MOSFET - N-Channel Silicon Carbide

Product Preview
NTBG040N120SC1
1200 V, 40.7 mΩ, 99.5 A

ON Semiconductor®

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter		Symbol	Value	Unit
Drain–to–Source Voltage		V_{DSS}	1200	V
Gate–to–Source Voltage		V_{GS}	+25/–15	V
Continuous Drain Current $R_{\theta JC}$	T_C = 25°C	I_{DC}	99.5	A
Power Dissipation $R_{\theta JC}$		P_{DC}	614	W
Continuous Drain Current $R_{\theta JC}$	T_C = 100°C	I_{DC}	70.3	A
Power Dissipation $R_{\theta JC}$		P_{DC}	307	W
Continuous Drain Current $R_{\theta JA}$	T_A = 25°C	I_{DA}	TBD	A
Power Dissipation $R_{\theta JA}$		P_{DA}	TBD	W
Continuous Drain Current $R_{\theta JA}$	T_A = 100°C	I_{DA}	TBD	A
Power Dissipation $R_{\theta JA}$		P_{DA}	TBD	W
Pulsed Drain Current $R_{\theta JC}$	T_C = 25°C, t_p = 10 μs	I_{DM}	443	A
Operating Junction and Storage Temperature Range		T_J, T_{stg}	−55 to +175	°C
Source Current (Body Diode)		I_S	129	A
Single Pulse Avalanche Energy (T_J = 25°C, V_{GS} = 20 V, I_{LPK} = 1 A, L = 0.1 mH, R_G = 25 Ω)		E_{AS}	TBD	mJ
Lead Temperature for Soldering Purposes		T_L	TBD	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.
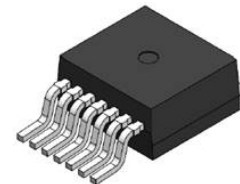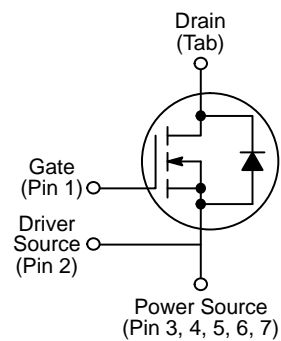
THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction–to–Case	$R_{\theta JC}$	0.24	°C/W
Thermal Resistance, Junction–to–Ambient	$R_{\theta JA}$	TBD	

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

$V_{(BR)DSS}$	$R_{DS(on)}$	I_D MAX
1200 V	40.7 mΩ @ 20 V	99.5 A

N–CHANNEL MOSFET

Drain (Tab)
Gate (Pin 1)
Driver Source (Pin 2)
Power Source (Pin 3, 4, 5, 6, 7)

D2PAK–7L
CASE 418AY

ORDERING INFORMATION

Device	Package	Shipping
NTBG040N120SC1	D²PAK	TBD

October, 2019 – Rev. P0

Publication Order Number:
NTBG040N120SC1/D

NTBG040N120SC1

ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain–to–Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 2.50e – 04A, T_C = 25°C	1200	–	–	V
Drain–to–Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSSTj}$	V_{GS} = 0 V, I_D = 2.50e – 04A, T_{Jmax} = 175°C	–	0.25	–	V/°C
Zero Gate Voltage Drain Current	I_{DSS}	T_C = 25°C	–	–	10.0	µA
		T_C = 175°C	–	–	250	
Gate–to–Source Leakage Current	I_{GSS}	V_G = 20 V, V_D = 0 V	–	–	250	nA
ON CHARACTERISTICS						
Drain–to–Source On Resistance	$R_{DS(on)}$	V_G = 20 V, I_D = 39.9 A	–	40.7	–	mΩ
Gate Threshold Voltage	$V_{GS(th)}$	V_G = V_D, I_D = 9.99e – 0.3 A	–	2.83	–	V
Gate Threshold Voltage Temperature Coefficient	$V_{GS(th)}/T_J$		–	–5.37	–	mV/°C
Forward Transconductance	g_{FS}	V_D = 10.0 V, I_D = 39.9 A	–	16.2	–	S
CHARGES, CAPACITANCES & GATE RESISTANCE						
Gate Resistance	R_G	V_G = 0 V, V_D = 600 V	–	2.23	–	Ω
Input Capacitance	C_{ISS}		–	2426	–	pF
Reverse Transfer Capacitance	C_{RSS}		–	7.69	–	
Output Capacitance	C_{OSS}		–	164	–	
Effective Output Capacitance	C_{OSSef}	V_{DS} = 0 to 600 V, V_G = 0 V	–	281	–	
Energy Related Output Capacitance	C_{OSSer}		–	201	–	
Coss Stored Energy	E_{OSS}		–	36.3	–	µJ
Total Gate Charge	$Q_{G(tot)}$	V_D = 960 V, I_D = 20 A, V_G = 20 V	–	91.2	–	nC
Gate–to–Source Charge	Q_{GS}		–	20.8	–	
Gate–to–Drain Charge	Q_{GD}		–	24.0	–	
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(on)}$	V_G = –5/20 V, I_D = 40 A, V_D = 960 V, R_G = 6 Ω	–	25.3	–	ns
Turn-Off Delay Time	$t_{d(off)}$		–	29.3	–	
Rise Time	t_r		–	6.75	–	
Fall Time	t_f		–	8.96	–	
Turn-On Switching Loss	E_{ON}		–	0.59	–	mJ
Turn-Off Switching Loss	E_{OFF}		–	0.12	–	
Total Switching Loss	E_{TOT}		–	0.70	–	
SOURCE–TO–DRAIN DIODE CHARACTERISTICS						
Forward Diode Voltage	V_{SD}	I_D = 20 A	–	3.89	–	V
Reverse Recovery Time	t_{RR}	I_D = 40 A, dI/dt = 1000 A/µs, V_{DS} = 960 V, V_{GS} = –5/20 V	–	74.5	–	ns
Reverse Recovery Charge	Q_{RR}		–	283	–	nC
Reverse Recovery Energy	E_{REC}		–	82.8	–	µJ
Peak Reverse Recovery Current	I_{RRM}		–	9.27	–	A

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL CHARACTERISTICS

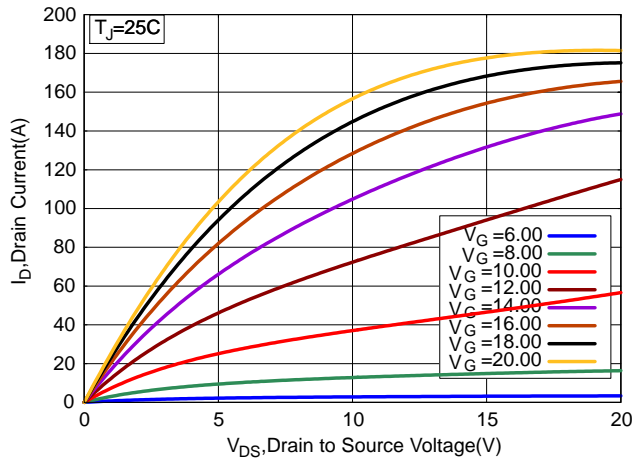**Figure 1. On−Region Characteristics**

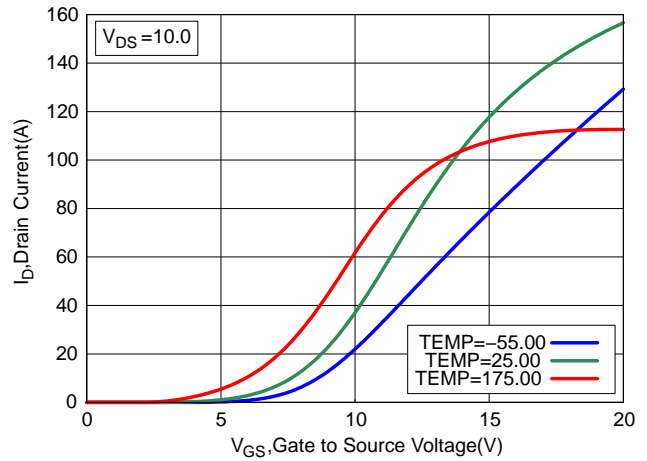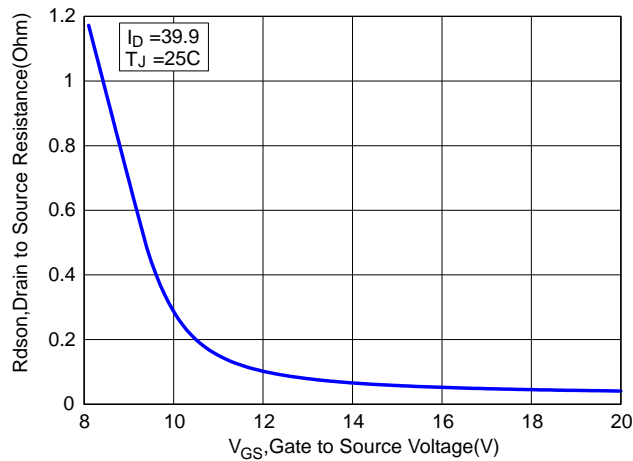**Figure 2. Transfer Characteristics**
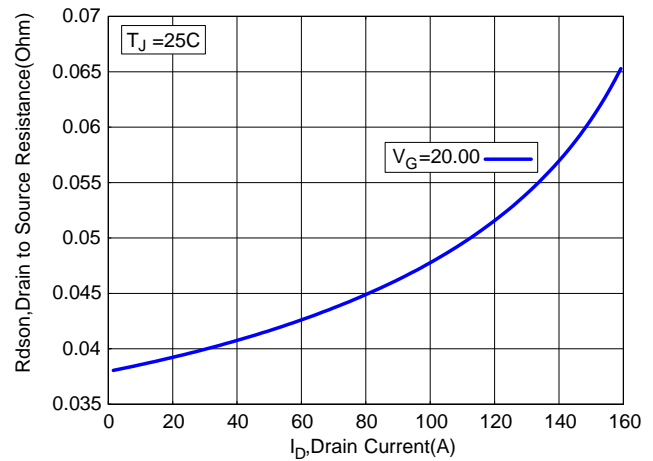

Figure 3. On−Resistance vs. VGS

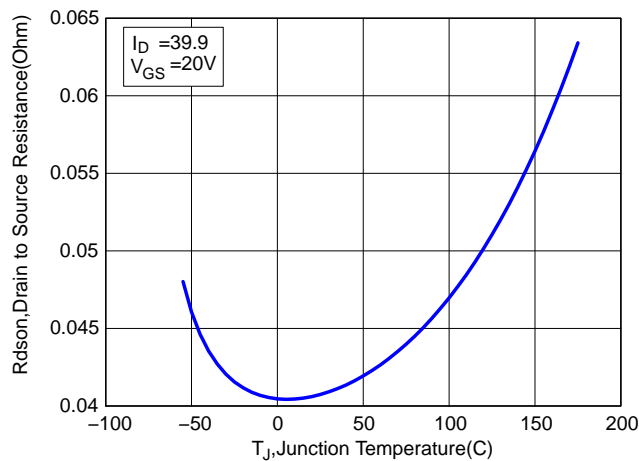**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**
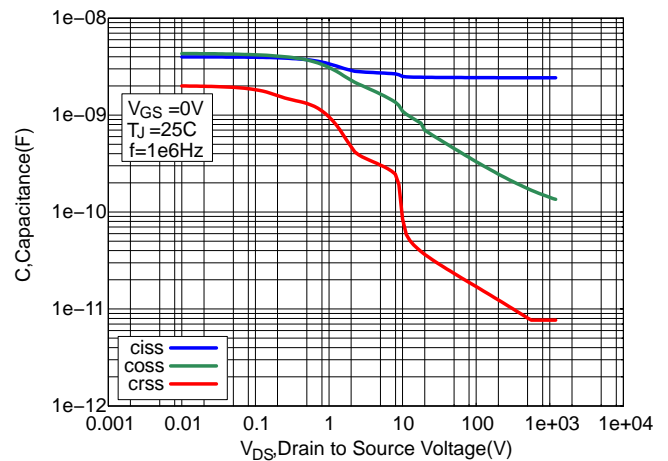

Figure 5. On−Resistance Variation with Temperature

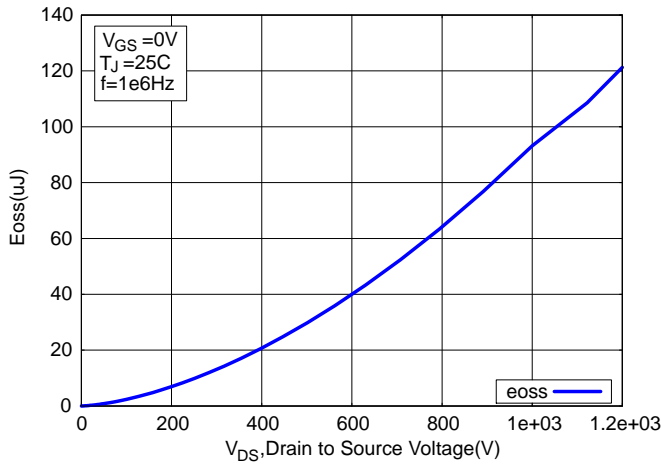**Figure 6. Capacitance Variation**

TYPICAL CHARACTERISTICS
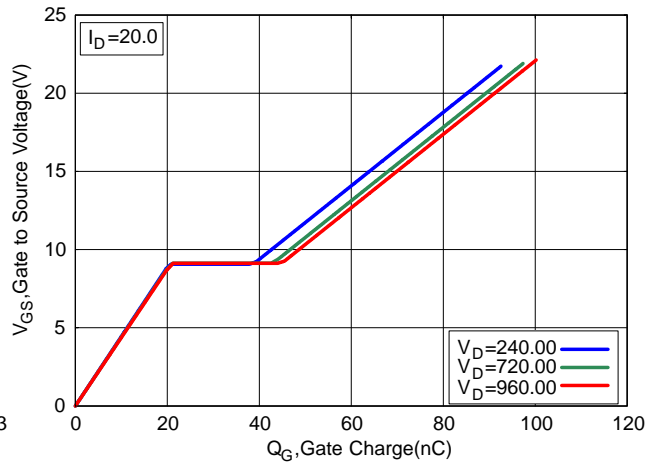

Figure 7. Eoss vs. Drain–to–Source Voltage
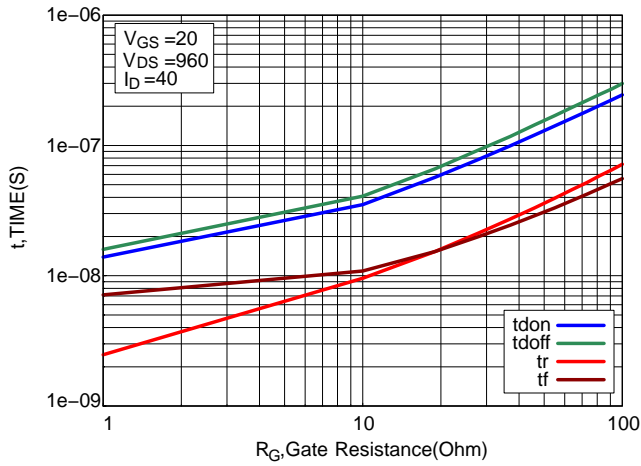

Figure 8. Gate–to–Source Voltage vs. Total Charge

Figure 9. Resistive Switching Time Variation vs. Gate Resistance
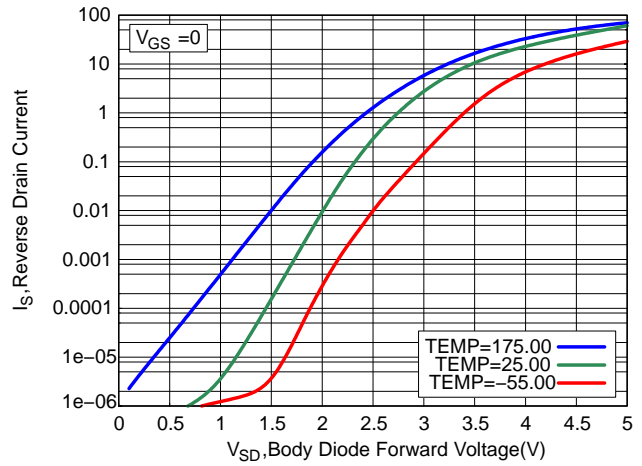
Figure 10. Diode Forward Voltage vs. Current
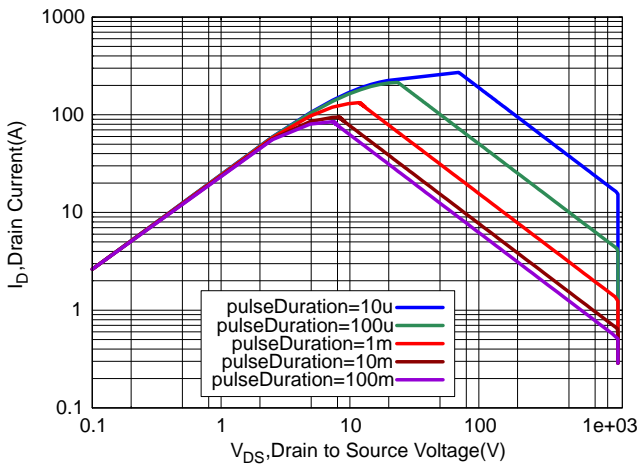
Figure 11. Maximum Rated Forward Biased Safe Operating Area
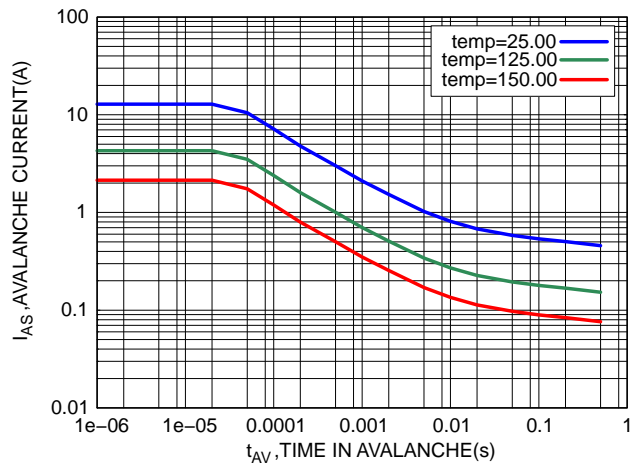
Figure 12. Ipeak vs. Time in Avalanche

NTBG040N120SC1

TYPICAL CHARACTERISTICS
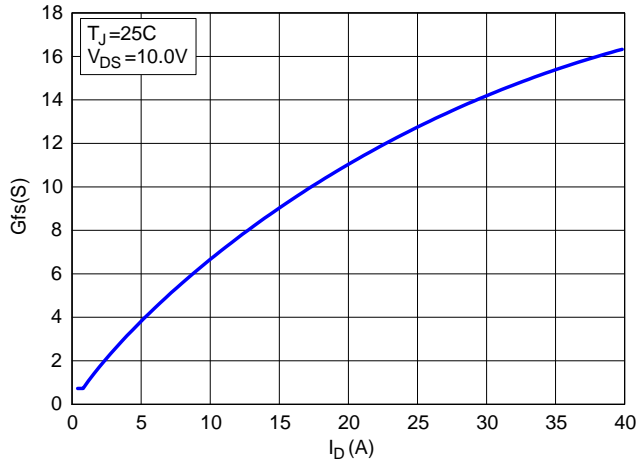
Figure 13. GFS vs. ID
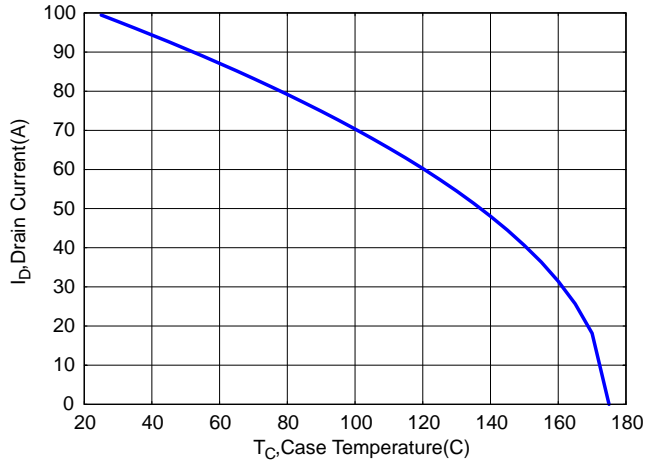
Figure 14. Maximum Current vs. Case Temperature
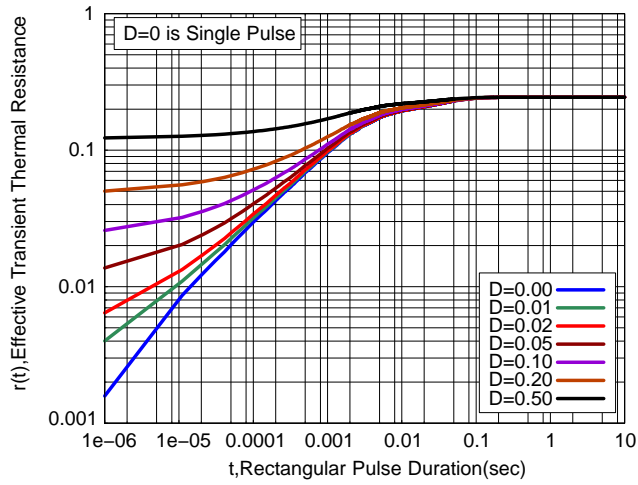
Figure 15. Thermal Response

PACKAGE DIMENSIONS

D2PAK7 (TO−263 7 LD)
CASE 418AY
ISSUE A

LAND PATTERN RECOMMENDATION
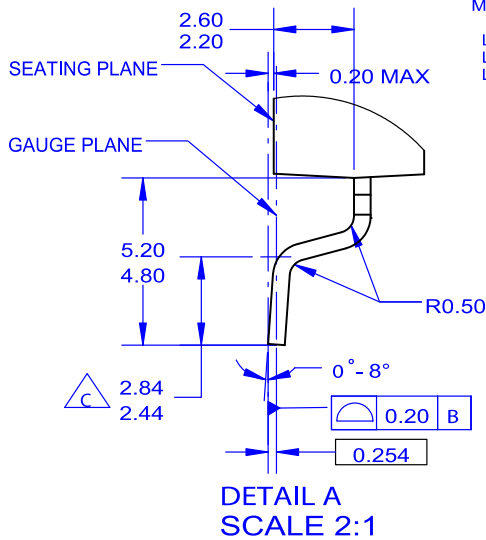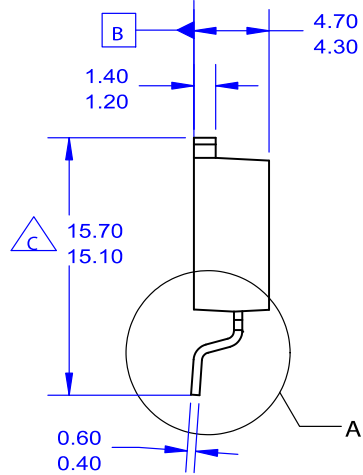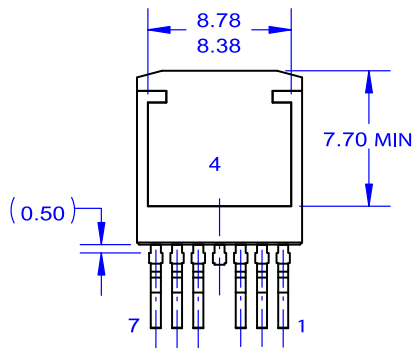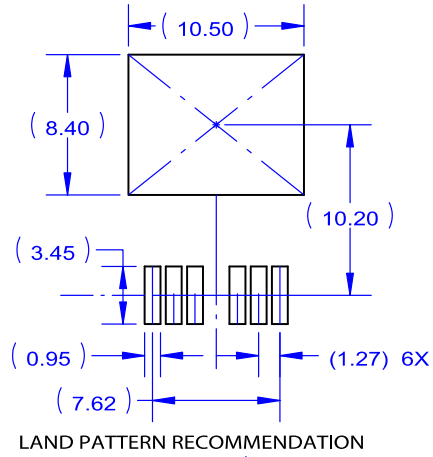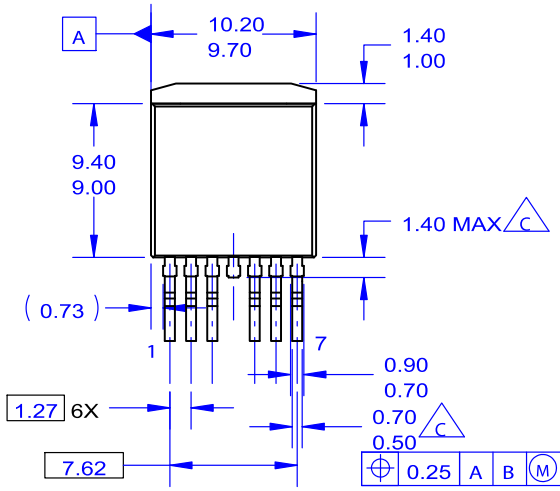
MARKING:

LINE 1 - LOGO & DATE CODE
LINE 2 - DEVICE MARKING
LINE 3 - DEVICE MARKING

DETAIL A
SCALE 2:1
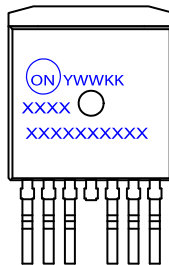
PIN1 - GATE
PIN2 - SOURCE
PIN3 - SOURCE
PIN4 - DRAIN
PIN5 - SOURCE
PIN6 - SOURCE
PIN7 - SOURCE

NOTES:

A. PACKAGE CONFORMS TO JEDEC TO-263
   VARIATION CB EXCEPT WHERE NOTED.
B. ALL DIMENSIONS ARE IN MILLIMETERS.

C. OUT OF JEDEC STANDARD VALUE.
D. DIMENSION AND TOLERANCE AS PER ASME
   Y14.5-2009.
E. DIMENSIONS ARE EXCLUSIVE OF BURRS,
   MOLD FLASH AND TIE BAR PROTRUSIONS.
F. LAND PATTERN RECOMMENDATION PER IPC.
   TO127P1524X465-8N.

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