CSD18504KCS 40V N-Channel NexFET™ Power MOSFET

1 Features

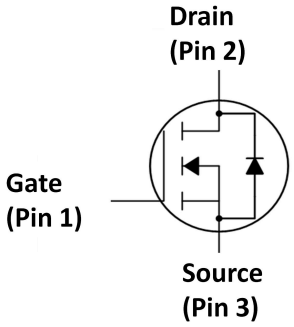
- Ultra low Qg and Qgd
- Low thermal resistance
- Avalanche rated
- Logic level
- Pb free terminal plating
- RoHS compliant
- Halogen free
- TO-220 plastic package

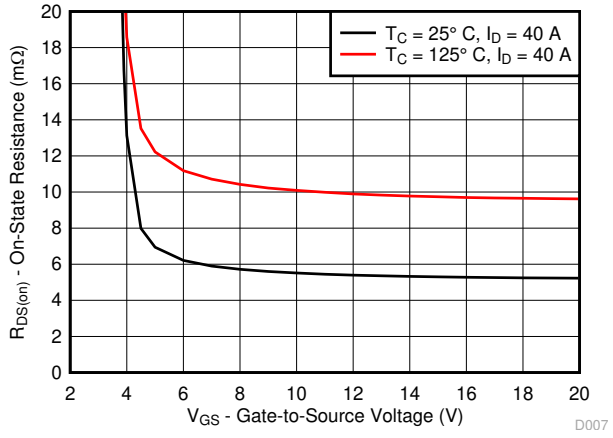
2 Applications

- DC-DC conversion
- Secondary side synchronous rectifier
- Motor control

3 Description

This 40V, 5.5mΩ, TO-220 NexFET™ power MOSFET is designed to minimize losses in power conversion applications.





$R_{DS(on)}$ vs V_{GS}

Product Summary

T_A = 25°C		TYPICAL VALUE		UNIT
V_{DS}	Drain-to-Source Voltage	40		V
Q_g	Gate Charge Total (10V)	19		nC
Q_{gd}	Gate Charge Gate-to-Drain	3.5		nC
$R_{DS(on)}$	Drain-to-Source On-Resistance	V_{GS} = 4.5V	8.0	mΩ
		V_{GS} = 10V	5.5	mΩ
$V_{GS(th)}$	Threshold Voltage	1.9		V

Ordering Information(1)

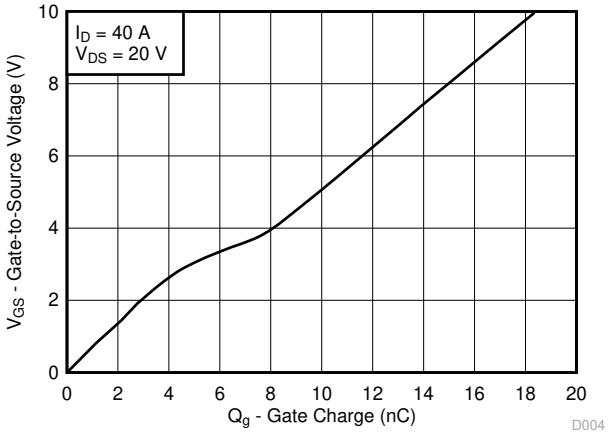
Device	Package	Media	Qty	Ship
CSD18504KCS	TO-220 Plastic Package	Tube	50	Tube

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Absolute Maximum Ratings

T_A = 25°C		VALUE	UNIT
V_{DS}	Drain to Source Voltage	40	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Continuous Drain Current (Package limited), T_C = 25°C	100	A
	Continuous Drain Current (Silicon limited), T_C = 25°C	89	
	Continuous Drain Current (Silicon limited), T_C = 100°C	63	
I_{DM}	Pulsed Drain Current (1)	238	A
P_D	Power Dissipation	115	W
T_J, T_{stg}	Operating Junction and Storage Temperature Range	–55 to 175	°C
E_{AS}	Avalanche Energy, single pulse I_D = 42A, L = 0.1mH, R_G = 25Ω	88	mJ

(1) Max $R_{\theta JC}$ = 1.3°C/W, pulse duration ≤100μs, duty cycle ≤1%



Gate Charge

Table of Contents

4 Specifications

4.1 Electrical Characteristics

(T_A = 25°C unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
STATIC CHARACTERISTICS						
BV_{DSS}	Drain-to-Source Voltage	V_{GS} = 0V, I_D = 250µA	40			V
I_{DSS}	Drain-to-Source Leakage Current	V_{GS} = 0V, V_{DS} = 32V			1	µA
I_{GSS}	Gate-to-Source Leakage Current	V_{DS} = 0V, V_{GS} = 20V			100	nA
$V_{GS(th)}$	Gate-to-Source Threshold Voltage	V_{DS} = V_{GS}, I_D = 250µA	1.5	1.9	2.3	V
$R_{DS(on)}$	Drain-to-Source On-Resistance	V_{GS} = 4.5V, I_D = 40A		8	10	mΩ
		V_{GS} = 10V, I_D = 40A		5.5	7	mΩ
g_{fs}	Transconductance	V_{DS} = 20V, I_D = 40A		72		S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{GS} = 0V, V_{DS} = 20V, f = 1MHz		1380	1800	pF
C_{oss}	Output Capacitance			320	416	pF
C_{rss}	Reverse Transfer Capacitance			8	10.4	pF
R_G	Series Gate Resistance			1.5	3	Ω
Q_g	Gate Charge Total (4.5V)	V_{DS} = 20V, I_D = 40A		9.2	12	nC
Q_g	Gate Charge Total (10V)			19	25	nC
Q_{gd}	Gate Charge Gate-to-Drain			3.5		nC
Q_{gs}	Gate Charge Gate-to-Source			4.4		nC
$Q_{g(th)}$	Gate Charge at Vth			3		nC
Q_{oss}	Output Charge	V_{DS} = 20V, V_{GS} = 0V		19		nC
$t_{d(on)}$	Turn On Delay Time	V_{DS} = 20V, V_{GS} = 10V, I_{DS} = 40A, R_G = 0Ω		4.4		ns
t_r	Rise Time			5.2		ns
$t_{d(off)}$	Turn Off Delay Time			11.2		ns
t_f	Fall Time			4.2		ns
DIODE CHARACTERISTICS						
V_{SD}	Diode Forward Voltage	I_{SD} = 40A, V_{GS} = 0V		0.8	1	V
Q_{rr}	Reverse Recovery Charge	V_{DS}= 20V, I_F = 40A, di/dt = 300A/µs		46		nC
t_{rr}	Reverse Recovery Time			33		ns

4.2 Thermal Information

(T_A = 25°C unless otherwise stated)

THERMAL METRIC		MIN	TYP	MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance			1.3	°C/W
$R_{\theta JA}$	Junction-to-Ambient Thermal Resistance			62	

4.3 Typical MOSFET Characteristics

(T_A = 25°C unless otherwise stated)

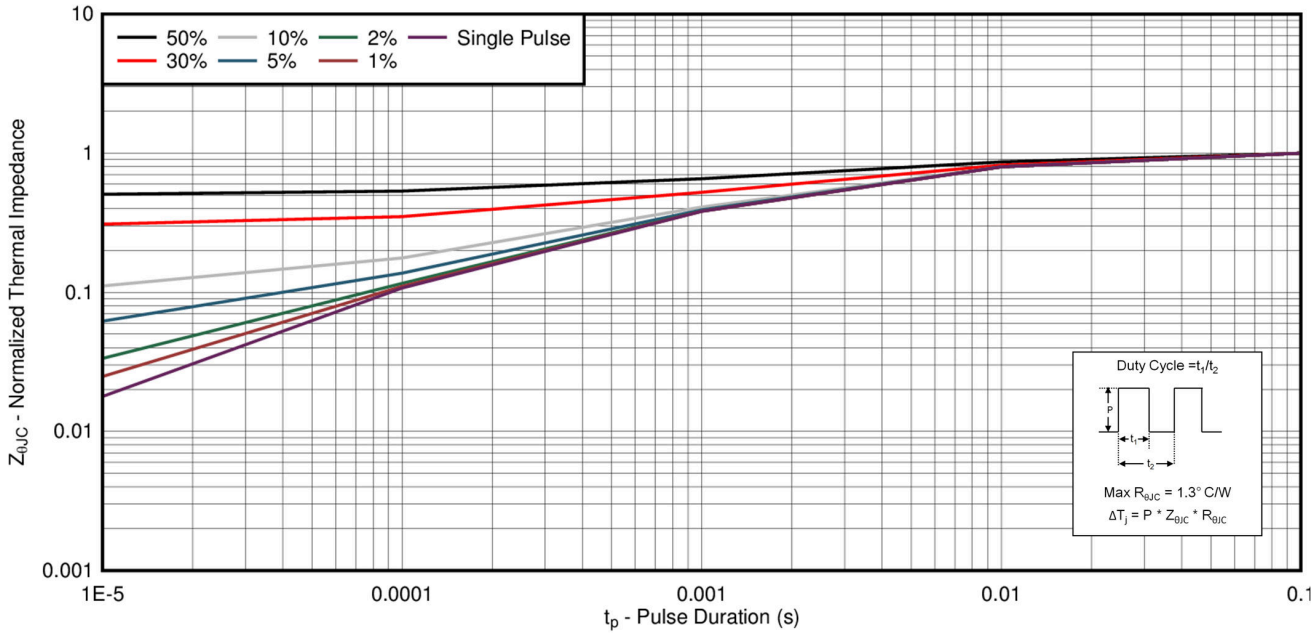


Figure 4-1. Transient Thermal Impedance

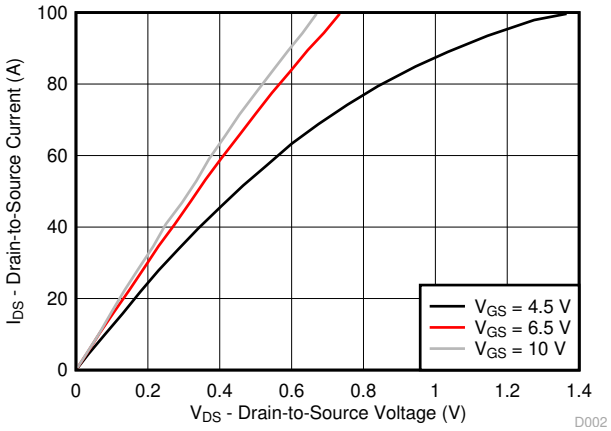
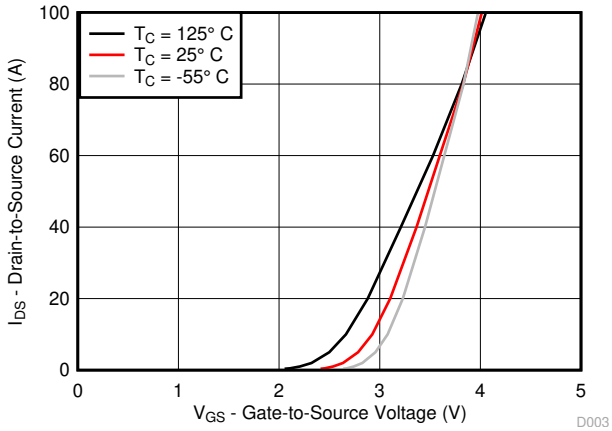
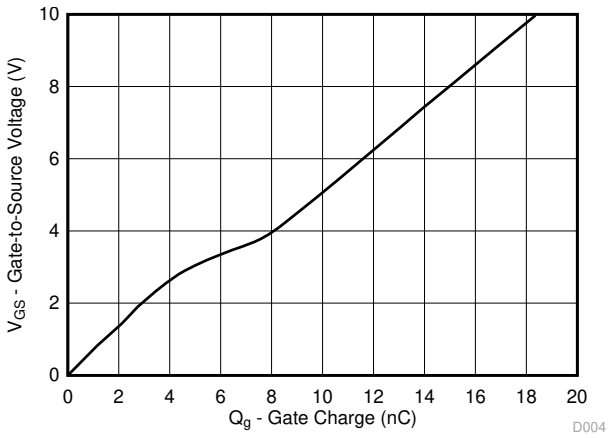


Figure 4-2. Saturation Characteristics



VDS = 5V

Figure 4-3. Transfer Characteristics



V_{DS} = 20V I_D = 40A

Figure 4-4. Gate Charge

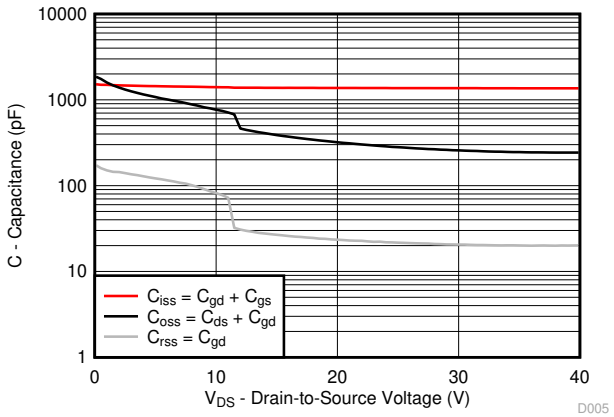
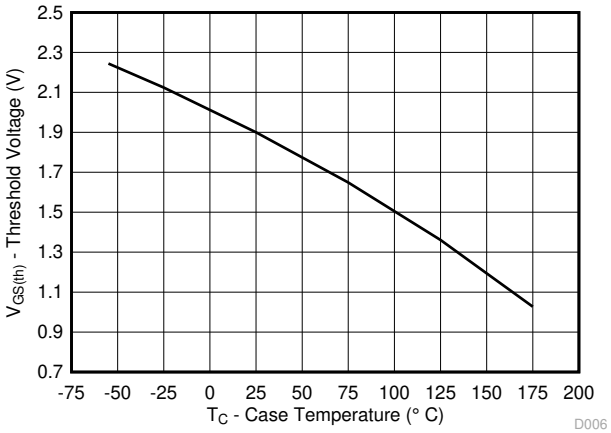


Figure 4-5. Capacitance



I_D = 250µA

Figure 4-6. Threshold Voltage vs Temperature

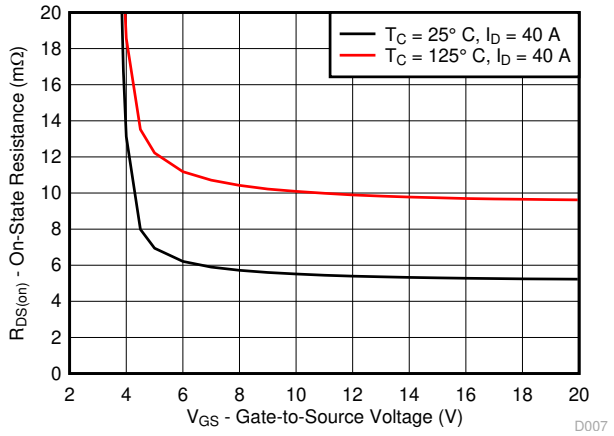
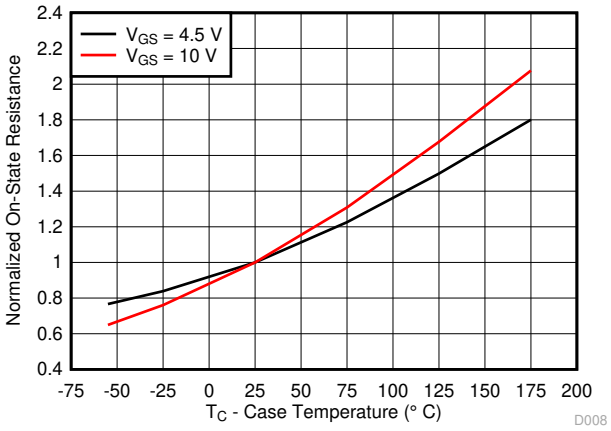


Figure 4-7. On-State Resistance vs Gate-to-Source Voltage



I_D = 40A

Figure 4-8. Normalized On-State Resistance vs Temperature

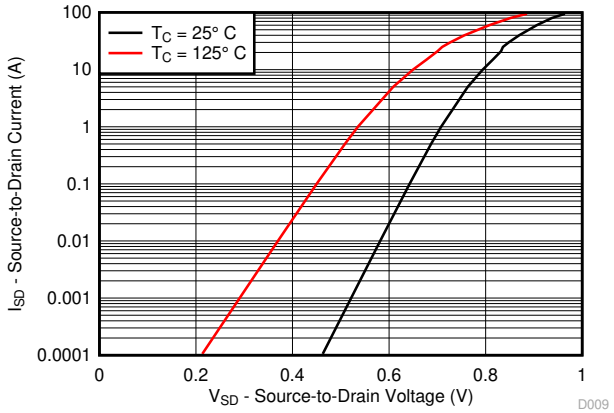
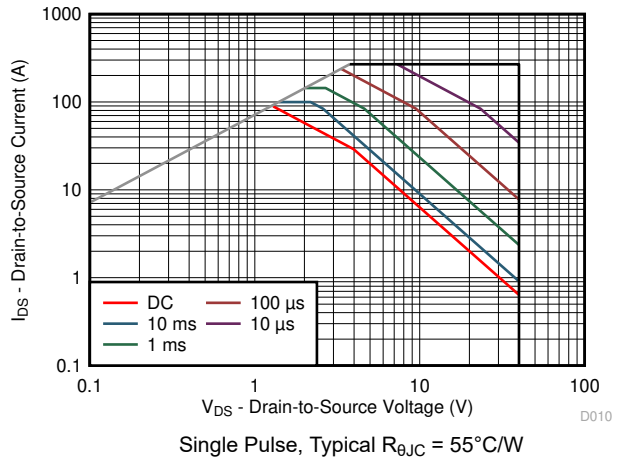


Figure 4-9. Typical Diode Forward Voltage



Single Pulse, Typical $R_{\theta JC}$ = 55°C/W

Figure 4-10. Maximum Safe Operating Area

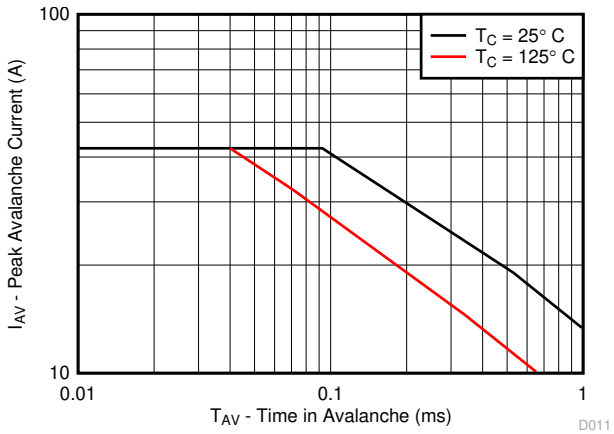


Figure 4-11. Single Pulse Unclamped Inductive Switching

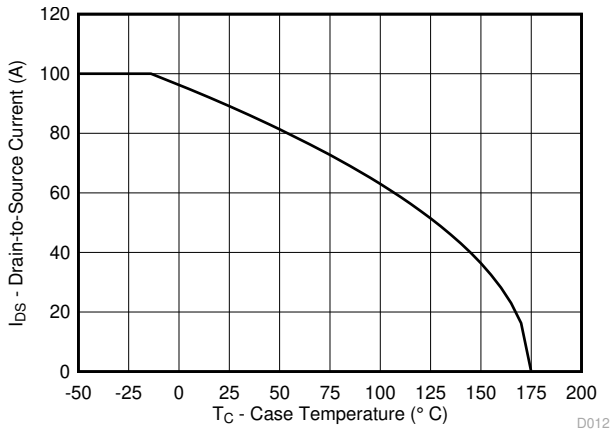


Figure 4-12. Maximum Drain Current vs Temperature

5 Device and Documentation Support

5.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

5.2 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

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5.3 Trademarks

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5.4 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

5.5 Glossary

TI Glossary	This glossary lists and explains terms, acronyms, and definitions.

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision A (January 2015) to Revision B (March 2024)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document	1

Changes from Revision * (October 2012) to Revision A (January 2015)	Page
• Added part number to title	1
• Increased the T_C = 25° continuous drain current to 89A	1
• Increased the T_C = 125° continuous drain current to 63A	1
• Increased the pulsed drain current to 238A	1
• Increased the max power dissipation to 115W	1
• Increased the max operating junction and storage temperature to 175°	1
• Updated the pulsed current conditions	1
• Updated Figure 4-1 from a normalized $R_{\theta JA}$ to an $R_{\theta JC}$ curve	4
• Updated Figure 4-6 to extend to 175°C	4
• Updated Figure 4-8 to extend to 175°C	4
• Updated the SOA in Figure 4-10	4
• Updated Figure 4-12 to extend to 175°C	4

7 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CSD18504KCS	Active	Production	TO-220 (KCS) | 3	50 | TUBE	ROHS Exempt	SN	N/A for Pkg Type	-55 to 175	CSD18504KCS
CSD18504KCS.B	Active	Production	TO-220 (KCS) | 3	50 | TUBE	ROHS Exempt	SN	N/A for Pkg Type	-55 to 175	CSD18504KCS

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

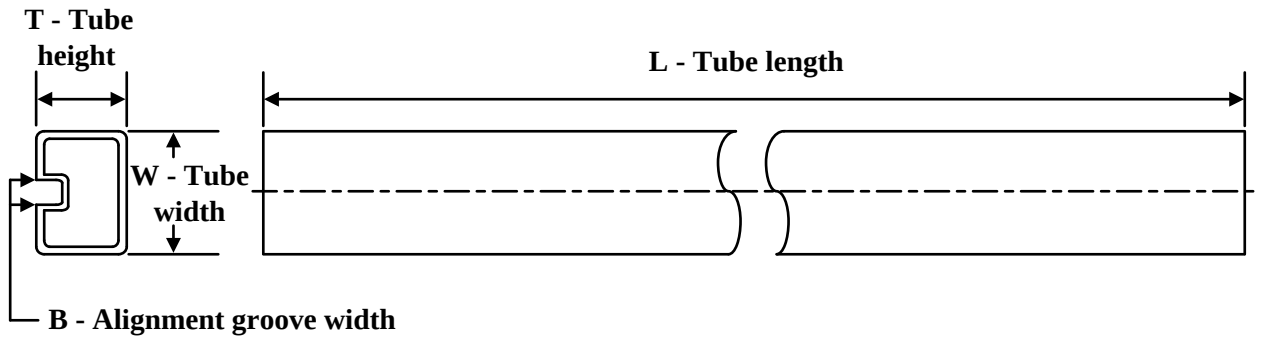
(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

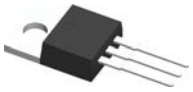
TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
CSD18504KCS	KCS	TO-220	3	50	532	34.1	700	9.6
CSD18504KCS.B	KCS	TO-220	3	50	532	34.1	700	9.6

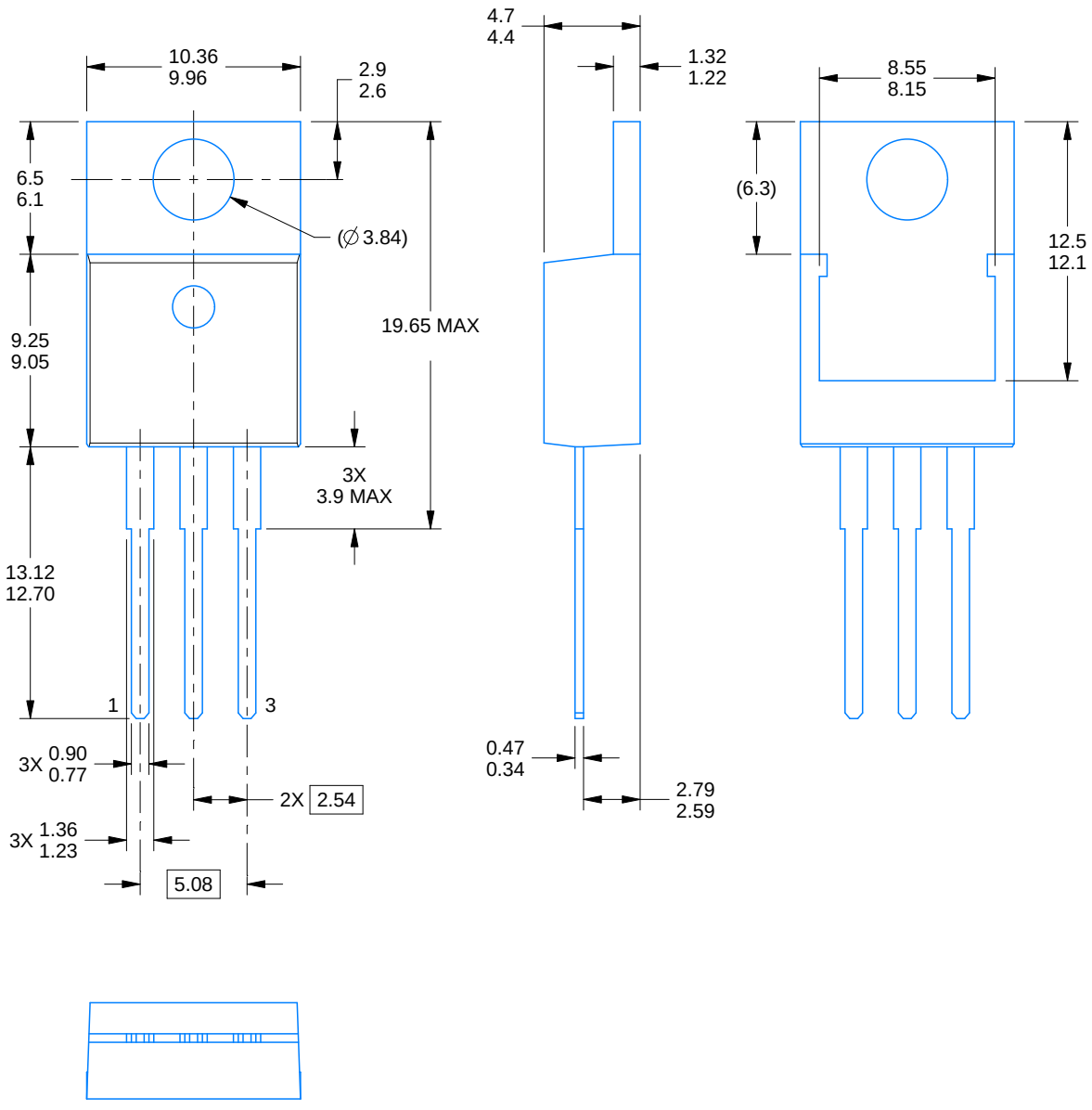
KCS0003B



PACKAGE OUTLINE

TO-220 - 19.65 mm max height

TO-220



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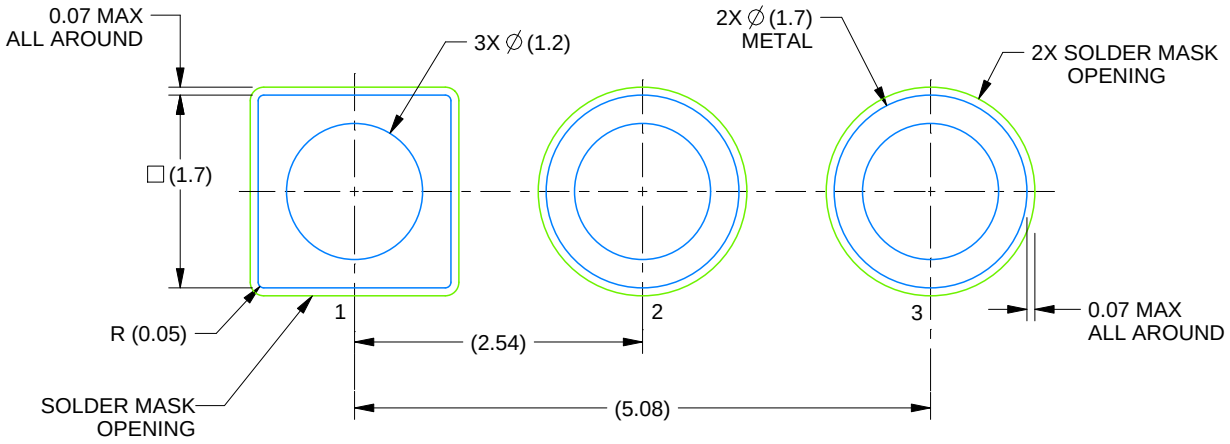
NOTES:

1. Dimensions are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-220.



LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE:15X

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