

NVBL0R5N04XC

Product Preview

N-Channel PowerTrench[®] MOSFET

40 V, 300 A, 0.57 mΩ

Features

- Typical $R_{DS(on)} = 0.46 \text{ m}\Omega$ at $V_{GS} = 10 \text{ V}$, $I_D = 80 \text{ A}$
- Typical $Q_{g(tot)} = 220 \text{ nC}$ at $V_{GS} = 10 \text{ V}$, $I_D = 80 \text{ A}$
- UIS Capability
- RoHS Compliant
- Qualified to AEC Q101

Applications

- Automotive Engine Control
- PowerTrain Management
- Solenoid and Motor Drivers
- Integrated Starter/Alternator
- Primary Switch for 12 V Systems

MAXIMUM RATINGS $T_J = 25^\circ\text{C}$ unless otherwise noted

Parameter	Symbol	Ratings	Units
Drain-to-Source Voltage	V_{DSS}	40	V
Gate-to-Source Voltage	V_{GS}	± 20	V
Drain Current – Continuous ($V_{GS} = 10$) (Note 1)	I_D	300	A
Pulsed Drain Current $T_C = 25^\circ\text{C}$		See Figure 4	
Single Pulse Avalanche Energy (Note 2)	E_{AS}	1064	mJ
Power Dissipation	P_D	429	W
Derate Above 25°C		2.86	W/ $^\circ\text{C}$
Operating and Storage Temperature	T_J, T_{STG}	-55 to $+175$	$^\circ\text{C}$
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.35	$^\circ\text{C/W}$
Maximum Thermal Resistance, Junction-to-Ambient (Note 3)	$R_{\theta JA}$	43	$^\circ\text{C/W}$

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.

1. Current is limited by bondwire configuration.
2. Starting $T_J = 25^\circ\text{C}$, $L = 0.3 \text{ mH}$, $I_{AS} = 84 \text{ A}$, $V_{DD} = 40 \text{ V}$ during inductor charging and $V_{DD} = 0 \text{ V}$ during time in avalanche.
3. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance, where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design, while $R_{\theta JA}$ is determined by the board design. The maximum rating presented here is based on mounting on a 1 in² pad of 2 oz copper.

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

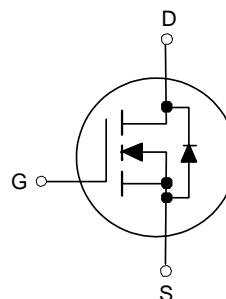


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MO-299A
CASE 100CU



ORDERING INFORMATION

Device	Package	Marking
NVBL0R5N04XC	MO-299A (Pb-Free)	0R5N04XC

NVBL0R5N04XC

Table 1. ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units	
OFF CHARACTERISTICS							
B_{VDSS}	Drain-to-Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	40	-	-	V	
I_{DSS}	Drain-to-Source Leakage Current	$V_{DS} = 40 \text{ V}, V_{GS} = 0 \text{ V}$	$T_J = 25^\circ\text{C}$	-	-	1	μA
			$T_J = 175^\circ\text{C}$ (Note 4)	-	-	1	mA
I_{GSS}	Gate-to-Source Leakage Current	$V_{GS} = \pm 20 \text{ V}$	-	-	± 100	nA	
ON CHARACTERISTICS							
$V_{GS(th)}$	Gate-to-Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	2.0	3.0	4.0	V	
$R_{DS(on)}$	Drain-to-Source On Resistance	$I_D = 80 \text{ A}, V_{GS} = 10 \text{ V}$	-	0.46	0.57	$\text{m}\Omega$	
DYNAMIC CHARACTERISTICS							
C_{iss}	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	15900	-	pF	
C_{oss}	Output Capacitance		-	4000	-	pF	
C_{rss}	Reverse Transfer Capacitance		-	600	-	pF	
R_g	Gate Resistance	$f = 1 \text{ MHz}$	-	2.6	-	Ω	
$Q_{g(ToT)}$	Total Gate Charge at 10 V	$V_{GS} = 0 \text{ to } 10 \text{ V}$	-	220	296	nC	
$Q_{g(th)}$	Threshold Gate Charge	$V_{GS} = 0 \text{ to } 2 \text{ V}$					
Q_{gs}	Gate-to-Source Gate Charge		-	73	-	nC	
Q_{gd}	Gate-to-Drain "Miller" Charge		-	41	-	nC	
SWITCHING CHARACTERISTICS							
t_{on}	Turn-On Time	$V_{DD} = 20 \text{ V}, I_D = 80 \text{ A}, V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$	-	-	221	ns	
$t_{d(on)}$	Turn-On Delay		-	54	-	ns	
t_r	Rise Time		-	82	-	ns	
$t_{d(off)}$	Turn-Off Delay		-	106	-	ns	
t_f	Fall Time		-	52	-	ns	
t_{off}	Turn-Off Time		-	-	215	ns	
DRAIN-SOURCE DIODE CHARACTERISTICS							
V_{SD}	Source-to-Drain Diode Voltage	$I_{SD} = 80 \text{ A}, V_{GS} = 0 \text{ V}$	-	-	1.25	V	
		$I_{SD} = 40 \text{ A}, V_{GS} = 0 \text{ V}$	-	-	1.2	V	
t_{rr}	Reverse-Recovery Time	$I_F = 80 \text{ A}, dI_{SD}/dt = 100 \text{ A}/\mu\text{s}, V_{DD} = 32 \text{ V}$	-	119	133	ns	
Q_{rr}	Reverse-Recovery Charge		-	228	274	nC	

4. The maximum value is specified by design at $T_J = 175^\circ\text{C}$. Product is not tested to this condition in production. 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

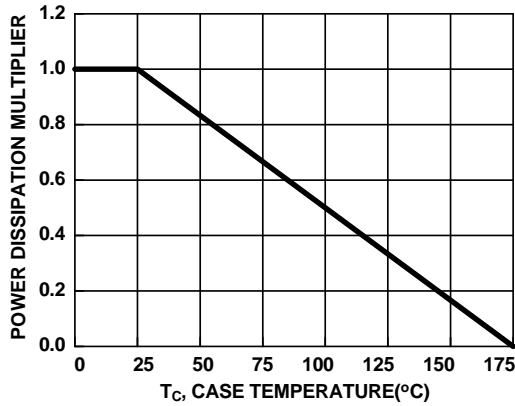


Figure 1. Normalized Power Dissipation vs. Case Temperature

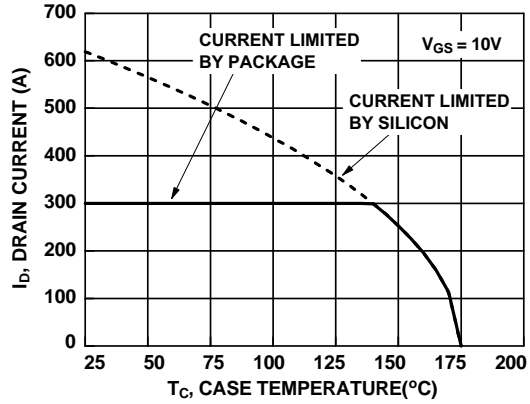


Figure 2. Maximum Continuous Drain Current vs. Case Temperature

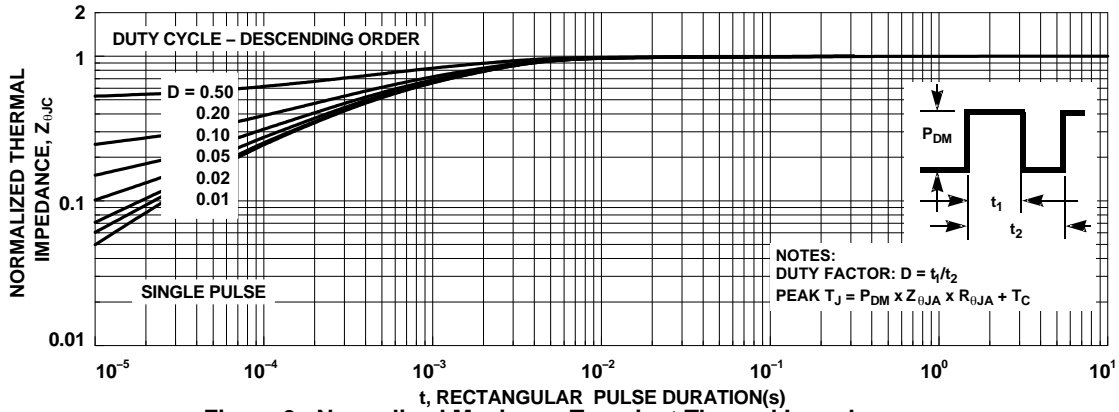


Figure 3. Normalized Maximum Transient Thermal Impedance

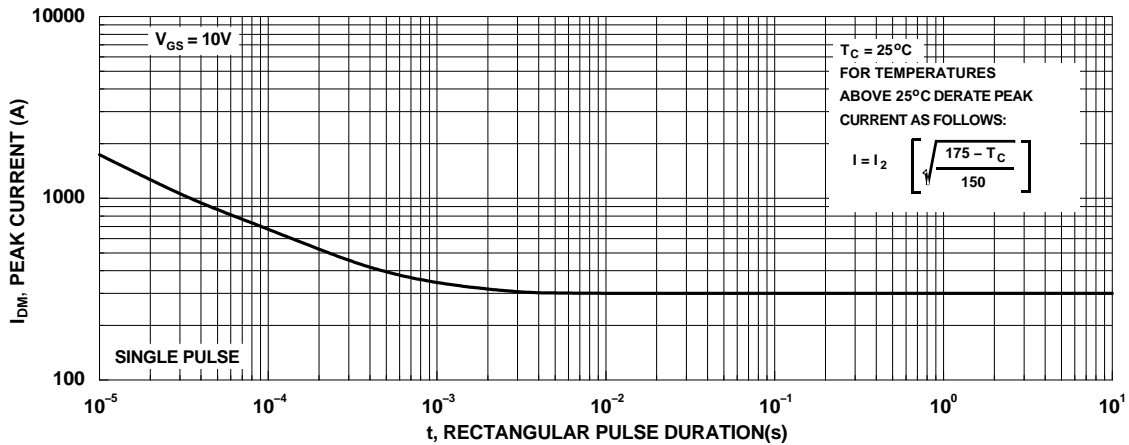


Figure 4. Peak Current Capability

Typical Characteristics

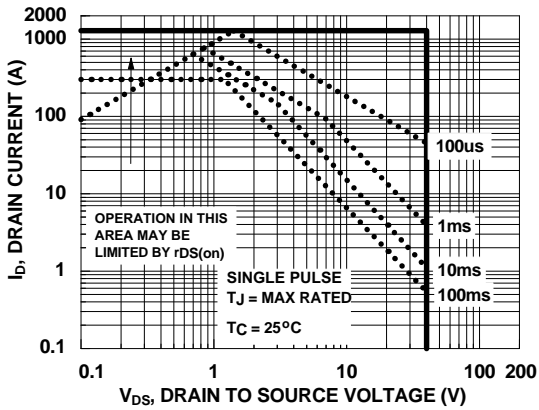
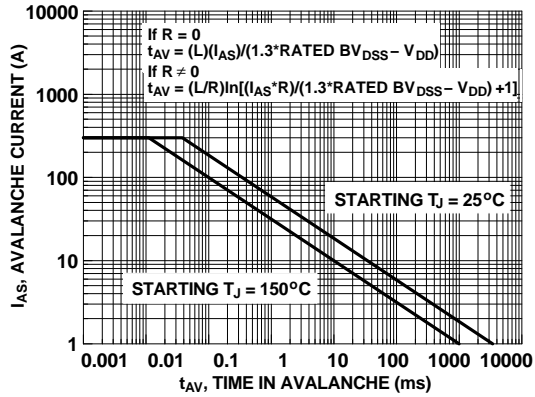


Figure 5. Forward Bias Safe Operating Area



NOTE: Refer to Fairchild Application Notes AN7514 and AN7515

Figure 6. Unclamped Inductive Switching Capability

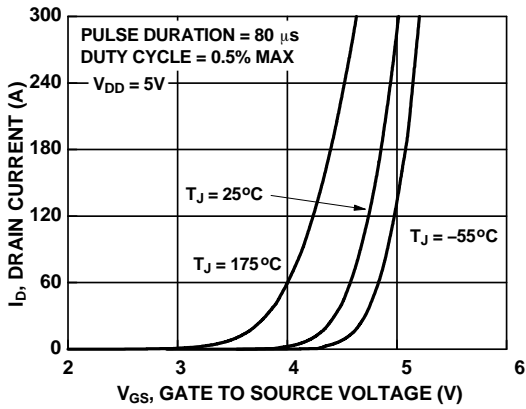


Figure 7. Transfer Characteristics

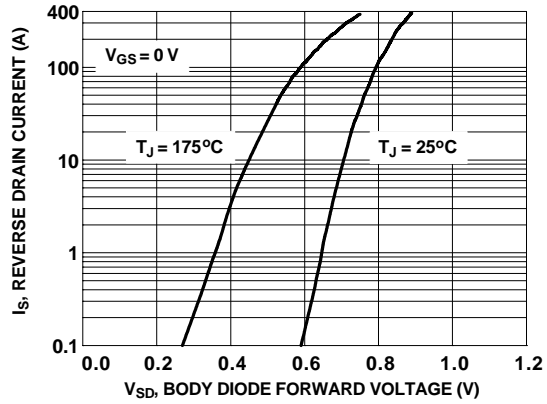


Figure 8. Forward Diode Characteristics

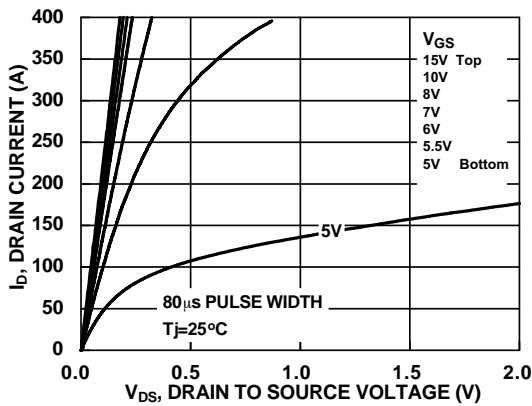


Figure 9. Saturation Characteristics

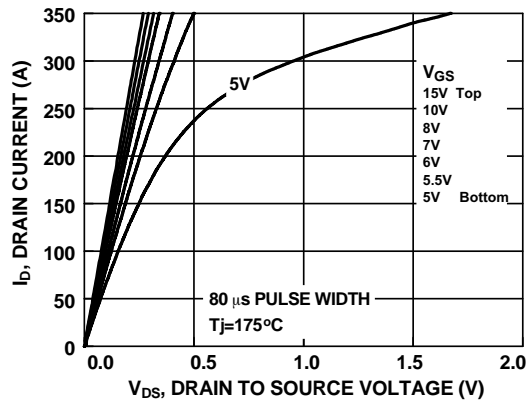


Figure 10. Saturation Characteristics

Typical Characteristics

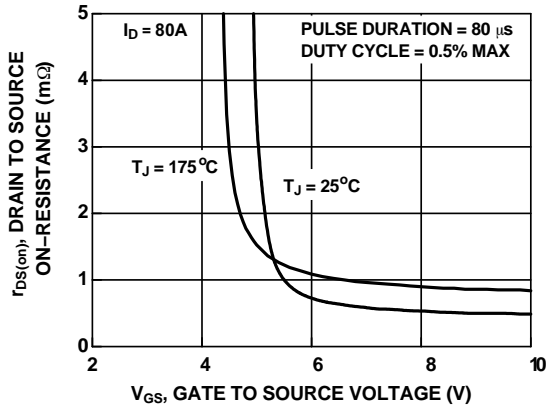


Figure 11. $R_{DS(on)}$ vs. Gate Voltage

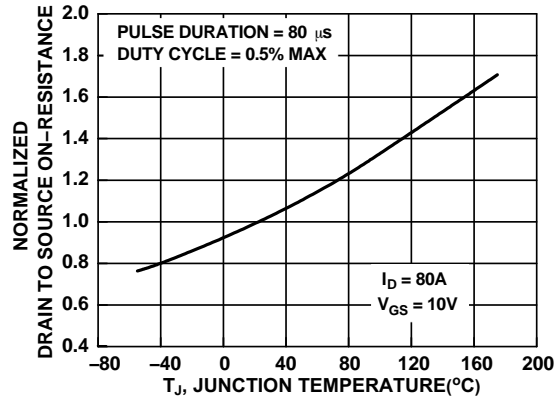


Figure 12. Normalized $R_{DS(on)}$ vs. Junction Temperature

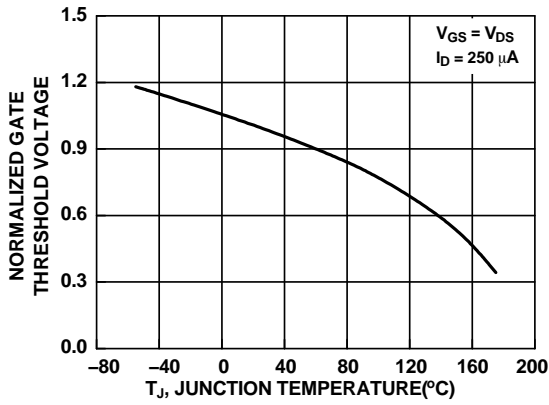


Figure 13. Normalized Gate Threshold Voltage vs. Temperature

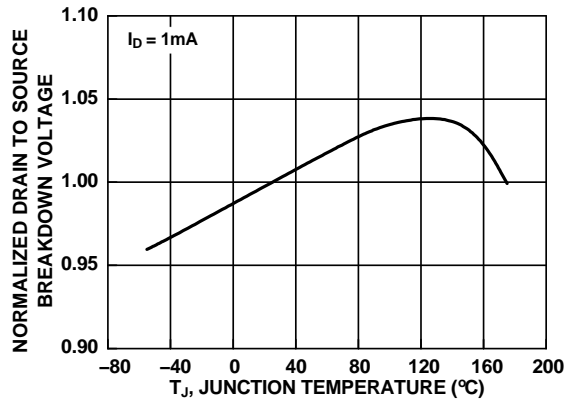


Figure 14. Normalized Drain to Source Breakdown Voltage vs. Junction Temperature

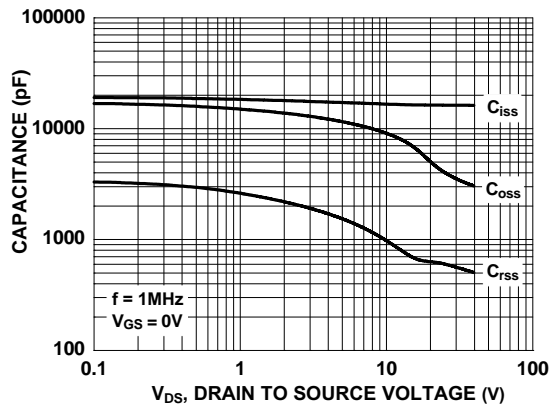


Figure 15. Capacitance vs. Drain to Source Voltage

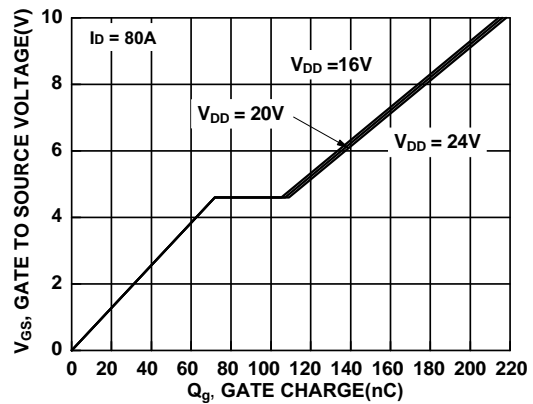
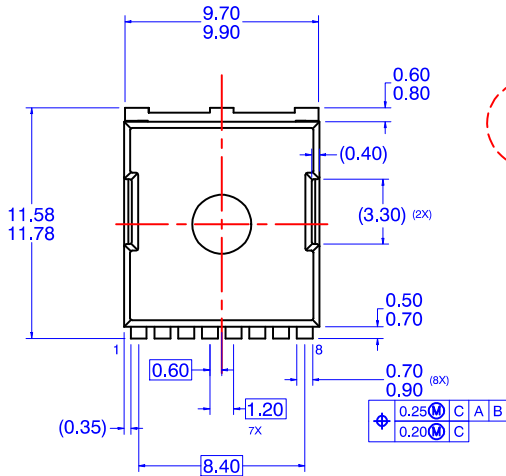


Figure 16. Gate Charge vs. Gate to Source Voltage

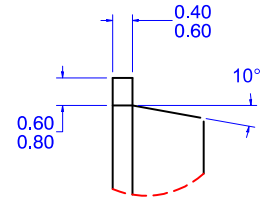
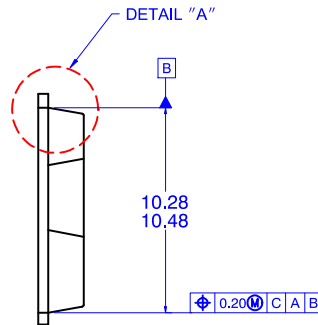
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PACKAGE DIMENSIONS

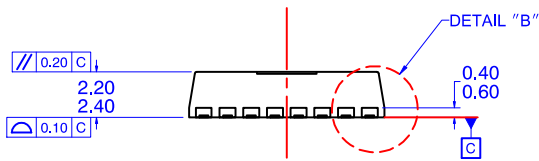
H-PSOF8L 11.68x9.80
CASE 100CU
ISSUE O



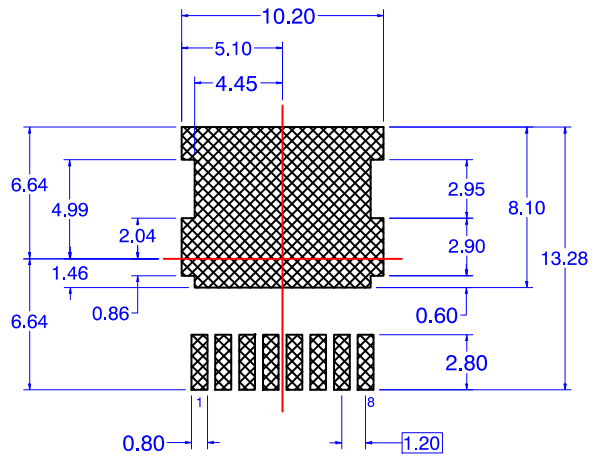
TOP VIEW



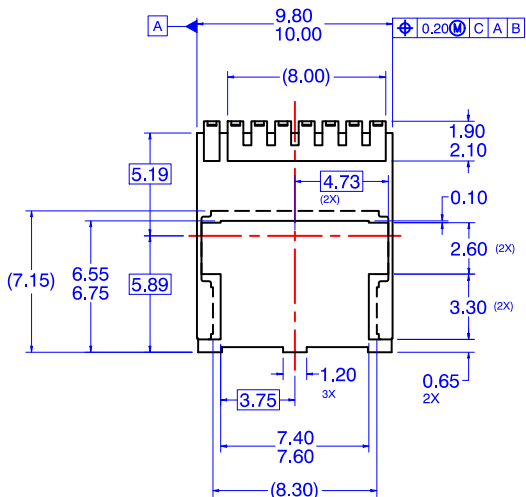
DETAIL "A"



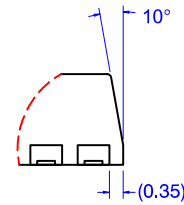
SIDE VIEW



LAND PATTERN RECOMMENDATION




BOTTOM VIEW



DETAIL "B"

- NOTES: UNLESS OTHERWISE SPECIFIED
- PACKAGE STANDARD REFERENCE: JEDEC MO-299, ISSUE A, DATED NOVEMBER 2009.
 - ALL DIMENSIONS ARE IN MILLIMETERS.
 - DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
 - DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

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