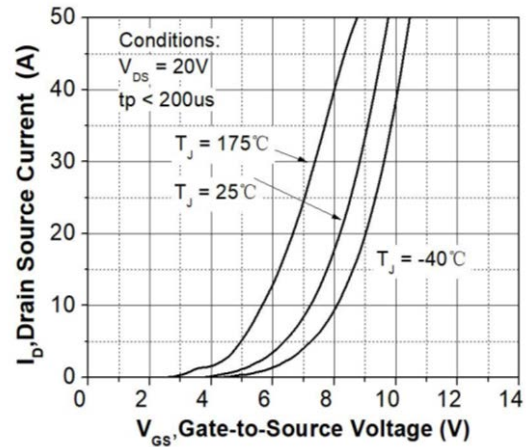


Fig 7: Body-diode Characteristic ($T_J = -40^{\circ}C$)

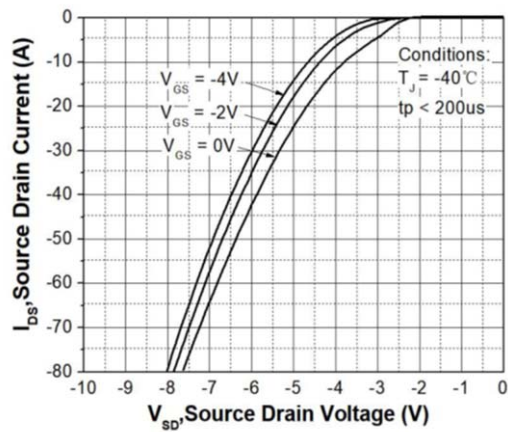


Fig 8: Body-diode Characteristic ($T_J = 25^{\circ}C$)

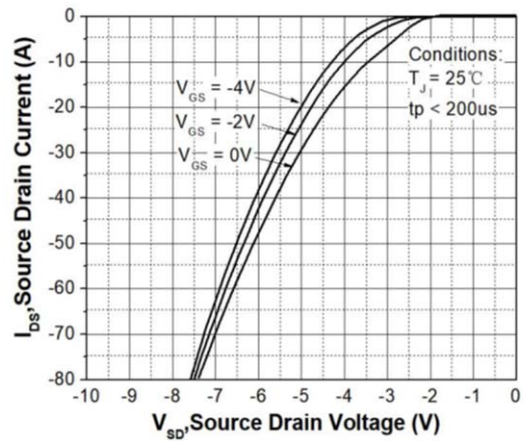


Fig 9: Body-diode Characteristic ($T_J = 175^{\circ}C$)

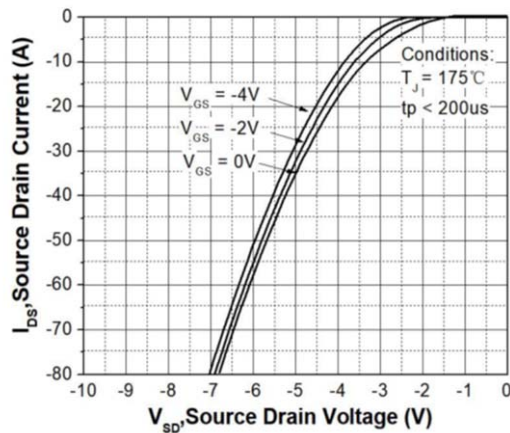


Fig 10: V_{TH} Vs T_J Temperature Characteristic

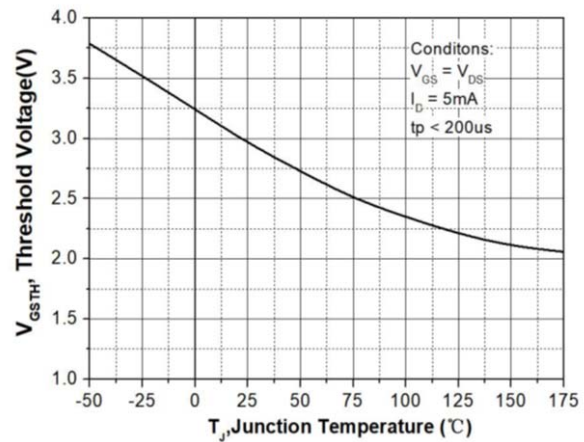




Fig 11: Gate Charge Characteristics

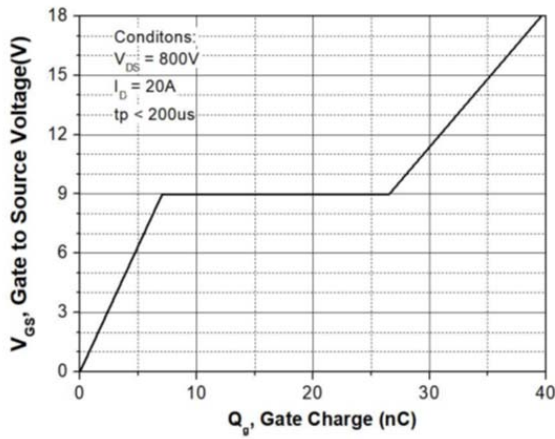


Fig 12: 3rd Quadrant Characteristic($T_J = -40^\circ C$)

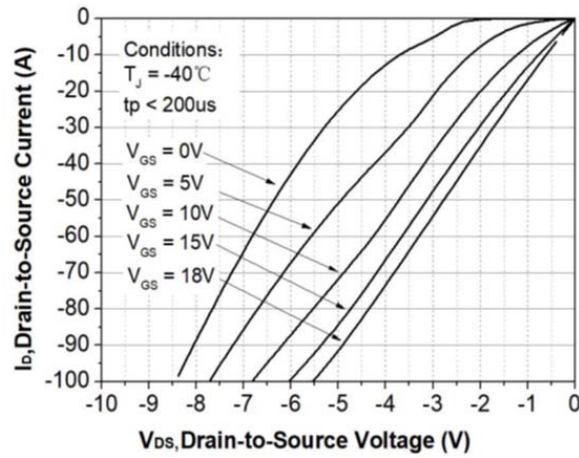


Fig 13: 3rd Quadrant Characteristic($T_J = 25^\circ C$)

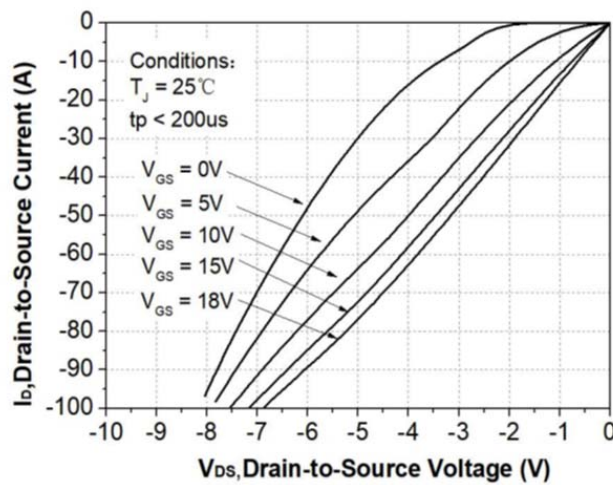


Fig 14: 3rd Quadrant Characteristic($T_J = 175^\circ C$)

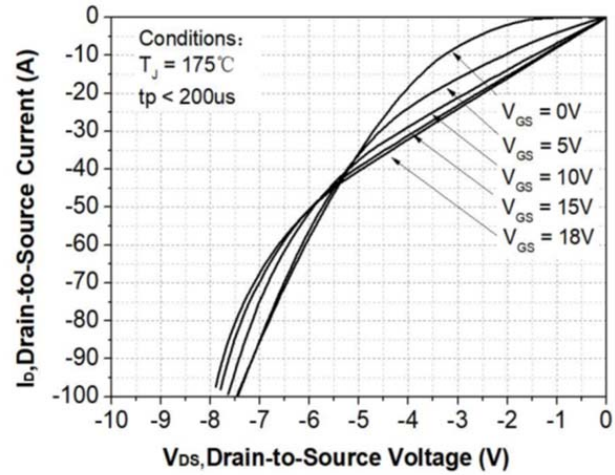


Fig 15: Capacitance Characteristic

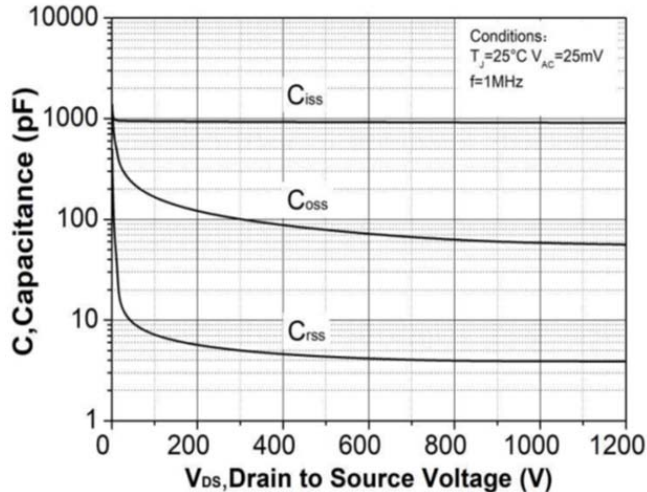


Fig 16: Safe Operating Area

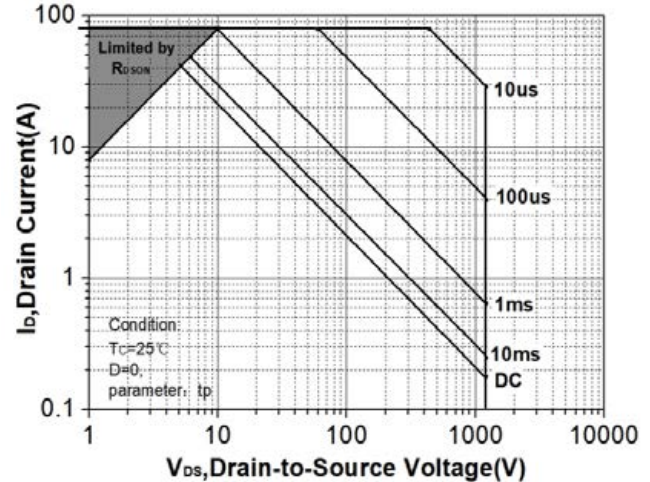
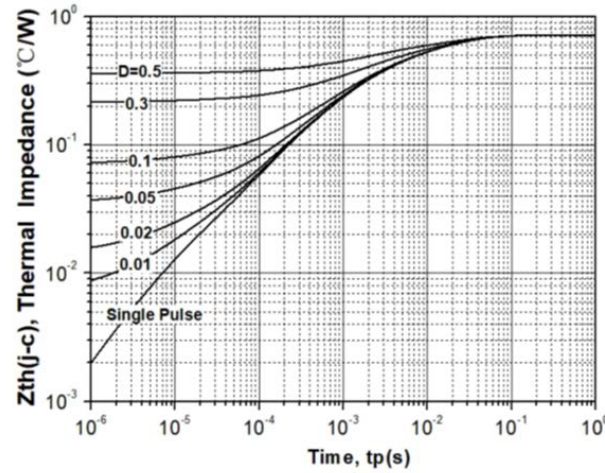




Fig 17: Transient Thermal Impedance



Test Circuit & Waveform

Figure A. Definition of switching times

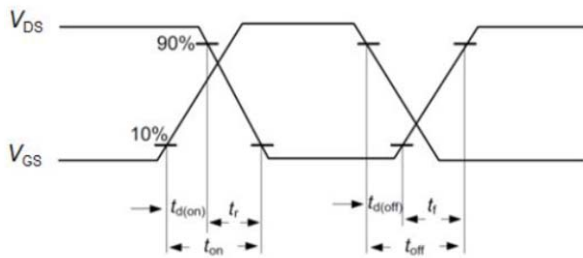


Figure B. Dynamic test circuit

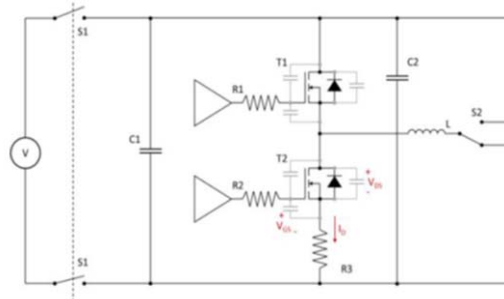


Figure C. Definition of body diodeswitching characteristics

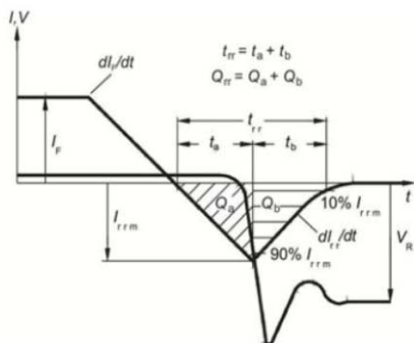
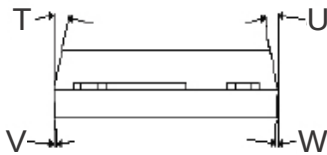
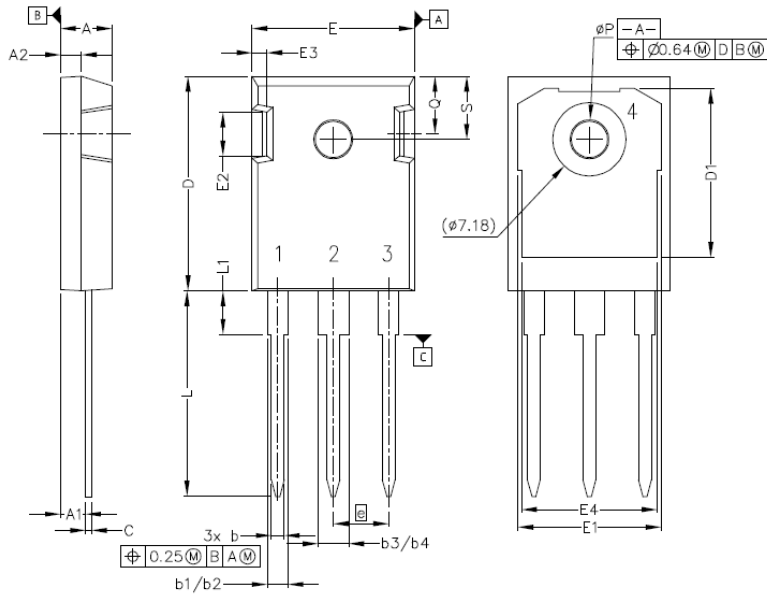


Figure C. Definition of diode switching characteristics



Package Dimensions

Package TO-247

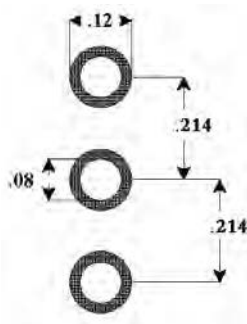


Pinout Information:

- Pin 1 = Gate
- Pin 2, 4 = Drain
- Pin 3 = Source

POS	Inches		Millimeters	
	Min	Max	Min	Max
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.042	.052	1.07	1.33
b1	.075	.095	1.91	2.41
b2	.075	.085	1.91	2.16
b3	.113	.133	2.87	3.38
b4	.113	.123	2.87	3.13
c	.022	.027	0.55	0.68
D	.819	.831	20.80	21.10
D1	.640	.695	16.25	17.65
D2	.037	.049	0.95	1.25
E	.620	.635	15.75	16.13
E1	.516	.557	13.10	14.15
E2	.145	.201	3.68	5.10
E3	.039	.075	1.00	1.90
E4	.487	.529	12.38	13.43
e	.214 BSC		5.44 BSC	
N	3		3	
L	.780	.800	19.81	20.32
L1	.161	.173	4.10	4.40
ØP	.138	.144	3.51	3.65
Q	.216	.236	5.49	6.00
S	.238	.248	6.04	6.30
T	9°	11°	9°	11°
U	9°	11°	9°	11°
V	2°	8°	2°	8°
W	2°	8°	2°	8°

Recommended Solder Pad Layout



TO-247



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